Engine: Application and ID

Engine:

Liquid-cooled, gasoline, inline, 4-cylinder, turbocharged engine. Aluminum alloy cylinder block with cast-iron cylinder liners cast directly into the block. Aluminum alloy cylinder head with double overhead camshafts and separate intake and outlet channels. Engine lubrication is provided by an eccentric pump driven from the crankshaft Full-flow type oil filter. Exhaust emission control is accomplished by multiport fuel injection, a heated oxygen sensor and a three-way catalytic converter.

Designation: Volvo B 4204 T3.

Output	162hp at 5100 rpm (121 kW at 5100 rpm)
Max torque	177 ft. lbs. at 1800-4800 rpm (240 Nm at 1800-4800 rpm)
Number of cylinders	4
Bore	3.27" (83 mm)
Stroke	3.54" (90 mm)
Displacement	1.95 liters
Compression ratio	9.0:1
Number of valves	16
Valve clearance	mechanical

Vehicle: Service and Repair

Cables, General

KA. Cables, general

General

This Service Manual is for the repair and replacement of cables in an existing cable harness. Choice of cable size and rating, cable routing for installing accessories or other installations are not covered here.

- For mounting accessories or subsequent wiring work refer to the instructions for the particular part involved.

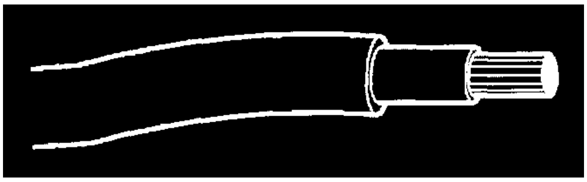
Normal multiple strand cable

There are different types of cable. The most common is multiple strand (more than 7 strands) of copper. There are also single strand cables and minimal strand (2-7 strands). Cables have different areas and color codes.

Cable area

Specifications that give a cable area are always based on the area of the core (the copper strands). The cable area does not include the insulation.

Cable insulation (sheath)

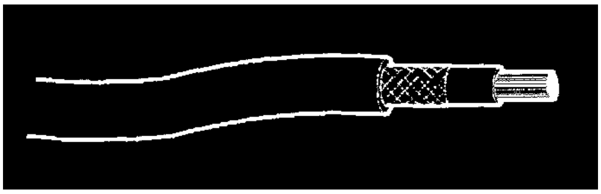


Nearly all cables are of the insulated type and have either single or double insulation.

Some copper cables have no insulation.

Other types of cable

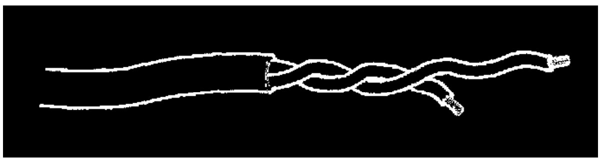
Shielded cables



Shielded cables are used for carrying signals from antenna and in wiring for engine control modules. Braided wire shield is wrapped around on or two conducting copper strands which provides protection against interference from electromagnetic high frequency fields.

Special tools are required for stripping, splicing and connecting shielded cables.

Twisted pair

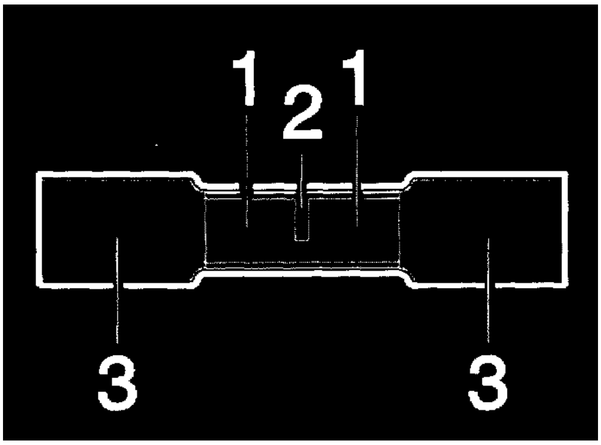


Twisted pair cables reduce the effects of magnetically induced interference. When splicing twisted pair cables the splice points must not be made parallel.

Splicing Cables, General

Splicing cables, general

Splicing, different types
Insulated moisture proof butt connector



A butt connector is used for joining two cables by crimping and shrinking.

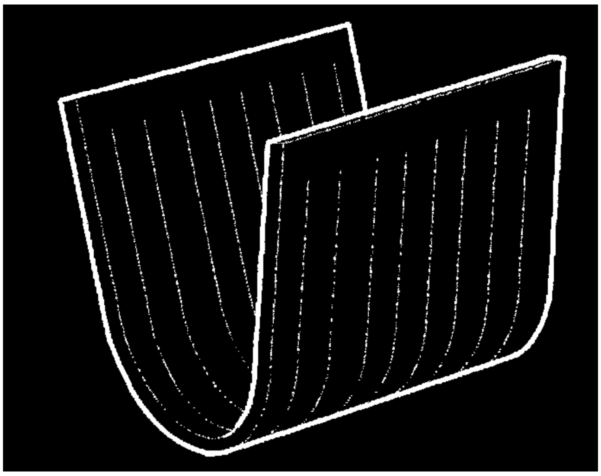
The crimping is done at two points (1) on a metal girdle to join the cable cores from each side.

The crimp section of the connector is divided in the center by an metal tab (2) which is where the cable core ends meet

The support sections (3) are coated with glue on the inside. When they are heated the plastic layer shrinks, the glue is released and flows out in the connector over the cable. When correctly used this method provides a strong and moisture proof joint.

For method details with insulated butt connector. See: Splicing Using Insulated Moisture Proof Butt Connector

Uninsulated butt connector



This type of butt connector is used in certain production operations to join cables.

To insulate the crimped butt connector a heat-shrinkable tubing is used that has an internal coating of glue. When heated the tube shrinks and the glue melts for good sealing properties and moisture protection.

Splicing using an uninsulated butt connector is not covered in this Service Manual.

Where an uninsulated butt connector must be replaced use an insulated butt connector. See: Splicing Using Insulated Moisture Proof Butt Connector

Branch point

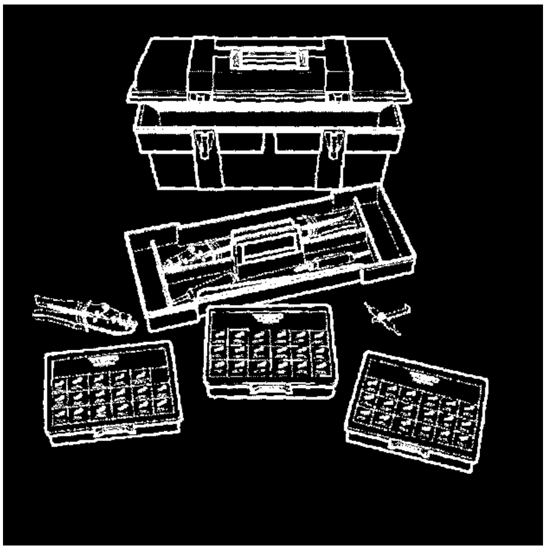
Several cables can be joined together in a branch point splice. To make a branch point use an insulated butt connector. See: Splicing Using Insulated Moisture Proof Butt Connector

New Cable Terminal

New cable terminal

CAUTION: Always use a new Volvo original cable terminal of the recommended type and quality when replacing a cable terminal.

Identify the cable terminal



First compare the cable terminal removed from the housing with the cable terminals in the repair kit pin **9814235.** Look inside the box lid and compare the terminal with those in the assortment available in the box.

NOTE: Cable area When the correct type of cable terminal is identified choose one of the right size for the cable area required. Seal sws For cable terminals designated sws a seal must be used.

Stripping the cable insulation

If no similar cable terminal is available in the cable terminal assortment

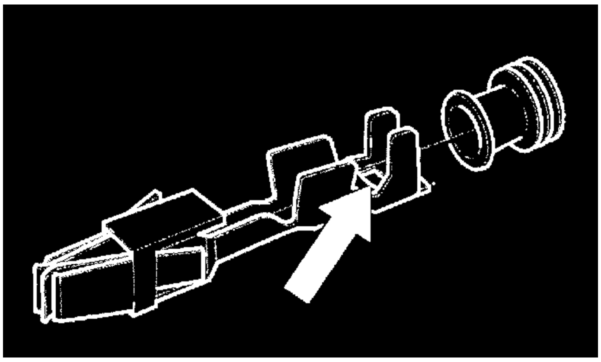
If the cable terminal does not compare with any of those available in the assortment in the box, check in the relevant Spare Parts Catalogue.

NOTE: When the correct type of cable terminal is identified in the Spare Parts Catalogue, choose a cable terminal of the right size for the cable area required and order the cable terminal.

Seal sws and plug

Seal sws for cable terminals

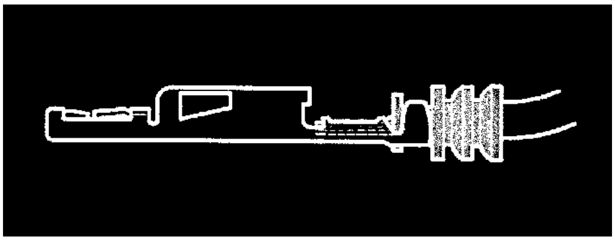
CAUTION: Always use the correct size of seal to match the cable.



A seal must always be used for cable terminals with the designation sws.

How to identify a cable terminal that requires a seal:

- If there is a hole or slot (see arrow in illustration) in the insulation wings a seal must be used.



Seals are used where the cables are exposed to aggressive environmental factors and there is a risk of moisture penetration in the housing cavities.

The rubber-based seals prevent oxidization and retain moisture proof properties even when subjected to heavy vibration and extremes of temperature.

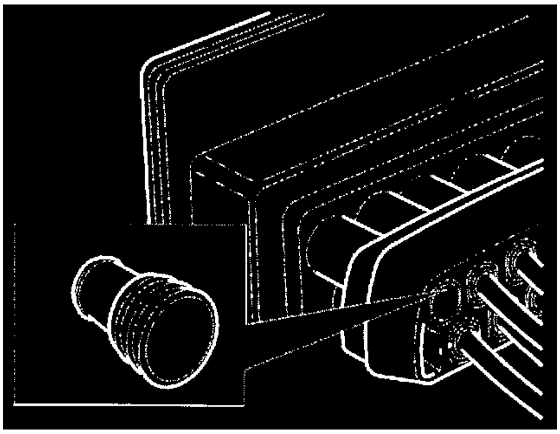
The seals are crimped round the cable at the insulation wings on the cable terminal.

The seals have different colors which are coded according to size as shown in the table below.

Table for cable terminal seals

Seal	Color	Abbreviation	Cable diameter mm
970772-0	Blue	BL	1.2 - 2.0
970773-8	White	W	2.1 - 2.9

Plug



Plugs are used to close the unused cavities in a moisture proof housing.

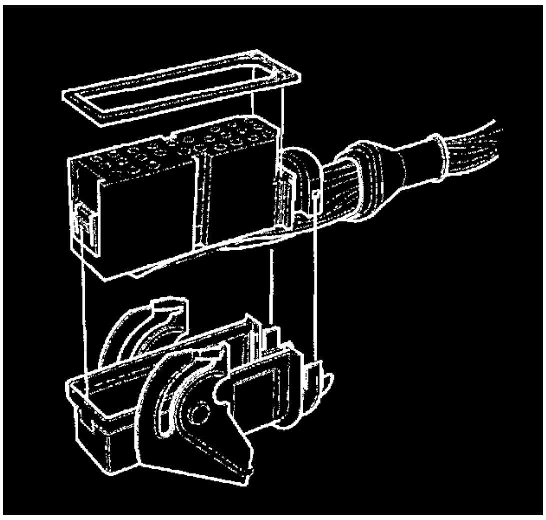
A plug is in principle like a seal but without a hole in it for a cable.

Plugs are included in the repair kit p/n **9814235** for housings with cable terminals of the type 2.8 sws.

Example 1

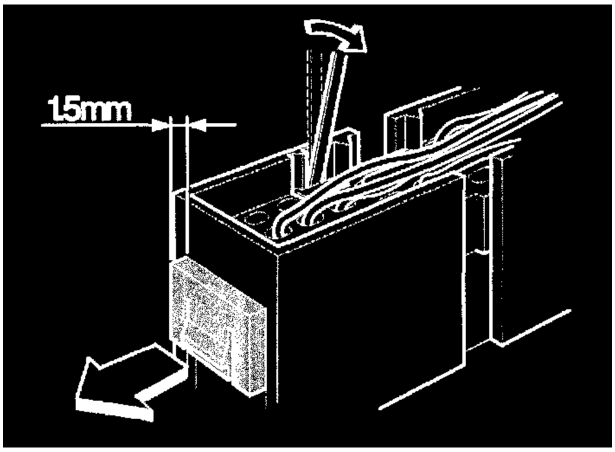
Example 1

Socket type housings p/n 3523410-3, and equivalent pin housings Replacement of cable terminals
Remove housing



- Pull back the rubber cover on the cables
- Remove rubber gasket (socket housings only).
- Carefully release the clips by bending them out with a small screwdriver (one clip per side).
- Depress the catch on the front of the housing and lift the housing out of the connector cover.

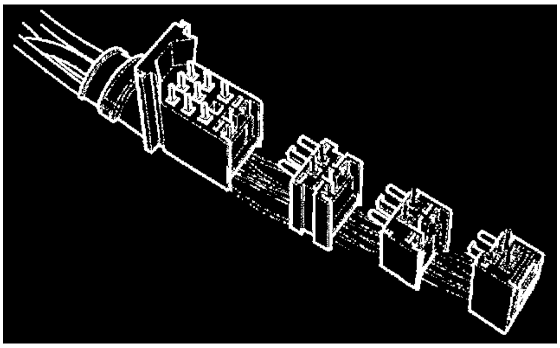
Open the housing



Release the housing secondary locking as shown.

- Insert a small screwdriver (approx. **3 mm** blade width) as shown. Bend the secondary locking catch outward carefully and push the locking cover forwards **1.5 mm.**

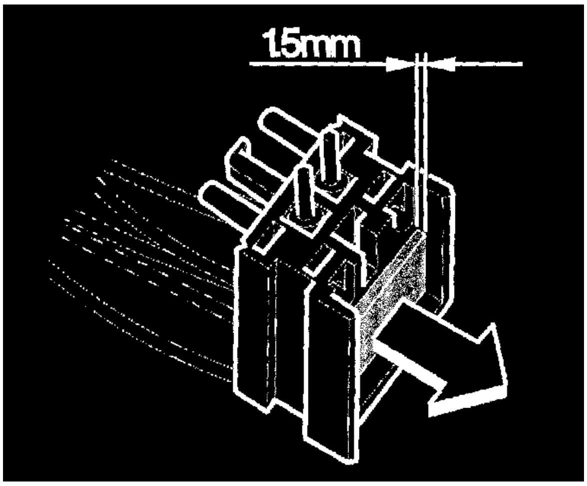
For a combined pin housing do the following:



- Release the pin housings from each other.

The illustration shows pin housings with the contact side up.

Open the housing section to replace terminal



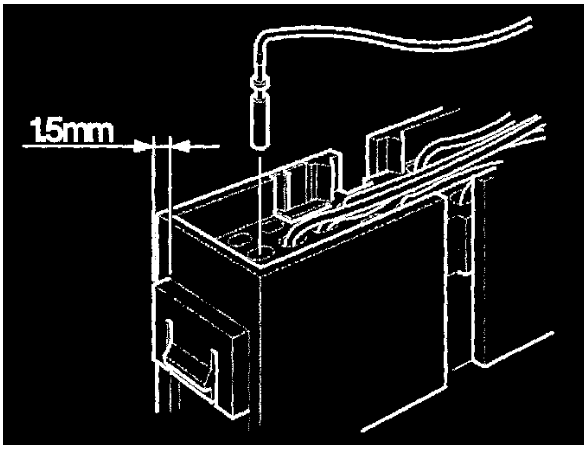
Front housing section

- The front housing section opens by carefully bending the secondary locking out and sliding the locking cover forwards **1.5 mm.**

Other housing sections

- The other housing sections open by pressing in the locking catch on the cable side and sliding the locking cover forwards **1.5 mm.**

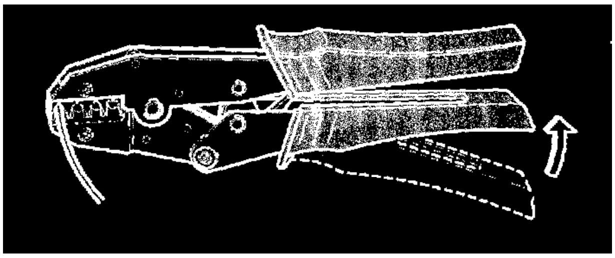
Extract the cable terminal



No terminal removal tool is required.

- Extract the cable terminal from rear of the by pulling on the cable.

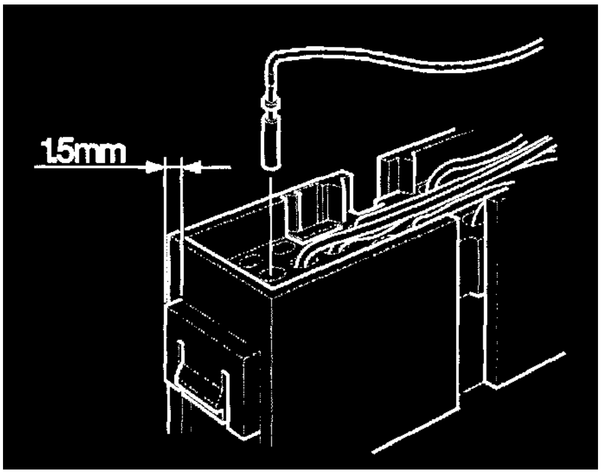
Crimp new cable terminal



The cable terminal is 1.6 Pin/Pin socket.

- Use a strip length of **3 to 4 mm** and strip the cable as described in Stripping a cable.
- Use crimp tool (green) p/n **981 4226** and crimp the cable terminal as described in **Crimping a cable terminal.**

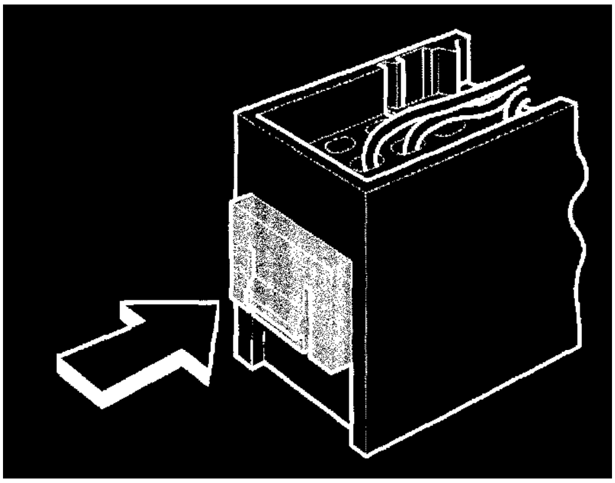
Insert new cable terminal



NOTE: The locking cover must be in the open position protruding **1.5 mm** as described in (NA2).

- Insert the new cable terminal in the housing from the cable side in the correct cavity. A "click" can be heard when the terminal is pushed fully home.

Close the housing



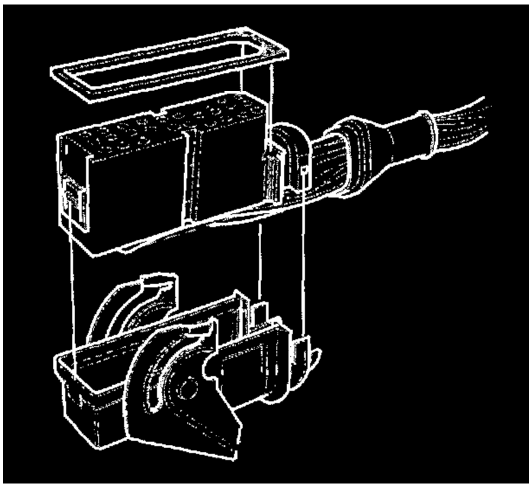
Secondary locking

- Push the locking cover back to the starting position for secondary locking of the housing. A "click" indicates the lock has engaged.

Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



- Replace the connector cover. Check that the catches (3 catches) engage.
- Replace gasket seal (only for socket housings).
- Push on rubber seal over housing

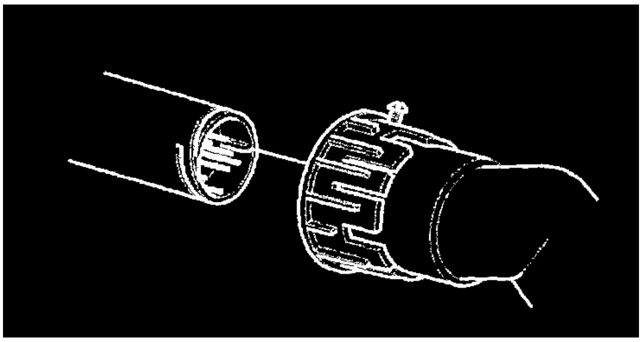
Example 2

Example 2A

Socket housings p/n 6849321-2
Replacement of cable terminal in socket housing

NOTE: For equivalent pin housing, see Example 2B.

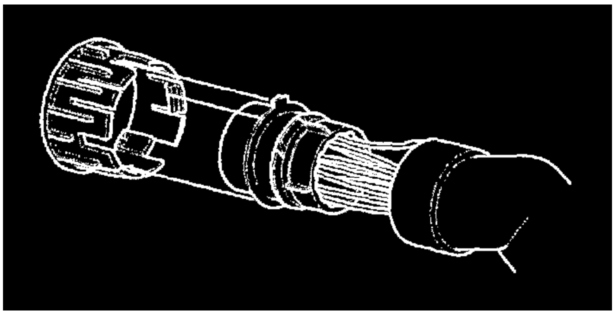
Separate the connector pin and socket housings



If the connector is intact then first remove the socket housing (female) from the pin housing (male). See illustration.

- Undo the locking screw. (Some connectors have no locking screw).
- Turn the connector housing retaining ring (outer ring) counterclockwise.
- Separate the two halves of the connector.

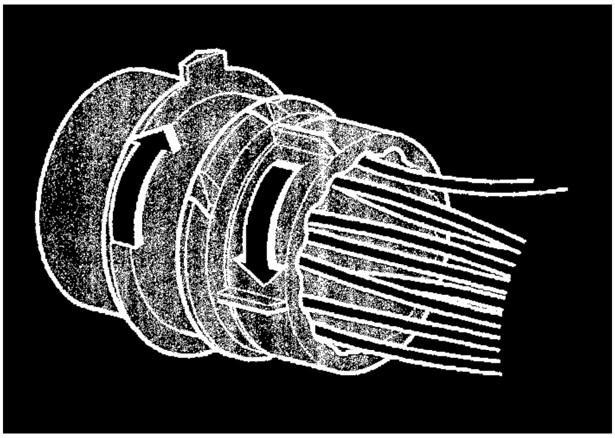
Extract socket housing



Extract socket housing from the connector housing as follows:

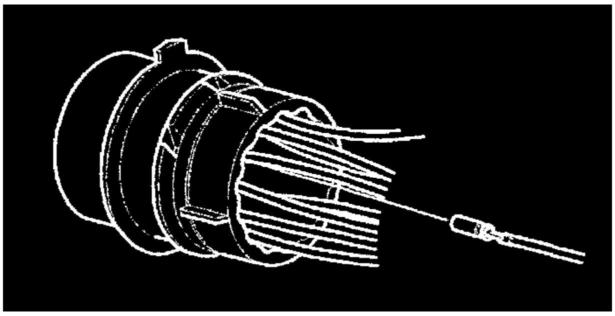
- Remove retaining ring from the connector by inserting a small screwdriver from the rear of the ring and pry open the 3 catches.
- Pull back rubber seal on the cables.

Open socket housing



- Open the socket housing secondary locking by turning the two rings shown in the illustration. A "click" indicates that the secondary locking has disengaged.

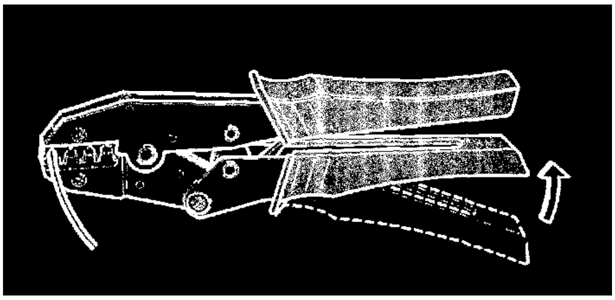
Extract the cable terminal



No terminal removal tool is required.

- Extract the cable terminal from the rear of the housing by tugging on the cable.

Crimp new cable terminal

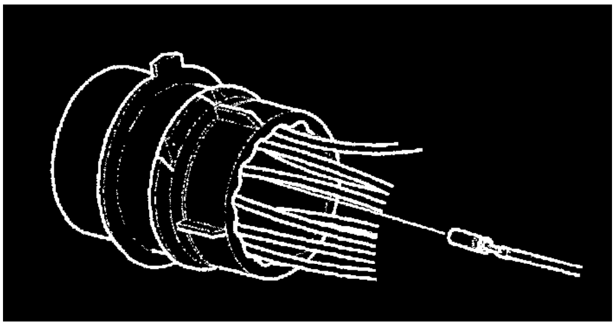


The cable terminal is 1.6 Pin socket.

- Use strip length **3 to 4 mm** and strip the cable as described in section **Stripping a cable.**
- Use crimp tool (green) pin **981 4226** and crimp the cable terminal as described in Crimping a cable terminal.

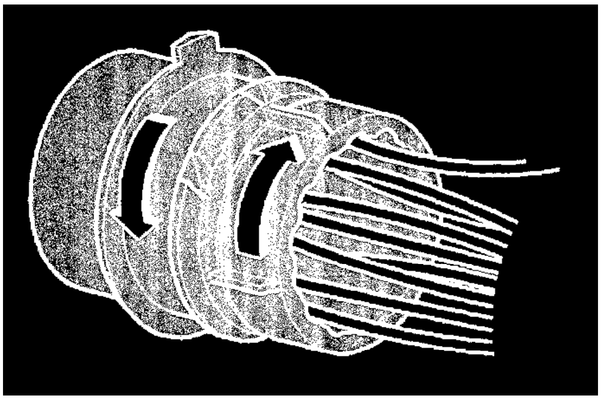
Insert new cable terminal in housing

NOTE: The housings secondary locking must be open, see (NB3).



- Insert the new cable terminal in the correct socket housing cavity from the cable side. A "click"" indicates that the catch has engaged.

Close socket housing

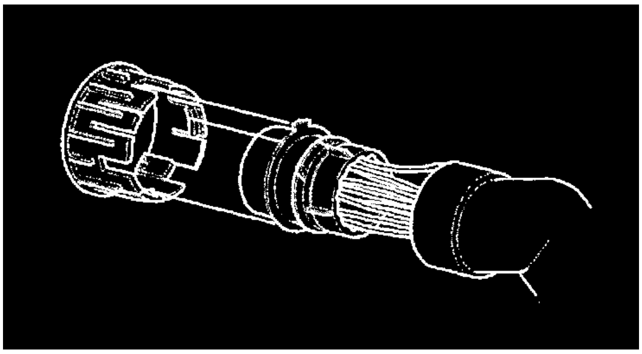


Secondary locking
- Activate secondary locking by Turing both the ring sections as shown in the illustration. A "click" indicates that the secondary locking has engaged.

Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



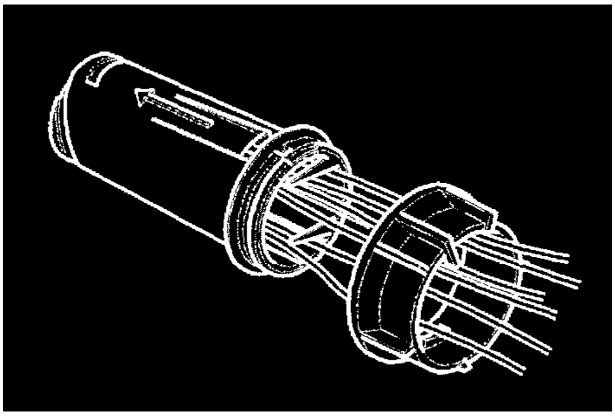
- Push the rubber seal on to the socket housing.
- Replace the retaining ring on the socket housing.

Example 2B

Pin type housing p/n 3545784-5
Replacement of cable terminals in pin housing

NOTE: For equivalent socket housing, see Example 2A.

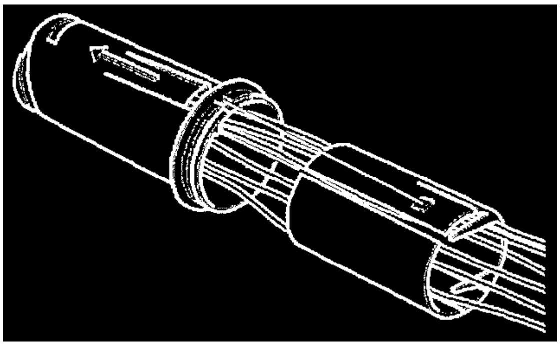
Separate the pin and socket housings of the connector



If the connector is intact:

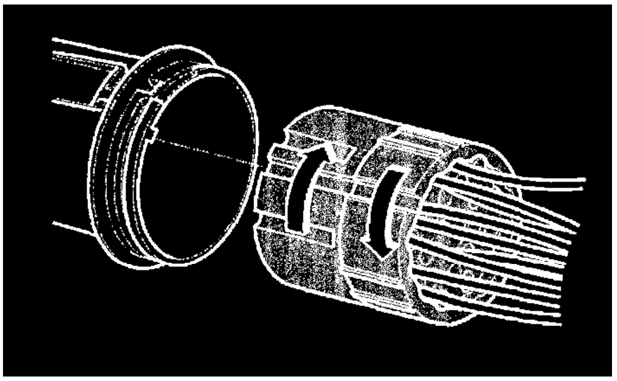
- First disconnect the socket housing from the pin housing as m **Example 2A.**

Open the connector



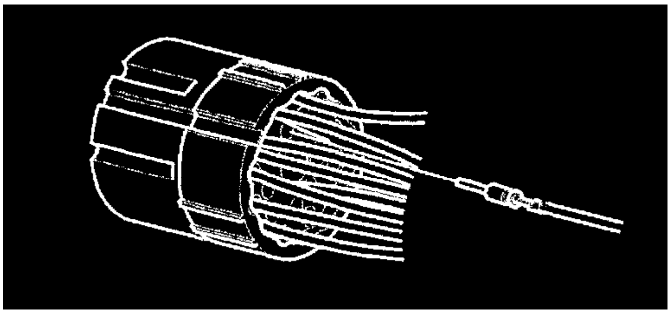
- Turn the retaining ring on the connector counterclockwise until a "click" indicates it has disengaged.
- Remove the retaining ring and pull back on the cables.
- Release the two catches on the sides using a narrow screwdriver.
- Withdraw the inner tube and pull back on the cables.

Open the pin housing



- First remove the pin housing from the outer shell.
- Open the pin housing secondary locking by Turing the two rings as shown. A "click" indicates that the secondary locking has disengaged.

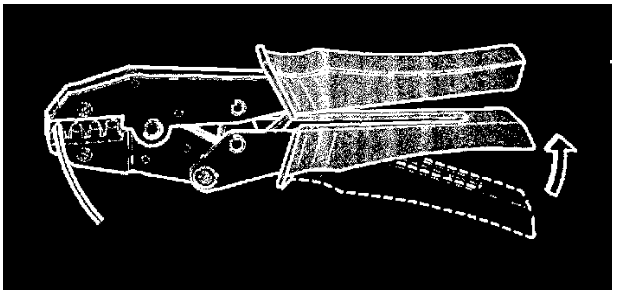
Extract the cable terminal



No terminal removal tool is required.

- Extract the cable terminal from the rear of the housing by pulling on the cable.

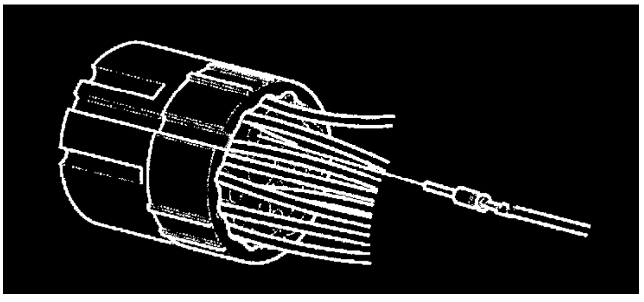
Crimp new cable terminal



The cable terminal is 1.6 Pin.

- use strip length **3 to 4 mm** and strip the cable as described in stripping a cable.
- Use crimp tool (green) p/n **9814226** and crimp the cable terminal as described in Terminal crimping.

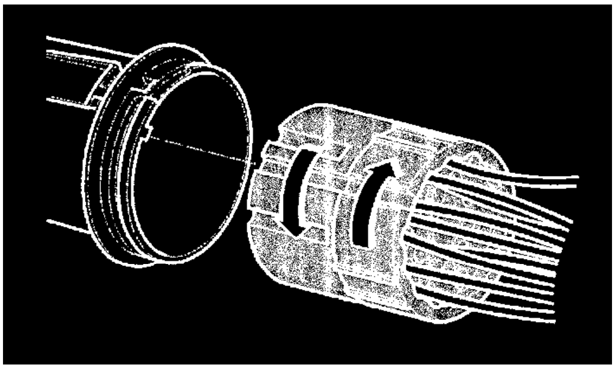
Insert the new cable terminal in housing



NOTE: The housing secondary locking must be open as in **(NC3).**

- Insert the new cable terminal in pin housing from the cable side in the correct cavity. A "click" indicates that the catch has engaged.

Close socket housings



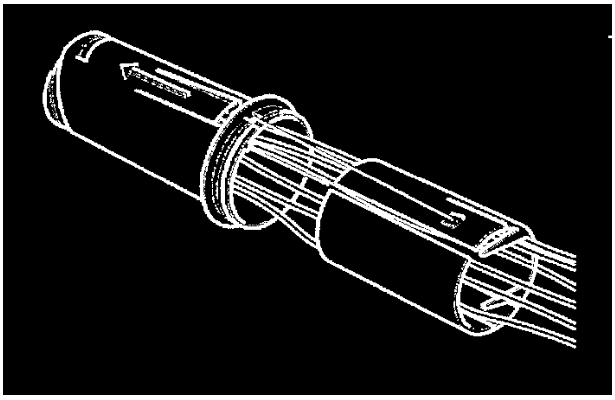
Secondary locking

- Close the housing and activate secondary locking by turning both the ring sections as shown in the illustration. A "click" indicates that the secondary locking has engaged.

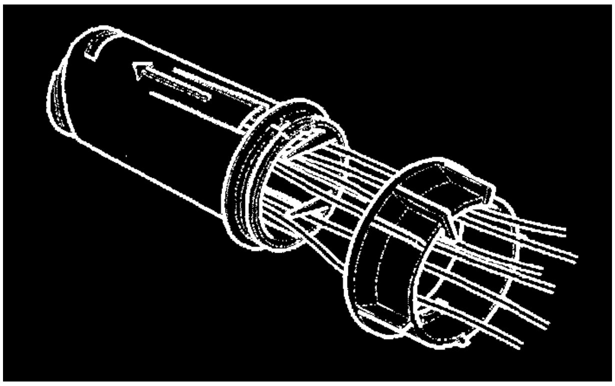
Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



- Insert the pin housing in the outer shell. The tab slot should be lined up with the guide groove.
- Insert the inner tube in the outer shell. Line up the slot with the guide groove. Press the inner tube firmly in so the catches engage in the correct position.



- Reinstall the retainer ring on the pin housing and turn the ring clockwise until the catch engages.

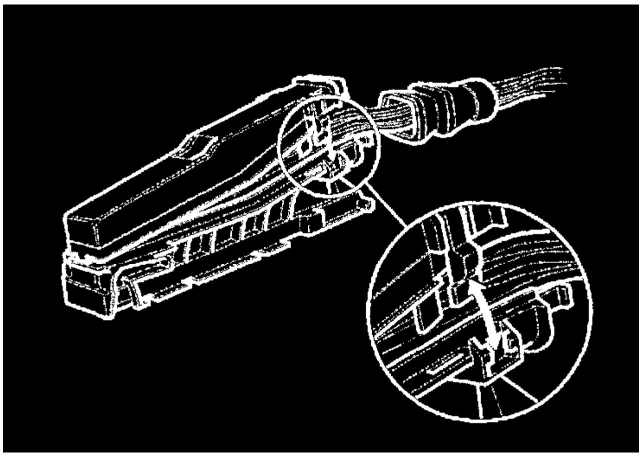
Example 3

Example 3

Socket type housing p/n 3523276-8

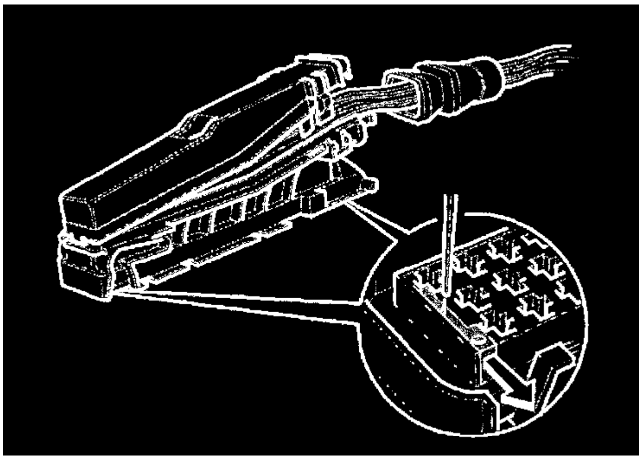
Replacement of cable terminals

Remove the connector cover



- Pull the rubber sleeve back on the cables.
- Keep both catches pressed in (one on each side) and pull the connector cover up.
- Remove the connector cover from the housing.

Open the housing



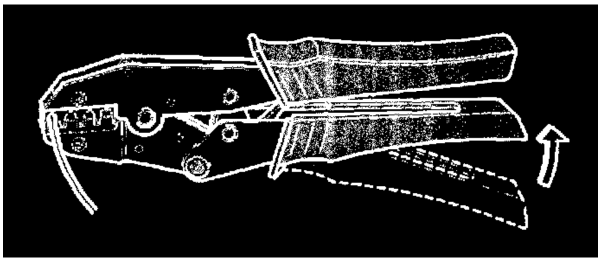
Release the secondary locking catches (one on each side) as follows:

- Insert a narrow screwdriver blade as shown. Carefully bend back the catch at the edge and push the secondary locking slightly forwards (approx. **1 mm**).

Extract the cable terminal

Follow the instructions in when the cavity opening has two extraction grooves.

Crimp new cable terminal



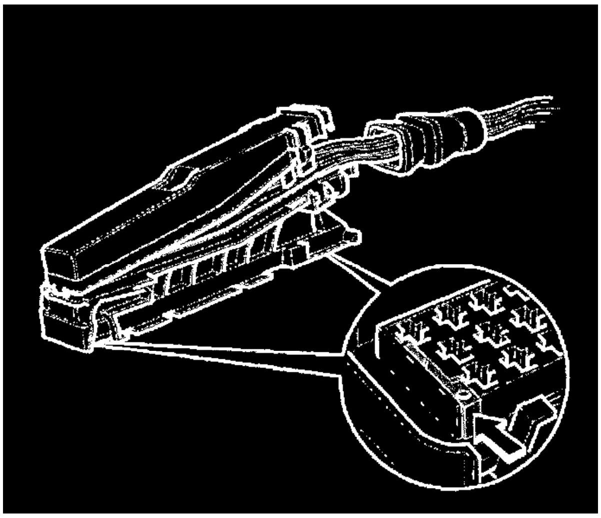
Crimp the cable terminal as in Crimping a cable terminal. Do not forget to install a new seal on the cable.

Insert the new cable terminal in the housing

NOTE: The housing secondary locking must be slightly open as in (ND2).

- Insert the new cable terminal in the housing from the cable side checking that it is in the correct cavity. A "click" indicates the catch has engaged.

Close the housing

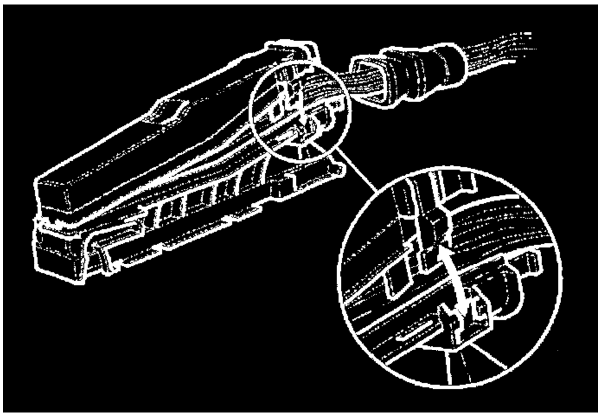


Secondary locking
Press the secondary locking catches (one on each side) slightly to their original position.

Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



- Replace the connector cover by depressing the locking catches (one on each side).

Check that the catches have engaged properly.

- Push rubber seal into place.

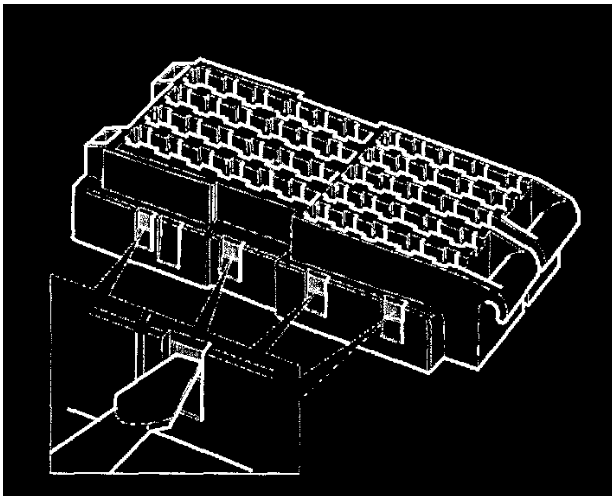
Example 4

Example 4

Socket type housings pin 1362989-4, and corresponding pin housings

Replacement of cable terminals

Open the housing



Hold the housing as shown and open the secondary locking as follows:

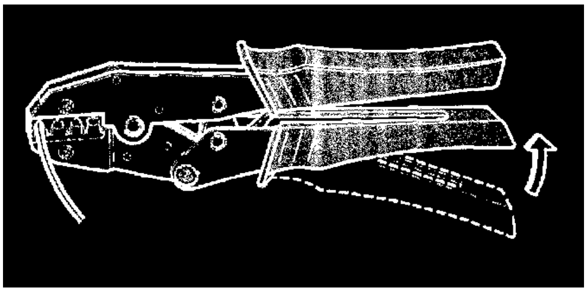
- Using a small screwdriver press the catches on the secondary locking in from the side shown in the illustration. A "click" will be heard.

When the secondary locking is pressed in the locking cover slides open and the cavities open.

Extract the cable terminal

Follow instructions in cavity opening with one extraction groove.

Crimp new cable terminal



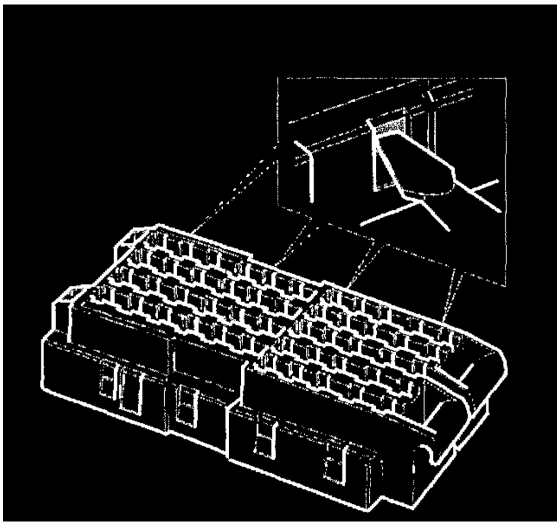
Crimp new cable terminal as in crimping! a cable terminal.

Insert the new cable terminal in the housing

NOTE: The housing secondary locking must be in the open position as in (NE1).

- Insert the new cable terminal in the housing from the cable side checking that it is in the correct cavity. A "click" indicates that the locking tab has engaged.

Close the housing



Hold the housing as shown and close it by activating the secondary locking as follows:

- Using a small screwdriver press in the catches on the secondary locking from the opposite side. A "click" indicates that the secondary locking has engaged.

General Information

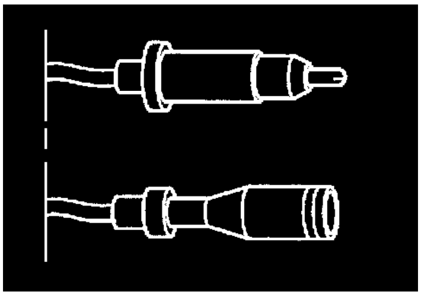
Cable terminals, different types

WARNING: SRS No cable repair or other repair work may be carried out on the SRS system wiring. Follow the instructions for repair work in the Restraint Systems.

The part numbers of the cable terminals are not given here. Look at the picture on the inside of the box containing the cable terminals, check the Contents table in the Special Tools and the Spare Parts Catalogue for the model concerned.

Cable terminals are divided up into the following main groups
There are many different types of cable terminals intended for different purposes depending on current, mechanical stress, temperature, vibration etc.

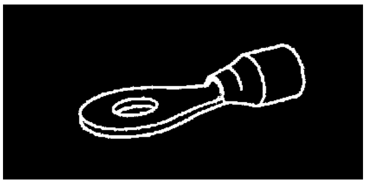
Moisture proof cable terminals



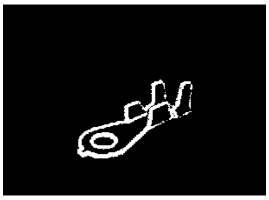
Moisture proof cable terminals are used where there is a risk of oxidation.
- Moisture proof cable terminals complete with cables are available both as pin and as socket fittings.

Note that these cable terminals are supplied as a complete spare part, ready-pressed and crimped with molded plastic covers on the cable.

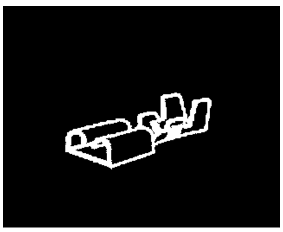
Ring cable terminal (and forked cable terminal)
Cable terminals intended for use with screws/bolts and available in the following variants:



- Insulated and uninsulated
- Closed crimping connection and open crimping connection
- Ring cable terminals are available in sizes to fit screws/bolts from M3.5 to M16



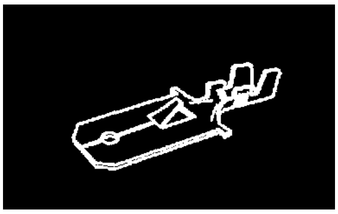
Receptacle terminals
Receptacle terminals are available in different variants:



- With locking tab and without locking tab.

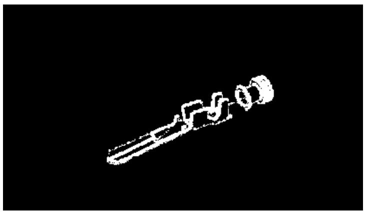
- With dimpling and without dimpling.
- In sizes 2.8, 4.8, 6.3, 8 and 9.5
- The most common sizes are 4.8 and 6.3

Tab
Tab terminals are available in different variants:



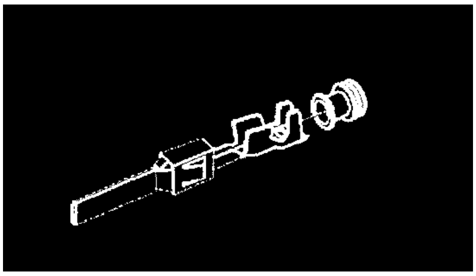
- With locking tab and without locking tab.
- In sizes 2.8, 6.3 and 9.5
- The most common sizes are 2.8 and 6.3

Tab sws (Single Wire Seal)



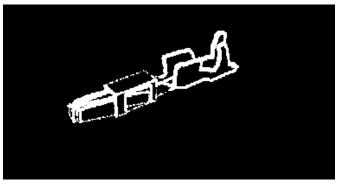
- **sws** designation means that a seal must be installed in the insulation wings.
- Tab sws is available in size 2.8

Tab steel sws



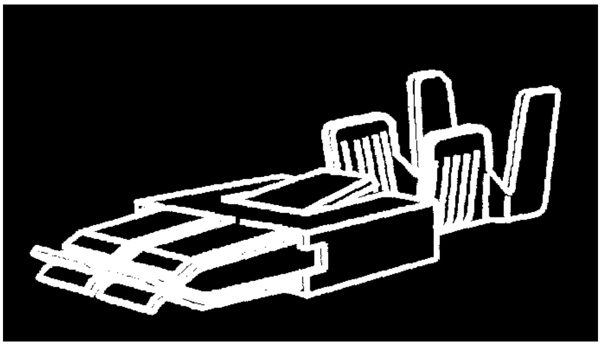
- **steel** The "steel" designation means that the cable terminal tab or pin is reinforced with a steel spring.
- **sws** The "sws" designation means that a seal must be used in the insulation wings.
- Tab steel sws is available in size 2.8

Timer



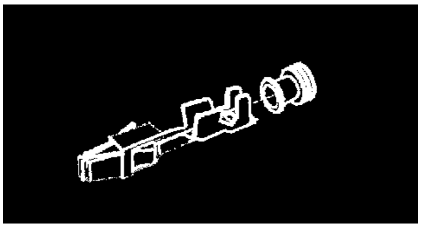
Timer is a socket type cable terminal used with a tab terminal. Timer terminals are found in multiple pin housings.

- Timer terminals variants can be found with 1 or 2 locking tabs.
- Timer are available in sizes 1.6, 2.8 and 6.3



1.6 Timer are also known as Microtimer.
2.8 Timer are also known as Minitimer.
6.3 Timer are also known as (Power)timer.

2.8 Timer sws

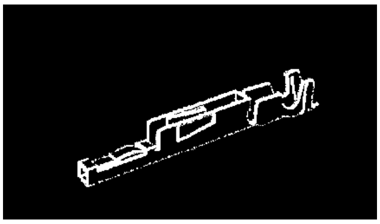


Timer is a socket type cable terminal used with a tab terminal. Timer terminals are found in multiple pin housings.

- **sws** The sws designation means that a seal must be used on the insulation wings.

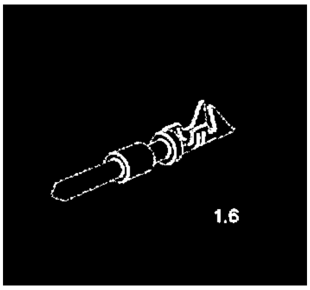
0.64 Socket

Cable terminal 0.64 is available in one variant:

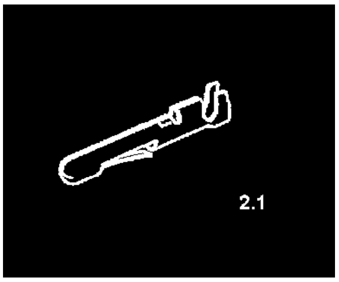


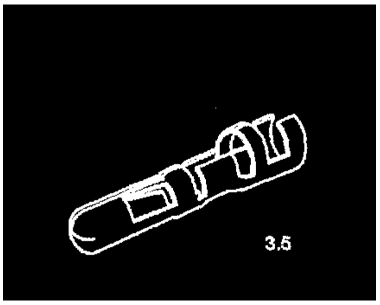
- With 2 locking tabs on the upper side
- Only 0.64 socket can be replaced. The equivalent 0.64 pin is mounted as a fixed part on components.

Pin terminals
Pin terminals are available in a number of variants:

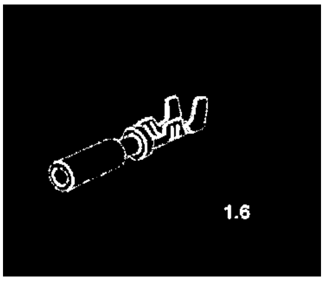


- Without locking tab, with 1 locking tab and with 2 locking tab.
- In sizes 1.6,2.1 and 3.5 (A selection of pin terminals is shown in the illustration on the left)
- The most common sizes are 1.6 and 3.5

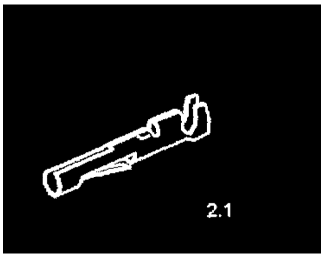


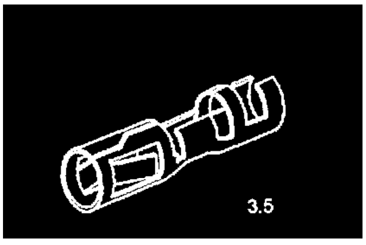


Socket terminals
Socket terminals are available in a number of variants:



- Without locking tab, with 1 locking tab and with 2 locking tab.
- In sizes 1.6, 2.1 and 3.5 (A selection of socket terminals is shown in the illustration on the left)
- The most common sizes are 1.6 and 3.5





Primary Locking In General

Primary locking in general

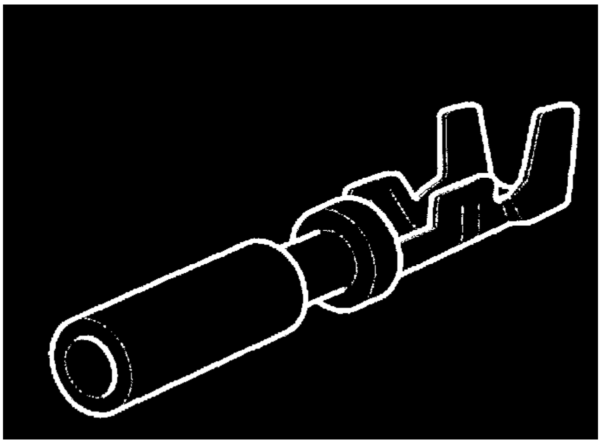
The cable terminal is retained in position in the cavity using different types of locking catches. These locking catches are called primary locking.

There are two main types of primary locking:

- Primary locking in cavities
- Primary locking on cable terminals

Primary locking in cavities

Cable terminals without locking tab

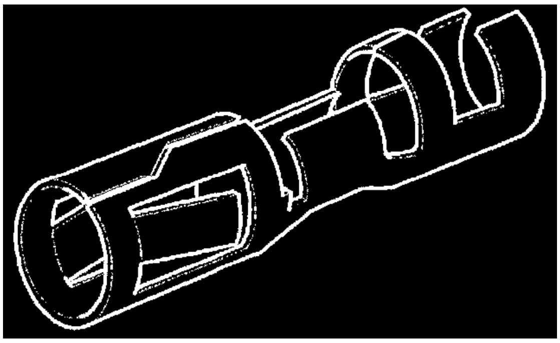


The primary locking is permanently located in the housing as an integral part of the cavity.

Cable terminals without locking tabs are used with housings which have integral primary locking in the cavities. An example is the 1.6 Pin/Socket

Primary locking on cable terminals

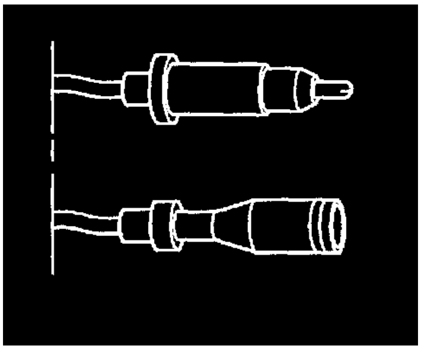
Cable terminals with locking tab



The primary locking tabs are located on the cable terminals.

Cable terminals can have either one locking tab (single primary locking) or two locking tabs (double primary locking).

Without primary locking

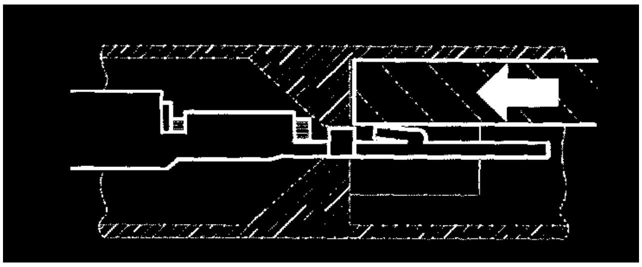


Some combinations of housing/cable terminal have no primary locking with lockable lock catches/locking tabs.

The cavities in the housing in these cases have integral catches which hold the cable terminals in place. When the secondary locking on the housing is opened the cable terminals can be lifted out No terminal removal tool is needed.

An example is a housing with moisture proof cable terminals.

Release primary locking

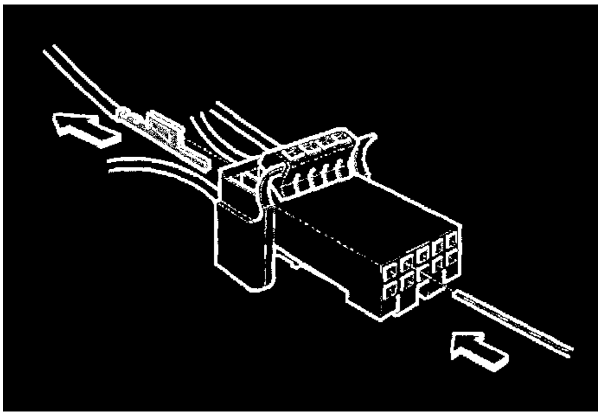


A terminal removal tool is usually required to release the locking tab/locking catch so that the cable terminal can be extracted and removed.

Using Terminal Removal Tools

Using terminal removal tools

Choosing the correct tool
General

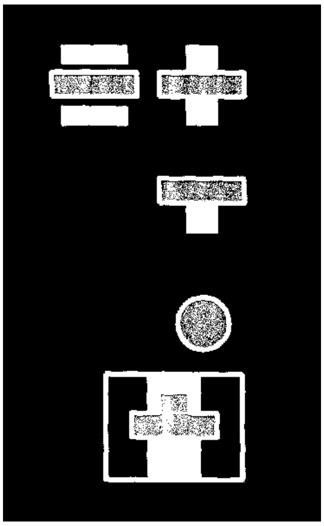


It is important to use the correct terminal removal tool when removing cable terminals. The tools are included in the repair kit or supplementary kits supplied in the future.

This describes how to choose the correct tool by inspecting the cavity opening and the shape of the cable terminal.

If the type of cable terminal is already known, the table for cable terminals and tools in the "Special tools" can be used.

Cavity opening and cable terminal profiles



The cavity opening in the housing has an easily identifiable profile on the connector side.

Turn the housing so that the connector side is visible. How does the cavity profile look?

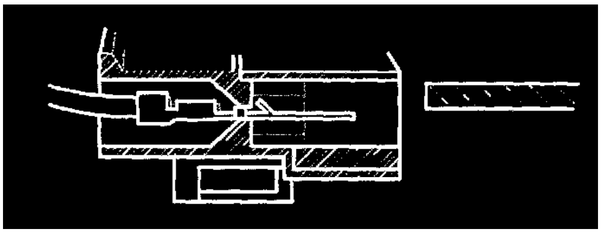
The cavity opening may be as follows:

- With one extraction groove
- With two extraction grooves
- A square profile
- A round profile

- Or housings with half-open connector sides (the cable terminal is partly exposed with a visible locking tab in the cavities).

Using terminal removal tools

NOTE: If the receptacle housing has a secondary locking, this must be in the open position. Always push the cable terminal forward in the cavity first. Push it towards the connector side of the receptacle housing before inserting the terminal removal tool.



The terminal removal tool shown in the following has been inserted in the cavity from the connector side of the housing.

The cable terminal is extracted by pulling on the cable from the cable side of the housing.

The housing cavities are numbered on the inside and

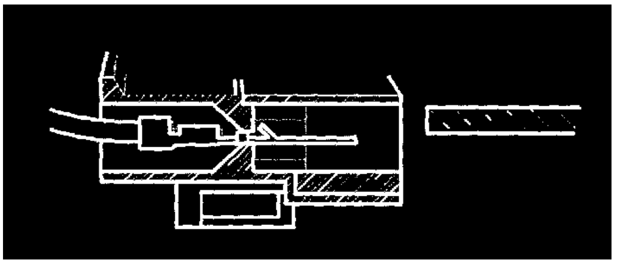
outside with the terminal numbers. Always check that the correct cable terminal has been removed.

If a wiring diagram is used for fault-tracing / repairs, check it against both the terminal numbers on the housing and the cable color code.

Removing cable terminals with locking tabs

NOTE: If the receptacle housing has a secondary locking, this must be in the open position. Always push the cable terminal forward in the cavity first. Push it towards the connector side of the receptacle housing before inserting the terminal removal tool.

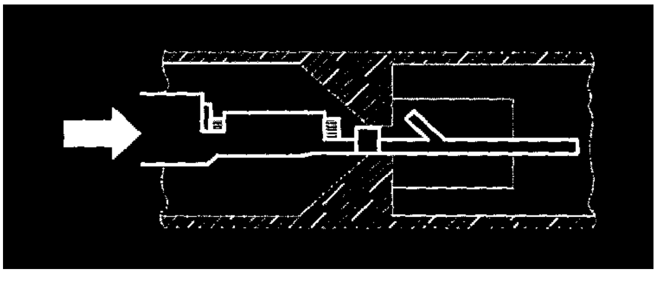
The locking tab secures the cable terminal



The illustration shows the location of the cable terminal in the housing with the locking tab (the primary locking) held by a catch in the cavity.

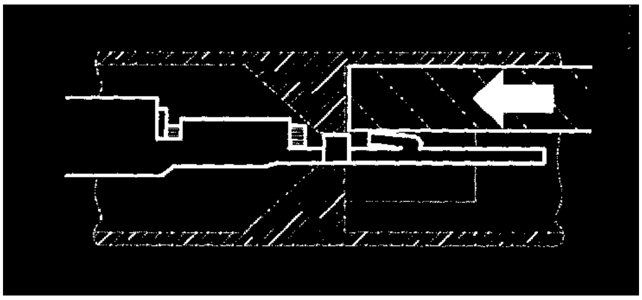
NOTE: The text describes, and the illustration shows, cable terminals with a locking tab. The same principle also applies to cable terminals with two locking tabs.

Release the locking tab for the cable terminal as follows

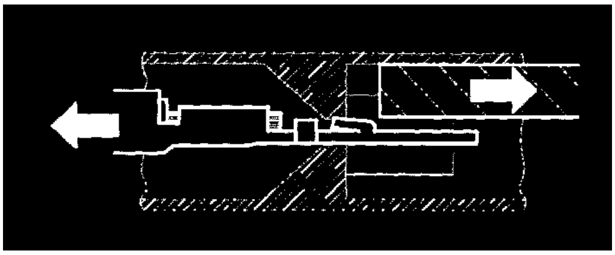


To extract the cable terminal, the locking tab must be released (held down) with a terminal removal tool.

1. Press the cable terminal in the cavity forwards as far as it will go. This will free the locking tab from the cavity catch.



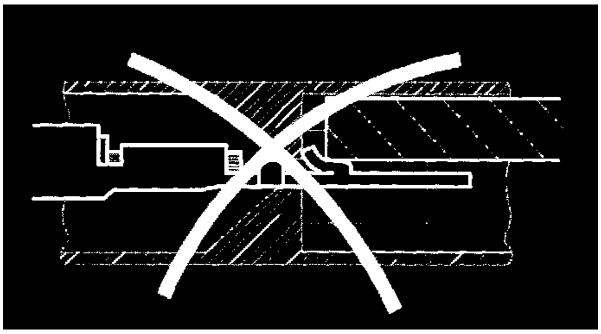
2. Insert the terminal removal tool in the cavity from the connector side of the housing. The tool presses down the locking tab. This allows the cable terminal to pass the catch in the cavity.
   Hold the terminal removal tool in place.



3. Extract the cable terminal from the cable side of the housing: Pull the cable.
   If the cable terminal is stuck, first remove the terminal removal tool.

What NOT to do

An example of an incorrect working method



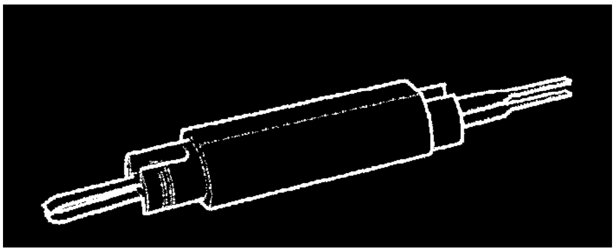
The locking tab may be damaged if the terminal removal tool is inserted in the cavity before the cable has been pushed forwards. The cable terminal could then be difficult to extract.

In the illustration beside, there is not room for the locking tab to be pressed down by the terminal removal tool. The locking tab is pressed down by the tools towards the stop lug. It bends into a shape that will lock it in position.

When the Cavity Opening Has Two Extraction Grooves

When the cavity opening has two extraction grooves

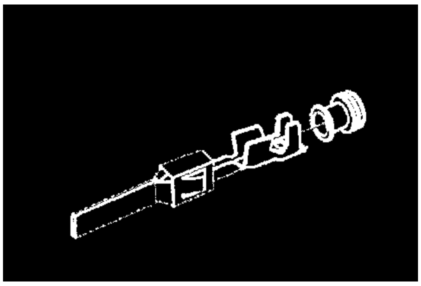
Terminal removal tool, P/N 9814228



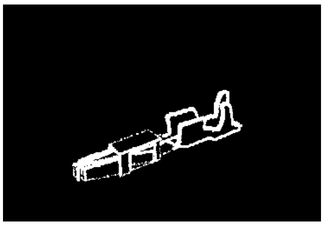
Use pointed, pincer type terminal removal tool, P/N 9814228.

This terminal removal tool is used for cable terminals with two locking tabs:

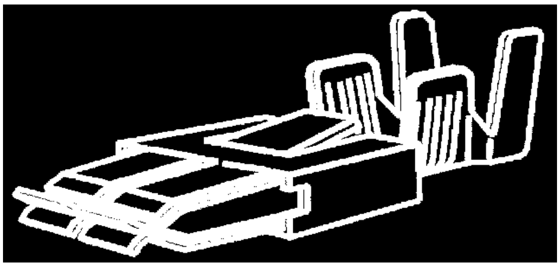
A 2.8 Flat pin steel



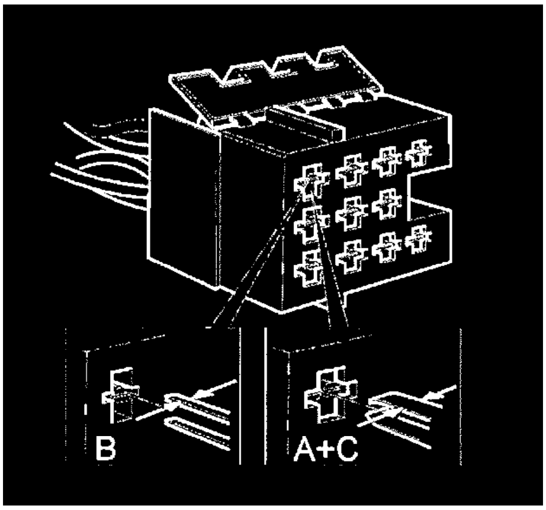
B 2.8 Timer and 2.8 Timer



C 6.3 Timer



Choose the terminal removal tool with the correct width



There are two sizes of cavity opening. See the example in the illustration.

Select the terminal removal tool with ends which match the extraction groove in the cavity opening.

- The narrow ends are **0.9 mm** wide.
- The broader ends are **1.6 mm** wide.

Press the cable terminal in the cavity forwards as far as it will go. This will free the locking tab from the cavity catch.

Insert the terminal removal tool in the groove over and under the cable terminal. Extract the cable terminal.

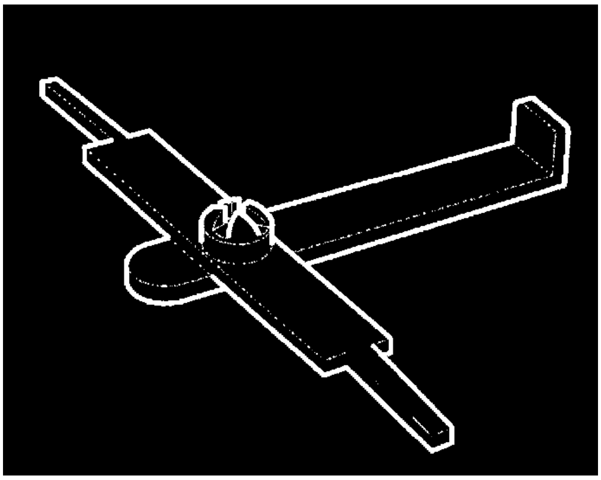
Always follow the instructions for using terminal removal tools. These instructions give the correct working procedure.

- Proceed for replacing a cable terminal instructions about how to crimp a new cable terminal.

Cavity Opening With One Extraction Groove

Cavity opening with one extraction groove

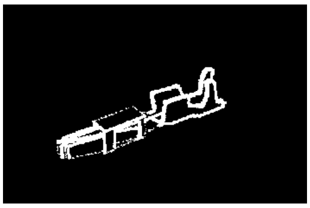
Terminal removal tool, p/n 9814229



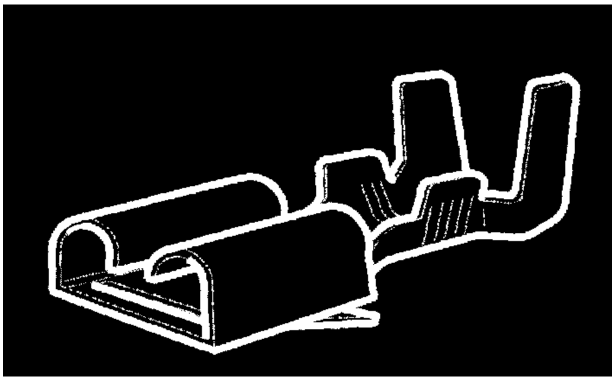
A terminal removal tool p/n 9814229 with a single blade type tip must be used.

This terminal removal tool is used for cable terminals with one locking tab:

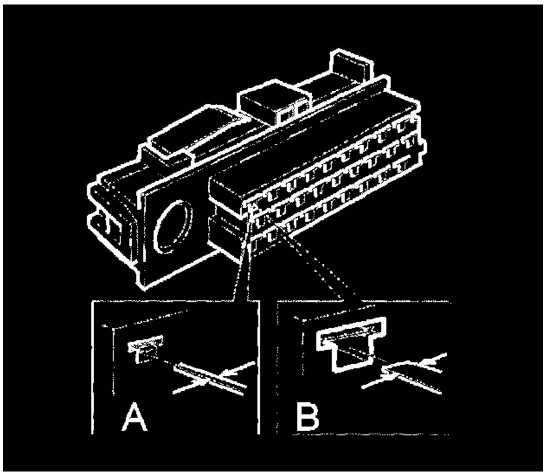
A 2.8 Timer



B 6.3 Receptacle terminal



Choose the terminal removal tool with the correct width



There are two sizes of the cavity opening. See illustration.

Choose a terminal removal tool with ends which match the cavity opening extraction groove.

- The narrow ends are **1.5 mm** wide.
- The wider ends are **2.7 mm** wide.

Press the cable terminal in the cavity forwards as far as it will go to free the locking tab from the cavity catch. Insert the terminal removal tool in the groove as illustrated.
Always follow the instructions, when secondary locking is of the lid type which give the correct working procedure.

- Proceed to replacing a cable terminal. Replacing a cable terminal in order to crimp a new cable terminal.

Housing With Half-Open Contact Side

Housing with half-open contact side

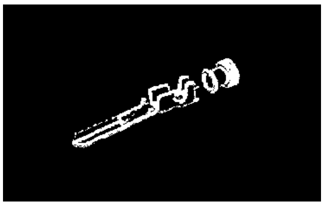
(When the cable terminals are partly exposed with the locking tabs visible in the cavities)

Housings of this type have partly exposed cable terminals on the contact side with the locking tabs visible in the cavities.

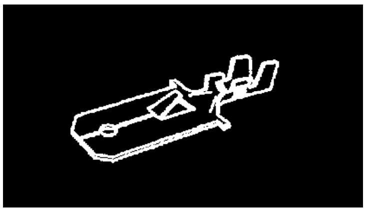
Usually this type only includes tab cable terminals with one locking tab.

Illustrated are:

A 2.8 Tab sws

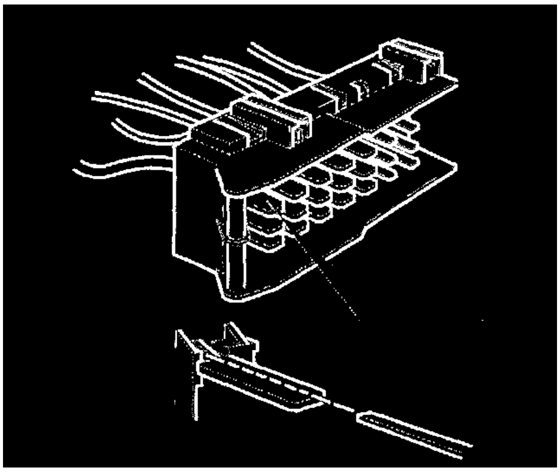


B 6.3 Tab (also in sizes 2.8 and 9.5)



Use terminal removal tool p/n **981 4229.**

The illustration below shows a housing with tabs. To extract pin cable terminals read the instructions at Housings with round cavity opening.



Choose a terminal removal tool with an end that matches the cavity opening.

- The narrow ended tool is **1.5 mm** wide.
- The wider end is **2.7 mm** wide.

Press the cable terminal in the cavity forwards as far as it will go to free the locking tab from the cavity catch.

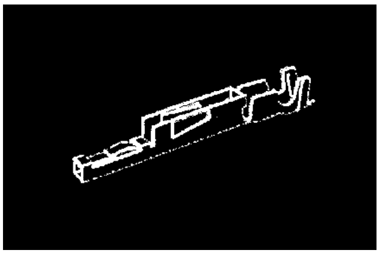
Insert the terminal removal tool in the groove as illustrated. Always follow the instructions for using terminal removal tools which give the correct working procedure.

Replacing a cable terminal in order to crimp a new cable terminal.

Housings With Square Cavity Openings

Housings with square cavity openings

Terminal removal tool

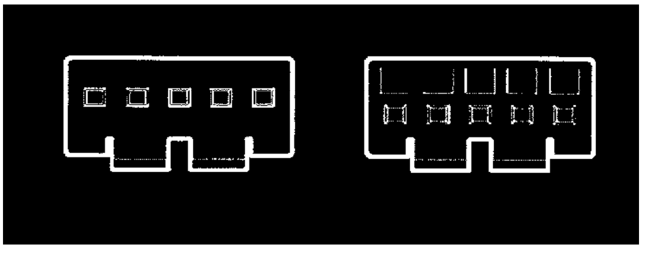


When a housing has 0.64 sockets use a terminal removal tool with a narrow square end (**1.2 x 1.2 mm**).

Shown is a 0.64 socket cable terminal.

The terminal removal tool for 0.64 sockets is not included in the repair kit p/n **981 4235.**

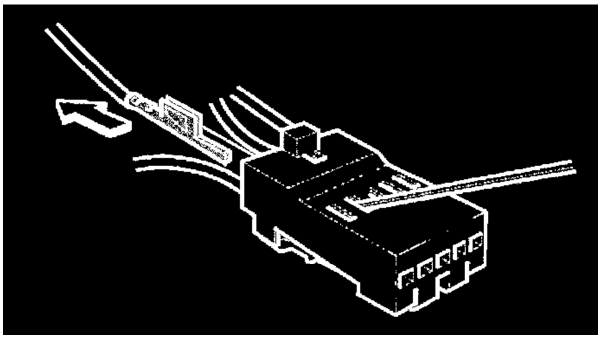
Single or double row of cavities



There are two main types of 0.64 housings. Check the contact side of the housing. Does the housing have a single or double row of cavities?

- Proceed to the appropriate type below.

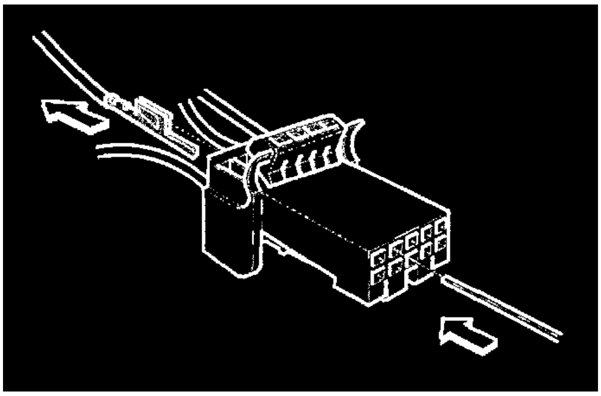
Single cavity row



For a single row of cavities the terminal removal tool is inserted in the open groove on the upper side for each terminal.

Press the cable terminal forwards in the cavity. Insert the terminal removal tool end between the cable terminal locking tabs and extract the cable terminal.

Double cavity row



For a double cavity row the terminal removal tool is inserted from the contact side in the upper row of cavities for the terminal to be extracted.

The lower cavities are used to fasten the cable terminals in place.

Press the cable terminal forwards in the cavity. Insert the terminal removal tool and extract the cable terminal.

Proceed

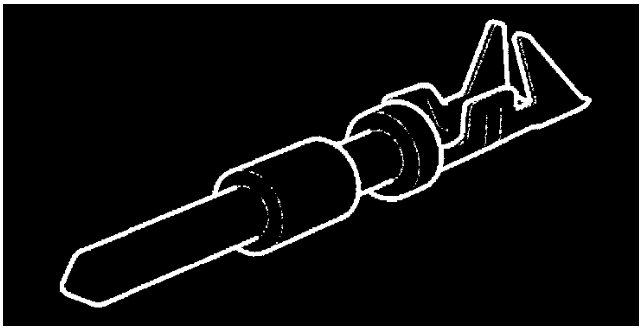
Replacing a cable terminal in order to crimp a new cable terminal.

Housings With Round Cavity Opening

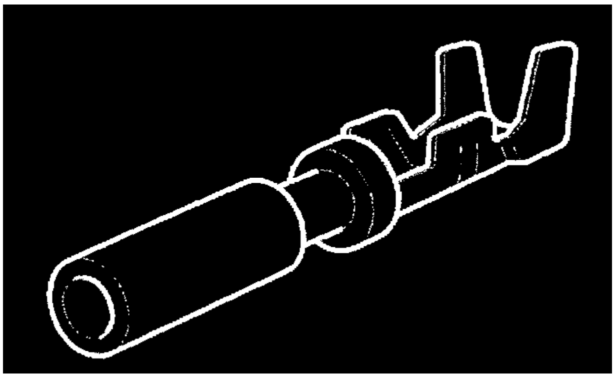
Housings with round cavity opening

Cable terminals that are extracted without using a terminal removal tool

1.6 Pin/Pin sockets

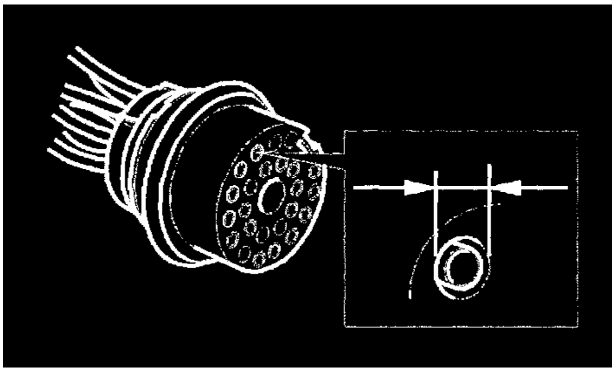


For housings for 1.6 Pin/pin sockets no terminal removal tool is used.
The cable terminals have no locking tabs. The primary locking is located in the cavities.



With the secondary locking opened the cable terminals can be extracted from the cable side by pulling the cable. No terminal removal tool is required.

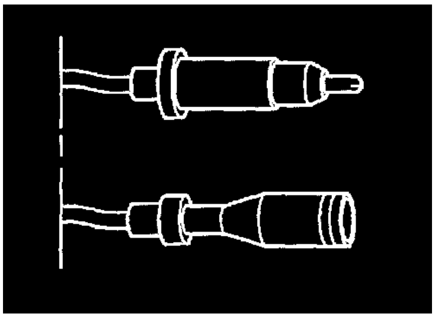
- See **Example 1** and **Example 2A** for the procedure.



The cavity opening for 1.6 Pin/Pin sockets is the smallest of the round cavity types.

Replacing a cable terminal in order to crimp a new cable terminal.

3.5 Moisture proof pin/pin sockets

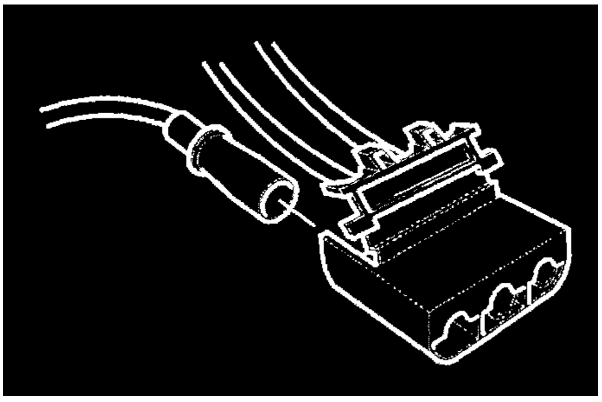


Housings intended for moisture proof pin/pin socket terminals do not require a terminal removal tool.

The cable terminals have no primary locking. Integral catches in the cavities retain the terminals in the housing.

With the secondary locking opened the cable terminals can be extracted from the cable side of the housing by lifting them up.

No terminal removal tool is required.

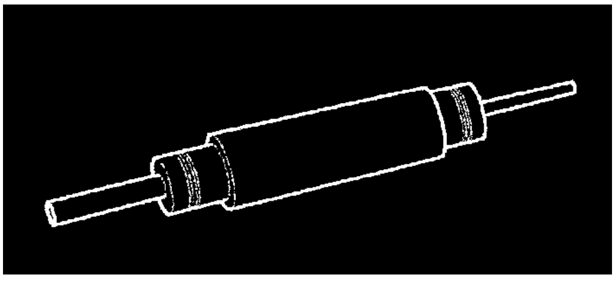


Moisture proof pin/pin sockets are ready-to-use with the cable fitted and are available as a complete spare part.

Cable terminals that are extracted with terminal removal tools

2.1 Pin/Pin sockets and 3.5 Pin/Pin sockets

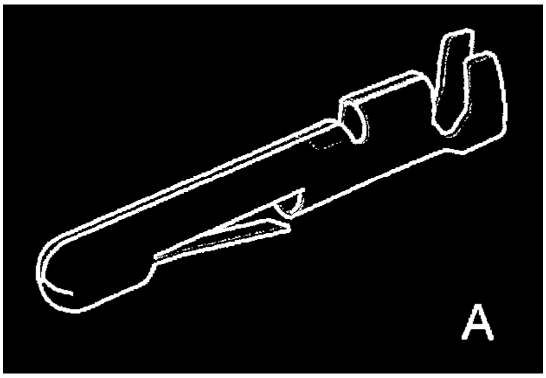
Terminal removal tool, pin 981 4230

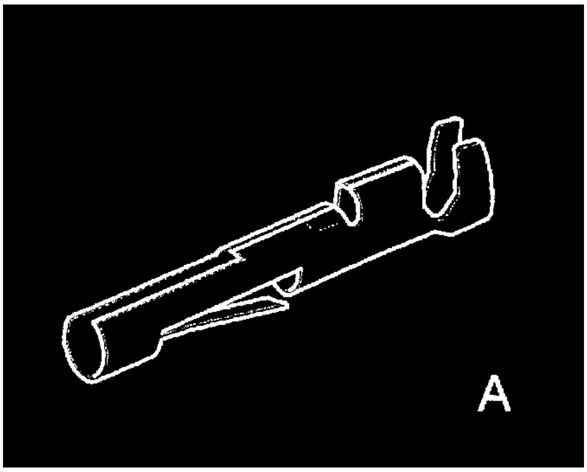


For round cavity openings a terminal removal tool with a hollow end is used.

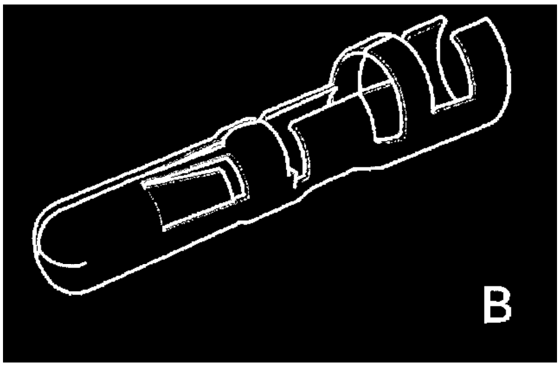
The terminal removal tool is used for the following cable terminals:

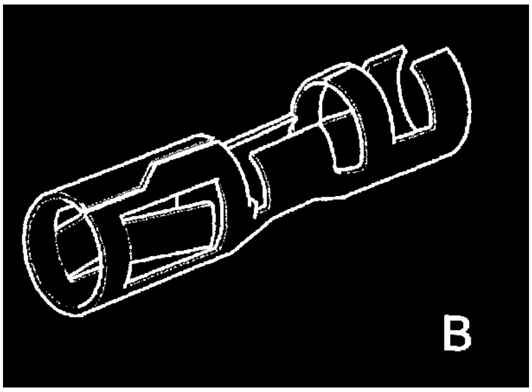
A 2.1 Pin/Pin sockets



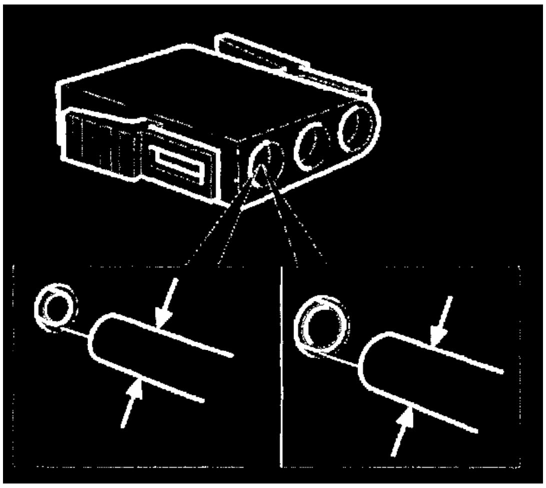


B 3.5 pin/pin sockets





Choose a terminal removal tool with the correct diameter



There are two cavity opening sizes. See illustration.

Choose a terminal removal tool which matches the cavity opening.

- The smaller end is for diameter 2.1
- The larger end is for diameter 3.5

Press the cable terminal in the cavity forwards as far as it will go to free the locking tab from the cavity catch.

Insert the terminal removal tool in the groove as illustrated.

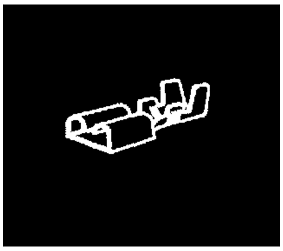
Always follow the instructions for using terminal removal tools which give the correct working procedure.

Replacing a cable terminal in order to crimp a new cable terminal.

Single Terminal Housings

Single terminal housings

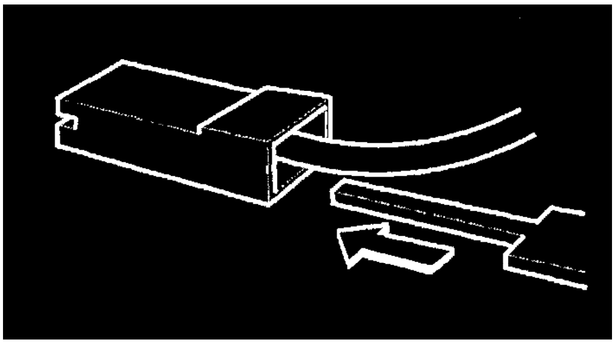
Cable terminals without locking tab



Single terminal housings without a locking tab such as receptacle terminals.

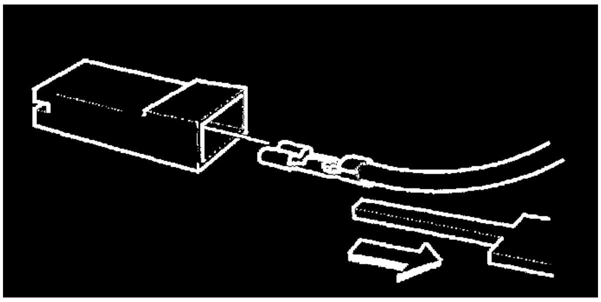
The terminal removal tool is inserted from the cable side.

Use terminal removal tool p/n **981 4229**.



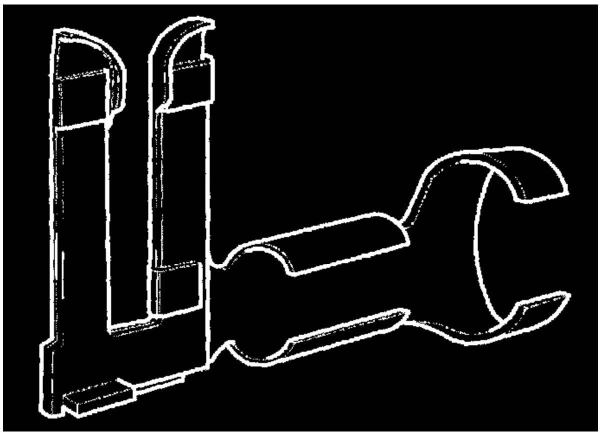
Insert the terminal removal tool under the cable terminal from the cable side.

The point of the terminal removal tool pushes in and releases the primary locking (locking catch) in the housing cavity.

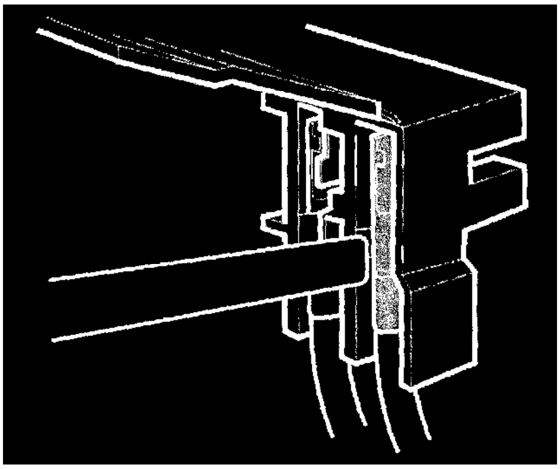


- Withdraw the cable terminal and terminal removal tool at the same time.
- Replacing a cable terminal in order to crimp a new cable terminal.

Miscellaneous, exceptions



The housings shown here have a divided cable terminal. The cable terminals have no locking tab. The primary locking is located in the housing cavity on the cable side.



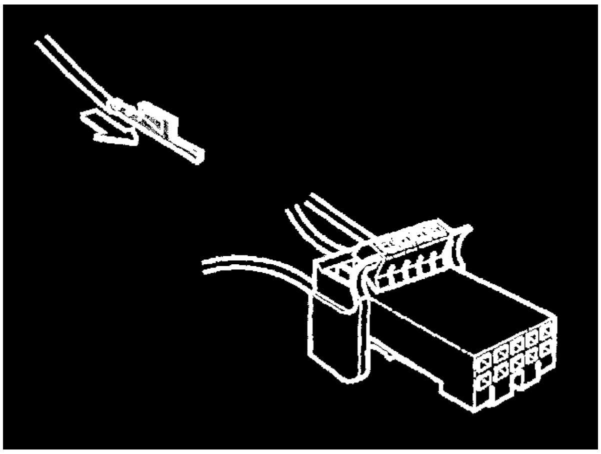
Use a feeler gauge approx. **0.15 mm.** Press in locking catch and extract the cable terminal.

Replacing a cable terminal in order to crimp a new cable terminal.

Inserting Cable Terminal In A Housing

When cable terminal is to be inserted in a housing

Keep in mind the following



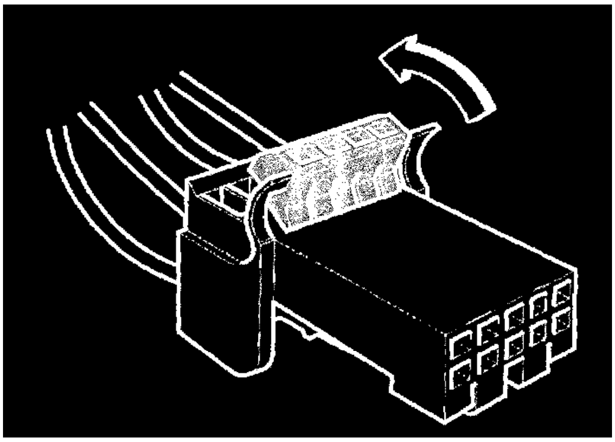
The secondary locking must always be open.
Inspect the locking tab/tabs on the terminal for damage and check that they are not pressed inward.
The cable terminal must be inserted from the housing's cable side.
Check against the wiring diagram that you have the correct cavity/position number.
Turn the cable terminal the right way up. Check against the other terminals.
When the cable terminal is inserted in the cavity a "click" is often heard when the primary locking engages.
Check that the cable terminal is firmly in place by pulling lightly on the cable.

Proceed

When the cable terminal is located in the housing it should be closed.

Closing the housing

Keep in mind the following



The secondary locking must always be adjusted to the initial position.
The secondary locking must be closed in reverse order to the way it was opened.
When the secondary locking is closed a "click" is often heard.
If it cannot be closed it might be because the cable terminal is not completely inserted in the cavity.
If the connector has a sheath, cover or rubber gasket for the housings, do not forget to reinstall it.

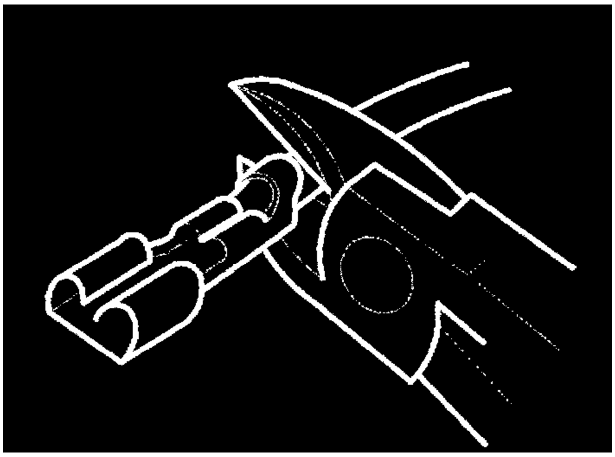
After completing the repair work

- Replace the battery negative cable terminal on the battery.
- check functions for the equipment affected by the repair.

Cutting and Checking A Cable

Cutting and checking a cable

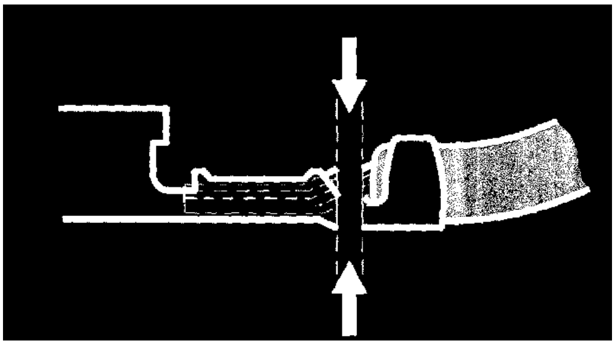
Cutting a cable



If the cable is connected to a connector first remove the cable with the cable terminal from the housing.

- Cut the cable at the cable terminal.

Minimize length loss on cables



If there Is a risk that the cable will be too short when the cable terminal is replaced follow this procedure in order to minimize length loss for tightly routed cables:

- Cut the cable terminal between the core crimp and the insulation wings.

Inspect the cable insulation

Check if there is
- Visible mechanical wear or damage from excessive loadings.
- Visible damage from excessive electrical loadings in the form of discoloration or melted material.

If the damage is only at the end of the cable
Cut off the damaged section and check that the length remaining is sufficient.

If the cable is too short it must be renewed or a new section of cable added
- Replacement of cable
- See Splicing using insulated moisture proof butt connector.

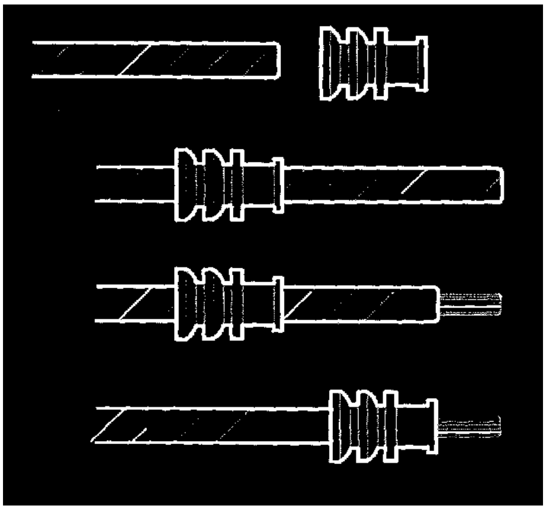
If there is damage along the cable

Replace the cable with a new one
- Replacement of cable. For small areas of damage such as scratches (not deep ones) it can be enough to apply reinforcement to the cable insulation by using a heat-shrinkable tubing over the damaged area. If good sealing properties are required then either a shrinkable tubing with internal coating of glue or self-vulcanizing tape p/n 3540116-5 must be used.

Stripping A Cable

Stripping the cable

Stripping the cable for a cable terminal



If the cable is to be stripped of the end insulation prior to terminal crimping in a cable terminal, check if a seal is required for that type of cable terminal.

- A description of which cable terminals require seals can be found in Seal sws and plug.

If no seal is to be used on the cable terminal

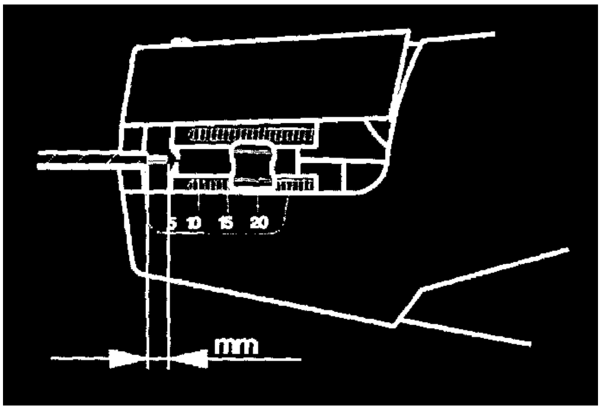
- Proceed to (FB2).

If a seal is to be used on the cable terminal
Thread the seal on to the cable before stripping the insulation. If the seal is threaded on to a cable that has been stripped both the copper conductors in the cable and the seal can be damaged.

- Push the seal about **5 cm** down the cable with the narrow end of the seal pointing towards the cable end. See illustration.

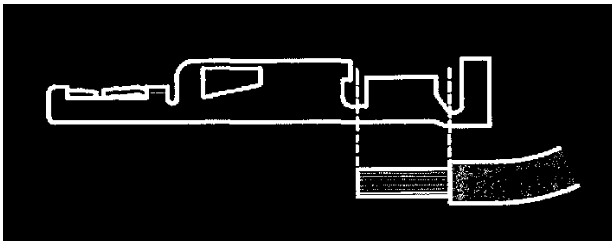
Always use a seal of the correct size for the cable it is intended for.

Length of the stripped section of cable



Volvo recommends the use of stripping pliers with an integral setting for the length of the stripped section and the cable area.

NOTE: Always used the correct length of stripped conductor to match the cable terminal to be used.



The cable must be stripped to a conductor length that matches the cable terminal type.

Compare the stripped conductor length with the cable terminals crimp contact connection. See illustration. The stripped length of the cable should be slightly longer than the crimp contact.

- A normal stripped length of conductor is approx. **4 to 5 mm.**

Soldering, General

Soldering, general

Soldering is a relatively easy method to apply to cable terminals. No expensive equipment is required and the core area dimension is not a critical factor.

The disadvantages with soldering are uneven results and that impurities and dirt on the contact points make it more difficult to get a clean soldered connection.

To ensure a good contact the soldering point must be free from dirt, oxidized metal, grease, paint etc.

NOTE: Avoid soldering connections that carry a high power load.

Soldered connection quality
choice of solder wire, flux and soldering tool as well as the location and method used affect the overall quality of a soldered connection.

Ensure that solder does not creep too far up the cable when soldering a terminal on to a cable, as there is a risk the cable can become brittle and break.

Soldering tool
There are different types of soldering tool. Usually a soldering iron with temperature control is used so that the temperature created on the soldering iron tip can be adjusted.

Soldering wire
It is important to use soldering wire with a high quality non-corrosive flux. Use 50-50 or 60-40 rosin core solder.

Do NOT use acid flux solder (e.g. plumbing solder) as this will cause oxidization.

When to solder
If a terminal has been crimped using a tool not intended for terminal crimping then the cable terminal must be soldered

To avoid soldering

CAUTION: Soldering cable terminals can be avoided by always making a point of using only Volvo special tools for terminal crimping or other tool recommended by Volvo.

General

Terminal crimping in general

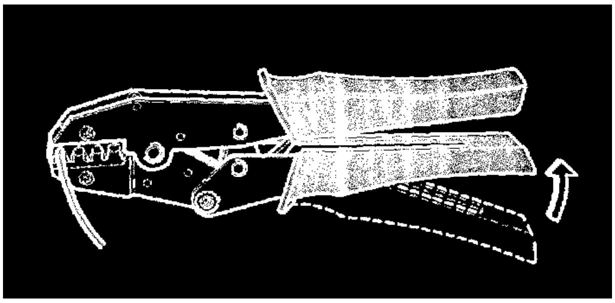
Advantages of terminal crimping

Terminal crimping is a way of creating an electrical contact by pressing the wings of the cable terminal round a cable with such force that the metal in the cable is deformed. Using the correct tool it is a rapid and simple way to fasten cable terminals to cables. A correctly crimped terminal provides a stronger and more reliable bonding than soldering the connection.

Terminal crimping, method and tools

NOTE: The results of the crimping process are entirely dependant on the use of the correct tools and method of carrying out the crimping.

Crimping contacts on different cable terminals



There are various designs and shapes of cable terminals that can be crimped. The type of cable terminal is determined by factors such as the cable used, the joint design, tool type, intended use etc.
The crimping tools in the repair kit p/n **9814235** have different crimping inserts to suit most types of cable terminal.

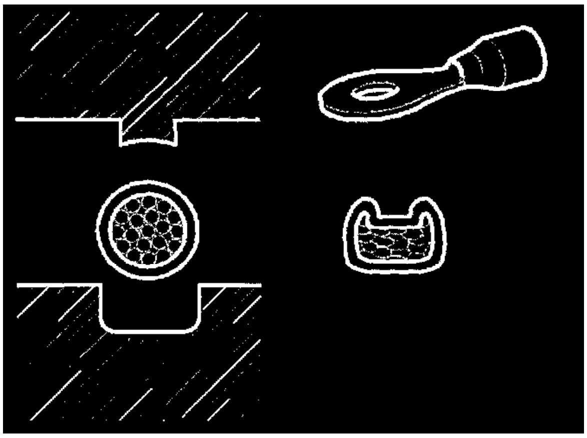
Terminal crimping insulated butt connectors and insulated ring cable terminals
To crimp insulated moisture proof butt connectors and insulated ring cable terminals, use the crimp tool recommended in other tools.

Cable Terminals - Crimping Core Wings

Cable terminals - crimping core wings

Insulated cable terminals

Crimping core wings, shape

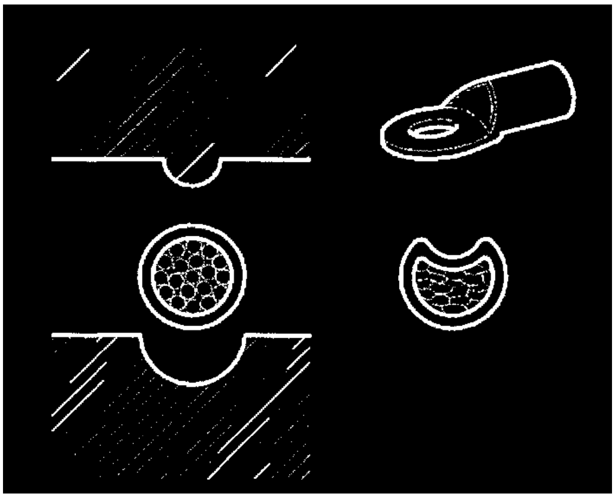


Terminal crimping occurs in an enclosed core crimp. An enclosed core crimp on a cable terminal has a soldered sleeve with an insulating layer of material around it. The cable is inserted in the core wings and crimped in place using a drift type crimp tool.
The cover around ring cable terminals is color coded to indicate the cable area.
Normally this type of terminal does not have insulation wings.
The illustration shows a cross section of a terminal crimping using a crimp tool intended for insulated terminals, referred to in other tools.

Uninsulated cable terminals

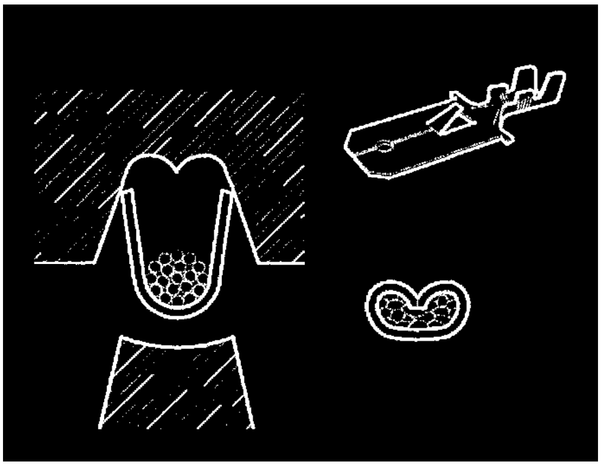
Terminal crimping is carried out in either an open or enclosed contact.

Enclosed type



An enclosed core crimp on a cable terminal has a soldered sleeve. The cable is inserted in the core crimp and crimped in place using a drift type crimp tool.
The illustration shows a cross section of a terminal crimping using a Volvo crimp tool p/n **9812451**, shown in other tools.

Open type



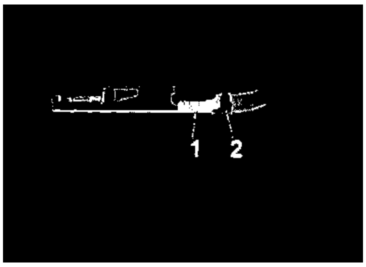
On the open type the cable terminals core crimp is U-shaped The cable is inserted in the core wings from the top. The crimp tool then applies a roll crimp the contact during crimping.
This type normally has insulation wings.
The illustration shows a cross section of a terminal crimping using the crimp tool from repair kit p/n **9814235**, which is described in the following Choice of crimp tool.

Core wings and insulation wings

The cable terminal crimping section consists of two parts which are formed simultaneously in the crimp tool.

Core wings
The core wings (I) are designed to make the electrical connection with the stripped section of the cable (the copper core).

Insulation wings



The insulation wings (2), relieve the core crimp wings from mechanical stress and are located on the insulating sheath around a cable.
The illustration shows a crimped cable terminal without seal.

Core crimp - electrical efficiency

The electrical characteristics for conduction for a contact are that it should be as least as efficient as the cable to which it is connected and provide good contact. These characteristics are dependent partly on the crimping process to fix the terminal on the cable and partly on the contact made between the two terminals (male and female) in the connector. The goal is to get a joint with the lowest possible transient resistance and to retain a low resistance even after extended periods of exposure (temperature extremes, mechanical wear etc.)

Core crimp - mechanical efficiency

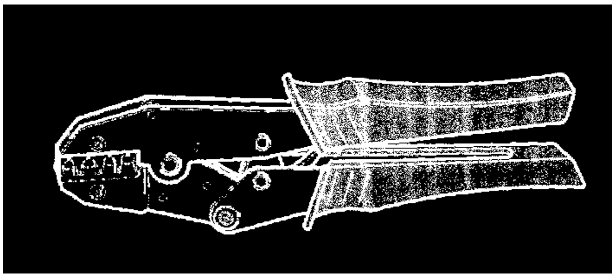
The joint in the core wings must retain the cable and support it so that it is not subjected to excessive bending forces at the entry point.

Choice of Crimp Tool

Choice of crimp tool

In repair kit p/n **9814235** are 5 crimp tools.
Supplementary kits may be supplied in future.

Color coded grip



The tools have different crimping inserts fitted and the plastic grips are color coded.

Correct choice of crimp tool for a cable terminal

NOTE: Always use the correct crimp tool intended for the cable terminal and use the correct crimping groove.

Below is a description of the crimp tools with information on:

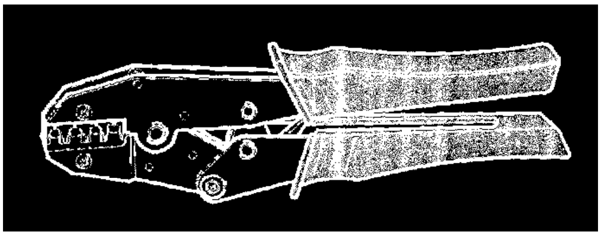
- Which cable terminals the tool is to be used for.
- Which cable areas the crimping inserts in the tool can be used for.

Crimp tool (black), p/n 9814223

Used for cable terminals types:

- 2.8 Tab
- 6.3 Receptacle terminal and 6.3 Tab
- 6.3 Timer
- M6 Ring cable terminal

The four crimping inserts are used for cable areas (in sq.mm):

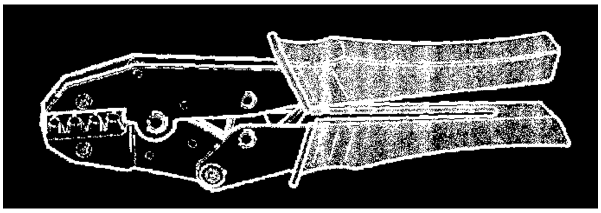


- 0.5 /0.6/0.75 /1.01 and 0.35 double folded wire
- 1.4/1.5/2.0/2.5
- 3.0/4.0
- 5.0/6.0

Crimp tool (red), p/n 9814224

Used for cable terminals types:
- 2.8 Timer sws
- 2.8 Tab sws
- 2.8 Tab steel sws

The two crimping inserts are used for cable areas (in sq.mm)

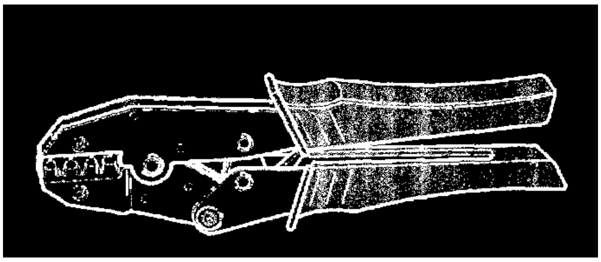


- 0.5/0.6/0.75/1.0
- 1.4/1.5/2.0/2.5

Crimp tool (yellow), pin 9814225

Used for cable terminals types:
- 2.8 Timer

The three crimping inserts are used for cable areas (in sq.mm):

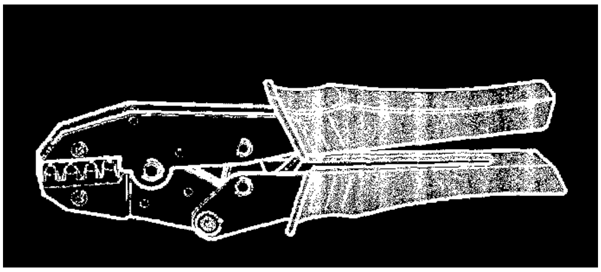


- 0.5 /0.6/ 0.75 /1.0, and 0.35 double folded wire
- 1.4/1.5/2.0/2.5
- 3.0

Crimp tool (green), pin 9814226

Used for cable terminals types:
- 1.6 Pin socket and 1.6 Pin

The two crimping inserts are used for cable areas (in sq.mm):

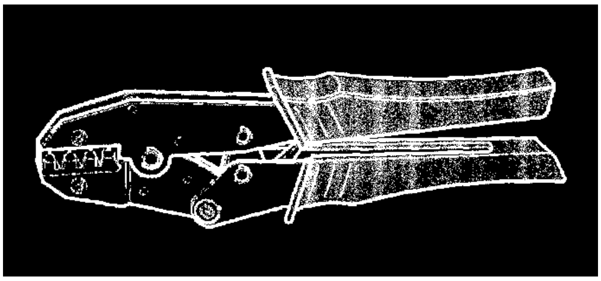


- 0.75/1.0/1.4/1.5 and 0.5 and 0.6 double folded wire
- 2.0/2.5

Crimp tool (blue), pin 9814227

Used for cable terminals types:
- 3.5 Pin socket and 3.5 Pin

The two crimping inserts are used for cable areas (in sq.mm):



- 1.0/1.4/1.5 /2.0/2.5/and 0.5, 0.6 and 0.75 double folded wire
- 3.0/4.0

Crimping A Cable Terminal

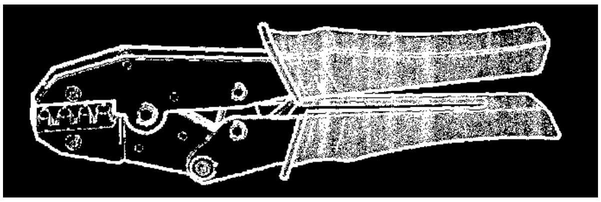
Crimping a cable terminal

CAUTION: An incorrectly crimped terminal means poor electrical contact, which can cause defective operation or intermittent faults. These problems can be difficult to detect and localize during subsequent fault tracing.

Use a Volvo crimp tool

The crimp tools from the repair kit p/n **9814235** will give a reliable result when used correctly.

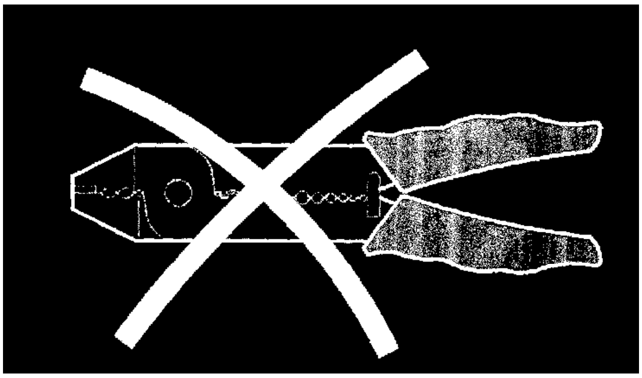
Contact crimp tool, inhibitor function



The contact crimp tool has a ratchet which normally

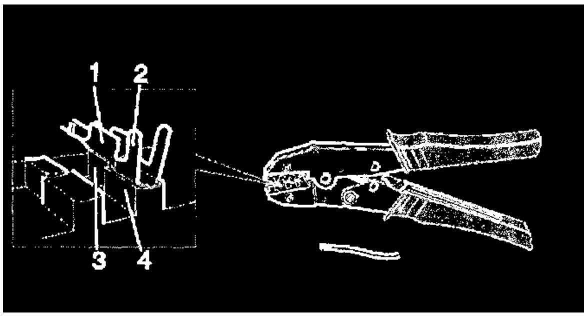
prevents a crimping operation from being aborted before the tool is at its final position (and the crimping operation correctly completed). The tool will then open automatically.
To abort a crimping operation when using the contact crimp tool see section (GD3).

NOTE: Do NOT use this type of tool!



Do not use this type of simple direct-acting crimping pliers which are intended for the home repairs and hobby market. The tool does not supply the necessary force required or meet Volvo quality standards to ensure reliable terminal crimping.

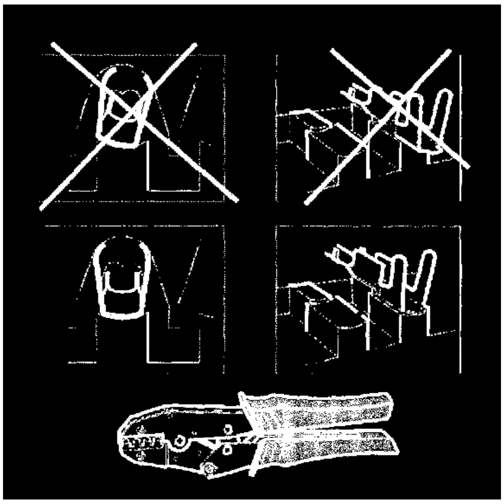
Place the cable terminal in the tool



- Select the crimping insert for the cable terminal type. Choice of crimp tool
- Locate the cable terminal correctly in the crimping insert.
  Check that the cable terminal deformation sections (1) and (2) are in contact with the crimp tool support section (3) and (4). The cable terminal must not be at an angle or he to far forwards or to the rear in the crimp tool insert.
- Carefully apply pressure to the crimp tool until the jaws hold the cable terminal in place without applying sufficient pressure to deform it.

Check the cable terminal is correctly located in the crimp tool jaws

If the cable terminal is not correctly located

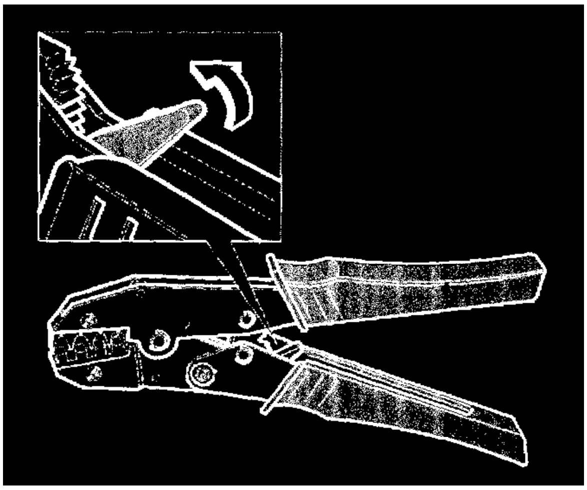


If the cable terminal has turned, moved forward or backwards, or is in the wrong cable area profile section, abort the crimping operation, see section (GD3).

If the cable terminal is located correctly

- Proceed to (GD4).

To abort a terminal crimping operation

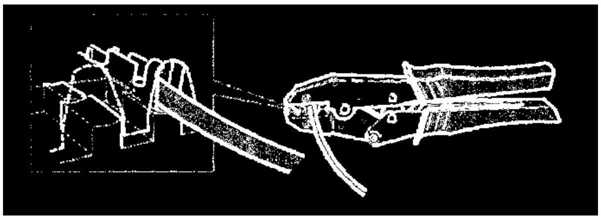


The crimp tools have a ratchet in the grip section. See illustration.

- Use a screwdriver to lift and release the ratchet.
- Reposition the cable terminal correctly in the insert and proceed with operation (GD4).

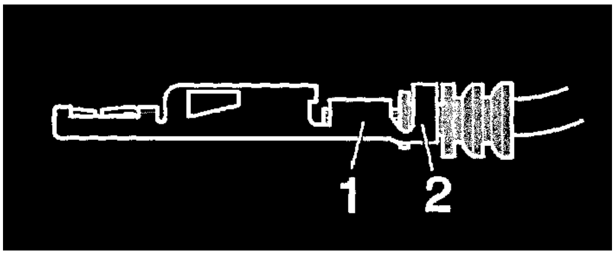
If the cable terminal is damaged
If the cable terminal has already been deformed replace with a new cable terminal and start again from operation (GD1).

Locate cable in the cable terminal



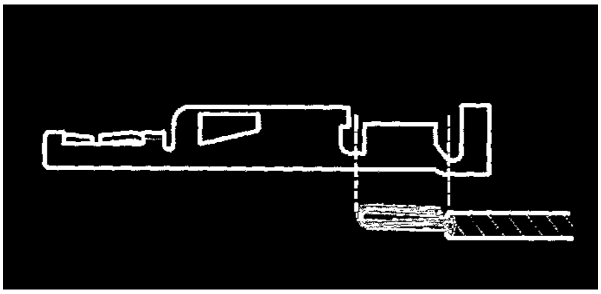
The cable terminal should be in the crimp tool as described in (GD1).

- Insert the cable end in the cable terminal.



The stripped section of copper conductor is located in the core wings (1) and the insulated cable section in the insulation wings (2).
If a seal is required on the cable it should be located as shown in the illustration.

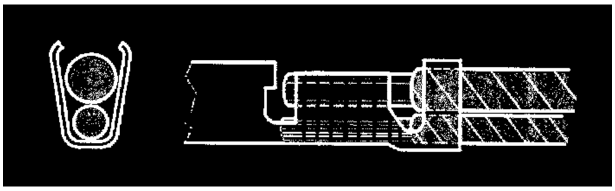
If the cable area is to small for the cable terminal



Always select a cable terminal intended for the cable area of the cable.
If on the other hand the correct cable terminal for the cable area is not available and only one cable terminal is available and it is for a larger cable area than is required:

- Strip the cable to double the normal stripping length and bend it double. In this way the conductor will make a tight and reliable connection in the terminal crimping operation.

Two cables crimped in one cable terminal

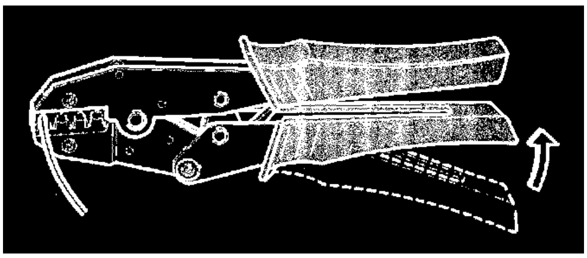


Always use a cable terminal that is large enough to take both the cables.

- Insert the cables one on top of the other

If the cables are of different areas always insert the larger cable on top.

Crimp the cable terminal



Check that the cable is still in the correct position in the cable terminal.

- Apply pressure to the grip of the crimp tool

Do not release the pressure on the tool until it is at the final position. Only when the crimping operation is completed will the tool open.

Proceed

Inspect the crimped terminal
Always inspect the crimped cable terminal as described in checking the result of the crimping operation.

After checking the cable terminal

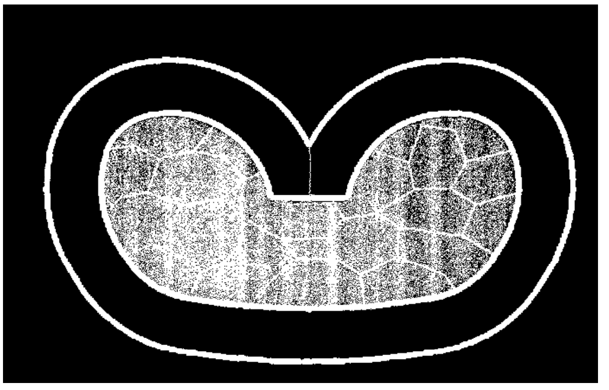
- To insert the cable terminal in the housing, continue to inserting a cable terminal in a housing.

Examples of Correct/Incorrect Crimping

Examples of correct terminal crimping

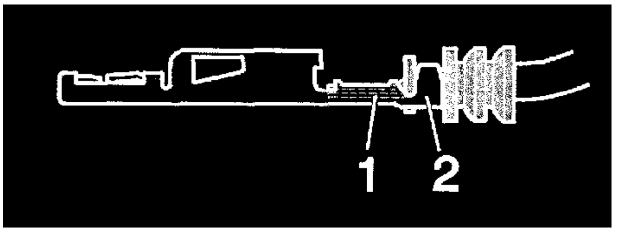
Checking crimping results

A correctly crimped cable should look like this:



- Core wings (1) should be completely pressed over the stripped core of wire.

The first illustration shows the copper strands in the core in cross section where they are completely compressed and covered by the core wings.

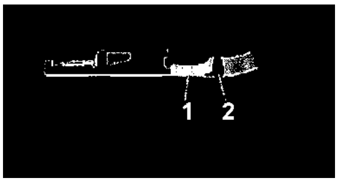


- Insulation wings (2) should be completely pressed over the cable insulation.

If a seal is used for cable terminal it should be pressed under the insulation wings as shown in the illustration.

Check the position of the cable

This is how a cable should be located In the terminal:



- The stripped core should be under the core wings (I). It must not stick out too far in front or behind the core wings.
- The cable insulation should only be under the insulation wings (2). It must not lie too far out in front of or lie too far in under the insulation wings.

Check the cable is firmly inserted by carefully holding the cable terminal and pulling on the cable.

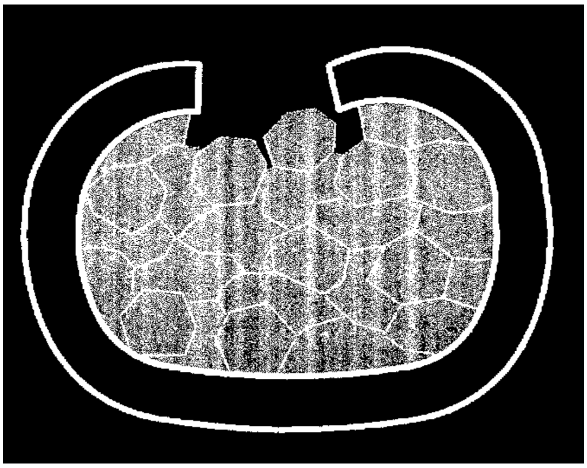
Check the cable terminal locking tabs
If the cable terminal has locking tab/locking tabs, check that they are not damaged or pressed inward so they will not engage when the terminal is inserted in a housing.

Poor results after crimping
If in doubt after crimping compare the results obtained with the examples incorrect terminal crimping. Examples of incorrect crimping. Where the crimping results are not correct, the operation must be repeated using a new cable terminal.

Examples of incorrect crimping

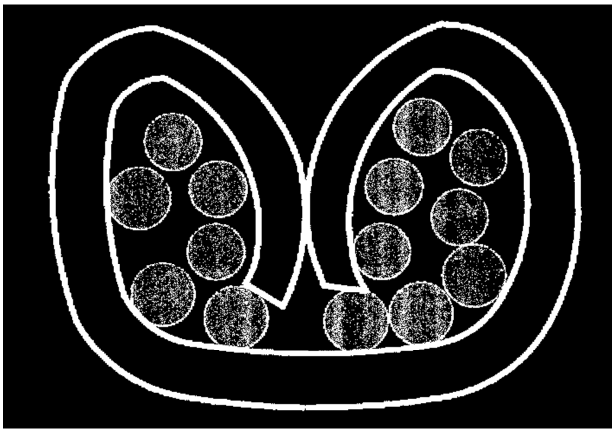
CAUTION: The most common reason for poor crimp results is using the wrong crimp tool/crimp tool insert for the cable terminal or the wrong area on the matching cable terminal/cable.

Core too large for the core wings



The illustration shows the cross section of the core crimp. The core wings are too small to completely cover the core of stripped copper strands.

Core is too small for the core wings



The illustration shows the cross section of the core crimp with the core which is too small for the core wings. As a result the core is not firmly held in place by the pressure of the core wings on the copper strands.

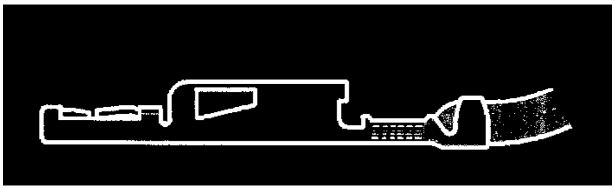
Reason
Incorrect crimping as shown above can be caused by:

- Cable terminal is the wrong size for the cable area
- The wrong crimp tool or the wrong forming section in the crimp tool was used.

Incorrect location of cable/cable terminal
The stripped cable is not located correctly

The cable has not been pushed far enough in. The entire stripped core must be located within the core crimp.

The stripped core is too short



The cable insulation is too far forward and has caught under the core crimp.

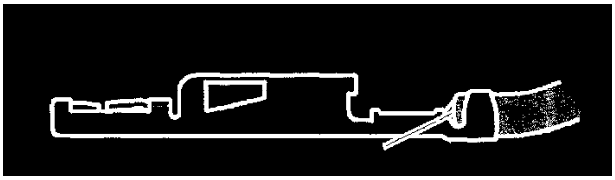
The stripped core is too long

The insulation is not fully located in the insulation wings.

The stripped core is too long

The stripped core is too far forward past the core crimp.

The stripped core is incorrectly crimped



The strip section is the right length but one of the copper strands is outside the terminal, indicating the terminal was incorrectly located in the crimp tool forming jaws.

All of the strands must be pressed together within the core wings.

Reason
Incorrect crimping as shown above can be caused by:

- Stripping the cable too short or too long.
- Incorrect location in the cable terminal.
- The cable terminal was incorrectly located in the crimp tool forming section.

Separate the Connector

Separate the connector

WARNING: SRS Nor cable repair or other repair work may be carried out on the SRS wiring. For repairs to the SRS system refer to the Restraint Systems.

If the connector halves (socket housing and pin housing) are connected together or if the connector is connected to a component, then the connector halves must first be separated.

General instructions

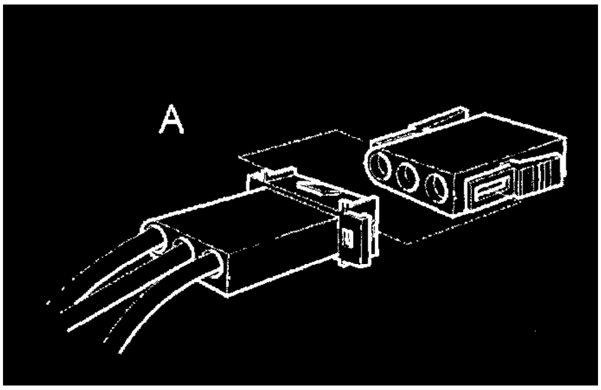
Note that these are general instructions, variations can occur in practice. Regard the examples shown and the procedures described as guidelines.

Types of catches and locks

The connector halves are connected to each other by different types of lock tabs/eyes. Separation

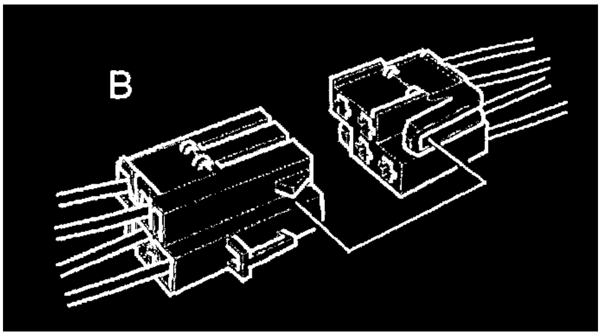
NOTE: Never pull the cables when separating. Hold the connector halves.

Active locking



For active locking Systems (Fig. A) a catch must be pressed down to release the lock.

Passive locking



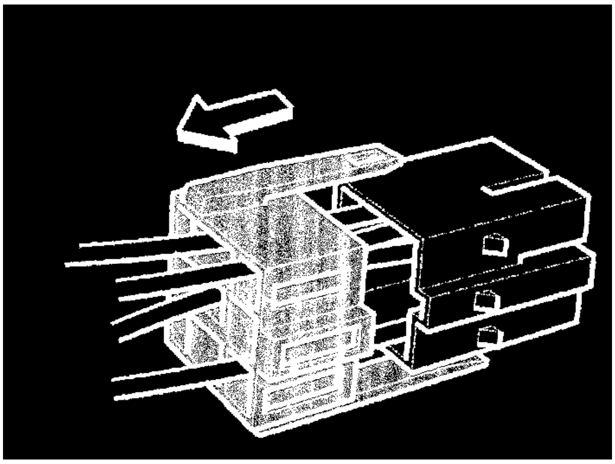
For passive locking systems (Fig. B) the catch is released when force is applied to separate the connector halves.

Reconnecting

The connector halves are physically located with a guide pin. Always turn the connector halves to the correct position when reconnecting. Check that connector halves lock properly into each other.

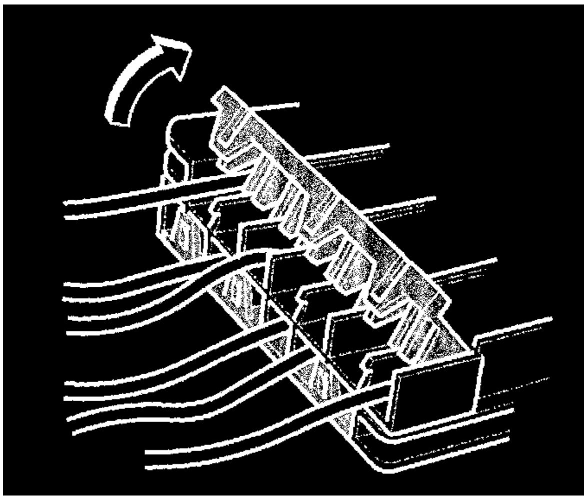
Secondary locking

The cable terminals are retained in the housing cavities by different forms of primary locking and secondary locking. This describes how the different secondary locking Systems on housing types are opened. If there is no secondary locking on the housing this can be ignored.



There are housings with and without secondary locking. In order to decide if the housing has secondary locking and if it has of which type, refer to the housings illustrated at Secondary locking - socket type, When secondary locking is of the lid type and When secondary locking is of the cavity cover type.

Housing with secondary locking



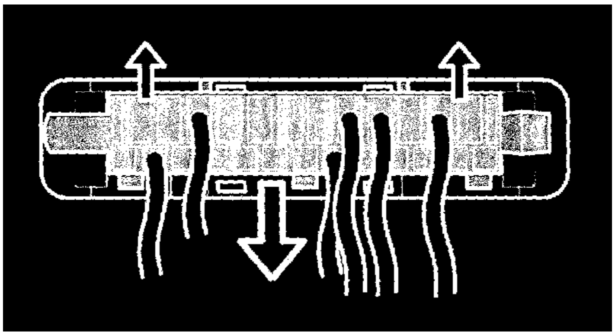
To replace a cable terminal the secondary locking must first be opened.

The following procedures describe how different types of secondary locking can he released to open a housing

- Secondary locking socket/housing retainer type
- Secondary locking lid/catch cover
- Secondary locking cavity cover /locking plate

More examples of procedures for opening secondary locking can be found in connectors some examples of methods.

Tools

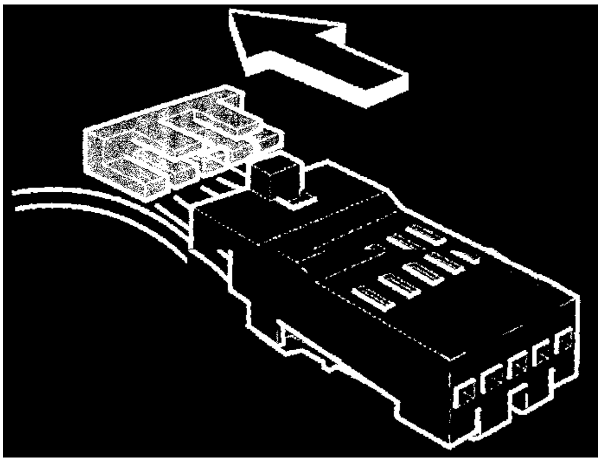


Use a thin screwdriver with a blade **3 - 4 mm** wide.

Secondary locking - socket type

Open the secondary locking as shown if it is of the socket/housing retainer type

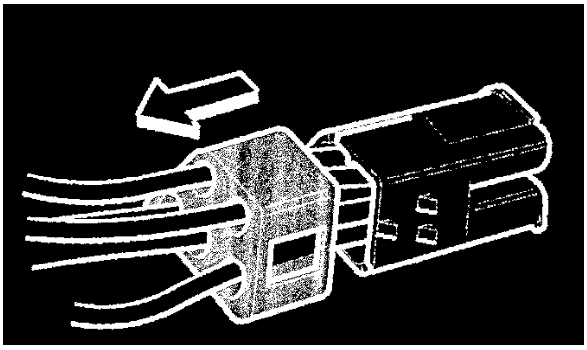
General instructions



Note that these are general instructions, variations can occur in practice.

Regard the examples shown and the procedures described as guidelines.

Release socket/housing retainer



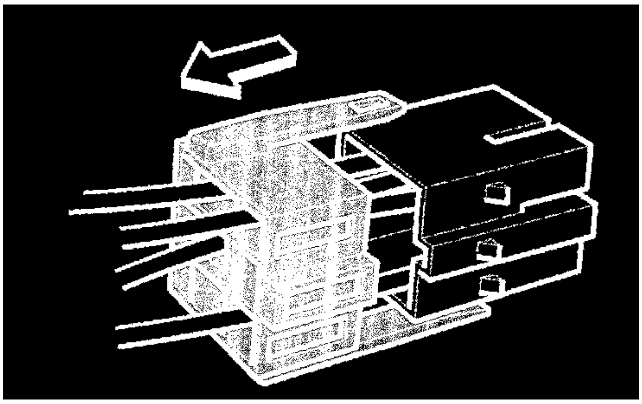
Use a thin screwdriver with a blade **3 - 4 mm** wide.

- Work the locking catches/eyes carefully loose on the socket or on the housing.

The number of locking catches/eyes and their location varies on different housings. There can also be variations between pin sizes in the housing types.

NOTE: Take care that the locking catches/eyes are not broken off when releasing the socket.

Remove



- Remove socket (and pull it back on the cables).

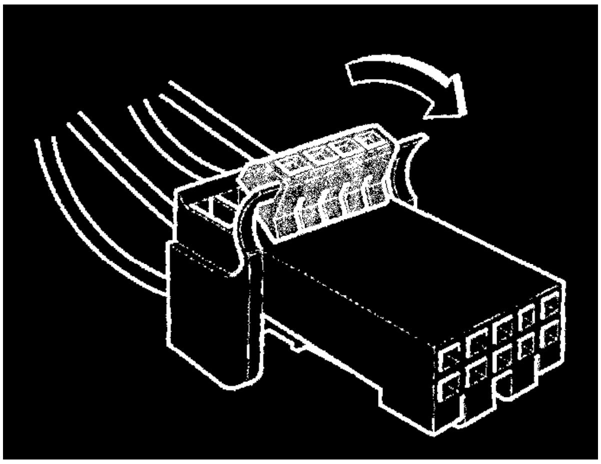
Proceed

To replace a cable terminal the next step is to remove the old cable terminal in the housing.

When secondary locking is of the lid type.

To open a housing secondary locking of the locking lid/catch type proceed as follows

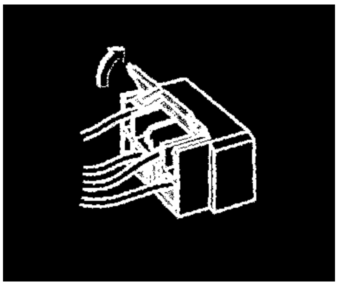
General instructions



Note that these are general instructions, variations can occur in practice.

Regard the examples shown and the procedures described as guidelines.

Open locking lid/catch



Use a thin screwdriver with a blade **3 - 4 mm** wide. Work the locking catches/eyes carefully loose on the locking lid or on the housing.

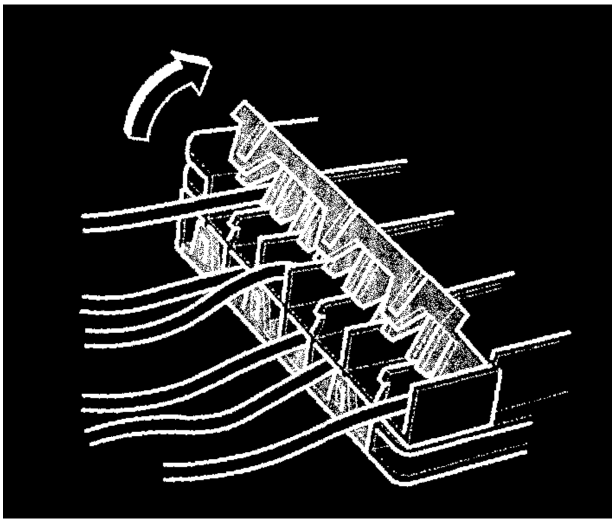
The number of locking catches/eyes and their location varies on different housings. There can also be variations between pin sizes in the housing types.

CAUTION: Take care that the locking catches/eyes are not broken off when releasing the lid.

- Unlock and open the locking lid

In multi-pin housings there can be separate locking lid for the upper cavity row and the lower. Only open the locking lid which is locking the cable terminal which is to be replaced.

Proceed

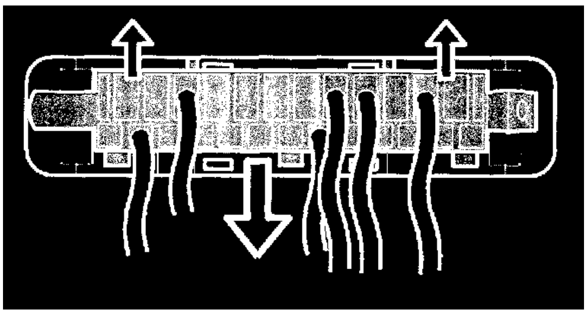


For replacement of a cable terminal the next step is to remove the old cable terminal which is in the housing.

When secondary locking is of the cavity cover type

To open a housing secondary locking when it is of the cavity cover/locking plate type, proceed as follows

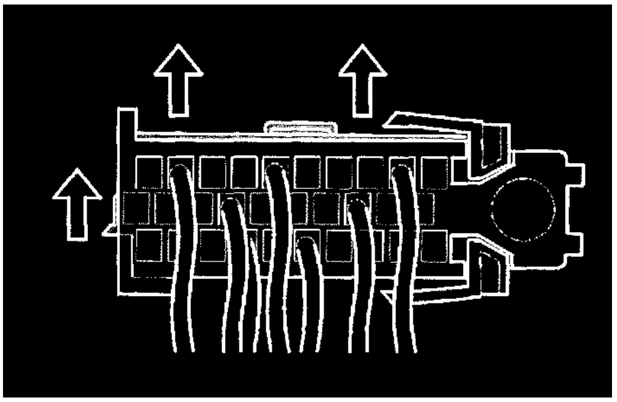
General instructions



Note that these are general instructions, variations can occur m practice.

Regard the examples shown and the procedures described as guidelines.

Open cavity cover/locking plate



For some housings a small, thin screwdriver can be used, for others no tool is required.

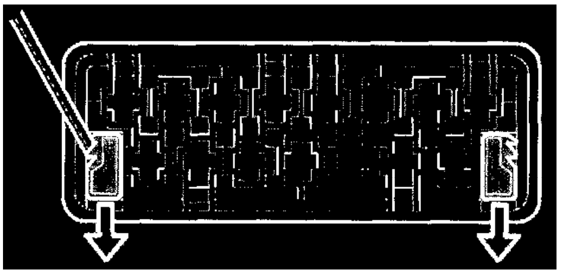
The secondary locking on this type of housing is released by setting the cavity cover/locking plate in the open position. There are two positions, open or closed.

- Lift up, push or unclip from the locking plate

A "click" can be heard when the plate unlocks and is in the open position.

NOTE: If the housing has a long, narrow locking plate check that it opens completely and not only along one edge. Work loose the locking plate along one entire long side.

Other examples of cavity cover/locking plates



More examples of housings with cavity cover/locking plate and procedures for opening them can be found in connectors, some examples of methods.

Proceed

To replace a cable terminal the next step is to remove the old cable terminal located in the housing.

- Proceed to extracting the cable terminal from the housing.

Operating Procedures For Repairs

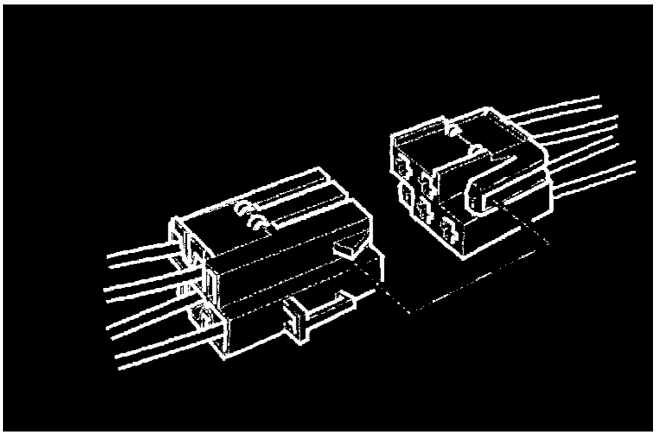
Proceed as follows

Using the information below most housings can be opened and the cable terminals replaced. Note that the stages in the operations can be used with most housings/cable terminals and that the illustrations only show a few individual types as examples. Other types can occur. The basic instructions for the repair/replacement of cable terminals are only a summary of the contents, with references to respective operations.

CAUTION: Note the contents, of these instructions must be followed before carrying out any repair work.

WARNING: SRS No cable repair or other repair work may be carried out on the SRS wiring. For repairs to the SRS system refer to the instructions in the Restraint Systems.

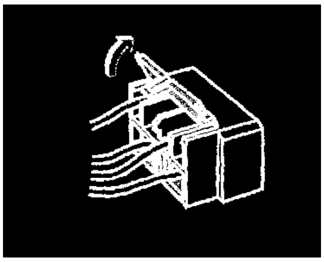
Basic procedures for repair operations
Opening a connector
Separate the connector



If the connector halves are connected they must first he opened.

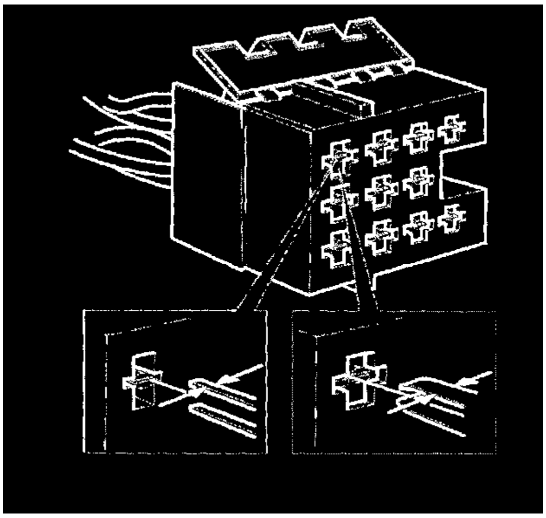
CAUTION: Never pull the cables when opening the connector. Hold the connector halves.

Open the housing
Secondary locking



Opening a housing's secondary locking.

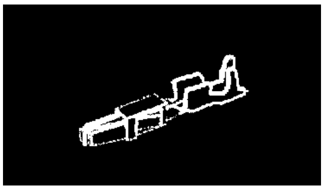
Select terminal removal tool



Select the terminal removal tool that matches the housing's cavity openings.

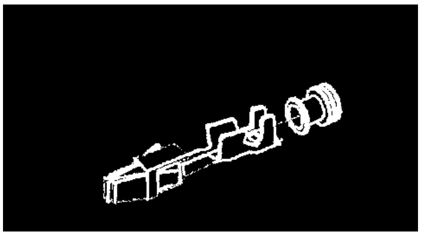
Remove the cable terminal from the housing
Use the recommended terminal removal tool and follow the operating procedure described.

Select a new cable terminal



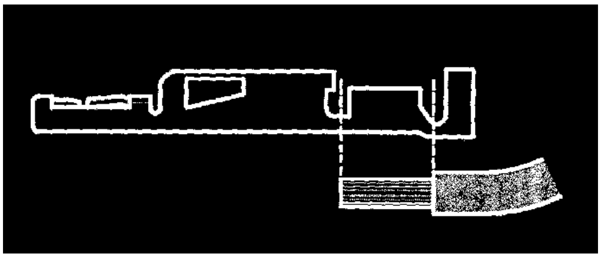
Select a new cable terminal of the same type as the existing terminal. Use the cable terminals in the repair kit p/n **981 4235.** Refer to the wiring diagram for information on the cable area.

Sws (Single Wire Seal)
Seal sws and plug



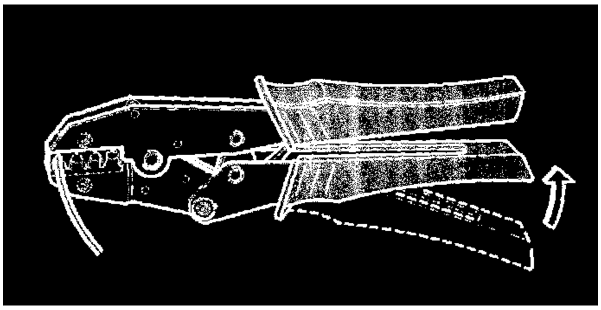
If a seal is to be used on the cable terminal thread the seal on to the cable before stripping the insulation on the cable.

Strip the cable



Cut and strip the cable to a length that matches the cable terminal.

Select a suitable crimp tool for the cable terminal



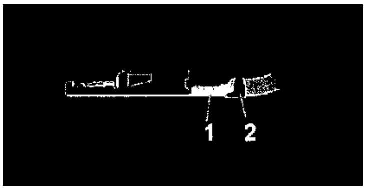
Refer to information on which tool is used for which type of cable terminal.

Crimp the cable terminal

Place the cable terminal in the crimp tool jaws, in the profile that matches the cable area of the cable. Position the cable in the cable terminal. Crimp the cable terminal on to the cable end.

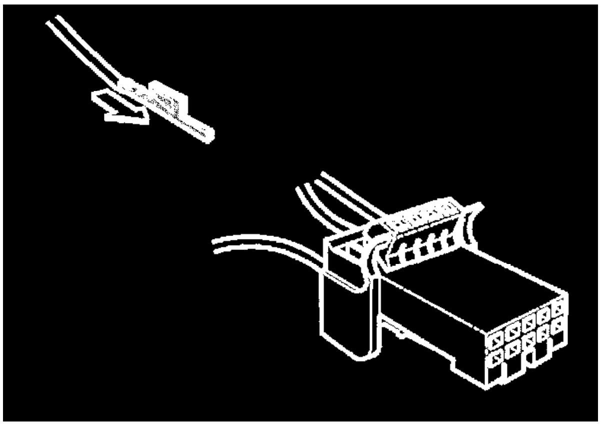
Checking crimping of a cable terminal

Checking the result of the crimping operation



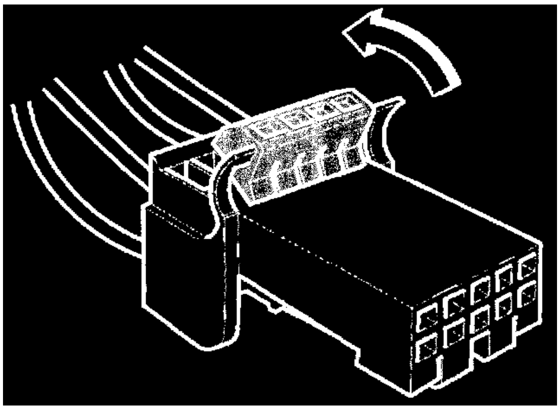
Always check the result of the crimping operation and that the primary locking is not damaged.

Insert the cable terminal in the housing



Insert the cable terminal in the appropriate cavity until the primary locking activates.
Check that the cable terminal is properly locked by pulling lightly on the cable.

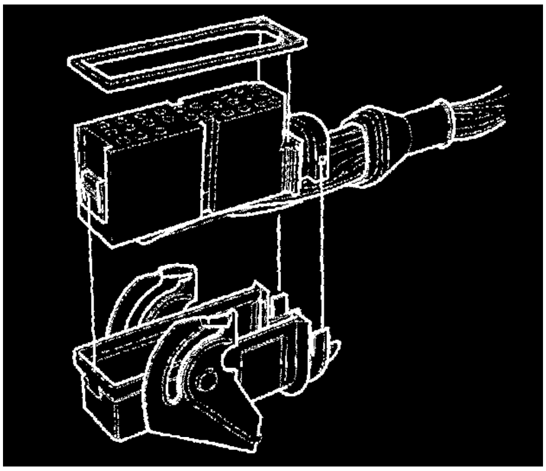
Close the housing



The housing's secondary locking must be closed.

Glossary For Connector/Housings

Glossary for connector/housings



Throughout the Service Manual certain terms are used to describe components and their location on the connector/housings.

A standard connector consists of a housing with cable terminals inside it. There are also connectors with different covers around the housings.

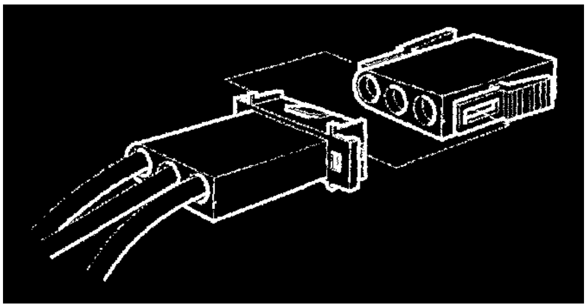
The purpose of the housings is to insulate the cable terminals and ensure a good electrical contact as well as to protect them from damage and deterioration due to the environment.

Pin housings and socket housings
Pin housings hold the Pin (male) cable terminals.
Socket housings hold the Socket (female) cable terminals.

The housings interlock with each other or to a component There are both color and mechanical physical) codings used.

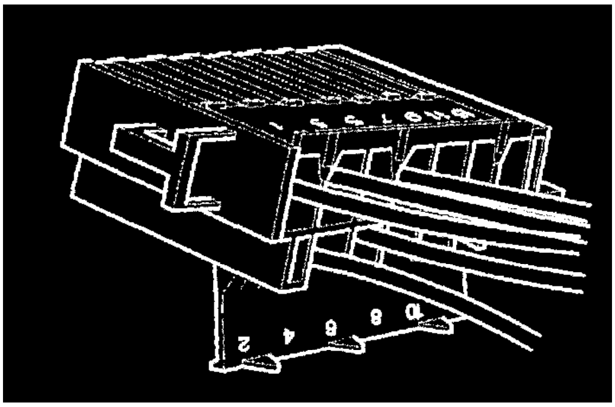
Connector halves
When a pin housing and a socket housing are connected together they are also called the connector halves.

Locking



To open the connector halves a catch must be released. There are two main types of locking systems: Active locking and Passive locking.

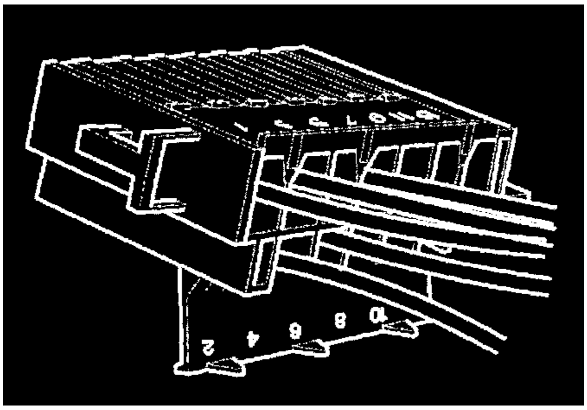
The housings - contact side V. cable side



The Contact side is the front of the housing where the cable terminals, Male or Female, are connected with each other.

The Cable side is the rear of the housing where the cable enters it.

The housings, top or bottom



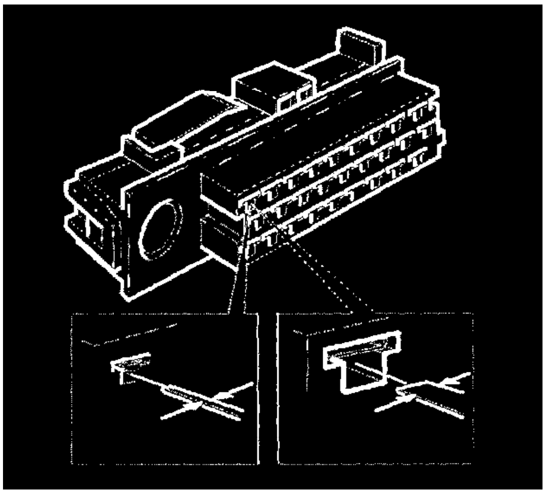
Refers to which orientation the housing is shown from in illustrations.

The side in the illustrations that is up is referred to as the top in the text. The side that is down is called the bottom.

The housings, cavities and position numbers
A cavity is the space in the housing where a cable terminal is located. Each cavity has a number and that number (terminal number) is given in the wiring diagrams as the position number.

Example: designation 24/11:3 means position 3 in connector 24/11.

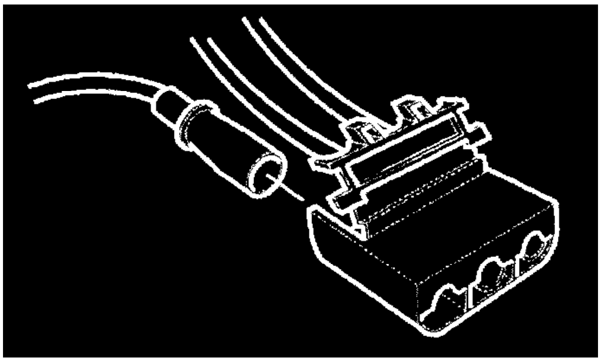
The housing cavity opening



The cavity opening on the housing contact side has an easily identifiable shape, to match the different types of cable terminals. It is the cavity shape which determines which terminal removal tool is to be used.

Extraction groove
Some housing cavity openings have a extraction groove. The groove is used to insert a terminal removal tool. Cavity openings can have one or two extraction grooves.

Moisture proof housings



Moisture proof housings have moisture proof cable terminals. The moisture proof cable terminals have wires fitted and then sealed in a plastic material.

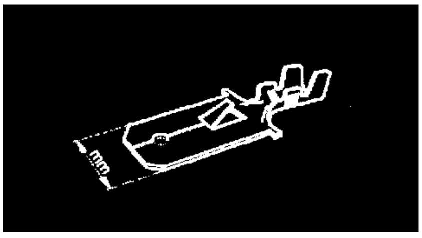
Other housings have enhanced moisture resistance through addition of various types of seal such as gaskets, a rubber sleeve fitted over the cables, plugs in unused cavities and seals on the insulation wings of the cable terminal.

Terms used for cable terminals

There are many different designs of cable terminals - tab, pin and timer are all examples. Here are some terms which apply to all cable terminals.

- The different types of cable terminals are described in extracting the cable terminal from the housing.

Size

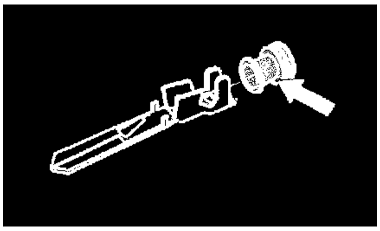


Cable terminal size is calculated as the width of the tab section. The receptacle terminal size is given as the matching tab's size. For pin/socket terminals the size is the diameter of the pin.

Cable terminal specifications are written with the size first, for example 2.8 Tab.

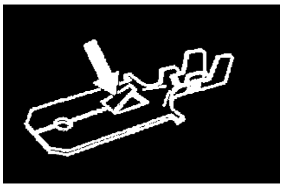
Cable areas
Every cable terminal type is available in sizes (approx 2 to 4) for different cable areas, so the size of the core wings and insulation wings vary.

Seal sws (single wire seal) on cable terminals



On SWS (single wire seal) cable terminals a seal must be used. The seal is crimped round the cable at the insulation wings and seals against the cavity in a housing.

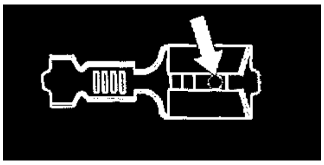
Locking tab



Most cable terminals have one or two locking tabs which retain the cable terminal in the cavity. There are also cable terminals without any locking tab.

It is important that the locking tab is sticking up from the cable terminal so that it catches properly in the housing when it is connected.

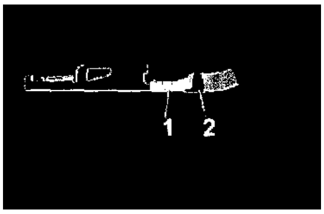
Dimples



Some tab/receptacle terminals in single pin (and multi pin) variants have dimples in the housing.

The dimple is a mechanical locking device between the tab and receptacle terminals.

Core crimp and insulation wings

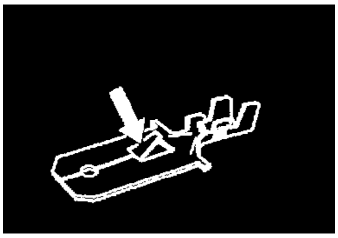


The cable terminals crimping section consists of two parts, which are both formed at the same time in the crimp tool.
Core crimp (1) for the electrical connection with the stripped section of the cable (the core).
Insulation wings(2), which are pressed on to the cable's insulating sheath and support the core crimp, reducing the effects of mechanical stress.

Primary locking and secondary locking
The cable terminals are retained in position in a housing by different types of locking devices which prevent the cable terminal being pushed out of the rear of the housing when they are connected together.

The locking catches must be opened when inserting a cable terminal in a housing.

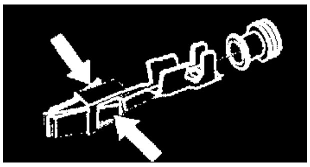
Primary locking



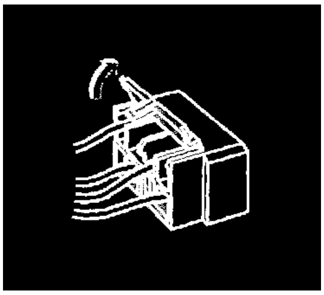
Primary locking is normally on the cable terminal, consisting usually of one or two locking tabs. See examples in illustration.

- Single primary locking uses one locking tab
- Double primary locking has two locking tabs

If there is no primary locking on the cable terminal there may be a type of locking catch located in the housing cavity instead. There is always one separate primary locking for each cable terminal.



Secondary locking



Secondary locking is always located in the housing itself. Secondary locking can be a socket section or locking lid with catches, which must be opened in order to remove a cable terminal. Secondary locking protects, supports and holds the cable terminals in place.

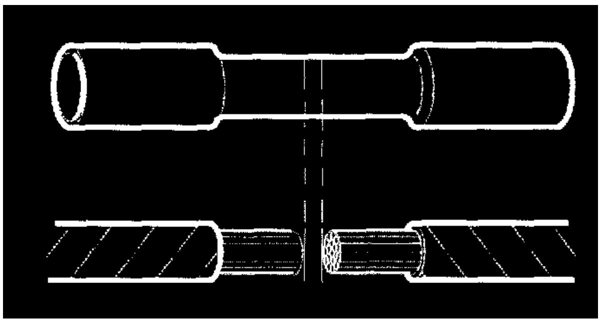
Splicing Using Insulated Moisture Proof Butt Connector

Splicing using insulated moisture proof butt connector

Table for insulated moisture proof butt connectors

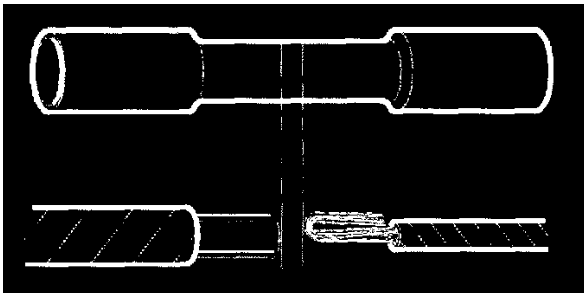
Butt connector	Color	Cable area mm^2	Strip length mm	Crimp tool
9130467-5	Red	0.5 - 1.0	4 - 5	See section **Other tools**
9130476-6	Blue	1.0 - 2.5	5 - 6	^
9130477-4	Yellow	4.0 - 6.0	6 - 7	^

Prepare the cables



- Select a suitable butt connector according to cable area.
- Cut the cables
- Strip cables to strip length as shown in table above.

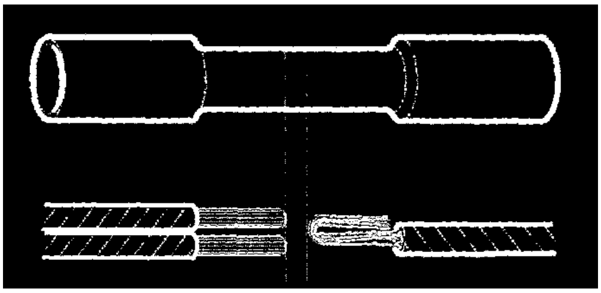
Splicing cables of different areas



If the cable areas are so different that they will not fit in the same butt connector, do as follows:

- Select butt connector to fit the larger cable.
- Strip the smaller cable to double length and bend the stripped section double.

Splice with several cables (branch point)

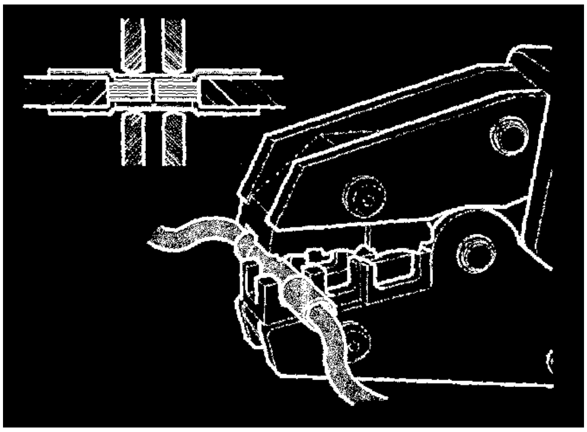


Select a butt connector large enough to take the cables to be inserted on the same side.

If a single cable is to be inserted on one side of the butt connector it will more than likely have too small an area compared to the opening in the butt connector.

Strip the cable to double length and bend it double.

Locate the butt connector in the crimp tool



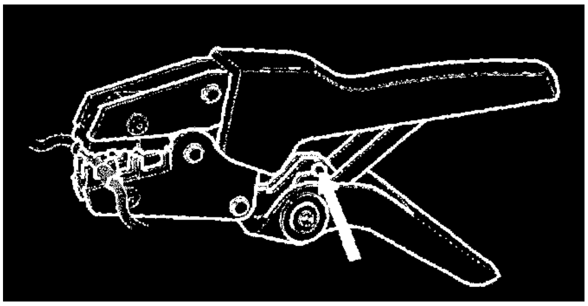
Use the crimp tool recommended **Other tools.**

Locate the butt connector in crimp tool jaws Use the correct insert that matches the area of the butt connector.

- Apply pressure to the tool grips until the insert in the jaws retains the without deforming it.
- Insert cables in both ends of the so that each stripped section of core is up against the center divider in the butt connector.

Crimping a butt connector

Before completing crimping:

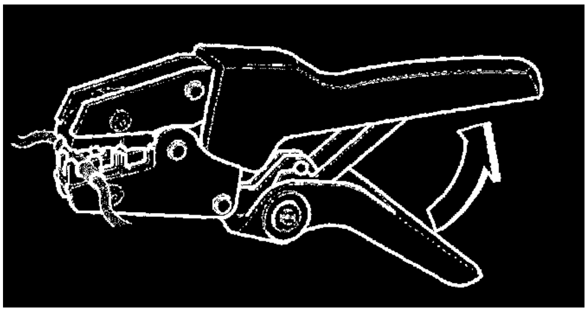


- Check that the butt connector is correctly located in the crimp tool forming section.
- Check the cables are still in the correct position in the butt connector.

If the butt connector is not correctly located, abort the crimp operation.

On most crimp tools of this type there is a locking device that can be released to open the tool. See picture.

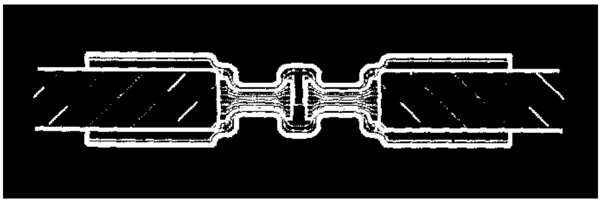
Complete the crimping operation:



- Press the tool grips together to close the jaws

Do not release pressure on the grips until the tool has fully completed the crimp operation. Not until then will complete crimping have occurred and the tool can be opened.

Inspect the crimped butt connector

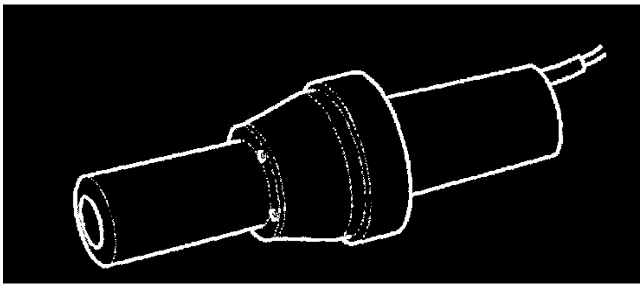


If the butt connector has been correctly crimped both crimping points should be uniformly compressed.

All cables should be crimped in place towards the center of the butt connector and not displaced towards the ends.

Pull the cables to ensure that none are loose.

Shrink butt connector using heat gun

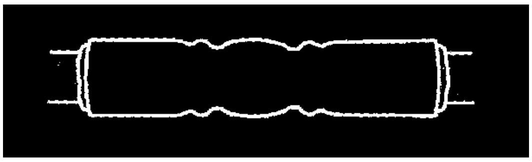


After crimping the butt connector it must be shrunk using a heat gun.

The butt connector has an internal layer of glue which is released when heated and flows out and around the cables. The glue and crimp together provide a mechanically robust and moisture proof splice.

- Use a heat gun with a high enough rating to shrink the crimped butt connector.

Inspect results of shrinking



Check the shrinking results. If ok the glue should have been forced out of the ends of the butt connector and around the splice.

Replacing a cable

If a cable must be replaced

If a cable is damaged it cannot be used again. The damage can be mechanical, electrical or the cable might be too short for crimping new cable terminals. The cable must be replaced or spliced.

Selecting a new cable

NOTE: A new cable must always be of the same type as the one it replaces: the same length, insulation, core area and preferably the same color.

Select a new cable that matches the old.

Cable length
Measure the original cable length.

Cable area
Measure diameter on the original cable with a vernier caliper. Always replace cables with a cable of the same diameter or a cable that is nearest in dimension to the original.

The cable area is stated on the wiring diagram (applies to 850 cars).

NOTE: It is always the cable core only that is used as the basis for cable area, not the area of the cable core and insulation together.

Color
Cable insulation color - if possible always use a cable of the same color when replacing cables.

The color code for the cable is stated on the wiring diagram (applies to 850 and 900 cars).

- Refer to color coding table Color coding table for color codes.

Install new cable
Use the same routing as the original cable and clamp the cable in appropriate cable clamp, tie etc.

If a new cable tie is used do not leave sharp edges when cutting.

Color coding table

Abbreviations used for cables and connectors/housings.

Color	Abbreviated form
Black	SB
Brown	BN
Red	R
Orange	OR
Yellow	Y
Green	GN
Blue	BL
Violet	VO
Grey	GR
White	W
Pink	P
Ivory	I
Light blue	LBL
Light brown	LBN
Natural	NL

Cable color coding with two colors

If the cable color code has two colors it appears in abbreviated form like this:

Example
Y/R (or Y-R) Is Yellow/Red.

The cable has a yellow insulation with a red stripe.

Engine: Description and Operation

A

A/C	AC Air Conditioning System (A/C System)
AP	Accelerator pedal
ACL	Air cleaner

C

CAC	Charge air cooler
CCM	Climate control module
CEM	Central electronic module
CFI	Continuous fuel injection
CKP	Crankshaft position
CMP	Camshaft position
CTP	Closed throttle position

D

DI	Distributor
DLC	Data Link Connector (DLC)
DTC	Diagnostic trouble code
DTM	Diagnostic test mode (DTM)
DSA	Dynamic Stability Assistance

E

ECC	Electronic climate control with air conditioning (A/C)
ECM	Engine control module
ECT	Engine coolant temperature
EGR	Exhaust gas recirculation
EI	Electronic ignition
EVAP	Evaporative control system

F

FC	Fan control
FP	Fuel pump

G

GEN	Generator

H

H02S	Heated oxygen sensor

I

IAC	Idle air control
IAT	Intake air temperature
ICM	Ignition control module

K

KS	Knock sensor

M

MAF	Mass air flow
MAP	Manifold absolute pressure
MCC	Manual climate control with air conditioning (A/C)
MFI	Multiport fuel injection
MIL	Malfunction indicator lamp

N

NTC	Negative temperature coefficient

O

02S	Oxygen sensor (not heated)
OBD	On-board diagnostic system

P

PAIR	Pulsed secondary air injection system
PNP	Park/neutral position (shift-lock) switch
PTC	Positive temperature coefficient
PWM	Pulse width modulated

R

RPM	Engine speed

S

SRI	Service reminder indicator
SRS	Supplementary restraint system (airbag)
ST	Volvo Scan Tool
STD	Manual climate control without air conditioning (A\C)

T

TB	Throttle body
TC	Turbocharger
TCM	Transmission control module
TDC	Top dead center
TP	Throttle position
TWC	Three-way catalytic converter

V

VSS	Vehicle speed sensor

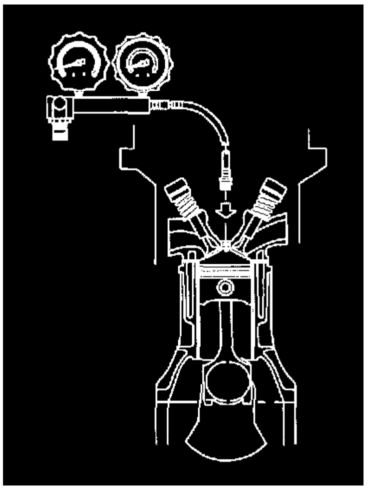
W

WOT	Wide open throttle

Engine: Testing and Inspection

General method description

The cylinders can be checked for leakage as an alternative to a compression test



Using this method, the amount of leakage at the engine cylinders is measured and it is possible to localize the source of any leaks.
A similar check can be performed with a compression gauge by injecting oil in the cylinder. However, this can cause a build-up of coke!
The result will not always be decisive or precise.
In addition, the VADIS station or the Volvo Scan Tool **(ST)** must always be connected afterwards to erase any Diagnostic Trouble Codes **(DTCs).**

How is the cylinder checked for leakage?

- The engine should be run to operating temperature so that the thermostat is open.
- The piston in the cylinder that is being checked must be set to Top Dead Center **(TDC)** at the compression stage.
- A controlled air pressure is connected to the relevant cylinder via an adapter that is secured in the spark plug/glow plug well.
- A gauge is used to measure the size of the leakage from the cylinder. This is a pressure sensor with a regulator and displays the size of the leak expressed as a percentage. This allows the extent of any problem to be determined.

Fault-tracing

Exhaust pipe	Faulty exhaust valve
Intake manifold / throttle body (TB)	Faulty intake valve
Dip stick hole / Crankcase ventilation	Faulty piston / piston ring
Adjacent cylinder	Faulty cylinder head gasket
Radiator	Faulty cylinder head gasket / cracked cylinder wall. Also check for bubbles in the expansion tank.

The source of a leak can be localized by analyzing sound at the points shown in the table.
A mechanic's stethoscope or a rubber hose can be used as a listening device.

Note! There is leakage at the piston rings even on a perfect engine. This is the only place where a small leak is permissible.

Check

If a leak is detected that is assumed to come from the valve system, first check that the piston in the relevant cylinder is at Top Dead Center **(TDC).**
Then try to set the piston just prior to Top Dead Center **(TDC)** and redo the test.
When repeating the leak test on the same engine, there are usually variations in the results of the measurements.
This is due to changes in the Engine Coolant Temperature **(ECT)** and the piston not reaching the same position as in the previous test, and is affected by the amount of oil on the piston rings at the time.

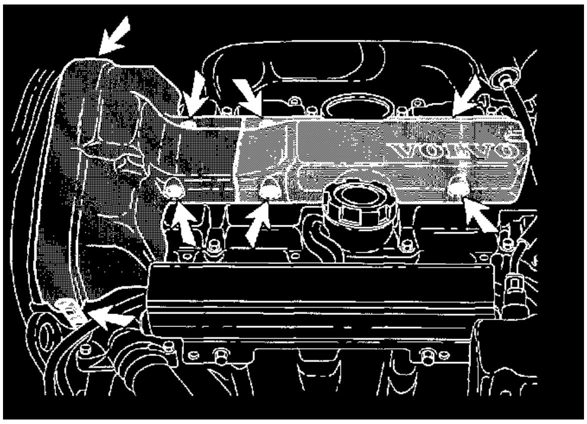
Other information

For information about cylinder leakage test equipment refer to equipment manufacturer.

Engine: Service and Repair
Removing Engine Top Cover

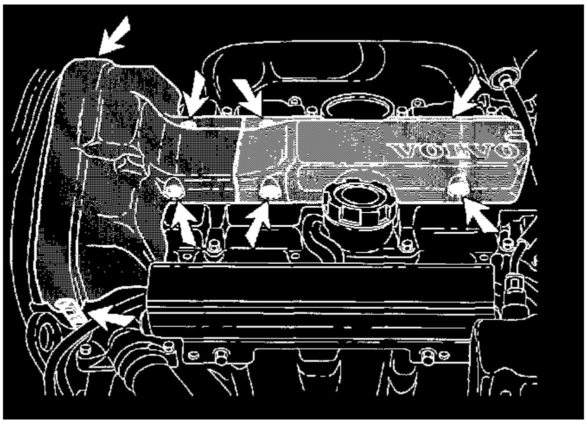
Special Tools
999 5702

Removing the cover on top of the engine



- Remove the screws from the rear of the cover
- Remove the two screws from the timing gear side
- Undo the clips on the timing gear side. Remove the cover{s)

Installing the cover on top of the engine



- Position the cover(s)
- Secure the clips on the timing gear side
- Install the screws. Tighten to **10 Nm.**

Engine: Service and Repair
Engine, Replacement

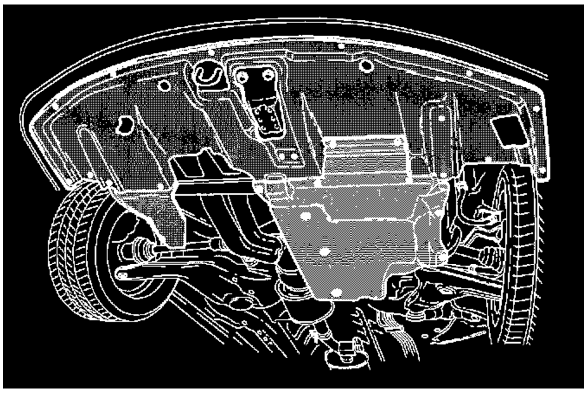
Removal

Special tools
999 2810
999 5185
999 5462
999 5474
999 5488
999 5533
999 5642
999 5666

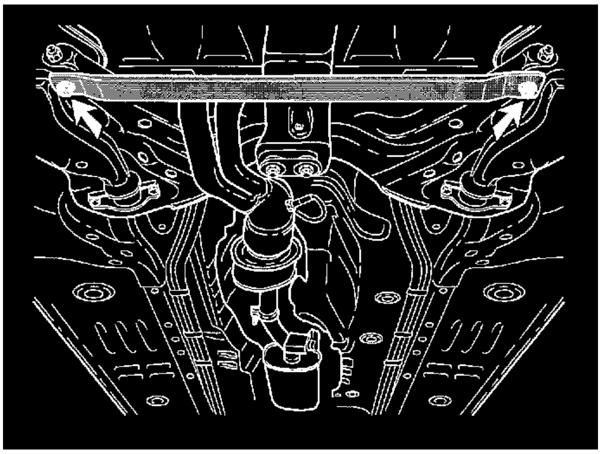
Draining coolant from radiator and engine
- See Replacing coolant, refer to Cooling System.

Undo drive shaft nut at the left side
Remove cover, undo nut.

Disconnect the air-conditioning (A/C) hose from the fan shroud

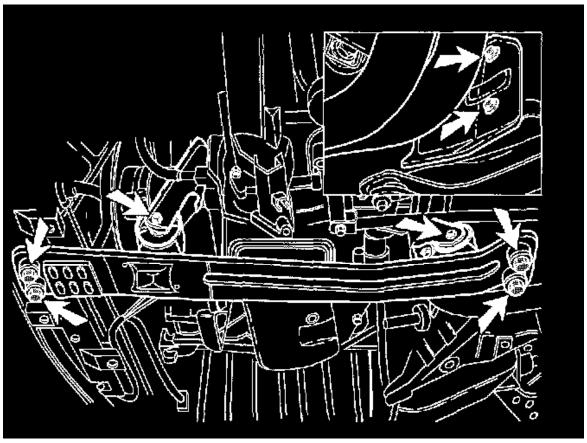


Remove engine splash guards front and rear



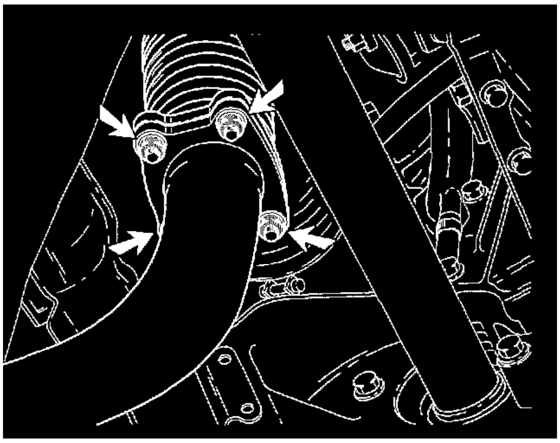
Remove crossmember stay

Remove longitudinal beam
Remove:



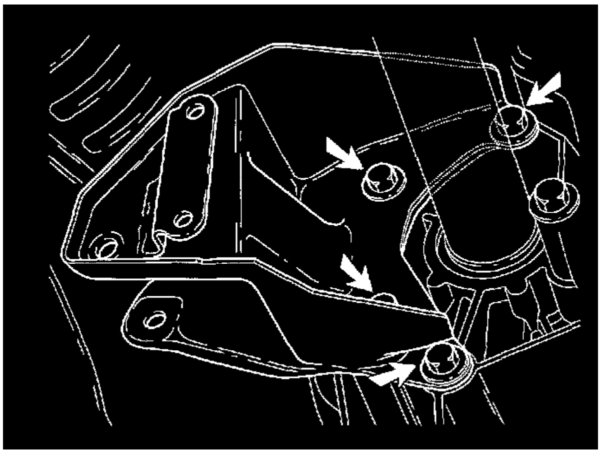
- the engine rubber heat shield
- the nuts from the engine rubbers
- the bolts front and rear
- the two bolts from the engine rubbers and remove the longitudinal beam from the car.

Remove exhaust down pipe from exhaust manifold



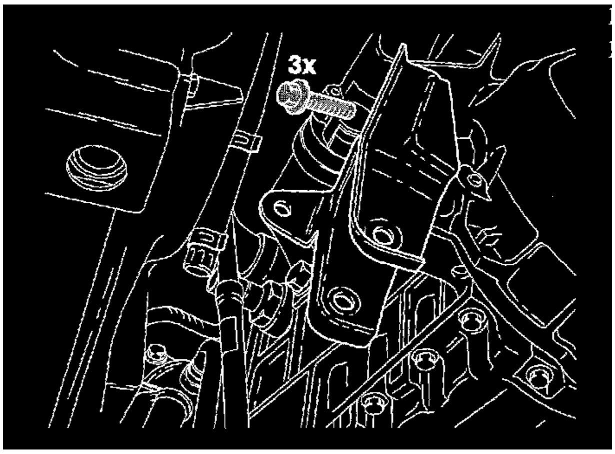
- Remove the nuts
- Pull the exhaust pipe downwards
- Remove the gasket.

Remove rear engine bracket



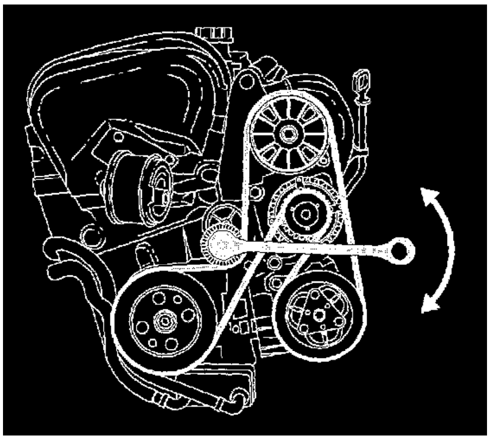
Remove the four bolts and the bracket.

Remove front engine bracket



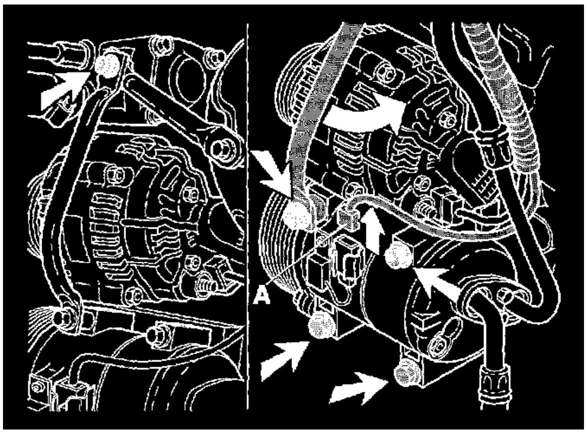
Remove the clamps of the Charge Air Cooler **(CAC)** hose.
Remove the three bolts and take the bracket off.

Remove poly V-belt



- Loosen the belt tension by turning the spanner counterclockwise
- Remove the poly V-belt and move it upwards.

Remove the air-conditioning (A/C) compressor



Undo the upper bolt from the bracket at the power steering pump.

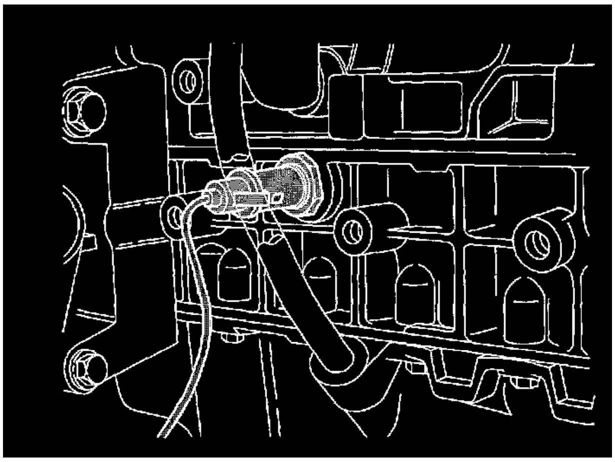
Remove:

- the connector (A)
- the four mounting bolts
- the compressor and turn it upwards as far as possible
- Move the bracket sidewards.
  Tie the compressor up at body at the front side.

  Note! Take care about the AC pipes/hoses.

Remove connector oil pressure sensor and alternator

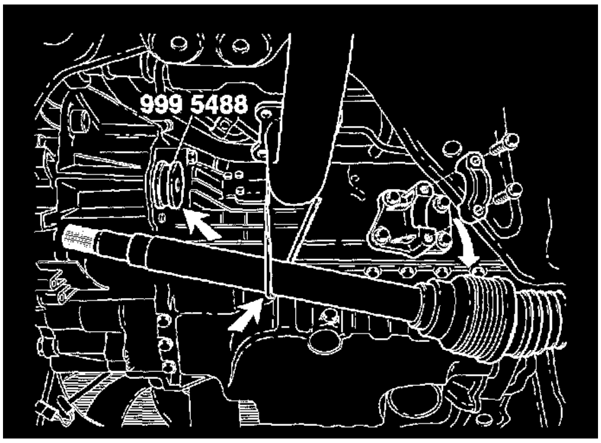
Remove:



- the connector from the oil pressure sensor
- the cable clamp from the bracket
- the connector at the center.

Remove right hand drive shaft from transmission

Remove:



- The bearing cap at the engine side
- Both the front wheels
- The brake hose clips and take the hose out of the bracket
- The ABS wiring out of the bracket
- The two nuts and the upper bolt from the shock absorber
- The knuckle out of the shock absorber (turning)
- The drive shaft out of the transmission
- The lower bolt and move the drive shaft sideways.

  Install special tool 999 5488 in the transmission.

  Install the knuckle in the lower shock absorber bolt.

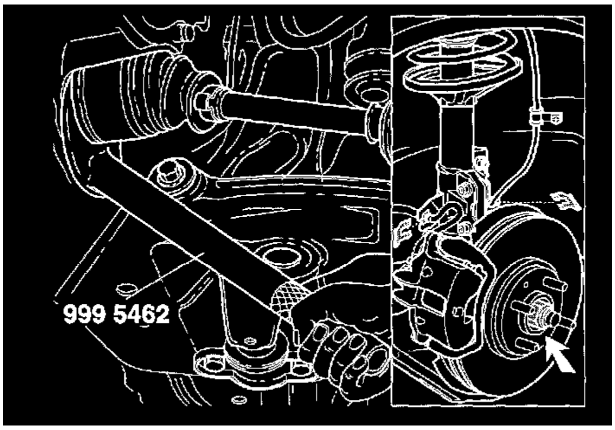
  Tie up the drive shaft to the wheel arm while bringing shaft (drive) underneath.

Remove the side cover left side

Remove the bolts, take panel out.

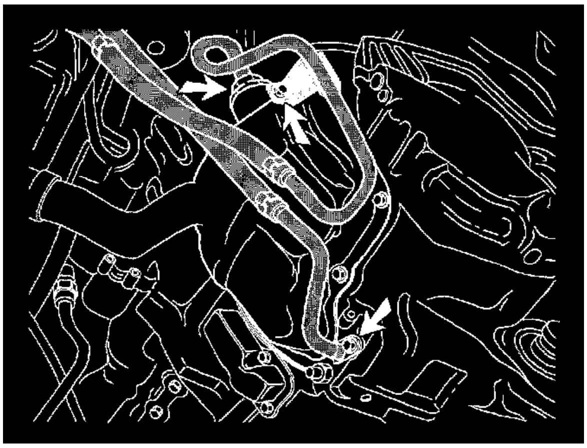
Remove complete left hand drive shaft

Remove:



- The brake hose clips and take the hose out of the bracket
- The ABS wiring out of the bracket
- The central nut from the drive shaft
- The two nuts and the upper bolt from the shock absorber
- Undo the drive shaft from the transmission, use special tool 999 5462
- The drive shaft complete
- Install the special tool 999 5488 in the transmission
- Install the knuckle in the lower, shock-absorber mounting hole.

AT: Disconnect transmission oil pipes

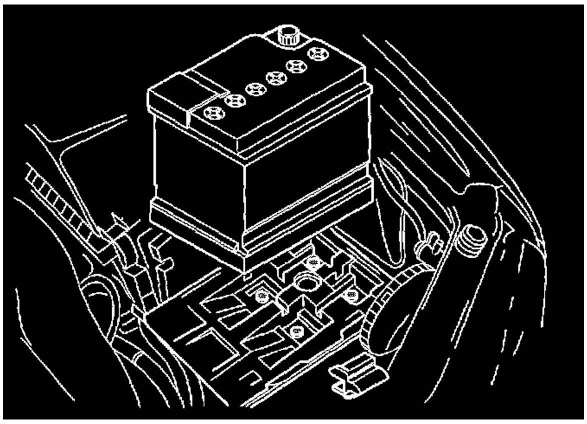


Disconnect the oil pipe connections from the transmission and push them to one side.
Ensure that no dirt gets into the transmission and the hoses.
Seal all openings with plastic plugs.

Note! Do not remove the hoses from the pipes.

Drain fuel system
See Draining the fuel injection system, refer to Powertrain Management.

Remove battery and shelf



Remove the battery.

Note! If the car is fitted with cruise control, you must undo the vacuum hose and leads to the vacuum motor.

Remove bolts shelf.
Undo the cable harness out of the clamp.
Remove the hose clamp from the shelf.

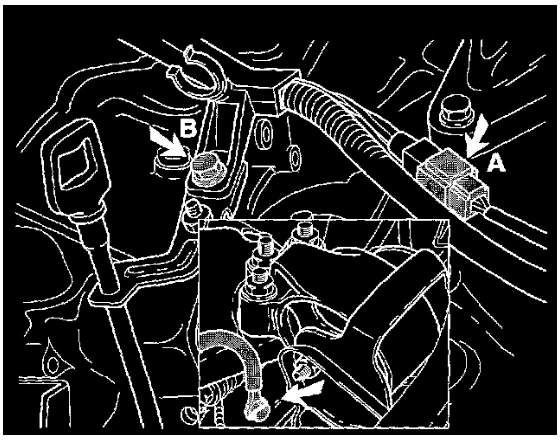
Remove air cleaner (ACL)

Remove the Air Cleaner **(ACL).**

Remove positive and negative battery lead

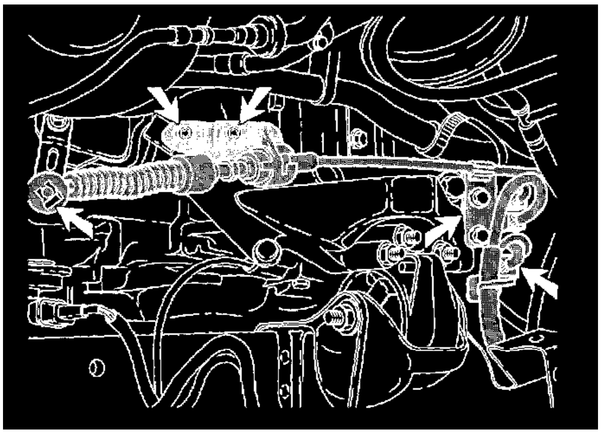
Disconnect the connector (A).

Remove:



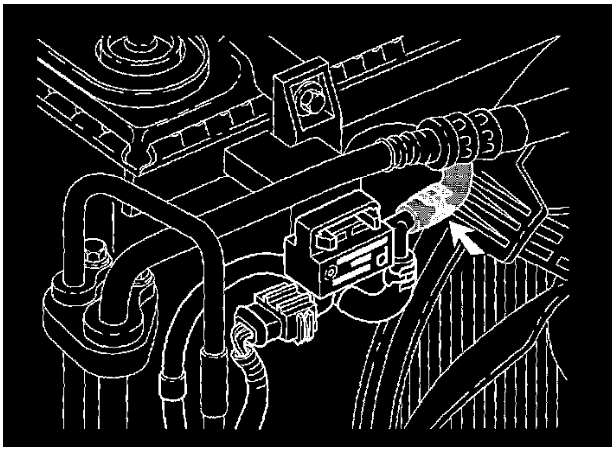
- The nut and remove the positive battery lead
- The ground lead from the transmission.

Remove gear shift mechanism cables



Remove: the gear selector cable support.
Disconnect the plug connector.
Remove the gear selector cable from the transmission.
Remove the connectors from transmission:

- The gear selector cable from the transmission
- The ground lead from the transmission
- Disconnect the connector bracket from the mounting on the transmission
- Separate the connector halves.



Remove hose from Canister Purge (CP) valve

Remove turbo hoses

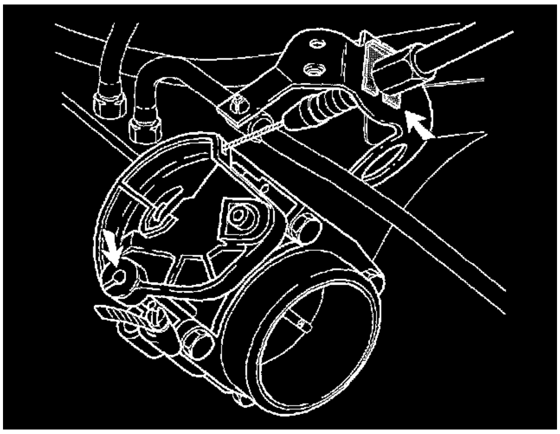
Remove:

- The inlet hose from the Charge Air Cooler **(CAC)** to the Throttle Body **(TB)**

- The idling control-valve hose at the Charge Air Cooler **(CAC)**
- The hose at the pipe
- The bolt for the bracket and remove the complete pipe with the hose out.

Remove throttle cable

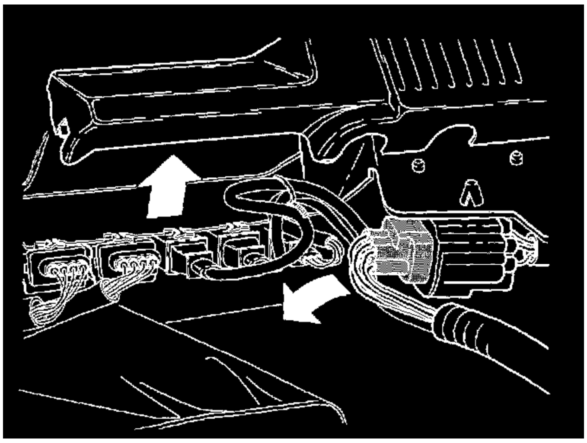
Remove:



- the cover by undoing one bolt and two plugs
- the inner cable at full throttle
- the clip and take the outer cable out.

Remove the bracket cover and connectors

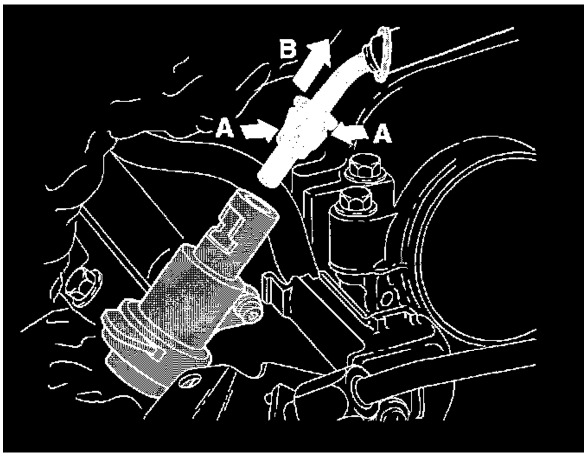
Remove connectors for:



- the engine speed sensor
- the camshaft position sensor
- the Knock Sensor **(KS)**
- cable harness.

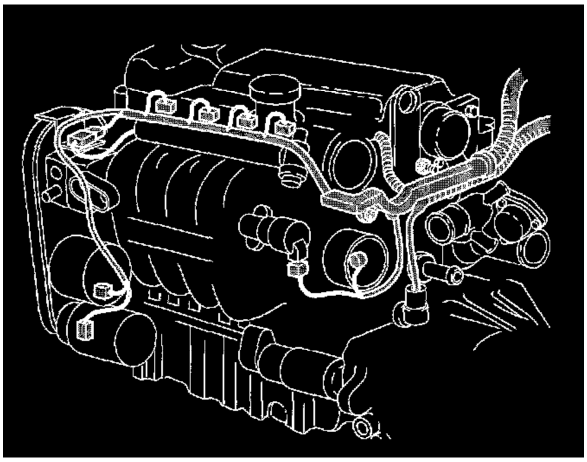
Remove:
- cable (protector) out of the clips (3x)
- the brake servo hose from the brake booster (press securing ring and pull hose out)
- hose from valve to air filter.

Remove fuel line from engine



- Press securing lips together, pull pipe out
- Pull pipe out clamps and move it sidewards.

Remove cable harness



Disconnect the plug connectors from the engine.

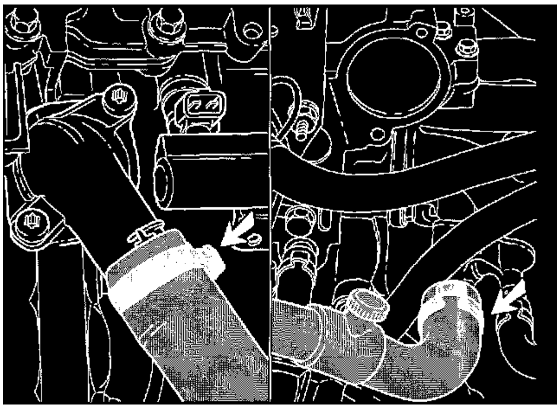
Note! Note all the positions of the cable harness mounting points.

Remove:
- the Engine Coolant Temperature **(ECT)** sensor

- cable out bracket
- remove injector cover (pull off)
- the injectors
- the Throttle Position **(TP)** sensor
- the Idle Air-Control **(IAC)** valve
- the cable guide by undoing one screw and one
- rear light switch
- move the whole cable sidewards.

Remove engine coolant hoses

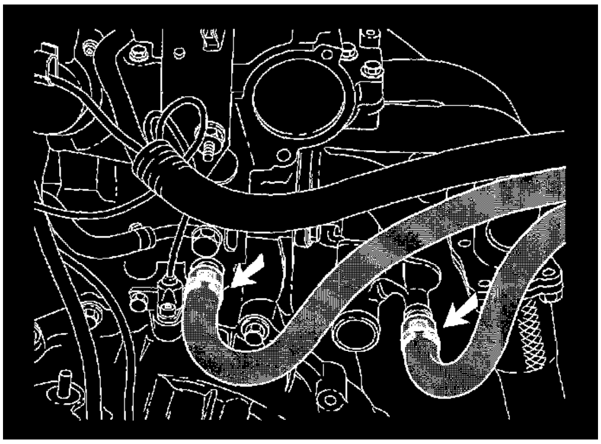
Remove:



- the clamps
- upper coolant hose
- the lower coolant hose at the engine side.

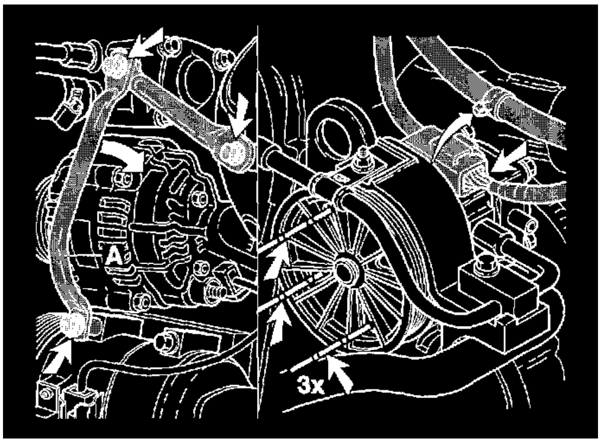
Remove heater hoses from engine connector

Remove:



- loosen the clamps (note the route)
- pull off the hoses.

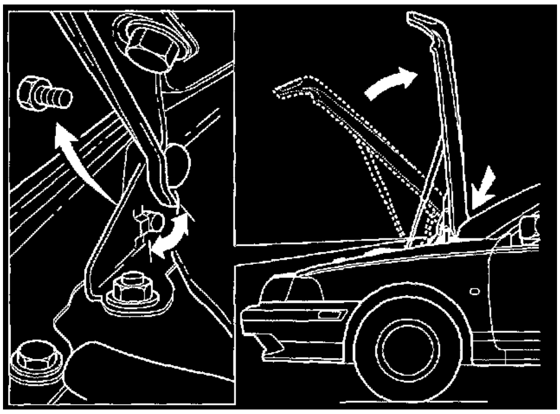
Remove power steering pump from engine



- Remove brackets between the pump and the inlet manifold and the lower bracket

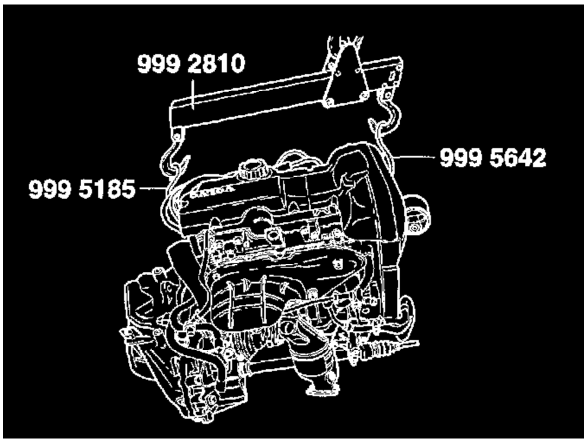
- Take the poly V-belt out
- Remove bolts via the opening in the pulley flange
- Remove reservoir from the body and lift the hose out of clips
- Pull power steering pump off and place it to the side.

Place hood in service position



Remove the two bolts.
Remove the stand at the body side.
Support the hood.

Remove engine complete with transmission



Attach lifting lugs 999 5185 and 999 5642 to 999 2810.
Lift the engine up until it is under tension.
Remove the engine mounting on the transmission side:
- Remove the nut and the bolt
- Remove the three bolts and take the transmission bracket away.

Remove the engine mounting bolt on the distributor side.

Note! Check carefully to see that the complete transmission does not touch the body or any optional extras. If necessary turn the clamp at the oil cooler.

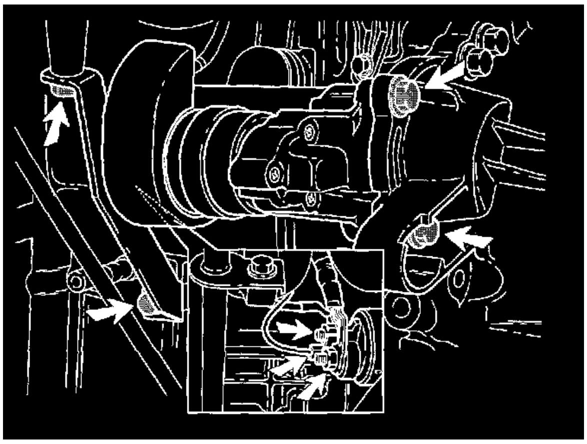
Lift the engine out.
Always adjust the tackle hook when lifting.
Place hood back in normal position.

Replacement of Components - Engine Removed

Special Tools

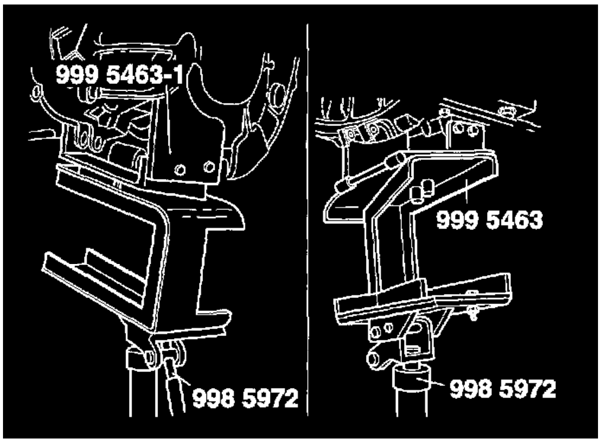
998 5972
999 2520
999 2810
999 5112
999 5297
999 5186
999 5642
999 5463

Remove starter motor



- Pull of the cap off
- Remove the bracket inlet manifold
- Disconnect the wiring from the starter motor
- Remove the bolts and the starter motor.

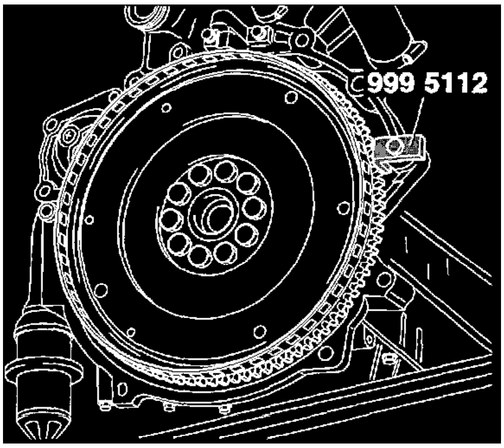
Remove transmission



Undo torque converter screws. Undo the transmission screws to and from the engine where the flywheel housing is mounted on the engine block.

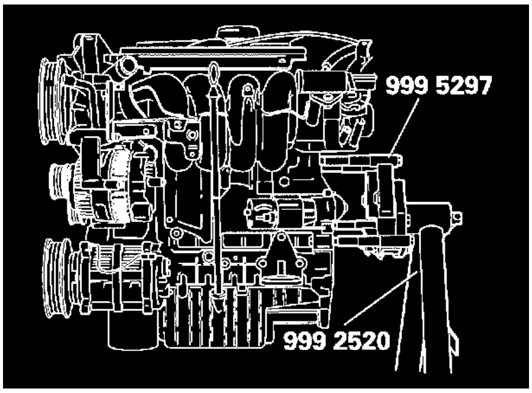
Warning When removing the transmission use lifting gear 998 5972 with the support 999 5463 to support the transmission and prevent damage.

Remove flange plate



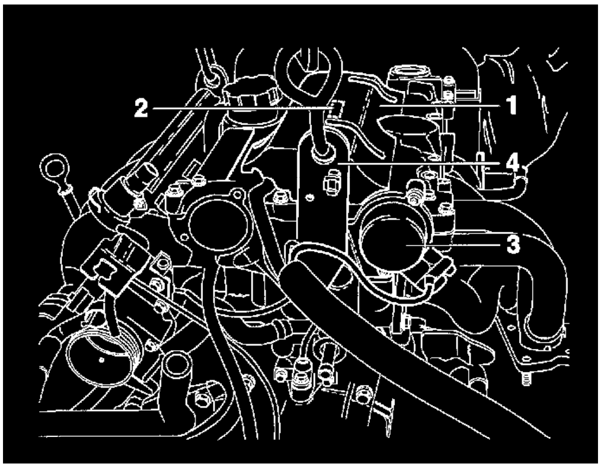
See Replacing flange plate, refer to Transmission and Drivetrain.

Mount engine on stand



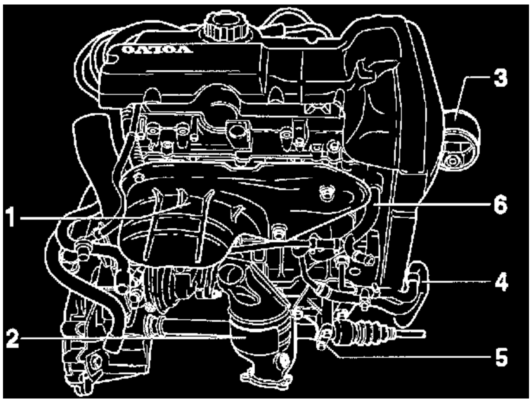
Use stand 999 2520 and support 999 5297.
Remove the lifting tools.
Install the correct quantity of washers to compensate for the transmission guide pins.

Transfer engine components at left side



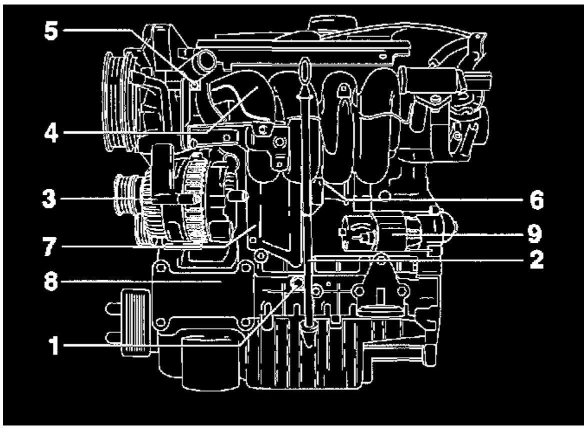
- The upper cover
- The coils and leads
- The Camshaft Position **(CMP)** sensor
- The lifting eve.

Transfer engine components at exhaust side



- The preheater plate
- The exhaust manifold
- The right engine mounting at the distribution side
- The thermostat housing, oil cooler with hoses
- The bracket, drive shaft bearing
- Water pipes.

Transfer engine components at air intake side

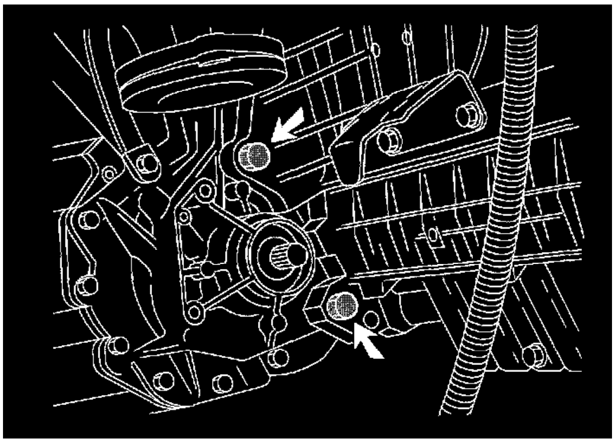


- The oil pressure sensor
- The dipstick and the pipe
- The alternator
- The intake manifold complete with water hose connection
- The thermostat housing complete
- The knock sensor
- The oil trap and the hoses
- The engine mountings with lifting eye
- Starter motor leads.

Install drive plate

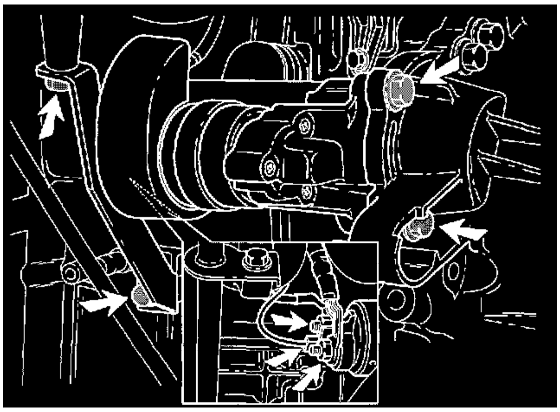
See Replacing flange plate, refer to transmission and Drivetrain.

Install transmission



Torque converter, tighten to **50 Nm.**
Plug the old engine in the same way as the new engine.
Install the cover plate exhaust side.
Install speed sensor and tighten **20 Nm.**
Place wiring guide and tighten.

Install starter motor



- Install the starter motor and tighten the bolts. Tighten to **50 Nm**
- Install the bracket and tighten tension free to the intake manifold

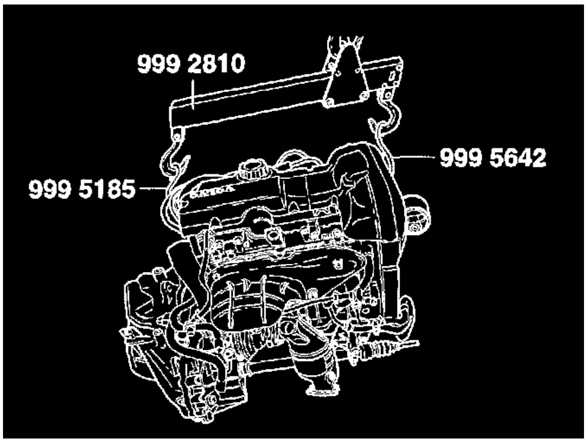
- Connect the wiring
- Place the protective cover.

Installation

Special Tools
951 2661
999 2810
999 5186
999 5642
999 5488

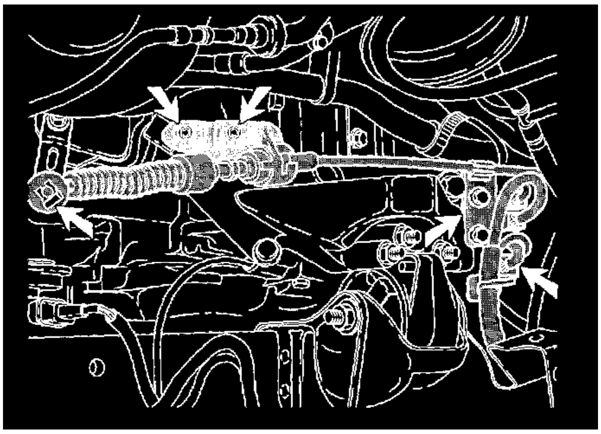
Place hood in service position

Install engine complete with transmission in car



Use the lifting beam 999 2810 and the lugs 999 5642 and 999 5186
- Attach the lifting beam so that the engine is balanced
- Always have the tackle hook on hand when lifting
- Install the nut and the bolt in the engine mounting at the distributor side.

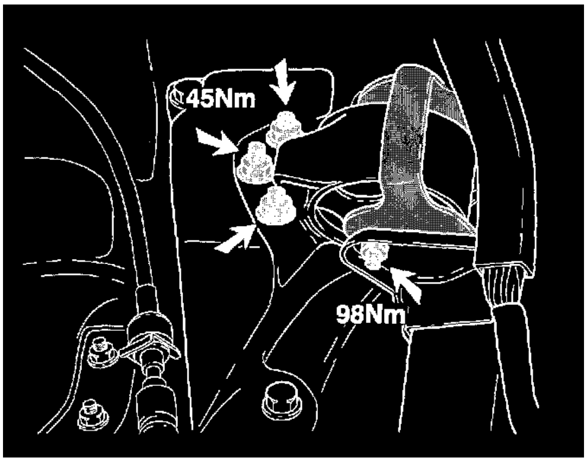
Install gear shift mechanism cables



Check the gear shift mechanism cable.

Install:
- The connectors and the bracket
- The ground lead
- The gear shift selector-cable.

Install engine mounting on transmission side



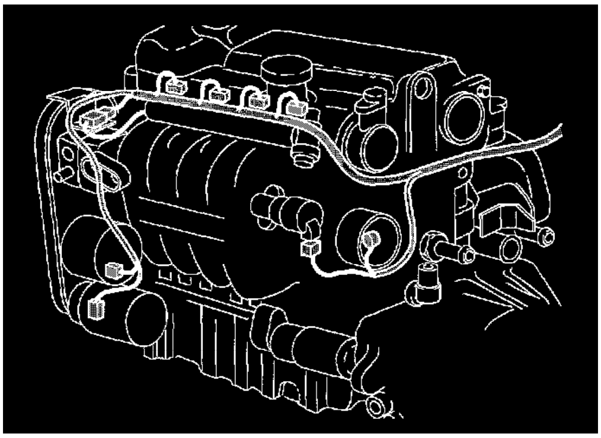
- Mount the bracket on the transmission. Tighten to **45 Nm.**

  Note! Make sure that the rubber gaiters are in the correct position.

- Install the bolt and the nut on the body bracket
- Remove the lifting system
- Tighten both the left and right engine mounting bolts to **98 Nm.**

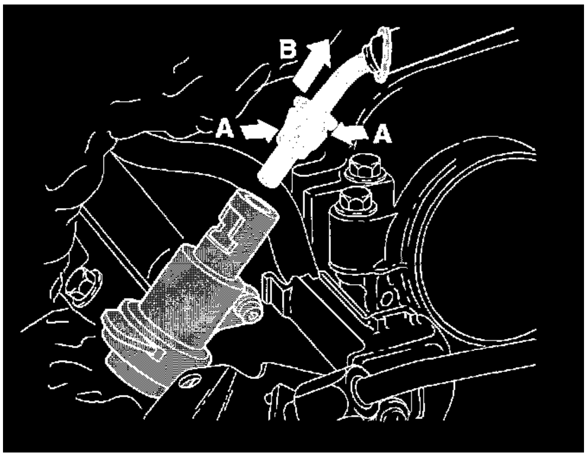
Place the hood back in the normal position.

Route and attach hoses and wiring



Connect:
- The injectors, tighten the cable
- The wiring ignition coils and the earth lead
- The cable guide to the engine, tighten to **10 Nm**
- The PCV valve
- The Throttle Position **(TP)** and the Idle Air Control **(IAC)** valves.

Route and fit fuel hose

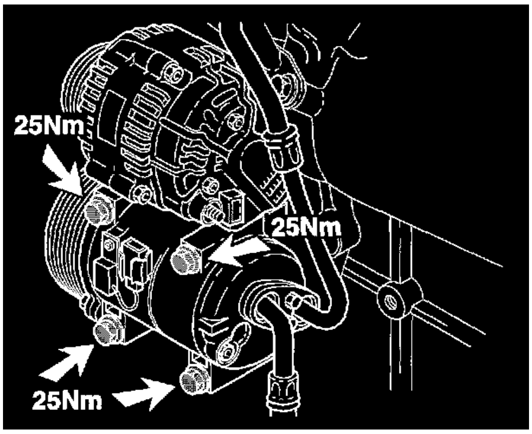


Fit the fuel hose(s) and pull to check for correct attachment.

Install turbo air outlet hose at top

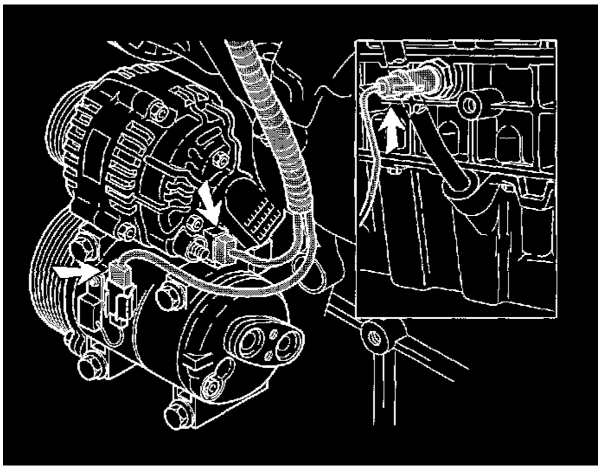
- Position the air pipe and fit it in the hose at the top
- Position the clamp and fit it to the engine with the spacer. Tighten the hose.

Install AC compressor on engine



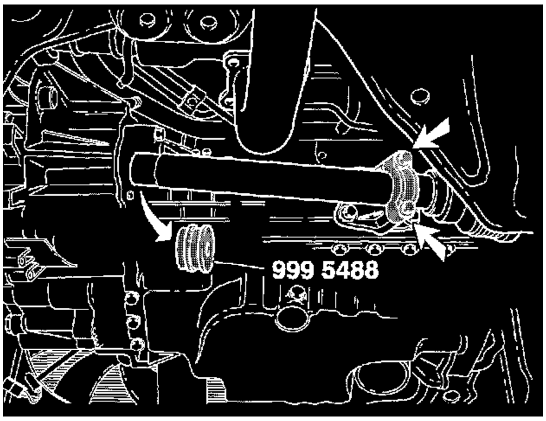
Install the AC compressor. Place the bracket at bolt (B), do not tighten the bolt (B). Tighten the other bolts to **25 Nm.**

Install connectors



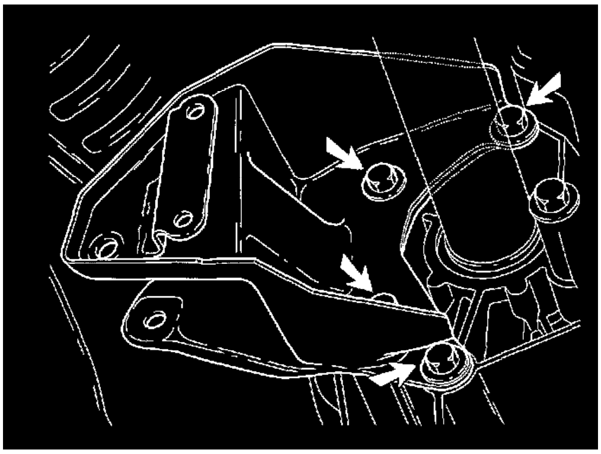
Install the connectors:
- The alternator
- The sensor AC compressor
- The oil pressure.

Install right drive shaft in transmission



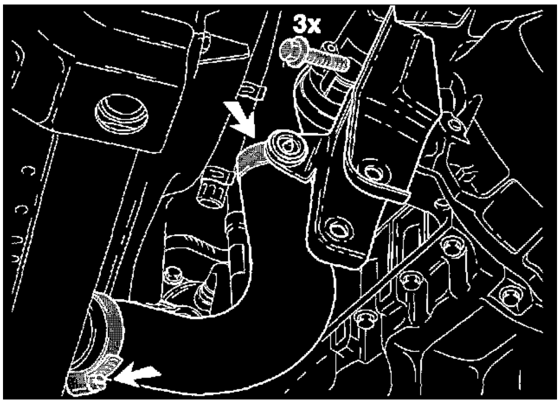
Remove the special tool 999 5488 from the transmission.
Place the drive shaft in the transmission and the bearing.
Finger-tighten the bearing cap.
Push the knuckle in the shock absorber. Install the bolts and the nuts.
Tighten the bearing cap bolts to **25 Nm.**

Mount rear engine bracket



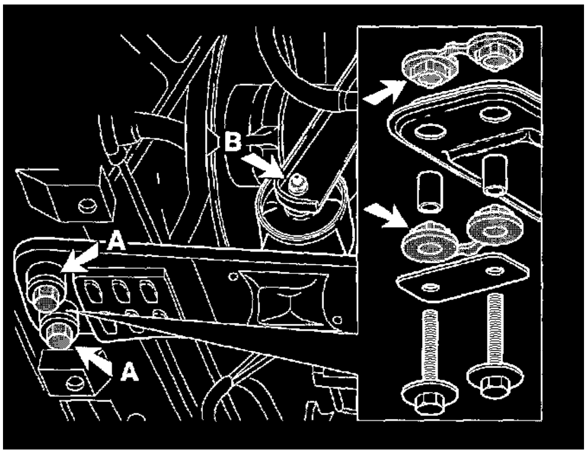
Install the bracket and tighten the four bolts.
Tighten to **40 Nm.**

Mount front engine bracket



Connect the inlet hose of the Charge Air Cooler **(CAC)** and tighten.
Mount the bracket on the hose and the engine and tighten the three bolts. Tighten to **50 Nm.**
Tighten the nut on the clamp.
Tighten to **6 Nm.**
Install the AC pipe to the engine bracket.

Install longitudinal beam

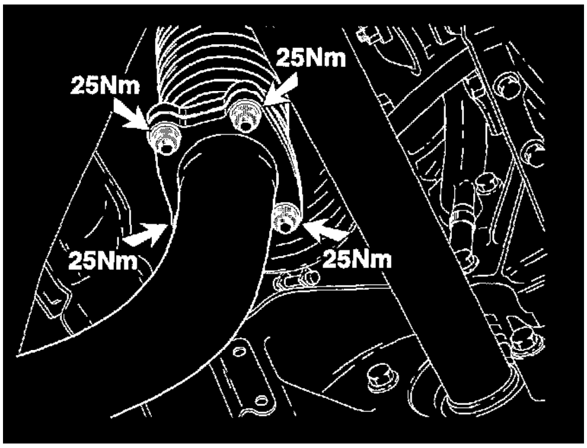


Install the heat shield.
Install the longitudinal beam, and push two bolts (B) into the engine rubbers. Tighten the two bolts. Torque setting **69 Nm.**

Note! Position the rubbers in the correct position (see illustration). The rear and front of the center member must be in similar positions.

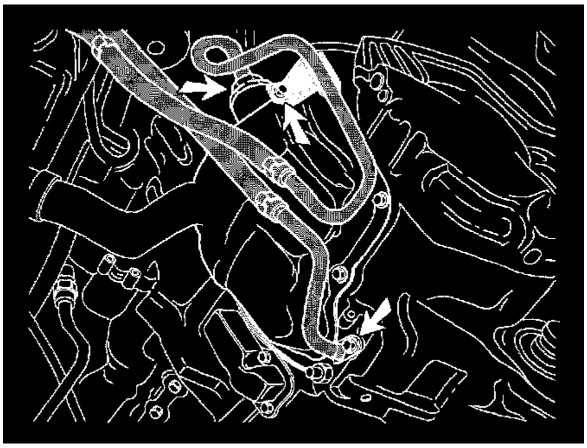
Loosen the front-mounting bolster bolt (A). First tighten the rear-mounting bolster bolt (torque setting **55 Nm**), then tighten the front mounting bolt again (torque setting **55 Nm**)

Attach exhaust pipe to exhaust manifold



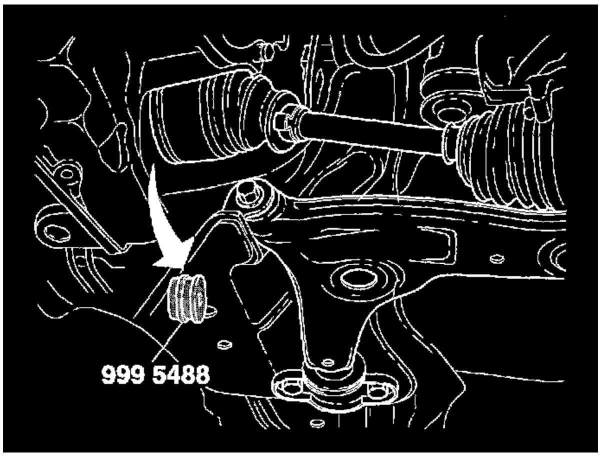
Apply new gasket.
Tighten nuts to **30 Nm.**

AT: Install oil pipes



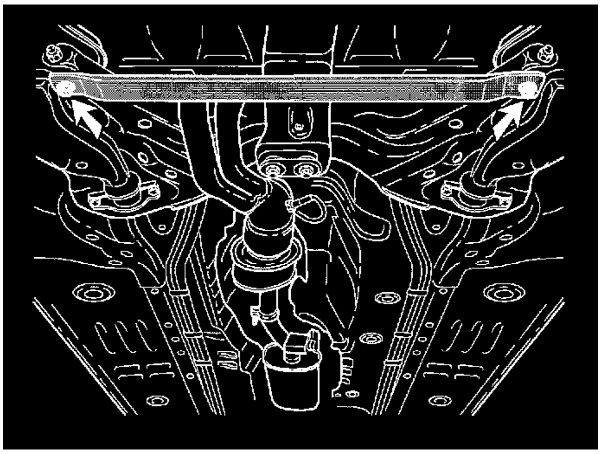
Install the lower pipe. Use a new O-ring.
Install the upper pipe (return pipe) with its mounting in the control system cover. Loosely install the connector.
The pipe cap nut is tightened later.

Install left drive shaft



- Clean the splines and the drive shaft
- Remove the special tool 999 5488 from the transmission
- Remove the bolt from the knuckle/shock absorber
- Push the drive shaft into the transmission until it stops
- Place the hub over the drive shaft splines and fit the nut
- Place the two bolts in the knuckle/shock absorber.

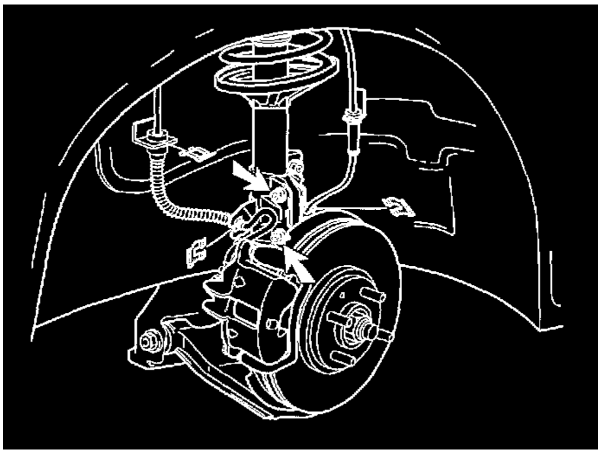
Install cross stay member



- Place the stay and fit the bolts
- Tighten the bolts to **50 Nm.**

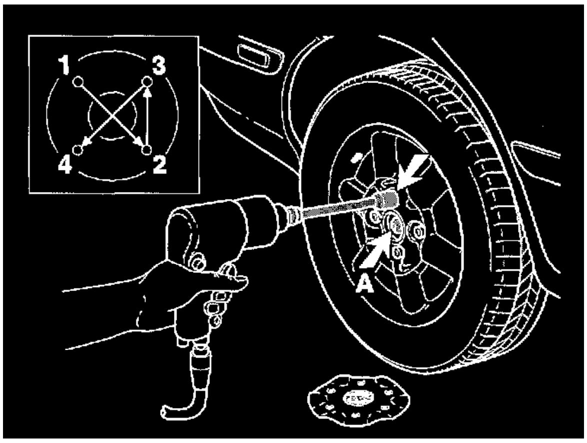
Install engine splash guards

Install:



- Tighten the two bolts from the knuckle/shock absorber. Tighten to **90 Nm**
- The ABS leads into the brackets
- The brake hose in the bracket, fit the clamp.

Fit front wheels



- Install the wheels and tighten the nuts slightly
- Tighten crosswise to 110 Nm
- Re-torque the wheel nuts by hand
- Lower the car.

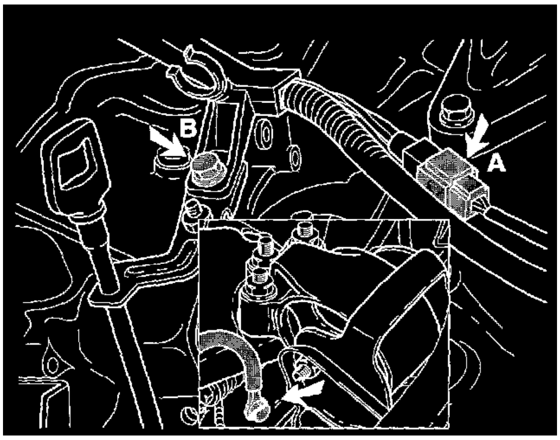
Note!

^ When tightening with an airgun, only use torque socket 555 2661.

^ Tightening the nuts crosswise and to the correct torque settings is important to avoid causing stresses in the brake disc.

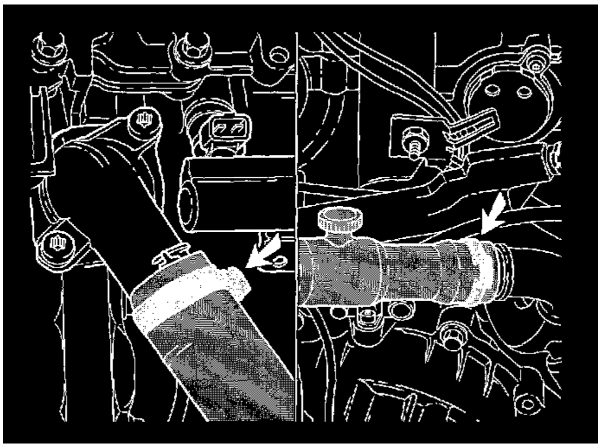
Tighten the central nut (A) to **120 Nm + 60°.**

Install wiring



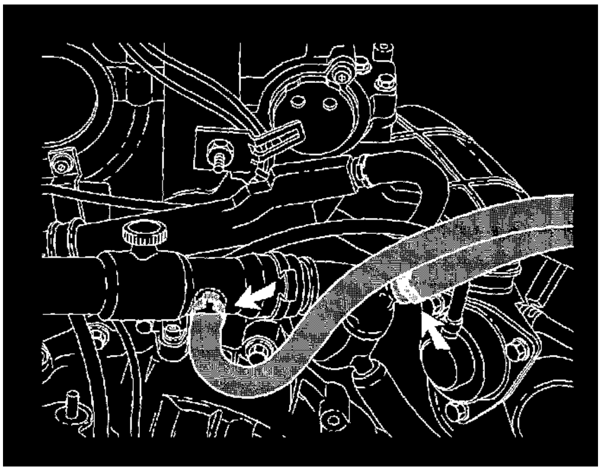
- The ground lead to the transmission
- The brake servo hose to the brake booster
- The starter motor wiring
- The battery positive lead
- Route the cables
- Fit the connectors and tie up.

Attach engine coolant hoses



- Install the clamp and fit the hose expansion tank
- Tighten the cap nut for the oil cooler on the transmission to **30 Nm.**

Attach heater hoses

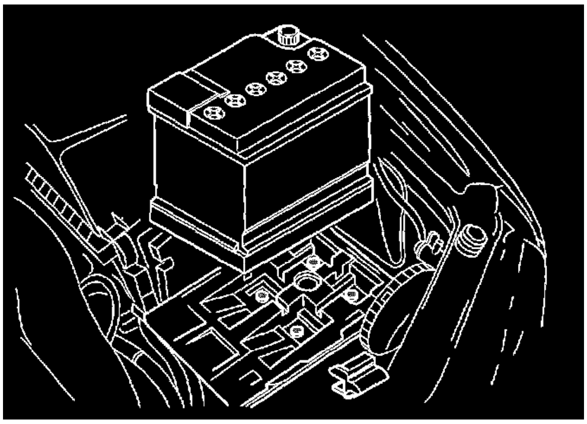


- Install and tighten the two heater hoses to the correct connections
- Install the heat shield on the fire wall.

Install air cleaner (ACL)

See Replacing the Air Cleaner **(ACL)**, refer to Powertrain Management, Fuel Delivery and Air Induction.

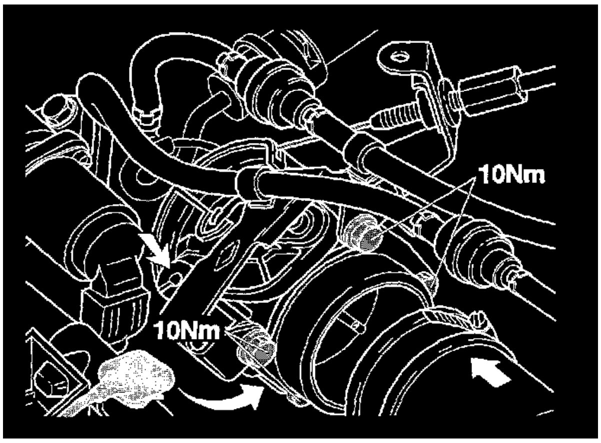
Install battery



- Install the battery shelf. Torque setting **16 Nm**
- The battery, secure with the locking part.

Note! If the car is equipped with cruise control, the vacuum hose and the leads to the vacuum motor must be installed before the battery shelf is secured.

Attach throttle cable and air inlet hose to Throttle Body (TB)

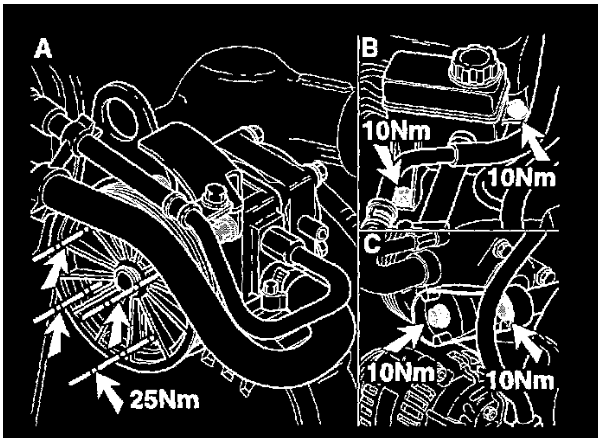


- Clean the air inlet hose and Throttle Body **(TB)**
- Install the hose and tighten the clamp

Note! Make sure that the clamp does not touch the throttle cam when the throttle cam is at the idle or Wide Open Throttle **(WOT)** position.

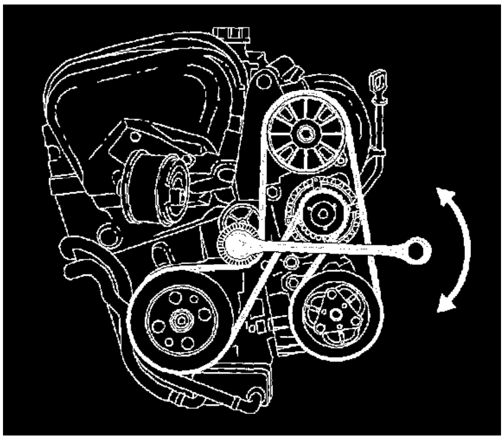
- Attach the hose to the Idle Air Control **(IAC)** valve. Use a new clamp.

Install power steering pump



- Position the pump and fit the bolts
- Loosely install the brackets between the alternator and the inlet manifold and lower bracket
- Tighten the bolts. Torque setting **25 Nm**
- Fit the cable in the bracket
- Tighten the bracket between the alternator and the inlet manifold to **25 Nm**
- Tighten the lower bolt from the bracket to **25 Nm.**

Install poly V-belt



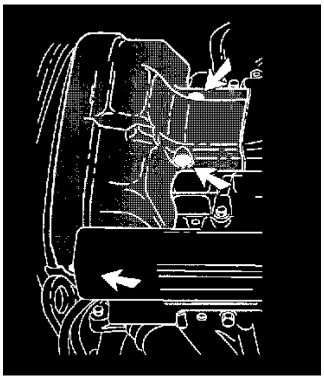
- Clean the pulley grooves
- Turn the tensioning device clockwise
- Install the auxiliaries belt as illustrated
- Release the belt tensioner (counterclockwise)
- Tighten the bracket. Torque to **10 Nm.**
- Install power steering hose. Torque to **10 Nm.**

Fill coolant

See Replacing coolant, refer to Cooling System.
Fit all covers.
Check the Automatic transmission oil level.

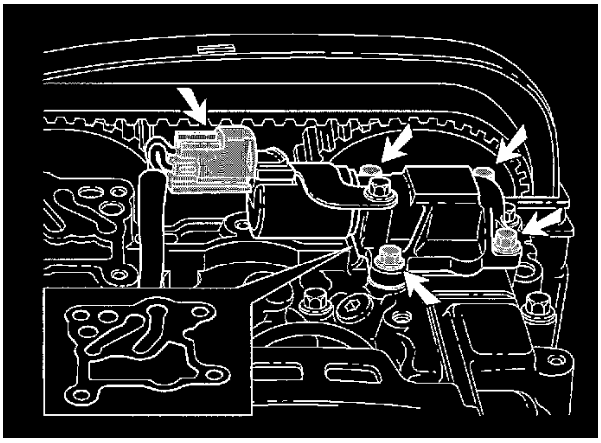
Variable Valve Timing Actuator: Service and Repair

Preparations



Remove:
- the upper timing cover.

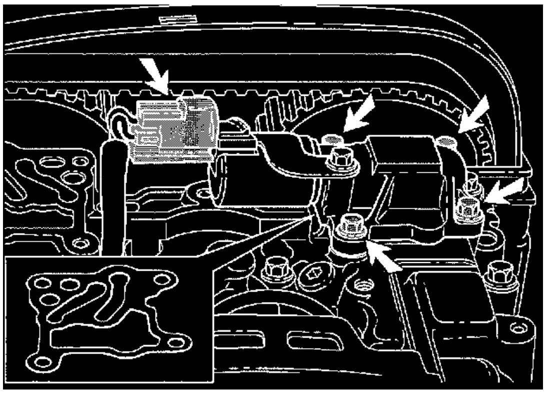
Remove the valve housing assembly
Remove:



- the connector
- the screws
- the valve
- the gasket.

Note! Clean the area around the Variable Valve Timing **(VVT)** valve thoroughly to avoid contaminated oil entering the ducts / the Variable Valve Timing **(VVT)** valve.

Install the valve housing assembly



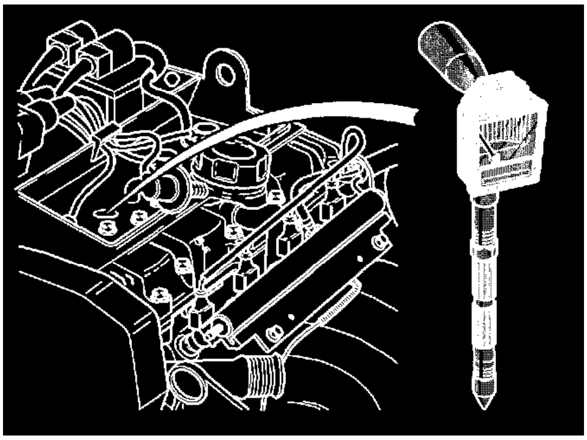
Install:
- a new gasket
- the valve
- the screws. Tighten to **10 Nm**
- the connector
- the upper timing cover.

Compression Check: Testing and Inspection

Special Tools
115 8540
999 9689

General

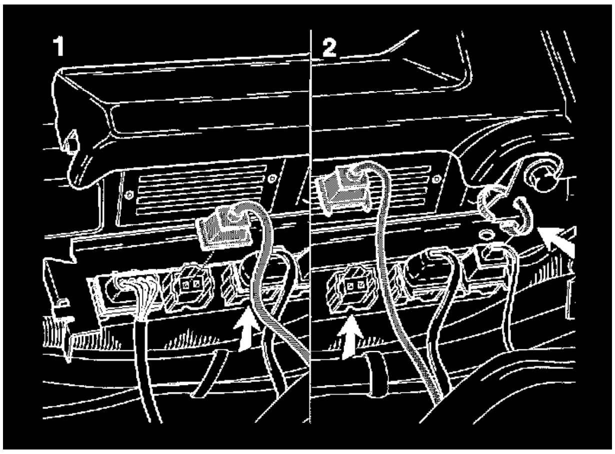
Warning The ignition system works with high ignition tension and dangerous voltage in both the low and high tension circuits. There are dangerous voltages throughout the entire ignition system including the connectors.



Test the compression with the engine at operating temperature and with Wide Open Throttle **(WOT)**
Normal value is **1.1 - 1.3 MPa**
The maximum difference between the cylinders must not exceed **2 MPa**

Note! Applies to engines at operating temperature, Wide Open Throttle **(WOT)** and starter motor turning at **4.2 -5.0 r/s (250 -300 rpm).**

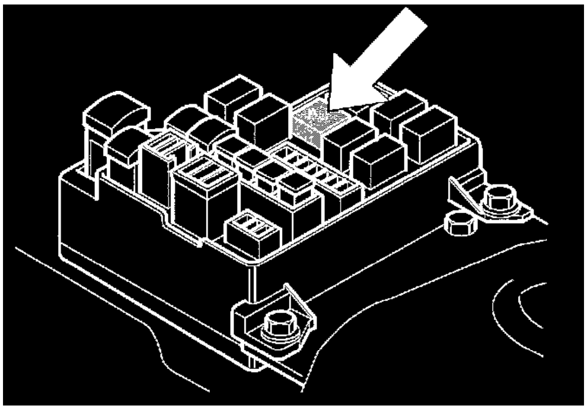
Disconnecting the ignition system



Remove:
- The connector from the flywheel sensor, turbocharged engines (1) or non turbocharged engines (2)
- the engine cover.
  Remove the ignition coils and spark plugs.

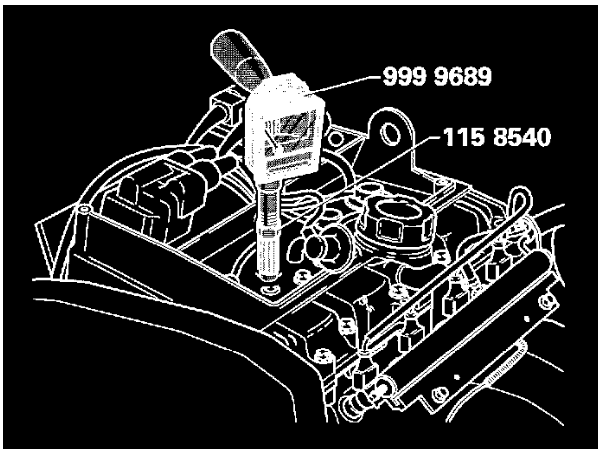
  Note! Mark up the ignition coils before removal.

Deactivating the fuel system



Remove the cover, Then remove the system relay.

Compression test



Open the throttle completely.
Use compression meter 999 9689 and extension socket 115 8540.
Test the compression in all the cylinders.
Install the spark plugs so that the gasket presses against the cylinder head.
Tighten to **25 Nm.**
Turbocharged engines: Install the ignition coils.
 Tighten to **10 Nm.**
Install all removed components.
Check whether any Diagnostic Trouble Codes **(DTCs)** are displayed.

Camshaft: Service and Repair
Replacing Camshaft Seal (Retaining Ring) Front Side

Special Tools

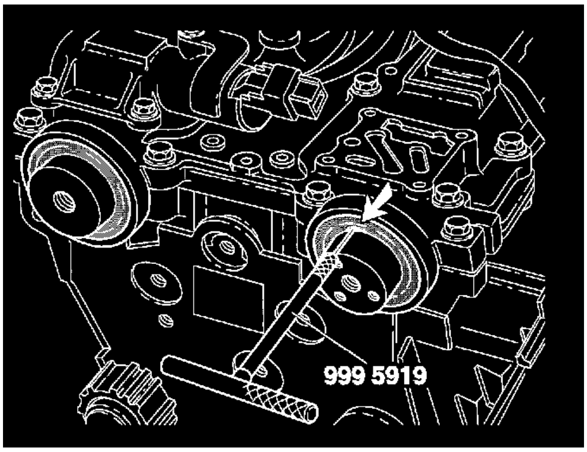
999 5719
999 5718
999 5919

Remove

Remove camshaft seal at VVT unit side

- Remove toothed belt, see Replacing toothed (timing) belt, refer to Timing Components, Timing Belt.
- Remove the gear pulley at the side to be replaced, see Replacing the camshaft seals/variable valve timing unit.

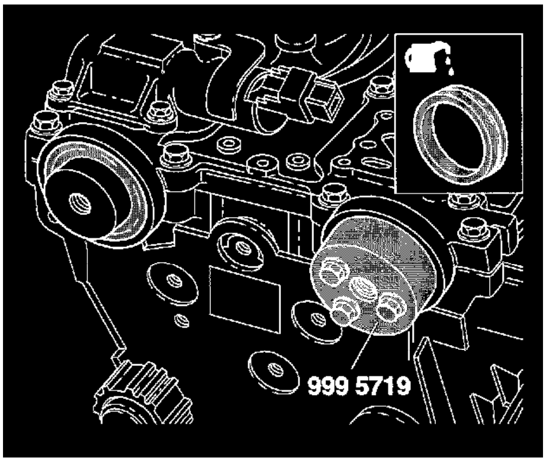
Remove camshaft retaining ring



- Remove the retaining ring with help of special tool 999 5919
- Clean the surfaces.

Install

Install camshaft retaining ring



- Grease the new retaining ring
- Install the ring by using special tool 999 5718 at VVT side and 999 5719 at other side
- Remove the tools and check proper fitting.
- Install gear pulley, see Replacing the camshaft seals/variable valve timing unit
- Install toothed belt.

  Check for leakage.

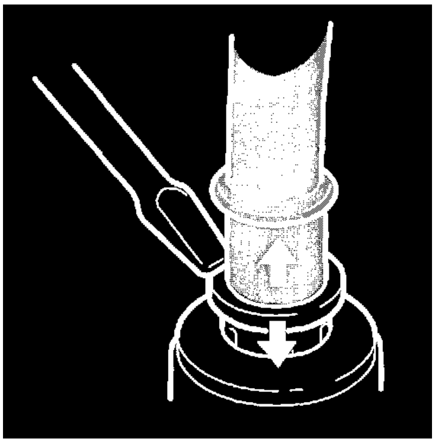
Camshaft: Service and Repair
Replacing the Camshaft Seals/Variable Valve Timing Unit

Special Tools
999 5006
999 5383
999 5460
999 5452
999 5451
999 5199
999 5718
999 5719
999 5651

Note!
- The crankshaft and the camshafts must not be turned more than is stated in the method description! If the shafts are turned in any other way the valves may be damaged.
- As the illustrations in this service information are used for different model years and/or models, some variation may occur. However, the essential information in the illustrations is always correct.

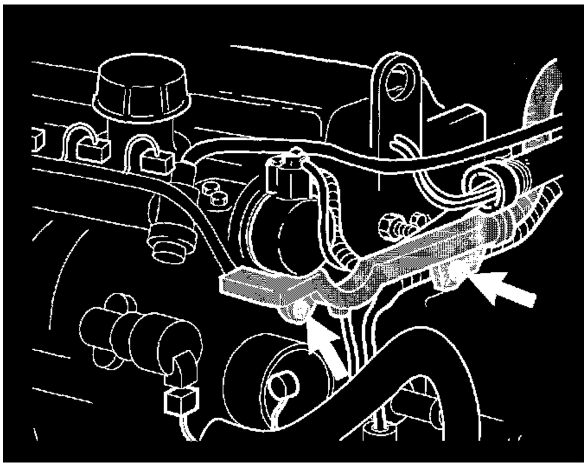
Preparations
Remove:
- the cable from the battery negative terminal. First read Note when disconnecting and connecting the battery lead
- the inlet hose between the Air Cleaner **(ACL)** and Throttle Body **(TB)**. Place it to one side.

Remove:



- the brake servo vacuum hose from the terminal in the Throttle Body **(TB)**. Disconnect the hose by pressing the plastic ring down. At the same time pull the hose upwards. Move the hose to one side
- the fuel line and wiring from the clips at the rear edge of the cylinder head.

Remove:

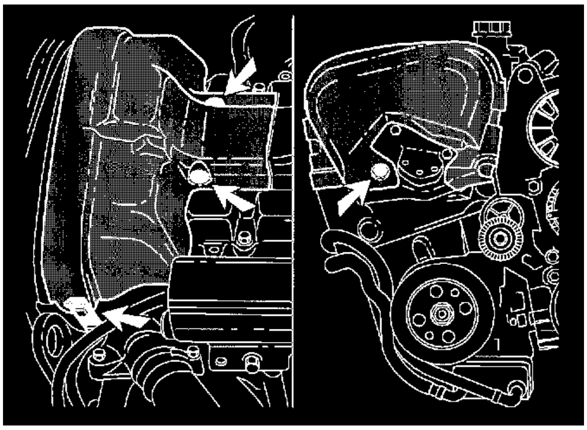


- the screws for the cable duct
- the rear cover for the camshaft
- the Camshaft Position **(CMP)** sensor housing
- the trigger wheel

- the right-hand engine splash guard
- the auxiliaries belt.

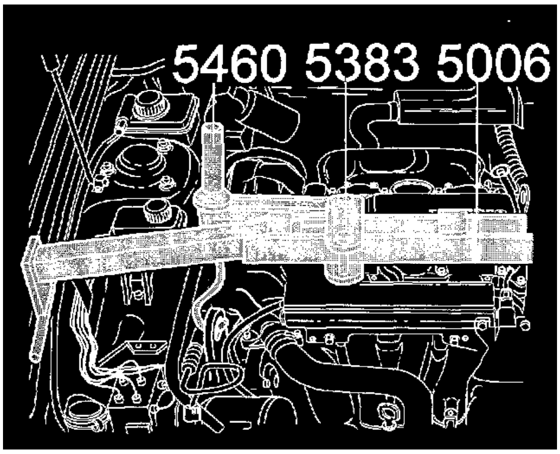
Removing the timing covers

Remove:



- the upper timing cover
- the front timing cover.

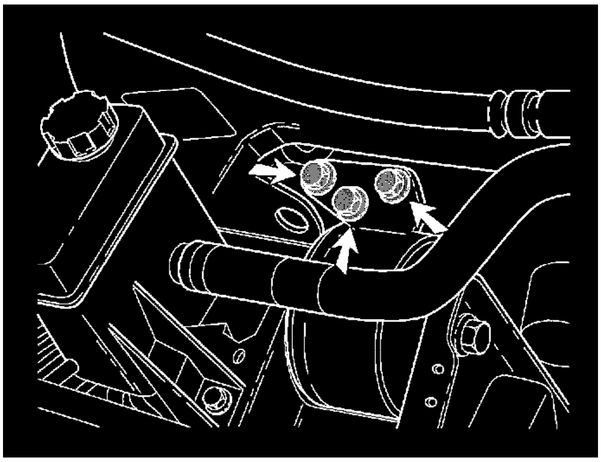
Installing the lifting beam and lifting hook



Remove the nut for the engine mounting.
Remove the metal bracket for the servo hose from the rotation protection for the auxiliaries belt.
Position lifting beam 999 5006 slightly in front of the front lifting eyelet for the engine. Use lift arm 999 5383 and lifting hook 999 5460 to lift the front edge of the engine a few mm until the engine mounting screw can be taken out.

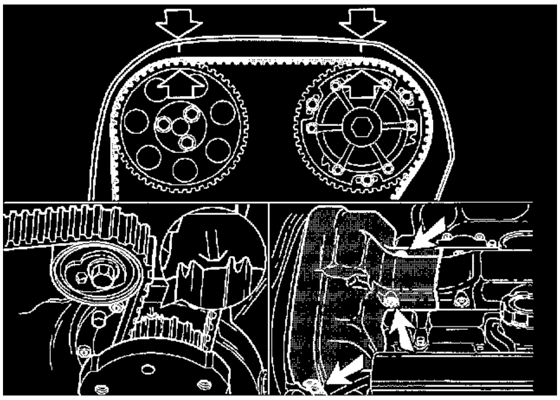
Removing the right-hand engine mounting

Remove:



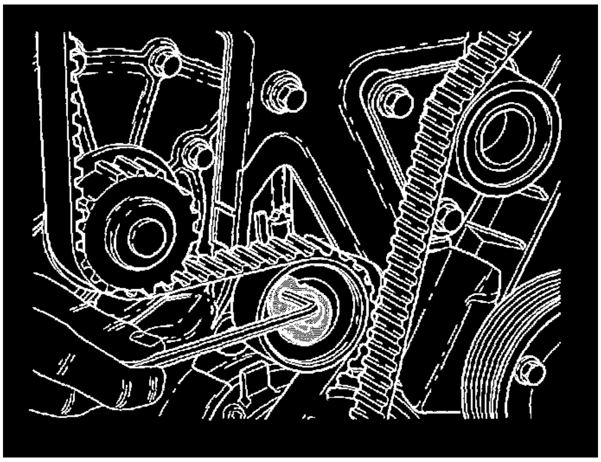
- the screws for the servo holder
- the engine mounting screws
- the engine mounting.

Position the engine according to the marking



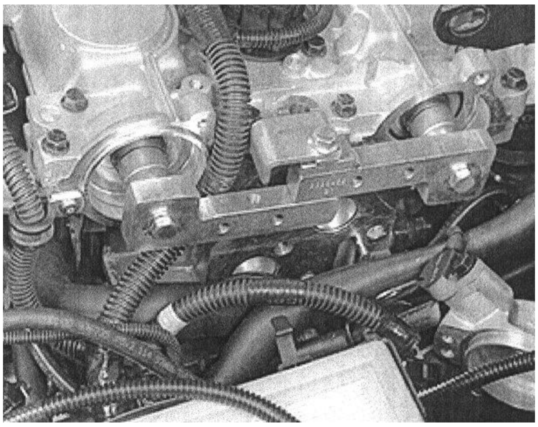
Remove the right front wheel.
Position the upper timing cover.
Turn the crankshaft until the markings on the crankshaft and camshaft pulley correspond. Turn the crankshaft a further 1/4 turn clockwise and then back again until the markings correspond. The markings are illustrated. Remove the upper timing cover.

Removing the timing belt



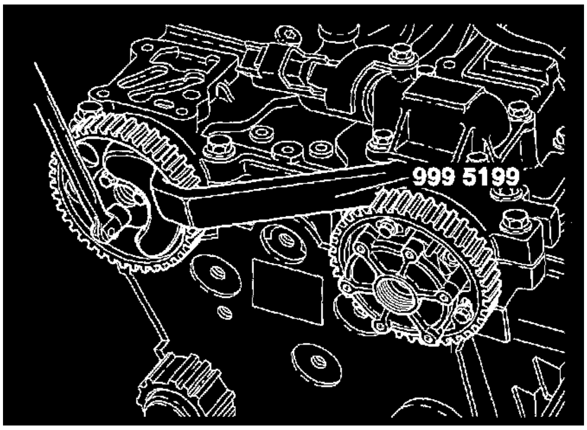
Slacken off the center screw for the belt tensioner slightly.
Hold the center screw still and turn the tensioner eccentric clockwise to the "10 o'clock" position using a 6 mm Allen key.
Remove the timing belt from the camshaft pulleys.

Removing the timing gear pulley



Timing gear pulleys with variable valve timing unit

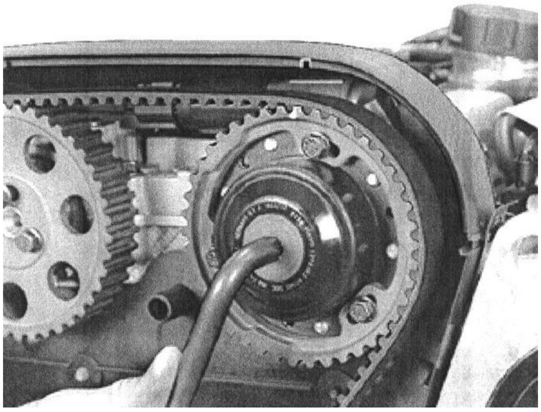
- Install camshaft adjustment tool 999 5452 at the rear of the camshafts.



Timing gear pulleys with variable valve timing units:

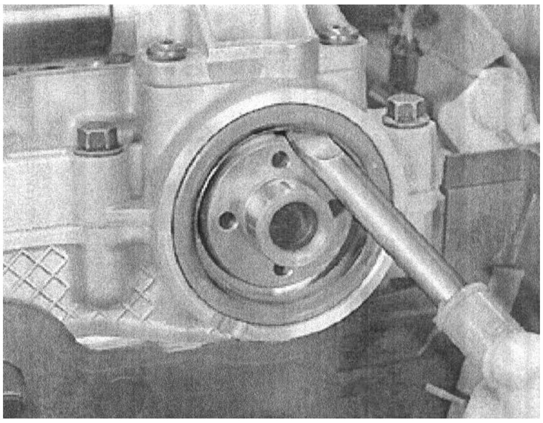
- Remove the plug at the front edge of the variable valve timing unit (TORX 55)
- Remove the center screw from the WT unit (TORX 55).
  Carefully pull out the timing gear pulley with the Variable Valve Timing **(VVT)** unit. A small amount of oil may run out. Place paper underneath.

Timing gear pulleys without variable valve timing units:

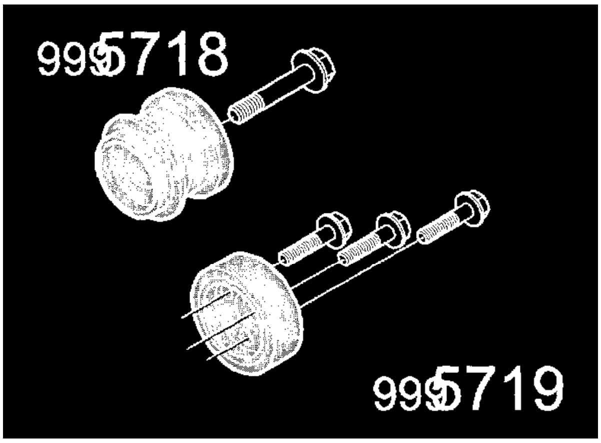


- Remove the screws for the timing gear pulley. Use counterhold 999 5199
- Remove the timing gear pulley
- Remove tool 999 5452
- Remove the screw holding the inner timing cover to the cylinder head.

Replacing the camshaft seal



Carefully press in tool 999 5651 between the sealing ring and the camshaft.
Carefully pry out the seal.
Oil the new seal.



Install the new seal for the camshaft with variable valve timing. Use drift 999 S718.
Install the new seal for the camshaft without variable valve timing. Use drift 999 S719.
Install the screw holding the inner timing cover to the cylinder head

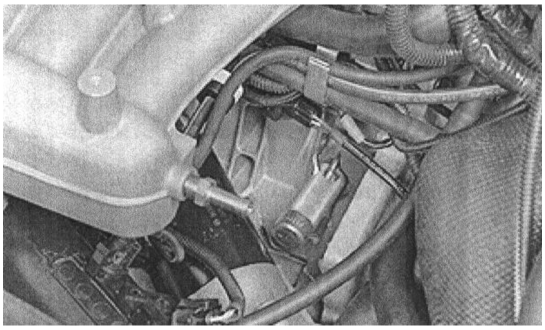
Secure the crankshaft position

Install the adjustment tool.

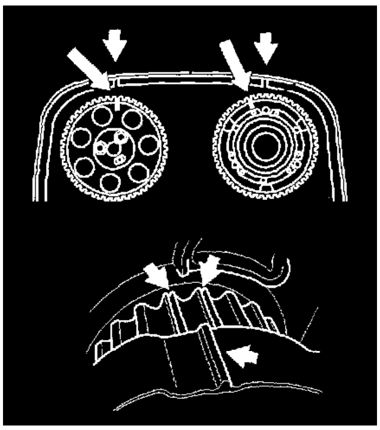
Remove:

- the front air baffle
- the support between the cylinder block and the intake manifold
- the mounting screws for the starter motor
- the lower timing cover.

Place the starter motor to one side.
Remove the blind cover plug and the blind cover washer
Turn the crankshaft clockwise slightly to avoid the adjustment tool being in the wrong position.

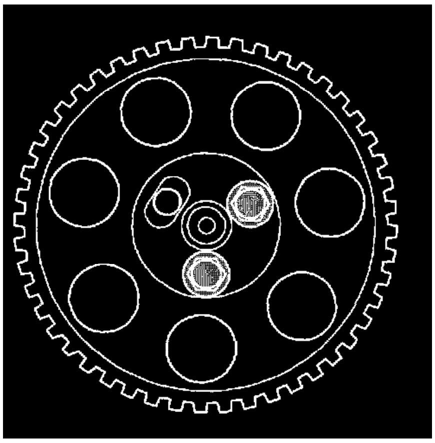


Install adjustment tool 999 5451. Ensure that the adjustment tool bottoms out against the cylinder block.
Turn the crankshaft back counter-clockwise until it stops against the drift.



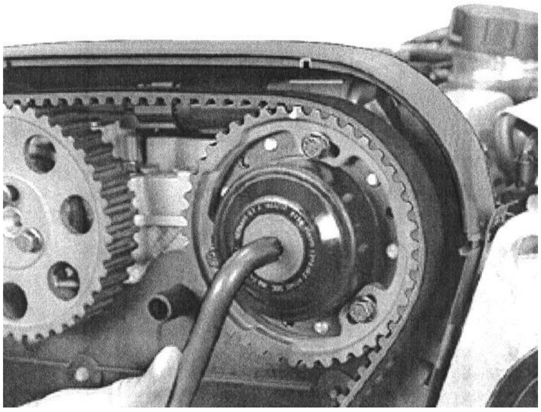
Check that the marking on the crankshaft timing gear pulley corresponds with the marking on the oil pump.

Installing the camshaft timing gear pulley



Timing gear pulleys without Variable Valve Timing (VVT)

- install the upper timing cover
- install the timing gear pulley without variable valve timing on the camshaft. Use the two screws positioned so that the markings on the timing gear pulleys and upper timing cover correspond. Do not tighten.

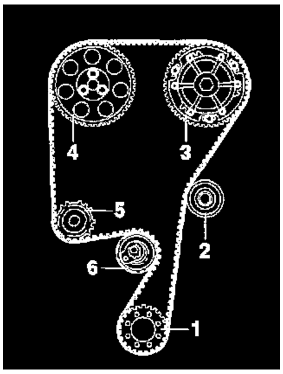


Timing gear pulleys with Variable Valve Timing (VVT):

- Install the timing gear pulley using the center screw on the camshaft. Ensure that the markings on the timing gear pulleys/upper timing cover correspond.
  Do not tighten.

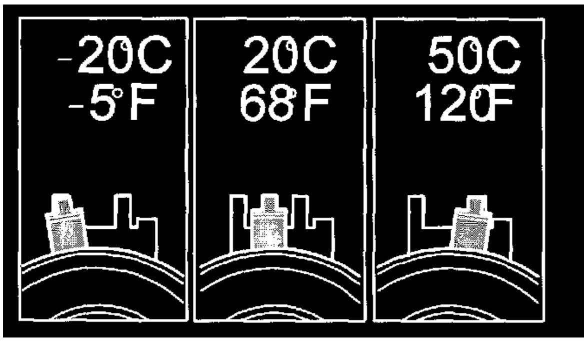
Installing the timing belt

Install the timing belt on the timing gear pulleys.

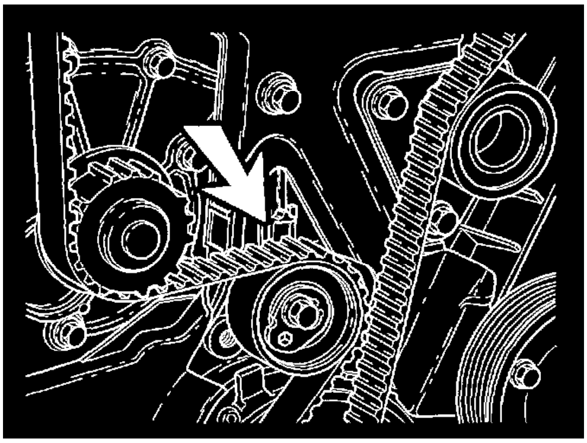


Note! Adjust so that the screws in the timing gear pulley without variable valve timing do not reach the limit position in the oval holes.

Note! This adjustment is to be made with a cold engine. Suitable temperature is approximately **20°C/67°F**. At higher temperatures (with the engine at operating temperature or a high outside temperature for example) the indicator is further to the right.



The illustration shows the position of the indicator at different engine temperatures.

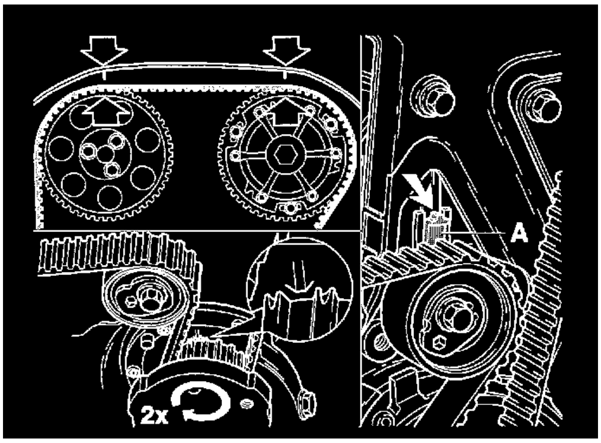


- Carefully turn the crankshaft clockwise until the timing belt is tensioned. The belt must be tensioned between the intake camshaft pulley, the idler pulley and the crankshaft
- Hold the belt tensioner center screw secure. Turn the belt tensioner eccentric counter-clockwise until the tensioner indicator passes the marked position. Then turn the eccentric back so that the indicator reaches the marked position in the center of the window
- Hold the eccentric securely. Tighten the center screw.
  Tighten to **20 Nm**

Tightening the timing gear pulley

Tighten the center screw on the timing belt tensioner with variable valve timing. Tighten to **90 Nm.**
Install the plug. Tighten to **35 Nm.**
Install the third screw on the camshaft without variable valve timing. Tighten to **20 Nm.**
Remove the adjustment tools.

Check



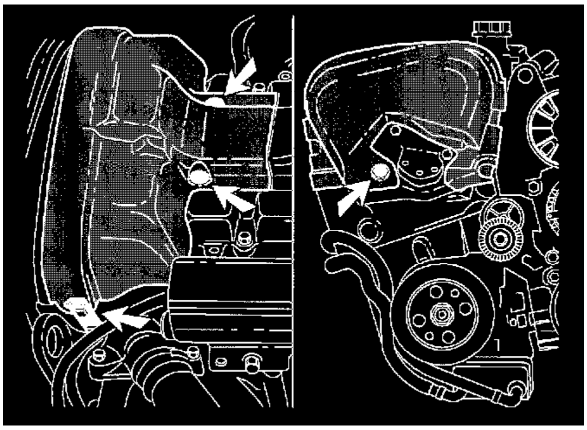
- Press the belt to check that the indicator on the tensioner moves easily
- Install the upper timing cover
- Turn the crankshaft two turns. Check that the markings on the crankshaft and camshaft pulley correspond.

  Note! Check that the indicator on the belt tensioner is within the marked area.

- Remove the upper timing cover.

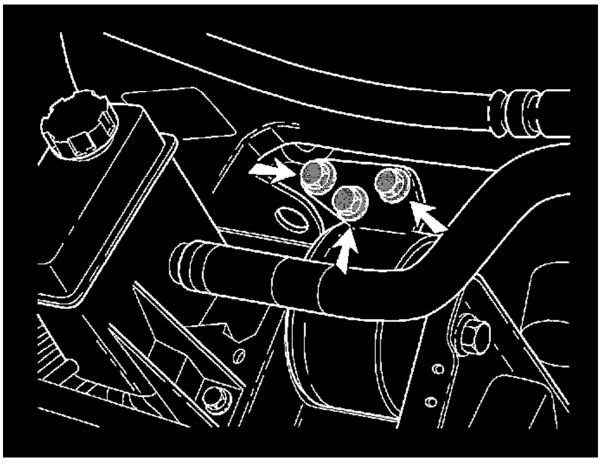
Installing timing covers

Install:



- the lower timing cover
- the front timing cover. Tighten to 12 Nm
- the upper timing cover.

Installing the right engine mounting



Screw the engine mounting onto the engine. Tighten to **67 Nm.**
Install the engine mounting screw and nut in the bodywork bracket. Tighten by hand.

Finishing

Remove the lifting beam and lifting hook.
Tighten the engine mounting nut. Tighten to 98 Nm.

Install:

- the power steering reservoir
- the metal bracket for the power steering hose on the rotation protection for the auxiliaries belt
- the auxiliaries belt
- the rear camshaft cover
- the trigger wheel. Tighten to **17 Nm**
- the Camshaft Position **(CMP)** sensor housing. Tighten to **5 Nm**
- the cable duct
- the brake servo vacuum hose

- the hose between the intake manifold and Air Cleaner **(ACL)** housing
- the blind cover plug
- the mounting screws for the starter motor
- the support between the cylinder block and the intake manifold
- the front air baffle
- the cable from the battery negative terminal. First read Note when disconnecting and connecting the battery lead.

Checking work

Function test:

- Test drive the car.

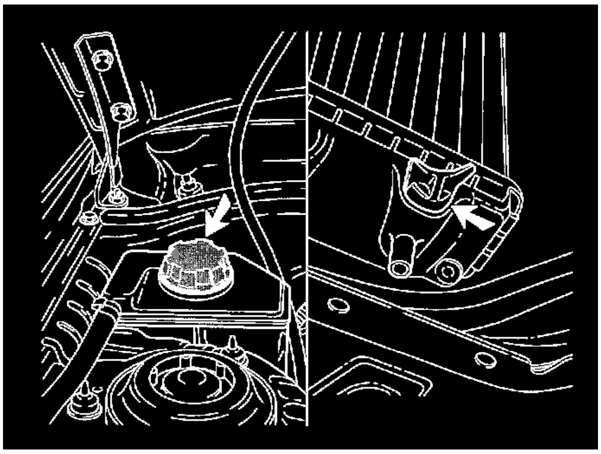
Cylinder Head Assembly: Service and Repair

Special Tools:
999 5454
951 2666
999 5670
999 5451
951 2050
951 2767
999 5452
999 5718
999 5719

Note! As the illustrations in this service information are used for different model years and/or models, some variation may occur. However, the essential information in the illustrations is always correct.

Preparation
Disconnect the battery negative lead. First read Note when disconnecting and connecting the battery lead.

Draining the coolant



- Remove the front air baffle
- Open the nipple on the engine
- Drain the coolant into a container
- Close the nipple
- Remove the screw that holds the inlet pipe for the coolant pump to the cylinder block.

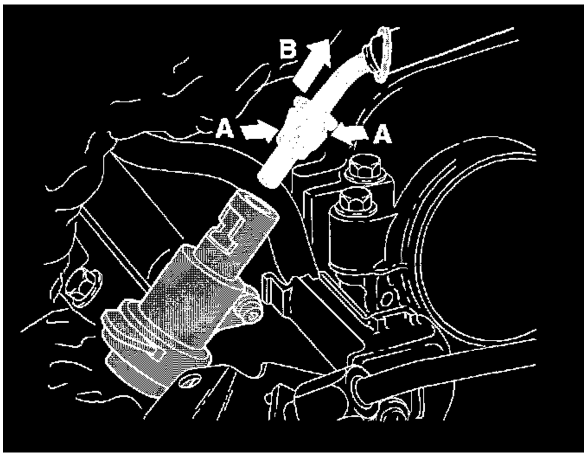
Separating the exhaust system
Remove the nuts where the Three-Way Catalytic Converter **(TWC)** and the front exhaust pipe divide.
Unhook the exhaust system and allow it to hang.

Removing the manifold and turbocharger (TC)
Remove the manifold according to Replacing exhaust manifold, refer to Exhaust System.

Removing the starter motor
Remove:
- the lower hose for the Charge Air Cooler **(CAC)**
- the support bracket for the intake manifold
- the connector for the oil pressure switch
- the plastic charge air pipe from the Turbocharger **(TC)**
- the screws for the starter motor
- unhook the starter motor and allow it to hang.

Draining the fuel line
Drain the fuel line according to Draining fuel injection system, refer to Powertrain Management, Fuel Delivery and Air Induction.

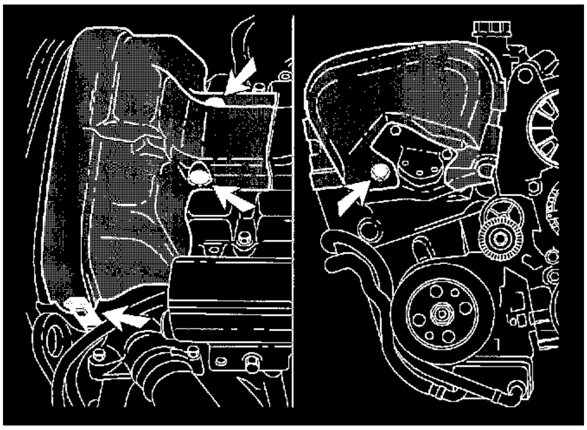
Removing the fuel line



Disconnect the quick-release connector between the fuel line and the fuel rail.
Use tool 951 2666.

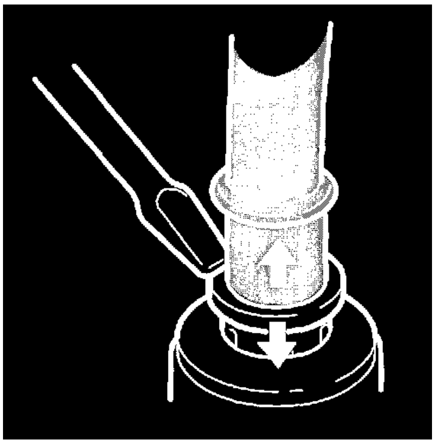
Removing components

Remove:



- the cover over the injector
- the cover over the Throttle Body **(TB)**
- the upper timing cover
- the cover over the ignition coils
- the front timing cover
- the throttle cable from the bracket for the Throttle Body **(TB).**

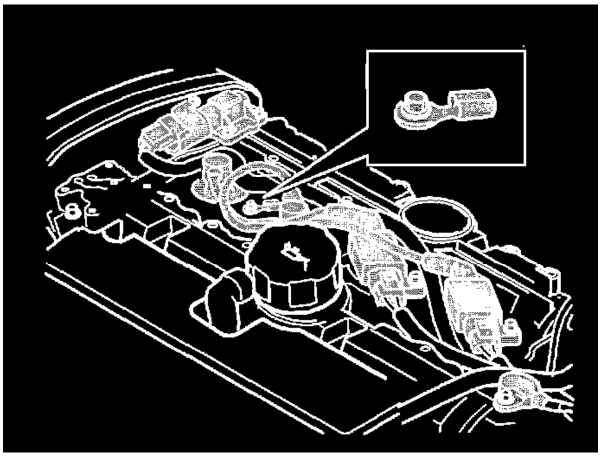
Remove:



- the vacuum hose for the brake servo. Pull the hose while pressing the plastic ring down
- the Turbocharger **(TC)** control valve from the Air Cleaner **(ACL)** housing
- the connector for the Mass Air Flow Engine **(MAP)** sensor
- the EVAP hose connection to the mass air flow Engine **(MAP)** sensor hose
- the upper section of the Air Cleaner **(ACL)** housing and hose
- the pipe screw for the water-heated crankcase ventilation
- the auxiliaries belt.

Exposing the cable harness

Remove:



- the screw from the ignition coil ground
- the camshaft position **(CMP)** sensor.

Remove:

- the variable valve timing valve connector
- the ignition coil connectors.
  Place the cable harness to one side.
  Unscrew the cable duct from the rear edge of the cylinder head and the Throttle Body **(TB)** bracket. Release the rear edge of the cylinder head from the cables and hoses.

Remove:

- the connector for the engine coolant temperature sensor
- the injector connectors.

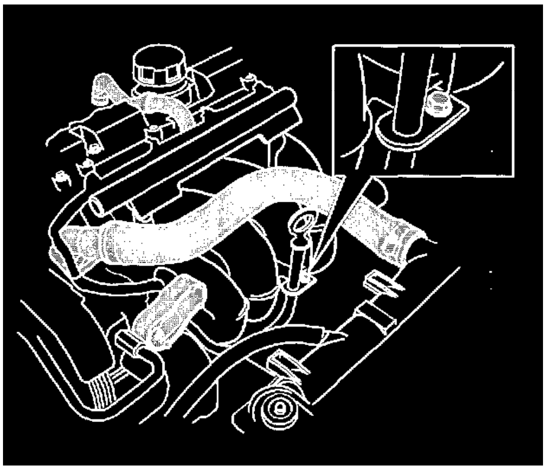
Place the cable duct and cable harness to one side.
Mark up and remove the ignition coils and ignition cables.

Remove:

- the rear cover for the camshaft
- the Camshaft Position **(CMP)** sensor housing
- the trigger wheel.

Removing the intake manifold

Remove:



- the upper radiator hose together with the cover for the thermostat housing
- the screw holding the dip stick pipe to the intake manifold
- the connectors from the assisted air control valve and the Throttle Position **(TP)** sensor
- the hose for the crankcase ventilation from the camshaft cover
- the vacuum hoses from the intake manifold, mark up the position
- the bracket between the servo pump and intake manifold
- the screws holding the intake manifold to the cylinder head
- the intake manifold.

Installing the lifting beam and lifting hook

Install the lifting beam and the lifting hook according to Replace the engine mountings, refer to Drive Belts, Mounts, Brackets and Accessories.

Removing the right-hand engine mounting

Remove the right engine mounting according to Replace the engine mounting, refer to Drive Belts, Mounts, Brackets and Accessories.

Position the engine according to the marking

See Replacing the timing belt, refer to Timing Components.

Removing the timing belt

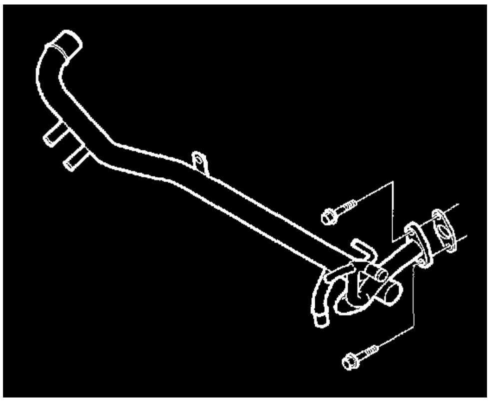
Remove the timing belt according to Replacing the timing belt, refer to Timing Components.

Removing the timing gear pulley

Remove the timing gear pulley according to Replacing the camshaft seals/variable valve timing unit, refer to Camshaft, Lifters and Push Rods.

Releasing the intake pipe for the coolant pump

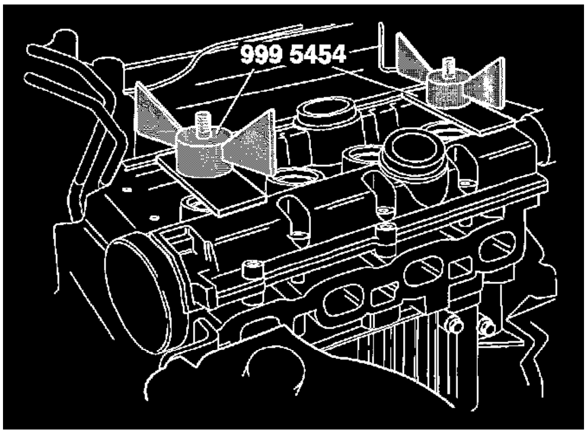
Remove the two screws at the coolant pipe connection to the bypass channel.



Carefully turn the pipe to remove it from the cylinder block.

Removing the camshaft cover and cylinder head

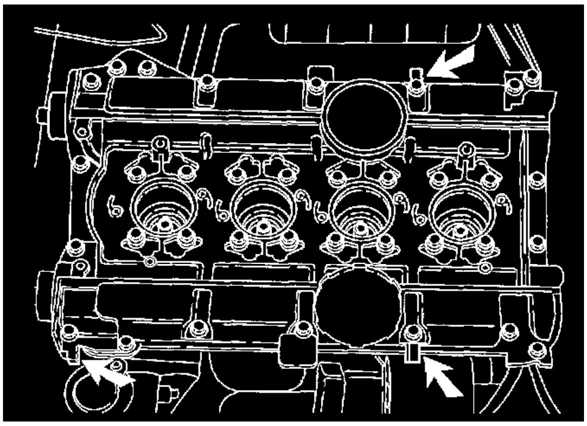
Remove:



- the variable valve timing valve
- the spark plugs from cylinders 1 and 4.

  Install 2 tools 999 5454. Leave a 2-3 mm gap to the camshaft cover. Ensure that the screw in the spark plug well is fully tightened.

  Remove all the screws securing the camshaft cover to the cylinder head.



Use pliers 999 5670 to lift the cover from the cylinder head. Install the pliers at the stop lugs. Start at the cylinder and work alternately backward.
Slacken off the wing nuts a few turns. Repeat the procedure.
Carefully press out the front and rear camshaft seals.

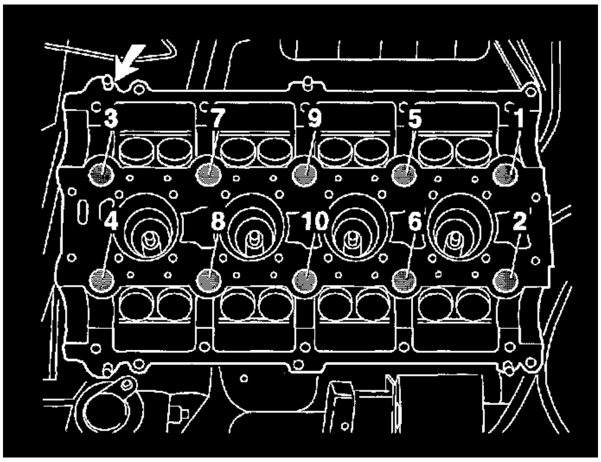
Caution Do not damage the sealing surfaces on the camshafts.

Remove:

- tools 999 5454
- the camshaft cover
- the camshafts.

Lift out the valve lifters. Use suction pads. Do not use magnets!

Caution Mark up and position the lifters so that their original positions can be established.

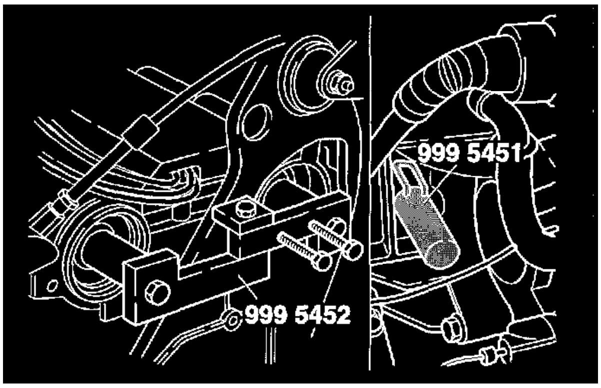


Remove the screws holding the cylinder head on the cylinder block. Start at the sides and work alternately towards the center.
Get help to lift off the cylinder head.

Caution Do not damage the mating surfaces.

When replacing or working on the cylinder head

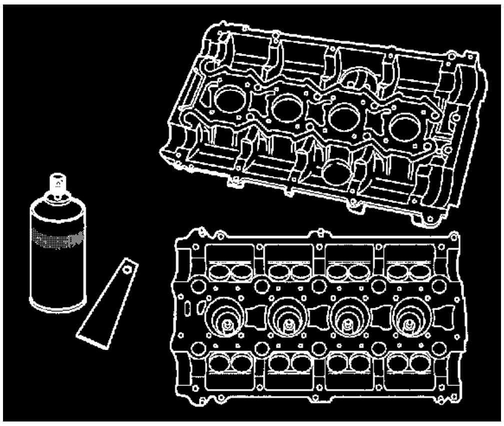
Remove:



- the thermostat housing
- the heat deflector plate above the manifold
- the manifold and gaskets.

Caution Do not damage the mating surfaces.

Cleaning the gasket face



Clean the gasket faces for:

- the coolant bypass channel
- the intake manifold
- the cylinder block
- camshaft cover.

When replacing or machining the cylinder head, clean the gasket faces for:

- the manifold. Check that the studs are tightened
- thermostat housing.

Blow the oil ducts clean.

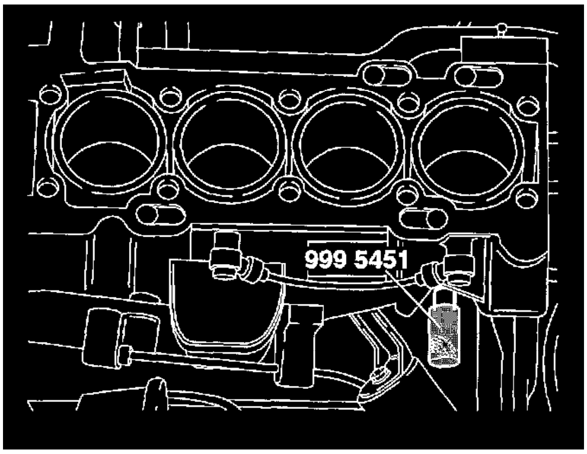
Caution Do not use a metal scraper. Use a soft putty knife and gasket solvent 1161340-3 if necessary. The surfaces must be completely clean in order to form a complete seal.

Warning Use a fume hood or extractor when using gasket solvent.

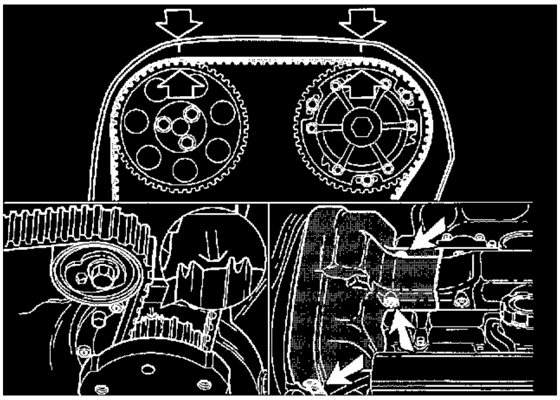
Installing the cylinder head

Note! For tightening torques not in the text, see Specifications

Aligning the crankshaft



Remove the blind cover plug.
Turn the crankshaft clockwise slightly to avoid the camshaft adjustment tool being in the wrong position.
Install crankshaft adjustment tool 999 5451. Ensure that the camshaft adjustment tool bottoms out against the cylinder block.
Turn the crankshaft back counter-clockwise until it stops against the drift.



Check that the marking on the crankshaft timing gear pulley corresponds with the marking on the oil pump.

When replacing or working on the cylinder head

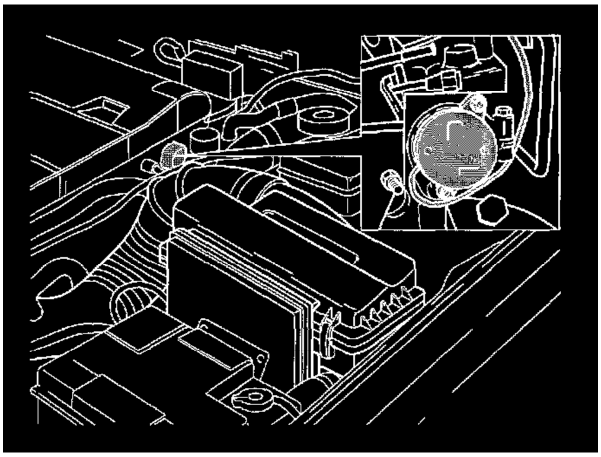
Install:

- the thermostat housing. Use a new gasket
- the manifold. Use new gaskets. Lubricate the studs with paste 116 1408
- the heat deflector plate above the manifold.

Caution Do not damage the mating surfaces.

Installing the cylinder head

Install a new cylinder head gasket.
Install the cylinder head.
Ensure that no wiring or hoses are trapped between the cylinder head and cylinder block.



Use new screws. Lubricate and install all the screws.
Tighten the screws as illustrated.
Tighten the screws in the following order:

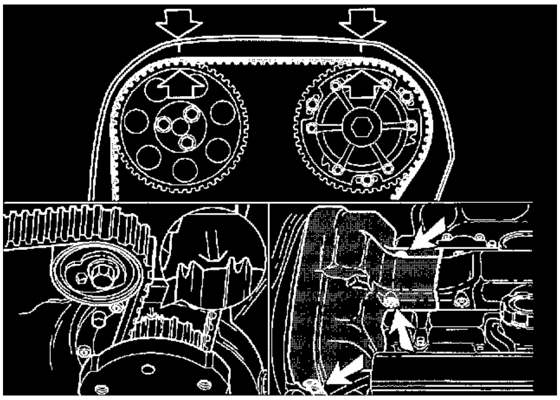
- Tighten to **20 Nm**
- Tighten to **60 Nm**
- Angle-tighten **130°**. Use protractor 951 2050.

Installing the valve lifters and camshafts

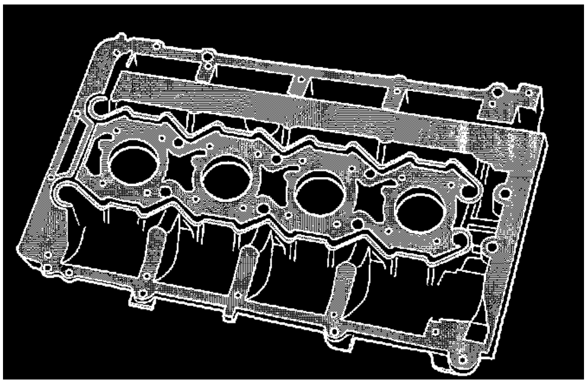
Note! When installing a new cylinder head, the valve clearance must be set according to valve clearance, setting/adjusting.

Lubricate the valve guide wells.
Install all the valve lifters.

Note! Make sure that the lifters are in the same position as before.



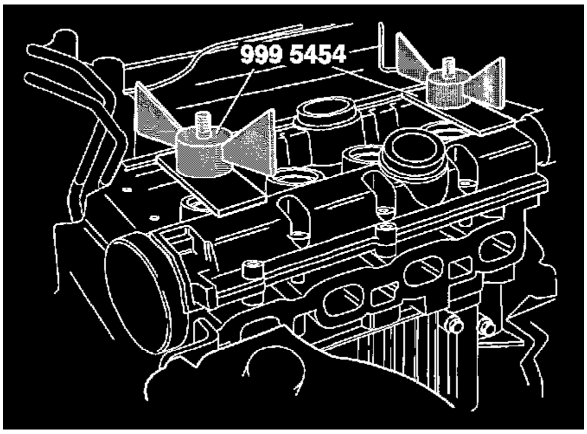
Lubricate the camshaft bearing seats.
Install the intake camshaft. Ensure that the groove at the rear edge of the camshaft is above an imaginary center line.
Position the exhaust camshaft. Ensure that the groove at the rear edge of the camshaft is below an imaginary center line.



Applying liquid gasket.
Wipe the oil film off the mating surfaces on the camshaft cover and cylinder head.
Install new O-rings around the spark plug wells on the cylinder head.
Apply liquid gasket 116 1O59 to the camshaft cover.
Use roller 951 2767.
The surface must be completely covered without any excess.

Caution Ensure that no liquid gasket gets into the coolant or oil ducts. Only a thin layer of liquid basket is required.

Installing the camshaft cover



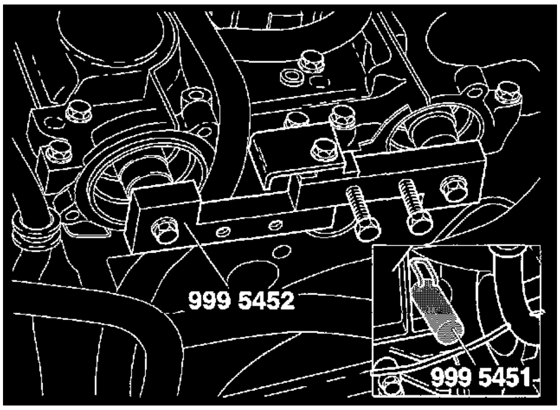
Lubricate the camshaft lobes, the camshaft bearing surfaces and the top of the valve lifters.
Install the camshaft cover.
Install 2 press tools 999 5454.
Tighten the camshaft cover screws alternately, keeping it parallel to the cylinder head with the press tools.
Install the intake manifold and lifting eyes, tighten screws from the middle and outwards.
Remove the press tools.

Install:
- the Variable Valve Timing **(VVT)** solenoid with a new gasket
- the spark plugs. Tighten to **30 Nm.**

Installing the intake pipe for the coolant pump

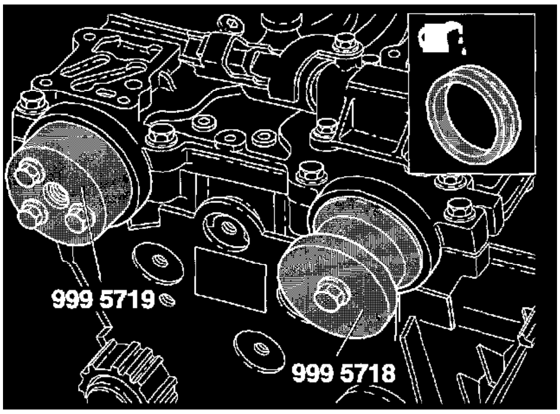
Install the inlet pipe for the coolant pump on the cylinder head. Use a new gasket.

Note! Apply thread sealant 116 156 to the screw threads.



Install camshaft adjustment tool 999 5452 at the rear of the camshafts. Check that the screws securing the adjustment tool to the camshafts and the screws holding the tool together are well tightened.

Installing the front camshaft seal



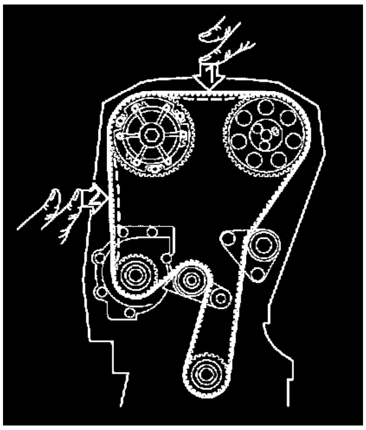
Lubricate the surfaces of the seal that the camshaft rotates against.
Install the new seal for the camshaft with variable valve timing. Use drift 999 5718.
Install the new seal for the camshaft without variable valve timing. Use drift 999 5719.
Install the screw holding the inner timing cover to the cylinder head.

Installing the camshaft timing gear pulley
Install the camshaft timing gear pulley according to Replacing the camshaft seals/variable valve timing unit.

Installing the timing belt
Install the timing belt according to Replacing the camshaft seals/variable valve timing unit.

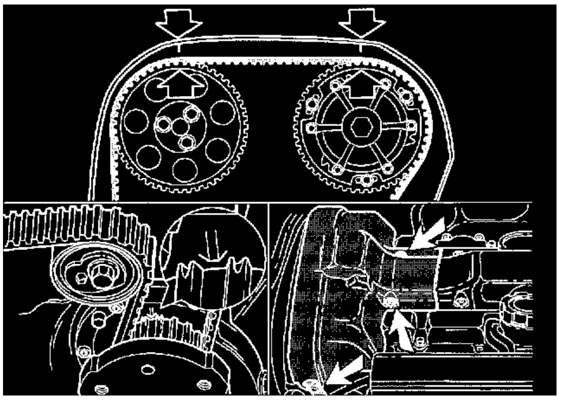
Tightening the timing gear pulley
See Replacing the camshaft seals/variable valve timing unit, refer to Camshaft, Lifters and Push Rods, Camshaft Oil Seal.

Check



- Press the belt to check that the indicator on the tensioner moves easily

- Position the upper timing cover.

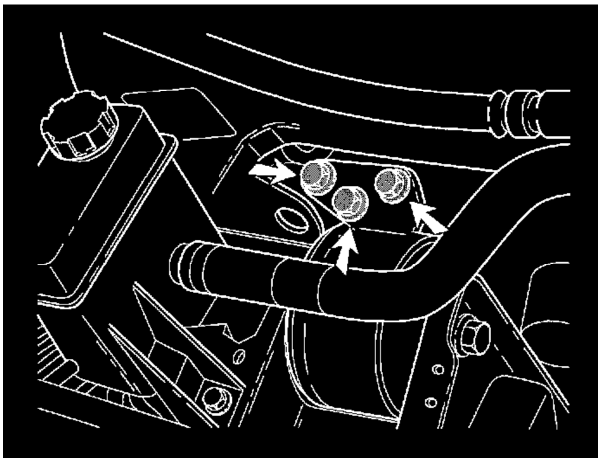


- Turn the crankshaft two turns. Check that the markings on the crankshaft and camshaft pulley correspond.

  Note! Check that the indicator on the belt tensioner is within the marked area.

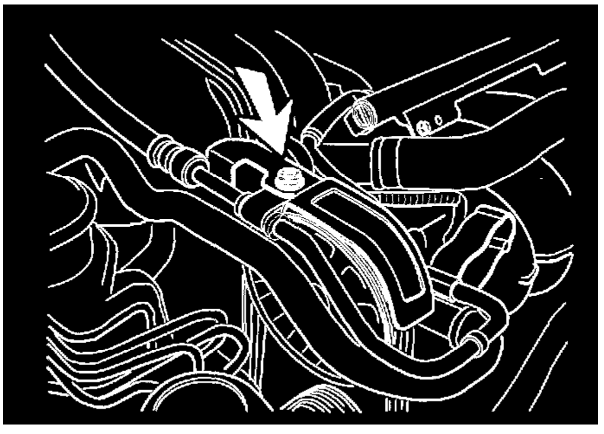
- Remove the upper timing cover.

Installing the right engine mounting



Screw the engine mounting onto the engine. Tighten to **67 Nm.**
Install the engine mounting screw and nut in the bodywork bracket. Tighten by hand.

Finishing



Remove the lifting beam and lifting hook.
Tighten the engine mounting nut. Tighten to **98 Nm.**

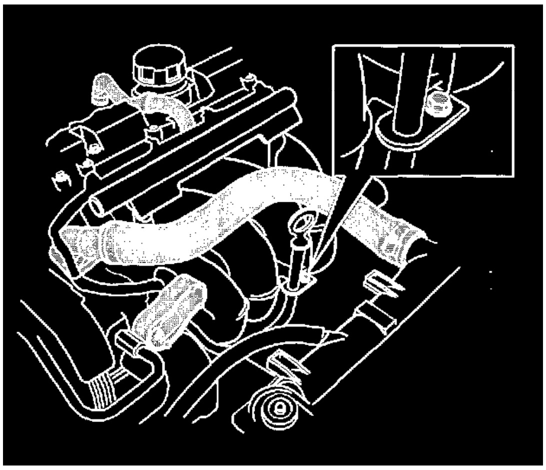
Install:

- the power steering reservoir
- the metal bracket for the power steering hose on the rotation protection for the auxiliaries belt
- the auxiliaries belt
- the rear camshaft cover
- the trigger wheel. Tighten to **17 Nm**
- the Camshaft Position **(CMP)** sensor housing. Tighten to **5 Nm**

- the cable duct.

Installing the intake manifold

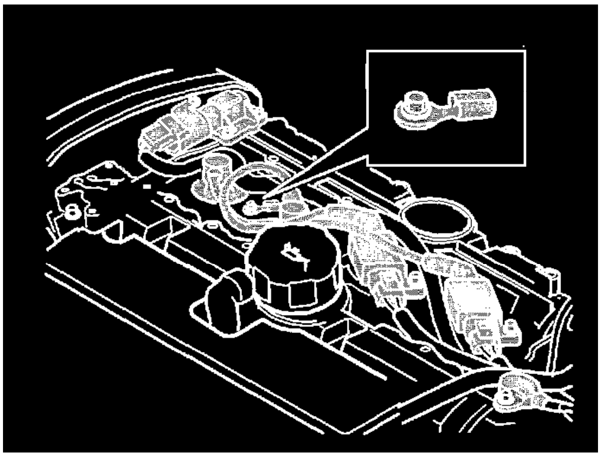
Remove:



- the intake manifold. Use a new gasket. Tighten to **17 Nm**
- the vacuum hoses from the intake manifold according to the markings
- the hose for the crankcase ventilation from the camshaft cover
- the connectors from the assisted air control valve and the Throttle Position **(TP)** sensor
- the dipstick pipe
- the upper radiator hose together with the thermostat housing cover.

Installing components

Install:



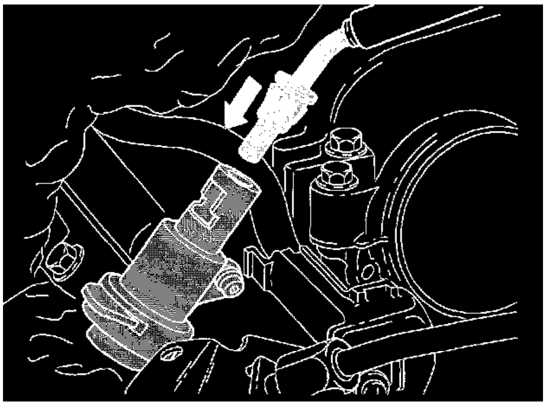
- the ignition coils and ignition cables according to earlier markings
- the connectors on the variable valve timing valve and ignition coils
- the ground lead for the ignition coils the Camshaft Position **(CMP)** sensor.
- Place the cable duct and cable harness in position.

Install:

- the screws for the cable duct on the rear edge of the cylinder head and Throttle Body **(TB)** bracket
- the bracket between the intake manifold and the power steering pump
- the connectors for the injectors
- the connector for the engine coolant temperature sensor
- the air preheating hose between the Air Cleaner **(ACL)** and
- the heat deflector plate for the exhaust manifold the auxiliaries belt
- the pipe screw for the water-heated crankcase ventilation the upper section of the Air Cleaner **(ACL)** housing and hose
- the EVAP hose connection to the Mass Air Flow Engine **(MAP)** sensor hose
- the connector for the Mass Air Flow Engine **(MAP)** sensor
- the Turbocharger **(TC)** control valve on the Air Cleaner **(ACL)** housing
- the brake servo vacuum hose
- the throttle cable
- the inlet hose between the Mass Air Flow **Engine (MAP)** sensor and Throttle Body **(TB)**
- the front timing cover
- the cover over the ignition coils
- the upper timing cover
- the cover over the Throttle Body **(TB)**

- the cover over the injectors.

Installing the fuel line

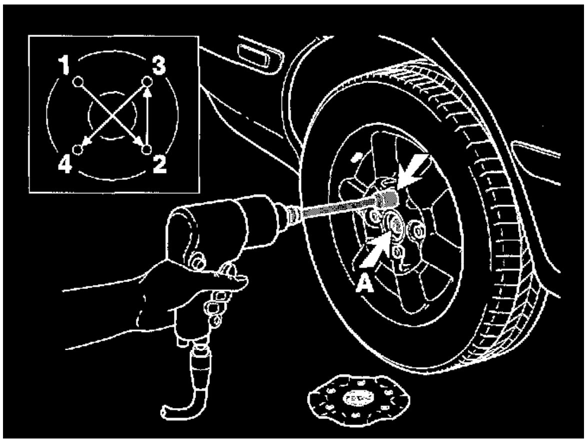


Press the fuel line into the quick-release connector on the fuel rail.

Installing the exhaust manifold

Install the manifold and Turbocharger **(TC)** according to Replace exhaust manifold.

Assembling the exhaust system



Install a new gasket where the front exhaust system and Three-Way Catalytic converter **(TWC)** separate.
Lift up and align the front exhaust system against the manifold.
Install a new gasket and new nuts. Tighten.

Installing the starter motor

Install:

- the blind cover plug
- the starter motor
- the plastic charge air pipe for the Turbocharger **(TC)**
- the support bracket for the intake manifold
- the connector for the oil pressure switch
- the lower hose for the Charge Air Cooler **(CAC)**
- the front air baffle
- the right front wheel according to front brake pads replacement, refer to Brakes and traction Control.
- the cable to the battery negative terminal. First read Note when disconnecting and connecting the battery lead.

Checking work

Change the oil. Replace the oil filter. Top up the coolant.

Check:

- the engine oil level
- the coolant level.

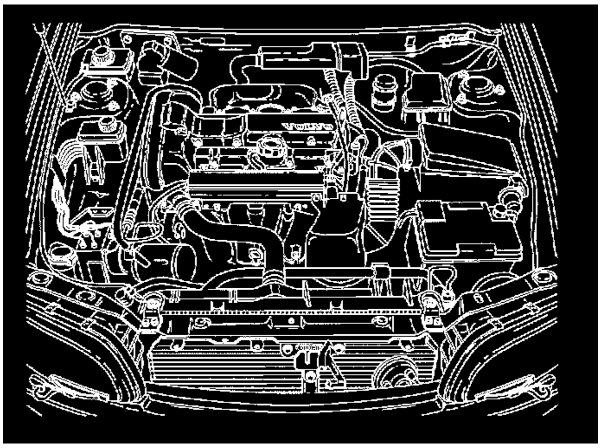
Warm up the engine until the thermostat opens.
Check the engine for leaks.
Top up the coolant if necessary.

Valve Clearance: Testing and Inspection

Special Tools
999 5752
999 5753

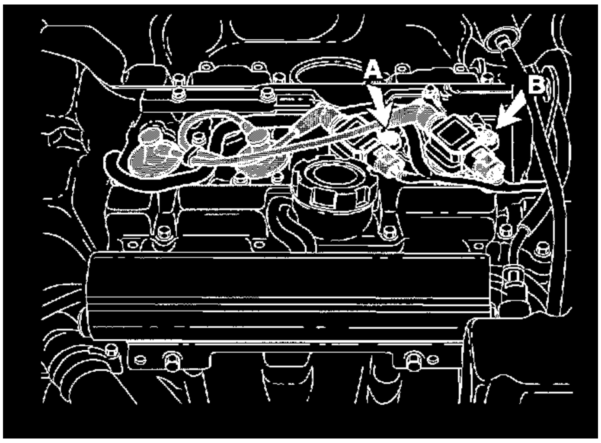
Note! As the illustrations in this service information are used for different model years and/or models, some variation may occur. However, the essential information in the illustrations is always correct.

Preparation
Remove:



- the cover over the intake camshaft
- the upper timing cover
- the cover over the ignition coils.

Remove:

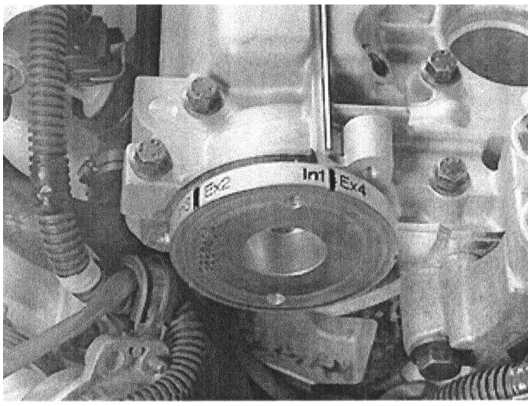


- the ignition coils without removing the connectors.

Note! Mark up before removal!

- the two ground connections
- the connector for the variable valve timing solenoid
- the right front wheel.

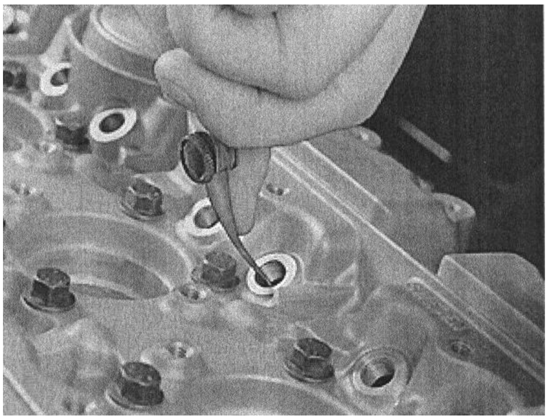
Set the engine to the test position



Install tool 999 5753 at the rear of the intake camshaft.
Turn the crankshaft in the direction of engine rotation (clockwise) until the marking on the tool (IN1/EX3) is opposite the thin flange running straight over the entire top of the cylinder head.
Remove all plugs from the test holes.

Note! If the crankshaft is turned too far, it is essential that it is turned back at least a quarter of a turn so that it can then be turned clockwise to the correct position.

Check the valve clearance



Check the valve clearance with feeler gauge 999 5752 at the intake valves for cylinder 1 and the exhaust valves for cylinder 3.
Insert the feeler gauge through the inspection holes. Bend the feeler gauge with light finger pressure so that it follows the top of the valve lifter.
The correct measurement will not be obtained until the feeler gauge has gone in approximately **15 mm.**

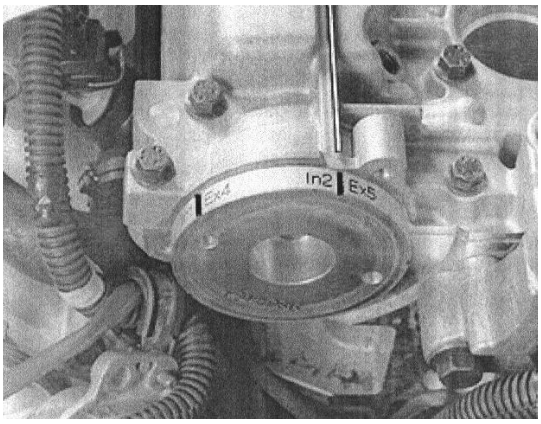
Valve:	Valve clearance:
Intake valve	0.15-0.45 mm
Exhaust valve	0.35-0.60 mm

Reference values

Note! Carry out this check with the engine at room temperature.

Make a note of the valve clearance on a form.

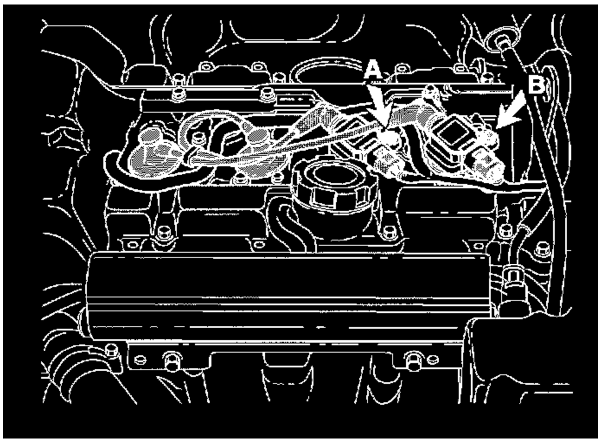
Next test measurement



Turn the crankshaft in the direction of engine rotation until the next marking In2/Ex1 is opposite the flange on top of the cylinder head. Perform the test measurement according to the previous description.
Continue by measuring the remaining valve clearances according to the markings on tool 999 5753.

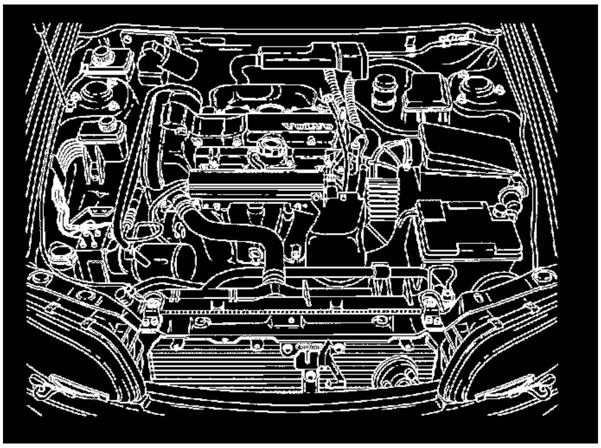
Finishing

Note! For tightening torques not in the text, refer to Specifications.



Install:
- the plugs for the test holes. Tighten to **20 Nm**
- the ignition coils according to the earlier markings
- the ground connections
- the connector for the variable valve timing solenoid.
  Remove tool 999 5753.

Install:



- a new cover over the intake camshaft
- the right front wheel according to Front brake pads replacement.

Valve Clearance: Adjustments

Special Tools

999 5006
999 5383
999 5460
999 5452
999 5199
999 5452
999 5454
999 5670
999 5765
999 5752
999 5451
951 2767
999 5454
999 5719
999 5718

Note! As the illustrations in this service information are used for different model years and/or models, some variation may occur. However, the essential information in the illustrations is always correct.

Preparation

Remove:

- the cable from the battery negative terminal. First read Note when disconnecting and connecting the battery lead.

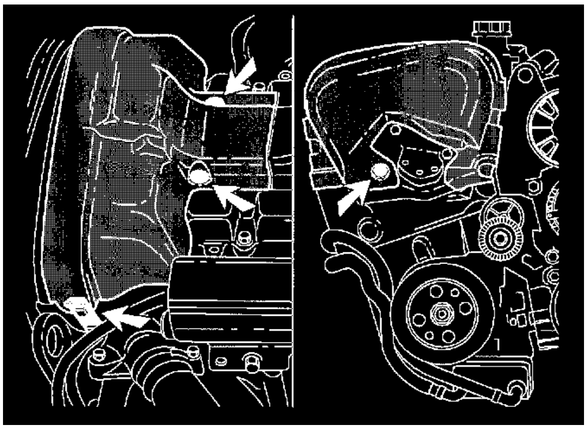
Removing the starter motor

Remove:

- the screws for the starter motor
- the support bracket for the intake manifold
- the connector for the oil pressure switch
- unhook the starter motor and allow it to hang.

Removing components

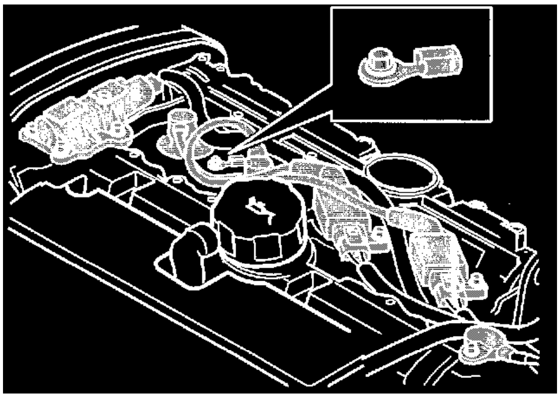
Remove:



- the cover over the injector
- the cover over the Throttle Body **(TB)**
- the upper timing cover
- the cover over the ignition coils
- front timing cover
- the inlet hose between the Mass Air Flow **Engine (MAP)** sensor and Throttle Body **(TB)**
- the auxiliaries belt.

Exposing the cable harness

Remove:



- the screw from the ignition coil ground
- the camshaft position (CMP) sensor.

Remove:
- the variable valve timing valve connector
- the ignition coil connectors.
  Place the cable harness to one side.
  Unscrew the cable duct from the rear edge of the cylinder head and the Throttle Body **(TB)** bracket.

Remove:
- the connector for the engine coolant temperature sensor
- the injector connectors.
  Place the cable duct and cable harness to one side.
  Mark up and remove the ignition coils and ignition cables.

Remove:
- the rear cover for the camshaft
- the Camshaft Position **(CMP)** sensor housing
- the trigger wheel
- the hose for the crankcase ventilation from the camshaft cover.

Installing the lifting beam and lifting hook

Install the lifting beam and the lifting hook according to Replacing the timing belt, refer to Timing Components, Timing Belt.

Removing the right-hand engine mounting

Remove the right engine mounting according to Replace the engine mountings, refer to Drive Belts, Mounts, Brackets and Accessories, Engine Mount.

Position the engine according to the marking

See Replacing the timing belt, Refer to Timing Components, Timing Belt.

Removing the timing belt

Remove the timing belt according to Replacing the timing belt, Refer to Timing Components, Timing Belt.

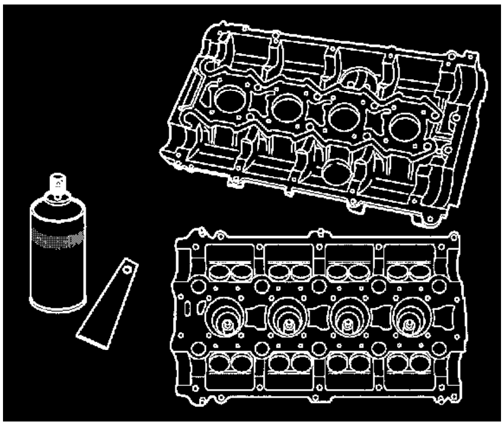
Removing the timing gear pulley

Remove the timing gear pulley according to Removing the camshaft seals/variable valve timing unit, refer to Camshaft, Lifters and Pushrods, Camshaft Oil Seal.

Removing the camshaft cover and cylinder head

Remove the camshaft cover and cylinder head, see Replacing the cylinder head and gasket, refer to Service and Repair.

Cleaning



Use a razor blade or a gasket scraper and gasket solvent P/N 1161 440 on the camshaft cover.

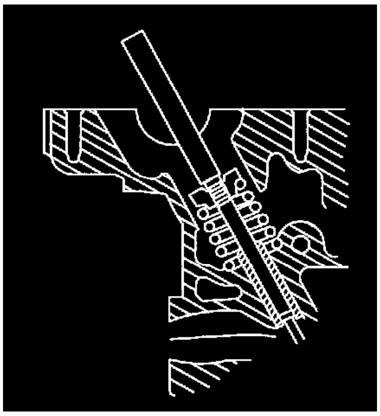
Warning Use a fume hood or extractor when using gasket solvent. Use only a gasket scraper or razor blade on the cylinder head.

Note! Take great care around the oil ducts for the variable valve timing solenoid. This applies to both the camshaft cover and the cylinder head. The solenoid is extremely sensitive to contaminants.

Dry and blow all surfaces clean.

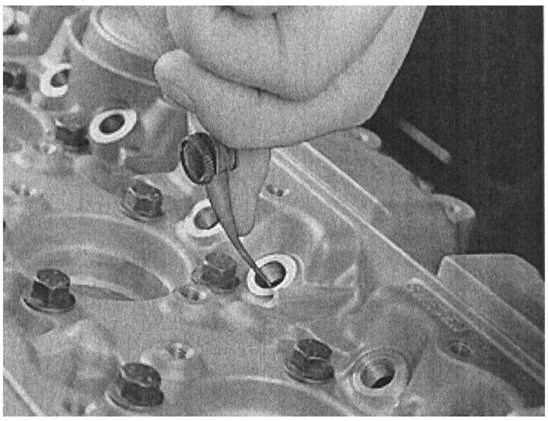
Preparations

Carefully tap the end of the valve stem to ensure that the valve is correctly located in the seat. Use a plastic aluminum or brass drift to protect the valve and the surface of the valve lifter.



The sound made by tapping reveals if the valve is correctly seated.

Installing the valve lifters and camshaft



Install both the valve lifters for the inlet valves at cylinder 1.
Check the notes made earlier. Select new valve lifters if necessary.

Note! Only install two valve lifters. The valve lifters must be placed at the same cylinder.

The valve clearance on a cold engine (approximately **20°C/68°F)** must be:

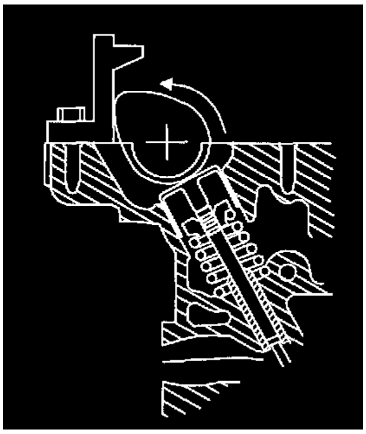
Valve:	Valve clearance:
Intake valve:	0.20 [plusmn] 0.03 mm
Exhaust valve:	0.40 [plusmn] 0.03 mm

Reference Values

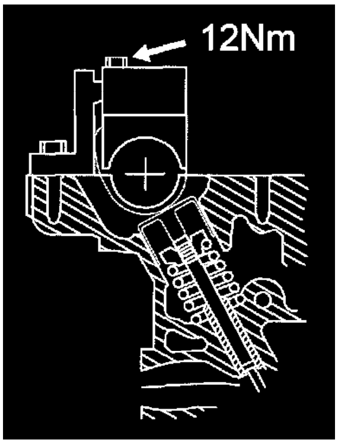
Note! The tolerances are less at setting! When checking the valve clearance through the plug hole the tolerances are larger.

Install the intake camshaft. Ensure that the lobes at cylinder 1 point upwards.
Apply a little oil to the cam lobe and the upper side of the valve lifter to facilitate measurement later.

Installing the camshaft press



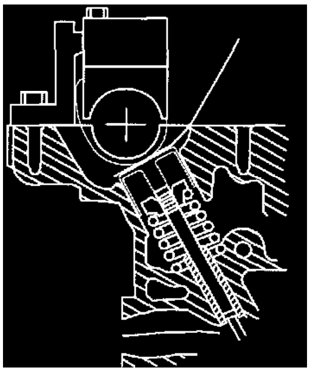
Install the lower section of camshaft press 999_765 at the intake valves for cylinder 1.
Tighten the tool against the cylinder head.
Tighten to **17 Nm.**
Turn the camshaft until it stops against the camshaft press.



Install the upper section of the camshaft press.
Tighten the screw which tensions the camshaft.
Tighten to **12 Nm.**

Measuring the valve clearance

Note! Measurement must be carried out on a cold engine. A suitable temperature is approximately **20°C/68°F.**



Use feeler gauge 999 5752.
Press with a finger so that the feeler gauge lies parallel to the upper side of the tappet (see illustration).
Move the feeler gauge sideways when taking the reading in order to obtain as accurate a measurement as possible.
The valve clearance on a cold engine (approximately **20°C/68°F)** must be:

Valve:	Valve clearance:
Intake valve:	0.20 [plusmn] 0.03 mm
Exhaust valve:	0.40 [plusmn] 0.03 mm

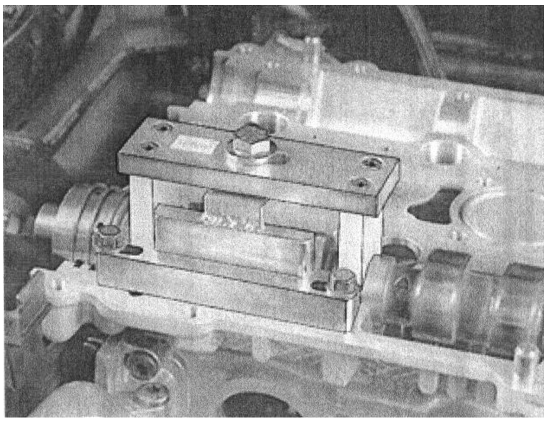
Reference values

Note! The tolerances are less at setting! When checking the valve clearance through the plug hole the tolerances are larger.

Differences in valve clearance for different engines/ambient temperatures:
- **-0.01 mm at 15°C**
- **+0.01 mm at 25°C**
- **+0.02 mm at 30°C**
- **+0.03 mm at 35°C**
- **+0.04 mm at 45°C.**

Correcting the measured clearance
Lift out the upper section of the press tool.
Lift out the camshaft.
Adjust the play by replacing the valve lifters.
Other valve lifters are available as replacement part/replacement part kits.
Reinstall the camshaft and the upper section of the press tool.
Tighten to **12 Nm.**
Take a new measurement according to Checking valve clearance, refer to Testing and Inspection, Procedures.

When the correct valve clearance is reached
Remove:



- press tool 999 5765
- the camshaft
- the valve lifters.

Carefully mark the valve lifters so that exact reinstallation can be carried out, for example:
- Intake side: I1, I2, I3 through I8
- Exhaust side: Al, A2, A3 through A8.

Repeat the procedure for measuring the valve clearance for all cylinders on both the intake and exhaust sides. See Checking valve clearance, refer to Testing and Inspection, Procedures.

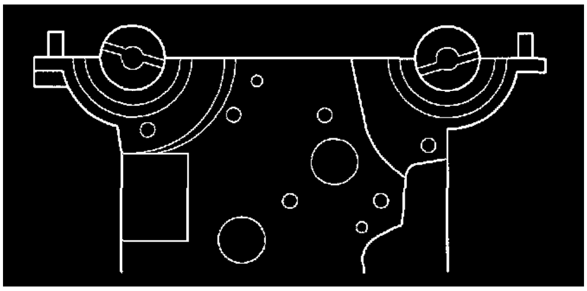
Note! For tightening torques not in the text, refer to Specifications, Mechanical.

Installing the valve lifters and camshafts

Lubricate the valve guide wells.
Install all the valve lifters.

Note! Make sure that the lifters are in the same position as before.

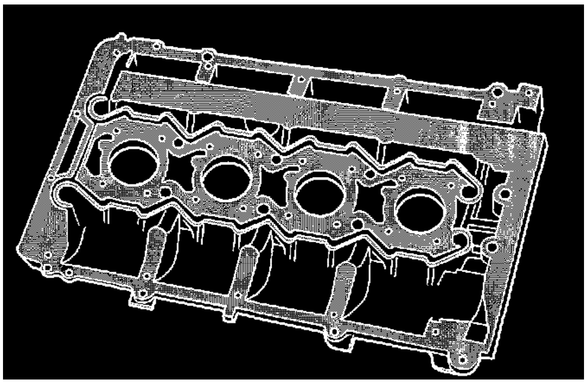
Lubricate the camshaft bearing seats.
Install the intake camshaft. Ensure that the groove at the rear edge of the camshaft is above an imaginary center line.



Position the exhaust camshaft. Ensure that the groove at the rear edge of the camshaft is below an imaginary center line.

Applying liquid gasket

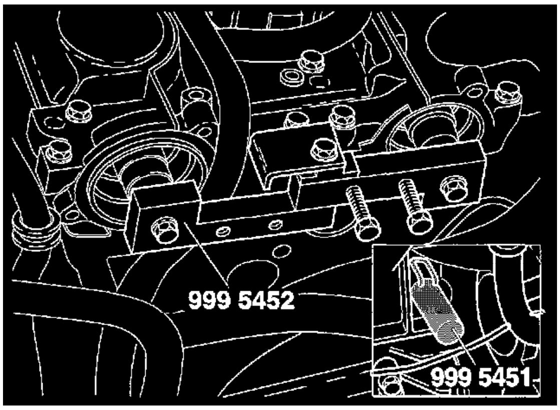
Wipe the oil film off the mating surfaces on the camshaft cover and cylinder head.
Install new O-rings around the spark plug wells on the cylinder head.



Apply liquid gasket 116 1059, or equivalent, to the camshaft cover.
Use roller 9S1 2767.
The surface must be completely covered without any excess.

Note! Ensure that no liquid gasket gets into the coolant or oil ducts. Only a thin layer of liquid gasket is required.

Installing the camshaft cover



To install the camshaft adjustment tool, see Replacing cylinder head and gasket, refer to Service and Repair.
Install camshaft adjustment tool 999 5452 at the rear of the camshafts.
Check that the screws securing the adjustment tool to the camshafts and the screws holding the tool together are well tightened.

Installing the front camshaft seal

To install the front camshaft seal, see Replacing the cylinder head and gasket, refer to Service and Repair.

Aligning the crankshaft

To align the crankshaft see Replacing the cylinder head and gasket.

Installing the camshaft timing gear pulley

Install the camshaft timing gear pulley according to Replacing the camshaft seals/variable valve timing unit, refer to Camshaft, Lifters and Pushrods, Camshaft Oil Seal.

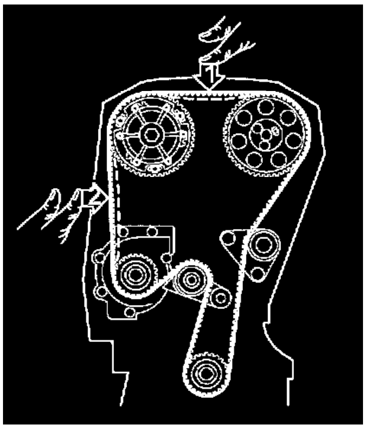
Installing the timing belt

Install the timing belt according to Replacing the camshaft seals/variable valve timing unit, refer to Camshaft, Lifters and Pushrods, Camshaft Oil Seal.

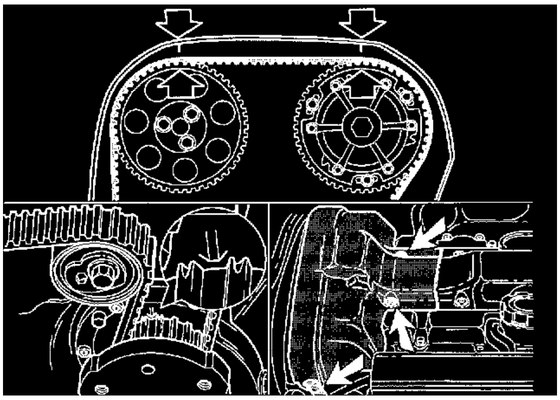
Tightening the timing gear pulley

See Replacing the camshaft seals/variable valve timing unit, refer to Camshaft, Lifters and Pushrods, Camshaft Oil Seal.

Check



- Press the belt to check that the indicator on the tensioner moves easily
- Position the upper timing cover.

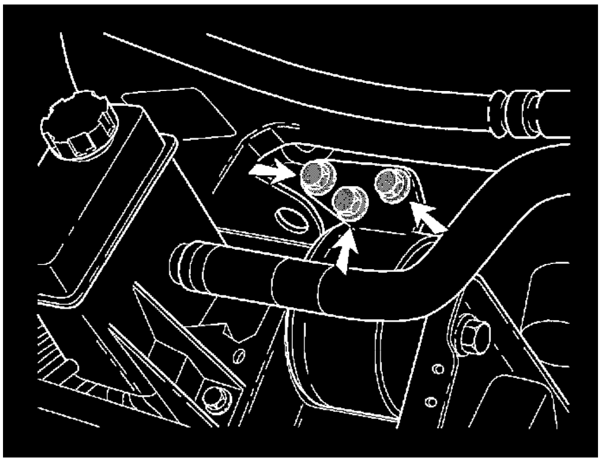


- Turn the crankshaft two turns. Check that the markings on the crankshaft and camshaft pulley correspond.

  Note! Check that the indicator on the belt tensioner is within the marked area.

- Remove the upper timing cover.

Installing the right engine mounting

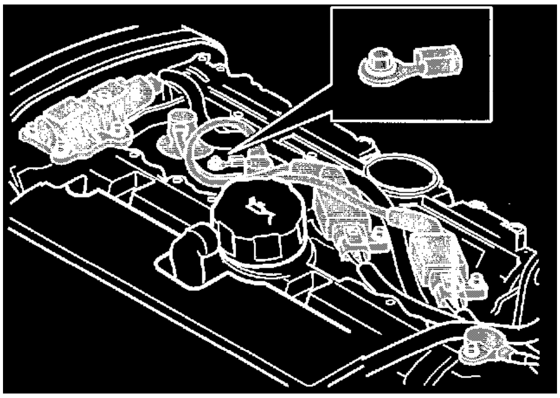


Screw the engine mounting onto the engine.
Tighten to **67 Nm.**
Install the engine mounting screw and nut in the bodywork bracket. Tighten by hand.

Finishing
Remove the lifting beam and lifting hook.
Tighten the engine mounting nut.
Tighten to **98 Nm.**

Install:
- the power steering reservoir
- the metal bracket for the power steering hose on the rotation protection for the auxiliaries belt
- the auxiliaries belt
- the rear camshaft cover
- the trigger wheel.
  Tighten to **17 Nm**
- the Camshaft Position **(CMP)** sensor housing.
  Tighten to **5 Nm**
- the hose for the crankcase ventilation on the camshaft cover.

Installing components
Install:



- the ignition coils and ignition cables according to earlier markings
- the connectors on the variable valve timing valve and ignition coils
- the ground lead for the ignition coils
- the camshaft position (CMP) sensor.
  Place the cable duct and cable harness in position.

Install:
- the screws for the cable duct on the rear edge of the cylinder head and Throttle Body **(TB)** bracket
- the connectors for the injectors
- the connector for the engine coolant temperature sensor
- the inlet hose between the Mass Air Flow **Engine (MAP)** sensor and Throttle Body **(TB)**
- front timing cover
- the cover over the ignition coils
- the upper timing cover
- the cover over the Throttle Body **(TB)**
- the cover over the injectors.

Installing the starter motor

Install the starter motor.

Finishing

Check:

- the engine oil level
- the coolant level.

Warm up the engine until the thermostat opens.

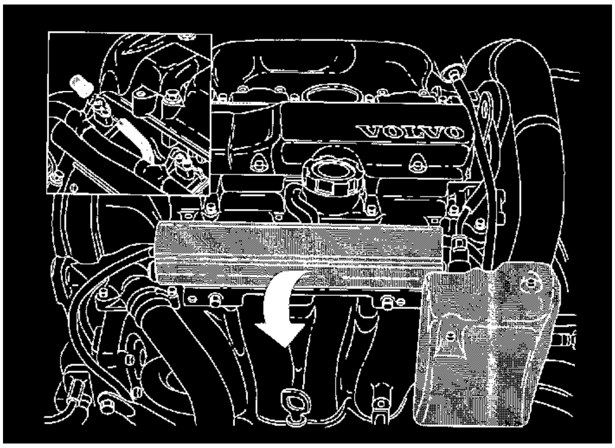
Check the engine for leaks.

Top up the coolant if necessary.

Fuel Pressure Release: Service and Repair

Special Tools
981 2270
981 2273
981 2282
999 5480
999 5484

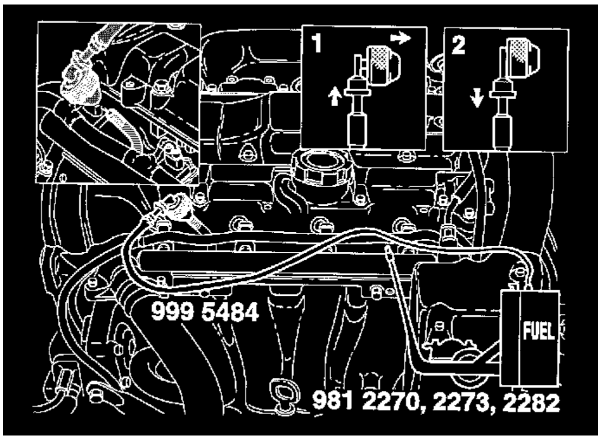
Removing the covers



- Turbocharged engines: remove the Throttle Body **(TB)** cover.
- The fuel rail cover.
- The protective cap for the nipple.

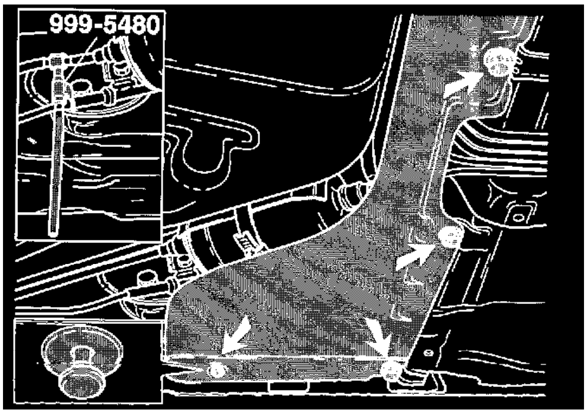
Draining the fuel injection system

Note! Ensure that ventilation is good.



Connect tool 999 5484 hose / nipple to liquid extractor 981 2270, 981 2273 and 981 2282. Start the drain pump.
- Connect the adapter to the valve on the fuel rail in restricted position (illustration 1: valve closed).
- Un-Secure the adapter (illustration 2: valve open).

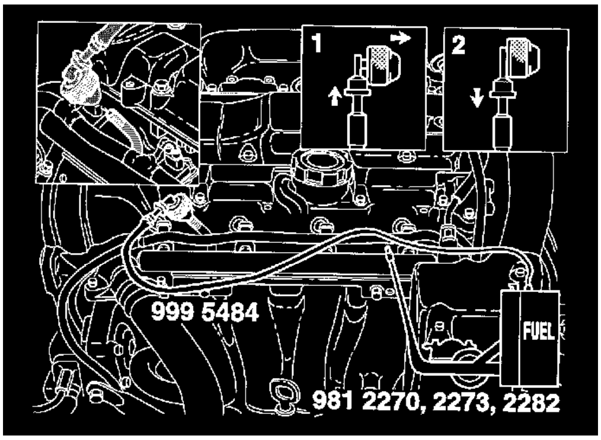
Install special tool 999 5480



Raise the car.

Remove:
- The protection on the left fuel filter.
- The cap over the nipple.
  Connect tool 999 5480 to the valve upstream of the fuel filter.
  It takes approximately 2 minutes to drain the system.

Removing the special tools



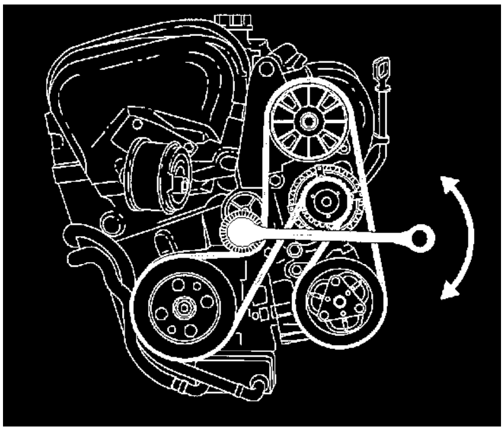
Remove the tool: 999 5480. Install the protective caps.
Reinstall the splash guard.
Lower the car.
Remove tool 999 5484. Install the protective caps.
Check for leaks.

Note! Do not forget to replace the protective caps on the nipples.

Install the cover over the fuel rail.
Turbocharged engines: Install the Throttle Body **(TB)** cover.

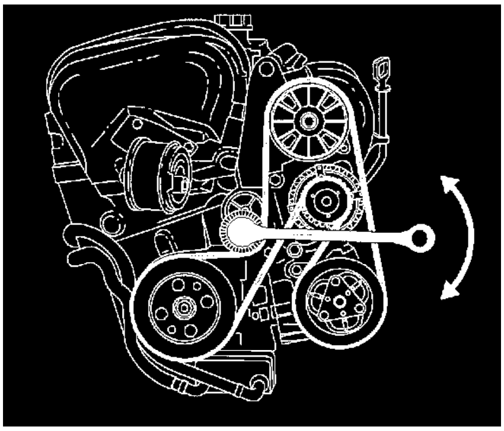
Drive Belt: Service and Repair

Replacing the Auxiliaries Belt



Remove auxiliaries belt

- Remove the right engine compartment cover and the cover above the right headlight unit
- Release the auxiliaries belt by turning the pulley screw clockwise
- Remove the auxiliaries belt
- Release the belt tensioner (counterclockwise).



Install auxiliaries belt

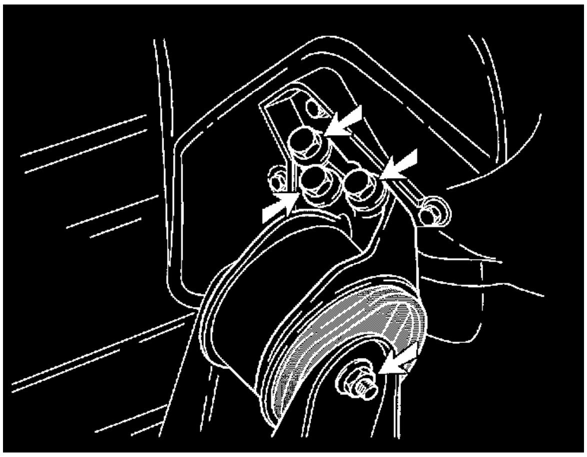
- Clean the pulley grooves
- Turn the tensioning device clockwise
- Install the auxiliaries belt as illustrated
- Release the belt tensioner (counterclockwise)
- Install the right engine compartment cover and headlight unit cover.

Engine Mount: Service and Repair

Special Tools
999 5006
999 5383
999 5460

Prerequisites
- Remove the right engine bay cover
- Remove the two bolts and move the AC hose support to one side.

Replace engine mounting bolster at distributor side



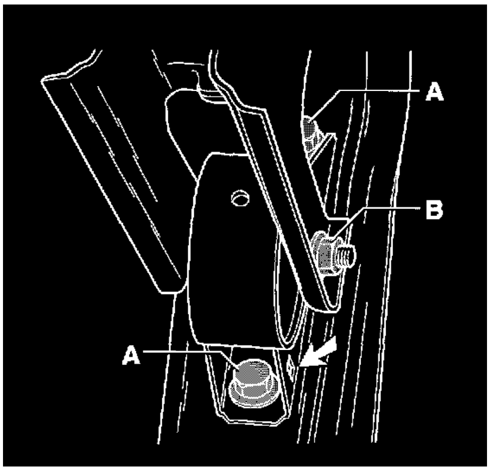
Remove the engine bolster nut.
Position the lifting beam 999 5006 and the support 999 5383 over the engine and locate the lifting lug 999 5460 at the front lifting eye.
Lift the engine up until the engine bolster bolt can be removed.
Remove the three bolts and remove the support (pushing power steering hose to one side).
Install the support on the engine and tighten the bolts.
Torque setting **76 Nm.**
Install the engine bolster. Finger-tighten.
Remove the lifting beam.
Tighten the bolster nut. Torque setting **98 Nm.**
Install the hose support. Torque setting **10 Nm.**
Install the engine cover.
Install the right engine bay cover.

Replacing engine mounting bolster at transmission side

Remove the complete Air Cleaner **(ACL)**, see Replace the Air Cleaner **(ACL)**, refer to Powertrain Management.
Remove the engine bolster nut.
Lift the engine/transmission up until the engine bolster bolt can be removed.
When lifting the engine/transmission, use a block of wood to protect the transmission.
Remove the cable harness clip from the wire end.
Remove the three nuts and remove the mounting bolster.
Install the mounting bolster and place the 2 rubber protecting flaps in the correct position.
Install the 3 nuts. Torque setting **45 Nm.**
Install the bolt and the nut in the bolster. Finger-tighten.
Remove the lifting beam.

Tighten the bolster nut. Torque setting **98 Nm.**
Install the complete Air Cleaner **(ACL)**, see Replacing the Air Cleaner **(ACL),** refer to Powertrain Management.
Install the inlet air-preheater hose.

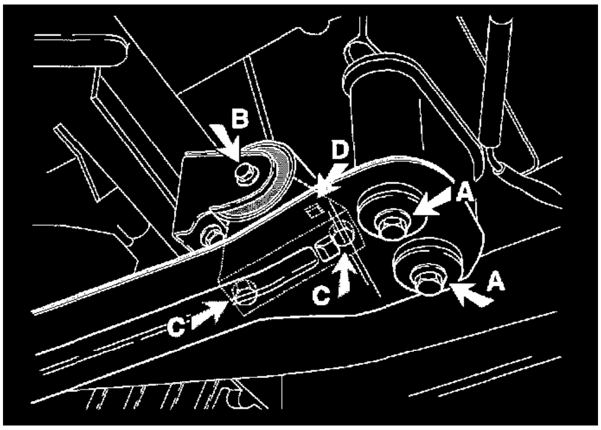
Replace front engine mounting bolster



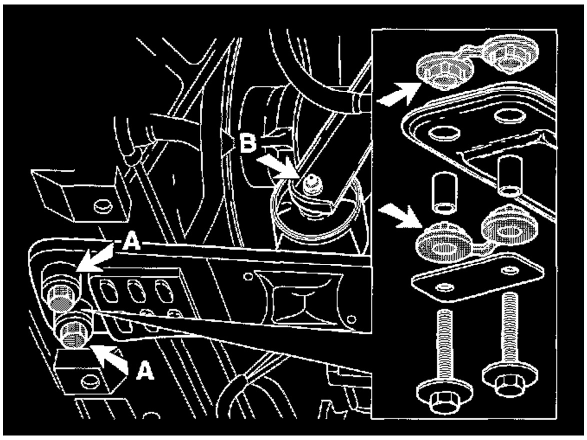
Remove the nut and the bolt from the engine mounting bolster.
Remove the two mounting bolts and remove the mounting bolster.
Install the new engine mounting bolster (Position the hole towards the front of the car).
Tighten the:

- Two bolts (A) on the longitudinal member to **35 Nm.**
- Central bolt (B) in the bolster to **55 Nm.**

Replace rear engine mounting bolster



Remove the splash guards from the underside.
Remove the drive shaft heat-shield.
Remove the two bolts (A) from the mounting on the body side.
Remove the bolt (B) of the mounting and pull the engine mounting down slightly.
Remove the two mounting bolts (C) and remove the mounting.
Install the mounting with the two bolts (C).
Position the hole (D) towards the rear of the car. Torque setting **35 Nm.**
Replace the bolt (B). Finger-tighten.



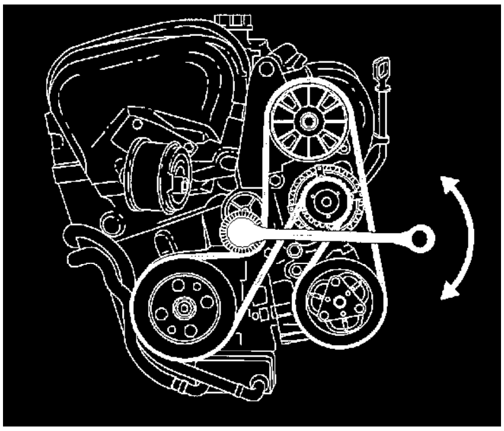
Install the two bolts (A). Torque setting **69 Nm.**

Note! Position the rubbers in the correct position (see illustration). (The rear and the front of the center member must be in similar positions).

Loosen the front mounting-bolster bolt (B). First tighten the rear mounting bolster bolt (torque setting **55 Nm**), then tighten the front mounting bolt again (torque setting **55 Nm**).
Install the heat shield and the splash guard.

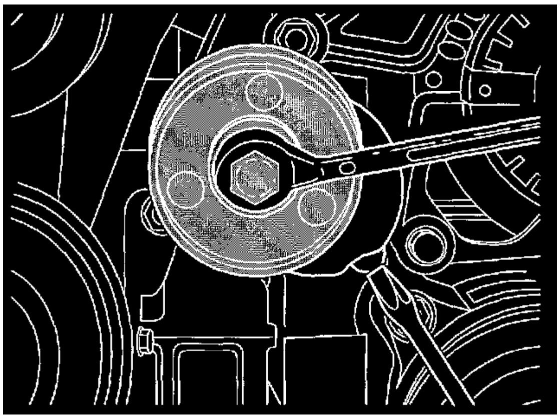
Idler Pulley: Service and Repair

Removing the drive belt



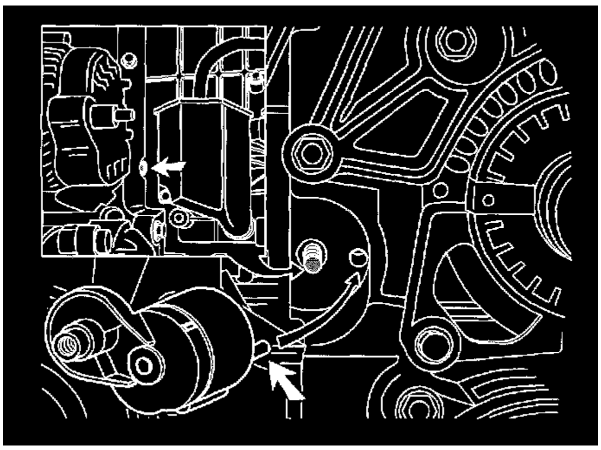
Use a **15 mm** socket wrench on the belt tensioner and slacken off the belt.
Remove the belt.

Replacing the belt tensioner idler pulley



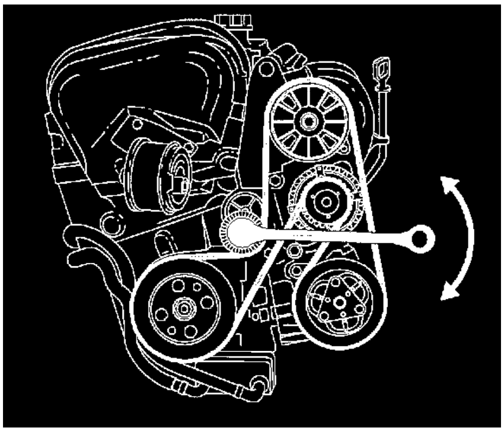
Remove the bolt and the tensioner idler pulley.
Install the new tensioner idler pulley.
- Tighten the bolt to **20 Nm.**
  Check the poly V-belt carefully. Replace the belt if necessary.

Replacing the belt tensioner



Remove the tensioner idler pulley.
Remove the center bolt at the rear. Remove the belt tensioner.
Install the new belt tensioner with the cut-out over the cam.
Install the central bolt. Tighten to **20 Nm.**
Install the tensioner idler pulley.

Installing the drive belt



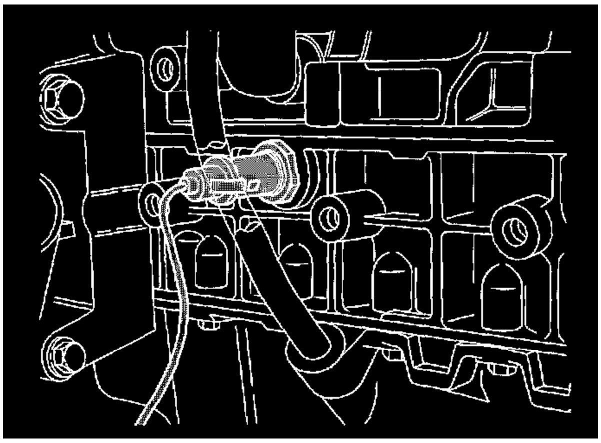
Route the belt around the crankshaft, then around the Air Conditioning **(A/C)** compressor, guide pulley, Generator **(GEN)** and power steering pump.
Lift the belt tensioner up. Position the belt on the tensioner the dotted line shows the routing of the belt in cars without Air Conditioning **(A/C)**
Check the function

Engine Lubrication: Testing and Inspection

Special Tools
999 5270
999 5271
999 5272
999 5273

Note! When checking the oil pressure, the engine should be at a temperature which corresponds to **15 minutes normal driving (100°C).** Replace the oil and filter if the engine oil grade, type or condition cannot be determined.

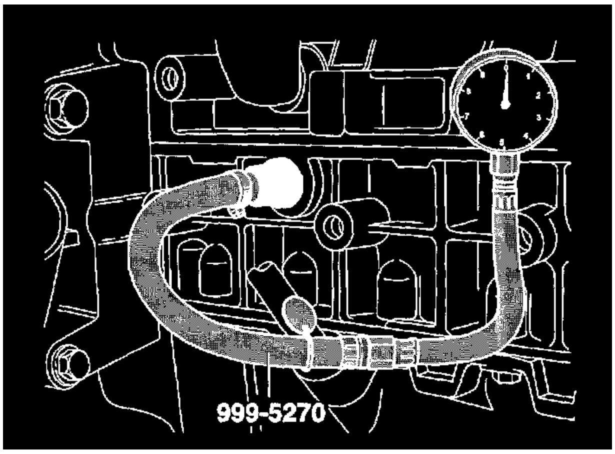
Checking the engine oil pressure sensor
Raise the car.
Remove the engine cover.



Check:
- The oil pressure sensor cable and connectors
- Check for an open-circuit in the cable between the oil pressure sensor and the indicator lamp.
- Type and remedy; try a new pressure sensor.

Note! Use a new seal between the oil pressure sensor and the cylinder block.

Checking oil pressure



Use oil pressure gauge kit 999 5270.
Adapter 999 5273, hose 999 5272 and gauge 999 5271.
Connect these items to the hole on the cylinder block for the oil pressure sensor.

13.3 r/s (800 r/min)	0.10 MPa
14.2 r/s (850 r/min)	0.10 MPa
66.7 r/s (4000 r/min) minimum	0.35 MPa
66.7 r/s (4000 r/min) maximum	0.70 MPa

Oil Pressure At RPM

Start the engine. Read off the oil pressure at different engine speeds **(RPM).**

Note! The relief valve begins to open at **0.5 MPa.**

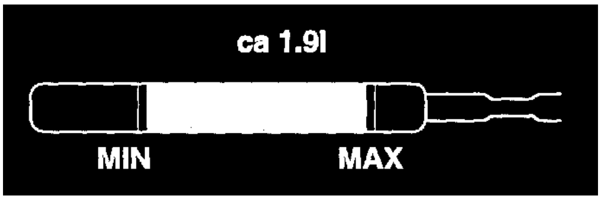
Remove the tools.
Use a new gasket when installing the oil pressure sensor.
Tighten to **25 Nm.**

Engine Oil: Service and Repair
Replacing the Oil and Oil Filter

Special Tools
999 5679

Warning Avoid long term skin contact with oil.
- **Extended and repeated contact with oil can cause skin to dry out. This can result in itchiness, dry skin, eczema and other skin complaints**
- **Used oil is more dangerous than new oil**
- **Used oil may contain contaminants that are a health risk**
- **Avoid skin contact, especially with engine oil**
- **Use protective gloves if necessary**
- **Avoid oil soaked clothing and rags**
- **Wash thoroughly after skin contact with oil, especially before meals**
- **Use a skin cream to prevent the skin drying.**

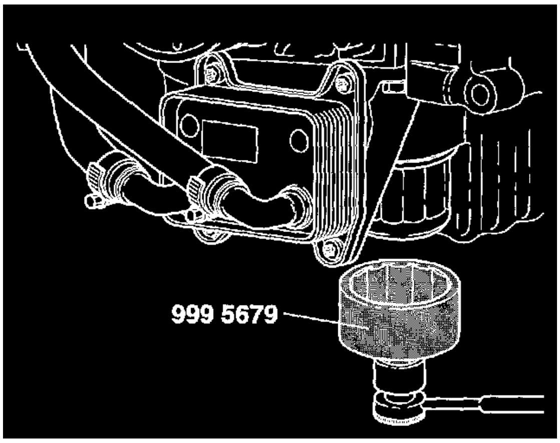
Checking engine oil
Position the car on a flat surface. Wipe the dipstick before this check.



The distance between MAX and MIN on the dipstick corresponds to approximately **1.9 liters.**
Engine at operating temperature: Wait at least three minutes after turning off the engine so that the oil can run back to the oil pan.
If the level is at the MIN marking, top up with a **maximum of 1 liter.**
Cold engine: The most accurate measurement is obtained by checking the oil when the engine is cold before it is started.
If the level is at the MIN marking, top up with **1.9 liters.**

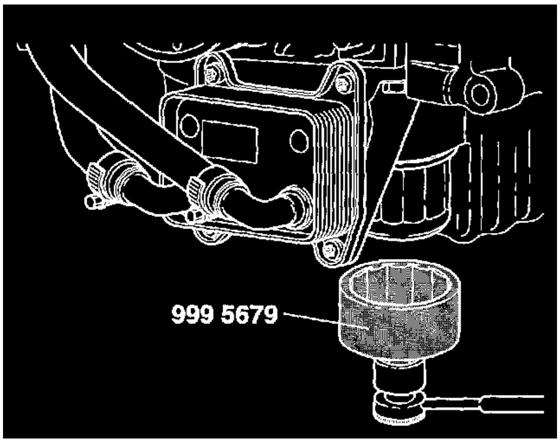
Draining engine oil
- Remove the drain plug
- Replace the copper washer
- Install the drain plug. Tighten the drain plug. Tighten to **35 Nm.**

Removing the oil filter



Remove the rear engine splash guard.
Use oil filter wrench 999 5679.
Wipe up any spilled oil (used kitchen paper for example).
Remove the oil filter from the housing.
Clean the housing and the engine.

Installing the oil filter



Install the filter in the housing.
Install the housing on the sump. Use oil filter wrench 999 5679.
Tighten to **25 Nm.**
Install the engine splash guard.

Filling with oil

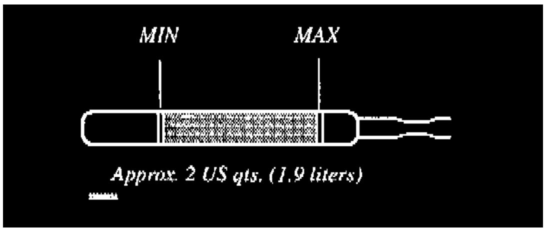
See the Specifications for the correct oil volume.
Start the engine. Check for leaks.

Oil pressure: Inspecting and replacing the oil pressure sensor

Special tools: 999 5270, 5271, 5272, 5273

Note! When checking the oil pressure, the engine should be at a temperature which corresponds to **15 minutes normal driving (100°C).**
Replace the oil and filter if the engine oil grade, type or condition cannot be determined.

Engine Oil: Service and Repair
Checking Engine Oil Level



CHECKING THE OIL LEVEL:

The oil level should be checked every time the car is refuelled. This is especially important during the period up to the first service.

CAUTION: Not checking the oil level regularly can result in serious engine damage if the oil level becomes too low.

Park the car on a level surface and wait for at least 3 minutes after the engine has been switched off. Be sure the oil level is maintained between the upper and lower marks on the dipstick. If oil is added, it should reach the MAX mark on the dipstick. Low oil level can cause internal damage to the engine and overfilling can result in high oil consumption. The distance between the dipstick marks represents approx. 2 US qts (1.9 liters). The oil should preferably be checked when cold, before the engine has been started.

NOTE: The engine must be stopped when checking the oil. Do not fill to the max when the engine is hot.

WARNING! Oil spilled on a hot exhaust pipe constitutes a fire risk.

Engine Oil: Service and Repair
Changing Engine Oil

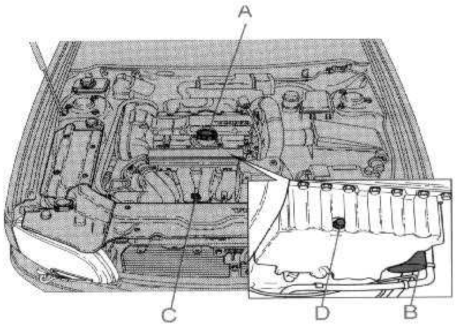


Image Legend:
A - Oil filler cap
B - Oil filter
C - Oil dipstick
D - Drain plug

DRAINING THE OIL:

Drain the oil after driving while the oil is still warm.

WARNING! The oil may be very hot.

If you change the engine oil and filter yourself, your Volvo retailer can assist you in disposing of the used oil. Engine oil can be harmful to your skin - gloves should be worn when performing this work.

TO ADD OR CHANGE OIL

Add oil of the same kind as already used.
Capacity (including filter): **5.7 US qts (5.4 liters)**.
Capacity (excluding filter): **5.3 US qts (5.0 liters)**.

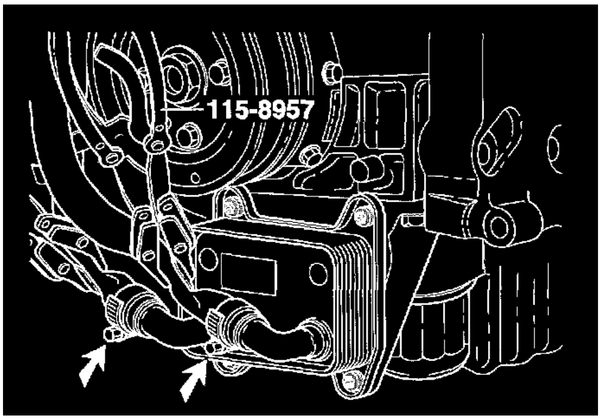
The oil filter should he replaced at every oil change.

Oil Cooler: Service and Repair

Special Tools
115 8957

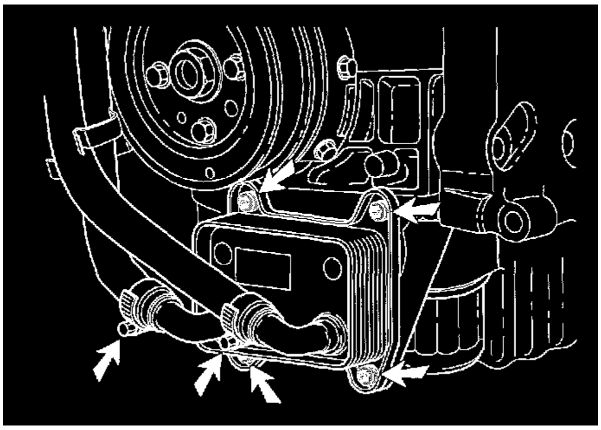
Draining engine oil
- See Replacing the oil and oil filter, refer to Oil, Service and Repair.

Removing the heat exchanger



- Install pliers 115 8957 on both the water hoses
- Release the clamps. Remove the water hoses from the heat exchanger
- Remove the four screws. Remove the heat exchanger
- Collect up any spilled oil and water.

Installing the heat exchanger



- Clean the mating surfaces
- Install a new O-ring
- Install the heat exchanger. Tighten the screws
- Install both the water hoses. Tighten the clamps
- Remove the pliers from the water hoses.

Filling with oil and coolant
- Top up the engine oil
- Check the engine coolant level. Top up if required
- Check for leaks.

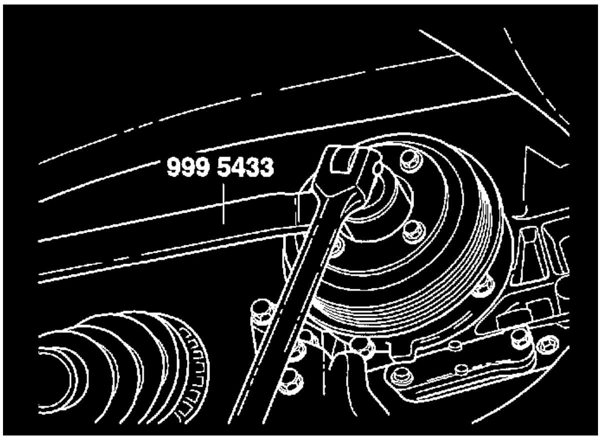
Oil Pump: Service and Repair

Special Tools
999 5433
999 5455
951 2834

If you suspect the oil pressure is low or the oil pump is defective, test the oil pressure, see Oil Pressure: Inspecting And Replacing The Oil Pressure Sensor, refer to Engine Lubrication, Testing and Inspection.

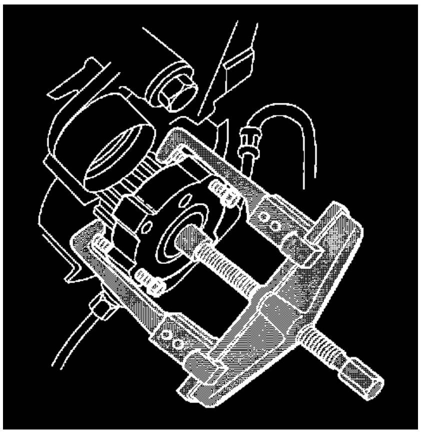
Remove camshaft belt
See replacing toothed (timing) belt, refer to Timing Components, Timing Belt.

Remove vibration damper



Remove the engine splash guard.
Remove the vibration damper using the counterhold 999 5433.

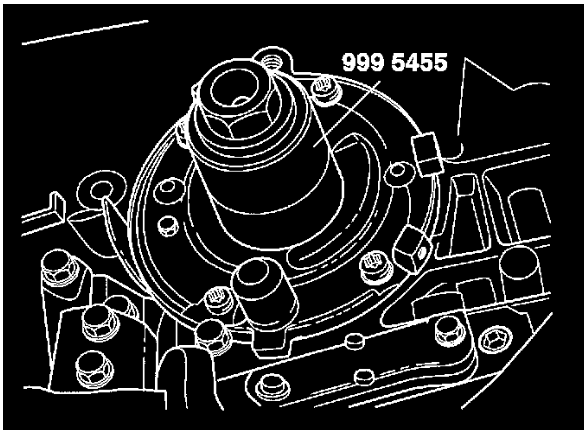
Remove distributor wheel from the crankshaft



Use the universal extractor and two of the vibration damper bolts.
Insert the two bolts in the pulley by hand as far as they will go.
Install the extractor so that the claws grip the bolts (not the wheel in front of the toothed belt).

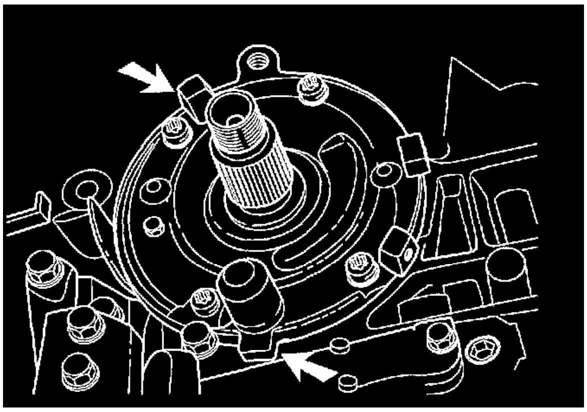
Note! Check that the claws of the extractor do not damage the teeth of the wheel.

If replacing the front retaining ring only



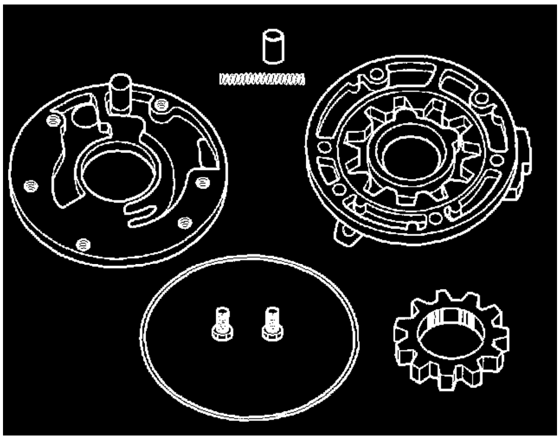
Use a screwdriver to remove the old retaining ring.
Clean the mating surface.
Install a new retaining ring, using die 999 5455; grease the retaining ring.
Push-in the retaining ring using the center nut on the crankshaft.

Remove oil pump

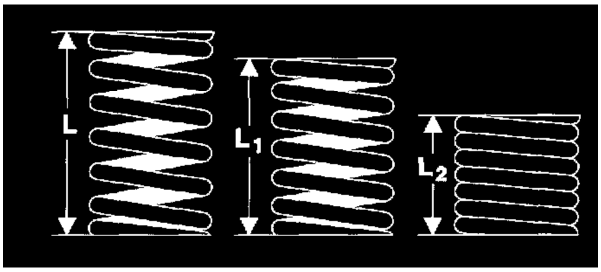


Undo the four bolts from the oil pump.
Carefully twist the oil pump loose. Use a screwdriver on the twist cams to free the oil pump.
Clean the gasket surface and contact surfaces.

Dismantling oil pump



Make sure that the oil pump does not spring apart.
Remove the two Allen head screws and the gasket.
Clean and check all parts
Check for damage and wear and tear. Make a special check of the half-moon shaped section (the surface between the inlet and outlet sides).
If there is a fault, replace the complete pump.
There are loose components for the oil pressure governor.



Spring Tension (Part 1 Of 2)

Load (N)	Length (mm)
0	L1 = 82.13
524	L2 = 56.10
858	L3 = 39.90

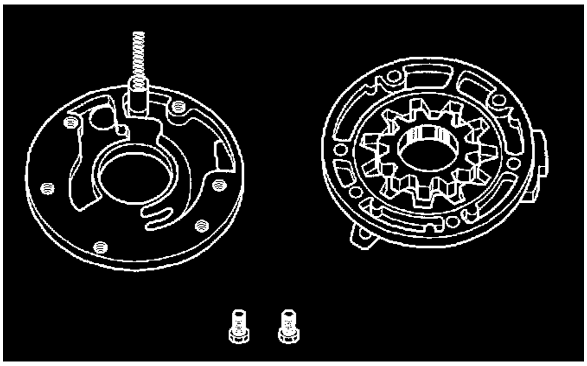
Spring Tension (Part 2 Of 2)

Checking oil pressure governor spring

The governor starts opening at **0.50 MPa.**

Insert pump rotor in casing and check play/clearance

Install the small pump rotor.



Check the play/clearance. If the play/clearance is excessive, replace the complete oil pump.

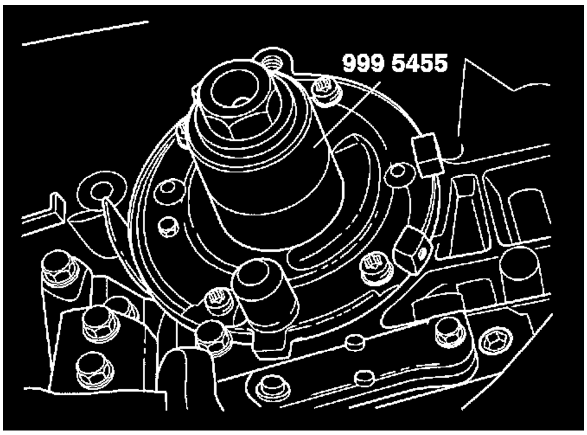
Caution If the measured play between the outer rotor and pump housing is greater than **0.35 mm** and the oil pressure at **100°C** oil temperature is less than 1 bar, the oil pump must be replaced.

Measure the play with a feeler gauge.

Assemble the pump

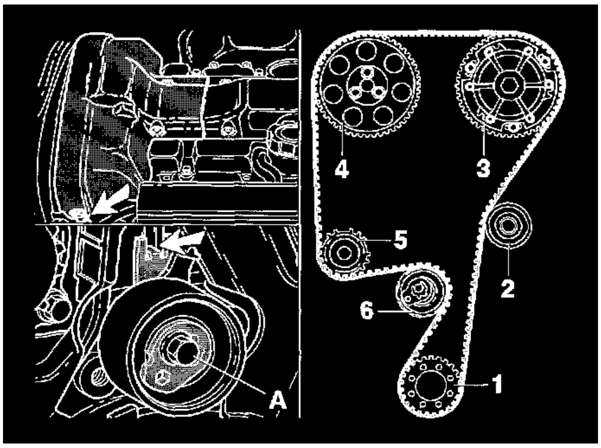
- Clean all surfaces carefully
- Assemble the pump
- Install the large pump rotor with the mark facing upwards.

Installing oil pump



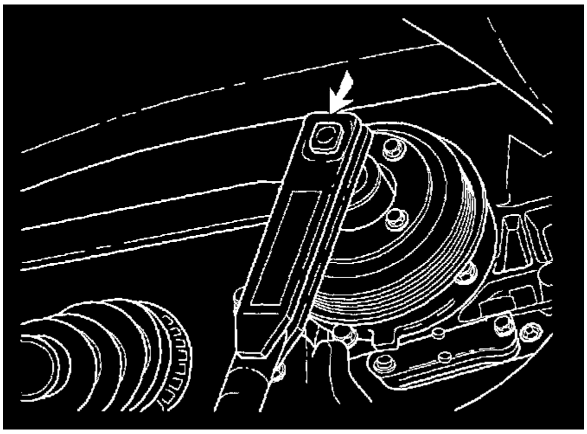
Use a new gasket.
When installing the pump, use the die 999 5455. Use the bolts as guides.
Push the oil pump in using the center nut on the crankshaft.
Tighten the bolts crosswise to **10 Nm.**
Install the crankshaft distributor wheel using the center nut and an extension.

Installing camshaft belt

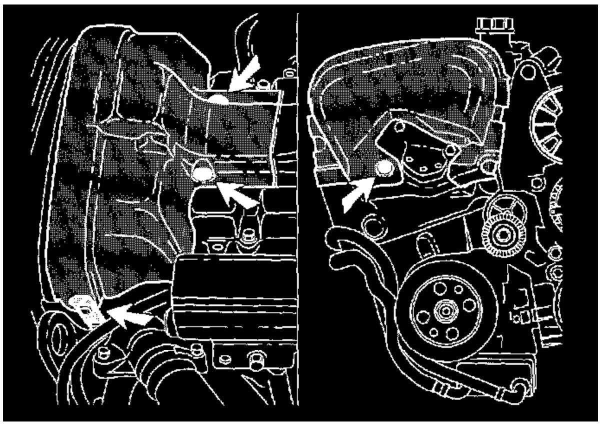


Put the belt around the crankshaft and the RH guide pulley.
Put the belt over the camshaft pulleys.
Put the belt around the water pump and press the belt over the tensioner pulley.

Installing vibration damper



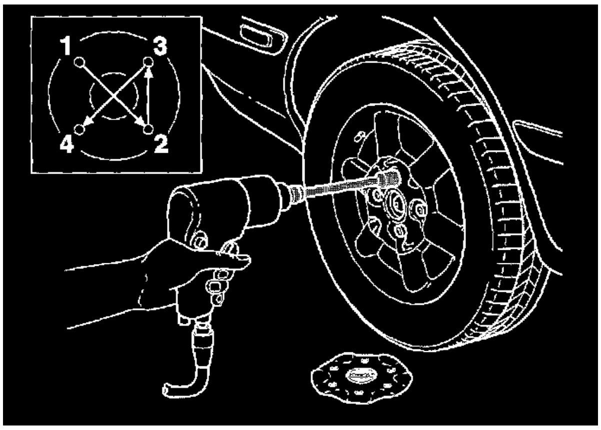
Remove the locating pin from the tensioner/damper.
Install the vibration damper.
Tighten the center nut to **180 Nm**
Use the counterhold 999 5433.
Remove the counterhold 999 5433 and tighten the bolts to **25 Nm** then turn them **30°** further.
Install the upper distributor cover.
Rotate the crankshaft twice and check that the marks on the crankshaft, the camshaft pulleys and the toothed belt correctly align.
Install the rear shield plate on the engine.



Install:

- The shield plate by the vibration damper and the upper and lower distributor covers
- The idler pulley
- The engine splash guard.

Install front wheel



- Install the wheel and loosely install the nuts
- Tighten the nuts crosswise to **110 Nm**
- Torque the nuts again by hand.

Note!

^ If tightening with an airgun, only use torque socket 951 2834.

^ Tightening the nuts crosswise and to the correct torque settings is important to avoid causing stresses in the brake disc.

Test-run the engine.

Oil Spray Jet: Service and Repair

Removing the timing belt and mechanical timing belt tensioner

Remove the timing belt according to Replacing toothed (timing) belt, refer to Timing Components.

Remove the timing belt tensioner. Remove the idler pulley.

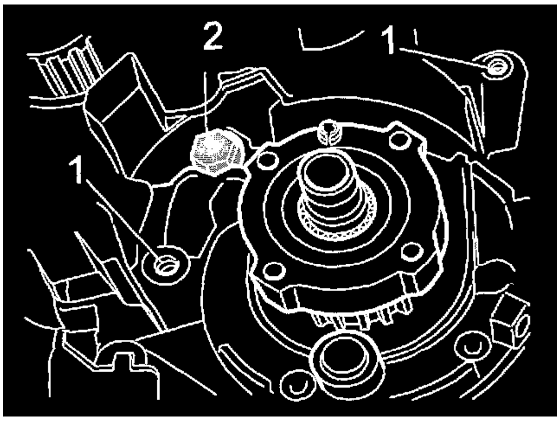
Remove the screw securing the inner timing cover to the cylinder head.

Raise the car. Continue with Replacing toothed (timing) belt.

Remove the vibration damper, refer to Cylinder Block Assembly, Harmonic Balancer.

Removing components

Remove:



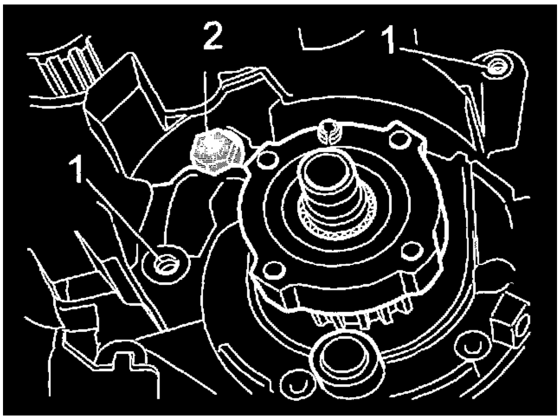
- the two screws (1) securing the inner timing cover to the cylinder block
- the lower belt guard at the oil pump housing.

  Press the inner timing cover off the flange around the coolant pump. Start at the lower edge of the pump.

  Hold the cover out of the way. Remove the piston cooling valve (2) and the seal washer.

Installing components

Install:



- a new piston cooling valve (2) with a new seal washer. Tighten to **35 Nm**
- the inner timing cover. First press the cover into place over the flange at the top of the coolant pump. Then press the remaining section of the cover into place over the flange around the pump. Check that the cover is correctly positioned.
- the two screws (1) securing the inner timing cover to the cylinder block
- the lower belt guard.

Installing the timing belt

Install:

- the screw securing the inner timing cover to the cylinder head
- idler pulley. Tighten to **25 Nm**
- the timing belt tensioner. Screw in the center screw by hand. Ensure that the fork on the tensioner centers above the cylinder block rib. Check that the Allen hole on the eccentric is at **"10 O'CLOCK"**
- the vibration damper.

Install the timing belt.

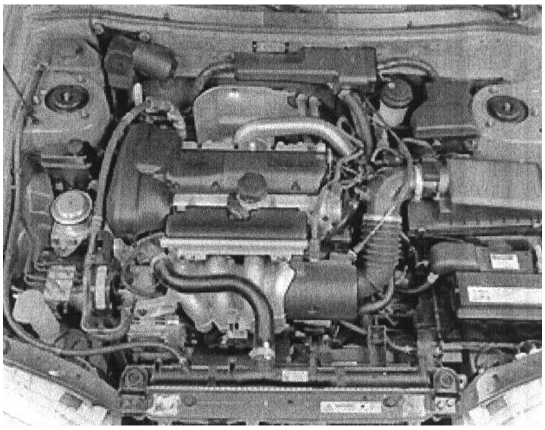
Intake Manifold: Service and Repair

Special Tools
951 2666

Note! As the illustrations in this service information are used for different model years and/or models, some variation may occur. However, the essential information in the illustrations is always correct.

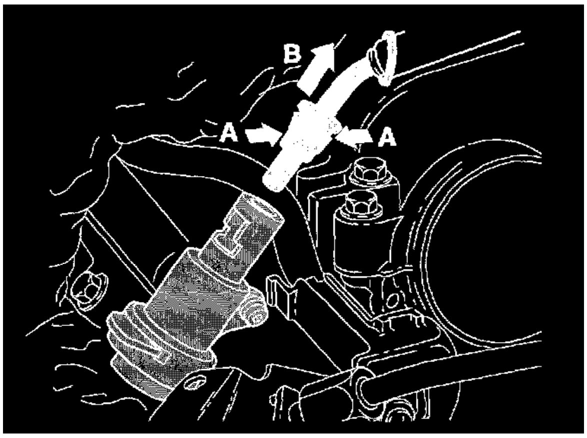
Preparation
Disconnect the battery negative lead. First read Note when disconnecting and connecting the battery lead.
Empty the fuel injection system according to Draining the fuel injection system, refer to Powertrain Management, Fuel Delivery and Air Induction.

Removing the fuel rail



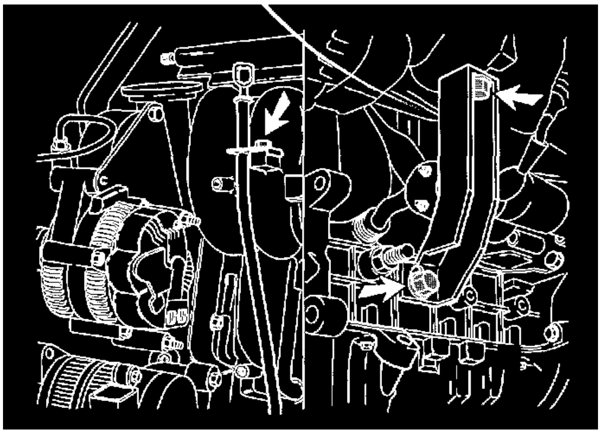
Remove:
- the cover over the ignition coils
- the crankcase ventilation hose from the top of the cam cover
- the cover over the Throttle Body **(TB)**
- the protective cover over the nozzle connectors
- the connectors from the nozzles
- the vacuum hose for the fuel pressure regulator from the Throttle Body **(TB).**

Removing the fuel line



Disconnect the quick-release connector between the fuel line and the fuel rail. Use tool 951 2666.
Remove the mounting screws from the fuel rail.
Gently work the fuel rail and injector nozzles loose as a single unit.

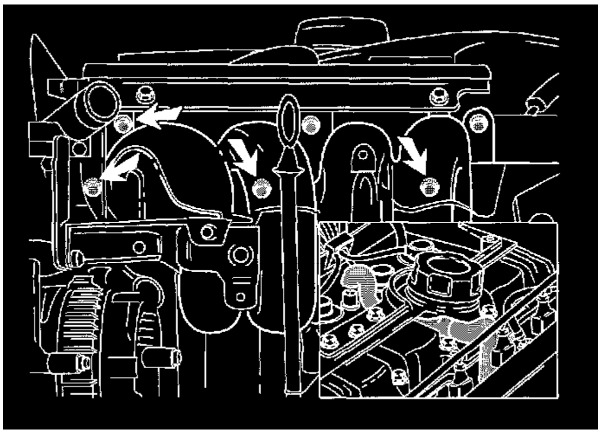
Removing components



Remove:

- the hose from the assisted air control valve in the inlet hose
- the inlet hose between the Mass Air Flow **Engine (MAP)** sensor and Throttle Body **(TB)**
- the vacuum hoses from the intake manifold
- the throttle cable
- the connectors from the assisted air control valve and Throttle Position **(TP)** switch
- the screw from the cable duct mounting in the Throttle Body **(TB)**
- the Knock Sensor **(KS)** cable from the clip
- the brake servo hose
- the bracket between the intake manifold and the pump
- the screw holding the dip stick pipe to the intake manifold
- the upper screw for the intake manifold support bracket, slacken the lower a few turns.

Removing the intake manifold



Remove:

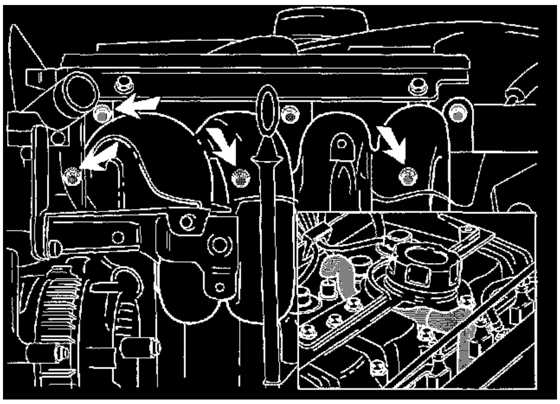
- the mounting screws for the intake manifold
- the intake manifold. Allow the crankcase ventilation hose to run through the intake manifold without disconnecting it from the flame trap.

Transferring components when replacing the intake manifold

Transfer the Throttle Body **(TB)** and the assisted air control valve. Use new gaskets. Tighten to **10 Nm.**

Installing the intake manifold and gasket

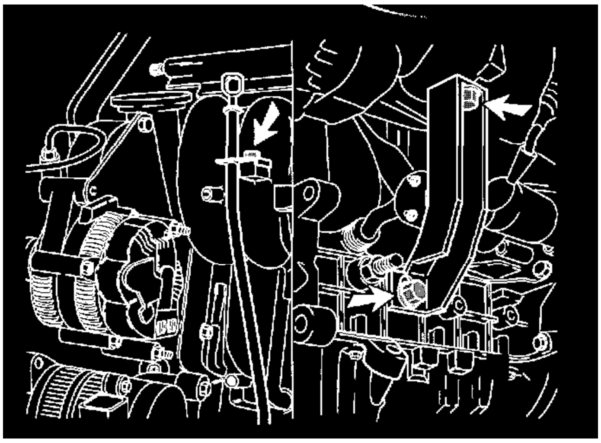
Note! Ensure that the gasket faces are clean.



Install:

- a new gasket
- the intake manifold. Do not forget the crankcase ventilation hose. The hose must be inserted up through the gap between the second and third ducts
- the screws.
  Tighten all the screws starting from the center. Tighten to **20 Nm.**
  Install and tighten the screws for the support bracket (under the intake manifold).

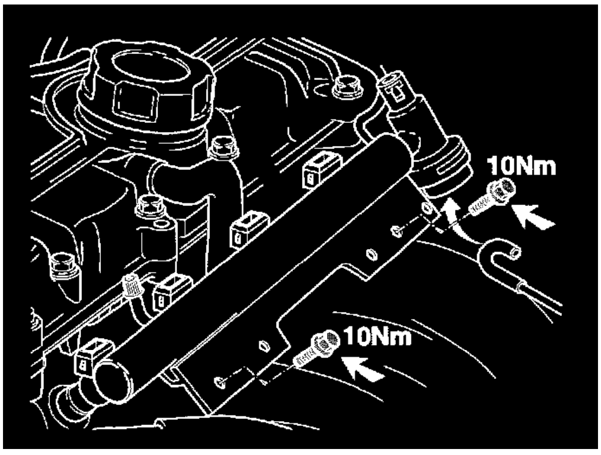
Installing components



Install:

- the screw holding the dip stick pipe to the intake manifold
- the bracket between the intake manifold and the pump
- the brake servo hose
- the cable for the Knock Sensor **(KS)**
- the mounting screw for the cable duct in the Throttle Body **(TB)**
- the connectors on the assisted air control valve and Throttle Position **(TP)** switch
- the throttle cable
- the vacuum hoses on the intake manifold
- the inlet hose between the Mass Air Flow **Engine (MAP)** sensor and Throttle Body **(TB)**
- the hose from the assisted air control valve in the inlet hose.

Installing the fuel rail



Install:

- the fuel rail and the injector nozzles. Press the quick- release connector together until it clicks. Use new screws. Tighten to **10 Nm**
- the vacuum hose for the fuel pressure regulator
- the crankcase ventilation hose on the top of the cam cover. Use a new clamp
- the connectors and protective cover for the injectors
- the covers over the ignition coils and Throttle Body **(TB)**.
  Install the battery negative lead. First read Note when disconnecting and connecting the battery lead.

Final check

Test drive the car. Check the following:

- that there is no fuel leakage
- that the engine operates normally.
  Clean the engine compartment. Check that everything is in position.

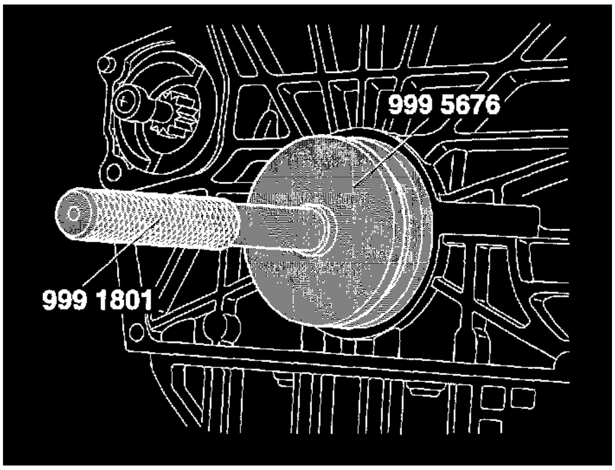
Crankshaft Main Bearing Seal: Service and Repair

Special Tools
999 1801
999 5112
999 5676

Note! This method assumes the transmission has been removed.

Removing flange plate
See Replacing flange plate, refer to Transmission and Drivetrain.

Replacing retaining ring



Remove the retaining ring with a screwdriver.

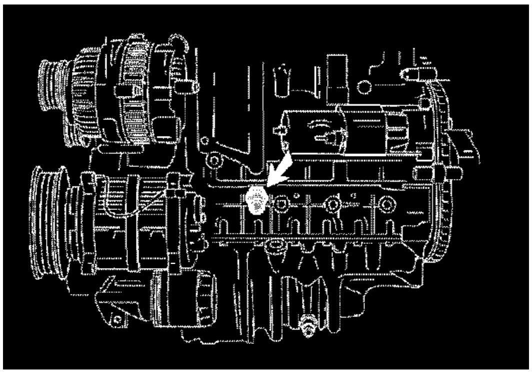
Note! Do not damage the contact faces. Note the position of the retaining ring relative to the retaining ring holder.

Oil the retaining ring mating lips.
Install the retaining ring using the installation kit 999 56?6 and the universal hand grip 999 1801.
Tap the retaining ring in until the die touches the crankshaft.

Installing flange plate
See Replacing flange plate.

Oil Pressure Sensor: Service and Repair

Replacing oil pressure sensor



The oil pressure sensor is at the front of the motor between the dipstick and the starter motor.

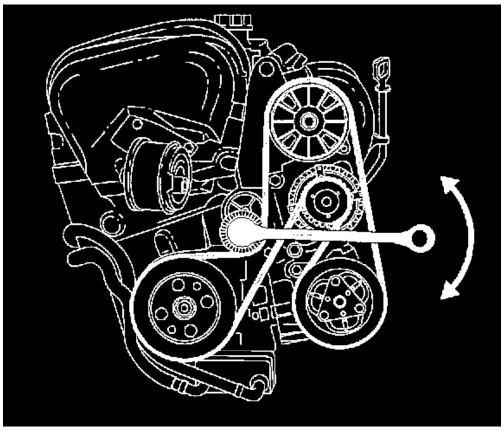
- Disconnect the connector.
- Unscrew the sensor.
- Install in reverse order.

Timing Belt: Service and Repair
Early Model
Replacing toothed (timing) belt

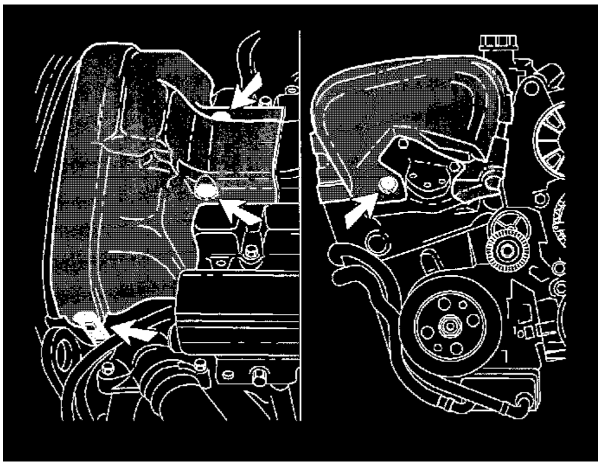
Special tools: 951 2661, 999 5433, 5006, 5383, 5460

General

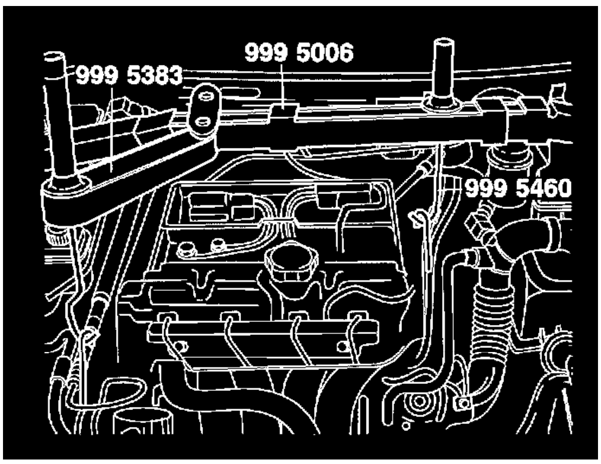
Note! Service interval for timing belt and tensioner pulley: 165,000 km/105,000 miles.



Remove auxiliaries belt
- Remove the right engine compartment cover and the cover above the right headlight unit
- Release the auxiliaries belt by turning the pulley screw clockwise
- Remove the auxiliaries belt
- Release the belt tensioner (counterclockwise).



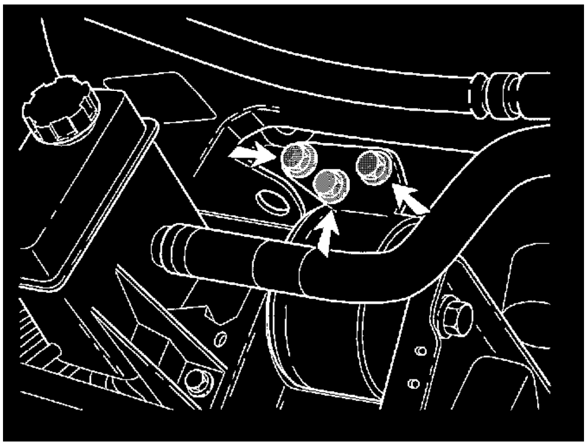
Remove upper timing gear covers
- Remove two screws and remove upper cover by undoing the two clips at the side
- Remove the screw and take the cover off.



Install lifting beam and lifting lug

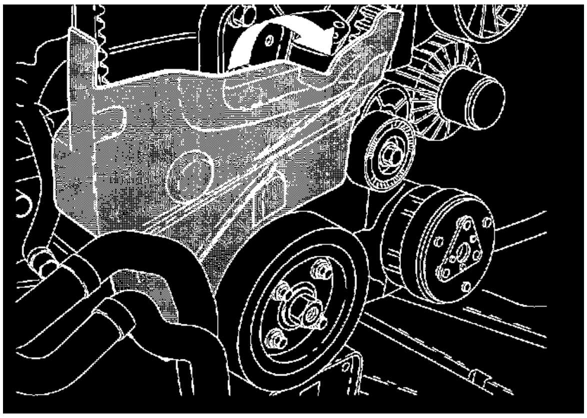
Note! Remove the nut from the body support.

- Position the lifting beam **999 5006** centrally above the engine and install the lifting lugs **999 5460** in the lifting eyes.
- Install the extra support **999 5383** (if necessary). Lift the engine up a few mm at the front.



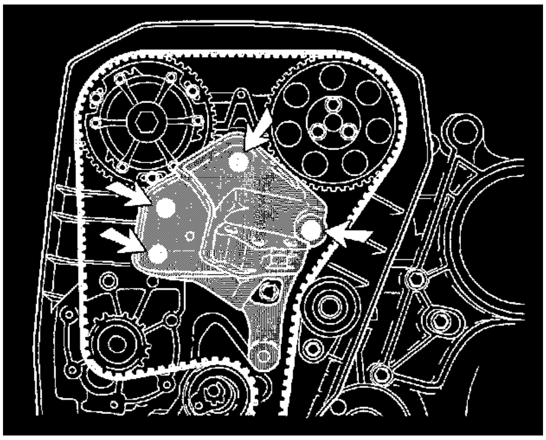
Remove engine mounting on timing gear side

- Remove three bolts and the screw from the mounting at body side and pull out the mounting with the rubber.



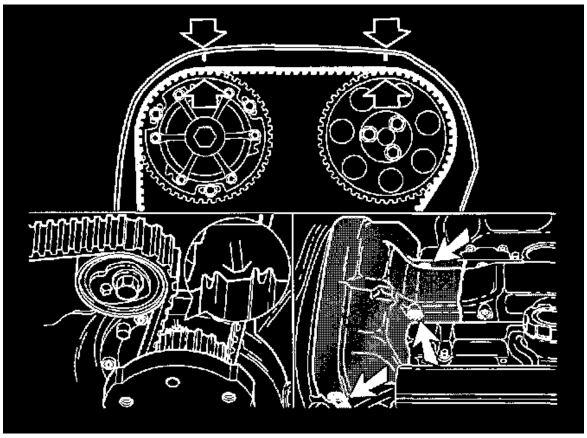
Remove lower timing gear cover

- Undo bottom cover and move backwards.



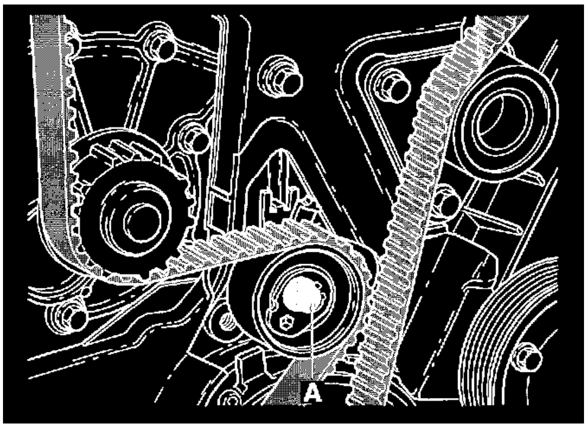
Remove engine bracket

- Remove the four bolts and pull bracket from engine. Lift engine if necessary.
- Turn wheel to the right.
- Open lid in side cover.



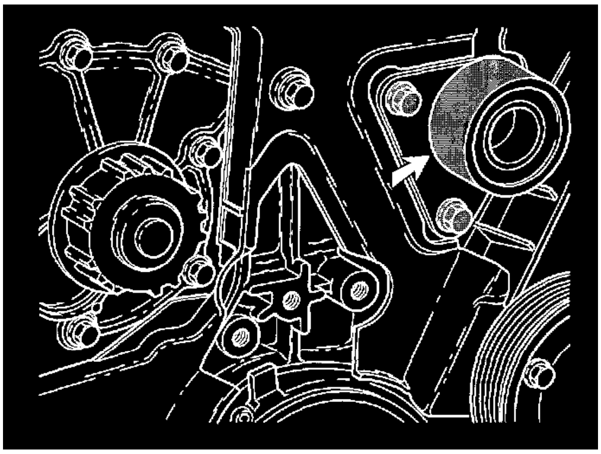
Align timing gear and crankshaft according to the markings

- Place the upper cover in position.
- Turn the crankshaft clockwise until the markings, camshaft gear, inner timing gear cover and the crankshaft/gear wheel align with the oil pump housing.
- Remove upper rear timing cover.



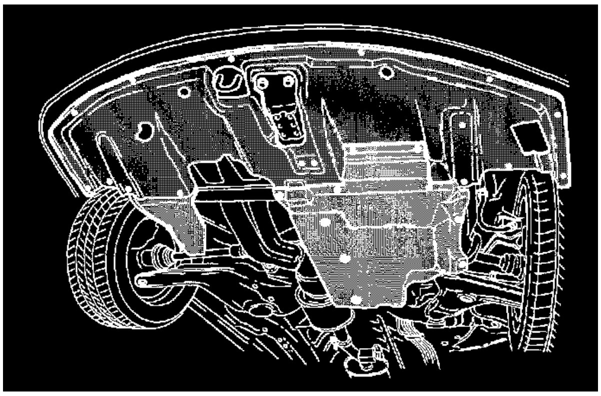
Remove timing belt at the top side

- Remove bolt (A) and take tensioner off
- Remove timing belt and move it downwards
- Clean and check the gears.



Check idler pulley

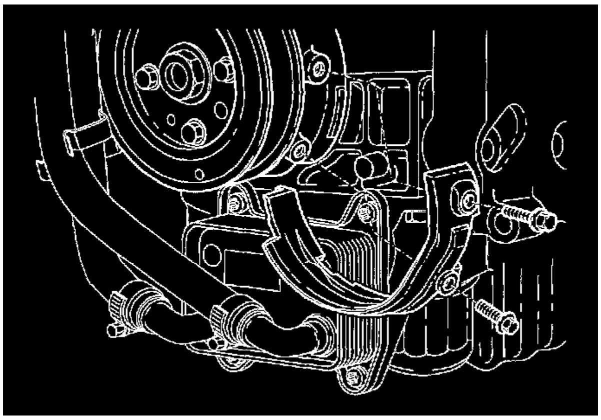
- Rotate the pulley rapidly and listen for abnormal noise from the bearing.
- When replacing: torque setting idler pulley **25 Nm**.
- Check that all pulley contact surfaces for the belt are clean and smooth.



Remove the engine splashguards

Remove:

- rear
- front.

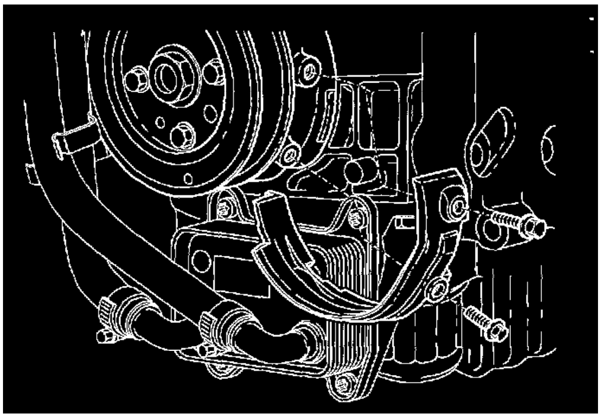


Remove timing belt at lower side

- Remove the two bolts from the snow cap
- Remove the timing belt and take it out with a turning movement
- Clean surrounding.

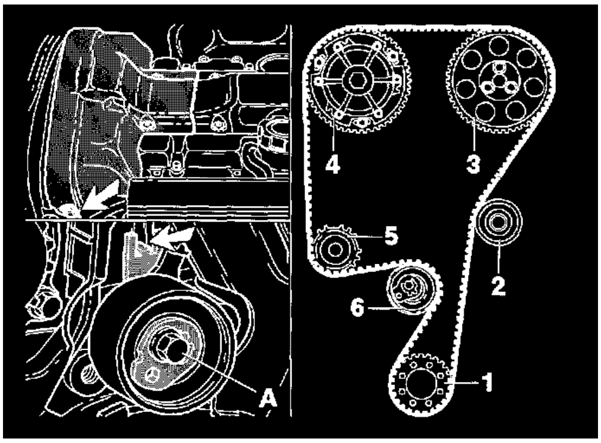
Install timing belt at lower side

- Place the timing belt between damper and engine block.
- Route belt upwards.



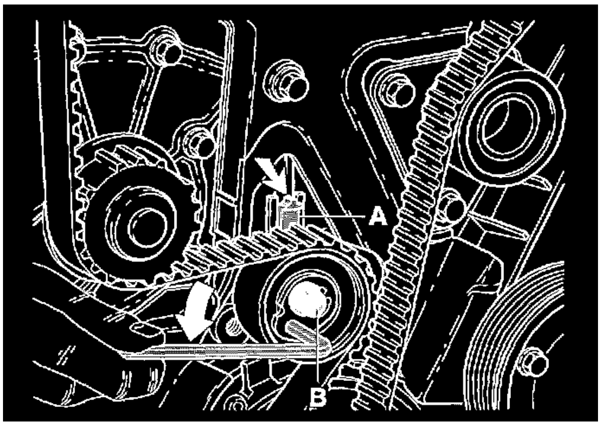
Install cover plates

- Place the lower snow cover and fit the two bolts
- Place the front and rear engine splashguards.



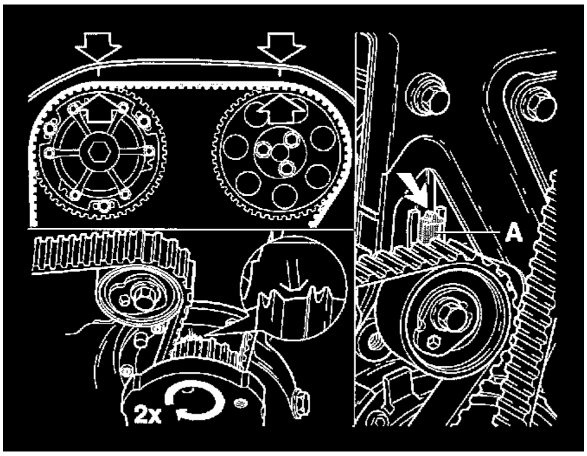
Install new timing belt and tensioner pulley

- Check timing marks
- Position the new tensioner, and finger tighten bolt (A)
- Turn excenter from tensioner in lowest position, see picture
- Route the belt around the crankshaft (1) and the idler pulley (2)
- Route the belt over both timing gears (3.4)
- Route the belt over the water pump (5) and around the tension pulley (6)
- Install upper rear timing cover on engine (do not tighten)
- Check alignment.



Adjusting timing belt tension

- Tighten bolt (B) to **3 Nm**
- Place a 6 mm hex tool in the tensioner and turn tensioner anti clockwise **until the toothed belt is tensioned**
- Move the adjuster until the indicator pin is in the middle (A)
- Tighten the bolt (B) to **20 Nm** without moving the tensioner
- Re-adjust if necessary
- Press pin (A) clockwise and anti-clockwise to check.

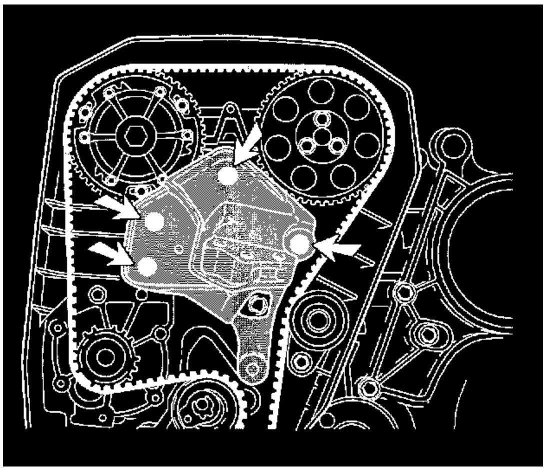


Check timing belt tension

- Rotate the crankshaft two revolutions and check that the markings on the crankshaft pulley and timing gears align with the marks on the timing gear cover
- Check the adjustment of the tensioner (indicator pin (A) in the middle)
- Adjust again if necessary

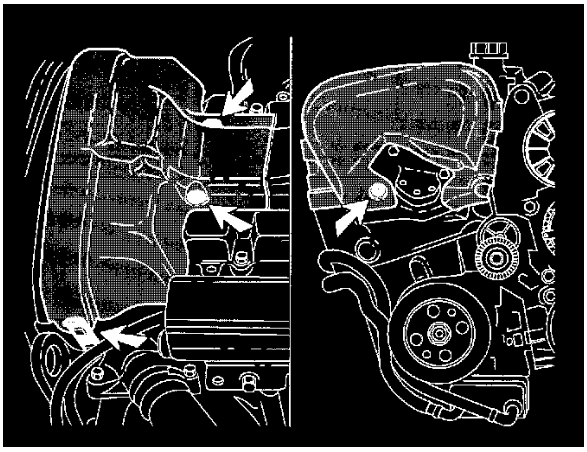
Note! After adjustment always turn crankshaft twice.

- Remove upper timing cover.



Install engine bracket

- Clean mounting pin, position bracket and install bolts. Tightening torque **35 Nm + 75°**

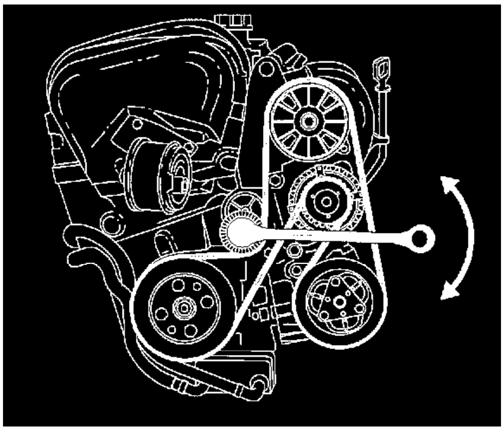


Install timing gear covers

Install:

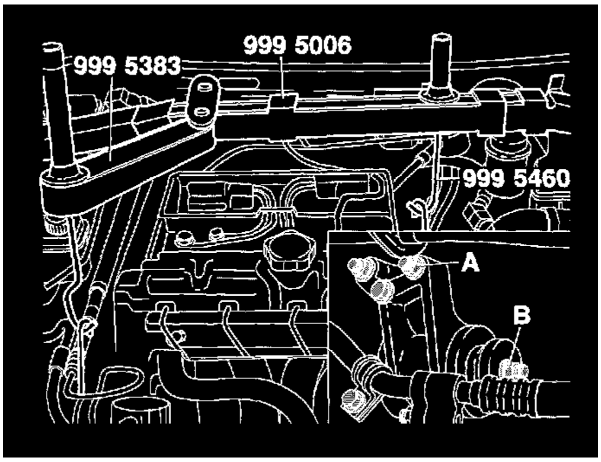
- lower timing gear cover. Check lower cover and water hose fittings
- the top cover (1x screw) (B), torque setting **10 Nm**
- the top timing cover and tighten.

Note! Close lid in side cover move front wheels straight.



Install auxiliaries belt

- Clean the pulley grooves
- Turn the tensioning device clockwise
- Install the auxiliaries belt as illustrated
- Release the belt tensioner (counterclockwise)
- Tighten the bracket. Torque to **10 Nm**
- Install power steering hose. Torque **10 Nm**.



Install engine suspension on timing gear side

- Position the support on the engine and tighten the bolts (A) to **67 Nm**
- Loosely install the bolts in the body support
- Remove the lifting beam 999 5006
- Tighten the body support (13) nut to **98 Nm**.

Test drive engine

- Start the engine and check function.

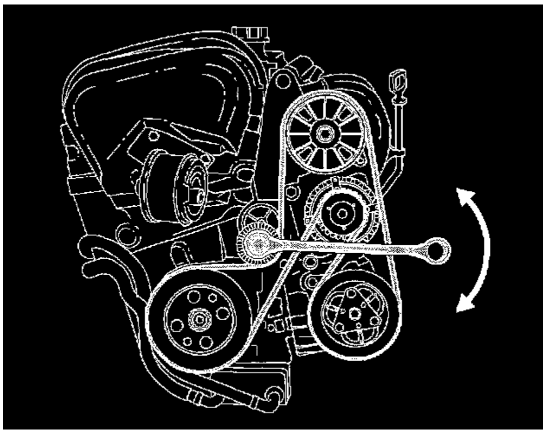
- Install the right engine compartment cover and headlight unit cover.

Timing Belt: Service and Repair
Late Model

Replacing The Timing Belt

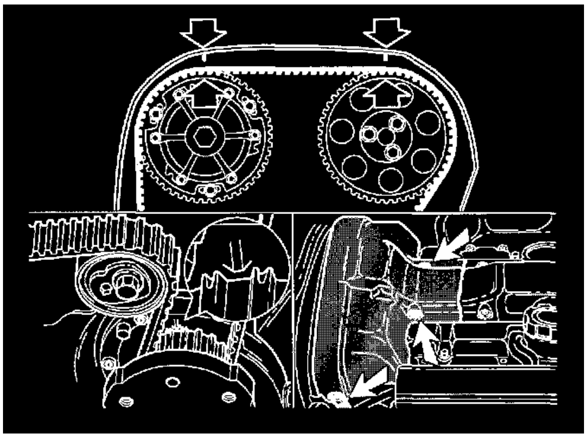
Special Tools
999 5006
999 5383
999 5460

Removing the auxiliaries belt



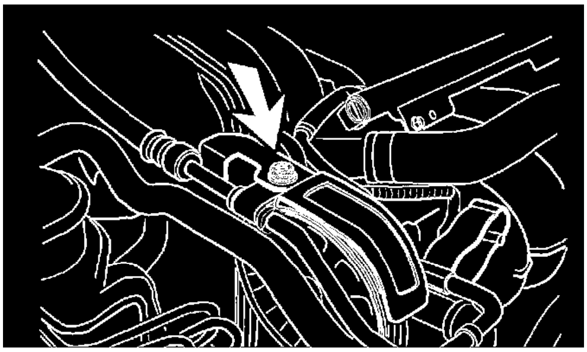
- Turbocharged engines: remove the right hand engine cover and the cover over the right headlamp
- Slacken off the auxiliaries belt by turning the screw on the tension pulley clockwise
- Remove the auxiliaries belt.

Removing the timing covers
Remove:

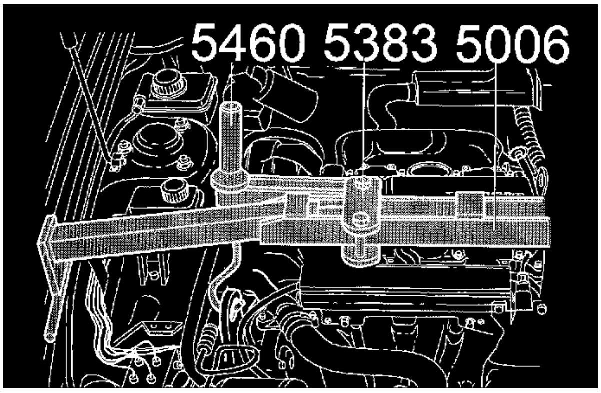


- the upper timing cover
- the front timing cover.

Installing the lifting beam and lifting hook

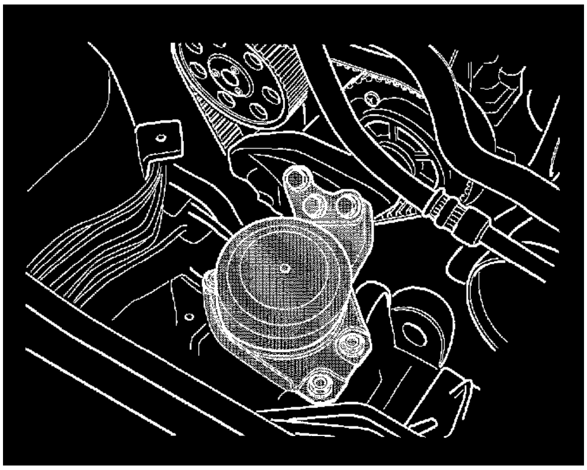


Remove the metal bracket for the servo hose from the rotation protection for the auxiliaries belt.



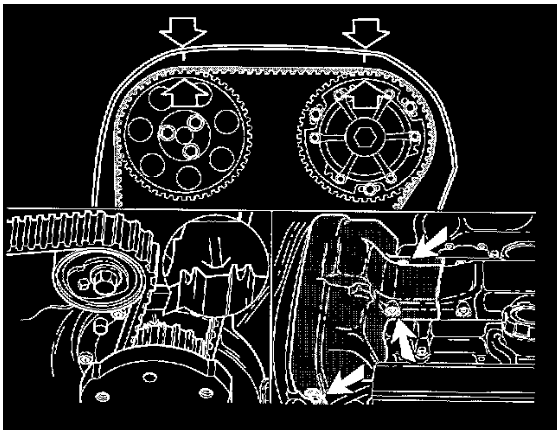
Position lifting beam 999 5006 slightly in front of the front lifting eyelet for the engine. Use lifting arm 999 5383 and lifting hook 999 5460 to raise the front of the engine a few millimeters.

Removing the right-hand engine mounting



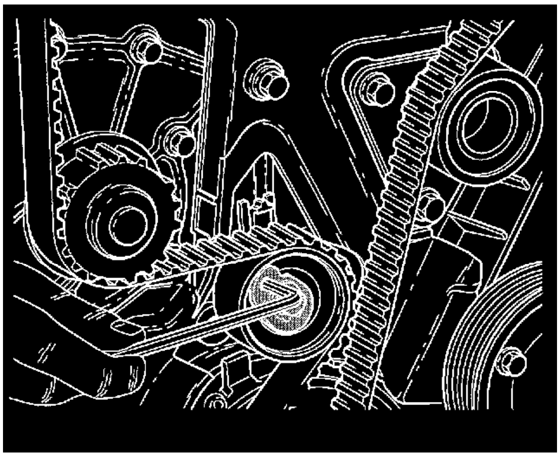
- the screws for the servo holder
- the engine mounting screws
- the engine mounting
- the lower timing cover.

Position the engine according to the marking



Remove the right front wheel.
Position the upper timing cover.
Turn the crankshaft until the markings on the crankshaft and camshaft pulley correspond.
Turn the crankshaft a further l/4 turn clockwise and then back again until the markings correspond. The markings are illustrated. Remove the upper timing cover.

Removing the timing belt



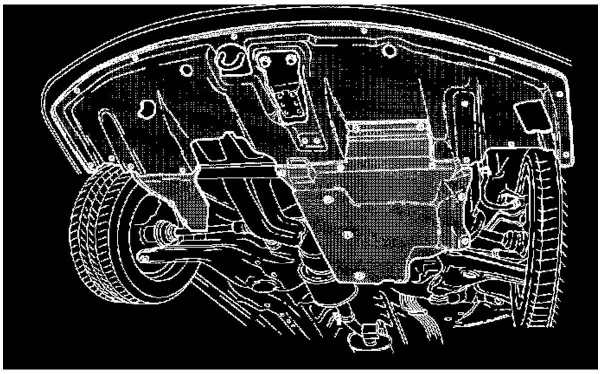
Slacken off the center screw for the belt tensioner slightly.
Hold the center screw still. Turn the tensioner eccentric clockwise using a 6 mm Allen key to 10 o'clock.
Remove the timing belt from the tension pulley, camshaft pulley and water pump.

Tensioning the tensioner pulley and the idler pulley

Spin the idler pulley and listen for noise. When replacing with a new idler pulley, tighten to **24 Nm**.
Spin the tension pulley and listen for noise. When replacing, screw the tension pulley into place using the center screw.
Screw in the center screw by hand.
Ensure that the tensioner fork is centered over the cylinder block rib.
Ensure that the Allen hole on the eccentric is at "10 o'clock".

Removing the splash guards under the engine

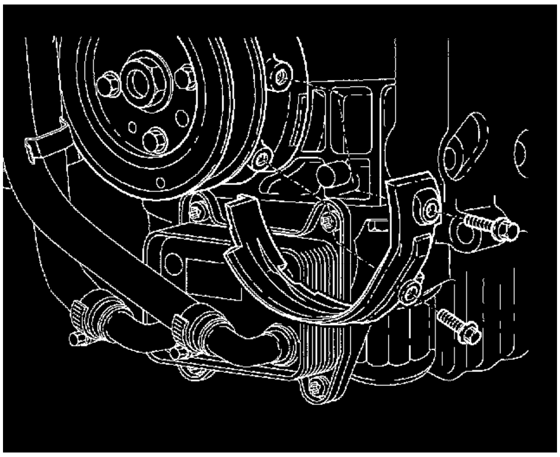
Remove:



- the front air baffle
- the rear air baffle.

Removing the timing belt (at the bottom)

Remove:



- the two screws from the lower belt cover
- the lower belt guard
- the timing belt using a twisting movement
- clean the surrounding area.

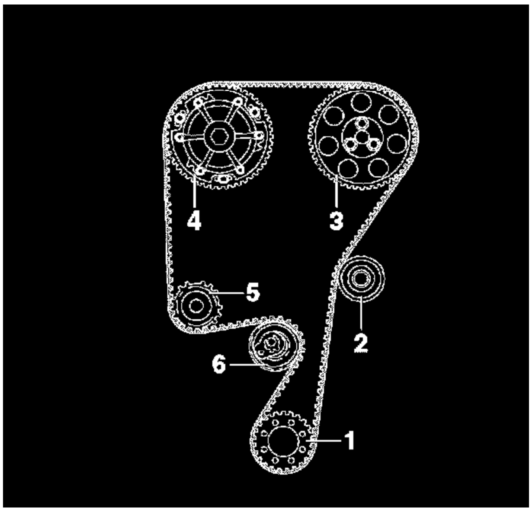
Installing the timing belt

Install the timing belt over the pulley on the crankshaft.

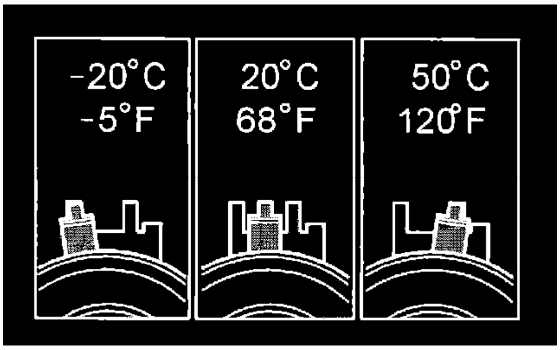
Install:

- the lower belt guard
- the front air baffle
- the rear air baffle.

Install the new belt in the following order:

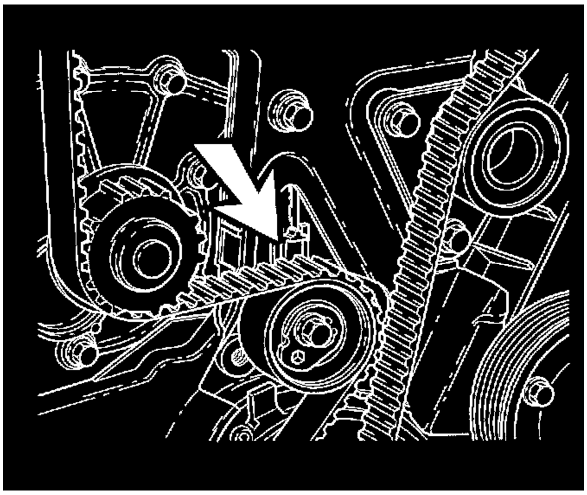


- crankshaft
- the idler pulley
- intake camshaft
- exhaust camshaft
- water pump
- belt tensioner.



Note:

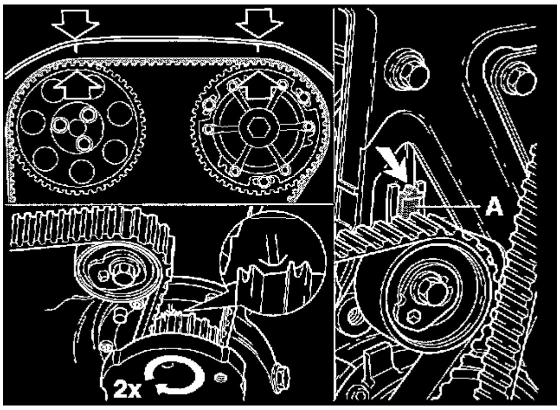
- This adjustment is to be made with a cold engine. Suitable temperature is approximately **20°C/67°F**. At higher temperatures (with the engine at operating temperature or a high outside temperature for example) the indicator is further to the right.
- The illustration shows the position of the indicator at different engine temperatures.



- Carefully turn the crankshaft clockwise until the timing belt is tensioned. The belt must be tensioned between the intake camshaft pulley, the idler pulley and the crankshaft
- Hold the belt tensioner center screw secure. Turn the belt tensioner eccentric counter-clockwise until the tensioner indicator passes the marked position. Then turn the eccentric back so that the indicator reaches the marked position in the center of the window
- Hold the eccentric securely. Tighten the center screw. Tighten to **20 Nm**.

Check that the indicator is in the correct position.

Check

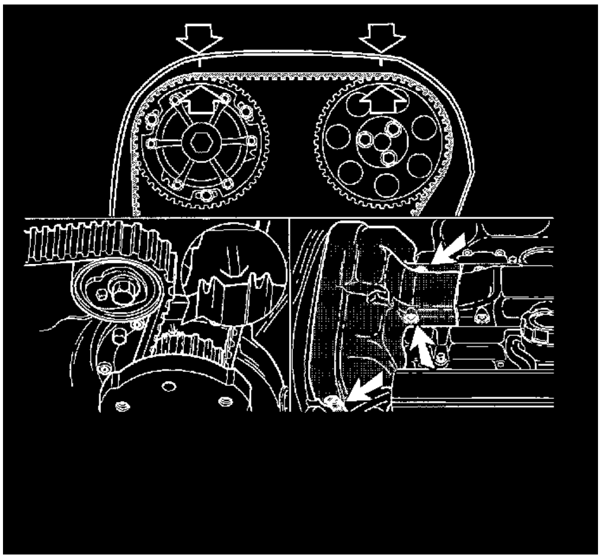


- Press the belt to check that the indicator on the tensioner moves easily
- Install the upper timing cover
- Turn the crankshaft two turns. Check that the markings on the crankshaft and camshaft pulley correspond.

Note: Check that the indicator on the belt tensioner is within the marked area.

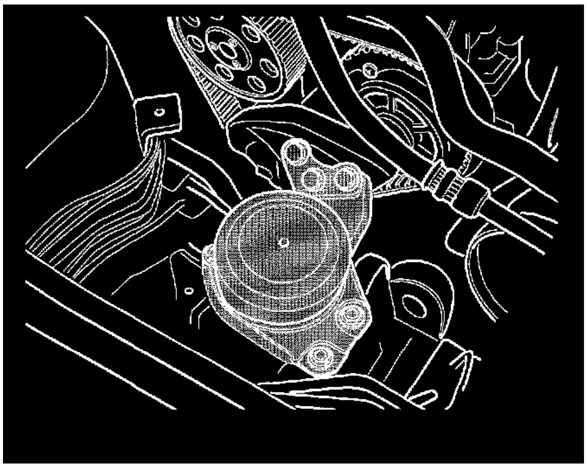
Installing timing covers

Install:



- the lower timing cover
- the front timing cover. Tighten to **12 Nm**
- the auxiliaries belt.

Installing the right engine mounting



Screw the engine mounting into place on the engine.
Tighten to **67 Nm**.

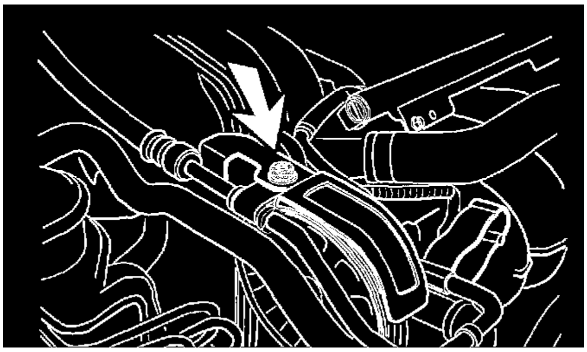
Install:

- the screws on the bracket for the bodywork. Tighten to **50 Nm**
- the servo reservoir.

Finishing

Remove the lifting beam and lifting hook.

Install:

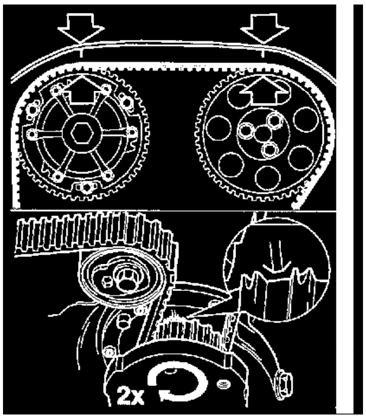


- the metal bracket for the power steering hose on the rotation protection for the auxiliaries belt
- the front wheel according to Front brake pads replacement
- the auxiliaries belt
- turbocharged engines: the right hand engine cover and the cover over the right headlamp unit.

Checking work

Function test:

- Test drive the engine.


2x

Fuel Pressure: Testing and Inspection
Checking the Fuel Pressure While Driving

Special Tools

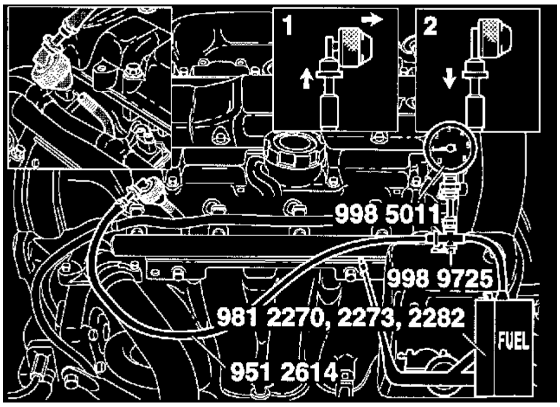
981 2270
981 2273
981 2282
999 5011
951 2614

Overview

The fuel pressure and residual pressure can usually be checked in the workshop. If required, there is a description of the method for checking the fuel pressure and residual pressure while driving.

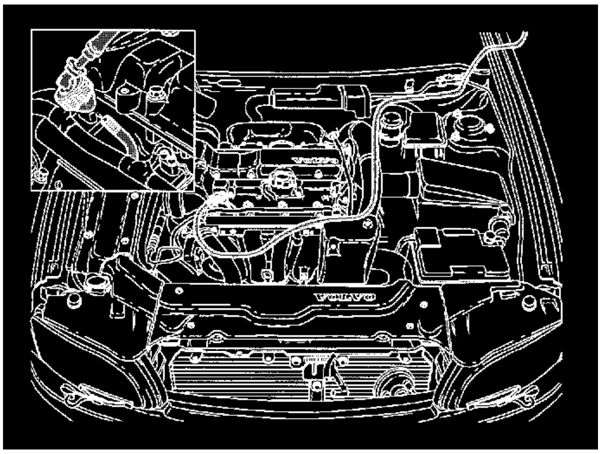
- Checking the fuel pressure and residual pressure in the workshop.
- Checking the fuel pressure while driving.

Connecting the pressure gauge



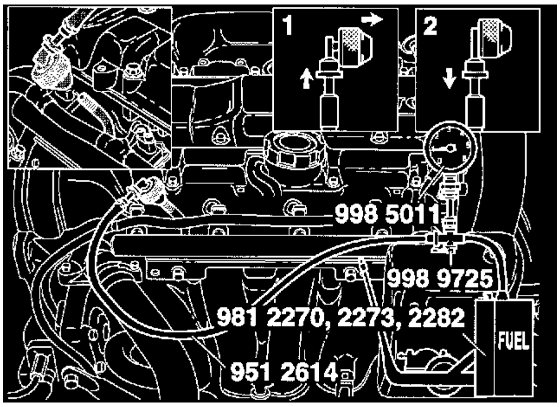
- Use pressure gauge 999 5011 with nipple 998 9725 and adapter 951 2614 before use.
- Remove the cover over the fuel rail.
- Connect the adapter to the valve on the fuel rail. Set the adapter in its locked position. (illustration 1, valve closed)
- Turn the tap on the pressure gauge in the direction of the hose 951 2614.
- Connect the other pressure gauge terminal to the fuel draining unit 981 2270, 981 2273, 981 2282.
- Open the adapter (illustration 2. valve open).

Routing the pressure hose



Note! Ensure that the hose follows the rubber trim on the plenum chamber. Ensure that it is then routed out of the engine compartment at the rear corner of the bonnet. The adapter hose joint at the T-valve must be outside the engine compartment. This is to ensure that neither the bonnet or the hose are damaged when the bonnet is closed.

Connecting the fuel pressure gauge

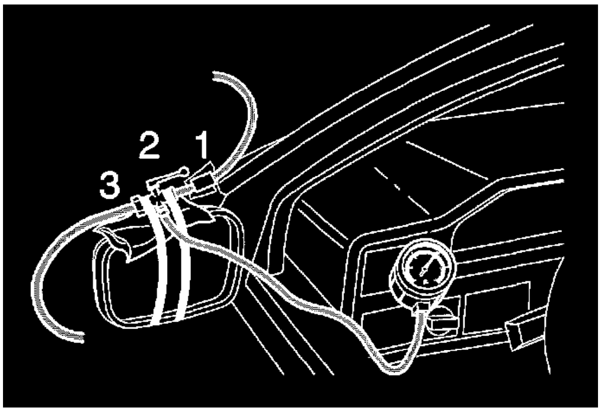


- Secure the T-valve on the left door mirror. Use tape.

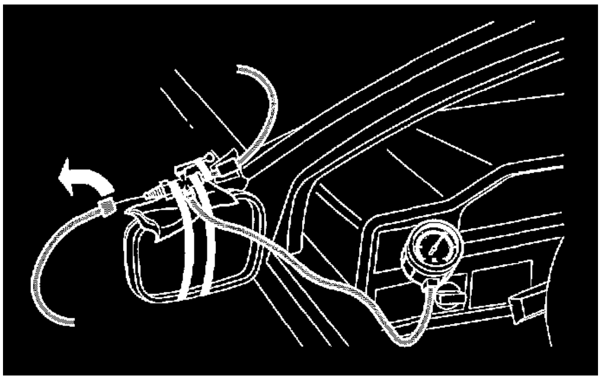
  Note! Protect the valve and the connector with foam rubber as illustrated.

- Turn the T-valve cock to the middle position (position 2 in the illustration).
- Start the draining unit.

Connecting the fuel pressure gauge, continued



- Turn the T valve cock toward the engine (position 1 in illustration)
- Stop the draining unit.

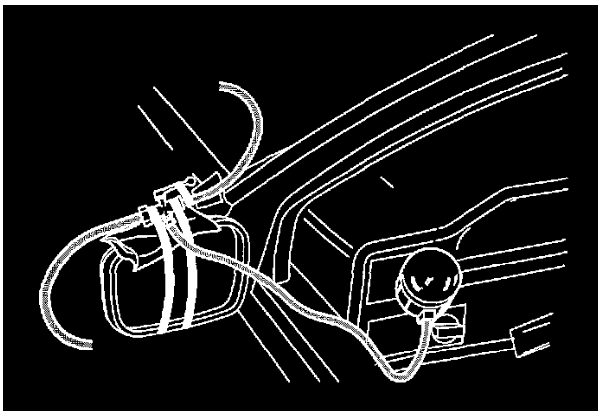


- Remove the draining unit hose from the T-valve hose connector.
- Lock the cock with a tie strap. The cock must be pointing towards the engine.
- Arrange the hose along the rubber trim on the plenum chamber cover to the left of the bonnet hinge. This is to prevent damage to both the bonnet and the hose.
- Carefully close the hood.

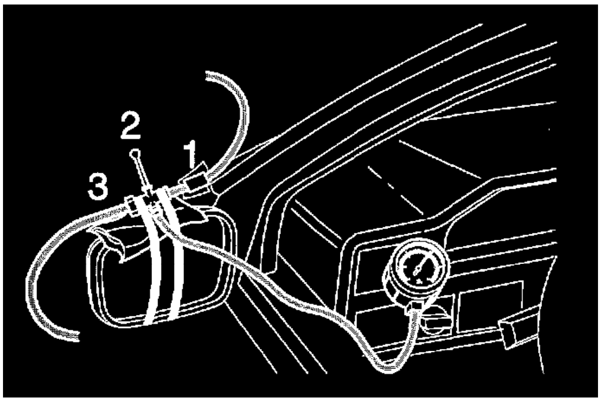
Checking the fuel pressure while the car is being driven

- Start the engine.
- Drive the car. Read off the fuel pressure while the car is being driven. The fuel pressure **must be: 220 - 310 kPa** in all driving conditions.

Removing the fuel pressure gauge



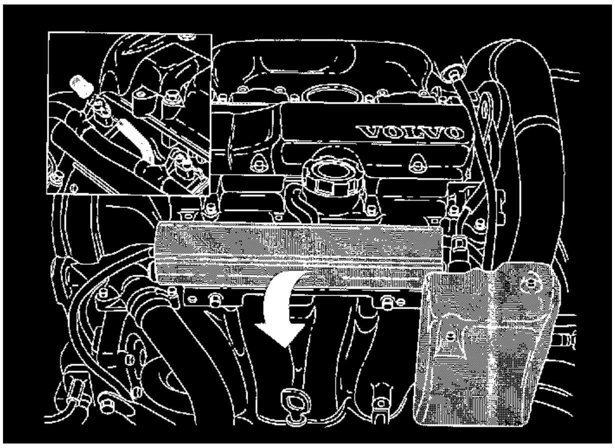
- Connect the draining unit hose to the hose nipple on the door mirror (the black arrow in the illustration).
- Start the draining unit



- Remove the tie strap locking the cock on the T-nipple.
- Set the cock in the central position. (position 2)
- Close the valve. (position 1)
- Disconnect adapter. Open the valve.
- Reinstall the protective cap.
- Remove the test equipment and hoses from the car.
- Reinstall the cover over the fuel rail.

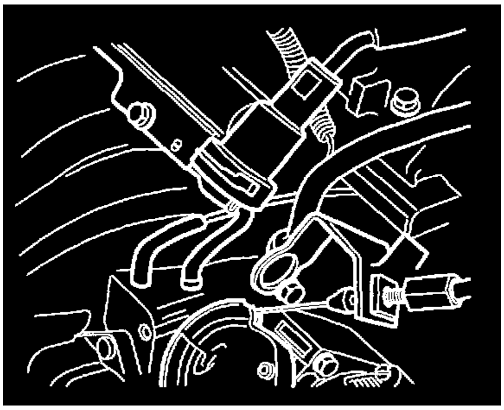
Fuel Pressure: Testing and Inspection
Measuring Fuel Pressure EMS 2000

Removal



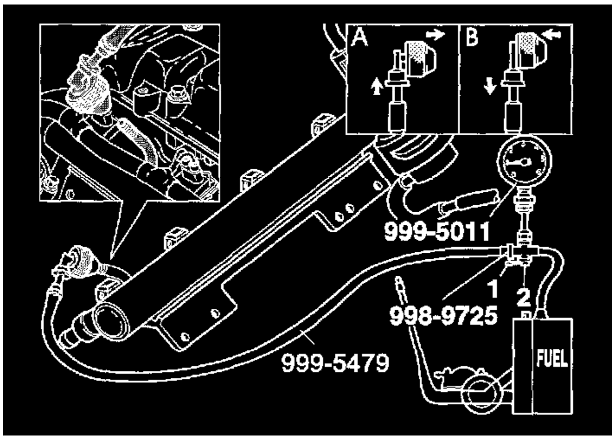
Remove
- The cover over the throttle pulley.
- The aluminum plate, (on turbocharged engines).
- The protective cap on the Schrader valve.

Checking the vacuum system



Disconnect the vacuum hose from the pressure regulator and the intake pipe.
Check that the vacuum hose is undamaged and not clogged.
Replace the front pressure regulator if there is fuel in the vacuum hose.
Check the vacuum hose nipple on the intake pipe, clean if necessary.
Continue with "Connect the test equipment" (3).

Connect the test equipment



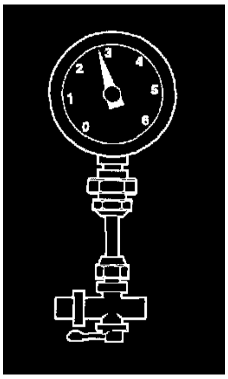
Assemble 999-5011 and 998-9725 with J-41031-A
Avoid fuel spillage.
Connect the open end of the hose from the fuel gauge to the fuel draining unit.

Warning Secure the hose onto the fuel draining unit to prevent fuel leakage

Screw nipple J-41031-A into place on the Schrader valve.
Hang the gauge on the hood catch or the safety catches.
Turn the cock to position (1).

Fuel pressure measurement

Note! Note the measurement value at this step. The result might be needed as a reference in step 12.



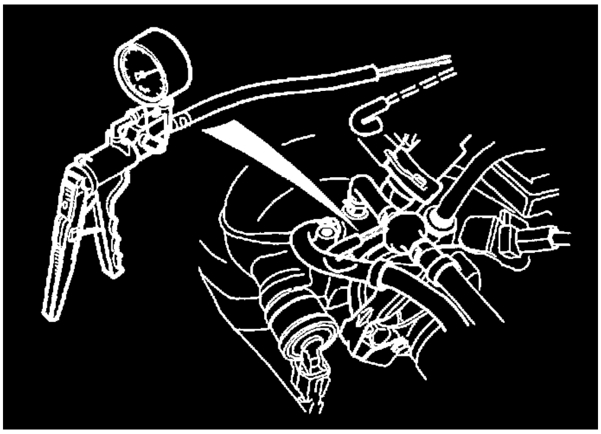
Disconnect the vacuum hose from the pressure regulator.

Note! Position the gauge so that the movement of the needle can be read when the engine is started.

Start the engine.
The pressure should rise to approximately **309 kPa (45 psi)** immediately.
If the pressure is correct, continue measuring the "Front pressure regulator" (5) or (6).
A: The pressure rises slowly to the correct pressure:
Switch off the engine.
Continue with " Check the rear fuel pressure" (8).
B: Too low or too high pressure.
Switch off the engine.
Continue with "Check the rear fuel pressure" (8).

Front pressure regulator, B4XX4T

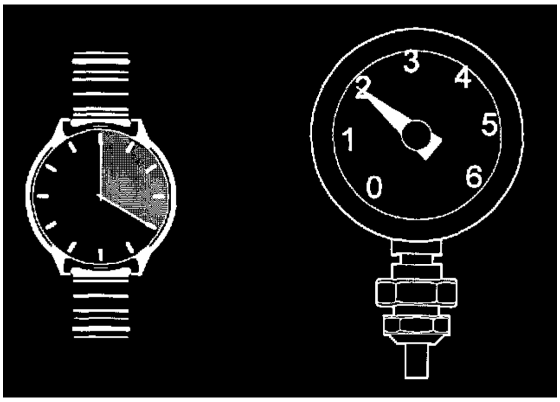
Caution When applying vacuum or pressure to the regulator, do not exceed the pressure values stated. Damage to the diaphragm in the regulator may occur.



Connect pump 999 5757 to the regulator.
Pump up a vacuum.
The pressure reading should go down.
Fuel pressure must not be lowered below **240 kPa.**
Release the vacuum.
The pressure should rise to approximately **309 kPa** immediately.
Pump up the pressure.
The pressure reading should go up.
Fuel pressure must not be raised above **380 kPa**
Release the pressure.
The pressure should return to approximately **309 kPa** immediately.

Continue with "Check the residual pressure"(7).
If the pressure regulator is not functioning correctly, replace the front pressure regulator.

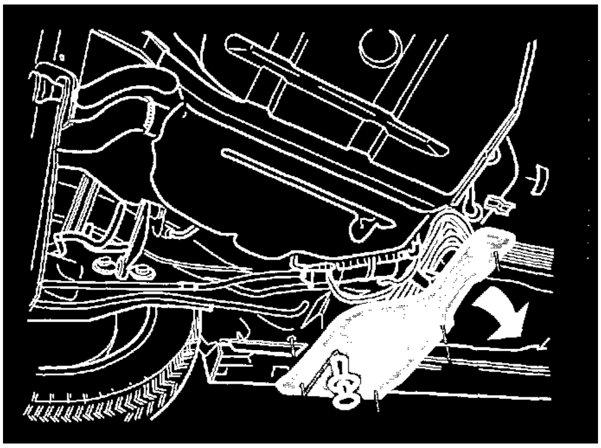
Checking the residual pressure



The starting pressure is **309 kPa**
Switch off the engine.
Note the time.
The fuel pressure must not be lower than **200 kPa** for 20 minutes.

Hint: Too low residual pressure can be caused by leakage in the injectors, the check valve in the fuel pump or leakage in the pressure regulators.

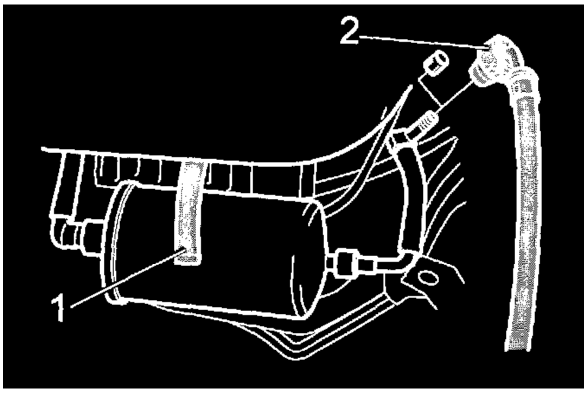
Remove the test equipment from the car. Return the equipment to the tool board.
Reinstall the removed components and the cap on the Schrader valve.



Note! The rear fuel pressure measurement test must only be carried out if the result of step 4 is in accordance with A or B.

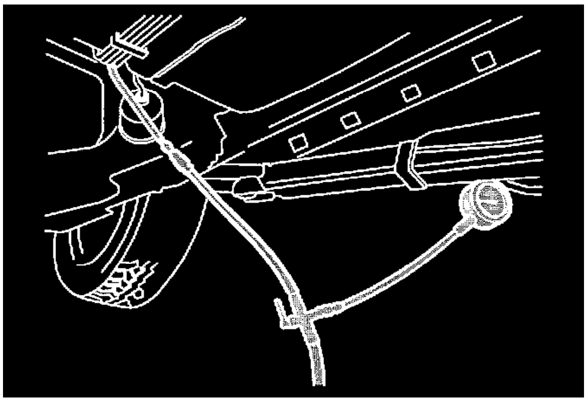
Raise the car.
Remove the guard.

Warning The fuel filter must not hang from the fuel lines during this test. Secure the fuel filter using tie straps.



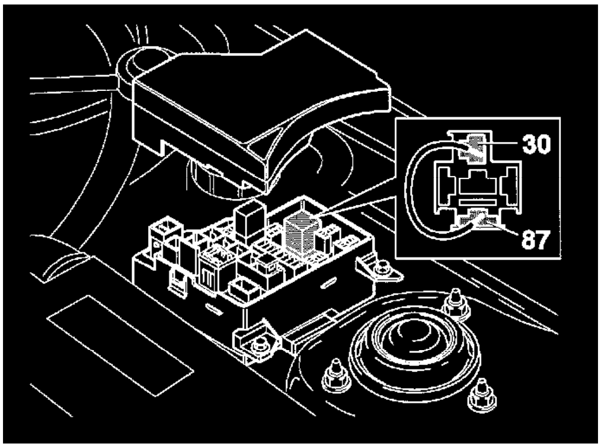
Slacken off end open the clamp for the fuel filter (1)
Carefully work the filter downwards.
Remove the cap on the Schrader valve.
Screw nipple J-41031-A (2) into place on the Schrader valve.

Note! Hang the pressure gauge so that the value can be read off easily when the car has been lowered.



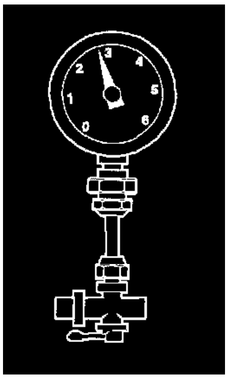
Lower the car.

Starting the fuel pump (FP)



Remove relay 2/14.
Make up a bridging cable.
Bridge terminals 30 and 87. The fuel pump (FP) starts.

Rear fuel pressure



The pressure must rise to approximately **430 kPa** immediately.
If the rear fuel pressure is incorrect, replace the rear pressure regulator which is integrated in the fuel pump **(FP).**
If the rear fuel pressure is correct and the fuel pressure is incorrect in step 4, select the fault tracing path. See note below.
A: The rear fuel pressure is normal but in step 4 rose slowly to approximately **309 kPa**. Check if the fuel line is damaged or pinched. If the fuel line is intact, replace the fuel filter.

The fault is remedied.
B: The rear fuel pressure is normal but in step 4 the pressure immediately rose to a too low/high value. Replace the front pressure regulator.

The fault is remedied.
Disconnect the test equipment.
Reinstall the components in reverse order.

Air Cleaner Housing: Service and Repair

Note! As the illustrations in this service information are used for different model years and / or models, some variation may occur. However, the essential information in the illustrations is always correct.

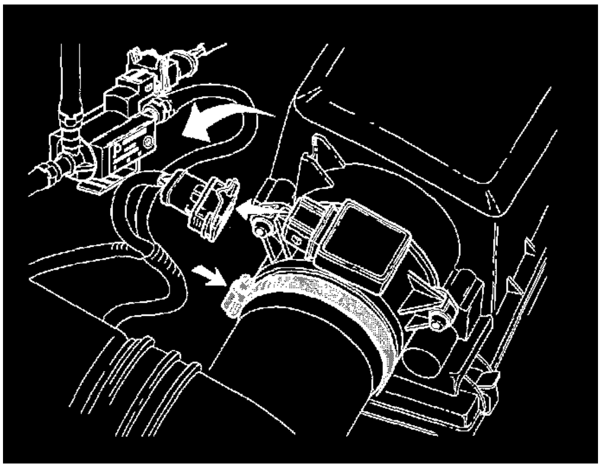
Preparation

Remove:

- the cable from the battery negative terminal. First read Note when disconnecting and connecting the battery lead
- the cable from the battery positive terminal
- the battery.

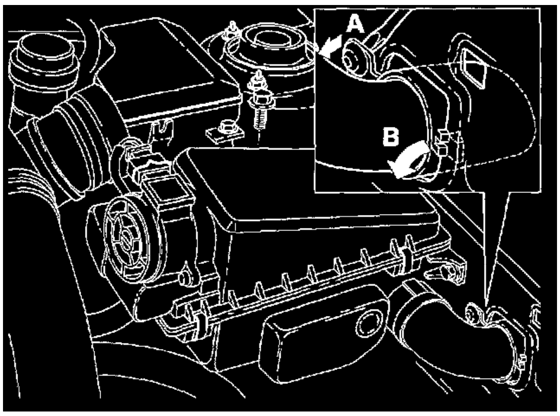
Removing the air cleaner (ACL) housing

Remove:



- the connectors from the Mass Air Flow **Engine (MAP)** sensor and the assisted air control valve. Disconnect the connectors, vacuum hoses and wiring from the Air Cleaner **(ACL)** housing
- the assisted air control valve from the Air Cleaner **(ACL)** housing
- the inlet hose from the terminal on the Mass Air Flow Engine **(MAP)** sensor
- the preheating hose.

Remove:

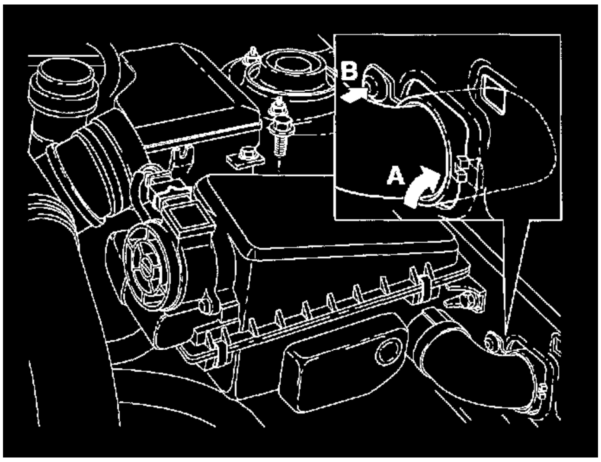


- the screws for the relay box. Move the box to one side
- the screws for the Air Cleaner **(ACL)** housing.
  Release the clip holding the fresh air intake on the Air Cleaner **(ACL)** housing. Lift off the Air Cleaner **(ACL)** housing assembly.

Installing the air cleaner (ACL) housing

Position the Air Cleaner **(ACL)** housing.

Install:



- the screws for the air cleaner **(ACL)** housing
- the screws for the relay box
- the preheating hose
- the inlet hose
- the assisted air control valve.
  Reconnect the vacuum hoses, connectors and wiring.

Installing the battery

Install:

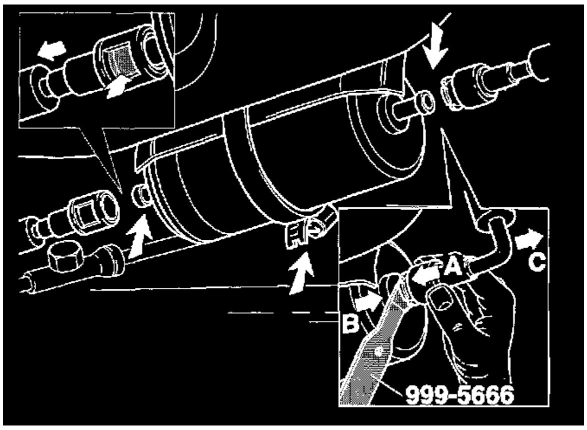
- the battery
- the cable on the battery positive terminal
- the cable on the battery negative terminal. First read Note when disconnecting and connecting the battery lead.

Fuel Filter: Service and Repair

Special Tools
999 5666

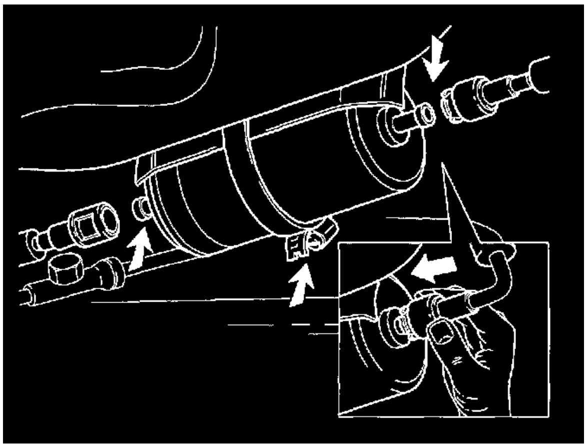
Draining fuel system
- Drain fuel system according to Draining the fuel injection system, refer to Fuel Delivery and Air Induction, Service and Repair.

Removing fuel filter
Front side:



Carefully release the quick-release connectors by pressing the fuel lines towards the filter (A) while moving the black circlip backwards (B), together with the fuel line. Use tool 999 5666.
Rear side:
Press the fuel line locking part in and pull the fuel line off.
Remove the clamp and remove the fuel filter.

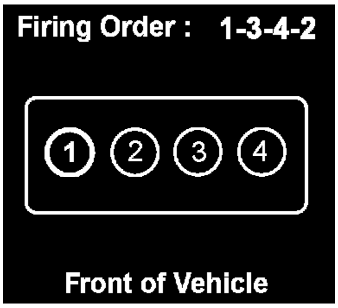
Installing fuel filter



Install the new filter and carefully reconnect fuel hoses.
Check that the quick-release connectors are secure by pulling them.
Secure filter on the bracket with the clamp.
Start the engine and check for leakage.

Removing special tools
See Draining the fuel injection system, refer to Fuel Delivery and Air Induction, Service and Repair.

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2



Spark Plug: Application and ID

Spark Plugs

Engine

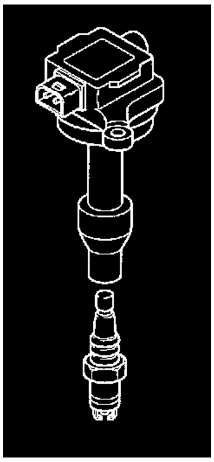
B4204T2
B4204T3

Torque	Part Number	Gap
18 ft. lb.	27 23 44-3	0.0315 inch

Spark Plug: Service and Repair

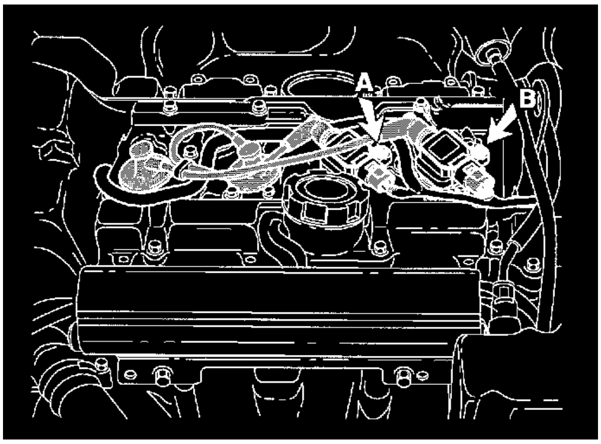
Special Tools
999 5702

Removing spark plugs



- Remove both engine covers.
- Disconnect the connectors.
- Disconnect the HT lead.
- Remove the mounting screws.
- Pull off the ignition coils.
- Remove the spark plug with special tool 999 5702.

Installing spark plugs:



- Check the rubber and the spring inside. Replace if necessary.
- Check the spark gap: **0.7 - 0.8 mm.**
- Install the spark plugs. Screw the spark plugs in until the gasket is pressed against the cylinder head. Tightening torque **25 Nm**. Use special tool 999 5702.
- Position the ignition coils. Press the ignition coils into place.
- Tighten the screw. Tightening torque **10 Nm.**
- Connect the high tension cables.
- Reconnect the connectors.

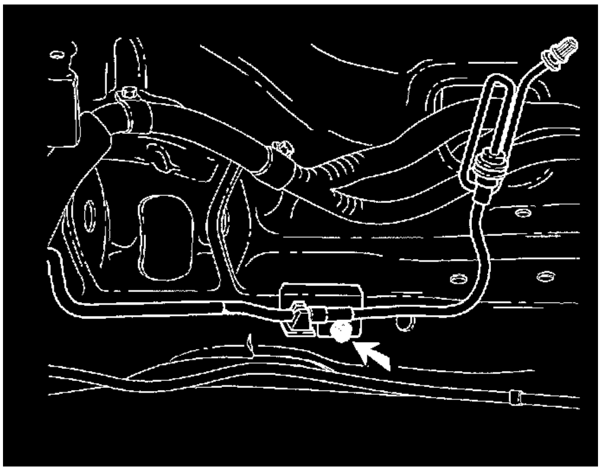
  Note! The gray connector is for the left coil (cylinders 2 and 3), the blue connector is for the right coil (cylinders 1 and 4).

- Check the function.
- Install both engine covers.

Water Pump: Service and Repair

Draining coolant

See Replacing coolant, refer to Coolant, Service and Repair.



Remove:

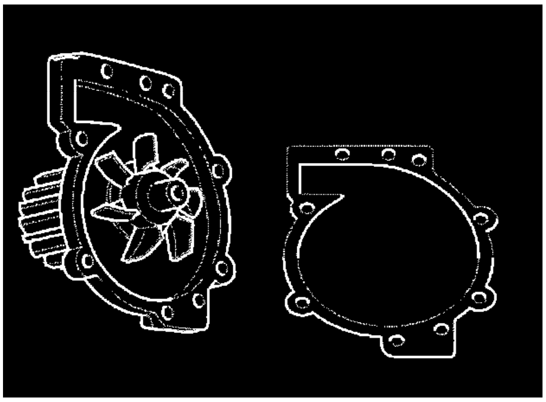
- The engine cover
- The upper and lower timing covers
- The idler pulley
- The right front wheel.
  Slacken off the fender liner slightly.
  Remove the protective panel from the front-rear member.
  Turn the crankshaft until all the markings correspond.

Remove:

- The upper timing cover.
  Remove the timing belt. Move the timing belt to one side, see Replacing toothed (timing) belt, refer to Engine Timing Components.
  Compress the tensioner damping unit with compression tool.
  Remove the tension pulley.

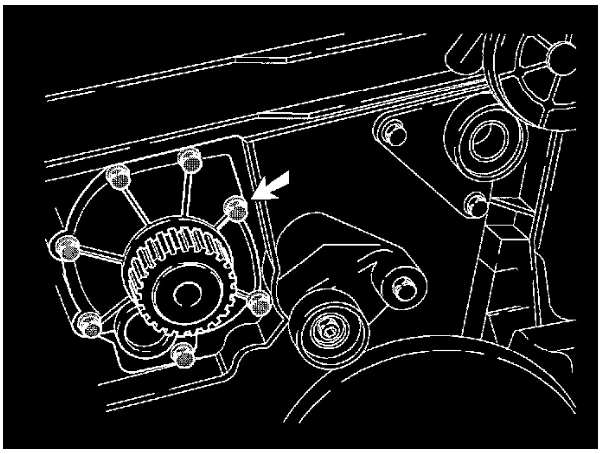
Removing the coolant pump

Cleaning the gasket and mating surfaces

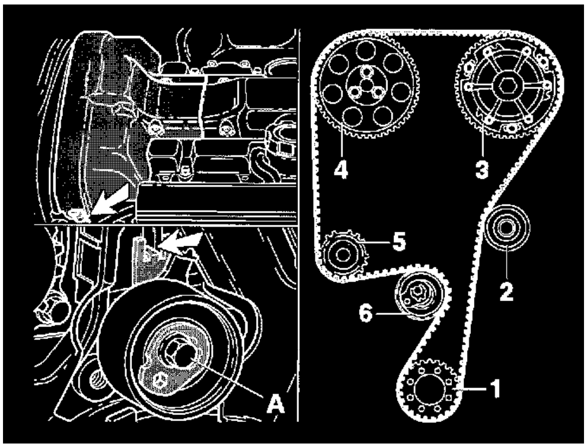


Clean the cylinder block thoroughly. Remove any gasket residue.

Installing the coolant pump

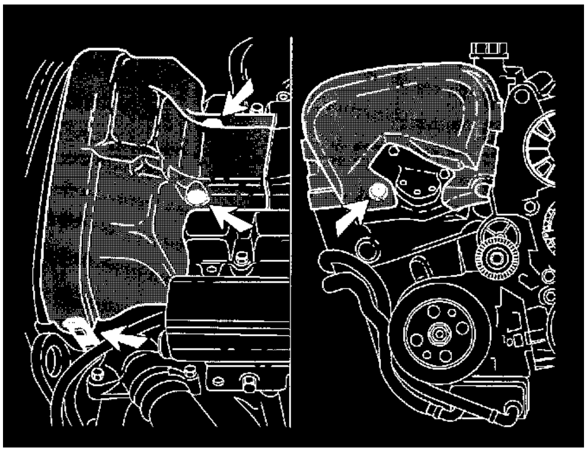


Use a new gasket.
Tighten the screws to **20 Nm.**



Install:

- The tension pulley
- The timing belt.
- The upper timing cover.
  Remove the lock pin from the tensioner damping unit.
  Turn the crankshaft two revolutions. Check that all markings correspond.



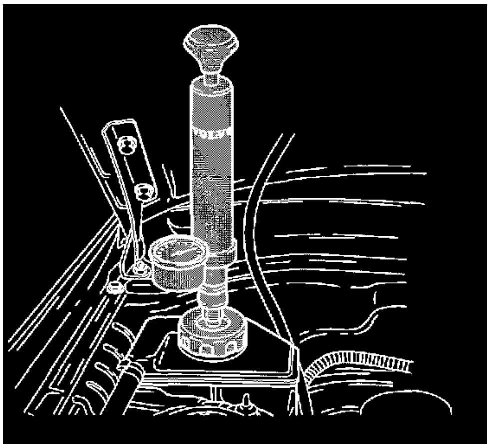
Install:

- The upper and lower timing covers
- The right front wheel.
- The protective panel for the front-rear member
- The engine cover and the splash guard under the engine
- The cover for the side member.
  Fill with coolant.

Cooling System: Testing and Inspection

Special Tools
998 5496

Leak testing the cooling system



Test pressurizing the cooling system
Use pressure gauge 998 5496.
Connect the pressure tester to the coolant reservoir.
Pump up the pressure. Check for leaks.

- Maximum permissible pressure **150 kPa.**

  Note! B4184SM, maximum permissible pressure: **90 kPa.**

- The pressure in the system must be steady. It must not fall noticeably within 30 seconds.

  Note! Allow the pressure to even out for a couple of minutes.

  Check the cooling system for leakage.

Gauging the pressure in the filler cover

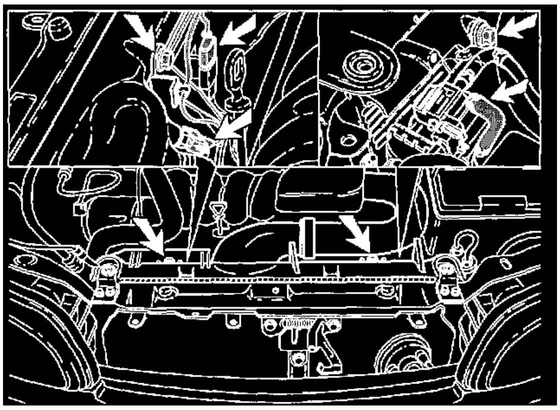
	-96	97-	B4184SM
Overpressure, kPa (Psi)	130-150 (18.9-21.8)	140-160 (20.3-23.2)	80-100 (11.6-14.5)
Negative pressure, kPa (Psi)	<7 (<1)	<7 (<1)	<7 (<1)

- Only the filler cover on B4184SM is white. All other models have black filler covers.

Radiator Cooling Fan Motor: Service and Repair

Note! Remove the complete unit with both of the fans if the car is equipped with air conditioning.

Remove at the top side

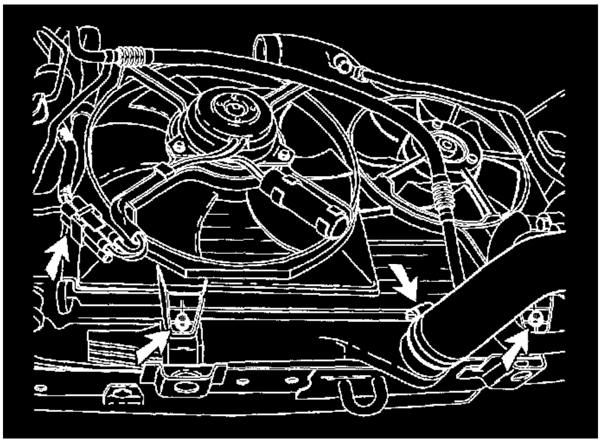


Remove:
- the front engine-bay cover
- mark the EVAP hose and remove it from the Canister Purge **(CP)** valve
- the connector from the Intake Air Temperature **(IAT)** sensor on the Charge Air Cooler **(CAC)** (undo wiring from the shroud)
- the connector from the right side fan
- the two bolts at the top from the unit.
  Raise the car.

Remove from the underneath

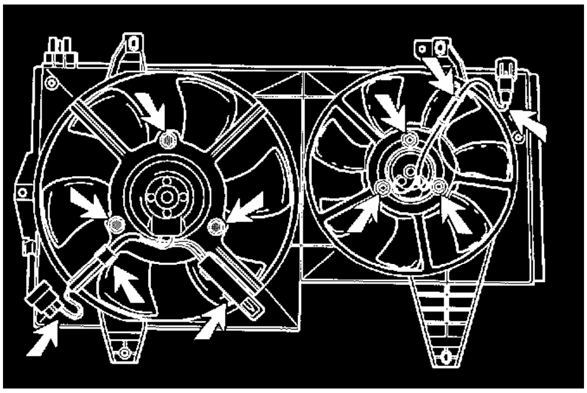
Remove:
- both the engine splash guards
- the longitudinal beam, see Remove turbo engine complete with transmission, refer to Engine, Service and Repair.

Remove complete unit



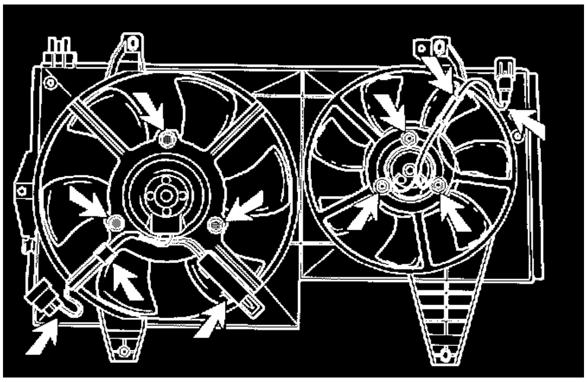
Remove:
- the connector fan at the left side
- the EVAP hose out of the clamp
- the two bolts from underneath
- the Charge Air Cooler **(CAC)** hose
- move the complete unit downwards and move the hoses sidewards.

Removing fan blade and motor



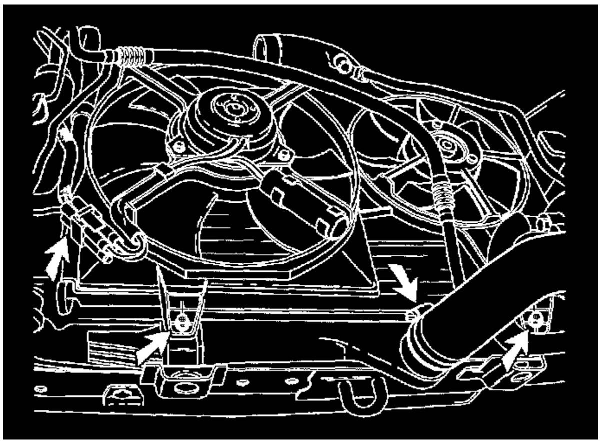
- Remove the nut or clip
- Pull off the fan blade
- Pull the cable out of the clamping and the connector
- Remove the nuts or bolts and take the fan motor out.

Install fan motor and blade



- Install the fan motor and tighten the bolt or nut to **10 Nm**
- Route the cables and fit the connectors
- Install the fan blade and secure it with the clip or nut. tightening torque **10 Nm**
- Route the wiring and fit the connectors.

Install complete unit

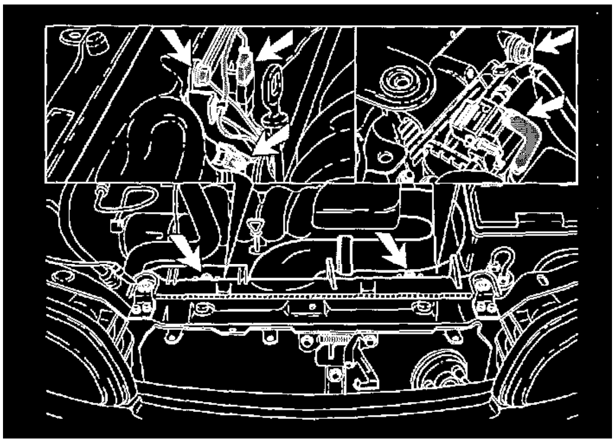


- Install the unit carefully in the correct position at the radiator side
- Install the bolts at the underside. Tighten to **10 Nm**
- Clean the connections and connect the Charge Air Cooler **(CAC)** hose
- Open the clamps and fit the EVAP hose
- Connect the connector.

Install from underneath

- The longitudinal beam, see Installing turbocharger engine with transmission, refer to Engine, Service and Repair.
- Both engine splash guards.

Tighten and fit parts from the top



- Position the holder and fit the two bolts. Tighten to **10 Nm**
- Install the EVAP valve and fit the connector
- Connect the fan connectors
- Tighten the cables and tie up
- Connect the cable of the Intake Air Temperature **(IAT)** sensor.
  Check the function and install the front engine-bay cover.

Heater Core: Service and Repair

Heat Exchanger

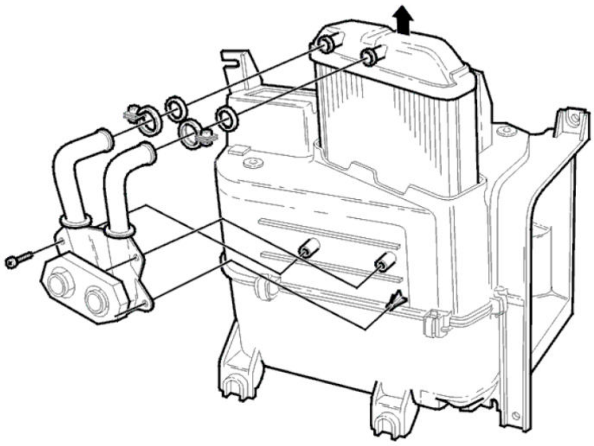
Replacing the heat exchanger

General

WARNING: Follow the safety instructions for work on the heating/ventilation system.

NOTE:
- Read the instructions about slow and large leaks.
- The O-rings must always be replaced when replacing the heat exchanger.

Removal



- Remove the dashboard according to Dashboard. See: Body and Frame/Interior Moulding / Trim/Dashboard / Instrument Panel/Service and Repair
- Remove the central unit according to Central electrical unit. See: Heating and Air Conditioning/Housing Assembly HVAC/Service and Repair/Central Electrical Unit

NOTE: In event of leakage the O - rings can be replaced without the heat exchanger being removed.

- Remove the support plate. Remove the tie straps and the pipes and replace the O - rings.
- Remove the mountings from the support plate.
- Carefully lift the holder over the guide pins.
- Withdraw the heat exchanger and pipes from the housing.
- Remove the tie straps and pipes.
- Replace the O-rings.
- Check the seal.

Installing the heat exchanger

- Install in reverse order.
- Replace the seal if necessary.

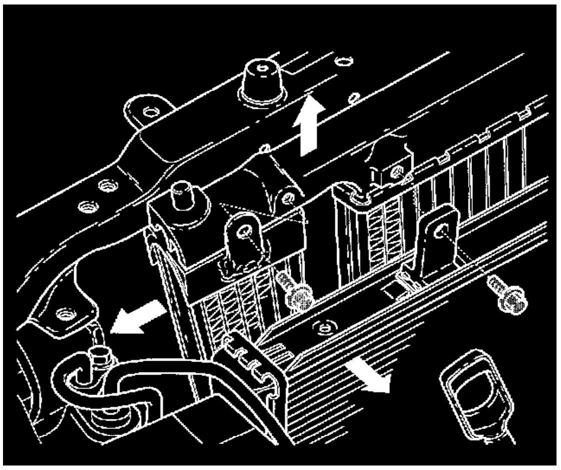
NOTE: Secure the support plate first and then the tie straps.

Radiator: Service and Repair
Replacing Radiator

Note! As the illustrations in this service information are used for different model years and/or models, some variation may occur. However, the essential information in the illustrations is always correct.

Conditions
- Drain the coolant. See Replacing coolant, refer to Coolant, Service and Repair.
- Remove the front engine cover
- Remove the Charge Air Cooler **(CAC)**, see Replacing turbo Charge Air Cooler **(CAC),** refer to Powertrain Management, Fuel Delivery and Air Induction.

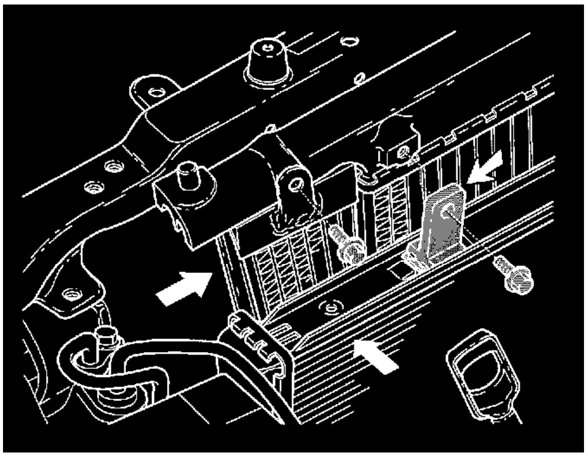
Removing the radiator



Remove the upper and lower radiator hoses.
Manual transmissions: Remove the radiator together with the Charge Air Cooler **(CAC).**
Automatic transmission: Move the Charge Air Cooler **(CAC)** as far to the right as possible. Press out the oil cooler.
Disconnect the radiator. Remove it above the Charge Air Cooler **(CAC)** hose connector.

Transferring components
Transfer the four radiator mountings to the radiator.

Installing the radiator
Manual transmissions:



- Install the radiator on the Charge Air Cooler **(CAC)**. Install the unit assembly. See Replacing turbo Charge Air Cooler **(CAC).**

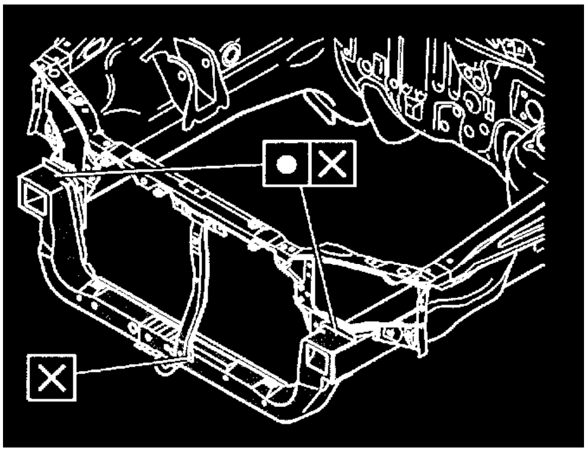
Automatic transmission:
- Install the Charge Air Cooler **(CAC)**. Press the oil cooler into place
- Install the radiator at the top right-hand first. Then install the radiator over the oil cooler connections
- Position the oil cooler. Check the alignment of the oil cooler
- Position the radiator on the Charge Air Cooler **(CAC)**
- Install the Charge Air Cooler **(CAC).**
- Install the front engine cover
- Fill the cooling system.

Radiator: Service and Repair
Replacing the Lower Radiator Member

Replacing The Lower Radiator Member

The extent of the damage may vary and with it the number of components that need to be removed.

Removing the lower radiator member



- Drill or grind out the spot welds.
- Pry off the member.
- Grind clean.
- Check that the dimensions of the car are correct.

Installing the lower radiator member

- Grind the welding surfaces clean.
- Apply welding primer.
- Adjust the member.
- Check the A and B dimensions.
- Secure the member.
- Weld into place.

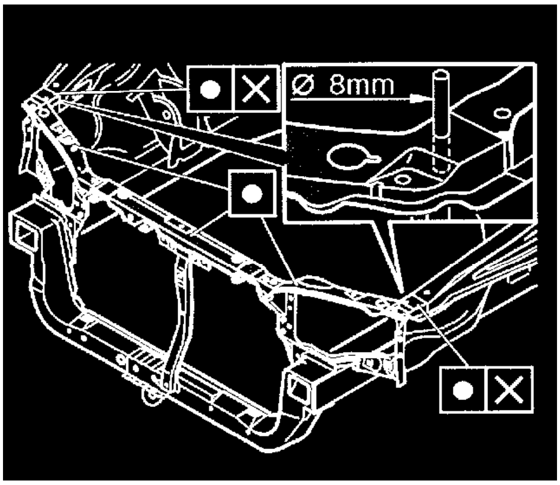
Hint: Use the painted edges from the removed member as an aide when aligning.

Radiator: Service and Repair
Replacing the Upper Radiator Member

Replacing The Upper Radiator Member

The extent of the damage may vary and with it the number of components that need to be removed.

Removing the upper radiator member



- Drill or grind out the spot welds.
- Pry off the component.
- Grind clean.

Installing the upper radiator member

- Apply welding primer.
- Adjust using an eight mm drift through both panels.
- Check the A dimensions.
- Secure the member.
- Weld into place.

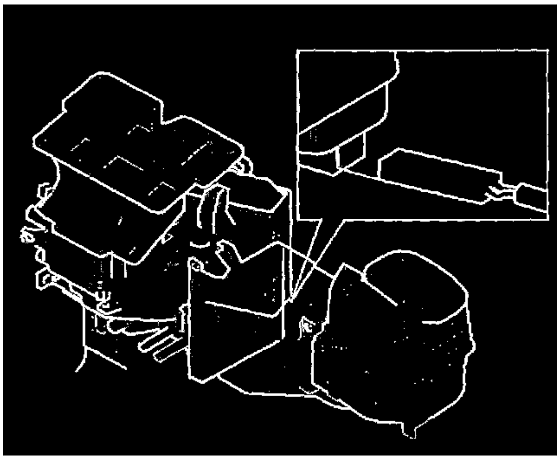
Hint: Use the painted edges from the removed member as an aide when aligning.

Engine - Coolant Temperature Sensor/Switch: Service and Repair

Engine Coolant Temperature Sensor

Replace engine coolant temperature sensor

Removal



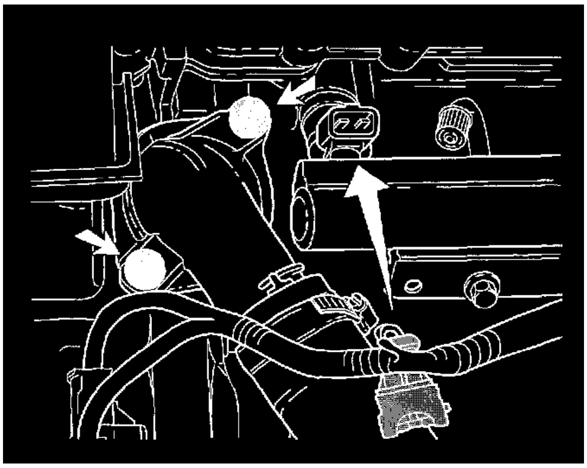
- Remove the lower cover and the tunnel side panel on the passenger side.
- Pull the floor mats to one side.
- Disconnect the wiring and the connectors.
- Carefully remove the sensor from the sleeve.

Installation

- In reverse order.

Coolant Temperature Sensor/Switch (For Computer): Service and Repair

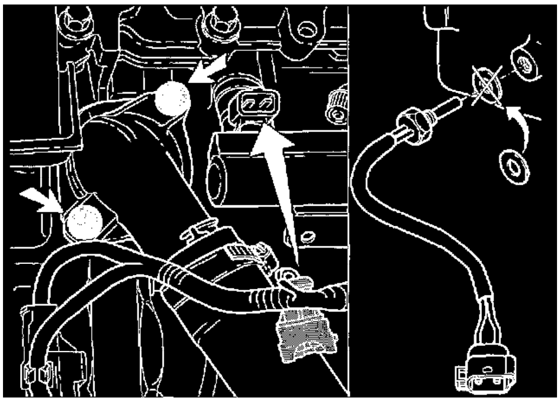
Removing the engine coolant temperature (ECT) sensor
Preparations



- Remove the expansion tank cover.
- Open the valve on the right underside of the radiator. Use a hose to collect the coolant (cars with Air Conditioning **(A/C):**
- partially remove the splash guard under engine).
- Drain two liters of coolant.
- Close the valve.
  Removing the thermostat housing cover
- Remove the cover over the fuel rail.
- Remove the upper camshaft cover.
- Remove the thermostat housing cover (two screws). Move the cover to one side.

Removing the Engine Coolant Temperature (ECT) sensor
- Remove the connector from the bracket.
- Disconnect the connector.
- Remove the Engine Coolant Temperature **(ECT)** sensor. Remove the sealing ring.

Installing the engine coolant temperature (ECT) sensor



- Clean the mating surfaces.
- Install a new sealing ring on the Engine Coolant Temperature **(ECT)** sensor.
- Install the Engine Coolant Temperature **(ECT)** sensor. Tighten the Engine Coolant Temperature **(ECT)** sensor to **10 Nm**
- Reconnect the connectors.
- Reinstall the connector on the bracket.

Installing the thermostat housing cover

- Clean the mating surfaces.
- Install a new gasket on the thermostat.
- Install the thermostat housing. Tighten the thermostat housing to **17 Nm**

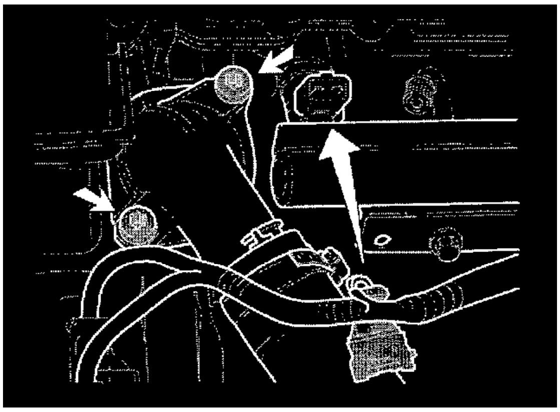
Note! Refill the coolant. Run the engine to operating temperature. Top up as necessary. Function test. Check for leakage.

Check for leakage. Reinstall the fuel rail cover. Reinstall the upper camshaft cover.
Connect the connector. Secure the connector on the bracket.

Thermostat: Testing and Inspection

Checking/Replacing the Thermostat

Draining coolant

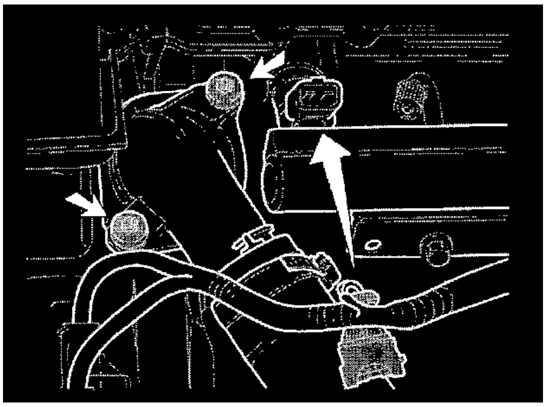


Drain off approximately 2 liters of coolant.

Removing the Thermostat

Turbocharged engines: remove the throttle body (TB) cover.
Remove the cover over the fuel rail.
Remove the upper timing cover.
Remove the thermostat housing cover (Torx 40 screws). Lift out the thermostat and the gasket.

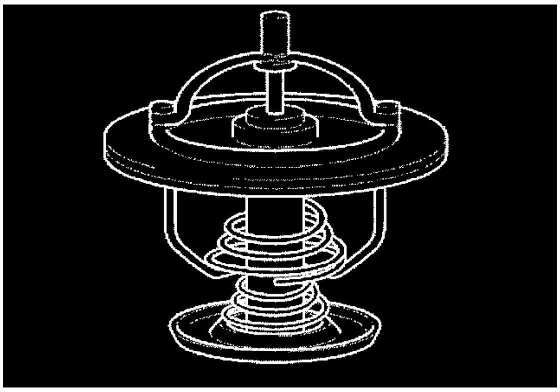
Checking the Thermostat



The function of the thermostat can be tested using hot water.
When the water temperature corresponds to the opening temperature of the thermostat, the thermostat should open fully within two minutes.

Marking: 90
Starts to open at: 90°C
Fully open at: 105°C

Installing the Thermostat



Clean the mating surfaces on the thermostat housing.

Install a new gasket on the thermostat.
Install the thermostat in the housing. Install the cover.
Tighten the cover. Tighten to **17 Nm.**
Install the upper timing cover.
Install the cover over the fuel rail.

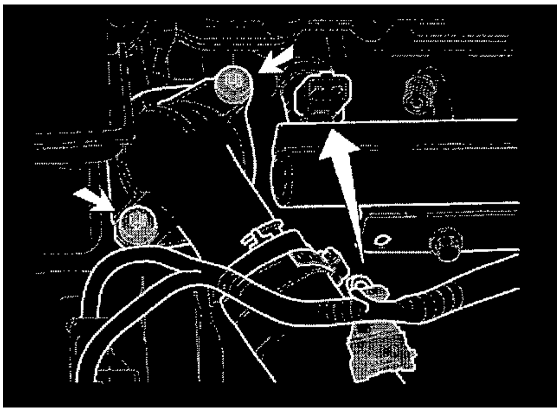
Turbocharged engines: install the throttle body cover.

Fill with coolant

Thermostat: Service and Repair

Checking/Replacing the Thermostat

Draining coolant

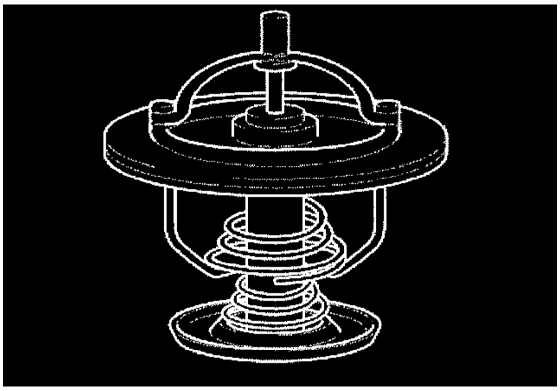


Drain off approximately 2 liters of coolant.

Removing the Thermostat

Turbocharged engines: remove the throttle body (TB) cover.
Remove the cover over the fuel rail.
Remove the upper timing cover.
Remove the thermostat housing cover (Torx 40 screws). Lift out the thermostat and the gasket.

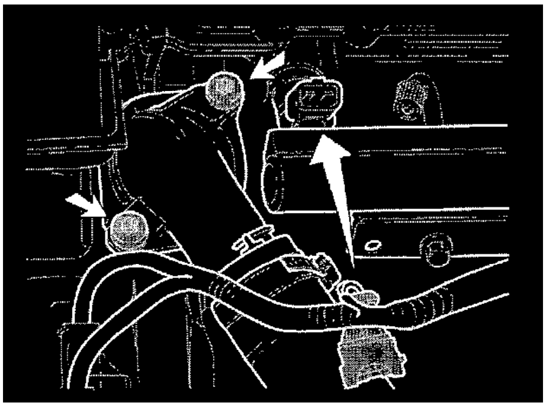
Checking the Thermostat



The function of the thermostat can be tested using hot water.
When the water temperature corresponds to the opening temperature of the thermostat, the thermostat should open fully within two minutes.

Marking: 90
Starts to open at: 90°C
Fully open at: 105°C

Installing the Thermostat



Clean the mating surfaces on the thermostat housing.

Install a new gasket on the thermostat.
Install the thermostat in the housing. Install the cover.
Tighten the cover. Tighten to **17 Nm.**
Install the upper timing cover.
Install the cover over the fuel rail.

Turbocharged engines: install the throttle body cover.

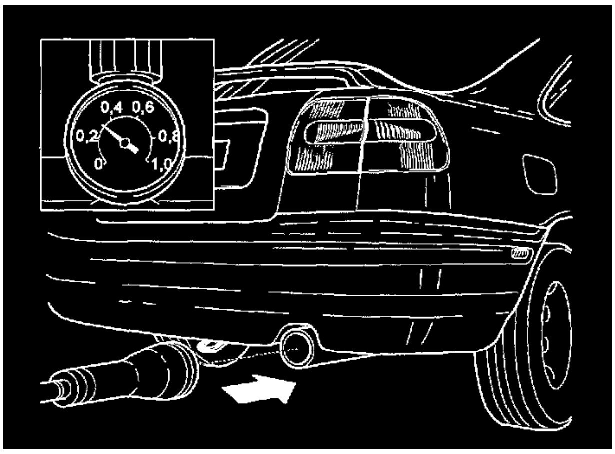
Fill with coolant

Exhaust System: Testing and Inspection

Special Tools
999 5544
999 5546

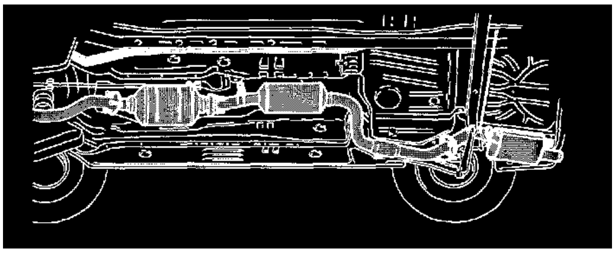
Connecting tools

Note! The exhaust system may be extremely hot if the car has been driven recently. Allow the car to cool down before beginning the check. Failure to do so may damage the special tool.



- Connect tool 999 5546 and pressure regulator 999 5544 to the exhaust pipe.
- Plug the end of the exhaust pipe. Ensure that it is fully sealed.
- B4204S2 engines: block one of the exhaust pipe ends.
- Adjust the pressure to 0.4 bar A lower pressure may be necessary depending on the condition of the exhaust system.

Procedure



- Check the exhaust system: Spraying a soap solution on all joints and the connections between the cylinder head and the rear Heated Oxygen Sensor **(HO2S)**.
- Only very small and slow bubbles are permissible.

Exhaust System: Service and Repair

Replacing the exhaust system assembly

General

Check the rubber mountings: install new ones if necessary.

The clearance between the exhaust system and the car body must be at least **20 mm.**

Transfer the vibration damper, if applicable.

Installing the exhaust system assembly

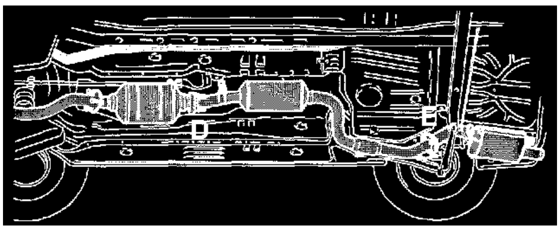
- Always use new gaskets
- Install all the components. Finger-tighten only
- Hang the exhaust system on the rubber mountings.

	B4164S2, B4184S2, B4204S2, B4184S3	B4194T2, B4204T2
A	9 Nm	30 Nm
B	35 Nm	
C	60 Nm	60 Nm
D	60 Nm	55 Nm

Tightening the exhaust system assembly:

- Tighten the mounting screw for the rubber mounting.
  Tighten to **13 Nm.**

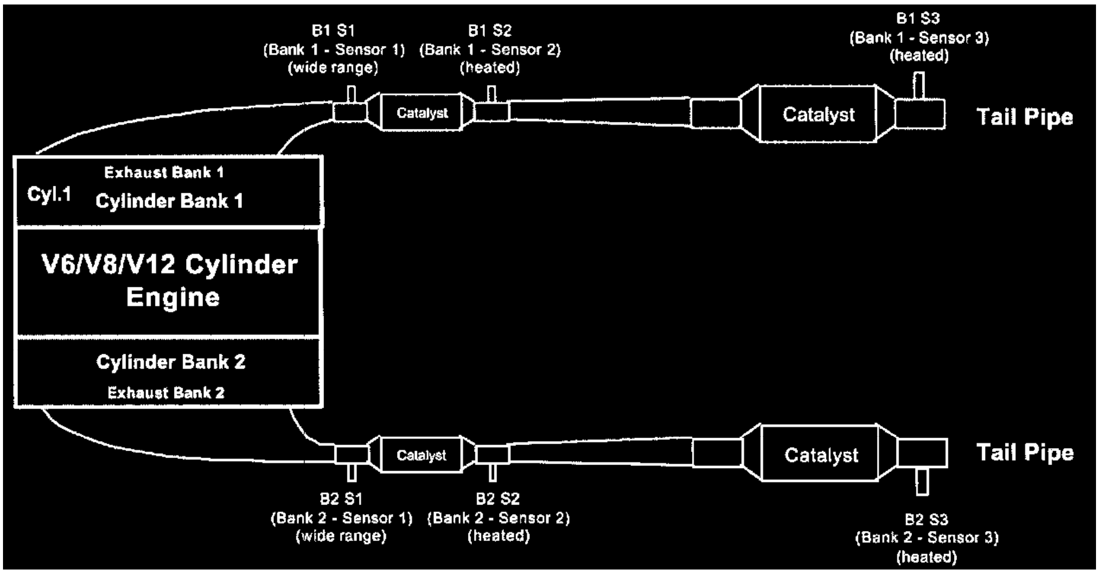
Check the function



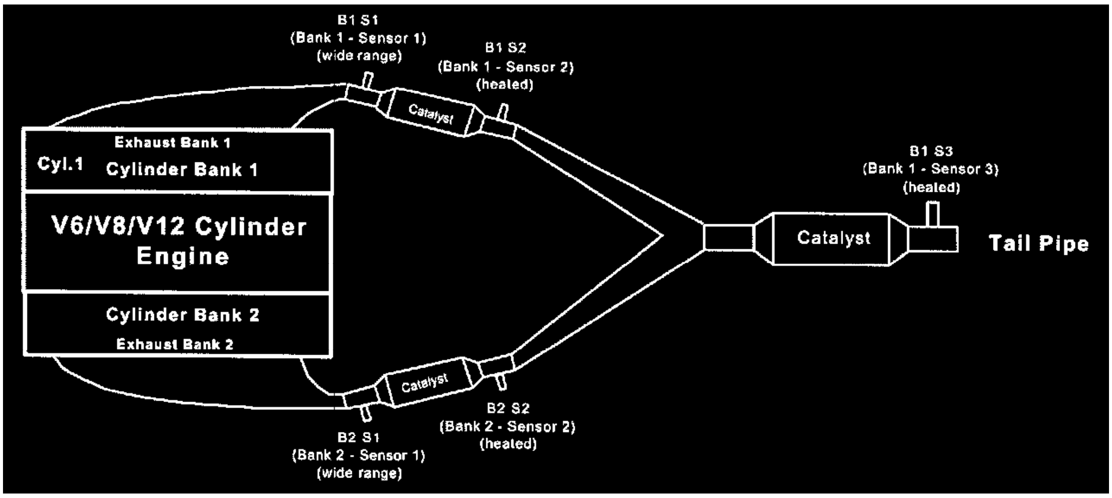
Start the engine. Check for leaks.

Catalytic Converter: Application and ID

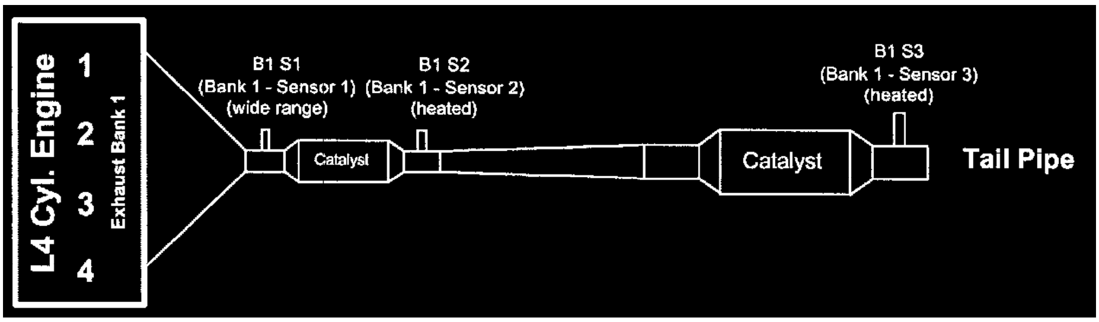
Oxygen Sensor and Catalyst Configuration Example



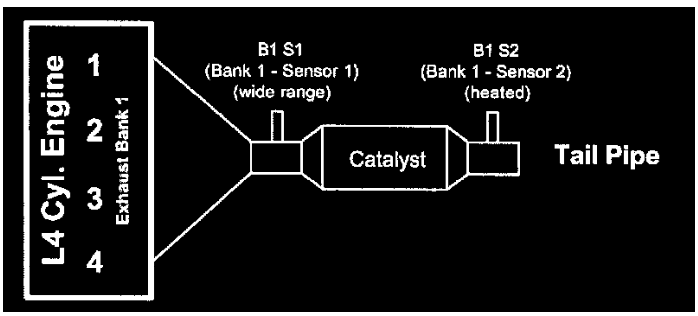
V6/V8/V12 Engine W/2 Exhaust Banks & 4 Catalysts



V6/V8/V12 Engine W/2 Exhaust Banks & 3 Catalysts



L4 Engine W/1 Exhaust Banks & 2 Catalysts

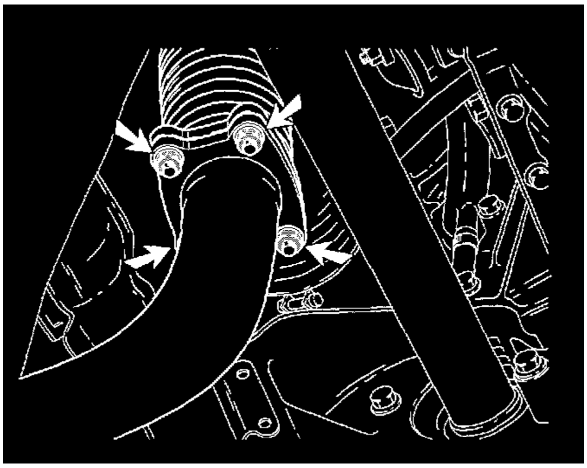


L4 Engine W/1 Exhaust Banks & 1 Catalysts

Catalytic Converter: Service and Repair

Special Tools
999 2901

Remove down pipe from catalytic converter
Remove down pipe



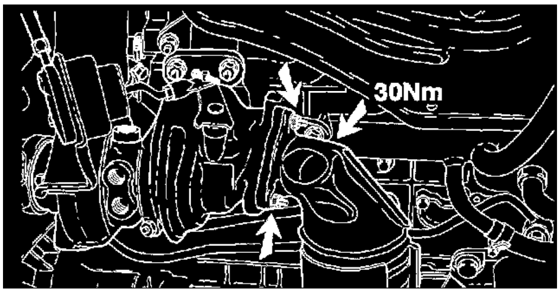
Raise car.
Spray all components with a rustproofing agent.

Remove:

- the rear engine splash guard
- the nuts and take the down pipe off
- the gasket
- the lower (rear) lambda sond.

Lower the car.

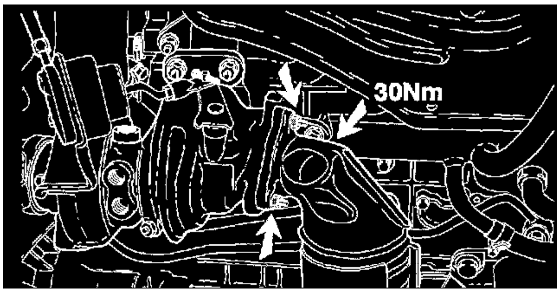
Remove catalytic converter
Remove:



- the heat shield from the body
- the upper (front) lambda sond
- the nuts and take the converter out
- the gasket.

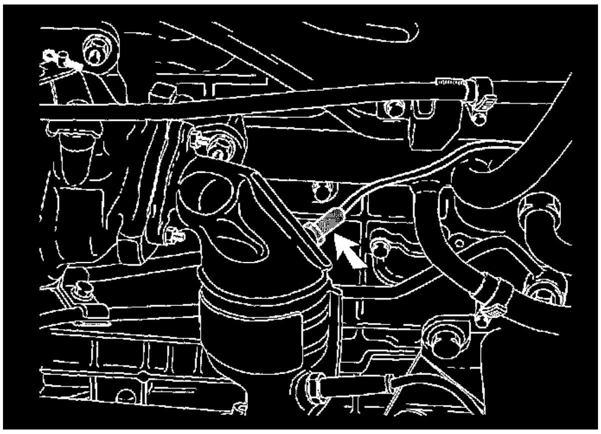
Install catalytic converter
Clean the mounting surfaces.

Install:



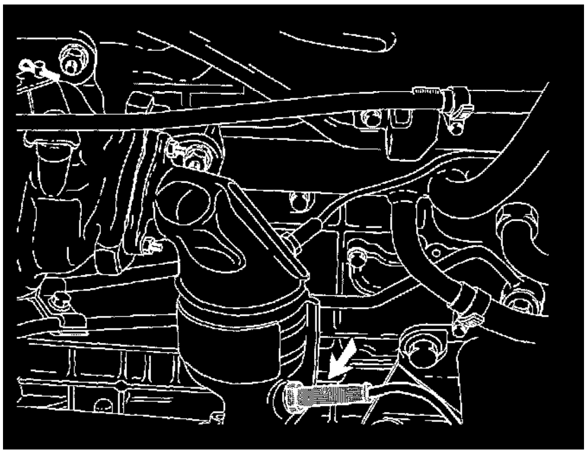
- the gasket on the turbo charger
- the converter and fit the nuts. Tighten to **30 Nm.**

Installing front (upper) lambda sond



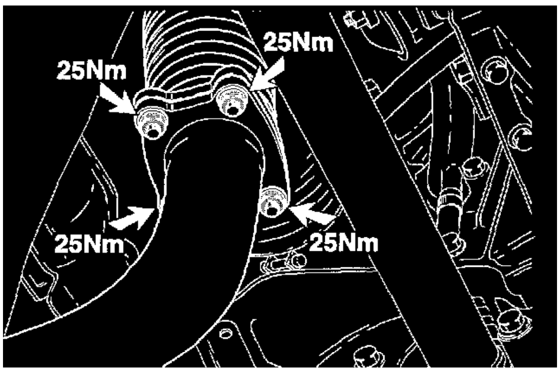
- Install a new sealing ring
- Smear the bolt packing component (P/N 1161035-9) on the entire length of the screw thread
- Turn the lambda sond counterclockwise about 4 times to avoid turning forces on the cable harness
- Install the lambda sonds and tighten to **55 Nm**
- Install heat shield at body.
  Raise car.

Installing rear (lower) lambda sond



- Install a new sealing ring
- Smear the bolt packing component (P/N 1161035-9) on the entire length of the screw thread
- Turn the lambda sond counterclockwise about 4 times to avoid turning forces on the cable harness
- Install the lambda sonds and tighten to **55 Nm.**

Installing front exhaust (down pipe) to catalytic converter



Clean the mounting surfaces.

- Place a new gasket
- Attach the front pipe to the exhaust manifold, tighten the nuts to **30 Nm**
- Fit the rear engine splashguard.

Check function

Start the engine and check for leakage.

Exhaust Manifold: Service and Repair

Special Tools
999 2901

Removing exhaust manifold
Remove:

- the heat shields on the exhaust manifold and the fireball
- the relay cover
- the support for the exhaust manifold
- the catalytic converter
- the Turbo Charger **(TC)** from the exhaust manifold, (3 nuts from the top and one from below)
- the rear engine splash guard
- the exhaust down pipe
- the support for the oil pipes
- the union of the top oil pipe
- the nuts from the exhaust manifold
- the hose at the Air Cleaner **(ACL)** and the hose to charge the Air Cooler **(CAC).**

Clamp both coolant hoses with hose pliers 999 2901 and release both unions at the Turbo Charger **(TC).**
Push the Turbocharger **(TC)** backwards and lift the lower oil pipe out of the engine block.
Remove the exhaust manifold and the gasket.

Install exhaust manifold
Install

Note! Use new gaskets and O-rings.

Clean surfaces.
Install the manifold; use new gaskets.
Attach the manifold to the cylinder head. Torque setting **25 Nm**. Begin tightening in the middle.
Mount the support for the exhaust manifold, torque setting **24 Nm.**
Push the lower oil pipe with a new O-ring into the engine block and attach the Turbocharger **(TC)** to the exhaust manifold. Tighten to **45 Nm**.
One nut must be tightened from below.

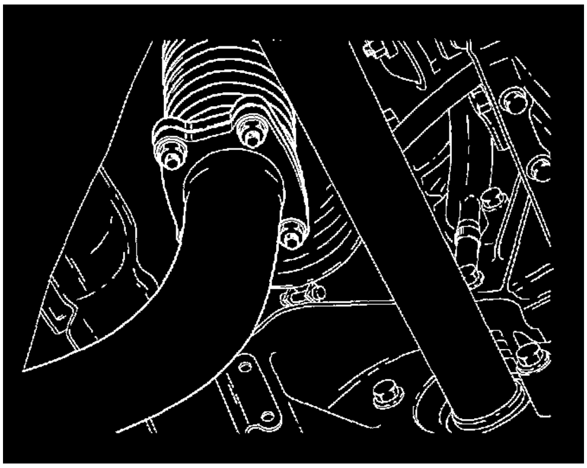
Install:
- the catalytic converter
- the union top oil pipe, torque setting **24 Nm**
- both coolant unions, torque setting **25 Nm**, remove the clamping tongs

- the heat shields on the exhaust manifold and the firewall
- the hose at the Air Cleaner **(ACL)** and the hose to charge the Air Cooler **(CAC)**
- the engine cover and the relay cover
- the support for the oil pipes
- the down pipe, use new gasket, see Replacing the catalytic converter (down pipe), refer to Powertrain Management, Emission Control Systems.
- the rear engine splash guard.

Exhaust Pipe: Service and Repair

Replace down pipe

Remove down pipe

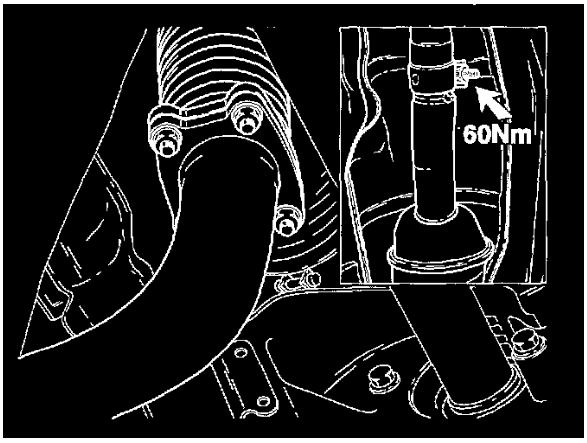


Spray all components with a rustproofing agent.

Remove:

- the rear engine splash guard.
- Undo the clamp at the rear exhaust pipe.
- the nuts and take the down pipe off.
- the gasket.
- the front pipe out the rear exhaust pipe.

Install down pipe

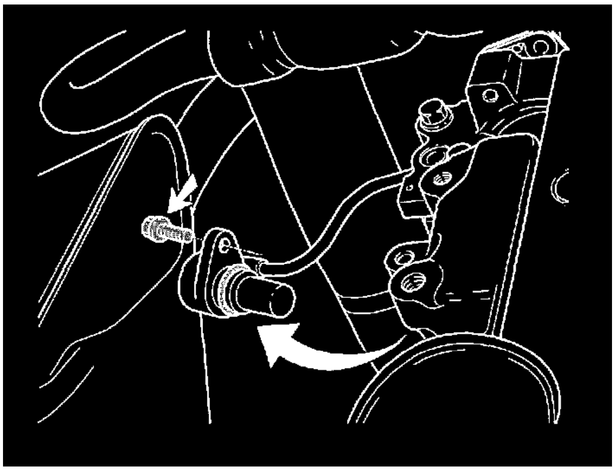


- Clean the mounting surfaces.
- Place the front pipe in the rear pipe.
- Fit a new gasket and attach the front pipe to the catalytic converter, tighten the nuts to **30 Nm.**
- Suspend the exhaust system and tighten the clamp at the rear pipe to **60 Nm.**
- Rear engine splashguard.

Camshaft Position Sensor: Service and Repair

Remove:
- relay cover bracket
- connector camshaft position sensor from bracket.

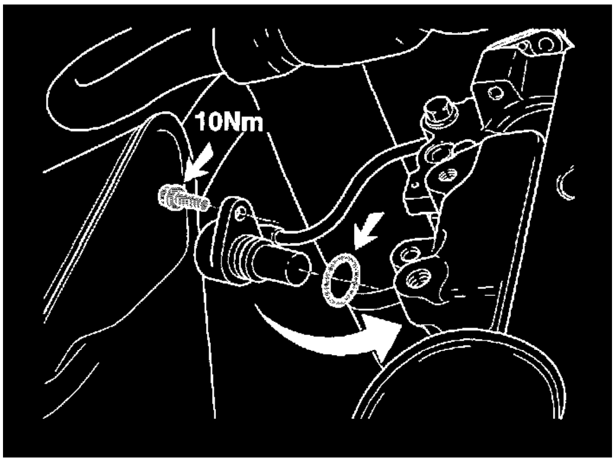
Removing camshaft position (CMP) sensor



- Remove the protective sleeve out of the clamp and open the outer cable protection
- Route the wiring out the protector
- Clean surrounding around sensor
- Remove bolt and move Camshaft Position **(CMP)** sensor by turning and take sensor out
- Take cable out clamp.

  Note! Note the route of the cable and take it out of the clamp.

Installing camshaft position (CMP) sensor



- Place a new O-ring on the sensor
- Clean housing
- Route the cable via the protective tube and connect the connector at the bracket
- Close the protective tube and install the tube in the clamps
- Place the sensor and tighten the bolt. Tightening torque **10 Nm**
- Secure cable in the clamp.

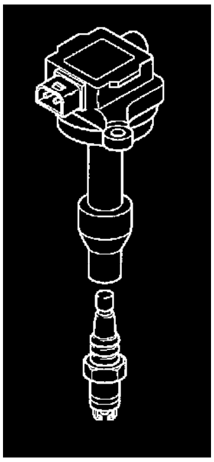
Install
- Connector bracket cover.

  Start engine. Read any Diagnostic Trouble Codes **(DTCs).**

Ignition Coil: Service and Repair

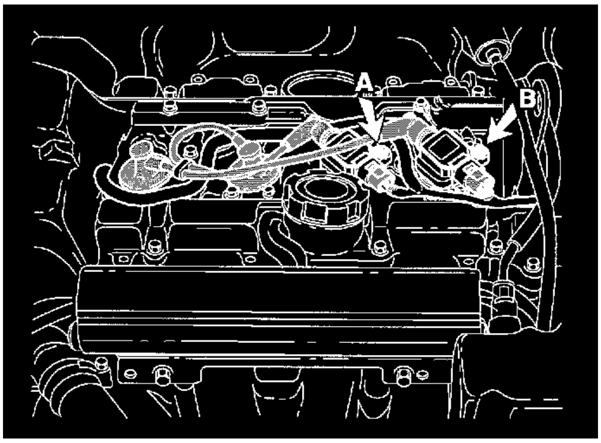
Special Tools
999 5702

Removing ignition coil(s)



- Remove both engine covers.
- Disconnect the connectors.
- Disconnect the HT lead.
- Remove the mounting screws.
- Pull off the ignition coils.

Installing ignition coil(s)



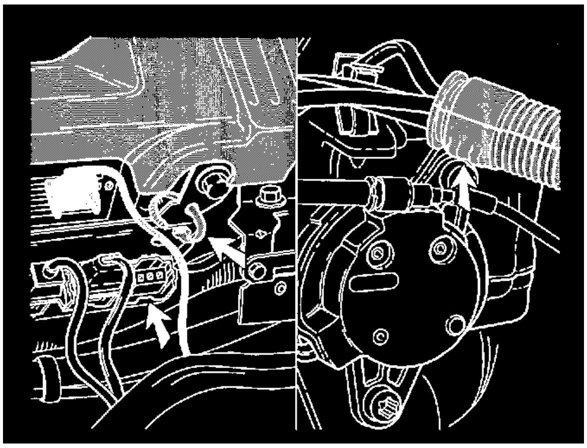
- Check the rubber and the spring inside. Replace if necessary.
- Position the ignition coils. Press the ignition coils into place.
- Tighten the screw. Tightening torque **10 Nm.**
- Connect the high tension cables.
- Reconnect the connector.

Note! The gray connector is for the left coil (cylinders 2 and 3), the blue connector is for the right coil (cylinders 1 and 4).

- Check the function.
- Reinstall both engine covers

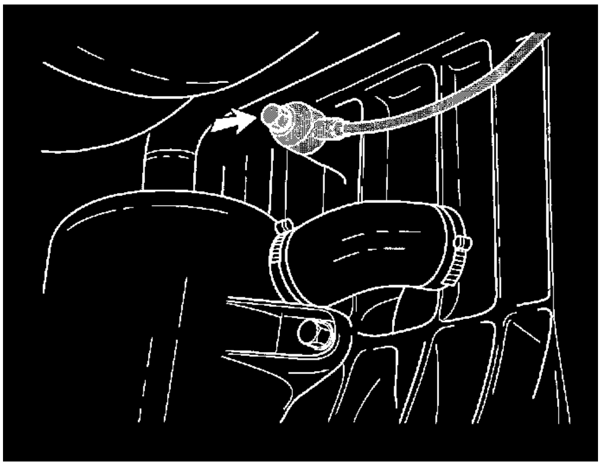
Knock Sensor: Service and Repair

Preparations



Remove
- The relay cover.
- The trim cover.
- The connector from the bracket. Open the two clamps. Pull out the cable from the protective tube.
- The battery negative lead.
- The front engine cover.
- The starter motor, see Engine replacement, transfer of components.

Replacing the knock sensor (KS)

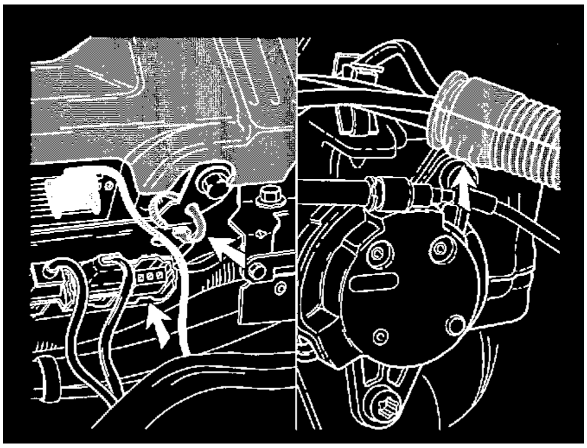


Remove
- The screw.
- The Knock Sensor **(KS)** from underneath. Remove the assembly with its wiring.

Install:
- The Knock Sensor **(KS)** from underneath. Tighten the nut to **20 Nm.**

  Note! Install the Knock Sensor **(KS)** as illustrated.

Installing components



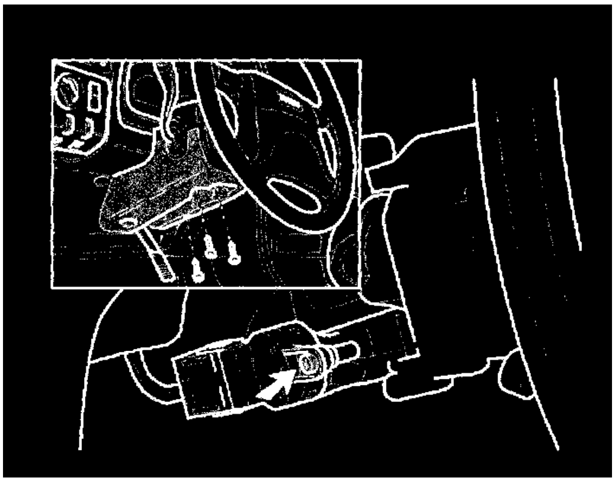
Install:

- The starter motor, see Engine replacement, transfer of components.
- Route the cable via the protective tube. Install the clamps.
- The connector on the bracket.
- The cover over the connector.
- The engine cover.
- The front engine cover.
- The battery negative lead.

  Start the engine. Read off any Diagnostic Trouble Codes **(DTCs).**

Ignition Switch: Service and Repair

Replacing the ignition switch



- Remove the lower steering shaft cover (3 screws).
- Remove the mounting screw on the back of the ignition switch.
- Disconnect the ignition switch connector.

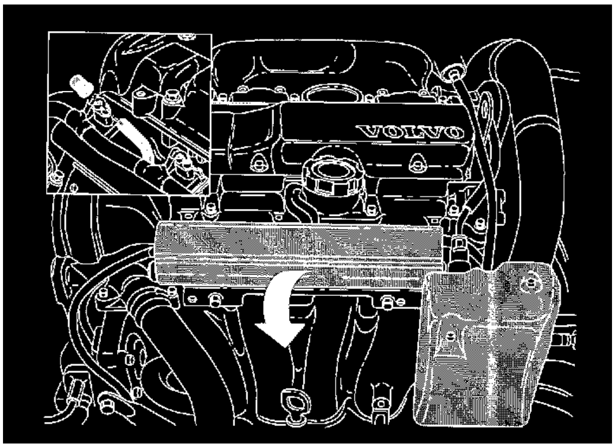
Reinstall the components in reverse order.

- Check the function.

Fuel Delivery and Air Induction: Service and Repair

Special Tools
981 2270
981 2273
981 2282
999 5480
999 5484

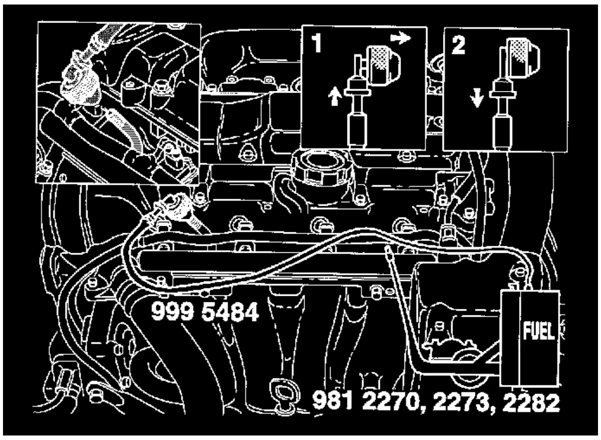
Removing the covers



- Turbocharged engines: remove the Throttle Body **(TB)** cover.
- The fuel rail cover.
- The protective cap for the nipple.

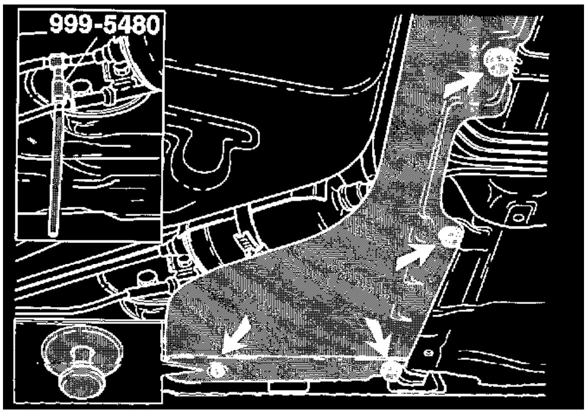
Draining the fuel injection system

Note! Ensure that ventilation is good.



Connect tool 999 5484 hose / nipple to liquid extractor 981 2270, 981 2273 and 981 2282. Start the drain pump.
- Connect the adapter to the valve on the fuel rail in restricted position (illustration 1: valve closed).
- Un-Secure the adapter (illustration 2: valve open).

Install special tool 999 5480

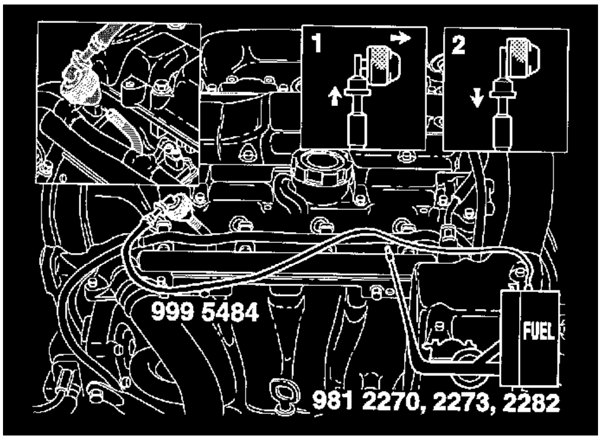


Raise the car.

Remove:

- The protection on the left fuel filter.
- The cap over the nipple.
  Connect tool 999 5480 to the valve upstream of the fuel filter.
  It takes approximately 2 minutes to drain the system.

Removing the special tools



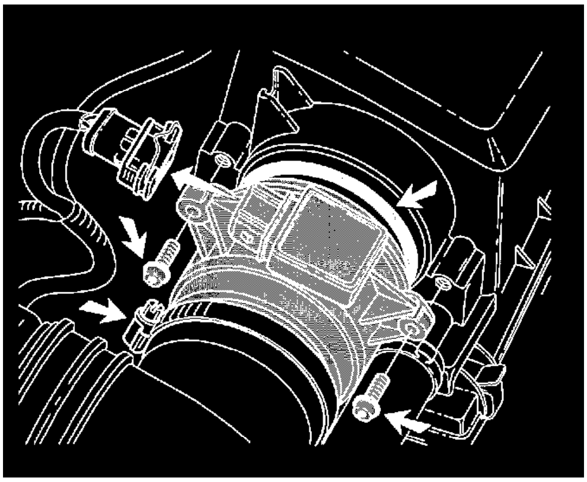
Remove the tool: 999 5480. Install the protective caps.
Reinstall the splash guard.
Lower the car.
Remove tool 999 5484. Install the protective caps.
Check for leaks.

Note! Do not forget to replace the protective caps on the nipples.

Install the cover over the fuel rail.
Turbocharged engines: Install the Throttle Body **(TB)** cover.

Air Flow Meter/Sensor: Service and Repair

Removing the Mass Air Flow Engine (MAP) sensor



- Remove the clamp and the air intake hose. Use a twisting movement.
- Disconnect the connector.
- Remove the two Tx 25 screws.
- Remove the Mass Air Flow Engine **(MAP)** sensor.
- Remove the O-ring.

Installing the mass air flow Engine (MAP) sensor

- Install a new O-ring.
- Position the Mass Air Flow Engine **(MAP)** sensor with the connector upward.
- Tighten the screws.
- Connect the connector.
- Clean the air intake hose. Press the air intake hose firmly into place on the Mass Air Flow Engine **(MAP)** sensor.
- Tighten the clamp.
- Check the function.

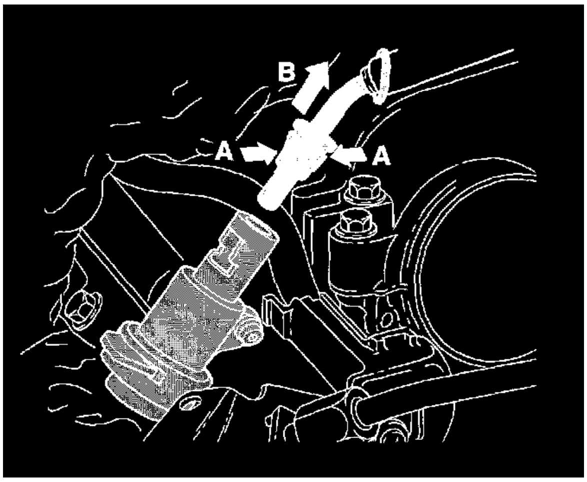
Fuel Injector: Service and Repair

Removal

Draining the fuel injection system

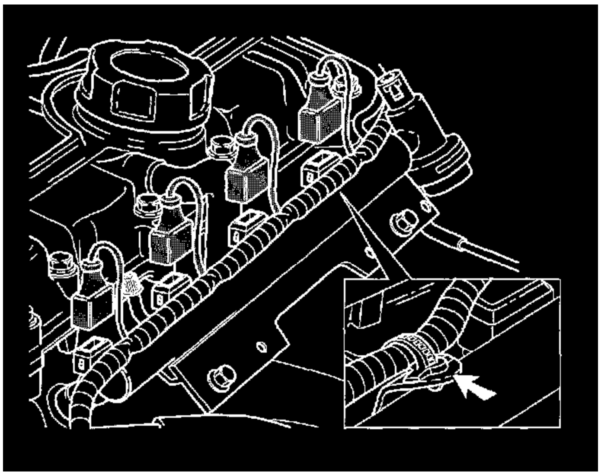
- Drain the fuel injection system according to Draining the fuel injection system, refer to Fuel Delivery and Air Induction, Service and Repair.

Disconnect the quick-release connector for the fuel line



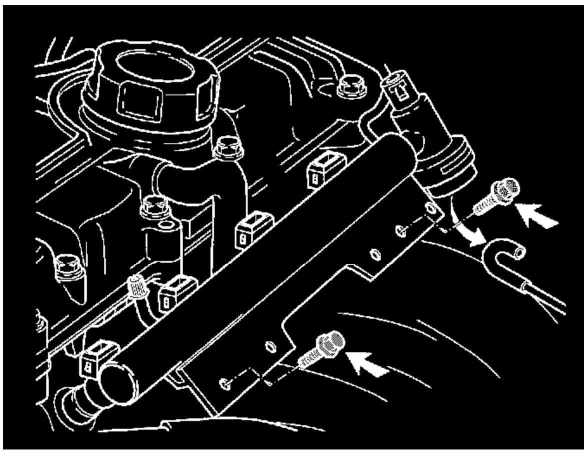
Wipe off any spilled fuel.
Release the fuel line from the clamps.
Press the clips together. Pull out the fuel line.

Removing the cover and the connectors



- Disconnect the injector(s) connectors.
- Turbocharged engines: remove the cable harness and its clips from the bracket.

Removing hoses and screws



- Remove the screws holding the fuel rail. Lift out the fuel distributor with the injectors still secured in place.
- Disconnect the vacuum hose from the manifold.

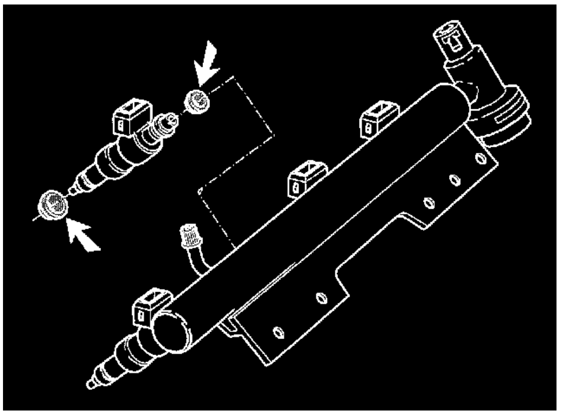
Note!
^ Handle the injectors carefully so that they are not damaged.
^ Retain all the rubber bushings for the intake manifold.

Removing the locking plate for the injectors

- Remove the three screws from the locking plate.
- Slacken off the fixing tool holding the injectors.
- Pull out the locking plate.
  Turbocharged engines: note the position of the bracket.

Removing the injector(s)

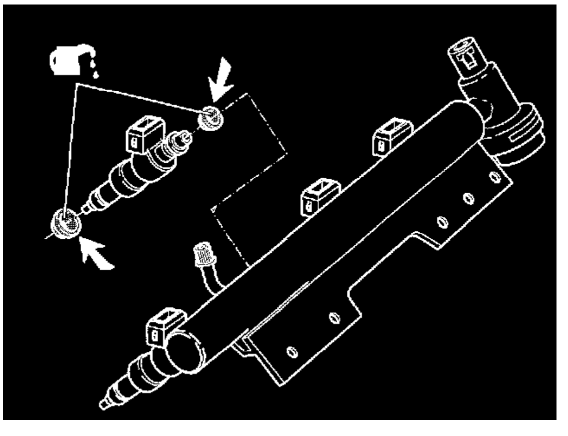
Remove:



- the injector(s): Turn them so that they come out of the fuel rail.
  Clean the outside.

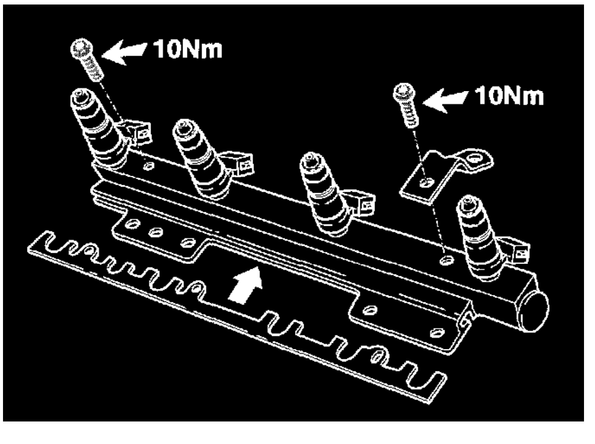
Installation

Installing the injector(s)



- Replace the O-rings.
- Lubricate the O-rings with petroleum jelly.
- Install the injectors in the fuel rail.

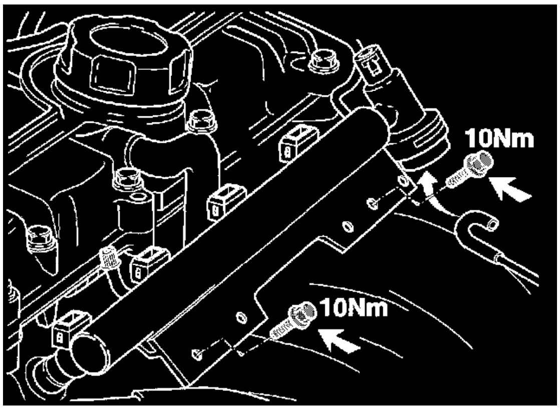
Installing the locking plate for the injectors



- Press the locking plate into the lower securing position for the injectors.
- Position the locking plate.
- Turbocharged engines: position the bracket.
- Install the three screws. Tighten the screws to **10 Nm.**
- Check that they are properly positioned (see the illustration)

Install the fuel rail with the injectors on the engine

Note! Use new O-rings. Lubricate the O-rings with petroleum jelly.



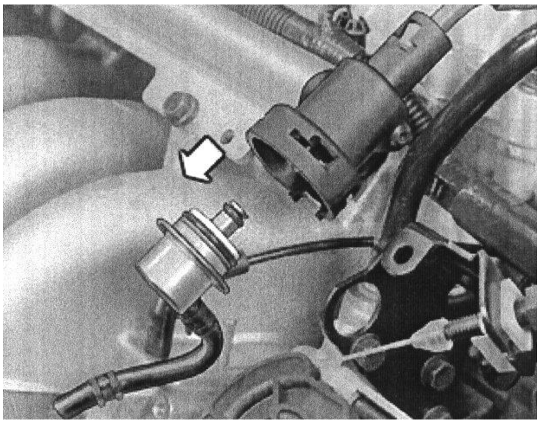
- Clean the intake manifold.
- Connect the vacuum hose to the manifold.
- Install the fuel rail on the intake manifold.
- Apply locking fluid (P/N 1161053) on the screws.
- Tighten the screws to **10 Nm.**
- Connect the injector(s) connectors. Check that all connectors have a rubber seal. Secure the cables in their holders.
- Turbocharged engines: secure the cable harness with the cable clips in the bracket.
- Secure the fuel line. Use a new retaining clip. Check that the fuel line is securely in place by pulling it.
- Reconnect all hoses.
- Check that it is properly sealed. Check the function.
- Install the throttle body cover.

Remove the pump trolley

Remove the pump trolley, see Draining the fuel injection system.

Fuel Pressure Regulator: Service and Repair

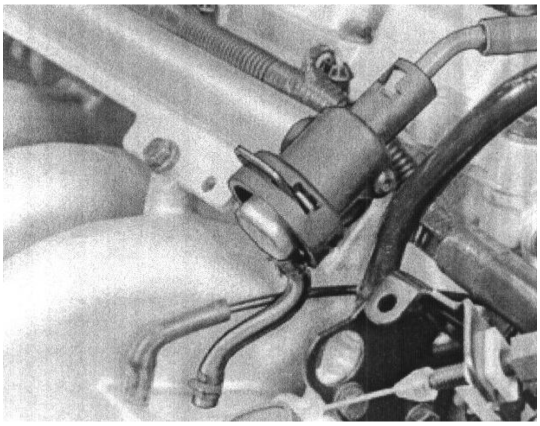
Remove:



- the cover over the Throttle Body **(TB)**
- the vacuum hose from the pressure regulator
- the retaining clip for the pressure regulator
- the pressure regulator.

Note! Place paper under the regulator to catch any remaining fuel.

Installing the pressure regulator
Install:



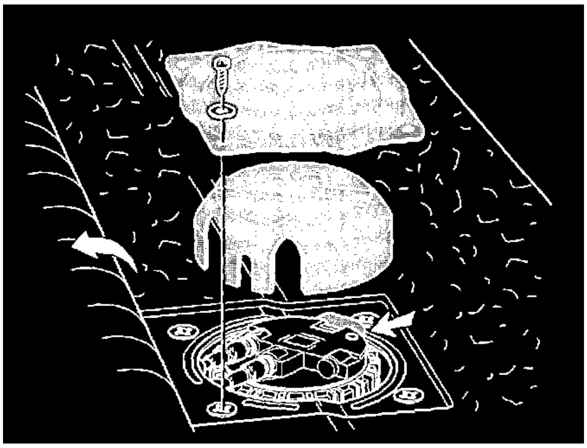
- a new O-ring. Use lubricant 1161580
- the regulator
- the retaining clip
- the vacuum hose
- the cover over the Throttle Body **(TB)**.

Fuel Pump: Service and Repair

Special Tools
999 5622

Draining the fuel tank
- Drain the fuel tank according to Draining the fuel tank, refer to Fuel Tank, Service and Repair.

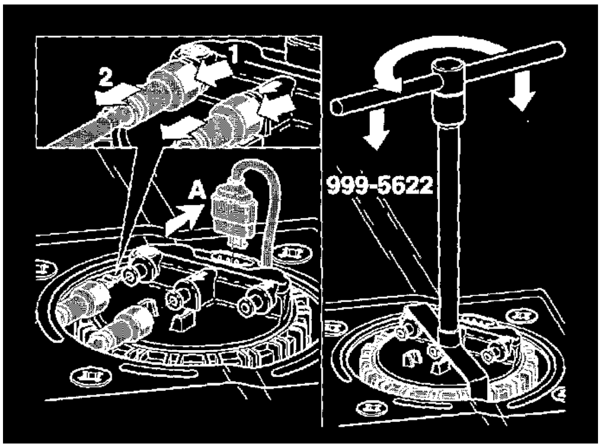
Removing the Fuel Pump (FP) protective cover



- Move the front seats as far forward as possible
- Fold the rear seat forward
- Pull the floor carpet forward
- Remove the four screws. Remove the protective cover
- Remove the protective cover.

Removing the fuel pump (FP)

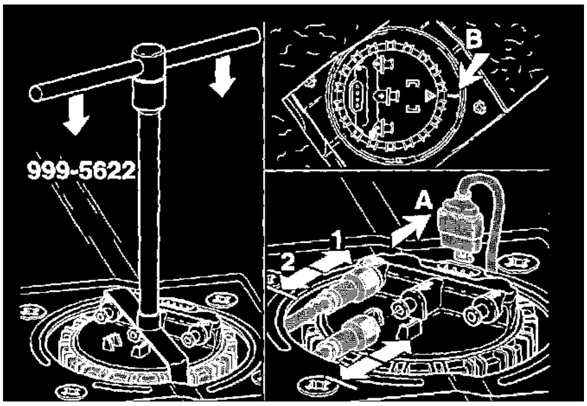
Note!
^ Ensure that ventilation is good.
^ Note the connections for the fuel lines to avoid later confusion.



- Disconnect the connector (A)
- Release the fuel lines by pressing in the catches and pulling out the lines
- Wipe up any spilled fuel using a rag
- Move the fuel lines and connectors to one side
- Remove the cap nut. Use special tool 999 5622.

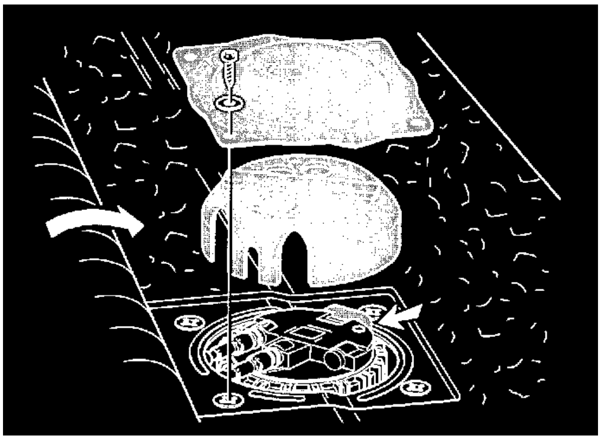
Note! Replace the Fuel Pump **(FP)** immediately because the threaded collar swells or reinstall the cap nut temporarily. The swelling can cause problems when reinstalling the cap nut.

Installing the fuel pump



- Check the gasket. Replace the gasket if necessary
- Install the cap nut on the pump unit
- Install the pump unit. Ensure that the arrow points towards the marking (B) on the fuel tank
- Install the cap nut. Use special tool 999 5622. Press the cap nut down firmly when installing it. Tighten to **50 Nm**
- Reconnect the connector (A)
- Carefully reconnect the fuel hoses. Pull the quick-release connectors to check that they are secure
- Remove the pump trolley. Fill the fuel injection system, see Draining the fuel tank, refer to Fuel Delivery and Air Induction, Service and Repair.

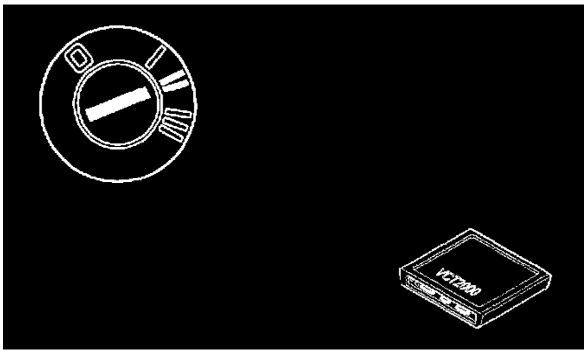
Installing the protective cover for the fuel pump (FP)



Reinstall / reconnect:
- The protective cover
- The protective cover with four screws
- The floor carpet under the sill trim panel and on the sides of the backrest
- The rear seat backrests.

Fuel Tank: Testing and Inspection
Checking Diagnostic Trouble Codes (DTCs)

Checking Diagnostic Trouble Codes (DTCs)



NOTE: No diagnostic trouble codes (DTCs) may be stored in EMS2000 if the quick test of the fuel tank system is to be carried out.

- Ignition on.
- Read off diagnostic trouble codes (DTCs)
- Any diagnostic trouble codes (DTCs) stored must be remedied and erased before the test can be carried out

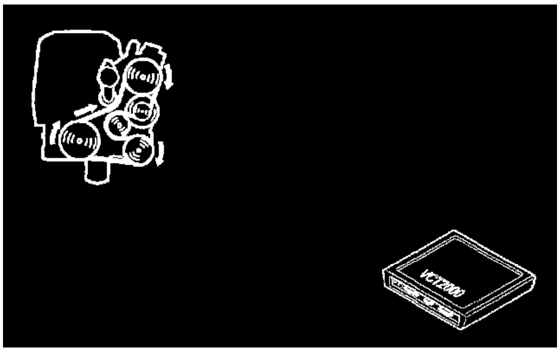
Are any diagnostic trouble codes (DTCs) stored in EMS2000?

Yes - Test Complete

No - See: Activating the Leak Diagnostic

Fuel Tank: Testing and Inspection
Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

NOTE: The engine must be idling throughout the test.

- Activate the leak diagnostic by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50 °C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic process may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module does not detect any faults. The Not OK status, numbered 1-8 will be displayed if the control module detects any faults. To interpret these faults, see the status definitions below

NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

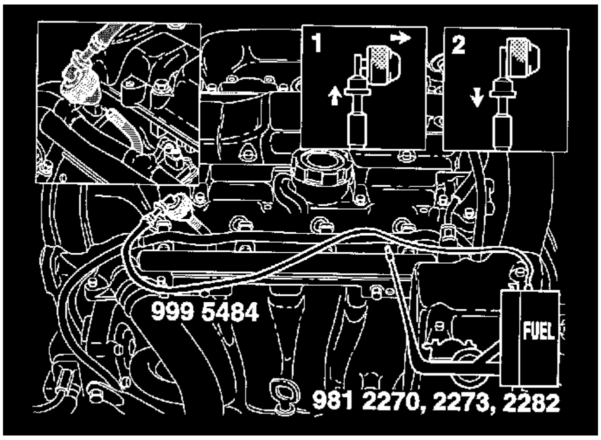
Status definitions:
- OK = The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).

Fuel Tank: Service and Repair
Fuel Tank Draining

Special Tools
981 2270
981 2273
981 2282
999 5484

Note! Ensure that ventilation is good

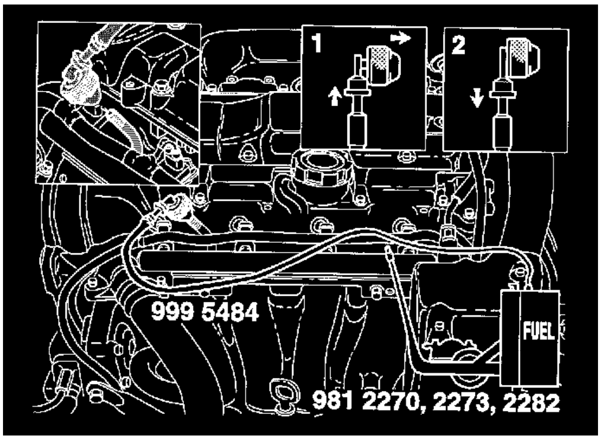
Remove:
- The protective caps for the nipples.
- The engine cover.



Connect tool 999 5484 to the valve on the fuel rail in its locked position. (figure A: valve closed).
Connect adapter 999 5484 to pump trolley 981 2270, 981 2273 and 981 2282.
Do not use the pump on the pump trolley.
Un-Secure the adapter (figure B: valve open).
Remove the system relay from the engine compartment. Bridge terminals 30 and 87 (C) on the relay base. Use a cable.
The pump capacity is approximately 2 liters/min.

Note! Do not dry run the car Fuel Pump **(FP)**. Before disconnecting tool '99 5484 empty the hose with pump 9812270 and 999 5484 in position A.

Removing the pump trolley and filling the fuel injection system



Remove tool: 999 5484, 981 2270, 981 2273 and 981 2282
Reinstall the system relay. Reinstall the relay cover.
Fill the fuel tank.
Check for leaks.
Install the engine cover.

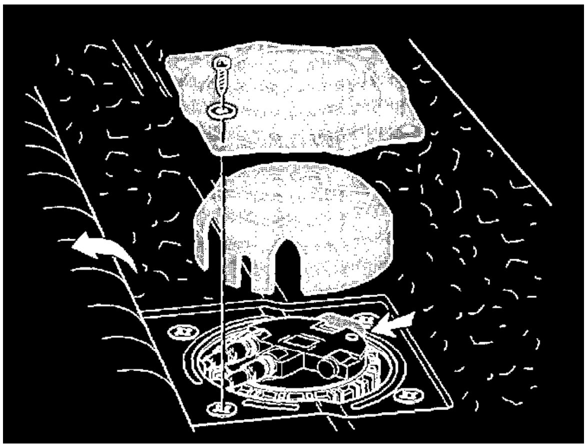
Note! Do not forget to replace the protective caps on the nipples.

Fuel Tank: Service and Repair
Fuel Tank Removal and Installation

Special Tools
999 5622
999 5666
999 5972

Draining fuel tank
- Drain fuel tank according to Draining The Fuel Tank.

Disconnecting upper side



- Fold the rear seat forward
- Remove floor carpet
- Remove four screws and protective plate
- Remove metal protection cover
- Disconnect connector.

Removing splash guards
- Remove left splash guard
- Remove the two bolts from the parking brake cable bracket. Pull cable down.

Removing connections

Warning Protective gloves and protective goggles should be used for the following operations because of the risk of fuel spillage

Remove:
- fuel filler hose
- fuel filter quick-release connector, see Replacing fuel filter, refer to Fuel Filter, Service and Repair.

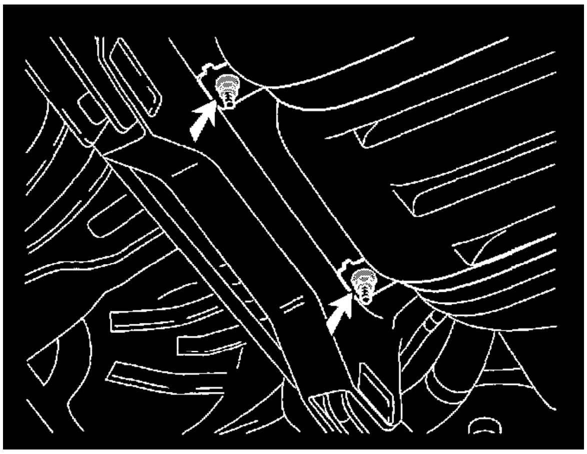
  Note! Wipe up any spilled fuel.

- EVAP hose quick-release connector. Press in lock and pull off hose.

  Note! Leave clips on the fuel line.

- purging system quick-release connector, press in lock and pull off hose
- fuel line quick-release connector press in lock and pull off hose
- EVAP system quick-release connector press in lock and pull off hose.

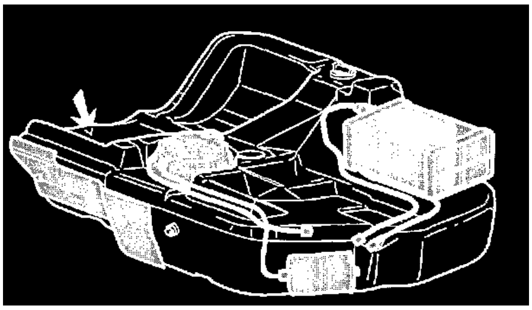
Removing fuel tank



- Apply rust solvent to components
- Slacken off lock nuts
- Support the fuel tank using a mobile jack with fixture 999 5972
- Remove nuts at the front and rear and remove tank straps
- Lower the fuel tank slightly and remove wiring bracket and wiring by the fuel tank and at the right heat shield
- Lower and remove the fuel tank.

Installing

Transferring fuel tank components



- Disconnect fuel lines and filter
- Transfer Fuel Pump **(FP)** unit
- Transfer EVAP canister unit
- Side and front heat shields. Tighten to **5 Nm.**

Installing fuel tank

Note! Tighten rear nuts until the inner edges of the straps are in contact with the car body.

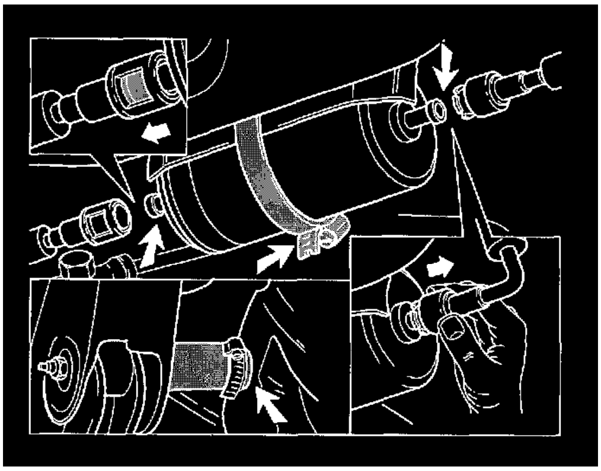
- Install the fuel tank under the car.

  Note! Check if foam pads on top of fuel tank are correctly fitted.

- Install the wiring in the bracket and on the fuel tank and heat shield. Tighten holders

- Install the straps and finger-tighten nuts
- Tighten front nuts. Tighten to **25 Nm.**

Connecting connections

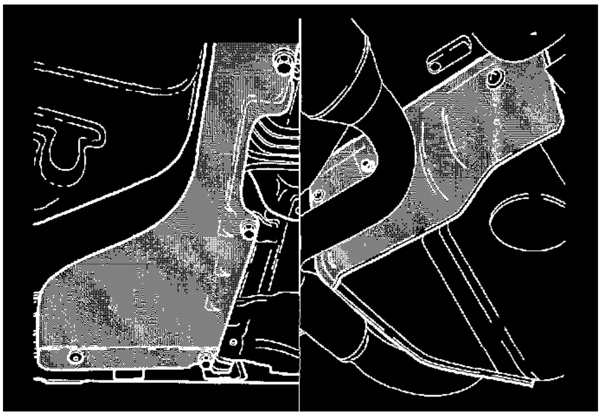


- Clean all components
- Connect quick-release connectors on the EVAP and fuel lines.

  Note! Check that they are secure by pulling them.

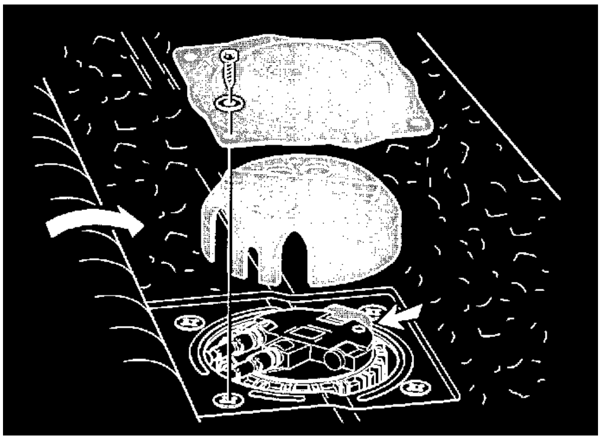
- Connect hose to fuel filler pipe
- Install the clamp. Tighten to **6 Nm** maximum
- Connect purging system quick-release.

Installing splash guard



- Install left splash guard. Secure splash guard and tighten bolts.

Installing fuel pump (FP) components



- Connect connector
- Reinstall splash guard
- Install metal protection cover.

  Warning Be sure to reinstall the metal protection cap. Failure of this cap may result in these components being damaged in an impact and possibly causing fuel leakage.

- Install protective plate with four screws
- Reinstall carpet

- Reinstall rear seat
- Fill fuel tank, see Draining the fuel tank.

Finishing

Check that the fuel line and fuel pipes are installed so that they do not rub or cause rattling

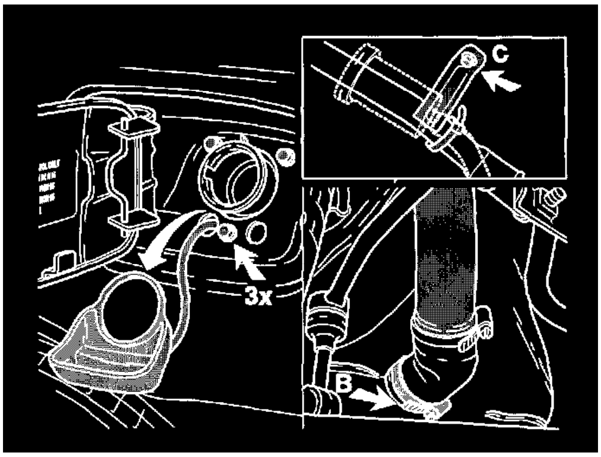
Start the engine and check for fuel leakage.

Proceed to VADIS vehicle communication and carry out the leak diagnostic test.

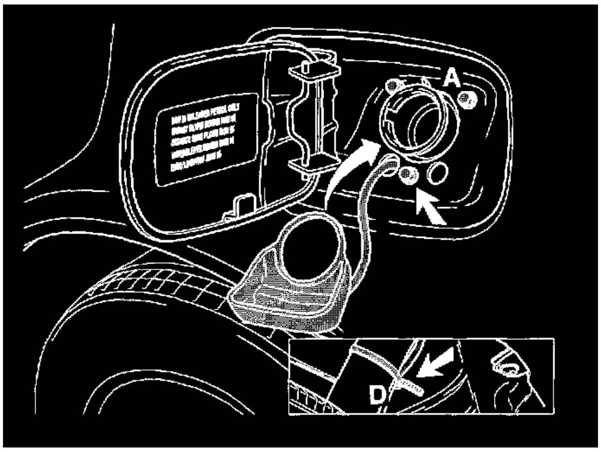
Fuel Filler Neck: Service and Repair

Removing fuel filler pipe

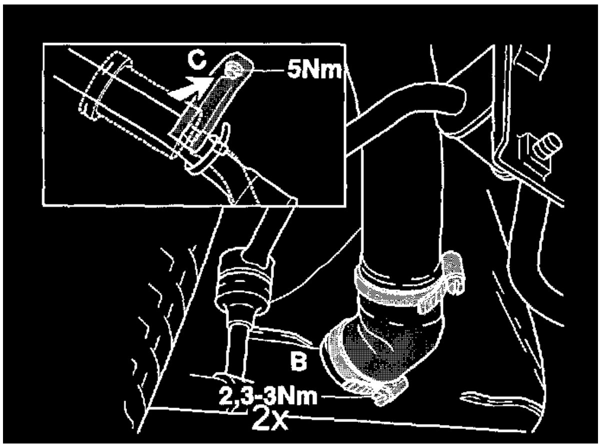
Warning Protective gloves and protective goggles should be used for the following operations because of the risk of fuel spillage



- Partially drain the fuel system, see Draining the fuel injection system, refer to Fuel Delivery and Air Induction, Service and Repair.
- Remove the filler cap
- Remove the leak diagnostic filter see Replacing the leak diagnostic filter, refer to Emission Control Systems, Leak Detector.
- Pull out the rubber seal and drain hose
- Remove three bolts
- Raise the car. Clean the fuel tank hose connector (B)
- Remove hose clamps on the side of the fuel filler pipe (B) and the bolt on the side member (C)
- Remove the leak diagnostic pump line from fuel filler pipe. Press in lock and pull
- Remove the line from EVAP canister. Press in lock and pull
- Remove fuel filler pipe together with hoses.



Installing fuel filler pipe



Install fuel filler pipe.
- Tighten fuel filler pipe (finger-tighten bolt C)
- Install fuel hoses (B).Tighten clamps to a maximum of **3 Nm**

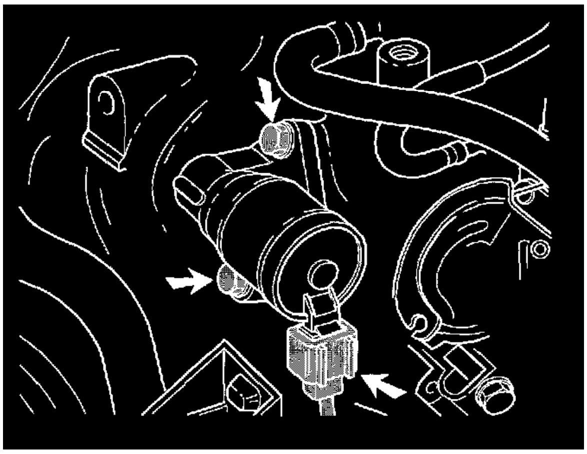
- Install the leak diagnostic pipe with clip and the fuel filler pipe bracket
- Install three bolts at the top. Tightening torque **5 Nm**
- Reinstall the leak diagnostic filter and pipe
- Reinstall gutter and secure the drain hose and the leak diagnostic filter pipe with a strap (D).

Finishing

Check that the fuel line and fuel pipes are installed so that they do not rub or cause rattling.
Start the engine and check for fuel leakage.
Proceed to VADIS vehicle communication and carry out the leak diagnostic test.

Idle Speed/Throttle Actuator - Electronic: Service and Repair

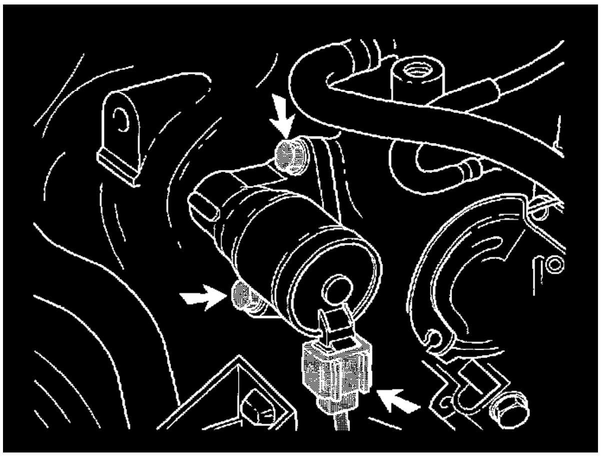
Removing the idle air control (IAC) valve



Remove:

- the cover over the throttle cable.
- the Idle Air Control **(IAC)** valve connector.
- the two screws.
- the Idle Air Control **(IAC)** valve and the gasket from the intake manifold.

Installing the idle air control (IAC) valve

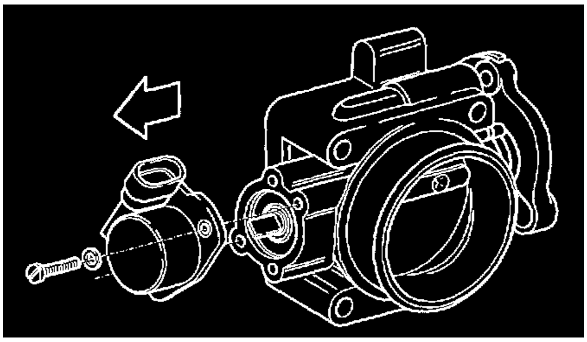


Always use a new gasket.

- Locate the new gasket. The tab must be pointing downwards to the right.
- Tighten the Idle Air Control **(IAC)** valve. Tightening torque **10 Nm.**
- Reconnect the connector.
- Check the function.
- Reinstall the cover over the throttle cable.
  Start the engine. Read off any Diagnostic Trouble Codes **(DTCs).**

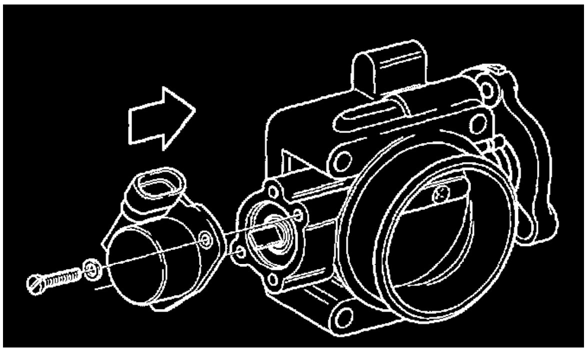
Throttle Position Sensor: Service and Repair

Removing throttle position (TP) sensor



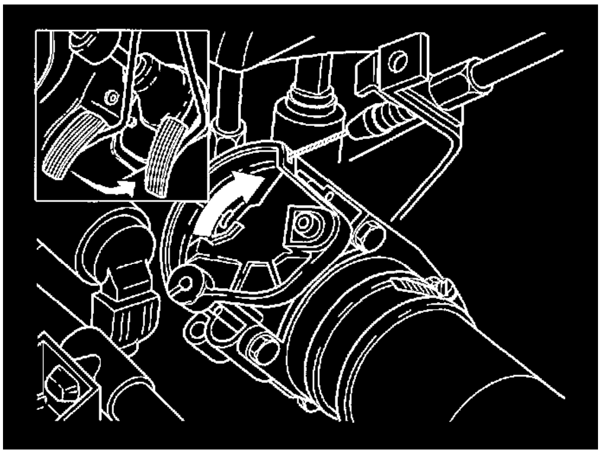
- Remove throttle body.
- Clean the surface
- Remove the two screws
- Pull off sensor
- Check the components.

Installing throttle position (TP) sensor



- Clean screws and apply locking fluid, P/N 1161053
- Secure the sensor, see illustration. Turn the sensor until some opposition can be felt
- Install the two screws. Torque to **5 Nm**
- Seal the screws
- Reinstall throttle body.
  Start engine. Read any Diagnostic Trouble Codes **(DTCs).**

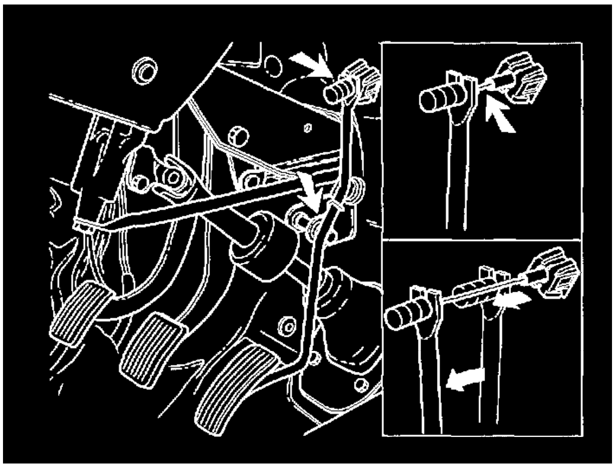
Throttle Cable/Linkage: Testing and Inspection



Remove the throttle body cover.
The throttle pulley should move easily without sticking.
The cable should be taut in the idling position. It must not affect the position of the throttle pulley. The throttle pulley should move towards the idling stop. Adjust the throttle cable sleeve if necessary.
Depress the Accelerator Pedal **(AP)** fully. Check that the throttle pulley is in contact with the wide open throttle stop.
Install the throttle body cover.

Throttle Cable/Linkage: Service and Repair

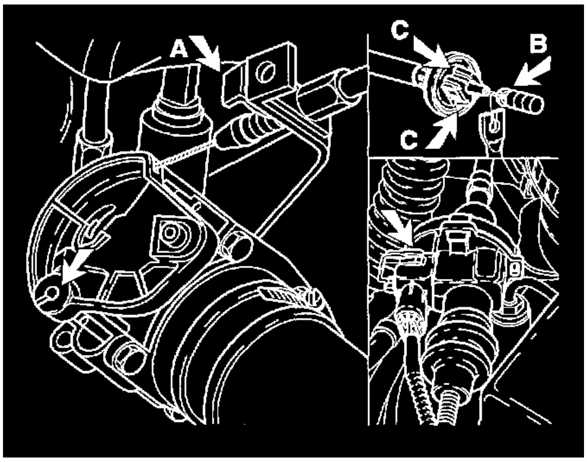
General



- The throttle cable must never be bent at any point
- The mechanical cable must be completely in line with the cable sleeve when the throttle is completely closed
- Adjust the cable and sleeve if they are not correctly aligned by bending the cable sleeve mounting
- When the Accelerator Pedal **(AP)** is depressed and released the cable must run straight in and out of the cable sleeve
- If necessary, this can be adjusted by bending the Accelerator Pedal **(AP)** arm on the mechanical cable side.
  When installing a new Accelerator Pedal **(AP)** the Accelerator Pedal **(AP)** pivot bearing must be lubricated with grease.

Removing the throttle cable

Note! Automatic transmissions: The kickdown switch is integrated in the throttle cable from and including model year 98 onwards.



Remove from the engine compartment:
- the engine cover above the Throttle Body **(TB)**
- the cable with the throttle in the wide open position
- the circlip (A). Remove the cable sleeve from the cable mounting

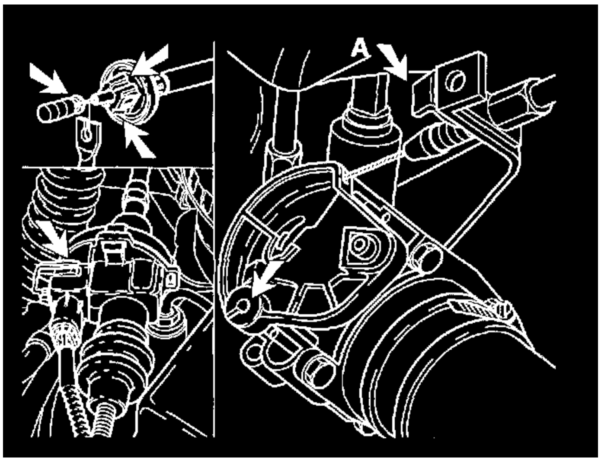
- **Automatic transmission from model year 98:** the connector from the kickdown switch.

Remove from the passenger compartment:
- the lower dashboard.

  Note! Remove the vacuum unit from cars with cruise control.

- press in the cable (B). Remove the throttle cable from the pedal
- the throttle cable from the firewall by press in the clips (C), first on one side and then on the other
- remove the cable.

Installing the throttle cable
Engine compartment:



- check the rubber on the cable
- insert the throttle cable through the cowl panel. Press it until it clicks.

The passenger compartment:

- connect the cable to the pedal. Ensure that the lock engages

  Note! Cars with cruise control: Install the vacuum unit.

- install the lower dashboard.

Engine compartment:

- **Automatic transmission:** install the connector for the kickdown switch

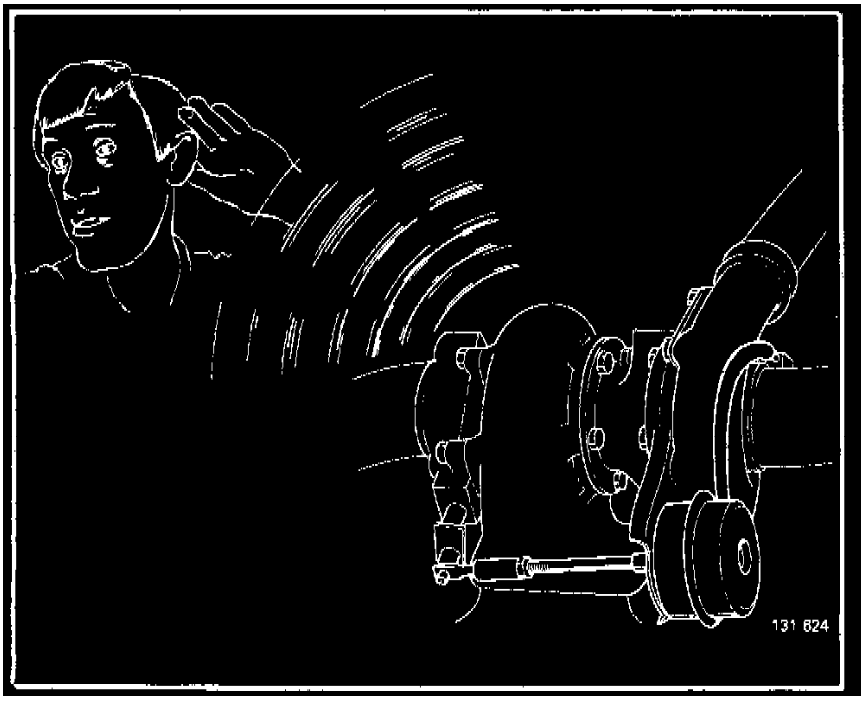
- install the cable sleeve on the cable mounting. Snap the clamp (B) into place
- connect the cable to the Throttle Body **(TB)**.

Checking and adjusting the throttle pulley and throttle cable

See Checking / adjusting the throttle pulley and throttle cable, refer to Adjustment.

Turbocharger: Testing and Inspection
Quick Check of the Turbocharger (TC)

Switching off the engine to listen to the Turbocharger (TC) with the engine off



Normally the moving parts in the Turbocharger **(TC)** stop slightly after the engine.
If this does not happen:
Remove the air intake hose from the compressor housing.
Check whether:
- The turbine is rotating
- The axial and radial play feels normal
- The turbine does not rub against the compressor housing.

Replacing the turbocharger (TC)
Turbochargers **(TC)** have previously been replaced unnecessarily.
Before replacing the turbocharger **(TC)**: Check the play to see if the bearings are worn.
If the Turbocharger **(TC)** needs replacing:
- Plug all the terminals on the old Turbocharger **(TC)** before it is sent away.

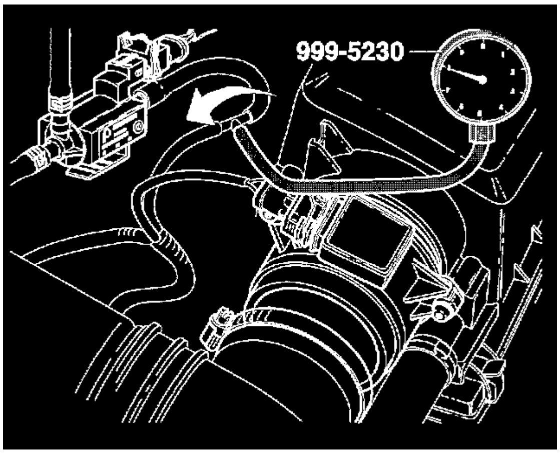
Turbocharger: Testing and Inspection
Checking Boost Pressure With Manometer While Test Driving Car

Special Tools
999 5230

Note! In order to ensure that the output of the turbo unit is correct, it is possible to measure the boost pressure.

Caution Excessive boost pressure can cause serious engine damage.

Connect the measuring equipment



- Remove the turbo control valve from the Air Cleaner **(ACL)** housing
- Remove the red marked hose from the turbo control valve.

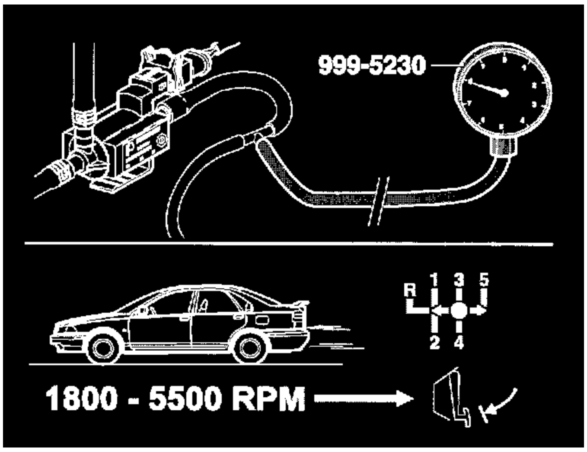
  Note! If it is not possible to pull it away, cut the hose.

- Connect manometer 999 5230 with a T-piece in between.

  Note! Route hose with manometer inside the passenger compartment and hang up the manometer vertically.

  Warning Test drive on a quiet road. Drive safely. Abide by local traffic regulations and speed limits while test driving.

Measure the boost pressure



Drive at approximately **1800 r/min** in 2nd gear.
Fully depress the accelerator pedal.
Apply the brakes while depressing the accelerator pedal at an engine speed of max. **5500 r/min** so that full boost is obtained.
Full boost should be between 1800-5500 r/min.

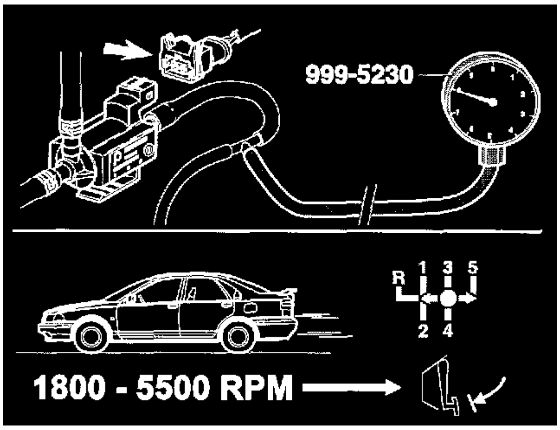
Important: Do not brake for longer than 5 seconds, otherwise serious damage may be caused to the braking system.

Measured at full load	Turbo control valve connector connected: Boost Pressure	Turbo control valve connector disconnected: Basic Boost Pressure
B4194T2 HP manual (kPa)	90 - 100	40 - 60
B4194T2 HP automatic (kPa)	50 - 60	20 - 30
B4204T2 LP automatic/manual (kPa)	50 - 60	20 - 30

Check the boost pressure and basic boost pressure values at full load.

If the test values differ from the above values, adjust the Boost Pressure Control **(BPC)** valve see Checking and adjusting boost pressure control valve on Turbocharger **(TC)**, refer to Wastegate Actuator, Adjustment

Measure the basic boost pressure



Remove the turbo control valve wiring connector and carry out the same test drive as when measuring boost pressure.

Note! These values are the basic values in "limp home" mode. If no repairs are required then continue with (A3)

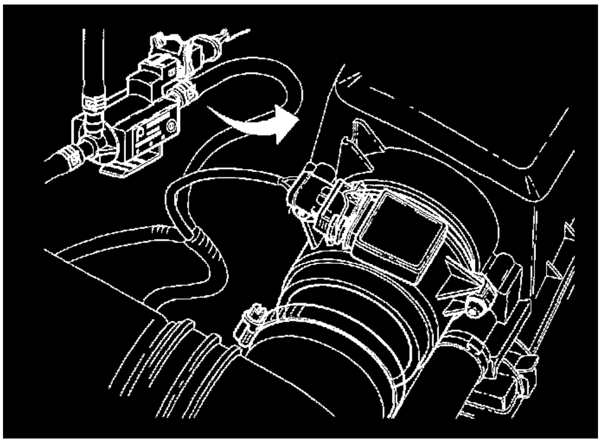
Repairs

If the test values differ from the above values, read off the DTCs from the EMS 2000 system.

Note! Fault code ECM-2D will be stored due to the disconnected turbo control valve.

Check the turbocharger inlet and outlet system for leakage, blockage and unusual noises.
Check that compression, sparkplugs, timing, fuel pressure, lambda, CO content, etc are functioning correctly/are correctly adjusted.
Check that the correct fuel octane is used.
If the boost pressure is correct and well adjusted but there is still power dissipation, first try a new EMS 2000 ECU and check the performance again.
If the result is the same, there is an internal fault. Replace the turbo charger.

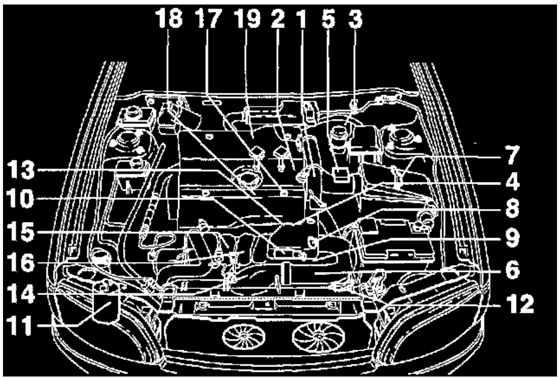
Remove the special tool



- Remove the measuring equipment and reinstall the hose and the hose clamp
- Connect the connector to the turbo control valve
- Install the turbo control valve to the Air Cleaner **(ACL)** housing
- Read off the diagnostic codes and erase all stored codes.

Note! Fault code ECM-2D will be stored because the turbo control valve is disconnected.

Turbocharger: Testing and Inspection
Checking Air and Vacuum Hoses



The following points should be carefully checked if leakage is suspected. Both the hoses and hose connections must be checked.
- The upper charge-air pipe
- The Turbocharger **(TC)** control valve and the Boost Pressure Control **(BPC)** valve
- The brake servo
- The crankcase ventilation
- The Mass Air Flow **Engine (MAP)** sensor
- The air intake hose
- The Turbocharger **(TC)** control valve
- The Throttle Body **(TB)**
- The lower charge-air pipe
- The Idle Air Control **(IAC)** valve
- The EVAP charcoal filter
- The Canister Purge **(CP)** valve
- The vacuum connections on the intake manifold
- The Charge Air Cooler **(CAC)**
- The intake manifold and the gasket
- The crankcase ventilation and the oil trap
- The fuel pressure regulator
- The injectors and seals
- The exhaust system.

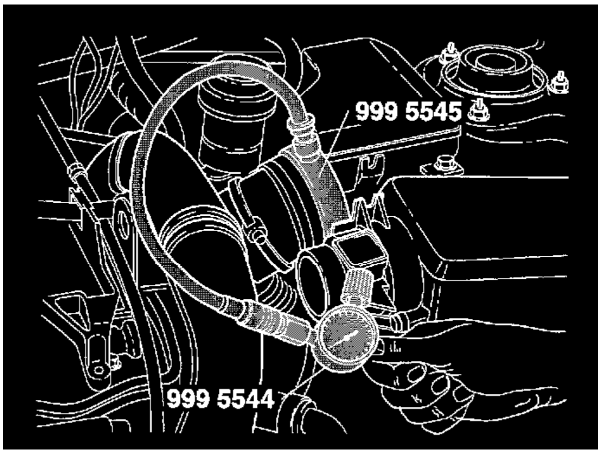
The following points should be carefully checked if leakage is suspected. Both the hoses and hose connections must be checked.
- The pressure regulator for the Idle Air Control **(IAC)** valve
- The Charge Air Cooler **(CAC)**
- The Turbocharger **(TC)** control valve
- The EVAP system
- The crankcase ventilation.

Turbocharger: Testing and Inspection
Checking Air Intake System

Special Tools
981 4215
999 5544
999 5545

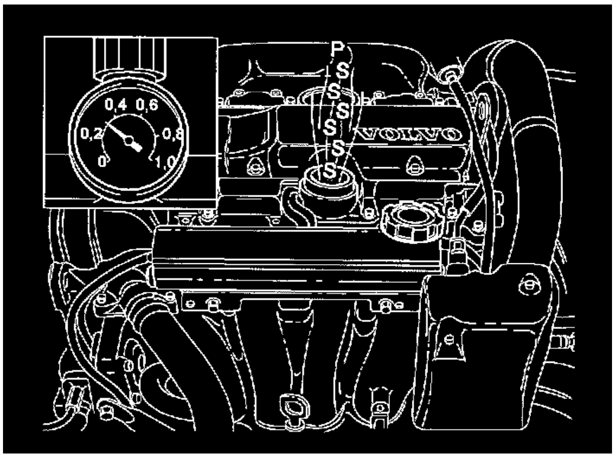
Preparations
- Check that all hoses are intact and are in the correct position with the hose clips tight.

Connect tools



- Disconnect the fresh air hose from the MAF sensor
- Connect the tool 999 5545 and the pressure regulator 999 5544 to the hose and tighten the hose clamp
- Use the hose clamp to block the crankcase ventilation hose
- Remove the oil filler cap
- Disconnect the bottom hose from the Canister Purge **(CP)** valve.

Checking procedure



- Adjust the regulator until the pressure gauge reads max. **0.3 bar**
- A gentle hissing sound can be heard from the oil filler opening due to the opening of an intake valve and leakage of the cylinder pressure past the piston rings.
- Check the components and the connections as per sections Checking air and vacuum hoses, turbocharged engines
- Coat the connections with soapy water if unsure whether a leakage is present
- Bubbles are permissible around the throttle spindle
- Small bubbles are permissible between the Throttle Body **(TB)** and the intake hose (if of plastic). No bubbles are permissible with rubber hose
- Check for air leakage from the Canister Purge **(CP)** valve. No leakage is permissible.

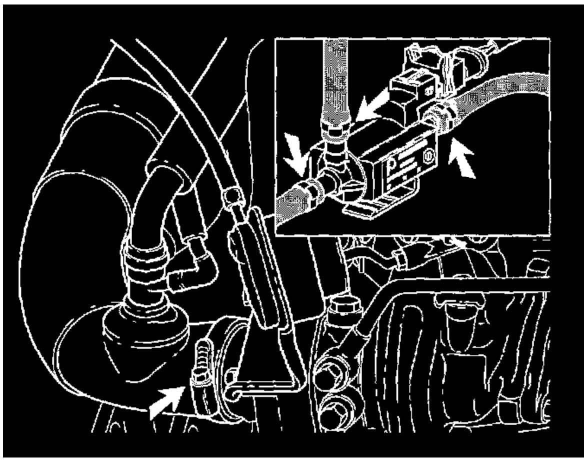
Turbocharger: Service and Repair

Prerequisites

Remove:

- The complete Air Cleaner **(ACL)**, see Replacing the Air Cleaner **(ACL)**, refer to Air Cleaner Housing, Service and Repair.
- the engine cover
- the rear engine splash guard
- the heat shield from inlet manifold / Turbo Charger **(TC).**

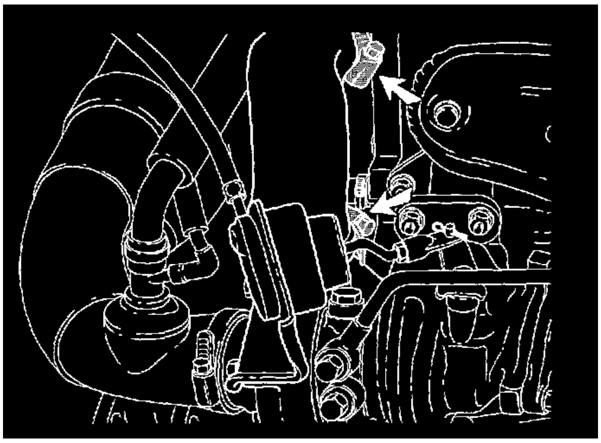
Remove the air hoses from turbo charger (TC)



- Remove the hoses from the Turbocharger Control Valve **(TCV)**
- Unscrew the hose clamp and disconnect the air inlet hose from the turbo.

Remove turbocharger (TC) upper charge air pipe

Remove:

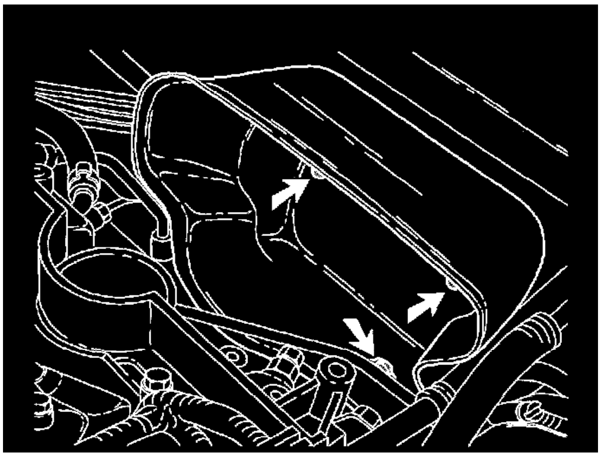


- the connector cover
- the clamps, and undo the upper charge air-pipe.

Draining coolant

See Replacing coolant, refer to Cooling System.

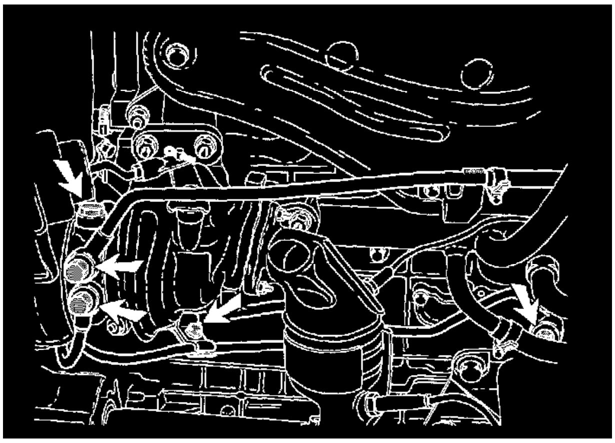
Remove heat shield from fireball



Remove the nuts and take the heat shield off.

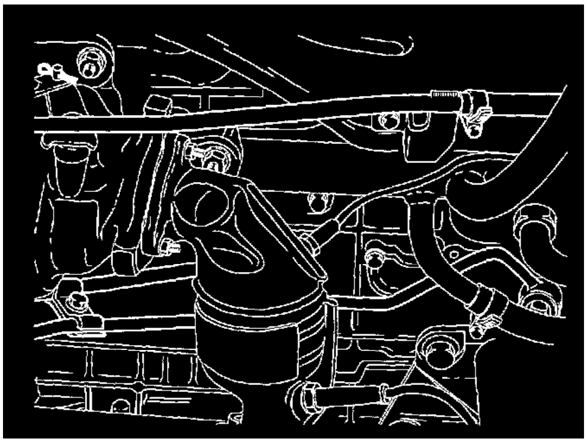
Remove oil and water hoses from turbo charger (TC)

Undo:



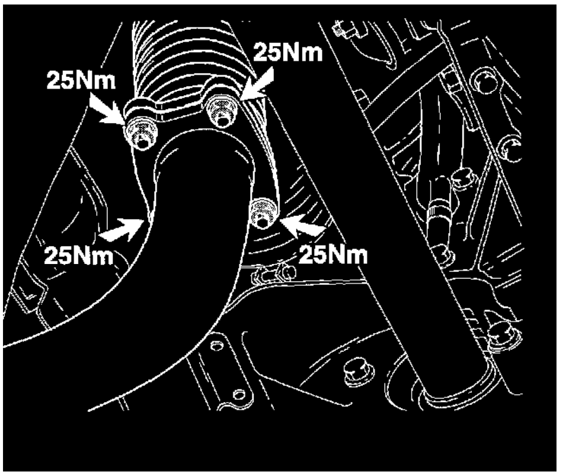
- the upper and lower TC coolant pipes
- the upper TC oil pipe
- the clamp from the lower oil pipe
- the banjo bolt from the oil pipe at the engine side. Catch spilt oil.

Remove the two lambda sonds



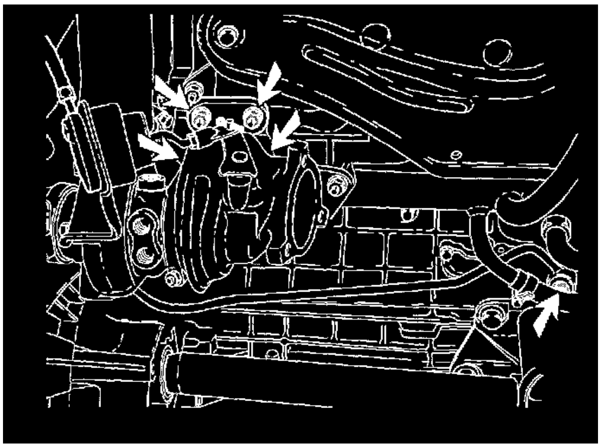
Remove the two lambda sonds, see Replacing lambda sond front and Replacing lambda sond rear, refer to Computers and Control System, Oxygen Sensor.

Remove exhaust down pipe from exhaust manifold



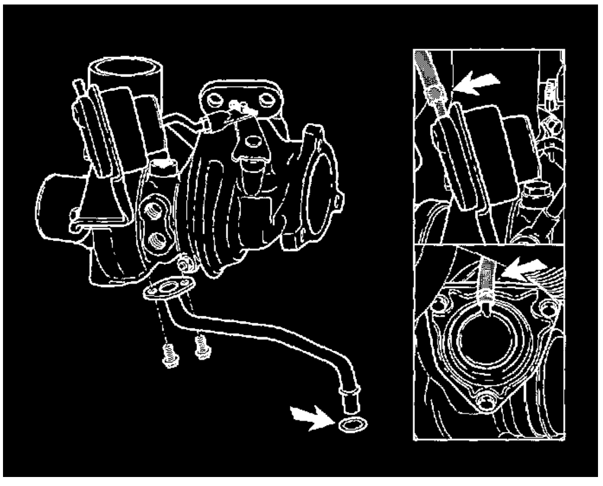
- Remove the nuts
- Pull the exhaust down pipe downwards
- Remove the gasket.

Remove turbocharger (TC)



- Remove the TC exhaust manifold nuts
- Remove the hoses from the Turbocharger Control Valve **(TCV)**. Mark the hoses
- Pull the Turbocharger **(TC)** from the exhaust manifold
- Pull the oil return pipe carefully out of the engine block
- Rotate the Turbocharger **(TC)** and remove it
- Seal the holes in the engine.

Remove parts from turbocharger (TC)
Remove:



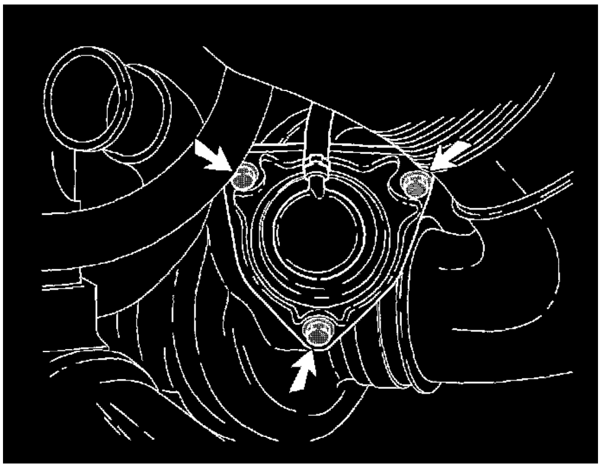
- the two hoses
- the oil return pipe and the gasket
- the catalytic converter.

Replacing the Boost Pressure Control (BBC) valve

See Replacing Boot Pressure Control **(BPC)** valve, refer to Wastegate Actuator, Service and Repair.

Replacing the bypass valve

Remove:

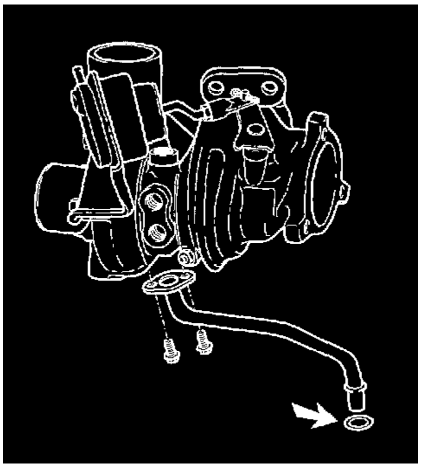


- the three bolts
- the diaphragm and the cover.

 Check the diaphragm valve.
 Install the diaphragm and the cover.
 Tighten the three bolts.

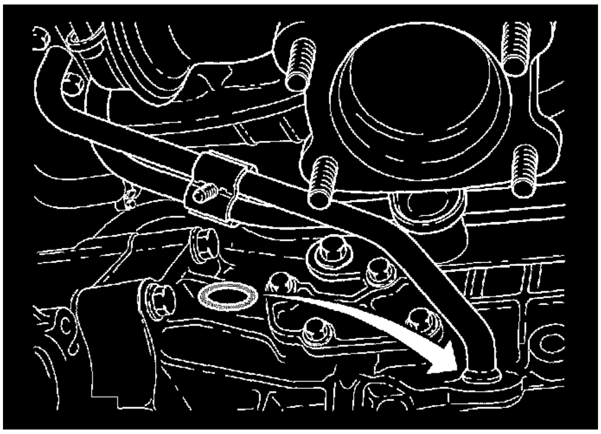
Installing parts on turbocharger (TC)

Install:



- the gasket and mount the oil return pipe on the Turbocharger **(TC)**
- the two hoses
- the catalytic converter.

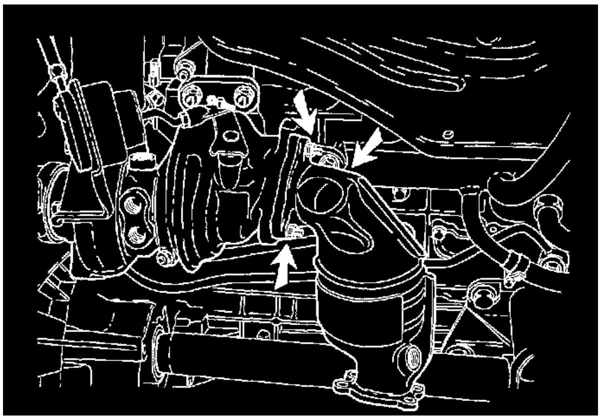
Installing turbocharger (TC)



Clean the manifold surface carefully.
Position the Turbocharger **(TC)** on the exhaust manifold.

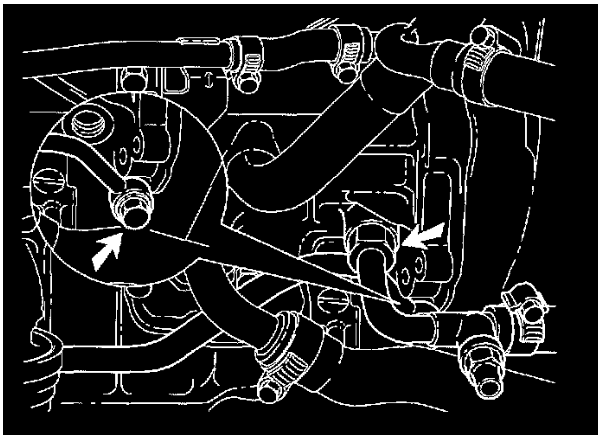
Install a new O-ring on the oil return pipe.
Push the oil return pipe into the engine block.
Tighten the nuts. Tightening torque **45 Nm.**

Install catalytic converter



Install catalytic converter, see Replace catalytic converter, refer to Emission Control Systems.

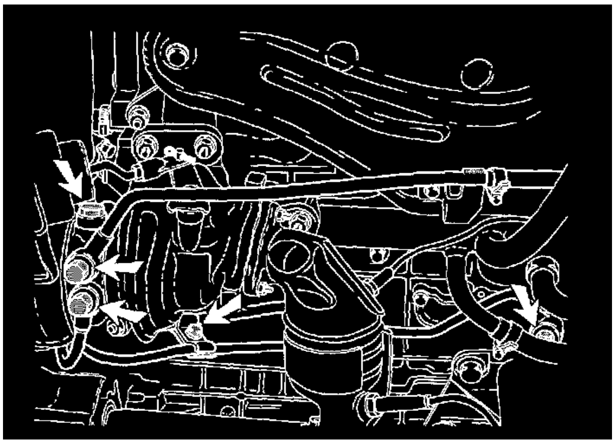
Install oil supply pipe at engine side and turbo charger (TC)



Note! Undo the water pipe cap-nut and bend the pipe away. Tighten the cap nut afterwards to **25 Nm.**

Install new rings on the bolt, use some grease on the engine.
Install the pipe with new rings on the turbo.

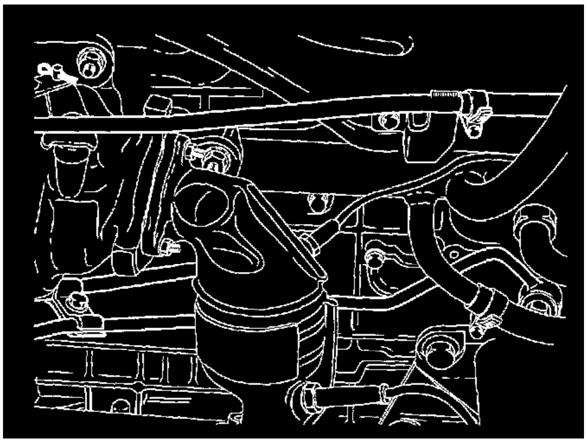
Install oil and coolant pipes
Install:



- the lower coolant pipe, tighten to **25 Nm**
- the upper coolant pipe, tighten to **25 Nm**
- the clamp on the oil pipe. Position the clamp.

Note! Use a new copper rings for coolant pipe and upper oil-pipes.

Install the two lambda sonds



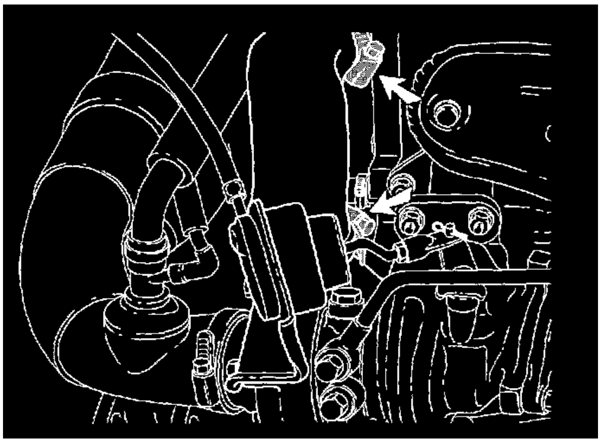
Remove the two lambda sonds, see Replacing lambda sond front and Replacing lambda sond rear, refer to Computers and Control Systems, Oxygen Sensor.

Install exhaust down pipe

Install the exhaust down pipe.
Use a new gasket.
Tighten to **25 Nm.**
Install the engine splash guard.

Install turbocharger (TC) upper charge air pipe

Install:

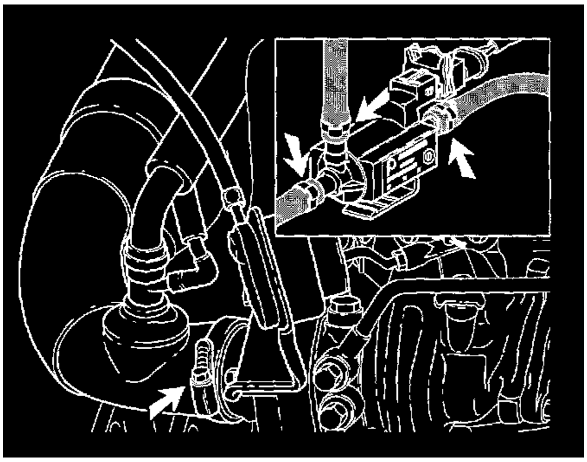


- the upper charge air pipe. Tighten to **6 Nm**
- the connector cover.

Mount heat shield on firewall

Install the heat shield and tighten the nuts.

Install air inlet hose



- Apply soap and push the air inlet hose onto the Turbocharger **(TC),** tighten to **6 Nm**
- Install the EVAP hoses
- Install the connector
- Install the vacuum hoses for the Turbocharger Control Valve **(TCV)** as marked.

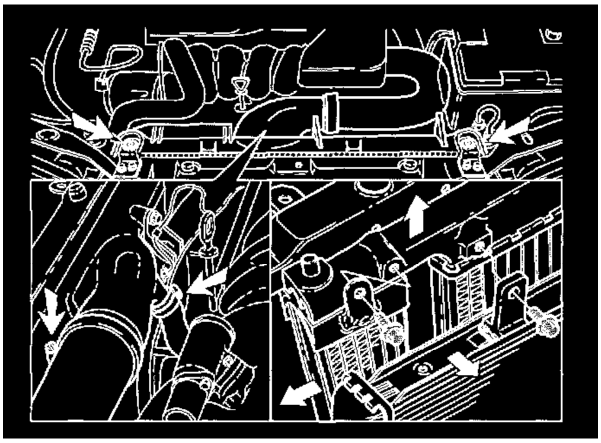
Install:
- Install the complete Air Cleaner **(ACL)**, see Replacing the Air Cleaner **(ACL),** refer to Air Cleaner Housing, Service and Repair.
- Fill the coolant system.
- Check the adjustment of the Turbocharger **(TC)**, see Checking and adjusting boost pressure control valve on Turbocharger **(TC)**, refer to Wastegate Actuator, Testing and Inspection.
- Fit the engine cover.

Intercooler: Service and Repair

Prerequisites
Remove the front engine-bay cover.

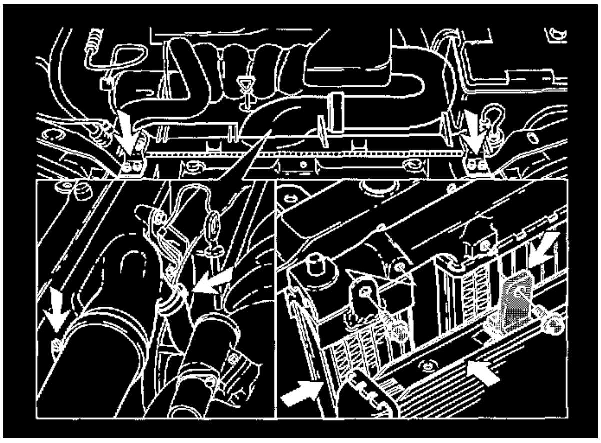
Remove complete fan unit
See: Replace engine coolant fans, turbo engines, refer to Cooling Systems, Cooling Fan Motor.

Remove Charge Air Cooler (CAC)



Remove:
- The air inlet hose
- The idle speed hose
- The two brackets at the top
- AT: Remove the bolt, move the Charge Air Cooler **(CAC)** as far as possible to the right and push the air cooler out
- Lift the radiator from the intercooler fixation and move it backwards
- Take the Charge Air Cooler **(CAC)** out carefully.

Install Charge Air Cooler (CAC)



- Replacing the intake air temperature sensor when you replace the Charge Air Cooler **(CAC)**
- Install the Charge Air Cooler **(CAC)** carefully and position the radiator on the Charge Air Cooler **(CAC).**

Note! Push the oil cooler into position in the Charge Air Cooler **(CAC).**

- Install the two brackets and tighten to **25 Nm**
- Clean the surface and fit and tighten the air inlet hose
- Fit the idle speed hose and tighten with a clamp.

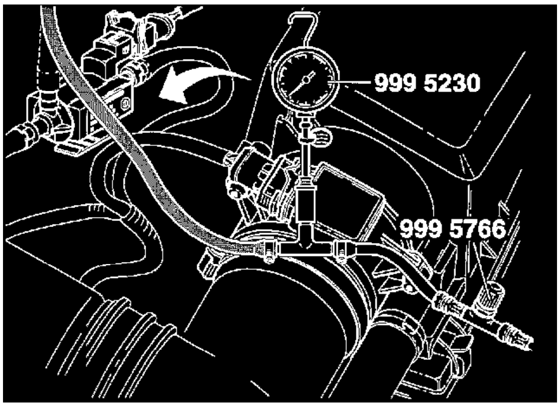
Install the complete fan unit
Raise the car.
Tighten the complete fan unit.

Wastegate Actuator: Testing and Inspection

Special Tools
999 5230
999 5766

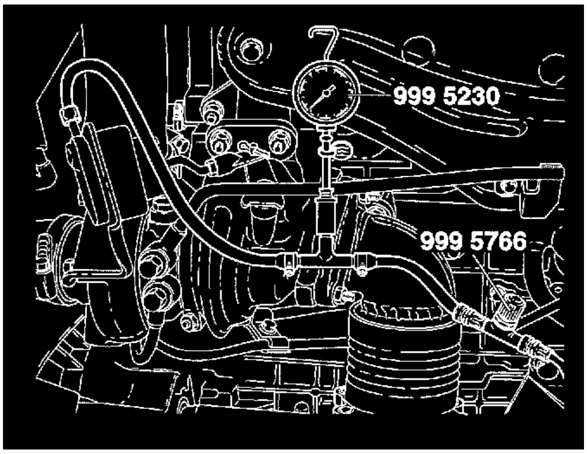
Manometer
- Use manometer 999 5230 to measure pressure during adjustment.

Connect test equipment



- Remove turbocharger control valve from Air Cleaner **(ACL)** housing
- Remove the yellow marked hose (A) from the turbocharger control valve
- Connect special tool 999 5230 and pressure regulator 999 5766 to the removed hose
- Connect air supply from the workshop to 999 5766.

Check the adjustment of the boost pressure control valve



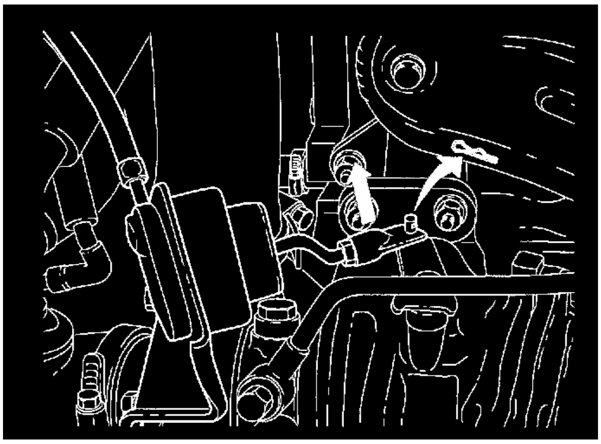
- Remove the exhaust manifold heat shield.

lever travel	B4194T2 HP MT (kPa)	B4194T2 HP AT (kPa)	B4204T2 LP MT/AT (kPa)	(kPa)
1	37	60	29	[plusmn] 4
5	74	97	50	[plusmn] 4
>7	> 80	> 100	> 60	

- Turn the regulator knob from special tool 999 5766 clockwise till the value given in the list and measure the movement with a caliper gauge
- The value represents the opening of the waste gate valve measured at the end of the lever (A).

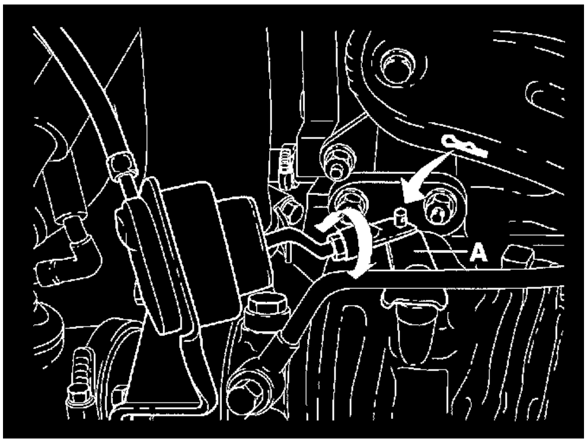
Note! Be sure that the valve is closed when the pushrod is in rest Position.

Release boost pressure control valve spindle



Remove the split pin from the lever.
Undo the nut.
Disconnect the spindle and lift it straight up.

Adjusting boost pressure control valve

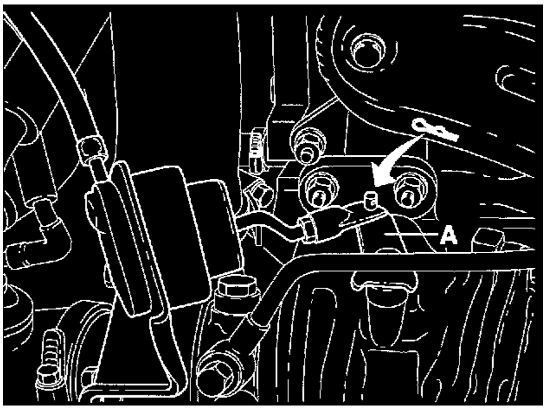


- Adjust the boost pressure control valve spindle until the right value see table above.
- Reset the air pressure every time checking/adjusting.

  Note! The boost pressure control valve spindle should be mounted on the lever when the lock-nut is loosened or tightened. Turning the boost pressure control valve spindle will damage the diaphragm in the pressure regulator.

- Tighten the lock nut on the boost pressure control valve spindle to **9 Nm**. Take care not to damage the diaphragm.

Reinstall/reconnect



- Install the ring and the split pin in the lever
- Remove the special tools
- Connect the hose on the turbocharger control valve and fit the clamp
- Install the turbocharger control valve on the air cleaner housing
- Install the exhaust manifold heat shield.
- Erase the Diagnostic Trouble Codes **(DTCs)**
- Test drive the car, accelerating to Wide Open Throttle **(WOT)** twice
- Check that no Diagnostic Trouble Codes **(DTCs)** have been stored.

Wastegate Actuator: Service and Repair

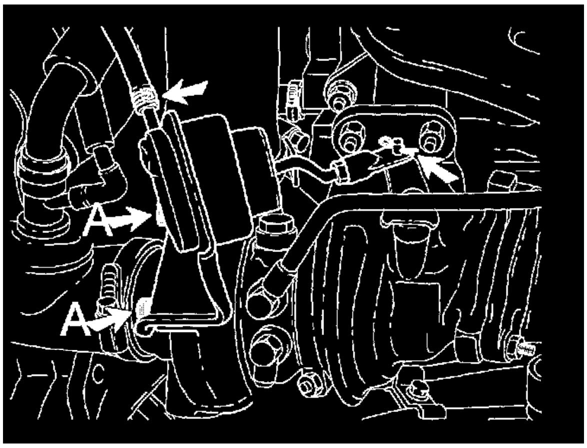
Prerequisites

Remove:

- the heat shield exhaust manifold
- the complete Air Cleaner **(ACL)**, see Replacing the Air Cleaner **(ACL)**, refer to Air Cleaner Housing, Service and Repair.
- the air intake hose.

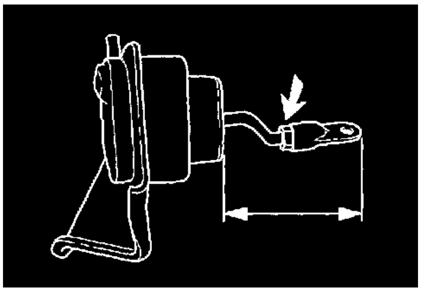
Remove Boost Pressure Control (BBC) valve

Remove:



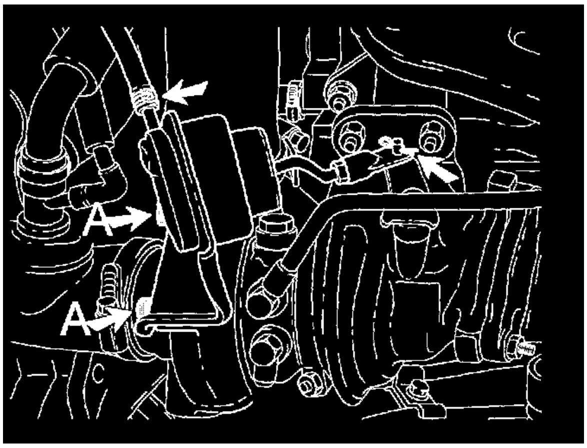
- the locking pin
- the two bolts (A)
- the vacuum hose from the valve
- the Boost Pressure Control **(BPC)** valve. Turn the BPC valve while removing it to disconnect the vacuum hose.

Copy adjustment from old Boost Pressure Control (BBC) valve to new one as basic adjustment



Measure the length from the pushrod of the old Boost Pressure Control **(BPC)** valve.
Adjust the new Boost Pressure Control **(BPC)** valve to the measured value.
Do not turn the shaft to avoid damage of the valve diaphragm.

Install the Boost Pressure Control (BBC) valve on the turbo charger (TC)



- Connect the vacuum hose to the BPC valve and fit the clamp
- Install the BPC valve over the pin and on the turbo unit
- Mount the two bolts (A), tighten to **25 Nm.**

Install

- Install the air intake hose
- Install the complete Air Cleaner **(ACL)**.

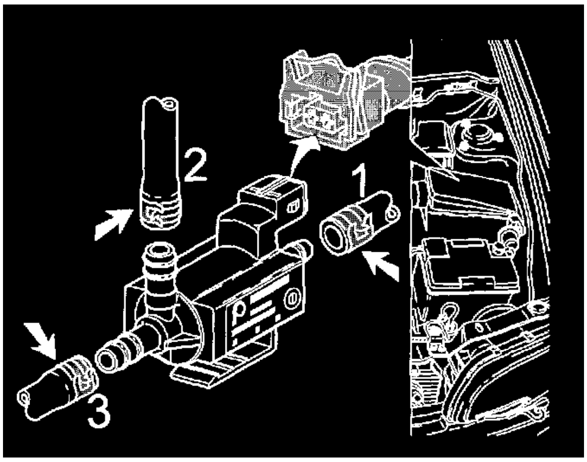
Check/Adjust boost pressure valve

- Adjust the Boost Pressure Control **(BPC)**, see Checking and adjusting boost pressure control valve on Turbocharger **(TC)**, refer to Adjustments.

Install

- The exhaust heat shield.

Wastegate Solenoid: Service and Repair



Removing / disconnecting

- The connector.
- The Turbocharger **(TC)** control valve from the Air Cleaner **(ACL)** housing.
- The clamps and hoses on the valve.

Note! Note how the hoses are connected.

Hint: If it is difficult to pull off the hose: Cut the hose along its length at the connection.

Installing / reconnecting

- The hoses in their original positions. The clamps.
- Red (on the intake pressure side)
- Yellow (to the Boost Pressure Control **(BBC)** valve)
- White (to the by-pass valve)
- The valve to the Air Cleaner **(ACL)** housing
- The connector.

Computers and Control Systems: Description and Operation

VIDA (Vehicle Information & Diagnostics For Aftersales)

VIDA (Vehicle Information & Diagnostics for Aftersales)

During the second half of 2004, VADIS (Volvo Aftersales Diagnostic and Information System) was phased out and replaced by VIDA (Vehicle Information & Diagnostics for Aftersales). The purpose of VIDA is to support service providers in repairing and servicing Volvo vehicles. VIDA provides Service and Parts information, as well as diagnostic fault tracing, and software downloads. As in VADIS, these areas are integrated into one single application. All functionality that could be found in VADIS will be found in VIDA. However, in some particular areas, e.g., the diagnostic work flow, search functionality, and the Parts catalogue, VIDA contains considerable enhancements when compared to VADIS.

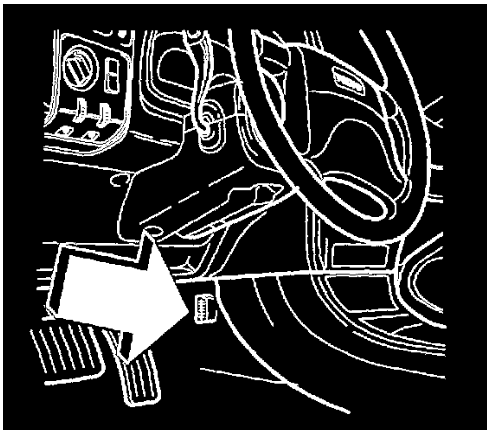
Volvo's VIDA (Vehicle Information & Diagnostics for Aftersales) system ties together service and repair data, parts data, service bulletins, software (firmware) downloads, fault tracing and on-board diagnostic as well as other related information to decrease service time.

Much of the diagnostic information provided here is presented in a manner that assumes the technician is using the web-based Volvo diagnostic system (VIDA) to diagnose the vehicle. Volvo does not provide any information based on performing diagnosis with a third party diagnostic tool aside from a conversion from P Codes to Volvo ECM Codes. See: Testing and Inspection/Diagnostic Trouble Code Descriptions/P Code Charts

Reading Off the Volvo on-Board Diagnostic (OBD) System

Reading Off the Volvo On-Board Diagnostic (OBD) System

Overview



Fault information and other data can be read using VADIS/VIDA connected to the data link connector **(DLC)** via VCT2000. The data link connector **(DLC)** is located on the left of the center console (the right of the center console for right hand drive cars). VCT2000 communicates with the DSA control module via a standardized interface.

Volvo on-board diagnostic (OBD) system
With VADIS/VIDA it is possible to:
- Read off and erase stored diagnostic trouble codes **(DTCs)**
- Reset adaptations
- Activate components and functions according to certain predetermined patterns
- Continuously monitor the value and status of the input and output signals for the system
- Read off the control module identification.

To activate the Volvo on-board diagnostic **(OBD)** system for DSA:
- The ignition must be on
- The battery voltage must be normal.

Reading and erasing diagnostic trouble codes (DTCs)
Stored diagnostic trouble codes **(DTCs)** can be read off and erased using this function. The on-board diagnostic **(OBD)** system can identify 17 different faults in the form of diagnostic trouble codes **(DTCs)**.

Note: Diagnostic trouble codes **(DTCs)** DSA-112, DSA-223, DSA-224 and DSA-233 are only stored in the DSA control module while the ignition is on / the engine is running. When the ignition is switched off, these diagnostic trouble codes **(DTCs)** are erased. Therefore the engine must be started before diagnostic trouble codes **(DTCs)** are read off from the control module. This is so that the control module is able to re-check and store diagnostic trouble codes **(DTCs)**.

Diagnostic trouble codes **(DTCs)** can only be erased when all diagnostic trouble codes **(DTCs)** have been read at least once.

Note: After the diagnostic trouble codes **(DTCs)** are erased the DSA function is disengaged. The DSA function is re-engaged using the DSA switch. If no diagnostic trouble codes **(DTCs)** have been stored, the DSA warning lamp goes out after engagement.

Resetting the wheel adaptation

This function allows the DSA system wheel adaptations to be reset to their center positions.

Activating components and functions
This function allows the system components and functions to be activated individually. The following components can be activated:
- Torque limiting request
- DSA warning lamp, flash status.

Note: After Activation is completed, the DSA function is disconnected. The DSA function is re-engaged using the DSA switch. If no diagnostic trouble codes **(DTCs)** have been stored, the DSA warning lamp goes out after engagement.

For further information about Activating components / functions. See: Testing and Inspection/Scan Tool Testing and Procedures

Reading off input and output signals
Using this function, the values and status of the control module input and output signals can be continuously read off.

Note: To obtain the relevant values, the engine must be running and the engine control module **(ECM)** must be initiated. The engine control module **(ECM)** is initiated the first time engine speed exceeds 600 rpm.

The following parameters can be read off:
- Engine speed (RPM), value
- Load signal, value
- Throttle position (TP) sensor, position
- Torque limiting, value
- Transmission type
- Control module initialization, status
- DSA function, status
- DSA switch, status
- DSA warning lamp, lit status
- DSA warning lamp, flash status
- Stop (brake) light switch, status
- The value for the left front wheel speed
- The value for the right front wheel speed
- The value for the left rear wheel speed
- The value for the right rear wheel speed
- Left front wheel adaptation, value
- Right front wheel adaptation, value
- Left rear wheel adaptation, value
- Right rear wheel adaptation, value
- Wheel adaptation permitted, status.

Reading off the control module identification
VADIS/VIDA identifies the control module by reading a code from the memory of the module. This code contains information about the control module P/N.

General

DSA SYSTEM OVERVIEW

General
Function in the dynamic stability assistance (DSA) antiwheel spin system

the DSA system assists the driver in holding the vehicle under control under (hard) acceleration, especially when the road surface provides less grip than the driver anticipated.

It also makes progress possible in very slippery conditions, which would not otherwise be possible without dynamic stability assistance.

Unlike the SRS-, ABS- or SIPS-systems, the DSA system is not a safety system. It is an aid to improve control of the car.

The DSA system can be switched off, but is automatically engaged every time the ignition is switched on.

A warning lamp in the dashboard indicates the status of the DSA system.

The DSA system consists of a single control module. This control module calculates wheelspin in the driven wheels from the information about the speed provided by the ABS control module. From this information the DSA control module calculates the torque reduction that is required. This information is transferred to the engine control module **(ECM)** which decreases the torque on the driven wheels to the normal driving conditions.

The DSA control module does not have sensors of its own. It uses the ABS system or engine control module **(ECM)** sensors.

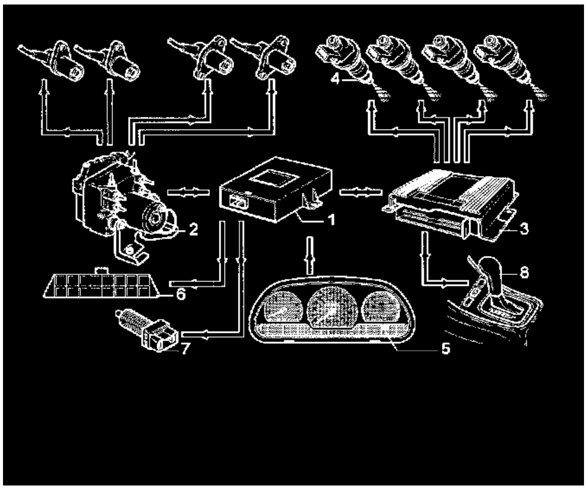
The DSA control module can be activated at all speeds, both when the car is moving forwards and when it is moving backwards.

There are no functional similarities between the DSA system and the TRACS system.
- The TRACS system uses wheel braking to prevent wheelspin in one of the front wheels when the car moves off.
- The DSA system decreases the engine torque to prevent wheelspin on one or both of the driven wheels in all driving conditions.

System Overview

DSA SYSTEM OVERVIEW

System overview



The DSA control module (1) needs data about the speed of all four wheels in order to detect wheel spin. This data is provided by the ABS control module (2). The data is transmitted continuously. The DSA control module is able to detect whether on or both of the drive wheels lose grip.

If wheel spin is detected, the DSA control module transmits a signal to the engine control module **(ECM)** (3) to reduce the torque. The engine control module **(ECM)** reduces the torque by shutting off one or more injectors (4) in different stages.

The engine control module **(ECM)** communicates with the DSA control module via three communication lines.
- The first communication line is used to transfer both speed (pulse frequency / one pulse per top dead center sweep) and engine load data. The engine load data is indicated by pulse width. Variations in the pulse width also provide additional data such as start, idling and transmission data.
- The second communication line transmits data about the position of the accelerator pedal **(AP)**. A pulse is transmitted every 20th millisecond. The pulse is proportional to the given value.
- A third communication line is used for the transfer of data about torque reduction from the DSA control module to the engine control module **(ECM)**. This pulse frequency is 5 milliseconds. Again it is the pulse width that provides the data.

The DSA system is switched on every time the engine is started.

The DSA system can be disengaged with the DSA switch (8) on the center console. The DSA system can be reengaged by pressing the DSA switch again. Otherwise, the system is activated the next time the ignition is switched on.

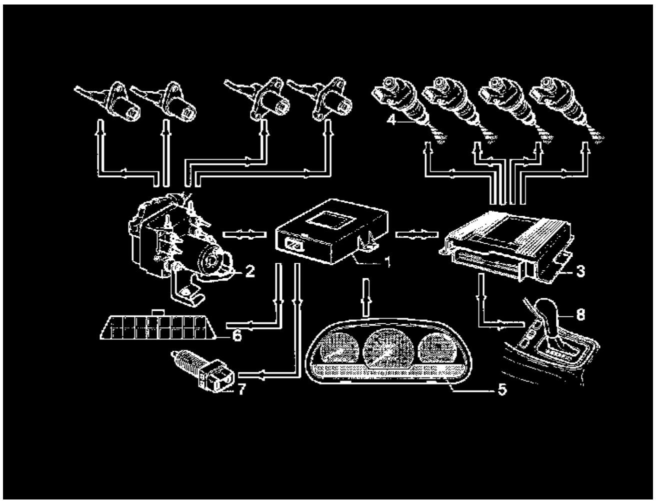
The DSA warning lamp is on the dashboard (5). This warning lamp indicates the status of the DSA system.
- The DSA warning lamp is lit for 2 seconds after the engine is started. During this time, the integrated DSA diagnostic system checks that both the ABS control module and the engine control module **(ECM)** are OK.
- The DSA system is not working if the DSA warning lamp remains lit. The is either a system failure or the system has been switched off manually.
- If the DSA warning lamp flashes while driving, the system is active and reducing the engine torque.

Diagnostic trouble codes **(DTCs)** from the DSA system can be read off with VADIS/VIDA. Connect VADIS/VIDA to the data link connector **(DLC)** (6) via VCT 2000.

System Function

DSA SYSTEM OVERVIEW

System function



The DSA system must take account of any deviations caused by the steering wheel.. It is therefore important that no incorrect data is introduced by the system itself and that it goes through a number of stages before the torque reduction is activated.

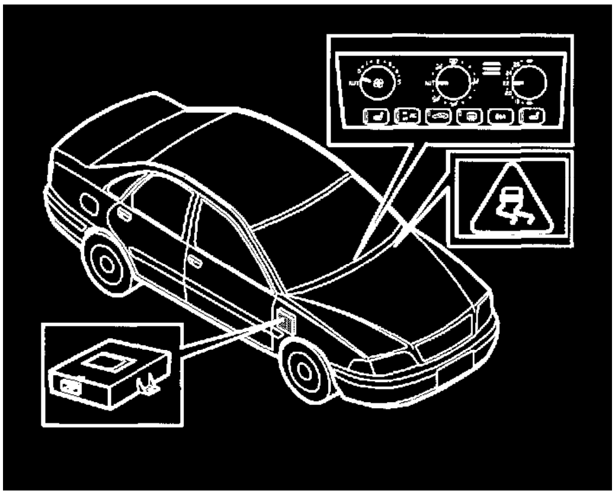
- When the DSA control module detects wheelspin it first determines the extent of the spin.
- The average spin of the two front wheels is calculated. Differences in wheel speed because of cornering is compensated using sensors on the rear wheels.
- Information about the engine speed and load comes from the engine control module **(ECM)**. The torque required from the engine is calculated from this.
- The selected gear can be derived by comparing wheel speed with engine speed. From this the friction coefficient between the tire and road surface can be deduced.
- Acceptable spin can be deduced from the accelerator pedal **(AP)** position and the friction coefficient.
- The engine control module **(ECM)** decreases torque by disengaging the injectors, so preventing wheel spin.

The DSA control module only sends information to the engine control module **(ECM)**. It is this that close the fuel injection. The engine control module **(ECM)** can control the injection by closing the injectors, so that one or more injectors can be closed every 4th cylinder compression. It reduces torque in 16 stages.

- Partial closure of the injectors occurs randomly to ensure that the heat is evenly distributed.
- If the torque reduction is very small, a safety program is activated. After a given period the DSA shuts off several injectors (greater torque reduction) to ensure that the combustion chambers are correctly ventilated.
- The DSA system functions up to maximum. It is also active while reversing.
- The DSA system aligns itself so that it is does not identify different wheel diameter as wheelspin, in cases of variable tire pressure for example. DSA is not engaged if there is a slow puncture in one of the tires.
- Switch off the DSA system when driving on a "special spare tire". If not the system aligns itself to the diameter of the tire on the wheel. To assist this the car should be driven slowly, then accelerated hard for approximately 4 seconds. The accelerator pedal **(AP)** should be released quickly so that the engine brakes the car for approximately 4 seconds. Repeat this one more time. This procedure should be repeated when the special spare tire is replaced by a normal tire.

Overview

DIAGNOSTIC FUNCTIONS
Overview
General



The DSA control module has an integrated diagnostic system, the Volvo on-board diagnostic **(OBD)** system. This system continuously monitors itself and the input and output signals.

Diagnostic trouble codes (DTCs)
A diagnostic trouble code **(DTC)** is stored and the DSA warning lamp lights if the control module detects a fault. The exception is diagnostic trouble code **(DTC)** DSA-122 DSA warning lamp. This DSA warning lamp cannot be activated if this fault is stored.

Faults, with the exception of diagnostic trouble code **(DTC)** DSA-122DSA warning lamp, disengage the DSA function. If diagnostic trouble code **(DTC)** DSA-122DSA warning lamp is stored, the warning lamp cannot be used to determine whether the DSA function is engaged or not. The DSA function is then always engaged and cannot be disengaged manually.

If the DSA warning lamp is lit, the DSA function is not operating normally or it is not engaged.

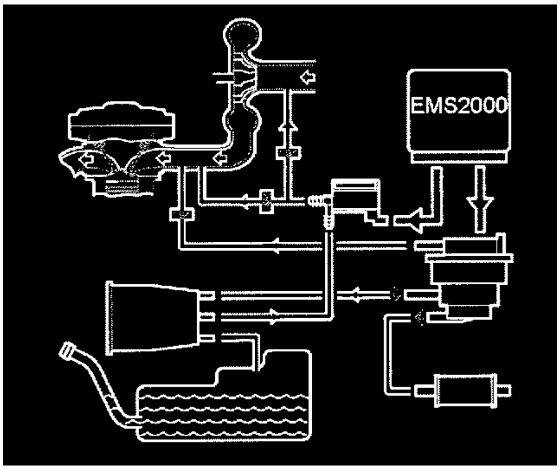
If a fault disappears for any reason (becomes intermittent) after the diagnostic trouble code **(DTC)** has been permanently stored in the control module, information about the fault remains in the control module.

Other
Every diagnostic trouble code **(DTC)** has a counter. The counter records the number of fault-free cycles since the diagnostic trouble code **(DTC)** was stored (intermittent fault). A cycle is defined as the first time the engine speed exceeds 600 rpm in the same interval in which the ignition is switched on (the engine starts) and then switched off. If diagnostic trouble code **(DTC)** DSA-22 1 Load signal is stored permanently, the cycle is defined as the first time the average wheel speed exceeds **50 km/h** in the same interval in which the ignition is switched on (the engine starts) and then switched off. When a counter is at 0, the control module interprets the fault as permanent. If the counter value is greater than 0, the control module interprets it as no fault (intermittent fault). If the fault recurs, the counter is reset to zero. When the counter reaches 254 (i e. 254 fault-free cycles), the counter is no longer updated.

Leak Diagnostics

LEAK DIAGNOSTIC

General



Vapor from the fuel in the fuel tank is routed to and stored in the EVAP canister. It is then guided into the combustion process via the canister purge (CP) valve and the negative pressure in the intake manifold. A leakage diagnostic has been introduced to ensure that the fuel tank system is not leaking. This diagnostic is designed so that the system is able to detect a leak / hole 0.5 mm or larger. Diagnostics are also carried out on the EVAP system.

The fuel tank system consists of the fuel tank, fuel filler pipe, roll-over valve, EVAP canister, canister purge (CP) valve and all cables between these components. In order to perform diagnostics, the fuel tank system is equipped with a leak diagnostic pump. The leak diagnostic pump is vacuum driven and pressurizes the fuel tank system. The vacuum that operates the leak diagnostic pump comes from the intake manifold via a non-return valve. The engine control module (ECM) activates I deactivates a three-way valve in the leak diagnostic pump (vacuum / atmospheric pressure). The pump action is obtained using a spring loaded diaphragm.

A position sensor is mounted on the diaphragm. This allows the control module to determine when the three-way valve should be activated. The position sensor acts on a contact breaker. The contact breaker transmits a high or low signal to the engine control module (ECM). The control module activates the three-way valve when the diaphragm is in the resting position. A vacuum is generated. The diaphragm is switched to the active position. The three-way valve is deactivated when the control module determines that the diaphragm has reached the activated position. The atmospheric pressure is allowed to enter and the diaphragm returns to the resting position. In order to detect leakage in the fuel tank system, the leak diagnostic pump is used according to the description in "Leak diagnostic" below.

The diagnostic takes place once per operating cycle if the following criterion are met:
- The battery voltage must be correct
- The engine coolant temperature (ECT) and intake air temperature (IAT) must be 4-60°C
- The engine coolant temperature (ECT) must have dropped by at least 15°C since the previous operating cycle
- The atmospheric pressure must remain constant.

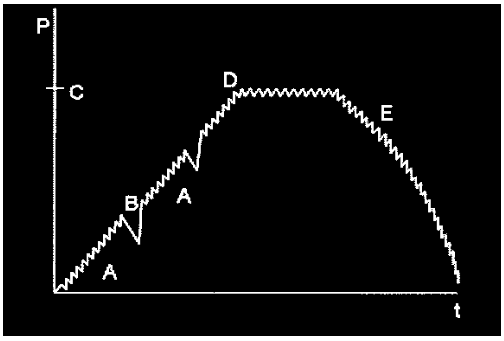
Function test

The diagnostic is divided into different phases in which the components involved are tested before the actual leak diagnostic begins. The diagnostic is cancelled and a diagnostic trouble code (DTC) is stored if a fault is detected in any of the phases.

The diagnostic test works as follows:

- The system must be depressurized. The control module checks that the pump diaphragm is in the resting position. Diagnostic trouble code (DTC) ECM-65, faulty signal, is stored if the control module registers that the position is active
- When the engine is started, a vacuum is generated in the intake manifold. The three-way valve opens a connection to the intake manifold via the non-return valve. The diaphragm is moved to the activated position by the vacuum. Diagnostic trouble code (DTC) ECM-65, high signal, is stored if the control module registers that the diaphragm is still in the resting position
- The three-way valve closes the connection with the intake manifold. The non-return valve closes. A connection to the atmospheric pressure opens. The spring-loaded diaphragm must then return to resting position. Diagnostic trouble code (DTC) ECM 65, low signal, is stored if the diaphragm does not return to the resting position.

Leak diagnostic

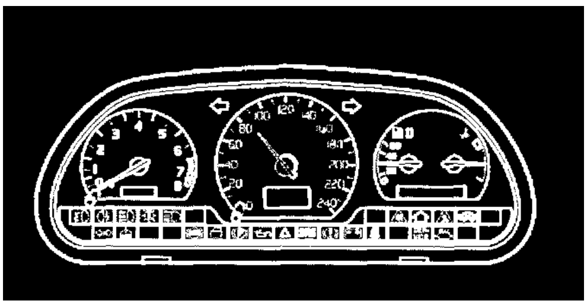


- The leak diagnostic pump is pulsed (A) rapidly at a rapid frequency. This is to pressurize the fuel tank system to the desired pressure (C)
- This rapid pulsing is interrupted regularly (B). This is to check that the correct pressure in the fuel tank system is reached. This is done by gauging the time taken for the pump to switch from active to resting position using the switch in the leak diagnostic pump. The constant pulse (A) and pressure check (B) alternate until the desired pressure (C) in the fuel tank system is obtained. If vehicle speed exceeds 40 km/h there is no pressure check (B). The pump is activated and deactivated a fixed number of times instead. If the pressure (C) is not reached, the control module interprets it as a leakage. Diagnostic trouble code (DTC) ECM6A, fuel tank filler cap missing, is stored
- When the pressure in the fuel tank is detected by the control module using the leak diagnostic pump, the control module begins to check for smaller leaks (D). To do this, the control module measures the time the diaphragm takes from active to resting position. Diagnostic trouble code (DTC) ECM-68, large leak, or ECM- 68, small leak, is stored if this time is too short
- If no leakage is detected in the fuel tank system, the flow in the evaporative emission (EVAP) system is checked for blockage. This is done by pulsing both the canister purge (CP) valve and the leak diagnostic pump at the same time. The control module checks that the pressure in the fuel tank drops (E). If the pressure does not drop, the control module interprets it as a blockage in the evaporative emission (EVAP) system. Diagnostic trouble code (DTC) ECM-6A is stored. The canister purge (CP) valve is pulsed until the fuel tank system is depressurized. The diagnostic takes place in the next operating cycle.

Description of Parameters

Description of parameters

VEHICLE SPEED



Measurement range **0-260 km/h, 0-160 miles/h.** The value displays the vehicle speed. The Signal is from the ABS control module.

ENGINE SPEED (RPM)

Measurement range **0-9024 rpm**.
The value indicates the engine speed (RPM). The signal is from the engine control module (ECM).

ENGINE COOLANT TEMPERATURE

Measurement range **-40 degrees C to +140 degrees C.**

The value indicates the engine coolant temperature (ECT).
The signal is from the engine control module (ECM).

OUTSIDE TEMPERATURE

NOTE: If the combined instrument panel is programmed to display the temperature in degrees C (degree F), the read out of the value in degrees F (degrees C) will not be correct.

Measurement range **-40 degrees C to +60 degrees C/-40 degrees Fto +140 degrees F.** The value indicates the ambient air temperature. The signal is from the sensor.

NOTE: Only if the car is equipped with a function displaying the outside temperature.

MANIPULATED

The value indicates how long in hours the speedometer signal to the combined instrument panel has been disengaged while the car was being driven.

FUEL VOLUME, ATTENUATED

NOTE: If the combined instrument panel is programmed to display the volume in liters(gallons), the read out of the value in gallons (liters) will not be correct.

Fuel level signal, attenuated (liters/gallons).
The value shows the volume signal from the fuel level sensor (gasoline/ diesel)

FUEL VOLUME, CALCULATED

NOTE: If the combined instrument panel is programmed to display the volume in liters(gallons), the read out of the value in gallons (liters) will not be correct.

Fuel level signal, calculated (liters/gallons).
The value displays the volume calculated by the combined instrument panel from the fuel level sensor signal (gasoline/diesel).

CLOCK ADJUSTMENT KNOB STATUS

The value displays the clock adjustment knob position for adjusting time.
Resting position = No time adjustment
Forward slow = Adjusting time, forward slowly.
Forward medium = Adjusting time, forward medium. NOTE Only model year 1999
Forward fast = Adjusting time, forward fast.
Backward slow = Adjusting time, backward slowly.
Backward medium = Adjusting time, backward medium. NOTE Only model year 1999
Backward fast = Adjusting time, backward fast.

TRIP COMPUTER, SET BUTTON

NOTE: Only model years 1999 and 2000.

Not depressed = Button released.
Depressed = Button depressed.
The value indicates the position of the trip computer set button.

NOTE: Only if the car is equipped with a trip computer function.

TRIP COMPUTER, RESET BUTTON

Not depressed = Button released.
Depressed = Button depressed.
The value indicates the position of the reset button for the trip computer.

NOTE: Only if the car is equipped with a trip computer function.

TRIP COMPUTER, SELECTOR

NOTE: Only if the car is equipped with a trip computer function.

The value indicates the position of the reset button for the mode selector. The following options can be displayed:

Model years 1999 and 2000

- Speed warning
- Average speed
- Present fuel consumption
- Average fuel consumption
- Outside temperature
- Mileage
- Range to empty fuel tank
- No selector connected. Displayed if the mode selector is disengaged.

Model year 2001

- Average speed
- Present fuel consumption
- Average fuel consumption
- Outside temperature
- Mileage
- Range to empty fuel tank
- Reset button The reset button for the trip computer is an internal switch connected to the wiring for the mode selector. This means that this parameter can be displayed
- No selector connected. Displayed if the mode selector is disengaged.

TRIP METER, RESET BUTTON

Released = Button released.
Depressed = Button depressed.
The value indicates the position of the reset button for the trip odometer.

HIGH ENGINE COOLANT TEMPERATURE, WARNING

OFF = Warning lamp off.
ON = Warning lamp on.

NOTE: Only for diesel cars equipped with this function.

LOW FUEL LEVEL, WARNING LAMP

OFF = Warning lamp off.
ON = Warning lamp on.

OUTSIDE TEMPERATURE WARNING LAMP

OFF = Warning lamp off.
ON = Warning lamp on.

NOTE: Only if the car is equipped with a function displaying the outside temperature.

MILEAGE SINCE SERVICE

The value displays the distance since the last service (km or miles).

MILEAGE TO SERVICE

The value displays the distance to the next service (km or miles).

ENGINE HOURS SINCE SERVICE

The value displays the number of engine hours since the last service.

ENGINE HOURS TO SERVICE

The value displays the number of engine hours until the next service.

TIME SINCE SERVICE

The value displays the time since the last service.

TIME REMAINING UNTIL SERVICE

The value displays the time until the next service.

Description of Parameters

No.	Text	Notes
1	Engine speed = rpm	Measurement range 0 - 8,160 rpm. Idling speed approximately 750 rpm.
2	Vehicle Speed = km/h	Vehicle speed. Measurement range 0-255 km/h
3	Coolant temperature = °C	Engine temperature. Measurement range -48 to +142°C.
4	Engine Coolant Temperature (ECT), start = °C	Engine temperature when ignition was last switched on. Measurement range -48 to +142°C.
5	Throttle position =°	Throttle position. 0° with the throttle closed and 75-100° with the throttle fully open.
6	Mass air flow, real = kg/h	Measured air consumption from the mass air flow (MAF) sensor. Normal value is approximately 8-13 kg/h at idling speed and warm engine.
7	Air consumption = mg/stroke	Air consumption per crankshaft revolution. Measurement range 0-1,389 mg/stroke. A measurement of the engine load. Normal value is approximately 100 mg/stroke when idling with the engine at operating temperature.
8	MAF real, MAF calculated, idle = kg/h	The difference between the measured consumption from the mass air flow (MAF) sensor and a calculated reference value. The value is only applicable during turbocharger (TC) control.
9	Battery voltage = V	Battery voltage after the system relay. Normal value is 13.5 -14.5 V when the generator (GEN) is charging.
10	Air temperature ° C	Intake air temperature measured after the charge air cooler (CAC)). Measurement range -48 to +142°C.
11	Ambient pressure =mbar	Atmospheric pressure, normal value is approximately 1000 mbar at sea level. The value varies depending on other circumstances.
12	Injection time = ms	Injector opening time. The normal value is approximately 2 ms when the engine is idling at operating temperature.
13	Lambda adaptation, part load = %	The value indicates how much the injection period at part load has been adjusted compared to a reference value. The value is first updated after the engine has been revved up.
14	Lambda adaptation, idle = ms	The value indicates how much the injection period at idling speed has been adjusted compared to a reference value. The value is first updated after the engine has been revved up.

Part 1 Of 3

15	Ignition angle = °	Measurement range 72° before top dead center (TDC) to 23° after top dead center (TDC). Normal value when idling is approximately 0-15°.
16	Lambda status	O/L= Open Loop, fuel trim not active C/L= Closed Loop, fuel trim active
17	Lambda integrator	Short-term fuel trim oscillates between -5 and +5 at lambda = 1 when the engine is idling at operating temperature.
18	Oxygen sensor front signal (Lambda) = V	Voltage from the front heated oxygen sensor (HO2S). Measurement range 0 -1 V. Oscillates between 0 and 1 V when fuel trim is activated.
19	Oxygen sensor signal, rear = V	Voltage from the rear heated oxygen sensor (HO2S). Measurement range 0 -1 V. Oscillates between 0 and 1 V when the three-way catalytic converter (TWC) is cold (>300°C). Stabilizes at 0.2-0.7 V when the three-way catalytic converter (TWC) is at operating temperature (<300°C)
20	Idle duty cycle = %	Idle air control (IAC) valve opening. Measurement range 0 - 100%. The normal value is approximately 20-40% when idling with the engine at operating temperature.
21	Idle air trim adaptation = %	The value shows by how much idle air control (IAC) valve opening has been adjusted in relation to a predetermined value. Measurement range -50 to +50%.
22	Idle adaptation, A/C = %	Idle air trim adaptation with the A/C compressor activated. The value shows by how much idle air control (IAC) valve opening has been adjusted in relation to a reference value.
23	Turbo control valve duty cycle = %	Turbocharger (TC) control valve opening. Measurement range 0 - 100%. A value over 0% means the engine power is regulated using the valve. The value only applies when the turbocharger control valve is activated.
24	EVAP duty cycle = %	EVAP valve opening. Measurement range 0-100%. 0% EVAP valve shut. 100% EVAP valve fully open. The intermediate values depend on the opening of the EVAP valve

Part 2 Of 3

25	A/C-pressure = mbar	Pressure in the air conditioning (A/C) system. Measurement range 0 - 3442 mbar.
26	A/C demand =	Displays whether the engine control module (ECM) has requested that the ECC control module starts the air conditioning (A/C) compressor. The A/C-compressor is permitted to start if the air conditioning (A/C) pressure is below a parameter. Yes = ECC requests that the A/C compressor starts. No = ECC does not request that the A/C compressor starts.
27	A/C relay	Yes = A/C relay activated. No = A/C relay not activated.
28	Immo locked =	NO= Immobilizer control module permits start. Yes = Immobilizer control module does not permit start.
29	VIN learned =	Yes = Engine control module (ECM) has learned the VIN-code. No = Engine control module (ECM) has not learned any VIN-code.
30	Faulty VIN =	Yes = Different VIN codes in the immobilizer control module and engine control module (ECM). No = Immobilizer control module and engine control module (ECM) have the same VIN-code. The parameter is relevant only when the communication between the immobilizer control module and the engine control module (ECM) is functioning.
31	Manifold pressure = hpa	The pressure in the intake system. Measurement range 0 -2400 mbar. Normal value when idling is approximately 400 mbar.
32	Camshaft position = °	The camshaft position in relation to crankshaft. Measurement range - 66° - 30°. The value varies depending on how camshaft is controlled. Camshaft control only occurs when the engine is cold.

Part 3 Of 3

Description of Activations

No.	Component	Function
1	Fuel pump / system relay.	The fuel pump (FP) is activated for 2 seconds. The system relay "clicks". The fuel pump (FP) "buzzes".
2	the canister purge (CP) valve.	The canister purge (CP) valve is activated once for 1 second. The valve clicks.
3	Turbocharger (TC) control valve.	The turbocharger (TC) control valve is activated 4 times for 1 seconds. The valve clicks.
4	Engine cooling fan (FC), low-speed.	Engine cooling fan (FC) low-speed, the fan runs for 3 seconds. The fan can be heard clearly.
5	Engine cooling fan (FC), high-speed.	Engine cooling fan (FC) high-speed, the fan runs for 3 seconds. The fan can be heard clearly.
6	A/C fan.	Air conditioning (A/C) condenser cooling fan, the fan runs for 3 seconds. The fan can be heard clearly.
7	Air conditioning (A/C) relay.	Air conditioning (A/C) relay, the relay is activated once for 4 second. A clicking noise is heard from the compressor clutch.
8	Injector 1.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
9	Injector 2.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
10	Injector 3.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
11	Injector 4.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
12	Idle air control (IAC) valve.	The idle air control (IAC) valve is activated and deactivated at a frequency of 0.2 Hz. A buzzing noise is heard from the valve.
13	Malfunction indicator lamp (MIL).	The malfunction indicator lamp (MIL) goes out for 1 second then lights up again.
14	Front heated oxygen sensor (HO2S).	Front heated oxygen sensor (HO2S) preheating, the heating is on for 1 second. Connect a voltmeter between connector terminal #1 (control module side) and ground. Check the signal.
15	Rear heated oxygen sensor (HO2S).	Rear heated oxygen sensor (HO2S) preheating, the heating is on for 1 second. Connect a voltmeter between connector terminal #1 (control module side) and ground. Check the signal.

Hint: Activate components and/or functions by clicking the VCT2000 symbol.

Note! Components cannot be activated when the engine is running.

Many of these activations will cause the Fuel Pump **(FP)** to start. This is because the system relay is activated to supply the components with power.

Reading Off Parameters

Note! To obtain the relevant values, the engine must be running and the Engine Control Module **(ECM)** must be initiated. The Engine Control Module **(ECM)** is initiated the first time engine speed exceeds 600 rpm.

Certain values may deviate from the values listed in DSA signal description. This is because the values given by VADIS/VIDA are calculated and filtered by the DSA control module.

No.	TEXT size	Remarks
1	RPM= rpm	Engine Speed (RPM), crankshaft. Measurement range: 0 and up. Idling speed approximately 800 rpm. The DSA control module derives the engine speed (rpm) from the load signal transmitted by the engine control module (ECM). The DSA control module uses the load signal to calculate anti-spin control.
2	LOAD TQ= [mu]s	Load signal from the engine control module (ECM). Measurement range: 0 - 680 [mu]s. Normal range idling with the engine at operating temperature, neutral selected and the air conditioning (A/C) off: approximately 36 [mu]s. The DSA control module uses the load signal to calculate anti-spin control. Value 16 [mu]s indicates when the engine is started. Value 20 [mu]s indicates fuel shut-off in the engine. Value 480 [mu]s indicates that the engine control module (ECM) is being initiated or that there is a fault in the engine control module (ECM). Value 512 [mu]s indicates a fault in the signal from the pressure sensor to the engine control module (ECM).
3	THROT ANG= %	Throttle position (TP) sensor position. Measurement range: 0 - 100 %. Normal value at closed throttle position (CTP): approximately 0 %, wide open throttle (WOT): approximately 100 %. Signal from the engine control module (ECM) about the position of the throttle position (TP) sensor. The DSA control module uses the throttle position (TP) sensor signal to calculate anti-spin control.
4	TO REDUC=	Torque limiting for anti-spin control. 0 = no torque limiting requested. 1 - 16 = torque limiting requested. The DSA control module requests torque limiting from the engine control module (ECM) during anti-spin control. Torque limiting is carried out by shutting off one or more injectors. Torque limiting can be carried out at 16 different levels. Level 1 means that one cylinder is shut off once during four cycles. Level 4 means that the same cylinder is shut off four times during four cycles, i e. all the time. Level 8 means that 2 cylinders are shut off all the time. Finally, level 16 means that all cylinders are shut off all the time.
5	TRANSM= MAN/AUT	Transmission type. MAN = manual transmission. AUT = automatic transmission. The engine control module (ECM) transmits a signal to the DSA control module about the type of transmission. The engine control module (ECM) detects whether there is a signal from the gear-shift position sensor. If there is a signal, the engine control module (ECM) interprets this as an automatic transmission and transmits a signal to the DSA control module. Until the engine control module (ECM) receives a signal from the gear-shift position sensor, the DSA control module interprets it as a manual transmission.

Part 1 Of 3

6	INIT ECM= NO/YES	Initiation of the engine control module (ECM). NO = initiation not carried out. YES = initiation carried out. The DSA control module establishes communication with the engine control module (ECM) when the engine speed exceeds 600 rpm for the first time in the ignition cycle. This informs the engine control module (ECM) that there is a DSA system. No anti-spin control van take place until the control module is initiated.
7	DSA FUNC= NO/YES	Activation of the DSA function. NO = The DSA function is disengaged. YES = The DSA function is engaged. When the DSA function is engaged, the system is ready to control. The DSA function can be disengaged with the DSA switch. It will also be disengaged if there is a fault in the DSA system or certain faults in the engine management system.
8	DSA SWITCH= ON/OFF	DSA switch. OFF = The DSA switch is not activated. ON = The DSA switch is activated. The signal from the DSA switch is used to engage / disengage the DSA function.
9	WARN LAMP= ON/OFF	The indicator amp and DSA warning lamp in the combined instrument panel. OFF = The DSA warning lamp is off. ON = The DSA warning lamp is on. The DSA warning lamp lights when the ignition is switched on, when the DSA function is disengaged manually with the DSA switch or if the DSA control module has detected a fault in the system. If no fault is detected, the DSA warning lamp goes out when the engine speed (RPM) exceeds 600 rpm.
10	W/LAMP FLASH= NO/YES	The indicator lamp and DSA warning lamp in the combined instrument panel. NO = The DSA warning lamp does not flash. YES = The DSA warning lamp flashes. The DSA warning lamp flashes at a frequency of 1.8 Hz during anti-spin control.
11	BRAKES= ON/OFF	Stop (brake) light switch status. OFF= The stop (brake) lamp switch is not activated. ON = the stop (brake) light switch is activated. The signal from the stop (brake) lamp switch is used to prevent wheel adaptation during braking.
12 13 14 15	WS LF= WS RF= WS LR= WS RR= km/h	Wheel speed left front wheel. Wheel speed right front wheel. Wheel speed left rear wheel. Wheel speed right rear wheel. Measurement range: 0 - 256 km/h. The ABS control module transmits signals to the DSA control module about the wheel speeds. The DSA control module uses the wheel speed signals to calculate the wheel speed and anti-spin control.

Part 2 Of 3

16 17 18 19	WH AD LF= WH AD RF= WH AD LR= WH AD RR= %	Wheel adaptation, left front wheel. Wheel adaptation, right front wheel. Wheel adaptation, left rear wheel. Wheel adaptation, right rear wheel. Measurement range: 75.00 - 125.00 %. At a constant vehicle speed, the wheel speed varies between the four wheels depending on load, air pressure, wear, tire make etc. The of adaptation is to even out wheel speeds so that DSA control module calculations are based on the same level of wheel speed. At the same speed on all wheels, the adaptation is approximately 100 %. If the speed of one wheel is lower than that of the others (the wheel has a greater circumference), the adaptation will be greater than 100 %. This is to raise the speed level. If the speed of one wheel is higher than that of the others (the wheel has a smaller circumference), the adaptation will be less than 100 %. This is to lower the speed level.
20	WH AD ON= NO/YES	Wheel adaptation permitted. NO = wheel adaptation is not permitted. YES = wheel adaptation is permitted. Wheel adaptation is permitted in normal driving conditions - on a flat road at constant speed and light load in a speed range up to approximately 90 km/h.

Part 3 Of 3

Activating Components / Functions

No.	Component / function	Remarks
1	TOR LIMIT	Torque limiting for anti-spin control. Level 4 request for torque limiting to the engine control module (ECM). Level 4 means that the same cylinder is shut off four times during four cycles, i e. all the time. The engine idles unevenly. The DSA warning lamp flashes during this activation.
2	W/LAMP FLASH	The indicator lamp and DSA warning lamp in the combined instrument panel. The DSA warning lamp flashes at a frequency of 1.8 Hz.

Note!

^ To activate components, the engine must be idling. Activation occurs for approximately 20 seconds.

^ After Activation is completed, the DSA function is disconnected. The DSA function is re-engaged using the DSA switch. If no Diagnostic Trouble Codes **(DTCs)** have been stored, the DSA warning lamp goes out after engagement.

Abbreviations

ABBREVIATIONS

A

A/C AC Air Conditioning System (A/C System)
AP Accelerator pedal
ACL Air cleaner

C

CAC Charge air cooler****
CCM Climate control module
GEM Central electronic module
CFI Continuous fuel injection
CKP Crankshaft position
CMP Camshaft position
CTP Closed throttle position

D

DI Distributor
DLC Data link connector (DLC)
DTC Diagnostic trouble code
DTM Diagnostic test mode (DTM)****
DSA Dynamic Stability Assistance

E

ECC Electronic climate control with air conditioning (A/C)
ECM Engine control module
ECT Engine coolant temperature
EGR Exhaust gas recirculation
EI Electronic ignition
EVAP Evaporative control system

F

FC Fan control
FP Fuel pump

G

GEN Generator

H

HO2S Heated oxygen sensor

I

IAC Idle air control
IAT Intake air temperature
ICM Ignition control module

K

KS Knocksensor

M

MAF	Mass air flow
MAP	Manifold absolute pressure****
MCC	Manual climate control with air conditioning (A/C)
MFI	Multiport****fuel injection
MIL	Malfunction indicator lamp

N

NTC	Negative temperature coefficient

O

02S	Oxygen sensor (not heated)
OBD	On-board diagnostic system

P

PAIR	Pulsed secondary air injection system
PNP	Park / neutral position (shift-lock) switch****
PTC	Positive temperature coefficient
PWM	Pulse width modulated

R

RPM	Engine speed

S

SRI	Service reminder indicator
SRS	Supplementary restraint system (airbag)
ST	Volvo Scan Tool
STD	Manual climate control without air conditioning (A/C)

T

TB	Throttle body
TC	Turbocharger
TCM	Transmission control module
TDC	Top dead center
TP	Throttle position
TWC	Three-way catalytic converter

V

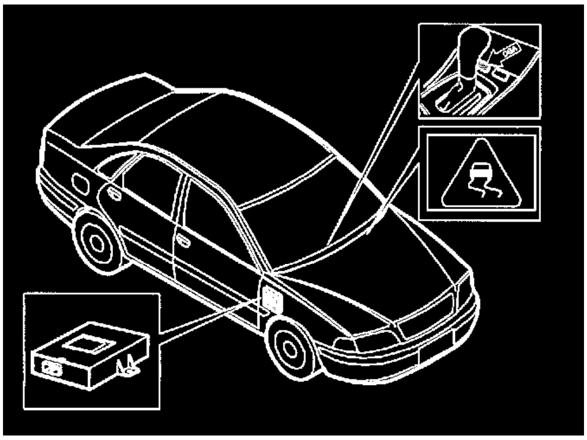
VSS	Vehicle speed sensor

W

WOT	Wide open throttle

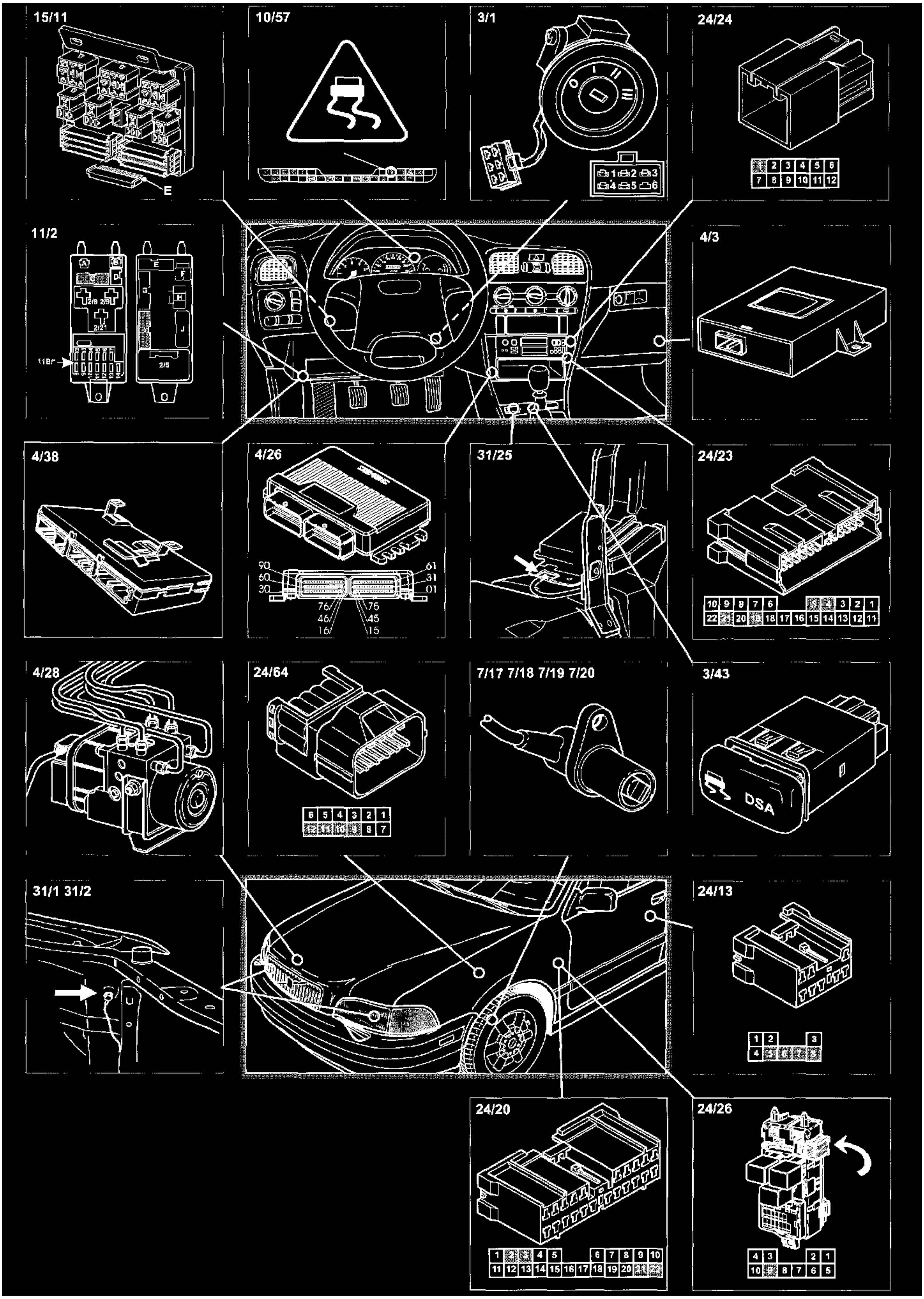
Computers and Control Systems: Locations
DSA Control Module

DSA System



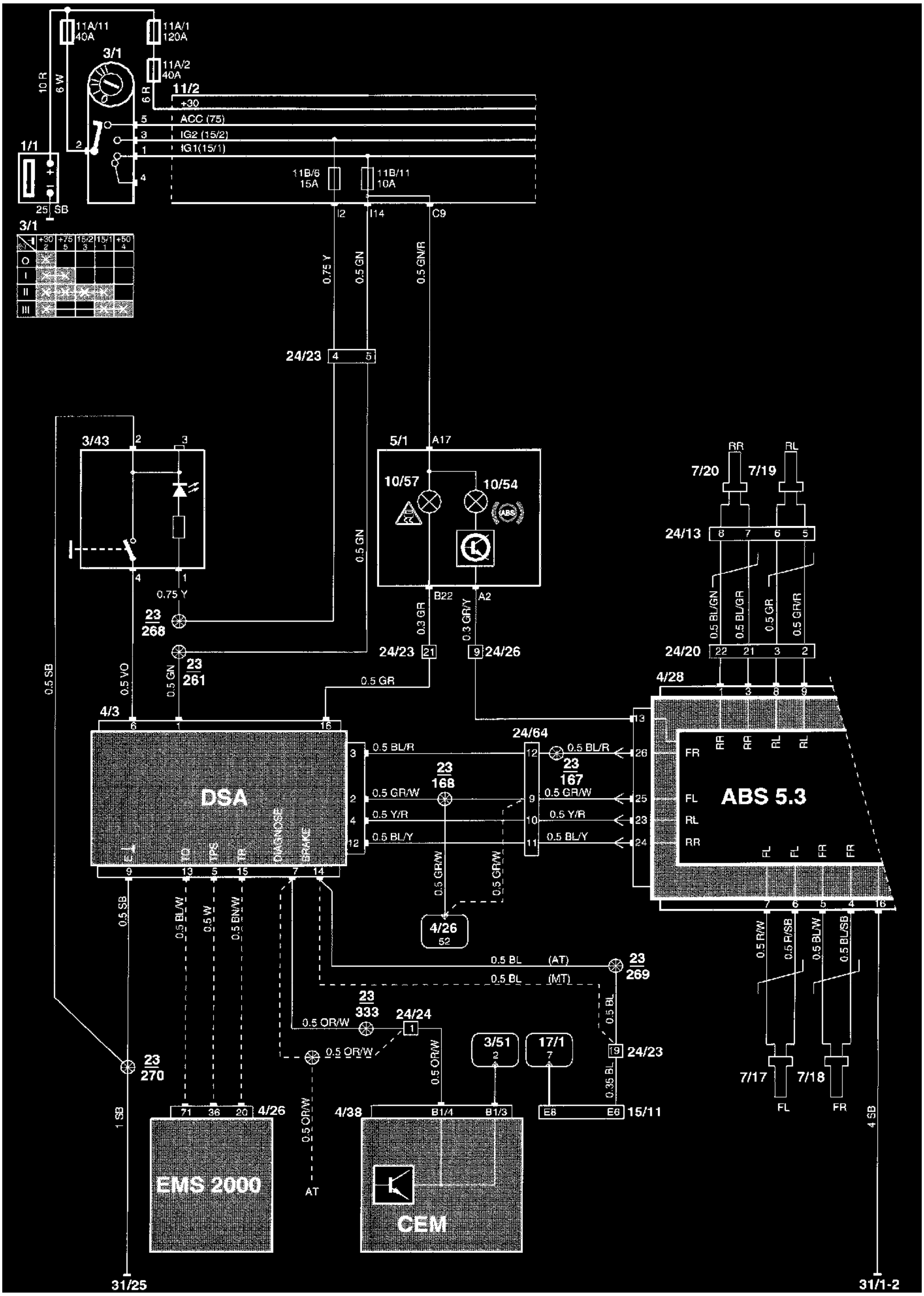
Control module, DSA warning lamp and DSA switch.

Computers and Control Systems: Locations
Dynamic Stability System (DSA)



Dynamic stability system (DSA), Part 2 Of 2

Component Locations



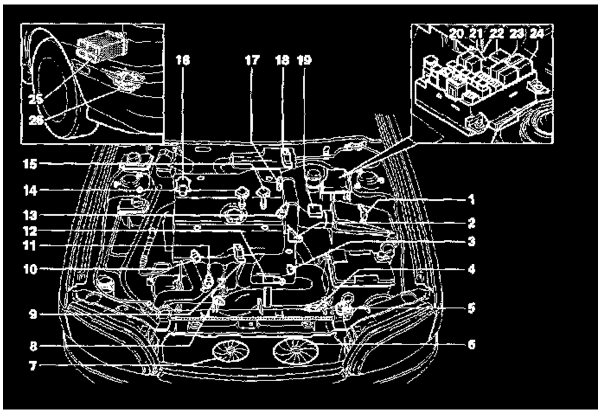
Dynamic Stability System (DSA), Part 1 Of 2

Wiring Diagram

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagrams/Diagram Information and Instructions/List of Components By Component Number

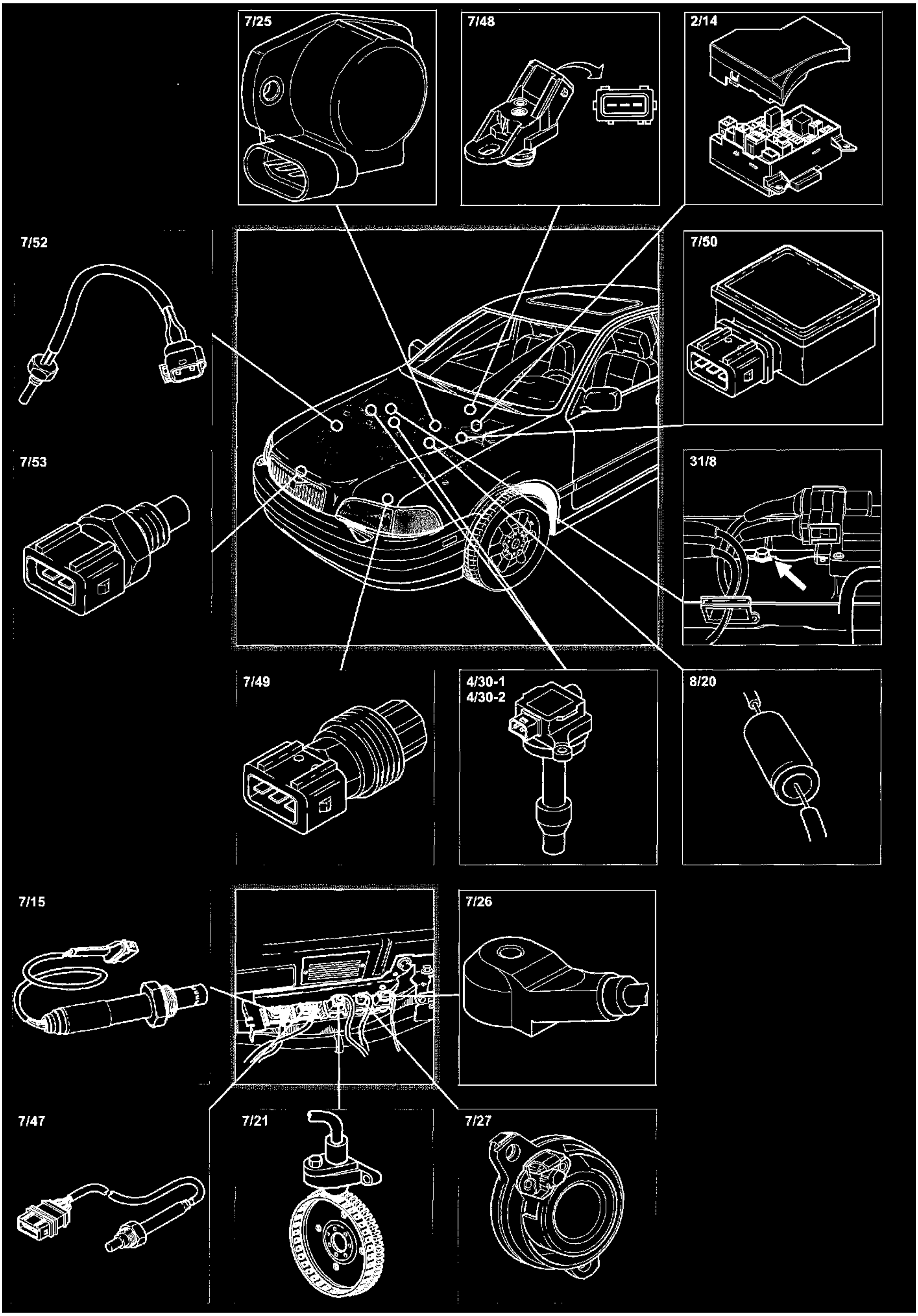
Computers and Control Systems: Locations
Engine Compartment

Engine Compartment



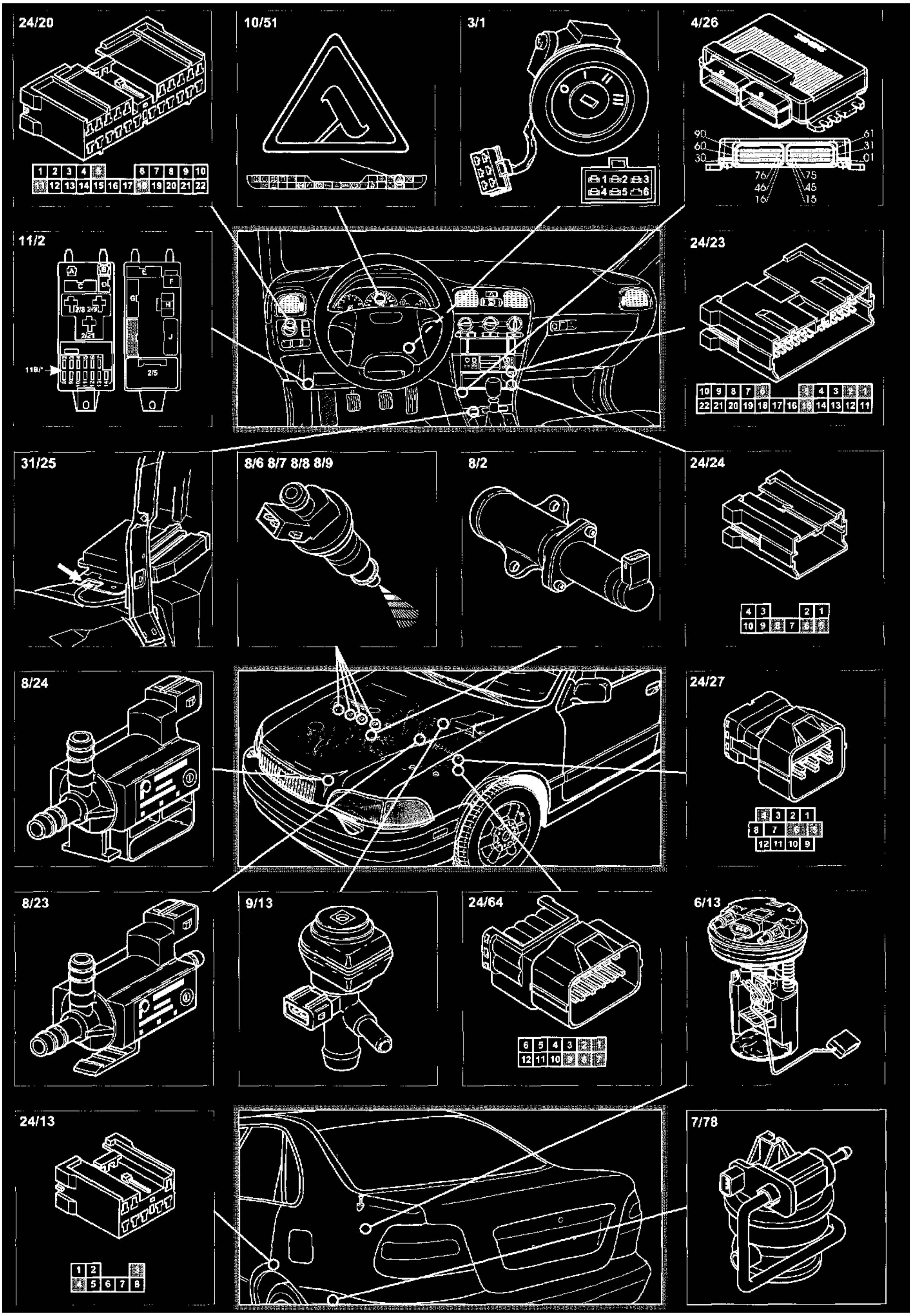
	Component	Location
1	Turbo control valve (TCV)	On the rear side of the air filter cover
2	Engine speed sensor (RPM)	On the engine, on the flywheel side
3	Throttle position sensor (TP)	On the throttle housing
4	EVAP purge valve	The electrical valve is situated on the coolant radiator
5	A/C linear pressure sensor	In the A/C dryer
6	Engine coolant fan (FC)	The left fan behind the radiator
7	Condenser fan	The right fan (small) behind the radiator
8	Intake air temperature sensor (IAT)	On the cold intercooler side. Underneath the connecting pipe to the inlet manifold
9	Manifold absolute pressure sensor (MAP)	Located on the inlet manifold between cylinder 3 and 4
10	Engine coolant temperature sensor (ECT)	Central coolant temperature sensor. The EMS 2000 communicates the temperature to the instrument as well
11	Knock sensor (KC)	On the front side of the engine between cylinders 2 and 3
12	Idle air control valve (IAC)	On the inlet manifold
13	PCV heating	The crankcase ventilation heating is on the hose, near the turbo compressor
14	Ignition coil	Cylinders 2 and 3
15	Ignition coil	Cylinders 1 and 4
16	VVT valve	Mounted on the cylinder head. Regulates the exhaust camshaft
17	Camshaft position sensor (CMP)	On the exhaust camshaft
18	Altitude sensor	On the bracket, with the connectors underneath the cover
19	Mass airflow sensor (MAF)	Outlet air filter
20	Relay A/C compressor	In relay box
21	Relay coolant fan (FC) speed 2	In relay box
22	System relay	In relay box
23	Relay condenser fan	In relay box
24	Relay FC speed 1	In relay box
25	EVAP canister	Located on the fuel tank
26	LDP pump	Located on the member to the rear

Computers and Control Systems: Locations
Fuel Injection System



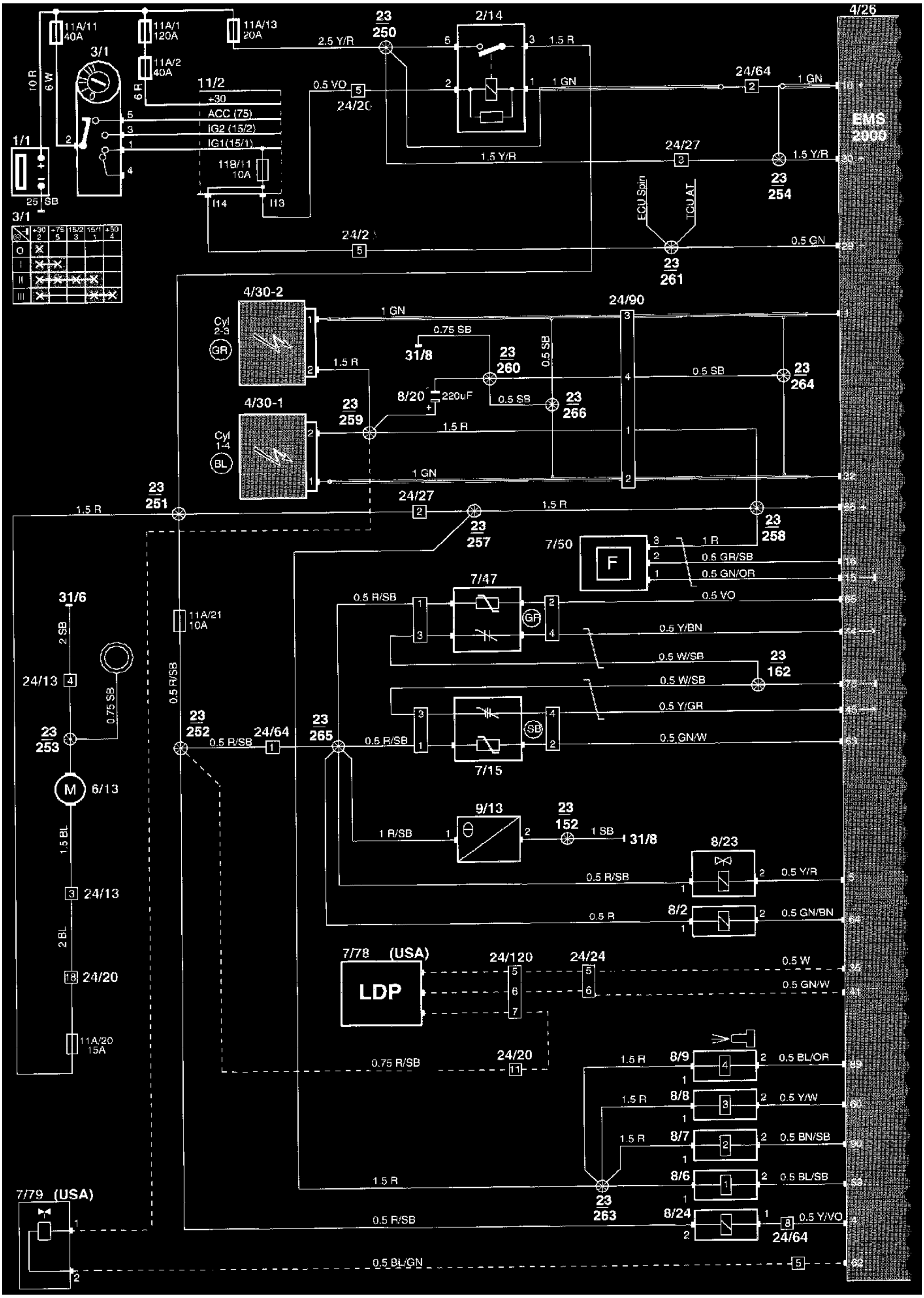
Fuel Injection System EMS 2000 Turbo, Part 3 Of 4

Component Locations



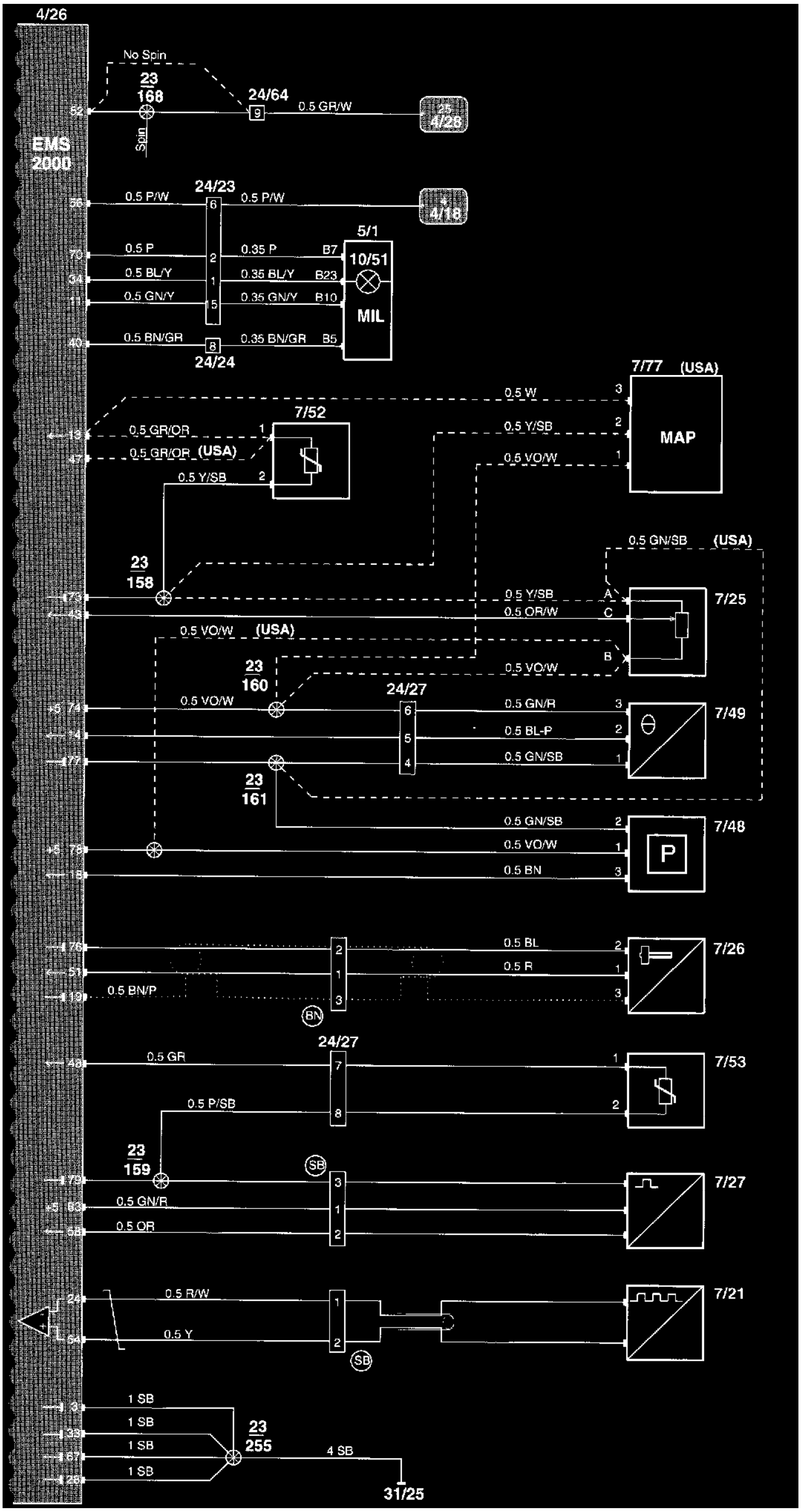
Fuel Injection System EMS 2000 Turbo, Part 4 Of 4

Component Locations



Fuel Injection System EMS 2000 Turbo, Part 1 Of 4

Wiring Diagram

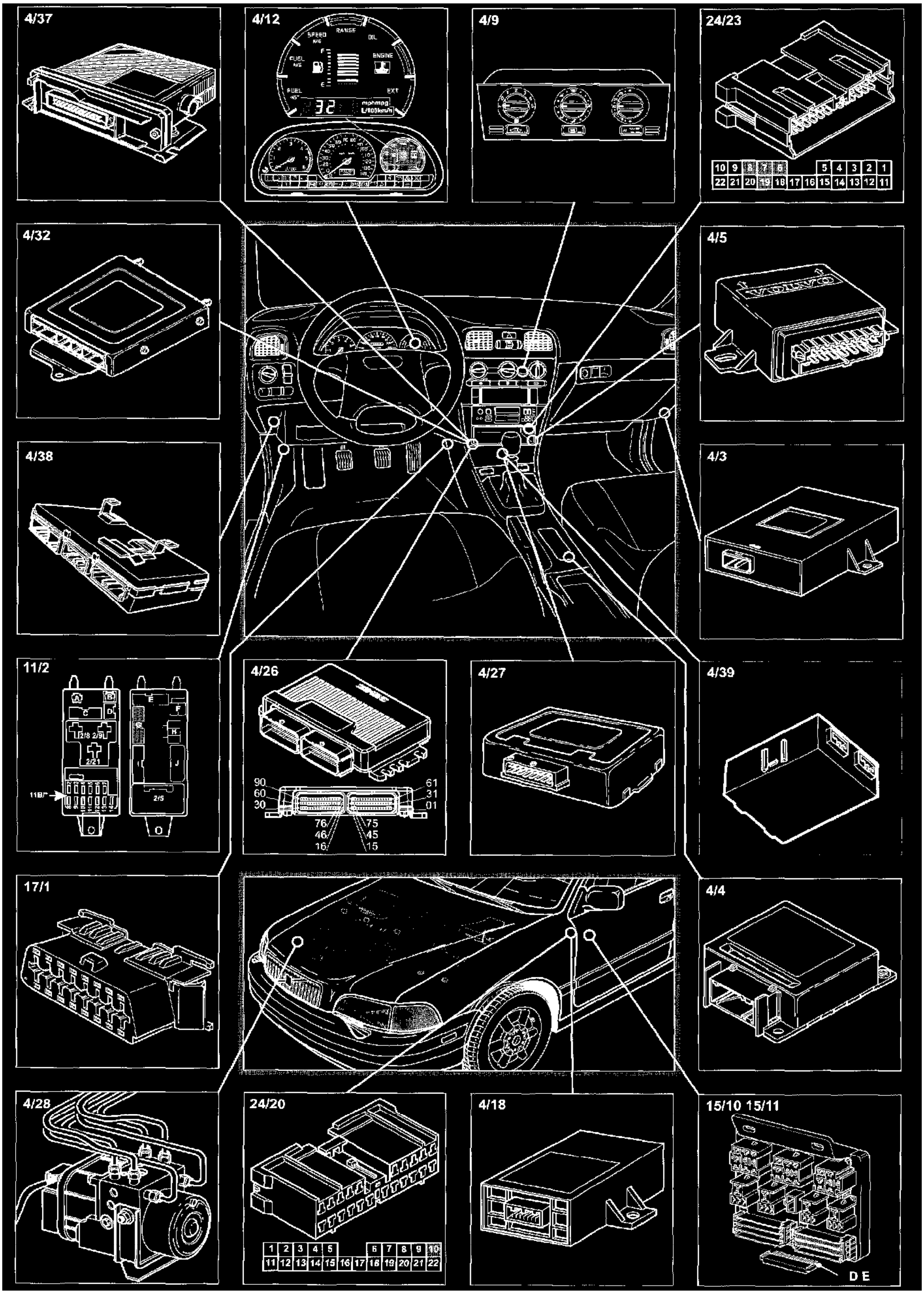


Fuel Injection System EMS 2000 Turbo, Part 2 Of 4

Wiring Diagram

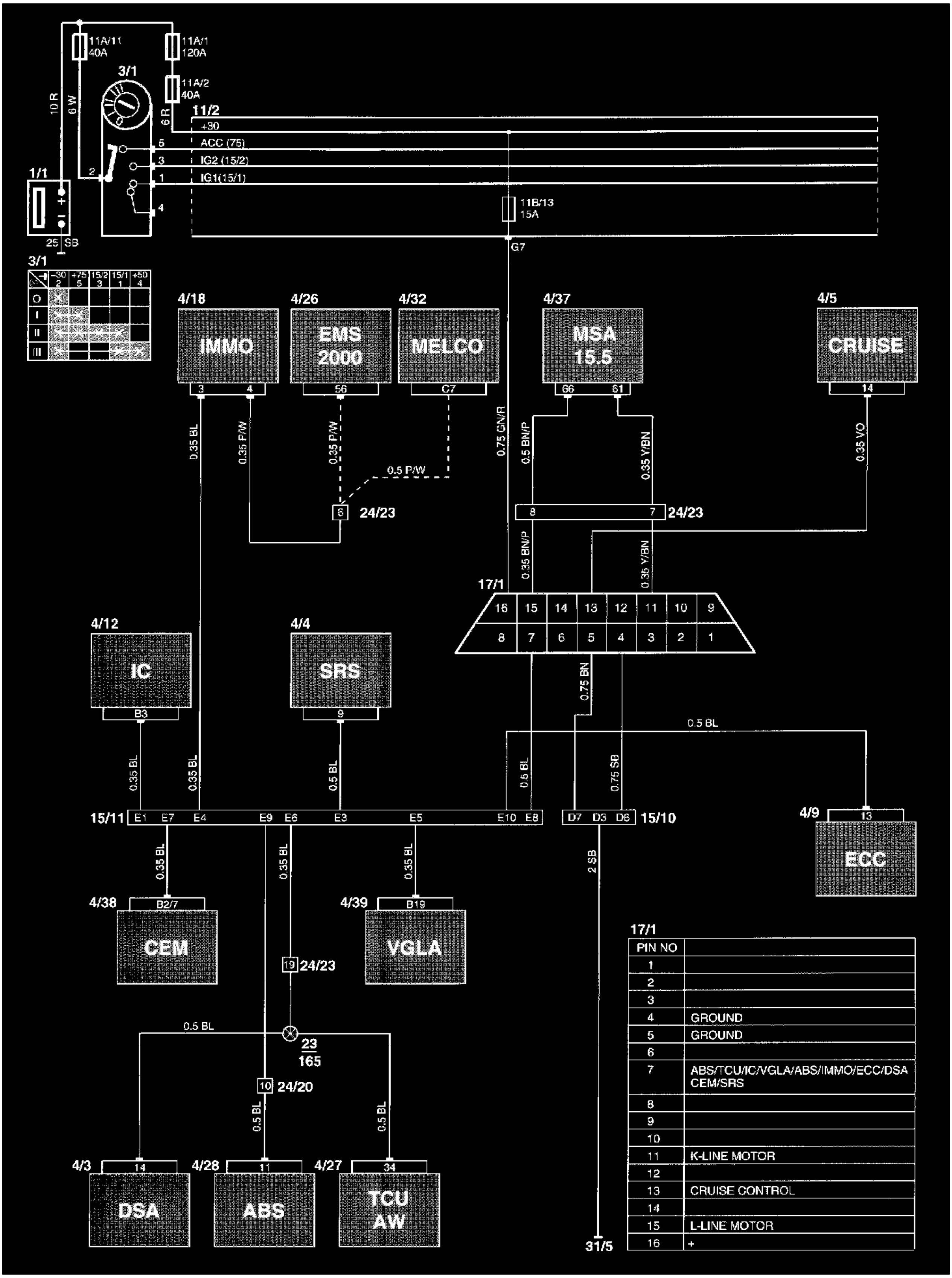
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagrams/Diagram Information and Instructions/List of Components By Component Number

Computers and Control Systems: Locations
On-Board Diagnostic System (OBD System)



On-Board Diagnostic (OBD) System, Part 2 Of 2

Component Locations



On-Board Diagnostic (OBD) System, Part 1 Of 2

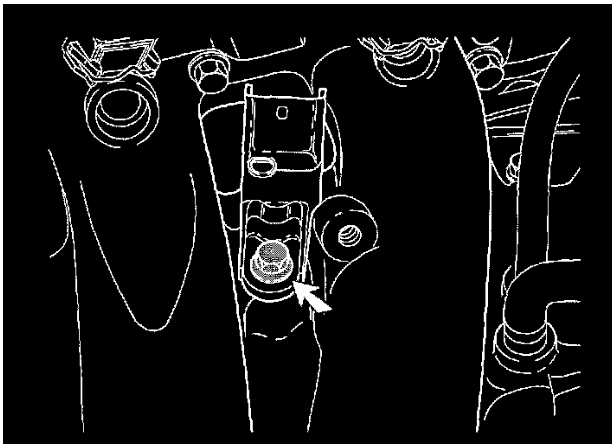
Wiring Diagram

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagrams/Diagram Information and Instructions/List of Components By Component Number

Absolute Pressure Sensor: Service and Repair

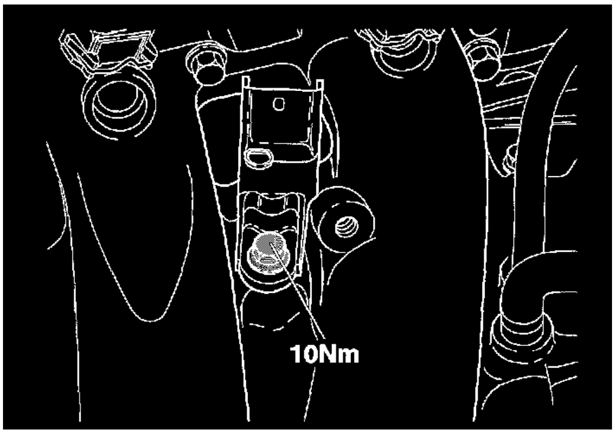
Remove fuel rail cover
- Remove cover throttle body
- Pull off fuel rail cover.

Remove MAP sensor



- Undo the connector
- Remove the bolt and take MAP sensor out.

Install MAP sensor

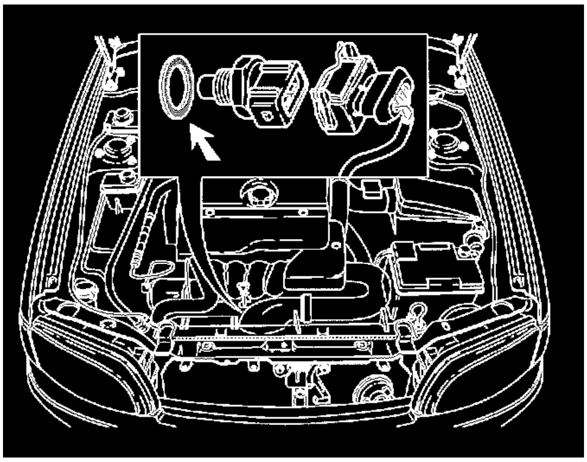


- Replace a new sealing ring (O-ring)
- Place sensor and tighten till **10 Nm**
- Fit the connector.

Install fuel rail cover
- Place cover and press on
- Fit throttle body cover.

Intake Air Temperature Sensor: Service and Repair

Removing the temperature sensor



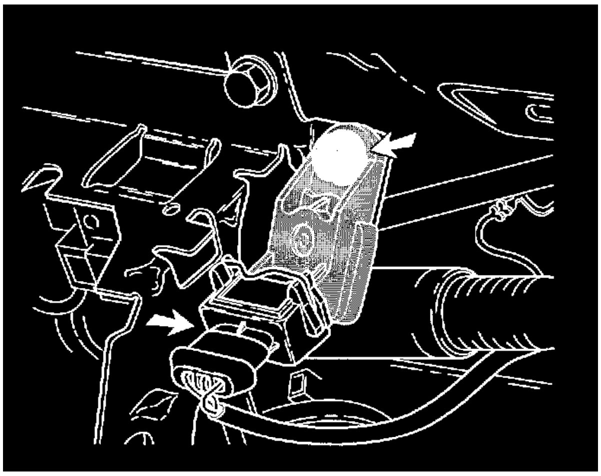
- Remove the front engine cover.
- Disconnect the connector.
- Remove the temperature sensor.

Installing the temperature sensor

- Use a new sealing ring.
- Install the temperature sensor. Tighten the temperature sensor to **25 Nm.**
- Reconnect the connector.
- Reinstall the front engine cover.

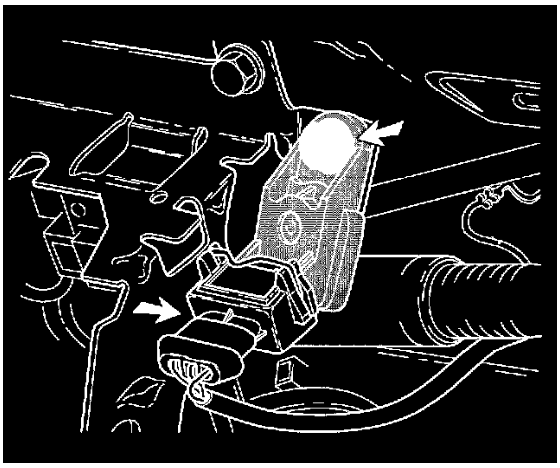
Barometric Pressure Sensor: Service and Repair

Removing the atmospheric pressure sensor



- Remove the relay cover.
- Disconnect the connector.
- Remove the screw. Remove the atmospheric pressure sensor.

Installing the atmospheric pressure sensor

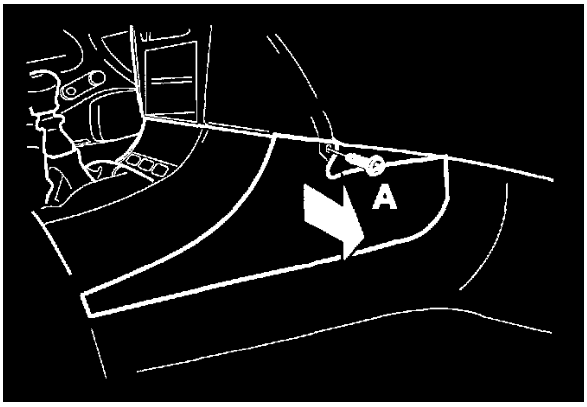


- Install the atmospheric pressure sensor. Tighten the atmospheric pressure sensor to **10 Nm.**
- Reconnect the connector.
- Reinstall the relay cover.
  Start the engine. Read off any Diagnostic Trouble Codes **(DTCs).**

Engine Control Module: Service and Repair
Replacing the Engine Control Module (ECM)

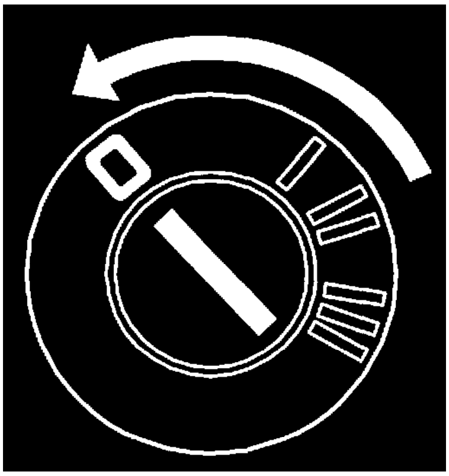
Preparations

Removing side panels



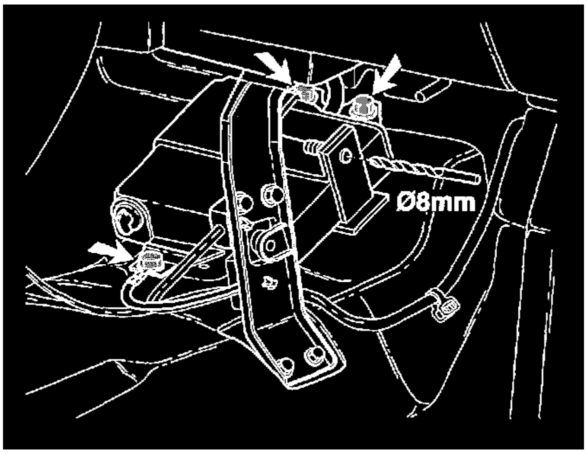
Remove the screw (A) on the left and right-hand sides.
Remove the side panel on the left and right-hand sides.

Switching off the ignition



Caution Switch off the ignition and wait for the engine Cooling Fan **(FC)** to stop running. Wait at least 30 seconds before disconnecting the control module connector.

Replacing the control module
Removing the control module



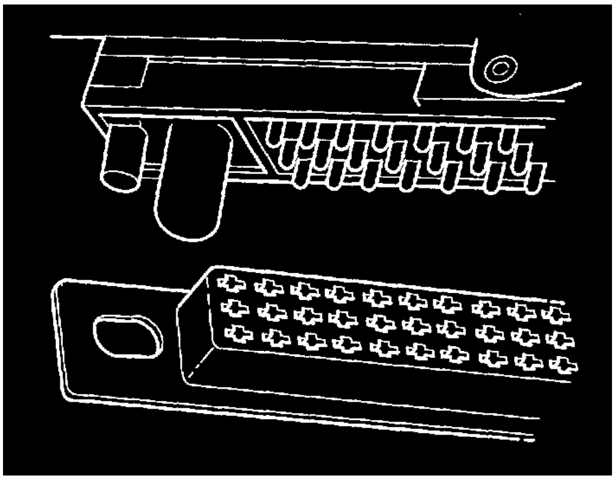
Drill out the security screw for the security strap.

Note! Remove swarf.

Remove the security strap.
Remove the screws securing the control module.

Work the control module forward on the right hand side.
Disconnect the connector.

Installing the control module



Check that no pins or sockets are damaged on the connector or the control module.
Connect the connector on the control module.
Screw the control module into place.
Reinstall the retaining strap and a new security screw

Finishing

Ordering software

Connect the VADIS station to the car.
Select the model, model year, engine alternative and enter the chassis number in the vehicle profile.
Order software according to the description in

Programming the control module

Program the control module according to parts supplier.

Reading and erasing diagnostic trouble codes (DTCs)

Read off and erase diagnostic trouble codes (DTCs).
Screw the Engine Control Module **(ECM)** into place.
Tighten the security screw.
Reinstall the side panels on the left and right-hand sides.
Test the function.

Engine Control Module: Service and Repair
Programming A New Control Module

Ordering Software

Ordering Software

PIN codes must be programmed into the control module after **a new** EMS2000 engine control module (ECM) has been installed in the car. The PIN codes are retrieved from the Volvo central database.
The new control module must be installed in the car before this programming is carried out. The malfunction indicator lamp (MIL) will flash on a new control module until the programming is complete.

NOTE: A new control module which is installed and programmed in a car is adapted for that particular car only. The engine control module (ECM) must not be moved to another car.

Order software for **S/V 40** according to.

After performing this procedure See: Programming Engine Control Modules (ECMs)

Programming Engine Control Modules (ECMs)

Programming Engine Control Modules (ECMs)

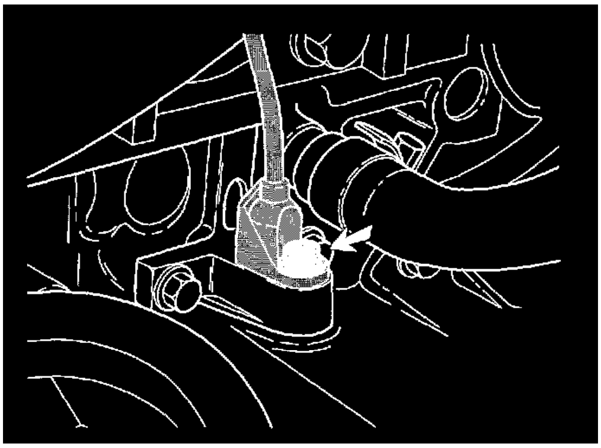
CAUTION
Programming can take place when the software is available.

Program the engine control module (ECM) for **S/V 40**.

Engine Speed Sensor: Service and Repair

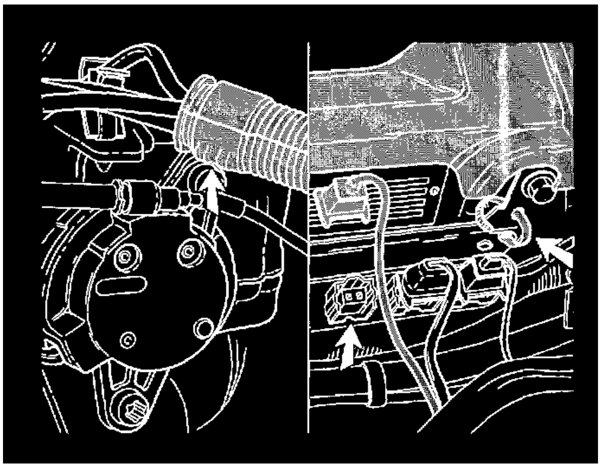
Remove
- Air Cleaner **(ACL)**, see Replacing the Air Cleaner **(ACL)**, refer to Fuel Delivery and Air Induction, Air Cleaner Housing.
- Engine cover.

Removing engine speed (RPM) sensor from engine



- Clean area around sensor
- Remove bolt and lift out sensor
- Release cable guide and remove engine speed (RPM) sensor wiring
- Pull cable upwards.

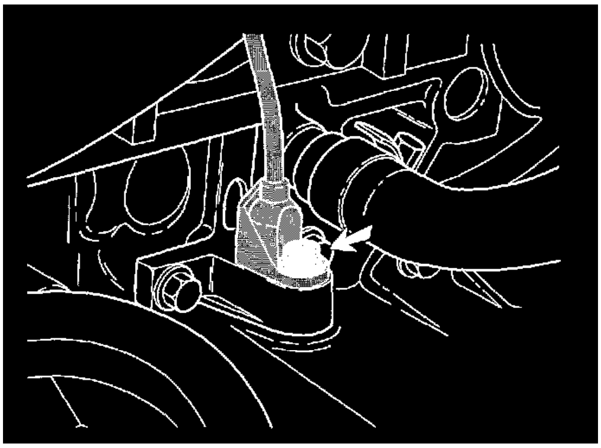
Removing engine speed (RPM) sensor



- Remove the two hose clamps from protective tube
- Carefully pull out the sensor
- Remove the relay cover and cut the tie strap
- Disconnect connector and lift off engine speed (RPM) sensor.

Installing engine speed (RPM) sensor
- Connect connector
- Clamp cable to the bracket with tie strap
- Route the cable via the protective tube to the cylinder head
- Close protective tube with two hose
- Reinstall relay cover.

Installing engine speed (RPM) sensor on the engine



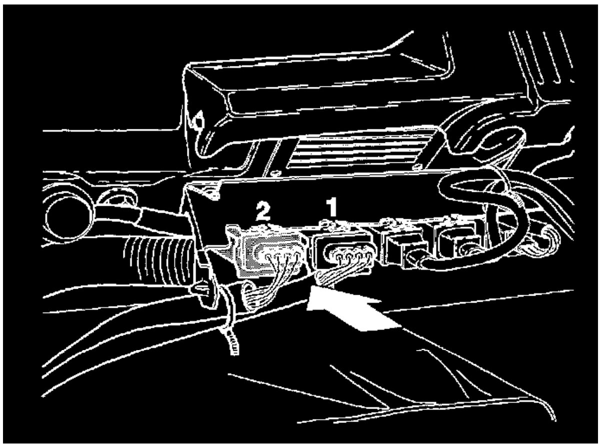
- Route the cable downwards
- Secure and tighten the cable guide
- Clean the sensor mounting surface
- Install engine speed (RPM) sensor. Tightening torque **10 Nm.**

Reconnect

- Air Cleaner **(ACL)**.
- Battery.
  Start engine. Read any Diagnostic Trouble Codes **(DTCs).**

Oxygen Sensor: Service and Repair
Front

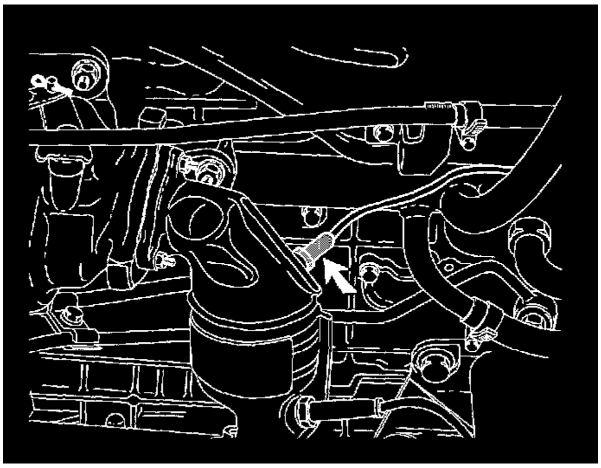
Removing heated oxygen sensor (H02S) wiring



Remove relay cover and disconnect connector from front (black (2)) or rear (white (1)) Heated Oxygen Sensor **(H02S),**

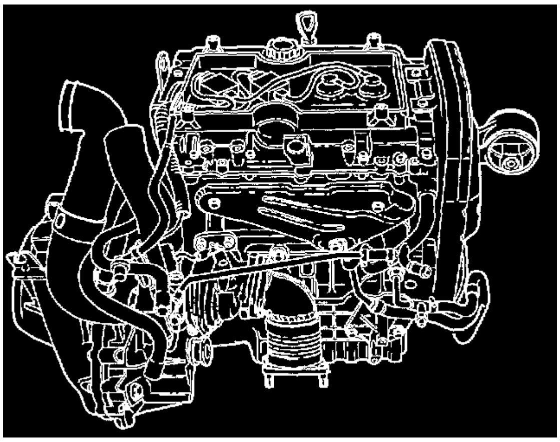
- Undo the cable wiring at the 3 fixing points
- 2 = black
- 1 = white.

Removing heated oxygen sensor (H02S)



- Apply rust removing agent
- Remove Heated Oxygen Sensor **(HO2S)**
- Remove the sealing ring.

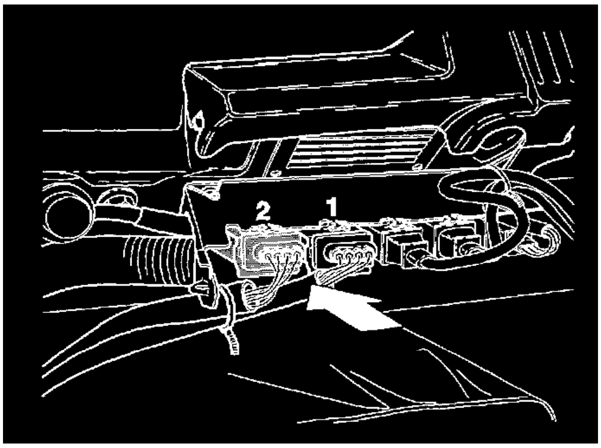
Installing heated oxygen sensor (H02S)



- Install a new seal ring. Apply copper paste (P/N 1161035-9) to the entire thread length. Tighten Heated Oxygen Sensor **(HO2S)** to **55 Nm**
- Place cable upwards.

Installing heated oxygen sensor (H02S) cable and connector

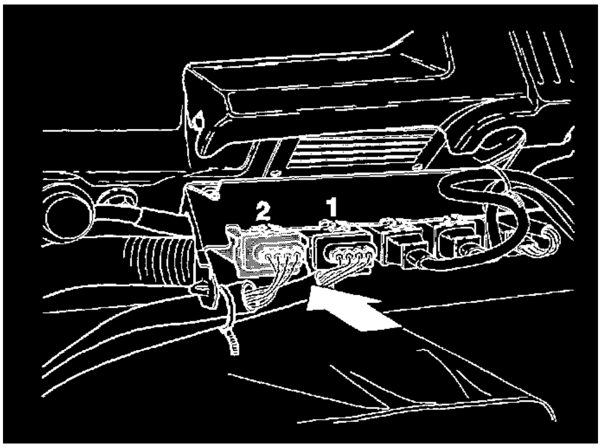
Note! Adjust wiring connections so that it does not come into contact with the exhaust system.



- Route cable and tighten at 3 places
- Connect connector and tighten cable to bracket
- Reinstall relay cover.

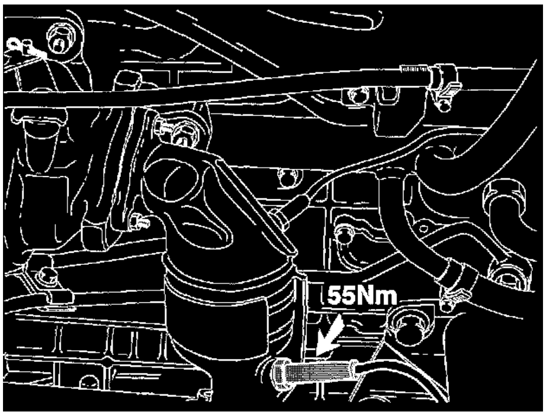
Oxygen Sensor: Service and Repair
Rear

Removing heated oxygen sensor (H02S) wiring



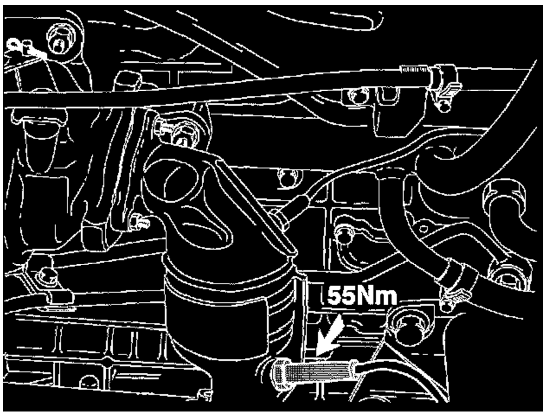
Remove relay cover and disconnect connector from front (black (2)) or rear (white (1)) heated oxygen sensor (H02S).
- Undo the cable wiring at the 3 fixing points
- Raise the car for the rear (lower) sensor.

Removing heated oxygen sensor (H02S)



- Apply rust removing agent
- Remove Heated Oxygen Sensor **(HO2S)**
- Remove the sealing ring.

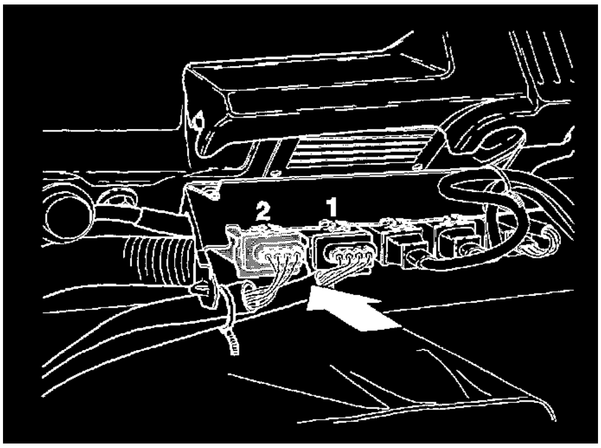
Installing heated oxygen sensor (H02S)



- Install a new seal ring. Apply copper paste (P/N 1161035- 9) to the entire thread length. Tighten Heated Oxygen Sensor **(HO2S)** to **55 Nm**
- Place cable upwards
- Lower the car for the rear (lower) sensor.

Installing heated oxygen sensor (H02S) cable and connector

Note! Adjust wiring connections so that it does not come into contact with the exhaust system.



- Route cable and tighten at 3 places
- Connect connector and tighten cable to bracket
- Reinstall relay cover.

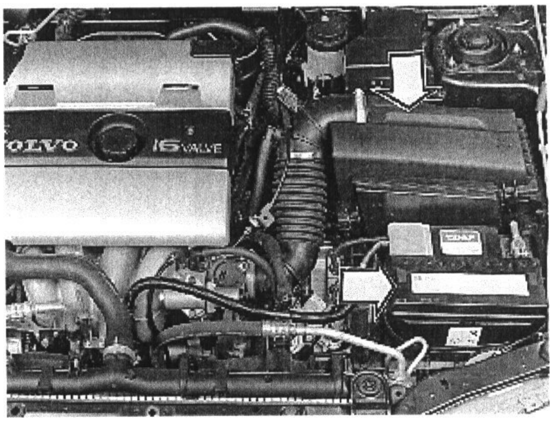
Transmission Position Switch/Sensor: Service and Repair

Replacing the gear-shift position sensor

Special tools: 9995-475

Removal

Preparations

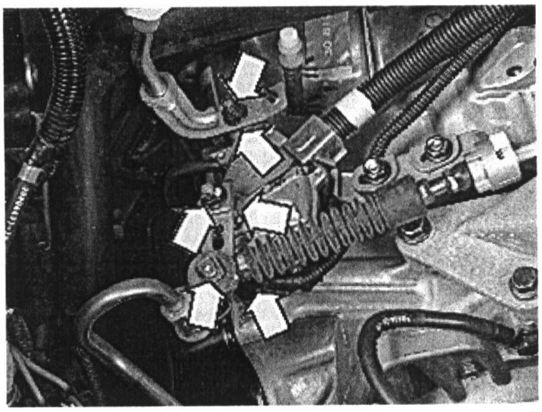


Remove:

- The battery.
- The air cleaner (ACL) housing assembly, see Replacing the air cleaner (ACL).
- The battery shelf.
- The tie straps from the cable harness for the sensor. (The straps can be reused.)

Disconnect the 10-pin connector from the sensor.

Removing the gear-shift position sensor



Remove:

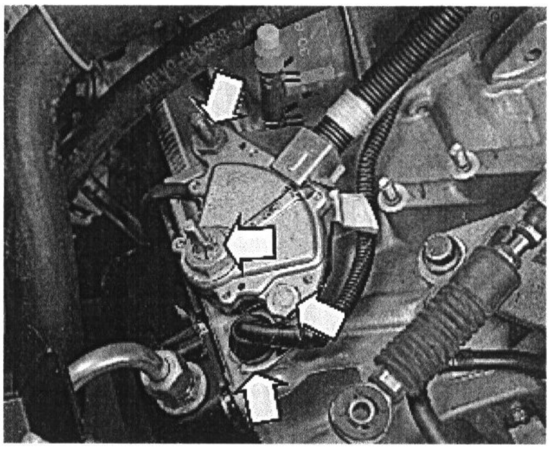
- The transmission cable from the lever.
- The lever.
- The nut, the locking washer and the rubber washer for the gear shift linkage rod.
- The dip stick pipe. Lift up the pipe and turn it to one side.
- The mounting screws for the gear-shift position sensor (two).

Carefully lift the sensor from the gear shift linkage rod.

If the metal tongue on the gear-shift position sensor gets stuck on the transmission cable bracket:

Remove the bracket and put it to one side.

Installing, adjusting and checking Installing the gear-shift position sensor



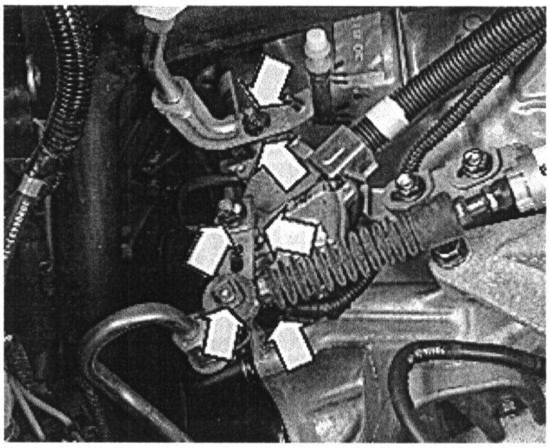
Ensure that the holder / spacer for the solenoid cable harness is in position.

Install:
- The sensor. Finger tighten the mounting screws.
- The rubber washer, the lock washer and the nut for the gear shift linkage rod. Lock the nut with the washer.

Adjusting and checking

Adjust the gear-shift position sensor.

Installation, continued



Install:
- The bracket for the dip stick pipe. Ensure that the O-ring is in position.

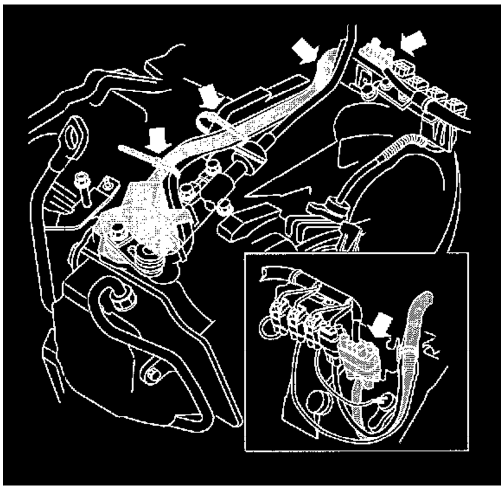
  Tighten the nut Torque: 25 Nm

- The lever on the gear shift linkage rod.

  Torque: 16 Nm

- The transmission cable on the lever with a washer and retaining clip. Apply a small amount of grease (P/N 1161241-3) to the lever shaft journal. If the transmission cable bracket was removed: Install the bracket. Adjust the transmission cable.

Installing connectors / cable harnesses

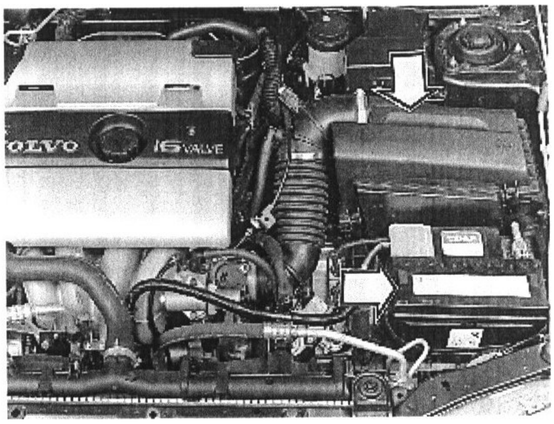


Connect the gear-shift position sensor connector. Install the connector on the bracket.

Clamp the cable harness for the sensor to the cable harnesses for the solenoids and oil temperature sensor.

Clamp the cable harnesses under the transmission cable harness and the gear-shift position sensor.

Installing engine compartment components



Install:
- The battery shelf
- The air cleaner (ACL) housing assembly, see Replacing the air cleaner (ACL).
- The battery

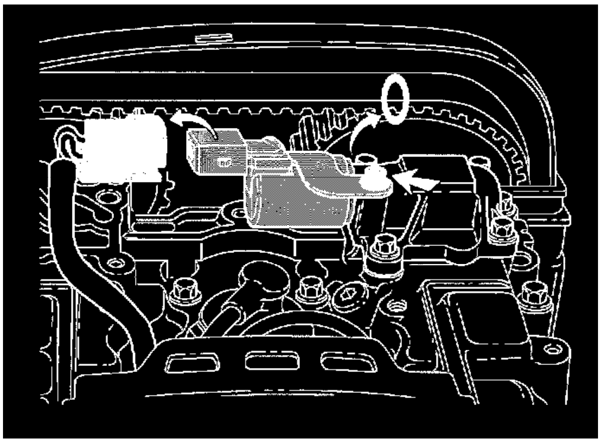
Checking diagnostic trouble codes (DTCs)

Check and erase any diagnostic trouble codes (DTCs). Check the positions of the gear-shift position sensor. If it is not possible to use VCT 2000 as a handheld test tool, use the Volvo Scan Tool (ST) as the test instrument instead. To connect the Volvo Scan Tool (ST), see Connecting the Volvo Scan Tool (ST).

Variable Valve Timing Solenoid: Service and Repair

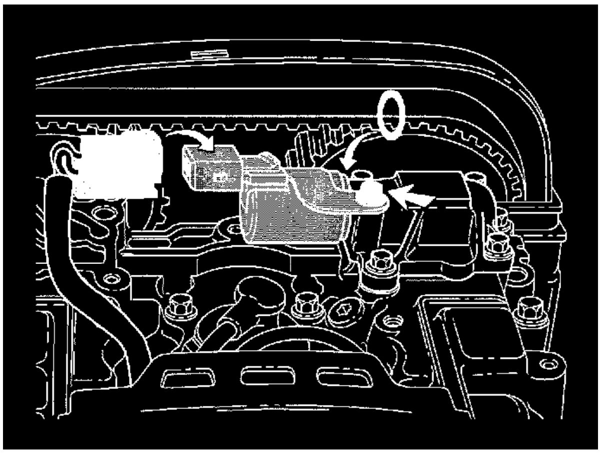
Remove the cover from the timing gear

Removing the variable valve timing system



- Remove the connector and the wiring beside the connector
- Remove the screw
- Carefully pull the device off
- Remove the O-ring.

Install the variable valve timing system



- Wipe up any spilled oil. Clean the mating surfaces
- Install a new O-ring
- Position the system. Turn the system into the correct position
- Install the bolt. Tighten to **8 Nm**
- Connect the wiring.

Install the cover on the timing gear
Start the engine. Check for leakage.

Vehicle: Specifications

Air Bag Systems

Electrical Specifications

Control module

Operating current	9-16 V, type 13.5 V
Wait position	<=9 [plusmn] 0.5 V (leaves wait position at >10 V)
SRS indicator lamp on	<=9 [plusmn] 0.5 V (low voltage warning)
Polarity shield	>= -16 V constantly
Over charging	18 V for 2 hours
Jump start	24 V max 1 minute
Start-up time	<= 3.5 - 6.5 s, type 5 s for full function

Battery

Battery

System Voltage

The electrical system voltage, with ignition off	12.5-12.7 V
Ground terminal	Minus terminal

Capacity

Cold Cranking Amps* CCA	Capacity	Reserve capacity RC	Recommended Charge current
600 A	65 Ah	115 min	6.0 A

* **Cold Start Amps (CCA)** is the discharge current which a battery can provide for **30 seconds**, at a temperature of **-18°C (0°F)** without voltage dropping below **7.2 V**.

Reserve Capacity (RC) is the time taken at a temperature of **+27°C (81°F)** and a discharge current of **25 A** to reduce the voltage of a fully charged battery to **10.5 V**.

System Specifications

Generator

Alternator B4204T2/T3

Alternator B4204T2/T3:	
Manufacturer	DENSO
Type	14V / 120A
Volvo P/N	86 01 699
Max. current rating:	120 A
Max. output	1730 W
Max. speed	300 r/s (18 000 rpm)

Charging Regulator

Test conditions:	In car:	Bench test:
Battery charge	75 %	100 %
Air temp.	+25°C/77°F	+25°C/77°F
Temperature, warm regulator	+60-80°C/140-175°F	+60-80°C/140-175°F
Test Values:	**In car:**	**Bench test:**
Alternator speed	100 r/s (6000 rpm)	100 r/s (6000 rpm)
Engine speed:	40 r/s (2400 rpm)	-
Check voltage between alternator terminals B+ and Engine Ground:		
Denso	13.5 - 14.5 V	14.1-14.9 V

Test Values

Charge regulator:		Denso
Resistance:		
-Rotor	Ω	2.6
-Stator 1[1]	Ω	0.03
Current rating at 13,5V:		
1500	A	40
1800	A	65
2000	A	79
3000	A	107
4000	A	117
6000	A	125

1 Phase. A low range ohmmeter should be used.

Alternator

Generator

Alternator B4204T2/T3

Alternator B4204T2/T3:	
Manufacturer	DENSO
Type	14V / 120A
Volvo P/N	86 01 699
Max. current rating:	120 A
Max. output	1730 W
Max. speed	300 r/s (18 000 rpm)

Charging Regulator

Test conditions:	In car:	Bench test:
Battery charge	75 %	100 %
Air temp.	+25°C/77°F	+25°C/77°F
Temperature, warm regulator	+60-80°C/140-175°F	+60-80°C/140-175°F
Test Values:	**In car:**	**Bench test:**
Alternator speed	100 r/s (6000 rpm)	100 r/s (6000 rpm)
Engine speed:	40 r/s (2400 rpm)	-
Check voltage between alternator terminals B+ and Engine Ground:		
Denso	13.5 - 14.5 V	14.1-14.9 V

Test Values

Charge regulator:		Denso
Resistance:		
-Rotor	Ω	2.6
-Stator 1[1]	Ω	0.03
Current rating at 13,5V:		
1500	A	40
1800	A	65
2000	A	79
3000	A	107
4000	A	117
6000	A	125

1 Phase. A low range ohmmeter should be used.

Voltage Regulator

Generator

Alternator B4204T2/T3

Alternator B4204T2/T3:	
Manufacturer	DENSO
Type	14V / 120A
Volvo P/N	86 01 699
Max. current rating:	120 A
Max. output	1730 W
Max. speed	300 r/s (18 000 rpm)

Charging Regulator

Test conditions:	In car:	Bench test:
Battery charge	75 %	100 %
Air temp.	+25°C/77°F	+25°C/77°F
Temperature, warm regulator	+60-80°C/140-175°F	+60-80°C/140-175°F
Test Values:	**In car:**	**Bench test:**
Alternator speed	100 r/s (6000 rpm)	100 r/s (6000 rpm)
Engine speed:	40 r/s (2400 rpm)	-
Check voltage between alternator terminals B+ and Engine Ground:		
Denso	13.5 - 14.5 V	14.1-14.9 V

Test Values

Charge regulator:		Denso
Resistance:		
-Rotor	Ω	2.6
-Stator 1[1]	Ω	0.03
Current rating at 13,5V:		
1500	A	40
1800	A	65
2000	A	79
3000	A	107
4000	A	117
6000	A	125

1 Phase. A low range ohmmeter should be used.

Resistance	14.5 +/- 0.4 ohms At 68.0 degrees F

Resistance	12.0 +/- 0.4 ohms At 68.0 degrees F

Base Timing

Base Timing

Engine Type	Ignition System	Engine RPM	Timing
B4204T2/T3	EMS 2000	750	0 - 15 +/- 3 deg BTDC

Pressure Regulating Solenoid, A/T

Component resistance values

Component	Remarks		Resistance ([ohm])		
Engine speed (RPM) sensor Vehicle speed sensor (VSS)	Resistance ([ohm]) at +20°C		300-600		
Shift solenoid S1	Resistance between the solenoid pin and the solenoid sleeve / transmission housing		12-18		
Shift solenoid S2					12-18
Lock-up solenoid SL			12-18		
Line pressure solenoid STH	Resistance between the solenoid pins		3-5		
Oil temperature sensor	Temperature (°C)	0	1700-2300		
				20	765-1035
				40	340-460
				80	107-143
				100	64-86
		150	23-31		

The resistance values assume a temperature of +20°C unless otherwise stated.

Shift Solenoid, A/T

Component resistance values

Component	Remarks		Resistance ([ohm])		
Engine speed (RPM) sensor Vehicle speed sensor (VSS)	Resistance ([ohm]) at +20°C		300-600		
Shift solenoid S1	Resistance between the solenoid pin and the solenoid sleeve / transmission housing		12-18		
Shift solenoid S2					12-18
Lock-up solenoid SL			12-18		
Line pressure solenoid STH	Resistance between the solenoid pins		3-5		
Oil temperature sensor	Temperature (°C)	0	1700-2300		
				20	765-1035
				40	340-460
				80	107-143
				100	64-86
		150	23-31		

The resistance values assume a temperature of +20°C unless otherwise stated.

Transmission Speed Sensor, A/T

Component resistance values

Component	Remarks		Resistance ([ohm])		
Engine speed (RPM) sensor Vehicle speed sensor (VSS)	Resistance ([ohm]) at +20°C		300-600		
Shift solenoid S1	Resistance between the solenoid pin and the solenoid sleeve / transmission housing		12-18		
Shift solenoid S2					12-18
Lock-up solenoid SL			12-18		
Line pressure solenoid STH	Resistance between the solenoid pins		3-5		
Oil temperature sensor	Temperature (°C)	0	1700-2300		
				20	765-1035
				40	340-460
				80	107-143
				100	64-86
		150	23-31		

The resistance values assume a temperature of +20°C unless otherwise stated.

Transmission Temperature Sensor/Switch, A/T

Component resistance values

Component	Remarks		Resistance ([ohm])		
Engine speed (RPM) sensor Vehicle speed sensor (VSS)	Resistance ([ohm]) at +20°C		300-600		
Shift solenoid S1	Resistance between the solenoid pin and the solenoid sleeve / transmission housing		12-18		
Shift solenoid S2					12-18
Lock-up solenoid SL			12-18		
Line pressure solenoid STH	Resistance between the solenoid pins		3-5		
Oil temperature sensor	Temperature (°C)	0	1700-2300		
				20	765-1035
				40	340-460
				80	107-143
				100	64-86
		150	23-31		

The resistance values assume a temperature of +20°C unless otherwise stated.

Alignment

Wheel Alignment Specifications

Wheel camber, specifications

Wheel angle front			-´97	´98-2000	2001- (2) Excluding Japan Excluding Sport	2001- (2) Japan 2002– (2/4) USA	2001- Sport (2)	2001- (2/5) OCC Comfort
King pin inclination (KPI) (1)		degrees degrees (3)	12.68° ±1° 12° 41' ±1°	12.68° ±1° 12° 41' ±1°	13.68° ±1° 13° 41' ±1°	13.68° ±1° 13° 41' ±1°	14.07° ±1° 14° 4' ±1°	13.26° ±1° 13° 15' ±1°
Caster (1)		degrees degrees (3)	2.2° ±1° 2° 12' ±1°	3.2° ±1° 3° 12' ±1°	4° ±1° 4° ±1°	4° ±1° 4° ±1°	4.15° ±1° 4 9'° ±1°	3.86° ±1° 3° 51' ±1°
Camber (1)		degrees degrees (3)	0° ±1° 0° ±1°	0° ±1° 0° ±1°	-0.16° ±0.5° 10' ±30'	-0.16° ±0.5° 10' ±30'	-0.33° ±0.5° -20' ±30'	-0.07° ±0.5° -4' ±30'
Toe-in for each wheel		degrees degrees (3)	0.15° ±0.05° 9' ±3'	0.15° ±0.05° 9' ±3'	0.15° ±0.05° 9' ±3'	0.08° ±0.05° 5' ±3'	0.15° ±0.05° 9' ±3'	0.15° ±0.05° 9' ±3'
The toe-in measured across two wheels	A - a	mm inches	2-4 0.079- 0.1577	2-4 0.079- 0.1577	2-4 0.079- 0.1577	0.6-2.6 0.024- 0.102	2-4 0.079- 0.1577	2-4 0.079- 0.1577
	B - b	mm inches	1.7-3.4 0.067- 0.134	1.7-3.4 0.067- 0.134	1.7-3.4 0.067- 0.134	0.4-2.0 0.016- 0.079	1.7-3.4 0.067- 0.134	1.7-3.4 0.067- 0.134
	C - c	mm inches	1.4-2.8 0.055- 0.110	1.4-2.8 0.055- 0.110	1.4-2.8 0.055- 0.110	0.2-1.4 0.008- 0.055	1.4-2.8 0.055- 0.110	1.4-2.8 0.055- 0.110

Wheel Camber Specifications - Front

(1) The maximum permitted difference between the right and left wheels is 0.68° or 40'.

(2) Applies to 2001-, identify the chassis type.

(3) Shows the angle in degrees, minutes, and seconds.

(4) USA 2000-, must be adjusted for USA 2002-.

(5) OCC = overseas comfort chassis.

Wheel camber rear			'96- (4)	´98- (4) Sport	Sport/Dynamic with nivomat (4/5)
Camber (1) (2)		degrees degrees (3)	-0.67° ±0.25° -40' ±15'	-0.90° ±0.25° 54' ±15'	-1.16° ±0.25° -1° 10' ±15'
Toe-in for each wheel		degrees degrees (3)	0.15° ±0.05° 9' ±3'	0.15° ±0.05° 9' ±3'	0.15° ±0.05° 9' ±3'
The toe-in measured across two wheels	A - a	mm inches	2-4 0.079-0.1577	2-4 0.079-0.1577	2-4 0.079-0.1577
	B - b	mm inches	1.7-3.4 0.067-0.134	1.7-3.4 0.067-0.134	1.7-3.4 0.067-0.134
	C - c	mm inches	1.4-2.8 0.055-0.110	1.4-2.8 0.055-0.110	1.4-2.8 0.055-0.110
Thrust angle		degrees degrees (3)	0° ±0.05° 0° ±3'	0° ±0.05° 0° ±3'	0° ±0.05° 0° ±3'

Wheel Camber Specifications - Rear

(1) The maximum permitted difference between the right and left wheels is 0.68° or 40'.

(2) Always adjust the toe-in after adjusting the camber angle.

(3) Shows the angle in degrees, minutes, and seconds.

(4) Applies to 2001-, identify the chassis type.

(5) Adjust cars with sport or dynamic chassis equipped with nivomat to these values.

Gear Ratios

1st gear 3.737:1
2nd gear 2.135:1
3rd gear 1.416:1
4th gear 1.018:1
Back-up (reverse) gear 4.093:1

Gear ratios

Ratios, Final Drive

Ratios, final drive

B4184S	3.095:1
B4204S	3.095:1

Torque Converter

Torque amplification, B4184S/ B4184S 2.1:1
Type, B4184S/B4184, K factor........ 235
Diameter, B4184S/ B4184 ....241 mm

Torque converter

Tightening Torques

Oil drain plug........40 Nm
Drive shaft nut........240 Nm
Mounting pads member - bracket, transmission, front and rear........ 50 Nm
Oil temperature sensor .... 25 Nm
Transmission speed sensor (rpm sensor) .... 5.5 Nm
Vehicle Speed sensor (VSS) .... 5.5 Nm
Wheels........110 Nm
Stub axle--spring strut........90 Nm
Lever / gear selector sensor ....16 Nm
Bracket, transmission, front and rear........ 67 Nm
Transmission connector, transmission........10 Nm
Control system--transmission........10 Nm
Control system, cover plate........ 10 Nm
Control system, cover .... 12 Nm
Torque converter / carrier plate........ 35 Nm
Dipstick pipe .... 25 Nm
Oil temperature sensor........25 Nm
Solenoid ....10 Nm
Support member under engine--transmission........70 Nm
Engine Speed (RPM) sensor........ 5.5 Nm
Gear selector sensor ....25 Nm
Transmission cable bracket / transmission .... 25 Nm
Transmission/engine .... 50 Nm
Transmission/starter motor .... 50 Nm
Upper transmission mounting........ 50 Nm

Tightening torques

Stall Speed (RPM), Line Pressure (MPA)

Stall speed (rpm), line pressure (MPa)

Stall speed at sea level and ambient air temperature of 20°C. Engine speed (RPM) decreases by 120 rpm per 1,000 m meters (3,300 feet) above se

Engine	Stall speed	Gear shift position	Line pressure MPa
B4184S	2450[plusmn]50	D / R	1.0-1.3/1.6-2.0
B4204S	2600[plusmn]50	D / R	1.0-1.3/1.6-2.0

CAUTION: Maximum time for stall speed test: 5 seconds.

Gear Shifting Speeds, km/H

Gear shifting speeds, km/h

The AW50- 42 automatic transmission is equipped with a "mode selector" with three different driving modes:

Economy(E), Sport (S) and Winter (W). Gear shift speeds and mechanical lock-up vary depending on which mode is selected and which gear (D,

The speeds in the table should be used as guidelines. This is because it is difficult to take exact readings while test driving the car.

Engine type	1)	Throttle opening (%)	Gear shift / gear shift speeds (km/h)					
			1-2	2-3	3-4	4-3	3-2	2-1
B4184S, B4204S	E	100/KD 25/60	44/49 16/30	85/94 38/60	137/148 56/110	100/134 42/66	65/83 24/40	25/38 9/10
	S	100/KD 25/60	49/49 16/34	94/94 38/73	148/148 56/133	138/138 42/100	80/86 24/52	38/41 9/20
	W	100/KD 25/60	--/49 -- /--	--/94 -- /--	137/148 56/110	100/134 42/66	--/83 -- /--	--/38 -- /--

1) **E**=Economy, **S**=Sport, **W**=Winter.

Gear selector in position **D**.

Mechanical Lock-Up

Mechanical Lock-up

Mechanical lock-up of the torque converter occurs at various speeds depending on the driving mode (Economy (E), Sport (S), Winter (W) and gea

The speeds in the table must be used as guidelines. This is because it is difficult to take exact readings of speed and throttle opening while test dri

Engine type	1)	Throttle opening (%)	Gear - lock-up (engaged / disengaged) Speeds (km/h)					
			2-in 2)	2 out 2)	3 in	3-out	4-in	4-out
B4184S, B4204S	E	100/KD 25/60	--/-- - -/--	--/-- -- /--	125/125 - -/110	65/83 80/65	137/148 70/110	110/134 61/90
	S	100/KD 25/60	--/-- - -/--	--/-- -- /--	125/125 - -/110	80/86 80/80	148/148 70/133	138/138 61/100
	W	100/KD 25/60	--/-- - -/--	--/-- -- /--	--/-- --/--	--/-- -- /--	137/148 70/110	101/134 61/90
2) Lock-up in 2nd gear is not engaged until transmission oil temperature (temperature to oil cooler) exceeds 115°C.								

1) **E**=Economy, **S**=sport, **W**=Winter.

Gear selector in position D.

Flex Plate, A/T

Carrier Plate

Tighten to .... 45 Nm (33 ft lb)

Tighten an additional .... 50°

Axle Nut

Drive Shaft Nut

Stage 1 .... 120 Nm (89 lb. ft.)

Stage 2 .... +60°

Thickness Applies to both front and rear.	Minimum	2.0 mm
	New	9.4 mm

Thickness	New	24 mm

	Discard	22.1 mm
Lateral throw (runout) with disc removed		0.04 mm

Thickness	New	10 mm
	Discard	8.9 mm
Lateral throw (runout) with disc removed		0.04 mm

Thickness Applies to both front and rear.	Minimum	2.0 mm
	New	9.4 mm

Brake Rotor/Disc

Dimensional Specifications

Front Brake Disc Minimum Disc Thickness .... 21.50 mm
Rear Brake Discs Minimum Disc Thickness .... 8.40 mm
Maximum Permitted Lateral Runout:
Front Or Rear .... 0.04 mm

System Specifications

Tightening Torques

Alternator B4204T2/T3 and Charging Regulator

Mechanical part:		Nm/ft. lb.
Bolt, battery tray		16/12
Nut, + and - on battery		8/6
Earth connection (extra) on body		23/17
Attachment bolt	M10	42/31
	M8	22/16
Attachment bolt		27/20
Pulley nut		60/44

Alternator

Tightening Torques

Alternator B4204T2/T3 and Charging Regulator

Mechanical part:		Nm/ft. lb.
Bolt, battery tray		16/12
Nut, + and - on battery		8/6
Earth connection (extra) on body		23/17
Attachment bolt	M10	42/31
	M8	22/16
Attachment bolt		27/20
Pulley nut		60/44

Voltage Regulator

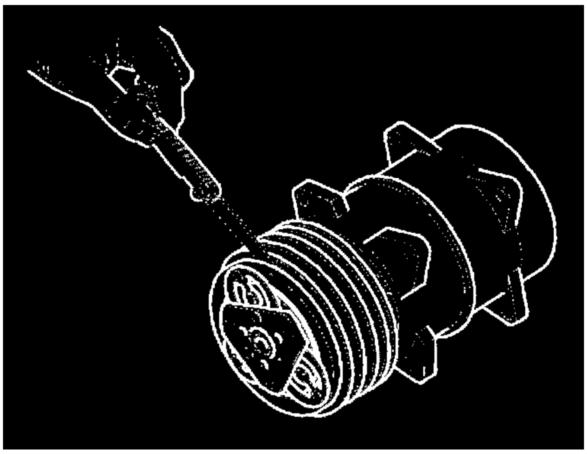
Tightening Torques

Alternator B4204T2/T3 and Charging Regulator

Mechanical part:		Nm/ft. lb.
Bolt, battery tray		16/12
Nut, + and - on battery		8/6
Earth connection (extra) on body		23/17
Attachment bolt	M10	42/31
	M8	22/16
Attachment bolt		27/20
Pulley nut		60/44

Compressor Clutch

TTTO27 Checking clearance



- Check clearance between coupling plate and pulley using a feeler gauge:
  - clearance should be between **0.3** and **0.5 mm (0.012 in and 0.020 in)**.
  - **0.3 mm (0.012 in)** clearance all the way round
  - **0.6 mm (0.024 in)** should not go in anywhere

- If clearance is not within the stated values; Replace shims. The following dimensions are available:
  - **0.2 mm (0.008 in)**
  - **0.3 mm (0.012 in)**
  - **1.0 mm (0.039 in)**

Engine Tightening Specifications

Tightening the cylinder head bolts B4204T2/T3

Tightening torques for oiled screws:		
Stage:	Remark:	Nm/ft.lb. Degrees:
1	Lightly oil the screw thread and the mating surface of the screw heads. Insert the screw and secure finger-tight. Tighten screw 1-2	20/15
2	Do this with the other screws: 3-4, 5-6, 7-8, 9-10	60/44
3	Angle-tighten in a single uninterrupted movement with special tool: Torque angel gauge: 951-2050	130°

S40/V40 Engine Mechanical Torque

Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

Mechanical part:	Nm/ft.lb. Degrees:
1.Torque all M10 bolts to (do not tighten M8 and M7 screws until steps 3 and 4)	20/15
2.Torque all M10 bolts to	45/33
3.Torque the M8 bolts to	24/18
4.Torque the M7 bolts to	17/13
5. Finally tighten the M10 bolts through	90°
Maximum length of M10 bolts mm (inch)	118 (4.65")
Main bearing/journal caps	-
Big-end bearing caps	20/15 +90° turn
Flywheel bolts (use new bolts) Petrol engine, Automatic transmission step 1	45/33
step 2	+50° turn
Bolt, camshaft sprocket	20/15
Nut/bolt, crankshaft pulley	180/133
Bolt, crankshaft pulley step 1	25/18
step 2	+30° turn
Idler pulley	25/18
Tensioner bolt on block	20/15
Timing gear cover	12/9
Thermostat housing	17/13
Water pump housing and cover	17/13
Bolts, longitudinal member to body	69/51
Bolts, engine mounting front/rear [1]	55/41
Oil pan, drain plug: Aluminium sump	35/26

S40/V40 Engine Torque Cont.

Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

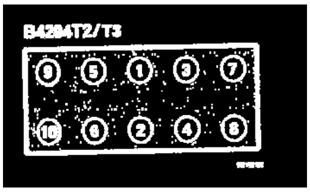
Oil pump on engine	10/7.4
Oil suction line	17/13
Threaded sleeve, oil cooler attachment	17/13
Sump: Aluminium	17/13[2]
Oil filter	25/18
Nipple, oil cooler/filter body	40/30
Oil pressure gauge	25/18

1 First tighten the rear bolt and then the front one.
2 Press sump against gearbox (or adjust to right measurement).

Tightening torques for engine mounting:	Nm/ft.lb.
Upper transmission mounting on gearbox	45/33
Front engine mounting on gearbox	50/37
Rear engine mounting on gearbox	40/30
Longitudinal beam on body	69/51
Engine pad to engine mounting front/rear[1]	55/41
Side engine bolster to body left/right	98/72
Right bolster to aluminium bracket engine	67/49

1 Rearmost first.

S40/V40 Engine Torque Cont.



S40/V40 Cylinder Head Torque Sequence

Engine Technical Specifications

Compression ratio, fuel octane requirements, output, torque

Data:			Power:		Maximum torque:	
Engine type:	Compression ratio:	RON Unleaded:	kW (rpm)	hp (rpm)	Nm (rpm)	ft.lbs. (rpm)
B4204T2	9.0:1	95	118 (5100)	160 (5100)	230 (1800-4800)	170 (1800-4800)
B4204T3	9.0:1	95	121 (5250)	162 (5250)	240 (1800-4200)	177 (1800-4200)

Gasoline: Use only unleaded gasoline.
Can be driven using RON 91–98 octane gasoline.
For the best performance and lowest fuel consumption use unleaded RON 98 octane gasoline.

Other engine data

Engine type:		B4204T2/T3
Number of cylinders		4
Displacement	Cubic centimeters/Cubic inch	1 948/118.9
Bore	mm/inch	83/3.268"
Stroke	mm/inch	90/3.543"
Firing order		1-3-4-2
Weight unit[1] approx	kg/lb	147/324

[1] Including auxiliary equipment and oil.

Compression pressure:

Measured with the engine hot and using the starter motor to turn the engine:		B4204T2/T3
Compression	MPa (psi)	1.1-1.3 (159-188)
Maximum difference between cylinders	MPa (psi)	0.2 (29)

S40/V40 Engine Mechanical Data

Mechanical data

Cylinder head B4204T2/T3:	mm:	inch:
Height, new	128.95-129.05	5.077"-5.081"
Max. machining	0.30	0.0118"
Max. warp:		
Along	0.50	0.0197"
Across	0.20	0.0079"

Cylinder block B4204T2/T3:	mm:	inch:
Cylinder diameter:		
Standard: -C marked	83.00-83.01	3.2677-3.2681"
Standard: -D marked	83.01-83.02	3.2681-3.2685"
Standard: -E marked	83.02-83.03	3.2685-3.2689"
Standard: -G marked oversize	83.04-83.05	3.2693-3.2697"
Oversize: Recondition		
-1	83.20-83.21	3.2756-3.2760"
-2	83.40-83.41	3.2835-3.2839

S40/V40 Engine Mechanical Cont.

Piston dimensions

Type/engine B4204T2/3:		mm	inch
A	T2:	59.9	2.358"
A	T3:	50.4	1.984"
B	T2:	35.9	1.413"
B	T3:	28.4	1.118"
C	T2:	16	0.630"
A	T3:	38	1.496"
E	T2:	42	1.654"

Piston dimensions B4204T2/T3

Piston diameter = D:	mm	inch
Standard:		
-C marked	82.98-82.99	3.2669-3.2673"
-D marked[1]	82.99-83.00	3.2673-3.2677"
-E marked	83.00-83.010	3.2677-3.2681"
-G marked oversize	83.017-83.032	3.2684-3.2690"
Oversize: Recondition		
-1	83.177-83.132	3.2747-3.2729"
-2	83.377-83.392	3.2825-3.2831"
Piston clearance (new piston)	-0.03 -0.01	-0.0012 -0.0004"

[1] Measured at right angles to gudgeon (piston) pin, distance C from bottom of piston.

S40/V40 Engine Mechanical Cont.

Weight

Piston weight B4204T2/T3: Includes: Piston, gudgeon pin, piston rings and circlips.		g	Ounce
Piston weight	T2:	485 g	17.1 oz
Piston weight	T3:	424 g	15 oz
Maximum permissible weight difference between pistons in same engine		10 g	0.353 oz

Camshaft and valve data

Timing gears:

Engine:	Camshaft: Profile (by number) Intake	Camshaft: Profile (by number) Exhaust	Control of camshaft setting (cold engine): Max. lift height Intake mm (inch)	Max. lift height Exhaust mm (inch)	Camshaft timing Intake[1] mm (inch)	Camshaft timing Exhaust[2] mm (inch)	With valve play Intake mm (inch)	With valve play Exhaust mm (inch)
B4204T2	9465106	9465107	8.15 (0.321")	8.30 (0.327")	52 (2.05")	54 (2.13")	0.20 (0.008")	0.40 (0.016")
B4204T2	9473217	9473218	8.15 (0.321")	8.30 (0.327")	56 (2.20")	54 (2.13")	0.20 (0.008")	0.40 (0.016")
B4204T3	9473217	9473218	8.15 (0.321")	8.30 (0.327")	56 (2.20")	54 (2.13")	0.20 (0.008")	0.40 (0.016")

[1] ATDC = After Top Dead Center
[2] BTDC = Before Top Dead Center

Play

Valve play B4204T2/T3:	mm:	inch:
Check values:		
Inlet	0.20 ± 0.05	0.008 ± 0.002"
Outlet	0.40 ± 0.05	0.016 ± 0.002"
Adjust values:		
Inlet	0.20 ± 0.03	0.008 ± 0.0012"
Outlet	0.20 ± 0.03	0.008 ± 0.0012"

S40/V40 Engine Mechanical Cont.

Classification of crankshaft main bearings.
Punched in end block and crankshaft.

Block / Crankshaft	A small diameter: block	A small diameter: int.sect	B medium diameter: block	B medium diameter: int.sect	C large diameter: block	C large diameter: int.sect
A Small	yellow	yellow	yellow	blue	blue	blue
	medium	medium	medium	heavy	heavy	heavy
B Medium	red	yellow	yellow	yellow	yellow	blue
	light	medium	medium	medium	medium	heavy
C Heavy	red	red	red	yellow	yellow	yellow
	light	light	light	medium	medium	medium

S40/V40 Engine Mechanical Cont.

Camshaft Gear/Sprocket

Timing Gear Pulley (camshafts without variable valve timing) .... 20 Nm

Timing Gear Pulley (camshafts with variable valve timing) .... 90 Nm

Engine Tightening Specifications

Tightening the cylinder head bolts B4204T2/T3

Tightening torques for oiled screws:		
Stage:	Remark:	Nm/ft.lb. Degrees:
1	Lightly oil the screw thread and the mating surface of the screw heads. Insert the screw and secure finger-tight. Tighten screw 1-2	20/15
2	Do this with the other screws: 3-4, 5-6, 7-8, 9-10	60/44
3	Angle-tighten in a single uninterrupted movement with special tool: Torque angel gauge: 951-2050	130°

S40/V40 Engine Mechanical Torque

Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

Mechanical part:	Nm/ft.lb. Degrees:
1.Torque all M10 bolts to (do not tighten M8 and M7 screws until steps 3 and 4)	20/15
2.Torque all M10 bolts to	45/33
3.Torque the M8 bolts to	24/18
4.Torque the M7 bolts to	17/13
5. Finally tighten the M10 bolts through	90°
Maximum length of M10 bolts mm (inch)	118 (4.65")
Main bearing/journal caps	-
Big-end bearing caps	20/15 +90° turn
Flywheel bolts (use new bolts) Petrol engine, Automatic transmission step 1	45/33
step 2	+50° turn
Bolt, camshaft sprocket	20/15
Nut/bolt, crankshaft pulley	180/133
Bolt, crankshaft pulley step 1	25/18
step 2	+30° turn
Idler pulley	25/18
Tensioner bolt on block	20/15
Timing gear cover	12/9
Thermostat housing	17/13
Water pump housing and cover	17/13
Bolts, longitudinal member to body	69/51
Bolts, engine mounting front/rear [1]	55/41
Oil pan, drain plug: Aluminium sump	35/26

S40/V40 Engine Torque Cont.

Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

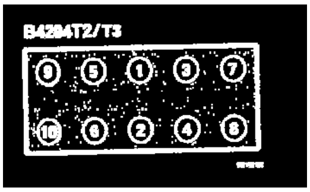
Oil pump on engine	10/7.4
Oil suction line	17/13
Threaded sleeve, oil cooler attachment	17/13
Sump: Aluminium	17/13[2]
Oil filter	25/18
Nipple, oil cooler/filter body	40/30
Oil pressure gauge	25/18

[1] First tighten the rear bolt and then the front one.
[2] Press sump against gearbox (or adjust to right measurement).

Tightening torques for engine mounting:	Nm/ft.lb.
Upper transmission mounting on gearbox	45/33
Front engine mounting on gearbox	50/37
Rear engine mounting on gearbox	40/30
Longitudinal beam on body	69/51
Engine pad to engine mounting front/rear[1]	55/41
Side engine bolster to body left/right	98/72
Right bolster to aluminium bracket engine	67/49

[1] Rearmost first.

S40/V40 Engine Torque Cont.



S40/V40 Cylinder Head Torque Sequence

Engine Technical Specifications

Compression ratio, fuel octane requirements, output, torque

Data:			Power:		Maximum torque:	
Engine type:	Compression ratio:	RON Unleaded:	kW (rpm)	hp (rpm)	Nm (rpm)	ft.lbs. (rpm)
B4204T2	9.0:1	95	118 (5100)	160 (5100)	230 (1800-4800)	170 (1800-4800)
B4204T3	9.0:1	95	121 (5250)	162 (5250)	240 (1800-4200)	177 (1800-4200)

Gasoline: Use only unleaded gasoline.
Can be driven using RON 91–98 octane gasoline.
For the best performance and lowest fuel consumption use unleaded RON 98 octane gasoline.

Other engine data

Engine type:		B4204T2/T3
Number of cylinders		4
Displacement	Cubic centimeters/Cubic inch	1 948/118.9
Bore	mm/inch	83/3.268"
Stroke	mm/inch	90/3.543"
Firing order		1-3-4-2
Weight unit[1] approx	kg/lb	147/324

[1] Including auxiliary equipment and oil.

Compression pressure:

Measured with the engine hot and using the starter motor to turn the engine:		B4204T2/T3
Compression	MPa (psi)	1.1-1.3 (159-188)
Maximum difference between cylinders	MPa (psi)	0.2 (29)

S40/V40 Engine Mechanical Data

Mechanical data

Cylinder head B4204T2/T3:	mm:	inch:
Height, new	128.95-129.05	5.077"-5.081"
Max. machining	0.30	0.0118"
Max. warp:		
Along	0.50	0.0197"
Across	0.20	0.0079"

Cylinder block B4204T2/T3:		mm:	inch:
Cylinder diameter:			
Standard:	-C marked	83.00-83.01	3.2677-3.2681"
Standard:	-D marked	83.01-83.02	3.2681-3.2685"
Standard:	-E marked	83.02-83.03	3.2685-3.2689"
Standard:	-G marked oversize	83.04-83.05	3.2693-3.2697"
Oversize: Recondition			
	-1	83.20-83.21	3.2756-3.2760"
	-2	83.40-83.41	3.2835-3.2839

S40/V40 Engine Mechanical Cont.

Piston dimensions

Type/engine B4204T2/3:		mm	Inch
A	T2:	59.9	2.358"
A	T3:	50.4	1.984"
B	T2:	35.9	1.413"
B	T3:	28.4	1.118"
C	T2:	16	0.630"
A	T3:	38	1.496"
E	T2:	42	1.654"

Piston dimensions B4204T2/T3

Piston diameter = D:	mm	inch
Standard:		
-C marked	82.98-82.98	3.2669-3.2673"
-D marked[1]	82.99-83.00	3.2673-3.2677"
-E marked	83.00-83.010	3.2677-3.2681"
-G marked oversize	83.017-83.032	3.2684-3.2690"
Oversize: Recondition		
-1	83.177-83.132	3.2747-3.2729"
-2	83.377-83.392	3.2825-3.2831"
Piston clearance (new piston)	-0.03 -0.01	-0.0012 -0.0004"

[1] Measured at right angles to gudgeon (piston) pin, distance C from bottom of piston.

S40/V40 Engine Mechanical Cont.

Weight

Piston weight B4204T2/T3: Includes: Piston, gudgeon pin, piston rings and circlips.		g	Ounce
Piston weight	T2:	485 g	17.1 oz
Piston weight	T3:	424 g	15 oz
Maximum permissible weight difference between pistons in same engine		10 g	0.353 oz

Camshaft and valve data

Timing gears:								
Engine:	Camshaft:		Control of camshaft setting (cold engine):					
	Profile (by number)		Max. lift height		Camshaft timing		With valve play	
	Intake	Exhaust	Intake mm (inch)	Exhaust mm (inch)	Intake[1] mm (inch)	Exhaust[2] mm (inch)	Intake mm (inch)	Exhaust mm (inch)
B4204T2	9465106	9465107	8.15 (0.321")	8.30 (0.327")	52 (2.05")	54 (2.13")	0.20 (0.008")	0.40 (0.016")
B4204T2	9473217	9473218	8.15 (0.321")	8.30 (0.327")	56 (2.20")	54 (2.13")	0.20 (0.008")	0.40 (0.016")
B4204T3	9473217	9473218	8.15 (0.321")	8.30 (0.327")	56 (2.20")	54 (2.13")	0.20 (0.008")	0.40 (0.016")

[1] ATDC = After Top Dead Center
[2] BTDC = Before Top Dead Center

Play

Valve play B4204T2/T3:	mm:	inch:
Check values:		
Inlet	0.20 ± 0.05	0.008 ± 0.002"
Outlet	0.40 ± 0.05	0.016 ± 0.002"
Adjust values:		
Inlet	0.20 ± 0.03	0.008 ± 0.0012"
Outlet	0.20 ± 0.03	0.008 ± 0.0012"

S40/V40 Engine Mechanical Cont.

Classification of crankshaft main bearings. Punched in end block and crankshaft.						
Block / Crankshaft	A small diameter		B medium diameter		C large diameter	
	block	int.sect	block	int.sect	block	int.sect
A Small	yellow	yellow	yellow	blue	blue	blue
	medium	medium	medium	heavy	heavy	heavy
B Medium	red	yellow	yellow	yellow	yellow	blue
	light	medium	medium	medium	medium	heavy
C Heavy	red	red	red	yellow	yellow	yellow
	light	light	light	medium	medium	medium

S40/V40 Engine Mechanical Cont.

Connecting Rod, Engine

Tightening Specifications

Connecting Rod cap

Stage 1 .... 20 Nm

Stage 2 .... Angle-Tighten 90°

Crankshaft Gear/Sprocket

Timing Gear Pulley (camshafts without variable valve timing) .... 20 Nm

Timing Gear Pulley (camshafts with variable valve timing) .... 10 Nm

Classification of crankshaft main bearings.
Punched in end block and crankshaft.

Block / Crankshaft	[illegible]		B [illegible] diameter		C large diameter	
	block	int.sect	block	int.sect	block	int.sect
[illegible]	yellow	yellow	yellow	blue	blue	blue

Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

Mechanical part:	Nm/ft.lb. Degrees:
1.Torque all M10 bolts to (do not tighten M8 and M7 screws until steps 3 and 4)	20/15
2.Torque all M10 bolts to	45/33
3.Torque the M8 bolts to	24/18
4.Torque the M7 bolts to	17/13
5. Finally tighten the M10 bolts through	90°
Maximum length of M10 bolts mm (inch)	118 (4.65")
Main bearing/journal caps	-
Big-end bearing caps	20/15 +90° turn
Flywheel bolts (use new bolts)	
Petrol engine, Automatic transmission step 1	45/33
step 2	+50° turn
Bolt, camshaft sprocket	20/15
Nut/bolt, crankshaft pulley	180/133
Bolt, crankshaft pulley step 1	25/18
step 2	+30° turn
Idler pulley	25/18
Tensioner bolt on block	20/15
Timing gear cover	12/9
Thermostat housing	17/13
Water pump housing and cover	17/13
Bolts, longitudinal member to body	69/51
Bolts, engine mounting front/rear [1]	55/41
Oil pan, drain plug: Aluminium sump	35/26

S40/V40 Engine Torque Cont.

Harmonic Balancer - Crankshaft Pulley

Nut/Bolt Crankshaft Pulley .... 180 Nm (133 ft lb)

Piston, Engine

Piston dimensions

Type/engine B4204T2/3:		mm	inch
A	T2:	59.9	2.358"
A	T3:	50.4	1.984"
B	T2:	35.9	1.413"
B	T3:	28.4	1.118"
C	T2:	16	0.630"
A	T3:	38	1.496"
E	T2:	42	1.654"

Piston dimensions B4204T2/T3

Piston diameter = D:	mm	inch
Standard:		
-C marked	82.98-82.99	3.2669-3.2673"
-D marked[1]	82.99-83.00	3.2673-3.2677"
-E marked	83.00-83.010	3.2677-3.2681"
-G marked oversize	83.017-83.032	3.2684-3.2690"
Oversize: Recondition		
-1	83.177-83.132	3.2747-3.2729"
-2	83.377-83.392	3.2825-3.2831"
Piston clearance (new piston)	-0.03 -0.01	-0.0012 -0.0004"

[1] Measured at right angles to gudgeon (piston) pin, distance C from bottom of piston.

S40/V40 Engine Mechanical Cont.

Dimensions

Compression ratio, fuel octane requirements, output, torque

Data:			Power:		Maximum torque:	
Engine type:	Compression ratio:	RON Unleaded:	kW (rpm)	hp (rpm)	Nm (rpm)	ft.lbs. (rpm)
B4204T2	9.0:1	95	118 (5100)	160 (5100)	230 (1800-4800)	170 (1800-4800)
B4204T3	9.0:1	95	121 (5250)	162 (5250)	240 (1800-4200)	177 (1800-4200)

Gasoline: Use only unleaded gasoline.
Can be driven using RON 91–98 octane gasoline.
For the best performance and lowest fuel consumption use unleaded RON 98 octane gasoline.

Other engine data

Engine type:		B4204T2/T3
Number of cylinders		4
Displacement	Cubic centimeters/Cubic inch	1 948/118.9
Bore	mm/inch	83/3.268"
Stroke	mm/inch	90/3.543"
Firing order		1-3-4-2
Weight unit[1] approx	kg/lb	147/324

[1] Including auxiliary equipment and oil.

Compression pressure:

Measured with the engine hot and using the starter motor to turn the engine:		B4204T2/T3
Compression	MPa (psi)	1.1-1.3 (159-188)
Maximum difference between cylinders	MPa (psi)	0.2 (29)

S40/V40 Engine Mechanical Data

Mechanical data

Cylinder head B4204T2/T3:	mm:	inch:
Height, new	128.95-129.05	5.077"-5.081"
Max. machining	0.30	0.0118"
Max. warp:		
Along	0.50	0.0197"
Across	0.20	0.0079"

Cylinder block B4204T2/T3:	mm:	inch:
Cylinder diameter:		
Standard: -C marked	83.00-83.01	3.2677-3.2681"
Standard: -D marked	83.01-83.02	3.2681-3.2685"
Standard: -E marked	83.02-83.03	3.2685-3.2689"
Standard: -G marked oversize	83.04-83.05	3.2693-3.2697"
Oversize: Recondition		
-1	83.20-83.21	3.2756-3.2760"
-2	83.40-83.41	3.2835-3.2839

S40/V40 Engine Mechanical Cont.

Piston dimensions

Type/engine B4204T2/3:		mm	inch
A	T2:	59.9	2.358"
A	T3:	50.4	1.984"
B	T2:	35.9	1.413"
B	T3:	28.4	1.118"
C	T2:	16	0.630"
A	T3:	38	1.496"
E	T2:	42	1.654"

Piston dimensions B4204T2/T3

Piston diameter = D:	mm	inch
Standard:		
-C marked	82.98-82.99	3.2669-3.2673"
-D marked[1]	82.99-83.00	3.2673-3.2677"
-E marked	83.00-83.010	3.2677-3.2681"
-G marked oversize	83.017-83.032	3.2684-3.2690"
Oversize: Recondition		
-1	83.177-83.132	3.2747-3.2729"
-2	83.377-83.392	3.2825-3.2831"
Piston clearance (new piston)	-0.03 -0.01	-0.0012 -0.0004"

[1] Measured at right angles to gudgeon (piston) pin, distance C from bottom of piston.

S40/V40 Engine Mechanical Cont.

Weight

Piston weight B4204T2/T3: Includes: Piston, gudgeon pin, piston rings and circlips.	g	Ounce
Piston weight T2:	485 g	17.1 oz
Piston weight T3:	424 g	15 oz
Maximum permissible weight difference between pistons in same engine	10 g	0.353 oz

Camshaft and valve data

Timing gears:								
Engine:	Camshaft:		Control of camshaft setting (cold engine):					
	Profile (by number)		Max. lift height		Camshaft timing		With valve play	
	Intake	Exhaust	Intake mm (inch)	Exhaust mm (inch)	Intake[1] mm (inch)	Exhaust[2] mm (inch)	Intake mm (inch)	Exhaust mm (inch)
B4204T2	9465106	9465107	8.15 (0.321")	8.30 (0.327")	52 (2.05")	54 (2.13")	0.20 (0.008")	0.40 (0.016")
B4204T2	9473217	9473218	8.15 (0.321")	8.30 (0.327")	56 (2.20")	54 (2.13")	0.20 (0.008")	0.40 (0.016")
B4204T3	9473217	9473218	8.15 (0.321")	8.30 (0.327")	56 (2.20")	54 (2.13")	0.20 (0.008")	0.40 (0.016")

1 ATDC = After Top Dead Center
2 BTDC = Before Top Dead Center

Play

Valve play B4204T2/T3:	mm:	inch:
Check values:		
Inlet	0.20 ± 0.05	0.008 ± 0.002"
Outlet	0.40 ± 0.05	0.016 ± 0.002"
Adjust values:		
Inlet	0.20 ± 0.03	0.008 ± 0.0012"
Outlet	0.20 ± 0.03	0.008 ± 0.0012"

S40/V40 Engine Mechanical Cont.

Classification of crankshaft main bearings. Punched in end block and crankshaft.						
Block	A small diameter		B medium diameter		C large diameter	
Crankshaft	block	int.sect	block	int.sect	block	int.sect
A Small	yellow	yellow	yellow	blue	blue	blue
	medium	medium	medium	heavy	heavy	heavy
B Medium	red	yellow	yellow	yellow	yellow	blue
	light	medium	medium	medium	medium	heavy
C Heavy	red	red	red	yellow	yellow	yellow
	light	light	light	medium	medium	medium

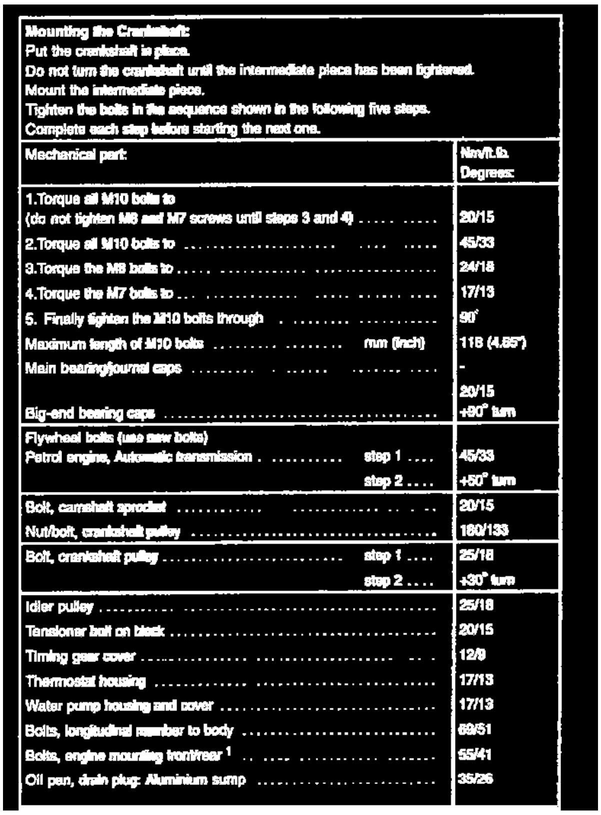
S40/V40 Engine Mechanical Cont.

Tightening Torque

Tightening the cylinder head bolts B4204T2/T3

Tightening torques for oiled screws:		
Stage:	Remark:	Nm/ft.lb. Degrees:
1	Lightly oil the screw thread and the mating surface of the screw heads. Insert the screw and secure finger-tight. Tighten screw 1-2	20/15
2	Do this with the other screws: 3-4, 5-6, 7-8, 9-10	60/44
3	Angle-tighten in a single uninterrupted movement with special tool: Torque angel gauge: 951-2050	130°

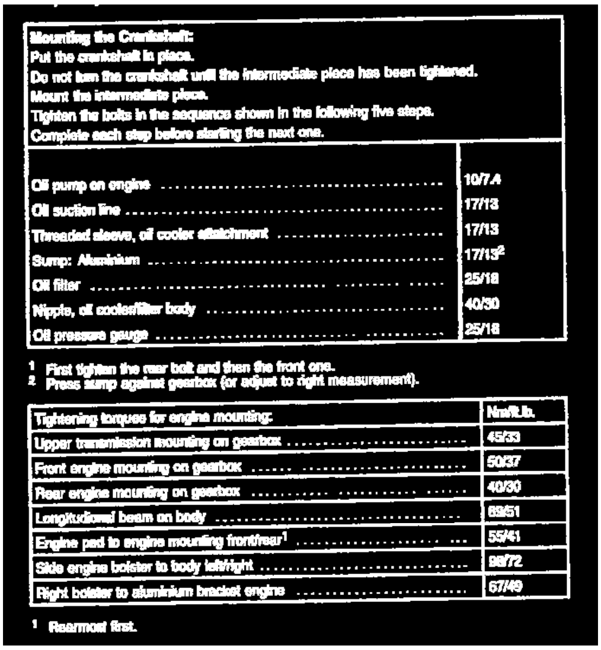
S40/V40 Engine Mechanical Torque



Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

Mechanical part:	Nm/ft.lb. Degrees:
1.Torque all M10 bolts to (do not tighten M8 and M7 screws until steps 3 and 4)	20/15
2.Torque all M10 bolts to	45/33
3.Torque the M8 bolts to	24/18
4.Torque the M7 bolts to	17/13
5. Finally tighten the M10 bolts through	90°
Maximum length of M10 bolts mm (inch)	118 (4.65")
Main bearing/journal caps	-
Big-end bearing caps	20/15 +90° turn
Flywheel bolts (use new bolts) Petrol engine, Automatic transmission step 1	45/33
step 2	+50° turn
Bolt, camshaft sprocket	20/15
Nut/bolt, crankshaft pulley	180/133
Bolt, crankshaft pulley step 1	25/18
step 2	+30° turn
Idler pulley	25/18
Tensioner bolt on block	20/15
Timing gear cover	12/9
Thermostat housing	17/13
Water pump housing and cover	17/13
Bolts, longitudinal member to body	69/51
Bolts, engine mounting front/rear [1]	55/41
Oil pan, drain plug: Aluminium sump	35/26

S40/V40 Engine Torque Cont.



Mounting the Crankshaft:
Put the crankshaft in place.
Do not turn the crankshaft until the intermediate piece has been tightened.
Mount the intermediate piece.
Tighten the bolts in the sequence shown in the following five steps.
Complete each step before starting the next one.

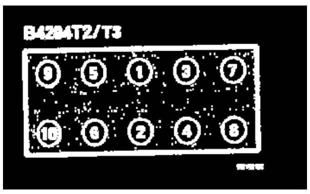
Oil pump on engine	10/7.4
Oil suction line	17/13
Threaded sleeve, oil cooler attachment	17/13
Sump: Aluminium	17/13[2]
Oil filter	25/18
Nipple, oil cooler/filter body	40/30
Oil pressure gauge	25/18

[1] First tighten the rear bolt and then the front one.
[2] Press sump against gearbox (or adjust to right measurement).

Tightening torques for engine mounting:	Nm/ft.lb.
Upper transmission mounting on gearbox	45/33
Front engine mounting on gearbox	50/37
Rear engine mounting on gearbox	40/30
Longitudinal beam on body	69/51
Engine pad to engine mounting front/rear[1]	55/41
Side engine bolster to body left/right	98/72
Right bolster to aluminium bracket engine	67/49

[1] Rearmost first.

S40/V40 Engine Torque Cont.



S40/V40 Cylinder Head Torque Sequence

Valve Clearance

Valve Clearance

Intake Valve .... 0.20 mm ± 0.03
Exhaust Valve .... 0.40 mm ± 0.03

Intake Manifold

Intake Manifold To Cylinder Head .... 19 Nm (14 ft lb)

Oil Pump, Engine

Oil Pump on Engine .... 10 Nm (7.4 ft lb)
Oil Suction Line .... 17 Nm (13 ft lb)

System Specifications

Tension Bolt On Block .... 20 Nm (15 ft lb)

Timing Belt Tensioner

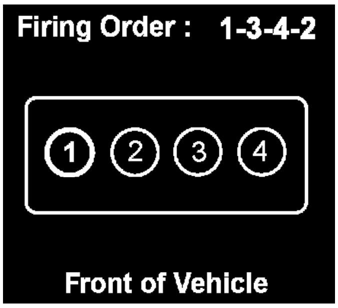
Tension Bolt On Block .... 20 Nm (15 ft lb)

Manifold	Cylinder Head Side	25 Nm
Turbocharger (TC)	To Manifold	25 Nm

Firing Order

Firing Order

1-3-4-2



Engine Speed	750 rpm

Spark Plug

Spark Plugs

Volvo P/N: **86 90 070**
Electrode gap: .... **0.70 - 0.80 mm (0.027 - 0.0315 in)**

Coolant Pump	Bolts	17 Nm Tighten in a crosswise pattern.

Wheel Fastener

TORQUE SPECIFICATIONS

Wheel Stud .... 110 Nm (81 ft lb)

Automatic Transmission/Transaxle

Engine	Idling speed	Gear shift position	Line pressure MPa
B4184 S, B4204 S	750	D / R	0.34-0.40/0.6-0.7

Line pressure (MPa) at engine coolant temperature (ECT) +80°C, idling speed (rpm)

Compression Check

Compression Pressure

Measured with the engine hot and using the starter motor to turn the engine:

Compression .... 1.1 - 1.3 mPa (159 - 188 psi)
Maximum Difference Between Cylinder .... 0.2 mPa (29 psi)

Engine Oil Pressure

Minimum oil pressure with a new filter and a hot engine:

12.5 r/s (750 rpm) .... 0.10 mPa (14.5 psi)
66.7 r/s (4000 rpm) .... 0.35 mPa (50.8 psi)

Line Pressure At Injectors	43.5 +/- 1.5 psi Above inlet manifold pressure	
Pump Pressure	At 12.5 Volts Max	116.0 psi
	At 12.5 Volts Min	70.0 psi
Line Pressure Regulator (On Fuel Pump)	58.0 - 72.5 psi	

Pump Capacity	12.5 Volts	39.6 Gal/hr gal (US)
	12.0 Volts	33.0 Gal/hr gal (US)

Thermostat	Begins opening	90 degrees C
	Fully Open	105 degrees C
	Marking	90

System Specifications

Transmission including cooler and hoses holds **7.7 ±0.25 liters**

Fluid - A/T

Transmission Fluid

Capacity including cooler .... 7.7 ±0.25 liters

Fluid Capacity	0.42 qt (US)

Brake Fluid

Brake Fluid

Brake System .... **0.4 liters (0.42 quarts)**

Coolant

Coolant Capacity

Capacity .... **5.7 liters (1.5 gallons)**

Engine Oil

Engine Oil

With filter .... 5.4L (5.7 Qt)
Without filter .... 5.0L (5.3 Qt)
Volume Difference Max-Min .... 1.9L (2.0 Qt)

Power Steering Fluid

Power Steering

Capacity .... **1 liter (1.05 quarts)**

Refrigerant

Refrigerant Capacity

Capacity .... **850 Grams (32 oz.)**

Refrigerant Oil

Refrigerant Oil

Oil Capacity .... **180 cc (6 oz.)**

Washer Fluid

Windshield Washer Reservoir:

Fluid Capacity **[1]** .... 3.9 qt (US)

[1] Capacity is approximate.

System Specifications

Automatic Transmission

Transmission Fluid .... **ATF Dextron III and Mercon**

Fluid - A/T

Automatic Transmission

Transmission Fluid .... ATF Dextron III and Mercon

Fluid Type

Fluid Type

Fluid Type	DOT 4+

Brake Fluid

Brake Fluid

Brake Fluid Type .... **Dot 4+**

Volvo Part Number **9437433**

Coolant

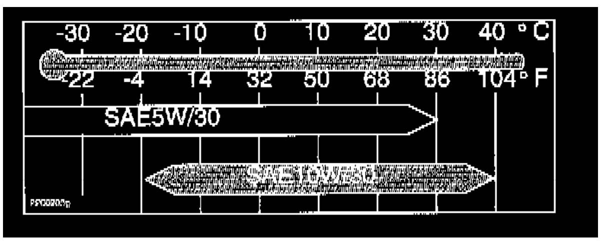
Engine Coolant

Type .... **Volvo Original Coolant**

Note: Volvo Original Coolant comes in different colors, it may be green, blue-green, red, or orange. Make a note of the color of the engine c

System Specifications

Engine oil



Viscosity Chart

Use engine oil that meets or exceeds the ILSAC GF-2 specification as well as the ACEA A1, API SJ, SJ/CF and SJ/Energy Conserving specification

Oil additives must not be used.

Engine Oil

Engine Oil

Grade .... API SJ, SJ/CF, SJ/EC, ACEA A1, ILSAC GF-2
Below 30° C (86° F) 5W-30
-20° to 40° C (-4° to 104° F) 10W-30

Fuel

Octane rating:

Volvo engines are designed for optimum performance on unleaded premium gasoline with an octane rating AKI of 91, or above. AKI (ANTI KNOC

The minimum octane requirement is AKI 87 (RON 91).

Refrigerant

Refrigerant

Refrigerant Type **R134a**

Refrigerant Oil

Refrigerant Oil Type

Refrigerant Oil Type .... **PAG**

System Specifications

Power steering fluid

Type .... **Pentosin CHF 11S**
Do not mix with other hydraulic fluids

Power Steering Fluid

Power steering fluid

Type .... **Pentosin CHF 11S**
Do not mix with other hydraulic fluids

Wheels and Tires

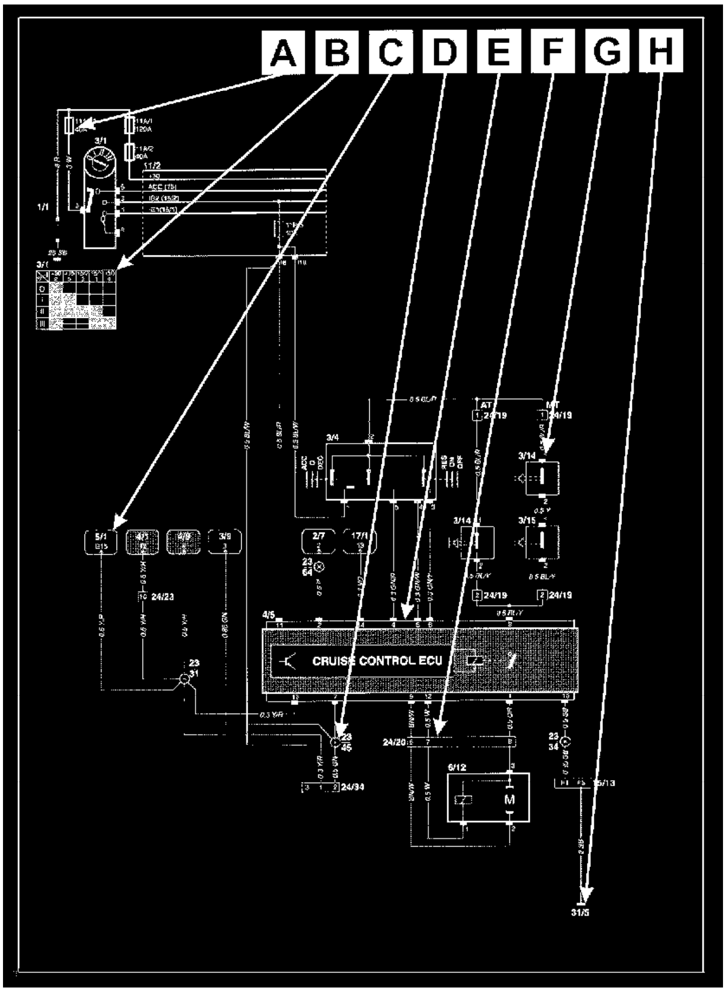
2000 VOLVO S40 1.9 Liter L4, FI, GAS

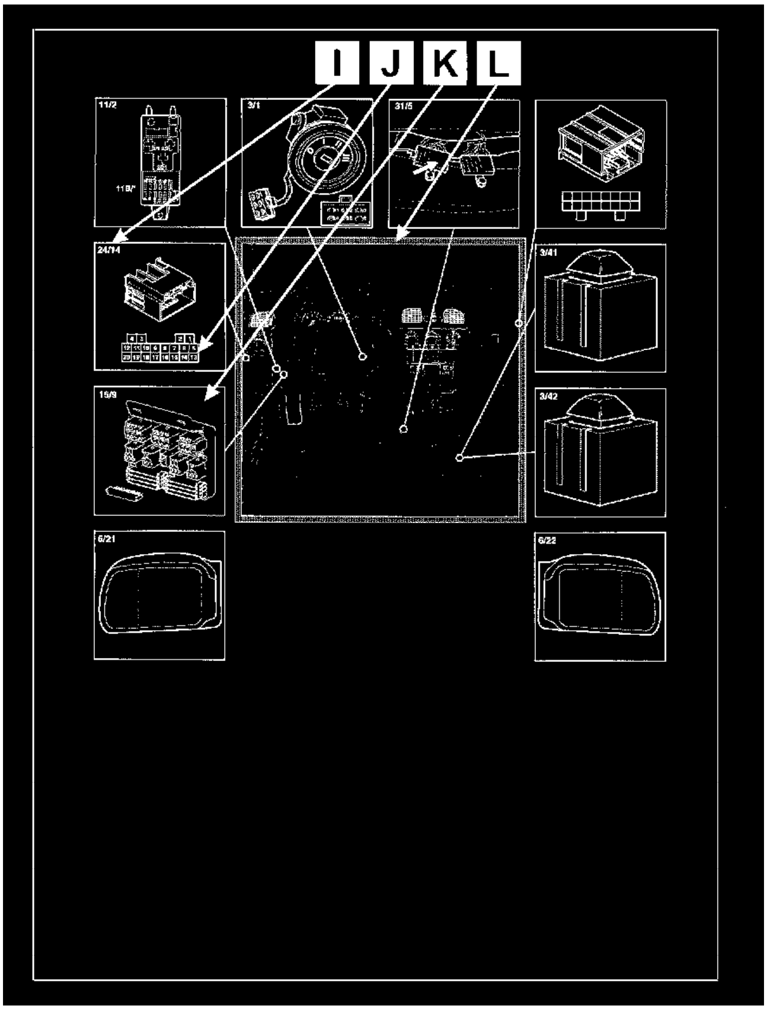
Front & Rear Tires
Tire Size **195/60R15**
Load Index 88
Speed Rating V
Inflation - Front .... 32 psi
Inflation - Rear .... 29 psi
Lug Torque .... 81 ft-lb
.

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

Vehicle: Diagrams

How to Use the Wiring Diagrams





The diagrams of the large complicated components are divided into sub-diagrams. These are designated 1(3), 2(3) and so on.

Battery (1/1), ignition switch(3/1) and central electrical unit (11B) in the passenger compartment are always at the top of the diagram. The connection for this central electrical unit (J1, J14 and so on) are on the page Relay box in the passenger compartment

A Fuses

The fuses are divided between the central electrical units. The fuses in the engine compartment start at 11A. The fuses in the passenger compartment start at 11B. There are also larger fuses in the engine compartment. These are indicated in the diagram by thick lines.

B Diagram

There are tables for certain components (the ignition lock for example) which display which terminals are electrically connected to each other at the various switch positions.

C Reference

Reference to a component that does not have any direct relevance to the open diagram.

D Junction

This is a junction in the cable harness.

E Control module

All control modules are gray. Any references to a control module are in gray blocks.

F Connector

Connector with terminal number (24/xx is always a connector).

G Component

Each component has a component designation. There is a foldout list of components at the back of this book.

H Ground terminals

Connector 31/1-2 means that the two ground terminals in the engine compartment are connected to each other. All components in the engine compartment are connected to this terminal, see "ground terminals".
See: Power and Ground Distribution/Locations

I Type number

The first part of the component designation indicates which type of component it is.

1	Battery
2	Relay
3	Contact breaker
4	Control modules
5	Instruments
6	Motors
7	Sensors
8	Components
9	Heater pad
10	Lighting
11	Fuses
15	Distribution rails (voltage supply, ground terminal etc.)
16	Audio
17	Diagnostic system
19	Gauges
20	Components (ignition and resistor)
23	Junction in the cable harness
24	Connectors
31	Ground terminals

J Terminal diagram for connectors

K Distribution rail

Distribution rail in the relay holder under the dashboard, see "distribution rails".

L Location of components in the car

For the routing of cable harnesses, see "cable harnesses". This also displays where the components and the connectors connect to the cable harness.
See: Harness

Wire Color Code Identification and Other Abbreviations

There are a number of abbreviations in the book. These are explained below.

Countries/Markets

A	=	Austria
AUS	=	Australia
B	=	Belgium
CDN	=	Canada
CH	=	Switzerland
D	=	Germany
DK	=	Denmark
E	=	Spain
EU/OS	=	Markets outside USA and Canada
FIN	=	Finland
GB	=	United Kingdom
JP	=	Japan
KOREA	=	Korea
N	=	Norway

NL	=	Holland
S	=	Sweden
WEU	=	Western Europe

Colors

BL	=	Blue
BN	=	Brown
GN	=	Green
GR	=	Gray
OR	=	Orange
P	=	Pink
R	=	Red
SB	=	Black
VO	=	Violet
W	=	White
Y	=	Yellow

Other

ABS	=	Anti-lock brakes
AC	=	Air Conditioning System (A/C System)
ACC	=	Accessories
ACC CONN	=	Accessories connector
AT	=	Automatic transmission
CDL	=	Central locking system
CEM	=	Central electronic module
Cruise	=	Cruise control
DH	=	Twin headlamps
Diesel	=	Diesel
DSA	=	Dynamic stability system
ECC	=	Electronic climate control
EMS 2000	=	Ignition control module (ICM) EMS 2000
FL	=	Left front
FR	=	Right front
HL	=	High equipment level
IC	=	Information center
LHD	=	Left hand drive
LL	=	Standard equipment level
Petrol	=	Gasoline
MAF	=	Mass Air Flow
MAP	=	Manifold absolute pressure
MELCO 1	=	Ignition control module (ICM) MELCO 1
MSA 15.5	=	Ignition control module (ICM) Diesel
MT	=	Manual transmission
RHD	=	Right hand drive
RL	=	Rear left
RR	=	Rear right
SH	=	Single headlamp

Siren	=	Siren
SRS	=	Safety restraint system
TCU	=	Automatic transmission control module
VGLA	=	Central locking/anti theft alarm (lock/alarm) control module

Engine variants

B4164S	=	Gasoline (petrol) engine
B4184S	=	Gasoline (petrol) engine
B4204S	=	Gasoline (petrol) engine
B4184SM	=	Direct injection gasoline (petrol) engine
B4204T	=	Low-pressure gasoline turbocharged engine
B4194T	=	High-pressure gasoline turbocharged engine
D4192T	=	Diesel turbocharged engine

Cars With SRS (Air Bag)/SIPS Bag

WARNING
Cars equipped with a Supplemental Restraint System (SRS)/SIPS bag must be treated extra carefully when repairs are being made. This is to help prevent:
1. Injuries when carrying out a repair.
2. Damage or malfunction of the SRS/SIPS bag system.
Repair to either the SRS/SIPS bag itself or a related system or component must be carried out by an authorized Volvo workshop.

Is the car equipped with SRS?

Cars with SRS are most easily recognized by the SRS letters on the steering wheel pad. If the car is also equipped with an air bag on the passenger side, the letters 'SRS' will be embossed on the instrument panel above the glove compartment. Cars with SRS are also equipped with pyrotechnic seat belt tensioners in the B-posts.
The SIPS bags are installed in all cars. Cars with SIPS bags are recognized by the identifying labels on the windshield and on seat storage tray.

Dashboard or around steering column

Take care to avoid the SRS wiring being pinched, frayed or pierced by screws when working on the firewall, ignition switch, steering column casings, glove compartment, instrument panel, door sills and B-posts.

Center console

The SRS collision sensor is located between the handbrake and gear lever (selector) in the center console. Never install accessories on or near the sensor.

Repairs to steering gear and column

When carrying out repairs to the steering wheel, steering gear or column always follow the repair procedures given in the appropriate SRS information. Read the relevant section. The contact reel in the steering column will be damaged if the steering wheel is turned more than three turns in either direction.

Seats

The SIPS bag sensor is located in the B-post. The SIPS bag can be activated by static electricity. Refer to Vadis information, "Seats, lifting in and out" when carrying out work on the front seats.

Test terminal

Data Link Connector socket in passenger compartment.

Modifications to May 1999 included.

Modifications introduced after the above date are not covered in this information.
See Service Bulletins as applicable.

Volvos are sold in versions adapted for different markets. These adaptations depend on many factors including legal, taxation and market requirements.
This information may therefore show illustrations and text which do not apply to cars in your country.

List of Components By Component Number

1/1	Battery
2/7	Starter motor (immobilizer)
2/8	Heating system
2/9	Heated rear window and door mirrors
2/10	Air conditioning (A/C) compressor
2/11	Engine cooling fan (FC), speed 1
2/12	Engine cooling fan (FC) (controlled by the air conditioning A/C)
2/13	Condenser fan for A/C
2/14	System relay for gasoline and Diesel
2/16	Power window driver's door (Autodown)
2/18	Power windows
2/19	Maximum speed blower fan motor ECC
2/21	Turn signal lamps
2/23	Shift lock
2/28	Engine cooling fan (FC), speed 2
2/30	Injectors/ignition MELCO 1
2/31	Fuel pump (FP) MELCO 1
2/33	System relay MELCO 1
2/34	Vacuum pump EMS 2000 (Turbo)
2/36	Relay glow plugs Diesel
2/37	Heater for engine coolant, relay 1
2/38	Heater for engine coolant, relay 2
2/39	Seat belt reminder
2/40	Seat belt reminder/ignition warning
2/41	Accessory relay
2/42	Trunk lid locking relay
3/1	Ignition switch
3/2	Light switch
3/3	Turn indicator/high-low beam switch
3/4	Controls cruise control
3/5	Switch warning light
3/6	Horn switches
3/7	Switch parking brake
3/10	Switch back-up (reversing) lamp
3/11	Switch windshield wipers
3/12	Switch tailgate washer/wiper
3/13	Power sun roof switch
3/14	Brake pedal switch
3/15	Clutch pedal switch
3/16	Front fog lamp switch
3/17	Rear fog lamp switch
3/18	Switch recirculation/air conditioning A/C
3/19	Switch blower fan motor
3/20	Controls blower fan motor
3/21	Switch windshield washer
3/22	Switch cargo compartment
3/24	Switch central locking
3/25	Lock switch rear door
3/26	Lock switch driver's door
3/27	Door switch driver's door
3/28	Door switch passenger door
3/29	Door switch rear left door
3/30	Door switch rear right door
3/31	Switch, heated seat, left
3/32	Switch, heated seat, right
3/33	Switch driver's side window (in the console)
3/34	Switch passenger side window (in the console)
3/35	Switch left rear window (in the console)
3/36	Switch right rear window (in the console)
3/37	Lock switch rear windows (in the console)
3/38	Switch left rear window
3/39	Switch right rear window
3/41	Control power door mirror, driver's side
3/42	Control power door mirror passenger side
3/43	
3/44	Switch automatic transmission to "winter" position

3/45	Switch automatic transmission to "econ/sport" position
3/47	Pressure switch A/C
3/48	Window control, driver's door
3/50	Switch hood
3/51	Switch brake pedal for locking gear shift selector
3/53	Shift lock switch
3/54	Lock switch driver's door
3/55	Wide open throttle switch
3/56	Control panel power seats
3/57	Switch retracting door mirrors
3/58	Switch ignition warning
3/59	Switch passenger airbag
3/60	Seat belt lock driver's seat
4/3	DSA control module
4/4	SRS control module
4/5	Cruise control control module
4/9	ECC control module
4/11	Power sun roof control module
4/12	Information center
4/14	ECC fan motor speed regulation
4/15	Adjustable resistance for the headlamps beam height adjustment
4/16	Dimmer
4/18	Immobilizer control module
4/19	A/C control module
4/20	Air conditioning (A/C) compressor control module
4/23	Electronic instruments
4/26	EMS 2000 control module
4/27	Automatic transmission control module (TCU)
4/28	ABS 5.3 control module
4/30	EMS 2000 ignition
4/32	Control module MELCO 1
4/33	Control module fuel injection system MELCO 1
4/34	Control module ignition system MELCO 1
4/35	Ignition warning control module
4/37	Engine control module (ECM) MSA 15.5 D4192T2
4/38	CEM (Central Electronic Module) Electronic central unit
4/39	VGLA control module for lock and alarm
4/40	Receiver VGLA
4/41	Ultrasonic, glass breakage sensor
5/1	Instrument panel
5/4	Display trip computer/outside temperature
6/1	Motor windshield wiper
6/2	Washer pump windshield wiper
6/3	Motor right headlamp wiper
6/4	Motor left headlamp wiper
6/5	Power sun roof motor
6/6	Starter motor
6/7	Generator
6/8	Motor blower fan passenger compartment
6/9	Motor engine cooling fan (FC)
6/10	Washer pump for rear windshield
6/11	Wiper motor for rear windshield
6/12	Cruise control vacuum pump
6/13	Fuel pump
6/14	Power antenna
6/15	Motor for headlamp beam height adjustment, left side
6/16	Motor for headlamp beam height adjustment, right side
6/17	Window lift mechanism motor driver's side
6/18	Window lift mechanism motor passenger side
6/19	Window lift mechanism motor left rear
6/20	Window lift mechanism motor right rear
6/21	Power door mirror left
6/22	Power door mirror right
6/23	Temperature - shutter motor ECC
6/24	Motor floor and defroster shutter ECC
6/25	Motor recirculation shutter

6/27	Condenser fan for A/C
6/28	Motor central locking system driver's door
6/29	Motor central locking system passenger door
6/30	Motor central locking system left rear door
6/31	Motor central locking system right rear door
6/32	Motor central locking system tailgate/cargo compartment
6/34	Motor locking system left rear
6/35	Motor locking system right rear
6/36	Deadlock driver's door
6/37	Deadlock passenger door
6/38	Deadlocked left rear door
6/39	Deadlocked right rear door
6/45	Motor power seat setting backrest rake
6/46	Motor power seat setting front of seat height
6/47	Motor power seat setting rear of seat height
6/48	Motor power seat setting seat forwards/backwards
6/49	Retractable door mirror driver's side
6/50	Retractable door mirror passenger side
6/51	EGR stepper motor
6/52	Fuel pump
6/54	Vacuum pump EMS 2000 (Turbo)
6/55	Lock motor for fuel tank filler cover

7/1	Bulb failure warning sensor rear
7/2	Fuel level sensor
7/3	Outside temperature sensor for trip computer
7/5	Engine coolant temperature (ECT) sensor for trip computer
7/6	Engine coolant temperature (ECT) sensor for Diesel
7/7	Oil pressure sensor
7/9	Brake fluid level sensor
7/10	Windshield washer reservoir level sensor
7/12	Thermostat driver's seat
7/13	Thermostat passenger seat
7/15	Heated oxygen sensor (H02S)
7/17	Vehicle speed sensor (VSS), left front wheel, ABS
7/18	Vehicle speed sensor (VSS), right front wheel, ABS
7/19	Vehicle speed sensor (VSS), left rear wheel, ABS
7/20	Vehicle speed sensor (VSS), right rear wheel, ABS
7/21	Engine speed (RPM) sensor, gasoline engines
7/22	manifold absolute pressure (MAP) sensor
	Manifold Absolute Pressure
7/25	Throttle position (TP) sensor
7/26	Knock sensor (KS)
7/27	Camshaft position sensor
7/28	ECC sun sensor
7/29	ECC outside temperature sensor
7/30	ECC engine coolant temperature (ECT) sensor
7/31	ECC temperature sensor, evaporator
7/33	Engine speed (RPM) sensor, Diesel
7/34	Injector needle, Diesel
7/36	Engine coolant temperature (ECT) sensor, Diesel
7/37	Outside temperature sensor, Diesel
7/39	Fuel temperature sensor
	Diesel cable harness
7/40	Vehicle lean sensor
7/47	Heated oxygen sensor (H02S) rear
7/48	Altitude sensor
7/49	Pressure sensor air conditioning (A/C)
7/50	Mass air flow (MAF) sensor
	Mass Air Flow
7/52	Engine coolant temperature (ECT) sensor
7/53	Intake air temperature (IAT) sensor
7/54	Glass breakage sensor
7/55	Ultrasonic sensor
7/56	Crankshaft sensor
7/57	Camshaft position sensor (CMP)
7/58	Fuel tank pressure sensor
7/59	Throttle position (TP) sensor
7/60	Sensor air pressure/temperature/flow
7/61	Automatic transmission oil temperature sensor

7/62	Engine coolant temperature (ECT) sensor
7/63	Brake vacuum sensor
7/64	Knock sensor (KS)
7/65	Control acknowledgement
7/67	Pressure switch vacuum pump EMS 2000 Turbo
7/68	Mass air flow (MAF) sensor
7/69	Fuel injection pump D419T2
7/70	Engine coolant temperature (ECT) switch and sensor Diesel
7/71	Fuel temperature sensor in injection pump
7/72	Accelerator pedal (AP) position sensor
7/73	Sensor, side airbag, driver's side
7/74	Sensor, side airbag, passenger side
7/77	Manifold absolute pressure (MAP) sensor (USA)
7/78	Leak diagnostic pump LDP
7/79	CVVT valve
7/80	Air assisted control valve
8/1	Air conditioning (A/C) compressor (magnetic clutch)
8/2	Idle air control (IAC) valve
8/3	SRS Driver unit
8/4	SRS passenger unit
8/6-9	Injectors
8/10	Seat belt tensioner driver's side
8/11	Seat belt tensioner passenger side
8/13	Exhaust Gas Recirculation Valve (EGR Valve), Diesel
8/16	Automatic transmission
8/23	Turbocharger (TC) control valve
8/24	Canister purge (CP) valve
8/25	Power seat, driver's side
8/26	Power seat, passenger side
8/27	Canister purge (CP) valve MELCO 1
8/28	Air by-pass valve, MELCO 1
8/29	Air by-pass valve, on/off MELCO 1
8/30	Injectors MELCO 1
8/31	Stop valve D4192T2
8/32	Control valve for injectors
8/33	Side airbag driver's side
8/34	Side airbag passenger side
8/35	Alarm horn
9/1	Cigarette lighter
9/2	Rear demist
9/7	Heating power door mirror left
9/8	Heating power door mirror right
9/9	Glow plug Diesel
9/10	Preheater fuel pump (FP) Diesel
9/12	Crankcase ventilation Diesel (NTC)
9/13	Crankcase ventilation (Turbo) (PTC)
9/14	Heater element for engine coolant
10/1	Left turn signal lamp front
10/2	Right turn signal lamp front
10/3	Turn signal lamp left fender
10/4	Turn signal lamp right fender
10/5	Front left parking lamp
10/6	Front right parking lamp
10/7	Low beam left front
10/8	Low beam right front
10/9	High beam left front
10/10	High beam right front
10/11	Left front parking lamp
10/12	Right front parking lamp
10/13	Front left fog lamp
10/14	Front right fog lamp
10/15	Left stop (brake) lamp
10/16	Right stop (brake) lamp
10/17	High-level stop (brake) lamp, in center
10/18	Back-up (reversing) lamp left
10/19	Back-up (reversing) lamp right
10/20	Left license plate lamp

10/21	Right license plate lamp
10/22	Turn signal lamp rear left
10/23	Turn signal lamp rear right
10/24	Parking lamp rear left
10/25	Parking lamp right rear
10/26	Tail lamp left
10/27	Tail lamp right
10/28	Left rear parking lamp
10/29	Right rear parking lamp
10/30	Rear fog lamp, on driver's side
10/31	Roof lamp for HL with reading lamps
10/32	Roof lamp for LL
10/33	Reading lamp rear left
10/34	Reading lamp rear right
10/35	Courtesy lighting
10/36	Vanity mirror lighting
10/37	Glove compartment lighting
10/38	Roof lamp rear, 5 door
10/39	Cargo compartment lighting, 4 door
10/40	Cargo compartment lighting, 5 door (2x)
10/41	Cigarette lighter, lighting
10/42	Gear selector position lighting, Automatic transmission
10/43	Ashtray, lighting
10/44	Heater controls, lighting
10/45	Light switch, lighting
10/47	Vanity mirror lighting, driver's side
10/48	Oil pressure warning lamp
10/49	Warning lamp charge current from the generator
10/50	Brake fluid level warning lamp
10/51	Exhaust warning lamp
10/52	Warning lamp parking brake EMS 2000
10/54	ABS warning lamp
10/55	SRS warning lamp
10/56	AT warning lamp
10/57	DSA warning lamp
10/58	Fuel level warning lamp
10/59	Engine coolant temperature (ECT) warning lamp
10/60	Warning light indicator lamp
10/61	Indicator lamp lighting
10/62	High beam indicator lamp
10/63	Door open indicator lamp
10/65	Immobilizer indicator lamp
10/66	Warning lamp bulb failure warning sensor
10/67	Indicator lamp left turn signal lamp
10/68	Indicator lamp right turn signal lamp
10/69	Seat belt reminder indicator lamp
10/70	Tow hitch indicator lamp
10/71	Indicator lamp pre-heater, Diesel
10/72	Windshield washer fluid warning lamp
10/73	Front fog lamp indicator lamp
10/74	Rear fog lamp indicator lamp
10/75	Instrument lighting
10/78	Seat belt indicator lamp
10/79	Service reminder indicator lamp
10/80	Sun Sensor LED
10/81	Cruise control indicator lamp
10/82	Parking lamp integrated with turn signal lamp, left
10/83	Parking lamp integrated with turn signal lamp, right
10/84	Single headlamp, right
10/85	Single headlamp, left
10/86	Twin headlamp, right
10/87	Twin headlamp, left
11/1	Fusebox in engine compartment
11/2	Fusebox in passenger compartment
11A/no	Fuses in engine compartment
11B/no	Fuses in passenger compartment
15/4	Distribution rail opening door lock A1-A6
15/5	Distribution rail interior lighting A8-A10

15/6	Distribution rail closing door lock B1-B6
15/7	Distribution rail dimmer B8-B11
15/8	Distribution rail deadlocking door lock C1-C6
15/9	Distribution rail low beam C8-C10
15/10	Distribution rail ground terminal D1-D11
15/11	Distribution rail on-board diagnostic (OBD) system E1-E10
15/13	Distribution ground terminal F2-F11
16/1	Radio
16/2	Loudspeaker left front door
16/3	Loudspeaker right front door
16/4	Loudspeaker instrument panel left side
16/5	Loudspeaker instrument panel right side
16/6	Loudspeaker parcel shelf left
16/7	Loudspeaker parcel shelf right
16/9	Horn 1
16/10	Antenna amplifier, 5-door
16/16	Horn 2
16/18	Bass speaker
17/1	On-board diagnostic system (OBD), connector
19/1	Fuel gauge
19/2	Temperature gauge
19/3	Tachometer
19/4	Speedometer
20/1	Heating resistor
23/xx	Junction points
24/11	Connector 22-pin Passenger compartment - Cargo compartment cable harness
24/12	Connector 4-pin Passenger compartment - Cargo compartment cable harness
24/13	Connector 8-pin Passenger compartment - Fuel tank
24/14	Connector 20-pin Passenger compartment - Driver's door cable harness
24/15	Connector 20-pin Passenger compartment - Passenger door cable harness
24/16	Connector 10-pin Passenger compartment - Rear door cable harness driver's side
24/17	Connector 10-pin Passenger compartment - Rear door cable harness passenger side
24/18	Connector 14-pin Passenger compartment - Dashboard cable harness
24/19	Connector 2-pin Passenger compartment - Cruise control cable harness
24/20	Connector 22-pin Passenger compartment - Engine compartment cable harness
24/21	Connector 3-pin Passenger compartment - Engine compartment cable harness
24/23	Connector 22-pin Passenger compartment - Engine control module (ECM) cable harness
24/24	Connector 12-pin Passenger compartment - Engine cable harness
24/25	Connector 1-pin Starter motor
24/26	Connector 10-pin Engine compartment - Dashboard cable harness
24/27	Connector 8-pin Engine compartment - Engine cable harness
24/29	10-pin connector Tailgate - Cargo compartment cable harness V40
24/30	Connector 2-pin Tailgate - Cargo compartment cable harness V40
24/31	Connector 6-pin Tailgate - Cargo compartment cable harness V40
24/32	Connector 10-pin

	Engine-Automatic transmission cable harness
24/33	Connector 4-pin
	Engine compartment harness - Engine cooling fan (FC) Diesel
24/64	Connector 12-pin
	Engine compartment - Engine cable harness
24/70	Connector 8-pin
	Engine compartment - Engine cable harness, MELCO 1
24/72	Connector 8-pin
	Engine cable harness - ABV, MELCO 1
24/73	Connector 6-pin
	Motor-Battery cable harness, MELCO 1
24/81	Connector 22-pin
	Passenger compartment - Engine compartment cable harness, Diesel
24/82	Connector 12-pin
	Passenger compartment - Engine compartment cable harness, Diesel
24/83	Connector 6-pin
	Engine compartment - Engine cable harness, Diesel
24/84	Connector 4-pin
	Engine compartment - Engine cable harness, Diesel
24/90	Connector 6-pin
	Motor - Ignition system cable harness, EMS 2000
24/91	Connector 4-pin
	Cargo compartment cable harness - Accessory cable harness
24/120	Connector 8-pin
	Passenger compartment - Cargo compartment cable harness, USA
31/xx	Ground terminals

VIDA (Vehicle Information & Diagnostics For Aftersales)

VIDA (Vehicle Information & Diagnostics for Aftersales)

During the second half of 2004, VADIS (Volvo Aftersales Diagnostic and Information System) was phased out and replaced by VIDA (Vehicle Information & Diagnostics for Aftersales). The purpose of VIDA is to support service providers in repairing and servicing Volvo vehicles. VIDA provides Service and Parts information, as well as diagnostic fault tracing, and software downloads. As in VADIS, these areas are integrated into one single application. All functionality that could be found in VADIS will be found in VIDA. However, in some particular areas, e.g., the diagnostic work flow, search functionality, and the Parts catalogue, VIDA contains considerable enhancements when compared to VADIS.

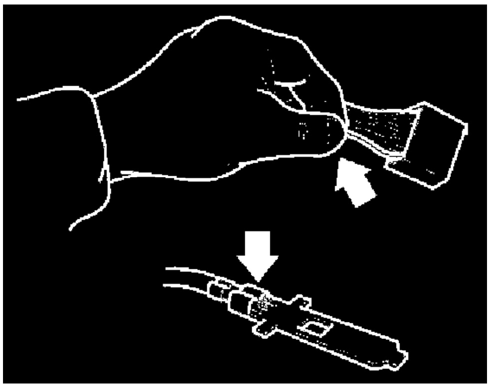
Volvo's VIDA (Vehicle Information & Diagnostics for Aftersales) system ties together service and repair data, parts data, service bulletins, software (firmware) downloads, fault tracing and on-board diagnostic as well as other related information to decrease service time.

Much of the diagnostic information provided here is presented in a manner that assumes the technician is using the web-based Volvo diagnostic system (VIDA) to diagnose the vehicle. Volvo does not provide any information based on performing diagnosis with a third party diagnostic tool aside from a conversion from P Codes to Volvo ECM Codes. See: Powertrain Management/Computers and Control Systems/Testing and Inspection/Diagnostic Trouble Code Descriptions/P Code Charts

Checking Wiring and Terminals - Permanent Faults

Checking wiring and terminals. Permanent faults

Check terminals visually



NOTE: When checking the engine control module (ECM), do not remove the control module from the car before the main relay has interrupted the power supply. This may take up to **4 minutes** after the ignition has been switched off and the engine cooling fan (FC) has stopped running.

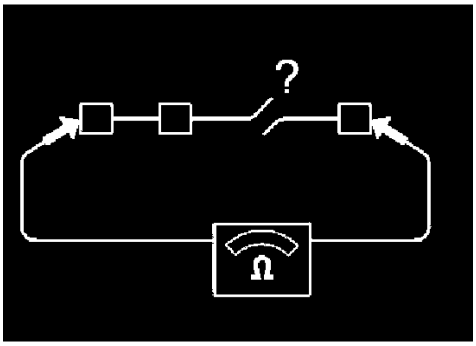
Inspect the terminals visually when checking, or taking readings from, opened connectors.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:

- Check for oxidation. This can cause poor connections in the terminals
- Check for damage to pins and terminals. Check that they are properly inserted into the connector. Check that the cable is properly connected to the pin or terminal. Check pins and terminals particularly carefully
- Use a separate male terminal to check the female terminal. Check that they are secure: Pull on the pin.

Open-circuit, permanent faults

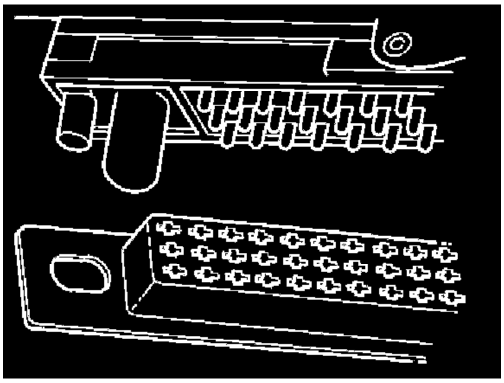


An open-circuit in a cable is indicated by a loss of one or more functions.

Chafed and broken cables or terminals that have come loose are common causes of faults in electrical systems.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:



- Disconnect the connectors at both ends of the cable.

Connect an ohmmeter between the ends of the cable.

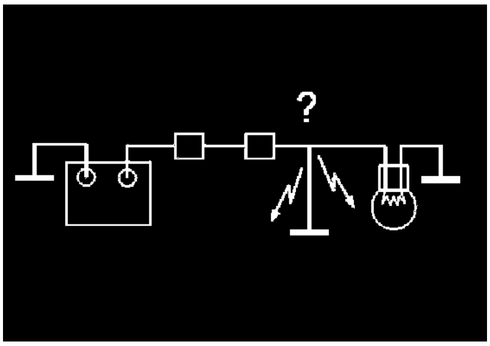
The ohmmeter should read approximately **0 Ohm** if there is no open-circuit in the cable.

Always check the control module and control module box connectors to ensure that their pins and sockets are not bent or damaged, as this can cause faults.

Check pins and terminals particularly for this fault.

See Check terminals visually.

Short-circuit to ground, permanent faults



A short-circuit between a live cable and ground is often indicated by the loss of a function or a fuse blowing when a current is passed through the cable.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:

- Activate all switches and sensors in the circuit. Check whether the fuse blows
- Disconnect the connectors in the circuit to ensure that they do not affect readings.

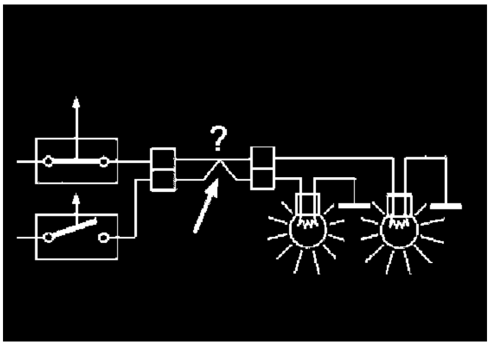
Use an ohmmeter to take a resistance reading between the cable and ground.

The ohmmeter should read infinite resistance if no components are connected.

Check pins and terminals particularly for this fault.

See Check terminals visually.

Short-circuit to supply voltage. Permanent faults



A short-circuit between a cable and supply voltage is often indicated by the loss of a function or a fuse blowing when voltage is passed through the cable.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:

- Use a voltmeter to take readings at various points in the circuit while operating switches and sensors.

Voltmeter readings will depend on which circuit is tested and the status of switches and sensors.

Use the wiring diagram to determine the correct voltage in the circuit.

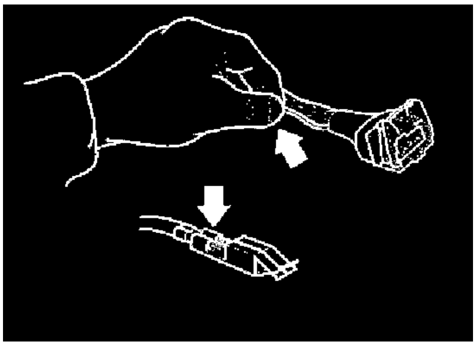
Use an ohmmeter between the suspect cables to detect short-circuits between them.

The ohmmeter should read infinite resistance between cables not connected to each other in the circuit.

Check pins and terminals particularly for this fault.

See Check terminals visually.

Contact resistance and oxidation



Repair wiring and cable terminals, as required, using proper service procedures.

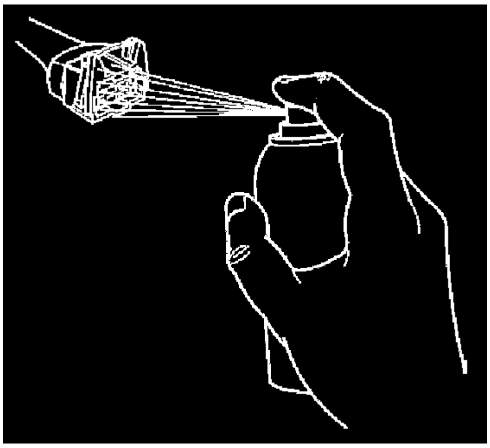
In theory, the resistance across contacts, leads and terminals should be **0 Ohm**. However, there is always some resistance due to terminal oxidation.

If this resistance becomes too great the result will be a malfunction. The magnitude of the resistance before it causes a malfunction depends on the circuit load.

Checks:

- Check the cables visually according to Check terminals visually.

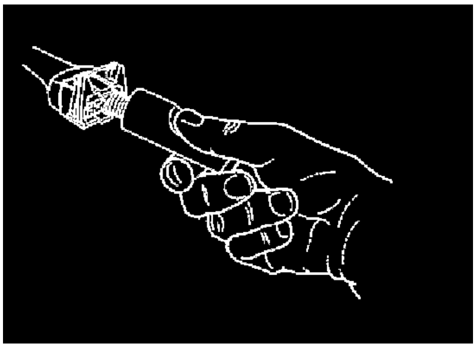
Cleaning female socket terminals and male pin terminals

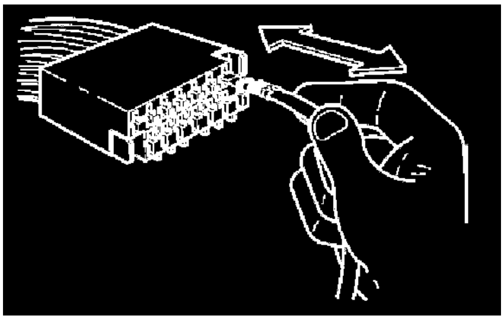


NOTE: Do not apply rust solvent spray or grease to the heated oxygen sensor (HO2S) or combined instrument panel connectors.

- Ignition off
- Disconnect the battery negative terminal
- Use compressed air to clean the disconnected connector
- Apply rust solvent spray 1161422 to the disconnected connectors
- Blow clean using compressed air.

Greasing female terminals





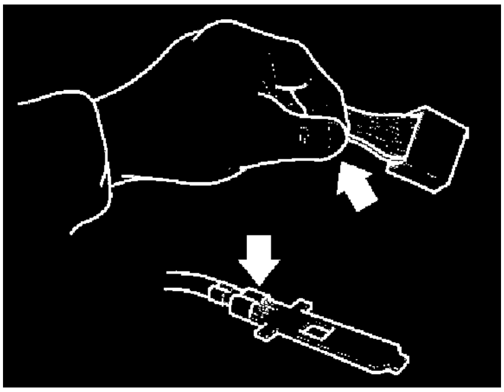
NOTE: Do not fill the protective cover with grease.

- Press grease, P/N 1161417-9, into the female sockets directly from tube
- Check that all the terminal cavities are filled
- Use a loose male pin to ensure that the connection in the sockets is good. The pin should remain in position when pulled gently.

Checking Wiring and Terminals - Intermittent Faults

Checking wiring and terminals. Intermittent faults

Inspect terminals visually



NOTE: When checking the engine control module (ECM), do not remove the control module from the car before the main relay has interrupted the power supply. This may take up to **4 minutes** after the ignition has been switched off and the engine cooling fan (FC) has stopped running.

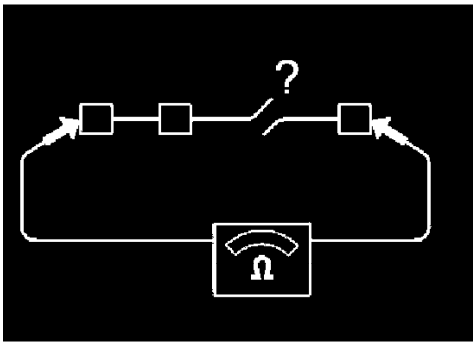
Inspect the terminals visually when checking, or taking readings from, opened connectors.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:

- Check for oxidation. This can cause poor connections in the terminals
- Check for damage to pins and terminals. Check that they are properly inserted into the connector. Check that the cable is properly connected to the pin or terminal. Check pins and terminals particularly carefully
- Using a loose male connector, test to see if the female connector provides a good contact and that the pin remains in place when the male connector is pulled lightly Shake the cable lightly and pull on connectors during measurement to locate damage.

Open-circuit, intermittent faults

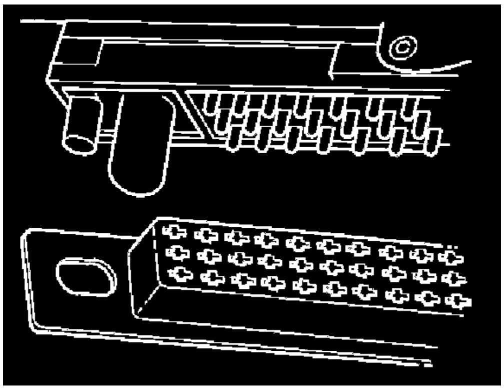


An open-circuit in a cable will be indicated by the loss of a function (or functions).

Chafed and broken leads are common causes of faults.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:



- Disconnect the connectors at both ends of the cable.

Check the cables visually according to Inspect terminals visually.

Connect an ohmmeter between the ends of the cable.

The ohmmeter should read approximately **0 Ohm** if there is no open-circuit in the cable.

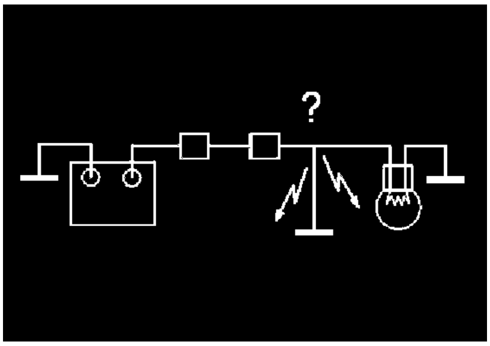
Shake the cable lightly and pull on connectors during measurement to locate the damage.

If the reading is not correct. Replace the cable and/or continue according to Contact resistance and oxidation.

Always check the control module and control module box connectors to ensure that their pins and sockets are not bent or damaged, this may cause faults.

Check pins and terminals particularly carefully.

Short-circuit to ground, intermittent faults



A short-circuit between a live cable and ground is often indicated by the loss of a function or a fuse blowing when a current is passed through the cable.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:

- Check the cables visually according to Inspect terminals visually.

  Activate all switches and sensors in the circuit. Check whether the fuse blows

- Disconnect the connectors in the circuit to ensure that they do not affect readings.

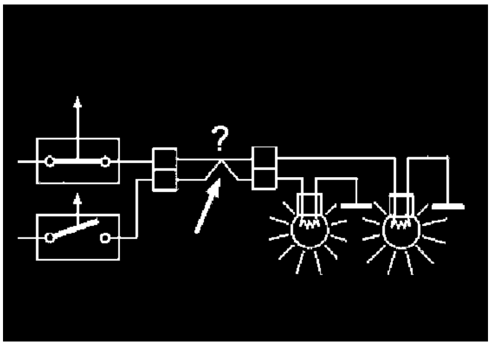
Connect an ohmmeter between cable and ground.

The ohmmeter should read infinite resistance if no components are connected.

Shake the cable lightly and pull on connectors during measurement to locate the damage.

If the value is not correct, try a new cable and/or continue according to Contact resistance and oxidation.

Short-circuit to supply voltage, intermittent faults



A short-circuit between a cable and supply voltage is often indicated by the loss of a function or a fuse blowing when a current is passed through the cable.

Repair wiring and cable terminals, as required, using proper service procedures.

Checks:

- Check the cables visually according to Inspect terminals visually.
  Use a voltmeter to take readings at various points in the circuit while operating switches and sensors.

The voltmeter reading depends on the circuit being tested and the positions of switches and sensors. Use the wiring diagram to determine the correct voltage in the circuit.

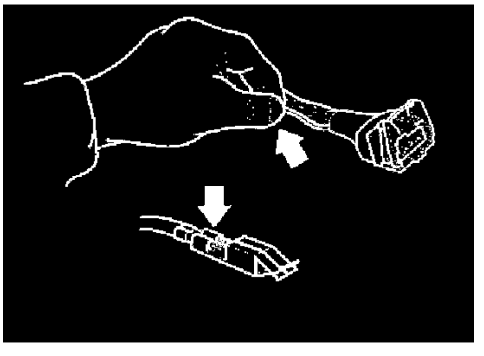
Use an ohmmeter between the suspect cables to detect short-circuits between them.

The ohmmeter should read infinite resistance between cables not connected to each other in the circuit.

Shake the cable lightly and pull on connectors during measurement to locate the damage.

If the reading is not correct. Replace the cable and/or continue according to Contact resistance and oxidation.

Loose connections (terminals)



Repair wiring and cable terminals, as required, using proper service procedures.

Loose connections in terminals may be caused by oxidation of the pins and sockets, or by a faulty connection of a cable to its cable terminal.

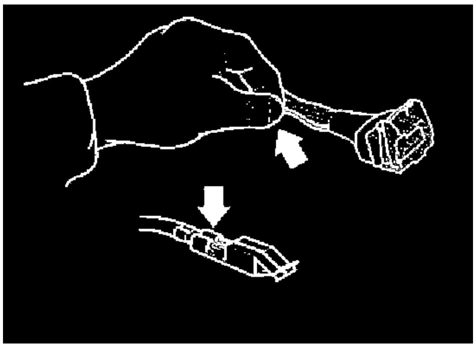
Loose connections produce the same faults as an intermittent open-circuit in a cable.

Checks:

- Inspect terminals visually according to Inspect terminals visually.

  Continue according to Contact resistance and oxidation.

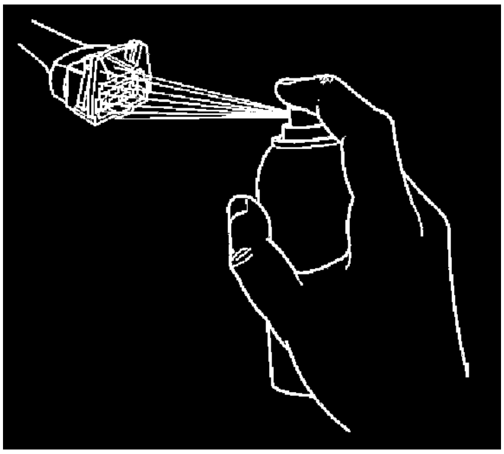
Contact resistance and oxidation



In theory, the resistance across contacts, leads and terminals should be **0 Ohm**. However, there is always some resistance due to terminal oxidation.

If resistance is too great there will be function problems. The magnitude of the resistance before it causes a malfunction depends on the circuit load. A guideline would be a **few ohms**.

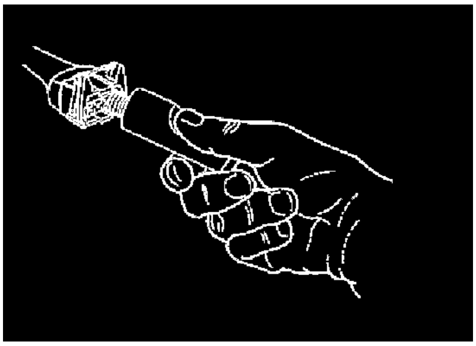
Cleaning female socket terminals and male pin terminals

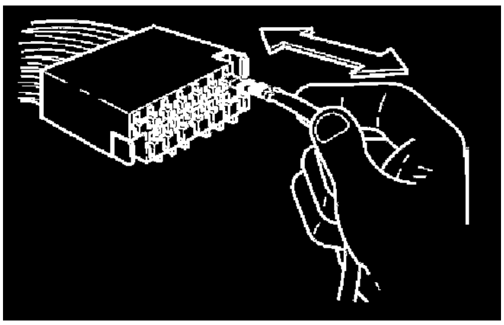


NOTE: Do not apply rust solvent spray or grease to the heated oxygen sensor (HO2S) or combined instrument panel connectors.

- Ignition off
- Disconnect the battery negative terminal
- Use compressed air to clean the disconnected connector
- Apply rust solvent spray 1161422 to the disconnected connectors
- Blow clean using compressed air.

Greasing female terminals





NOTE: Do not fill the protective cover with grease.

- Press grease, P/N 1161417-9, into the terminals directly from the tube
- Check that all the cavities in the connectors are filled
- Use a loose male pin to ensure that contact in sockets is good. The pin should remain in position when pulled gently.

Cables, General

KA. Cables, general

General

This Service Manual is for the repair and replacement of cables in an existing cable harness. Choice of cable size and rating, cable routing for installing accessories or other installations are not covered here.

- For mounting accessories or subsequent wiring work refer to the instructions for the particular part involved.

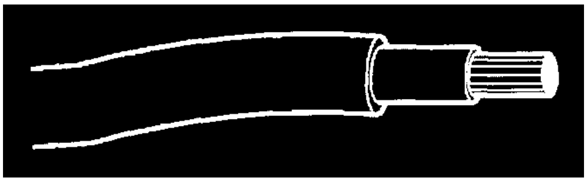
Normal multiple strand cable

There are different types of cable. The most common is multiple strand (more than 7 strands) of copper. There are also single strand cables and minimal strand (2-7 strands). Cables have different areas and color codes.

Cable area

Specifications that give a cable area are always based on the area of the core (the copper strands). The cable area does not include the insulation.

Cable insulation (sheath)

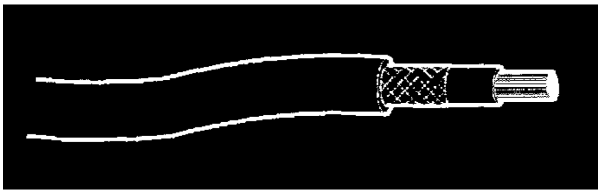


Nearly all cables are of the insulated type and have either single or double insulation.

Some copper cables have no insulation.

Other types of cable

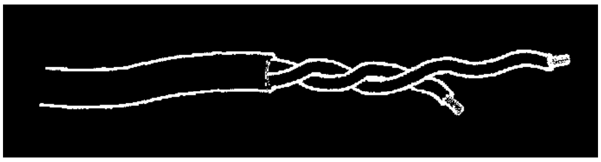
Shielded cables



Shielded cables are used for carrying signals from antenna and in wiring for engine control modules. Braided wire shield is wrapped around on or two conducting copper strands which provides protection against interference from electromagnetic high frequency fields.

Special tools are required for stripping, splicing and connecting shielded cables.

Twisted pair

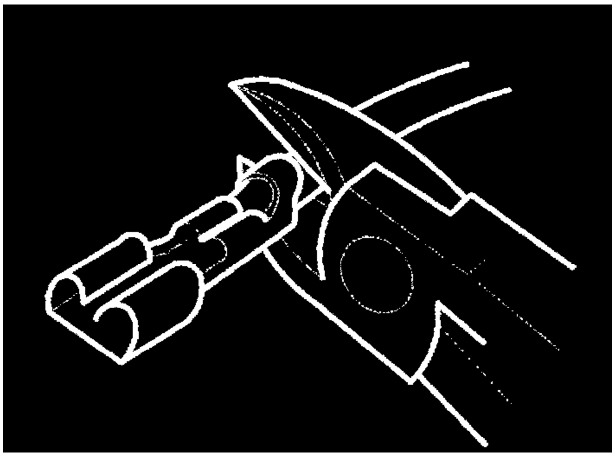


Twisted pair cables reduce the effects of magnetically induced interference. When splicing twisted pair cables the splice points must not be made parallel.

Cutting and Checking A Cable

Cutting and checking a cable

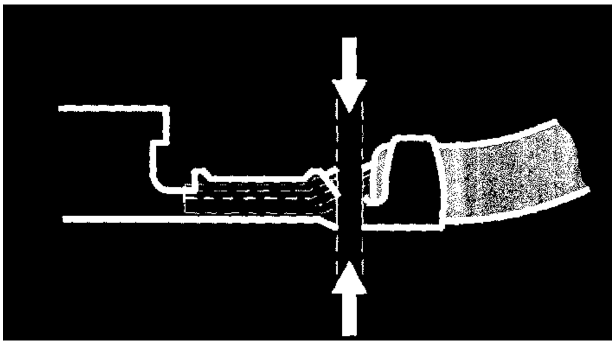
Cutting a cable



If the cable is connected to a connector first remove the cable with the cable terminal from the housing.

- Cut the cable at the cable terminal.

Minimize length loss on cables



If there Is a risk that the cable will be too short when the cable terminal is replaced follow this procedure in order to minimize length loss for tightly routed cables:

- Cut the cable terminal between the core crimp and the insulation wings.

Inspect the cable insulation

Check if there is
- Visible mechanical wear or damage from excessive loadings.
- Visible damage from excessive electrical loadings in the form of discoloration or melted material.

If the damage is only at the end of the cable
Cut off the damaged section and check that the length remaining is sufficient.

If the cable is too short it must be renewed or a new section of cable added
- Replacement of cable
- See Splicing using insulated moisture proof butt connector.

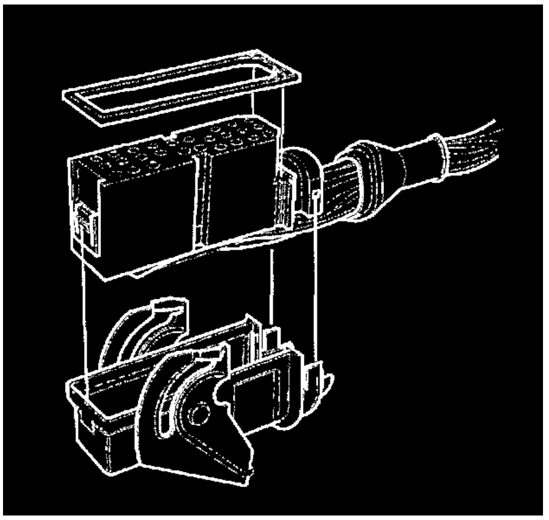
If there is damage along the cable

Replace the cable with a new one
- Replacement of cable. For small areas of damage such as scratches (not deep ones) it can be enough to apply reinforcement to the cable insulation by using a heat-shrinkable tubing over the damaged area. If good sealing properties are required then either a shrinkable tubing with internal coating of glue or self-vulcanizing tape p/n 3540116-5 must be used.

Example 1

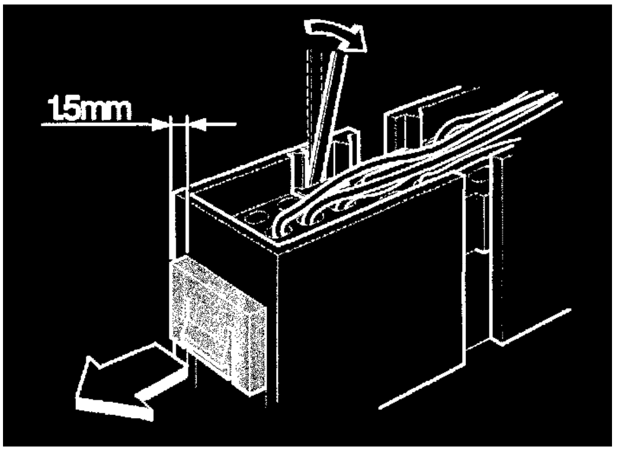
Example 1

Socket type housings p/n 3523410-3, and equivalent pin housings Replacement of cable terminals
Remove housing



- Pull back the rubber cover on the cables
- Remove rubber gasket (socket housings only).
- Carefully release the clips by bending them out with a small screwdriver (one clip per side).
- Depress the catch on the front of the housing and lift the housing out of the connector cover.

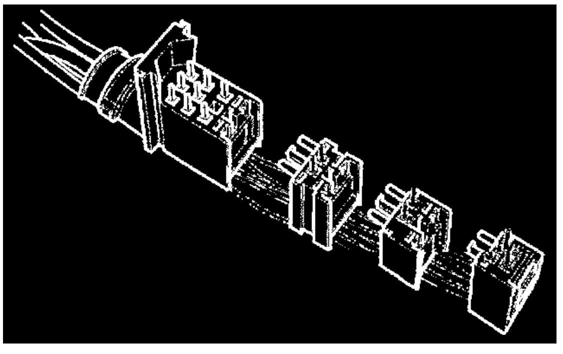
Open the housing



Release the housing secondary locking as shown.

- Insert a small screwdriver (approx. **3 mm** blade width) as shown. Bend the secondary locking catch outward carefully and push the locking cover forwards **1.5 mm.**

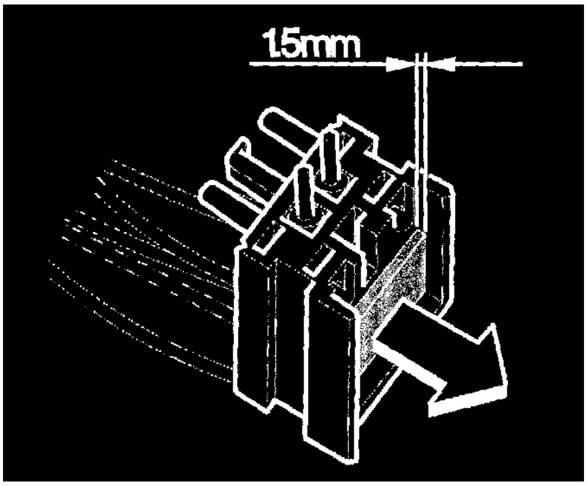
For a combined pin housing do the following:



- Release the pin housings from each other.

The illustration shows pin housings with the contact side up.

Open the housing section to replace terminal



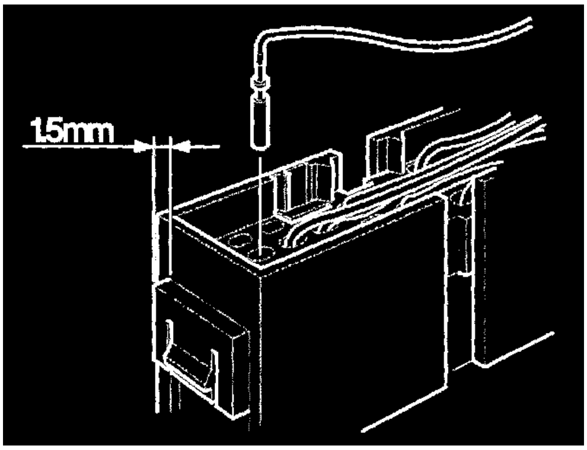
Front housing section

- The front housing section opens by carefully bending the secondary locking out and sliding the locking cover forwards **1.5 mm.**

Other housing sections

- The other housing sections open by pressing in the locking catch on the cable side and sliding the locking cover forwards **1.5 mm.**

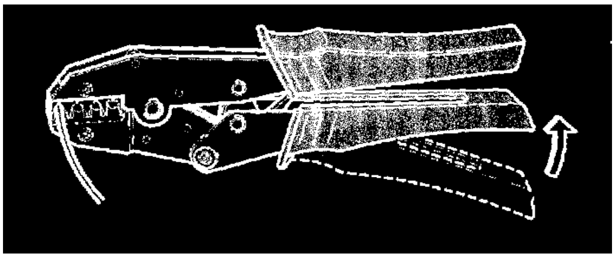
Extract the cable terminal



No terminal removal tool is required.

- Extract the cable terminal from rear of the by pulling on the cable.

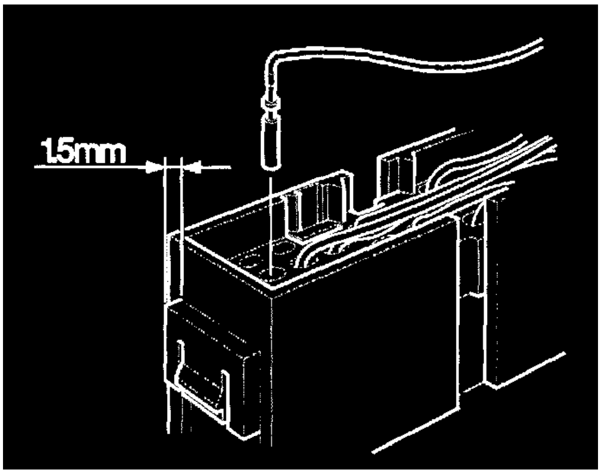
Crimp new cable terminal



The cable terminal is 1.6 Pin/Pin socket.

- Use a strip length of **3 to 4 mm** and strip the cable as described in Stripping a cable.
- Use crimp tool (green) p/n **981 4226** and crimp the cable terminal as described in **Crimping a cable terminal.**

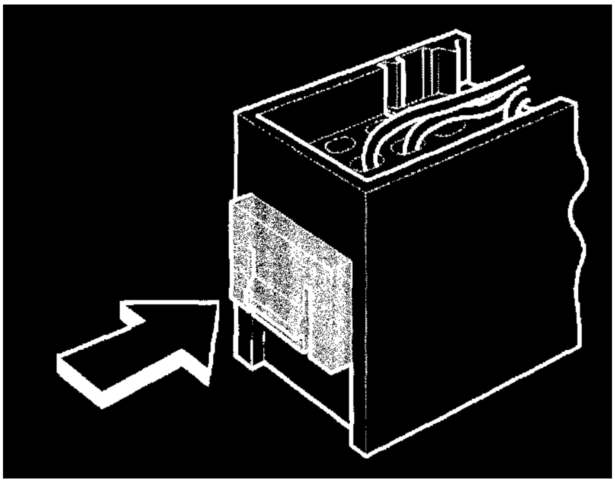
Insert new cable terminal



NOTE: The locking cover must be in the open position protruding **1.5 mm** as described in (NA2).

- Insert the new cable terminal in the housing from the cable side in the correct cavity. A "click" can be heard when the terminal is pushed fully home.

Close the housing



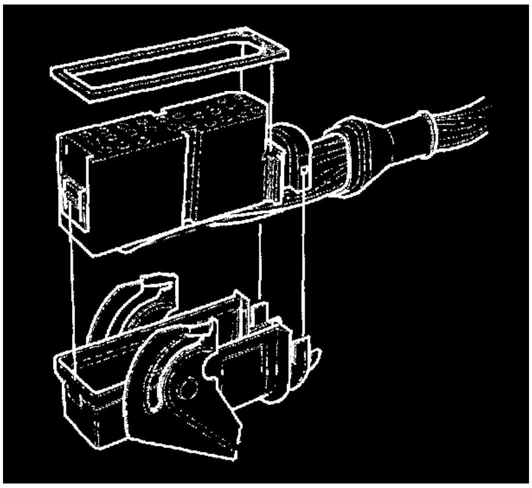
Secondary locking

- Push the locking cover back to the starting position for secondary locking of the housing. A "click" indicates the lock has engaged.

Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



- Replace the connector cover. Check that the catches (3 catches) engage.
- Replace gasket seal (only for socket housings).
- Push on rubber seal over housing

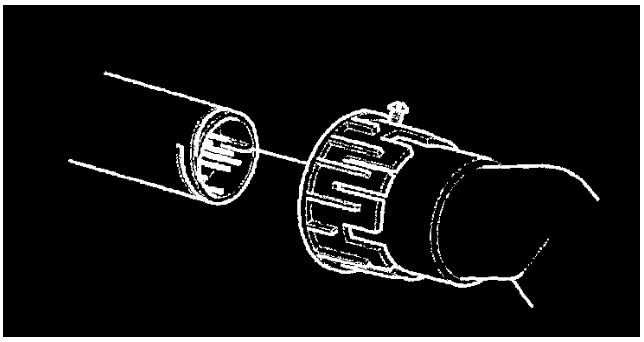
Example 2

Example 2A

Socket housings p/n 6849321-2
Replacement of cable terminal in socket housing

NOTE: For equivalent pin housing, see Example 2B.

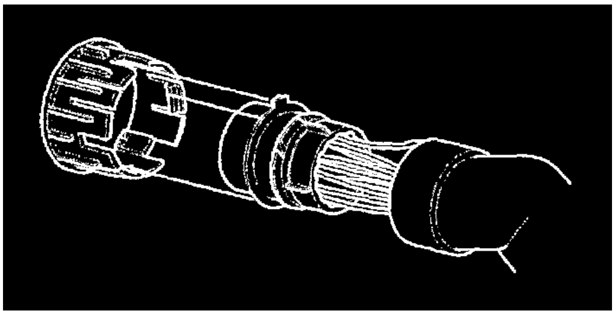
Separate the connector pin and socket housings



If the connector is intact then first remove the socket housing (female) from the pin housing (male). See illustration.

- Undo the locking screw. (Some connectors have no locking screw).
- Turn the connector housing retaining ring (outer ring) counterclockwise.
- Separate the two halves of the connector.

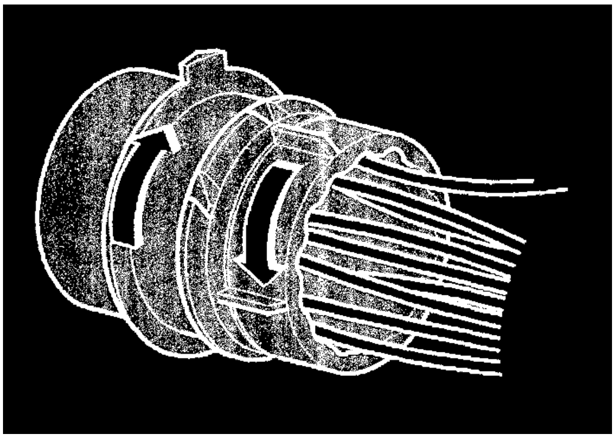
Extract socket housing



Extract socket housing from the connector housing as follows:

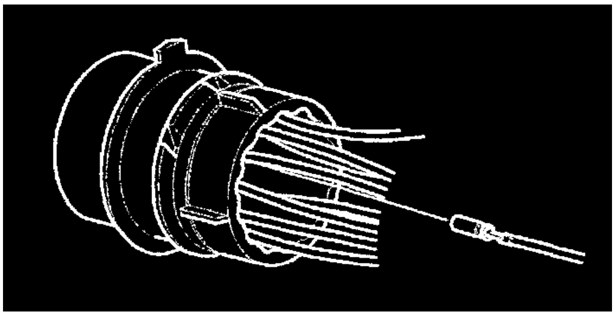
- Remove retaining ring from the connector by inserting a small screwdriver from the rear of the ring and pry open the 3 catches.
- Pull back rubber seal on the cables.

Open socket housing



- Open the socket housing secondary locking by turning the two rings shown in the illustration. A "click" indicates that the secondary locking has disengaged.

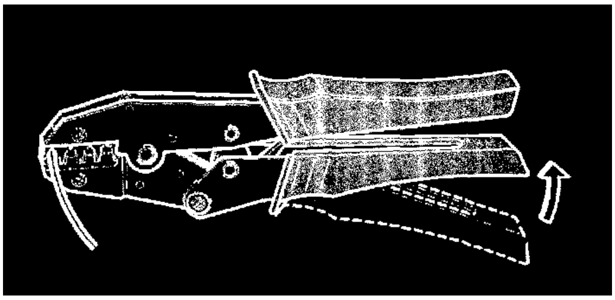
Extract the cable terminal



No terminal removal tool is required.

- Extract the cable terminal from the rear of the housing by tugging on the cable.

Crimp new cable terminal

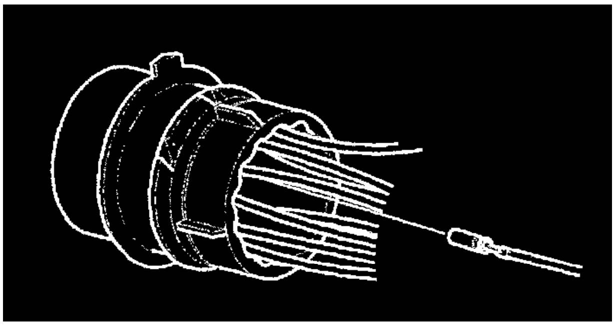


The cable terminal is 1.6 Pin socket.

- Use strip length **3 to 4 mm** and strip the cable as described in section **Stripping a cable.**
- Use crimp tool (green) pin **981 4226** and crimp the cable terminal as described in Crimping a cable terminal.

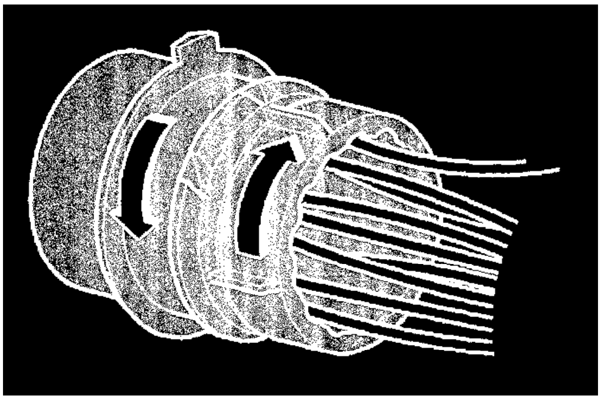
Insert new cable terminal in housing

NOTE: The housings secondary locking must be open, see (NB3).



- Insert the new cable terminal in the correct socket housing cavity from the cable side. A "click"" indicates that the catch has engaged.

Close socket housing

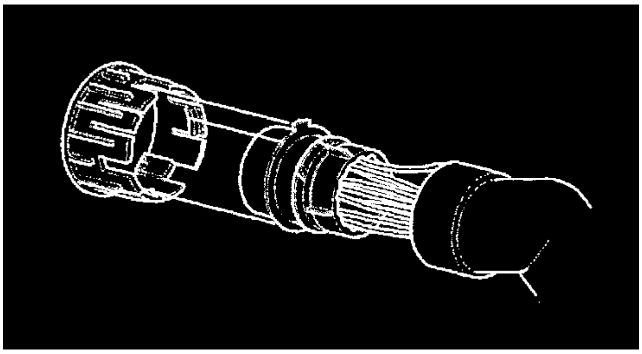


Secondary locking
- Activate secondary locking by Turing both the ring sections as shown in the illustration. A "click" indicates that the secondary locking has engaged.

Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



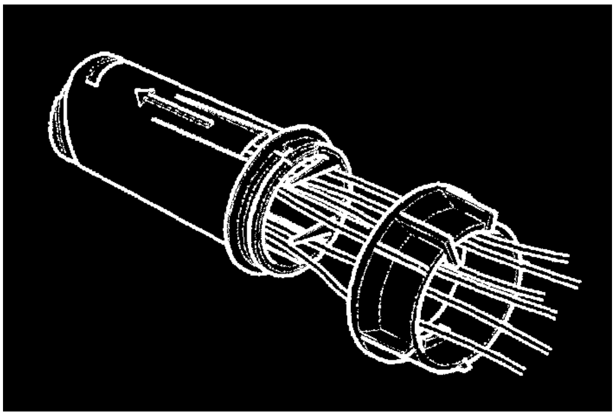
- Push the rubber seal on to the socket housing.
- Replace the retaining ring on the socket housing.

Example 2B

Pin type housing p/n 3545784-5
Replacement of cable terminals in pin housing

NOTE: For equivalent socket housing, see Example 2A.

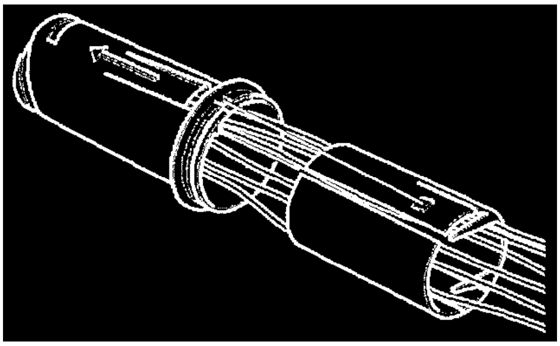
Separate the pin and socket housings of the connector



If the connector is intact:

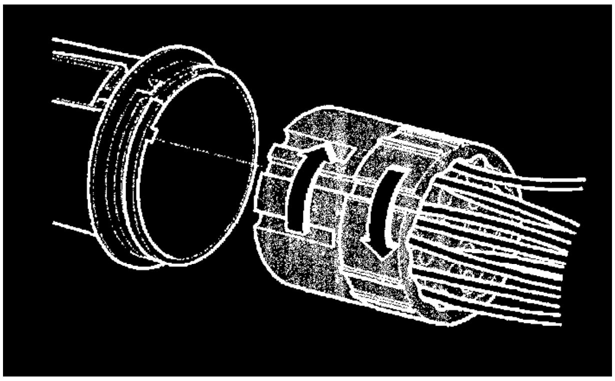
- First disconnect the socket housing from the pin housing as m **Example 2A.**

Open the connector



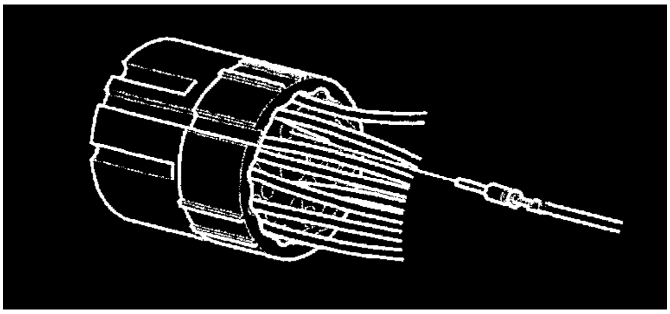
- Turn the retaining ring on the connector counterclockwise until a "click" indicates it has disengaged.
- Remove the retaining ring and pull back on the cables.
- Release the two catches on the sides using a narrow screwdriver.
- Withdraw the inner tube and pull back on the cables.

Open the pin housing



- First remove the pin housing from the outer shell.
- Open the pin housing secondary locking by Turing the two rings as shown. A "click" indicates that the secondary locking has disengaged.

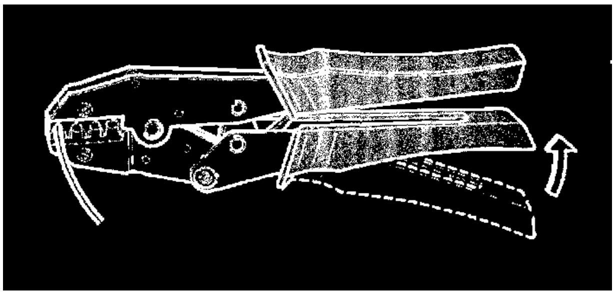
Extract the cable terminal



No terminal removal tool is required.

- Extract the cable terminal from the rear of the housing by pulling on the cable.

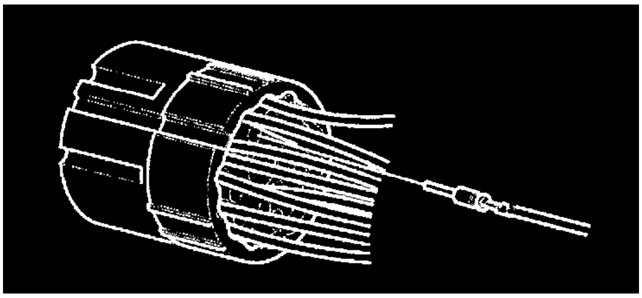
Crimp new cable terminal



The cable terminal is 1.6 Pin.

- use strip length **3 to 4 mm** and strip the cable as described in stripping a cable.
- Use crimp tool (green) p/n **9814226** and crimp the cable terminal as described in Terminal crimping.

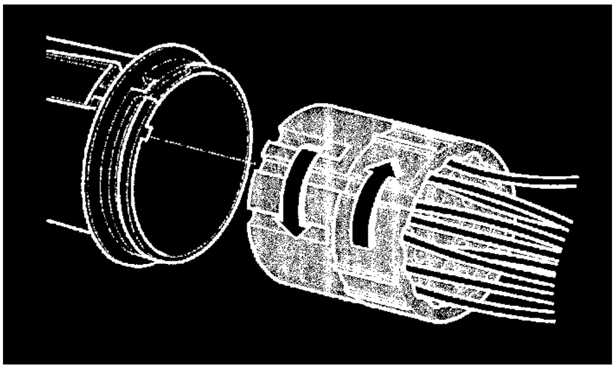
Insert the new cable terminal in housing



NOTE: The housing secondary locking must be open as in **(NC3).**

- Insert the new cable terminal in pin housing from the cable side in the correct cavity. A "click" indicates that the catch has engaged.

Close socket housings



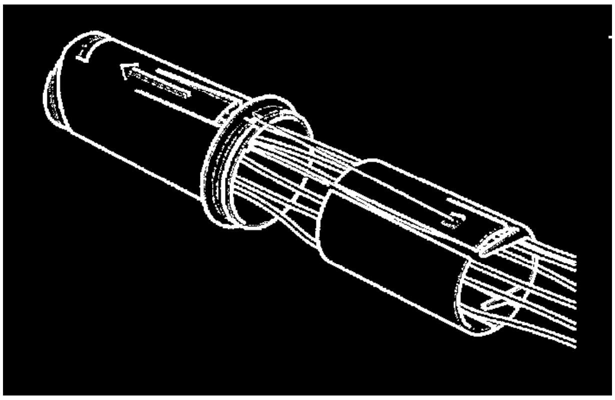
Secondary locking

- Close the housing and activate secondary locking by turning both the ring sections as shown in the illustration. A "click" indicates that the secondary locking has engaged.

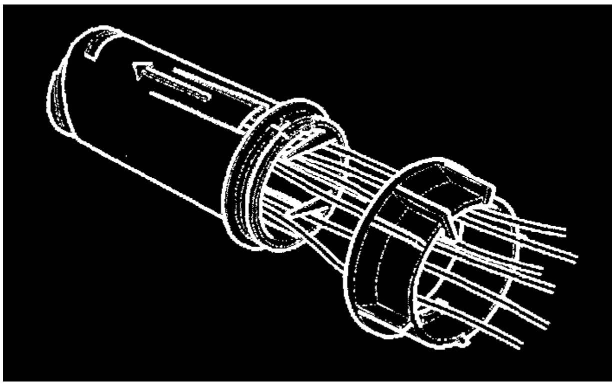
Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



- Insert the pin housing in the outer shell. The tab slot should be lined up with the guide groove.
- Insert the inner tube in the outer shell. Line up the slot with the guide groove. Press the inner tube firmly in so the catches engage in the correct position.



- Reinstall the retainer ring on the pin housing and turn the ring clockwise until the catch engages.

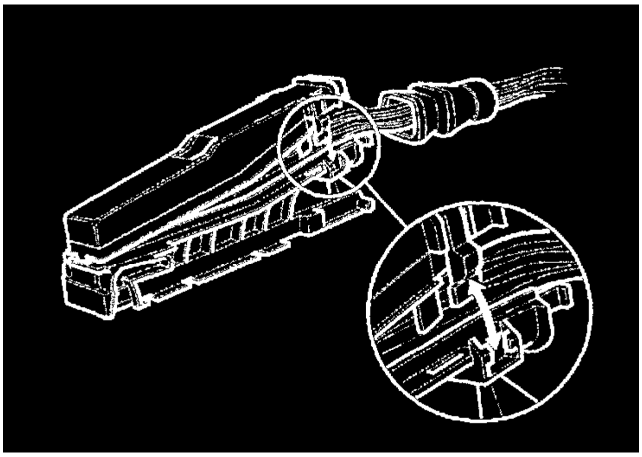
Example 3

Example 3

Socket type housing p/n 3523276-8

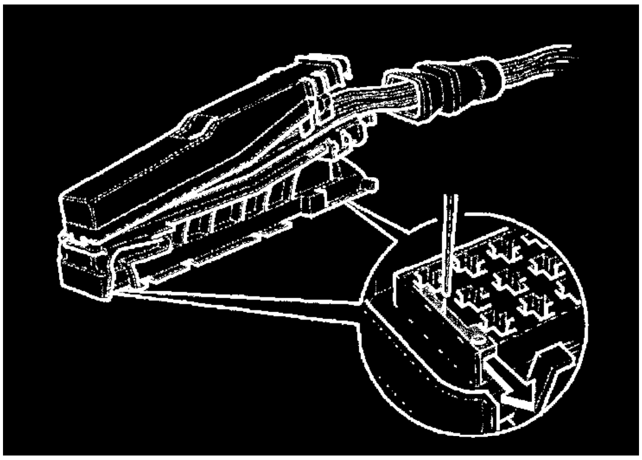
Replacement of cable terminals

Remove the connector cover



- Pull the rubber sleeve back on the cables.
- Keep both catches pressed in (one on each side) and pull the connector cover up.
- Remove the connector cover from the housing.

Open the housing



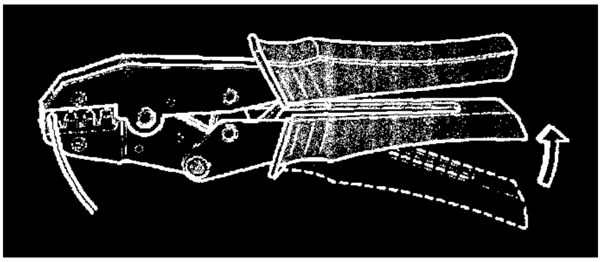
Release the secondary locking catches (one on each side) as follows:

- Insert a narrow screwdriver blade as shown. Carefully bend back the catch at the edge and push the secondary locking slightly forwards (approx. **1 mm**).

Extract the cable terminal

Follow the instructions in when the cavity opening has two extraction grooves.

Crimp new cable terminal



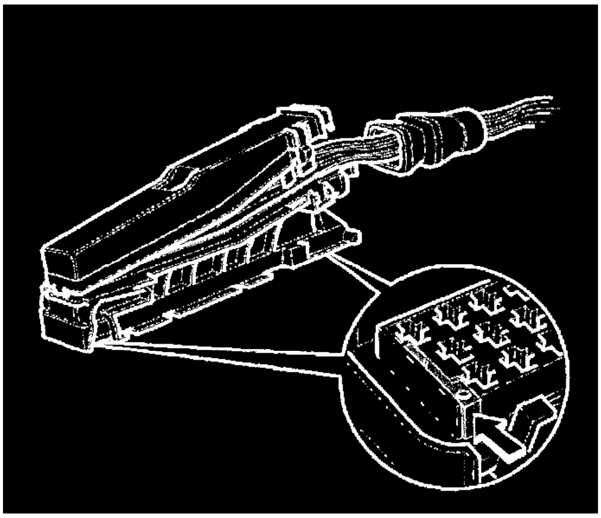
Crimp the cable terminal as in Crimping a cable terminal. Do not forget to install a new seal on the cable.

Insert the new cable terminal in the housing

NOTE: The housing secondary locking must be slightly open as in (ND2).

- Insert the new cable terminal in the housing from the cable side checking that it is in the correct cavity. A "click" indicates the catch has engaged.

Close the housing



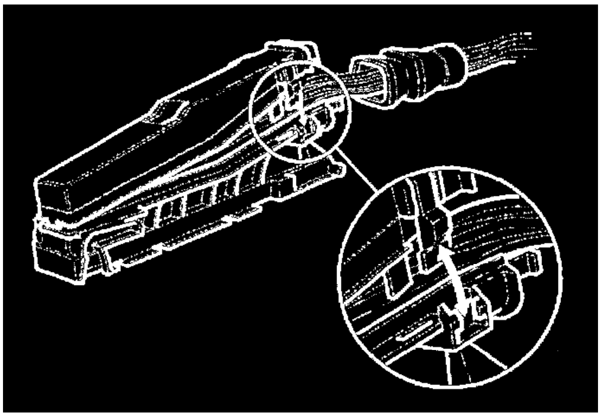
Secondary locking

Press the secondary locking catches (one on each side) slightly to their original position.

Check

- Carefully pull on the cables to check the terminal is firmly attached.

Reassemble the connector



- Replace the connector cover by depressing the locking catches (one on each side).

Check that the catches have engaged properly.

- Push rubber seal into place.

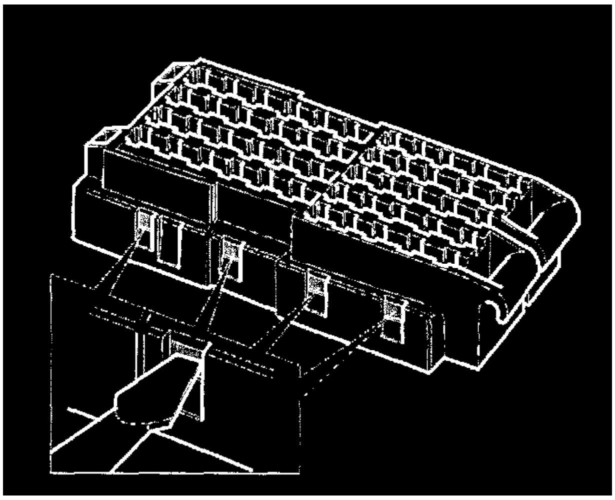
Example 4

Example 4

Socket type housings pin 1362989-4, and corresponding pin housings

Replacement of cable terminals

Open the housing



Hold the housing as shown and open the secondary locking as follows:

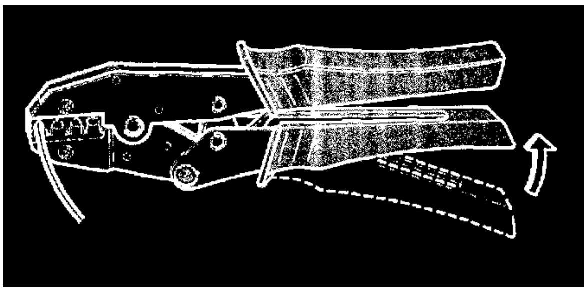
- Using a small screwdriver press the catches on the secondary locking in from the side shown in the illustration. A "click" will be heard.

When the secondary locking is pressed in the locking cover slides open and the cavities open.

Extract the cable terminal

Follow instructions in cavity opening with one extraction groove.

Crimp new cable terminal



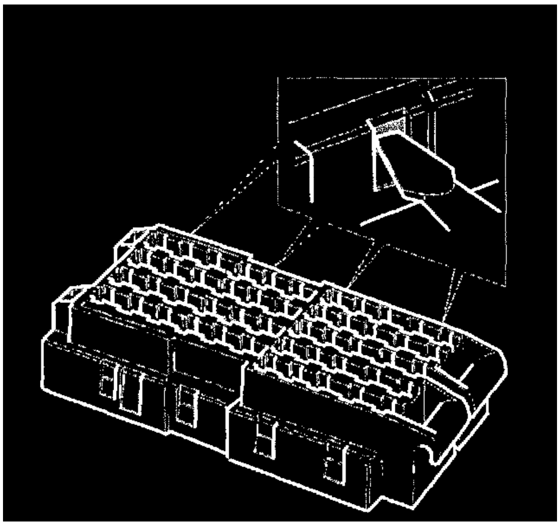
Crimp new cable terminal as in crimping! a cable terminal.

Insert the new cable terminal in the housing

NOTE: The housing secondary locking must be in the open position as in (NE1).

- Insert the new cable terminal in the housing from the cable side checking that it is in the correct cavity. A "click" indicates that the locking tab has engaged.

Close the housing



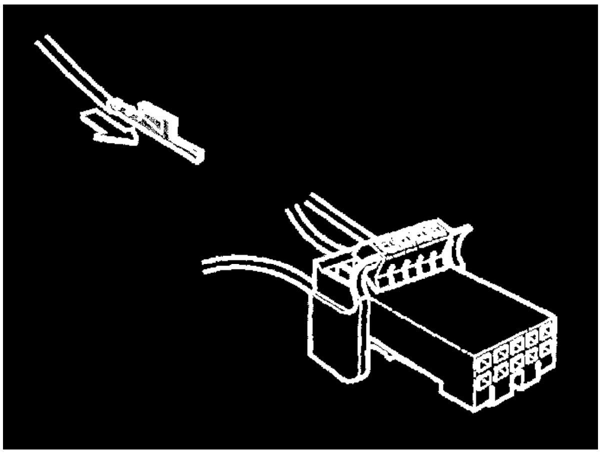
Hold the housing as shown and close it by activating the secondary locking as follows:

- Using a small screwdriver press in the catches on the secondary locking from the opposite side. A "click" indicates that the secondary locking has engaged.

Inserting Cable Terminal In A Housing

When cable terminal is to be inserted in a housing

Keep in mind the following



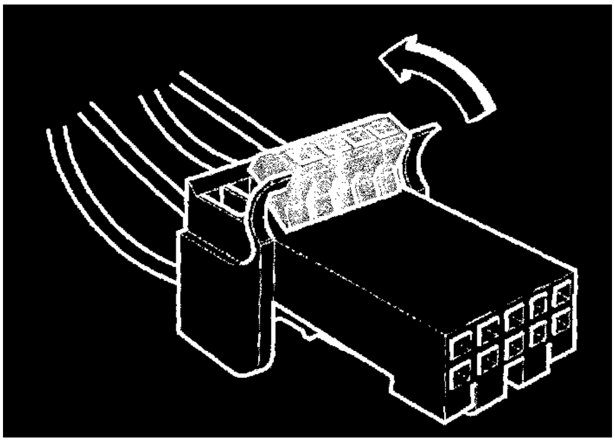
The secondary locking must always be open.
Inspect the locking tab/tabs on the terminal for damage and check that they are not pressed inward.
The cable terminal must be inserted from the housing's cable side.
Check against the wiring diagram that you have the correct cavity/position number.
Turn the cable terminal the right way up. Check against the other terminals.
When the cable terminal is inserted in the cavity a "click" is often heard when the primary locking engages.
Check that the cable terminal is firmly in place by pulling lightly on the cable.

Proceed

When the cable terminal is located in the housing it should be closed.

Closing the housing

Keep in mind the following



The secondary locking must always be adjusted to the initial position.
The secondary locking must be closed in reverse order to the way it was opened.
When the secondary locking is closed a "click" is often heard.
If it cannot be closed it might be because the cable terminal is not completely inserted in the cavity.
If the connector has a sheath, cover or rubber gasket for the housings, do not forget to reinstall it.

After completing the repair work

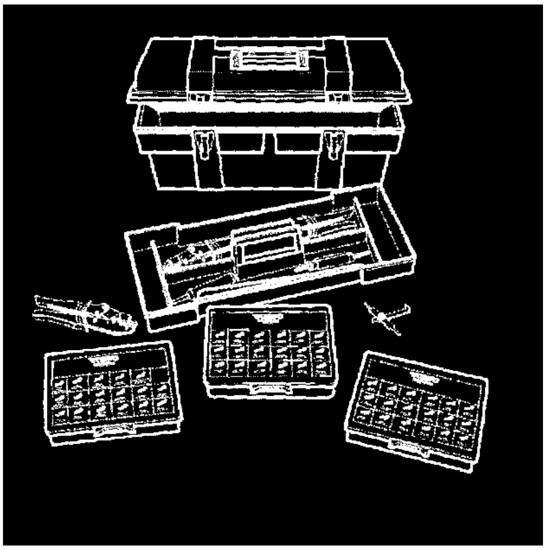
- Replace the battery negative cable terminal on the battery.
- check functions for the equipment affected by the repair.

New Cable Terminal

New cable terminal

CAUTION: Always use a new Volvo original cable terminal of the recommended type and quality when replacing a cable terminal.

Identify the cable terminal



First compare the cable terminal removed from the housing with the cable terminals in the repair kit pin **9814235.** Look inside the box lid and compare the terminal with those in the assortment available in the box.

NOTE: Cable area When the correct type of cable terminal is identified choose one of the right size for the cable area required. Seal sws For cable terminals designated sws a seal must be used.

Stripping the cable insulation

If no similar cable terminal is available in the cable terminal assortment

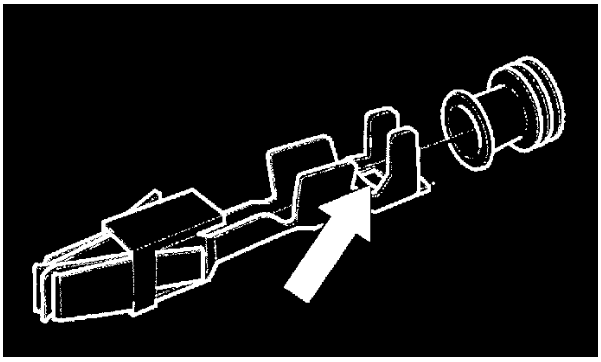
If the cable terminal does not compare with any of those available in the assortment in the box, check in the relevant Spare Parts Catalogue.

NOTE: When the correct type of cable terminal is identified in the Spare Parts Catalogue, choose a cable terminal of the right size for the cable area required and order the cable terminal.

Seal sws and plug

Seal sws for cable terminals

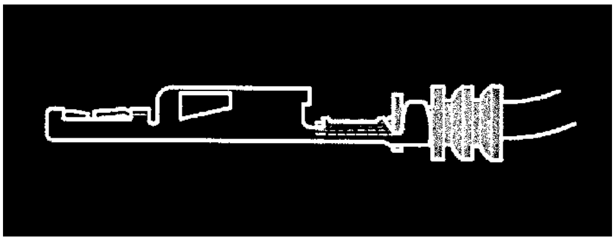
CAUTION: Always use the correct size of seal to match the cable.



A seal must always be used for cable terminals with the designation sws.

How to identify a cable terminal that requires a seal:

- If there is a hole or slot (see arrow in illustration) in the insulation wings a seal must be used.



Seals are used where the cables are exposed to aggressive environmental factors and there is a risk of moisture penetration in the housing cavities.

The rubber-based seals prevent oxidization and retain moisture proof properties even when subjected to heavy vibration and extremes of temperature.

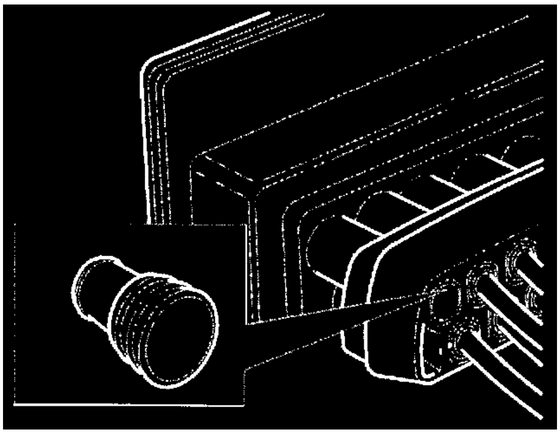
The seals are crimped round the cable at the insulation wings on the cable terminal.

The seals have different colors which are coded according to size as shown in the table below.

Table for cable terminal seals

Seal	Color	Abbreviation	Cable diameter mm
970772-0	Blue	BL	1.2 - 2.0
970773-8	White	W	2.1 - 2.9

Plug



Plugs are used to close the unused cavities in a moisture proof housing.

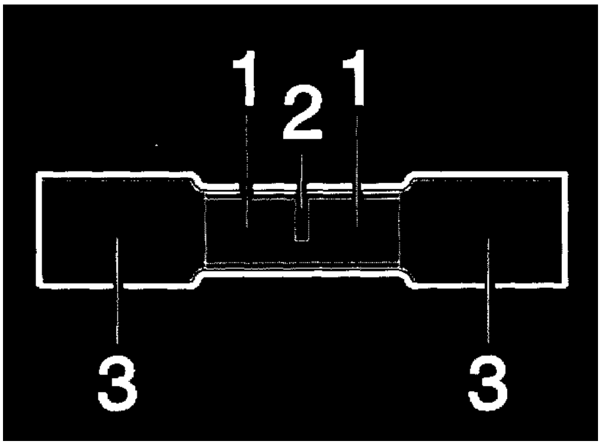
A plug is in principle like a seal but without a hole in it for a cable.

Plugs are included in the repair kit p/n **9814235** for housings with cable terminals of the type 2.8 sws.

Splicing Cables, General

Splicing cables, general

Splicing, different types
Insulated moisture proof butt connector



A butt connector is used for joining two cables by crimping and shrinking.

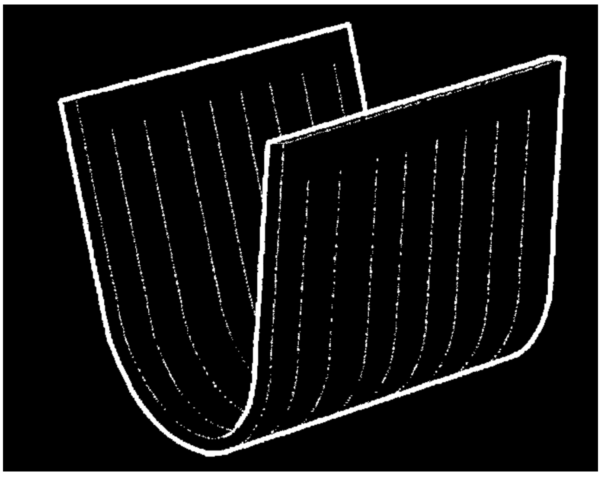
The crimping is done at two points (1) on a metal girdle to join the cable cores from each side.

The crimp section of the connector is divided in the center by an metal tab (2) which is where the cable core ends meet

The support sections (3) are coated with glue on the inside. When they are heated the plastic layer shrinks, the glue is released and flows out in the connector over the cable. When correctly used this method provides a strong and moisture proof joint.

For method details with insulated butt connector, refer to Splicing Using Insulated Moisture Proof Butt Connector. See: Diagnostic Aids/Splicing Using Insulated Moisture Proof Butt Connector

Uninsulated butt connector



This type of butt connector is used in certain production operations to join cables.

To insulate the crimped butt connector a heat-shrinkable tubing is used that has an internal coating of glue. When heated the tube shrinks and the glue melts for good sealing properties and moisture protection.

Splicing using an uninsulated butt connector is not covered in this Service Manual.

Where an uninsulated butt connector must be replaced use an insulated butt connector, refer to Splicing Using Insulated Moisture Proof Butt Connector. See: Diagnostic Aids/Splicing Using Insulated Moisture Proof Butt Connector

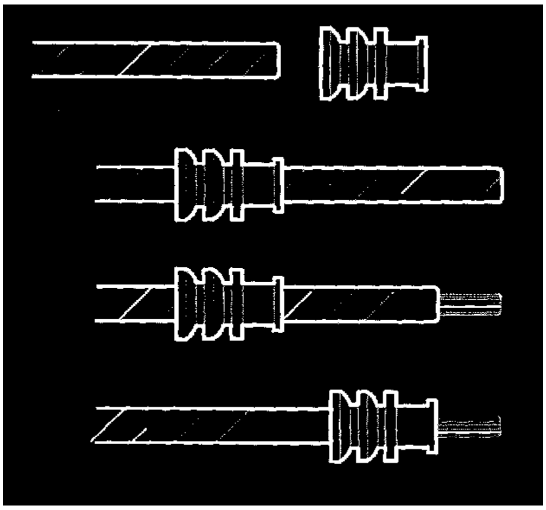
Branch point

Several cables can be joined together in a branch point splice. To make a branch point use an insulated butt connector, refer to Splicing Using Insulated Moisture Proof Butt Connector. See: Diagnostic Aids/Splicing Using Insulated Moisture Proof Butt Connector

Stripping A Cable

Stripping the cable

Stripping the cable for a cable terminal



If the cable is to be stripped of the end insulation prior to terminal crimping in a cable terminal, check if a seal is required for that type of cable terminal.

- A description of which cable terminals require seals can be found in Seal sws and plug.

If no seal is to be used on the cable terminal

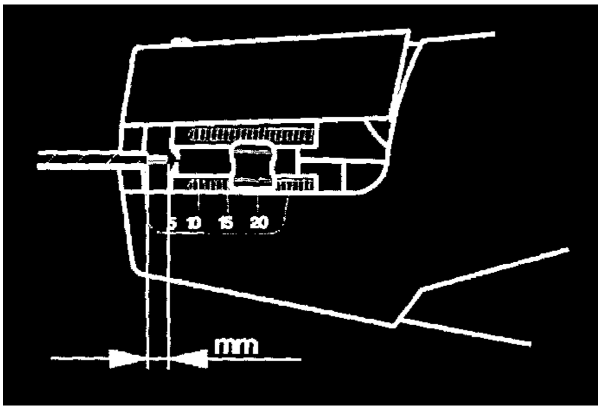
- Proceed to (FB2).

If a seal is to be used on the cable terminal
Thread the seal on to the cable before stripping the insulation. If the seal is threaded on to a cable that has been stripped both the copper conductors in the cable and the seal can be damaged.

- Push the seal about **5 cm** down the cable with the narrow end of the seal pointing towards the cable end. See illustration.

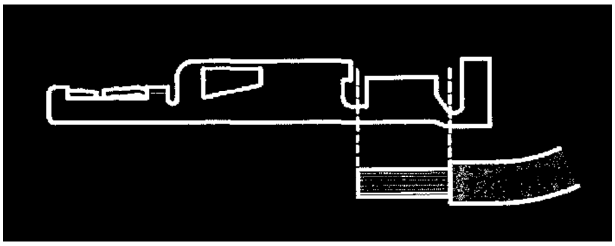
Always use a seal of the correct size for the cable it is intended for.

Length of the stripped section of cable



Volvo recommends the use of stripping pliers with an integral setting for the length of the stripped section and the cable area.

NOTE: Always used the correct length of stripped conductor to match the cable terminal to be used.



The cable must be stripped to a conductor length that matches the cable terminal type.

Compare the stripped conductor length with the cable terminals crimp contact connection. See illustration. The stripped length of the cable should be slightly longer than the crimp contact.

- A normal stripped length of conductor is approx. **4 to 5 mm.**

General Information

Cable terminals, different types

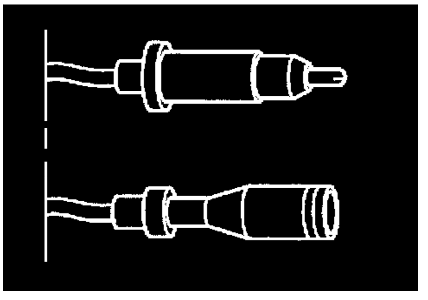
WARNING: SRS No cable repair or other repair work may be carried out on the SRS system wiring. Follow the instructions for repair work in the Restraint Systems.

The part numbers of the cable terminals are not given here. Look at the picture on the inside of the box containing the cable terminals, check the Contents table in the Special Tools and the Spare Parts Catalogue for the model concerned.

Cable terminals are divided up into the following main groups

There are many different types of cable terminals intended for different purposes depending on current, mechanical stress, temperature, vibration etc.

Moisture proof cable terminals

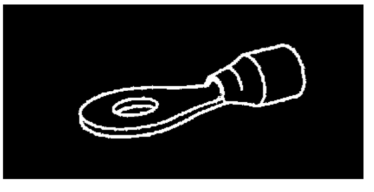


Moisture proof cable terminals are used where there is a risk of oxidation.

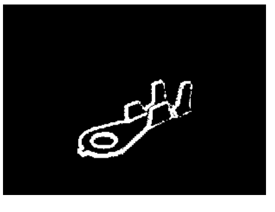
- Moisture proof cable terminals complete with cables are available both as pin and as socket fittings.

Note that these cable terminals are supplied as a complete spare part, ready-pressed and crimped with molded plastic covers on the cable.

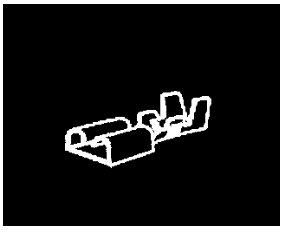
Ring cable terminal (and forked cable terminal)
Cable terminals intended for use with screws/bolts and available in the following variants:



- Insulated and uninsulated
- Closed crimping connection and open crimping connection
- Ring cable terminals are available in sizes to fit screws/bolts from M3.5 to M16



Receptacle terminals
Receptacle terminals are available in different variants:

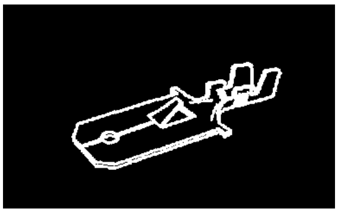


- With locking tab and without locking tab.
- With dimpling and without dimpling.
- In sizes 2.8, 4.8, 6.3, 8 and 9.5

- The most common sizes are 4.8 and 6.3

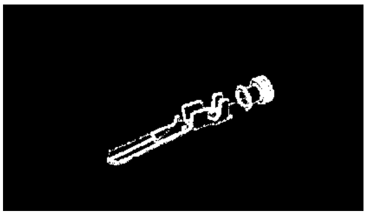
Tab

Tab terminals are available in different variants:



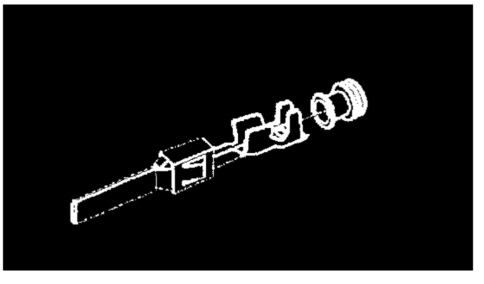
- With locking tab and without locking tab.
- In sizes 2.8, 6.3 and 9.5
- The most common sizes are 2.8 and 6.3

Tab sws (Single Wire Seal)



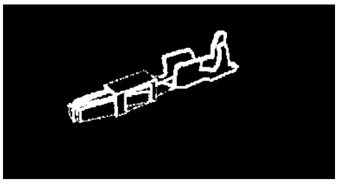
- **sws** designation means that a seal must be installed in the insulation wings.
- Tab sws is available in size 2.8

Tab steel sws



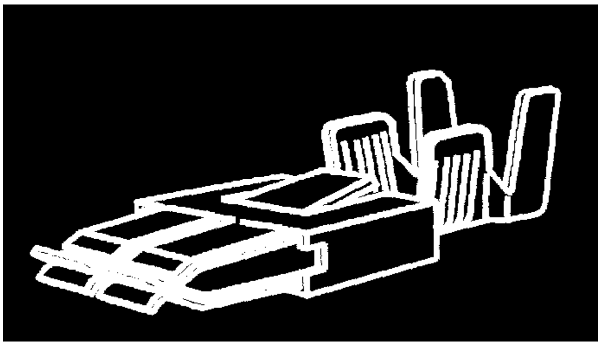
- **steel** The "steel" designation means that the cable terminal tab or pin is reinforced with a steel spring.
- **sws** The "sws" designation means that a seal must be used in the insulation wings.
- Tab steel sws is available in size 2.8

Timer



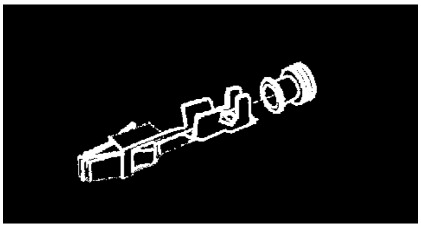
Timer is a socket type cable terminal used with a tab terminal. Timer terminals are found in multiple pin housings.

- Timer terminals variants can be found with 1 or 2 locking tabs.
- Timer are available in sizes 1.6, 2.8 and 6.3



1.6 Timer are also known as Microtimer.
2.8 Timer are also known as Minitimer.
6.3 Timer are also known as (Power)timer.

2.8 Timer sws

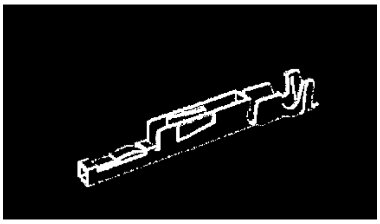


Timer is a socket type cable terminal used with a tab terminal. Timer terminals are found in multiple pin housings.

- **sws** The sws designation means that a seal must be used on the insulation wings.

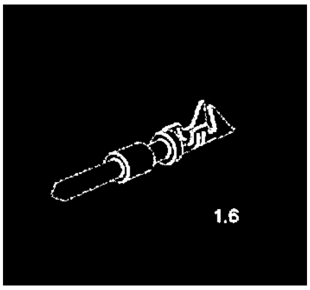
0.64 Socket

Cable terminal 0.64 is available in one variant:

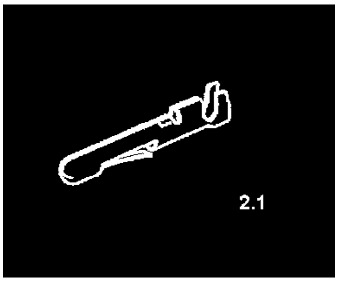


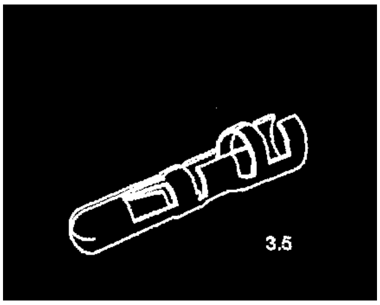
- With 2 locking tabs on the upper side
- Only 0.64 socket can be replaced. The equivalent 0.64 pin is mounted as a fixed part on components.

Pin terminals
Pin terminals are available in a number of variants:



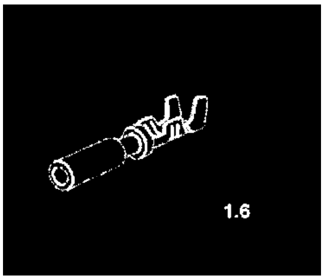
- Without locking tab, with 1 locking tab and with 2 locking tab.
- In sizes 1.6,2.1 and 3.5 (A selection of pin terminals is shown in the illustration on the left)
- The most common sizes are 1.6 and 3.5



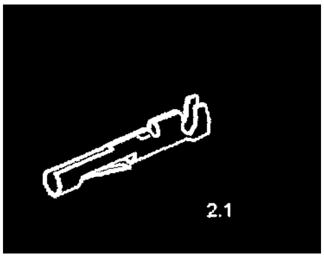


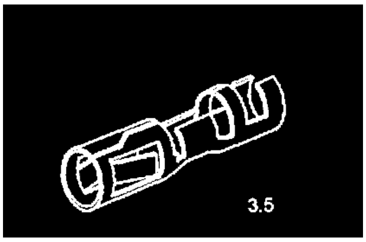
Socket terminals

Socket terminals are available in a number of variants:



- Without locking tab, with 1 locking tab and with 2 locking tab.
- In sizes 1.6, 2.1 and 3.5 (A selection of socket terminals is shown in the illustration on the left)
- The most common sizes are 1.6 and 3.5





Primary Locking In General

Primary locking in general

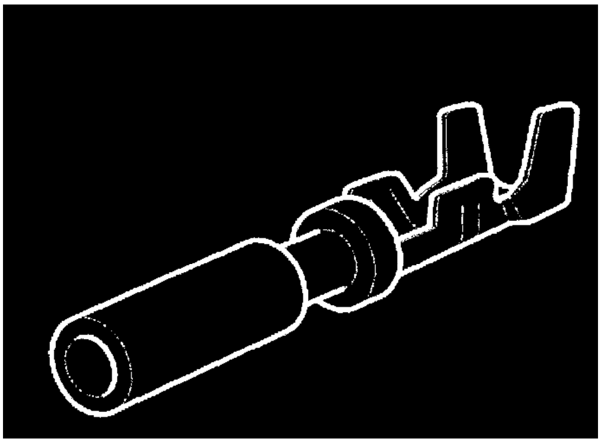
The cable terminal is retained in position in the cavity using different types of locking catches. These locking catches are called primary locking.

There are two main types of primary locking:

- Primary locking in cavities
- Primary locking on cable terminals

Primary locking in cavities

Cable terminals without locking tab

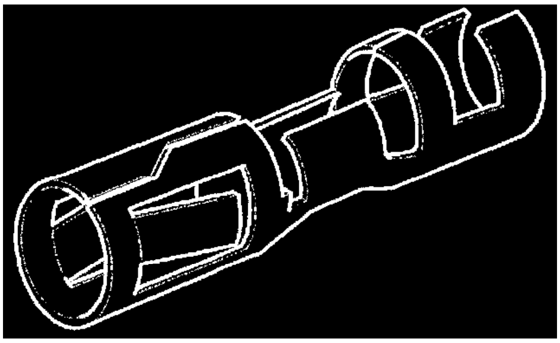


The primary locking is permanently located in the housing as an integral part of the cavity.

Cable terminals without locking tabs are used with housings which have integral primary locking in the cavities. An example is the 1.6 Pin/Socket

Primary locking on cable terminals

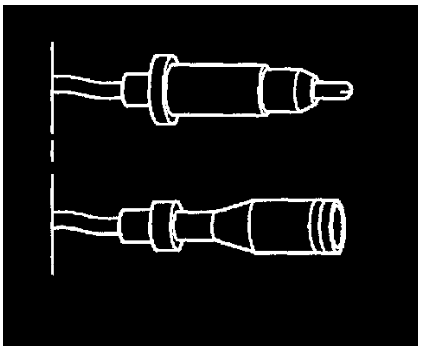
Cable terminals with locking tab



The primary locking tabs are located on the cable terminals.

Cable terminals can have either one locking tab (single primary locking) or two locking tabs (double primary locking).

Without primary locking

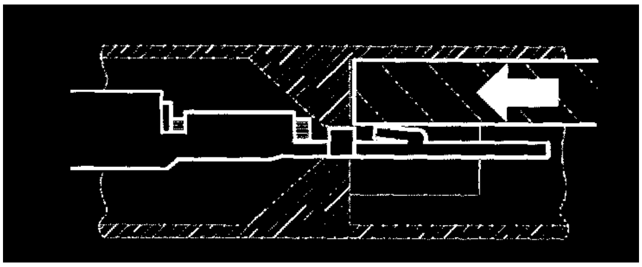


Some combinations of housing/cable terminal have no primary locking with lockable lock catches/locking tabs.

The cavities in the housing in these cases have integral catches which hold the cable terminals in place. When the secondary locking on the housing is opened the cable terminals can be lifted out No terminal removal tool is needed.

An example is a housing with moisture proof cable terminals.

Release primary locking

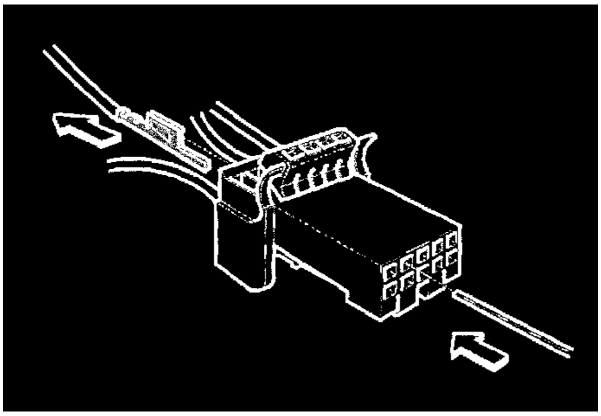


A terminal removal tool is usually required to release the locking tab/locking catch so that the cable terminal can be extracted and removed.

Using Terminal Removal Tools

Using terminal removal tools

Choosing the correct tool
General

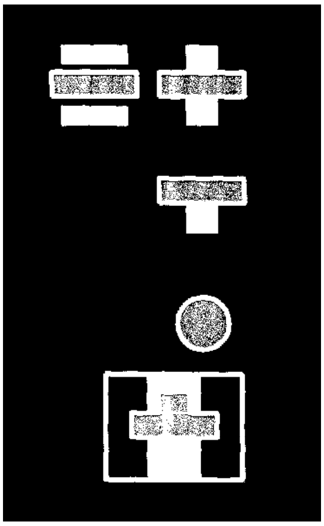


It is important to use the correct terminal removal tool when removing cable terminals. The tools are included in the repair kit or supplementary kits supplied in the future.

This describes how to choose the correct tool by inspecting the cavity opening and the shape of the cable terminal.

If the type of cable terminal is already known, the table for cable terminals and tools in the "Special tools" can be used.

Cavity opening and cable terminal profiles



The cavity opening in the housing has an easily identifiable profile on the connector side.

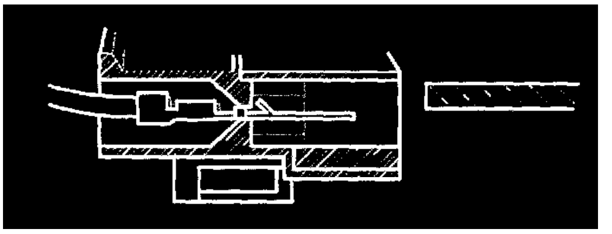
Turn the housing so that the connector side is visible. How does the cavity profile look?

The cavity opening may be as follows:
- With one extraction groove
- With two extraction grooves
- A square profile
- A round profile

- Or housings with half-open connector sides (the cable terminal is partly exposed with a visible locking tab in the cavities).

Using terminal removal tools

NOTE: If the receptacle housing has a secondary locking, this must be in the open position. Always push the cable terminal forward in the cavity first. Push it towards the connector side of the receptacle housing before inserting the terminal removal tool.



The terminal removal tool shown in the following has been inserted in the cavity from the connector side of the housing.

The cable terminal is extracted by pulling on the cable from the cable side of the housing.

The housing cavities are numbered on the inside and

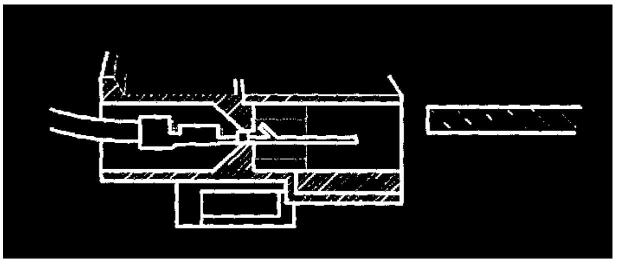
outside with the terminal numbers. Always check that the correct cable terminal has been removed.

If a wiring diagram is used for fault-tracing / repairs, check it against both the terminal numbers on the housing and the cable color code.

Removing cable terminals with locking tabs

NOTE: If the receptacle housing has a secondary locking, this must be in the open position. Always push the cable terminal forward in the cavity first. Push it towards the connector side of the receptacle housing before inserting the terminal removal tool.

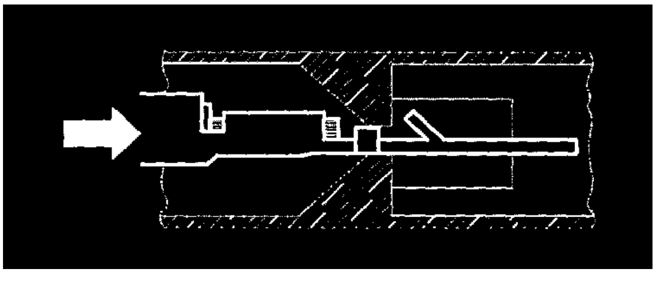
The locking tab secures the cable terminal



The illustration shows the location of the cable terminal in the housing with the locking tab (the primary locking) held by a catch in the cavity.

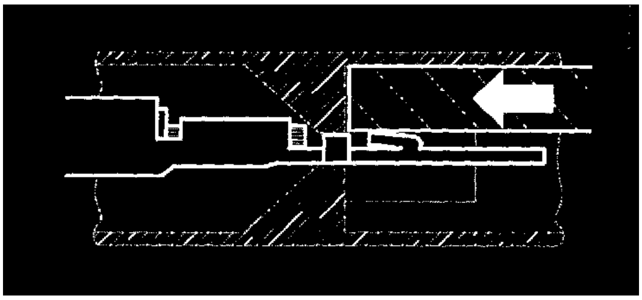
NOTE: The text describes, and the illustration shows, cable terminals with a locking tab. The same principle also applies to cable terminals with two locking tabs.

Release the locking tab for the cable terminal as follows

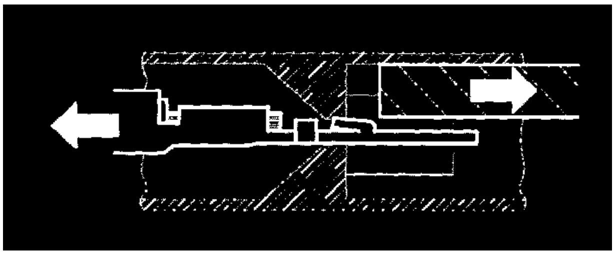


To extract the cable terminal, the locking tab must be released (held down) with a terminal removal tool.

1. Press the cable terminal in the cavity forwards as far as it will go. This will free the locking tab from the cavity catch.



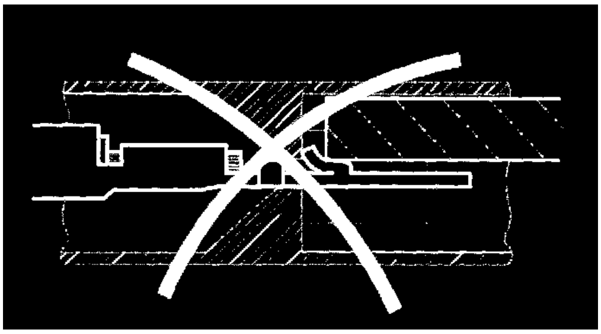
2. Insert the terminal removal tool in the cavity from the connector side of the housing. The tool presses down the locking tab. This allows the cable terminal to pass the catch in the cavity.
   Hold the terminal removal tool in place.



3. Extract the cable terminal from the cable side of the housing: Pull the cable.
   If the cable terminal is stuck, first remove the terminal removal tool.

What NOT to do

An example of an incorrect working method



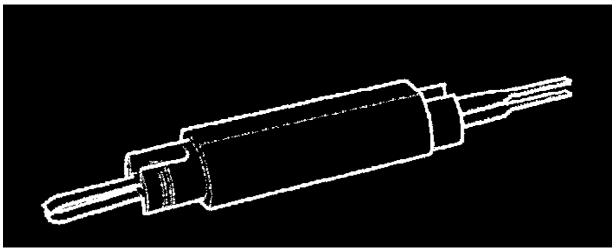
The locking tab may be damaged if the terminal removal tool is inserted in the cavity before the cable has been pushed forwards. The cable terminal could then be difficult to extract.

In the illustration beside, there is not room for the locking tab to be pressed down by the terminal removal tool. The locking tab is pressed down by the tools towards the stop lug. It bends into a shape that will lock it in position.

When the Cavity Opening Has Two Extraction Grooves

When the cavity opening has two extraction grooves

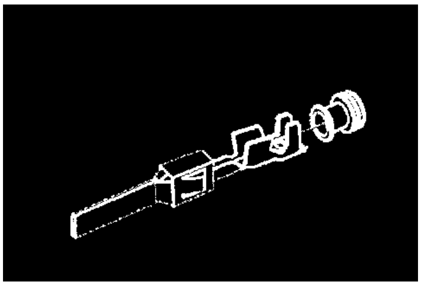
Terminal removal tool, P/N 9814228



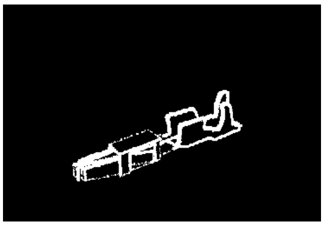
Use pointed, pincer type terminal removal tool, P/N 9814228.

This terminal removal tool is used for cable terminals with two locking tabs:

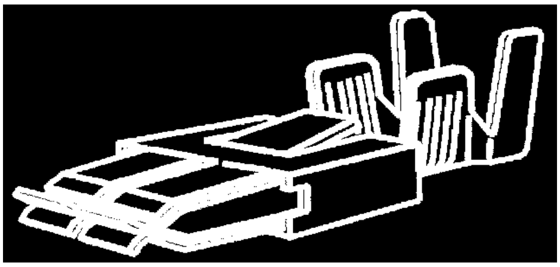
A 2.8 Flat pin steel



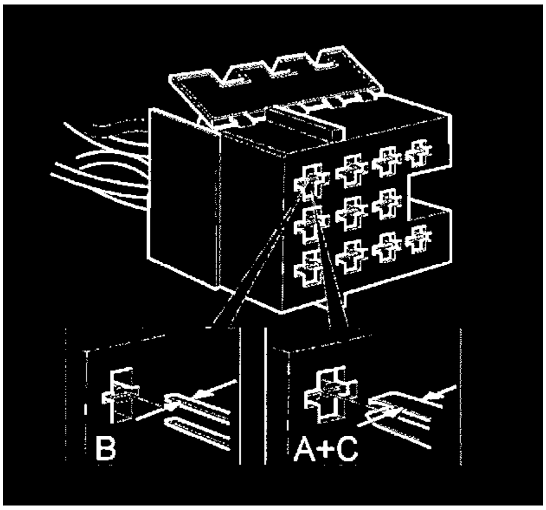
B 2.8 Timer and 2.8 Timer



C 6.3 Timer



Choose the terminal removal tool with the correct width



There are two sizes of cavity opening. See the example in the illustration.

Select the terminal removal tool with ends which match the extraction groove in the cavity opening.

- The narrow ends are **0.9 mm** wide.
- The broader ends are **1.6 mm** wide.

Press the cable terminal in the cavity forwards as far as it will go. This will free the locking tab from the cavity catch.

Insert the terminal removal tool in the groove over and under the cable terminal. Extract the cable terminal.

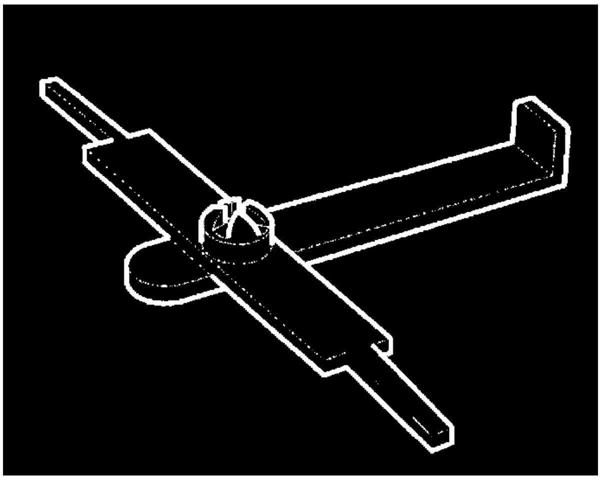
Always follow the instructions for using terminal removal tools. These instructions give the correct working procedure.

- Proceed for replacing a cable terminal instructions about how to crimp a new cable terminal.

Cavity Opening With One Extraction Groove

Cavity opening with one extraction groove

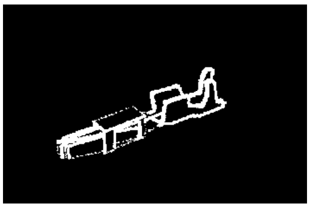
Terminal removal tool, p/n 9814229



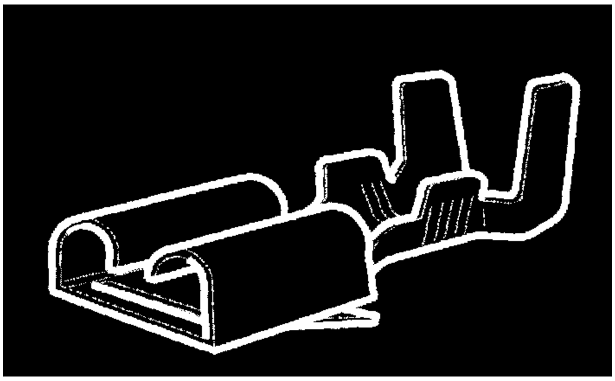
A terminal removal tool p/n 9814229 with a single blade type tip must be used.

This terminal removal tool is used for cable terminals with one locking tab:

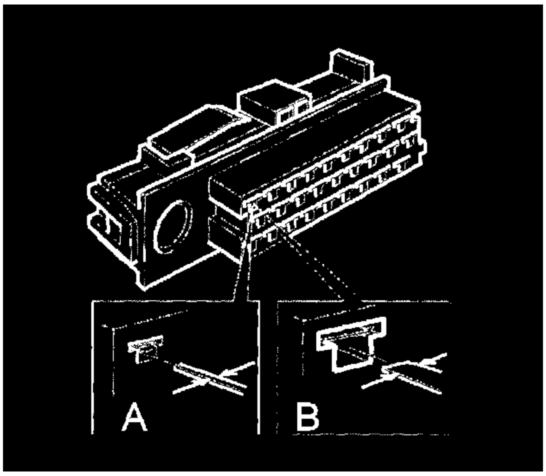
A 2.8 Timer



B 6.3 Receptacle terminal



Choose the terminal removal tool with the correct width



There are two sizes of the cavity opening. See illustration.

Choose a terminal removal tool with ends which match the cavity opening extraction groove.

- The narrow ends are **1.5 mm** wide.
- The wider ends are **2.7 mm** wide.

Press the cable terminal in the cavity forwards as far as it will go to free the locking tab from the cavity catch. Insert the terminal removal tool in the groove as illustrated.
Always follow the instructions, when secondary locking is of the lid type which give the correct working procedure.

- Proceed to replacing a cable terminal. Replacing a cable terminal in order to crimp a new cable terminal.

Housing With Half-Open Contact Side

Housing with half-open contact side

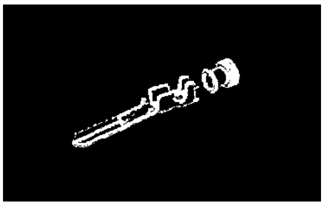
(When the cable terminals are partly exposed with the locking tabs visible in the cavities)

Housings of this type have partly exposed cable terminals on the contact side with the locking tabs visible in the cavities.

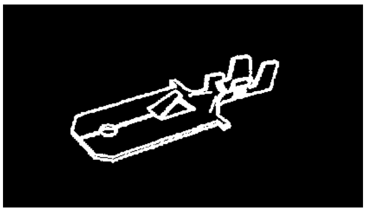
Usually this type only includes tab cable terminals with one locking tab.

Illustrated are:

A 2.8 Tab sws

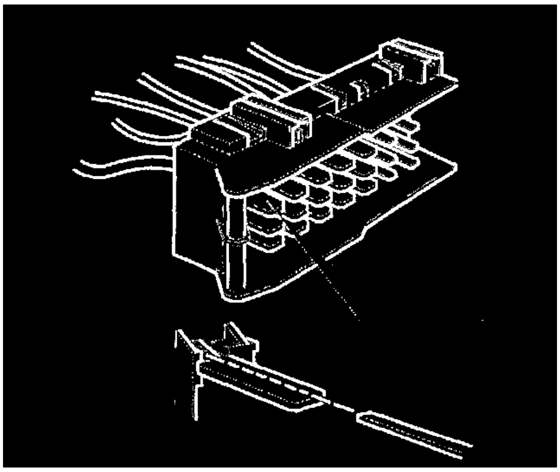


B 6.3 Tab (also in sizes 2.8 and 9.5)



Use terminal removal tool p/n **981 4229.**

The illustration below shows a housing with tabs. To extract pin cable terminals read the instructions at Housings with round cavity opening.



Choose a terminal removal tool with an end that matches the cavity opening.

- The narrow ended tool is **1.5 mm** wide.
- The wider end is **2.7 mm** wide.

Press the cable terminal in the cavity forwards as far as it will go to free the locking tab from the cavity catch.

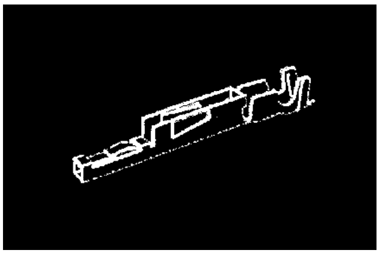
Insert the terminal removal tool in the groove as illustrated. Always follow the instructions for using terminal removal tools which give the correct working procedure.

Replacing a cable terminal in order to crimp a new cable terminal.

Housings With Square Cavity Openings

Housings with square cavity openings

Terminal removal tool

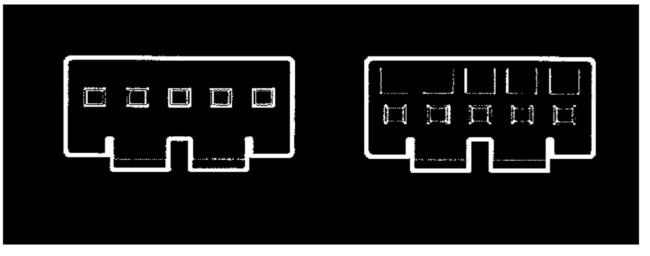


When a housing has 0.64 sockets use a terminal removal tool with a narrow square end (**1.2 x 1.2 mm**).

Shown is a 0.64 socket cable terminal.

The terminal removal tool for 0.64 sockets is not included in the repair kit p/n **981 4235.**

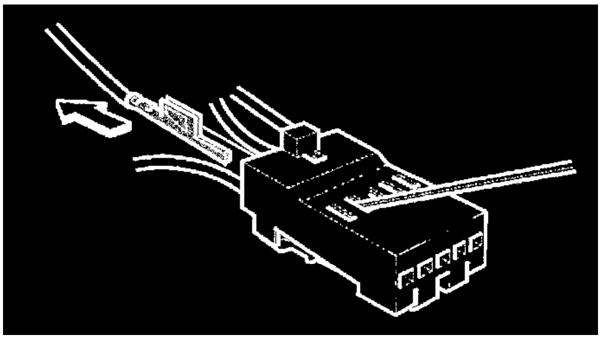
Single or double row of cavities



There are two main types of 0.64 housings. Check the contact side of the housing. Does the housing have a single or double row of cavities?

- Proceed to the appropriate type below.

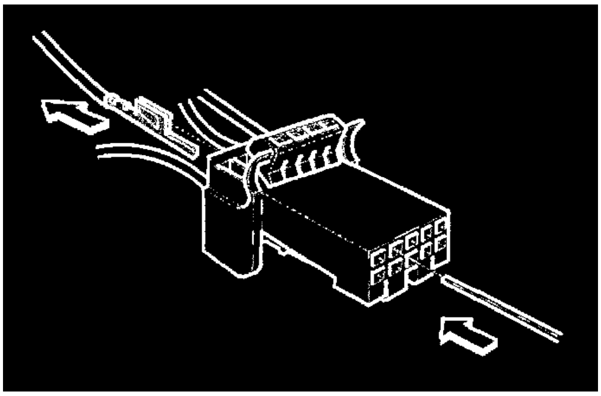
Single cavity row



For a single row of cavities the terminal removal tool is inserted in the open groove on the upper side for each terminal.

Press the cable terminal forwards in the cavity. Insert the terminal removal tool end between the cable terminal locking tabs and extract the cable terminal.

Double cavity row



For a double cavity row the terminal removal tool is inserted from the contact side in the upper row of cavities for the terminal to be extracted.

The lower cavities are used to fasten the cable terminals in place.

Press the cable terminal forwards in the cavity. Insert the terminal removal tool and extract the cable terminal.

Proceed

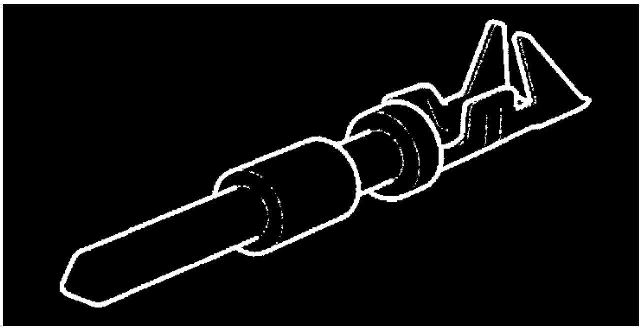
Replacing a cable terminal in order to crimp a new cable terminal.

Housings With Round Cavity Opening

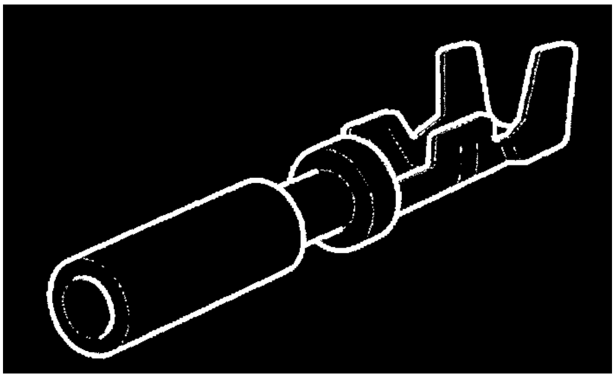
Housings with round cavity opening

Cable terminals that are extracted without using a terminal removal tool

1.6 Pin/Pin sockets

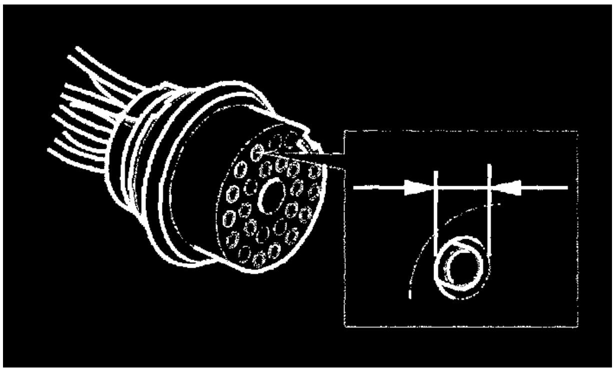


For housings for 1.6 Pin/pin sockets no terminal removal tool is used.
The cable terminals have no locking tabs. The primary locking is located in the cavities.



With the secondary locking opened the cable terminals can be extracted from the cable side by pulling the cable. No terminal removal tool is required.

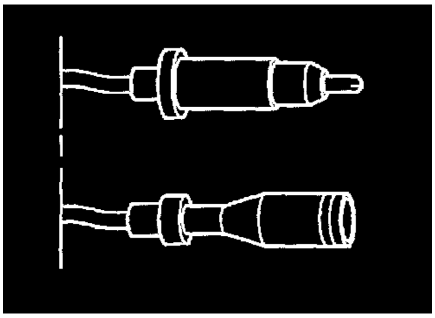
- See **Example 1** and **Example 2A** for the procedure.



The cavity opening for 1.6 Pin/Pin sockets is the smallest of the round cavity types.

Replacing a cable terminal in order to crimp a new cable terminal.

3.5 Moisture proof pin/pin sockets

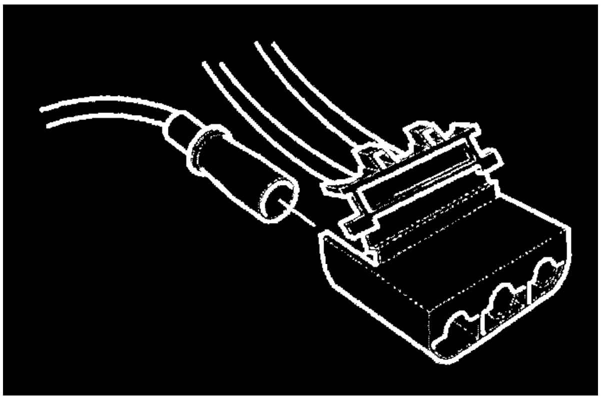


Housings intended for moisture proof pin/pin socket terminals do not require a terminal removal tool.

The cable terminals have no primary locking. Integral catches in the cavities retain the terminals in the housing.

With the secondary locking opened the cable terminals can be extracted from the cable side of the housing by lifting them up.

No terminal removal tool is required.

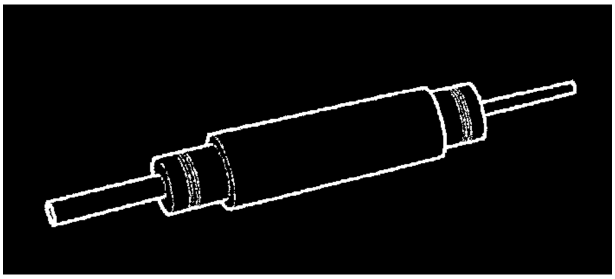


Moisture proof pin/pin sockets are ready-to-use with the cable fitted and are available as a complete spare part.

Cable terminals that are extracted with terminal removal tools

2.1 Pin/Pin sockets and 3.5 Pin/Pin sockets

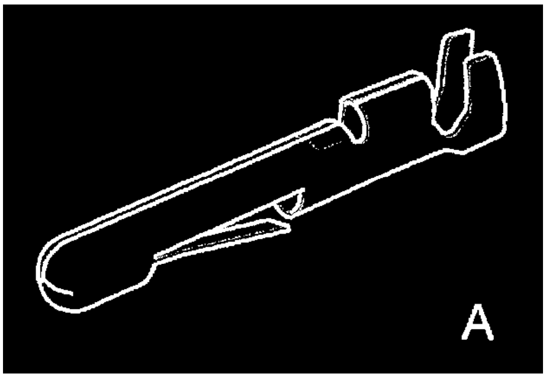
Terminal removal tool, pin 981 4230

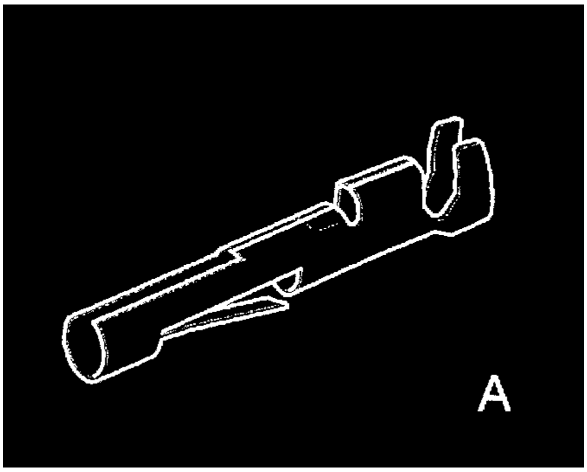


For round cavity openings a terminal removal tool with a hollow end is used.

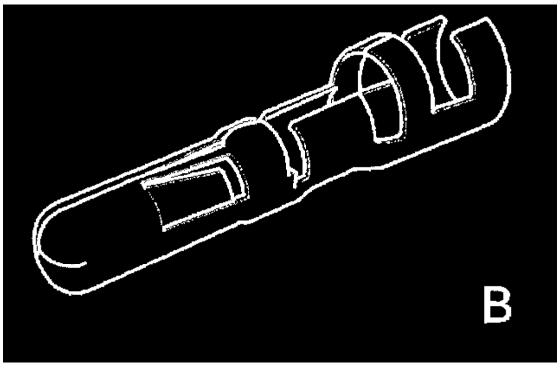
The terminal removal tool is used for the following cable terminals:

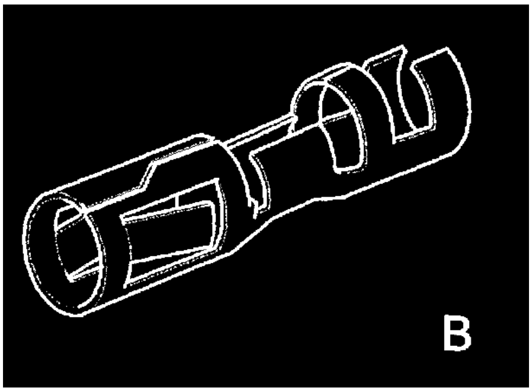
A 2.1 Pin/Pin sockets



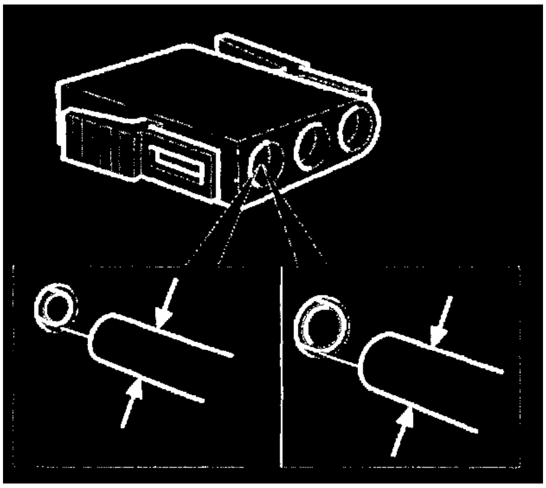


B 3.5 pin/pin sockets





Choose a terminal removal tool with the correct diameter



There are two cavity opening sizes. See illustration.

Choose a terminal removal tool which matches the cavity opening.

- The smaller end is for diameter 2.1
- The larger end is for diameter 3.5

Press the cable terminal in the cavity forwards as far as it will go to free the locking tab from the cavity catch.

Insert the terminal removal tool in the groove as illustrated.

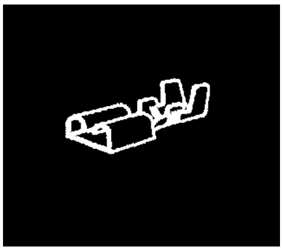
Always follow the instructions for using terminal removal tools which give the correct working procedure.

Replacing a cable terminal in order to crimp a new cable terminal.

Single Terminal Housings

Single terminal housings

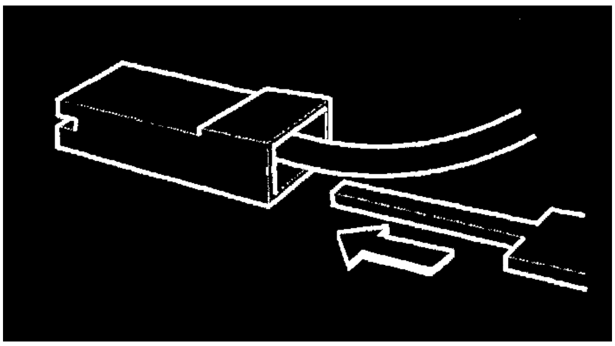
Cable terminals without locking tab



Single terminal housings without a locking tab such as receptacle terminals.

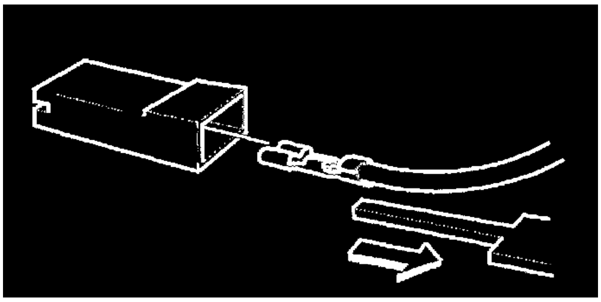
The terminal removal tool is inserted from the cable side.

Use terminal removal tool p/n **981 4229**.



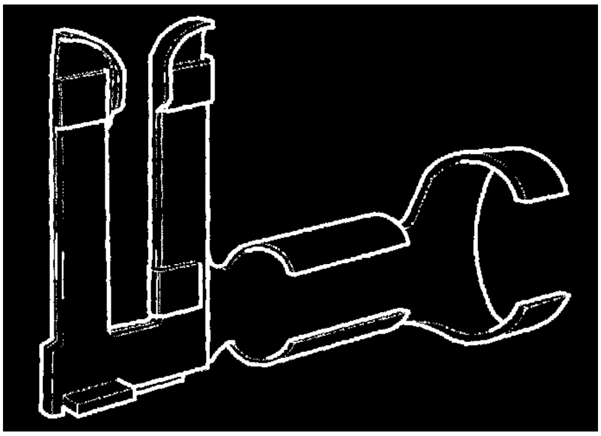
Insert the terminal removal tool under the cable terminal from the cable side.

The point of the terminal removal tool pushes in and releases the primary locking (locking catch) in the housing cavity.

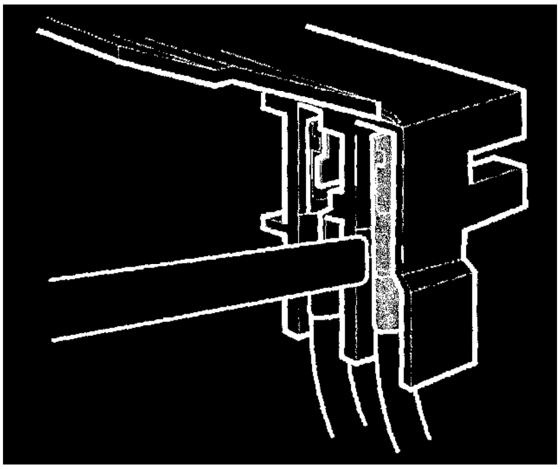


- Withdraw the cable terminal and terminal removal tool at the same time.
- Replacing a cable terminal in order to crimp a new cable terminal.

Miscellaneous, exceptions



The housings shown here have a divided cable terminal. The cable terminals have no locking tab. The primary locking is located in the housing cavity on the cable side.



Use a feeler gauge approx. **0.15 mm.** Press in locking catch and extract the cable terminal.

Replacing a cable terminal in order to crimp a new cable terminal.

Soldering, General

Soldering, general

Soldering is a relatively easy method to apply to cable terminals. No expensive equipment is required and the core area dimension is not a critical factor.

The disadvantages with soldering are uneven results and that impurities and dirt on the contact points make it more difficult to get a clean soldered connection.

To ensure a good contact the soldering point must be free from dirt, oxidized metal, grease, paint etc.

NOTE: Avoid soldering connections that carry a high power load.

Soldered connection quality

choice of solder wire, flux and soldering tool as well as the location and method used affect the overall quality of a soldered connection.

Ensure that solder does not creep too far up the cable when soldering a terminal on to a cable, as there is a risk the cable can become brittle and break.

Soldering tool

There are different types of soldering tool. Usually a soldering iron with temperature control is used so that the temperature created on the soldering iron tip can be adjusted.

Soldering wire

It is important to use soldering wire with a high quality non-corrosive flux. Use 50-50 or 60-40 rosin core solder.

Do NOT use acid flux solder (e.g. plumbing solder) as this will cause oxidization.

When to solder

If a terminal has been crimped using a tool not intended for terminal crimping then the cable terminal must be soldered

To avoid soldering

CAUTION: Soldering cable terminals can be avoided by always making a point of using only Volvo special tools for terminal crimping or other tool recommended by Volvo.

General

Terminal crimping in general

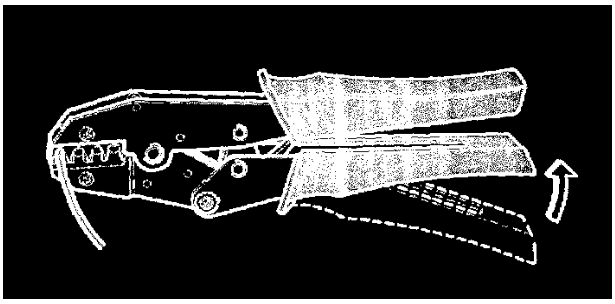
Advantages of terminal crimping

Terminal crimping is a way of creating an electrical contact by pressing the wings of the cable terminal round a cable with such force that the metal in the cable is deformed. Using the correct tool it is a rapid and simple way to fasten cable terminals to cables. A correctly crimped terminal provides a stronger and more reliable bonding than soldering the connection.

Terminal crimping, method and tools

NOTE: The results of the crimping process are entirely dependant on the use of the correct tools and method of carrying out the crimping.

Crimping contacts on different cable terminals



There are various designs and shapes of cable terminals that can be crimped. The type of cable terminal is determined by factors such as the cable used, the joint design, tool type, intended use etc.
The crimping tools in the repair kit p/n **9814235** have different crimping inserts to suit most types of cable terminal.

Terminal crimping insulated butt connectors and insulated ring cable terminals

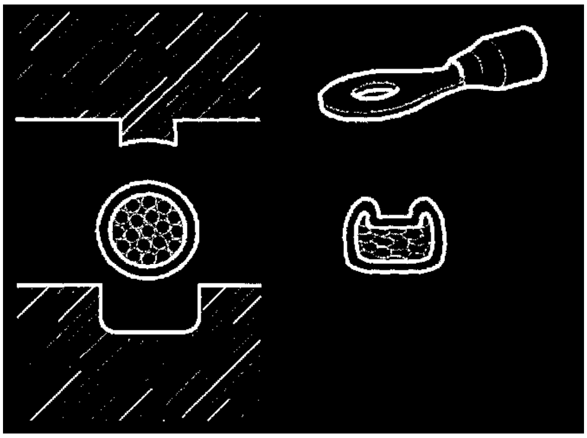
To crimp insulated moisture proof butt connectors and insulated ring cable terminals, use the crimp tool recommended in other tools.

Cable Terminals - Crimping Core Wings

Cable terminals - crimping core wings

Insulated cable terminals

Crimping core wings, shape

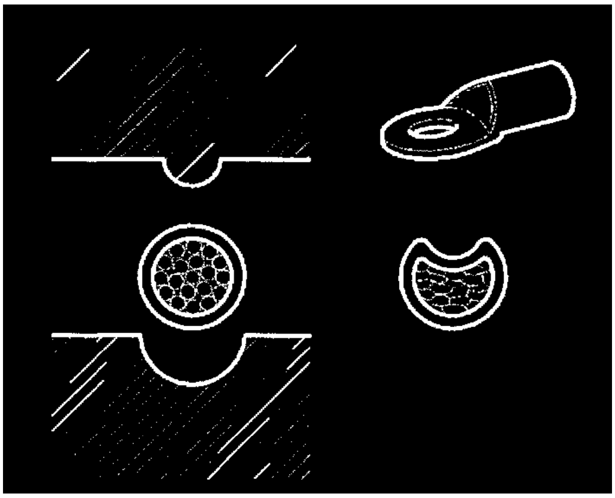


Terminal crimping occurs in an enclosed core crimp. An enclosed core crimp on a cable terminal has a soldered sleeve with an insulating layer of material around it. The cable is inserted in the core wings and crimped in place using a drift type crimp tool.
The cover around ring cable terminals is color coded to indicate the cable area.
Normally this type of terminal does not have insulation wings.
The illustration shows a cross section of a terminal crimping using a crimp tool intended for insulated terminals, referred to in other tools.

Uninsulated cable terminals

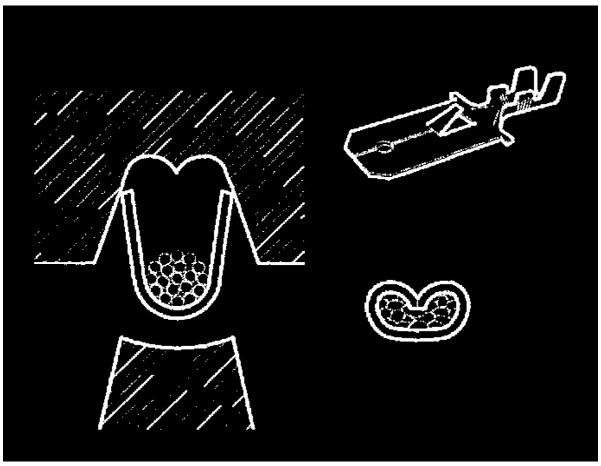
Terminal crimping is carried out in either an open or enclosed contact.

Enclosed type



An enclosed core crimp on a cable terminal has a soldered sleeve. The cable is inserted in the core crimp and crimped in place using a drift type crimp tool.
The illustration shows a cross section of a terminal crimping using a Volvo crimp tool p/n **9812451**, shown in other tools.

Open type



On the open type the cable terminals core crimp is U-shaped The cable is inserted in the core wings from the top. The crimp tool then applies a roll crimp the contact during crimping.

This type normally has insulation wings.
The illustration shows a cross section of a terminal crimping using the crimp tool from repair kit p/n **9814235**, which is described in the following Choice of crimp tool.

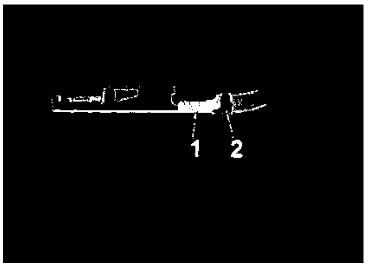
Core wings and insulation wings

The cable terminal crimping section consists of two parts which are formed simultaneously in the crimp tool.

Core wings

The core wings (I) are designed to make the electrical connection with the stripped section of the cable (the copper core).

Insulation wings



The insulation wings (2), relieve the core crimp wings from mechanical stress and are located on the insulating sheath around a cable.
The illustration shows a crimped cable terminal without seal.

Core crimp - electrical efficiency

The electrical characteristics for conduction for a contact are that it should be as least as efficient as the cable to which it is connected and provide good contact. These characteristics are dependent partly on the crimping process to fix the terminal on the cable and partly on the contact made between the two terminals (male and female) in the connector. The goal is to get a joint with the lowest possible transient resistance and to retain a low resistance even after extended periods of exposure (temperature extremes, mechanical wear etc.)

Core crimp - mechanical efficiency

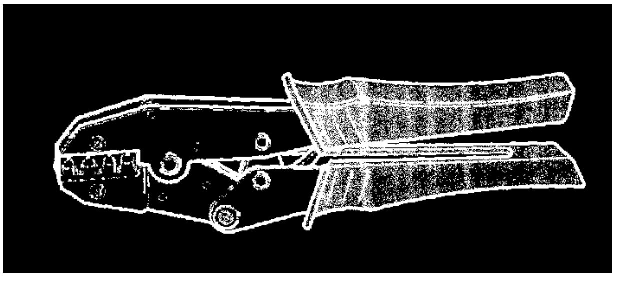
The joint in the core wings must retain the cable and support it so that it is not subjected to excessive bending forces at the entry point.

Choice of Crimp Tool

Choice of crimp tool

In repair kit p/n **9814235** are 5 crimp tools.
Supplementary kits may be supplied in future.

Color coded grip



The tools have different crimping inserts fitted and the plastic grips are color coded.

Correct choice of crimp tool for a cable terminal

NOTE: Always use the correct crimp tool intended for the cable terminal and use the correct crimping groove.

Below is a description of the crimp tools with information on:

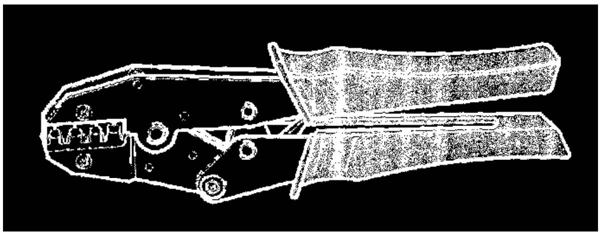
- Which cable terminals the tool is to be used for.
- Which cable areas the crimping inserts in the tool can be used for.

Crimp tool (black), p/n 9814223

Used for cable terminals types:

- 2.8 Tab
- 6.3 Receptacle terminal and 6.3 Tab
- 6.3 Timer
- M6 Ring cable terminal

The four crimping inserts are used for cable areas (in sq.mm):

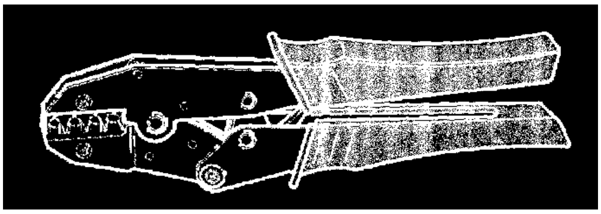


- 0.5 /0.6/0.75 /1.01 and 0.35 double folded wire
- 1.4/1.5/2.0/2.5
- 3.0/4.0
- 5.0/6.0

Crimp tool (red), p/n 9814224

Used for cable terminals types:
- 2.8 Timer sws
- 2.8 Tab sws
- 2.8 Tab steel sws

The two crimping inserts are used for cable areas (in sq.mm)

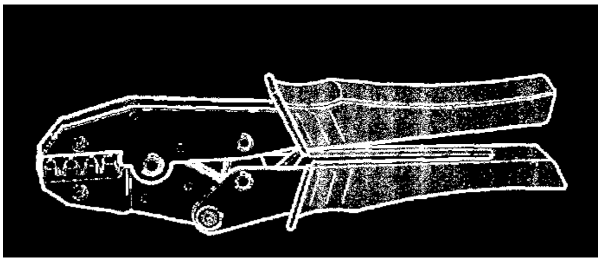


- 0.5/0.6/0.75/1.0
- 1.4/1.5/2.0/2.5

Crimp tool (yellow), pin 9814225

Used for cable terminals types:
- 2.8 Timer

The three crimping inserts are used for cable areas (in sq.mm):

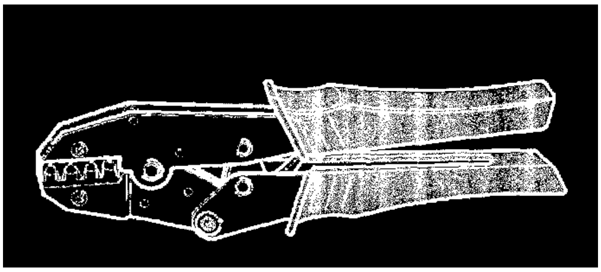


- 0.5 /0.6/ 0.75 /1.0, and 0.35 double folded wire
- 1.4/1.5/2.0/2.5
- 3.0

Crimp tool (green), pin 9814226

Used for cable terminals types:
- 1.6 Pin socket and 1.6 Pin

The two crimping inserts are used for cable areas (in sq.mm):

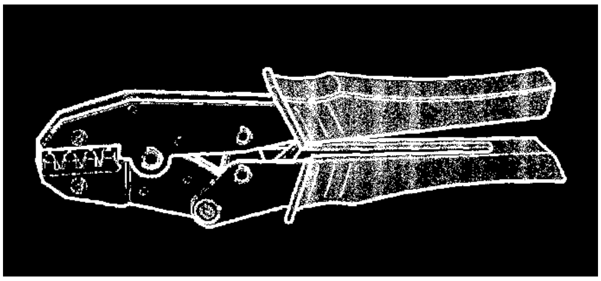


- 0.75/1.0/1.4/1.5 and 0.5 and 0.6 double folded wire
- 2.0/2.5

Crimp tool (blue), pin 9814227

Used for cable terminals types:
- 3.5 Pin socket and 3.5 Pin

The two crimping inserts are used for cable areas (in sq.mm):



- 1.0/1.4/1.5 /2.0/2.5/and 0.5, 0.6 and 0.75 double folded wire
- 3.0/4.0

Crimping A Cable Terminal

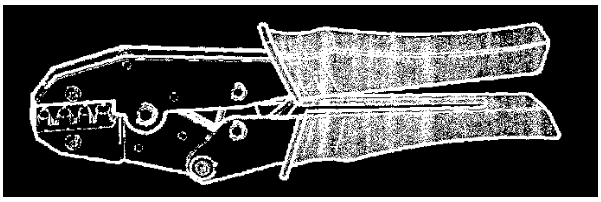
Crimping a cable terminal

CAUTION: An incorrectly crimped terminal means poor electrical contact, which can cause defective operation or intermittent faults. These problems can be difficult to detect and localize during subsequent fault tracing.

Use a Volvo crimp tool

The crimp tools from the repair kit p/n **9814235** will give a reliable result when used correctly.

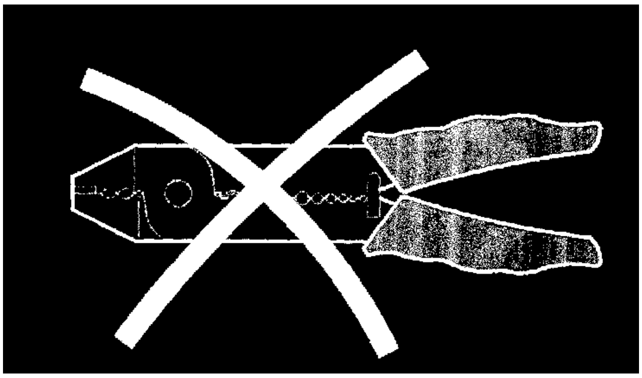
Contact crimp tool, inhibitor function



The contact crimp tool has a ratchet which normally

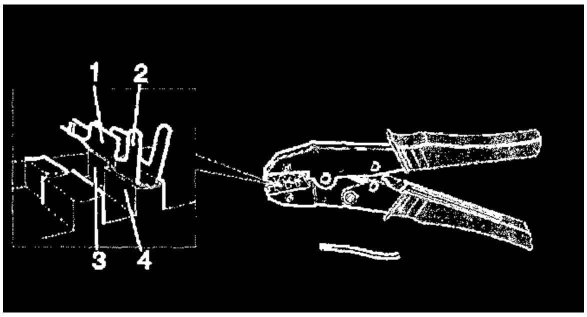
prevents a crimping operation from being aborted before the tool is at its final position (and the crimping operation correctly completed). The tool will then open automatically.
To abort a crimping operation when using the contact crimp tool see section (GD3).

NOTE: Do NOT use this type of tool!



Do not use this type of simple direct-acting crimping pliers which are intended for the home repairs and hobby market. The tool does not supply the necessary force required or meet Volvo quality standards to ensure reliable terminal crimping.

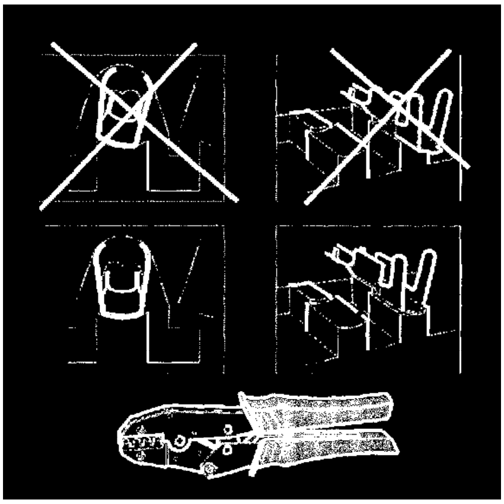
Place the cable terminal in the tool



- Select the crimping insert for the cable terminal type. Choice of crimp tool
- Locate the cable terminal correctly in the crimping insert.
  Check that the cable terminal deformation sections (1) and (2) are in contact with the crimp tool support section (3) and (4). The cable terminal must not be at an angle or he to far forwards or to the rear in the crimp tool insert.
- Carefully apply pressure to the crimp tool until the jaws hold the cable terminal in place without applying sufficient pressure to deform it.

Check the cable terminal is correctly located in the crimp tool jaws

If the cable terminal is not correctly located

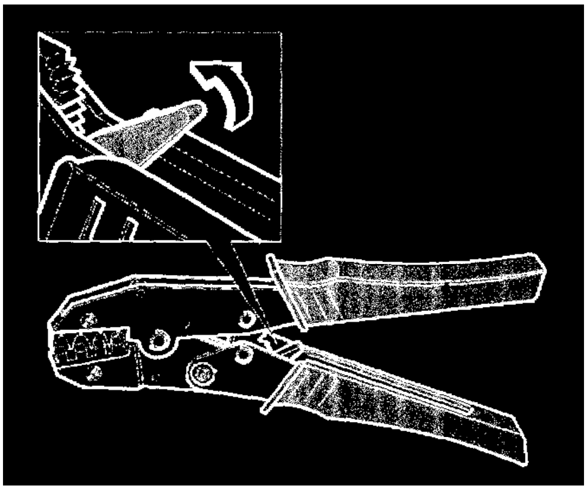


If the cable terminal has turned, moved forward or backwards, or is in the wrong cable area profile section, abort the crimping operation, see section (GD3).

If the cable terminal is located correctly

- Proceed to (GD4).

To abort a terminal crimping operation



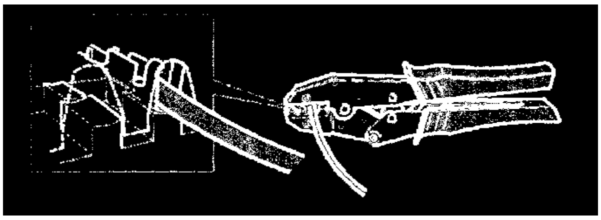
The crimp tools have a ratchet in the grip section. See illustration.

- Use a screwdriver to lift and release the ratchet.
- Reposition the cable terminal correctly in the insert and proceed with operation (GD4).

If the cable terminal is damaged

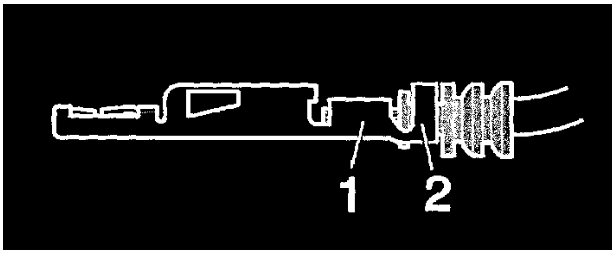
If the cable terminal has already been deformed replace with a new cable terminal and start again from operation (GD1).

Locate cable in the cable terminal



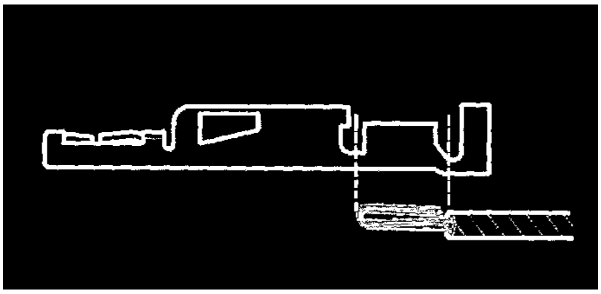
The cable terminal should be in the crimp tool as described in (GD1).

- Insert the cable end in the cable terminal.



The stripped section of copper conductor is located in the core wings (1) and the insulated cable section in the insulation wings (2).
If a seal is required on the cable it should be located as shown in the illustration.

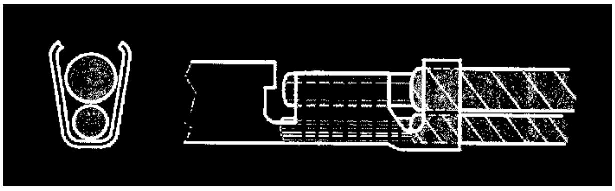
If the cable area is to small for the cable terminal



Always select a cable terminal intended for the cable area of the cable.
If on the other hand the correct cable terminal for the cable area is not available and only one cable terminal is available and it is for a larger cable area than is required:

- Strip the cable to double the normal stripping length and bend it double. In this way the conductor will make a tight and reliable connection in the terminal crimping operation.

Two cables crimped in one cable terminal

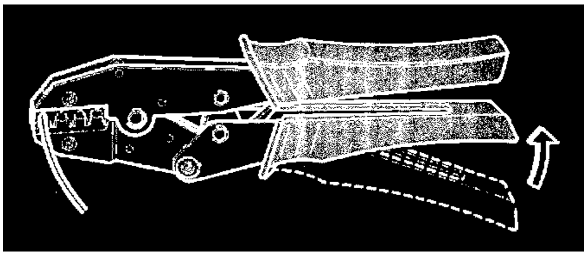


Always use a cable terminal that is large enough to take both the cables.

- Insert the cables one on top of the other

If the cables are of different areas always insert the larger cable on top.

Crimp the cable terminal



Check that the cable is still in the correct position in the cable terminal.

- Apply pressure to the grip of the crimp tool

Do not release the pressure on the tool until it is at the final position. Only when the crimping operation is completed will the tool open.

Proceed

Inspect the crimped terminal

Always inspect the crimped cable terminal as described in checking the result of the crimping operation.

After checking the cable terminal

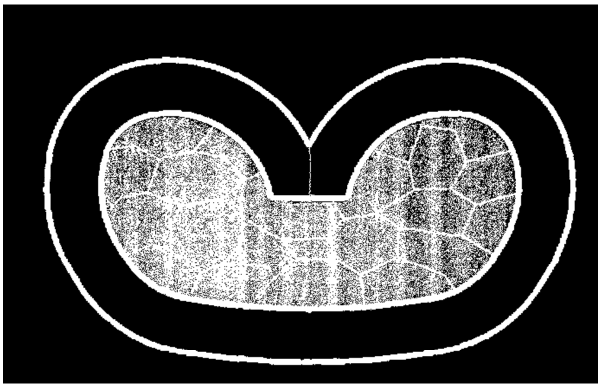
- To insert the cable terminal in the housing, continue to inserting a cable terminal in a housing.

Examples of Correct/Incorrect Crimping

Examples of correct terminal crimping

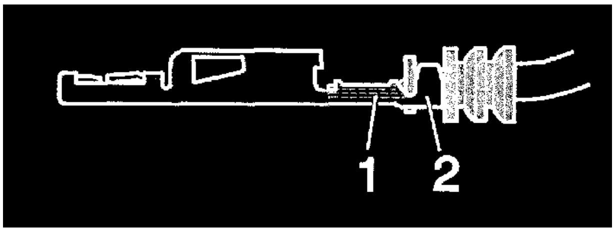
Checking crimping results

A correctly crimped cable should look like this:



- Core wings (1) should be completely pressed over the stripped core of wire.

The first illustration shows the copper strands in the core in cross section where they are completely compressed and covered by the core wings.

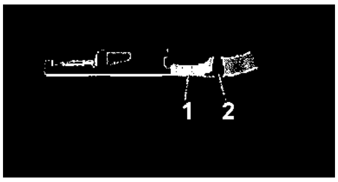


- Insulation wings (2) should be completely pressed over the cable insulation.

If a seal is used for cable terminal it should be pressed under the insulation wings as shown in the illustration.

Check the position of the cable

This is how a cable should be located In the terminal:



- The stripped core should be under the core wings (I). It must not stick out too far in front or behind the core wings.
- The cable insulation should only be under the insulation wings (2). It must not lie too far out in front of or lie too far in under the insulation wings.

Check the cable is firmly inserted by carefully holding the cable terminal and pulling on the cable.

Check the cable terminal locking tabs

If the cable terminal has locking tab/locking tabs, check that they are not damaged or pressed inward so they will not engage when the terminal is inserted in a housing.

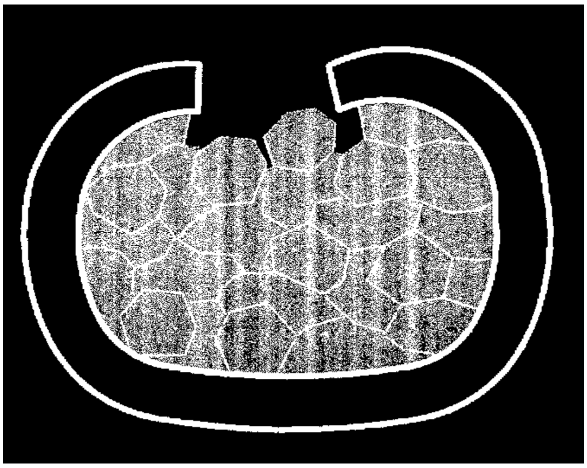
Poor results after crimping

If in doubt after crimping compare the results obtained with the examples incorrect terminal crimping. Examples of incorrect crimping. Where the crimping results are not correct, the operation must be repeated using a new cable terminal.

Examples of incorrect crimping

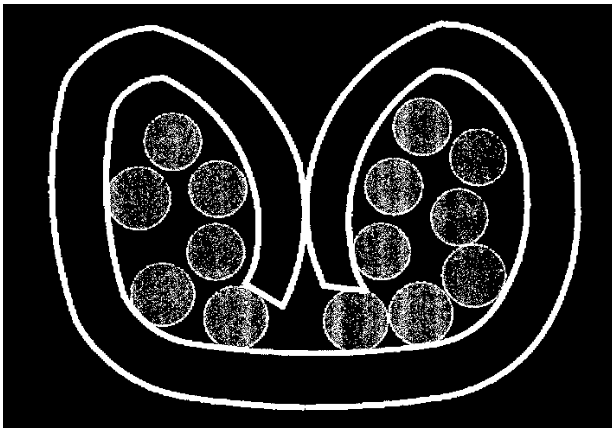
CAUTION: The most common reason for poor crimp results is using the wrong crimp tool/crimp tool insert for the cable terminal or the wrong area on the matching cable terminal/cable.

Core too large for the core wings



The illustration shows the cross section of the core crimp. The core wings are too small to completely cover the core of stripped copper strands.

Core is too small for the core wings



The illustration shows the cross section of the core crimp with the core which is too small for the core wings. As a result the core is not firmly held in place by the pressure of the core wings on the copper strands.

Reason

Incorrect crimping as shown above can be caused by:

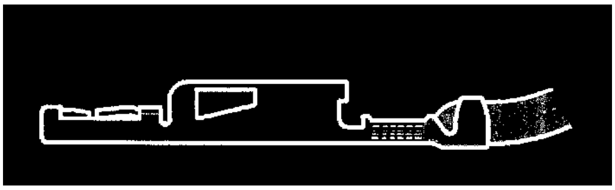
- Cable terminal is the wrong size for the cable area
- The wrong crimp tool or the wrong forming section in the crimp tool was used.

Incorrect location of cable/cable terminal

The stripped cable is not located correctly

The cable has not been pushed far enough in. The entire stripped core must be located within the core crimp.

The stripped core is too short



The cable insulation is too far forward and has caught under the core crimp.

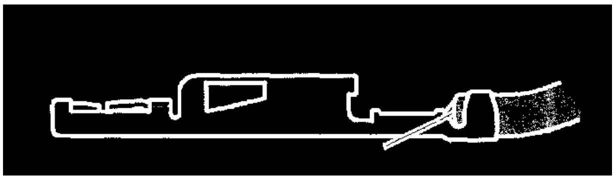
The stripped core is too long

The insulation is not fully located in the insulation wings.

The stripped core is too long

The stripped core is too far forward past the core crimp.

The stripped core is incorrectly crimped



The strip section is the right length but one of the copper strands is outside the terminal, indicating the terminal was incorrectly located in the crimp tool forming jaws.

All of the strands must be pressed together within the core wings.

Reason
Incorrect crimping as shown above can be caused by:

- Stripping the cable too short or too long.
- Incorrect location in the cable terminal.
- The cable terminal was incorrectly located in the crimp tool forming section.

Separate the Connector

Separate the connector

WARNING: SRS Nor cable repair or other repair work may be carried out on the SRS wiring. For repairs to the SRS system refer to the Restraint Systems.

If the connector halves (socket housing and pin housing) are connected together or if the connector is connected to a component, then the connector halves must first be separated.

General instructions

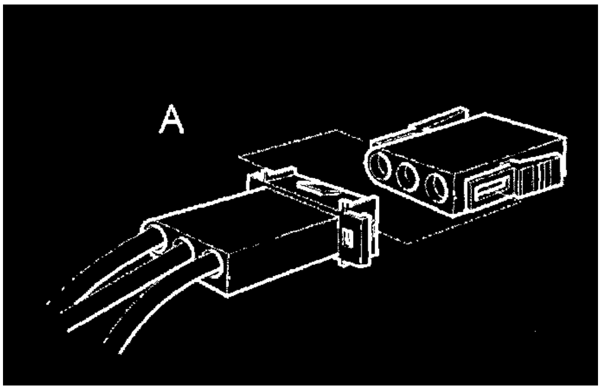
Note that these are general instructions, variations can occur in practice. Regard the examples shown and the procedures described as guidelines.

Types of catches and locks

The connector halves are connected to each other by different types of lock tabs/eyes. Separation

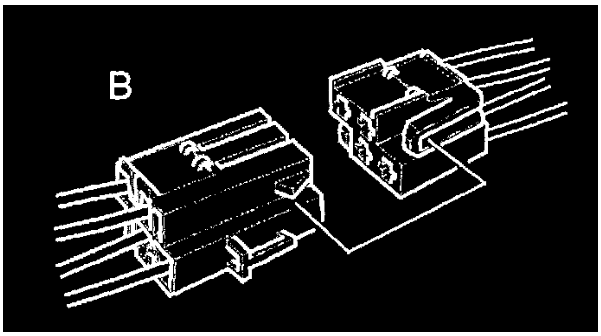
NOTE: Never pull the cables when separating. Hold the connector halves.

Active locking



For active locking Systems (Fig. A) a catch must be pressed down to release the lock.

Passive locking



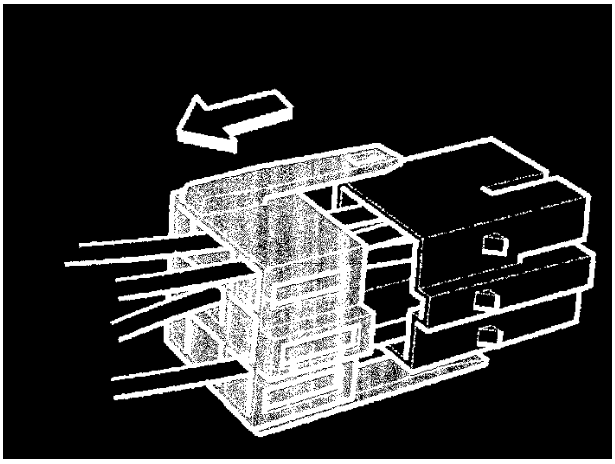
For passive locking systems (Fig. B) the catch is released when force is applied to separate the connector halves.

Reconnecting

The connector halves are physically located with a guide pin. Always turn the connector halves to the correct position when reconnecting. Check that connector halves lock properly into each other.

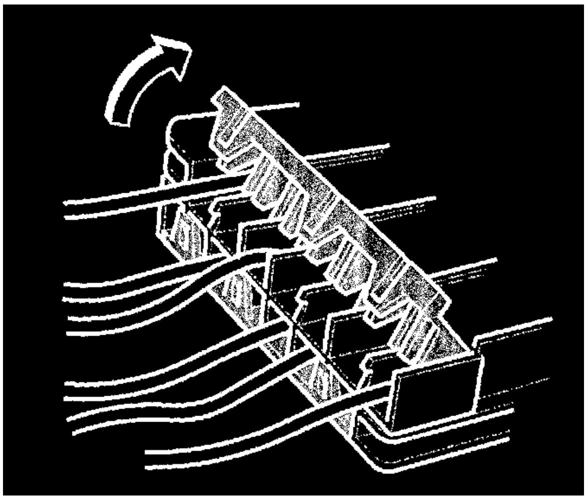
Secondary locking

The cable terminals are retained in the housing cavities by different forms of primary locking and secondary locking. This describes how the different secondary locking Systems on housing types are opened. If there is no secondary locking on the housing this can be ignored.



There are housings with and without secondary locking. In order to decide if the housing has secondary locking and if it has of which type, refer to the housings illustrated at Secondary locking - socket type, When secondary locking is of the lid type and When secondary locking is of the cavity cover type.

Housing with secondary locking



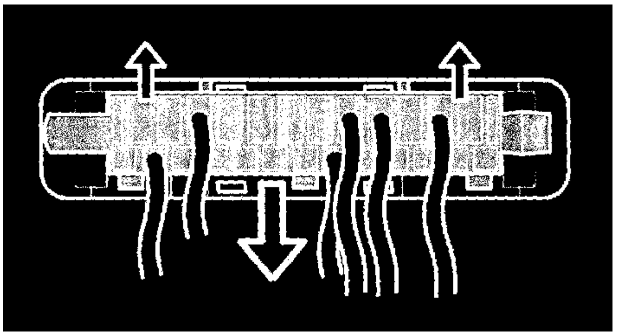
To replace a cable terminal the secondary locking must first be opened.

The following procedures describe how different types of secondary locking can he released to open a housing

- Secondary locking socket/housing retainer type
- Secondary locking lid/catch cover
- Secondary locking cavity cover /locking plate

More examples of procedures for opening secondary locking can be found in connectors some examples of methods.

Tools

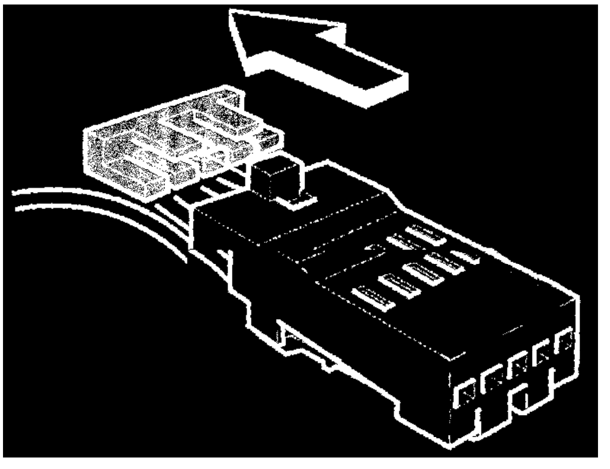


Use a thin screwdriver with a blade **3 - 4 mm** wide.

Secondary locking - socket type

Open the secondary locking as shown if it is of the socket/housing retainer type

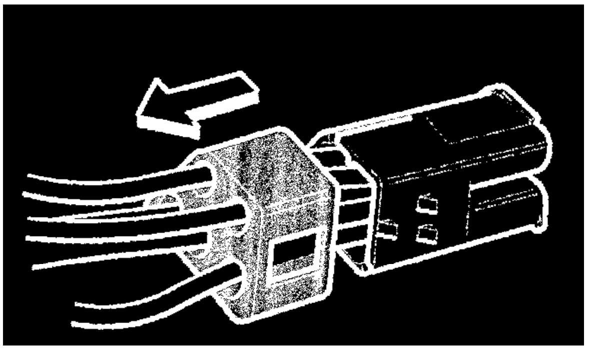
General instructions



Note that these are general instructions, variations can occur in practice.

Regard the examples shown and the procedures described as guidelines.

Release socket/housing retainer



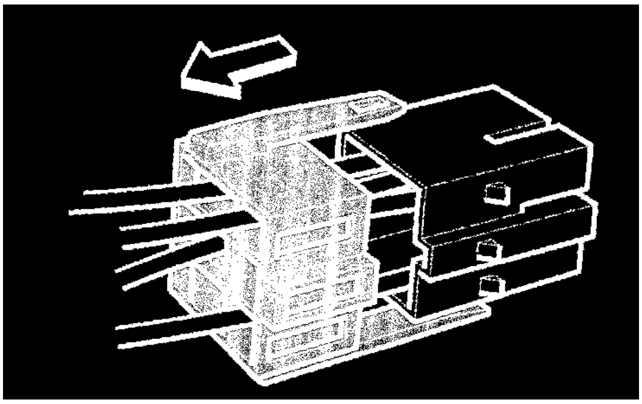
Use a thin screwdriver with a blade **3 - 4 mm** wide.

- Work the locking catches/eyes carefully loose on the socket or on the housing.

The number of locking catches/eyes and their location varies on different housings. There can also be variations between pin sizes in the housing types.

NOTE: Take care that the locking catches/eyes are not broken off when releasing the socket.

Remove



- Remove socket (and pull it back on the cables).

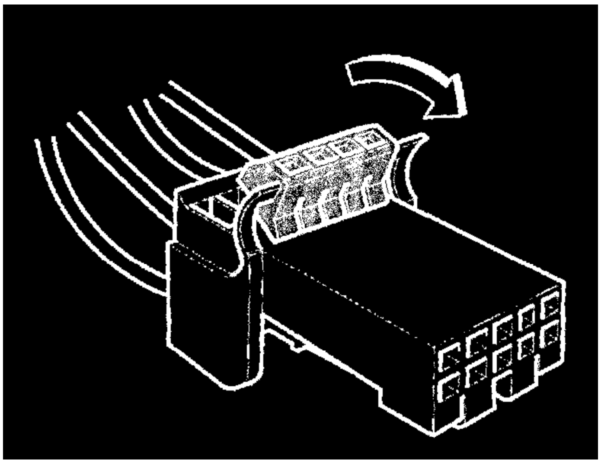
Proceed

To replace a cable terminal the next step is to remove the old cable terminal in the housing.

When secondary locking is of the lid type.

To open a housing secondary locking of the locking lid/catch type proceed as follows

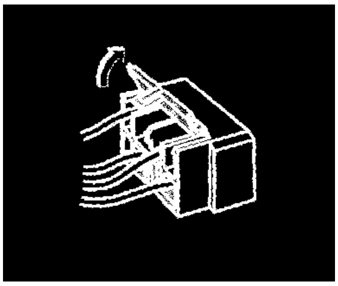
General instructions



Note that these are general instructions, variations can occur in practice.

Regard the examples shown and the procedures described as guidelines.

Open locking lid/catch



Use a thin screwdriver with a blade **3 - 4 mm** wide. Work the locking catches/eyes carefully loose on the locking lid or on the housing.

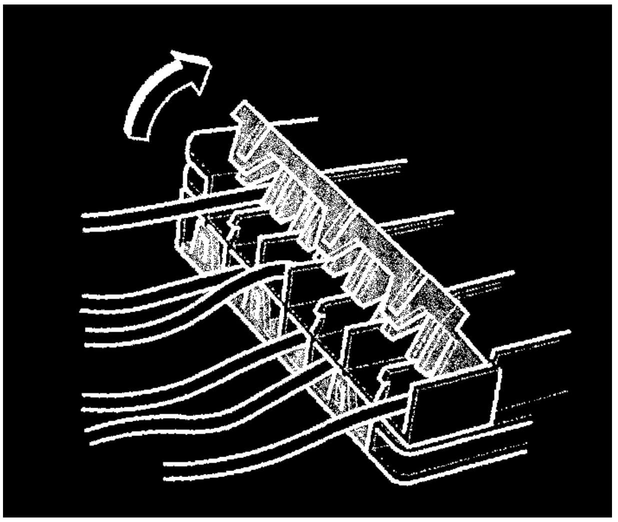
The number of locking catches/eyes and their location varies on different housings. There can also be variations between pin sizes in the housing types.

CAUTION: Take care that the locking catches/eyes are not broken off when releasing the lid.

- Unlock and open the locking lid

In multi-pin housings there can be separate locking lid for the upper cavity row and the lower. Only open the locking lid which is locking the cable terminal which is to be replaced.

Proceed

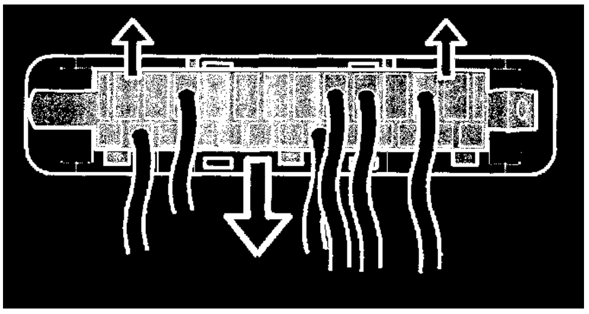


For replacement of a cable terminal the next step is to remove the old cable terminal which is in the housing.

When secondary locking is of the cavity cover type

To open a housing secondary locking when it is of the cavity cover/locking plate type, proceed as follows

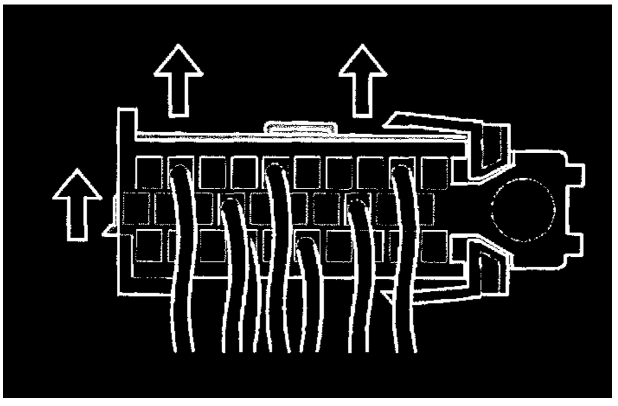
General instructions



Note that these are general instructions, variations can occur m practice.

Regard the examples shown and the procedures described as guidelines.

Open cavity cover/locking plate



For some housings a small, thin screwdriver can be used, for others no tool is required.

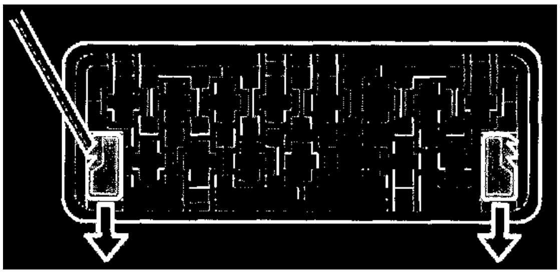
The secondary locking on this type of housing is released by setting the cavity cover/locking plate in the open position. There are two positions, open or closed.

- Lift up, push or unclip from the locking plate

A "click" can be heard when the plate unlocks and is in the open position.

NOTE: If the housing has a long, narrow locking plate check that it opens completely and not only along one edge. Work loose the locking plate along one entire long side.

Other examples of cavity cover/locking plates



More examples of housings with cavity cover/locking plate and procedures for opening them can be found in connectors, some examples of methods.

Proceed

To replace a cable terminal the next step is to remove the old cable terminal located in the housing.

- Proceed to extracting the cable terminal from the housing.

Operating Procedures For Repairs

Proceed as follows

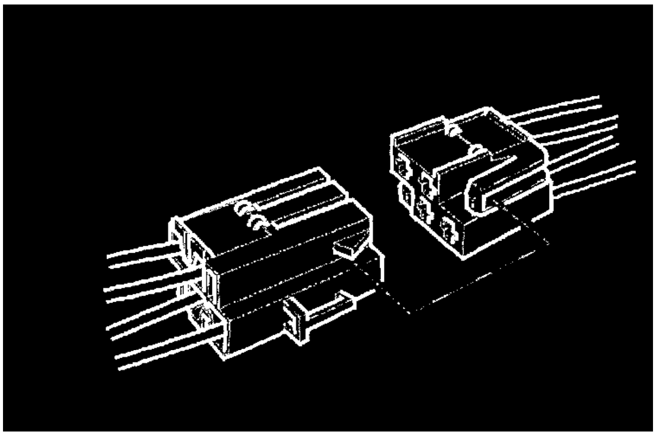
Using the information below most housings can be opened and the cable terminals replaced. Note that the stages in the operations can be used with most housings/cable terminals and that the illustrations only show a few individual types as examples. Other types can occur. The basic instructions for the repair/replacement of cable terminals are only a summary of the contents, with references to respective operations.

CAUTION: Note the contents, of these instructions must be followed before carrying out any repair work.

WARNING: SRS No cable repair or other repair work may be carried out on the SRS wiring. For repairs to the SRS system refer to the instructions in the Restraint Systems.

Basic procedures for repair operations
Opening a connector

Separate the connector

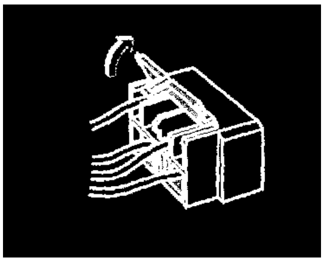


If the connector halves are connected they must first he opened.

CAUTION: Never pull the cables when opening the connector. Hold the connector halves.

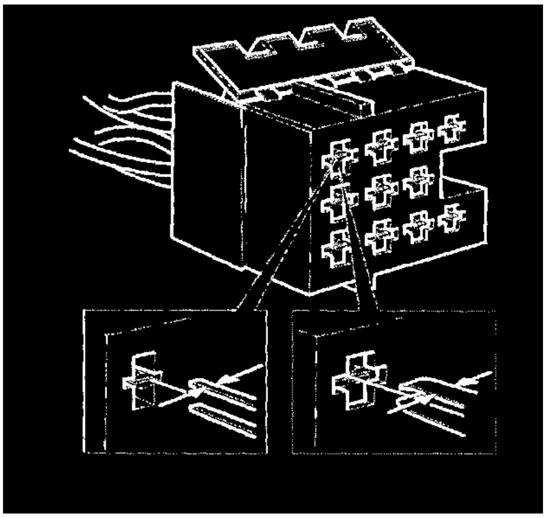
Open the housing

Secondary locking



Opening a housing's secondary locking.

Select terminal removal tool

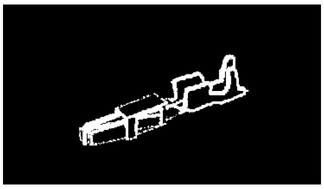


Select the terminal removal tool that matches the housing's cavity openings.

Remove the cable terminal from the housing

Use the recommended terminal removal tool and follow the operating procedure described.

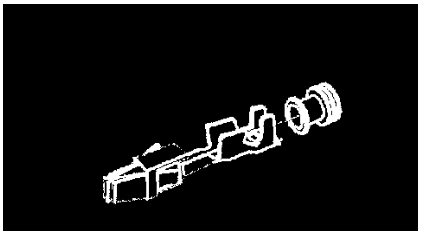
Select a new cable terminal



Select a new cable terminal of the same type as the existing terminal. Use the cable terminals in the repair kit p/n **981 4235.** Refer to the wiring diagram for information on the cable area.

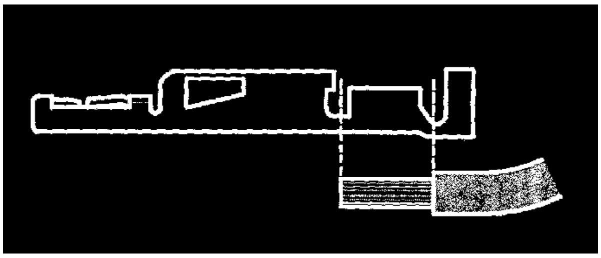
Sws (Single Wire Seal)

Seal sws and plug



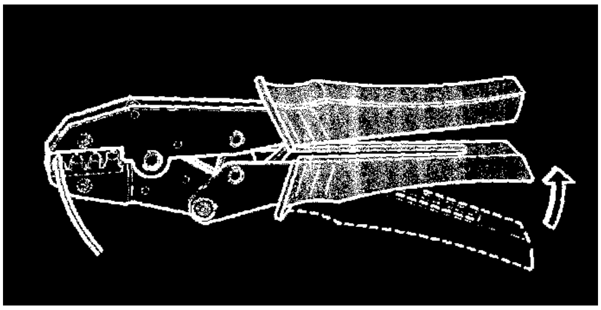
If a seal is to be used on the cable terminal thread the seal on to the cable before stripping the insulation on the cable.

Strip the cable



Cut and strip the cable to a length that matches the cable terminal.

Select a suitable crimp tool for the cable terminal



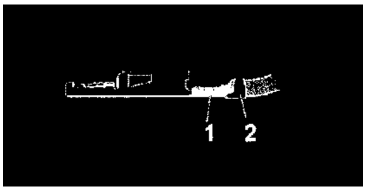
Refer to information on which tool is used for which type of cable terminal.

Crimp the cable terminal

Place the cable terminal in the crimp tool jaws, in the profile that matches the cable area of the cable. Position the cable in the cable terminal. Crimp the cable terminal on to the cable end.

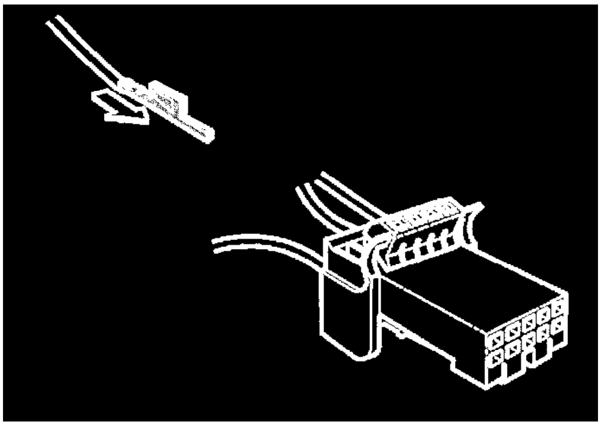
Checking crimping of a cable terminal

Checking the result of the crimping operation



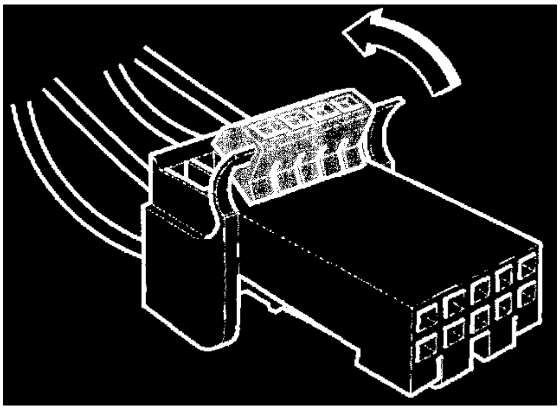
Always check the result of the crimping operation and that the primary locking is not damaged.

Insert the cable terminal in the housing



Insert the cable terminal in the appropriate cavity until the primary locking activates.
Check that the cable terminal is properly locked by pulling lightly on the cable.

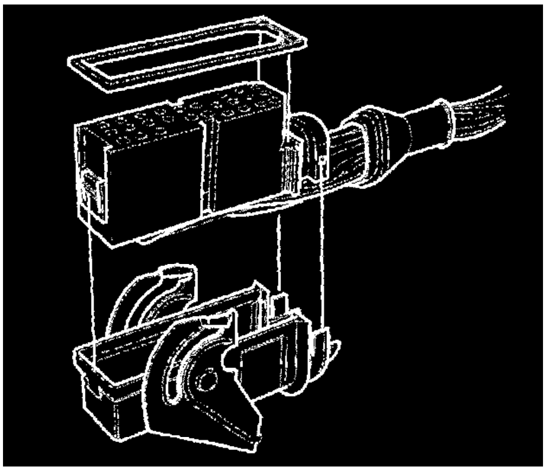
Close the housing



The housing's secondary locking must be closed.

Glossary For Connector/Housings

Glossary for connector/housings



Throughout the Service Manual certain terms are used to describe components and their location on the connector/housings.

A standard connector consists of a housing with cable terminals inside it. There are also connectors with different covers around the housings.

The purpose of the housings is to insulate the cable terminals and ensure a good electrical contact as well as to protect them from damage and deterioration due to the environment.

Pin housings and socket housings

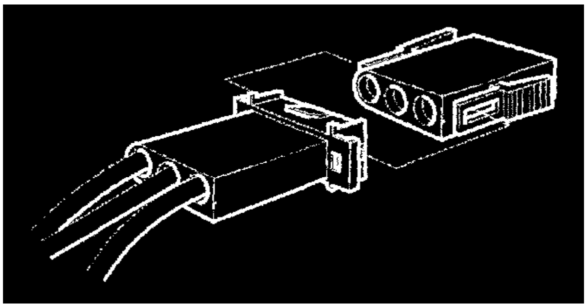
Pin housings hold the Pin (male) cable terminals.
Socket housings hold the Socket (female) cable terminals.

The housings interlock with each other or to a component There are both color and mechanical physical) codings used.

Connector halves

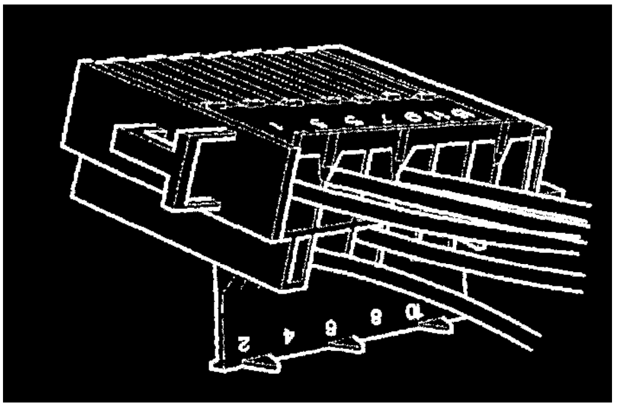
When a pin housing and a socket housing are connected together they are also called the connector halves.

Locking



To open the connector halves a catch must be released. There are two main types of locking systems: Active locking and Passive locking.

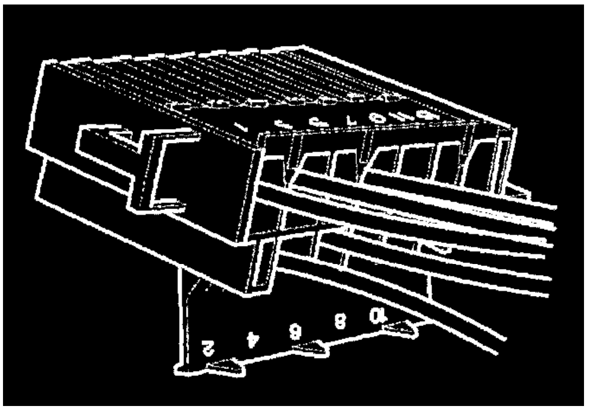
The housings - contact side V. cable side



The Contact side is the front of the housing where the cable terminals, Male or Female, are connected with each other.

The Cable side is the rear of the housing where the cable enters it.

The housings, top or bottom



Refers to which orientation the housing is shown from in illustrations.

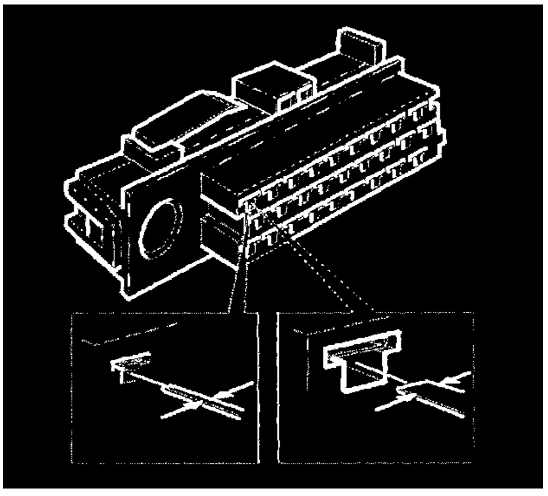
The side in the illustrations that is up is referred to as the top in the text. The side that is down is called the bottom.

The housings, cavities and position numbers

A cavity is the space in the housing where a cable terminal is located. Each cavity has a number and that number (terminal number) is given in the wiring diagrams as the position number.

Example: designation 24/11:3 means position 3 in connector 24/11.

The housing cavity opening

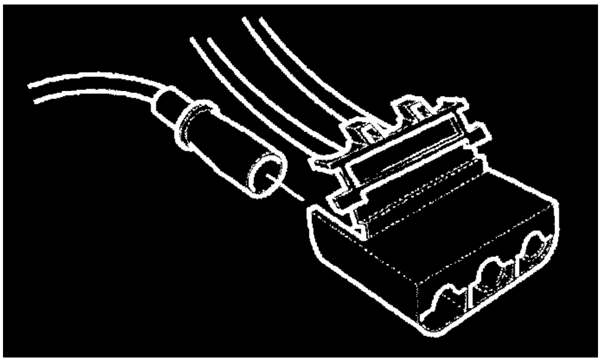


The cavity opening on the housing contact side has an easily identifiable shape, to match the different types of cable terminals. It is the cavity shape which determines which terminal removal tool is to be used.

Extraction groove

Some housing cavity openings have a extraction groove. The groove is used to insert a terminal removal tool. Cavity openings can have one or two extraction grooves.

Moisture proof housings



Moisture proof housings have moisture proof cable terminals. The moisture proof cable terminals have wires fitted and then sealed in a plastic material.

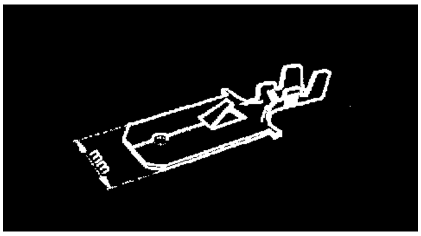
Other housings have enhanced moisture resistance through addition of various types of seal such as gaskets, a rubber sleeve fitted over the cables, plugs in unused cavities and seals on the insulation wings of the cable terminal.

Terms used for cable terminals

There are many different designs of cable terminals - tab, pin and timer are all examples. Here are some terms which apply to all cable terminals.

- The different types of cable terminals are described in extracting the cable terminal from the housing.

Size



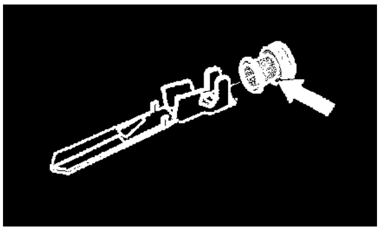
Cable terminal size is calculated as the width of the tab section. The receptacle terminal size is given as the matching tab's size. For pin/socket terminals the size is the diameter of the pin.

Cable terminal specifications are written with the size first, for example 2.8 Tab.

Cable areas

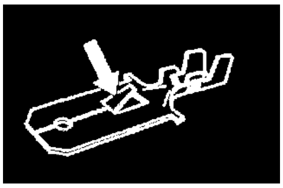
Every cable terminal type is available in sizes (approx 2 to 4) for different cable areas, so the size of the core wings and insulation wings vary.

Seal sws (single wire seal) on cable terminals



On SWS (single wire seal) cable terminals a seal must be used. The seal is crimped round the cable at the insulation wings and seals against the cavity in a housing.

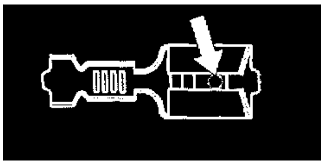
Locking tab



Most cable terminals have one or two locking tabs which retain the cable terminal in the cavity. There are also cable terminals without any locking tab.

It is important that the locking tab is sticking up from the cable terminal so that it catches properly in the housing when it is connected.

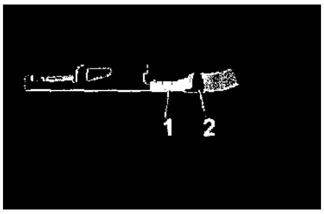
Dimples



Some tab/receptacle terminals in single pin (and multi pin) variants have dimples in the housing.

The dimple is a mechanical locking device between the tab and receptacle terminals.

Core crimp and insulation wings



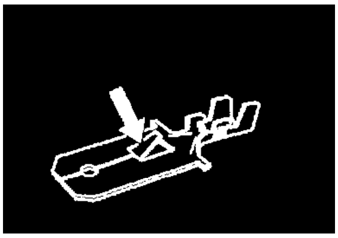
The cable terminals crimping section consists of two parts, which are both formed at the same time in the crimp tool.
Core crimp (1) for the electrical connection with the stripped section of the cable (the core).
Insulation wings(2), which are pressed on to the cable's insulating sheath and support the core crimp, reducing the effects of mechanical stress.

Primary locking and secondary locking

The cable terminals are retained in position in a housing by different types of locking devices which prevent the cable terminal being pushed out of the rear of the housing when they are connected together.

The locking catches must be opened when inserting a cable terminal in a housing.

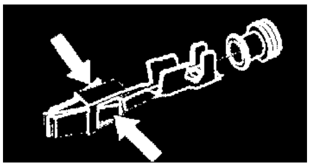
Primary locking



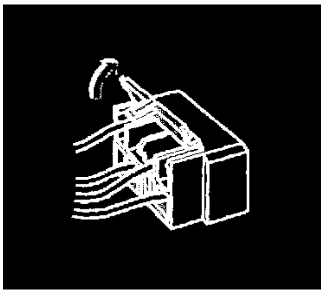
Primary locking is normally on the cable terminal, consisting usually of one or two locking tabs. See examples in illustration.

- Single primary locking uses one locking tab
- Double primary locking has two locking tabs

If there is no primary locking on the cable terminal there may be a type of locking catch located in the housing cavity instead. There is always one separate primary locking for each cable terminal.



Secondary locking



Secondary locking is always located in the housing itself. Secondary locking can be a socket section or locking lid with catches, which must be opened in order to remove a cable terminal. Secondary locking protects, supports and holds the cable terminals in place.

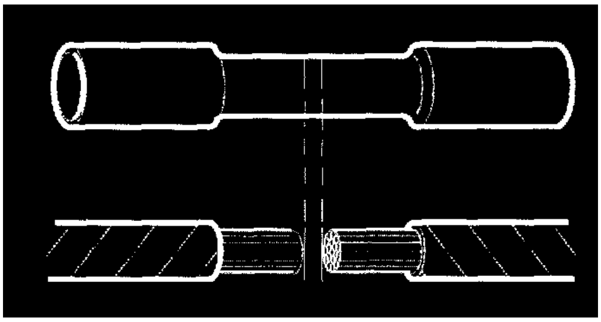
Splicing Using Insulated Moisture Proof Butt Connector

Splicing using insulated moisture proof butt connector

Table for insulated moisture proof butt connectors

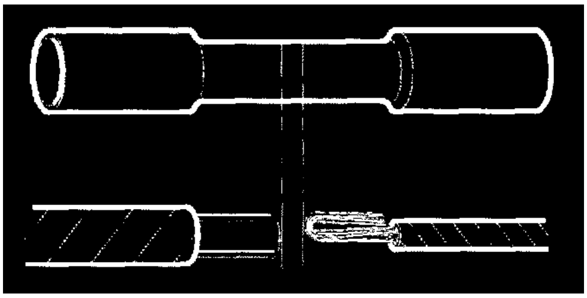
Butt connector	Color	Cable area mm^2	Strip length mm	Crimp tool
9130467-5	Red	0.5 - 1.0	4 - 5	See section **Other tools**
9130476-6	Blue	1.0 - 2.5	5 - 6	^
9130477-4	Yellow	4.0 - 6.0	6 - 7	^

Prepare the cables



- Select a suitable butt connector according to cable area.
- Cut the cables
- Strip cables to strip length as shown in table above.

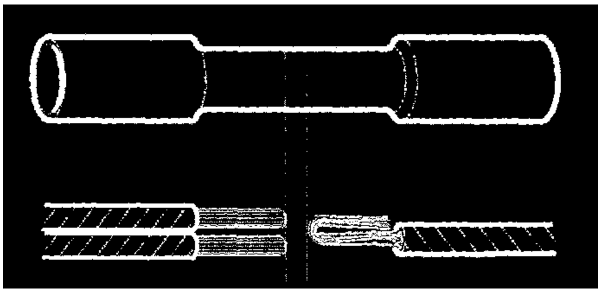
Splicing cables of different areas



If the cable areas are so different that they will not fit in the same butt connector, do as follows:

- Select butt connector to fit the larger cable.
- Strip the smaller cable to double length and bend the stripped section double.

Splice with several cables (branch point)

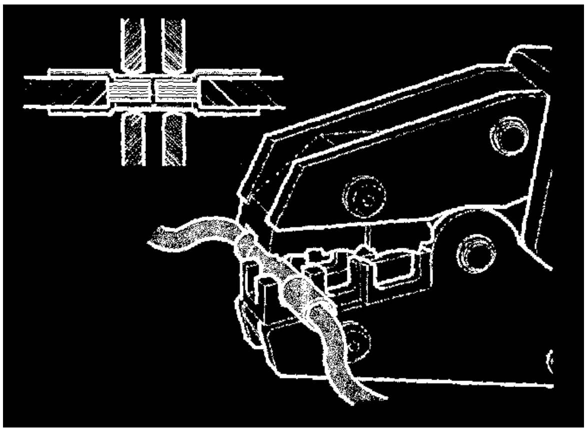


Select a butt connector large enough to take the cables to be inserted on the same side.

If a single cable is to be inserted on one side of the butt connector it will more than likely have too small an area compared to the opening in the butt connector.

Strip the cable to double length and bend it double.

Locate the butt connector in the crimp tool



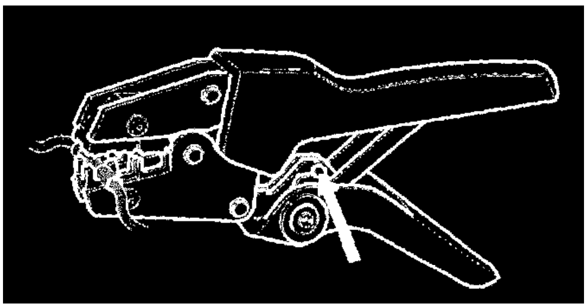
Use the crimp tool recommended **Other tools.**

Locate the butt connector in crimp tool jaws Use the correct insert that matches the area of the butt connector.

- Apply pressure to the tool grips until the insert in the jaws retains the without deforming it.
- Insert cables in both ends of the so that each stripped section of core is up against the center divider in the butt connector.

Crimping a butt connector

Before completing crimping:

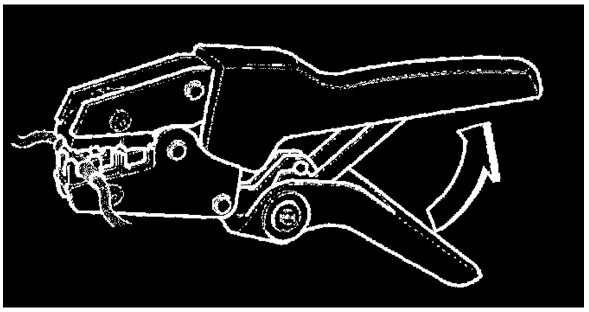


- Check that the butt connector is correctly located in the crimp tool forming section.
- Check the cables are still in the correct position in the butt connector.

If the butt connector is not correctly located, abort the crimp operation.

On most crimp tools of this type there is a locking device that can be released to open the tool. See picture.

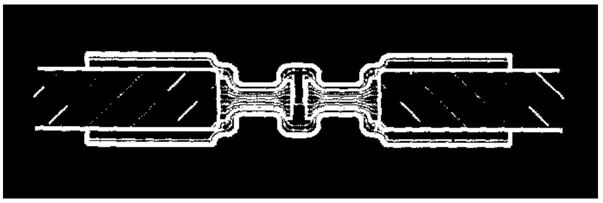
Complete the crimping operation:



- Press the tool grips together to close the jaws

Do not release pressure on the grips until the tool has fully completed the crimp operation. Not until then will complete crimping have occurred and the tool can be opened.

Inspect the crimped butt connector

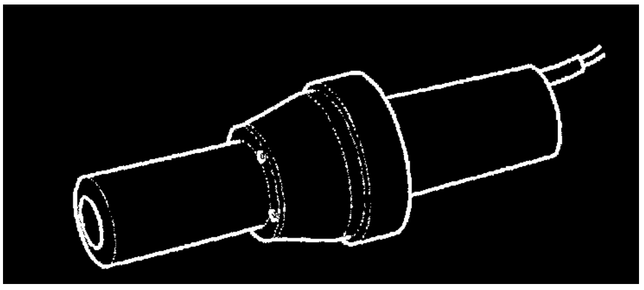


If the butt connector has been correctly crimped both crimping points should be uniformly compressed.

All cables should be crimped in place towards the center of the butt connector and not displaced towards the ends.

Pull the cables to ensure that none are loose.

Shrink butt connector using heat gun

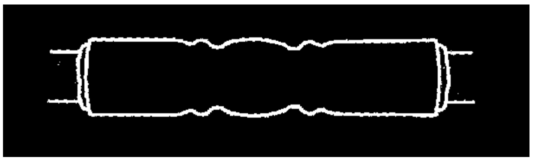


After crimping the butt connector it must be shrunk using a heat gun.

The butt connector has an internal layer of glue which is released when heated and flows out and around the cables. The glue and crimp together provide a mechanically robust and moisture proof splice.

- Use a heat gun with a high enough rating to shrink the crimped butt connector.

Inspect results of shrinking



Check the shrinking results. If ok the glue should have been forced out of the ends of the butt connector and around the splice.

Replacing a cable

If a cable must be replaced

If a cable is damaged it cannot be used again. The damage can be mechanical, electrical or the cable might be too short for crimping new cable terminals. The cable must be replaced or spliced.

Selecting a new cable

NOTE: A new cable must always be of the same type as the one it replaces: the same length, insulation, core area and preferably the same color.

Select a new cable that matches the old.

Cable length

Measure the original cable length.

Cable area

Measure diameter on the original cable with a vernier caliper. Always replace cables with a cable of the same diameter or a cable that is nearest in dimension to the original.

The cable area is stated on the wiring diagram (applies to 850 cars).

NOTE: It is always the cable core only that is used as the basis for cable area, not the area of the cable core and insulation together.

Color

Cable insulation color - if possible always use a cable of the same color when replacing cables.

The color code for the cable is stated on the wiring diagram (applies to 850 and 900 cars).

- Refer to color coding table Color coding table for color codes.

Install new cable

Use the same routing as the original cable and clamp the cable in appropriate cable clamp, tie etc.

If a new cable tie is used do not leave sharp edges when cutting.

Color coding table

Abbreviations used for cables and connectors/housings.

Color	Abbreviated form
Black	SB
Brown	BN
Red	R
Orange	OR
Yellow	Y
Green	GN
Blue	BL
Violet	VO
Grey	GR
White	W
Pink	P
Ivory	I
Light blue	LBL
Light brown	LBN
Natural	NL

Cable color coding with two colors

If the cable color code has two colors it appears in abbreviated form like this:

Example

Y/R (or Y-R) Is Yellow/Red.

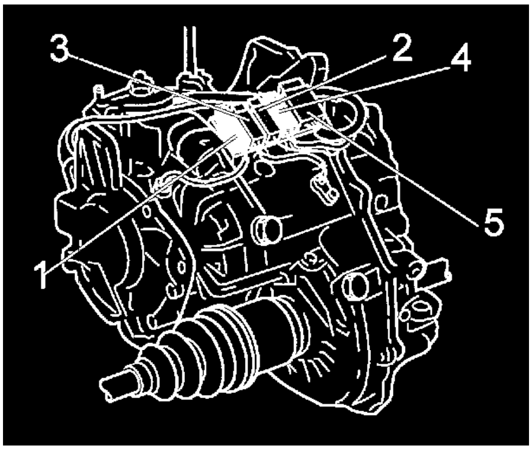
The cable has a yellow insulation with a red stripe.

Automatic Transmission/Transaxle

Transmission connectors

Transmission connectors (x5)

There are five connectors on a bracket mounted on the transmission the engine compartment. The transmission sensors are connected to system via these connectors. The connectors are "marked" and column below.

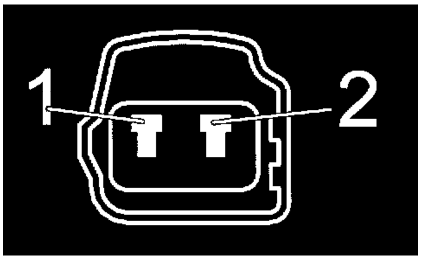


1. Engine speed (RPM) sensor
2. Oil temperature sensor
3. Vehicle speed sensor (VSS)
4. Solenoids
5. Gear-shift position sensor

The illustrations below show the connectors connected to the trans module (TCM) cable hamess and to the car's electrical system. The connectors (mounted on the bracket) are numbered in the opposite

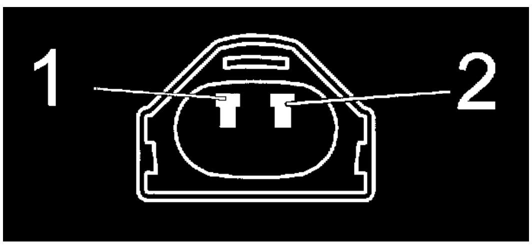
The connections apply to two different engine management system

- EMS 2000
- Fenix.



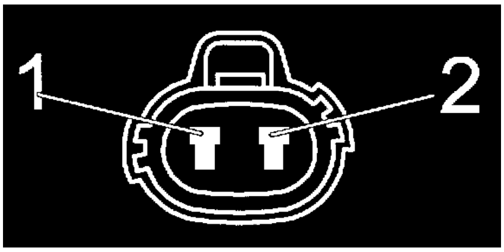
Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Transmission speed sensor signal ground (NC1G)	39	22
2	Transmission speed (RPM) sensor signal (NC1)	25	37

1. Engine speed (RPM) sensor Connector, black (2-pin)



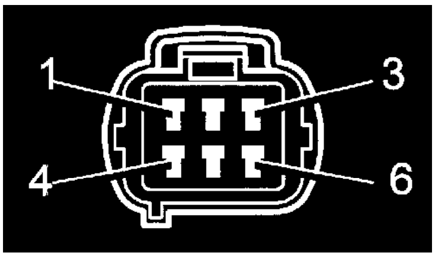
Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Oil temperature sensor signal ground (OTG)	18	19
2	Oil temperature sensor signal (OT)	33	34

2. Oil temperature sensor Connector, gray (2- pin)



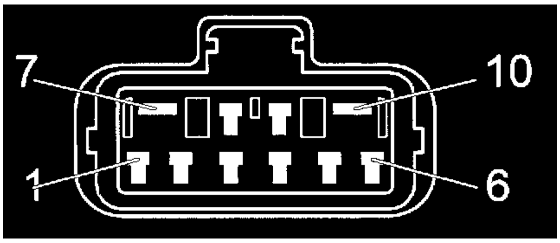
Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Vehicle speed sensor (VSS) signal ground (SPG)	24	36
2	Vehicle speed sensor (VSS) signal (SP)	11	8

3. Vehicle speed sensor (VSS) Connector, white (2-pin)



Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Line pressure solenoid STH control signal (STH)	16	16
2	Control signal (SL), lock-up solenoid SL	2	2
3	Shift solenoid S1 control signal (S1)	17	17
4	Line pressure solenoid STH signal (STHG)	4	4
5	--	--	--
6	Shift solenoid S2 control signal (S2)	31	31

4. Solenoids Connector, dark gray (6-pin)

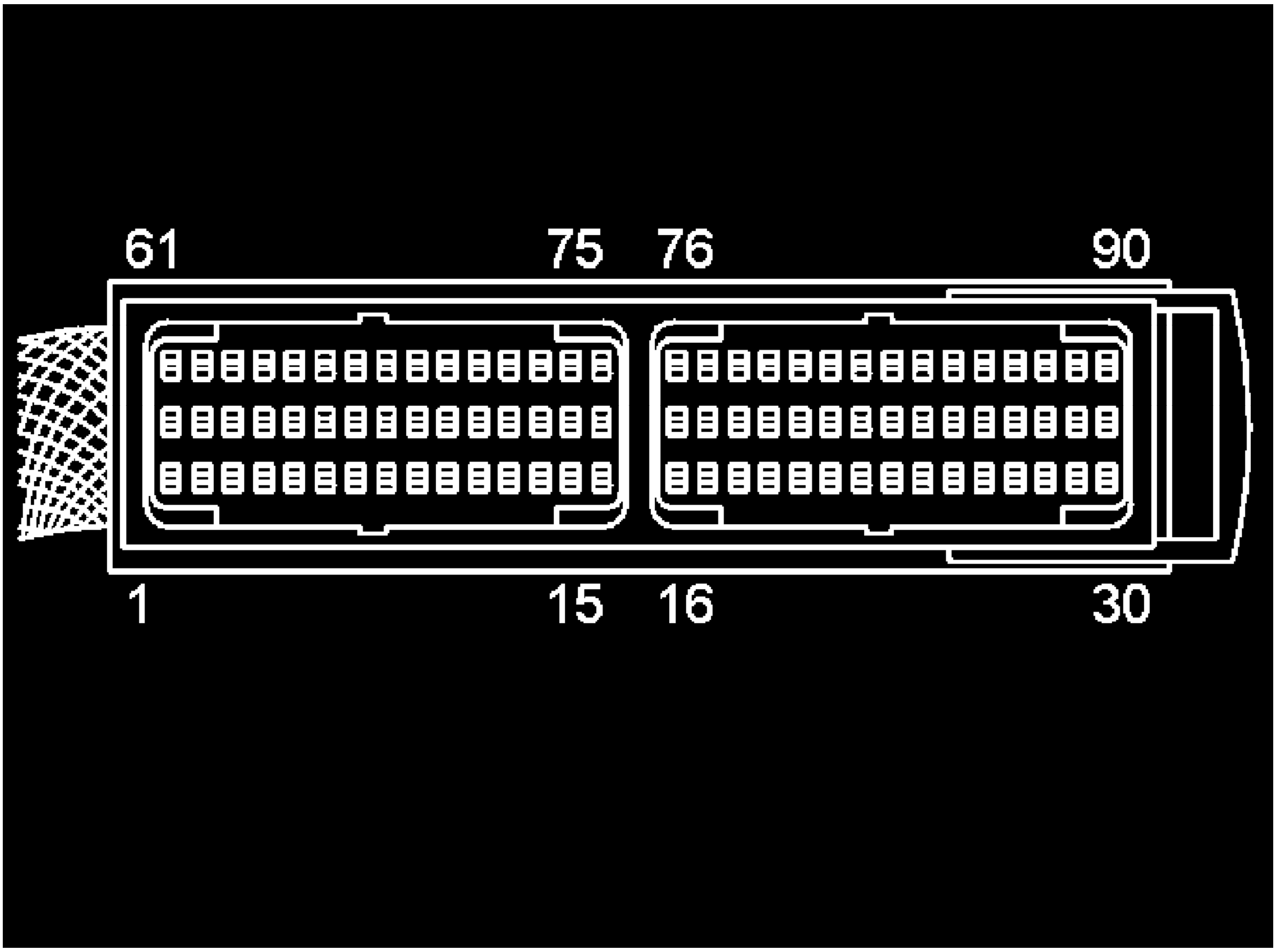


-97 Terminal	98- Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	10	Power ground (PG)	--	--
2	9	--	--	--
3	8	Gear-shift position sensor signal, terminal C	9	26
4	7	Gear-shift position sensor signal terminal PA	22	13
5	6	Gear-shift position sensor signal terminal A	23	27
6	5	Gear-shift position sensor signal terminal B	37	41

-97 Terminal	98- Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
7	4	Power supply (50-supply) to gear selector park / neutral position (PNP) switch terminal 50	--	--
8	2	Back-up (reversing) light switch (15 I)	--	--
9	3	Power supply to back-up (reversing) light terminal BL	--	--
10	1	Starter motor solenoid control signal terminal 50S	--	--

5. Gear-shift position sensor Connector, gray (10- pin)

Engine Control Module


61
75
76
90
1
15
16
30

Terminal *(Engine control module (ECM) Breakout box)*	*Signal type*	*Ignition on*	*Engine idling*	*Notes*
1/A1	Ignition coil cyl. 2/3 Control signal	U_{bat} (for 1 second after the ignition is switched on)	Low pulse for 3 milliseconds from U_{bat} to U_{low}, then a voltage peak greater than or equal to 100 V	Frequency 13 Hz when the engine is idling
2/A2	-	-	-	-
3/A3	Power ground terminal #4	U_{low}	-	-
4/A4	Canister purge (CP) valve, control signal	U_{bat} for 1 second after the ignition is switched on	-	During control: the voltage oscillates between U_{low} and U_{bat}
5/A5	Turbocharger (TC) control valve, control signal	U_{bat} (for 1 second after the ignition is switched on)	U_{bat}	During control, a pulsed signal between U_{bat} and U_{low} with a fixed frequency of 32 Hz and variable pulse ratio (%duty)
6/A6	-	-	-	-
7/A7	-	-	-	-

1/A1 - 7/A7

8/A8	Engine cooling fan (FC) high-speed, control signal	Engine cooling fan (FC) off = U_{bat} Engine cooling fan (FC) on = U_{low}	-	-
9/A9	-	-	-	-
10/A10	System relay, control signal	U_{low}(after 1 second U_{bat})	U_{low}	-
11/A11	Engine coolant temperature (ECT) sensor signal to the combined instrument panel	f=45 Hz at +25 °C f=20 Hz at +100 °C	-	A pulsed signal between 0 V and 5 V with variable frequency and fixed pulse ratio (% duty) f increases with decreasing temperature
12/A12	-	-	-	-
13/A13	Boost pressure sensor 2, signal	U = 1.8 V	U=0.7 V	The voltage increases with increased pressure in the intake manifold.
14/A14	Air conditioning (A/C) system pressure sensor, signal	U = 0.9 V	U = 0.9 V (when the air conditioning (A/C) has not been on)	The voltage depends on the pressure in the system 1.4-1.8 V when the air conditioning (A/C) is activated
15/A15	Mass air flow (MAF) sensor, ground	U_{low}	-	-
16/B1	Mass air flow (MAF) sensor, signal	U_{low}	U = 0.6 V	U increases with engine speed (RPM) and load
17/B2	-	-	-	-

8/A8 - 17/B2

18/B3	Atmospheric pressure sensor, signal (model year -00)	U=4.6 V	U=4.6 V	The voltage varies with the atmospheric pressure
19/B4	Knock sensor (KS) ground screen	U_{low}	-	-
20/B5	Torque limiting signal from DSA to ECM	U =5 V	U=2 V (with DSA) U=5 V (without DSA)	Pulsed signal with fixed frequency of 200 Hz and fixed pulse ratio of 3 ms pulse with factor Tr=0
21/B6	-	-	-	-
22/B7	-	-	-	-
23/B8	-	-	-	-
24/B9	Engine speed (RPM) sensor, signal (-)	U = 1.8 V	U DC = 1.8 V U AC = 2.5 Vt-t	Sine signal retained over DC Frequency and amplitude depend on engine speed (RPM)
25/B10	-	-	-	-
26/B11	-	-	-	-
27/B12	CAN-H to / from TCM	U=2-3 V average voltage	U=2-3 V average voltage	-
28/B13	Power ground terminal #1 Measured to the battery negative terminal (-)	U_{low}	-	-
29/B14	15 supply (+12 V, when the ignition is on)	U_{bat}	-	-

18/B3 - 29/B14

30/B15	30 supply (+12 V, battery voltage)	U $_{bat}$	-	-
31/A16	-	-	-	-
32/A17	Ignition coil cylinder 1/4 control signal	U_{bat} (for 1 second after the ignition is switched on)	Low pulse for 3 milliseconds from U $_{bat}$ to U_{low}, then a voltage peak greater than or equal to 100 V	Frequency 13 Hz when the engine is idling
33/A18	Power ground terminal #3 Measured to the battery negative terminal (-)	-	-	-
34/A19	Malfunction indicator lamp (MIL), control signal (to the combined instrument panel)	U_{low} =lamp lit U_{bat} =Lamp not lit	-	-
35/A20	The leak diagnostic pump valve, control signal (Certain markets only)	U $_{low}$	U $_{low}$	During the leak diagnostic the voltage oscillates between U_{low} and U_{bat}
36/A21	Throttle position (TP) sensor output signal from ECM to DSA	pulse ratio = 5% (closed throttle position (CTP)) pulse ratio = 80% (open)	pulse ratio = 5% (closed) pulse ratio = 80% (open) f = 50 Hz	A pulsed signal between 0 V and 9 V with fixed frequency and variable pulse ratio (% duty)
37/A22	-	-	-	-

30/B15 - 37/A22

38/A23	Engine cooling fan (FC) low-speed, control signal	Engine cooling fan (FC) off: U_{bat} Engine cooling fan (FC) on =	-	-
39/A24	-	-	-	-
40/A25	Fuel consumption signal to the combined instrument panel.	With infocenter: U_{stable} Without infocenter: U_{low}	Pulse train at 500 ms intervals; 1-10 x 1 ms pulses depending on engine coolant temperature (ECT), engine speed (RPM) and load. Pulses between 0 V and 5 V.	-
41/A26	The leak diagnostic pump, signal (Certain markets only)	U_{low}	-	During the leak diagnostic the voltage oscillates between U_{low} and U_{bat}
42/A27	-	-	-	-
43/A28	Throttle position (TP) sensor, signal	U = 0.6-0.7 V with unaffected throttle position (TP) sensor	-	U = 0.6-4.5 V depending on the position of the accelerator pedal (AP)
44/A29	Rear heated oxygen sensor (HO2S) signal measured to terminal #75	U = 0.5 V	U = oscillates between 0.1 V - 1 V, cold three-way catalytic converter (TWC). U = fixed value 0.4 V - 0.6 V, hot three-way catalytic converter (TWC).	-
45/A30	Front heated oxygen sensor (HO2S) signal measured to terminal #75	U = 0.5 V	The voltage fluctuates between 0 - 1 V	High voltage = Rich Low voltage = Lean
46/B16	-	-	-	-
47/B17	Engine coolant temperature (ECT) sensor, signal	$U_{average}$=2.6 V(+25°C) $U_{average}$=0.6 V(+100°C)	$U_{average}$=2.6 V(+25°C) $U_{average}$=0.6 V(+100°C)	Voltage decreases with increasing temperature

38/A23 - 47/B17

48/B18	Intake air temperature (IAT) sensor, signal intake air	U=2 V at +25 °C U = 0.25 V at +100 °C	-	-
49/B19	-	-	-	-
50/B20	-	-	-	-
51/B21	Knock sensor (KS), signal	U_{low}	-	-
52/B22	Speed signal from the ABS control module	U_{bat}	U_{bat}(-1 V)	Pulsed signal between U_{low} and U_{bat} when the front left wheel is rotated
53/B23	-	-	-	-
54/B24	Engine speed (RPM) sensor, signal (+) Measured to terminal #24	U_{low}	U_{AC} = 5Vt-t f = 775 Hz (current rpm)	DC 1.8 Volts with retained sine signal amplitude and frequency increase with engine speed
55/B25	-	-	-	-
56/B26	Immobilizer communication cable (also data link connector (DLC) communication link)	No communication on the cable: U=90% of Ubat. During communication: data communication, pulsed signal between Ubat and 0 V.	Other values apply if a generic fault-tracing instrument is connected to the data link connector (DLC).	The engine control module (ECM) and immobilizer control module communicate with each other for 2 seconds after the ignition is switched on to determine whether engine start should be permitted. After this interval, the immobilizer switches internally so that the cable is connected to the communication link in the data link connector (#7).

48/B18 - 56/B26

57/B27	CAN-L to / from TCM	U=2-3 V average voltage	U=2-3 V average voltage	-
58/B28	Camshaft position (CMP) sensor, signal	U=0 V or 5 V depending on position of the camshaft	-	Variable pulse ratio at constant engine speed due to the design of the camshaft position (CMP) sensor.
59/B29	Injector 1, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load
60/B30	Injector 3, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load
61/A31	-	-	-	-
62/A32	Camshaft reset valve, control signal	U_{bat} for 1 second after the ignition is switched on	f = 250•Hz	A pulsed signal with fixed duty cycle and variable frequency.
63/A33	Front heated oxygen sensor (HO2S), preheating, control signal	U = 0 V U_{bat} when the system relay is connected	Preheating off: U_{bat} Preheating on: U=0.5-4.5 V	Pulsed signal from U_{bat} to U_{low}. The pulse ratio reduces as the temperature in the heated oxygen sensor (HO2S) increases
64/A34	Idle air control (IAC) valve, control signal	U_{bat} for 1 second after the ignition is switched on	U_{low}	A pulsed signal with fixed duty cycle and variable frequency.

57/B27 - 64/A34

65/A35	Rear heated oxygen sensor (HO2S), preheating, control signal	$U = 0$ V U_{bat} when the system relay is connected	Preheating off: U_{bat} Preheating on: U=0.5-4.5 V	Pulsed signal from U_{bat} to U_{low}. The pulse ratio reduces as the temperature in the heated oxygen sensor (HO2S) increases
66/A36	Power supply from the system relay	U_{bat} (for 1 second after the ignition is switched on)	U_{bat}	-
67/A37	Power ground terminal #2 Measured to the battery negative terminal (-)	U_{low}	-	-
68/A38	A/C relay, control signal	U_{bat}	U_{bat} when the relay is not connected U_{low} when the relay is connected	-
69/A39	A/C fan, control signal	U_{low}	$_{bat}$ when the engine cooling fan (FC) is running U_{low} when the engine cooling fan (FC) is not running	-
70/A40	Engine speed (RPM) signal to the combined instrument panel	U_{low}	f = 25 Hz (current rpm/30)	Pulsed signal between 0 V and 10 V with variable frequency and fixed pulse ratio (% duty)
71/A41	Torque signal from ECM to DSA	U_{low}	No pulses when the engine is idling	Pulsed signal between 0 V and U_{bat} with a length of up to 100 seconds during throttle opening and engine without load

65/A35 - 71/A41

72/A42	Boost pressure sensor 1, signal (applies to model year 2001-)	U = 1.8 V	U = 1.8 V	-
73/A43	Sensor, ground	U_{low}	U_{low}	-
74/A44	Power supply, sensor	U =5 V	U =5 V	Boost pressure sensor, boost pressure sensor 2, air conditioning (A/C) pressure sensor
75/A45	Front + rear heated oxygen sensor (HO2S), ground	-	-	-
76/B31	Knock sensor (KS) ground	U_{low}	-	-
77/B32	Sensor, ground	U_{low}	U_{low}	-
78/B33	Power supply, throttle position (TP) sensor	U =5 V	U =5 V	-
79/B34	Sensor, ground	U_{low}	U_{low}	Intake air temperature (IAT) sensor, boost pressure sensor 2, air conditioning (A/C) pressure sensor
80/B35	-	-	-	-
81/B36	-	-	-	-
82/B37	-	-	-	-
83/B38	Power supply, camshaft position (CMP) sensor	U =5 V	-	-
84/B39	-	-	-	-

72/A42 - 84/B39

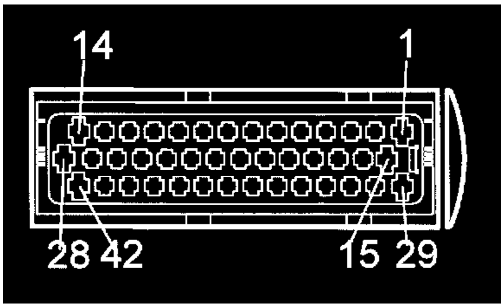
85/B40	-	-	-	-
86/B41			-	-
87/B42	-	-	-	-
88/B43	Air conditioning (A/C) request from MCC or ECC	U_{low}	Air conditioning (A/C) relay not activated: U_{low} Air conditioning (A/C) relay activated: U_{bat}	Applies when the air conditioning (A/C) and blower fan switch buttons are in the on position
89/B44	Injector 4, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load
90/B45	Injector 2, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load

85/B40 - 90/B45

Transmission Control Module (TCM) Connector

Transmission control module (TCM) connector

General



There are six unique connectors in the transmission Control system, one to the transmission control module (TCM) and five located on a bracket. This bracket is mounted on the transmission mounting on the left of the engine compartment.

Otherwise, the transmission control system wiring is routed along other cable harnesses in the car.

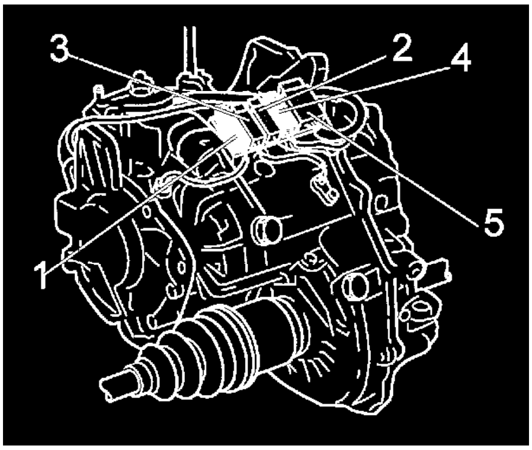
The illustration shows the terminals on the cable harness connector that are connected to the transmission control module (TCM).

Transmission Connectors

Transmission connectors

Transmission connectors (x5)

There are five connectors on a bracket mounted on the transmission the engine compartment. The transmission sensors are connected to system via these connectors. The connectors are "marked" and column below.

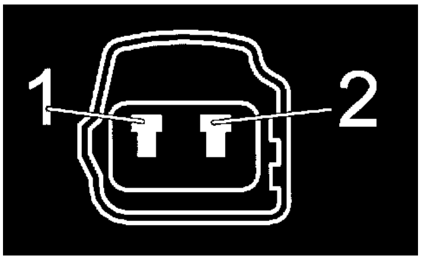


1. Engine speed (RPM) sensor
2. Oil temperature sensor
3. Vehicle speed sensor (VSS)
4. Solenoids
5. Gear-shift position sensor

The illustrations below show the connectors connected to the trans module (TCM) cable hamess and to the car's electrical system. The connectors (mounted on the bracket) are numbered in the opposite

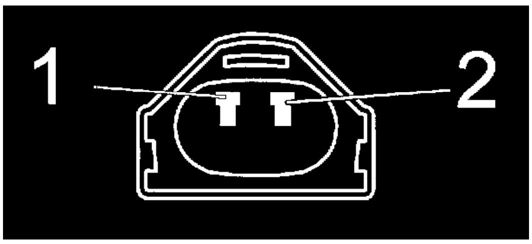
The connections apply to two different engine management system

- EMS 2000
- Fenix.



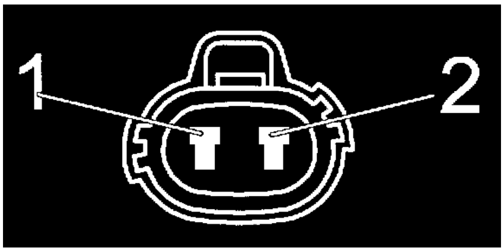
Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Transmission speed sensor signal ground (NC1G)	39	22
2	Transmission speed (RPM) sensor signal (NC1)	25	37

1. Engine speed (RPM) sensor Connector, black (2-pin)



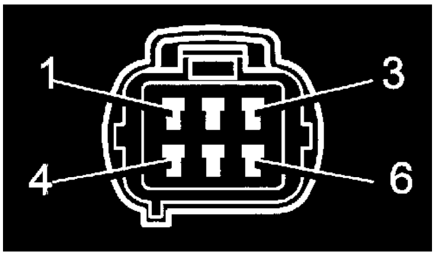
Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Oil temperature sensor signal ground (OTG)	18	19
2	Oil temperature sensor signal (OT)	33	34

2. Oil temperature sensor Connector, gray (2- pin)



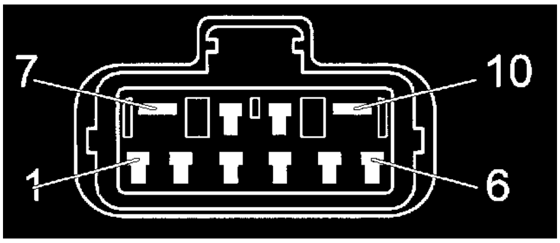
Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Vehicle speed sensor (VSS) signal ground (SPG)	24	36
2	Vehicle speed sensor (VSS) signal (SP)	11	8

3. Vehicle speed sensor (VSS) Connector, white (2-pin)



Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	Line pressure solenoid STH control signal (STH)	16	16
2	Control signal (SL), lock-up solenoid SL	2	2
3	Shift solenoid S1 control signal (S1)	17	17
4	Line pressure solenoid STH signal (STHG)	4	4
5	--	--	--
6	Shift solenoid S2 control signal (S2)	31	31

4. Solenoids Connector, dark gray (6-pin)

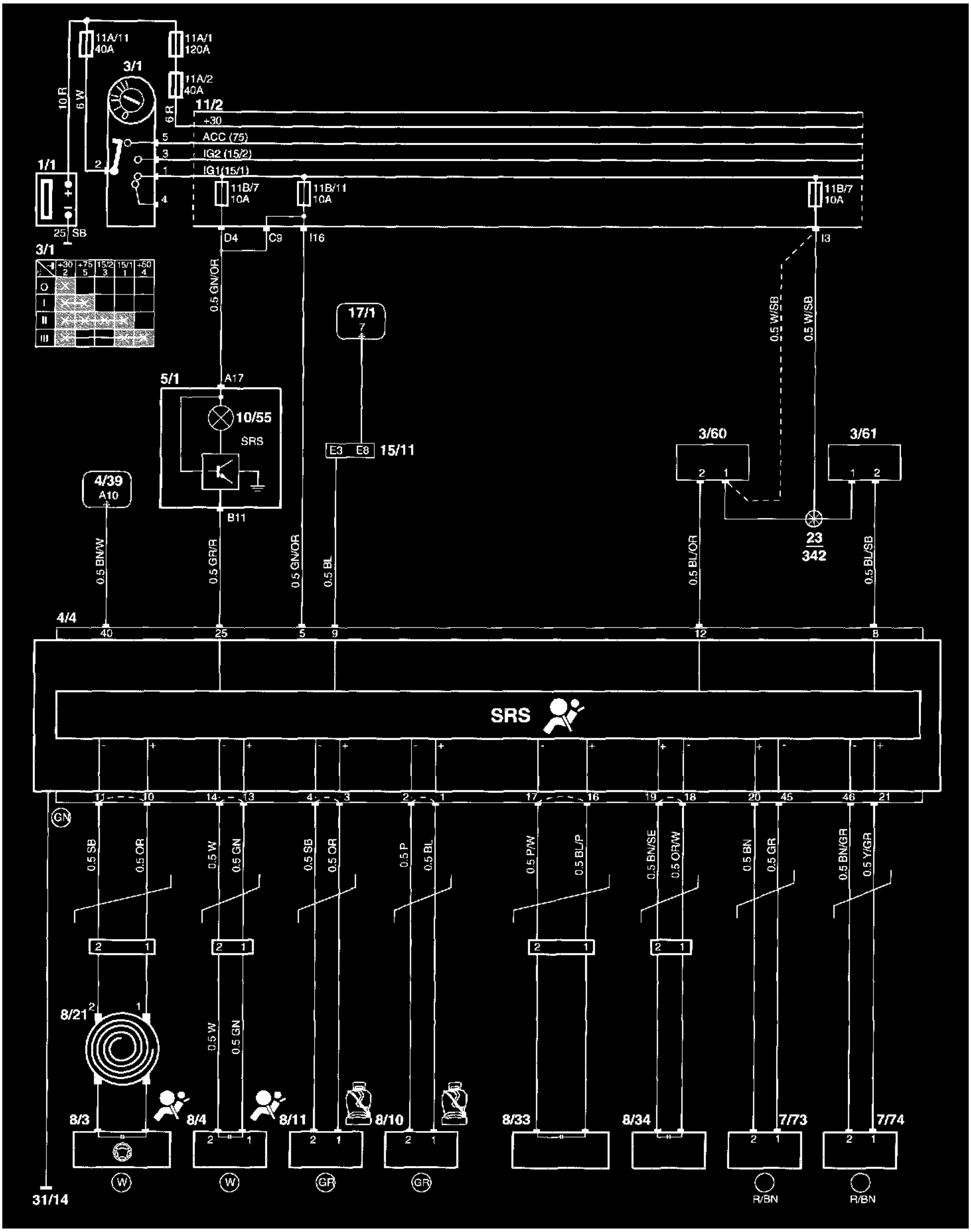


-97 Terminal	98- Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
1	10	Power ground (PG)	--	--
2	9	--	--	--
3	8	Gear-shift position sensor signal, terminal C	9	26
4	7	Gear-shift position sensor signal terminal PA	22	13
5	6	Gear-shift position sensor signal terminal A	23	27
6	5	Gear-shift position sensor signal terminal B	37	41

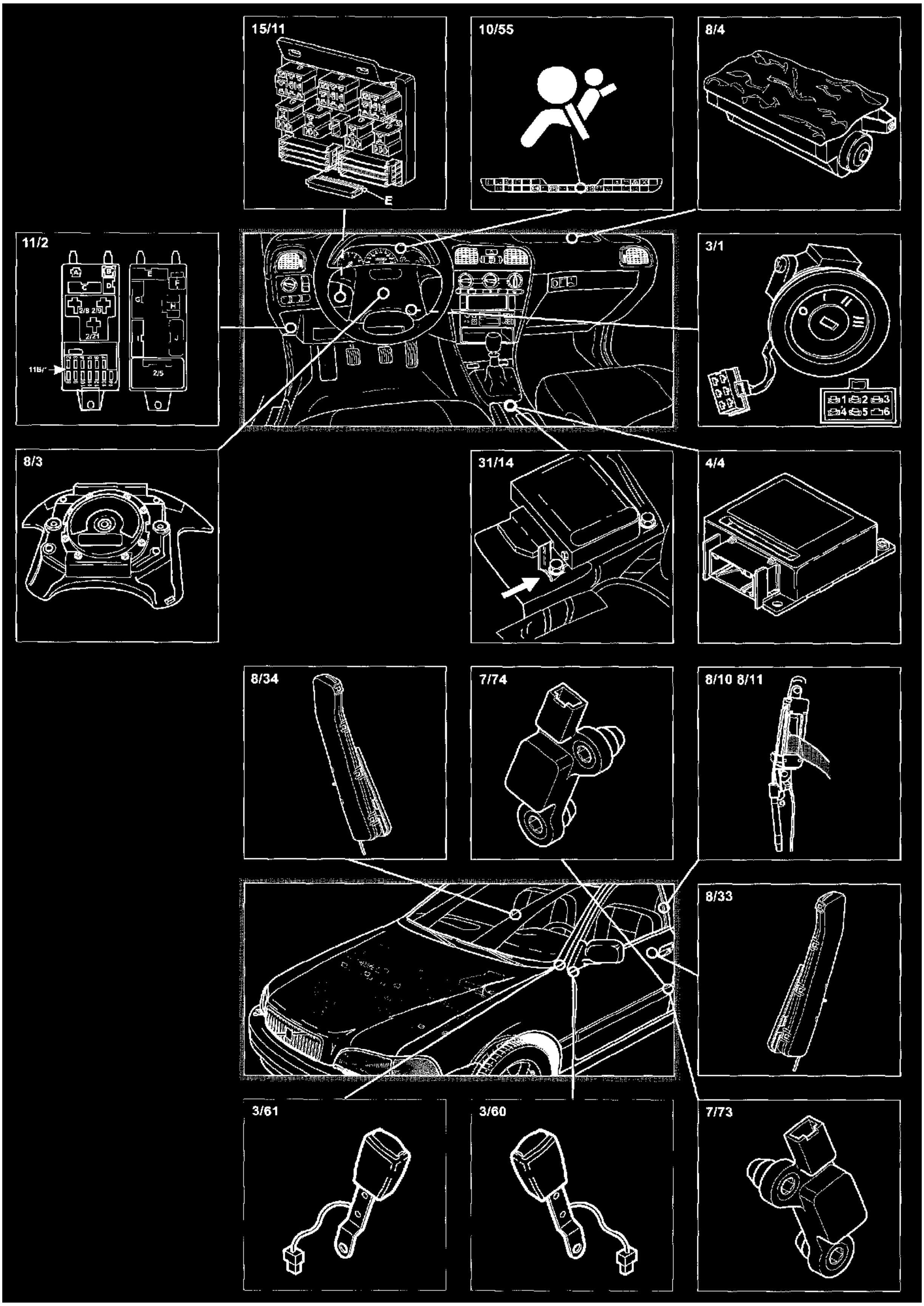
-97 Terminal	98- Terminal	Signal	EMS 2000 Connected to control module terminal #	Fenix Connected to control module terminal #
7	4	Power supply (50-supply) to gear selector park / neutral position (PNP) switch terminal 50	--	--
8	2	Back-up (reversing) light switch (15 I)	--	--
9	3	Power supply to back-up (reversing) light terminal BL	--	--
10	1	Starter motor solenoid control signal terminal 50S	--	--

5. Gear-shift position sensor Connector, gray (10- pin)

System Diagram



Airbag And/Or Seat Belt Tensioner



Airbag And/Or Seat Belt Tensioner

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Air Bag Control Module

Refer to **Restraint Systems - Diagrams - Electrical**

See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

Impact Sensor

Refer to **Restraint Systems - Diagrams - Electrical**

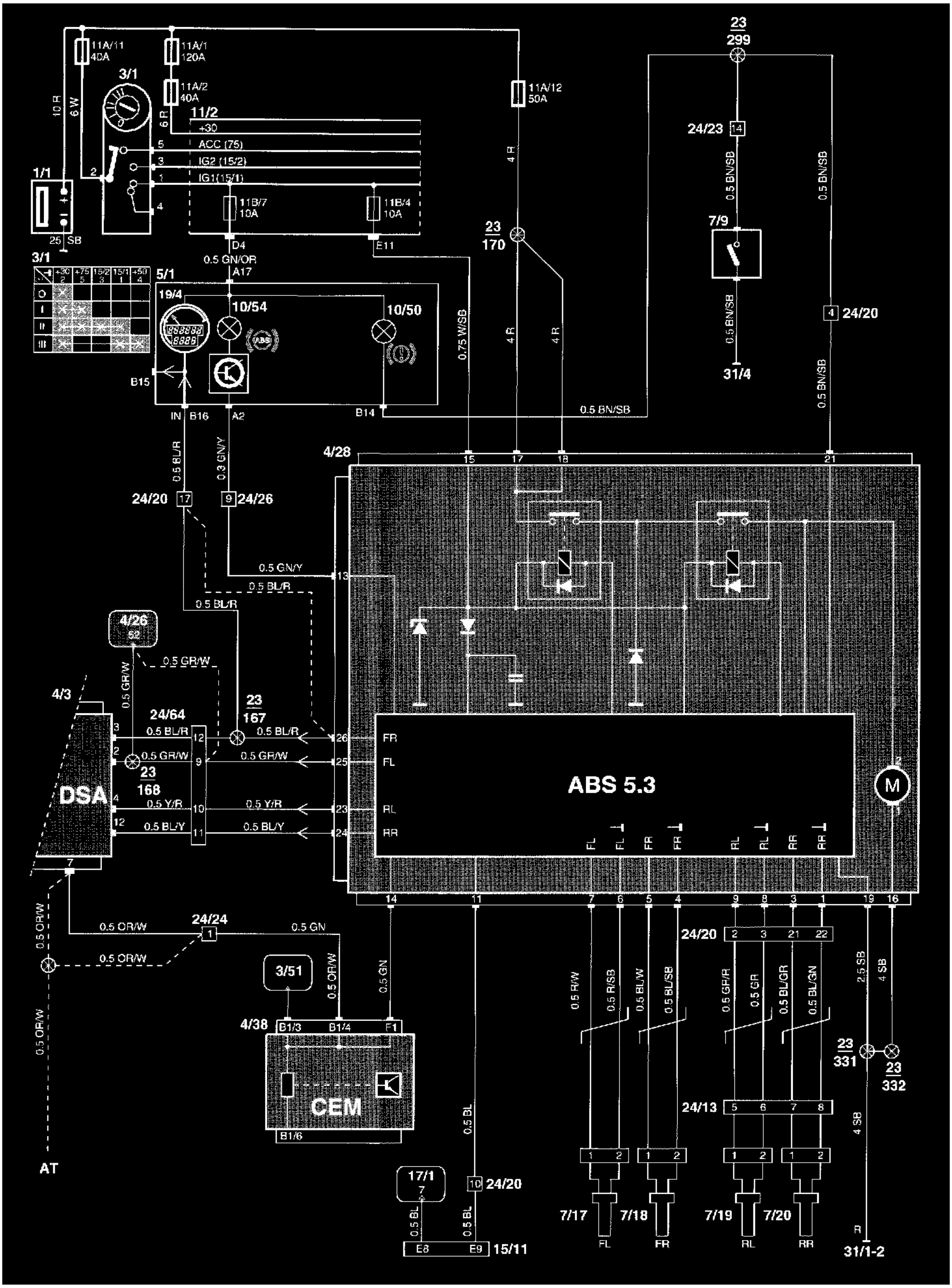
See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

Side Air Bag

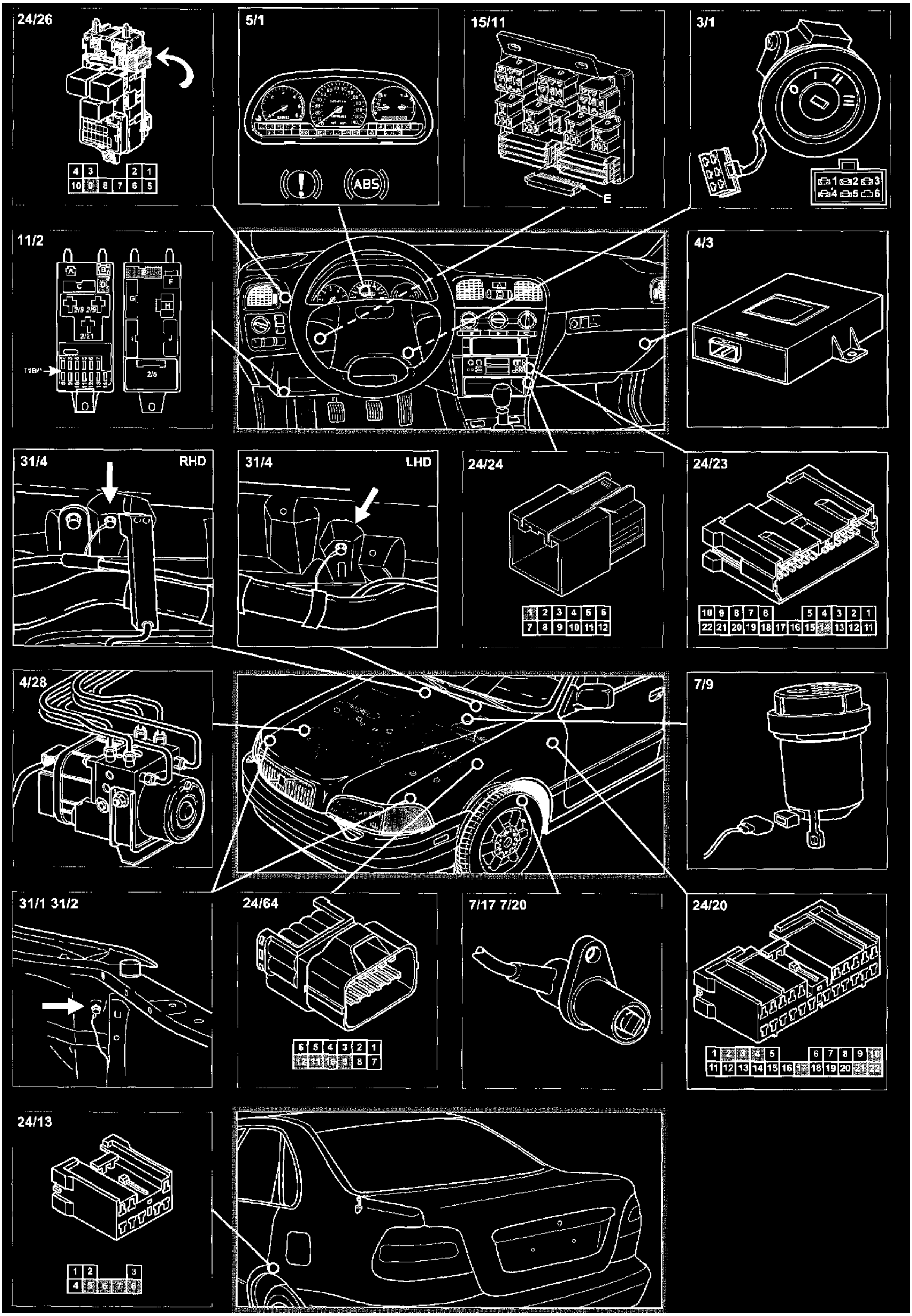
Refer to **Restraint Systems - Diagrams - Electrical**

See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

System Diagram



ABS System, Part 1 Of 2



ABS System, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

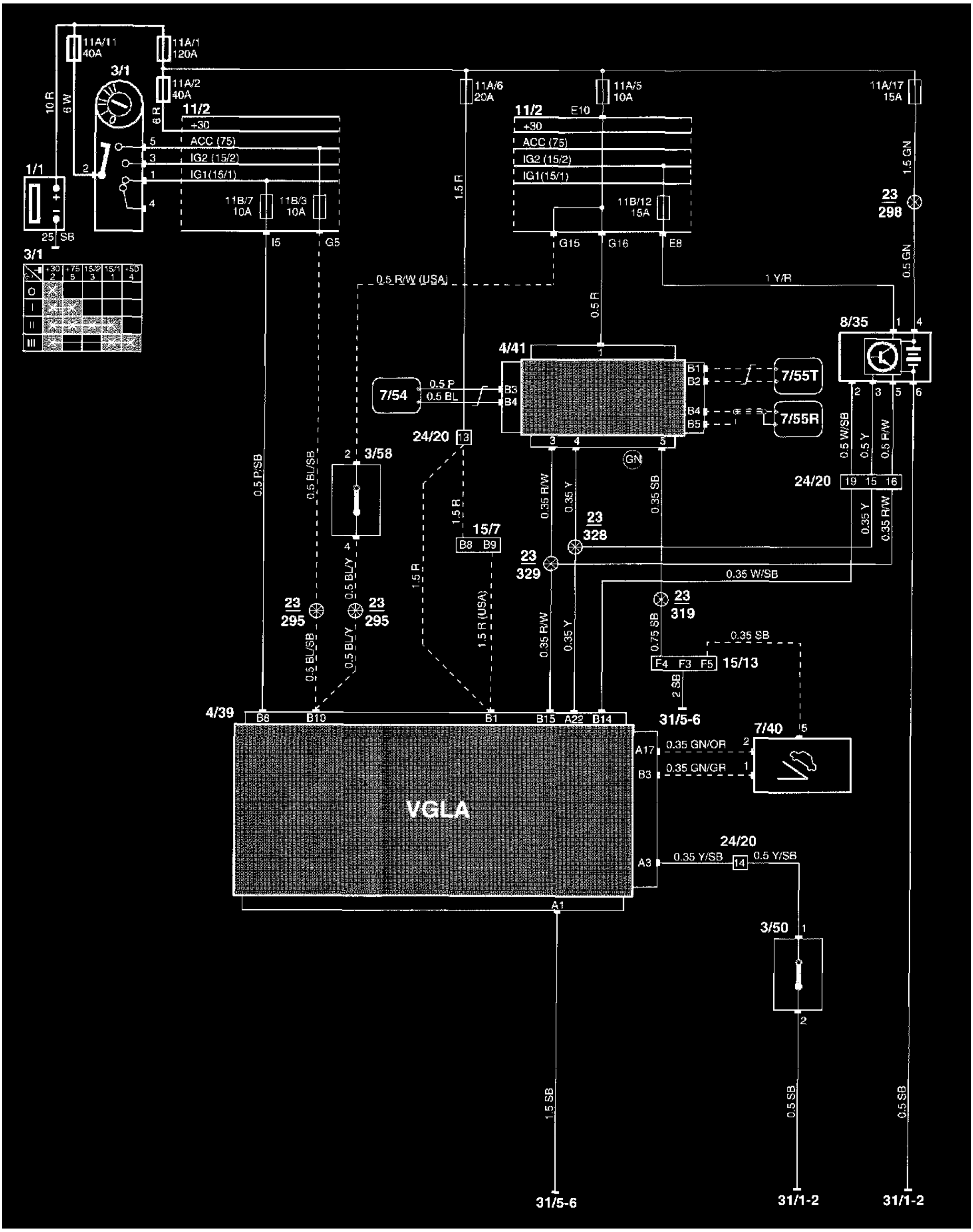
Hydraulic Control Assembly - Antilock Brakes

Refer to **Antilock Brakes/Traction Control Systems - Diagrams - Electrical**

See: Brakes and Traction Control/Antilock Brakes / Traction Control Systems/Diagrams/Electrical Diagrams

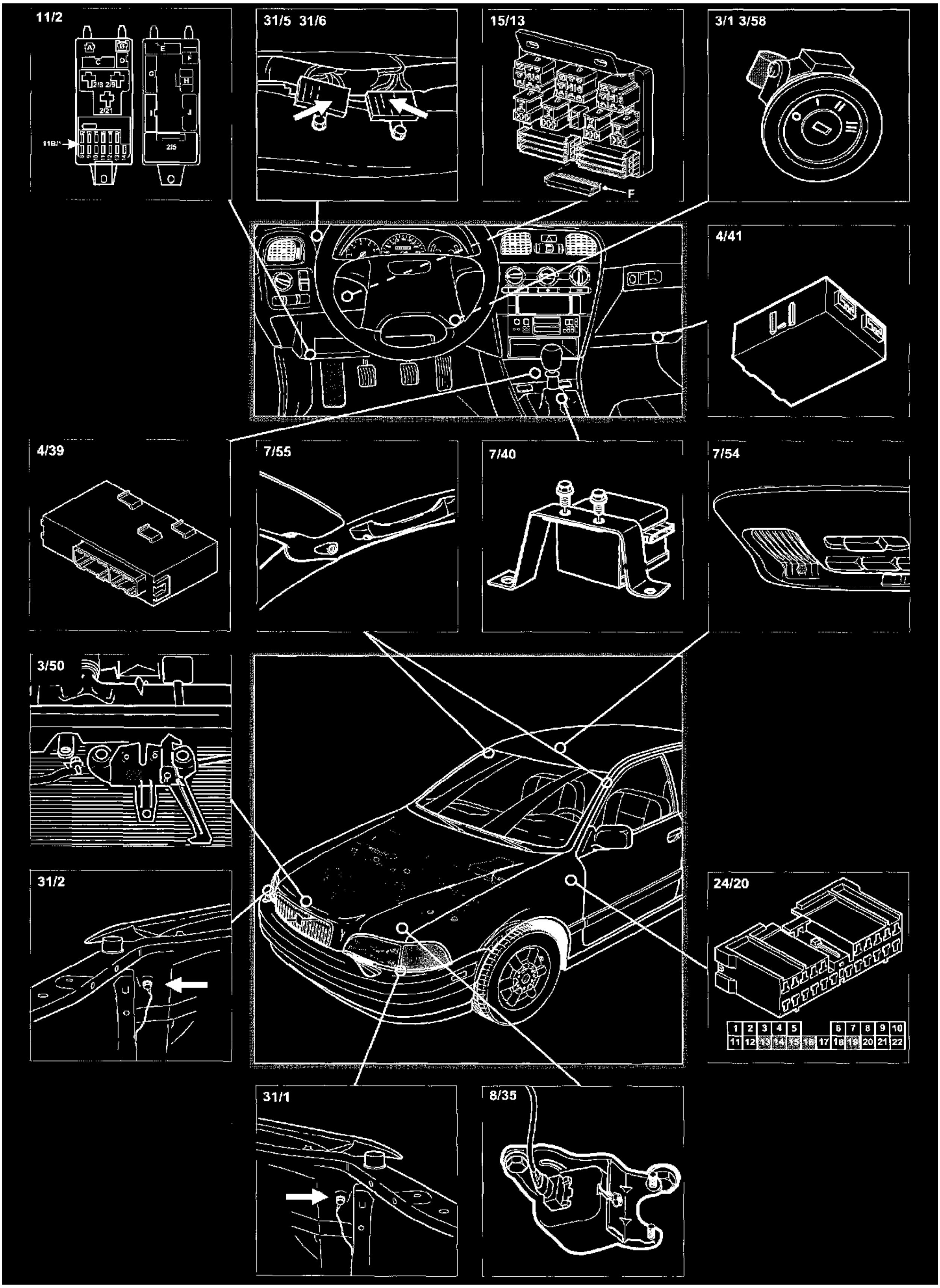
2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

Alarm



Anti-Theft Alarm, Part 1 Of 2

Wiring Diagram

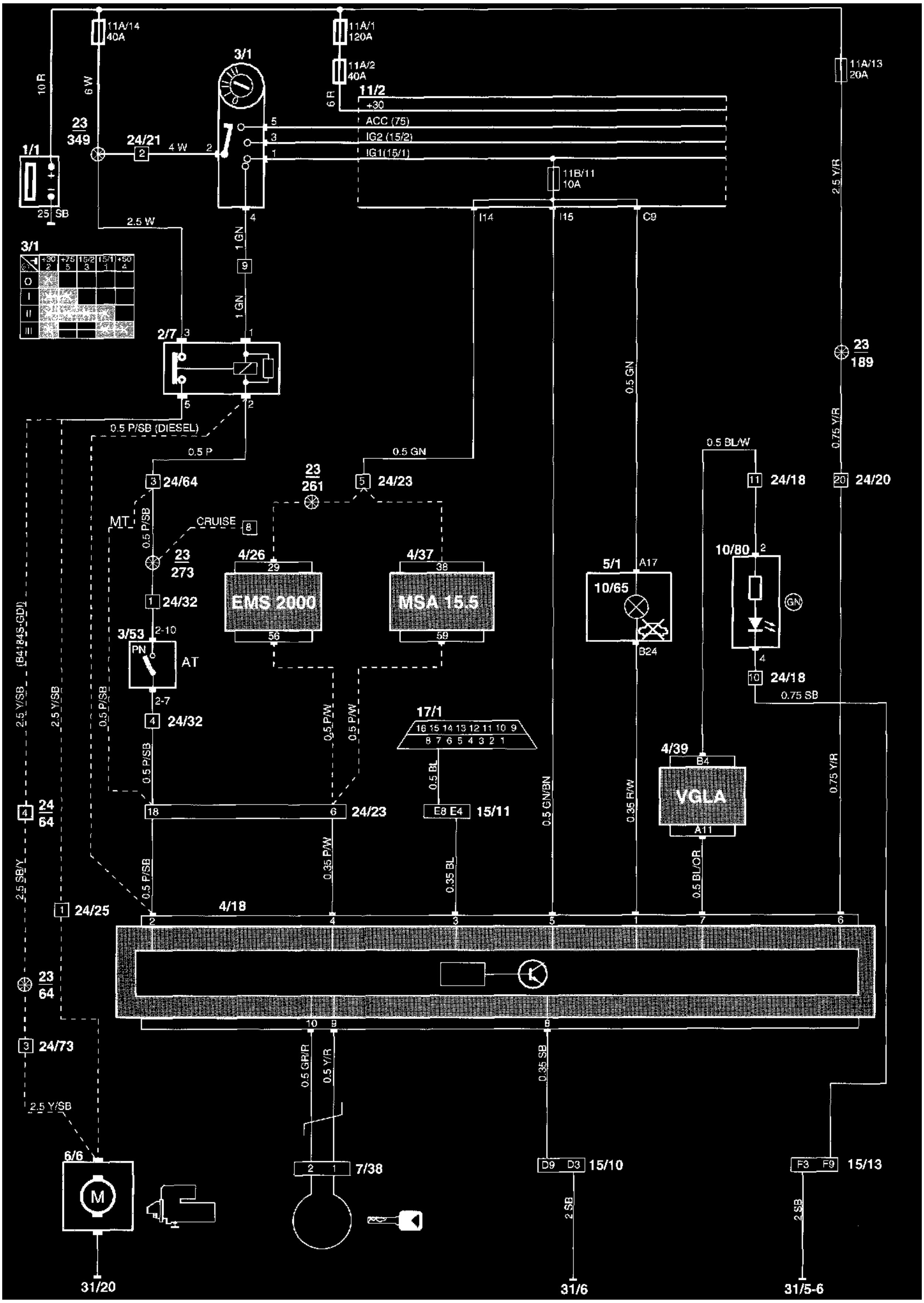


Anti-Theft Alarm, Part 2 Of 2

Component Locations

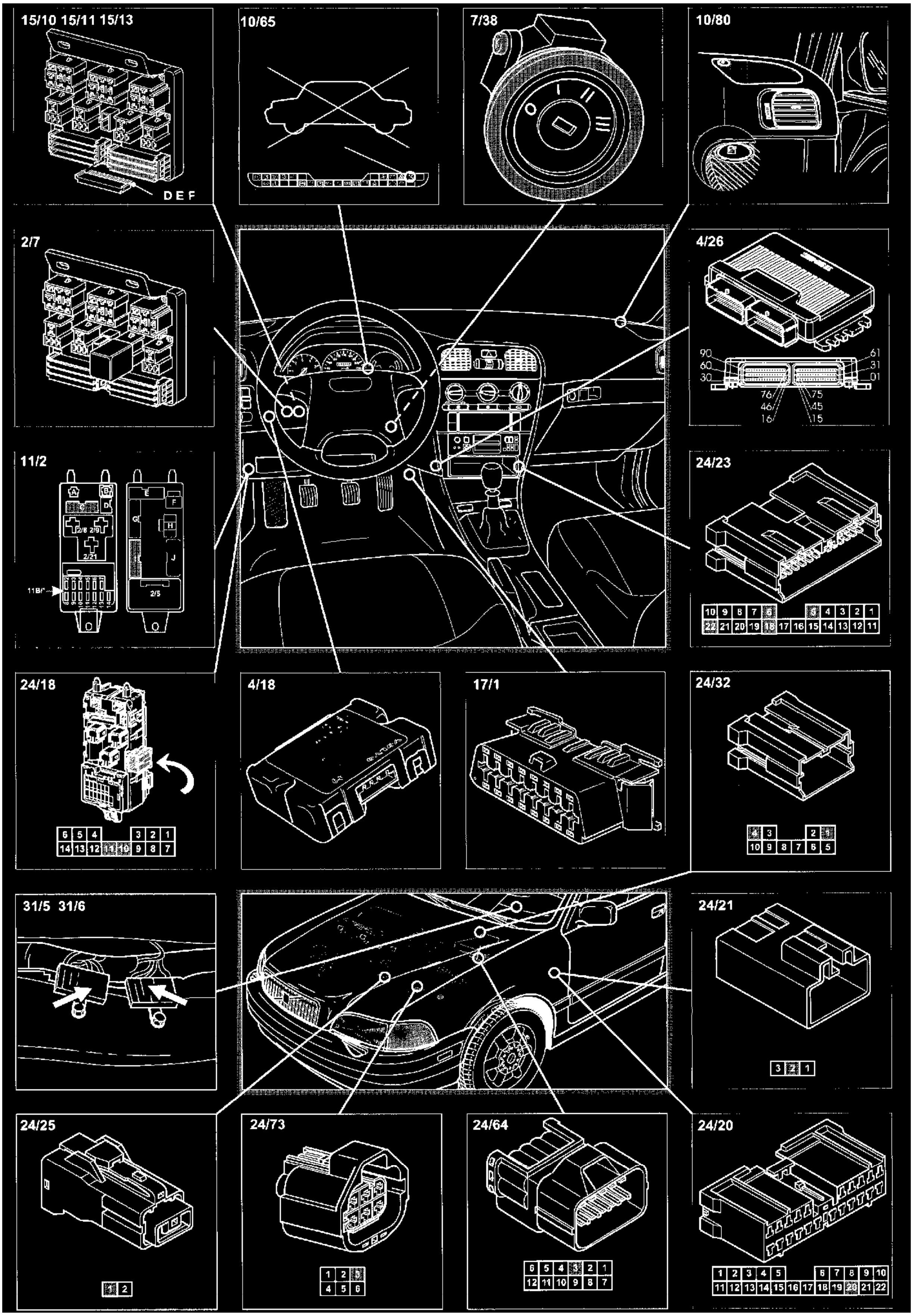
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Immobilizer



Immobilizer, Part 1 Of 2

Wiring Diagram

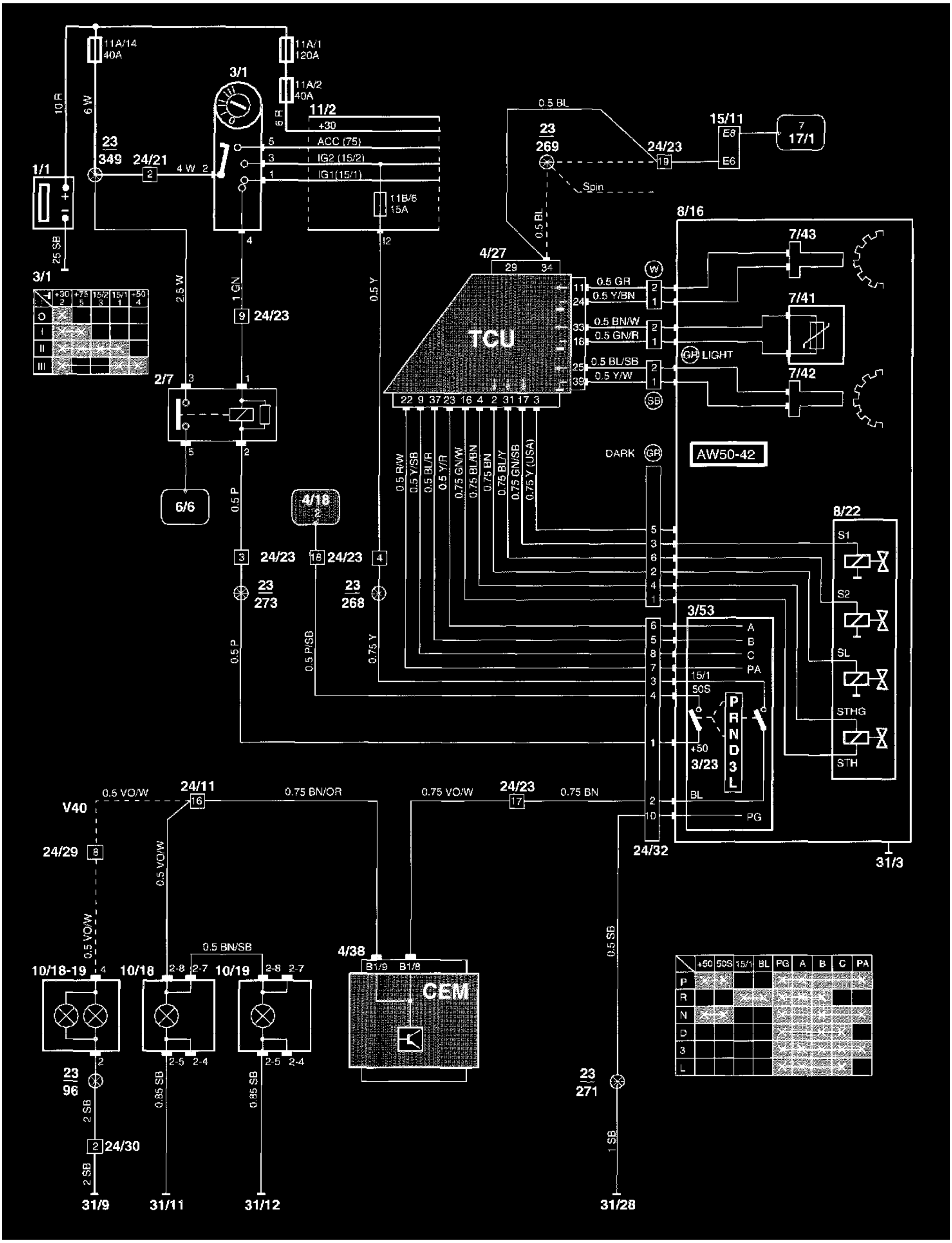


Immobilizer, Part 2 Of 2

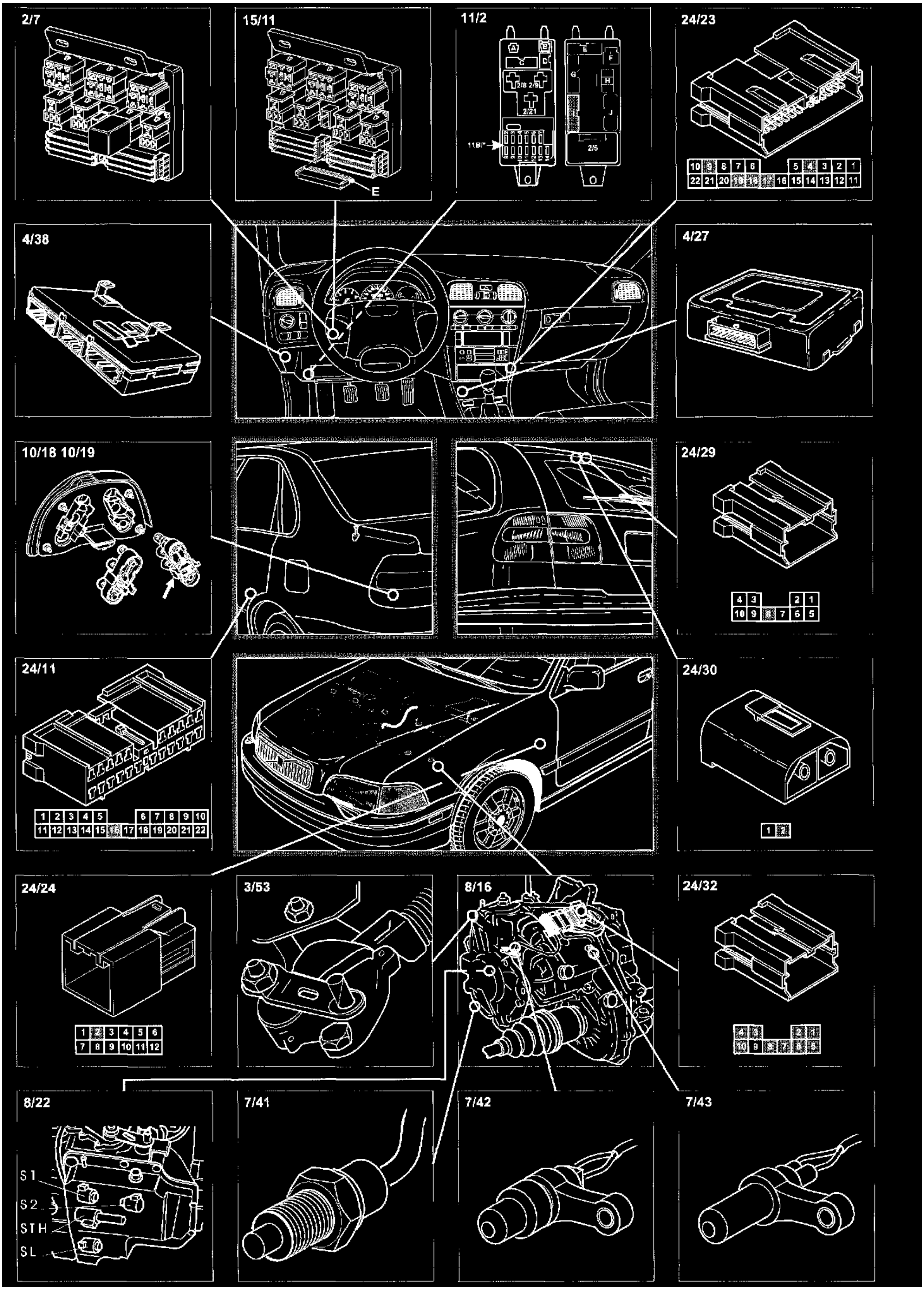
Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

System Diagram



Automatic Transmission, Part 1 Of 2



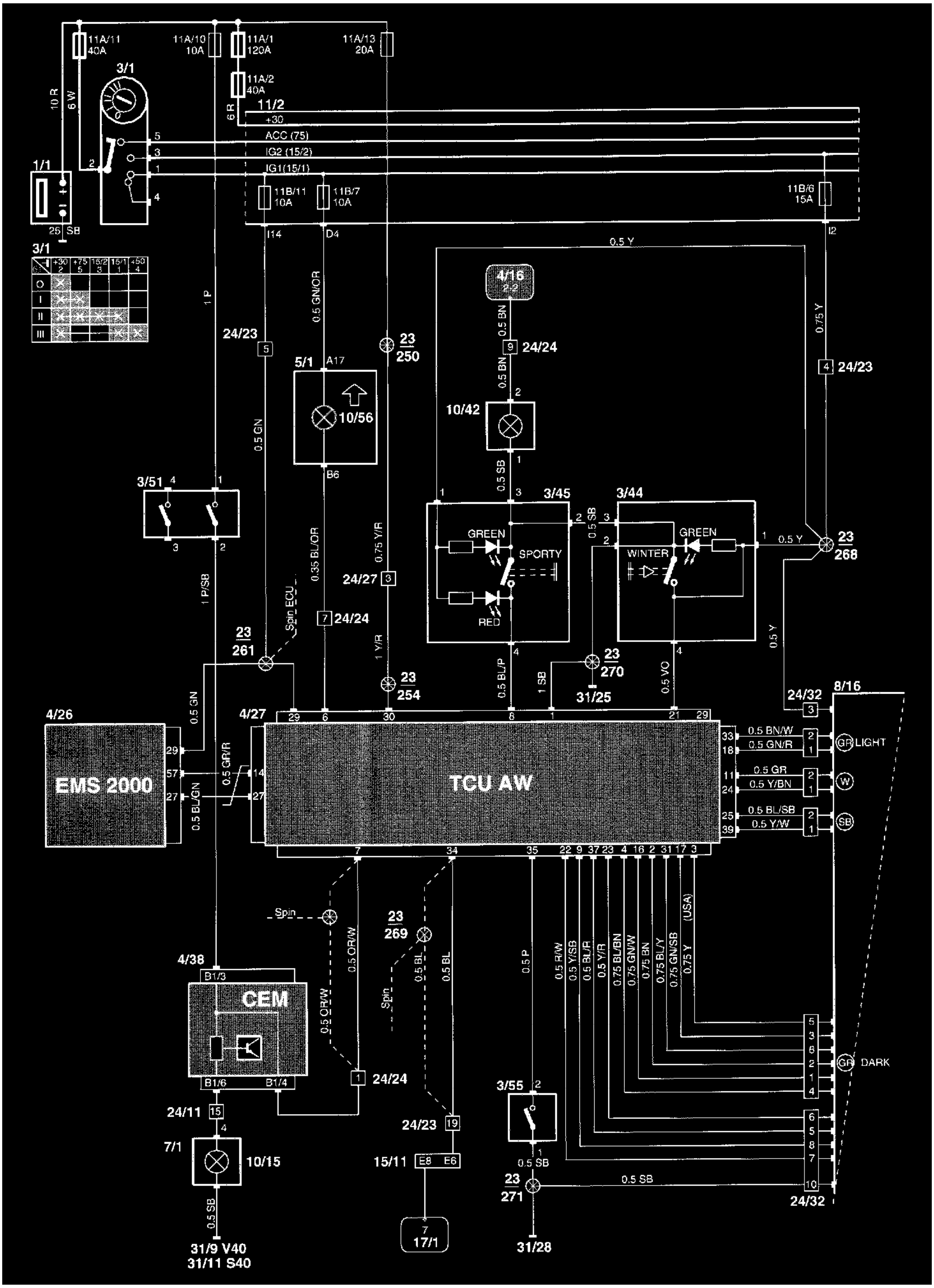
Automatic Transmission, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

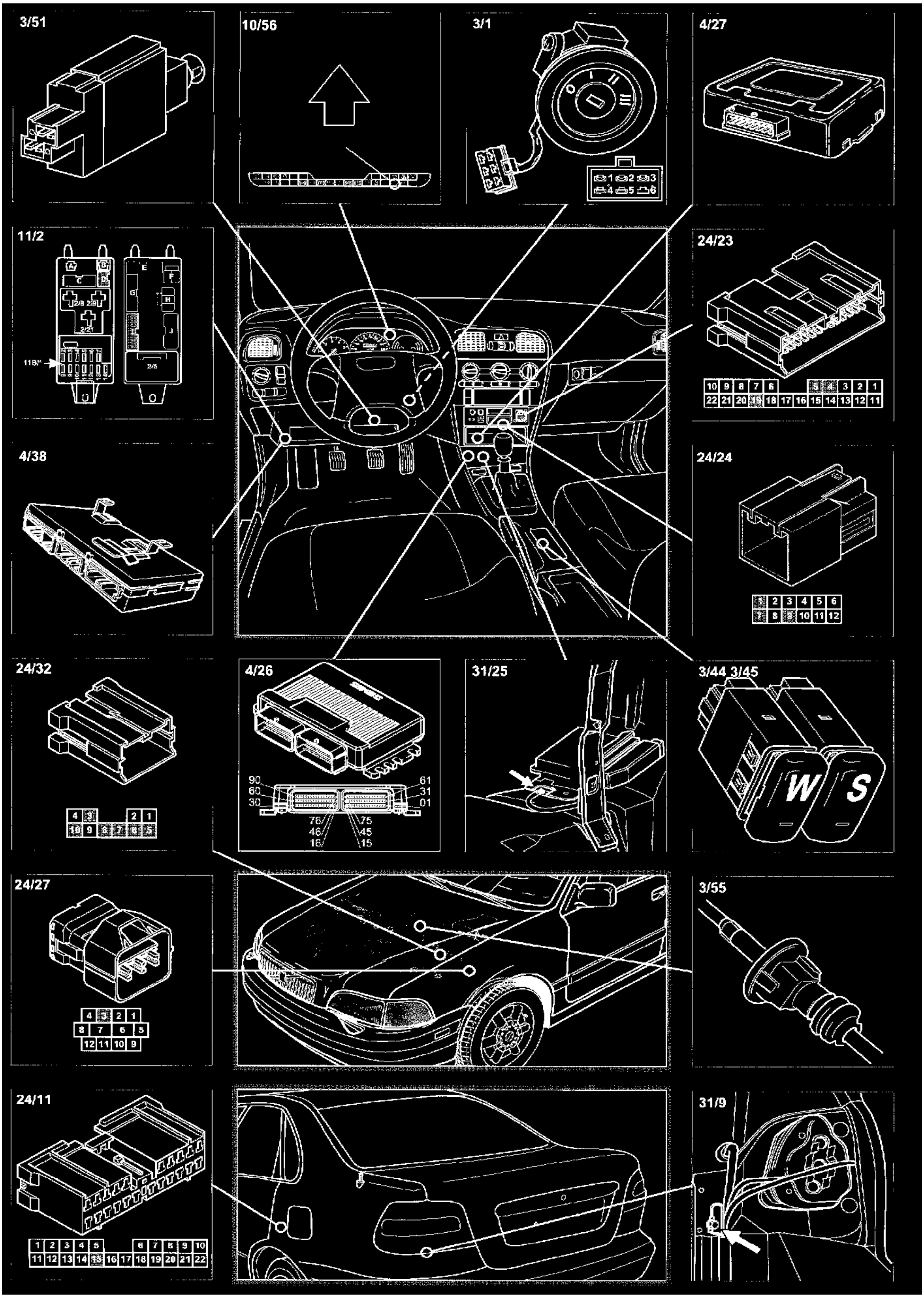
Control Module, A/T

Control module for automatic transmission



Control Module, Part 1 Of 2

Wiring Diagram

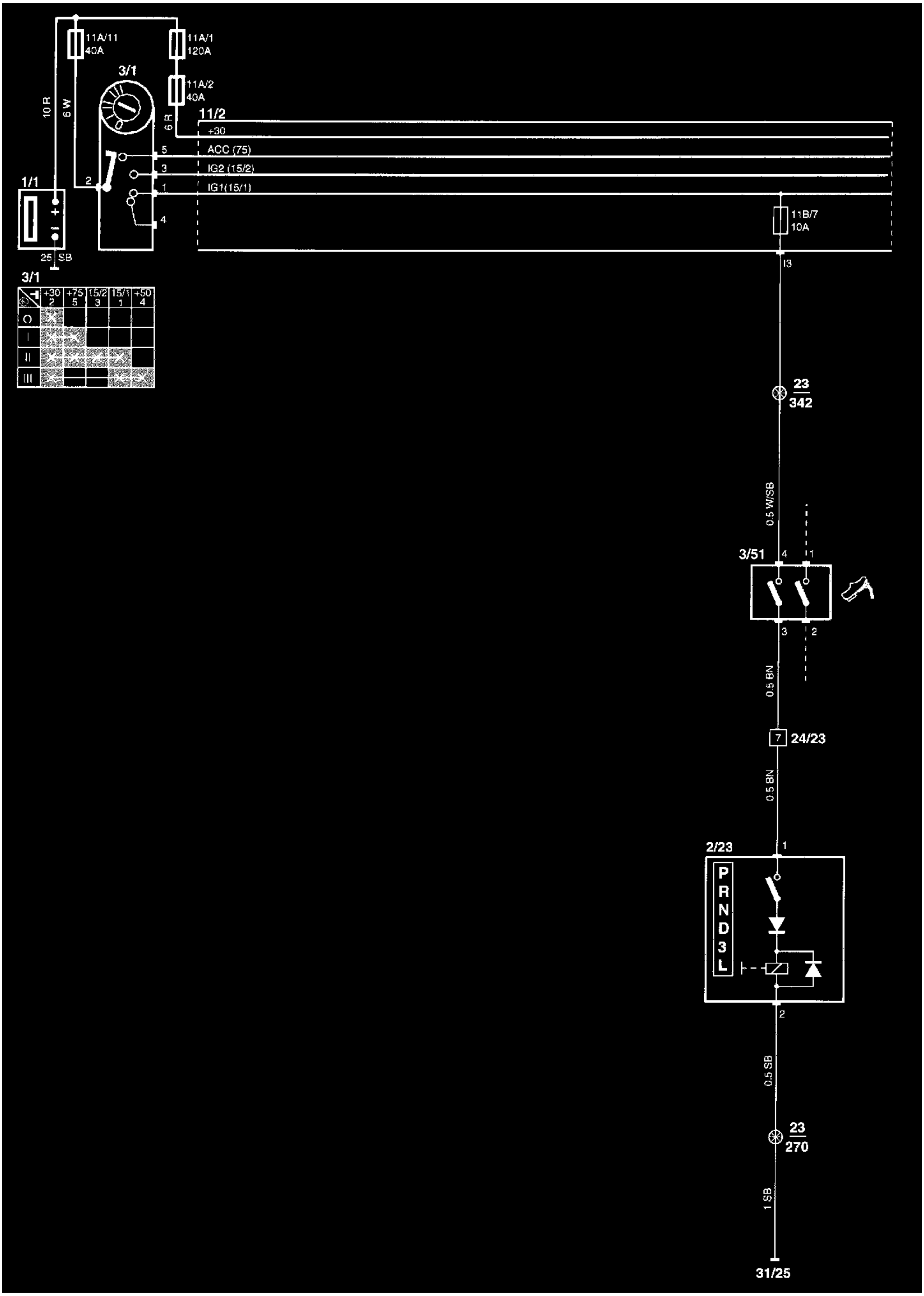


Control Module, Part 2 Of 2

Component Locations

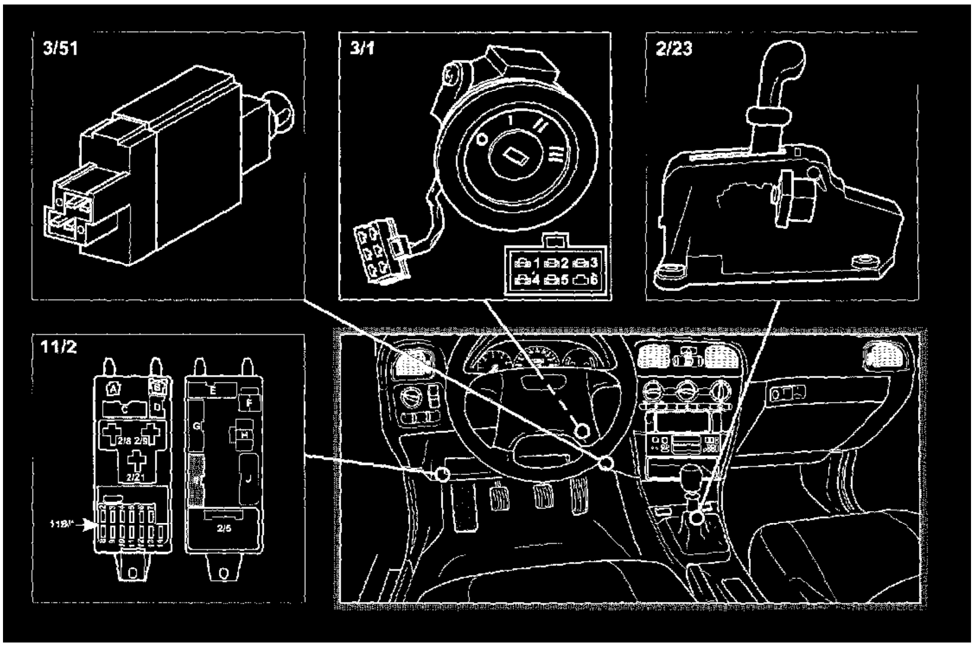
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Shift Interlock, A/T



Shift Lock, Part 1 Of 2

Wiring Diagram



Shift Lock, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Brake Booster Vacuum Sensor

Refer to **Antilock Brakes/Traction Control Systems - Diagrams - Electrical**

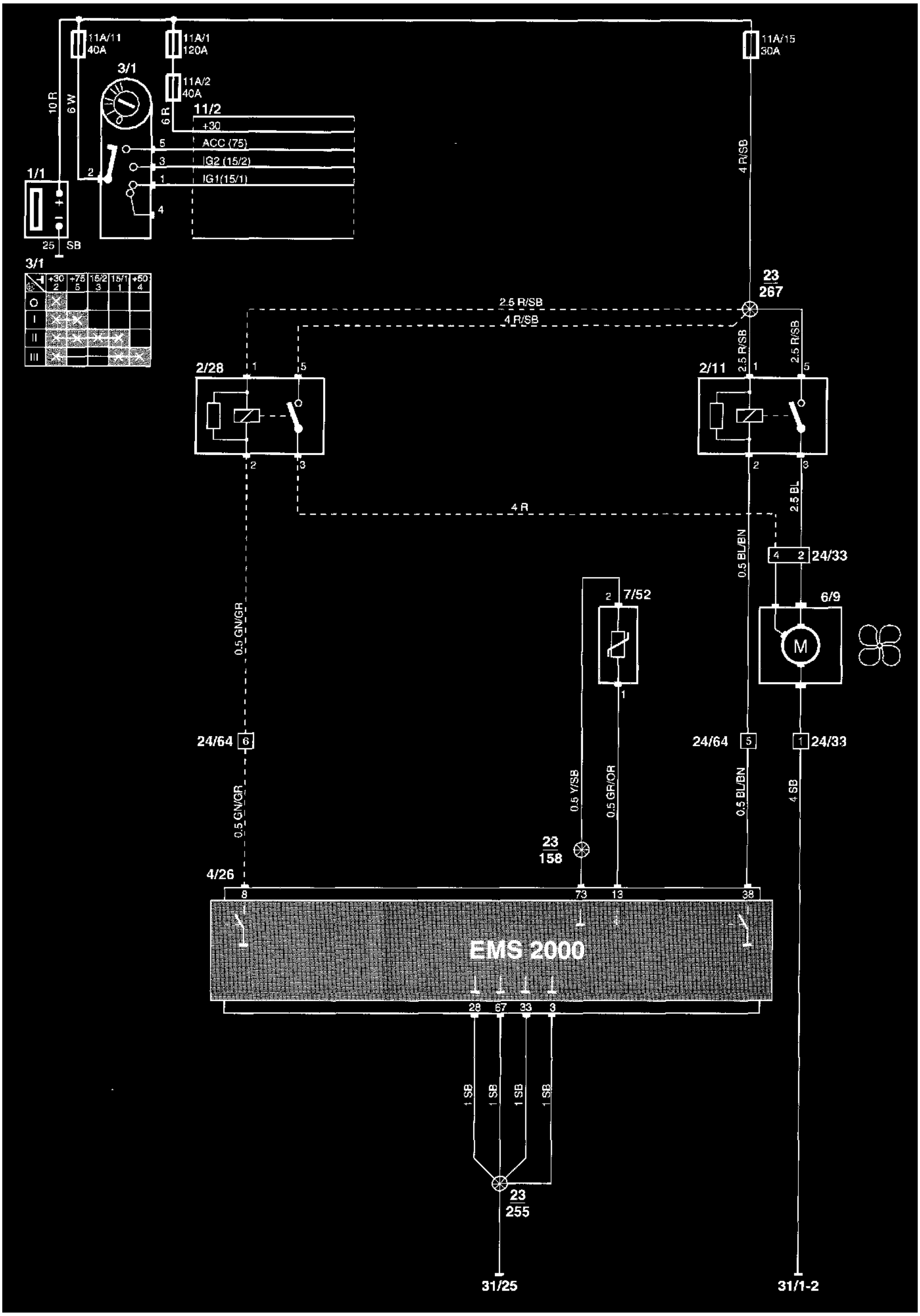
See: Brakes and Traction Control/Antilock Brakes / Traction Control Systems/Diagrams/Electrical Diagrams

Brake Fluid Level Sensor/Switch

Refer to **Antilock Brakes/Traction Control Systems - Diagrams - Electrical**

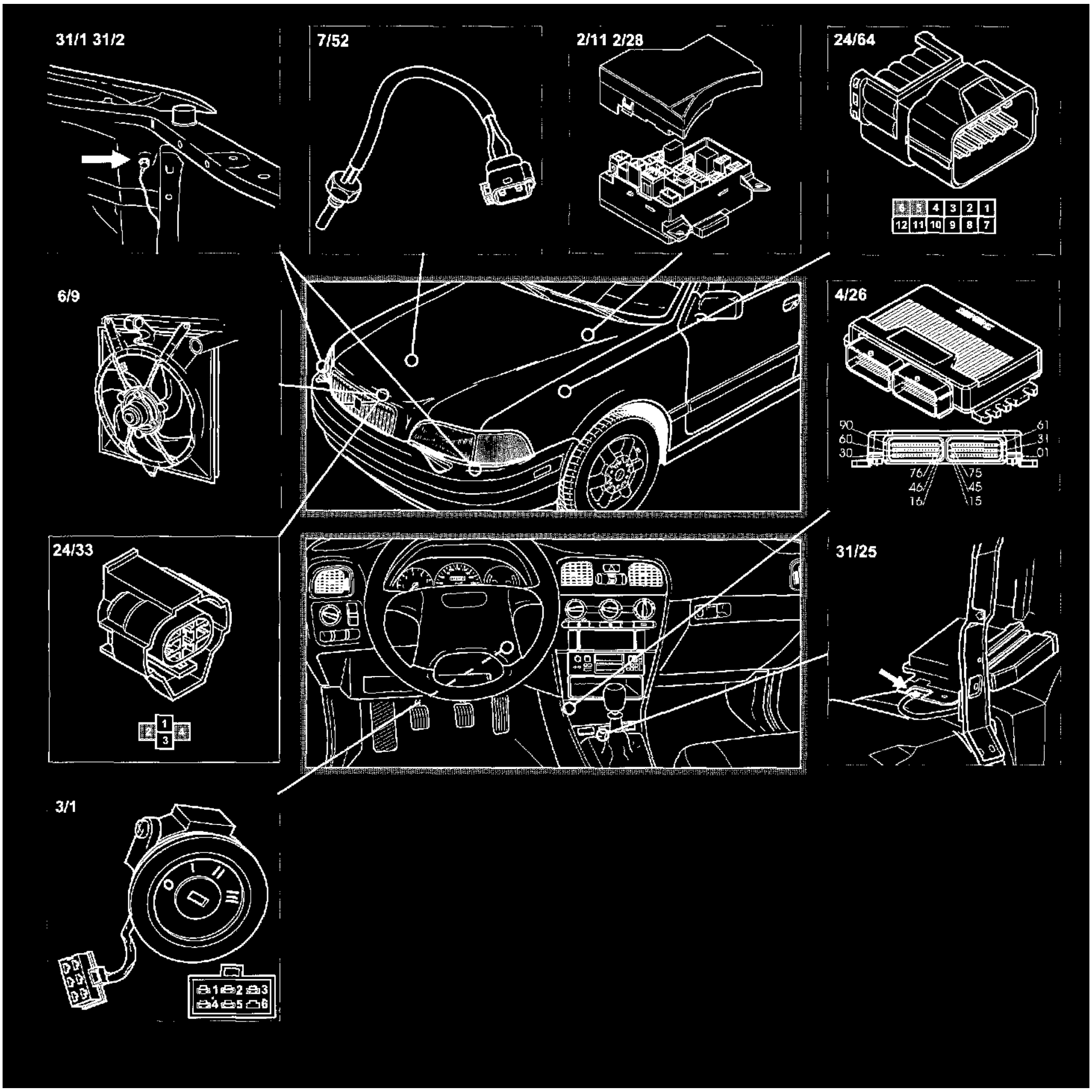
See: Brakes and Traction Control/Antilock Brakes / Traction Control Systems/Diagrams/Electrical Diagrams

EMS 2000



Cooling EMS 2000, Part 1 Of 2

Wiring Diagram

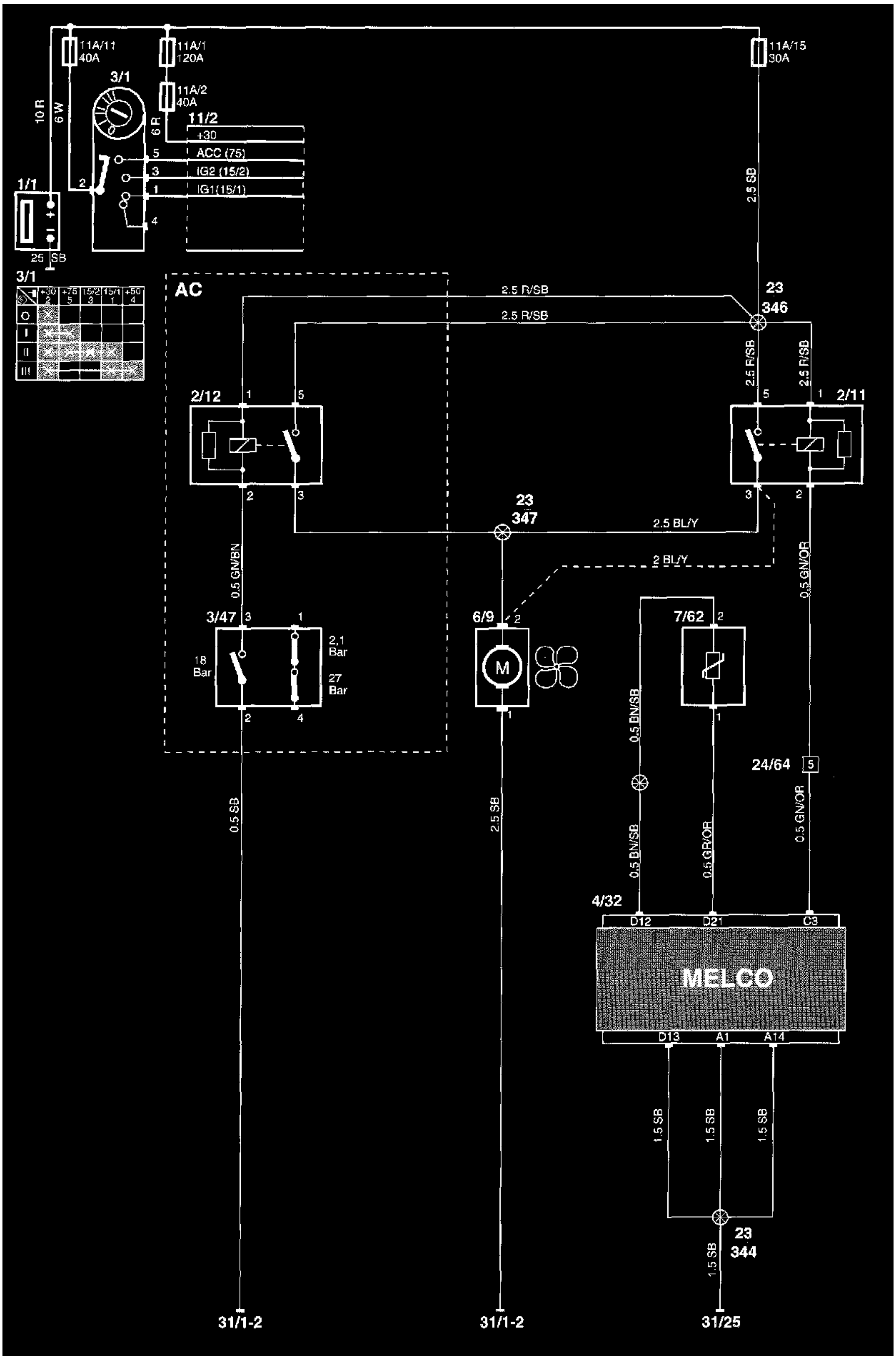


Cooling EMS 2000, Part 2 Of 2

Component Locations

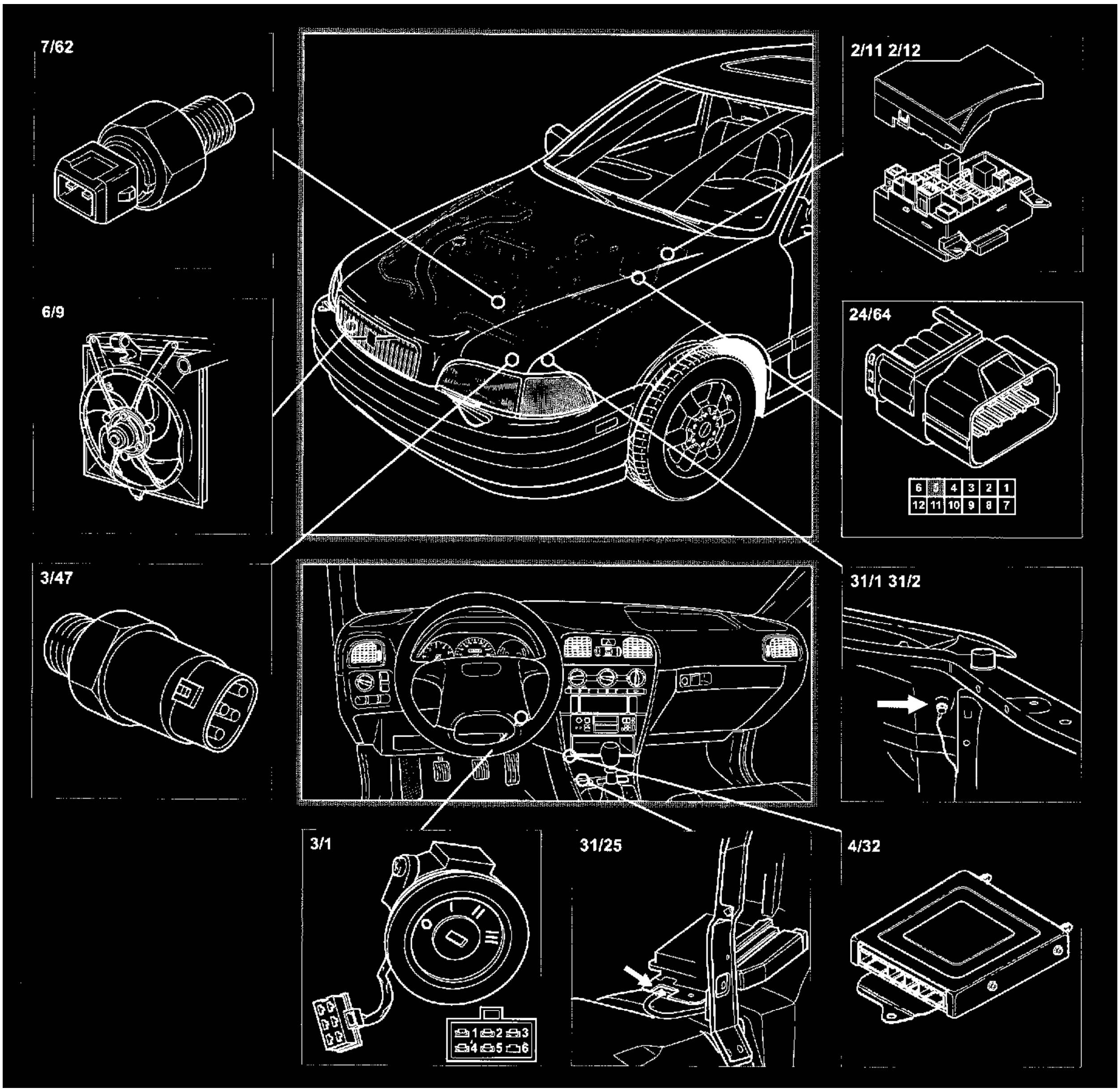
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

MELCO 1



Cooling MELCO 1, Part 1 Of 2

Wiring Diagram



Cooling MELCO 1, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

System Diagram

Radiator Cooling Fan

For Radiator Cooling Fan wiring diagrams refer to: **"Engine,Cooling and Electrical : Cooling System : Diagrams"**. See: Engine, Cooling and Exhaust/Cooling System/Diagrams/Electrical Diagrams

Radiator Cooling Fan Motor

Cooling Fan Motor

For Cooling Fan Motor wiring diagrams refer to: **"Engine,Cooling and Electrical : Cooling System : Diagrams"**. See: Engine, Cooling and Exhaust/Cooling System/Diagrams/Electrical Diagrams

Radiator Cooling Fan Control Module

Cooling Fan Control Module

For Cooling Fan Control Module wiring diagrams refer to: **"Engine,Cooling and Electrical : Cooling System : Diagrams"**. See: Engine, Cooling and Exhaust/Cooling System/Diagrams/Electrical Diagrams

Radiator Cooling Fan Motor Relay

Cooling Fan Motor Relay

For Cooling Fan Motor Relay wiring diagrams refer to: **"Engine,Cooling and Electrical : Cooling System : Diagrams"**. See: Engine, Cooling and Exhaust/Cooling System/Diagrams/Electrical Diagrams

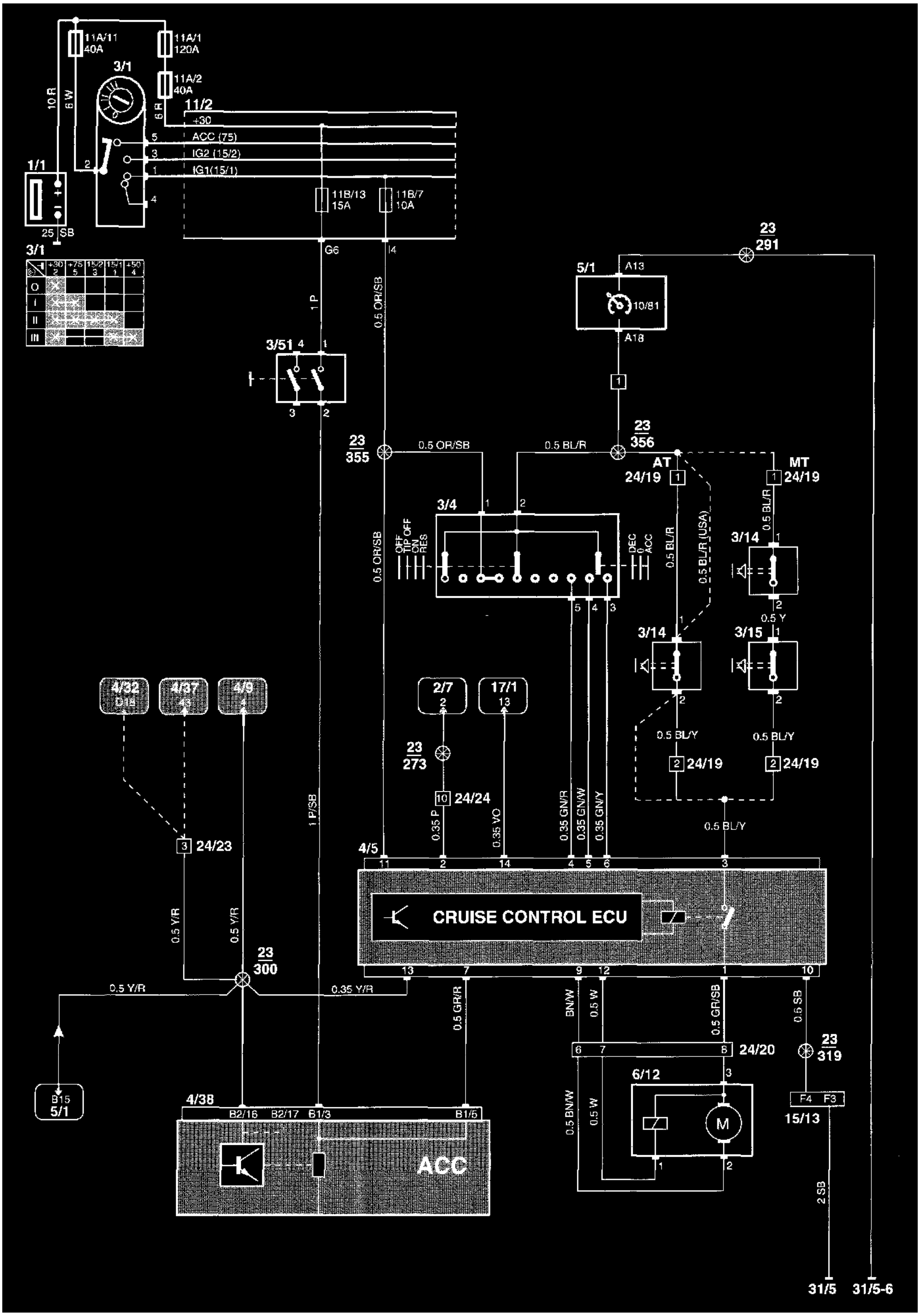
Radiator Cooling Fan Temperature Sensor / Switch

Cooling Fan Temperature Sensor/Switch

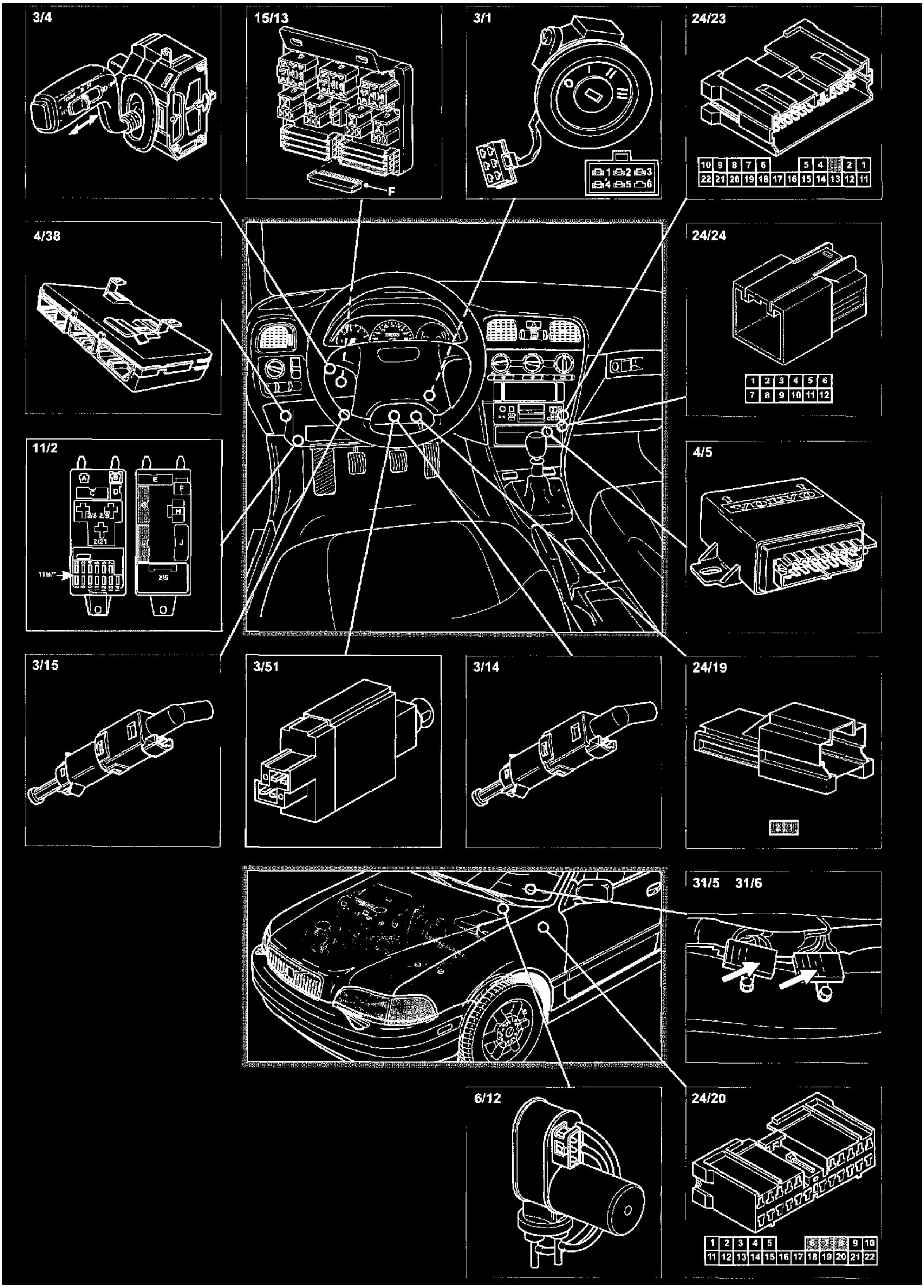
For Cooling Fan Temperature Sensor/Switch wiring diagrams refer to: **"Engine,Cooling and Electrical : Cooling System : Diagrams"**. See: Engine, Cooling and Exhaust/Cooling System/Diagrams/Electrical Diagrams

Cruise Control

Cruise Control



Wiring Diagram



Components

Component I.D. List

3/1 - Ignition switch
3/4 - Controls cruise control
3/14 - Brake pedal switch
3/15 - Clutch pedal switch
3/51 - Switch brake pedal for locking gear shift selector
4/5 - Cruise control module
4/38 - CEM (Central Electronic Module) Electronic central unit

6/12 -	Cruise control vacuum pump
11/2 -	Fusebox in passenger compartment
15/13 -	Distribution ground terminal F2-F11
24/19 -	Connector 2-pin Passenger compartment - Cruise control cable harness
24/20 -	Connector 22-pin Passenger compartment - Engine compartment cable harness
24/23 -	Connector 22-pin Passenger compartment - Engine control module (ECM) cable harness
24/24 -	Connector 12-pin Passenger compartment - Engine cable harness
31/5 -	Ground terminal
31/6 -	Ground terminal

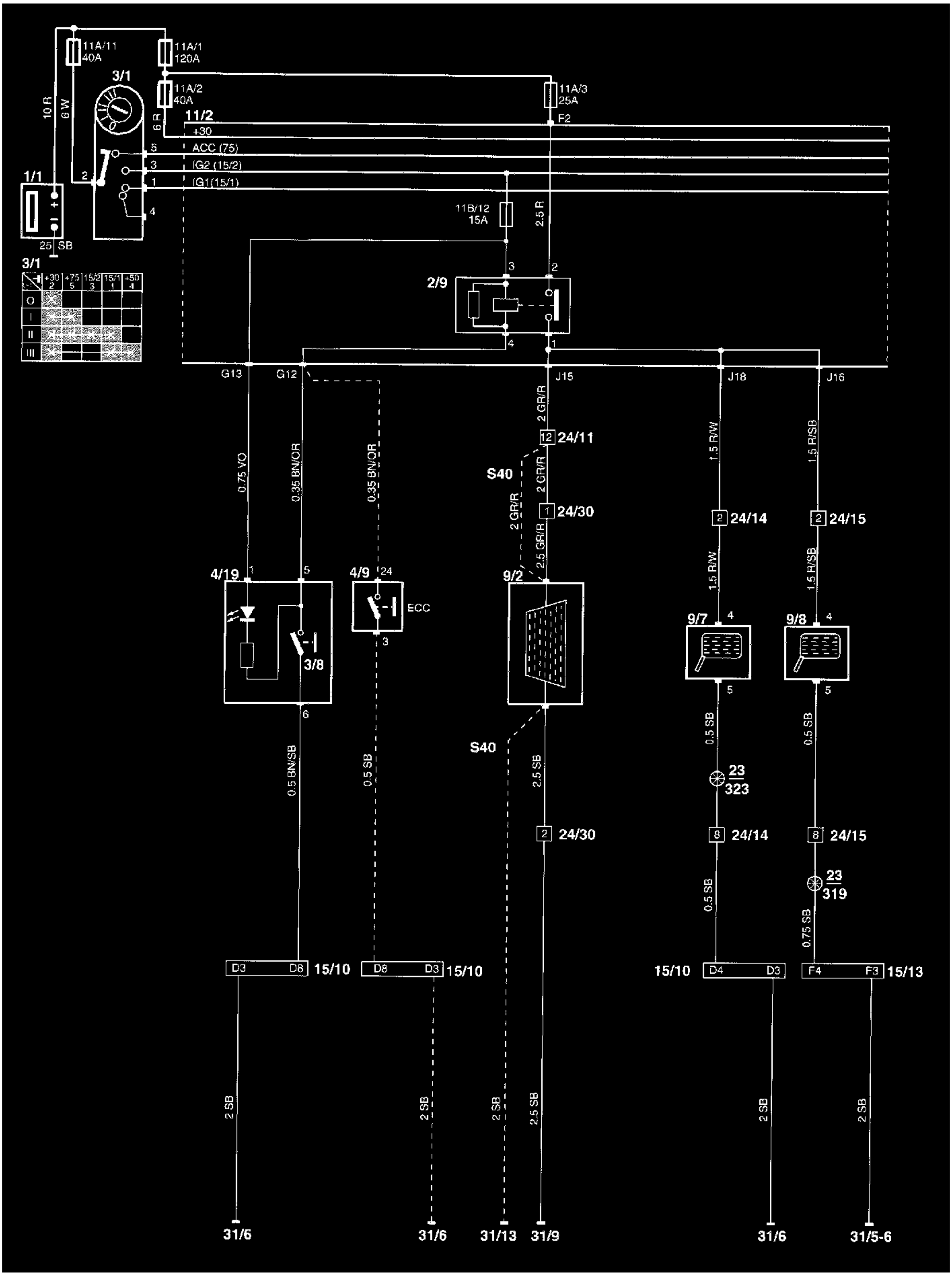
Electronic Brake Control Module

Refer to **Antilock Brakes/Traction Control Systems - Diagrams - Electrical**

See: Brakes and Traction Control/Antilock Brakes / Traction Control Systems/Diagrams/Electrical Diagrams

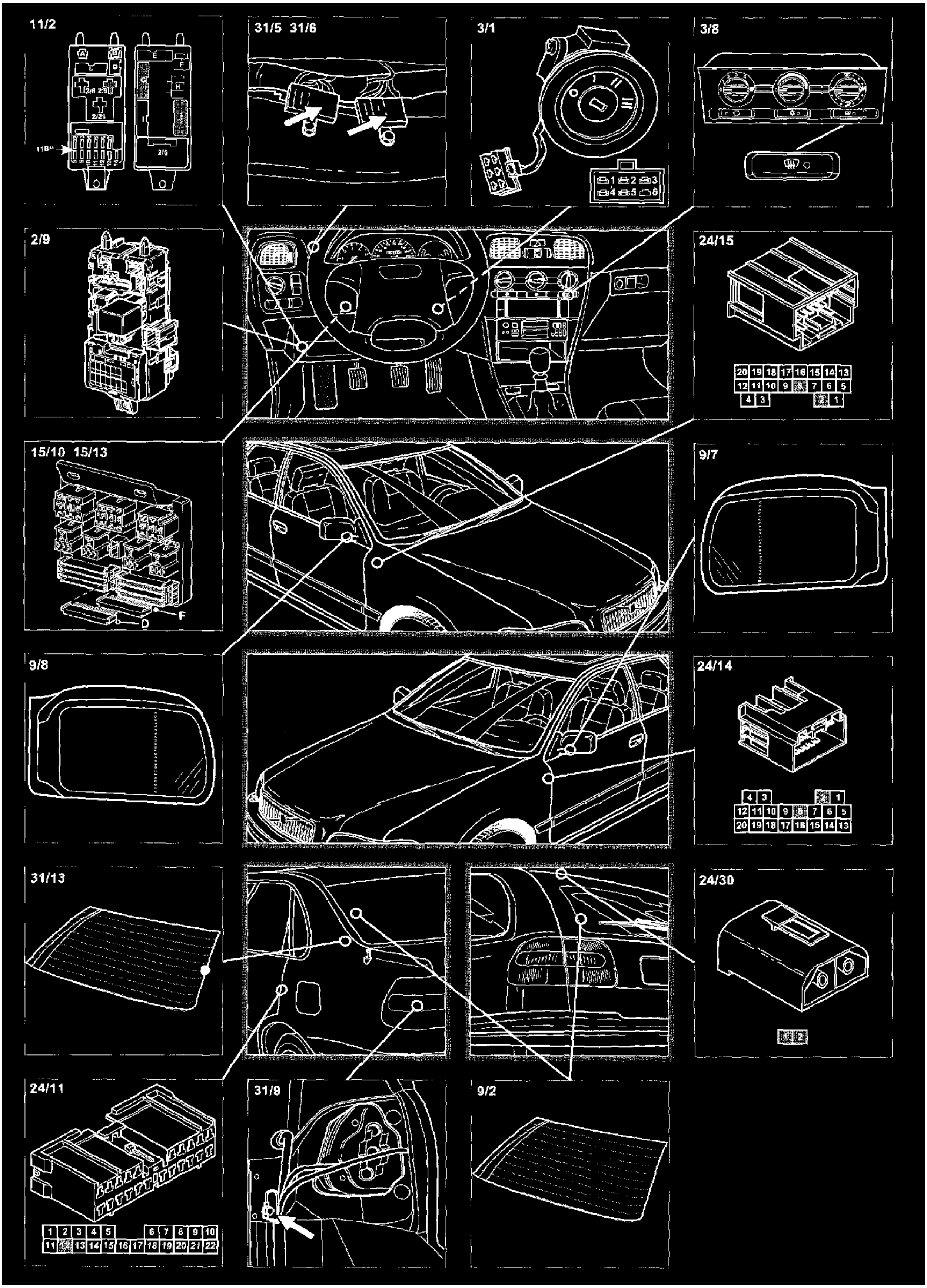
Heated Glass Element

Heated Rear Window And Heated Door Mirrors



Heated Rear Window And Door Mirrors, Part 1 Of 2

Wiring Diagram

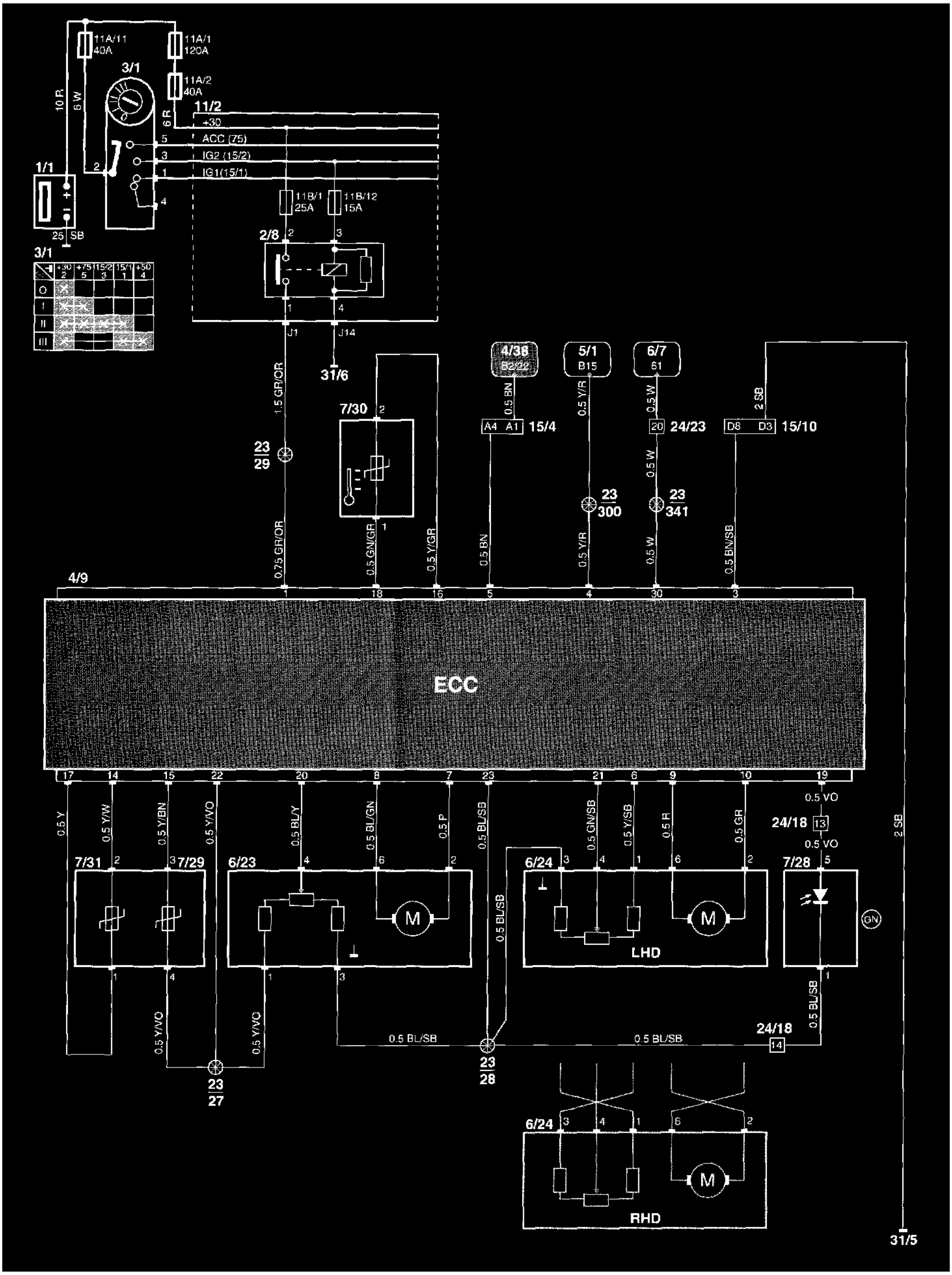


Heated Rear Window And Door Mirrors, Part 2 Of 2

Component Locations

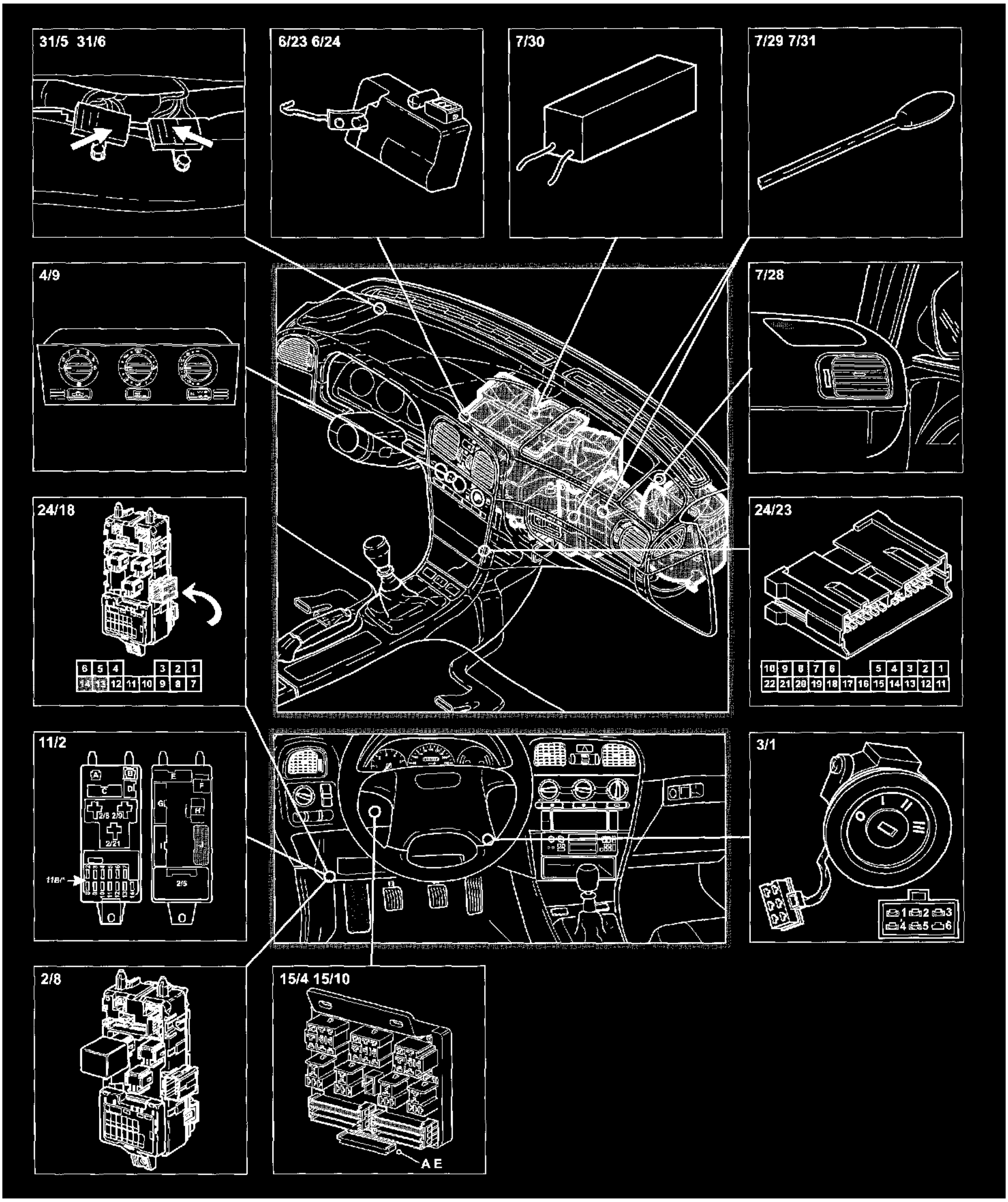
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Electronic Climate Control



ECC - Control Of Motors And Sensors, Part 1 Of 2

Wiring Diagrams

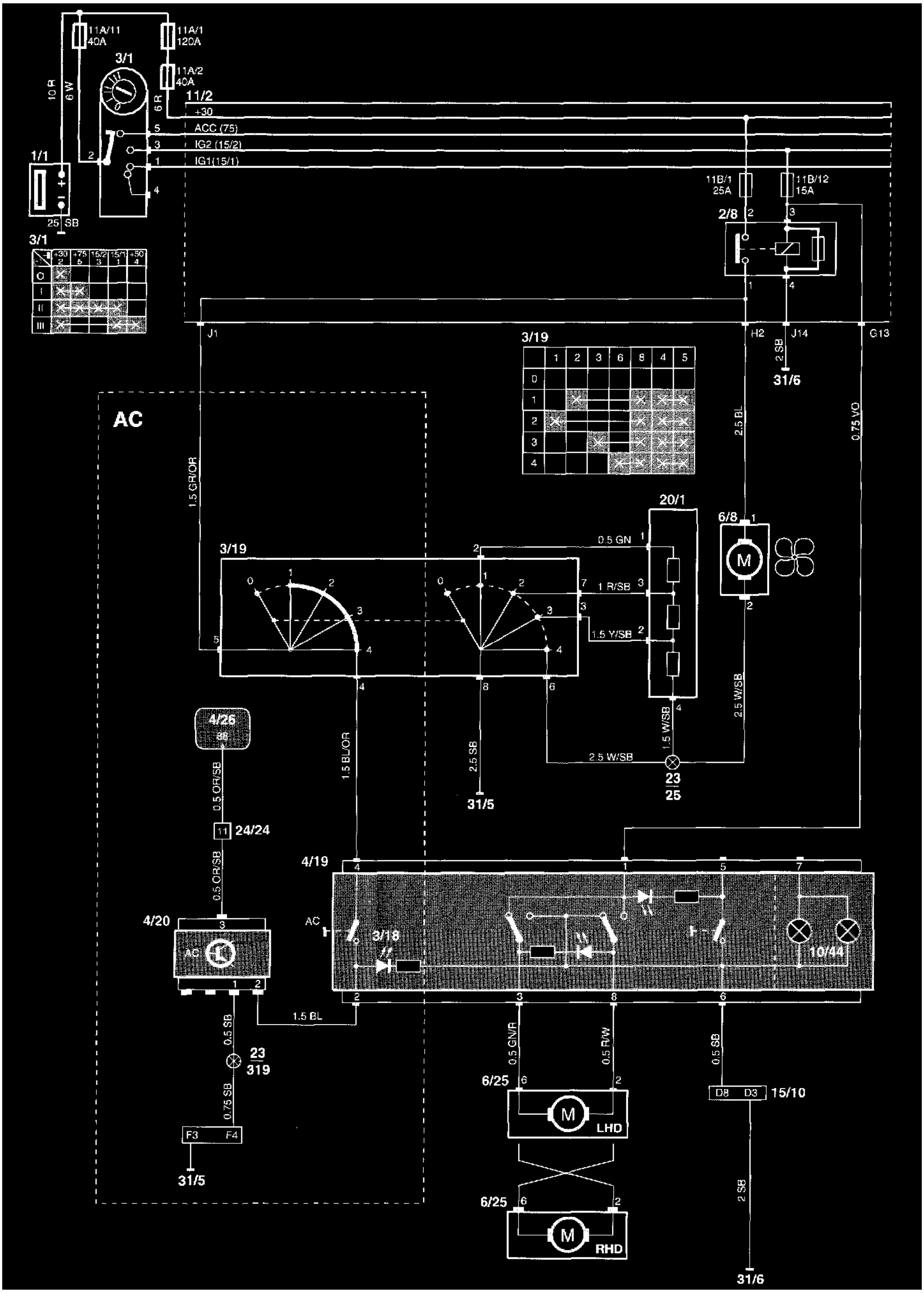


ECC - Control Of Motors And Sensors, Part 2 Of 2

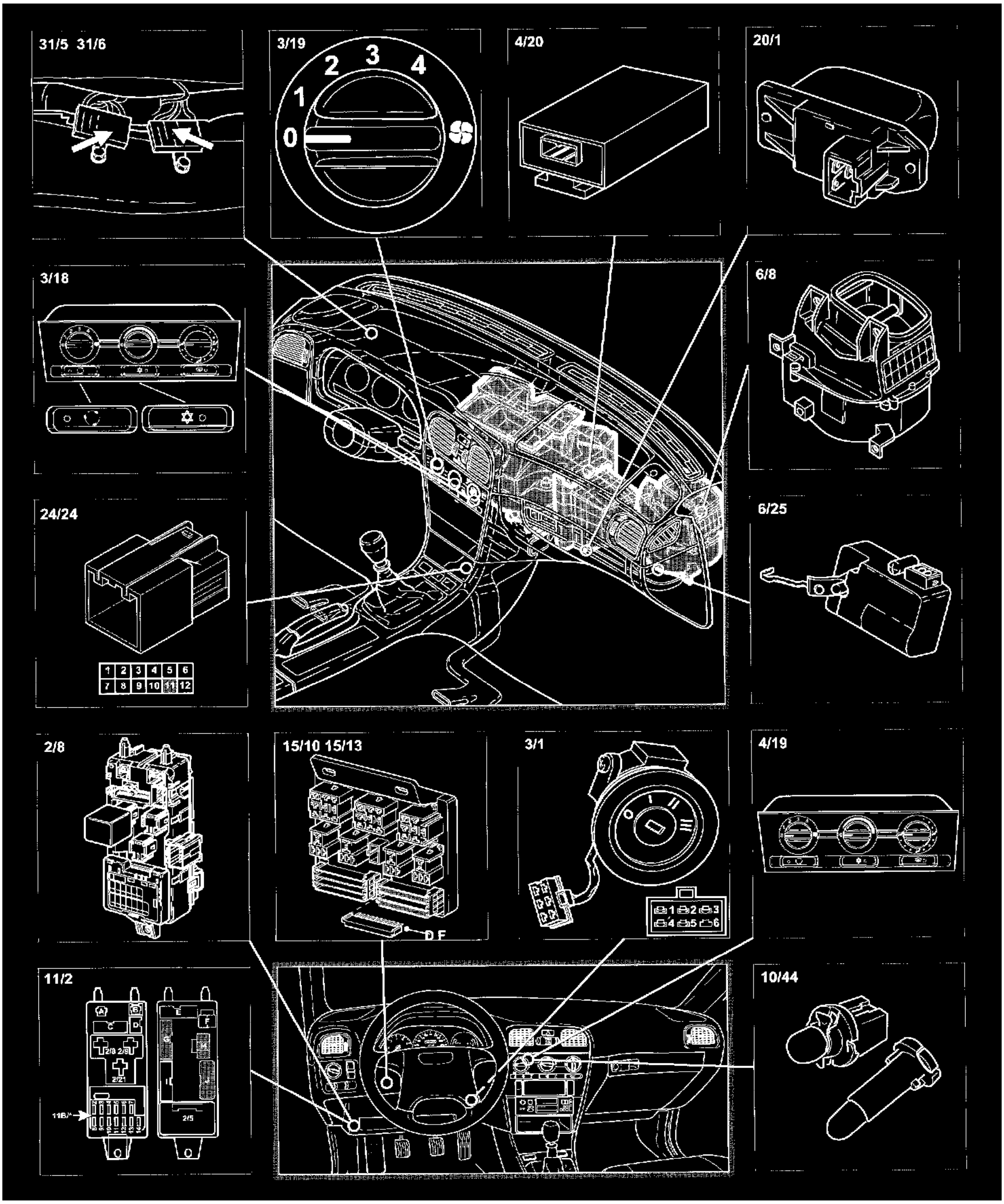
Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Manual Climate Control (MCC)



Manual Climate Control, MCC, Part 1 Of 2



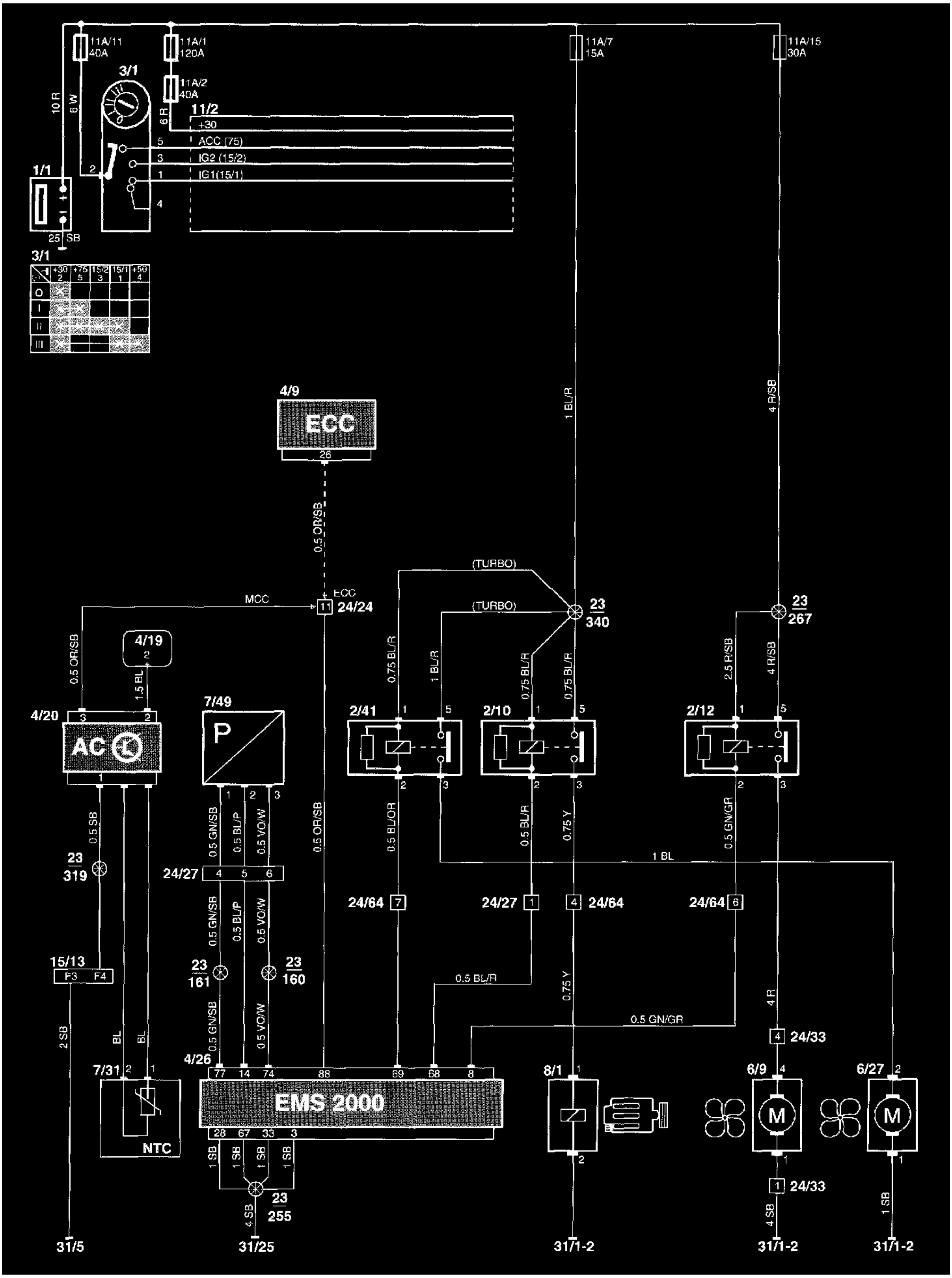
Manual Climate Control, MCC, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

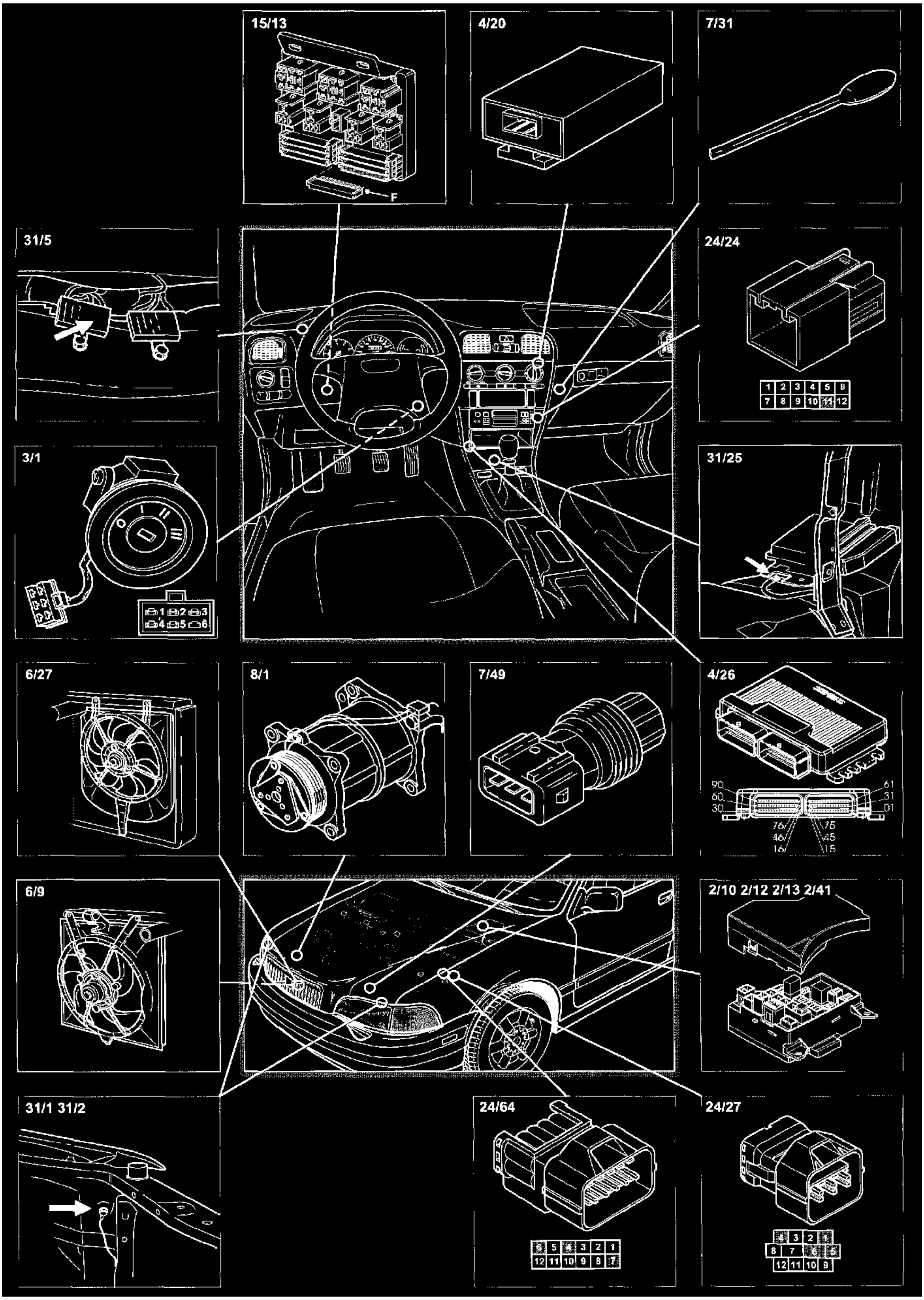
Air Conditioning (A/C) Compressor, Ems 2000

Air Conditioning (A/C) Compressor, EMS 2000



Air Conditioning (A/C) Compressor, Part 1 Of 2

Wiring Diagram



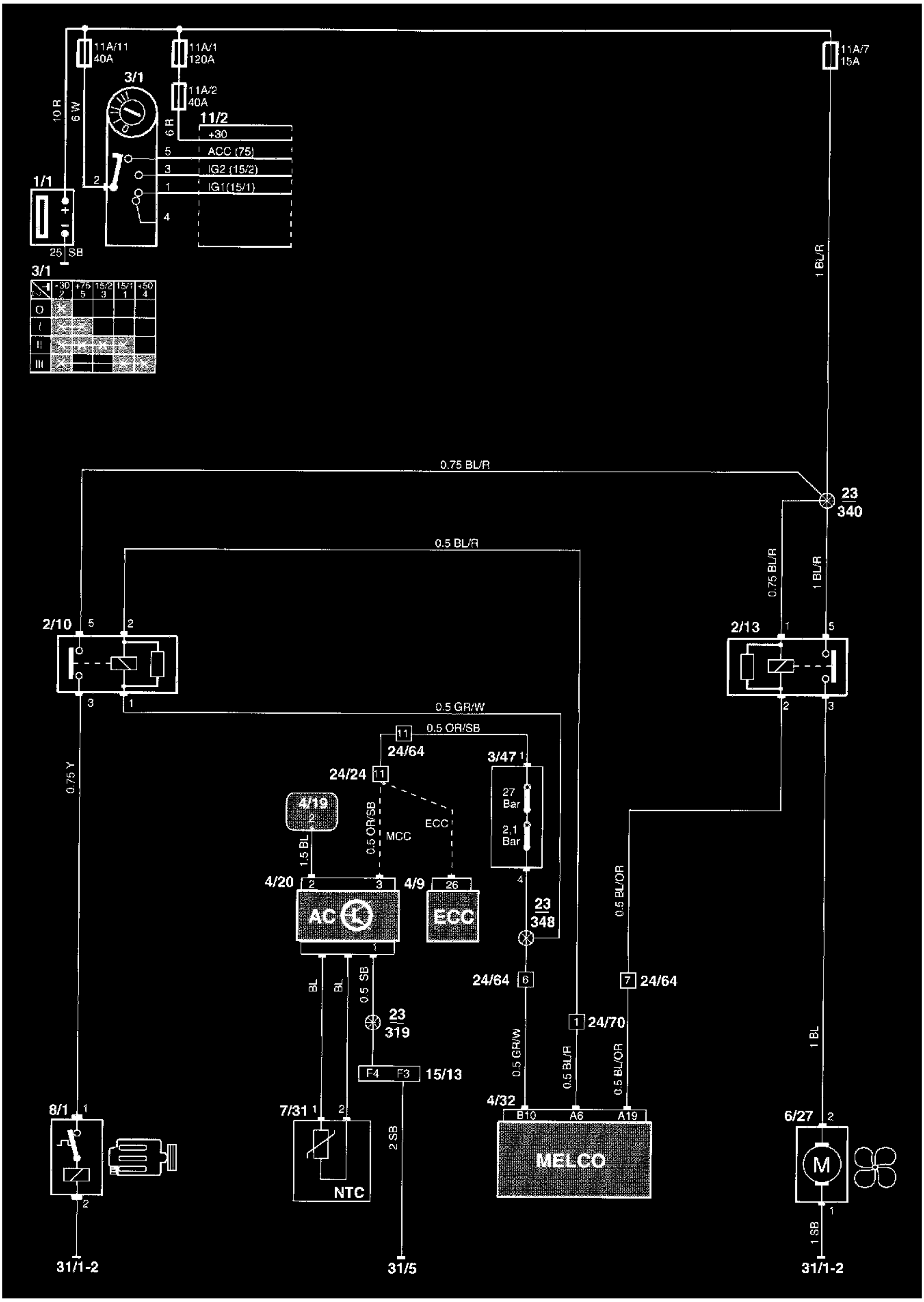
Air Conditioning (A/C) Compressor, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

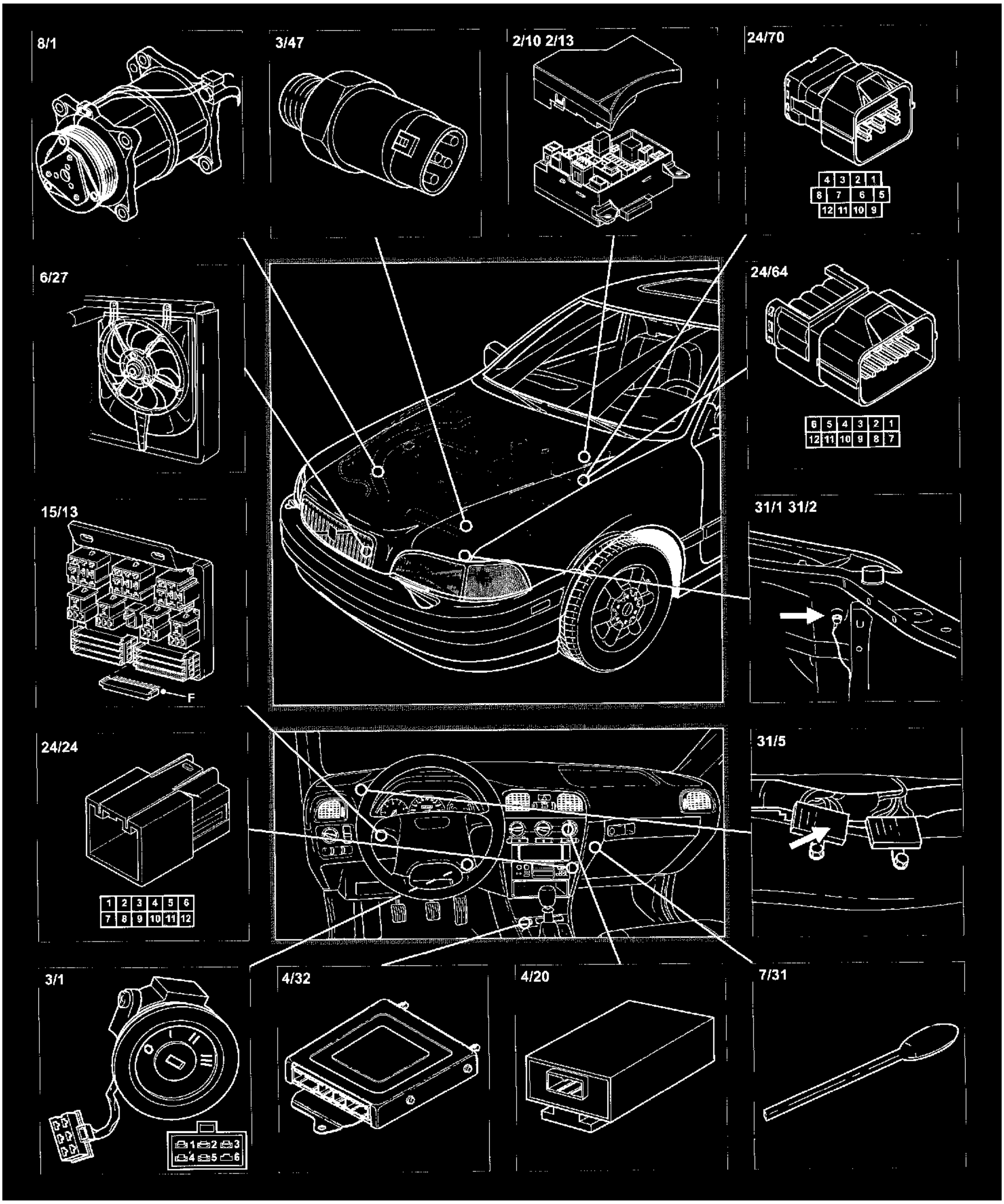
Air Conditioning (A/C) Compressor, Melco 1

Air Conditioning (A/C) Compressor, MELCO 1



Air Conditioning (A/C) Compressor, Part 1 Of 2

Wiring Diagram

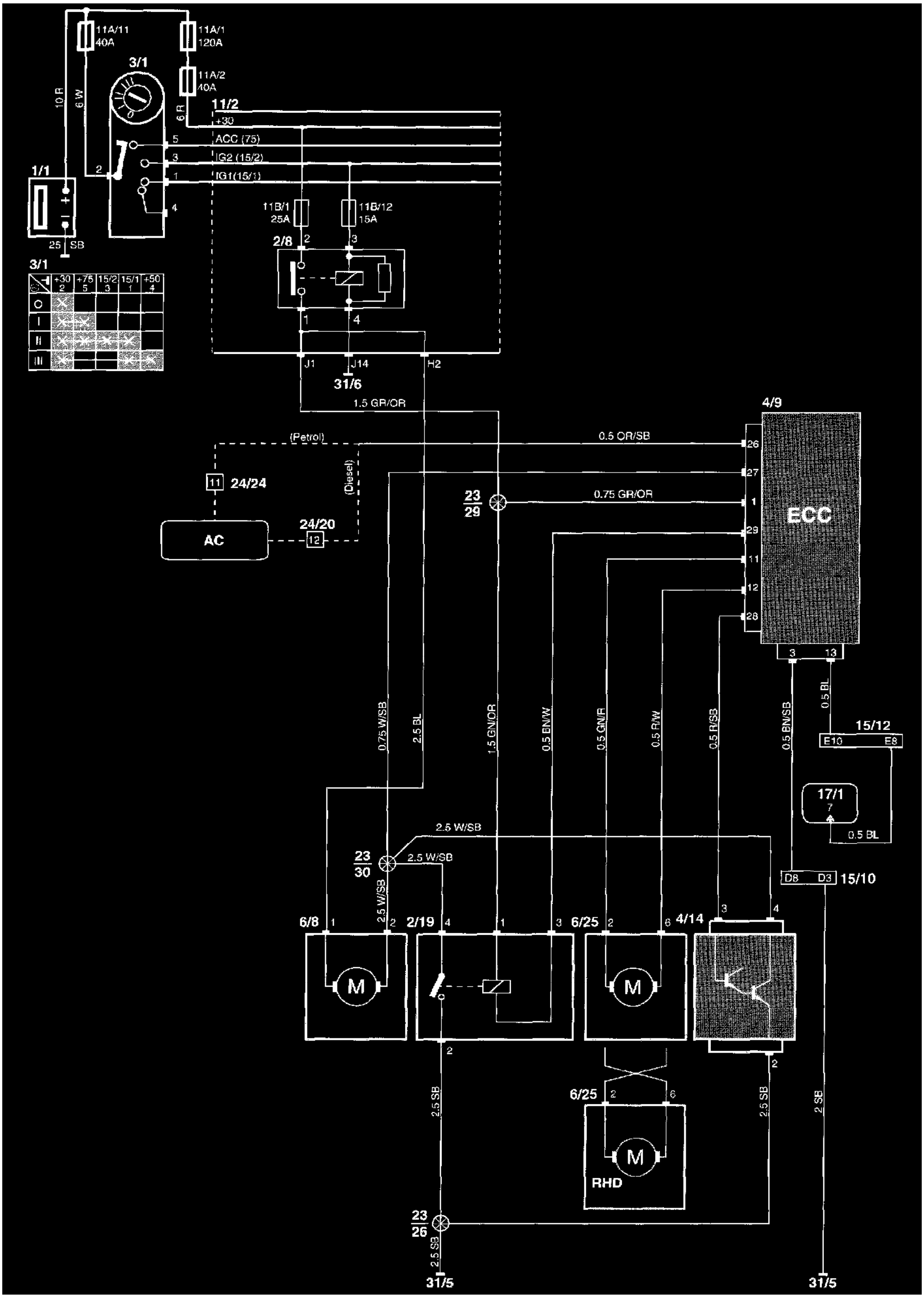


Air Conditioning (A/C) Compressor, Part 2 Of 2

Component Locations

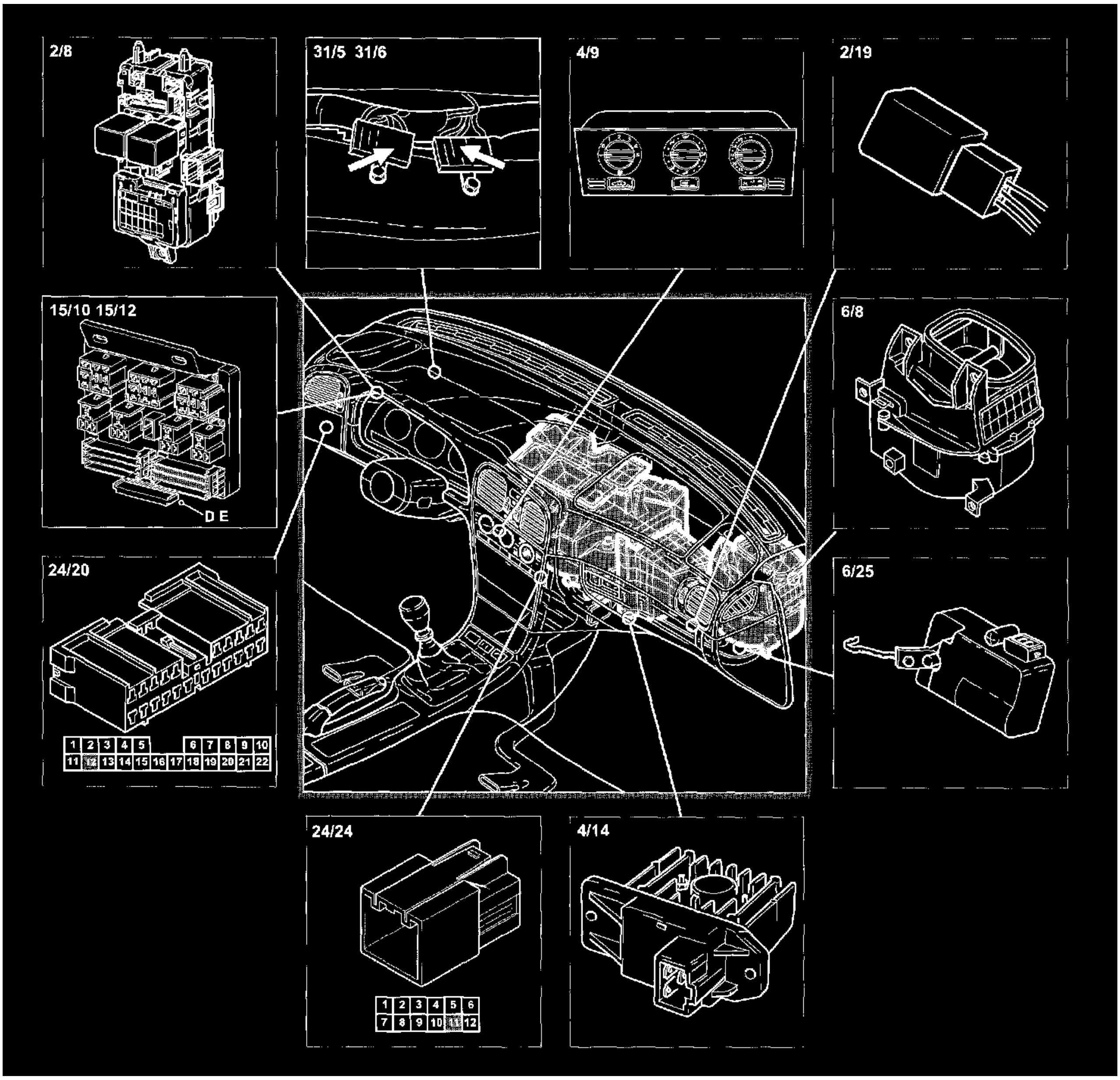
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Control Module HVAC



ECC - Control Module, Part 1 Of 2

Wiring Diagram

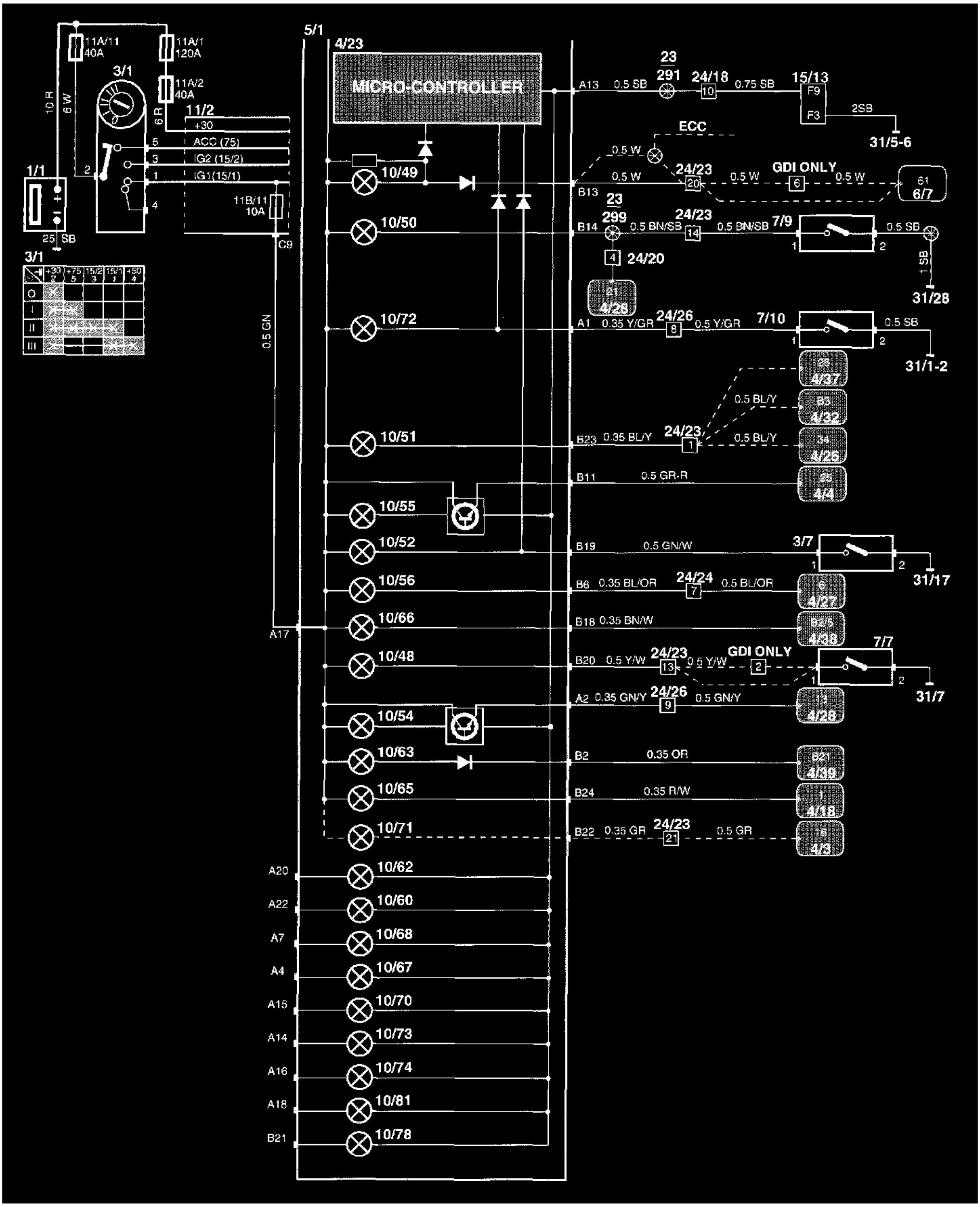


ECC - Control Module, Part 2 Of 2

Component Locations

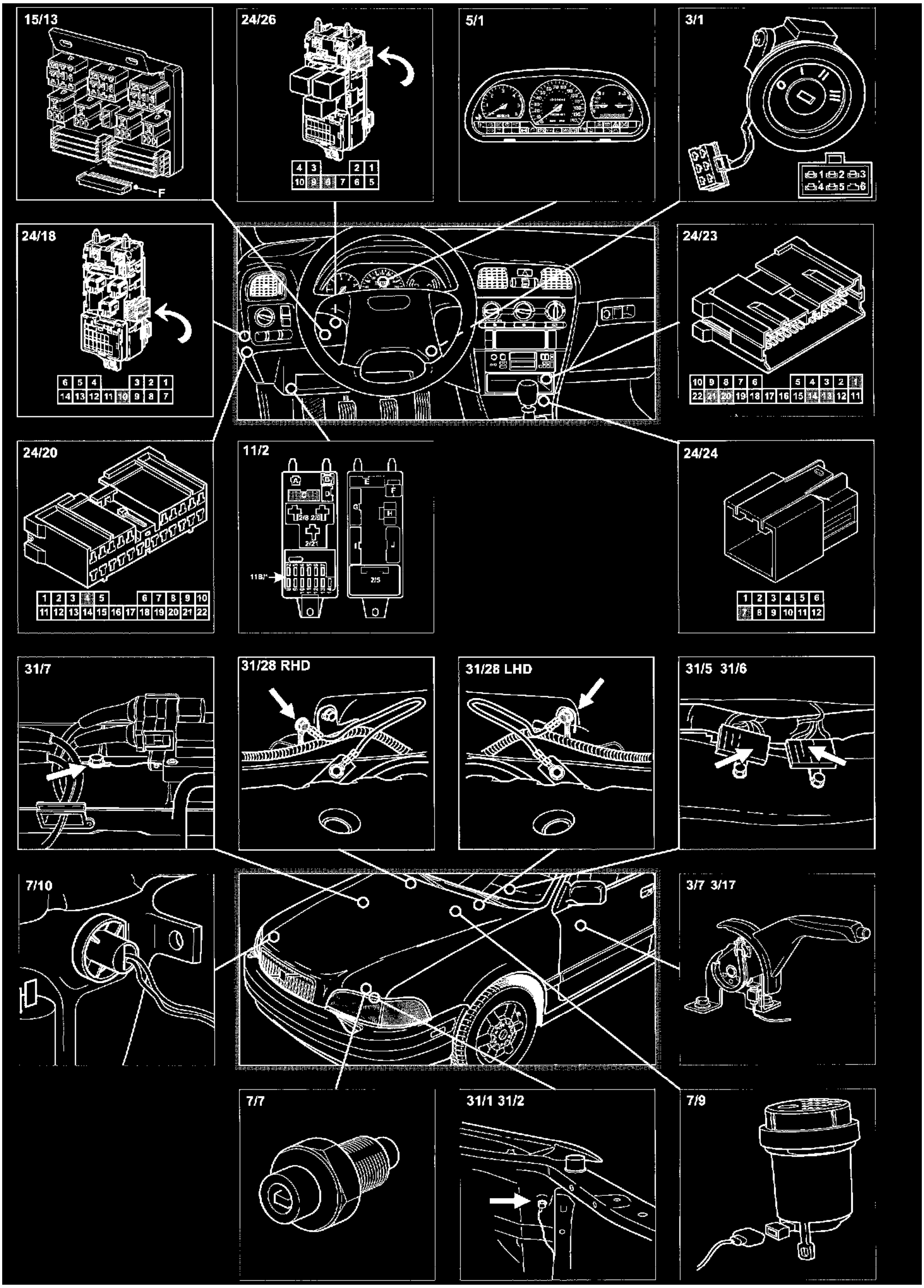
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Instruments - General



Instruments - General, Part 1 Of 2

Wiring Diagram

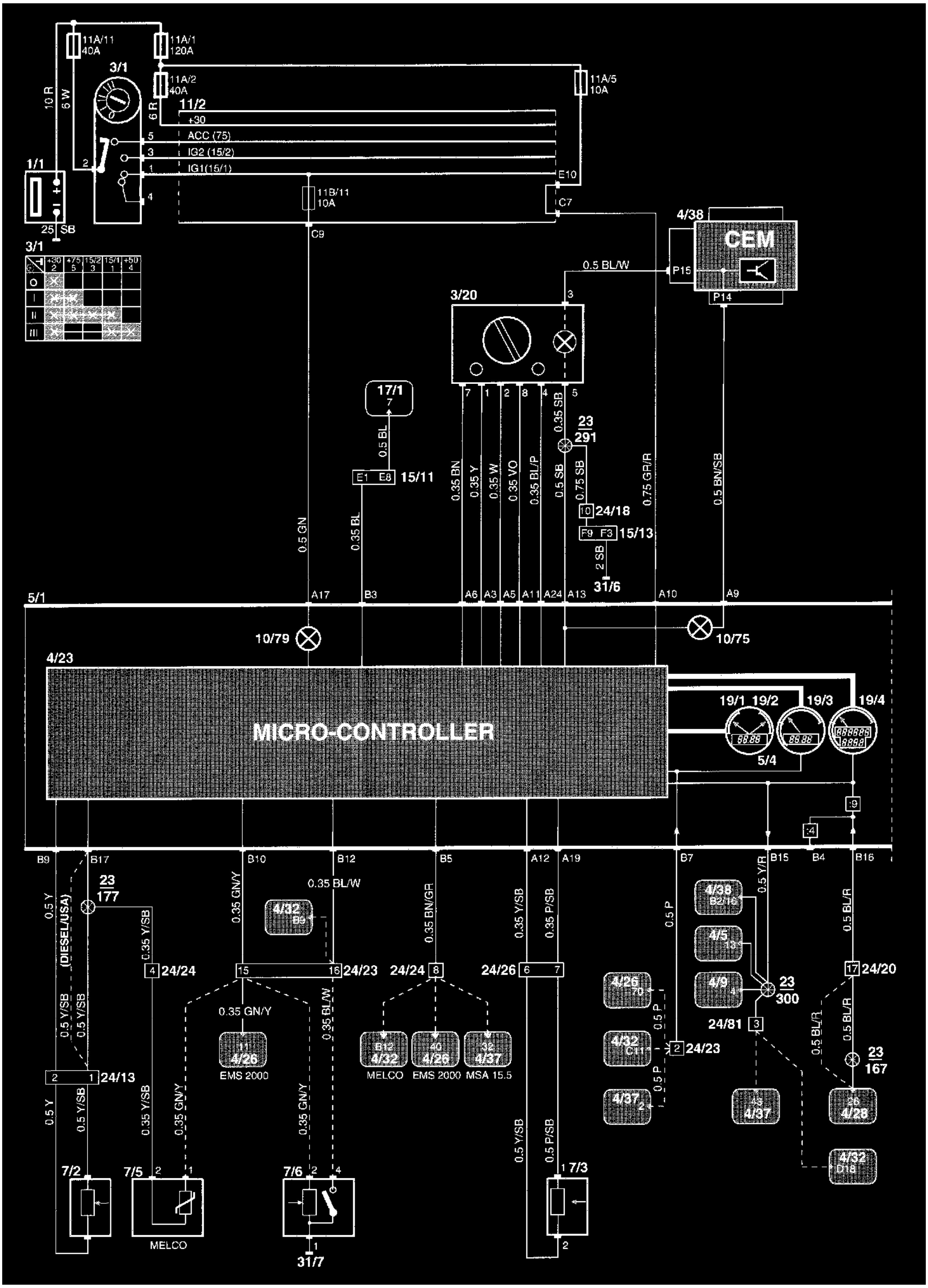


Instruments - General, Part 2 Of 2

Component Locations

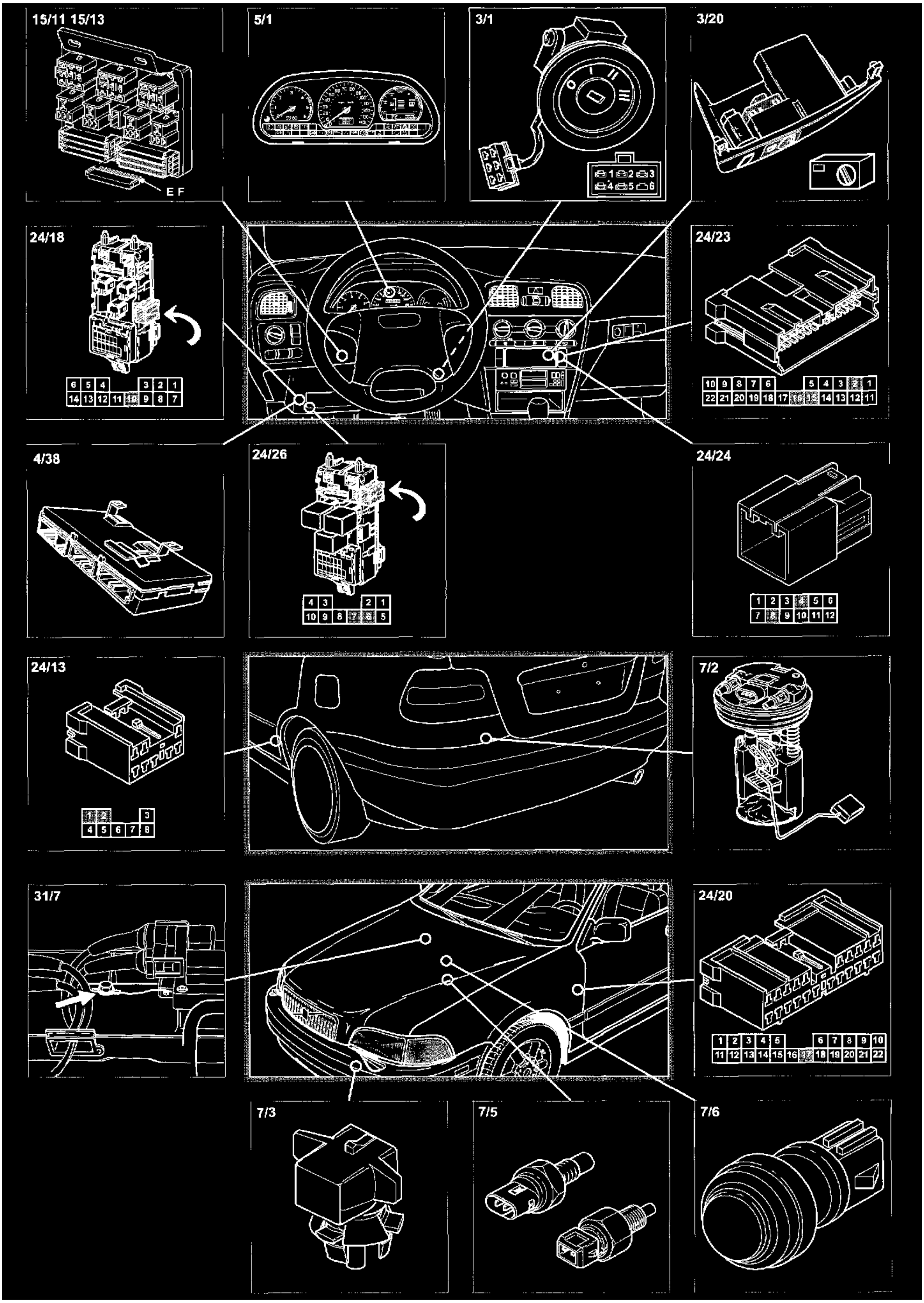
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Combined Instrument Panel



Combined Instrument Panel, Part 1 Of 2

Wiring Diagram

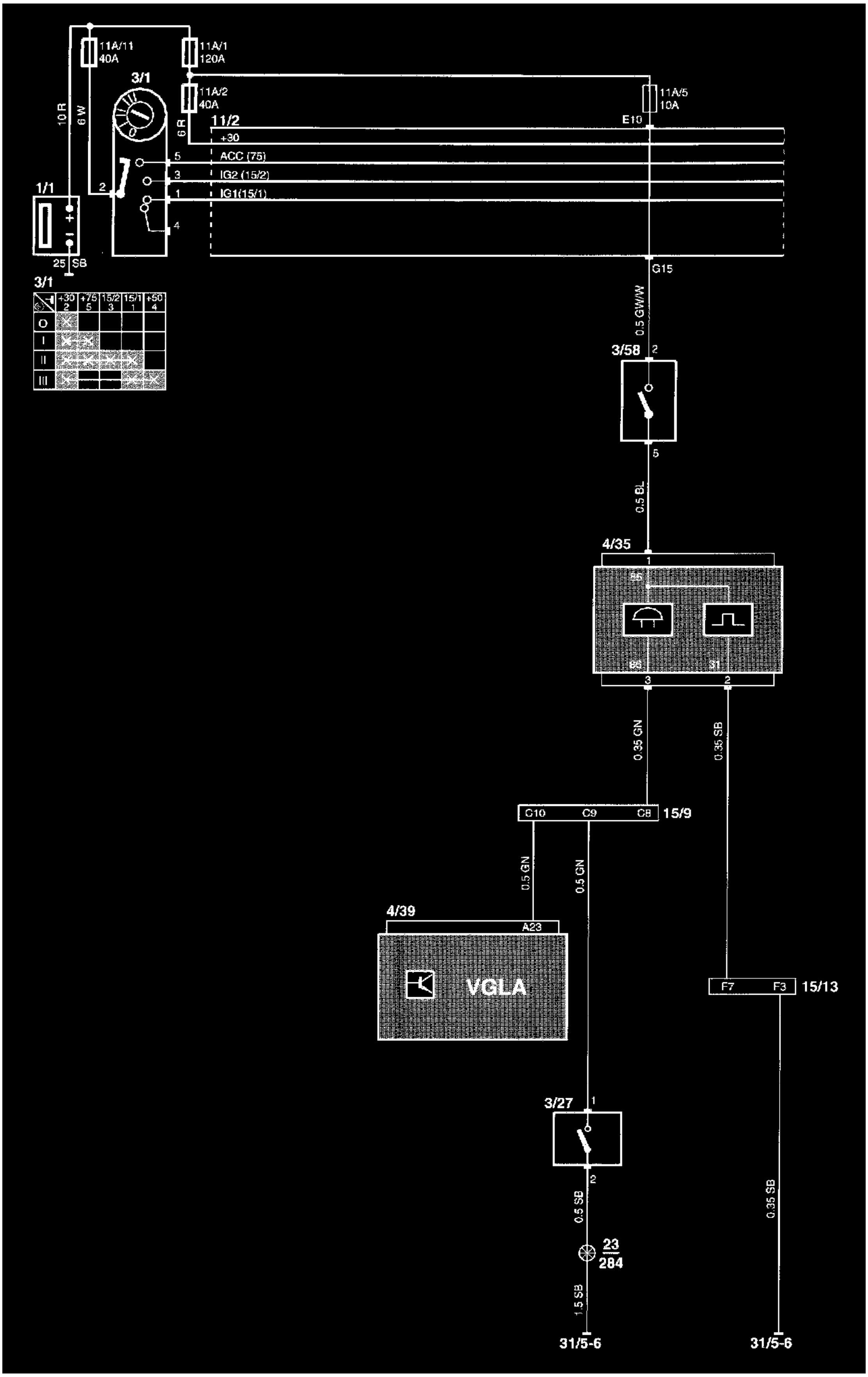


Combined Instrument Panel, Part 2 Of 2

Component Locations

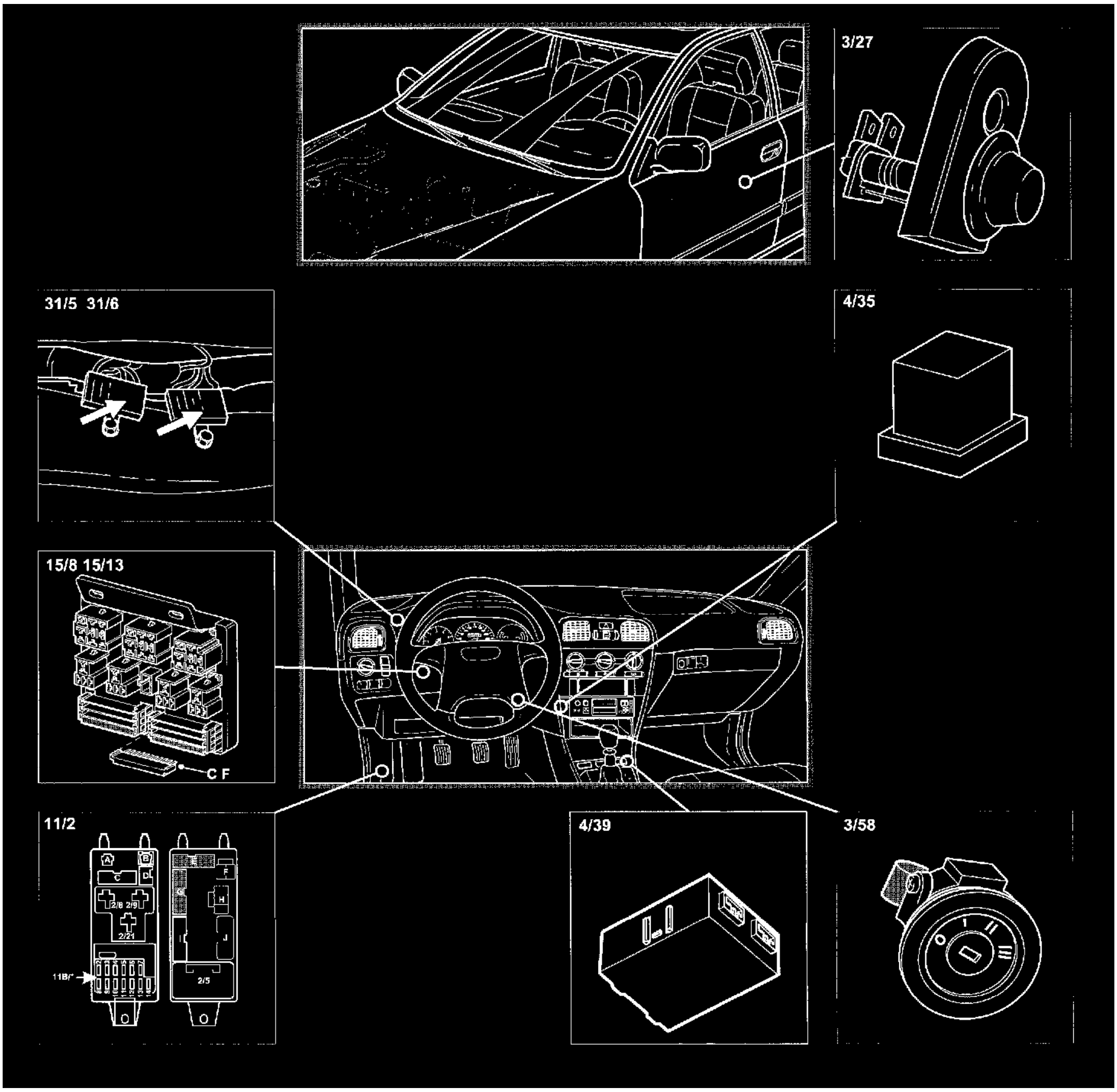
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Ignition Warning



Ignition Warning, Part 1 Of 2

Wiring Diagram

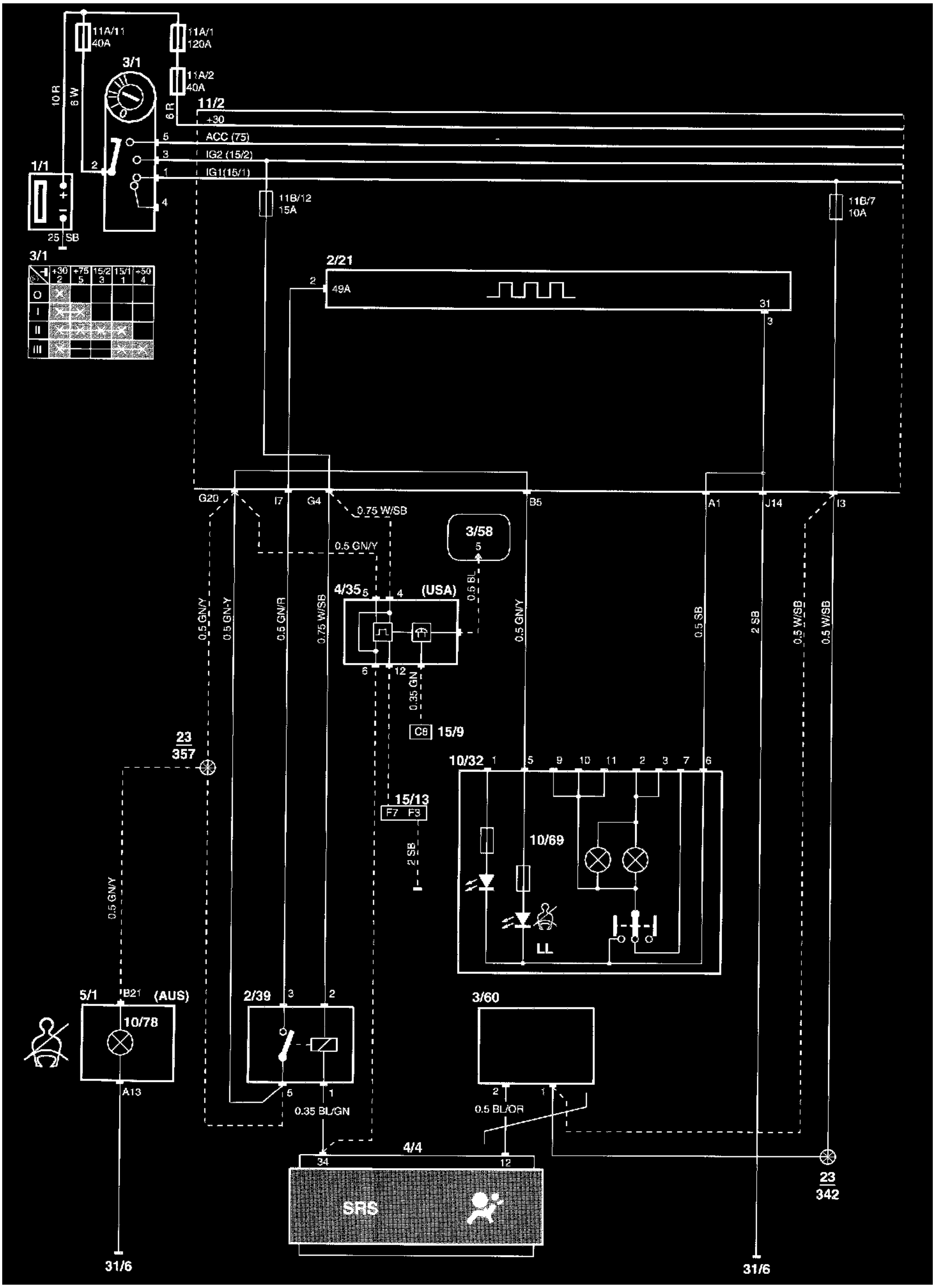


Ignition Warning, Part 2 Of 2

Component Locations

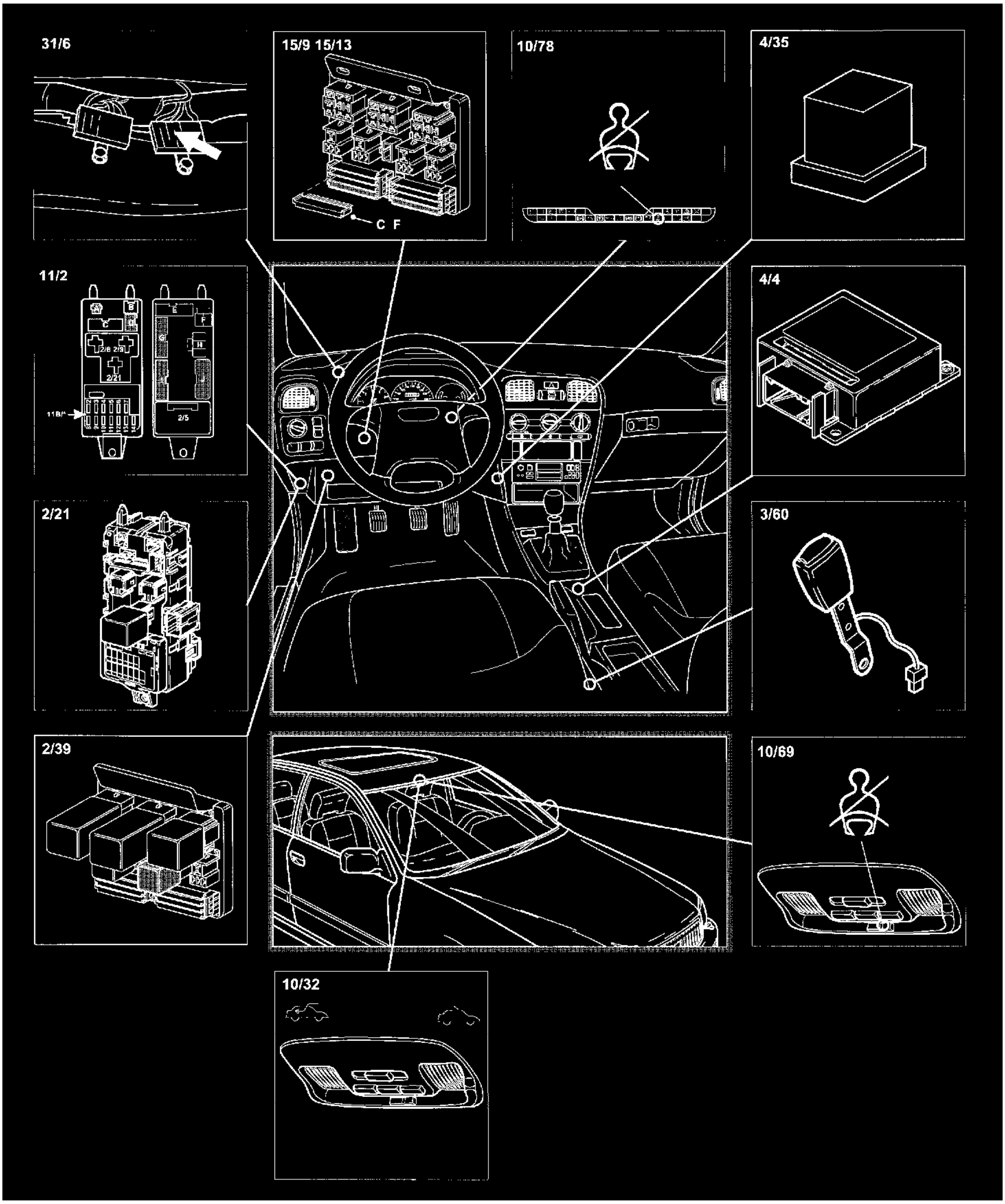
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Seat Belt Reminder



Seat Belt Reminder, Part 1 Of 2

Wiring Diagram

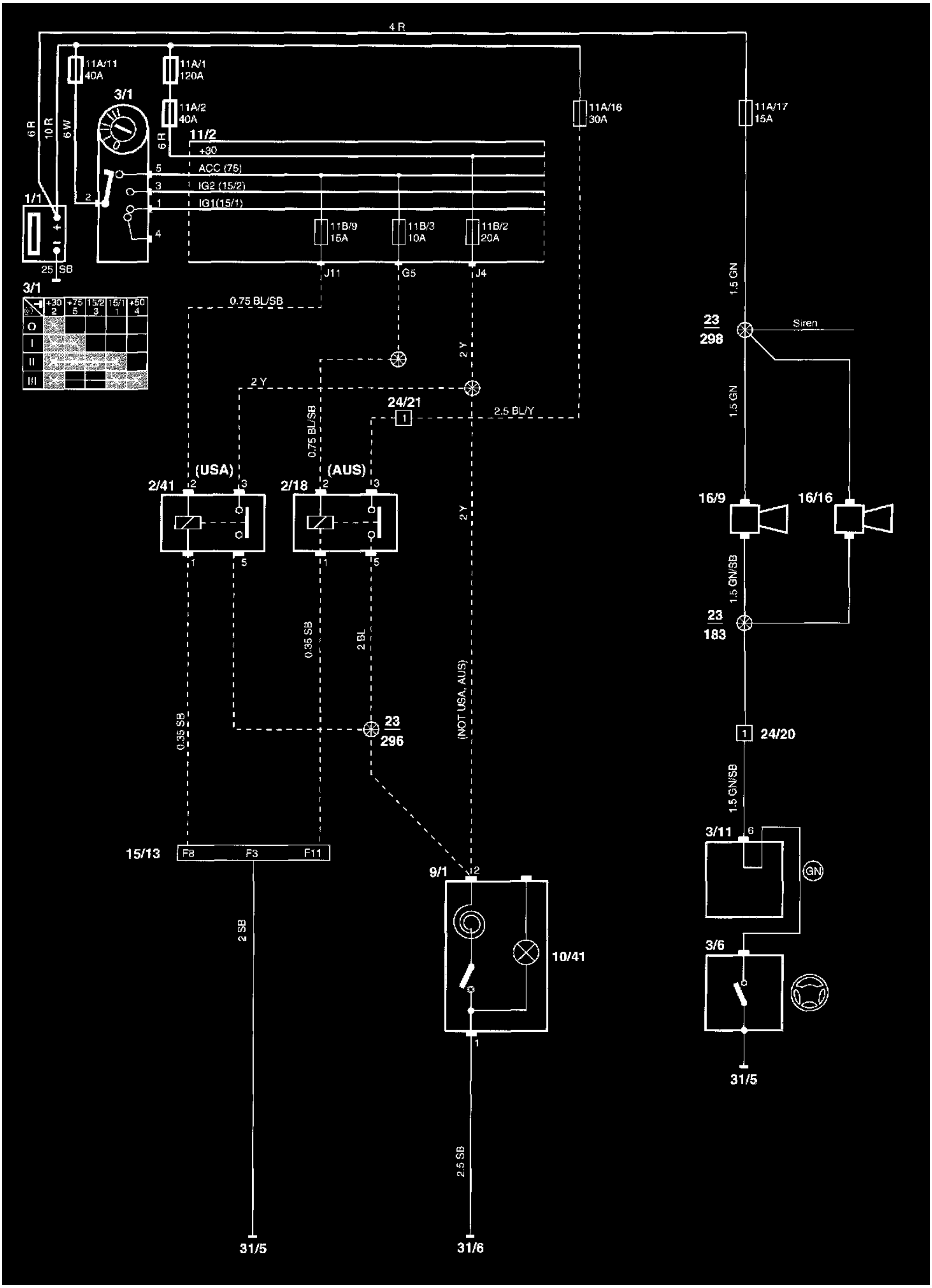


Seat Belt Reminder, Part 2 Of 2

Component Locations

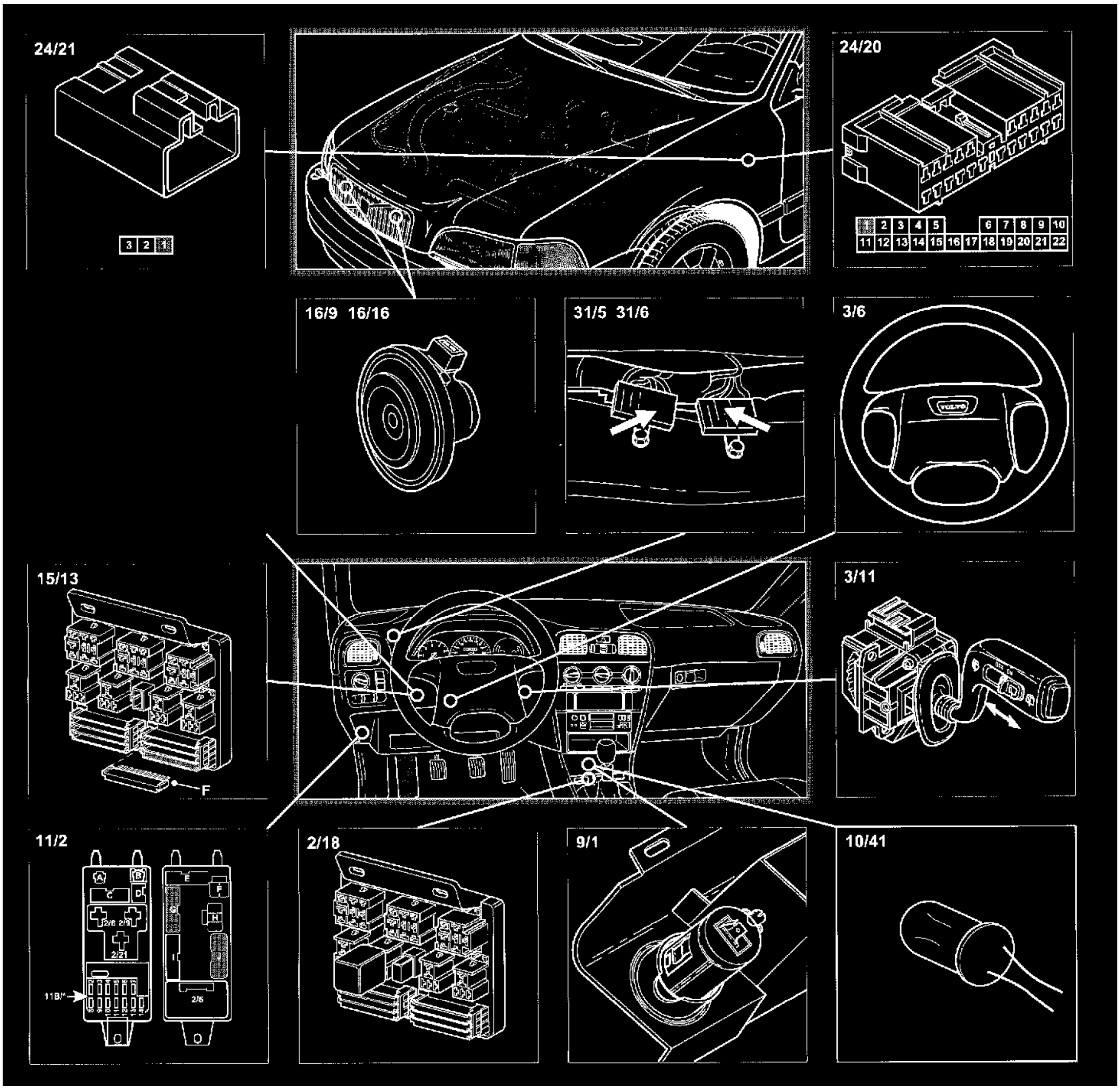
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Cigarette Lighter



Cigarette Lighter And Horn, Part 1 Of 2

Wiring Diagram

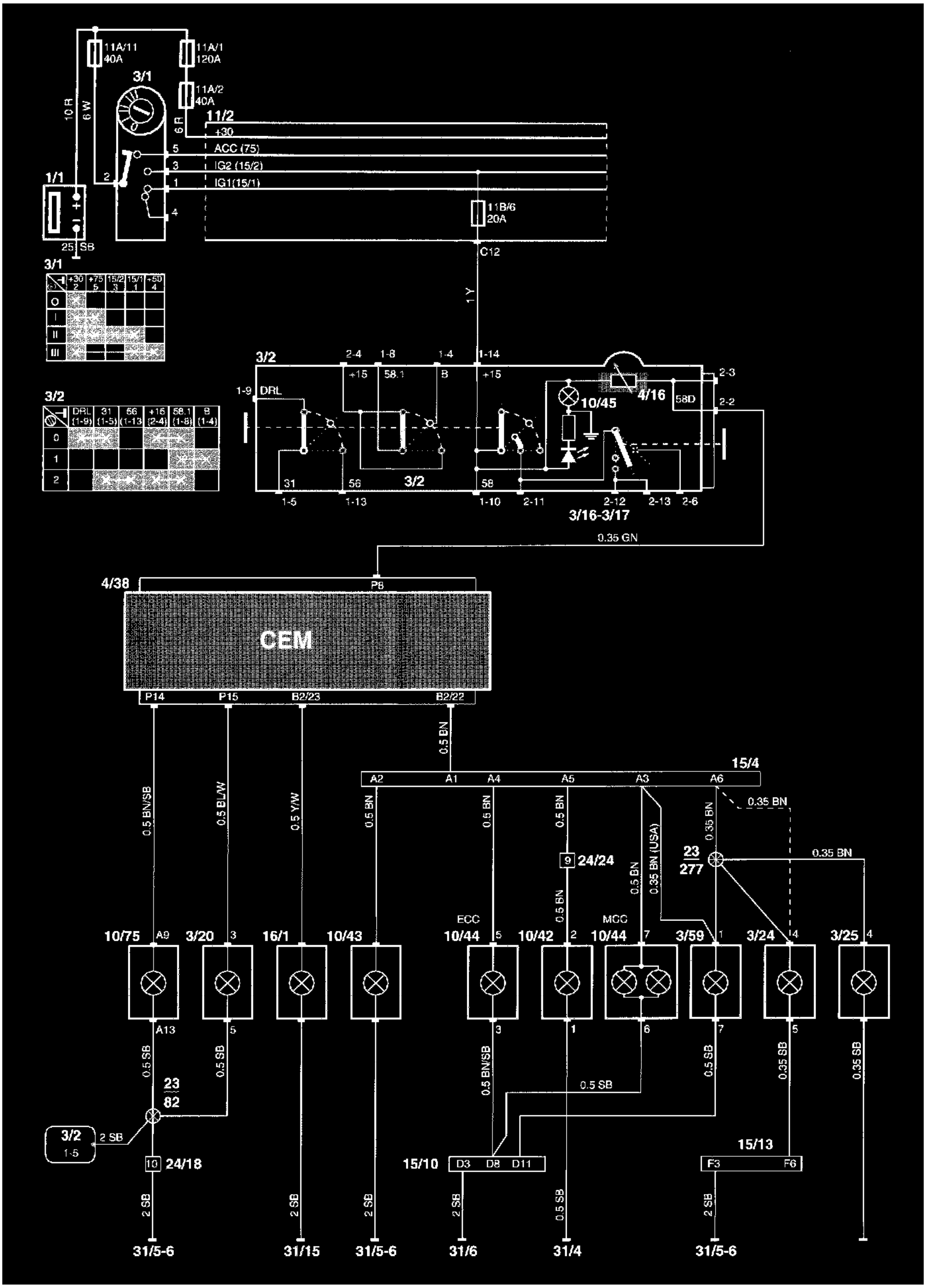


Cigarette Lighter And Horn, Part 2 Of 2

Component Locations

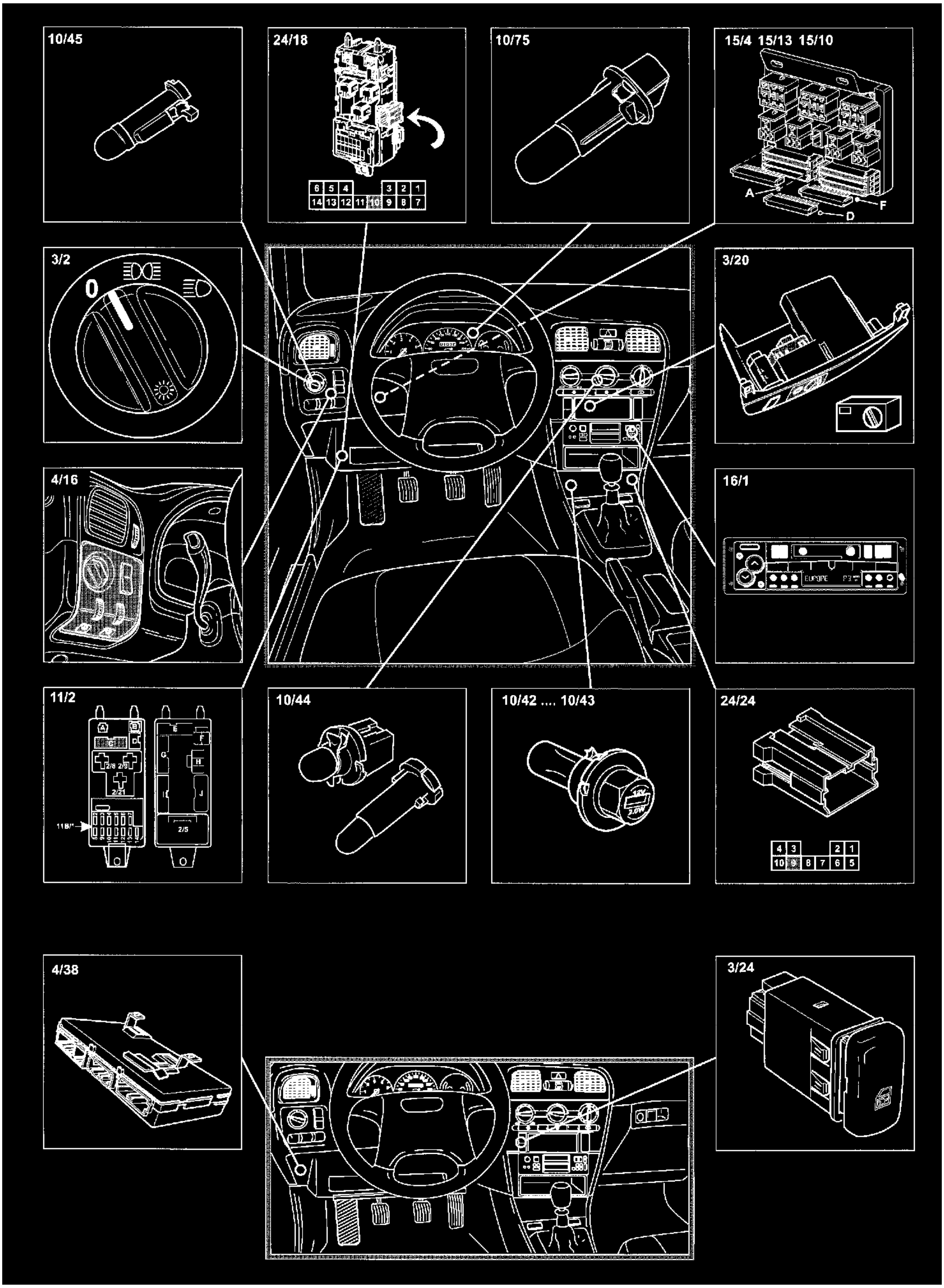
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

System Diagram



Dimmer, Part 1 Of 2

Wiring Diagram

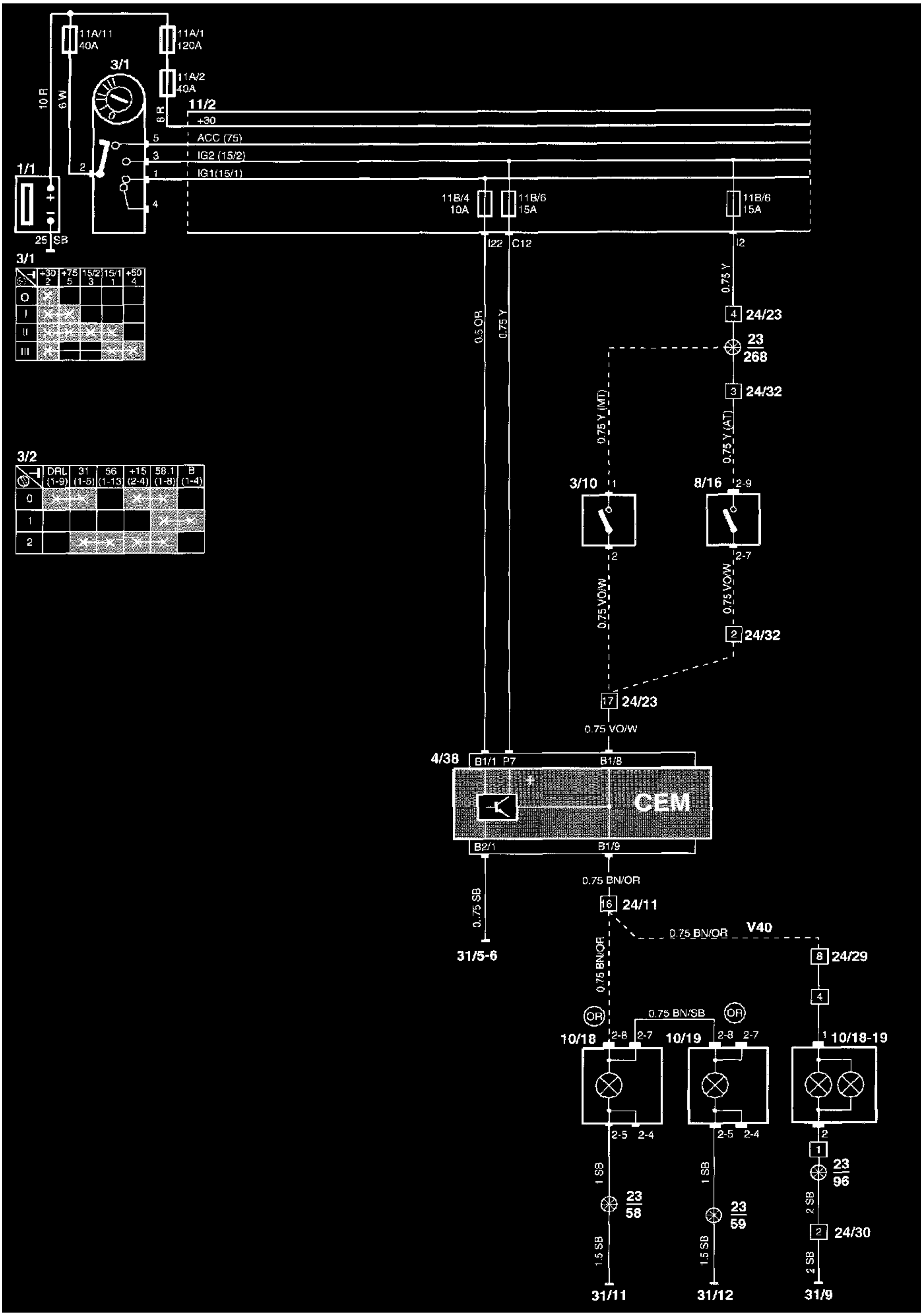


Dimmer, Part 2 Of 2

Component Locations

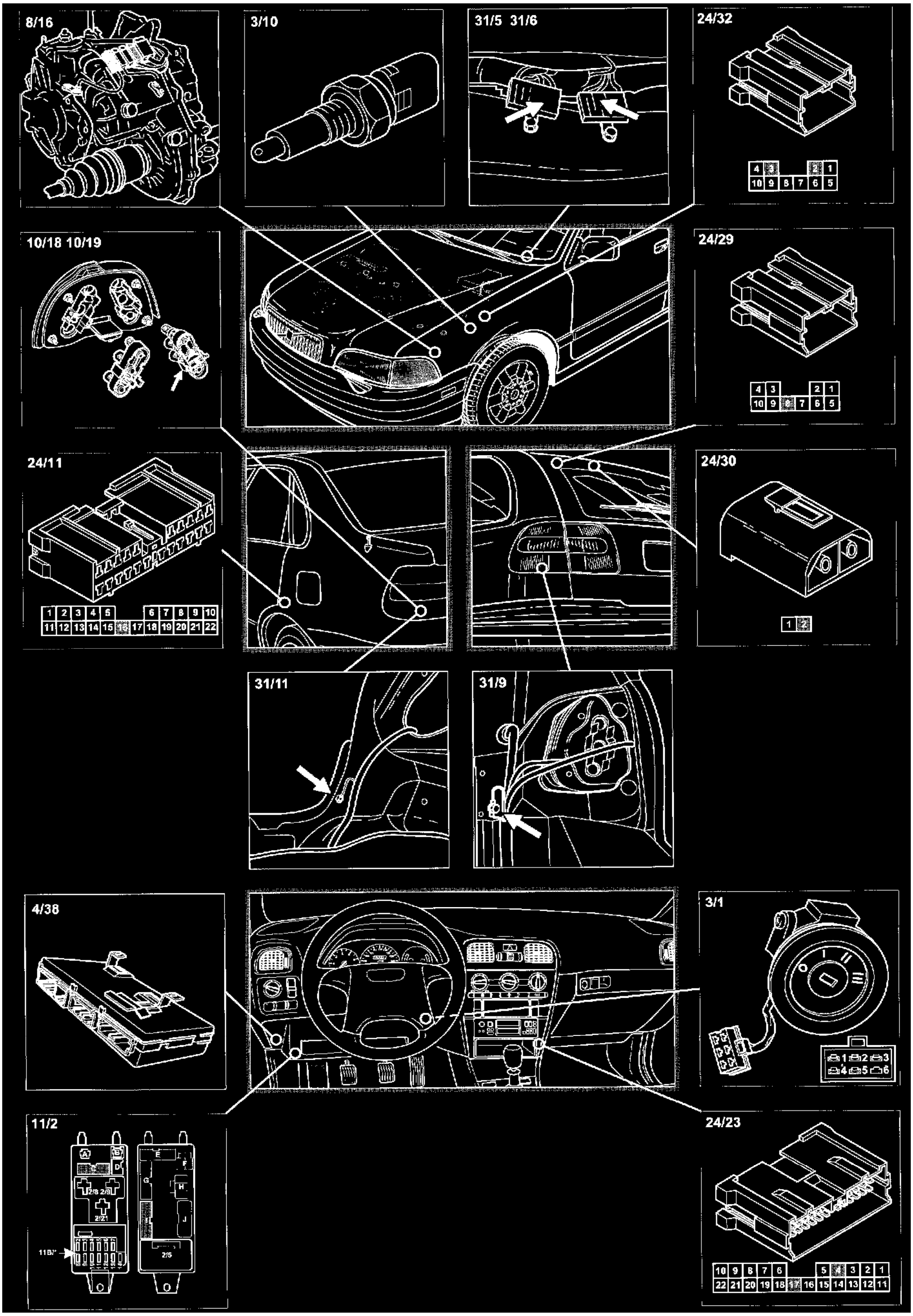
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Backup Lamp



Back-Up (Reversing) Lamps, Part 1 Of 2

Wiring Diagram



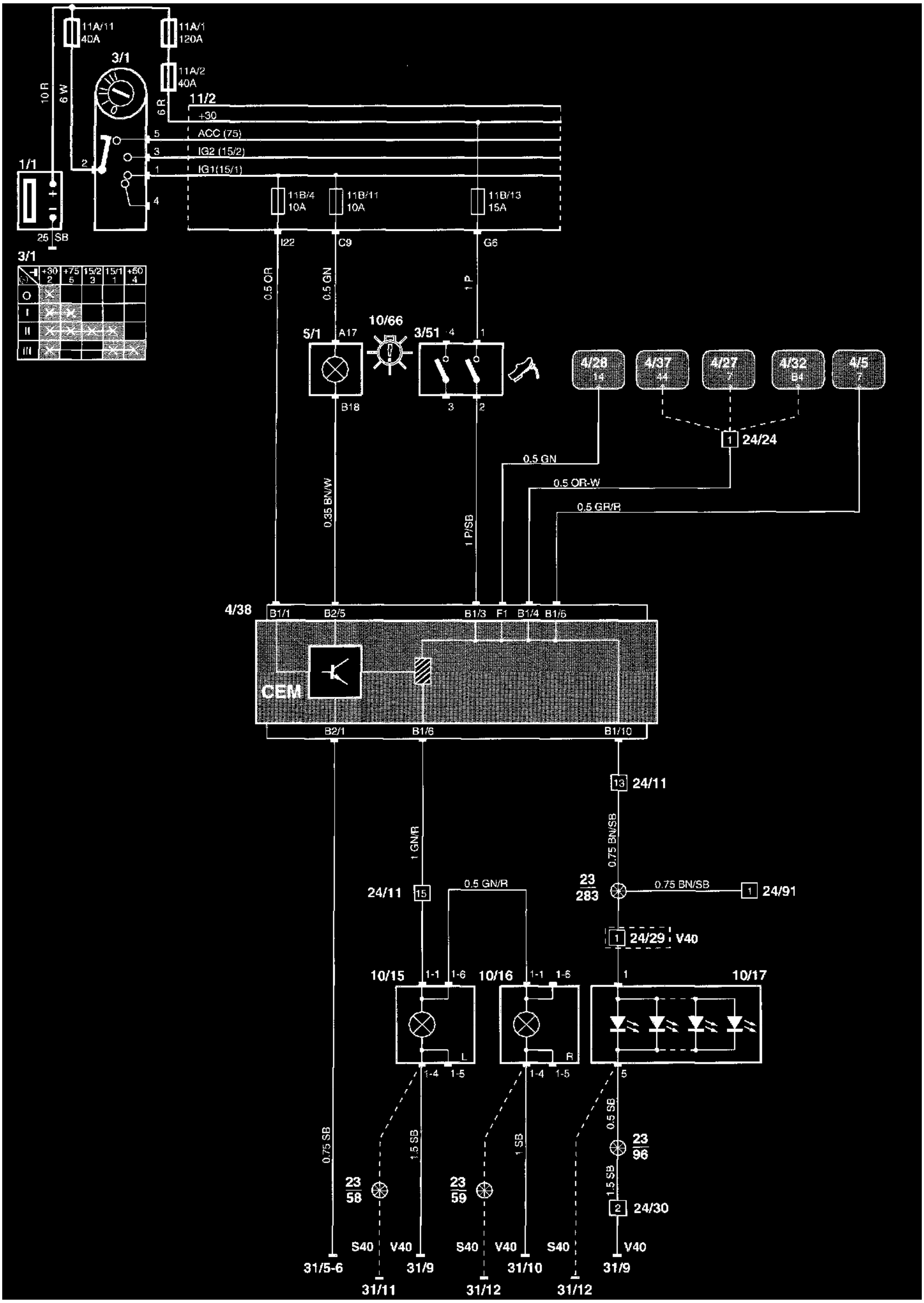
Back-Up (Reversing) Lamps, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

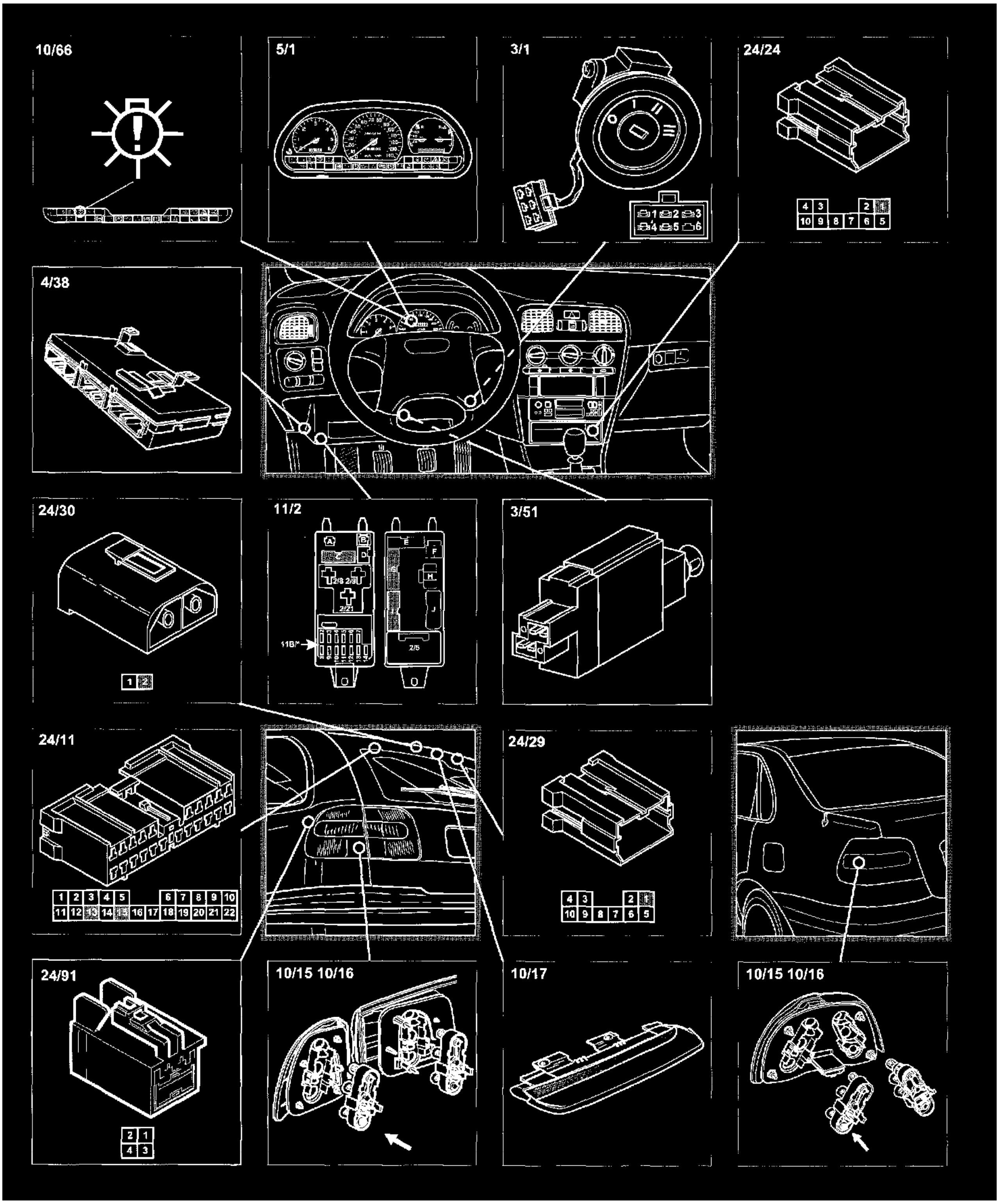
Brake Lamp

Stop (brake) lamps and bulb failure warning sensor



Stop Lamps & Bulb Failure Warning Sensor, Part 1 Of 2

Wiring Diagram

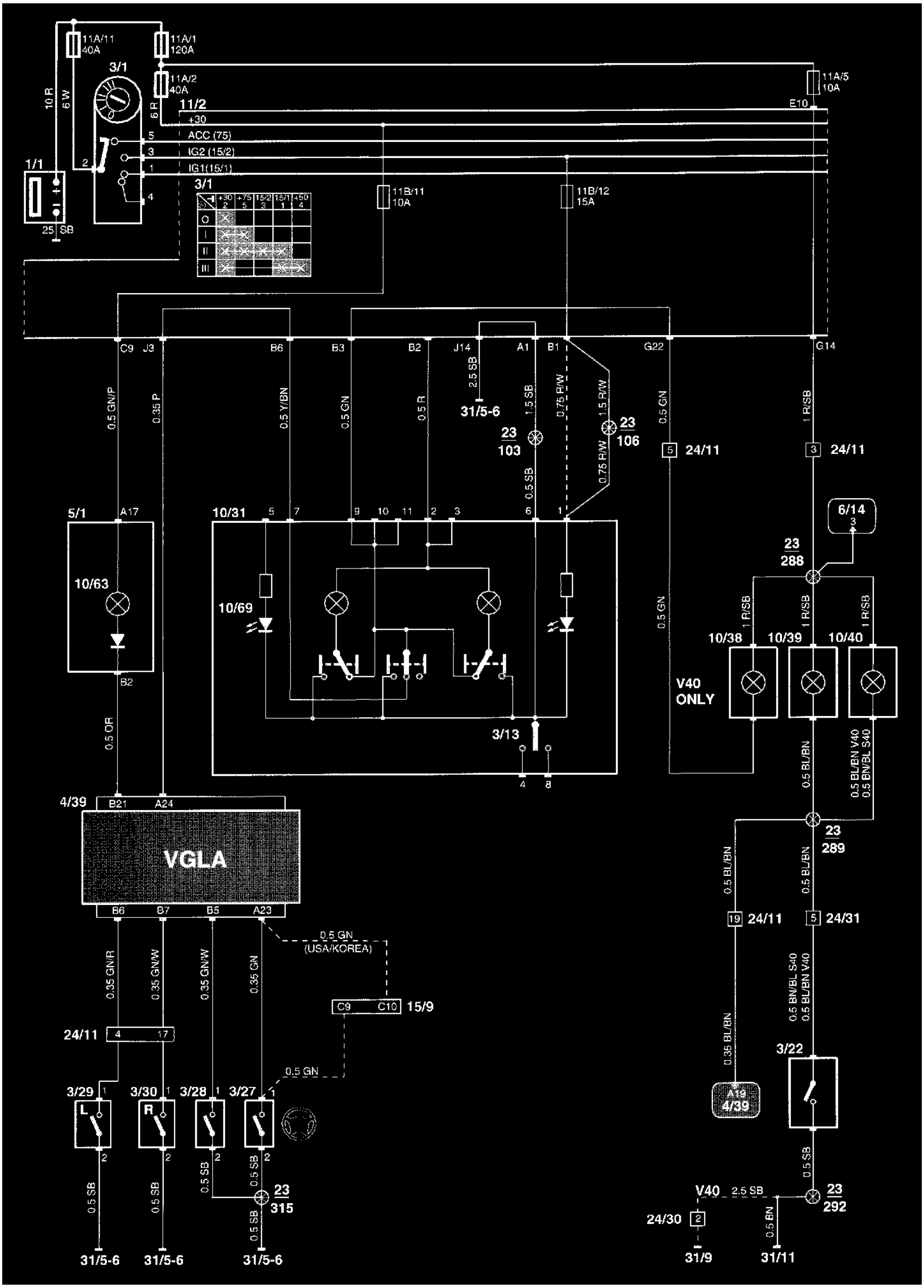


Stop Lamps & Bulb Failure Warning Sensor, Part 2 Of 2

Component Locations

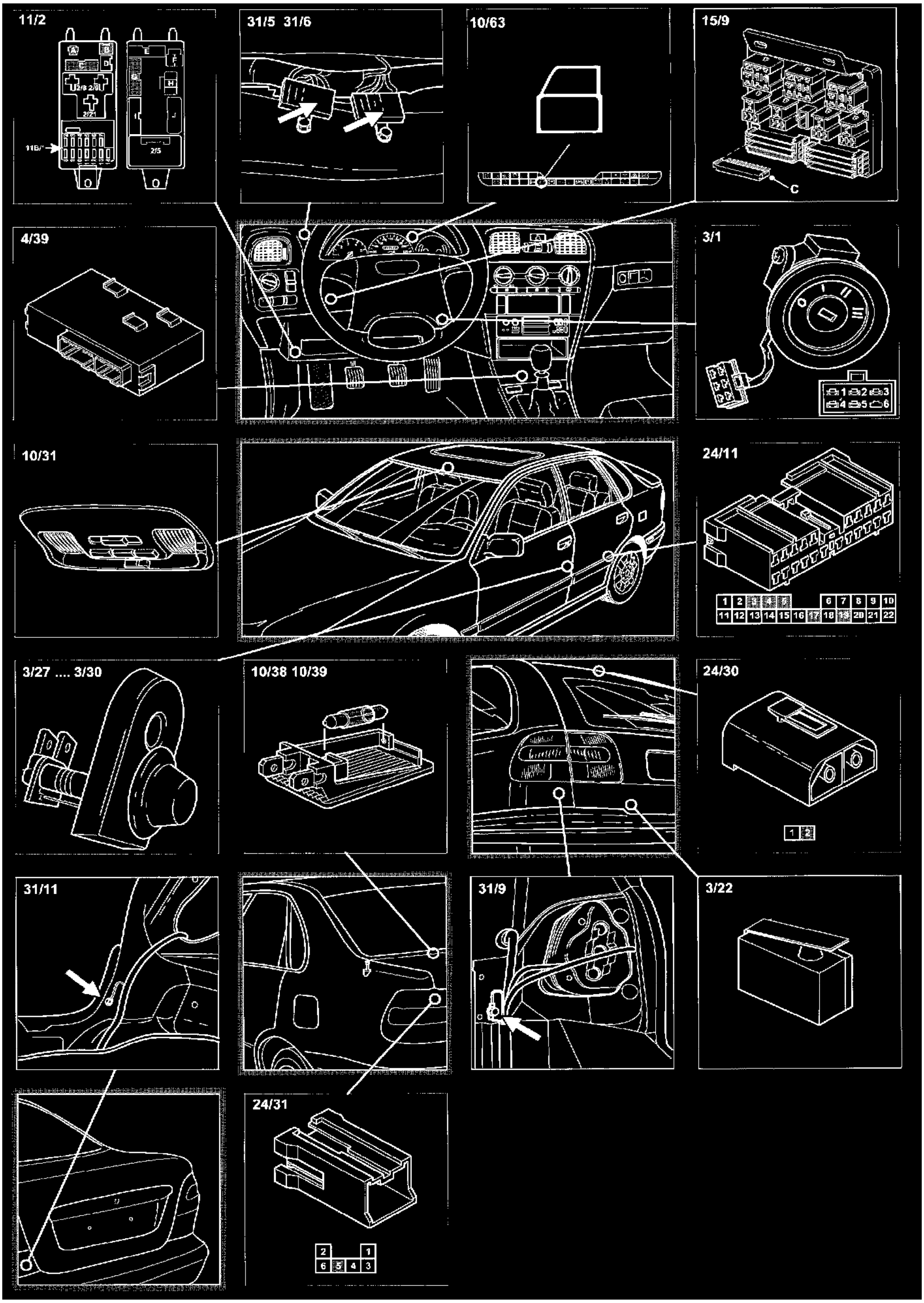
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Cargo Lamp



Cargo Compartment And Tailgate Lighting, Part 1 Of 2

Wiring Diagram

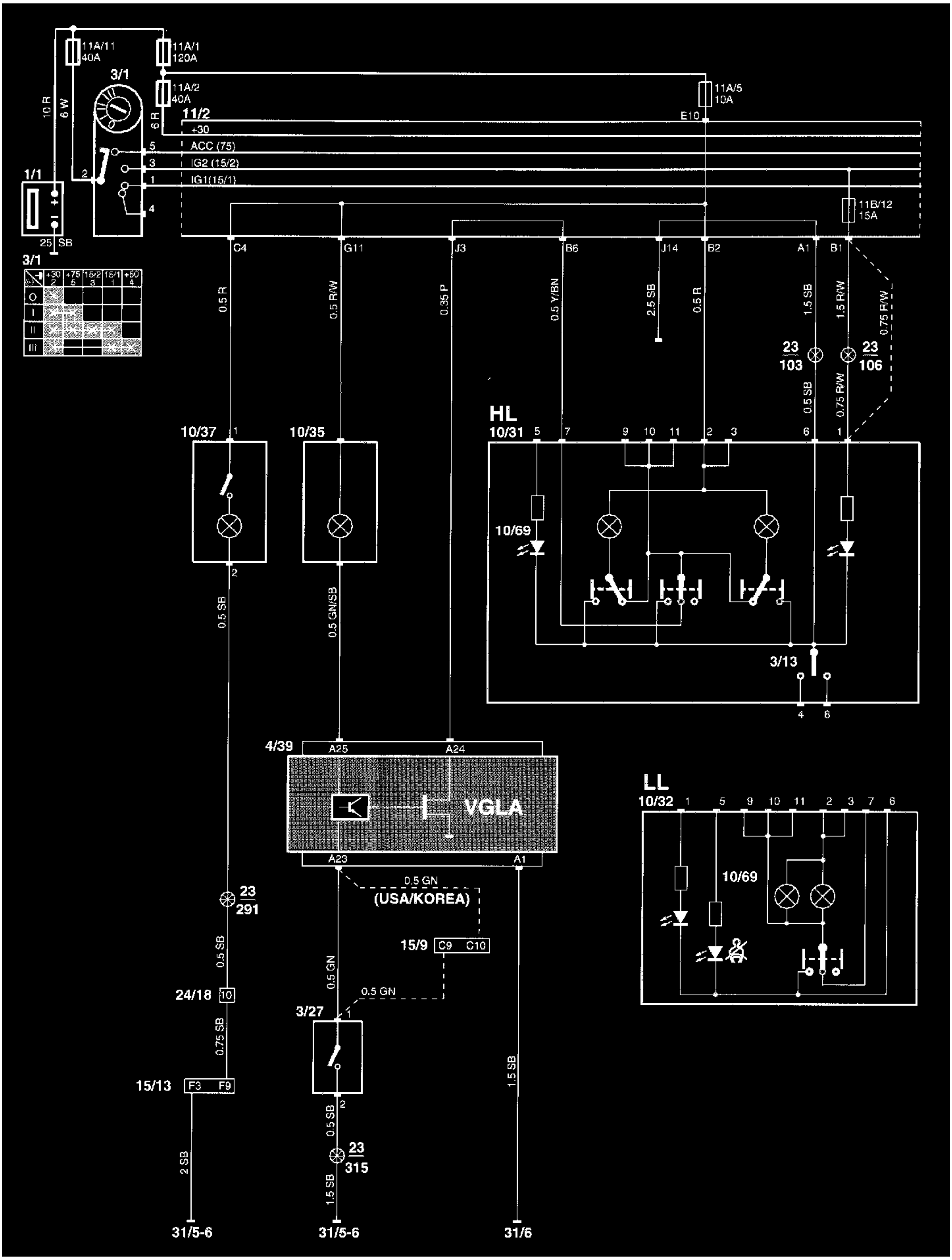


Cargo Compartment And Tailgate Lighting, Part 2 Of 2

Component Locations

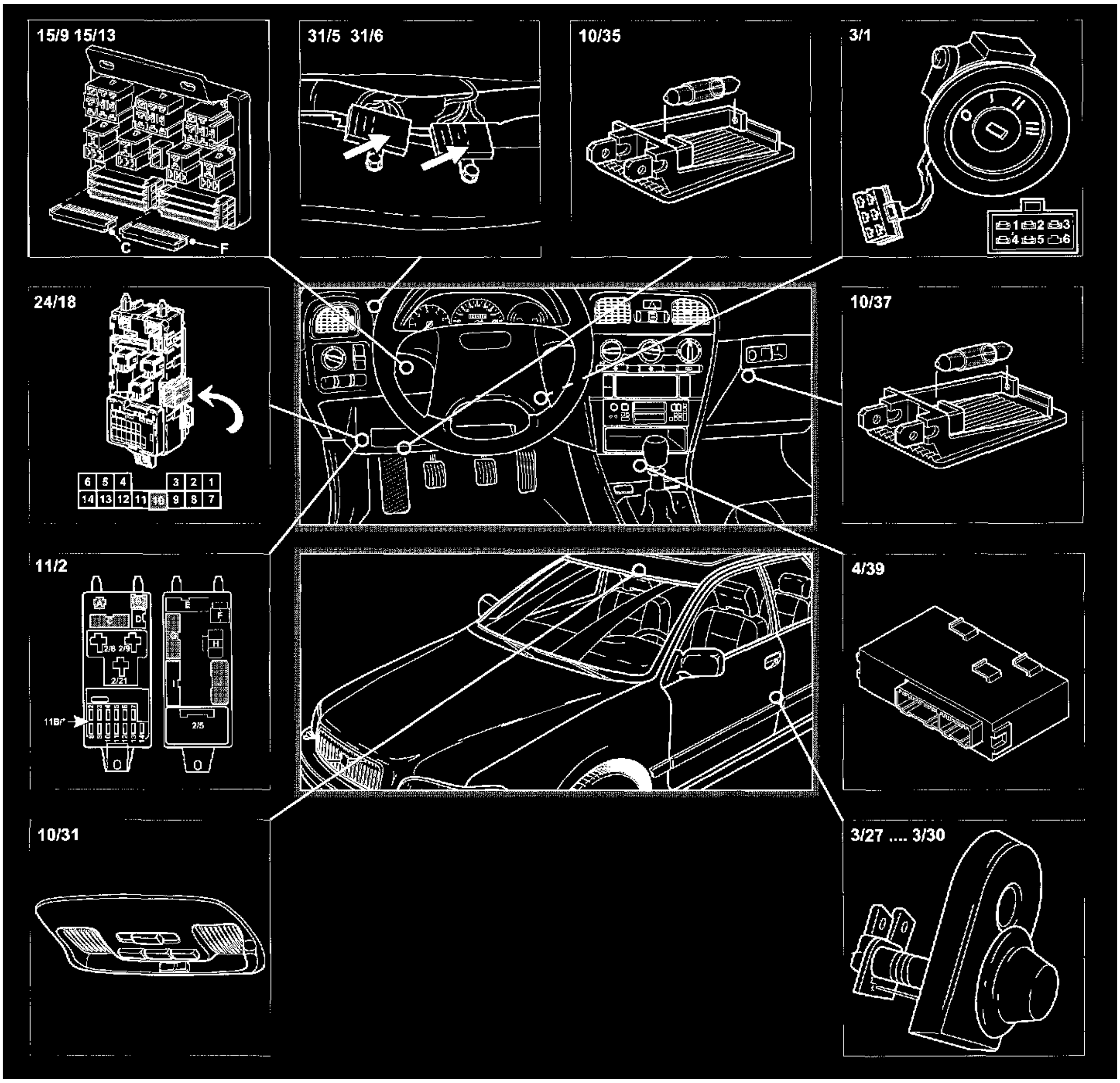
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Glove Compartment and Courtesy Lighting



Glove Compartment And Courtesy Lighting, Part 1 Of 2

Wiring Diagram

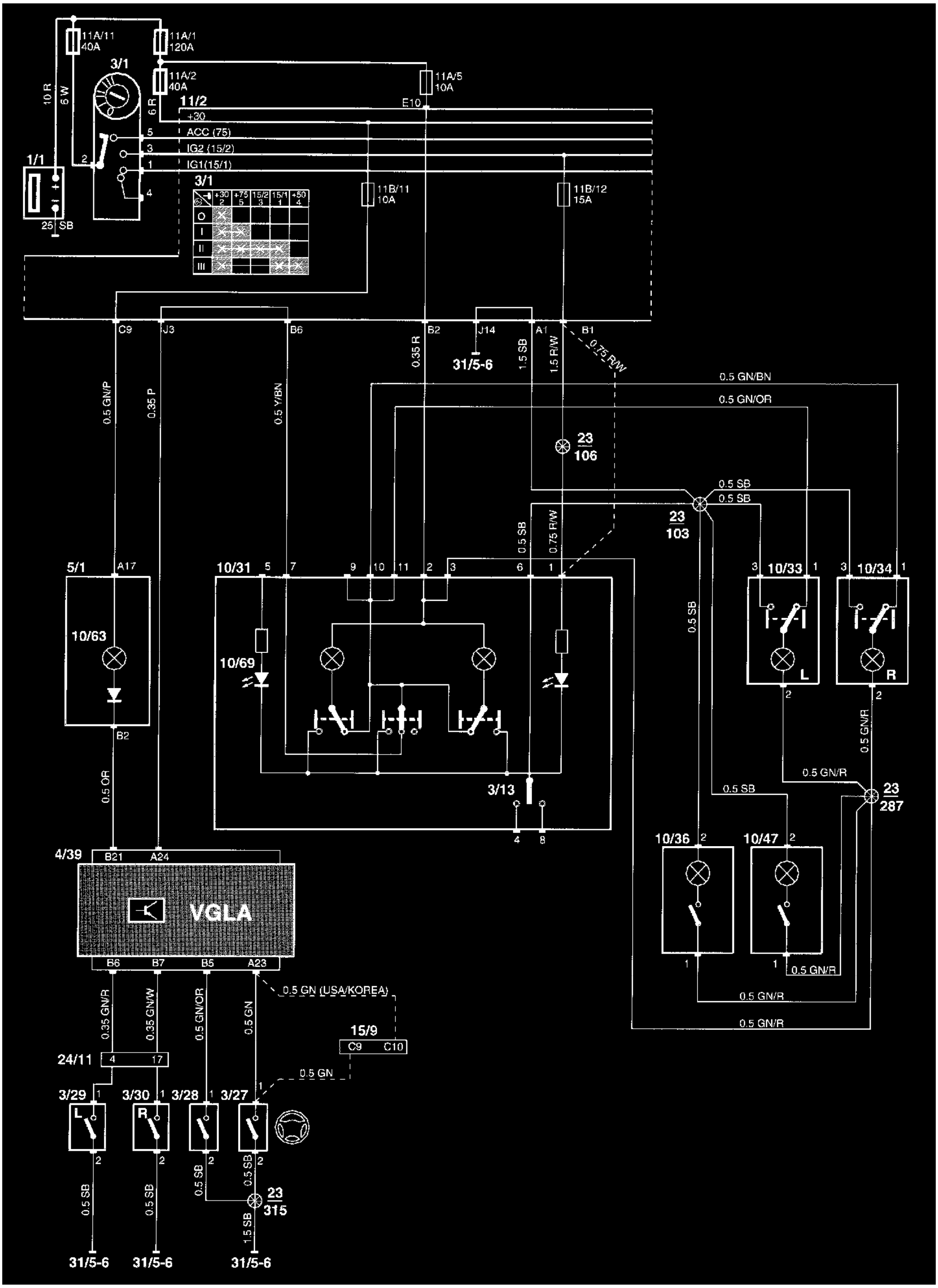


Glove Compartment And Courtesy Lighting, Part 2 Of 2

Component Locations

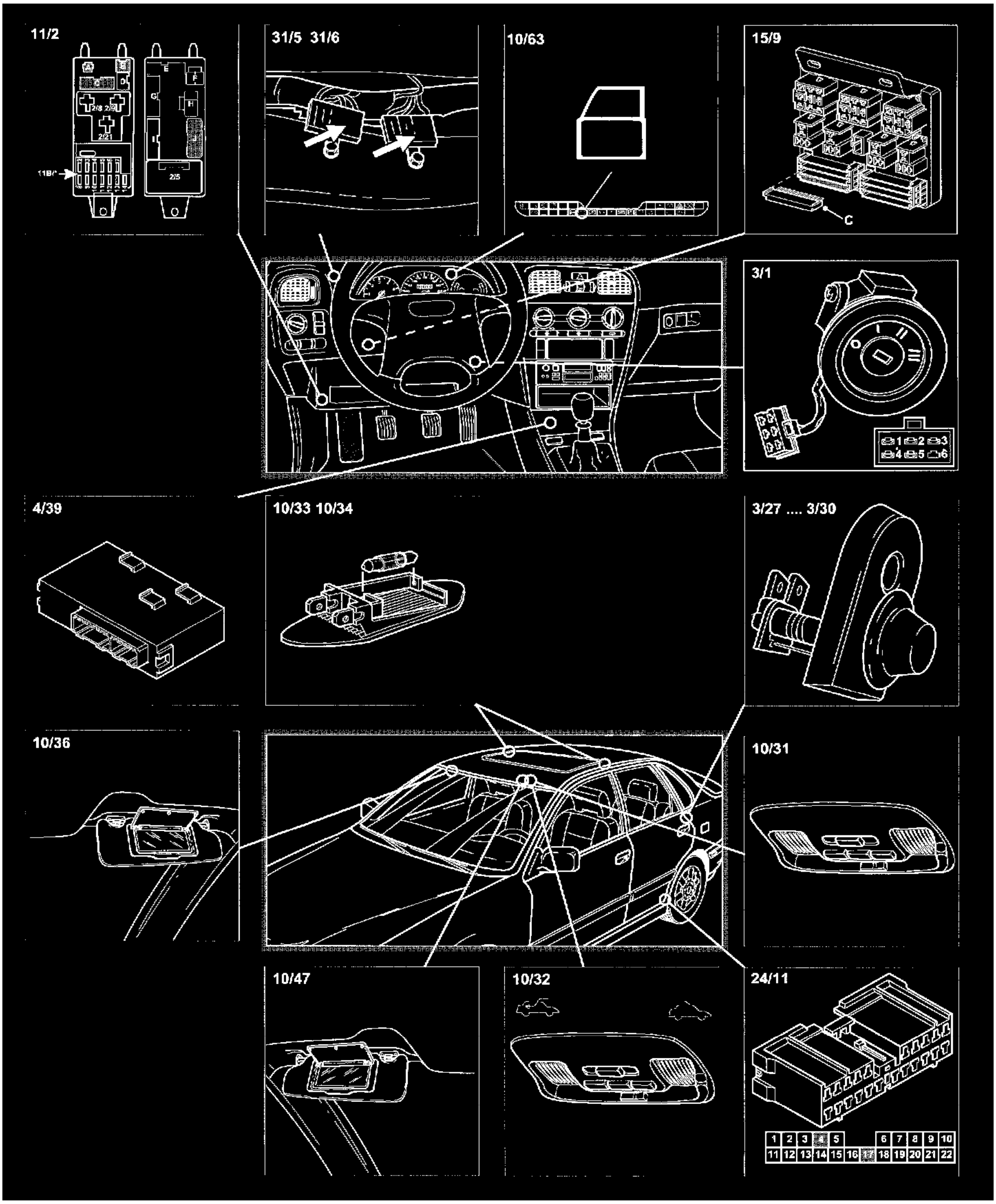
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Courtesy Lighting



Interior Lighting, Part 1 Of 2

Wiring Diagram

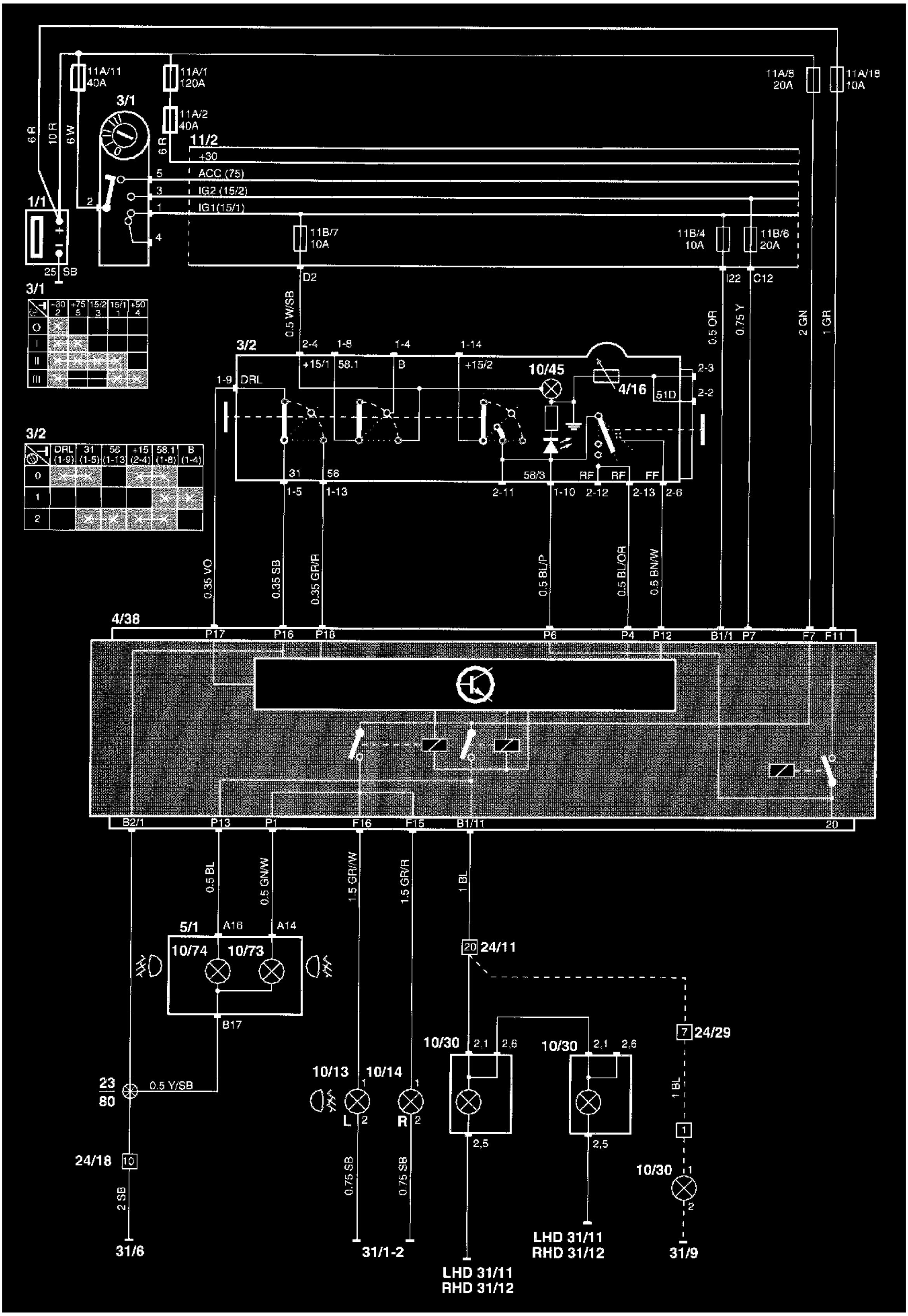


Interior Lighting, Part 2 Of 2

Component Locations

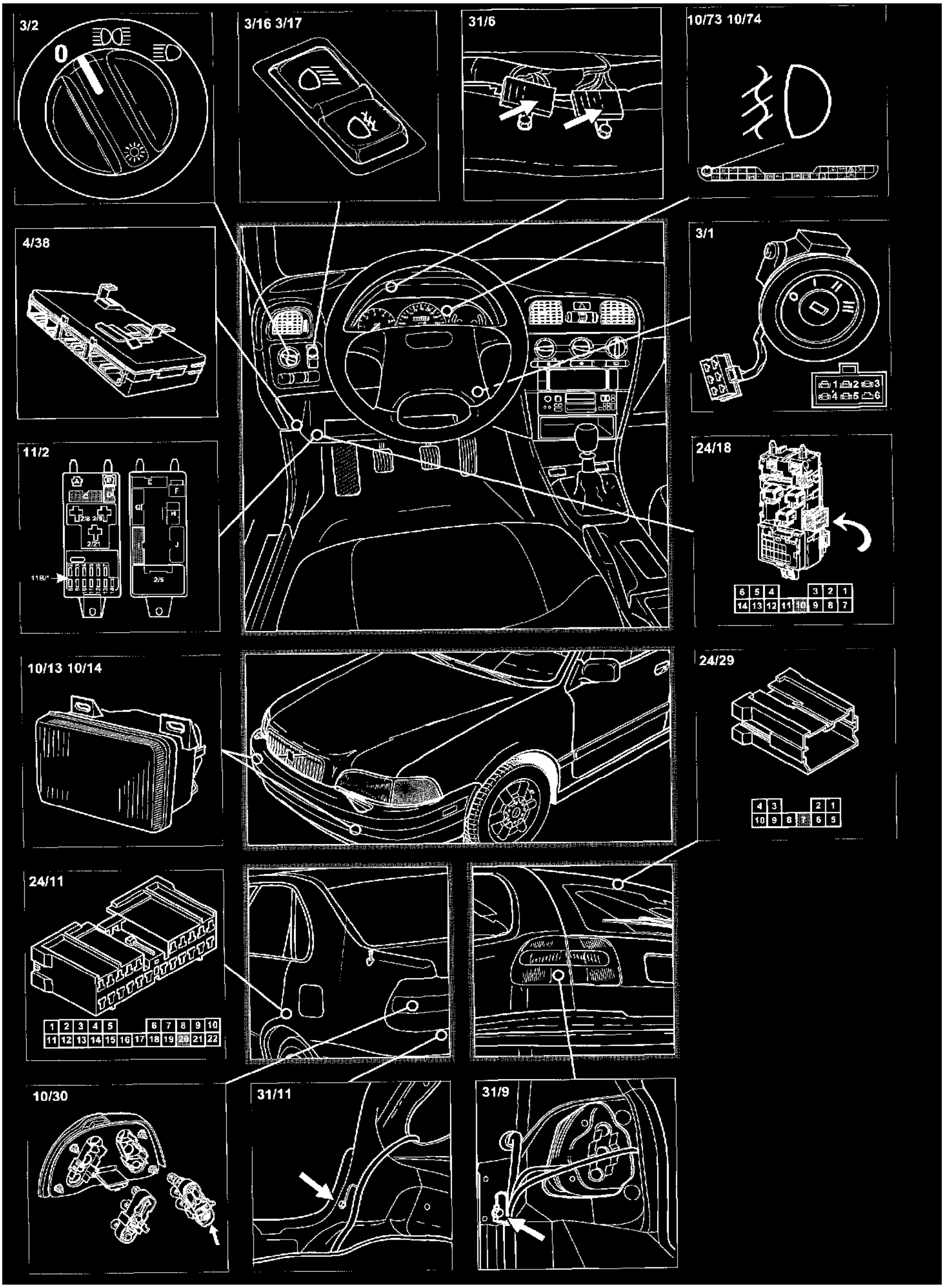
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Fog/Driving Lamp



Fog Lamps, Part 1 Of 2

Wiring diagram



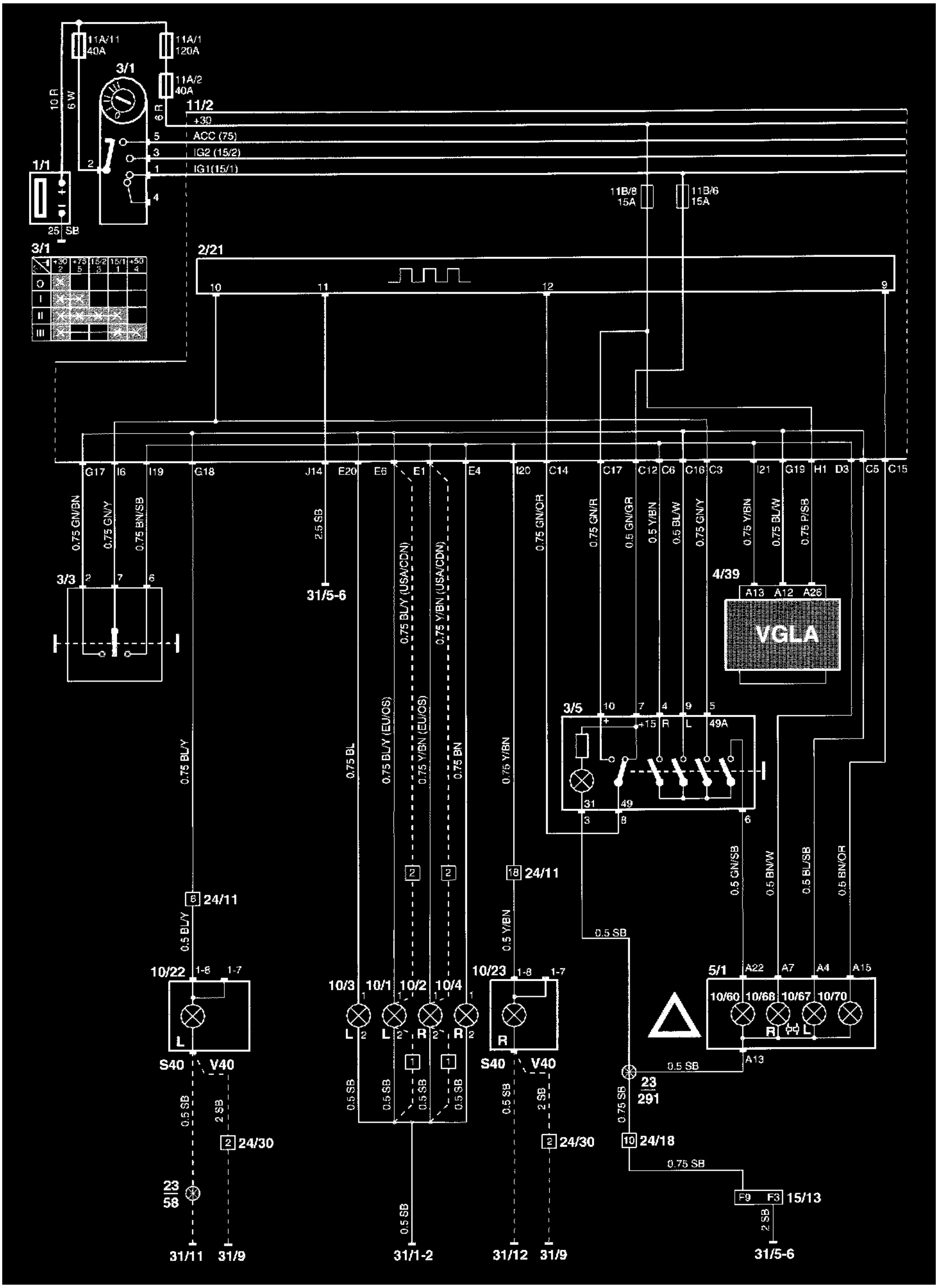
Fog Lamps, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

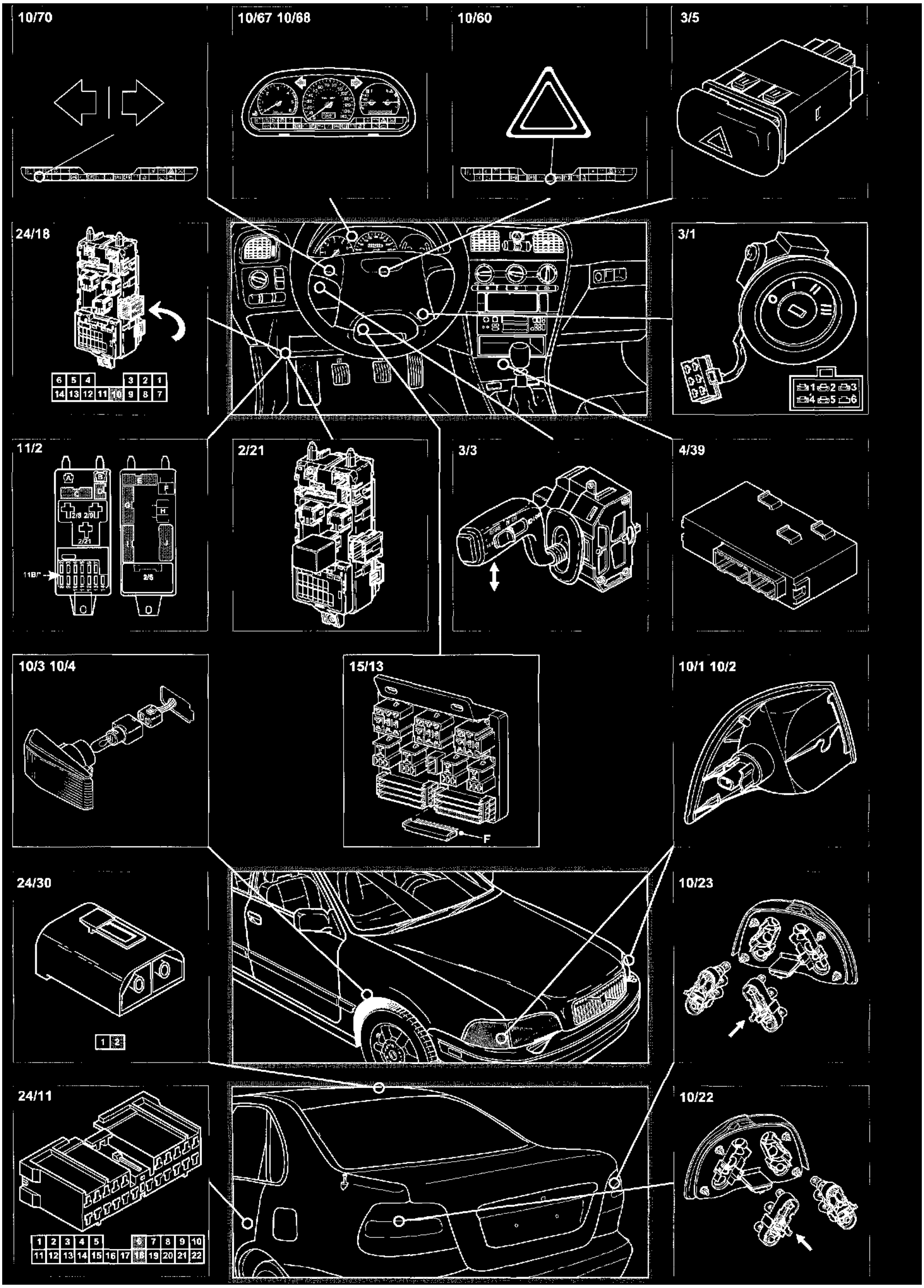
Hazard Warning Lamps

Turn Signal Lamps/Hazard Warning Signal Flashers



Turn Signal Lamps/Hazard Warning Signal, Part 1 Of 2

Wiring Diagram

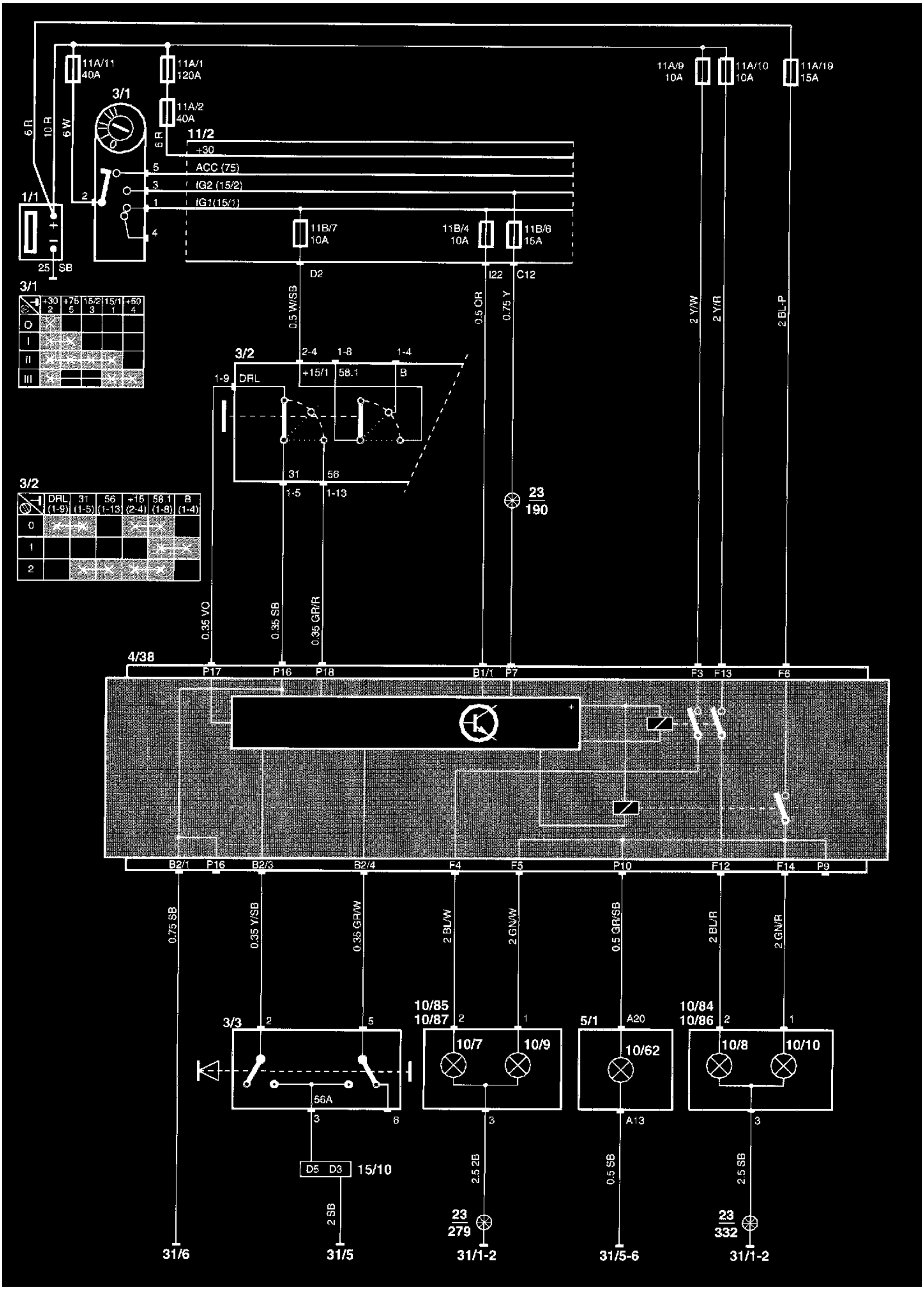


Turn Signal Lamps/Hazard Warning Signal, Part 2 Of 2

Component Locations

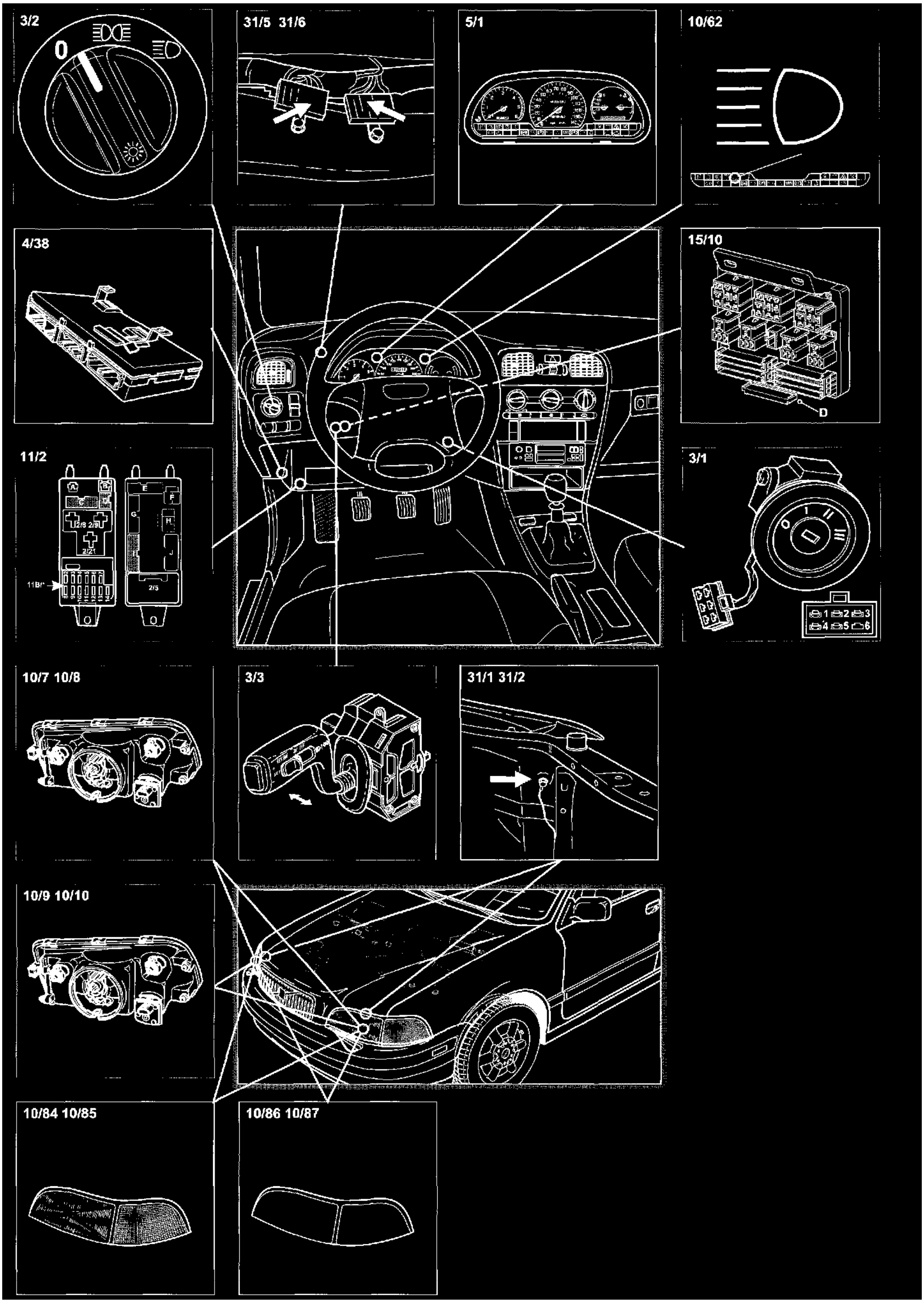
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

High and Low Beams



High And Low Beams, Part 1 Of 2

Wiring Diagram



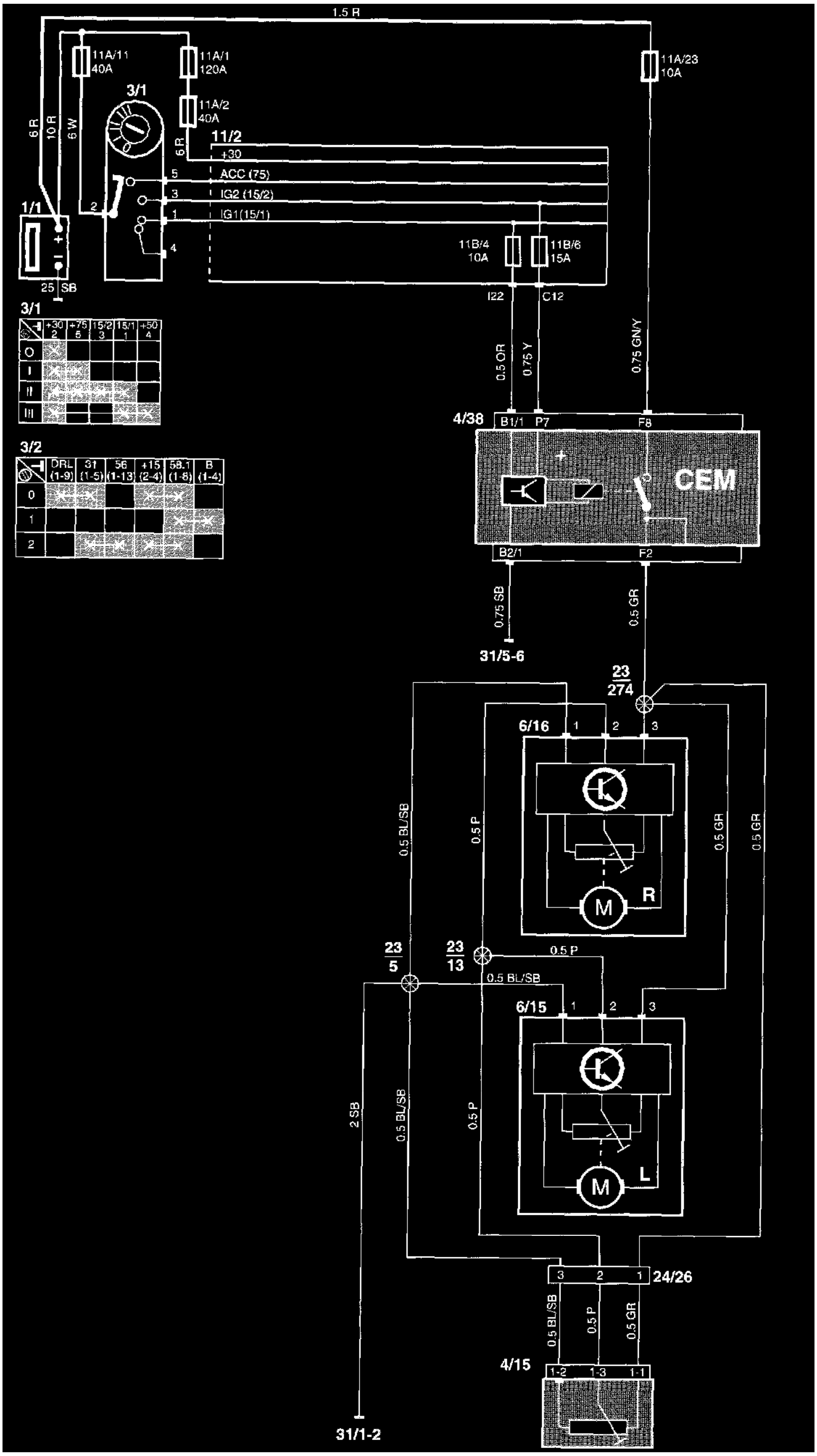
High And Low Beams, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

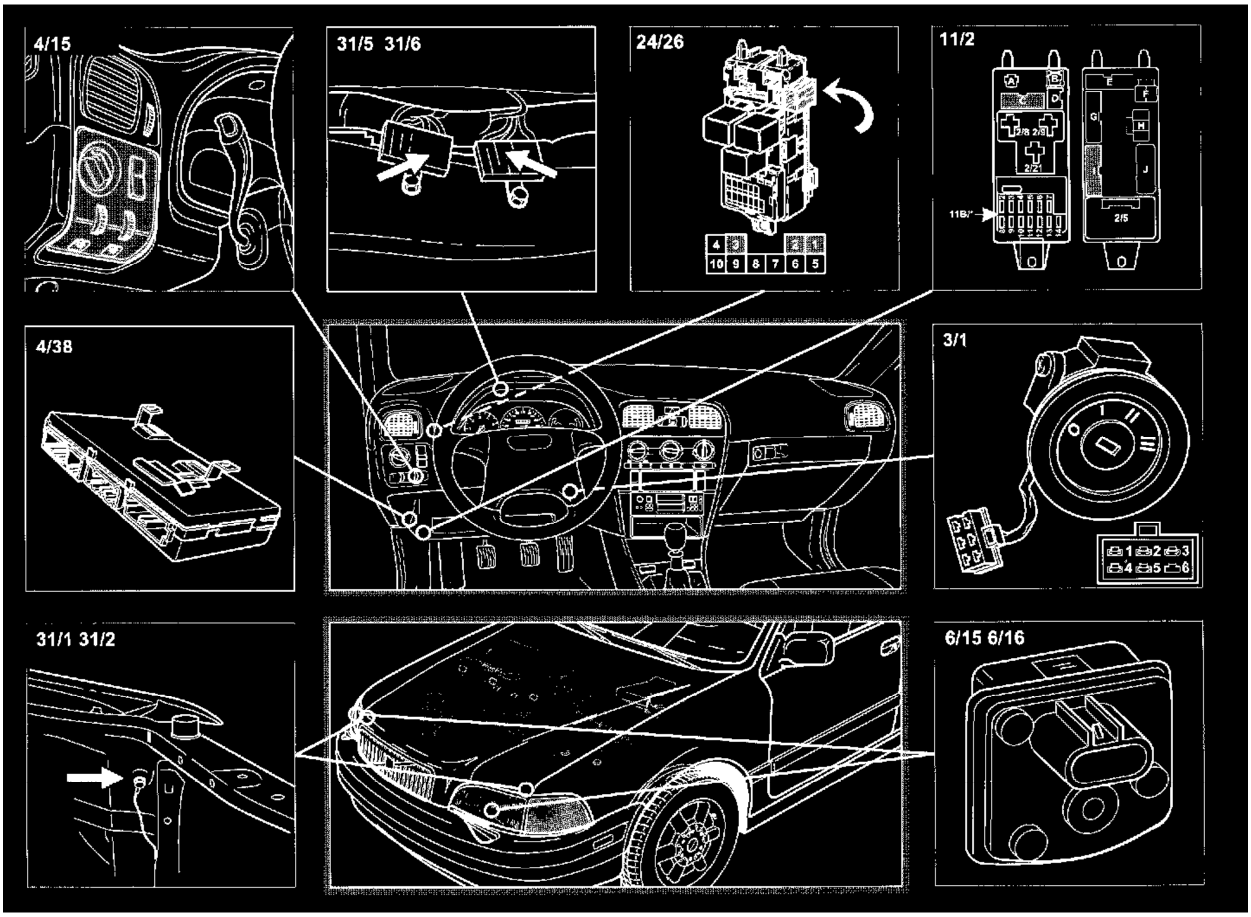
Headlamp Alignment

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2



Headlamp Alignment, Part 1 Of 2

Wiring Diagram

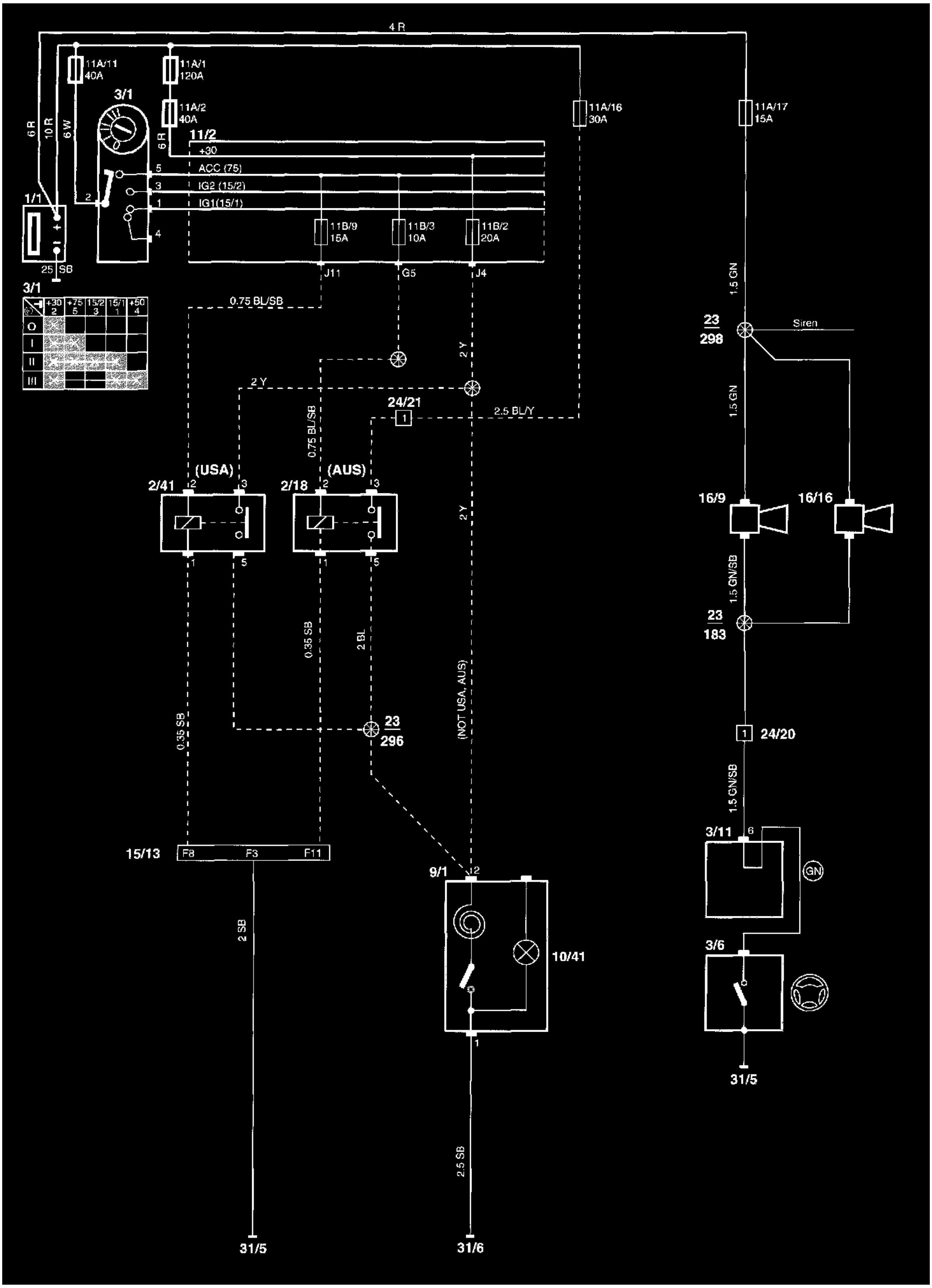


Headlamp Alignment, Part 2 Of 2

Component Locations

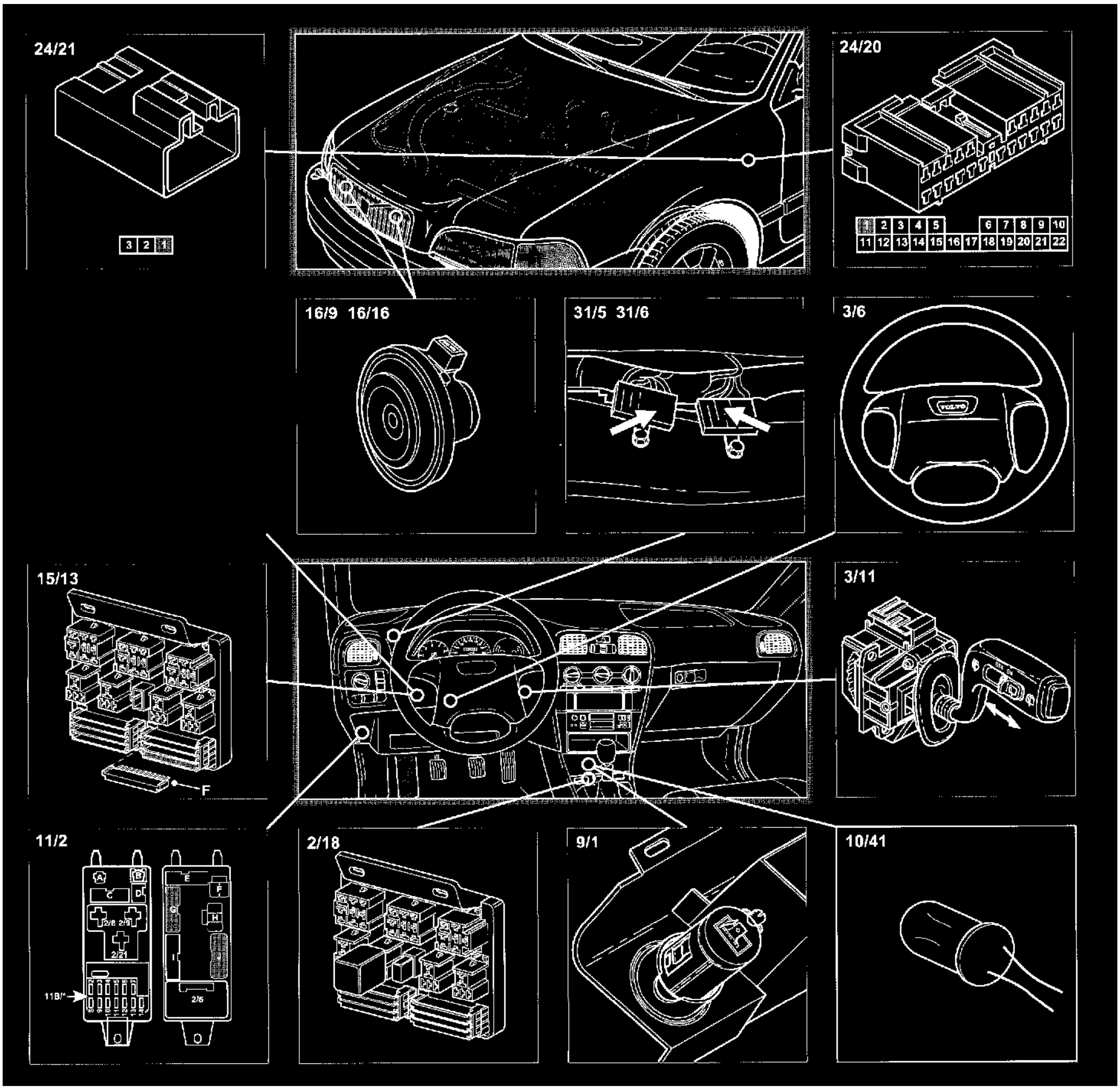
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Horn



Cigarette Lighter And Horn, Part 1 Of 2

Wiring Diagram



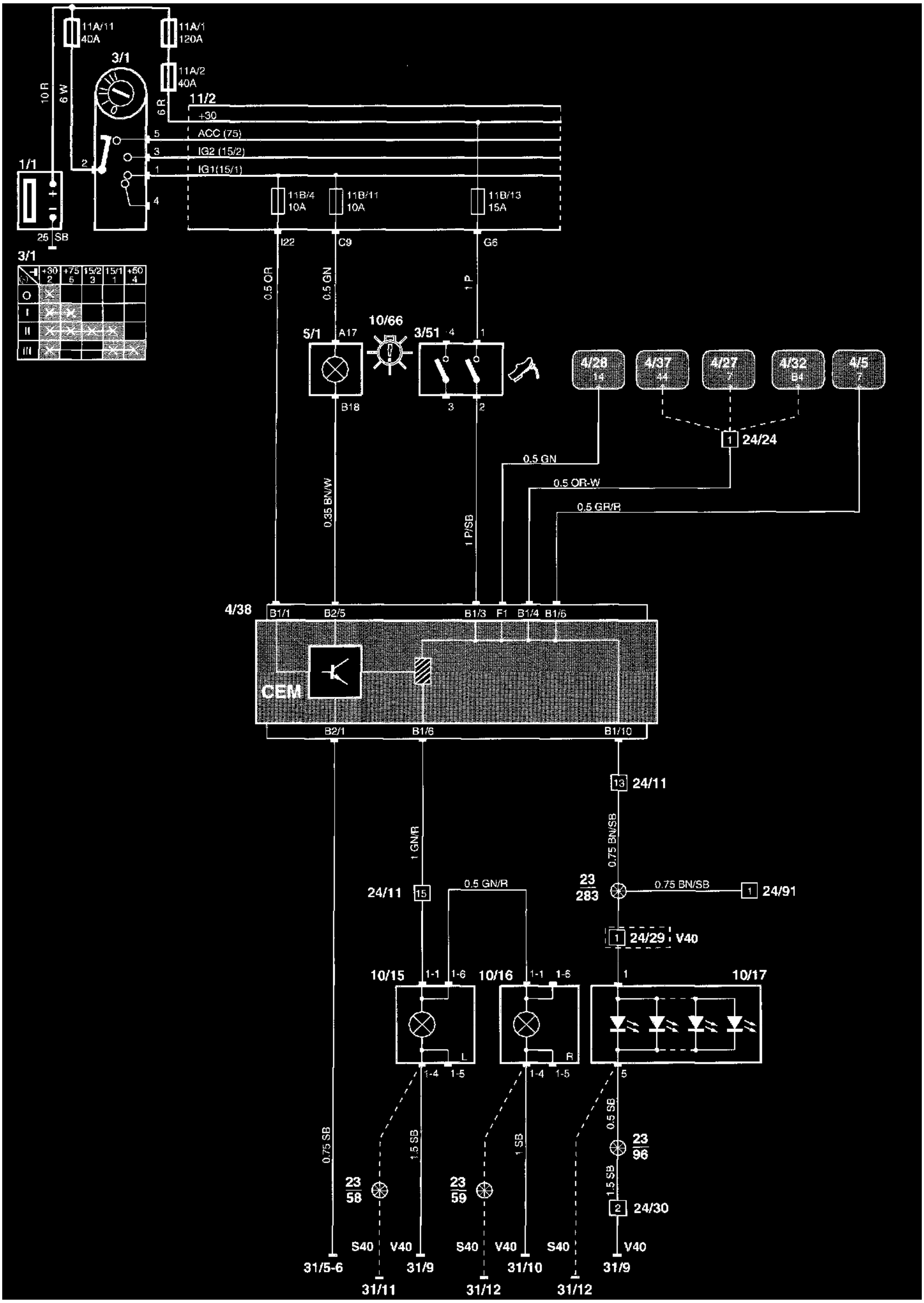
Cigarette Lighter And Horn, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

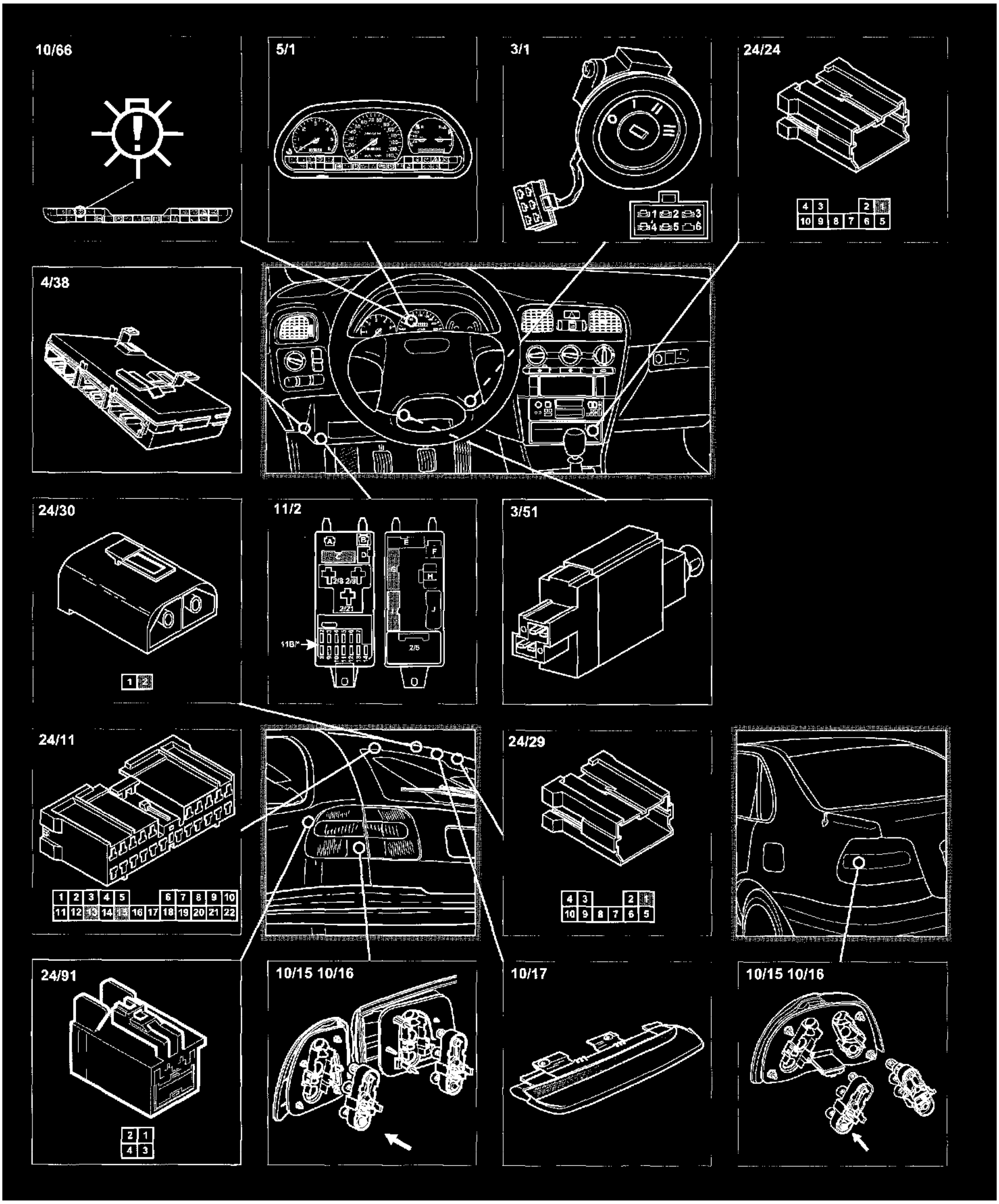
Lamp Out Sensor

Stop (brake) lamps and bulb failure warning sensor



Stop Lamps & Bulb Failure Warning Sensor, Part 1 Of 2

Wiring Diagram

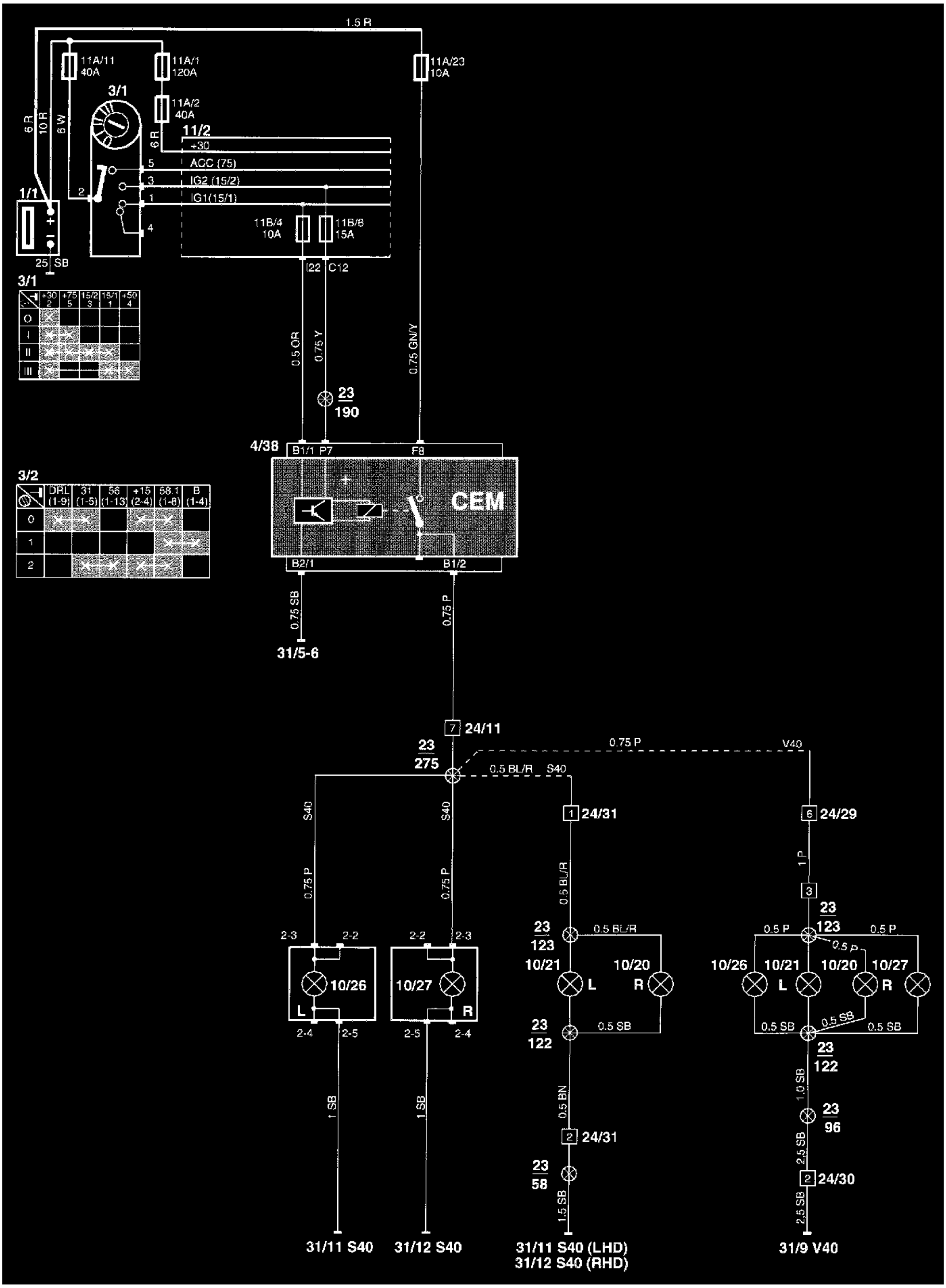


Stop Lamps & Bulb Failure Warning Sensor, Part 2 Of 2

Component Locations

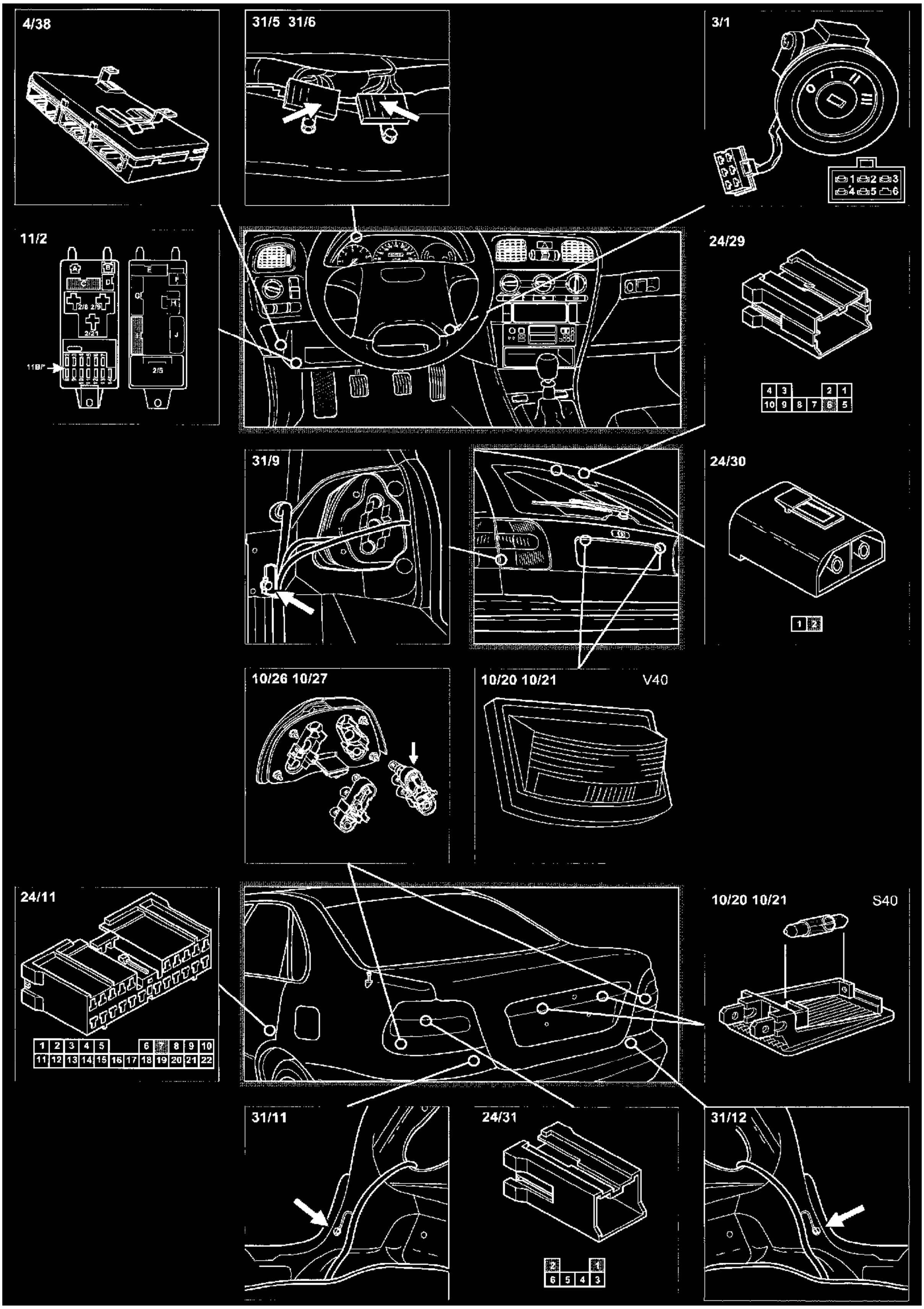
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

License Plate Lamp



Tail Lighting And License Plate Lighting, Part 1 Of 2

Wiring Diagram

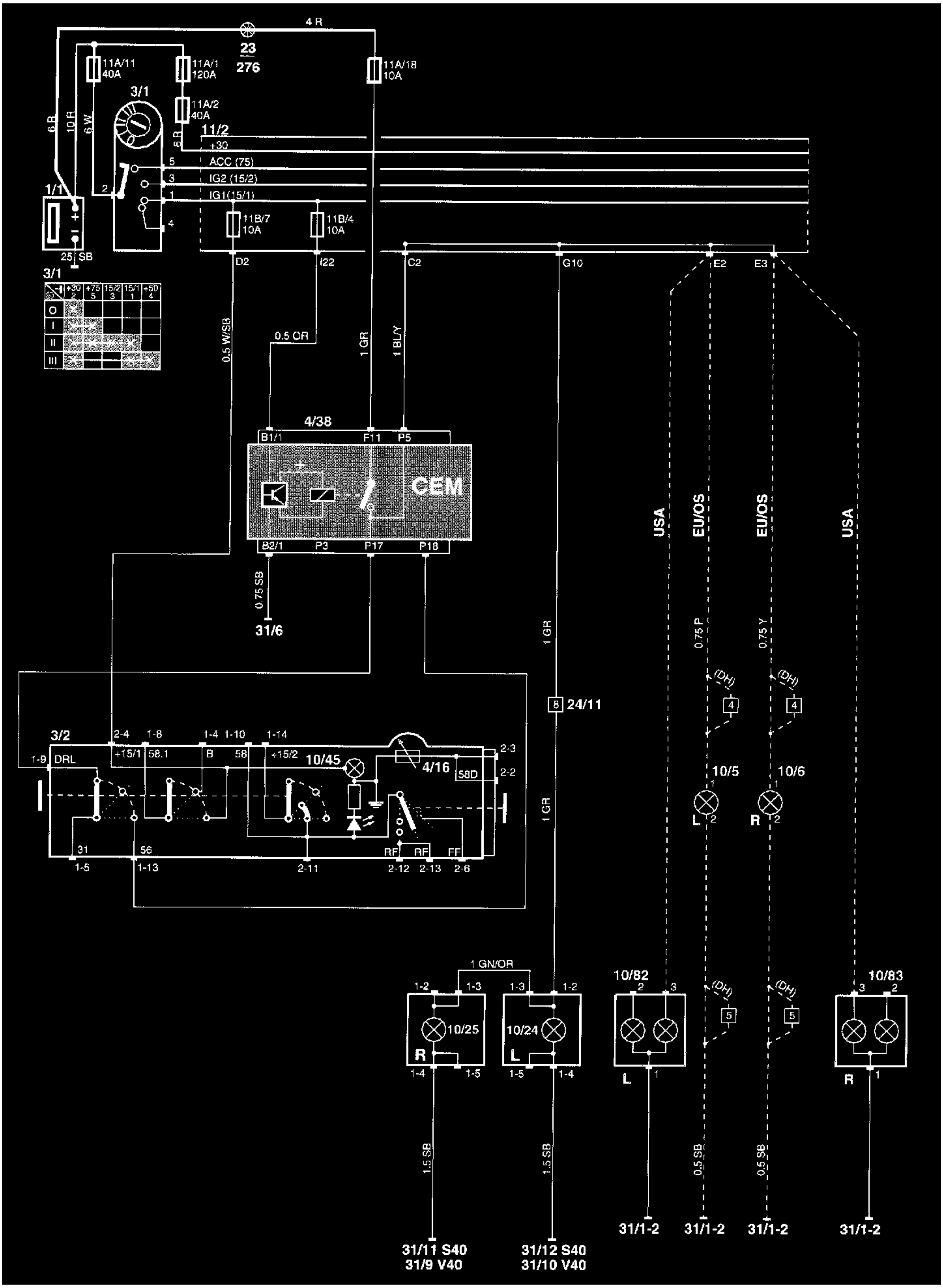


Tail Lighting And License Plate Lighting, Part 2 Of 2

Component Locations

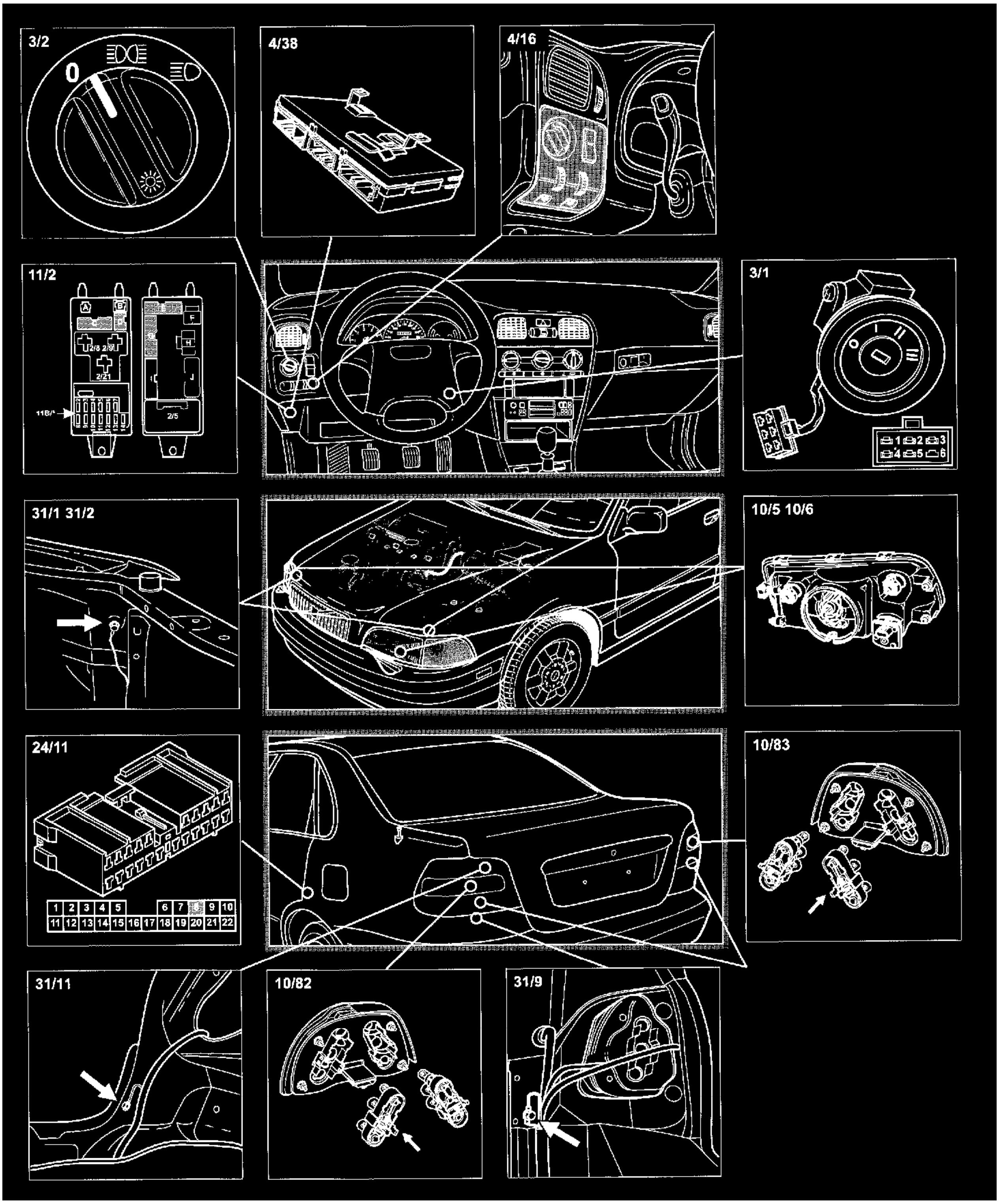
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Parking Lamps 1



Parking Lamps, Part 1 Of 2

Wiring Diagram

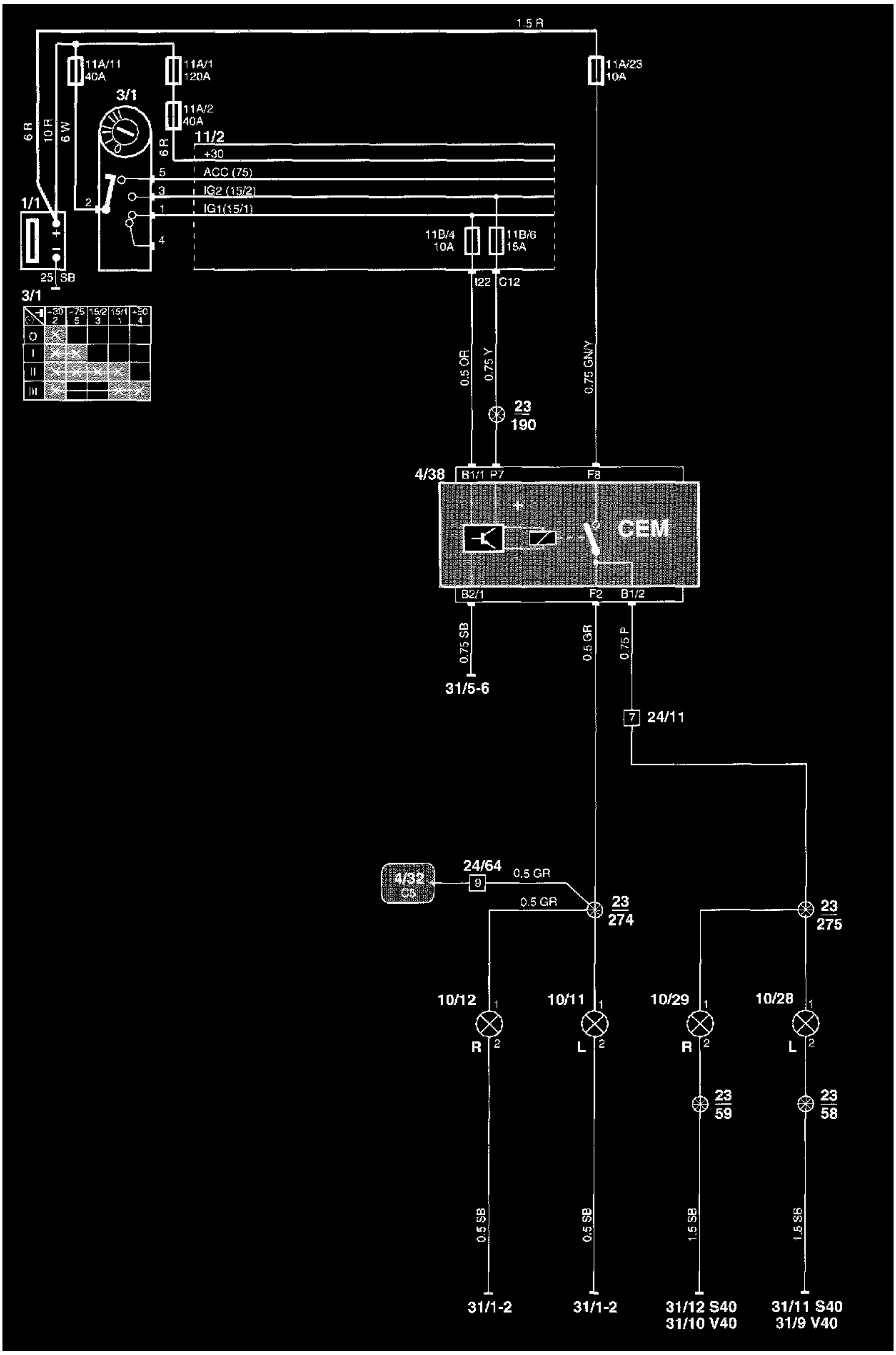


Parking Lamps, Part 2 Of 2

Component Locations

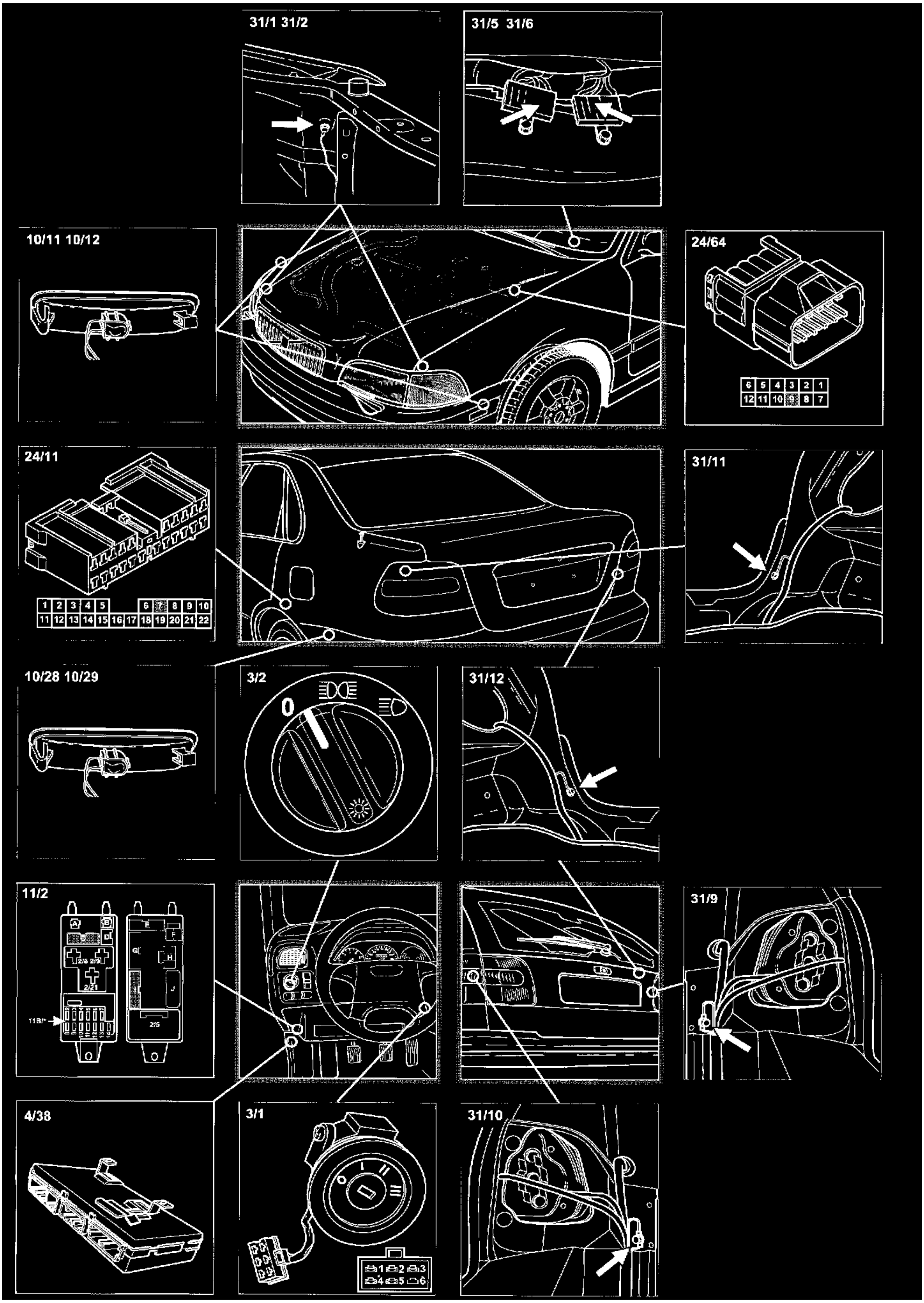
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Parking Lamps 2



Parking Lamps, Part 1 Of 2

Wiring Diagram

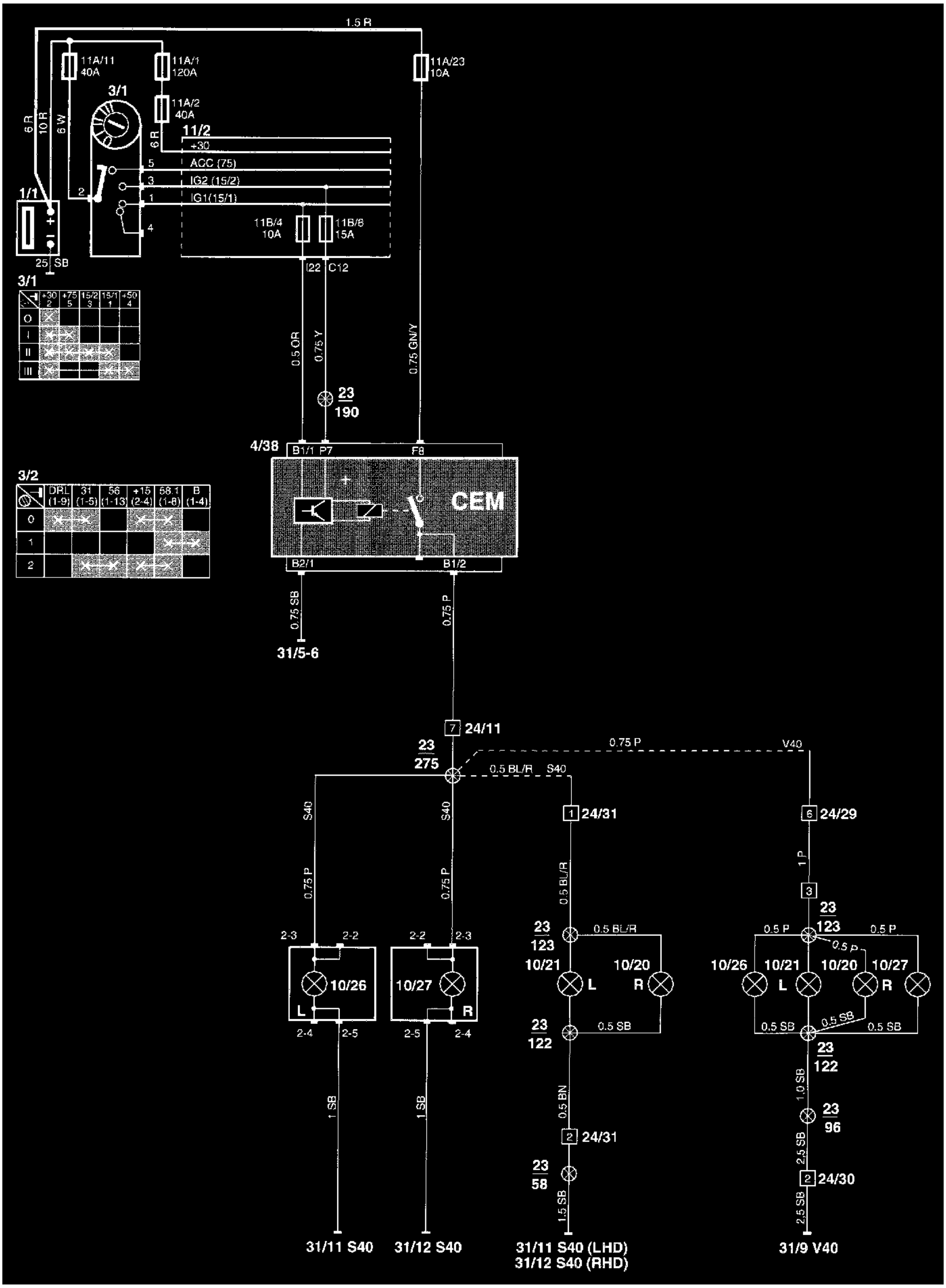


Parking Lamps, Part 2 Of 2

Component Locations

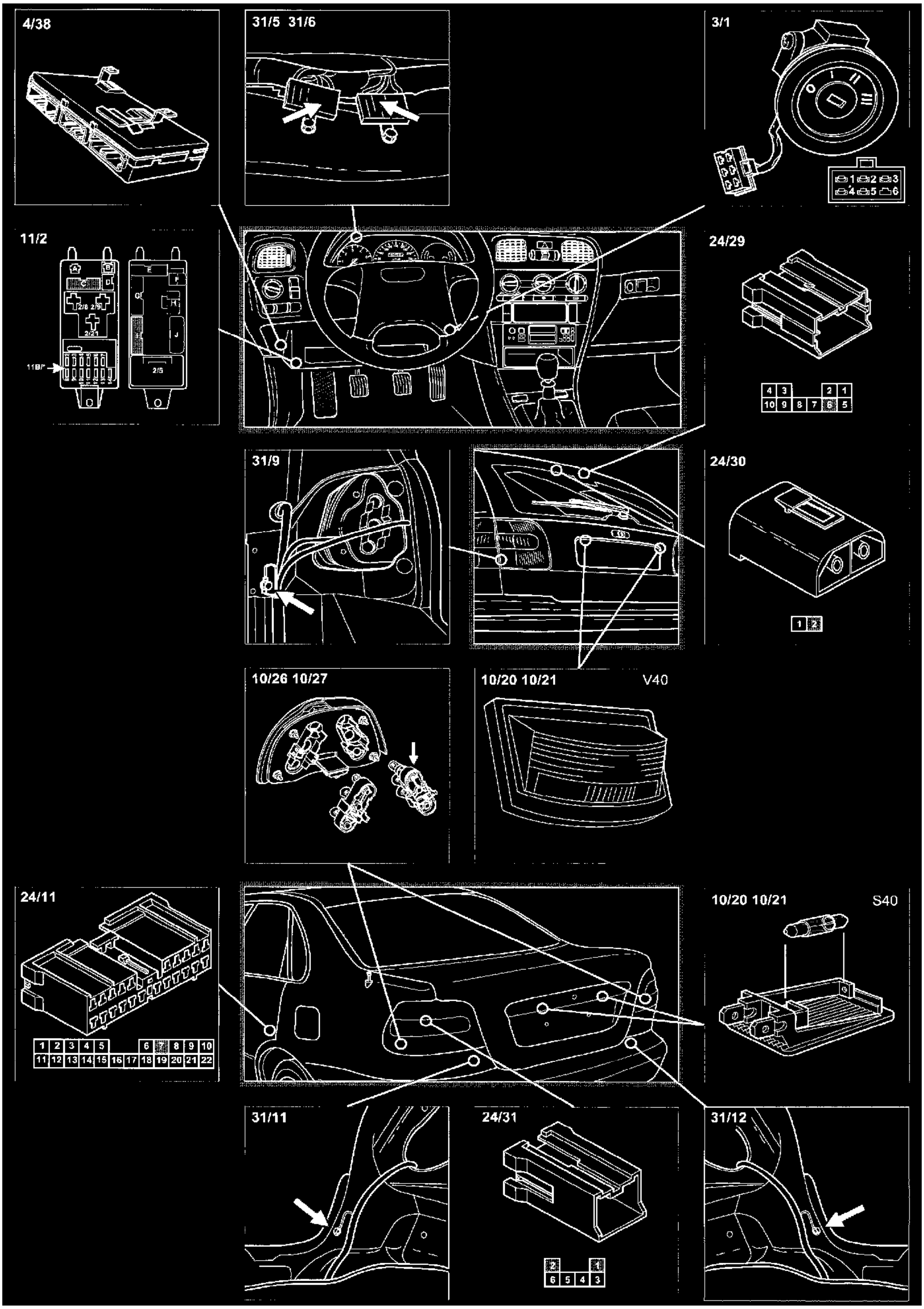
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Tail Lamp



Tail Lighting And License Plate Lighting, Part 1 Of 2

Wiring Diagram

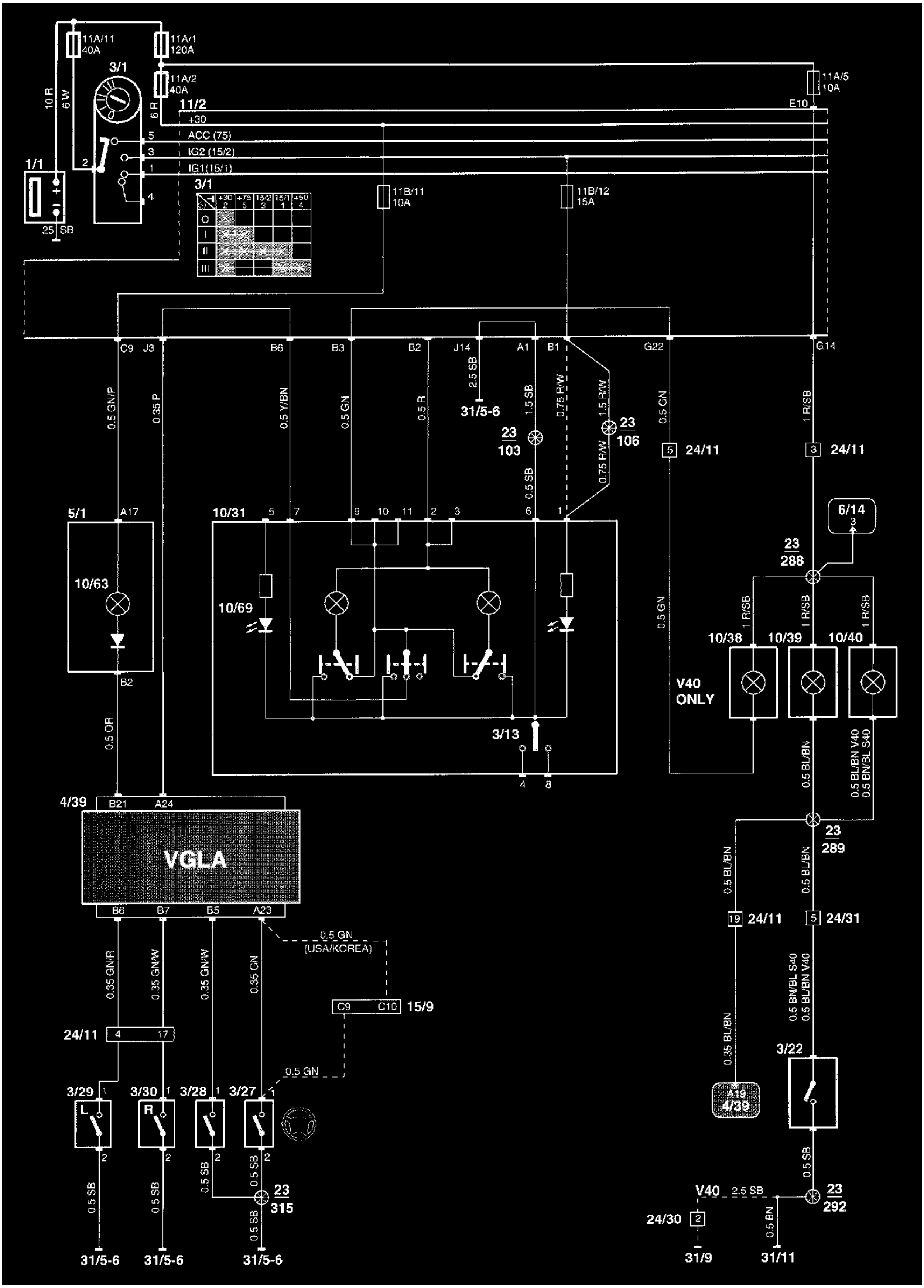


Tail Lighting And License Plate Lighting, Part 2 Of 2

Component Locations

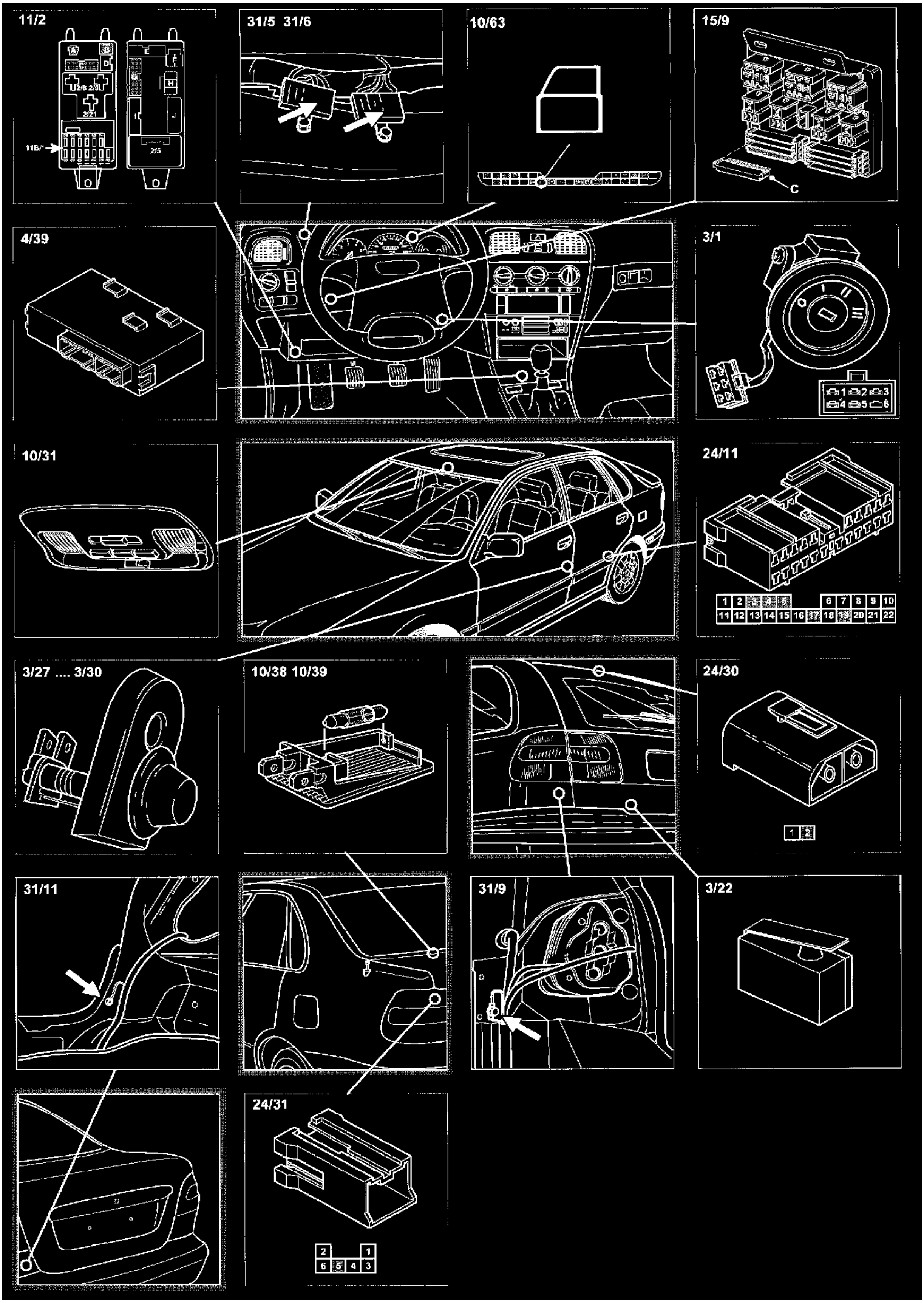
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Trunk Lamp



Cargo Compartment And Tailgate Lighting, Part 1 Of 2

Wiring Diagram



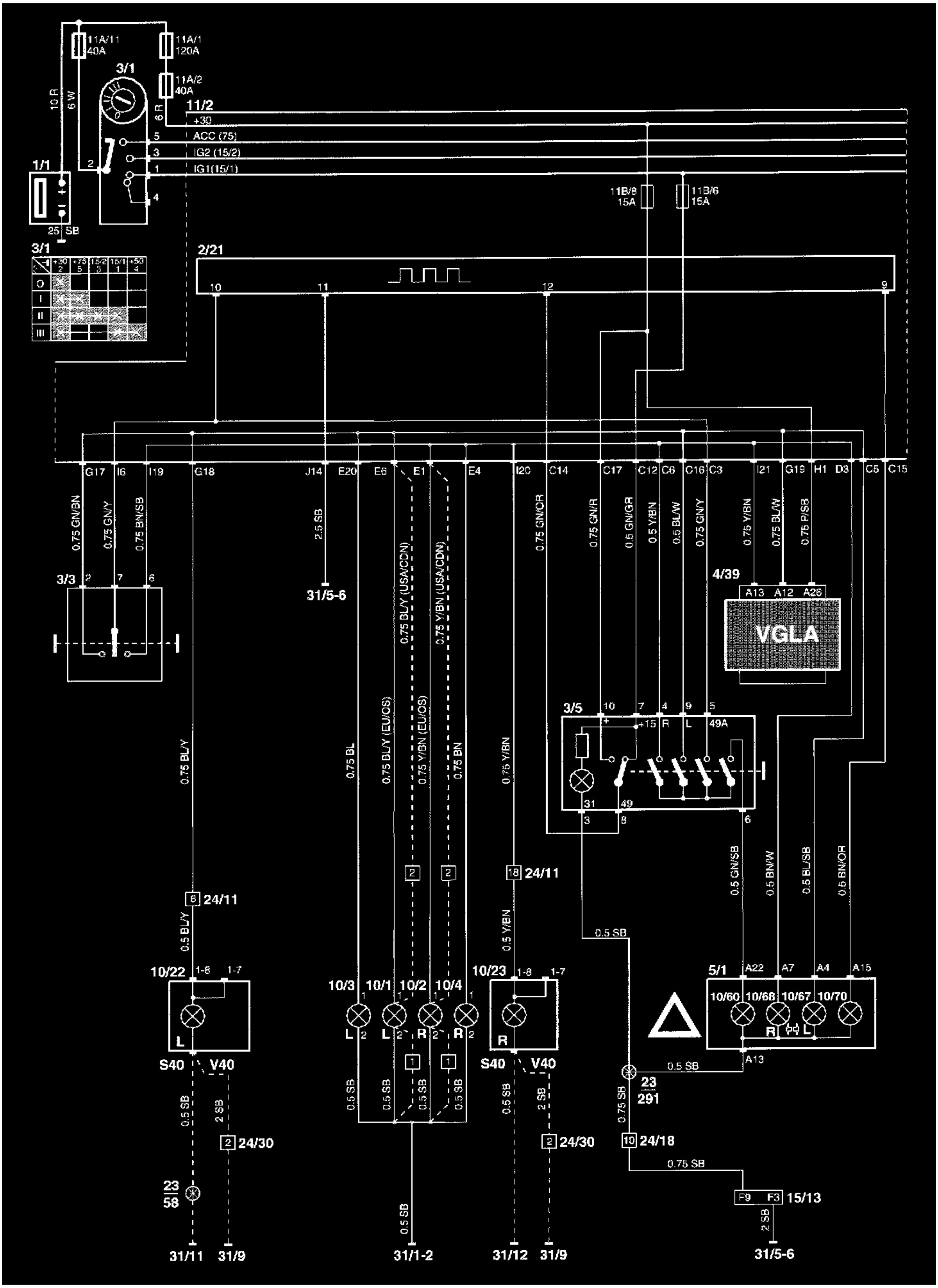
Cargo Compartment And Tailgate Lighting, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

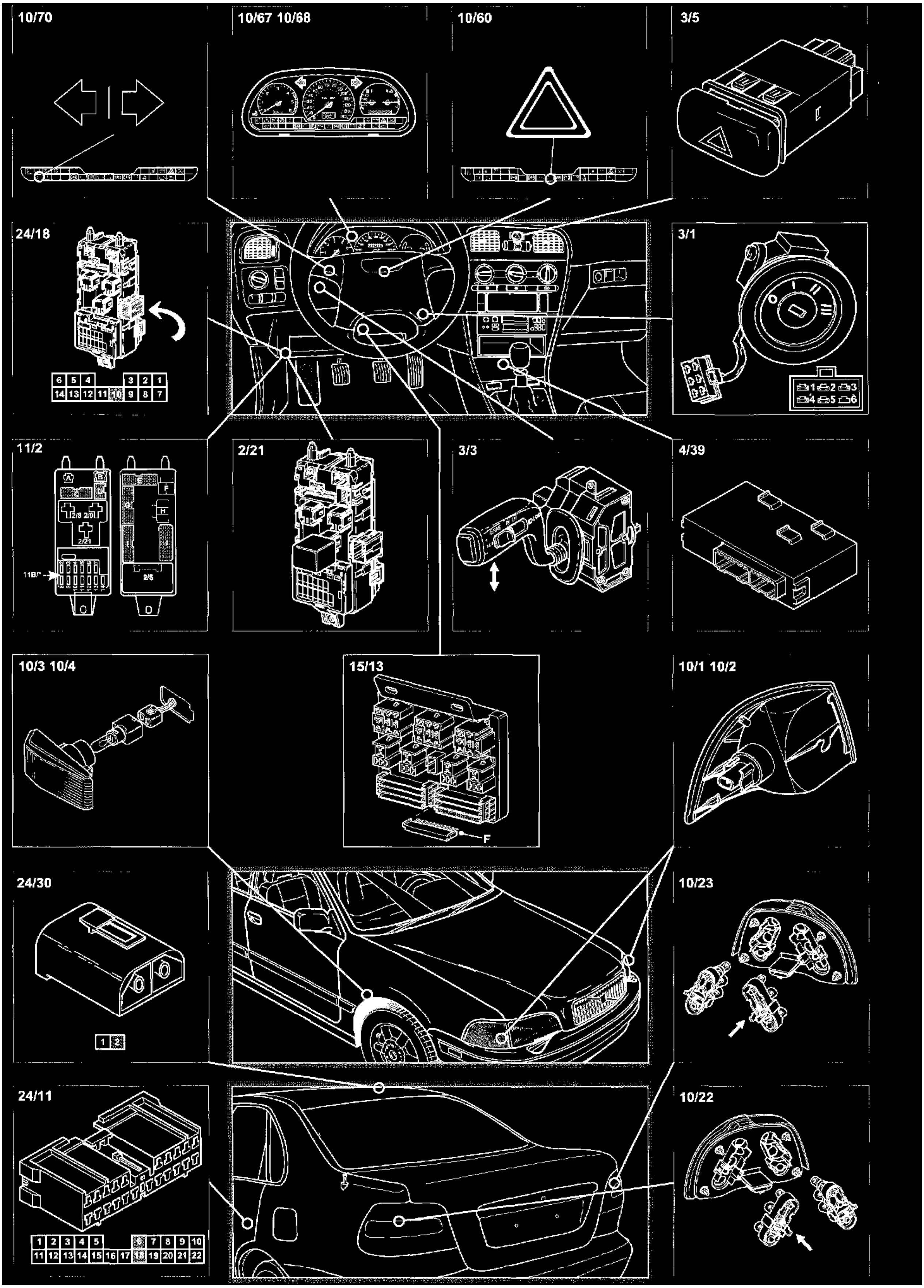
Turn Signals

Turn Signal Lamps/Hazard Warning Signal Flashers



Turn Signal Lamps/Hazard Warning Signal, Part 1 Of 2

Wiring Diagram



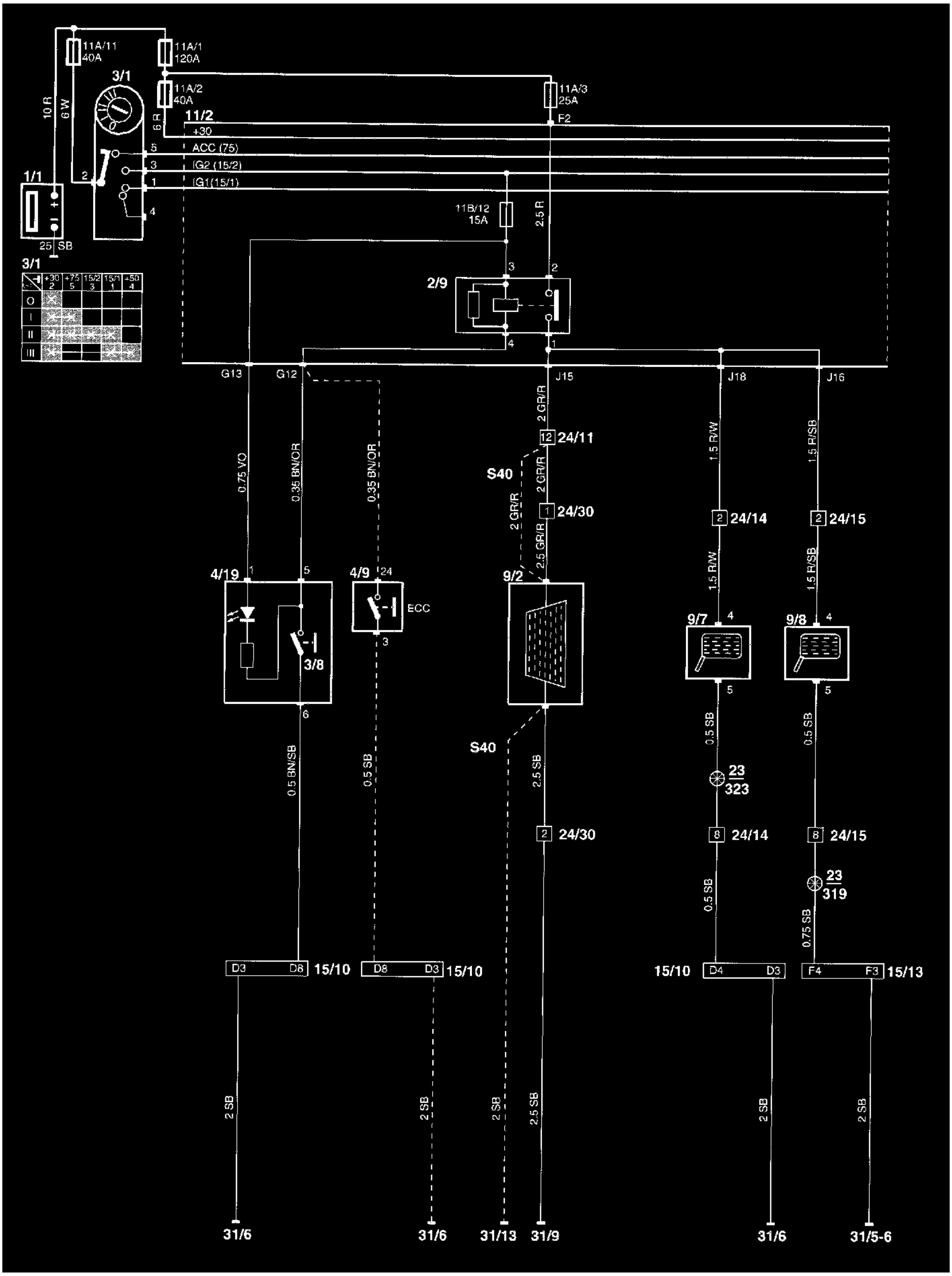
Turn Signal Lamps/Hazard Warning Signal, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

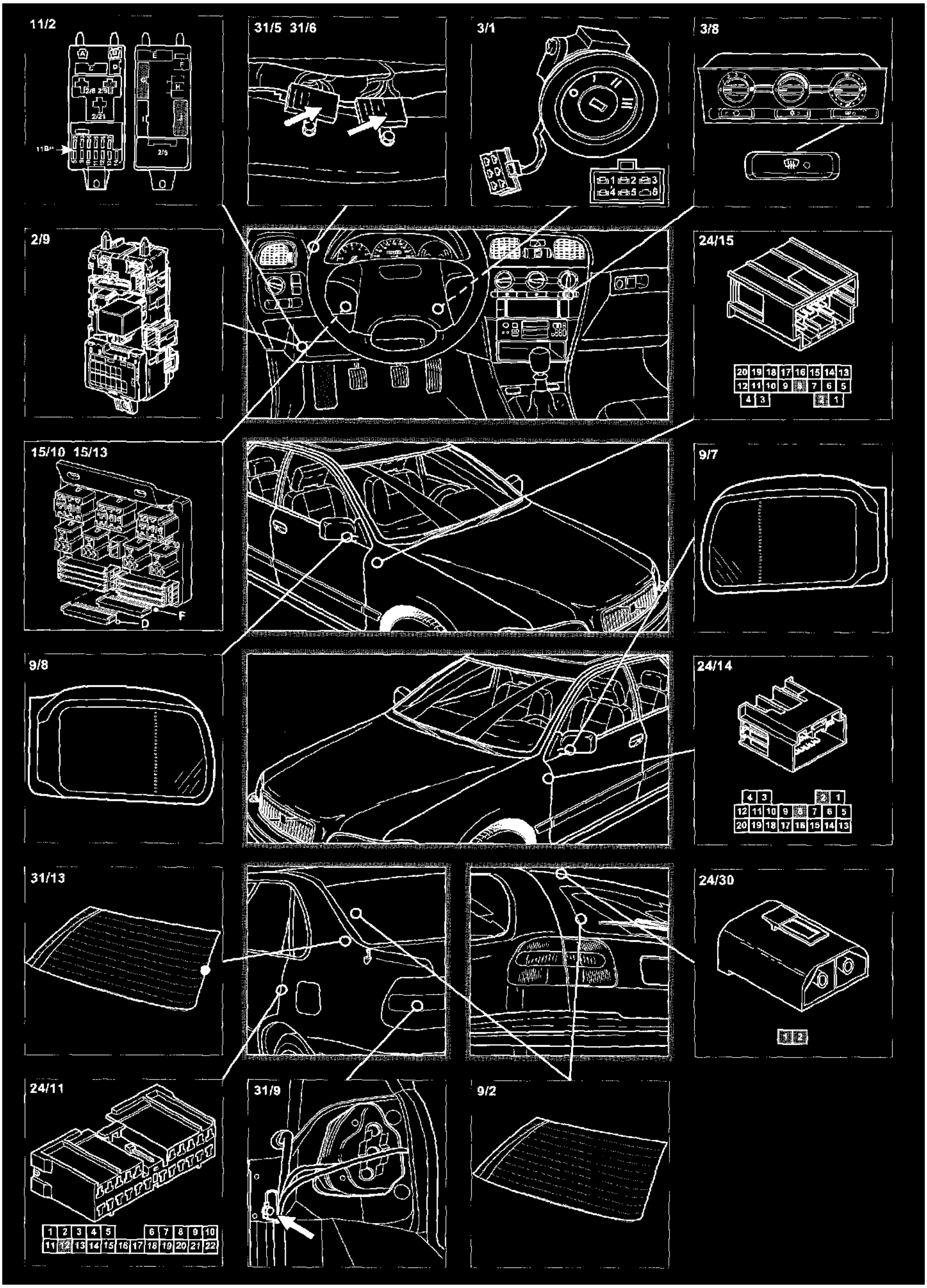
Rear Demist, Heated Door Mirrors

Heated Rear Window And Heated Door Mirrors



Heated Rear Window And Door Mirrors, Part 1 Of 2

Wiring Diagram

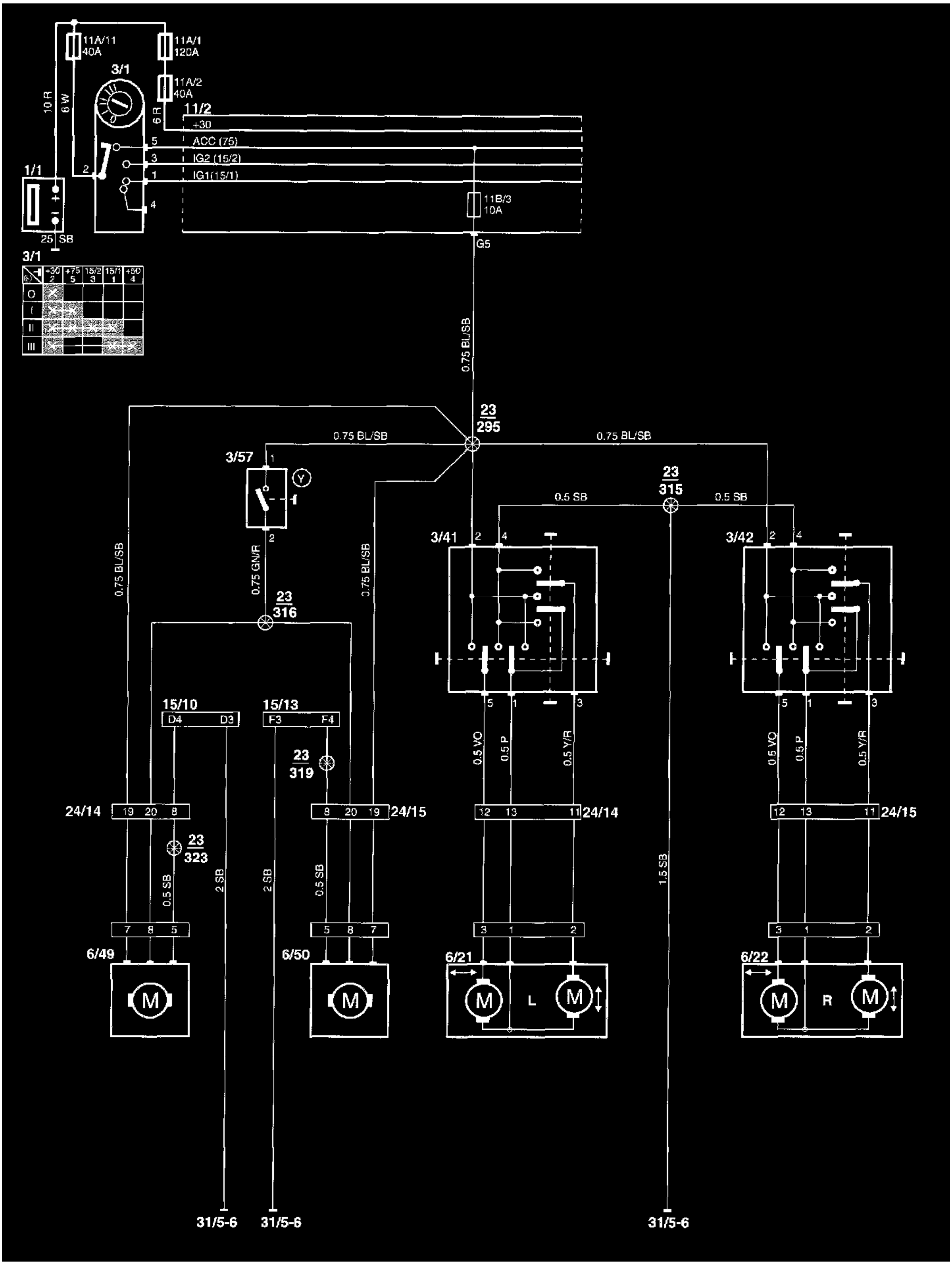


Heated Rear Window And Door Mirrors, Part 2 Of 2

Component Locations

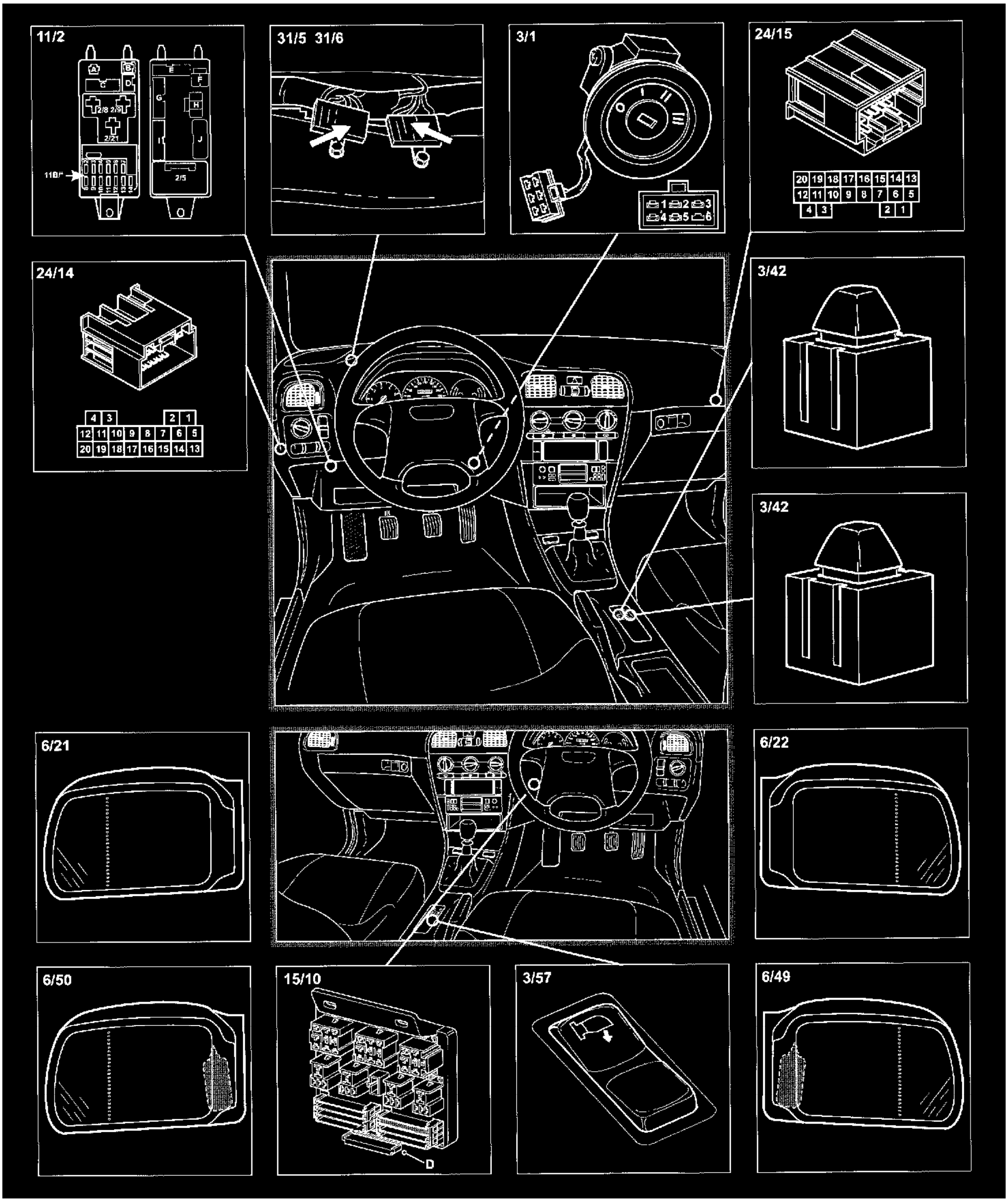
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Power Door Mirrors



Power Door Mirrors, Part 1 Of 2

Wiring Diagram



Power Door Mirrors, Part 2 Of 2

Component Locations

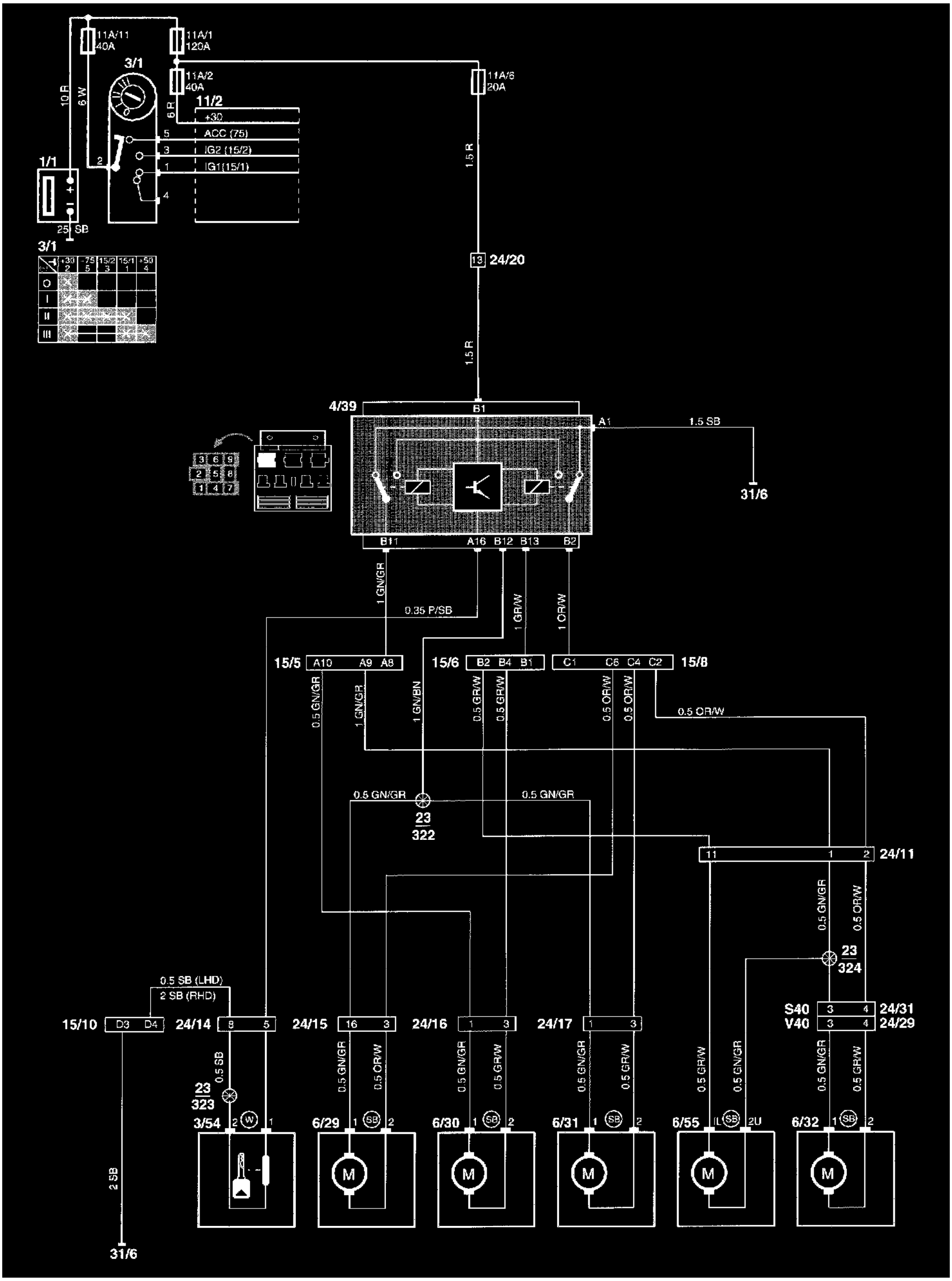
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Parking Brake Warning Switch

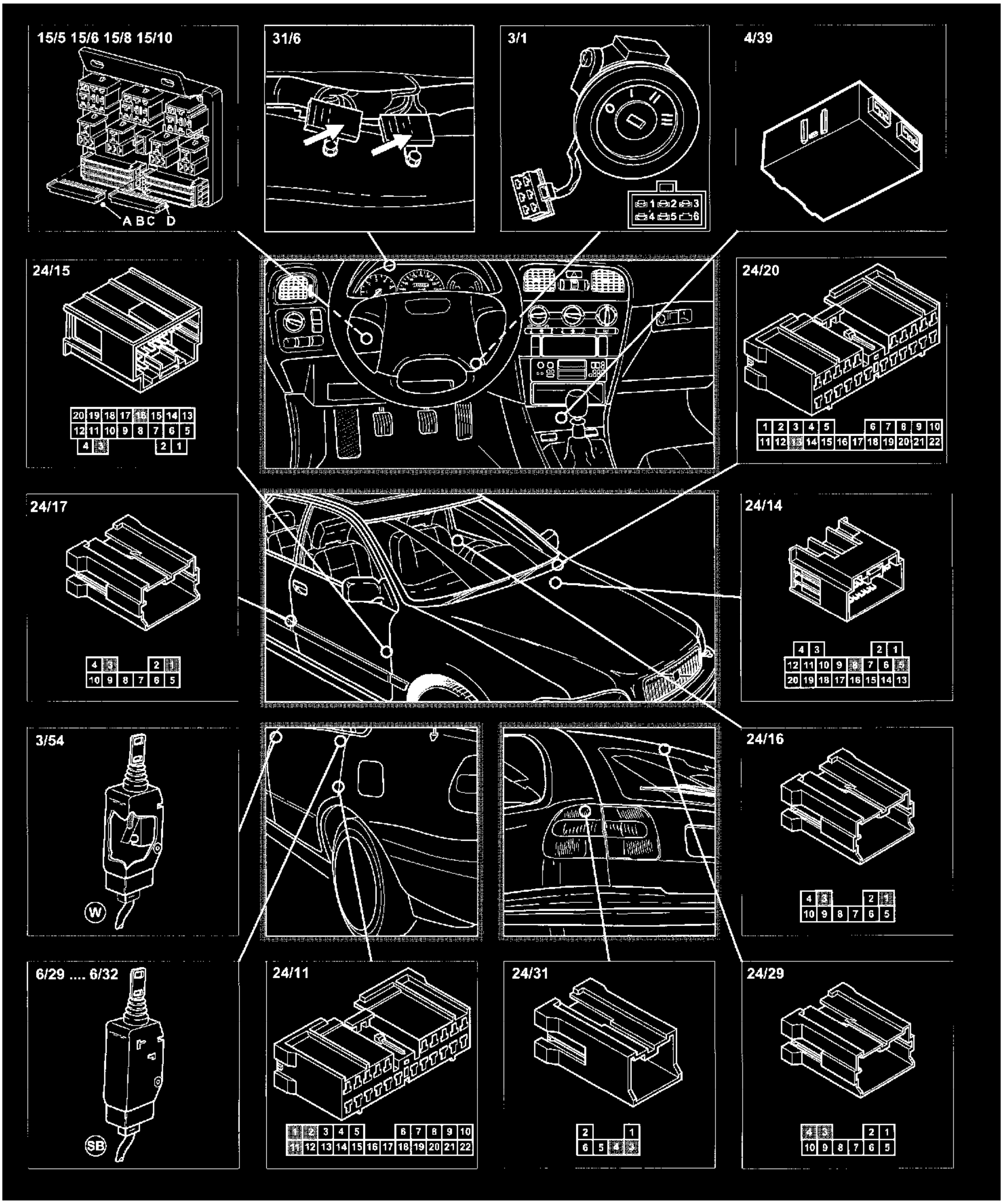
Refer to **Antilock Brakes/Traction Control Systems - Diagrams - Electrical**

See: Brakes and Traction Control/Antilock Brakes / Traction Control Systems/Diagrams/Electrical Diagrams

Central Locking



Central Locking, Part 1 Of 2

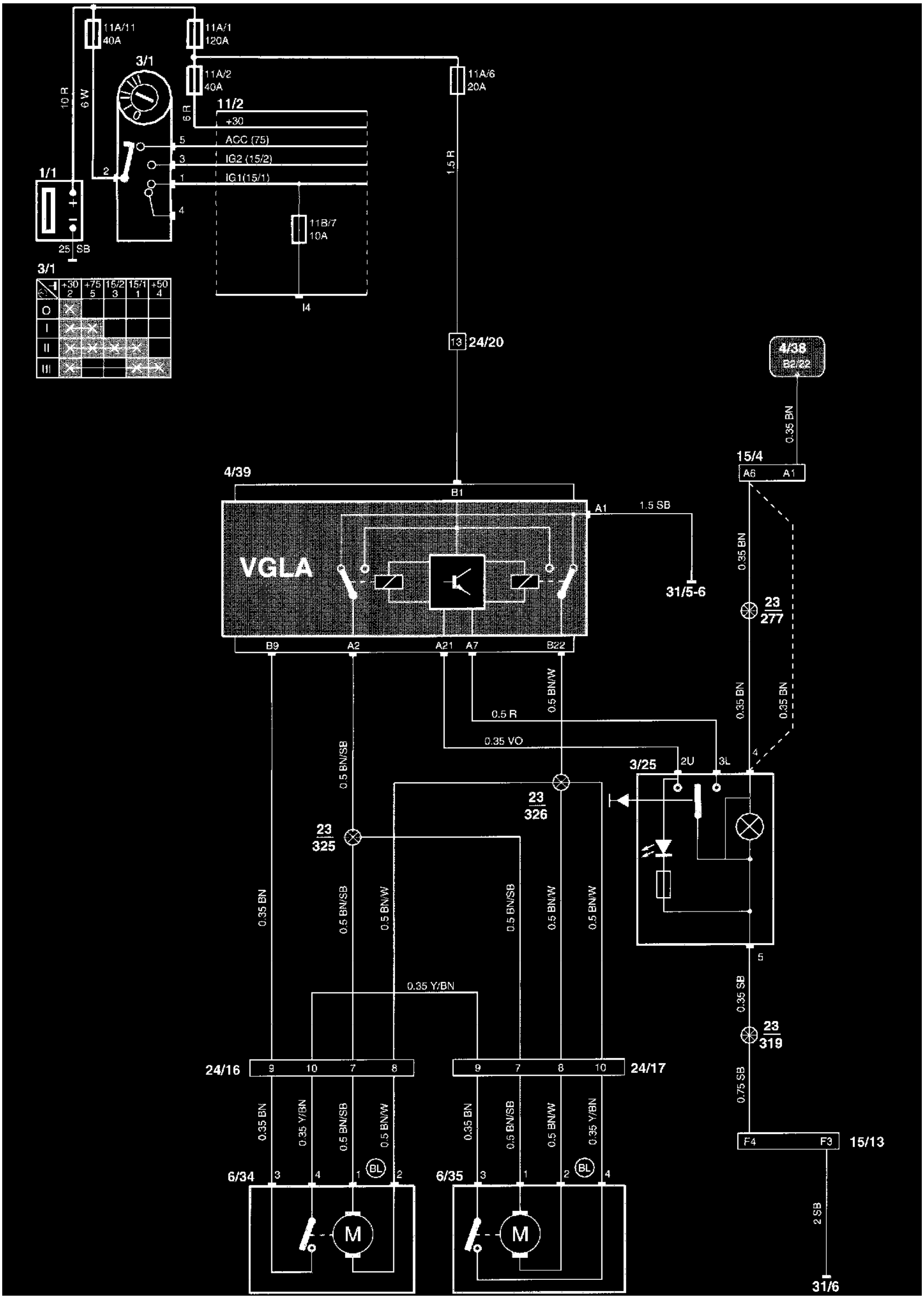


Central Locking, Part 2 Of 2

Component Locations

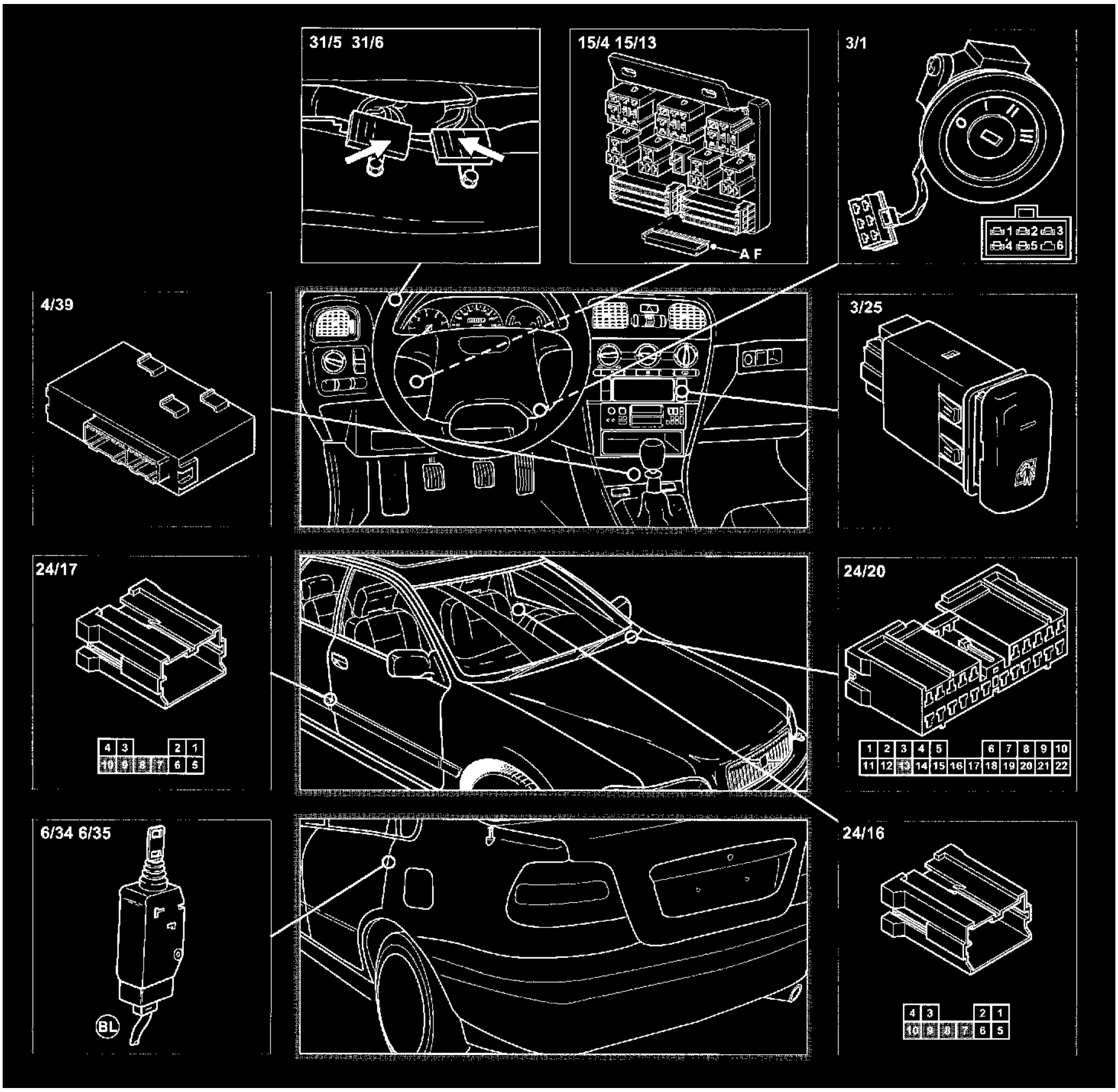
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Electrical Door Lock Rear



Electrical Door Locks Rear, Part 1 Of 2

Wiring Diagram



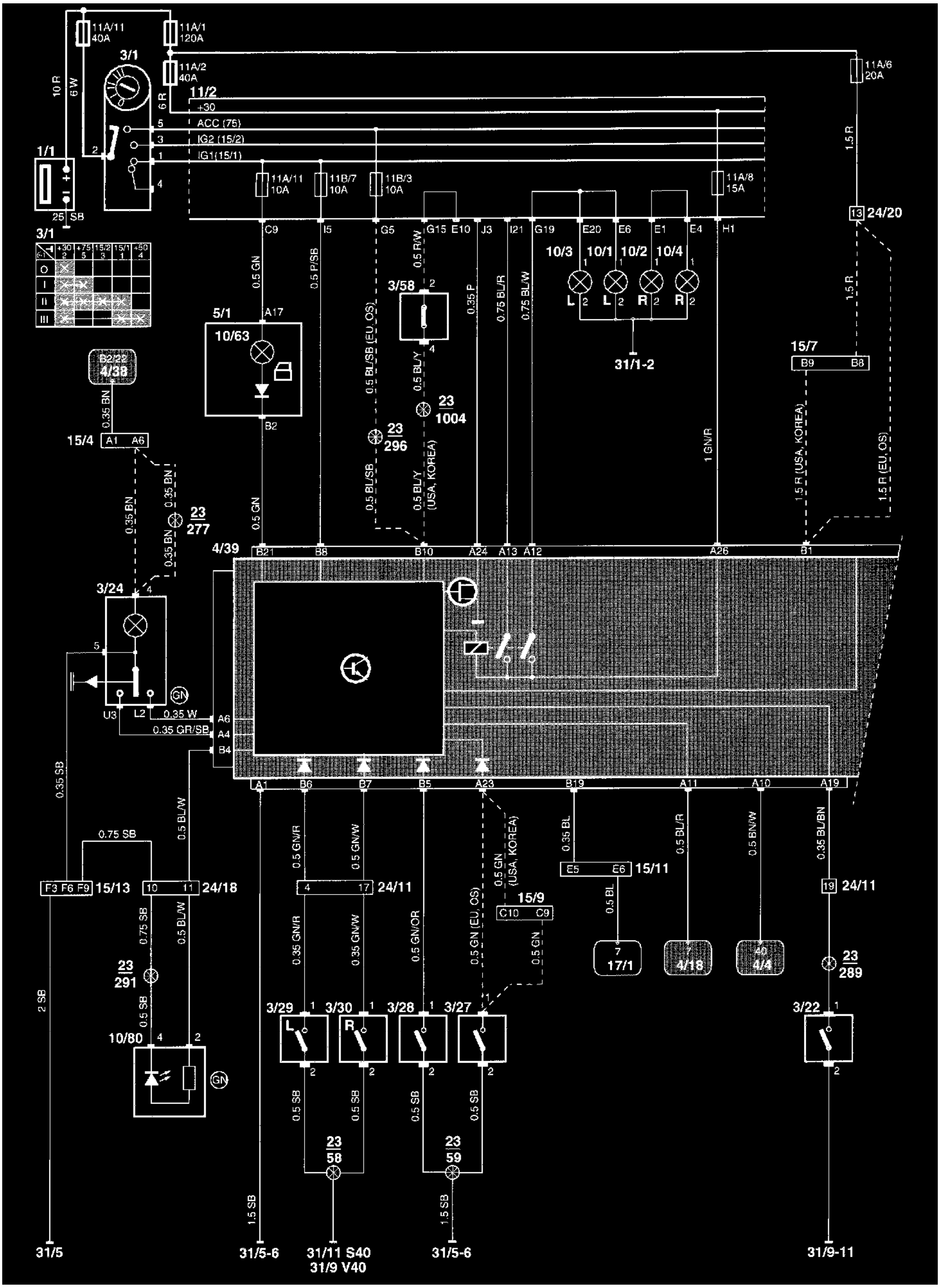
Electrical Door Locks Rear, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

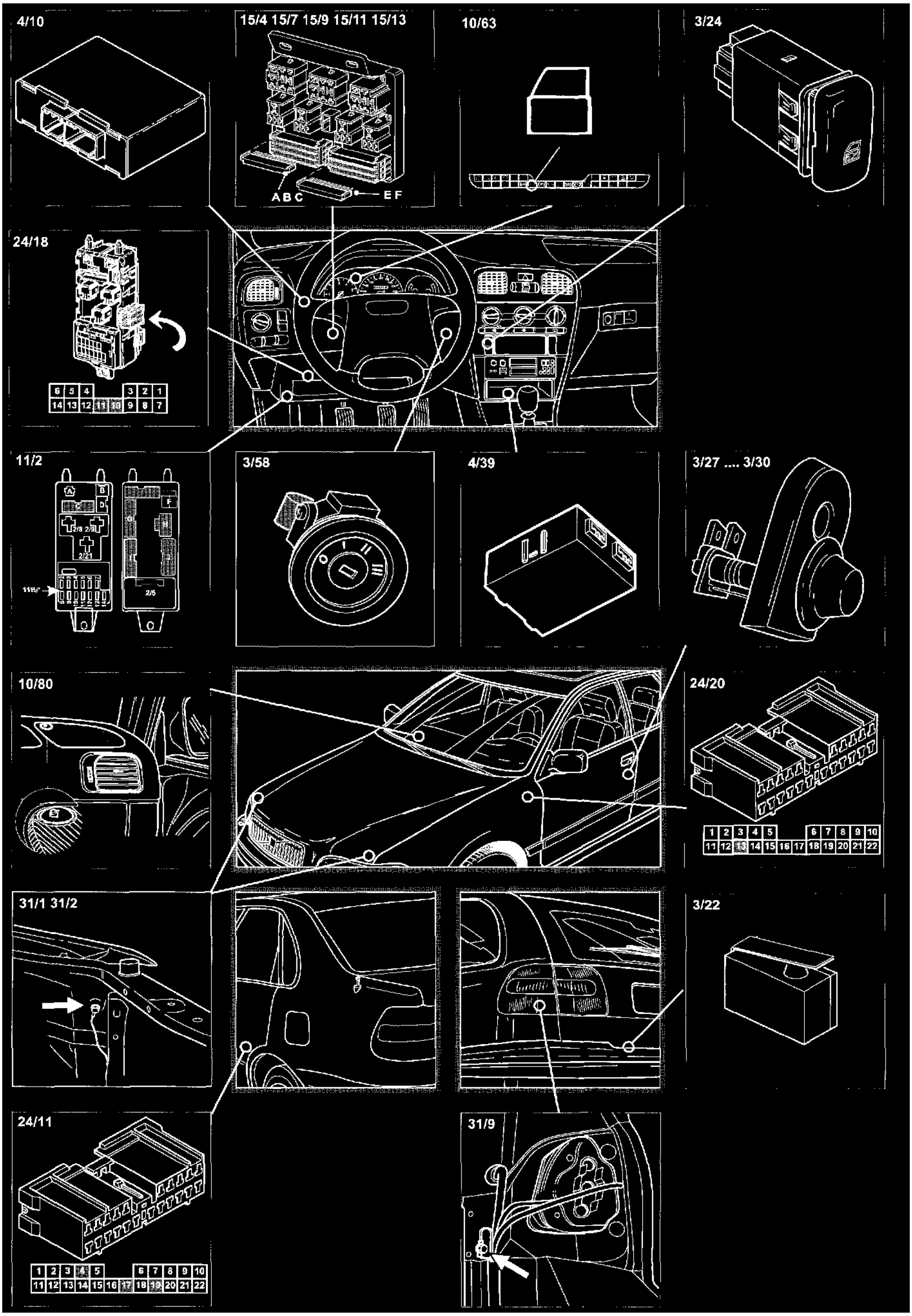
Remote Controlled Central Locking - General

Remote Controlled Central Locking - General



Remote Controlled Central Locking, Part 1 Of 2

Wiring Diagram



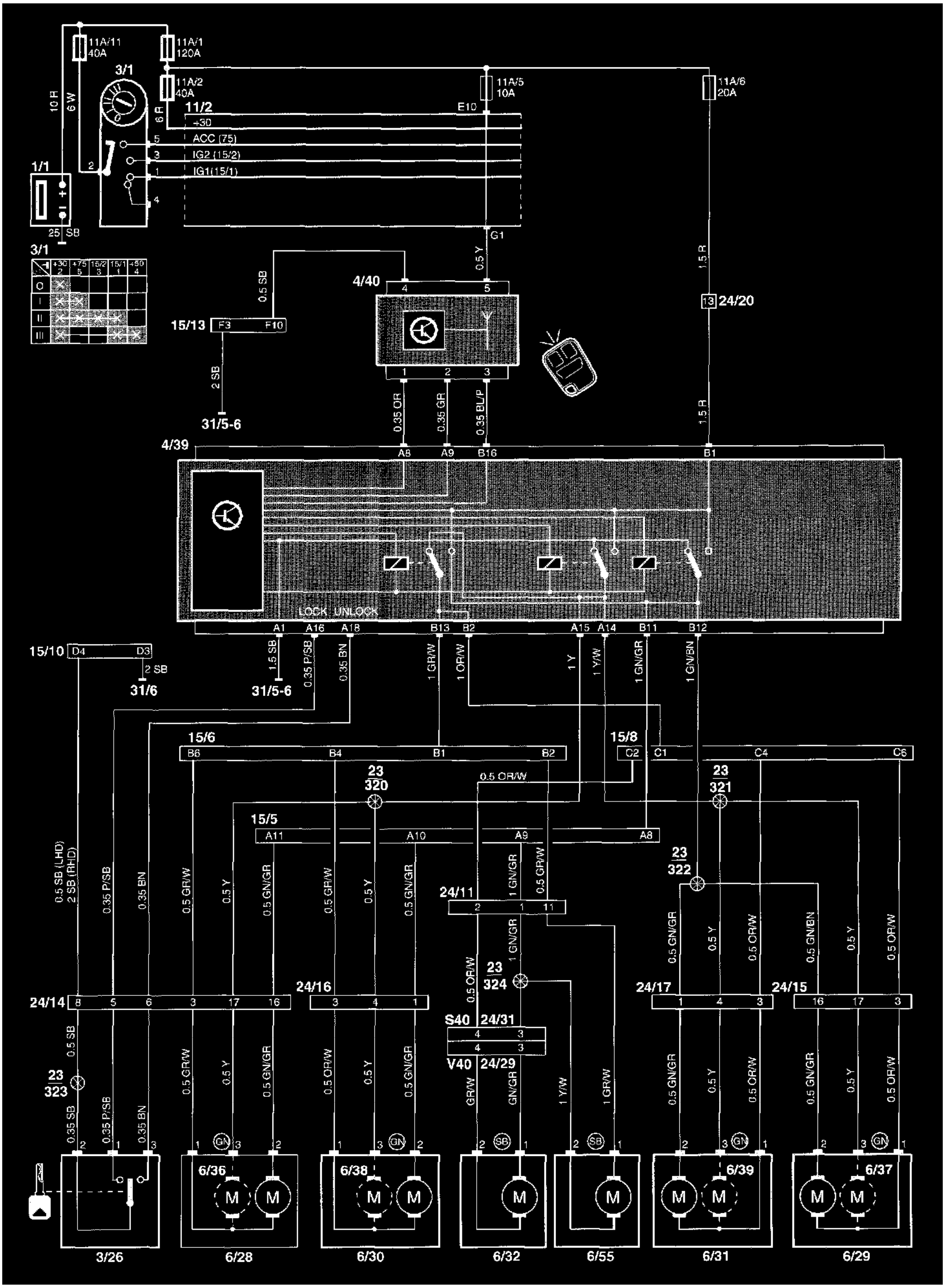
Remote Controlled Central Locking, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

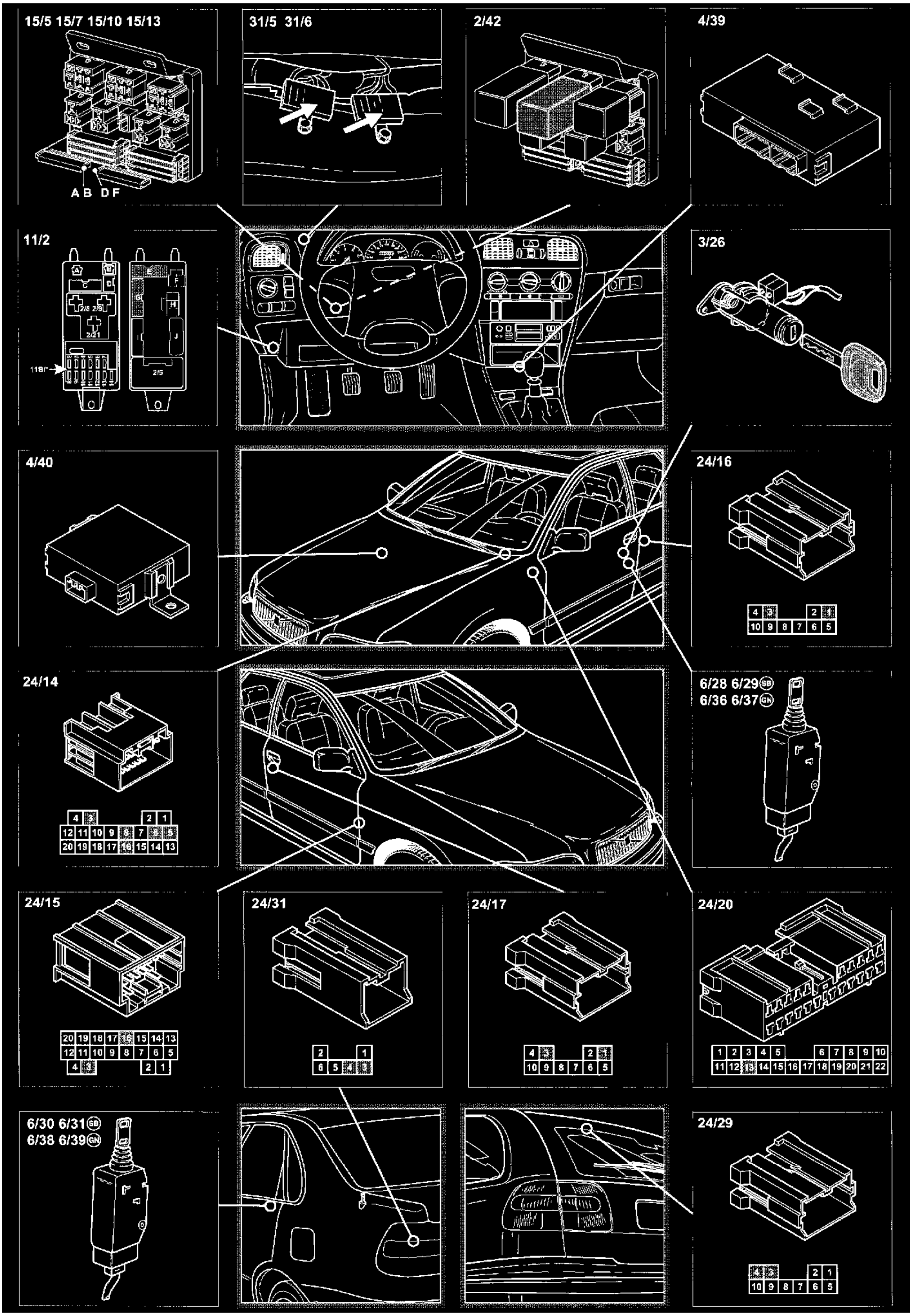
Remote Controlled Central Locking - Motors

Remote Controlled Central Locking - Motors



Remote Controlled Central Locking, Part 1 Of 2

Wiring Diagram



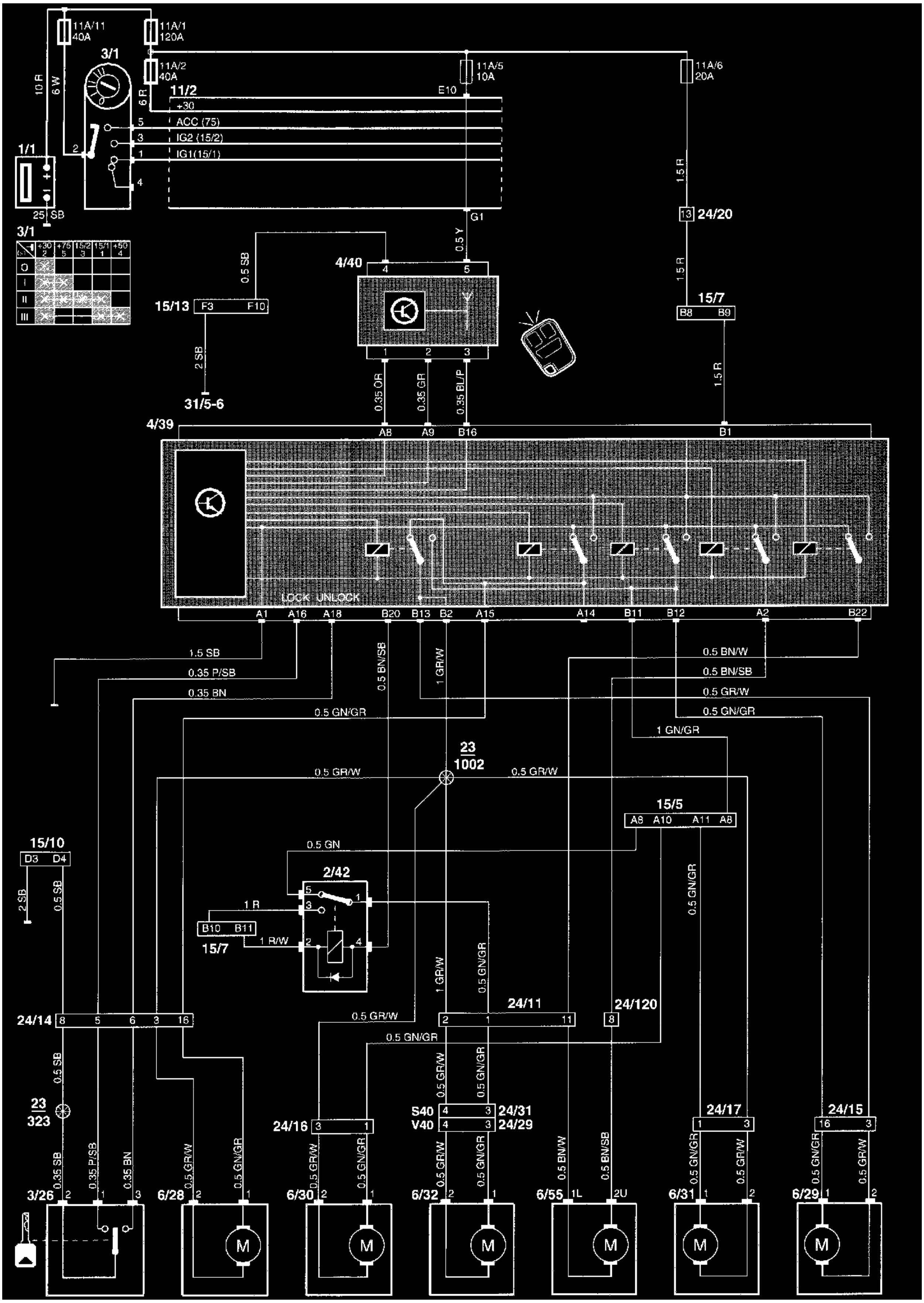
Remote Controlled Central Locking, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

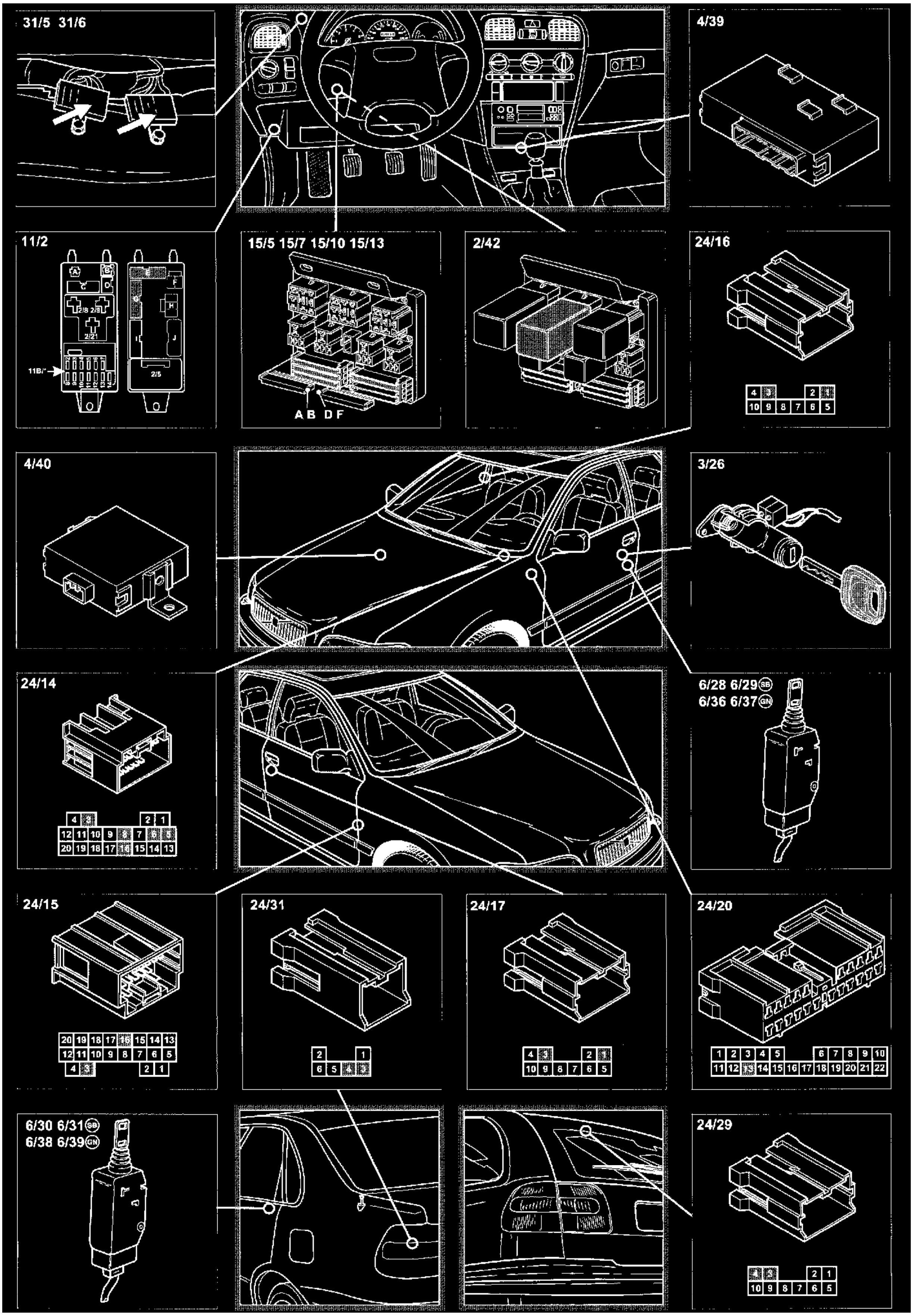
Remote Controlled Central Locking - Motors, USA

Remote Controlled Central Locking - Motor, USA



Remote Controlled Central Locking, Part 1 Of 2

Wiring Diagram

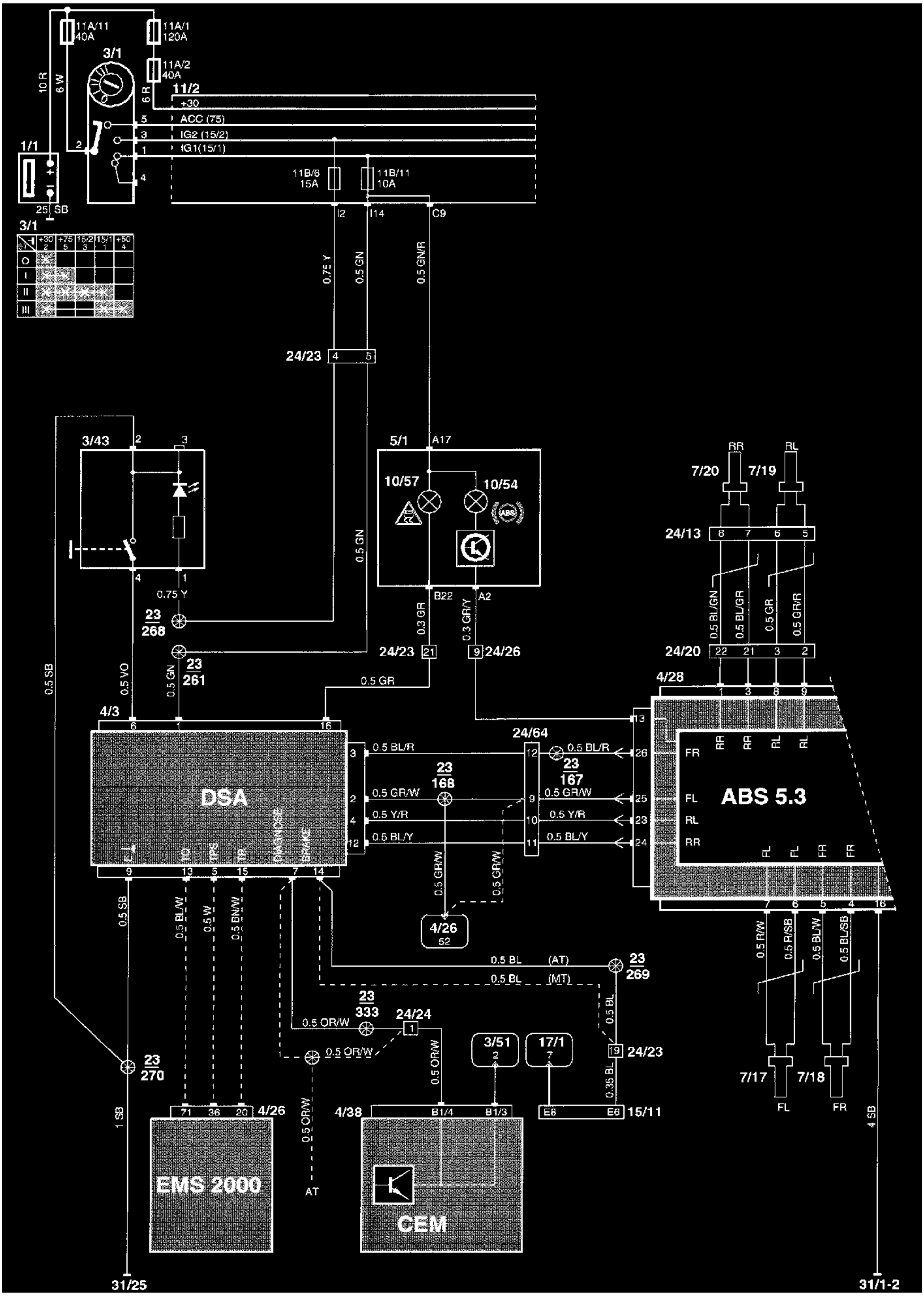


Remote Controlled Central Locking, Part 2 Of 2

Component Locations

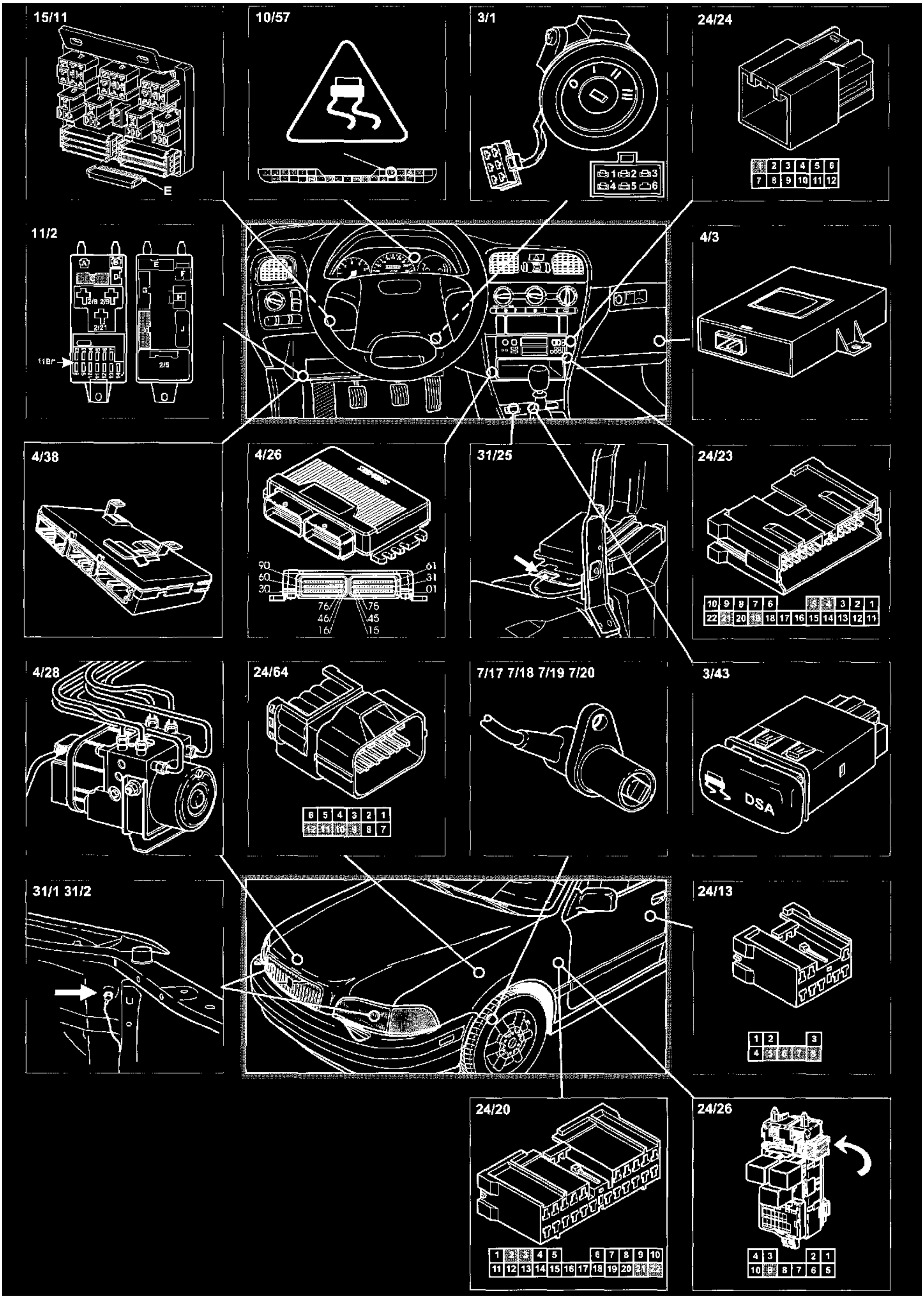
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Dynamic Stability System (DSA)



Dynamic Stability System (DSA), Part 1 Of 2

Wiring Diagram

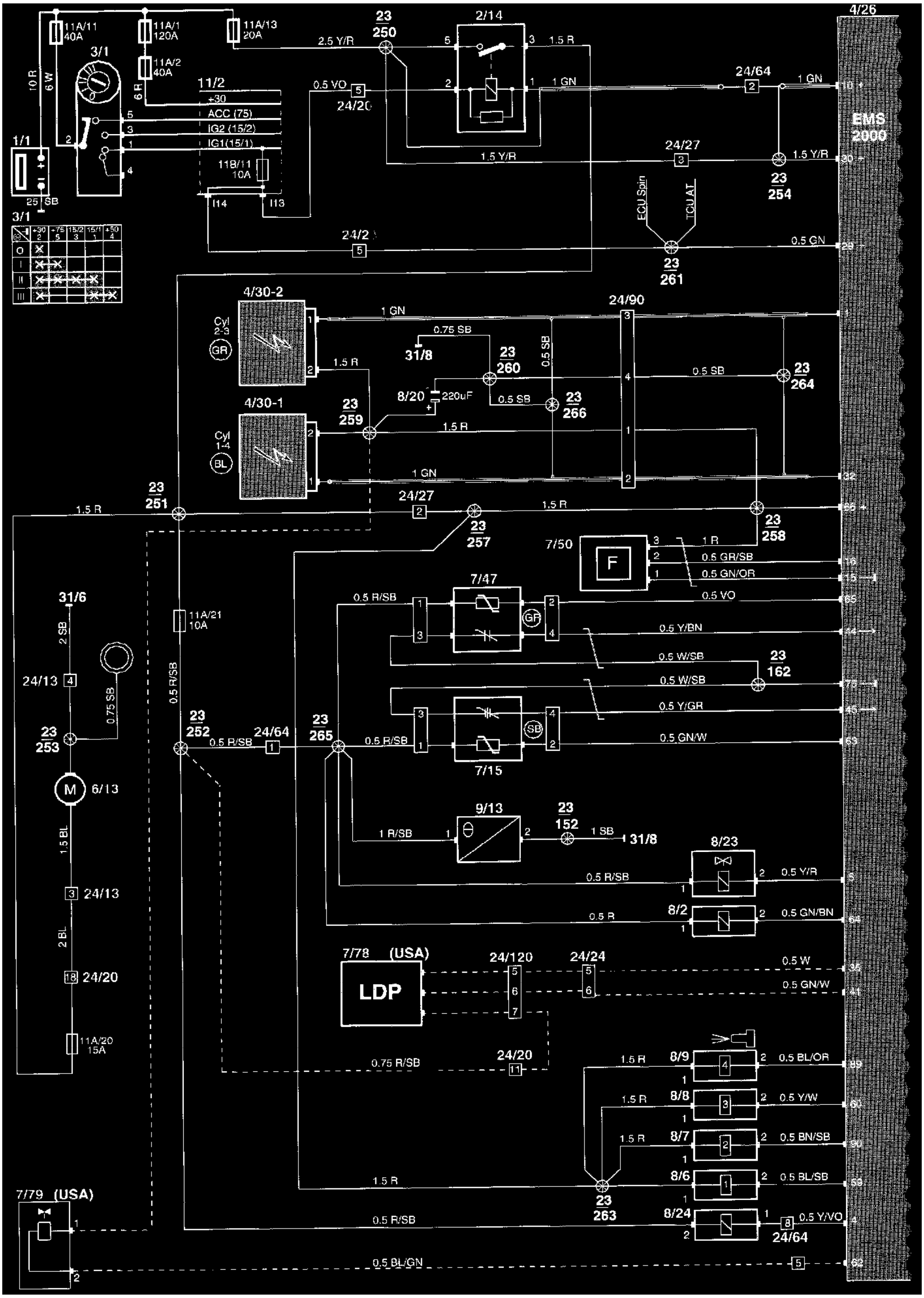


Dynamic stability system (DSA), Part 2 Of 2

Component Locations

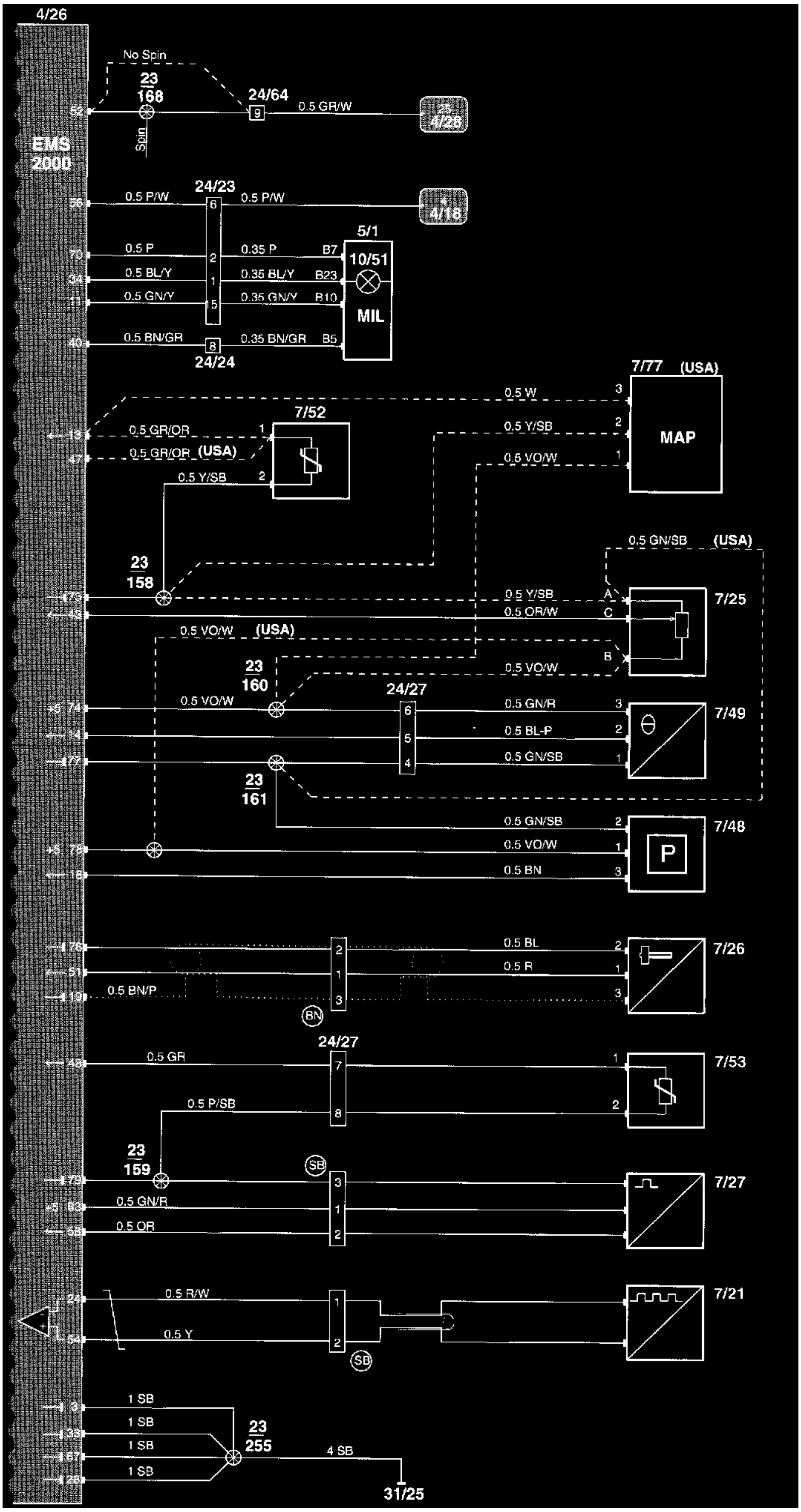
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Fuel Injection System



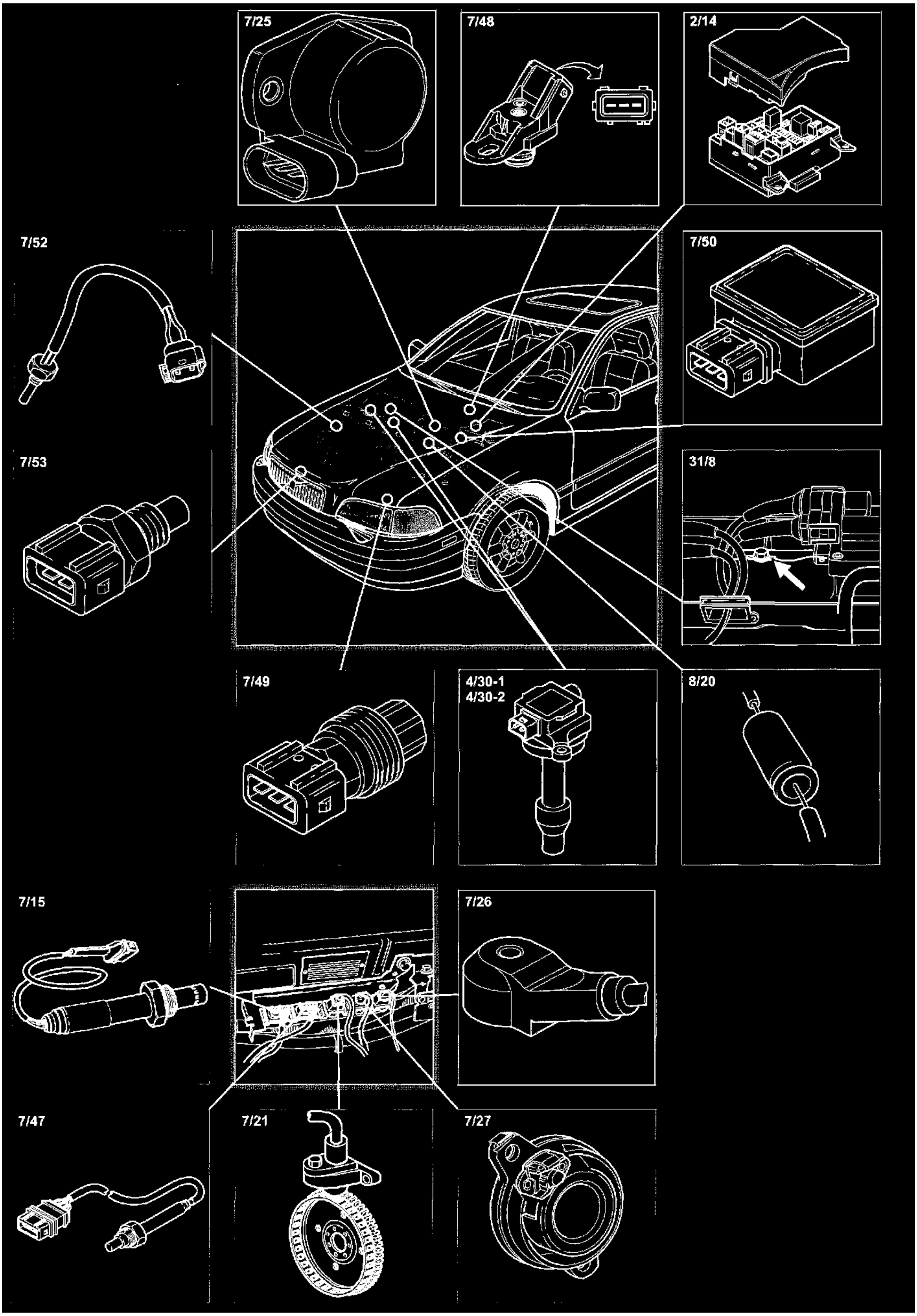
Fuel Injection System EMS 2000 Turbo, Part 1 Of 4

Wiring Diagram



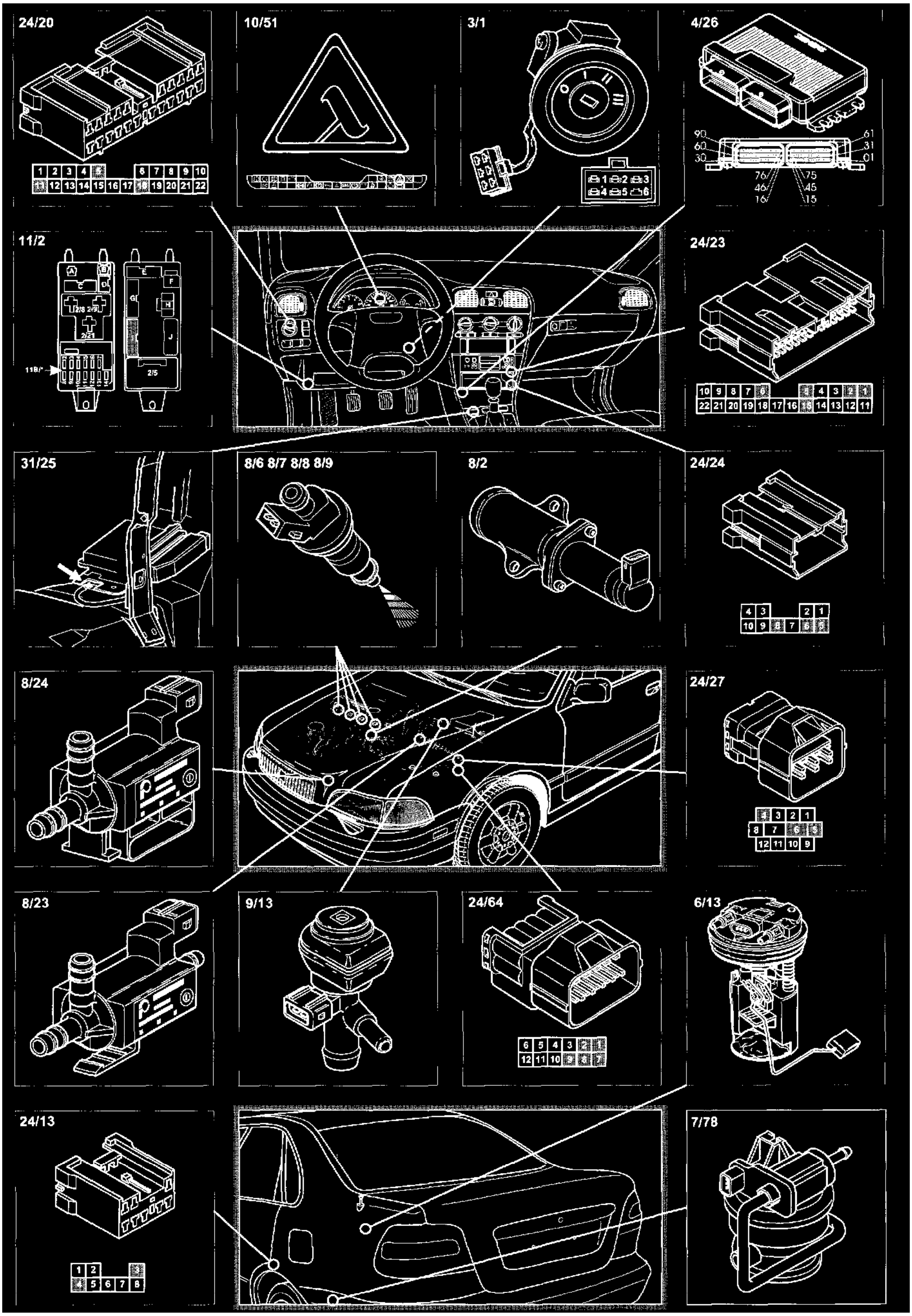
Fuel Injection System EMS 2000 Turbo, Part 2 Of 4

Wiring Diagram



Fuel Injection System EMS 2000 Turbo, Part 3 Of 4

Component Locations

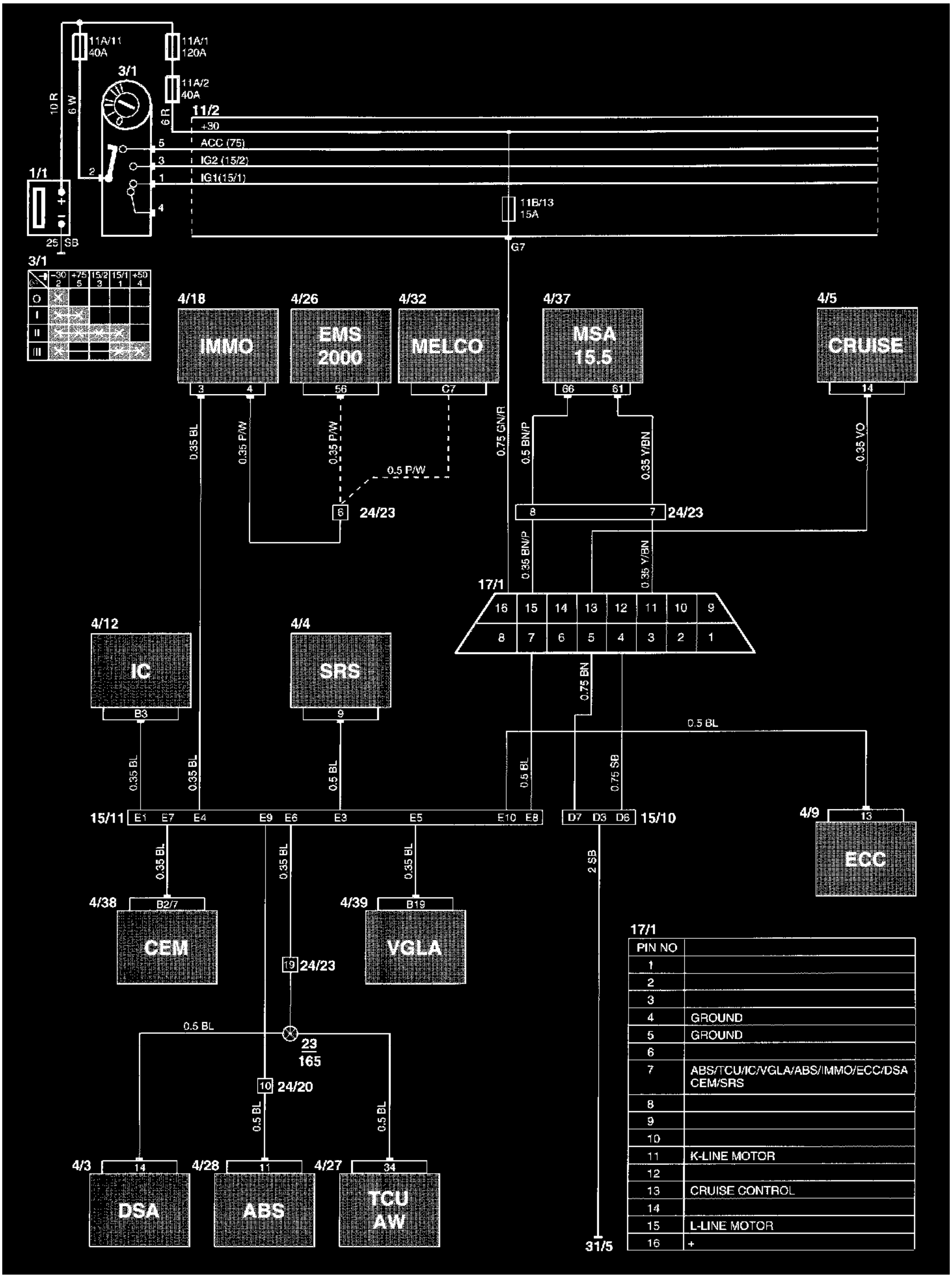


Fuel Injection System EMS 2000 Turbo, Part 4 Of 4

Component Locations

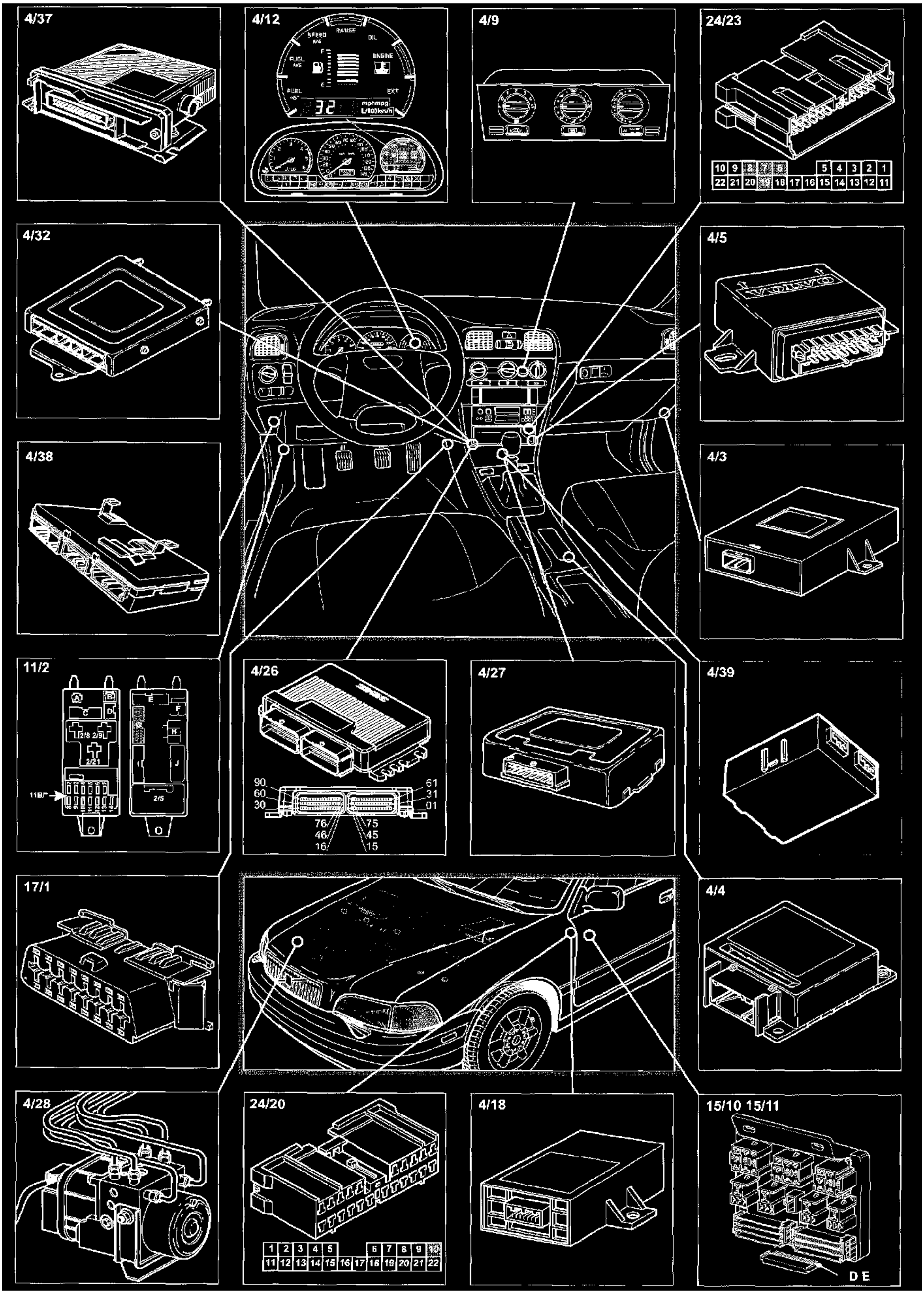
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

On-Board Diagnostic (OBD) System



On-Board Diagnostic (OBD) System, Part 1 Of 2

Wiring Diagram



On-Board Diagnostic (OBD) System, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

System Diagram

For wiring diagrams and schematics please refer to **"Powertrain Management : Diagrms : Electrical"**. See: Powertrain Management/Diagrams/Electrical Diagrams

Absolute Pressure Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Air Flow Meter/Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Barometric Pressure Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Camshaft Position Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

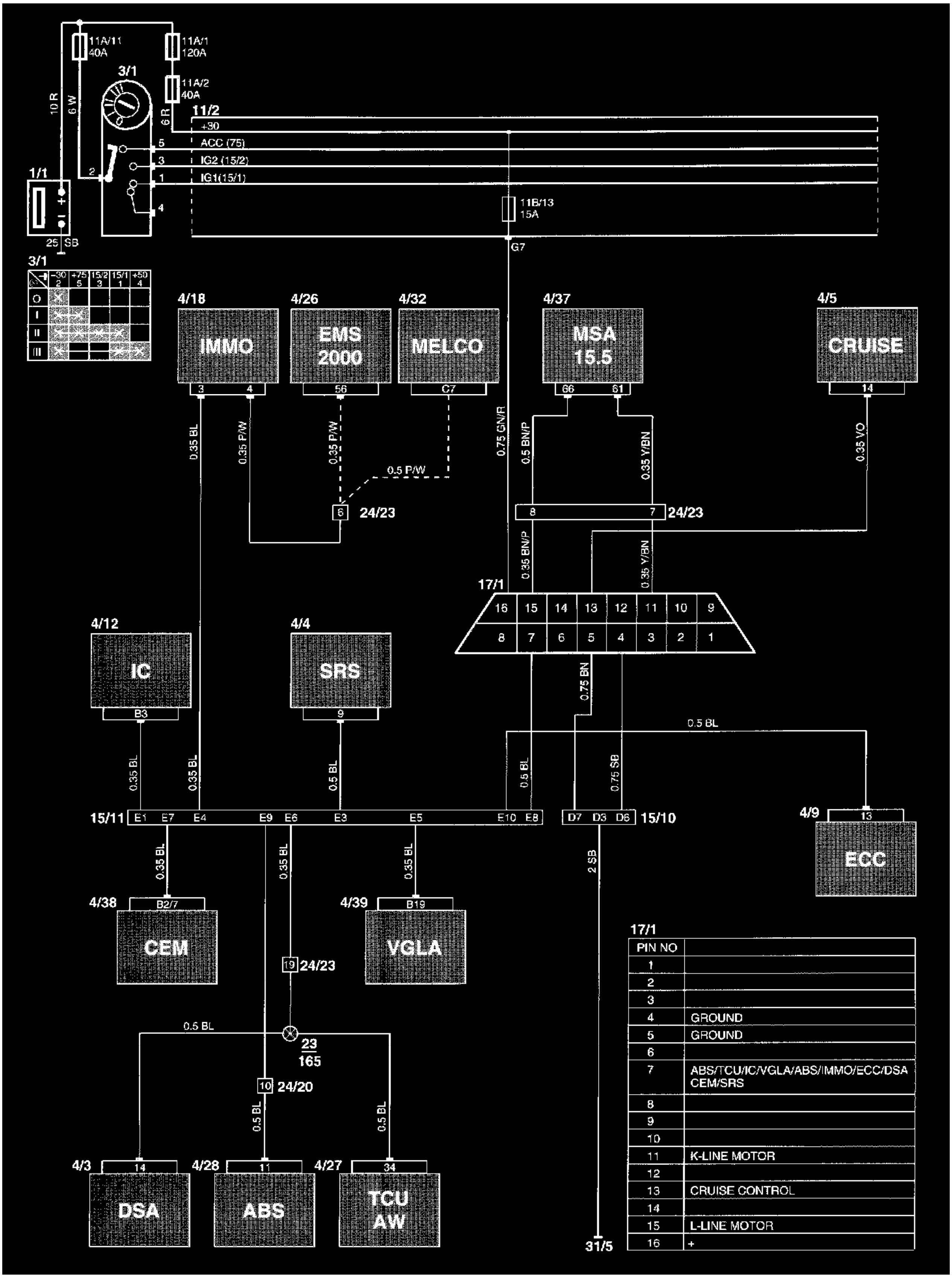
See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Coolant Temperature Sensor/Switch (For Computer)

Refer to **Computers and Control Systems : Diagrams : Electrical**

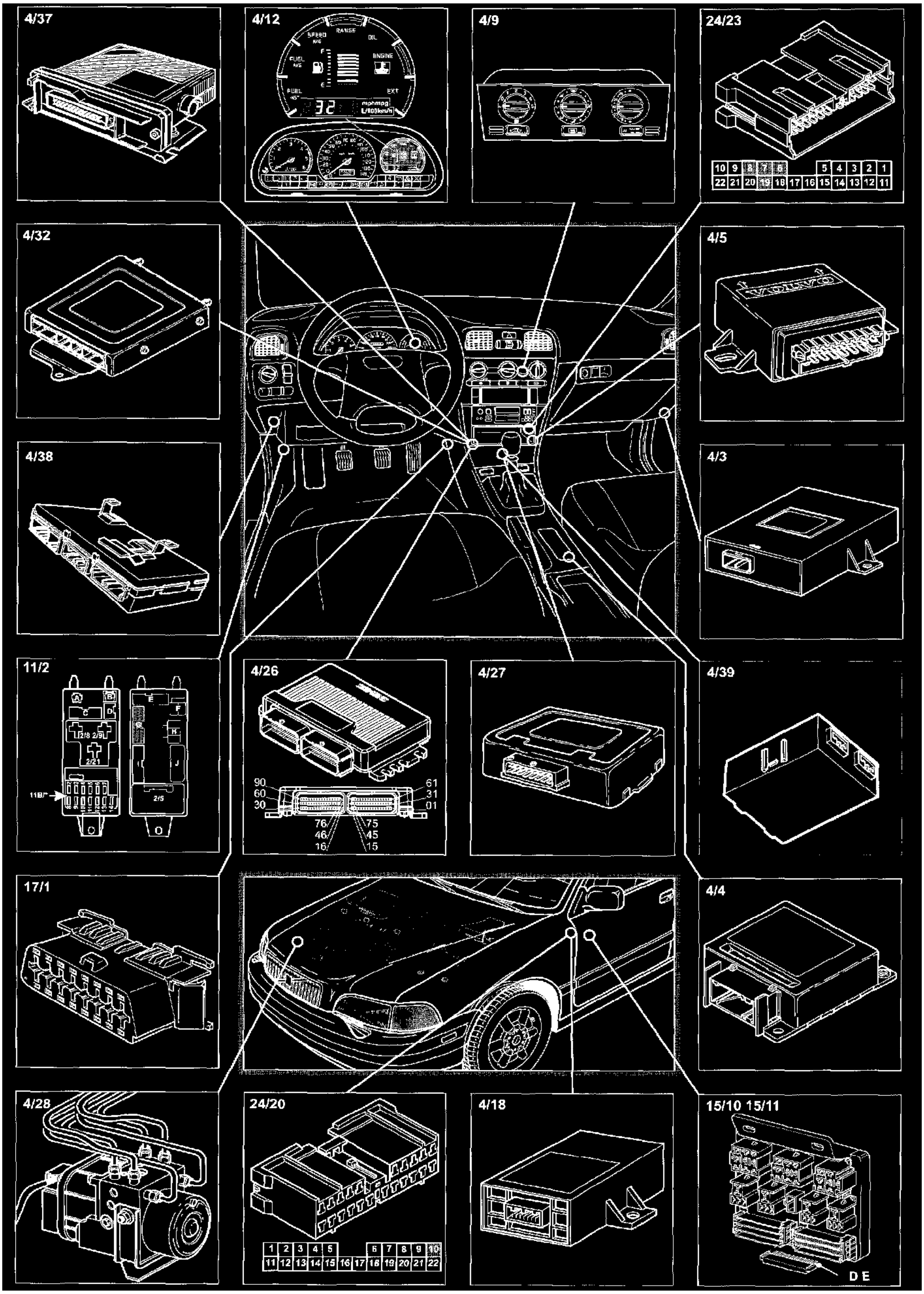
See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Data Link Connector



On-Board Diagnostic (OBD) System, Part 1 Of 2

Wiring Diagram



On-Board Diagnostic (OBD) System, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Engine Control Module

For wiring diagrams and schematics please refer to **"Powertrain Management : Diagrms : Electrical"**. See: Powertrain Management/Diagrams/Electrical Diagrams

Engine Speed Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Idle Speed/Throttle Actuator - Electronic

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Intake Air Temperature Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Knock Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Oxygen Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Throttle Position Sensor

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Variable Valve Timing Actuator

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Variable Valve Timing Solenoid

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

System Diagram

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

System Diagram

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Canister Purge Solenoid

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Leak Detection Pump, Evaporative System

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

System Diagram

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Fuel Injector

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

System Diagram

Refer to **Computers and Control Systems : Diagrams : Electrical**

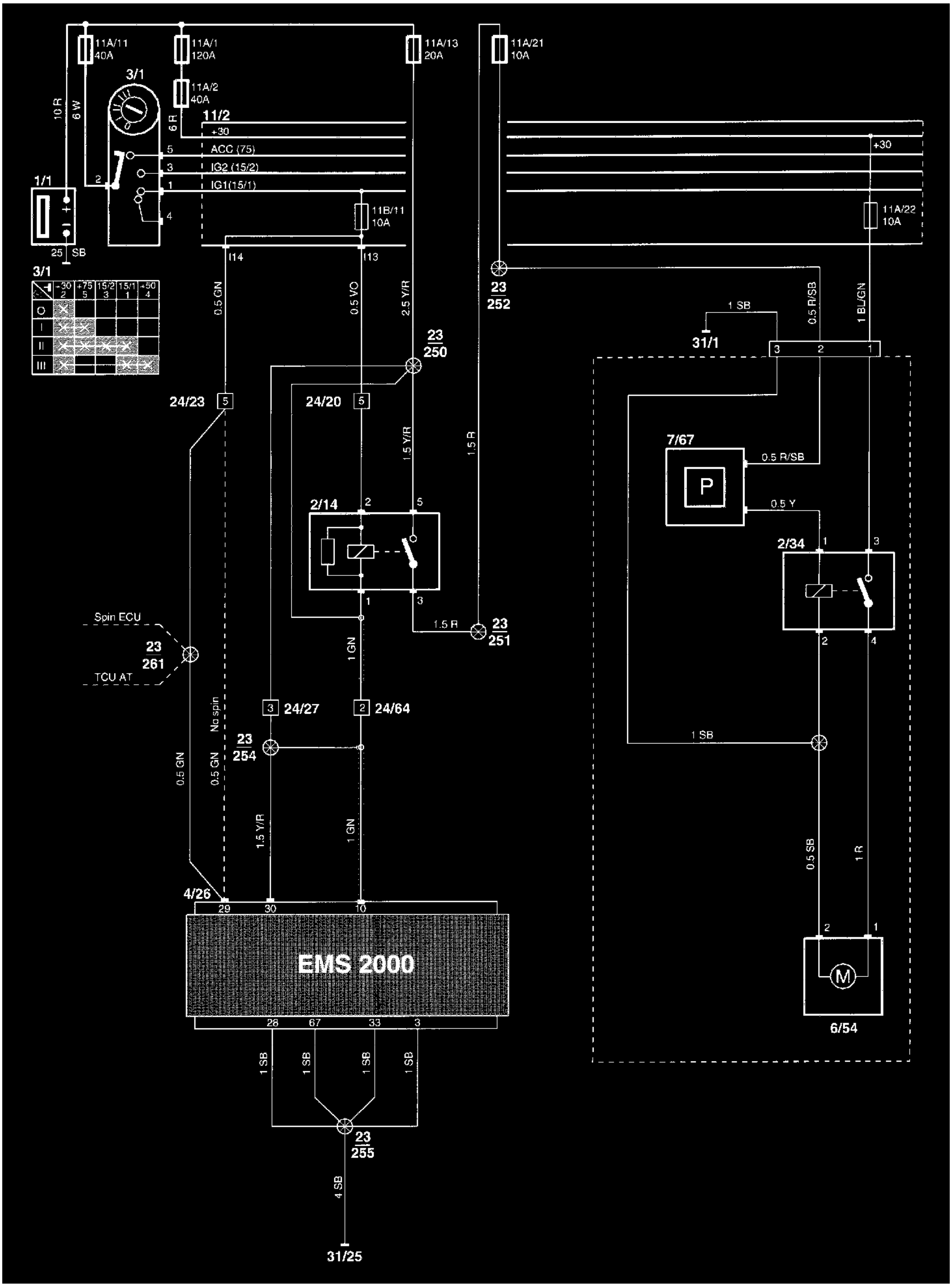
See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Fuel Pump Relay

Refer to **Computers and Control Systems : Diagrams : Electrical**

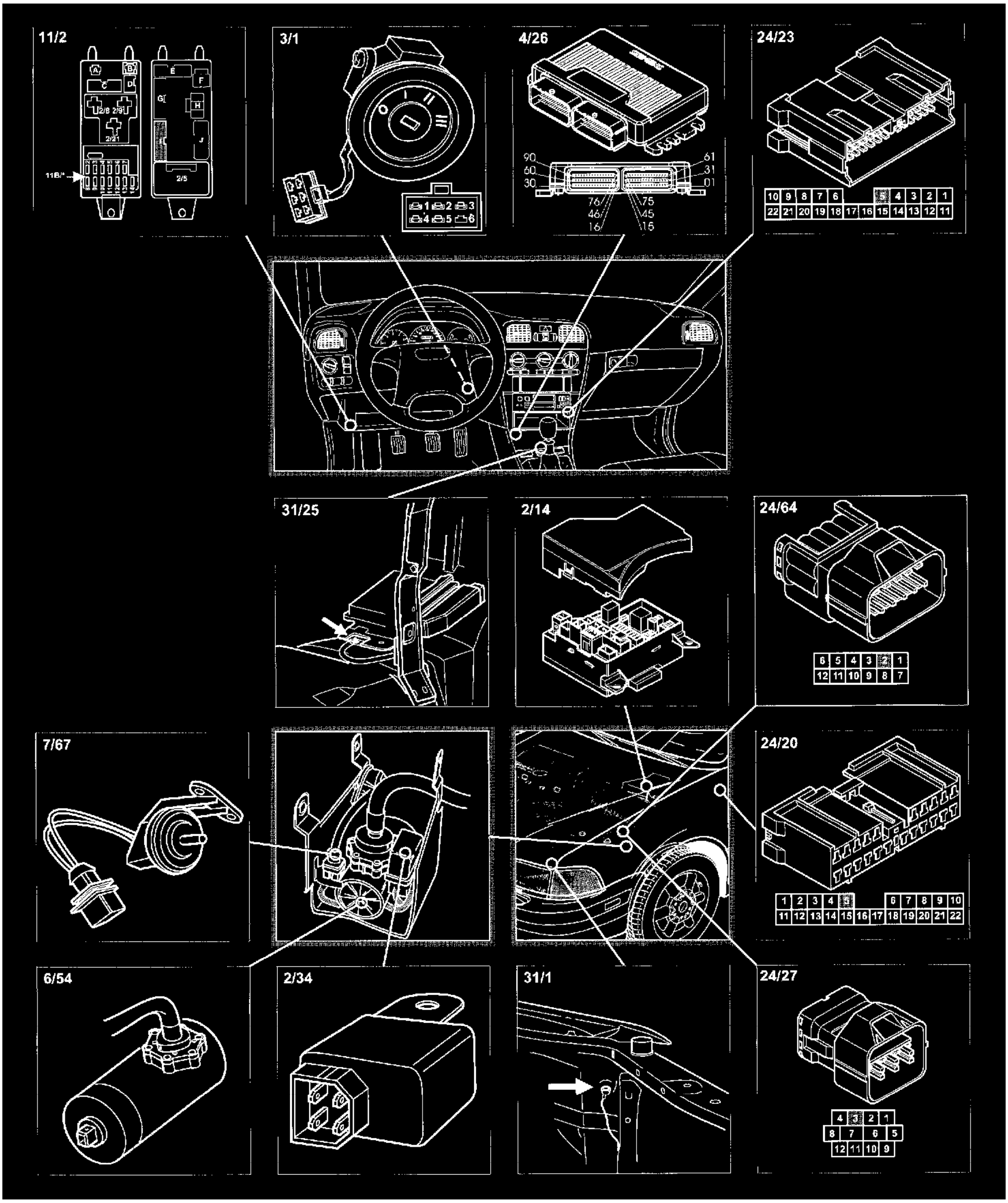
See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Vacuum Pump



Vacuum Pump EMS 2000 (Turbo), Part 1 Of 2

Wiring Diagram



Vacuum Pump EMS 2000 (Turbo), Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Wastegate Solenoid

Refer to **Computers and Control Systems : Diagrams : Electrical**

See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

System Diagram

Refer to **Computers and Control Systems : Diagrams : Electrical**

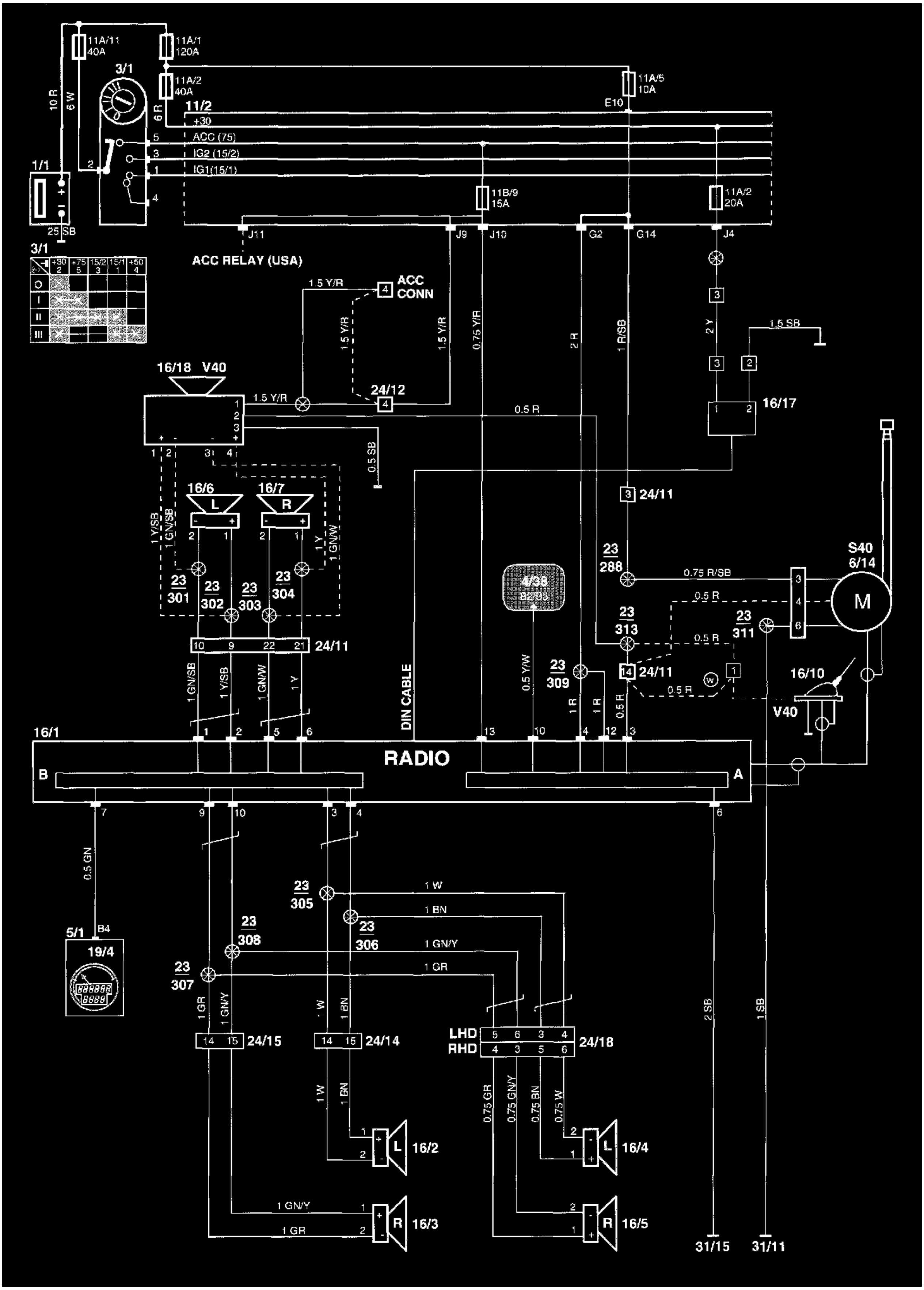
See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Ignition Coil

Refer to **Computers and Control Systems : Diagrams : Electrical**

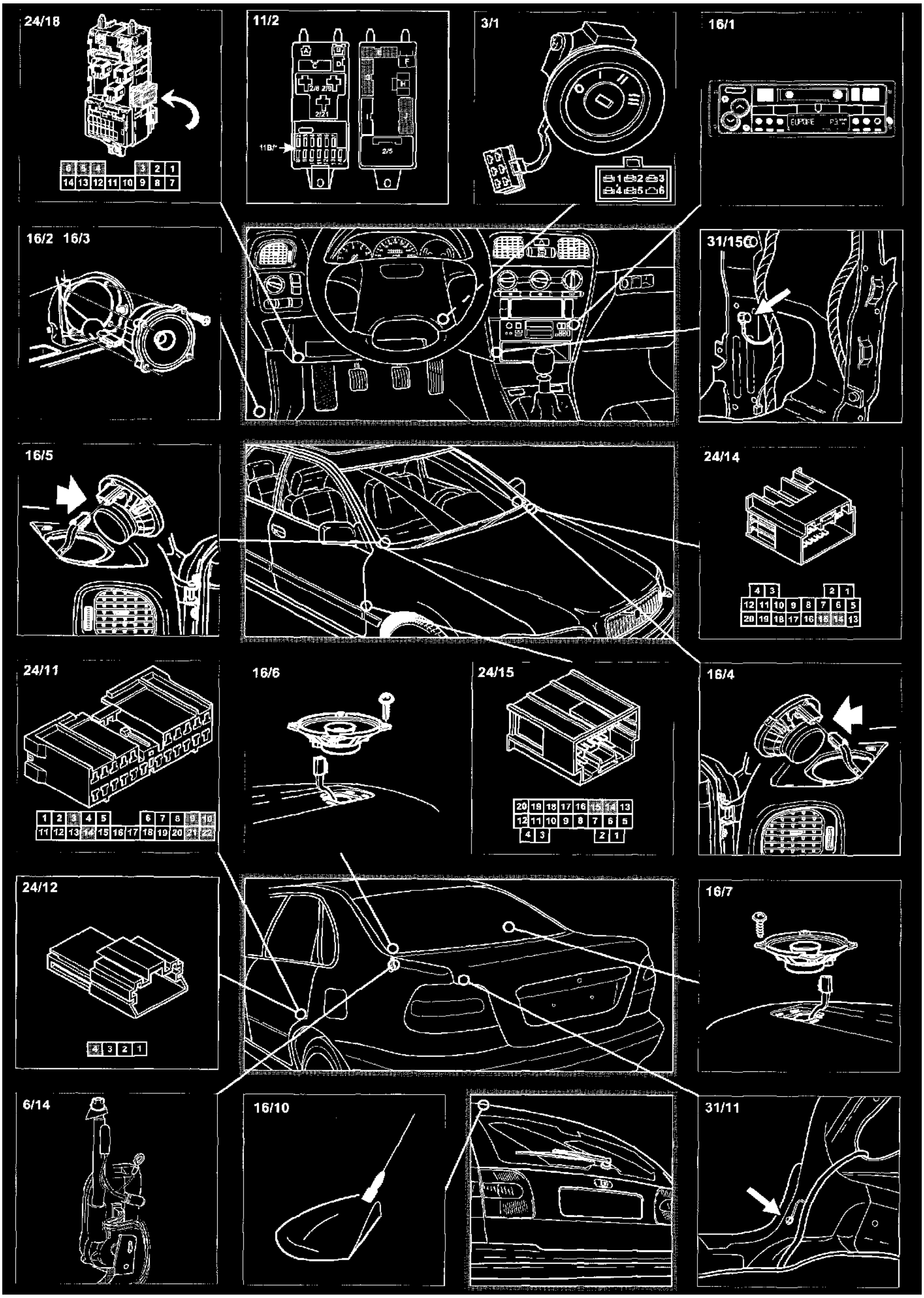
See: Powertrain Management/Computers and Control Systems/Diagrams/Electrical Diagrams

Radio/Stereo



Radio, Part 1 Of 2

Wiring Diagrams



Radio, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

System Diagram

Refer to **Restraint Systems - Diagrams - Electrical**

See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

Seat Belt

Refer to **Restraint Systems - Diagrams - Electrical**

See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

Seat Belt Tensioner

Refer to **Restraint Systems - Diagrams - Electrical**

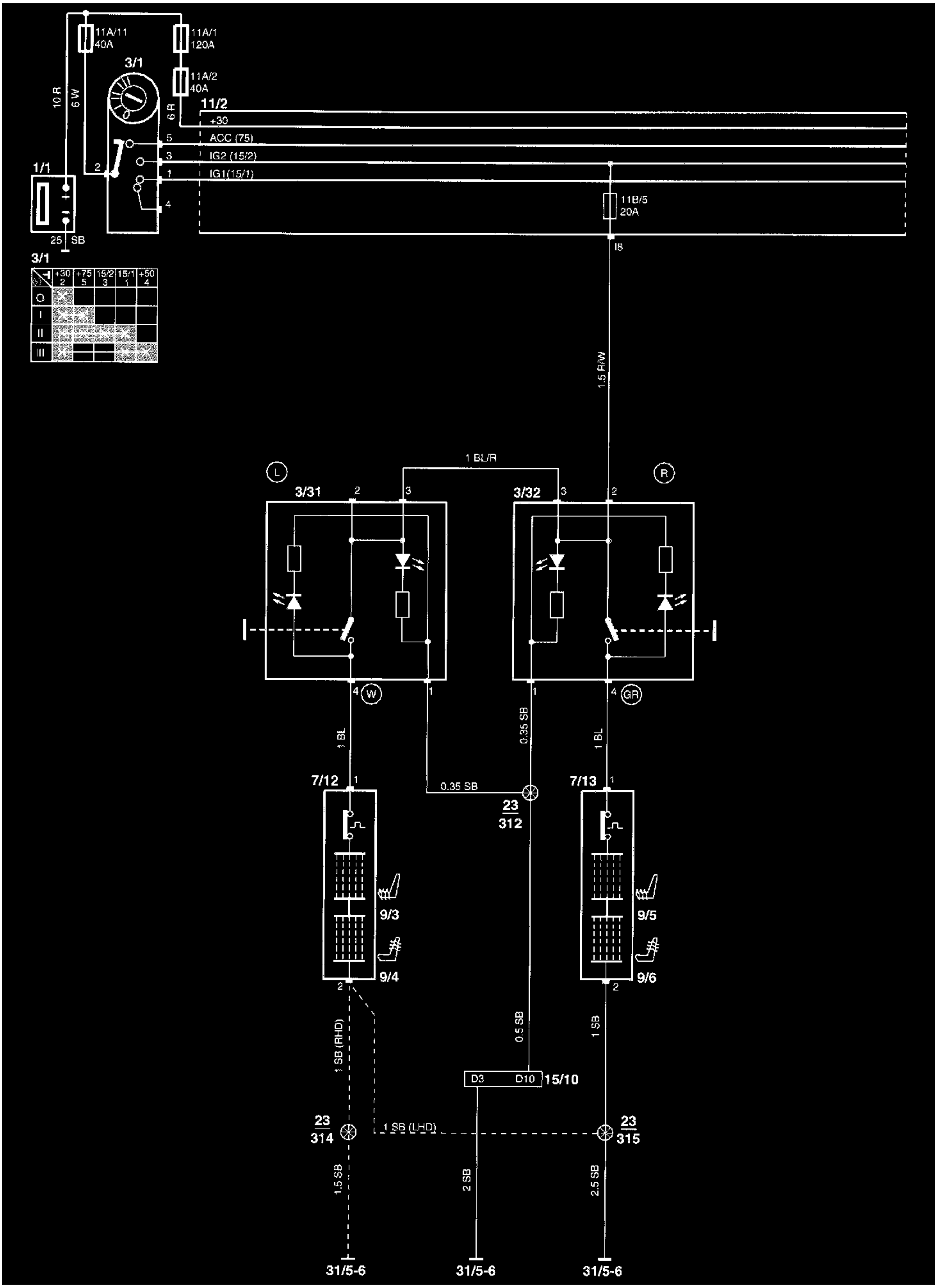
See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

Seat Belt Warning Relay

Refer to **Restraint Systems - Diagrams - Electrical**

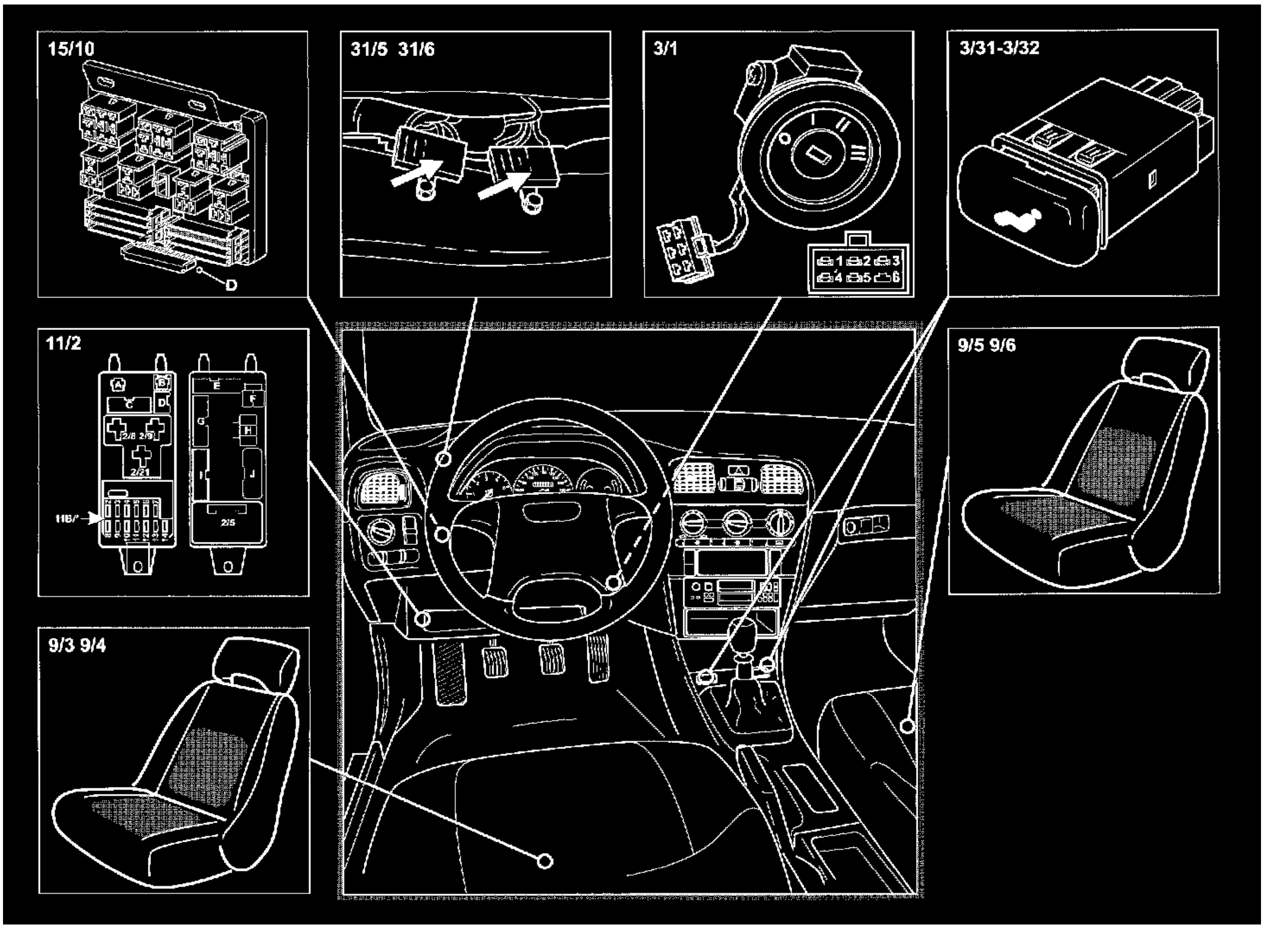
See: Restraint Systems/Air Bag Systems/Diagrams/Electrical Diagrams

Electrically Heated Front Seats



Electrically Heated Seats Front, Part 1 Of 2

Wiring Diagrams

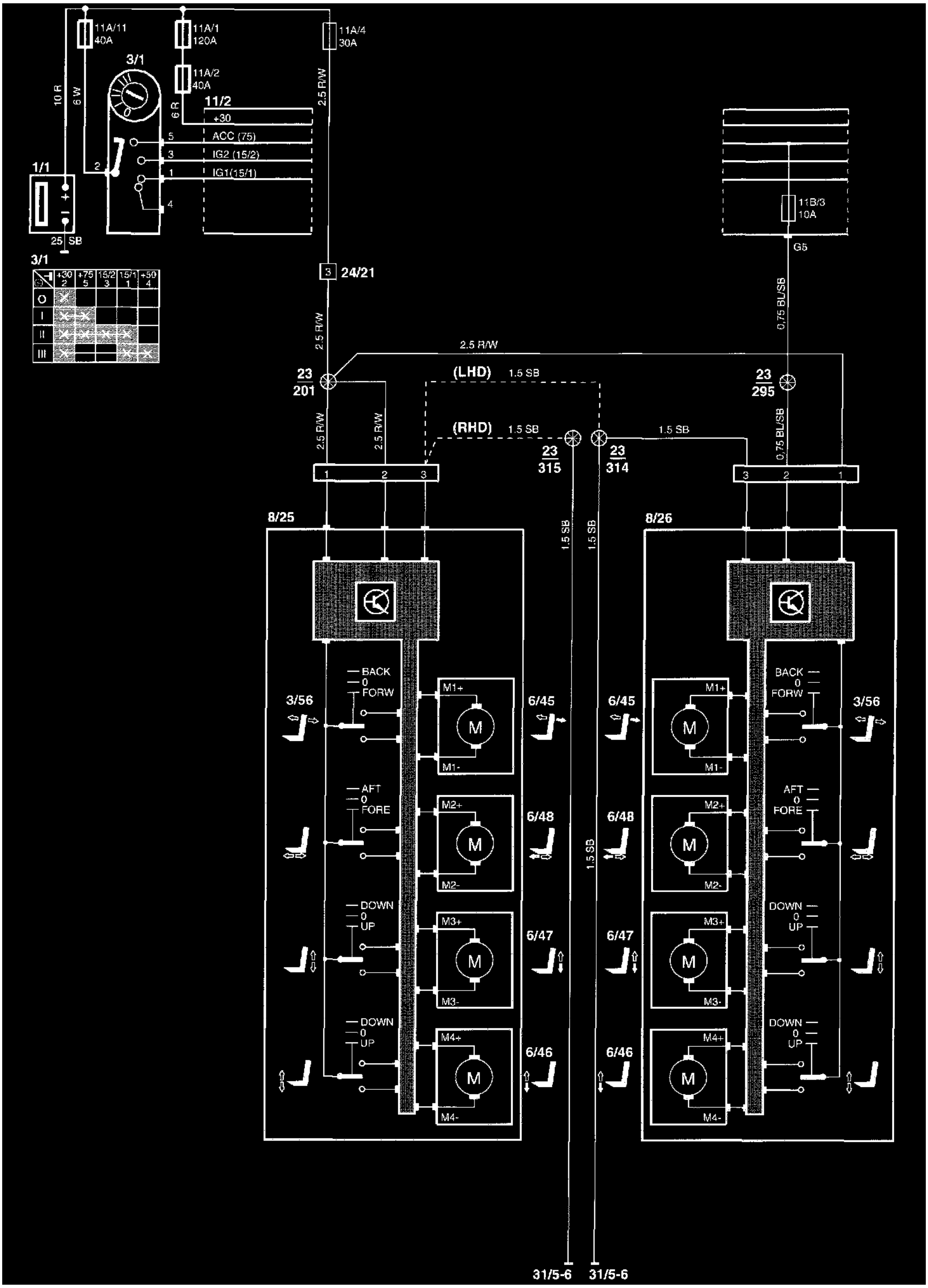


Electrically Heated Seats Front, Part 2 Of 2

Component Locations

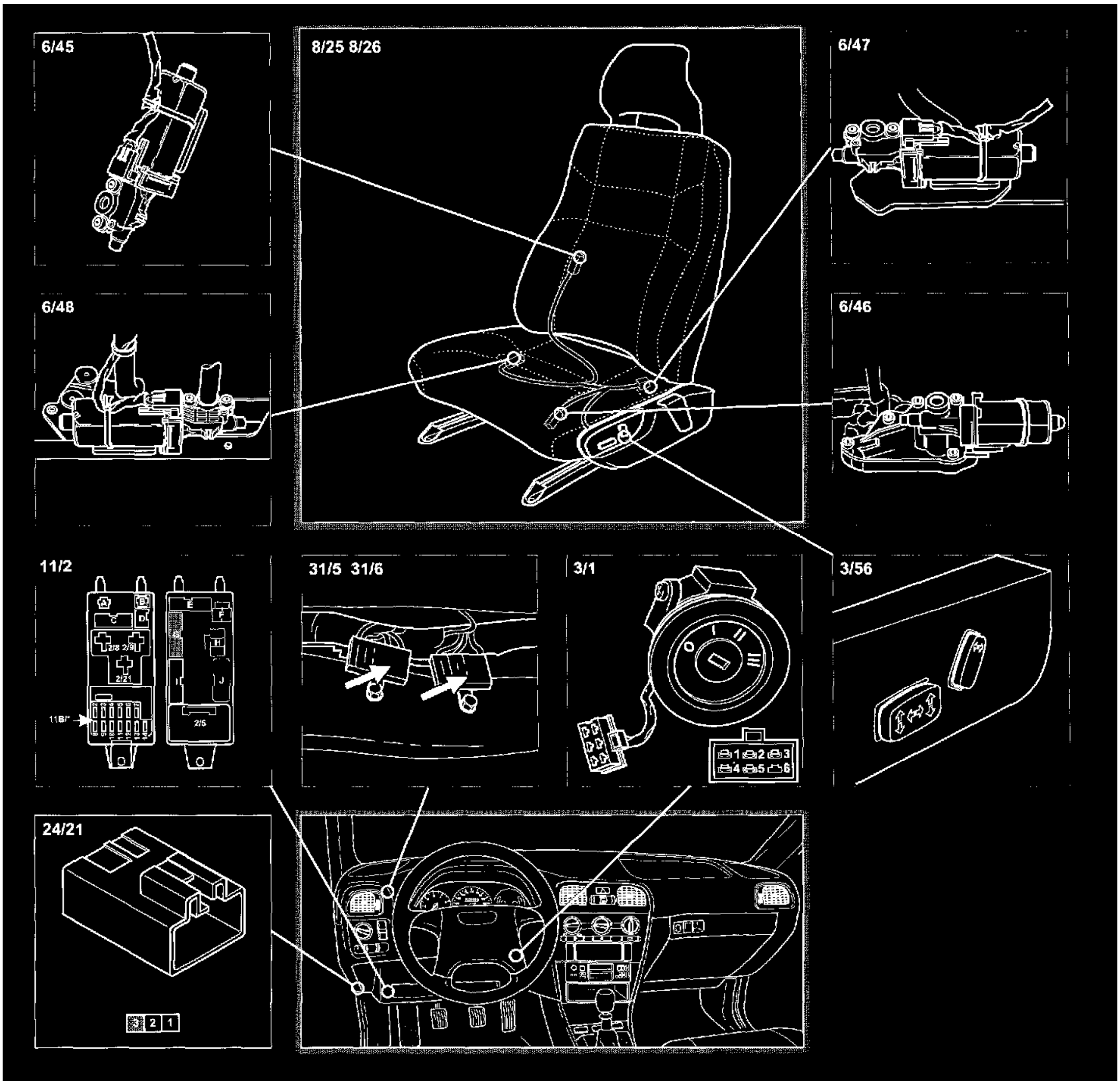
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Power Seats



Power Seats, Part 1 Of 2

Wiring Diagrams

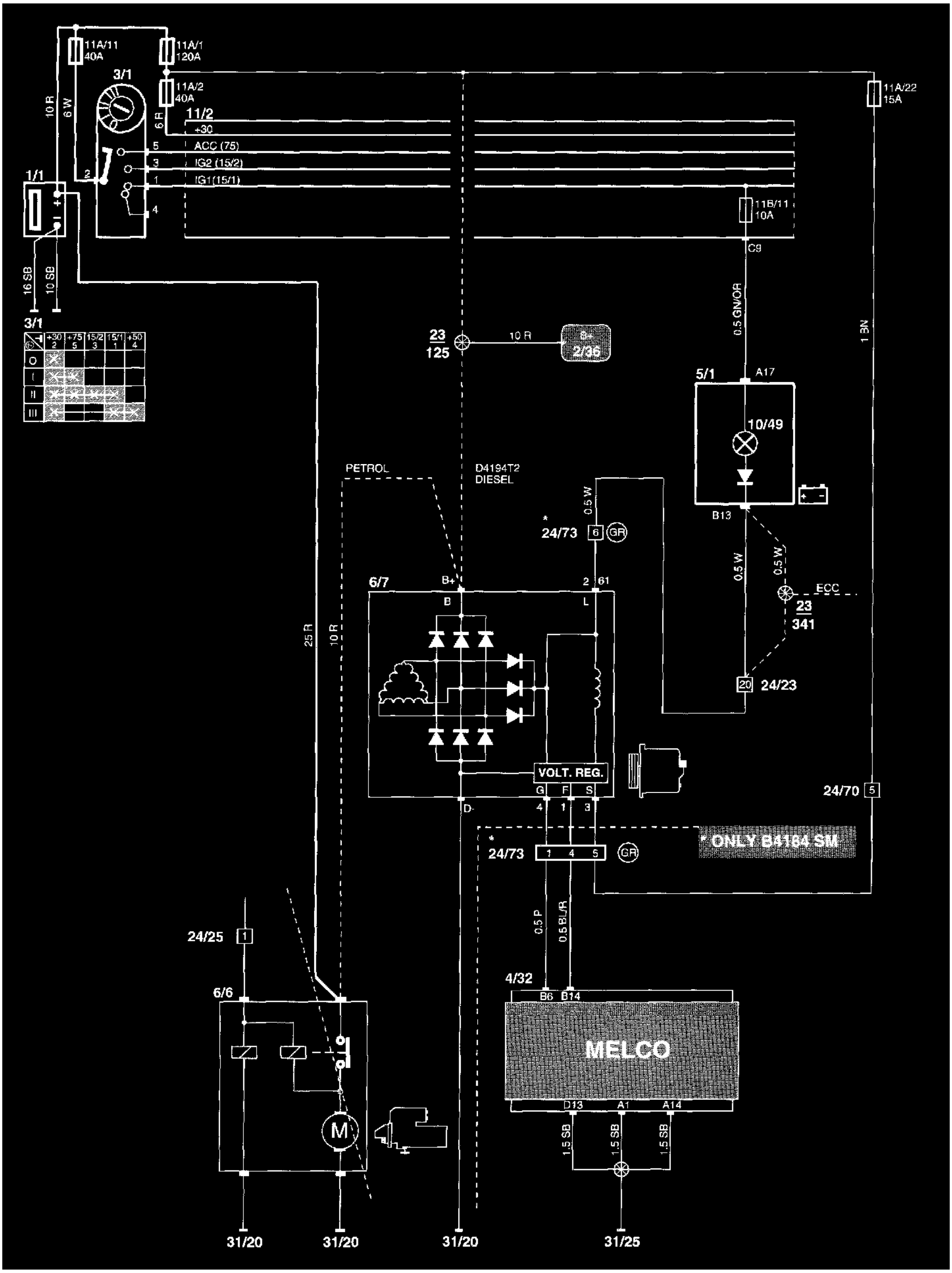


Power Seats, Part 2 Of 2

Component Locations

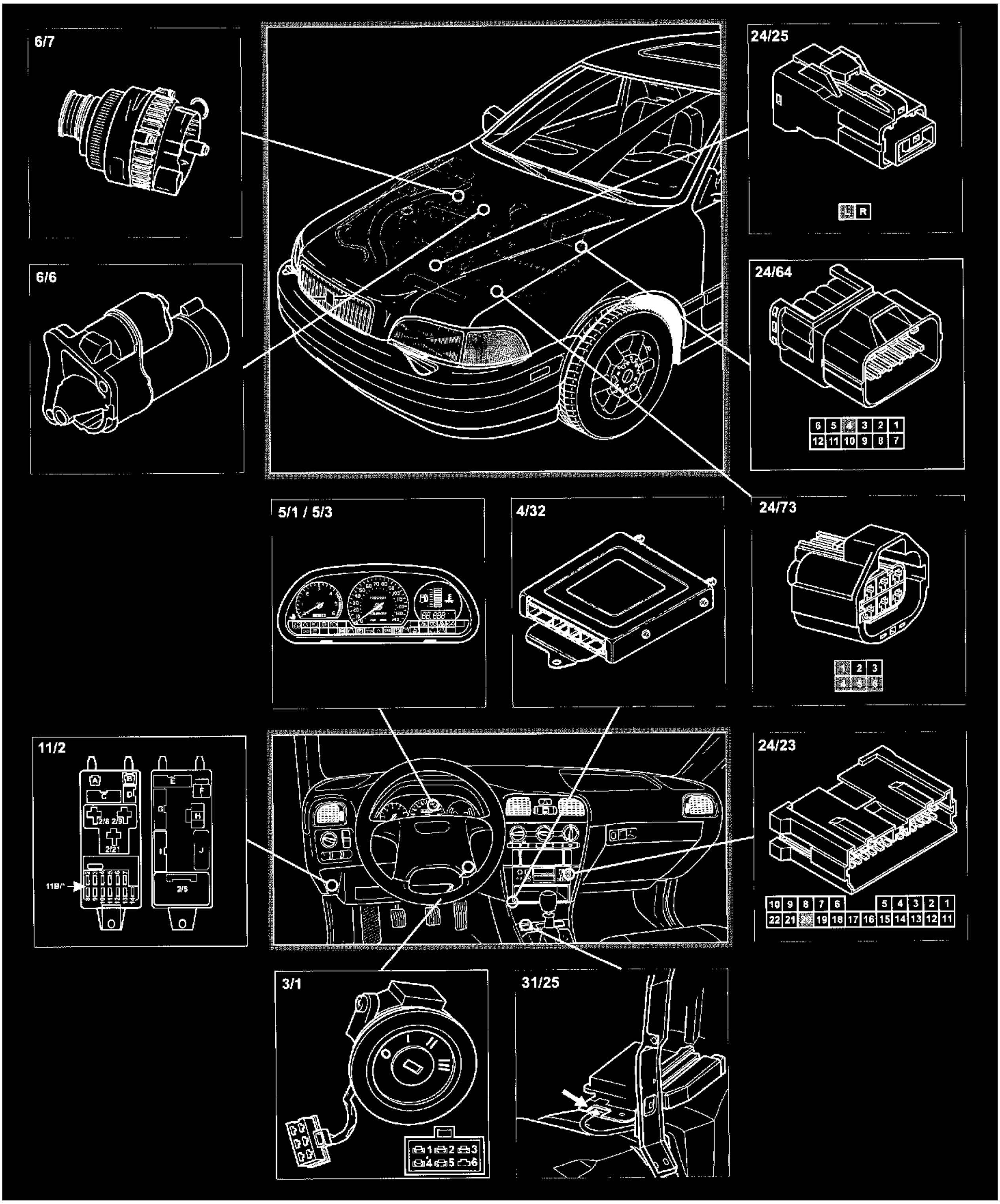
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Charging



Charging Circuit, Wiring Diagram

Wiring Diagrams

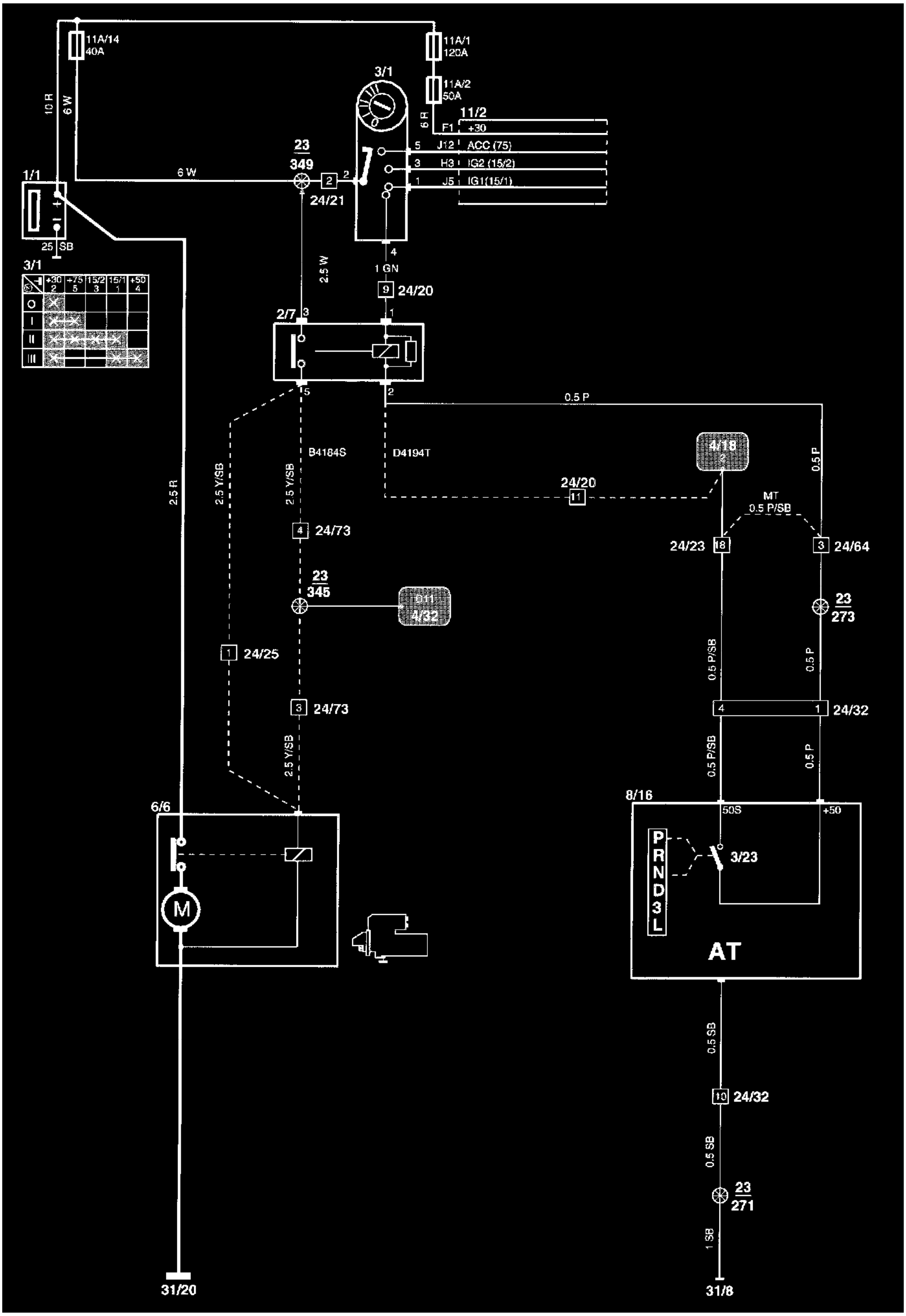


Charging Circuit, Component Locations

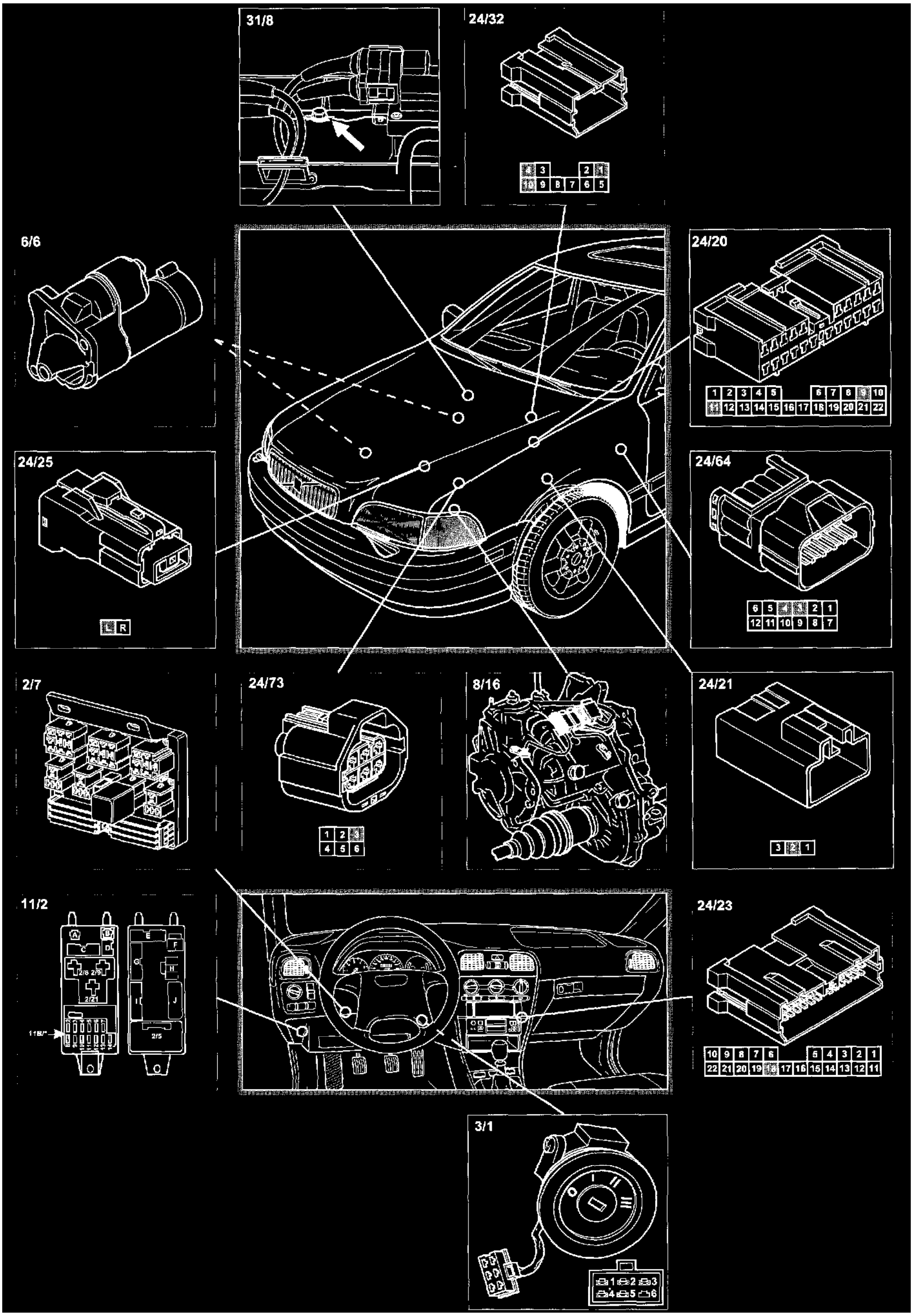
Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Starter



Starter Circuit, Wiring Diagram

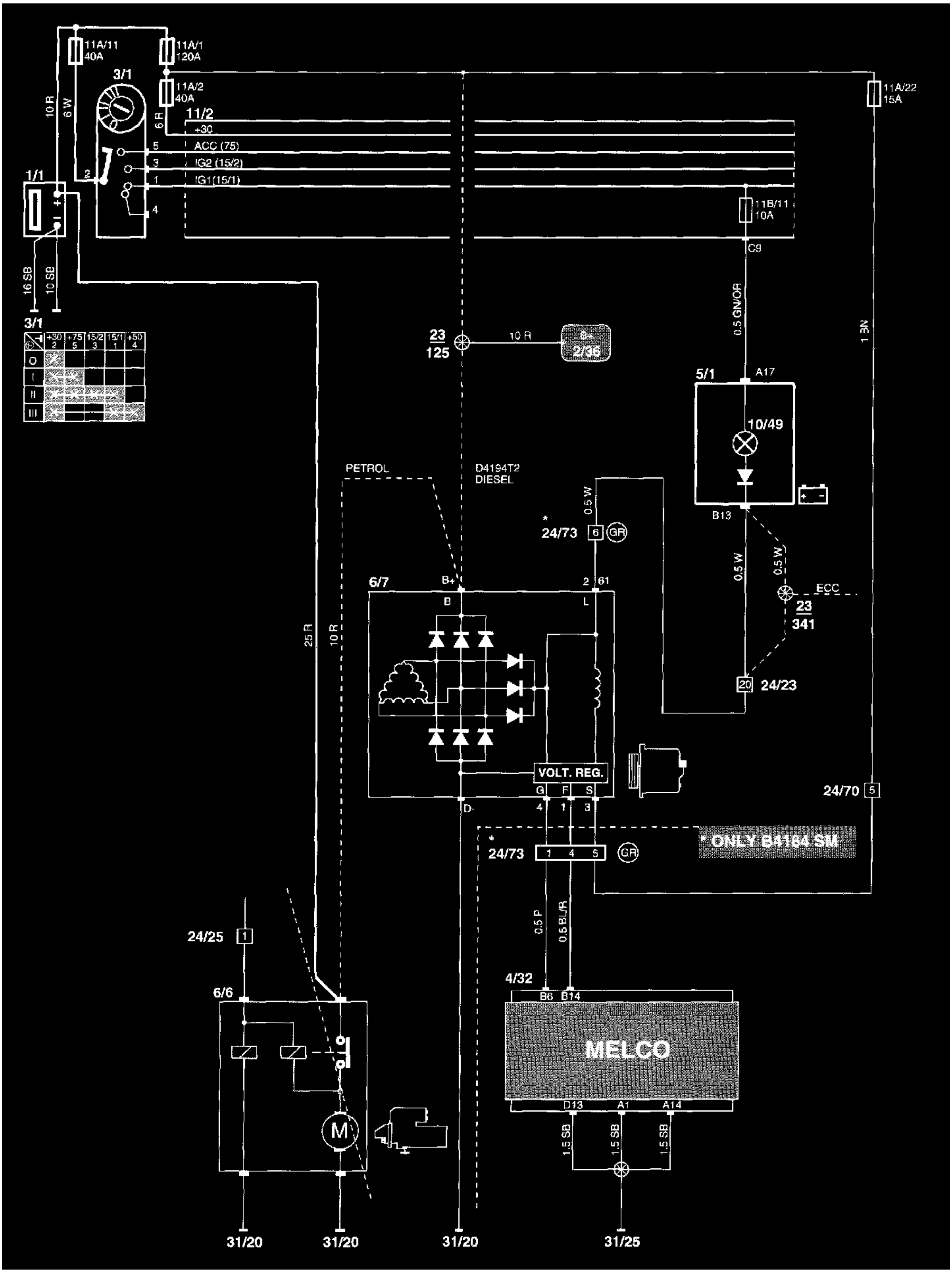


Starter Circuit, Component Locations

Component Locations

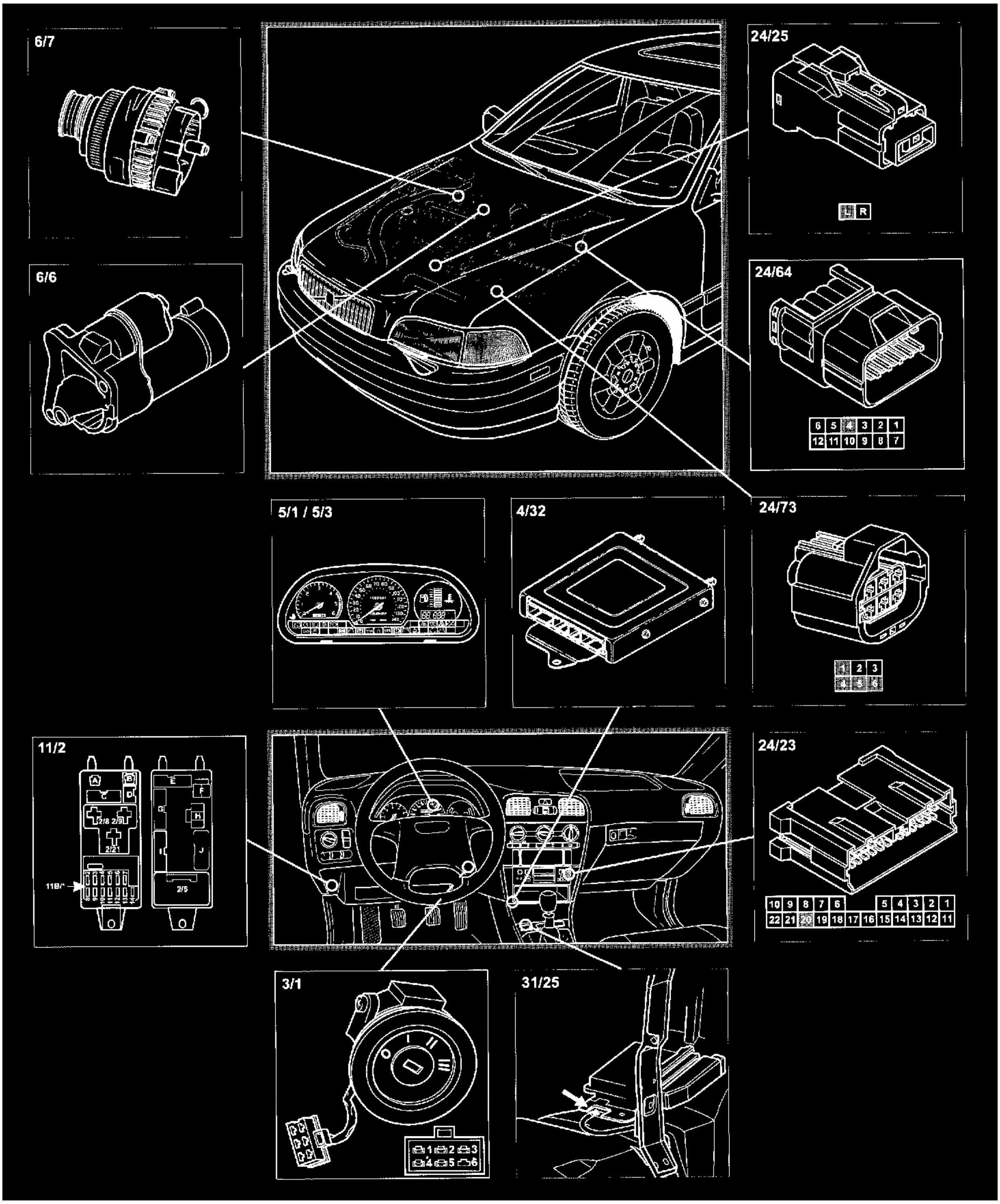
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Charging System



Charging Circuit, Wiring Diagram

Wiring Diagrams



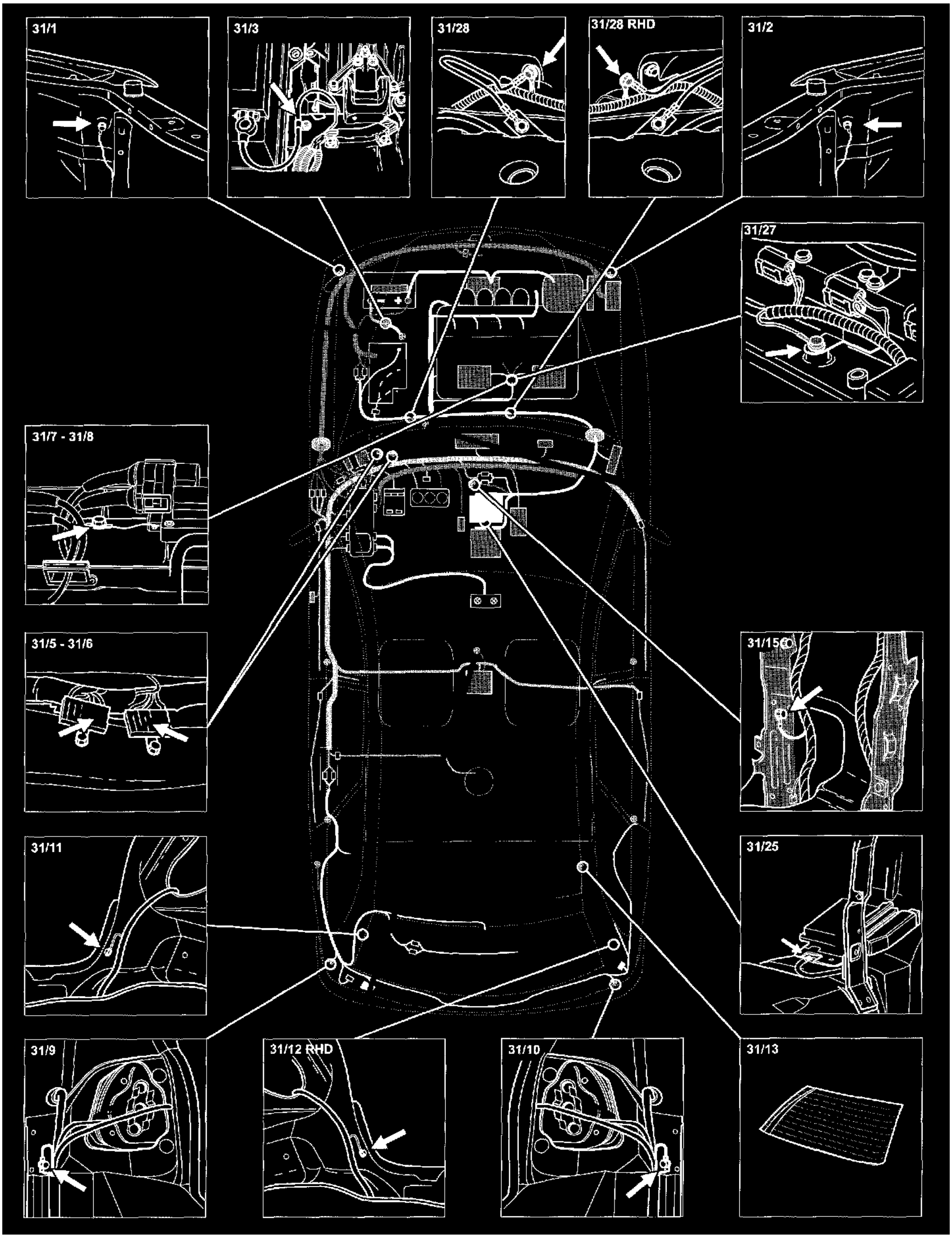
Charging Circuit, Component Locations

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Grounding Point

Ground terminals 31/1-28



Ground Terminals - Overview

31/1 and 31/2

2/34:3	Vacuum pump (Turbo, Automatic)
6/2:2	Windshield washer motor
6/10:2	Rear window washer motor
10/5:2	Left parking lamp front
10/6:2	Right parking lamp front
4/28:16	ABS control module
10/82:1	Turn signal lamp & parking lamp left (USA)
10/83:1	Turn signal lamp & parking lamp right (USA)
10/1:2	Left turn signal lamp front (EU OS)
10/2:2	Right turn signal lamp front (EU OS)
10/3:2	Turn signal lamp left fender
10/4:2	Turn signal lamp right fender

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

7/10:2	Windshield washer reservoir level sensor
10/12:2	Left parking lamp front
10/11:2	Right parking lamps front
10/13:2	Left fog lamp front
10/14:2	Right fog lamp front
6/27:1	Condenser fan
6/43:1	Cooling fan
6/15:1	Motor height adjustment left headlamp
6/16:1	Motor height adjustment right headlamp
4/15:2	Headlamp alignment control module
6/3:C	Motor right headlamp wiper
6/4:C	Motor left headlamp wiper
10/84:3	Headlamp right (single)
10/85:3	Headlamp left (single)
10/86:3	Headlamp right (twin)
10/86:5	Headlamp right (twin) (EU OS)
10/87:3	Headlamp left (twin)
10/87:5	Headlamp left (twin) (EU OS)
3/50:2	Hood catch switch
8/35:6	Siren
6/9:1	Cooling fan (MELCO 1)
2/12:2	Engine cooling fan (FC) (controlled by the air conditioning A/C) (Diesel)
7/70:3	Engine coolant temperature (ECT) switch and sensor (Diesel)
3/47:2	Pressure switch A/C (MELCO 1, Diesel)

31/3

11/1	Battery (-)

31/5

23/26	Junction point
23/315	Junction point
24/13:4	Connector
31/6:3	Ground terminal
15/13	Distribution rail
15/10:D3	Distribution rail

31/6

4/35:B2/1	Ignition warning control module
11/2:J	14 Passenger compartment fusebox
24/13:4	Connector
31/5:3	Ground terminal
23/314	Junction point
4/39:A1	VGLA

31/8

24/90:4	Connector
31/8	Ground terminal
23/266	Junction point
-	Capacitor (**220 (micro) F**)

31/9

3/30	Door switch right rear door
3/29	Door switch left rear door
10/28:2	Left rear parking lamp
10/15:4	Left stop (brake) lamp
24/91:2	Connector accessory
24/30:2	Connector

31/10

16/18:3	Bass speaker
10/29:2	Right rear parking lamp
10/16:4	Right inner stop (brake) lamp

31/11

10/17:5	High-level stop (brake) lamp (center)
3/29:2	Door switch left rear door
3/30:2	Door switch right rear door
24/91:2	Connector (ACC)
6/14:6	Power antenna
10/28:2	Left rear parking lamp

10/15:4	Left outer stop (brake) lamp
10/15:5	Left inner stop (brake) lamp
10/20	License plate lighting right
10/21	License plate lighting left
3/22	Cargo compartment switch

31/12

10/29:2	Right rear parking lamp
10/16:4	Right outer stop (brake) lamp
10/19:5	Right inner stop (brake) lamp

31/13

9/2	Heated rear window

31/15

16/1:A6	Radio

31/25

4/26:3	EMS 2000
4/26:28	EMS 2000
4/26:33	EMS 2000
4/26:67	EMS 2000
4/3:9	Control module DSA
4/27:1	Automatic transmission control module
2/23:2	Shift lock
3/44:2	Automatic transmission switch (winter)
3/45:2	Automatic transmission switch (econ/sport)
4/37:1	MSA 15.5 (Diesel)
4/37:24	MSA 15.5 (Diesel)
4/37:46	MSA 15.5 (Diesel)
7/68:1	Mass air flow (MAF) sensor (Diesel)
2/36:A2	Glow plug relay (Diesel)
7/34	Injector needle (Screen) (Diesel)
7/33	Engine speed (RPM) sensor (Screen) (Diesel)
4/32:A1	MELCO 1
4/32:A14	MELCO 1
4/32:D13	MELCO 1
7/56:2	Crankshaft sensor MELCO 1
7/64	Knock sensor (KS) (Screen) MELCO 1
7/15	Heated oxygen sensor (H02S) (Screen)

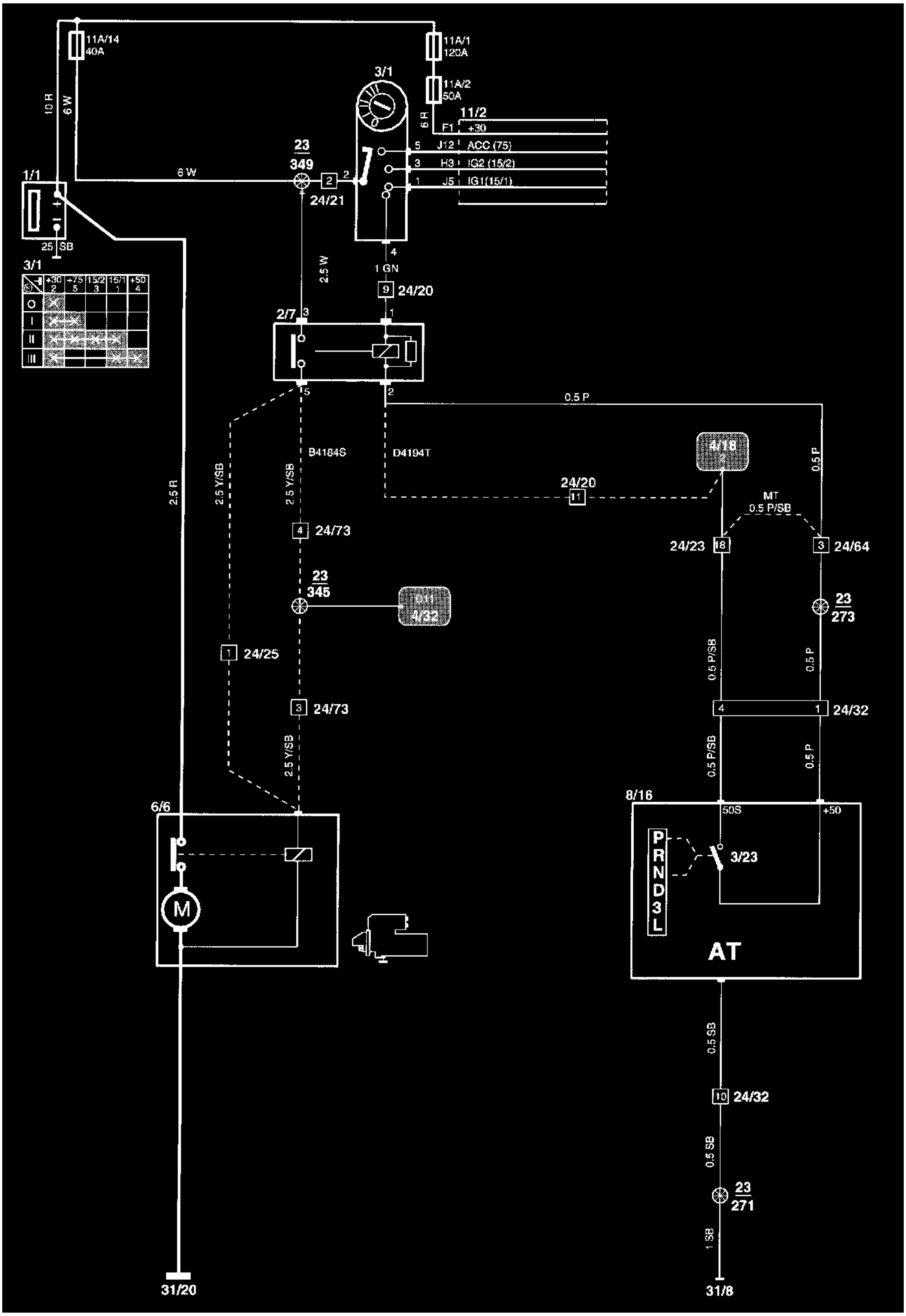
31/27

7/57:3	Camshaft position (CMP) sensor
4/34-1:2	Control module ignition system MELCO 1
4/34-2:2	Control module ignition system MELCO 1
4/34-3:2	Control module ignition system MELCO 1
4/34-4:2	Control module ignition system MELCO 1

31/28

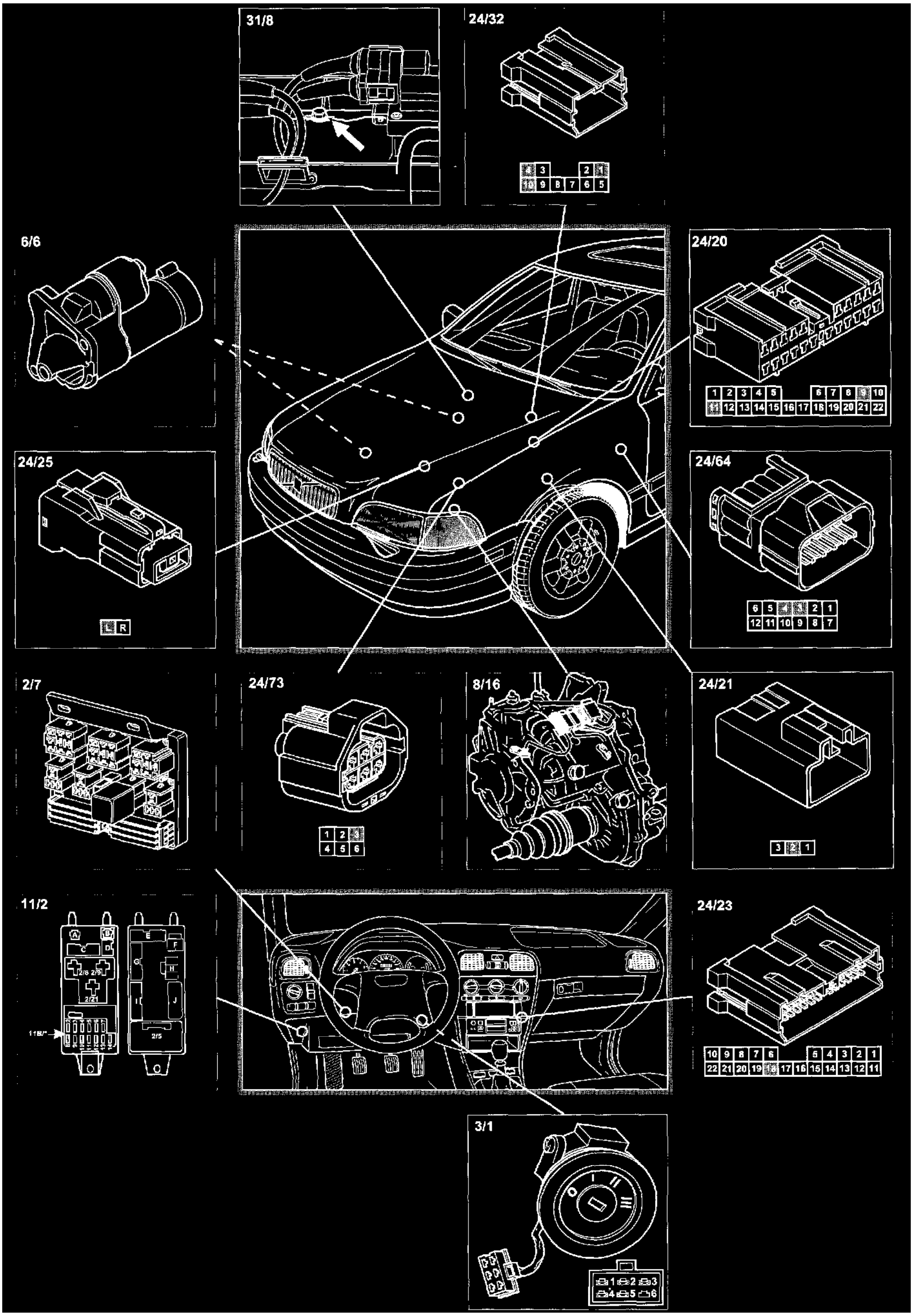
7/9:2	Brake fluid level sensor
6/1:5	Windshield wiper motor
3/55:1	Kick-down switch
24/32:10	Connector AW
9/13:2	Crankcase ventilation (USA)
4/33:14	MELCO 1
4/33:22	MELCO 1
9/10:A	Fuel pre-heating (Diesel pump)
9/12:2	Crankcase ventilation (Diesel)
7/39:2	Fuel temperature sensor (Diesel)

System Diagram



Starter Circuit, Wiring Diagram

Wiring Diagrams



Starter Circuit, Component Locations

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Ignition Switch

Refer to **"STARTING AND CHARGING : DIAGRAMS : ELECTRICAL"**. See: Starting and Charging/Diagrams/Electrical Diagrams

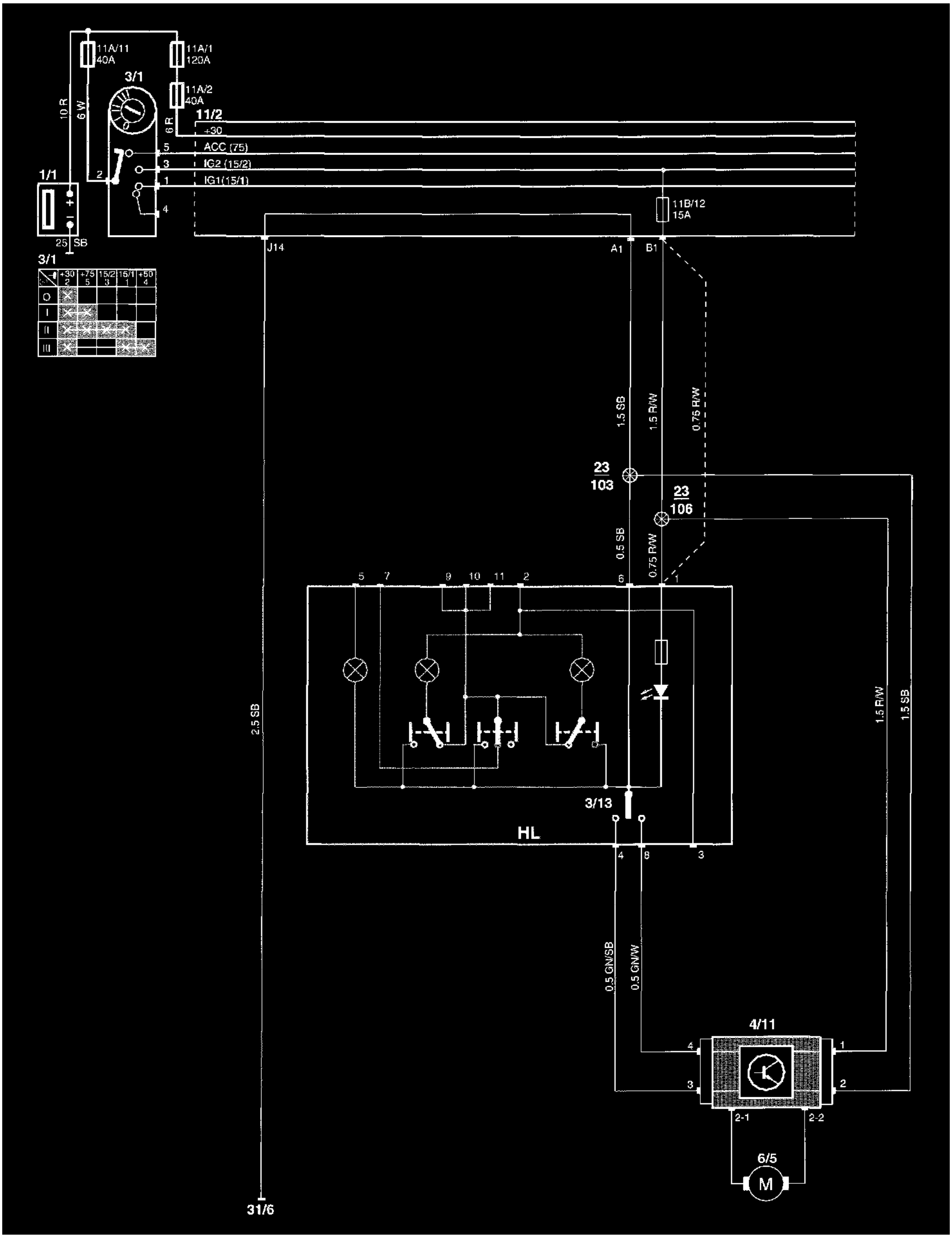
Neutral Safety Switch

Refer to **"STARTING AND CHARGING : DIAGRAMS : ELECTRICAL"**. See: Starting and Charging/Diagrams/Electrical Diagrams

Starter Motor

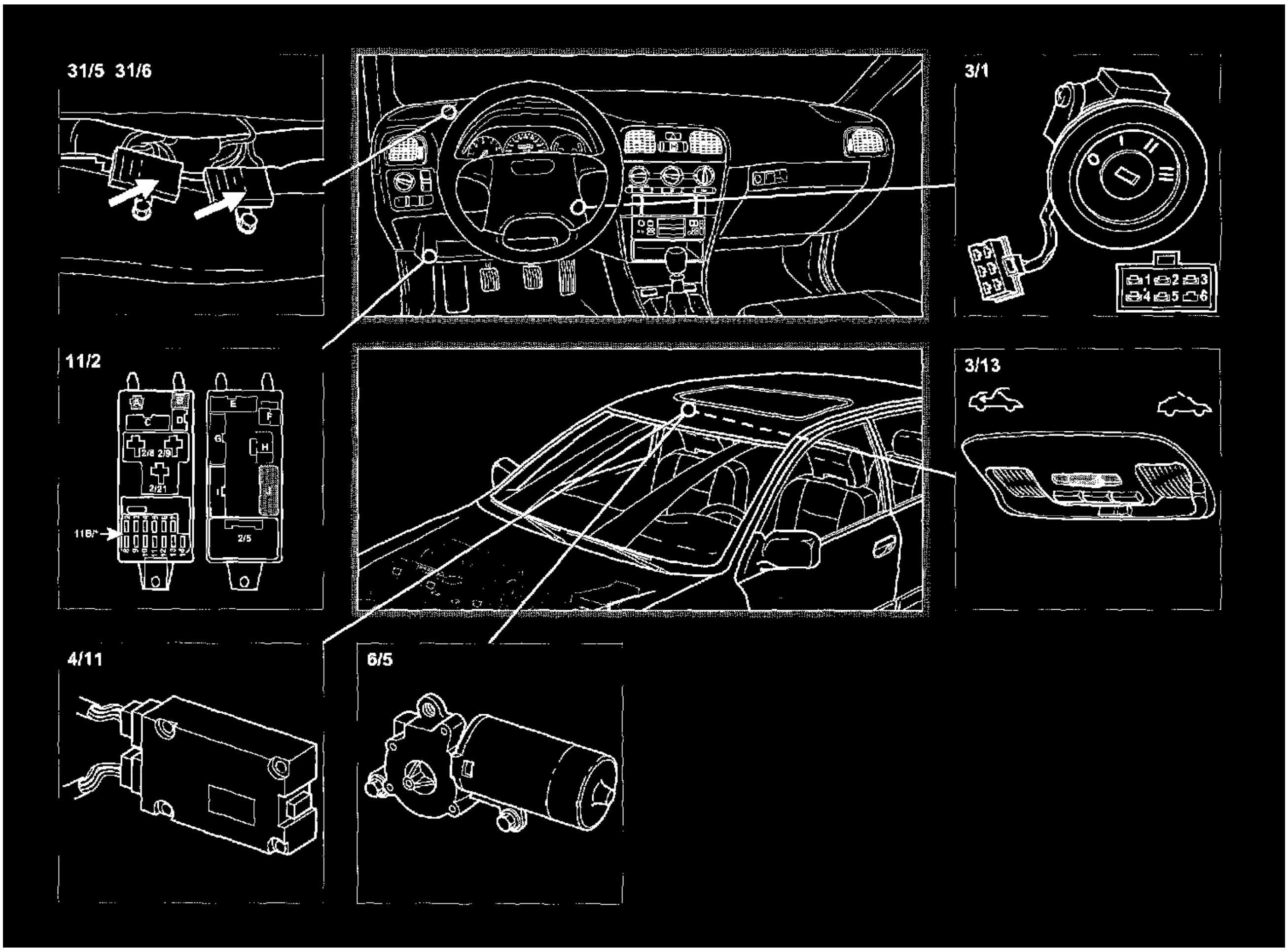
Refer to **"STARTING AND CHARGING : DIAGRAMS : ELECTRICAL"**. See: Starting and Charging/Diagrams/Electrical Diagrams

Sunroof / Moonroof



Power Sunroof, Part 1 Of 2

Wiring Diagrams

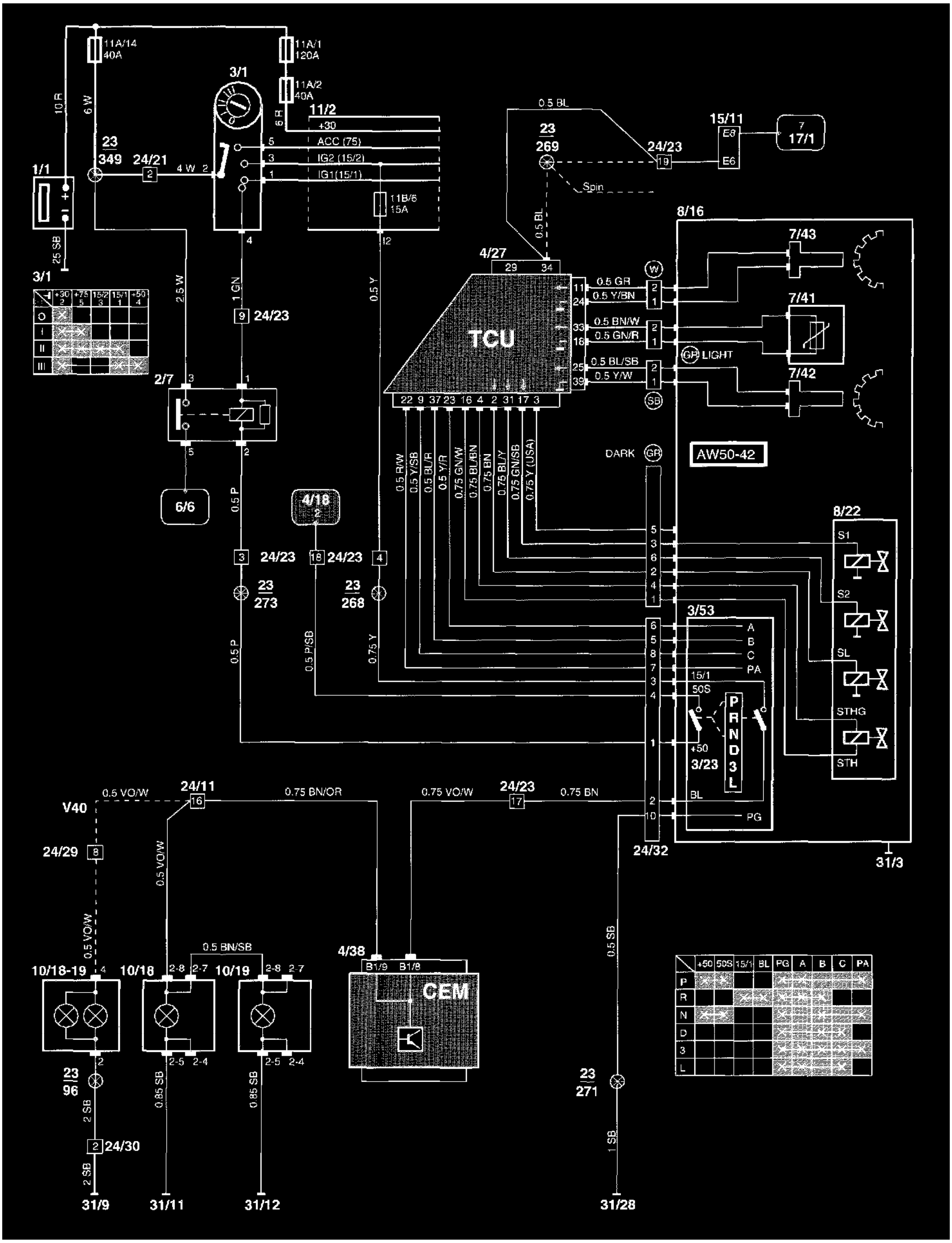


Power Sunroof, Part 2 Of 2

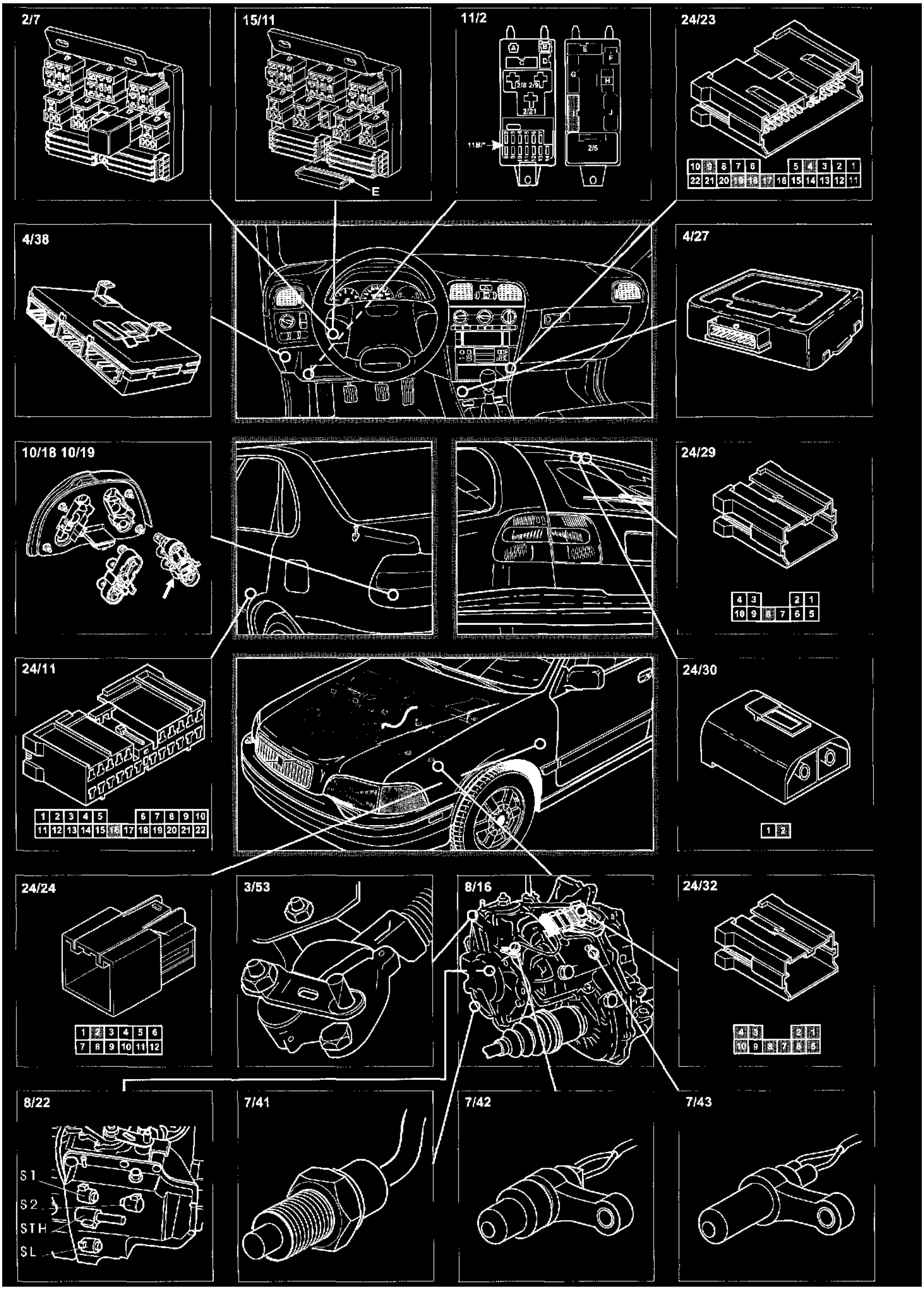
Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Transmission Control Systems



Automatic Transmission, Part 1 Of 2



Automatic Transmission, Part 2 Of 2

Component Locations

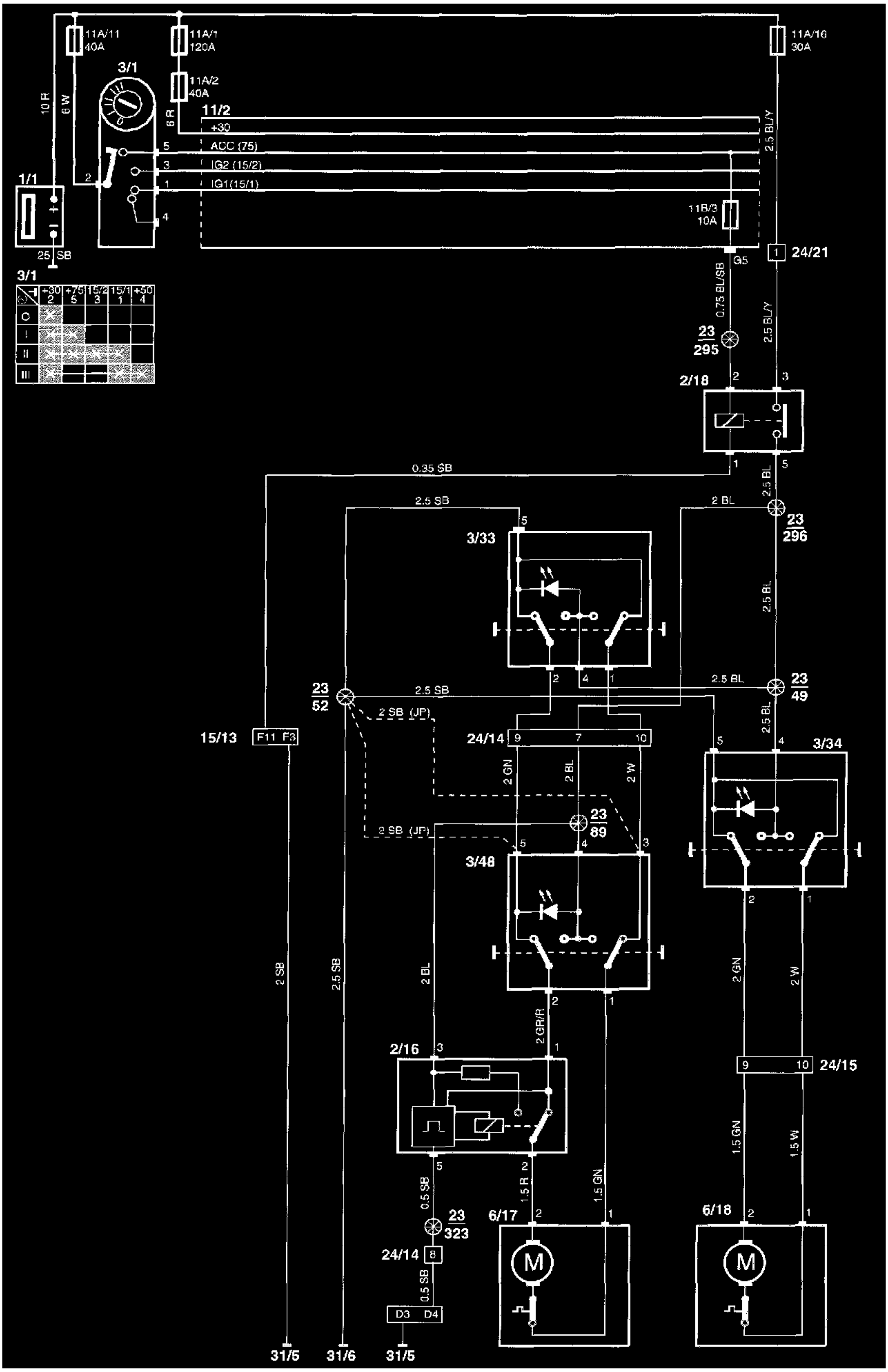
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Wheel Speed Sensor

Refer to **Antilock Brakes/Traction Control Systems - Diagrams - Electrical**

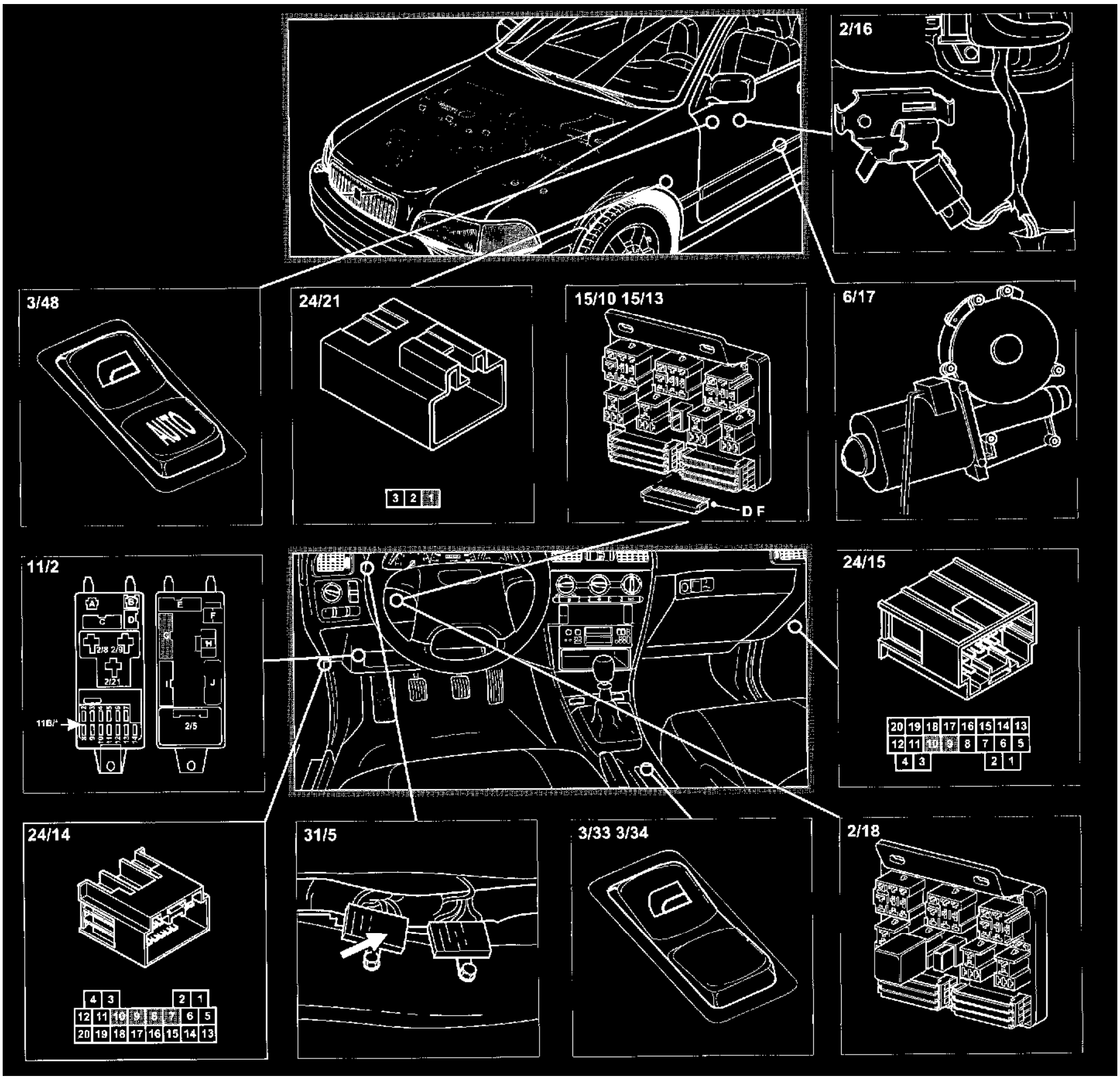
See: Brakes and Traction Control/Antilock Brakes / Traction Control Systems/Diagrams/Electrical Diagrams

Power Windows Front



Power Windows Front, Part 1 Of 2

Wiring Diagram

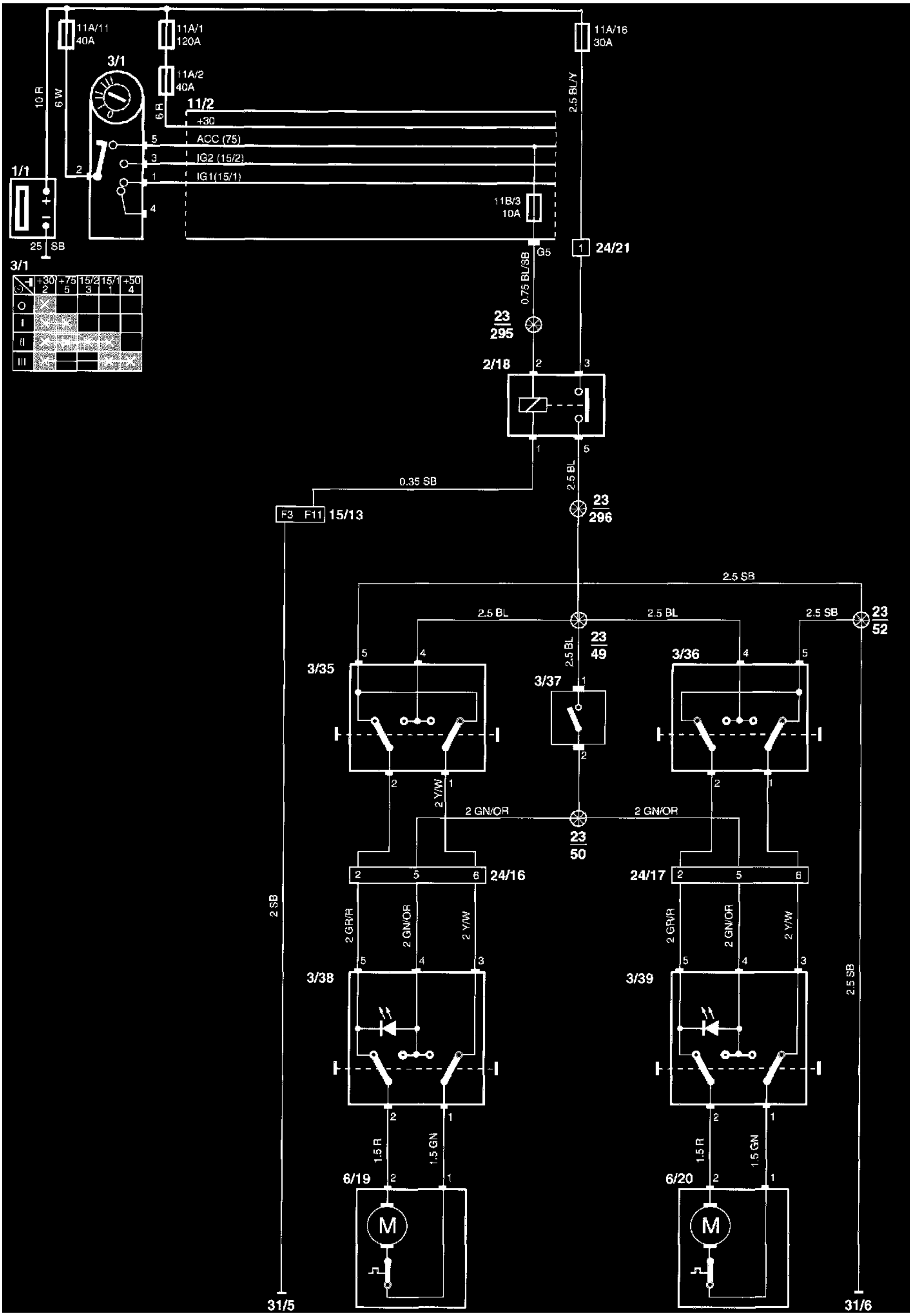


Power Windows Front, Part 2 Of 2

Component Locations

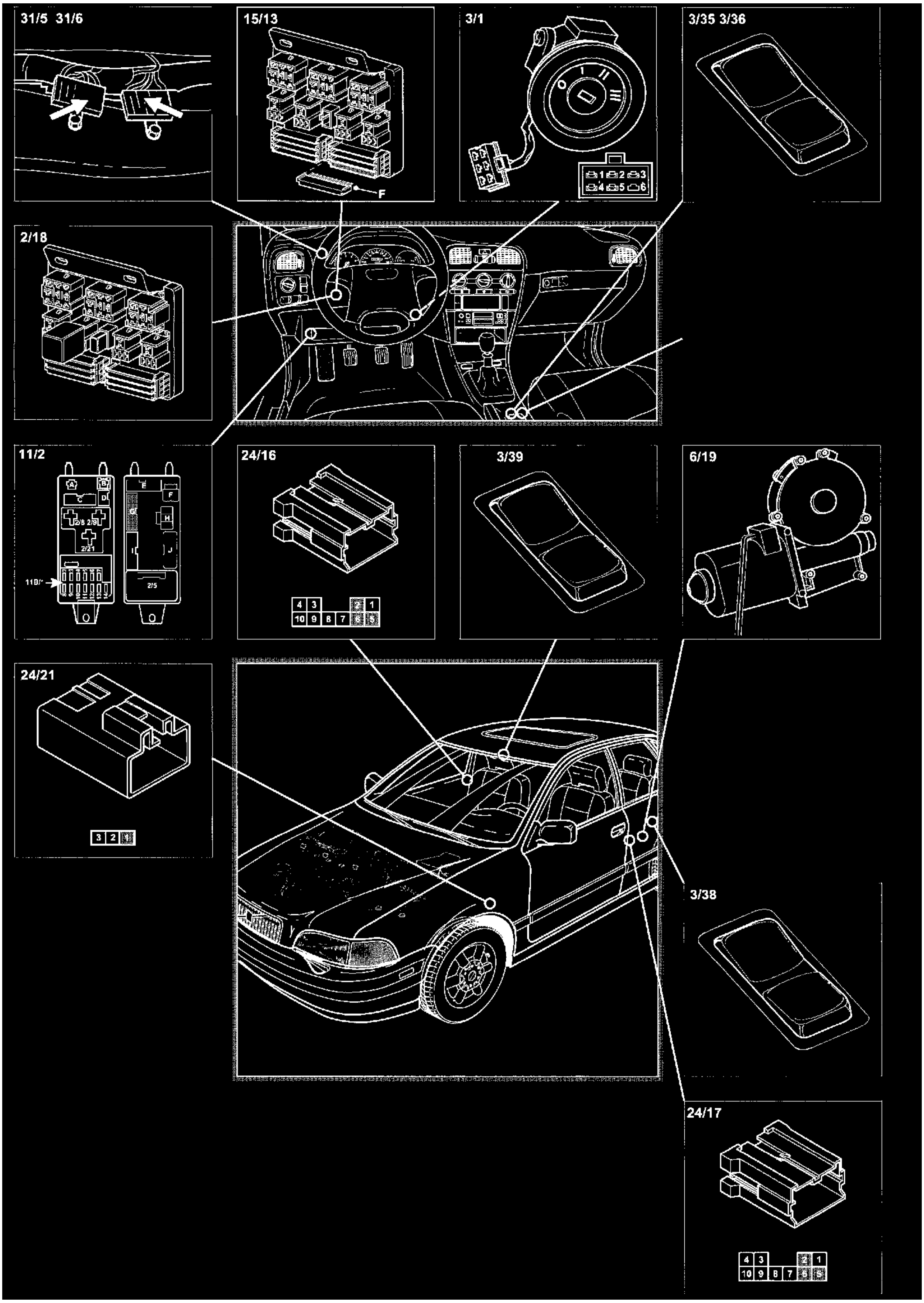
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Power Windows Rear



Power Windows Rear, Part 1 Of 2

Wiring Diagram

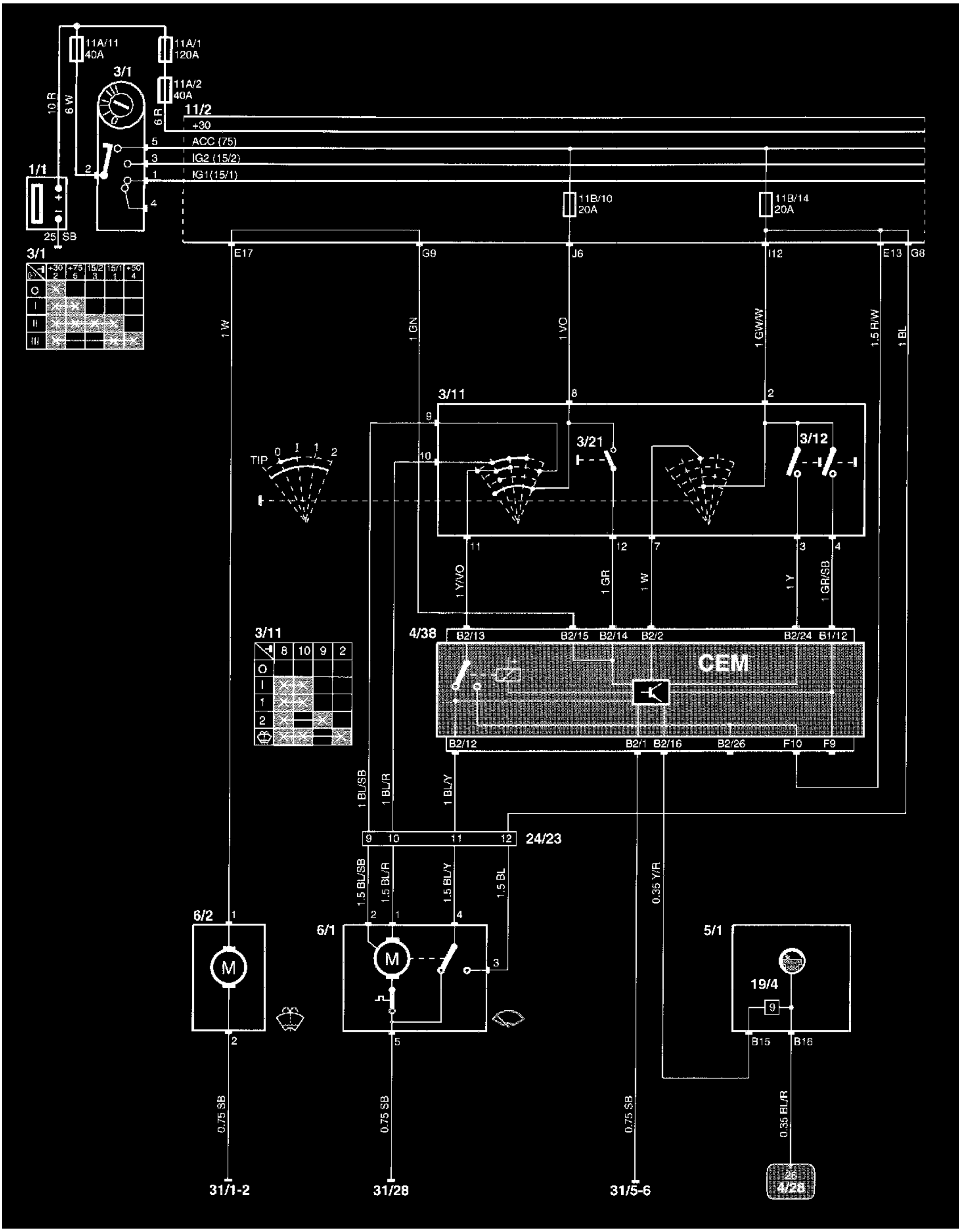


Power Windows Rear, Part 2 Of 2

Component Locations

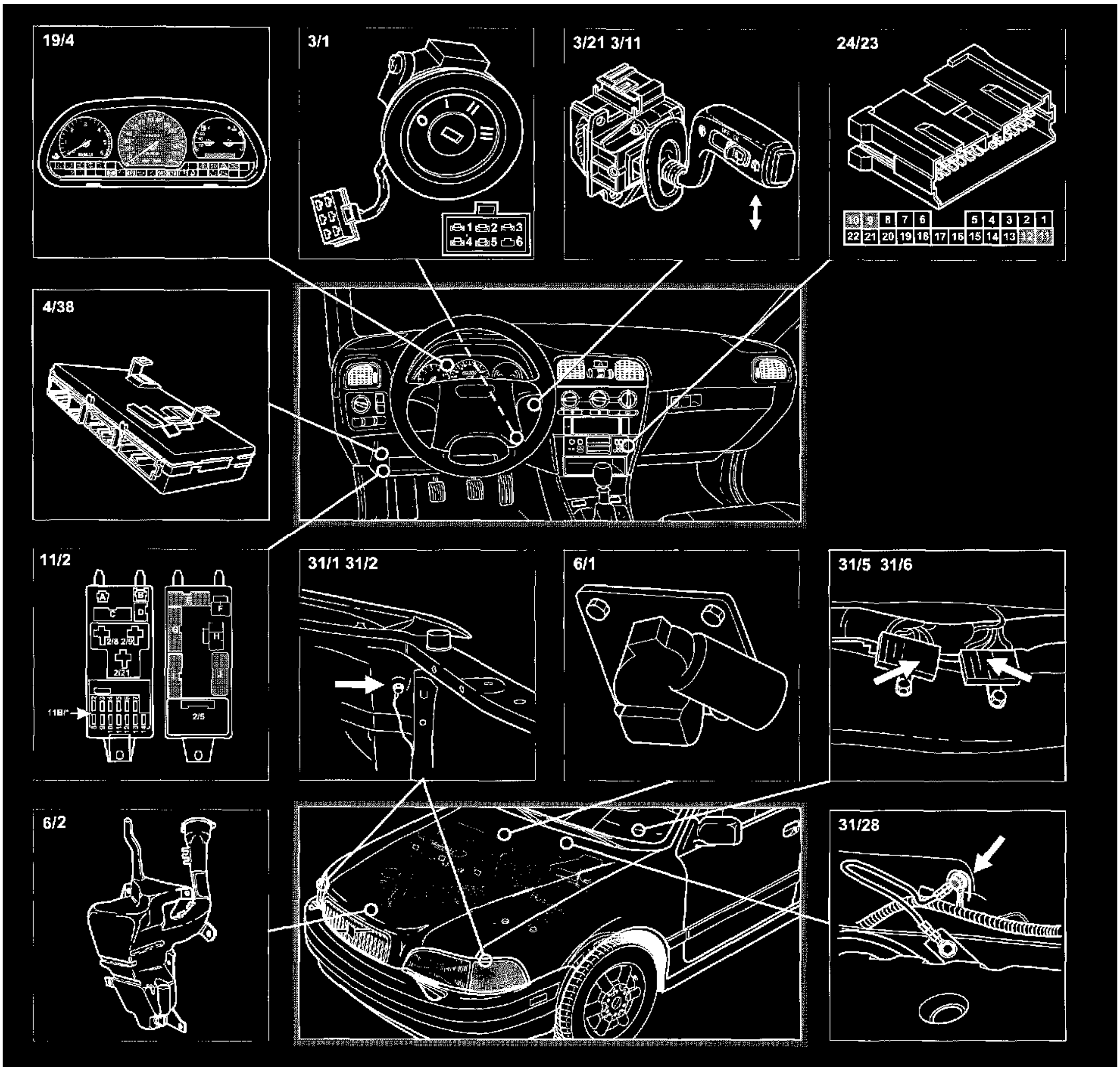
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Windshield



Windshield Wiper And Windshield Washer, Part 1 Of 2

Wiring Diagram

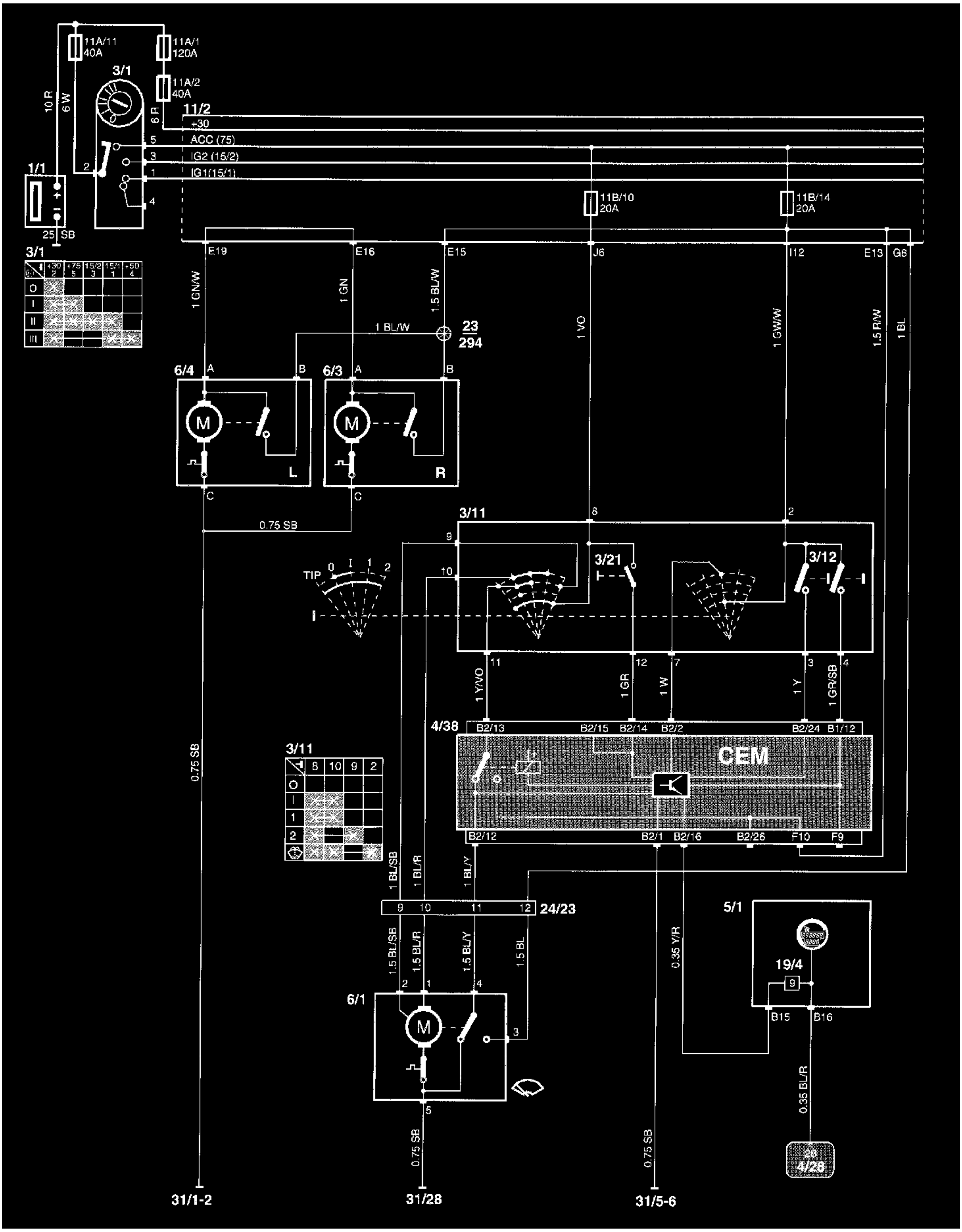


Windshield Wiper And Windshield Washer, Part 2 Of 2

Component Locations

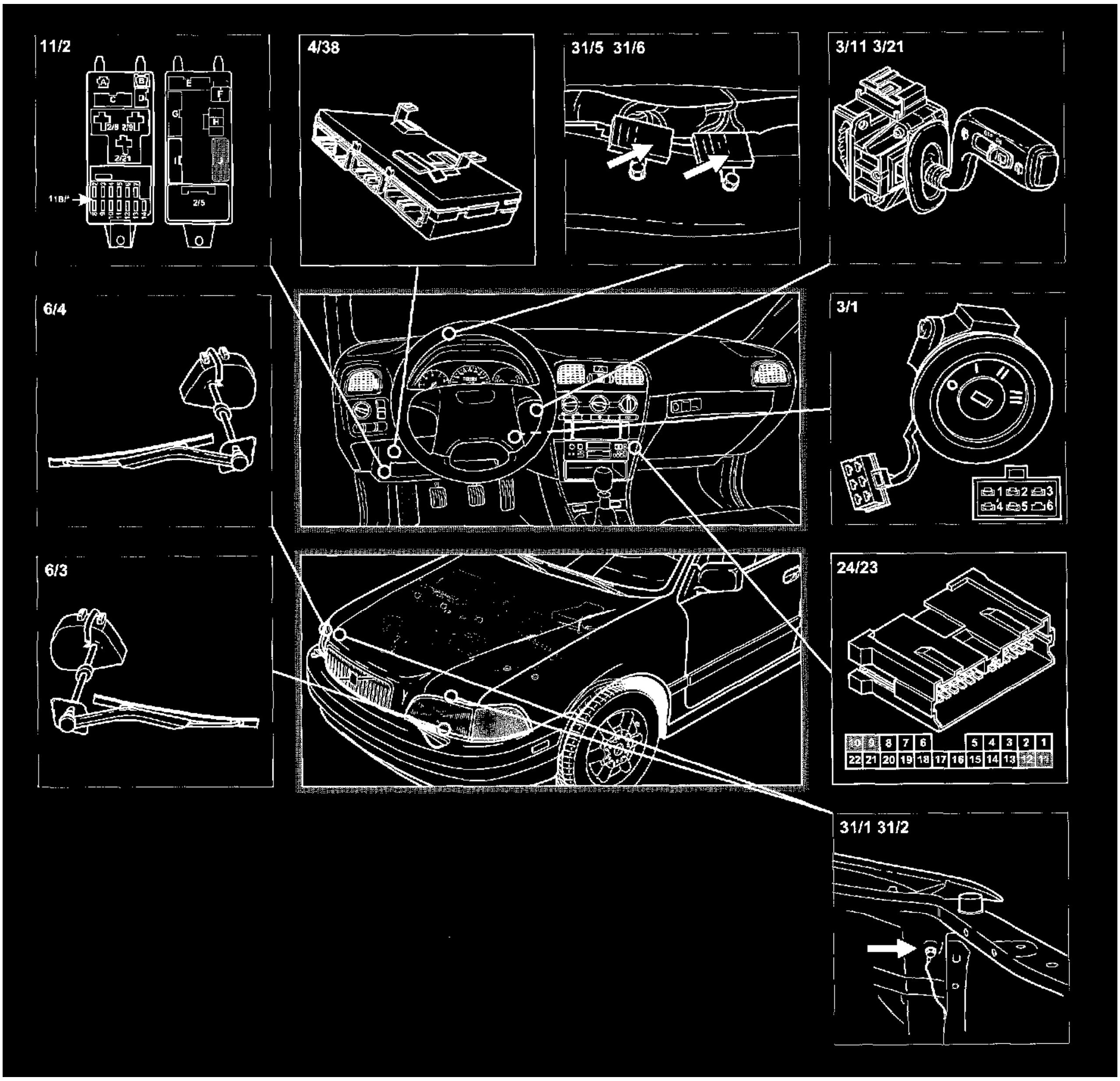
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Headlamps



Headlamp Wiper, Part 1 Of 2

Wiring Diagram

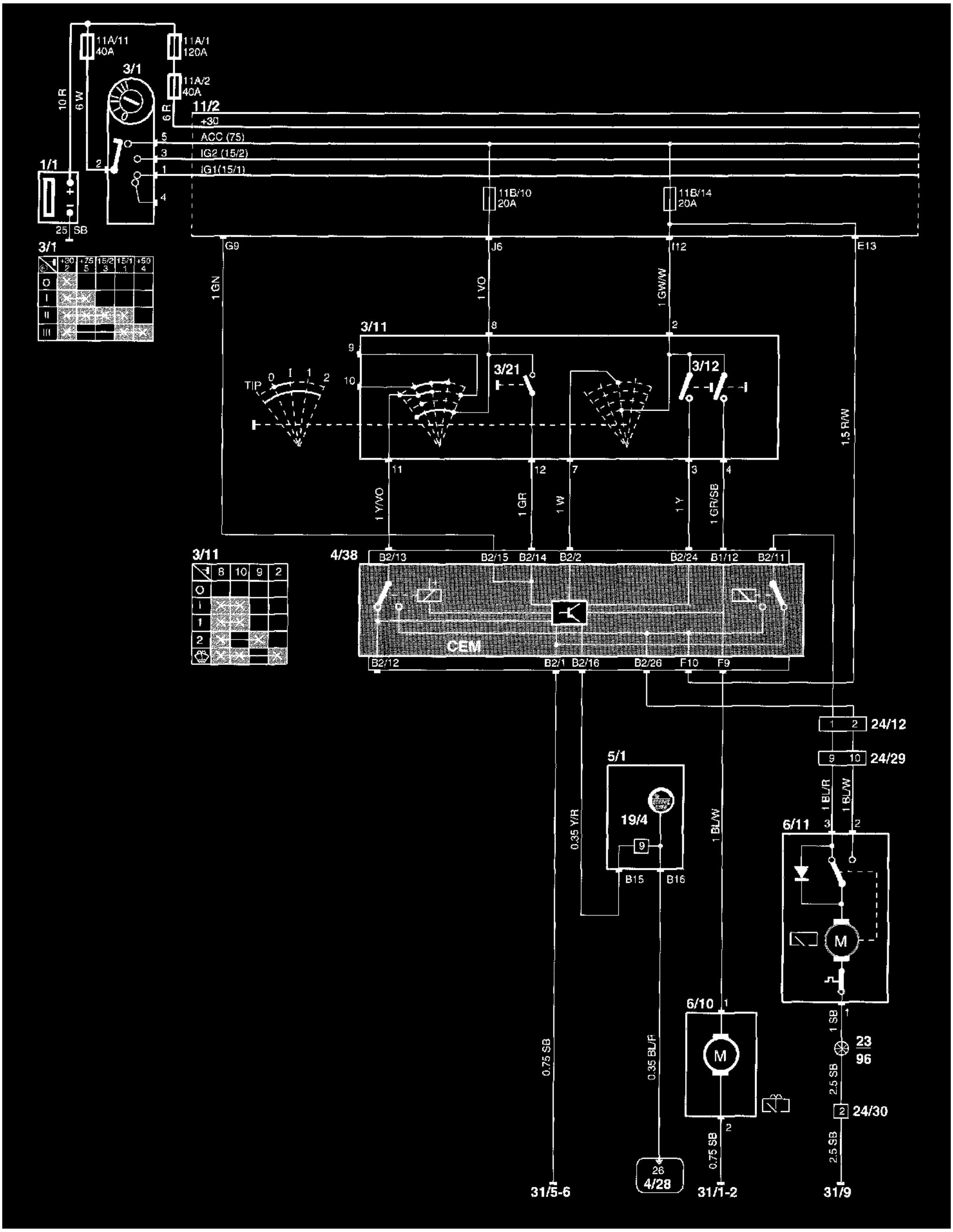


Headlamp Wiper, Part 2 Of 2

Component Locations

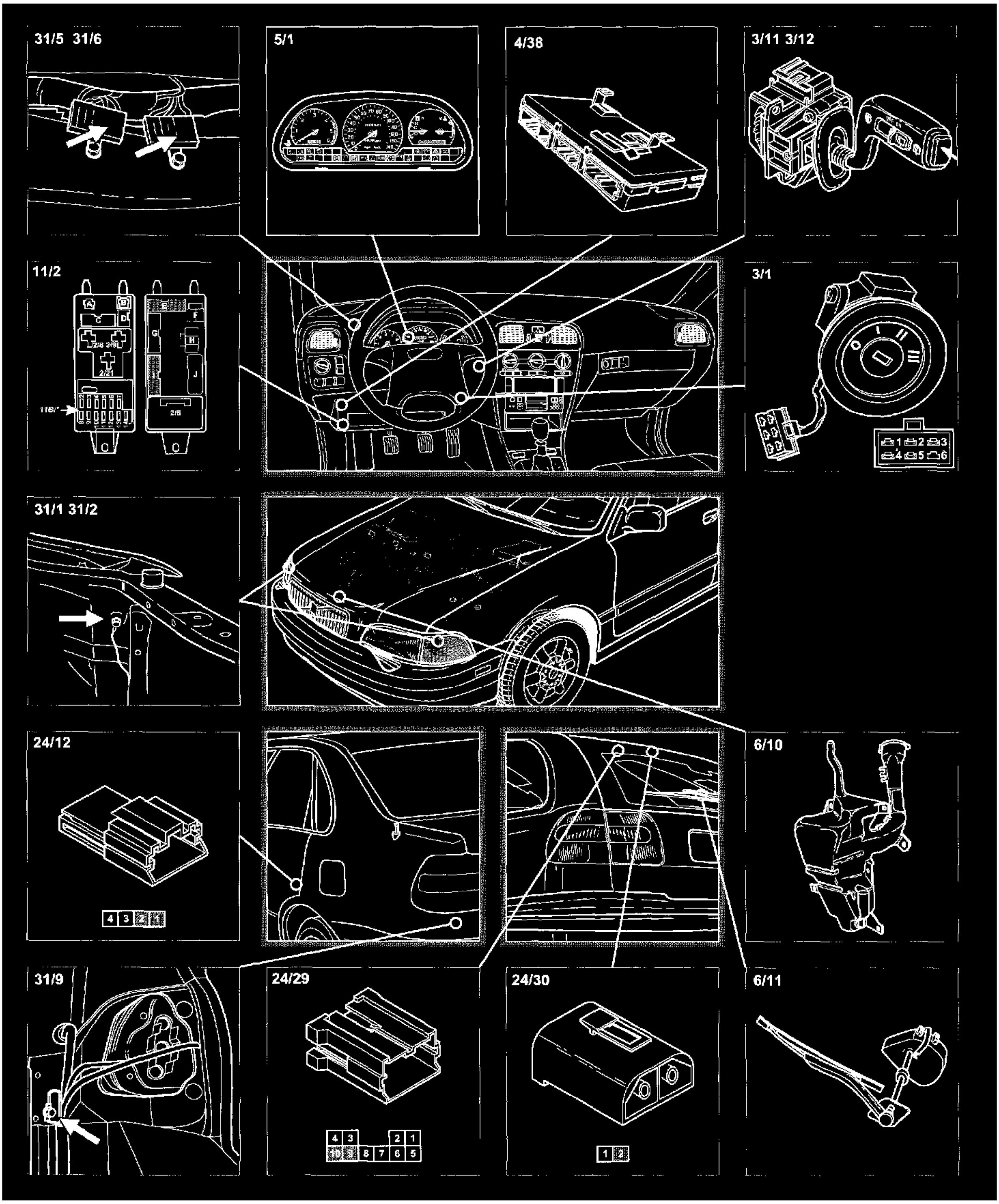
Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Rear Windshield V40



Tailgate Wiper And Washer, V40, Part 1 Of 2

Wiring Diagram



Tailgate Wiper And Washer, V40, Part 2 Of 2

Component Locations

Diagram Legend can be found at **"Vehicle : Diagrams : Diagram Information and Instructions : Component List."** See: Diagram Information and Instructions/List of Components By Component Number

Headlamp Washer Motor

For Headlamp Washer Motor electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams

Headlamp Wiper Motor

For Headlamp Wiper Motor electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams

Windshield Washer Motor

For Front or Rear Windshield Washer Motor electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams

Windshield Washer Switch

For Front or Rear Windshield Washer Switch electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams

Wiper Motor

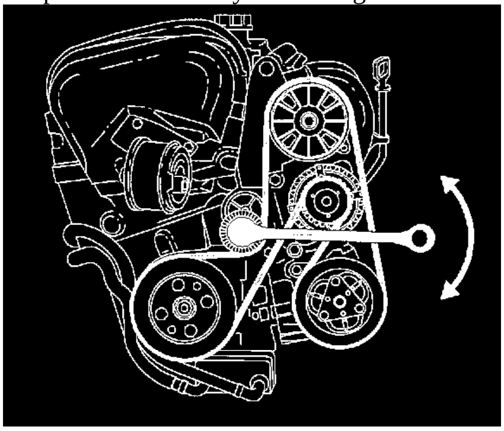
For Front or Rear Wiper Motor electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams

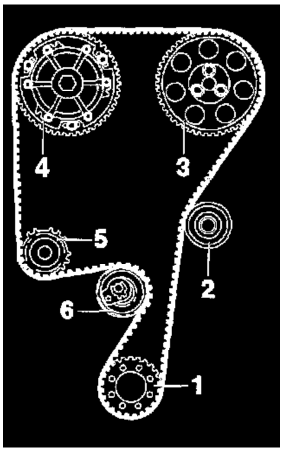
Wiper Relay

For Wiper Motor Relay electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams

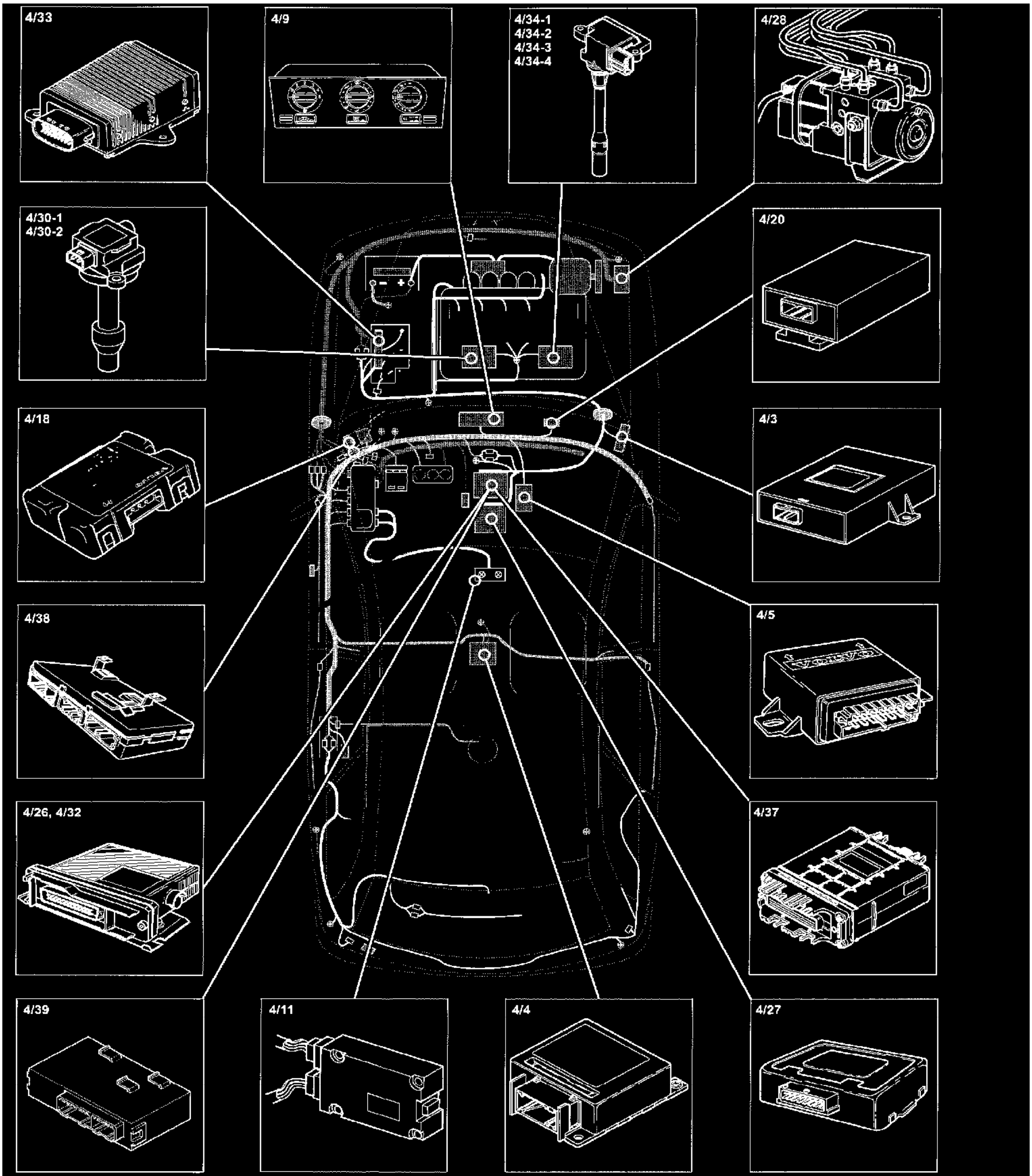
Wiper Switch

For Wiper Switch electrical diagrams, refer to See: Wiper and Washer Systems/Diagrams/Electrical Diagrams



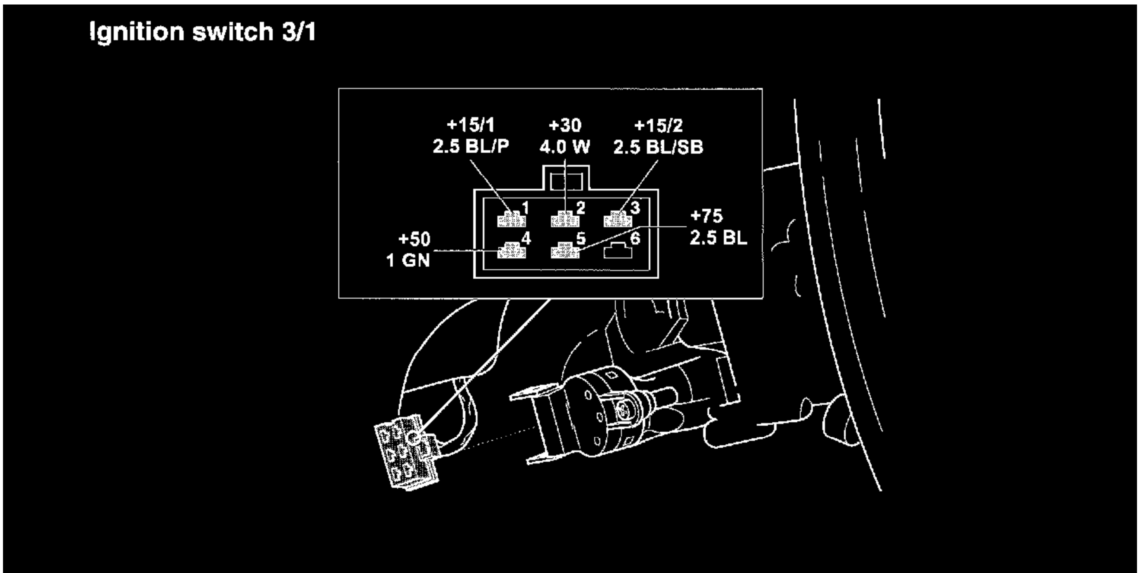


Components



4/3	DSA control module
4/4	SRS control module
4/5	Cruise control control module
4/9	ECC control module
4/11	Power sun roof control module
4/18	Immobilizer control module
4/20	Air conditioning (A/C) compressor control module
4/26	EMS 2000 control module
4/27	Control module for automatic transmission
4/28	ABS control module 5.3
4/30	Ignition EMS 2000
4/32	Control module MELCO 1
4/33	Control module for fuel injection system MELCO 1
4/34	Control module for ignition system MELCO 1
4/37	Engine management system MSA 15.5
4/38	CEM (Central Electronic Module)
4/39	VGLA

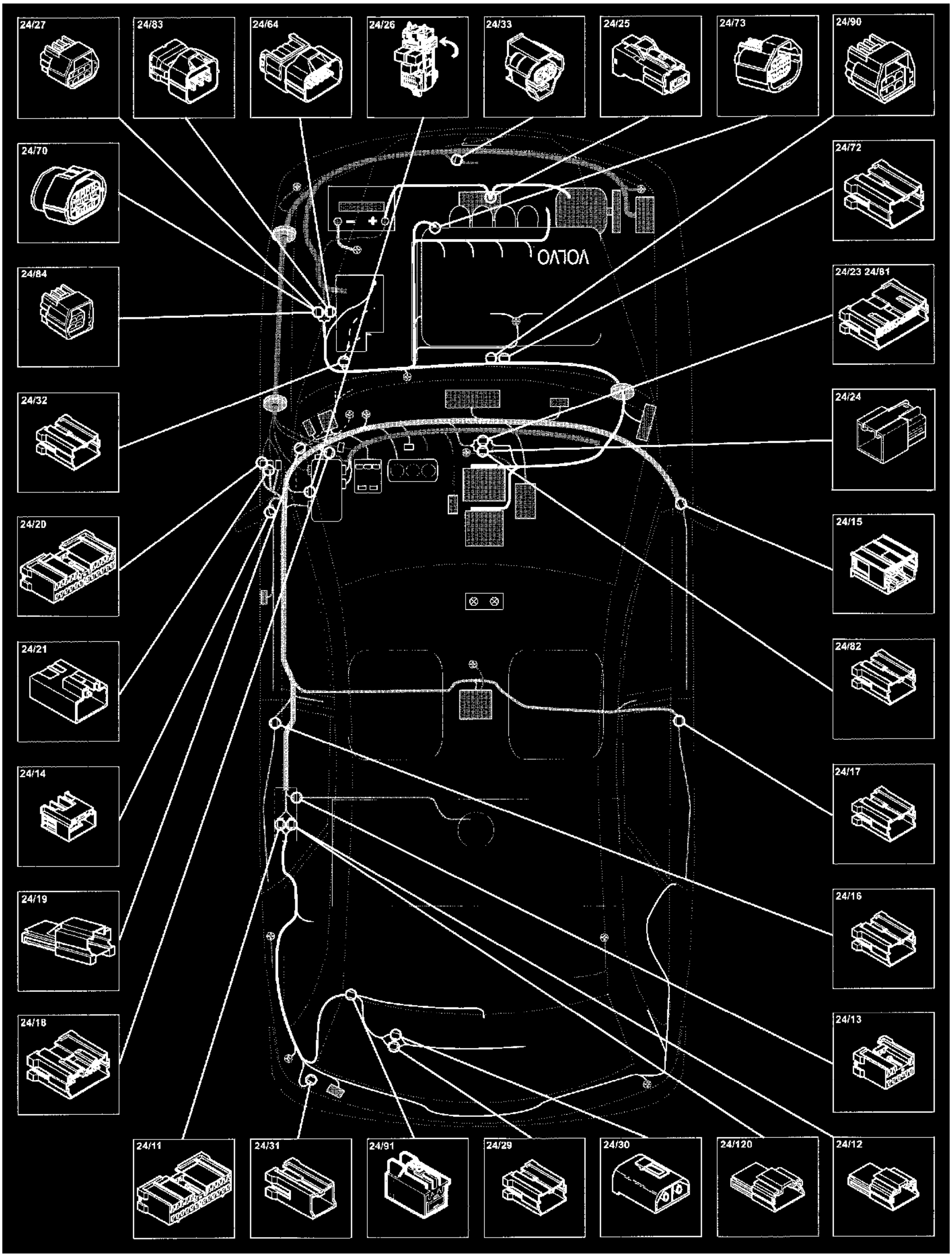
Control Modules - Overview



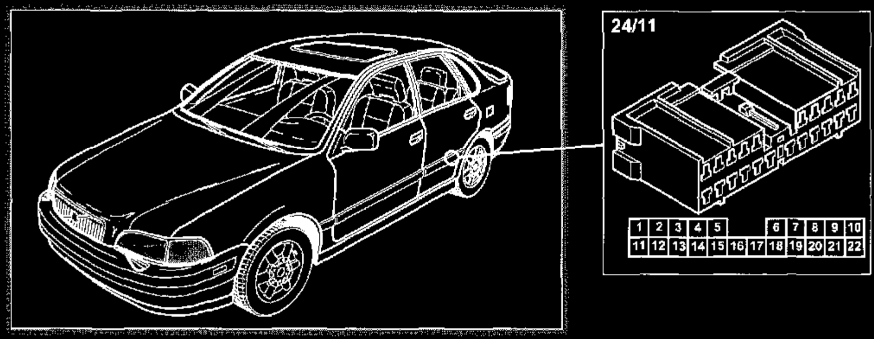
Key position	Function	Voltage on terminal
0 +30		2
I +75	Optional position	2 and 5
II 15/1 15/2	Switch in position (switched on by start) Switch in position(switched off by start)	1,2,3 and 5 1 and 2
III +50	Start	1,2 and 4

Ignition Switch 3/1

Connectors



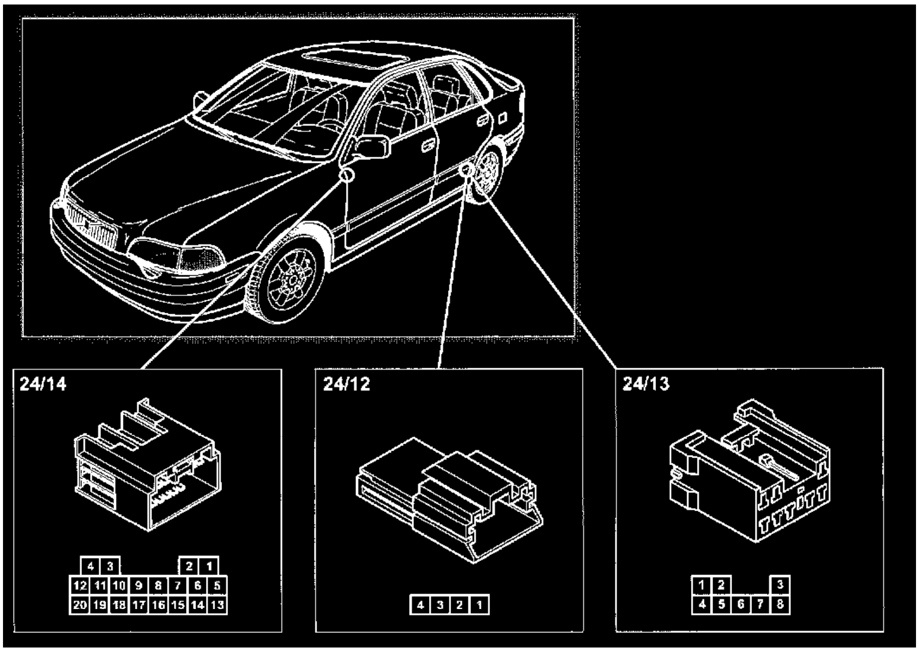
Connectors - Overview



24/11 Passenger compartment - Cargo compartment cable harness 22-pin

Ter.	Female	Male	Color
1	Junction point 23/324	Distribution rail opening door lock (A9) Relay for cargo compartment lock (1)	GN-GR
2	Connector 24/31:4 (S40) Connector 24/29:4 (V40)	Distribution rail deadlock door lock (C2) Junction point 23/1002	DR-W
3	Junction point 23/88	Fusebox in passenger compartment (G14)	R-SB
4	Door switch left rear door (1)	VGLA (B8)	GN-R
5	Roof lamp rear (only V40)	Fusebox in passenger compartment (G22)	GN
6	Turn signal lamp left rear (1,8)	Fusebox in passenger compartment (G18)	BL-Y
7	Junction point 23/275	Central electronic module (CEM), (B1/2)	P
8	Parking lamp left rear (1-2)	Fusebox in passenger compartment (G10)	GR
9	Loudspeaker left rear (1) (S40) Junction point 23/302 (V40)	Radio (2)	Y-SB
10	Loudspeaker left rear (2) (S40) Junction point 23/301 (V40)	Radio (1)	GR-W
11	Lock motor for fuel tank filler cap	Distribution rail closing door lock (B2) VGLA (B22)	BN-SB
12	Rear demist (S40) Connector 24/30:1 (V40)	Fusebox in the passenger compartment (J15)	OR-R
13	Junction point 23/283	Central electronic module (CEM), (B1/10)	GN-R
14	Telescopic antenna (4) (S40) Junction point 23/313 (V40)	Radio (3)	R
15	Stop (brake) lamp (Turbo, MELCO 1, Diesel) Stop (brake) lamp left rear (1,1) (Gasoline)	Central electronic module (CEM), (B1/6)	GN-R
16	Telescopic antenna (2,8) (S40) Connector 24/29:8 (V40), Back-up (reversing) lamp (Turbo)	Central electronic module (CEM), (B1/9)	BN-OR
17	Door switch right rear door	VGLA (B7)	GN-W
18	Turn signal lamp right rear	Fusebox in passenger compartment (I20)	Y-BN
19	Junction point 23/289	VGLA (A19)	BL-BN
20	Driver's side rear fog lamp (2,1) (S40) Connector 24/29:7 (V40)	CEM, (B1/11)	BL
21	Loudspeaker right rear (1) (S40) Junction point 23/304 (V40)	Radio (6)	Y
22	Loudspeaker right rear (2) (S40) Junction point 23/303 (V40)	Radio (5)	GR-W

Connectors 24/11



Connectors 24/12-14

24/12 Passenger Compartment - Cargo Compartment Cable Harness 4-pin

24/12 Passenger compartment - Cargo compartment cable harness 4-pin

Ter.	Female	Male	Color
1	Connector 24/29:9 (V40)	Central electronic module (CEM), (B2/11)	BL-R
2	Connector 24/29:10 (V40)	Central electronic module (CEM), (B2/26)	BL-W
3	Connector accessory	Junction point 23/1001 Fusebox in passenger compartment (J4) (AUS)	Y
4	Junction point 23/1000 (V40)	Fusebox in the passenger compartment (J9)	W

24/13 Passenger Compartment - Fuel Tank 8-pin

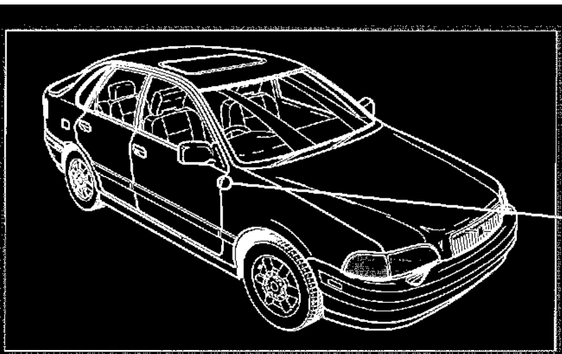
24/13 Passenger compartment - Fuel tank 8-pin

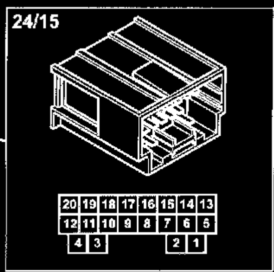
Ter.	Female	Male	Color
1	Fuel level sensor (+)	Instrument panel (17) (Diesel) Junction point 23/177 (Gasoline)	Y-SB
2	Fuel level sensor (-)	Instrument panel (9)	Y
3	Fuel pump (FP) (+)	Connector 24/20:18	BL
4	Junction point 23/253	Ground terminal 31/6, behind instrument (2)	SB
5	Vehicle speed sensor (VSS), left rear wheel, ABS (+)	Connector 24/20:2	GR-R
6	Vehicle speed sensor (VSS), left rear wheel, ABS (-)	Connector 24/20:03	GR
7	Vehicle speed sensor (VSS), right rear wheel, ABS (+)	Connector 24/20:21	BL-GR
8	Vehicle speed sensor (VSS), right rear wheel, ABS (-)	Connector 24/20:22	BL-GN

24/14 Passenger Compartment - Driver's Door Cable Harness 20-pin

24/14 Passenger compartment - Driver's door cable harness 20-pin

Ter.	Female	Male	Color
1	-	-	-
2	Heating driver's door mirror(4)	Fusebox in passenger compartment (J18)	R-W
3	Motor central locking system driver's door (1) Motor central locking system driver's door (2)	Distribution rail closing door lock (B6) Junction point 23/1002 (USA)	GR-W
4	-	-	-
5	Lock switch driver's door(1)	VGLA (A16)	P-SB
6	Lock switch driver's door (3) (Only remote controlled central locking)	VGLA (A18)	BN
7	Junction point 23/89	Junction point 23/296	BL
8	Junction point 23/323	Distribution rail ground terminal (D4)	SB
9	Window controls, driver's door (5)	Switch window, driver's door (2)	GN
10	Window controls, driver's door (3)	Switch window, driver's door (1)	W
11	Power door mirror, driver's side (2)	Controls power door mirror, driver's side (3)	Y-R
12	Power door mirror, driver's side (3)	Controls power door mirror, driver's side (5)	VO
13	Power door mirror, driver's side (1)	Controls power door mirror, driver's side (1)	P
14	Loudspeaker front door driver's side (2)	Junction point 23/305	W
15	Loudspeaker front door driver's side (1)	Junction point 23/306	BN
16	Motor central locking system driver's door (2) Motor central locking system driver's door (1)	Distribution rail opening door lock (A11) VGLA (A15) (USA)	GN-GR
17	Motor central locking system driver's door (3)	Junction point 23/320 (NOT USA)	Y
18	-	-	-
19	Retracting door mirror, driver's side (7)	Junction point 23/295 (RHD, Japan)	BL-SB
20	Retracting door mirror, driver's side (8)	Junction point 23/316 (RHD, Japan)	GN-R

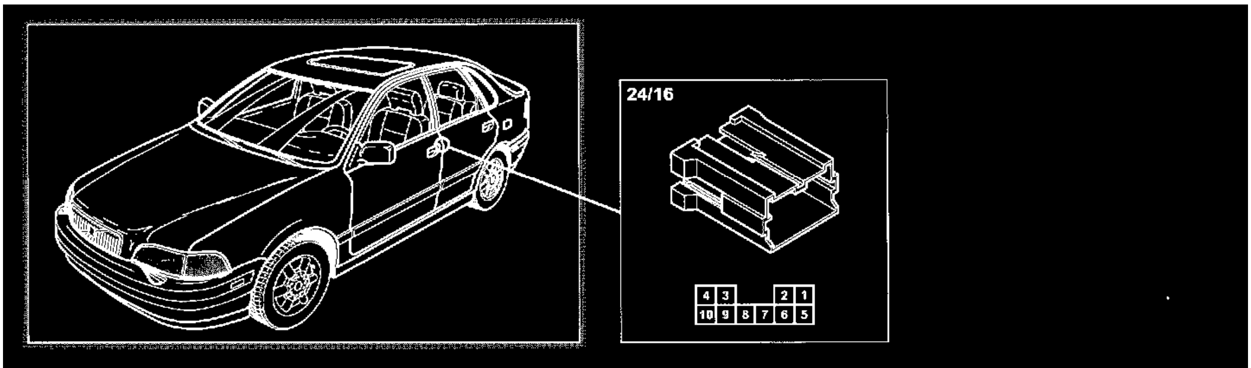




24/15 Passenger compartment - Passenger door cable harness front 20-pin

Ter.	Female	Male	Color
1	-	-	-
2	Heating passenger door mirror(4)	Fusebox in passenger compartment (J16)	R-SB
3	Motor central locking system passenger door (1) Motor central locking system passenger door (2)	Distribution rail deadlock door lock (C6) VGLA (B13) (USA)	OR-W
4	-	-	-
5	-	-	-
6	-	-	-
7	-	-	-
8	Heating passenger door mirror (5)	Junction point 23/319	SB
9	Window lift mechanism motor, passenger door (2)	window switch, passenger door (2)	GN
10	Window lift mechanism motor, passenger door (1)	Window switch, passenger door (1)	W
11	Power door mirror, passenger side (2)	Controls power door mirror, passenger side (3)	Y-R
12	Power door mirror, passenger side (3)	Controls power door mirror, passenger side (5)	VO
13	Power door mirror, passenger side (1)	Controls power door mirror, passenger side (1)	P
14	Loudspeaker front door passenger side (2)	Junction point 23/307	GR
15	Loudspeaker front door passenger side (1)	Junction point 23/308	GN-Y
16	Motor central locking system passenger door (2) Motor central locking system passenger door (1)	Junction point 23/322 VGLA (B12) (USA)	GN-GR
17	Motor central locking system passenger door (3)	Junction point 23/321 (NOT USA)	Y
18	-	-	-
19	Retracting door mirror, passenger side (7)	Junction point 23/295 (RHD, Japan)	BL-SB
20	Retracting door mirror, passenger side (8)	Junction point 23/316 (RHD, Japan)	GN-R

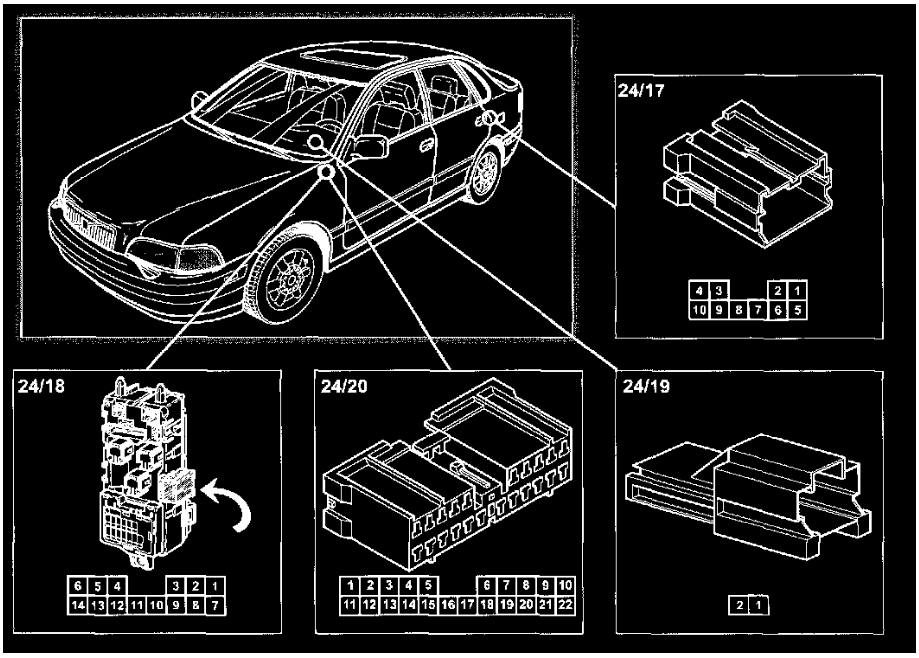
Connectors 24/15



24/16 Passenger compartment - Rear door cable harness driver's side 10-pin

Ter.	Female	Male	Color
1	Motor central locking system driver's side rear door (2) Motor central locking system driver's side rear door (1)	Distribution rail opening door lock (A10)	GN-GR
2	Switch window left rear 3/38:5	Switch window left rear (in console) 3/35:2	GR-R
3	Motor central locking system driver's side rear door (1) Motor central locking system driver's side rear door (2)	Distribution rail closing door lock (B4) Junction point 23/1002 (USA)	GR-W
4	Motor central locking system driver's side rear door (3)	Junction point 23/320 (Not USA)	Y
5	Power window switch left rear 3/38:4	Junction point 23/50	GN-OR
6	Switch window left rear 3/38:3	Switch window left rear (in console) 3/35:1	Y-W
7	Lock system motor left rear 6/34:1	Junction point 23/325 (Not USA)	BN-SB
8	Lock system motor left rear 6/34:2	Junction point 23/326 (Not USA)	GN-W
9	Lock system motor left rear 6/34:3	VGLA 4/39 (B9) (Not USA)	BN
10	Lock system motor left rear 6/34:4	Junction point 24/17:9 (Not USA)	Y-BN

Connectors 24/16



Connectors 24/17-20

24/17 Passenger Compartment - Rear Door Cable Harness Passenger Side 10-pin

24/17	Passenger compartment - Rear door cable harness passenger side		10-pin
Ter.	**Female**	**Male**	**Color**
1	Motor central locking system passenger side rear door (2) Motor central locking system passenger side rear door (1)	Junction point 23/322	GN-GR
2	Switch window right rear 3/39:5	Switch window right rear (in console) 3/35:2	GR-R
3	Motor central locking system passenger side rear door (1) Motor central locking system passenger side rear door (2)	Distribution rail deadlocking door lock 15/8:C4 Junction point 23/1002 (USA)	GN-GR
4	Motor central locking system passenger side rear door (3)	Junction point 23/321 (Not USA)	Y
5	Power window switch right rear 3/39:4	Junction point 23/50	GN-OR
6	Switch window right rear (in console) 3/36:1	Switch window right rear (in console) 3/36:1	Y-W
7	Junction point 23/325 (Not USA)	Junction point 23/325 (Not USA)	BN-SB
8	Junction point 23/326 (Not USA)	Junction point 23/326 (Not USA)	BN-W
9	Connector (Not USA) 24/16:10	Connector (Not USA) 24/16:10	Y-BN
10	Junction point 23/326 (Not USA)	Junction point 23/326 (Not USA)	BN-W

24/18 Passenger Compartment - Dashboard Cable Harness 14-pin

24/18	Passenger compartment - Dashboard cable harness	14-pin	
Ter.	**Female**	**Male**	**Color**
1	Instrument (A18)	Junction point 23/354 (Diesel), 23/356 (Gasoline)	BL-R
2	-	-	-
3	Loudspeaker driver's side (1)	Junction point 23/306	BN
4	Loudspeaker driver's side (2)	Junction point 23/305	W
5	Loudspeaker passenger side (1)	Junction point 23/307	GN-Y
6	Loudspeaker passenger side (2)	Junction point 23/308	GR
7	-	-	-
8	-	-	-
9	-	-	-
10	Junction point 23/291	Distribution rail ground terminal (F9)	SB
11	Sun sensor LED (2)	VGLA (B4)	BL
12	-	-	-
13	Sun sensor (5)	ECC (19)	VO
14	Sun sensor (1)	Junction point 23/18	BL-SB

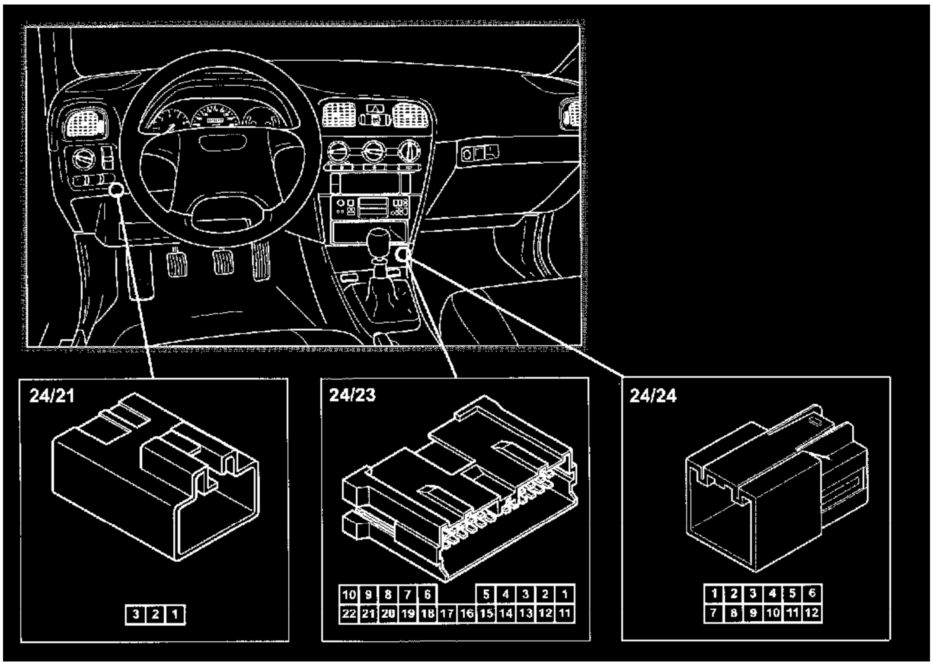
24/19 Passenger Compartment - Cruise Control Cable Harness 2-pin EU/OS

24/19	Passenger compartment - Cruise control cable harness	2-pin EU/OS	
Ter.	**Female**	**Male**	**Color**
1	Brake switch (1) (EU/OS)	Junction point 23/356	BL-R
2	Brake switch (2) (Automatic) Clutch switch(2) (Manual) (EU/OS)	Control module cruise control (3) (EU/OS)	BL-Y

24/20 Passenger Compartment - Engine Compartment Cable Harness 22-pin

24/20 Passenger compartment - Engine compartment cable harness 22-pin

Ter.	Female	Male	Color
1	Junction point 23/183	Switch horn (6)	GN-SB
2	ABS RL-sensor (9)	Connector 24/13:5	GR-R
3	ABS RL-sensor (8)	Connector 24/13:6	GR
4	ABS EBO (21)	Junction point 23/299	BN-SB
5	EMS 2000 System relay (2) MELCO 1 Junction point 23/191	Fuse 11B/11	VO
6	Vacuum pump cruise control (2)	Control module cruise control (9)	BN-W
7	Vacuum pump cruise control (1)	Control module cruise control (12)	W
8	Vacuum pump cruise control (3)	Control module cruise control (1)	GR-SB
9	Starter motor (1)	Ignition switch (4)	GN
10	ABS diagnostic (11)	Distribution rail on-board diagnostic (OBD) system (E9)	BL
11	Junction point 23/252 Starter relay (2)	24/120:7(USA) Immobilizer (2)	R-SB P-SB
12	Junction point 23/17	Air conditioning (A/C) compressor control module 4/20:3	OR-SB
13	Fuse 11A/6	VGLA (B1) Distribution rail dimmer switch (B8) (USA)	R
14	Hood switch (1)	VGLA (A3)	Y-SB
15	Glass breakage sensor (4)	Junction point 23/328	Y
16	Glass breakage sensor (3)	Junction point 23/329	R-W
17	ABS (26)	Instrument (B16)	BL-R
18	Fuel pump (FP) relay (3)	Connector 24/13:3	BL
19	Alarm horn (2)	VGLA (B14)	W-SB
20	Junction point 23/189	Immobilizer (6)	Y-R
21	ABS RR-sensor (3)	Connector 24/13:7	BL-GR
22	ABS RR-sensor (1)	Connector 24/13:8	BL-GN



Connectors 24/21-24

24/21 Passenger Compartment - Engine Compartment Cable Harness 3-pin

24/21 Passenger compartment - Engine compartment cable harness 3-pin

Ter.	Female	Male	Color
1	Fuse 11A/16	Relay power windows (3)	BL-Y
2	Junction point 23/349	Ignition switch (2)	W
3	Fuse 11A/4	Junction point 23/201	R-W

24/23 Passenger Compartment - Engine Control Module (ECM) Cable Harness 22-pin

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

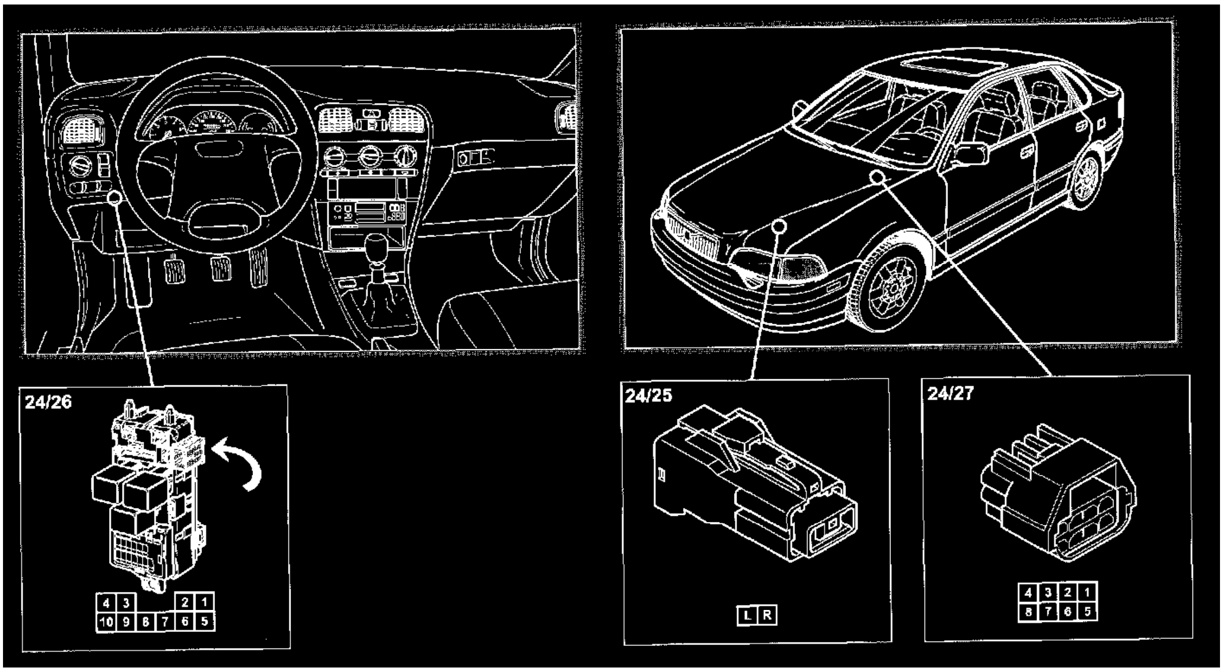
24/23 Passenger compartment - Engine control module (ECM) cable harness 22-pin

Ter.	Female	Male	Color
1	EMS 2000 (34) MELCO 1 (B3)	Instrument (B23)	BL-Y
2	EMS 2000 (70) MELCO 1 (C11)	Instrument (B7)	P
3	Vehicle speed signal engine control module (ECM)	Instrument (B15)	Y-R
4	Switch, Econ/Sport (Automatic) connector 24/32:4	Fuse 11B/6	Y
5	Spincontr. (1) 23/261-EMS 2000(29) TCU (29)	Fuse 11B/11	GN
6	EMS 2000 (56) MELCO 1 (C7)	Immobilizer (4)	P-W
7	Shift lock solenoid (2)	Stop (brake) lamp switch (3)	Y-BN
8	MELCO 1 (C1)	On-board diagnostic (OBD) system (15)	BN-P
9	Windshield wiper motor (2), position 2	Windshield wiper switch (9)	BL-SB
10	Windshield wiper motor (1), position 1	Windshield wiper switch (10)	BL-R
11	Windshield wiper motor(4), intermittent	Central electronic module (CEM), B2/12	BL-Y
12	Windshield wiper motor (3), return	Fuse 11B/14	BL
13	Oil pressure sensor	Instrument (B20)	Y-W
14	Brake fluid level sensor	Instrument (B14)	BN-SB
15	Engine coolant temperature (ECT) sensor signal, EMS 2000 (11) MELCO 1 (1)	Instrument (B10)	GN-Y
16	MELCO 1 (B9)	Instrument (B12)	BL-W
17	Back-up (reversing) lamp switch (2), connector 24/32:2	Central electronic module (CEM), B1/8	VO-W
18	Connector 24/32:4	Immobilizer (2)	OR
19	Distribution rail on-board diagnostic (OBD) system (E6)	TCU (34)	P-SB
20	Generator signal (61)	Junction point 23/341 Instrument (B13)	W
21	DSA control module (16)	Instrument (B22)	GR
22	-	-	-

24/24 Passenger Compartment - Engine Cable Harness 12-pin

24/24 Passenger compartment - Engine cable harness 12-pin

Ter.	Female	Male	Color
1	MELCO 1 (B4) Junction point 23/333 TCU AW (7)	CEM (B1/4)	OR-W
2	MELCO 1 (D2)	Passenger compartment fusebox (G3)	BL-R
3	-	-	-
4	Junction point 23/177	Temperature sensor MELCO 1 (2)	Y-SB
5	EMS 2000 (35)	Connector not named (5) (USA)	W
6	EMS 2000 (41)	Connector not named (6) (USA)	GN-W
7	TCU AW (6)	Instrument (B6)	BL-OR
8	EMS 2000 (40) MELCO 1 (B12) Fuel consumption	Instrument (B5)	BN-GR
9	Distribution rail opening door lock	Automatic transmission gear selector light (2)	BN
10	Junction point 23/273	ECU (2)	P
11	EMS 2000 (88) MELCO 1 connector 24/64:11	ECC (26) AC ECU (3)	OR-SB
12	-	-	-



Connectors 24/25-27

24/25 Starter Motor 1-pin

24/25 Starter motor 1-pin

Ter.	Female	Male	Color
1	-	Starter motor	Y-SB

24/26 Engine Compartment - Dashboard Cable Harness 10-pin

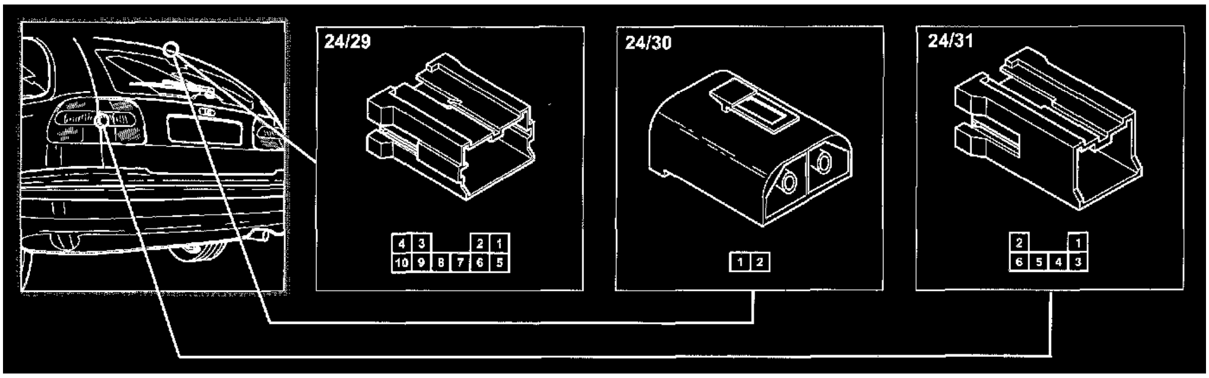
24/26 Engine compartment - Dashboard cable harness 10-pin

Ter.	Female	Male	Color
1	Junction point 23/274	Adjustable resistor height adjust. headlamp 4/15:1.1	GR
2	Junction point 23/13	Adjustable resistor height adjust. headlamp 4/15:1.3	P
3	Junction point 23/5	Adjustable resistor height adjust. headlamp 4/15:1.2	BL-SB
4	-	-	-
5	-	-	-
6	Outside temperature sensor trip computer 7/3:2	Instrument panel 5/1:A12	Y-SB
7	Outside temperature sensor trip computer 7/3:1	Instrument panel 5/1:A19	P-SB
8	Windshield washer reservoir level sensor 7/10:1	Instrument panel 5/1:A1	Y-GR
9	ABS control module 4/28:13	Instrument panel 5/1:A2	GN-Y
10	-	-	-

24/27 Engine Compartment - Engine Cable Harness 8-pin

24/27 Engine compartment - Engine cable harness 8-pin

Ter.	Female	Male	Color
1	Air conditioning (A/C) compressor relay (2)	EMS 2000 (68)	BL-R
2	Junction point 23/251	Junction point 23/257	R
3	Junction point 23/250	Junction point 23/254	Y-R
4	Pressure sensor A/C Turbo (1)	Junction point 23/261 EMS 2000 (77)	GN-SB
5	Pressure sensor A/C Turbo (2)	EMS 2000 (14)	BL-P
6	Pressure sensor A/C Turbo (3)	Junction point 23/160	VO-W
7	Intake air temperature (IAT) sensor (1)	EMS 2000 (48)	GR
8	Intake air temperature (IAT) sensor (2)	Junction point 23/159	P-SB



Connectors 24/29-31

24/29 Tailgate - Cargo Compartment Carpet V40 10-pin

24/29 Tailgate - Cargo compartment carpet V40 10-pin

Ter.	Female	Male	Color
1	High-mounted stop (brake) lamp V40 10/17:1	Junction point 23/283	BN-SB
2	-	-	-
3	Cargo compartment central locking motor 6/32:1	Junction point 23/324	GN-GR
4	Cargo compartment central locking motor 6/32:2	Connector 24/11:2	GR-W
5	Switch cargo compartment 3/22	Junction point 23/289	BL-BN
6	Junction point 23/123	Junction point 23/275	P
7	Fog lamp driver's side 10/30:1	Connector 24/11:20	BL
8	Connector 24/11:16	Back-up (reversing) lamp V40	VO-W
9	Wiper motor rear windshield V40 6/11:3	Connector 24/12:1	BL-R
10	Wiper motor rear windshield V40 6/11:2	Connector 24/12:2	BL-W

24/30 Tailgate - Cargo Compartment Carpet V40 2-pin

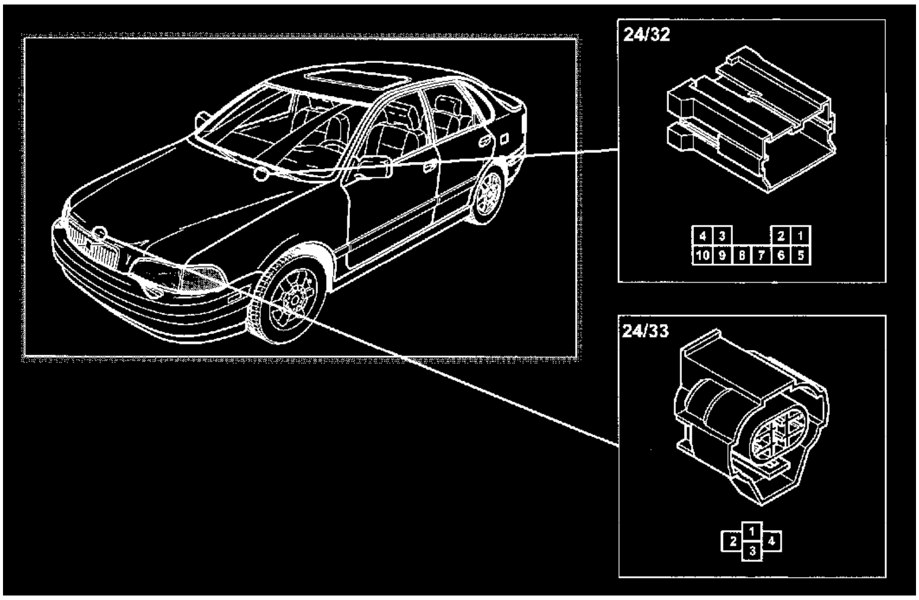
24/30 Tailgate - Cargo compartment carpet V40 2-pin

Ter.	Female	Male	Color
1	Heated rear windshield 9/2	Connector 24/11:12	GR-R
2	Ground terminal 31/9	Junction point 23/96	SB

24/31 Tailgate - Cargo Compartment Cable Harness S40 6-pin

24/31 Tailgate - Cargo compartment cable harness S40 6-pin

Ter.	Female	Male	Color
1	Junction point 23/123	Junction point 23/275	BL-R
2	Junction point 23/122	Junction point 23/280	BN
3	Central locking motor trunk lid 6/32:1	Junction point 23/324	
4	Central locking motor trunk lid 6/32:2	Junction point 24/11:2	OR-W
5	Cargo compartment central locking motor 3/22	Junction point 23/289	BL-BN
6	-	-	-



Connectors 24/32-33

24/32 Engine - Automatic Transmission Cable Harness 10-pin

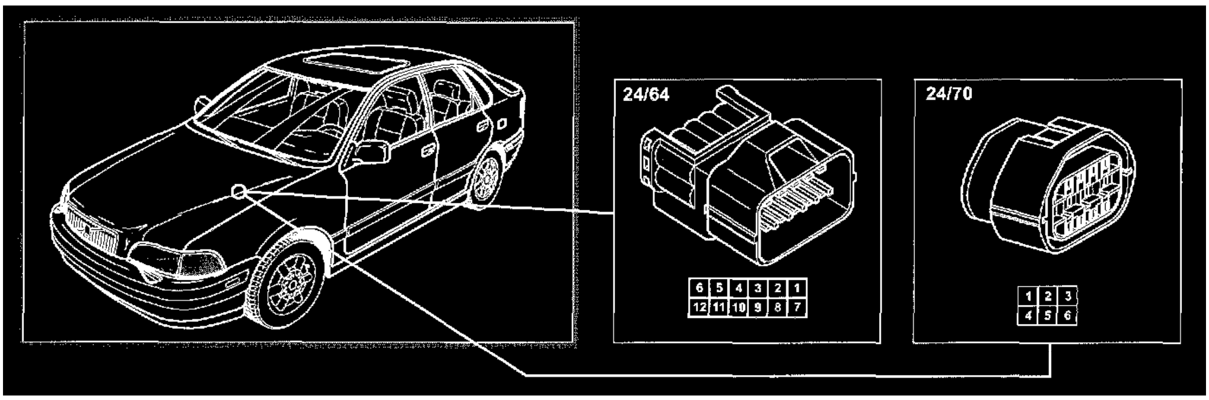
24/32 Engine - Automatic transmission cable harness 10-pin

Ter.	Female	Male	Color
1	Shift lock 3/23	Junction point 23/273	P
2	Shift lock 3/23	Connector 24/23:17	VO-W
3	Shift lock 3/23	Junction point 23/268	Y
4	Shift lock 3/23	Connector 24/23:18	P-SB
5	Shift lock switch 3/53:B	Automatic transmission control module TCU 4/27:37	BL-R
6	Shift lock switch 3/53:A	Automatic transmission control module TCU 4/27:23	Y-R
7	Shift lock switch 3/53:PA	Automatic transmission control module TCU 4/27:22	R-W
8	Shift lock switch 3/53:C	Automatic transmission control module TCU 4/27:9	Y-SB
9	-	-	-
10	Shift lock 3/53:PG	Junction point 23/271	SB

24/33 Engine Compartment Harness - Engine Cooling Fan (FC) Diesel 4-pin

24/33 Engine compartment harness - Engine cooling fan (FC) Diesel 4-pin

Ter.	Female	Male	Color
1	Motor engine cooling fan (FC) 6/9:1	Ground terminal 31/1-2	SB
2	Motor engine cooling fan (FC) 6/9:2	Junction point 23/224 Engine cooling fan (FC) speed 1 2/11:3	BL
3	-	-	-
4	Motor engine cooling fan (FC) 6/9:4	Engine cooling fan (FC) speed 2 2/28:3	R



Connectors 24/64-70

24/64 Engine Compartment - Engine Cable Harness 12-pin

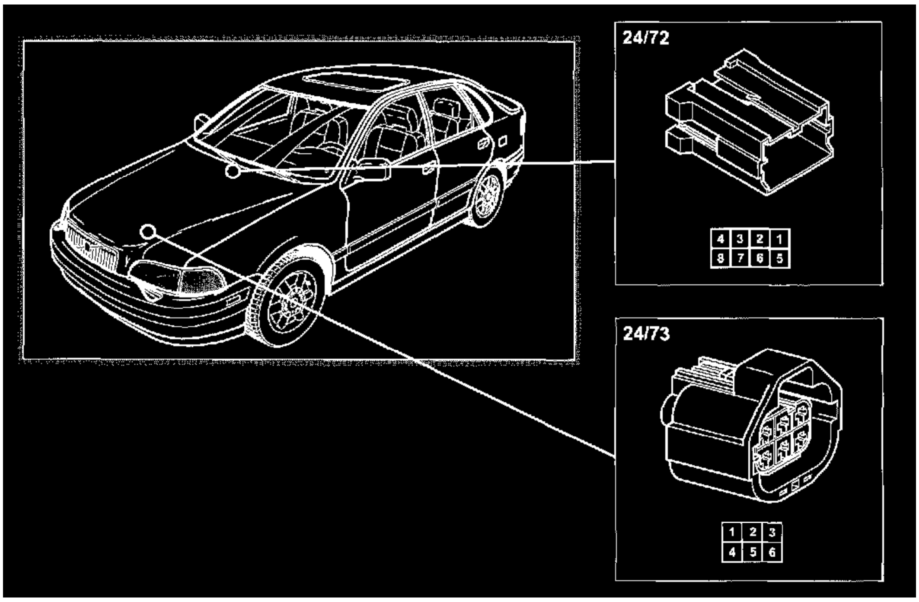
24/64 Engine compartment - Engine cable harness 12-pin

Ter.	Female	Male	Color
1	Junction point 23/252 Fuse 11A/21 MELCO 1	Junction point 23/265 Junction point 23/192 MELCO 1	R-SB
2	System relay (1) System relay (2/33:1) MELCO 1	EMS 2000 (10) MELCO 1 4/32:B1	GN GN-SB
3	Starter motor relay (2)	Junction point 23/273 Connector 24/23:18	P
4	Air conditioning (A/C) compressor relay (3) Control acknowledgement 7/65 MELCO 1	Air conditioning (A/C) compressor magnetic clutch (1) MELCO 1 4/32:B2	Y GN-Y
5	Heater unit fan relay (2) Blower fan speed 1 (2/11:2) MELCO 1	EMS 2000 (38) MELCO 1 4/32:C3	BL-GR GR-OR
6	Relay A/C fan (2) Heater unit fan relay (2) Junction point (23/348:1) MELCO 1	EMS 2000 (8) MELCO 1 4/32:B10	GN-GR GR-W
7	Air conditioning (A/C) fan relay (2) Condenser fan (2/13:2) MELCO 1	EMS 2000 (69) MELCO 1 4/32:B10	BL-OR
8	Canister purge (CP) valve (1) 2/31:2 Fuel pump (FP) MELCO 1	EMS 2000 (4) MELCO 1 4/32:A18	Y-VO W
9	ABS control module (25) Junction point 23/274	Junction point 23/168, EMS 2000 (52) MELCO 1 4/32:C5	GR-W GR
10	ABS control module (23) Injector/Ignition (2/30:1) MELCO 1	Control module DSA (4) MELCO 1 4/32:A20	Y-R Y
11	ABS control module (24) Pressure switch (3/47:1) MELCO 1	Control module DSA (12) Connector 24/24:11 MELCO 1	BL-Y OR-SB
12	Junction point 23/167	Control module DSA (3)	BL-R

24/70 Engine Compartment - Engine Cable Harness 8-pin, MELCO 1

24/70 Engine compartment - Engine cable harness 8-pin, MELCO 1

Ter.	Female	Male	Color
1	Air conditioning (A/C) compressor (2/10:2) MELCO 1	MELCO 1 4/32:A6	BL-R
2	Junction point 23/343	Junction point 23/186	R
3	Injection/Ignition 2/30:3 MELCO 1	Junction point 23/195	R-W
4	Starter motor relay 2/7:5	Junction point 23/345	Y-SB
5	Connector 24/70:5	Connector 24/73:5	BN
6	-	-	-



Connectors 24/72-73

24/72 Engine Cable Harness - ABV 8-pin, MELCO 1

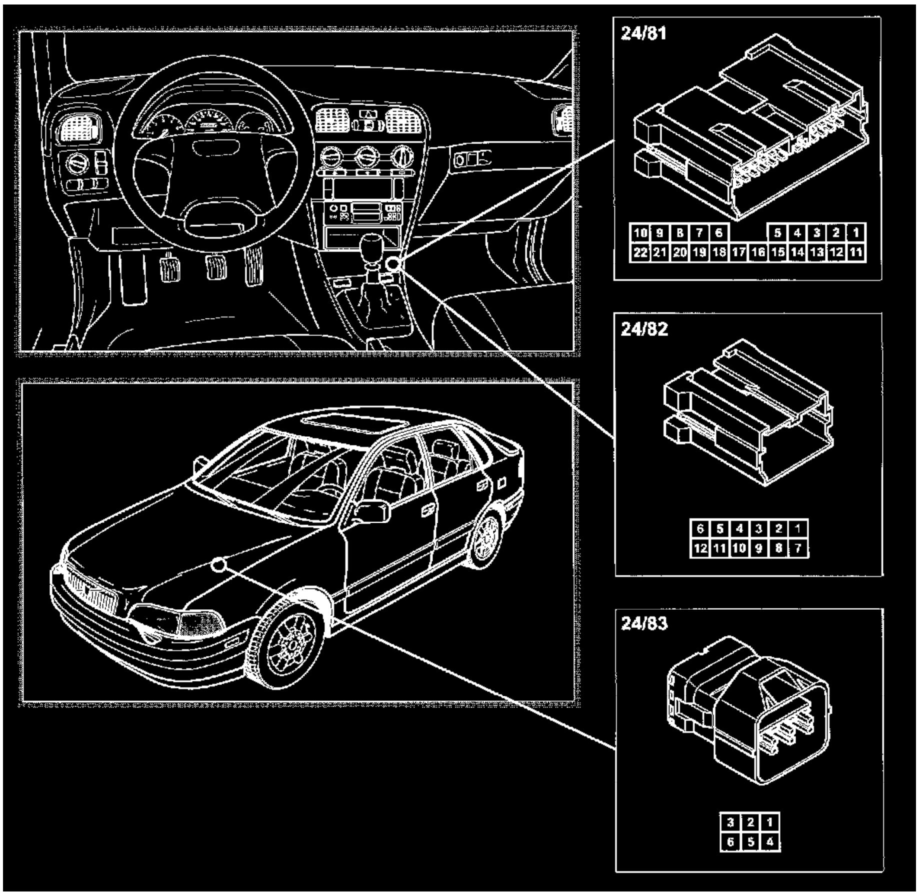
24/72 Engine cable harness - ABV 8-pin, MELCO 1

Ter.	Female	Male	Color
1	EGR stepper motor 6/51:2	Junction point 23/192	R-SB
2	By-pass valve 8/28:1	MELCO 1 4/32:A24	VO
3	EGR stepper motor 6/51:1	MELCO 1 4/32:B15	GR
3	EGR stepper motor 6/51:3	MELCO 1 4/32:B16	BL
5	EGR stepper motor 6/51:5	Junction point 23/192	R-SB
6	By-pass valve 8/29:1 air on/off	MELCO 1 4/32:A11	P
7	EGR stepper motor 6/51:4	MELCO 1 4/32:B7	W
8	EGR stepper motor 6/51:6	MELCO 1 4/32:B8	GN-W

24/73 Engine - Battery Cable Harness 6-pin, MELCO 1

24/73 Engine - Battery cable harness 6-pin, MELCO 1

Ter.	Female	Male	Color
1	MELCO 1 4/32:B6	Generator (GEN) 6/7:4	P
2	-	-	-
3	Junction point 23/345	Starter motor	Y-SB
4	MELCO 1 4/32:B14	Generator (GEN) 6/7:1	BL-R
5	Connector 24/70:5	Generator (GEN) 6/7:3	BN
6	Connector 24/23:20	Generator (GEN) 6/7:61	W



Connectors 24/81-83

24/81 Passenger Compartment - Engine Compartment Cable Harness 22-pin, Diesel

24/81 Passenger compartment - Engine compartment cable harness 22-pin, Diesel

Ter.	Female	Male	Color
1	MSA 15.5 (26)	Instrument (B23)	BL-Y
2	MSA 15.5 (2)	Instrument (B7)	P
3	MSA 15.5 (43)	Instrument (B15)	Y-R
4	-	-	
5	MSA 23/216 15.5 (38)	Fuse 11B/11	GN
6	MSA 15.5 (59)	Immobilizer (4)	P-W
7	MSA 15.5 (61)	On-board diagnostic (OBD) system (11)	Y-BN
8	MSA 15.5 (66)	On-board diagnostic (OBD) system (15)	BN-P
9	-	-	-
10	-	-	-
11	-	-	-
12	-	-	-
13	-	-	-
14	-	-	-
15	Engine coolant temperature (ECT) sensor signal Diesel (2)	Instrument (B10)	GN-Y
16	Engine coolant temperature (ECT) sensor signal Diesel (4)	Instrument (B12)	BL-W
17	-	-	-
18	MSA 15.5 (34)	Cruise control control (3)	OR
19	MSA 15.5 (58)	Cruise control control (4)	BL
20	Generator (GEN) signal (61)	Instrument (B13)	W
21	MSA 15.5 (54)-Glow plugs	Instrument (B22)	GR
22	MSA 15.5 (62)	Cruise control control (5)	GN-R

24/82 Passenger Compartment - Engine Compartment Cable Harness 12-pin, Diesel

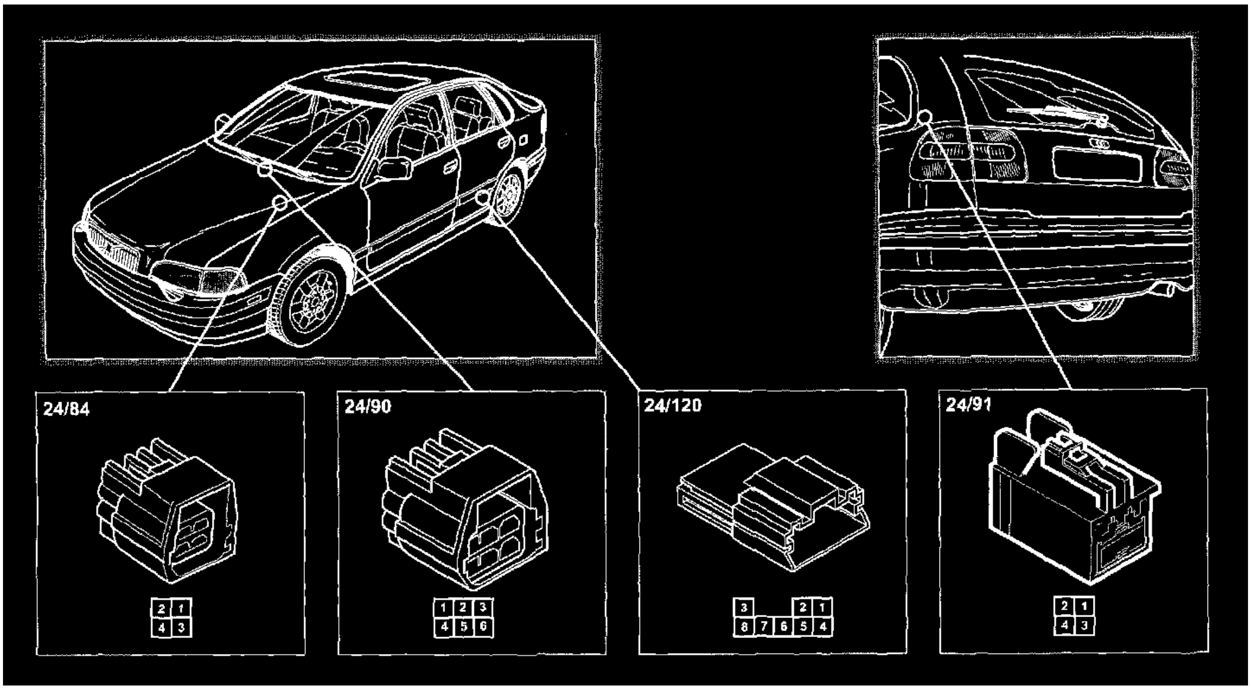
24/82 Passenger compartment - Engine compartment cable harness 12-pin, Diesel

Ter.	Female	Male	Color
1	MSA 15.5 (44)	CEM (B1/4)	OR-W
2	MSA 15.5 (18)	Junction point 23/354	BL-R
3	MSA 15.5 (65)	Accelerator pedal (AP) position sensor (A2)	VO-W
4	Junction point 23/210	Accelerator pedal (AP) position sensor (A1)	Y-GR
5	MSA 15.5 (15)	Accelerator pedal (AP) position sensor (B2)	R-W
6	MSA 15.5 (57)	Accelerator pedal (AP) position sensor (B1)	BL-SB
7	MSA 15.5 (55)	Accelerator pedal (AP) position sensor (B3)	Y-W
8	MSA 15.5 (32) Fuel consumption	Instrument (B5)	BN-GR
9	MSA 15.5 (17)	Clutch switch (2)	R-SB
10	MSA 15.5 (20)	Brake switch (2)	VO
11	-	-	-
12	-	-	-

24/83 Engine Compartment - Engine Cable Harness 6-pin, Diesel

24/83 Engine compartment - Engine cable harness 6-pin, Diesel

Ter.	Female	Male	Color
1	Junction point 23/351	Junction point 23/352	R-SB
2	System relay 2/14:1	MSA 15.5 4/37:42	W-SB
3	Engine coolant heater relay 2/37:2	MSA 15.5 4/37:27	GN-GR
4	Air conditioning (A/C) compressor 2/10:3	Air conditioning (A/C) compressor magnetic clutch 8/1:1	Y
5	Engine coolant heater relay 2/38:2	MSA 15.5 4/37:47	GN-OR
6	Junction point 23/95	MSA 15.5 4/37:37	GR-W



Connectors 24/84-120

24/84 Engine Compartment - Engine Cable Harness 4-pin, Diesel

24/84 Engine compartment - Engine cable harness 4-pin, Diesel

Ter.	Female	Male	Color
1	Air conditioning (A/C) compressor 2/10:2	MSA 15.5 4/37:28	BL-W
2	Junction point 23/350	Junction point 23/214	R
3	Engine coolant heater relay 2/37:5	Coolant heater element 9/14:2	R-W
4	Engine coolant heater relay 2/38:5	Coolant heater element 9/14:1	R-W

24/90 Engine - Ignition System Cable Harness 6-pin, EMS 2000

24/90 Engine - Ignition system cable harness 6-pin, EMS 2000

Ter.	Female	Male	Color
1	Junction point 23/259	Junction point 23/257	R
2	Ignition coil 4/30-1:1 (cyl 1-4)	EMS 2000 4/26:32	GN
3	Ignition coil 4/30-2:2 (cyl 2-3)	EMS 2000 4/26:1	GN
4	Junction point 23/260	Junction point 23/264	SB
5	CVVT valve 7/79:2	EMS 2000 4/26:62	BL-GR
6	-	-	-

24/91 Cargo Compartment Cable Harness - Accessory Cable Harness 4-pin

24/91 Cargo compartment cable harness - Accessory cable harness 4-pin

Ter.	Female	Male	Color
1	Connector accessory	Junction point 23/283	BN-SB
2	Connector accessory	Junction point 31/12 (S40) 31/9 (V40)	SB
3	Connector accessory	Connector 24/12:3	Y
4	Connector accessory	Junction point 23/1000 (Active bass speakers) Connector 24/12:4 (no active bass speaker)	Y-R

24/120 Passenger Compartment - Cargo Compartment Cable Harness 8-pin, USA

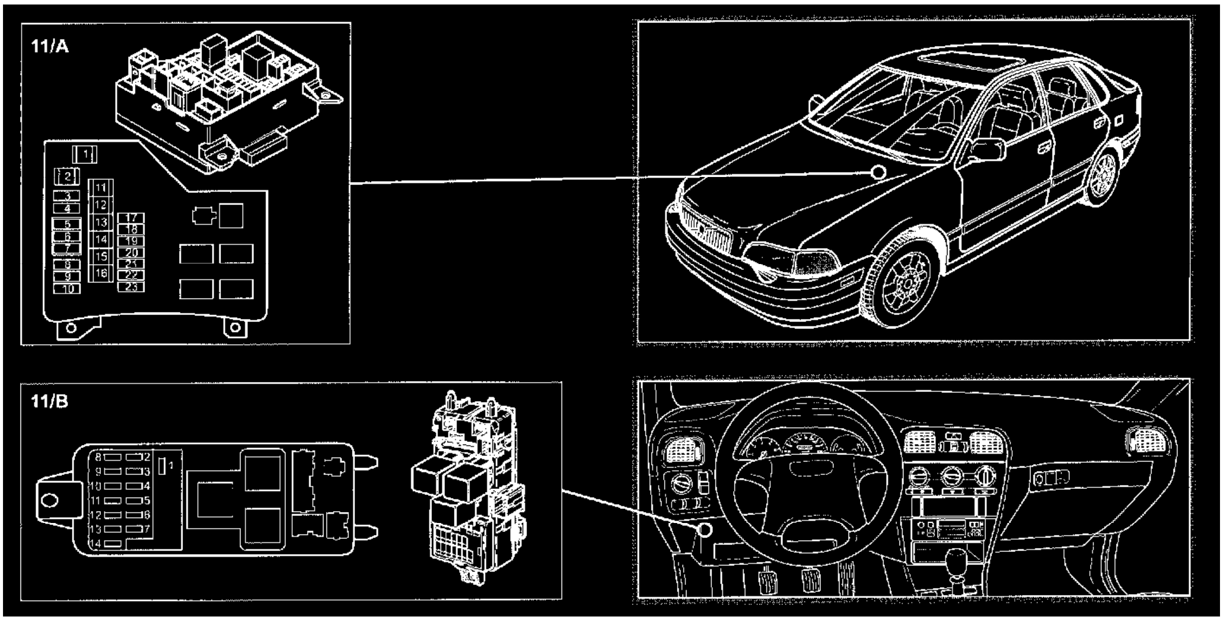
24/120 Passenger compartment - Cargo compartment cable harness 8-pin, USA

Ter.	Female	Male	Color
1	Connector 24/29:9	CEM, (B2/11)	BL-R
2	Connector 24/29:10	CEM, (B2/26)	BL-W
3	Accessory switch (3)	Junction point 23/1001	Y
4	Junction point 23/1000	Fusebox in passenger compartment (J9)	W
5	Leak diagnostic pump (3)	Connector 24/24:5	W
6	Leak diagnostic pump (4)	Connector 24/24:6	GN-W
7	Leak diagnostic pump (2)	Connector 24/20:11	R-SB
8	Lock motor for fuel tank filler cap (2)	VGLA (A2)	GN-SB

Fuse and Fusible Links

Fuse/Relay Identification and Location

Fuses

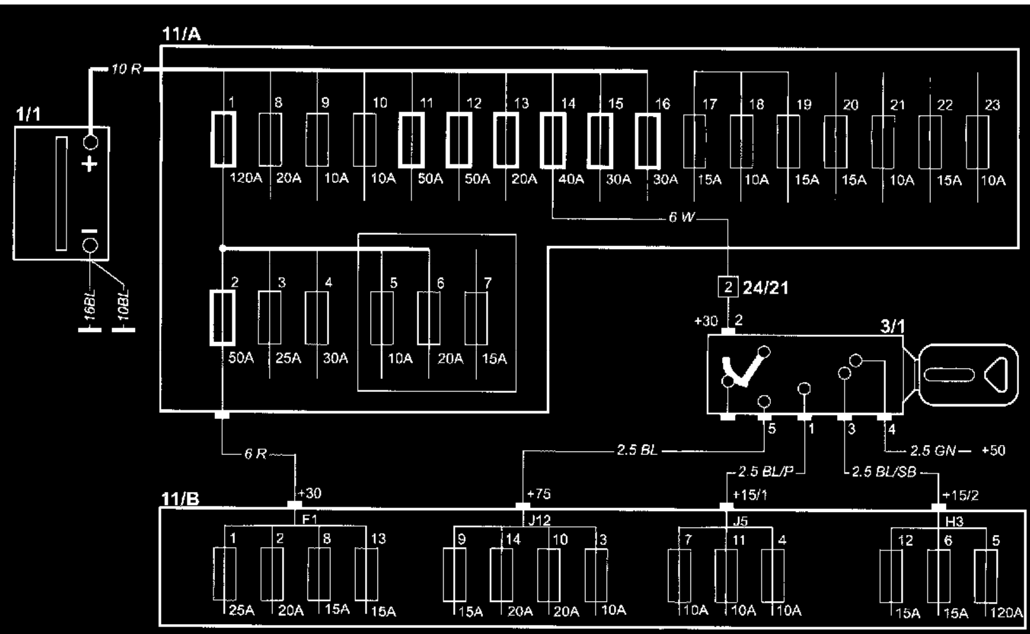


Fuses In Engine Compartment

Fuses, 11A, Engine compartment

No.	Fuse function	A
1	Generator, power supply to fuses 2,3,4,5,6 and 7, pulsed secondary air injection system (PAIR) pump, Diesel glow plugs	120
2	Power supply to fuses in the passenger compartment	50
3	Heated rear window, heated door mirrors	25
4	Power seats	30
5	Power antenna, glass breakage sensor	10
6	VGLA , central locking, child safety block motor	20
7	Air conditioning (A/C) compressor, condenser fan (Turbo, MELCO 1)	15
8	Fog lamps front and rear	20
9	Central electronic module (CEM), left low beam	10
10	Central electronic module (CEM), right low beam	10
11	Coolant heater (Diesel)	50
12	ABS	50
13	Engine (via system relay) Gasoline: injectors, ignition Diesel: glow plug relay, fuel pre-heat	20
14	Ignition switch	40
15	Engine cooling fan (FC), A/C condenser fan	30
16	Power windows	30
17	Horn, alarm	15
18	Parking lights	10
19	Central electronic module (CEM), high and low beam	15
20	Fuel pump (FP)	15
21	Engine subsystem	10
22	Vacuum pump (Turbo auto), generator (MELCO 1)	15
23	Motor level control high and low beam	10

Fuses - 11A/1-23



30 = Direct current battery
75 = Accessories
15/1 = Switch for (IG1) (remains connected during start)
15/2 = Switch for (IG2) (connection broken during start)

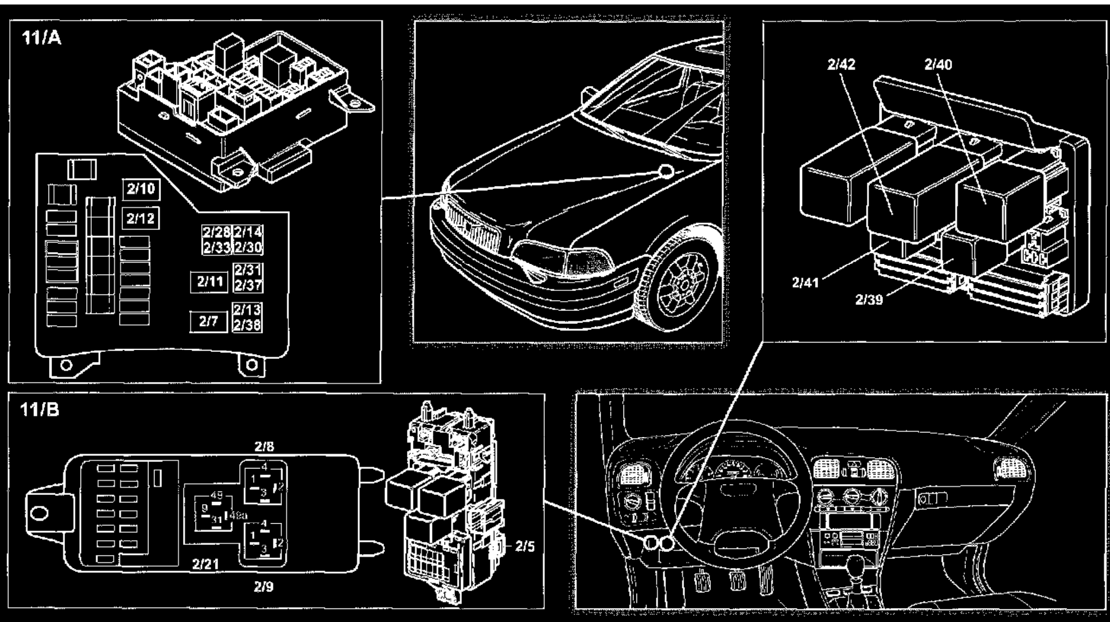
Fuses In Passenger Compartment

Fuses, 11B

No.	Fuse function	A
1	Blower fan motor, A/C switch, compressor, ECU, ECC	25
2	Accessory (Tow hitch), cigarette lighter	10
3	Power seats, heated door mirrors, power windows, VGLA	20
4	CEM, ABS 5.3	10
5	Heated seats	20
6	Back-up (reversing) lamp, central electronic module (CEM), turn signal lamp	15
7	P-shift lock, VGLA, cruise controls, light switch, seat belt buckle, airbag	10
8	VGLA, hazard warning signal flasher	20
9	Radio	15
10	Windshield wiper switch	20
11	Central locking, SRS(airbag) deadlock position system relay for ECU gasoline and Diesel Diesel fuel shut-off immobilizer	10
12	Sun roof, interior lighting, heated rear window, heated door mirror headlamp, high beam indicator lamp blower fan/heater/Air Conditioning System (A/C System) spotlight relay, alarm horn, seat belt reminder	15
13	Switch brake pedal for locking gear shift selector, stop (brake) lamp	15
14	CEM, headlamp washer motor, washer pump	20

Fuse - 11B/1-14

Relays



Relays in engine compartment

1	2/10	Air conditioning (A/C) compressor
2	2/12	Engine cooling fan (FC) (operated by air conditioning A/C, MELCO 1, Diesel)
3	2/11	Engine cooling fan (FC) speed 1 (EMS 2000, Diesel)
4	2/31 2/37	Fuel pump (FP) (MELCO 1) Coolant heater 1 (Diesel)
5	2/7	Starter motor (immobilizer)
6	2/13 2/38	Air conditioning condenser fan (Gasoline) Coolant heater 2 (Diesel)
7	2/28 2/33	Engine cooling fan (FC) speed 2 (EMS 2000, Diesel) System (MELCO 1)
8	2/14 2/30	System (EMS 2000, Diesel) Injectors/ignition (MELCO 1)

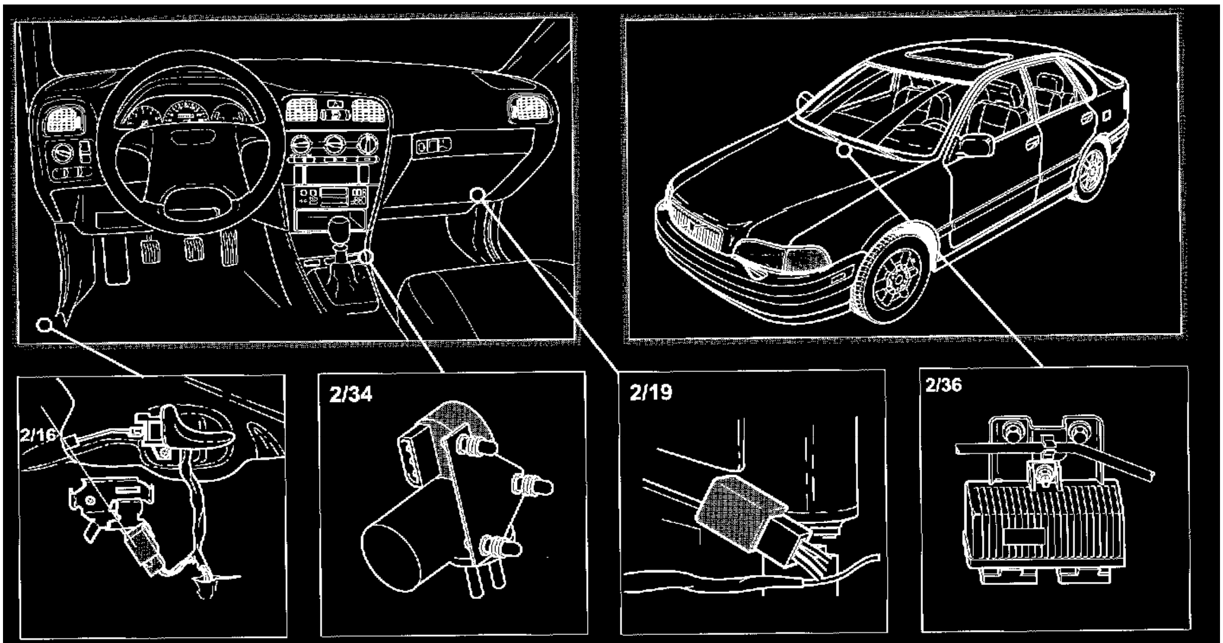
Relays in passenger compartment

1	2/8	Heating system
2	2/9	Heated rear window and door mirrors
3	2/21	Turn signal lamp

Relays in the passenger compartment (in the separate relay holder)

1	2/40	Relay seat belt reminder/Ignition warning (USA, CDN, Korea)
2	2/42	Trunk lid lock relay
3	2/18	Power windows relay
4	2/39	Seat belt reminder
5	2/41	Accessory relay

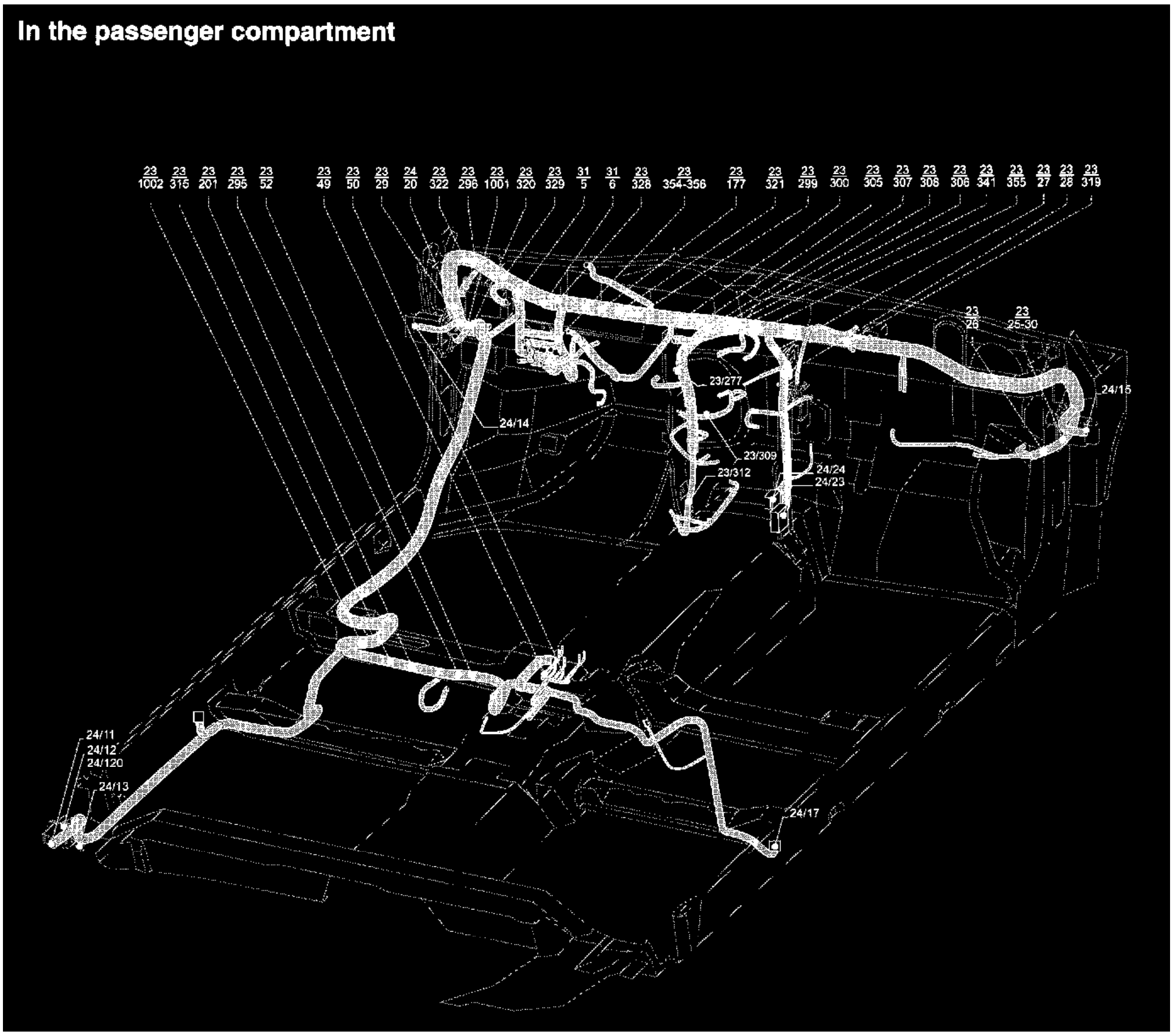
Relays In Engine Compartment And Passenger Compartment



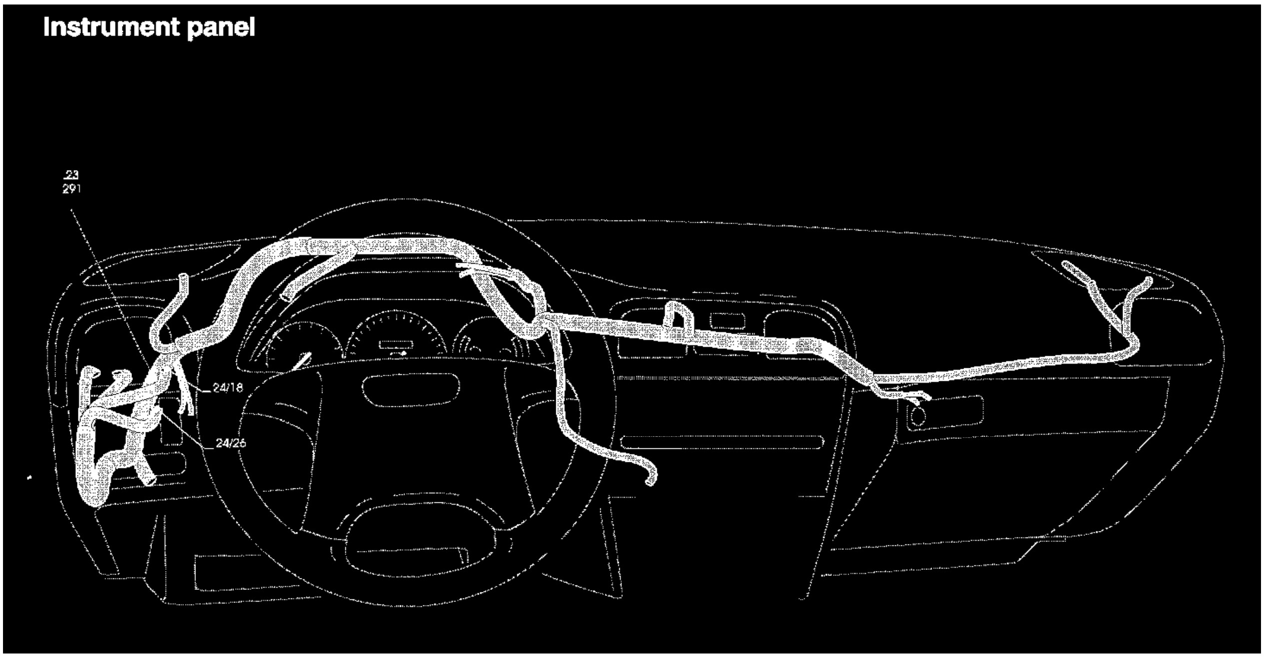
1	2/36	Glow plugs Diesel
2	2/34	Relay vacuum pump EMS 2000 Turbo
3	2/16	Relay power window driver's door (Autodown)
4	2/19	Relay maximum speed blower fan motor ECC

Other Relays

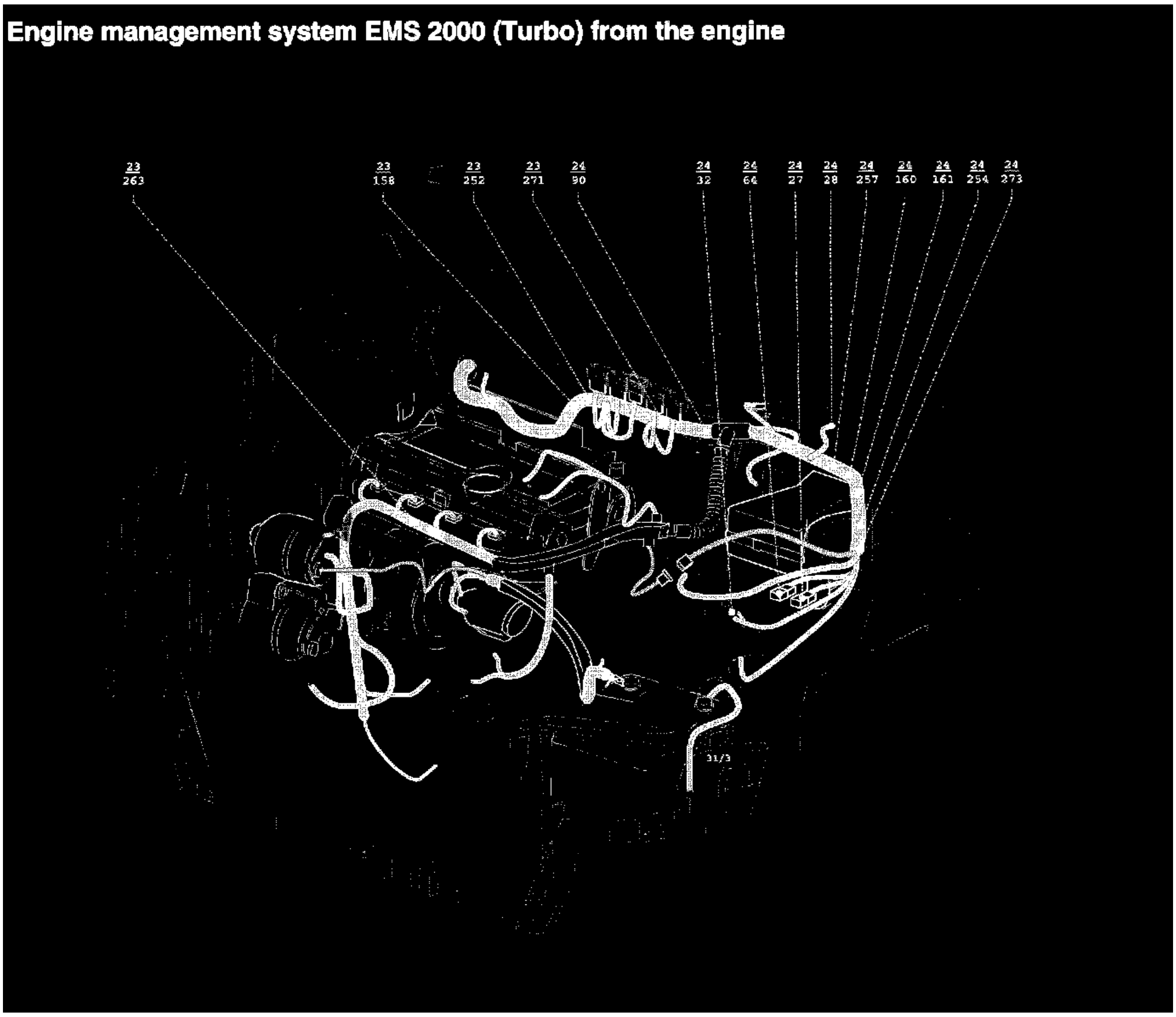
Harness



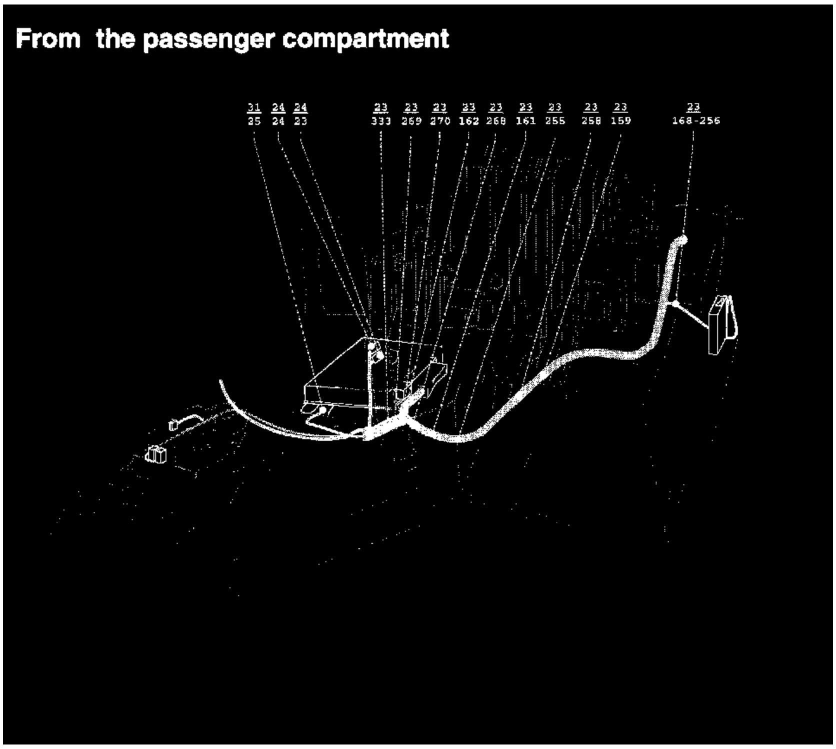
In The Passenger Compartment



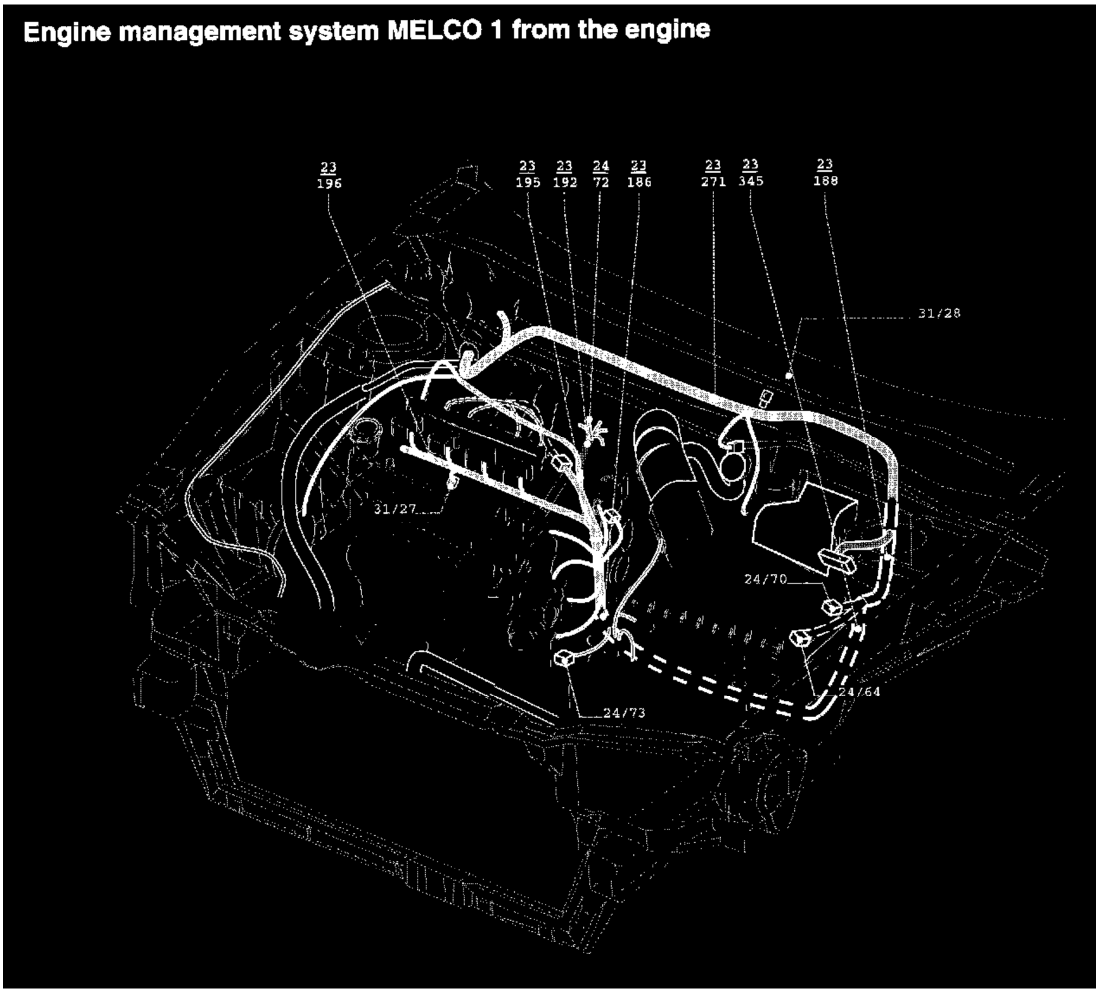
Instrument Panel



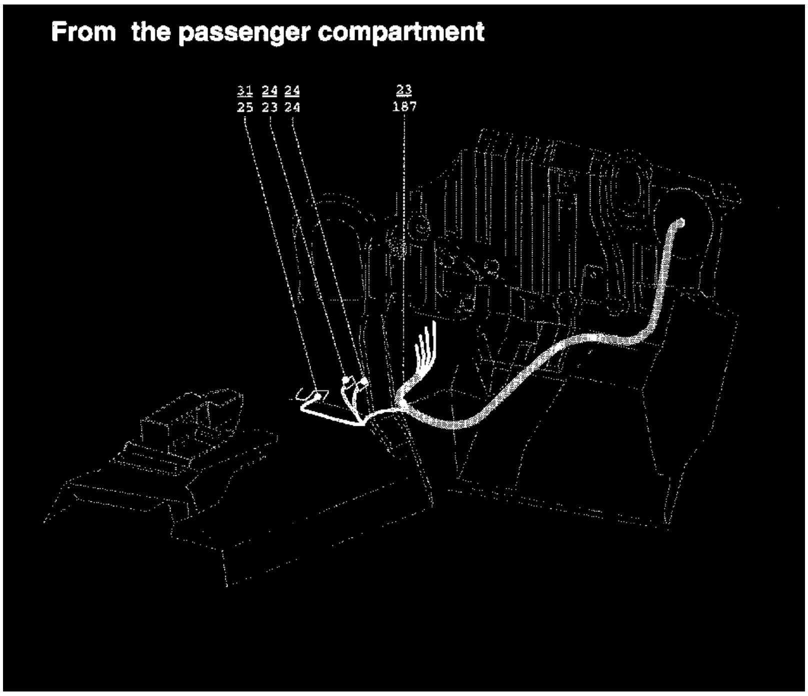
Engine Management System EMS 2000 (Turbo)



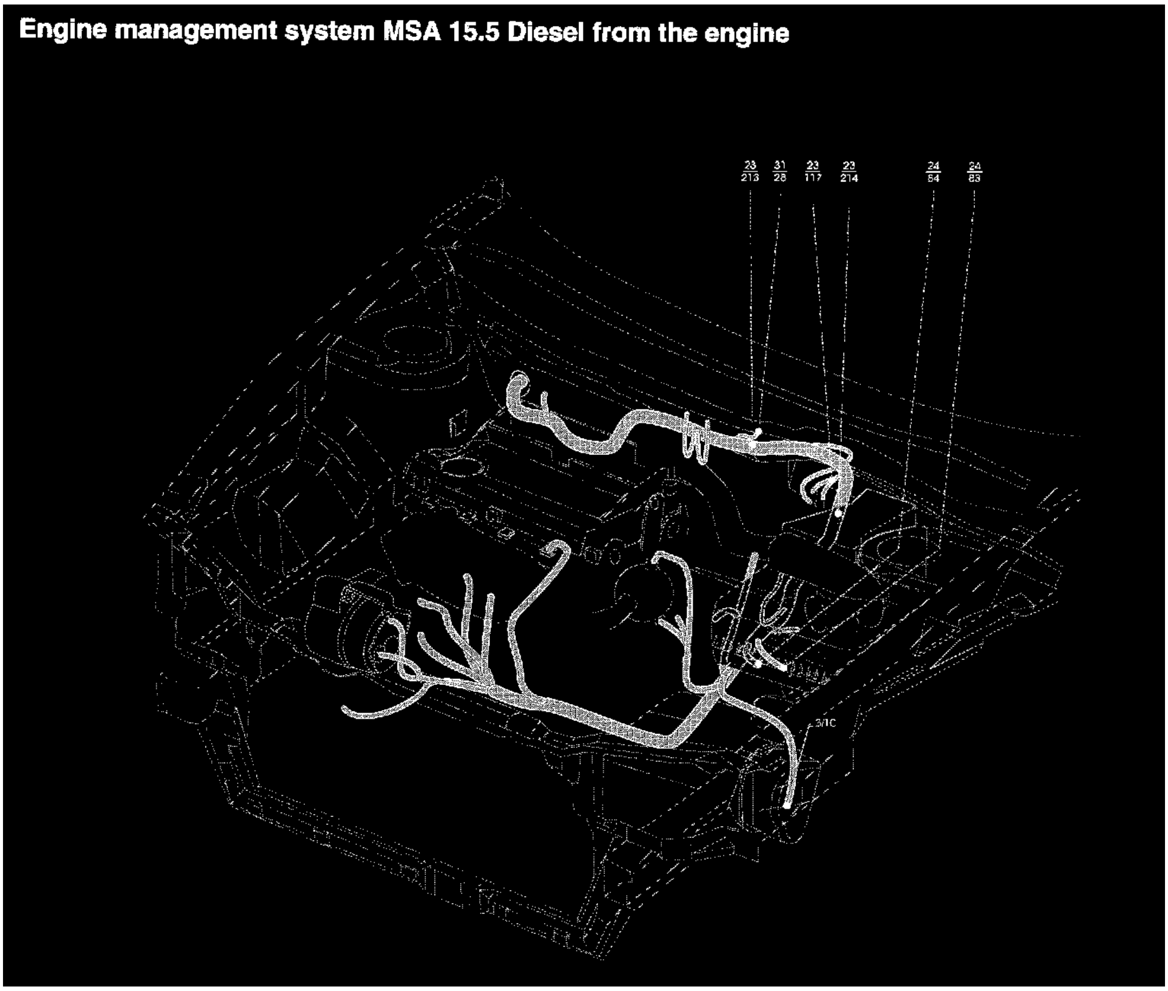
From The Passenger Compartment



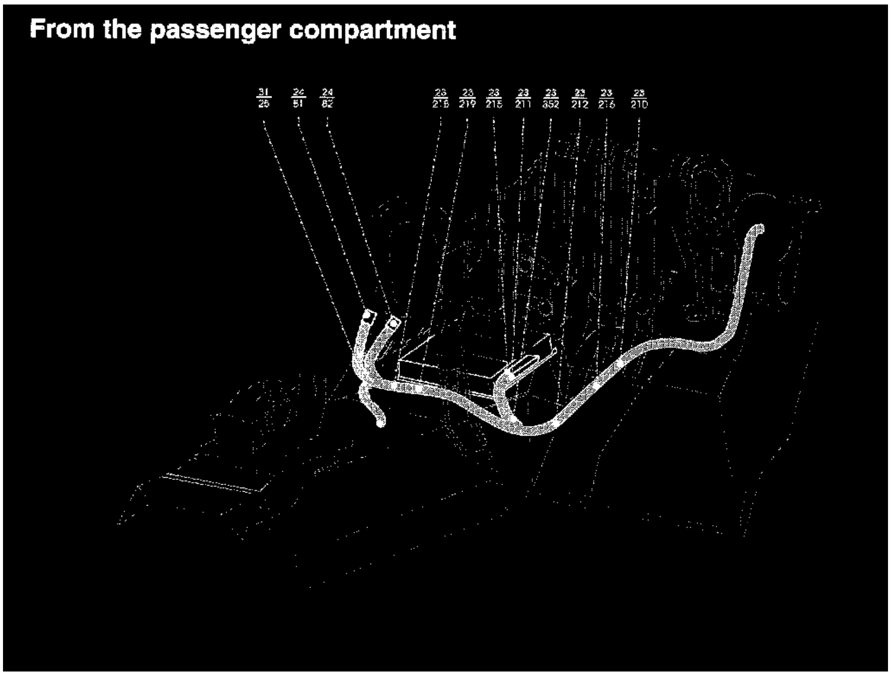
Engine Management System MELCO 1 From The Engine



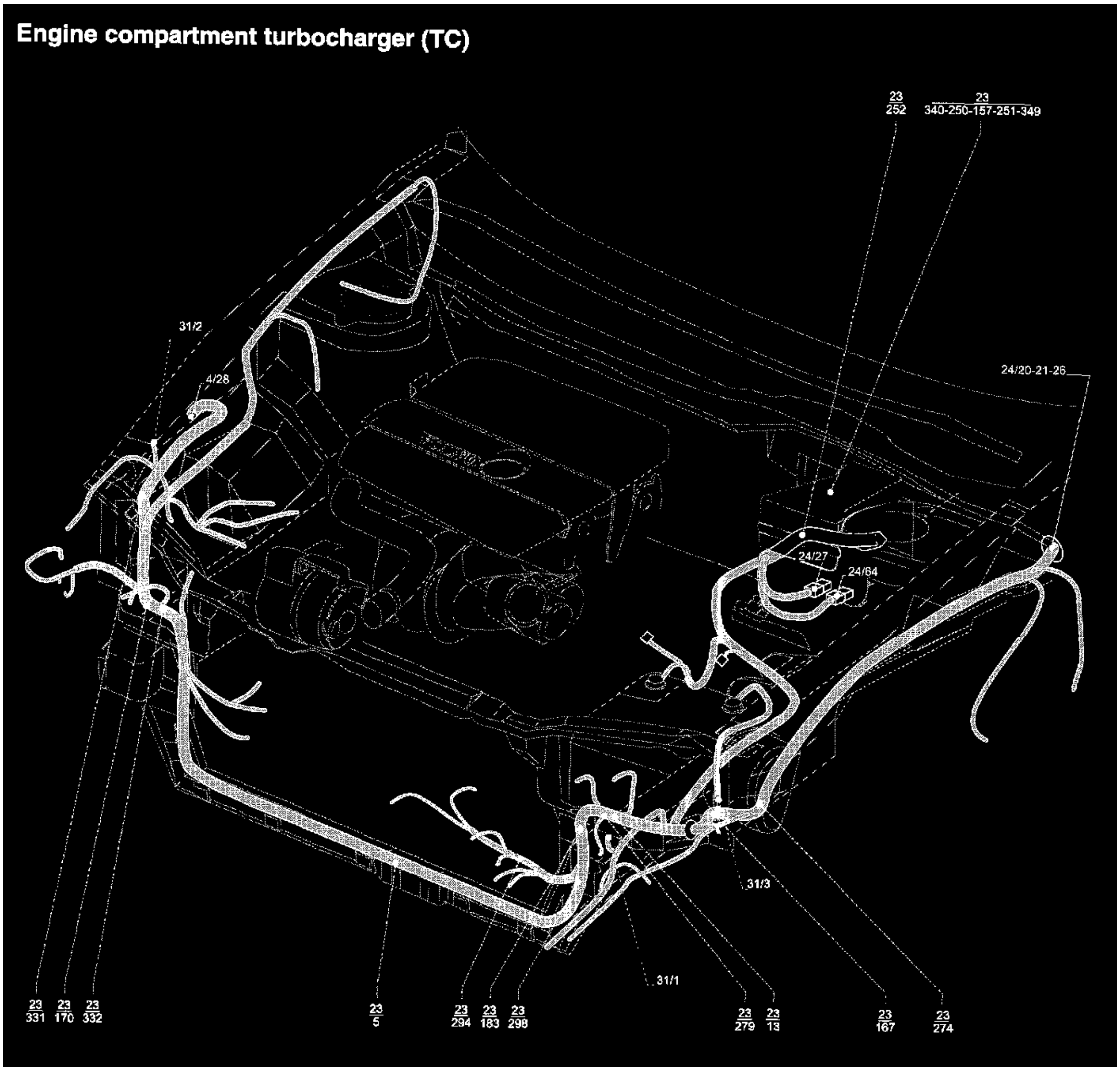
From The Passenger Compartment



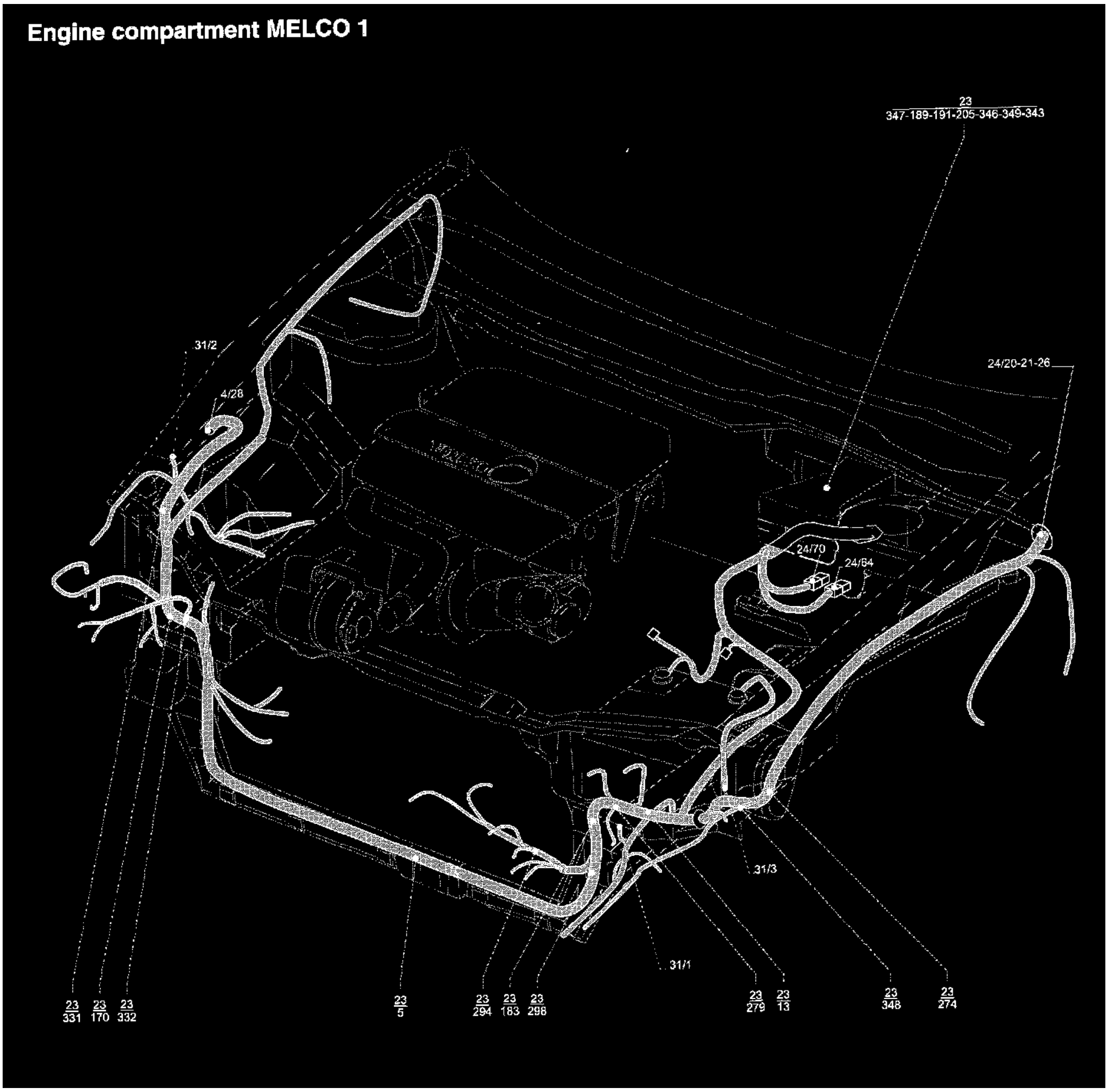
Engine Management System MSA 15.5 Diesel



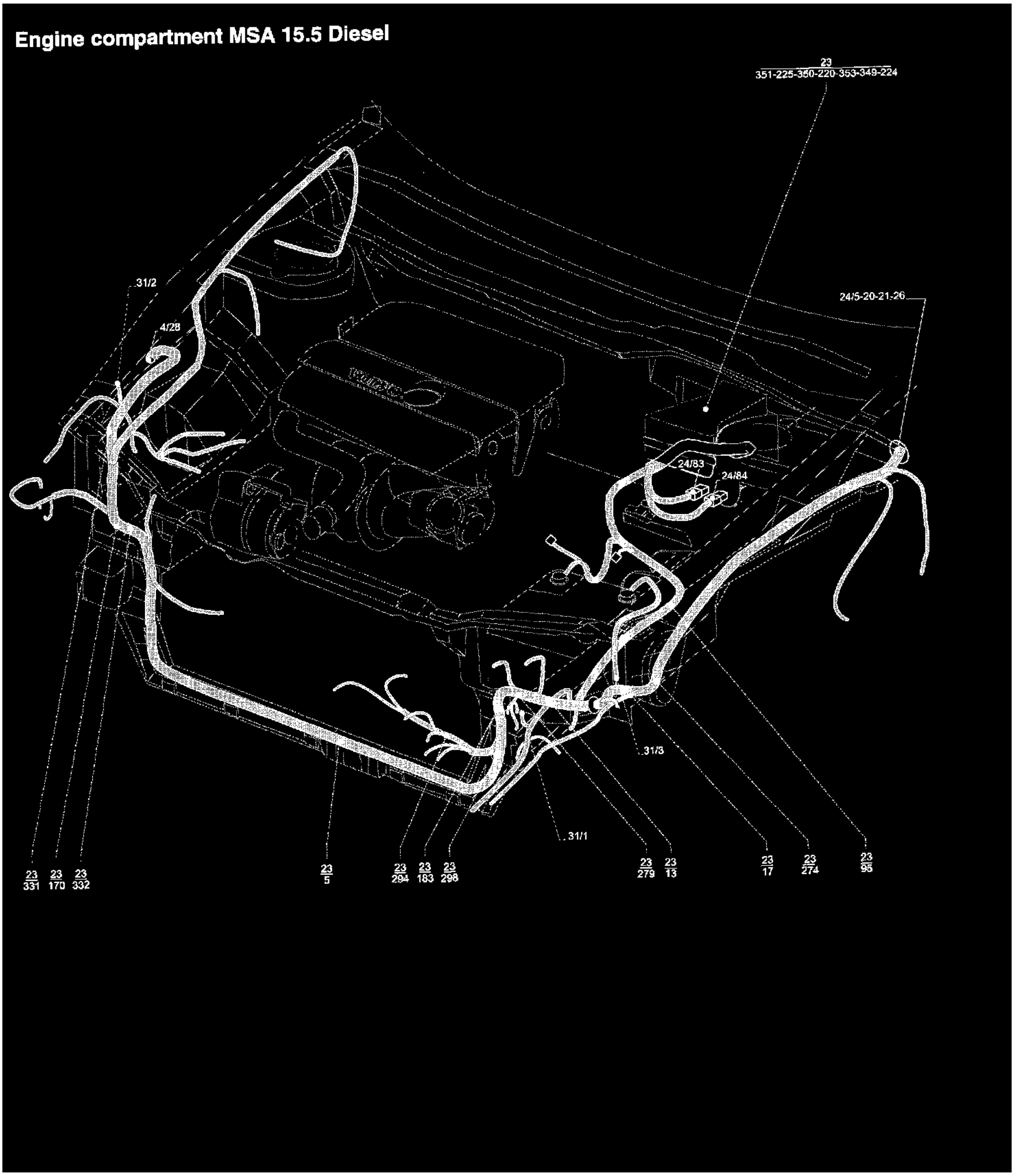
From The Passenger Compartment



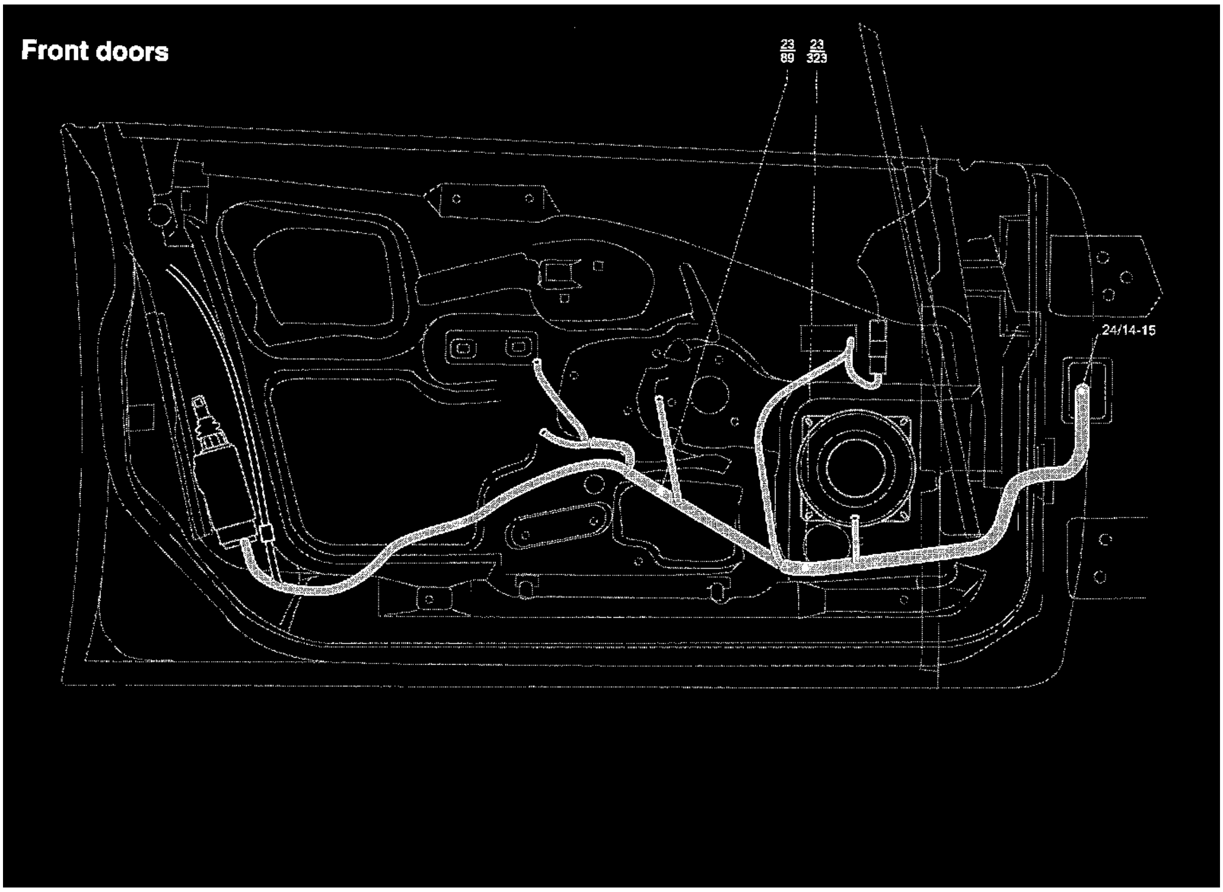
Engine Compartment Turbocharger (TC)



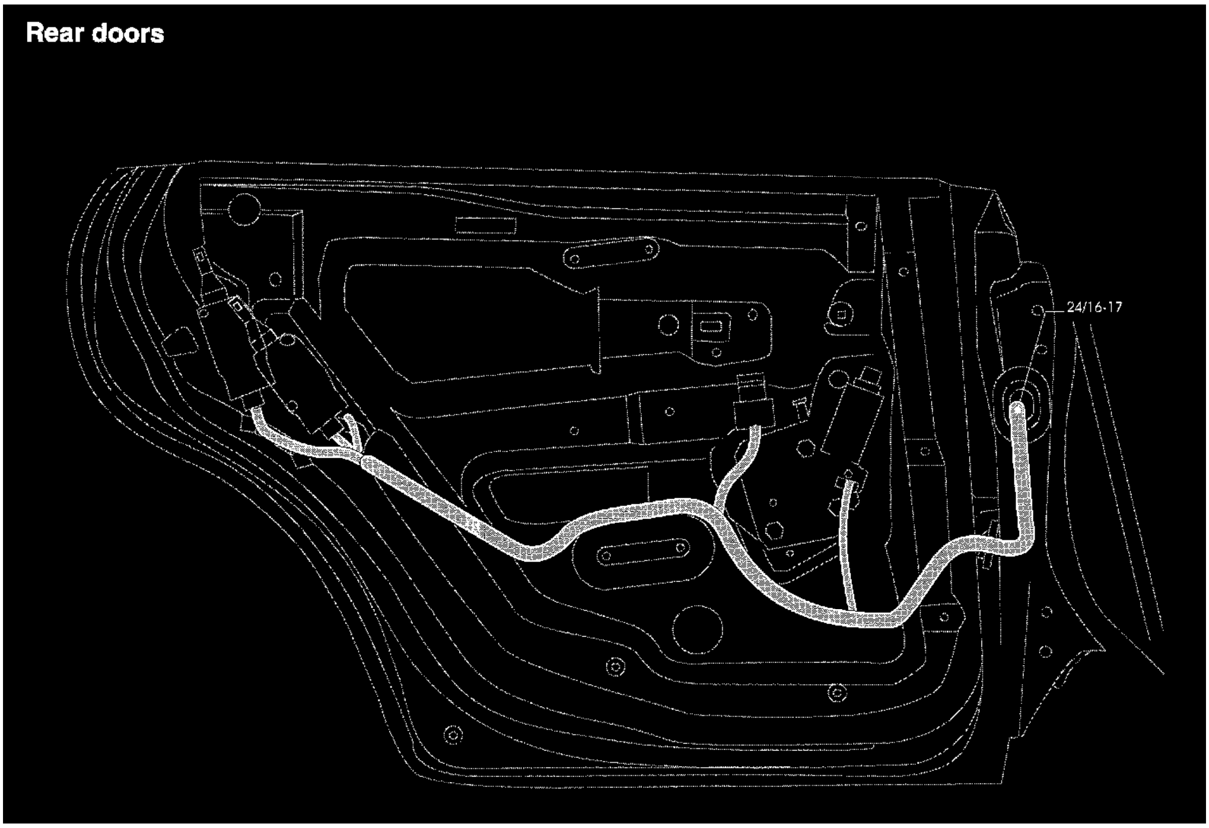
Engine Compartment MELCO 1



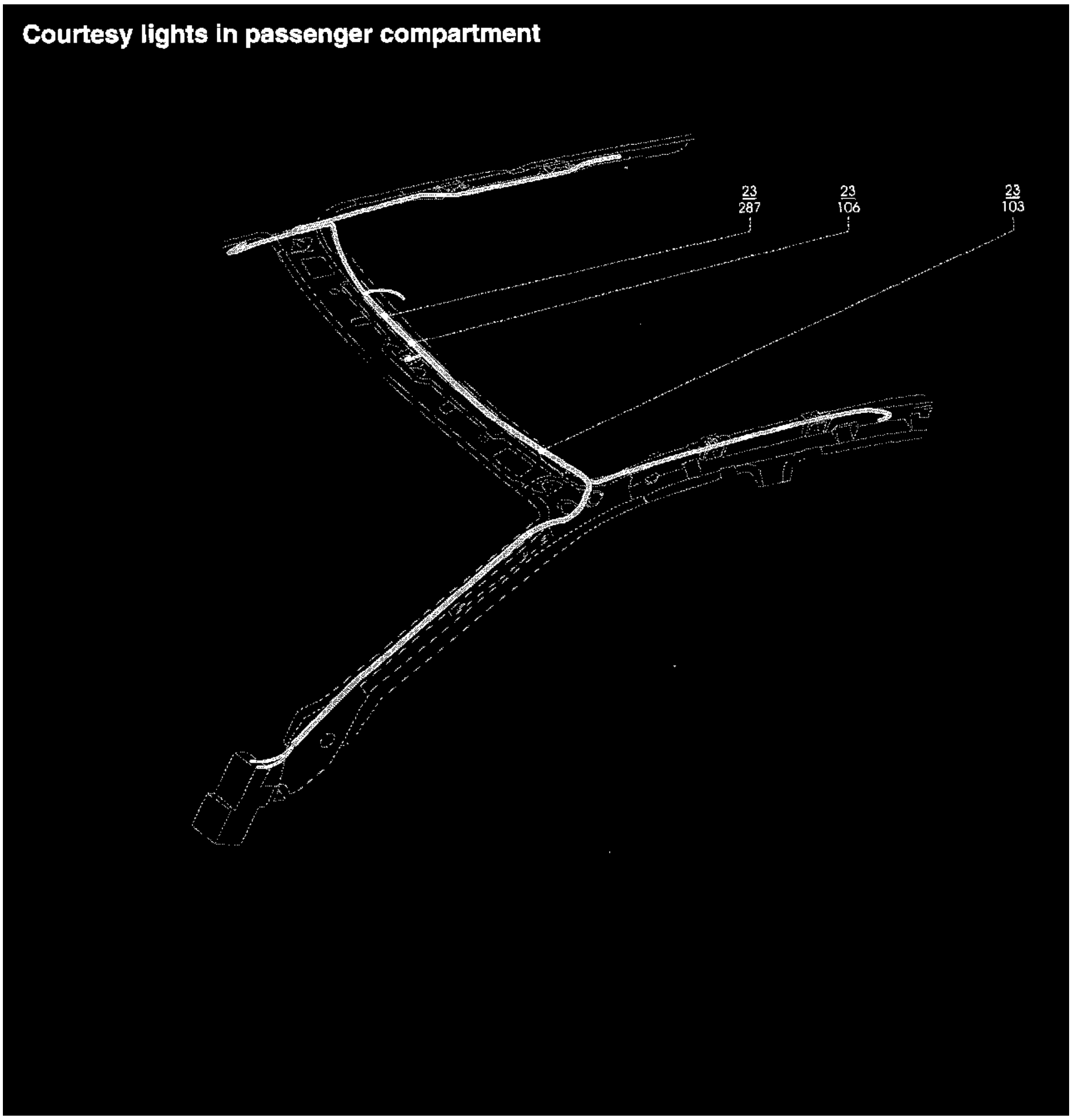
Engine Compartment MSA 15.5 Diesel



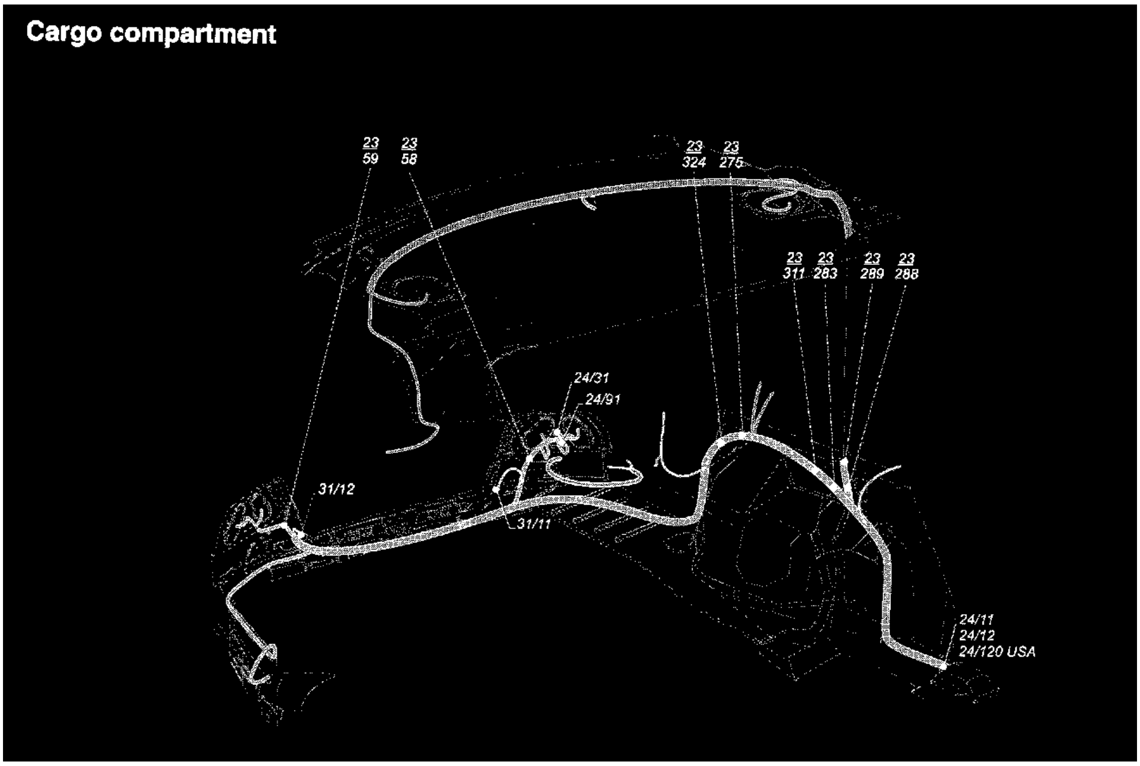
Front Doors



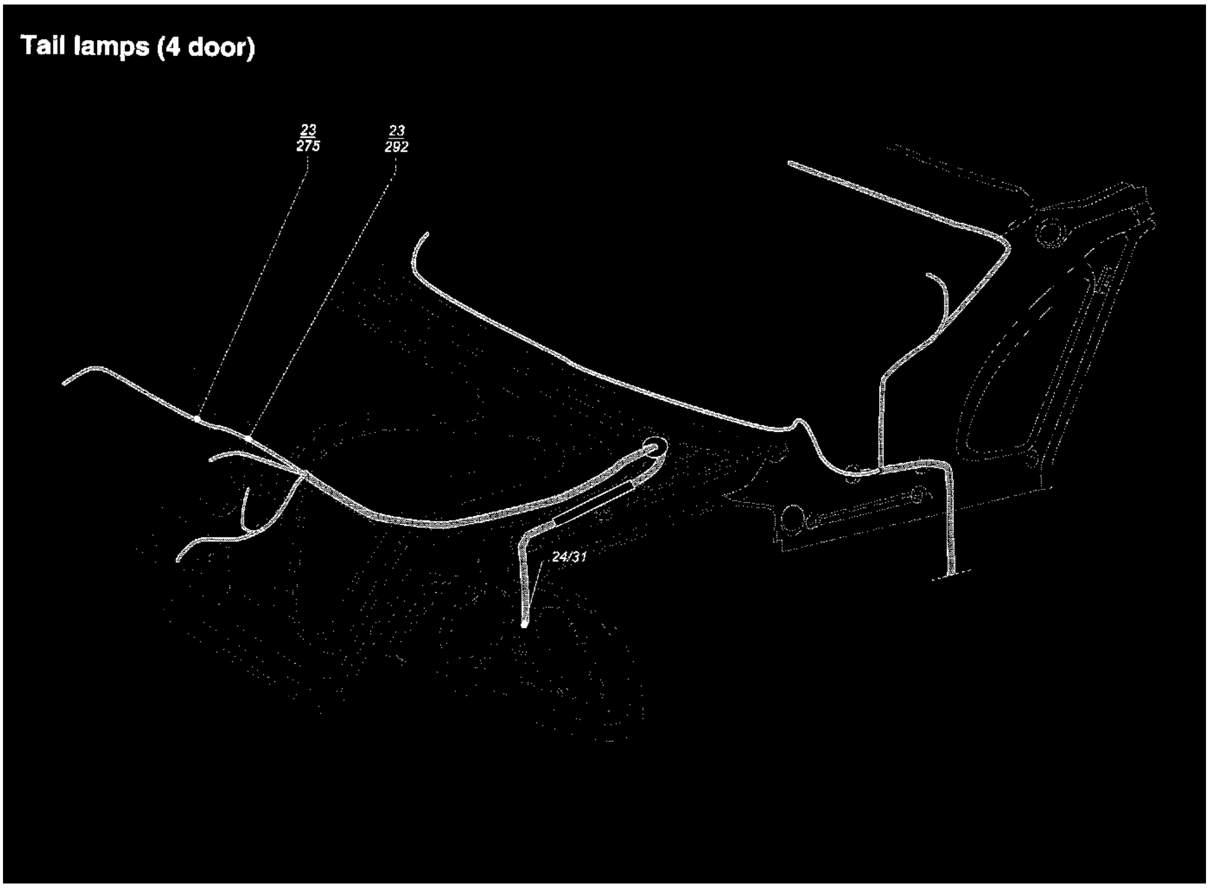
Rear Doors



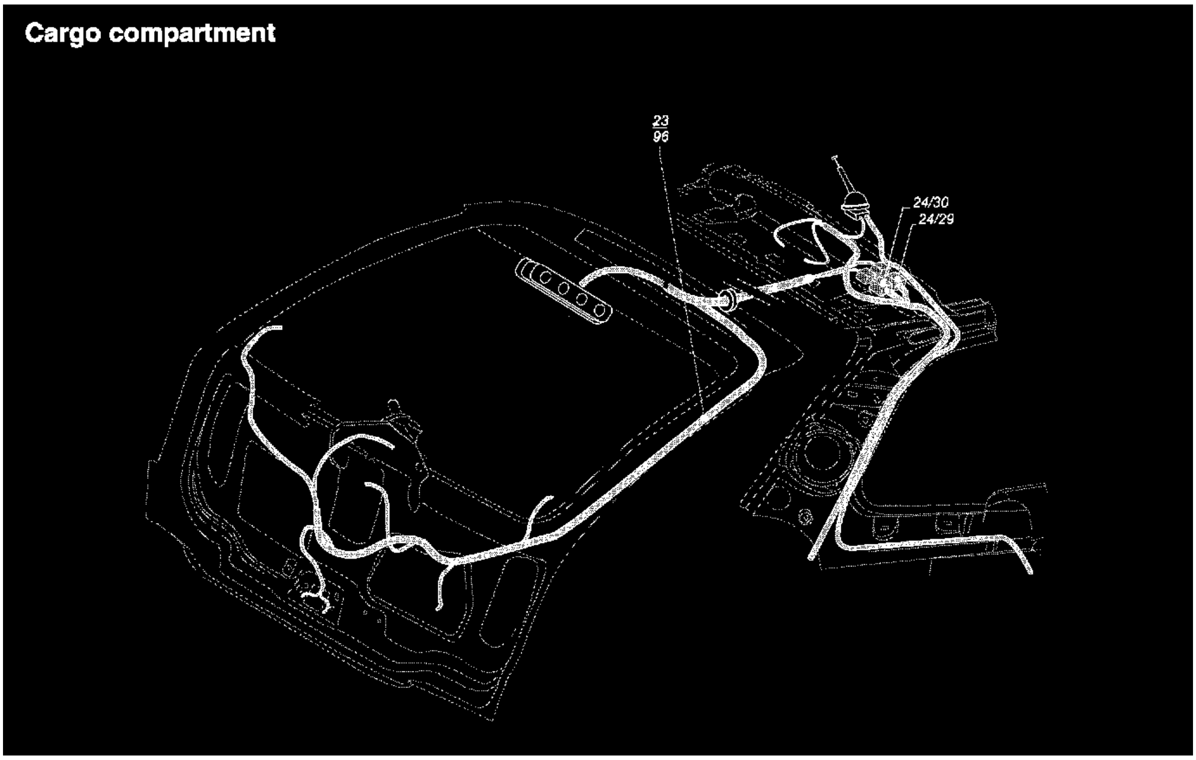
Courtesy Lights In Passenger Compartment



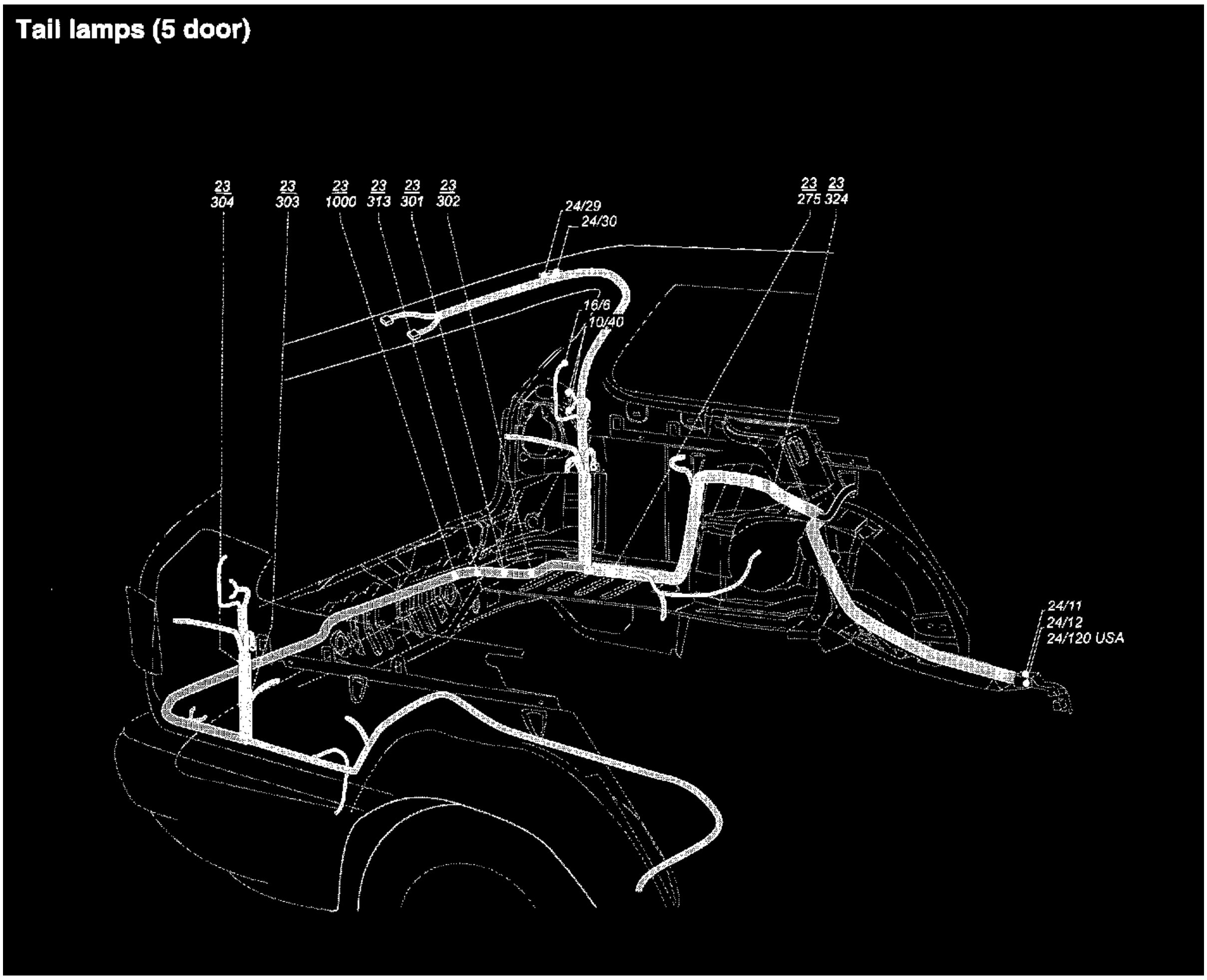
Cargo Compartment



Tail Lamps (4 Door)



Cargo Compartment



Tail Lamps (5 Door)

Computers and Control Systems: Testing and Inspection

VIDA (Vehicle Information & Diagnostics For Aftersales)

VIDA (Vehicle Information & Diagnostics for Aftersales)

During the second half of 2004, VADIS (Volvo Aftersales Diagnostic and Information System) was phased out and replaced by VIDA (Vehicle Information & Diagnostics for Aftersales). The purpose of VIDA is to support service providers in repairing and servicing Volvo vehicles. VIDA provides Service and Parts information, as well as diagnostic fault tracing, and software downloads. As in VADIS, these areas are integrated into one single application. All functionality that could be found in VADIS will be found in VIDA. However, in some particular areas, e.g., the diagnostic work flow, search functionality, and the Parts catalogue, VIDA contains considerable enhancements when compared to VADIS.

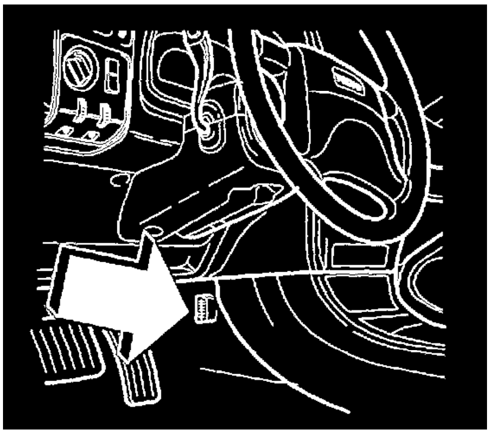
Volvo's VIDA (Vehicle Information & Diagnostics for Aftersales) system ties together service and repair data, parts data, service bulletins, software (firmware) downloads, fault tracing and on-board diagnostic as well as other related information to decrease service time.

Much of the diagnostic information provided here is presented in a manner that assumes the technician is using the web-based Volvo diagnostic system (VIDA) to diagnose the vehicle. Volvo does not provide any information based on performing diagnosis with a third party diagnostic tool aside from a conversion from P Codes to Volvo ECM Codes. See: Diagnostic Trouble Code Descriptions

Reading Off the Volvo On-Board Diagnostic System

Reading Off the Volvo On-Board Diagnostic (OBD) System

Overview



Fault information and other data can be read using VIDA connected to the data link connector **(DLC)** via VCT2000. The data link connector **(DLC)** is located on the left of the center console (the right of the center console for right hand drive cars). VCT2000 communicates with the DSA control module via a standardized interface.

Volvo on-board diagnostic (OBD) system
With VIDA it is possible to:
- Read off and erase stored diagnostic trouble codes **(DTCs)**
- Reset adaptations
- Activate components and functions according to certain predetermined patterns
- Continuously monitor the value and status of the input and output signals for the system
- Read off the control module identification.

To activate the Volvo on-board diagnostic **(OBD)** system for DSA:
- The ignition must be on
- The battery voltage must be normal.

Reading and erasing diagnostic trouble codes (DTCs)
Stored diagnostic trouble codes **(DTCs)** can be read off and erased using this function. The on-board diagnostic **(OBD)** system can identify 17 different faults in the form of diagnostic trouble codes **(DTCs)**.

Note: Diagnostic trouble codes **(DTCs)** DSA-112, DSA-223, DSA-224 and DSA-233 are only stored in the DSA control module while the ignition is on / the engine is running. When the ignition is switched off, these diagnostic trouble codes **(DTCs)** are erased. Therefore the engine must be started before diagnostic trouble codes **(DTCs)** are read off from the control module. This is so that the control module is able to re-check and store diagnostic trouble codes **(DTCs)**.

Diagnostic trouble codes **(DTCs)** can only be erased when all diagnostic trouble codes **(DTCs)** have been read at least once.

Note: After the diagnostic trouble codes **(DTCs)** are erased the DSA function is disengaged. The DSA function is re-engaged using the DSA switch. If no diagnostic trouble codes **(DTCs)** have been stored, the DSA warning lamp goes out after engagement.

Resetting the wheel adaptation

This function allows the DSA system wheel adaptations to be reset to their center positions.

Activating components and functions
This function allows the system components and functions to be activated individually. The following components can be activated:
- Torque limiting request
- DSA warning lamp, flash status.

Note: After Activation is completed, the DSA function is disconnected. The DSA function is re-engaged using the DSA switch. If no diagnostic trouble codes **(DTCs)** have been stored, the DSA warning lamp goes out after engagement.

For further information about Activating components / functions. See: Scan Tool Testing and Procedures

Reading off input and output signals
Using this function, the values and status of the control module input and output signals can be continuously read off.

Note: To obtain the relevant values, the engine must be running and the engine control module **(ECM)** must be initiated. The engine control module **(ECM)** is initiated the first time engine speed exceeds 600 rpm.

The following parameters can be read off:
- Engine speed (RPM), value
- Load signal, value
- Throttle position (TP) sensor, position
- Torque limiting, value
- Transmission type
- Control module initialization, status
- DSA function, status
- DSA switch, status
- DSA warning lamp, lit status
- DSA warning lamp, flash status
- Stop (brake) light switch, status
- The value for the left front wheel speed
- The value for the right front wheel speed
- The value for the left rear wheel speed
- The value for the right rear wheel speed
- Left front wheel adaptation, value
- Right front wheel adaptation, value
- Left rear wheel adaptation, value
- Right rear wheel adaptation, value
- Wheel adaptation permitted, status.

Reading off the control module identification
VIDA identifies the control module by reading a code from the memory of the module. This code contains information about the control module P/N.

General

DSA SYSTEM OVERVIEW

General
Function in the dynamic stability assistance (DSA) antiwheel spin system

the DSA system assists the driver in holding the vehicle under control under (hard) acceleration, especially when the road surface provides less grip than the driver anticipated.

It also makes progress possible in very slippery conditions, which would not otherwise be possible without dynamic stability assistance.

Unlike the SRS-, ABS- or SIPS-systems, the DSA system is not a safety system. It is an aid to improve control of the car.

The DSA system can be switched off, but is automatically engaged every time the ignition is switched on.

A warning lamp in the dashboard indicates the status of the DSA system.

The DSA system consists of a single control module. This control module calculates wheelspin in the driven wheels from the information about the speed provided by the ABS control module. From this information the DSA control module calculates the torque reduction that is required. This information is transferred to the engine control module **(ECM)** which decreases the torque on the driven wheels to the normal driving conditions.

The DSA control module does not have sensors of its own. It uses the ABS system or engine control module **(ECM)** sensors.

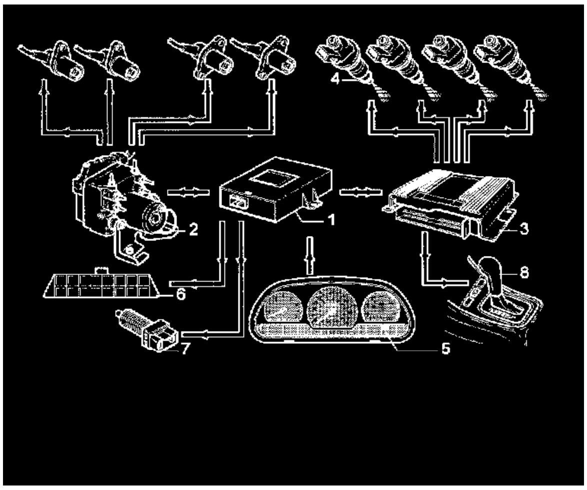
The DSA control module can be activated at all speeds, both when the car is moving forwards and when it is moving backwards.

There are no functional similarities between the DSA system and the TRACS system.
- The TRACS system uses wheel braking to prevent wheelspin in one of the front wheels when the car moves off.
- The DSA system decreases the engine torque to prevent wheelspin on one or both of the driven wheels in all driving conditions.

System Overview

DSA SYSTEM OVERVIEW

System overview



The DSA control module (1) needs data about the speed of all four wheels in order to detect wheel spin. This data is provided by the ABS control module (2). The data is transmitted continuously. The DSA control module is able to detect whether on or both of the drive wheels lose grip.

If wheel spin is detected, the DSA control module transmits a signal to the engine control module **(ECM)** (3) to reduce the torque. The engine control module **(ECM)** reduces the torque by shutting off one or more injectors (4) in different stages.

The engine control module **(ECM)** communicates with the DSA control module via three communication lines.
- The first communication line is used to transfer both speed (pulse frequency / one pulse per top dead center sweep) and engine load data. The engine load data is indicated by pulse width. Variations in the pulse width also provide additional data such as start, idling and transmission data.
- The second communication line transmits data about the position of the accelerator pedal **(AP)**. A pulse is transmitted every 20th millisecond. The pulse is proportional to the given value.
- A third communication line is used for the transfer of data about torque reduction from the DSA control module to the engine control module **(ECM)**. This pulse frequency is 5 milliseconds. Again it is the pulse width that provides the data.

The DSA system is switched on every time the engine is started.

The DSA system can be disengaged with the DSA switch (8) on the center console. The DSA system can be reengaged by pressing the DSA switch again. Otherwise, the system is activated the next time the ignition is switched on.

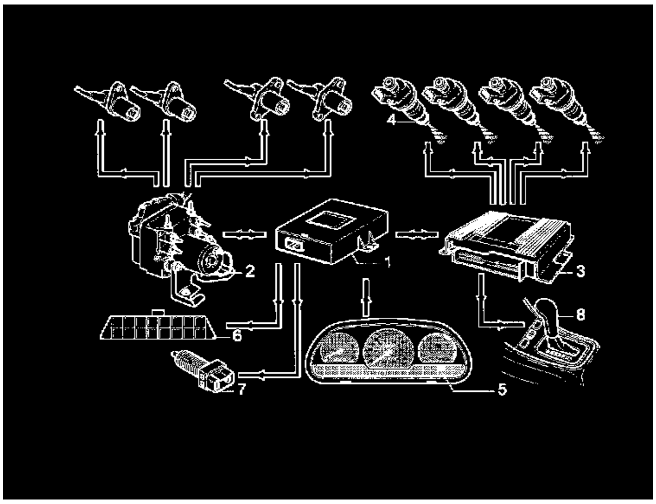
The DSA warning lamp is on the dashboard (5). This warning lamp indicates the status of the DSA system.
- The DSA warning lamp is lit for 2 seconds after the engine is started. During this time, the integrated DSA diagnostic system checks that both the ABS control module and the engine control module **(ECM)** are OK.
- The DSA system is not working if the DSA warning lamp remains lit. The is either a system failure or the system has been switched off manually.
- If the DSA warning lamp flashes while driving, the system is active and reducing the engine torque.

Diagnostic trouble codes **(DTCs)** from the DSA system can be read off with VIDA. Connect VIDA to the data link connector **(DLC)** (6) via VCT 2000.

System Function

DSA SYSTEM OVERVIEW

System function



The DSA system must take account of any deviations caused by the steering wheel.. It is therefore important that no incorrect data is introduced by the system itself and that it goes through a number of stages before the torque reduction is activated.

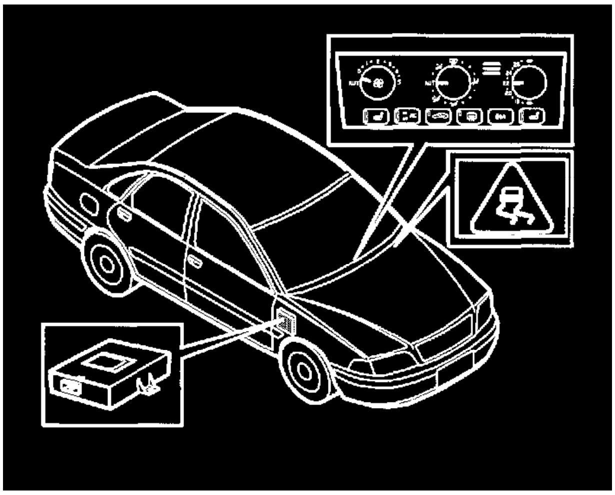
- When the DSA control module detects wheelspin it first determines the extent of the spin.
- The average spin of the two front wheels is calculated. Differences in wheel speed because of cornering is compensated using sensors on the rear wheels.
- Information about the engine speed and load comes from the engine control module **(ECM)**. The torque required from the engine is calculated from this.
- The selected gear can be derived by comparing wheel speed with engine speed. From this the friction coefficient between the tire and road surface can be deduced.
- Acceptable spin can be deduced from the accelerator pedal **(AP)** position and the friction coefficient.
- The engine control module **(ECM)** decreases torque by disengaging the injectors, so preventing wheel spin.

The DSA control module only sends information to the engine control module **(ECM)**. It is this that close the fuel injection. The engine control module **(ECM)** can control the injection by closing the injectors, so that one or more injectors can be closed every 4th cylinder compression. It reduces torque in 16 stages.

- Partial closure of the injectors occurs randomly to ensure that the heat is evenly distributed.
- If the torque reduction is very small, a safety program is activated. After a given period the DSA shuts off several injectors (greater torque reduction) to ensure that the combustion chambers are correctly ventilated.
- The DSA system functions up to maximum. It is also active while reversing.
- The DSA system aligns itself so that it is does not identify different wheel diameter as wheelspin, in cases of variable tire pressure for example. DSA is not engaged if there is a slow puncture in one of the tires.
- Switch off the DSA system when driving on a "special spare tire". If not the system aligns itself to the diameter of the tire on the wheel. To assist this the car should be driven slowly, then accelerated hard for approximately 4 seconds. The accelerator pedal **(AP)** should be released quickly so that the engine brakes the car for approximately 4 seconds. Repeat this one more time. This procedure should be repeated when the special spare tire is replaced by a normal tire.

Overview

DIAGNOSTIC FUNCTIONS
Overview
General



The DSA control module has an integrated diagnostic system, the Volvo on-board diagnostic **(OBD)** system. This system continuously monitors itself and the input and output signals.

Diagnostic trouble codes (DTCs)
A diagnostic trouble code **(DTC)** is stored and the DSA warning lamp lights if the control module detects a fault. The exception is diagnostic trouble code **(DTC)** DSA-122 DSA warning lamp. This DSA warning lamp cannot be activated if this fault is stored.

Faults, with the exception of diagnostic trouble code **(DTC)** DSA-122DSA warning lamp, disengage the DSA function. If diagnostic trouble code **(DTC)** DSA-122DSA warning lamp is stored, the warning lamp cannot be used to determine whether the DSA function is engaged or not. The DSA function is then always engaged and cannot be disengaged manually.

If the DSA warning lamp is lit, the DSA function is not operating normally or it is not engaged.

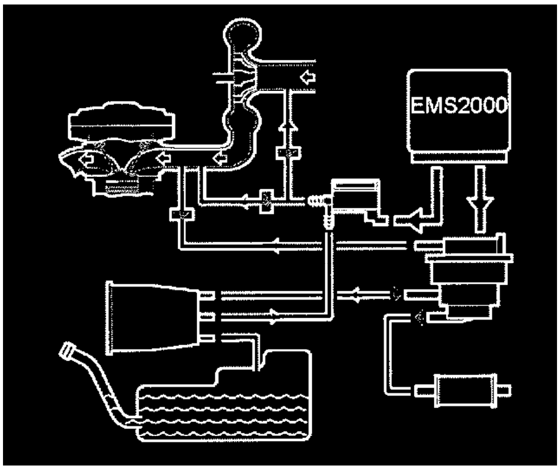
If a fault disappears for any reason (becomes intermittent) after the diagnostic trouble code **(DTC)** has been permanently stored in the control module, information about the fault remains in the control module.

Other
Every diagnostic trouble code **(DTC)** has a counter. The counter records the number of fault-free cycles since the diagnostic trouble code **(DTC)** was stored (intermittent fault). A cycle is defined as the first time the engine speed exceeds 600 rpm in the same interval in which the ignition is switched on (the engine starts) and then switched off. If diagnostic trouble code **(DTC)** DSA-22 1 Load signal is stored permanently, the cycle is defined as the first time the average wheel speed exceeds **50 km/h** in the same interval in which the ignition is switched on (the engine starts) and then switched off. When a counter is at 0, the control module interprets the fault as permanent. If the counter value is greater than 0, the control module interprets it as no fault (intermittent fault). If the fault recurs, the counter is reset to zero. When the counter reaches 254 (i e. 254 fault-free cycles), the counter is no longer updated.

Leak Diagnostics

LEAK DIAGNOSTIC

General



Vapor from the fuel in the fuel tank is routed to and stored in the EVAP canister. It is then guided into the combustion process via the canister purge (CP) valve and the negative pressure in the intake manifold. A leakage diagnostic has been introduced to ensure that the fuel tank system is not leaking. This diagnostic is designed so that the system is able to detect a leak / hole 0.5 mm or larger. Diagnostics are also carried out on the EVAP system.

The fuel tank system consists of the fuel tank, fuel filler pipe, roll-over valve, EVAP canister, canister purge (CP) valve and all cables between these components. In order to perform diagnostics, the fuel tank system is equipped with a leak diagnostic pump. The leak diagnostic pump is vacuum driven and pressurizes the fuel tank system. The vacuum that operates the leak diagnostic pump comes from the intake manifold via a non-return valve. The engine control module (ECM) activates I deactivates a three-way valve in the leak diagnostic pump (vacuum / atmospheric pressure). The pump action is obtained using a spring loaded diaphragm.

A position sensor is mounted on the diaphragm. This allows the control module to determine when the three-way valve should be activated. The position sensor acts on a contact breaker. The contact breaker transmits a high or low signal to the engine control module (ECM). The control module activates the three-way valve when the diaphragm is in the resting position. A vacuum is generated. The diaphragm is switched to the active position. The three-way valve is deactivated when the control module determines that the diaphragm has reached the activated position. The atmospheric pressure is allowed to enter and the diaphragm returns to the resting position. In order to detect leakage in the fuel tank system, the leak diagnostic pump is used according to the description in "Leak diagnostic" below.

The diagnostic takes place once per operating cycle if the following criterion are met:
- The battery voltage must be correct
- The engine coolant temperature (ECT) and intake air temperature (IAT) must be 4-60°C
- The engine coolant temperature (ECT) must have dropped by at least 15°C since the previous operating cycle
- The atmospheric pressure must remain constant.

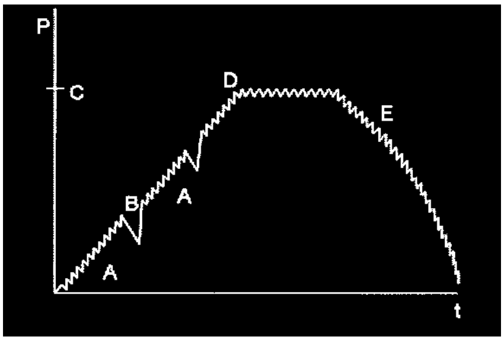
Function test

The diagnostic is divided into different phases in which the components involved are tested before the actual leak diagnostic begins. The diagnostic is cancelled and a diagnostic trouble code (DTC) is stored if a fault is detected in any of the phases.

The diagnostic test works as follows:

- The system must be depressurized. The control module checks that the pump diaphragm is in the resting position. Diagnostic trouble code (DTC) ECM-65, faulty signal, is stored if the control module registers that the position is active
- When the engine is started, a vacuum is generated in the intake manifold. The three-way valve opens a connection to the intake manifold via the non-return valve. The diaphragm is moved to the activated position by the vacuum. Diagnostic trouble code (DTC) ECM-65, high signal, is stored if the control module registers that the diaphragm is still in the resting position
- The three-way valve closes the connection with the intake manifold. The non-return valve closes. A connection to the atmospheric pressure opens. The spring-loaded diaphragm must then return to resting position. Diagnostic trouble code (DTC) ECM 65, low signal, is stored if the diaphragm does not return to the resting position.

Leak diagnostic



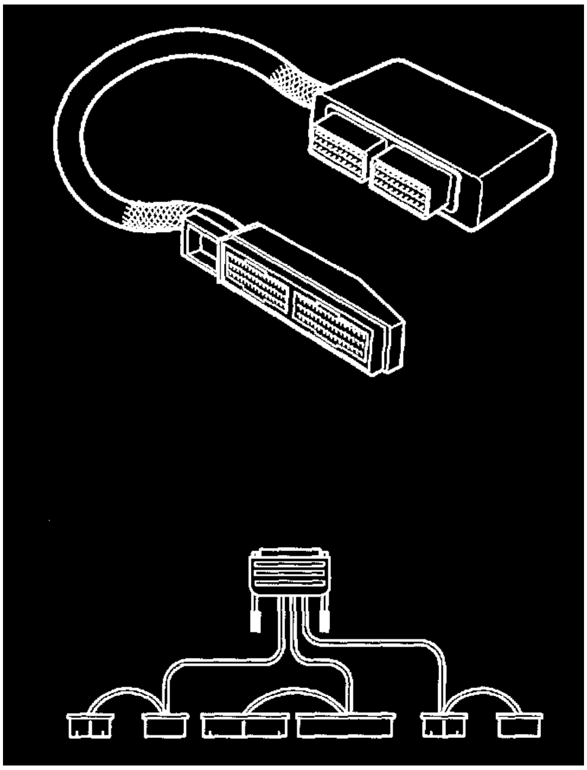
- The leak diagnostic pump is pulsed (A) rapidly at a rapid frequency. This is to pressurize the fuel tank system to the desired pressure (C)
- This rapid pulsing is interrupted regularly (B). This is to check that the correct pressure in the fuel tank system is reached. This is done by gauging the time taken for the pump to switch from active to resting position using the switch in the leak diagnostic pump. The constant pulse (A) and pressure check (B) alternate until the desired pressure (C) in the fuel tank system is obtained. If vehicle speed exceeds 40 km/h there is no pressure check (B). The pump is activated and deactivated a fixed number of times instead. If the pressure (C) is not reached, the control module interprets it as a leakage. Diagnostic trouble code (DTC) ECM6A, fuel tank filler cap missing, is stored
- When the pressure in the fuel tank is detected by the control module using the leak diagnostic pump, the control module begins to check for smaller leaks (D). To do this, the control module measures the time the diaphragm takes from active to resting position. Diagnostic trouble code (DTC) ECM-68, large leak, or ECM- 68, small leak, is stored if this time is too short
- If no leakage is detected in the fuel tank system, the flow in the evaporative emission (EVAP) system is checked for blockage. This is done by pulsing both the canister purge (CP) valve and the leak diagnostic pump at the same time. The control module checks that the pressure in the fuel tank drops (E). If the pressure does not drop, the control module interprets it as a blockage in the evaporative emission (EVAP) system. Diagnostic trouble code (DTC) ECM-6A is stored. The canister purge (CP) valve is pulsed until the fuel tank system is depressurized. The diagnostic takes place in the next operating cycle.

Connecting the Breakout Box (DSA)

Connecting The Breakout Box. DSA

Special tools: 981 3194, 9813190

Connecting the breakout box to the DSA control module



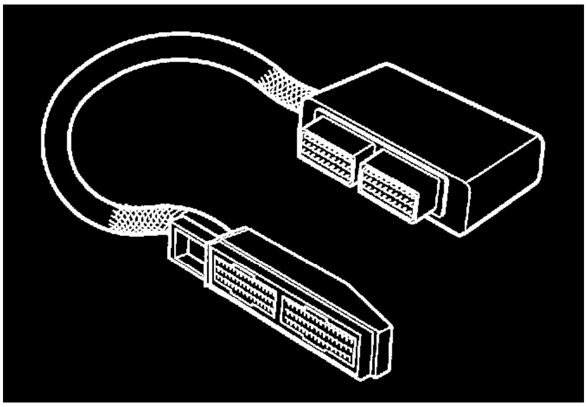
- Ignition off
- Expose the DSA control module
- Remove the control module from the holder
- Disconnect the control module
- Check that the male and female terminals in the control module and the control module connector are intact and secure. Check that the wiring to the female terminals is properly secured to the pins
- In particular, check the terminal pins relevant to the diagnostic trouble code (DTC)/symptom
- Connect adapter **981 3194** (the 16-pin terminal) to the control module connector (wiring side). Connect breakout box **981 3190** to the adapter.

Connecting the Breakout Box, ECM (EMS 2000)

Connecting The Breakout Box, ECM (EMS 2000)

Special tools: 951 1314, 981 3190

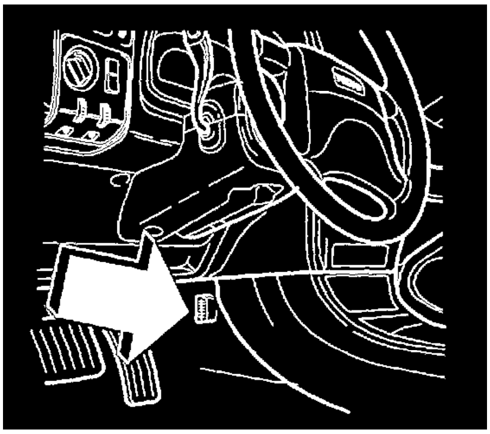
Connecting the breakout box to the connector at the engine control module (ECM)



- Ignition off
- Remove the security strap around the Engine Control Module **(ECM)**. Remove the control module from the bracket
- Disconnect the Engine Control Module **(ECM)**
- To avoid interfering with the pedals, the cable harness with the control module connector must be pulled over to the right of the center console (left hand drive) or to the left of the center console (right-hand drive). The connector must be placed on the floor
- Check that the male and female terminals in the control module and the control module connector are intact and secure. Check that the wiring to the female terminals is properly secured to the pins
- In particular, check the terminal pins relevant to the Diagnostic Trouble Code **(DTC)** or symptom
- Connect adapter 951 1314 to the Engine Control Module **(ECM)** connector. Connect breakout box 981 3190 to the adapter.

Connecting the Volvo Communication Tool 2000 (VCT 2000)

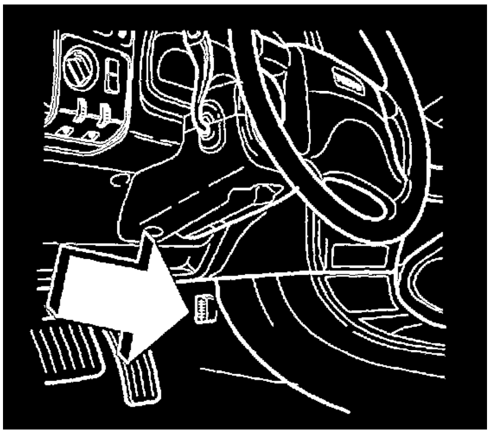
Connecting The Volvo Communication Tool 2000 (VCT 2000)



The VCT 2000 must be connected to both the VIDA PC and the data link connector (DLC) in the car to communicate with the control modules in the car.

With Generic Scan Tool

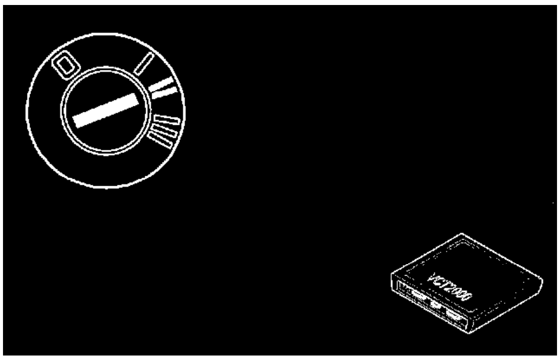
Displaying & Reading Trouble Codes
With Generic OBD II Scan Tool



To display and read diagnostic trouble codes with a generic OBD II compliant scan tool, follow the scan tool manufacturers instructions.

With Manufacturer's Scan Tool

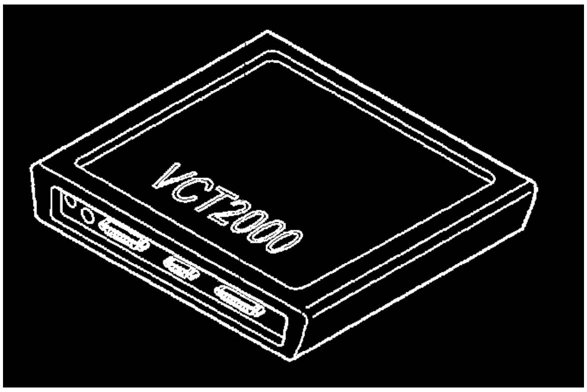
Reading Diagnostic Trouble Codes (DTCs), engine control module (ECM)



- Ignition on.

Read Diagnostic Trouble Codes (DTCs) by clicking on the VCT 2000 symbol.

Communication fault



Communication has been interrupted for one of the following reasons:

- Ignition switched off.
- The switch is **not** in position for VCT 2000.
- VCT 2000 disconnected from Data Link Connector (DLC).
- VCT 2000 disconnected from VIDA cart/switch.
- Communication problems in VIDA application or in car.

Check therefore:

- that the ignition is on and switch is in correct position for VCT 2000.
- that battery voltage (system voltage) is normal (approximately **12 V**). If necessary a battery charger can be connected during the test.

- that VCT 2000 is correctly connected to VIDA cart/switch and Data Link Connector (DLC).
- that VCT 2000 and wiring is fault-free.

Try to establish communication again or exit Reading Diagnostic Trouble Codes (DTCs). Depending on the communication fault, select one of the following alternatives.

- Try again.
- Fault-trace more comprehensively for the communication problem that has occurred.
- Exit fault-tracing / Read from next system.

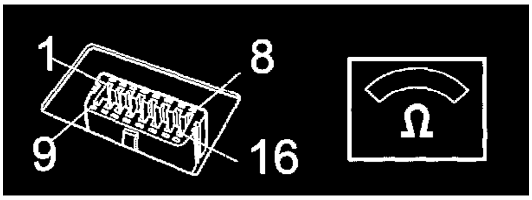
Selecting the model

Select the car model to obtain the relevant fault tracing data.

Select one of the following model options

- V70 2000-, S60 and S80
- V70 -2000 and S70/C70
- S40/V40.

Checking communication faults, model V70 2000-, S60 and S80



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)

- Check the power supply to the Data Link Connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the Data Link Connector (DLC) terminals # 4 and # 5.

Hint: When the VCT2000 is connected to the Data Link Connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cable between the Data Link Connector (DLC) terminal # 7 and Central Electronic Module (CEM) terminal # D6 and with other connected control modules.
- Check for an open-circuit.
- Check for a short-circuit to ground.

CAUTION
If there is a fault in the communication cable, it will not be possible to establish communication on either the low or high speed network.

The first time there is communication on this cable, the low and high speed network cables are connected between the Data Link Connector (DLC) and Central Electronic Module (CEM) to the other network in the car. This is controlled via a relay in the Central Electronic Module (CEM).

- For communication problems with control modules on the **high speed network**, check the communication cables between Data Link Connector (DLC) terminals # 6 and # 14 and Central Electronic Module (CEM) terminals # 137 and # 138.
- For communication problems with control modules on the **low speed network**, check the communication cables between Data Link Connector (DLC) terminals # 3 and # 11 and Central Electronic Module (CEM) terminals # 1319 and # 1320.
- Check these cables for an open-circuit, a short-circuit to ground and a short circuit to supply voltage.
- Also check the communication cables for the low and high speed networks between the Central Electronic Module (CEM) and the other connected Control modules.

Control modules
- Check that the control module power supply and ground terminal are fault-free.

CAUTION
If none of the above checks help, try Reading the Diagnostic Trouble Codes (DTCs) in the central electronic module. This is carried out via VIDA vehicle communication.

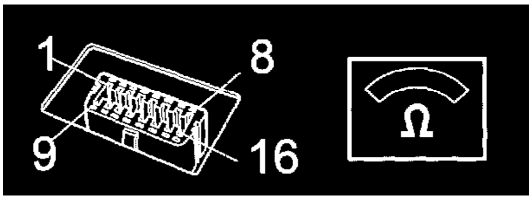
VCT2000 and wiring
- **Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing**.

Fault-tracing information

Falut-tracing communication problems is now finished.

Do you want to try establishing communication again?
Yes - Repeat test
No - Testing for the DTC is complete

Checking communication problems, V70 - 2000 and S70/C70 models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)
- Check the power supply to the Data Link Connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the Data Link Connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the Data Link Connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables
- Check the communication cable between the Data Link Connector (DLC) terminal #7 and combined instrument panel terminal #B4 and with other connected control modules.
- Check for an open-circuit.
- Check for a short-circuit to ground.
- Check for a short-circuit to supply voltage.

CAUTION
If there is a fault in the communication cable, it will not be possible to establish communication on the high speed network. The first time there is communication on this cable, the high speed network cables are connected between the Data Link Connector (DLC) and the combined instrument panel to the high speed network in the car. This is controlled via a relay in the combined instrument panel.

- Check the communication cables between Data Link Connector (DLC) terminals #6 and #14 and combined instrument panel terminals #A 19 and #A20.
- Check the cables for an open-circuit, short-circuit to ground and a short-circuit to supply voltage
- Also check the communication cables for the high speed network between the combined instrument panel and the other connected control modules.

Communication cable for the cruise control as an independent system (not integrated)
- Check the communication cable between the Data Link Connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltag.

Communication cable for engine management system Fenix 5.2

- Check the communication cable between Data Link Connector (DLC) terminal #3 and the engine control module (ECM).
- Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage.

Control modules

- Check that the control module power supply and ground terminal are fault-free.

CAUTION
If none of the above checks help, try Reading the Diagnostic Trouble Codes (DTCs) in the combined instrument panel. This is carried out via VIDA vehicle communication.

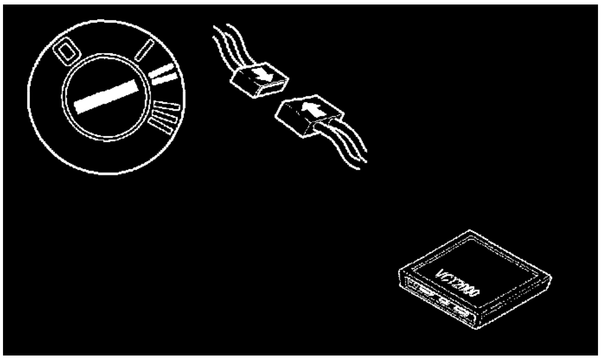
VCT2000 and wiring

- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

With Manufacturer's Scan Tool

Erasing Diagnostic Trouble Codes (DTCs)

NOTE: To obtain the correct communication with the control module during the procedure the instructions concerning the ignition switch position must be followed.



Before erasing Diagnostic Trouble Codes (DTCs) all indicated faults must be corrected.

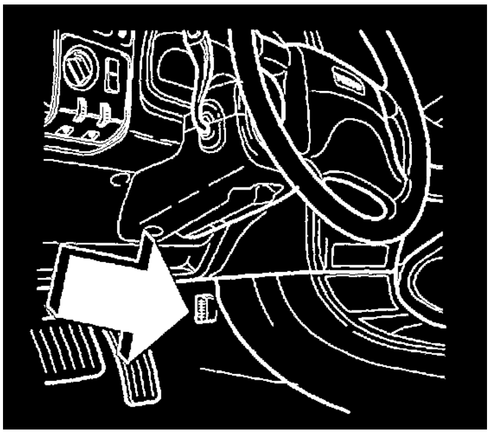
NOTE: VCT 2000 connected to data link connector (DLC) and VIDA PC

- Reinstall all components, reconnect all connectors.
- Ignition on.
- Erase Diagnostic Trouble Codes (DTCs).

Select 1 to erase.
Select 2 to interrupt erasing.

With Generic Scan Tool

Clearing Trouble Codes
With Generic OBD II Scan Tool



To erase diagnostic trouble codes with a generic OBD II compliant scan tool, follow the scan tool manufacturers instructions.

DTC Conversion Table Notes

Conversion table standardized diagnostic trouble codes (DTCs)/Volvo diagnostic trouble codes (DTCs)

Information
Background

OBD II is a diagnostics system designed to meet statutory requirements. A standardized instrument for fault-tracing can be plugged in to the data link connector (DLC) (OBD II socket) to read diagnostic trouble codes (DTCs) and system parameters. OBD II contains only emissions related diagnostic trouble codes (DTCs) and parameters. It cannot provide the comprehensive range of information available from the Volvo On-board diagnostics system.

Volvo has its own diagnostic trouble code (DTC) designations that adhere to the in-house Volvo On-board Diagnostics protocol (called DII from model year 1999).

Table explanations

The table below is a conversion table between standardized diagnostic trouble codes (DTCs) (SAE/ISO) and the equivalent Volvo diagnostic trouble codes (DTCs) (DII).

SAE/ISO diagnostic trouble code (DTC): Standardized diagnostic trouble code (DTC) according to SAE J2012/ISO 15031-6. The diagnostic trouble code (DTC) can be read off on vehicles with standardized on-board diagnostic systems for emissions related faults, certified in accordance with OBD II. Reading off is performed with a generic scan tool, an instrument for fault-tracing standardized in accordance with SAE J1978/ISO 15031-4.
Volvo DII diagnostic trouble code (DTC): Volvo-specific diagnostic trouble code (DTC) in accordance with the Volvo On-Board Diagnostic protocol. Can be read off using VIDA on cars from model year 1999.
Diagnostic trouble code (DTC) designation: Volvo diagnostic trouble code (DTC) designation. Used in VIDA.
Fault type: Volvo method for specifying the actual fault. Used in VIDA.

Note! An SAE/ISO diagnostic trouble code (DTC) can correspond to several DII diagnostic trouble codes (DTCs). All of these must therefore by rectified in order for the corresponding SAE/ISO diagnostic trouble code (DTC) to disappear.

Several SAE/ISO diagnostic trouble codes (DTCs) may also refer to the same DII diagnostic trouble code (DTC).

There are DII diagnostic trouble codes (DTCs) for non emissions-related faults that do not correspond to any SAE/ISO diagnostic trouble code (DTC).

Engine Control System

Volvo On-Board Diagnostic (OBD) System Diagnostic Trouble Code (DTC)

Volvo DTC Codes	Description
ECM-0B	Atmospheric pressure sensor.
ECM-0C	Boost pressure sensor.
ECM-0D	Boost pressure sensor.
ECM-0F	Intake air temperature (IAT) sensor.
ECM-10	Intake air temperature (IAT) sensor.
ECM-13	Mass air flow (MAF) sensor signal.
ECM-14	Mass air flow (MAF) sensor.
ECM-15	Engine coolant temperature (ECT) sensor signal.
ECM-16	Front heated oxygen sensor signal.
ECM-18	Front heated oxygen sensor (HO2S), preheating.
ECM-1A	Signal, rear heated oxygen sensor (HO2S).
ECM-1C	Rear heated oxygen sensor (HO2S), preheating.
ECM-1E	Injector 1.
ECM-1F	Injector 2.
ECM-20	Injector 3.
ECM-21	Injector 4.
ECM-24	System relay control signal.
ECM-25	Long-term fuel trim. Lean.
ECM-28	Front heated oxygen sensor (HO2S) short-term fuel trim.
ECM-29	Rear heated oxygen sensor (HO2S).
ECM-2D	Turbocharger (TC) control valve signal.
ECM-2E	Boost pressure.
ECM-32	Camshaft position (CMP) sensor signal.
ECM-38	Ignition coil 1.
ECM-3A	Ignition coil 2.
ECM-41	Knock sensor (KS).
ECM-43	Control module.
ECM-44	Misfire, Emission level.
ECM-45	Misfire, Emission level.
ECM-4D	Misfire damages the catalytic converter.
ECM-53	Engine speed (RPM) sensor. Sporadic.
ECM-5A	Three-way catalytic converter (TWC) efficiency.
ECM-5C	Canister purge (CP) valve signal.
ECM-5D	Camshaft reset valve.
ECM-5E	Camshaft reset valve.
ECM-5F	Camshaft reset valve.
ECM-60	Camshaft reset valve.

ECM-0A - ECM-60

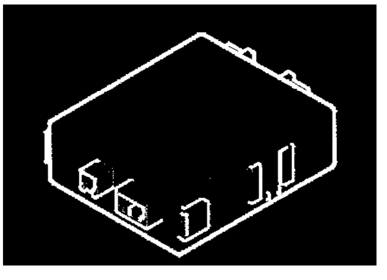
Volvo DTC Codes	Description
ECM-61	Camshaft reset valve.
ECM-62	Camshaft reset valve.
ECM-65	Leak diagnostic
ECM-66	Leak diagnostic.
ECM-68	Leak diagnostic. Fuel tank filler cap missing.
ECM-6A	Leak diagnostic.
ECM-6B	Air conditioning (A/C) pressure sensor.
ECM-6F	Speedometer signal.
ECM-70	DSA signal cable.
ECM-73	Throttle position (TP) sensor signal.
ECM-74	Throttle position (TP) sensor signal.
ECM-76	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)
ECM-78	Engine speed (RPM) sensor.
ECM-7D	Air conditioning (A/C) relay signal.
ECM-7F	Malfunction indicator lamp.
ECM-82	Air conditioning (A/C) condenser fan.
ECM-85	Engine cooling fan (FC) low-speed.
ECM-87	Engine cooling fan (FC) high-speed.
ECM-8A	Idle air control (IAC) valve.
ECM-8D	Idling speed.
ECM-91	Torque reduction. Diagnostic trouble code (DTC) in the DSA.
ECM-9A	Communication problems, Immobilizer. No communication
ECM-9B	Communication problems, Immobilizer. Faulty VIN
ECM-9D	Control module. Internal fault.
ECM-A0	Engine coolant temperature (ECT) sensor.
ECM-A1	Engine coolant temperature (ECT) sensor.
ECM-A2	Engine coolant temperature (ECT) sensor.
ECM-A3	System relay output
ECM-AF	Leak diagnostic pump.
ECM-DC	Communication, Transmission control module (TCM).
ECM-DD	Communication, Transmission control module (TCM).
ECM-DE	Communication, Transmission control module (TCM).
ECM-E0	Communication, Transmission control module (TCM).

ECM-61 - ECM-E0

Diagnostic Trouble Code (DTC)	DTC Description
ABS-112	Control module
ABS-142	Stop (brake) lamp switch
ABS-311	Wheel sensor signal, left front wheel
ABS-312	Wheel sensor signal, right front wheel
ABS-313	Wheel sensor signal, left rear wheel
ABS-314	Wheel sensor signal, right rear wheel
ABS-331	Faulty wheel sensor signal
ABS-411	Inlet valve, left front wheel
ABS-412	Outlet valve, left front wheel
ABS-413	Inlet valve, right front wheel
ABS-414	Outlet valve, right front wheel
ABS-421	Inlet valve, left rear wheel
ABS-422	Outlet valve, left rear wheel
ABS-423	Inlet valve, right rear wheel
ABS-424	Outlet valve, right rear wheel.
ABS-433	Battery voltage
ABS-441	Power supply valves
ABS-443	Pump motor

GLA-113

Diagnostic Trouble Code (DTC) Information



Condition

This diagnostic trouble code (DTC) is stored when the control module is supplied to the factory.

Condition

- None.

Possible source

- The control module is not programmed.

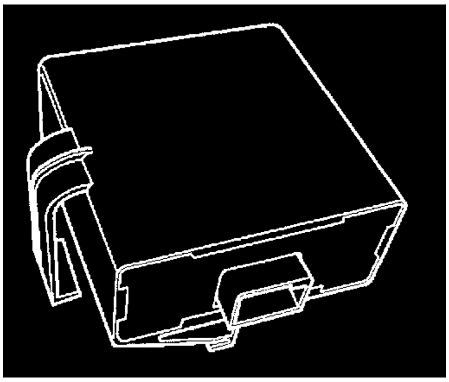
Condition

- The indicator LED on the dashboard is flashing.
- The central locking system, alarm system and courtesy lighting do not work.

GLA-312

Diagnostic trouble code (DTC) information

Condition



If the control module registers that the voltage level in the sirens internal battery is **< 2.5 V** when the alarm system is powered up or the alarm is activated/deactivated, then diagnostic trouble code (DTC) GLA-312 is stored after **2 seconds**.

Condition

- None.

Possible source

- Defective internal battery.
- Fault in 15 I-supply to the siren.
- Defective siren.

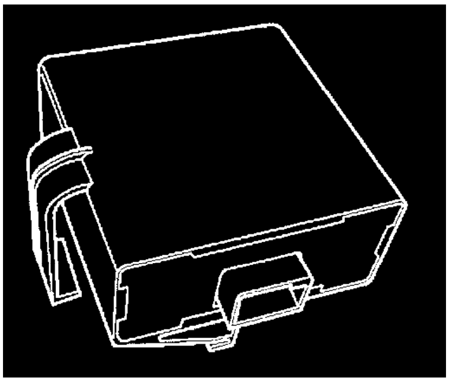
Condition

- The indicator LED flashes for **15 seconds** when the ignition is switched on.

GLA-321

Diagnostic Trouble Code (DTC) Information

Condition



If the control module registers that the siren control module is transmitting a signal indicating that the siren battery voltage level has sunk under **6.0 V** when: the siren is powered up or the alarm is activated/deactivated, then diagnostic trouble code (DTC) GLA-321 is stored.

Condition

- None.

Possible source

- Battery voltage too low due to insufficient charging or poor battery.
- Open-circuit or short-circuit to ground in the siren communication cable.
- Open-circuit in the siren power supply or ground lead.

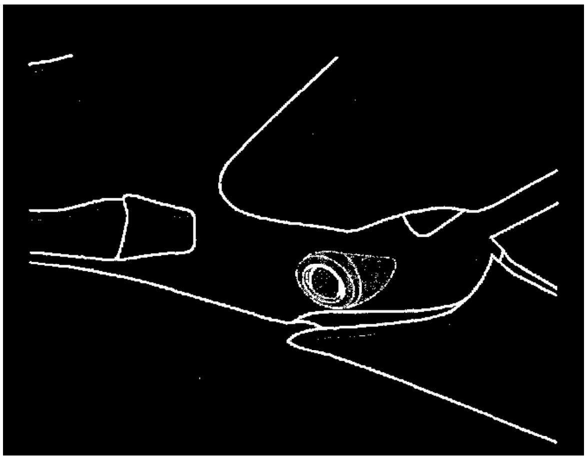
Condition

- The indicator LED flashes for **15 seconds** when the ignition is switched on.
- When the alarm is activated the internal battery takes over power supply and the siren sounds for **30 seconds**.

GLA-415

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) GLA-415 is stored after approximately **2 seconds** if the control module registers an error in communication with the ultrasonic sensor control module when the alarm system is powered up or when the alarm is activated or deactivated.

Condition

- None.

Possible source

- Short-circuit to ground or voltage in communication cable.
- Open-circuit in communication cable.
- The communication cable is too close to a source of interference.

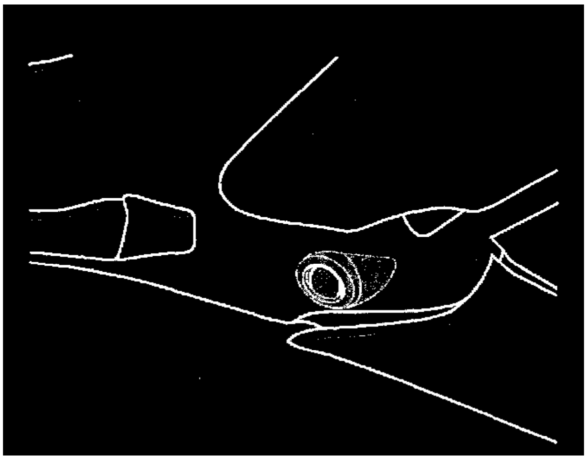
Condition

- The indicator LED flashes for **15 seconds** on ignition.
- The system will not trigger the alarm if there is movement in the passenger compartment.

GLA-416

Diagnostic Trouble Code (DTC) Information

Condition



If the Control module registers that there is an internal fault in the ultrasonic sensor own control module when: the alarm system is powered up or the alarm is activated/deactivated, then diagnostic trouble code (DTC) GLA-416 is stored after approximately **2 seconds**.

Condition

- None.

Possible source

- Defective ultrasonic sensor.

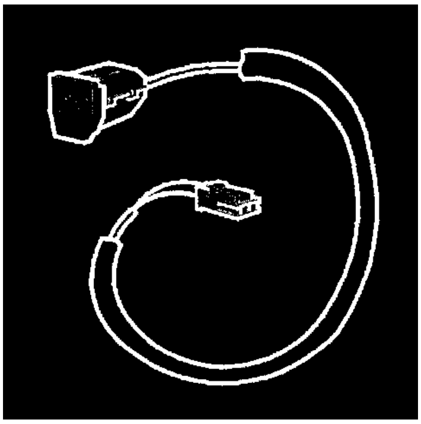
Condition

- The indicator LED flashes for **15 seconds** when the ignition is switched on.
- The system will not trigger the alarm if there is movement in the passenger compartment.

GLA-421

Diagnostic Trouble Code (DTC) Information

Condition



If the control module registers that communication with the glass breakage sensor 5 own control module is faulty when: The alarm system is powered up or the alarm is activated/deactivated, then diagnostic trouble code (DTC) GLA-421 is stored after approximately **2 seconds**. The fault must be present when the alarm has been activated seven times before the diagnostic trouble code (DTC) will be stored.

Condition

- None.

Possible source

- Short-circuit to ground or voltage in the communication cable.
- Open-circuit in communication cable.
- The communication cable is too close to a source of interference.
- Defective glass breakage sensor.

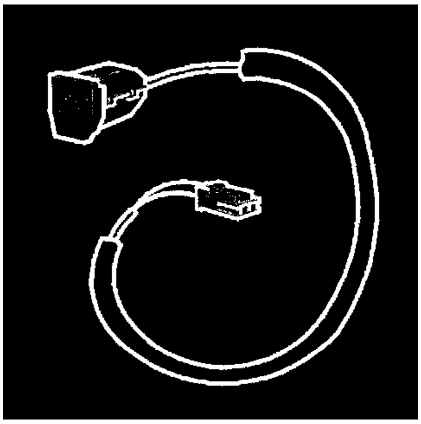
Condition

- The indicator LED in the sun sensor flashes for **15 seconds** when the ignition is switched on.
- The system will not trigger the alarm if there is a glass breakage in the passenger compartment.

GLA-422

Diagnostic Trouble Code (DTC) Information

Condition



If the control module registers that there is a fault in the glass breakage sensor microphone or if the communication between the microphone and the internal control module is judged as faulty when: The alarm system is powered up or the alarm is activated/deactivated, then diagnostic trouble code (DTC) GLA-422 is stored after approximately **2 seconds**. The fault must be present when the alarm has been activated seven times before the diagnostic trouble code (DTC) will be stored.

Condition

- None.

Possible source

- Fault in the communication between the microphone and the glass breakage sensor control module.

Condition

- The indicator LED in the sun sensor flashes for **15 seconds** when the ignition is switched on.
- The system will not trigger the alarm if there is a glass breakage in the passenger compartment.

GLA-432

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-432 is stored if the control module registers that the signal from the tilt sensor is faulty when the alarm is activated.

Condition

- No substitute value.

Possible source

- Open-circuit, short-circuit to ground or short-circuit to supply voltage in the signal cable.

Condition

- Does not alarm the sensor.
- False alarm.
- The Indicator LED flashes when the ignition is switched on.

GLA-455

Diagnostic Trouble Code (DTC) Information

Condition

If the car is equipped with an alarm, the alarm must be deactivated using the remote control or, in certain markets, via the lock cylinder in the driver's door. If the alarm is deployed, when the remote control is not activated, it should be possible to deactivate it by inserting an approved ignition key into the ignition switch and switching on the ignition. The engine can then be started. Diagnostic trouble code (DTC) GLA-455 is stored if the Immo-VGLA code is faulty.

Condition

- No substitute value.

Possible source

- A used immobilizer system has been installed.
- A used VGLA control module has been installed.
- A non-approved or defective key.

Condition

- The starter motor does not turn.
- Alarm indicator LED lit.

GLA-456

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-456 is stored if the control module registers that the signal from the SRS control module is low for more than **6 seconds** on ignition.

- No substitute value.

Possible source

- Short-circuit to ground in the cable from the SRS control module.

Condition

- None.

GLA-511

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-511 is stored if the control module registers that the signal for locking from the driver's door switch is less than **1.5 V for 10 seconds** when the ignition is on.

Condition

- None.

Possible source

- The control switch in the driver's door lock unit sticks or has jammed in the locked position.
- Signal cable for locking from the driver's door lock unit short-circuited to ground.

NOTE: The diagnostic trouble code (DTC) is stored if the door key is turned to lock the driver's door and is held in this position for at least **10 seconds**. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- When the fault occurs all the doors are locked and the central locking is put out of function.

GLA-512

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-512 is stored if the control module registers that the signal for unlocking from the driver's door switch is less than **1.5 V for 10 seconds** when the ignition is on.

Condition

- None.

Possible source

- The control switch in the driver's door lock unit sticks or has jammed in the locked position.
- Signal cable for unlocking from the driver's door lock unit is short-circuited to ground.

NOTE: The diagnostic trouble code (DTC) is stored if the door key is turned to unlock the driver's door and is held in this position for at least **10 seconds**. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- When the faults occurs the doors are unlocked and the central locking is put out of function.

GLA-521

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-521 is stored if the control module registers that the signal from the central locking switch is less than **15 V for 10 seconds** when the ignition is on.

Condition

- None.

Condition

- Cannot be controlled using the central locking switch.

GLA-526

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-526 is stored if the control module registers that the signal for unlocking from the central locking switch is less than **1.5 V for 10 seconds** when the ignition is on.

Condition

- None.

Condition

- Cannot be controlled using the central locking switch.

GLA-531

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-531 is stored if the control module registers that the signal from the interior lighting is higher than **15 V for 10 seconds** when a door is opened or the car is unlocked using the remote control or the key.

Condition

- None.

Possible source

- Short-circuit to supply voltage in the signal cable.
- Open-circuit in the signal cable.
- Contact resistance in the terminals.
- Internal fault in control module output stage.

Condition

- Interior lighting does not light.

GLA-541

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-541 is stored if the control module registers that the signal from ignition switch terminal S is less than **1.5 V for 3 seconds** when the ignition is switched on.

Condition

- None.

Possible source

- Short-circuit to ground in the signal cable.
- Open-circuit in the signal cable.
- Fault in the ignition switch.

Condition

- The doors can be locked even though the key is still in the ignition switch.

GLA-551

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-551 is stored if the control module registers that the unlocking signal from the childlock switch is less than **1.5 V for 10 seconds** when the ignition is on.

Condition

- None.

Possible source

- The childlock switch in the dashboard is sticking or has jammed in the unlocked position.
- Short-circuit to ground in the signal cable from the childlock switch in the dashboard.

NOTE: The diagnostic trouble code (DTC) is stored if the childlock switch is held depressed in the unlocking position for at least **10 seconds**. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- When the faults occurs the doors are locked or unlocked and the central locking is put out of function.

GLA-552

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) GLA-552 is stored if the control module registers that the unlocking signal from the childlock switch is less than **1.5 V for 10 seconds** when the ignition is on.

Condition

- None.

Possible source

- The childlock switch in the dashboard is sticking or has jammed in the unlocked position.
- Short-circuit to ground in the signal cable from the childlock switch in the dashboard.

NOTE: The diagnostic trouble code (DTC) is stored if the childlock switch is held depressed in the unlocking position for at least **10 seconds**. Fault causes of this type are not included in the fault-tracing procedure.

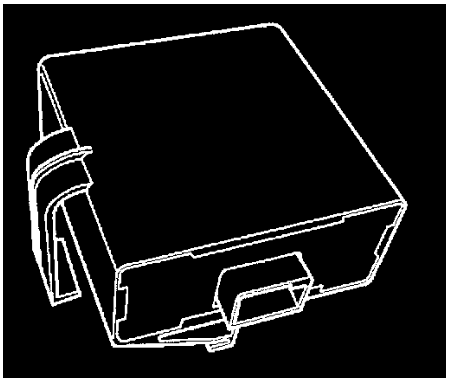
Condition

- When the faults occurs the doors are locked or unlocked and the central locking is put out of function.

KEY Codes

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) KEY-311 is stored after approximately **2 seconds** if the control module registers an error in communication with the siren control module when the alarm system is powered up or when the alarm is activated or deactivated.

Condition

- None.

Possible source

- Short-circuit to ground or voltage in communication cable.
- Open-circuit in communication cable.
- Interference affecting the communication cable.
- Defective siren.

Condition

- The indicator LED flashes for **15 seconds** when the ignition is switched on.
- The siren will not then work when the panic button is pressed on the remote control.
- No siren sound when the alarm is activated.

CEM Trouble Code List

Volvo On-Board Diagnostic (OBD) System Diagnostic Trouble Code (DTC)

Volvo DTC Code	Description
CEM 0001	Control module. Internal fault.
CEM 0002	High beam flash. Signal too low.
CEM 0003	Lighting switch. Signal too low.
CEM 0009	15/2-Power supply. Signal too low.
CEM 000A	75-Power supply. Signal too low.
CEM 000B	Switch, front fog lamps. Signal too high.
CEM 000C	Switch, rear fog lamps. Signal too high.
CEM 000D	Rheostat, input. Signal too high.
CEM 000E	Speed signal. Faulty signal.
CEM 000F	High beam. Signal too high.
CEM 0010	High beam. Signal too low.
CEM 001E	Rheostat, output. Signal too low.
CEM 0021	Control module, internal fault. Signal too high.
CEM 0022	Windshield wiper, parking position switch. Signal too high.
CEM 0023	Windshield wiper, parking position switch. Signal too low.
CEM 0024	Control module, internal fault. Signal too low.
CEM 0025	Bulb failure warning sensor. Signal too high.
CEM 0026	Bulb failure warning sensor. Signal too low.
CEM 0027	Battery voltage. Signal too low.

CEM 0001 - CEM 0027

CEM-0001

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0001 is stored if the control module registers an internal fault.

Condition
The control module selects pre-selected settings for automatic low beam, the tailgate wiper and the front fog lamps.

Possible source
- Internal fault in the central electronic module (CEM).

Condition
- The low beam is constantly lit.
- The rear windshield wiper motor does not operate.
- The front fog lamps do not work.

CEM-0002

Diagnostic Trouble Code (DTC) Information

Condition
Diagnostic trouble code (DTC) CEM-0002 is stored if the control module registers that the signal from the high beam flash in the turn signal lamp switch is low for more than **180 seconds.**

Condition
None

Possible source
- Short-circuit to ground in the signal cable from the turn signal lamp switch
- Defective turn signal lamp switch
- The high beam flash has been active for **180 seconds**

Condition
- The high beam flash does not work
- The timer for the follow-me home lights does not function

CEM-0003

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0003 is stored if the control module registers that both the signals from the lighting switch are low at the same time.

Condition
None.

Possible source
- Short-circuit to ground in one of the signal cables from the lighting switch
- Defective lighting switch

Condition
- The low beam is constantly lit.

CEM-0009

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0009 is stored if the control module registers that the 15/2-signal from the ignition switch is missing or low when the ignition switch is in position II.

Condition
None

Possible source
- Defective fuse.
- Open-circuit in the signal cable from the ignition switch.
- Short-circuit to ground in the signal cable from the ignition switch.
- Contact resistance and oxidation.

Condition

- The instrument lighting does not operate.
- The back-up (reversing) lamp is not working.

CEM-000A

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) CEM-000A is stored if the control module registers that the 75-signal from the ignition switch is missing or low when the ignition switch is in position II.

Condition

None

Possible source

- Defective fuse.
- Open-circuit in the signal cable from the ignition switch.
- Short-circuit to ground in the signal cable from the ignition switch.
- Contact resistance and oxidation.

Condition

- The wiper intermittent function/return does not function
- The rear windshield wiper motor does not operate

CEM-000B

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) CEM-000B is stored if the control module registers that the signal from the switch for the front fog lamps is high for more than **180 seconds**

Condition

None

Possible source

- Short-circuit to supply voltage in the signal cable from the switch for the front fog lamps
- Defective switch for the front fog lamp
- The switch for the front fog lamp has been active for **180 seconds**

Condition

- The front fog lamps are constantly lit

CEM-000C

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) CEM-000C is stored if the control module registers that the signal from the switch for the rear fog lamps is high for more than **180 seconds.**

Condition

None

Possible source

- Short-circuit to supply voltage in the signal cable from the switch for the rear fog lamps
- Defective switch for the rear fog lamp
- The switch for the rear fog lamp has been active for **180 seconds**

Condition

- The rear fog lamp is constantly lit

CEM-000D

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-000D is stored if the control module registers that the signal from the rheostat is missing or lower than **5 V.**

Condition
The resistance of the rheostat is set to **24 k [ohm].**

Possible source
- Open-circuit in the signal cable from the rheostat
- Short-circuit to battery voltage in the signal cable from the rheostat
- Defective rheostat

Condition
- The instrument lighting is constantly lit at full strength

CEM-000E

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-000E is stored if the control module registers that the speed signal which governs the interval time for the wipers for the windshield and rear windshield corresponds to a speed in excess of **254 km/h.**

Condition
None

Possible source
- The signal cable is too close to a source of interference

Condition
- None

CEM-000F

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-000F is stored if the control module registers that the signal for the high beam bulbs is high when the high beam is switched off.

Condition
None

Possible source
- Short-circuit to battery voltage in one of the cables to the high beam
- There is a short-circuit to supply voltage in the control cable to the relay for the auxiliary lamps.

Condition
- The high beam is constantly lit.

CEM-0010

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0010 is stored if the control module registers that the signal for the high beam bulbs is low when the high beam is switched on.

Condition
None

Possible source
- Defective fuse
- Open-circuit in the power supply from the fuse
- Contact resistance and oxidation
- Short-circuit to ground in the power supply from the fuse
- Short-circuit to ground in one of the cables to the high beam

Condition

- The high beam is not working

CEM-001E

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-001E is stored if the control module registers that the signal to the lamps affected by the rheostat is low.

Condition
None

Possible source
- Short-circuit to ground in one cables to the lamps affected by the rheostat

Condition
- The instrument lighting does not operate

CEM-0021

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0021 is stored if the control module registers an internal fault

Condition
None

Possible source
- Internal fault in the central electronic module (CEM) (defective intermittent wiper relay)

Condition
- The windshield wiper motor runs constantly

CEM-0022

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0022 is stored if the control module registers that the signal from the switch for the wiper motor parking position is high when the windshield wipers are switched off

Condition
None.

Possible source
- Defective parking position switch in the wiper motor
- Sticking wiper motor / wiper arms
- Frozen wiper blade

Condition
- The windshield wiper motor runs constantly

CEM-0023

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0023 is stored if the control module registers that the signal from the switch for the wiper motor parking position is missing or low when the windshield wipers are activated.

Condition
None.

Possible source
- Open-circuit in the signal cable from the wiper motor parking position switch
- Contact resistance and oxidation
- Defective parking position switch in the wiper motor

- Sticking wiper motor / wiper arms
- Frozen wiper blade

Condition
- The windshield wiper motor does not return to its original position

CEM-0024

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0024 is stored if the control module registers an internal fault

Condition
None

Possible source
- Internal fault in the central electronic module (CEM) (defective intermittent wiper relay)

Condition
- The wiper intermittent function/return does not function

CEM-0025

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0025 is stored if the control module registers that the signal to the bulb failure warning sensor is high when the bulb failure warning sensor is activated.

Condition
Substitute value

Possible source
- Short-circuit to battery voltage in the cable to the bulb failure warning sensor

Condition
- The bulb failure warning sensor does not light

CEM-0026

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0026 is stored if the control module registers that the signal to the bulb failure warning sensor is missing or low when the bulb failure warning sensor is not activated.

Substitute Value
None

Possible source
- Defective bulb in the bulb failure warning sensor
- Open-circuit in the cable to the bulb failure warning sensor
- Contact resistance and oxidation
- Short-circuit to ground in the cable to the bulb failure warning sensor

Fault Symptoms
- The bulb failure warning sensor is constantly lit
- The bulb failure warning sensor does not light

CEM-0027

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CEM-0027 is stored if the control module registers that the 15/2-power supply from the ignition switch is below **10.5 V** when the ignition switch is in position II.

Condition
None

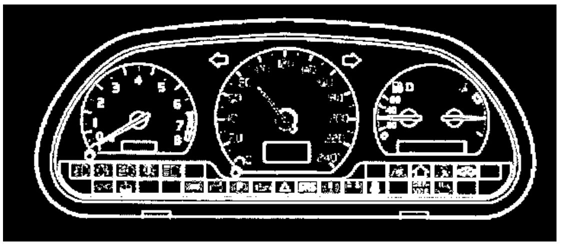
Possible source
- Low battery voltage
- Contact resistance or oxidation

Condition
- None

CI-01

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-01 is stored in the combined instrument panel if the combined instrument panel registers an internal fault.

Condition
None.

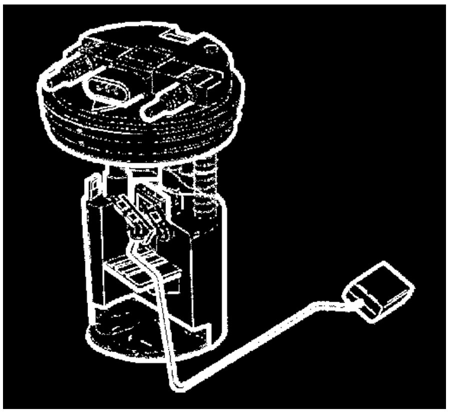
Possible source
- defective combined instrument panel.

Condition
- combined instrument panel is not operating.

CI-02

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-02 is stored in the combined instrument panel if the combined instrument panel registers a fault in the signal cable from the fuel level sensor.

Condition
None.

Possible source
- short-circuit to supply voltage in the signal cable
- open-circuit in the signal cable or in the ground lead
- contact resistance in terminals
- defective fuel level sensor.

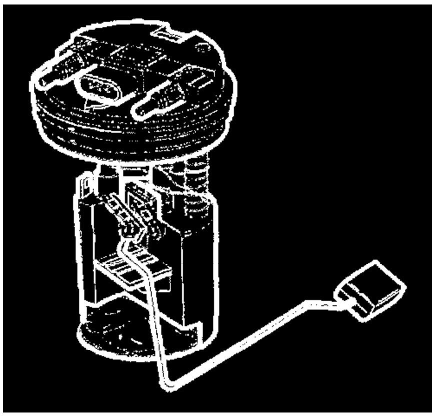
Condition

- the fuel gauge does not work
- the trip computer displays an empty fuel tank too early.

CI-03

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-03 is stored in the combined instrument panel if the combined instrument panel registers a fault in the signal cable from the fuel level sensor.

Condition

None.

Possible source

- short-circuit to ground in the signal cable
- defective fuel level sensor.

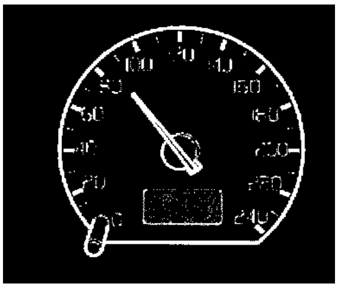
Condition

- fuel level reading faulty.

CI-05

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-05 is stored in the combined instrument panel if the speedometer registers a faulty signal from the ABS control module.

Condition

None.

Possible source

- defective ABS control module
- defective combined instrument panel.

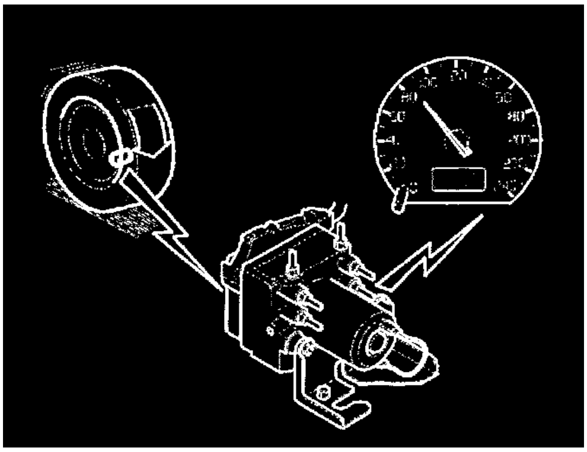
Condition

- the speedometer displays the wrong value.

CI-06

Diagnostic trouble code (DTC) information

Condition



If the engine speed exceeds **1500 rpm** for at least **60 seconds** at the same time as the speed signal from the ABS control module is lower than **2 km/h** it is registered as a faulty signal. Diagnostic trouble code (DTC) CI-06 is stored in the combined instrument panel.

Condition
None.

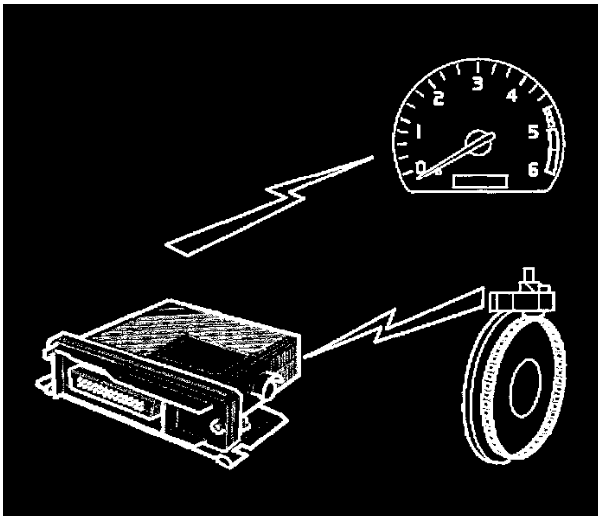
Possible source
- short-circuit to ground in the signal cable
- short-circuit to supply voltage in the signal cable
- open-circuit in the signal cable
- defective ABS control module
- defective combined instrument panel.

Condition
- the speedometer does not function.

CI-07

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-07 is stored in the combined instrument panel if the tachometer receives a signal corresponding to more than **8000 rpm** for over **1 second**.

Condition
None.

Possible source
- defective engine control module (ECM)
- defective combined instrument panel

NOTE: In cars with the Melco 2 engine management system, the engine speed (RPM) signal comes directly from the ignition sensor in the engine management system.

defective ignition sensor. Diagnostic trouble codes (DTCs) are stored in the engine management system if there is a fault in the ignition sensor. These diagnostic trouble codes (DTCs) must be fault-traced first.

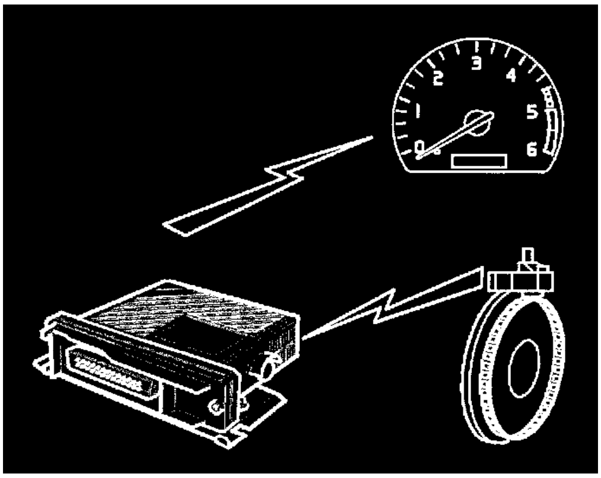
Condition

- the tachometer does not function.

CI-08

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-08 is stored in the combined instrument panel if the fuel consumption signal increases in the combined instrument panel at the same time as the engine speed (RPM) signal from the engine control module (ECM) is lower than **150 rpm.**

Condition
None.

Possible source

- short-circuit to ground in the signal cable
- short-circuit to supply voltage in the signal cable
- open-circuit in the signal cable
- defective engine control module (ECM) (does not apply to Melco2)
- defective combined instrument panel

NOTE: In cars with the Melco 2 engine management system, the engine speed (RPM) signal comes directly from the ignition sensor in the engine management system.

defective ignition sensor

- open-circuit, short-circuit to ground or short-circuit to supply voltage in the signal cable for the engine control module (ECM) or ignition sensor. Diagnostic trouble codes (DTCs) are stored in the engine control module (ECM) if there is a fault in the ignition sensor. These diagnostic trouble codes (DTCs) must be fault-traced first.

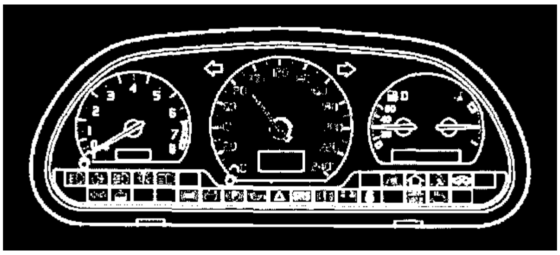
Condition

- tachometer not working.

CI-09

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-08 is stored in the combined instrument panel if the fuel consumption calculator is not updated in the combined instrument panel, at the same time as the engine speed (RPM) is higher than **500 rpm** and the vehicle speed is **0 km/h** for more than **10 seconds**.

This diagnostic trouble code (DTC) cannot be stored in Bi-fuel cars.

Condition
None.

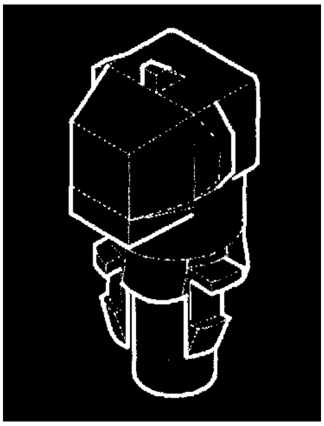
Possible source
short-circuit to ground in the signal cable
- short-circuit to supply voltage in the signal cable
- open-circuit in the signal cable or in the ground lead
- defective engine control module (ECM)
- defective combined instrument panel.

Condition
- FUEL INST displays incorrect value
- FUEL AVGT displays incorrect value.

CI-0A

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-0A is stored if the resistance in the outside temperature sensor wiring circuit exceeds **100 kohm** for more than **80 ms.**

Condition
None.

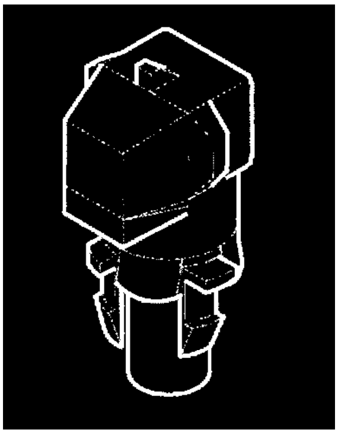
Possible source
- short-circuit to supply voltage in the signal cable
- open-circuit in the signal cable or in the ground lead
- defective outside temperature sensor.

Condition
- too low engine coolant temperature (ECT) displayed.

CI-0B

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-0B is stored in the combined instrument panel if the resistance in the outside temperature sensor wiring circuit exceeds 107 ohm for more than **80 ms**.

Condition
None.

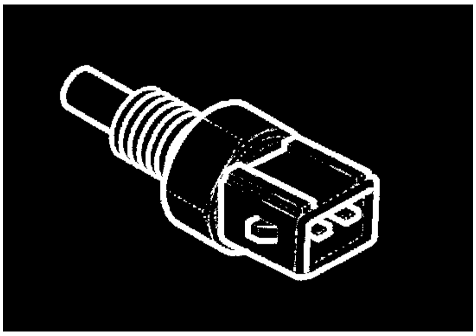
Possible source
- short-circuit to ground in the signal cable
- defective outside temperature sensor.

Condition
- too high engine coolant temperature (ECT) displayed.

CI-10

Diagnostic trouble code (DTC) information

Condition



The engine coolant temperature (ECT) signal from the engine control module (ECM) is a pulsed signal between **0 V** and **5 V** with a variable frequency and fixed pulse ratio (% duty). The frequency (f) increases with decreasing temperature.

Diagnostic trouble code (DTC) CI- 10 is stored in the combined instrument panel if the engine coolant temperature (ECT) signal from the engine control module (ECM) has had a time constant that is less than **2 ms** for more than **2 seconds.**

Condition
None.

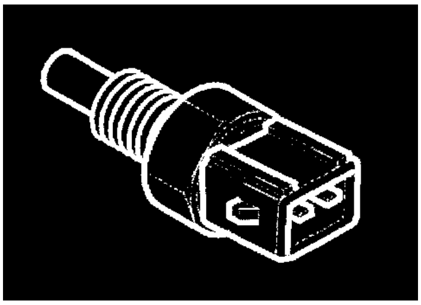
Possible source
- defective combined instrument panel
- defective engine control module (ECM).

Condition
- the engine coolant temperature (ECT) gauge does not function (does not apply to Bi-fuel cars)
- the high engine coolant temperature (ECT) warning lamp flashes. The lamp flashes for **10 seconds** if a fault is detected (Bi-fuel cars only).

CI-11

Diagnostic trouble code (DTC) information

Condition



The engine coolant temperature (ECT) signal from the engine control module (ECM) is a pulsed signal between **0 V** and **5 V** with a variable frequency and fixed pulse ratio (% duty). The frequency (f) increases with decreasing temperature.

Diagnostic trouble code (DTC) CI-11 is stored in the combined instrument panel if the engine coolant temperature (ECT) signal from the engine control module (ECM) has had a time constant that is greater than **65 ms** for more than **2 seconds.**

Condition
None.

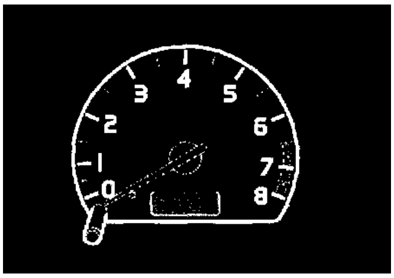
Possible source
- short-circuit to ground in the signal cable
- short-circuit to supply voltage in the signal cable
- open-circuit in the signal cable
- defective combined instrument panel
- defective engine control module (ECM).

Condition
- the engine coolant temperature (ECT) gauge does not function (does not apply to Bi-fuel cars)
- the high engine coolant temperature (ECT) warning lamp flashes. The lamp flashes for **10 seconds** if a fault is detected (Bi-fuel cars only).

CI-14

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-14 is stored in the combined instrument panel if the combined instrument panel receives a signal from the clock adjustment knob that indicates that it has been affected for over **10 minutes.**

Condition
None.

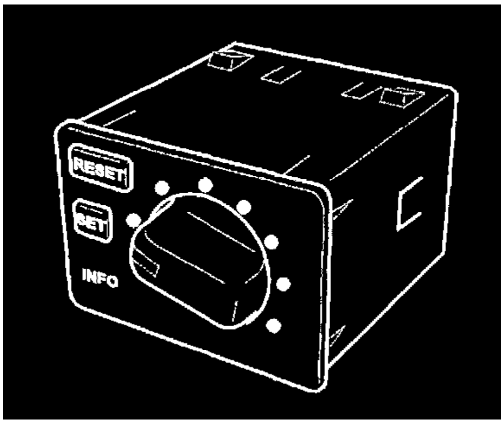
Possible source
- short-circuit to supply voltage in the signal cable
- the clock adjustment knob has been turned for more than **10 minutes**
- defective combined instrument panel.

Condition
- digital clock fault indication.

CI-16

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-16 is stored in the combined instrument panel control module if the signal to the trip computer reset function (RESET) is low for longer than **25 seconds.**

Condition
None.

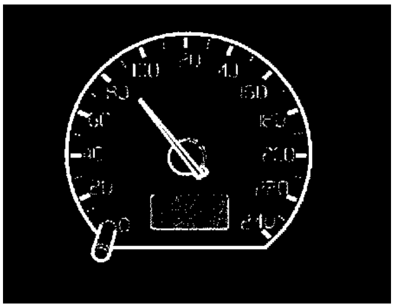
Possible source
- short-circuit to ground in the signal cable
- trip computer reset button (RESET) pressed in for more than **25 seconds**
- trip computer reset button (RESET) is mechanically/electrically defective.

Condition
- the trip computer displays faulty values.

CI-17

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-17 is stored in the combined instrument panel control module if the signal to the trip odometer reset function is low for longer than **25 seconds.**

Condition
None.

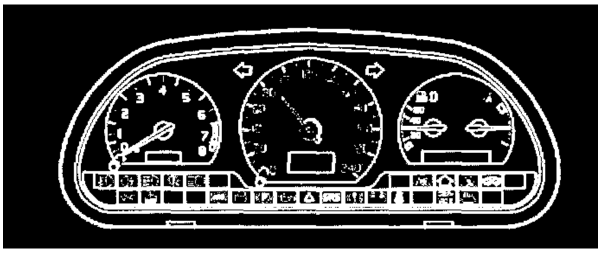
Possible source
- short-circuit to ground in the signal cable
- the trip odometer reset button is pressed in for more than **25 seconds**
- the trip odometer reset button is mechanically/electrically defective.

Condition
- the trip odometer display shows no value.

CI-18

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-18 is stored in the combined instrument panel control module if the wiring for the speed signal (1/9) are high at the same time as the speed exceeds **5 km/h** for at least **10 seconds.**

Condition
None.

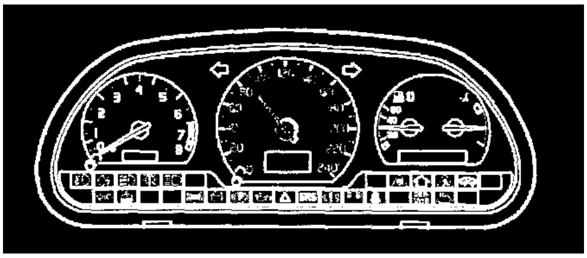
Possible source
- Vehicle speed signal (1/9) wiring is short-circuited to supply voltage
- internal fault in the combined instrument panel.

Condition
- the speedometer does not operate
- the cruise control does not function at all.

CI-19

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-19 is stored in the combined instrument panel control module if the wiring for the speed signal (1/9) are low at the same time as the speed exceeds **5 km/h** for at least **10 seconds.**

Condition
None.

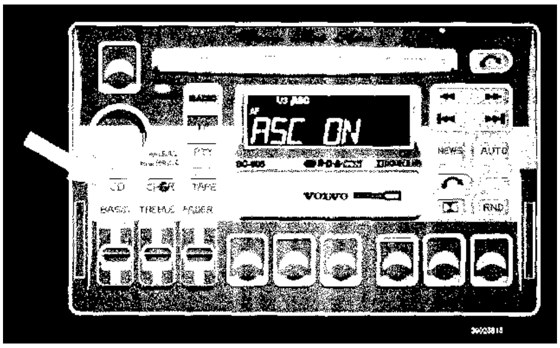
Possible source
- Vehicle speed signal (1/9) wiring is short-circuited to ground
- Control module, cruise control defective
- Defective Climate Control Module
- defective engine control module (ECM)
- internal fault in the combined instrument panel.

Condition
- the speedometer does not operate.

CI-1A

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-1A is stored in the combined instrument panel control module if the cable for the speed signal (1/4) is high at the same time as the speed exceeds **5 km/h** for at least **10 seconds.**

Condition
None.

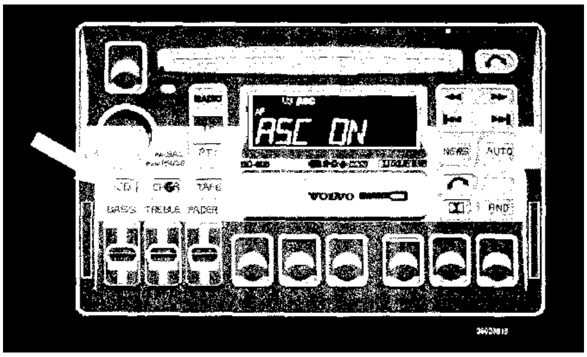
Possible source
- Vehicle speed signal (1/4) cable is short-circuited to supply voltage.

Condition
- Speed related radio volume control does not function.

CI-1B

Diagnostic trouble code (DTC) information

Condition



Diagnostic trouble code (DTC) CI-1B is stored in the combined instrument panel control module if the cable for the speed signal (1/4) is low at the same time as the speed exceeds **5 km/h** for at least **10 seconds.**

Condition
None.

Possible source
- Vehicle speed signal (1/4) cable is short-circuited to ground
- Control module, radio defective

Condition
- Speed related radio volume control does not function.

CI-1C

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) CI-1C is stored in the combined instrument panel control module if there is data missing.

Condition
None.

Possible source
- no data to configure the combined instrument panel
- no data to initialize the service reminder indicator (SRI)

- PIN code missing.

Condition

- currently unknown.

CI-1D

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) CI-1D is stored in the combined instrument panel control module if the signal to the trip computer setting function (SET) is low for longer than **25 seconds.**

Condition

None.

Possible source

- short-circuit to ground in the signal cable
- the trip computer setting button is depressed for longer than **25 seconds**
- the trip computer setting button is mechanically/electrically defective.

Condition

- the trip computer displays faulty values.

Dynamic Stability Assistance (DSA)

Volvo On-Board Diagnostic (OBD) System Diagnostic Trouble Code (DTC)

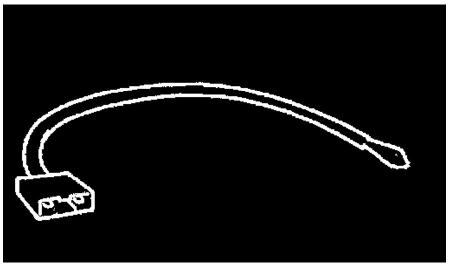
Volvo DTC Codes	Description
DSA-112	Control Module. EEPROM memory fault
DSA-121	DSA switch.
DSA-122	DSA warning lamp.
DSA-131	Torque reduction signal.
DSA-211	Stop (brake) lamp switch.
DSA-212	Stop (brake) lamp switch.
DSA-221	Load signal.
DSA-222	Load signal.
DSA-223	Engine control module (ECM) initialization.
DSA-224	Engine control module (ECM). Diagnostic trouble code (DTC) stored in the engine control module (ECM)
DSA-231	Throttle position (TP) sensor signal.
DSA-232	Throttle position (TP) sensor signal.
DSA-233	Engine control module (ECM). Diagnostic trouble code (DTC) stored in the engine control module (ECM)
DSA-311	Wheel speed signal, left front wheel.
DSA-312	Wheel speed signal, right front wheel.
DSA-313	Wheel speed signal, left rear wheel.
DSA-314	Wheel speed signal, right rear wheel.

DSA-112 - DSA-314

ECC-121

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-121 is stored if the ECC Control module detects that the outside temperature sensor signal is missing or that there is a short-circuit to ground in the signal cable.

Possible source

- Open-circuit in outside temperature sensor or signal cable.
- Short-circuit to ground in the signal cable.

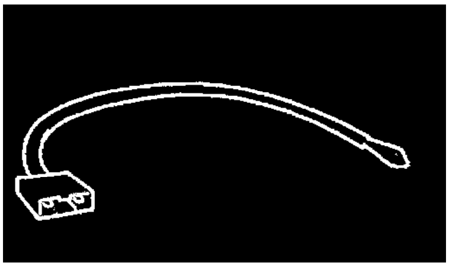
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-121, 135, 137, 211, 221

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble codes (DTCs) ECC-121, 135, 137, 211 and 221 are stored if the ECC control module registers that the signal cable to the outside temperature sensor is short-circuited to ground.

Possible source

- Short-circuit to ground in signal cable.

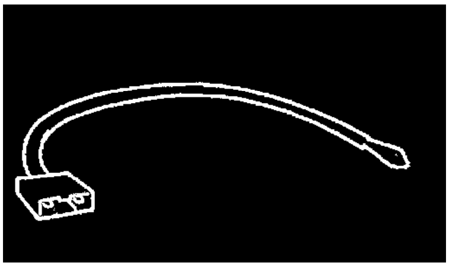
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-122

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-122 is stored if the ECC Control module detects a short-circuit to supply voltage in the outside temperature sensor signal cable.

Possible source

- Short-circuit in the outside temperature sensor.
- Short-circuit to reference voltage in the signal cable from the outside temperature sensor to ECC control module.

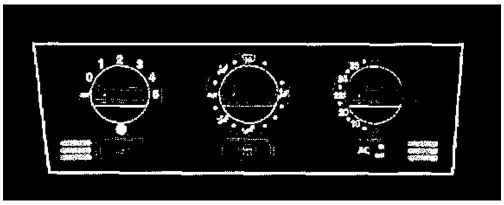
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-123

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-123 is stored if the ECC Control module detects that there is no passenger compartment temperature sensor (in the ECC control module) or that there is a short-circuit to ground in the signal cable.

Possible source

- Open-circuit in the passenger compartment temperature sensor.
- Short-circuit to ground in the passenger compartment temperature sensor.

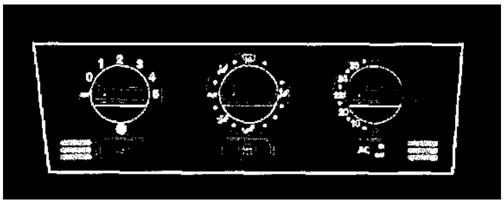
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-124

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-124 is stored if the ECC control module detects a short-circuit to supply voltage in the passenger compartment temperature sensor (in the ECC control module) signal cable.

Possible source

- Short-circuit to supply voltage in the passenger compartment temperature sensor.

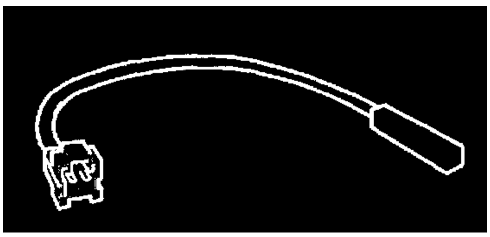
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-135

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-135 is stored if the ECC control module detects that the engine coolant temperature sensor signal is missing or that there is a short-circuit to ground in the signal cable.

Possible source

- Open-circuit in engine coolant temperature sensor or signal cable.
- Short-circuit to ground in the signal cable.

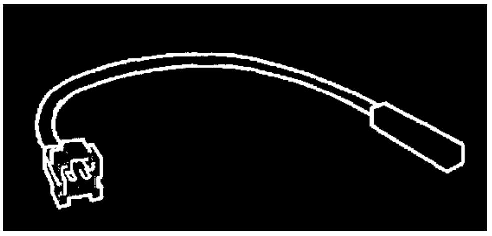
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-136

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-136 is stored if the ECC control module detects a short-circuit to supply voltage in the engine coolant temperature (ECT) sensor signal cable.

Possible source

- Short-circuit in engine coolant temperature sensor.
- Short-circuit to reference voltage in the signal cable from the engine coolant temperature sensor to ECC control module.

Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-137

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECC-137 is stored if the ECC control module detects that the evaporator sensor signal is missing or that there is a short-circuit to ground in the signal cable.

Possible source

- Open-circuit in evaporator sensor or in signal cable.
- Short-circuit to ground in the signal cable.

Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-138

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECC-138 is stored if the ECC control module detects a short-circuit to supply voltage in the evaporator sensor signal cable.

Possible source

- Short-circuit in evaporator sensor.
- Short-circuit to reference voltage in the signal cable from the evaporator sensor to ECC control module.

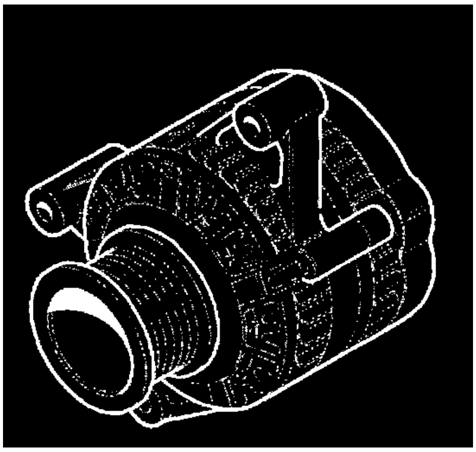
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-139

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-139 is stored if the ECC control module detects that the voltage from generator (GEN) D+ is missing.

This diagnostic trouble code (DTC) is only stored if road speed is above **50 km/h**.

Possible source

- Open-circuit in cable between generator (GEN) D+ and ECC control module.

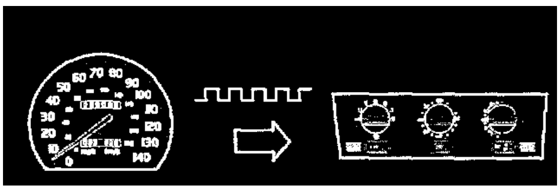
Condition

- Compressor does not start.
- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The charging lamp in the combined instrument panel does not go out when the engine is running.

ECC-140

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-140 is stored if the ECC control module detects that the vehicle speed signal from the combined instrument panel corresponds to a **speed above 250 km/h** for a certain period.

Possible source

- Defective engine speed (RPM) sensor.
- Defective speedometer/combined instrument panel.

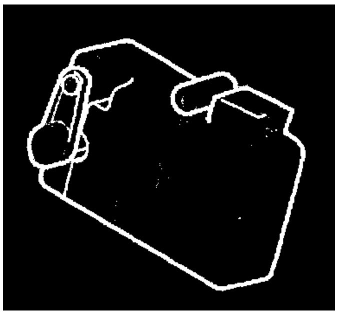
Condition

- Maximum speedometer reading.

ECC-211

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-211 is stored if the ECC control module detects a short-circuit to ground in the temperature damper motor position sensor signal cable.

Possible source

- Short-circuit to ground in the signal cable.

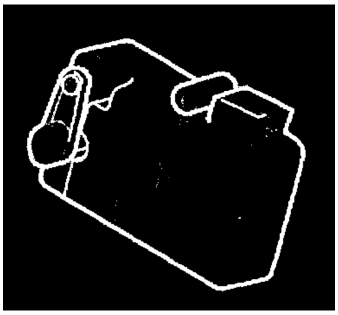
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-212

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-212 is stored if the ECC control module detects a short-circuit to supply voltage in the temperature damper motor position sensor signal cable or that the signal is missing.

Possible source

- Open-circuit in signal cable from the damper motor potentiometer to the ECC control module.
- Open-circuit in the potentiometer.
- Short-circuit to supply voltage in the signal cable.

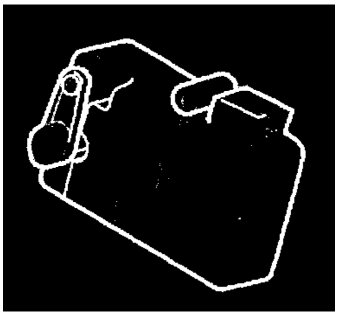
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-221

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-221 is stored if the ECC control module detects a short-circuit to ground in the air distribution damper motor position sensor signal cable.

Possible source

- Short-circuit to ground in the signal cable.

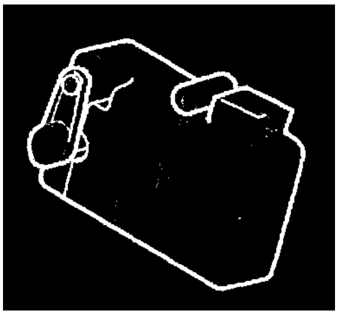
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-222

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-222 is stored if the ECC control module detects a short-circuit to supply voltage in the air distribution damper motor position sensor signal cable or that the signal is missing.

Possible source

- Open-circuit in signal cable from the damper motor potentiometer to the ECC control module.
- Damper motor potentiometer is short-circuited.
- Short-circuit to supply voltage in the signal cable.

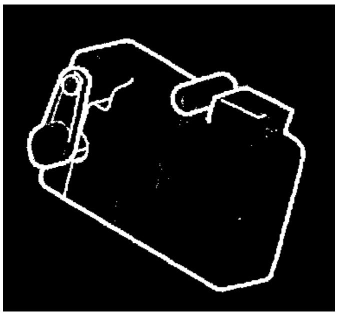
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-311

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-311 is stored if the ECC control module detects that the power supply from the ECC control module to the temperature damper motor is not approximately **10 V**.

Possible source

- Short-circuit to supply voltage or ground in power supply to temperature damper motor.

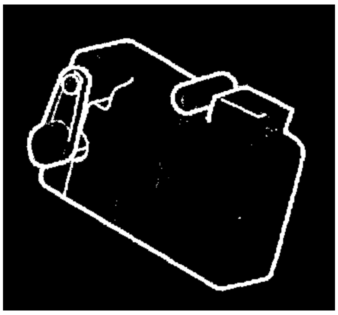
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- Control module keeps the damper motor shut down for as long as the fault persists.

ECC-312

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-312 is stored if the ECC control module detects that the signal to the temperature damper motor does not assume a correct value within **12 seconds**.

Possible source

- Temperature damper motor blocked.

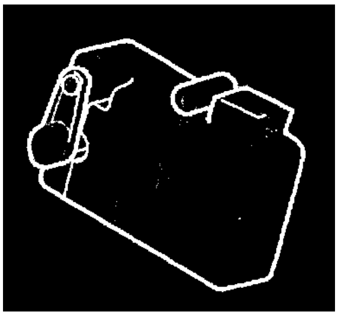
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The damper motor is stopped.

ECC-321

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-321 is stored if the ECC control module detects that the power supply from the ECC control module to the air distribution damper motor is not approximately **10 V**.

Possible source

- Short-circuit to supply voltage or ground in power supply to air distribution damper motor.

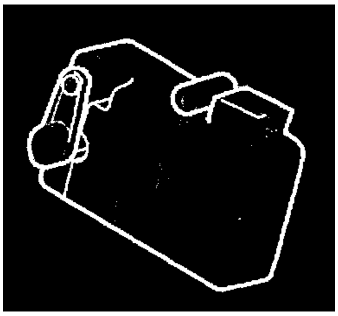
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- Control module keeps the damper motor shut down for as long as the fault persists.

ECC-322

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-322 is stored if the transmission control module (TCM) registers that the damper motor does not assume the correct position approximately **12 seconds**.

Possible source

- Air distribution damper motor blocked.

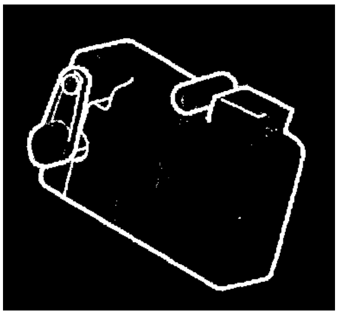
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The damper motor is stopped.

ECC-323

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-323 is stored if the ECC control module detects that the power Supply from the ECC control module to the recirculation damper motor is not approximately **10 V**.

Possible source

- Short-circuit to supply voltage or ground in power supply to recirculation damper motor.

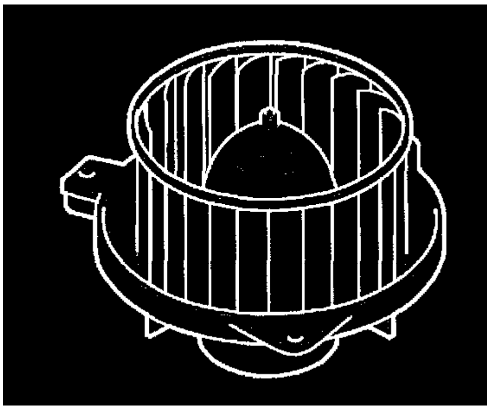
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- Control module keeps the damper motor shut down for as long as the fault persists.

ECC-411

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-411 is stored if the control signal is missing or is faulty.

Condition

- The ECC control module attempts to compensate with a pre-set substitute value via a control signal to the power unit. This substitute value is lower than the maximum value. If the blower fan switch is in position 0, no control signal is transmitted.

Possible source

- Fault in blower fan power unit.
- Open-circuit in the cable between the ECC control module and the blower fan power unit.
- Fault in blower fan motor.

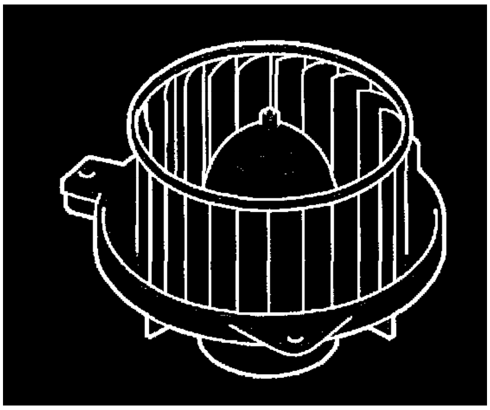
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The blower fan motor does not react when the blower fan switch is set to different manual positions (positions 1 to 4).

ECC-412

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-412 is stored if the ECC control module detects that the control signal is incorrect.

Condition

- The ECC control module attempts to compensate with a pre-set substitute value via a control signal to the power unit. This substitute value is lower than the maximum value. If the blower fan switch is in position 0, no control signal is transmitted.

Possible source

- Short-circuit to ground in the cable between the ECC control module connector terminal 28 and the blower fan power unit.
- Fault in the blower fan power unit.

Condition

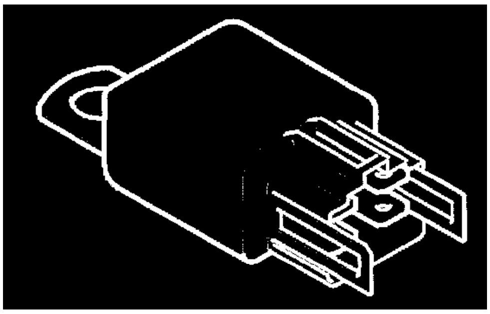
- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

- The blower fan motor does not react when the blower fan switch is set to different manual positions (positions 1 to 4).

ECC-421

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-421 is stored if the ECC control module registers that there is no voltage.

Possible source

- Fault in blower fan relay.
- Open-circuit in the cable between ECC control module terminal 29 and blower fan relay (beside blower fan motor).
- Fault in the blower fan motor.

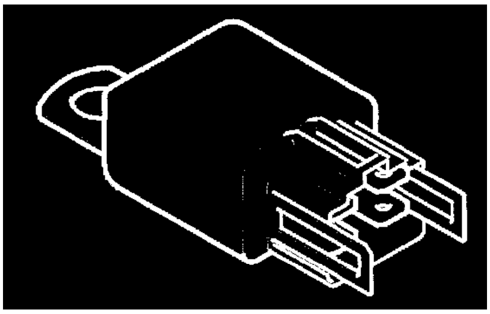
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The blower fan motor does not react when the blower fan switch is in position 5.

ECC-422

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-422 is stored if the ECC control module detects that the power supply is incorrect.

Possible source

- Short-circuit in the cable between ECC control module terminal 29 and blower fan relay (by the fan motor).

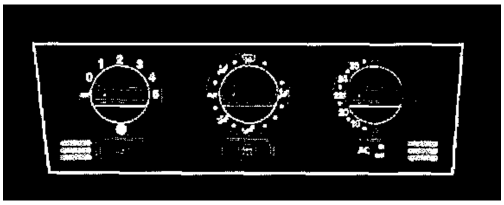
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The blower fan motor does not react when the blower fan switch is in position 5.

ECC-431

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-431 is stored if the ECC control module detects that there is no signal from the blower fan switch.

Condition

- The ECC control module ignores the faulty signal and compensates the shortfall with a substitute value.

Possible source

- Open-circuit in blower fan switch in ECC control module.
- Internal fault in ECC control module.

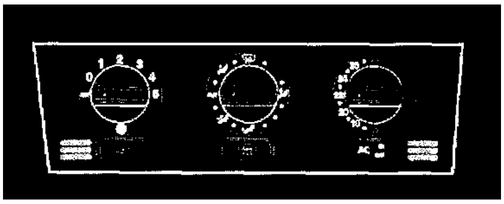
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-432

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-432 is stored if the ECC control module detects a short-circuit to ground in the signal cable from the blower fan switch.

Condition

- The ECC control module ignores the faulty signal and compensates the shortfall with a substitute value.

Possible source

- Short-circuit to ground in the blower fan switch in the ECC control module.
- Internal fault in the ECC control module.

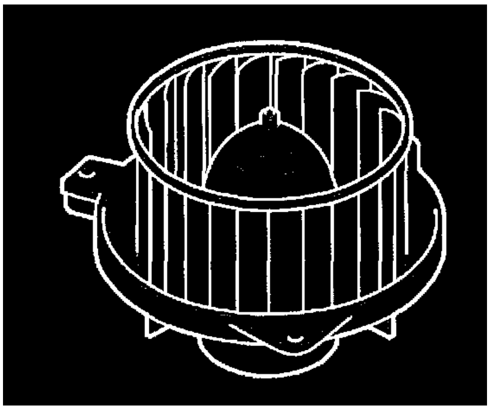
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

ECC-433

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-433 is stored if the ECC control module detects that the blower fan motor is consuming too much current.

Possible source

- Fault in the blower fan (defective blower fan motor or blocked blower fan rotor).

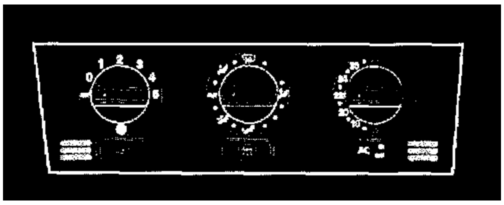
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.
- The control module keeps the blower fan shut down for as long as the fault persists.

ECC-440

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) ECC-440 is stored if the ECC control module detects that its internal signals are incorrect.

Possible source

- Fault in ECC control module.

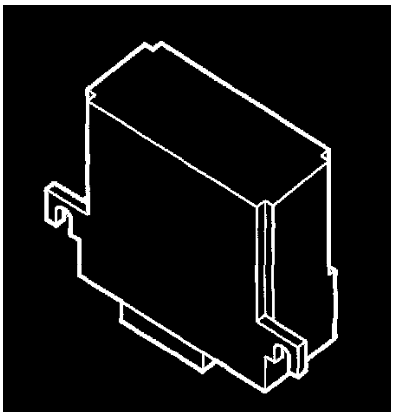
Condition

- Driver fault warning. The LEDs beside the A/C and REC switches flash for approximately **20 seconds**.

HEA-11X

Diagnostic Trouble Code (DTC) Information

Condition



This diagnostic trouble code is stored for certain internal control module faults.

Condition

- Heater not activated.

Possible source

- Defective control module.

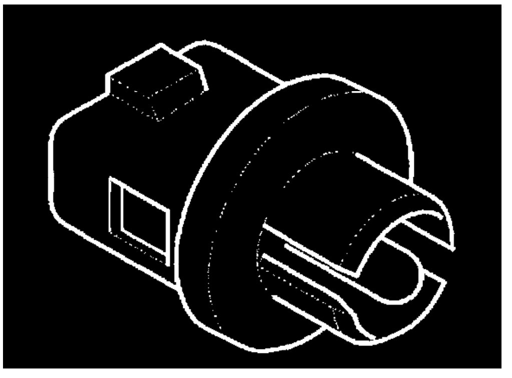
Condition

- Poor heating in passenger compartment.

HEA-142

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage or an open-circuit in the outside temperature sensor circuit.

Condition

- The heater is allowed to start regardless of outer temperature.

Possible source

- Contact resistance in control module connector.
- Open-circuit on signal ground cable.
- Open-circuit or short-circuit to supply voltage in signal cable.
- Defective outside temperature sensor.

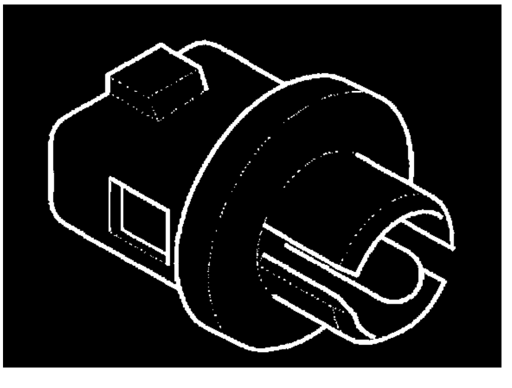
Condition

- Additional heater starts and runs at incorrect outside temperature.

HEA-143

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to ground in the outside temperature sensor circuit.

Condition

- The heater is activated regardless of outside temperature.

Possible source

- Short-circuit to ground in signal cable.
- Defective outside temperature sensor.

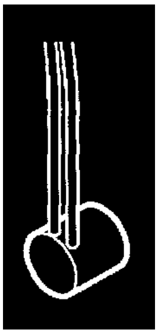
Condition

- Additional heater starts and runs at incorrect outside temperature.

HEA-801

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage or an open-circuit in the coolant temperature sensor circuit.

Condition

- Heater not activated.

Possible source

- Contact resistance in control module connector.
- Open-circuit on signal ground cable.
- Open-circuit or short-circuit to supply voltage in signal cable.
- Defective coolant temperature sensor.

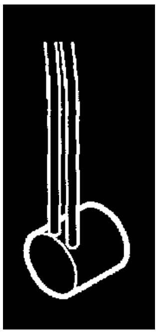
Condition

- Poor heating in passenger compartment.

HEA-802

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short- circuit to ground in the coolant temperature sensor circuit.

Condition

- Heater not activated.

Possible source

- Short-circuit to ground in signal cable
- Defective coolant temperature sensor.

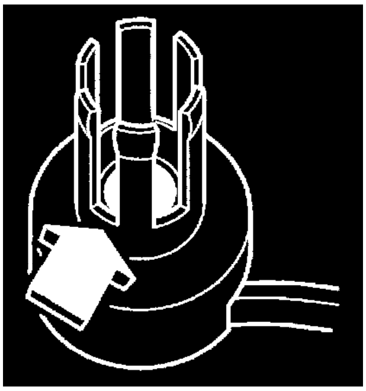
Condition

- Poor heating in passenger compartment.

HEA-811

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to ground in the flame sensor circuit.

Condition

- Heater not activated.

Possible source

- Short-circuit to ground in signal cable.
- Defective flame sensor.

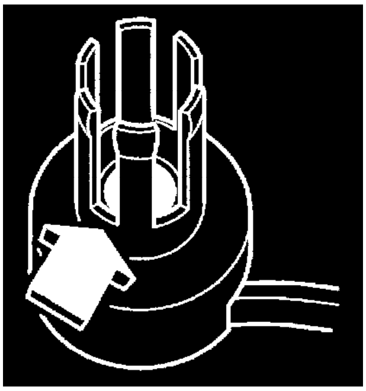
Condition

- Poor heating in passenger compartment.

HEA-813

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if the flame goes out due to a malfunction while the system is operating.

Condition

- Heater not activated.

Possible source

- No fuel supply.
- Contact resistance in control module connector.
- Open-circuit in the signal cable.
- Short-circuit to supply voltage in signal cable.
- Flame sensor clogged with soot.
- Defective flame sensor.
- Open-circuit in ground lead.

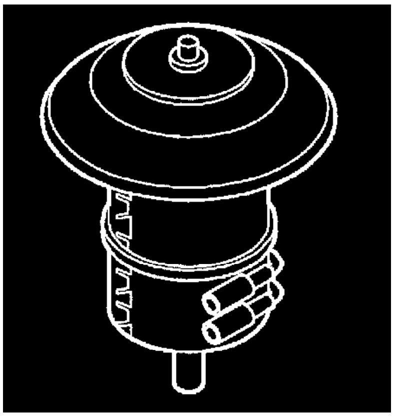
Condition

- Poor heating in passenger compartment.

HEA-814

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage in the combustion fan circuit.

Condition

- Heater not activated.

Possible source

- Short-circuit to Supply voltage in signal cable.
- Defective combustion fan.

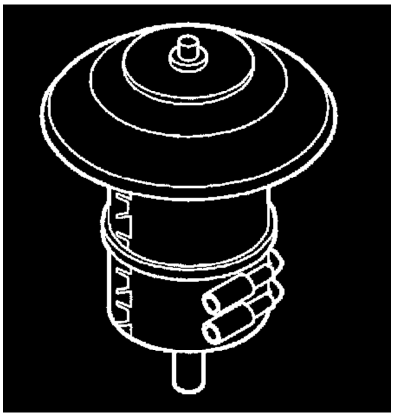
Condition

- Poor heating in passenger compartment.

HEA-815

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to ground or an open-circuit in the combustion fan circuit.

Condition

- Heater not activated.

Possible source

- Contact resistance in control module or combustion fan connectors.
- Open-circuit in the signal cable.
- Open-circuit in power cable.
- Short-circuit to ground in signal cable.
- Defective combustion fan.

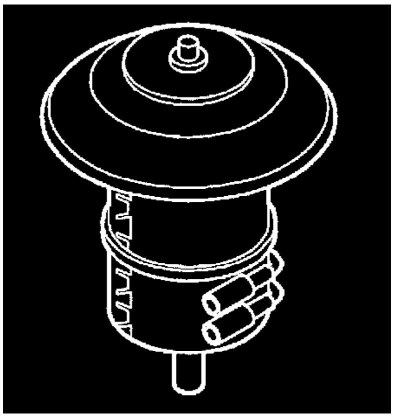
Condition

- Poor heating in passenger compartment.

HEA-816

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if the combustion fan is running too Slowly.

Condition

- Heater not activated.

Possible source

- Defective combustion fan.
- Contact resistance in control module or combustion fan connectors.

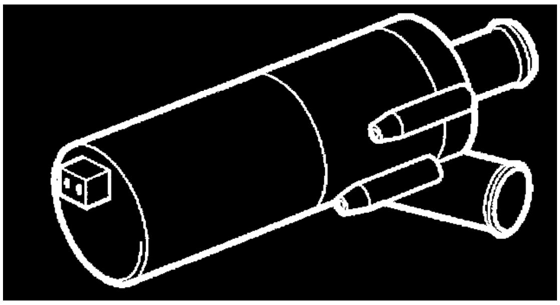
Condition

- Poor heating in passenger compartment.

HEA-821

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage in the water pump circuit.

Condition

- Any engine block heater function will be shut down.

Possible source

- Short-circuit to supply voltage in signal cable.
- Defective water pump.

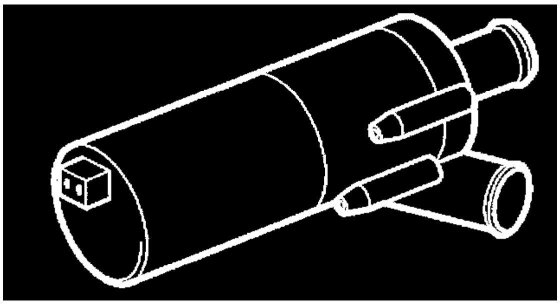
Condition

- Engine block heater not working.
- Poor heating in passenger compartment.

HEA-822

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to ground or an open-circuit in the water pump circuit.

Condition

- Any engine block heater function will be shut down.

Possible source

- Contact resistance in control module or water pump connectors.
- Short-circuit to ground in signal cable.
- Open-circuit in power cable.
- Open-circuit in the signal cable.
- Defective water pump.

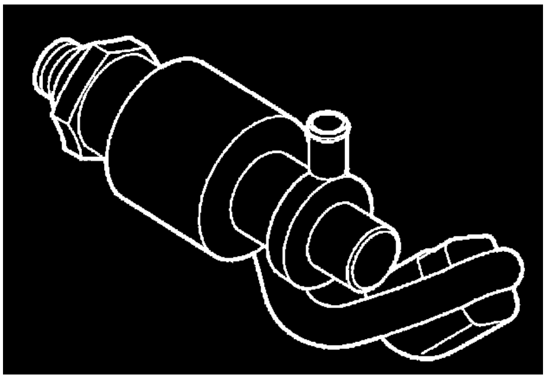
Condition

- Engine block heater not working.
- Poor heating in passenger compartment.

HEA-825

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage in the fuel pump circuit.

Condition

- Heater not activated.

Possible source

- Short-circuit to supply voltage in signal cable.
- Defective fuel pump.

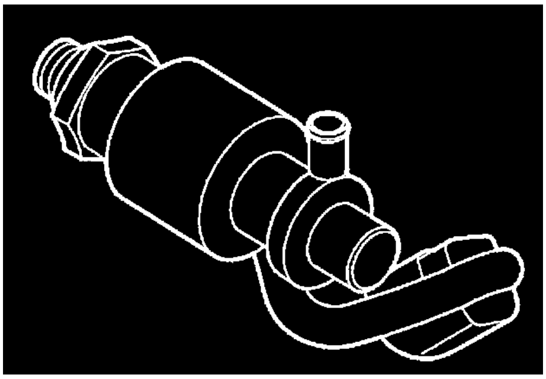
Condition

- Poor heating in passenger compartment.

HEA-826

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to ground or an open-circuit in the fuel pump circuit.

Condition

- Heater not activated.

Possible source

- Contact resistance in control module or fuel pump connectors.
- Open-circuit in the signal cable.
- Open-circuit in power cable
- Short-circuit to ground in signal cable.
- Defective fuel pump.
- Defective overheat protection thermostat.

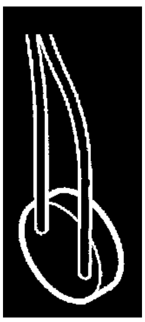
Condition

- Poor heating in passenger compartment.

HEA-831

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if the overheat protection thermostat is tripped.

Condition

- The heater is disabled, but is allowed to restart.

Possible source

- Air in the cooling system.
- Cooling system blocked.
- Defective overheat protection thermostat.
- Defective coolant temperature sensor.

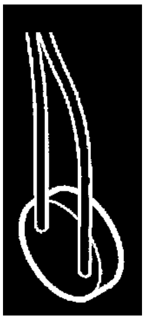
Condition

- Poor heating in passenger compartment.

HEA-832

Diagnostic Trouble Code (DTC) Information

Condition



This diagnostic trouble code is stored if the overheat protection thermostat is tripped three times in a row.

Condition

- Heater not activated.

Possible source

- Defective overheat protection thermostat.

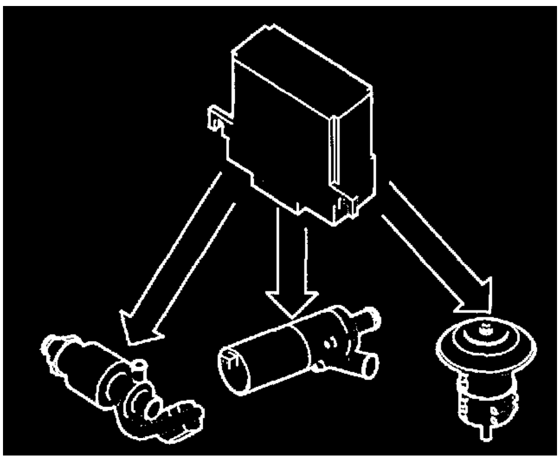
Condition

- Poor heating in passenger compartment.

HEA-841

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage in the power supply from the control module to the fuel pump, water pump and combustion fan.

Condition

- None.

Possible source

- Short-circuit to supply voltage in the power supply cable.

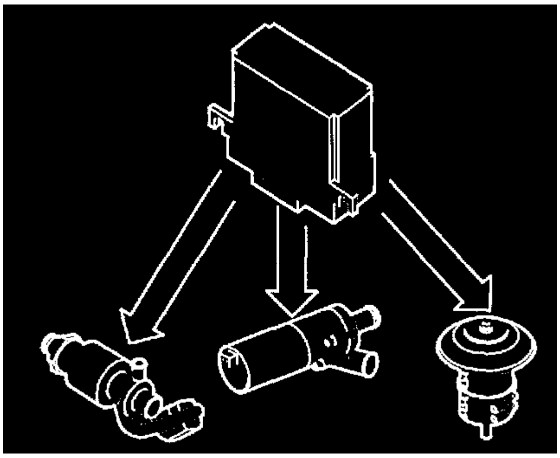
Condition

- None.

HEA-842

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to ground or an open-circuit in the power supply from the control module to the fuel pump, water pump and combustion fan.

Condition

- Heater not activated.

Possible source

- Contact resistance in control module connector.
- Short-circuit to ground in the power supply circuit.
- Open-circuit in the power supply cable.

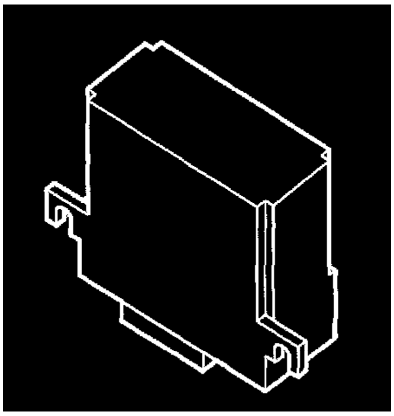
Condition

- Poor heating in passenger compartment.

HEA-843

Diagnostic Trouble Code (DTC) Information

Condition



This diagnostic trouble code is stored if the supply voltage to the control module exceeds **16 V**.

Condition

- Heater not activated.

Possible source

- Defective generator (GEN).
- Battery charger or starter unit with faulty charge voltage connected.

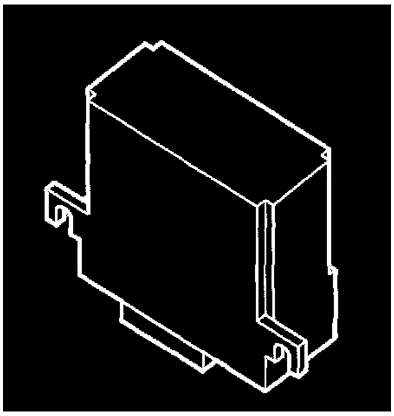
Condition

- Poor heating in passenger compartment.

HEA-851

Diagnostic Trouble Code (DTC) Information

Condition



The control module can control the blower fan via a relay. Diagnostic trouble code (DTC) HEA-851 is stored if the control module registers that the signal to the relay is too high.

Condition

- None.

Possible source

- Short-circuit to supply voltage in the signal cable.

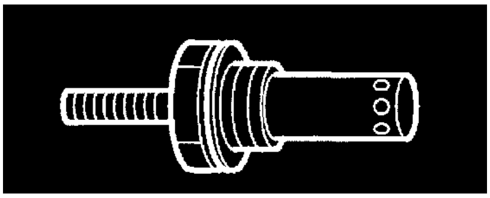
Condition

- Poor heating in the passenger compartment (applies if the warmer is connected with this function).

HEA-861

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if there is a short-circuit to supply voltage, ground or an open-circuit in the glow plug circuit.

Condition

- Heater not activated.

Possible source

- Contact resistance in control module connector.
- Contact resistance in glow plug connection.
- Open-circuit in the signal cable.
- Short-circuit to ground or supply voltage in signal cable.
- Defective glow plug.

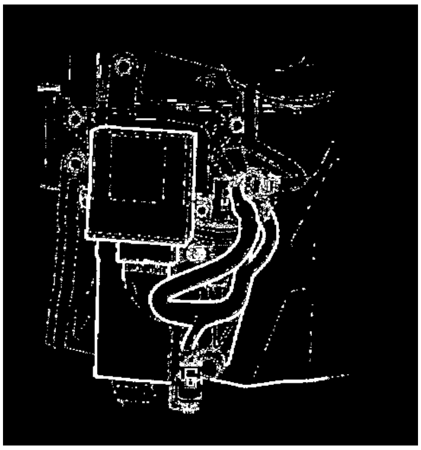
Condition

- Poor heating in passenger compartment.

HEA-891

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) is stored if the heater makes three failed start attempts in a row.

Condition

- Heater not activated.

Possible source

- Leakage in heater fuel system.
- Defective fuel pump.
- Blocked air intake.
- No fuel supply.
- Contact resistance in the control module connector.
- Open-circuit in the flame sensor control signal cable.
- Cable for the flame sensor control signal, short-circuited to supply voltage.
- Flame sensor clogged with soot.
- Defective flame sensor.
- Open-circuit on signal ground cable.

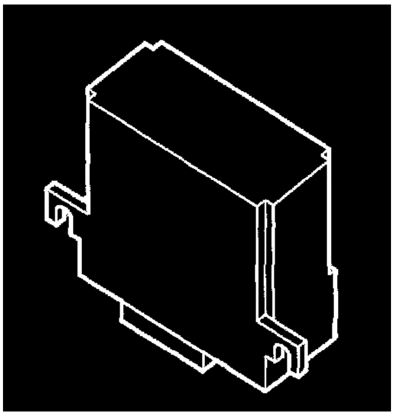
Condition

- Poor heating in passenger compartment.

HEA-898

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) HEA-898 is stored during manufacture of the control module to ensure that the heater is tested at the factory before the car is delivered to the customer. In other words this diagnostic trouble code (DTC) cannot be set by the control module itself; only by the manufacturer. The diagnostic trouble code (DTC) is automatically erased at the factory when the unit is tested.

When the unit is installed as a replacement part the diagnostic trouble code (DTC) must be erased manually after the heater has been tested in the car.

Condition

- None.

Possible source

- Is only a reminder that the heater must be tested before the car is returned to the customer.

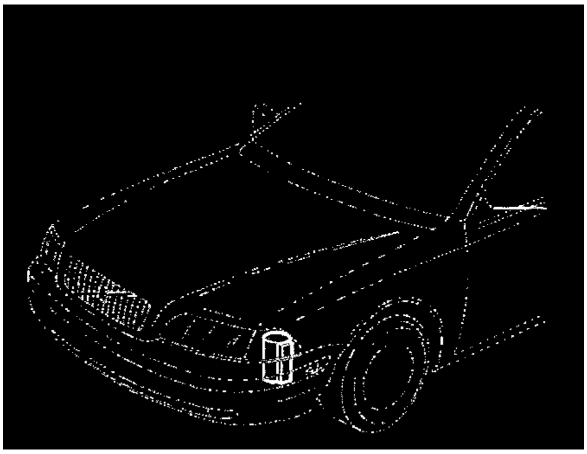
Condition

- None.

HEA-899

Diagnostic Trouble Code (DTC) Information

Condition



A diagnostic trouble code (DTC) was stored while the car was being manufactured. There is nothing wrong with the heater.

Condition

- None.

Possible source

- The diagnostic trouble code (DTC) was not erased in the factory.

Condition

- None.

DTC 2-4-1

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) 2-4-1 is stored if the timer registers that the signal at output 2 is low.

Condition

- None.

Possible source

- Control signal cable to heater short-circuited to ground.

Condition

- Missing parking heater function.

DTC 2-4-2

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) 2-4-2 is stored if the timer registers that the signal at output 3 is low.

Condition

- None.

Possible source

- Control signal cable to the electrical heater short-circuited to ground.

Condition

- Missing engine block heater function.

DTC 2-4-3

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) 2-4-3 is stored if the timer registers an internal fault (NTC-resistor).

Condition

- None.

Possible source

- Defective NTC-resistor.

Condition

- Missing parking heater function.

DTC 2-4-4

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) 2-4-4 is stored if the timer registers an internal fault.

Condition

- None.

Possible source

- Defective timer.

Condition

- Missing parking heater function.

Diagnostic Trouble Code (DTC)	Trouble Code Description
SRS-0001	Control module
SRS-0065	SRS indicator lamp
SRS-0066	SRS indicator lamp
SRS-0067	Battery voltage
SRS-0068	Driver Airbag
SRS-0069	Driver Airbag
SRS-006A	Driver's seat belt tensioner
SRS-006B	Driver's seat belt tensioner
SRS-006C	Passenger seat belt tensioner
SRS-006D	Passenger seat belt tensioner
SRS-006E	Passenger airbag
SRS-006F	Passenger airbag
SRS-0074	Left SIPS bag
SRS-0075	Left SIPS bag
SRS-0076	Right SIPS bag
SRS-0077	Right SIPS bag
SRS-0078	Driver Airbag
SRS-0079	Driver Airbag
SRS-007A	Driver's seat belt tensioner
SRS-007B	Driver's seat belt tensioner
SRS-007C	Passenger seat belt tensioner
SRS-007D	Passenger seat belt tensioner
SRS-007E	Passenger airbag
SRS-007F	Passenger airbag
SRS-0084	Left SIPS bag
SRS-0085	Left SIPS bag
SRS-0086	Right SIPS bag
SRS-0087	Right SIPS bag
SRS-0088	Driver's Airbag
SRS-0089	Driver's seat belt tensioner

Diagnostic Trouble Code (DTC)	Trouble Code Description
SRS-008A	Passenger seat belt tensioner
SRS-008B	Passenger airbag
SRS-008E	Left SIPS airbag
SRS-008F	SIPS airbag
SRS-0090	Driver's seat belt buckle
SRS-0091	Driver's seat belt buckle
SRS-0092	Driver's seat belt buckle
SRS-0093	Passenger seat belt buckle
SRS-0094	Passenger seat belt buckle
SRS-0095	Passenger seat belt buckle
SRS-0096	Driver's seat belt buckle
SRS-0097	Passenger seat belt buckle
SRS-00A0	Left side impact sensor
SRS-00A1	Left side impact sensor
SRS-00A2	Right side impact sensor
SRS-00A3	Right side impact sensor
SRS-00A4	Left side impact sensor
SRS-00A5	Right side impact sensor
SRS-00C7	Control module

Conversion Table Standardized Diagnostic Trouble Codes (DTCS)/Volvo Diagnostic Trouble Codes (DTCS)

Conversion Table Standardized Diagnostic Trouble Codes (DTCs)/Volvo Diagnostic Trouble Codes (DTCs)

Information

Background
OBD II is a diagnostics system designed to meet statutory requirements. A standardized instrument for fault-tracing can be plugged in to the data link connector (DLC) (OBD II socket) to read diagnostic trouble codes (DTCs) and system parameters. OBD II contains only emissions related diagnostic trouble codes (DTCs) and parameters. It cannot provide the comprehensive range of information available from the Volvo On-board diagnostics system.

Volvo has its own diagnostic trouble code (DTC) designations that adhere to the in-house Volvo On-board Diagnostics protocol (called DII from model year 1999).

Table explanations
The table below is a conversion table between standardized diagnostic trouble codes (DTCs) (SAE/ISO) and the equivalent Volvo diagnostic trouble codes (DTCs) (DII).

SAE/ISO diagnostic trouble code (DTC): Standardized diagnostic trouble code (DTC) according to SAE J2012/ISO 15031-6. The diagnostic trouble code (DTC) can be read off on vehicles with standardized on-board diagnostic systems for emissions related faults, certified in accordance with OBD II. Reading off is performed with a generic scan tool, an instrument for fault-tracing standardized in accordance with SAE J1978/ISO 15031-4.

Volvo DII diagnostic trouble code (DTC): Volvo-specific diagnostic trouble code (DTC) in accordance with the Volvo On-Board Diagnostic protocol. Can be read off using VIDA on cars from model year 1999.

Diagnostic trouble code (DTC) designation: Volvo diagnostic trouble code (DTC) designation. Used in VIDA.

Fault type: Volvo method for specifying the actual fault. Used in VIDA.

NOTE: An SAE/ISO diagnostic trouble code (DTC) can correspond to several DII diagnostic trouble codes (DTCs). All of these must therefore by rectified in order for the corresponding SAE/ISO diagnostic trouble code (DTC) to disappear.

Several SAE/ISO diagnostic trouble codes (DTCs) may also refer to the same DII diagnostic trouble code (DTC).

There are DII diagnostic trouble codes (DTCs) for non emissions-related faults that do not correspond to any SAE/ISO diagnostic trouble code (DTC).

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0115	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0455	Leak diagnostic, Fuel tank filler cap missing	ECM-68*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1600	DSA signal cable, Signal too high	ECM-70
P1600	DSA signal cable, Signal too low	ECM-70
P1600	DSA signal cable, Faulty signal	ECM-70
P1600	Torque reduction, No signal	ECM-91
P1600	Torque reduction, Faulty signal	ECM-91
P1600	Torque reduction, Diagnostic trouble code (DTC) in the DSA	ECM-91
P1600	Torque reduction, Initiation fault	ECM-91

All Other P Codes

For diagnosis of all P codes - See: Diagnostic Trouble Code Tests and Associated Procedures/P Code Charts

DTC Conversion Table Notes

Conversion Table Standardized Diagnostic Trouble Codes (DTCs)/Volvo Diagnostic Trouble Codes (DTCs)

Information

Background
OBD II is a diagnostics system designed to meet statutory requirements. A standardized instrument for fault-tracing can be plugged in to the data link connector (DLC) (OBD II socket) to read diagnostic trouble codes (DTCs) and system parameters. OBD II contains only emissions related diagnostic trouble codes (DTCs) and parameters. It cannot provide the comprehensive range of information available from the Volvo On-board diagnostics system.

Volvo has its own diagnostic trouble code (DTC) designations that adhere to the in-house Volvo On-board Diagnostics protocol (called DII from model year 1999).

Table explanations
The table below is a conversion table between standardized diagnostic trouble codes (DTCs) (SAE/ISO) and the equivalent Volvo diagnostic trouble codes (DTCs) (DII).

SAE/ISO diagnostic trouble code (DTC): Standardized diagnostic trouble code (DTC) according to SAE J2012/ISO 15031-6. The diagnostic trouble code (DTC) can be read off on vehicles with standardized on-board diagnostic systems for emissions related faults, certified in accordance with OBD II. Reading off is performed with a generic scan tool, an instrument for fault-tracing standardized in accordance with SAE J1978/ISO 15031-4.

Volvo DII diagnostic trouble code (DTC): Volvo-specific diagnostic trouble code (DTC) in accordance with the Volvo On-Board Diagnostic protocol. Can be read off using VIDA on cars from model year 1999.

Diagnostic trouble code (DTC) designation: Volvo diagnostic trouble code (DTC) designation. Used in VIDA.

Fault type: Volvo method for specifying the actual fault. Used in VIDA.

NOTE: An SAE/ISO diagnostic trouble code (DTC) can correspond to several DII diagnostic trouble codes (DTCs). All of these must therefore by rectified in order for the corresponding SAE/ISO diagnostic trouble code (DTC) to disappear.

Several SAE/ISO diagnostic trouble codes (DTCs) may also refer to the same DII diagnostic trouble code (DTC).

There are DII diagnostic trouble codes (DTCs) for non emissions-related faults that do not correspond to any SAE/ISO diagnostic trouble code (DTC).

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0013	Camshaft reset valve, Signal too high	ECM-5D
P0013	Camshaft reset valve, Signal too low	ECM-5D
P0013	Camshaft reset valve, No signal	ECM-5D
P0014	Camshaft reset valve, Incorrect signal	ECM-5E*
P0014	Camshaft reset valve, Incorrect signal	ECM-5F*
P0014	Camshaft reset valve, Incorrect signal	ECM-60*
P0015	Camshaft reset valve, Incorrect signal	ECM-61*
P0030	Front heated oxygen sensor (HO2S) preheating, No signal	ECM-18
P0031	Front heated oxygen sensor (HO2S) preheating, Signal too low	ECM-18
P0032	Front heated oxygen sensor (HO2S) preheating, Signal too high	ECM-18
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0036	Rear heated oxygen sensor (HO2S) preheating, No signal	ECM-1C
P0037	Rear heated oxygen sensor (HO2S) preheating, Signal too low	ECM-1C
P0038	Rear heated oxygen sensor (HO2S) preheating, Signal too high	ECM-1C
P0101	Mass air flow (MAF) sensor, Faulty signal	ECM-14*
P0102	Mass air flow (MAF) sensor signal, Signal too low	ECM-13*
P0103	Mass air flow (MAF) sensor signal, Signal too high	ECM-13*
P0107	Boost pressure sensor, Signal too low	ECM-0C*
P0107	Boost pressure sensor, Signal too low	ECM-0D*
P0108	Boost pressure sensor, Signal too high	ECM-0C*
P0108	Boost pressure sensor, Signal too high	ECM-0D*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0115	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0112	Intake air temperature (IAT) sensor, Signal too low	ECM-0F*
P0113	Intake air temperature (IAT) sensor, Signal too high	ECM-0F*
P0114	Intake air temperature (IAT) sensor, Faulty signal	ECM-10*
P0117	Engine coolant temperature (ECT) sensor, Signal too low	ECM-15*
P0118	Engine coolant temperature (ECT) sensor, Signal too high	ECM-15*
P0119	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A0*
P0121	Throttle position (TP) sensor signal, Faulty signal	ECM-74

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0122	Throttle position (TP) sensor signal, Signal too low	ECM-73
P0123	Throttle position (TP) sensor signal, Signal too high	ECM-73
P0125	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A2
P0128	Engine coolant temperature (ECT) sensor, Faulty signal	ECM-A1*
P0130	Front heated oxygen sensor (HO2S) signal, No signal	ECM-16
P0131	Front heated oxygen sensor (HO2S) signal, Signal too low	ECM-16
P0132	Front heated oxygen sensor (HO2S) signal, Signal too high	ECM-16

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0133	Front heated oxygen sensor (HO2S) short-term fuel trim, Faulty signal	ECM-28*
P0135	Front heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-18
P0138	Rear heated oxygen sensor (HO2S) signal, Signal too high	ECM-1A
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0139	Rear heated oxygen sensor (HO2S), Faulty signal	ECM-29*
P0140	Rear heated oxygen sensor (HO2S) signal, Signal too low	ECM-1A*
P0140	Rear heated oxygen sensor (HO2S) signal, No signal	ECM-1A*
P0141	Rear heated oxygen sensor (HO2S) preheating, Faulty signal	ECM-1C
P0171	Long-term fuel trim, Lean	ECM-25*
P0172	Long-term fuel trim, Rich	ECM-25*
P0201	Injector 1, No signal	ECM-1E*
P0202	Injector 2, No signal	ECM-1F*
P0203	Injector 3, No signal	ECM-20*
P0204	Injector 4, No signal	ECM-21*
P0231	System relay control signal, Signal too low	ECM-24*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0232	System relay control signal, Signal too high	ECM-24*
P0234	Boost pressure, Signal too high	ECM-2E*
P0236	Boost pressure sensor, Signal too high	ECM-AD*
P0236	Boost pressure sensor, Signal too low	ECM-AD*
P0237	Boost pressure sensor, Signal too low	ECM-AC*
P0238	Boost pressure sensor, Signal too high	ECM-AC*
P0243	Turbocharger (TC) control valve signal, No signal	ECM-2D
P0245	Turbocharger (TC) control valve signal, Signal too low	ECM-2D
P0246	Turbocharger (TC) control valve signal, Signal too high	ECM-2D
P0261	Injector 1, Signal too low	ECM-1E*
P0262	Injector 1, Signal too high	ECM-1E*
P0264	Injector 2, Signal too low	ECM-1F*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

P0301

Alldata Editor Note:

Volvo does not provide information regarding DTC P0301 for some models.
However, it has been reported that various Volvo engine control modules will produce this code. The code is associated with cylinder misfire [cyl #1] and causes increased emissions which may cause three-way catalytic converter (TWC) damage.

Possible Causes

- Defective spark plugs, ignition cables, ignition coil or flywheel/pulse wheel
- Blocked/leaking injector
- Uneven compression
- Leakage between the cooling system and cylinders
- Moisture, flashover in the ignition system on HT side
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit
- Fuel stoppage
- Water in the spark plug wells
- Contaminated fuel or incorrect fuel type
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Manufacture codes associated with this P code may include ECM-44, ECM-45, ECM-4D.

P0302

Alldata Editor Note:

Volvo does not provide information regarding DTC P0302 for some models.
However, it has been reported that various Volvo engine control modules will produce this code. The code is associated with cylinder misfire [cyl #2] and causes increased emissions which may cause three-way catalytic converter (TWC) damage.

Possible Causes

- Defective spark plugs, ignition cables, ignition coil or flywheel/pulse wheel
- Blocked/leaking injector
- Uneven compression
- Leakage between the cooling system and cylinders
- Moisture, flashover in the ignition system on HT side
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit
- Fuel stoppage
- Water in the spark plug wells
- Contaminated fuel or incorrect fuel type
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Manufacture codes associated with this P code may include ECM-44, ECM-45, ECM-4D.

P0303

Alldata Editor Note:

Volvo does not provide information regarding DTC P0303 for some models.

However, it has been reported that various Volvo engine control modules will produce this code. The code is associated with cylinder misfire [cyl #3] and causes increased emissions which may cause three-way catalytic converter (TWC) damage.

Possible Causes

- Defective spark plugs, ignition cables, ignition coil or flywheel/pulse wheel
- Blocked/leaking injector
- Uneven compression
- Leakage between the cooling system and cylinders
- Moisture, flashover in the ignition system on HT side
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit
- Fuel stoppage
- Water in the spark plug wells
- Contaminated fuel or incorrect fuel type
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Manufacture codes associated with this P code may include ECM-44, ECM-45, ECM-4D.

P0304

Alldata Editor Note:

Volvo does not provide information regarding DTC P0304 for some models.
However, it has been reported that various Volvo engine control modules will produce this code. The code is associated with cylinder misfire [cyl #4] and causes increased emissions which may cause three-way catalytic converter (TWC) damage.

Possible Causes

- Defective spark plugs, ignition cables, ignition coil or flywheel/pulse wheel
- Blocked/leaking injector
- Uneven compression
- Leakage between the cooling system and cylinders
- Moisture, flashover in the ignition system on HT side
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit
- Fuel stoppage
- Water in the spark plug wells
- Contaminated fuel or incorrect fuel type
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Manufacture codes associated with this P code may include ECM-44, ECM-45, ECM-4D.

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0265	Injector 2, Signal too high	ECM-1F*
P0267	Injector 3, Signal too low	ECM-20*
P0268	Injector 3, Signal too high	ECM-20*
P0270	Injector 4, Signal too low	ECM-21*
P0271	Injector 4, Signal too high	ECM-21*
P0300	Misfire, Emission level, Faulty signal	ECM-44
P0300	Misfire, Emission level, Faulty signal	ECM-45
P0300	Misfiring damaging to the three-way catalytic converter (TWC), Faulty signal	ECM-4D
P0324	Control module, Internal fault	ECM-43
P0326	Knock sensor (KS), Faulty signal	ECM-41
P0335	Engine speed (RPM) sensor, No signal	ECM-78*
P0336	Engine speed (RPM) sensor, Faulty signal	ECM-78*
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0340	Camshaft position (CMP) sensor signal, No signal	ECM-32*
P0341	Camshaft position (CMP) sensor signal, Faulty signal	ECM-32*
P0351	Ignition coil 1, Signal too high	ECM-38*
P0351	Ignition coil 1, Signal too low	ECM-38
P0352	Ignition coil 2, Signal too high	ECM-38*
P0352	Ignition coil 2, Signal too low	ECM-38*
P0420	Three-way catalytic converter (TWC) efficiency, Faulty signal	ECM-5A
P0441	Leak diagnostic, Faulty signal	ECM-6A*
P0442	Leak diagnostic, Major leak	ECM-68*
P0443	Canister purge (CP) valve signal, Signal too high	ECM-5C*
P0444	Canister purge (CP) valve signal, No signal	ECM-5C*
P0445	Canister purge (CP) valve signal, Signal too low	ECM-5C*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0455	Leak diagnostic, Fuel tank filler cap missing	ECM-68*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0456	Leak diagnostic, Minor leak	ECM-68*
P0480	Engine cooling fan (FC) low-speed, Signal too high	ECM-85
P0480	Engine cooling fan (FC) low-speed, Signal too low	ECM-85
P0481	Engine cooling fan (FC) high-speed, Signal too high	ECM-87
P0481	Engine cooling fan (FC) high-speed, Signal too low	ECM-87
P0500	Speedometer signal, Faulty signal	ECM-6F*
P0505	Idle air control (IAC) valve, No signal	ECM-8A*
P0506	Idle speed, Signal too low	ECM-8D
P0507	Idle speed, Signal too high	ECM-8D
P0508	Idle air control (IAC) valve, Signal too low	ECM-8A*
P0509	Idle air control (IAC) valve, Signal too high	ECM-8A*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0513	Communication fault, Immobilizer, Incorrect VIN	ECM-9B
P0533	Air conditioning (A/C) pressure sensor, Signal too high	ECM-6B
P0533	Air conditioning (A/C) pressure sensor, Signal too low	ECM-6B
P0560	System relay output, Signal too high	ECM-A3*
P0562	System relay output, Signal too low	ECM-A3*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0630	ECM-9B	Communication problems, Immobilizer	Faulty VIN
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Permanent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Permanent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Intermittent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Permanent fault

P0600 - P1108

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0630	ECM-9B	Communication problems, Immobilizer	Faulty VIN
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Permanent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Permanent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Intermittent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Permanent fault

P0600 - P1108

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DC
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DD
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-DE
P0600	Communication, transmission control module (TCM), Faulty signal	ECM-E0
P0603	Control module, Internal fault	ECM-9D
P0604	Control module, Internal fault	ECM-9D
P0605	Control module, Internal fault	ECM-9D
P0646	Air conditioning (A/C) relay signal, Signal too low	ECM-7D

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0500	SP open	AT-232 *
P0600	ECM communication malfunction	AT-511 *
P0600	ECM communication malfunction	AT-522 *
P0600	ECM communication malfunction	AT-523 *
P0600	ECM communication malfunction	AT-524 *
P0600	ECM communication malfunction	AT-525 *
P0600	ECM communication malfunction	AT-526 *
P0600	ECM communication malfunction	AT-527 *
P0601	TCM ROM checksum error	AT-412 *
P0705	Gear selector fault	AT-313 *
P0715	NC open	AT-311 *
P0731	Gear ratio fault 1. gear	AT-321 *
P0732	Gear ratio fault 2. gear	AT-322 *
P0733	Gear ratio fault 3. gear	AT-323 *
P0734	Gear ratio fault 4. gear	AT-324 *
P0740	Lockup slipping	AT-341 *
P0740	Lockup solenoid SL, short-circuit to B+	AT-331 *
P0740	Lockup solenoid SL, open circuit	AT-332 *
P0740	Lockup solenoid SL, short-circuit to Gnd	AT-333 *
P0745	Solenoid STH, signal line short-circuit to B+	AT-123 *
P0745	Solenoid STH, driver shorted	AT-132
P0745	Solenoid STH, signal line short-circuit to Gnd or open circuit	AT-131 *
P0750	Shift solenoid S1, short-circuit to B+ or open circuit	AT-122 *
P0750	Shift solenoid S1, short to Gnd	AT-121 *
P0755	Shift solenoid S2, short-circuit to B+ or open circuit	AT-222 *
P0755	Shift solenoid S2, short to Gnd	AT-221 *

***) Activates malfunction indicator lamp (MIL).**

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0630	ECM-9B	Communication problems, Immobilizer	Faulty VIN
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Permanent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Permanent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Intermittent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Permanent fault

P0600 - P1108

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0630	ECM-9B	Communication problems, Immobilizer	Faulty VIN
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Permanent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Permanent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Intermittent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Permanent fault

P0600 - P1108

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DD	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-DE	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Intermittent fault
P0600	ECM-E0	Communication, transmission control module (TCM)	Faulty signal. Permanent fault
P0630	ECM-9B	Communication problems, Immobilizer	Faulty VIN
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too low. Permanent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Intermittent fault
P0645	ECM-7D	Air conditioning (A/C) relay signal	Signal too high. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal missing. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too low. Permanent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Intermittent fault
P0650	ECM-7F	Malfunction indicator lamp (MIL)	Signal too high. Permanent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1106	ECM-0B	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Intermittent fault
P1107	ECM-0A	Atmospheric pressure sensor signal	Signal too low. Permanent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Intermittent fault
P1108	ECM-0A	Atmospheric pressure sensor signal	Signal too high. Permanent fault

P0600 - P1108

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P1241	ECM-2E	Boost pressure	Signal too high. Intermittent fault
P1241	ECM-2E	Boost pressure	Signal too high. Permanent fault
P1336	ECM-53	Engine speed (RPM) sensor	Sporadic. Intermittent fault
P1336	ECM-53	Engine speed (RPM) sensor	Sporadic. Permanent fault
P1440	ECM-66	Leak diagnostic	Signal too low. Intermittent fault
P1440	ECM-66	Leak diagnostic	Signal too low. Permanent fault
P1446	ECM-AF	Leak diagnostic pump	Signal missing. Intermittent fault
P1446	ECM-AF	Leak diagnostic pump	Signal missing. Permanent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too low. Intermittent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too low. Permanent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too high. Intermittent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too high. Permanent fault
P1449	ECM-65	Leak diagnostic	Faulty signal. Intermittent fault
P1449	ECM-65	Leak diagnostic	Faulty signal. Permanent fault
P1449	ECM-65	Leak diagnostic	Signal too high. Intermittent fault
P1449	ECM-65	Leak diagnostic	Signal too high. Permanent fault
P1449	ECM-65	Leak diagnostic	Signal too low. Intermittent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too low. Intermittent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too low. Permanent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too high. Intermittent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too high. Permanent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal missing. Intermittent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal missing. Permanent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too low. Intermittent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too low. Permanent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too high. Intermittent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too high. Permanent fault
P1600	ECM-91	Torque reduction	Faulty signal. Intermittent fault

P1241 - P1600

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P0647	Air conditioning (A/C) relay signal, Signal too high	ECM-7D
P0650	Malfunction indicator lamp (MIL), Signal too high	ECM-7F
P0650	Malfunction indicator lamp (MIL), Signal too low	ECM-7F
P0650	Malfunction indicator lamp (MIL), No signal	ECM-7F
P0700	Diagnostic trouble code (DTC) in the automatic transmission control module (TCM)	ECM-76*
P1014	Camshaft reset valve, Incorrect signal	ECM-62*
P1236	Boost pressure, Signal too low	ECM-2E*
P1336	Engine speed (RPM) sensor, Sporadic	ECM-53
P1440	Leak diagnostic, Signal too low	ECM-66*

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

SAE/ISO diagnostic trouble code (DTC)	Volvo DII diagnostic trouble code (DTC)	Diagnostic trouble code (DTC) designation	Fault type
P1241	ECM-2E	Boost pressure	Signal too high. Intermittent fault
P1241	ECM-2E	Boost pressure	Signal too high. Permanent fault
P1336	ECM-53	Engine speed (RPM) sensor	Sporadic. Intermittent fault
P1336	ECM-53	Engine speed (RPM) sensor	Sporadic. Permanent fault
P1440	ECM-66	Leak diagnostic	Signal too low. Intermittent fault
P1440	ECM-66	Leak diagnostic	Signal too low. Permanent fault
P1446	ECM-AF	Leak diagnostic pump	Signal missing. Intermittent fault
P1446	ECM-AF	Leak diagnostic pump	Signal missing. Permanent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too low. Intermittent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too low. Permanent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too high. Intermittent fault
P1446	ECM-AF	Leak diagnostic pump	Signal too high. Permanent fault
P1449	ECM-65	Leak diagnostic	Faulty signal. Intermittent fault
P1449	ECM-65	Leak diagnostic	Faulty signal. Permanent fault
P1449	ECM-65	Leak diagnostic	Signal too high. Intermittent fault
P1449	ECM-65	Leak diagnostic	Signal too high. Permanent fault
P1449	ECM-65	Leak diagnostic	Signal too low. Intermittent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too low. Intermittent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too low. Permanent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too high. Intermittent fault
P1483	ECM-82	Air conditioning (A/C)-engine cooling fan (FC)	Signal too high. Permanent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal missing. Intermittent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal missing. Permanent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too low. Intermittent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too low. Permanent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too high. Intermittent fault
P1600	ECM-70	Signal cable DSA (dynamic stability assistance)	Signal too high. Permanent fault
P1600	ECM-91	Torque reduction	Faulty signal. Intermittent fault

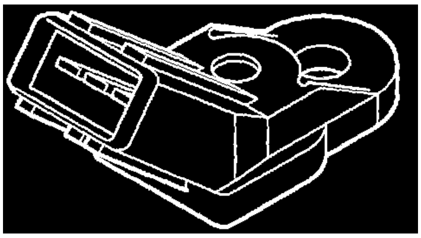
P1241 - P1600

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1446	Leak diagnostic pump, Signal too high	ECM-AF*
P1446	Leak diagnostic pump, Signal too low	ECM-AF*
P1446	Leak diagnostic pump, No signal	ECM-AF*
P1449	Leak diagnostic, Signal too high	ECM-65*
P1449	Leak diagnostic, Signal too low	ECM-65*
P1449	Leak diagnostic, Faulty signal	ECM-65*
P1482	Air conditioning (A/C) condenser fan, Signal too high	ECM-82
P1482	Air conditioning (A/C) condenser fan, Signal too low	ECM-82
P1482	Air conditioning (A/C) condenser fan, No signal	ECM-82
P1513	Communication fault, Immobilizer, No communication	ECM-9A

OBD II-codes	Fault message	Volvo on-board diagnostic (OBD) system diagnostic trouble code (DTC)
P1600	DSA signal cable, Signal too high	ECM-70
P1600	DSA signal cable, Signal too low	ECM-70
P1600	DSA signal cable, Faulty signal	ECM-70
P1600	Torque reduction, No signal	ECM-91
P1600	Torque reduction, Faulty signal	ECM-91
P1600	Torque reduction, Diagnostic trouble code (DTC) in the DSA	ECM-91
P1600	Torque reduction, Initiation fault	ECM-91

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-0A is stored if the atmospheric pressure sensor circuit is short-circuited to ground or voltage or if there is an open-circuit in the circuit.

Condition

- **90 kPa** (approximately **1000 meters** above sea-level)
- No leak diagnostic.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Faulty atmospheric pressure sensor.

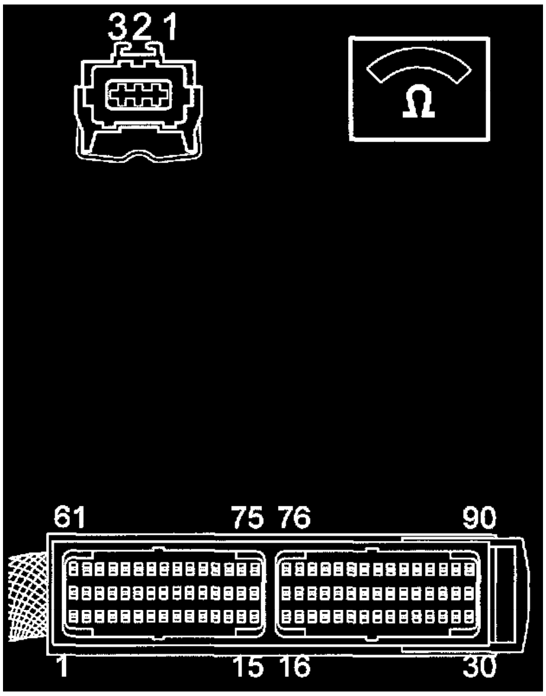
Signal too low:

- Short-circuit to ground in signal cable
- Open-circuit in the signal cable
- Faulty atmospheric pressure sensor.

Condition
- Malfunction indicator lamp (MIL) lit.

Signal Too High - Intermittent Fault

Checking Wiring



Check the engine Control module (ECM) and atmospheric pressure sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check in particular for damage, or loose terminal pins.

Check the signal cable between engine control module (ECM) terminal 18 and atmospheric pressure sensor terminal 3 for an intermittent short-circuit to supply voltage. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

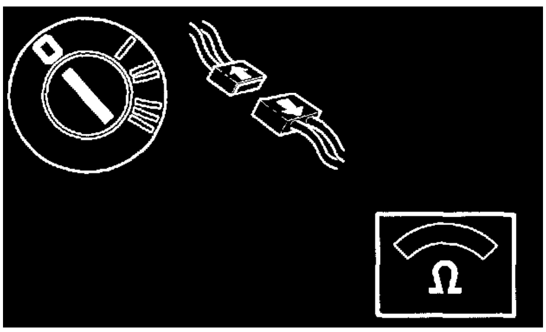
Check the voltage cable between engine control module (ECM) connector terminal 77 and atmospheric pressure sensor terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the atmospheric pressure sensor, see **Replacing the air conditioning (A/C) system pressure sensor.**

Checking the Terminal

Checking The Terminal



- Ignition off

- Disconnect the connector for the atmospheric pressure sensor.

Check the atmospheric pressure sensor connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

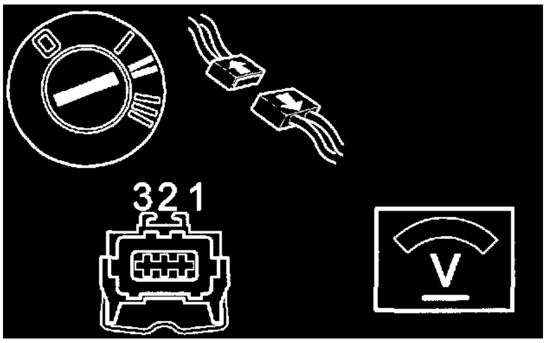
Was a fault detected?

Yes - This information to be published by O.E. at a later date.

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Checking the Signal Cable - I

Checking the Signal Cable - I

Checking The Signal Cable



- Ignition off
- Disconnect the connector for the atmospheric pressure sensor
- Ignition on.

Connect a voltmeter between the atmospheric pressure sensor connector terminal 3 (control module side) and ground.

The voltmeter should read 0 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Checking the Ground Lead - I

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Checking the Signal Cable - II

Checking the Ground Lead - I

Checking The Ground Lead

Connect an ohmmeter between atmospheric pressure sensor connector terminal 2 and ground.

The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Defective Atmospheric Pressure Sensor

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Checking the Ground Lead - II

Defective Atmospheric Pressure Sensor

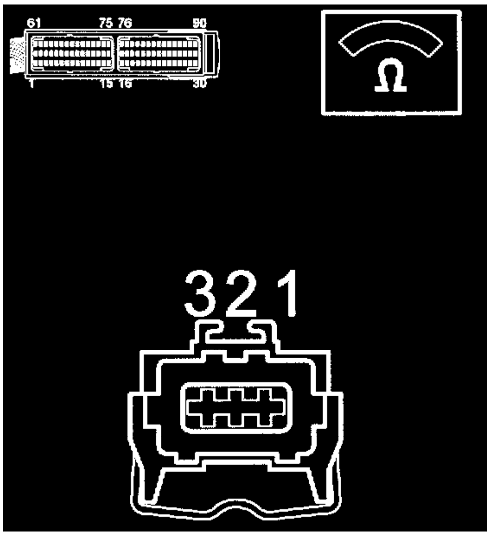
Defective Atmospheric Pressure Sensor

Try a new atmospheric pressure sensor according to **Replacing the atmospheric pressure sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Verification

Checking the Ground Lead - II

Checking The Ground Lead



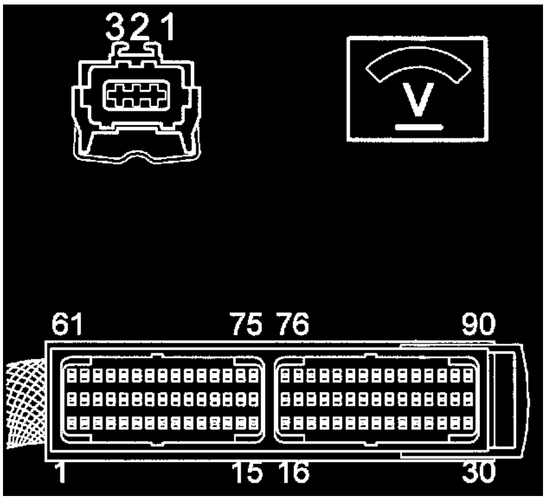
Check the cable between atmospheric pressure sensor connector terminal 2 (control module side) and engine control module (ECM) terminal 77 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



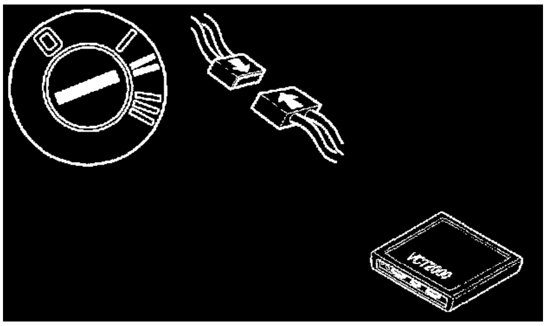
Check the cable between atmospheric pressure sensor connector terminal 3 (control module side) and engine control module (ECM) terminal 18 for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Verification

Verification

Verification

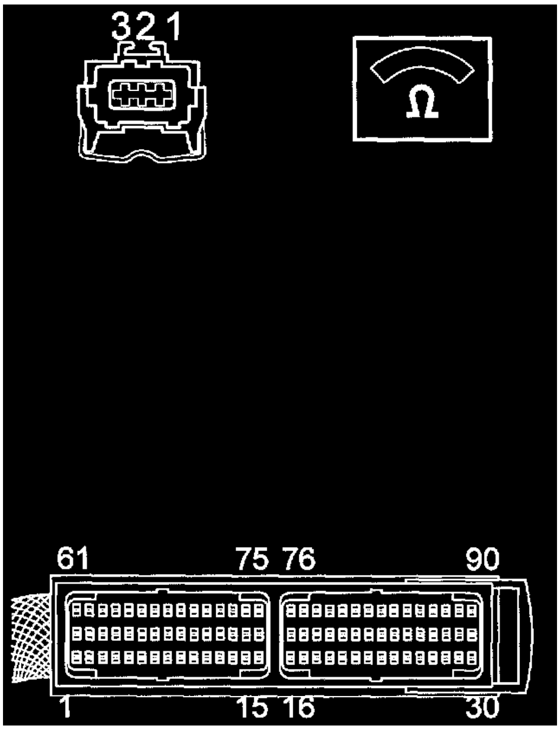


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Read off the BARO parameter.
The value indicates atmospheric pressure.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the engine control module (ECM) and atmospheric pressure sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults.**

Check in particular for damage, or loose terminal pins.

Check the signal cable between engine control module (ECM) terminal 18 and atmospheric pressure sensor terminal 3 for an intermittent short-circuit to ground. Remedy according to **Checking wiring and terminals - Intermittent faults** and for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults.**

Check the voltage cable between engine control module (ECM) connector terminal 78 and atmospheric pressure sensor terminal 1 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent faults.**

The supply voltage should be **5 V**.

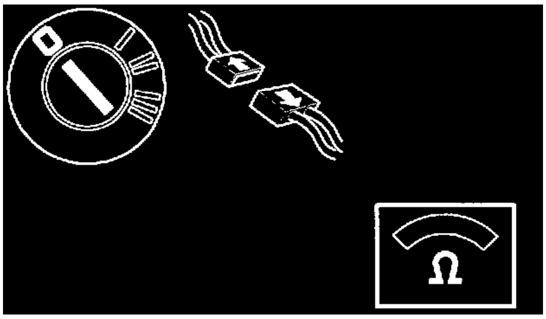
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the atmospheric pressure sensor, see **Replacing the air conditioning (A/C) system pressure sensor.**

Checking the Terminal

Checking The Terminal



- Ignition off
- Disconnect the connector for the atmospheric pressure sensor.

Check the atmospheric pressure sensor connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

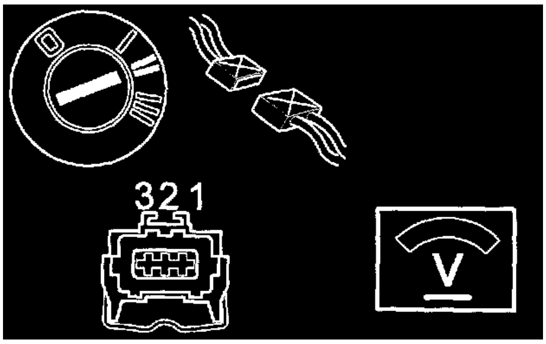
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Checking the Power Cable - I

Checking the Power Cable - I

Checking The Power Cable



- Ignition on
- Atmospheric pressure sensor connector disconnected.

Connect a voltmeter between atmospheric pressure sensor connector terminal 1 (control module side) and the ground terminal.

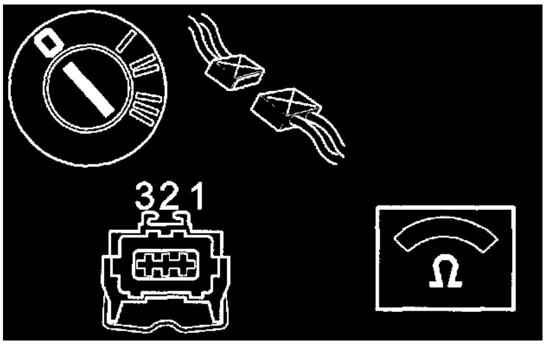
The voltmeter should read approximately 5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Checking the Signal Cable - I

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Checking the Power Cable - II

Checking the Signal Cable - I

Checking The Signal Cable



- Ignition off
- Atmospheric pressure sensor connector disconnected.

Connect an ohmmeter between atmospheric pressure sensor connector terminal 3 (control module side) and the ground terminal.

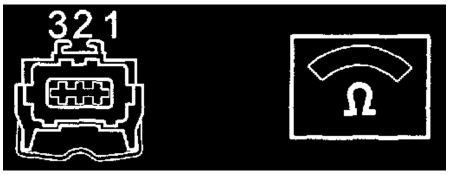
The ohmmeter should read approximately 59 k[ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Checking the Ground Lead - I

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Checking the Signal Cable - II

Checking the Ground Lead - I

Checking The Ground Lead



Connect an ohmmeter between atmospheric pressure sensor connector terminal 2 (engine control module (ECM) side) and ground.

The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Defective Atmospheric Pressure Sensor

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Checking the Ground Lead - II

Defective Atmospheric Pressure Sensor

Defective Atmospheric Pressure Sensor

Try a new atmospheric pressure sensor according to **Replacing the atmospheric pressure sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too High - Permanent Fault/Verification

Checking the Ground Lead - II

Checking The Ground Lead

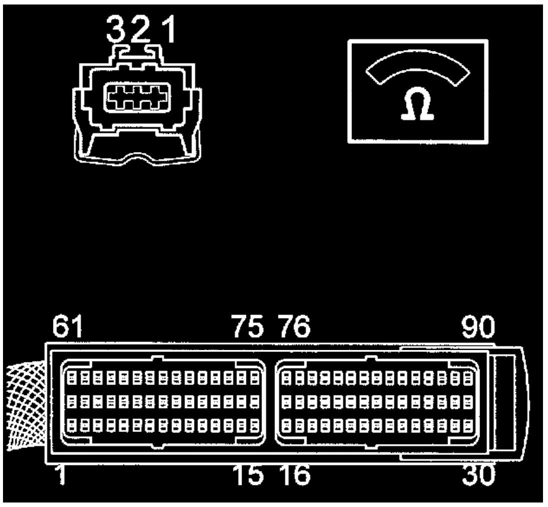
Check the cable between atmospheric pressure sensor connector terminal 2 (control module side) and engine control module (ECM) terminal 77 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



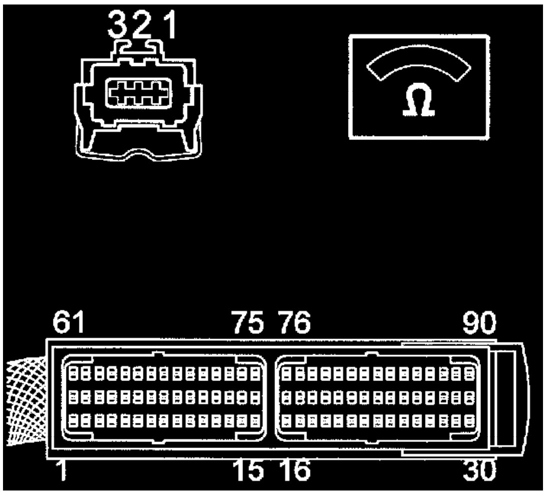
Check the cable between atmospheric pressure sensor connector terminal 3 (control module side) and engine control module (ECM) terminal 18 for a short-circuit to ground according See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Verification

Checking the Power Cable - II

Checking The Power Cable



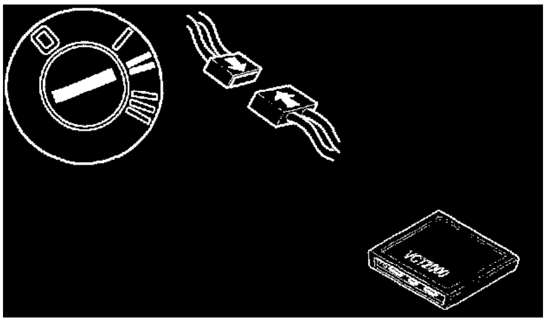
Check the cable between atmospheric pressure sensor connector terminal 1 (control module side) and engine control module (ECM) terminal 78 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing the procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0A/Signal Too Low - Permanent Fault/Verification

Verification

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Read off the BARO parameter.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-0B is stored is stored if the control module detects that the atmospheric pressure sensor signal is lower that the boost pressure sensor signal when the ignition is on, the engine is not running and no diagnostic trouble code (DTC) is stored for the boost pressure sensor.

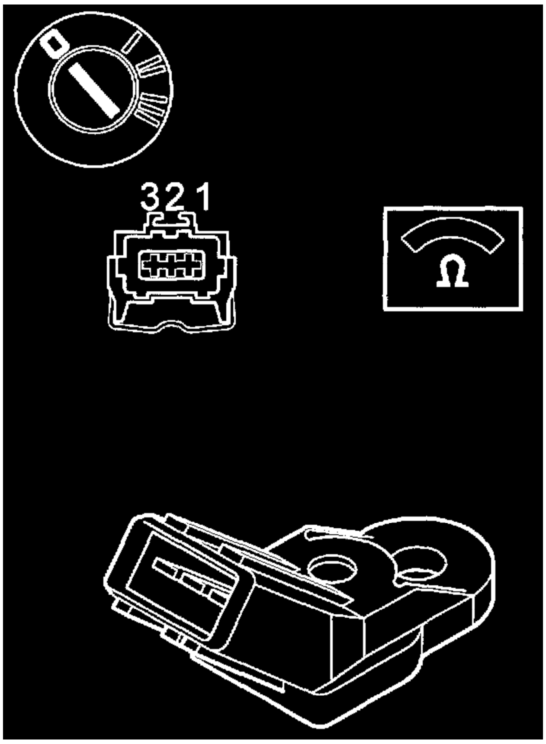
Condition
EVAP control only at idling, no leak diagnostic.

Possible source
- Contact resistance in the wiring
- Defective atmospheric pressure sensor.

Condition
- None.

Signal Too Low - Intermittent Fault

Checking The Connectors



- Ignition off

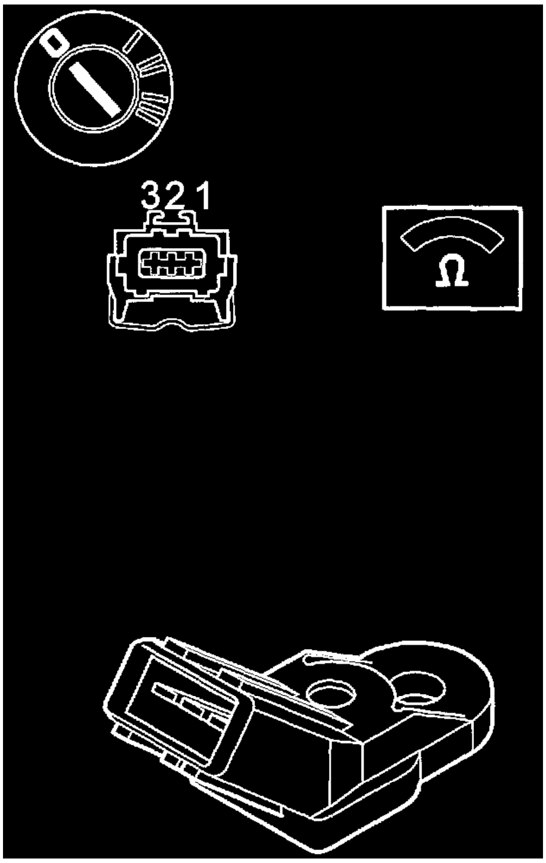
- Check the atmospheric pressure sensor and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults** and loose connections according to **Checking wiring and terminals - Intermittent Faults.** Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the atmospheric pressure sensor, see **Replacing the atmospheric pressure sensor.**

Checking Wiring and Connectors

Checking Wiring And Connectors



- Ignition off

- Check the atmospheric pressure sensor and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.**

- Check the signal cable between atmospheric pressure sensor terminal 3 and control module terminal 18. Check the power supply cable between atmospheric pressure sensor terminal 1 and control module terminal 74. Check these cables for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

Check the atmospheric pressure sensor signal cable terminal 3 for a short-circuit to ground according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

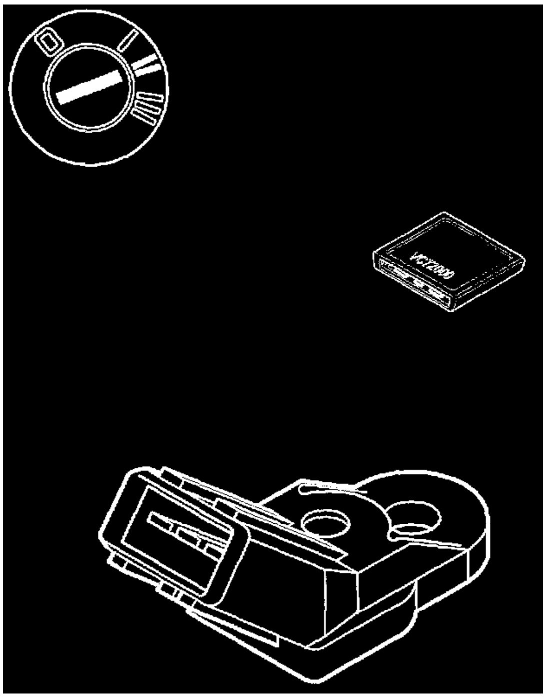
- Remedy as necessary
- Try a atmospheric pressure sensor if no fault is found during the above fault-tracing.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, see **Replacing the air conditioning (A/C) system pressure sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control

Verification

Verification

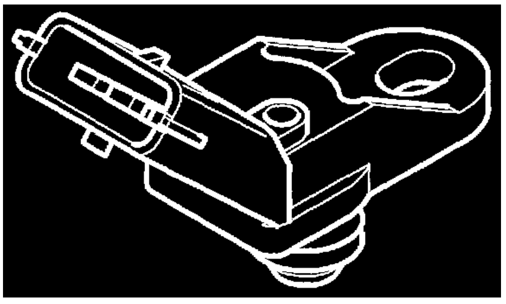


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Ignition on.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-0C is stored if the control module detects that the signal from the boost pressure sensor is too high, too low or missing.

Condition
EVAP diagnostic disabled.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable
- Open-circuit in the ground lead
- Contact resistance in the terminals
- Defective boost pressure sensor.

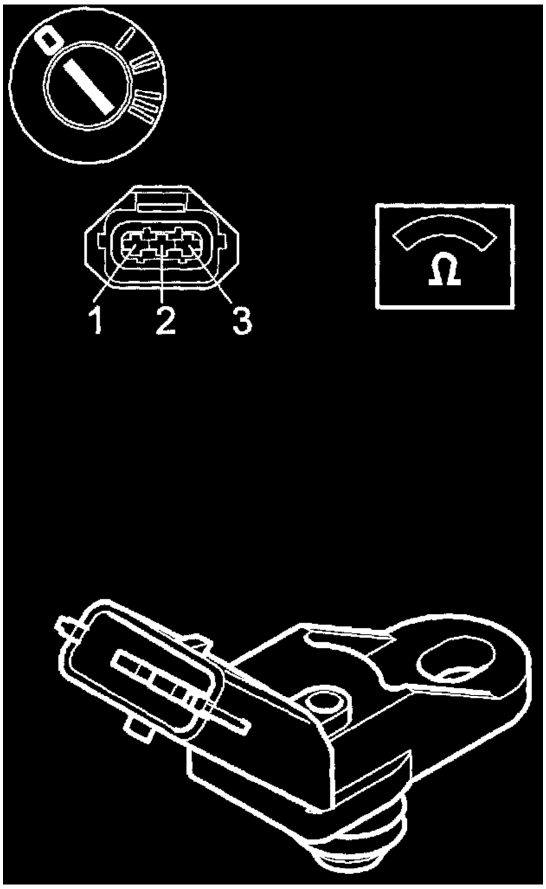
Signal too low:
- Open-circuit in the signal cable
- Short-circuit to ground in the signal cable

- Open-circuit in the power supply cable for the boost pressure sensor
- Contact resistance in the terminals
- Defective boost pressure sensor.

Condition
- Malfunction indicator lamp (MIL) lit.

Signal Too High - Intermittent Fault

Checking Wiring And Connectors



- Ignition off.

Check the boost pressure sensor connector for intermittent contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults** and loose connections according to **Checking wiring and terminals - Intermittent Faults.** Check for damage carefully.

Check the cable between boost pressure sensor terminal 3 and control module terminal 13 for an intermittent short- circuit to supply voltage according to **Checking wiring and terminals - Intermittent Faults** and the cable between boost pressure sensor terminal 2 and ground for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults**

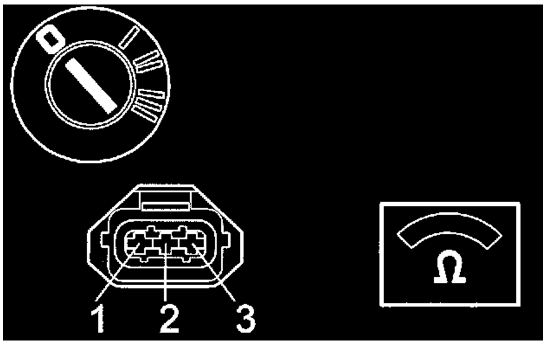
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the boost pressure sensor, see **Replacing the atmospheric pressure sensor.**

Checking the Connectors

Checking The Connectors



- Ignition off
- Check the boost pressure sensor connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.** Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

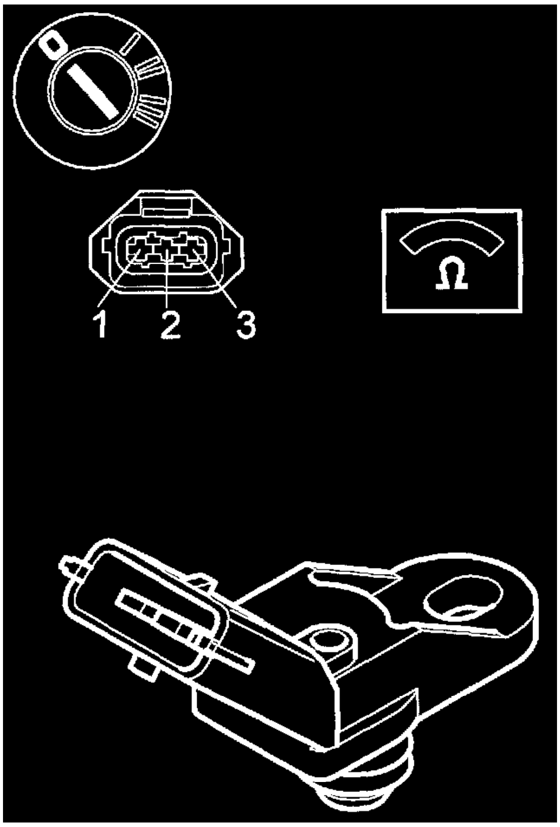
Was a fault detected?

Yes **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0C/Signal Too High - Permanent Fault/Verification

No **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0C/Signal Too High - Permanent Fault/Checking the Cable and Components

Checking the Cable and Components

Checking The Cable And Components



- Ignition off.

Check the cable between the boost pressure sensor terminal 3 and control module terminal 13 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent Faults.**

and the cable between boost pressure sensor terminal 2 and ground for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

If no fault is found during the above fault-tracing, try a new boost pressure sensor according to **Replacing the atmospheric pressure sensor if necessary.**

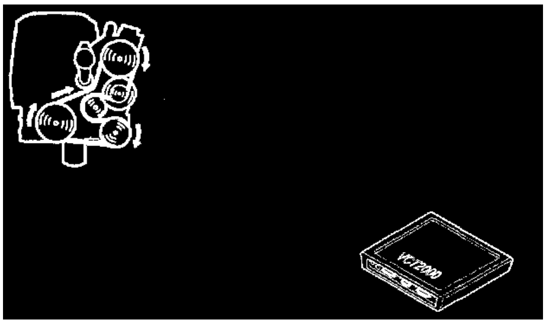
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0C/Signal Too High - Permanent Fault/Verification

Verification

Verification

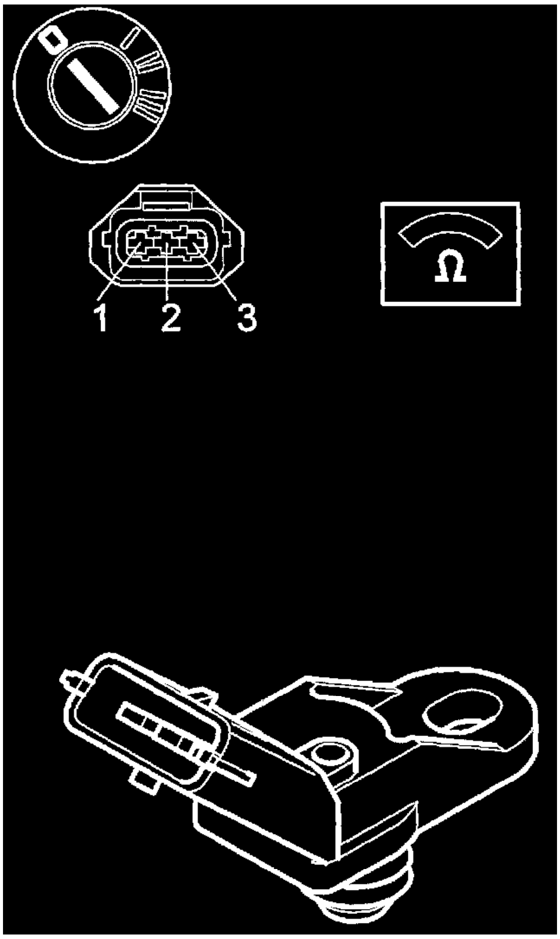


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine above **4000 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Signal Too Low - Intermittent Fault

Checking The Connectors



- Ignition off.

Check the boost pressure sensor connector for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults** and loose connections according to **Checking wiring and terminals - Intermittent Faults.** Check for damage carefully.

Check the signal cable between boost pressure sensor terminal 3 and control module terminal 13. Check the power supply cable between boost pressure sensor terminal 1 and control module terminal 74. Check these cables for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.**

Hint: The boost pressure sensor receives **5 V** from control module terminal 74.

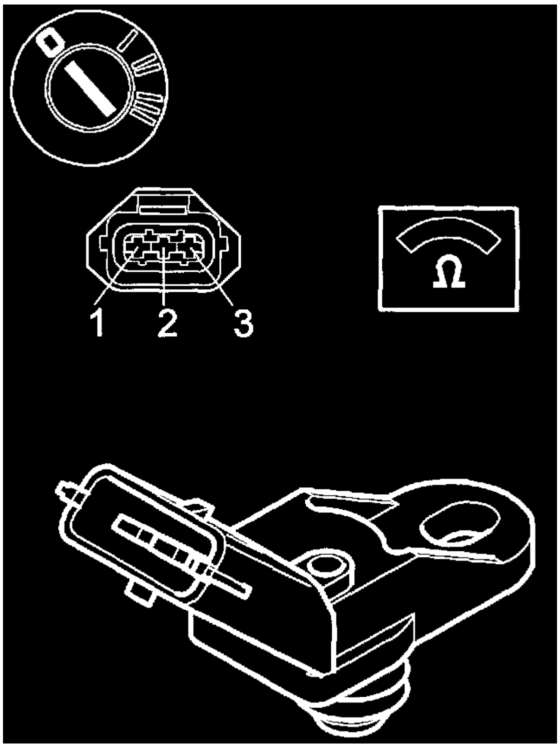
Check the signal cable between boost pressure sensor terminal 3 and control module terminal 13 for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the boost pressure sensor, see **Replacing the atmospheric pressure sensor.**

Checking the Connectors

Checking The Connectors



- Ignition off.

Check the boost pressure sensor connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

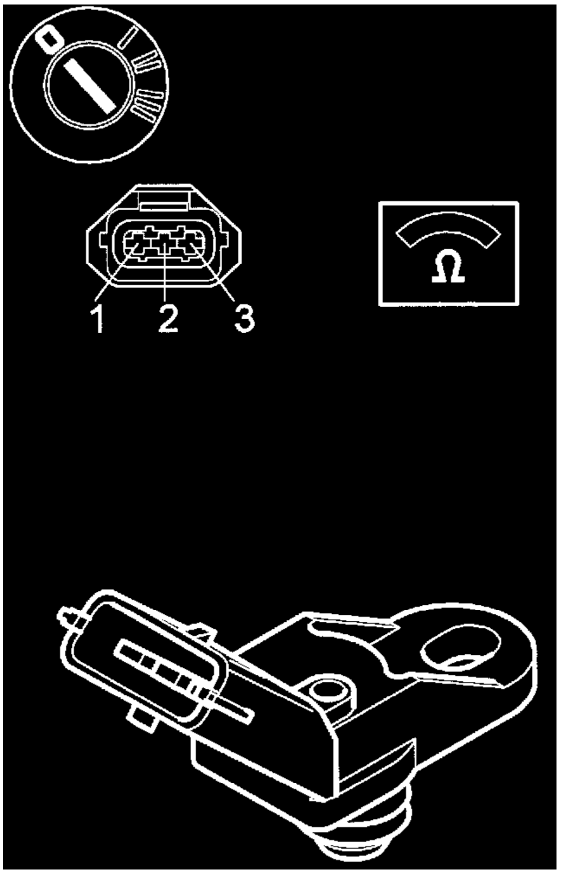
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0C/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0C/Signal Too Low - Permanent Fault/Checking the Cable and Components

Checking the Cable and Components

Checking The Cable And Components



- Ignition off

Check the signal cable between boost pressure sensor terminal 3 and control module terminal 13. Check the power supply cable between boost pressure sensor terminal 1 and control module terminal 74. Check these cables for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

Check boost pressure sensor terminal 3 for a short-circuit to ground according to **Checking wiring and terminals - Permanent Faults.**

Hint: The boost pressure sensor receives **5 V** from control module terminal 74.

If no fault is found during the above fault-tracing, try a new boost pressure sensor according to **Replacing the atmospheric pressure sensor if necessary.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

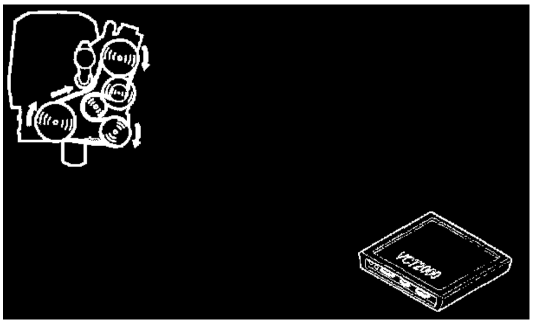
Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0C/Signal Too Low - Permanent Fault/Verification

Verification

Verification

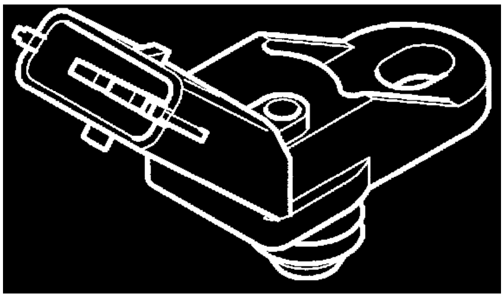


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine above **4000 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-0D is stored (signal too low) if the boost pressure sensor value is lower than the atmospheric pressure sensor value when the ignition is on and the engine is not running. Diagnostic trouble code (DTC) ECM-0D is stored (signal too high) if the boost pressure sensor value is higher than expected when the engine is running.

Condition

The leak diagnostic is disabled.

Possible source

Signal too low:

- Contact resistance in the terminals
- Defective boost pressure sensor.

Signal too high

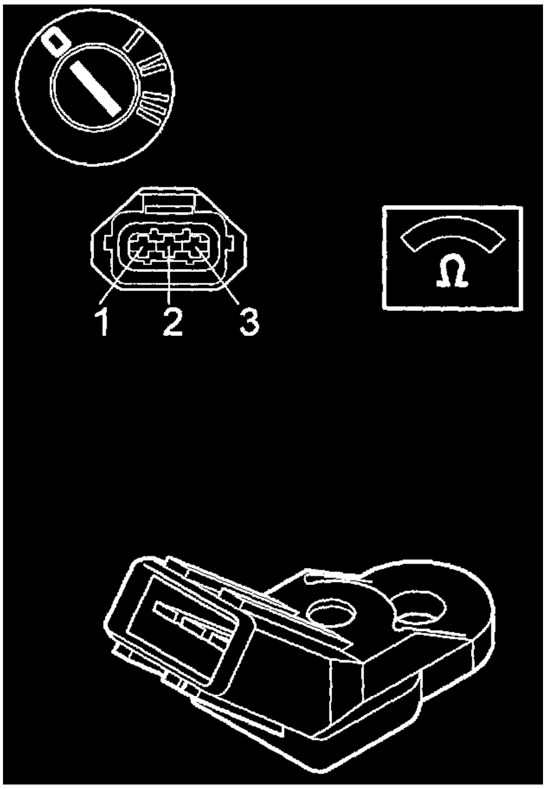
- Contact resistance in the terminals
- Defective boost pressure system
- Defective boost pressure sensor.

Condition

- Malfunction indicator lamp (MIL) lit
- Idle speed too high
- Idle speed too low.

Signal Too High - Intermittent Fault

Checking The Connectors



- Ignition off.

Release the boost pressure control (BPC) valve according to See: Fuel Delivery and Air Induction/Turbocharger/Wastegate Actuator/Testing and Inspection Check that the boost pressure control (BPC) valve does not stick in the closed position.

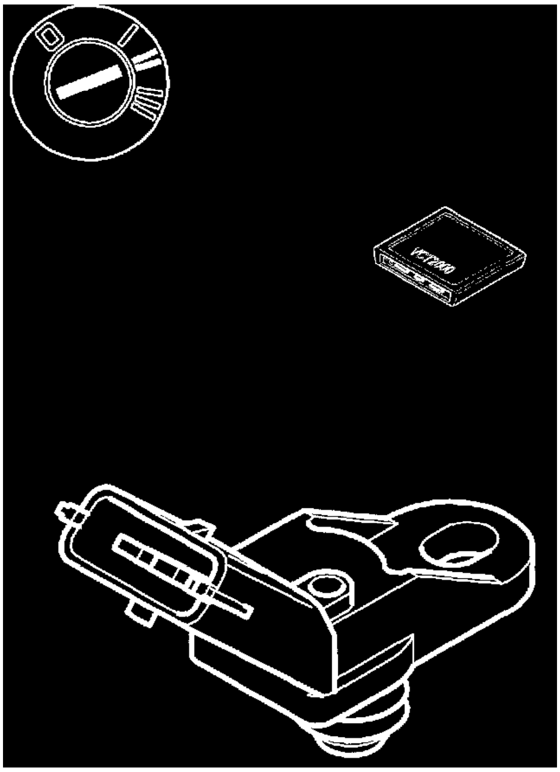
Check the turbocharger (TC) according to See: Fuel Delivery and Air Induction/Turbocharger/Testing and Inspection Check in particular the hoses and the function of the pressure regulator.

Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the boost pressure sensor, see **Replacing the atmospheric pressure sensor.**

Checking the Boost Pressure Sensor Signal - I

Checking The Boost Pressure Sensor Signal



- Ignition on
- Read off the boost pressure sensor and atmospheric pressure sensor values
- Check that the boost pressure sensor value is within **200 mbar** of the atmospheric pressure sensor value. The atmospheric pressure sensor value is used as a reference value for this test.

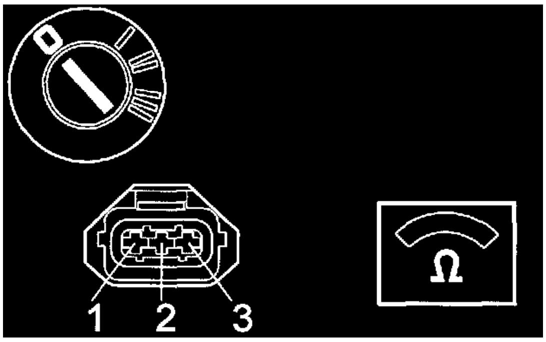
Select one of the following alternatives to continue:
1 - The boost pressure sensor value is more than **200 mbar** higher than the atmospheric pressure sensor value
2 - The boost pressure sensor value is approximately the same as the atmospheric pressure sensor value.

1 **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too High - Permanent Fault/Checking the Wiring

2 **-** This information to be published by O.E. at a later date.

Checking the Wiring

Checking The Wiring



- Ignition off.

Check the boost pressure sensor connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.**

Check the signal cable between boost pressure sensor terminal 3 and control module terminal 13 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent Faults** and the ground lead between boost pressure sensor terminal 2 and control module terminal 73 for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

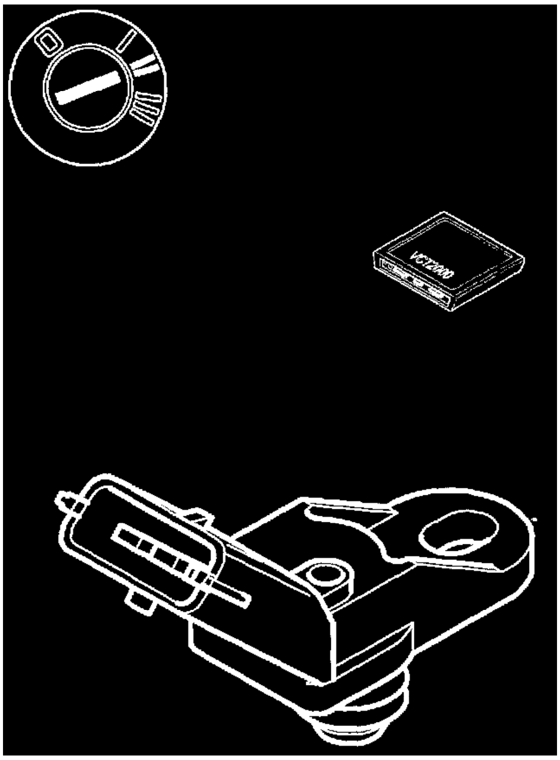
Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too High - Permanent Fault/Checking the Boost Pressure Sensor Signal - II

Checking the Boost Pressure Sensor Signal - II

Checking The Boost Pressure Sensor Signal



- Reinstall the connector
- Ignition on.

Read off the boost pressure sensor and atmospheric pressure sensor values.

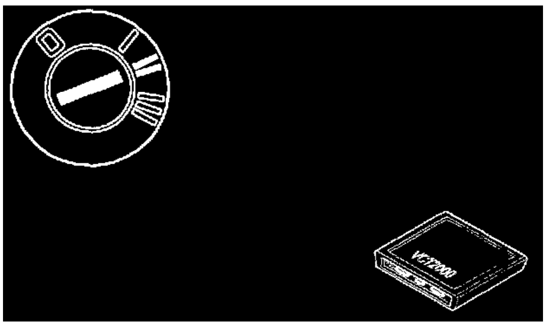
Check that the boost pressure sensor value does not deviate from the atmospheric pressure sensor value by more than **200 mbar**. The atmospheric pressure sensor value is used as a reference value for this test.

Try a new boost pressure sensor if the boost pressure sensor value does not correspond to the atmospheric pressure sensor value to an accuracy of **200 mbar**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too High - Permanent Fault/Verification

Verification

Verification

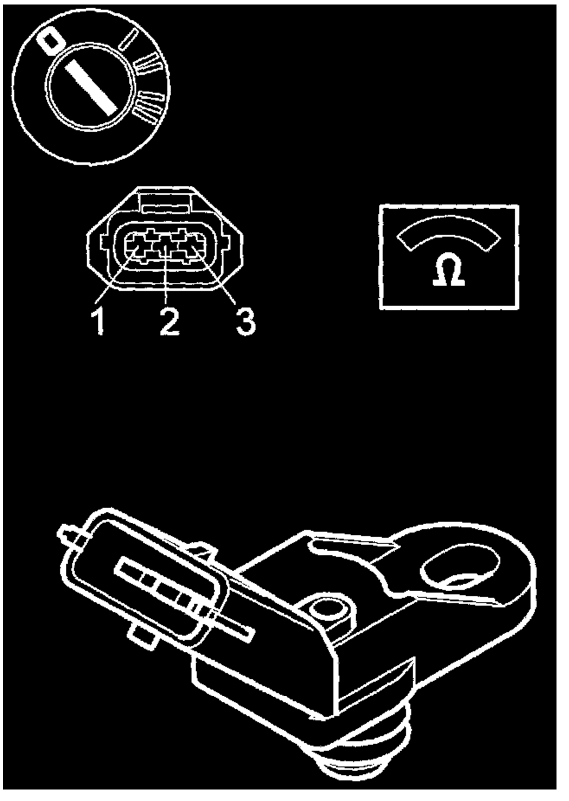


Hint: After carrying out the repair, check that the fault has been remedied.

- Test drive the car with changing throttle opening and at constant throttle opening. This will ensure that the boost pressure system operates throughout the entire range
- Connect the VIDA station
- Ignition on
- Check if the diagnostic trouble code (DTC) status has changed to intermittent. If it has, the fault has been remedied.

Signal Too Low - Intermittent Fault

Checking The Connectors



- Ignition off.

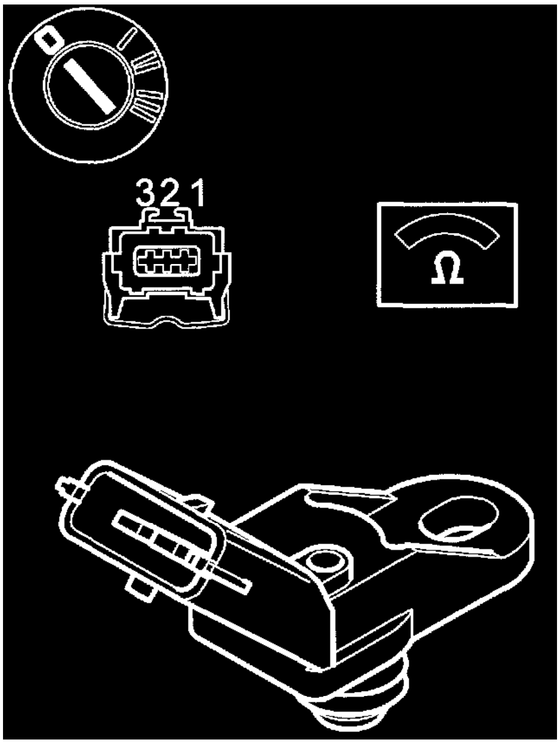
Check the boost pressure sensor and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults** and loose connections according to **Checking wiring and terminals - Intermittent Faults.** Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the boost pressure sensor, see **Replacing the atmospheric pressure sensor.**

Checking Wiring and Connectors

Checking Wiring And Connectors



- Ignition off.

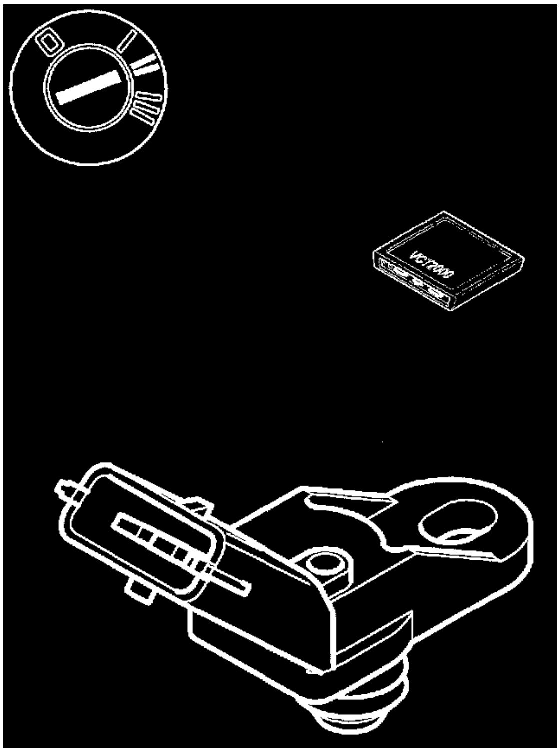
Check the boost pressure sensor and engine control module (ECM) connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too Low - Permanent Fault/Checking the Boost Pressure Sensor Signal - I

Checking the Boost Pressure Sensor Signal - I

Checking The Boost Pressure Sensor Signal



- Reinstall the connector
- Ignition on.

Read off the boost pressure and atmospheric pressure.

Check that the boost pressure sensor value does not deviate from the atmospheric pressure sensor value by more than **200 mbar**. The atmospheric pressure sensor value is used as a reference value for this test.

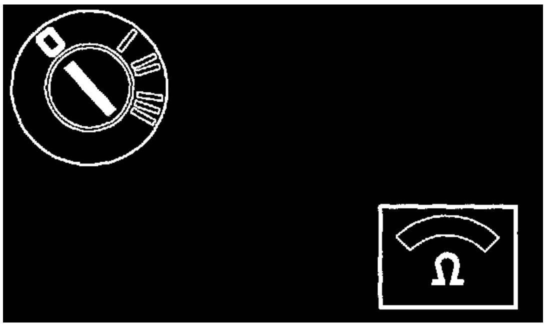
Is the boost pressure sensor value within 200 mbar of the atmospheric pressure sensor value?

Yes - Test Complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too Low - Permanent Fault/Checking the Wiring

Checking the Wiring

Checking The Wiring



- Ignition off.

Check the signal cable between boost pressure sensor connector terminal 3 and control module terminal 13. Check the power supply cable between boost pressure sensor terminal 1 and control module terminal 74. Check these cables for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

Check the boost pressure sensor signal cable terminal 3 to control module terminal 13 for a short-circuit to ground according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

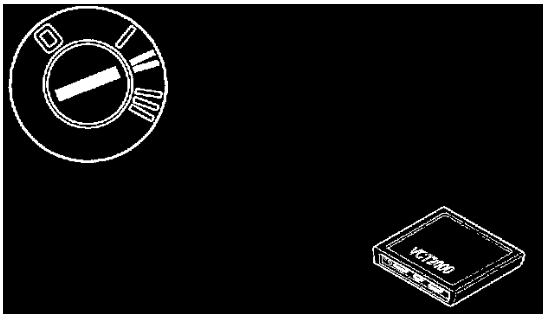
Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too Low - Permanent Fault/Checking the Boost Pressure Sensor Signal - II

Checking the Boost Pressure Sensor Signal - II

Checking The Boost Pressure Sensor Signal



- Reinstall the connector
- Ignition on.

Read off the boost pressure and atmospheric pressure.

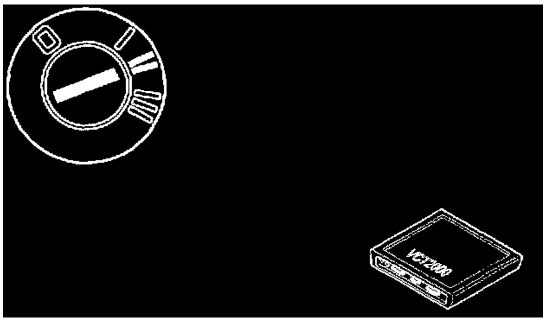
Check that the boost pressure sensor value does not deviate from the atmospheric pressure sensor value by more than **200 mbar**. The atmospheric pressure sensor value is used as a reference value for this test.

Try a new boost pressure sensor if the boost pressure sensor value does not correspond to the atmospheric pressure sensor value.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0D/Signal Too Low - Permanent Fault/Verification

Verification

Verification

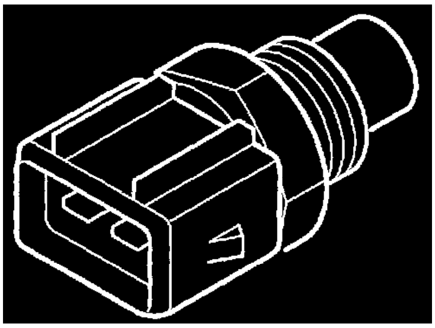


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Ignition on.
- Read off the boost pressure sensor and atmospheric pressure sensor values by clicking on the VCT-2000 symbol
- Compare the boost pressure sensor and atmospheric pressure sensor values. The atmospheric pressure sensor value is used as a reference value for this test

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-0F is stored if the control module receives a signal from the intake air temperature (IAT) sensor which corresponds to a temperature lower than **-48°C** (low signal) or higher than **+142°C** (high signal).

Condition
- When driving: latest correct values
- Adaptation values not updated

Possible source

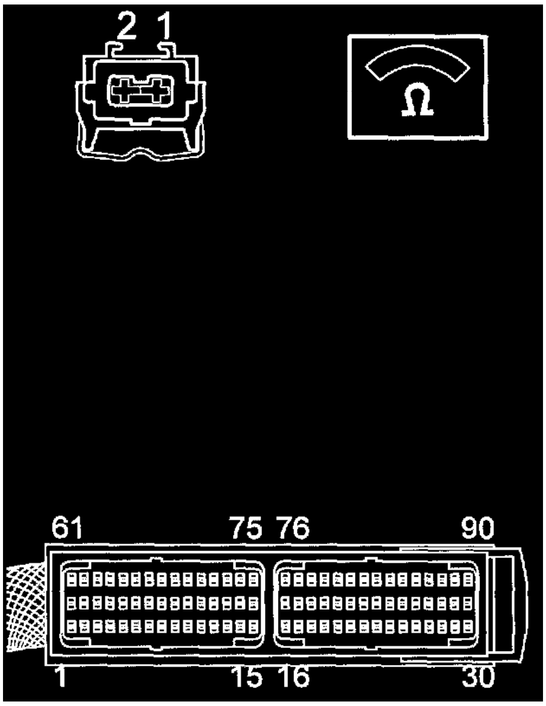
Signal too high:
- Short-circuit to supply voltage in the signal cable
- Open-circuit in the signal cable or in the ground lead
- Faulty intake air temperature (IAT) sensor.

Signal too low:
- Short-circuit to ground in the signal cable
- Faulty intake air temperature (IAT) sensor.

Condition
- Malfunction indicator lamp (MIL) lit
- No leak diagnostic.

Signal Too High - Intermittent Fault

Checking Wiring



Check the engine Control module (ECM) and intake air temperature (IAT) sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check in particular for damage, or loose terminal pins.

Check the signal cable between engine control module (ECM) terminal 48 and intake air temperature (IAT) sensor terminal 1 for an intermittent short-circuit to Supply voltage. Remedy according to **Checking wiring and terminals - Intermittent Faults** and for an intermittent open-circuit **Checking wiring and terminals - Intermittent Faults.**

Check the ground lead between engine control module (ECM) terminal 79 and intake air temperature (IAT) sensor terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

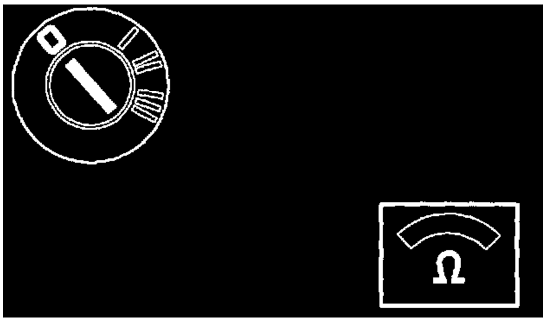
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To replace the intake air temperature (IAT) sensor, see **Replacing the intake air temperature sensor**
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connector

Checking The Connector



- Ignition off
- Intake air temperature (IAT) sensor connector disconnected.

Check the connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

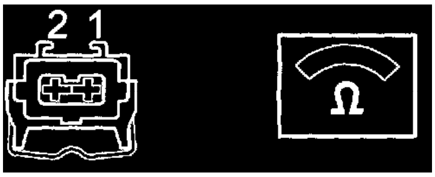
Were any faults found?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Checking the Ground Lead

Checking the Ground Lead

Checking The Ground Lead



Connect an ohmmeter between the intake air temperature (IAT) sensor connector terminal #2 (control module side) and ground.

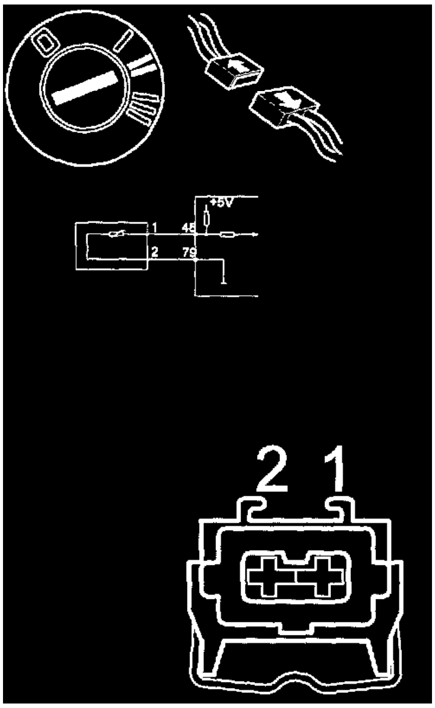
The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Checking Wiring and Terminals - I

Checking the Signal Cable

Checking The Signal Cable



- Ignition on
- Disconnect the intake air temperature sensor connector.

Connect a voltmeter between the intake air temperature (IAT) sensor connector terminal #1 (control module side) and ground.

The voltmeter should read approximately **5 V**.
- more than **5 V**
- approximately **5 V**
- **0 V**.

Select one of the above options:

1 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal

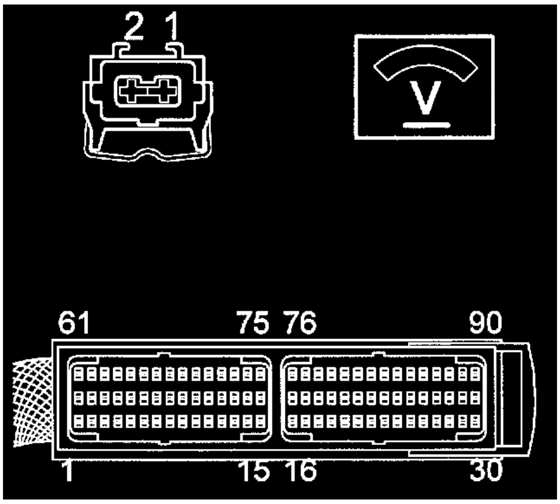
Too High - Permanent Fault/Checking Wiring and Terminals - I

2 **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Defective Intake Air Temperature (IAT) Sensor

3 **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Checking Wiring and Terminals - II

Checking Wiring and Terminals - I

Checking Wiring And Terminals



Check the cable between intake air temperature (IAT) sensor connector terminal #1 (engine control module (ECM) side) and engine control module (ECM) terminal #48. Check for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Verification

Defective Intake Air Temperature (IAT) Sensor

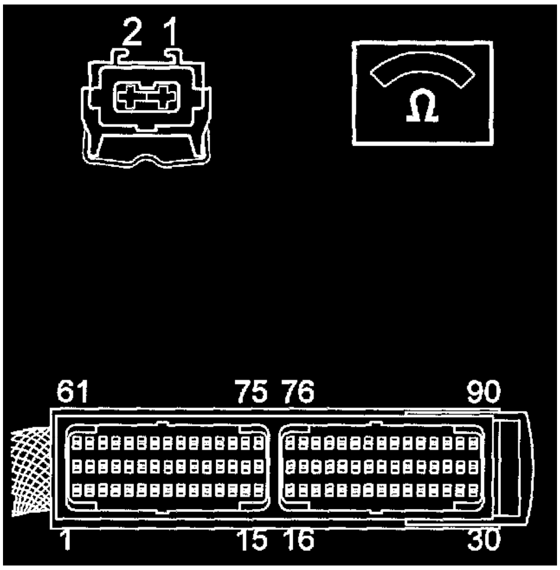
Defective Intake Air Temperature (IAT) Sensor

Try a new intake air temperature (IAT) sensor according to **Replacing the intake air temperature sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Verification

Checking Wiring and Terminals - II

Checking Wiring And Terminals



Check the cable between intake air temperature (IAT) sensor connector terminal #1 (engine control module (ECM) side) and engine control module (ECM) terminal #48. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

Check the cable between intake air temperature (IAT) sensor connector terminal #2 (engine control module (ECM) side) and engine control module (ECM) terminal #79. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

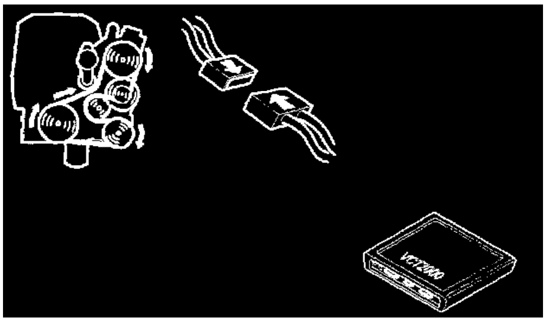
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

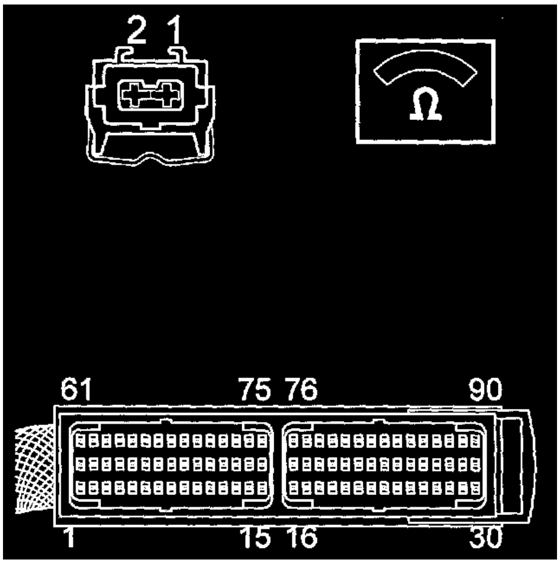
- Reconnect the connectors, reinstall components etc.
- Start the engine. Let the engine idle.

Read off diagnostic trouble codes (DTCs).

Check that the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Signal Too Low - Intermittent Fault

Checking Wiring



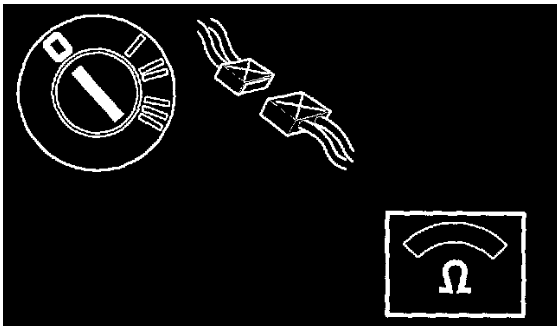
Check the signal cable between the engine control module (ECM) terminal 48 and the intake air temperature (IAT) sensor terminal 1 for an intermittent short-circuit to ground and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the mass air flow (MAF) sensor, see **Replacing the intake air temperature sensor.**

Checking the Connector

Checking The Connector



- Ignition off
- Intake air temperature (IAT) sensor connector disconnected.

Connect an ohmmeter between intake air temperature (IAT) sensor connector terminal #1 (control module side) and ground.

The ohmmeter should read 3,000-4,500 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too Low - Permanent Fault/Defective Intake Air Temperature (IAT) Sensor

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too Low - Permanent Fault/Checking the Cable

Defective Intake Air Temperature (IAT) Sensor

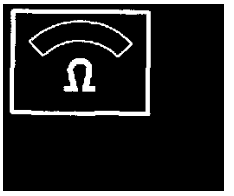
Defective Intake Air Temperature (IAT) Sensor

Try a new intake air temperature (IAT) sensor according to **Replacing the intake air temperature sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too High - Permanent Fault/Verification

Checking the Cable

Checking The Cable



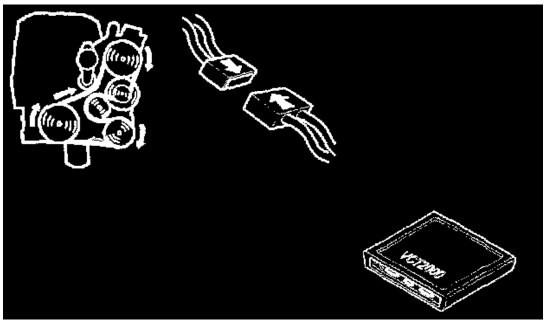
Check the cable between intake air temperature (IAT) sensor connector terminal #1 and engine control module (ECM) terminal #48. Check for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-0F/Signal Too Low - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

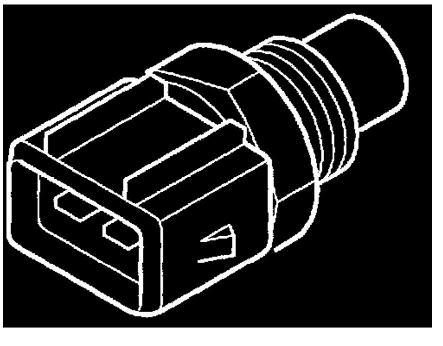
- Reconnect the connectors, reinstall components etc.
- Start the engine. Let the engine idle.

Read off diagnostic trouble codes (DTCs).

Check that the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-10 is stored if the control module detects changes in the air temperature within the normal operating range of the intake air temperature (IAT) sensor that are too rapid.

Condition

- The Wastegate diagnostic is disabled
- The EVAP diagnostic is disabled
- Limited EVAP control
- No fuel trim adaptation
- No idling speed adaptation.

Possible source

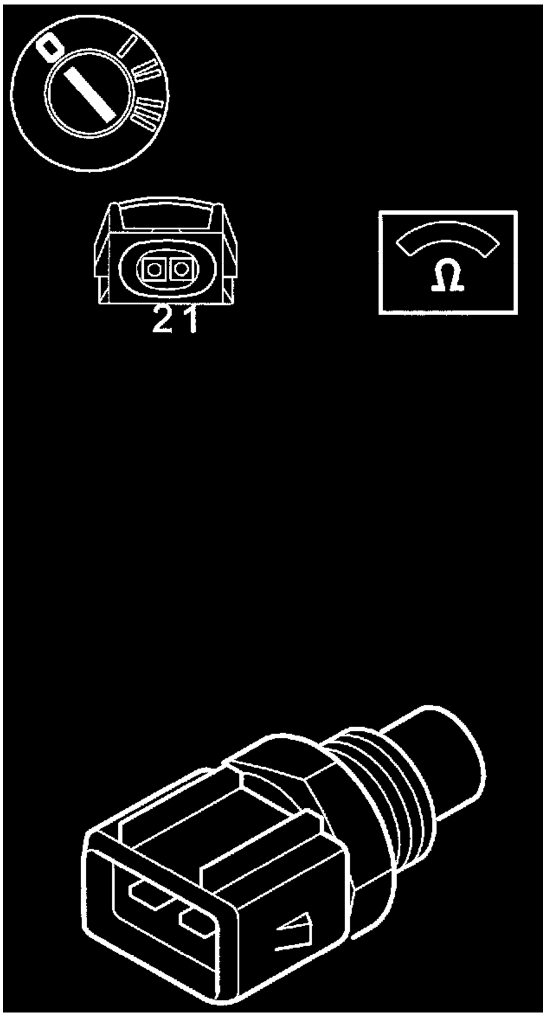
- Contact resistance in the terminals
- Defective intake air temperature (IAT) sensor
- Intermittent open-circuit, short-circuit to ground or short-circuit to supply voltage in the signal cable
- Intermittent open-circuit or short-circuit to supply voltage in the ground lead.

Condition

- Malfunction indicator lamp (MIL) lit
- High fuel consumption
- High idling speed
- Low idling speed.

Faulty Signal - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the intake air temperature (IAT) sensor and engine control module (ECM) connectors for loose connections according to **Checking wiring and terminals - Intermittent Faults** and contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults**
- Check the signal cable between engine control module (ECM) terminal 48 and intake air temperature (IAT) sensor terminal 1 for a short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults**
- Check the ground lead between intake air temperature (IAT) sensor terminal 2 and engine control module (ECM) terminal 79 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults**
- Check the signal cable between intake air temperature (IAT) sensor terminal 1 and engine control module (ECM) terminal 48. Check the cable between intake air temperature (IAT) sensor terminal 2 and engine control module (ECM) terminal 79. Check these cables for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent Faults**
- Remedy as necessary

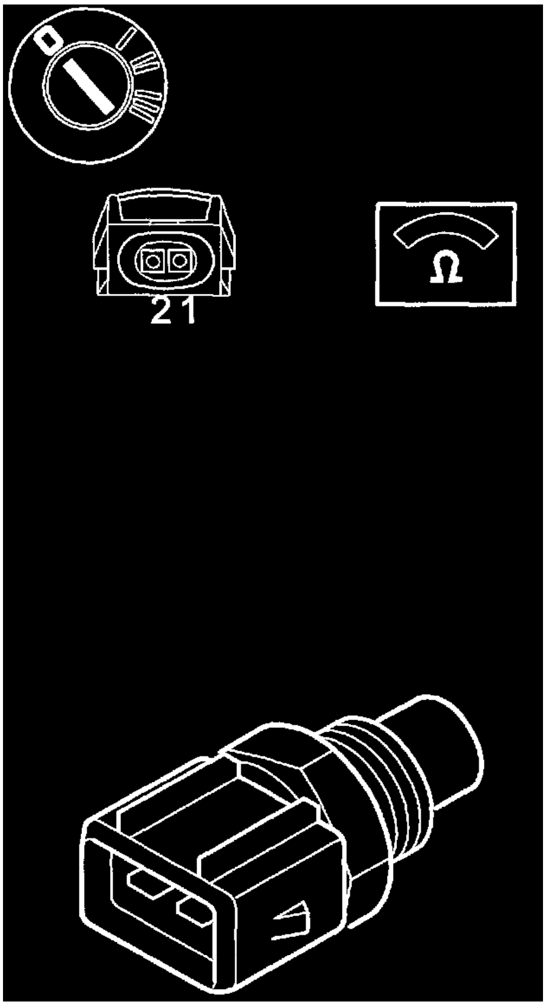
- Try a new intake air temperature (IAT) sensor if no fault is found during the above fault-tracing.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Faulty Signal - Permanent Fault

Checking Wiring And Connectors



- Ignition off

- Check the intake air temperature (IAT) sensor and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults**

- Check the signal cable between engine control module (ECM) terminal #48 and intake air temperature (IAT) sensor terminal #1. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent Faults**

- Check the ground lead between intake air temperature (IAT) sensor terminal #2 and engine control module (ECM) terminal # 79. Check for an intermittent open-circuit according to **Checking wiring and terminals - Permanent Faults**

- Check the signal cable between intake air temperature (IAT) sensor terminal #1 and engine control module (ECM) terminal #48. Check the ground lead between intake air temperature (IAT) sensor terminal #2 and engine control module (ECM) terminal # 79. Check these cables for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Permanent Faults**

- Remedy as necessary

- Try a new intake air temperature (IAT) sensor if no fault is found during the above fault-tracing.

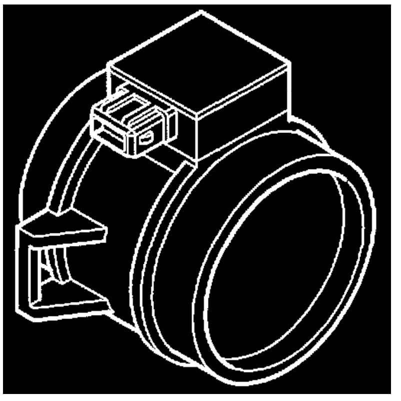
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-13 is stored if the control module detects that the signal from the mass air flow (MAF) sensor is too high or too low.

Condition

- Initial boost pressure
- No idle air trim adaptation
- No long-term fuel trim
- No three-way catalytic converter (TWC) diagnostic
- Limited EVAP control
- The boost pressure sensor and the intake air temperature (IAT) sensor are used to calculate the mass air flow.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Open-circuit in the ground lead
- Faulty mass air flow (MAF) sensor.

Signal too low:

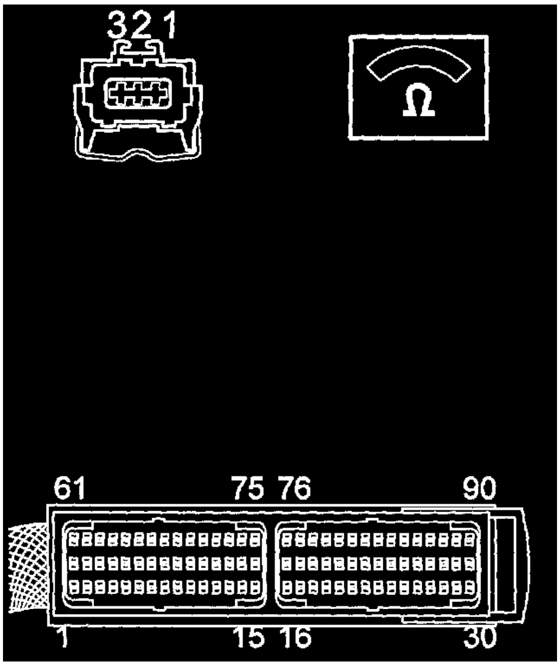
- Short-circuit to ground in signal cable
- Open-circuit in the signal cable or the power supply
- Air leakage in the intake system
- Faulty mass air flow (MAF) sensor
- Faulty idle air control (IAC) system.

Condition

- High idling speed
- Low idling speed
- Malfunction indicator lamp (MIL) lit.

Signal Too High - Intermittent Fault

Checking Wiring



Check the engine Control module (ECM) and mass air flow (MAF) sensor connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults**

Check in particular for damage or loose terminal pins.

Check the signal cable between engine control module (ECM) terminal #16 and mass air flow (MAF) sensor terminal #2. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Check the ground lead between engine control module (ECM) terminal #15 and mass air flow (MAF) sensor terminal #1. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

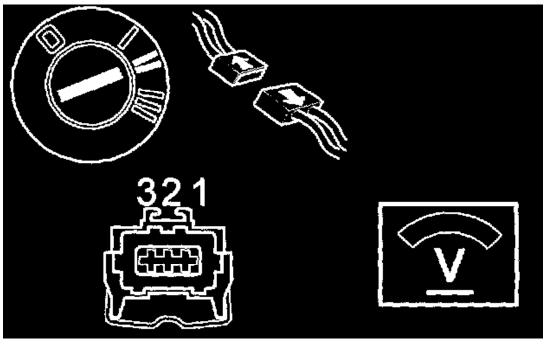
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Voltage

Checking The Voltage



- Ignition off
- Disconnect the mass air flow (MAF) sensor connector
- Ignition on.

Connect a voltmeter between mass air flow (MAF) sensor connector terminal #2 (control module side) and ground.

The voltmeter should read 0 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too High - Permanent Fault/Checking the Ground Lead

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too High - Permanent Fault/Checking Wiring and Terminals

Checking the Ground Lead

Checking The Ground Lead

Connect a voltmeter between mass air flow (MAF) sensor connector terminal #1 (engine control module (ECM) side) and ground.

The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too High - Permanent Fault/Defective Mass Air Flow (MAF) Sensor

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too High - Permanent Fault/Checking Wiring and Terminals

Defective Mass Air Flow (MAF) Sensor

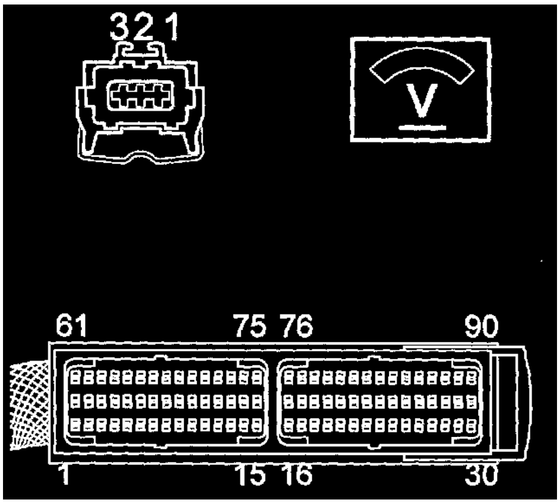
Defective Mass Air Flow (MAF) Sensor

Try a new mass air flow (MAF) sensor according to **Replacing the mass air flow sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too High - Permanent Fault/Verification

Checking Wiring and Terminals

Checking Wiring And Terminals



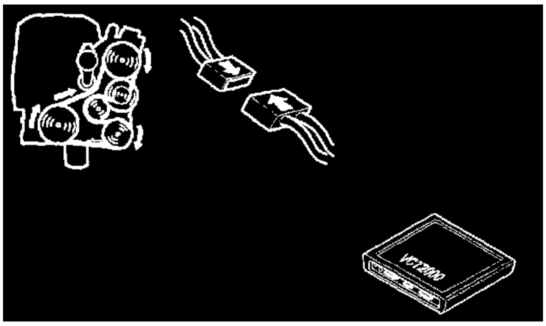
Check the cable between mass air flow (MAF) sensor connector terminal #2 (engine control module (ECM) side) and engine control module (ECM) terminal #15. Check for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too High - Permanent Fault/Verification

Verification

Verification



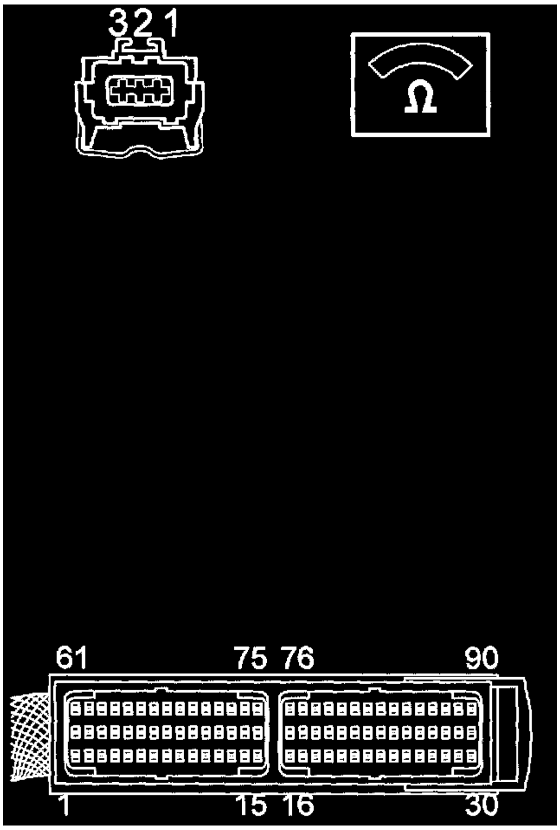
- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Start the engine. Let the engine run until it reaches operating temperature.

Read off the MAF parameter.

The value should be **8-13 kg/h** when idling. It should increase with throttle opening.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the engine Control module (ECM) and mass air flow (MAF) sensor connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults**

Check in particular for damage or loose terminal pins. Check the signal cable between engine control module (ECM) terminal #16 and mass air flow (MAF) sensor terminal #2. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Check the power supply cable between mass air flow (MAF) sensor terminal #3 and system relay (2/14) terminal #3. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

The supply voltage should be approximately battery voltage when the system relay is activated.

Check that the idling system air ducts are not blocked.

Hint: If there is a mechanical defect in the idle air control (IAC) valve the air flow may be hindered by blockages in the idling system air ducts.

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

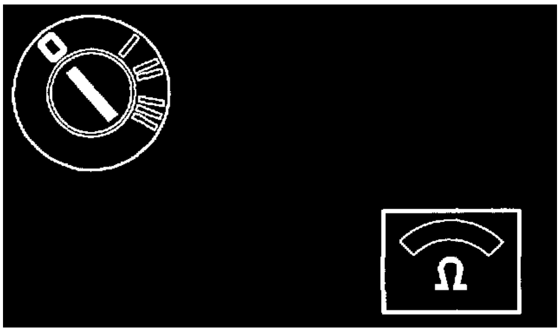
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the mass air flow (MAF) sensor, see **Replacing the mass air flow (MAF) sensor**
- To replace the idle air control (IAC) valve, see **Replacing the idle air control (IAC) valve.**

Checking the Connector

Checking The Connector



- Ignition off
- Disconnect the mass air flow (MAF) sensor connector.

Check the connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.** Remedy as necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

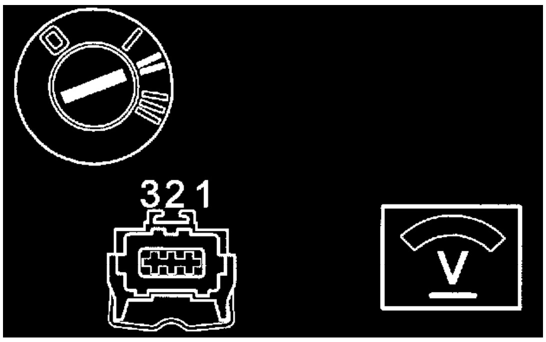
Was a fault detected?

Yes **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Verification

No **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Checking the Power Cable

Checking the Power Cable

Checking The Power Cable



- Ignition off
- Mass air flow (MAF) sensor connector disconnected
- Ignition on.

Connect a voltmeter between mass air flow (MAF) sensor connector terminal #3 (control module side) and ground.

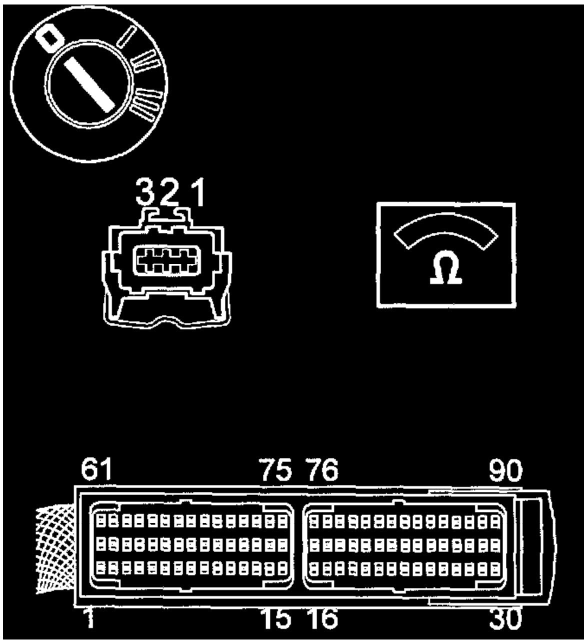
The voltmeter must display battery voltage for 2 seconds immediately after the ignition is switched on.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Checking Wiring and Terminals

Checking the Signal Cable

Checking The Signal Cable



- Ignition off.

Check the cable between mass air flow (MAF) sensor connector terminal #2 (engine control module (ECM) side) and engine control module (ECM) terminal #16. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.** Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Checking Intake System

Checking Intake System

Checking Intake System

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Defective Mass Air Flow (MAF) Sensor

Defective Mass Air Flow (MAF) Sensor

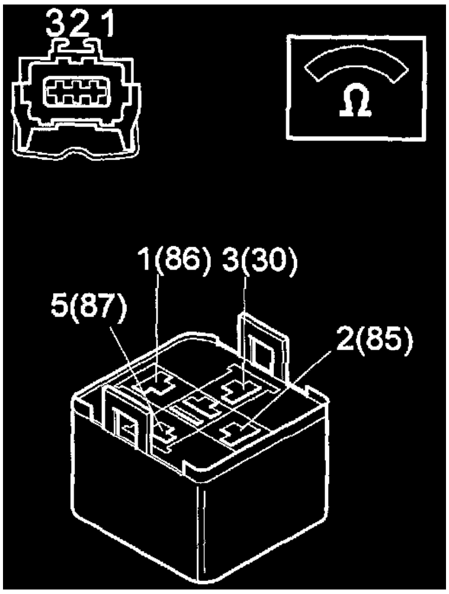
Defective Mass Air Flow (MAF) Sensor

Try a new mass air flow (MAF) sensor according to **Replacing the mass air flow (MAF) sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Verification

Checking Wiring and Terminals

Checking Wiring And Terminals



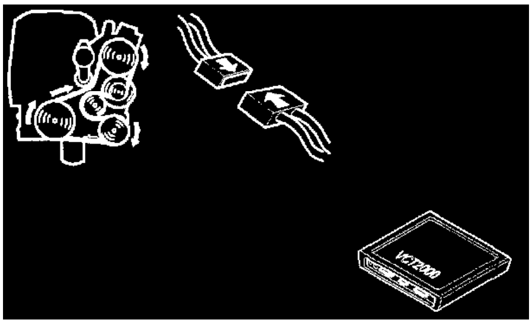
Check the cable between mass air flow (MAF) sensor connector terminal #3 (engine control module (ECM) side) and system relay 2/14 base terminal #5 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-13/Signal Too Low - Permanent Fault/Verification

Verification

Verification



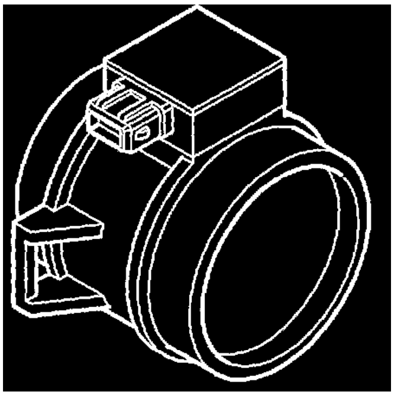
- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Start the engine. Let the engine run until it reaches operating temperature.

Read off the MAFH parameter.

The value should be **8-13 kg/h** when idling. It should increase with throttle opening.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The control module calculates a value for the mass air flow based on the signal from the boost pressure sensor and the intake air temperature (IAT) sensor. The control module compares the calculated value with the signal from the mass air flow (MAF) sensor. Diagnostic trouble code (DTC) ECM-14 is stored if the signal from the mass air flow (MAF) sensor does not correspond with the calculated value.

Condition

- The fuel injection system diagnostics are disabled
- The control module calculates the mass air flow using the boost pressure sensor and the intake air temperature (IAT) sensor.

Possible source

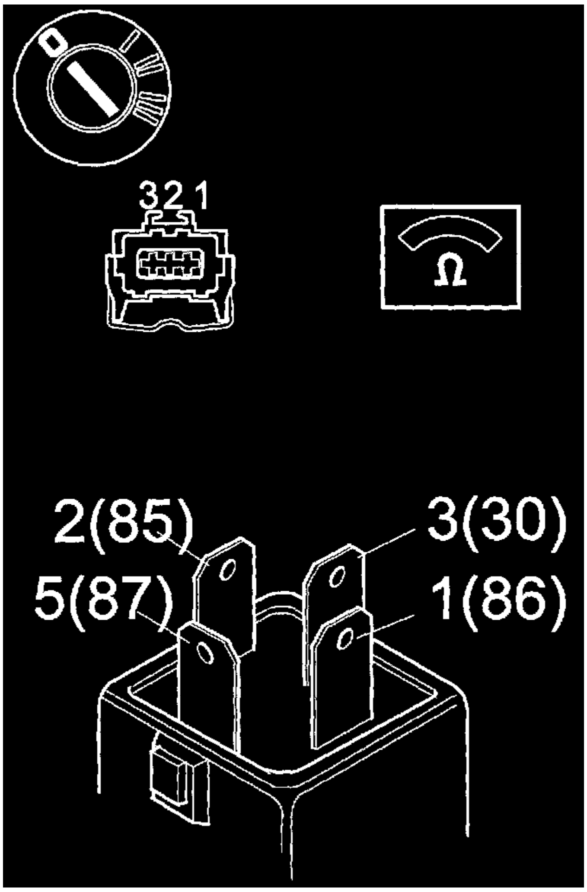
- Contact resistance in the terminals
- Air leakage in the intake system
- Defective mass air flow (MAF) sensor.

Condition

- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Checking Wiring And Connectors



- Ignition off

- Check the connectors for the control module, system relay and mass air flow (MAF) sensor. Check the connections visually according to

Checking wiring and terminals - Intermittent Faults. Check for intermittent contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

- Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

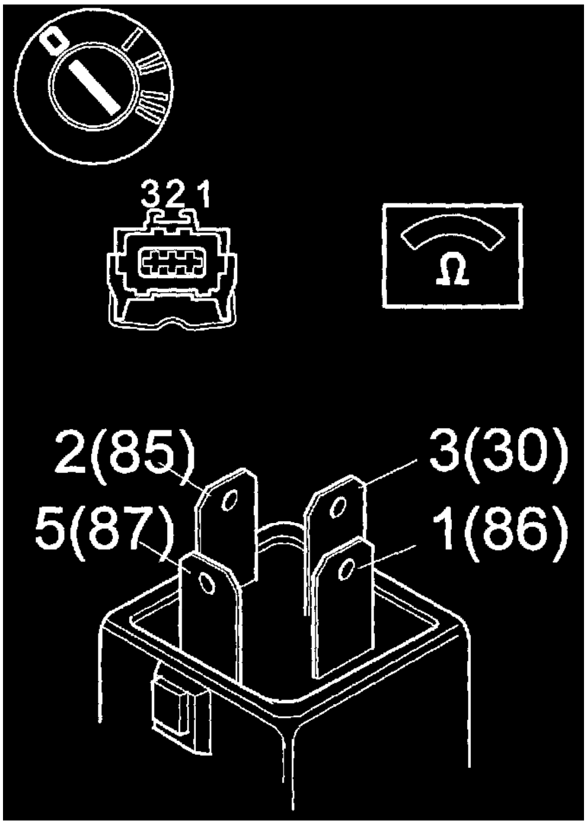
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information:
- To access the engine control module (ECM), see **Replacing the engine control module (ECM)**
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the mass air flow (MAF) sensor, see **Replacing the mass air flow (MAF) sensor.**

Faulty Signal - Permanent Fault

Checking Wiring And Connectors

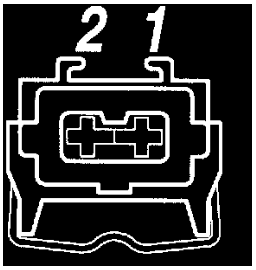


- Ignition off
- Check the mass air flow (MAF) sensor, the system relay and engine control module (ECM) connectors. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Other information
- To access the engine control module (ECM), see **Replacing the engine control module (ECM)**
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-15 is stored if the engine coolant temperature (ECT) sensor circuit is short-circuited to ground or voltage or if there is an open-circuit in the circuit.

Condition

- The engine coolant temperature (ECT) is calculated theoretically after start
- Initial boost pressure
- The A/C is switched off
- No heated oxygen sensor (HO2S) diagnostics
- No idle air trim adaptation
- No leak diagnostic.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Open-circuit in the signal cable or ground lead
- Faulty engine coolant temperature (ECT) sensor
- Contact resistance and oxidation.

Signal too low:

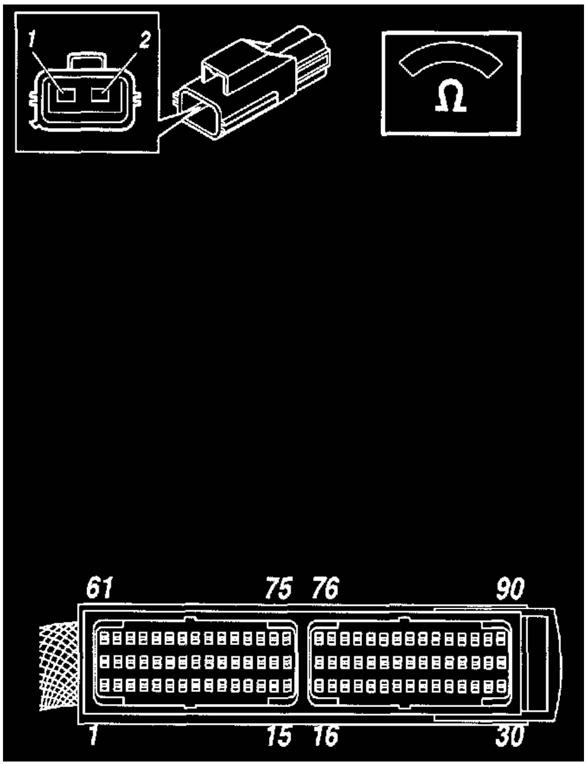
- Short-circuit to ground in signal cable
- Faulty engine coolant temperature (ECT) sensor.

Condition

- Difficult to start
- The engine cooling fan (FC) operates constantly
- Low idling speed
- High idling speed
- Malfunction indicator lamp (MIL) lit.

Signal Too High - Intermittent Fault

Checking Wiring



Check the engine control module (ECM) and engine coolant temperature (ECT) sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check in particular for damage or loose terminal pins.

Check the signal cable between engine control module (ECM) terminal #47 and engine temperature (ECT) sensor terminal #1. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent Faults.** Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Check the ground lead between engine control module (ECM) terminal #73 and engine coolant temperature (ECT) sensor terminal #2. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

If no faults are found in the above fault-tracing, try a new engine coolant temperature (ECT) sensor. See **Replacing the engine coolant temperature (ECT) sensor.**

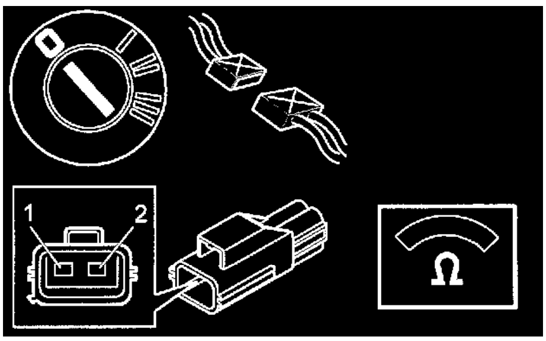
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connector

Checking The Connector



- Ignition off
- Engine coolant temperature (ECT) sensor connector disconnected.

Check the connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

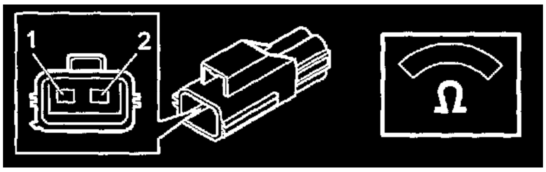
Were any faults found?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Checking the Ground Lead

Checking the Ground Lead

Checking The Ground Lead



Connect an ohmmeter between engine coolant temperature (ECT) sensor connector terminal #2 (control module side) and ground.

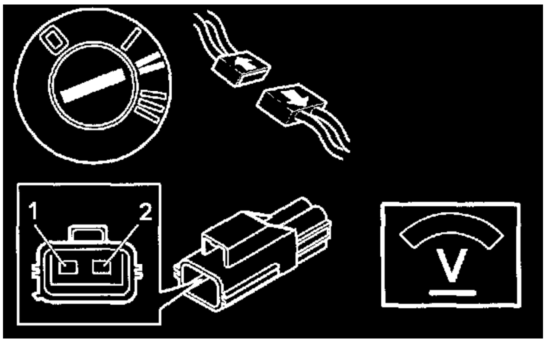
The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Checking Wiring and Terminals - I

Checking the Signal Cable

Checking The Signal Cable



- Ignition on
- Disconnect the intake air temperature sensor connector. Connect a voltmeter between engine coolant temperature (ECT) sensor connector terminal #1 (control module side) and ground.

The voltmeter should read approximately **5 V**.
- more than **5 V**
- approximately **5 V**
- **0 V**.

Select one of the above options:

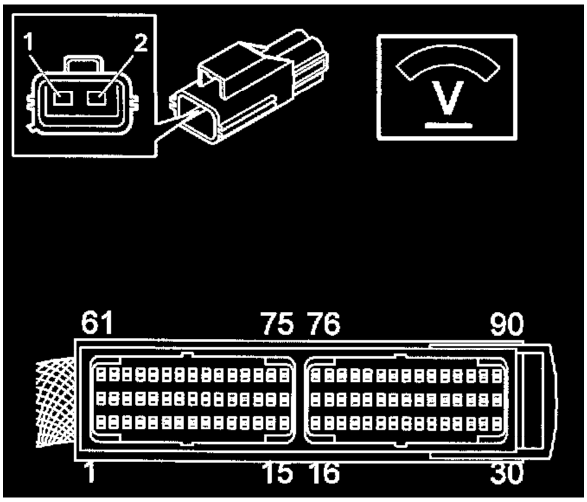
1 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Checking Wiring and Terminals - I

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Defective Engine Coolant Temperature (ECT) Sensor

3 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Checking Wiring and Terminals - II

Checking Wiring and Terminals - I

Checking Wiring And Terminals



Check the cable between engine coolant temperature (ECT) sensor connector terminal #1 (engine control module (ECM) side) and engine control module (ECM) terminal #47. Check for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Verification

Defective Engine Coolant Temperature (ECT) Sensor

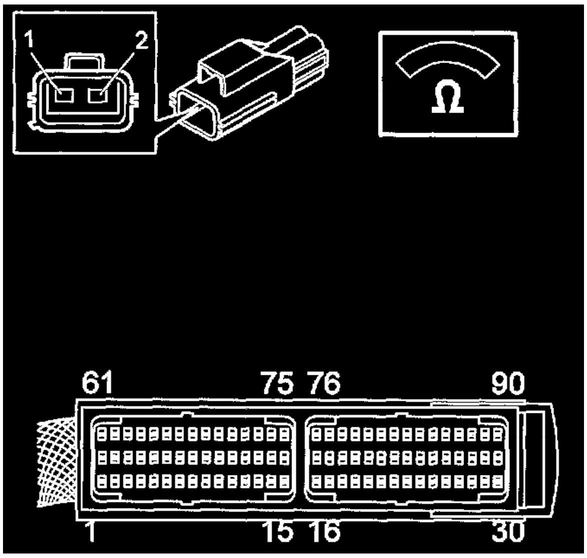
Defective Engine Coolant Temperature (ECT) Sensor

Try a new engine coolant temperature (ECT) sensor according to **Replacing the engine coolant temperature (ECT) sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Verification

Checking Wiring and Terminals - II

Checking Wiring And Terminals



Check the cable between engine coolant temperature (ECT) sensor connector terminal #1 (engine control module (ECM) side) and engine control module (ECM) terminal #47. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

Check the cable between engine coolant temperature (ECT) sensor connector terminal #2 (engine control module (ECM) side) and engine control module (ECM) terminal #73. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

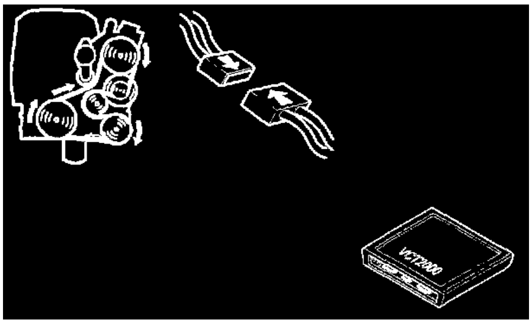
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too High - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

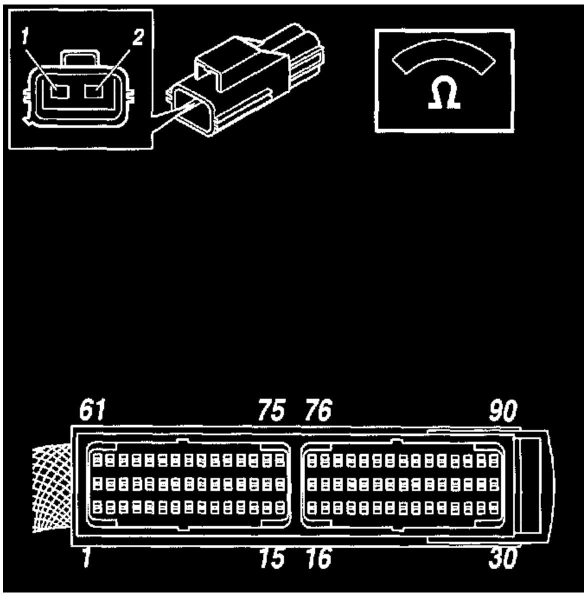
- Reconnect the connectors, reinstall components etc.
- Start the engine. Let the engine idle.

Read off diagnostic trouble codes (DTCs).

Check that the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the signal cable between engine control module (ECM) terminal #47 and engine coolant temperature (ECT) sensor terminal #1. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Try a new engine coolant temperature (ECT) sensor according to **Replacing the engine coolant temperature (ECT) sensor.**

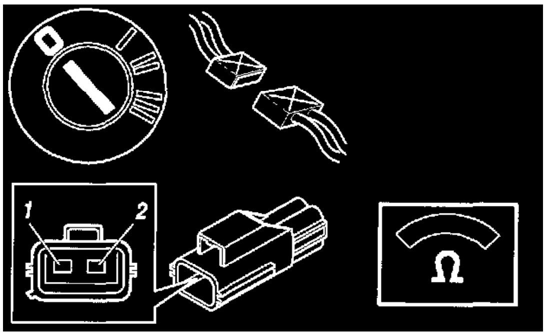
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Engine coolant temperature (ECT) sensor connector disconnected.

Connect an ohmmeter between engine coolant temperature (ECT) sensor connector terminal #1 (control module side) and ground.

The ohmmeter must read more than 1000 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too Low - Permanent Fault/Defective Engine Coolant Temperature (ECT) Sensor

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too Low - Permanent Fault/Checking the Cable

Defective Engine Coolant Temperature (ECT) Sensor

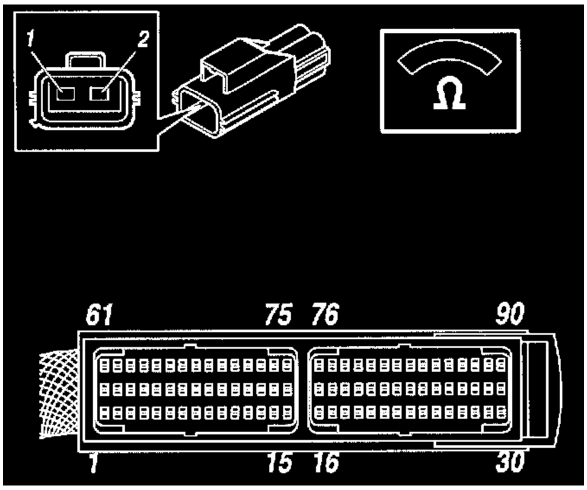
Defective Engine Coolant Temperature (ECT) Sensor

Try a new engine coolant temperature (ECT) sensor according to **Replacing the engine coolant temperature (ECT) sensor.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too Low - Permanent Fault/Verification

Checking the Cable

Checking The Cable



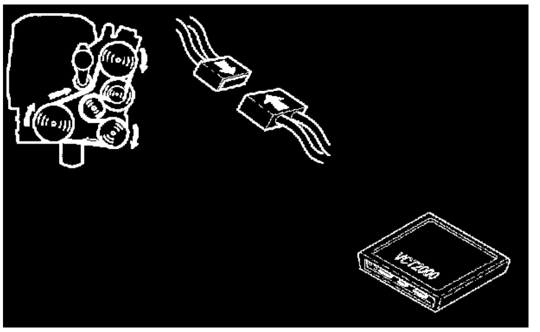
Check the cable between engine coolant temperature sensor connector terminal #1 and engine control module (ECM) terminal #47. Check for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-15/Signal Too Low - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

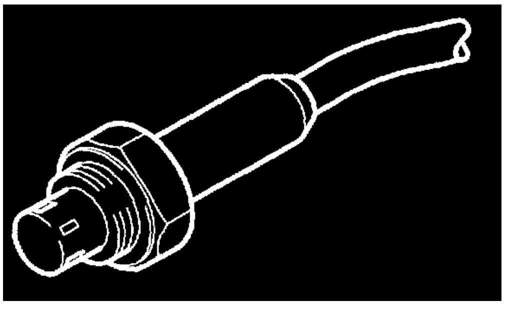
- Reconnect the connectors, reinstall components etc.
- Start the engine. Let the engine idle.

Read off diagnostic trouble codes (DTCs).

Check that the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code ECM-16 is stored if the heated oxygen sensor (HO2S) signal cable short-circuits to ground/voltage or if there is an open-circuit in the circuit that the control module has interpreted as a fault.

Condition

Fuel trim disabled.

Possible source

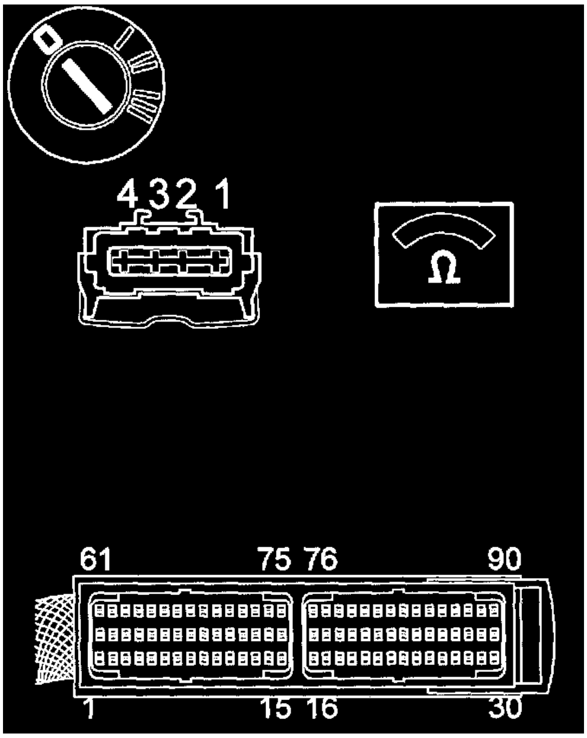
Signal too high:
- Short-circuit to supply voltage in the signal cable.
- Faulty heated oxygen sensor (HO2S).

Signal too low:
- Short-circuit to ground in the signal cable.
- Faulty heated oxygen sensor (HO2S).
- Open-circuit in the signal cable.

Condition
- None.

Signal Missing - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the front heated oxygen sensor (HO2S) connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the cable between control module terminal #45 and heated oxygen sensor (HO2S) connector terminal #4. Check for an intermittent open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

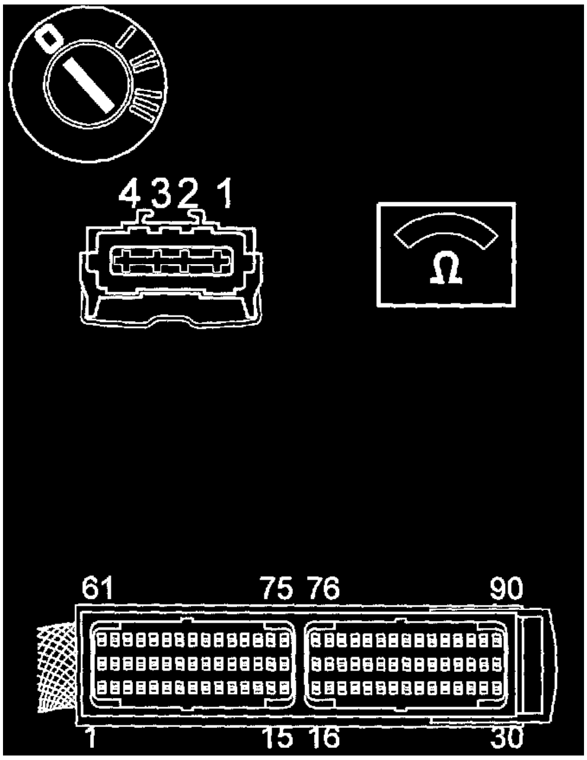
Remedy as necessary.

Other information

- To connect the breakout box and access the control module, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access or replace the front heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Checking the Wiring and Component

Checking The Wiring And Component



- Ignition off
- Check the front heated oxygen sensor (HO2S) connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.**

Check the cable between control module terminal #45 and heated oxygen sensor (HO2S) connector terminal #4. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

Try a new heated oxygen sensor (HO2S) if no fault is found during the above fault-tracing.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

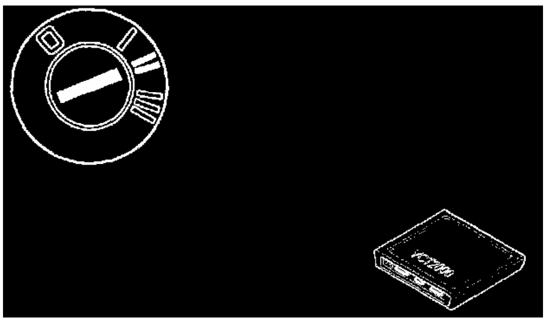
Remedy as necessary.

Other information
- To connect the breakout box and access the control module, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access or replace the front heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Missing - Permanent Fault/Verification

Resetting the Adaptation

Resetting The Adaptation

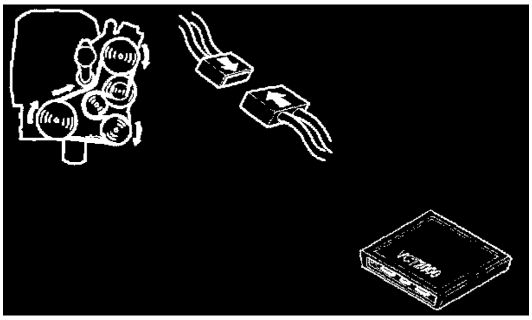


Hint: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Start the engine. Let the engine idle until it reaches operating temperature.

Read off the signal for the front heated oxygen sensor (HO2S).

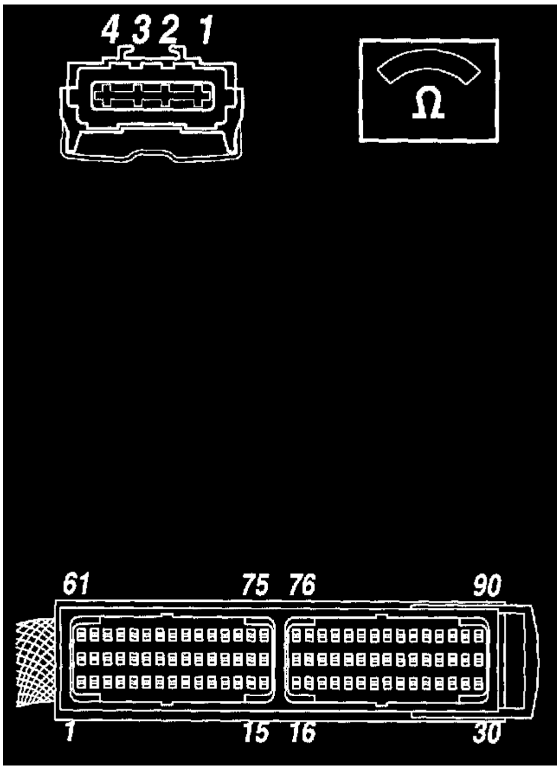
Does the value oscillate between approximately 0 and 1 V?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Missing - Permanent Fault/Resetting the Adaptation

No - Test Complete

Signal Too High - Intermittent Fault

Checking Wiring



Check the engine Control module (ECM) and heated oxygen sensor (HO2S) connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check in particular for damage or loose terminal pins. Check the ground lead between engine control module (ECM) terminal #75 and heated oxygen sensor (HO2S) terminal #3. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Check the signal cable between engine control module (ECM) terminal #45 and heated oxygen sensor (HO2S) terminal #4. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Try a new heated oxygen sensor (HO2S) if no fault is found in the above fault-tracing.

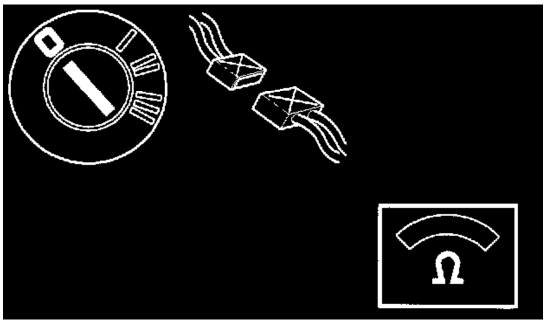
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Terminal

Checking The Terminal



- Ignition off
- Front heated oxygen sensor (HO2S) connector disconnected.

Check the heated oxygen sensor (HO2S) connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

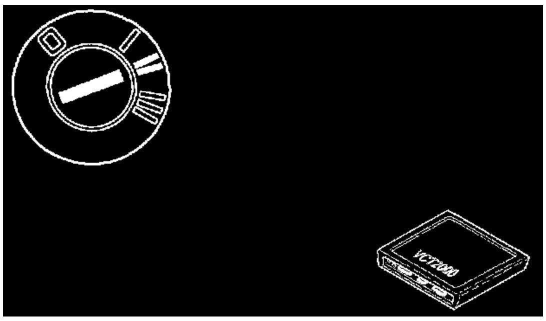
Were any faults found?

Yes **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Verification

No **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Checking the Signal Cable - I

Resetting the Adaptation

Resetting The Adaptation

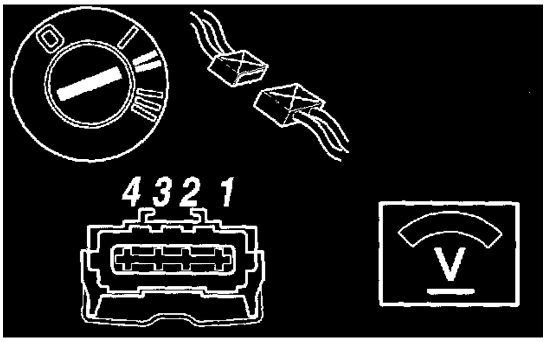


Hint: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Checking the Signal Cable - I

Checking The Signal Cable



- Front heated oxygen sensor (HO2S) connector disconnected
- Ignition on.

Connect a voltmeter between connector terminal #4 on the heated oxygen sensor (HO2S) (control module side) and ground.

The voltmeter should read approximately 0.5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Defective Heated Oxygen Sensor (HO2S)

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Checking the Signal Cable - II

Defective Heated Oxygen Sensor (HO2S)

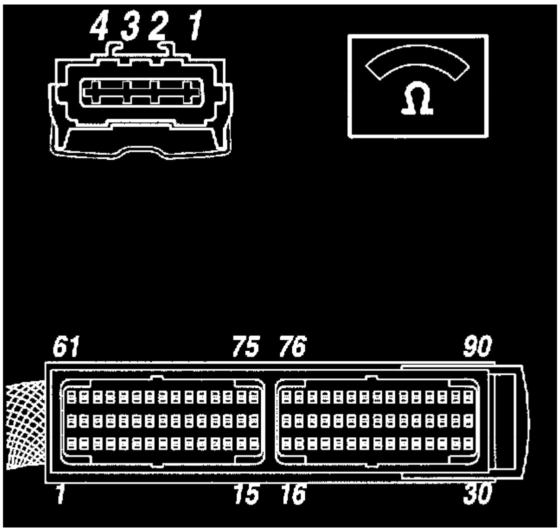
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S). See **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



Check the cable between heated oxygen sensor (HO2S) connector terminal #4 and engine control module (ECM) connector terminal #45. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.** Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent Faults.**

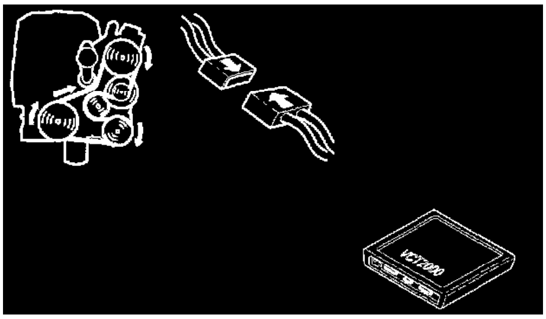
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Start the engine. Let the engine idle until it reaches operating temperature.

Read off the signal for the front heated oxygen sensor (HO2S).

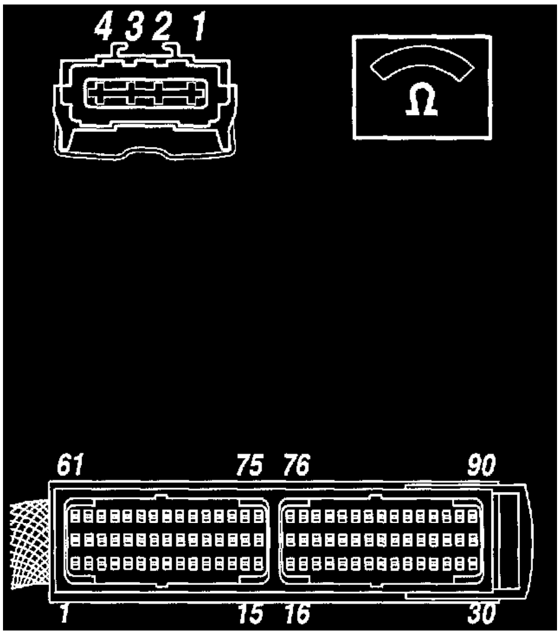
Does the value oscillate between approximately 0 and 1 V?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Resetting the Adaptation

No - Test Complete

Signal Too Low - Intermittent Fault

Checking Wiring



Check the signal cable between engine control module (ECM) terminal #45 and heated oxygen sensor (HO2S) terminal 4. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults.** Remedy if necessary.

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Try a new heated oxygen sensor (HO2S) if no fault is found in the above fault-tracing.

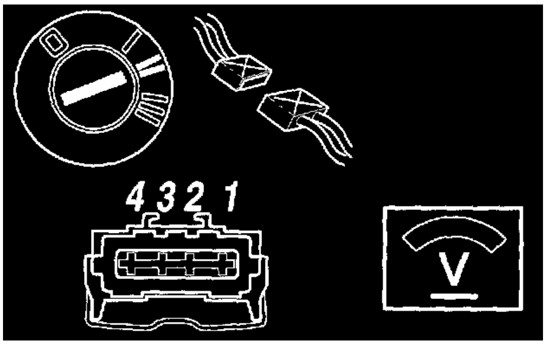
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Signal Cable - I

Checking The Signal Cable



- Front heated oxygen sensor (HO2S) connector disconnected
- Ignition on.

Connect a voltmeter between connector terminal #4 on the heated oxygen sensor (HO2S) (control module side) and ground.

The voltmeter should read approximately 0.5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too Low - Permanent Fault/Checking Intake System

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too Low - Permanent Fault/Checking the Signal Cable - II

Checking Intake System

Checking Intake System

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

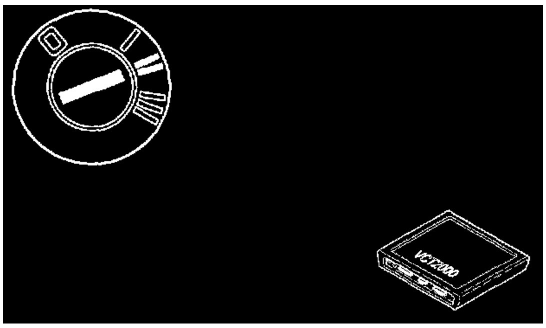
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too Low - Permanent Fault/Defective Heated Oxygen Sensor (HO2S)

Resetting the Adaptation

Resetting The Adaptation



Hint: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Defective Heated Oxygen Sensor (HO2S)

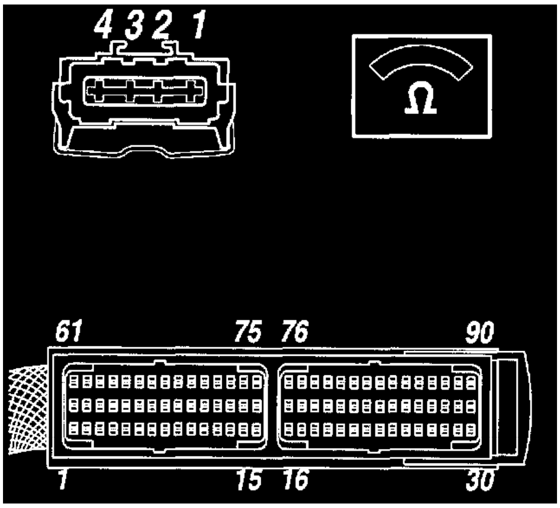
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S). See **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



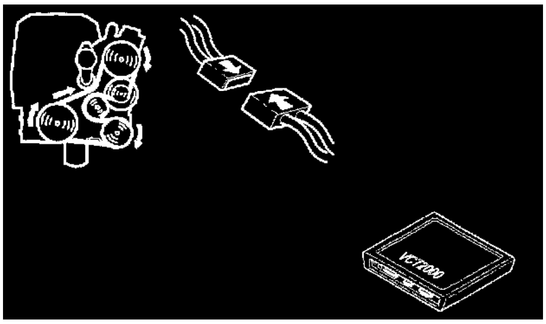
Check the cable between heated oxygen sensor (HO2S) connector terminal #4 and engine control module (ECM) connector terminal #45. Check for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too Low - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Start the engine. Let the engine idle until it reaches operating temperature.

Read off the signal for the front heated oxygen sensor (HO2S).

Does the value oscillate between approximately 0 and 1 V?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-16/Signal Too Low - Permanent Fault/Resetting the Adaptation

No - Test Complete

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-18 or ECM-1C is stored if the heated oxygen sensor (HO2S) pre-heating circuit is short-circuited to ground or voltage, if there is an open-circuit in the circuit or if the resistance in the element is incorrect.

Condition

Fuel trim disabled.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable
- Faulty heated oxygen sensor (HO2S).

Signal too low:
- Short-circuit to ground in the signal cable
- Faulty heated oxygen sensor (HO2S).

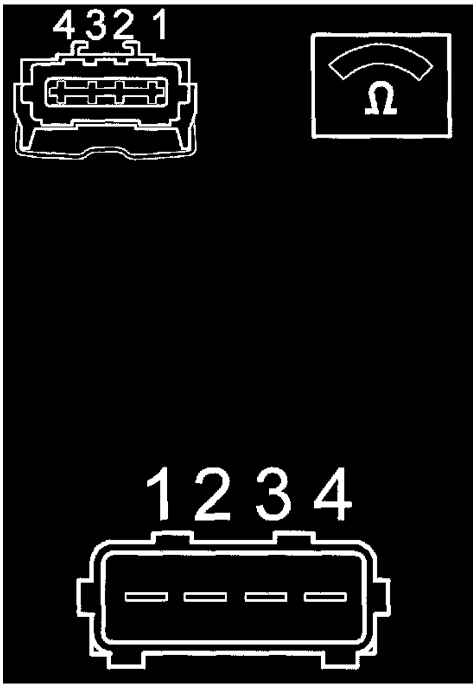
Signal missing:
- Open-circuit in the signal cable
- Faulty heated oxygen sensor (HO2S)
- Contact resistance and oxidation.

Faulty signal:
- Faulty heated oxygen sensor (HO2S)
- Contact resistance in the terminals.

Condition
- None.

Signal Missing - Intermittent Fault

Checking Components And Wiring



Check the heated oxygen sensor (HO2S) and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check that the resistance in the heated oxygen sensor (HO2S) preheating element, between terminals 1 and 2, is approximately **5-10 [ohm]** at **+20° C**.

Check the signal cable between engine control module (ECM) terminal 63 and heated oxygen sensor (HO2S) terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

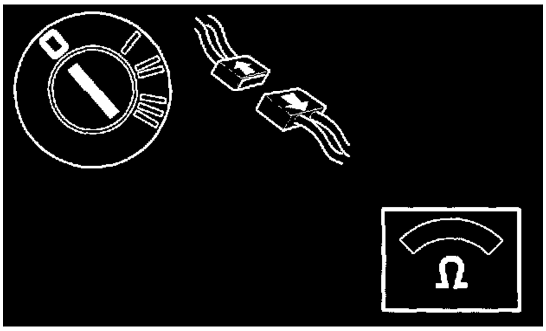
Remedy as necessary.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access/replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Heated Oxygen Sensor (HO2S)

Checking The Heated Oxygen Sensor (HO2S)



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S).

Check the connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

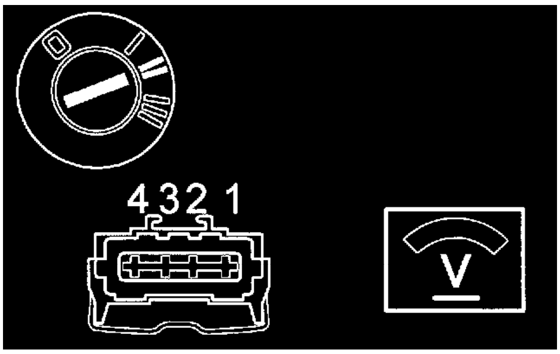
Was a fault detected?

Yes **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

No **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Checking the Power Cable - I

Checking the Power Cable - I

Checking The Power Cable



- Ignition off.

Connect a voltmeter between connector terminal 1 on the heated oxygen sensor (HO2S) (engine control module (ECM) side) and ground. Ignition on.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK **-** This information to be published by O.E. at a later date.

Not OK **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Checking the Power Cable - II

Defective Heated Oxygen Sensor (HO2S)

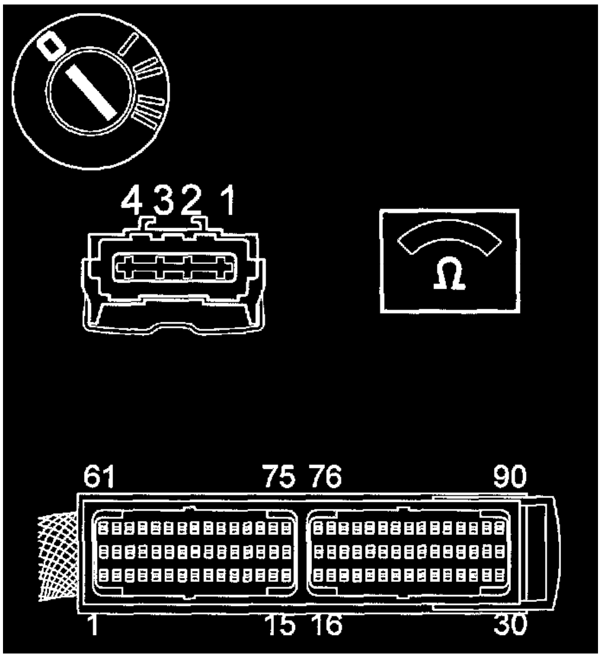
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S) according to **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

Checking the Signal Cable

Checking The Signal Cable



- Ignition off.

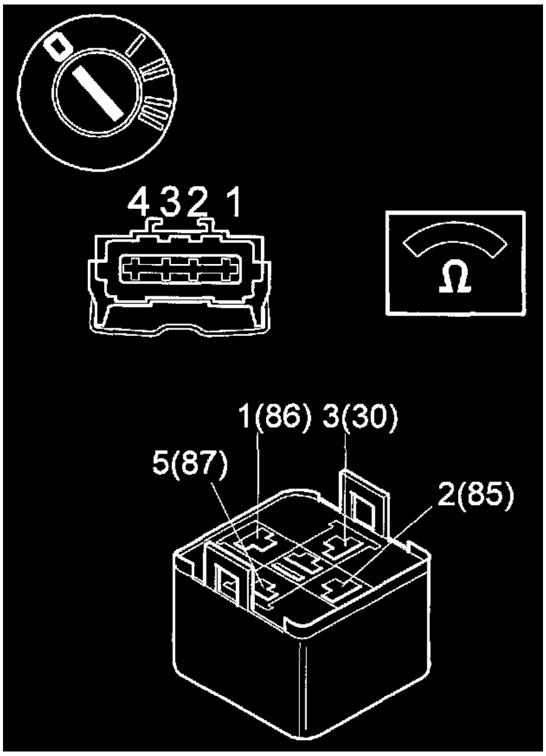
Check the cable between heated oxygen sensor (HO2S) connector terminal 2 (control module side) and engine control module (ECM) connector terminal 63 (ECM-18) or terminal 65 (ECM-1C) for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

Checking the Power Cable - II

Checking The Power Cable



- Ignition off.

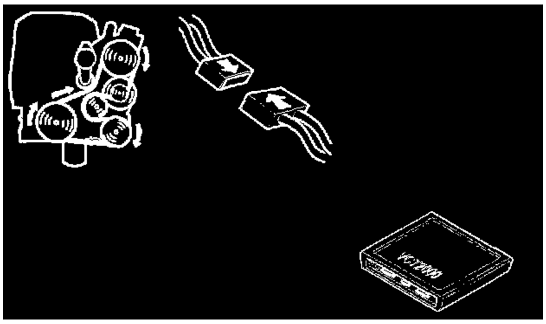
Check the cable between heated oxygen sensor (HO2S) connector terminal 1 (control module side) and system relay 2/14 base # 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

Verification

Verification

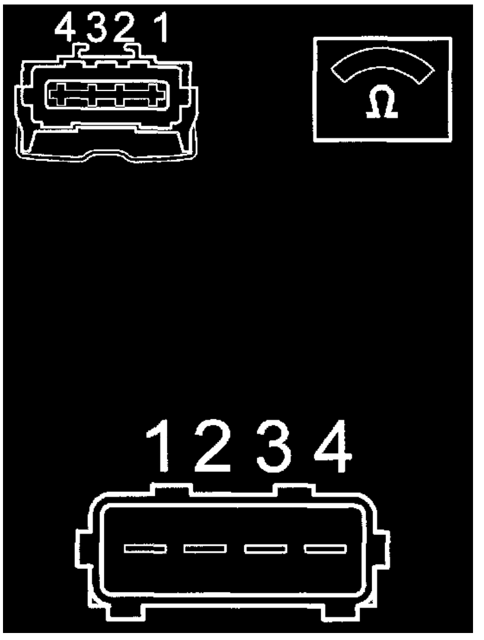


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine.

Check whether diagnostic trouble code (DTC) ECM-18 or ECM-1C has changed status to intermittent.

Signal Too High - Intermittent Fault

Checking Components And Wiring



Check that the resistance in the heated oxygen sensor (HO2S) preheating element, measured between probe terminals 1 and 2, is approximately **5-10 [ohm]** at **+20°C**

Check the signal cable between engine control module (ECM) terminal 63 and heated oxygen sensor (HO2S) terminal 2 for an intermittent short-circuit to supply voltage. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

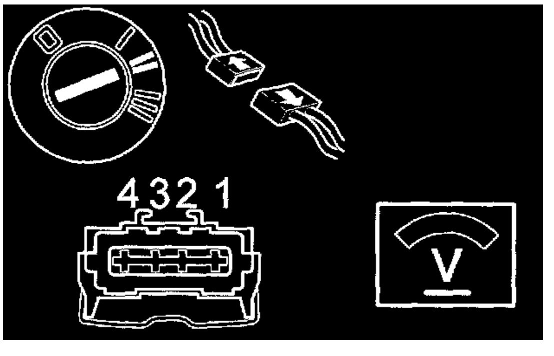
Remedy as necessary.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access/replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Power Cable

Checking The Power Cable



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S)
- Ignition on.

Connect a voltmeter between connector terminal 2 on the heated oxygen sensor (HO2S) (engine control module (ECM) side) and ground.

The voltmeter should read 3-5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Defective Heated Oxygen Sensor (HO2S)

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Checking the Signal Cable

Defective Heated Oxygen Sensor (HO2S)

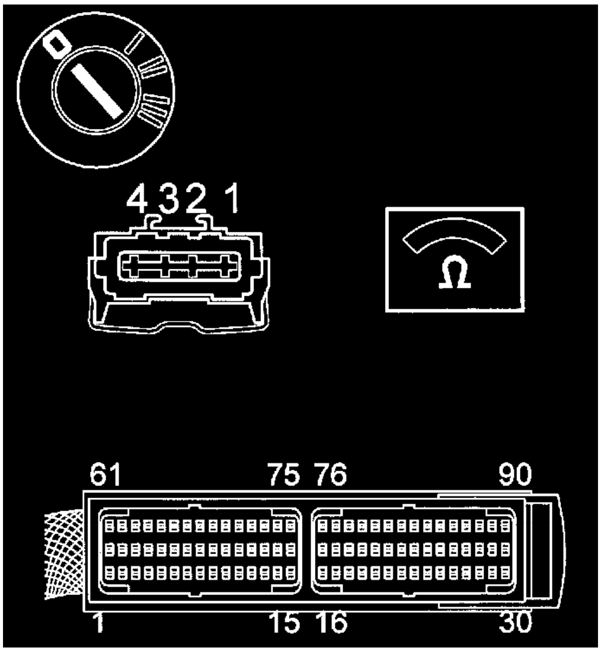
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S) according to **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable

Checking The Signal Cable



- Ignition off.

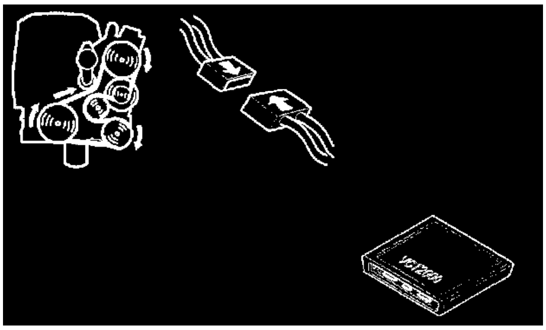
Check the cable between heated oxygen sensor (HO2S) connector terminal 2 (control module side) and engine control module (ECM) connector terminal 63 (ECM-18) or terminal 65 (ECM-1C) for a short-circuit to voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Verification

Verification

Verification

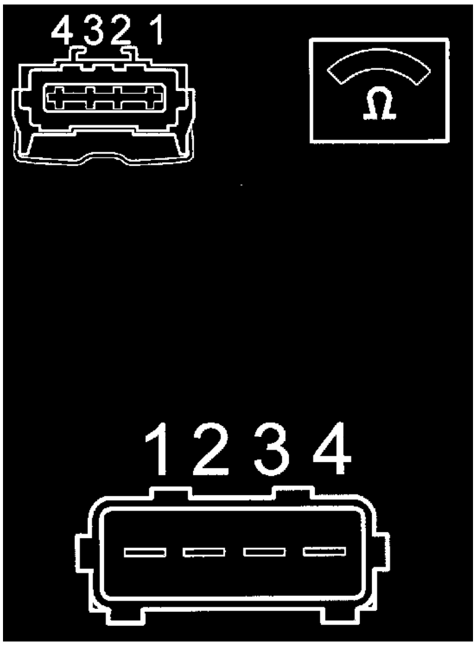


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine.

Check whether diagnostic trouble code (DTC) ECM-18 or ECM-1C has changed status to intermittent.

Signal Too Low - Intermittent Fault

Checking Components And Wiring



Check that the resistance in the heated oxygen sensor (HO2S) preheating element, measured between probe terminals 1 and 2, is approximately **5-10 [ohm]** at **+20°C**.

Check the signal cable between engine control module (ECM) terminal 63 and heated oxygen sensor (HO2S) terminal 2 for an intermittent short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

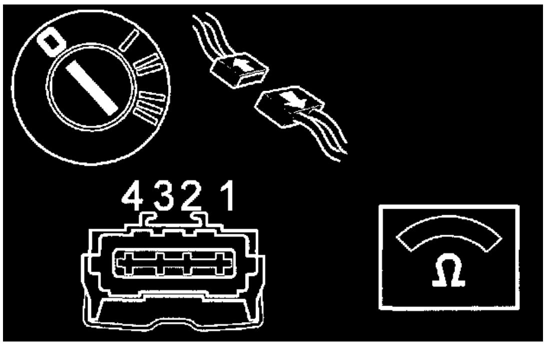
Remedy as necessary.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access/replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Heated Oxygen Sensor (HO2S)

Checking The Heated Oxygen Sensor (HO2S)



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S).

Connect an ohmmeter between connector terminals 1 and 2 for the heated oxygen sensor (HO2S) (probe side).

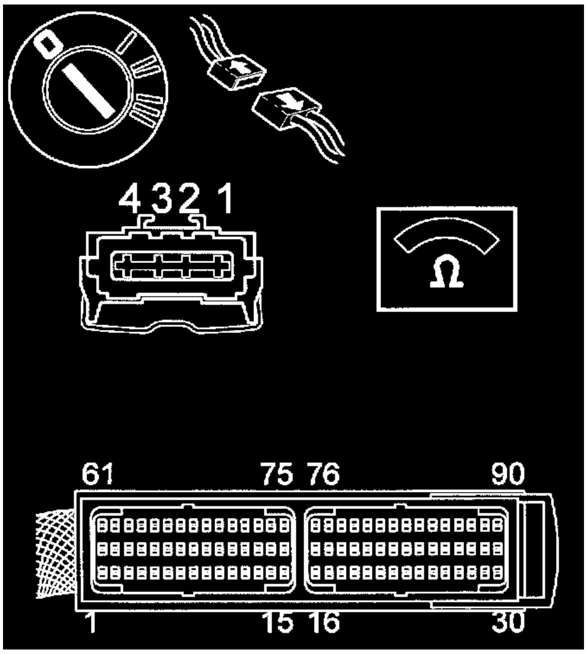
The resistance should be 6-25 [ohm] depending on the temperature of the heated oxygen sensor (HO2S).

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Defective Heated Oxygen Sensor (HO2S)

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S).

Check the cable between heated oxygen sensor (HO2S) connector terminal 2 (control module side) and engine control module (ECM) connector terminal 63 (ECM-18) or terminal 65 (ECM-1C) for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Verification

Defective Heated Oxygen Sensor (HO2S)

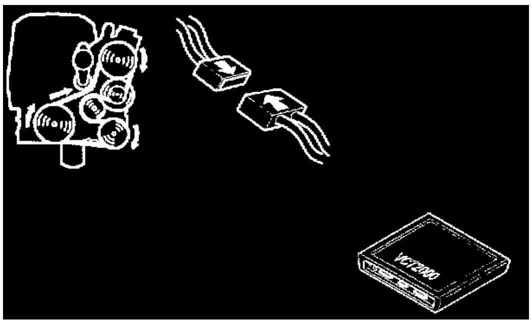
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S) according to **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Verification

Verification

Verification



- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine.

Check whether diagnostic trouble code (DTC) ECM-18 or ECM-1C has changed status to intermittent.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

The rear heated oxygen sensor (HO2S) signal is checked when the control module carries out a three-way catalytic converter (TWC) diagnostic. A diagnostic trouble code (DTC) is stored if the rear heated oxygen sensor (HO2S) signal is not within the range permissible for three-way catalytic converter (TWC) diagnostics. Diagnostic trouble code (DTC) ECM-1A is stored if the signal from the rear heated oxygen sensor (HO2S) is too high, too low or missing.

Condition

- Fuel trim disabled.
- Three-way catalytic converter (TWC) diagnostic disabled.

Possible source

Signal too high:

- Contact resistance in the terminals
- Short-circuit to supply voltage in the signal cable
- Defective rear heated oxygen sensor (HO2S).

Signal too low:

- Contact resistance in the terminals
- Short-circuit to ground in signal cable
- Air leakage in the intake system
- Defective rear heated oxygen sensor (HO2S).

Signal missing:

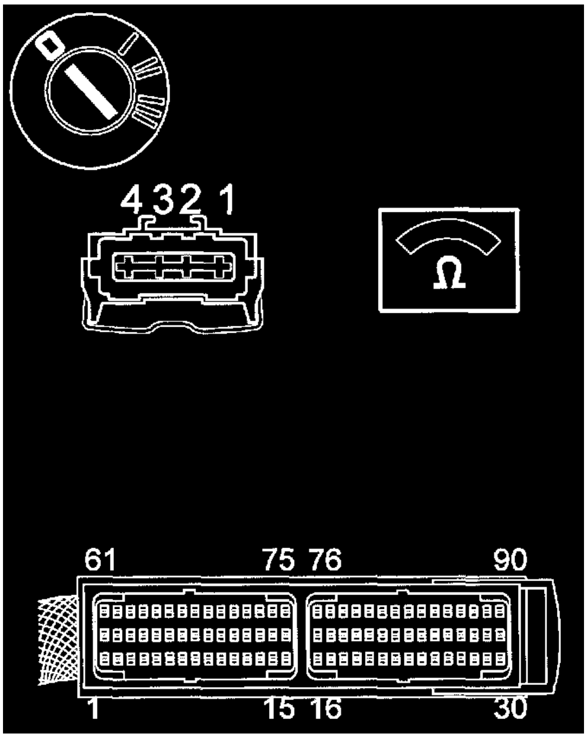
- Contact resistance in the terminals
- Open-circuit in the signal cable
- Defective rear heated oxygen sensor (HO2S).

Condition

- Malfunction indicator lamp (MIL) lit.

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off

- Check the connectors for the rear heated oxygen sensor (HO2S) and control module. Check for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

- Check the signal cable between terminal #4 for the rear heated oxygen sensor (HO2S) and control module terminal #44. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

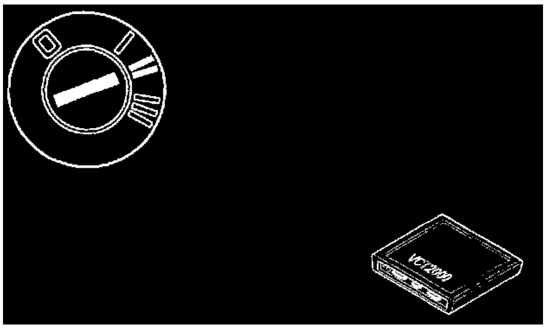
- Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the rear heated oxygen sensor (HO2S), see **Replacing lambda sond rear.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Missing - Intermittent Fault/Resetting the Adaptation

Resetting the Adaptation

Resetting The Adaptation

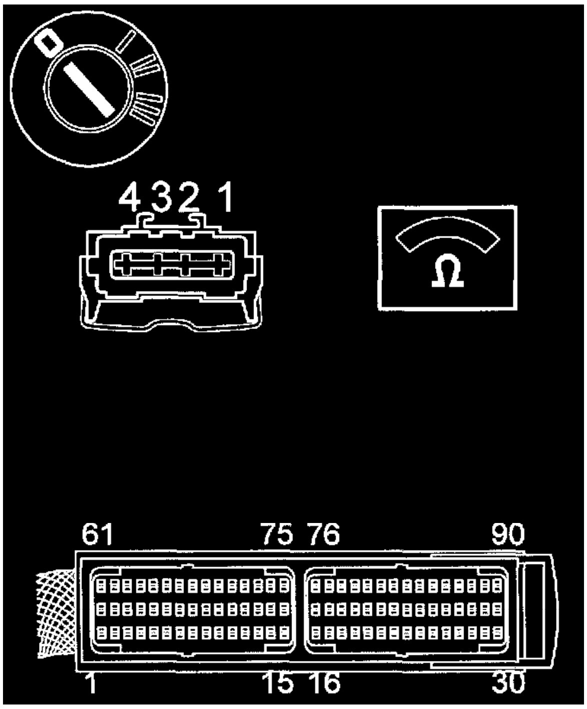


NOTE: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on.
- Click on the VCT2000 symbol to reset the fuel trim

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off

- Check the connectors for the rear heated oxygen sensor (HO2S) and control module. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.**

- Check the signal cable between connector terminal #4 for the rear heated oxygen sensor (HO2S) and control module terminal #44. Check for an open-circuit according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

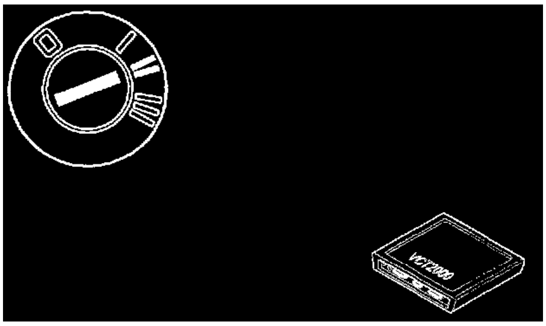
Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Missing - Permanent Fault/Checking Diagnostic Trouble Codes (DTCS)

Checking Diagnostic Trouble Codes (DTCS)

Checking Diagnostic Trouble Codes (DTCs)



- Test drive the vehicle for at least **10 minutes** at a constant speed and throttle opening
- Allow the engine to idle for at least **5 minutes**.
- Read off diagnostic trouble codes (DTCs)
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent

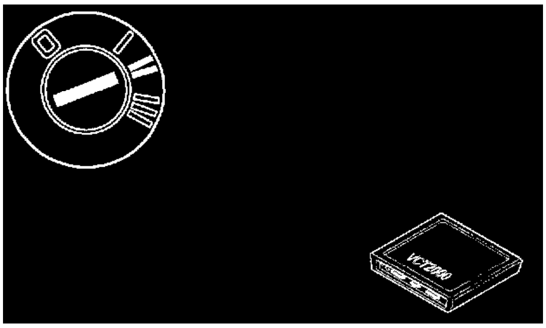
Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Missing - Permanent Fault/Resetting the Adaptation

No **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Missing - Permanent Fault/Replacing the Component

Resetting the Adaptation

Resetting The Adaptation



NOTE: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

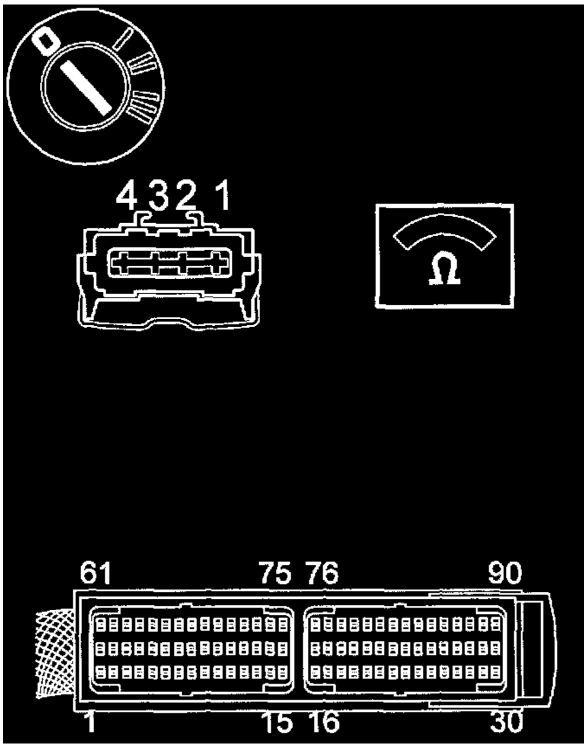
Replacing the Component

Replacing The Component

- Replace the rear heated oxygen sensor (HO2S) according to **Replacing lambda sond rear.**

Checking Connectors and Components

Checking Connectors And Components



- Ignition off
- Check the rear heated oxygen sensor (HO2S) and control module connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**
- Check the signal cable between connector terminal 4 for the rear heated oxygen sensor (HO2S) and control module terminal 44 for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

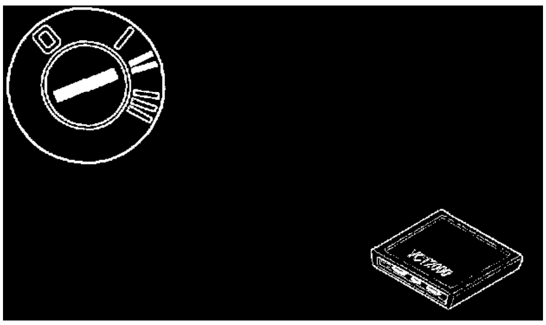
- Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the rear heated oxygen sensor (HO2S), see **Replacing lambda sond rear.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too High - Intermittent Fault/Resetting Fuel Trim

Resetting Fuel Trim

Resetting Fuel Trim

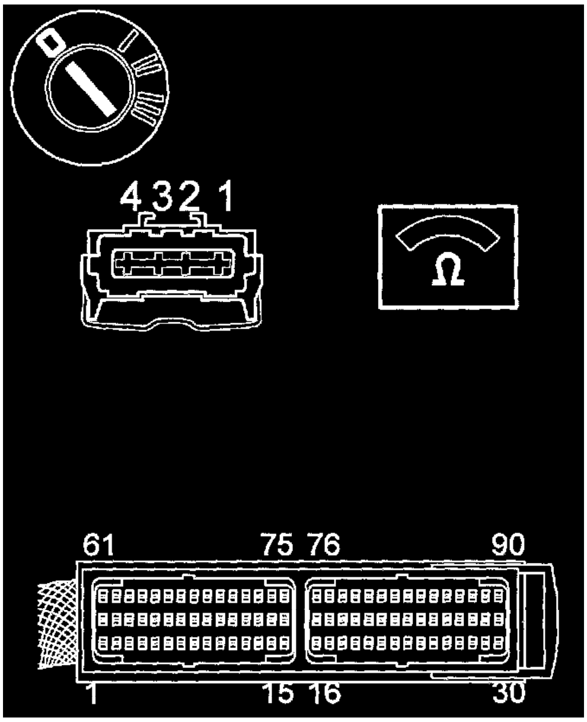


NOTE: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems even though the fault is no longer present.

- Ignition on.
- Reset the fuel trim by clicking on the VCT 2000 symbol

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off

- Check the connectors for the rear heated oxygen sensor (HO2S) and control module. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.**

- Check the signal cable between connector terminal #4 for the rear heated oxygen sensor (HO2S) and control module terminal #44. Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

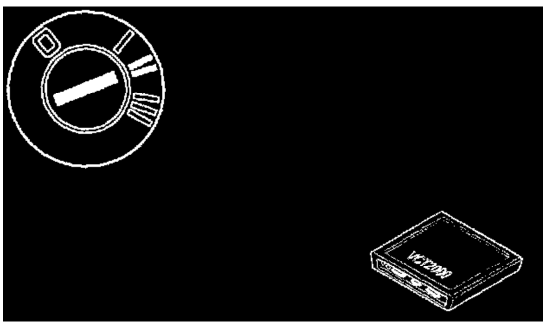
- Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too High - Permanent Fault/Checking Diagnostic Trouble Codes (DTCS)

Checking Diagnostic Trouble Codes (DTCS)

Checking Diagnostic Trouble Codes (DTCs)



- Test drive the vehicle for at least **10 minutes** at a constant speed and throttle opening
- Allow the engine to idle for at least **5 minutes**.

- Read off diagnostic trouble codes (DTCs)
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. The status of the diagnostic trouble code (DTC) will have changed to intermittent if the fault has been remedied

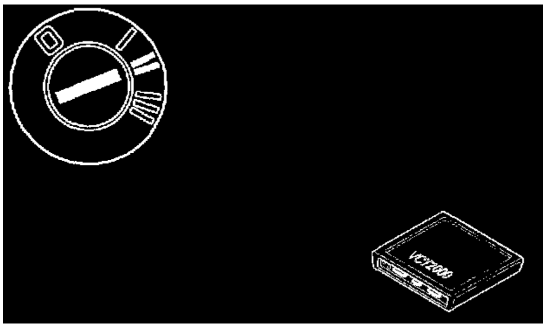
Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too High - Permanent Fault/Resetting the Adaptation - I

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too High - Permanent Fault/Replacing the Component

Resetting the Adaptation - I

Resetting The Adaptation



Hint: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Replacing the Component

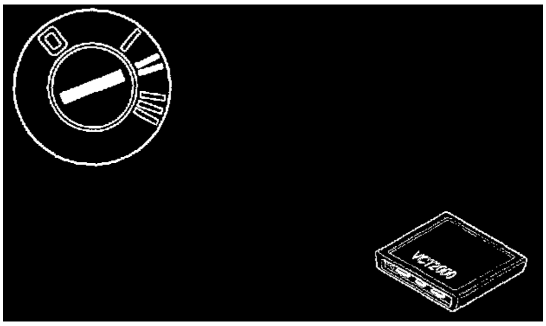
Replacing The Component

- Replace the rear heated oxygen sensor (HO2S) according to **Replacing lambda sond rear.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too High - Permanent Fault/Resetting the Adaptation - II

Resetting the Adaptation - II

Resetting The Adaptation



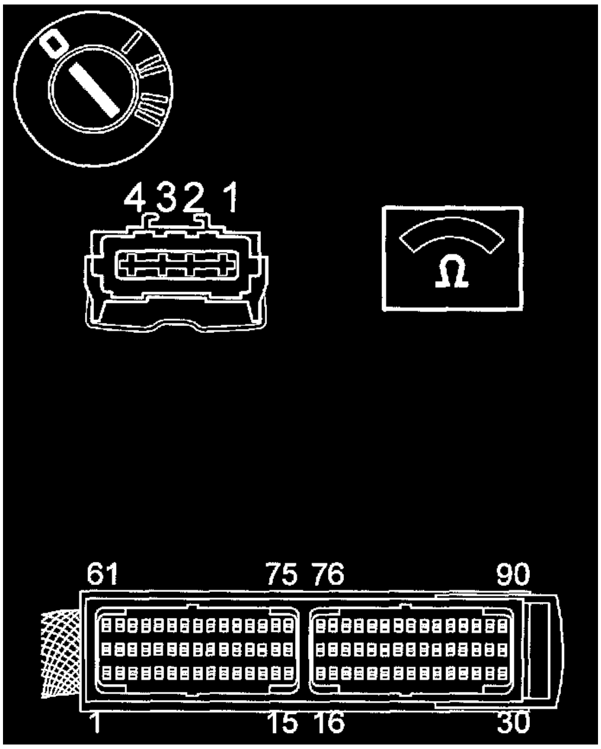
Hint: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems even though the fault is no longer present.

- Ignition on.
- Click on the VCT2000 symbol to reset the fuel trim

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too High - Permanent Fault/Checking Diagnostic Trouble Codes (DTCS)

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off.

Check the connectors for the rear heated oxygen sensor (HO2S) and Control module for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check the intake system for leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Check the signal cable between rear heated oxygen sensor (HO2S) terminal #4 and control module terminal #44 for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

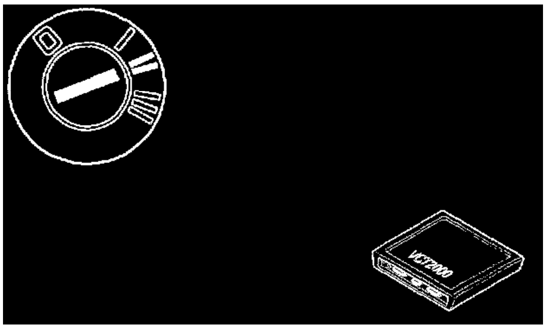
Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the rear heated oxygen sensor (HO2S), see **Replacing lambda sond rear.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too Low - Intermittent Fault/Resetting the Adaptation

Resetting the Adaptation

Resetting The Adaptation

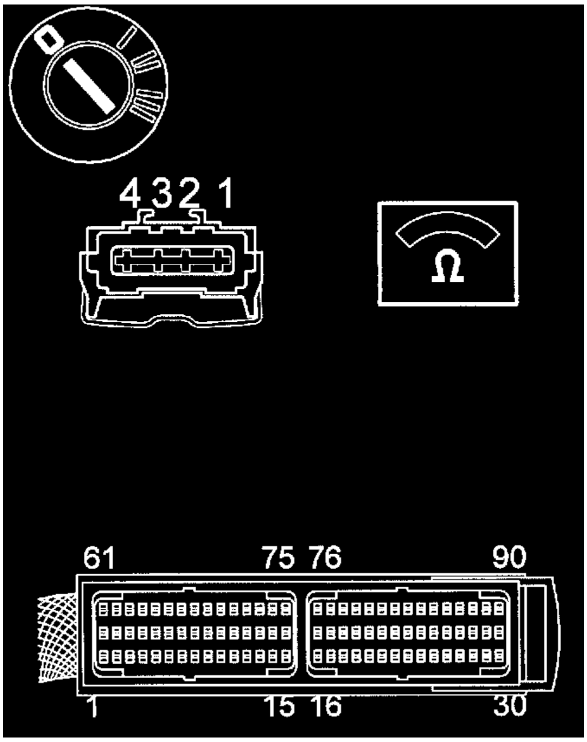


NOTE: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on.
- Click on the VCT2000 symbol to reset the fuel trim

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off.

Check the connectors for the rear heated oxygen sensor (HO2S) and control module for contact resistance and oxidation according to **Checking wiring and terminals - Permanent Faults.**

Check the signal cable between rear heated oxygen sensor (HO2S) connector terminal #4 and control module terminal #44 for a short-circuit to ground according to **Checking wiring and terminals - Permanent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the intake system for leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

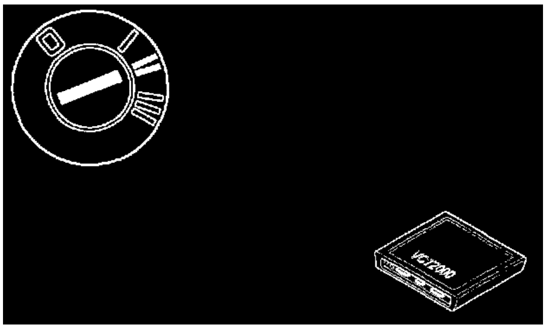
Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too Low - Permanent Fault/Checking Diagnostic Trouble Codes (DTCS)

Checking Diagnostic Trouble Codes (DTCS)

Checking Diagnostic Trouble Codes (DTCs)



- Test drive the vehicle for at least **10 minutes** at a constant speed and throttle opening
- Allow the engine to idle for at least **5 minutes**

- Read off diagnostic trouble codes (DTCs)
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. The status of the diagnostic trouble code (DTC) will have changed to intermittent if the fault has been remedied.

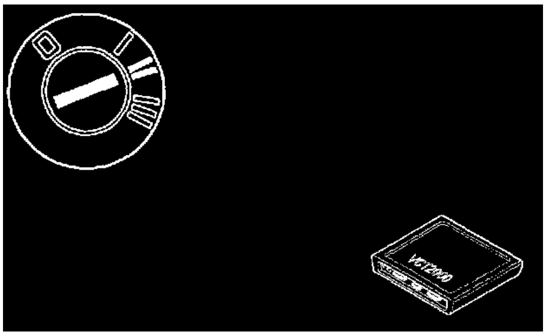
Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too Low - Permanent Fault/Resetting the Adaptation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too Low - Permanent Fault/Replacing the Component

Resetting the Adaptation

Resetting The Adaptation



NOTE: It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on
- Check on the VCT2000 symbol to reset the fuel trim.

Replacing the Component

Replacing The Component

Replace the rear heated oxygen sensor (HO2S) according to **Replacing lambda sond rear.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-1A/Signal Too Low - Permanent Fault/Resetting the Adaptation

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-18 or ECM-1C is stored if the heated oxygen sensor (HO2S) pre-heating circuit is short-circuited to ground or voltage, if there is an open-circuit in the circuit or if the resistance in the element is incorrect.

Condition

Fuel trim disabled.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable
- Faulty heated oxygen sensor (HO2S).

Signal too low:
- Short-circuit to ground in the signal cable
- Faulty heated oxygen sensor (HO2S).

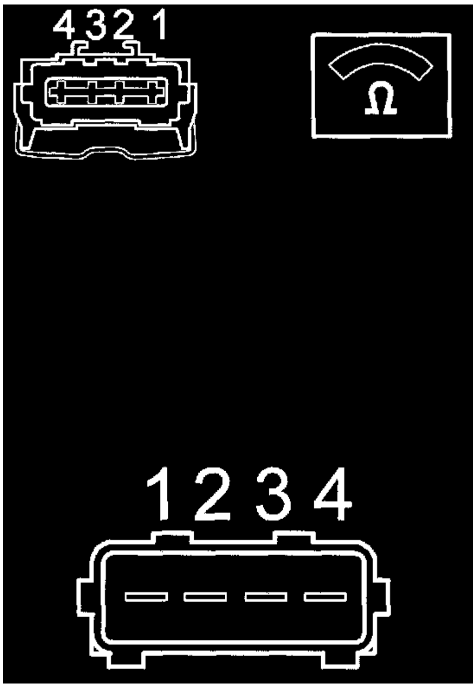
Signal missing:
- Open-circuit in the signal cable
- Faulty heated oxygen sensor (HO2S)
- Contact resistance and oxidation.

Faulty signal:
- Faulty heated oxygen sensor (HO2S)
- Contact resistance in the terminals.

Condition
- None.

Signal Missing - Intermittent Fault

Checking Components And Wiring



Check the heated oxygen sensor (HO2S) and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check that the resistance in the heated oxygen sensor (HO2S) preheating element, between terminals 1 and 2, is approximately **5-10 [ohm]** at **+20° C**.

Check the signal cable between engine control module (ECM) terminal 63 and heated oxygen sensor (HO2S) terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

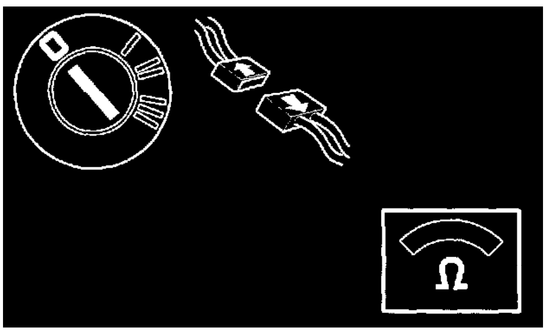
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access/replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Heated Oxygen Sensor (HO2S)

Checking The Heated Oxygen Sensor (HO2S)



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S).

Check the connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

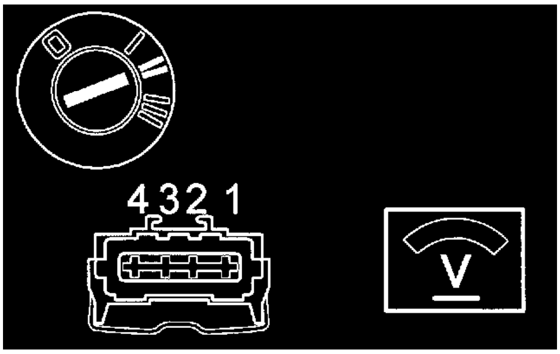
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Checking the Power Cable - I

Checking the Power Cable - I

Checking The Power Cable



- Ignition off.

Connect a voltmeter between connector terminal 1 on the heated oxygen sensor (HO2S) (engine control module (ECM) side) and ground. Ignition on.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - This information to be published by O.E. at a later date.

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Checking the Power Cable - II

Defective Heated Oxygen Sensor (HO2S)

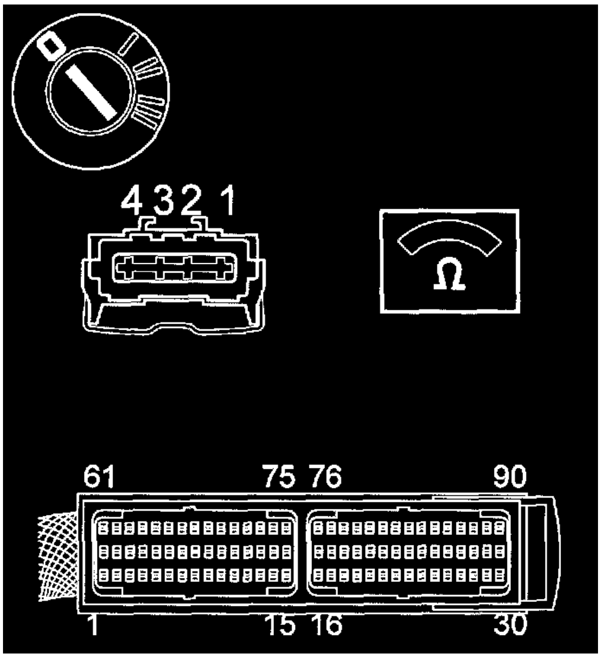
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S) according to **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

Checking the Signal Cable

Checking The Signal Cable



- Ignition off.

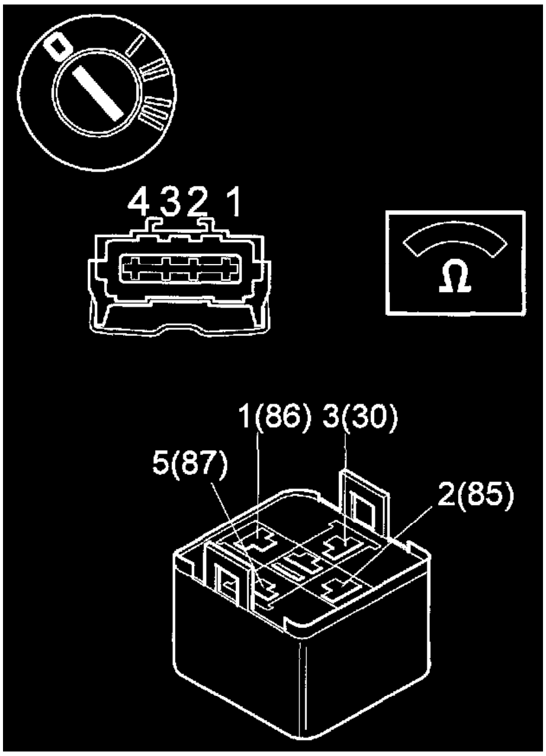
Check the cable between heated oxygen sensor (HO2S) connector terminal 2 (control module side) and engine control module (ECM) connector terminal 63 (ECM-18) or terminal 65 (ECM-1C) for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

Checking the Power Cable - II

Checking The Power Cable



- Ignition off.

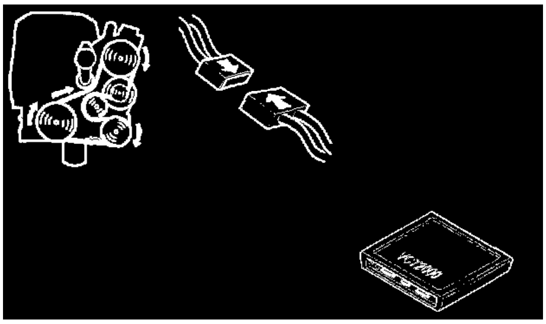
Check the cable between heated oxygen sensor (HO2S) connector terminal 1 (control module side) and system relay 2/14 base # 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Missing - Permanent Fault/Verification

Verification

Verification

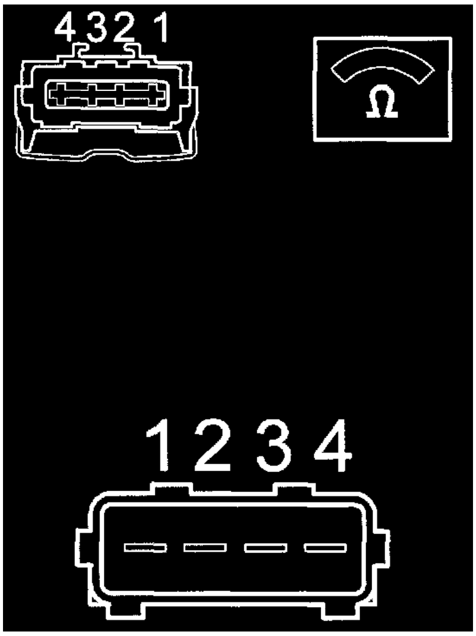


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine.

Check whether diagnostic trouble code (DTC) ECM-18 or ECM-1C has changed status to intermittent.

Signal Too High - Intermittent Fault

Checking Components And Wiring



Check that the resistance in the heated oxygen sensor (HO2S) preheating element, measured between probe terminals 1 and 2, is approximately **5-10 [ohm]** at **+20°C**

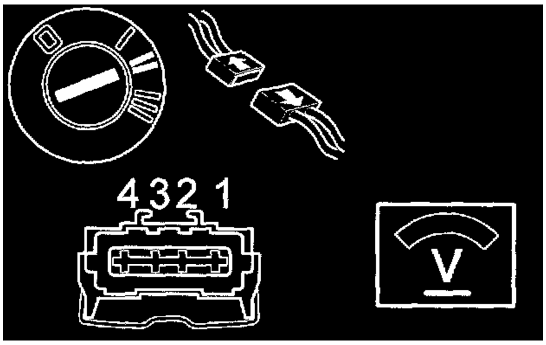
Check the signal cable between engine control module (ECM) terminal 63 and heated oxygen sensor (HO2S) terminal 2 for an intermittent short-circuit to supply voltage. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access/replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Power Cable

Checking The Power Cable



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S)
- Ignition on.

Connect a voltmeter between connector terminal 2 on the heated oxygen sensor (HO2S) (engine control module (ECM) side) and ground.

The voltmeter should read 3-5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Defective Heated Oxygen Sensor (HO2S)

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Checking the Signal Cable

Defective Heated Oxygen Sensor (HO2S)

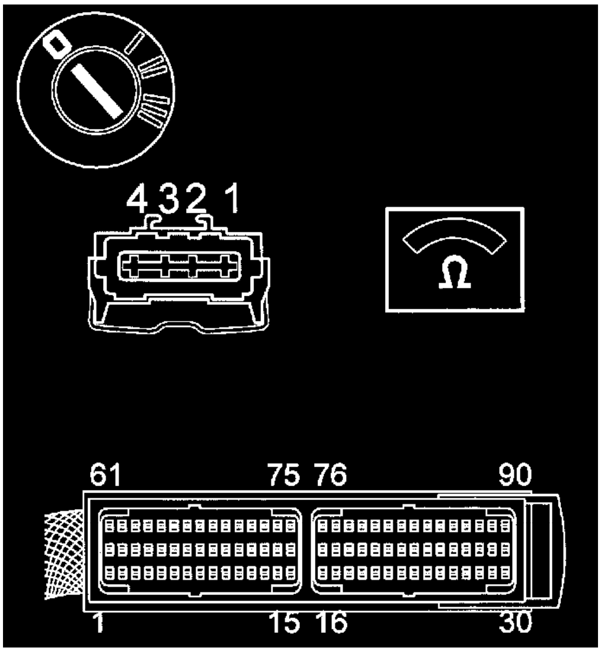
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S) according to **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable

Checking The Signal Cable



- Ignition off.

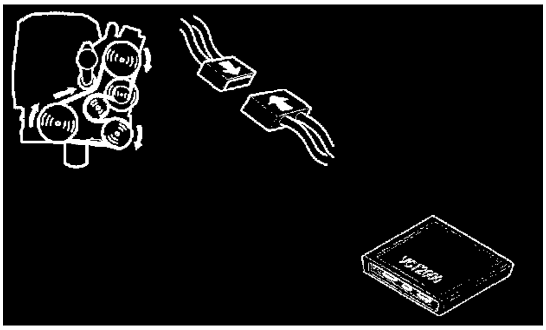
Check the cable between heated oxygen sensor (HO2S) connector terminal 2 (control module side) and engine control module (ECM) connector terminal 63 (ECM-18) or terminal 65 (ECM-1C) for a short-circuit to voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too High - Permanent Fault/Verification

Verification

Verification

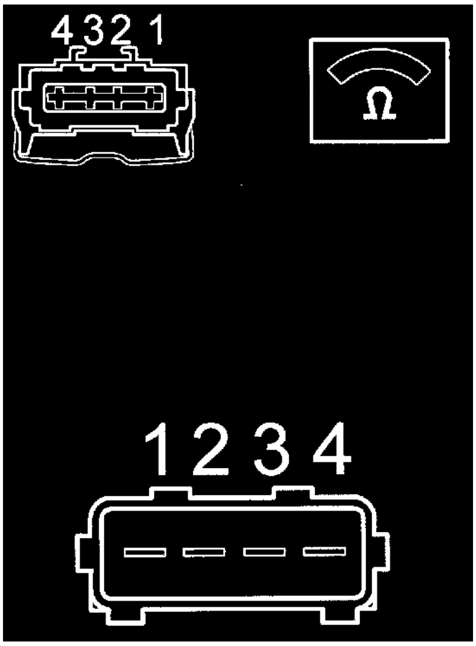


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine.

Check whether diagnostic trouble code (DTC) ECM-18 or ECM-1C has changed status to intermittent.

Signal Too Low - Intermittent Fault

Checking Components And Wiring



Check that the resistance in the heated oxygen sensor (HO2S) preheating element, measured between probe terminals 1 and 2, is approximately **5-10 [ohm]** at **+20°C**.

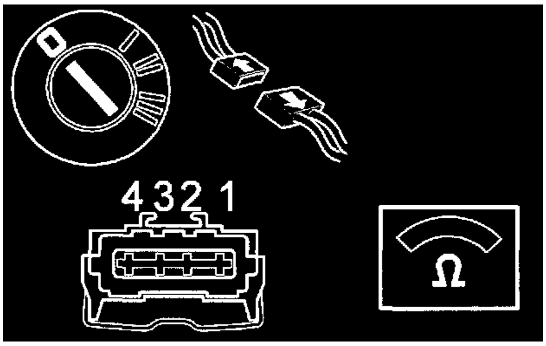
Check the signal cable between engine control module (ECM) terminal 63 and heated oxygen sensor (HO2S) terminal 2 for an intermittent short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access/replace the heated oxygen sensor (HO2S), see **Replace the front heated oxygen sensor (HO2S).**

Checking the Heated Oxygen Sensor (HO2S)

Checking The Heated Oxygen Sensor (HO2S)



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S).

Connect an ohmmeter between connector terminals 1 and 2 for the heated oxygen sensor (HO2S) (probe side).

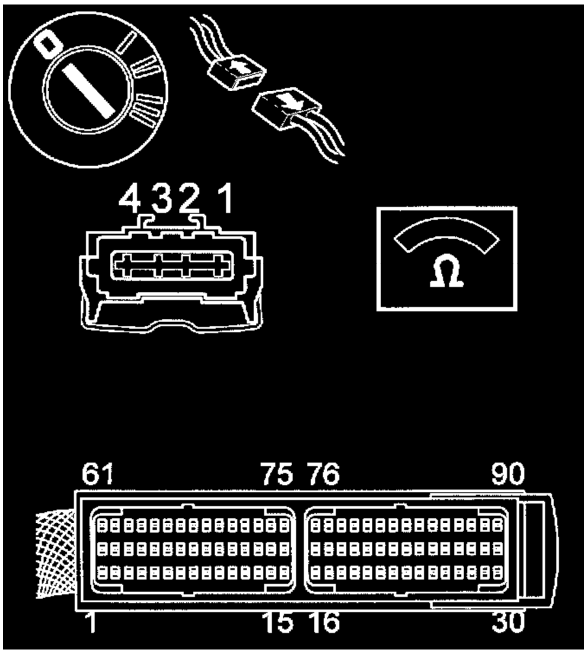
The resistance should be 6-25 [ohm] depending on the temperature of the heated oxygen sensor (HO2S).

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Defective Heated Oxygen Sensor (HO2S)

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Disconnect the connectors for the front (ECM-18) and rear (ECM-1C) heated oxygen sensor (HO2S).

Check the cable between heated oxygen sensor (HO2S) connector terminal 2 (control module side) and engine control module (ECM) connector terminal 63 (ECM-18) or terminal 65 (ECM-1C) for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Verification

Defective Heated Oxygen Sensor (HO2S)

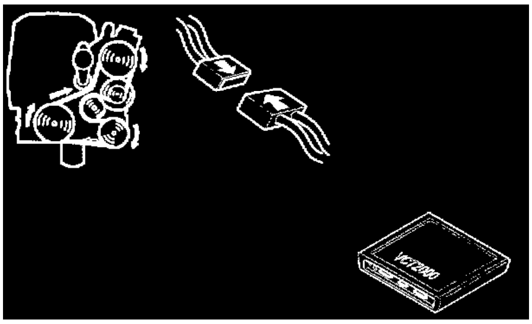
Defective Heated Oxygen Sensor (HO2S)

Try a new heated oxygen sensor (HO2S) according to **Replace the front heated oxygen sensor (HO2S).**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-18/Signal Too Low - Permanent Fault/Verification

Verification

Verification



- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine.

Check whether diagnostic trouble code (DTC) ECM-18 or ECM-1C has changed status to intermittent.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

If an injector circuit is short-circuited to ground/voltage or if there is an open-circuit in the circuit the control module interprets it as a fault and a diagnostic trouble code (DTC) is stored for the injector.

Condition

Fuel trim disabled.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable
- Faulty injector.

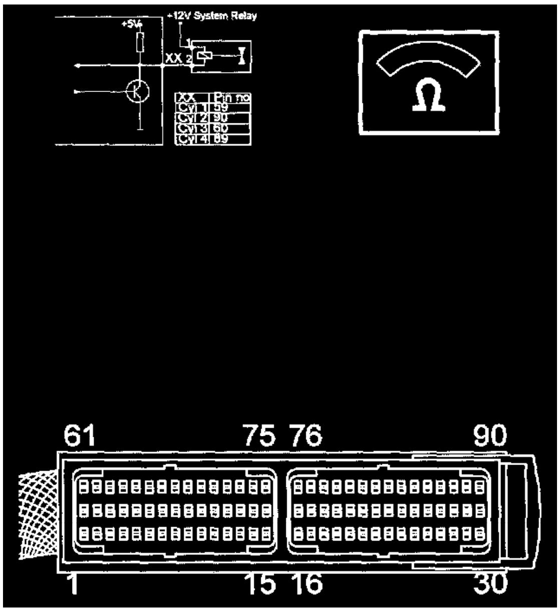
Signal too low:
- Short-circuit to ground in the signal cable.

Signal missing:
- Open-circuit in the signal cable
- Faulty injector.

Condition
- Engine not firing on all cylinders
- Engine does not start
- Malfunction indicator lamp (MIL) lit.

Signal Missing - Intermittent Fault

Checking Components And Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Check the power cable between injector terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Try a new injector if no faults are found in the above fault-tracing.

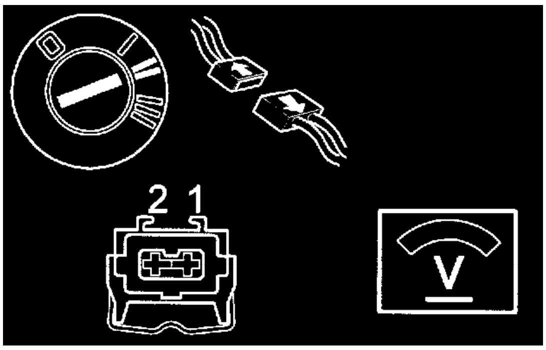
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Missing - Permanent Fault

Checking The Power Cable



- Ignition off
- Disconnect the injector connector
- Ignition on.

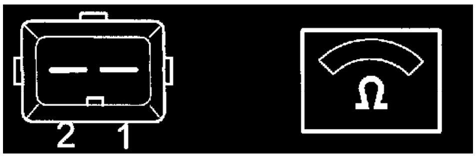
Connect a voltmeter between injector connector terminal 1 (control module side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - Continue below.

Not OK - Skip to "**Checking Wiring And Terminals - II**"

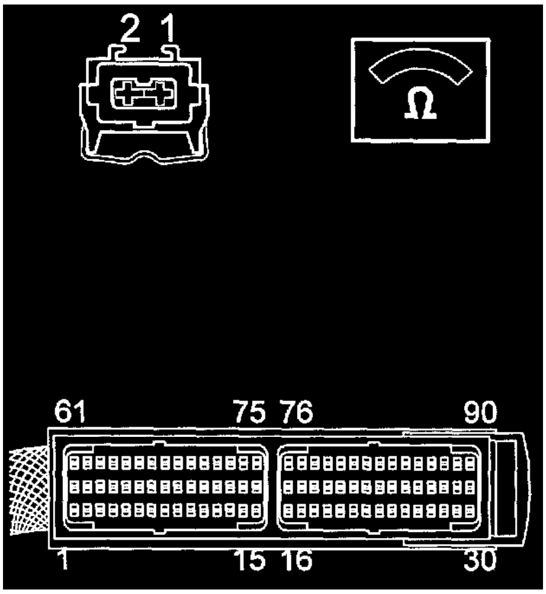
Checking Injectors



Connect an ohmmeter between injector connector terminals 1 and 2 (injector side).

The ohmmeter should read approximately 14-15 [ohm] at +20°C.
OK - Continue below.
Not OK - Skip to "**Defective Injector**"

Checking Wiring And Terminals - I



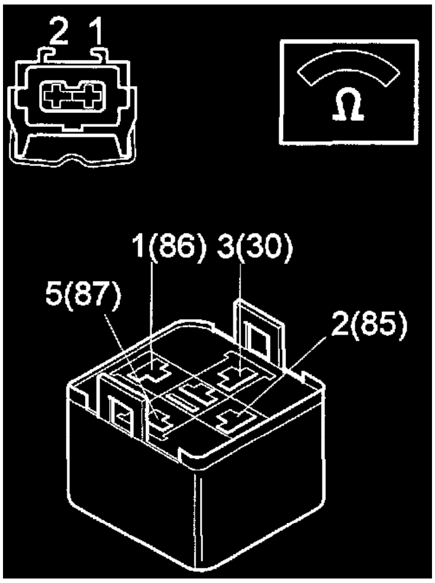
The cause of the diagnostic trouble code (DTC) was loose connections in the injector and/or engine control module (ECM) connectors. Check the connectors for loose terminals and contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the cable between injector connector terminal 2 (control module side) and engine control module (ECM) terminal 59 (EFI-115), terminal 90 (EFI-125), terminal 60 (EFI-135) or terminal 89 (EFI-145) depending on the diagnostic trouble code (DTC) stored, for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Skip to "**Verification**"

Checking Wiring And Terminals - II



Check the cable between injector terminal 1 and system relay 2/14 terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

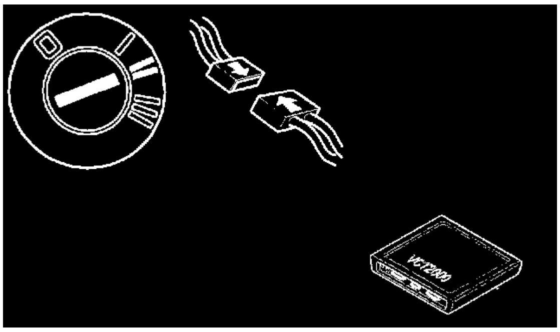
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

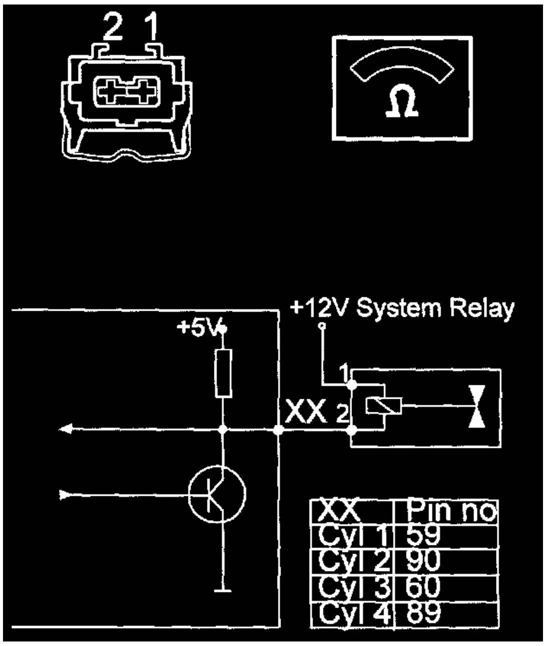
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too High - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal #59 and injector terminal #2 for an intermittent short-circuit to supply voltage. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

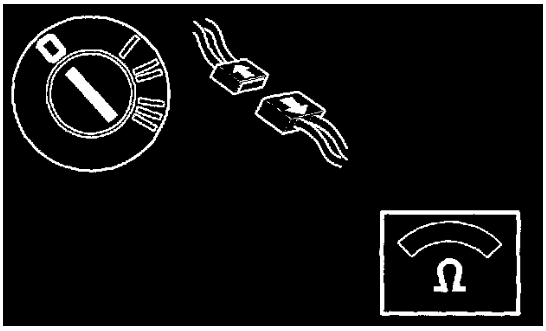
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To replace the injector, see **Replacing the injector(s).**

Signal Too High - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

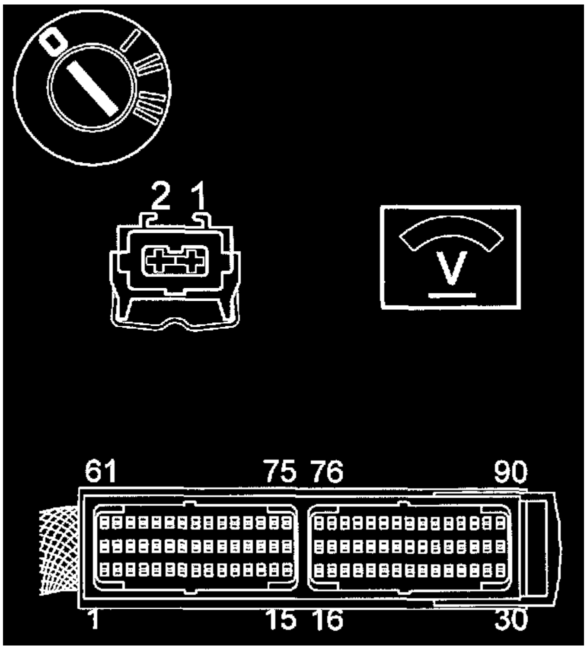
Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read approximately 15 [ohm].

OK - Continue below.

Not OK Skip to "**Defective Injector**"

Checking The Signal Cable



- Ignition off.

Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

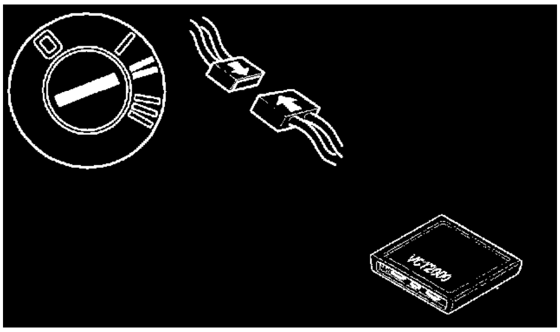
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

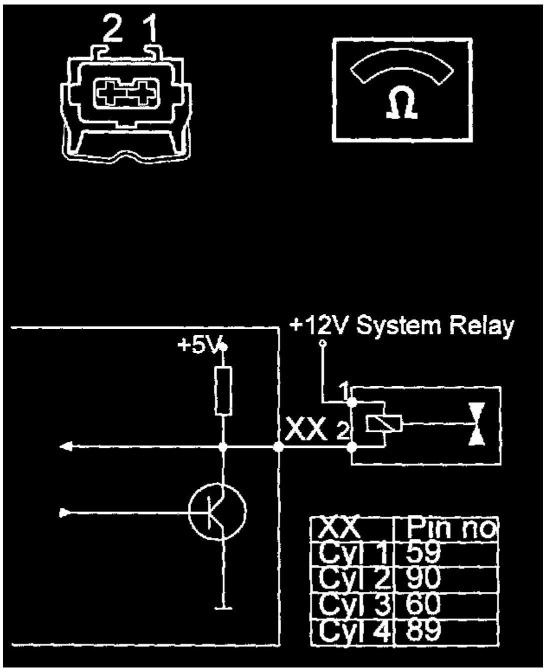
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

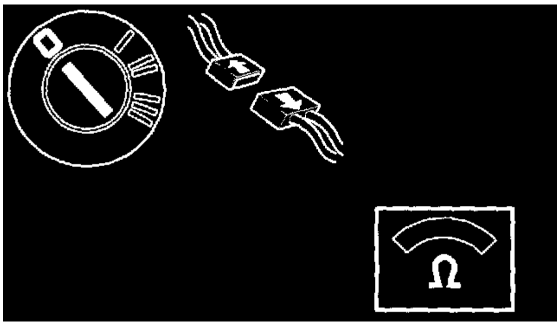
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Too Low - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read 14-15 [ohm] at 20°C.

OK - Continue below.

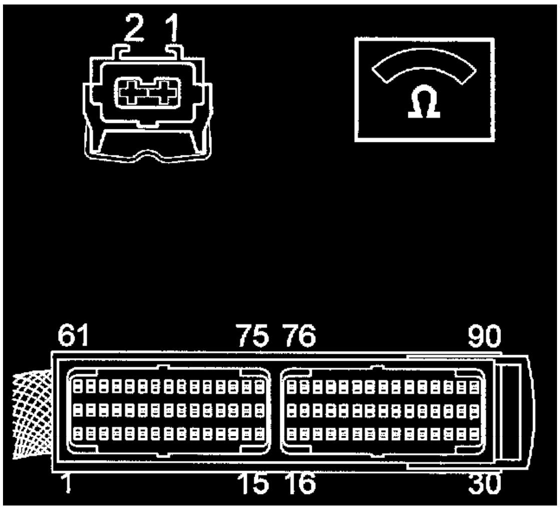
Not OK - Skip to "**Checking Wiring and Terminals**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Skip to "**Verification**"

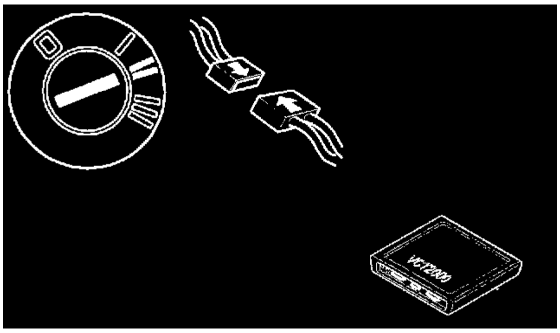
Checking Wiring And Terminals



Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?
Yes- Testing Complete
No - Contin8ue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

If an injector circuit is short-circuited to ground/voltage or if there is an open-circuit in the circuit the control module interprets it as a fault and a diagnostic trouble code (DTC) is stored for the injector.

Condition

Fuel trim disabled.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Faulty injector.

Signal too low:

- Short-circuit to ground in the signal cable.

Signal missing:

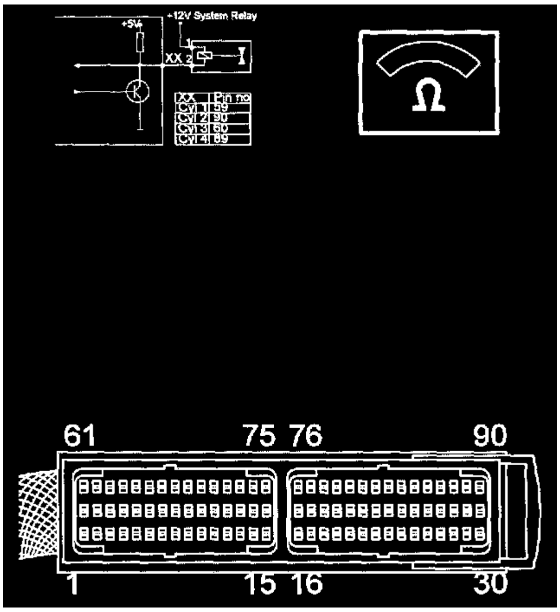
- Open-circuit in the signal cable
- Faulty injector.

Condition

- Engine not firing on all cylinders
- Engine does not start
- Malfunction indicator lamp (MIL) lit.

Signal Missing - Intermittent Fault

Checking Components And Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Check the power cable between injector terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Try a new injector if no faults are found in the above fault-tracing.

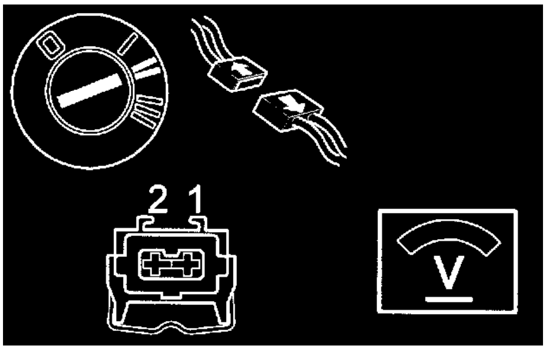
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Missing - Permanent Fault

Checking The Power Cable

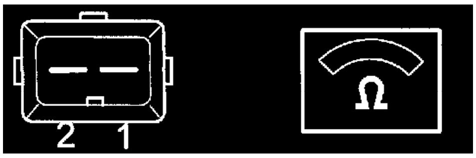


- Ignition off
- Disconnect the injector connector
- Ignition on.

Connect a voltmeter between injector connector terminal 1 (control module side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.
OK - Continue below.
Not OK - Skip to "**Checking Wiring And Terminals - II**"

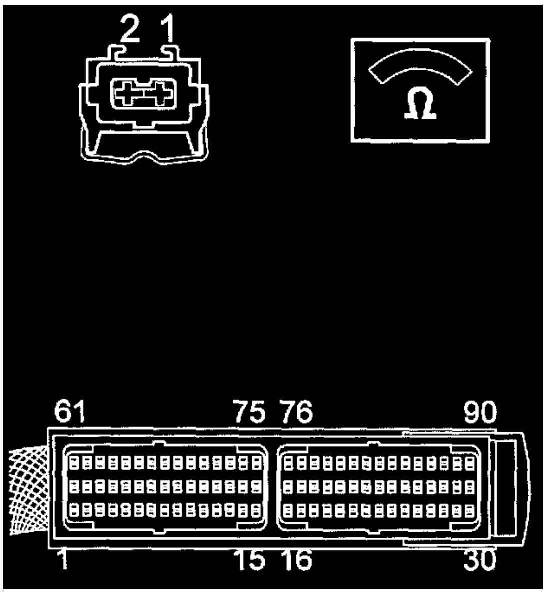
Checking Injectors



Connect an ohmmeter between injector connector terminals 1 and 2 (injector side).

The ohmmeter should read approximately 14-15 [ohm] at +20°C.
OK - Continue below.
Not OK - Skip to "**Defective Injector**"

Checking Wiring And Terminals - I



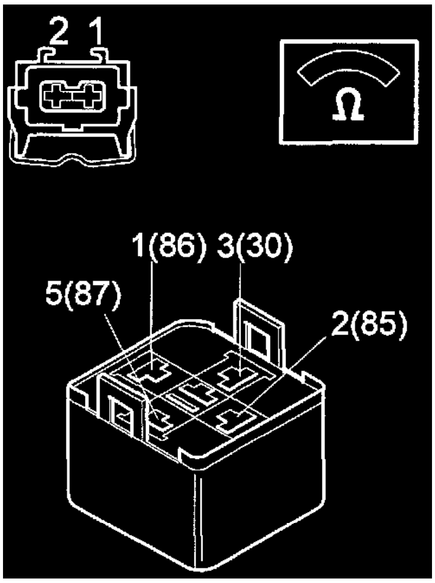
The cause of the diagnostic trouble code (DTC) was loose connections in the injector and/or engine control module (ECM) connectors. Check the connectors for loose terminals and contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the cable between injector connector terminal 2 (control module side) and engine control module (ECM) terminal 59 (EFI-115), terminal 90 (EFI-125), terminal 60 (EFI-135) or terminal 89 (EFI-145) depending on the diagnostic trouble code (DTC) stored, for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Skip to "**Verification**"

Checking Wiring And Terminals - II



Check the cable between injector terminal 1 and system relay 2/14 terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

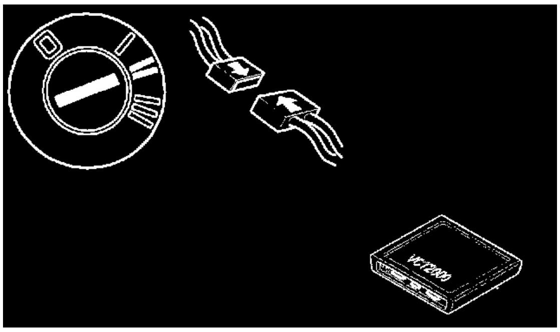
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

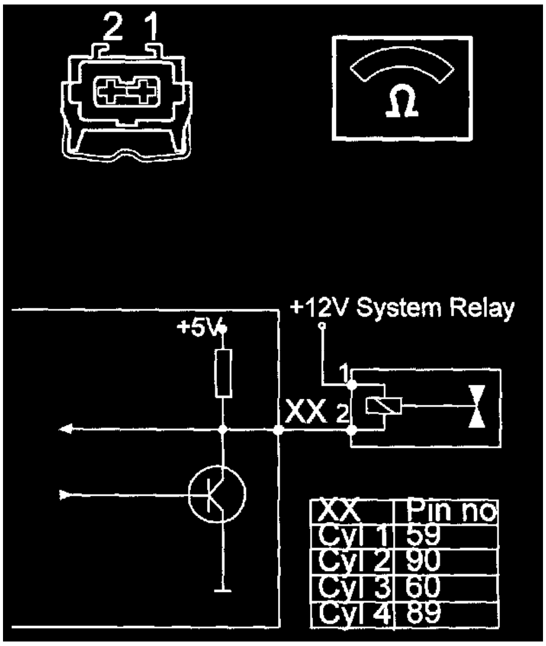
Does the injector click?
Yes- Testing Complete
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too High - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal #59 and injector terminal #2 for an intermittent short-circuit to supply voltage. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

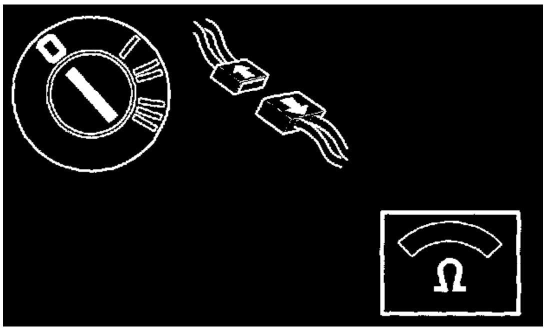
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To replace the injector, see **Replacing the injector(s).**

Signal Too High - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

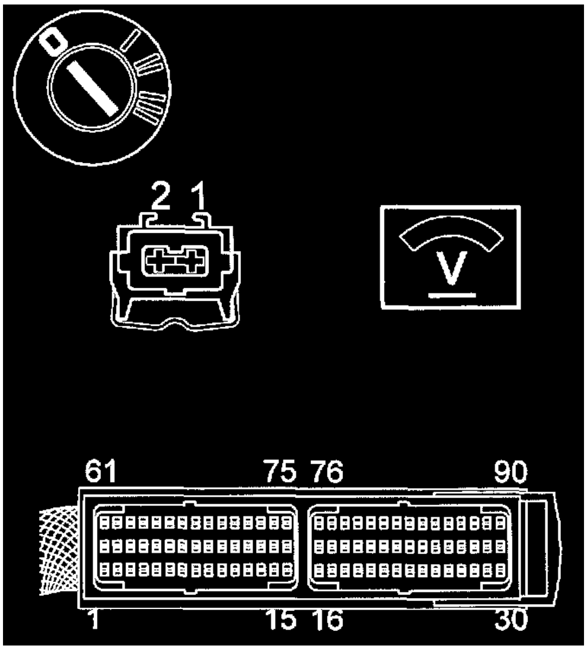
Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read approximately 15 [ohm].

OK - Continue below.

Not OK Skip to "**Defective Injector**"

Checking The Signal Cable



- Ignition off.

Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

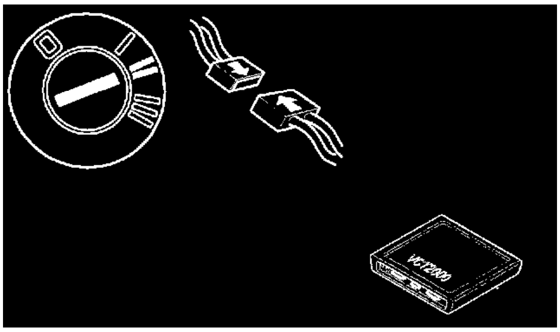
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

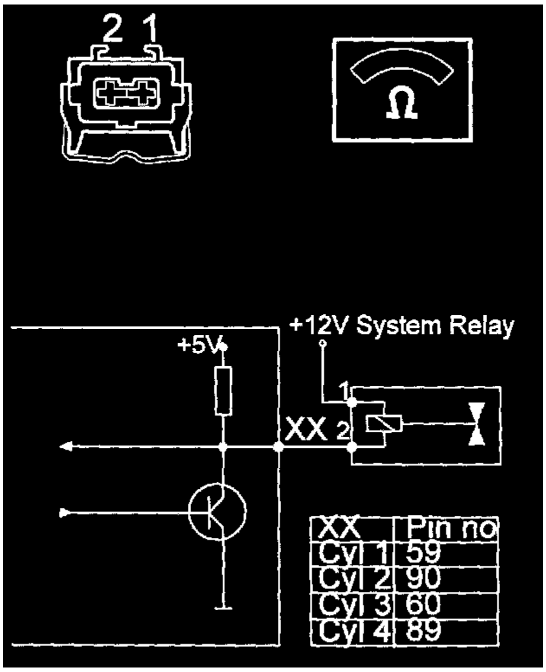
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

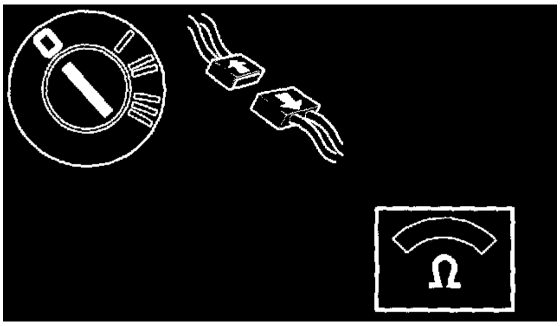
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Too Low - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read 14-15 [ohm] at 20°C.

OK - Continue below.

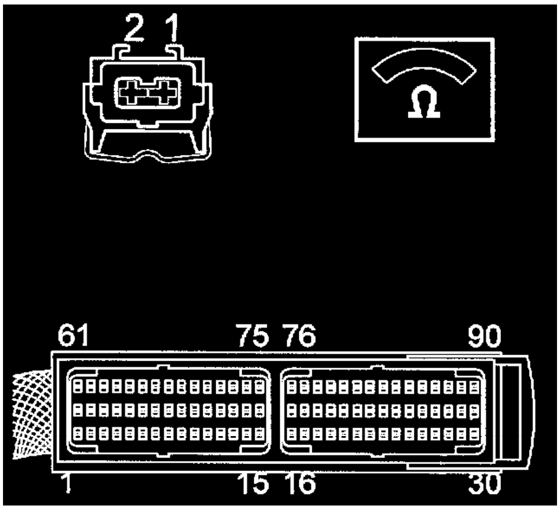
Not OK - Skip to "**Checking Wiring and Terminals**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Skip to "**Verification**"

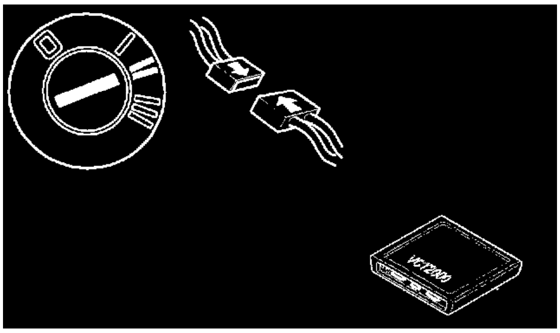
Checking Wiring And Terminals



Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?
Yes- Testing Complete
No - Contin8ue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

If an injector circuit is short-circuited to ground/voltage or if there is an open-circuit in the circuit the control module interprets it as a fault and a diagnostic trouble code (DTC) is stored for the injector.

Condition

Fuel trim disabled.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Faulty injector.

Signal too low:

- Short-circuit to ground in the signal cable.

Signal missing:

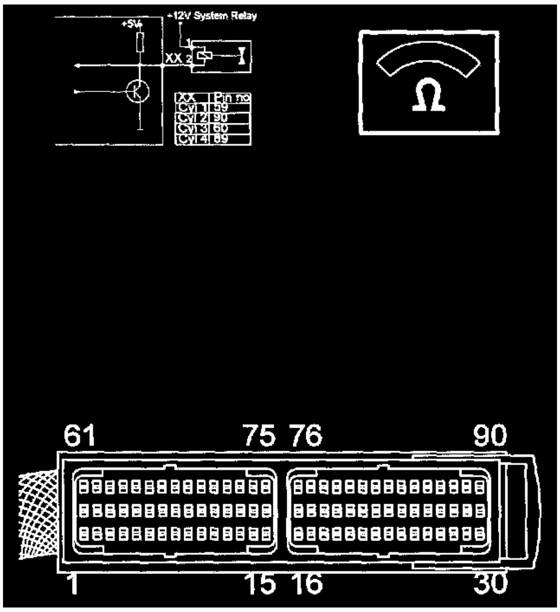
- Open-circuit in the signal cable
- Faulty injector.

Condition

- Engine not firing on all cylinders
- Engine does not start
- Malfunction indicator lamp (MIL) lit.

Signal Missing - Intermittent Fault

Checking Components And Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Check the power cable between injector terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Try a new injector if no faults are found in the above fault-tracing.

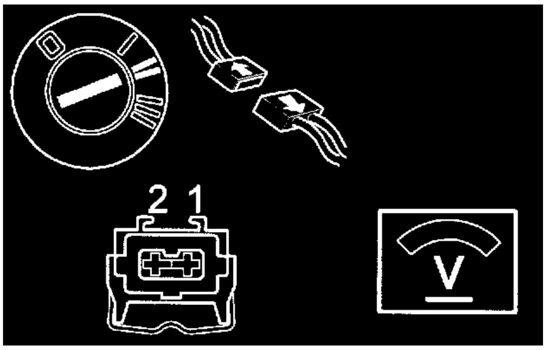
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Missing - Permanent Fault

Checking The Power Cable



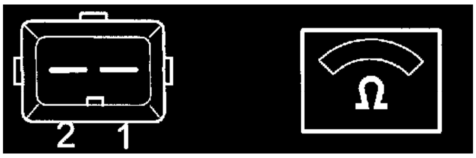
- Ignition off
- Disconnect the injector connector
- Ignition on.

Connect a voltmeter between injector connector terminal 1 (control module side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - Continue below.
Not OK - Skip to "**Checking Wiring And Terminals - II**"

Checking Injectors

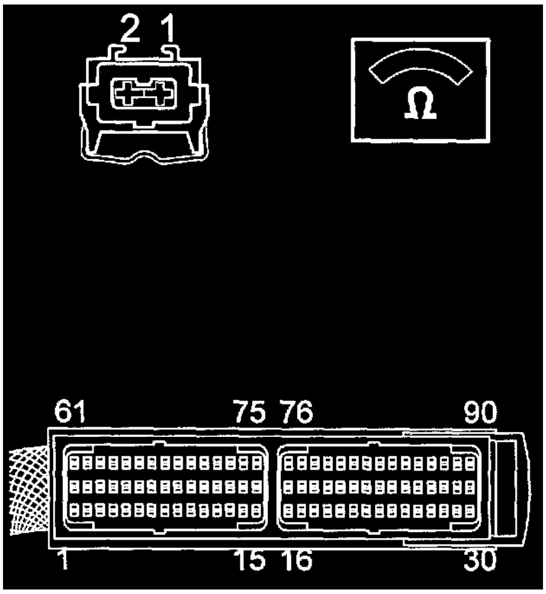


Connect an ohmmeter between injector connector terminals 1 and 2 (injector side).

The ohmmeter should read approximately 14-15 [ohm] at +20°C.

OK - Continue below.
Not OK - Skip to "**Defective Injector**"

Checking Wiring And Terminals - I



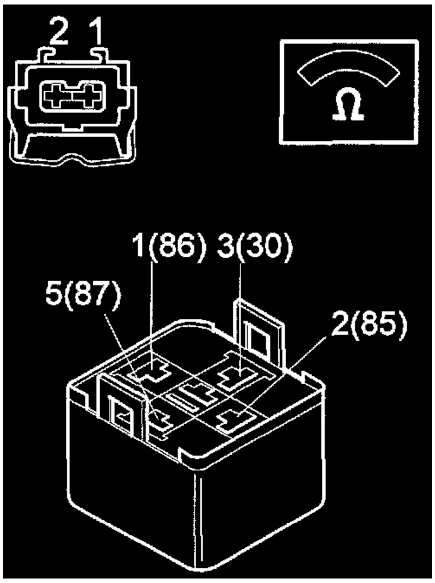
The cause of the diagnostic trouble code (DTC) was loose connections in the injector and/or engine control module (ECM) connectors. Check the connectors for loose terminals and contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the cable between injector connector terminal 2 (control module side) and engine control module (ECM) terminal 59 (EFI-115), terminal 90 (EFI-125), terminal 60 (EFI-135) or terminal 89 (EFI-145) depending on the diagnostic trouble code (DTC) stored, for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Skip to "**Verification**"

Checking Wiring And Terminals - II



Check the cable between injector terminal 1 and system relay 2/14 terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

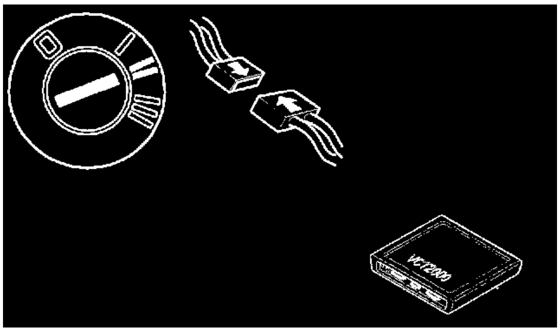
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

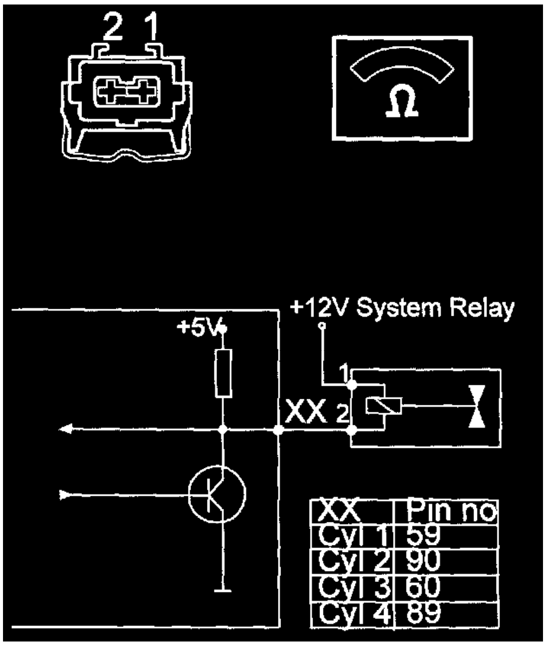
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too High - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal #59 and injector terminal #2 for an intermittent short-circuit to supply voltage. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

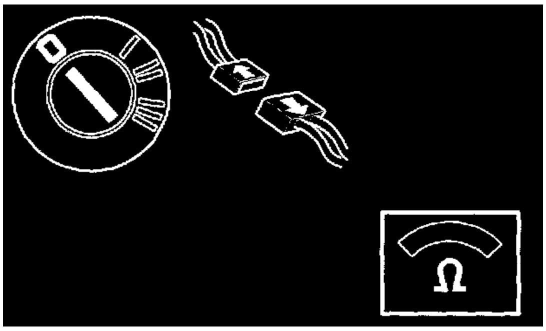
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To replace the injector, see **Replacing the injector(s).**

Signal Too High - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

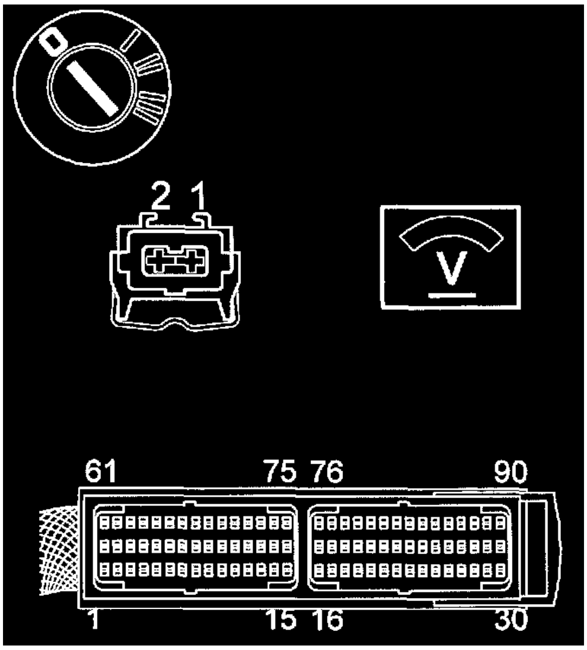
Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read approximately 15 [ohm].

OK - Continue below.

Not OK - Skip to "**Defective Injector**"

Checking The Signal Cable



- Ignition off.

Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

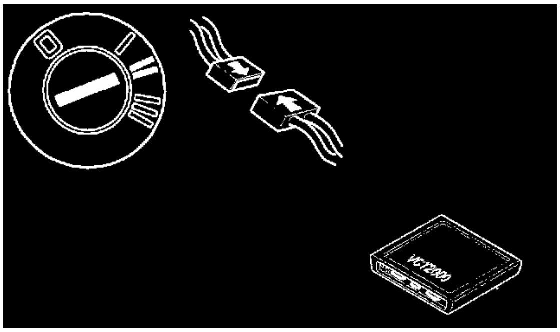
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

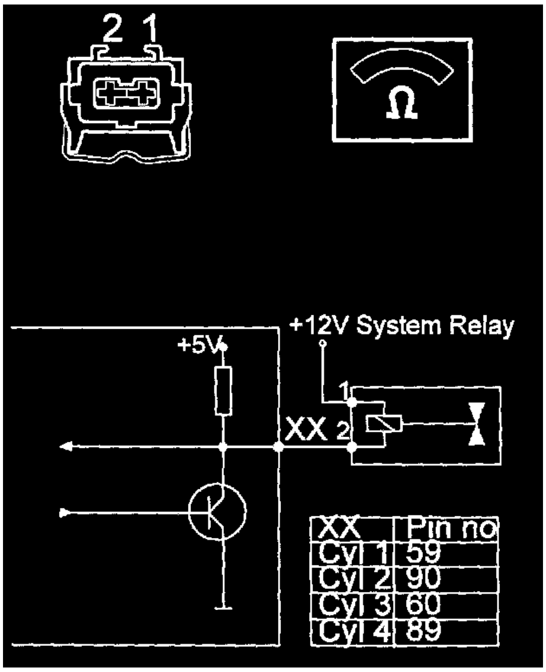
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

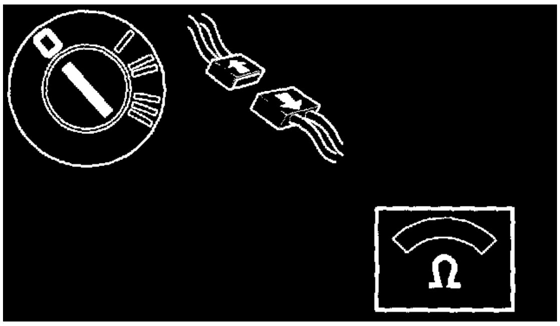
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Too Low - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

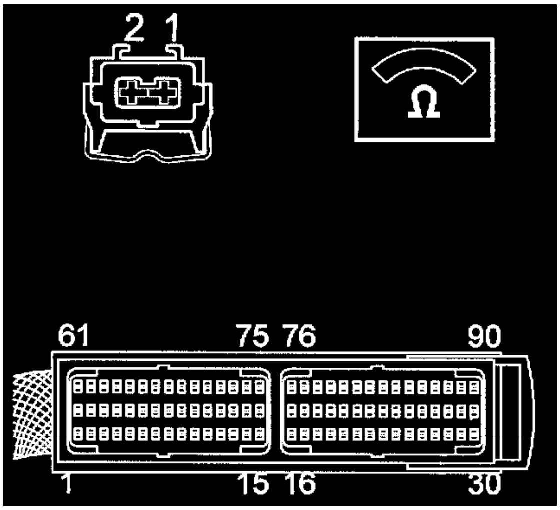
Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read 14-15 [ohm] at 20°C.
OK - Continue below.
Not OK - Skip to "**Checking Wiring and Terminals**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**
Skip to "**Verification**"

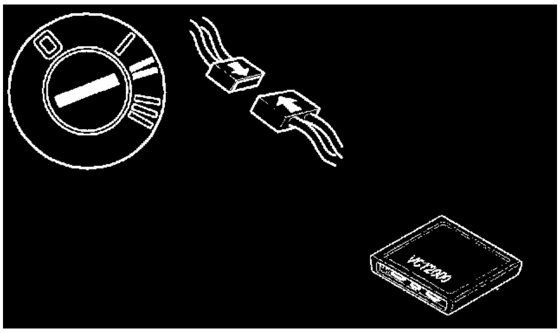
Checking Wiring And Terminals



Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?
Yes- Testing Complete
No - Contin8ue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

If an injector circuit is short-circuited to ground/voltage or if there is an open-circuit in the circuit the control module interprets it as a fault and a diagnostic trouble code (DTC) is stored for the injector.

Condition

Fuel trim disabled.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable
- Faulty injector.

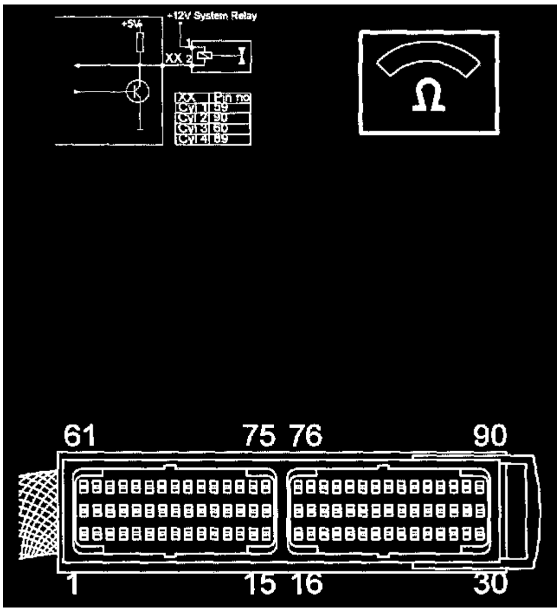
Signal too low:
- Short-circuit to ground in the signal cable.

Signal missing:
- Open-circuit in the signal cable
- Faulty injector.

Condition
- Engine not firing on all cylinders
- Engine does not start
- Malfunction indicator lamp (MIL) lit.

Signal Missing - Intermittent Fault

Checking Components And Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

Check the power cable between injector terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent Faults.**

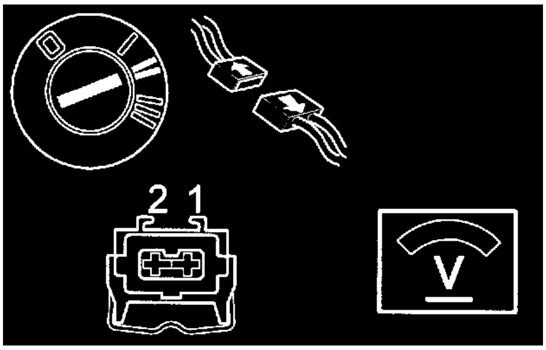
Try a new injector if no faults are found in the above fault-tracing.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Missing - Permanent Fault

Checking The Power Cable



- Ignition off
- Disconnect the injector connector
- Ignition on.

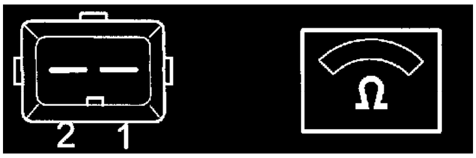
Connect a voltmeter between injector connector terminal 1 (control module side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - Continue below.

Not OK - Skip to "**Checking Wiring And Terminals - II**"

Checking Injectors



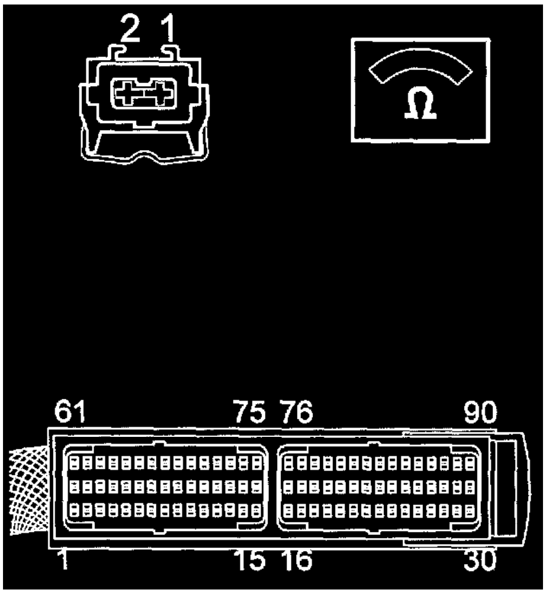
Connect an ohmmeter between injector connector terminals 1 and 2 (injector side).

The ohmmeter should read approximately 14-15 [ohm] at +20°C.

OK - Continue below.

Not OK - Skip to "**Defective Injector**"

Checking Wiring And Terminals - I



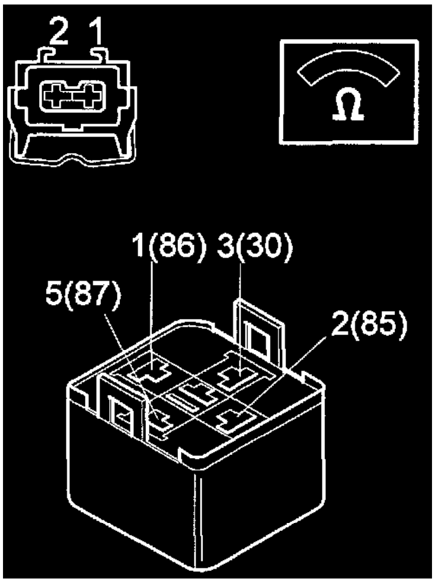
The cause of the diagnostic trouble code (DTC) was loose connections in the injector and/or engine control module (ECM) connectors. Check the connectors for loose terminals and contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the cable between injector connector terminal 2 (control module side) and engine control module (ECM) terminal 59 (EFI-115), terminal 90 (EFI-125), terminal 60 (EFI-135) or terminal 89 (EFI-145) depending on the diagnostic trouble code (DTC) stored, for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Skip to "**Verification**"

Checking Wiring And Terminals - II



Check the cable between injector terminal 1 and system relay 2/14 terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

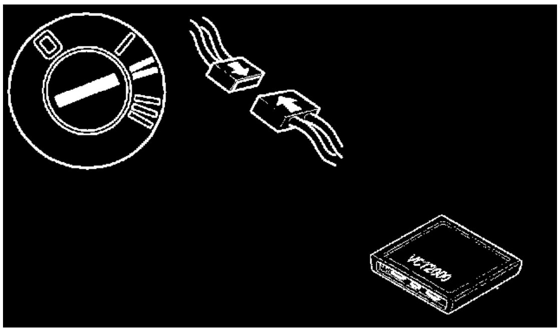
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

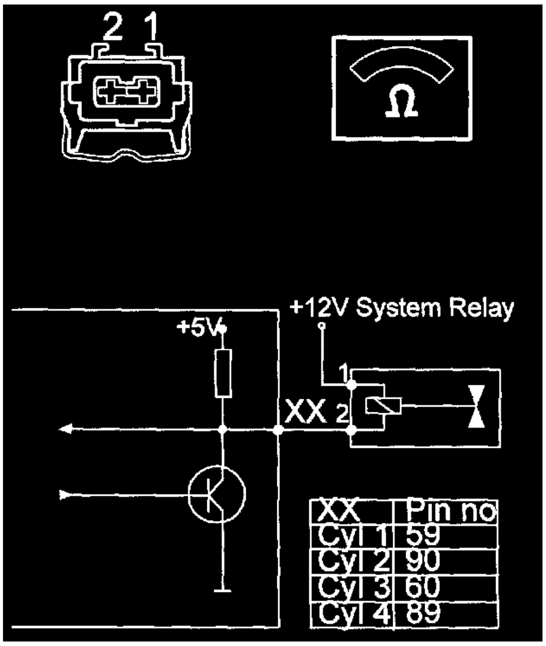
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too High - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal #59 and injector terminal #2 for an intermittent short-circuit to supply voltage. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

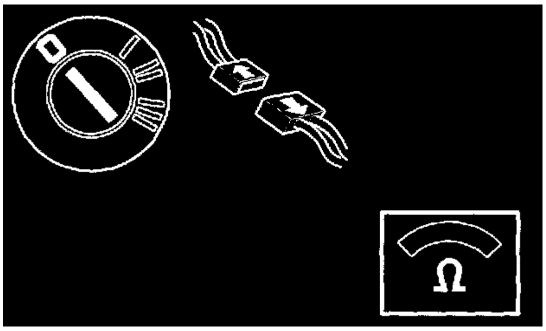
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To replace the injector, see **Replacing the injector(s).**

Signal Too High - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

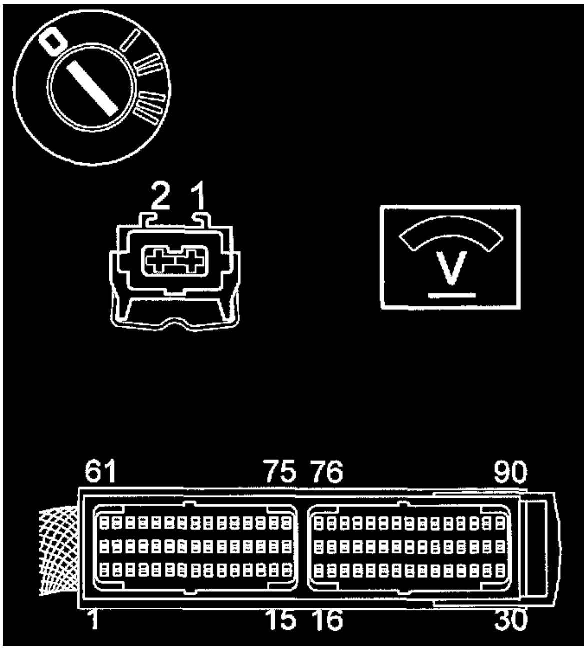
Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read approximately 15 [ohm].

OK - Continue below.

Not OK Skip to "**Defective Injector**"

Checking The Signal Cable



- Ignition off.

Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

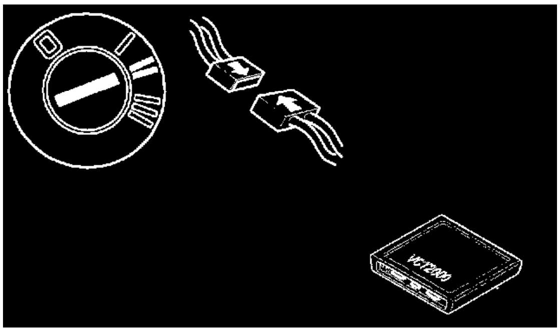
Remedy as necessary.

Skip to "**Verification**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?

Yes- Testing Complete

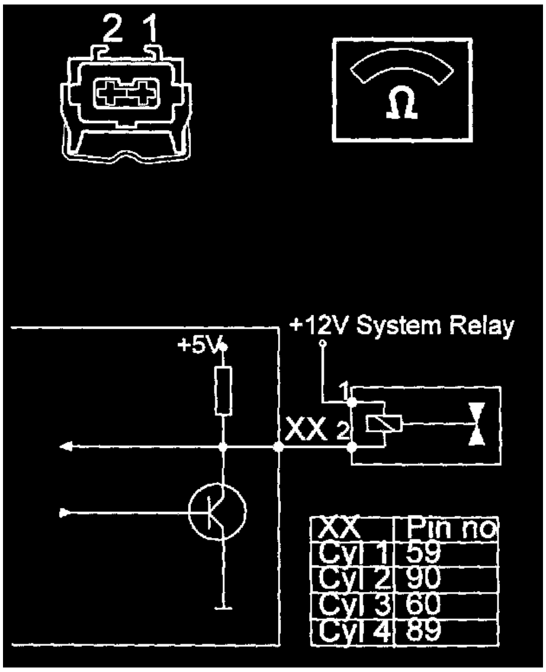
No - Contin8ue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Signal Too Low - Intermittent Fault

Checking Wiring



Check the signal cable between the engine control module (ECM) terminal and injector terminal 2 for an intermittent short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

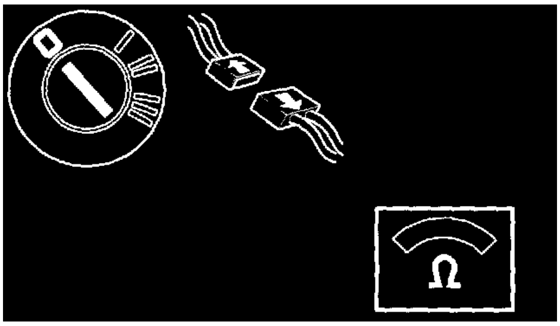
Try a new injector if no faults are found in the above fault-tracing.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the injector, see **Replacing the injector(s).**

Signal Too Low - Permanent Fault

Checking Injectors



- Ignition off
- Disconnect the injector connector.

Connect an ohmmeter between injector connector terminals 1 and 2.

The ohmmeter should read 14-15 [ohm] at 20°C.

OK - Continue below.

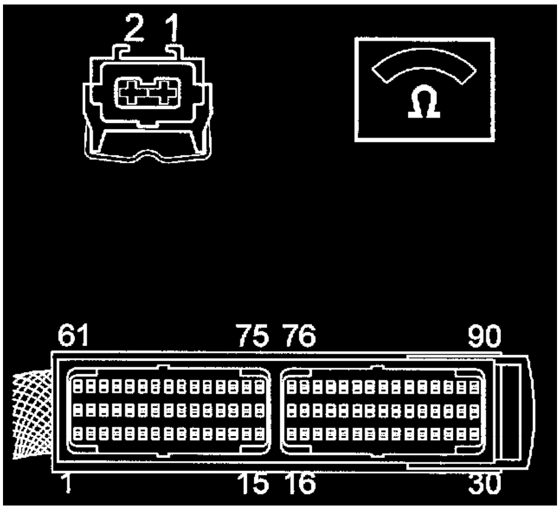
Not OK - Skip to "**Checking Wiring and Terminals**"

Defective Injector

Try a new injector according to **Replacing the injector(s).**

Skip to "**Verification**"

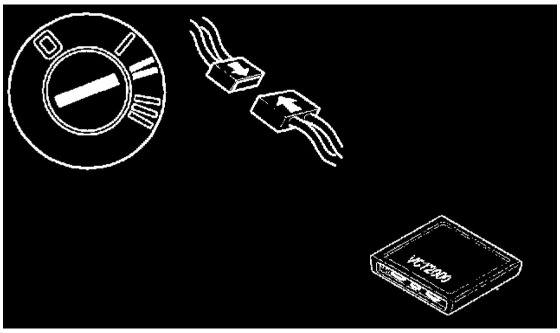
Checking Wiring And Terminals



Check the cable between injector connector terminal 2 and engine control module (ECM) connector terminal 59 (ECM-1E), terminal 90 (ECM-1F), terminal 60 (ECM-20) or terminal 89 (ECM-21) for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Verification



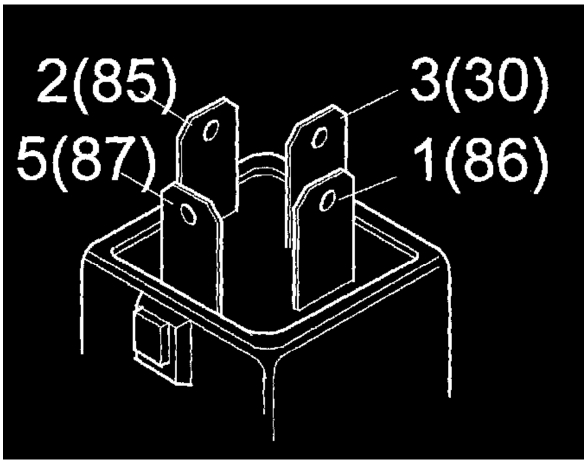
- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the injector by clicking on the VCT 2000 symbol.

Does the injector click?
Yes- Testing Complete
No - Contin8ue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed. Exit fault tracing for this diagnostic trouble code (DTC) or make another attempt.

Diagnostic Trouble Code (DTC) Information



Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM-24 is stored if there is a short-circuit to ground or supply voltage or an open- circuit in the signal cable for the system relay.

Condition

None.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable.

Signal too low:

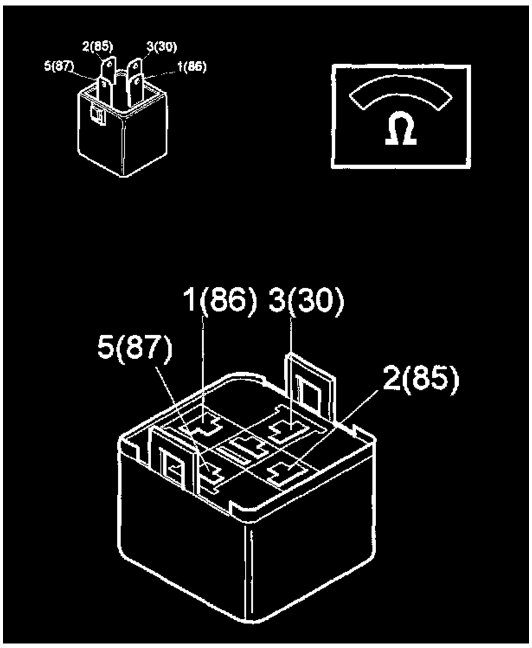
- Short-circuit to ground in signal cable
- Open-circuit in the signal cable.

Condition

- The engine fails to start
- Malfunction indicator lamp (MIL) lit.

Signal Too High - Intermittent Fault

Signal too high. Intermittent fault



Checking components and wiring

Check that the resistance in the system relay between terminals 1 and 2 is approximately 75 [ohm] at +20°C.

Check the signal cable between engine control module (ECM) terminal 10 and system relay (2/14) base terminal 1 for an intermittent short-circuit to supply voltage and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

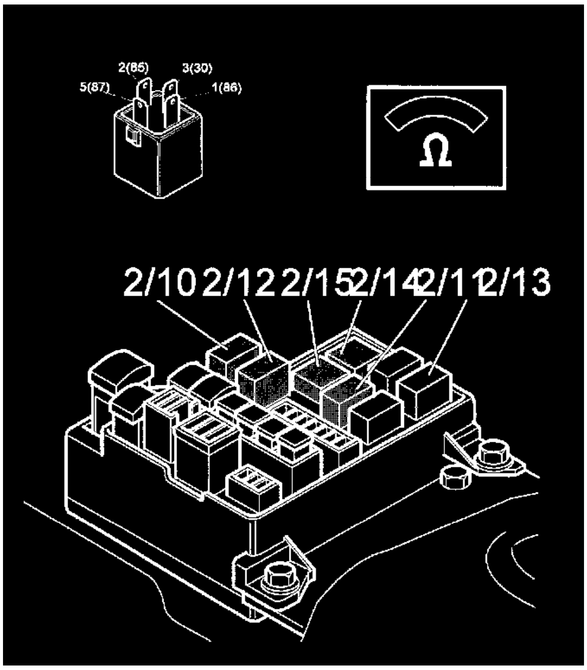
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too High - Permanent Fault

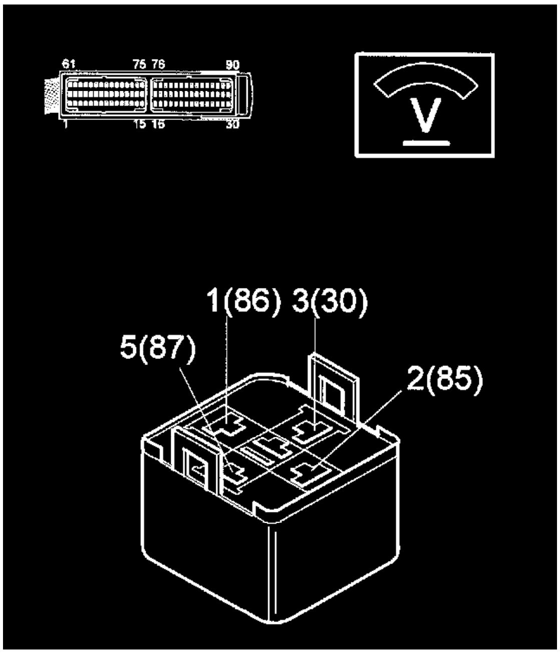
Signal too high. Permanent fault

Checking wiring and components



Check that the resistance in the system relay (2/14) between terminals 1 and 2 is approximately 75 [ohm] at +20°C.
Replace the system relay if necessary.

Checking wiring and components

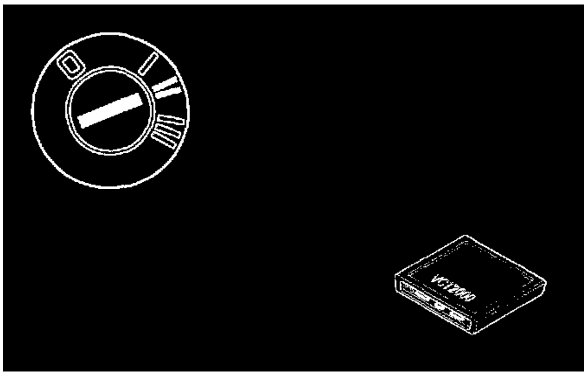


Check the signal cable between engine control module (ECM) terminal 10 and system relay base terminal 1 for a short-circuit to supply voltage.
Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Verification



- Ignition on.

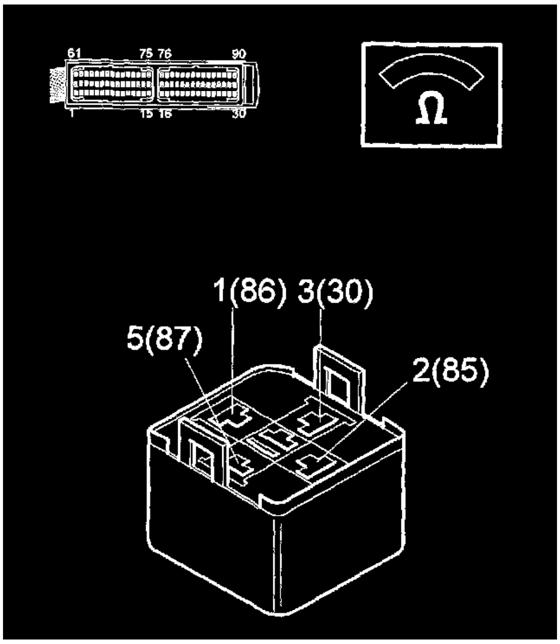
Activate the system relay. Check that the relay clicks and the fuel pump (FP) starts when it is activated.

Is the function OK?

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too Low - Intermittent Fault

Signal too low. Intermittent fault



Checking cables
Check the signal cable between engine control module (ECM) terminal 10 and system relay terminal 2 for an intermittent short-circuit to ground and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

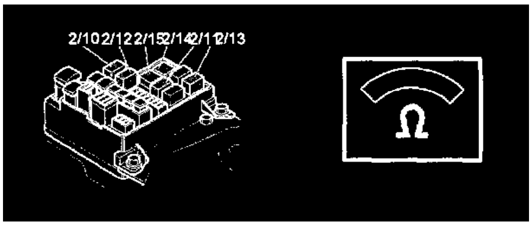
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Fault-tracing information
If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too Low - Permanent Fault

Signal too low. Permanent fault

Checking wiring and components



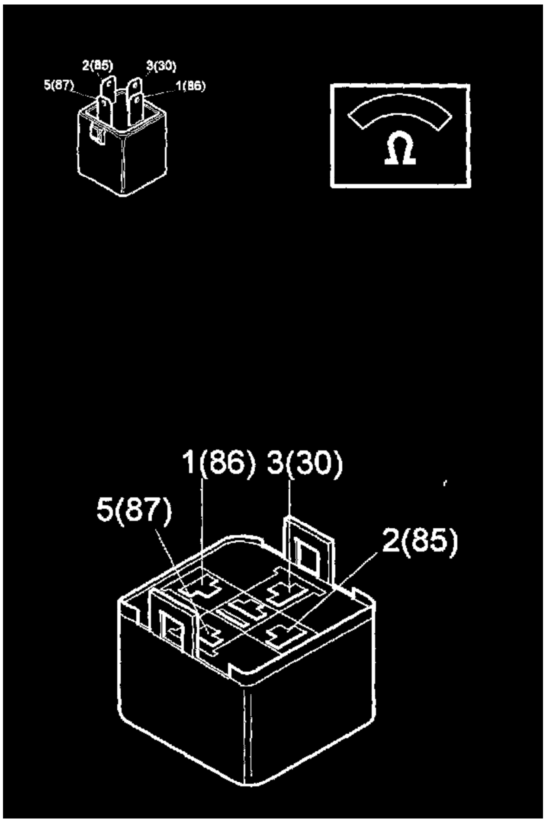
Check the system relay (2/14) base and engine control module (ECM) connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Check for loose or damaged terminal pins. Was a fault detected?

Yes - Skip to "**Verification**"

No - Continue below.

Checking wiring and components



Check that the resistance in the system relay (2/14) between terminals 1 and 2 is approximately 75 [ohm] at +20°C. Replace the system relay if necessary.

Check the system relay power supply to terminal 2 (86) via fuse 11 in the relay box in the passenger compartment.

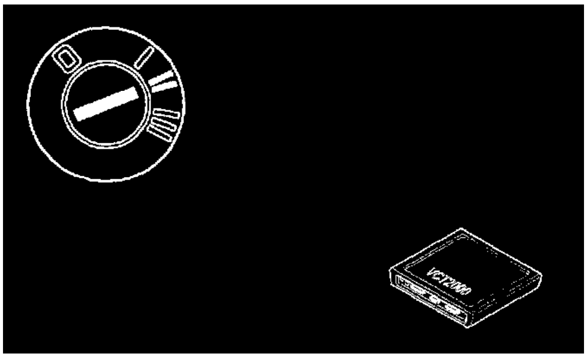
Check the cable between system relay base 2 (86) and fuse 11 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Check the signal cable between engine control module (ECM) terminal 10 and system relay base terminal 1 for a short-circuit to ground. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals and for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Verification



- Ignition on.

Activate the system relay. Check that the relay clicks when it is activated.

Is the function OK?
Yes - Testing Complete.
No - Continue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information Condition

Diagnostic trouble code (DTC) information Condition
The control module receives information from the heated oxygen sensor (HO2S) about fuel / air mixture. If the fuel / air mixture deviates from [lambda]=1, the short-term fuel trim will compensate for this by adjusting the injection interval so that [lambda]=1 is achieved. When the short-term fuel trim makes an adjustment, the long term fuel trim ([lambda]) will also be adjusted. A diagnostic trouble code (DTC) is stored when fuel trim has reached an upper limit (lean limit) or a lower limit (rich limit).

Condition
Fuel trim disabled.

Possible source

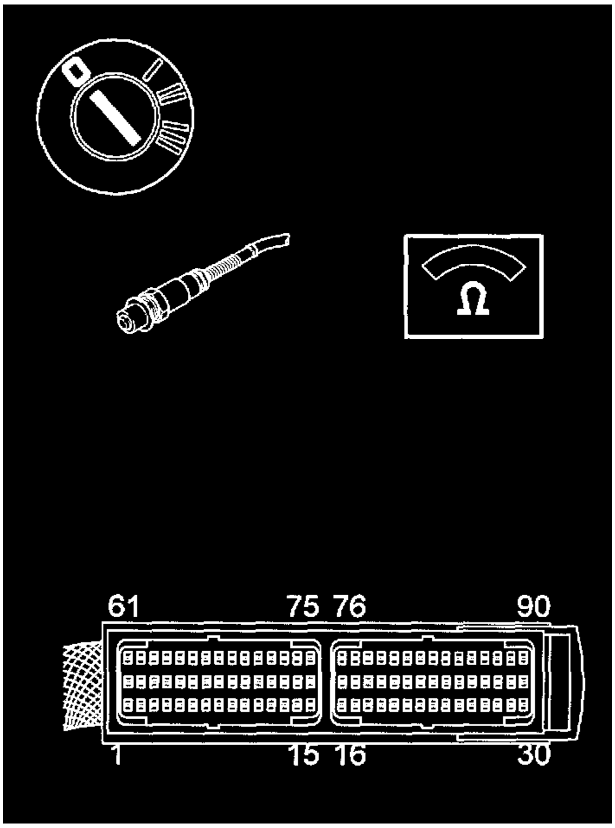
Rich limit:
- Contact resistance in the terminals
- High fuel pressure
- Leaking injectors
- Contaminated oil
- Defective heated oxygen sensor (HO2S).

Lean limit:
- Contact resistance in the terminals
- Low fuel pressure
- Air leakage in the intake system
- Leakage in the exhaust system
- Defective heated oxygen sensor (HO2S).

Condition
- Malfunction indicator lamp (MIL) lit.

Lean - Intermittent Fault

Lean. Intermittent fault



Checking the connectors and components

- Ignition off
- Check the front heated oxygen sensor (HO2S) and control module connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Check for too low fuel pressure
- Check the intake system for leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System
- Check the exhaust system for leakage according to See: Component Tests and General Diagnostics/Checking For Air Leakage In the Exhaust System
- Remedy as necessary.

Other information:

- To access the control module, See: Engine Control Module/Service and Repair
- To replace the front heated oxygen sensor (HO2S), See: Oxygen Sensor/Service and Repair

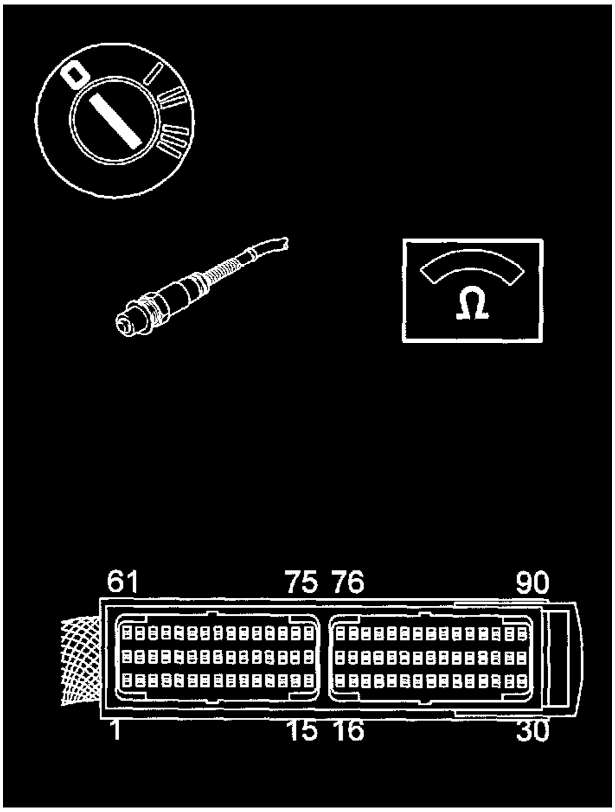
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Lean - Permanent Fault

Lean. Permanent fault

Checking the connectors and components

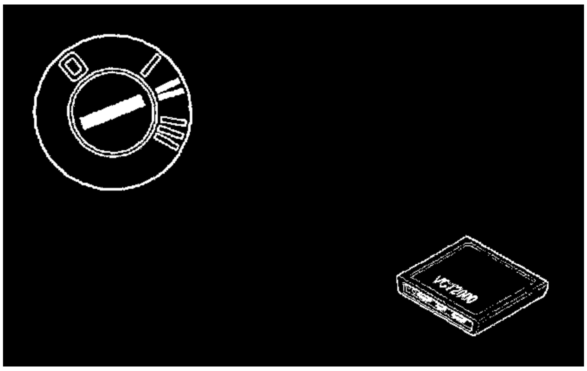


- Ignition off.
- Check the front heated oxygen sensor (HO2S) and control module connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Check for too low fuel pressure according to Measuring fuel pressure EMS 2000
- Check the intake system for leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System
- Check the exhaust system for leakage according to See: Component Tests and General Diagnostics/Checking For Air Leakage In the Exhaust System
- Remedy as necessary.

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking diagnostic trouble codes (DTCs)

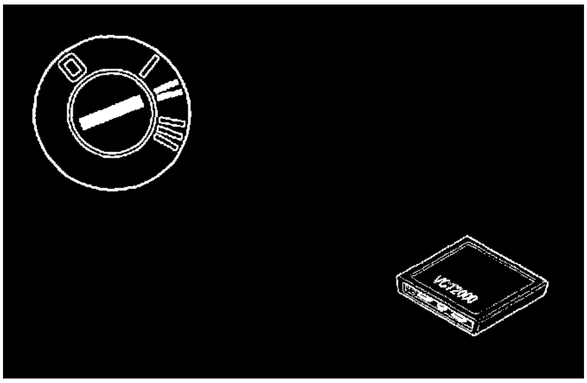


- Test drive the vehicle for at least 10 minutes at a constant speed and throttle opening.
- Allow the engine to idle for at least 5 minutes.
- Read off diagnostic trouble codes (DTCs)
- Check if the diagnostic trouble code (DTC) status has changed to intermittent. If the diagnostic trouble code (DTC) status has changed, the fault has been remedied

Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes - Continue below.
No - Skip to "**Replacing the Component**"

Resetting the adaptation

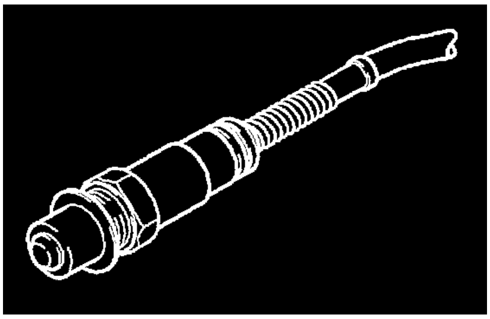


Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim. Select "Continue" when the fuel trim is reset.

--Testing Complete--

Replacing the component

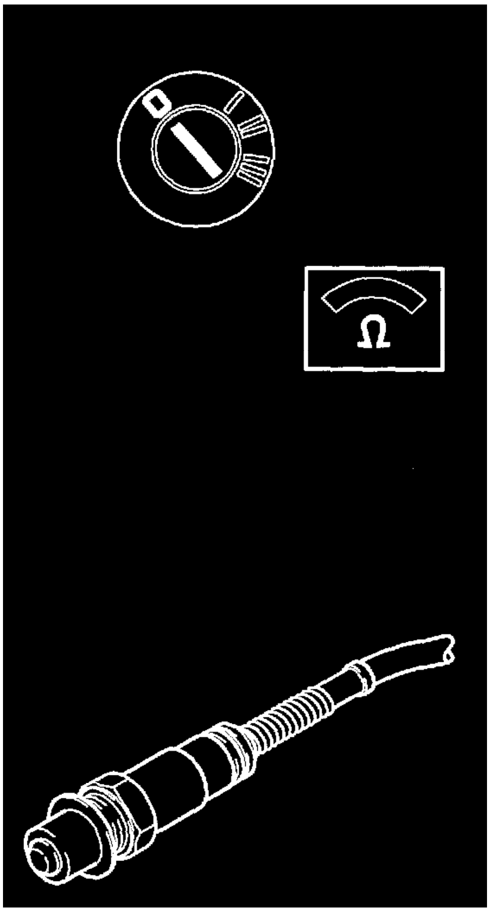


- Replace the front heated oxygen sensor (HO2S) according to See: Oxygen Sensor/Service and Repair

Select Continue when the fault has been remedied.

Rich - Intermittent Fault

Rich. Intermittent fault



Checking the connectors and components

- Ignition off.

Check the air cleaner (ACL) and intake system for blockage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Check for too high fuel pressure.

Check the injectors for leakage.

Check that the engine oil level is not too high and that it is not contaminated with fuel.

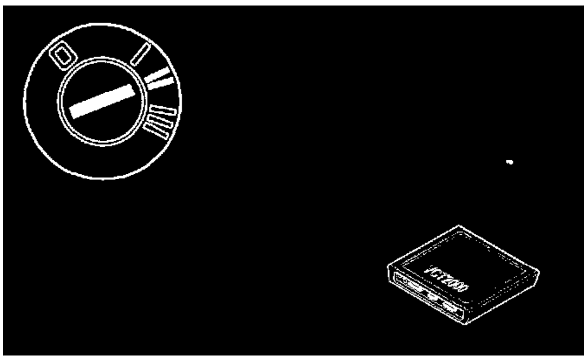
Check the front heated oxygen sensor (HO2S) and control module connectors. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:

- To access the control module, See: Engine Control Module/Service and Repair
- To replace the front heated oxygen sensor (HO2S), See: Oxygen Sensor/Service and Repair

Select "Continue" when the fault has been remedied.



Resetting the adaptation

Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on.
- Click on the VCT2000 symbol to reset the fuel trim Select "Continue" when the fuel trim is reset.

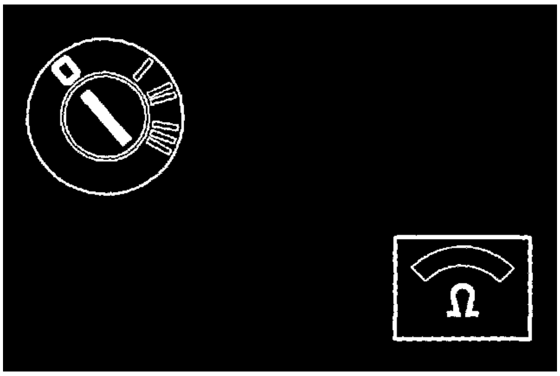
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Rich - Permanent Fault

Rich. Permanent fault

Checking the connectors and components

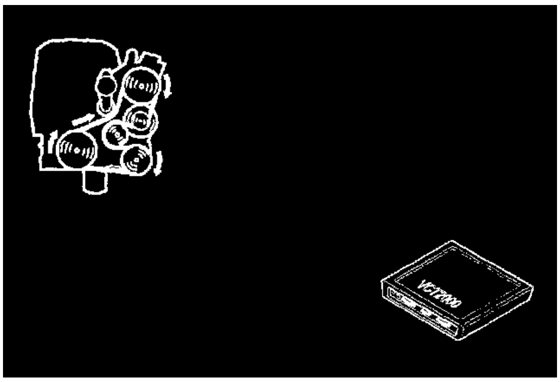


- Ignition off
- Check the front heated oxygen sensor (HO2S) and control module connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
- Check the air filter and intake system for blockage.
- Check for too high fuel pressure.
- Check the injectors for leakage.
- Check that the engine oil level is not too high and that it is not contaminated with fuel.
- Remedy as necessary.

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking diagnostic trouble codes (DTCs)

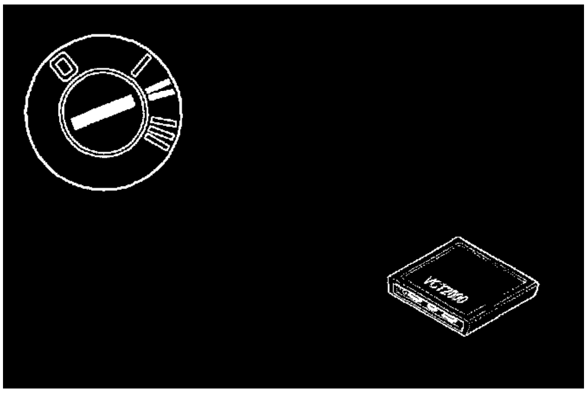


- Test drive the vehicle for at least 10 minutes at a constant speed and throttle opening.
- Allow the engine to idle for at least 5 minutes.
- Read off diagnostic trouble codes (DTCs).
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes - Continue below.
No - Skip to "**Replacing the Component**"

Resetting the adaptation

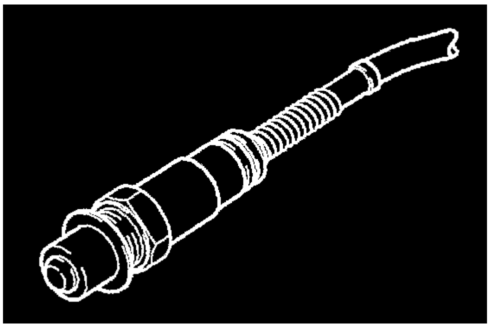


Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on.
- Click on the VCT2000 symbol to reset the fuel trim

Select "Continue" when the fuel trim is reset.
--Testing Complete--

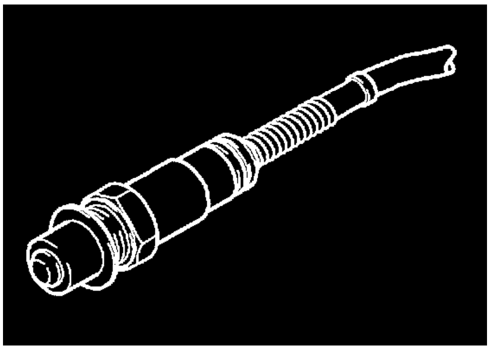
Replacing the component



- Replace the front heated oxygen sensor (HO2S) according to See: Oxygen Sensor/Service and Repair

Select Continue when the fault has been remedied.

Diagnostic Trouble Code (DTC) Information Condition



Diagnostic trouble code (DTC) information Condition
The control module monitors how long it takes for the front heated oxygen sensor (HO2S) to switch between high and low (from rich to lean fuel mixture). Diagnostic trouble code (DTC) ECM-28 is stored if it takes too long.

Condition
- Fuel trim is disabled
- No three-way catalytic converter (TWC) diagnostic.

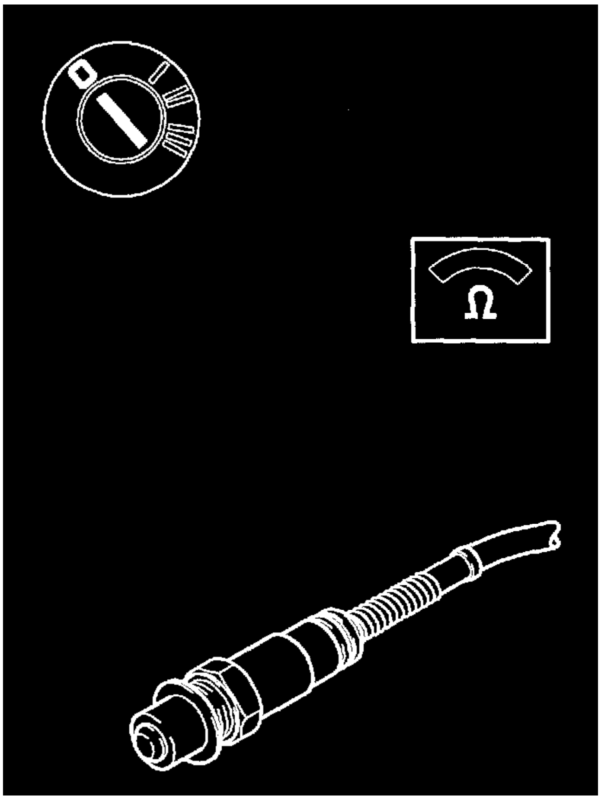
Possible source
- Contact resistance in the terminals
- Air leakage in the intake system
- Defective front heated oxygen sensor (HO2S).

Condition

- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Faulty signal. Intermittent fault



Checking the connectors and components

- Ignition off

Check the front heated oxygen sensor (HO2S) and control module connectors. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

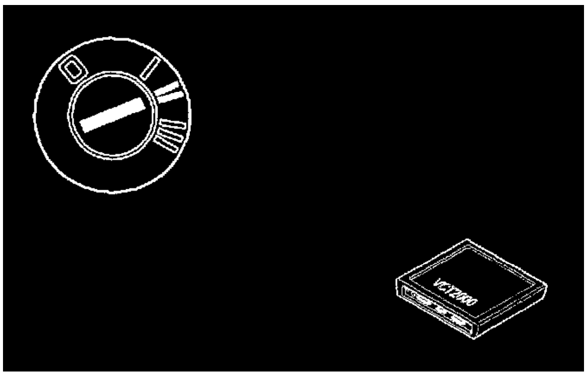
Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Remedy as necessary.

Other information:

- To access the control module, See: Engine Control Module/Service and Repair
- To replace the front heated oxygen sensor (HO2S), See: Oxygen Sensor/Service and Repair

Select Continue when the fault has been remedied.



Resetting the adaptation

Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Select "Continue" when the fuel trim is reset.

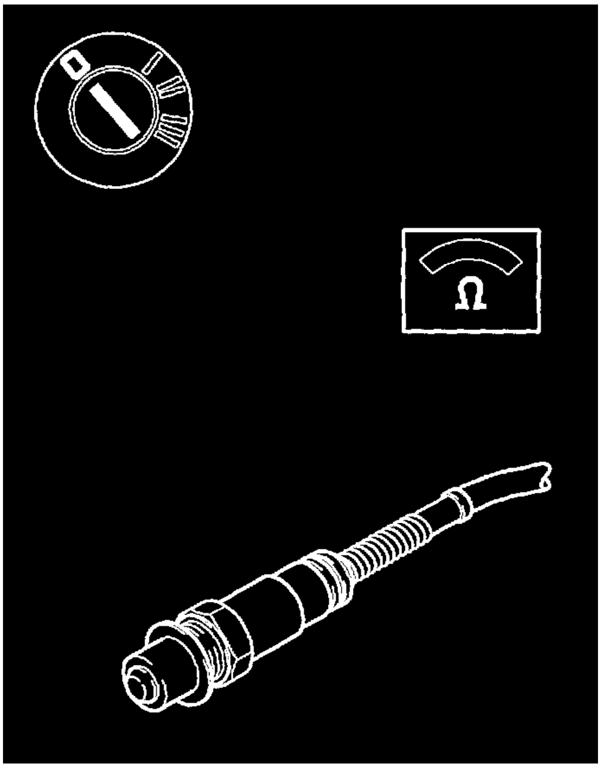
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Faulty Signal - Permanent Fault

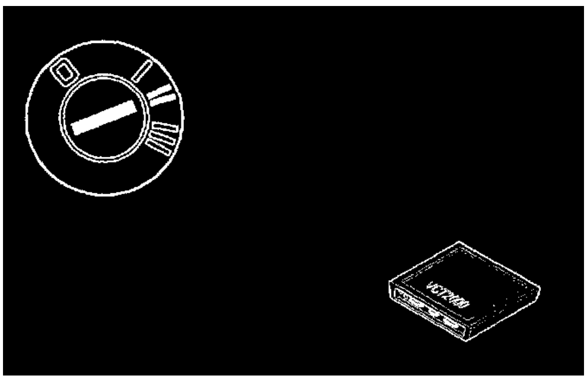
Faulty signal. Permanent fault

Checking the connectors and components



- Ignition off.
- Check the front heated oxygen sensor (HO2S) and control module connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System
- Remedy as necessary

Checking diagnostic trouble codes (DTCs)



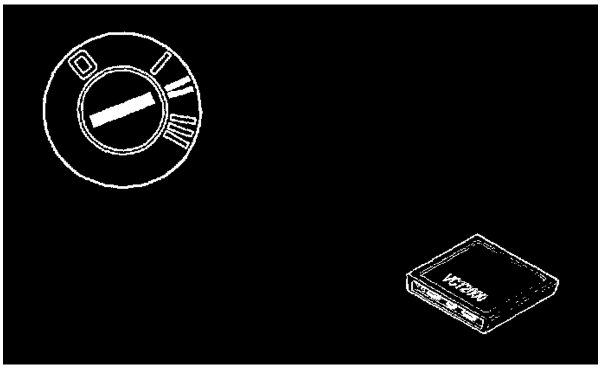
- Test drive the vehicle for at least 10 minutes at a constant speed and throttle opening.
- Allow the engine to idle for at least 5 minutes.
- Read off diagnostic trouble codes (DTCs)
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes- Continue below.

No - Skip to "**Replacing the component**"

Resetting the adaptation

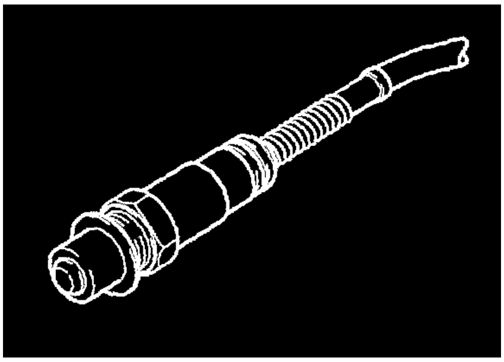


Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on.
- Click on the VCT2000 symbol to reset the fuel trim.

Select "Continue" when the fuel trim is reset.
--Testing Complete--

Replacing the component



- Replace the front heated oxygen sensor (HO2S) according to See: Oxygen Sensor/Service and Repair

Select Continue when the fault has been remedied.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

The rear heated oxygen sensor (HO2S) signal is checked when the control module carries out a three-way catalytic converter (TWC) diagnostic. A diagnostic trouble code (DTC) is stored if the rear heated oxygen sensor (HO2S) signal is not within the range permissible for three-way catalytic converter (TWC) diagnostics. Diagnostic trouble code (DTC) ECM-29 is stored if the signal from the heated oxygen sensor (HO2S) is faulty.

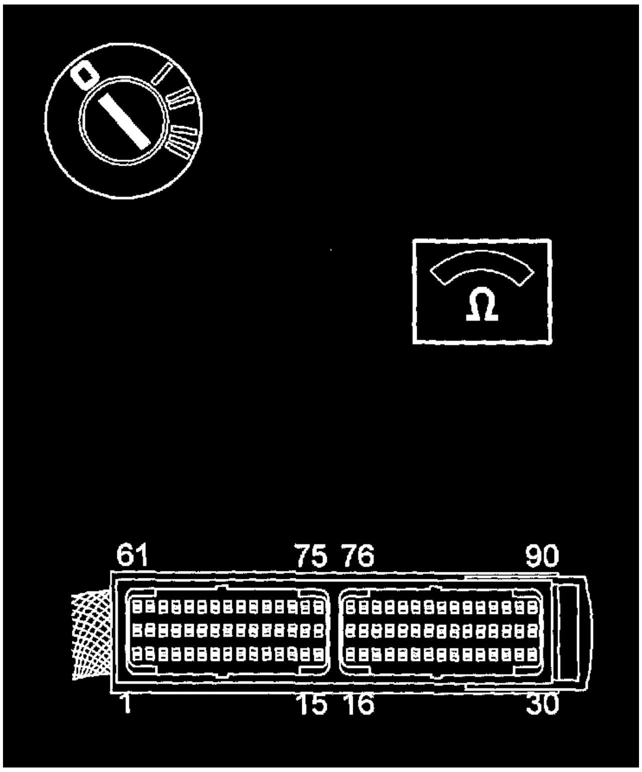
Condition
- Fuel trim disabled
- Three-way catalytic converter (TWC) diagnostic disabled.

Possible source
- Contact resistance in the terminals
- Leakage in the exhaust system
- Defective rear heated oxygen sensor (HO2S).

Condition
- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Faulty signal. Intermittent fault



Checking the connectors and components

- Ignition off.

Check the connectors for the rear heated oxygen sensor (HO2S) and control module for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

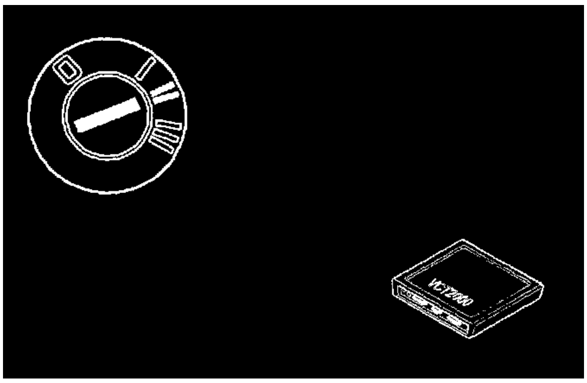
Check the exhaust system for leakage according to See: Component Tests and General Diagnostics/Checking For Air Leakage In the Exhaust System

Remedy as necessary.

Other information:

- To access the control module, See: Engine Control Module/Service and Repair
- To replace the rear heated oxygen sensor (HO2S), See: Oxygen Sensor/Service and Repair

Select Continue.



Resetting the adaptation

Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Select "Continue" when the fuel trim is reset.

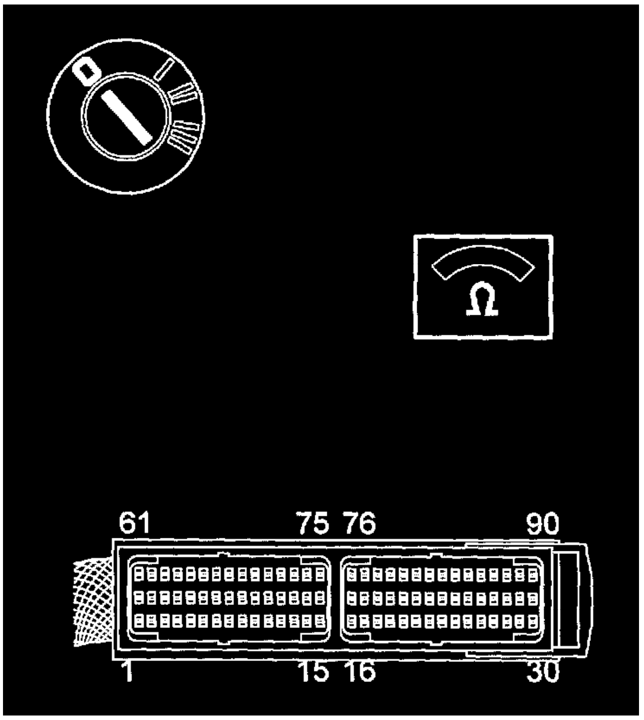
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Faulty Signal - Permanent Fault

Faulty signal. Permanent fault

Checking the connectors and components

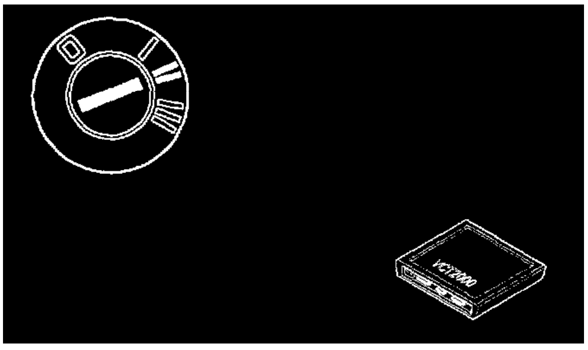


- Ignition off
- Check the connectors for the rear heated oxygen sensor (HO2S) and control module. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
- Check the exhaust system for leakage according to See: Component Tests and General Diagnostics/Checking For Air Leakage In the Exhaust System
- Remedy as necessary.

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking diagnostic trouble codes (DTCs)



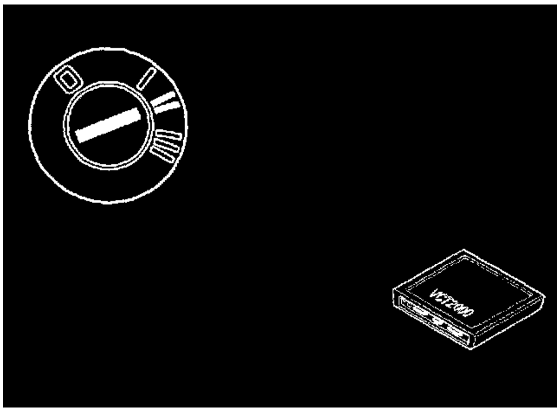
- Test drive the vehicle for at least 10 minutes at a constant speed and throttle opening
- Allow the engine to idle for at least 5 minutes.
- Read off diagnostic trouble codes (DTCs)
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. The status of the diagnostic trouble code (DTC) will have changed to intermittent if the fault has been remedied

Has the status of the diagnostic trouble code (DTC) changed to intermittent?

Yes- Continue below.

No - Skip to "**Replacing the component**"

Resetting the adaptation



Note! It is important that the fuel trim is reset after this diagnostic trouble code (DTC) is remedied. If this is not done there may be driveability problems, even though the fault is no longer present.

- Ignition on
- Click on the VCT2000 symbol to reset the fuel trim.

Select "Continue" when the fuel trim is reset.
--Testing Complete--

Replacing the component
- Replace the rear heated oxygen sensor (HO2S) according to See: Oxygen Sensor/Service and Repair

Select Continue when the fault has been remedied.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) ECM-2D is stored if the turbocharger (TC) control valve circuit is short-circuited to ground or voltage or if there an open-circuit in the circuit.

Condition
The fuel shut-off system operates at high air mass. Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable.

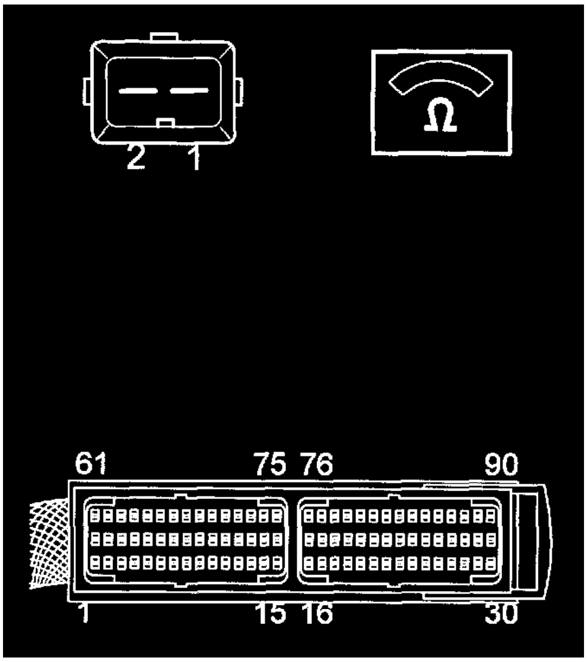
Signal too low:
- Short-circuit to ground in the signal cable.

Signal missing:
- Open-circuit in the signal cable.

Condition
- Poor performance
- Better performance.

Signal Missing - Intermittent Fault

Signal missing. Intermittent fault



Checking components and wiring

Check that the resistance in the turbocharger (TC) control valve between terminals 1 and 2 is approximately 30 [ohm] at +20°C.

Check the signal cable between engine control module (ECM) terminal 5 and turbocharger (TC) control valve terminal 2 for an intermittent open-circuit. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the power supply cable between turbocharger (TC) control valve terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).

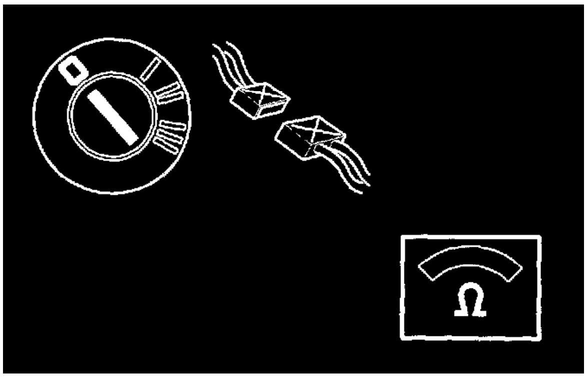
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Missing - Permanent Fault

Signal missing. Permanent fault

Checking the terminal



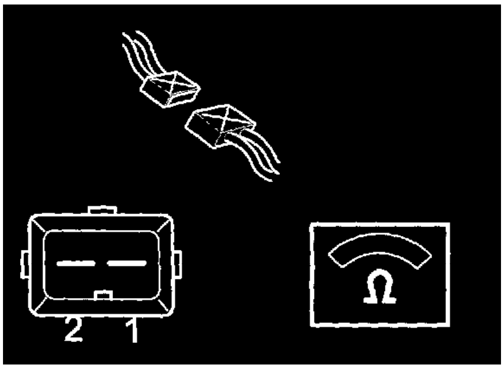
- Ignition off
- Turbocharger (TC) control valve connector disconnected.

Check the turbocharger (TC) control valve connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
Remedy as necessary.

Were any faults found?

Yes - Skip to "**Verification**"
No - Continue below.

Checking the turbocharger (TC) control valve



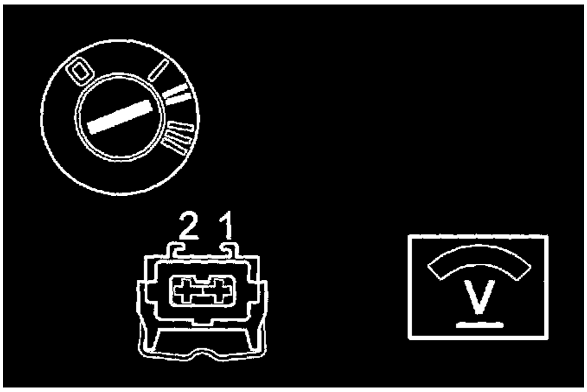
- Turbocharger (TC) control valve connector disconnected Connect an ohmmeter between turbocharger (TC) control valve connector terminals 1 and 2.

The ohmmeter should read approximately 30 [ohm].

OK - Continue below.

Not OK - Skip to "**Defective turbocharger (TC) control valve**"

Checking the power supply



- Ignition on.

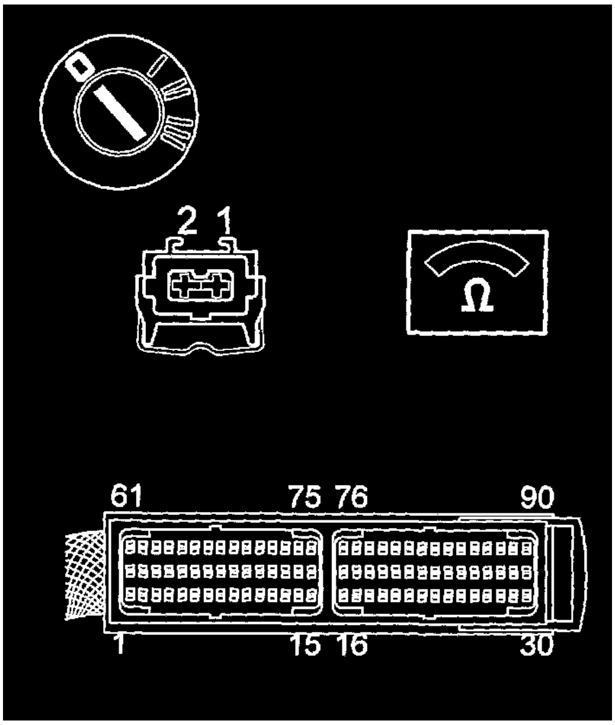
Connect a voltmeter between turbocharger (TC) control valve connector terminal 1 (control module side) and the ground terminal.

The voltmeter should read battery voltage for 2 seconds immediately after the ignition is switched on.

OK - Continue below.

Not OK - Skip to "**Checking the signal cable**"

Checking the signal cable



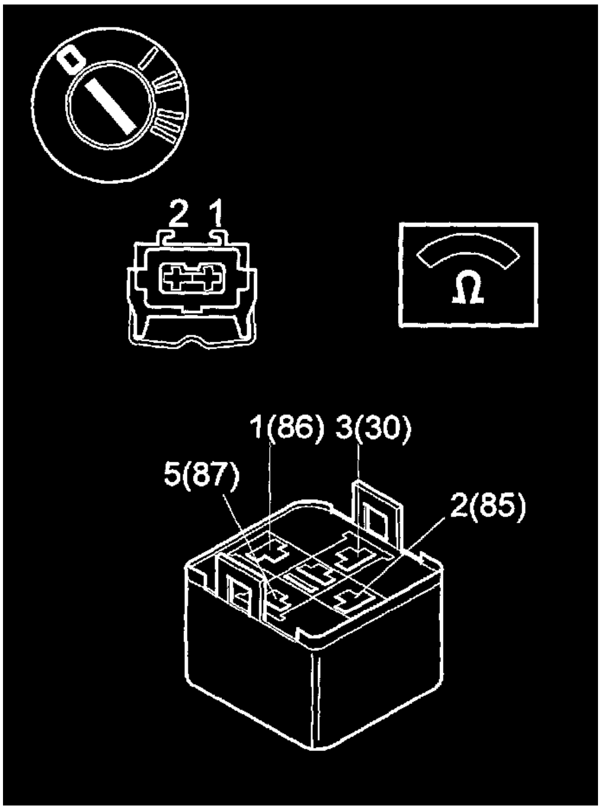
- Ignition off.

Check the cable between turbocharger (TC) control valve connector terminal 2 and engine control module (ECM) connector terminal 5 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Skip to "**Verification**"

Checking the signal cable



- Ignition off.

Check the cable between turbocharger (TC) control valve connector terminal 1 and system relay 2/14 terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

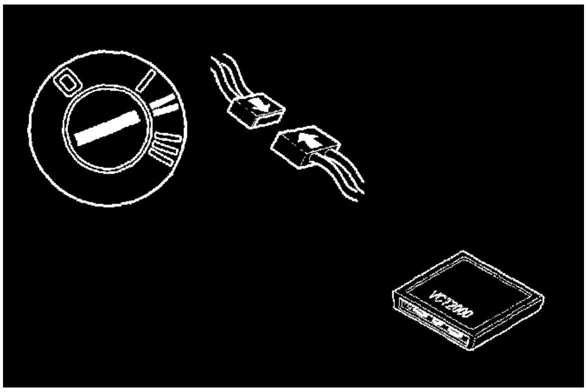
Remedy as necessary.

Skip to "**Verification**"

Defective turbocharger (TC) control valve

Try a new turbocharger (TC) control valve according to See: Fuel Delivery and Air Induction/Turbocharger/Wastegate Solenoid/Service and Repair

Verification



- Reconnect the connectors, reinstall components etc.
- Ignition on.

Activate the turbocharger (TC) control valve.

Does the turbocharger (TC) control valve click?

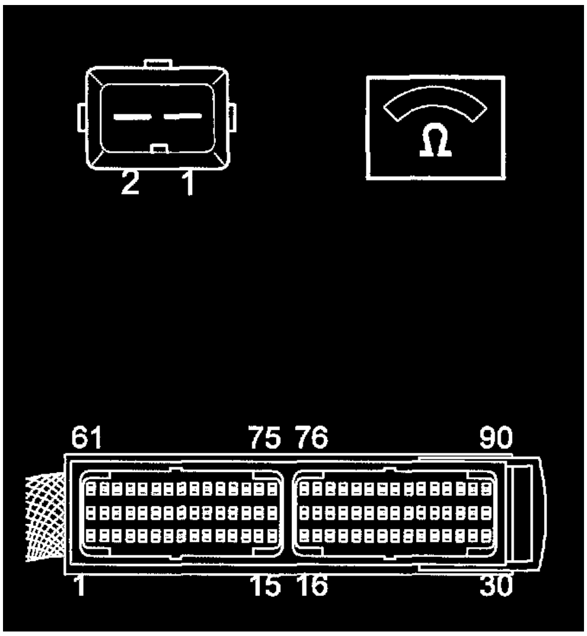
Yes - Testing Complete
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too High - Intermittent Fault

Signal too high. Intermittent fault



Checking components and wiring

Check that the resistance between turbocharger (TC) control valve terminals 1 and 2 is approximately 30 [ohm] at +20°C.

Check the signal cable between engine control module (ECM) terminal 5 and turbocharger (TC) control valve terminal 2 for an intermittent

short-circuit to supply voltage.
Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).

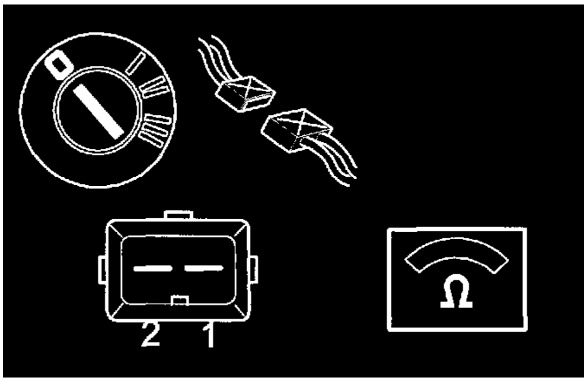
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too High - Permanent Fault

Signal too high. Permanent fault

Checking the turbocharger (TC) control valve

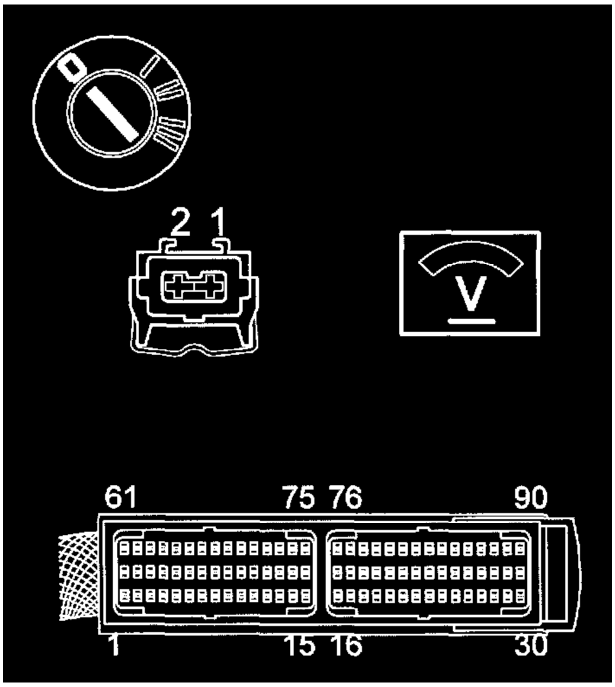


- Ignition off
- Turbocharger (TC) Control valve connector disconnected. Connect an ohmmeter between turbocharger (TC) control valve connector terminals 1 and 2.

The ohmmeter should read approximately 30 [ohm].

Yes - Continue below.
No - Skip to "**Defective turbocharger (TC) control valve**"

Checking the signal cable



- Ignition off.

Check the cable between turbocharger (TC) control valve connector terminal 2 and engine control module (ECM) terminal 5 for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

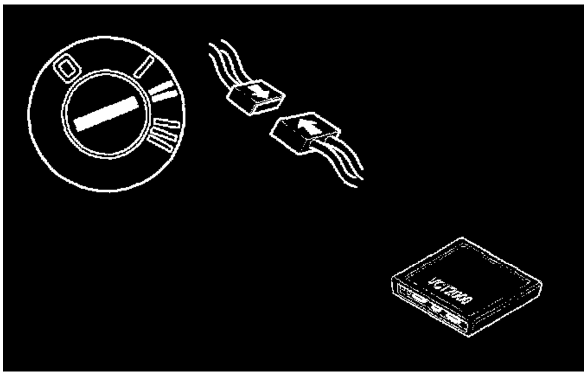
Remedy as necessary.

Skip to "**Verification**"

Defective turbocharger (TC) control valve

Try a new turbocharger (TC) control valve according to See: Fuel Delivery and Air Induction/Turbocharger/Wastegate Solenoid/Service and Repair

Verification



- Reconnect the connectors, reinstall components etc.
- Ignition on.

Activate the turbocharger (TC) control valve.

Does the turbocharger (TC) control valve click?

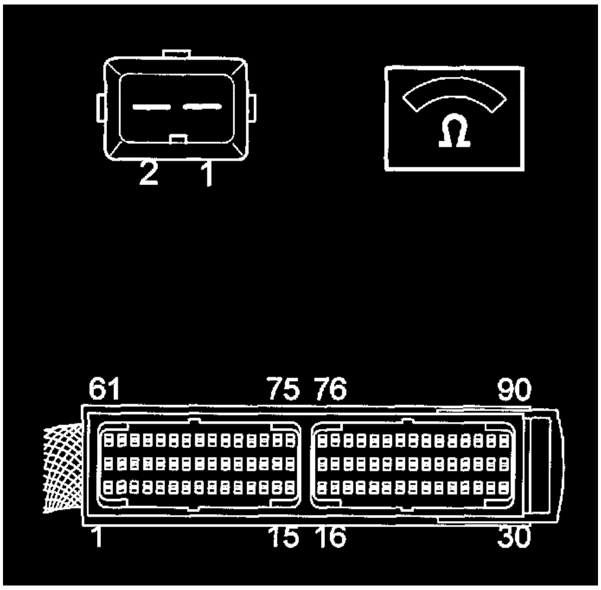
Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too Low - Intermittent Fault

Signal too low. Intermittent fault



Checking components and wiring

Check the signal cable between engine control module (ECM) terminal 5 and turbocharger (TC) control valve terminal 2 for an intermittent short-circuit to ground.

Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).

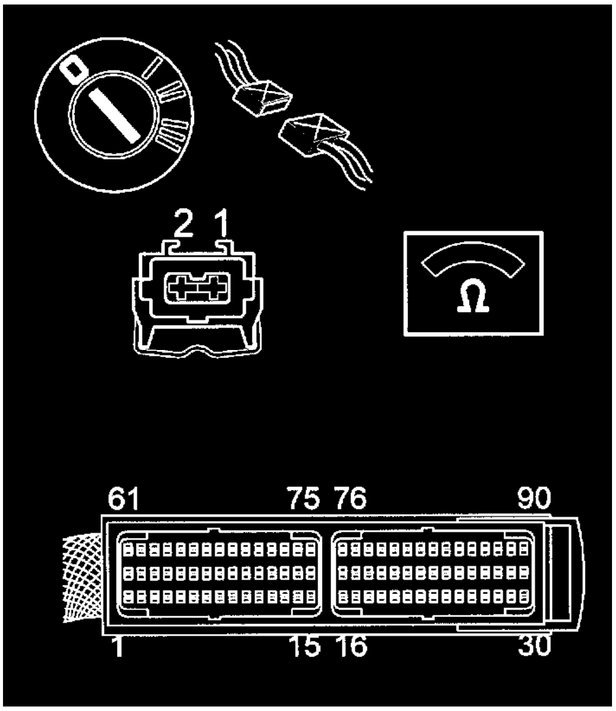
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too Low - Permanent Fault

Signal too low. Permanent fault

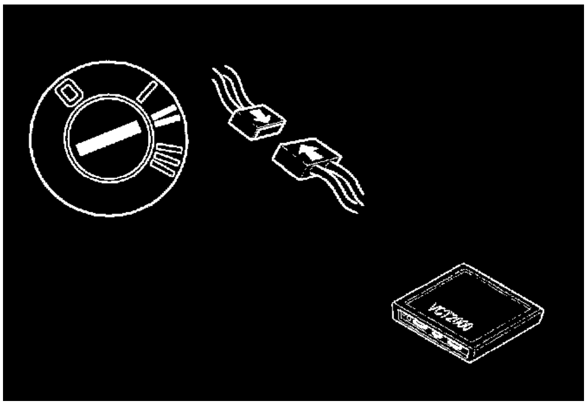
Checking the signal cable



- Ignition off
- Turbocharger (TC) Control valve connector disconnected. Check the cable between turbocharger (TC) control valve connector terminal 2 (control module side) and engine control module (ECM) terminal 5 for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

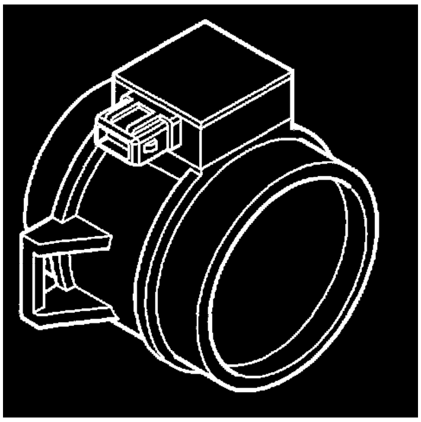
Activate the turbocharger (TC) control valve.

Does the turbocharger (TC) control valve click?

Yes - Testing Complete
No - Continue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information



Diagnostic trouble code (DTC) information

Condition
Diagnostic trouble code (DTC) ECM-2E is stored if the control module detects that a too high or too low air mass is forced into the engine. This is interpreted as too high or too low boost pressure.

Condition
- No idle air trim adaptation
- No engine speed (RPM) limitation
- The boost presure control (BPC) diagnostic is disabled.

Possible source

Signal too low:
- The boost pressure control (BPC) valve has stuck in the open position.
- Air leakage in the charge air pipe or intake manifold.
- Defective turbocharger (TC).
- Defective mass air flow (MAF) sensor.

Signal to high:
- The boost pressure control (BPC) valve has stuck in the closed position.
- Leakage in the hoses for the boost pressure control (BPC) pressure regulator.
- Defective boost pressure control (BPC) valve pressure regulator.
- Defective mass air flow (MAF) sensor.

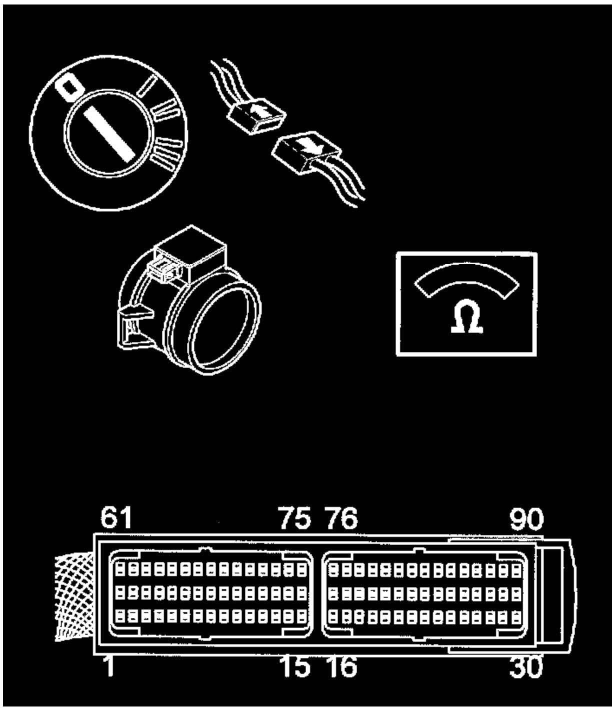
Condition
- Malfunction indicator lamp (MIL) lit.
- Deterioration in performance.
- Improved performance.
- High idling speed.
- Low idling speed.

Signal Too High - Intermittent Fault

Checking the turbocharger (TC) control system
- Release the boost pressure control (BPC) valve according to Checking and adjusting the boost pressure control (BPC) valve on the turbocharger (TC). Check that the boost pressure control (BPC) valve is unimpeded and does not stick in the closed position.
- Check the turbocharger (TC) according to Checking boost pressure with manometer while test driving the car. In particular check the hoses and the function of the pressure regulator
- Remedy as necessary.

Was a fault detected?
Yes- Skip to "**Fault-tracing information**"
No - Continue below.

Checking the connectors and components



- Ignition off
- Check the control module and mass air flow (MAF) sensor connectors. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals Check for loose connections according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals In particular, check for any damage.
- Remedy as necessary.

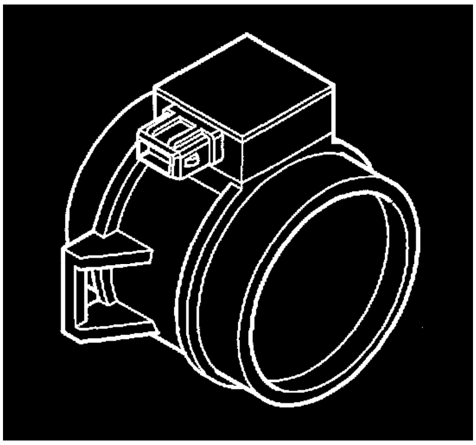
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too High - Permanent Fault

Signal too high. Permanent fault

Checking the turbocharger (TC) control system

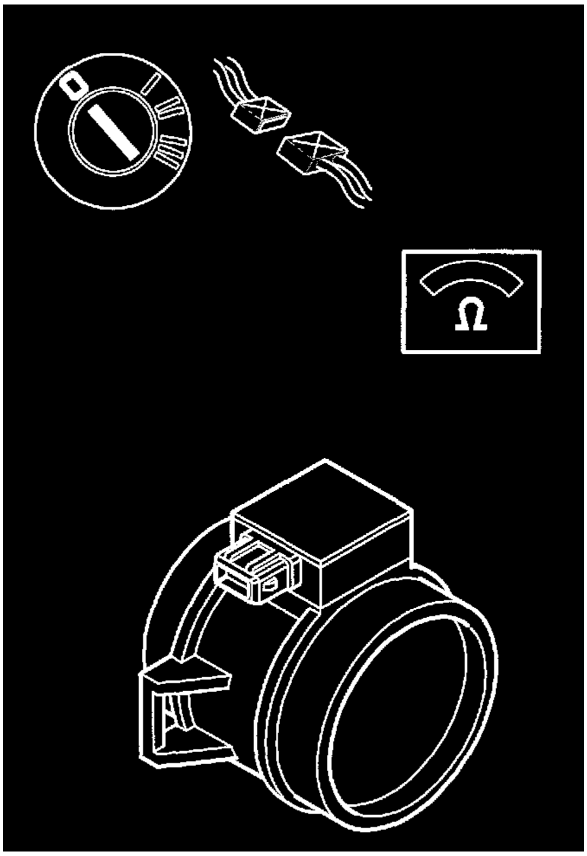


- Release the boost pressure control (BPC) valve according to See: Fuel Delivery and Air Induction/Turbocharger/Wastegate Actuator/Testing and Inspection Check that the boost pressure control (BPC) valve is unimpeded and does not stick in the closed position
- Check the turbocharger (TC) according to Checking boost pressure with manometer while test driving the car. In particular check the hoses and the function of the pressure regulator
- Remedy as necessary.

Was a fault detected?

Yes - Skip to "**Verification**"
No - Continue below.

Checking the connectors and components

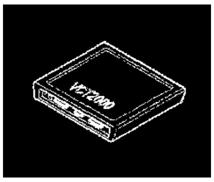


- Ignition off
- Check the mass air flow (MAF) sensor, system relay and control module connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals. In particular, check for any damage
- Remedy as necessary.

Other information

- To access the control module, See: Engine Control Module/Service and Repair
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Checking the component



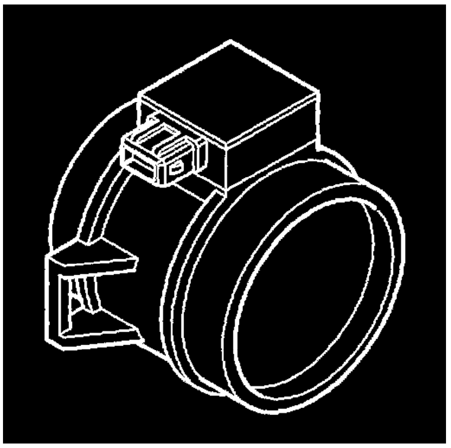
Hint: After carrying out the repair, check that the fault has been remedied.

- Test drive the car with constantly changing throttle opening.
- Connect the VIDA station.
- Ignition on.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Has the diagnostic trouble code (DTC) status changed?

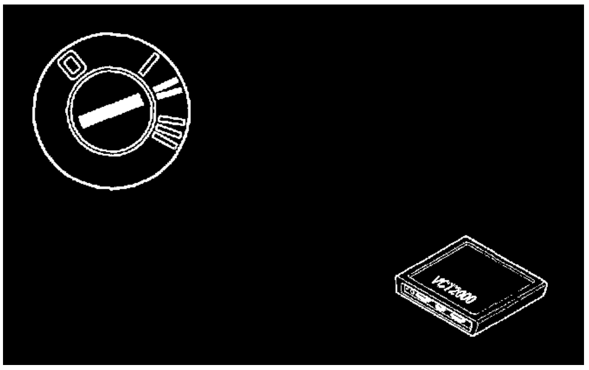
Yes - Testing Complete.
No - Continue below.

Replacing the component



- Try a new mass air flow (MAF) sensor. See: Air Flow Meter/Sensor/Service and Repair

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Test drive the car with changing throttle opening and at constant throttle opening. This will ensure that the boost pressure system operates throughout the entire range
- Connect the VIDA station
- Ignition on
- Check if the diagnostic trouble code (DTC) status has changed to intermittent. If it has, the fault has been remedied.

Has the status of the diagnostic trouble code (DTC) status changed?

Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too Low - Intermittent Fault

Signal too low. Intermittent fault

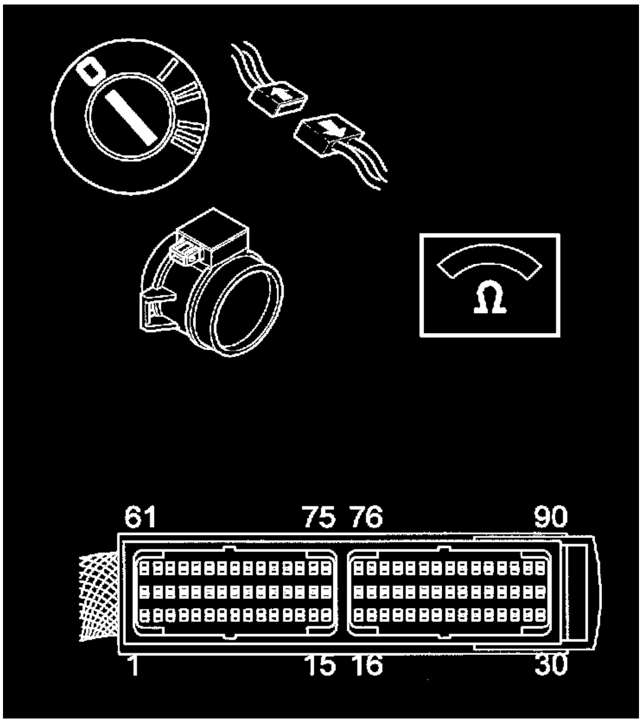
Checking for air leakage and the turbocharger (TC) control system

- Check the engine intake system according to Checking air intake system, turbo engines. Check in particular the charge air pipe and the intake manifold for air leakage.
- Release the boost pressure control (BPC) valve according to Checking and adjusting the boost pressure control (BPC) valve on the turbocharger (TC). Check that the boost pressure control (BPC) valve is unimpeded and does not stick in the open position
- Check the turbocharger (TC) according to Checking boost pressure with manometer while test driving the car.
- Check the air cleaner (ACL) for blockage
- Remedy as necessary.

Was a fault detected?

Yes- Skip to "**Fault-tracing information**"
No - Continue below.

Checking the cable and component



- Ignition off
- Check the Control module and mass air flow (MAF) sensor connectors. Check for contact resistance and oxidation and check for loose connections according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals In particular, check for any damage.
- Remedy as necessary.

Other information
- To replace the mass air flow (MAF) sensor, See: Air Flow Meter/Sensor/Service and Repair

Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too Low - Permanent Fault

Signal too low. Permanent fault

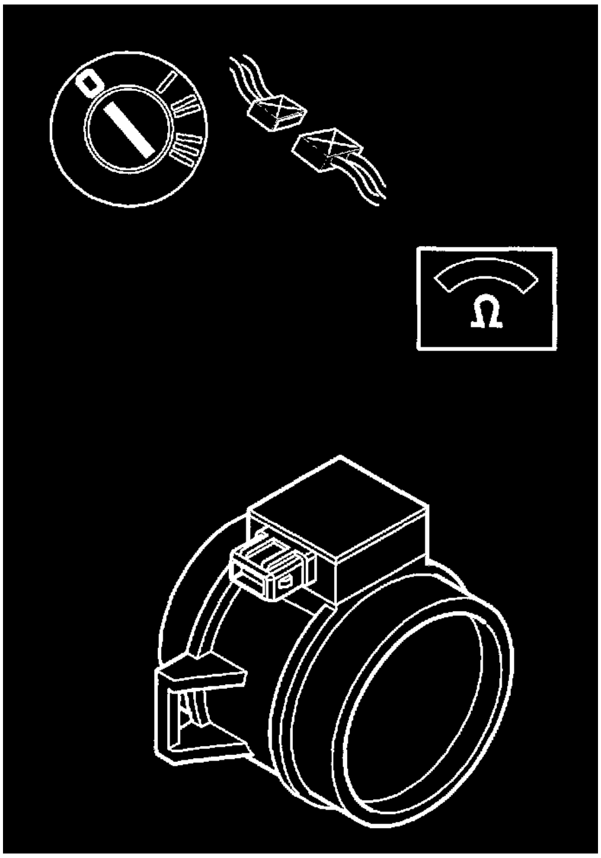
Checking for air leakage and the turbocharger (TC) control system
- Check the engine intake system according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System Check in particular the charge air pipe and the intake manifold for air leakage
- Release the boost pressure control (BPC) valve according to See: Fuel Delivery and Air Induction/Turbocharger/Wastegate Actuator/Testing and Inspection Check that the boost pressure control (BPC) valve is unimpeded and does not stick in the open position
- Check the turbocharger (TC) according to Checking boost pressure with manometer while test driving the car.
- Check the air cleaner (ACL) for blockage
- Remedy as necessary.

Was a fault detected?

Yes - Skip to "**Verification**"

No - Continue below.

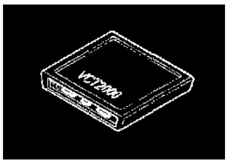
Checking the connectors and components



- Ignition off
- Check the mass air flow (MAF) sensor, system relay and control module connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals. In particular, check for any damage.
- Remedy as necessary.

Other information
- To access the control module, See: Engine Control Module/Service and Repair
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Checking the component

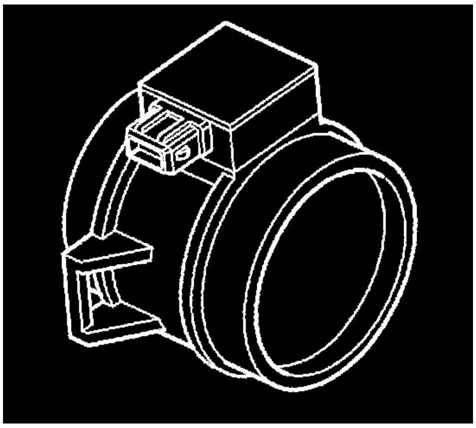


Hint: After carrying out the repair, check that the fault has been remedied.

- Test drive the car with constantly changing throttle opening
- Connect the VIDA station
- Ignition on
- Check whether the status of the diagnostic trouble code (DTC) has changed to intermittent. If the status has changed to intermittent the fault has been remedied.

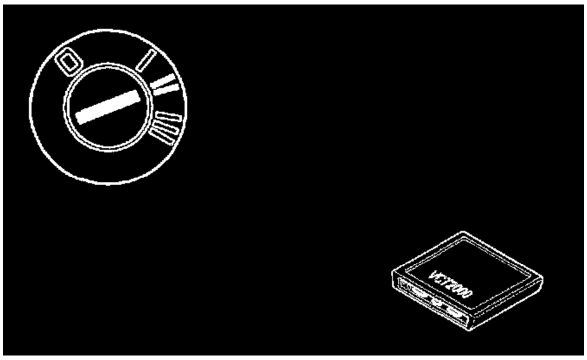
Has the diagnostic trouble code (DTC) status changed?
Yes - Testing Complete.
No - Continue below.

Replacing the component



- Try a new mass air flow (MAF) seat. See: Air Flow Meter/Sensor/Service and Repair

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Test drive the car with changing throttle opening and at constant throttle opening. This will ensure that the boost pressure system operates throughout the entire range.
- Connect the VIDA station.
- Ignition on.
- Check if the diagnostic trouble code (DTC) status has changed to intermittent. If it has, the fault has been remedied.

Has the status of the diagnostic trouble code (DTC) status changed?

Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM-32 is stored if the control module does not receive a signal from the camshaft position (CMP) sensor (signal missing) or if the control module cannot interpret the signal from the camshaft sensor (faulty signal).

Condition

None.

Possible source

Signal missing:

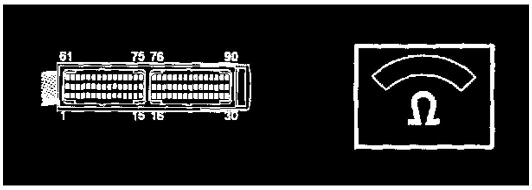
- Contact resistance in the terminals
- Open-circuit in the signal cable
- Short-circuit to ground in signal cable
- Short-circuit to supply voltage in the signal cable
- Defective camshaft position (CMP) sensor.

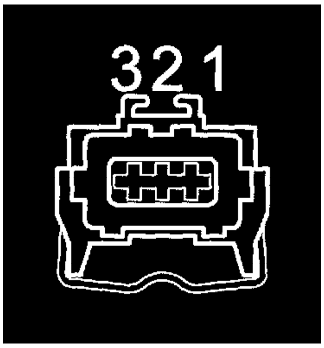
Faulty signal:

- Contact resistance in the terminals
- Defective camshaft position (CMP) sensor.

Condition
- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault
Faulty signal. Intermittent fault





Checking components and wiring
Check the engine control module (ECM) and camshaft position (CMP) sensor connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the voltage cable between engine control module (ECM) connector terminal 83 and camshaft position (CMP) sensor terminal 3 for an intermittent open-circuit. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

The power supply should be 5 V.

Check the signal cable between engine control module (ECM) terminal 58 and camshaft position (CMP) sensor terminal 2 for an intermittent open-circuit, an intermittent short-circuit to ground and for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the ground lead between engine control module (ECM) terminal 79 and camshaft position (CMP) sensor terminal 1 for an intermittent open-circuit. Remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

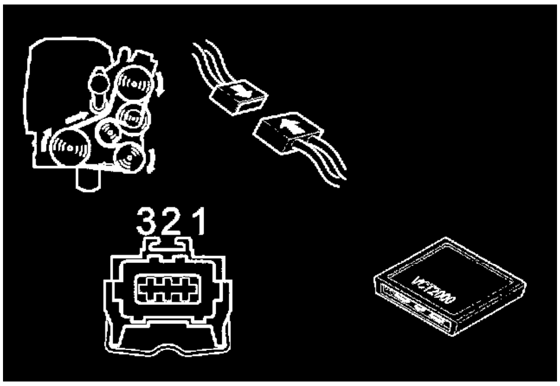
Try a new camshaft position (CMP) sensor if no faults are found in the above fault-tracing.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the camshaft position (CMP) sensor, See: Camshaft Position Sensor/Service and Repair

Fault-tracing information
If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Faulty Signal Permanent Fault
Faulty signal Permanent fault

Checking the connector



- Ignition off
- Check the connector for the camshaft position (CMP) sensor for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine a couple of times
- Read off diagnostic trouble codes (DTCs).

If the status of the diagnostic trouble code (DTC) has changed to intermittent, the fault was caused by loose connections in the connector and the fault has been remedied.

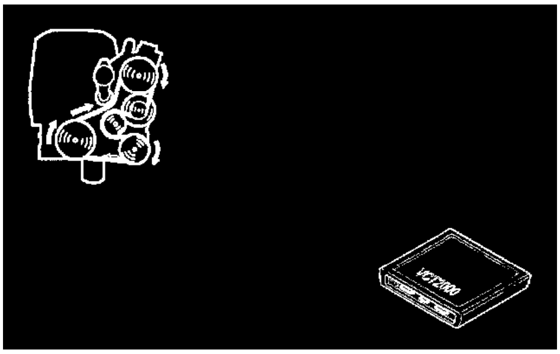
Other information
- To access or replace the camshaft position (CMP) sensor, See: Camshaft Position Sensor/Service and Repair

Is the status of the diagnostic trouble code (DTC) intermittent?
Yes - Testing Complete.
No - Continue below.

Checking components and wiring
Try a new camshaft position (CMP) sensor.

Other information
- To replace the camshaft position (CMP) sensor, See: Camshaft Position Sensor/Service and Repair

Verification



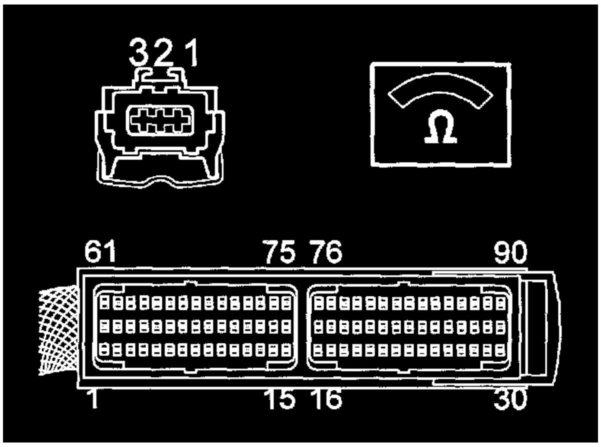
- Start the engine.

Read off diagnostic trouble codes (DTCs).

Has the diagnostic trouble code (1)TC) ECM-32 changed status to intermittent?
Yes - Testing Complete.
No - Continue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Missing - Intermittent Fault
Signal missing. Intermittent fault



Checking components and wiring

Check the engine control module (ECM) and camshaft position (CMP) sensor connectors. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check power supply cable between engine control module (ECM) connector terminal #83 and camshaft position (CMP) sensor terminal 3. Check for an intermittent open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals Remedy if necessary.

The power supply must be 5 V.

Check remedy the signal cable between engine control module (ECM) terminal #58 and the camshaft position (CMP) sensor terminal 2. Check for an intermittent open-circuit, an intermittent short-circuit to ground and for a short-circuit to supply voltage See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals Remedy if necessary.

Check the ground lead between engine control module (ECM) terminal #79 and camshaft position (CMP) sensor terminal 1. Check for an intermittent open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals Remedy if necessary.

Try a new camshaft position (CMP) sensor if no faults are found in the above fault-tracing.

Other information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the camshaft position (CMP) sensor, See: Camshaft Position Sensor/Service and Repair

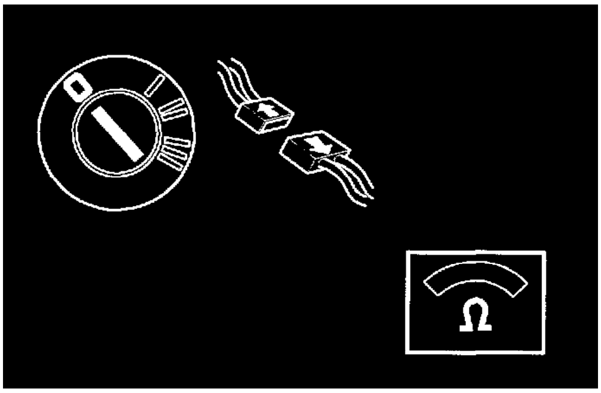
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Missing - Permanent Fault

Signal missing. Permanent fault

Checking the terminal



- Ignition off
- Disconnect the connector for the camshaft position (CMP) sensor

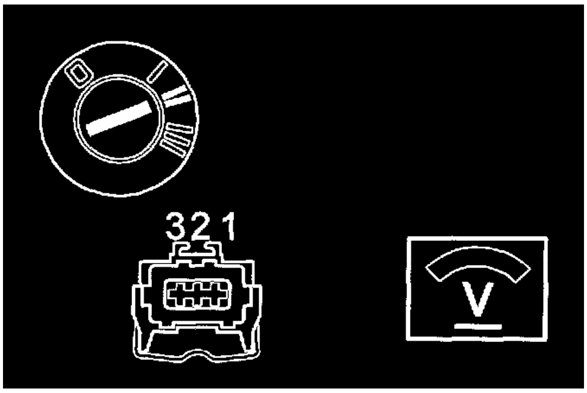
Check the connector for the camshaft position (CMP) sensor for contact resistance and oxidation according to See: Diagnostic Trouble Code

Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Was a fault detected?
Yes - Skip to "**Verification**"
No - Continue below.

Checking the signal cable

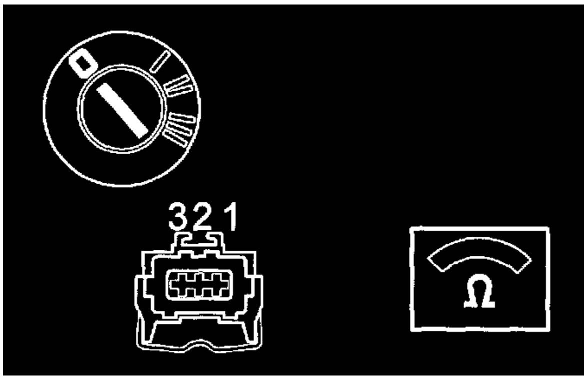


- Ignition on

Connect a voltmeter between connector terminal 2 for the camshaft position (CMP) sensor (control module side) and ground and between terminal 3 and ground.

In both cases the voltmeter should display approximately 5 V.
OK - Continue below.
Not OK - Skip to "**Checking cables**"

Checking the ground lead - I



- Ignition off.

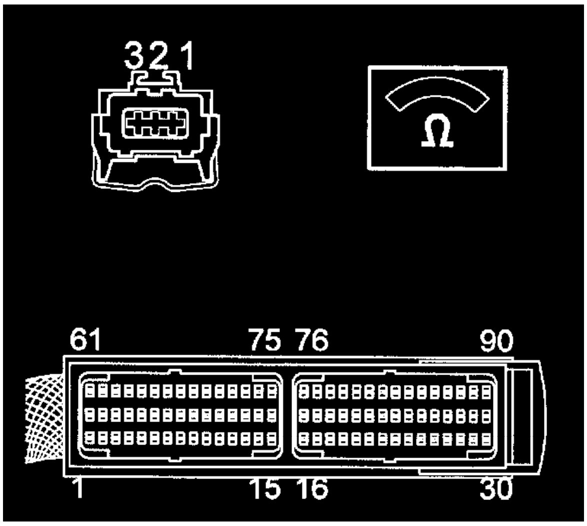
Connect an ohmmeter between connector terminal 1 on the camshaft position (CMP) sensor (control module side) and the ground terminal.

The ohmmeter should read approximately 0[Ohm].
OK - Continue below.
Not OK - Skip to "**Checking the ground lead - II**"

Defective camshaft position (CMP) sensor
Try a new camshaft position (CMP) sensor according to See: Camshaft Position Sensor/Service and Repair

Skip to "**Verification**"

Checking the ground lead - II

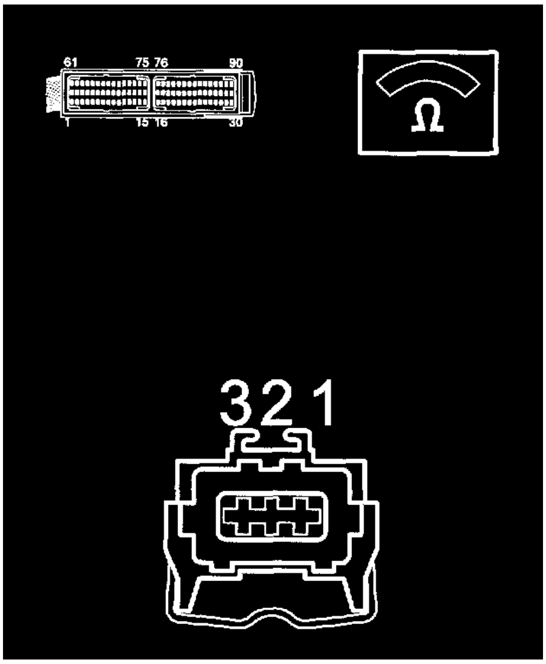


Check the cable between connector terminal 1 for the camshaft position (CMP) sensor and engine control module (ECM) connector terminal 79 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Skip to "**Verification**"

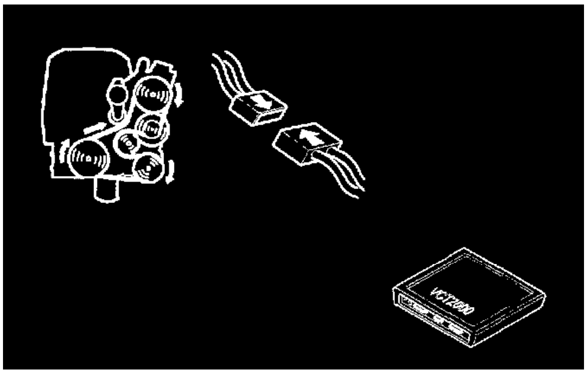
Checking cables



Check the cable between connector terminal 2 for the camshaft position (CMP) sensor and engine control module (ECM) connector terminal 58. Check the cable connector terminal 3 for the camshaft position (CMP) sensor (control module side) and engine control module (ECM) terminal 83. Check these cables for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals and for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals and for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Verification



- Reconnect the connectors, reinstall components etc.
- Start the engine.

Read off diagnostic trouble codes (DTCs).

Has the diagnostic trouble code (DTC) ECM-32 changed status to intermittent?

Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM-38 or ECM-3A is stored if the ignition coil circuit short-circuited to ground / voltage or if there is open-circuit in the circuit that the control module has interpreted as a fault.

Condition

Injectors 1 and 4 are disabled. Injectors 2 and 3 are disabled.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable.
- Faulty ignition coil.

Signal too low:

- Short-circuit to ground in the signal cable.

Signal missing:

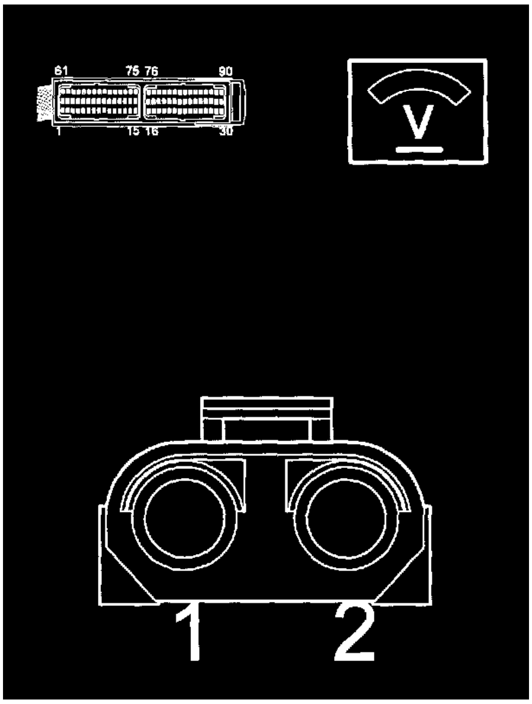
- Open-circuit in the signal cable.
- Faulty ignition coil.

Condition

- Malfunction indicator lamp (MIL) lit.
- Engine not firing on all cylinders.
- The engine misfires.

Signal Too High - Intermittent Fault

Signal too high. Intermittent fault



Checking wiring and components

Check the signal cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38), #1 (ECM-3A) for an intermittent short-circuit to supply voltage and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If no faults are found in the above fault-tracing try a new ignition coil.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).
- To replace the ignition coil, See: Ignition System/Ignition Coil/Service and Repair

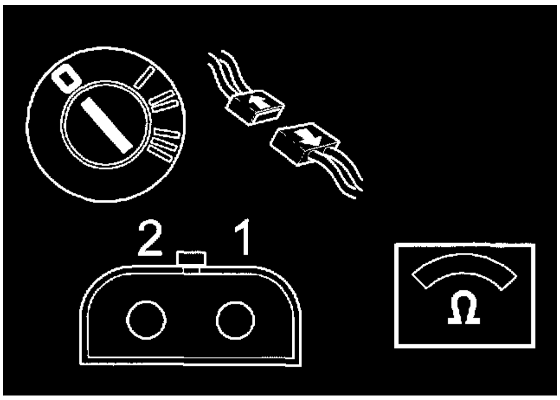
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too High - Permanent Fault

Signal too high. Permanent fault

Checking ignition coil



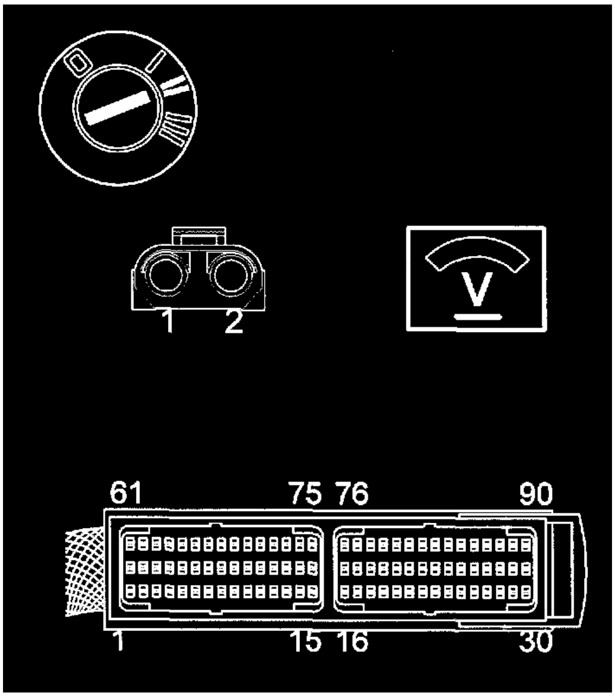
- Ignition off.
- Disconnect the ignition Coil connector.

Connect an ohmmeter between the ignition coil terminals 1 and 2 (ignition coil side).

The ohmmeter should read approximately 0.5[ohm].

OK - Continue below.
Not OK - Skip to "**Checking ignition coil - II**"

Checking the signal cable



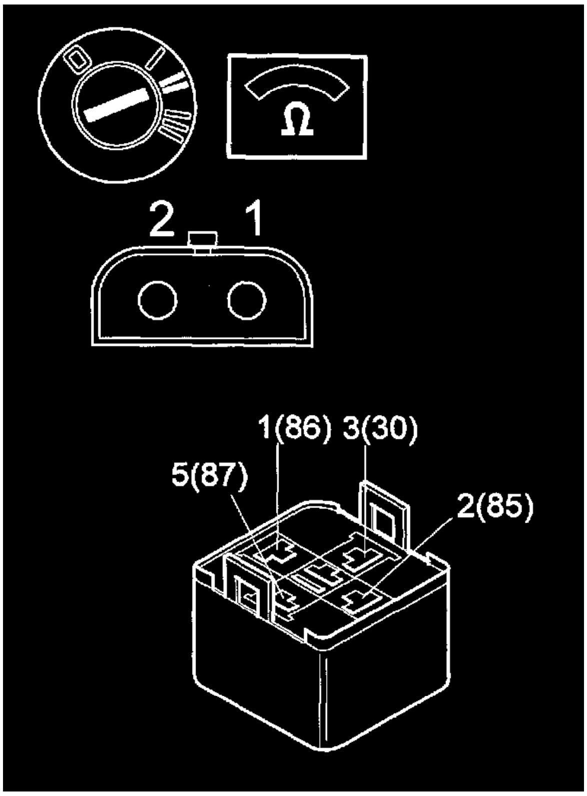
- Ignition on.

Check the cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38), #1 (ECM-3A) for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - Testing Complete.
Not OK - Continue below.

Checking ignition coil - I



- Ignition on.

Check the cable between ignition coil connector terminal 1 and system relay 2/14 base terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

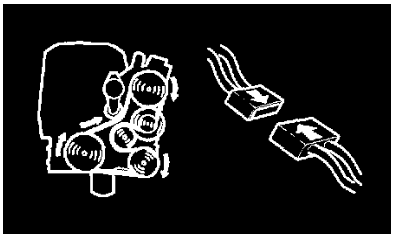
Remedy as necessary.

Skip to "**Verification**"

Checking ignition coil - II

Try a new ignition coil according to See: Ignition System/Ignition Coil/Service and Repair

Verification



- Reconnect the connectors, reinstall components etc.
- Ignition on.
- Start the engine.

Does the engine run on all cylinders?

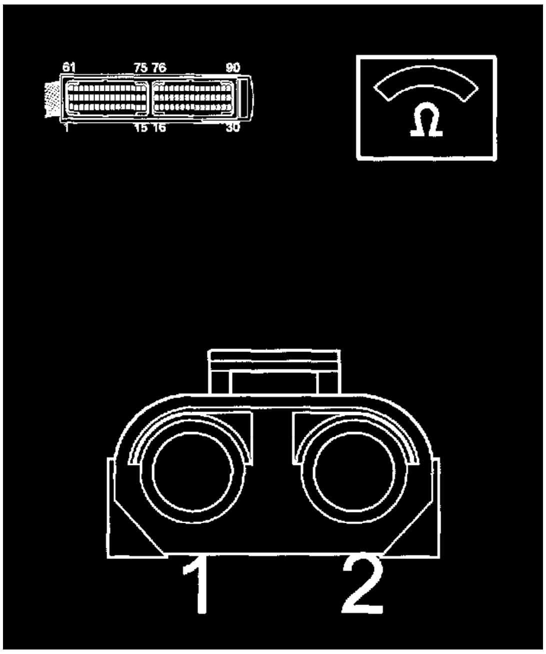
Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too Low - Intermittent Fault

Signal too low. Intermittent fault



Checking cables

Check the signal cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38), #1 (ECM-3A) for an intermittent short-circuit to ground and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).

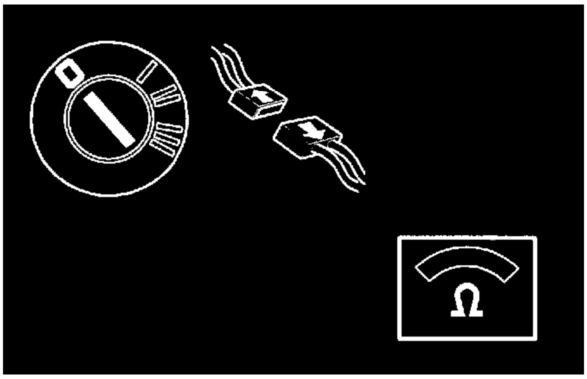
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too Low - Permanent Fault

Signal too low. Permanent fault

Checking terminals



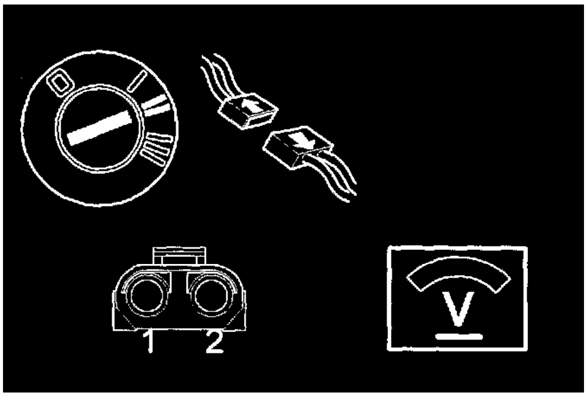
- Ignition off.
- Disconnect the ignition coil connector.

Check the ignition coil connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Was a fault detected?

Yes - Skip to "**Verification**"
No - Continue below.

Checking the signal cable

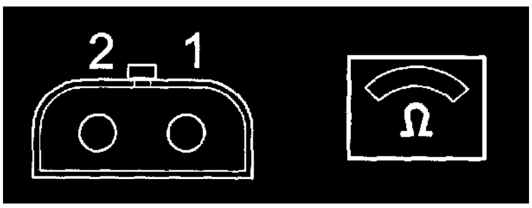


- Disconnect the ignition coil connector.
- Ignition on.

Connect a voltmeter between the ignition coil connector terminal 2 (engine control module (ECM) side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.
OK - Continue below.
Not OK - Skip to "**Checking ignition coil - IV**"

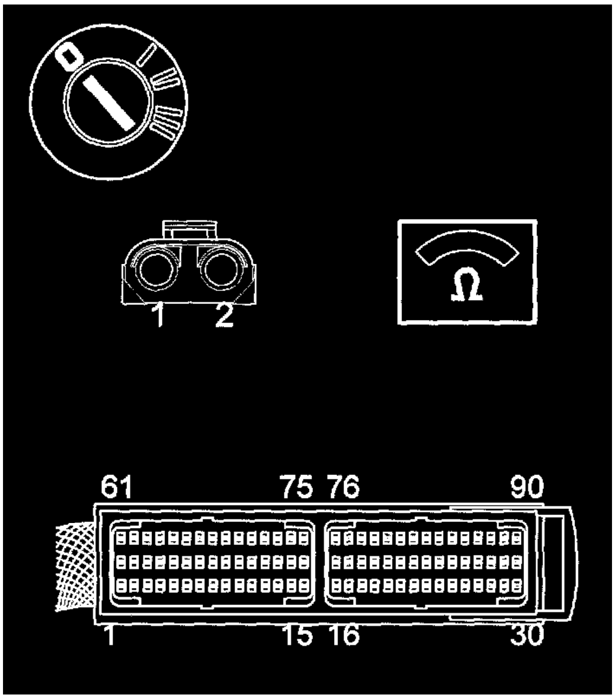
Checking ignition coil - I



Connect an ohmmeter between the ignition coil terminals 1 and 2 (ignition coil side).

The ohmmeter should read approximately 0.5[ohm].
OK - Continue below.
Not OK - Skip to "Checking ignition coil - III"

Checking ignition coil - II



- Ignition off.

Check the cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38) or #1 (ECM-3A) for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals and for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

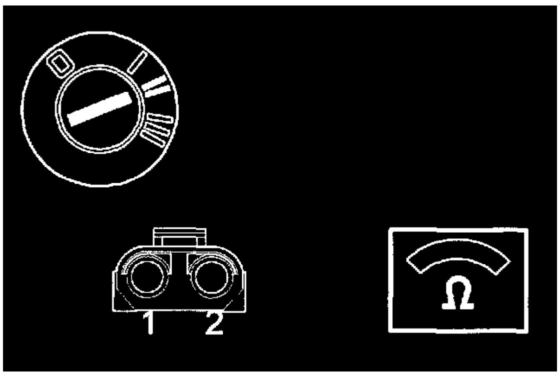
Skip to "**Verification**"

Checking ignition coil - III

Try a new ignition Coil according to See: Ignition System/Ignition Coil/Service and Repair

Skip to "**Verification**"

Checking ignition coil - IV

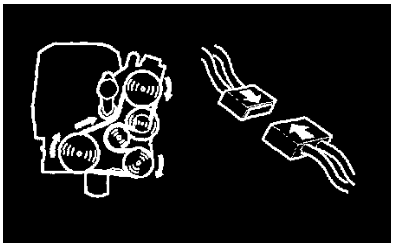


- Ignition on.

Check the cable between ignition coil connector terminal 2 and system relay 2/14 base terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Verification



- Reconnect the connectors, reinstall components etc.
- Ignition on.
- Start the engine.

Does the engine run on all cylinders?

Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM-38 or ECM-3A is stored if the ignition coil circuit short-circuited to ground / voltage or if there is open-circuit in the circuit that the control module has interpreted as a fault.

Condition

Injectors 1 and 4 are disabled. Injectors 2 and 3 are disabled.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable.
- Faulty ignition coil.

Signal too low:

- Short-circuit to ground in the signal cable.

Signal missing:

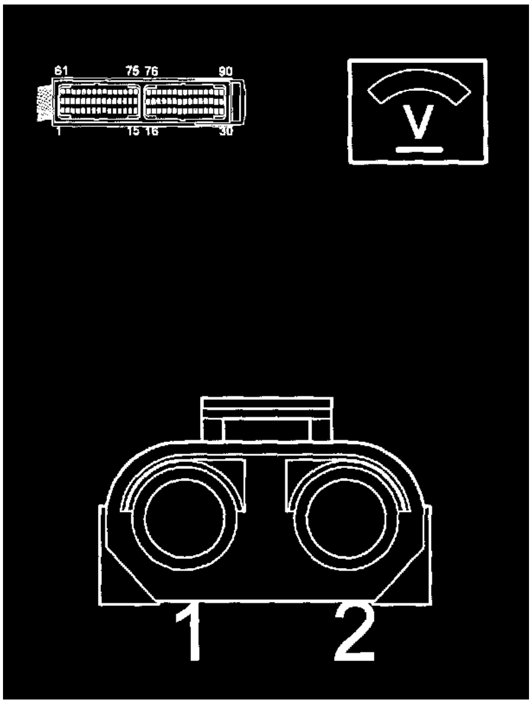
- Open-circuit in the signal cable.
- Faulty ignition coil.

Condition

- Malfunction indicator lamp (MIL) lit.
- Engine not firing on all cylinders.
- The engine misfires.

Signal Too High - Intermittent Fault

Signal too high. Intermittent fault



Checking wiring and components

Check the signal cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38), #1 (ECM-3A) for an intermittent short-circuit to supply voltage and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If no faults are found in the above fault-tracing try a new ignition coil.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).
- To replace the ignition coil, See: Ignition System/Ignition Coil/Service and Repair

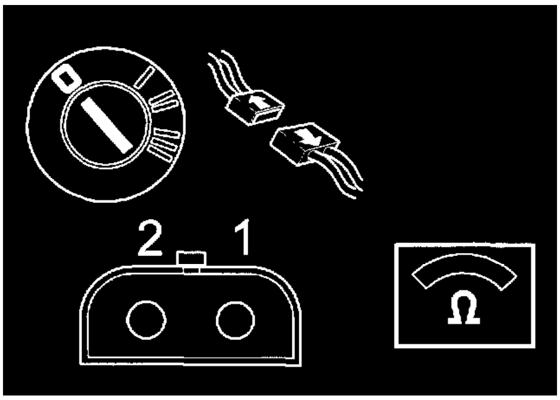
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too High - Permanent Fault

Signal too high. Permanent fault

Checking ignition coil



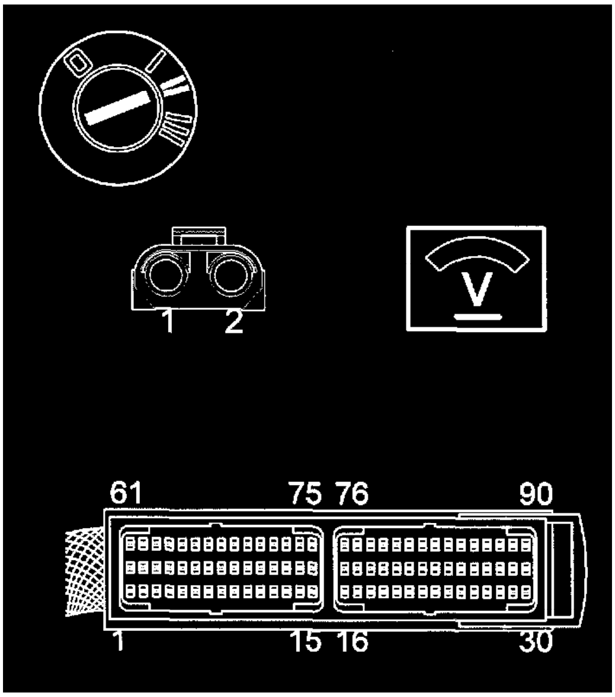
- Ignition off.
- Disconnect the ignition Coil connector.

Connect an ohmmeter between the ignition coil terminals 1 and 2 (ignition coil side).

The ohmmeter should read approximately 0.5[ohm].

OK - Continue below.
Not OK - Skip to "**Checking ignition coil - II**"

Checking the signal cable



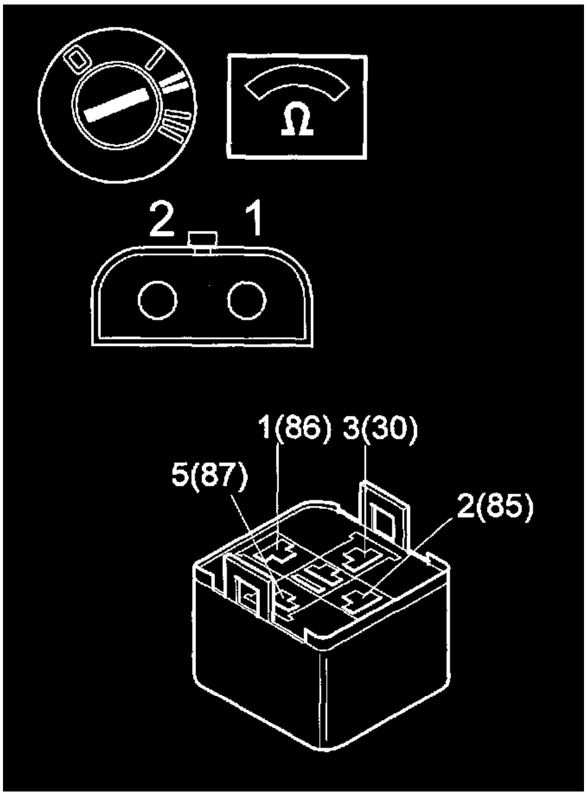
- Ignition on.

Check the cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38), #1 (ECM-3A) for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - Testing Complete.
Not OK - Continue below.

Checking ignition coil - I



- Ignition on.

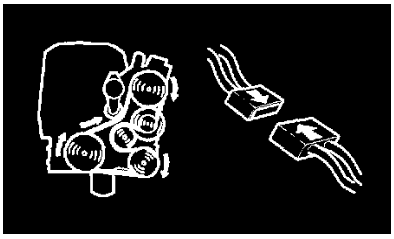
Check the cable between ignition coil connector terminal 1 and system relay 2/14 base terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Skip to "**Verification**"

Checking ignition coil - II
Try a new ignition coil according to See: Ignition System/Ignition Coil/Service and Repair

Verification

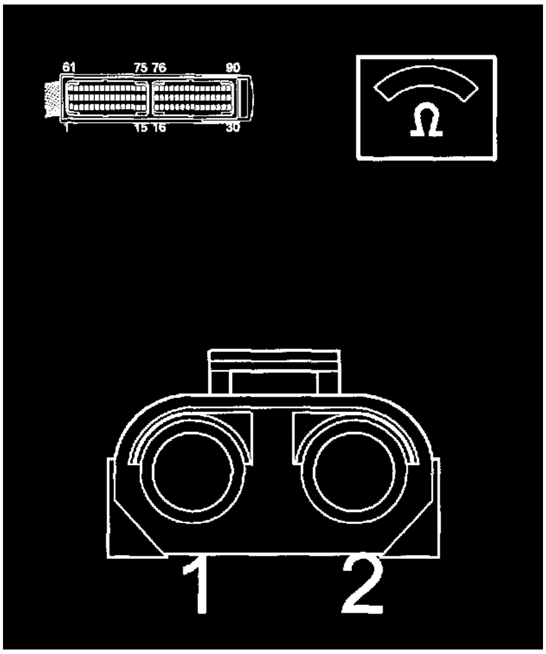


- Reconnect the connectors, reinstall components etc.
- Ignition on.
- Start the engine.

Does the engine run on all cylinders?
Yes - Testing Complete.
No - Continue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too Low - Intermittent Fault
Signal too low. Intermittent fault



Checking cables
Check the signal cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38), #1 (ECM-3A) for an intermittent short-circuit to ground and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

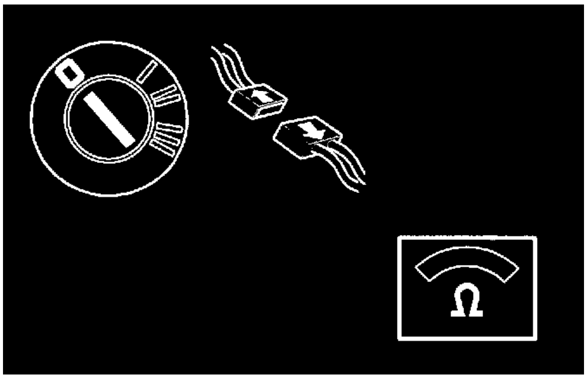
Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000).

Fault-tracing information
If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too Low - Permanent Fault

Signal too low. Permanent fault

Checking terminals



- Ignition off.
- Disconnect the ignition coil connector.

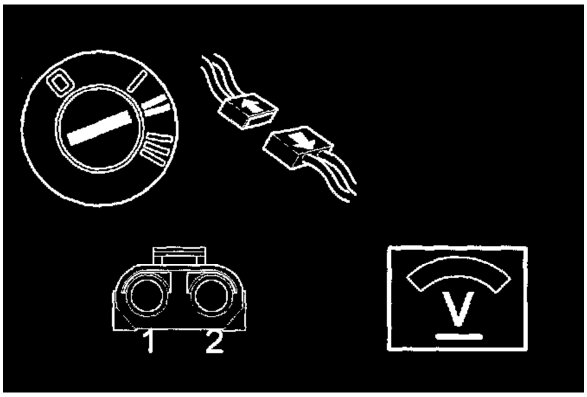
Check the ignition coil connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Was a fault detected?

Yes - Skip to "**Verification**"

No - Continue below.

Checking the signal cable



- Disconnect the ignition coil connector.
- Ignition on.

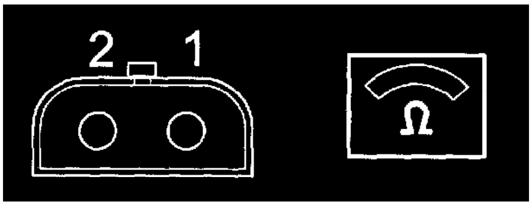
Connect a voltmeter between the ignition coil connector terminal 2 (engine control module (ECM) side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

OK - Continue below.

Not OK - Skip to "**Checking ignition coil - IV**"

Checking ignition coil - I



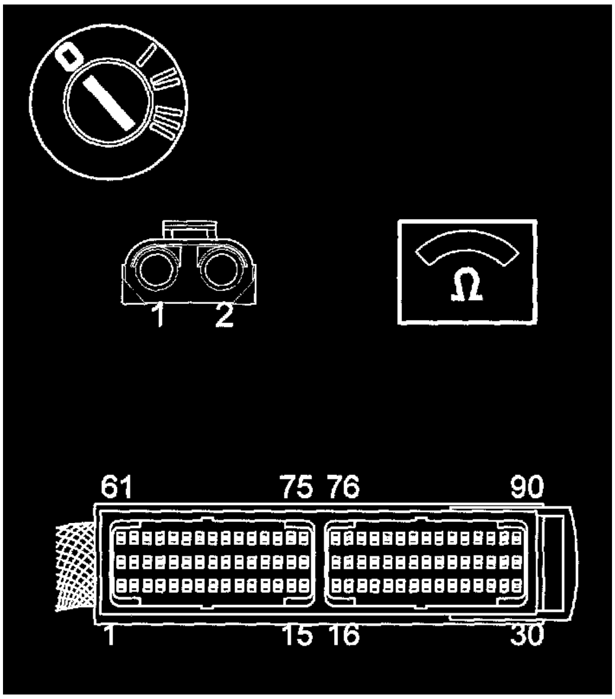
Connect an ohmmeter between the ignition coil terminals 1 and 2 (ignition coil side).

The ohmmeter should read approximately 0.5[ohm].

OK - Continue below.

Not OK - Skip to "Checking ignition coil - III"

Checking ignition coil - II



- Ignition off.

Check the cable between ignition coil terminal 1 and engine control module (ECM) terminal #32 (ECM-38) or #1 (ECM-3A) for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals and for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

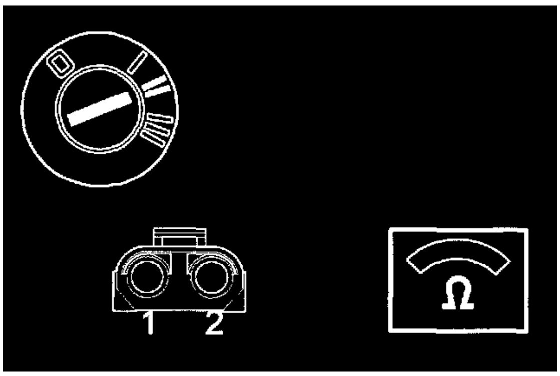
Skip to "**Verification**"

Checking ignition coil - III

Try a new ignition Coil according to See: Ignition System/Ignition Coil/Service and Repair

Skip to "**Verification**"

Checking ignition coil - IV

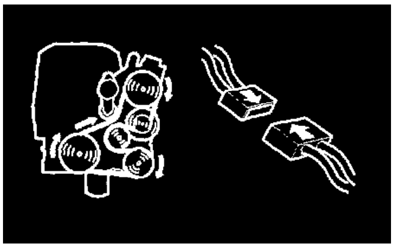


- Ignition on.

Check the cable between ignition coil connector terminal 2 and system relay 2/14 base terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Verification



- Reconnect the connectors, reinstall components etc.
- Ignition on.
- Start the engine.

Does the engine run on all cylinders?

Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM-41 is stored if the engine speed (RPM) signal exceeds 3,500 rpm, the load exceeds 250 mg/stroke and the signal from the knock sensor (KS) is missing.

Condition

- Initial boost pressure
- Retarded ignition.

Possible source

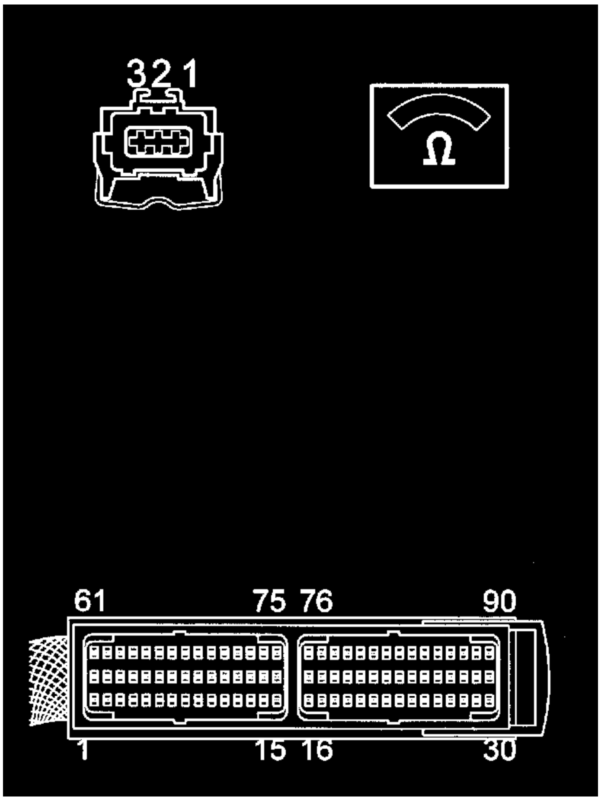
- Open-circuit in the signal cable
- Short-circuit to ground in signal cable
- Short-circuit to supply voltage in the signal cable
- Faulty knock sensor (KS).

Condition

- Poor performance.

Faulty Signal - Intermittent Fault

Faulty signal. Intermittent fault



Checking wiring

Check the engine control module (ECM) and heated oxygen sensor (1102S) connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check in particular for damage, or loose terminal pins. Check the signal cable between engine control module (ECM) terminals 76 and 19 and knock sensor (KS) terminals 2 and 3 for an intermittent open-circuit and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check signal cable between engine control module (ECM) terminal 51 and knock sensor (KS) terminal 1 for an intermittent short-circuit to ground, for an intermittent short-circuit to supply voltage and for an intermittent open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the knock sensor (KS), See: Knock Sensor/Service and Repair

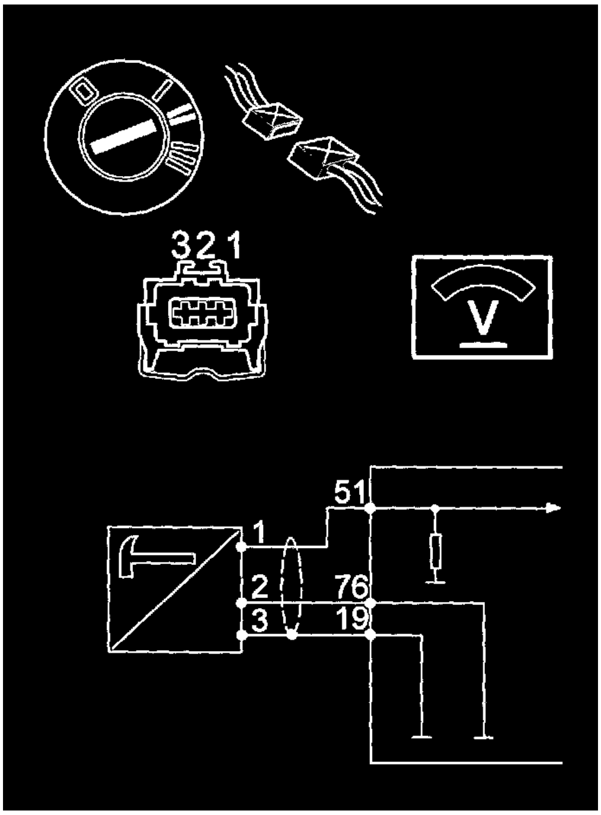
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Faulty Signal - Permanent Fault

Faulty signal. Permanent fault

Checking the signal cable

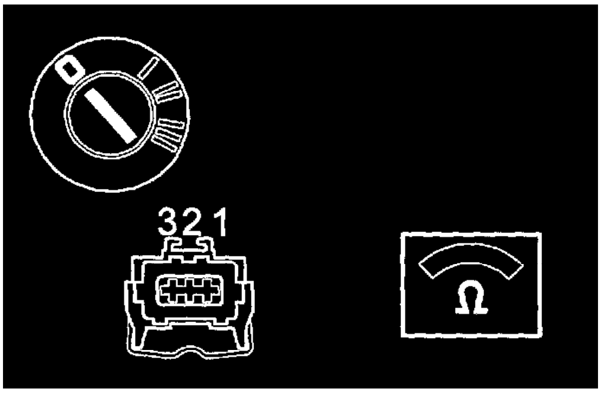


- Ignition off
- Knock sensor (KS) connector disconnected
- Ignition on.

Connect a voltmeter between knock sensor connector terminal 1 (control module side) and ground.

The voltmeter should read approximately 0 V.
OK - Continue below.
Not OK - Skip to "**Checking the signal cable**"

Checking the signal cable - I



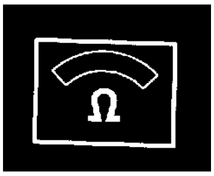
- Ignition off.

Connect an ohmmeter between the knock sensor (KS) connector terminals 1 and 2 (engine control module (ECM) side).

The ohmmeter should read approximately 100 k[ohm].
1 - 95-105k[ohm]
1 - 0[ohm]
3 - Infinite resistance.

Select one of the above options to continue.
1 - Continue below.
2 - Skip to "**Checking the signal cable - II**"
3 - Skip to "**Checking ground leads**"

Checking terminals



Check the knock sensor (KS) connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Were any faults found?

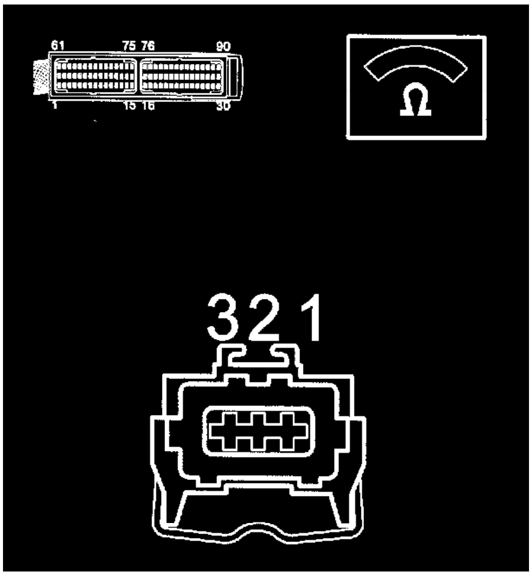
Yes - Skip to "**Verification**"
No - Continue below.

Defective knock sensor (KS)

Try a new knock sensor (KS). See: Knock Sensor/Service and Repair

Skip to "**Verification**"

Checking the signal cable - II

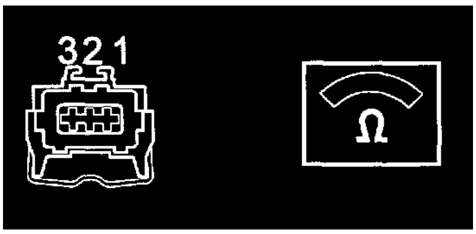


Check the cable between knock sensor (KS) connector terminal 1 (control module side) and engine control module (ECM) terminal #51. Check for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Skip to "**Verification**"

Checking ground leads

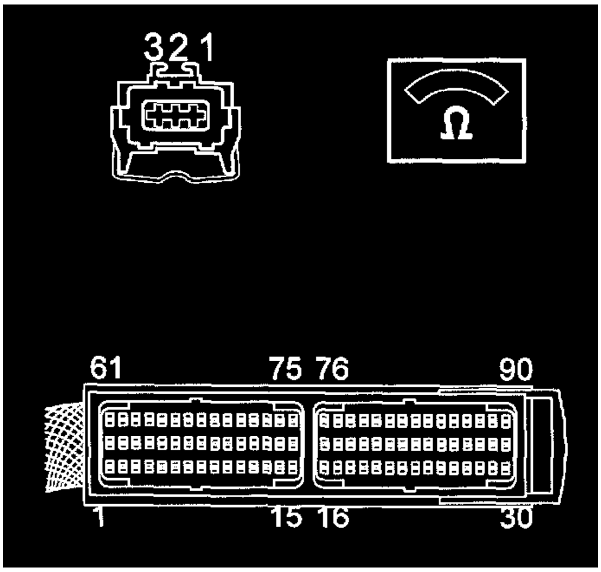


Connect an ohmmeter between knock sensor (KS) connector terminal 2 (engine control module (ECM) side) and ground. Connect an ohmmeter between knock sensor (KS) connector terminal #3 (control module side) and ground. In both cases the ohmmeter should display approximately 0 [ohm].

Was a fault detected?

Yes - Skip to "**Verification**"
No - Continue below.

Checking the ground lead

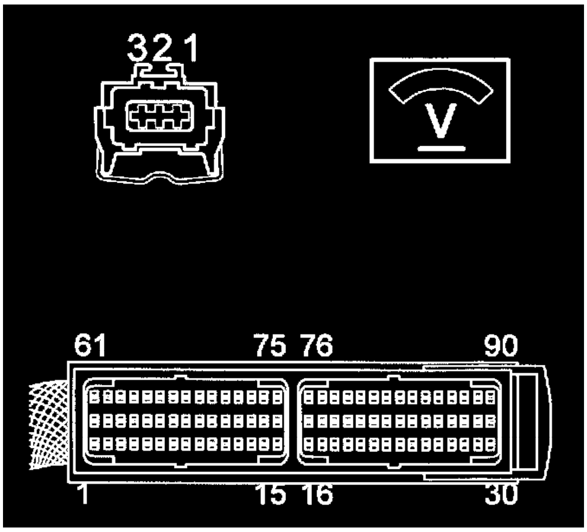


Check the cables between knock sensor (KS) connector terminal 2 (control module side) and engine control module (ECM) terminal #76 and between knock sensor (KS) connector terminal 3 (control module side) and engine control module (ECM) terminal #19. Check for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Skip to "**Verification**"

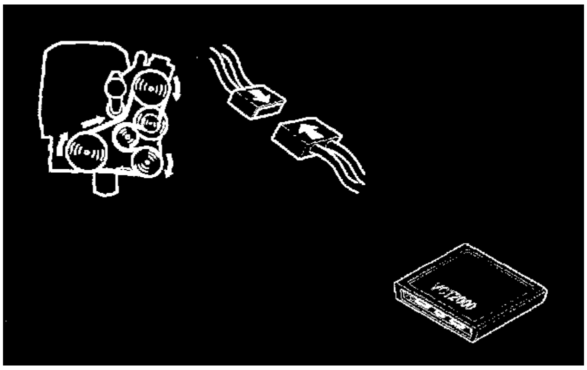
Checking the signal cable



Check the cable between knock sensor (KS) connector terminal 1 (control module side) and engine control module (ECM) terminal #51. Check for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

Remedy as necessary.

Verification



- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Start the engine
- Rev the engine to 4000 rpm a couple of times.

Read off diagnostic trouble codes (DTCs).

Has the status of the diagnostic trouble code (DTC) changed to intermittent?
Yes- Testing Complete.
No - Continue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information
Diagnostic trouble code (DTC) information

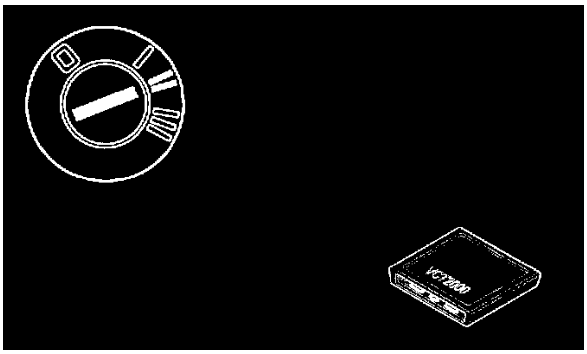
Condition
Diagnostic trouble code (DTC) ECM-43 is stored if the engine control module (ECM) detects an internal fault with knock control.

Condition
- Ignition retardation
- No knock adaptation
- Initial boost pressure.

Possible source
- Defective engine control module (ECM).

Condition
- Deterioration in performance
- High fuel consumption.

Internal Fault - Intermittent Fault
Internal fault. Intermittent fault



Erasing diagnostic trouble code (DTC)
- The control module has previously registered a fault
- Ignition on.

Erase the diagnostic trouble codes (DTC).

Internal Fault - Permanent Fault

Internal fault. Permanent fault

Defective control module I
Replace engine control module (ECM) according to See: Engine Control Module/Service and Repair

Diagnostic Trouble Code (DTC) Information Condition
Diagnostic trouble code (DTC) information

Condition
The control module checks for misfiring after the engine's first 1000 crankshaft revolutions after starting. Diagnostic trouble code (DTC) ECM -44 is stored if the control module registers a misfire which causes increased emissions.

Condition
- Fuel trim disabled.
- Three-way catalytic converter (TWC) diagnostic disabled.
- Knock retardation disabled.
- Idle air trim adaptation is disabled.
- Evaporative emission (EVAP) system operates at minimum.

Possible source
- Defective spark plugs, ignition cables, ignition coil or flywheel / pulse wheel.
- Blocked / leaking injector.
- Uneven compression.
- Leakage between cooling system and cylinder.
- Moisture, flashover in the ignition system on HT side.
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit.
- Fuel stoppage.
- Water in spark plug wells.
- Contaminated fuel or incorrect fuel type.
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Condition
- Engine difficult to start.
- The engine runs unevenly at idle or there are marked jerks in engine response when driving.
- Poor performance.
- High emissions.

Faulty Signal - Intermittent Fault
Faulty Signal. Intermittent Fault

Checking the fuel injection system, ignition system and components

Check that the engine oil level is correct.

Check the ignition system for moisture in the spark plug wells. Check the ignition cables for open-circuits.

Check the spark plugs. Search for damage in the insulation and other damage. If there is any doubt about their function, replace the spark plugs.

Check the ignition coil connectors and the ground cable.

Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the engine compression.

Check the injectors.

Check the fuel pressure and residual pressure.

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Fault-tracing information
If the fault is intermittent, do not verify fault-tracing if the fault does not recur

Faulty Signal - Permanent Fault
Faulty signal. Permanent fault

Checking the fuel injection system, ignition system and components

Check that the engine idle speed is correct.

Check the ignition system for moisture in the spark plug wells. Check the ignition cables for open-circuits.

Check the spark plugs. Search for damage in the insulation and other damage. If there is any doubt about their function, replace the spark plugs.

Check the ignition coil connectors and the ground cable.

Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

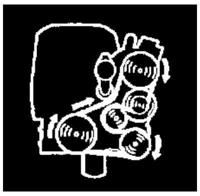
Check the engine compression.

Check the injectors.

Check the fuel pressure and residual pressure.

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

If the engine is running unevenly or is jerky, this may indicate misfiring.

- Reinstall the components, reconnect the connectors etc.
- Start the engine. Check immediately that there is no misfiring
- Let the engine idle. Check that there is no misfiring
- Rev the engine. Check that there is no misfiring as engine speed increases, at constant engine speeds and when returning to idle speed.

Hint: It may be difficult to detect misfiring in the workshop. Further checks can be made when carrying out the final checks after the diagnostic trouble codes (DTCs) have been erased.

Is the engine misfiring?
Yes - Continue below.
No - Testing Complete.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition
The control module checks for misfiring after the engine's first 1000 crankshaft revolutions after starting. Diagnostic trouble code (DTC) ECM -45 is stored if the control module registers a misfire which causes increased emissions.

Condition
- Fuel trim disabled.
- Three-way catalytic converter (TWC) diagnostic disabled.
- Knock retardation disabled.
- Idle air trim adaptation is disabled.
- Evaporative emission (EVAP) system operates at minimum.

Possible source
- Defective spark plugs, ignition cables, ignition coil or flywheel / pulse wheel.
- Blocked / leaking injector.
- Uneven compression.
- Leakage between cooling system and cylinder.

- Moisture, flashover in the ignition system on HT side.
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit.
- Fuel stoppage.
- Water in spark plug wells.
- Contaminated fuel or incorrect fuel type.
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Condition
- Engine difficult to start.
- The engine runs unevenly at idle or there are marked jerks in engine response when driving.
- Poor performance.
- High emissions.

Faulty Signal - Intermittent Fault

Faulty signal. Intermittent fault

Checking the fuel injection system, ignition system and components

Check that the engine oil level is correct.

Check the ignition system for moisture in the spark plug wells. Check the ignition cables for open-circuits.

Check the spark plugs. Search for damage in the insulation and other damage. If there is any doubt about their function, replace the spark plugs.

Check the ignition coil connectors and the ground cable.
Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the engine compression.

Check the injectors.

Check the fuel pressure and residual pressure.

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Fault-tracing information
If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Faulty Signal - Permanent Fault

Faulty signal. Permanent fault

Checking the fuel injection system, ignition system and components

Check that the engine oil level is correct.

Check the ignition system for moisture in the spark plug wells. Check the ignition cables for open-circuits. Check the spark plugs. Search for damage in the insulation and other damage. If there is any doubt about their function, replace the spark plugs.

Check the ignition coil connectors and the ground cable. Check for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

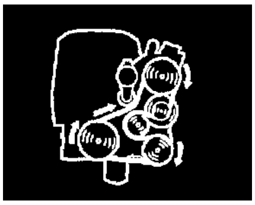
Check the engine compression.

Check the injectors.

Check the fuel pressure and residual pressure.

Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

If the engine is running unevenly or is jerky, this may indicate misfiring.

- Reinstall the components, reconnect the connectors etc.
- Start the engine. Check immediately that there is no misfiring
- Let the engine idle. Check that there is no misfiring
- Rev the engine. Check that there is no misfiring as engine speed increases, at constant engine speeds and when retarning to idle speed.

  Hint: It may be difficult to detect misfiring in the workshop. Further checks can be made when carrying out the final checks after the diagnostic trouble codes (DTCs) have been erased.

Is the engine misfiring?

Yes - Continue below.
No - Testing Complete.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM- 4D is stored if the control module registers misfiring of such severity that the three-way catalytic converter (TWC) will be damaged.

Condition

- Fuel trim disabled.
- Three-way catalytic converter (TWC) diagnostic disabled.
- Knock retardation disabled.
- Idle air trim adaptation is disabled.
- Evaporative emission (EVAP) system operates at minimum.
- Altitude compensation disabled.

Possible source

- Defective spark plugs, ignition cables, distributor cap, rotor, ignition coil or flywheel / pulse wheel.
- Blocked / leaking injector.
- Uneven compression.
- Leakage between cooling system and cylinder.
- Moisture, flashover in the ignition system on HT side.
- Intermittent open-circuit, intermittent short-circuit to ground, intermittent short-circuit to voltage supply, contact resistance or loose connection in the ignition system low-tension side, in the injector circuit or fuel pump (FP) circuit.
- Fuel stoppage.
- Water in spark plug wells.
- Contaminated fuel or incorrect fuel type.
- Repeated cold starting where the engine coolant temperature (ECT) has not reached normal operating temperature between starts.

Condition

- Engine difficult to start.
- The engine runs unevenly at idle or there are marked jerks in engine response when driving.
- Poor performance.
- High emissions.

Fault-Tracing Information

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

Diagnostic trouble code (DTC) ECM-53 is stored if the engine control module (ECM) counts more than two teeth too few or too many on the carrier plate / flywheel for two consecutive crankshaft revolutions.

Condition
None.

Possible source
- Contact resistance in the terminals.
- Signal cable insulation damaged.
- Damaged carrier plate / drive plate.
- Defective engine speed (RPM) sensor.

Condition
- Engine running very jerkily.

Sporadic Signal - Intermittent Fault
Sporadic signal. Intermittent fault

Checking wiring
Check the flywheel and carrier plate for damage. Check the signal cables between engine control module (ECM) terminals #24 and #54 and engine speed (RPM) sensor terminals #1 and #2. Check for an intermittent short- circuit to ground, an intermittent short-circuit to supply voltage and for intermittent open-circuits according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Hint: With the ignition on, the voltage between engine speed (RPM) sensor connector terminals #1 and #2 must be approximately 1.8 V with the reading taken at the ground terminal.

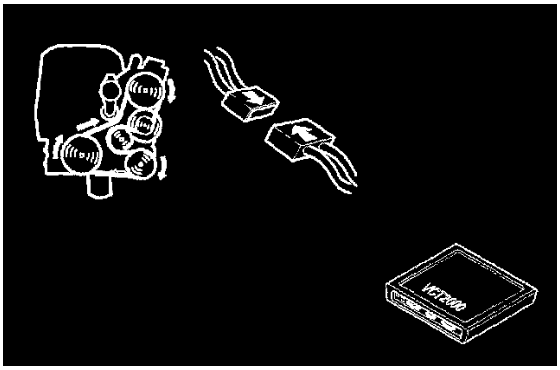
Try a new engine speed (RPM) sensor if the above fault-tracing does not reveal any faults.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the engine speed (RPM) sensor, See: Engine Speed Sensor/Service and Repair

Fault-tracing information
If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Sporadic Signal - Permanent Fault
Sporadic signal. Permanent fault

Checking the connectors



Check the engine speed (RPM) sensor and engine control module (ECM) connectors for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals. Remedy if necessary.

Check in particular for damage or loose terminal pins.

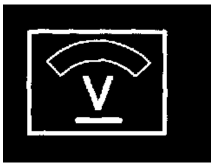
Reconnect the connectors.

Start the engine.

Read off the status of the diagnostic trouble code (DTC).

Is the status intermittent?
Yes - Skip to "**Verification**"
No - Continue below.

Checking components and wiring



Check the flywheel and carrier plate for damage.

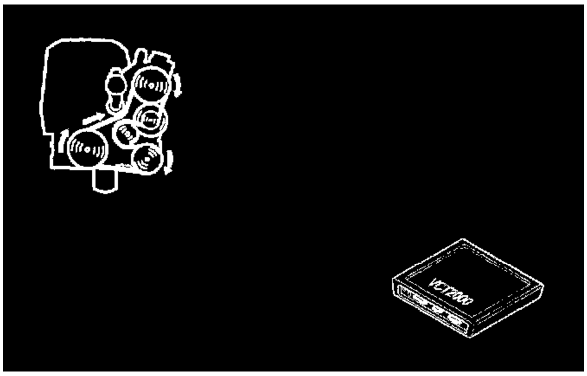
Check the signal cables between engine control module (ECM) terminals #24 and #54 and engine speed (RPM) sensor terminals #1 and #2. Check for a short-circuit to ground, a short-circuit to supply voltage and for open-circuits according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals. Remedy if necessary.

Hint: With the ignition on, the voltage between engine speed (RPM) sensor connector terminals #1 and #2 must be approximately 1.8V with the reading taken at the ground terminal.

Try a new engine speed (RPM) sensor if no faults are found in the above fault-tracing.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the engine speed (RPM) sensor, See: Engine Speed Sensor/Service and Repair

Verification



Start the engine.
Allow the engine to idle for approximately 2 minutes.
Read off the status of the diagnostic trouble code (DTC).

Is the status intermittent?
Yes - Testing Complete.
No - Continue below.

Fault-tracing information
The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information

Condition

The three-way catalytic converter (TWC) efficiency is checked once every driving cycle. The control module applies a different cycle to the front heated oxygen sensor (HO2S). Diagnostic trouble code (DTC) ECM-5A is stored and the rear heated oxygen sensor (HO2S) signal is altered if the three-way catalytic converter (TWC) efficiency is diminished.

Condition

None.

Possible source

- Uneven compression.
- Air leakage in the intake system.
- Leakage in the exhaust system.
- Faulty fuel pressure.
- Defective three-way catalytic converter (TWC).

Condition

- May result in poor performance.

Faulty Signal - Permanent Fault

Faulty signal. Permanent fault

Checking for air leakage in the intake system

Check for air leakage in the intake system according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

Remedy as necessary.

Was there any air leakage?

Yes- Skip to "**Fault-tracing information**"
No - Continue below.

Checking fuel and residual pressures

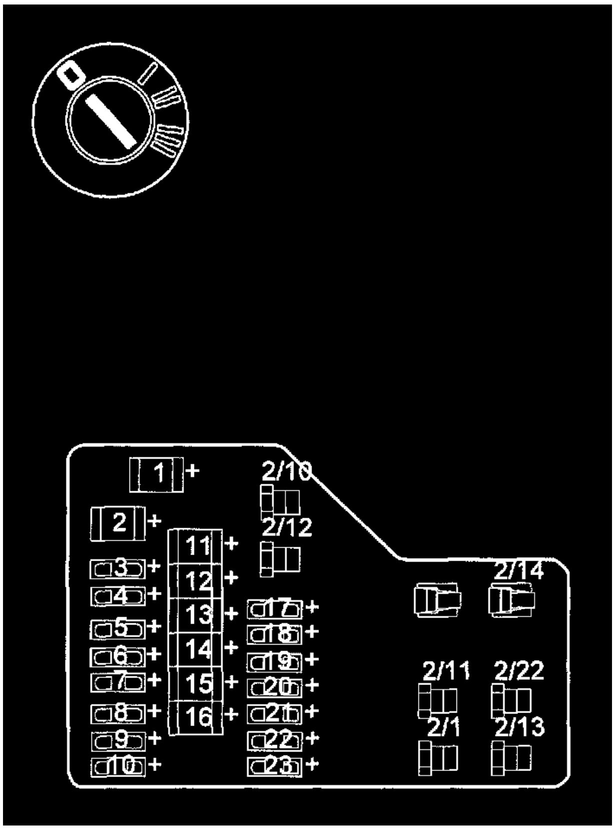
Check the fuel pressure and residual pressure.

Remedy as necessary.

Was the pressure OK?

Yes- Continue below.
No - Skip to "**Fault-tracing information**"

Checking the engine:



- Ignition off
- Disconnect system relay 2/14
- Remove spark plugs.

Check the compression at wide open throttle (WOT).

In particular, check for uneven compression between the cylinders.

Note! Compression testing should always be carried out at wide open throttle (WOT) and with the engine at operating temperature. Diagnostic trouble codes (DTCs) ECM-24 and ECM-A3 will be stored because the system relay is disconnected.

Is the compression OK?

Yes- Continue below.
No - Skip to "**Engine repairs**"

Replacing the component

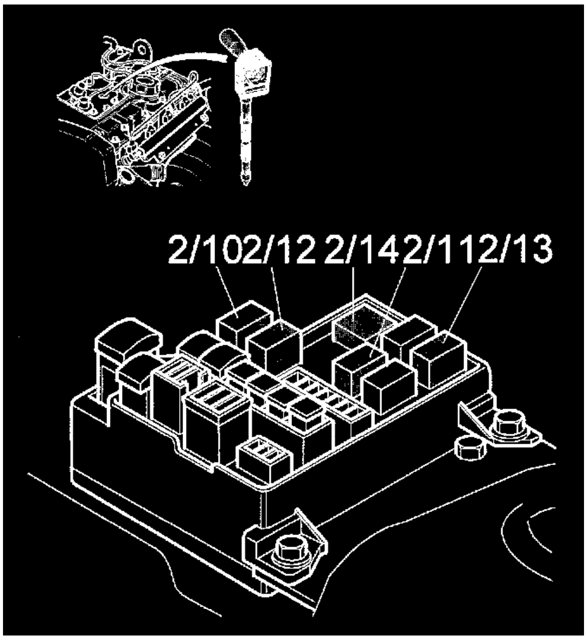
- Try a new three-way catalytic converter (TWC).

Skip to "**Fault-tracing information**"

Engine repairs

Carry out the repair required to the engine.

Verification



Hint: Check after repair that the fault has been rectified.

- Reinstall system relay 2/14.

Start the engine and check that idle speed runs evenly.

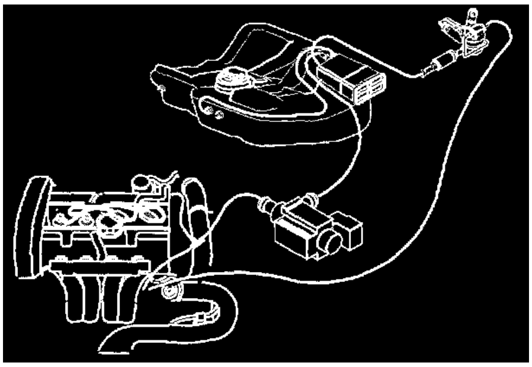
Is idle speed even?

Fault-tracing information

Fault-tracing is not followed by verification for this fault.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-5C is stored if the canister purge (CP) valve signal cable is short-circuited to ground or voltage or if there is an open-circuit in the circuit.

Condition

- No leak diagnostic
- No idle air trim adaptation
- No long-term fuel trim.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Defective canister purge (CP) valve.

Signal too low:

- Short-circuit to ground in the signal cable.

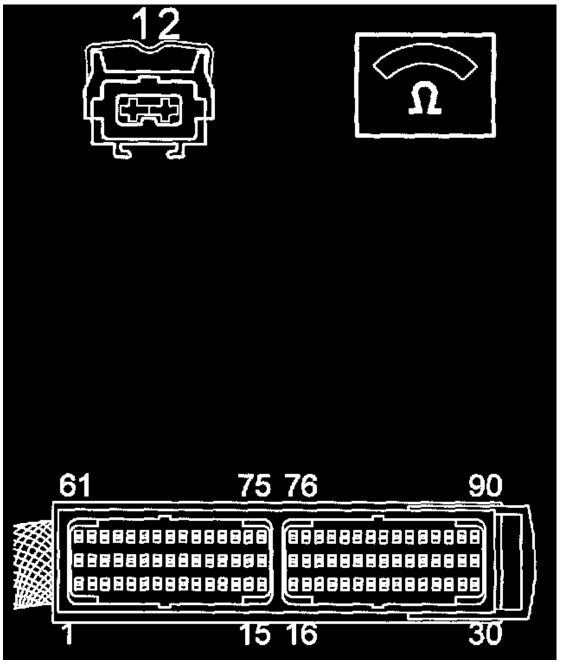
Signal missing:

- Open-circuit in the signal cable
- Contact resistance and oxidation.

Condition
- Malfunction indicator lamp (MIL) lit
- High idling speed
- Low idling speed.

Signal Missing - Intermittent Fault

Checking Cables



Check the engine control module (ECM) and canister purge (CP) valve connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check that the resistance in the canister purge (CP) valve between terminals 1 and 2 is approximately **30 [ohm]** at **+20°C**.

Check the signal cable between engine control module (ECM) #4 and canister purge (CP) valve terminal 2 for an intermittent open-circuit and remedy according to **Checking wiring and terminals - Intermittent Faults.**

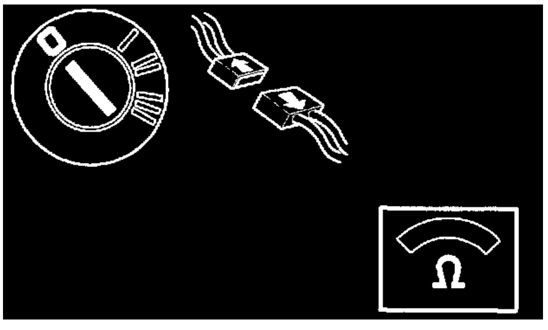
Check the power supply cable between the canister purge (CP) valve terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Terminal

Checking The Terminal



- Ignition off
- Disconnect the canister purge (CP) valve connector.

Check the canister purge (CP) valve connector for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

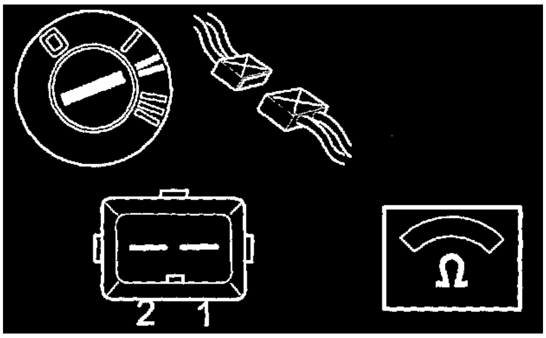
Were any faults found?

Yes **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Verification

No **-** See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Checking the Canister Purge (CP) Valve

Checking the Canister Purge (CP) Valve

Checking The Canister Purge (CP) Valve



- Canister purge (CP) valve connector disconnected
- Ignition on.

Connect an ohmmeter between canister purge (CP) valve connector terminals 1 and 2.

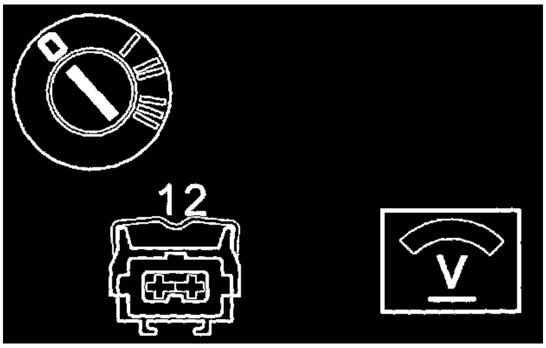
The ohmmeter should read approximately 30 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Checking the Power Supply

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Defective Canister Purge (CP) Valve

Checking the Power Supply

Checking The Power Supply



- Ignition off.

Connect a voltmeter between the canister purge (CP) valve connector terminal 2 (control module side) and ground.

The voltmeter should read battery voltage for 2 seconds immediately the ignition is switched on.

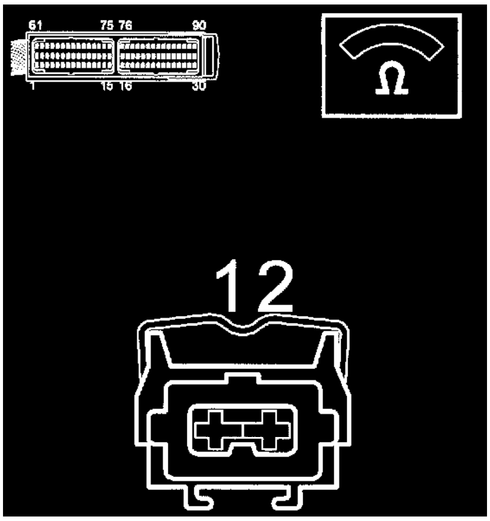
OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal

Missing - Permanent Fault/Checking the Power Cable

Checking the Signal Cable

Checking The Signal Cable



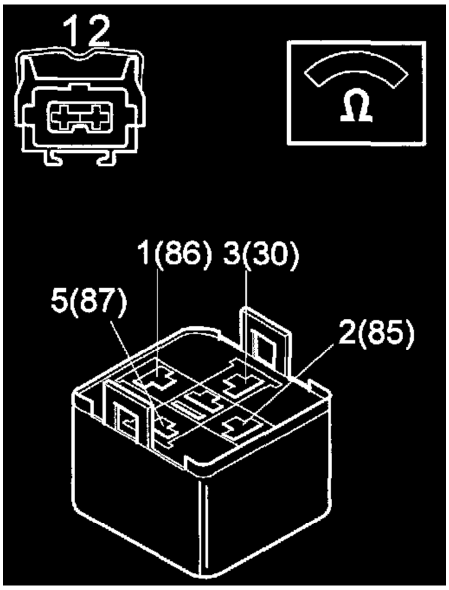
Check the cable between canister purge (CP) valve terminal 1 and engine control module (ECM) connector terminal 45 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Verification

Checking the Power Cable

Checking The Power Cable



Check the cable between canister purge (CP) valve terminal 2 and system relay base 2/14 terminal 3 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Verification

Defective Canister Purge (CP) Valve

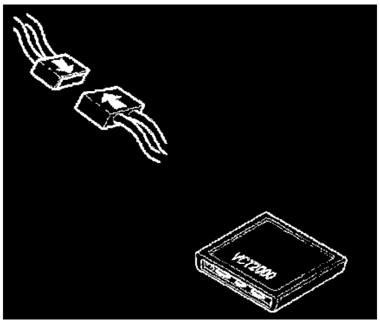
Defective Canister Purge (CP) Valve

Try new canister purge (CP) valve according to **Replacing the canister purge (CP) valve.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Missing - Permanent Fault/Verification

Verification

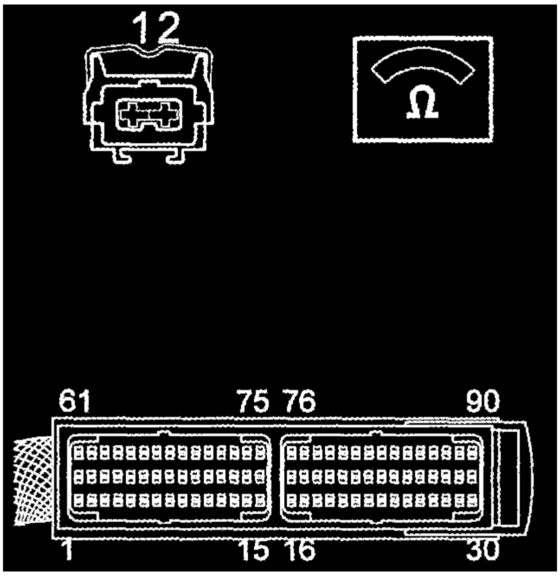
Verification



- Reconnect the connectors, reinstall components etc Activate the canister purge (CP) valve according to See: Scan Tool Testing and Procedures/Description of Activation

Signal Too High - Intermittent Fault

Checking Components And Wiring



Check at the resistance in the canister purge (CP) valve between terminals 1 and 2 is approximately **30 [ohm]** at **+20°C**.

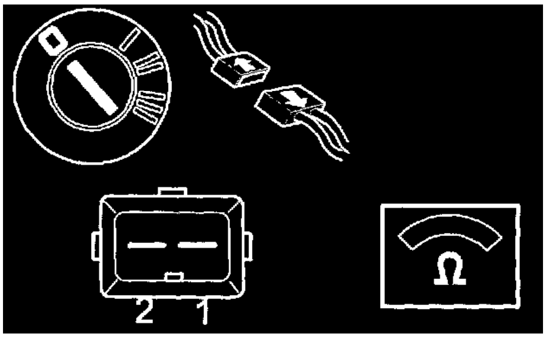
Check the signal cable between engine control module (ECM) terminal 4 and canister purge (CP) valve terminal 2 for an intermittent short-circuit to supply voltage and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Check Canister Purge (CP) Valve

Check Canister Purge (CP) Valve



- Ignition off
- Disconnect the front canister purge (CP) valve connector.

Connect an ohmmeter between the canister purge (CP) valve terminals 1 and 2 (valve side).

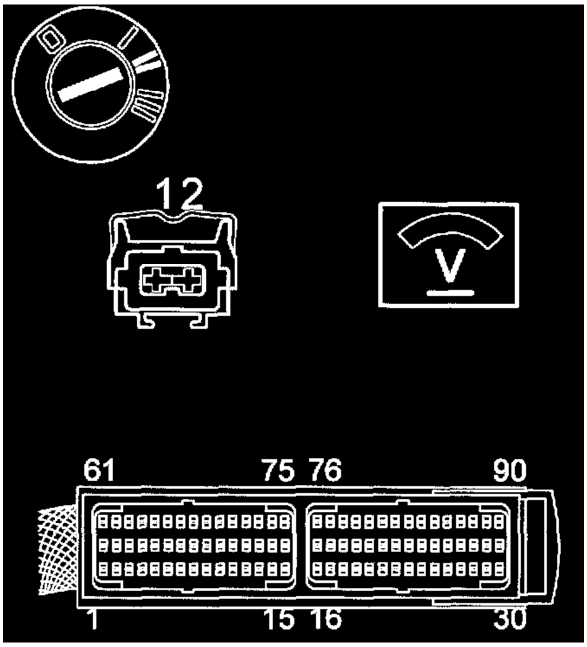
The ohmmeter should read approximately 30 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Too High - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Too High - Permanent Fault/Defective Canister Purge (CP) Valve

Checking the Signal Cable

Checking The Signal Cable



- Ignition on.

Check the cable between the canister purge (CP) valve connector terminal 2 (control module side) and control module connector terminal 4 for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Too High - Permanent Fault/Verification

Defective Canister Purge (CP) Valve

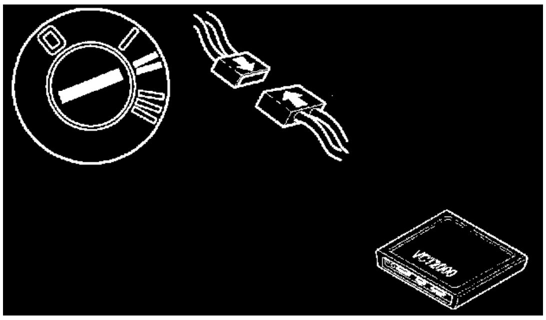
Defective Canister Purge (CP) Valve

Try a new valve according to **Replacing the canister purge (CP) valve.**

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Too High - Permanent Fault/Verification

Verification

Verification

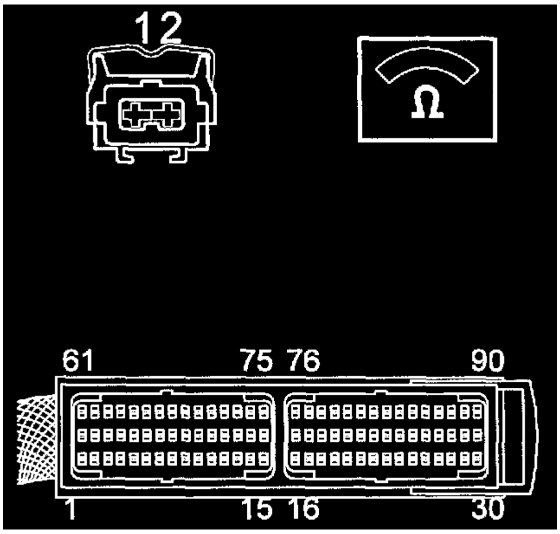


- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the canister purge (CP) valve according to See: Scan Tool Testing and Procedures/Description of Activation

Signal Too Low - Intermittent Fault

Checking Wiring



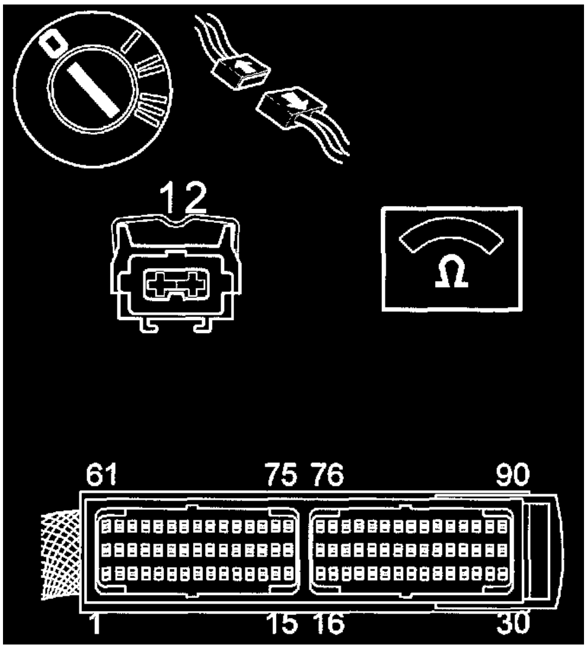
Check the signal cable between engine control module (ECM) terminal #4 and canister purge (CP) valve terminal #1 Check for an intermittent short-circuit to ground and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Disconnect the front canister purge (CP) valve connector.

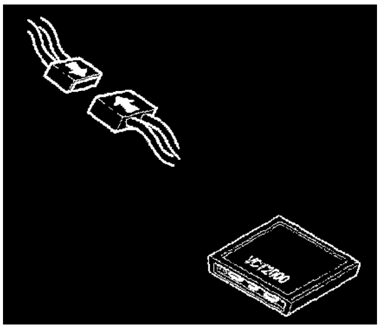
Check the cable between the canister purge (CP) valve connector terminal 1 (control module side) and engine control module (ECM) connector terminal 4 for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5C/Signal Too Low - Permanent Fault/Verification

Verification

Verification

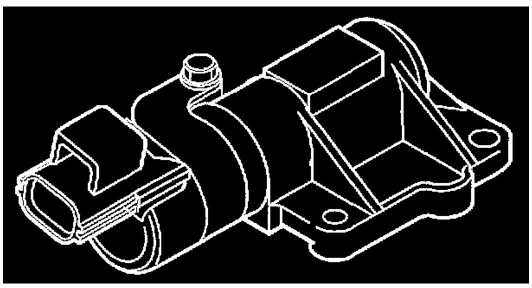


- Reconnect the connectors, reinstall components etc
- Connect VCT 2000

Activate the canister purge (CP) valve according to See: Scan Tool Testing and Procedures/Description of Activation

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

Diagnostic trouble code (DTC) ECM-5D is stored if the control module detects that the signal to the camshaft reset valve is too high, too low or missing.

Condition

No camshaft control.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable.
- Defective reset valve.

Signal too low:

- Short-circuit to ground in the signal cable.
- System relay power cable short-circuited to ground.
- Defective reset valve.

Signal missing:

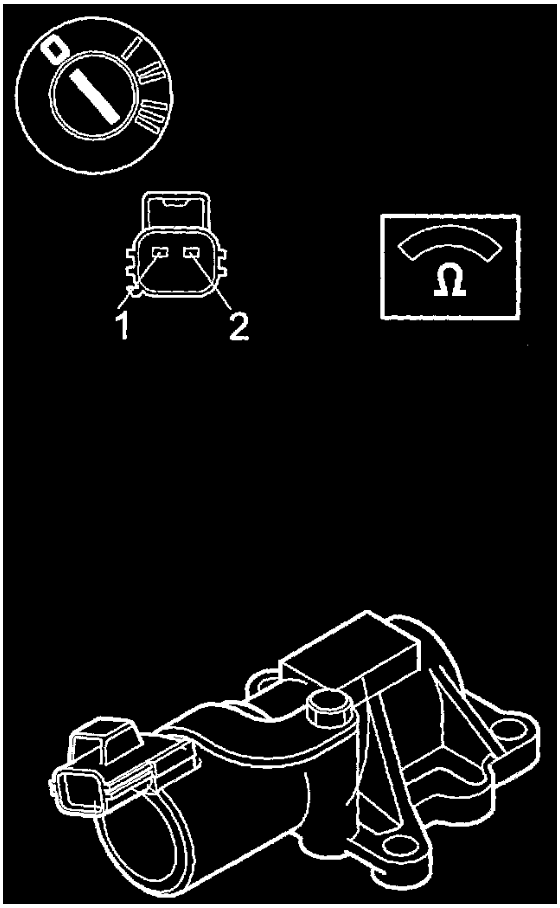
- Open-circuit in the signal cable.
- Open-circuit in the power cable from the system relay.
- Contact resistance in the terminals.
- Defective reset valve.

Condition

- Poor performance.

Signal Missing - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the connector on the camshaft reset valve. Check for loose connections according to **Checking wiring and terminals. Intermittent faults**. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**
- Check the signal cable between engine control module (ECM) terminal #62 and camshaft reset valve terminal #2. Check for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**
- Check the power supply cable between system relay terminal #5 (87) and camshaft reset valve terminal #1. Check for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary
- Try a new camshaft reset valve if no fault is found during the above fault-tracing.

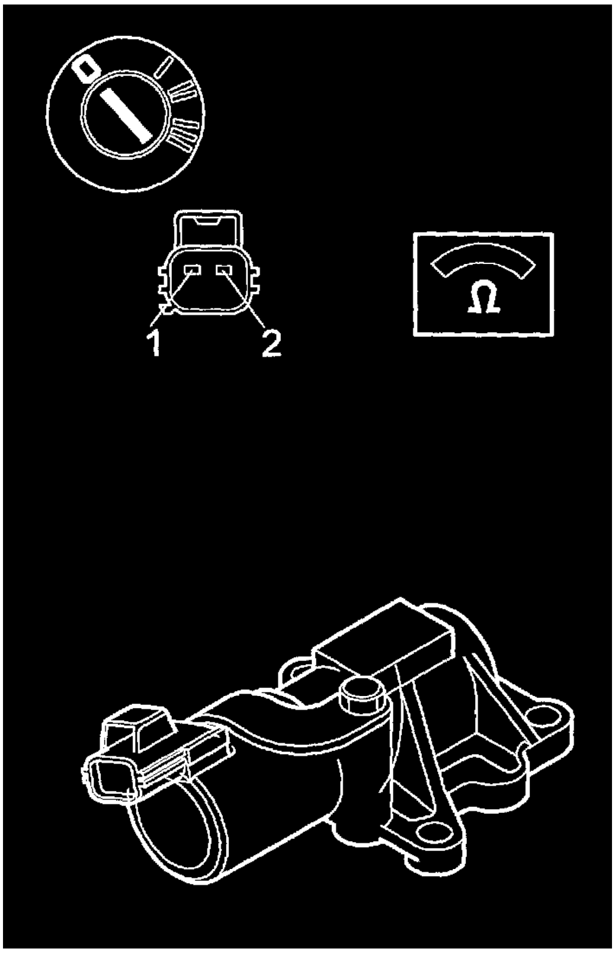
Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access and replace the camshaft reset valve, See **Replacing the variable valve timing (VVT) control valve**
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Signal Missing - Permanent Fault

Signal missing. Permanent fault

Checking wiring and connectors

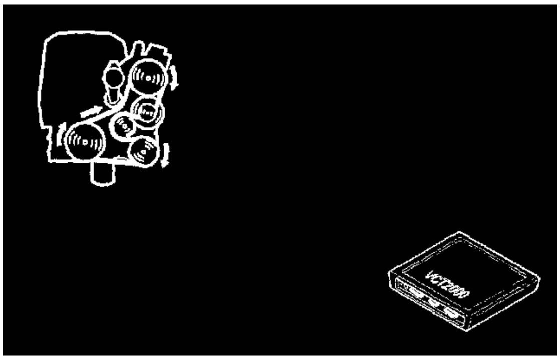


- Ignition off
- Check the connector on the camshaft reset valve for contact resistance and oxidation. See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
- Check the resistance of the camshaft reset valve between terminals #1 and #2. The resistance should be approximately 7 [ohm] at 25°C
- Check the signal cable between engine control module (ECM) terminal #62 and camshaft reset valve terminal #2. Check for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
- Check the power supply cable between system relay terminal #5 (87) and camshaft reset valve terminal #1 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.

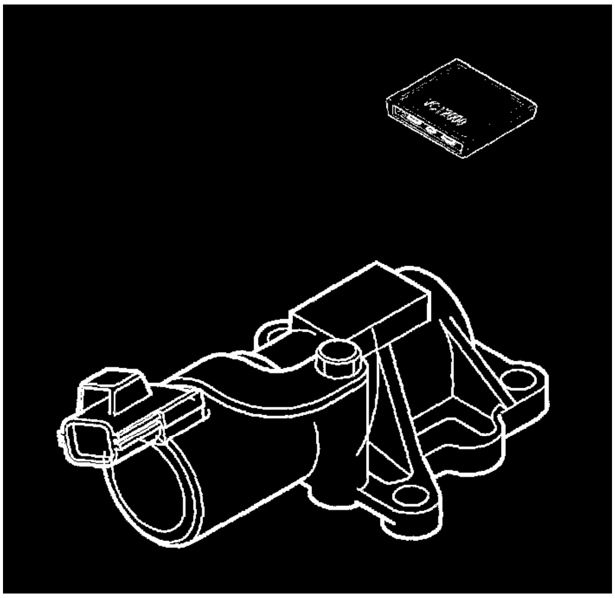
Other information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access and replace the camshaft reset valve, See: Variable Valve Timing Actuator/Service and Repair
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Verification



- After carrying out the repair, check that the fault has been remedied.
- Reinstall the components and connectors etc.
- Start the engine and let it idle.
- Activate reading off engine coolant temperature (ECT):
  Click the symbol for VCT-2000
- Check that the engine coolant temperature (ECT) exceeds 50°C.



- Rev the engine to 4000 rpm twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent.

Has the diagnostic trouble code (DTC) status switched to intermittent?

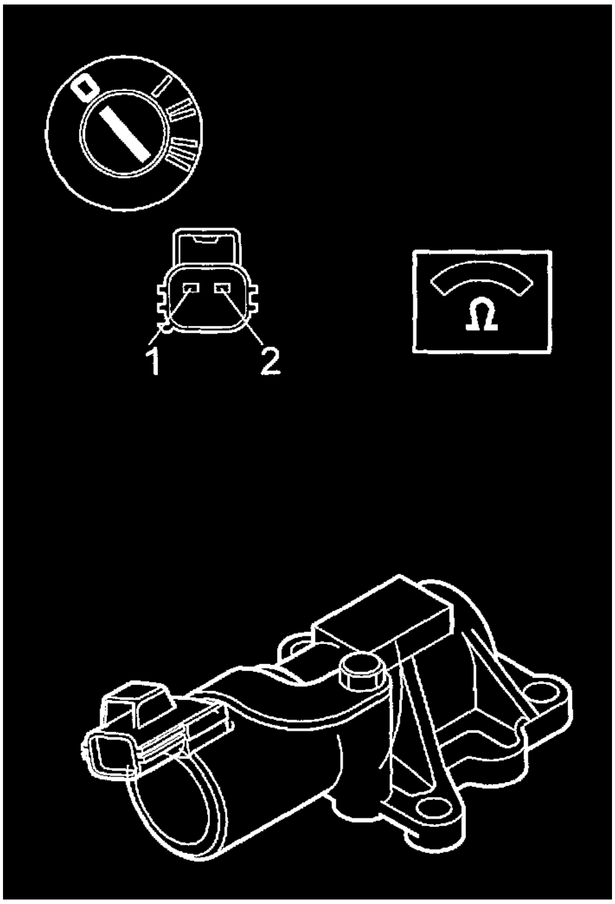
Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too High - Intermittent Fault

Signal too high. Intermittent fault



Checking wiring and connectors

- Ignition off
- Check the connector on the camshaft reset valve. Check for loose connections and for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Check the signal cable between engine control module (ECM) terminal #62 and camshaft reset valve terminal #2. Check for an intermittent short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Remedy as necessary.

Other information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access and replace the camshaft reset valve, See: Variable Valve Timing Actuator/Service and Repair
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

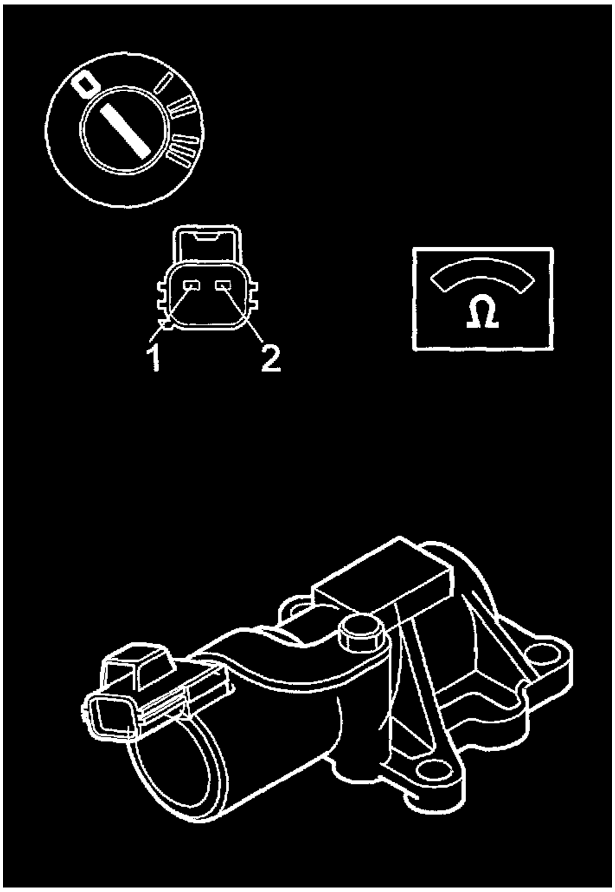
Fault-tracing information

If the fault is intermittent, do not verify fault-tracing if the fault does not recur.

Signal Too High - Permanent Fault

Signal too high. Permanent fault

Checking the wiring

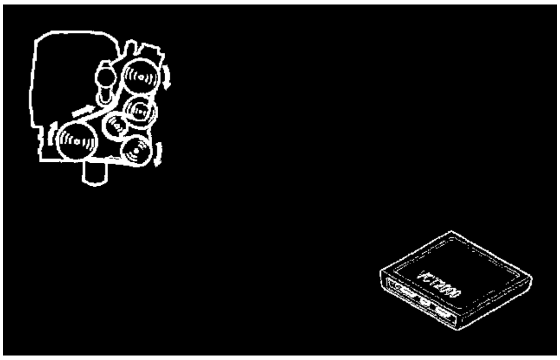


- Ignition off
- Check the resistance of the camshaft reset valve between terminals #1 and #2. Resistance should be approximately 7 [Omega]
- Check the signal cable between engine control module (ECM) terminal #62 and camshaft reset valve terminal #2 for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Remedy as necessary.

Other information:

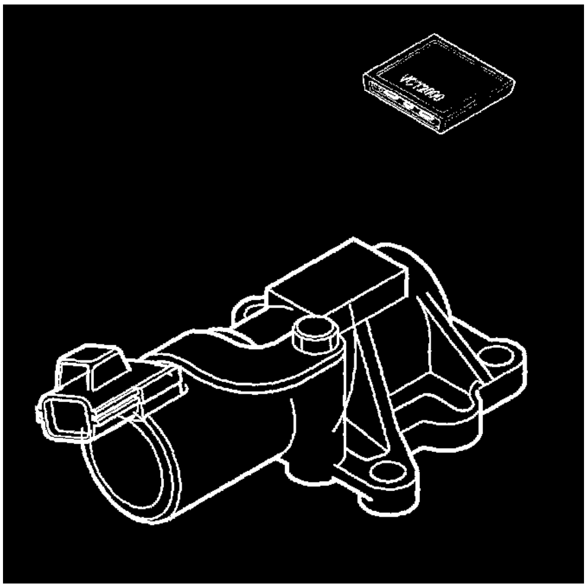
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access and replace the camshaft reset valve, See: Variable Valve Timing Actuator/Service and Repair
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Verification



After carrying out the repair, check that the fault has been remedied.

- Reinstall the components and connectors etc.
- Start the engine and let it idle.
- Activate reading off engine coolant temperature (ECT): Click the symbol for VCT-2000.
- Check that the engine coolant temperature (ECT) exceeds 50°C.



- Rev the engine to 4000 rpm twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent.

Has the diagnostic trouble code (DTC) status switched to intermittent?

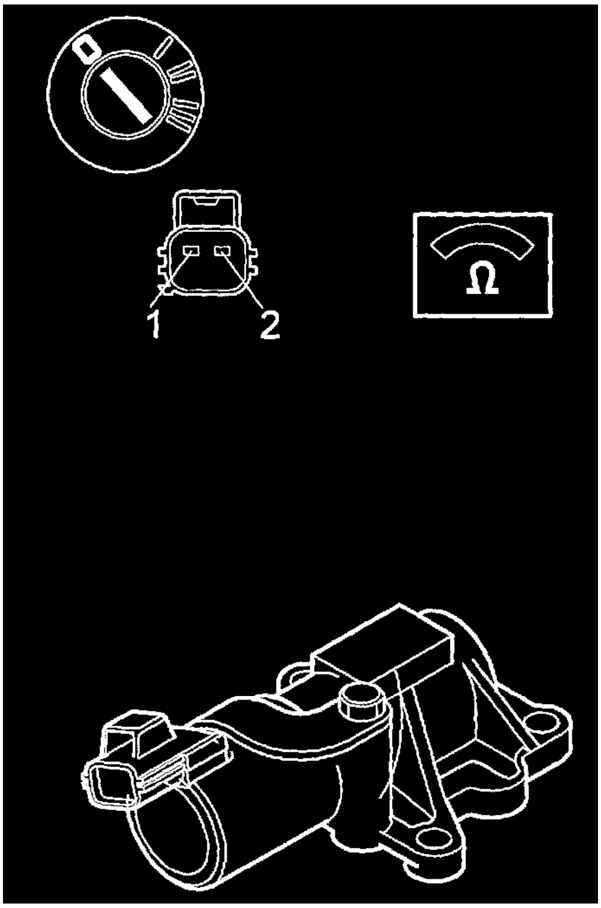
Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Signal Too Low - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the connector on the camshaft reset valve. Check for loose connections according to **Checking wiring and terminals. Intermittent**

faults. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**
- Check the signal cable between engine control module (ECM) terminal #62 and camshaft reset valve terminal #2. Check for an intermittent short-circuit to ground according **Checking wiring and terminals. Intermittent faults**.
- Check the power supply cable between system relay terminal #5 (87) and camshaft reset valve terminal #1. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**

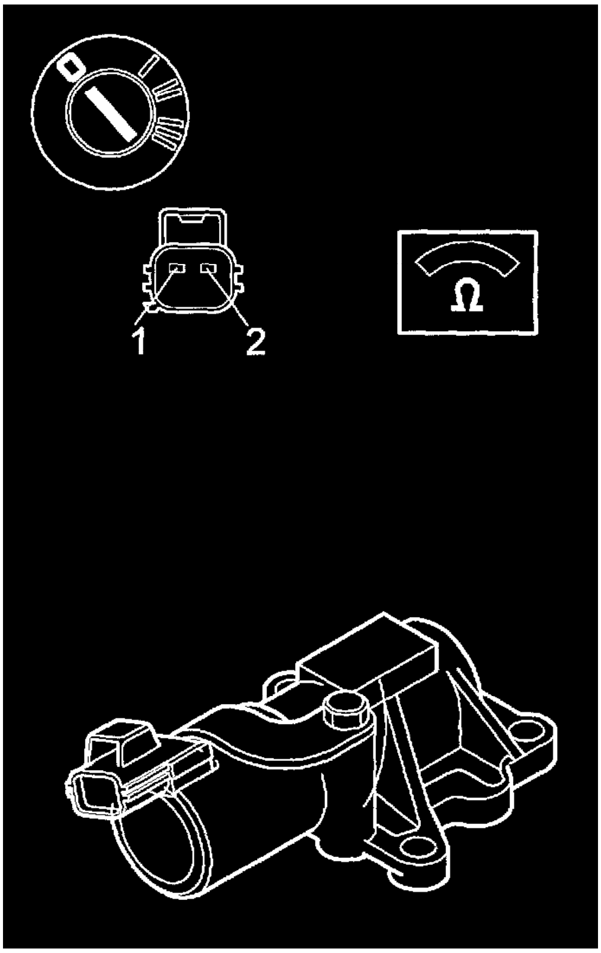
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access or replace the camshaft reset valve, See **Replacing the variable valve timing (VVT) control valve**
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Signal Too Low - Permanent Fault
Signal too low. Permanent fault

Checking the wiring

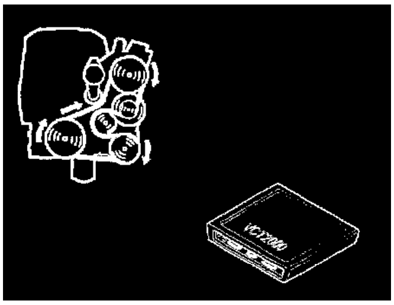


- Ignition off
- Check the connector on the camshaft reset valve for contact resistance and oxidation according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Check the resistance of the camshaft reset valve between terminals #1 and #2. The restance must be approximately. 7 [ohms]
- Check the signal cable between engine control module (ECM) terminal #62 and camshaft reset valve terminal #2 for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals.
- Check the power supply cable between system relay terminal #5 (87) and camshaft reset valve terminal #1 for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals
- Remedy as necessary.

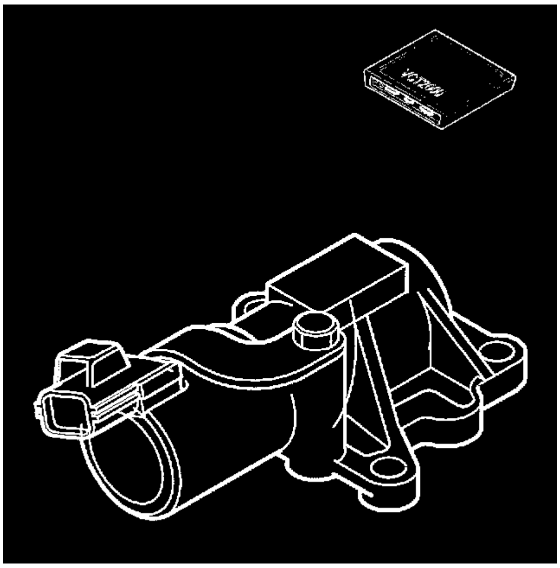
Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access and replace the camshaft reset valve, See: Variable Valve Timing Actuator/Service and Repair

- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Verification



- After carrying out the repair, check that the fault has been remedied.
- Reinstall the components and connectors etc.
- Start the engine and let it idle.
- Activate reading off engine coolant temperature (ECT):
  Click the symbol for VCT-2000.
- Check that the engine coolant temperature (ECT) exceeds 50°C.



- Rev the engine to 4000 rpm twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent.

Has the diagnostic trouble code (DTC) status switched to intermittent?

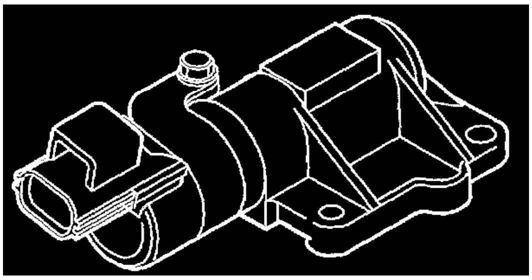
Yes - Testing Complete.
No - Continue below.

Fault-tracing information

The fault should have been detected and remedied. As this is not the case fault-tracing has failed.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

When the control module requests that the position of the camshaft remains unchanged, the pulse ratio of the camshaft reset valve should be approximately 50%. Diagnostic trouble code (DTC) ECM-5E is stored if the control module detects that a higher or lower pulse ratio is required to keep the camshaft in the same position.

Condition

None.

Possible source
- Variable oil pressure
- Blocked oil ducts
- Defective camshaft reset valve.

Condition
- Malfunction indicator lamp (MIL) lit
- Poor driveability, cold engine.

Faulty Signal - Intermittent Fault

Check

- Ignition off.

Check the connectors on the camshaft reset valve, control module and camshaft position (CMP) sensor. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.

Check the engine oil quality, check for contaminants in particular.

Replace the engine oil if necessary.

Check engine oil pressure for unstable oil pressure.

Remove the camshaft reset valve.

Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:
- To check the oil pressure, See: Component Tests and General Diagnostics/Checking Oil Pressure
- To access the control module See **Replacing the engine control module (ECM)**
- To access or replace the camshaft reset valve, See **Replacing the variable valve timing (VVT) control valve**.

Checking the Oil Pressure

Checking The Oil Pressure

- Check the engine oil quality. Check for contaminants particularly
- Replace the engine oil if necessary
- Check whether the engine oil pressure is unstable. See: Component Tests and General Diagnostics/Checking Oil Pressure
- Remedy as necessary.

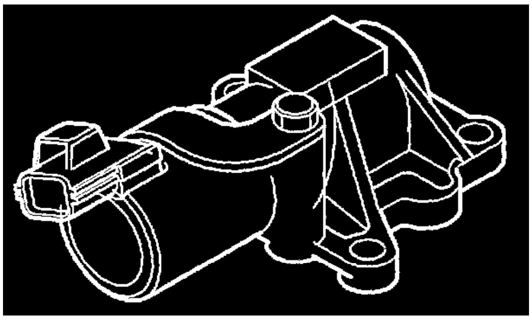
Was the engine oil pressure incorrect?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5E/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5E/Faulty Signal - Permanent Fault/Checking Oil Ducts

Checking Oil Ducts

Checking Oil Ducts



- Remove the camshaft reset valve
- Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

  NOTE: If it is suspected that there are any contaminants in the camshaft reset valve it should be replaced.

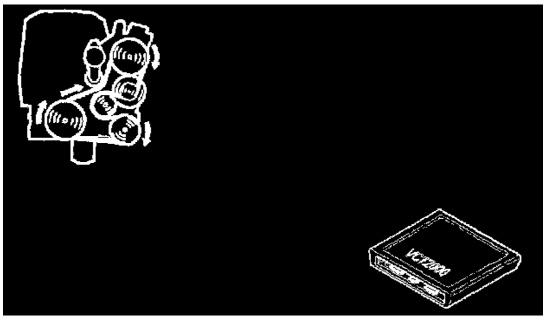
- Remedy as necessary
- Try a new camshaft reset valve, if no fault is found in the oil ducts.

Other information:
- To remove or replace the camshaft reset valve, See **Replacing the camshaft seals/variable valve timing unit**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5E/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

Activating the Continuous Variable Valve Timing (VVT) Test

Activating The Continuous Variable Valve Timing (VVT) Test



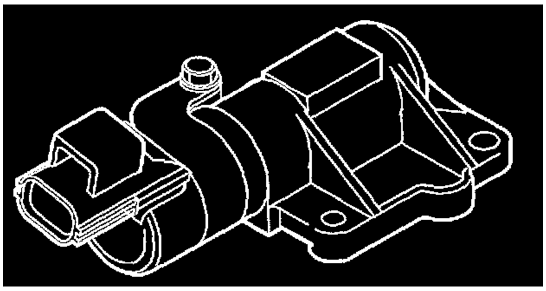
- Start the engine and let it idle.

  NOTE: The engine must be idling and the engine coolant temperature (ECT) must be between **50°C** and **92°C** throughout the entire test.

- Activate the continuous variable valve timing (VVT) test by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the continuous variable valve timing (VVT) test
- Wait until the continuous variable valve timing (VVT) test is complete. CVVT test complete YES is displayed with the test is complete
- Read off the results of the continuous variable valve timing (VVT) test. The continuous variable valve timing (VVT) test results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module does not detect any faults. The NOT OK status will be displayed if the control module detects any faults
- Click the stop button to re-run the test.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The engine control module (ECM) calculates the camshaft position in relation to the crankshaft using the camshaft position (CMP) sensor and engine speed (RPM) sensor signals. The control module adjusts the camshaft position using the reset valve. Diagnostic trouble code (DTC) ECM -5F is stored if the required change to the camshaft position takes too long.

Condition

None.

Possible source

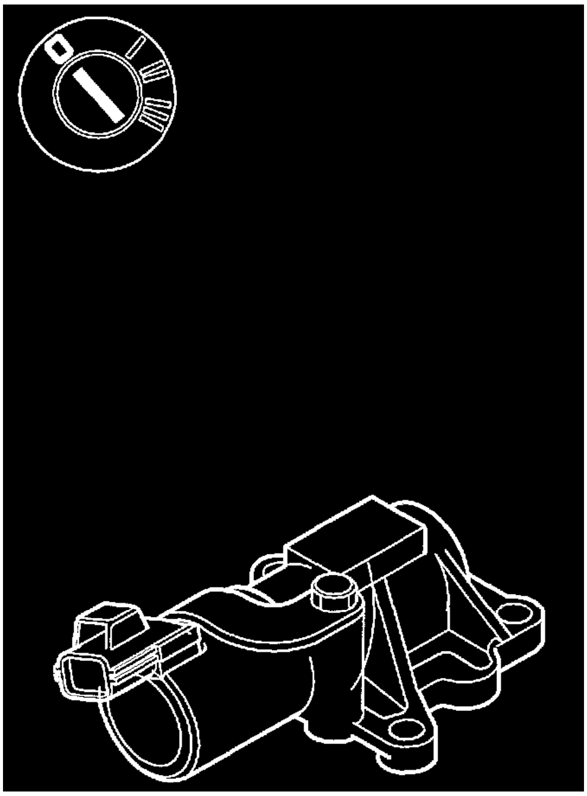
- Low oil pressure in the engine
- Blocked oil ducts for the camshaft reset valve
- Defective camshaft reset valve.

Condition

- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Check



- Ignition off.

Check the connectors on the camshaft reset valve, control module and camshaft position (CMP) sensor. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.
Check the engine oil quality, check for contaminants in particular.
Replace the engine oil if necessary.
Check the engine oil pressure for low oil pressure.

Remove the camshaft reset valve.
Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:
- To check the oil pressure, See: Component Tests and General Diagnostics/Checking Oil Pressure
- To access the control module, See **Replacing the engine control module (ECM)**
- To access or replace the camshaft reset valve, See **Replacing the variable valve timing (VVT) control valve**.

Checking the Oil Pressure

Checking The Oil Pressure

- Check the engine oil quality. Check for contaminants particularly
- Replace the engine oil if necessary
- Check that the engine oil pressure is not low. See: Component Tests and General Diagnostics/Checking Oil Pressure
- Remedy as necessary.

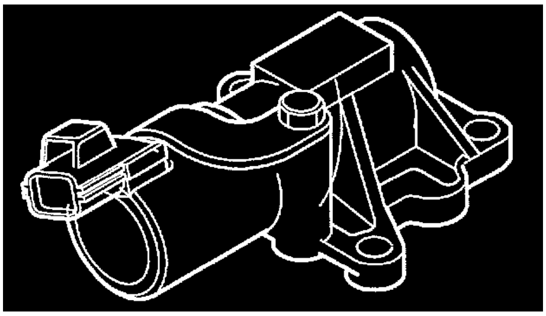
Was the engine oil pressure incorrect?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5F/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5F/Faulty Signal - Permanent Fault/Checking Oil Ducts

Checking Oil Ducts

Checking Oil Ducts



- Remove the camshaft reset valve
- Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

  NOTE: If it is suspected that there are any contaminants in the camshaft reset valve it should be replaced.

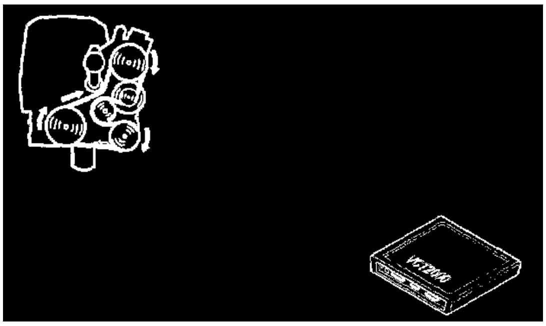
- Remedy as necessary
- Try a new camshaft reset valve, if no fault is found in the oil ducts.

Other information:
- To remove or replace the camshaft reset valve, See **Replacing the camshaft seals/variable valve timing unit**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-5F/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

Activating the Continuous Variable Valve Timing (VVT) Test

Activating The Continuous Variable Valve Timing (VVT) Test



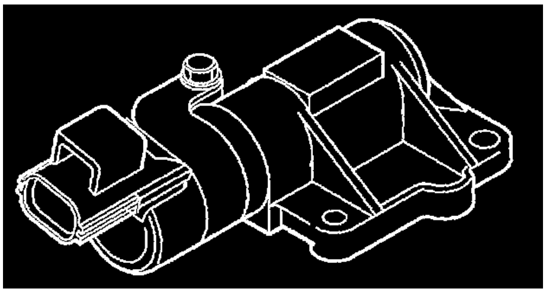
- Start the engine and let it idle.

  NOTE: The engine must be idling and the engine coolant temperature (ECT) must be between **50°C** and **92°C** throughout the entire test.

- Activate the continuous variable valve timing (VVT) test by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the continuous variable valve timing (VVT) test
- Wait until the continuous variable valve timing (VVT) test is complete. CVVT test complete YES is displayed with the test is complete
- Read off the results of the continuous variable valve timing (VVT) test. The continuous variable valve timing (VVT) test results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module does not detect any faults. The NOT OK status will be displayed if the control module detects any faults
- Click the stop button to re-run the test.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The engine control module (ECM) checks the camshaft position in relation to the crankshaft using the camshaft position (CMP) and engine speed (RPM) sensors. Diagnostic trouble code (DTC) ECM-60 is stored if the control module detects that the obtained position differs from the requested position.

Condition

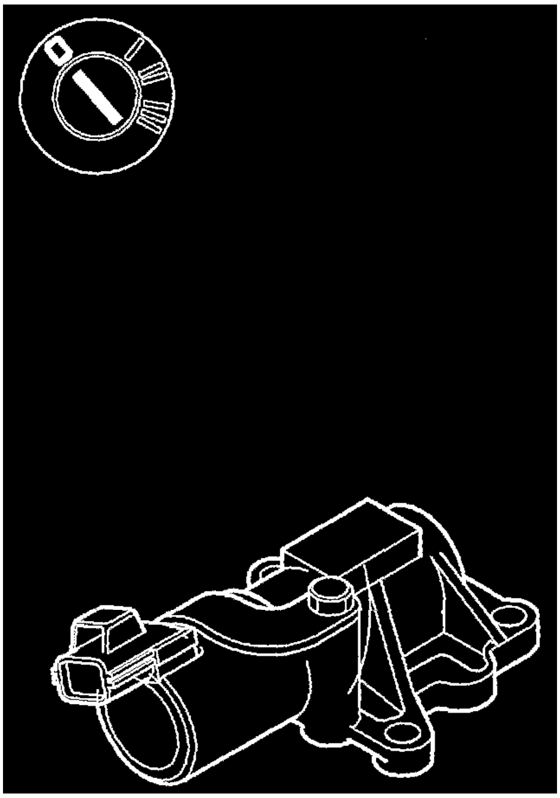
None.

Possible source
- Low oil pressure in the engine
- Blocked oil ducts for the camshaft reset valve
- Defective camshaft reset valve.

Condition
- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Check



- Ignition off.

Check the connectors on the camshaft reset valve, control module and camshaft position (CMP) sensor. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.

Check the engine oil quality, check for contaminants in particular.
Replace the engine oil if necessary.
Check the engine oil pressure for low oil pressure.
Remove the camshaft reset valve.
Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:
- To check the oil pressure, See: Component Tests and General Diagnostics/Checking Oil Pressure
- To access the control module, See **Replacing the engine control module (ECM)**
- To access or replace the camshaft reset valve, See **Replacing the variable valve timing (VVT) control valve**.

Checking the Oil Pressure

Checking The Oil Pressure

- Check the engine oil quality. Check for contaminants particularly
- Replace the engine oil if necessary
- Check that the engine oil pressure is not low, See: Component Tests and General Diagnostics/Checking Oil Pressure
- Remedy as necessary.

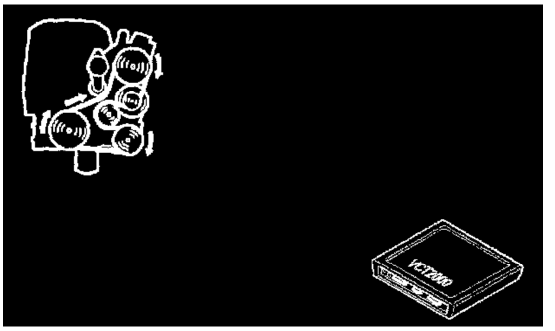
Was the engine oil pressure incorrect?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-60/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-60/Faulty Signal - Permanent Fault/Checking Oil Ducts

Activating the Continuous Variable Valve Timing (VVT) Test

Activating The Continuous Variable Valve Timing (VVT) Test



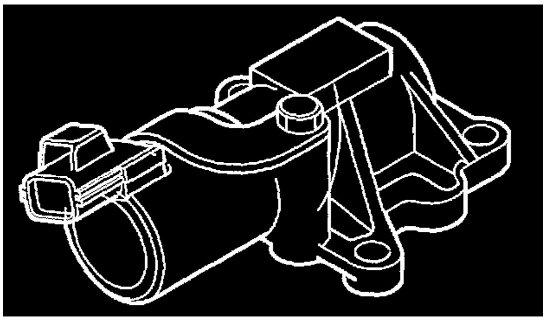
- Start the engine and let it idle.

  NOTE: The engine must be idling and the engine coolant temperature (ECT) must be between **50°C** and **92°C** throughout the entire test.

- Activate the continuous variable valve timing (VVT) test by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceed **50°C**
- Start the continuous variable valve timing (VVT) test
- Wait until the continuous variable valve timing (VVT) test is complete. CVVT test complete YES is displayed with the test is complete
- Read off the results of the continuous variable valve timing (VVT) test. The continuous variable valve timing (VVT) test results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module does not detect any faults. The NOT OK status will be displayed if the control module detects any faults
- Click the stop button to re-run the test.

Checking Oil Ducts

Checking Oil Ducts



- Remove the camshaft reset valve
- Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

  NOTE: If it is suspected that there are any contaminants in the camshaft reset valve it should be replaced.

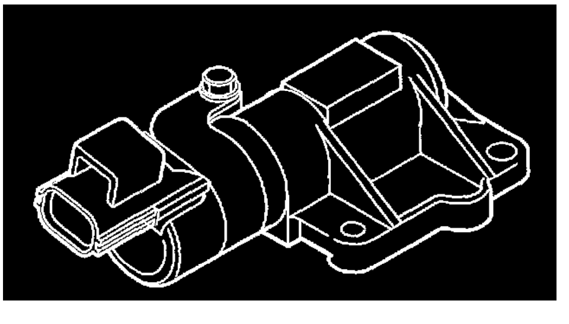
- Remedy as necessary
- Try a new camshaft reset valve, if no fault is found in the oil ducts.

Other information:
- To remove or replace the camshaft reset valve, See **Replacing the camshaft seals/variable valve timing unit**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-60/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Each time that the engine is switched off the camshaft pulley sets itself in the locked position. The control module checks that the camshaft pulley leaves the locked position when the engine is started again. Diagnostic trouble code (DTC) ECM-61 is stored if the control module detects that the camshaft pulley is in the locked position.

Condition

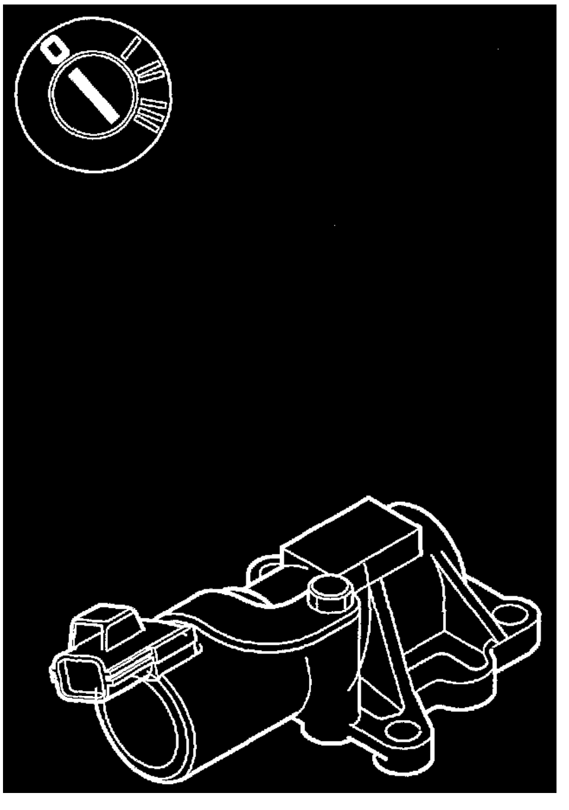
None.

Possible source
- Low oil pressure in the engine
- Blocked oil ducts for the camshaft reset valve
- Defective camshaft reset valve.

Condition
- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Check



- Ignition off.

Check the connectors on the camshaft reset valve, control module and camshaft position (CMP) sensor. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.

Check the engine oil quality, check for contaminants in particular.
Replace the engine oil if necessary.
Check the engine oil pressure for low oil pressure.
Remove the camshaft reset valve.
Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:
- To check the oil pressure, See: Component Tests and General Diagnostics/Checking Oil Pressure
- To access the control module, See **Replacing the engine control module (ECM)**
- To access or replace the camshaft reset valve, See **Replacing the variable valve timing (VVT) control valve**.

Checking the Oil Pressure

Checking The Oil Pressure

- Check the engine oil quality. Check for contaminants particularly
- Replace the engine oil if necessary
- Check that the engine oil pressure is not low. See: Component Tests and General Diagnostics/Checking Oil Pressure
- Remedy as necessary.

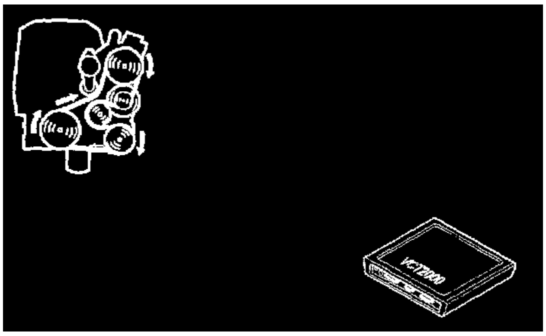
Was the engine oil pressure incorrect?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-61/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-61/Faulty Signal - Permanent Fault/Checking Oil Ducts

Activating the Continuous Variable Valve Timing (VVT) Test

Activating The Continuous Variable Valve Timing (VVT) Test



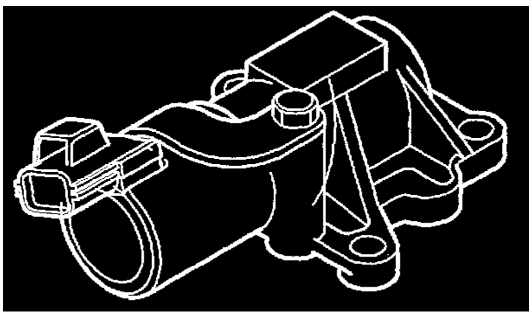
- Start the engine and let it idle.

  NOTE: The engine must be idling and the engine coolant temperature (ECT) must be between **50°C** and **92°C** throughout the entire test.

- Activate the continuous variable valve timing (VVT) test by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the continuous variable valve timing (VVT) test
- Wait until the continuous variable valve timing (VVT) test is complete. CVVT test complete YES is displayed with the test is complete
- Read off the results of the continuous variable valve timing (VVT) test. The continuous variable valve timing (VVT) test results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module does not detect any faults. The NOT OK status will be displayed if the control module detects any faults
- Click the stop button to re-run the test.

Checking Oil Ducts

Checking Oil Ducts



- Remove the camshaft reset valve
- Check the oil ducts for the camshaft reset valve and camshaft pulley in the cylinder head for blockages.

  NOTE: If it is suspected that there are any contaminants in the camshaft reset valve it should be replaced.

- Remedy as necessary
- Try a mew camshaft reset valve, if no fault is found in the oil ducts.

Other information:

- To remove or replace the camshaft reset valve, See **Replacing the camshafts seals/variable valve timing unit**

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-61/Faulty Signal - Permanent Fault/Activating the Continuous Variable Valve Timing (VVT) Test

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

At engine start-up the control module checks that the camshaft is in the correct position in relation to the crankshaft. Diagnostic trouble code (DTC) ECM-62 is stored if the control module detects the camshaft in an incorrect position on start up.

Condition

None.

Possible source

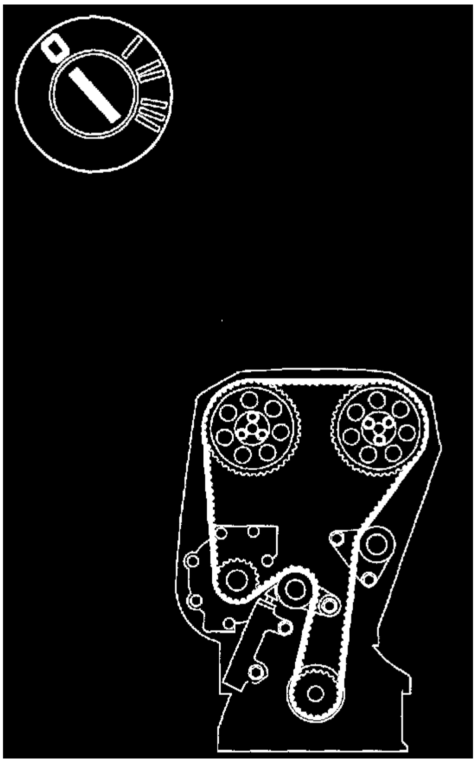
- Camshaft cogs incorrectly seated
- Incorrectly installed camshaft pulley
- Contact resistance in the terminals.

Condition

- Malfunction indicator lamp (MIL) lit
- The engine misfires.

Faulty Signal - Intermittent Fault

Checking The Connectors And Camshaft Adjustment



- Ignition off
- Check the camshaft position (CMP) sensor and the control module connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**
- Check the setting of the camshafts. See **Replacing the camshaft seals/variable valve timing unit**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

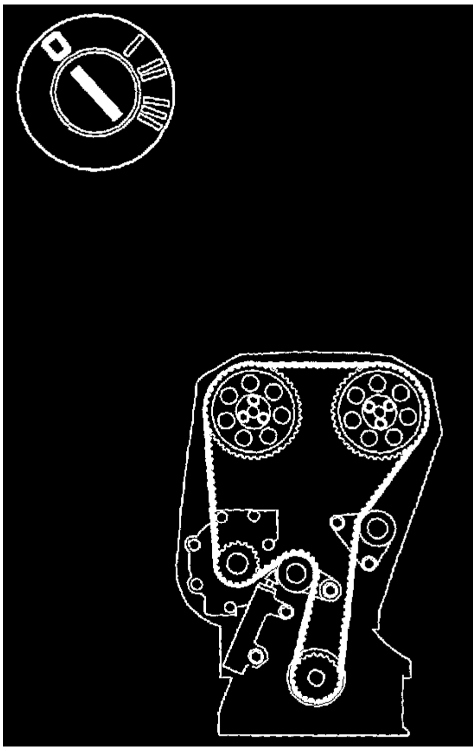
- Remedy as necessary.

Other information:

- To access the control module, See **Replacing the engine control module (ECM)**
- To access the camshaft position (CMP) sensor connector, See **Replacing camshaft position (CMP) sensor**.

Checking Camshaft Setting

Checking Camshaft Setting



- Ignition off
- Check the camshaft position (CMP) sensor and the Control module connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**
- Check the setting of the camshafts. See **Replacing the camshaft seals/variable valve timing unit**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

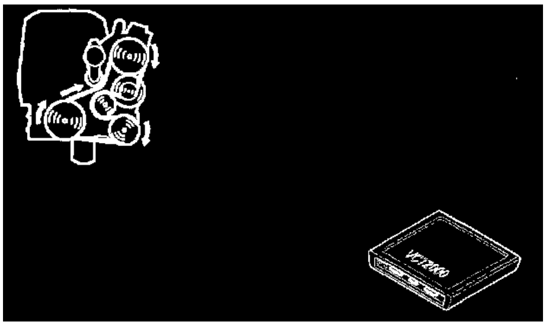
Other information:

- To access the control module, See **Replacing the engine control module (ECM)**
- To access the camshaft position (CMP) sensor connector, See **Replacing camshaft position (CMP) sensor**

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-62/Faulty Signal - Permanent Fault/Verification/Verification - I

Verification - I

Verification

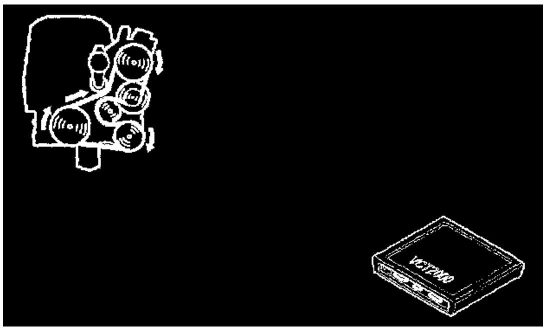


- Let the control module carry out a diagnostic of the CVVT system to verify the diagnostic trouble code (DTC). The control module will only carry out a diagnostic for the diagnostic trouble code (DTC) if the engine coolant temperature (ECT) was **+50°C** or higher the last time the ignition was switched on
- Start the engine and let it run at idle speed
- Read off the engine coolant temperature (ECT). Let the engine idle until the engine coolant temperature (ECT) is at least **+50°C**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control

Verification - II

Verification

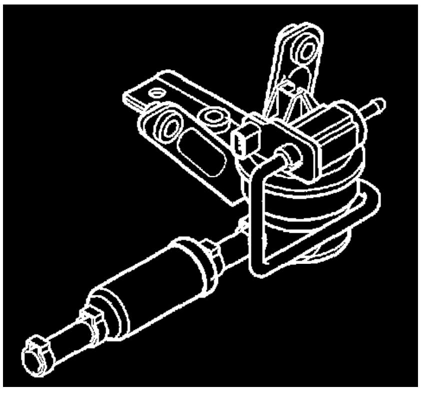


- Ignition off
- Start the engine. Let it idle for approximately **1 minute** in order to update the control module reference value for the camshaft position.

Read off diagnostic trouble codes (DTCs).
Check that the status of the diagnostic trouble code (DTC) has changed to intermittent. The fault has been remedied if the status of the diagnostic trouble code (DTC) has changed to intermittent.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The control module performs a function test of the leak diagnostic system. A diagnostic trouble code (DTC) is stored if a faulty position or faulty movement of the leak diagnostic pump membrane is detected. For further information about leak diagnostics, See: Component Tests and General Diagnostics/Leak Diagnostics

Condition

Leak diagnostics disabled.

Possible source

Signal too high:
- Contact resistance in the terminals
- The vacuum for the leak diagnostic pump is too low or non-existent
- Defective leak diagnostic pump.

Signal too low:
- Open-circuit in the power supply cable for the leak diagnostic pump
- Contact resistance in the terminals
- Defective leak diagnostic pump.

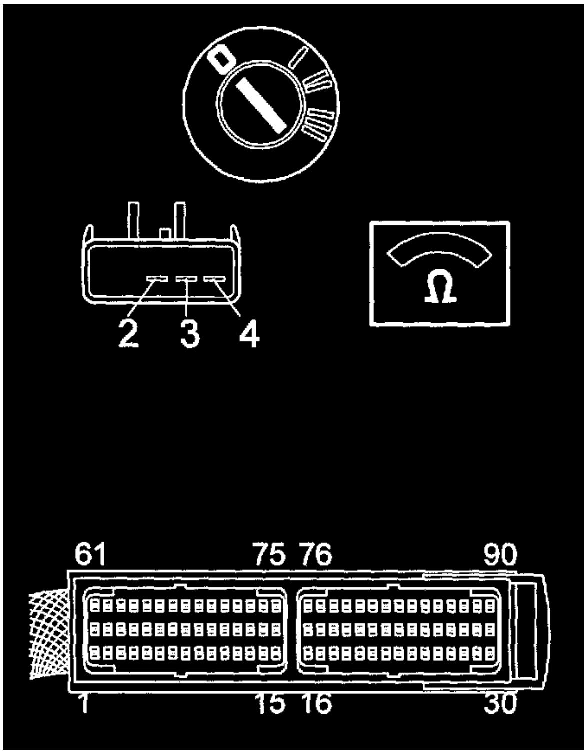
Faulty signal:
- Contact resistance in the terminals
- The pump ventilation for atmospheric pressure is blocked
- Defective leak diagnostic pump.

Condition

- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Checking Connectors And Components



- Ignition off.

Check the leak diagnostic pump, system relay and control module connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.
Check if the hose between the lower terminal on the leak diagnostic pump and the filter in the wheel arch are blocked.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

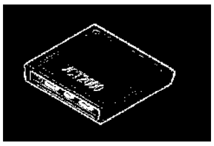
Remedy as necessary.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the filter for the leak diagnostic pump, See **Replacing the leak diagnostic filter**
- To replace the leak diagnostic pump, See **Replacing the leak diagnostic pump**

Other Diagnostic Trouble Codes (DTCs) - I

Other Diagnostic Trouble Codes (DTCs)



NOTE: Any other diagnostic trouble codes DTCs) in EMS2000 must be remedied and erased before fault-tracing can be carried out.

Are other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Other Diagnostic Trouble Codes (DTCs) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Checking the Connectors

Other Diagnostic Trouble Codes (DTCs) - II

Other Diagnostic Trouble Codes (DTCs)

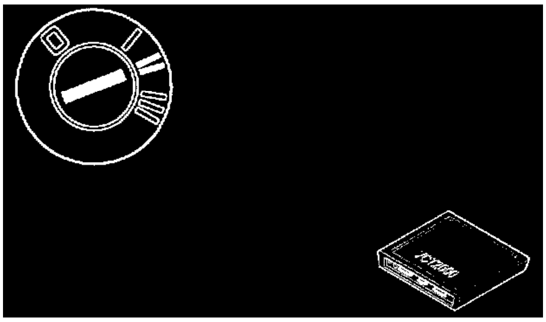
Have these diagnostic trouble codes(DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Codes (DTCs)

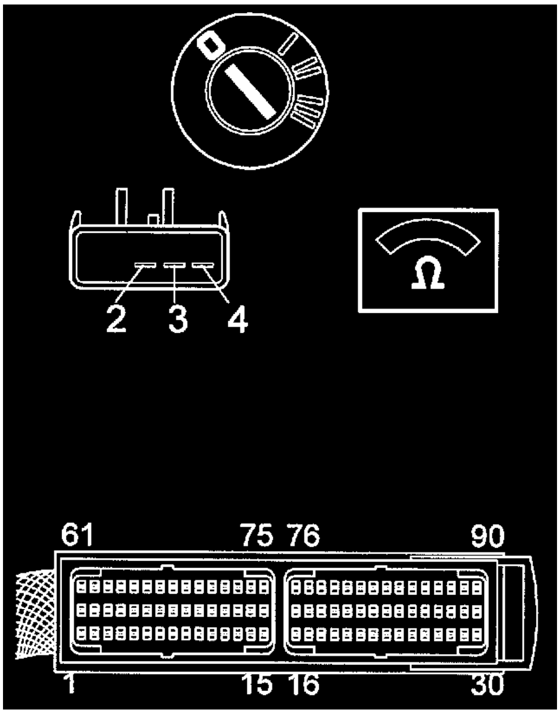


- Ignition on
- Erase the diagnostic trouble codes (DTCs).

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Checking the Connectors

Checking the Connectors

Checking The Connectors



- Ignition off
- Check the leak diagnostic pump, system relay and control module connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**
- Check if the hose between the lower terminal on the leak diagnostic pump and the filter in the wheel arch are blocked

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

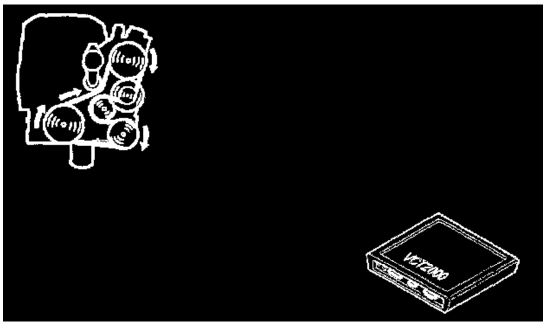
Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box,

ECM (EMS 2000)
- To replace the filter for the leak diagnostic pump, See **Replacing the leak diagnostic filter**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Activating the Leak Diagnostic

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

  NOTE: The engine must be idling throughout the test.

- Activate the leak diagnostic by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The NOT OK status, and a number from 1 - 8 will be displayed if the control module has detected any faults. To interpret these faults, See the status definitions below.

  NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

- Click the stop button to re-run the test.

Status definitions:
- OK = The system is free of faults
- NOT OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low.)
- NOT OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high.)
- NOT OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal.)
- NOT OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low.)
- NOT OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak.)
- NOT OK, status 6 = Leakage **1 mm**. (ECM-68, major leak.)
- NOT OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing.)
- NOT OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low.).

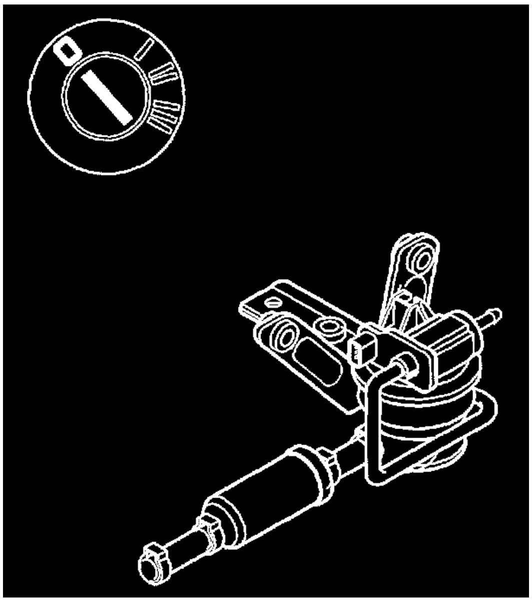
Select a suitable alternative to continue:
- Status OK
- Status NOT OK, status 1, 2 or 3 detected
- Status NOT OK, for another diagnostic trouble code (DTC) that has been detected.

1 - Test Complete

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Replacing the Component

Replacing the Component

Replacing The Component

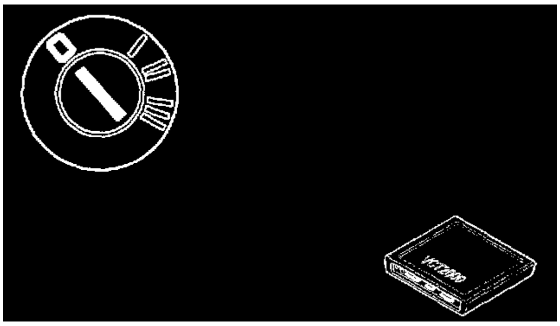


- Ignition off
- Replace the leak diagnostic pump according to **Replacing the leak diagnostic pump**

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

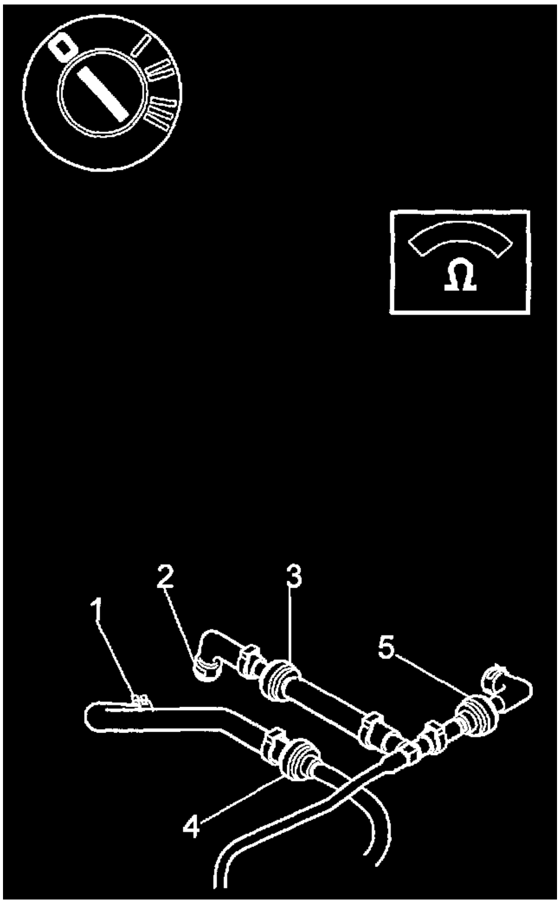
Are other diagnostic trouble codes (DTCs) stored?

Yes - Test complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Activating the Leak Diagnostic

Signal Too High - Intermittent Fault

Checking The Connectors And Components



- Ignition off.

Check the leak diagnostic pump, system relay and control module connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.
Check that the air flow through the hoses from the upper terminal on the leak diagnostic pump to the intake manifold terminal (1) is unimpeded. Check that there is no leakage between the terminals.

NOTE: Air can only flow from the leak diagnostic pump to the intake manifold.

Check the function of the non-return valve (2). See the arrow on the non-return valve.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the leak diagnostic pump, See **Replacing the leak diagnostic pump**.

Other Diagnostic Trouble Codes (DTCs) - I

Other Diagnostic Trouble Codes (DTCs)

NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault-tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Other Diagnostic Trouble Codes (DTCs) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Checking the Connectors and Components

Other Diagnostic Trouble Codes (DTCs) - II

Other Diagnostic Trouble Codes (DTCs)

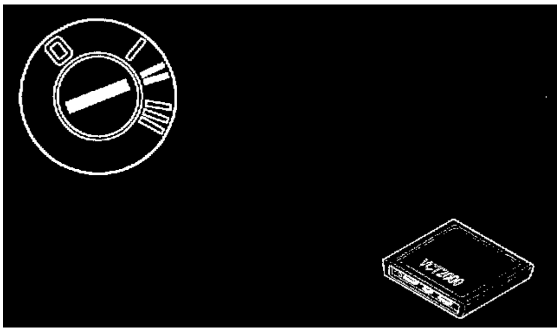
Have these diagnostic trouble codes(DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)

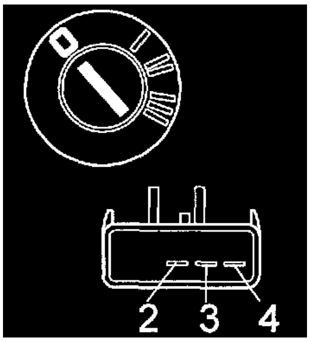


- Ignition on
- Erase diagnostic trouble codes (DTCs).

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Checking the Connectors and Components

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off.

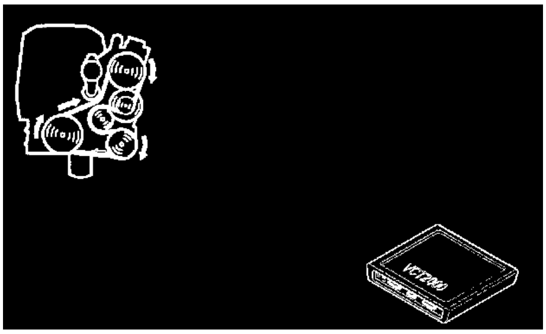
Check the leak diagnostic pump, system relay and Control module connectors. Check for contact resistance and oxidation, See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Activating the Leak Diagnostic

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

  NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The Not OK status, and a number from 1 - 8 will be displayed if the control module has detected any faults. To interpret these faults, See the status definitions below.

  NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

- Click the stop button to re-run the test.

Status definitions:

- OK = The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).

Select a suitable alternative to continue:

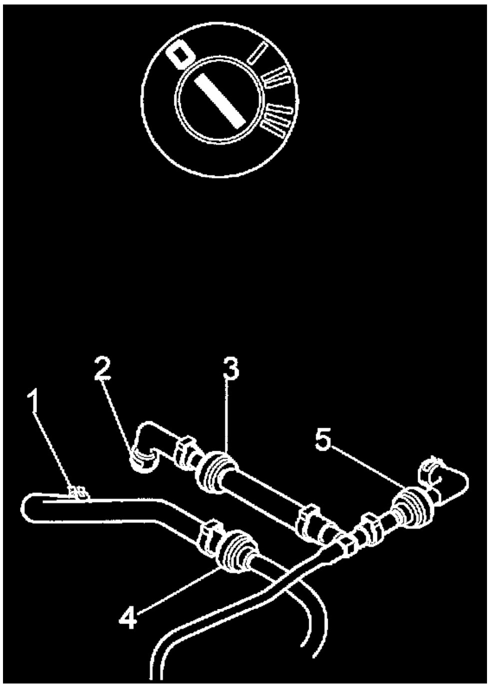
- Status OK
- Status Not OK, status 1, 2 or 3
- Status Not OK, another diagnostic trouble code (DTC) has been detected.

1 - Test Complete

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Checking Components

Checking Components

Checking Components



- Ignition off
- Check that the air flow through the hoses from the upper rear connection on the leak diagnostic pump to the intake manifold connection (1) is unimpeded Check that there is no leakage between the connections

  NOTE: Air can only flow from the leak diagnostic pump to the intake manifold.

- Check the function of the non-return valve (4). See the arrow on the non-return valve.
- Remedy as necessary.

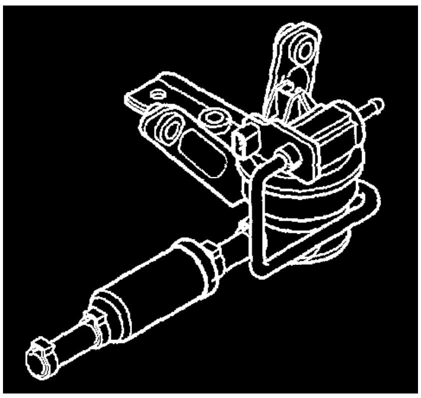
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Replacing the Component

Replacing the Component

Replacing The Component

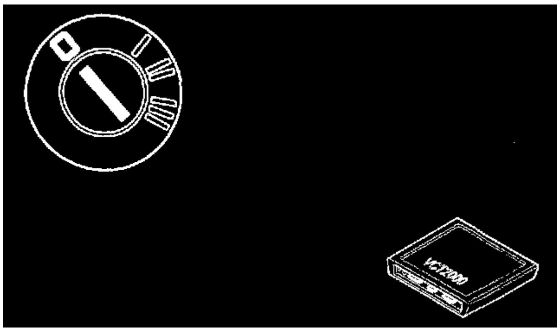


Replace the leak diagnostic pump according to **Replacing the leak diagnostic pump**

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

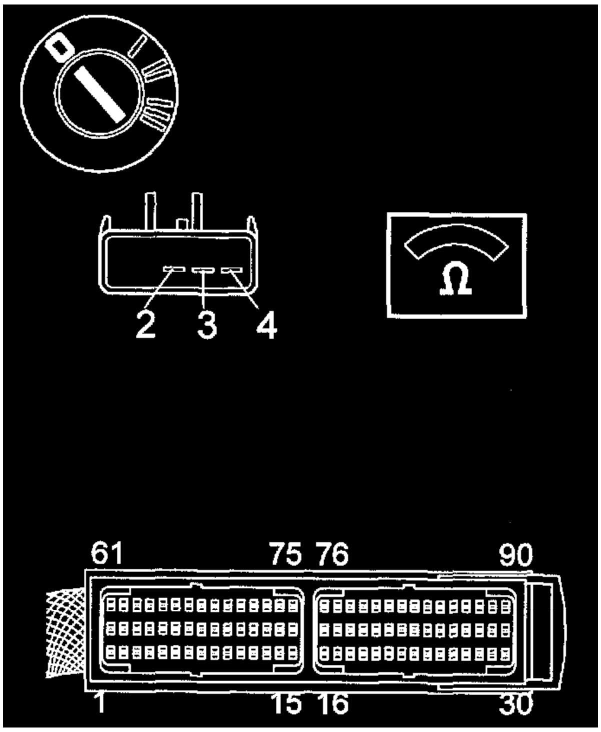
Are other diagnostic trouble codes (DTCs) stored?

Yes - Test complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too High - Permanent Fault/Activating the Leak Diagnostic

Signal Too Low - Intermittent Fault

Checking The Connectors And Components



- Ignition off.

Check the leak diagnostic pump, system relay and control module connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.
Check the cable between leak diagnostic pump terminal #2 and control module terminal #35. Check for an open-circuit according to **Checking wiring and terminals. Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

- To replace the leak diagnostic pump, See **Replacing the leak diagnostic pump**.

Other Diagnostic Trouble Codes (DTCs) - I

Other Diagnostic Trouble Codes (DTCs)

NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Other Diagnostic Trouble Codes (DTCs) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Checking the Connectors

Other Diagnostic Trouble Codes (DTCs) - II

Other Diagnostic Trouble Codes (DTCs)

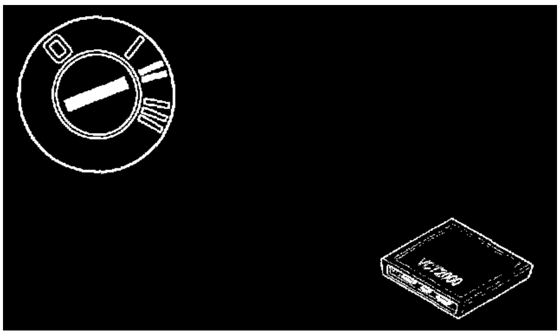
Have these diagnostic trouble codes (DTCs) remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)

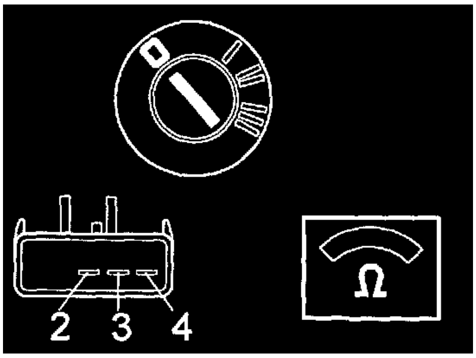


- Ignition on
- Erase diagnostic trouble codes (DTCs).

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Checking the Connectors

Checking the Connectors

Checking The Connectors



- Ignition off.

Check the connectors for the leak diagnostic pump, the system relay and control module. Check for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.
Check the cable between leak diagnostic pump terminal #2 and control module terminal #35. Check for an open-circuit according to **Checking wiring and terminals. Permanent faults**. Check for a short-circuit to ground according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

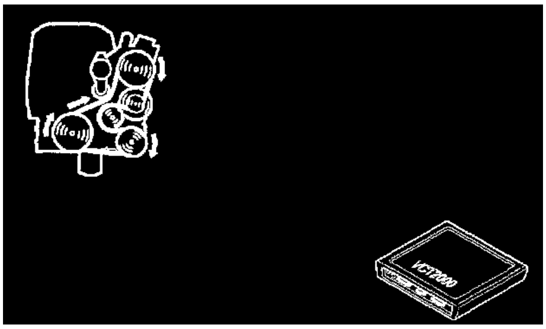
Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Activating the Leak Diagnostic

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

  NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The Not OK status, and a number from 1 - 8 will be displayed if the control module has detected any faults. To interpret these faults, See the status definitions below.

  NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

- Click the stop button to re-run the test.

Status definitions:
- OK = The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)

- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)

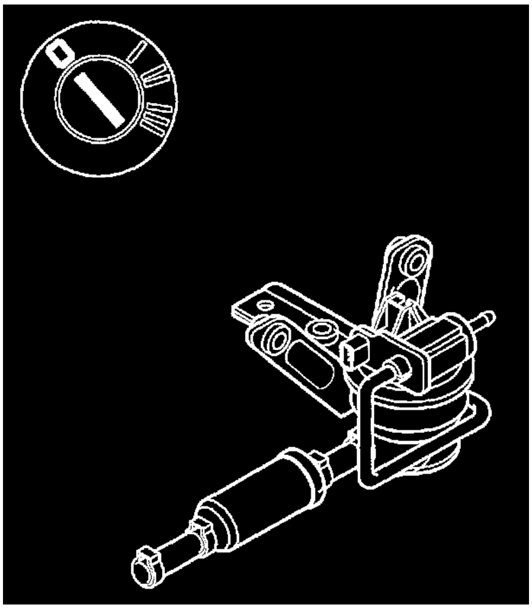
Select a suitable alternative to continue:
- Status OK
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).
- Status Not OK, status 1, 2 or 3 detected
- Status Not OK, another diagnostic trouble code (DTC) has been detected.

1 - Test Complete

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Replacing the Component

Replacing the Component

Replacing The Component

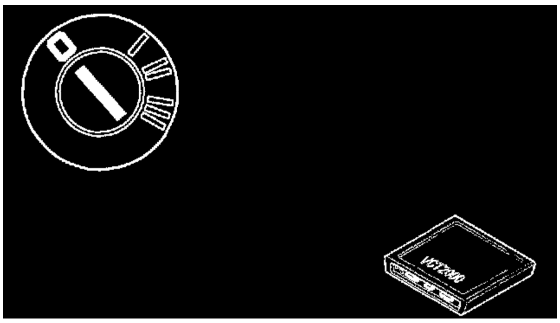


- Ignition off
- Replace the leak diagnostic pump according to **Replacing the leak diagnostic pump**

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes DTCs) stored in EMS 2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on

- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

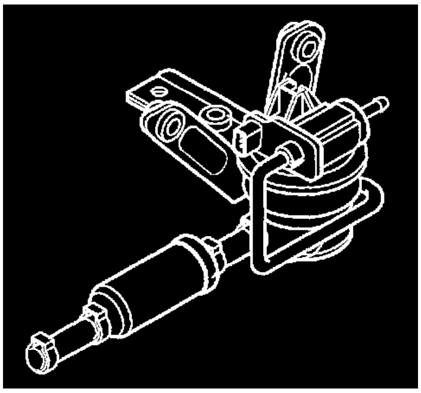
Are other diagnostic trouble codes DTCs) stored?

Yes - Test complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Signal Too Low - Permanent Fault/Activating the Leak Diagnostic

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The control module performs a function test of the leak diagnostic system. Diagnostic trouble code (DTC) ECM-66 is stored if the movement of the membrane in the leak diagnostic pump from active position to resting position is too slow. For further information about leak diagnostics, See: Component Tests and General Diagnostics/Leak Diagnostics

Condition

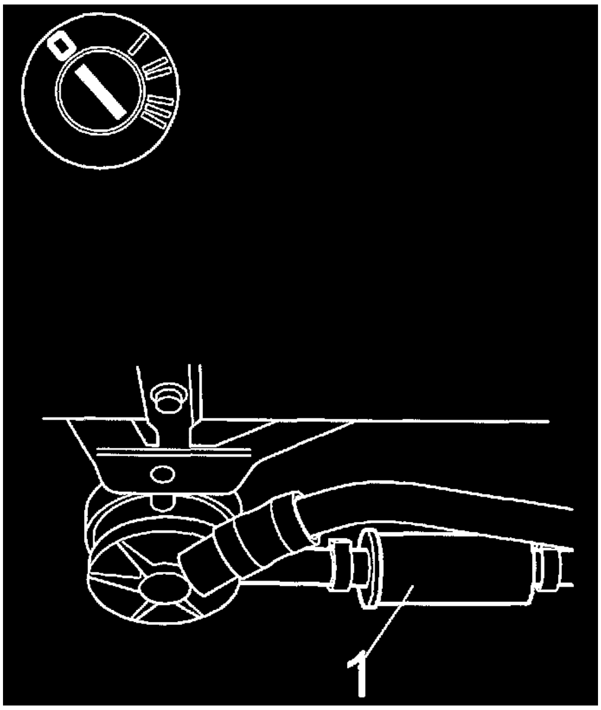
Leak diagnostics disabled

Possible source
- Blocked filter between the leak diagnostic pump and the EVAP canister
- Blocked hose between the leak diagnostic pump and the EVAP canister
- Blocked hose between the EVAP canister and the fuel tank
- Defective leak diagnostic pump.

Condition
- Malfunction indicator lamp (MIL) lit.

Signal Too Low - Intermittent Fault

Checking The Filter



- Ignition off
- Check the filter (1) between the leak diagnostic pump and the EVAP canister for blockage
- Check if the hoses between the leak diagnostic pump and the EVAP canister and between the EVAP canister and the fuel tank are blocked.

Other information:
- For expose the EVAP canister, See **Replacing the canister purge (CP) valve**
- To replace the filter, See **Replacing the leak diagnostic filter**
- To replace the leak diagnostic pump, See **Replacing the leak diagnostic pump**

Other Diagnostic Trouble Codes (DTCS) - I

Other Diagnostic Trouble Codes (DTCs)

NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault-tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Other Diagnostic Trouble Codes (DTCS) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Checking the Connectors and Components

Other Diagnostic Trouble Codes (DTCS) - II

Other Diagnostic Trouble Codes (DTCs)

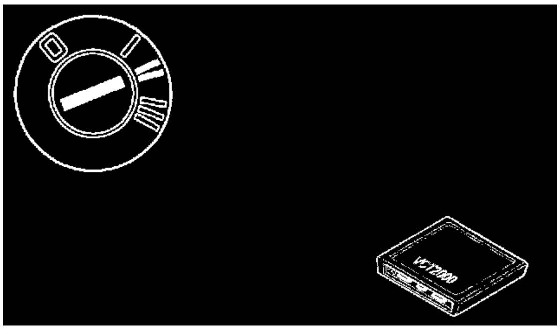
Have these diagnostic trouble codes(DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-65/Faulty Signal - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)

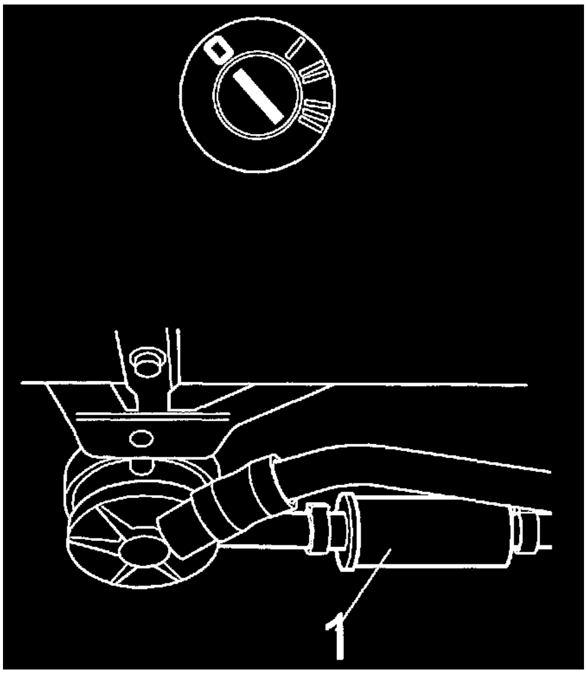


- Ignition on
- Erase diagnostic trouble codes (DTCs).

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Checking the Connectors and Components

Checking the Connectors and Components

Checking The Connectors And Components



- Ignition off
- Check the filter (1) between the leak diagnostic pump and the EVAP canister for blockage
- Check if the hoses between the leak diagnostic pump and the EVAP canister and between the EVAP canister and the fuel tank are blocked
- Remedy as necessary.

Other information:
- To expose the EVAP canister, See **Replacing the charcoal filter**

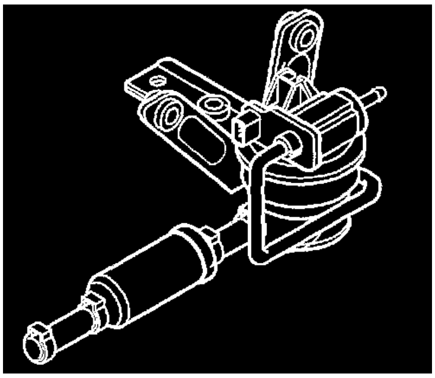
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Replacing the Component

Replacing the Component

Replacing The Component

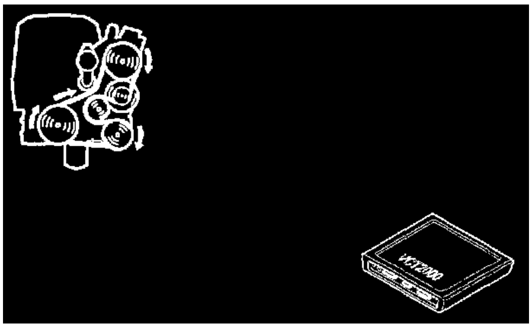


- Replace the leak diagnostic pump according to **Replacing the leak diagnostic pump**

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Verification

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

  NOTE: The engine must be idling throughout the test.

- Activate the leak diagnostic by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The NOT OK status, and a number from 1 - 8 will be displayed if the control module has detected any faults. To interpret these faults, See the status definitions below.

  NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

- Click the stop button to re-run the test.

Status definitions:

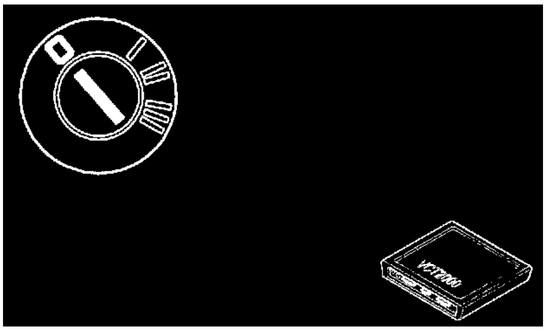
- OK The system is free of faults
- NOT OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low.)
- NOT OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high.)
- NOT OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal.)
- NOT OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low.)
- NOT OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak.)
- NOT OK, status 6 = Leakage **1 mm**. (ECM-68, major leak.)
- NOT OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing.)
- NOT OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low.).

Select a suitable alternative to continue:

- The status is OK
- Status NOT OK (for the current diagnostic trouble code (DTC)) has been detected
- Status NOT OK, (for another diagnostic trouble code (DTC)) has been detected.

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes (DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc. Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

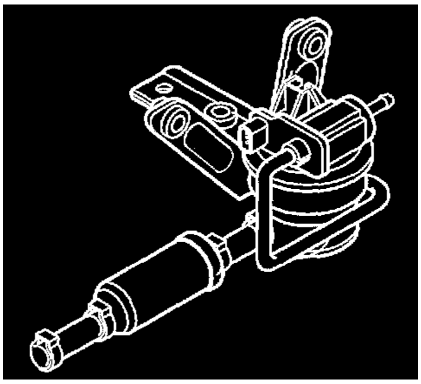
Are other diagnostic trouble codes (DTCs) stored?

Yes - Test Complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-66/Signal Too Low - Permanent Fault/Activating the Leak Diagnostic

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The control module has performed a leak diagnostic of the fuel tank system.
If the diaphragm in the leak diagnostic pump moves from the active to the resting position too rapidly (the pressure drops too quickly), or if the leak diagnostic pump is unable to pressurize the fuel tank system, the control module interprets it as a leakage. Diagnostic trouble code (DTC) ECM-68 is stored. For further information about leak diagnostics, See: Component Tests and General Diagnostics/Leak Diagnostics

Condition

None.

Possible source

Fuel tank filler cap missing:
- The fuel tank filler cap is missing or not tightened, there is a large leak in the fuel tank, fuel filler pipe, fuel tank filler cap, EVAP canister, canister purge (CP) valve, or in the hoses between these components.

Major leak:
- There is leak larger than **1 mm** in the fuel tank, fuel filler pipe, fuel tank filler cap, EVAP canister, canister purge (CP) valve, or in the hoses between these components.

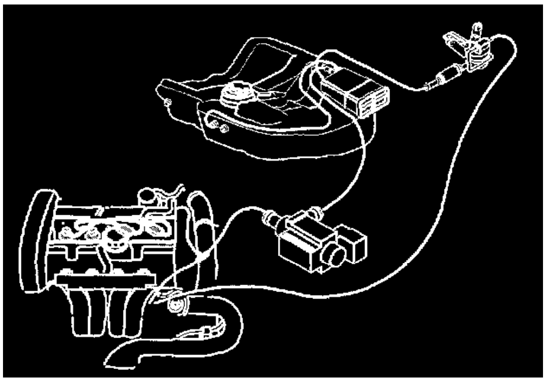
Minor leak:

- There is leak larger than **0.5 mm** but smaller than **1 mm** in the fuel tank, fuel filler pipe, fuel tank filler cap, EVAP canister, canister purge (CP) valve, or in the hoses between these components.

Condition
- Malfunction indicator lamp (MIL) lit.

Intermittent Fault

Intermittent Fault



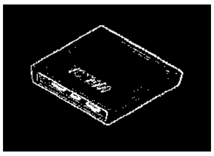
The Control module has previously detected a leak in the tank system but the fault is no longer active. The fault may be due to leakage in the fuel tank, fuel filler pipe, fuel tank filler cap, EVAP canister, Canister purge (CP) valve, leak diagnostic pump or in the hoses between these components.

Hint: This DTC can be stored if the car is driven without the fuel tank filler cap or if the fuel tank filler cap is incorrectly tightened

Other information:
- To replace the canister purge (CP) valve, See **Replacing the canister purge (CP) valve**
- To replace the leak diagnostic pump, See **Replacing the leak diagnostic pump**

Other Diagnostic Trouble Codes (DTCS) - I

Other Diagnostic Trouble Codes (DTCs)



NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault-tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Other Diagnostic Trouble Codes (DTCS) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Checking the Component

Other Diagnostic Trouble Codes (DTCS) - II

Other Diagnostic Trouble Codes (DTCs)

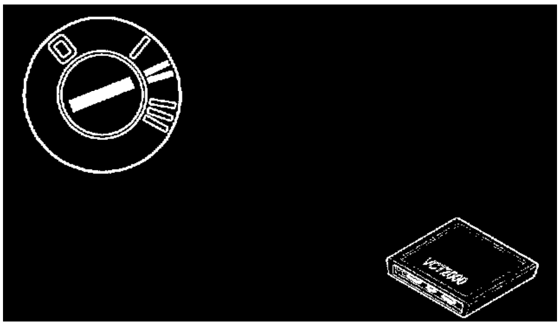
Have these diagnostic trouble codes (DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)

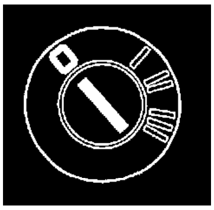


- Ignition on
- Erase diagnostic trouble codes (DTCs).

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Checking Components

Checking Components

Checking Components

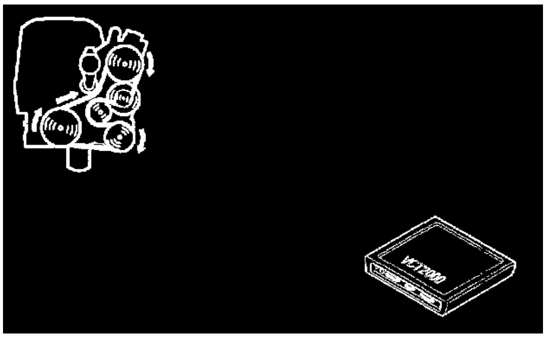


- Ignition off.
- Check that the fuel tank filler cap is properly tightened and that its seal is intact
- Check the hoses and terminals on the leak diagnostic pump and fuel filler pipe for leakage and damage
- Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Activating the Leak Diagnostic

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine. Allow the engine to idle.

  NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic process may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module does not detect any faults. The Not OK status, numbered 1 - 8 will be displayed if the control module detects any faults

NOTE: The status types can be translated into diagnostic trouble codes DTCs). However they are not stored as DTCs during this test.

Status definitions:

- OK The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).

Select a suitable alternative to continue:

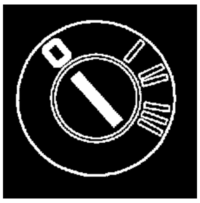
- Status OK
- Status Not OK, status 5, 6 or 7 detected
- Status Not OK, another diagnostic trouble code (DTC) has been detected.

1 - Test Complete

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Checking the Component

Checking the Component

Checking The Component



- Ignition off
- Expose the canister purge (CP) valve.
- Remove the hose between the canister purge (CP) valve and the intake manifold
- Connect a vacuum pump to the canister purge (CP) valve instead
- Pump up a vacuum. Check that the vacuum does not drop
- If the vacuum drops, there is a leak through the canister purge (CP) valve
- Remedy as necessary.

Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Checking the Fuel Tank System

Checking the Fuel Tank System

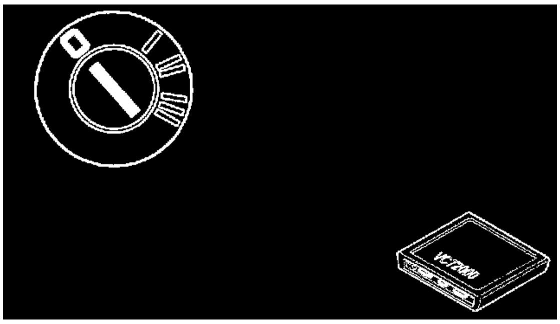
Checking The Fuel Tank System

- The fault may be due to leakage in the fuel tank, fuel filler pipe, fuel tank filler cap, EVAP canister or in the hoses between these components
- Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Activating the Leak Diagnostic

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

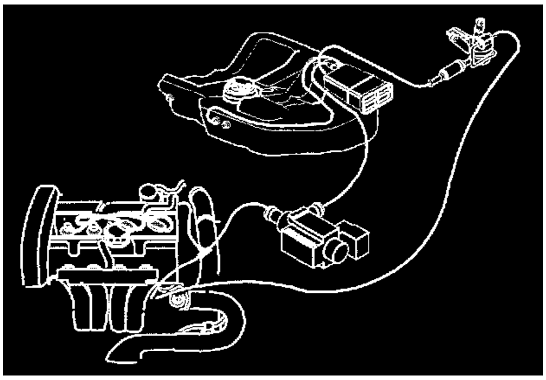
Are other diagnostic trouble codes (DTCs) stored?

Yes - Test Complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Permanent Fault/Activating the Leak Diagnostic

Fault-Tracing Information

Fault-tracing Information



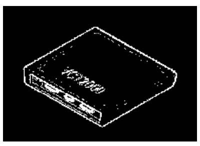
The control module has detected leakage in the tank system. The size of the leak is unknown. The size and status of the leak can be established by activating the leak diagnostic (Fuel tank system quick test).

The fault is intermittent if this diagnostic trouble code (DTC) is detected without any fault being found when the leak diagnostic is run.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Other Diagnostic Trouble Codes (DTCS) - I

Other Diagnostic Trouble Codes (DTCS) - I

Other Diagnostic Trouble Codes (DTCs)



NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault- tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Other Diagnostic Trouble Codes (DTCS) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Activating the Leak Diagnostic

Other Diagnostic Trouble Codes (DTCS) - II

Other Diagnostic Trouble Codes (DTCs)

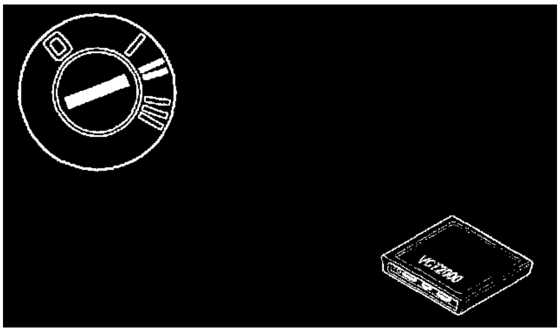
Have these diagnostic trouble codes (DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)

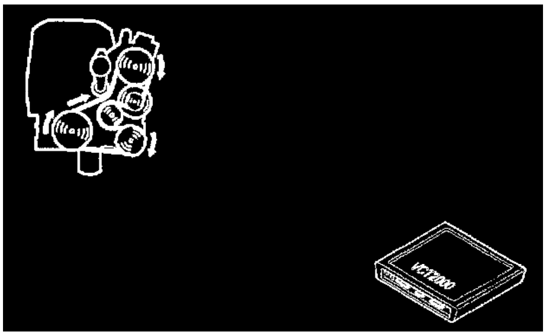


- Ignition on
- Erase diagnostic trouble codes (DTCs).

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Activating the Leak Diagnostic

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine. Allow the engine to idle.

  NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic process may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The Not OK status, numbered 1 - 8 will be displayed if the control module detects any faults

NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

Status definitions:

- OK = The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).

Select a suitable alternative to continue:

- Status OK
- Status Not OK, status 5, 6 or 7 detected
- Status Not OK, another diagnostic trouble code (DTC) has been detected.

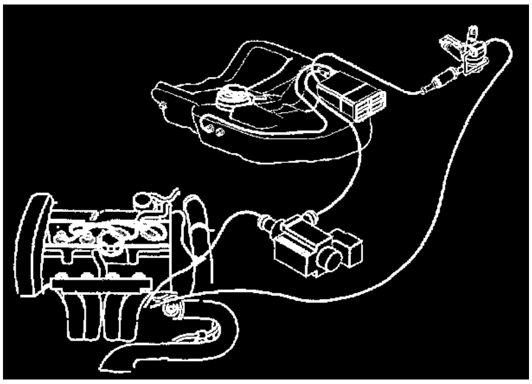
1 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Intermittent Fault

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Checking Components

3 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Fault Tracing Information

Intermittent Fault

Intermittent Fault



The control module has previously detected a leak in the tank system but the fault is no longer active. The fault may be due to leakage in the fuel tank, fuel filler pipe, fuel tank filler cap, EVAP canister, Canister purge (CP) valve, leak diagnostic pump or in the hoses between these components.

Hint: This DTC can be stored if the car is driven without the fuel tank filler cap or if the fuel tank filler cap is incorrectly tightened.

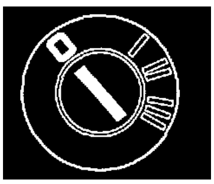
Other information:

- To replace the canister purge (CP) valve, See **Replacing the canister purge (CP) valve**
- To replace the leak diagnostic pump, See **Replacing the leak diagnostic pump**

Test Complete

Checking Components

Checking Components



- Ignition off.
- Check that the fuel tank filler cap is properly tightened and that its seal is intact

- Check the hoses and terminals on the leak diagnostic pump and fuel filler pipe for leakage and damage
- Remedy as necessary

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-68/Qualifier Not Recognized - Permanent Fault/Activating the Leak Diagnostic

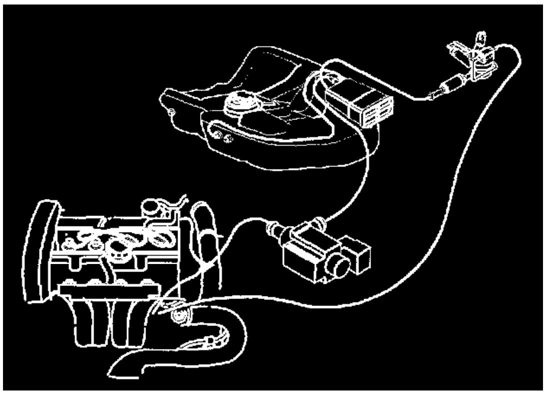
Fault Tracing Information

Fault Tracing Information

- The control module has detected a fault other than the one that affects the relevant diagnostic trouble code (DTC). This may be because a fault occurred during the fault tracing. Check that hoses, connectors and components etc have been correctly reinstalled. Check that they are not damaged

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The Control module carries out a flow check of the evaporative emission (EVAP) system. The canister purge (CP) valve is pulsed when the fuel tank system is pressurized. At the same time the control module checks that the pressure in the fuel tank system drops. If the diaphragm in the leak diagnostic pump does not move from the active to the resting position rapidly enough (the pressure does not drop), the control module interprets it as a blockage in the evaporative emission (EVAP) system. For further information about leak diagnostics, See: Component Tests and General Diagnostics/Leak Diagnostics

Condition

None.

Possible source
- Blocked canister purge (CP) valve
- Blocked hose between the canister purge (CP) valve and the vacuum tank
- Blocked hose between the EVAP canister and the canister purge (CP) valve.

Condition
- Malfunction indicator lamp (MIL) lit.

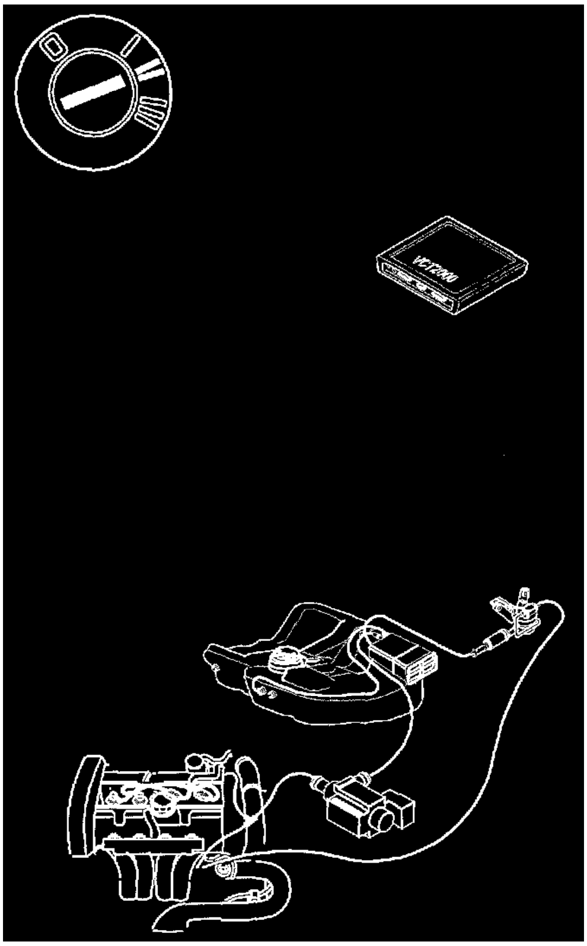
Faulty Signal - Intermittent Fault

Information

There is no fault tracing for this diagnostic trouble code For further information on this diagnostic trouble code, first select Information, then Diagnostic Trouble Code Information.

Checking Air Flow

Checking Air Flow



- Expose the canister purge (CP) valve
- Remove the hose from the canister purge (CP) valve to the EVAP canister
- Ignition on.

Activate the canister purge (CP) valve by clicking on the VCT-2000 symbol.
Check that the connection with the intake manifold opens and closes when the canister purge (CP) valve opens and closes: Blow into the exposed terminal in the canister purge (CP) valve.

NOTE: A certain resistance will be felt because of the non-return valve.

If necessary, remedy the hoses / hoses connections for the intake manifold.
Replace the non-return valves or canister purge (CP) valve if necessary.

- To access the canister purge (CP) valve, See **Replacing the canister purge (CP) valve**
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

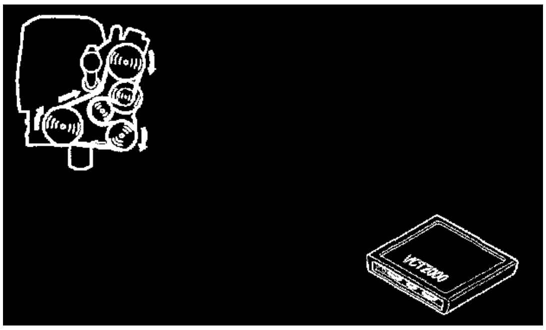
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6A/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6A/Faulty Signal - Permanent Fault/Checking Hoses

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

  NOTE: The engine must be idling throughout the test.

- Activate the leak diagnostic by clicking on the VCT-2000 symbol
- Wait until the engine coolant temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

  Hint: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The NOT OK status, and a number from 1 - 8 will be displayed if the control module has detected any faults. To interpret these faults, See the status definitions below.

  NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

- Click the stop button to re-run the test.

Status definitions:

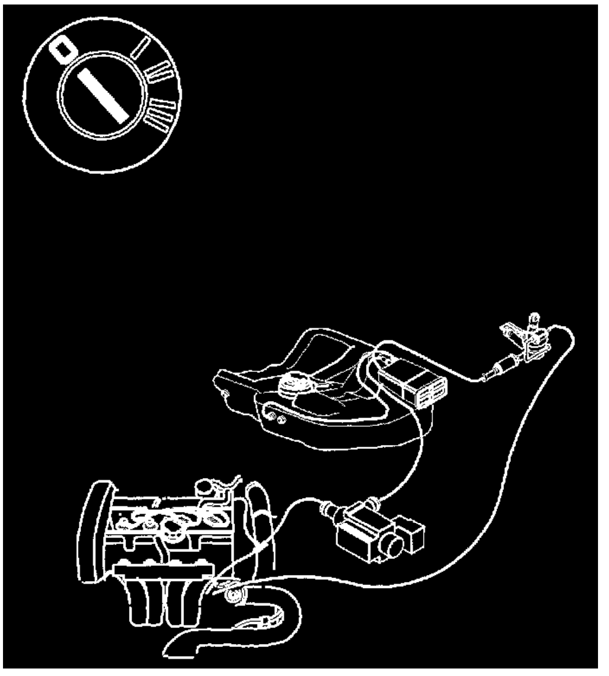
- OK = The system is free of faults
- NOT OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low.)
- NOT OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high.)
- NOT OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal.)
- NOT OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low.)
- NOT OK, status 5 = Leakage **0.5 mm.** (ECM-68, minor leak.)
- NOT OK, status 6 = Leakage **1 mm**. (ECM-68, major leak.)
- NOT OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing.)
- NOT OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low.).

Select a suitable alternative to continue:

- The status is OK
- Status NOT OK (for the current diagnostic trouble code (DTC)) has been detected
- Status NOT OK, (for another diagnostic trouble code (DTC)) has been detected.

Checking Hoses

Checking Hoses



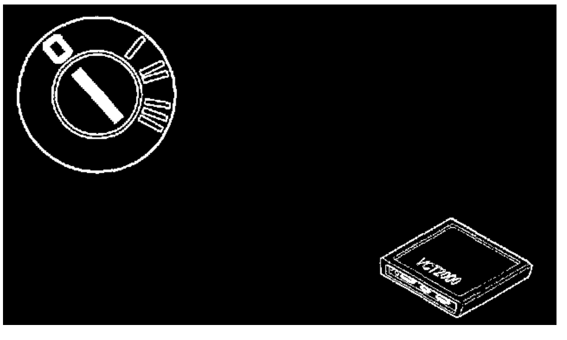
- Ignition off
- The fault may be due to blocked hoses or components between the canister purge (CP) valve and the fuel tank
- Expose the EVAP canister and the roll-over valve to check the evaporative emission (EVAP) system.

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6A/Faulty Signal - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

Are other diagnostic trouble codes(DTCs) stored?

Yes - Test Complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6A/Faulty Signal - Permanent Fault/Activating the Leak Diagnostic

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-6B is stored if the air conditioning (A/C) pressure sensor signal is too high or too low.

Condition
- Air conditioning (A/C) shut off. Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable
- Open-circuit in the ground lead
- Contact resistance and oxidation
- Defective air conditioning (A/C) pressure sensor.

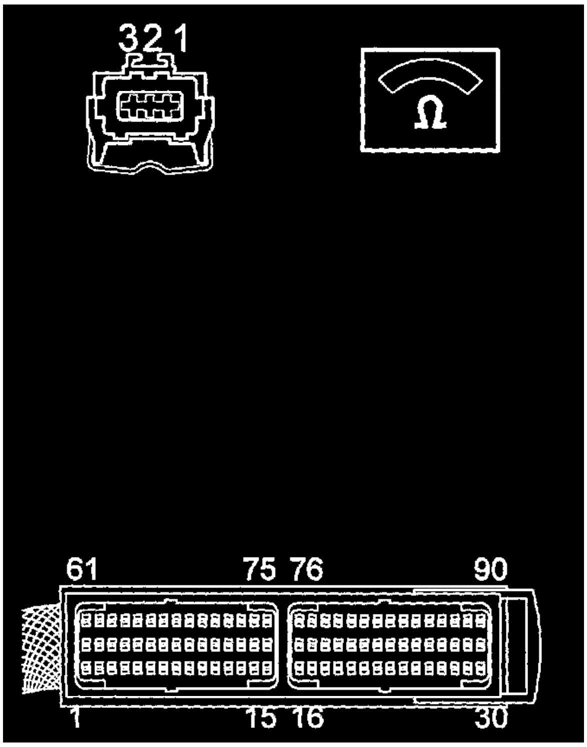
Signal too low:
- Short-circuit to ground in signal cable
- Open-circuit in the signal cable
- Low pressure m the air conditioning (A/C) system
- Contact resistance and oxidation
- Defective air conditioning (A/C) pressure sensor.

Hint: A diagnostic trouble code (DTC) may be stored at low temperatures despite the absence of any faults.

Condition
- The air conditioning (A/C) system does not operate.

Signal Too High - Intermittent Fault

Checking Wiring



Check the engine control module (ECM) and air conditioning (A/C) pressure sensor connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**

Check in particular for damage or loose terminal pins. Check the signal cable between engine control module (ECM) terminal #14 and air conditioning (A/C) pressure sensor terminal 2. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals. Intermittent faults**. Remedy if necessary.
Check the ground lead between engine control module (ECM) terminal #77 and air conditioning (A/C) pressure sensor terminal 1. Check for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

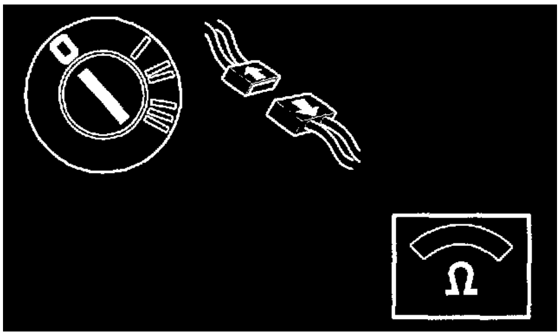
Remedy if necessary.
Try a new air conditioning (A/C) pressure sensor if no faults are found in the above fault-tracing.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

- To replace the air conditioning (A/C) pressure sensor, See **Replacing the air conditioning(A/C) system pressure sensor**

Checking the Terminal

Checking The Terminal



- Ignition off
- Disconnect the connector for the air conditioning (A/C) pressure sensor.

Check the connector for the air conditioning (A/C) pressure sensor. Check for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary

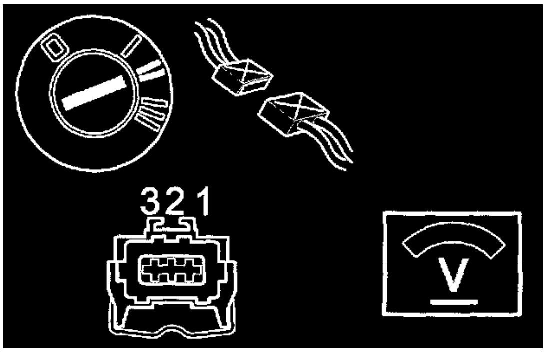
Were any faults found?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Checking the Signal Cable - I

Checking the Signal Cable - I

Checking The Signal Cable



- Air conditioning (A/C) pressure sensor connector disconnected
- Ignition on.

Connect a voltmeter between connector terminal 2 for the air conditioning (A/C) pressure sensor (control module side) and ground.

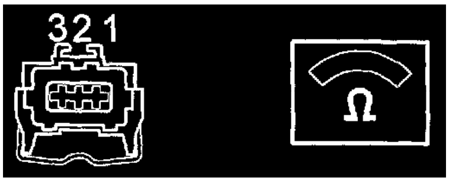
The voltmeter should read 0 V.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Checking the Ground Lead - I

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Checking the Signal Cable - II

Checking the Ground Lead - I

Checking The Ground Lead



Connect an ohmmeter between connector terminal 1 for the air conditioning (A/C) pressure sensor and the ground terminal.

The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Defective Air Conditioning (A/C) Pressure Sensor

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Checking the Ground Lead - II

Defective Air Conditioning (A/C) Pressure Sensor

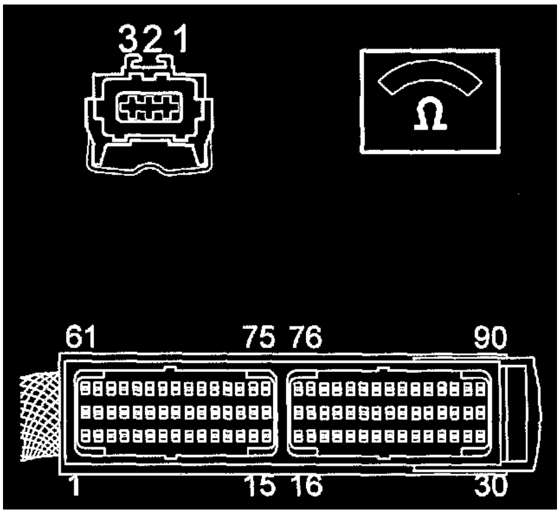
Defective Air Conditioning (A/C) Pressure Sensor

Try a new air conditioning (A/C) pressure sensor according to **Replacing the air conditioning (A/C) system pressure sensor**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Verification

Checking the Ground Lead - II

Checking The Ground Lead



Check the cable between connector terminal 1 for the air conditioning (A/C) pressure sensor (control module side) and engine control module (ECM) terminal #77. Check for an open-circuit according to **Checking wiring and terminals. Permanent faults**.

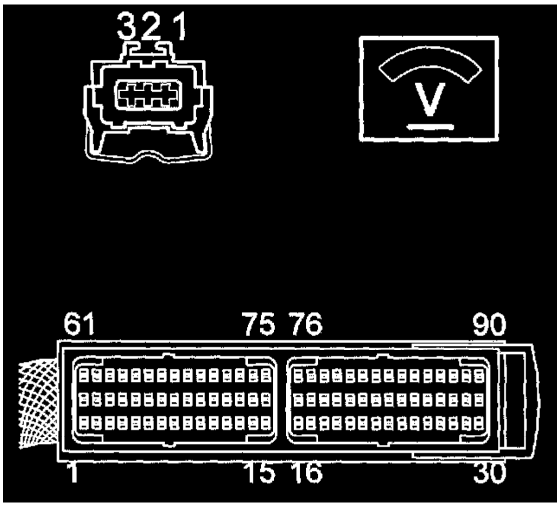
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



Check the cable between connector terminal 2 for the air conditioning (A/C) pressure sensor (control module side) and engine control module (ECM) terminal #14. Check for a short-circuit to supply voltage according to **Checking wiring and terminals. Permanent faults**

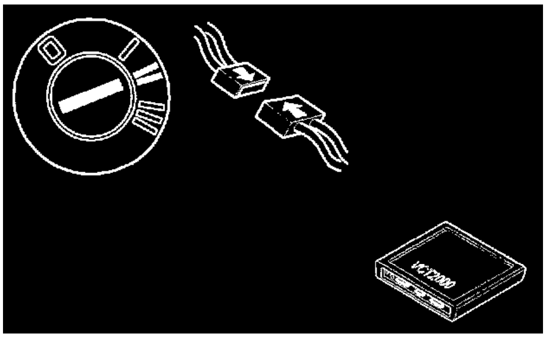
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too High - Permanent Fault/Verification

Verification

Verification

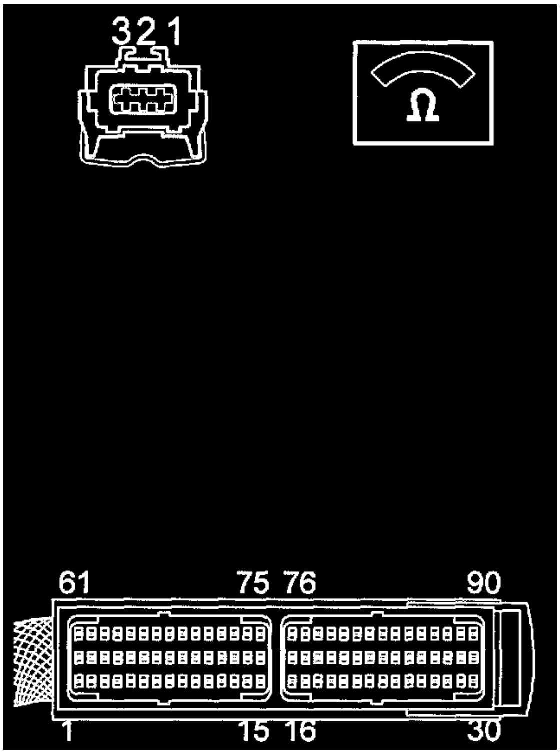


- Reconnect the connectors, reinstall components etc.
- Ignition on.

Read off the parameter for the pressure in the air conditioning (A/C) system.

Signal Too Low - Intermittent Fault

Checking The Wiring



Check the engine control module (ECM) and air conditioning (A/C) pressure sensor connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.
Check in particular for damage or loose terminal pins. Check the signal cable between engine control module (ECM) terminal #14 and air conditioning (A/C) pressure sensor terminal 2. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**.
Check the power supply cable between engine control module (ECM) terminal #74 and air conditioning (A/C) pressure sensor terminal 3. Check for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

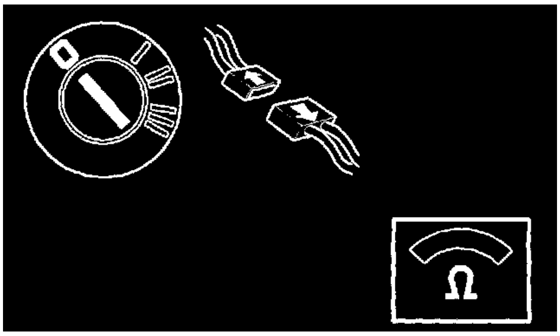
Remedy as necessary.

Hint: The diagnostic trouble code (DTC) may be caused by low temperatures despite there being no faults.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the air conditioning (A/C) pressure sensor, See **Replacing the air conditioning (A/C) system pressure sensor**.

Checking the Terminal

Checking The Terminal



- Ignition off
- Disconnect the connector for the air conditioning (A/C) pressure sensor.

Check the connector for the air conditioning (A/C) pressure sensor for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

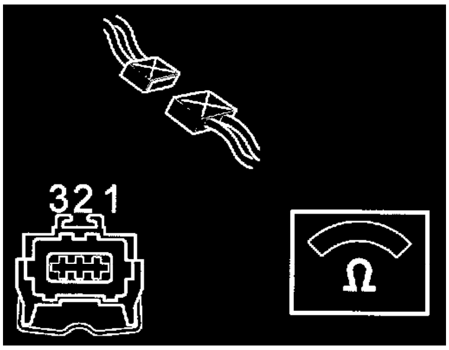
Were any faults found?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Checking the Signal Cable - I

Checking the Signal Cable - I

Checking The Signal Cable



- Air conditioning (A/C) pressure sensor connector disconnected.

Connect an ohmmeter between connector terminal 2 for the air conditioning (A/C) pressure sensor (control module side) and the ground terminal.

The ohmmeter should read 300 - 400 k[ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Checking the Ground Lead

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Checking the Signal Cable - II

Checking the Ground Lead

Checking The Ground Lead

Connect an ohmmeter between connector terminal 1 for the air conditioning (A/C) pressure sensor and the ground terminal.

The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Defective Air Conditioning (A/C) Pressure Sensor

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Checking the Power Cable

Defective Air Conditioning (A/C) Pressure Sensor

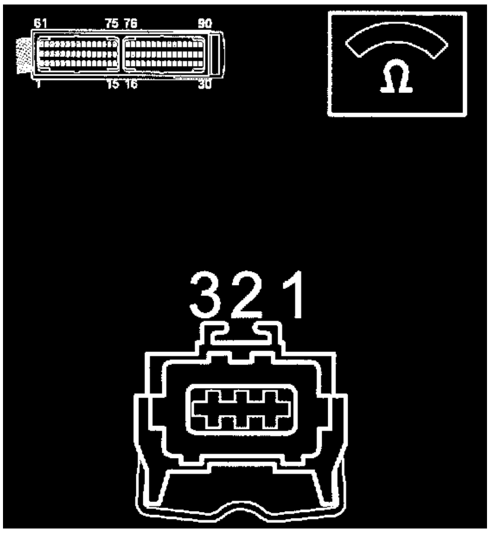
Defective Air Conditioning (A/C) Pressure Sensor

Try a new air conditioning (A/C) pressure sensor according to **Replacing the air conditioning (A/C) system pressure sensor**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Verification

Checking the Power Cable

Checking The Power Cable



Check the cable between connector terminal 3 for the air conditioning (A/C) pressure sensor (control module side) and engine control module (ECM) terminal 74 for an open-circuit according to **Checking wiring and terminals. Permanent faults**.

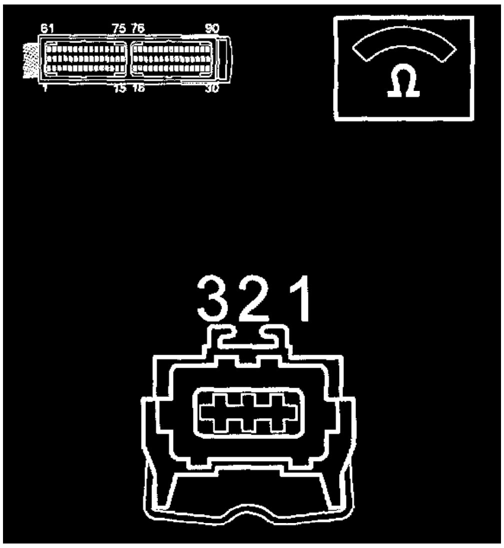
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



Check the cable between connector terminal 2 for the air conditioning (A/C) pressure sensor (control module side) and engine control module (ECM) terminal 14 for a short-circuit to ground according to **Checking wiring and terminals. Permanent faults**.

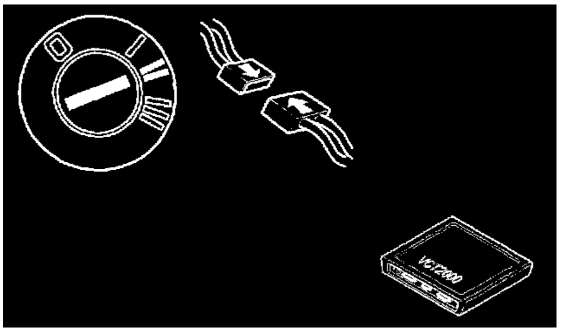
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6B/Signal Too Low - Permanent Fault/Verification

Verification

Verification



- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Ignition on.

Read off the A/C PRESS parameter.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-6F is stored if the engine speed (RPM) exceeds **2000 rpm**, the load signal is above **800 mg/str** and the vehicle speed signal is missing for more than **10 seconds**.

Condition
- The maximum engine speed (RPM) is limited
- Initial boost pressure
- No leak diagnostic
- No idle air trim adaptation.

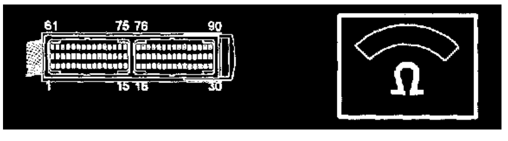
Possible source

Faulty signal:
- Open-circuit in the signal cable
- Short-circuit to ground in the signal cable
- Short-circuit to supply voltage in the signal cable
- Contact resistance and oxidation.

Condition
- The speedometer does not work
- Malfunction indicator lamp (MIL) lit
- Poor performance
- Too high idling speed
- Too low idling speed.

Faulty Signal - Intermittent Fault

Checking Cables



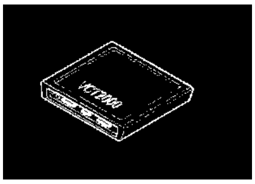
Check the signal cable between the engine control module (ECM) #52 and ABS control module terminal 25 for an intermittent open-circuit and remedy according to **Checking wiring and terminals. Intermittent faults** and for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking ABS Diagnostic Trouble Codes (DTCS)

Checking ABS Diagnostic Trouble Codes (DTCs)



Read off the diagnostic trouble codes (DTCs) in the ABS control module for a missing signal from the left front wheel.

Was a diagnostic trouble code (DTC) found?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/ABS Diagnostic Trouble Codes (DTCS)

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/Checking Vehicle Speed Signal

ABS Diagnostic Trouble Codes (DTCS)

ABS Diagnostic Trouble Codes (DTCs)

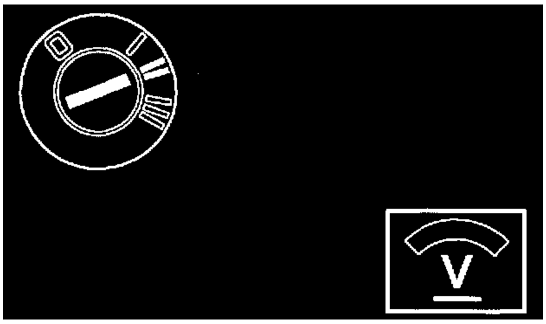
Remedy the fault according to Brakes S40/V40.

The parameter should display battery voltage.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/Verification

Checking Vehicle Speed Signal

Checking Vehicle Speed Signal



- Ignition on.

Raise the front wheels and check the vehicle speed signal at the engine control module (ECM) terminal #52.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

The value should oscillate between approximately 0 volts and just on battery voltage when the left front wheel is spun.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/Checking Terminals

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/Checking Wiring and Terminals

Checking Terminals

Checking Terminals

Check the ABS control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

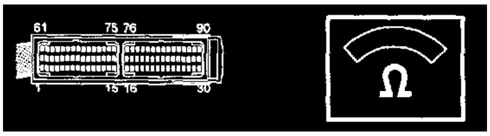
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary

After performing the procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/Verification

Checking Wiring and Terminals

Checking Wiring And Terminals



Check the cable between engine control module (ECM) terminal 52 and ABS control module terminal #25 for an open-circuit according to **Checking wiring and terminals. Permanent faults**. Check for a short-circuit to ground according to **Checking wiring and terminals. Permanent faults**. Check for a short-circuit to supply voltage according to **Checking wiring and terminals. Permanent faults**.

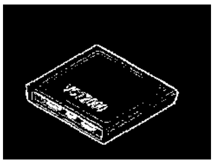
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-6F/Faulty Signal - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Raise the car so that the drive wheels are clear of the ground. Ensure that the car is secure.
- Start the engine and let it idle.
- Activate reading off the vehicle speed: Click on the VCT2000 symbol.
- Shift gear selector to position D so that the drive wheels begin to rotate

Depress the accelerator pedal (AP) and check that the speed is updated.

NOTE: Ensure that the wheels are not rotating when the gear selector is moved.

NOTE: Diagnostic trouble codes (DTCs) may be stored in the ABS system when the rear wheels are stationary and the front wheels rotate.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-70 is stored if the control module registers that the throttle position sensor signal cable between the engine control module (ECM) and the DSA control module has a short-circuit to ground / voltage or if there is an open-circuit in the circuit.

Condition

DSA function disabled.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable.

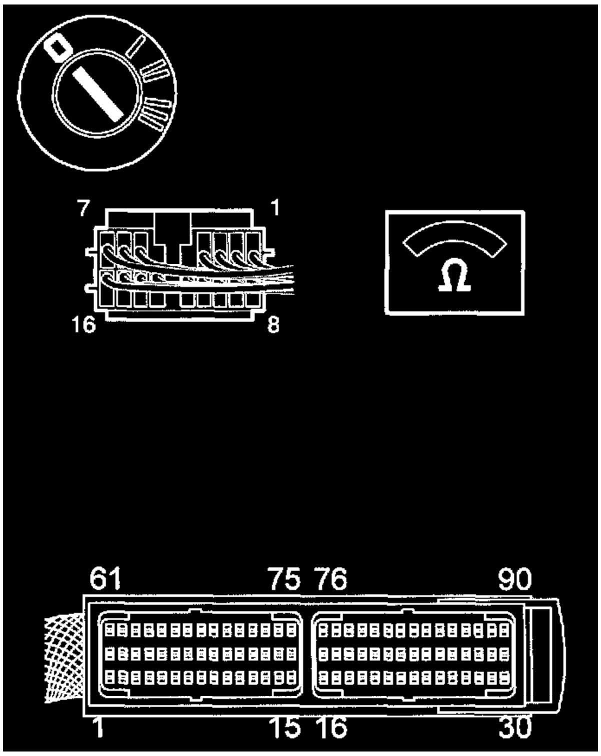
Signal too low:
- Contact resistance in the terminals
- Short-circuit to ground in the signal cable.

Signal missing:
- Contact resistance in the terminals
- Open-circuit in the signal cable.

Condition
- DSA-lamp lights
- No DSA function.

Signal Missing - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the DSA control module and engine control module (ECM) connectors for loose connections according to **Checking wiring and terminals. Intermittent faults** and contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**
- Check the signal cable between engine control module (ECM) terminal 36 and DSA control module terminal 5 for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**

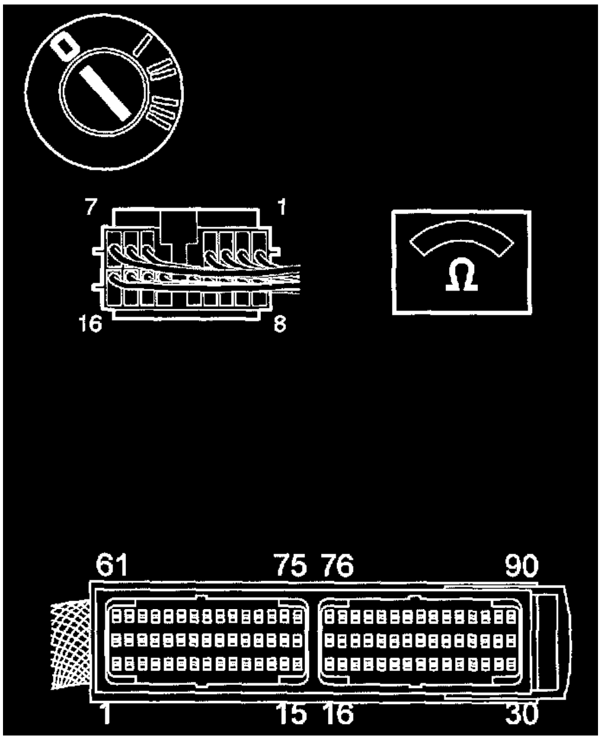
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information
- To connect the engine control module (ECM) breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For connecting the DSA control module breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Checking Wiring and Connectors

Checking Wiring And Connectors



- Ignition off
- Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**
- Check the signal cable between engine control module (ECM) terminal 36 and DSA control module terminal 5 for an open-circuit according to **Checking wiring and terminals. Permanent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

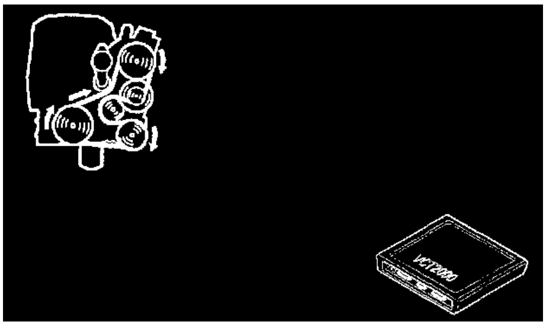
- Remedy as necessary.

Other information
- To connect the engine control module (ECM) breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For connecting DSA control module breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-70/Signal Missing - Permanent Fault/Verification

Verification

Verification

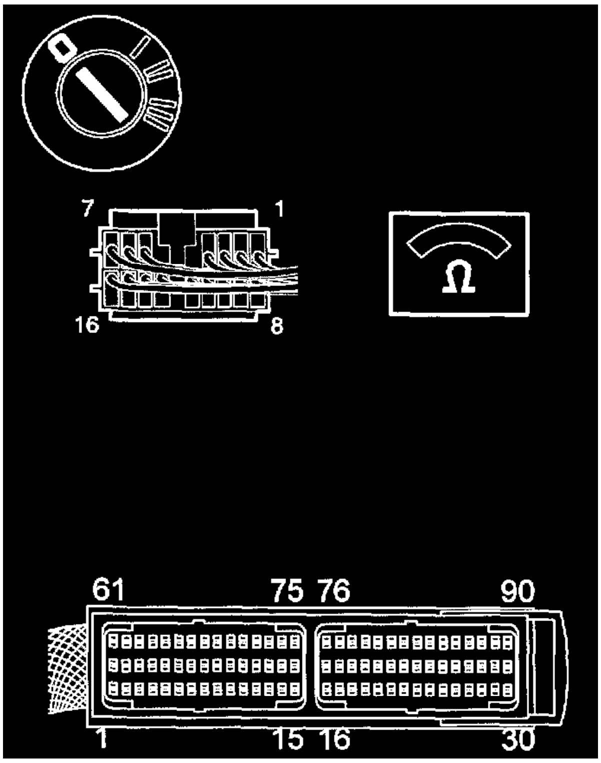


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine above **4500 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Signal Too High - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the DSA control module and engine control module (ECM) connectors for loose connections according to **Checking wiring and terminals. Intermittent faults** and contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.
- Check the signal cable between engine control module (ECM) terminal 36 and DSA control module terminal 5 for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals. Intermittent faults**

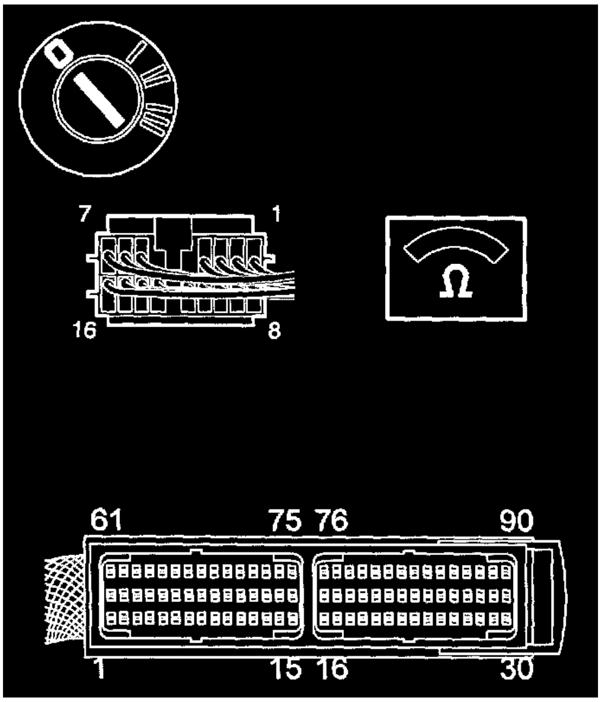
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information
- To connect the engine control module (ECM) breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For connecting DSA control module breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Checking the Wiring

Checking The Wiring



- Ignition off
- Check the signal cable between engine control module (ECM) terminal 36 and DSA control module terminal 5 for a short-circuit to supply voltage according to **Checking wiring and terminals. Permanent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

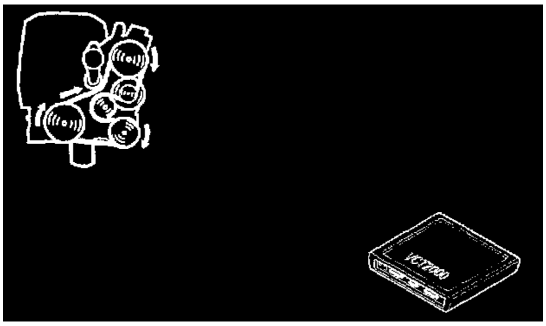
- Remedy as necessary.

Other information:
- To connect the engine control module (ECM) breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For connecting DSA control module breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-70/Signal Too High - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine above **4500 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

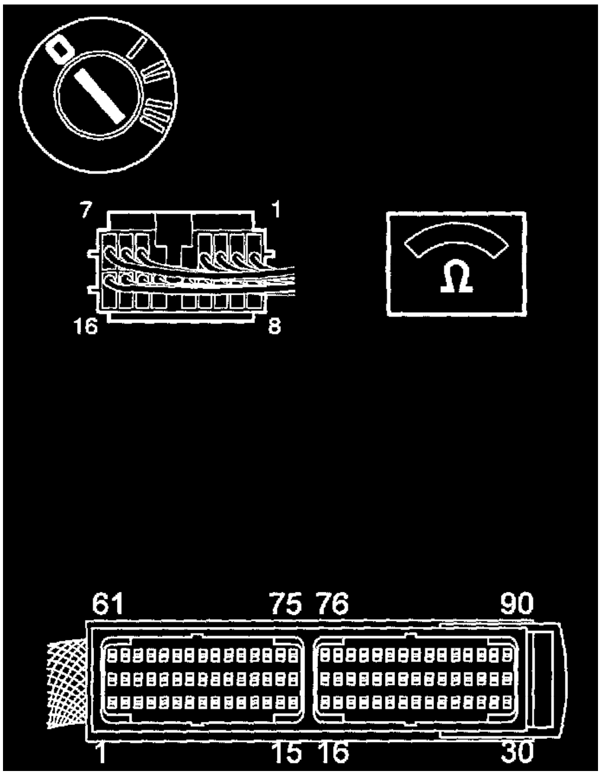
Is the status of the diagnostic trouble code (DTC) intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-70/Signal Too High - Permanent Fault/Checking the Wiring

No - Test Complete

Signal Too Low - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the connectors on the engine control module (ECM) and DSA control module. Check for loose connections according to **Checking wiring and terminals. Intermittent faults**. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**
- Check the signal cable between engine control module (ECM) terminal #36 and DSA control module terminal #5. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**

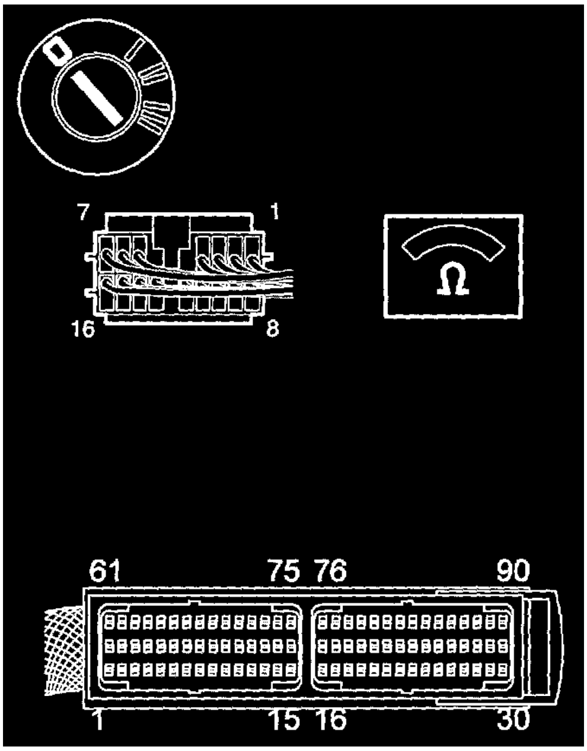
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information
- To connect the engine control module (ECM) breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To connect the DSA control module breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Checking the Wiring

Checking The Wiring



- Ignition off
- Check the connectors on DSA control module terminal 5 and Control module terminal 36 for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**
- Check the signal cable between engine control module (ECM) terminal 36 and DSA control module terminal 5 for a short-circuit to ground according to **Checking wiring and terminals. Permanent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

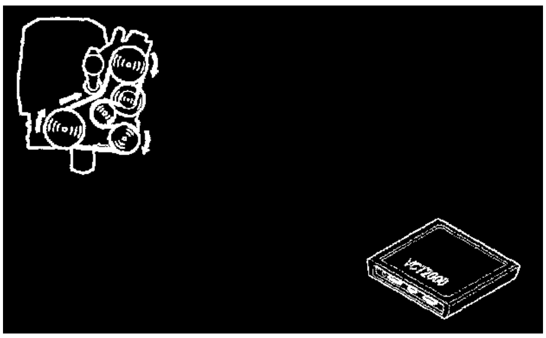
- Remedy as necessary

Other information:
- To connect the engine control module (ECM) breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For connecting DSA control module breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-70/Signal Too Low - Permanent Fault/Verification

Verification

Verification

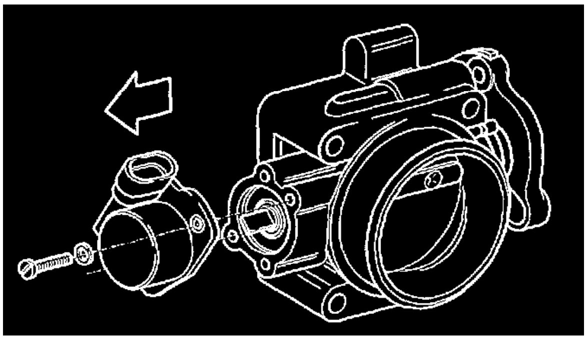


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc. Start the engine
- Rev the engine above **4500 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-73 is stored if the control module detects that the signal from the throttle position (TP) sensor is too high or too low.

Condition

- Limited DSA function
- Initial boost pressure
- No fuel trim adaptation
- Limited EVAP control
- The mass air flow (MAF) sensor signal is used to determine the throttle angle.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Open-circuit in the ground lead
- Contact resistance in the terminals
- Defective throttle position (TP) sensor.

Signal too low:

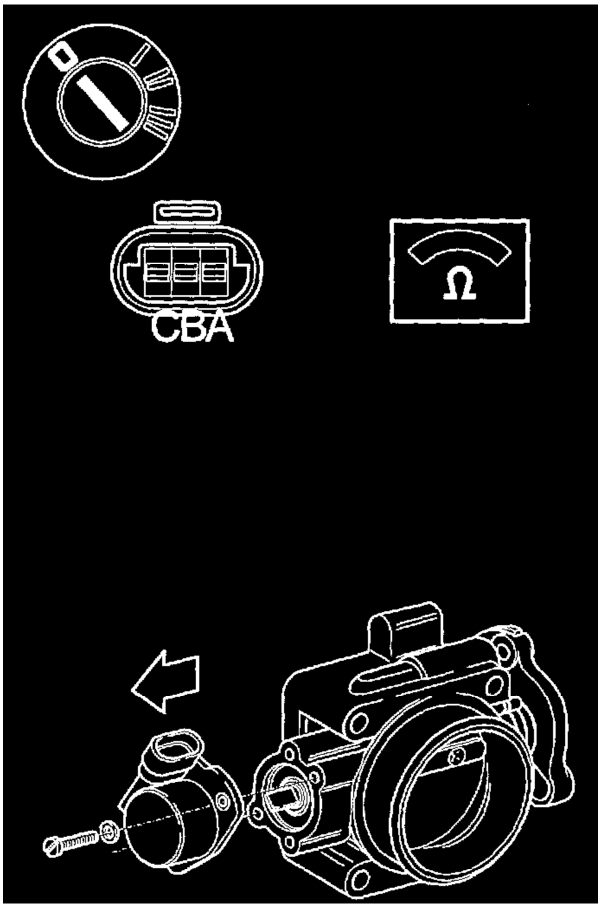
- Short-circuit to ground in the signal cable
- Open-circuit in the signal cable
- Open-circuit in the power cable
- Contact resistance in the terminals
- Defective throttle position (TP) sensor.

Condition

- Transmission slap when applying / lifting off the throttle
- Poor performance
- Deteriorated DSA function
- The DSA warning lamp lights
- Idle speed too high
- Idle speed too low.

Signal Too High - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the throttle position (TP) sensor connector. Check for intermittent contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**. Check for loose connections according to **Checking wiring and terminals. Intermittent faults**. In particular, check for any damage
- Check the cable between throttle position (TP) sensor terminal #C and control module terminal #43. Check the cable between throttle position (TP) sensor terminal #B and control module terminal #78. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals. Intermittent faults**. Check the cable between throttle position (TP) sensor terminal #A and control module terminal #77. Check for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**

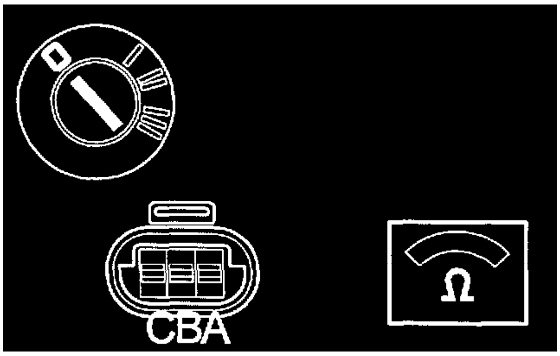
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To check and replace the throttle position (TP) sensor, See **Replacing throttle position (TP) sensor**.

Checking the Connectors

Checking The Connectors



- Ignition off
- Check the throttle position (TP) sensor connector for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**. Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-73/Signal Too High - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-73/Signal Too High - Permanent Fault/Checking the Cable and Components

Checking the Cable and Components

Checking The Cable And Components

- Ignition off.

Check the signal cable between throttle position sensor terminal C and control module terminal 43. Check the power supply cable between throttle position sensor terminal B and control module terminal 78. Check these cables for a short-circuit to supply voltage according to **Checking wiring and terminals. Permanent faults**.
Check the ground lead between throttle position (TP) sensor terminal A and terminal 77 for an open-circuit according to **Checking wiring and terminals. Permanent faults**.
Check the signal from the throttle position (TP) sensor terminal C to the control module terminal 43.
Replace the throttle position (TP) sensor according to **Replacing throttle position (TP) sensor** if necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

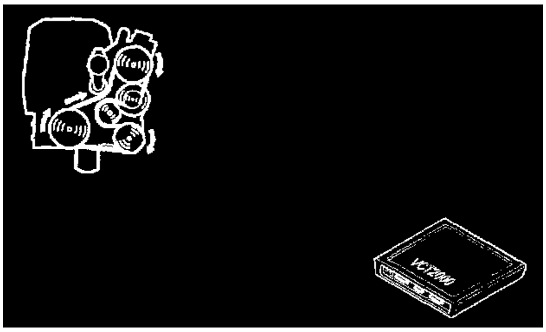
Other information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-73/Signal Too High - Permanent Fault/Verification

Verification

Verification

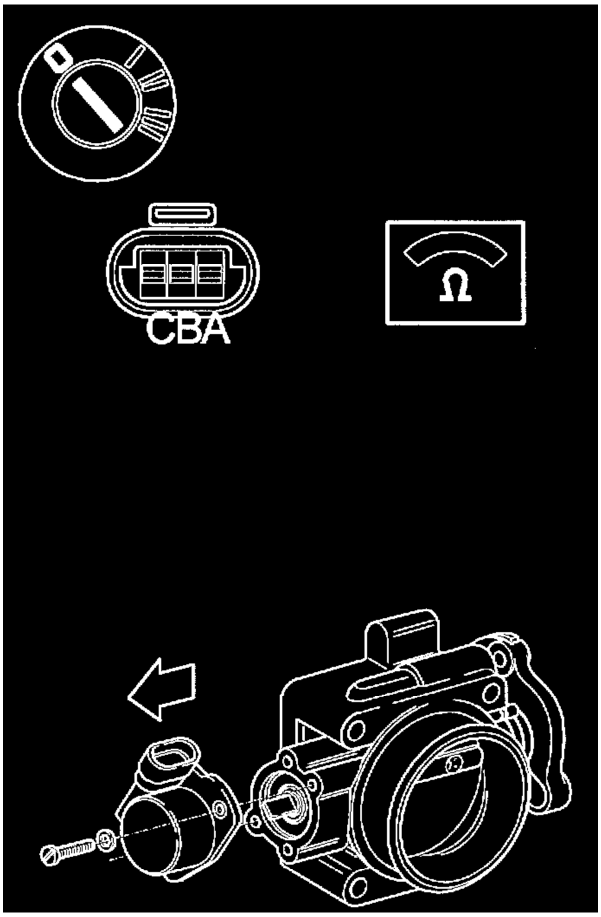


Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine.
- Rev the engine above **4500 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Signal Too Low - Intermittent Fault

Checking The Connectors



- Ignition off
- Check the throttle position (TP) sensor connector. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**. Check for loose connections according to **Checking wiring and terminals. Intermittent faults**. In particular, check for any damage
- Check the signal cable between throttle position sensor terminal #C and control module terminal #43. Check the power supply cable between

throttle position sensor terminal #B and control module terminal #78. Check these cables for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**.

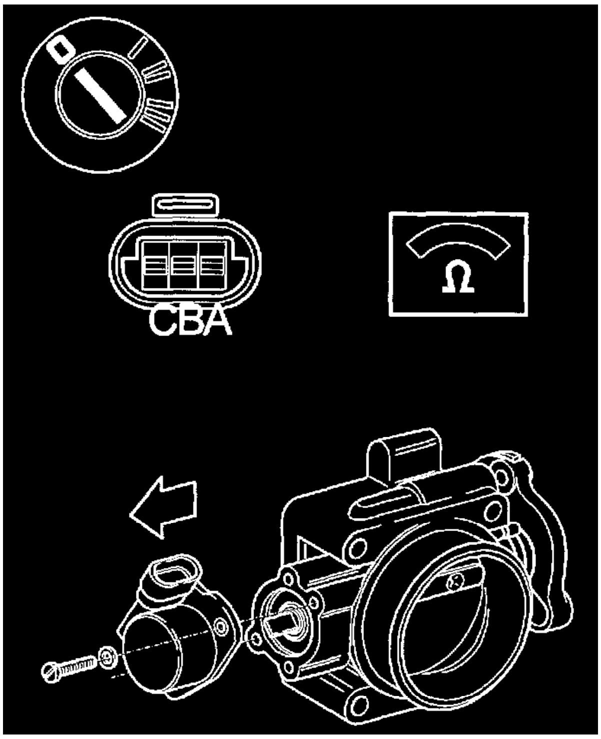
Hint: The throttle position (TP) sensor receives **5 V** from control module terminal #78.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To check and replace the throttle position (TP) sensor, See **Replacing throttle position (TP) sensor**.

Checking the Connectors

Checking The Connectors



- Ignition off
- Check the throttle position (TP) sensor connector for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

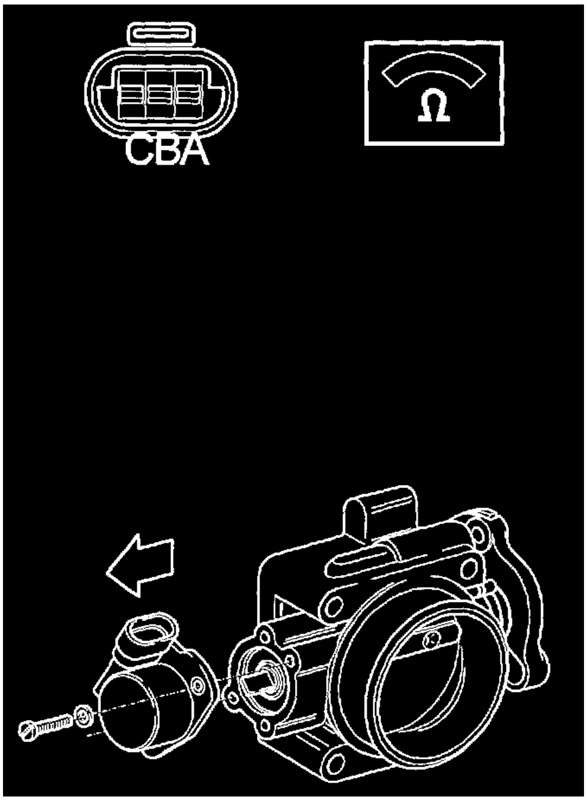
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-73/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-73/Signal Too Low - Permanent Fault/Checking the Cable and Components

Checking the Cable and Components

Checking The Cable And Components



- Ignition off.

Check the signal cable between throttle position sensor terminal C and control module terminal 43. Check the power supply cable between throttle position sensor terminal B and control module terminal 77. Check these cables for an open-circuit according to **Checking wiring and terminals. Permanent faults**.
Check signal cable terminal C on the throttle position (TP) sensor for a short-circuit to ground according to **Checking wiring and terminals. Permanent faults**.

Hint: The throttle position (TP) sensor receives **5 V** from engine control module terminal 78.

Check the signal from the throttle position (TP) sensor terminal C to control module terminal 43.
Replace the throttle position (TP) sensor according to **Replacing throttle position (TP) sensor** if necessary.

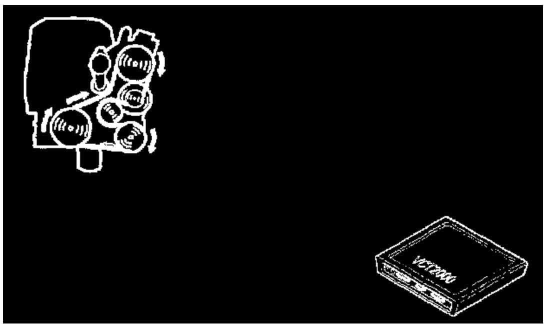
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-73/Signal Too Low - Permanent Fault/Verification

Verification

Verification



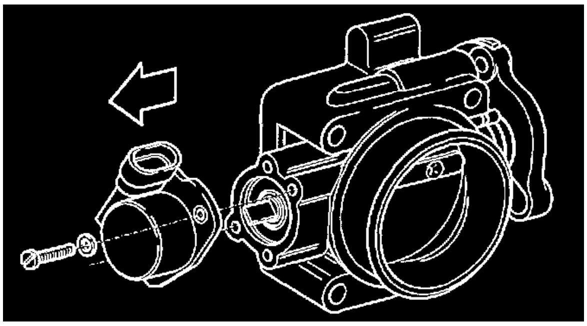
Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine above **4500 rpm** twice.

- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-74 is stored if the control module detects that the signal from the throttle position (TP) sensor is too low at high load and high engine speed (RPM).

Condition

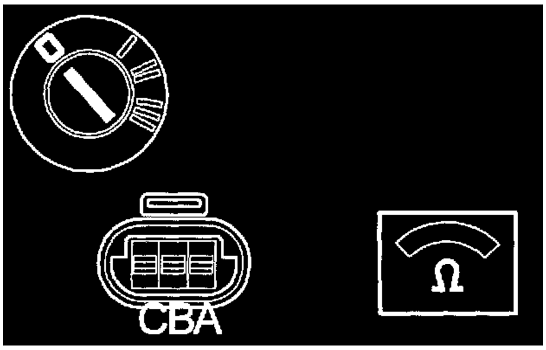
The fuel injection system diagnostics are disabled.

Possible source
- Contact resistance in the terminals
- Defective throttle position (TP) sensor.

Condition
- Transmission slap when applying/lifting off the throttle
- Limited DSA function.

Faulty Signal - Intermittent Fault

Checking Wiring And Connectors



- Ignition off
- Check the throttle position (TP) sensor and engine control module (ECM) terminals visually according to **Checking wiring and terminals. Intermittent faults** and for intermittent contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**

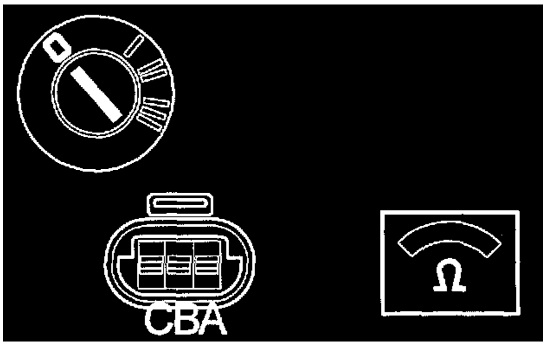
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To check / replace the throttle position (TP) sensor, See **Replacing throttle position (TP) sensor**.

Checking Wiring and Connectors

Checking Wiring And Connectors



- Ignition off
- Check the throttle position (TP) sensor and engine Control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

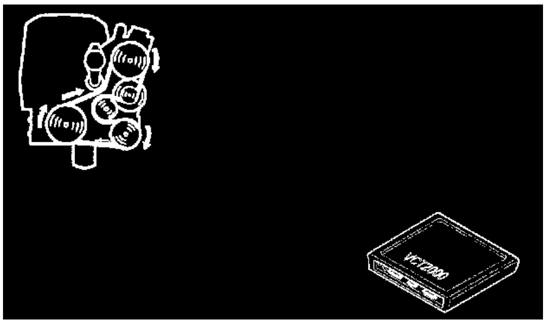
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-74/Faulty Signal - Permanent Fault/Checking Signal

Checking Signal

Checking Signal



Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc. Start the engine.
- Rev the engine above **4500 rpm** twice
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Is the status of the diagnostic trouble code (DTC) intermittent?

Yes - Test Complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-74/Faulty Signal - Permanent Fault/Replacing the Component

Replacing the Component

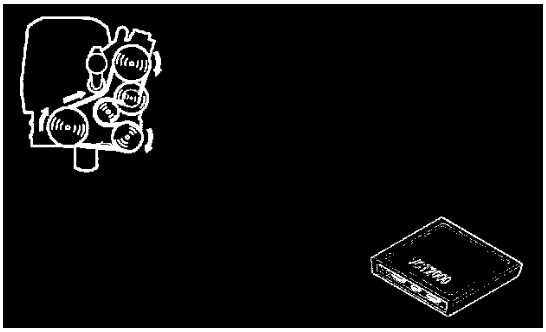
Replacing The Component

- Try a new throttle position (TP) sensor according to **Replacing throttle position (TP) sensor**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-74/Faulty Signal - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine
- Rev the engine above **4500 rpm** twice.
- Check whether the diagnostic trouble code (DTC) status changes to intermittent. If the fault has been remedied, the diagnostic trouble code (DTC) status should have changed to intermittent

Diagnostic Trouble Code (DTC) In Tcm

Diagnostic Trouble Code (DTC) In Automatic Transmission Control Module (TCM)

Check

Read off diagnostic trouble codes (DTCs) in the automatic transmission control module (TCM) and fault-trace according to the relevant diagnostic trouble code (DTC), See Automatic transmission AW50-42 S40/V40.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

This diagnostic trouble code (DTC) only indicates whether there are one or more emission related diagnostic trouble codes (DTCs) stored in the automatic transmission control module (TCM).

Condition
Turbocharger (TC) control disabled.

Possible source
- One or more diagnostic trouble codes (DTCs) stored in automatic transmission control module (TCM).

Condition
- Malfunction indicator lamp (MIL) lit.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

If the engine control module (ECM) does not receive a signal from the engine speed (RPM) sensor (signal missing), or if the control module counts more than two teeth too many or too few on the flywheel during one revolution (faulty signal): The control module interprets it as a fault and diagnostic trouble code (DTC) ECM-78 is stored.

Condition
- No camshaft diagnostics
- No camshaft control
- Ignition retardation
- No boost pressure diagnostics
- No heated oxygen sensor (HO2S) diagnostics.

Possible source

Signal missing:
- Open-circuit in the signal cable

- Short-circuit to ground in the signal cable
- Short-circuit to supply voltage in the signal cable
- Faulty engine speed (RPM) sensor.

Faulty signal:

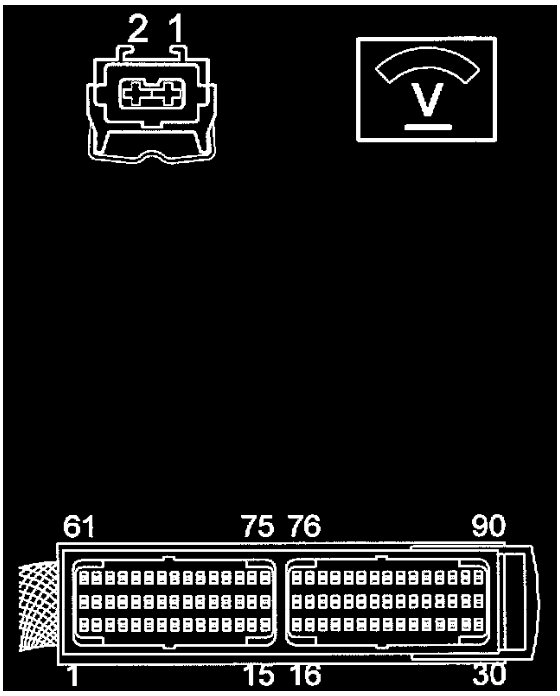
- Loose connections
- Damaged flywheel
- Faulty engine speed (RPM) sensor.

Condition

- Malfunction indicator lamp (MIL) lit.

Faulty Signal - Intermittent Fault

Checking Wiring



Check the engine Control module (ECM) and engine speed (RPM) sensor connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals. Intermittent faults**.

Check in particular for damage or loose terminal pins.
Check the signal cables between engine control module (ECM) terminals #54 and #24 and engine speed (RPM) sensor terminals #2 and #1. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals. Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**. Check for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**. Check for a short-circuit to each other.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

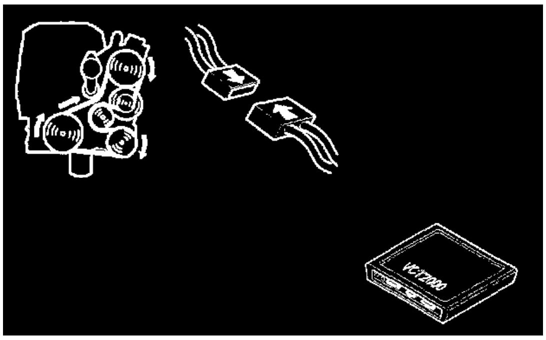
If no faults are found in the above fault-tracing, try a new engine speed (RPM) sensor. See **Replacing engine speed (RPM) sensor**.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connectors

Checking The Connectors



Check the engine speed (RPM) sensor and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

Check in particular for damage or loose terminal pins.
Reconnect the connectors.
Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Ignition off for **30 seconds**.

NOTE: If the engine cooling fan (FC) is running, the ignition must be off for **30 seconds** after the engine cooling fan (FC) has stopped.

Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Read off the status of the diagnostic trouble code (DTC).

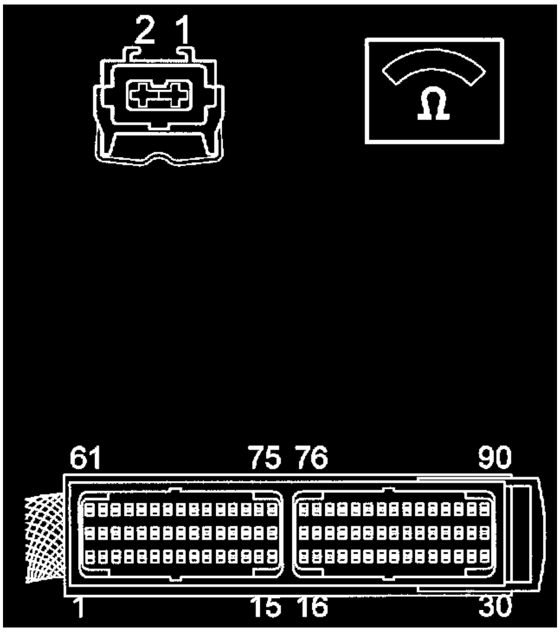
Is the status intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Faulty Signal - Permanent Fault/Checking the Wiring and Components

Checking the Wiring and Components

Checking The Wiring And Components



Check the engine speed (RPM) sensor resistance. The resistance must be between **250 - 350 [ohm]**.
Check the signal cables between engine control module (ECM) terminals 24 and 54 and engine speed (RPM) sensor terminals 1 and 2. Check for a short-circuit to ground and voltage, short-circuit to each other and for an open-circuit.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

Hint: With the ignition on, the voltage between the engine speed (RPM) sensor connector terminals 1 and 2 should be approximately **1.8 V** with the reading taken at the ground terminal.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Was a fault found in the above fault-tracing?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Faulty Signal - Permanent Fault/Defective Engine Speed (RPM) Sensor

Defective Engine Speed (RPM) Sensor

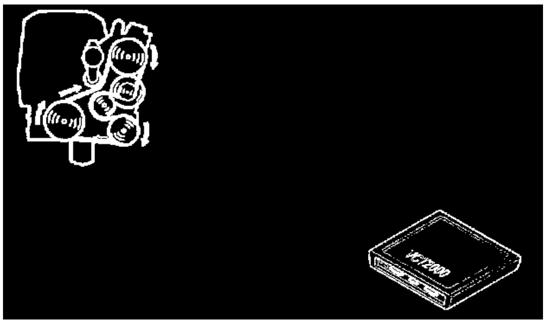
Defective Engine Speed (RPM) Sensor

Try a new engine speed (RPM) sensor according to **Replacing engine speed (RPM) sensor**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Faulty Signal - Permanent Fault/Verification

Verification

Verification



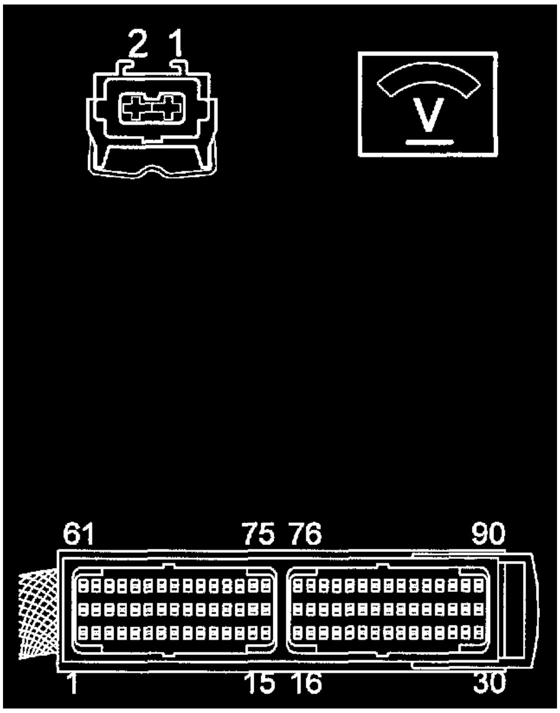
Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Ignition off for **30 seconds**.

NOTE: If the engine cooling fan (FC) is running, the ignition must be off for **30 seconds** after the engine cooling fan (FC) has stopped.

Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Read off the status of the diagnostic trouble code (DTC).

Signal Missing - Intermittent Fault

Checking Wiring



Check the flywheel and carrier plate for damage. Check the signal cables between engine control module (ECM) terminals #24 and #54 and engine speed (RPM) sensor terminals #1 and #2. Check for an intermittent short-circuit to Supply voltage according to **Checking wiring and terminals. Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals. Intermittent faults**. Check for an intermittent short-circuit to each other or for an intermittent open-circuit according to **Checking wiring and terminals. Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

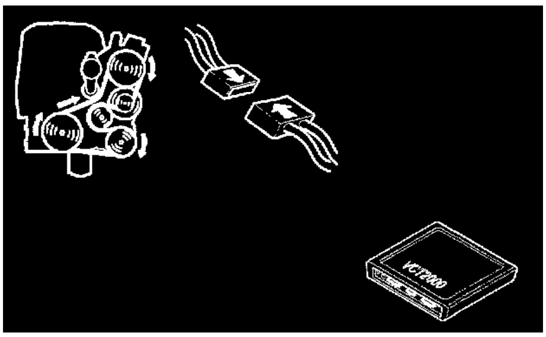
Hint: With the ignition on, the voltage between engine speed (RPM) sensor connector terminals #1 and #2 must be approximately **1.8 V** with the reading taken at the ground terminal.

Other information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the engine speed (RPM) sensor, See **Replacing engine speed (RPM) sensor**.

Checking the Connectors

Checking The Connectors



Check the engine speed (RPM) sensor and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

Check in particular for damage or loose terminal pins. Reconnect the connectors.
Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Ignition off for **30 seconds**.

NOTE: If the engine cooling fan (FC) is running, the ignition must be off for **30 seconds** after the engine cooling fan (FC) has stopped.

Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Read off the status of the diagnostic trouble code (DTC).

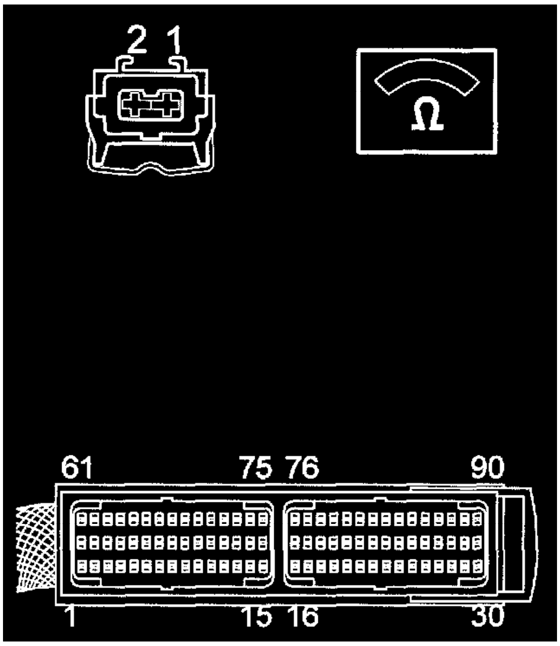
Is the status intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Signal Missing - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Signal Missing - Permanent Fault/Checking the Wiring and Components

Checking the Wiring and Components

Checking The Wiring And Components



Check the engine speed (RPM) sensor resistance. The resistance must be between **250 - 350 [ohm]**.
Check the signal cables between engine control module (ECM) terminals #24 and #54 and engine speed (RPM) sensor terminals #1 and #2. Check for a short-circuit to ground or supply voltage, for a short-circuit to each other or an open-circuit according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

Hint: With the ignition on, the voltage between engine speed (RPM) sensor connector terminals #1 and #2 must be approximately **1.8 V** with the reading taken at the ground terminal.

Other information
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Was a fault found in the above fault-tracing?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Signal Missing - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-78/Signal Missing - Permanent Fault/Defective Engine Speed (RPM) Sensor

Defective Engine Speed (RPM) Sensor

Defective Engine Speed (RPM) Sensor

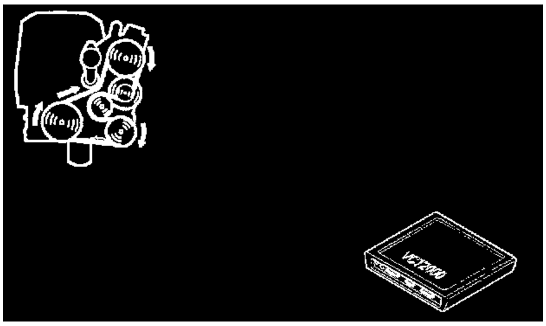
Try a new engine speed (RPM) sensor according to **Replacing engine speed (RPM) sensor**.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control

System/ECM-78/Signal Missing - Permanent Fault/Verification

Verification

Verification



- Start the engine. Allow the engine to run at idle speed for **30 seconds**

Ignition off for **30 seconds**.

NOTE: If the engine cooling fan (FC) is running, the ignition must be off for **30 seconds** after the engine cooling fan (FC) has stopped.

Start the engine. Allow the engine to run at idle speed for **30 seconds**.
Read off the status of the diagnostic trouble code (DTC).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-7D is stored if the control signal cable to the air conditioning (A/C) relay has a short-circuit to ground, short-circuit to supply voltage or an open-circuit.

Condition

None.

Possible source

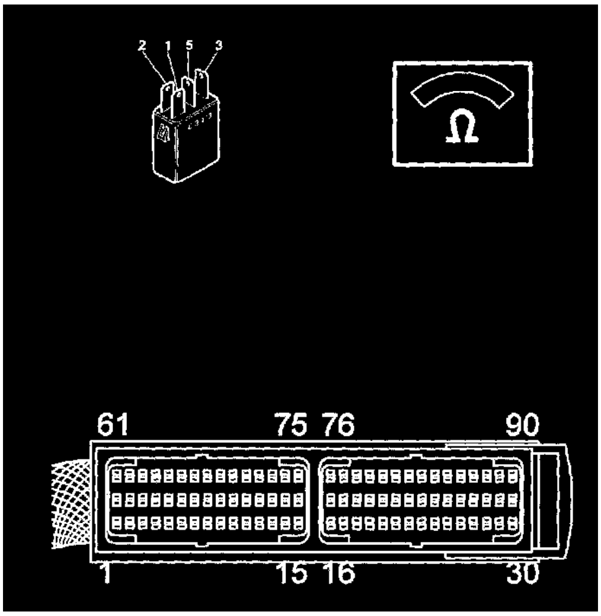
Signal too high:
- Short-circuit to supply voltage in the signal cable.
- Faulty air conditioning (A/C) relay.

Signal too low:
- Short-circuit to ground in the signal cable.
- Open-circuit in the signal cable.
- Faulty air conditioning (A/C) relay.

Condition
- The air conditioning (A/C) compressor does not function.
- Air conditioning (A/C) compressor operates constantly.

Intermittent Fault - Signal Too Low - Checking Wiring

Checking Wiring



Check that the resistance between the air conditioning (A/C) relay terminals 1 and 2 is approximately **105 [ohm] at +20°C**.

Check the signal cable between the Engine Control Module (ECM) terminal #68 and air conditioning (A/C) relay terminal 2 for an intermittent short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults**.

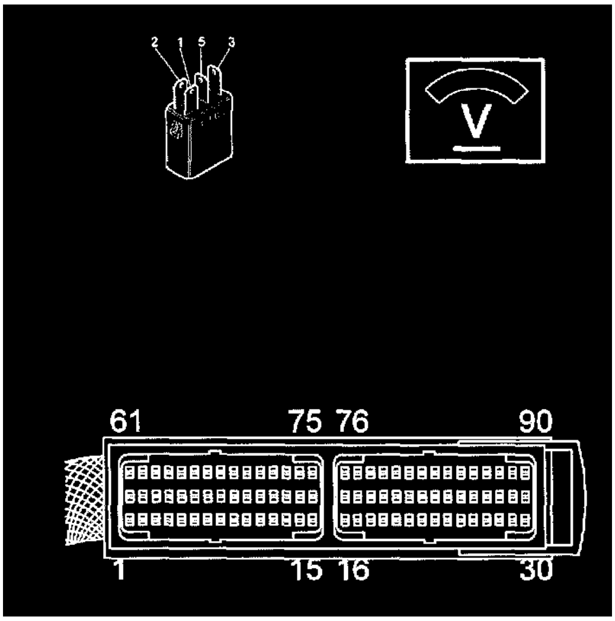
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Intermittent Fault Signal Too High Checking Components & Wiring

Checking Components And Wiring



Check that the resistance between the air conditioning (A/C) relay terminals 1 and 2 is approximately **105 [ohm] at +20°C.**

Check the signal cable between the Engine Control Module (ECM) terminal #68 and air conditioning (A/C) relay terminal 2 for an intermittent short-circuit to supply voltage and remedy according to **Checking wiring and terminals - Intermittent faults**

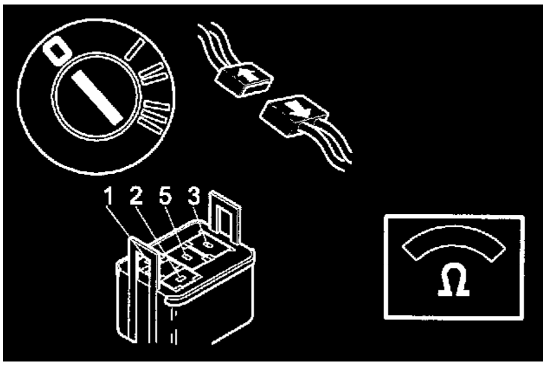
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking Air Conditioning (A/C) Relay

Checking Air Conditioning (A/C) Relay



- Ignition off
- Disconnect air conditioning (A/C) relay 2/10.

Connect an ohmmeter between the air conditioning (A/C) relay terminals 1 and 2 (relay side).

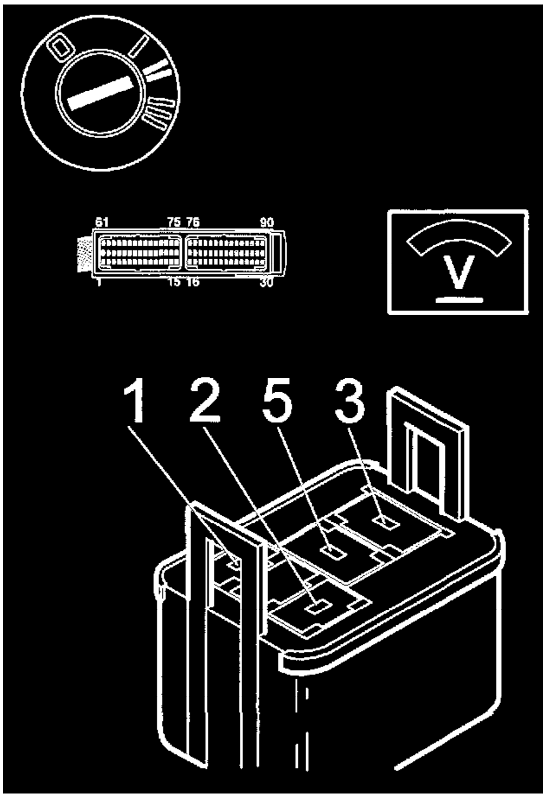
The ohmmeter should read approximately 105 [ohm] at +20°C

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too High/Checking the Signal Cable

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too High/Defective Air Conditioning (A/C) Relay

Checking the Signal Cable

Checking The Signal Cable



- Ignition on.

Check the cable between the engine cooling fan (FC) relay base terminal 2 and the engine control module (ECM) connector terminal 68 for a short-circuit to supply voltage according to **Checking wiring and terminals. Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control

System/ECM-7D/Permanent Fault - Signal Too High/Verification

Defective Air Conditioning (A/C) Relay

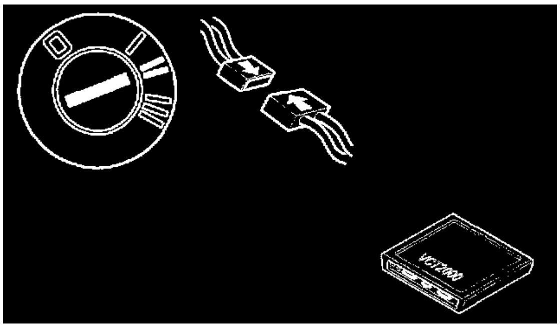
Defective Air Conditioning (A/C) Relay

Try a new air conditioning (A/C) relay.

After performing this procedure, See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too High/Verification

Verification

Verification

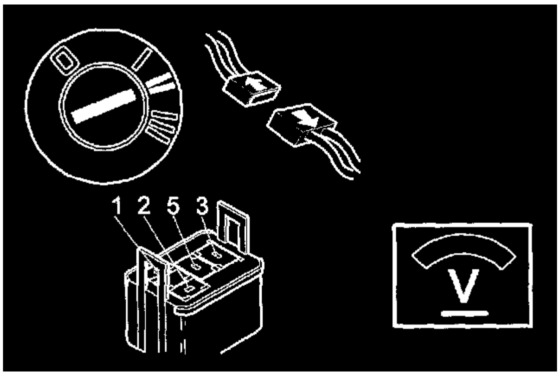


- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Ignition on.

Activate the air conditioning (A/C) relay by clicking the VCT2000 symbol.

Checking the Power Supply

Checking The Power Supply



- Ignition off
- Disconnect air conditioning (A/C) relay 2/10
- Ignition on.

Connect a voltmeter between air conditioning (A/C) relay base terminal #1 and ground.

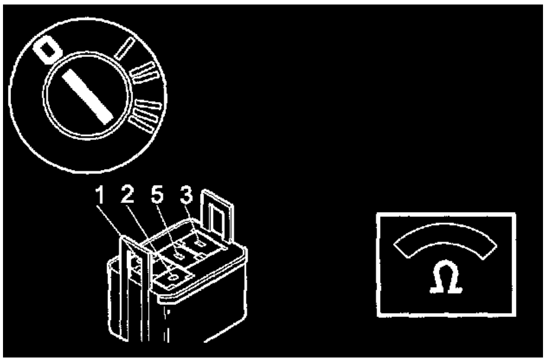
The voltmeter should read battery voltage.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Checking the Signal Cable - I

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Checking the Signal Cable - IV

Checking the Signal Cable - I

Checking the Signal Cable



- Ignition off.

Connect an ohmmeter between air conditioning (A/C) relay base terminal #2 and ground.

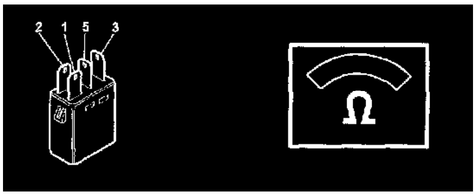
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Checking Air Conditioning (A/C) Relay

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Checking the Signal Cable - III

Checking Air Conditioning (A/C) Relay

Checking Air Conditioning (A/C) Relay



Connect an ohmmeter between the air conditioning (A/C) relay terminals #1 and #2 (relay side).

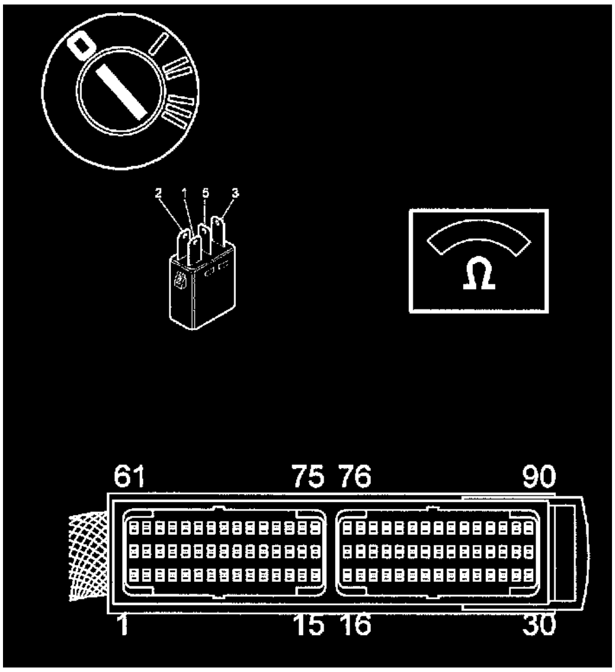
The ohmmeter should read approximately 105 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Checking the Signal Cable - II

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Defective Air Conditioning (A/C) Relay

Checking the Signal Cable - II

Checking the Signal Cable



- Ignition off.

Check the cable between air conditioning (A/C) system relay base terminal #2 and the Engine Control Module (ECM) connector terminal #68 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

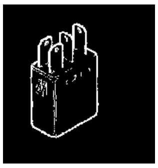
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Verification

Defective Air Conditioning (A/C) Relay

Defective Air Conditioning (A/C) Relay

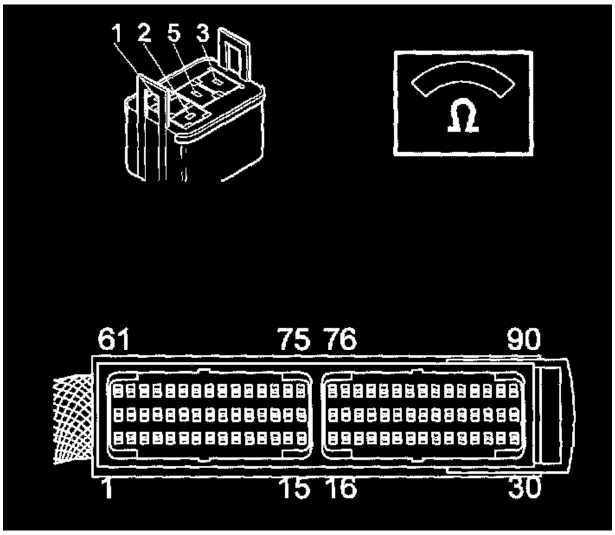


Try A New Air Conditioning (a/c) Relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Verification

Checking the Signal Cable - III

Checking The Signal Cable



Check the cable between air conditioning (A/C) system relay base terminal #2 and the Engine Control Module (ECM) connector terminal #68 for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**.

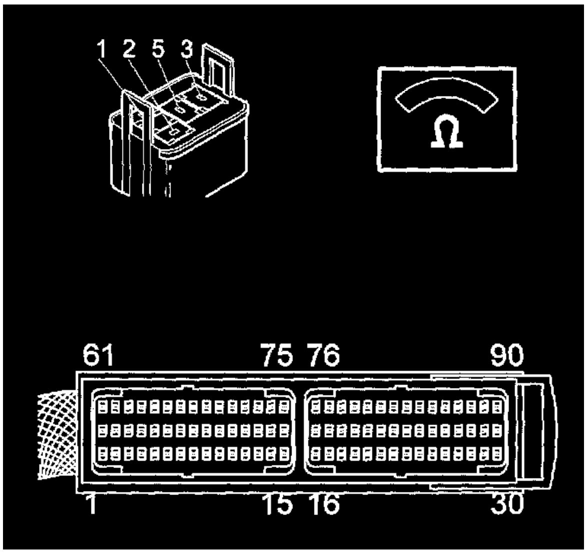
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Verification

Checking the Signal Cable - IV

Checking The Signal Cable



Check the cable between air conditioning (A/C) system relay base terminal #2 and the Engine Control Module (ECM) connector terminal #68 for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**.

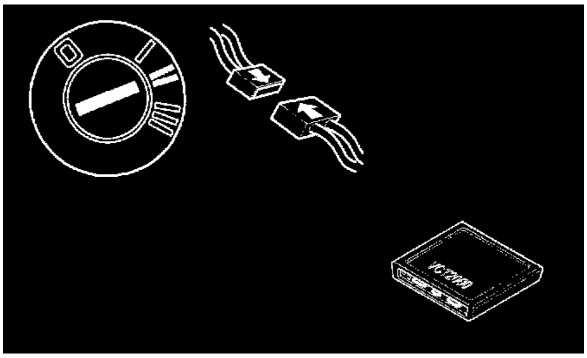
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7D/Permanent Fault - Signal Too Low/Verification

Verification

Verification



- Reconnect the connectors, reinstall components etc
- Connect VCT 2000
- Ignition on

Activate the air conditioning (A/C) using the VCT 2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-7F is stored if the malfunction indicator lamp (MIL) circuit is short-circuited to ground / voltage or if there is an open-circuit in the circuit the control module has interpreted as a fault.

Condition

None.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable.

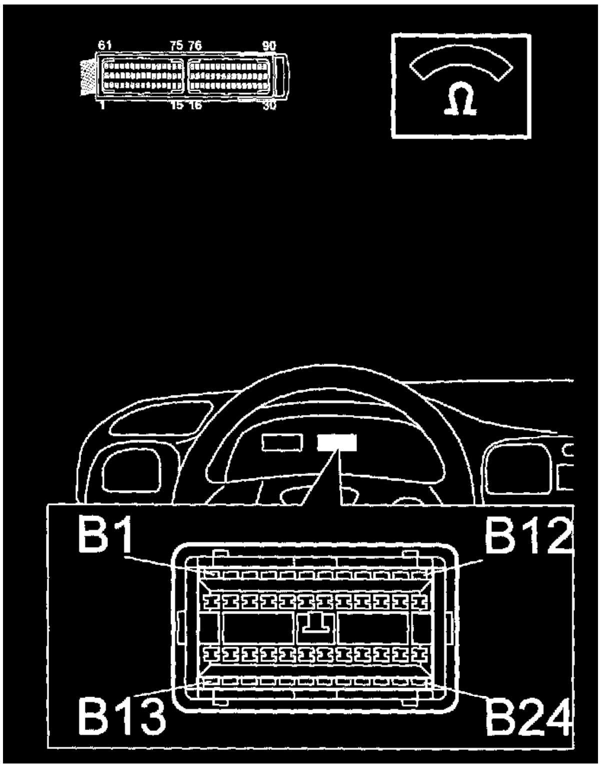
Signal too low:
- Short-circuit to ground in the signal cable.

Signal missing:
- Open-circuit in the signal cable
- Damaged MIL lamp.

Condition
- None.

Intermittent Fault - Signal Missing - Checking Wiring

Checking Wiring



Check the signal cable between Engine Control Module (ECM) terminal 34 and combined instrument panel terminal B23 for an intermittent open-circuit and remedy according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If no fault can be found in the above fault-tracing try a new malfunction indicator lamp (MIL).

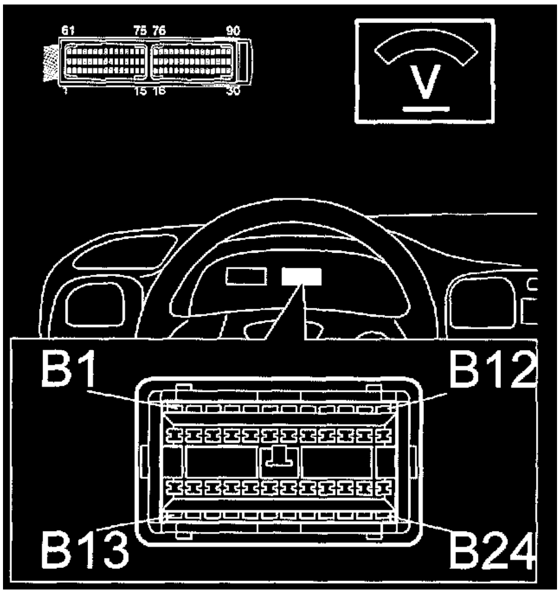
If that does not help, try a new combined instrument panel.

Other Information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To replace the malfunction indicator lamp (MIL), see **Replacing bulbs in the combined instrument panel**

Intermittent Fault - Signal Too High - Checking Wiring

Checking Wiring



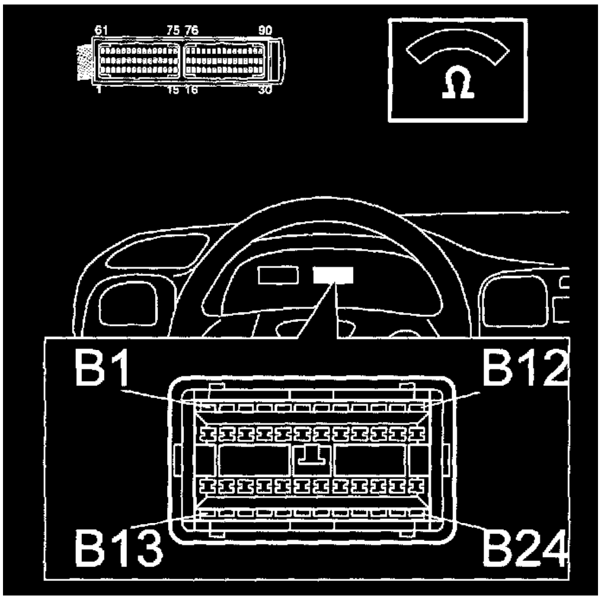
Check the signal cable between Engine Control Module (ECM) terminal #34 and combined instrument panel terminal B23. Check for an intermittent short-circuit to Supply voltage according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

Intermittent Fault - Signal Too Low - Checking Wiring

Checking Wiring



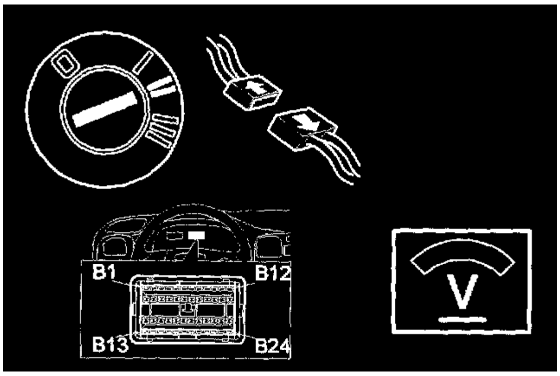
Check the signal cable between Engine Control Module (ECM) terminal #34 and combined instrument panel terminal B23. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

Checking the Terminal

Checking The Terminal



- Ignition off
- Disconnect the combined instrument panel connector
- Ignition on.

Connect a voltmeter between the combined instrument panel connector terminal B23 (Engine Control Module (ECM) side) and ground.

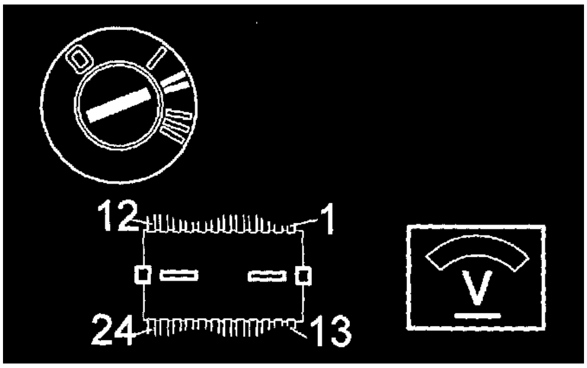
The voltmeter should read 5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Checking the Malfunction Indicator Lamp (MIL)

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Checking Wiring and Terminals

Checking the Malfunction Indicator Lamp (MIL)

Checking The Malfunction Indicator Lamp (MIL)



- Ignition on.

Connect a voltmeter between the combined instrument panel terminal B23 and ground.

The voltmeter should read battery voltage.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Loose Connections

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Defective Malfunction Indicator Lamp (MIL)

Loose Connections

Loose Connections

The cause of the diagnostic trouble code (DTC) has been loose connections in the combined instrument panel and/or control module connectors.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Verification

Defective Malfunction Indicator Lamp (MIL)

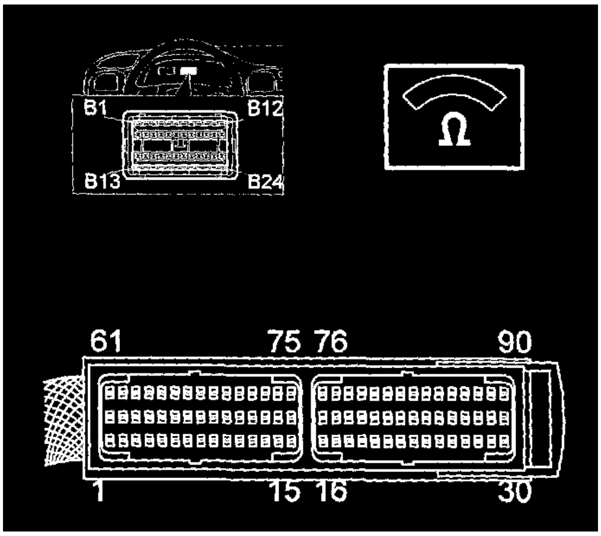
Defective Malfunction Indicator Lamp (MIL)

Replace the malfunction indicator lamp (MIL) according to Replacing bulbs in the combined instrument panel.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Verification

Checking Wiring and Terminals

Checking Wiring And Terminals

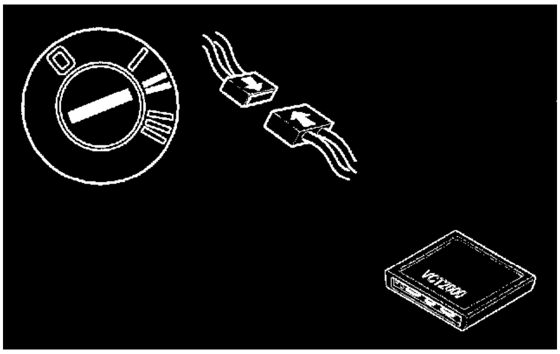


Check the cable between Engine Control Module (ECM) terminal 34 and combined instrument panel connector terminal B23 for an open-circuit according to Checking wiring and terminals Permanent faults.

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Missing/Verification

Verification



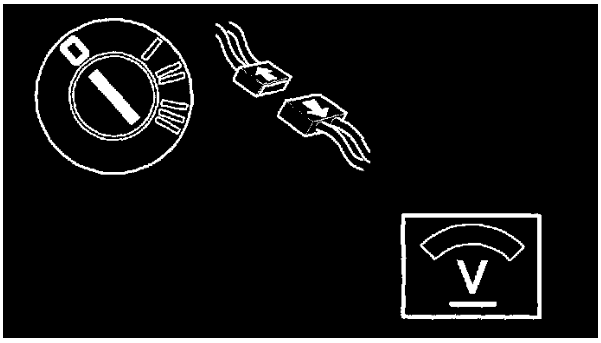
Verification

- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the malfunction indicator lamp (MIL) according to See: Scan Tool Testing and Procedures/Description of Activation

Checking the Signal Cable - I

Checking The Signal Cable



- Ignition off
- Disconnect the combined instrument panel connector.
- Ignition on.

Connect a voltmeter between the combined instrument panel connector terminal #B23 (control module side) and ground.

The voltmeter should read 5 V.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Checking the Malfunction Indicator Lamp (MIL)

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Checking the Signal Cable - II

Checking the Malfunction Indicator Lamp (MIL)

Checking The Malfunction Indicator Lamp (MIL)

- Disconnect the malfunction indicator lamp (MIL) from the combined instrument panel according to Replacing bug bulbs in the combined instrument panel.

Take an Ohm reading from the malfunction indicator lamp (MIL).

The ohmmeter should read 10-15 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Defective Combined Instrument Panel

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Defective Malfunction Indicator Lamp (MIL)

Defective Combined Instrument Panel

Defective Combined Instrument Panel

Try a new combined instrument panel according to Combined instrument panel installing/removing, replacing components.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Verification

Defective Malfunction Indicator Lamp (MIL)

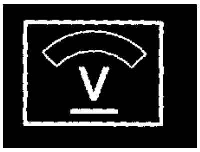
Defective Malfunction Indicator Lamp (MIL)

Replace the malfunction indicator lamp (MIL) according to Replacing bulbs in the combined instrument panel.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Verification

Checking the Signal Cable - II

Checking The Signal Cable



Check the cable between Engine Control Module (ECM) terminal #34 and the combined instrument panel connector terminal #B23 Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

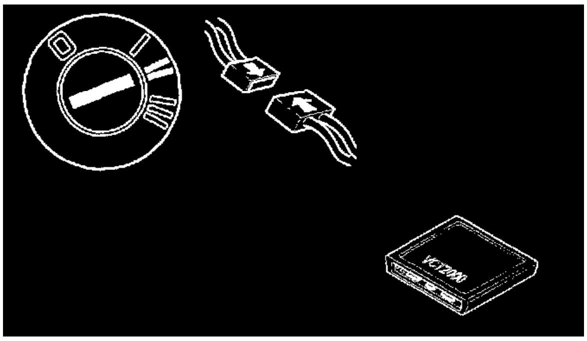
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too High/Verification

Verification

Verification



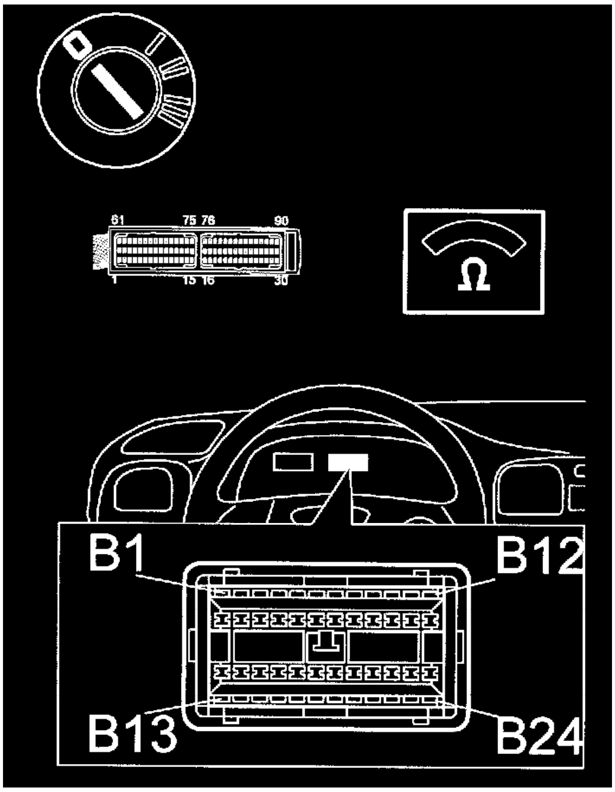
- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect.2VCT2000

- Ignition on.

Activate the malfunction indicator lamp (MIL).

Checking the Signal Cable

Checking The Signal Cable



- Ignition off.

Check the cable between combined instrument panel connector terminal B23 (control module side) and Engine Control Module (ECM) terminal 34 for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**.

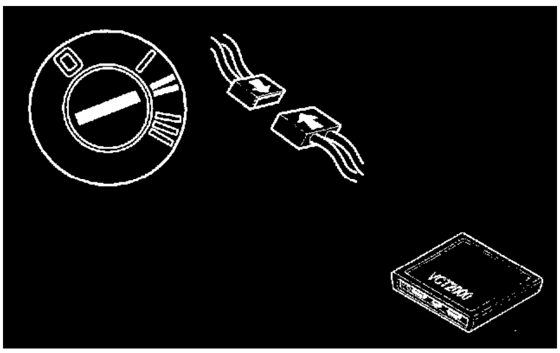
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-7F/Permanent Fault - Signal Too Low/Verification

Verification

Verification

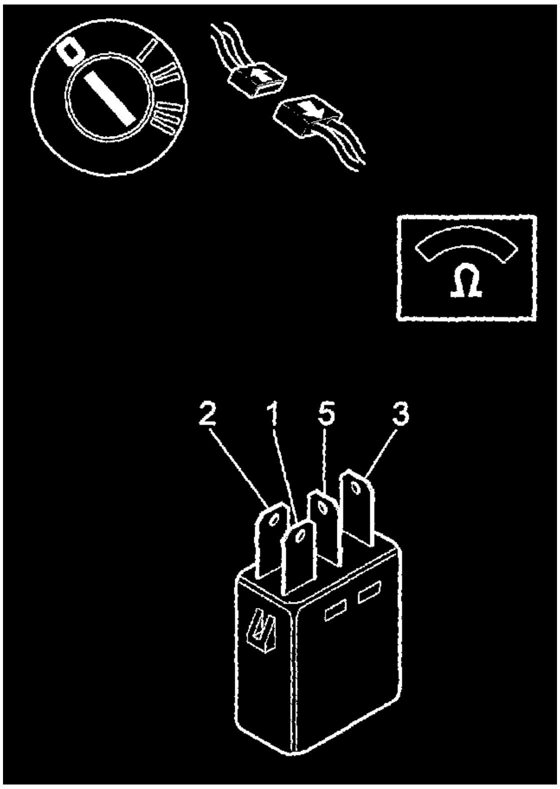


- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the malfunction indicator lamp (MIL) using VCT 2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Checking the Engine Cooling Fan (FC) Relay

Checking The Engine Cooling Fan (FC) Relay



- Ignition off
- Disconnect air conditioning (A/C) condenser fan relay 2/13.

Connect an ohmmeter between the air conditioning (A/C) condenser fan relay terminals #1 and #2 (relay side).

Other Information
- To access or replace the relay or fuse, see the inside of the cover on the engine compartment relay/fusebox or the Service Manual, wiring diagram section, 3 (39).

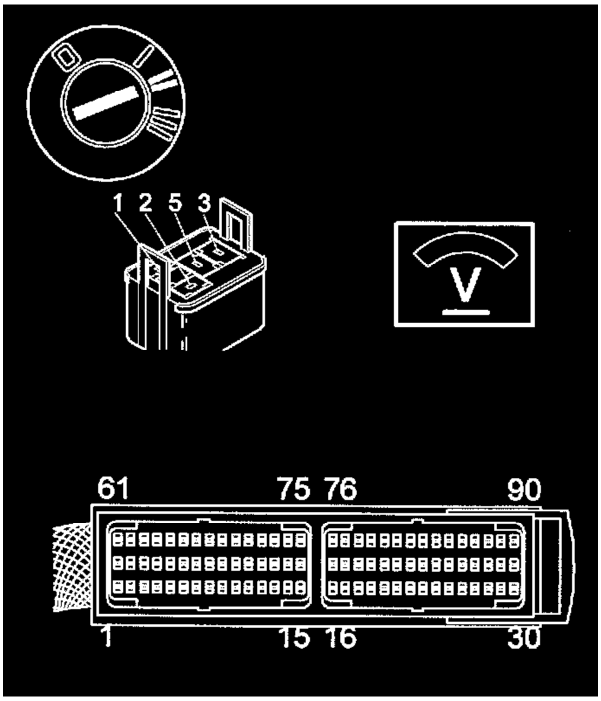
The ohmmeter should read approximately 105 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too High - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too High - Permanent Fault/Defective Air Conditioning (A/C) Condenser Fan Relay

Checking the Signal Cable

Checking The Signal Cable



- Ignition on.

Check the cable between air conditioning (A/C) condenser fan relay base terminal #2 and Engine Control Module (ECM) connector terminal #69. Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too High - Permanent Fault/Verification

Defective Air Conditioning (A/C) Condenser Fan Relay

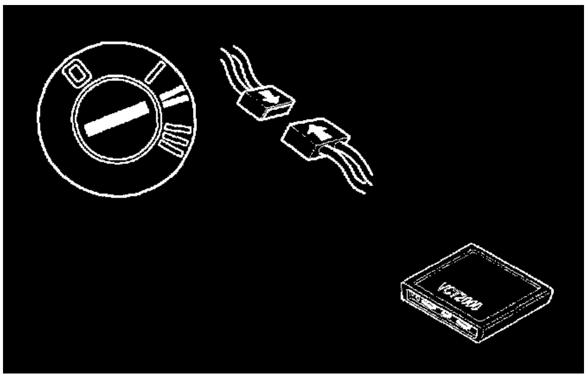
Defective Air Conditioning (A/C) Condenser Fan Relay

Try a new air conditioning (A/C) condenser fan relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too High - Permanent Fault/Verification

Verification

Verification

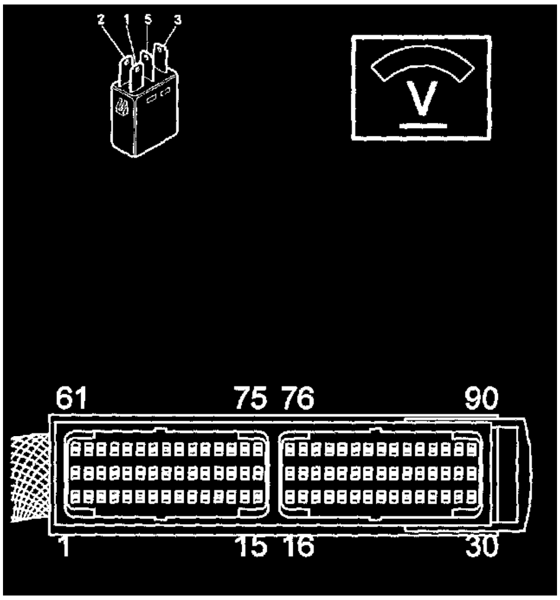


- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Ignition on.

Activate the air conditioning (A/C) condenser fan using VCT2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Signal Too High Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



Check that the resistance between relay terminals 1 and 2 is approximately **75 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) terminal 38 (half speed), terminal 8 (full speed), terminal 69 (air conditioning (A/C) cooling fan) and relay terminal 2 for an intermittent short-circuit to supply voltage and remedy according to **Checking wiring and terminals - Intermittent faults**.

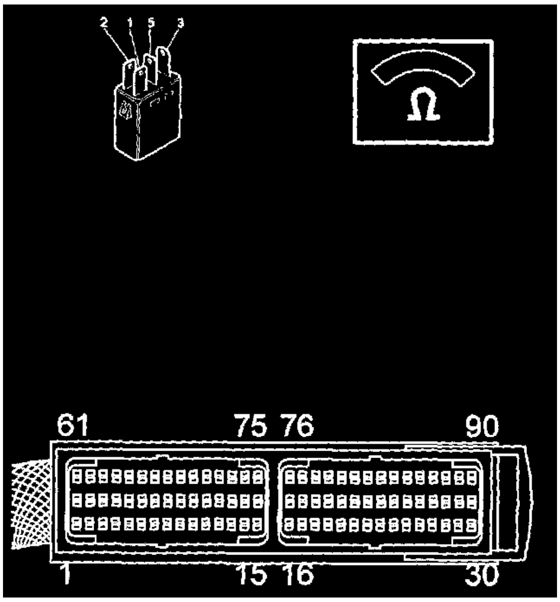
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Signal Too Low - Intermittent Fault - Checking Wiring

Checking Wiring



Check that the resistance between relay terminals #1 and #2 is approximately **75-105 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) terminal #38 (half speed), terminal #8 (full speed) and terminal #69 (air conditioning (A/C) cooling fan) and relay terminal #2. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent open-circuit according **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

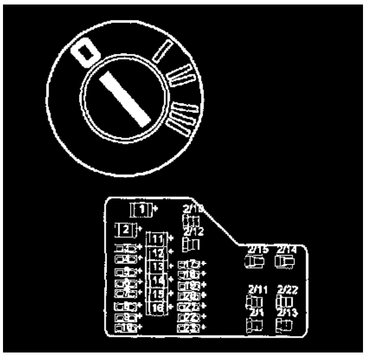
Remedy as necessary.

Other Information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Fuse

Checking The Fuse



- Ignition off.

Check that fuse 9 in the integrated relay / fusebox in the engine compartment is intact.

Replace if necessary.

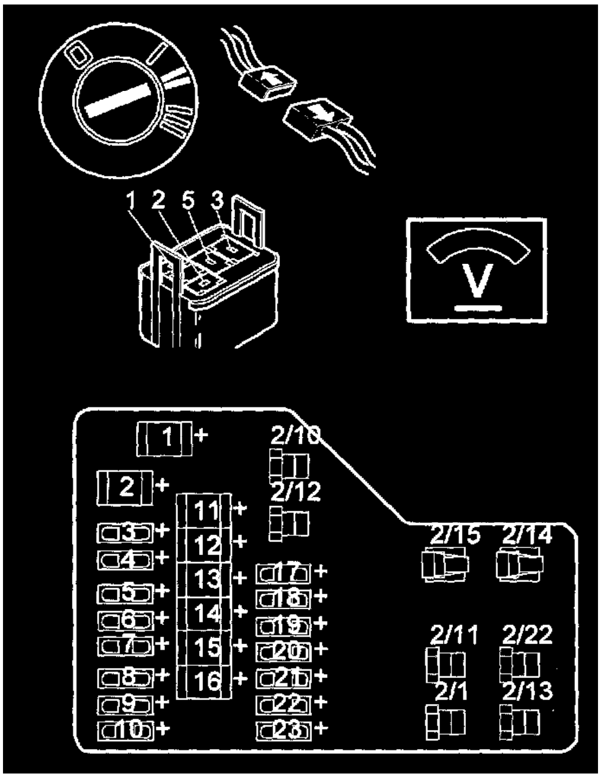
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Checking the Power Supply - I

Checking the Power Supply - I

Checking The Power Supply



- Ignition off
- Disconnect air conditioning (A/C) condenser fan relay 2/13
- Ignition on.

Connect a voltmeter between air conditioning (A/C) condenser fan relay base terminal #1 and ground.

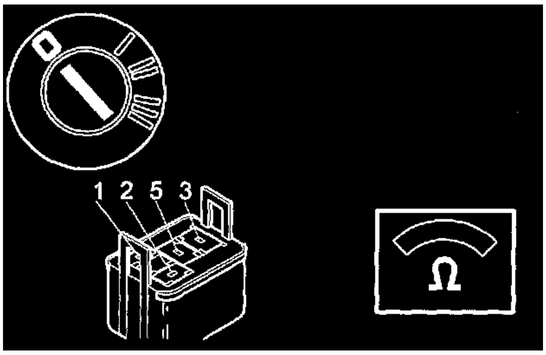
The voltmeter should read battery voltage.

OKSee: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Checking the Signal Cable - I

Not OK See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Checking the Power Supply - II

Checking the Signal Cable - I

Checking The Signal Cable



- Ignition off.

Connect an ohmmeter between air conditioning (A/C) condenser fan relay base terminal #2 and ground.

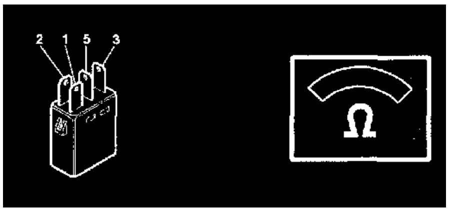
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Checking the Air Conditioning (A/C) Condenser Fan Relay

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Checking the Signal Cable - III

Checking the Air Conditioning (A/C) Condenser Fan Relay

Checking The Air Conditioning (A/C) Condenser Fan Relay



Connect an ohmmeter between the air conditioning (A/C) condenser fan relay terminals #1 and #2 (relay side).

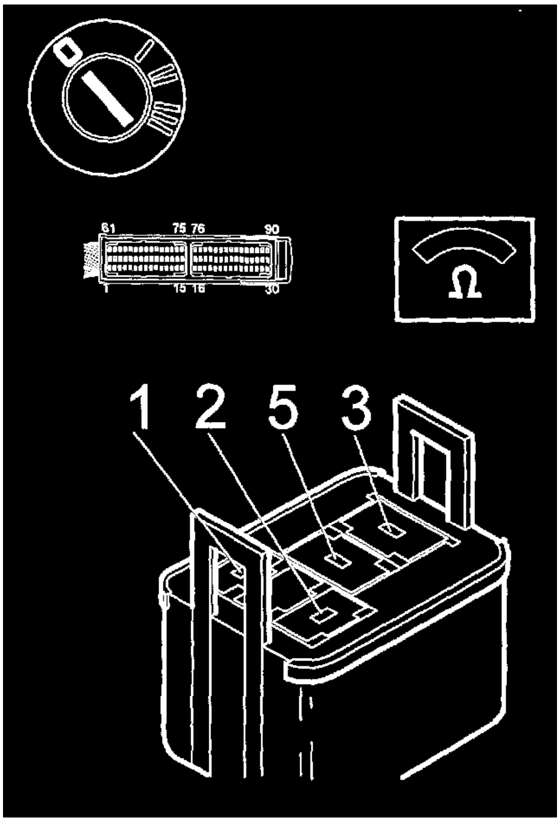
The ohmmeter should read approximately 105 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Checking the Signal Cable - II

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Defective Air Conditioning (A/C) Condenser Fan Relay

Checking the Signal Cable - II

Checking The Signal Cable



- Ignition off.

Check the cable between air conditioning (A/C) condenser fan relay base terminal #2 and Engine Control Module (ECM) connector terminal #69 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Verification

Defective Air Conditioning (A/C) Condenser Fan Relay

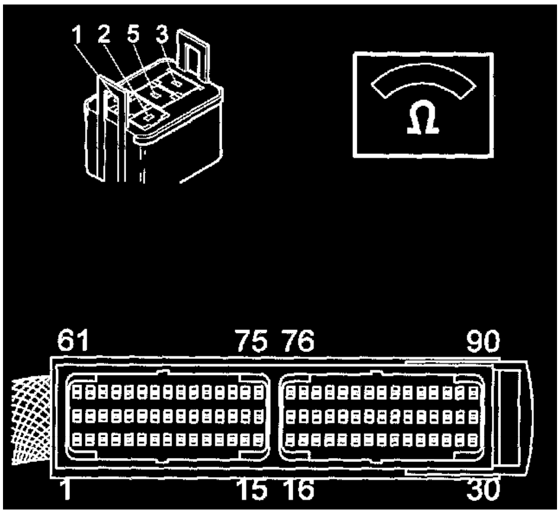
Defective Air Conditioning (A/C) Condenser Fan Relay

Try a new air conditioning (A/C) condenser fan relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too High - Permanent Fault/Verification

Checking the Signal Cable - III

Checking The Signal Cable



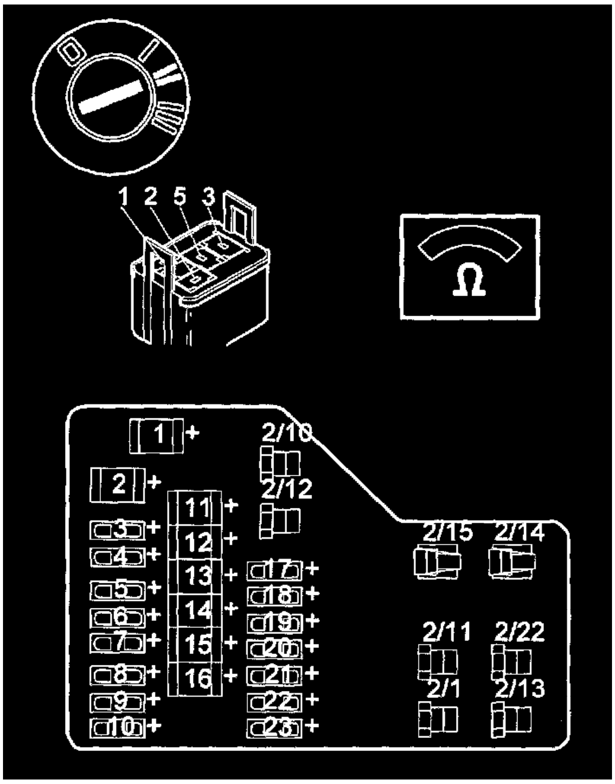
Check the cable between air conditioning (A/C) condenser fan relay base terminal #2 and the Engine Control Module (ECM) connector terminal #69 for a short-circuit to ground according **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Checking the Power Supply - II

Checking The Power Supply



- Ignition on.

Check the cable between air conditioning (A/C) condenser fan relay base terminal #1 and fuse 9 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

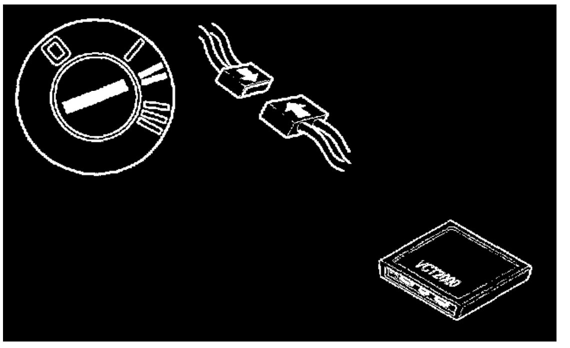
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-82/Signal Too Low - Permanent Fault/Verification

Verification

Verification



- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the air conditioning (A/C) condenser fan using VCT 2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-85 is stored if the signal circuit for the cooling fan low speed control is short- circuited to ground, short-circuited to supply voltage or there is an open-circuit in the circuit that the control module has interpreted as a fault.

Condition

None.

Possible source

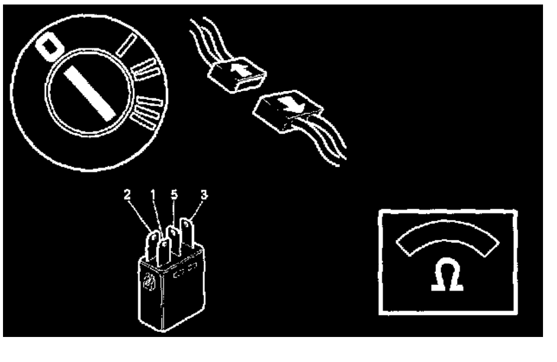
Signal too high:
- Short-circuit to supply voltage in the signal cable.
- Faulty relay.

Signal too low:
- Short-circuit to ground in the signal cable.
- Open-circuit in the signal cable.
- Faulty relay.

Condition
- None.

Checking the Engine Cooling Fan (FC) Relay

Checking The Engine Cooling Fan (FC) Relay



- Ignition off
- Disconnect engine cooling fan (FC) relay 2/11.

Connect an ohmmeter between engine cooling fan (FC) relay terminals #1 and #2 (relay side).

Other Information

- To access or replace the relay or fuse, see the inside of the cover on the engine compartment relay/fusebox or the Service Manual, wiring diagram section, 3 (39).

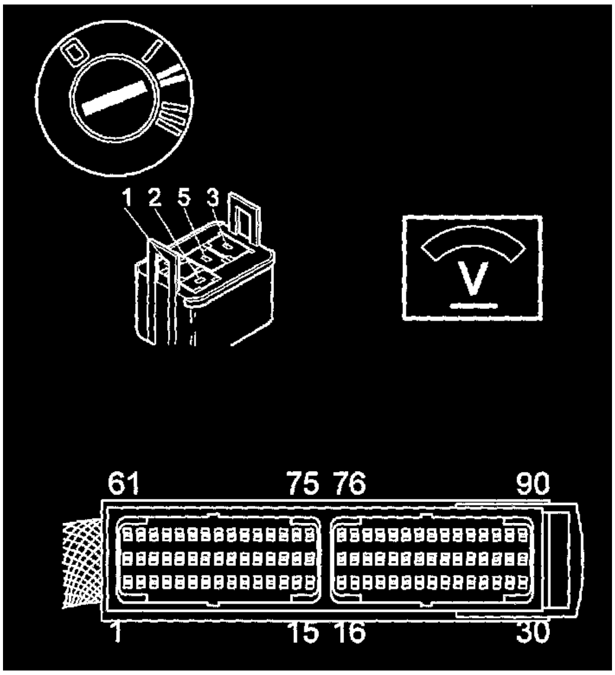
The ohmmeter should read approximately 105 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too High - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too High - Permanent Fault/Defective Air Conditioning (A/C) Condenser Fan Relay

Checking the Signal Cable

Checking The Signal Cable



- Ignition on.

Check the cable between engine cooling fan (FC) relay base terminal #2 and Engine Control Module (ECM) connector terminal #38. Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too High - Permanent Fault/Verification

Defective Air Conditioning (A/C) Condenser Fan Relay

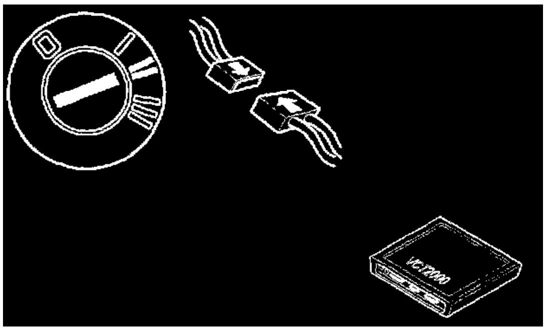
Defective Air Conditioning (A/C) Condenser Fan Relay

Try a new air conditioning (A/C) condenser fan relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too High - Permanent Fault/Verification

Verification

Verification

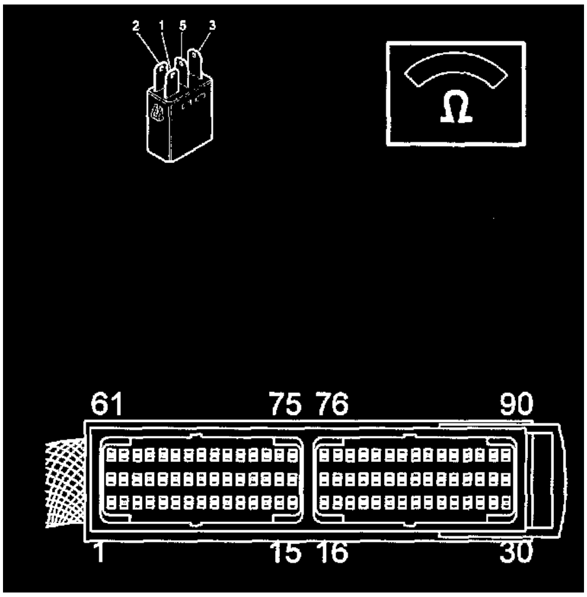


- Reconnect the connectors, reinstall components etc
- Connect VCT20000
- Ignition on.

Activate the engine cooling fan (FC) low-speed using VCT2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Signal Too High Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



Check that the resistance between relay terminals #1 and #2 is approximately **75-105 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) terminal #38 (half speed), terminal #8 (full speed) and terminal #69 (air conditioning (A/C) cooling fan) and relay terminal #2. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

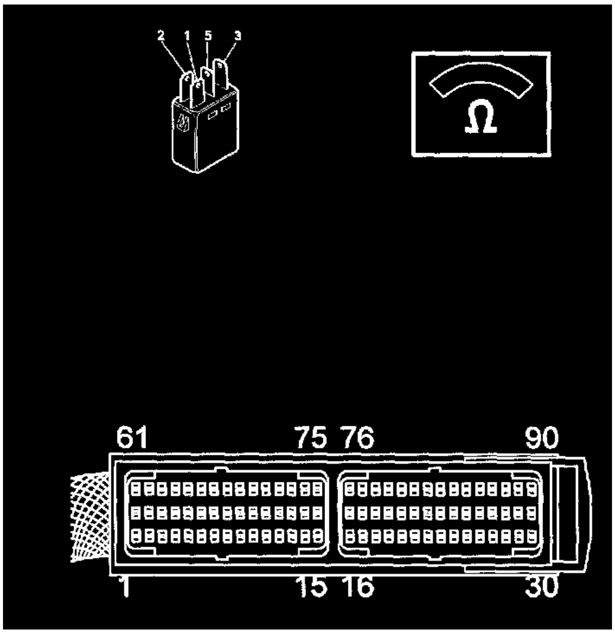
Remedy as necessary.

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Signal Too Low - Intermittent Fault - Checking Wiring

Checking Wiring



Check that the resistance between relay terminals #1 and #2 is approximately **75-105 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) terminal #38 (half speed), terminal #8 (full speed) and terminal #69 (air conditioning (A/C) cooling fan) and relay terminal #2. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

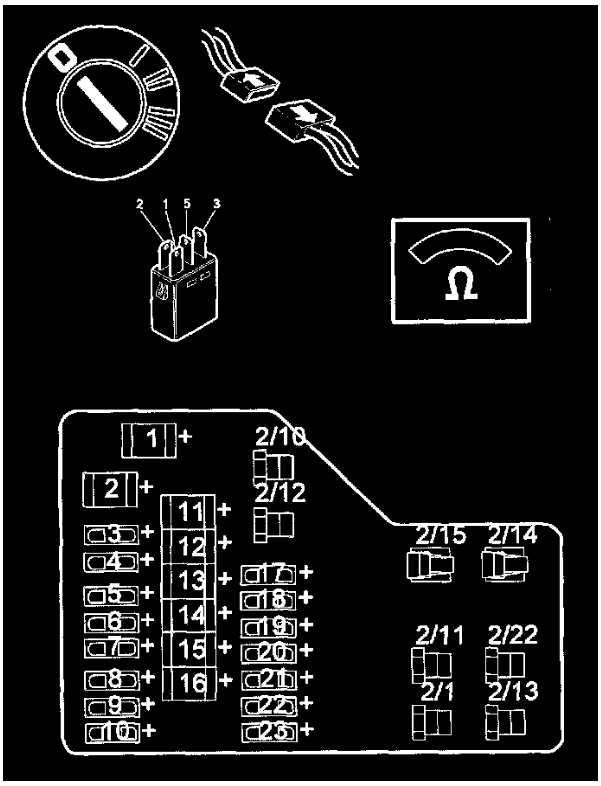
Remedy if necessary.

Other Information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking Engine Cooling Fan (FC) Relay

Checking Engine Cooling Fan (FC) Relay



- Ignition off
- Disconnect engine cooling fan (FC) relay 2/10.

Connect an ohmmeter between the engine cooling fan (FC) relay terminals 1 and 2 (relay side).

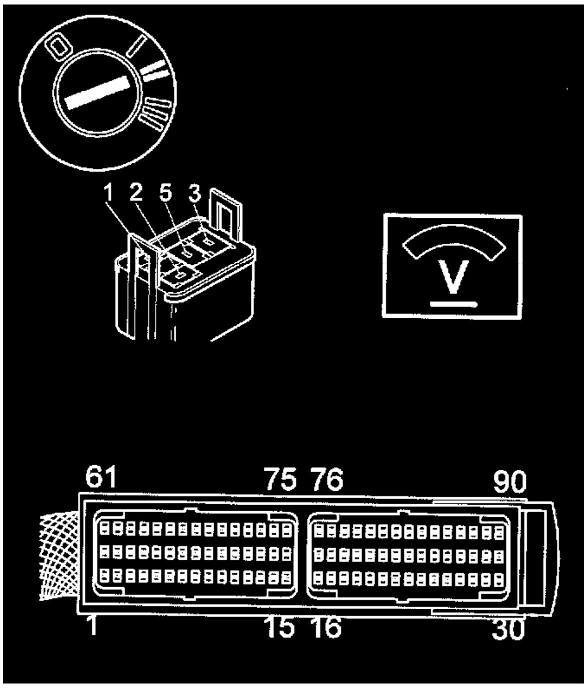
The ohmmeter should read approximately 105 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too Low - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too Low - Permanent Fault/Defective Engine Cooling Fan (FC) Relay

Checking the Signal Cable

Checking The Signal Cable



- Ignition on.

Check the cable between the engine cooling fan (FC) relay base terminal 2 and the Engine Control Module (ECM) connector terminal 38 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too Low - Permanent Fault/Verification

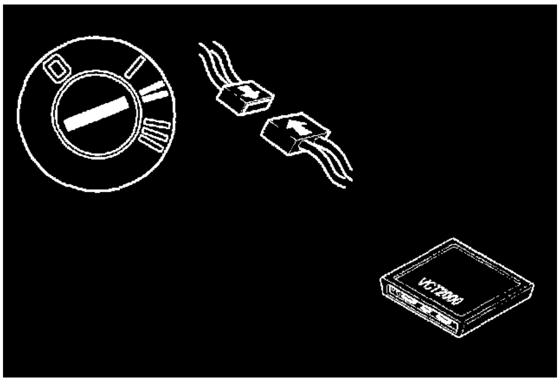
Defective Engine Cooling Fan (FC) Relay

Defective Engine Cooling Fan (FC) Relay

Try a new engine cooling fan (FC) relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too Low - Permanent Fault/Verification

Verification



Verification

- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the engine cooling fan (FC) low-speed using VCT 2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-87 is stored if the control signal circuit for the cooling fan high speed is short- circuited to ground / voltage or if there is an open-circuit in the circuit that the control module has interpreted as a fault.

Condition

None.

Possible source

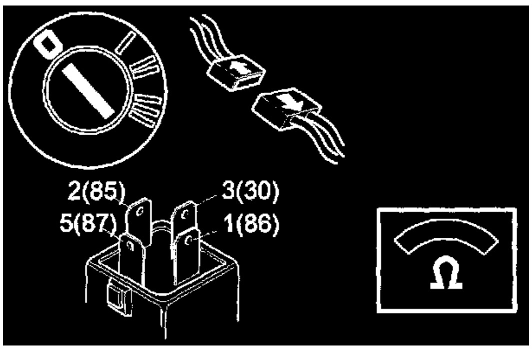
Signal too high:
- Short-circuit to supply voltage in the signal cable.
- Faulty relay.

Signal too low:
- Short-circuit to ground in the signal cable.
- Open-circuit in the signal cable.
- Faulty relay.

Condition
- None.

Checking the Engine Cooling Fan (FC) Relay

Checking The Engine Cooling Fan (FC) Relay



- Ignition off
- Disconnect engine cooling fan (FC) relay 2/15.

Connect an ohmmeter between engine cooling fan (FC) relay terminals #1 and #2 (relay side).

Other Information

- To access or replace the relay or fuse, see the inside of the cover on the engine compartment relay/fusebox or the Service Manual, wiring diagram section, 3 (39).

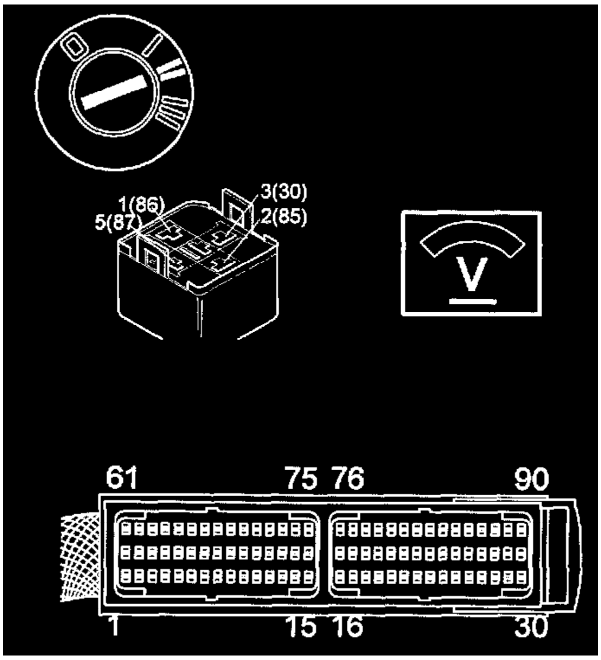
The ohmmeter should read approximately 75 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too High - Permanent Fault/Checking the Signal Cable

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too High - Permanent Fault/Defective Engine Cooling Fan (FC) Relay

Checking the Signal Cable

Checking The Signal Cable



- Ignition on.

Check the cable between the engine cooling fan (FC) relay base terminal #2 and the Engine Control Module (ECM) connector terminal #8. Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too High - Permanent Fault/Verification

Defective Engine Cooling Fan (FC) Relay

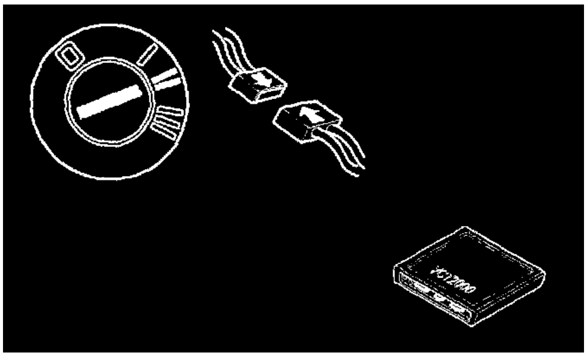
Defective Engine Cooling Fan (FC) Relay

Try a new engine cooling fan (FC) relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-85/Signal Too Low - Permanent Fault/Verification

Verification

Verification

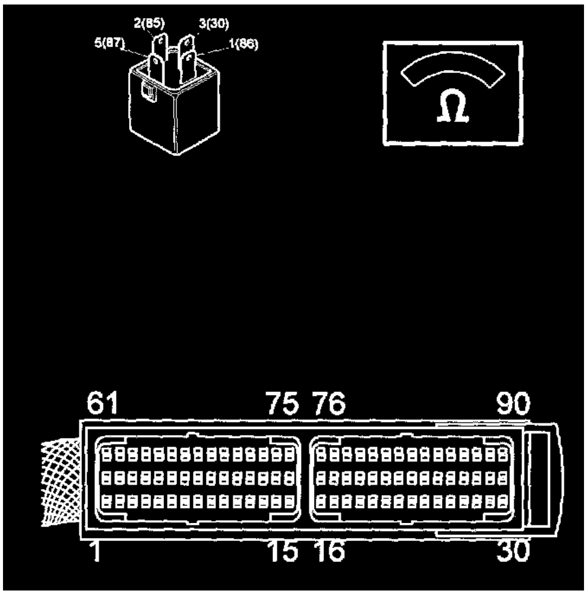


- Reconnect the connectors, reinstall components etc.
- Connect VCT2000
- Ignition on.

Activate the engine cooling fan (FC) high-speed using VCT2000 according to See: Scan Tool Testing and Procedures/Description of Activation

Signal Too High Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



Check that the resistance between relay terminals 1 and 2 is approximately **75 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) #38 (half speed), #8 (full speed), #69 (air conditioning (A/C) cooling fan) and relay terminal 2 for an intermittent short-circuit to supply voltage and remedy according to **Checking wiring and terminals - Intermittent faults**.

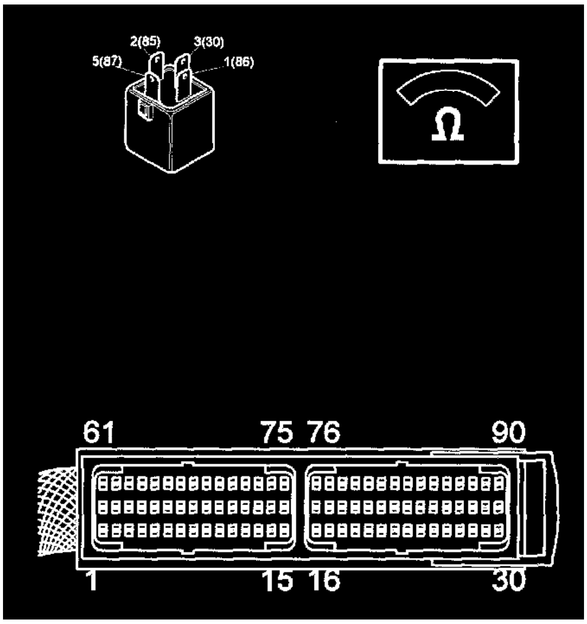
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Signal Too Low - Intermittent Fault - Checking Cables

Checking Cables



Check that the resistance between relay terminals 1 and 2 is approximately **75 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) #38 (half speed), #8 (full speed), #69 (air conditioning (A/C) cooling fan) and relay terminal 2 for an intermittent short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults** and for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

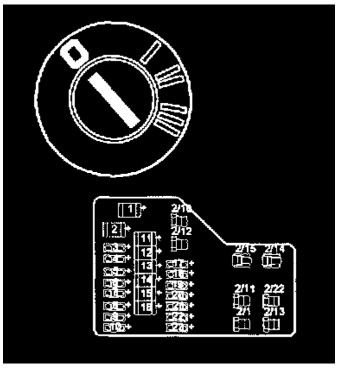
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Fuse

Checking The Fuse



- Ignition off.

Check that fuse 15 in the integrated relay / fusebox in the engine compartment is intact.

Replace if necessary.

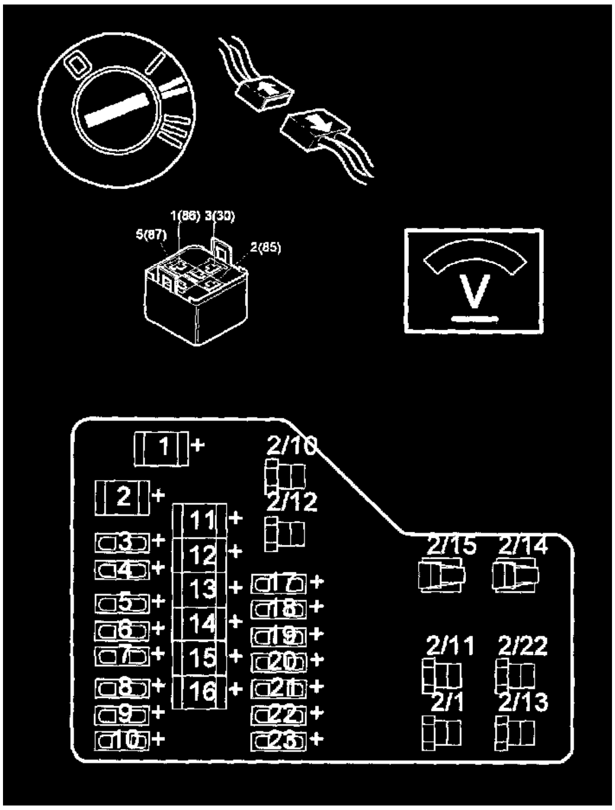
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Checking the Power Supply - I

Checking the Power Supply - I

Checking The Power Supply



- Ignition off
- Disconnect engine cooling fan (FC) relay 2/15
- Ignition on.

Connect a voltmeter between engine cooling fan (FC) relay base terminal #1 and ground.

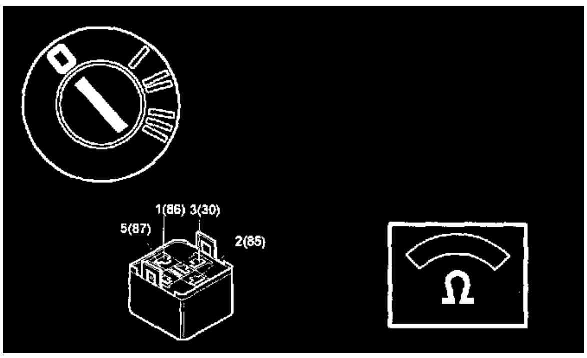
The voltmeter should read battery voltage.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Checking the Signal Cable - I

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Checking the Power Supply - II

Checking the Signal Cable - I

Checking The Signal Cable



- Ignition off.

Connect a voltmeter between engine cooling fan (FC) relay base terminal #2 and ground.

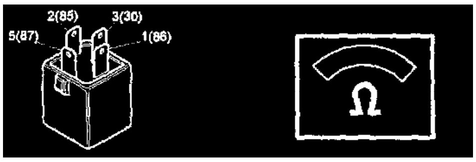
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Checking the Engine Cooling Fan (FC) Relay

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Checking the Signal Cable - III

Checking the Engine Cooling Fan (FC) Relay

Checking The Engine Cooling Fan (FC) Relay



Connect an ohmmeter between the engine cooling fan (FC) relay terminals #1 and #2 (relay side).

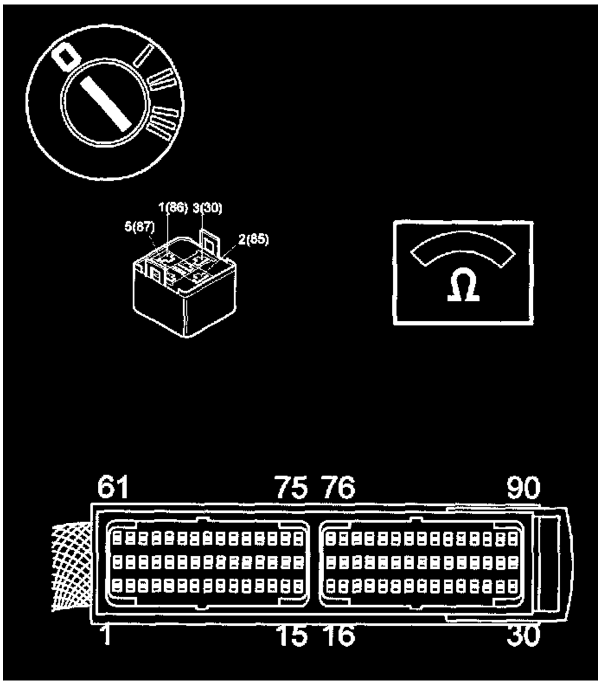
The ohmmeter should read approximately 75 [ohm] at +20°C.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Checking the Signal Cable - II

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Defective Engine Cooling Fan (FC) Relay

Checking the Signal Cable - II

Checking The Signal Cable



- Ignition off.

Check the cable between engine cooling fan (FC) relay terminal #2 and Engine Control Module (ECM) connector terminal #8 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Test Complete

Defective Engine Cooling Fan (FC) Relay

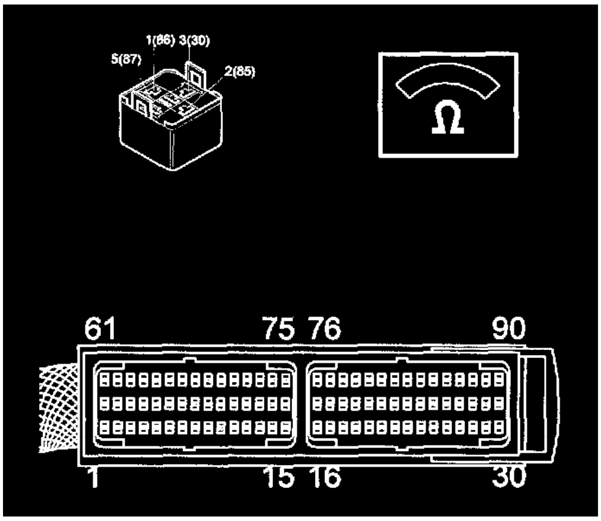
Defective Engine Cooling Fan (FC) Relay

Try a new engine cooling fan (FC) relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Verification

Checking the Signal Cable - III

Checking The Signal Cable



Check the cable between engine cooling fan (FC) relay base terminal #2 and Engine Control Module (ECM) connector terminal #8. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**.

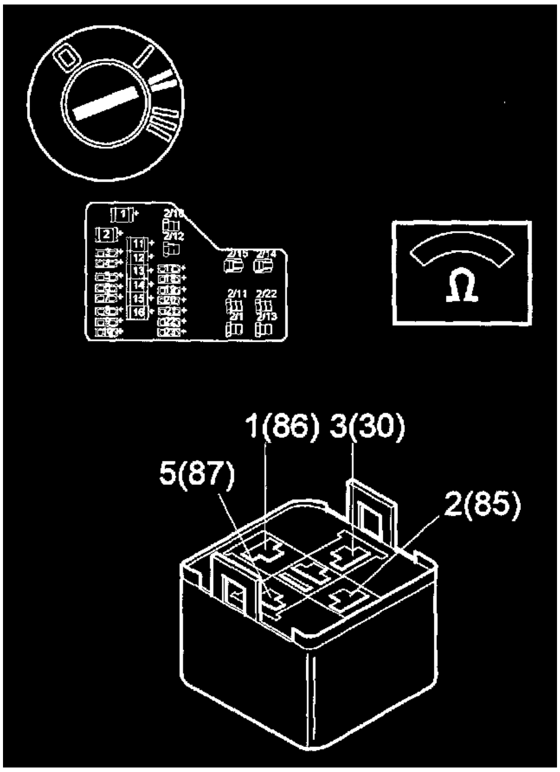
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Verification

Checking the Power Supply - II

Checking The Power Supply



- Ignition on.

Check the cable between engine cooling fan (FC) relay base terminal #1 and fuse 15. Check for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

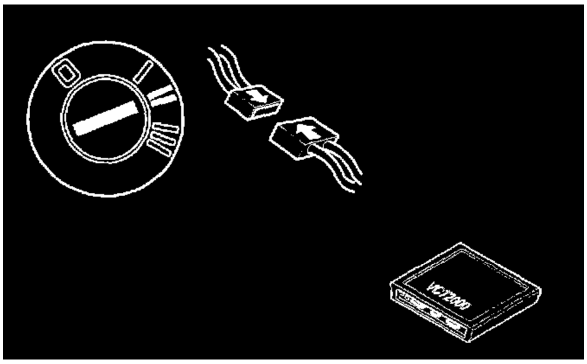
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-87/Signal Too Low - Permanent Fault/Verification

Verification

Verification

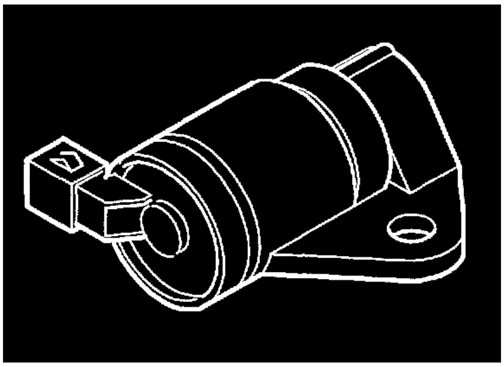


- Reconnect the connectors, reinstall components etc
- Connect VCT 2000
- Ignition on.

Activate the engine cooling fan (FC) high-speed using VCT 2000. See: Scan Tool Testing and Procedures/Description of Activation

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-8A is stored if there is a short-circuit to supply voltage in the Idle Air Control (IAC) valve signal cable or if there is an open-circuit in the circuit that the control module interprets as a fault.

Condition

Fuel shut-off conditions changed.

Possible source

Signal too high:
- Short-circuit to supply voltage in the signal cable.

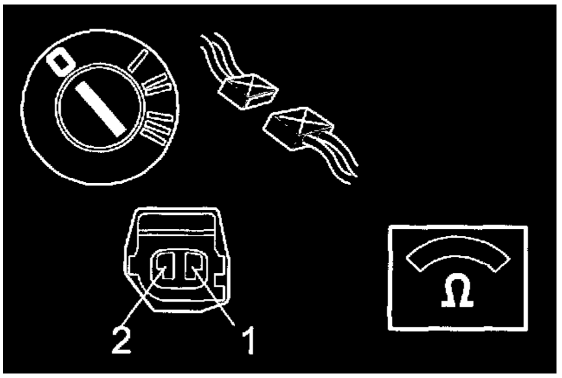
Signal too low:
- Short-circuit to ground in the signal cable.

Signal missing:
- Open-circuit in the signal cable:

Condition
- High idling speed.
- Low idling speed.
- Malfunction indicator lamp (MIL) lit.

Checking the Terminal

Checking The Terminal



- Ignition off
- Idle Air Control (IAC) valve connector disconnected.

Check the Idle Air Control (IAC) valve connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

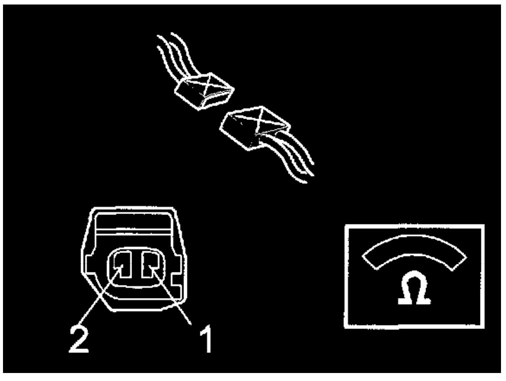
Were any faults found?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Checking Idle Air Control (IAC) Valve

Checking Idle Air Control (IAC) Valve

Checking Idle Air Control (IAC) Valve



- Idle Air Control (IAC) valve connector disconnected.

Connect an ohmmeter between Idle Air Control (IAC) valve connector terminals #1 and #2.

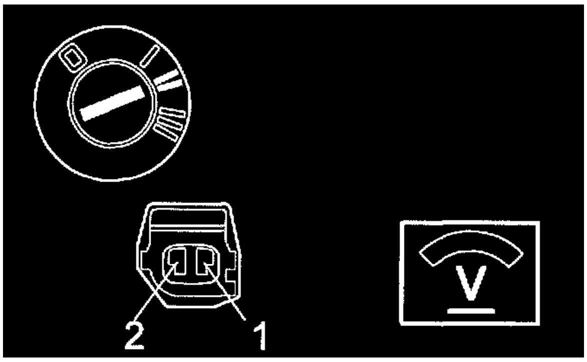
The ohmmeter should read 9-11[ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Checking the Power Supply

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Defective Idle Air Control (IAC) Valve

Checking the Power Supply

Checking The Power Supply



- Ignition on.

Connect a voltmeter between the Idle Air Control (IAC) valve connector terminal #1 (Engine Control Module (ECM) side) and ground.

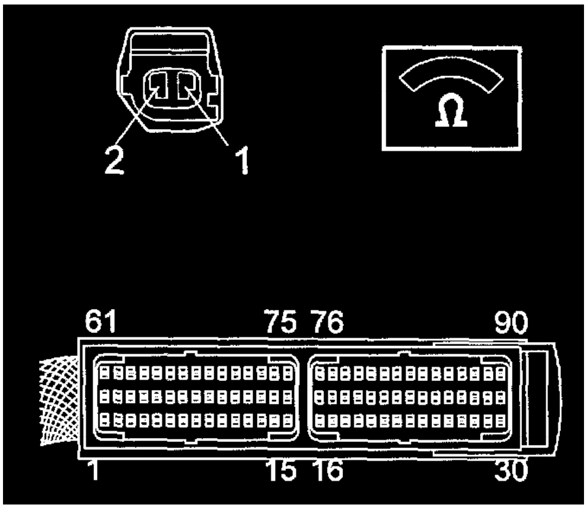
The voltmeter should read battery voltage for 2 seconds immediately after the ignition is switched on.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Checking the Signal Cable - I

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Checking the Signal Cable - II

Checking the Signal Cable - I

Checking The Signal Cable



Check the cable between Idle Air Control (IAC) valve connector terminal #2 and Engine Control Module (ECM) connector terminal #64 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

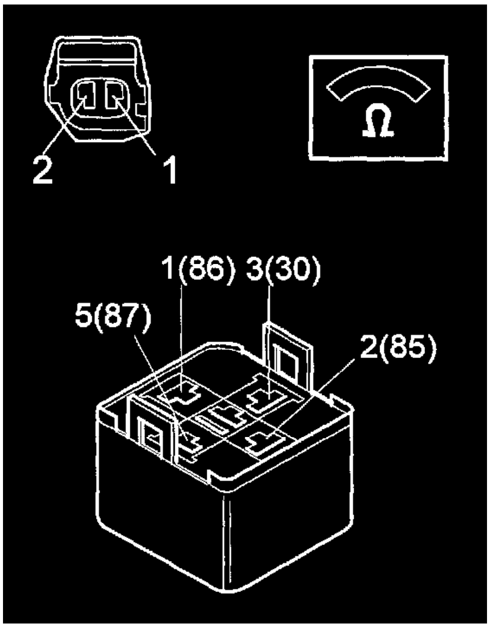
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Verification

Checking the Signal Cable - II

Checking The Signal Cable



Check the cable between Idle Air Control (IAC) valve connector terminal #1 and system relay 2/14 terminal #3 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Verification

Defective Idle Air Control (IAC) Valve

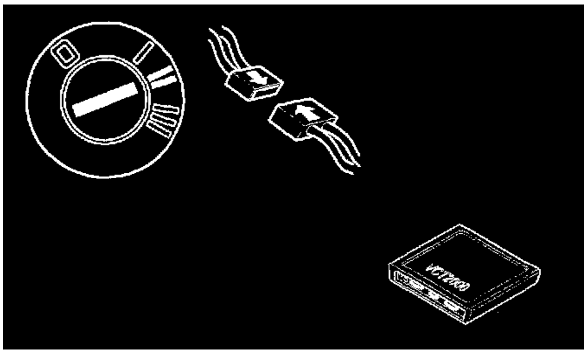
Defective Idle Air Control (IAC) Valve

Try a new Idle Air Control (IAC) valve according to **Replacing the Idle Air Control (IAC) valve**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Missing - Permanent Fault/Verification

Verification

Verification

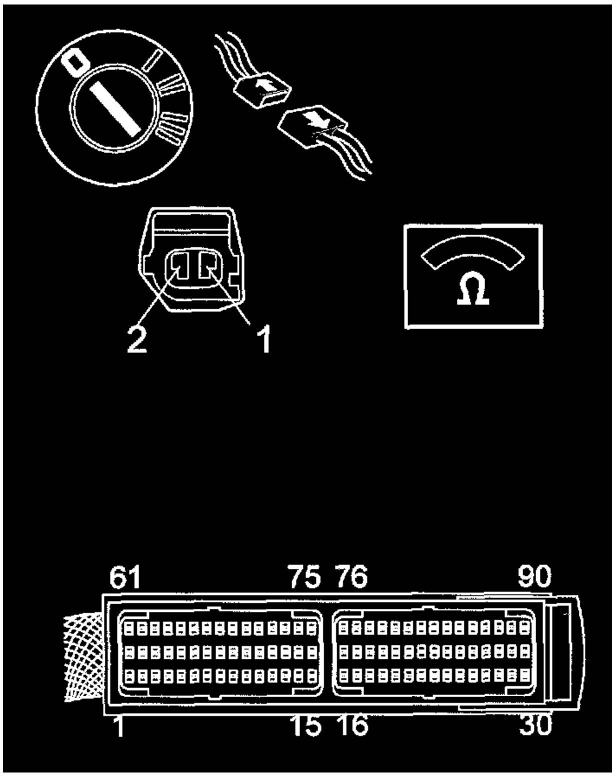


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the Idle Air Control (IAC) valve by clicking on the VCT 2000 symbol.

Signal Missing Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



- Ignition off
- Disconnect Idle Air Control (IAC) valve.

Check that the resistance in the Idle Air Control (IAC) valve between terminals 1 and 2 is approximately **10 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) terminal 64 and Idle Air Control (IAC) valve terminal 2 for an intermittent open-circuit. Remedy according to **Checking wiring and terminals - Intermittent faults**.

Check the power supply cable between Idle Air Control (IAC) valve terminal 1 and system relay (2/14) terminal 3 for an intermittent open-circuit and remedy according to **Checking wiring and terminals - Intermittent faults**.

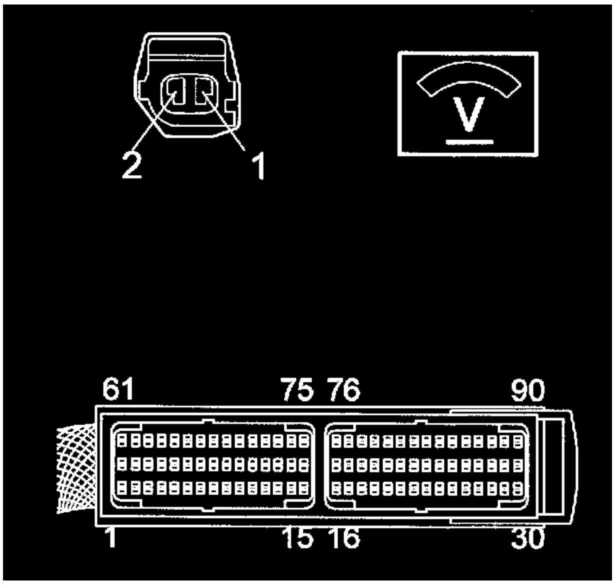
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking Idle Air Control (IAC) Valve

Checking Idle Air Control (IAC) Valve



Check that the Idle Air Control (IAC) valve resistance across terminals 1 and 2 is approximately 10[ohm].

Check the signal cable between Idle Air Control (IAC) valve terminal 2 and Engine Control Module (ECM) terminal 64 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

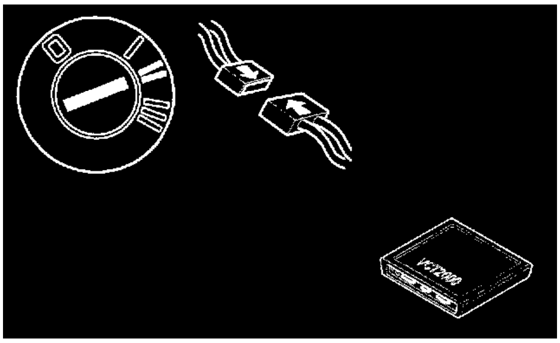
Other Information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Too High - Permanent Fault/Verification

Verification

Verification

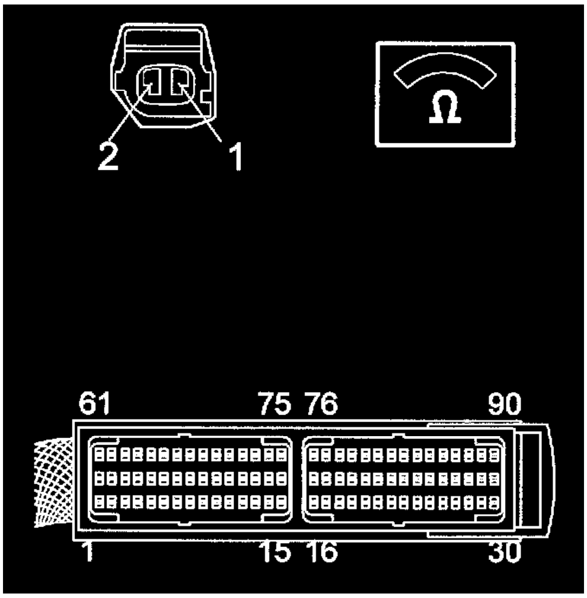


- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the Idle Air Control (IAC) valve by clicking on the VCT 2000 symbol.

Signal Too High Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



Check that the resistance between Idle Air Control (IAC) valve terminals 1 and 2 is approximately **10 [ohm] at +20°C**.

Check the signal cable between Engine Control Module (ECM) terminal 64 and Idle Air Control (IAC) valve terminal 2 for an intermittent short-circuit to supply voltage. Remedy according **Checking wiring and terminals - Intermittent faults**.

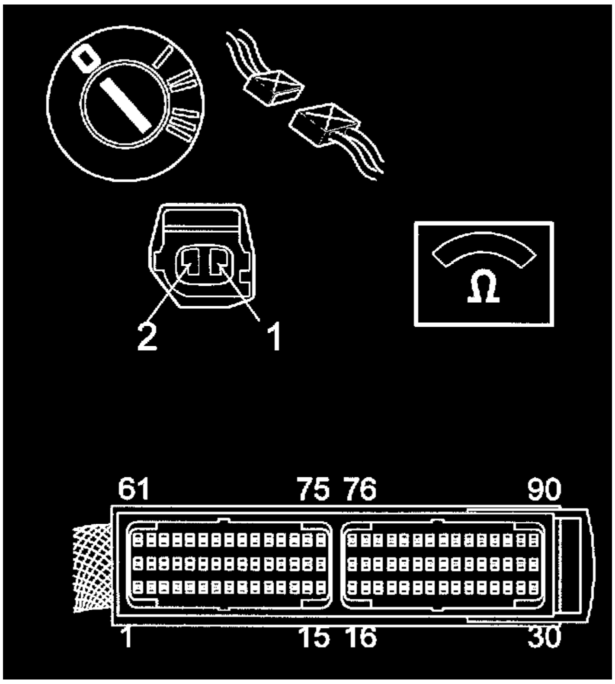
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Idle Air Control (IAC) valve disconnected.

Check the cable between Idle Air Control (IAC) valve connector terminal 2 (control module side) and Engine Control Module (ECM) terminal 64 for a short-circuit to ground according **Checking wiring and terminals - Permanent faults**.

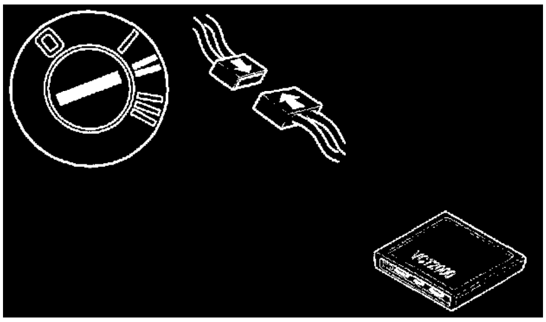
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8A/Signal Too Low - Permanent Fault/Verification

Verification

Verification

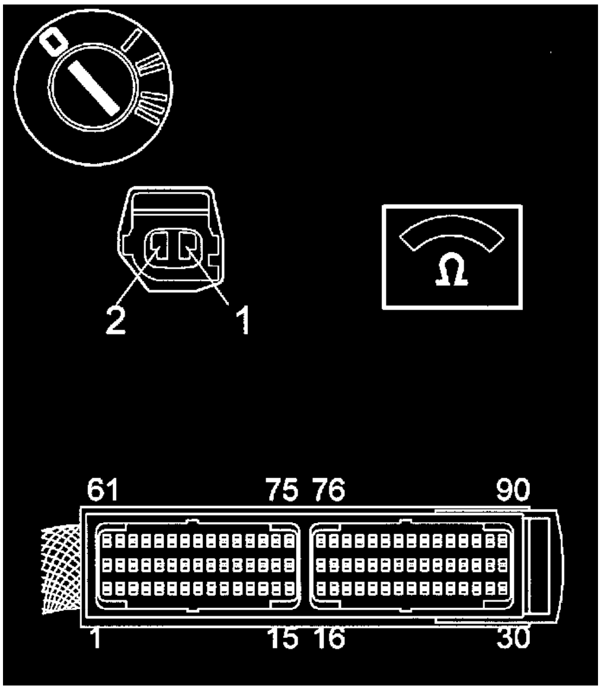


- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Activate the Idle Air Control (IAC) valve by clicking on the VCT 2000 symbol.

Signal Too Low Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



- Ignition off.

Check that the resistance between Idle Air Control (IAC) valve terminals 1 and 2 is approximately **10 [ohm] at +20°C**.

Check signal cable between Engine Control Module (ECM) terminal 64 and Idle Air Control (IAC) valve terminal 2 for an intermittent short-circuit to ground. Remedy according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-8D is stored if the idling speed is too high or too low when the throttle position (TP) sensor is in the closed position.

Condition

- No fuel trim adaptation
- Limited EVAP control
- The conditions for fuel shut-off are changed.

Possible source

Signal too low:

- The Idle Air Control (IAC) valve sticks in the closed position
- Blocked hoses
- Contact resistance.

Signal too high:

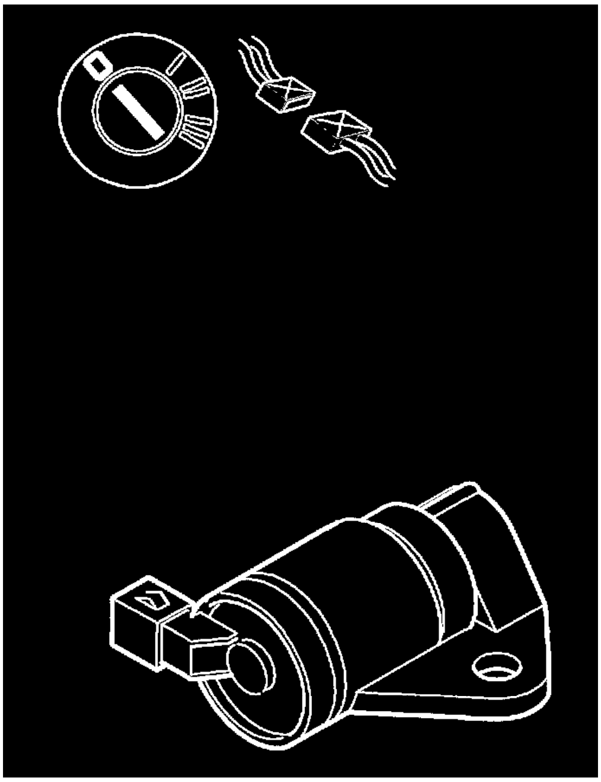
- The Idle Air Control (IAC) valve sticks in the open position
- Defective throttle position (TP) sensor
- Air leakage in the intake system.

Condition

- Low idling speed
- High idling speed.

Signal Too High - Intermittent Fault - Checking the Connectors

Checking The Connectors



- Ignition off
- Check the Idle Air Control (IAC) valve and throttle position (TP) sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**. Check for damage carefully

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

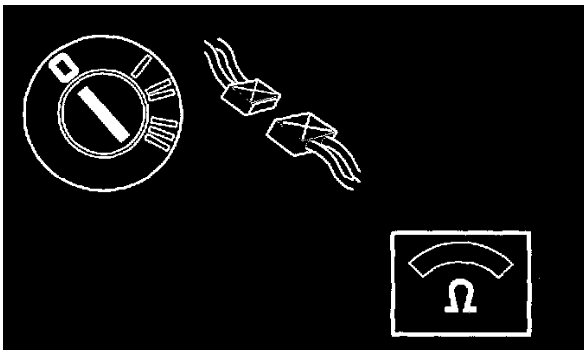
- Check the throttle body (TB) for play between the throttle spindle and the throttle position (TP) sensor according to **Replacing throttle position (TP) sensor**
- Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System

- Remedy as necessary.

Other Information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the Idle Air Control (IAC) valve, see **Replacing the Idle Air Control (IAC) valve**
- To replace the throttle position (TP) sensor, see **Replacing throttle position (TP) sensor**.

Checking the Connectors

Checking The Connectors



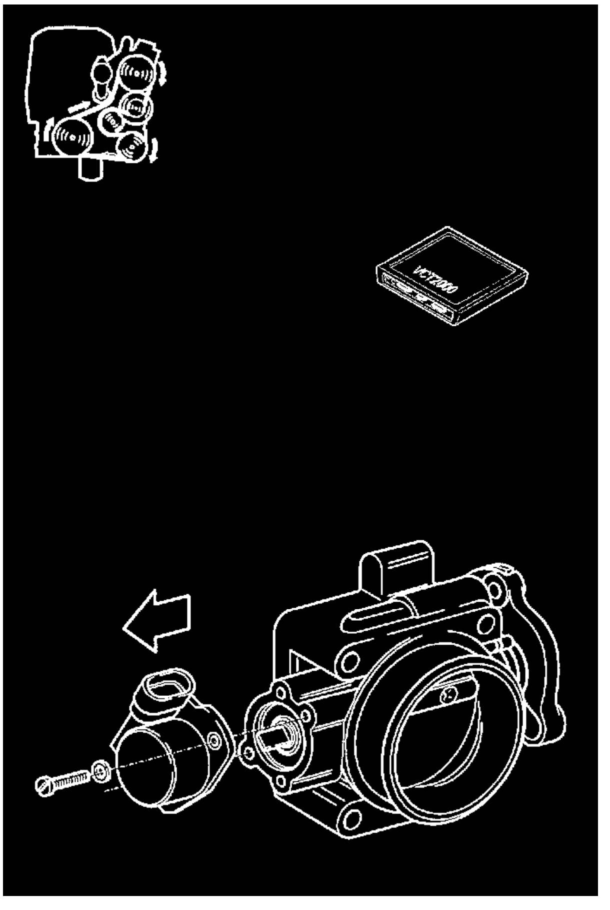
- Ignition off
- Check the Idle Air Control (IAC) valve and throttle position (TP) sensor connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**. Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8D/Signal Too High - Permanent Fault/Checking Components

Checking Components

Checking Components



- Ignition off
- Reinstall the connectors
- Start the engine.

Click on the VCT2000 symbol to read off the value for the throttle angle.

Open the throttle slightly and check that the throttle angle signal increases with increased throttle angle.

NOTE: In particular, check the signal in the area before closed position. (Close to idling speed).

Other Information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

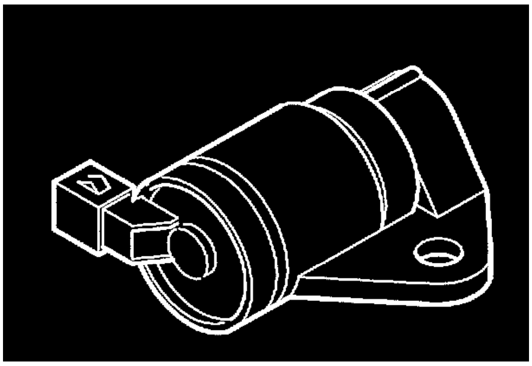
Is the throttle position (TP) sensor signal correct?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8D/Signal Too High - Permanent Fault/Checking For Air Leakage

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8D/Signal Too High - Permanent Fault/Checking the Component

Checking For Air Leakage

Checking For Air Leakage

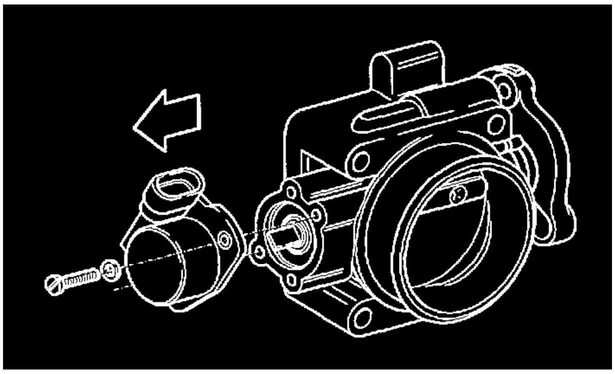


- Check the intake system for air leakage according to See: Component Tests and General Diagnostics/Check For Air Leaks In the Intake System
- Replace the Idle Air Control (IAC) valve if no air leakage is found in the above fault-tracing. See **Replacing the Idle Air Control (IAC) valve**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8D/Signal Too High - Permanent Fault/Verification

Checking the Component

Checking The Component



Check the throttle body (TB) for play between the throttle spindle and the throttle position (TP) sensor.

Remedy as necessary.

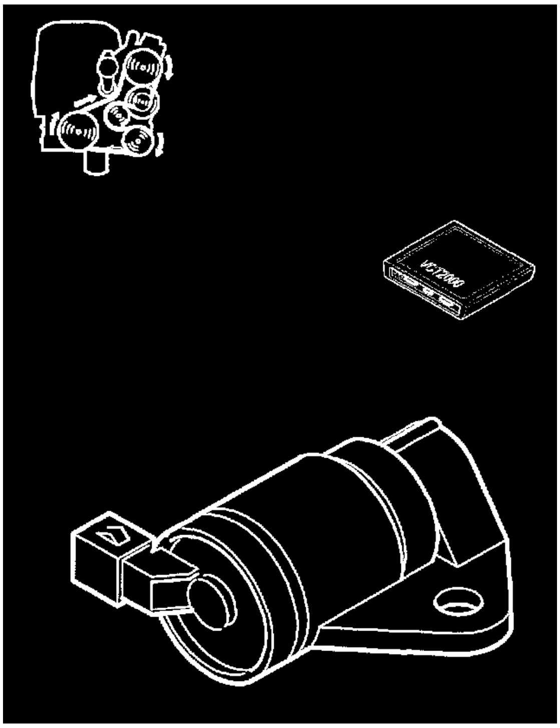
Try a new throttle position (TP) sensor if no fault is found during the above fault-tracing.

Other Information:
- To check and replace the throttle position (TP) sensor, see **Replacing throttle position sensor**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8D/Signal Too High - Permanent Fault/Verification

Verification

Verification

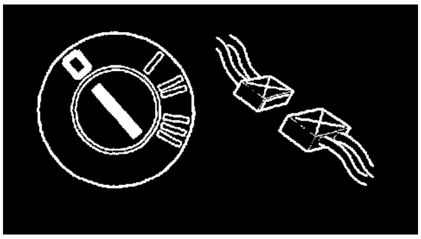


HINT: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine and run it to normal operating temperature. Let the engine idle.
- Read off the engine speed (RPM) by clicking the symbol for VCT-2000
- Check that the idling speed is be approximately **750 rpm**

Signal Too Low - Intermittent Fault - Checking the Connectors

Checking The Connectors



- Ignition off
- Check the Idle Air Control (IAC) valve and throttle position (TP) sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**. Check for damage carefully

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

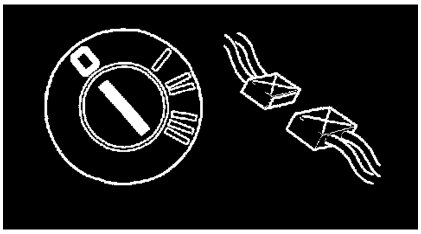
- Remove the Idle Air Control (IAC) valve according to **Replacing the Idle Air Control (IAC) valve**. Check if the hoses and ducts for the idling system and throttle angle are blocked.

Other Information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the Idle Air Control (IAC) valve, see **Replacing the Idle Air Control (IAC) valve**.

Checking the Connectors

Checking The Connectors



- Ignition off
- Check the Idle Air Control (IAC) valve and throttle position (TP) sensor connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**. Check for damage carefully

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

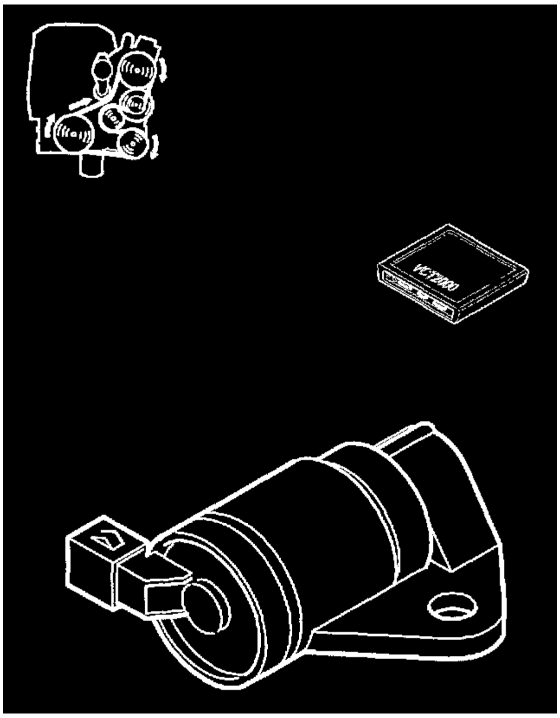
- Remove the Idle Air Control (IAC) valve according to **Replacing the Idle Air Control (IAC) valve**. Check if the hoses and ducts for the idling system and throttle angle are blocked
- Try a new Idle Air Control (IAC) valve if no fault is found during the above fault-tracing.

Other Information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-8D/Signal Too High - Permanent Fault/Verification

Verification

Verification

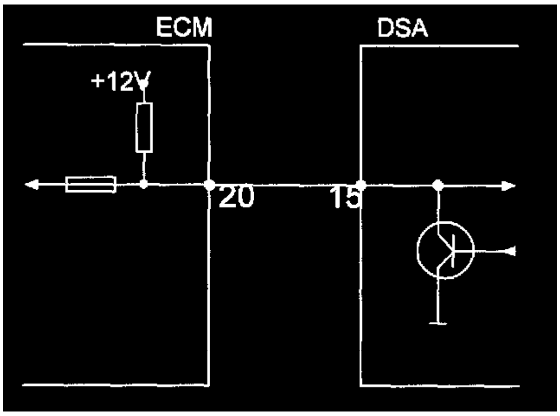


HINT: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine and run it to normal operating temperature. Let the engine idle.
- Read off the engine speed (RPM) by clicking the symbol for VCT-2000
- Check that the idling speed is be approximately **750 rpm**

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

During anti-spin control, the DSA Control module transmits a signal to the Engine Control Module (ECM) which requests torque limiting.

Diagnostic trouble code (DTC) EFI-91 is stored if: The signal cable for the DSA control module is short-circuited to ground, short-circuited to Supply voltage or there is an open-circuit in the circuit (signal missing). The signal from the DSA control module exists but is faulty (faulty signal). There are diagnostic trouble codes (DTCs) in the DSA control module (DTCs in the DSA). The initiating signal from the DSA control module is missing or is faulty (initiating fault).

Condition

DSA deactivated.

Possible source

Signal missing:

- Open-circuit in the signal cable.
- Short-circuit to ground in the signal cable.
- Short-circuit to supply voltage in the signal cable.
- Faulty DSA.

Faulty signal:

- Contact resistance in the terminals.
- Loose connections.
- Faulty DSA.

Diagnostic trouble code (DTC) in the DSA:

- Diagnostic trouble code (DTC) in the DSA.

Initiating fault:

- Contact resistance in the terminals.
- Loose connections.
- Faulty DSA.

Condition

- None.

DTC In the DSA - Intermittent Fault - Checking the DSA System

Checking The DSA System

Read off diagnostic trouble codes (DTCs) in the DSA system.
This is carried out via VIDA communication

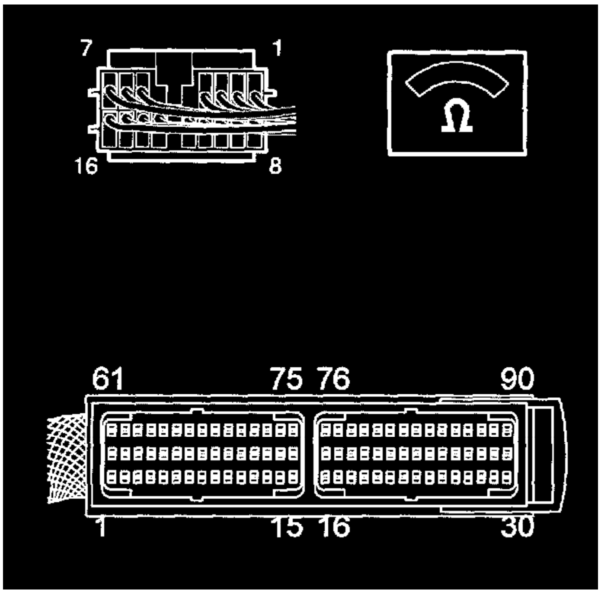
DTC In the DSA - Permanent Fault - Checking the DSA System

Checking The DSA System

Read off diagnostic trouble codes (DTCs) in the DSA system.
This is carried out via VIDA communication

Faulty Signal - Intermittent Fault - Checking Wiring

Checking Wiring



Check the DSA control module and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and Intermittent faults**.

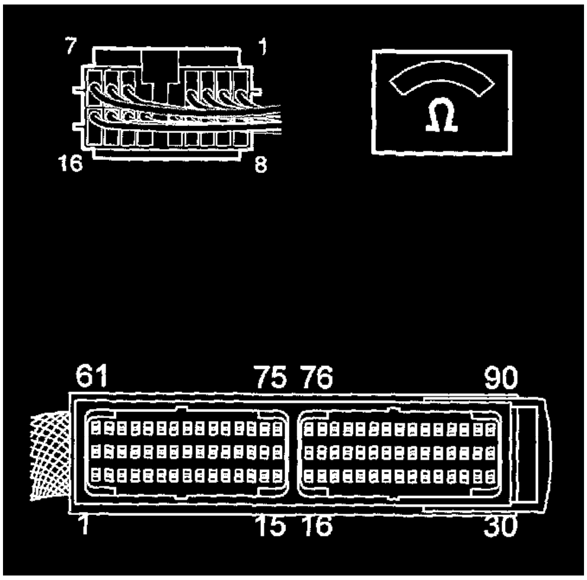
Check in particular for damaged or loose terminal pins.

Check the signal cable between the Engine Control Module (ECM) terminal #20 and DSA control module terminal 15 for an intermittent open-circuit and remedy according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Checking Wiring

Checking Wiring



Check the Engine Control Module (ECM) and DSA control module connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Check in particular for damaged or loose terminal pins.

Check the signal cable between Engine Control Module (ECM) terminal #20 and DSA control module terminal #15.

Check for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

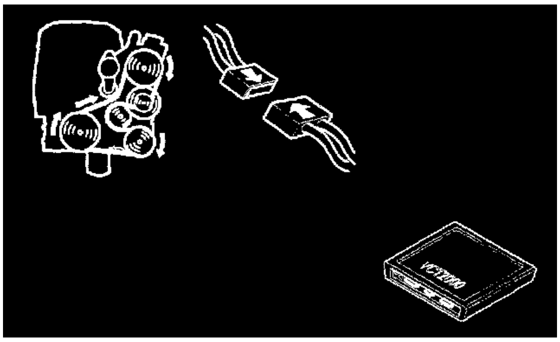
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy if necessary.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control

Verification

Verification

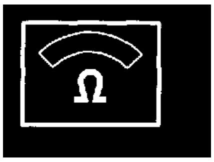


- Ignition off
- Reconnect the connectors, reinstall components etc.
- Start the engine.

Read off diagnostic trouble codes (DTCs).

Initiation Fault - Intermittent Fault - Checking Wiring

Checking Wiring



Check the DSA control module and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

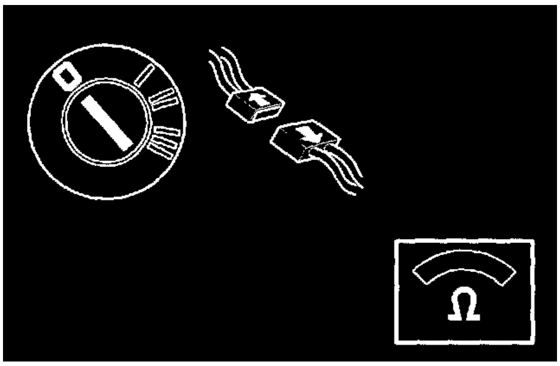
Check in particular for damaged or loose terminal pins.

Check the signal cable between the Engine Control Module (ECM) #20 and DSA control module terminal 15 for an intermittent open-circuit and remedy according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Checking Terminals

Checking Terminals



- Ignition off
- Disconnect the Engine Control Module (ECM) and DSA control module connectors.

Check the connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

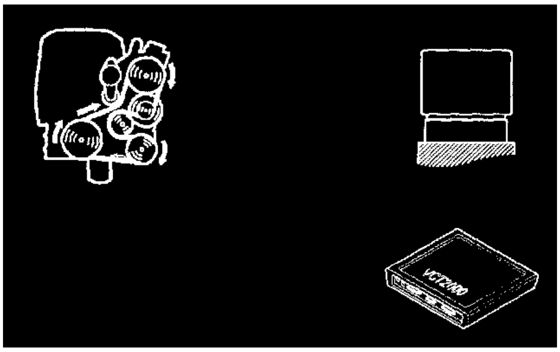
Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Initiation Fault - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Initiation Fault - Permanent Fault/Checking the Status of the Diagnostic Trouble Code (DTC)

Checking the Status of the Diagnostic Trouble Code (DTC)

Checking The Status Of The Diagnostic Trouble Code (DTC)



- Ignition off.
- Start and stop the engine a few times.
- Let the engine idle.

Read off diagnostic trouble codes (DTCS).

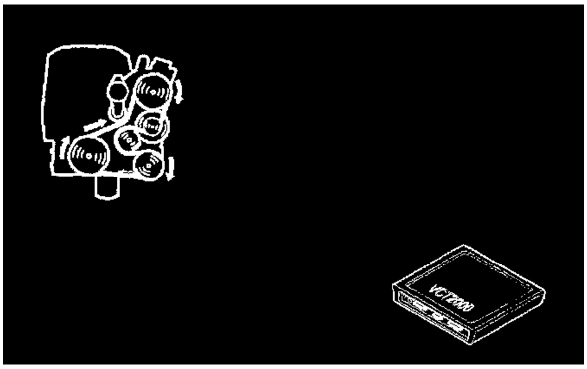
Is diagnostic trouble code (DTC) DSA-223 still stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Initiation Fault - Permanent Fault/Checking the DSA Control Module

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Initiation Fault - Permanent Fault/Replacing the Component - II

Checking the DSA Control Module

Checking The DSA Control Module



- Ignition off.
- Expose the DSA Control module.
- Disconnect the DSA control module.
- Connect a new DSA control module alongside.
- Start and stop the engine a few times.
- Let the engine idle.

Read off diagnostic trouble codes (DTCs).

Is diagnostic trouble code (DTC) DSA-223 still stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Initiation Fault - Permanent Fault/Replacing the Component - I

No - This information to be published by O.E. at a later date.

Replacing the Component - I

Replacing The Component

The old DSA control module is OK: Reinstall it.

NOTE: It is vital that any diagnostic trouble codes (DTCs) in the Engine Control Module (ECM) and the DSA control module are remedied before the Engine Control Module (ECM) is replaced.

FENIX 5.1

- Try a new Engine Control Module (ECM) according to **Replacing Engine Control Module (ECM)**.

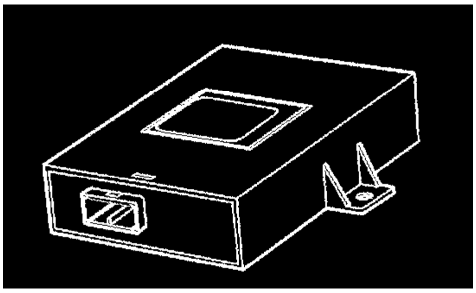
EMS 2000

- Try a new Engine Control Module (ECM) according to **Replacing the Engine Control Module (ECM)**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Initiation Fault - Permanent Fault/Verification

Replacing the Component - II

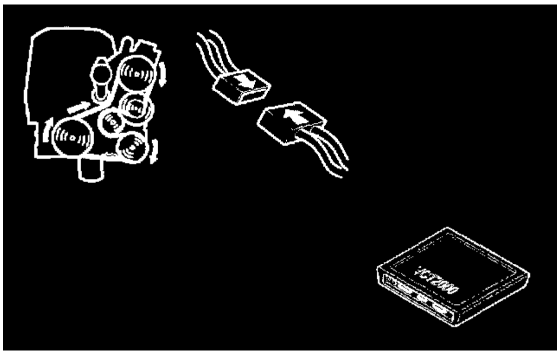
Replacing The Component



The old DSA control is defective.
Install the new DSA control module.

Verification

Verification

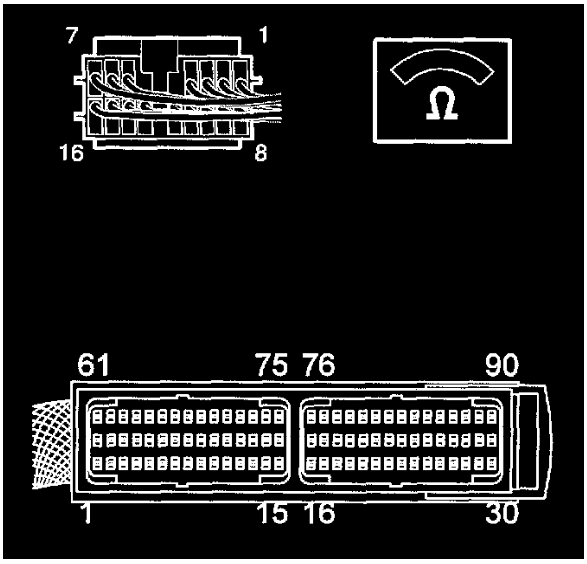


- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000.
- Start and stop the engine a few times.

Read off diagnostic trouble codes (DTCs).

Signal Missing - Intermittent Fault - Checking Wiring

Checking Wiring



Check the DSA control module and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

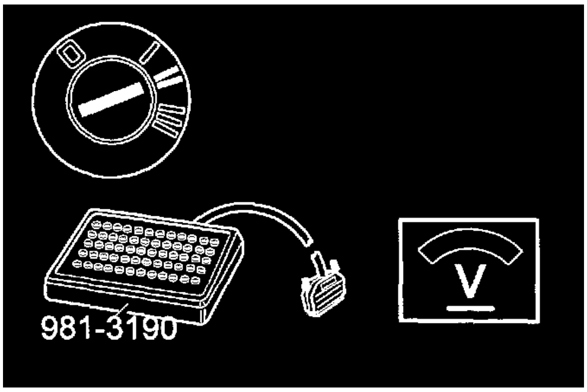
Check in particular for damaged or loose terminal pins.

Check the signal cable between the Engine Control Module (ECM) terminal #20 and DSA control module terminal 15 for an intermittent open-circuit and remedy according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Connect the breakout box
- Ignition on.

Connect a voltmeter between the breakout box terminal #B5 and ground.

HINT:

Other Information
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

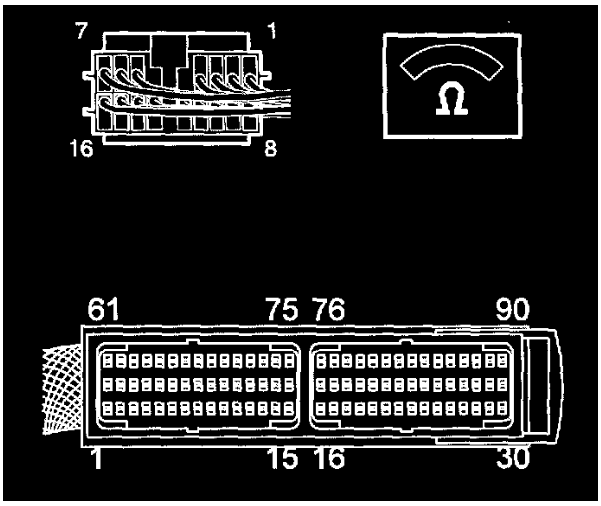
The voltmeter should read **5 V**.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Signal Missing - Permanent Fault/Checking Wiring and Terminals

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-91/Signal Missing - Permanent Fault/Checking Wiring and Terminals

Checking Wiring and Terminals

Checking Wiring And Terminals



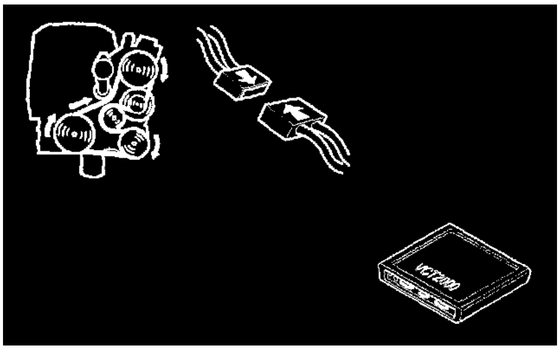
Check the cable between Engine Control Module (ECM) terminal #20 and DSA control module terminal # 15. Check for an open-circuit according to **Checking wiring terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Verification

Verification



- Ignition off
- Reconnect the connectors, reinstall components etc.
- Start the engine.

Read off diagnostic trouble codes (DTCs).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-9A/9B is stored if the Engine Control Module (ECM) has not succeeded in communicating with the immobilizer within 2 seconds of the ignition being switched on (no communication) or if the control module detects an incorrect VIN code 3 times (faulty VIN).

HINT: Diagnostic trouble codes (DTCs) are stored in the immobilizer in the event of this fault.

Condition

None.

Possible source

No communication:

- Open-circuit in the signal cable
- Short-circuit to ground in the signal cable
- Short-circuit to supply voltage in the signal cable
- Contact resistance in the Engine Control Module (ECM) and immobilizer control module terminals
- Defective immobilizer control module.

Faulty VIN:

- The VIN code differs between the Engine Control Module (ECM) and the immobilizer.

Condition

- Engine does not start.

Fault-Tracing Information - Information

Information

No fault-tracing has been developed for the diagnostic trouble code (DTC) for this fault. The diagnostic trouble code (DTC) may also be stored in another system for which there are fault-tracing procedures. Read off diagnostic trouble codes (DTCs) from the affected system. Fault-trace the system. For further information about this diagnostic trouble code (DTC), select Information, then DTC information.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-9A/9B is stored if the Engine Control Module (ECM) has not succeeded in communicating with the immobilizer within 2 seconds of the ignition being switched on (no communication) or if the control module detects an incorrect VIN code 3 times (faulty VIN).

HINT: Diagnostic trouble codes (DTCs) are stored in the immobilizer in the event of this fault.

Condition

None.

Possible source

No communication:

- Open-circuit in the signal cable
- Short-circuit to ground in the signal cable
- Short-circuit to supply voltage in the signal cable
- Contact resistance in the Engine Control Module (ECM) and immobilizer control module terminals
- Defective immobilizer control module.

Faulty VIN:

- The VIN code differs between the Engine Control Module (ECM) and the immobilizer.

Condition

- Engine does not start.

Faulty VIN - Information

Information

No fault-tracing has been developed for this diagnostic trouble code (DTC). The diagnostic trouble code (DTC) may also be stored in another system for which there are fault-tracing procedures. Read off diagnostic trouble codes (DTCs) from the affected system. Fault-trace the system. For further information about this diagnostic trouble code (DTC), select Information, then DTC information.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-9D is stored if the Engine Control Module (ECM) detects an internal fault.

Condition

Fuel injection is disabled.

Possible source
- Defective Engine Control Module (ECM).

Condition
- Engine does not start.

Internal Fault Intermittent Fault Trouble-Shooting Information

Trouble-shooting Information

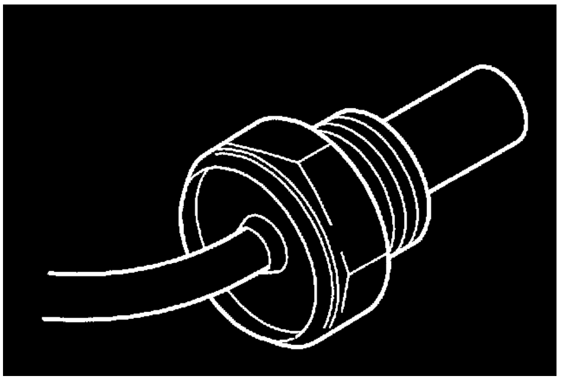
The diagnostic trouble code indicates that the control unit has registered an intermittent fault on a previous occasion but that the fault is no longer there.

Internal Fault - Permanent Fault - Defective Control Module I

Defective Control Module I

Replace the Engine Control Module (ECM) according to **Replacing the Engine Control Module (ECM)**.

Diagnostic Trouble Code (DTC) Information



Diagnostic Trouble Code (DTC) Information

Condition

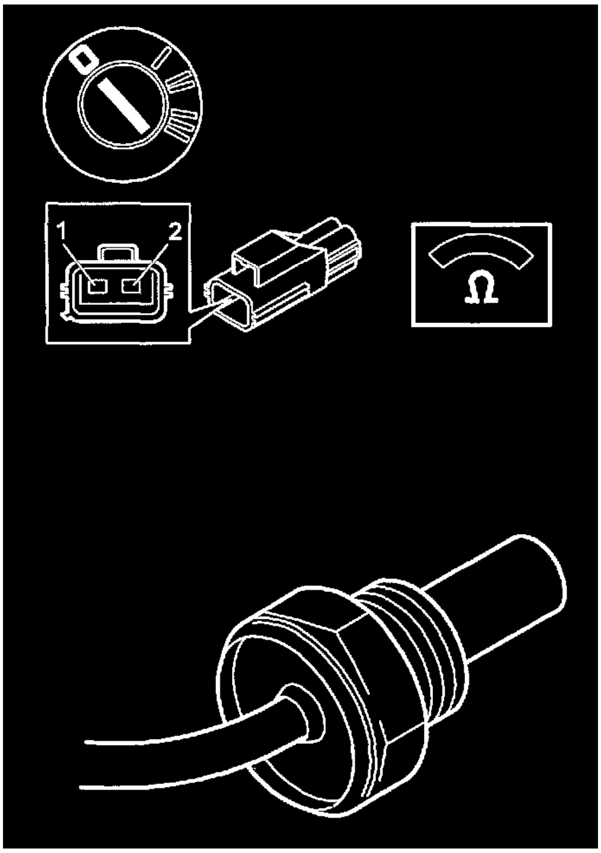
Diagnostic trouble code (DTC) ECM-A0 is stored if the control module detects rapid changes in the Engine Coolant Temperature (ECT).

Condition
- No fuel trim
- Limited EVAP control
- No three-way catalytic converter (TWC) diagnostic.

Possible source
- Defective Engine Coolant Temperature (ECT) sensor
- Contact resistance in the terminals.

Condition
- Malfunction indicator lamp (MIL) lit
- High fuel consumption.

Faulty Signal - Permanent Fault - Checking Wiring & Connectors



Checking Wiring And Connectors

- Ignition off

Check the Engine Coolant Temperature (ECT) sensor connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) terminals visually according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

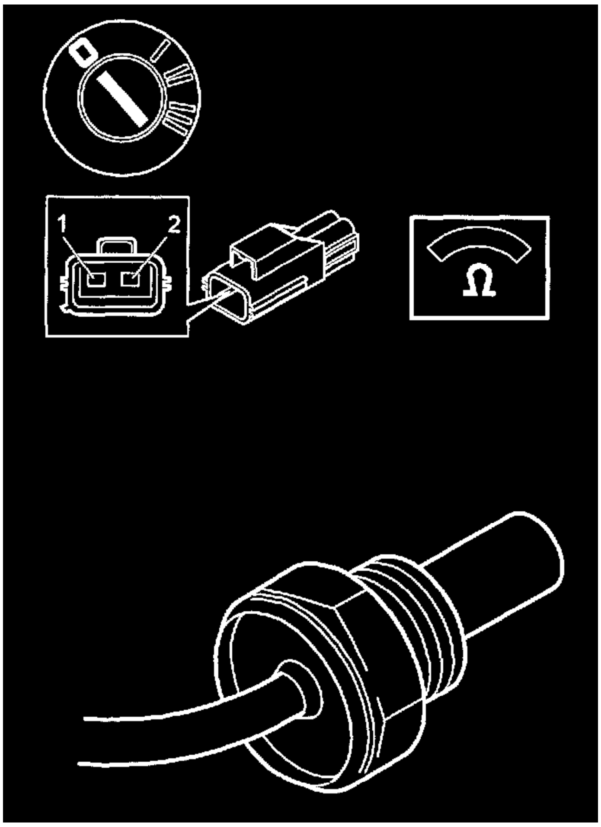
Remedy as necessary.

Try a new Engine Coolant Temperature (ECT) sensor if no fault is found during the above fault-tracing.

Other Information:

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the Engine Coolant Temperature (ECT) sensor, see **Replacing the Engine Coolant Temperature (ECT) sensor**.

Faulty Signal Intermittent Fault Checking Wiring & Connectors



Checking Wiring And Connectors

- Ignition off.

Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) connectors for intermittent contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) terminals visually according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other Information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the Engine Coolant Temperature (ECT) sensor, see **Replacing the Engine Coolant Temperature (ECT) sensor**.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) ECM-A1 is stored if the control module detects that the correct Engine Coolant Temperature (ECT) is not reached or that the Engine Coolant Temperature (ECT) rises too slowly.

Condition

None.

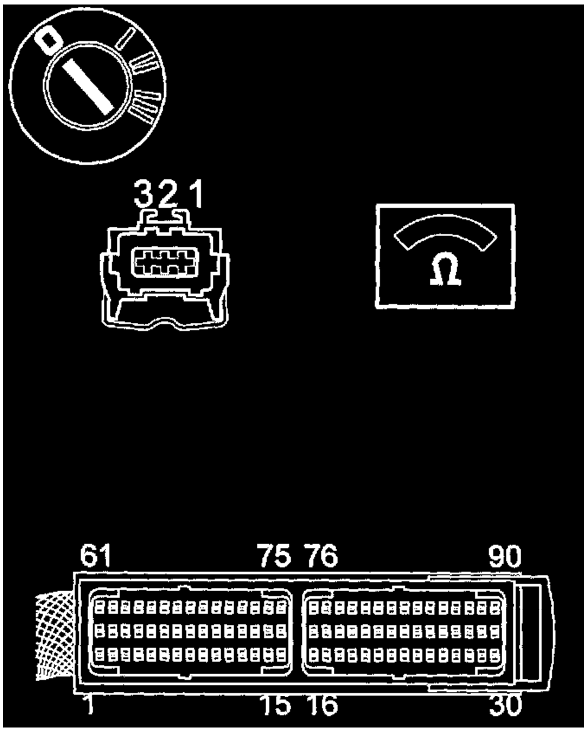
Possible source
- Defective thermostat
- Defective Engine Coolant Temperature (ECT) sensor
- Contact resistance in the terminals.

Condition
- Malfunction indicator lamp (MIL) lit
- Low Engine Coolant Temperature (ECT)

- The Engine Coolant Temperature (ECT) warning lamp is lit.

Faulty Signal - Intermittent Fault - Checking the Connectors

Checking The Connectors



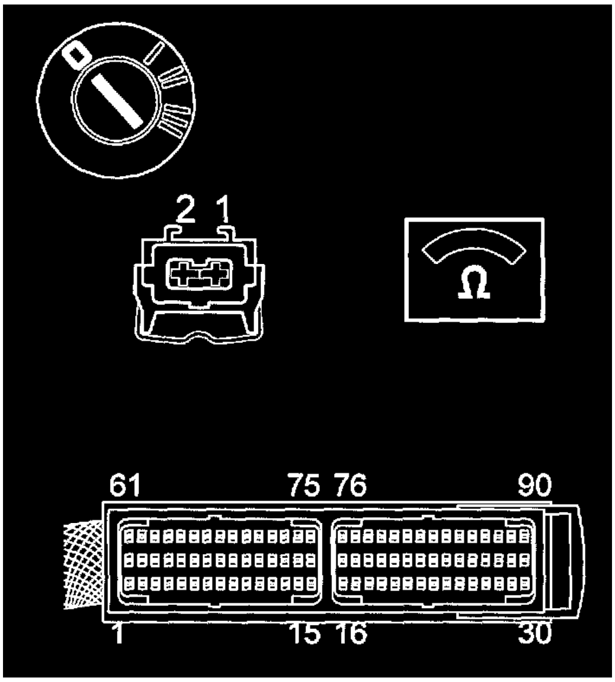
- Ignition off
- Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults** and loose connections according to **Checking wiring and terminals - Intermittent faults**. Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information:
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the thermostat, See: Component Tests and General Diagnostics/Component Access/Replace Procedures
- To replace the Engine Coolant Temperature (ECT) sensor, see **Replacing the Engine Coolant Temperature (ECT) sensor**.

Checking the Connectors

Checking The Connectors



- Ignition off
- Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other Information
- To access the Engine Control Module (ECM), see **Replacing the Engine Control Module (ECM)**.

Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A1/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A1/Faulty Signal - Permanent Fault/Checking Component

Checking Component

Checking Component
- Remove the thermostat and check it according to See: Component Tests and General Diagnostics/Component Access/Replace Procedures

- Replace the thermostat if there is any doubt about its function.

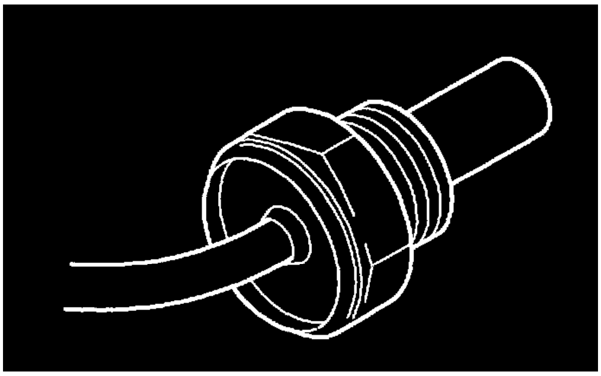
Was a fault found in the thermostat?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A1/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A1/Faulty Signal - Permanent Fault/Replacing the Engine Coolant Temperature (ECT) Sensor

Replacing the Engine Coolant Temperature (ECT) Sensor

Replacing The Engine Coolant Temperature (ECT) Sensor

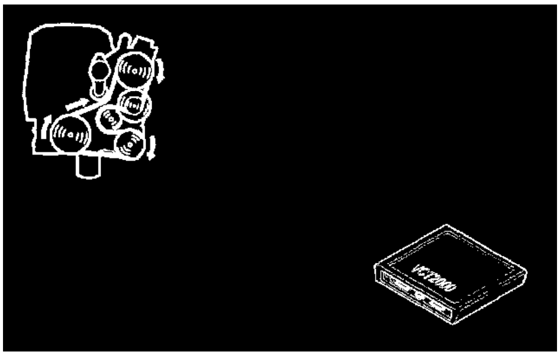


- If the function of the thermostat is correct, try a new Engine Coolant Temperature (ECT) sensor according to **Replacing the Engine Coolant Temperature (ECT) sensor**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A1/Faulty Signal - Permanent Fault/Verification

Verification

Verification



HINT: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine.
- Click on the VCT2000 symbol to read off the Engine Coolant Temperature (ECT)
- Check that the Engine Coolant Temperature (ECT) increases normally and that the engine reaches operating temperature

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

At a certain time after the engine is started, the control module checks that the Engine Coolant Temperature (ECT) exceeds **35°C**. Diagnostic trouble code (DTC) ECM-A2 is stored if the control module detects that the Engine Coolant Temperature (ECT) is below **35°C**.

Condition

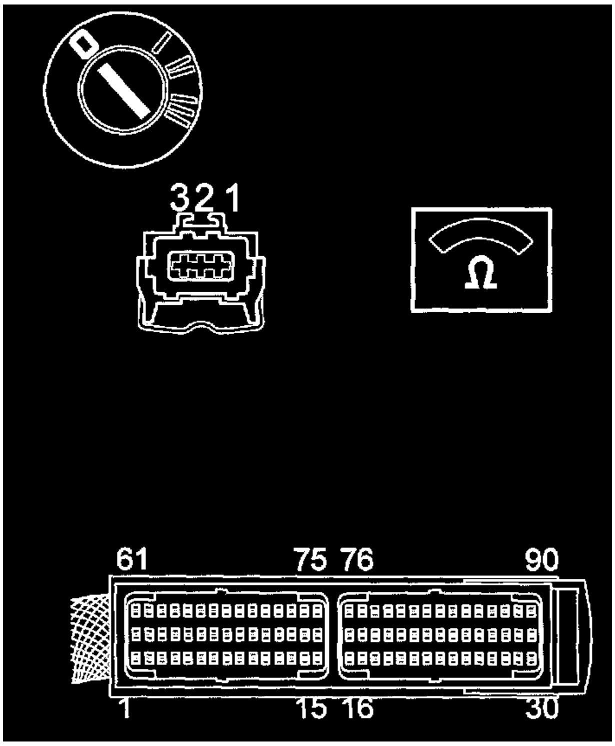
None.

Possible source
- Defective thermostat
- Defective Engine Coolant Temperature (ECT) sensor
- Contact resistance in the terminals.

Condition
- Low Engine Coolant Temperature (ECT)
- High fuel consumption.

Faulty Signal - Intermittent Fault - Checking the Connectors

Checking The Connectors



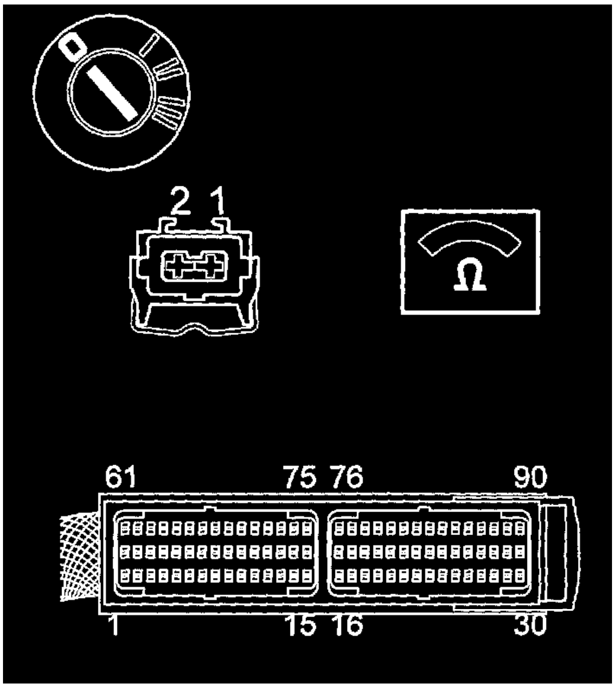
- Ignition off
- Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults** and loose connections according to **Checking wiring and terminals - Intermittent faults**. Check for damage carefully.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information:
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To replace the thermostat, See: Component Tests and General Diagnostics/Component Access/Replace Procedures
- To replace the Engine Coolant Temperature (ECT) sensor, see **Replacing the Engine Coolant Temperature (ECT) sensor**.

Checking the Connectors

Checking The Connectors



- Ignition off

- Check the Engine Coolant Temperature (ECT) sensor and Engine Control Module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

- Remedy as necessary.

Other Information

- To access the Engine Control Module (ECM), see **Replacing the engine module (ECM)**.

Was a fault detected?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A2/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A2/Faulty Signal - Permanent Fault/Checking Component

Checking Component

Checking Component

- Remove the thermostat and check it according to See: Component Tests and General Diagnostics/Component Access/Replace Procedures

- Replace the thermostat if there is any doubt about its function.

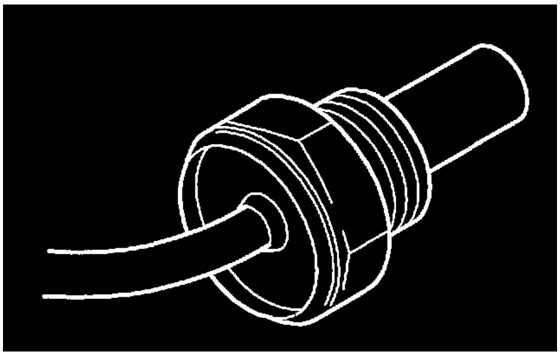
Was a fault found in the thermostat?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A2/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A2/Faulty Signal - Permanent Fault/Replacing the Engine Coolant Temperature (ECT) Sensor

Replacing the Engine Coolant Temperature (ECT) Sensor

Replacing The Engine Coolant Temperature (ECT) Sensor

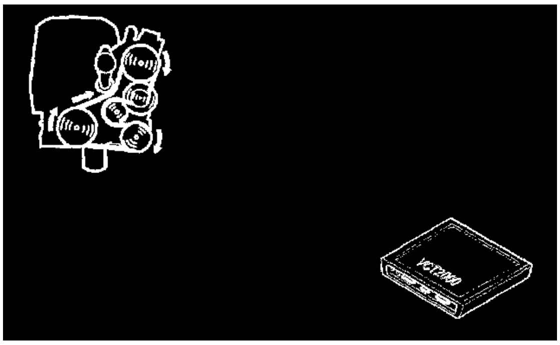


- If the function of the thermostat is correct, try a new Engine Coolant Temperature (ECT) sensor according to **Replacing the Engine Coolant Temperature (ECT) sensor**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A2/Faulty Signal - Permanent Fault/Verification

Verification

Verification

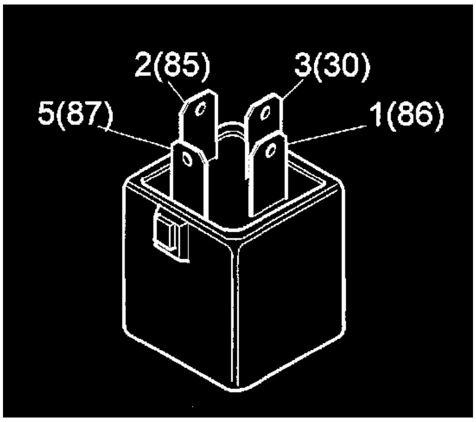


HINT: After carrying out the repair, check that the fault has been remedied.

- Reinstall the components, reconnect the connectors etc.
- Start the engine.
- Click on the VCT2000 symbol to read off the Engine Coolant Temperature (ECT)
- Check that the Engine Coolant Temperature (ECT) increases normally and that the engine reaches operating temperature.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-A3 is stored if the power cable from the system relay is short-circuited to supply voltage or if there is an open-circuit in the circuit and the control module has interpreted it as a fault.

Condition

None idle air trim adaptation.

Possible source

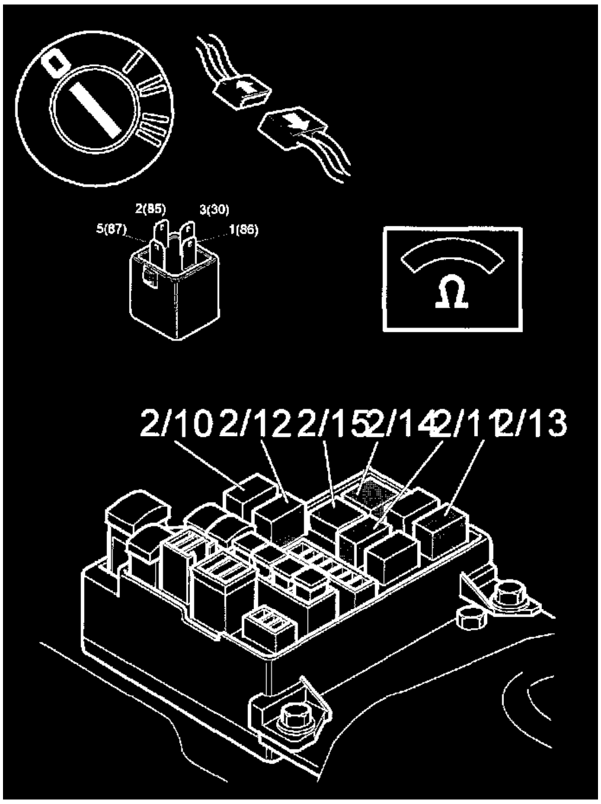
Signal too high:
- Short-circuit to supply voltage in the signal cable.
- Faulty system relay.

Signal too low:
- Open-circuit in the signal cable.
- Faulty system relay.

Condition
- Engine does not start.
- Malfunction indicator lamp (MIL) lit.

Checking System Relay

Checking System Relay



- Ignition off
- Remove system relay 2/14 from the integrated relay/fusebox in the engine compartment.

Connect an ohmmeter between system relay terminals 3 and 5.

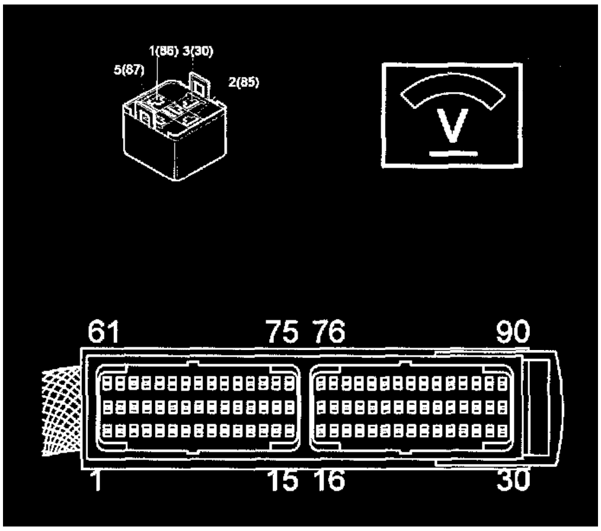
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too High - Permanent Fault/Checking Cables

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too High - Permanent Fault/Defective System Relay

Checking Cables

Checking Cables



Check the cable between the system relay block terminal 3 and Engine Control Module (ECM) terminal 66 for a short circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too High - Permanent Fault/Verification

Defective System Relay

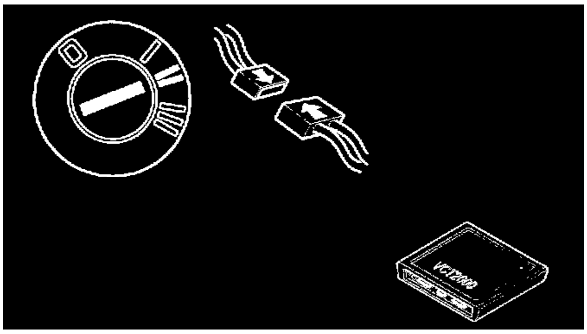
Defective System Relay

Try a new system relay.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too High - Permanent Fault/Verification

Verification

Verification

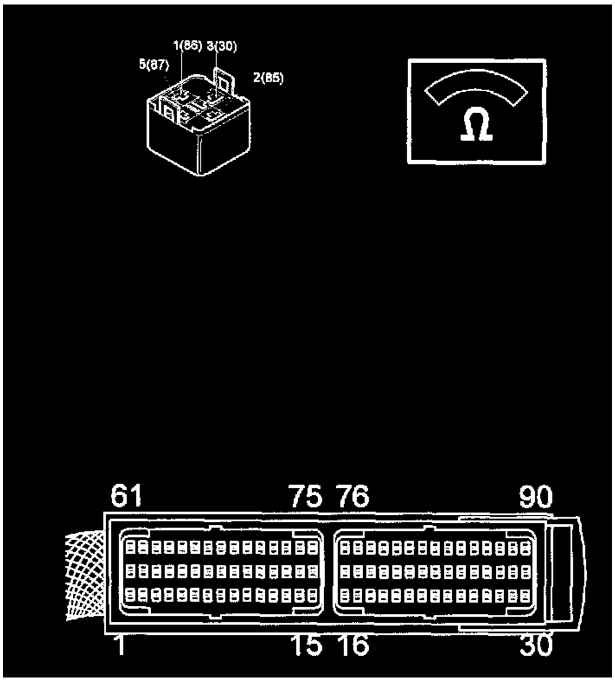


- Ignition off
- Reconnect the connectors, reinstall components etc.
- Connect VCT 2000
- Ignition on.

Replace the system relay.

Signal Too High Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



Check that the resistance between system relay terminals 3 and 5 is infinite.

Check the power supply cable between Engine Control Module (ECM) terminal #66 and the system relay base terminal 3 for a short-circuit to supply voltage and remedy according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check the power supply cable between the system relay terminal 3 and injectors terminal 1, ignition coils terminal 2, idle air control valve terminal 1, turbo charger (TC) control valve terminal 1, mass air flow (MAF) sensor terminal 3 and heated oxygen sensors (HO2S) terminal 1 for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

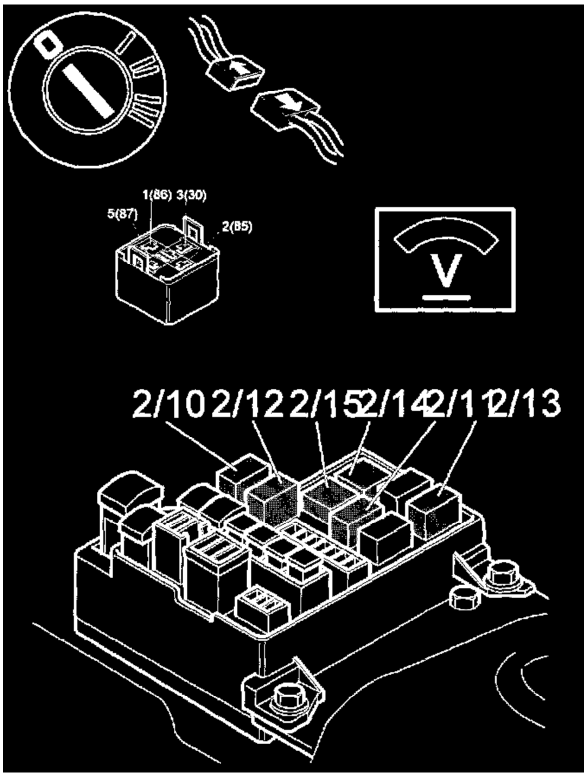
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Power Supply

Checking The Power Supply



- Ignition off
- Remove system relay 2/14 from the integrated relay / fusebox in the engine compartment.

Using a voltmeter, measure the voltage between system relay base terminal 5 and ground.

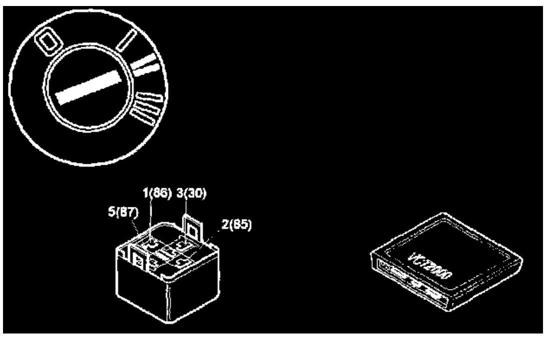
The voltmeter should read battery voltage.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too Low - Permanent Fault/Verification

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too Low - Permanent Fault/Checking the Power Cable

Checking the Power Cable

Checking The Power Cable



- Bridge the system relay base terminal 3 to 5 with a piece of electrical cable.
- Ignition on.

Read off parameter BATTERY.

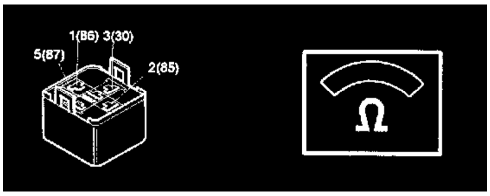
The parameter should display battery voltage.

OK - This information to be published by O.E. at a later date.

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too Low - Permanent Fault/Checking Cables

Checking Cables

Checking Cables



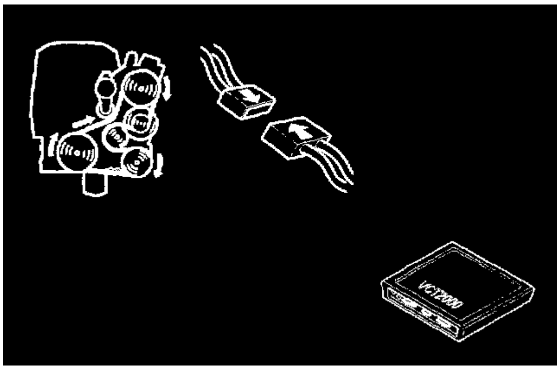
Check the cable between fuse no. 13 in the integrated relay / fusebox in the engine compartment and the system relay base terminal 5 for an open circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-A3/Signal Too Low - Permanent Fault/Verification

Verification

Verification

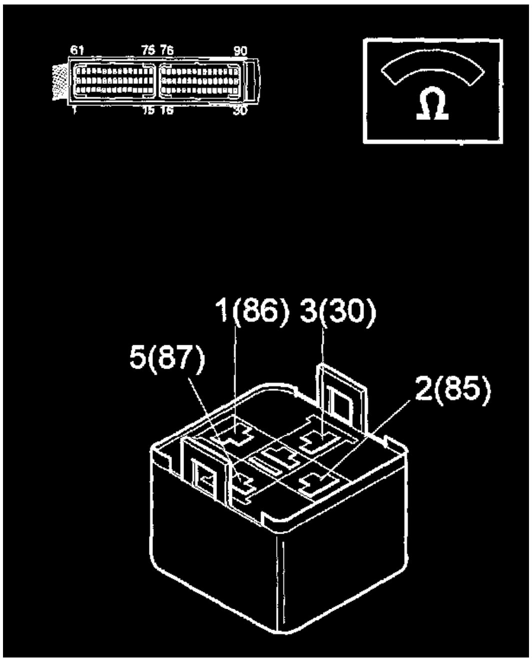


- Ignition off
- Reconnect the connectors, reinstall components etc.
- Start the engine.

Read off parameter **BATTERY**.

Signal Too Low Intermittent Fault Checking Components & Wiring

Checking Components And Wiring



Check the signal cable between Engine Control Module (ECM) terminal #66 and system relay terminal 3 for an intermittent short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults** and for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

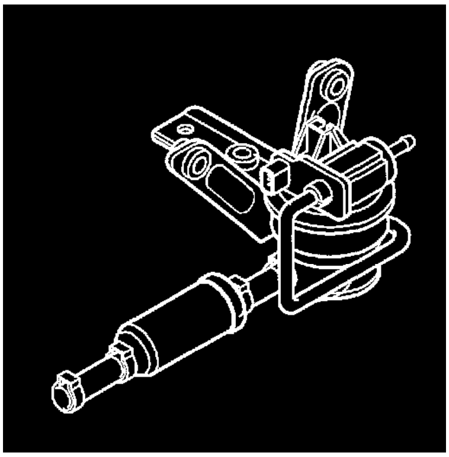
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) ECM-AF is stored if the control module detects that the signal from the leak diagnostic pump is too high, too low or missing.

Condition

- No leak diagnostic
- No EVAP diagnostics.

Possible source

Signal too high:

- Short-circuit to supply voltage in the signal cable
- Defective leak diagnostic pump.

Signal too low:

- Short-circuit to ground in the signal cable

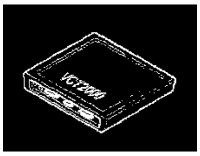
- Short-circuit to ground in the power cable
- Defective leak diagnostic pump.

Signal missing:
- Open-circuit in the signal cable
- Open-circuit in the power cable
- Contact resistance in the terminals
- Defective leak diagnostic pump.

Condition
- Malfunction indicator lamp (MIL) lit.

Other Diagnostic Trouble Codes (DTCs)

Other Diagnostic Trouble Codes (DTCs)



NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault-tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Missing - Permanent Fault/Other Diagnostic Trouble Codes (DTCs) - Continued

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Missing - Permanent Fault/Checking Wiring and Connectors

Other Diagnostic Trouble Codes (DTCs) - Continued

Other Diagnostic Trouble Codes (DTCs)

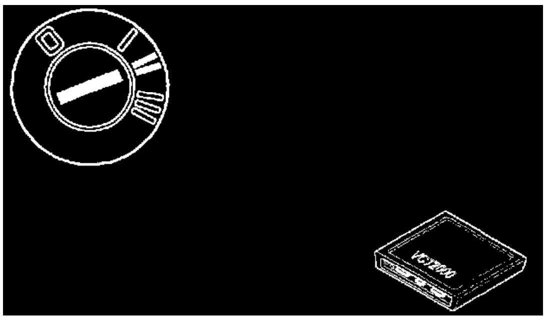
Have these diagnostic trouble codes (DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Missing - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)



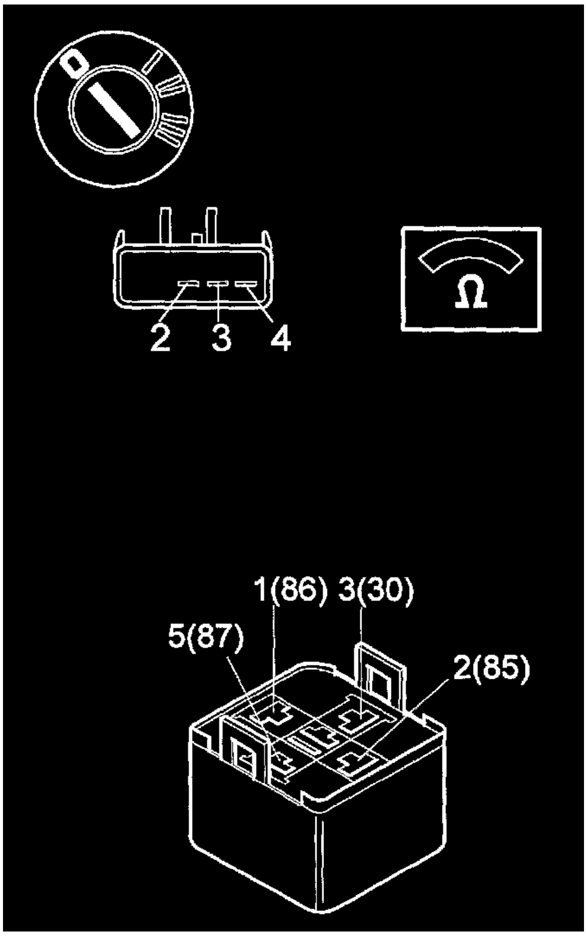
- Ignition on
- Erase diagnostic trouble codes (DTCs).

Select "Continue" when the diagnostic trouble codes (DTCs) have been erased.

Continue - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Missing - Permanent Fault/Checking Wiring and Connectors

Checking Wiring and Connectors

Checking Wiring And Connectors



- Ignition off.

Check the connector on the leak diagnostic pump. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Check the signal cable between Engine Control Module (ECM) terminal #41 and leak diagnostic pump terminal #4. Check for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

Check the power supply cable between system relay terminal #5 (87) and leak diagnostic pump terminal #2. Check for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Try a new leak diagnostic pump if no fact is found during the above fault-tracing.

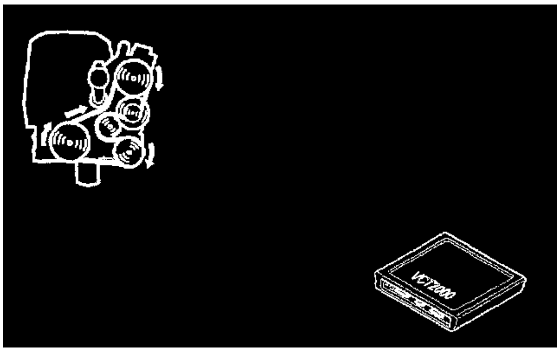
Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access or replace the leak diagnostic pump, see **Replacing the leak diagnostic pump**
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Missing - Permanent Fault/Verification

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the Engine Coolant Temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

HINT: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The Not OK status, and a number from 1-8 will be displayed if the control module has detected any faults. To interpret these faults, see the status definitions below.

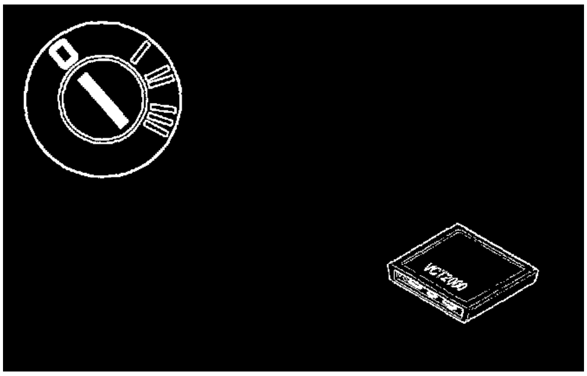
NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.
- Click the stop button to re-run the test.

Status definitions:
- OK The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).

Select a suitable alternative to continue:
- The status is OK
- Status Not OK, status 1 2 or 3
- Status Not OK, (for another diagnostic trouble code (DTC)) has been detected.

Verification

Verification



HINT: After carrying out the repair, check that the fault has been remedied.

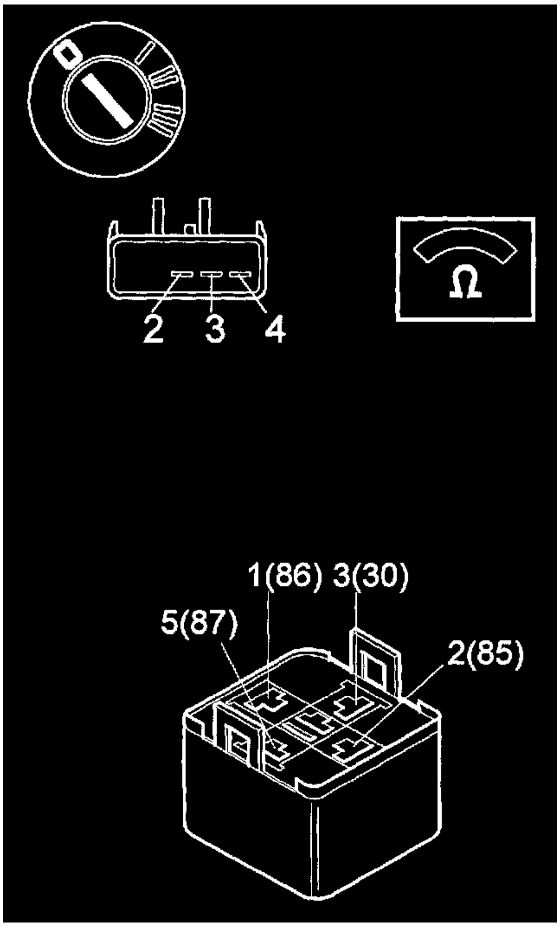
NOTE: This test cannot be performed if there are diagnostic trouble codes (DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.

- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

Signal Missing Intermittent Fault Checking Wiring & Connectors

Checking Wiring And Connectors



- Ignition off.

Check the connector on the leak diagnostic pump for loose connections according to **checking wiring and terminals - Intermittent faults** and contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the signal cable between Engine Control Module (ECM) terminal 41 and leak diagnostic pump terminal 4 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

Check the power supply cable between system relay terminal 5 (87) and leak diagnostic pump terminal 2 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

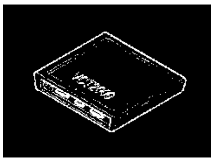
Remedy as necessary.

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access / replace the leak diagnostic pump, see **Replacing the leak diagnostic pump**
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Other Diagnostic Trouble Codes (DTCs)

Other Diagnostic Trouble Codes (DTCs)



NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault-tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too High - Permanent Fault/Other Diagnostic Trouble Codes (DTCs) - Continued

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too High - Permanent Fault/Checking the Wiring

Other Diagnostic Trouble Codes (DTCs) - Continued

Other Diagnostic Trouble Codes (DTCs)

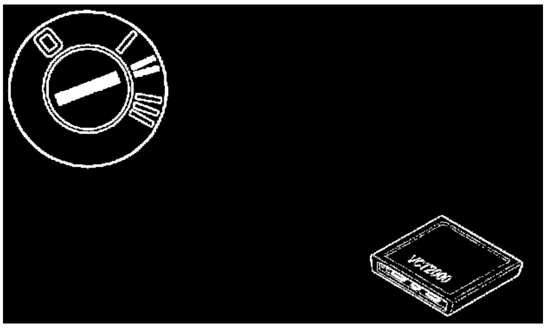
Have these diagnostic trouble codes (DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Missing - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)



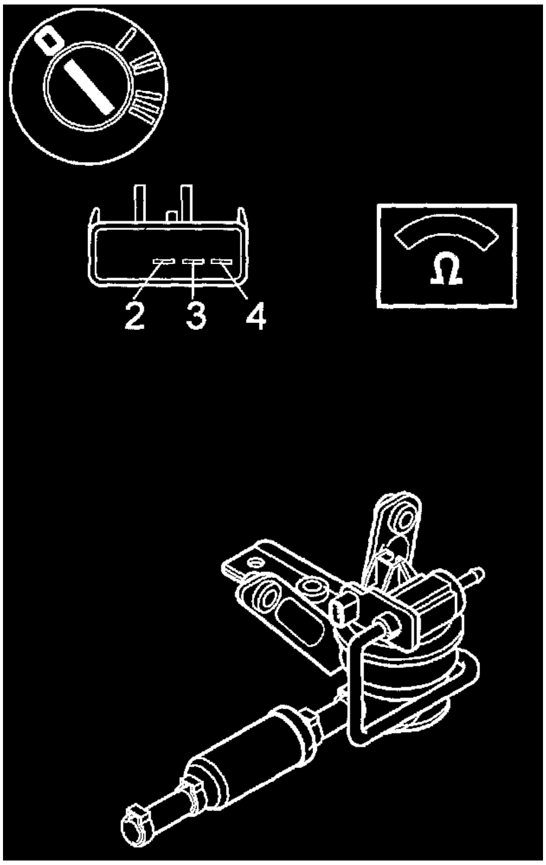
- Ignition on
- Erase diagnostic trouble codes (DTCs).

Select "Continue" when the diagnostic trouble codes (DTCs) have been erased.

Continue - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too High - Permanent Fault/Checking the Wiring

Checking the Wiring

Checking The Wiring



- Ignition off.

Check the connector on the leak diagnostic pump. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Check the signal cable between Engine Control Module (ECM) terminal #41 and leak diagnostic pump terminal #4.
Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

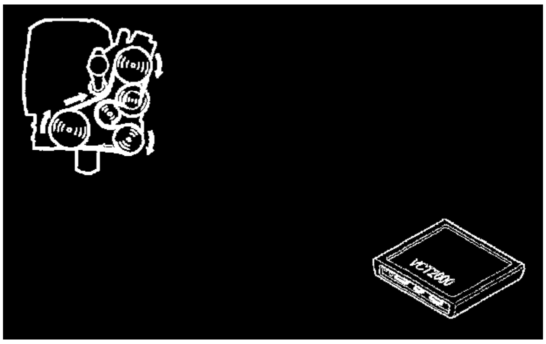
Remedy as necessary.

Try a new leak diagnostic pump if no fault is found during the above fault-tracing.

Other Information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access or replace the leak diagnostic pump, see **Replacing the leak diagnostic pump**
- For information about signals See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the Engine Coolant Temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

HINT: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The Not OK status, and a number from 1-8 will be displayed if the control module has detected any faults. To interpret these faults, see the status definitions below.

NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

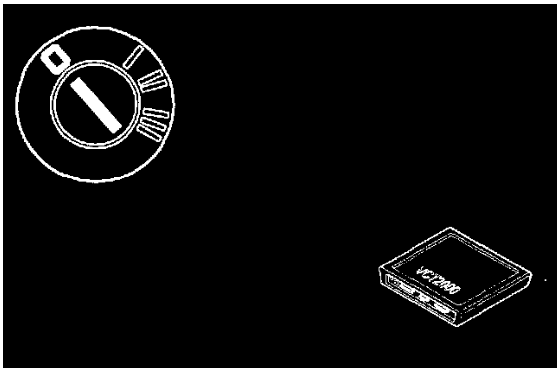
- Click the stop button to re-run the test.

Status definitions:
- OK = The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked. (ECM-6A, signal too low).

Select a suitable alternative to continue:
- The status is OK
- Status Not OK, status 1, 2 or 3
- Status Not OK, (for another diagnostic trouble code (DTC)) has been detected.

Verification

Verification



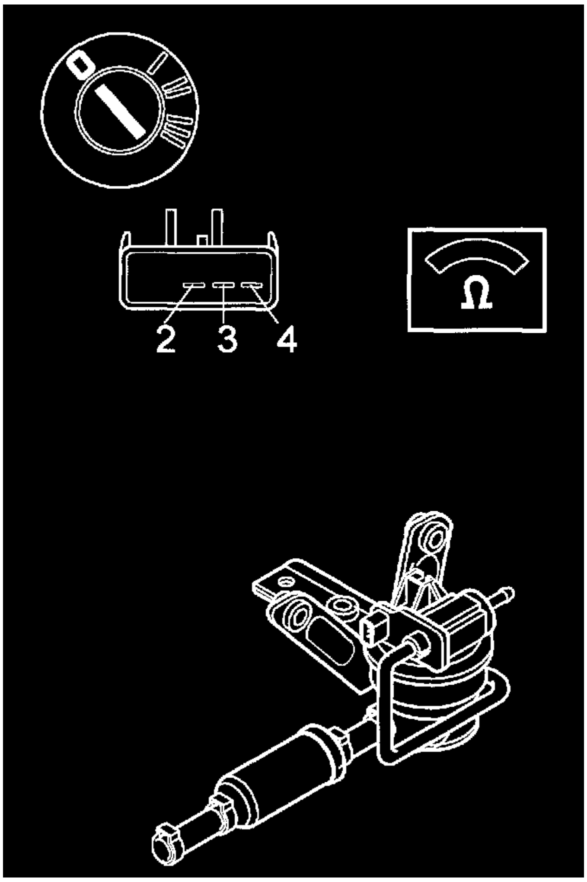
HINT: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes (DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

Signal Too High Intermittent Fault Checking Wiring & Connectors

Checking Wiring And Connectors



- Ignition off

Check the connector on the leak diagnostic pump for loose connections according to **Checking wiring and terminals - Intermittent faults** and contact resistance and oxidation according to **Checking wiring terminals - Intermittent faults**.

Check the signal cable between Engine Control Module (ECM) terminal 41 and leak diagnostic pump terminal 4 for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

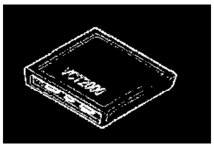
Remedy as necessary.

Other Information

- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access / replace the leak diagnostic pump, see **Replacing the leak diagnostic pump**
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Other Diagnostic Trouble Codes (DTCS) - I

Other Diagnostic Trouble Codes (DTCs)



NOTE: Any other diagnostic trouble codes (DTCs) in EMS2000 must be remedied and erased before this fault- tracing can be carried out.

Are any other diagnostic trouble codes (DTCs) stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too Low - Permanent Fault/Other Diagnostic Trouble Codes (DTCS) - II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too Low - Permanent Fault/Checking Wiring and Connectors

Other Diagnostic Trouble Codes (DTCS) - II

Other Diagnostic Trouble Codes (DTCs), Continued

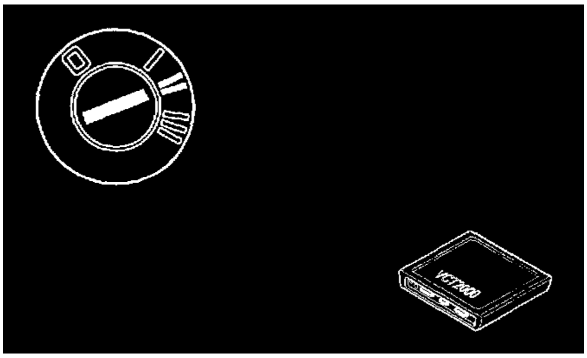
Have these diagnostic trouble codes (DTCs) been remedied?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too Low - Permanent Fault/Erasing Diagnostic Trouble Code (DTC)

No - Test Complete

Erasing Diagnostic Trouble Code (DTC)

Erasing Diagnostic Trouble Code (DTC)



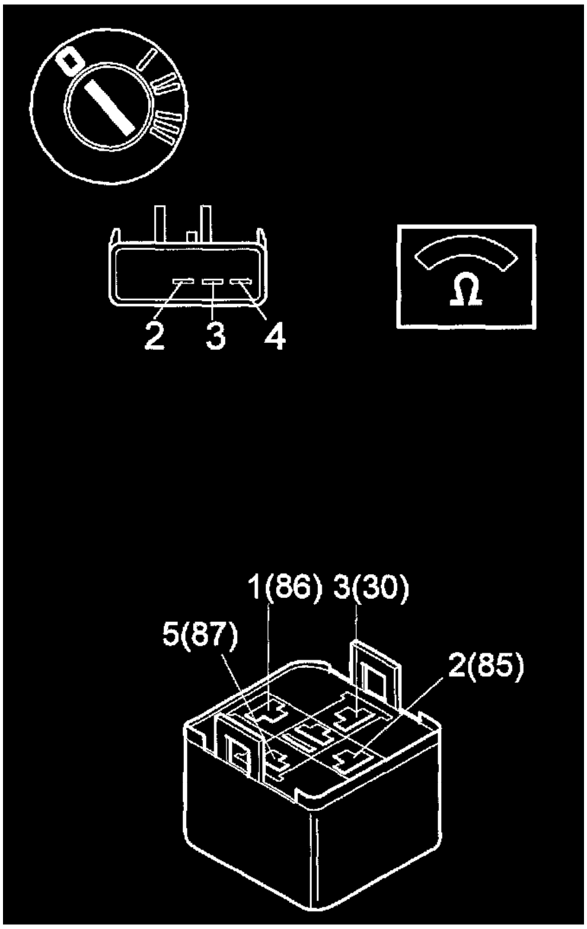
- Ignition on
- Erase diagnostic trouble codes (DTCs).

Select "Continue" when the diagnostic trouble codes (DTCs) have been erased.

Continue - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too Low - Permanent Fault/Checking Wiring and Connectors

Checking Wiring and Connectors

Checking Wiring And Connectors



- Ignition off.

Check the connector on the leak diagnostic pump. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Check the signal cable between Engine Control Module (ECM) terminal #41 and leak diagnostic pump terminal #4.

Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**. Check the power supply cable between system relay terminal #5 (87) and leak diagnostic pump terminal #2. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**. Remedy as necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

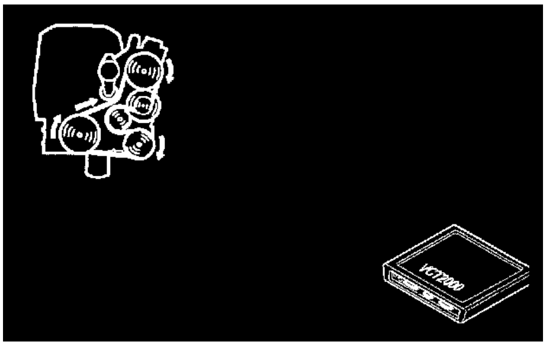
Try a new leak diagnostic pump if no fault is found during the above fault-tracing.

Other Information:
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access or replace the leak diagnostic pump, see **Replacing the leak diagnostic pump**
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-AF/Signal Too Low - Permanent Fault/Verification

Activating the Leak Diagnostic

Activating The Leak Diagnostic



- Start the engine and let it idle.

NOTE: The engine must be idling throughout the test.

- Clicking the VCT2000 symbol to activate the leak diagnostic
- Wait until the Engine Coolant Temperature (ECT) exceeds **50°C**
- Start the leak diagnostic. YES is displayed during leak diagnostics
- Wait until the leak diagnostic is complete. Leak diagnostic active NO and leak diagnostic complete YES is displayed when the leak diagnostic is complete.

HINT: The time taken for the diagnostic varies depending on the fault status of the fuel tank system. The diagnostic may take up to **4 minutes**.

- Read off the results of the leak diagnostic. The leak diagnostic results are read off automatically when the test has been correctly completed
- The OK status will be displayed if the control module has not detected any faults. The Not OK status, and a number from 1-8 will be displayed if the control module has detected any faults. To interpret these faults, see the status definitions below.

NOTE: The status types can be translated into diagnostic trouble codes (DTCs). However they are not stored as DTCs during this test.

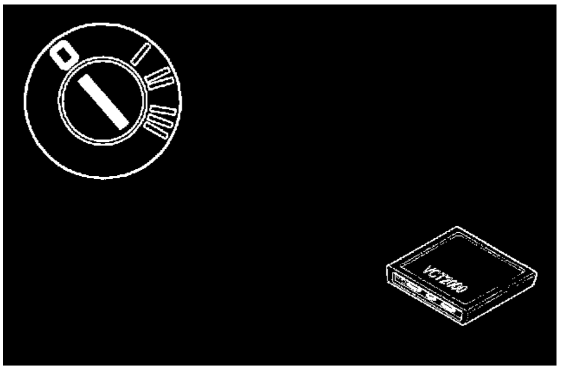
- Click the stop button to re-run the test.

Status definitions:
- OK = The system is free of faults
- Not OK, status 1 = Leak diagnostic pump, signal too low. (ECM-65, signal too low)
- Not OK, status 2 = Leak diagnostic pump, signal too high. (ECM-65, signal too high)
- Not OK, status 3 = Leak diagnostic pump, faulty signal. (ECM-65, faulty signal)
- Not OK, status 4 = Leak diagnostic pump, blocked hose. (ECM-66, signal too low)
- Not OK, status 5 = Leakage **0.5 mm**. (ECM-68, minor leak)
- Not OK, status 6 = Leakage **1 mm**. (ECM-68, major leak)
- Not OK, status 7 = Leakage larger than **1 mm**. (ECM-68, Fuel tank filler cap missing)
- Not OK, status 8 = Evaporative emission (EVAP) system blocked (ECM-6A, signal too low).

Select a suitable alternative to continue:
- The status is OK
- Status Not OK, status 1, 2 or 3
- Status Not OK, (for another diagnostic trouble code (DTC)) has been detected.

Verification

Verification



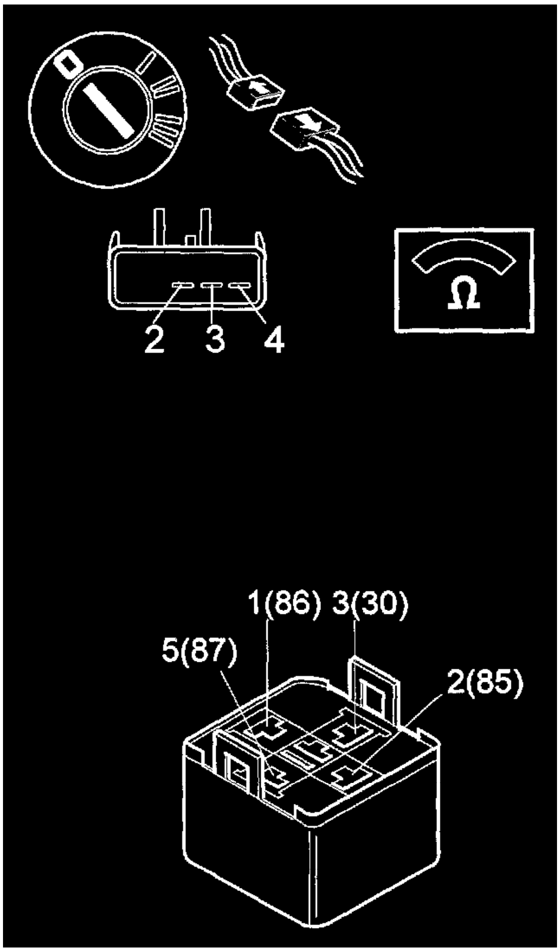
HINT: After carrying out the repair, check that the fault has been remedied.

NOTE: This test cannot be performed if there are diagnostic trouble codes (DTCs) stored in EMS2000.

- Reinstall the components, reconnect the connectors etc.
- Ignition on
- Check that no other diagnostic trouble codes (DTCs) are stored. If other diagnostic trouble codes (DTCs) are stored, these must be remedied and erased first.

Signal Too Low Intermittent Fault Checking Wiring & Connectors

Checking Wiring And Connectors



- Ignition off
- Disconnect the connectors.

Check the connector on the camshaft reset valve for loose connections according to **Checking wiring and terminals - Intermittent faults** and contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the signal cable between Engine Control Module (ECM) terminal 41 and leak diagnostic pump terminal 4 for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**.

Check the power supply cable between system relay terminal 5 (87) and leak diagnostic pump terminal 2 for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Remedy as necessary.

Other Information
- To connect the breakout box See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- To access / replace the leak diagnostic pump, see **Replacing the leak diagnostic pump**
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

The Engine Control Module (ECM) and transmission control module (TCM) communicate via a standardized serial interface. Both the control modules transmit and receive information. One of the diagnostic trouble codes (DTC) ECM-DC/DD/DE/EO is stored if communication is interrupted or ceases.

Condition
- Turbocharger (TC) control disabled
- Ignition retardation.

Possible source
- Open-circuit in one or both signal cables
- One or both signal cables short-circuited to ground, voltage or each other
- Contact resistance in the terminals
- Defective Engine Control Module (ECM) or transmission control module (TCM).

Condition
- Poor performance
- Harsh gear shifting.

Faulty Signal - Intermittent Fault - Check

Check

Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27 for a short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults** and for a short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**, short-circuit to each other and for an open-circuit according to **Checking wiring and terminals - Intermittent fault**.

Check the Engine Control Module (ECM) and transmission control module (TCM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

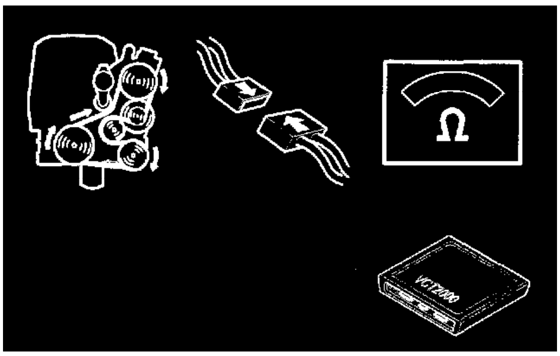
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check in particular for damage, or loose terminal pins.

Other Information:
- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connectors

Checking The Connectors



Check the Engine Control Module (ECM) and transmission control module (TCM) connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check for loose or damaged terminal pins.
Reconnect the connectors.

Start the engine.
Read off the status of the diagnostic trouble code (DTC).

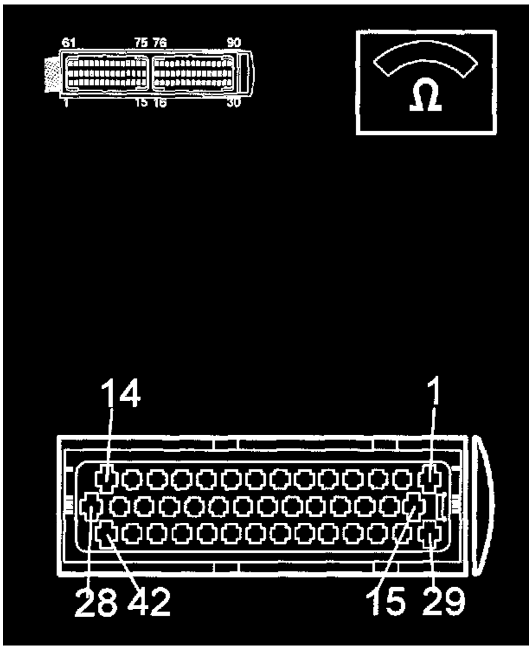
Is the status intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Checking Wiring

Checking Wiring

Checking Wiring



Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**. Check for a short-circuit to supply voltage according to **Checking wiring terminals - Permanent faults**. Check for a short-circuit to each other and for open-circuits according to **Checking wiring terminals - Permanent faults**. Remedy if necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If the above fault-tracing does not reveal any faults, try a new transmission control module (TCM).

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

Verification

Verification
- Start the engine.

Read off the status of the diagnostic trouble code (DTC).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

The Engine Control Module (ECM) and transmission control module (TCM) communicate via a standardized serial interface. Both the control modules transmit and receive information. One of the diagnostic trouble codes (DTC) ECM-DC/DD/DE/EO is stored if communication is interrupted or ceases.

Condition
- Turbocharger (TC) control disabled

- Ignition retardation.

Possible source

- Open-circuit in one or both signal cables
- One or both signal cables short-circuited to ground, voltage or each other
- Contact resistance in the terminals
- Defective Engine Control Module (ECM) or transmission control module (TCM).

Condition

- Poor performance
- Harsh gear shifting.

Faulty Signal - Intermittent Fault - Check

Check

Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27 for a short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults** and for a short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**, short-circuit to each other and for an open-circuit according to **Checking wiring and terminals - Intermittent fault**.

Check the Engine Control Module (ECM) and transmission control module (TCM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

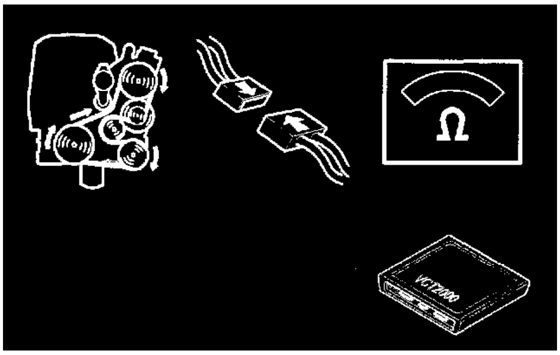
Check in particular for damage, or loose terminal pins.

Other Information:

- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connectors

Checking The Connectors



Check the Engine Control Module (ECM) and transmission control module (TCM) connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check for loose or damaged terminal pins.
Reconnect the connectors.
Start the engine.
Read off the status of the diagnostic trouble code (DTC).

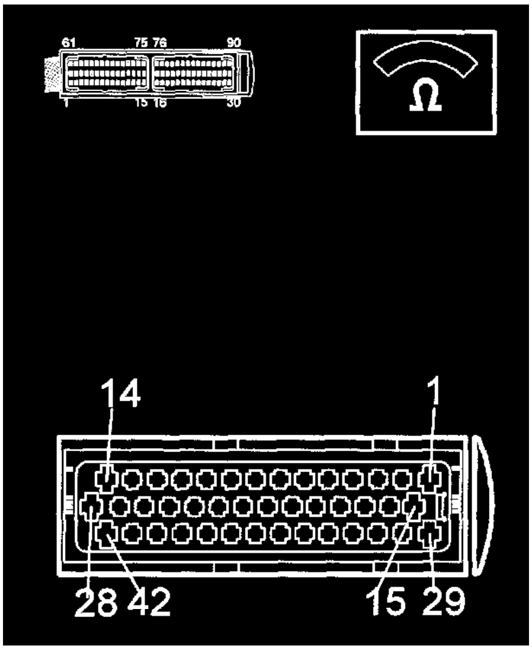
Is the status intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Checking Wiring

Checking Wiring

Checking Wiring



Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**. Check for a short-circuit to supply voltage according to **Checking wiring terminals - Permanent faults**. Check for a short-circuit to each other and for open-circuits according to **Checking wiring terminals - Permanent faults**. Remedy if necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If the above fault-tracing does not reveal any faults, try a new transmission control module (TCM).

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

Verification

Verification
- Start the engine.

Read off the status of the diagnostic trouble code (DTC).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

The Engine Control Module (ECM) and transmission control module (TCM) communicate via a standardized serial interface. Both the control modules transmit and receive information. One of the diagnostic trouble codes (DTC) ECM-DC/DD/DE/EO is stored if communication is interrupted or ceases.

Condition
- Turbocharger (TC) control disabled
- Ignition retardation.

Possible source
- Open-circuit in one or both signal cables
- One or both signal cables short-circuited to ground, voltage or each other
- Contact resistance in the terminals
- Defective Engine Control Module (ECM) or transmission control module (TCM).

Condition

- Poor performance
- Harsh gear shifting.

Faulty Signal - Intermittent Fault - Check

Check

Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27 for a short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults** and for a short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**, short-circuit to each other and for an open-circuit according to **Checking wiring and terminals - Intermittent fault**.

Check the Engine Control Module (ECM) and transmission control module (TCM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

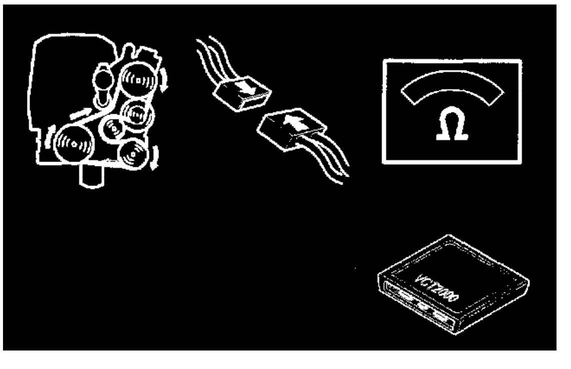
Check in particular for damage, or loose terminal pins.

Other Information:

- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connectors

Checking The Connectors



Check the Engine Control Module (ECM) and transmission control module (TCM) connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check for loose or damaged terminal pins.
Reconnect the connectors.
Start the engine.
Read off the status of the diagnostic trouble code (DTC).

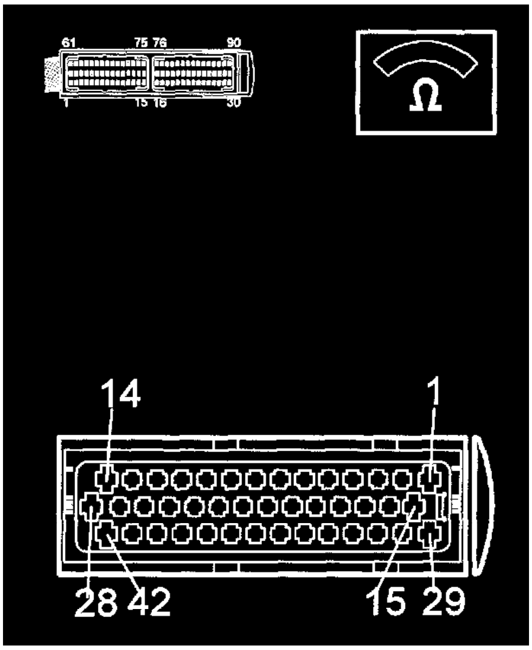
Is the status intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Checking Wiring

Checking Wiring

Checking Wiring



Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**. Check for a short-circuit to supply voltage according to **Checking wiring terminals - Permanent faults**. Check for a short-circuit to each other and for open-circuits according to **Checking wiring terminals - Permanent faults**. Remedy if necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If the above fault-tracing does not reveal any faults, try a new transmission control module (TCM).

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

Verification

Verification
- Start the engine.

Read off the status of the diagnostic trouble code (DTC).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information

Condition

The Engine Control Module (ECM) and transmission control module (TCM) communicate via a standardized serial interface. Both the control modules transmit and receive information. One of the diagnostic trouble codes (DTC) ECM-DC/DD/DE/EO is stored if communication is interrupted or ceases.

Condition
- Turbocharger (TC) control disabled
- Ignition retardation.

Possible source
- Open-circuit in one or both signal cables
- One or both signal cables short-circuited to ground, voltage or each other
- Contact resistance in the terminals
- Defective Engine Control Module (ECM) or transmission control module (TCM).

Condition
- Poor performance
- Harsh gear shifting.

Faulty Signal - Intermittent Fault - Check

Check

Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27 for a short-circuit to ground and remedy according to **Checking wiring and terminals - Intermittent faults** and for a short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**, short-circuit to each other and for an open-circuit according to **Checking wiring and terminals - Intermittent fault**.

Check the Engine Control Module (ECM) and transmission control module (TCM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

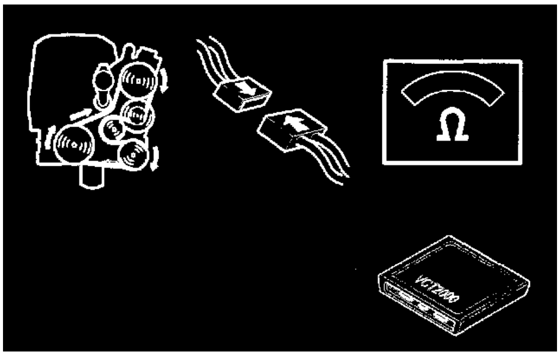
Check in particular for damage, or loose terminal pins.

Other Information:

- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Checking the Connectors

Checking The Connectors



Check the Engine Control Module (ECM) and transmission control module (TCM) connectors. Check for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check for loose or damaged terminal pins.
Reconnect the connectors.
Start the engine.
Read off the status of the diagnostic trouble code (DTC).

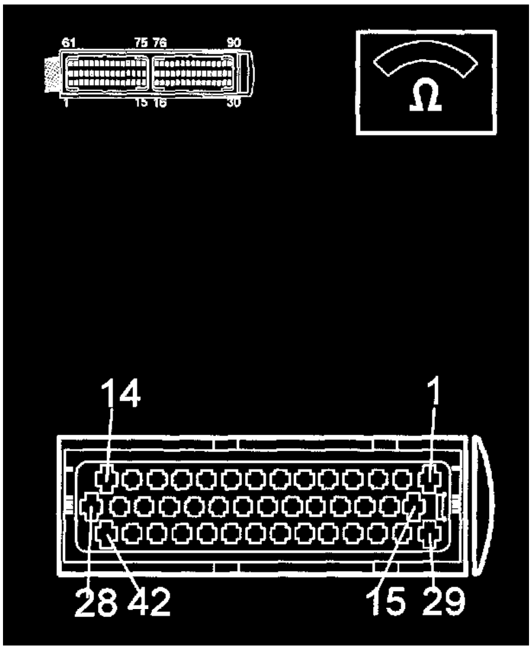
Is the status intermittent?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Checking Wiring

Checking Wiring

Checking Wiring



Check the signal cables between Engine Control Module (ECM) terminals 57 and 27 and transmission control module (TCM) terminals 14 and 27. Check for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**. Check for a short-circuit to supply voltage according to **Checking wiring terminals - Permanent faults**. Check for a short-circuit to each other and for open-circuits according to **Checking wiring terminals - Permanent faults**. Remedy if necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

If the above fault-tracing does not reveal any faults, try a new transmission control module (TCM).

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Engine Control System/ECM-DC/Faulty Signal - Permanent Fault/Verification

Verification

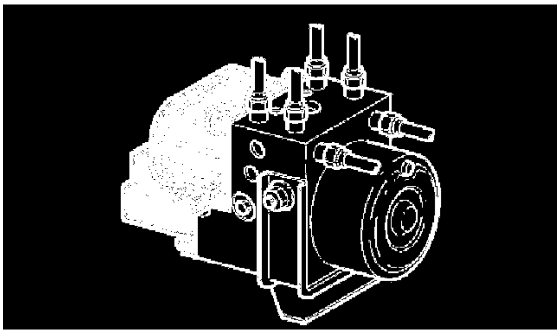
Verification
- Start the engine.

Read off the status of the diagnostic trouble code (DTC).

ABS-112

DTC ABS - 112 Control Module

Condition



The control module checks the internal functions when the ignition is switched on.
Diagnostic trouble code **(DTC)** ABS-112 is stored if the control module registers an internal fault in the control module.

Substitute value
- The ABS function is disengaged.

Possible source
- Defective control module.

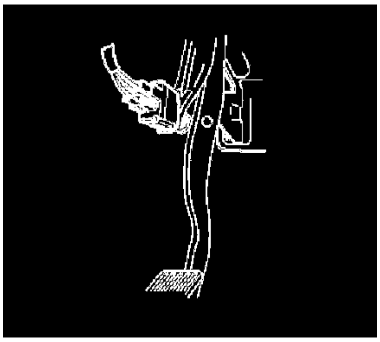
Fault symptom[s]

- The ABS warning lamp lights.
- There is a danger that the wheels will lock during braking when the ABS function is disengaged.

ABS-142

DTC ABS - 142 Stop (Brake) Lamp Switch

Condition



The stop (brake) light switch informs the control module that braking is in progress.

The control module terminal is grounded via the stop (brake) lamp bulbs when the stop (brake) lamp switch is not activated. The control module (and bulbs) are supplied with battery voltage supply when the stop (brake) light switch is activated.

Diagnostic trouble code **(DTC)** ABS-142 is stored if the control module registers that the signal is too high (high voltage) **continuously for 15 minutes.**

Diagnostic trouble code **(DTC)** ABS-142 is also stored if the control module registers that the signal ground via the light bulbs ceases when the stop (brake) lamp switch is **unaffected for 15 minutes.**

Hint: Consequently the diagnostic trouble code **(DTC)** can be stored if the brake pedal is depressed for more than 15 minutes with the ignition on. Fault causes of this type are not included in the fault-tracing procedure.

Substitute value
- The diagnostic trouble code **(DTC)** is stored without the ABS and EBD function being disengaged. If the fault occurs during ABS control, the ABS system is not disengaged until the ABS control has been cancelled.

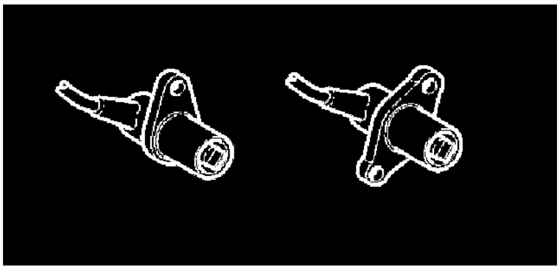
Possible source
- Short-circuit to supply voltage in the signal cable
- Open-circuit in the signal cable
- Incorrectly adjusted stop (brake) lamp switch
- Defective stop (brake) light switch
- Defective bulbs in the stop (brake) lights
- Contact resistance in the terminals.

Fault symptom[s]
- The stop (brake) lamps are lit constantly
- The bulb failure warning sensor is lit constantly
- The stop (brake) lamps do not light up when the brake pedal is depressed.

ABS-311

DTC ABS - 311 Wheel Sensor Signal, Left Front Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-311, ABS312, ABS-313 or ABS-314 is stored if the control module registers a fault in the wheel sensor circuit.

Substitute value

- The ABS function is disengaged.
- If a wheel is under ABS control and a wheel sensor fault for the wheel occurs, the ABS system is disengaged immediately.
- If more than one wheel is under the ABS control and a wheel sensor fault occurs, the ABS system is disengaged when the ABS control ceases.

Possible source

- Open-circuit in the signal cable (+) or signal cable (-).
- The sensor is dislodged from its mounting.
- The sensor is not installed.
- Short-circuit to +12 V in the signal cable.
- Short-circuit to ground in the signal cable.
- Defective wheel sensor.
- Contact resistance in the terminals.

Fault symptom[s]

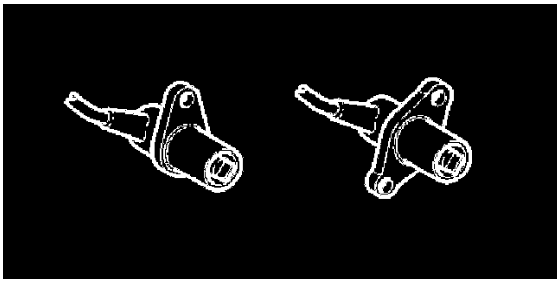
- The ABS warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

Hint: If the fault is intermittent, the ABS warning lamp will go out the next time the vehicle speed **exceeds 12 km/h** the next time the ignition is switched on. If the fault is an intermittent open circuit, the ABS warning lamp will go out the next time the ignition is switched on.

ABS-312

DTC ABS - 312 Wheel Sensor Signal, Right Front Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-311, ABS312, ABS-313 or ABS-314 is stored if the control module registers a fault in the wheel sensor circuit.

Substitute value

- The ABS function is disengaged.
- If a wheel is under ABS control and a wheel sensor fault for the wheel occurs, the ABS system is disengaged immediately.
- If more than one wheel is under the ABS control and a wheel sensor fault occurs, the ABS system is disengaged when the ABS control ceases.

Possible source

- Open-circuit in the signal cable (+) or signal cable (-).
- The sensor is dislodged from its mounting.
- The sensor is not installed.
- Short-circuit to +12 V in the signal cable.
- Short-circuit to ground in the signal cable.
- Defective wheel sensor.
- Contact resistance in the terminals.

Fault symptom[s]

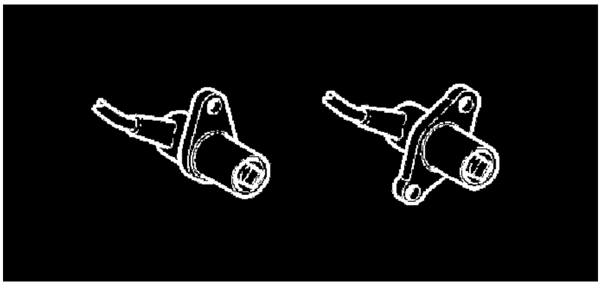
- The ABS warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

Hint: If the fault is intermittent, the ABS warning lamp will go out the next time the vehicle speed exceeds **12 km/h** the next time the ignition is switched on. If the fault is an intermittent open circuit, the ABS warning lamp will go out the next time the ignition is switched on.

ABS-313

DTC ABS - 313 Wheel Sensor Signal, Left Rear Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-311, ABS312, ABS-313 or ABS-314 is stored if the control module registers a fault in the wheel sensor circuit.

Substitute value

- The ABS function is disengaged.
- If a wheel is under ABS control and a wheel sensor fault for the wheel occurs, the ABS system is disengaged immediately.
- If more than one wheel is under the ABS control and a wheel sensor fault occurs, the ABS system is disengaged when the ABS control ceases.

Possible source

- Open-circuit in the signal cable (+) or signal cable (-).
- The sensor is dislodged from its mounting.
- The sensor is not installed.
- Short-circuit to +12 V in the signal cable.
- Short-circuit to ground in the signal cable.
- Defective wheel sensor.
- Contact resistance in the terminals.

Fault symptom[s]

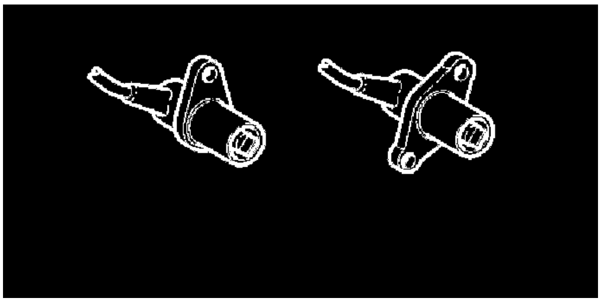
- The ABS warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

Hint: If the fault is intermittent, the ABS warning lamp will go out the next time the vehicle speed exceeds **12 km/h** the next time the ignition is switched on. If the fault is an intermittent open circuit, the ABS warning lamp will go out the next time the ignition is switched on.

ABS-314

DTC ABS - 314 Wheel Sensor Signal, Right Rear Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-311, ABS-312, ABS-313 or ABS-314 is stored if the control module registers a fault in the wheel sensor circuit.

Substitute value

- The ABS function is disengaged.
- If a wheel is under ABS control and a wheel sensor fault for the wheel occurs, the ABS system is disengaged immediately.
- If more than one wheel is under the ABS control and a wheel sensor fault occurs, the ABS system is disengaged when the ABS control ceases.

Possible source

- Open-circuit in the signal cable (+) or signal cable (-).
- The sensor is dislodged from its mounting.
- The sensor is not installed.
- Short-circuit to +12 V in the signal cable.
- Short-circuit to ground in the signal cable.

- Defective wheel sensor.
- Contact resistance in the terminals.

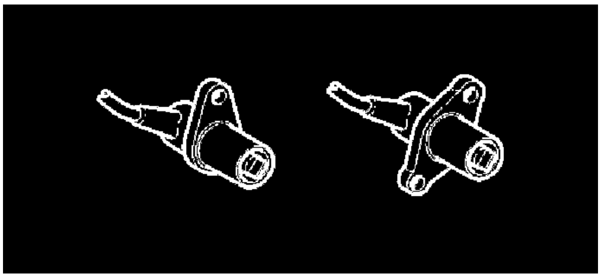
Fault symptom[s]
- The ABS warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

Hint: If the fault is intermittent, the ABS warning lamp will go out the next time the vehicle speed exceeds **12 km/h** the next time the ignition is switched on. If the fault is an intermittent open circuit, the ABS warning lamp will go out the next time the ignition is switched on.

ABS-331

DTC ABS - 331 Faulty Wheel Sensor Signal

Condition



Diagnostic trouble code **(DTC)** ABS-331 is stored if, via the wheel sensor signals, the control module registers one or more wheel speeds deviates too much from the car's reference speed.

Diagnostic trouble code **(DTC)** ABS-331 is stored is the control module needs to activate ABS control for one or more wheels for **more than 60 seconds** consecutively.

Diagnostic trouble code **(DTC)** ABS-31X is stored if the control module registers that the wheel sensor signals are affected by interference, or if there is interference on one or more wheels (for **more than 5 seconds** with the brakes off or for **more than 20 seconds** with the brakes on).

Substitute value
- The ABS function is disengaged.
- If a wheel is under ABS control and a wheel sensor fault for the wheel occurs, the ABS system is disengaged immediately.
- If more than one wheel is under the ABS control and a wheel sensor fault occurs, the ABS system is disengaged when the ABS control ceases.

Possible source
- The wheel sensor is loose.
- Defective pulse wheel.
- Hub vibrations or play in the wheel bearings.

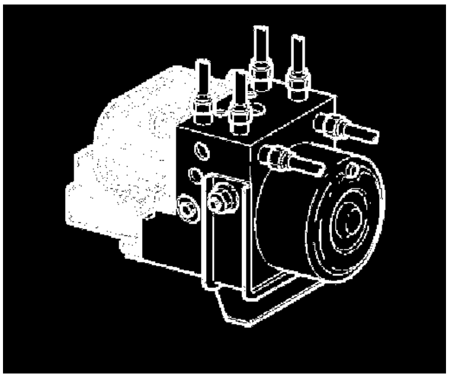
Fault symptom[s]
- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a danger that the wheels will lock during braking when the ABS function is disengaged.
- Poor braking effect.
- The brakes pull to one side.

Hint: If the fault becomes intermittent, the ABS warning lamp will not go out until the ignition is next switched on.

ABS-411

DTC ABS - 411 Inlet Valve, Left Front Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.** One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

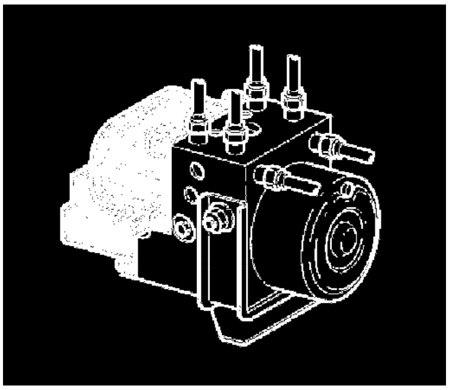
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-412

DTC ABS - 412 Outlet Valve, Left Front Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.** One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

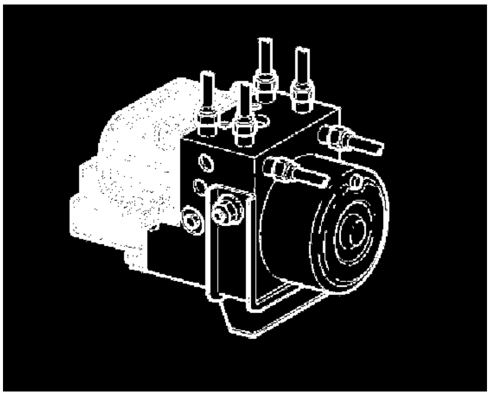
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-413

DTC ABS - 413 Inlet Valve, Right Front Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms**. One of these diagnostic trouble codes **(DTCs**) will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

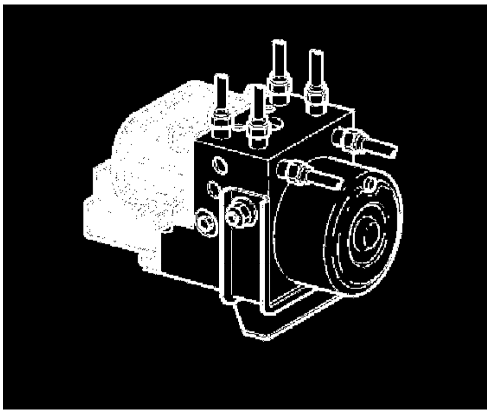
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-414

DTC ABS - 414 Outlet Valve, Right Front Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.**

One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

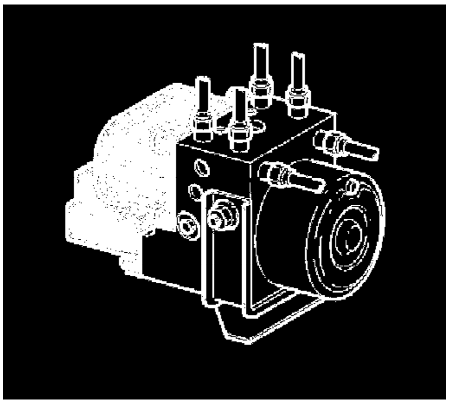
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-421

DTC ABS - 421 Inlet Valve, Left Rear Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.** One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

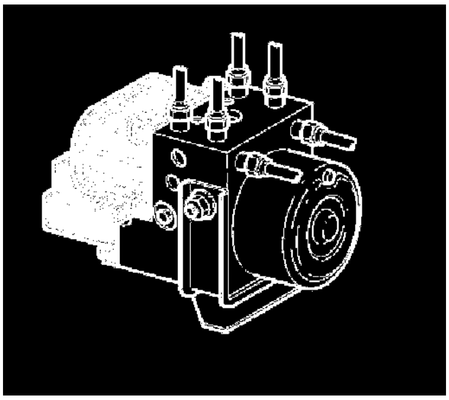
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-422

DTC ABS - 422 Outlet Valve, Left Rear Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.** One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

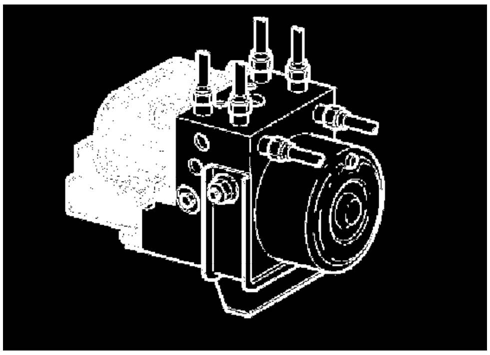
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-423

DTC ABS - 423 Inlet Valve, Right Rear Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.** One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

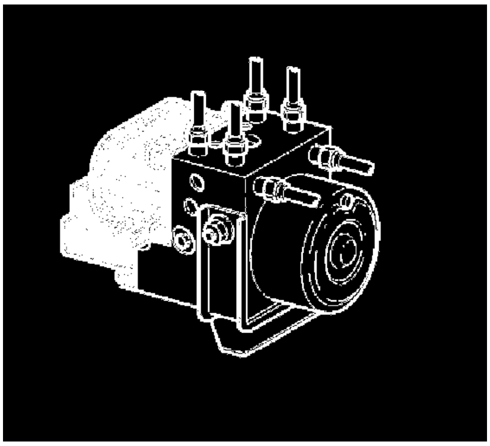
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-424

DTC ABS - 424 Outlet Valve, Right Rear Wheel

Condition



Diagnostic trouble code **(DTC)** ABS-411, ABS-412, ABS-413, ABS-414, ABS-421, ABS-422, ABS-423 or ABS-424 is stored (depending on the valve coil) if the control module registers that the signal from the valve coil (either activated or deactivated) is shut off for **more than 20 ms.** One of these diagnostic trouble codes **(DTCs)** will also be stored if the signal from the valve coil is shut off for **more than 10 ms** when testing the valve and pump motor.

The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle as long as the brake pedal is not depressed. The test is carried out at **15 km/h** if the brake pedal is depressed.

Substitute value

- The ABS function is disengaged.

Possible source

- Interference, noise etc. affecting the control module calculations.
- Defective control module.

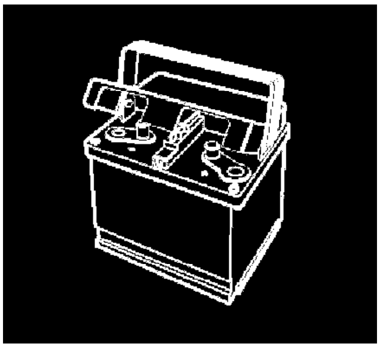
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-433

DTC ABS - 433 Battery Voltage

Condition



Diagnostic trouble code **(DTC)** ABS-433 is stored if the vehicle speed is **above 6 km/h or 15 km/h** and the control module registers that the battery voltage at terminal 15 is **below 9.4 V for longer than 0.5 seconds** when ABS control is not activated. Diagnostic trouble code **(DTC)**

ABS-433 will also be stored if the battery voltage is **below 8.8 V for longer than 0.5 seconds** when the ABS function is activated. The EBD function can operate **down to 6.9 volts.** It is not activated until the voltage **exceeds 7.1 volts.**

Substitute value

- None.

Possible source

- Open-circuit in the power supply.
- Contact resistance in the terminals.
- The charging system is not charging.

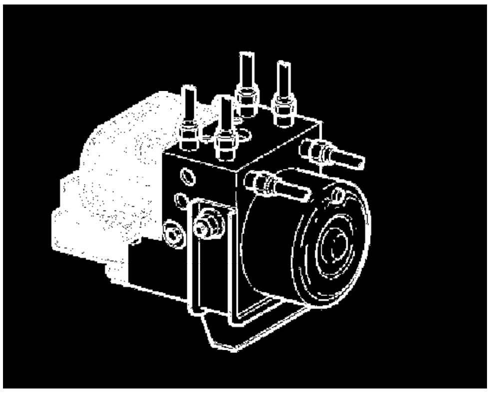
Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-441

DTC ABS - 441 Power Supply to Valves

Condition



Diagnostic trouble code **(DTC)** ABS-441 is stored if the control module registers a fault in the internal control module valve relay, or there is a fault in the power supply to the valve coils. The valves and pump motor are activated during ABS control and when testing the valve and pump motor. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** each driving cycle.

Substitute value

- The ABS function is disengaged. Certain faults disengage the ABS system only when the valve and pump motor test have been carried out.

Possible source

- Replace fuse 12 (50A) in the integrated relay/fuse box.
- Open-circuit in the power supply to control module connector terminal: 18.
- Contact resistance in the terminals.
- Defective control module.

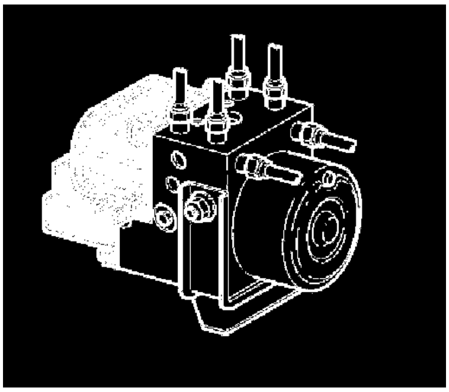
Fault symptom[s]

- The ABS warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

ABS-443

DTC ABS - 443 Pump Motor

Condition



Diagnostic trouble code **(DTC)** ABS-443 is stored if the control module registers that the pump is running without being activated; that the pump motor has no supply voltage when it is activated; that the signal generated in the pump motor circuit when the pump motor supply voltage has been cut off (generated voltage), is abnormal or an open circuit to ground in the pump motor. The pump motor is activated during ABS control and during the valve and pump motor test. The control module carries out the valve and pump motor test the first time the car reaches **6 km/h** or **15 km/h** during the same driving cycle.

Substitute value

- The ABS function is disengaged.
- The EBD function is disengaged if fuse 12 has blown.

Possible source

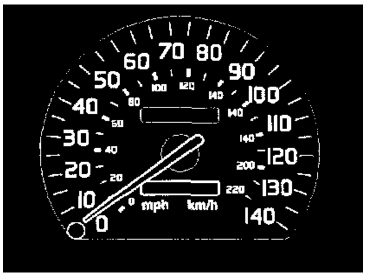
- Replace fuse 12 (50A) in the integrated relay/fuse box.
- Open-circuit in the power supply (30-supply) to control module connector terminal: 17.
- Open-circuit in the pump motor power supply or in the ground lead.
- Defective hydraulic pump.
- Contact resistance in the terminals.
- Defective control module.

Fault symptom[s]

- The ABS warning lamp lights.
- The stop (brake) warning lamp lights.
- There is a risk of wheel lock-up when braking if the ABS system is disengaged.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Special tools: 998 8686

Condition

Data about the vehicle speed is sent from the combined instrument panel to the cruise control control module.

The signal is an homogenous rectangular wave with a variable frequency; the frequency increases with vehicle speed.

The control module uses the signal as a reference speed when setting and checking the speed. The signal is also used to determine whether the variations in speed are normal.

The control module has an internal function which can disengage the cruise control for safety reasons.

This function is activated if acceleration or deceleration is abnormal (wheel-spin) or (wheel lock-up) and when vehicle speed is less than 75% of the set speed when driving up steep hills, when the engine cannot maintain a constant speed.

However, disengagement of the cruise control for safety reasons does not necessarily mean that it is not functioning correctly.

Diagnostic trouble code (DTC) 1-1-2 is stored if the cruise control has been disengaged for safety reasons due to an incorrect speed signal.

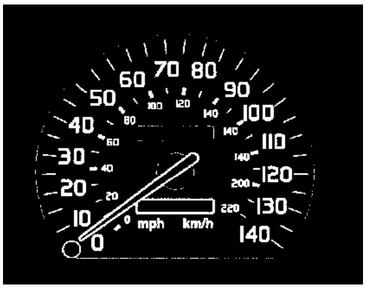
The diagnostic trouble code (DTC) is only generated if the control module has detected a normal road speed signal at some point during the test drive.

Possible source
An abnormal vehicle speed signal can be caused by:
- Incorrect installation or poor suppression of accessories connected to the same vehicle speed signal or same ground terminal as the speedometer.
- different ground terminals for the control module and the combined instrument panel
- short-circuit to ground or voltage in the signal cable from the combined instrument panel
- intermittent open-circuit in the signal cable from the combined instrument panel
- defective speedometer
- contact resistance in the terminals.

Condition
- The cruise control is disengaged while the car is being driven.
- The speedometer displays an incorrect value.

Checking the Speedometer

Checking The Speedometer



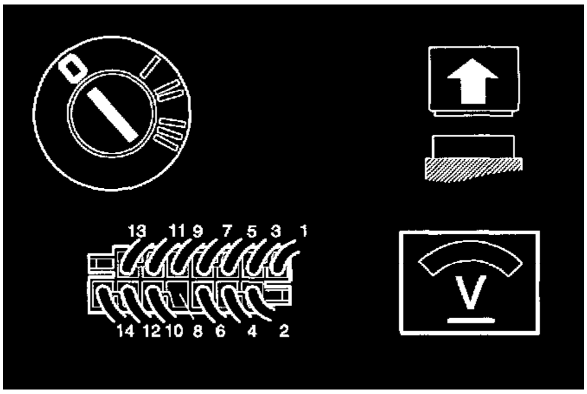
Did the speedometer operate correctly while driving?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking the Vehicle Speed Signal

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking Components - III

Checking the Vehicle Speed Signal

Checking The Vehicle Speed Signal



- Ignition off.
- Disconnect the control module.
- Raise the car so that the front wheels are off the ground.

Connect a voltmeter between control module connector terminal 13 and ground.

Then spin the front wheels slowly by hand.

The voltmeter should oscillate between battery voltage and approximately **1.5 V** when the wheels are rotated slowly. The voltmeter should oscillate between battery voltage and approximately **6 V** when the wheel is rotated quickly.
- **1.** The value is OK.

- **2.** The voltmeter reads battery voltage constantly.
- **3.** The voltmeter reads approximately **0 V** constantly.

Select one of the above options.

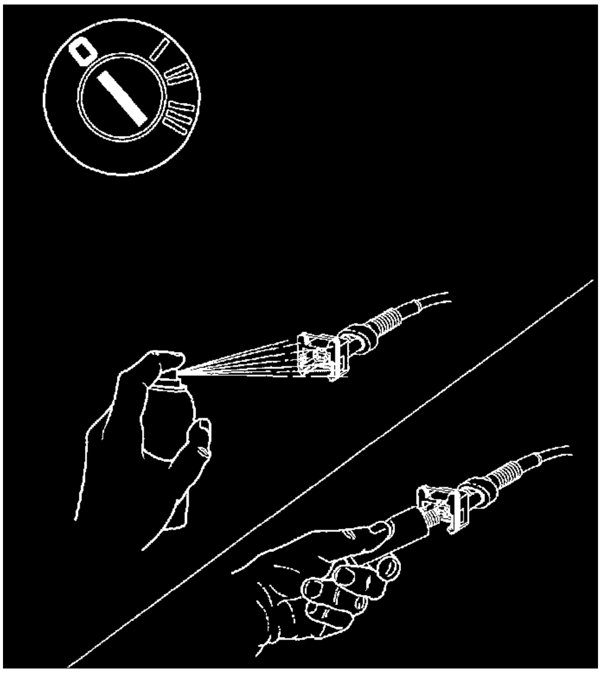
1 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking For Contact Resistance and Oxidation

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking Components - I

3 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking Components - II

Checking For Contact Resistance and Oxidation

Checking For Contact Resistance And Oxidation



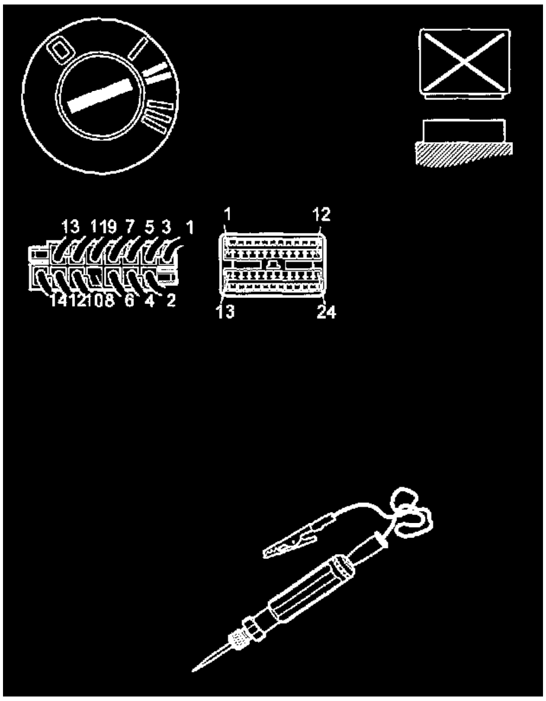
- Ignition off.
- The cause of the diagnostic trouble code (DTC) was loose terminals in the control module connector. Check control module connector terminal 13 for contact resistance and oxidation. Remedy according to **Checking wiring and terminals - Permanent faults**. Check for loose connections according to **Checking wiring and terminals - Intermittent faults**.

See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults
See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Intermittent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Verification

Checking Components - I

Checking Components



- Ignition on.
- Control module disconnected.
- Connect an electrician's screwdriver (at least **3 W**) between control module connector terminal 13 and ground.

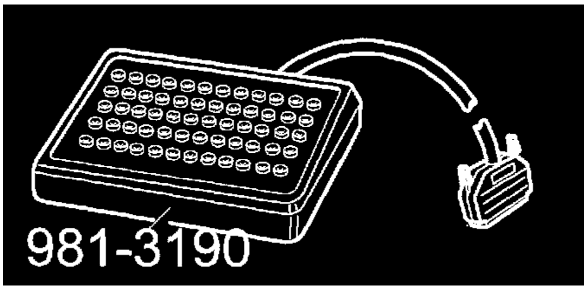
Does the electrician's screwdriver light?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

Connecting the Breakout Box (the Combined Instrument Panel)

Connecting The Breakout Box (The Combined Instrument Panel)



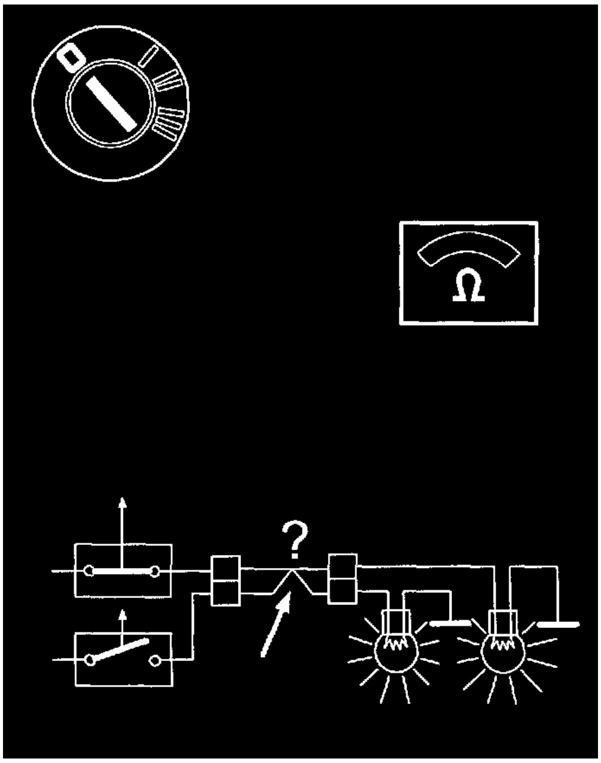
Is the breakout box connected to the control module?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking For A Short-Circuit

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box

Checking For A Short-Circuit

Checking For A Short-Circuit

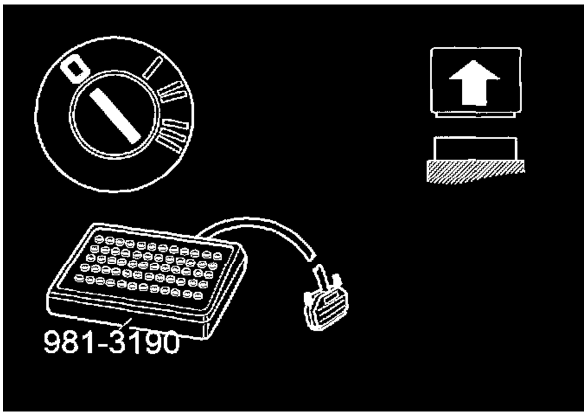


- Ignition off.
- Check the cable between control module terminal 13 and combined instrument panel terminal B15. Check the cable between engine control module (ECM) terminal 12 and combined instrument panel B15. Check for a short-circuit to supply voltage according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Verification

Connecting the Breakout Box

Connecting The Breakout Box



- Ignition off.
- Expose the combined instrument panel.
- Disconnect the connector from the combined instrument panel.

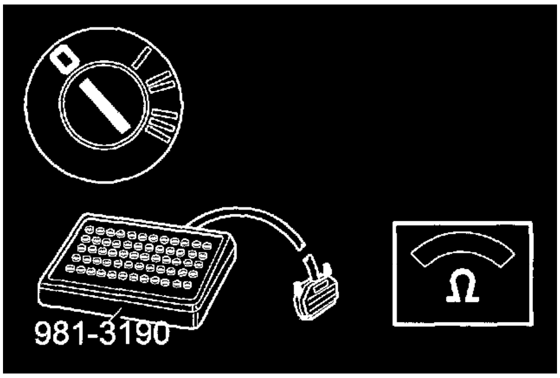
On the combined instrument panel connector check that:

- The male and female terminals are undamaged and properly attached (cannot be pressed in).
- The wiring for the female terminals is securely connected.
- In particular check those terminals that are relevant to the stored diagnostic trouble code (DTC) / symptoms.
- Connect adapter **951 1372** to the combined instrument panel connectors A and B (wiring side). Connect breakout box **981 3190** to the adapter.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking the Ground Terminal

Checking the Ground Terminal

Checking The Ground Terminal



- Ignition off.
- Switch off all power consuming components such as the courtesy lighting and the radio.

Connect an ohmmeter between the battery negative terminal and:
- #13 (#A13) on the breakout box
- #12 (#A12) on the breakout box
- #47 (#B17) on the breakout box.

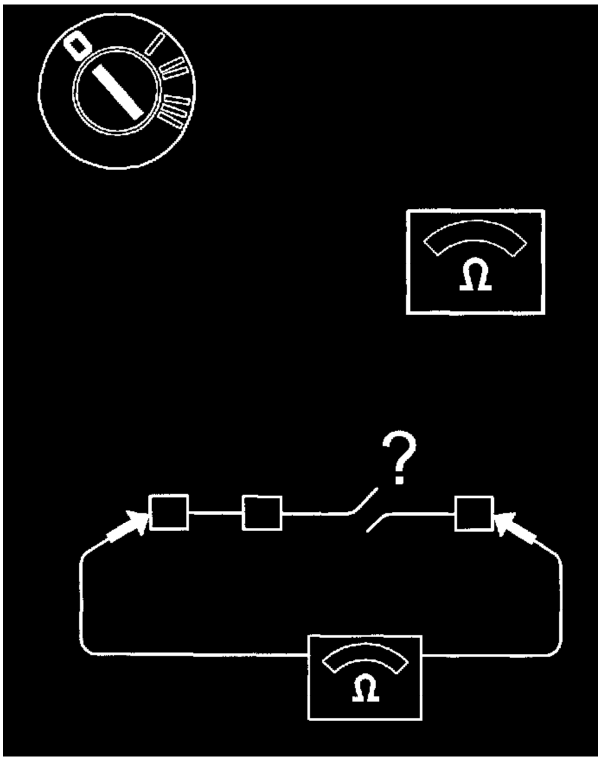
The ohmmeter should read approximately 0 [ohm] for all readings.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking For A Short-Circuit

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking For an Open-Circuit

Checking For an Open-Circuit

Checking For An Open-Circuit

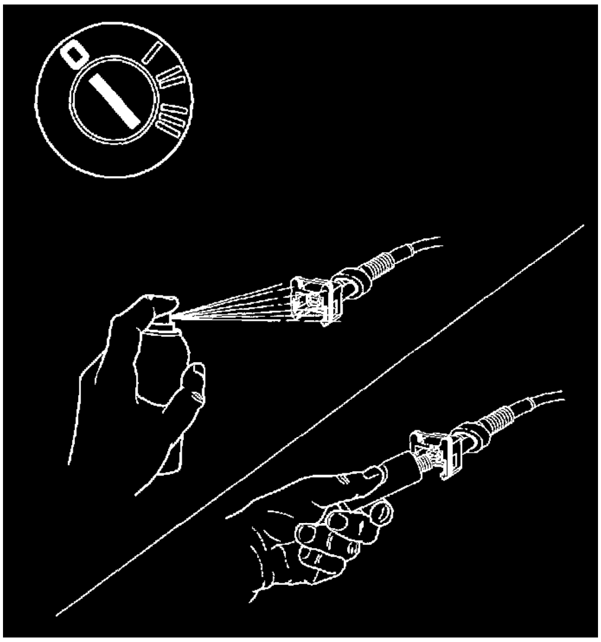


- Ignition off.
- Check ground terminal 31/6 and the wiring connected to it for an open-circuit according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Checking Contact Resistance and Oxidation

Checking Contact Resistance and Oxidation

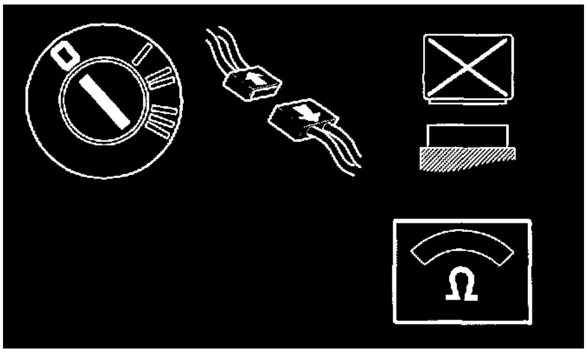
Checking Contact Resistance And Oxidation



- Ignition off.
- Check ground terminal 31/6 and the wiring connected to it for contact resistance and oxidation according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

Checking Components - II

Checking Components



- Ignition off
- Control module disconnected.
- Disconnect the engine control module (ECM).
- Expose the combined instrument panel
- Disconnect the combined instrument panel.
- Connect an ohmmeter between control module terminal 13 and combined instrument panel terminal B15.

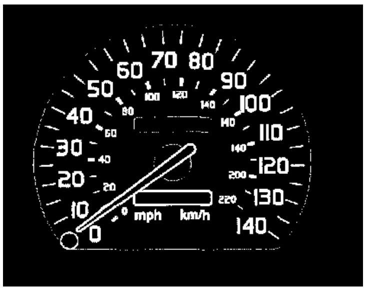
The resistance must be 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

Not Ok - This information to be published by O.E. at a later date.

Checking Components - III

Checking Components

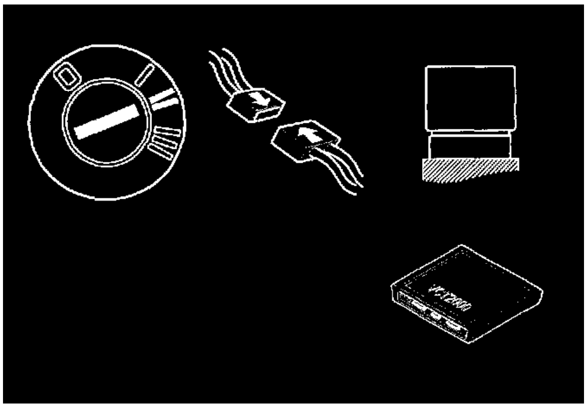


- Fault-trace the speedometer according to Combined instrument panel.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-1-2/Speed Signal Outside the Permitted Range/Verification

Verification

Verification



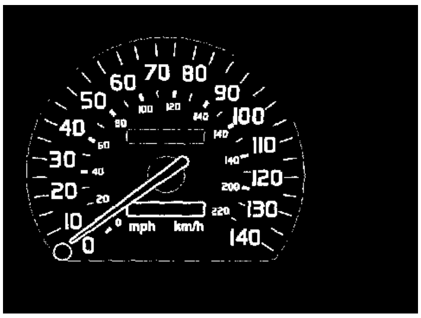
Hint: After carrying out the repair, check that the fault has been remedied as follows:
- Ignition off.
- Reinstall the connectors, components etc.
- Control module connected.
- Disconnect the VCT 2000 from the data link connector (DLC).
- Ignition on.
- Test drive the car. Do not switch off the engine after the test drive!
- Connect VCT 2000 to the data link connector (DLC) in the car.

Read off diagnostic trouble codes (DTCs).

Diagnostic trouble code (DTC) 1-1-2 or 1-2-2 should not have been stored.

Diagnostic Trouble Code (DTC) Information

Diagnostic trouble code (DTC) information



Special tools: 998 8686

Condition
This diagnostic trouble code (DTC) is stored when the ignition is switched on and remains until vehicle speed has exceeded **35 km/h** for at least **15 seconds**. The control module is not receiving a vehicle speed signal (VSS) if the diagnostic trouble code (DTC) is still stored after a test drive at above **35 km/h**.

Possible source

A missing vehicle speed signal can be caused by.

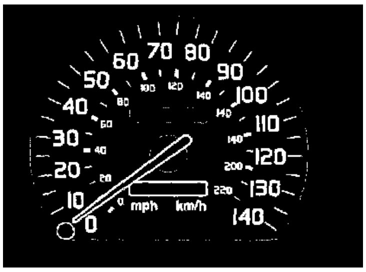
- incorrect installation or poor suppression of accessories connected to the same vehicle speed signal or same ground terminal as the speedometer.
- short-circuit to ground or voltage in the signal cable from the combined instrument panel
- open-circuit in the signal cable from the combined instrument panel
- defective speedometer
- contact resistance in the terminals.

Condition

- The cruise control does not engage.
- The speedometer display is incorrect.

Checking the Speedometer

Checking The Speedometer



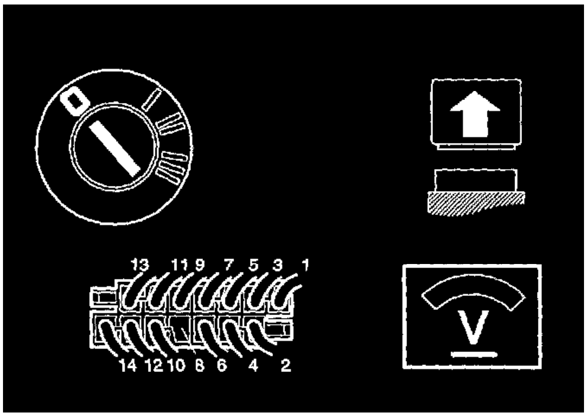
Did the speedometer operate correctly while driving?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking the Vehicle Speed Signal

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking Components - III

Checking the Vehicle Speed Signal

Checking The Vehicle Speed Signal



- Ignition off.
- Disconnect the control module.
- Raise the car so that the front wheels are off the ground.

Connect a voltmeter between control module connector terminal 13 and ground.

Then spin the front wheels slowly by hand.

The voltmeter should oscillate between battery voltage and approximately **1.5 V** when the wheels are rotated slowly. The voltmeter should oscillate between battery voltage and approximately **6 V** when the wheel is rotated quickly.

- **1.** The value is OK.
- **2.** The voltmeter reads battery voltage constantly.
- **3.** The voltmeter reads approximately **0 V** constantly.

Select one of the above options.

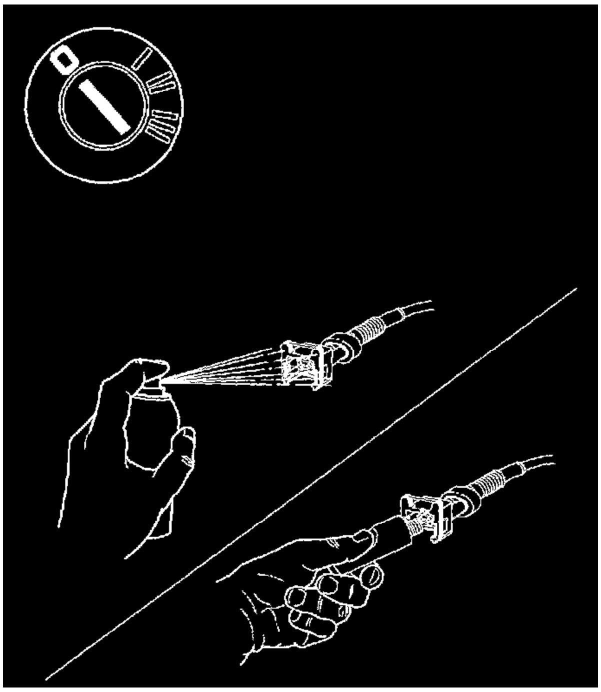
1 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking For Contact Resistance and Oxidation

2 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking Components- I

3 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking Components - II

Checking For Contact Resistance and Oxidation

Checking For Contact Resistance And Oxidation



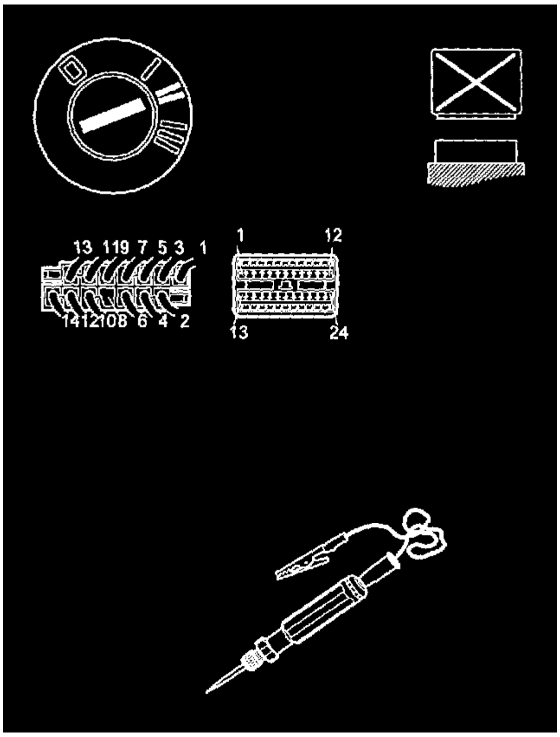
- Ignition off.
- The cause of the diagnostic trouble code (DTC) was loose terminals in the control module connector. Check control module connector terminal 13 for contact resistance and oxidation. Remedy according to **Checking wiring and terminals - Permanent faults**. Check for loose connections according to **Checking wiring and terminals - Intermittent faults**.

See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults
See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Intermittent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Verification

Checking Components- I

Checking Components - I



- Ignition on.
- Control module disconnected.
- Connect an electrician 5 screwdriver (at least **3 W**) between control module connector terminal 13 and ground.

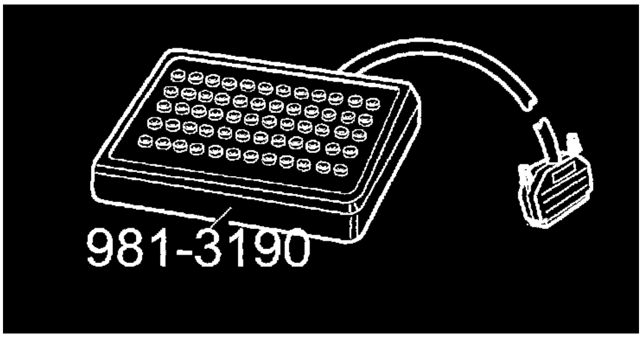
Does the electrician's screwdriver light?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

Connecting the Breakout Box (the Combined Instrument Panel)

Connecting The Breakout Box (The Combined Instrument Panel)



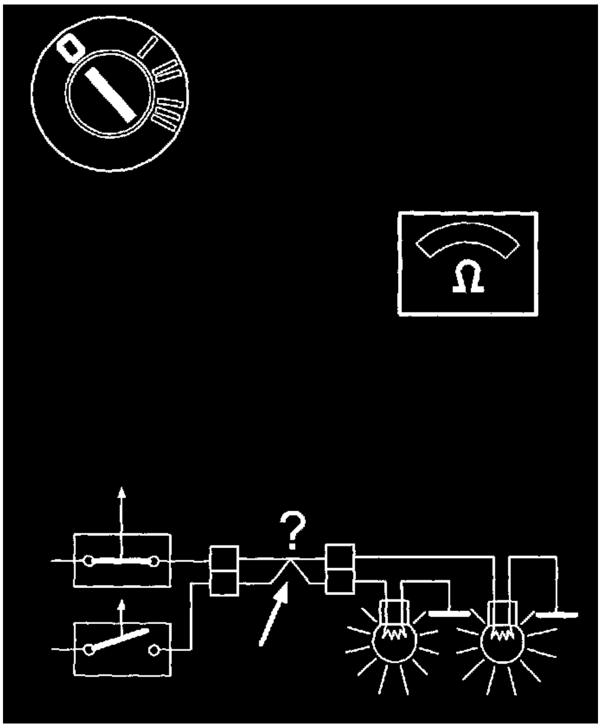
Is the breakout box connected to the control module?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking For A Short-Circuit

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box

Checking For A Short-Circuit

Checking For A Short-Circuit

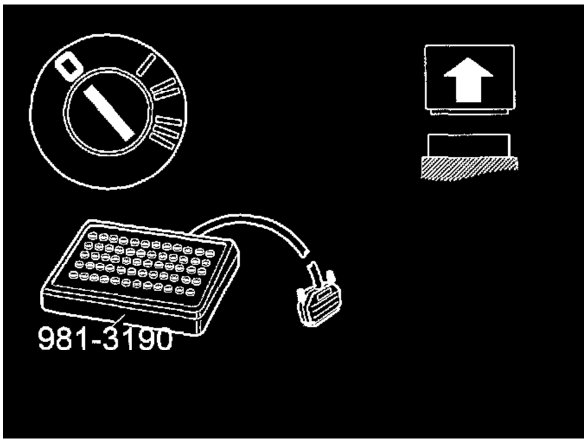


- Ignition off.
- Check the cable between control module terminal 13 and combined instrument panel terminal B15. Check the cable between engine control module (ECM) terminal 12 and combined instrument panel B15. Check for a short-circuit to supply voltage according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Verification

Connecting the Breakout Box

Connecting The Breakout Box



- Ignition off.
- Expose the combined instrument panel.
- Disconnect the connector from the combined instrument panel.

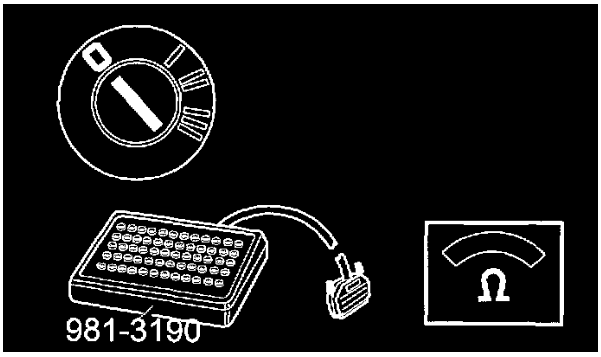
On the combined instrument panel connector check that:
- The male and female terminals are undamaged and properly attached (cannot be pressed in).
- The wiring for the female terminals is securely connected.
- In particular check those terminals that are relevant to the stored diagnostic trouble code (DTC) / symptoms.
- Connect adapter **951 1372** to the combined instrument panel connectors A and B (wiring side). Connect breakout box **981 3190** to the adapter.

See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults
See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Intermittent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC

Checking the Ground Terminal

Checking The Ground Terminal



- Ignition off.
- Switch off all power consuming components such as the courtesy lighting and the radio.

Connect an ohmmeter between the battery negative terminal and:
- #13 (#A13) on the breakout box
- #12 (#A12) on the breakout box
- #47 (#B17) on the breakout box.

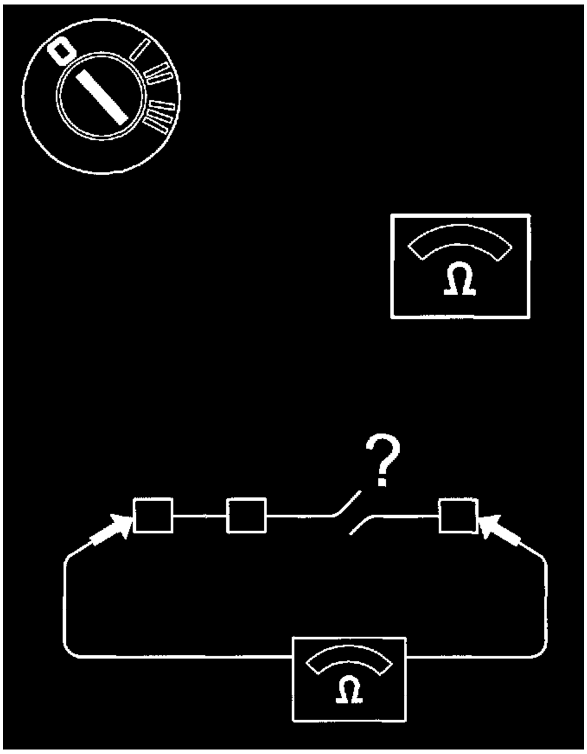
The ohmmeter should rend approximately 0 [ohm] for all readings.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking For an Open-Circuit

Checking For an Open-Circuit

Checking For An Open-Circuit

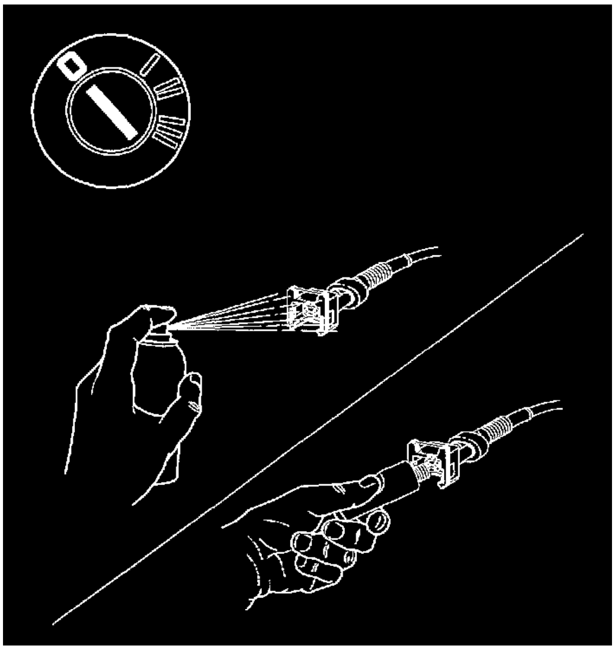


- Ignition off.
- Check ground terminal 31/6 and the wiring connected to it for an open-circuit according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Checking Contact Resistance and Oxidation

Checking Contact Resistance and Oxidation

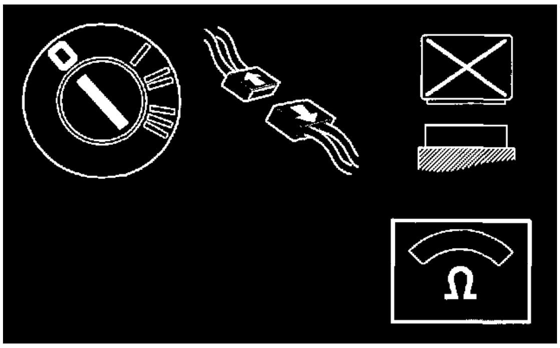
Checking Contact Resistance And Oxidation



- Ignition off.
- Check ground terminal 31/6 and the wiring connected to it for contact resistance and oxidation according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

Checking Components - II

Checking Components



- Ignition off.
- Control module disconnected.
- Disconnect the engine control module (ECM).
- Expose the combined instrument panel.
- Disconnect the combined instrument panel.
- Connect an ohmmeter between control module terminal 13 and combined instrument panel terminal B15.

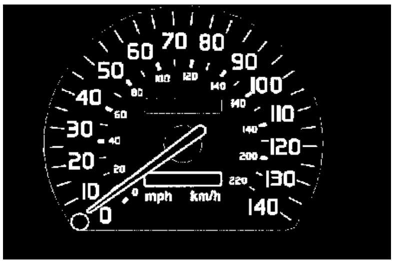
The resistance must be 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Connecting the Breakout Box (the Combined Instrument Panel)

Checking Components - III

Checking Components

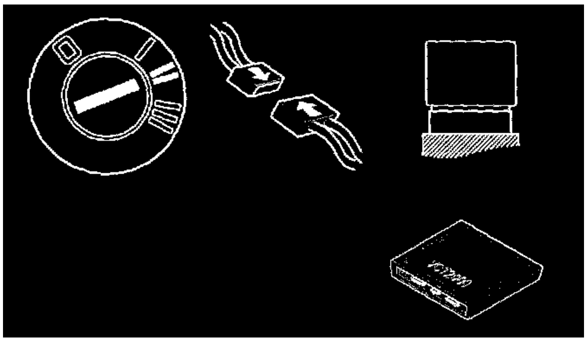


- Fault-trace the speedometer according to Combined instrument panel.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 1-2-2/Speed Signal Outside the Permitted Range/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied as follows:

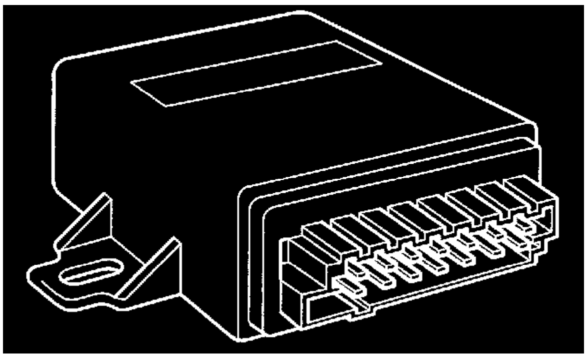
- Ignition off.
- Reinstall the connectors, components etc.
- Control module connected.
- Disconnect the VCT 2000 from the data link connector (DLC).
- Ignition on.
- Test drive the car. Do not switch off the engine after the test drive!
- Connect VCT 2000 to the data link connector (DLC) in the car.

Read off diagnostic trouble codes (DTCs).

Diagnostic trouble code (DTC) 1-1-2 or 1-2-2 should not have been stored.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Special tools: 998 8686

Condition
Diagnostic trouble code (DTC) 2-1-1 is stored if there is an internal fault in the control module.

The control module will not operate if the voltage to the control module is less than **10.5 V** or higher than **16 V**.

Possible source

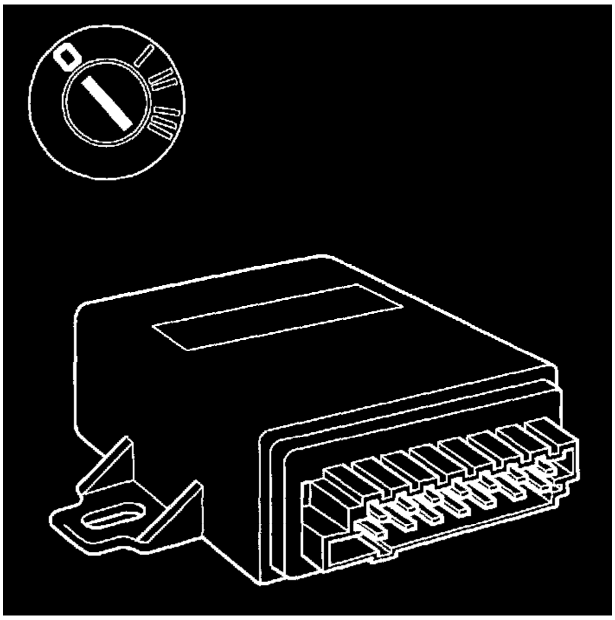
Defective control module.

Condition

- The cruise control does not engage.
- The cruise control disengages while the car is being driven.

Replacing the Component

Replacing The Component

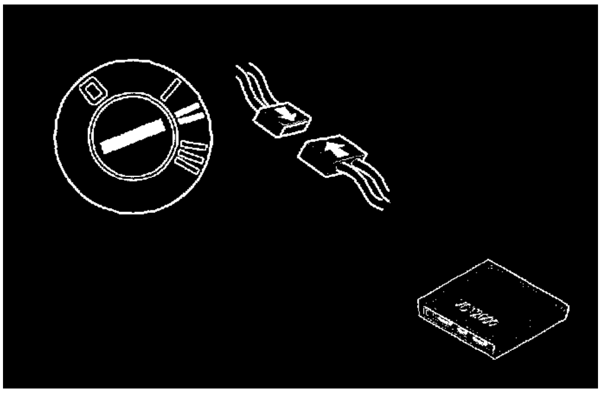


- Ignition off.
- Replace with a control module according to **Control module**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-1-1/Internal Fault In the Control Module/Verification

Verification

Verification

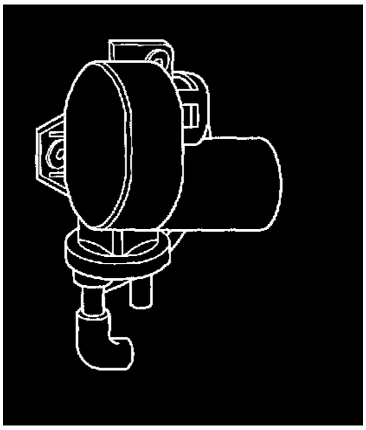


Hint: After carrying out the repair, check that the fault has been remedied as follows:

- Ignition off.
- Reinstall the connectors, components etc.
- Disconnect the VCT 2000 from the data link connector (DLC).
- Ignition on.
- Test drive the car. Do not switch off the engine after the test drive!
- Connect VCT 2000 to the data link connector (DLC) in the car.
- Read off the diagnostic trouble codes (DTCs). Check whether diagnostic trouble code (DTC) 2-1-1 has been stored.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Special tools: 998 8686

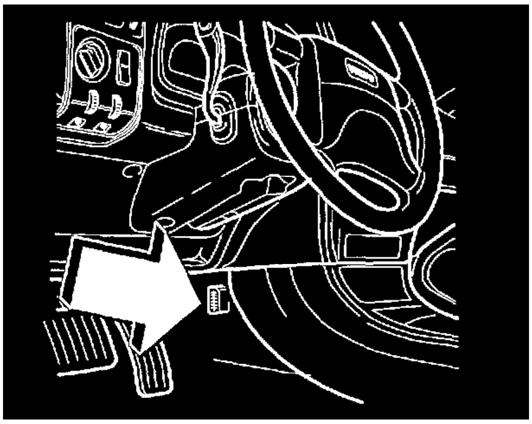
Condition
Diagnostic trouble code (DTC) 2-1-2 is stored if the control module detects abnormal signals in the circuit for the vacuum pump or regulator.

Possible source
- Open-circuit in the wiring between the control module and the vacuum pump / regulator.
- Short-circuit to ground or voltage in the cables between the control module and the vacuum pump / regulator.
- Defective vacuum pump or regulator.
- Contact resistance in the terminals.

Condition
- The cruise control does not engage.
- The cruise control disengages while the car is being driven.

Connecting the Volvo Communication Tool 2000 (VCT 2000)

Connecting The Volvo Communication Tool 2000 (VCT 2000)



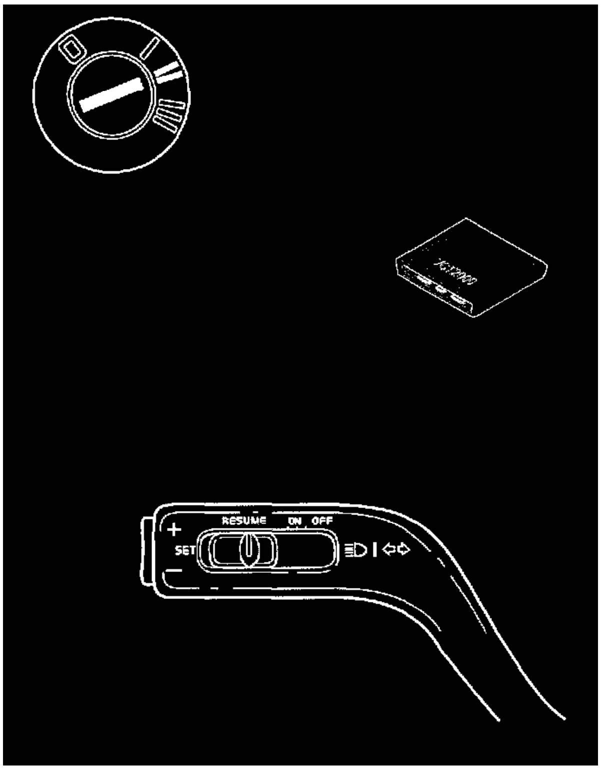
The VCT 2000 must be connected to both the VADIS PC and the data link connector (DLC) in the car to communicate with the control modules in the car.

For information about connection, See: Cruise Control/Testing and Inspection/Testing and Inspection Procedures/Displaying & Reading Trouble Codes

After performing this procedure See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Power and Ground Terminals

Checking the Ground Lead. Checking the Power Supply

Checking The Ground Lead. Checking The Power Supply



- Ignition on.
- Try to establish communication with the cruise control control module.

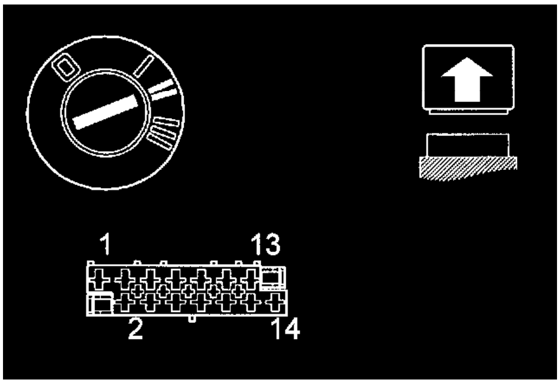
Is communication with the cruise control control module established?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Function of the Governor

No - Test Complete

Checking the Function of the Governor

Checking The Function Of The Governor



- Ignition off.
- Disconnect the control module.
- Ignition on.

Connect the single wire cable between terminals 1 an 11 on the control module connector.

Connect the other cable with the double flat pins to control module connector terminal 10. Connect one cable to control module connector terminal 12.

The governor should click.

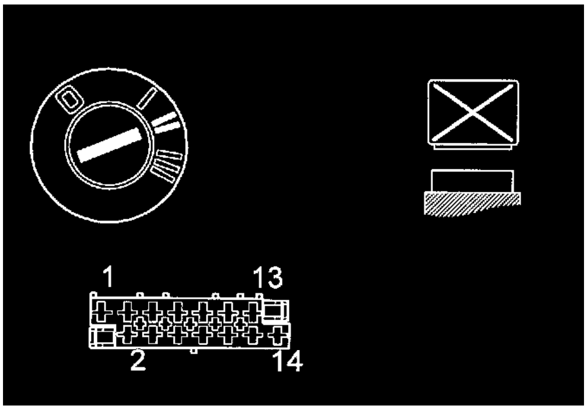
Did the governor click?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Function of the Vacuum Pump

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Cable For the Governor

Checking the Function of the Vacuum Pump

Checking The Function Of The Vacuum Pump



- Ignition on.
- Control module disconnected.
- Connect the single wire cable between terminals 1 and 11 on the control module connector.

Connect the other cable with the double flat pin to control module connector terminal 10. Connect one of the other ends to control module connector terminal 12.

Connect the other cable to control module connector terminal 9. The vacuum pump should start. The vacuum regulator should compress.

Remove the cable from terminal 9 when the vacuum regulator is fully depressed. The vacuum pump should stop.

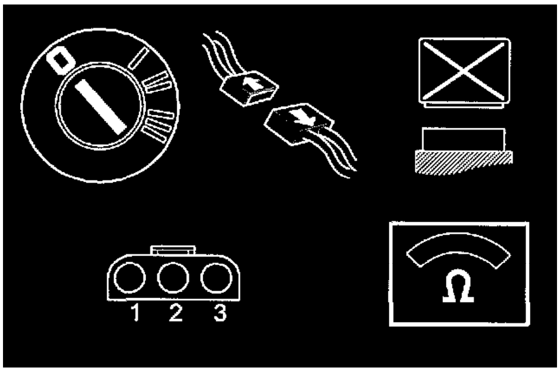
Is the vacuum pump operating normally?

Yes - Test Complete

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Cable to the Vacuum Pump

Checking the Cable to the Vacuum Pump

Checking The Cable To The Vacuum Pump



- Ignition off.
- Disconnect the vacuum pump.
- Control module disconnected.

Connect a voltmeter between vacuum pump connector terminal 2 and ground.

The ohmmeter should read infinite resistance.

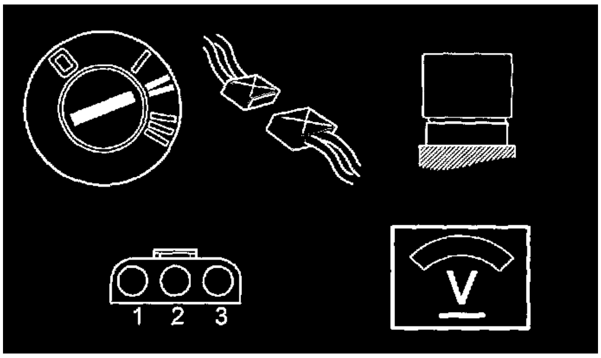
Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Voltage to the Vacuum Pump

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the

Vacuum System/Checking For A Short-Circuit

Checking the Voltage to the Vacuum Pump

Checking The Voltage To The Vacuum Pump



- Ignition off.
- Control module connected.
- Vacuum pump removed.
- Ignition on.

Connect a voltmeter between vacuum pump connector terminal 2 and ground.

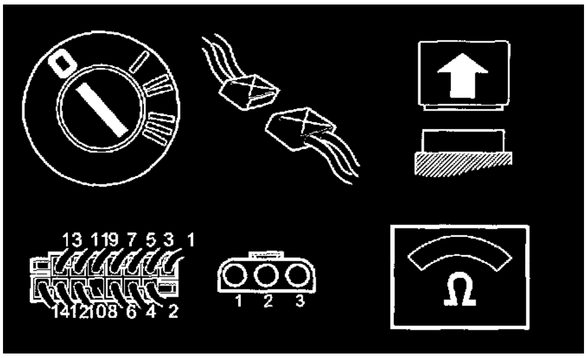
The voltmeter should read approximately 0 V.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Resistance In the Cable

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking For A Short-Circuit

Checking the Resistance In the Cable

Checking The Resistance In The Cable



- Ignition off.
- Disconnect the control module.
- Vacuum pump removed.

Connect an ohmmeter between vacuum pump connector terminal 2 and control module connector terminal 9.

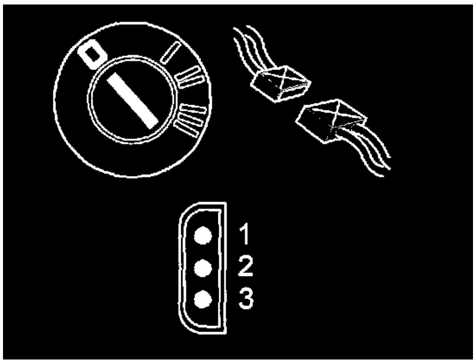
The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Vacuum Pump

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking For an Open-Circuit

Checking the Vacuum Pump

Checking The Vacuum Pump



- Ignition off.
- Vacuum pump removed.
- Temporarily connect a cable between vacuum pump pin terminal 3 and the battery positive terminal. Connect a cable between vacuum pump pin terminal 2 and the battery negative terminal. The vacuum pump should start.
- Remove the temporarily connected cables.

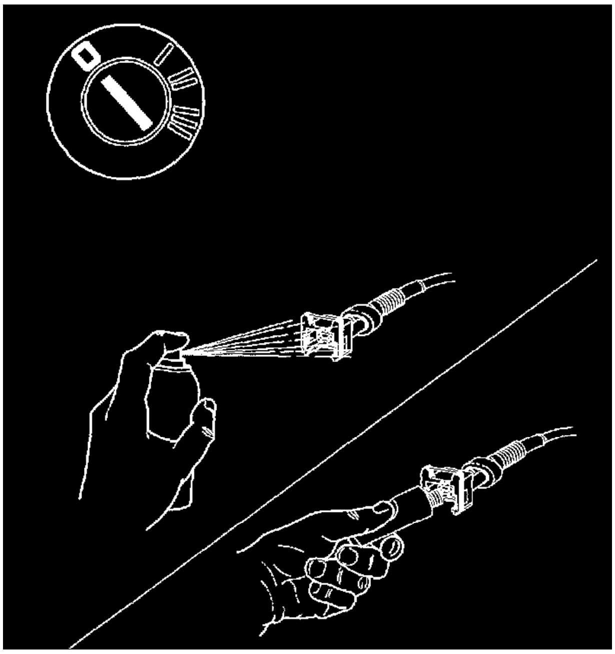
Did the vacuum pump start?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Replacing the Component

Checking For Contact Resistance and Oxidation

Checking For Contact Resistance And Oxidation



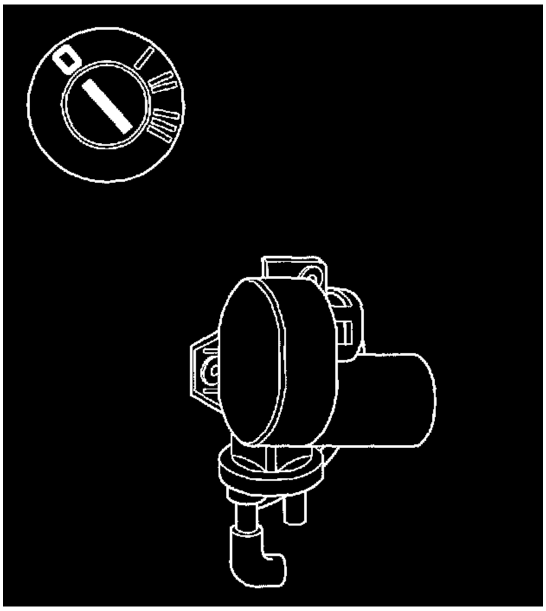
- Ignition off.
- Check the control module terminal and vacuum pump connectors for contact resistance and oxidation. Remedy according to **Checking wiring and terminals - Permanent faults**. Check for loose connections according to **Checking wiring and terminals - Intermittent faults**.

See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults
See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Intermittent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Verification

Replacing the Component

Replacing The Component

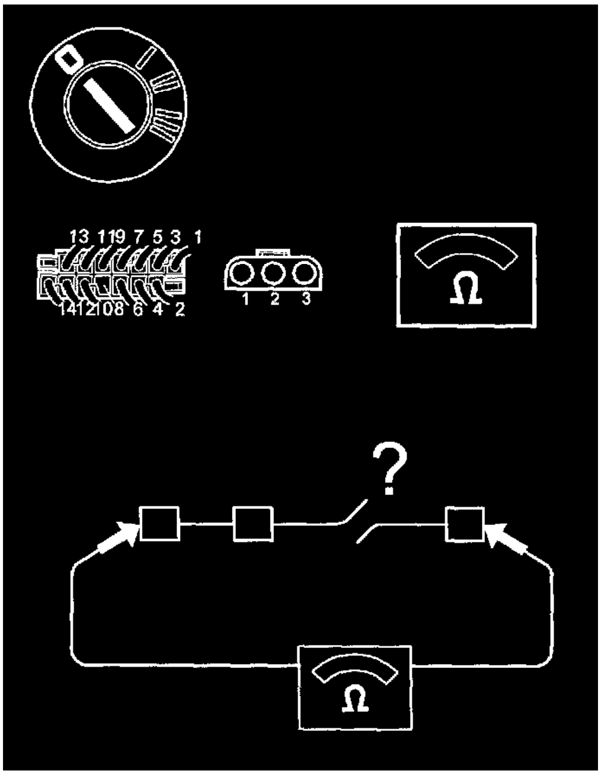


- Ignition off.
- Replace the vacuum pump according to **Vacuum pump and regulator**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Verification

Checking For an Open-Circuit

Checking For An Open-Circuit

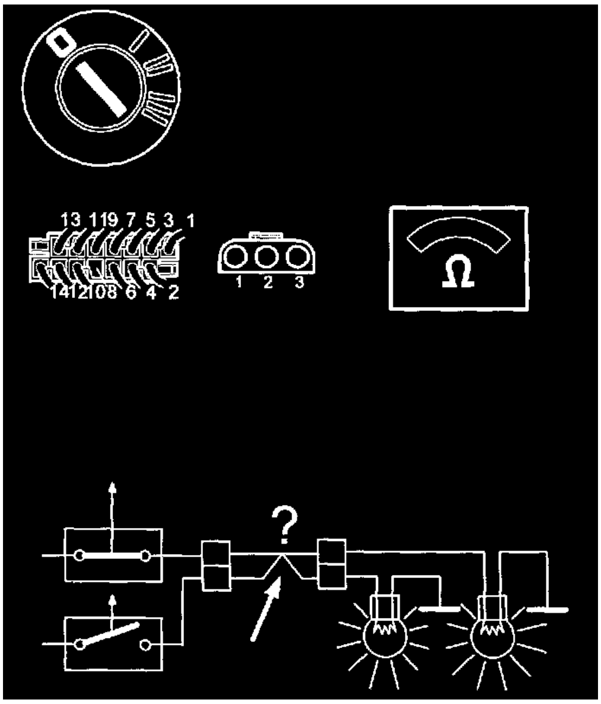


- Ignition off.
- Check the cable between vacuum pump connector terminal 2 and control module connector terminal 9 for a open-circuit according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Verification

Checking For A Short-Circuit

Checking For A Short-Circuit

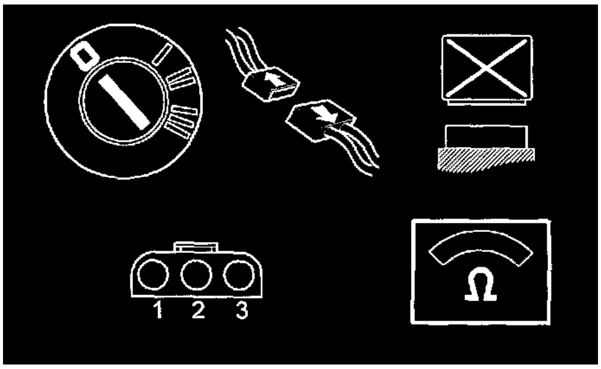


- Ignition off.
- Check the cable between vacuum pump connector terminal 2 and control module connector terminal 9 for a short-circuit to supply voltage according to See: Cruise Control/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests and Information/Checking Wiring and Terminals/Checking Wiring and Terminals - Permanent Faults

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Verification

Checking the Cable For the Governor

Checking The Cable For The Governor



- Ignition off.
- Control module disconnected.
- Disconnect the vacuum pump.

Connect a voltmeter between vacuum pump connector terminal 1 and ground.

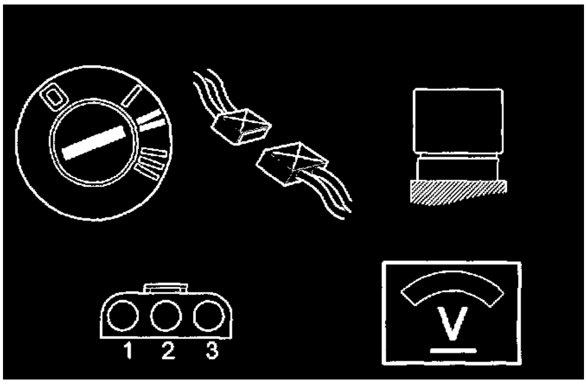
The ohmmeter should read infinite resistance.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Power Supply For the Governor

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking For A Short-Circuit

Checking the Power Supply For the Governor

Checking The Power Supply For The Governor



- Ignition off.
- Control module connected.
- Vacuum pump removed.
- Ignition on.

Connect a voltmeter between vacuum pump connector terminal 1 and ground.

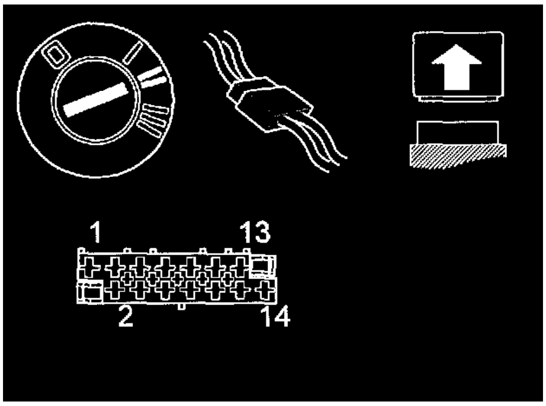
The voltmeter should read approximately 10 V.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking the Function of the Governor

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Cruise Control/DTC 2-2-1/Checking the Vacuum System/Checking For an Open-Circuit

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied as follows:

- Ignition off
- Disconnect the control module.
- Vacuum pump connected.
- Ignition on.

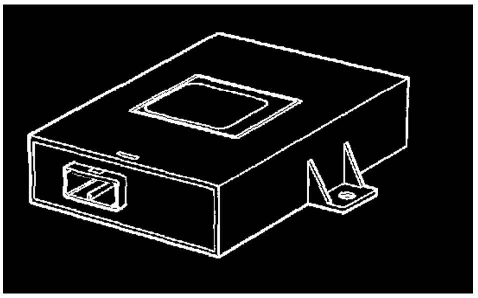
Connect the single cable between control module connector terminals 11 and 1.

Connect the other cable with the twinned blade terminal to control module connector terminal 10.

Connect one cable end to control module connector terminal 12.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) DSA-112 is stored if the DSA control module detects that the EEPROM memory is defective when the ignition is on or the engine is running.

NOTE: The diagnostic trouble code (DTC) is only stored as long as the ignition is on / the engine is running and the fault is permanent. If the fault disappears (becomes intermittent) the diagnostic trouble code (DTC) will no longer be stored.

Condition

The DSA function is disconnected.

Possible source

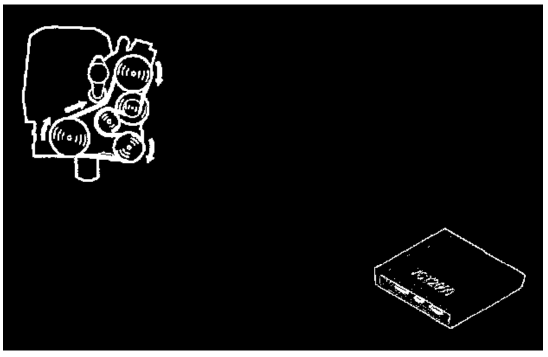
- Defective control module.

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the DSA Control Module

Checking The DSA Control Module



- Ignition off.
- Start the engine.
- Read off diagnostic trouble codes (DTCs).

Check whether diagnostic trouble code (DTC) DSA-112 is still stored.

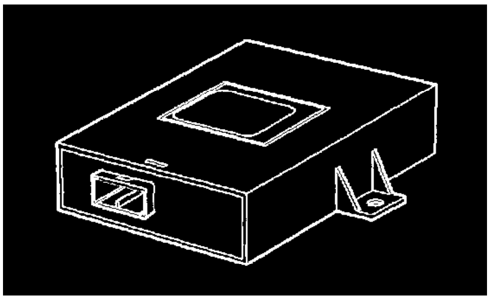
Is diagnostic trouble code (DTC) DSA-112 still stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-112/EEPROM Memory Fault/EEPROM Memory Fault - Permanent Fault

No - Test Complete

EEPROM Memory Fault - Permanent Fault

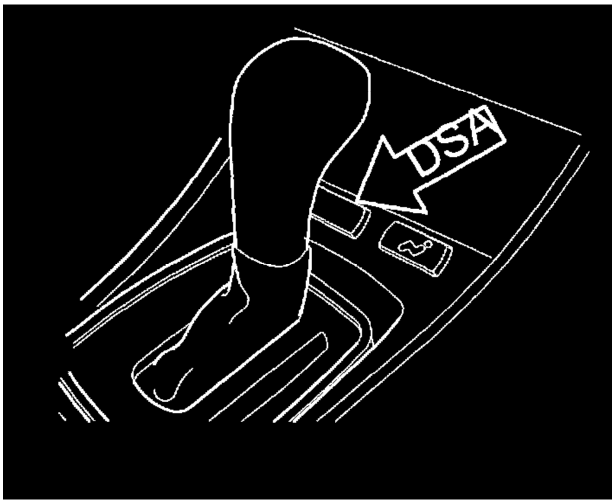
EEPROM Memory Fault - Permanent Fault



Try a new DSA control module according to **DSA control module, replacement**.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

when the DSA switch is not activated, the signal to the DSA control module is high. The signal to the DSA control module is grounded when the switch is pressed in. This engages or disengages the DSA function. Diagnostic trouble code (DTC) DSA-121 is stored if the DSA control module registers that the signal from the switch is low for more than approximately **60 seconds** when the engine is running.

NOTE: The diagnostic trouble code (DTC) can then be stored if the DSA button is held pressed in for more than approximately **60 seconds**. Fault causes of this type are not included in the fault-tracing procedure.

Condition

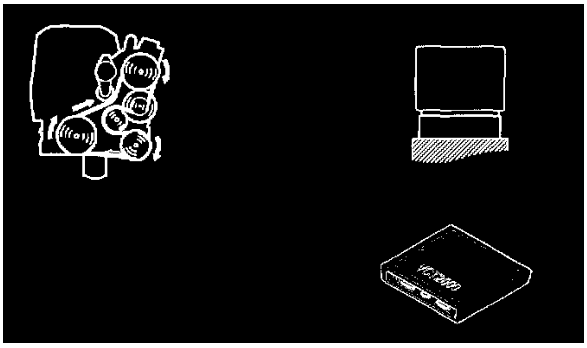
The DSA function is disengaged.

Possible source
- Short-circuit to ground in the signal cable.
- Defective switch.

Condition
- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the DSA Switch

Checking The DSA Switch



- Control module connected.
- Start the engine.
- Read off the status of the switch.

Check the function of the switch: OFF should be displayed when the switch is unaffected. On should be displayed when the switch is activated (pressed in).

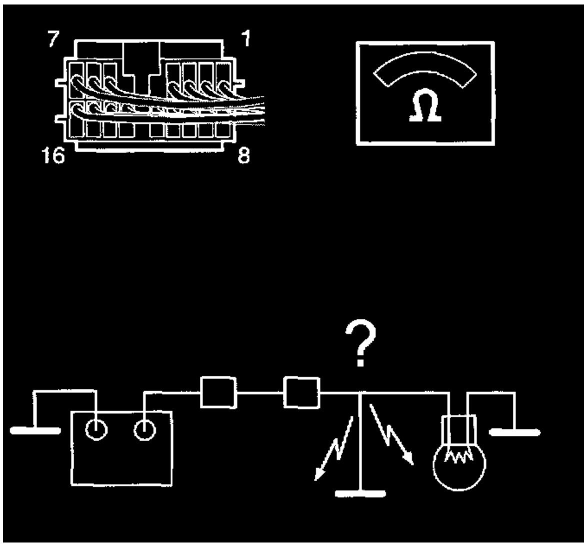
Is the function of the switch OK?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-121/Signal Too Low/Checking Wiring and Terminals

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-121/Signal Too Low/Checking the Signal Cable

Checking Wiring and Terminals

Checking Wiring And Terminals

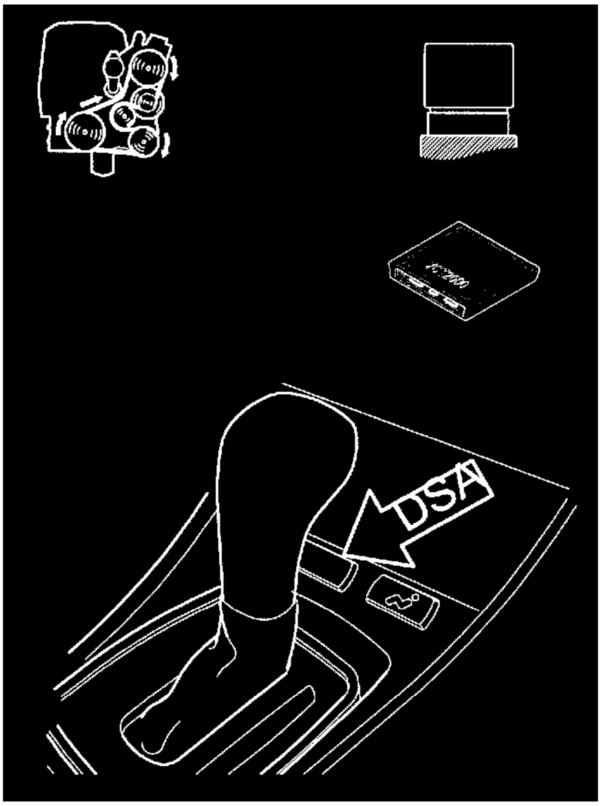


Check that the DSA switch button does not catch or stick in the depressed position. Remedy as necessary.

Check the cable between switch connector terminal 4 and DSA control module terminal 6 for an intermittent short circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Checking the Signal Cable

Checking The Signal Cable



- Control module connected.
- Start the engine.
- Read off the status of the switch.
- Carefully remove the switch from the instrument panel.
- Disconnect the switch.

Check whether the ON or OFF status is displayed.

Is the OFF status displayed?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-121/Signal Too Low/Replacing the Component

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-121/Signal Too Low/Checking For A Short-Circuit

Replacing the Component

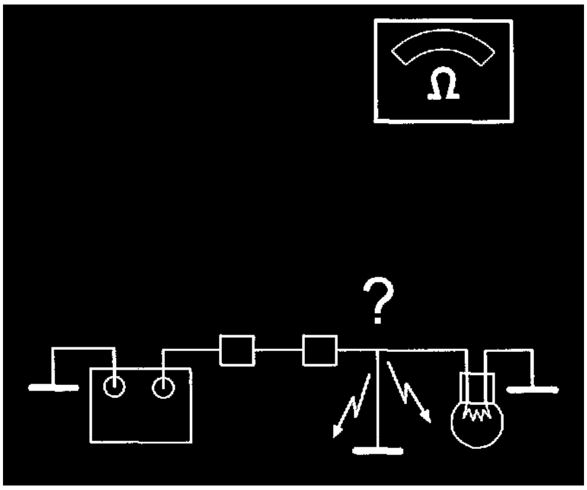
Replacing The Component

Try a new DSA switch according to **Replacing the DSA switch**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-121/Signal Too Low/Verification

Checking For A Short-Circuit

Checking For A Short-Circuit

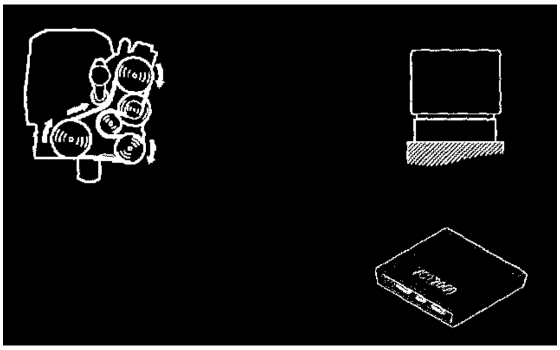


Check the cable between switch connector terminal 4 and control module terminal 6 for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-121/Signal Too Low/Verification

Verification

Verification



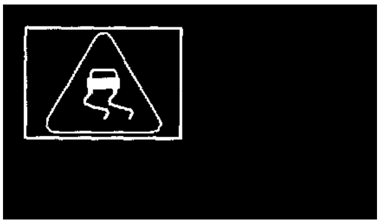
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Control module connected.
- Start the engine.
- Read off the status of the switch.

Check the function of the switch: OFF should be displayed when the switch is unaffected. On should be displayed when the switch is activated (pressed in).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

Diagnostic trouble code (DTC) DSA-122 is stored if the DSA control module detects that the current in the circuit for the bulb in the combined instrument panel is too large or too small when the ignition is on or the engine is running.

Condition

When the DSA warning lamp cannot indicate if the DSA function is disengaged or engaged, the DSA function is always connected. The DSA function cannot be disengaged with the switch.

Possible source

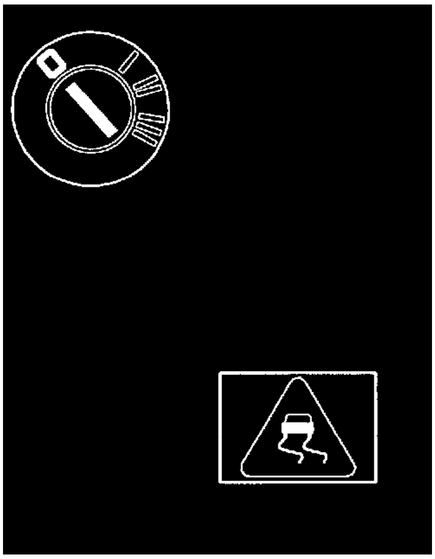
- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Defective bulb.
- Defective combined instrument panel.

Condition

- Certain faults can cause the DSA warning lamp to light continuously.
- The DSA function cannot be disengaged with the switch.

Checking the DSA Warning Lamp With the Ignition Off

Checking The DSA Warning Lamp With The Ignition Off



- Ignition off.

Check whether the ABS warning lamp lights.

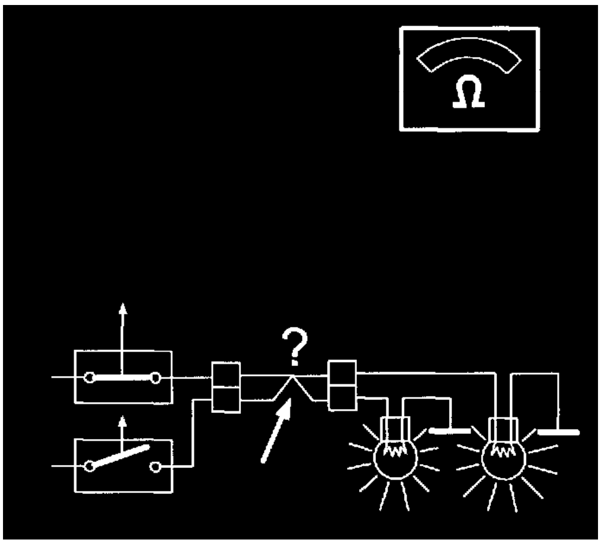
Does the warning lamp light?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking For A Short-Circuit - I

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Check Other Warning Lamps In the Combined Instrument Panel

Checking For A Short-Circuit - I

Checking For A Short-Circuit



Check the cable between combined instrument panel connector B terminal #22 and control module terminal #16. Check for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Verification

Check Other Warning Lamps In the Combined Instrument Panel

Checking The Other Warning Lamps In The Combined Instrument Panel

Check that the other warning lamps in the combined instrument panel are functioning.

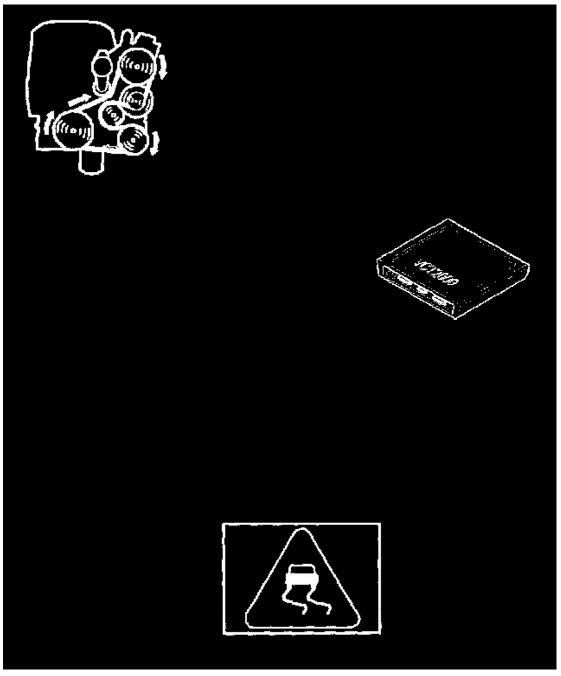
Are the other warning lamps functioning?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking the DSA Warning Lamp

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking the Combined Instrument Panel

Checking the DSA Warning Lamp

Checking The DSA Warning Lamp



- Start the engine
- Activate the DSA warning lamp so that it flashes.

Check the function of the warning lamp.

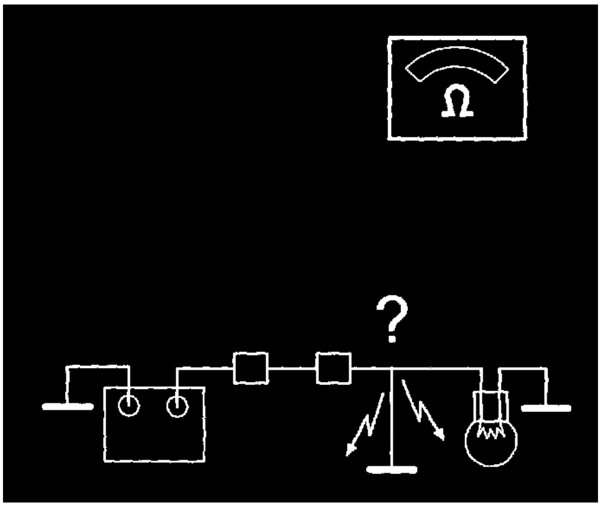
Is the warning lamp lit continuously?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking For A Short-Circuit - I

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking the Signal From the Combined Instrument Panel

Checking For A Short-Circuit - II

Checking For A Short-Circuit

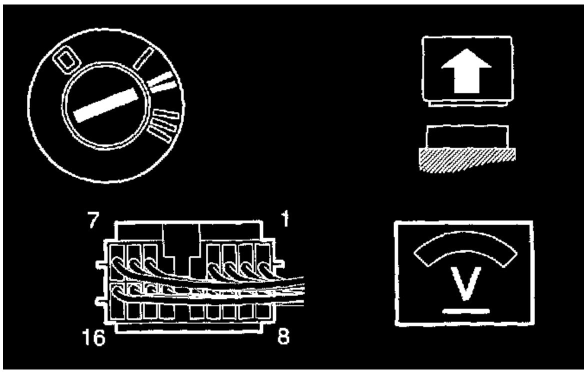


Check the cable between combined instrument panel connector B terminal #22 and control module terminal #16. Check for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Verification

Checking the Signal From the Combined Instrument Panel

Checking The Signal From The Combined Instrument Panel



- Ignition off
- Expose the DSA control module Disconnect the control module
- Ignition on.

Connect a voltmeter between control module connector terminal #16 and ground.

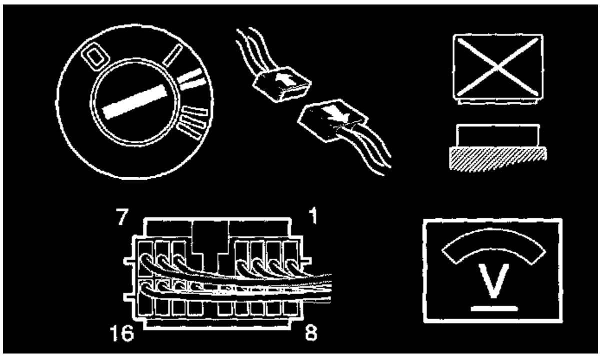
The voltmeter should read approximately battery voltage.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking the Resistance of the Signal Cable

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off
- Expose the combined instrument panel
- Disconnect the combined instrument panel
- Control module disconnected
- Ignition on.

Connect a voltmeter between control module connector terminal #16 and ground.

The voltmeter should read approximately 0 V.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Fault Cause and Checking For Contact Resistance and Oxidation

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking For A Short-Circuit - I

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

The cause of the diagnostic trouble code (DTC) was loose connections in the DSA control module connector and/or connector B for the combined instrument panel.

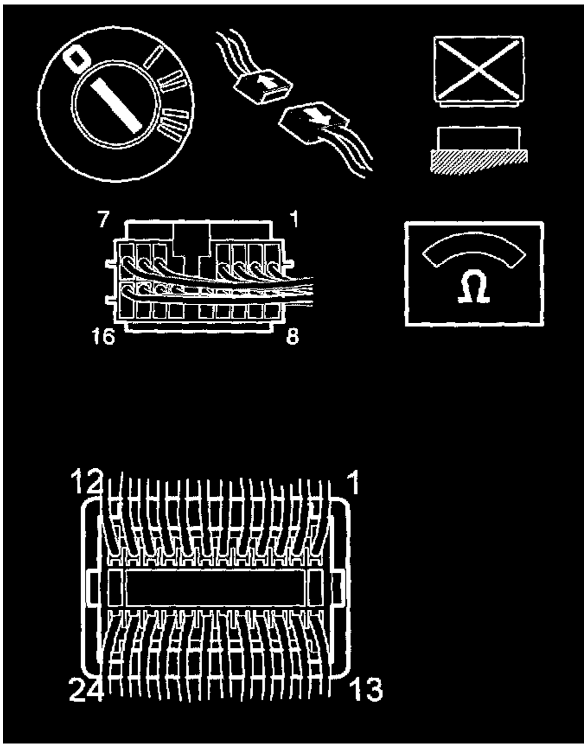
Check the connectors for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**. Remedy if necessary.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Verification

Checking the Resistance of the Signal Cable

Checking The Resistance Of The Signal Cable



- Ignition off
- Expose the combined instrument panel
- Disconnect the combined instrument panel
- Control module disconnected

Connect an ohmmeter between combined instrument panel connector B terminal #22 and control module connector terminal #16.

The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Checking the Bulb

Not Ok - This information to be published by O.E. at a later date.

Checking the Bulb

Checking The Bulb

Check that the bulb in the combined instrument panel is intact.

Is the bulb intact?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Replacing the Component - I

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Replacing the Component - II

Replacing the Component - I

Replacing The Component

Try a new combined instrument panel.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Verification

Replacing the Component - II

Replacing The Component

Replace the bulb.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-122/Faulty Signal - Permanent Fault/Verification

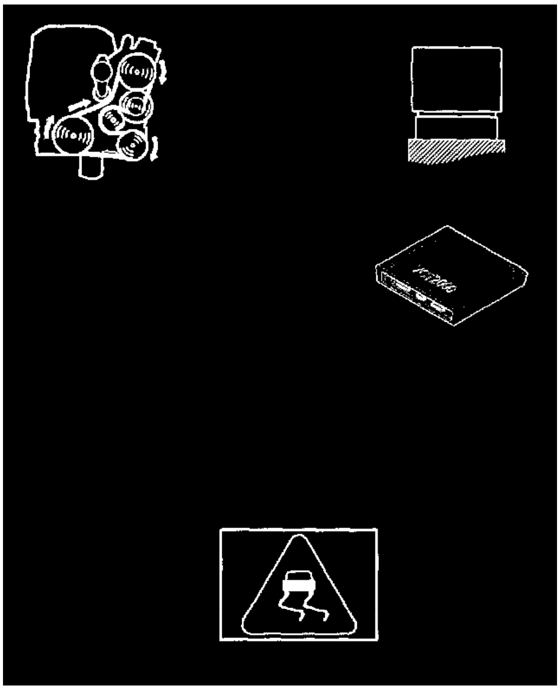
Checking the Combined Instrument Panel

Checking The Combined Instrument Panel

Check that the combined instrument panel is functioning.

Verification

Verification



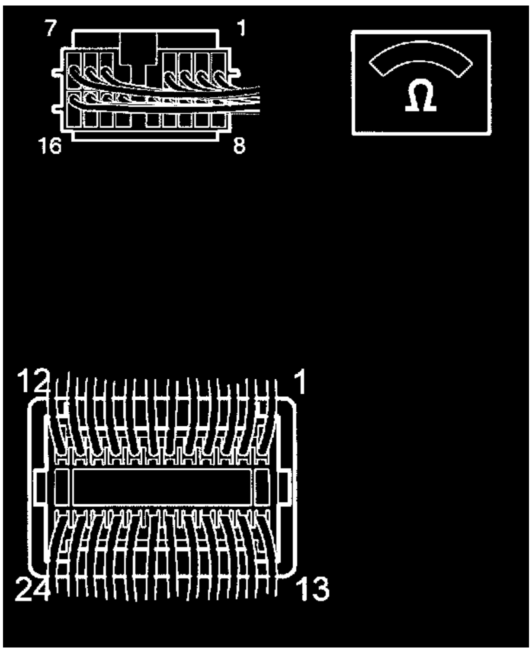
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Start the engine.
- Activate the DSA warning lamp so that it flashes.

Check the function of the warning lamp.

Faulty Signal - Intermittent Fault

Checking Wiring And Terminals



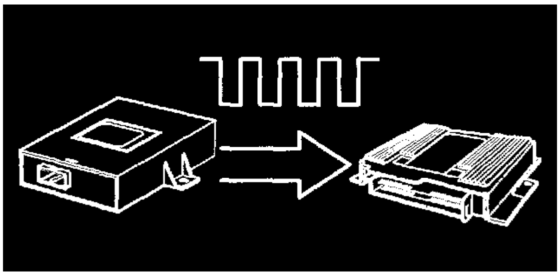
Check combined instrument panel connector B and the control module connector for contact resistance and oxidation according to **Checking** wiring and terminals - Intermittent faults

Check the cable between combined instrument connector B terminal 22 and control module terminal 16 for an open-circuit according to **Checking wiring and terminals - Intermittent faults** an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults** and an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

When the DSA control module registers that the speed at one of the front wheels increases too much (spins), the DSA control module transmits a signal requesting torque limiting to the engine control module (ECM). Diagnostic trouble code (DTC) DSA-131 is stored if the DSA control module registers that the current in the circuit for the engine control module (ECM) is too large or too small with the engine running.

Condition

The DSA function is disengaged.

Possible source

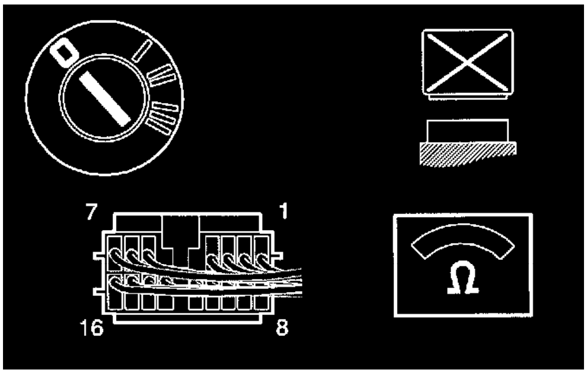
- Open-circuit in the signal cable
- Short-circuit to supply voltage or ground in the signal cable
- Contact resistance in the terminals.

Condition

- The DSA warning lamp lights
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Resistance of the Signal Cable

Checking The Resistance Of The Signal Cable



- DSA control module disconnected.
- Engine control module (ECM) disconnected.
- Breakout box connected to the engine control module (ECM).

- Connect an ohmmeter between DSA control module connector terminal 15 and engine control module (ECM) breakout box terminal 20.

Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

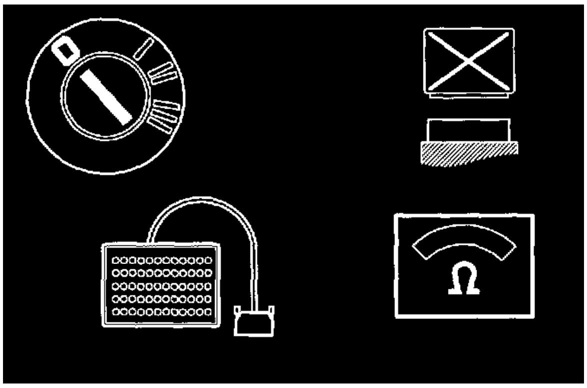
The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Checking the Signal Cable Resistance to Ground

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- Engine control module (ECM) disconnected.
- Breakout box connected to the engine control module (ECM).

- Connect an ohmmeter between breakout box terminal 20 and ground.

Other information
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

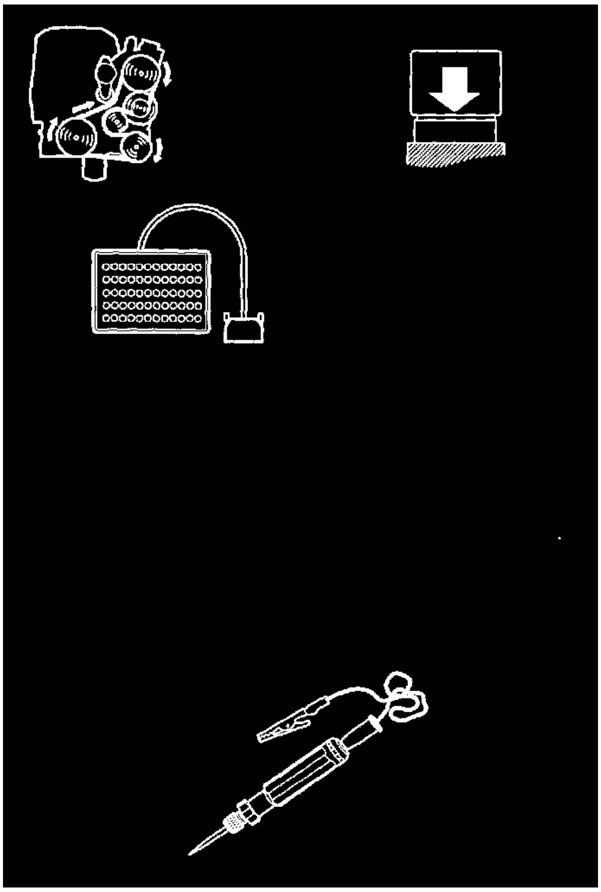
The ohmmeter should read infinite resistance.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Checking For A Short-Circuit

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the engine control module (ECM).
- Breakout box connected to the engine control module (ECM).
- Start the engine.

- Connect an electrician's screwdriver (with a bulb of at least **3 W**) between breakout box terminal 20 and ground.

Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Checking For A Short-Circuit

Fault Cause and Checking For Contact Resistance and Oxidation

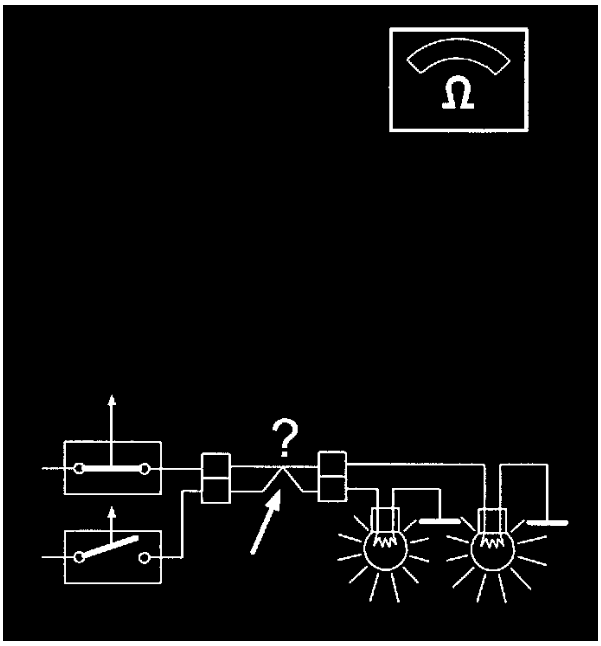
Fault Cause And Checking For Contact Resistance And Oxidation

The diagnostic trouble code (DTC) was poor contact in the engine control module (ECM) and or the DSA control module connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Checking For A Short-Circuit

Checking For A Short-Circuit



For FENIX 5.1

- Check the cable between engine control module (ECM) terminal 42 and DSA control module terminal 15 for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

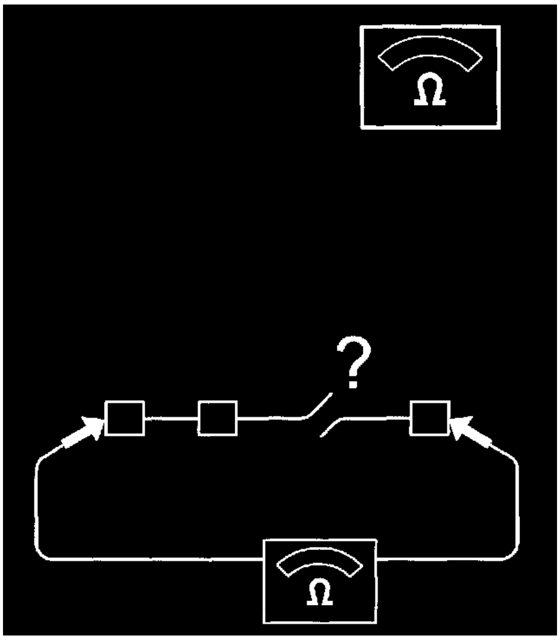
For EMS 2000

- Check the cable between engine control module (ECM) terminal 20 and DSA control module terminal 15 for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-131/Faulty Signal - Permanent Fault/Verification

Checking For an Open-Circuit

Checking For An Open-Circuit



For FENIX 5.1

- Check the cable between engine control module (ECM) terminal 42 and DSA control module terminal 15 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

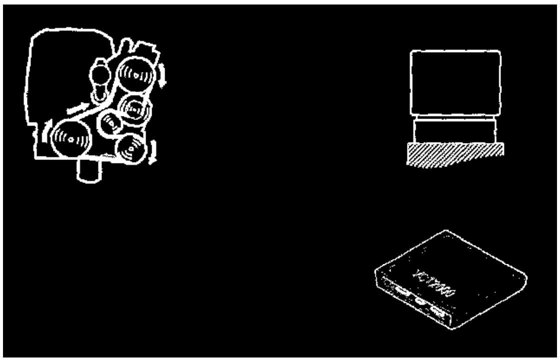
For EMS 2000

- Check the cable between engine control module (ECM) terminal 20 and DSA control module terminal 15 for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability

Verification

Verification



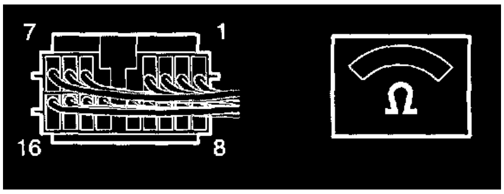
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Start the engine.
- Activate torque limiting by clicking on the VCT 2000 symbol.

Check that the engine is uneven when idling.

Faulty Signal - Intermittent Fault

Checking Wiring And Terminals



Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

- Check the cable between the DSA control module terminal 15 and engine control module (ECM) terminal 20 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

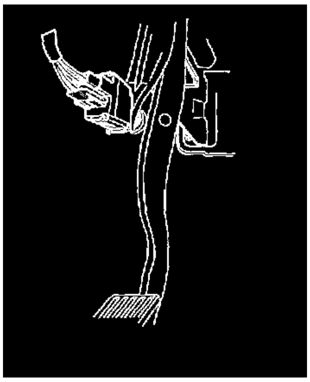
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module terminal is grounded via the stop (brake) lamp bulbs when the stop (brake) lamp switch is not activated. The DSA control module (and bulbs) are supplied with battery voltage supply when the stop (brake) light switch is activated. If the vehicle speed is in excess of **50 km/h** and the DSA control module registers that the signal is too high (high voltage) continuously for **15 minutes**, the DSA control module interprets it as being outside the permitted range. Diagnostic trouble code (DTC) DSA-211 is stored.

Condition

The DSA function is disengaged.

NOTE: This fault is considered to be serious. If the status of the fault changes to intermittent, the DSA function will not be engaged until the diagnostic trouble code (DTC) has been erased.

Possible source

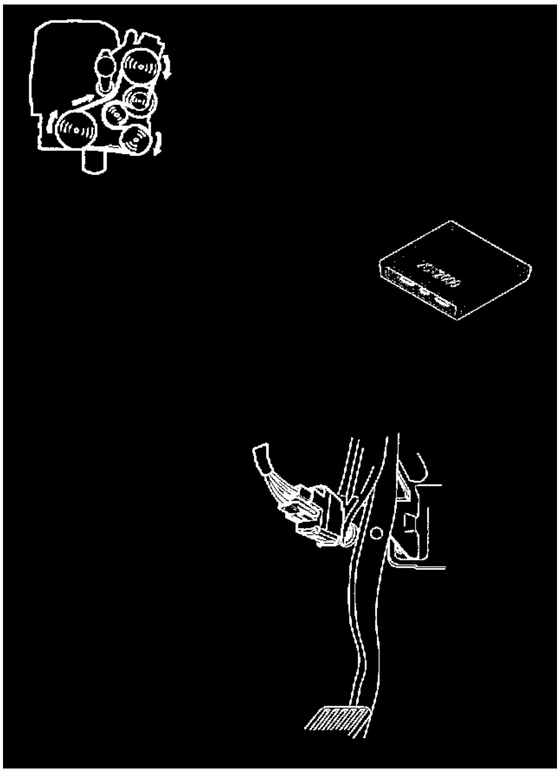
- Open-circuit in the signal cable
- Short-circuit to supply voltage in the signal cable
- Incorrectly adjusted stop (brake) lamp switch
- Defective stop (brake) light switch.

Condition

- The DSA warning lamp lights
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Stop Lamp Switch - I

Checking The Stop Lamp Switch



- Start the engine.

Read off the status of the stop lamp switch.

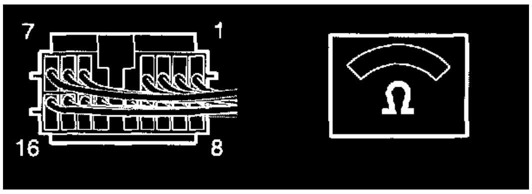
When the brake pedal is unaffected, the value should be OFF. When the brake pedal is depressed the value should be ON.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Checking Wiring and Terminals

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Checking the Status of the Stop Lamp

Checking Wiring and Terminals

Checking Wiring And Terminals



Check the DSA control module connector. Check for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the cable between DSA control module terminal #7 and one of the stop lamps. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

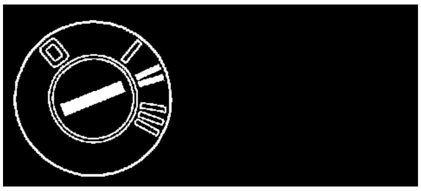
Check the stop lamp ground terminal. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

Check the wiring between DSA control module #7 and the ABS control module, the automatic transmission control module (TCM) and the cruise control control module. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Checking the Status of the Stop Lamp

Checking The Status Of The Stop Lamp



- Ignition on.

Check whether any of the stop lamps light even though the brake pedal is not depressed.

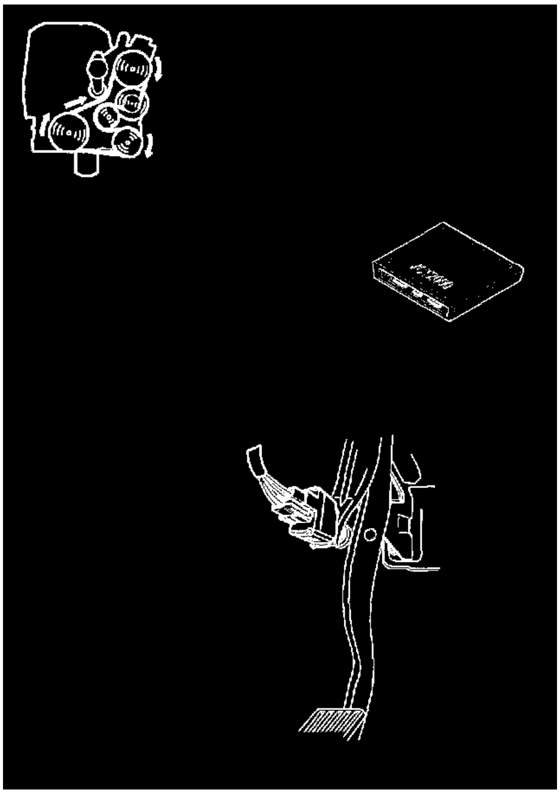
Are any of the stop lamps lit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Checking and Adjusting the Stop Lamp Switch

No - This information to be published by O.E. at a later date.

Checking and Adjusting the Stop Lamp Switch

Checking And Adjusting The Stop Lamp Switch



- Start the engine.

Check that the stop lamp switch is correctly adjusted. It must **not** be activated when the brake pedal is released.

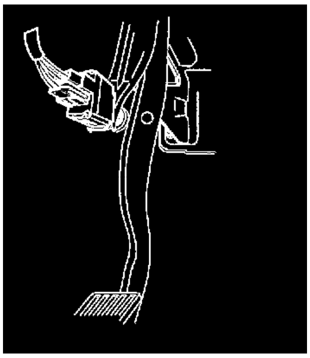
Is the stop lamp switch activated when the brake pedal is released?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Fault Causes and Adjusting the Stop Lamp Switch

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Checking the Stop Lamp Switch - II

Fault Causes and Adjusting the Stop Lamp Switch

Fault Causes And Adjusting The Stop Lamp Switch



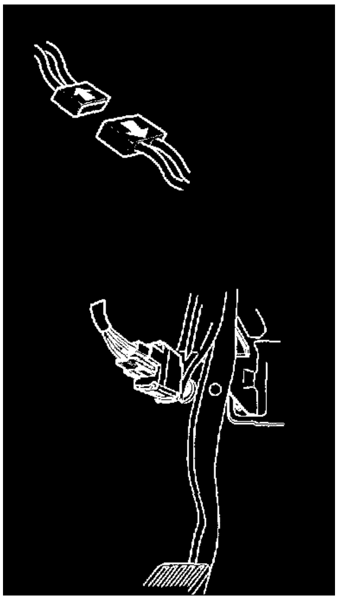
The cause of the diagnostic trouble code (DTC) was incorrect adjustment of the stop lamp switch.

Adjust the stop lamp switch

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Verification

Checking the Stop Lamp Switch - II

Checking The Stop Lamp Switch



- Disconnect the stop lamp switch.

Check whether the stop lamps go out.

Do the stop lamps go out?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Replacing the Component

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Checking For A Short-Circuit

Replacing the Component

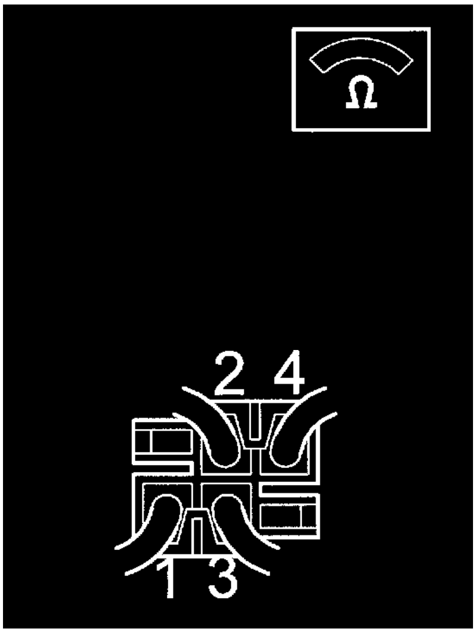
Replacing The Component

Try a new stop lamp switch according to Replacing the stop lamp switch.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Verification

Checking For A Short-Circuit

Checking For A Short-Circuit



Check the wiring between stop lamp switch terminal #3, the stop lamps and DSA control module terminal #7. Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

Check the cable between DSA control module terminal #7 and stop lamp switch terminal #2. Check for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

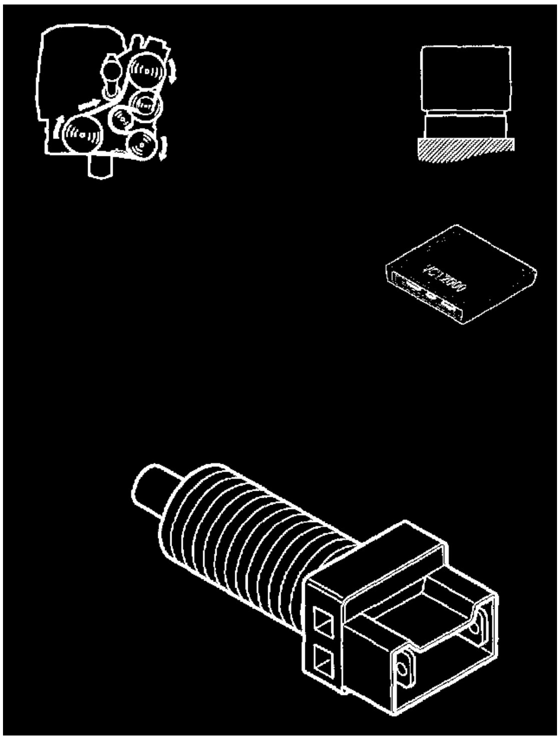
The connection is via the central electrical module. The input signal is via terminal #B1:3. The output signal is via terminal #B1:4 to the DSA control module.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-211/Signal Too High/Verification

Verification

Verification



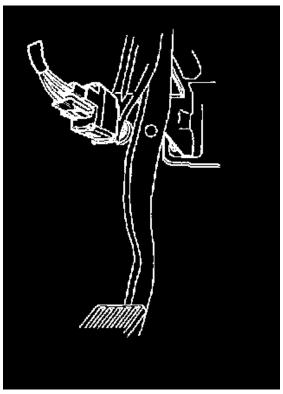
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Start the engine.

Read off the status of the stop (brake) lamp switch.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module terminal is grounded via the stop lamp bulbs when the stop lamp switch is unaffected. The DSA control module (and bulbs) are supplied with battery voltage when the stop light switch is activated. Diagnostic trouble code (DTC) DSA-212 is stored if the DSA control module registers, when the engine is running, that there is no ground connection via the bulbs, or that the signal (voltage) during braking is lower than battery voltage as a result of a drop in the voltage supply.

Condition

The DSA function is disengaged.

Possible source

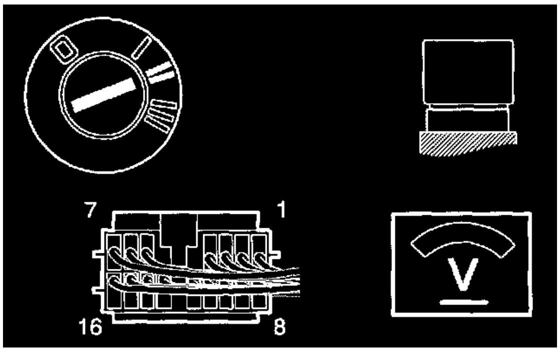
- Open-circuit in the signal cable
- Contact resistance in the terminals
- Voltage drop in the power supply.

Condition

- The DSA warning lamp lights
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Signal Cable

Checking The Signal Cable



- Ignition off
- Expose the DSA control module
- Ignition on
- DSA control module connected.
- The brake pedal is released.

Connect a voltmeter between ground and DSA control module connector terminal 7.

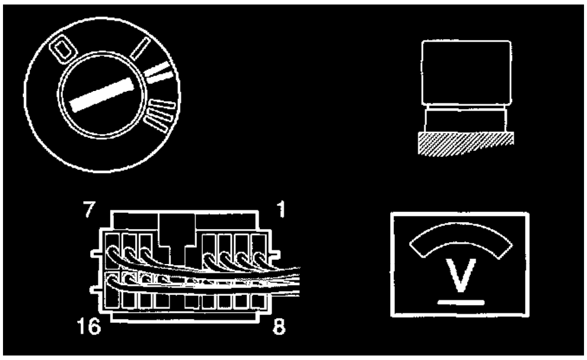
The voltmeter should read approximately 0 V.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Checking A Voltage Drop In the Signal Cable

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Checking For an Open-Circuit

Checking A Voltage Drop In the Signal Cable

Checking A Voltage Drop In The Signal Cable



Hint: All stop (brake) lamps must be intact during this check. This is so that the voltage in the circuit is as high as possible.

- Ignition on
- DSA control module connected.

- Depress the brake pedal. Hold it depressed.

Connect a voltmeter between ground and DSA control module connector terminal 7.

The voltmeter should read 0-1.5 V below battery voltage.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Fault Cause and Checking For Contact Resistance and Oxidation

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Checking A Voltage Drop In the Stop (Brake) Lamp Switch

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

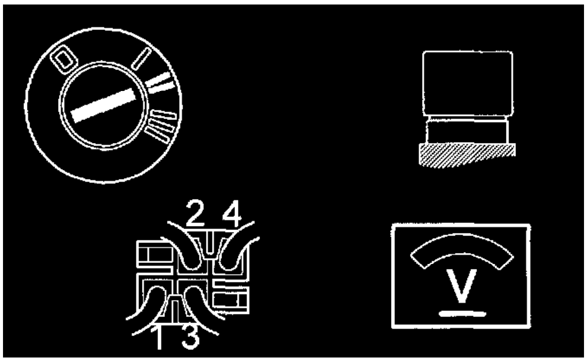
The cause of the diagnostic trouble code (DTC) was loose connections in the DSA control module connector.

Check the control module connector for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Verification

Checking A Voltage Drop In the Stop (Brake) Lamp Switch

Checking A Voltage Drop In The Stop (Brake) Lamp Switch



- Ignition on
- DSA control module connected.
- Depress the brake pedal. Hold it depressed.

Connect a voltmeter between stop (brake) lamp switch connector terminals 2 and 1.

The voltmeter should read 0-1.5 V.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Checking For Contact Resistance and Oxidation

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Replacing the Component

Checking For Contact Resistance and Oxidation

Checking For Contact Resistance And Oxidation

Check the circuit for stop (brake) lamp switch connector terminal 1 for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Check the cable between DSA control module terminal 7 and stop (brake) lamp switch terminal 2 for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

The connection is via the central electrical module. The input signal is via terminal B1:3. The output signal is via terminal B1:4 to the DSA control module.

Check the central electrical module (CEM) connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Verification

Replacing the Component

Replacing The Component

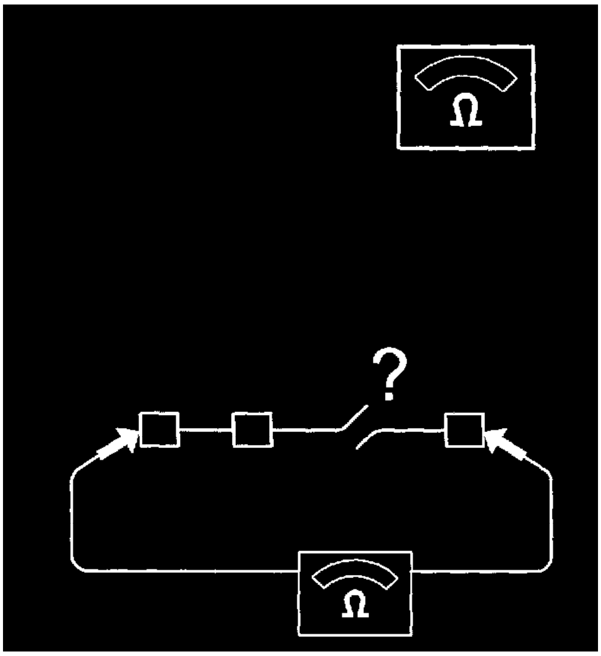
Check that the correct bulbs are installed in the stop (brake) lamps. Check that no extra power consuming components are connected to the circuit.

Then replace the stop (brake) lamp switch according to **Replacing the stop lamp switch**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Verification

Checking For an Open-Circuit

Checking For An Open-Circuit



Check the cable between DSA control module terminal 7 and one of the stop (brake) lamps for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

Check the central electrical module (CEM) connector for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

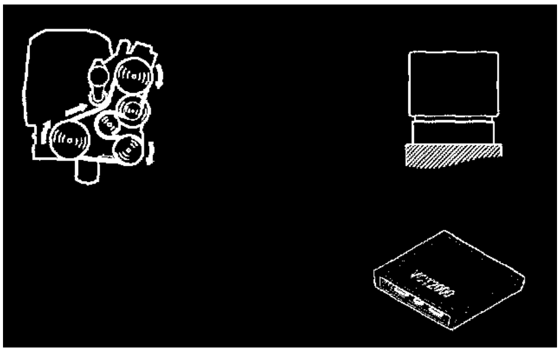
If the cable is OK, check the stop (brake) lamp bulbs and the stop (brake) lamp ground terminal for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-212/Faulty Signal - Permanent Fault/Verification

Verification

Verification



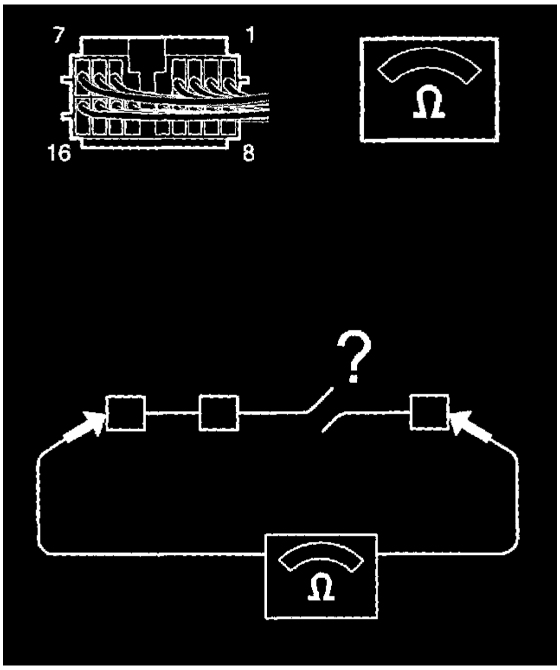
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Start the engine.
- Depress the brake pedal. Hold it down for approximately **10 seconds**.

Read off the status of the diagnostic trouble code (DTC).

Faulty Signal - Intermittent Fault

Checking Wiring And Terminals



Check the DSA control module connector for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

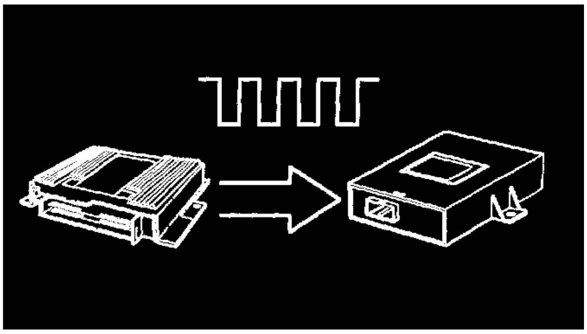
Check the central electrical module (CEM) connector for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the cable between DSA control module terminal 7 and one of the stop (brake) lamps for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The load signal from the engine control module (ECM) is a pulsed signal (between approximately **0 V** and battery voltage) with a variable frequency and pulse ratio (% duty). The frequency increases with engine speed. The pulse ratio increases with load. Diagnostic trouble code (DTC) DSA-221 is stored if the DSA control module registers that that there are no pulses from the engine control module (ECM) for approximately **1.5 seconds**.

Condition

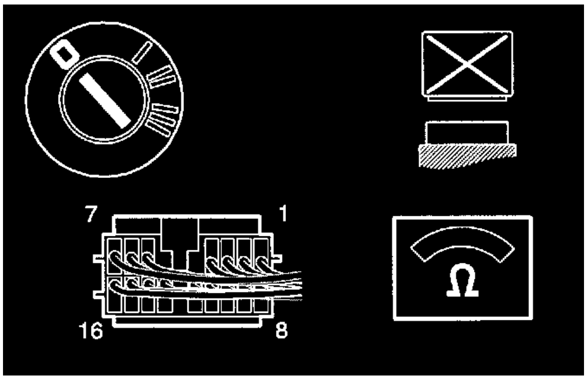
The DSA function is disengaged.

Possible source
- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Intermittent open-circuit in the supply voltage or the ground lead for the DSA control module.
- Contact resistance in the terminals.

Condition
- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Resistance In the Signal Cable

Checking The Resistance In The Signal Cable



- DSA control module disconnected.
- Engine control module (ECM) disconnected.
- Breakout box connected to the engine control module (ECM).

- Connect an ohmmeter between DSA control module connector terminal 13 and engine control module (ECM) breakout box terminal 71.

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

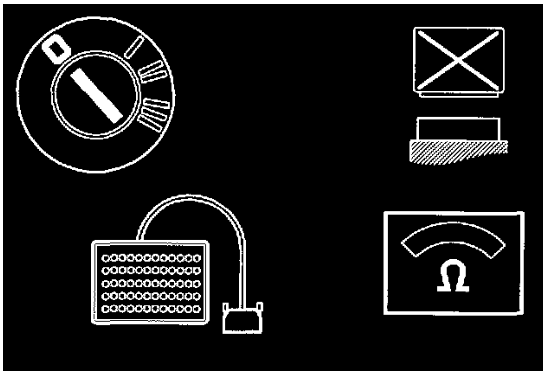
The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Checking the Signal Cable Resistance to Ground

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- Engine control module (ECM) disconnected.
- Breakout box connected to the engine control module (ECM).

- Connect an ohmmeter between breakout box terminal 71 and ground.

Other information
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

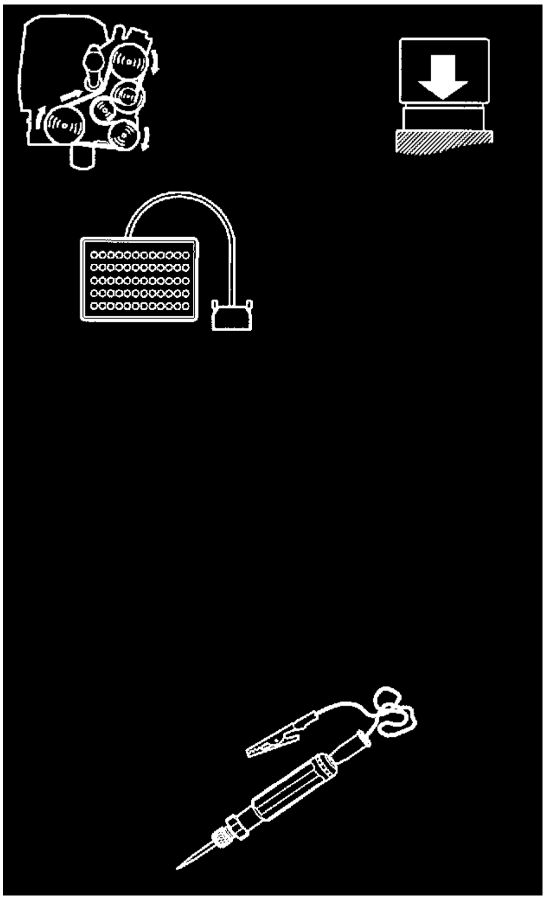
The ohmmeter should read infinite resistance.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Checking For A Short-Circuit

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the engine control module (ECM).
- Breakout box connected to the engine control module (ECM).
- Start the engine.

- Connect an electrician's screwdriver (with a bulb of at least **3 W**) between breakout box terminal 71 and ground.

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Checking For A Short-Circuit

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

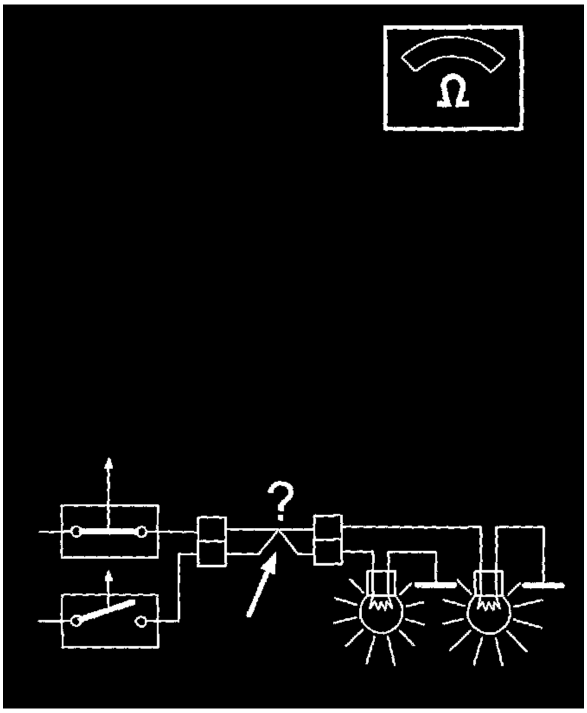
The diagnostic trouble code (DTC) was caused by poor contact in the DSA control module and / or engine control module (ECM) connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Verification

Checking For A Short-Circuit

Checking For A Short-Circuit



FENIX 5.1

- Check the cable between engine control module (ECM) terminal 37 and DSA control module terminal 13 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.
- On vehicles with automatic transmission. Also check the cable between engine control module (ECM) terminal 37 and automatic transmission control module (TCM) terminal 23 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

EMS 2000

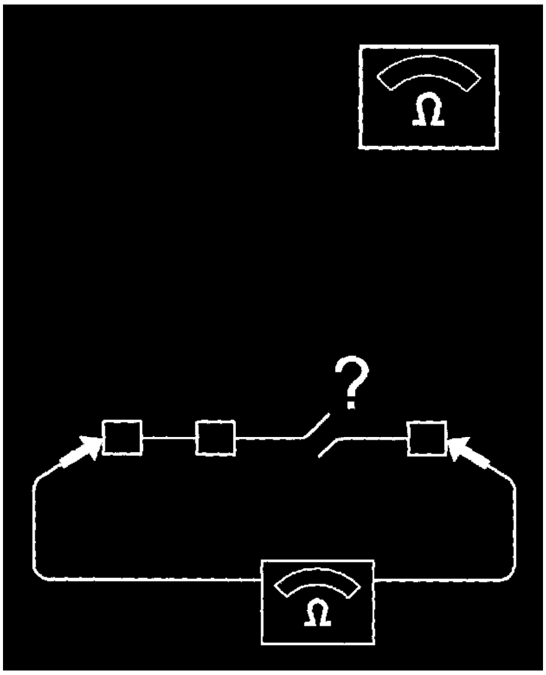
- Check the cable between engine control module (ECM) terminal 71 and DSA control module terminal 13 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Verification

Checking For an Open-Circuit

Checking For An Open-Circuit



FENIX 5.1

- Check the cable between DSA control module connector terminal 13 and engine control module (ECM) terminal 37 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

EMS 2000

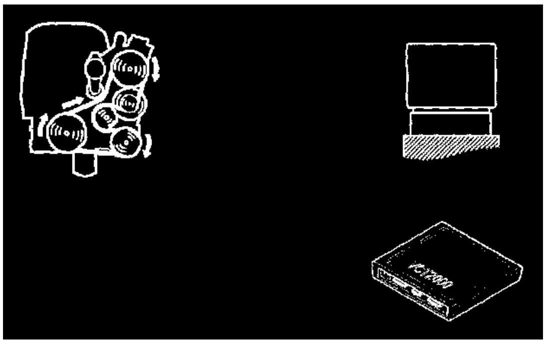
- Check the cable between DSA control module connector terminal 13 and engine control module (ECM) terminal 71 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

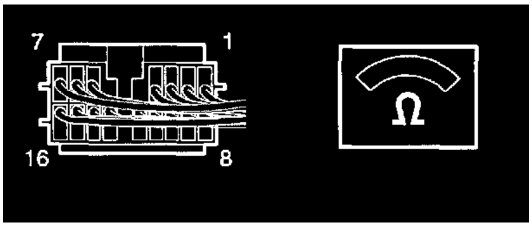
- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Start the engine.

Read off the load signal. Check that the value is OK.

Hint: Normal range idling with the engine at operating temperature, neutral selected and the air conditioning (A/C) off: approximately **36 [mu]s**. This value increases with load.

Signal Missing - Intermittent Fault

Checking Wiring And Terminals



Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation. See **Checking wiring and terminals - Intermittent faults**.

- Check the cable between DSA control module terminal #13 and engine control module (ECM) terminal #71. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

- Check the cable between DSA control module terminal #9 and ground terminal 31/25. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

- Check the cable between DSA control module terminal #1 and the fuse. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

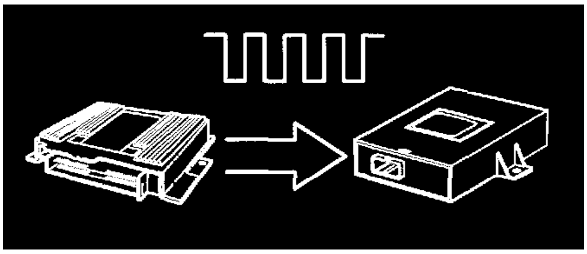
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the

Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The load signal from the engine control module (ECM) is a pulsed signal (between approximately **0 V** and battery voltage) with a variable frequency and pulse ratio (% duty). The frequency increases with engine speed. The pulse ratio increases with load. Diagnostic trouble code (DTC) DSA-222 is stored if the DSA control module registers that the frequency (engine speed) changes too quickly or that the pulse ratio (load) is based on implausible maximum or minimum values from the engine control module (ECM).

Condition

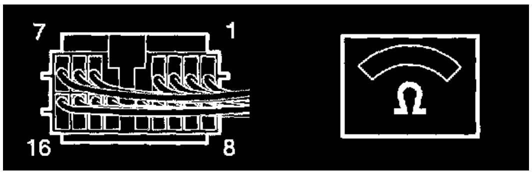
The DSA function is disengaged.

Possible source
- Signal cable interference.
- Intermittent open-circuit in the signal cable.
- Intermittent short-circuit to supply voltage or ground in the signal cable.
- Contact resistance in the terminals.

Condition
- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Faulty Signal

Checking Wiring And Terminals



Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

- Cars with automatic transmissions: Check the cable between engine control module (ECM) terminal #37 and automatic transmission control module (TCM) terminal #23. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**. Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

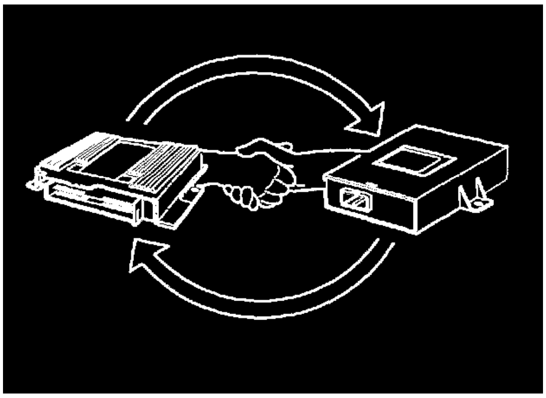
- Check the cable between DSA control module terminal #13 and engine control module (ECM) terminal #71. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**. Check that the cable is not too dose to sources of interference such as electric motors, ignition cables, carphone cables etc.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module establishes communication with the engine control module (ECM) when the engine speed exceeds **600 rpm** for the first time in the ignition cycle. This informs the engine control module (ECM) that there is a DSA system. The communication between the control modules is via cables for the load signal and the torque limiting signal. The engine control module (ECM) replies to the DSA control module with a special signal. Diagnostic trouble code (DTC) DSA-223 is stored within approximately **3 seconds** if the DSA control module registers that the response is missing or deviates from the permitted value.

NOTE: The diagnostic trouble code (DTC) is only stored as long as the ignition is on / the engine is running and the fault is permanent. If the fault disappears (becomes intermittent) the diagnostic trouble code (DTC) will no longer be stored.

Condition

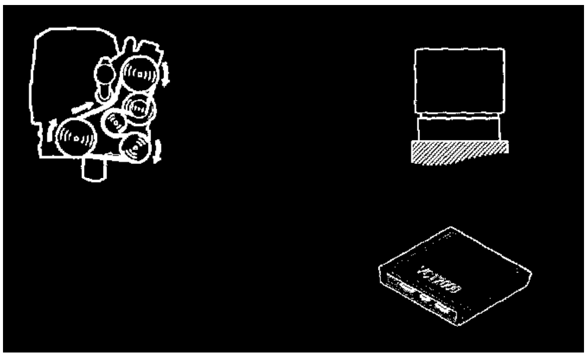
The DSA function is disengaged.

Possible source
- Fault in the engine management system.
- Intermittent open-circuit in the supply voltage or the ground lead for the DSA control module.

Condition
- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Status of the Diagnostic Trouble Code (DTC)

Checking The Status Of The Diagnostic Trouble Code (DTC)



- Ignition off.
- Start and stop the engine a few times.
- Let the engine idle.

Read off diagnostic trouble codes (DTCs).

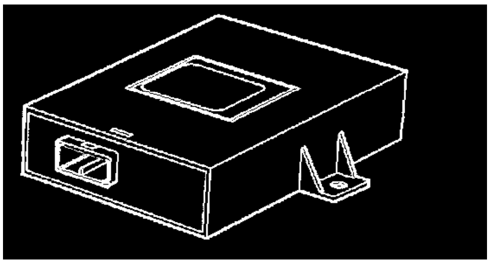
Is diagnostic trouble code (DTC) DSA-223 still stored?

Yes - This information to be published by O.E. at a later date.

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-223/Faulty Signal/Checking Wiring and Terminals

Replacing the Component

Replacing The Component

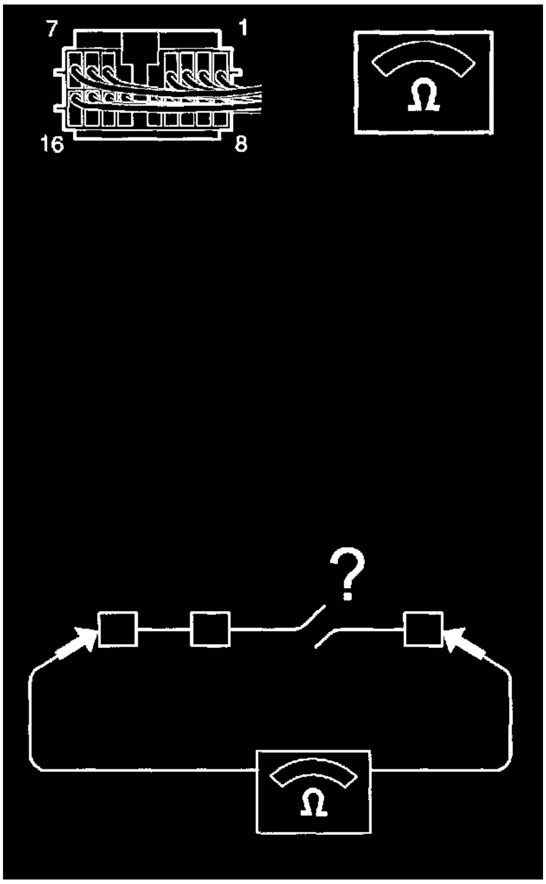


The old DSA control module is defective.
Install the new DSA Control module according to **DSA control module replacement**.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-223/Faulty Signal/Verification

Checking Wiring and Terminals

Checking Wiring And Terminals



Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the cable between DSA control module terminal #1 and the fuse. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

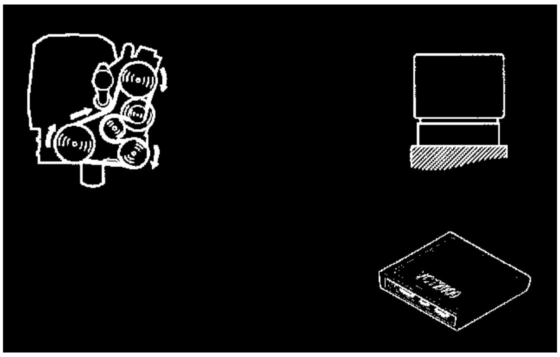
- Check the cable between DSA control module terminal #9 and ground terminal 31/25. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Verification

Verification



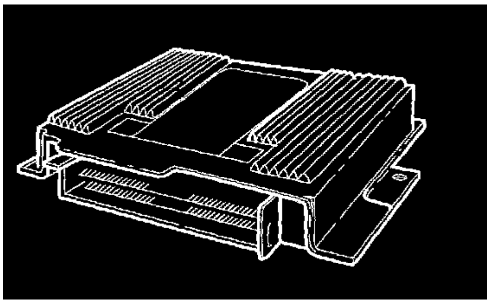
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Start and stop the engine a few times.
- Let the engine idle.

Read off diagnostic trouble codes (DTCs).

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

If a fault has occurred in the engine management system which affects the fuel shut-off system, the engine control module (ECM) transmits a load signal (TQ) with a specific value to the DSA control module Diagnostic trouble code (DTC) DSA-224 is stored when the DSA control module has received this specific signal.

NOTE: The diagnostic trouble code (DTC) is only stored as long as the ignition is on / the engine is running and the fault is permanent. If the fault in the engine management system disappears (the fault becomes intermittent) the diagnostic trouble code (DTC) will no longer be stored in the DSA control module.

Condition

The DSA function is disengaged.

Possible source

- One or more diagnostic trouble codes (DTCs) has been stored in the engine control module (ECM).
- Intermittent open-circuit in the supply voltage or the ground terminals for the engine control module (ECM).

Condition

- The DSA warning lamp lights
- The anti-spin function is not operative while the DSA function is disengaged.

Selecting the Engine Management System

Selecting The Engine Management System

Enter the engine management system:

- FENIX 5.1

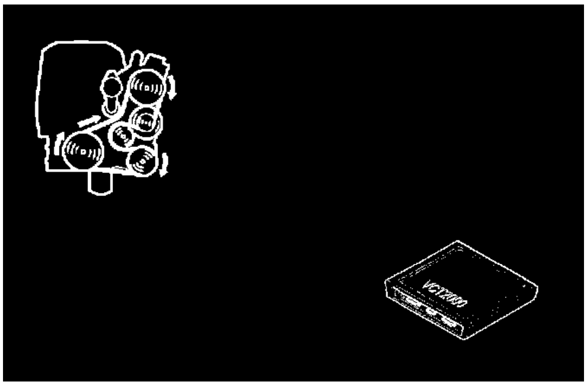
- EMS 2000.

1 - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-224/Diagnostic Trouble Code Stored In the Engine Control Module/Check Diagnostic Trouble Codes In the Engine Control Module -I

2 - This information to be published by O.E. at a later date.

Check Diagnostic Trouble Codes In the Engine Control Module -I

Checking Diagnostic Trouble Codes (DTCs) In The Engine Control Module (ECM)



Hint: Diagnostic trouble codes (DTC) DSA-224 are stored if any of the following diagnostic trouble codes (DTCs) are permanently stored in the engine control module (ECM) and if the fault is permanent: EFI-115, EFI-121, EFI-125, EFI-135, EFI-137, EFI-145, EFI-337, EFI-411, EFI-525 or EFI-526.

- Start the engine and let it idle.

Read off diagnostic trouble codes (DTCs) from the **engine control module (ECM)**.

Have any of the above diagnostic trouble codes (DTCs) been stored?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-224/Diagnostic Trouble Code Stored In the Engine Control Module/Check Diagnostic Trouble Codes In the Engine Control Module -II

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-224/Diagnostic Trouble Code Stored In the Engine Control Module/Checking Wiring and Terminals

Check Diagnostic Trouble Codes In the Engine Control Module -II

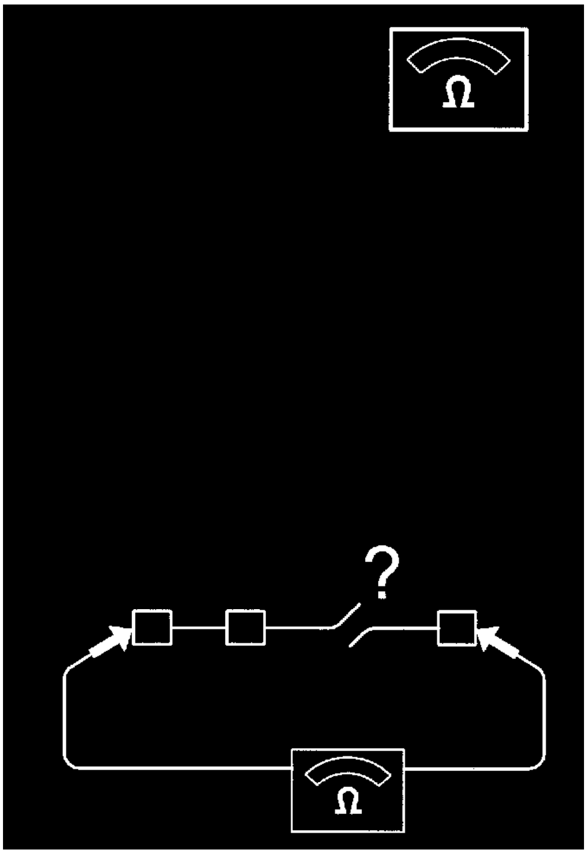
Checking Diagnostic Trouble Codes (DTCs) In The Engine Control Module (ECM)

Fault-trace according to the relevant system.

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-224/Diagnostic Trouble Code Stored In the Engine Control Module/Checking Wiring and Terminals

Checking Wiring and Terminals

Checking Wiring And Terminals



Check the engine Control module (ECM) connector for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

- Check the voltage supply to engine control module (ECM) terminals #29 and #30. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.
- Check the engine control module (ECM) ground terminals #3, #28, #33 and #67. Check for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**.

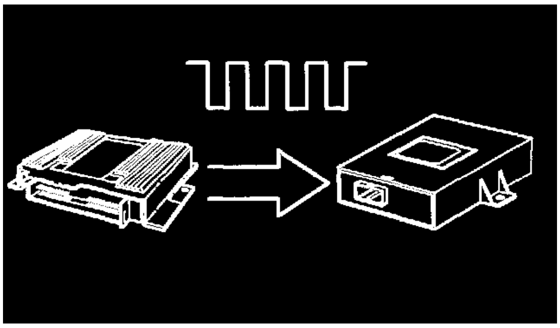
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information

- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The throttle position (TP) sensor signal from the engine control module (ECM) is a pulsed signal (between approximately **0 V** and battery voltage) with a fixed frequency (approximately **50 Hz**). The pulse ratio (% duty) changes as the throttle opens. Diagnostic trouble code (DTC) DSA-231 is stored if the DSA control module registers that that there are no pulses from the engine control module (ECM) for approximately **0.5 seconds**.

Condition

The DSA function is disengaged.

Possible source

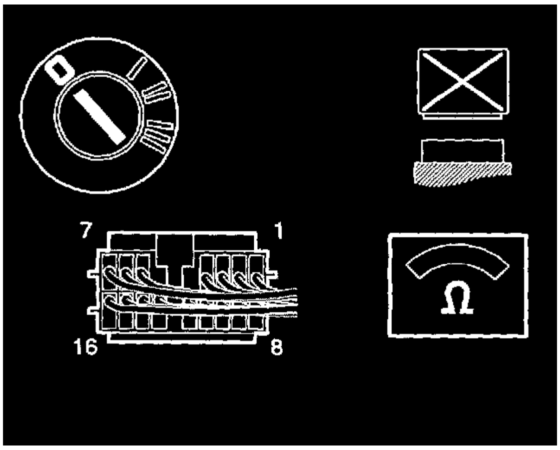
- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Contact resistance in the terminals.

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Resistance In the Signal Cable

Checking The Resistance In The Signal Cable



- DSA Control module disconnected.
- Engine control module (ECM) disconnected.
- Breakout box connected to the engine control module (ECM).

- Connect an ohmmeter between DSA control module connector terminal 5 and engine control module (ECM) breakout box terminal 36.

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

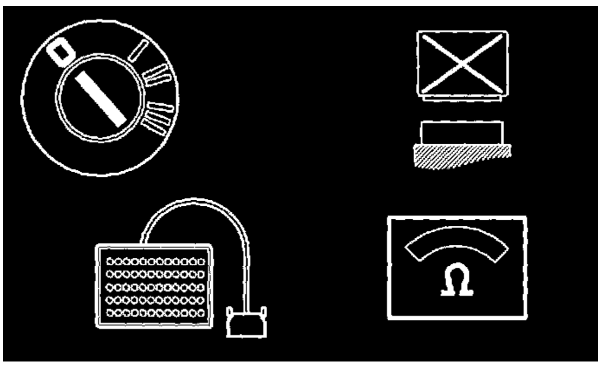
The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Checking the Signal Cable Resistance to Ground

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- Engine control module (ECM) disconnected.
- Breakout box connected to the engine control module (ECM).

- On vehicles with automatic transmission: Disconnect the automatic transmission control module (TCM).

- Connect an ohmmeter between breakout box terminal 36 and ground.

Other information
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

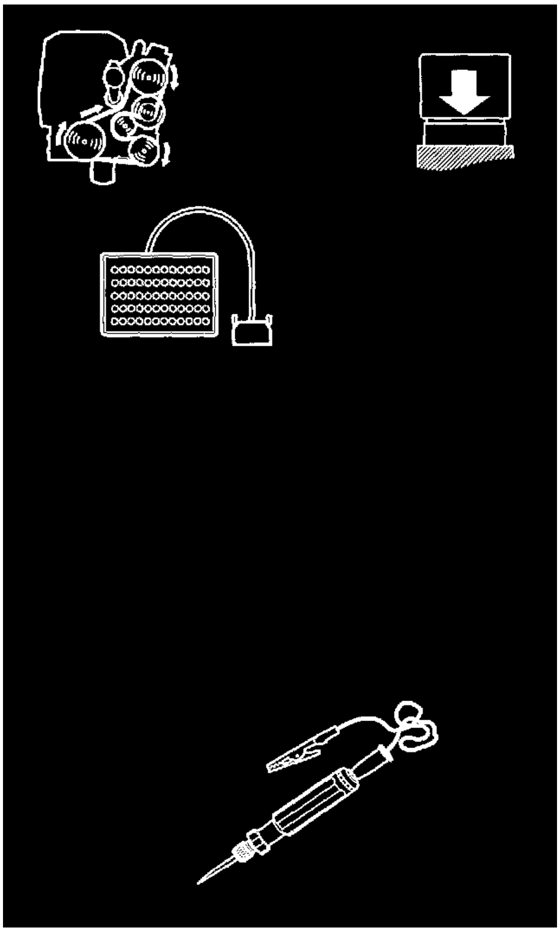
The ohmmeter should read infinite resistance.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Checking For A Short-Circuit

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-Circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the engine control module (ECM).
- On vehicles with automatic transmission: Connect the automatic transmission control module (TCM).
- Breakout box connected to the engine control module (ECM).
- Start the engine.

- Connect an electrician's screwdriver (with a bulb of at least **3 W**) between breakout box terminal 36 and ground.

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Checking For A Short-Circuit

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

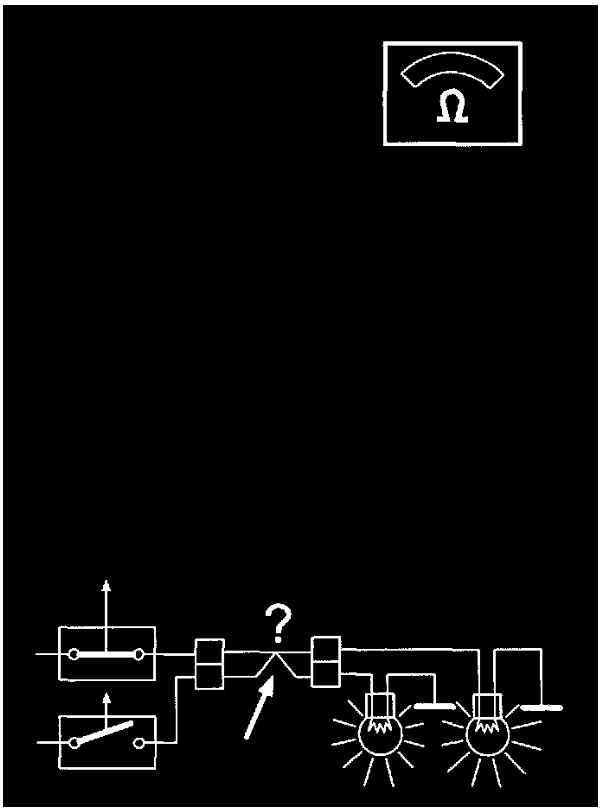
The diagnostic trouble code (DTC) was caused by poor contact in the DSA control module and / or engine control module (ECM) connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-221/Signal Missing - Permanent Fault/Verification

Checking For A Short-Circuit

Checking For A Short-Circuit



- On vehicles with automatic transmission: Also check the cable between engine control module (ECM) terminal 41 and automatic transmission control module (TCM) terminal 38 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

- Check the cable between engine control module (ECM) terminal 36 and DSA control module terminal 5 for a short-circuit to supply voltage according to **Checking wiring and terminals - Permanent faults**.

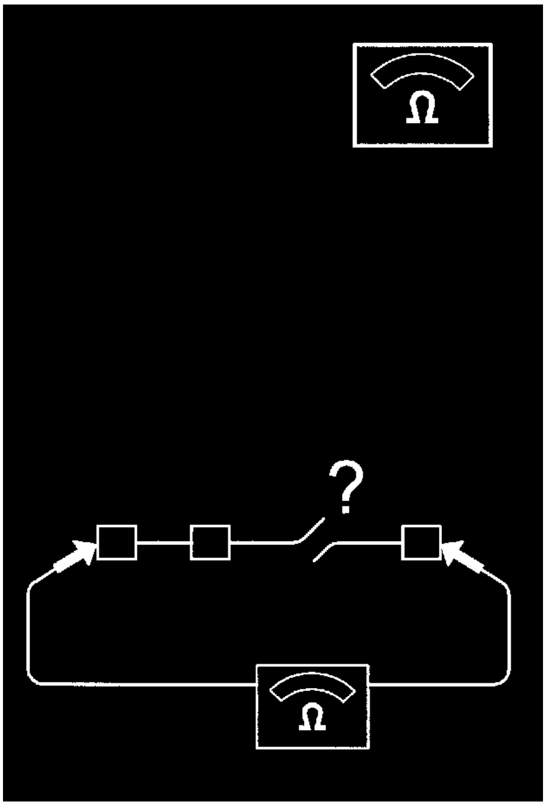
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Verification

Checking For an Open-Circuit

Checking For An Open-Circuit



- Check the cable between DSA control module terminal 5 and engine control module (ECM) terminal 36 for an open-circuit according to **Checking wiring and terminals - Permanent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

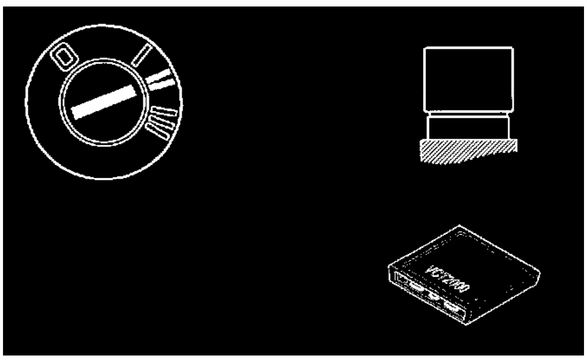
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-231/Signal Missing - Permanent Fault/Verification

Verification

Verification



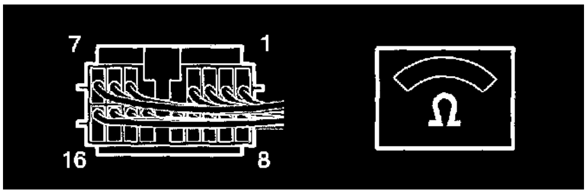
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Start the engine.
- Depress the accelerator pedal quickly a few times. Release the pedal so that the engine idles each time.
- Switch off the engine.
- Ignition on.
- Read off the position of the throttle position (TP) sensor.

Fully depress the accelerator pedal several times. Check that the throttle position (TP) sensor position increases and decreases.

Signal Missing - Intermittent Fault

Checking Wiring And Terminals



Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

- On vehicles with automatic transmission: Also check the cable between engine control module (ECM) terminal 41 and automatic transmission control module (TCM) terminal 38 for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults** and for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

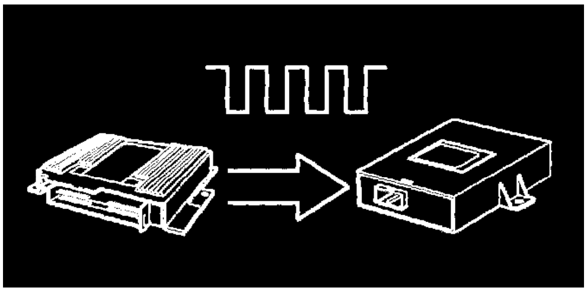
- Check the cable between the DSA control module terminal 5 and engine control module (ECM) terminal 36 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The throttle position (TP) sensor signal from the engine control module (ECM) is a pulsed signal (between approximately **0 V** and battery voltage) with a fixed frequency (approximately **50 Hz**). The pulse ratio (% duty) changes as the throttle opens. Diagnostic trouble code (DTC) DSA-232 is stored if the DSA control module registers that the frequency deviates or that the pulse ratio is based on implausible maximum or minimum values.

Condition

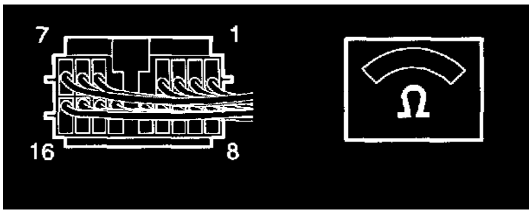
The DSA function is disengaged.

Possible source
- Signal cable interference.
- Defective throttle position (TP) sensor.
- Intermittent open-circuit in the signal cable.
- Intermittent short-circuit to supply voltage or ground in the signal cable.

Condition
- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Faulty Signal

Checking Wiring And Terminals



Check the DSA control module and engine control module (ECM) connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

- Applies to cars with automatic transmission: Check the cable between engine control module (ECM) terminal 41 and automatic transmission control module (TCM) terminal 38 for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults** and for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**. Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

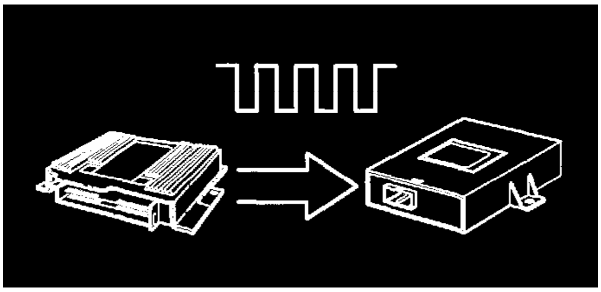
- Check the cable between the DSA control module terminal 5 and engine control module (ECM) terminal 36 for an intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults**. Check for an intermittent short-circuit to supply voltage according to **Checking wiring and terminals - Intermittent faults**. Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for EMS 2000, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The throttle position (TP) sensor signal from the engine control module (ECM) is a pulsed signal (between approximately **0 V** and battery voltage) with a fixed frequency (approximately **50 Hz**). The pulse ratio (% duty) changes as the throttle opens. If the engine control module (ECM) registers a fault in the signal from the throttle position (TP) sensor, the engine control module (ECM) transmits a special throttle position (TP) sensor signal to the DSA control module. This informs the DSA control module that the throttle position (TP) sensor signal to the engine control module (ECM) is faulty. Diagnostic trouble code (DTC) DSA-233 is stored when the DSA control module has received this signal.

NOTE: The diagnostic trouble code (DTC) is only stored as long as the ignition is on / the engine is running and the fault is permanent. If the fault in the engine management system disappears (the fault becomes intermittent) the diagnostic trouble code (DTC) in the DSA control module will no longer be stored.

Condition

The DSA function is disengaged.

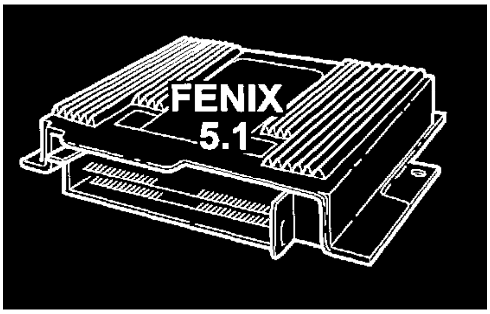
Possible source
- A diagnostic trouble code (DTC) for the throttle position (TP) sensor has been stored in the engine control module (ECM).

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Diagnostic Trouble Code Stored In the Engine Control Module

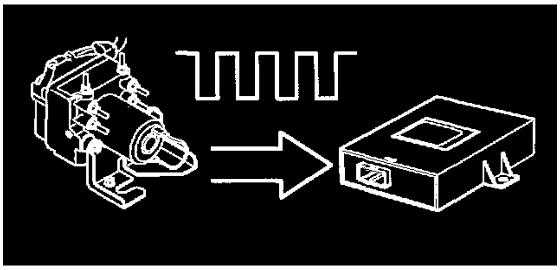
Checking Diagnostic Trouble Codes (DTCs) In The Engine Control Module (ECM)



Read off diagnostic trouble codes (DTCs) from the **engine control module (ECM)**. Fault-trace according to the system information.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module receives wheel speed signals from the ABS control module. The ABS control module converts the wheel sensor AC signal into a pulsed signal for the DSA control module. The signal is pulsed between approximately **0 V** and battery voltage. It has a fixed pulse ratio (% duty [ap] 50 %) where the frequency changes with the wheel speed.

Diagnostic trouble code (DTC) DSA-311, DSA-312, DSA-313 or DSA-314 is stored (depending on the actual wheel speed signal) if the vehicle speed is above **8 km/h** and the DSA control module registers that the increase in wheel speed is to great or too little, that the wheel speed at a wheel is less than or the same as half the speed of one of the rear wheels or that there is significant deviation in the speed signal.

Condition

The DSA function is disengaged.

Possible source

- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Interference in the wheel sensor circuit.
- Contact resistance in the terminals.

NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the car is driven with one or more wheels locked. Fault causes of this type are not included in the fault-tracing procedure.

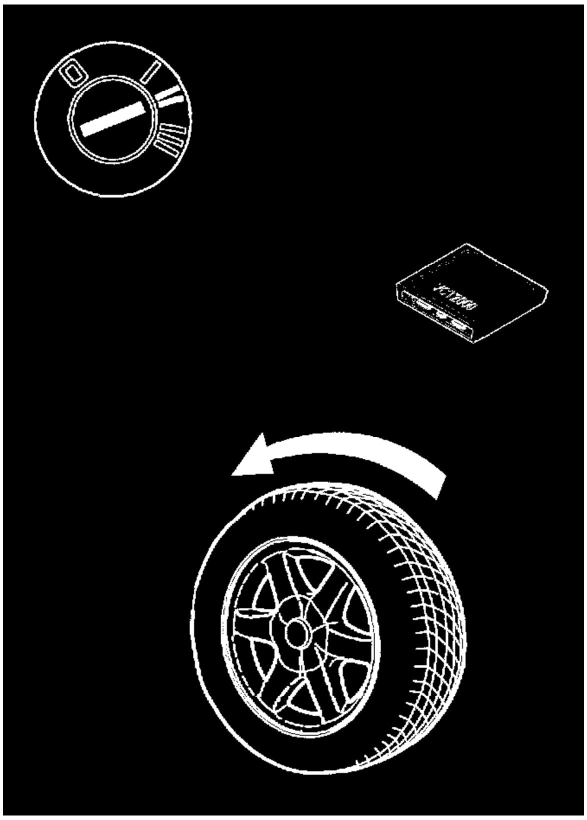
NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the power supply and / or the ground terminal for the ABS control module is defective. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Wheel Speed

Checking the wheel speed



- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. Check the wheel speed.

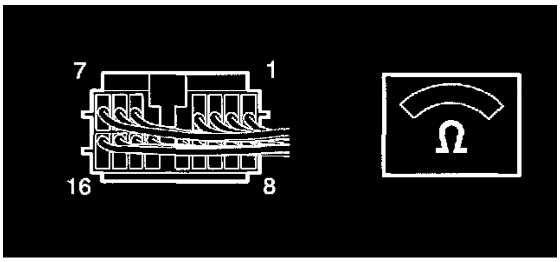
Is the wheel speed OK?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking Wiring and Terminals

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking the Resistance In the Signal Cable

Checking Wiring and Terminals

Checking Wiring And Terminals



Check DSA Control module and ABS control module connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent faults**.

Check the cable between the DSA control module:
- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for intermittent open-circuit according to **Checking wiring and terminals - Intermittent faults** an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent faults** and an intermittent short-circuit to supply according to **Checking wiring and terminals - Intermittent faults**.

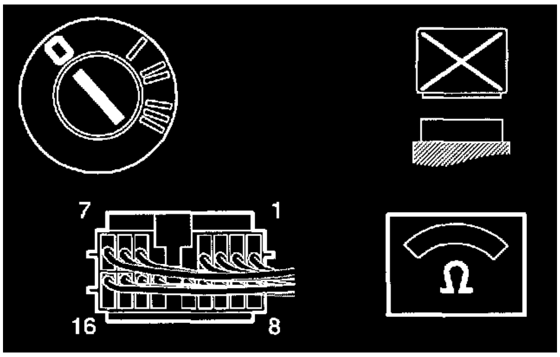
See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

Checking the Resistance In the Signal Cable

Checking The Resistance In The Signal Cable



- Ignition off.
- DSA Control module disconnected.
- ABS control module disconnected.
- Breakout box connected to the ABS control module.

Connect an ohmmeter between DSA control module connector.
- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

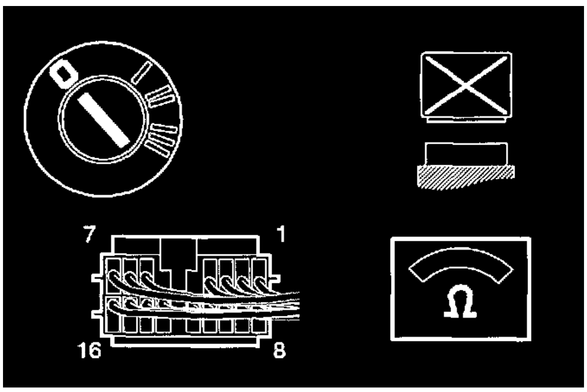
The ohmmeter should read approximately 0 [ohm].

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking the Signal Cable Resistance to Ground

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- ABS control module disconnected.

Connect an ohmmeter between ground and DSA control module connector:

- terminal 2 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 (diagnostic trouble code (DTC) DSA-314).

Other information

- To connect the breakout box for DSA, see Connecting the breakout box. DSA.

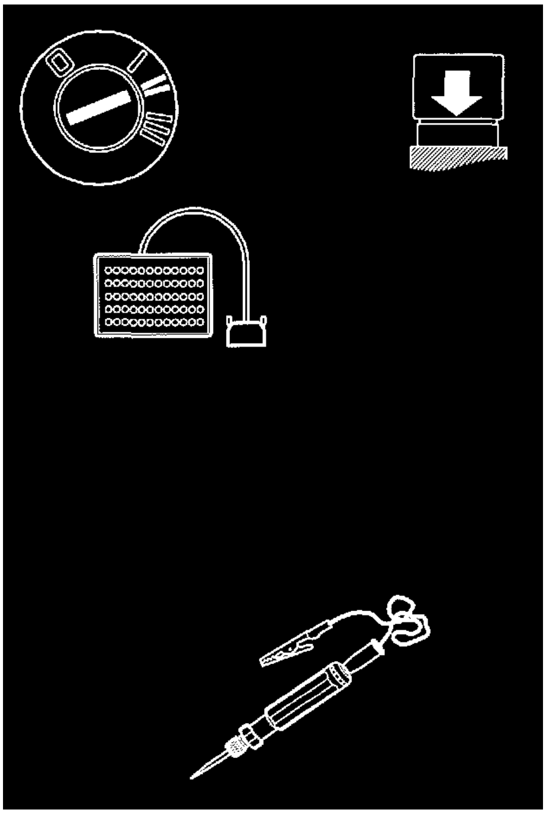
The ohmmeter should read infinite resistance.

Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not Ok - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking For A Short-Circuit

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the ABS control module.
- Breakout box connected to the ABS control module.
- Ignition on.

Connect an electrician's screwdriver (with a bulb of at least **3 W**) between ground and breakout box:

- terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information

- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Checking For A Short-Circuit

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

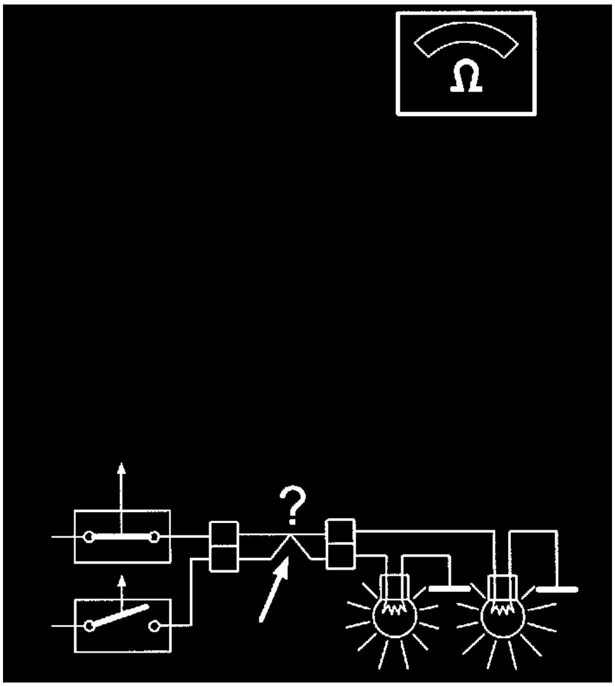
The diagnostic trouble code (DTC) was caused by poor contact in the DSA control module and / or ABS control module connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Verification

Checking For A Short-Circuit

Checking For A Short-Circuit



Check the cable between the DSA control module:

- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314).

for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

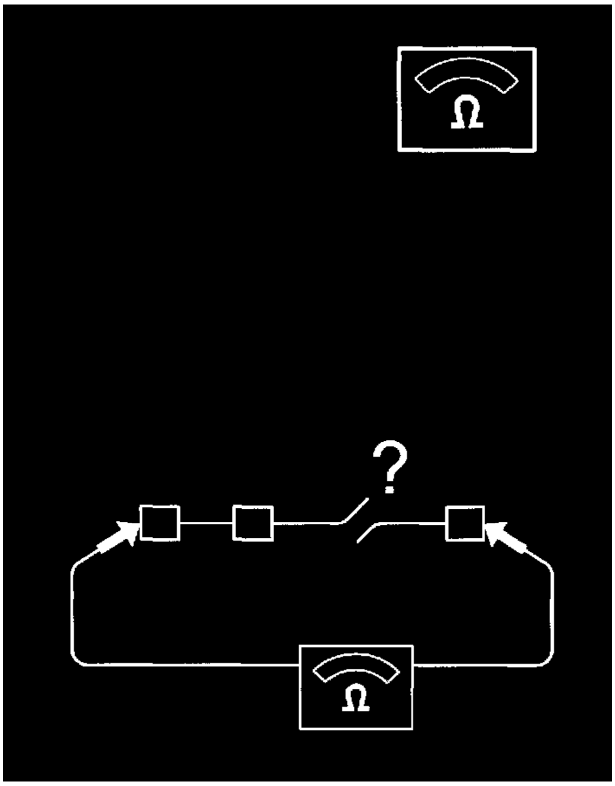
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Verification

Checking For an Open-Circuit

Checking For An Open-Circuit



Check the cable between the DSA control module:

- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314).

for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

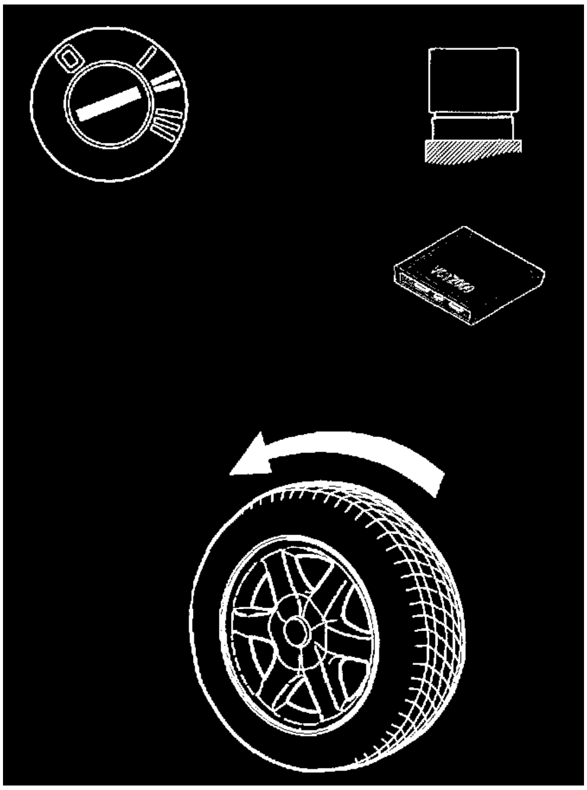
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-311/Faulty Signal/Verification

Verification

Verification



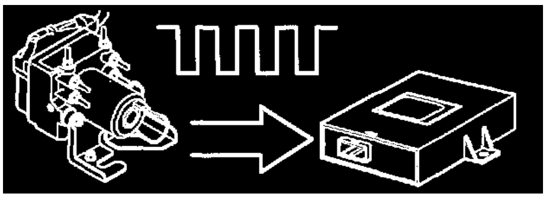
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. Check the wheel speed.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module receives wheel speed signals from the ABS control module. The ABS control module converts the wheel sensor AC signal into a pulsed signal for the DSA control module. The signal is pulsed between approximately **0 V** and battery voltage. It has a fixed pulse ratio (% duty [ap] 50 %) where the frequency changes with the wheel speed.

Diagnostic trouble code (DTC) DSA-311, DSA-312, DSA-313 or DSA-314 is stored (depending on the actual wheel speed signal) if the vehicle speed is above **8 km/h** and the DSA control module registers that the increase in wheel speed is to great or too little, that the wheel speed at a wheel is less than or the same as half the speed of one of the rear wheels or that there is significant deviation in the speed signal.

Condition

The DSA function is disengaged.

Possible source

- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Interference in the wheel sensor circuit.
- Contact resistance in the terminals.

NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the car is driven with one or more wheels locked. Fault causes of this type are not

included in the fault-tracing procedure.

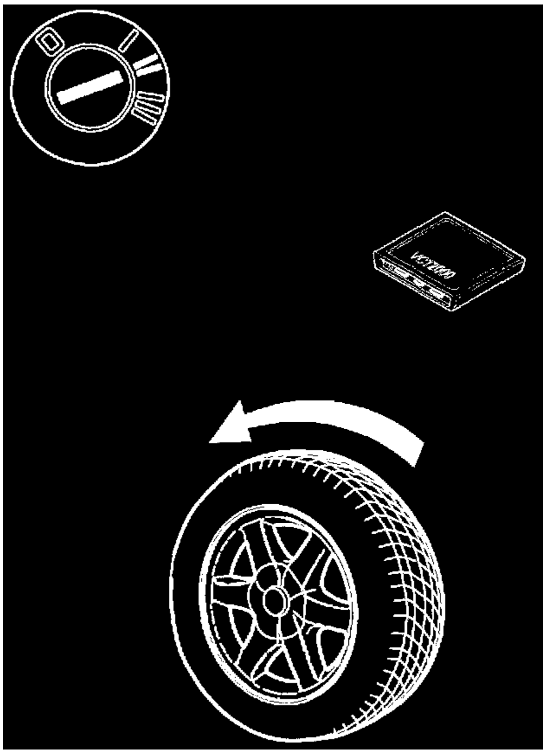
NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the power supply and/or the ground terminal for the ABS control module is defective. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Wheel Speed

Checking The Wheel Speed



- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. Check the wheel speed.

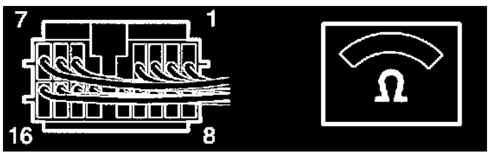
Is the wheel speed OK?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking Wiring and Terminals

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking the Resistance In the Signal Cable

Checking Wiring and Terminals

Checking Wiring And Terminals



Check DSA control module and ABS Control module connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check the cable between the DSA control module:

- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)

- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults**, an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults** and an intermittent short-circuit to supply according to **Checking wiring and terminals - Intermittent Faults.**

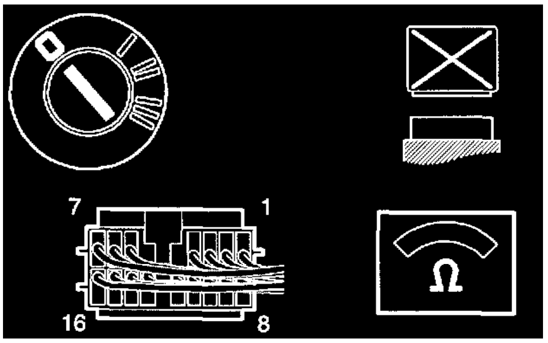
Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

Checking the Resistance In the Signal Cable

Checking The Resistance In The Signal Cable



- Ignition off.
- DSA control module disconnected.
- ABS control module disconnected.
- Breakout box connected to the ABS control module.

Connect an ohmmeter between DSA control module Connector:
- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

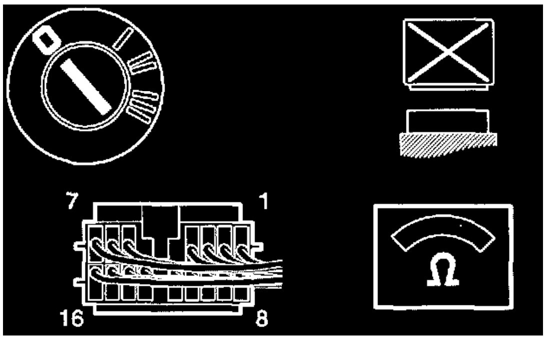
The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking the Signal Cable Resistance to Ground

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- ABS control module disconnected.

Connect an ohmmeter between ground and DSA control module connector:
- terminal 2 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)

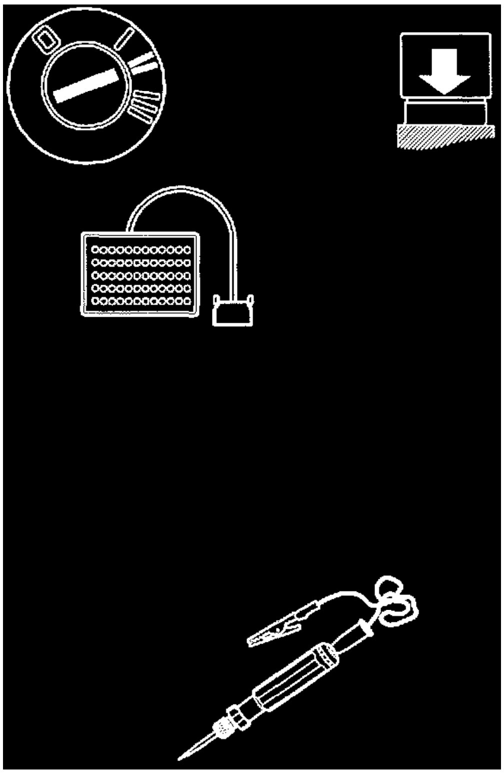
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking For A Short-Circuit

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the ABS control module.
- Breakout box connected to the ABS control module.
- Ignition on.

Connect an electrician's screwdriver (with a bulb of at least **3 W**) between ground and breakout box:
- terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Checking For A Short-Circuit

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

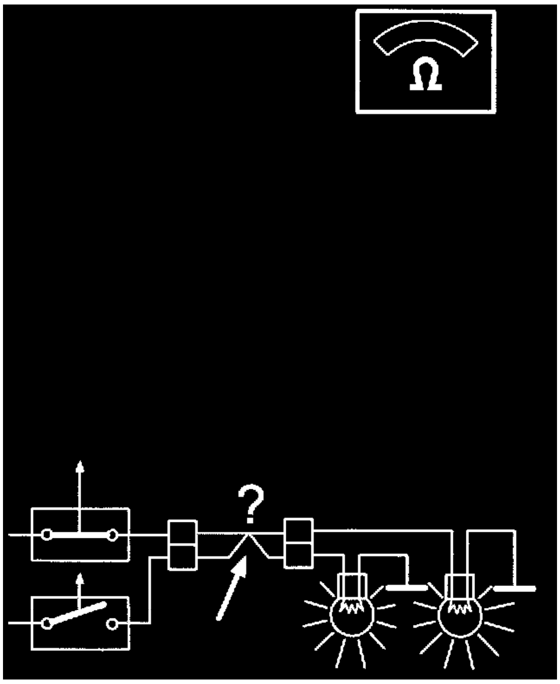
The diagnostic trouble code (DTC) was caused by poor contact in the DSA control module and/or ABS control module connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Verification

Checking For A Short-Circuit

Checking For A Short-circuit



Check the cable between the DSA control module:
- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

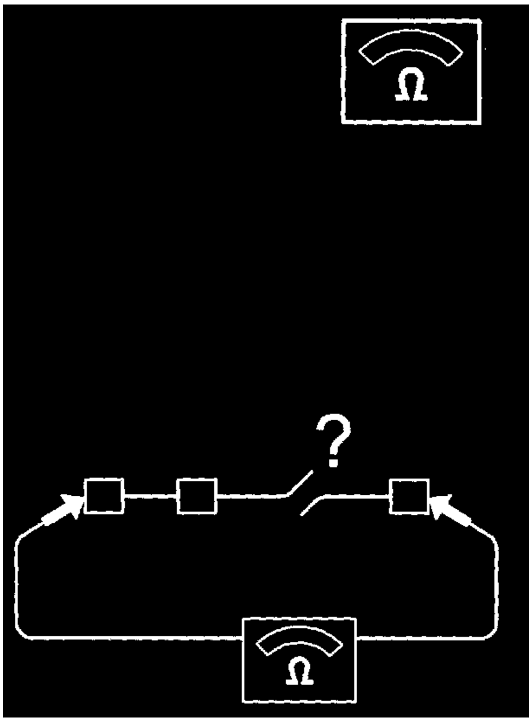
Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)

- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Verification

Checking For an Open-Circuit

Checking For An Open-circuit



Check the cable between the DSA control module:
- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- termina1 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314)

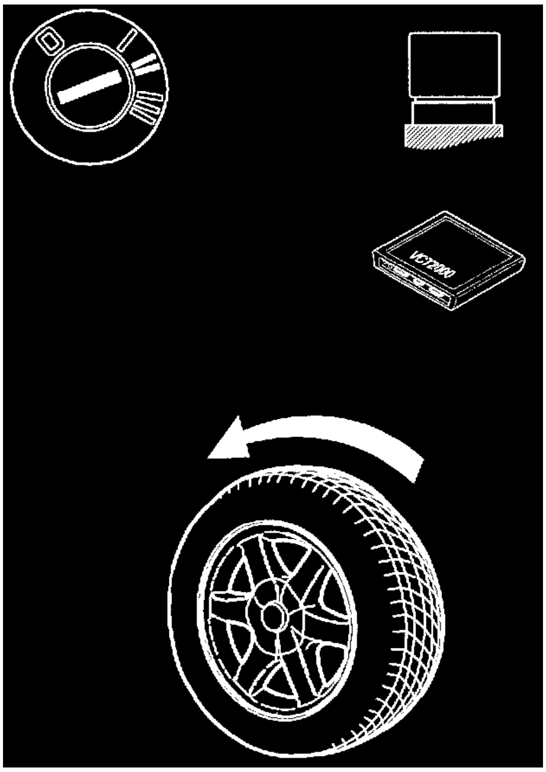
for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-312/Faulty Signal/Verification

Verification

Verification



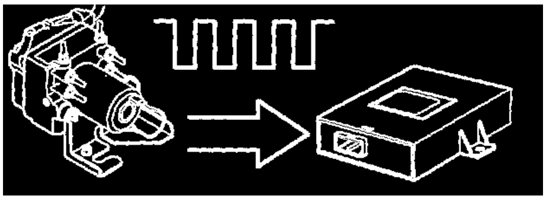
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. check the wheel speed.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module receives wheel speed signals from the ABS control module. The ABS control module converts the wheel sensor AC signal into a pulsed signal for the DSA control module. The signal is pulsed between approximately **0 V** and battery voltage. It has a fixed pulse ratio (% duty [ap] 50 %) where the frequency changes with the wheel speed.

Diagnostic trouble code (DTC) DSA-311, DSA-312, DSA-313 or DSA-314 is stored (depending on the actual wheel speed signal) if the vehicle speed is above **8 km/h** and the DSA control module registers that the increase in wheel speed is to great or too little, that the wheel speed at a wheel is less than or the same as half the speed of one of the rear wheels or that there is significant deviation in the speed signal.

Condition

The DSA function is disengaged.

Possible source

- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Interference in the wheel sensor circuit.
- Contact resistance in the terminals.

NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the car is driven with one or more wheels locked. Fault causes of this type are not

included in the fault-tracing procedure.

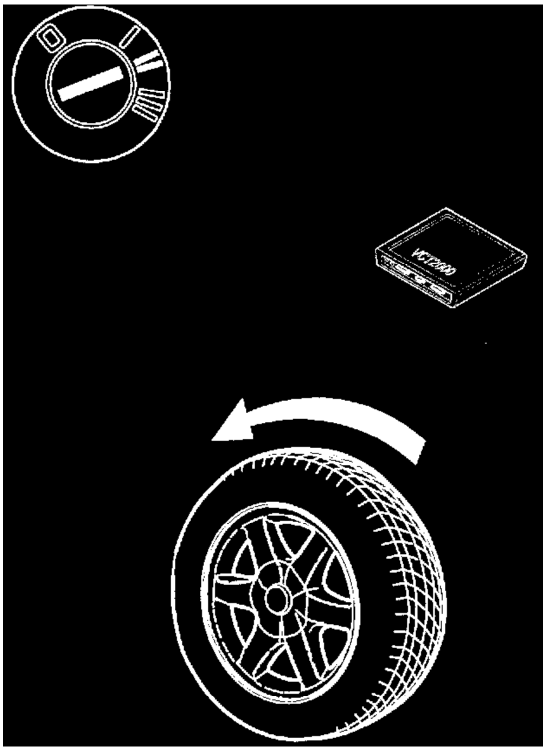
NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the power supply and/or the ground terminal for the ABS control module is defective. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Wheel Speed

Checking The Wheel Speed



- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. Check the wheel speed.

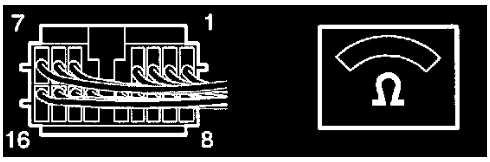
Is the wheel speed OK?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking Wiring and Terminals

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking the Resistance In the Signal Cable

Checking Wiring and Terminals

Checking Wiring And Terminals



Check DSA control module and ABS control module connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check the cable between the DSA control module:

- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)

- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 2 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults**, an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults** and an intermittent short-circuit to supply according to **Checking wiring and terminals - Intermittent Faults.**

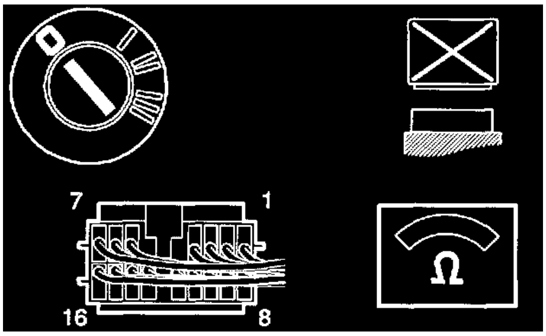
Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

Checking the Resistance In the Signal Cable

Checking The Resistance In The Signal Cable



- Ignition off
- DSA control module disconnected.
- ABS control module disconnected.
- Breakout box connected to the ABS Control module.

Connect an ohmmeter between DSA Control module Connector:
- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

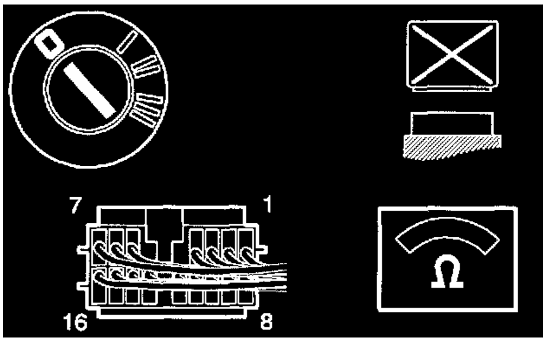
The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking the Signal Cable Resistance to Ground

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- ABS control module disconnected.

Connect an ohmmeter between ground and DSA control module connector:

- terminal 2 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 (diagnostic trouble code (DTC) DSA-314).

Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)

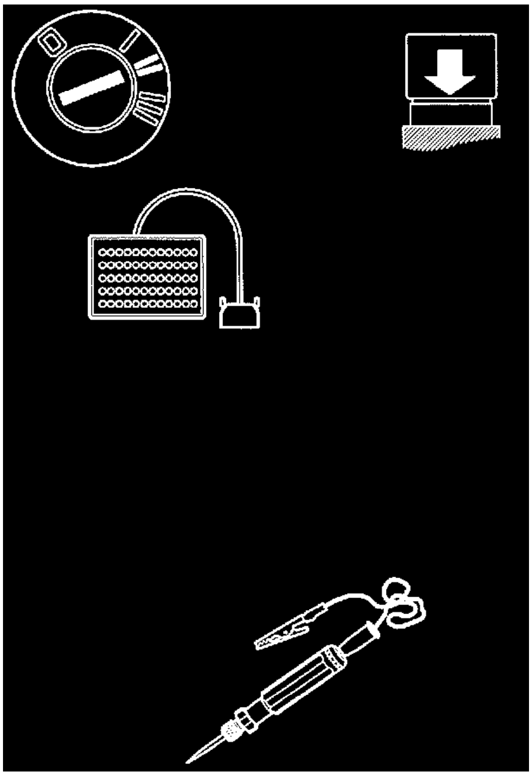
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking For A Short-Circuit

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the ABS control module.
- Breakout box connected to the ABS control module.
- Ignition on.

Connect an electrician's screwdriver (with a bulb of at least **3 W**) between ground and breakout box:
- terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Checking For A Short-Circuit

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

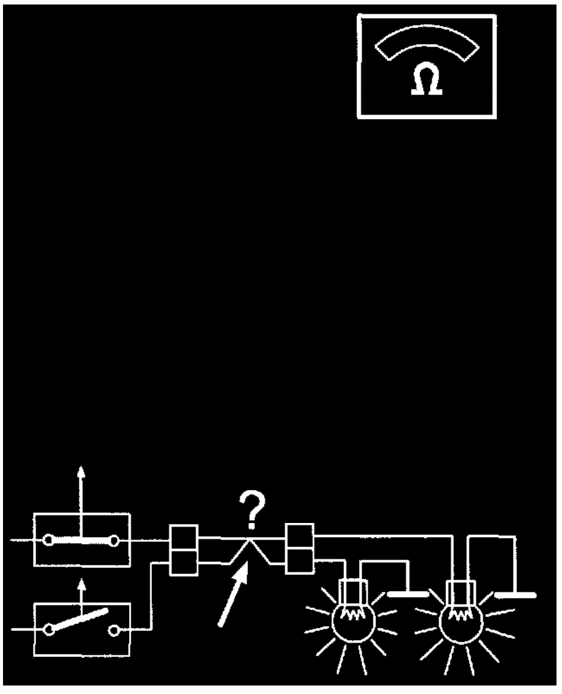
The diagnostic trouble code (DTC) was caused by poor contact in the DSA control module and/or ABS control module connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Verification

Checking For A Short-Circuit

Checking For A Short-circuit



Check the cable between the DSA control module:
- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

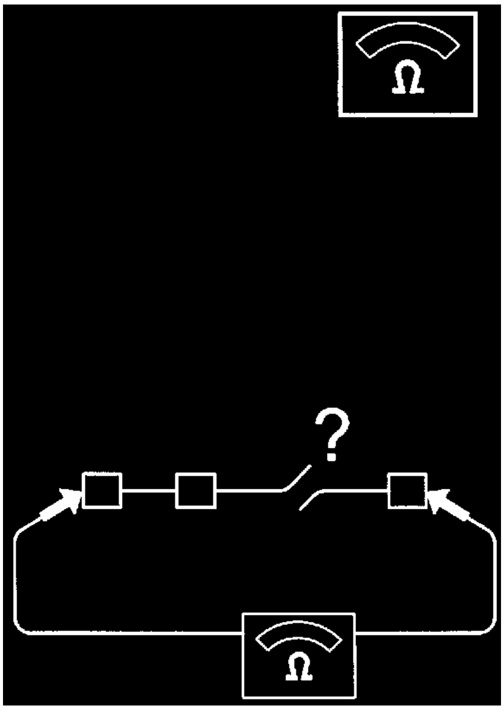
Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)

- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Verification

Checking For an Open-Circuit

Checking For An Open-circuit



Check the cable between the DSA control module:

- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314)

for an open-circuit according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

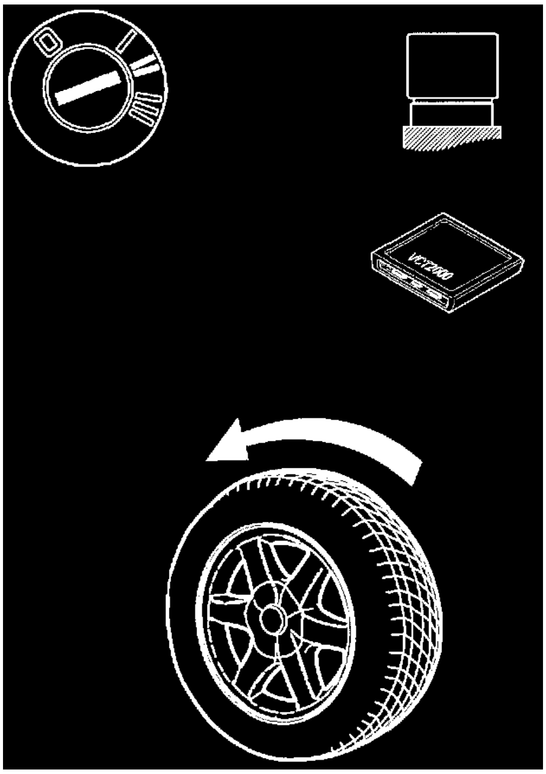
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-313/Faulty Signal/Verification

Verification

Verification



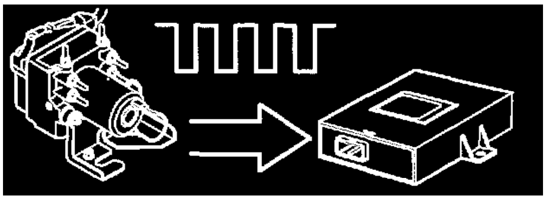
Hint: After carrying out the repair, check that the fault has been remedied.

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. check the wheel speed.

Diagnostic Trouble Code (DTC) Information

Diagnostic Trouble Code (DTC) Information



Condition

The DSA control module receives wheel speed signals from the ABS control module. The ABS control module converts the wheel sensor AC signal into a pulsed signal for the DSA control module. The signal is pulsed between approximately **0 V** and battery voltage. It has a fixed pulse ratio (% duty [ap] 50 %) where the frequency changes with the wheel speed.

Diagnostic trouble code (DTC) DSA-311, DSA-312, DSA-313 or DSA-314 is stored (depending on the actual wheel speed signal) if the vehicle speed is above **8 km/h** and the DSA control module registers that the increase in wheel speed is to great or too little, that the wheel speed at a wheel is less than or the same as half the speed of one of the rear wheels or that there is significant deviation in the speed signal.

Condition

The DSA function is disengaged.

Possible source
- Open-circuit in the signal cable.
- Short-circuit to supply voltage or ground in the signal cable.
- Interference in the wheel sensor circuit.
- Contact resistance in the terminals.

NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the car is driven with one or more wheels locked. Fault causes of this type are not

included in the fault-tracing procedure.

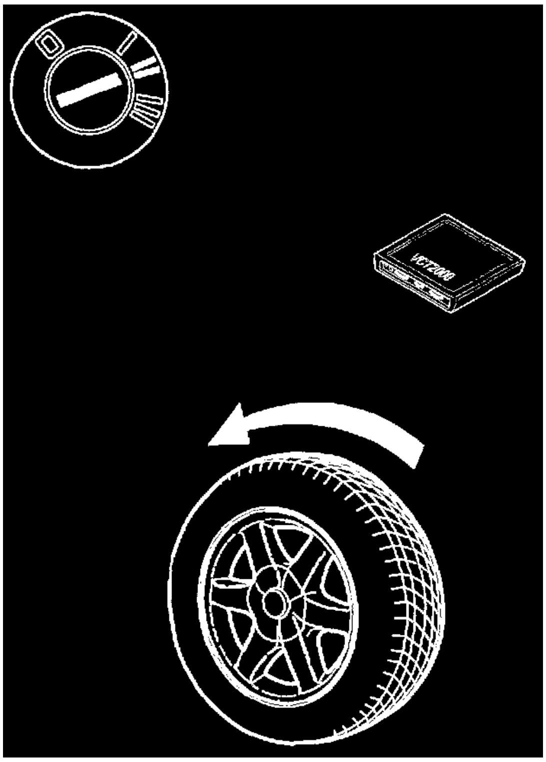
NOTE: Diagnostic trouble code(s) (DTC(s)) may be stored if the power supply and/or the ground terminal for the ABS control module is defective. Fault causes of this type are not included in the fault-tracing procedure.

Condition

- The DSA warning lamp lights.
- The anti-spin function is not operative while the DSA function is disengaged.

Checking the Wheel Speed

Checking The Wheel Speed



- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. Check the wheel speed.

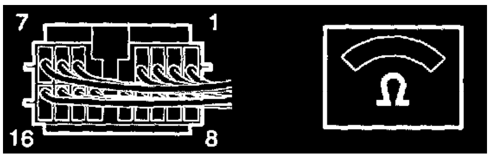
Is the wheel speed OK?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking Wiring and Terminals

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking the Resistance In the Signal Cable

Checking Wiring and Terminals

Checking Wiring And Terminals



Check DSA control module and ABS control module connectors for contact resistance and oxidation according to **Checking wiring and terminals - Intermittent Faults.**

Check the cable between the DSA control module:

- terminal 2 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)

- terminal 4 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for intermittent open-circuit according to **Checking wiring and terminals - Intermittent Faults**, an intermittent short-circuit to ground according to **Checking wiring and terminals - Intermittent Faults** and an intermittent short-circuit to supply according to **Checking wiring and terminals - Intermittent Faults.**

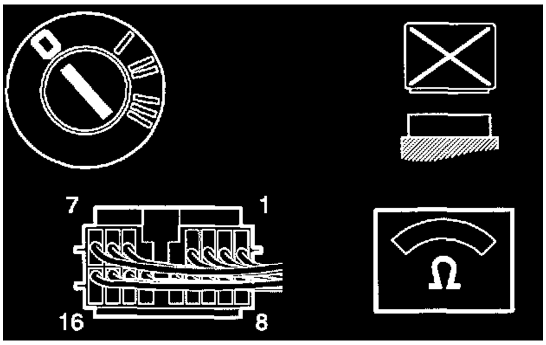
Check that the cable is not too close to sources of interference such as electric motors, ignition cables, carphone cables etc.

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

Checking the Resistance In the Signal Cable

Checking The Resistance In The Signal Cable



- Ignition off.
- DSA control module disconnected.
- ABS control module disconnected.
- Breakout box connected to the ABS Control module.

Connect an ohmmeter between DSA control module Connector:
- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

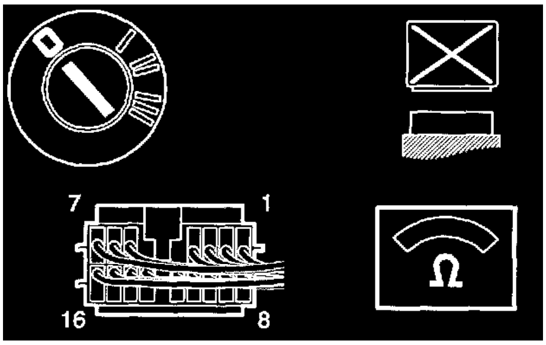
The ohmmeter should read approximately 0 [ohm].

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking the Signal Cable Resistance to Ground

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking For an Open-Circuit

Checking the Signal Cable Resistance to Ground

Checking The Signal Cable Resistance To Ground



- Ignition off.
- DSA control module disconnected.
- ABS control module disconnected.

Connect an ohmmeter between ground and DSA control module connector:
- terminal 2 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 (diagnostic trouble code (DTC) DSA-314).

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)

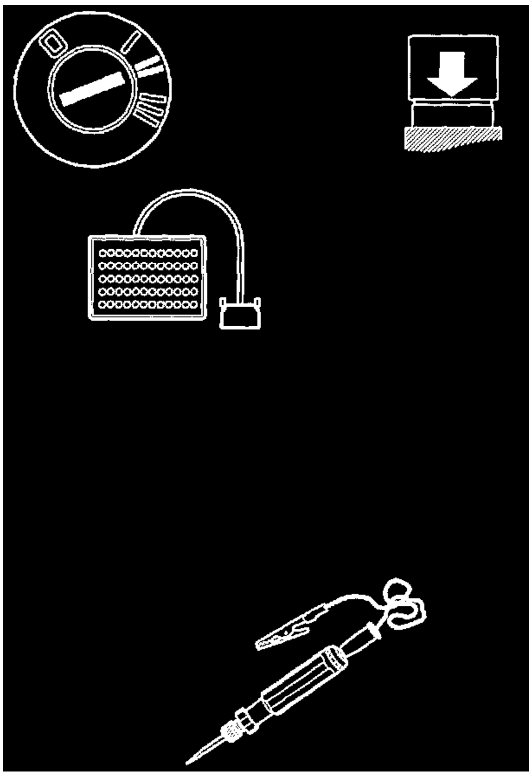
The ohmmeter should read infinite resistance.

OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking the Signal Cable For A Short-Circuit to Supply Voltage

Not OK - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking For A Short-Circuit - II

Checking the Signal Cable For A Short-Circuit to Supply Voltage

Checking The Signal Cable For A Short-circuit To Supply Voltage



- Ignition off.
- Connect the DSA control module.
- Connect the ABS control module.
- Breakout box connected to the ABS control module.
- Ignition on.

Connect an electrician's screwdriver (with a bulb of at least **3 W**) between ground and breakout box:

- terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 24 (diagnostic trouble code (DTC) DSA-314).

Other information

- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

The electricians screwdriver should not light. Is the electrician's screwdriver unlit?

Yes - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Fault Cause and Checking For Contact Resistance and Oxidation

No - See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Checking For A Short-Circuit - I

Fault Cause and Checking For Contact Resistance and Oxidation

Fault Cause And Checking For Contact Resistance And Oxidation

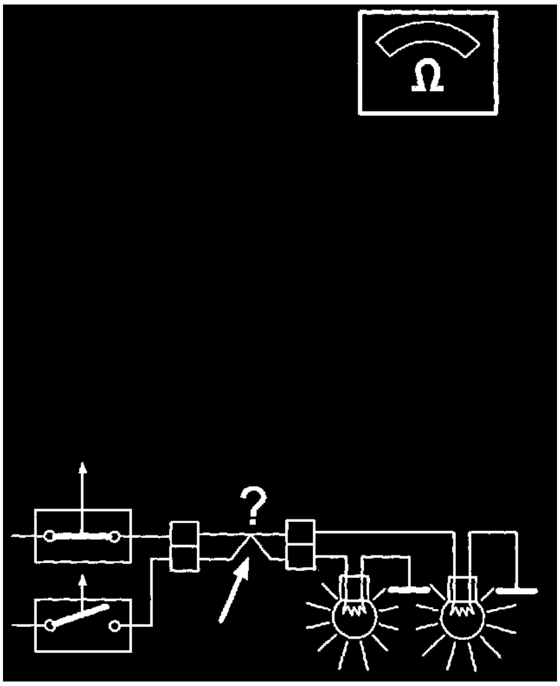
The diagnostic trouble code (DTC) was caused by poor contact the DSA control module and/or ABS control module connectors.

Check the connectors for contact resistance and oxidation and remedy according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Verification

Checking For A Short-Circuit - I

Checking For A Short-circuit



Check the cable between the DSA control module:

- terminal 12 and ABS control module terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 13 and ABS control module terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 14 and ABS control module terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and ABS control module terminal 24 (diagnostic trouble code (DTC) DSA-314)

for a short-circuit to supply voltage according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

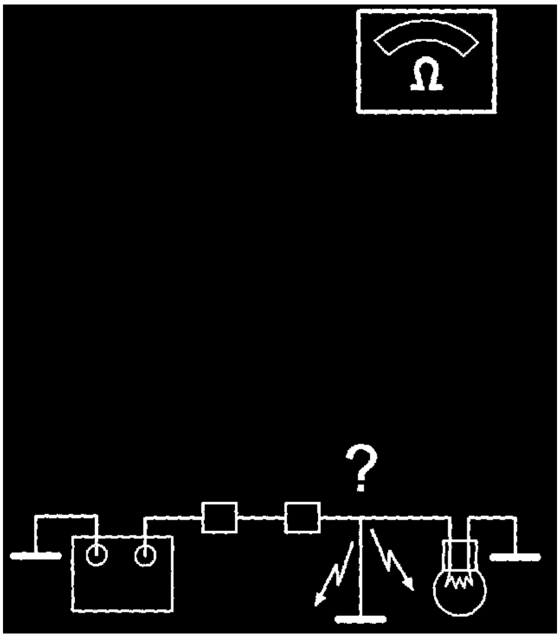
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Verification

Checking For A Short-Circuit - II

Checking For A Short-circuit



Check the cable between the DSA control module:
- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314).

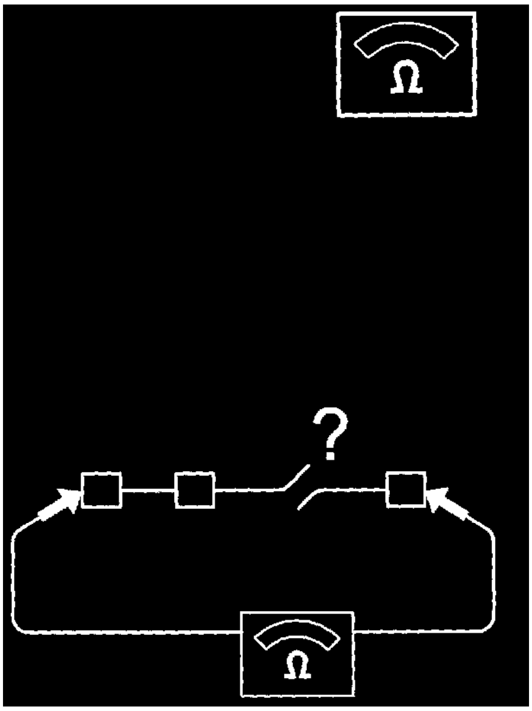
for a short-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Other information
- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Verification

Checking For an Open-Circuit

Checking For An Open-circuit



Check the cable between the DSA control module:

- terminal 2 and breakout box terminal 25 (diagnostic trouble code (DTC) DSA-311)
- terminal 3 and breakout box terminal 26 (diagnostic trouble code (DTC) DSA-312)
- terminal 4 and breakout box terminal 23 (diagnostic trouble code (DTC) DSA-313)
- terminal 12 and breakout box terminal 24 (diagnostic trouble code (DTC) DSA-314).

for a open-circuit to ground according to See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

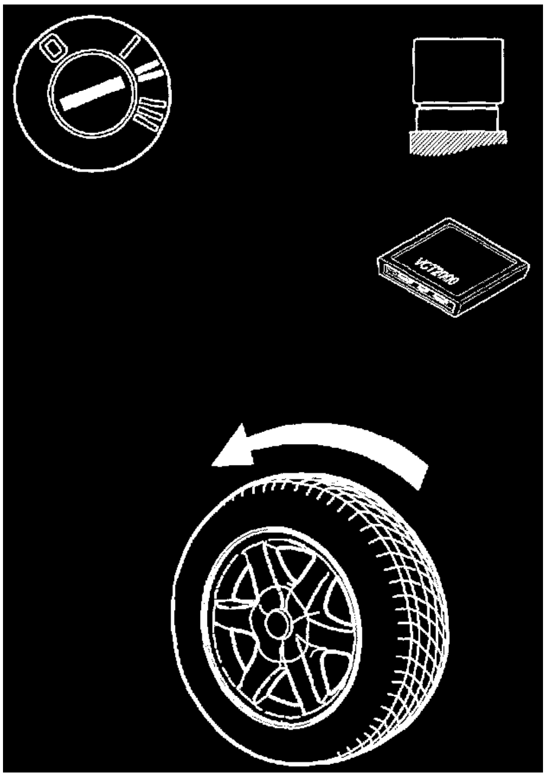
Other information

- To connect the breakout box for DSA, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box (DSA)
- To connect the breakout box for ABS, refer to "**Antilock Brakes / Traction Control Systems**"

After performing this procedure See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Dynamic Stability Assistance (DSA)/DSA-314/Faulty Signal/Verification

Verification

Verification



Hint: After carrying out the repair, check that the fault has been remedied.

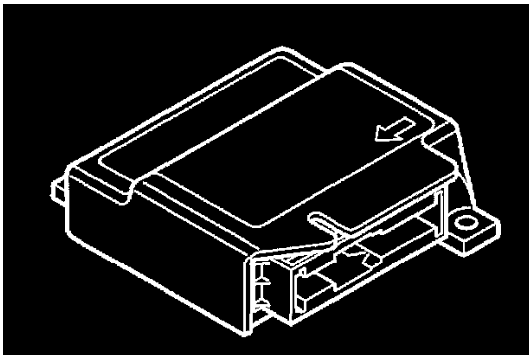
- Ignition off.
- Reconnect the connectors, reinstall components etc.
- DSA control module connected.
- Ignition on.
- Read off the wheel speeds.
- Raise the car so that the relevant wheel is clear of the ground.

Spin the relevant wheel. check the wheel speed.

SRS-0001

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0001 is stored if the on-board diagnostic system has stored a fault in any of the internal control module functions.

Possible source

- Internal fault in the control module.

Condition

- The SRS indicator lamp lights.

WARNING: There is a risk that the SRS will not function if this diagnostic trouble code (DTC) is stored.

NOTE:

- Diagnostic trouble code (DTC) SRS-O9O1 must not be erased if it occurs during the warranty period. In such cases the control module must be returned to Volvo according to standard procedures.
- If diagnostic trouble code (DTC) SRS-OOO1 is stored, no other DTCs can be erased.

SRS-0065

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) SRS-0065 is stored if the voltage in the wiring circuit is too low for more than **2 seconds**.

Possible source

- Open-circuit or short-circuit to ground in the cable or in the connectors between the combined instrument panel and control module.

Condition

- SRS indicator lamp lit (open-circuit).
- The SRS indicator lamp does not light when the ignition is switched on (short-circuit to ground).

SRS-0066

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) SRS-0066 is stored if the voltage in the wiring circuit is too high for more than **2 seconds**.

Possible source

- Short-circuit to supply voltage in the cable or in the connectors between the combined instrument panel and control module.

Condition

- No fault symptoms.

SRS-0067

Diagnostic Trouble Code (DTC) Information

Condition

Diagnostic trouble code (DTC) SRS-0067 is stored if the battery voltage is below **9 V** (signal too low) when the ignition is switched on.

Possible source

- Generator (GEN) not charging sufficiently.
- Low battery voltage.
- Contact resistance in the terminals.

Condition

- The SRS indicator lamp lights.

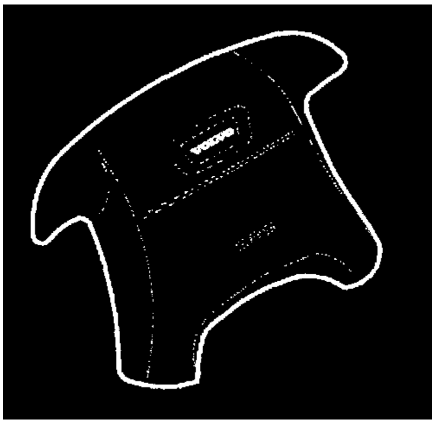
Hint: The lamp goes out if the voltage returns to normal. However the diagnostic trouble code (DTC) remains.

SRS-0068

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble code (DTC) SRS-0068 is stored if the resistance in the wiring circuit is too low for more than **3 seconds**.

Possible source

- Short-circuit to ground in the connectors or in the signal cable between the driver's air bag and the control module.
- Short-circuit to ground in the driver's air bag (resistance too low in igniter).
- Short-circuit to ground in the contact reel.

Condition

- No fault symptoms except that the SRS indicator lamp lights.

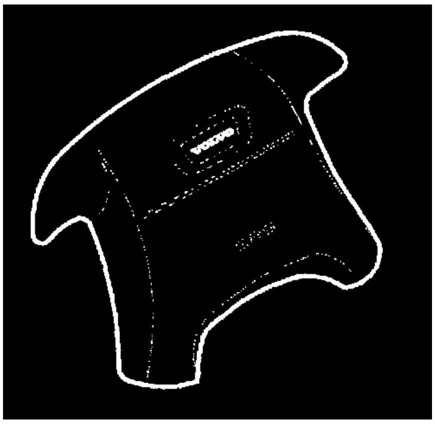
WARNING: There is a danger that the SRS air bag module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-0069

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble code (DTC) SRS-0069 is stored if the voltage in the wifing circuit is too high for more than **3 seconds**.

Possible source

- Short-circuit to supply voltage in the SRS ignition cable or in the driver's air bag.
- Short-circuit to supply voltage in the contact reel.

Condition

- The SRS indicator lamp lights.

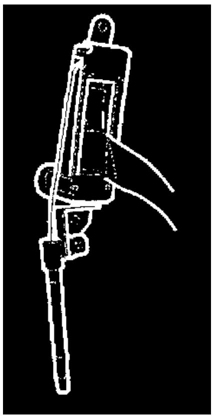
WARNING: There is a danger that the SRS steering wheel module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-006A

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble codes (DTCs) SRS-006A and SRS-006C are stored if resistance in the wiring circuit is too low for longer than **3 seconds**.

Possible source

- Short-circuit to ground in the connectors or in the signal cable between the driver's or passenger seat belt tensioner and the control module.
- Short-circuit to ground in the driver's or passenger seat belt tensioner (resistance too low in the igniter).

Condition

- The SRS indicator lamp lights.

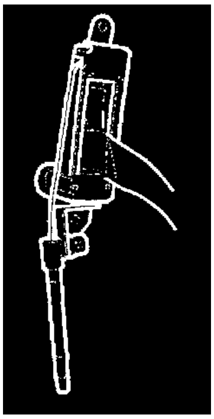
WARNING: There is a risk that the seat belt tensioner will not function if this diagnostic trouble code (DTC) is stored.

SRS-006B

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble codes (DTCs) SRS-006B and SRS-006D are stored if resistance in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Short-circuit to supply voltage in the connectors or in the signal cable for the driver's or passenger seat belt tensioner.
- Short-circuit to supply voltage in the driver1s or passenger seat belt tensioner.

Condition

- The SRS indicator lamp lights.

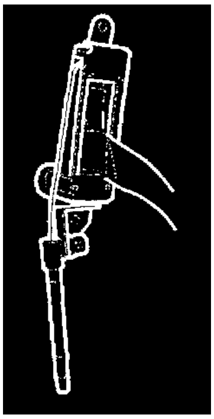
NOTE: Diagnostic trouble code (DTC) SRS-007B or SRS-007D is stored after this fault-tracing. This is because the seat belt tensioner is disconnected during the fault-tracing. Ignore the diagnostic trouble code (DTC).

SRS-006C

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble codes (DTCs) SRS-006A and SRS-006C are stored if resistance in the wiring circuit is too low for longer than **3 seconds**.

Possible source

- Short-circuit to ground in the connectors or in the signal cable between the driver's or passenger seat belt tensioner and the control module.
- Short-circuit to ground in the driver's or passenger seat belt tensioner (resistance too low in the igniter).

Condition

- The SRS indicator lamp lights.

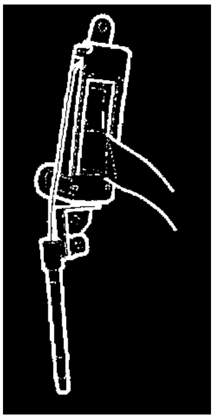
WARNING: There is a risk that the seat belt tensioner will not function if this diagnostic trouble code (DTC) is stored.

SRS-006D

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble codes (DTCs) SRS-006B and SRS-006D are stored if resistance in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Short-circuit to supply voltage in the connectors or in the signal cable for the driver's or passenger seat belt tensioner.
- Short-circuit to supply voltage in the driver1s or passenger seat belt tensioner.

Condition

- The SRS indicator lamp lights.

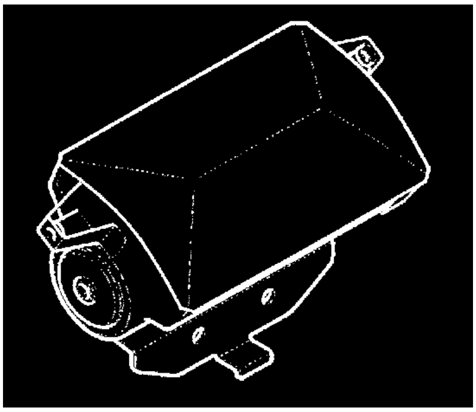
NOTE: Diagnostic trouble code (DTC) SRS-007B or SRS-007D is stored after this fault-tracing. This is because the seat belt tensioner is disconnected during the fault-tracing. Ignore the diagnostic trouble code (DTC).

SRS-006E

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732.

Condition



Diagnostic trouble code (DTC) SRS-006E is stored if resistance in the wiring circuit is too low for longer than **3 seconds**.

Possible source

- Short-circuit to ground in the connectors or in the ignition cable between the passenger air bag and control module.
- Short-circuit to ground in the passenger air bag (resistance too low in igniter).

Condition

- The SRS indicator lamp lights.

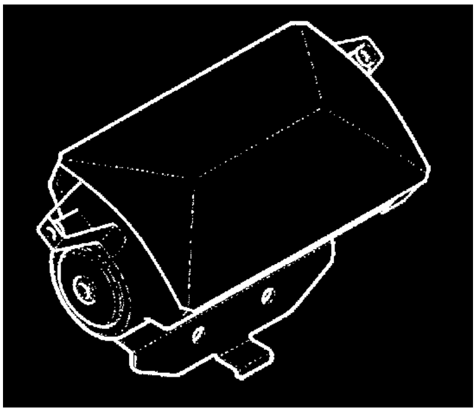
WARNING: There is a danger that the SRS passenger module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-006F

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732.

Condition



Diagnostic trouble code (DTC) SRS-006F is stored if the voltage in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Short-circuit to supply voltage in the signal cable or passenger air bag.

Condition

- No fault symptoms except that the SRS indicator lamp lights.

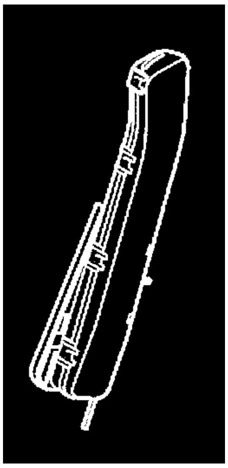
WARNING: There is a danger that the SRS passenger module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-0074

Diagnostic Trouble Code (DTC) Information

Special tools: 861 8437.

Condition



Diagnostic trouble code (DTC) SRS-0074 is stored if the voltage is too low in the wiring circuit for **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Short-circuit to ground in the wiring circuit or in the side impact protection (SIPS) bag.
- Short-circuit to ground in the connector.

Condition

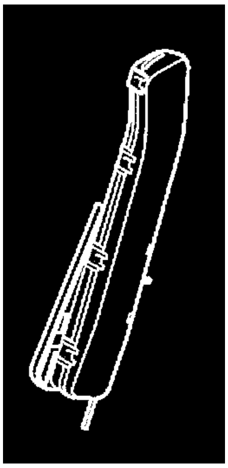
- The SRS indicator lamp is lit.

SRS-0075

Diagnostic Trouble Code (DTC) Information

Special tools: 861 8437

Condition



Diagnostic trouble code (DTC) SRS-0075 is stored if the voltage in the wiring circuit is too high for **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Short-circuit to supply voltage in the wiring circuit or in the SIPS bag.
- Short-circuit to supply voltage in the connector.

Condition

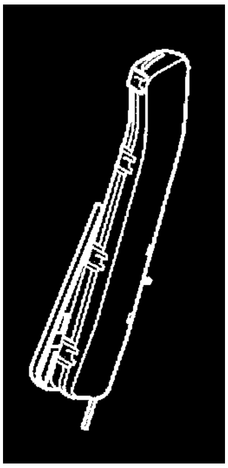
- The SRS indicator lamp is lit.

SRS-0076

Diagnostic Trouble Code (DTC) Information

Special tools: 861 8437.

Condition



Diagnostic trouble code (DTC) SRS-0076 is stored if the voltage in the wiring circuit is too high for **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Short-circuit to ground in the wiring circuit or in the side impact protection (SIPS) bag.
- Short-circuit to ground in the connector.

Condition

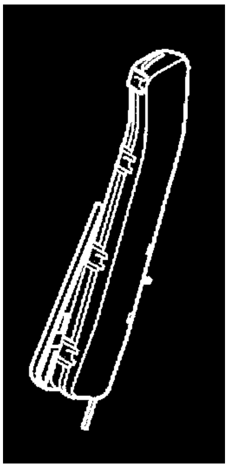
- The SRS indicator lamp is lit.

SRS-0077

Diagnostic Trouble Code (DTC) Information

Special tools: 861 5437

Condition



Diagnostic trouble code (DTC) SRS-0077 is stored if the voltage in the wiring circuit is too high for **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Short-circuit to supply voltage in the wiring circuit or in the side impact protection (SIPS) bag.
- Short-circuit to supply voltage in the connector.

Condition

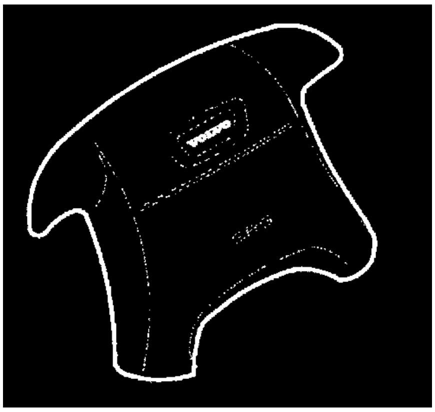
- The SRS indicator lamp is lit.

SRS-0078

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695.

Condition



Diagnostic trouble code (DTC) SRS-0078 is stored if the resistance in the wiring circuit is too low for more than **3 seconds**.

Possible source

- Short-circuit in the connectors or in the signal cable between the driver's Airbag and the control module.
- Short-circuit in the driver's Airbag (resistance too low in igniter).

Condition

- The SRS indicator lamp lights.

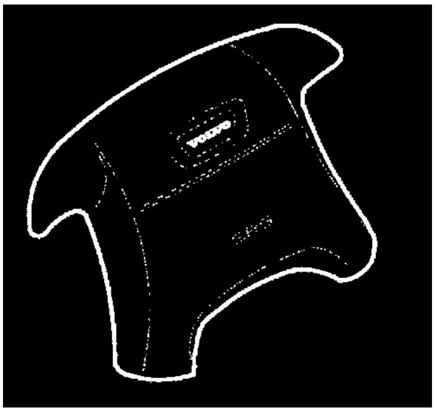
WARNING: There is a danger that the SRS steering wheel module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-0079

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695

Condition



Diagnostic trouble code (DTC) SRS-0079 is stored if resistance in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Open-circuit in the cable or contact resistance in the connectors between the driver's air bag and the contact reel or between the control module and the contact reel.
- Open-circuit in the air bag module (resistance too high in the igniter).

Condition

- The SRS indicator lamp lights.

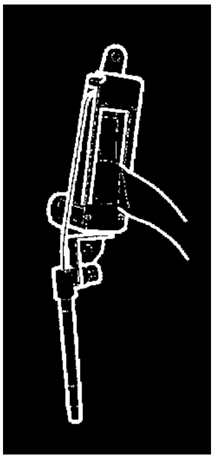
WARNING: There is a danger that the SRS steering wheel module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-007A

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695

Condition



Diagnostic trouble codes (DTCs) SRS-007A and SRS-007C are stored if resistance in the wiring circuit is too low for longer than **3 seconds**.

Possible source

- Short-circuit in the connectors or in the signal cable between the driver's or passenger seat belt tensioner and the control module.
- Short-circuit in the driver's or passenger seat belt tensioner (resistance too low in the igniter).

Condition

- No fault symptoms except that the SRS indicator lamp lights.

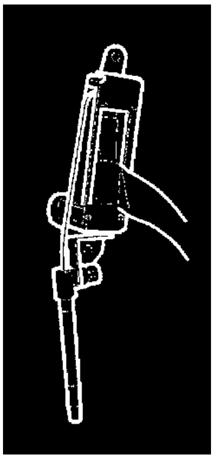
WARNING: There is a risk that the seat belt tensioner will not function if this diagnostic trouble code (DTC) is stored.

SRS-007B

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695

Condition



Diagnostic trouble codes (DTCs) SRS-007B and SRS-007D are stored if resistance in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Contact resistance or open-circuit in the cable between the driver's or passenger seat belt tensioner and control module.
- Open-circuit in the driver's or passenger seat belt tensioner (resistance too high in the igniter).

Condition

- The SRS indicator lamp lights.

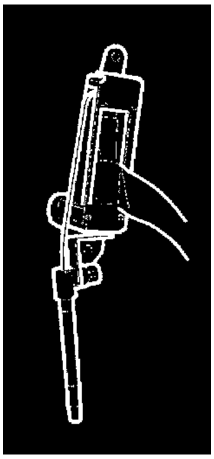
WARNING: There is a risk that the seat belt tensioner will not function if this diagnostic trouble code (DTC) is stored.

SRS-007C

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695

Condition



Diagnostic trouble codes (DTCs) SRS-007A and SRS-007C are stored if resistance in the wiring circuit is too low for longer than **3 seconds**.

Possible source

- Short-circuit in the connectors or in the signal cable between the driver's or passenger seat belt tensioner and the control module.
- Short-circuit in the driver's or passenger seat belt tensioner (resistance too low in the igniter).

Condition

- No fault symptoms except that the SRS indicator lamp lights.

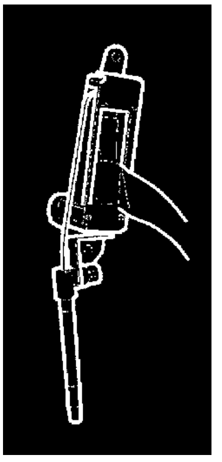
WARNING: There is a risk that the seat belt tensioner will not function if this diagnostic trouble code (DTC) is stored.

SRS-007D

Diagnostic Trouble Code (DTC) Information

Special tools: 998 8695

Condition



Diagnostic trouble codes (DTCs) SRS-007B and SRS-007D are stored if resistance in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Contact resistance or open-circuit in the cable between the driver's or passenger seat belt tensioner and control module.
- Open-circuit in the driver's or passenger seat belt tensioner (resistance too high in the igniter).

Condition

- The SRS indicator lamp lights.

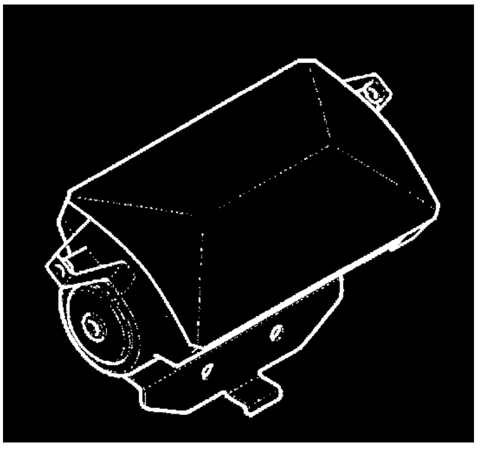
WARNING: There is a risk that the seat belt tensioner will not function if this diagnostic trouble code (DTC) is stored.

SRS-007E

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732

Condition



Diagnostic trouble code (DTC) SRS-007E is stored if resistance in the wiring circuit is too low for longer than **3 seconds**.

Possible source

- Short-circuit in the connectors or in the signal cable between the Passenger Airbag and control module.
- Short-circuit in passenger air bag (resistance too low in igniter).

Condition

- The SRS indicator lamp lights.

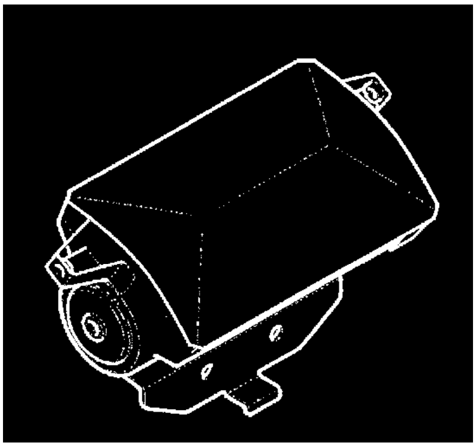
WARNING: There is a danger that the SRS passenger module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-007F

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732

Condition



Diagnostic trouble code (DTC) SRS-007F is stored if resistance in the wiring circuit is too high for longer than **3 seconds**.

Possible source

- Contact resistance in connector or open-circuit in the cable between the passenger air bag and control module.
- Open-circuit in the air bag module (resistance too high in the igniter).

Condition

- The SRS indicator lamp lights.

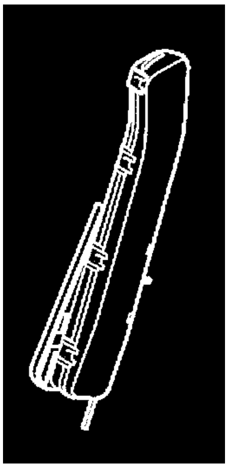
WARNING: There is a danger that the SRS passenger module will not operate if this diagnostic trouble code (DTC) is stored.

SRS-0084

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732

Condition



Diagnostic trouble code (DTC) SRS-0084 is stored if the resistance is too low for **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Short-circuit in connector.
- Short-circuit in the wiring.
- Faulty SIPS bag.

Condition

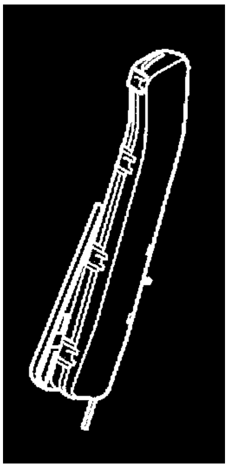
- The SRS indicator lamp is lit.

SRS-0085

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732.

Condition



Diagnostic trouble code (DTC) SRS-0085 is stored after **3 - 5.5 seconds** if the resistance is too high in the wiring circuit.

Condition

- None.

Possible source

- Open-circuit in wiring circuit.
- Faulty SIPS bag.
- Contact resistance or oxidation.

Condition

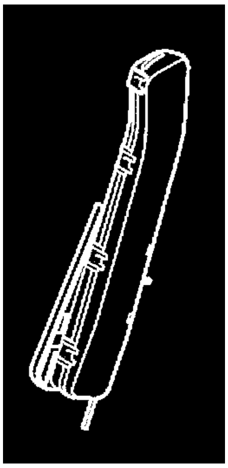
- The SRS indicator lamp is lit.

SRS-0086

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732.

Condition



Diagnostic trouble code (DTC) SRS-0086 is stored if the resistance is too low for **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Short-circuit in connector.
- Short-circuit in the wiring.
- Faulty side impact protection (SIPS) bag.

Condition

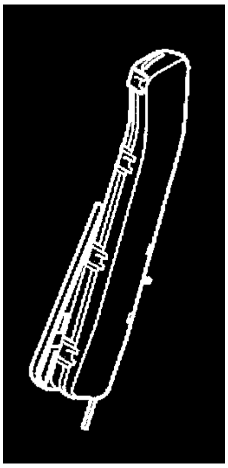
- The SRS indicator lamp is lit.

SRS-0087

Diagnostic Trouble Code (DTC) Information

Special tools: 919 4732

Condition



Diagnostic trouble code (DTC) SRS-0087 is stored after **3 - 5.5 seconds** if the resistance is too high in the wiring circuit.

Condition

- None.

Possible source

- Open-circuit in wiring circuit.
- Faulty side impact protection (SIPS) bag.
- Contact resistance or oxidation.

Condition

- The SRS indicator lamp is lit.

SRS-0088

Diagnostic Trouble Code (DTC) Information

Condition

The diagnostic trouble codes (DTCs) SRS-0088, SRS-008B, SRS-0089 and SRS-008A have been developed for the construction test.

These diagnostic trouble codes (DTCs) should not normally be stored because the control module is delivered to Volvo preprogrammed and connector coded.

Possible source

- If the control module detects an air bag or a seat belt tensioner despite the control module being programmed that these are not installed. However connector coding should prevent this happening.

Condition

- The SRS indicator lamp lights.

SRS-0089

Diagnostic Trouble Code (DTC) Information

Condition

The diagnostic trouble codes (DTCs) SRS-0088, SRS-008B, SRS-0089 and SRS-008A have been developed for the construction test.

These diagnostic trouble codes (DTCs) should not normally be stored because the control module is delivered to Volvo preprogrammed and connector coded.

Possible source

- If the control module detects an air bag or a seat belt tensioner despite the control module being programmed that these are not installed. However connector coding should prevent this happening.

Condition

- The SRS indicator lamp lights.

SRS-008A

Diagnostic Trouble Code (DTC) Information

Condition

The diagnostic trouble codes (DTCs) SRS-0088, SRS-008B, SRS-0089 and SRS-008A have been developed for the construction test.

These diagnostic trouble codes (DTCs) should not normally be stored because the control module is delivered to Volvo preprogrammed and connector coded.

Possible source

- If the control module detects an air bag or a seat belt tensioner despite the control module being programmed that these are not installed. However connector coding should prevent this happening.

Condition

- The SRS indicator lamp lights.

SRS-008B

Diagnostic Trouble Code (DTC) Information

Condition

The diagnostic trouble codes (DTCs) SRS-0088, SRS-008B, SRS-0089 and SRS-008A have been developed for the construction test.

These diagnostic trouble codes (DTCs) should not normally be stored because the control module is delivered to Volvo preprogrammed and connector coded.

Possible source

- If the control module detects an air bag or a seat belt tensioner despite the control module being programmed that these are not installed. However connector coding should prevent this happening.

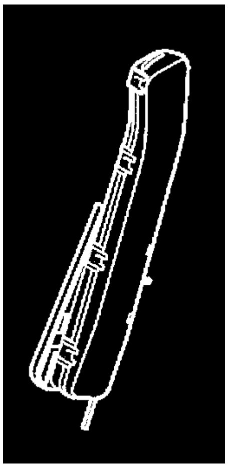
Condition

- The SRS indicator lamp lights.

SRS-008E

Diagnostic Trouble Code (DTC) Information

Condition



The diagnostic trouble code (DTC) is stored if the control module registers that a SIPS bag is installed despite the control module being programmed that there should not be one. Usually connector coding should prevent this happening.

Condition

- None.

Possible source

- The control module registers that a SIPS bag is installed despite the control module being programmed that there should not be one.

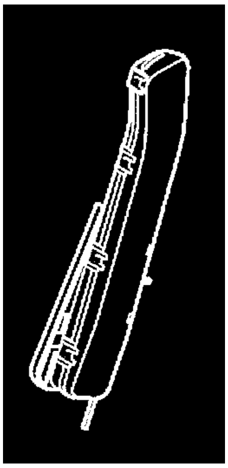
Condition

- SRS indicator lamp lit.

SRS-008F

Diagnostic Trouble Code (DTC) Information

Condition



The diagnostic trouble code (DTC) is stored if the Control module registers that a SIPS bag is installed despite the control module being programmed that there should not be one. Usually connector coding should prevent this happening.

Condition

- None.

Possible source

- The control module registers that a SIPS bag is installed despite the control module being programmed that there should not be one.

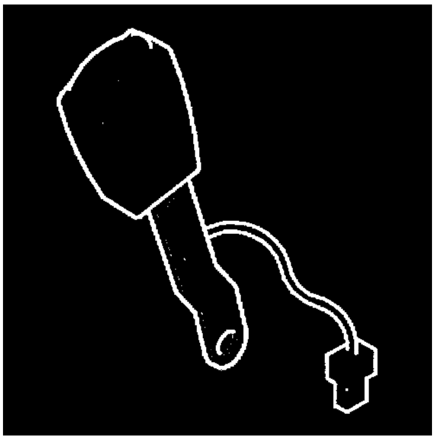
Condition

- SRS indicator lamp lit.

SRS-0090

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0090 is stored if there is no signal from the seat belt buckle for more than **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Open-circuit or short-circuit to ground in the seat belt buckle or in the wiring.

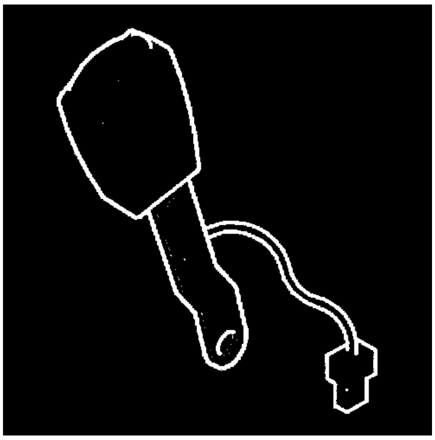
Condition

- SRS indicator lamp is lit.

SRS-0091

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0091 is stored if the current through the seat belt buckle is outside its defined parameters for more than **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Defective seat belt buckle.
- Contact resistance too high.

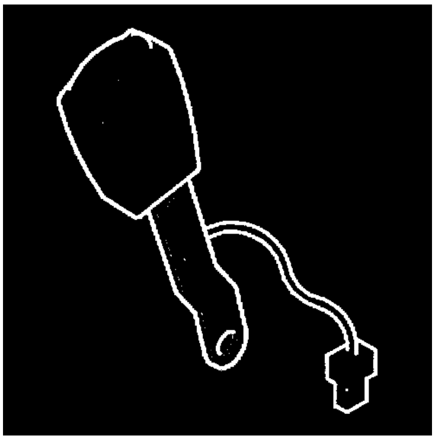
Condition

- SRS indicator lamp is lit.

SRS-0092

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0092 is stored if the voltage is too high in the seat belt buckle for more than **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Defective seat belt buckle.
- Short-circuit to supply voltage in the wiring or in the connector.

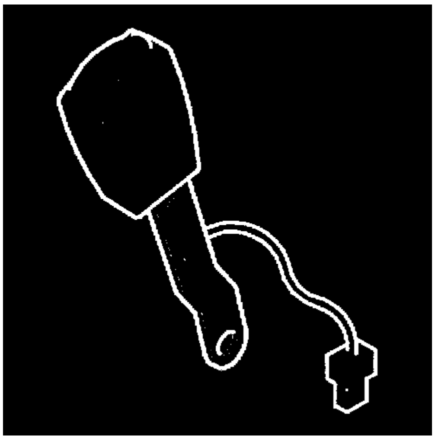
Condition

- The SRS indicator lamp is lit.

SRS-0093

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0093 is stored if there is no signal from the seat belt buckle for more than **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Open-circuit or short-circuit to ground in the seat belt buckle or in the wiring.

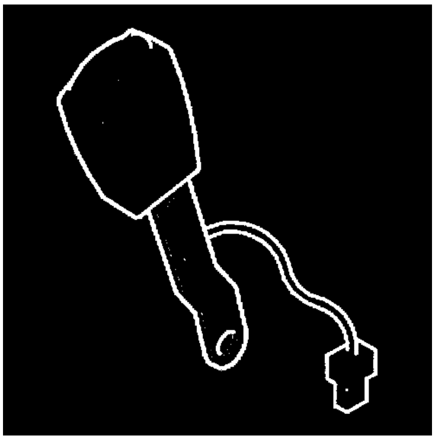
Condition

- The SRS indicator lamp is lit.

SRS-0094

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0094 is stored if the current through the seat belt buckle is outside its defined parameters for more than **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Defective seat belt buckle.

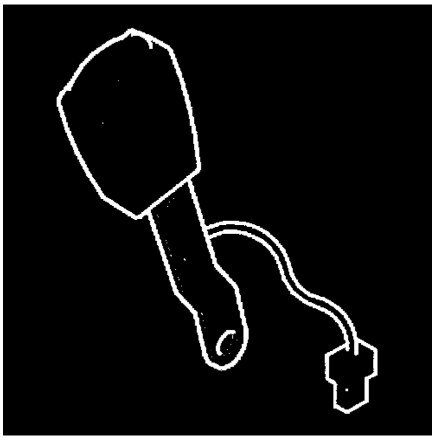
Condition

- The SRS indicator lamp is lit.

SRS-0095

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-0095 is stored if the voltage is too high in the seat belt buckle for more than **3 - 5.5 seconds**.

Condition

- None.

Possible source

- Defective seat belt buckle.
- Short-circuit to supply voltage in the wiring or in the connector.

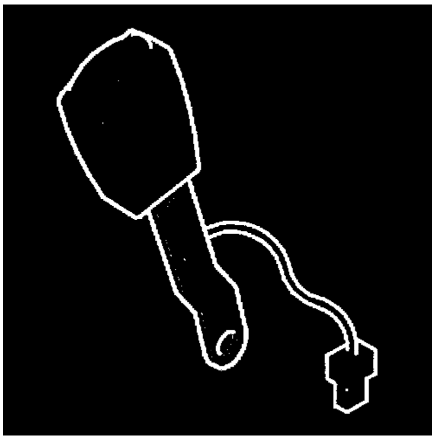
Condition

- The SRS indicator lamp is lit.

SRS-0096

Diagnostic Trouble Code (DTC) Information

Condition



The diagnostic trouble code (DTC) is stored if the control module registers that there is a seat belt buckle, despite the control module being programmed that there should not be one. Normally it should not be possible to store the diagnostic trouble code (DTC) because the control module is delivered to Volvo preprogrammed and connector coded.

Condition

- None.

Possible source

- The control module registers that there is a seat belt buckle despite being programmed that there should not be one.

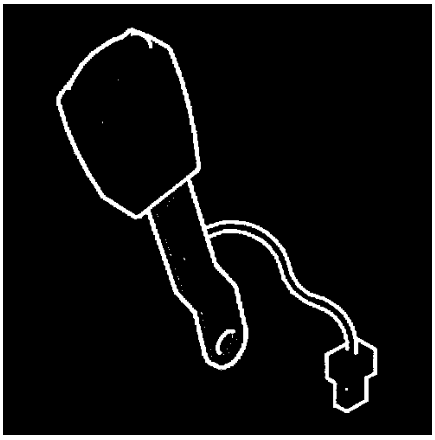
Condition

- The SRS indicator lamp is lit.

SRS-0097

Diagnostic Trouble Code Information

Condition



If the control unit identifies that a seat-belt buckle is present, despite the control unit being programmed for none to be present, this diagnostic trouble code is set. Normally no diagnostic codes can be set as the control unit is delivered to Volvo preprogrammed and with the connector coded.

Condition

- Nothing.

Possible source

- The control unit identifies that a seat-belt buckle is present, despite the control unit being programmed for none to be present.

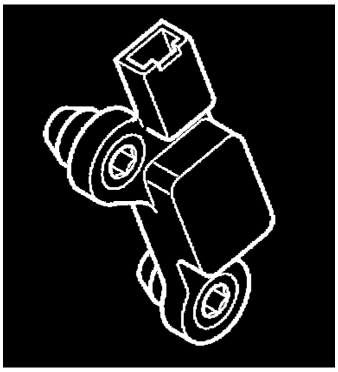
Condition

- SRS warning lamp comes on.

SRS-00A0

Diagnostic Trouble Code (DTC) Information

Condition



A fault has occurred in the left side impact sensor.

Condition

- None.

Possible source

- Defective collision sensor.

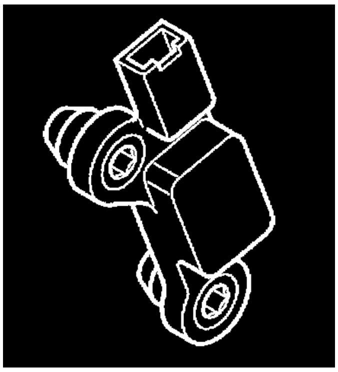
Condition

- The SRS indicator lamp is lit.

SRS-00A1

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-00A1 is stored if there is no live signal from the left side impact sensor within **3.5 - 6 seconds**.

Condition

- None.

Possible source

- Defective collision sensor.
- Open-circuit or short-circuit to ground in the signal cable.

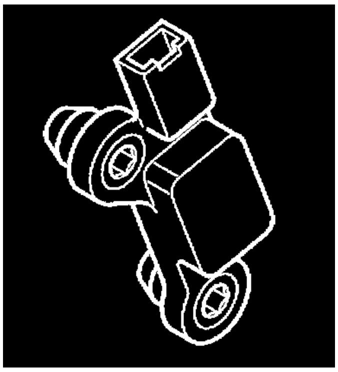
Condition

- The SRS indicator lamp is lit.

SRS-00A2

Diagnostic Trouble Code (DTC) Information

Condition



A fault has occurred in the right side impact sensor. Diagnostic trouble code (DTC) SRS-00A2 is stored.

Condition

- None.

Possible source

- Defective collision sensor.

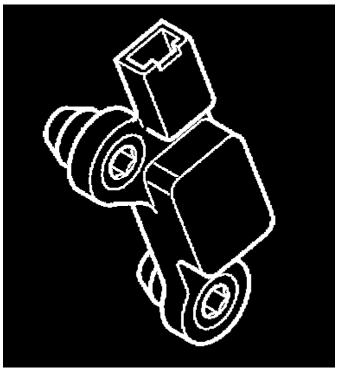
Condition

- The SRS indicator lamp is lit.

SRS-00A3

Diagnostic Trouble Code (DTC) Information

Condition



Diagnostic trouble code (DTC) SRS-00A3 is stored if there is no live signal from the left side impact sensor within **3.5 - 6 seconds**.

Condition

- None.

Possible source

- Defective collision sensor.
- Open-circuit or short-circuit to ground in the signal cable.

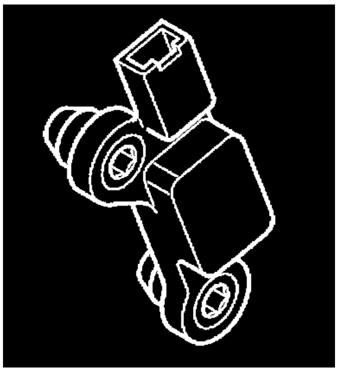
Condition

- The SRS indicator lamp is lit.

SRS-00A4

Diagnostic Trouble Code (DTC) Information

Condition



Normally it is not possible to store the diagnostic trouble codes (DTCs) because the control module is delivered to Volvo pre-programmed and connector coded.

Condition

- None.

Possible source

- If the control module registers that a side impact sensor is installed even though the control module is not programmed for one.

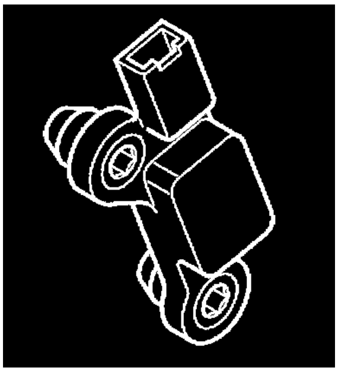
Condition

- The SRS indicator lamp is lit.

SRS-00A5

Diagnostic Trouble Code (DTC) Information

Condition



Normally it is not possible to store the diagnostic trouble codes (DTCs) because the control module is delivered to Volvo pre-programmed and connector coded.

Condition

- None.

Possible source

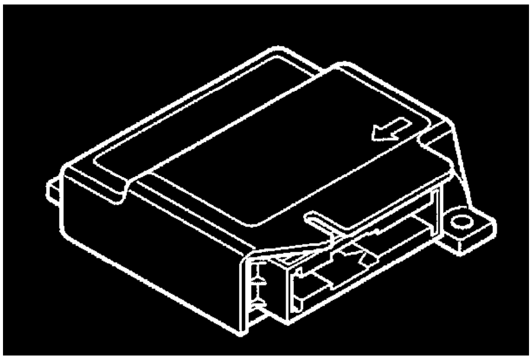
- If the control module registers that a side impact sensor is installed even though the control module is not programmed for one.

Condition

- The SRS indicator lamp is lit.

SRS-00C7

Condition



Diagnostic trouble code (DTC) SRS-00C7 is stored if the Control module registers three collisions.

Condition

- None.

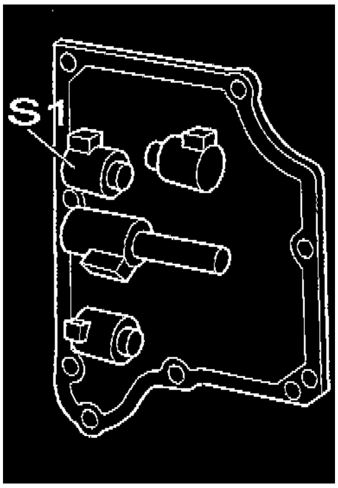
Possible source

- The control module has registered three collisions. These may be lighter frontal collisions where only the seat belt tensioners have been activated or side collisions where the SIPS bag has been activated.

Condition

- no fault symptoms.

Trouble Code Conditions



SPECIAL TOOLS

Volvo scan tool No. 998 8686 or equivalent

CONDITION

Solenoid S1 operates in tandem with solenoid S2 to control gear-shifting. Solenoid S1 operates when it receives a battery voltage from the transmission control module (TCM) and is activated in 2nd and 3rd gears. Diagnostic trouble code (DTC) AT-121 is posted if the transmission control module (TCM) registers a short-circuit to ground in the solenoid S1 circuit when the solenoid should be activated. Solenoid S1 cannot then be activated.

SUBSTITUTE VALUE

The transmission control module (TCM) limp-home program has been initiated.

Possible source

- Short-circuit to ground in signal cable.
- Defective solenoid

FAULT SYMPTOM(S)

- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the transmission control module (TCM) prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

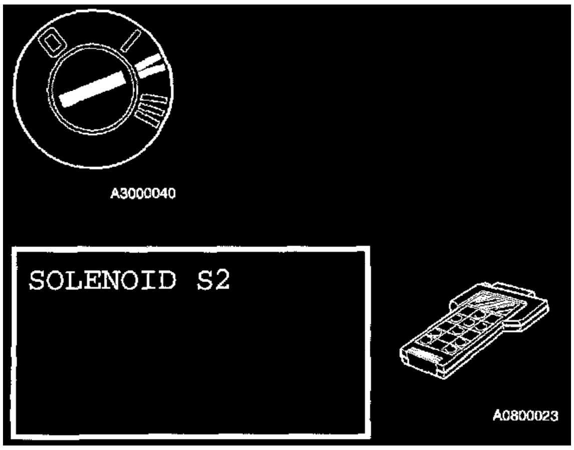
NOTE:

- The Motronic 4.4 engine control module (ECM) posts a diagnostic trouble code (DTC) when the transmission sends a malfunction indicator lamp (MIL) request.
- Erase this diagnostic trouble code (DTC) in the Motronic engine control module (ECM) when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at Short Circuit To Ground. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-121 Shift Solenoid S1/Short-Circuit To Ground

Short-Circuit To Ground



Checking Solenoid S1

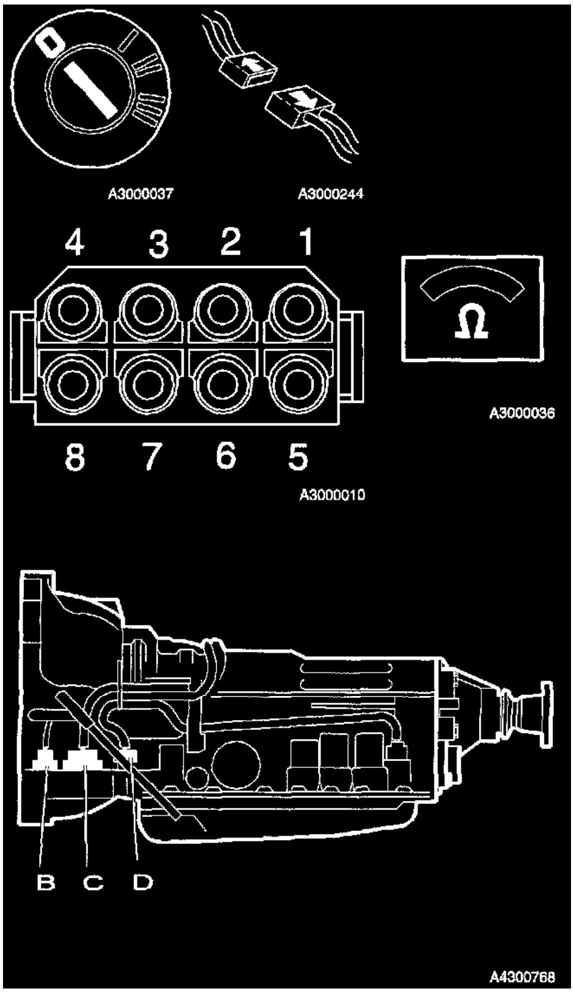
- Ignition ON.
- Move gear selector to position P.
- Activate solenoid S1. Read off solenoid status. The status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

Yes:

- Proceed to: **Intermittent Fault** section below.

No:

- Proceed to: **Checking Signal Wiring Resistance To Ground In The Transmission** section below.



Checking Signal Wiring Resistance To Ground In The Transmission

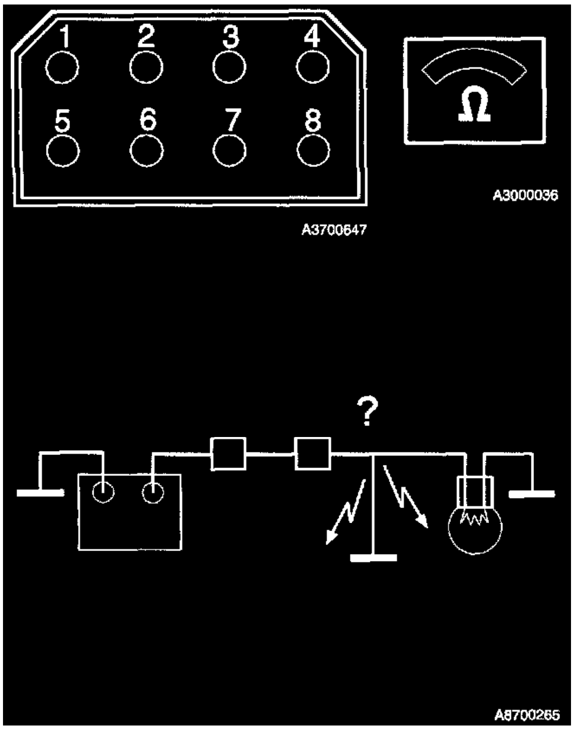
- Ignition OFF.
- Raise the car to access the transmission.
- Carefully clean round connector D.
- Disconnect transmission connector D.
- Connect an ohmmeter between transmission connector D terminal 1 (transmission side) and transmission housing.
- The ohmmeter should read **12 - 18 Ohms**.

If reading is OK:

- Proceed to: **Checking For A Short-circuit** section below.

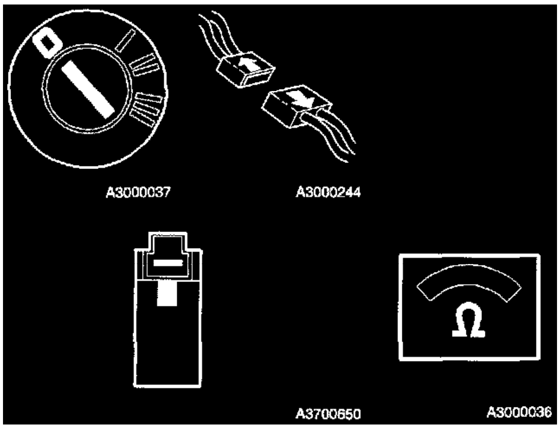
If reading is incorrect:

- Proceed to: **Checking Solenoid S1** section below.



Checking For A Short-circuit

- Check cable between transmission connector D terminal 1 and transmission control module # 17 for a short-circuit to ground.
- Proceed to: **Verification** section below.



Checking Solenoid S1

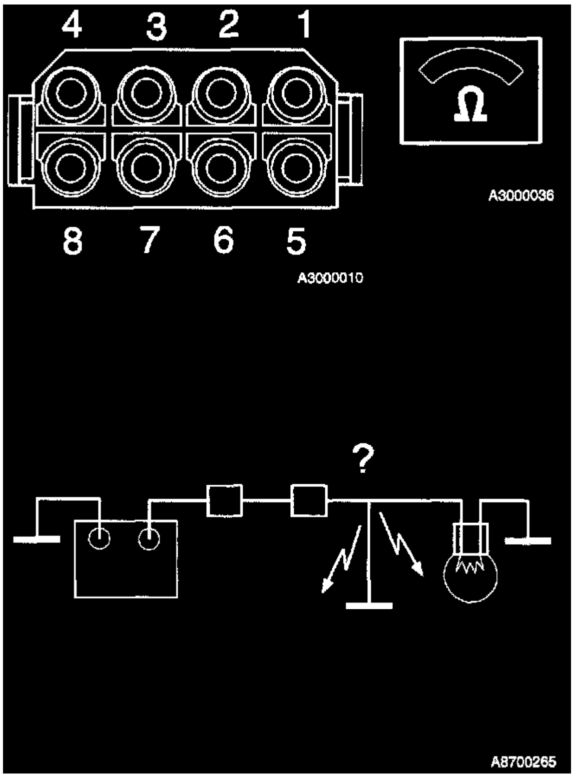
- Ignition OFF.
- Open the control system.
- Disconnect solenoid S1.
- Use an ohmmeter to measure between the pin on solenoid S1 and the transmission housing.
- The ohmmeter should read **12 - 18 Ohms**.

If reading is OK:

- Proceed to: **Checking For A Short-circuit** section below.

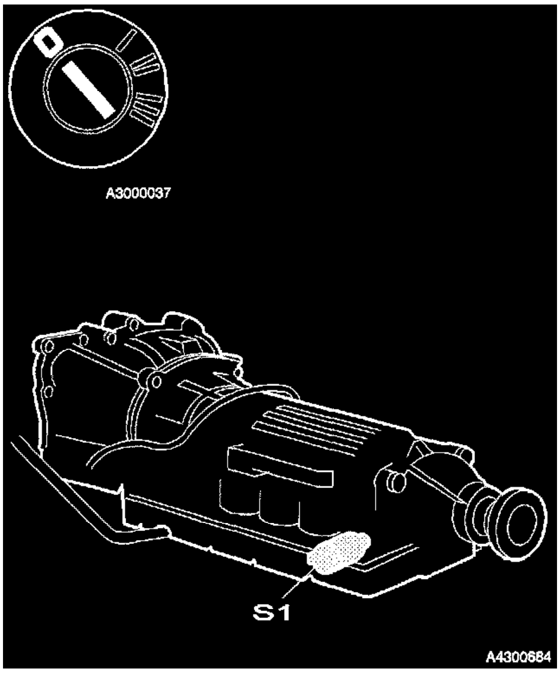
If reading is incorrect:

- Proceed to: **Replacing Component** section below.



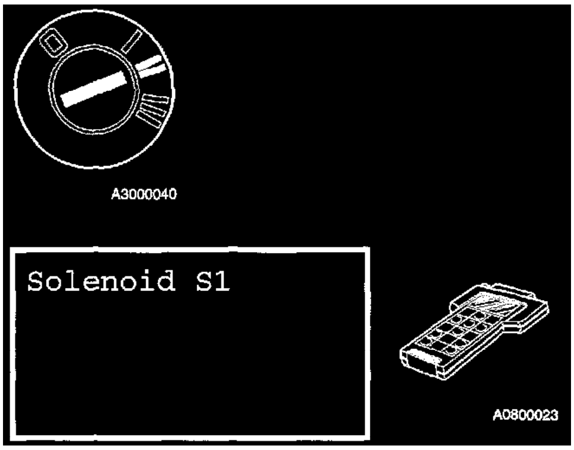
Checking For A Short-circuit

- Check the cable between solenoid S1 and transmission connector D terminal 1 for short circuit to ground.
- Proceed to: **Verification** section below.



Replacing Component

- Ignition OFF.
- Try a new solenoid S1.
- Proceed to: **Verification** section below.



Verification

After repairs have been completed they must be verified as follows to ensure the fault has been eliminated:

- Ignition ON.
- Move gear selector to position P.
- Activate solenoid S1. Read off the solenoid status. The status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

  Yes:
  - Fault corrected.

  No:
  - Proceed to: **Fault-tracing Information** section below.

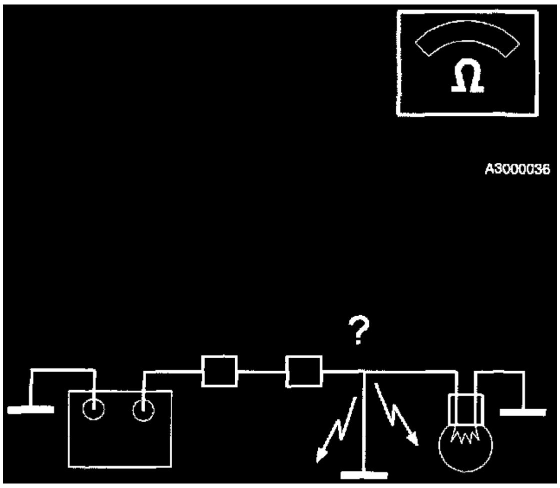
Fault-tracing Information

The verification result shows that the fault persists.

- Do you want to exit fault-racing?

  Yes:
  - Fault not corrected.

  No:
  - Proceed to: **Checking Solenoid S1** section above.



Intermittent Fault

- Check cable between solenoid S1 in the transmission and transmission control module # 17 for an intermittent short-circuit to ground.
- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.

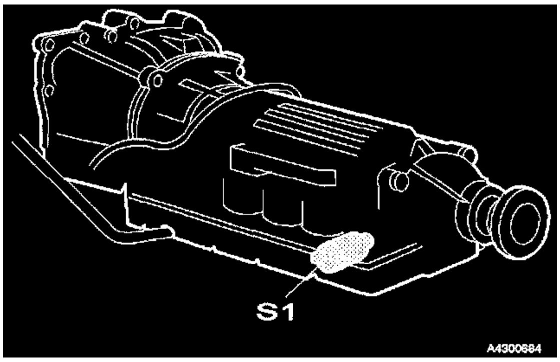
- Do you want to repeat fault-tracing?

  Yes:
  - Proceed to: **Checking Solenoid S1** section above.

No:

- Operation done.

Trouble Code Conditions



Special Tools

- 981 3190
- 998 8686

Trouble Code Conditions

- Shift solenoids S2 and S1 operate in tandem to control gear-shifting. The solenoids are controlled by the amplifier in the transmission control module **(TCM)**. The transmission control module opens the amplifier to activate the solenoids sending a voltage through the circuit. Solenoid S1 is activated on reverse, 1st and 2nd gears. Diagnostic trouble code **(DTC)** AT-122 is stored if the transmission control module registers an open-circuit or short-circuit to supply voltage in the solenoid S1 circuit when the solenoid should not be activated. DTC AT-122 is also stored if the transmission control module registers a short-circuit in the solenoid S1 amplifier when it should not be activated, vehicle speed is over 25 km/h (16 mph) and the gear selector is in D, or 3 in 3rd and 4th gears. Solenoid S1 cannot then be activated or is activated continuously (depending on the fault).

Substitute value(s)

- The transmission control module limp-home program has been initiated.

Possible source(s)

- Open-circuit in signal cable.
- Short-circuit to supply voltage in the signal cable.
- Open-circuit in power ground.
- Defective solenoid.
- Contact resistance in terminals.
- Fault in transmission control module.

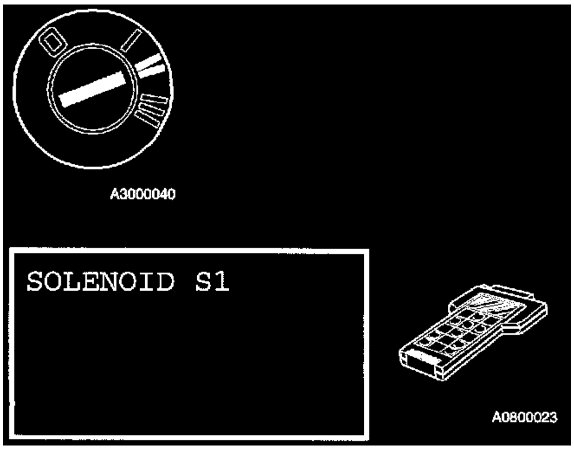
Fault symptom(s)

- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the transmission control module prevents activation of the solenoids, this stops gear-shifting. The transmission only operates in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear. If there is a short-circuit to supply voltage in the solenoid circuit the transmission will probably only operate in 1st gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

  NOTE: The Motronic 4.4 engine control module **(ECM)** posts a diagnostic trouble code when the transmission sends a malfunction indicator lamp **(MIL)** request. Erase this diagnostic trouble code in the Motronic engine control module when the transmission fault has been repaired.

- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-122 Shift Solenoid S1/Fault In Solenoid Circuit

Fault In Solenoid Circuit



Checking Component

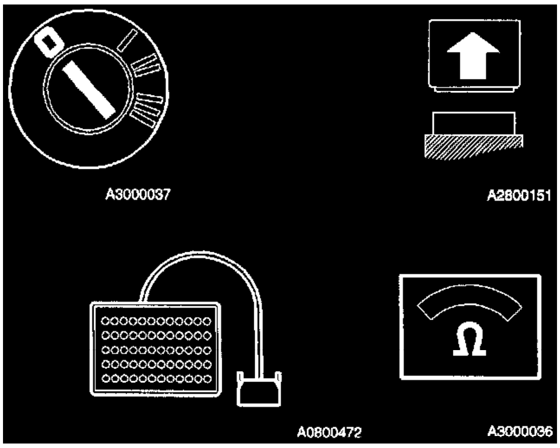
- Ignition ON.
- Move gear selector to position P.
- Activate solenoid S1. Read off the solenoid status. The status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

Yes:

- Proceed to: **Intermittent Fault** section below.

No:

- Proceed to: **Checking Power Ground** section below.



Checking Power Ground

- Ignition OFF.
- Connect the test box and check ground terminals.
- Check the power ground carefully.
- The ohmmeter should read **approx. 0 Ohms** if the power ground is OK.

If reading is OK:

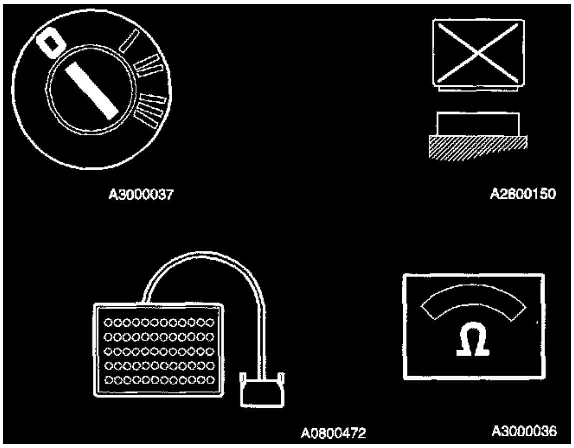
- Proceed to: **Checking Resistance In Solenoid S1 Circuit** section below.

If reading is incorrect:

- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

- The diagnostic trouble code **(DTC)** has been caused by a poor power ground.
- Proceed to: **Verification** section below.



Checking Resistance In Solenoid S1 Circuit

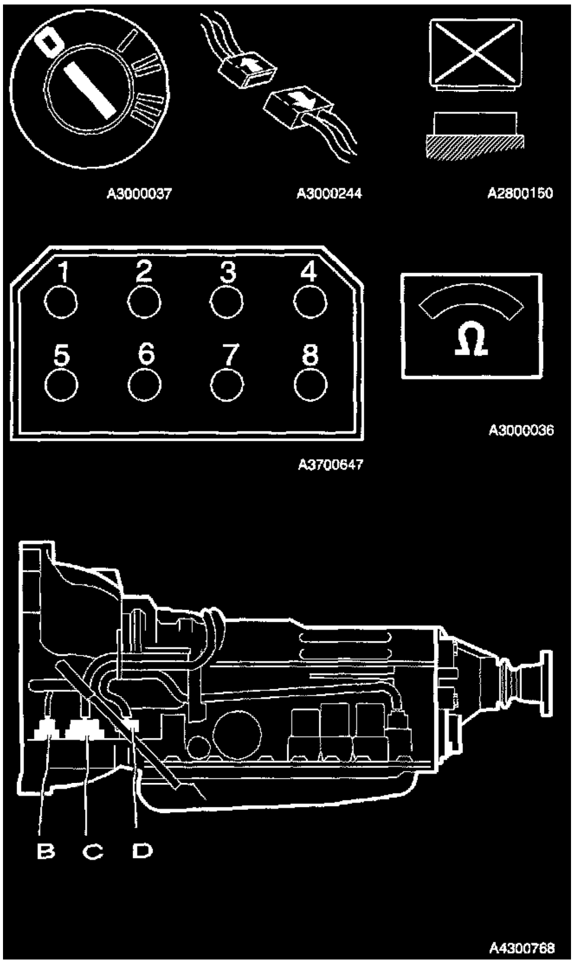
- Ignition OFF.
- Transmission control module **(TCM)** disconnected.
- Connect an ohmmeter between # 17 and # 1 on test box.
- The ohmmeter should read **12 - 18 Ohms**.

If reading is OK:

- Proceed to: **Checking Signal Cable For Short-circuit To Supply Voltage** section below.

If reading is incorrect:

- Proceed to: **Checking Signal Cable** section below.



Checking Signal Cable

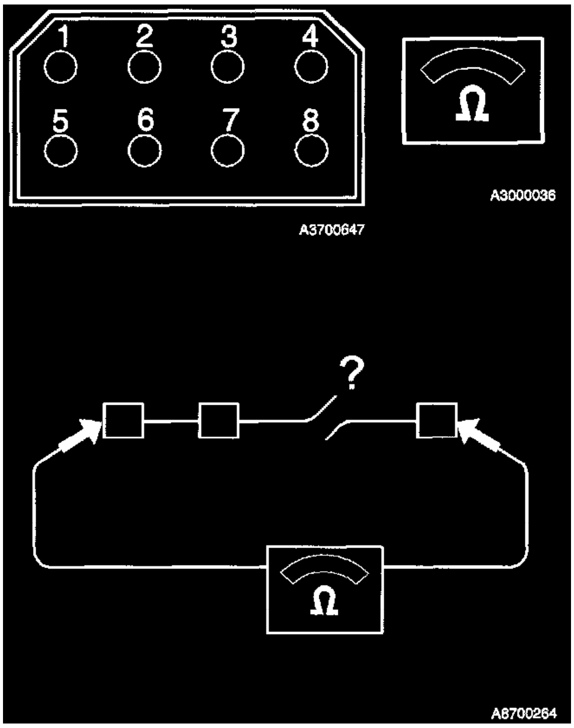
- Ignition OFF.
- Raise the car to access the transmission.
- Carefully clean round connector D.
- Disconnect transmission connector D.
- Connect an ohmmeter between transmission connector D terminal 1 (transmission control module side) and # 17 on the test box.
- The ohmmeter should read **approx. 0 Ohms**.

If reading is OK:

- Proceed to: **Checking Solenoid S1 Circuit In Transmission** section below.

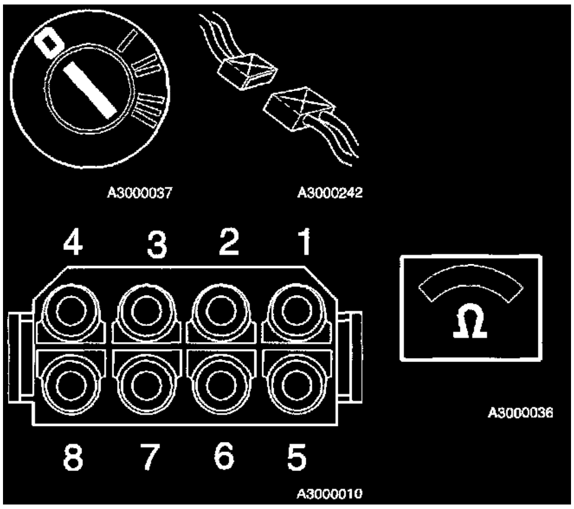
If reading is incorrect:

- Proceed to: **Checking For An Open-circuit** section below.



Checking For An Open-circuit

- Check cable between transmission connector D terminal 1 and transmission control module # 17 for an open-circuit.
- Proceed to: **Verification** section below.



Checking Solenoid S1 Circuit In Transmission

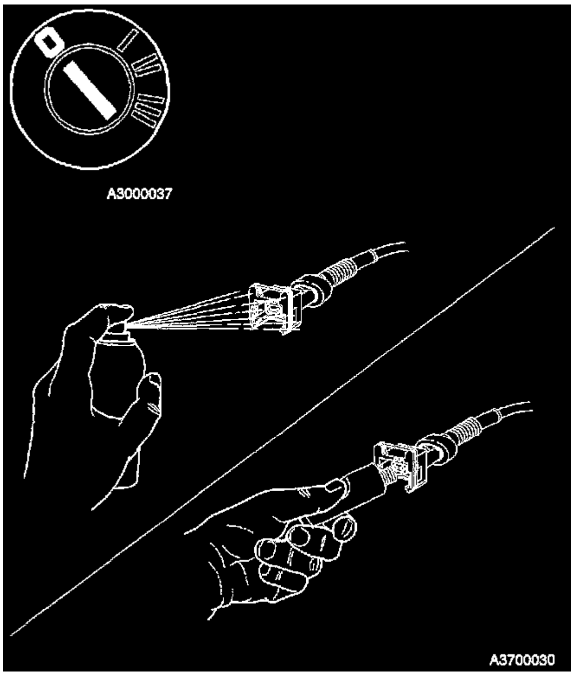
- Ignition OFF.
- Transmission connector D disconnected.
- Connect an ohmmeter between transmission connector D terminal 1 (transmission side) and transmission housing.
- The ohmmeter should read **12 - 18 Ohms**.

If reading is OK:

- Proceed to: **Checking For Loose Connections And Contact Resistance** section below.

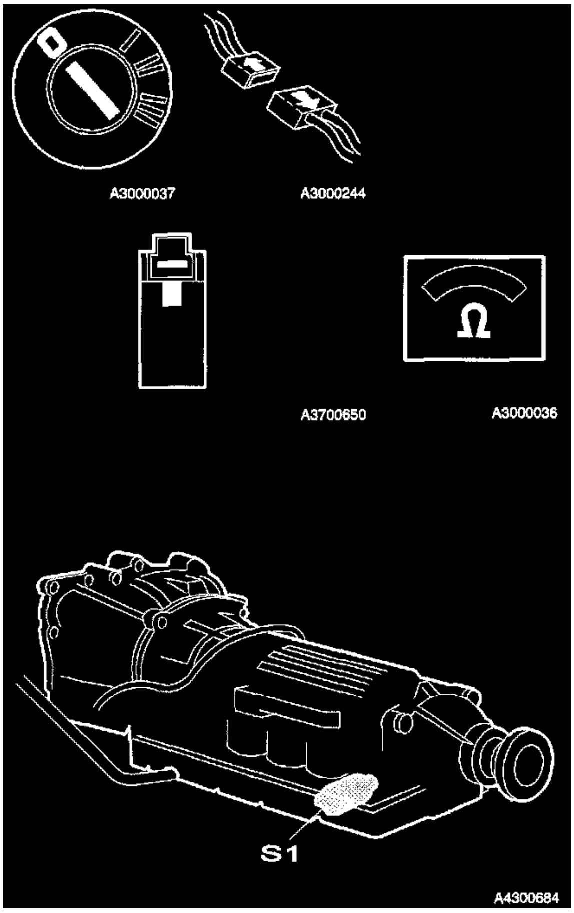
If reading is incorrect:

- Proceed to: **Checking Resistance In Solenoid S1 Circuit** section below.



Checking For Loose Connections And Contact Resistance

- Ignition OFF.
- The diagnostic trouble code was caused by loose connections in the transmission connector. Check the transmission and transmission control module connectors for loose connections, contact resistance and oxidation.
- Proceed to: **Verification** section below.



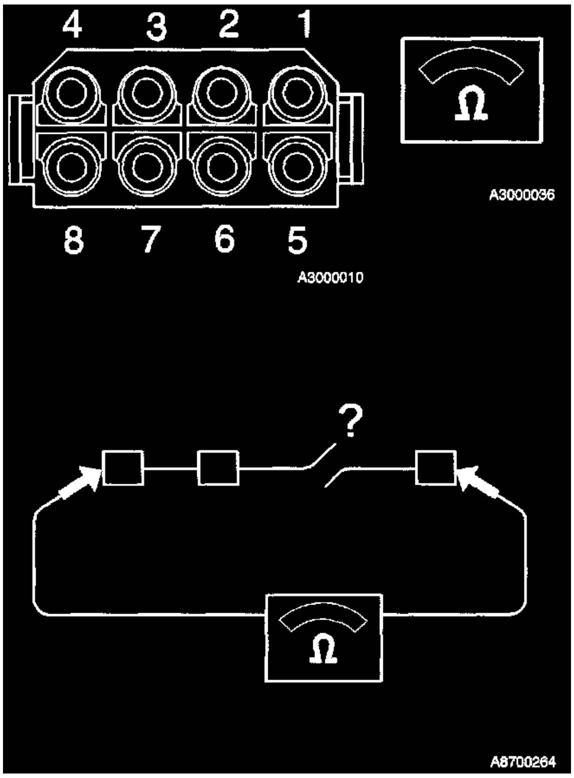
Checking Resistance In Solenoid S1 Circuit

- Open the control system.
- Disconnect solenoid S1.
- Connect an ohmmeter between the pin on solenoid S1 and the transmission housing.
- The ohmmeter should read **12 - 18 Ohms**.

  If reading is OK:
  - Proceed to: **Checking For An Open-circuit** section below.

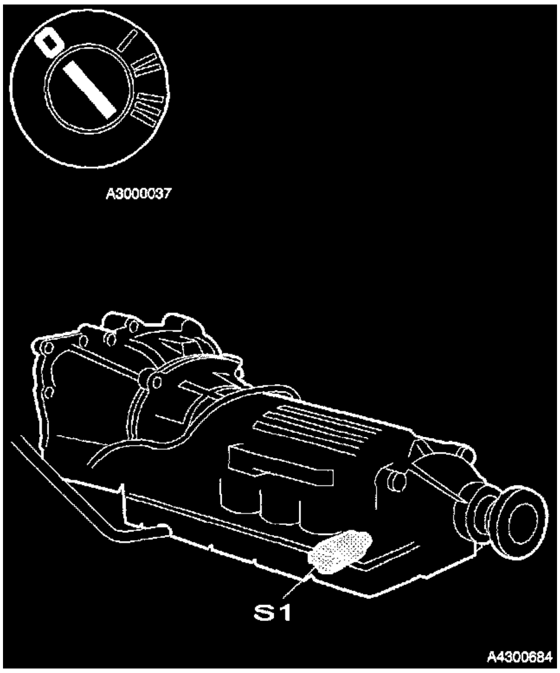
  If reading is incorrect:

- Proceed to: **Replacing Component** section below.



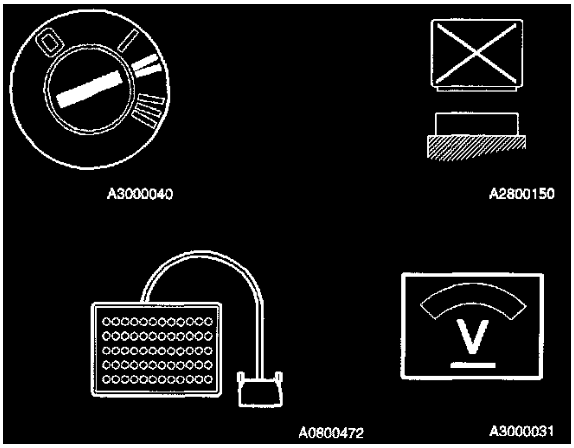
Checking For An Open-circuit

- Check cable between solenoid S1 and transmission connector D terminal 1 (transmission side) for an open-circuit.
- Proceed to: **Verification** section below.



Replacing Component

- Ignition OFF.
- Try a new solenoid S1.
- Proceed to: **Verification** section below.



Checking Signal Cable For Short-circuit To Supply Voltage

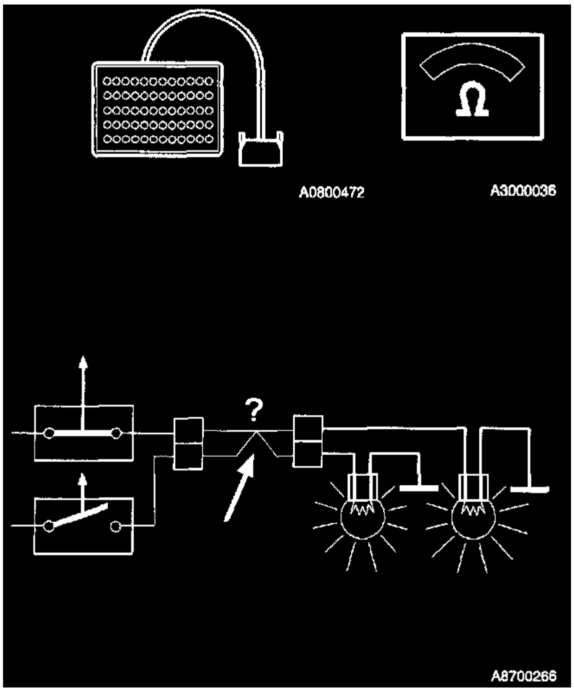
- Ignition OFF.
- Transmission control module disconnected.
- Ignition ON.
- Connect a voltmeter between # 17 and # 1 on the test box.
- The voltmeter should read **approx. 0 Volts**.

If reading is OK:

- Proceed to: **Checking Voltage Drop Over Signal Ground And Power Ground** section below.

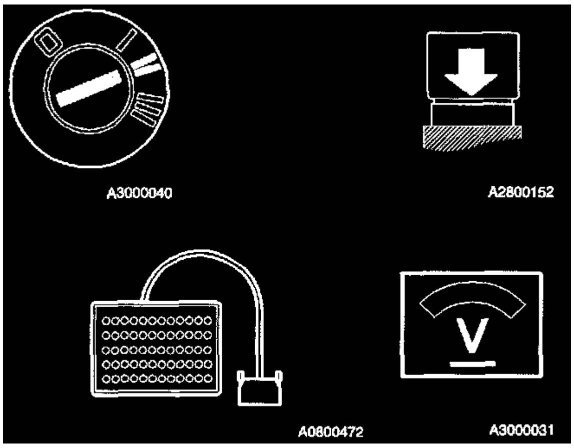
If reading is incorrect:

- Proceed to: **Checking For A Short-circuit To Supply Voltage** section below.



Checking For A Short-circuit To Supply Voltage

- Check cable between solenoid S1 and transmission control module # 17 for a short-circuit to supply voltage.
- Proceed to: **Verification** section below.



Checking Voltage Drop Over Signal Ground And Power Ground

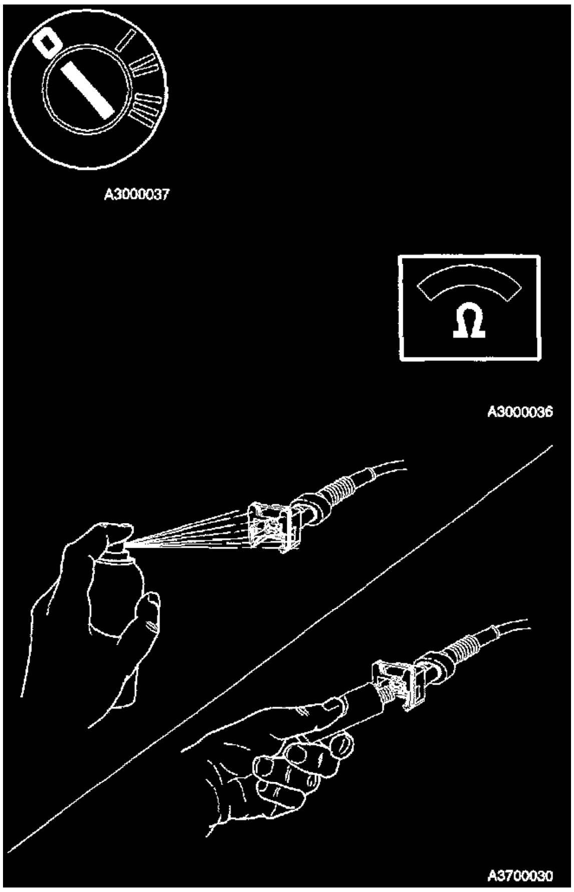
- Ignition OFF.
- Connect transmission control module.
- Ignition ON.
- Turn ON as many power consuming items as possible.
- Connect a voltmeter between # 15 and # 1 on the test box.
- The voltmeter should read less than **0.6 Volts**.

If reading is OK:

- Proceed to: **Checking Transmission Control Module** section below.

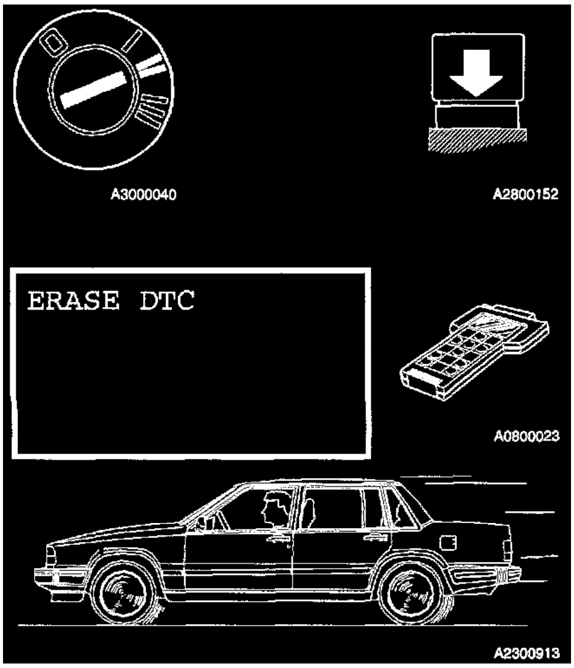
If reading is incorrect:

- Proceed to: **Checking For Open-circuit, Contact Resistance And Oxidation** section below.



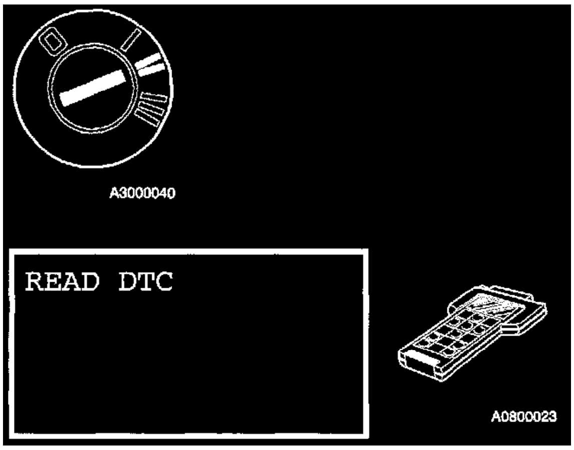
Checking For Open-circuit, Contact Resistance And Oxidation

- Ignition OFF.
- Check ground terminals 31/53 and 31/66, cables between ground terminals and transmission control module # 15 and # 1 and transmission control module connector for an open-circuit, contact resistance and oxidation.
- Proceed to: **Verification** section below.



Checking Transmission Control Module

- Ignition OFF.
- Disconnect test box.
- Connect transmission control module.
- Ignition ON.
- Erase diagnostic trouble code.
- Gear selector in position P.
- Start the engine.
- Wait for about **15 seconds**.
- Test drive car at a speed above **25 km/h (16 mph)**.
- Check to see it the diagnostic trouble code recurs.
- Proceed to: **Checking Transmission Control Module, Continued** section below.



Checking Transmission Control Module, Continued

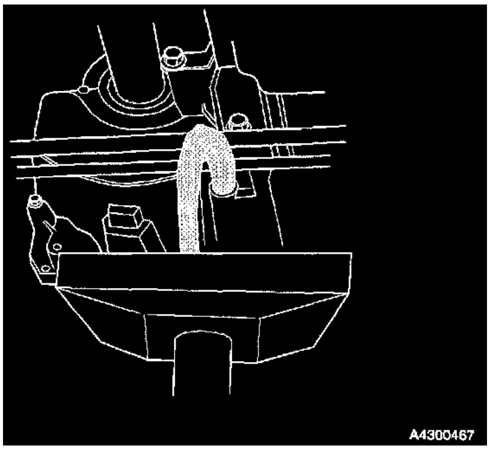
- Ignition ON.
- Check to see it the diagnostic trouble code recurs.
- Does the diagnostic trouble code recur?

Yes:

- Proceed to: **Replacing Transmission Control Module** section below.

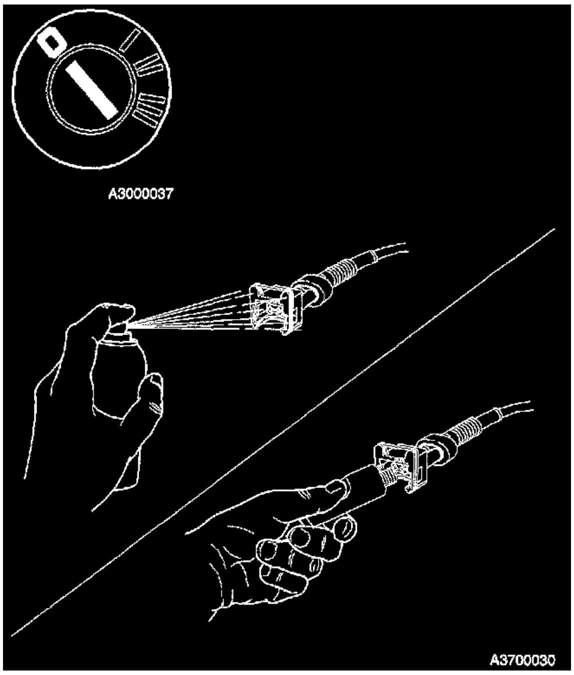
No:

- Proceed to: **Checking For Contact Resistance And Oxidation** section below.



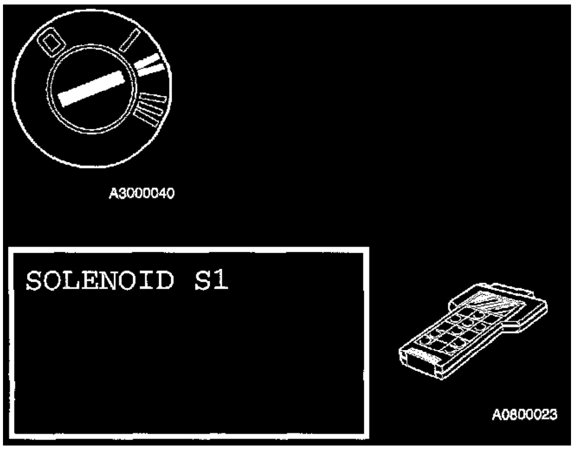
Replacing Transmission Control Module

- Try a new transmission control module.
- Proceed to: **Verification** section below.



Checking For Contact Resistance And Oxidation

- Ignition OFF.
- The diagnostic trouble code was caused by loose connections in the transmission control module connector. Check transmission control module connector for contact resistance and oxidation and remedy.
- Proceed to: **Verification** section below.



Verification

- After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:

    - Ignition OFF.
    - Reinstall components, reconnect connectors etc.

- Ignition ON.
- Read off solenoid S1 status. Status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

Yes:
- Fault corrected.

No:
- Proceed to: **Fault Tracing Information** section below.

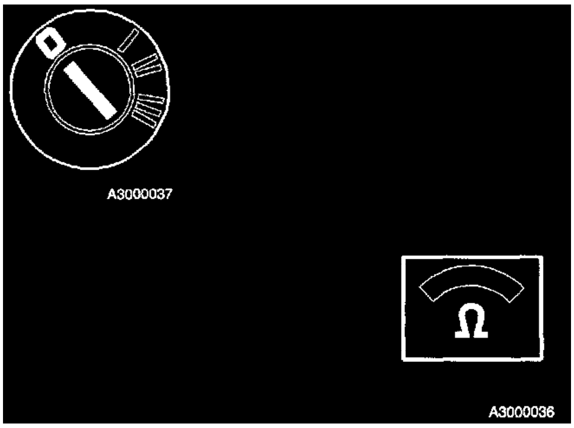
Fault-tracing Information

The verification result shows that the fault persists.

- Do you want to exit fault-tracing?

Yes:
- Fault not corrected.

No:
- Proceed to: **Checking Component** section above.



Intermittent Fault
- Check transmission and transmission control module connectors for loose connections, contact resistance and oxidation.
- Check the cable between the solenoid S1 and transmission control module # A17 for an intermittent open-circuit and an intermittent short-circuit to supply voltage.
- Check cable between ground terminal 31/66 and transmission control module # 1 for an intermittent open-circuit.
- Check ground terminal 31/66 for contact resistance and oxidation.
- Check the cable between the positive terminal on the battery and transmission control module # A29 for an intermittent open-circuit.
- Proceed to: **Fault Tracing Information** section below.

Fault-tracing Information

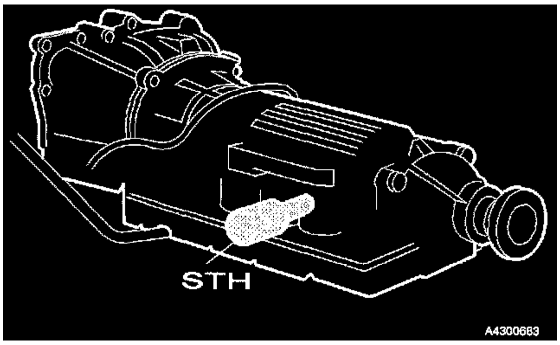
For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.

- Do you want to repeat fault-tracing?

Yes:
- Proceed to: **Checking Component** section above.

No:
- Operation done.

Trouble Code Conditions



Special Tools
- 981 3190
- 998 8686

Trouble Code Conditions
- System pressure solenoid STH controls system pressure in the transmission. The solenoid is controlled by an amplifier in the transmission control module **(TCM)** output.
- The transmission control module uses the amplifier to control the current to the solenoid. A low amperage provides a high system pressure and a high amperage **(approx. 1A)** provides a low system pressure. This amperage is primarily affected by throttle position. Diagnostic trouble code **(DTC)** AT-123 is stored if the transmission control module registers a short-circuit to supply voltage in the solenoid STH circuit causing a high amperage. Solenoid STH cannot control system pressure.

Substitute value(s)
- The transmission control module limp-home program has been initiated.

Possible source(s)
- Short-circuit to supply voltage in the signal cable.
- Defective solenoid STH.

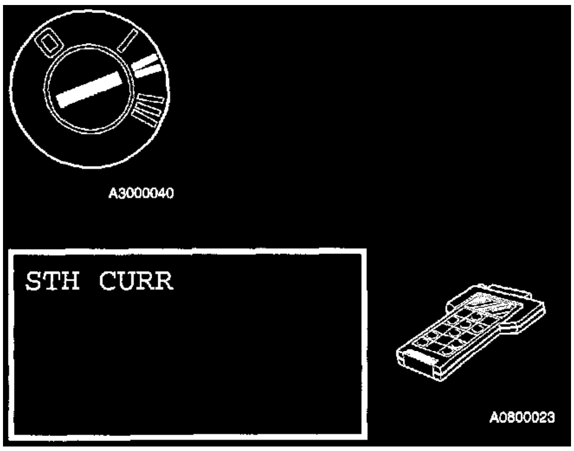
Fault symptom(s)
- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the transmission control module prevents activation of the solenoids, this stops gear-shifting. The transmission only operates in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gears.
- No lock-up function.

  CAUTION: There is a danger that system pressure may be too low, which will result in wear.

  NOTE: The Motronic 4.4 engine control module **(ECM)** posts a diagnostic trouble code when the transmission sends a malfunction indicator lamp **(MIL)** request. Erase this diagnostic trouble code in the Motronic engine control module when the transmission fault has been repaired.

- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-123 System Pressure Solenoid STH/Short-Circuit To Supply Voltage

Short-Circuit To Supply Voltage



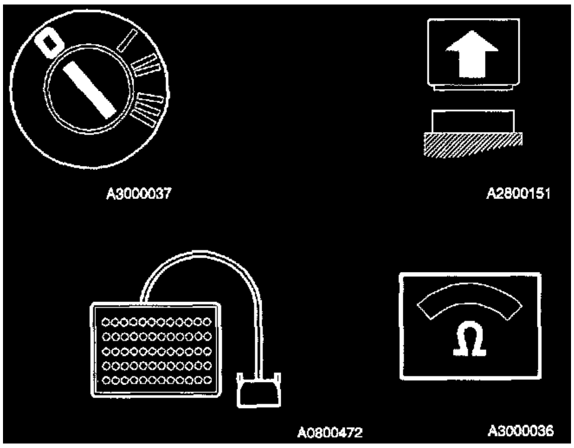
Checking System Pressure Solenoid STH
- Ignition ON.
- Go into scrolling values.
- Read off current in solenoid circuit.
- Depress accelerator pedal **(AP)** slowly.
- The current should decrease as the accelerator pedal is depressed.

If reading is OK:

- Proceed to: **Checking For A Short Circuit** section below.

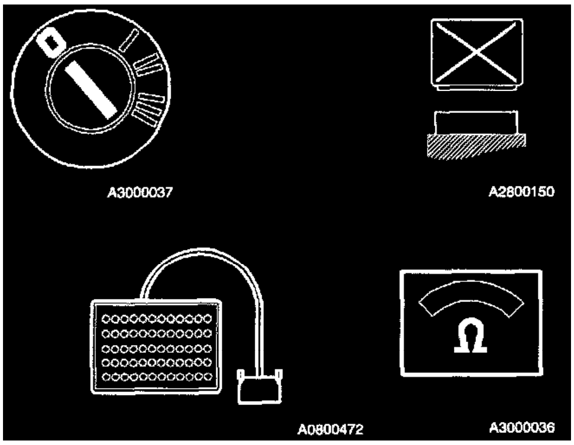
If reading is incorrect:

- Proceed to: **Connecting The Test Box** section below.



Connecting The Test Box

- Ignition OFF.
- Connect the test box and check ground terminals.
- Proceed to: **Checking Resistance In Solenoid STH Circuit** section below.



Checking Resistance In Solenoid STH Circuit

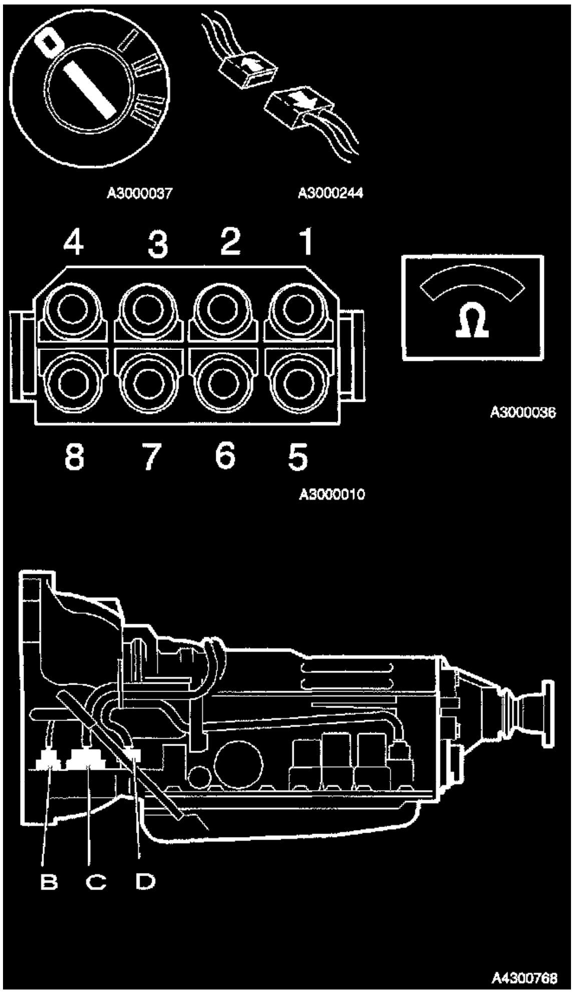
- Ignition OFF.
- Engine control module **(ECM)** disconnected.
- Connect an ohmmeter between # 16 and # 4 on test box.
- The ohmmeter should read **2 - 6 Ohms**.

If reading is OK:

- Proceed to: **Checking The Control Signal Cable For A Short-circuit To Supply Voltage** section below.

If reading is incorrect:

- Proceed to: **Checking Solenoid STH Circuit In The Transmission** section below.



Checking Solenoid STH Circuit In The Transmission

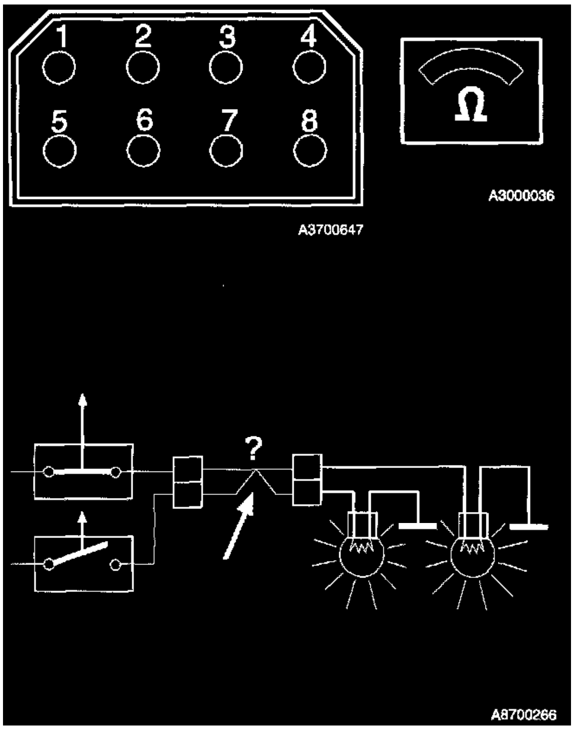
- Ignition OFF.
- Raise the car to access the transmission.
- Carefully clean round connector D.
- Disconnect transmission connector D.
- Connect an ohmmeter between the transmission connector terminals 4 and 5 (transmission side).
- The ohmmeter should read **2 - 6 Ohms**.

If reading is OK:

- Proceed to: **Checking For A Short-circuit** section below.

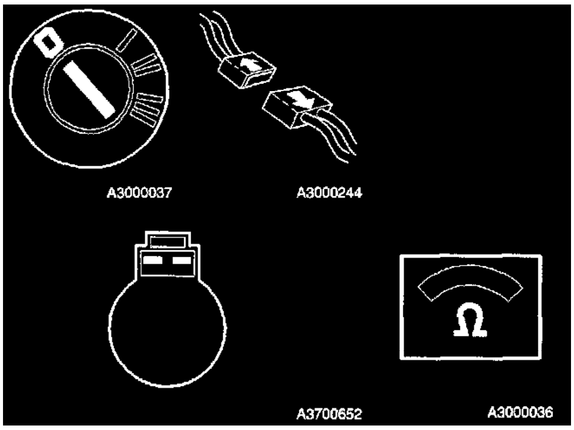
If reading is incorrect:

- Proceed to: **Checking Resistance In Solenoid STH** section below.



Checking For A Short-circuit

- Check cables between transmission connector D terminals 4 and 5 and transmission control module **(TCM)** # 16 and # 4 for a short-circuit to each other.
- Proceed to: **Checking The Transmission Control Module** section below.

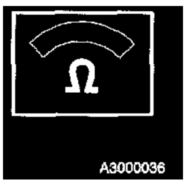


Checking Resistance In Solenoid STH

- Ignition OFF.
- Open the control system.
- Disconnect solenoid STH.
- Connect ohmmeter between the pins in the solenoid connector.
- The ohmmeter should read **2 - 6 Ohms**.

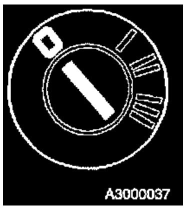
  If reading is OK:
  - Proceed to: **Checking For A Short-circuit** section below.

  If reading is incorrect:
  - Proceed to: **Replacing Component** section below.



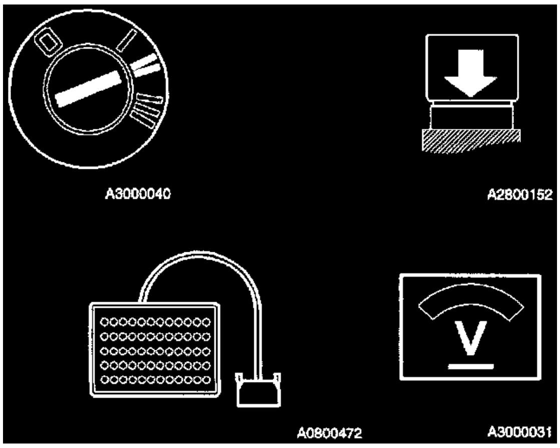
Checking For A Short-circuit

- Check cables between solenoid STH and transmission connector D terminals 4 and 5 for a short-circuit to each other.
- Proceed to: **Checking The Transmission Control Module** section below.



Replacing Component

- Ignition OFF.
- Replace transmission control system.
- Proceed to: **Checking The Transmission Control Module** section below.

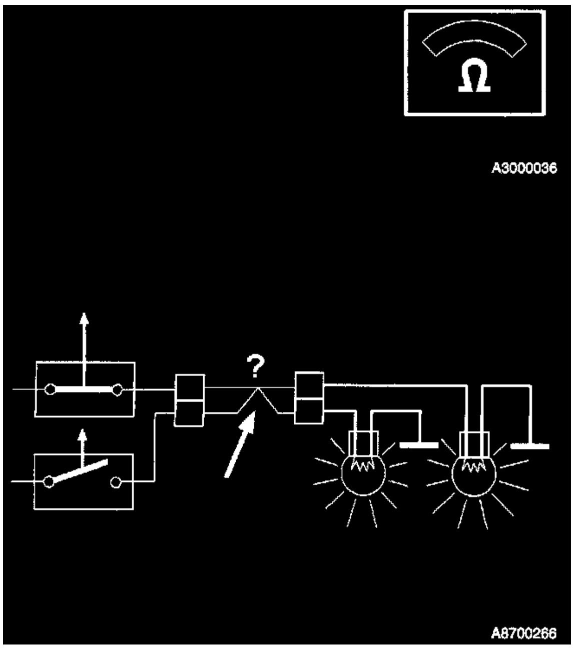


Checking The Control Signal Cable For A Short-circuit To Supply Voltage

- Ignition OFF.
- Test box connected.
- Connect transmission control module.
- Ignition ON.
- Connect a voltmeter between # 16 and # 1 on the test box.
- The voltmeter should read **0 - 6 Volts**.

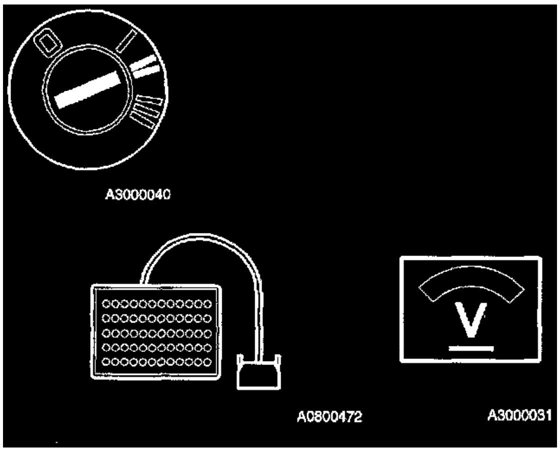
  If reading is OK:
  - Proceed to: **Checking Signal Cable For Short-circuit To Supply Voltage** section below.

  If reading is incorrect:
  - Proceed to: **Checking For A Short-circuit** section below.



Checking For A Short-circuit

- Check cable between solenoid STH and transmission control module # 16 for a short-circuit to supply.
- Proceed to: **Checking The Transmission Control Module** section below.



Checking Signal Cable For Short-circuit To Supply Voltage

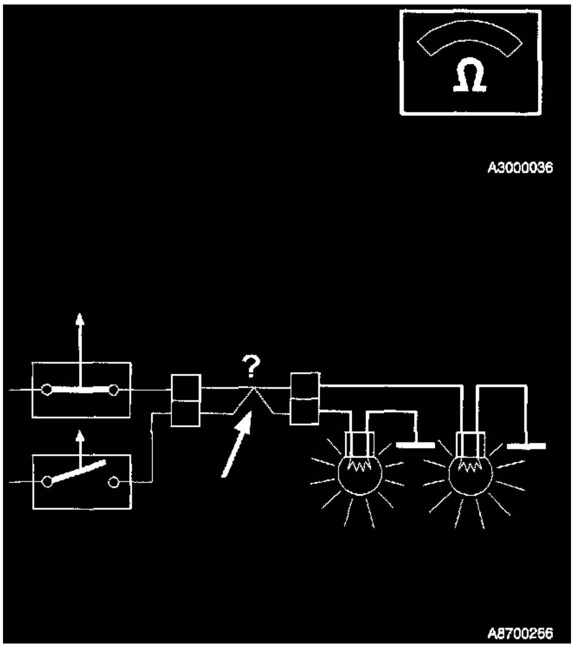
- Ignition ON.
- Connect a voltmeter between # 4 and # 1 on the test box.
- The voltmeter should read **0 - 2 Volts**.

If reading is OK:

- Proceed to: **Checking The Transmission Control Module** section below.

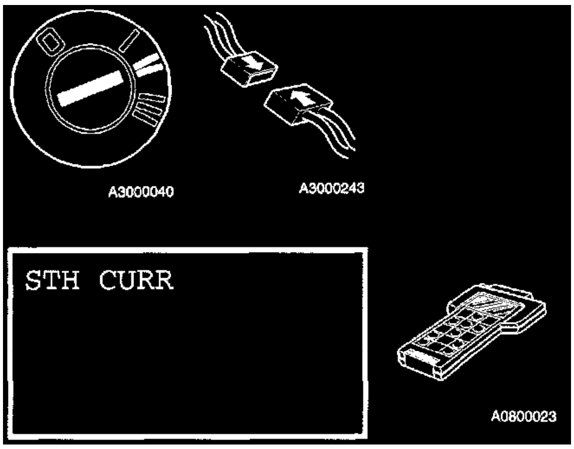
If reading is incorrect:

- Proceed to: **Checking For A Short-circuit** section below.



Checking For A Short-circuit

- Check cable between solenoid STH and transmission control module # 4 for a short-circuit to supply voltage.
- Proceed to: **Checking The Transmission Control Module** section below.



Checking The Transmission Control Module

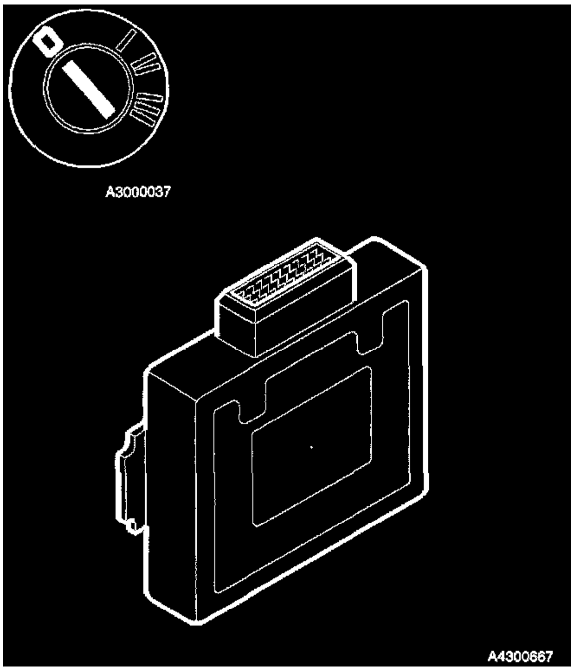
- The transmission control module can malfunction if there has been a short-circuit to supply voltage in the solenoid STH circuit. Check the transmission control module as follows:

  - Ignition OFF.
  - Connect connector and reinstall air cleaner **(ACL)** housing.
  - Ignition ON.
  - Go into scrolling values.
  - Read off current in solenoid circuit.
  - Depress accelerator pedal slowly.

- The current should decrease as the accelerator pedal is depressed.

  If reading is OK:
  - Proceed to: **Checking System Pressure** section below.

  If reading is incorrect:
  - Proceed to: **Replacing Component** section below.



Replacing Component

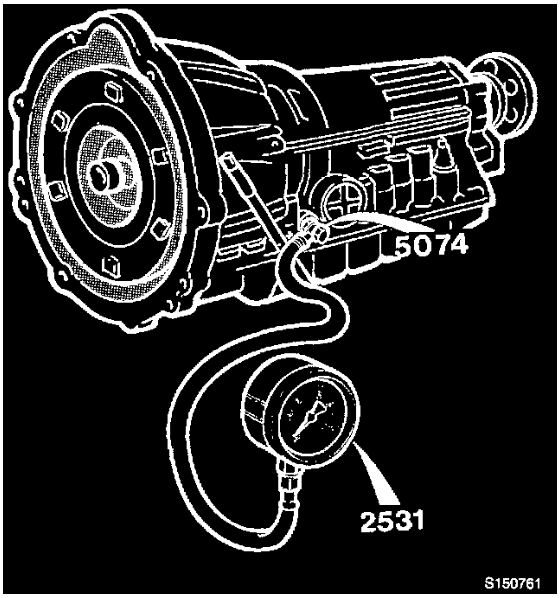
- Ignition OFF.
- Try a new transmission control module.

  CAUTION: It is important that the solenoid STH circuit is not short-circuited to battery voltage. A short-circuit can damage the new transmission control module.

- Fault corrected.

Checking For A Short-circuit

- Check cables between solenoid STH and transmission control module # 16 and # 4 for an intermittent short-circuit to supply voltage and intermittent short-circuit to each other.
- Proceed to: **Checking System Pressure** section below.

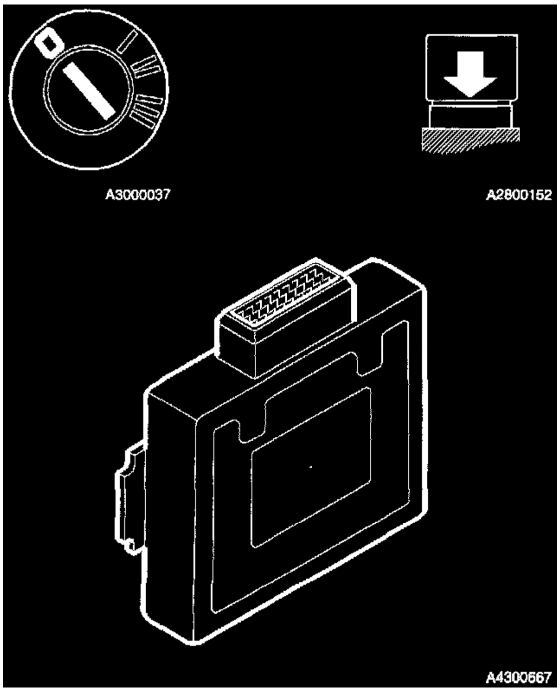


Checking System Pressure

- Diagnostic trouble code AT-123 indicates that transmission system pressure may be too low, which will result in increased wear.
- Check system pressure.
- Is system pressure OK?

  Yes:
  - Proceed to: **Test Driving** section below.

  No:
  - Proceed to: **Checking Transmission Control Module Operation** section below.



Checking Transmission Control Module Operation

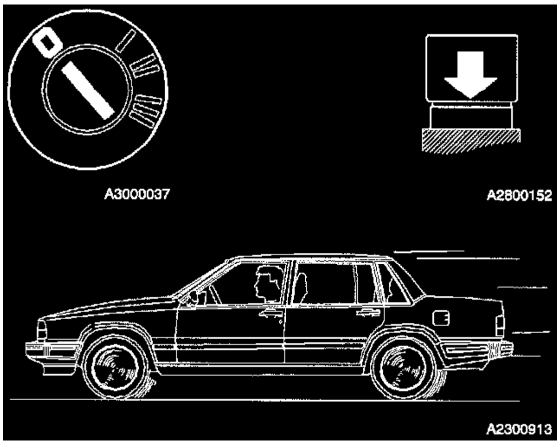
- Ignition OFF.
- Disconnect the old transmission control module and install a new transmission control module.
- Check system pressure again.
- Is system pressure OK?

  Yes:
  - Proceed to: **Fault-tracing Information** section below.

  No:
  - Proceed to: **Checking Transmission Control Module Operation, Continued** section below.

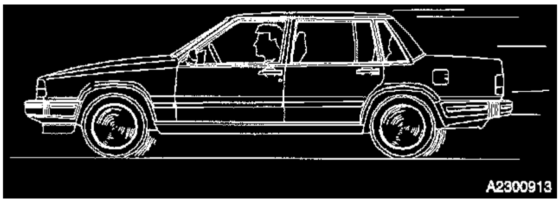
Fault-tracing Information

- The old transmission control module is faulty.
- Proceed to: **Verification** section below.



Checking Transmission Control Module Operation, Continued

- Ignition OFF.
- Reinstall the old transmission control module.
- Test transmission according to Test Drive Form.
- Proceed to: **Verification** section below.



Test Driving

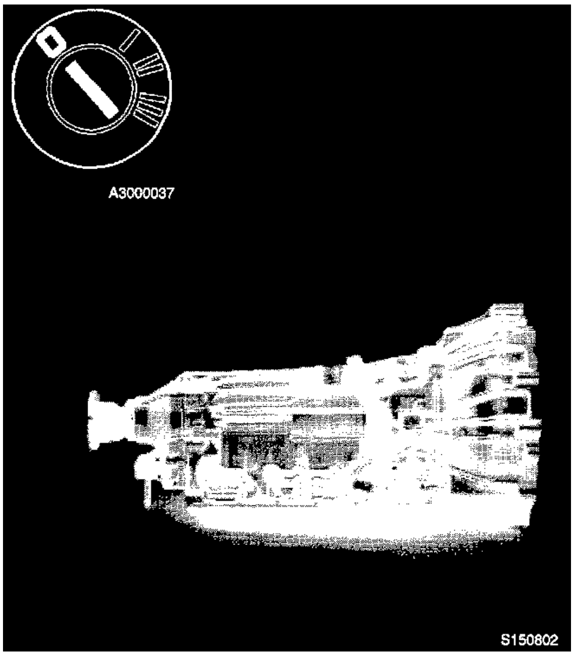
- Make the car ready for test driving
- Test drive car according to Test Drive Form.
- Note transmission performance during test drive.
- Is the transmission free of mechanical symptoms?

  Yes:
  - Proceed to: **Fault-tracing Information** section below.

  No:
  - Proceed to: **Replacing Component** section below.

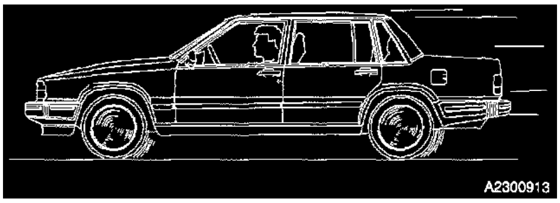
Fault-tracing Information

- The transmission is operating correctly.
- Fault corrected.



Replacing Component

- Ignition OFF.
- Try a new control system.
- Proceed to: **Verification** section below.



Verification

- Make the car ready for test driving.
- Test drive car according to Test Drive Form.
- Note transmission performance during test drive.
- Is the transmission free of mechanical symptoms?

Yes:

- Fault corrected.

No:

- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

The verification result shows that the fault persists.

- Do you want to exit fault-tracing?

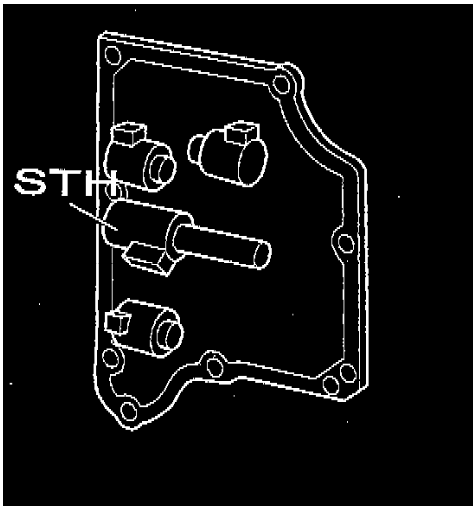
Yes:

- Fault not corrected.

No:

- Proceed to: **Checking System Pressure Solenoid STH** section above.

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

System pressure solenoid STH controls system pressure in the transmission. The solenoid is controlled by an amplifier in the transmission control module **(TCM)** output. The TCM uses the amplifier to control the current to the solenoid. A low amperage gives a high system pressure and a high amperage (approx. 1 A) gives a low system pressure. This amperage is primarily affected by throttle position. Diagnostic Trouble Code **(DTC)** AT-131 is posted if the TCM registers an open-circuit or short-circuit to ground in the solenoid STH circuit so there is too little current passing through the circuit. Solenoid STH cannot control system pressure.

SUBSTITUTE VALUE

The TCM "Emergency mode II" program is initiated.

POSSIBLE SOURCE

- Open-circuit in the control signal cable or signal cable.
- Short-circuit to ground in the control signal cable or signal cable.
- Short-circuit between control signal cable and signal cable
- Short-circuit to supply voltage in control signal cable
- Defective solenoid STH.
- Open-circuit in power ground
- Contact resistance in terminals
- Defective control module.

FAULT SYMPTOM(S)
- The combined instrument panel warning lamp flashes.
- No lock-up function.
- No adaption of the gear slippage times at high altitude (High Altitude Compensation)
- No torque limiting request to Engine Control Module **(ECM)** when shifting
- No system pressure solenoid STH control, this results in constant maximum system pressure and leads to harsher shifting and gear meshing.

TESTING PROCEDURE
- Start fault-tracing, Short-Circuit To Ground Or Open-circuit. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-131 System Pressure Solenoid STH/Short-Circuit To Ground Or Open-Circuit

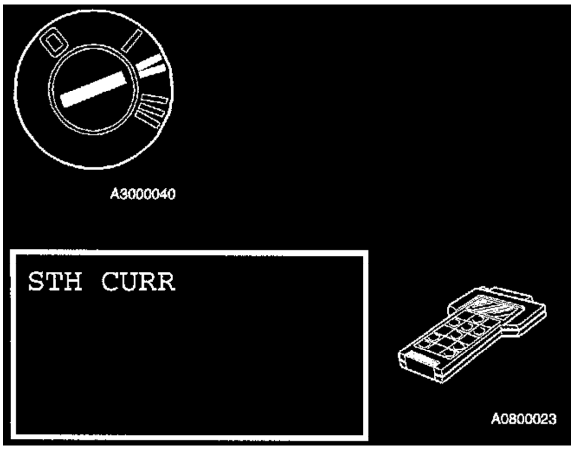
Short-Circuit To Ground Or Open-Circuit

Other Diagnostic Trouble Codes
- Read off OTHER DTCs.
- Is diagnostic trouble code **(DTC)** AT-123 stored?

Yes:
^ Proceed to: **Fault-tracing Information** section below.

No:
^ Proceed to: **Checking Solenoid STH** section below.

Fault-tracing Information
- Fault-trace according to diagnostic trouble code AT-123. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-123 System Pressure Solenoid STH
- Proceed to: **Verification** section below.



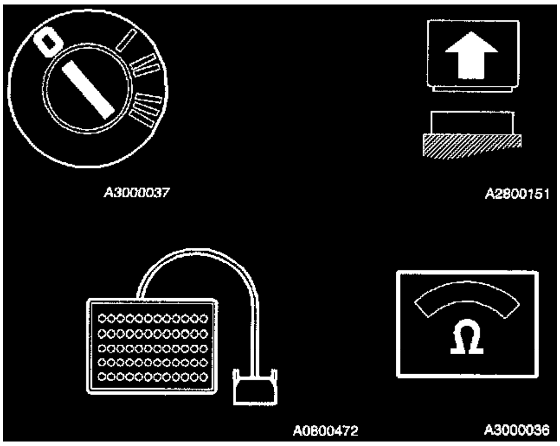
Checking Solenoid STH
- Ignition ON.
- Go into scrolling values.
- Read off current in solenoid circuit.
- Depress accelerator pedal **(AP)** slowly.
- The current should decrease as the accelerator pedal is depressed.

If reading is OK:

^ Proceed to: **Checking For Open-circuit, Contact Resistance And Oxidation** section below.

If reading is incorrect:

^ Proceed to: **Checking Power Ground** section below.



Checking Power Ground

- Ignition OFF.
- Connect the test box and check ground terminals.
- Check the power ground carefully.
- Is the reading OK?

Yes:

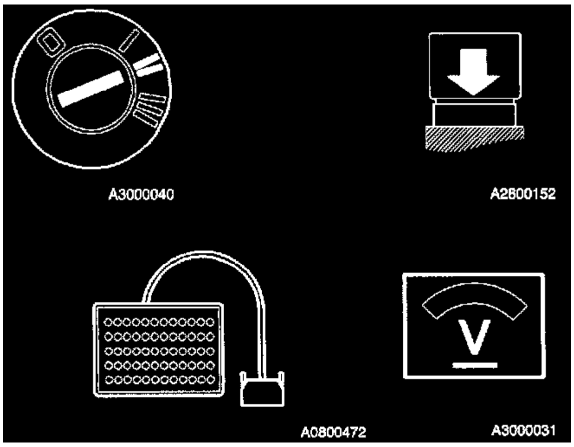
^ Proceed to: **Checking Voltage Drop Over Signal Ground And Power Ground** section below.

No:

^ Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

- The diagnostic trouble code has been caused by a poor power ground.
- Proceed to: **Verification** section below.



Checking Voltage Drop Over Signal Ground And Power Ground

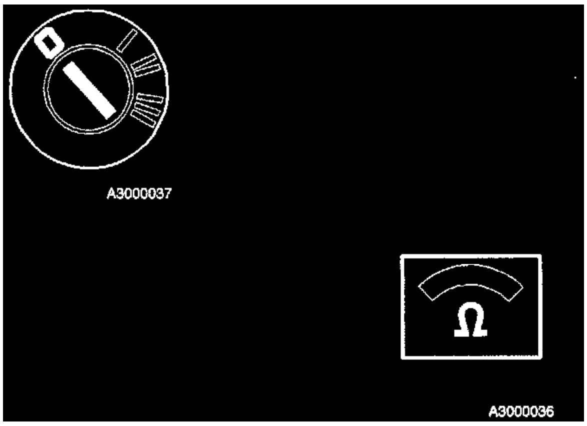
- Ignition OFF.
- Connect transmission control module.
- Ignition ON.
- Turn on as many power consuming items as possible.
- Connect a voltmeter between # 15 and # 1 on the test box.
- The voltmeter should read less than **0.6 Volts**.

If reading is OK:

^ Proceed to: **Checking Resistance In Solenoid STH Circuit** section below.

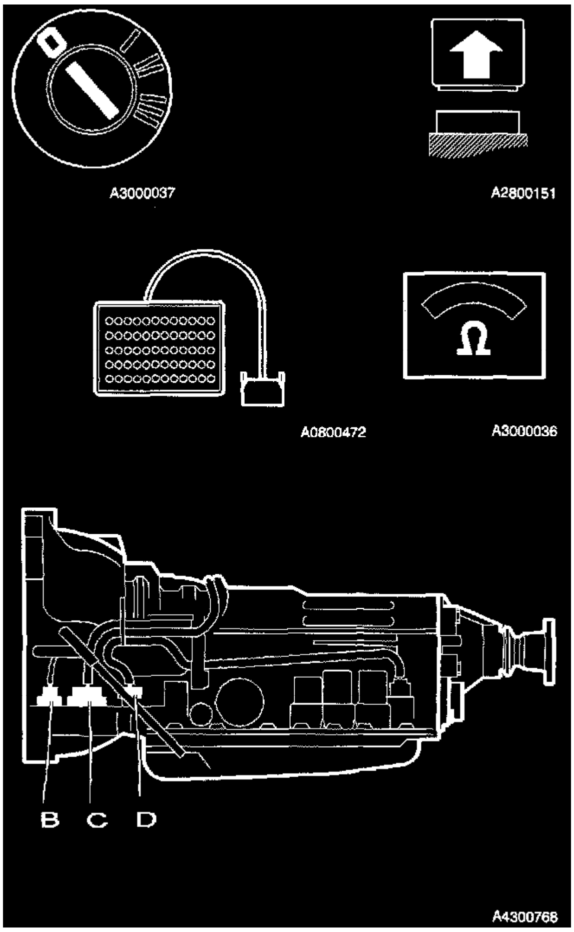
If reading is incorrect:

^ Proceed to: **Checking For Open-circuit, Contact Resistance And Oxidation** section below.



Checking For Open-circuit, Contact Resistance And Oxidation

- Ignition OFF.
- Check ground terminals 31/53 and 31/66, cables between ground terminal and transmission control module **(TCM)** and transmission control module connector for an open-circuit, contact resistance and oxidation.
- Proceed to: **Verification** section below.



Checking Resistance In Solenoid STH Circuit

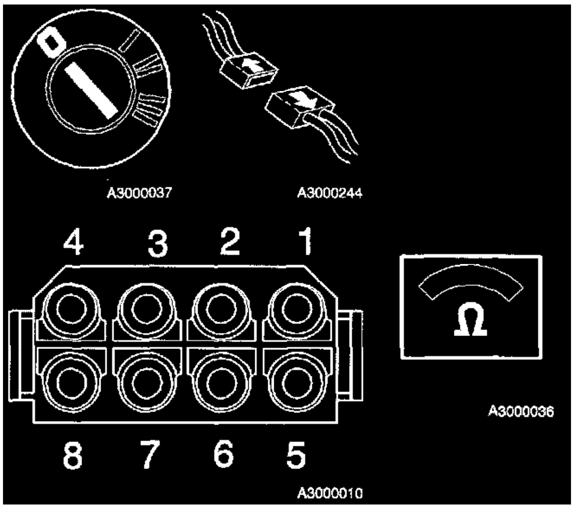
- Ignition OFF.
- Disconnect engine control module **(ECM)**.
- Connect an ohmmeter between # 4 and # 16 on test box.
- The ohmmeter should read **2 - 6 Ohms**.

  If reading is OK:

  ^ Proceed to: **Checking Solenoid STH Circuit For Short-circuit To Ground** section below.

  If reading is incorrect:

  ^ Proceed to: **Checking Resistance In Solenoid STH Circuit In The Transmission** section below.



Checking Resistance In Solenoid STH Circuit In The Transmission

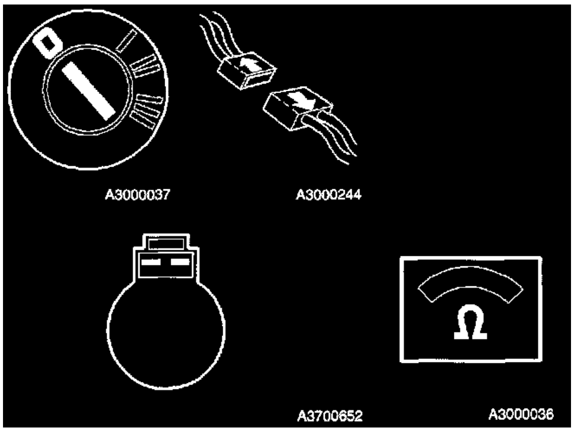
- Ignition OFF.
- Raise the car to access the transmission.
- Carefully clean round connector D.
- Disconnect transmission connector D.
- Connect an ohmmeter between transmission connector D terminals 4 and 5 (transmission side).
- The ohmmeter should read **2 - 6 Ohms**.

If reading is OK:

^ Proceed to: **Checking Resistance In The Control Signal Cable** section below.

If reading is incorrect:

^ Proceed to: **Checking Resistance In Solenoid STH** section below.



Checking Resistance In Solenoid STH

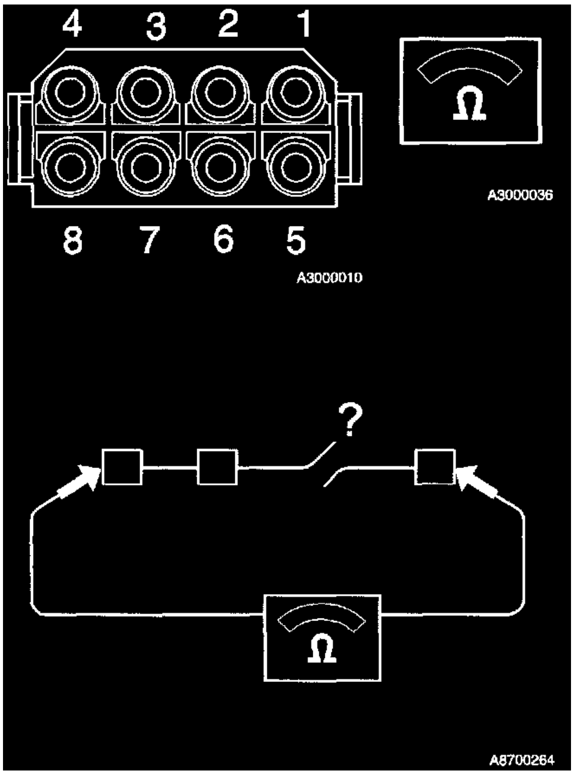
- Ignition OFF.
- Open the control system.
- Disconnect solenoid STH.
- Connect ohmmeter between the pins in the solenoid connector.
- The ohmmeter should read **2 - 6 Ohms**.

If reading is OK:

^ Proceed to: **Checking For An Open-circuit** section below.

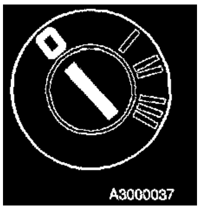
If reading is incorrect:

^ Proceed to: **Replacing Component** section below.



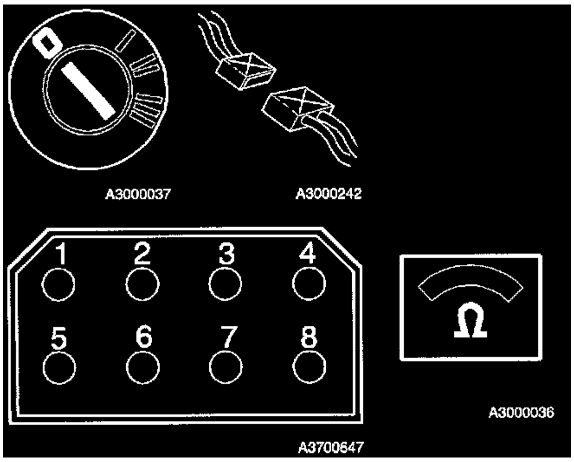
Checking For An Open-circuit

- Check cables between solenoid STH and transmission connector D terminals 4 and 5 for an open-circuit.
- Proceed to: **Verification** section below.



Replacing Component

- Ignition OFF.
- Replace transmission control system.
- Proceed to: **Verification** section below.



Checking Resistance In The Control Signal Cable

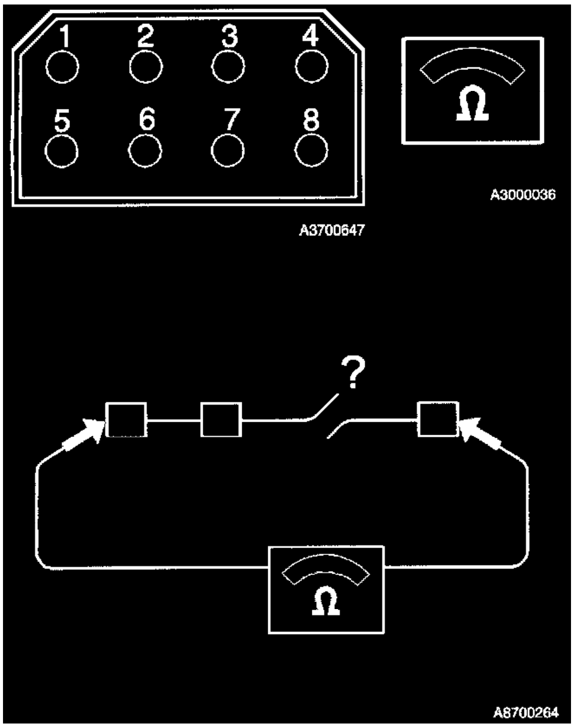
- Ignition OFF.
- Transmission connector D disconnected.
- Connect an ohmmeter between transmission connector terminal 4 (transmission control module side) and # 16 on the test box.
- The ohmmeter should read **approx. 0 Ohms**.

If reading is OK:

^ Proceed to: **Checking Signal Cable Resistance** section below.

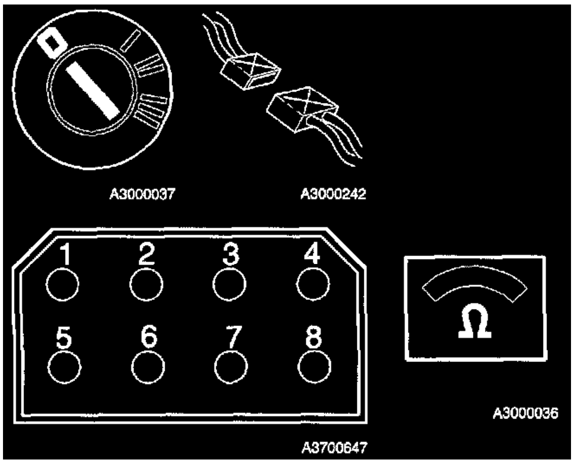
If reading is incorrect:

^ Proceed to: **Checking For An Open-circuit** section below.



Checking For An Open-circuit

- Check cable between transmission connector D terminal 4 and transmission control module # 16 for an open-circuit.
- Proceed to: **Verification** section below.



Checking Signal Cable Resistance

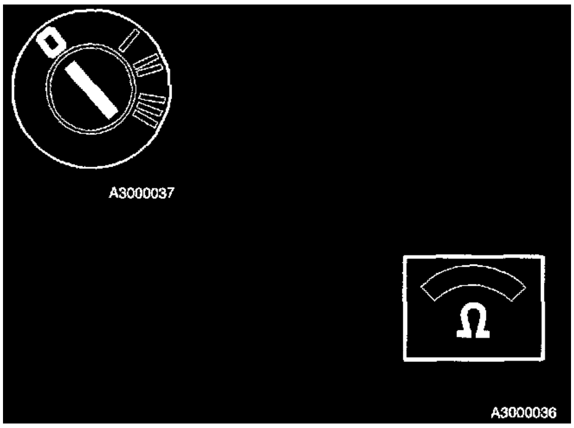
- Ignition OFF.
- Transmission connector D disconnected.
- Connect an ohmmeter between transmission connector D terminal 5 (transmission control module side) and # 4 on the test box.
- The ohmmeter should read **approx. 0 Ohms**.

If reading is OK:

^ Proceed to: **Checking For Loose Connections, Contact Resistance And Oxidation** section below.

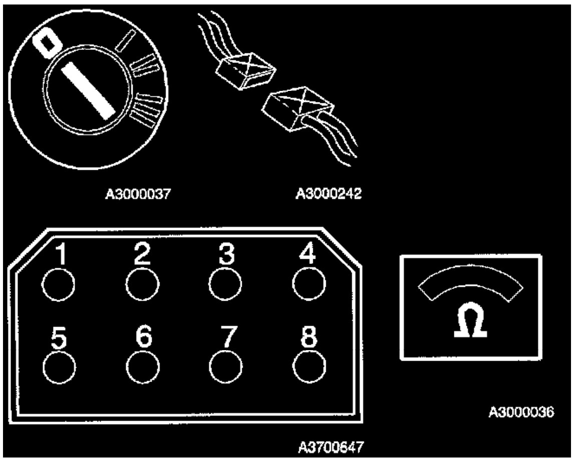
If reading is incorrect:

^ Proceed to: **Checking For An Open-Circuit** section below.



Checking For Loose Connections, Contact Resistance And Oxidation

- Ignition OFF.
- The diagnostic trouble code was caused by loose connections in the transmission control module or transmission connectors.
- Check the connectors for loose connections and remedy. Check contact resistance and oxidation.
- Proceed to: **Verification** section below.



Checking For An Open-Circuit

- Check cable between transmission connector D terminal 5 and transmission control module # 4 for an open-circuit.
- Proceed to: **Verification** section below.

Checking Solenoid STH Circuit For Short-circuit To Ground

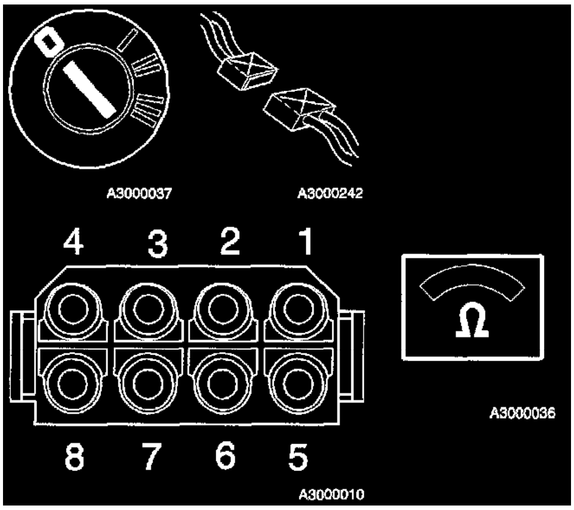
- Ignition OFF.
- Engine control module disconnected.
- Connect an ohmmeter between # 16 on the test box and transmission housing.
- The ohmmeter should read **infinite resistance**.

If reading is OK:

^ Proceed to: **Checking The Control Signal Cable For A Short-circuit To Supply Voltage** section below.

If reading is incorrect:

^ Proceed to: **Checking Solenoid STH Circuit In The Transmission For A Short-circuit To Ground** section below.



Checking Solenoid STH Circuit In The Transmission For A Short-circuit To Ground

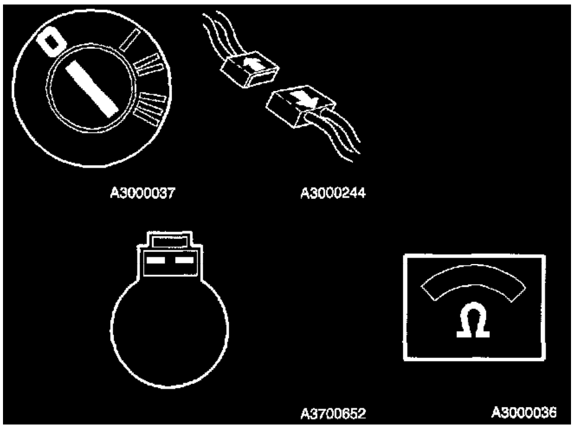
- Ignition OFF.
- Raise the car to access the transmission.
- Transmission connector D disconnected.
- Connect an ohmmeter between transmission connector D terminal 4 (transmission side) and transmission housing.
- The ohmmeter should read **infinite resistance**.

If reading is OK:

^ Proceed to: **Checking Signal Cable Resistance To Ground** section below.

If reading is incorrect:

^ Proceed to: **Checking Solenoid STH For Resistance To Ground** section below.



Checking Solenoid STH For Resistance To Ground

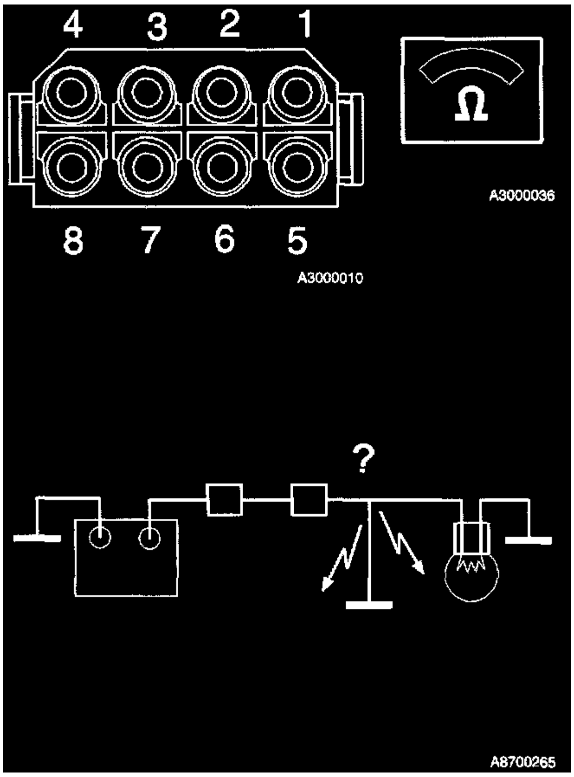
- Ignition OFF.
- Open the control system.
- Disconnect solenoid STH.
- Connect an ohmmeter between one of the pins in the solenoid connector and the transmission housing.
- The ohmmeter should read **infinite resistance**.

If reading is OK:

^ Proceed to: **Checking For A Short-circuit** section below.

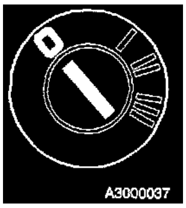
If reading is incorrect:

^ Proceed to: **Replacing Component** section below.



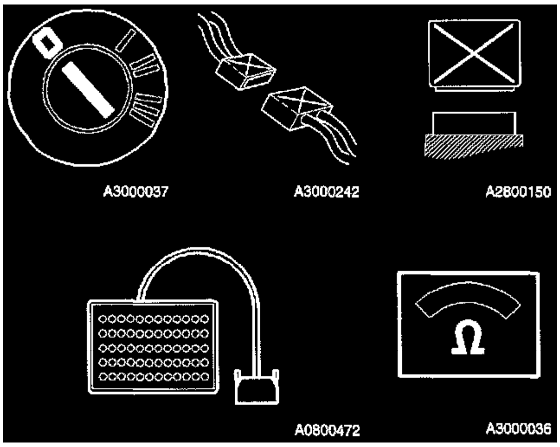
Checking For A Short-circuit

- Check cables between solenoid STH and transmission connector D terminals 4 and 5 for a short-circuit to ground.
- Proceed to: **Verification** section below.



Replacing Component

- Ignition OFF.
- Replace transmission control system.
- Proceed to: **Verification** section below.



Checking Signal Cable Resistance To Ground

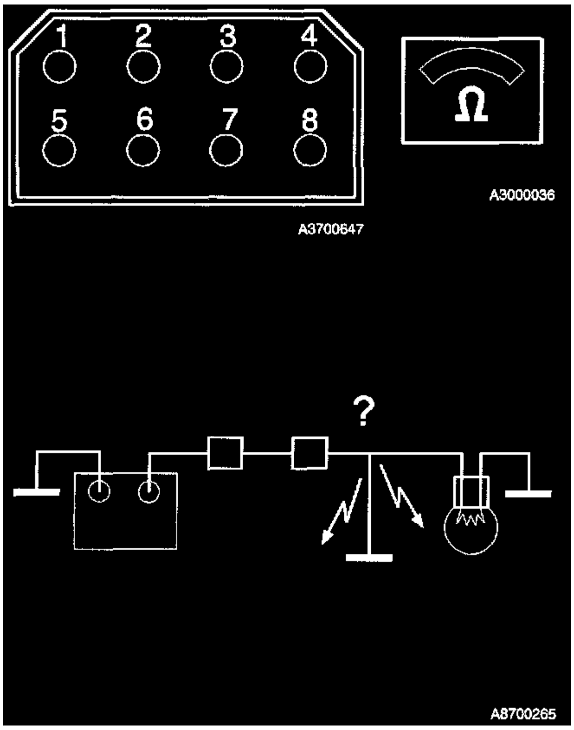
- Ignition OFF.
- Engine control module disconnected.
- Transmission connector D disconnected.
- Connect an ohmmeter between # 16 on the test box and transmission housing.
- The ohmmeter should read **infinite resistance**.

If reading is OK:

^ Proceed to: **Checking For A Short-circuit** section below.

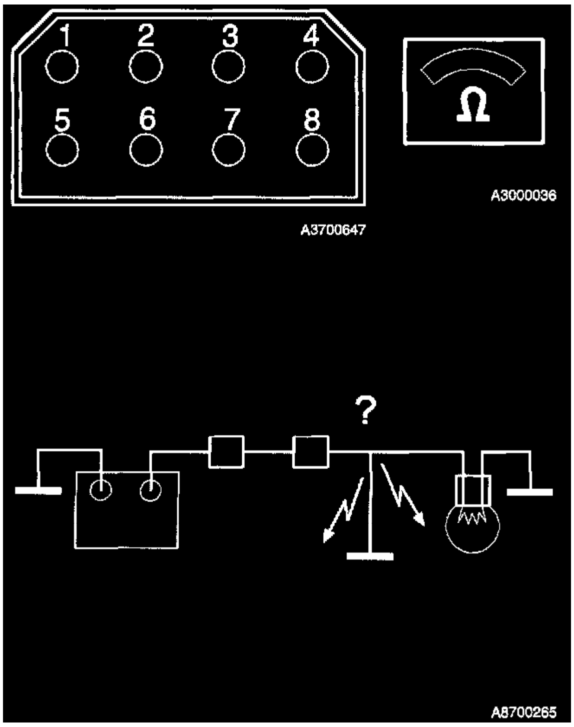
If reading is incorrect:

^ Proceed to: **Checking For A Short-circuit** 2 sections below.



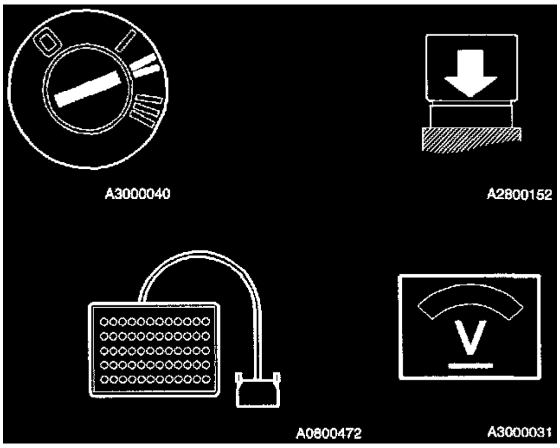
Checking For A Short-circuit

- Check cable between transmission connector D terminal 5 and transmission control module # 4 for a short-circuit to ground.
- Proceed to: **Verification** section below.



Checking For A Short-circuit

- Check cable between transmission connector D terminal 4 and transmission control module # 16 for a short-circuit to ground.
- Proceed to: **Verification** section below.



Checking The Control Signal Cable For A Short-circuit To Supply Voltage

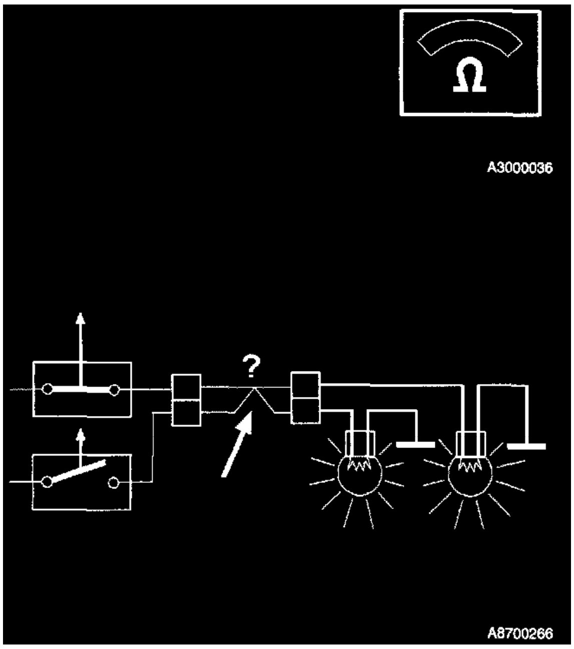
- Ignition OFF.
- Test box connected.
- Connect transmission control module.
- Ignition on.
- Connect a voltmeter between # 16 and # 1 on the test box.
- The voltmeter should read **0 - 6 Volts**.

If reading is OK:

^ Proceed to: **Checking Signal Cable For Short-circuit To Supply Voltage** section below.

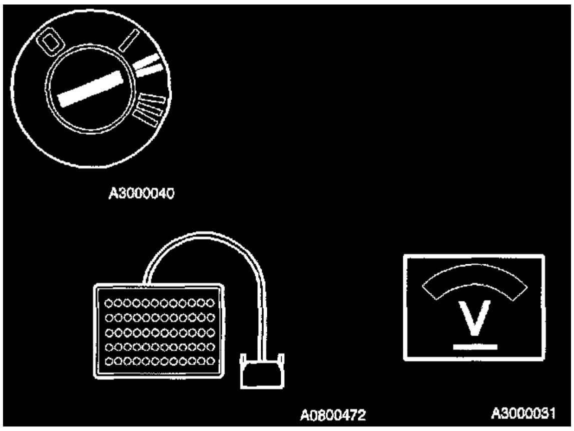
If reading is incorrect:

^ Proceed to: **Checking For A Short-circuit** section below.



Checking For A Short-circuit

- Check cable between solenoid STH and transmission control module # 16 for a short-circuit to supply voltage.
- Proceed to: **Checking The Transmission Control Module** section below.



Checking Signal Cable For Short-circuit To Supply Voltage

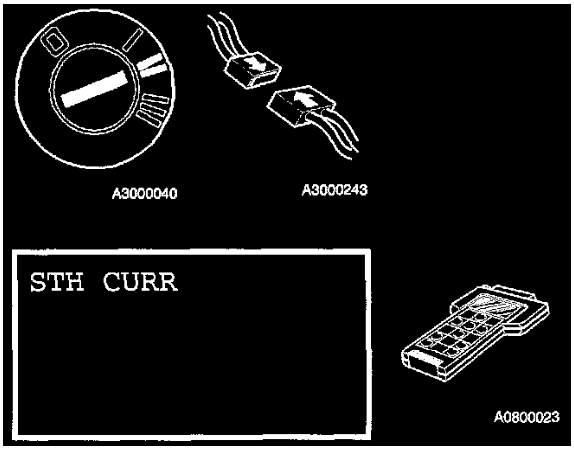
- Ignition ON.
- Connect a voltmeter between # 4 and # 1 on the test box.
- The voltmeter should read **0 - 2 Volts**.

If reading is OK:

^ Proceed to: **Checking Signal Cable For Short-circuit To Supply Voltage** section below.

If reading is incorrect:

^ Proceed to: **Checking For A Short-circuit** section below.



Checking Signal Cable For Short-circuit To Supply Voltage

- The transmission control module can malfunction if there has been a short-circuit to supply voltage in the solenoid STH circuit. Check the transmission control module as follows:

  - Ignition OFF.
  - Reconnect connectors, reinstall components etc.
  - Ignition ON.
  - Go into scrolling values.
  - Read off current in solenoid circuit.
  - Depress accelerator pedal slowly.

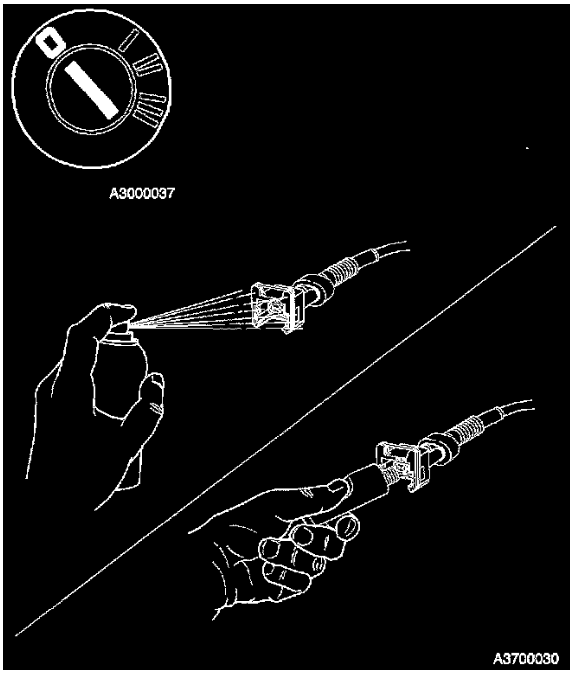
- The current should decrease as the accelerator pedal is depressed.

If reading is OK:

^ Proceed to: **Checking For Contact Resistance And Oxidation** section below.

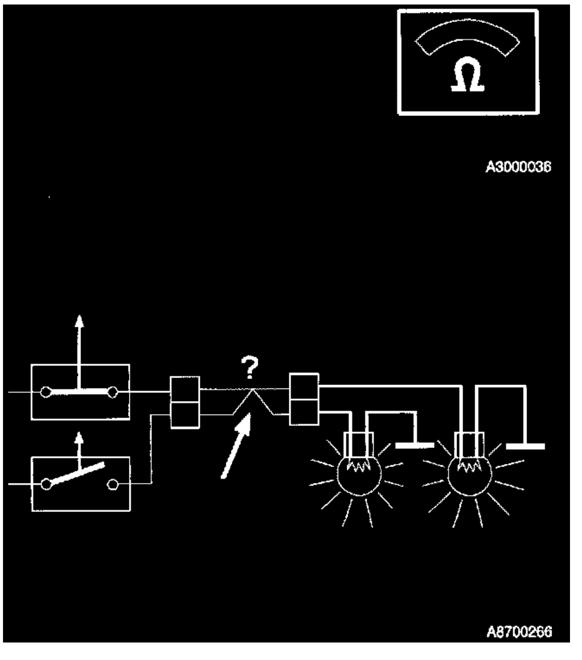
If reading is incorrect:

^ Proceed to: **Replacing Component** section below.



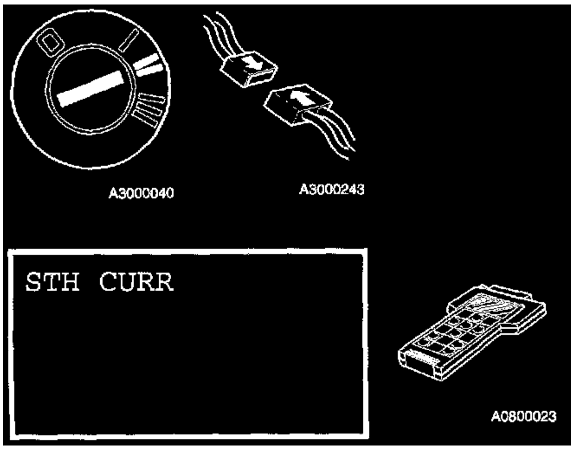
Checking For Contact Resistance And Oxidation

- Ignition OFF.
- The diagnostic trouble code was caused by poor contact in the transmission control module or transmission connectors. Check connector for contact resistance and oxidation and remedy.
- Proceed to: **Verification** section below.



Checking For A Short-circuit

- Check cable between solenoid STH and transmission control module # 4 for a short-circuit to supply voltage.
- Proceed to: **Checking The Transmission Control Module** section below.



Checking The Transmission Control Module

- The transmission control module can malfunction if there has been a short-circuit to supply voltage in the solenoid STH circuit. Check the transmission control module as follows:

  - Ignition OFF.
  - Reconnect connectors, reinstall components etc.
  - Ignition ON.
  - Go into scrolling values.
  - Read off current in solenoid circuit.
  - Depress accelerator pedal slowly.

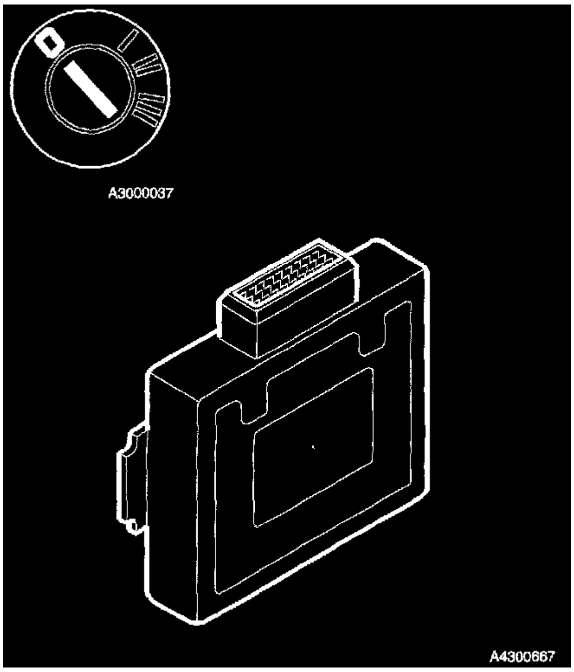
- The current should decrease as the accelerator pedal is depressed.

  If reading is OK:
  ^ Proceed to: **Fault-tracing Information** section below.

  If reading is incorrect:
  ^ Proceed to: **Replacing Component** section below.

Fault-tracing Information

- Transmission control module is OK.
- Fault corrected.

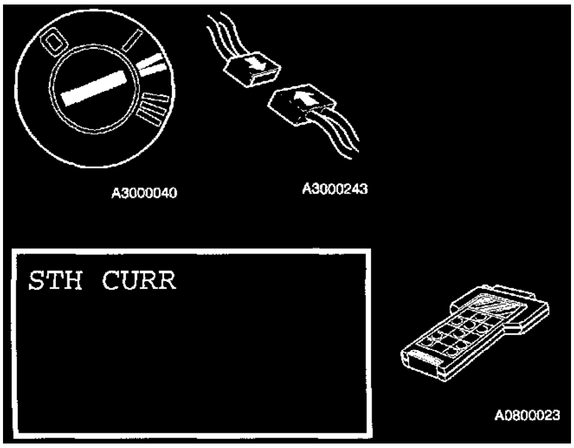


Replacing Component

- Ignition OFF.
- Try a new transmission control module.

  NOTE: It is important that the solenoid STH circuit is not short-circuited to battery voltage. A short-circuit can damage the new transmission control module.

- Proceed to: **Verification** section below.



Verification

- After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:

    - Ignition OFF.
    - Reconnect connectors, reinstall components etc.
    - Ignition ON.
    - Select scrolling values.
    - Read off current in solenoid circuit.
    - Depress accelerator pedal slowly.

- The current should decrease as the accelerator pedal is depressed.

    If reading is OK:
    ^ Fault corrected.

    If reading is incorrect:
    ^ Proceed to: **Fault-tracing Information** section below.

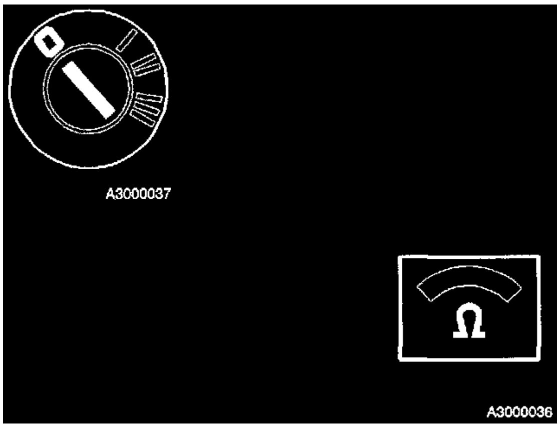
Fault-tracing Information

The verification result shows that the fault persists.

- Do you want to exit fault-tracing?

    Yes:
    ^ Fault not corrected.

    No:
    ^ Proceed to: **Other Diagnostic Trouble Codes** section above.



Intermittent Fault

- Ignition OFF.
- Check transmission and transmission control module connectors for loose connections, contact resistance and oxidation.
- Check cable between solenoid STH and transmission control module # 16 and # 4 for an intermittent open-circuit, and intermittent short-circuit to ground.
- Check cable between ground terminal 31/66 and transmission control module # 1 for an intermittent open-circuit.
- Check ground terminal 31/66 for contact resistance and oxidation.
- Proceed to: **Verification** section below.

Fault-tracing Information

For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.

- Do you want to repeat fault-tracing?

  Yes:

  ^ Proceed to: **Other Diagnostic Trouble Codes** section above.

  No:

  ^ Operation done.

Trouble Code Conditions

Special Tools:

- 981 3190
- 998 8686

Trouble Code Conditions

- System pressure solenoid STH controls the system pressure in the transmission. The solenoid is controlled by an amplifier in the transmission control module **(TCM)** output. The transmission control module uses the amplifier to control the current to the solenoid. A low amperage provides a high system pressure and a high amperage **(approx. 1A)** provides a low system pressure. This amperage is primarily affected by throttle position. Diagnostic Trouble Code **(DTC)** AT-132 is stored if the TCM registers that the amperage in the TCM circuit is too high. Solenoid STH cannot control system pressure.

Substitute value(s)

- The transmission control module limp-home program has been initiated.

Possible source(s)

- Defective transmission control module.

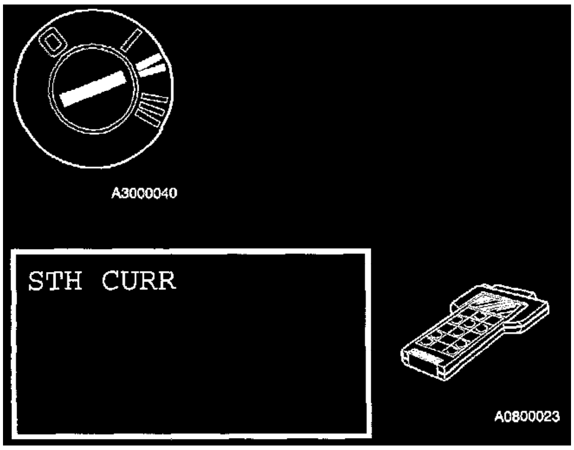
Fault symptom(s)

- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission only operates in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th and reverse gears.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

  CAUTION: The ECM posts a DTC when the transmission sends a malfunction indicator lamp **(MIL)** request. Erase the DTC in the ECM when the transmission fault has been repaired.

- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-132 Transmission Control Module/Short Circuit In STH Amplifier

Short Circuit In STH Amplifier

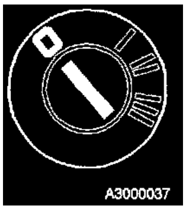


Checking Solenoid STH

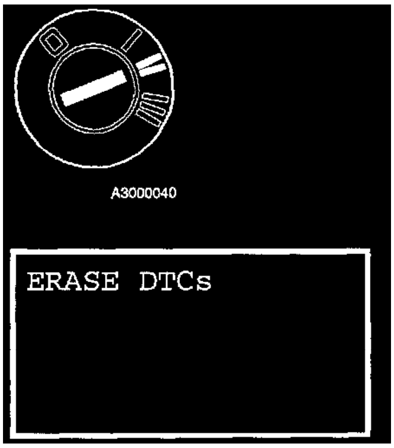
- Ignition ON.
- Go into scrolling values.
- Read off current in solenoid circuit.
- Depress accelerator pedal **(AP)** slowly.
- The current should decrease as the accelerator pedal is depressed.

If reading is OK:
- Proceed to: **Erase Diagnostic Trouble Code** section below.

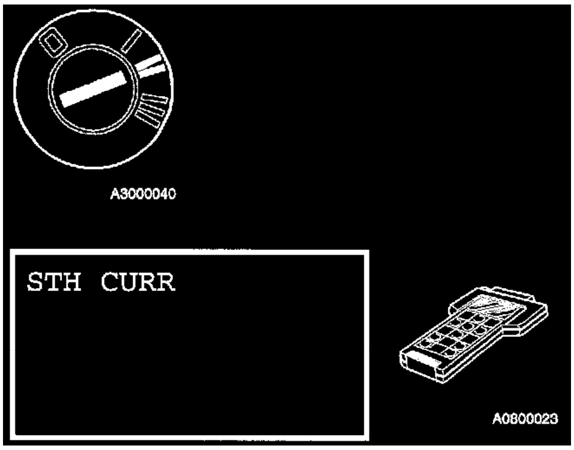
If reading is incorrect:
- Proceed to: **Replacing Component** section below.



Replacing Component
- Ignition OFF.
- Try a new transmission control module **(TCM)**.
- Proceed to: **Verification** section below.



Erase Diagnostic Trouble Code
- Ignition ON.
- The transmission control module previously posted a fault.
- Erase diagnostic trouble code **(DTC)**.
- Proceed to: **Verification** section below.



Verification
- After carrying out the repair, check that the fault has been remedied as follows:

  - Ignition ON.
  - Go into scrolling values.
  - Read off current in solenoid circuit.
  - Depress accelerator pedal slowly.

- The current should decrease as the accelerator pedal is depressed.

If reading is OK:
- Fault corrected.

If reading is incorrect:

- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

The verification result shows that the fault persists.

- Do you want to exit fault-tracing?

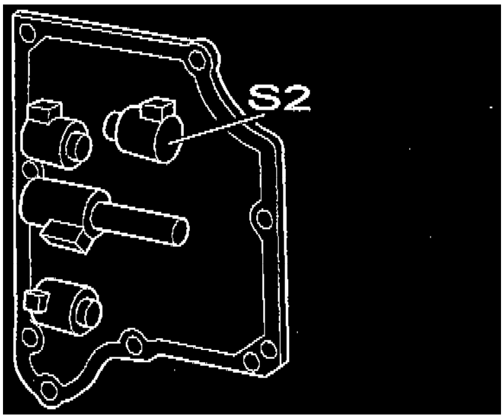
Yes:

- Fault not corrected.

No:

- Proceed to: **Checking Solenoid STH** section above.

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

Shift solenoids S2 and S1 operate in tandem to control gear-shifting. Solenoid S2 operates when it receives battery voltage from the Transmission Control Module **(TCM)** and is activated in reverse, 1st and 2nd gears. Diagnostic Trouble Code **(DTC)** AT-221 is posted if the TCM registers a short-circuit to ground in solenoid S2 circuit when the solenoid should not be activated. Solenoid S2 cannot be activated.

SUBSTITUTE VALUE

The TCM limp-home program has been initiated.

POSSIBLE SOURCE

- Short-circuit to ground in signal cable.
- Defective solenoid

FAULT SYMPTOM(S)

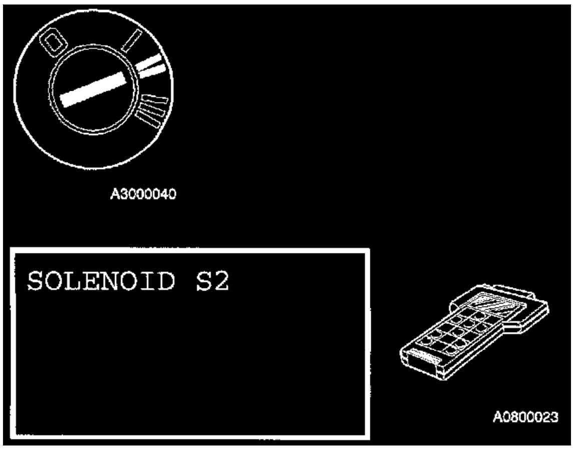
- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

NOTE: The Motronic 4.4 ECM posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request. Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at Short Circuit To Ground. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-221 Shift Solenoid S2/Short-Circuit To Ground

Short-Circuit To Ground



Checking Solenoid S2

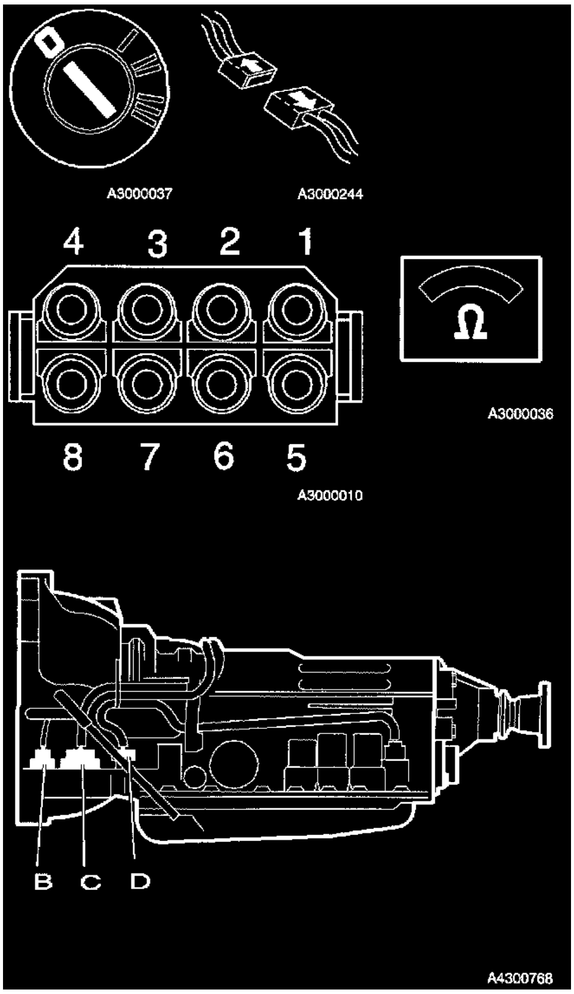
- Ignition ON.
- Move gear selector to position P.
- Activate solenoid S2. Read off the solenoid status. The status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

Yes:

- Proceed to: **Intermittent Fault** section below.

No:

- Proceed to: **Checking Signal Wiring Resistance To Ground In The Transmission** section below.



Checking Signal Wiring Resistance To Ground In The Transmission

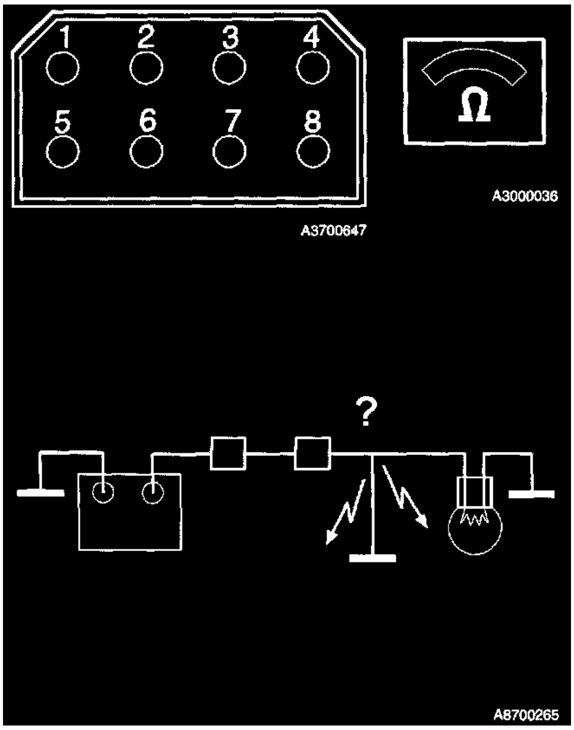
- Ignition OFF.
- Raise the car to access the transmission.
- Carefully clean round connector D.
- Disconnect transmission connector D.
- Connect an ohmmeter between transmission connector D, terminal 2 (transmission side) and ground.
- The ohmmeter should read **12-18 Ohms**.

If reading is OK:

- Proceed to: **Checking For A Short-circuit** section below.

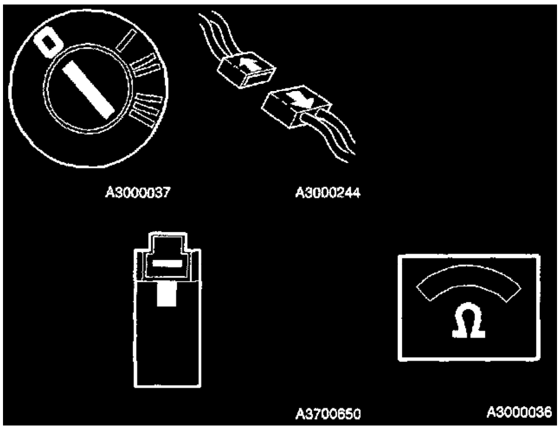
If reading is incorrect:

- Proceed to: **Checking Solenoid S2** section below.



Checking For A Short-circuit

- Check cable between transmission connector D terminal 2 and transmission control module **(TCM)** # 31 for a short-circuit to ground.
- Proceed to: **Verification** section below.



Checking Solenoid S2

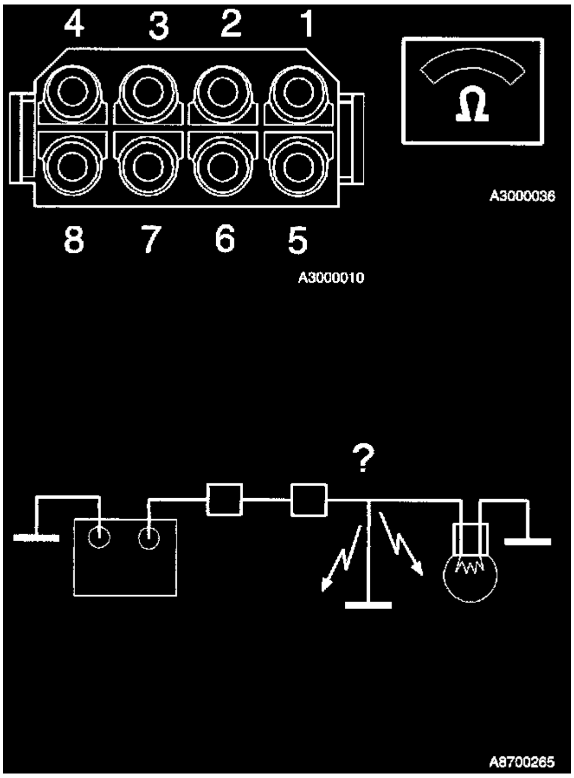
- Ignition OFF.
- Open the control system.
- Disconnect solenoid S2.
- Use an ohmmeter to measure between the pin on solenoid S2 and the transmission housing.
- The ohmmeter should read **12-18 Ohms**.

If reading is OK:

- Proceed to: **Checking For A Short-circuit** section below.

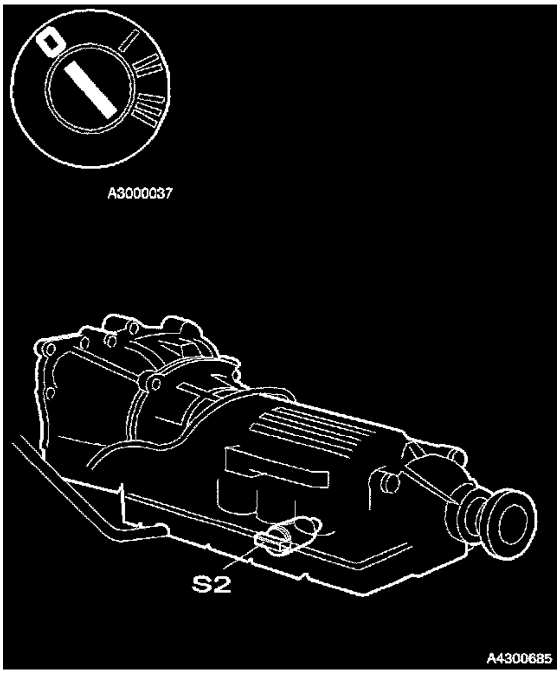
If reading is incorrect:

- Proceed to: **Replacing Component** section below.



Checking For A Short-circuit

- Check cable between solenoid S2 and transmission connector D terminal 2 for a short circuit to ground.
- Proceed to: **Verification** section below.



Replacing Component

- Ignition OFF.
- Try a new solenoid S2.
- Proceed to: **Verification** section below.

Verification

- After repairs have been completed they must be verified as follows to ensure the fault has been eliminated:
    - Ignition ON.
    - Move gear selector to position P.
- Activate solenoid S2. Read off the solenoid status. The status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

    Yes:
    - Fault corrected.

    No:
    - Proceed to: **Fault-tracing Information** section below.

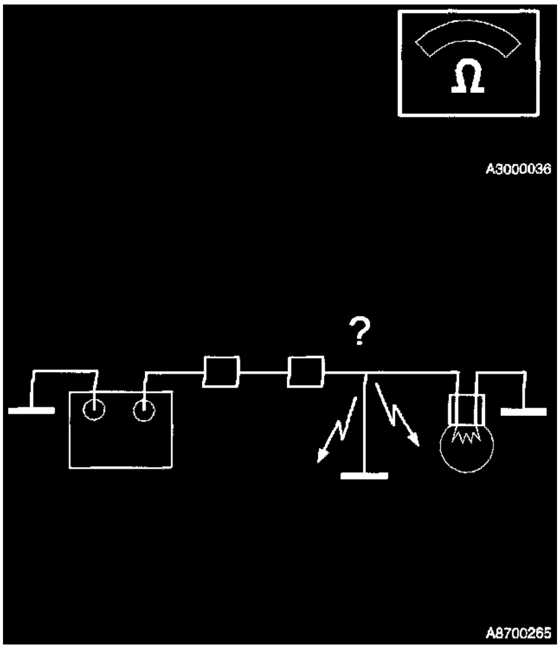
Fault-tracing Information

The verification result shows that the fault persists.

- Do you want to exit fault-tracing?

    Yes:
    - Fault not corrected.

    No:
    - Proceed to: **Checking Solenoid S2** section above.



Intermittent Fault

- Check cable between solenoid S2 in transmission and transmission control module # 31 for an intermittent short-circuit to ground.
- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

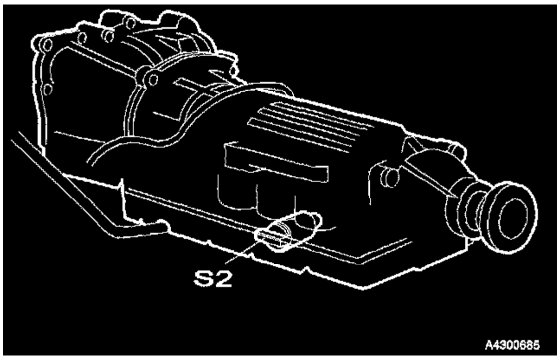
For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.

- Do you want to repeat fault-tracing?

  Yes:
  - Proceed to: **Checking Solenoid S2** section above.

  No:
  - Operation done.

Trouble Code Conditions



Special Tools:
- 981 3190
- 998 8686

Trouble Code Conditions
- Shift solenoids S2 and S1 operate in tandem to control gear-shifting. The solenoids are controlled by the amplifier in the transmission control module **(TCM)**. The transmission control module opens the amplifier to activate the solenoids sending a voltage through the circuit. Solenoid S2 is activated on 2nd and 3rd gears. Diagnostic trouble code **(DTC)** AT-222 is stored if the transmission control module registers an open-circuit or short-circuit to supply voltage in the solenoid S2 circuit when the solenoid should not be activated. Diagnostic trouble code AT-222 is also stored if the control module registers a short-circuit in the solenoid S2 amplifier when it should not be activated, and the gear shift selector is in position D, 3, or L. Solenoid S2 cannot be activated or is activated constantly (depending on cause of the fault).

Substitute value(s)
- The transmission control module limp-home program has been initiated.

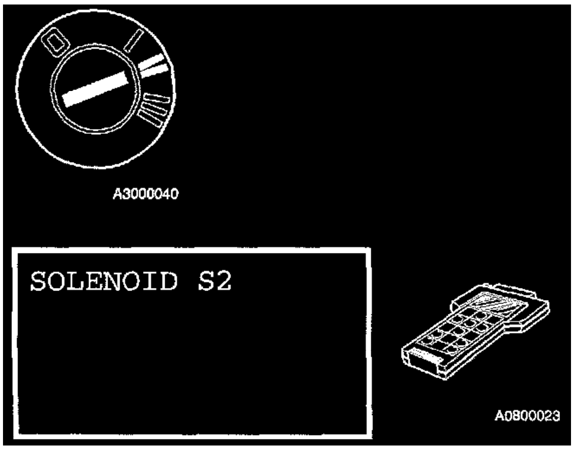
Possible source(s)
- Open-circuit in signal cable.
- Short-circuit to supply voltage in the signal cable.
- Open-circuit in power ground.
- Defective solenoid.
- Contact resistance in terminals.
- Fault in transmission control module.

Fault symptom(s)
- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the transmission control module prevents activation of the solenoids, this stops gear-shifting. The transmission only operates in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gears. If there is a short-circuit to supply voltage in the solenoid circuit the transmission will probably only operate in 3rd gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.
- No reverse gear (depending on fault).

  NOTE: The Motronic 4.4 engine control module **(ECM)** posts a diagnostic trouble code when the transmission sends a malfunction indicator lamp **(MIL)** request. Erase this diagnostic trouble code in the Motronic engine control module when the transmission fault has been repaired.

- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-222 Shift Solenoid S2/Fault In Solenoid Circuit

Fault In Solenoid Circuit

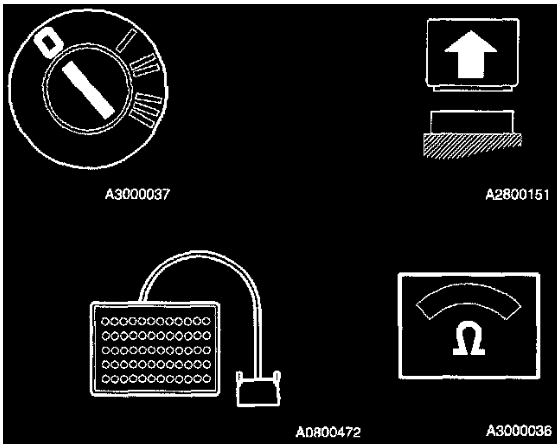


Checking Solenoid S2

- Ignition ON.
- Move gear selector to position P.
- Activate solenoid S2. Read off the solenoid status. The status should alternate between OFF/ON.
- Does the status alternate between OFF/ON?

  Yes:
  - Proceed to: **Intermittent Fault** section below.

  No:
  - Proceed to: **Checking Power Ground** section below.



Checking Power Ground

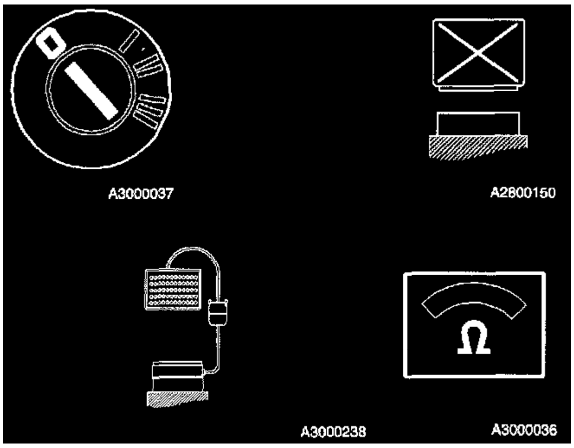
- Ignition OFF.
- Connect the test box and check ground terminals. Check the power ground carefully.
- The ohmmeter should read **approx. 0 Ohms** if the power ground is OK.

  If reading is OK:
  - Proceed to: **Checking Resistance In Solenoid S2 Circuit** section below.

  If reading is incorrect:
  - Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

- The diagnostic trouble code **(DTC)** has been caused by a poor power ground.
- Proceed to: **Verification** section below.



Checking Resistance In Solenoid S2 Circuit

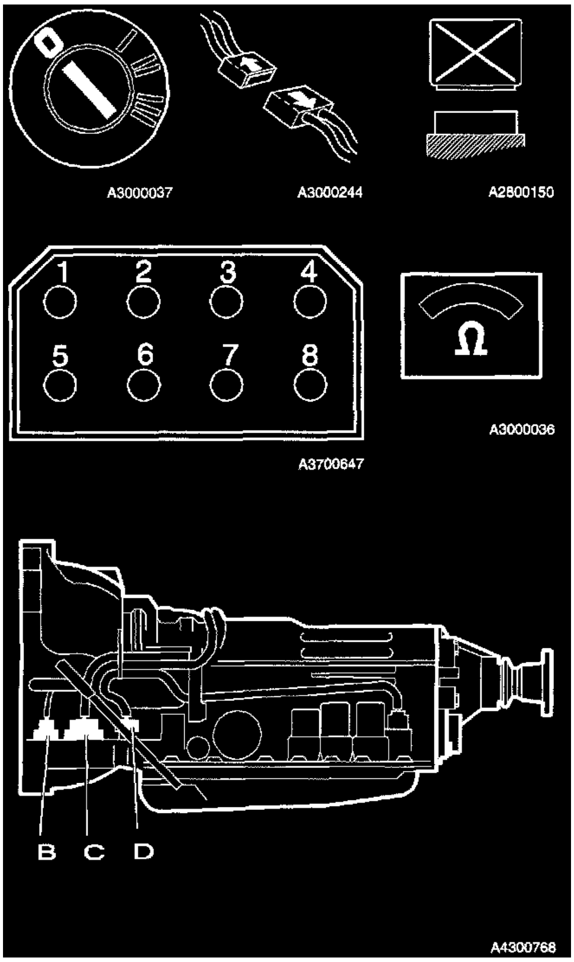
- Ignition OFF.
- Engine control module **(ECM)** disconnected.
- Connect an ohmmeter between # 31 and # 15 on test box.
- The ohmmeter should read **12-18 Ohms**.

If reading is OK:

- Proceed to: **Checking Signal Cable For Short-circuit To Supply Voltage** section below.

If reading is incorrect:

- Proceed to: **Checking Signal Cable** section below.



Checking Signal Cable

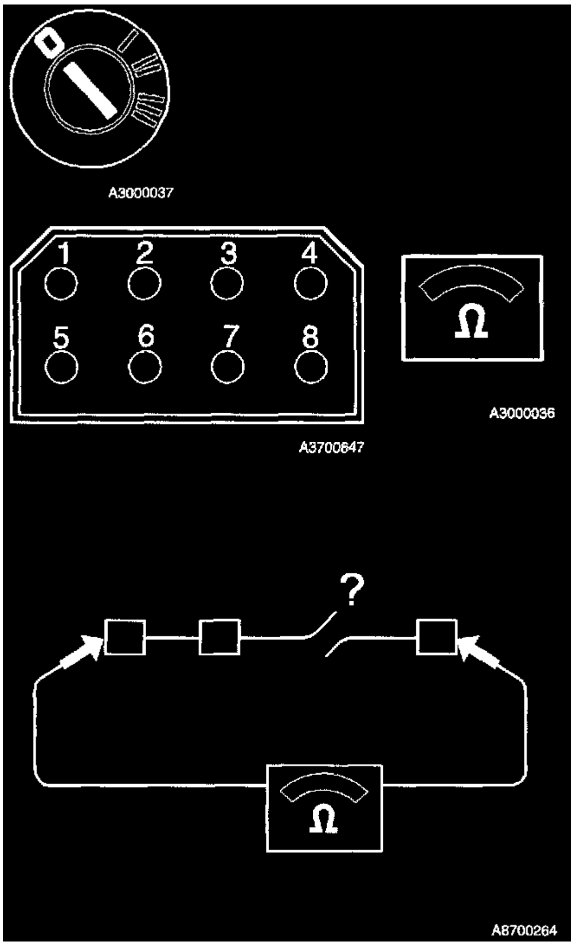
- Ignition OFF.
- Raise the car to access the transmission.
- Carefully clean round connector D.
- Disconnect transmission connector D.
- Connect an ohmmeter between transmission connector D terminal 2 (transmission control module **(TCM)** side) and # 31 on the test box.
- The ohmmeter should read **approx. 0 Ohms**.

If reading is OK:

- Proceed to: **Checking Solenoid S2 Circuit In The Transmission** section below.

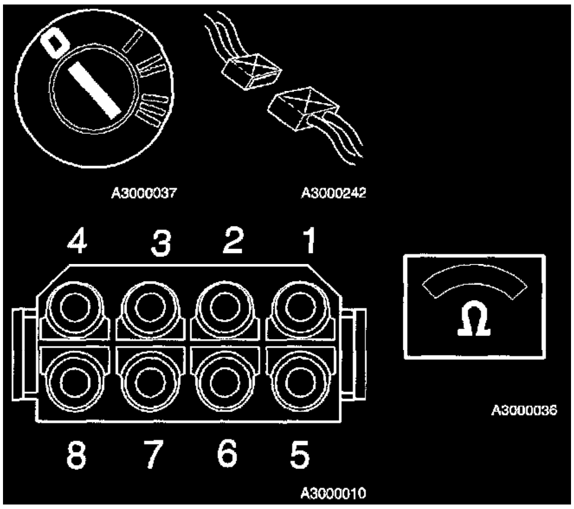
If reading is incorrect:

- Proceed to: **Checking For An Open-circuit** section below.



Checking For An Open-circuit

- Ignition OFF.
- Check cable between transmission connector terminal 2 and transmission control module # 31 for an open-circuit.
- Proceed to: **Verification** section below.



Checking Solenoid S2 Circuit In The Transmission

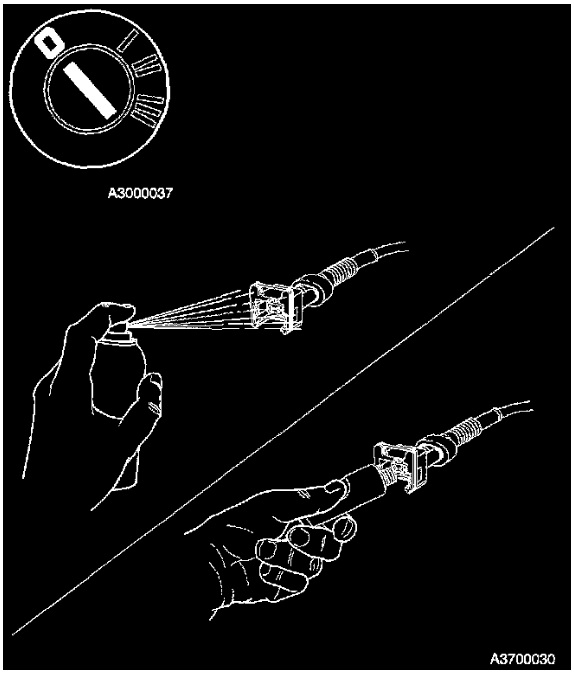
- Ignition OFF.
- Transmission connector D disconnected.
- Connect an ohmmeter between transmission connector D terminal 2 (transmission side) and transmission housing.
- The ohmmeter should read **12-18 Ohms**.

If reading is OK:

- Proceed to: **Checking For Loose Connections And Contact Resistance** section below.

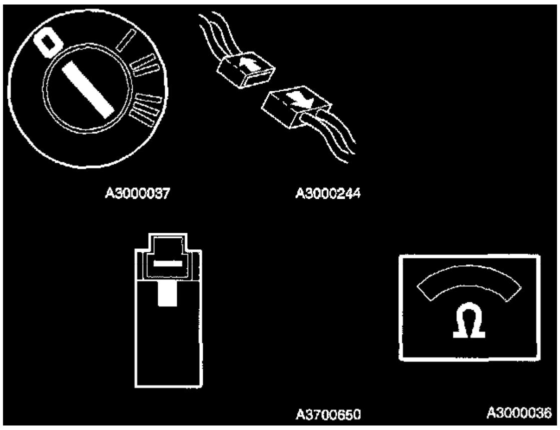
If reading is incorrect:

- Proceed to: **Checking Resistance In Solenoid S2** section below.



Checking For Loose Connections And Contact Resistance

- Ignition OFF.
- The diagnostic trouble code was caused by loose connections in the transmission connector. Check the transmission and transmission control module connectors for loose connections and remedy and contact resistance and oxidation.
- Proceed to: **Verification** section below.

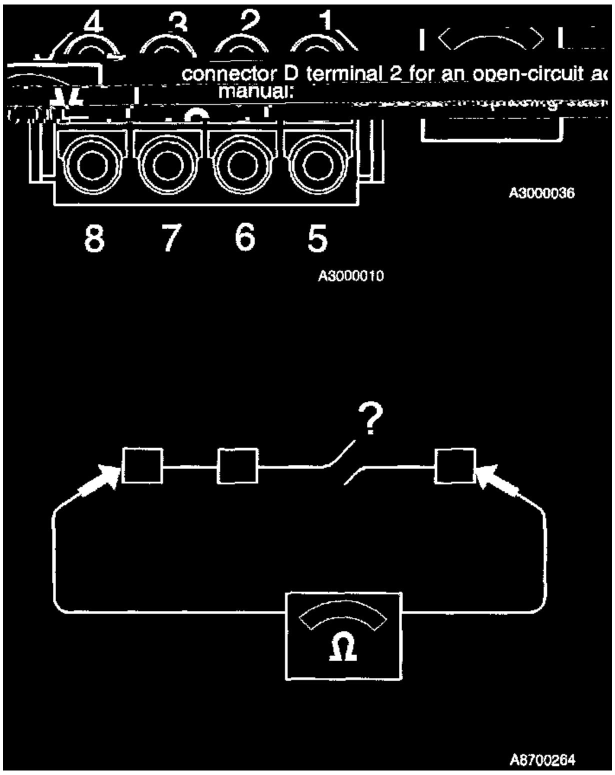


Checking Resistance In Solenoid S2

- Ignition OFF.
- Open the control system.
- Disconnect solenoid S2.
- Use an ohmmeter to measure between the pin on solenoid S2 and the transmission housing.
- The ohmmeter should read **12-18 Ohms**.

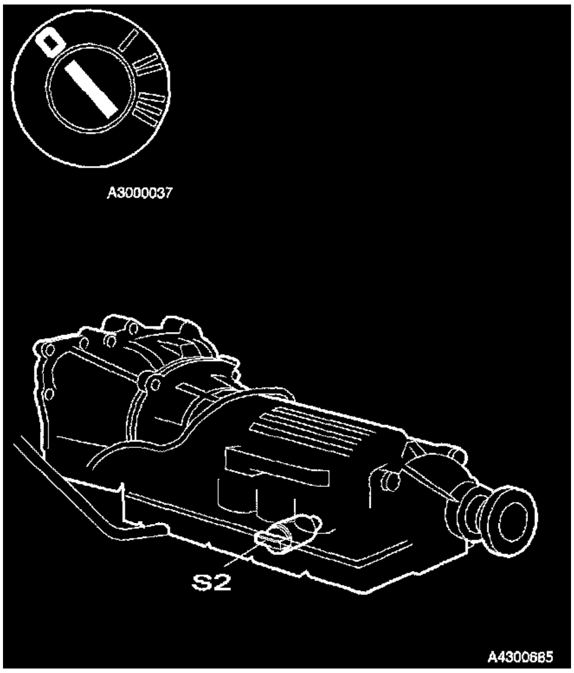
  If reading is OK:
  - Proceed to: **Checking For An Open-circuit** section below.

  If reading is incorrect:
  - Proceed to: **Replacing Component** section below.



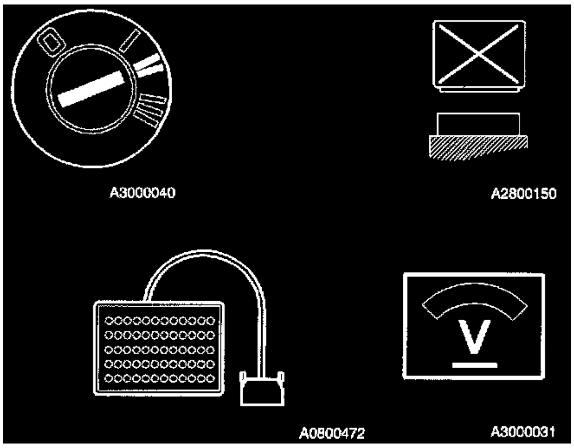
Checking For An Open-circuit

- Check cable between solenoid S2 and transmission connector D terminal 2 for an open-circuit.
- Proceed to: **Verification** section below.



Replacing Component

- Ignition OFF.
- Try a new solenoid S2.
- Proceed to: **Verification** section below.



Checking Signal Cable For Short-circuit To Supply Voltage

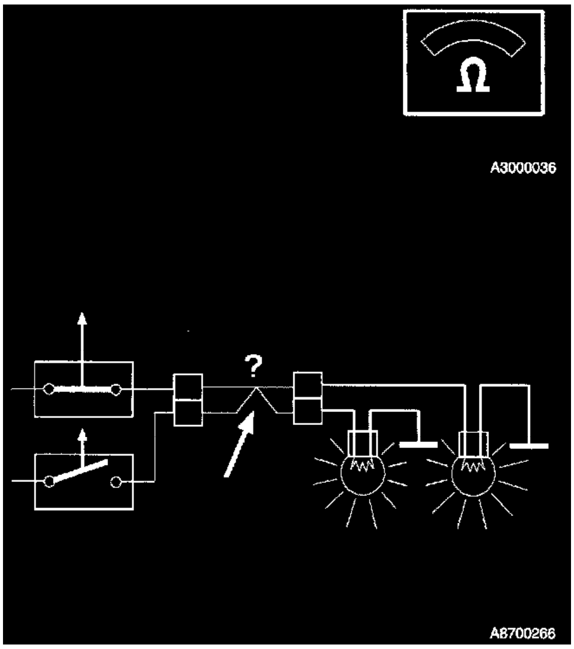
- Ignition OFF.
- Transmission control module disconnected.
- Ignition ON.
- Connect a voltmeter between # 31 and # 1 on the test box.
- The voltmeter should read **approx. 0 Volts**.

If reading is OK:

- Proceed to: **Checking Voltage Drop Over Signal Ground And Power Ground** section below.

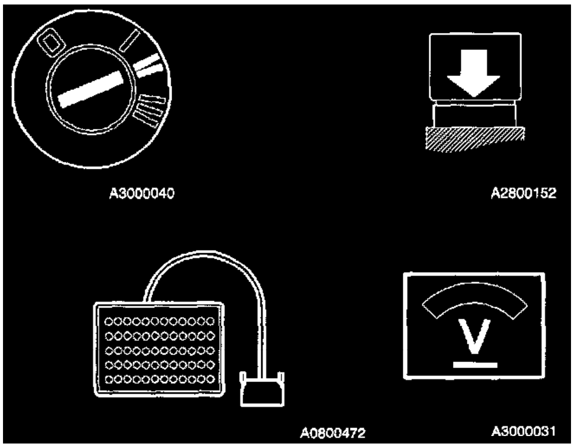
If reading is incorrect:

- Proceed to: **Checking For A Short-circuit To Supply Voltage** section below.



Checking For A Short-circuit To Supply Voltage

- Check cable between solenoid S2 and transmission control module # 31 for a short-circuit to supply voltage.
- Proceed to: **Verification** section below.

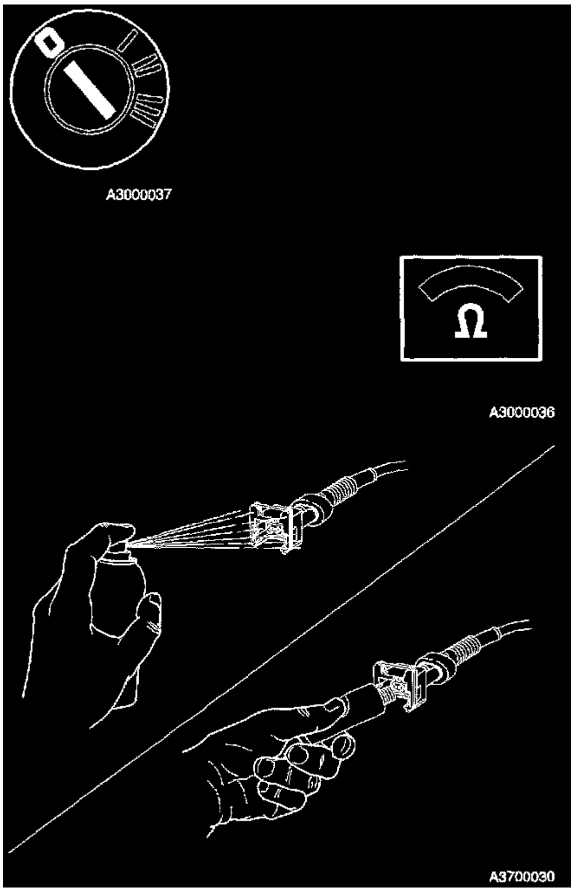


Checking Voltage Drop Over Signal Ground And Power Ground

- Ignition OFF.
- Connect transmission control module.
- Ignition ON.
- Turn on as many power consuming items as possible.
- Connect a voltmeter between # 15 and # 1 on the test box.
- The voltmeter should read less than **0.6 Volts**.

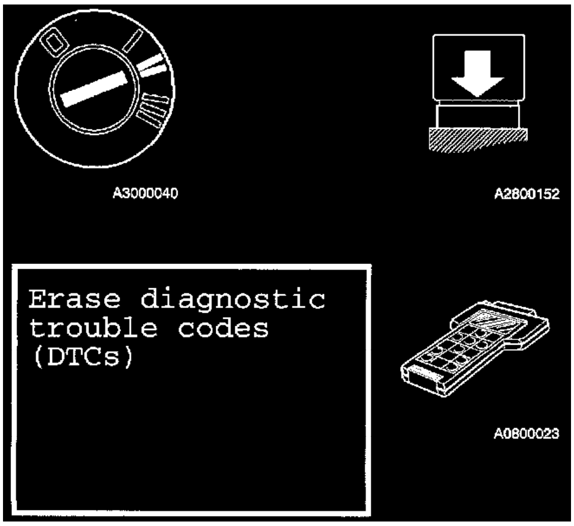
  If reading is OK:
  - Proceed to: **Checking Transmission Control Module** section below.

  If reading is incorrect:
  - Proceed to: **Checking For Open-circuit, Contact Resistance And Oxidation** section below.



Checking For Open-circuit, Contact Resistance And Oxidation

- Ignition OFF.
- Check ground terminals 31/53 and 31/66, cables between ground terminals and transmission control module # 15 and # 1 and transmission control module connector for an open-circuit and contact resistance and oxidation.
- Proceed to: **Verification** section below.



Checking Transmission Control Module

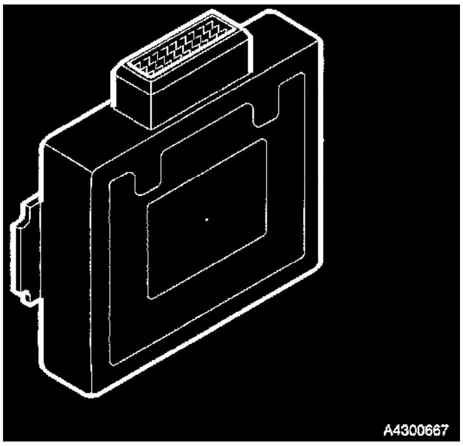
- Ignition OFF.
- Disconnect test box.
- Connect transmission control module.
- Ignition ON.
- Erase diagnostic trouble code.
- Gear selector in position P.
- Start the engine.
- Wait for about **15 seconds**.
- Check to see if the diagnostic trouble code recurs.
- Does the diagnostic trouble code recur?

Yes:

- Proceed to: **Replacing Component** section below.

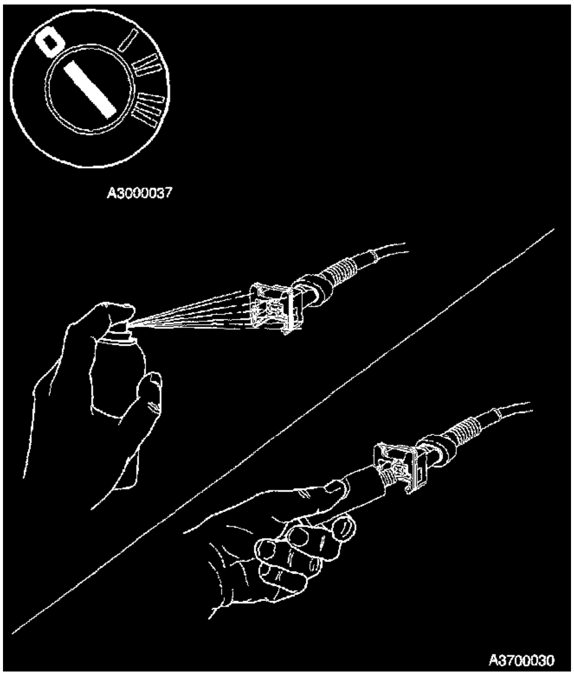
No:

- Proceed to: **Checking For Contact Resistance And Oxidation** section below.



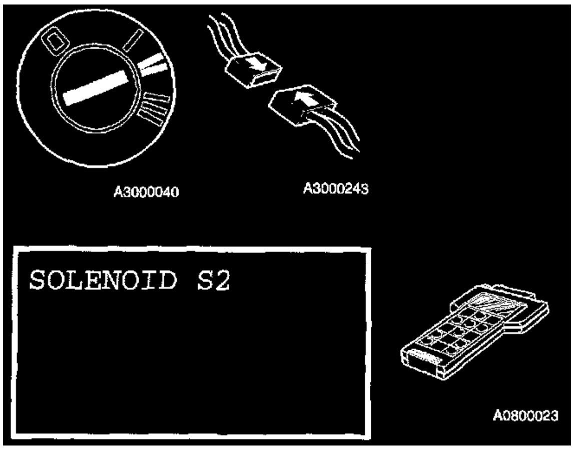
Replacing Component

- Try a new transmission control module.
- Proceed to: **Verification** section below.



Checking For Contact Resistance And Oxidation

- Ignition OFF.
- The diagnostic trouble code was caused by loose connections in the transmission control module connector. Check engine control module connector for contact resistance and oxidation and remedy.
- Proceed to: **Verification** section below.



Verification

After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:

- Ignition OFF.
- Reinstall components, connectors etc.
- Ignition ON.
- Read off solenoid S2 status. Status should alternate between OFF/ON.
- Does the solenoid status alternate between OFF/ON?

Yes:

- Fault corrected.

No:

- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

The verification result shows that the fault persists.

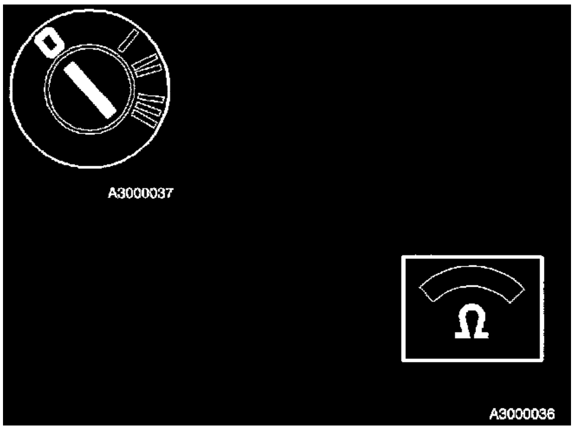
- Do you want to exit fault-tracing?

Yes:

- Fault not corrected.

No:

- Proceed to: **Checking Solenoid S2** section above.



Intermittent Fault

- Check transmission and transmission control module connectors for loose connections and contact resistance and oxidation.
- Check cable between solenoid S2 and transmission control module # 31 for an intermittent open-circuit and an intermittent short-circuit to supply voltage.
- Check cable between ground terminal 31/66 and transmission control module # 1 for an intermittent open-circuit.
- Check ground terminal 31/66 for contact resistance and oxidation.
- Check the cable between the positive terminal on the battery and transmission control module # A29 for an intermittent open-circuit.
- Proceed to: **Fault-tracing Information** section below.

Fault-tracing Information

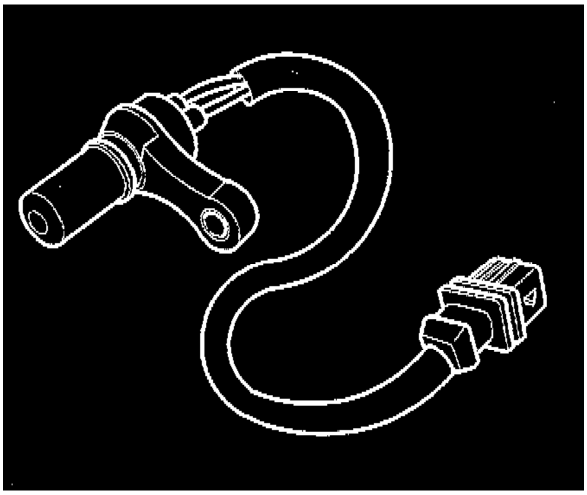
For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment,

- Do you want to repeat fault-tracing?

  Yes:
  - Proceed to: **Checking Solenoid S2** section above.

  No:
  - Operation done.

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

The Vehicle Speed Signal **(VSS)** comes from a sensor on the transmission. The Transmission Control Module **(TCM)** uses the signal to select the correct gear. The TCM also uses the transmission speed sensor signal to determine vehicle speed. Diagnostic Trouble Code **(DTC)** AT-232 is posted if the TCM registers that there is no VSS signal.

SUBSTITUTE VALUE

The TCM "Emergency mode II" program is initiated.

POSSIBLE SOURCE

- Open-circuit in the signal cable (+) or signal cable (-).

- Signal cable (+) or signal cable (-) short-circuited to ground, supply voltage or each other.
- Defective VSS
- Contact resistance in terminals

FAULT SYMPTOM(S)

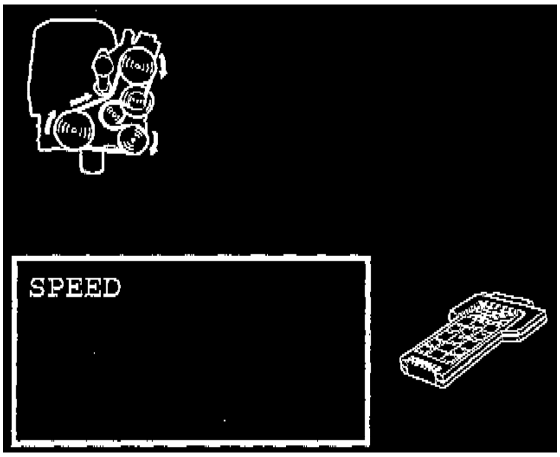
- The combined instrument panel warning lamp flashes.
- No lock-up function.
- No adaption of the gear slippage times at high altitude (High Altitude Compensation)
- No reduction of system pressure when shifting, making shifting harsher.
- No reduction of system pressure when moving the gear selector between positions P-R, N-R and N-D which causes harsh gear meshing.
- No torque limiting request to Engine Control Module **(ECM)** when shifting

  NOTE:
  - The Motronic 4.4 ECM posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request.
  - Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at Signal Missing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-232 Speedometer Signal/Signal Missing

Signal Missing



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

SIGNAL MISSING

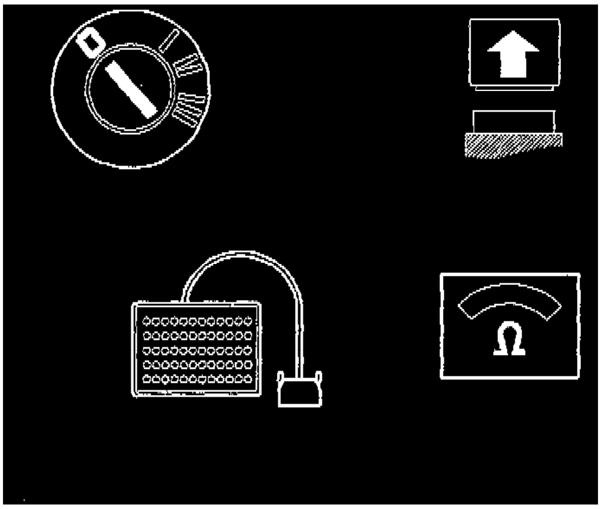
1. Checking vehicle speed signal

   NOTE: An alternative to the following method is to drive the car on the road.

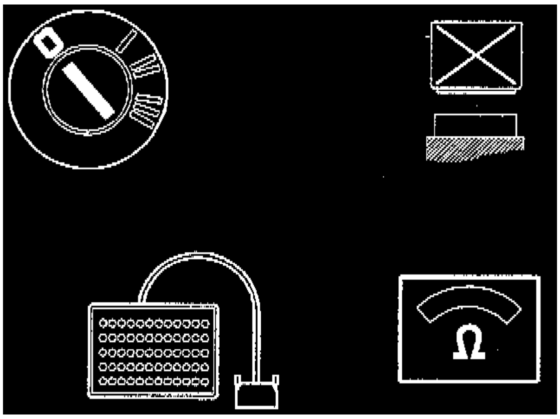
   - Preparation:
     Ignition OFF
     Raise car so that front wheels rotate freely.
     Engine idling.
     Select scrolling values.
     Read off speed.
     Move the gear selector to position D so the front wheels begin to rotate.
   - Check that speed increases with engine speed (RPM).

   NOTE:
   - When the rear wheels are stationary and the front wheels rotate Diagnostic Trouble Codes **(DTCs)** may can be stored in the ABS system.
   - Erase any DTCs stored in the ABS system after fault-tracing.
   - Refer to Brakes and Traction Control.
   - Ensure that the front wheels are not rotating when the gear shift lever is moved.
   - Does speed increase with engine speed (RPM)?

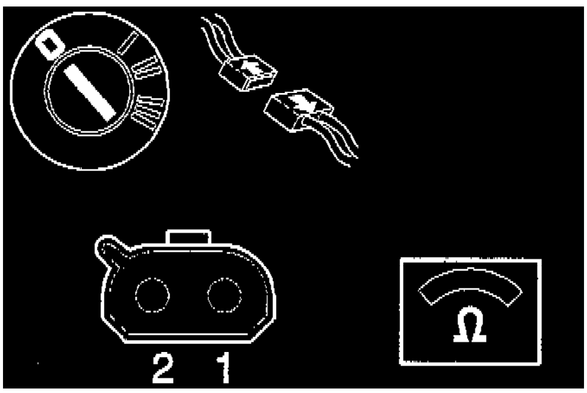
     YES: Proceed to step 19
     NO: Proceed to step 2



2. Connecting the test box
   - Preparation:
     Ignition OFF
   - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 3

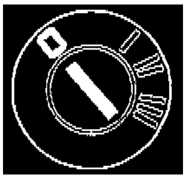


3. Checking Vehicle Speed Sensor (VSS) circuit.
   - Preparation:
     Ignition OFF
     Transmission Control Module **(TCM)** disconnected.
   - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
   - The ohmmeter should read **300-600 Ohms**
   - If reading is OK:
     Proceed to step 13
   - If reading is incorrect:
     Proceed to step 4

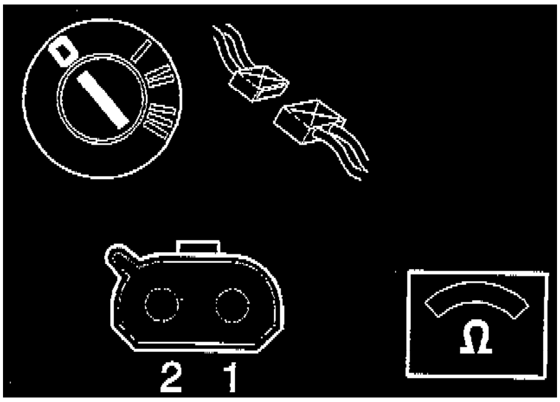


4. Checking VSS resistance
   - Preparation:
     Ignition OFF
     Remove the Air Cleaner **(ACL)** housing to access the VSS connector.
     Disconnect the VSS connector.
   - Connect an ohmmeter between VSS connector terminals 1 and 2 (VSS side)

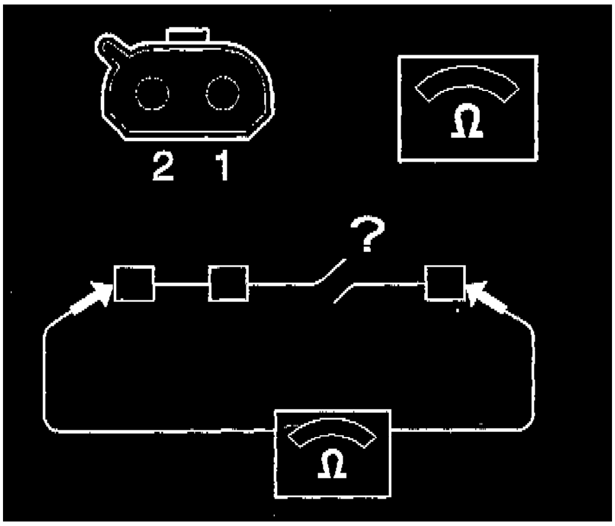
- The ohmmeter should read approximately **300-600 Ohms**
- If reading is OK:
  Proceed to step 6
- If reading is incorrect:
  Proceed to step 5



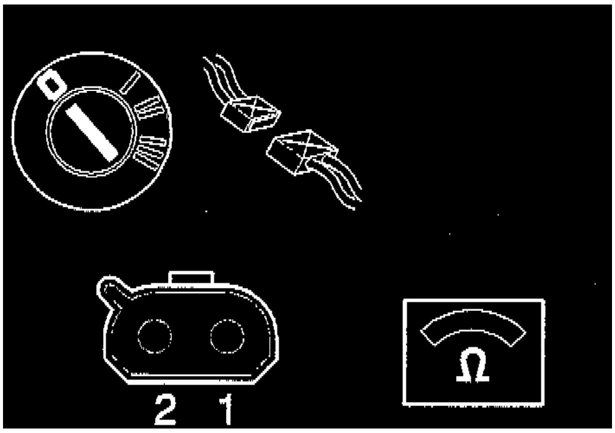
5. Replacing component
   - Preparation:
     Ignition OFF
   - Try a new VSS, refer to Powertrain Management.
   - Then continue with step 17



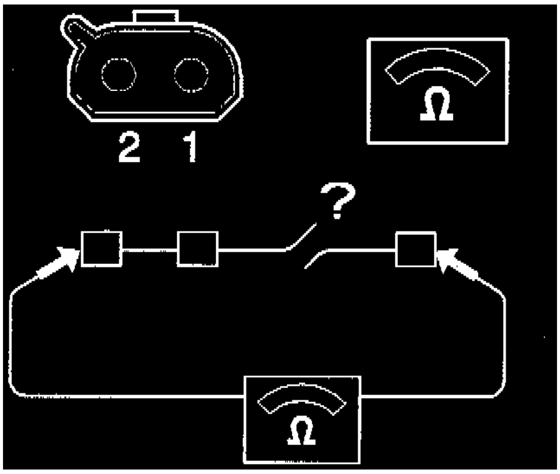
6. Checking resistance in signal (+) cable
   - Preparation:
     Ignition OFF
     VSS disconnected.
   - Connect an ohmmeter between VSS connector terminals 1 and #11 (#A11) on the test box.
   - The ohmmeter should read approx. **0 Ohms**
   - If reading is OK:
     Proceed to step8
   - If reading is incorrect:
     Proceed to step7



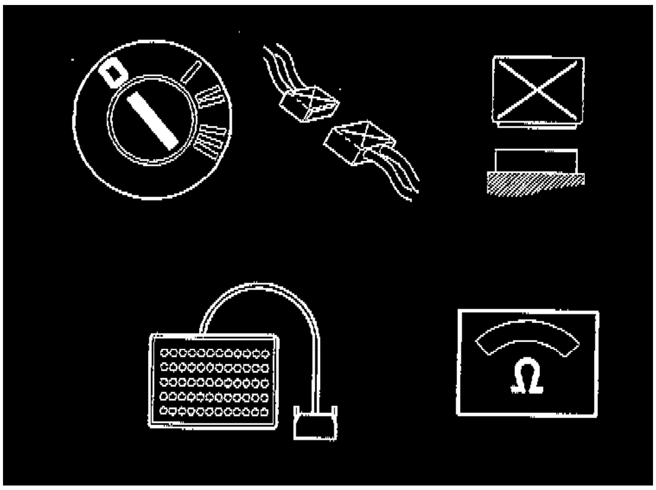
7. Checking for an open-circuit
   - Check cable between VSS connector terminal 1 and TCM #All for an open-circuit according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17



8. Checking resistance in signal (-) cable
   - Preparation:
     Ignition OFF
     VSS disconnected.
   - Connect an ohmmeter between VSS connector terminals 2 and #12 (#A12) on the test box.
   - The ohmmeter should read approx. **0 Ohms**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 9



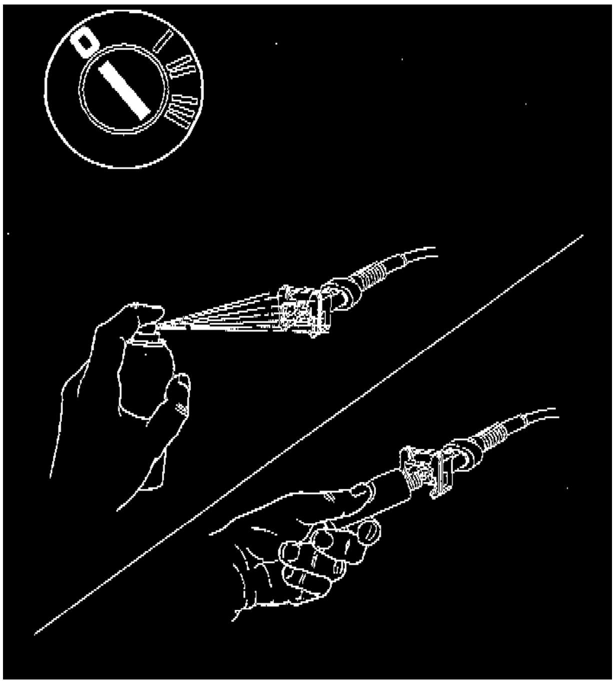
9. Checking for an open-circuit
   - Check cable between VSS connector terminal 2 and TCM terminal #A12 for an open-circuit according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17



10. Checking signal cable resistance
   - Preparation:
     Ignition OFF
     VSS disconnected.

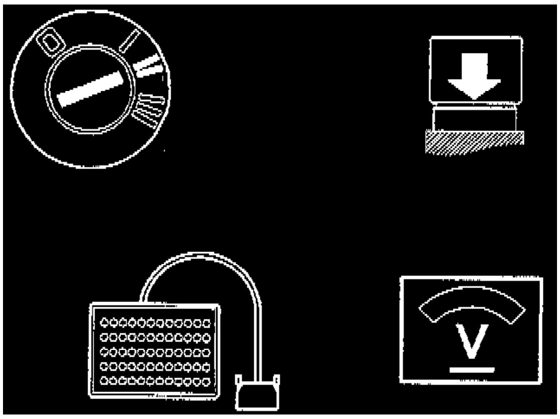
TCM disconnected.

- Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
- The ohmmeter should read **infinite resistance**
- If reading is OK:
  Proceed to step 11
- If reading is incorrect:
  Proceed to step 12



11. Checking for contact resistance and oxidation.
   - Preparation:
     Ignition OFF
   - The DTC was caused by poor contact in TCM and VSS connectors.
   - Check connectors for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17

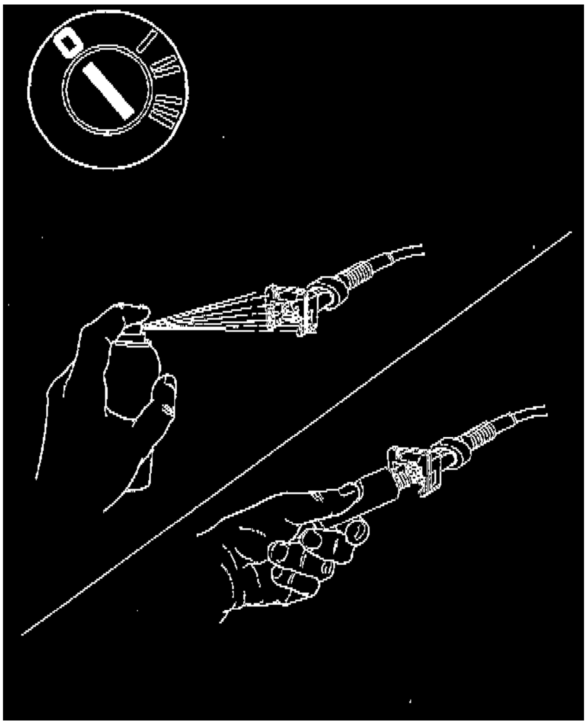
12. Checking for a short-circuit
   - Check cable between VSS connector terminal 1 and TCM #All and cable between terminal 2 and TCM #A12 for a short-circuit to each other.
   - Then continue with step 17



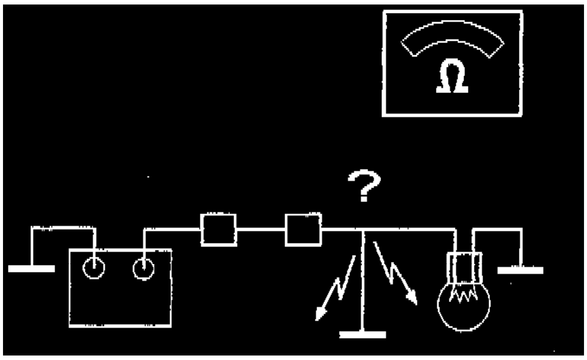
13. Checking signal cables
   - Preparation:
     Ignition OFF

Test box connected
Connect TCM
Ignition ON

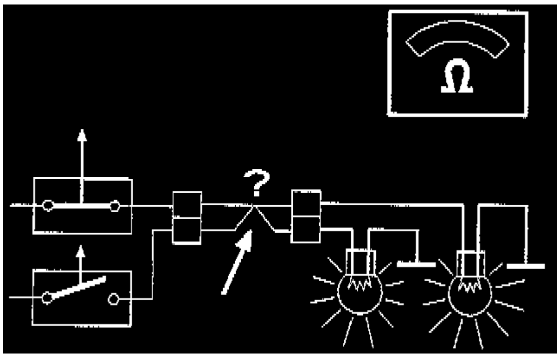
- Connect a voltmeter between #11 (#A11) and #12 (#A12) on the test box.
- The voltmeter should read approx. **2.5 volts**
- If reading is OK:
  Proceed to step 14
- If value is lower:
  Proceed to step 15
- If value is higher:
  Proceed to step 16



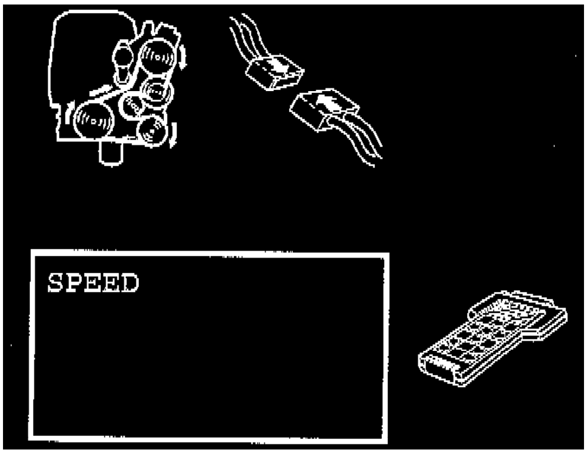
14. Checking for contact resistance and oxidation.
    - Preparation
      Ignition OFF
    - The DTC was caused by poor contact in the TCM connector
    - Check transmission and control module connectors for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17



15. Checking for a short-circuit
    - Check cables between VSS and TCM #All and #A12 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17



16. Checking for a short-circuit
    - Check cables between VSS and TCM #All and #A12 for a short-circuit to supply voltage according to step 4 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17

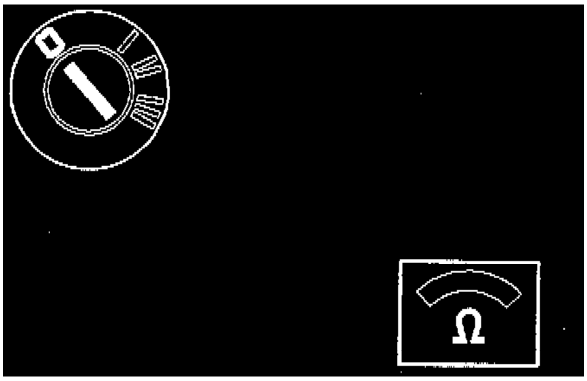


17. Verification
    - After carrying out the repair, check that the fault has been remedied as follows

      NOTE: An alternative to the following method is to drive the car on the road.

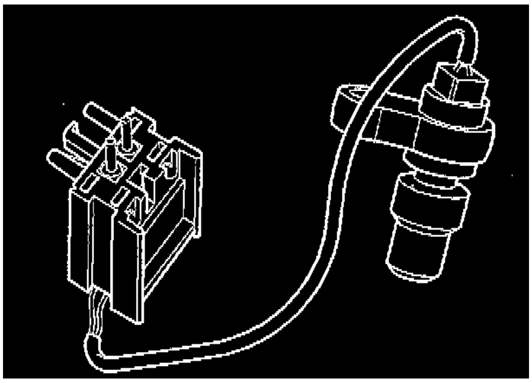
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Raise car so that front wheels rotate freely.
      Engine idling
    - Check that speed increases with engine speed (RPM).

      NOTE:
      - When the rear wheels are stationary and the front wheels rotate DTCs may can be stored in the ABS system.
      - Erase any DTCs stored in the ABS system after fault-tracing.
      - Refer to Brakes and Traction Control
      - Ensure that the front wheels are not rotating when the gear shift lever is moved.
    - Does speed increase with engine speed (RPM)?
      YES: Fault corrected
      NO: Proceed to step 18
18. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
      YES: Fault not corrected
      NO: Proceed to step 1



19. Intermittent fault
    - Preparation:
      Ignition OFF
    - Check VSS and TCM connectors for contact resistance and oxidation according to step 6 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Check cables between VSS and TCM #All and #A12 for:
      An intermittent open-circuit according to step 2 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
      An intermittent short-circuit to ground according to step 3 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
      An intermittent short-circuit to supply voltage according to step 4 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
      An intermittent short-circuit to each other.
    - Then continue with step 20
20. Fault-tracing information
    - For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.
    - Do you want to repeat fault-tracing?
      YES: Proceed to step 1
      NO: Operation done

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

The transmission speed signal is sent by a sensor on the transmission. The Transmission Control Module **(TCM)** uses the signal to determine the input shaft speed after the torque converter. This signal is used to compare the transmission speed with vehicle speed. The TCM uses this comparison to calculate gear-shift timing. The transmission speed and vehicle speed data are also utilized in modulating system pressure, lock-up function control and in torque limiting. The result is smooth gear-shifting. Diagnostic Trouble Code **(DTC)** AT-311 is posted if the TCM does not register this signal when vehicle speed exceeds 25 km/h.

SUBSTITUTE VALUE

The TCM "Emergency mode II" program is initiated.

POSSIBLE SOURCE

- Open-circuit in the signal cable (+) or signal cable (-).
- Short-circuit to supply voltage or ground in the signal cable

- Short-circuit to supply voltage in the signal cable (-).
- Short circuit between the signal (+) wiring and signal (-) wiring.
- Defective speed sensor
- Contact resistance in terminals

FAULT SYMPTOM(S)

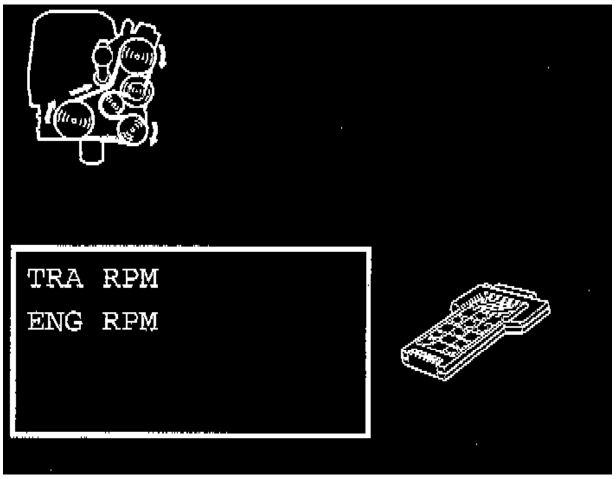
- The combined instrument panel warning lamp flashes.
- No lock-up function.
- No adaption of the gear slippage times at high altitude (High Altitude Compensation)
- No reduction of system pressure when shifting, making shifting harsher.
- No reduction of system pressure when moving the gear selector between positions P-R, N-R and N-D which causes harsh gear meshing.
- No torque limiting request to Engine Control Module **(ECM)** when shifting

  NOTE:
  - The Motronic 4.4 ECM posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request
  - Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at signal missing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-311 Transmission Speed Sensor/Signal Missing

Signal Missing



SPECIAL TOOLS

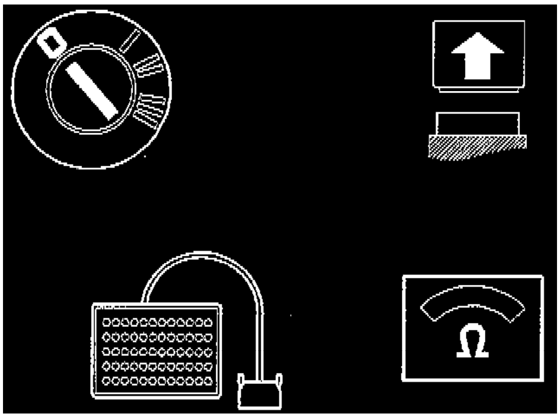
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

SIGNAL MISSING

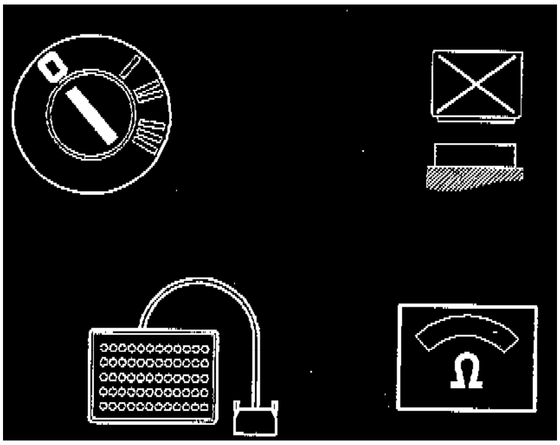
1. Checking transmission speed signal

   NOTE: An alternative to the following method is to drive the car on the road.
   - Preparation:
     Ignition OFF
     Raise car so that front wheels rotate freely.
     Engine idling.
     Select scrolling values
     Read off transmission input speed.
     Move the gear selector to position D so the front wheels begin to rotate.
   - Check that the transmission input speed is updated.
   - The transmission input speed should increase with engine speed.

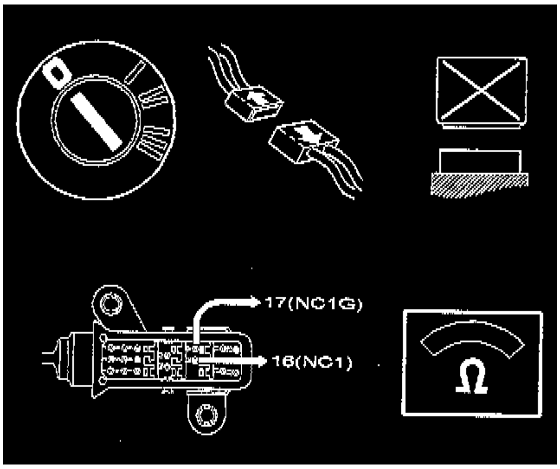
     NOTE:
     - When the rear wheels are stationary and the front wheels rotate Diagnostic Trouble Codes **(DTCs)** may can be stored in the ABS system.
     - Erase any DTCs stored in the ABS system after fault-tracing.
     - Refer to Brakes and Traction Control
     - Ensure that the front wheels are not rotating when the gear shift lever is moved
   - Is the transmission input speed OK?
     YES: Proceed to step 19
     NO: Proceed to step 2



2. Connecting the test box
    - Preparation:
        Ignition OFF
    - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
- Then continue with step 3

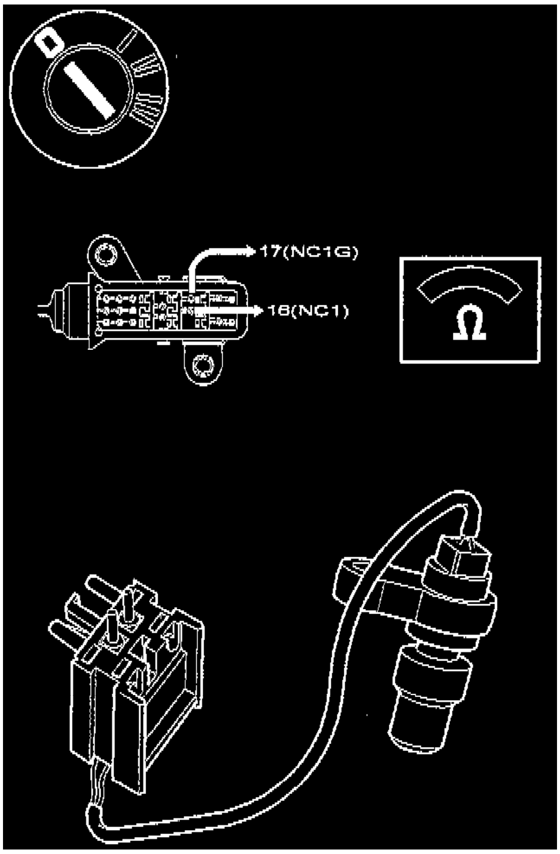


3. Checking transmission speed sensor circuit
    - Preparation:
        Ignition OFF
        Transmission Control Module **(TCM)** disconnected.
    - Use an ohmmeter to measure between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
        Proceed to step 13
    - If reading is incorrect:
        Proceed to step 4

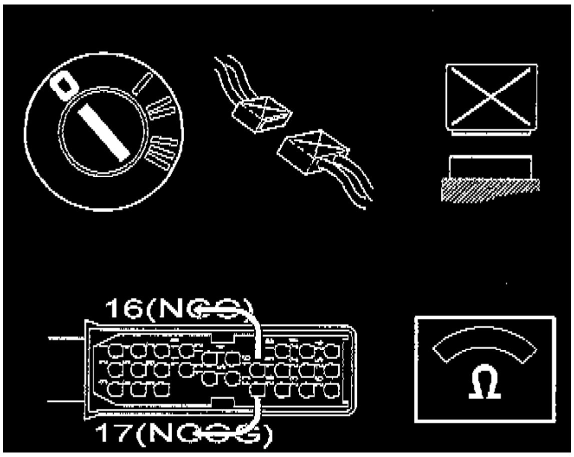


4. Checking transmission speed sensor resistance
    - Preparation:
        Ignition OFF
        Remove the Air Cleaner **(ACL)** housing to access the transmission connector.
        Disconnect the transmission connector.
        TCM disconnected.

- Connect an ohmmeter between the transmission connector terminals 16 and 17 (transmission speed sensor side)
- The ohmmeter should read **300-600 Ohms**
- If reading is OK:
  Proceed to step 6
- If reading is incorrect:
  Proceed to step 5

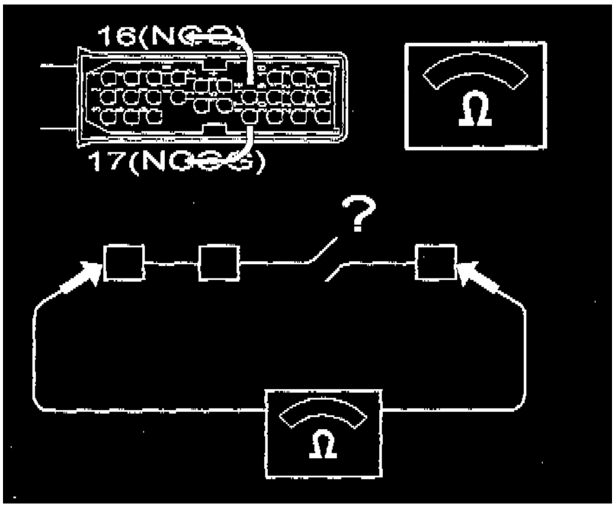


5. Checking for open-circuit and replacement of component
   - Preparation:
     Ignition OFF
   - Check the cables between the transmission speed sensor and transmission connector terminal 16 and 17 for:
     An open-circuit according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
     A short circuit to each other.
   - If the wiring is OK, try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
   - Then continue with step 17

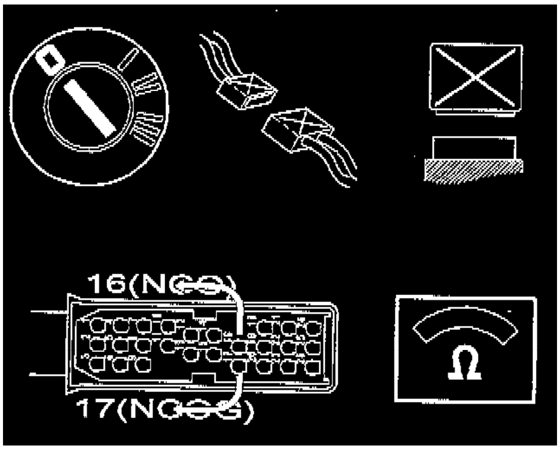


6. Checking resistance in signal (+) cable
   - Preparation:
     Ignition OFF
     Disconnect transmission connector.
     TCM disconnected.
   - Connect an ohmmeter between the transmission connector terminal 16 (TCM side) and #1 (#A1) on the test box.

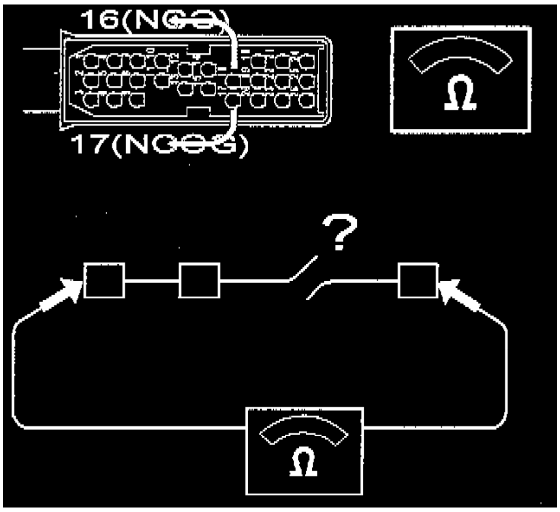
- The ohmmeter should read approx. **0 Ohms**
- If reading is OK:
  Proceed to step 8
- If reading is incorrect:
  Proceed to step 7



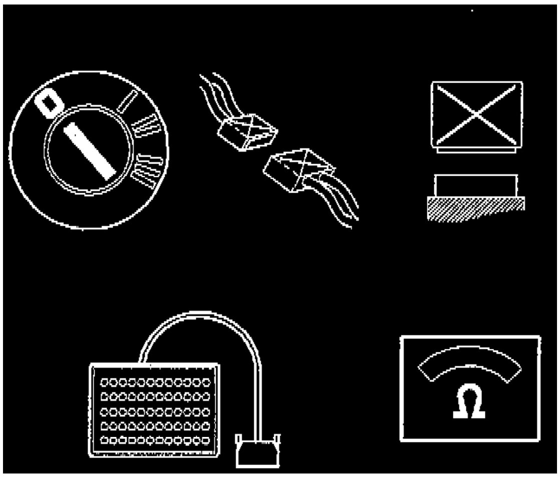
7. Checking for an open-circuit
   - Check cable between transmission connector terminal 16 and control module #A1 for an open-circuit according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17



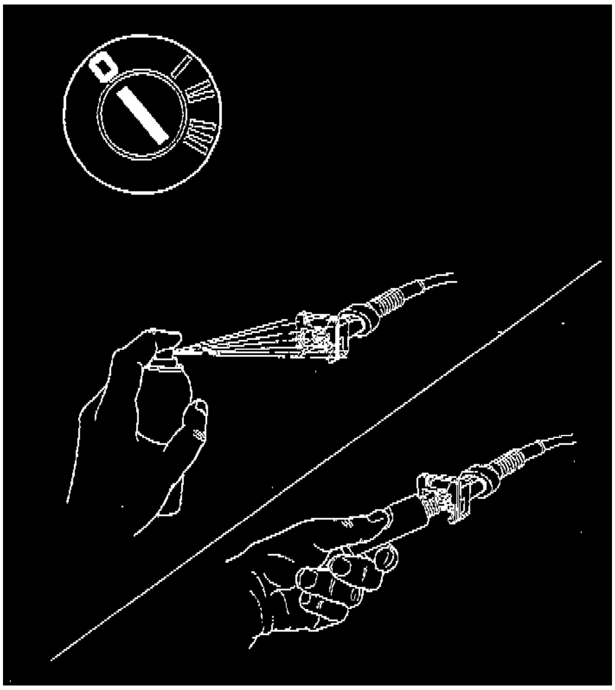
8. Checking resistance in signal (-) cable
   - Preparation:
     Ignition OFF
     Disconnect transmission connector.
     TCM disconnected.
   - Connect an ohmmeter between the transmission connector terminal 17 (TCM side) and #2 (#A2) on the test box.
   - The ohmmeter should read approx. **0 Ohms**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 9



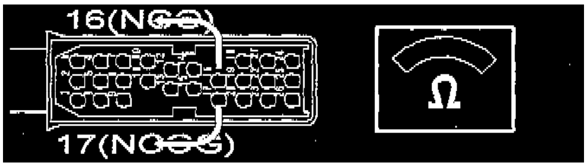
9. Checking for an open-circuit
   - Check cable between transmission connector terminal 17 and control module #A2 for an open-circuit in according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17



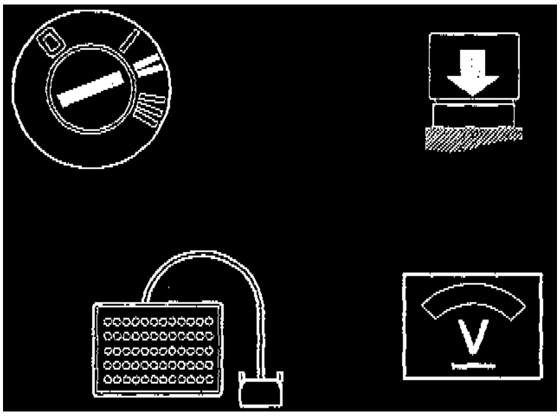
10. Checking signal wiring resistance
    - Preparation:
      Ignition OFF
      Disconnect transmission connector.
      TCM disconnected
    - Use an ohmmeter to measure between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **infinite resistance**
    - If reading is OK:
      Proceed to step 11
    - If reading is incorrect:
      Proceed to step 12



11. Checking for contact resistance and oxidation.
    - Preparation:
      Ignition OFF
    - The DTC was set because of poor contact in the TCM and transmission connectors.
    - Check connectors for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17

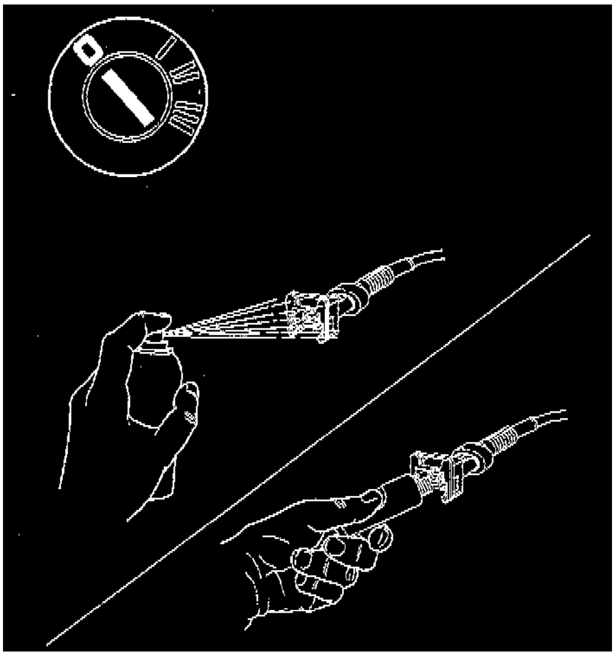


12. Checking for a short-circuit
    - Check the cable between the transmission connector terminal 16 and TCM #A1 for short circuit to cable between the transmission connector terminal 17 and TCM #A2.
    - Then continue with step 17

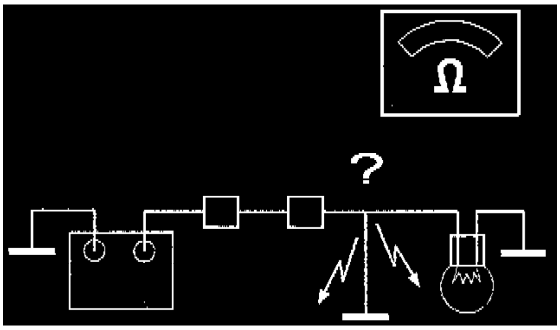


13 Checking the signal wiring
- Preparation:
  Ignition OFF
  Test box connected
  Connect TCM
  Ignition ON
- Use a voltmeter between #1 (#A1) and #20 (#A20) on the test box.
- The voltmeter should register approx. **2.5 volts**
- If reading is OK:
  Proceed to step 14
- If value is lower:
  Proceed to step 15

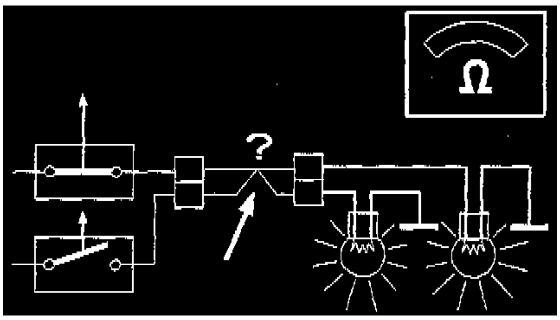
- If value is higher:
  Proceed to step 16



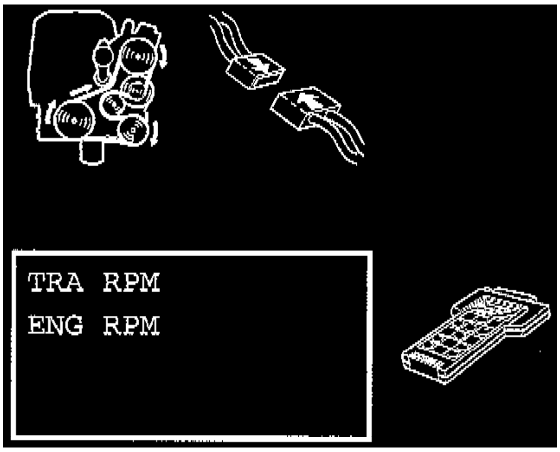
14. Checking for contact resistance and oxidation.
    - Preparation:
      Ignition OFF
    - The DTC was caused by poor contact in the TCM connector.
    - Check transmission and control module connectors for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17



15. Checking for a short-circuit
    - Check cables between transmission speed sensor and TCM #A1 and #A2 for short circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17



16 Checking for a short-circuit
   - Check cables between transmission speed sensor and TCM #A1 and #A2 for a short-circuit to supply voltage according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17



17. Verification
    - After carrying out the repair, check that the fault has been remedied.
    - Carry out the following.

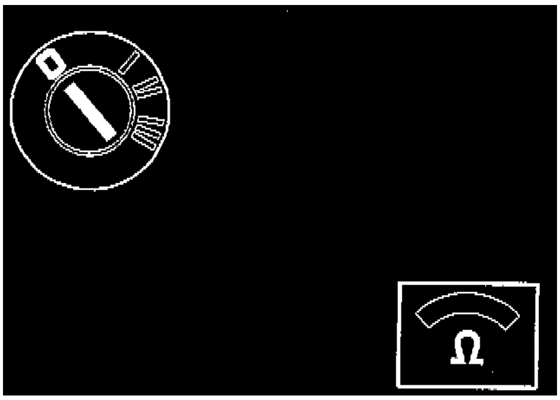
      NOTE: An alternative to the following method is to drive the car on the road.

    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Raise car so that front wheels rotate freely.
      Engine idling.
      Select scrolling values
      Read off transmission input speed.
      Move the gear selector to position D so the front wheels begin to rotate.
    - Check that the transmission input speed is update.
    - The transmission input speed should increase with engine speed.

      NOTE:
      - When the rear wheels are stationary and the front wheels rotate DTCs may can be stored in the ABS system
      - Erase any DTCs stored in the ABS system after fault-tracing.
      - Refer to Brakes and Traction Control
      - Ensure that the front wheels are not rotating when the gear shift lever is moved

    - Is the transmission input speed OK?
      YES: Fault corrected
      NO: Proceed to step 18

18 Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
      YES: Fault not corrected
      NO: Proceed to step 1



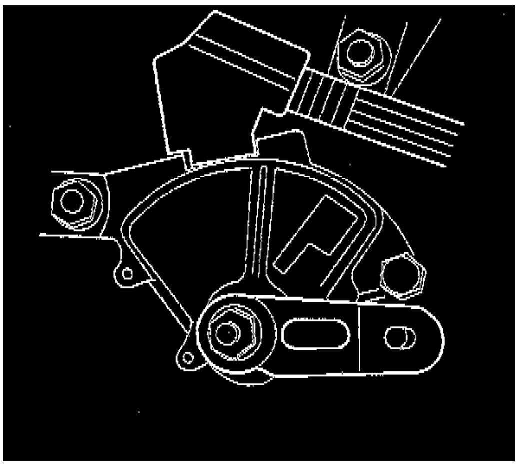
19. Intermittent fault
    - Preparation:
      Ignition OFF
    - Check transmission connector and control module connector for:
      Loose connections according to step 5 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults

Contact resistance and oxidation according to step 6 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults

- Check cables between transmission speed sensor and TCM #A1 and #A2 for:
  An intermittent open-circuit according to step 2 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
  An intermittent short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
  An intermittent short-circuit to supply voltage according to step 4 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
- Check cables between the transmission speed sensor and TCM #A1 and #A2 for an intermittent short-circuit to each other.
- Then continue with step 20

20. Fault-tracing information
    - For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.
    - Do you want to repeat fault-tracing?
      YES: Proceed to step 1
      NO: Operation done

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

The gear-shift position sensor signals provide the Transmission Control Module **(TCM)** with data on the gear selector position. This information is transmitted by grounding a combination of signals A, B. C and PA inside the gear-shift position sensor. Diagnostic Trouble Code **(DTC)** AT-313 is posted if the TCM registers an unacceptable combination of A, B. C and PA for a period of 5 seconds as shown below.

A	B	C	PA	
•	•	o	o	Diagnostic trouble code (DTC)
•	•	•	•	Diagnostic trouble code (DTC)
•	•	•	o	Diagnostic trouble code (DTC)
o	•	•	•	Diagnostic trouble code (DTC)
•	•	o	•	Diagnostic trouble code (DTC)
o	o	o	•	Diagnostic trouble code (DTC)

• = 0–2 V below battery voltage
o = ground

SUBSTITUTE VALUE

The TCM limp-home program has been initiated.

POSSIBLE SOURCE

- Short-circuit to supply voltage or ground in the signal cable
- Open-circuit in signal cable
- Gear-shift position sensor incorrectly adjusted
- Defective gear-shift position sensor
- Contact resistance in terminals.

FAULT SYMPTOM(S)

- The combined instrument panel warning lamp flashes.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

CAUTION: The gear-shift position sensor cannot be short-circuited to supply voltage.

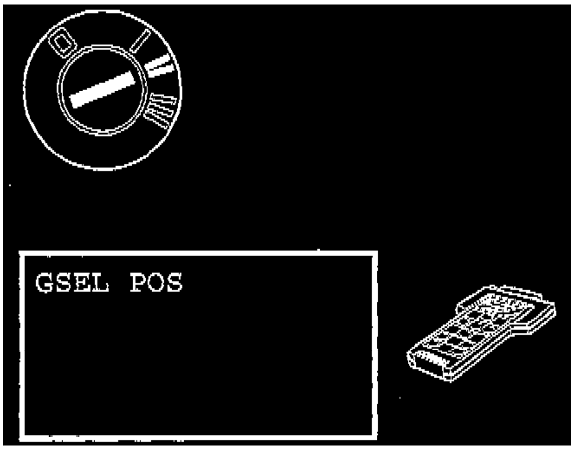
NOTE:

- The Motronic 4.4 Engine Control Module **(ECM)** posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request.
- Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at, Faulty signal. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-313 Gear-Shift Position Sensor/Faulty Signal

Faulty Signal

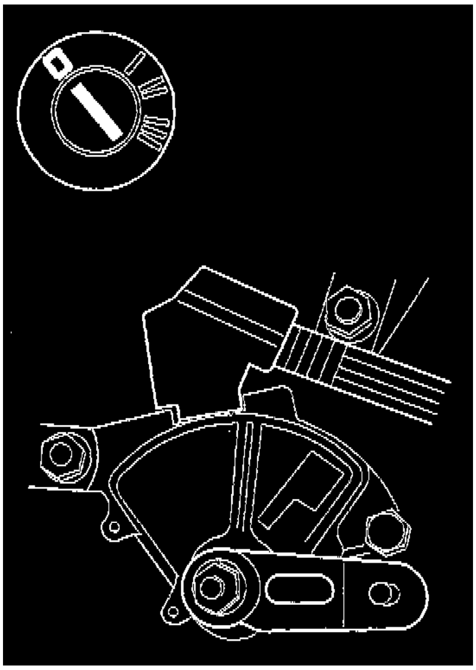


SPECIAL TOOLS

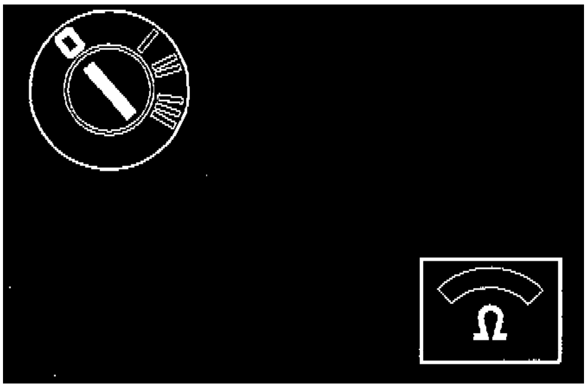
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

FAULTY SIGNAL

1. Checking gear-shift position sensor
   - Preparation:
     Ignition ON
     Select scrolling value.
     Read gear-shift position sensor position.
   - Move the gear selector to all shift positions a number of times, and repeatedly select the same position to check the operation of the gear-shift position sensor.
   - Are all values OK?
     YES: Proceed to step 19
     NO: Proceed to step 2



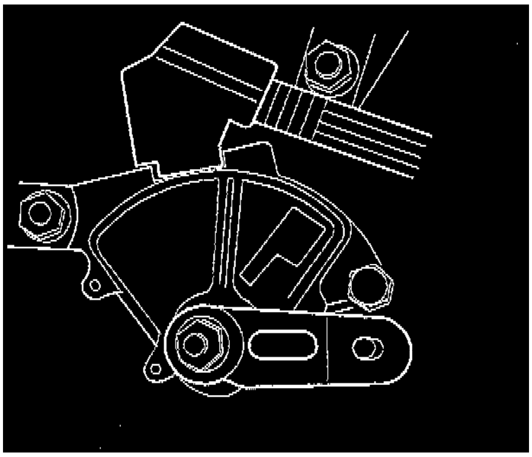
2. Checking gear-shift position sensor adjustment
   - Preparation:
     Ignition OFF
   - Check gear position sensor adjustment, refer to Transmission Position Switch/Sensor found under Powertrain Management.
   - Is the gear-shift position sensor correctly adjusted?
     YES: Proceed to step 4
     NO: Proceed to step 3
3. Adjusting component
   - Adjust gear-shift position sensor according to Transmission Position Switch/Sensor found under Powertrain Management.
   - Then continue with step 17



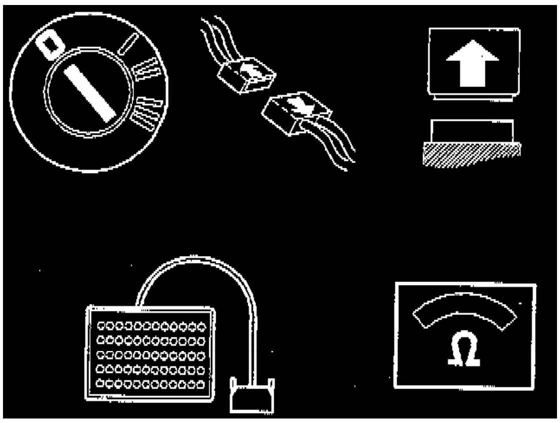
4. Checking gear-shift position sensor ground terminal

   NOTE: The gear-shift position sensor is grounded via its two retaining screws and its mating surface with the transmission.

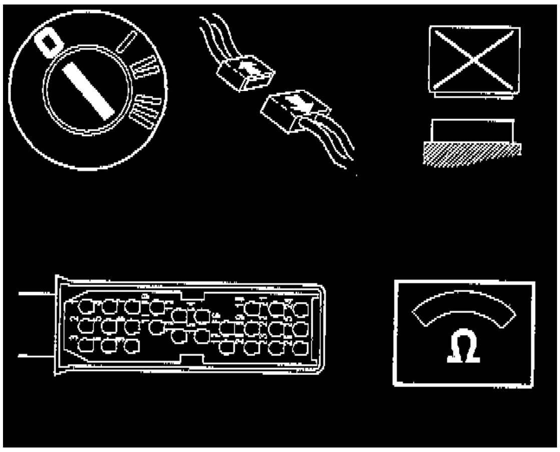
   - Preparation:
     Ignition OFF
   - Connect an ohmmeter between gear-shift position sensor casing and transmission housing.
   - The ohmmeter should read approx. **0 Ohms**
   - If reading is OK:
     Proceed to step 6
   - If reading is incorrect:
     Proceed to step 5



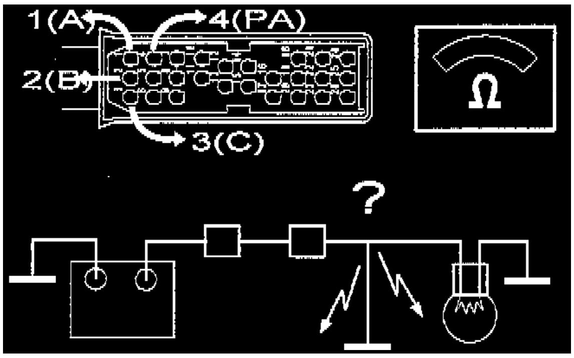
5. Remedying gear-shift position sensor ground terminal
   - Remedy gear-shift position sensor ground terminal.
   - Check gear-shift position sensor adjustment after corrective action according to Transmission Position Switch/Sensor found under Powertrain Management.
   - Then continue with step 17



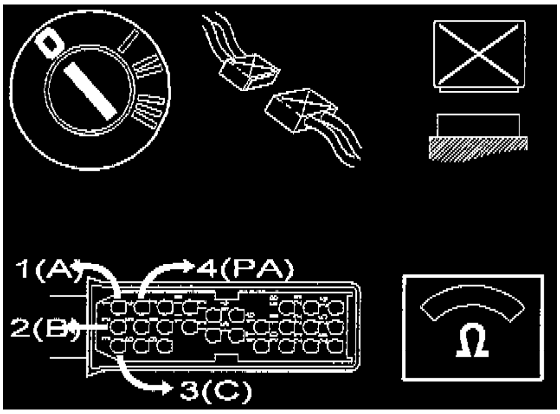
6. Connecting the test box
   - Preparation:
     Ignition OFF
     Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 7



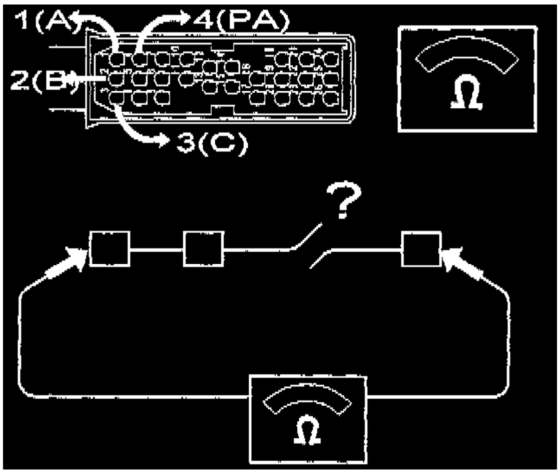
7. Checking signal cable resistance to ground
   - Preparation:
     Ignition OFF
     Disconnect the transmission connector.
     Test box connected
     Transmission Control Module **(TCM)** disconnected
   - Connect ohmmeter between test box #20 (#A20) and terminal:
     #3 (#A3) "A"
     #4 (#A4) "B"
     #5 (#A5) "C"
     #6 (#As) "PA"
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step9
   - If reading is incorrect:
     Proceed to step8



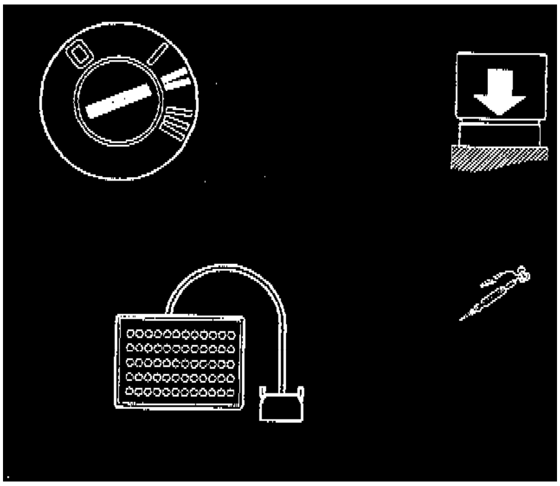
8. Checking for short-circuit to ground
   - Check cable between transmission connector (TCM side) terminal:
     1 and TCM #3 "A"
     2 and TCM #4 "B"
     3 and TCM #5 "C"
     4 and TCM #6 "PA" for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 17



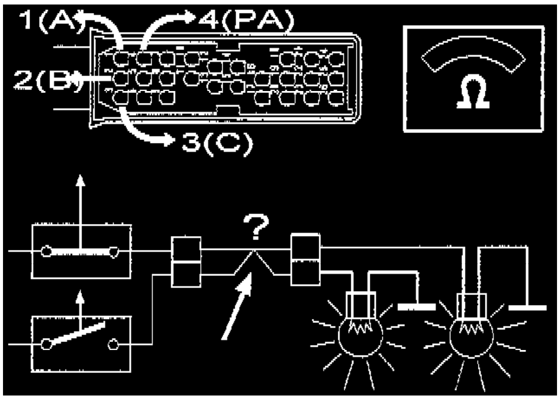
9. Checking signal cable resistance
   - Preparation:
     Ignition OFF
     Disconnect transmission connector
   - Connect an ohmmeter between transmission connector (TCM side) terminal:
     1 and test box #3 (#As) "A"
     2 and test box #4 (#A4) "B"
     3 and test box #5 (#A5) "C"
     4 and test box #6 (#A6) "PA"
   - The ohmmeter should read approx. **0 Ohms** for all readings.
   - If reading is OK:
     Proceed to step 11
   - If reading is incorrect:
     Proceed to step 10



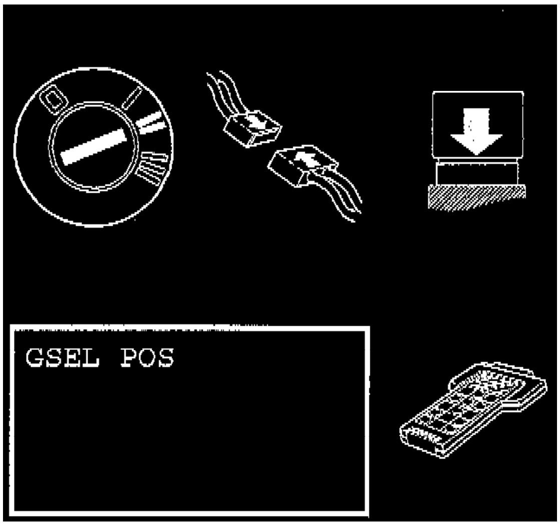
10. Checking for an open-circuit
    - Check cable between transmission connector terminal:
      1 and TCM #3 "A"
      2 and TCM #4 "B"
      3 and TCM #5 "C"
      4 and TCM #6 "PA"
    - Check for open-circuits according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17



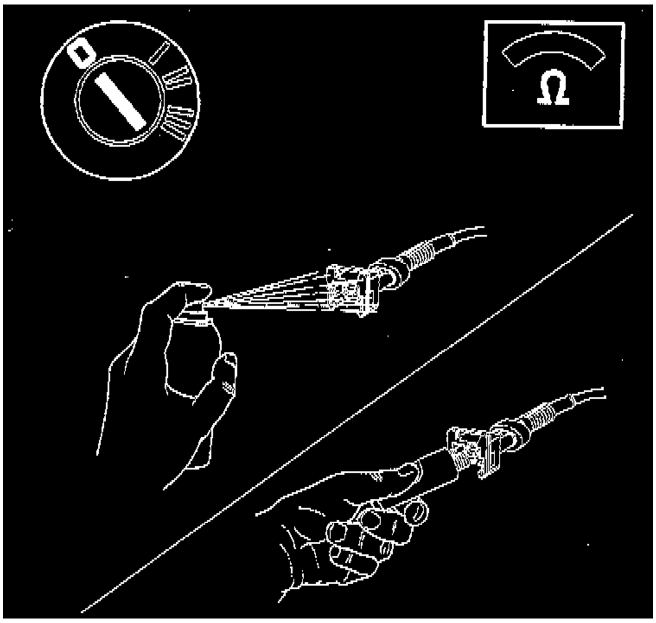
11. Checking for short-circuit to supply voltage in signal cable
    - Preparation:
      Ignition OFF
      Connect TCM
      Ignition ON
    - Connect an test light (bulb at least 3 watt) between test box #A20 (#A20) and:
      #3 (#A3) "A"
      #4 (#A4) "B"
      #5 (#As) "C"
      #6 (#A6) "PA"
    - Did the bulb light?
      YES: Proceed to step 12
      NO: Proceed to step 13



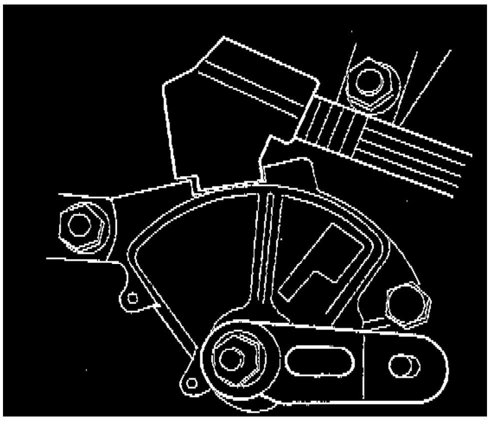
12. Checking for short-circuit to supply voltage
    - Check cable between transmission connector terminal:
      1 and TCM #3 "A"
      2 and TCM #4 "B"
      3 and TCM #5 "C"
      4 and TCM #6 "PA"
    - Check for a short-circuit to supply voltage according to BBA4.
    - Then continue with step 16



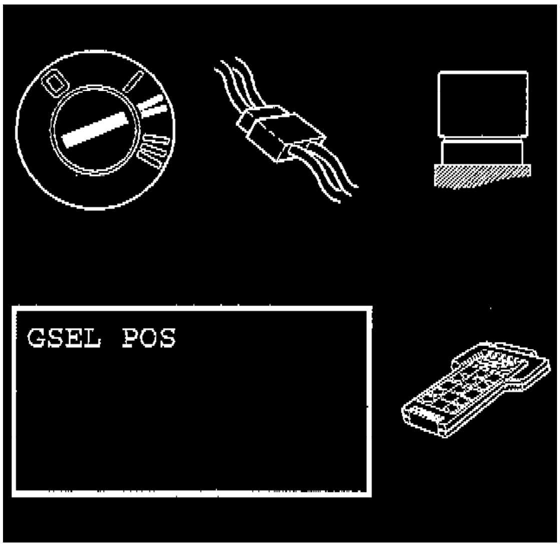
13. Checking gear-shift position sensor operation
    - Preparation:
      Ignition OFF
      Connect transmission connector.
      Connect TCM
      Ignition ON
      Go into scrolling values.
      Read gear-shift position sensor position.
      Move the gear-shift position sensor to all shift positions a number of times, and repeatedly select the same position to check the operation of the gear-shift position sensor.
    - Are all values OK?
    - If reading is OK:
      Proceed to step 14
    - If reading is incorrect:
      Proceed to step 15



14. Remedy contact resistance and oxidation
    - Preparation:
      Ignition OF
    - The Diagnostic Trouble Code **(DTC)** was caused by poor contact in the TCM and transmission connectors
    - Check connectors for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 17



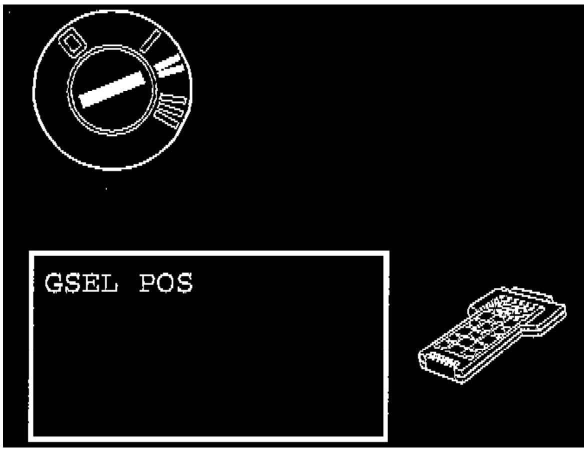
15. Replacing component
    - Try a new gear-shift position sensor, refer to Transmission Position Switch/Sensor found under Powertrain Management.
    - Then continue with step 17



16. Checking gear-shift position sensor

    NOTE: The gear-shift position sensor can break if the signal cable has been short-circuited to supply voltage

    - Check the gear position sensor as follows.
    - Preparation:
      Ignition OFF
      Connect transmission connector.
      TCM connected.
    - Ignition ON
    - Select scrolling values.
    - Read gear-shift position sensor position.
    - Move the gear selector to all shift positions a number of times, and repeatedly select the same position to check the operation of the gear-shift position sensor.
    - Are all values OK?
      YES: Fault corrected
      NO: Proceed to step 15

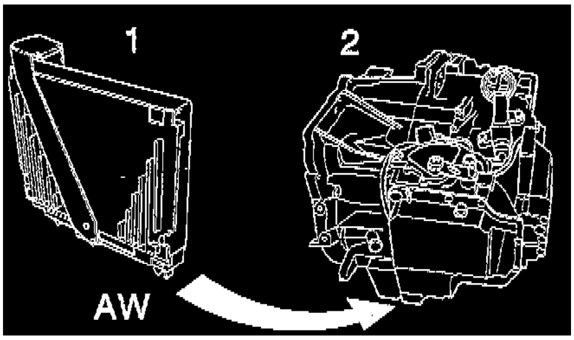


17. Verification
    - After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:
      Ignition OFF
      Reinstall components, components etc.
      Ignition ON
      Select scrolling values.
      Read gear-shift position sensor position.
      Move the gear selector to all shift positions a number of times, and repeatedly select the same position to check the operation of the gear selector.
    - Are all values OK?
      YES: Fault corrected
      NO: Proceed to step 18
18. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
      YES: Fault not corrected
      NO: Proceed to step 1

19. Intermittent fault
    - Preparation:
      Ignition OFF
    - Check that the gear-shift position sensor is securely attached.
    - Check control module and transmission connectors and gear-shift position sensor ground terminal for:
      Loose connections according to step 5 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
      Contact resistance and oxidation according to step 6 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Check the cables between the gear-shift position sensor and TCM for:
      An intermittent open-circuit according to step 2 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
      An intermittent short-circuit to ground according to step 3 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
      An intermittent short-circuit to supply voltage according to step 4 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Then continue with step 20
20. Fault-tracing information

- For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.
- Do you want to repeat fault-tracing?
  YES: Proceed to step 1
  NO: Operation done

Trouble Code Conditions



SPECIAL TOOLS
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION
The Transmission Control Module **(TCM)** calculates the ratio between the transmission input speed and the vehicle speed. There is a specific ratio for each gear. Diagnostic Trouble Codes **(DTCs)** AT-321, AT-322, AT323 or AT-324 are posted if the TCM registers a deviation of more than 10% in these ratios, depending on the gear. Oil temperature must be above +20°C and throttle position above 3%.

SUBSTITUTE VALUE
The TCM limp-home program has been initiated.

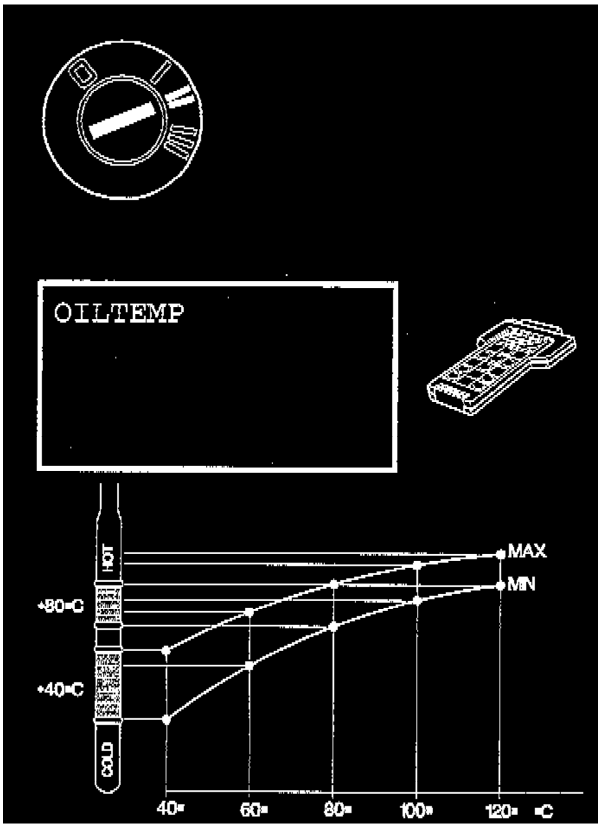
POSSIBLE SOURCE
- Interference with or faulty transmission speed sensor signal
- Interference with faulty Vehicle Speed Sensor **(VSS)** signal
- Contact resistance in the Solenoid S1 and S2 circuits.
- Gear-shift position sensor incorrectly adjusted
- Transmission oil level too low.
- Mechanical fault in the transmission. Worn components in the transmission causing slippage or reduced system pressure.
- Defective power ground
- Transmission speed sensor signal cable (-) short circuited to ground.

FAULT SYMPTOM(S)
- The combined instrument panel warning lamp flashes.
- Mechanical malfunction. Faults are usually indicated by noise or other obvious function problems.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

NOTE:
- The Motronic 4.4 Engine Control Module **(ECM)** posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request
- Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE
- Start fault-tracing at incorrect gear ratio. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-321 Incorrect Gear Ratio/Incorrect Gear Ratio

Incorrect Gear Ratio



SPECIAL TOOLS

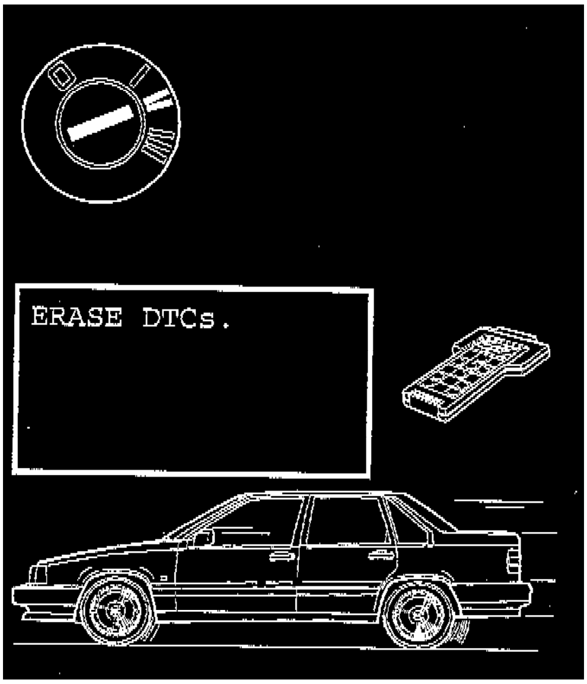
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

INCORRECT GEAR RATIO

1. Checking transmission oil level
   - Preparation:
     Ignition ON
   - Select scrolling values.
   - Read off oil temperature.
   - Check transmission oil, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
     Check level at different temperatures.
   - Is level OK?
     YES: Proceed to step 3
     NO: Proceed to step 2
2. Checking for oil leakage
   - Check for oil leaks
   - Remedy as necessary.
   - Top up oil to correct level, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection

     NOTE: Driving the car with low oil level may have damaged the transmission. Test drive car to ensure that the transmission is OK.

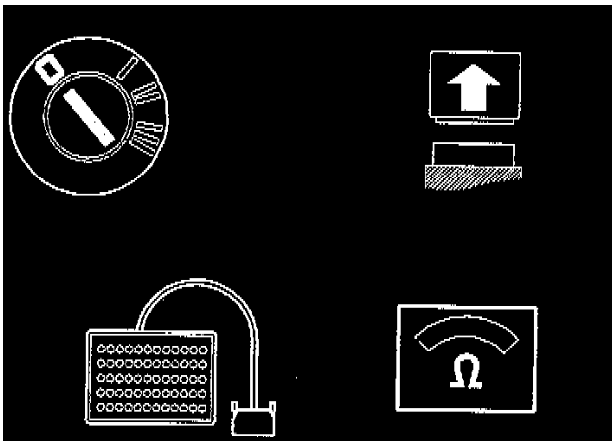
   - Then continue with step 32



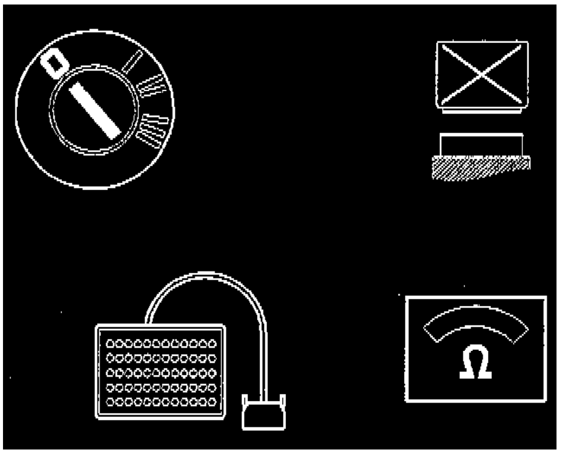
3. Checking for mechanical faults in the transmission.
   - Preparation:
     Ignition ON
     Note Diagnostic Trouble Code **(DTC)** frozen values.
     Erase (DTCs.
   - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
   - Repeat the driving conditions in force when the DTC was posted.
   - Watch the automatic transmission warning light.
   - If the warning lamp starts flashing a DTC has been stored.
   - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

   NOTE:
     - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the Transmission Control Module **(TCM)** activates the emergency "Limp Home" program.
     - The transmission will not then operate normally. See "Limp Home" under Emergency Programs. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation

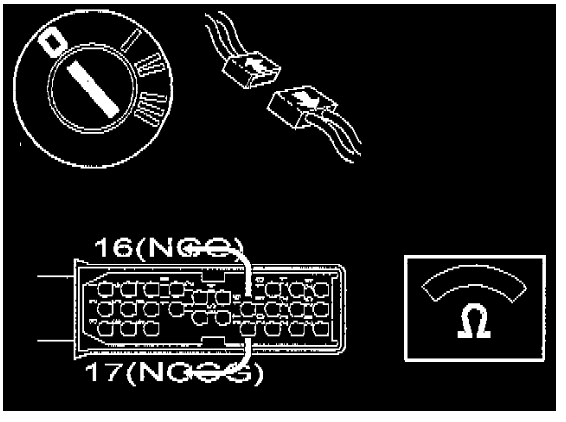
   - Is the transmission exhibiting any obvious mechanical faults or making any noises?
     YES: Proceed to step 4
     NO: Proceed to step 5
4. Fault-tracing information, refer to Mechanical Malfunction Symptom Tables. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
   - Then continue with step 37



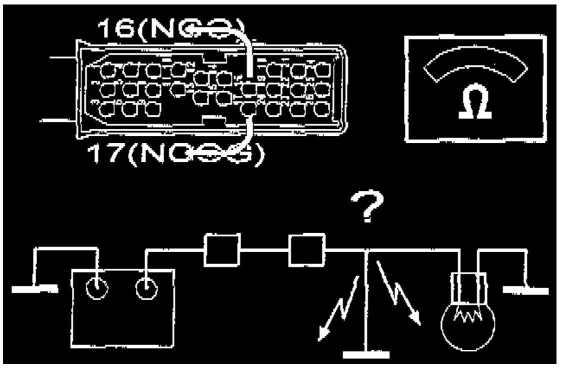
5. Connecting the test box
   - Preparation:
     Ignition OFF
   - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 6



6. Checking transmission speed sensor signal cable (-)
   - Preparation:
     Ignition OFF
     TCM disconnected.
   - Use an ohmmeter to measure between #2 (#A2) and #20 (#A20) on the test box.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 7

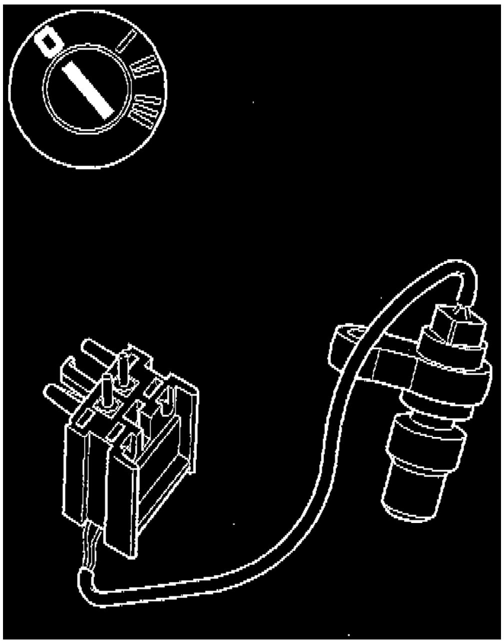


7. Checking transmission speed sensor
   - Preparation:
     Ignition OFF
     Disconnect the transmission connector.
   - Connect an ohmmeter between transmission connector terminal 17 (transmission speed sensor side) and ground.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 8
   - If reading is incorrect:
     Proceed to step 9

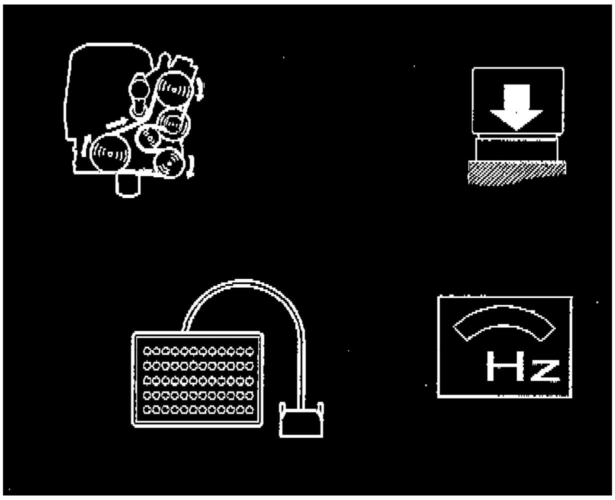


8. Checking for a short-circuit
   - Check cable between transmission connector terminal 17 and TCM #A2 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults

- Then continue with step 37



9. Replacing component
   - Preparation:
     Ignition OFF
   - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
   - Then continue with step 37



10. Checking signal from transmission speed sensor
    - Preparation:
      Ignition OFF
      Connect TCM
      Connect a multimeter (frequency meter) between #1 (#A1) and #2 (#A2) on the test box.
      Raise car so that front wheels can rotate freely.
      Engine idling.
      A/C turned off.
      Move the gear selector to position D so the front wheels begin to rotate.
      Increase Engine Speed **(RPM)** to 2,000 rpm.
      Keep RPM constant at 2,000 rpm.

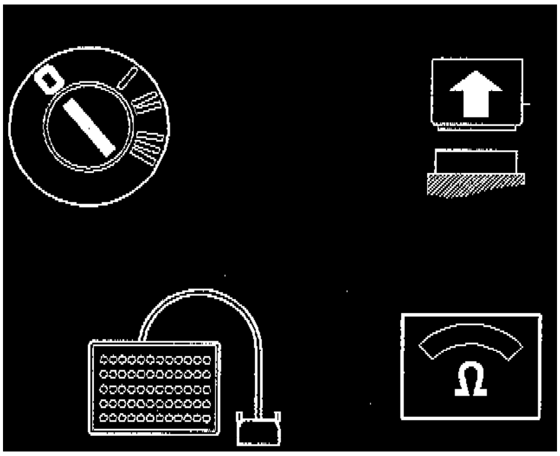
    NOTE:
    - When the rear wheels are stationary and the front wheels rotate DTCs may can be stored in the ABS system.
    - Erase any DTCs stored in the ABS system after fault-tracing.
    - Refer to Brakes and Traction Control

    - The multimeter should give a stable reading (Hz) when the engine speed is constant and the transmission is not shifting.

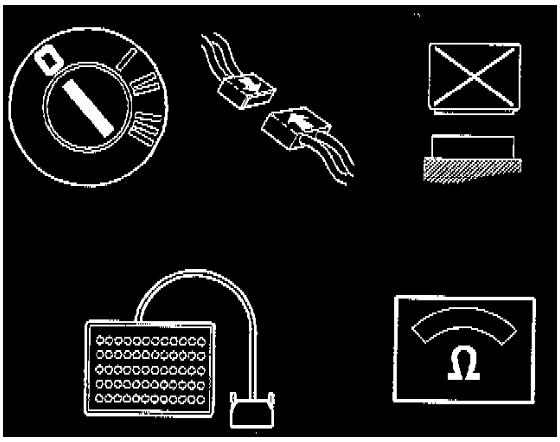
    NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

    - Is the frequency stable?

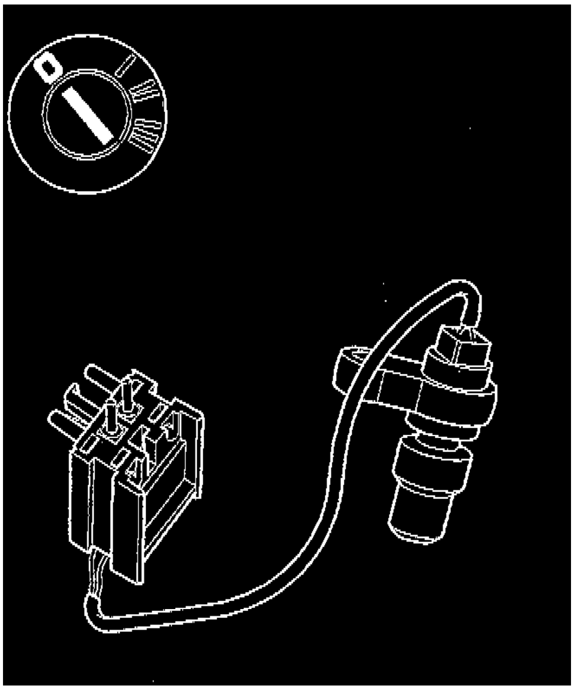
YES: Proceed to step 16
NO: Proceed to step 11



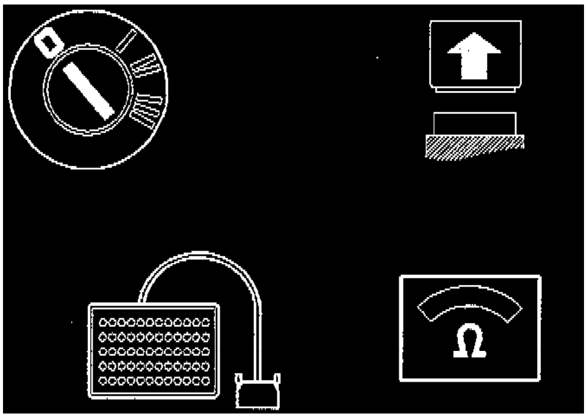
11. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect transmission control module (TCM) Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 12
    - If reading is incorrect:
      Proceed to step 13
12. Checking for sources of interference
    - Check that the transmission speed sensor wiring is not too near sources of interference, such as electric motors, ignition cables, mobile telephone cables etc.
    - Then continue with step 32



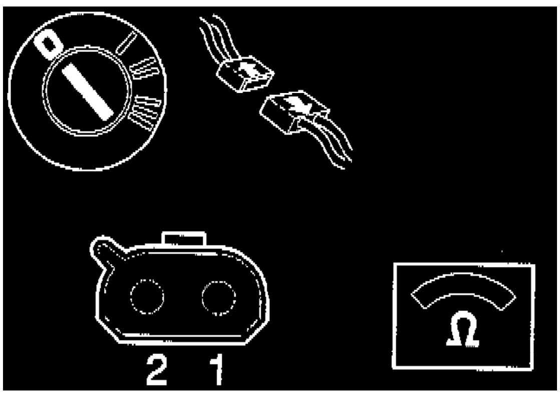
13. Checking the transmission connector
    - Preparation:
      Ignition OFF
      TCM disconnected.
      Disconnect the transmission connector.
      Check TCM connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission connector.
    - Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 14
    - If reading is incorrect:
      Proceed to step 15
14. Fault-tracing information
    - The DTC was caused by poor contact in the transmission connector.
    - Then continue with step 37



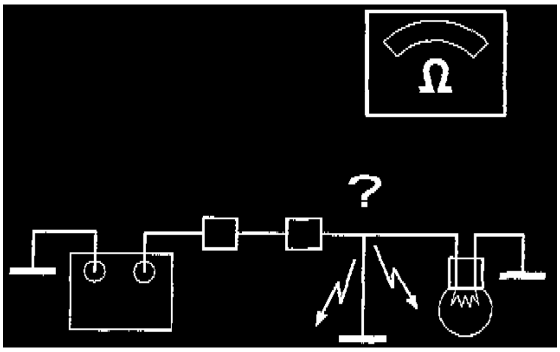
15. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



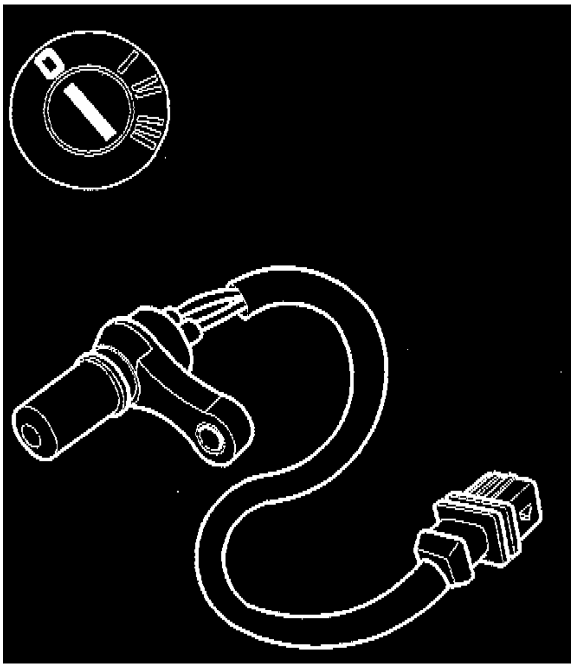
16. Checking transmission speed sensor signal cable (-)
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Use an ohmmeter to measure between #12 (#A12) and #20 (#A20) on the test box.
    - The ohmmeter should read **infinite resistance.**
    - If reading is OK:
      Proceed to step 20
    - If reading is incorrect:
      Proceed to step 17



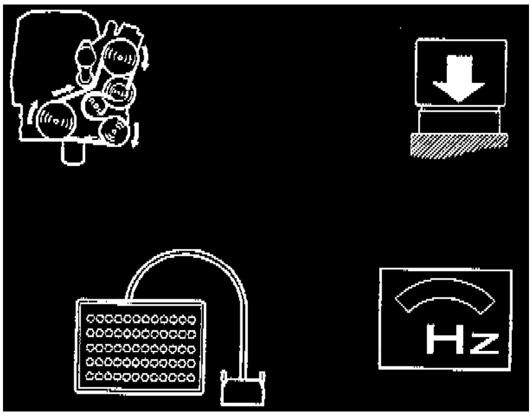
17. Checking transmission speed sensor
    - Preparation:
      Ignition OFF
      Disconnect transmission speed sensor
    - Connect an ohmmeter between transmission speed sensor connector terminal 2 (to transmission speed sensor) and ground.
    - The ohmmeter should read **infinite resistance**
    - If reading is OK:
      Proceed to step 18
    - If reading is incorrect:
      Proceed to step 19



18. Checking for a short-circuit
    - Check cable between transmission speed sensor connector terminal 2 and TCM terminal #A12 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 37



19. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



20. Checking signal from transmission speed sensor

    NOTE: An alternative to the following method is to drive the car on the road.

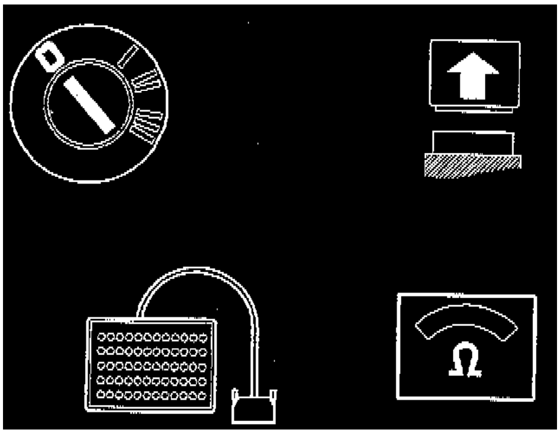
    - Preparation:
      Ignition OFF
      Connect TCM
      Ignition ON
      Raise car so that front wheels hang free
      Connect a multimeter (frequency meter) between #11 (#A11) and #12 (#A12) on the test box.
      Engine idling.
      Move the gear selector to position D so the front wheels start to rotate
    - Increase engine speed (RPM) to 2,000 rpm and keep engine speed constant.

      NOTE:
      - When the rear wheels are stationary and the front wheels rotate diagnostic trouble codes (DTCs) may can be stored in the ABS system.
      - Erase any diagnostic trouble codes (DTCs) stored in the ABS system after fault-tracing.
      - Refer to Brakes and Traction Control

    - The multimeter should give a stable reading (Hz) when the speed is constant.

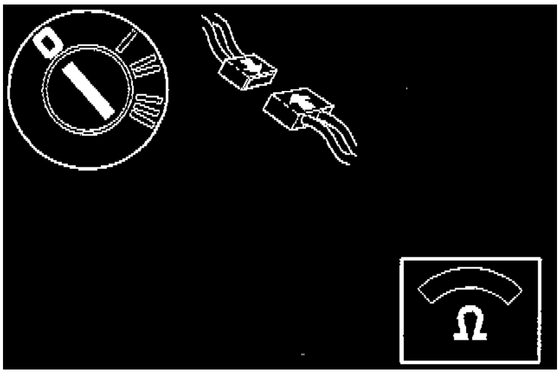
      NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

    - Is the frequency stable?
      YES: Proceed to step 26
      NO: Proceed to step 21

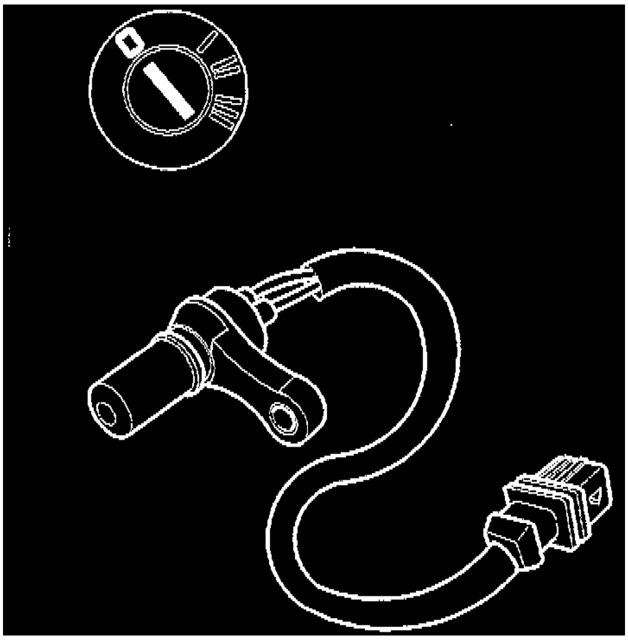


21. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 22
    - If reading is incorrect:
      Proceed to step 23
22. Checking for sources of interference
    - Check that the transmission speed sensor cables are not too near sources of interference, such as electric motors, ignition cables, mobile

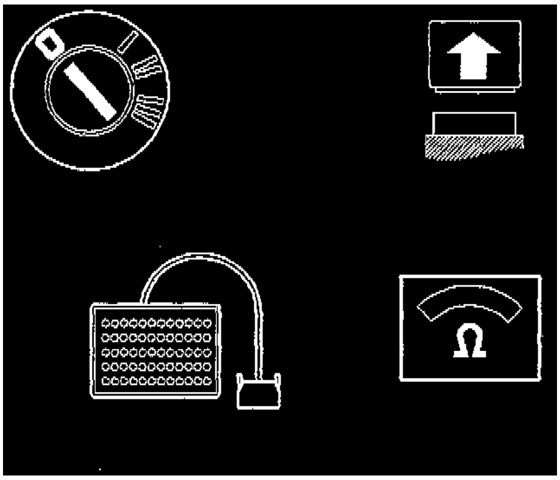
telephone cables etc and that the transmission speed sensor is not loose.
- Then continue with step 32



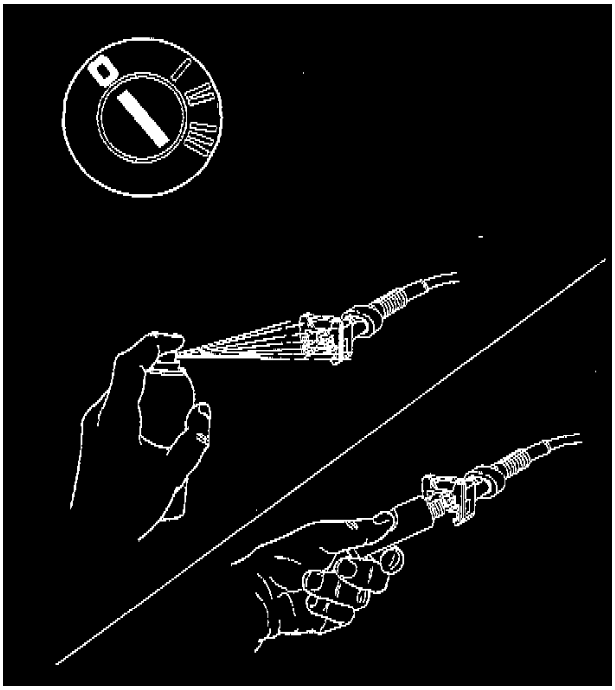
23. Checking transmission speed sensor connector
    - Preparation:
      Ignition OFF
    - Check transmission speed sensor connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission speed sensor connector.
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 24
    - If reading is incorrect:
      Proceed to step 25
24. Fault-tracing information
    - The cause of the DTC has been loose connections in the transmission speed sensor connector.
    - Then continue with step 37



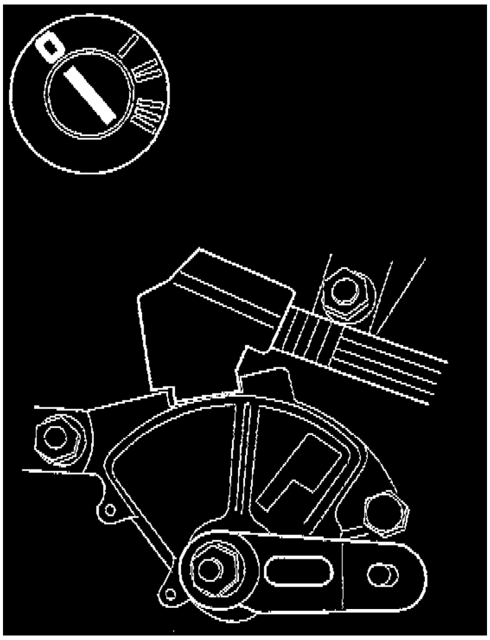
25. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



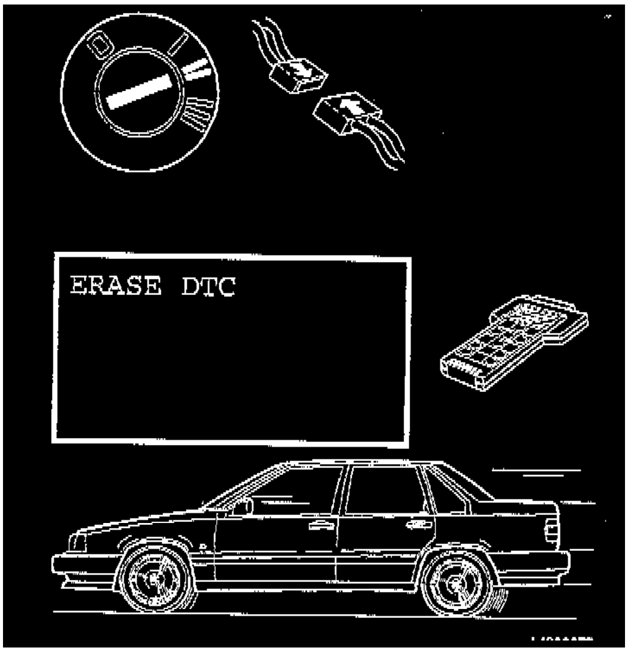
26. Checking resistance in solenoid S1 and S2 circuits
    - Preparation:
        Ignition OFF
        Disconnect TCM
    - Connect an ohmmeter between the test box terminals:
        #27 (#A27) and #29 (#A29), solenoid S1
        #28 (#A28) and #29 (#A29), solenoid S2
    - The ohmmeter should read **12-18 Ohms**
    - If reading is OK:
        Proceed to step 28
    - If reading is incorrect:
        Proceed to step 27



27. Checking for contact resistance and oxidation.
    - Preparation:
        Ignition OFF Check transmission connector for contact resistance and oxidation according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 32



28. Checking gear-shift position sensor
    - Preparation:
      Ignition OFF Check gear-shift position sensor adjustment. refer to Powertrain Management.
    - Is adjustment OK?
      YES: Proceed to step 29
      NO: Proceed to step 31

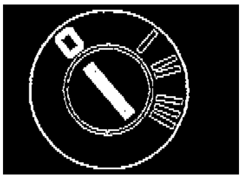


29. Checking the transmission control module
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
      Gear selector in position L, speed approx. 30 km/h (1st gear).
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
      Gear selector in position 3, speed approx. 60 km/h.
      Move gear selector to position L so that 2nd gear is engaged.
      Accelerate evenly (engine speed (RPM) over 1400 rpm).
    - DTC AT-323:
      Gear selector in position 3, speed approx. 60 km/h.
      Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:

Gear selector in position D, speed approx. 80 km/h.
Maintain throttle opening at approx. 10%.
Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

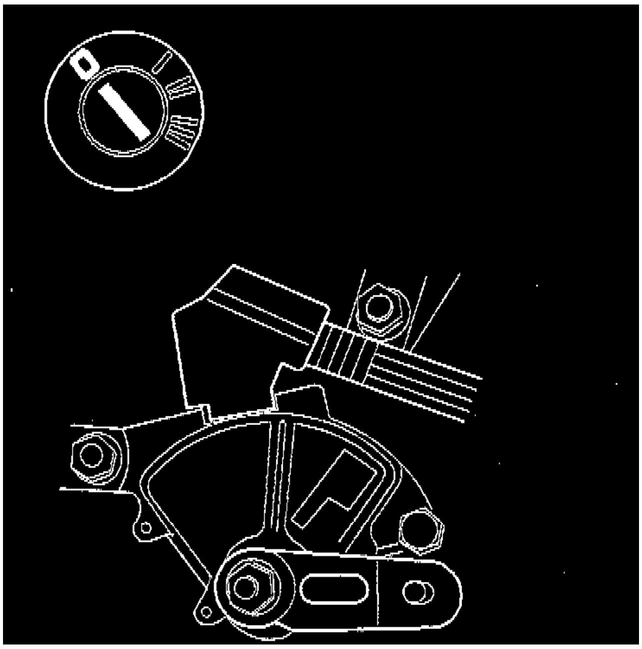
- Stop car
- Check to see if the DTC has been stored again.
- Has the diagnostic trouble code (DTC) been stored again?

  YES: Proceed to step 30
  NO: Proceed to step 32



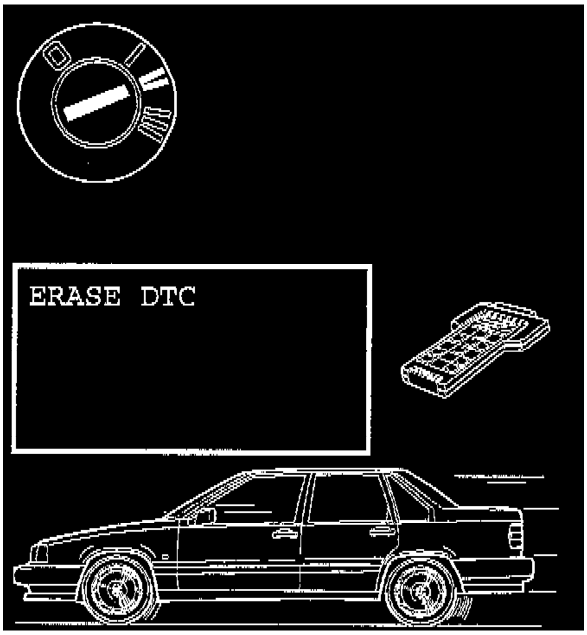
30. Replacing component
    - Preparation:

      Ignition OFF
    - Try a new transmission control module, refer to Replacement. See: Transmission Control Systems/Relays and Modules - Transmission and Drivetrain/Relays and Modules - A/T/Control Module/Service and Repair
    - Then continue with step 33



31. Adjusting gear-shift position sensor.
    - Preparation:

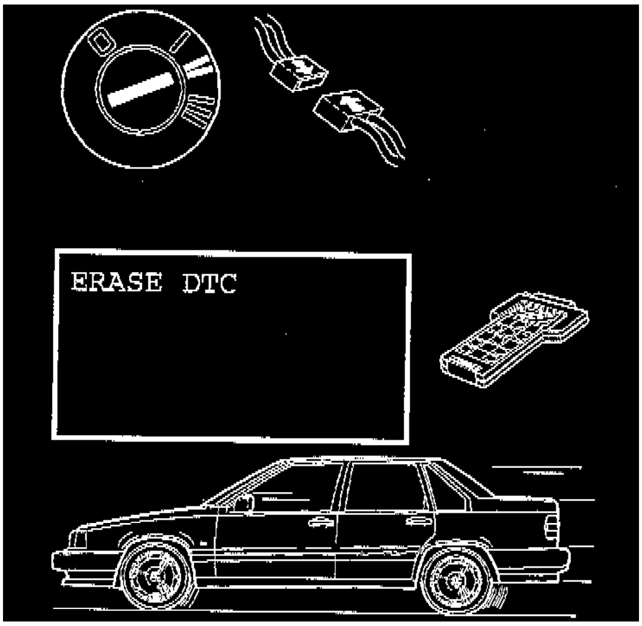
      Ignition OFF
    - Adjust gear-shift position sensor, refer to Powertrain Management.
    - Then continue with step 32



32. Test driving
    - Preparation:
      Ignition ON
      Erase DTCs
    - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
    - Repeat the driving conditions in force when the DTC was posted.
    - Watch the automatic transmission warning light.
    - If the warning lamp starts flashing a DTC has been stored.
    - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

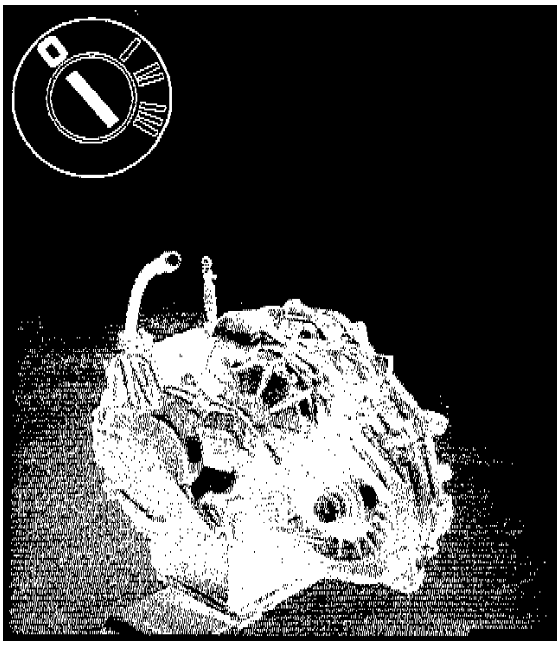
    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for"Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation
    - Is the transmission exhibiting any obvious mechanical faults or making any noises?

      YES: Proceed to step 34
      NO: Proceed to step 35

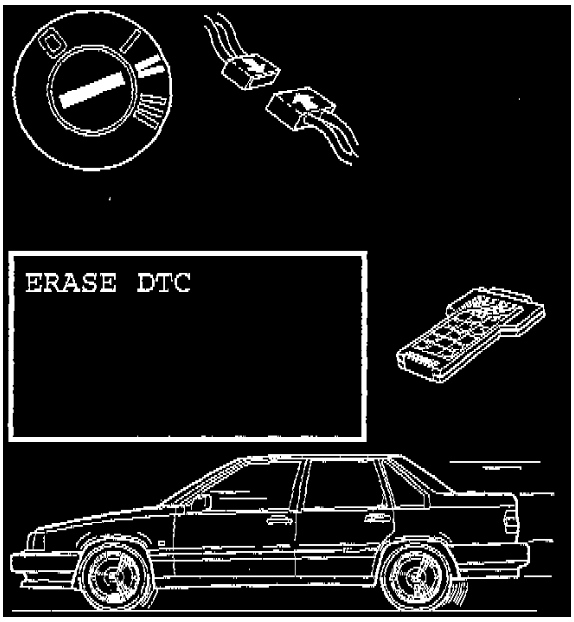


33. Checking component
    - Preparation:
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.

- DTC AT-321:
  Gear selector in position L, speed approx. 30 km/h (1st gear).
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-322:
  Gear selector in position 3, speed approx. 60 km/h.
  Move gear selector to position L so that 2nd gear is engaged.
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-323:
  Gear selector in position 3, speed approx. 60 km/h.
  Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-324:
  Gear selector in position D, speed approx. 80 km/h.
  Maintain throttle opening at approx. 10%.
  Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)
- Stop car
- Check to see if the DTC has been stored again
- Has the DTC been stored again?
  YES: Proceed to step 34
  NO: Proceed to step 36



34. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission according, refer to Replacement. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair
    - Then continue with step 37
35. Fault-tracing information
    - Transmission is OK.
    - Fault corrected
36. Fault-tracing information
    - Old control module was defective.
    - Fault corrected

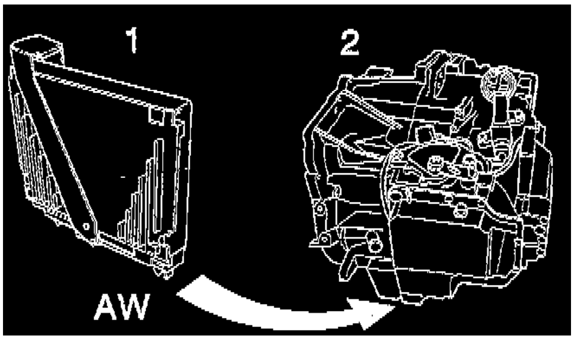


37. Verification
    - After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Ignition ON
      Erase DTCs
    - Test drive the car
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
      Gear selector in position L, speed approx. 30 km/h (1st gear).
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
      Gear selector in position 3, speed approx. 60 km/h.
      Move gear selector to position L so that 2nd gear is engaged.
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-323:
      Gear selector in position 3, speed approx. 60 km/h
      Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:
      Gear selector in position D, speed approx. 80 km/h
      Maintain throttle opening at approx. 10%
      Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for "Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair

    - Stop car.
    - The DTC does not recur and the transmission is not exhibiting operating faults?
    - If reading is OK:
      Fault corrected
    - If reading is incorrect:
      Proceed to step 38
38. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
      YES: Fault not corrected
      NO: Proceed to step 1

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

The Transmission Control Module **(TCM)** calculates the ratio between the transmission input speed and the vehicle speed. There is a specific ratio for each gear. Diagnostic Trouble Codes **(DTCs)** AT-321, AT-322, AT323 or AT-324 are posted if the TCM registers a deviation of more than 10% in these ratios, depending on the gear. Oil temperature must be above +20°C and throttle position above 3%.

SUBSTITUTE VALUE

The TCM limp-home program has been initiated.

POSSIBLE SOURCE

- Interference with or faulty transmission speed sensor signal
- Interference with faulty Vehicle Speed Sensor **(VSS)** signal
- Contact resistance in the Solenoid S1 and S2 circuits.
- Gear-shift position sensor incorrectly adjusted
- Transmission oil level too low.
- Mechanical fault in the transmission. Worn components in the transmission causing slippage or reduced system pressure.
- Defective power ground
- Transmission speed sensor signal cable (-) short circuited to ground.

FAULT SYMPTOM(S)

- The combined instrument panel warning lamp flashes.
- Mechanical malfunction. Faults are usually indicated by noise or other obvious function problems.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

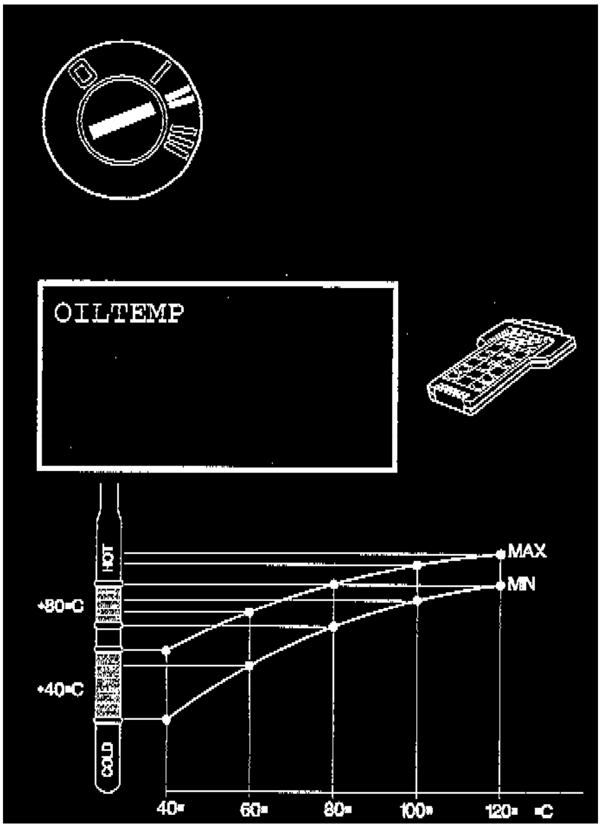
NOTE:

- The Motronic 4.4 Engine Control Module **(ECM)** posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request
- Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at incorrect gear ratio. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-324 Incorrect Gear Ratio/Testing

Incorrect Gear Ratio



SPECIAL TOOLS

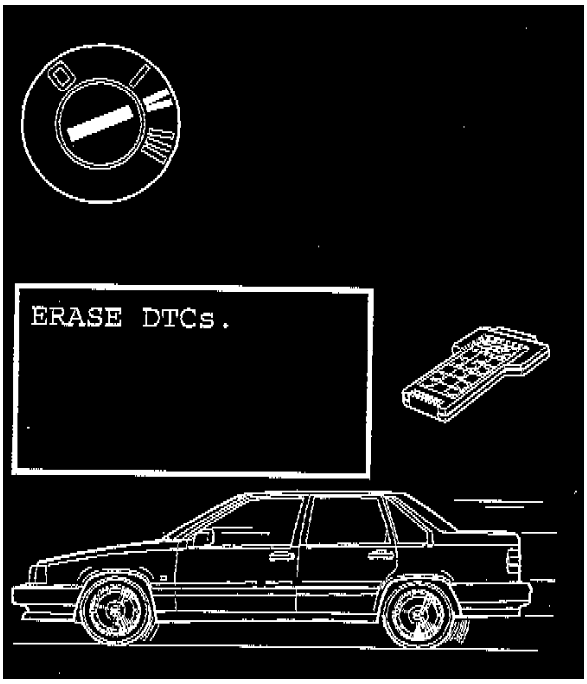
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

INCORRECT GEAR RATIO

1. Checking transmission oil level
   - Preparation:
     Ignition ON
   - Select scrolling values.
   - Read off oil temperature.
   - Check transmission oil, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
     Check level at different temperatures.
   - Is level OK?
     YES: Proceed to step 3
     NO: Proceed to step 2
2. Checking for oil leakage
   - Check for oil leaks
   - Remedy as necessary.
   - Top up oil to correct level, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection

     NOTE: Driving the car with low oil level may have damaged the transmission. Test drive car to ensure that the transmission is OK.

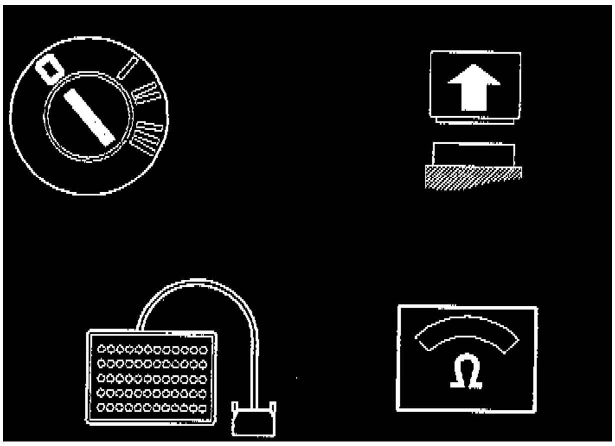
   - Then continue with step 32



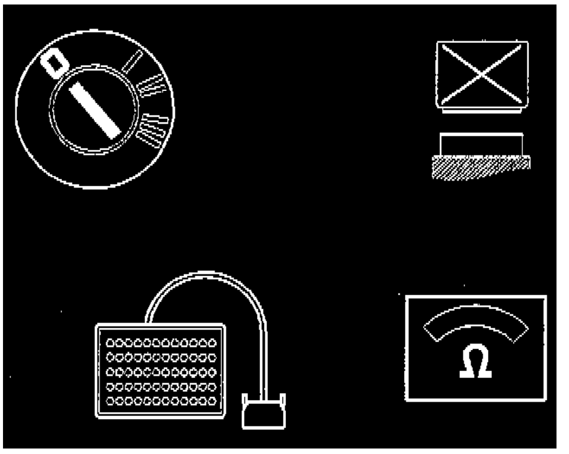
3. Checking for mechanical faults in the transmission.
   - Preparation:
     Ignition ON
     Note Diagnostic Trouble Code **(DTC)** frozen values.
     Erase (DTCs.
   - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
   - Repeat the driving conditions in force when the DTC was posted.
   - Watch the automatic transmission warning light.
   - If the warning lamp starts flashing a DTC has been stored.
   - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

     NOTE:
     - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the Transmission Control Module **(TCM)** activates the emergency "Limp Home" program.
     - The transmission will not then operate normally. See "Limp Home" under Emergency Programs. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation

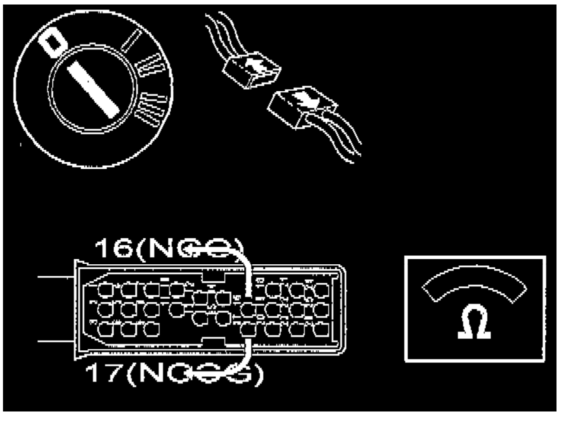
   - Is the transmission exhibiting any obvious mechanical faults or making any noises?
     YES: Proceed to step 4
     NO: Proceed to step 5
4. Fault-tracing information, refer to Mechanical Malfunction Symptom Tables. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
   - Then continue with step 37



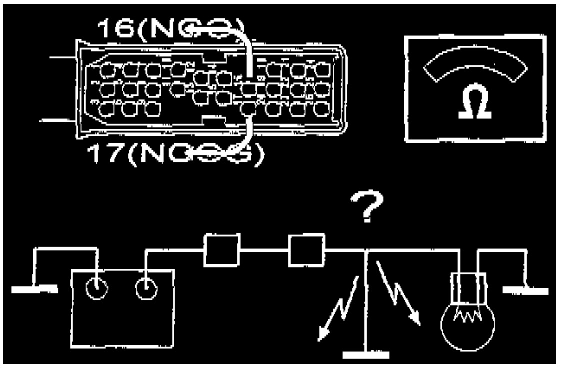
5. Connecting the test box
   - Preparation:
     Ignition OFF
   - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 6



6. Checking transmission speed sensor signal cable (-)
   - Preparation:
     Ignition OFF
     TCM disconnected.
   - Use an ohmmeter to measure between #2 (#A2) and #20 (#A20) on the test box.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 7

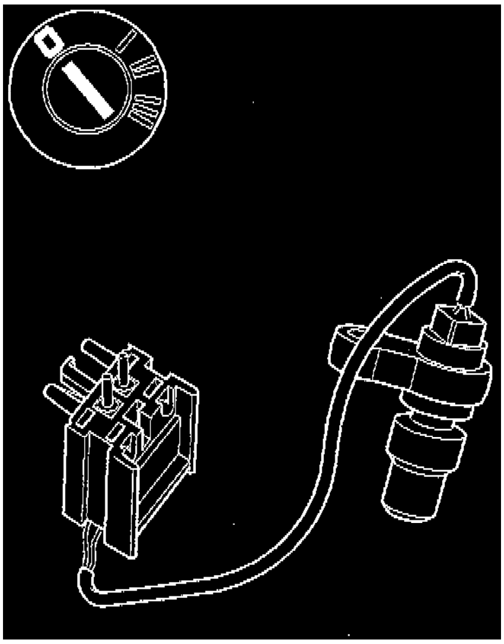


7. Checking transmission speed sensor
   - Preparation:
     Ignition OFF
     Disconnect the transmission connector.
   - Connect an ohmmeter between transmission connector terminal 17 (transmission speed sensor side) and ground.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 8
   - If reading is incorrect:
     Proceed to step 9

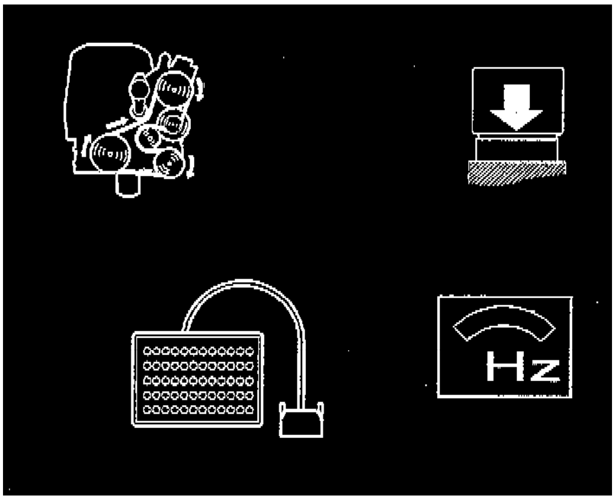


8. Checking for a short-circuit
   - Check cable between transmission connector terminal 17 and TCM #A2 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults

- Then continue with step 37



9. Replacing component
   - Preparation:
     Ignition OFF
   - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
   - Then continue with step 37



10. Checking signal from transmission speed sensor
    - Preparation:
      Ignition OFF
      Connect TCM
      Connect a multimeter (frequency meter) between #1 (#A1) and #2 (#A2) on the test box.
      Raise car so that front wheels can rotate freely.
      Engine idling.
      A/C turned off.
      Move the gear selector to position D so the front wheels begin to rotate.
      Increase Engine Speed **(RPM)** to 2,000 rpm.
      Keep RPM constant at 2,000 rpm.

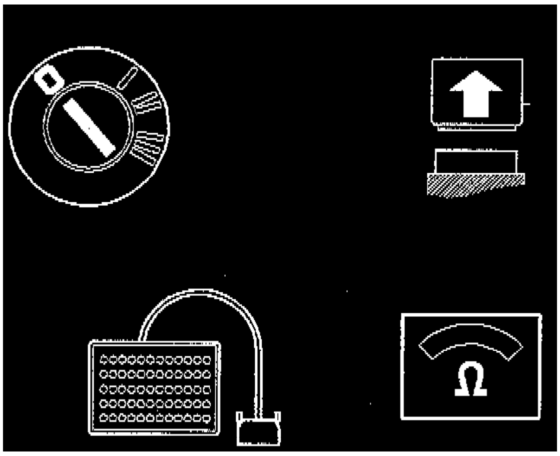
    NOTE:
    - When the rear wheels are stationary and the front wheels rotate DTCs may can be stored in the ABS system.
    - Erase any DTCs stored in the ABS system after fault-tracing.
    - Refer to Brakes and Traction Control

    - The multimeter should give a stable reading (Hz) when the engine speed is constant and the transmission is not shifting.

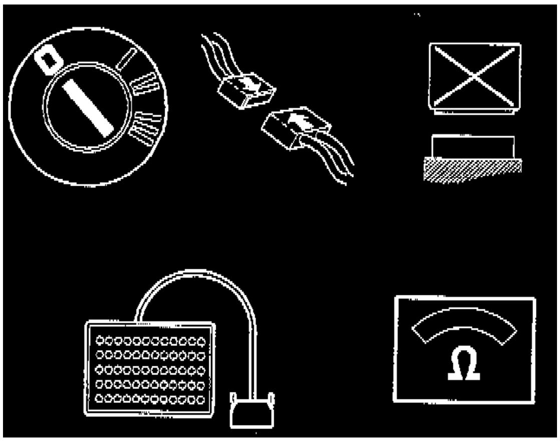
    NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

    - Is the frequency stable?

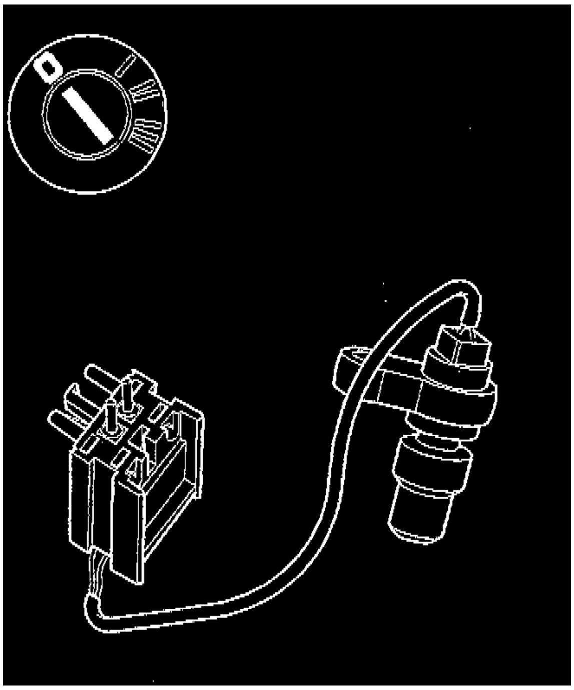
YES: Proceed to step 16
NO: Proceed to step 11



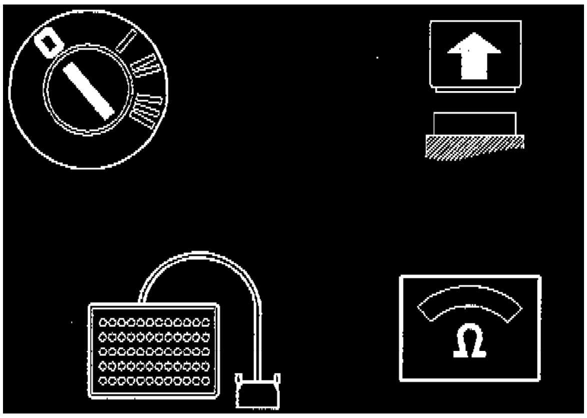
11. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect transmission control module (TCM) Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 12
    - If reading is incorrect:
      Proceed to step 13
12. Checking for sources of interference
    - Check that the transmission speed sensor wiring is not too near sources of interference, such as electric motors, ignition cables, mobile telephone cables etc.
    - Then continue with step 32



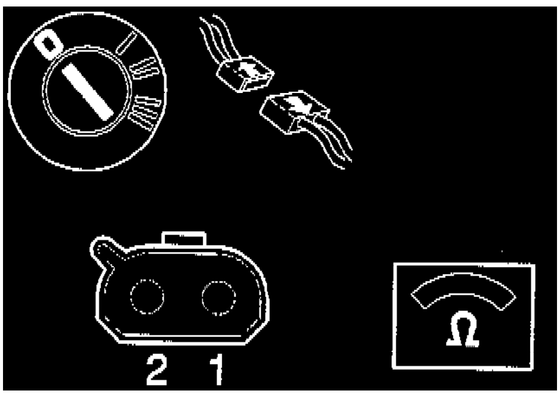
13. Checking the transmission connector
    - Preparation:
      Ignition OFF
      TCM disconnected.
      Disconnect the transmission connector.
      Check TCM connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission connector.
    - Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 14
    - If reading is incorrect:
      Proceed to step 15
14. Fault-tracing information
    - The DTC was caused by poor contact in the transmission connector.
    - Then continue with step 37



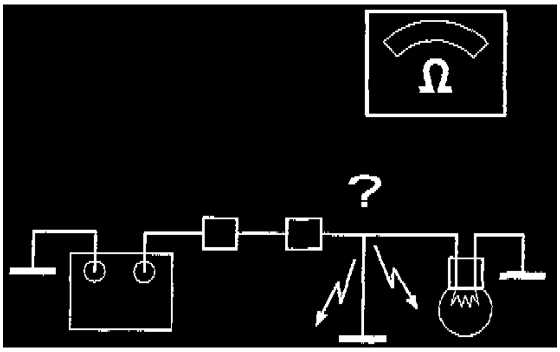
15. Replacing component
    - Preparation:
        Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



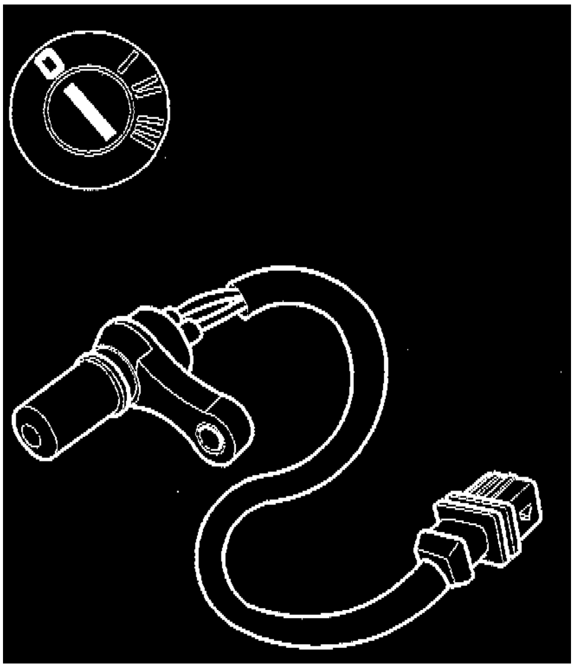
16. Checking transmission speed sensor signal cable (-)
    - Preparation:
        Ignition OFF
        Disconnect TCM
    - Use an ohmmeter to measure between #12 (#A12) and #20 (#A20) on the test box.
    - The ohmmeter should read **infinite resistance.**
    - If reading is OK:
        Proceed to step 20
    - If reading is incorrect:
        Proceed to step 17



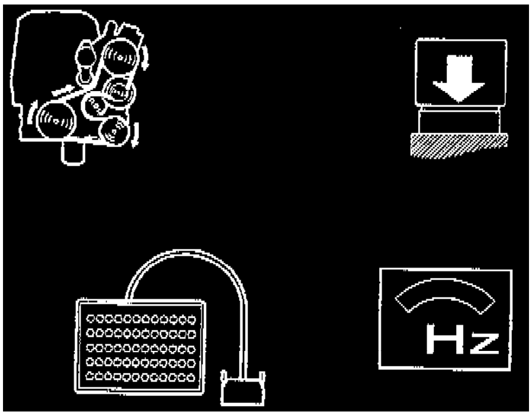
17. Checking transmission speed sensor
    - Preparation:
      Ignition OFF
      Disconnect transmission speed sensor
    - Connect an ohmmeter between transmission speed sensor connector terminal 2 (to transmission speed sensor) and ground.
    - The ohmmeter should read **infinite resistance**
    - If reading is OK:
      Proceed to step 18
    - If reading is incorrect:
      Proceed to step 19



18. Checking for a short-circuit
    - Check cable between transmission speed sensor connector terminal 2 and TCM terminal #A12 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 37



19. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



20. Checking signal from transmission speed sensor

    NOTE: An alternative to the following method is to drive the car on the road.

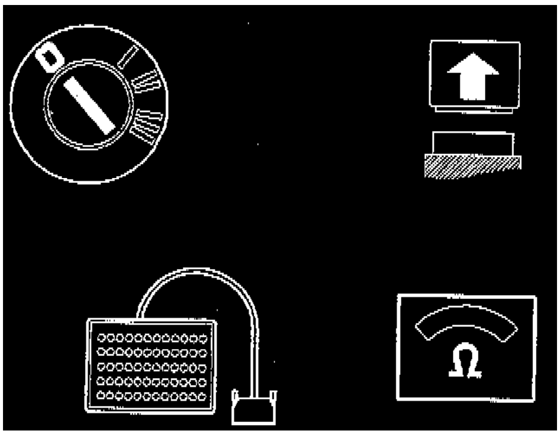
    - Preparation:
      Ignition OFF
      Connect TCM
      Ignition ON
      Raise car so that front wheels hang free
      Connect a multimeter (frequency meter) between #11 (#A11) and #12 (#A12) on the test box.
      Engine idling.
      Move the gear selector to position D so the front wheels start to rotate
    - Increase engine speed (RPM) to 2,000 rpm and keep engine speed constant.

      NOTE:
      - When the rear wheels are stationary and the front wheels rotate diagnostic trouble codes (DTCs) may can be stored in the ABS system.
      - Erase any diagnostic trouble codes (DTCs) stored in the ABS system after fault-tracing.
      - Refer to Brakes and Traction Control

    - The multimeter should give a stable reading (Hz) when the speed is constant.

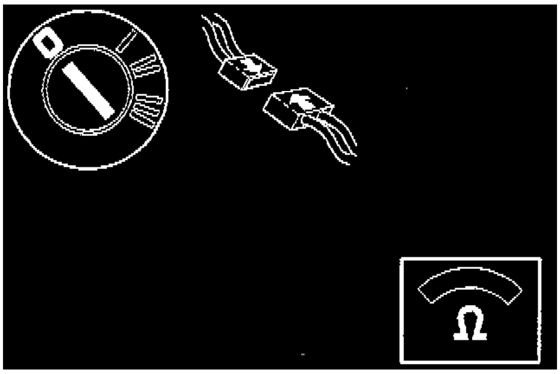
      NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

    - Is the frequency stable?
      YES: Proceed to step 26
      NO: Proceed to step 21

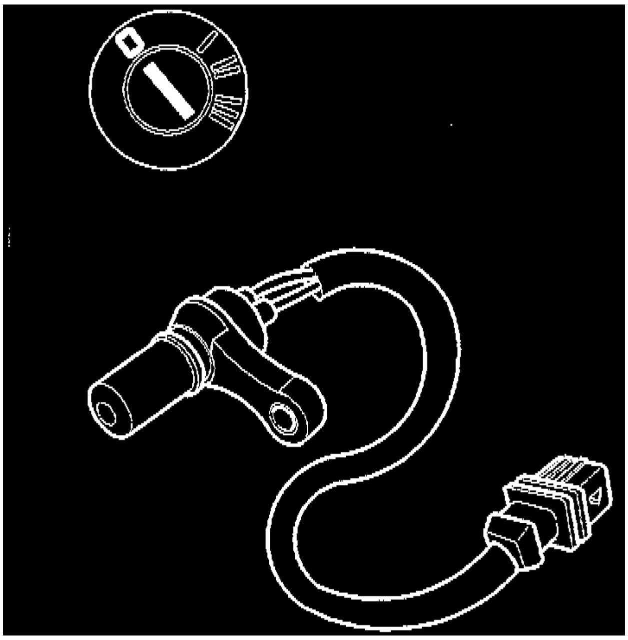


21. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 22
    - If reading is incorrect:
      Proceed to step 23
22. Checking for sources of interference
    - Check that the transmission speed sensor cables are not too near sources of interference, such as electric motors, ignition cables, mobile

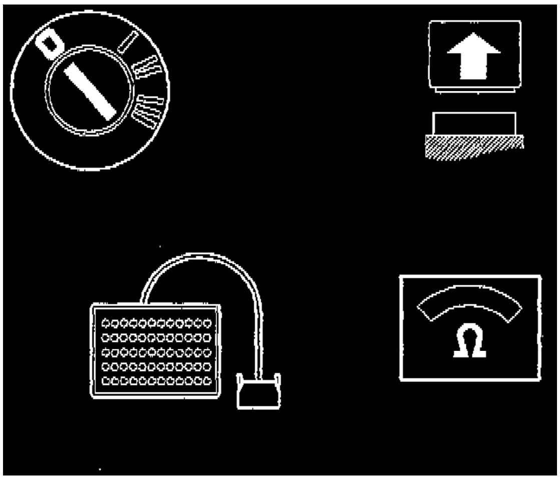
telephone cables etc and that the transmission speed sensor is not loose.
- Then continue with step 32



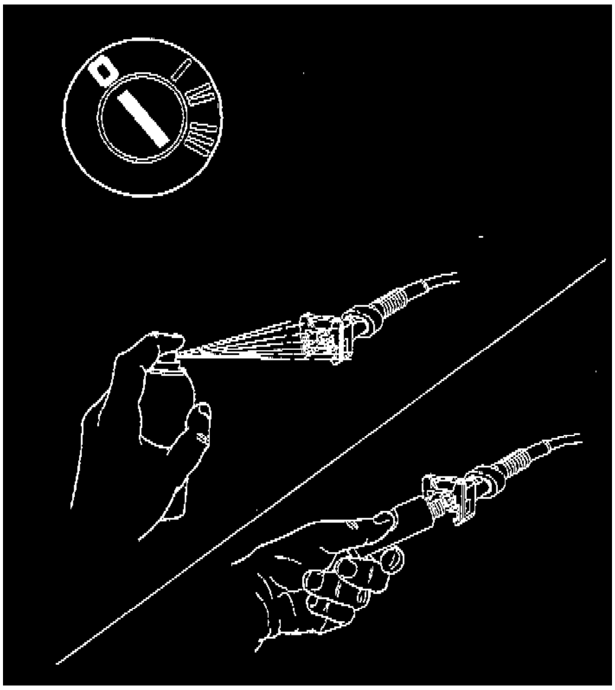
23. Checking transmission speed sensor connector
    - Preparation:
      Ignition OFF
    - Check transmission speed sensor connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission speed sensor connector.
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 24
    - If reading is incorrect:
      Proceed to step 25
24. Fault-tracing information
    - The cause of the DTC has been loose connections in the transmission speed sensor connector.
    - Then continue with step 37



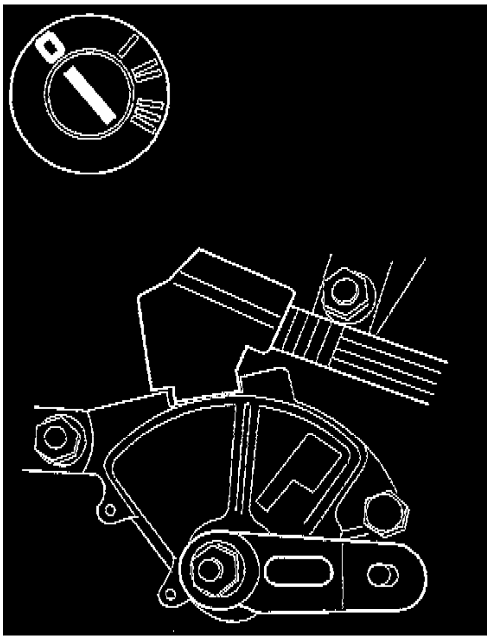
25. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



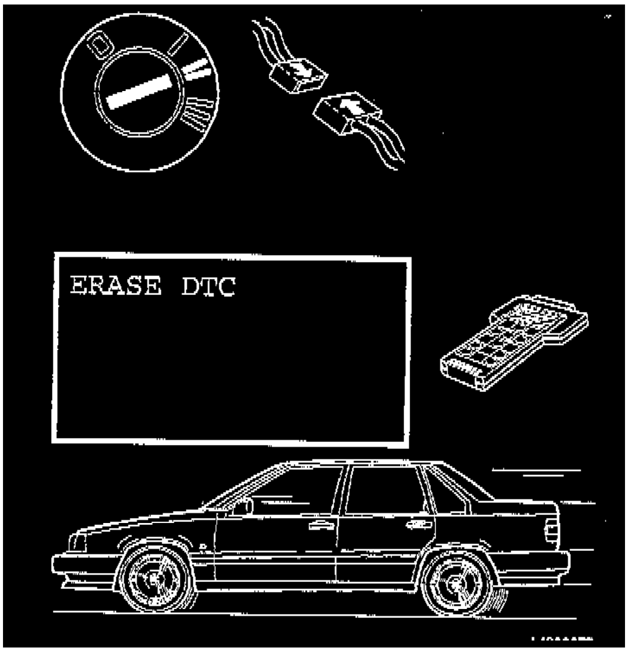
26. Checking resistance in solenoid S1 and S2 circuits
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between the test box terminals:
      #27 (#A27) and #29 (#A29), solenoid S1
      #28 (#A28) and #29 (#A29), solenoid S2
    - The ohmmeter should read **12-18 Ohms**
    - If reading is OK:
      Proceed to step 28
    - If reading is incorrect:
      Proceed to step 27



27. Checking for contact resistance and oxidation.
    - Preparation:
      Ignition OFF Check transmission connector for contact resistance and oxidation according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 32



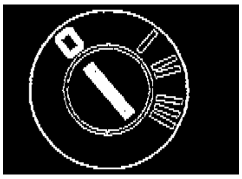
28. Checking gear-shift position sensor
    - Preparation:
      Ignition OFF Check gear-shift position sensor adjustment. refer to Powertrain Management.
    - Is adjustment OK?
      YES: Proceed to step 29
      NO: Proceed to step 31



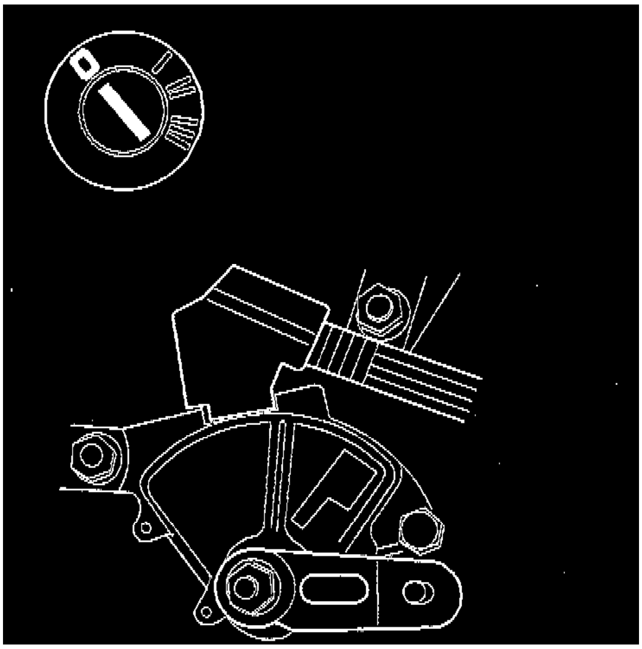
29. Checking the transmission control module
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
      Gear selector in position L, speed approx. 30 km/h (1st gear).
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
      Gear selector in position 3, speed approx. 60 km/h.
      Move gear selector to position L so that 2nd gear is engaged.
      Accelerate evenly (engine speed (RPM) over 1400 rpm).
    - DTC AT-323:
      Gear selector in position 3, speed approx. 60 km/h.
      Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:

Gear selector in position D, speed approx. 80 km/h.
Maintain throttle opening at approx. 10%.
Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

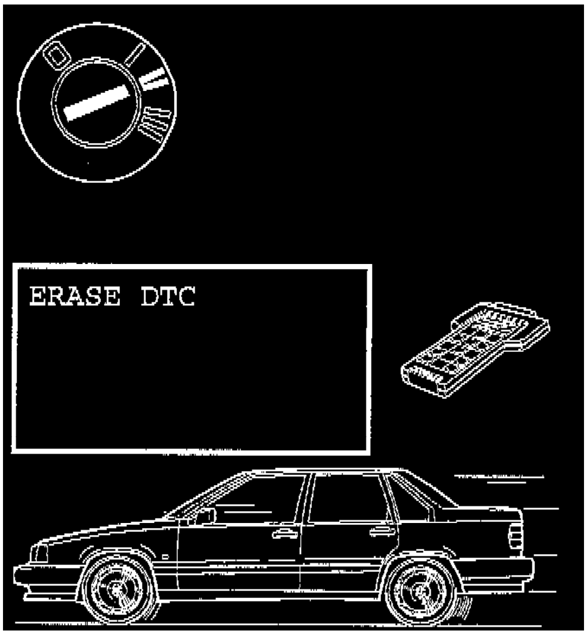
- Stop car
- Check to see if the DTC has been stored again.
- Has the diagnostic trouble code (DTC) been stored again?
  YES: Proceed to step 30
  NO: Proceed to step 32



30. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission control module, refer to Replacement. See: Transmission Control Systems/Relays and Modules - Transmission and Drivetrain/Relays and Modules - A/T/Control Module/Service and Repair
    - Then continue with step 33



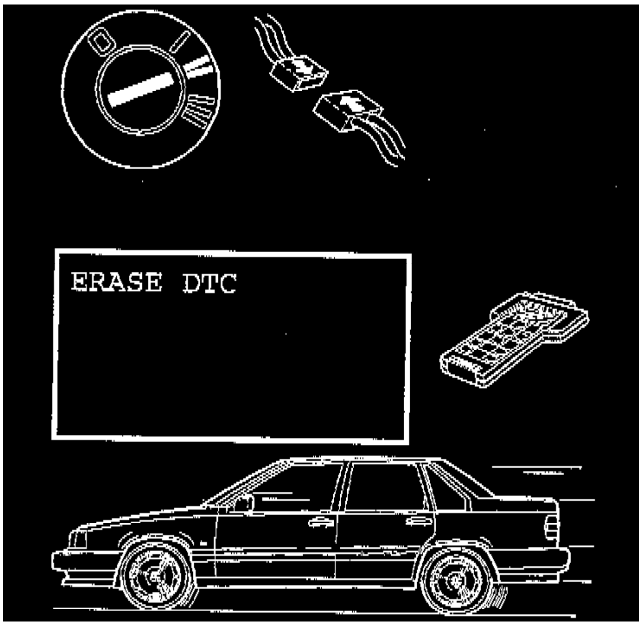
31. Adjusting gear-shift position sensor.
    - Preparation:
      Ignition OFF
    - Adjust gear-shift position sensor, refer to Powertrain Management.
    - Then continue with step 32



32. Test driving
    - Preparation:
      Ignition ON
      Erase DTCs
    - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
    - Repeat the driving conditions in force when the DTC was posted.
    - Watch the automatic transmission warning light.
    - If the warning lamp starts flashing a DTC has been stored.
    - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

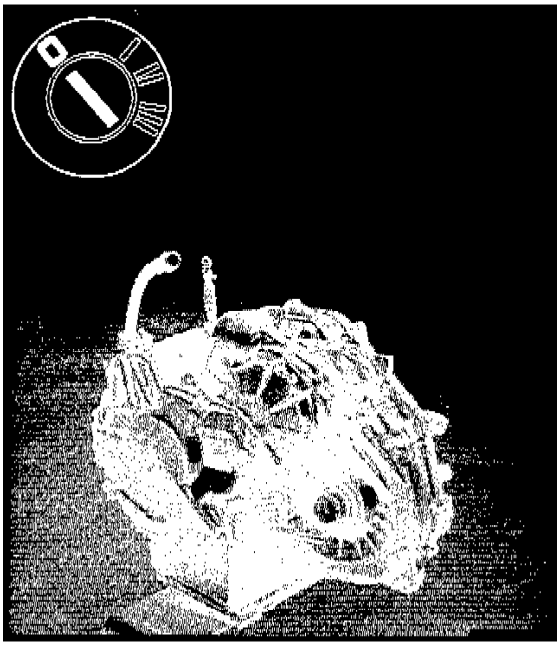
    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for"Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation
    - Is the transmission exhibiting any obvious mechanical faults or making any noises?

      YES: Proceed to step 34
      NO: Proceed to step 35

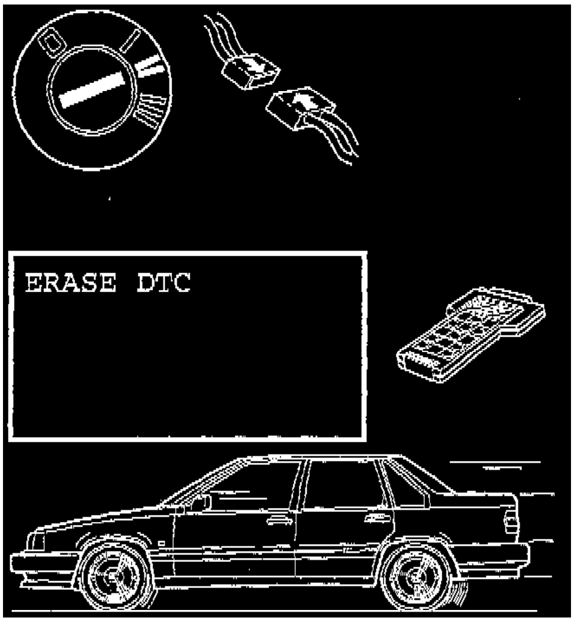


33. Checking component
    - Preparation:
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.

- DTC AT-321:
  Gear selector in position L, speed approx. 30 km/h (1st gear).
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-322:
  Gear selector in position 3, speed approx. 60 km/h.
  Move gear selector to position L so that 2nd gear is engaged.
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-323:
  Gear selector in position 3, speed approx. 60 km/h.
  Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-324:
  Gear selector in position D, speed approx. 80 km/h.
  Maintain throttle opening at approx. 10%.
  Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)
- Stop car
- Check to see if the DTC has been stored again
- Has the DTC been stored again?
  YES: Proceed to step 34
  NO: Proceed to step 36



34. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission according, refer to Replacement. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair
    - Then continue with step 37
35. Fault-tracing information
    - Transmission is OK.
    - Fault corrected
36. Fault-tracing information
    - Old control module was defective.
    - Fault corrected

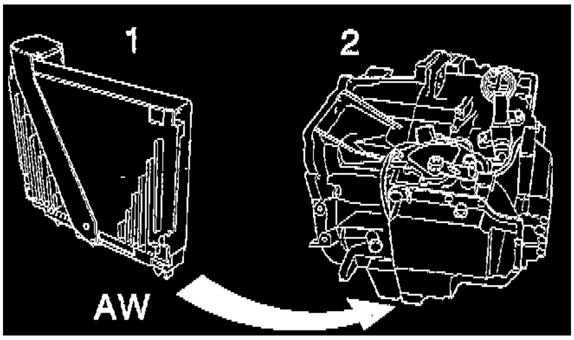


37. Verification
    - After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:
    - Preparation:
        Ignition OFF
        Reconnect connectors, reinstall components etc.
        Ignition ON
        Erase DTCs
    - Test drive the car
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
        Gear selector in position L, speed approx. 30 km/h (1st gear).
        Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
        Gear selector in position 3, speed approx. 60 km/h.
        Move gear selector to position L so that 2nd gear is engaged.
        Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-323:
        Gear selector in position 3, speed approx. 60 km/h
        Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:
        Gear selector in position D, speed approx. 80 km/h
        Maintain throttle opening at approx. 10%
        Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for "Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair

    - Stop car.
    - The DTC does not recur and the transmission is not exhibiting operating faults?
    - If reading is OK:
        Fault corrected
    - If reading is incorrect:
        Proceed to step 38
38. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
        YES: Fault not corrected
        NO: Proceed to step 1

Trouble Code Conditions



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

The Transmission Control Module **(TCM)** calculates the ratio between the transmission input speed and the vehicle speed. There is a specific ratio for each gear. Diagnostic Trouble Codes **(DTCs)** AT-321, AT-322, AT323 or AT-324 are posted if the TCM registers a deviation of more than 10% in these ratios, depending on the gear. Oil temperature must be above +20°C and throttle position above 3%.

SUBSTITUTE VALUE

The TCM limp-home program has been initiated.

POSSIBLE SOURCE

- Interference with or faulty transmission speed sensor signal
- Interference with faulty Vehicle Speed Sensor **(VSS)** signal
- Contact resistance in the Solenoid S1 and S2 circuits.
- Gear-shift position sensor incorrectly adjusted
- Transmission oil level too low.
- Mechanical fault in the transmission. Worn components in the transmission causing slippage or reduced system pressure.
- Defective power ground
- Transmission speed sensor signal cable (-) short circuited to ground.

FAULT SYMPTOM(S)

- The combined instrument panel warning lamp flashes.
- Mechanical malfunction. Faults are usually indicated by noise or other obvious function problems.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

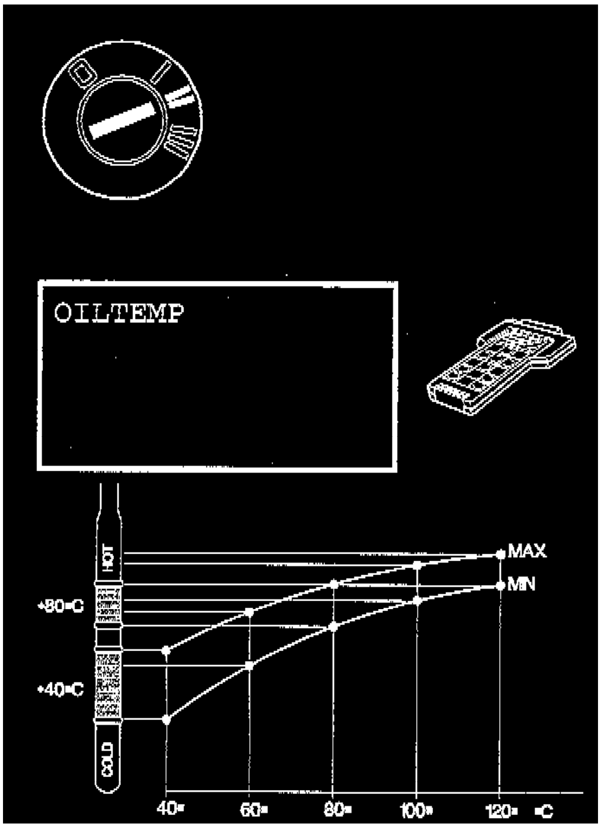
NOTE:

- The Motronic 4.4 Engine Control Module **(ECM)** posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request
- Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at incorrect gear ratio. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-324 Incorrect Gear Ratio/Testing

Incorrect Gear Ratio



SPECIAL TOOLS

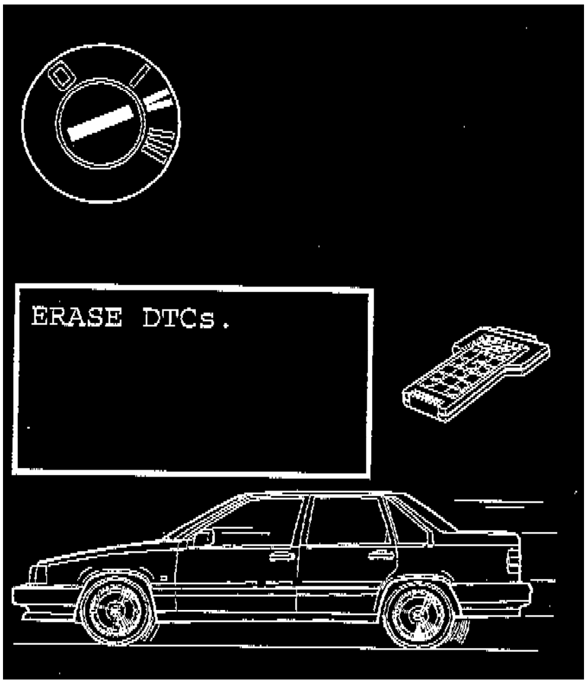
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

INCORRECT GEAR RATIO

1. Checking transmission oil level
   - Preparation:
     Ignition ON
   - Select scrolling values.
   - Read off oil temperature.
   - Check transmission oil, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
     Check level at different temperatures.
   - Is level OK?
     YES: Proceed to step 3
     NO: Proceed to step 2
2. Checking for oil leakage
   - Check for oil leaks
   - Remedy as necessary.
   - Top up oil to correct level, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection

     NOTE: Driving the car with low oil level may have damaged the transmission. Test drive car to ensure that the transmission is OK.

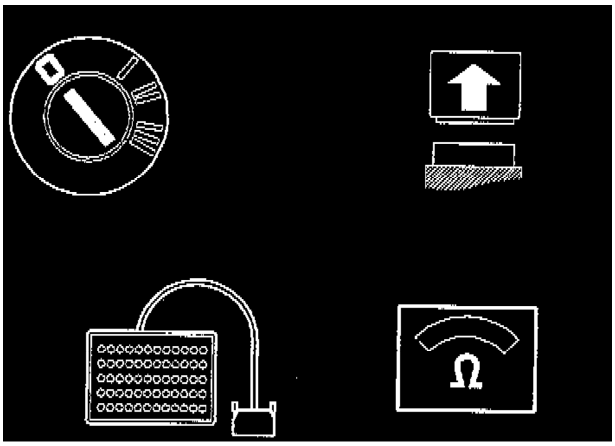
   - Then continue with step 32



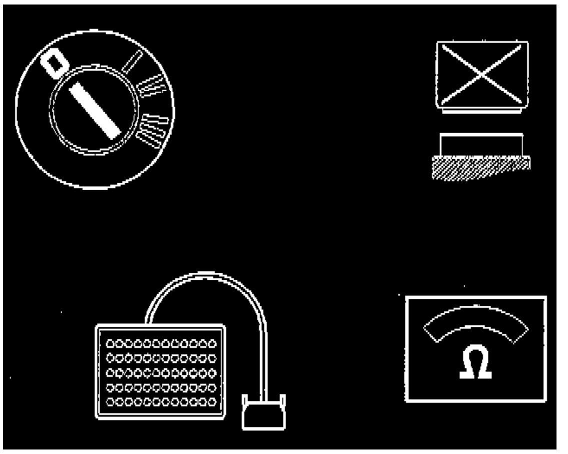
3. Checking for mechanical faults in the transmission.
   - Preparation:
     Ignition ON
     Note Diagnostic Trouble Code **(DTC)** frozen values.
     Erase (DTCs.
   - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
   - Repeat the driving conditions in force when the DTC was posted.
   - Watch the automatic transmission warning light.
   - If the warning lamp starts flashing a DTC has been stored.
   - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

   NOTE:
     - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the Transmission Control Module **(TCM)** activates the emergency "Limp Home" program.
     - The transmission will not then operate normally. See "Limp Home" under Emergency Programs. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation

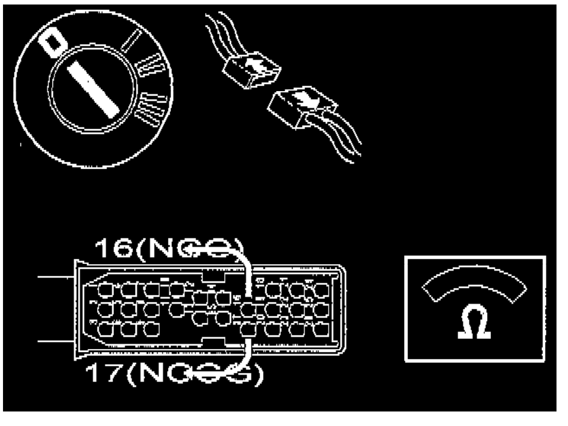
   - Is the transmission exhibiting any obvious mechanical faults or making any noises?
     YES: Proceed to step 4
     NO: Proceed to step 5
4. Fault-tracing information, refer to Mechanical Malfunction Symptom Tables. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
   - Then continue with step 37



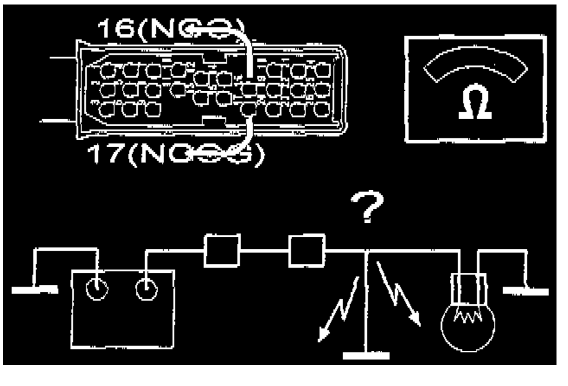
5. Connecting the test box
   - Preparation:
     Ignition OFF
   - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 6



6. Checking transmission speed sensor signal cable (-)
   - Preparation:
     Ignition OFF
     TCM disconnected.
   - Use an ohmmeter to measure between #2 (#A2) and #20 (#A20) on the test box.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 7

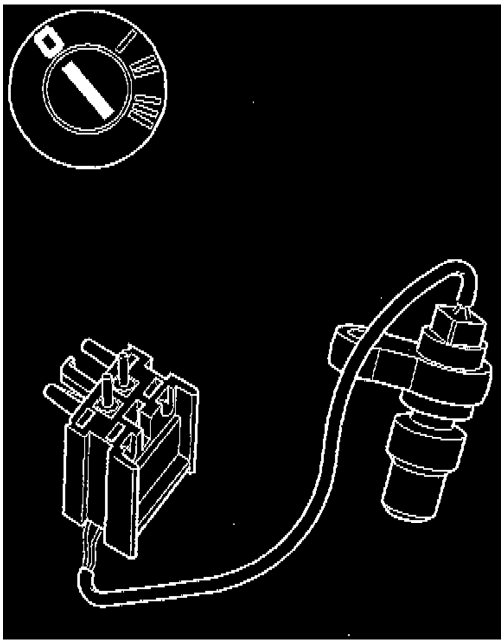


7. Checking transmission speed sensor
   - Preparation:
     Ignition OFF
     Disconnect the transmission connector.
   - Connect an ohmmeter between transmission connector terminal 17 (transmission speed sensor side) and ground.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 8
   - If reading is incorrect:
     Proceed to step 9

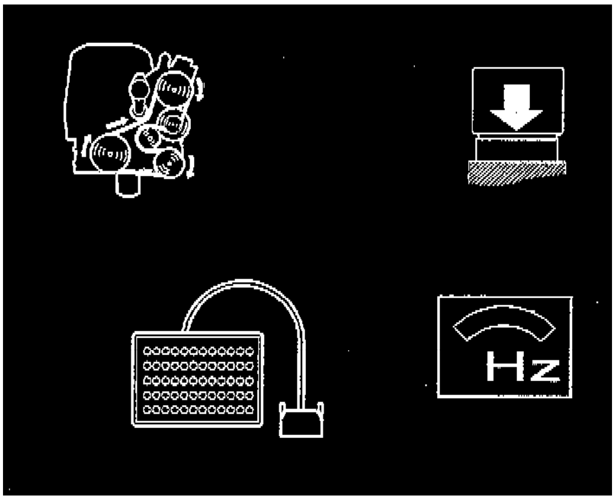


8. Checking for a short-circuit
   - Check cable between transmission connector terminal 17 and TCM #A2 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults

- Then continue with step 37



9. Replacing component
   - Preparation:
     Ignition OFF
   - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
   - Then continue with step 37



10. Checking signal from transmission speed sensor
   - Preparation:
     Ignition OFF
     Connect TCM
     Connect a multimeter (frequency meter) between #1 (#A1) and #2 (#A2) on the test box.
     Raise car so that front wheels can rotate freely.
     Engine idling.
     A/C turned off.
     Move the gear selector to position D so the front wheels begin to rotate.
     Increase Engine Speed **(RPM)** to 2,000 rpm.
     Keep RPM constant at 2,000 rpm.

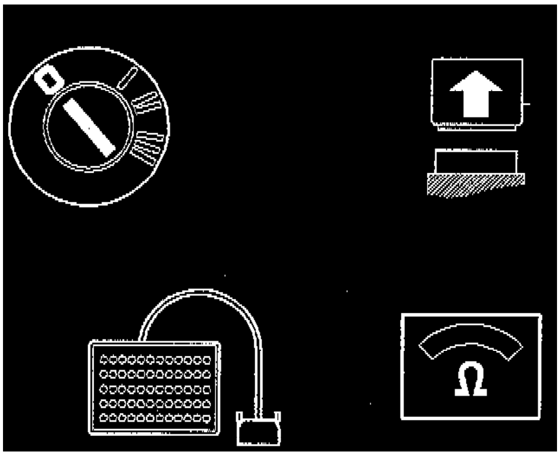
   NOTE:
   - When the rear wheels are stationary and the front wheels rotate DTCs may can be stored in the ABS system.
   - Erase any DTCs stored in the ABS system after fault-tracing.
   - Refer to Brakes and Traction Control

   - The multimeter should give a stable reading (Hz) when the engine speed is constant and the transmission is not shifting.

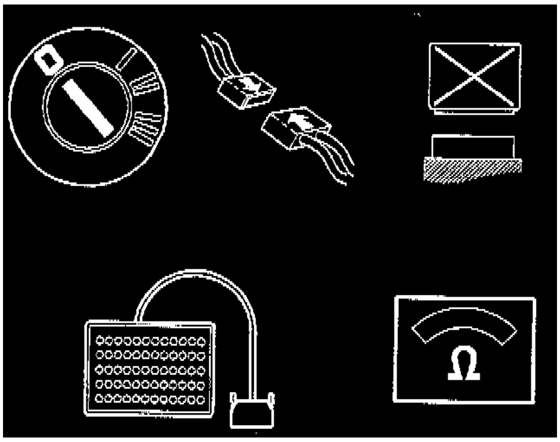
   NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

   - Is the frequency stable?

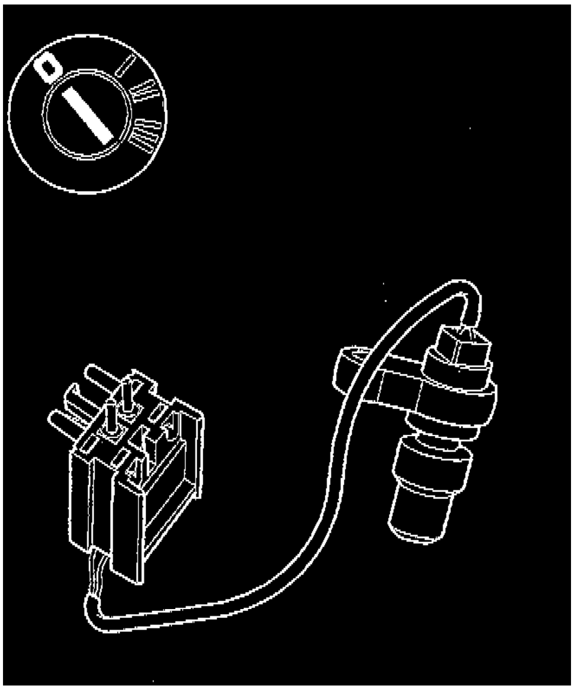
YES: Proceed to step 16
NO: Proceed to step 11



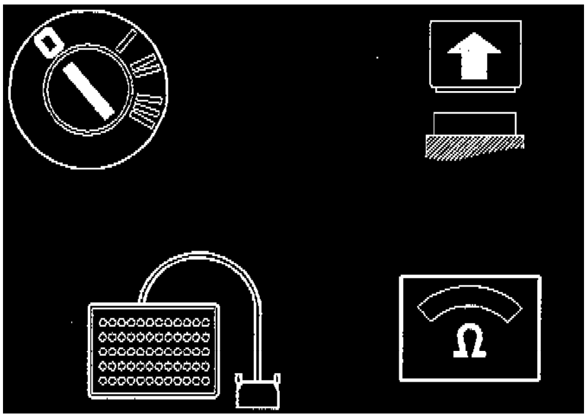
11. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect transmission control module (TCM) Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 12
    - If reading is incorrect:
      Proceed to step 13
12. Checking for sources of interference
    - Check that the transmission speed sensor wiring is not too near sources of interference, such as electric motors, ignition cables, mobile telephone cables etc.
    - Then continue with step 32



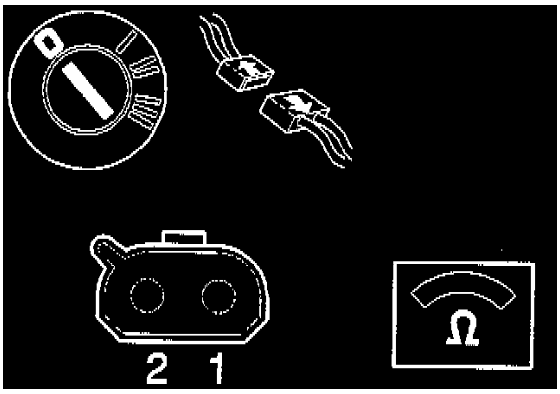
13. Checking the transmission connector
    - Preparation:
      Ignition OFF
      TCM disconnected.
      Disconnect the transmission connector.
      Check TCM connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission connector.
    - Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 14
    - If reading is incorrect:
      Proceed to step 15
14. Fault-tracing information
    - The DTC was caused by poor contact in the transmission connector.
    - Then continue with step 37



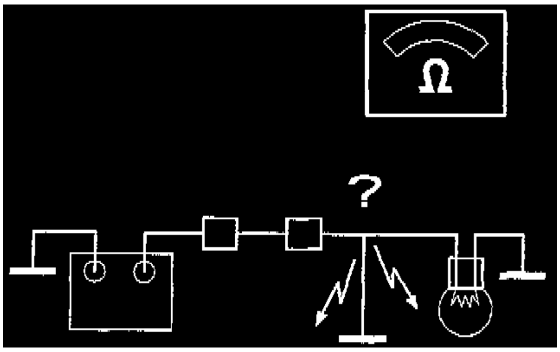
15. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



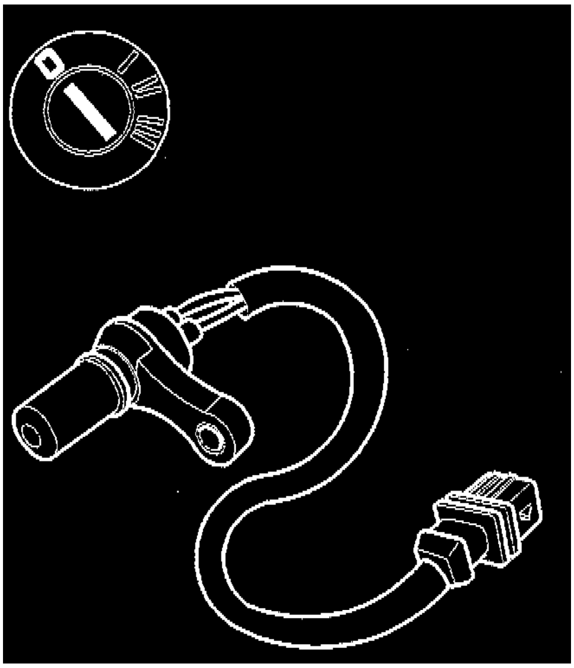
16. Checking transmission speed sensor signal cable (-)
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Use an ohmmeter to measure between #12 (#A12) and #20 (#A20) on the test box.
    - The ohmmeter should read **infinite resistance.**
    - If reading is OK:
      Proceed to step 20
    - If reading is incorrect:
      Proceed to step 17



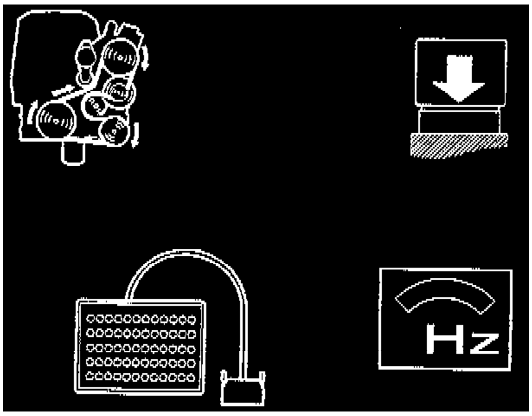
17. Checking transmission speed sensor
    - Preparation:
      Ignition OFF
      Disconnect transmission speed sensor
    - Connect an ohmmeter between transmission speed sensor connector terminal 2 (to transmission speed sensor) and ground.
    - The ohmmeter should read **infinite resistance**
    - If reading is OK:
      Proceed to step 18
    - If reading is incorrect:
      Proceed to step 19



18. Checking for a short-circuit
    - Check cable between transmission speed sensor connector terminal 2 and TCM terminal #A12 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 37



19. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



20. Checking signal from transmission speed sensor

    NOTE: An alternative to the following method is to drive the car on the road.

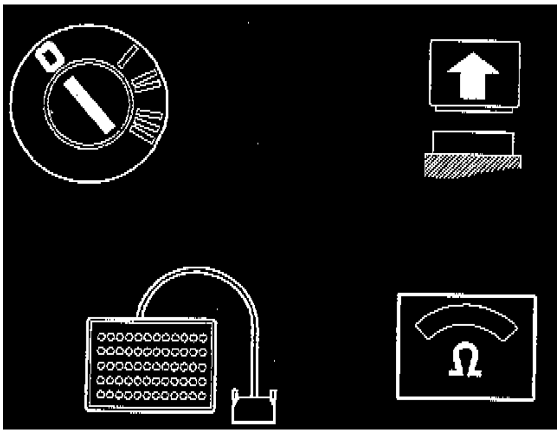
    - Preparation:
      Ignition OFF
      Connect TCM
      Ignition ON
      Raise car so that front wheels hang free
      Connect a multimeter (frequency meter) between #11 (#A11) and #12 (#A12) on the test box.
      Engine idling.
      Move the gear selector to position D so the front wheels start to rotate
    - Increase engine speed (RPM) to 2,000 rpm and keep engine speed constant.

      NOTE:
      - When the rear wheels are stationary and the front wheels rotate diagnostic trouble codes (DTCs) may can be stored in the ABS system.
      - Erase any diagnostic trouble codes (DTCs) stored in the ABS system after fault-tracing.
      - Refer to Brakes and Traction Control

    - The multimeter should give a stable reading (Hz) when the speed is constant.

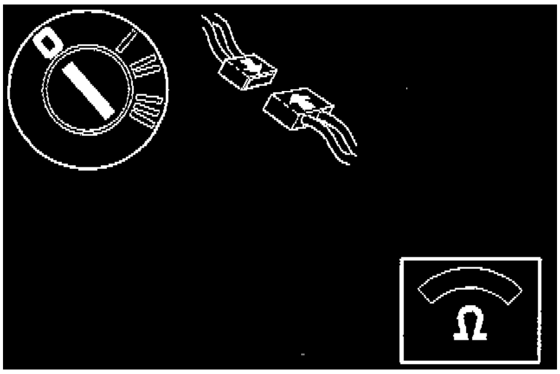
      NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

    - Is the frequency stable?
      YES: Proceed to step 26
      NO: Proceed to step 21

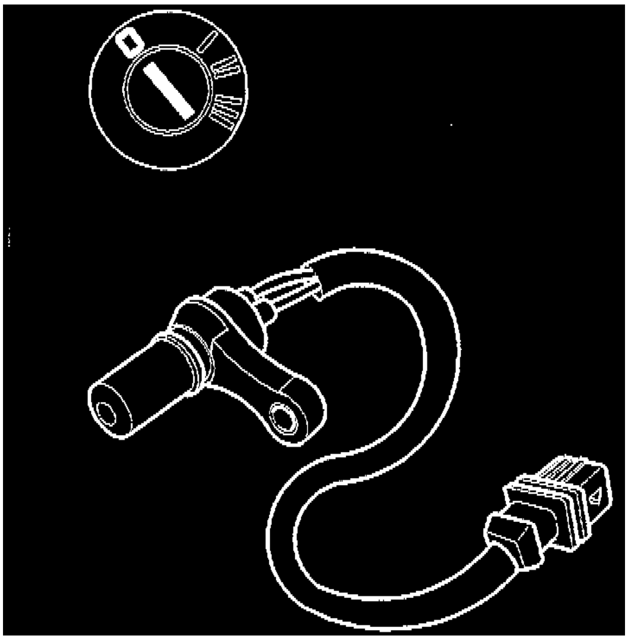


21. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 22
    - If reading is incorrect:
      Proceed to step 23
22. Checking for sources of interference
    - Check that the transmission speed sensor cables are not too near sources of interference, such as electric motors, ignition cables, mobile

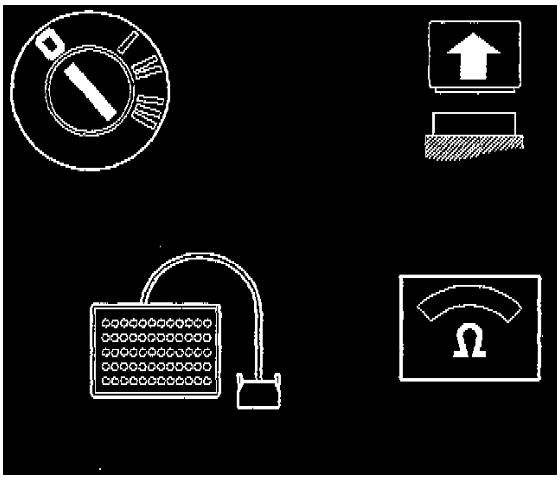
telephone cables etc and that the transmission speed sensor is not loose.
- Then continue with step 32



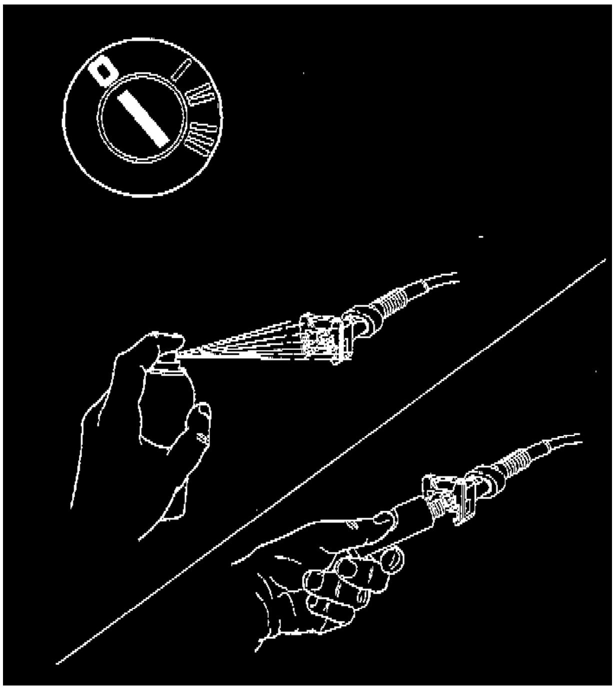
23. Checking transmission speed sensor connector
    - Preparation:
      Ignition OFF
    - Check transmission speed sensor connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission speed sensor connector.
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 24
    - If reading is incorrect:
      Proceed to step 25
24. Fault-tracing information
    - The cause of the DTC has been loose connections in the transmission speed sensor connector.
    - Then continue with step 37



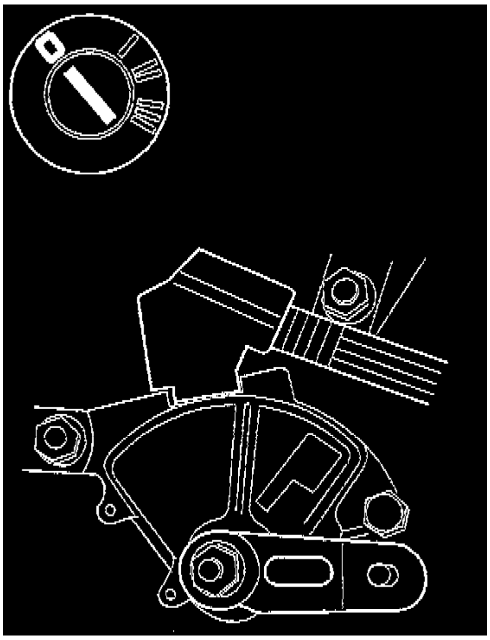
25. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



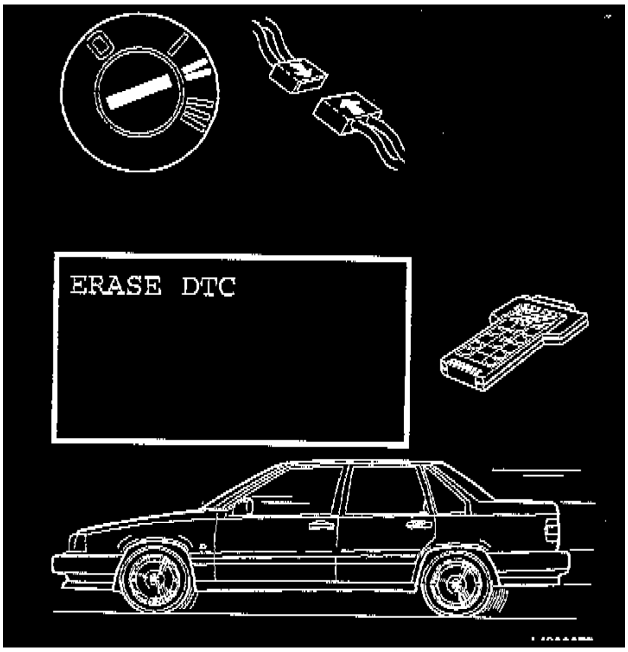
26. Checking resistance in solenoid S1 and S2 circuits
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between the test box terminals:
      #27 (#A27) and #29 (#A29), solenoid S1
      #28 (#A28) and #29 (#A29), solenoid S2
    - The ohmmeter should read **12-18 Ohms**
    - If reading is OK:
      Proceed to step 28
    - If reading is incorrect:
      Proceed to step 27



27. Checking for contact resistance and oxidation.
    - Preparation:
      Ignition OFF Check transmission connector for contact resistance and oxidation according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 32



28. Checking gear-shift position sensor
    - Preparation:
      Ignition OFF Check gear-shift position sensor adjustment. refer to Powertrain Management.
    - Is adjustment OK?
      YES: Proceed to step 29
      NO: Proceed to step 31

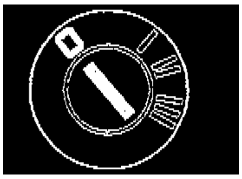


29. Checking the transmission control module
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
      Gear selector in position L, speed approx. 30 km/h (1st gear).
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
      Gear selector in position 3, speed approx. 60 km/h.
      Move gear selector to position L so that 2nd gear is engaged.
      Accelerate evenly (engine speed (RPM) over 1400 rpm).
    - DTC AT-323:
      Gear selector in position 3, speed approx. 60 km/h.
      Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:

Gear selector in position D, speed approx. 80 km/h.
Maintain throttle opening at approx. 10%.
Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

- Stop car
- Check to see if the DTC has been stored again.
- Has the diagnostic trouble code (DTC) been stored again?

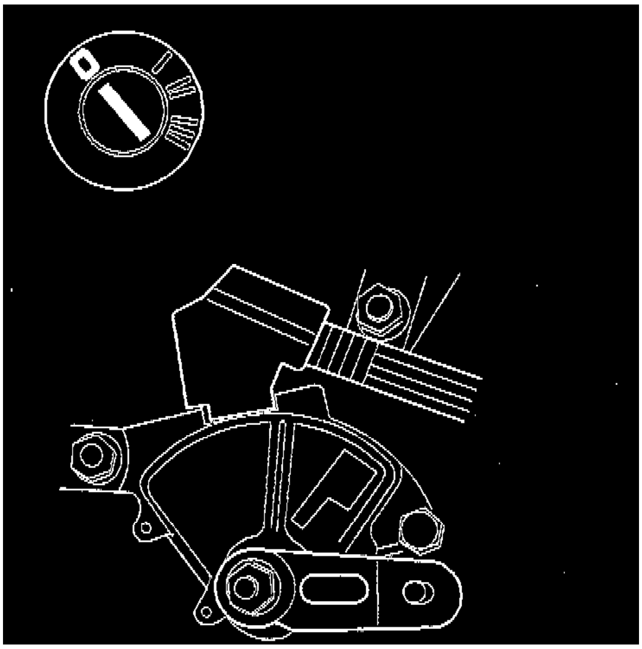
YES: Proceed to step 30
NO: Proceed to step 32



30. Replacing component
- Preparation:

Ignition OFF

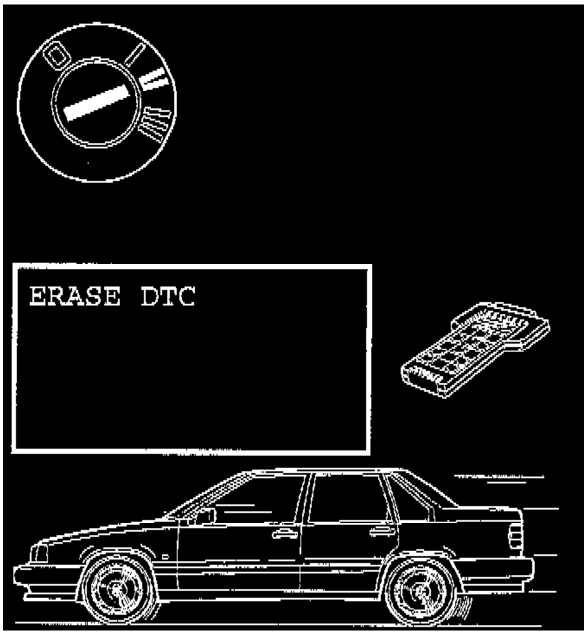
- Try a new transmission control module, refer to Replacement. See: Transmission Control Systems/Relays and Modules - Transmission and Drivetrain/Relays and Modules - A/T/Control Module/Service and Repair
- Then continue with step 33



31. Adjusting gear-shift position sensor.
- Preparation:

Ignition OFF

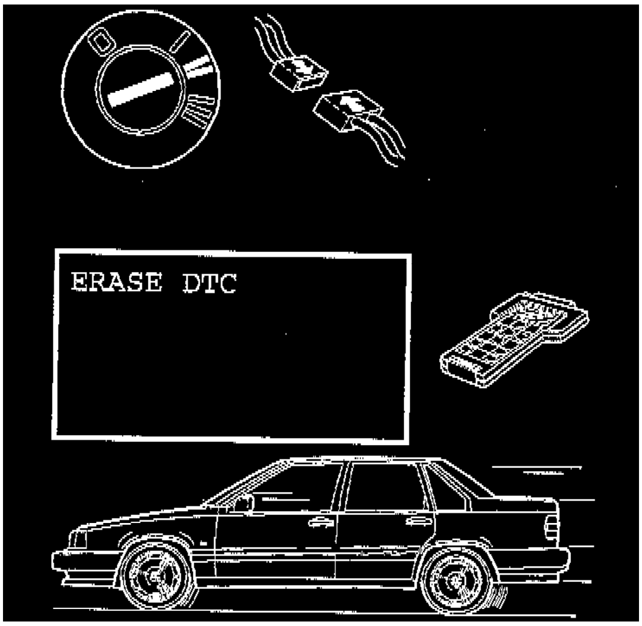
- Adjust gear-shift position sensor, refer to Powertrain Management.
- Then continue with step 32



32. Test driving
    - Preparation:
        Ignition ON
        Erase DTCs
    - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
    - Repeat the driving conditions in force when the DTC was posted.
    - Watch the automatic transmission warning light.
    - If the warning lamp starts flashing a DTC has been stored.
    - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

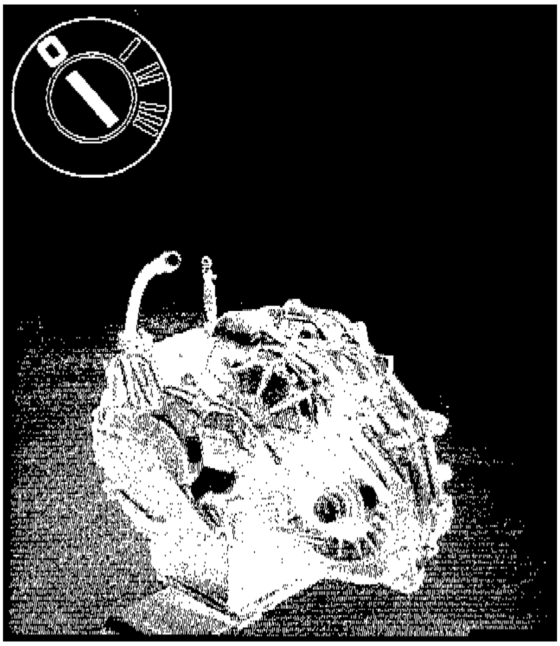
    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for"Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation
    - Is the transmission exhibiting any obvious mechanical faults or making any noises?

        YES: Proceed to step 34
        NO: Proceed to step 35

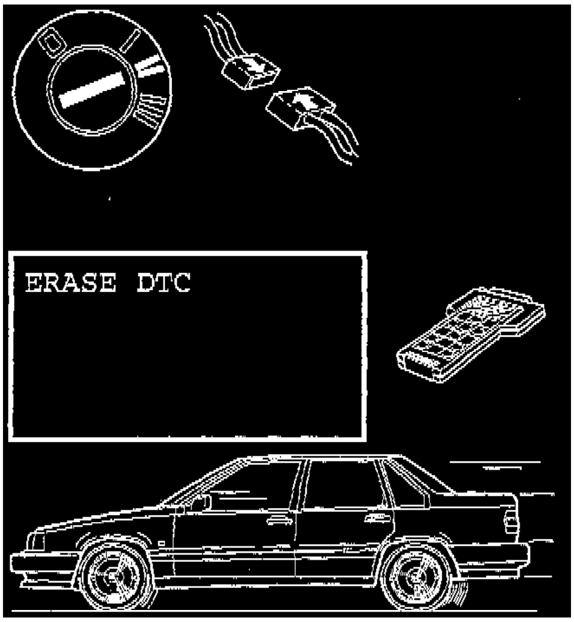


33. Checking component
    - Preparation:
        Ignition ON
        Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.

- DTC AT-321:
  Gear selector in position L, speed approx. 30 km/h (1st gear).
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-322:
  Gear selector in position 3, speed approx. 60 km/h.
  Move gear selector to position L so that 2nd gear is engaged.
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-323:
  Gear selector in position 3, speed approx. 60 km/h.
  Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-324:
  Gear selector in position D, speed approx. 80 km/h.
  Maintain throttle opening at approx. 10%.
  Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)
- Stop car
- Check to see if the DTC has been stored again
- Has the DTC been stored again?
  YES: Proceed to step 34
  NO: Proceed to step 36



34. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission according, refer to Replacement. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair
    - Then continue with step 37
35. Fault-tracing information
    - Transmission is OK.
    - Fault corrected
36. Fault-tracing information
    - Old control module was defective.
    - Fault corrected

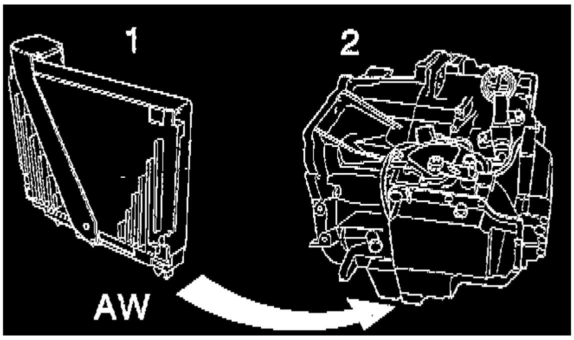


37. Verification
    - After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Ignition ON
      Erase DTCs
    - Test drive the car
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
      Gear selector in position L, speed approx. 30 km/h (1st gear).
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
      Gear selector in position 3, speed approx. 60 km/h.
      Move gear selector to position L so that 2nd gear is engaged.
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-323:
      Gear selector in position 3, speed approx. 60 km/h
      Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:
      Gear selector in position D, speed approx. 80 km/h
      Maintain throttle opening at approx. 10%
      Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for "Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair

    - Stop car.
    - The DTC does not recur and the transmission is not exhibiting operating faults?
    - If reading is OK:
      Fault corrected
    - If reading is incorrect:
      Proceed to step 38
38. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
      YES: Fault not corrected
      NO: Proceed to step 1

DTC Information



SPECIAL TOOLS

Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

CONDITION

The Transmission Control Module **(TCM)** calculates the ratio between the transmission input speed and the vehicle speed. There is a specific ratio for each gear. Diagnostic Trouble Codes **(DTCs)** AT-321, AT-322, AT323 or AT-324 are posted if the TCM registers a deviation of more than 10% in these ratios, depending on the gear. Oil temperature must be above +20°C and throttle position above 3%.

SUBSTITUTE VALUE

The TCM limp-home program has been initiated.

POSSIBLE SOURCE

- Interference with or faulty transmission speed sensor signal
- Interference with faulty Vehicle Speed Sensor **(VSS)** signal
- Contact resistance in the Solenoid S1 and S2 circuits.
- Gear-shift position sensor incorrectly adjusted
- Transmission oil level too low.
- Mechanical fault in the transmission. Worn components in the transmission causing slippage or reduced system pressure.
- Defective power ground
- Transmission speed sensor signal cable (-) short circuited to ground.

FAULT SYMPTOM(S)

- The combined instrument panel warning lamp flashes.
- Mechanical malfunction. Faults are usually indicated by noise or other obvious function problems.
- Deterioration in performance because the TCM prevents activation of the solenoids, this stops gear-shifting. The transmission operates only in 3rd gear in positions 3 and L, 4th gear in position D and reverse in position R. Shifting can only be carried out manually between 3rd, 4th, and reverse gear.
- No system pressure solenoid STH control resulting in constant maximum system pressure leading to harsher shifting and gear meshing.
- No lock-up function.

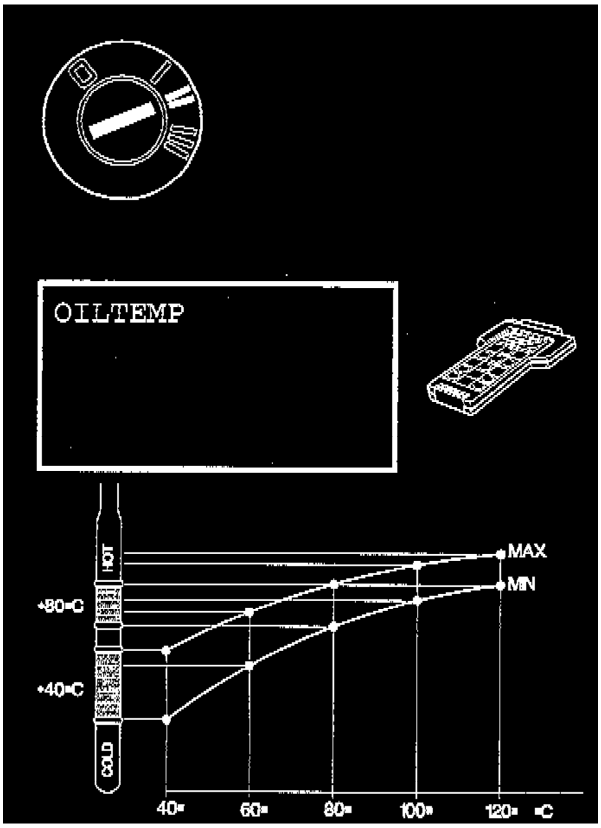
NOTE:

- The Motronic 4.4 Engine Control Module **(ECM)** posts a DTC when the transmission sends a Malfunction Indicator Lamp **(MIL)** request
- Erase this DTC in the Motronic ECM when the transmission fault has been repaired.

TESTING PROCEDURE

- Start fault-tracing at incorrect gear ratio. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-324 Incorrect Gear Ratio/Testing

Testing



SPECIAL TOOLS

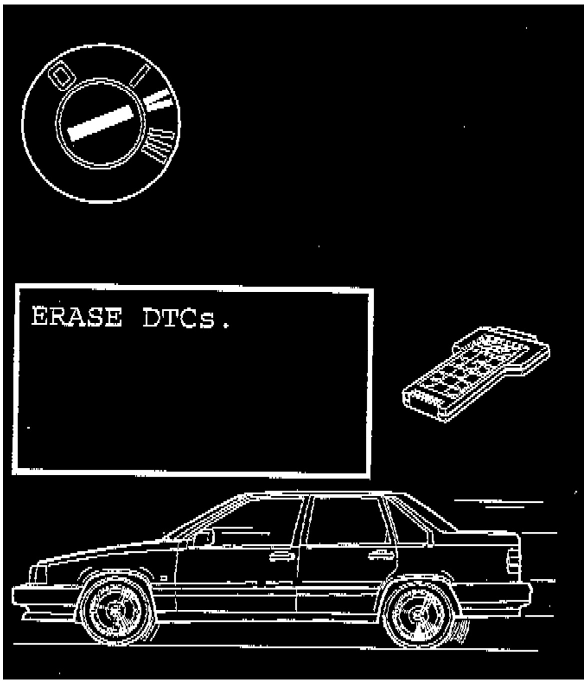
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

INCORRECT GEAR RATIO

1. Checking transmission oil level
   - Preparation:
     Ignition ON
   - Select scrolling values.
   - Read off oil temperature.
   - Check transmission oil, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
     Check level at different temperatures.
   - Is level OK?
     YES: Proceed to step 3
     NO: Proceed to step 2
2. Checking for oil leakage
   - Check for oil leaks
   - Remedy as necessary.
   - Top up oil to correct level, refer to Checking/Adjusting Oil Level. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection

     NOTE: Driving the car with low oil level may have damaged the transmission. Test drive car to ensure that the transmission is OK.

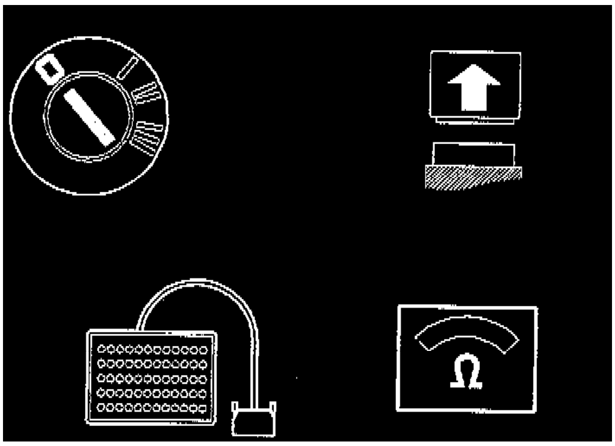
   - Then continue with step 32



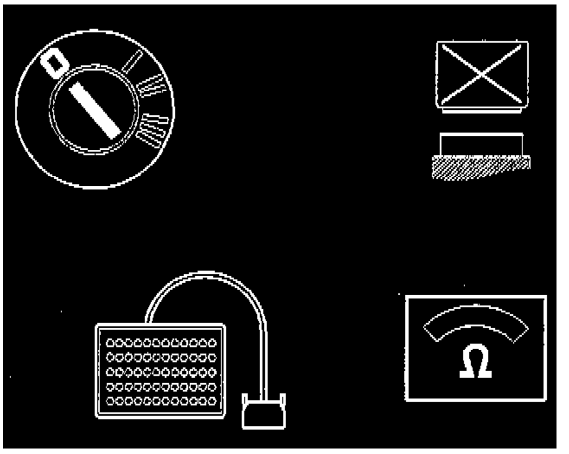
3. Checking for mechanical faults in the transmission.
   - Preparation:
     Ignition ON
     Note Diagnostic Trouble Code **(DTC)** frozen values.
     Erase (DTCs.
   - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
   - Repeat the driving conditions in force when the DTC was posted.
   - Watch the automatic transmission warning light.
   - If the warning lamp starts flashing a DTC has been stored.
   - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

   NOTE:
     - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the Transmission Control Module **(TCM)** activates the emergency "Limp Home" program.
     - The transmission will not then operate normally. See "Limp Home" under Emergency Programs. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation

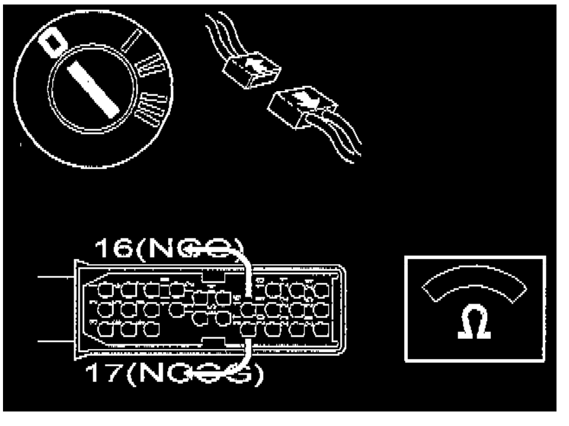
   - Is the transmission exhibiting any obvious mechanical faults or making any noises?
     YES: Proceed to step 4
     NO: Proceed to step 5
4. Fault-tracing information, refer to Mechanical Malfunction Symptom Tables. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Testing and Inspection
   - Then continue with step 37



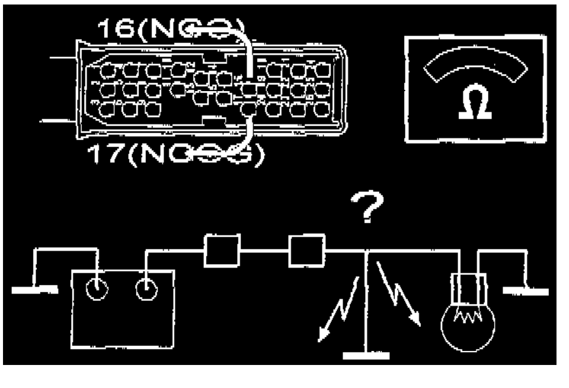
5. Connecting the test box
   - Preparation:
     Ignition OFF
   - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 6



6. Checking transmission speed sensor signal cable (-)
   - Preparation:
     Ignition OFF
     TCM disconnected.
   - Use an ohmmeter to measure between #2 (#A2) and #20 (#A20) on the test box.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 7

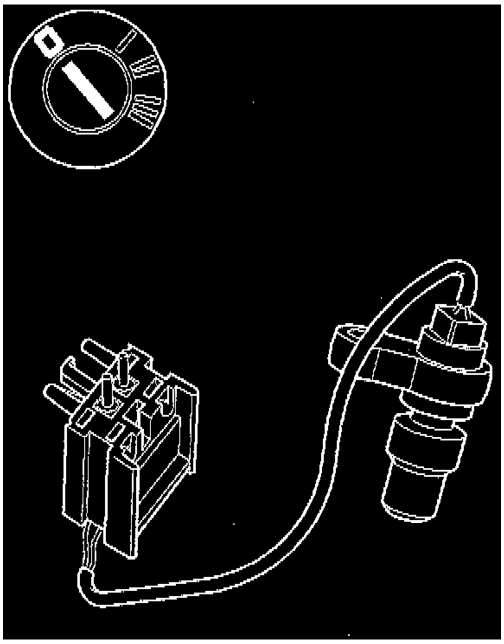


7. Checking transmission speed sensor
   - Preparation:
     Ignition OFF
     Disconnect the transmission connector.
   - Connect an ohmmeter between transmission connector terminal 17 (transmission speed sensor side) and ground.
   - The ohmmeter should read **infinite resistance.**
   - If reading is OK:
     Proceed to step 8
   - If reading is incorrect:
     Proceed to step 9

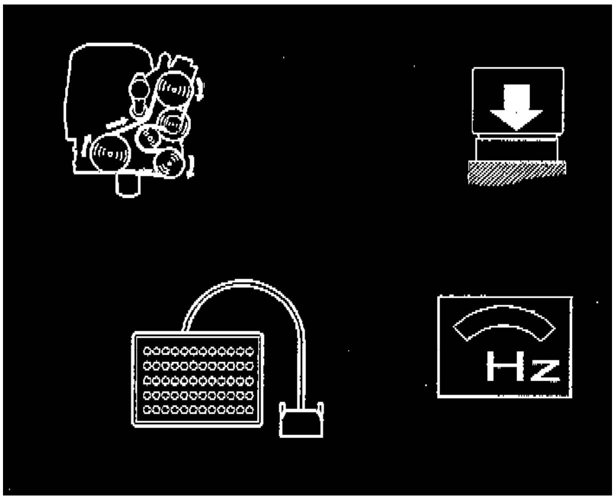


8. Checking for a short-circuit
   - Check cable between transmission connector terminal 17 and TCM #A2 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults

- Then continue with step 37



9. Replacing component
   - Preparation:
     Ignition OFF
   - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
   - Then continue with step 37



10. Checking signal from transmission speed sensor
   - Preparation:
     Ignition OFF
     Connect TCM
     Connect a multimeter (frequency meter) between #1 (#A1) and #2 (#A2) on the test box.
     Raise car so that front wheels can rotate freely.
     Engine idling.
     A/C turned off.
     Move the gear selector to position D so the front wheels begin to rotate.
     Increase Engine Speed **(RPM)** to 2,000 rpm.
     Keep RPM constant at 2,000 rpm.

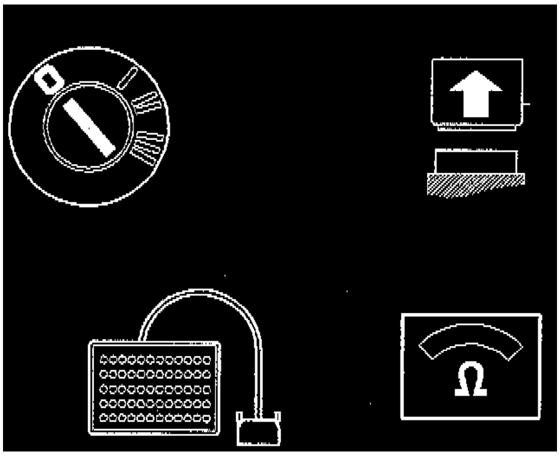
   NOTE:
   - When the rear wheels are stationary and the front wheels rotate DTCs may can be stored in the ABS system.
   - Erase any DTCs stored in the ABS system after fault-tracing.
   - Refer to Brakes and Traction Control

   - The multimeter should give a stable reading (Hz) when the engine speed is constant and the transmission is not shifting.

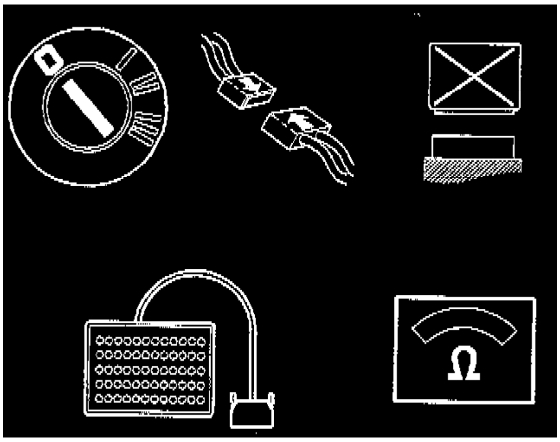
   NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

   - Is the frequency stable?

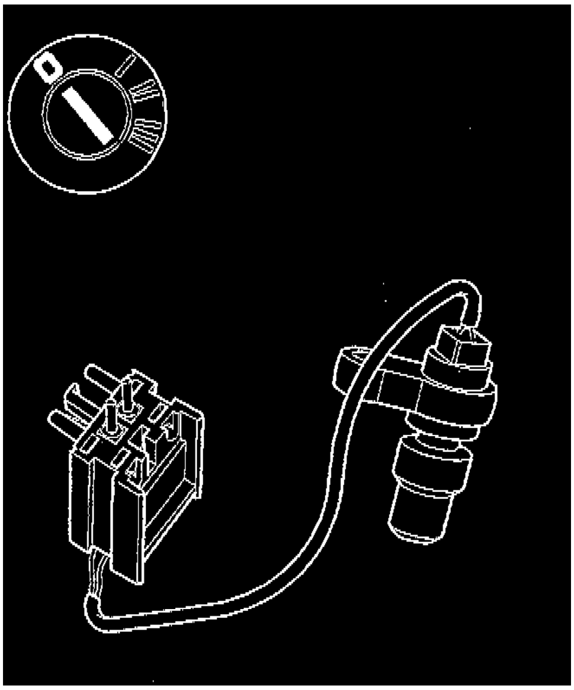
YES: Proceed to step 16
NO: Proceed to step 11



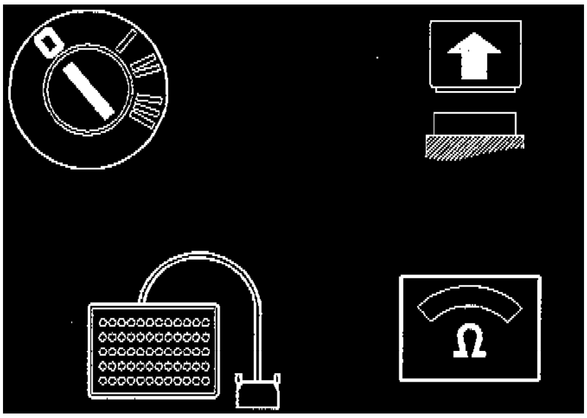
11. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect transmission control module (TCM) Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 12
    - If reading is incorrect:
      Proceed to step 13
12. Checking for sources of interference
    - Check that the transmission speed sensor wiring is not too near sources of interference, such as electric motors, ignition cables, mobile telephone cables etc.
    - Then continue with step 32



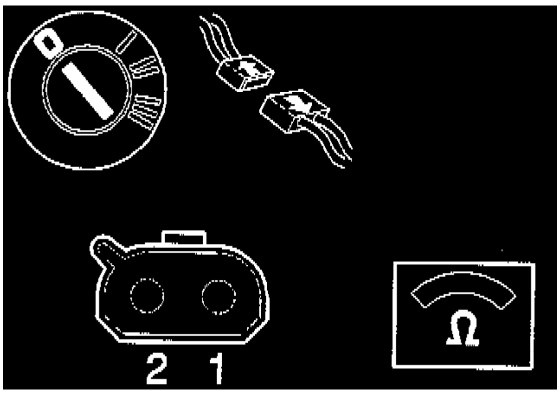
13. Checking the transmission connector
    - Preparation:
      Ignition OFF
      TCM disconnected.
      Disconnect the transmission connector.
      Check TCM connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission connector.
    - Connect an ohmmeter between #1 (#A1) and #2 (#A2) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 14
    - If reading is incorrect:
      Proceed to step 15
14. Fault-tracing information
    - The DTC was caused by poor contact in the transmission connector.
    - Then continue with step 37



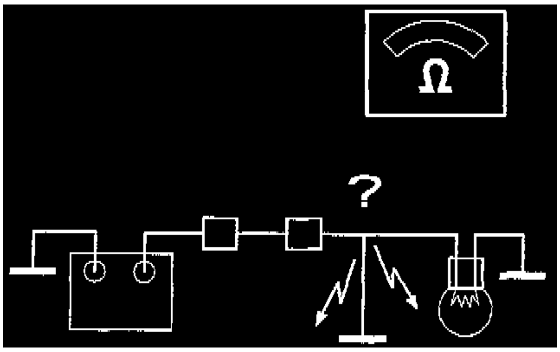
15. Replacing component
    - Preparation:
        Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



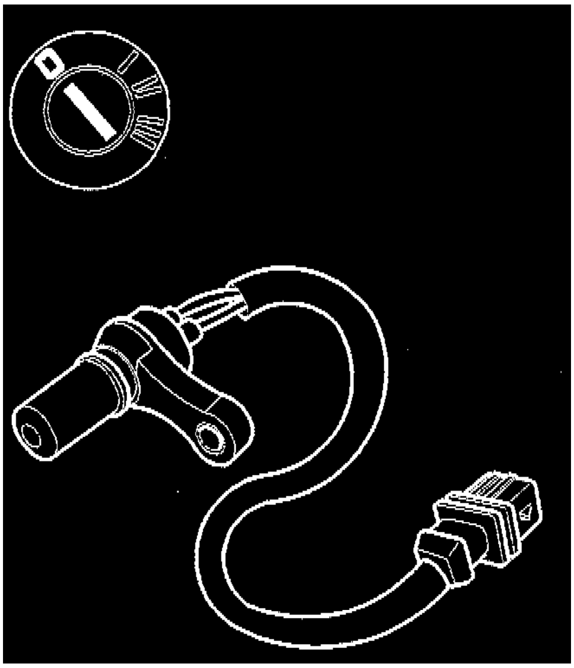
16. Checking transmission speed sensor signal cable (-)
    - Preparation:
        Ignition OFF
        Disconnect TCM
    - Use an ohmmeter to measure between #12 (#A12) and #20 (#A20) on the test box.
    - The ohmmeter should read **infinite resistance.**
    - If reading is OK:
        Proceed to step 20
    - If reading is incorrect:
        Proceed to step 17



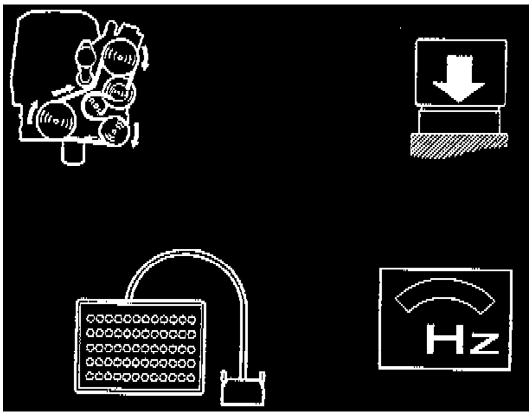
17. Checking transmission speed sensor
    - Preparation:
        Ignition OFF
        Disconnect transmission speed sensor
    - Connect an ohmmeter between transmission speed sensor connector terminal 2 (to transmission speed sensor) and ground.
    - The ohmmeter should read **infinite resistance**
    - If reading is OK:
        Proceed to step 18
    - If reading is incorrect:
        Proceed to step 19



18. Checking for a short-circuit
    - Check cable between transmission speed sensor connector terminal 2 and TCM terminal #A12 for a short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 37



19. Replacing component
    - Preparation:
        Ignition OFF
    - Try a new transmission speed sensor, refer to Replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



20. Checking signal from transmission speed sensor

    NOTE: An alternative to the following method is to drive the car on the road.

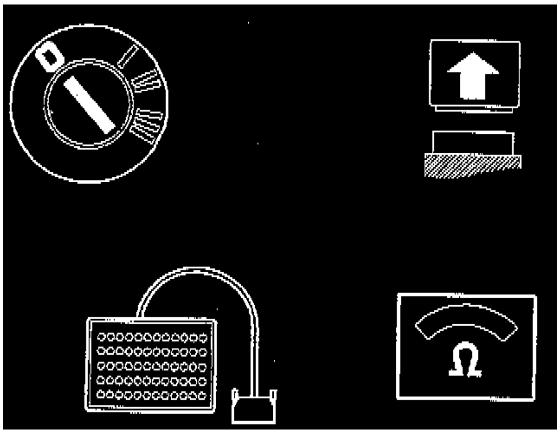
    - Preparation:
      Ignition OFF
      Connect TCM
      Ignition ON
      Raise car so that front wheels hang free
      Connect a multimeter (frequency meter) between #11 (#A11) and #12 (#A12) on the test box.
      Engine idling.
      Move the gear selector to position D so the front wheels start to rotate
    - Increase engine speed (RPM) to 2,000 rpm and keep engine speed constant.

      NOTE:
      - When the rear wheels are stationary and the front wheels rotate diagnostic trouble codes (DTCs) may can be stored in the ABS system.
      - Erase any diagnostic trouble codes (DTCs) stored in the ABS system after fault-tracing.
      - Refer to Brakes and Traction Control

    - The multimeter should give a stable reading (Hz) when the speed is constant.

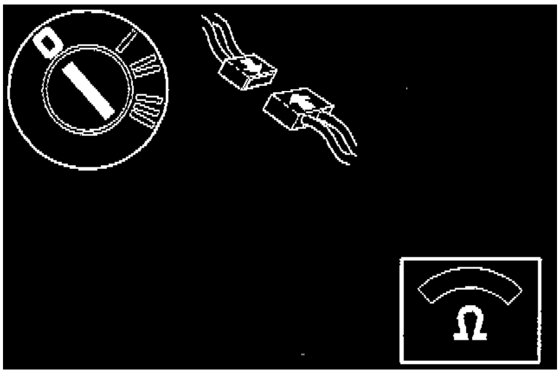
      NOTE: Ensure that the front wheels are not rotating when the gear shift lever is moved.

    - Is the frequency stable?
      YES: Proceed to step 26
      NO: Proceed to step 21

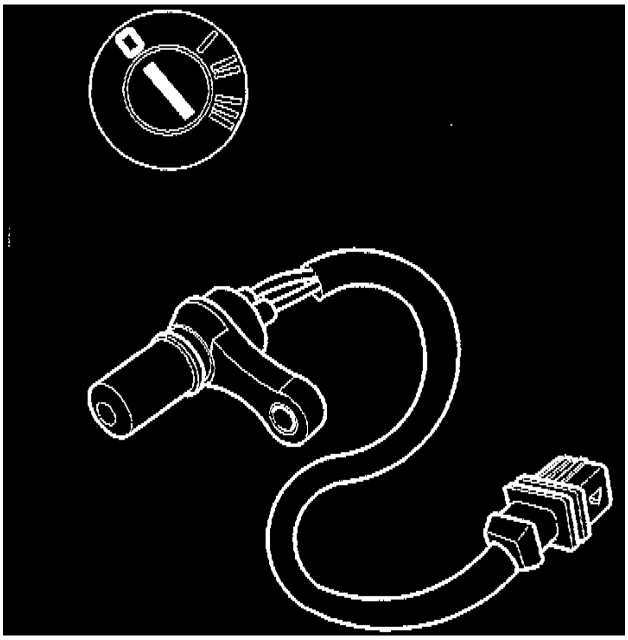


21. Checking transmission speed sensor resistance
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 22
    - If reading is incorrect:
      Proceed to step 23
22. Checking for sources of interference
    - Check that the transmission speed sensor cables are not too near sources of interference, such as electric motors, ignition cables, mobile

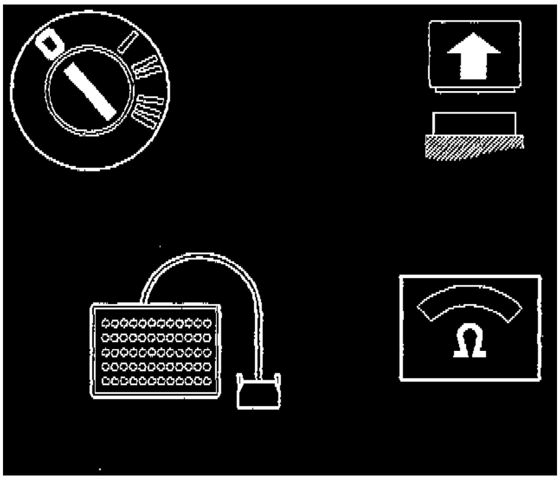
telephone cables etc and that the transmission speed sensor is not loose.
- Then continue with step 32



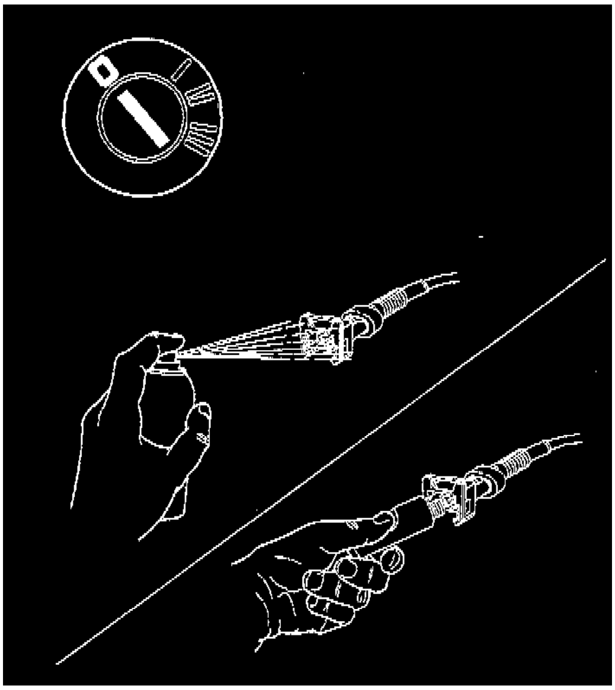
23. Checking transmission speed sensor connector
    - Preparation:
      Ignition OFF
    - Check transmission speed sensor connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
      Connect transmission speed sensor connector.
    - Connect an ohmmeter between #11 (#A11) and #12 (#A12) on the test box.
    - The ohmmeter should read **300-600 Ohms**
    - If reading is OK:
      Proceed to step 24
    - If reading is incorrect:
      Proceed to step 25
24. Fault-tracing information
    - The cause of the DTC has been loose connections in the transmission speed sensor connector.
    - Then continue with step 37



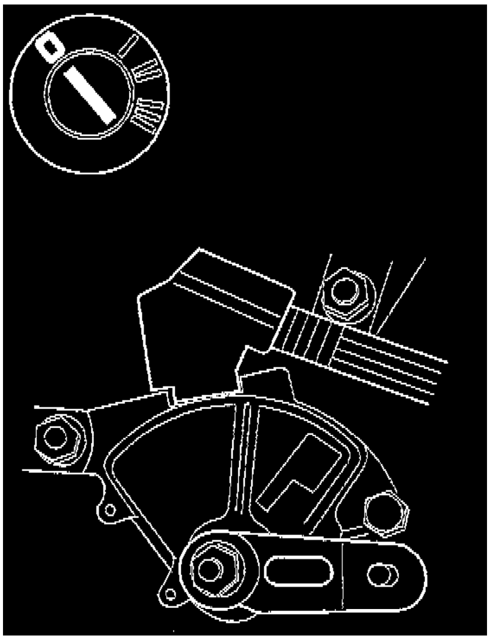
25. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission speed sensor, refer to replacement. See: Transmission Control Systems/Sensors and Switches - Transmission and Drivetrain/Sensors and Switches - A/T/Transmission Speed Sensor/Service and Repair
    - Then continue with step 37



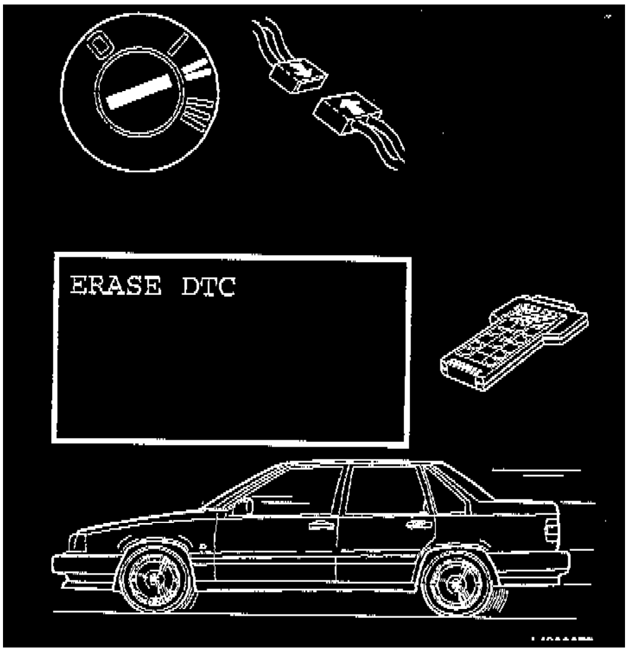
26. Checking resistance in solenoid S1 and S2 circuits
    - Preparation:
      Ignition OFF
      Disconnect TCM
    - Connect an ohmmeter between the test box terminals:
      #27 (#A27) and #29 (#A29), solenoid S1
      #28 (#A28) and #29 (#A29), solenoid S2
    - The ohmmeter should read **12-18 Ohms**
    - If reading is OK:
      Proceed to step 28
    - If reading is incorrect:
      Proceed to step 27



27. Checking for contact resistance and oxidation.
    - Preparation:
      Ignition OFF Check transmission connector for contact resistance and oxidation according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 32



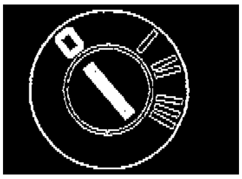
28. Checking gear-shift position sensor
    - Preparation:
      Ignition OFF Check gear-shift position sensor adjustment. refer to Powertrain Management.
    - Is adjustment OK?
      YES: Proceed to step 29
      NO: Proceed to step 31



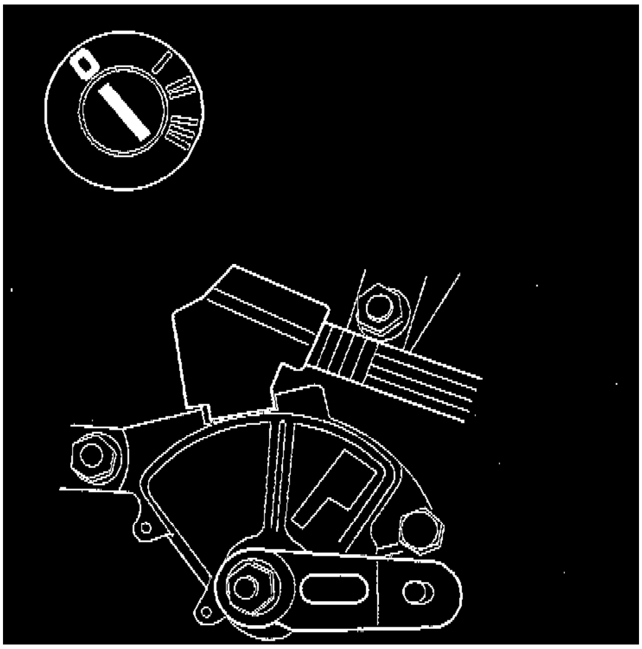
29. Checking the transmission control module
    - Preparation:
      Ignition OFF
      Reconnect connectors, reinstall components etc.
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
    - DTC AT-321:
      Gear selector in position L, speed approx. 30 km/h (1st gear).
      Accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-322:
      Gear selector in position 3, speed approx. 60 km/h.
      Move gear selector to position L so that 2nd gear is engaged.
      Accelerate evenly (engine speed (RPM) over 1400 rpm).
    - DTC AT-323:
      Gear selector in position 3, speed approx. 60 km/h.
      Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
    - DTC AT-324:

Gear selector in position D, speed approx. 80 km/h.
Maintain throttle opening at approx. 10%.
Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

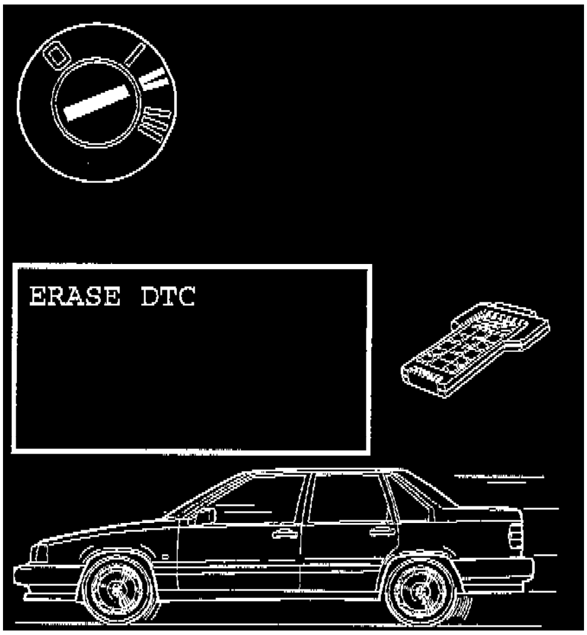
- Stop car
- Check to see if the DTC has been stored again.
- Has the diagnostic trouble code (DTC) been stored again?
  YES: Proceed to step 30
  NO: Proceed to step 32



30. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission control module, refer to Replacement. See: Transmission Control Systems/Relays and Modules - Transmission and Drivetrain/Relays and Modules - A/T/Control Module/Service and Repair
    - Then continue with step 33



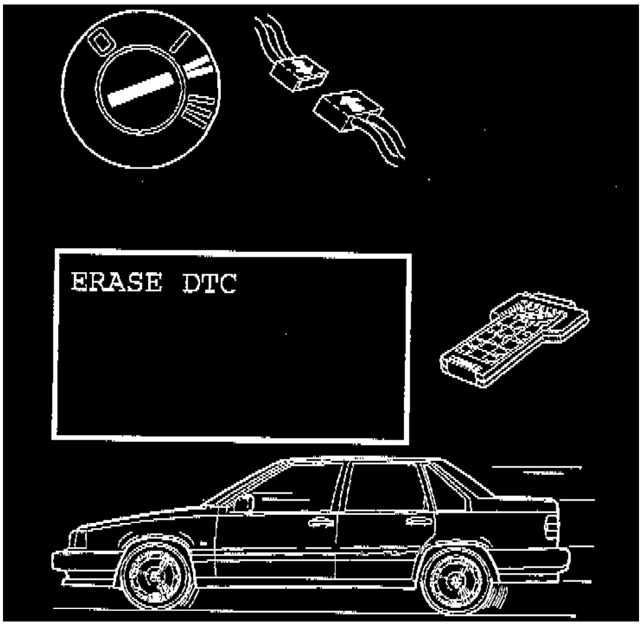
31. Adjusting gear-shift position sensor.
    - Preparation:
      Ignition OFF
    - Adjust gear-shift position sensor, refer to Powertrain Management.
    - Then continue with step 32



32. Test driving
    - Preparation:
      Ignition ON
      Erase DTCs
    - Test drive car according to Test Drive Form. See: Transmission Control Systems/Testing and Inspection/Initial Inspection and Diagnostic Overview
    - Repeat the driving conditions in force when the DTC was posted.
    - Watch the automatic transmission warning light.
    - If the warning lamp starts flashing a DTC has been stored.
    - Make an immediate note of abnormalities in the operation of the transmission before and after the warning lamp started flashing.

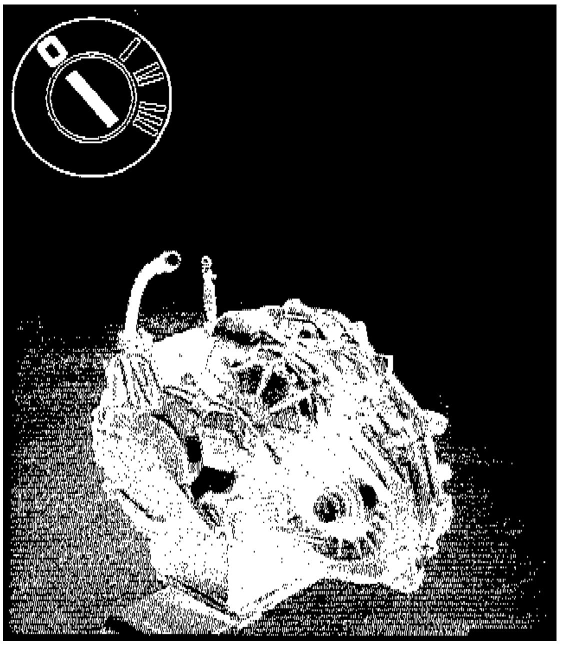
    NOTE:
    - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
    - The transmission will not then operate normally.
    - Refer to Emergency programs for"Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Description and Operation
    - Is the transmission exhibiting any obvious mechanical faults or making any noises?

      YES: Proceed to step 34
      NO: Proceed to step 35

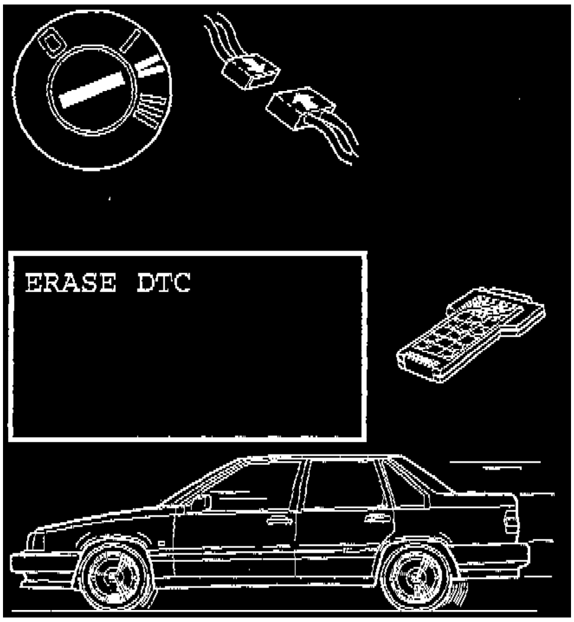


33. Checking component
    - Preparation:
      Ignition ON
      Erase DTCs
    - Test drive the car.
    - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.

- DTC AT-321:
  Gear selector in position L, speed approx. 30 km/h (1st gear).
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-322:
  Gear selector in position 3, speed approx. 60 km/h.
  Move gear selector to position L so that 2nd gear is engaged.
  Accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-323:
  Gear selector in position 3, speed approx. 60 km/h.
  Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
- DTC AT-324:
  Gear selector in position D, speed approx. 80 km/h.
  Maintain throttle opening at approx. 10%.
  Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)
- Stop car
- Check to see if the DTC has been stored again
- Has the DTC been stored again?
  YES: Proceed to step 34
  NO: Proceed to step 36



34. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new transmission according, refer to Replacement. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair
    - Then continue with step 37
35. Fault-tracing information
    - Transmission is OK.
    - Fault corrected
36. Fault-tracing information
    - Old control module was defective.
    - Fault corrected



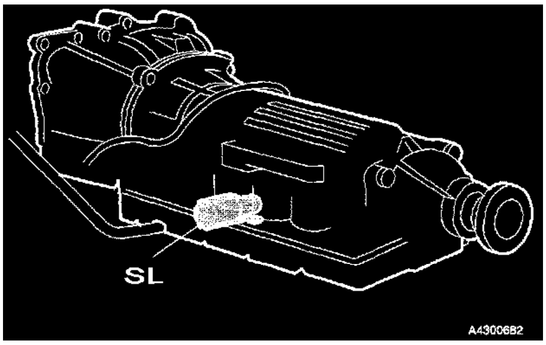
37. Verification
   - After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:
   - Preparation:
     Ignition OFF
     Reconnect connectors, reinstall components etc.
     Ignition ON
     Erase DTCs
   - Test drive the car
   - During the test drive the oil temperature should be over +20°C and the throttle opening should be more than 5%.
   - DTC AT-321:
     Gear selector in position L, speed approx. 30 km/h (1st gear).
     Accelerate evenly (engine speed (RPM) over 1,400 rpm).
   - DTC AT-322:
     Gear selector in position 3, speed approx. 60 km/h.
     Move gear selector to position L so that 2nd gear is engaged.
     Accelerate evenly (engine speed (RPM) over 1,400 rpm).
   - DTC AT-323:
     Gear selector in position 3, speed approx. 60 km/h
     Maintain throttle opening at approx. 10% and accelerate evenly (engine speed (RPM) over 1,400 rpm).
   - DTC AT-324:
     Gear selector in position D, speed approx. 80 km/h
     Maintain throttle opening at approx. 10%
     Accelerate evenly (engine speed (RPM) above approx. 1,400 rpm, 4th gear)

   NOTE:
   - When DTCs AT321, AT-322, AT-323 or AT-324 are stored the TCM activates the emergency "Limp Home" program.
   - The transmission will not then operate normally.
   - Refer to Emergency programs for "Limp Home" symptoms. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Service and Repair

   - Stop car.
   - The DTC does not recur and the transmission is not exhibiting operating faults?
   - If reading is OK:
     Fault corrected
   - If reading is incorrect:
     Proceed to step 38
38. Fault-tracing information
   - The verification result shows that the fault persists.
   - Do you want to exit fault-tracing?
     YES: Fault not corrected
     NO: Proceed to step 1

Trouble Code Conditions

Special Tools:
- 998 8686



Trouble Code Conditions

- Lock-up solenoid SL controls the transmission lock-up function. Solenoid SL operates when it receives battery voltage from the transmission control module **(TCM)** and is activated during different driving conditions depending on road speed, throttle position and the driving mode selected. Diagnostic trouble code **(DTC)** AT-331 is stored if the transmission control module registers a short-circuit to supply voltage in the solenoid SL circuit when the solenoid should not be activated. Solenoid SL is probably permanently activated.

Substitute value(s)

- The transmission control module "Emergency mode I" program has been initiated.

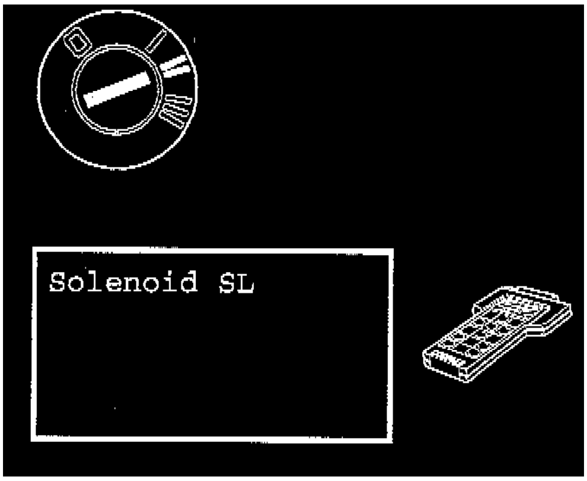
Possible source(s)

- Short-circuit to supply voltage in the signal cable.

Fault symptom(s)

- Since the solenoid is permanently activated the lockup function is permanently engaged on 2nd, 3rd and 4th gears. Harsh gear shifting. Engine braking on 2nd, 3rd and 4th gears.
- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-331 Lock-Up Solenoid SL/Short Circuit To Supply

Short Circuit To Supply

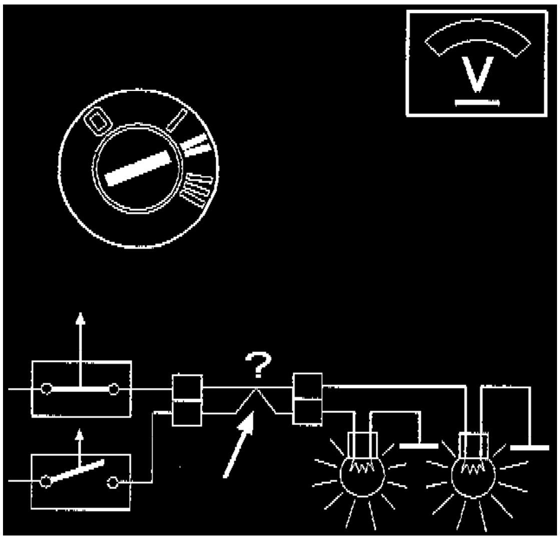


SPECIAL TOOLS

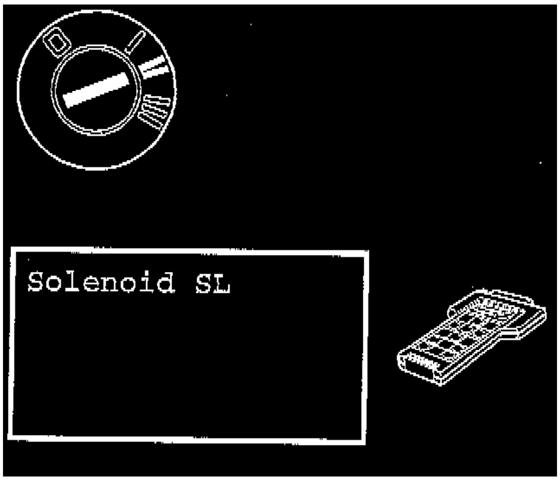
Volvo scan tool No. 998 8686, or equivalent

SHORT-CIRCUIT TO SUPPLY

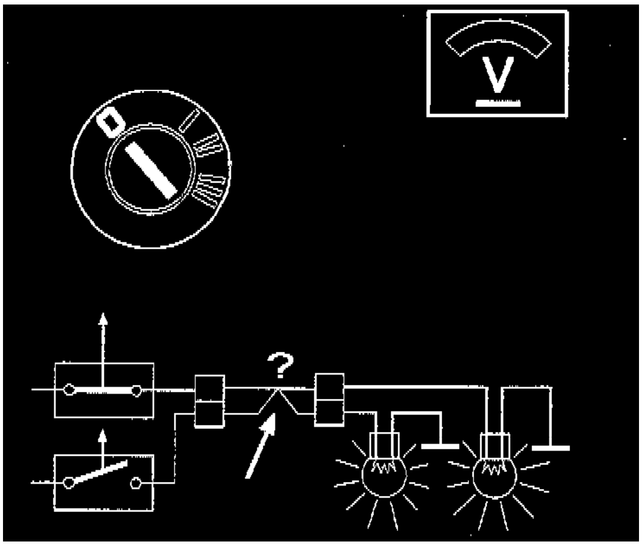
1. Checking, Lock-up solenoid SL
   - Preparation:
     Ignition ON
     Move gear selector to position P.
   - Activate solenoid SL.
   - Read off the solenoid status.
   - The status should alternate between OFF/ON.
   - Does the status alternate between OFF/ON?
     YES: Proceed to step 5
     NO: Proceed to step 2Yes:



2. Checking for short-circuit
   - Preparation:
     Ignition ON
   - Check wiring between solenoid SL and Transmission Control Module **(TCM)** #A9 for short-circuit to supply according to step 4 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 3



3. Verification
   - After repairs have been completed they must be verified as follows to ensure the fault has been eliminated:
   - Preparation:
     Ignition ON
   - Move gear selector to position P.
   - Activate solenoid SL.
   - Read off status for solenoid SL.
   - The status should alternate between OFF/ON.
   - Does the solenoid status alternate between OFF/ON?
     YES: Fault corrected
     NO: Proceed to step 4Yes:
4. Fault-tracing information
   - The verification result shows that the fault persists.
   - Do you want to exit fault-tracing?
     YES: Fault not corrected
     NO: Proceed to step 1

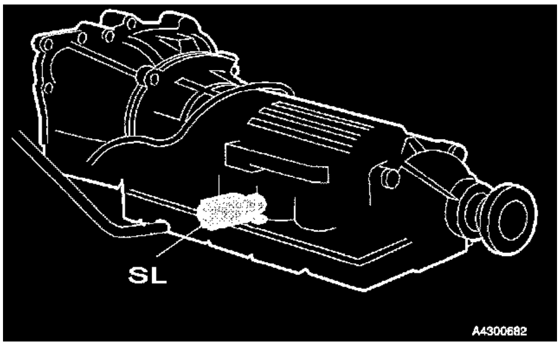


5. Intermittent fault
   - Preparation:
     Ignition OFF
   - Check wiring between solenoid SL and TCM #A9 for intermittent short-circuit to supply according to step 4 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
   - Then continue with step 6
6. Fault-tracing information
   - For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.
   - Do you want to repeat fault-tracing?
     YES: Proceed to step 1
     NO: Operation done

Trouble Code Conditions

Special Tools:

- 998 8686



Trouble Code Conditions

- Lock-up solenoid SL controls the transmission lock-up function. Solenoid SL operates when it receives battery voltage from the transmission control module **(TCM)** and is activated during different driving conditions depending on road speed, throttle position and the driving mode selected. Diagnostic trouble code **(DTC)** AT-332 is stored if the transmission control module registers an open-circuit in the solenoid SL circuit when the solenoid should not be activated. Solenoid SL cannot be activated.
- Diagnostic trouble code AT-332 is also stored if the transmission control module registers a short-circuit in the solenoid SL amplifier when this should not be activated. Solenoid SL cannot then be activated.

Substitute value(s)

- The transmission control module "Emergency mode I" program has been initiated.

Possible source(s)

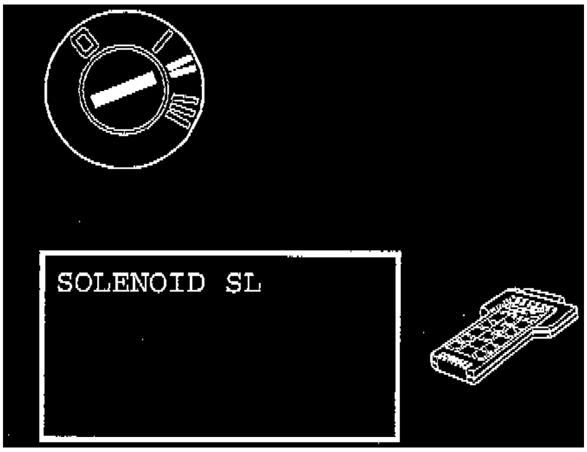
- Open-circuit in signal cable.
- Defective solenoid.
- Open-circuit in power ground.
- Contact resistance in terminals.
- Defective transmission control module.

Fault symptom(s)

- No lock-up function.
- No adaption of the gear slippage times at high altitude (High Altitude Compensation).

- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-332 Lock-Up Solenoid SL/Open-Circuit

Open-Circuit

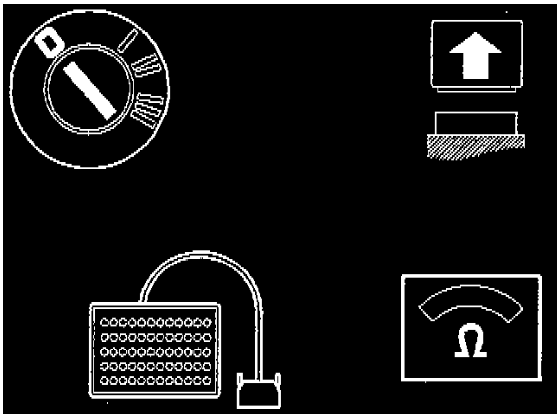


SPECIAL TOOLS

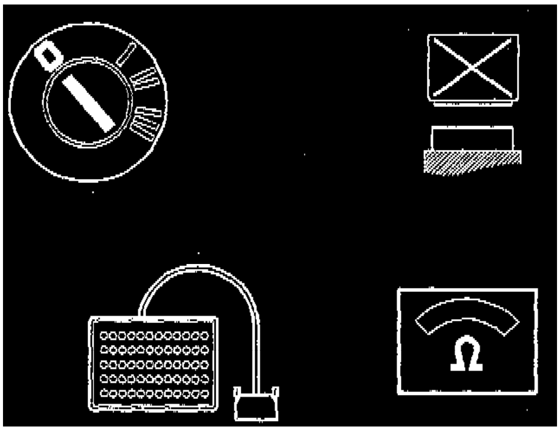
Test box tool No. 981 3190, or equivalent
Volvo scan tool No. 998 8686, or equivalent

OPEN-CIRCUIT

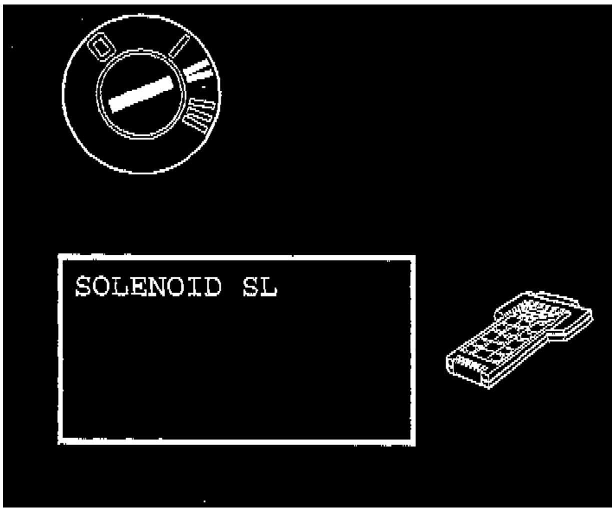
1. Checking lock-up solenoid SL
   - Preparation:
     Ignition ON
     Move gear selector to position P.
   - Activate solenoid SL.
   - Read off the solenoid status.
   - The status should alternate between OFF/ON.
   - Does the solenoid status alternate between OFF/ON?
     YES: Proceed to step 17
     NO: Proceed to step 2



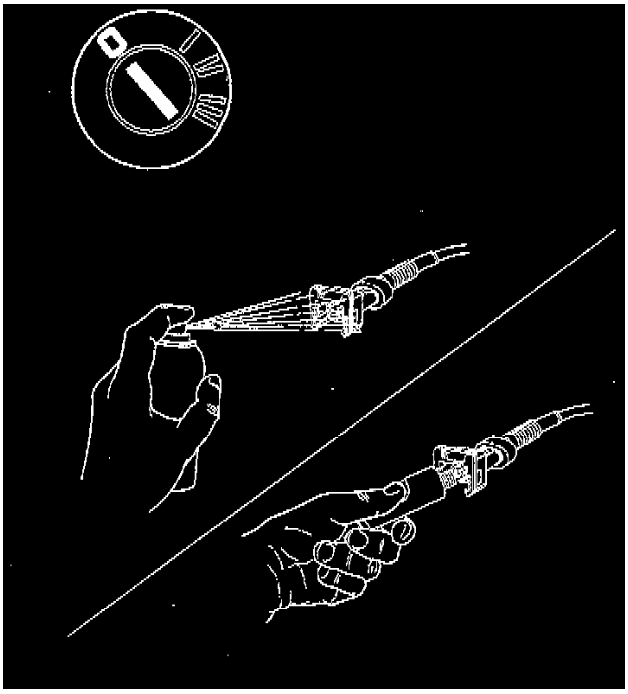
2. Checking power ground
   - Preparation:
     Ignition OFF
   - Connect the test box and check ground terminals. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Check the power ground carefully.
   - Are the ground terminals OK?
     YES: Proceed to step 4
     NO: Proceed to step 3
3. Fault-tracing information
   - The cause of the Diagnostic Trouble Code **(DTC)** has been a poor power ground.
   - Then continue with step 15



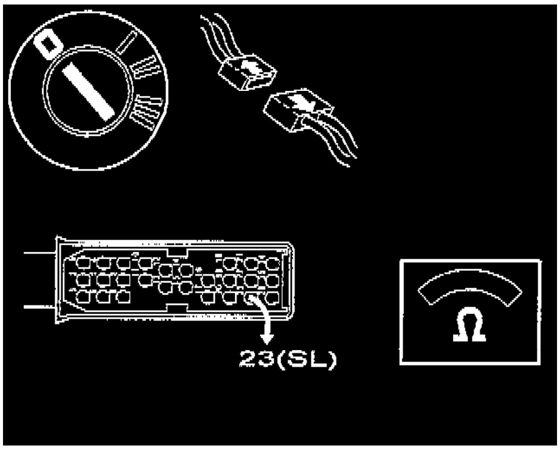
4. Checking resistance in solenoid SL circuit
   - Preparation:
     Ignition OFF
     Transmission Control Module **(TCM)** disconnected.
   - Connect an ohmmeter between #9 (#A9) and #29 (#A29) on the test box.
   - The ohmmeter should read **12-18 Ohms**
   - If reading is OK:
     Proceed to step 5
   - If reading is incorrect:
     Proceed to step 8



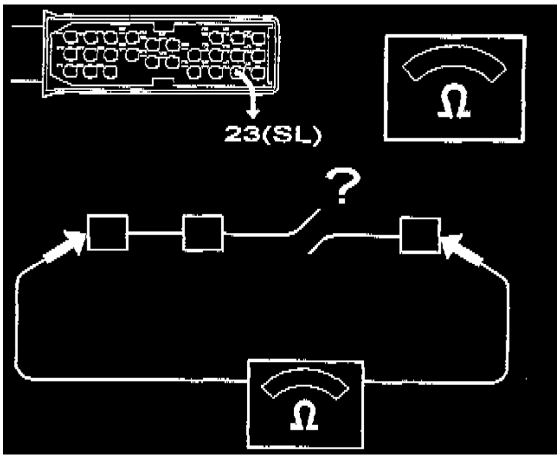
5. Checking control module
   - Preparation:
     Ignition ON
     Move gear selector to position P.
   - Read off solenoid SL status.
   - Its status should alternate between OFF/ON.
   - Does the solenoid status alternate between OFF/ON?
     YES: Proceed to step 7
     NO: Proceed to step 6
6. Replacing component
   - Try a new transmission control module, refer to Replacement. See: Transmission Control Systems/Relays and Modules - Transmission and Drivetrain/Relays and Modules - A/T/Control Module/Service and Repair
   - Then continue with step 15



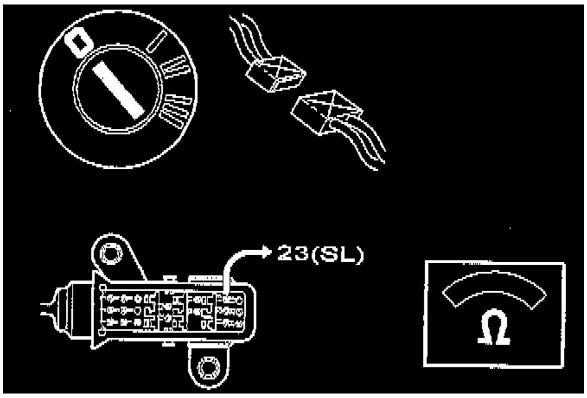
7. Checking for contact resistance and oxidation.
   - Preparation:
     Ignition OFF
   - The DTC was caused by poor contact in the TCM connector.
   - Check connector for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 15



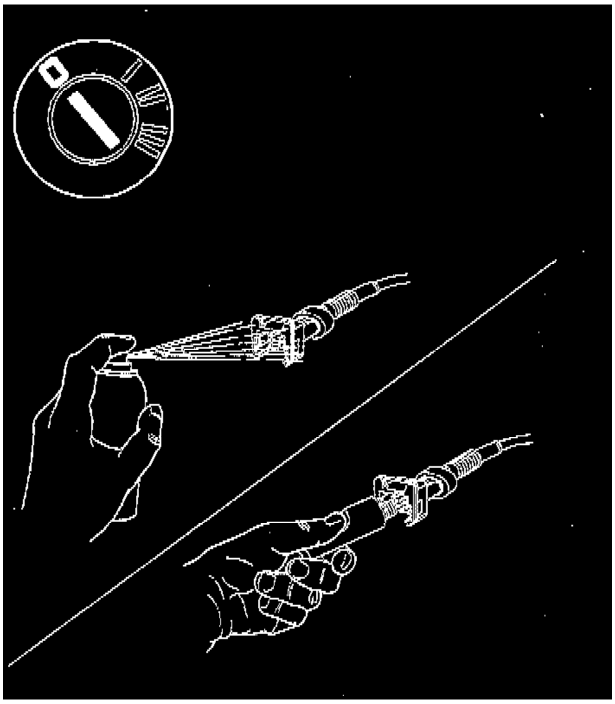
8. Checking signal cable
   - Preparation:
     Ignition OFF
     Remove the Air Cleaner **(ACL)** housing to access the transmission connector.
     Disconnect the transmission connector.
   - Connect an ohmmeter between the transmission connector terminal 23 (TCM side) and #9 (#A9) on the test box.
   - The ohmmeter should read approx. **0 Ohms**
   - If reading is OK:
     Proceed to step 10
   - If reading is incorrect:
     Proceed to step 9



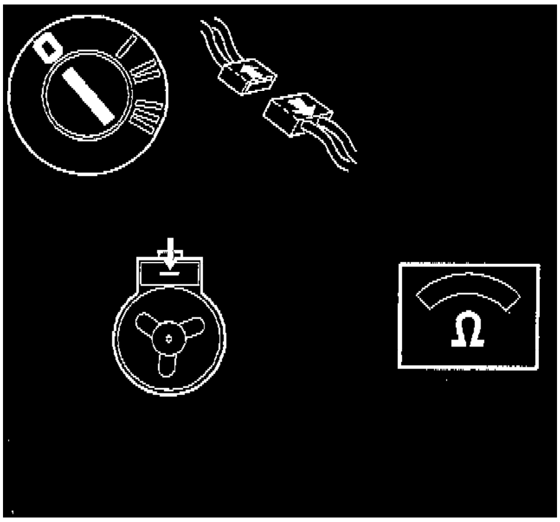
9. Checking for an open-circuit
   - Check the cable between the transmission connector terminal 23 and TCM #A9 for an open-circuit according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 15



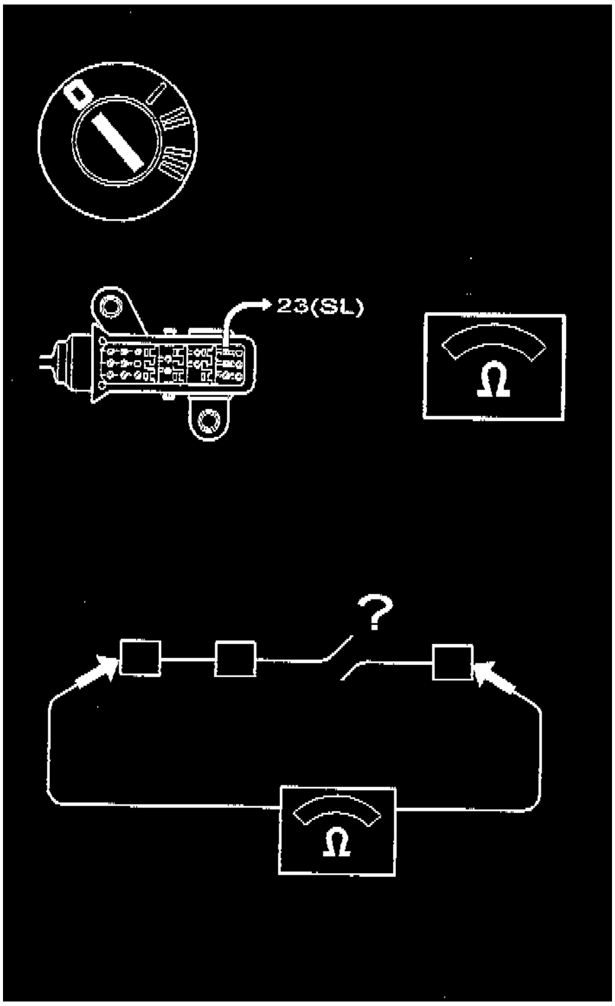
10. Checking solenoid SL circuit in the transmission
    - Preparation:
      Ignition OFF
      Disconnect transmission connector
    - Connect an ohmmeter between the transmission connector terminal 23 (transmission side) and the transmission housing.
    - The ohmmeter should read **12-18 Ohms**
    - If reading is OK:
      Proceed to step 11
    - If reading is incorrect
      Proceed to step 12



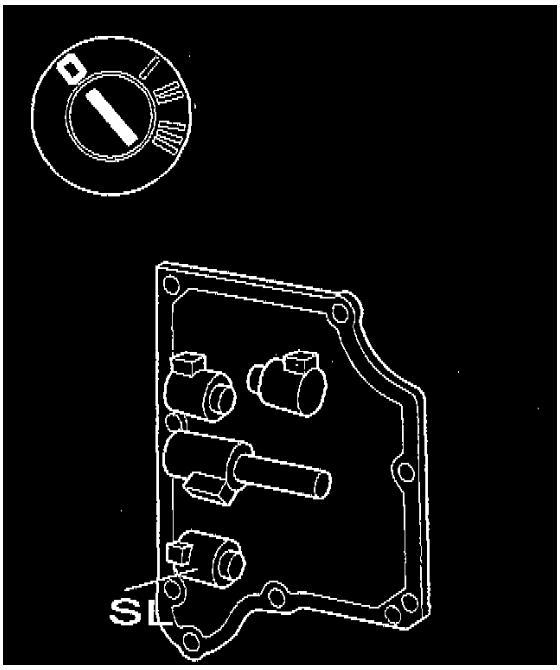
11. Checking for contact resistance and oxidation.
    - Preparation:
      Ignition OFF
    - The DTC was set because of poor contact in the transmission connector.
    - Check transmission and TCM connectors for contact resistance and oxidation and remedy according to step 5 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Then continue with step 15



12. Checking resistance in solenoid SL
    - Preparation:
      Ignition OFF
      Open the control system according to steps 1 through 14. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Valve Body/Service and Repair
      Disconnect solenoid SL.
    - Connect an ohmmeter between the pin on solenoid SL and the transmission housing (ground point).
    - The ohmmeter should read **12-13 Ohms**
    - If reading is OK:
      Proceed to step 13
    - If reading is incorrect:
      Proceed to step 14

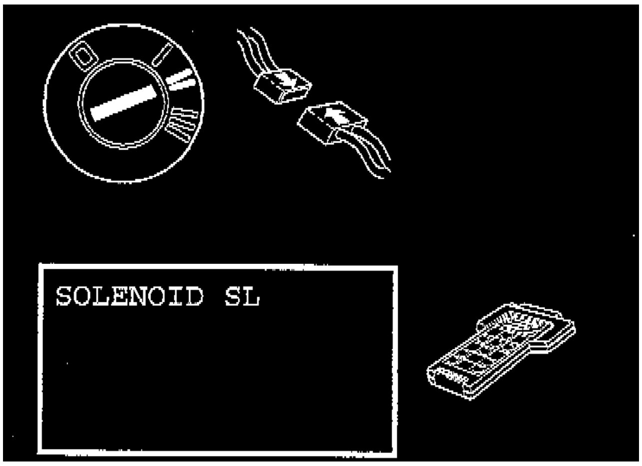


13. Checking for an open-circuit
    - Preparation:
      Ignition OFF
    - Check the cable between solenoid SL and transmission connector terminal 23 for an open-circuit according to step 2 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
    - Refer to replacing cable harness. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Valve Body/Service and Repair
    - Then continue with step 15



14. Replacing component
    - Preparation:
      Ignition OFF
    - Try a new solenoid SL according to step 21 of Shift Solenoid Inspection/Replacement. See: Transmission Control Systems/Actuators and

Solenoids - Transmission and Drivetrain/Actuators and Solenoids - A/T/Shift Solenoid/Service and Repair
- Then continue with step 15



15. Verification
    - After repairs have been completed they must be verified as follows to ensure that the fault has been eliminated:
    - Preparation:
        Ignition OFF
        Reconnect the connectors, reinstall components etc.
        Ignition ON
        Move gear selector to position P.
    - Activate solenoid SL.
    - Read off the solenoid status.
    - The status should alternate between OFF/ON.
    - Does the status alternate between OFF/ON??
        YES: Fault corrected
        NO: Proceed to step 16
16. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
        YES: Fault not corrected
        NO: Proceed to step 1Yes:

17. Intermittent fault
    - Preparation:
        Ignition OFF
    - Check transmission and TCM connectors for:
        Loose connections according to step 5 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
        Contact resistance and oxidation according to step 6 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Check cable between solenoid SL in the transmission and TCM #A9 for an intermittent open-circuit according to step 2 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Check cable between ground terminal 31/32 and TCM #A29 for an intermittent open-circuit according to step 2 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Check ground terminal 31/32 for contact resistance and oxidation according to step 6 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults

- Then continue with step 18

18. Fault-tracing information
    - For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.
    - Do you want to repeat fault-tracing?

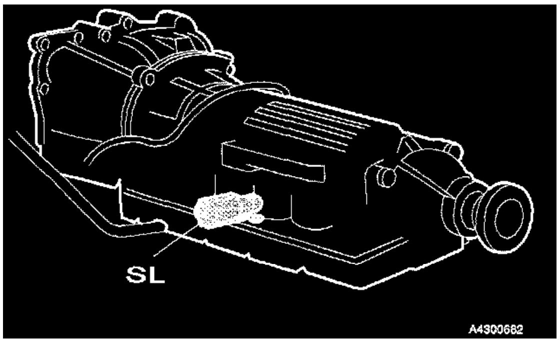
      YES: Proceed to step 1

      NO: Operation done

Trouble Code Conditions

Special Tools:

- 981 3190
- 998 8686



Trouble Code Conditions

- Lock-up solenoid SL controls the transmission lock-up function. Solenoid SL operates when it receives battery voltage from the transmission control module **(TCM)** and is activated during different driving conditions depending on road speed, throttle position and the driving mode selected. Diagnostic trouble code **(DTC)** AT-333 is stored if the transmission control module registers a short-circuit to ground in the solenoid SL circuit when the solenoid should be activated. Solenoid SL cannot then be activated.

Substitute value(s)

- The transmission control module "Emergency mode I" program has been initiated.

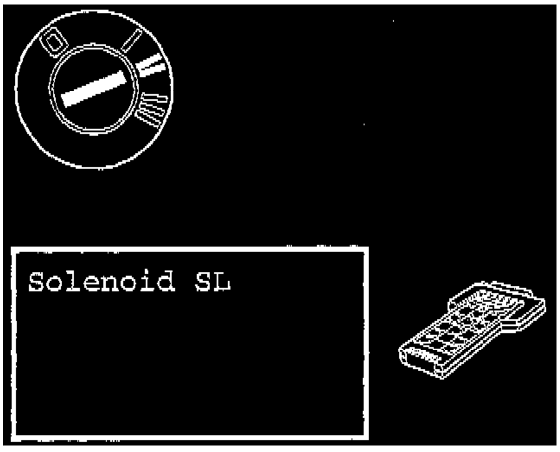
Possible source(s)

- Short-circuit to ground in signal cable.
- Defective solenoid.
- Defective transmission control module.

Fault symptom(s)

- No lock-up function.
- No adaption of the gear slippage times at high altitude (High Altitude Compensation).
- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-333 Lock-Up Solenoid SL/Short-Circuit To Ground

Short-Circuit To Ground



SPECIAL TOOLS

Volvo scan tool No. 998 8686, or equivalent

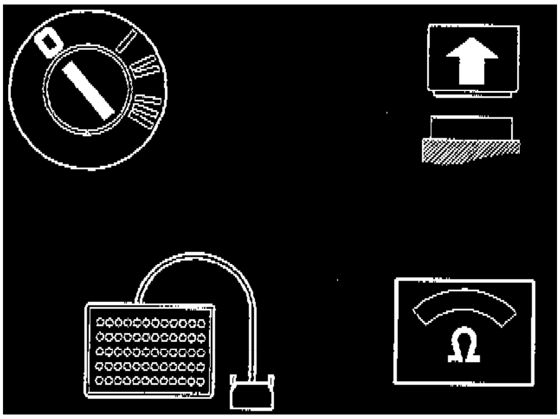
SHORT-CIRCUIT TO GROUND

1. Checking lock up solenoid SL
    - Preparation:

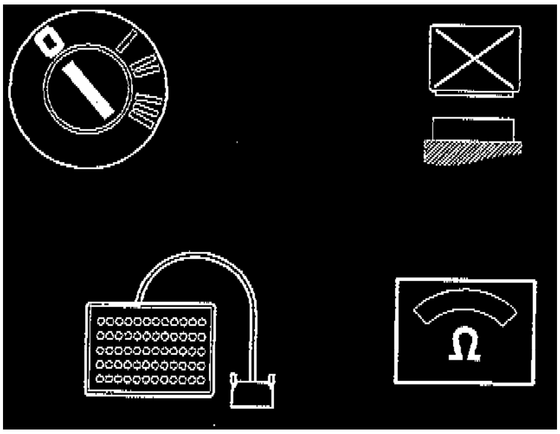
      Ignition ON

      Move gear selector to position P

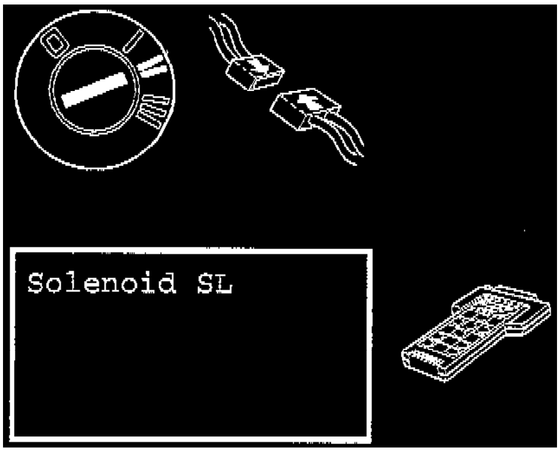
- Activate solenoid SL
- Read off the solenoid status
- The status can alternate between OFF/ON.
- Does the status alternate between OFF/ON?
  YES: Proceed to step 14
  NO: Proceed to step 7



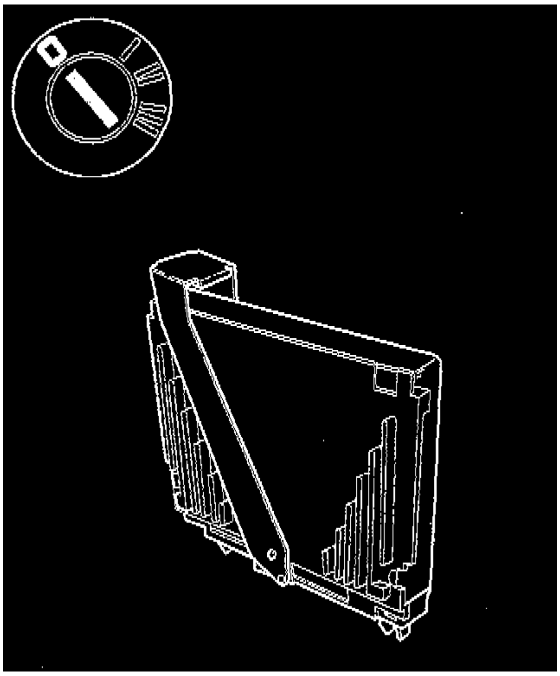
2. Connecting the test box
   - Preparation:
     Ignition OFF
   - Connect the Test Box and check ground points. See: Transmission Control Systems/Testing and Inspection/Pinout Values and Diagnostic Parameters/Test Box and Parameter Tables
   - Then continue with step 3



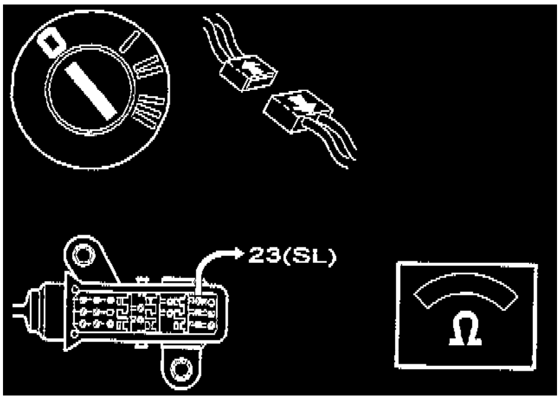
3. Checking resistance in-circuit to solenoid SL
   - Preparation:
     Ignition OFF
     Transmission Control Module **(TCM)** disconnected.
   - Connect an ohmmeter between #9 (A#9) and #29 (A#29) on the test box.
   - The ohmmeter should indicate **12-18 Ohms**
   - If reading is OK:
     Proceed to step 4
   - If reading is incorrect:
     Proceed to step 7



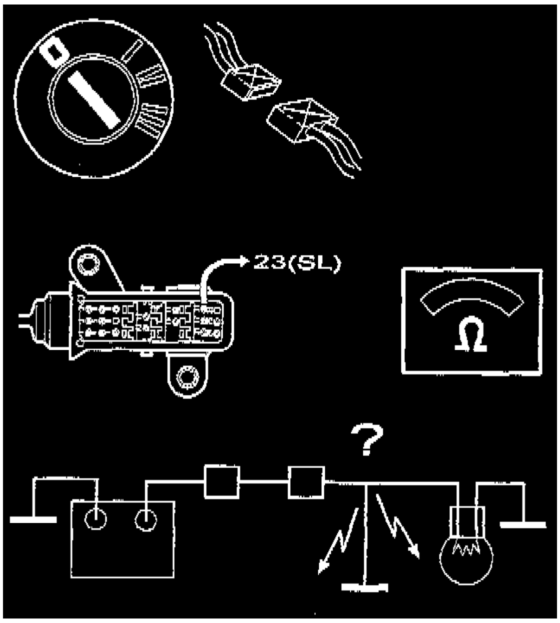
4. Checking the transmission control module
   - Preparation:
     Ignition OFF
     Reconnect the connectors, reinstall components etc.
     Ignition ON
     Move gear selector to position P.
   - Activate solenoid SL.
   - Read off the solenoid status.
   - The status should alternate between OFF/ON.
   - Does the status alternate between OFF/ON?
     YES: Proceed to step 5
     NO: Proceed to step
5. Fault-tracing information
   - According to this fault-tracing procedure the fault is no longer present.
   - Fault corrected



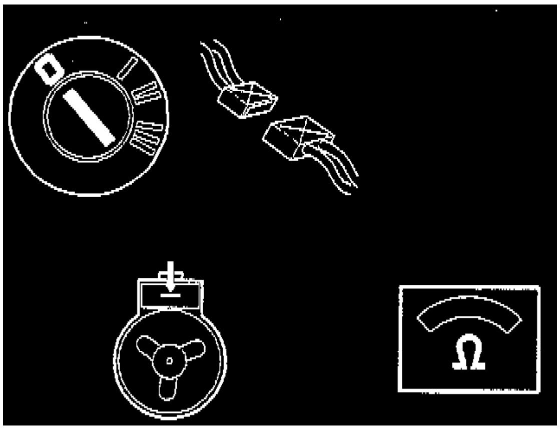
6. Replacing component
   - Preparation:
     Ignition OFF
   - Try a new TCM, refer to replacement. See: Transmission Control Systems/Relays and Modules - Transmission and Drivetrain/Relays and Modules - A/T/Control Module/Service and Repair
   - Then continue with step 12



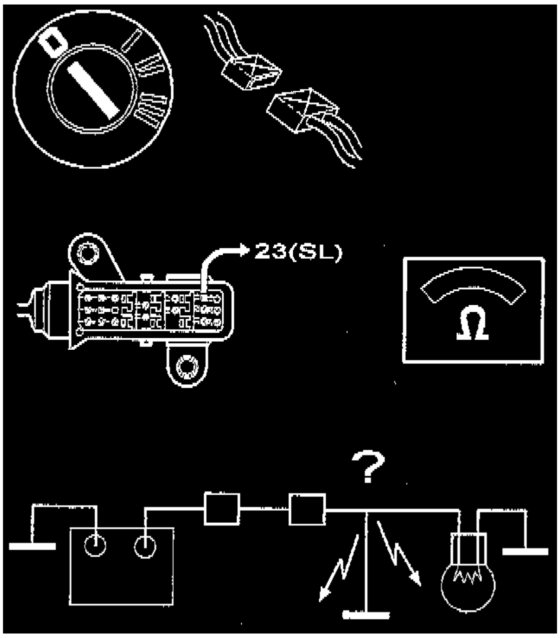
7. Checking the signal wiring resistance to ground in the transmission
   - Preparation:
     Ignition OFF
     Remove the Air Cleaner **(ACL)** housing to access the transmission connector
     Disconnect the transmission connector
   - Connect an ohmmeter between the transmission connector terminal 23 (transmission side) and the transmission housing.
   - The ohmmeter should read approximately **10-15 Ohms**
   - If reading is OK:
     Proceed to step 8
   - If reading is incorrect:
     Proceed to step 9



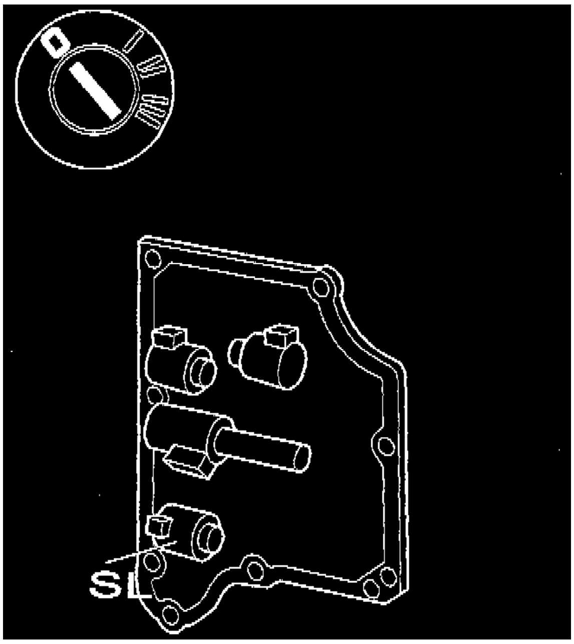
8. Checking for short-circuit
   - Preparation:
     Ignition OFF
     Connector disconnected
   - Check the cable between the transmission connector terminal 23 and TCM #A9 for short-circuit in the circuit according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - Then continue with step 12



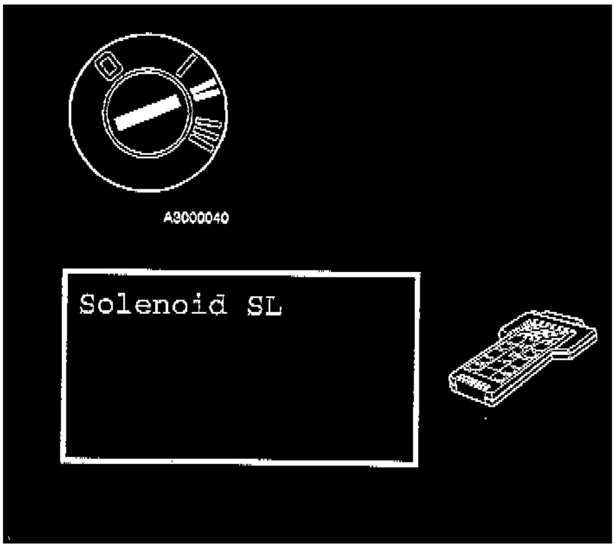
9. Checking resistance in lock-up solenoid SL
   - Preparation:
     Ignition OFF
     Open the control system, according to steps 1 through 14. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Valve Body/Service and Repair
     Disconnect solenoid SL.
   - Use an ohmmeter to measure between the pin on solenoid SL and the transmission housing.
   - The ohmmeter should indicate **10-15 Ohms**
   - If reading is OK:
     Then continue with step 10
   - If reading is incorrect:
     Then continue with step 11



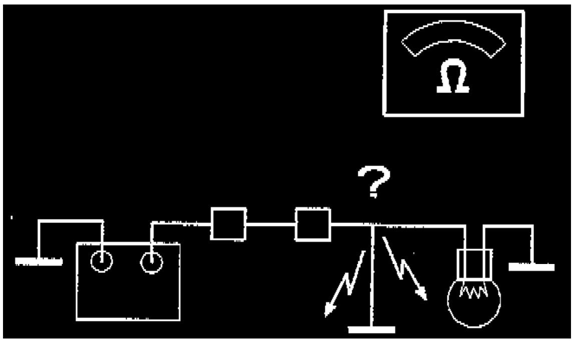
10. Checking for short-circuit
   - Preparation:
     Ignition OFF
     Control system open.
   - Check the cable between the solenoid SL and transmission connector terminal 23 for short-circuit to ground according to step 3 of checking for permanent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Permanent Faults
   - If replacing cable harness, refer to Solenoid Wire Harness Inspection/Replacement. See: Transmission and Drivetrain/Automatic Transmission/Transaxle/Valve Body/Service and Repair
   - Then continue with step 12



11. Replacing component
    - Preparation:
        Ignition OFF
    - Try a new solenoid SL according to step 21 of Shift Solenoid Inspection/Replacement. See: Transmission Control Systems/Actuators and Solenoids - Transmission and Drivetrain/Actuators and Solenoids - A/T/Shift Solenoid/Service and Repair
    - Then continue with step 12



12. Verification
    - After repairs have been completed they must be verified as follows to ensure the fault has been eliminated:
    - Preparation:
        Ignition OFF
        Move gear selector to position P
    - Activate solenoid SL
    - Read off the solenoid status
    - The status should alternate between OFF/ON.
    - Does the status alternate between OFF/ON?
        YES: Fault corrected
        NO: Proceed to step 13
13. Fault-tracing information
    - The verification result shows that the fault persists.
    - Do you want to exit fault-tracing?
        YES: Fault not corrected
        NO: Proceed to step 13



14. Intermittent fault
    - Check the wiring between solenoid SL in the transmission and TCM #A9 for intermittent short-circuit to ground according to step 3 of checking for intermittent faults. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking For Intermittent Faults
    - Then continue with step 15
15. Fault-tracing information
    - For intermittent faults fault-tracing is not followed by a verification because the fault is not present at this moment.
    - Do you want to repeat fault-tracing?

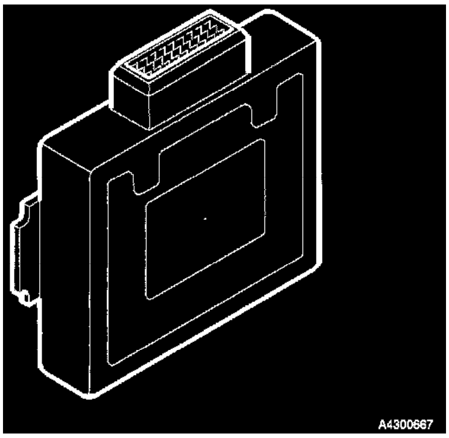
      YES: Proceed to step 1

      NO: Operation done

Trouble Code Conditions

Special Tools:

- 981 3190
- 998 8686



Trouble Code Conditions

- The transmission control module **(TCM)** calculates the ratio between the torque converter input speed (engine speed RPM) and the transmission speed after the torque converter. Diagnostic trouble code **(DTC)** AT-341 is stored if the transmission control module registers a difference of over 100 rpm between the speeds, even though the lock-up function is activated.

Substitute value(s)

- The transmission control module "Emergency mode I" program has been initiated.

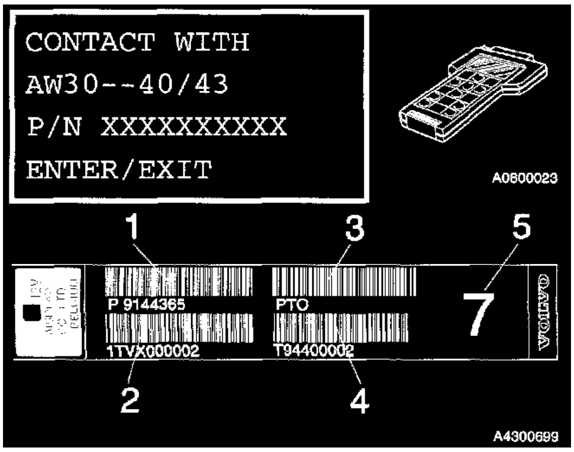
Possible source(s)

- Contact resistance in terminals.
- Mechanical fault in the transmission.

Fault symptom(s)

- The combined instrument panel warning lamp flashes.
- Mechanical malfunction. Faults are usually indicated by noise or other obvious function problems.
- No lock-up function.
- No adaption of the gear slippage times at high altitude (High Altitude Compensation).
- Start fault-tracing. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-341 Lock-Up Function/Slipping Or Not Engaged

Slipping Or Not Engaged

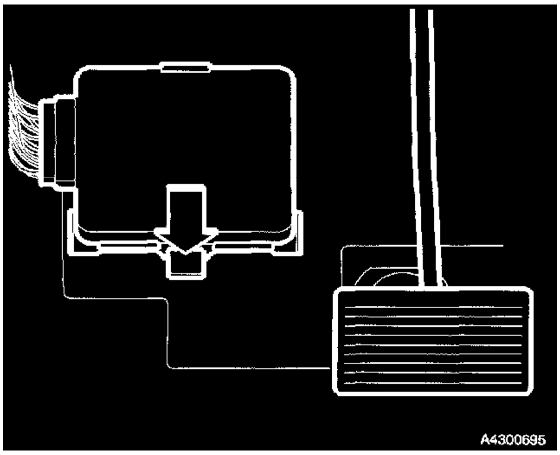


Checking The Transmission Control Module

- Check that the transmission control module **(TCM)** has the correct P/N. Compare the transmission control module P/N with the engine and transmission specifications.
- Is the transmission control module P/N correct?

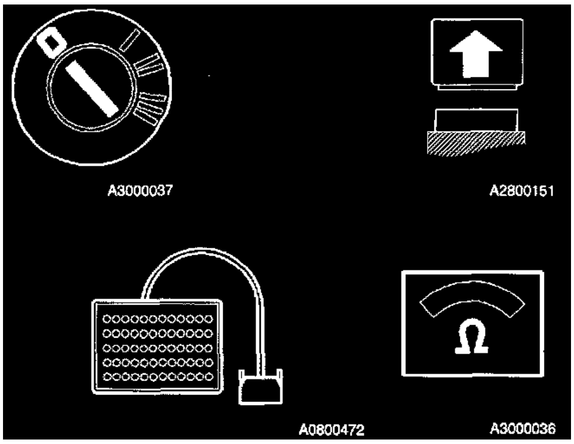
  Yes:
  - Proceed to: **Connecting The Test Box** section below.

  No:
  - Proceed to: **Replacing Component** section below.



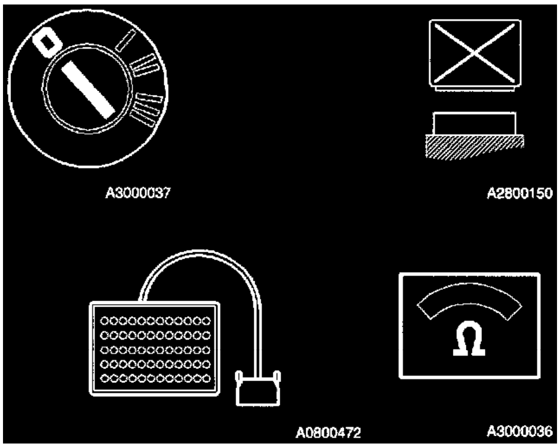
Replacing Component

- Try a new transmission control module.
- Proceed to: **Test Driving** section below.



Connecting The Test Box

- Ignition OFF.
- Connect the test box and check ground terminals.
- Proceed to: **Checking Resistance In Solenoid SL Circuit** section below.

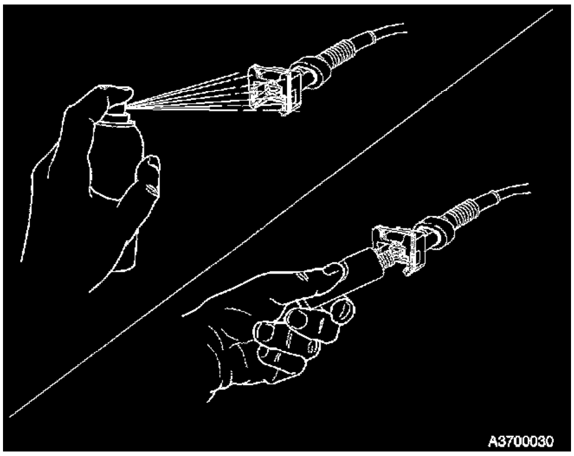


Checking Resistance In Solenoid SL Circuit

- Ignition OFF.
- Transmission control module disconnected.
- Test box connected.
- Connect an ohmmeter between # 2 and # 15 on test box.
- The ohmmeter should read **12-18 Ohms**.

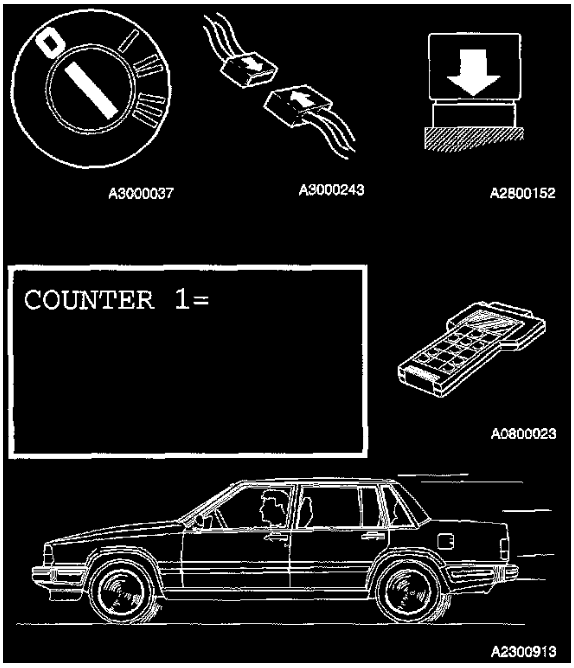
  If reading is OK:
  - Proceed to: **Test Driving** section below.

  If reading is incorrect:
  - Proceed to: **Checking For Contact Resistance And Oxidation** section below.



Checking For Contact Resistance And Oxidation

- Check transmission and transmission control module connectors for contact resistance and oxidation and remedy.
- Proceed to: **Test Driving** section below.



Test Driving

- Ignition OFF.
- Reconnect connectors, reinstall components.
- Read off diagnostic trouble code **(DTC)** counter and note value.
- Test drive car according to Test Drive Form.
- For the driving conditions required to engage and disengage lock-up. See: Diagnostic Trouble Code Tests and Associated Procedures/Manufacturer Code Charts/Transmission Control Module (TCM/AT Codes)/AT-341 Lock-Up Function/Lock-Up
- The transmission should have normal operating temperature when test driving because lock-up engagement is dependent on the temperature of the oil in the transmission.

  NOTE: Do not switch OFF ignition.

- Read off diagnostic trouble code counter with-out switching OFF the ignition.
- Is counter value greater than 0?

  Yes:
  - Fault corrected.

  No:
  - Proceed to: **Checking Mechanical Faults** section below.

Checking Mechanical Faults

- Check and remedy mechanical transmission faults.
- Proceed to: **Test Driving** section above.

Lock-Up

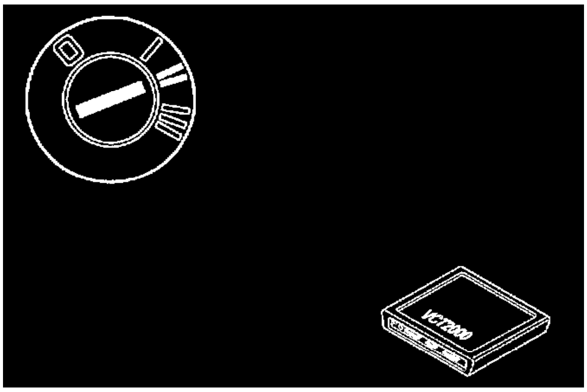
The torque converter lock-up, as with the shifting speeds, occurs at different speeds depending on which driving mode and gear has been selected and engaged at any particular time. As well as vehicle speed the transmission and outside air temperature and engine load are taken into consideration.

The lock-up function is also controlled by the temperature of the oil in the transmission, and, because of the oil temperature sensor location in the transmission a tolerance of **±10%** must be allowed for when using vehicle speeds contained in the tables. (The oil temperature sensor is not located in the hottest part of the transmission).

Lock-up engagement normally occurs only in 4th gear in the D position and in 3rd gear in the 3 position, but lock-up can also be engaged in 3rd and 2nd gear at high transmission oil temperatures. Lock-up is always disengaged if the throttle opening is below **3%** regardless of the vehicle speed.

TCM-XXXX - Unknown Diagnostic Trouble Code (DTC) For the Current Control Module Version

Reading Off Diagnostic Trouble Codes (DTCs)



- Ignition on.

Read off the diagnostic trouble code (DTC) that is stored in the car.

Make a note of the code. Report the code to VIDA customer support.

CONTINUE: Refer to Trouble Code Descriptions. See: Transmission Control Systems/Testing and Inspection/Diagnostic Trouble Code Descriptions

VIDA (Vehicle Information & Diagnostics For Aftersales)

VIDA (Vehicle Information & Diagnostics for Aftersales)

During the second half of 2004, VADIS (Volvo Aftersales Diagnostic and Information System) was phased out and replaced by VIDA (Vehicle Information & Diagnostics for Aftersales). The purpose of VIDA is to support service providers in repairing and servicing Volvo vehicles. VIDA provides Service and Parts information, as well as diagnostic fault tracing, and software downloads. As in VADIS, these areas are integrated into one single application. All functionality that could be found in VADIS will be found in VIDA. However, in some particular areas, e.g., the diagnostic work flow, search functionality, and the Parts catalogue, VIDA contains considerable enhancements when compared to VADIS.

Volvo's VIDA (Vehicle Information & Diagnostics for Aftersales) system ties together service and repair data, parts data, service bulletins, software (firmware) downloads, fault tracing and on-board diagnostic as well as other related information to decrease service time.

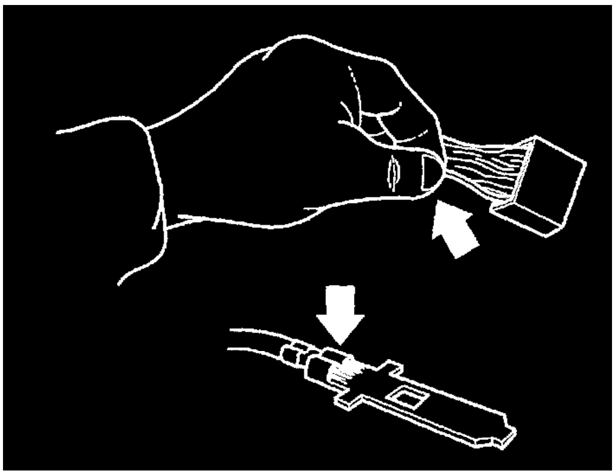
Much of the diagnostic information provided here is presented in a manner that assumes the technician is using the web-based Volvo diagnostic system (VIDA) to diagnose the vehicle. Volvo does not provide any information based on performing diagnosis with a third party diagnostic tool aside from a conversion from P Codes to Volvo ECM Codes. See: Diagnostic Trouble Code Descriptions

Checking Wiring and Terminals - Intermittent Faults

Cleaning female socket terminals and male pin terminals
Greasing female terminals

Checking Wiring And Terminals - Intermittent Faults

Inspect terminals visually



NOTE: When checking the engine control module (ECM), do not remove the control module from the car before the main relay has interrupted the power supply. This may take up to **4 minutes** after the ignition has been switched off and the engine cooling fan (FC) has stopped running.

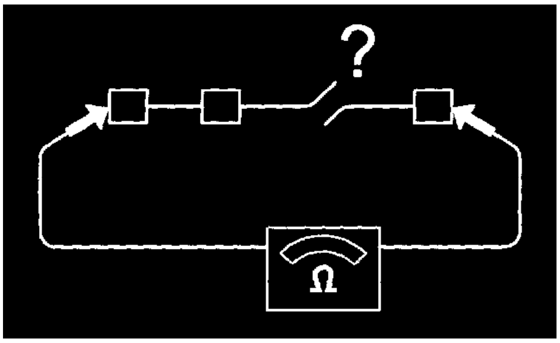
Inspect the terminals visually when checking, or taking readings from, opened connectors.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:

- Check for oxidation. This can cause poor connections in the terminals
- Check for damage to pins and terminals. Check that they are properly inserted into the connector. Check that the cable is properly connected to the pin or terminal. Check pins and terminals particularly carefully
- Using a loose male connector, test to see if the female connector provides a good contact and that the pin remains in place when the male connector is pulled lightly
- Shake the cable lightly and pull on connectors during measurement to locate damage.

Open-circuit, intermittent faults



An open-circuit in a cable will be indicated by the loss of a function (or functions).

Chafed and broken leads are common causes of faults.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:

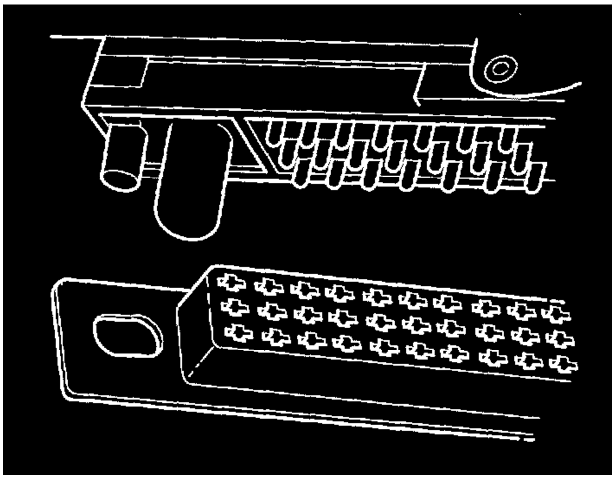
- Disconnect the connectors at both ends of the cable.

Check the cables visually according to **(LA1).**

Connect an ohmmeter between the ends of the cable.

The ohmmeter should read approximately **0 [ohm]** if there is no open-circuit in the cable.

Shake the cable lightly and pull on connectors during measurement to locate the damage.

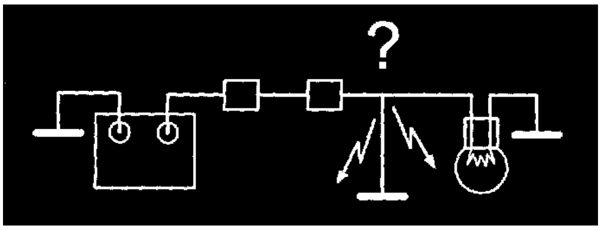


If the reading is not Correct. Replace the cable and/or continue according to **(LA6).**

Always check the control module and control module box connectors to ensure that their pins and sockets are not bent or damaged, this may cause faults.

Check pins and terminals particularly carefully.

Short-circuit to ground, intermittent faults



A short-circuit between a live cable and ground is often indicated by the loss of a function or a fuse blowing when a current is passed through the cable.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:

- Check the cables visually according to **(LA1)**. Activate all switches and sensors in the circuit. Check whether the fuse blows
- Disconnect the connectors in the circuit to ensure that they do not affect readings.

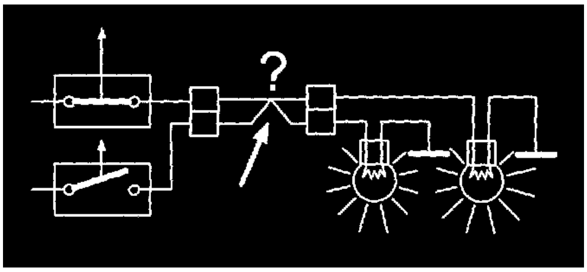
Connect an ohmmeter between cable and ground.

The ohmmeter should read infinite resistance if no components are connected.

Shake the cable lightly and pull on connectors during measurement to locate the damage.

If the value is not correct, try a new cable and/or continue according to **(LA6)**.

Short-circuit to supply voltage, intermittent faults



A short-circuit between a cable and supply voltage is often indicated by the loss of a function or a fuse blowing when a current is passed through the cable.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:

- Check the cables visually according to (LA1). Use a voltmeter to take readings at various points in the circuit while operating switches and sensors.

The voltmeter reading depends on the circuit being tested and the positions of switches and sensors. Use the wiring diagram to determine the correct voltage in the circuit.

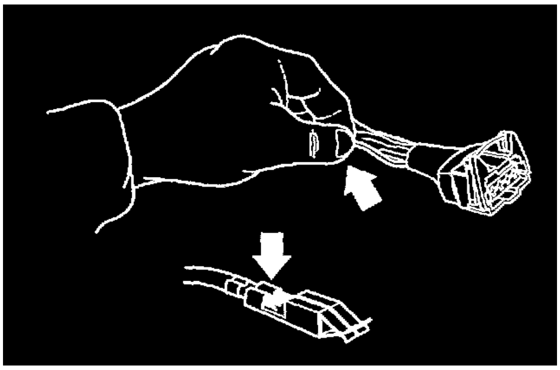
Use an ohmmeter between the suspect cables to detect short-circuits between them.

The ohmmeter should read infinite resistance between cables not connected to each other in the circuit.

Shake the cable lightly and pull on connectors during measurement to locate the damage.

If the reading is not correct. Replace the cable and/or continue according to **(LA6).**

Loose connections (terminals)



To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

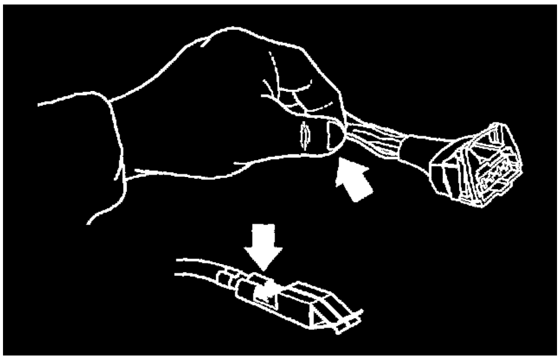
Loose connections in terminals may be caused by oxidation of the pins and sockets, or by a faulty connection of a cable to its cable terminal.

Loose connections produce the same faults as an intermittent open-circuit in a cable.

Checks:

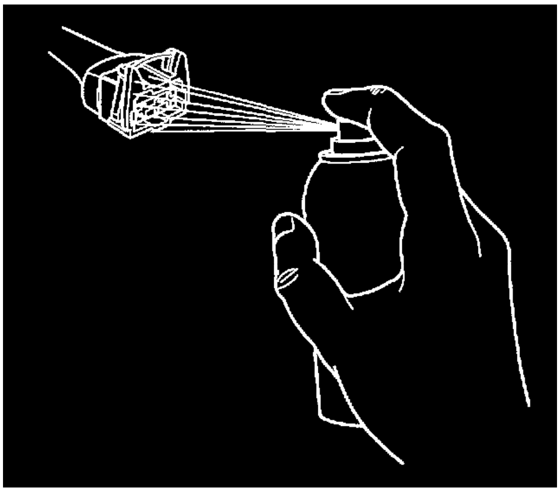
- Inspect terminals visually according to **(LA1)**. Continue according to **(LA6)**.

Contact resistance and oxidation



In theory, the resistance across contacts, leads and terminals should be **0 [ohm]**. However, there is always some resistance due to terminal oxidation.

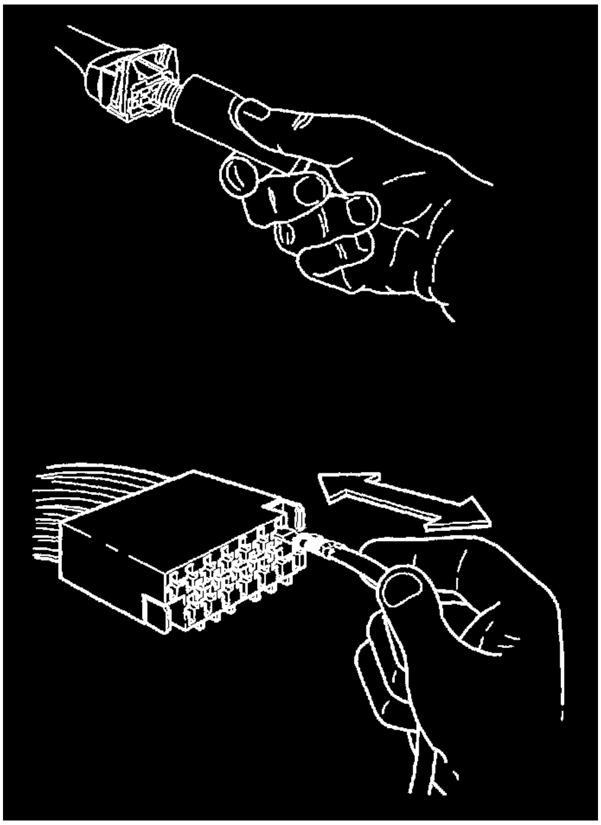
If resistance is too great there will be function problems.
The magnitude of the resistance before it causes a malfunction depends on the circuit load. A guideline would be a few ohms.



NOTE: Do not apply rust solvent spray or grease to the heated oxygen sensor (HO2S) or combined instrument panel connectors.

- Ignition off
- Disconnect the battery negative terminal
- Use compressed air to clean the disconnected connector
- Apply rust solvent spray 1161422 to the disconnected connectors
- Blow clean using compressed air.

NOTE: Do not fill the protective cover with grease.



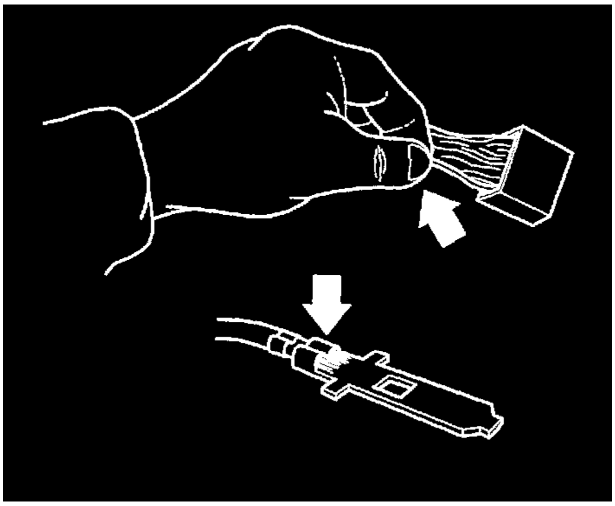
- Press grease, P/N 1161417-9, into the terminals directly from the tube
- Check that all the cavities in the connectors are filled
- Use a loose male pin to ensure that contact in sockets is good. The pin should remain in position when pulled gently.

Checking Wiring and Terminals - Permanent Faults

Cleaning female socket terminals and male pin terminals
Greasing female terminals

Checking Wiring And Terminals - Permanent Faults

Check Terminals Visually



NOTE: When checking the engine control module (ECM), do not remove the control module from the car before the main relay has interrupted the power supply. This may take up to **4 minutes** after the ignition has been switched off and the engine cooling fan (FC) has stopped running.

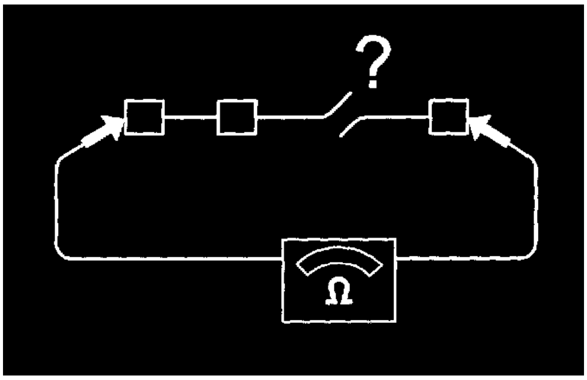
Inspect the terminals visually when checking, or taking readings from, opened connectors.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:
- Check for oxidation. This can cause poor connections in the terminals
- Check for damage to pins and terminals. Check that they are properly inserted into the connector. Check that the cable is properly connected

to the pin or terminal. Check pins and terminals particularly carefully
- Use a separate male terminal to check the female terminal. Check that they are secure. Pull on the pin.

Open-circuit, permanent faults



An open-circuit in a cable is indicated by a loss of one or more functions.

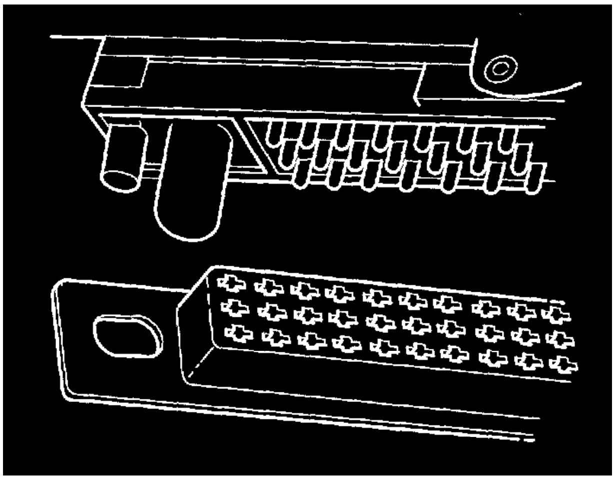
Chafed and broken cables or terminals that have come loose are common causes of faults in electrical systems.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:
- Disconnect the connectors at both ends of the cable.

Connect an ohmmeter between the ends of the cable.

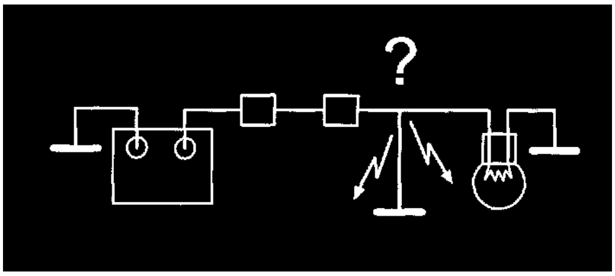
The ohmmeter should read approximately **0 [ohm]** if there is no open-circuit in the cable.



Always check the control module and control module box connectors to ensure that their pins and sockets are not bent or damaged, as this can cause faults.

Check pins and terminals particularly for this fault. See **(LA1)**.

Short-circuit to ground, permanent faults



A short-circuit between a live cable and ground is often indicated by the loss of a function or a fuse blowing when a current is passed through the cable.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:

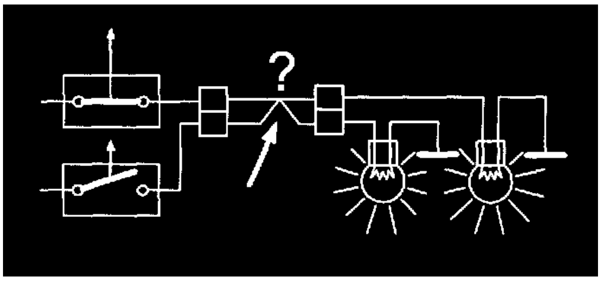
- Activate all switches and sensors in the circuit. Check whether the fuse blows
- Disconnect the connectors in the circuit to ensure that they do not affect readings.

Use an ohmmeter to take a resistance reading between the cable and ground.

The ohmmeter should read infinite resistance if no components are connected.

Check pins and terminals particularly for this fault. See **(LA1)**.

Short-circuit to supply voltage. Permanent faults



A short-circuit between a cable and supply voltage is often indicated by the loss of a function or a fuse blowing when voltage is passed through the cable.

To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

Checks:

- Use a voltmeter to take readings at various points in the circuit while operating switches and sensors.

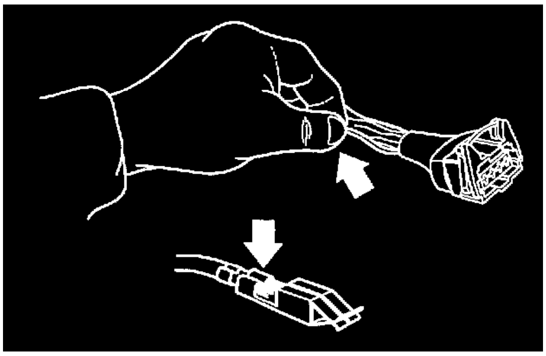
Voltmeter readings will depend on which circuit is tested and the status of switches and sensors. Use the wiring diagram to determine the correct voltage in the circuit.

Use an ohmmeter between the suspect cables to detect short-circuits between them.

The ohmmeter should read infinite resistance between cables not connected to each other in the circuit.

Check pins and terminals particularly for this fault. See **(LA1)**.

Contact resistance and oxidation



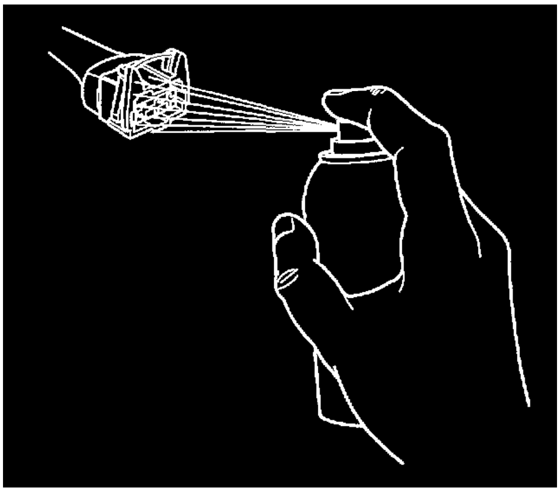
To repair wiring and cable terminals, see **Wiring repairs**, Wiring repairs and replacing cable terminals, 850, 900.

In theory, the resistance across contacts, leads and terminals should be **0 [ohm]**. However, there is always some resistance due to terminal oxidation.

If this resistance becomes too great the result will be a malfunction. The magnitude of the resistance before it causes a malfunction depends on the circuit load.

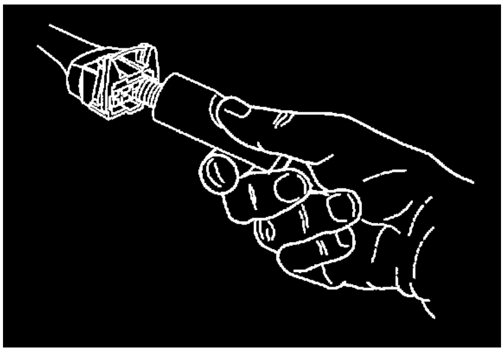
Checks:

- Check the cables visually according to **(LA1)**.



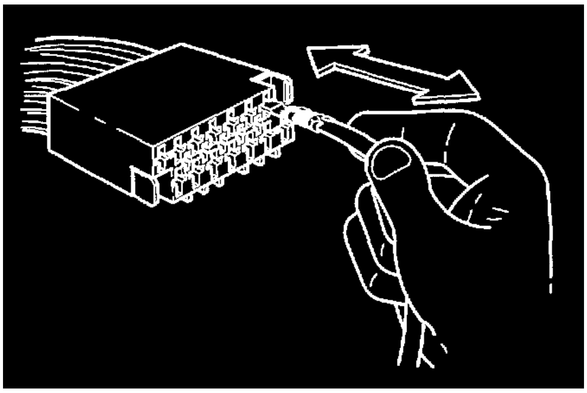
NOTE: Do not apply rust solvent spray or grease to the heated oxygen sensor (HO2S) or combined instrument panel connectors.

- Ignition off
- Disconnect the battery negative terminal
- Use compressed air to clean the disconnected connector
- Apply rust solvent spray 1161422 to the disconnected connectors
- Blow clean using compressed air.



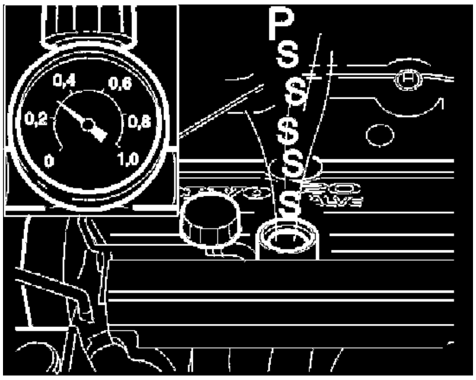
NOTE: Do not fill the protective cover with grease.

- Press grease, P/N 1161417-9, into the female sockets directly from tube
- Check that all the terminal cavities are filled
- Use a loose male pin to ensure that the connection in the sockets is good. The pin should remain in position when pulled gently.



Check For Air Leaks In the Intake System

CHECK FOR AIR LEAKS IN THE INTAKE SYSTEM



Preparations

Check that all hoses are undamaged and are in place with their hose clips tightened.

Connecting

Remove fresh air hose from mass air flow (MAF) sensor.

Install tool 999 5545 with pressure regulator 999 5544 on fresh air hose and tighten hose clamp.

Use hose clip to seal crankcase ventilation hose.

Remove oil filler cap.

Remove the lower hose from the canister purge (CP) valve.

Check
Connect the compressed air hose and adjust the regulator to obtain a pressure of maximum 0.3 bar.

A gentle hissing sound can be heard from the oil filler opening. This is due to the opening of an intake valve and the leakage of cylinder pressure past the piston rings.

If a leak is suspected spray a soap solution onto the area.

Small bubbles are permissible between throttle body (TB) and intake hose (if made of plastic). No bubbles are permissible with rubber hose.

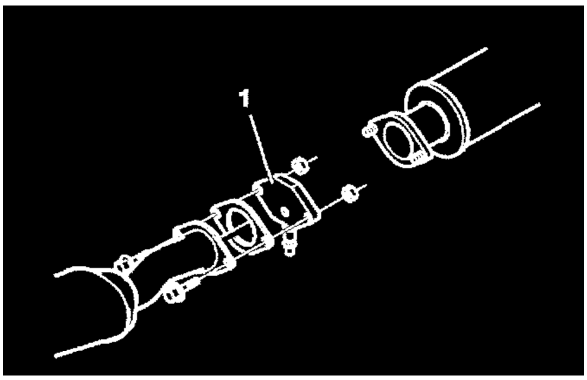
Check for air leakage from canister purge (CP) valve. No leakage is permissible.

Checking For Air Leakage In the Exhaust System

CHECKING FOR AIR LEAKAGE IN THE EXHAUST SYSTEM

Special tools: 999 5544, 999 7085

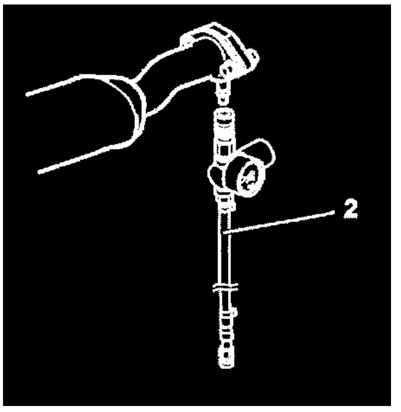
Note! The illustrations in this service information are used for different model years and/or models. Some variation may occur. However, the essential information in the illustrations is always correct.



Preparatory work
Removing components
Remove:
- the nut where the three-way catalytic converter (TWC) and exhaust system separate

Note! Use rust solvent or similar on the nuts.

- the gasket. Separate the exhaust system from the three-way catalytic converter (TWC).



Installing tool

Install:

- The tool (1) 999 7085 using a new gasket pressure regulator 999 5544 on tool 999 7085.

Adjust the pressure to 0.4 bar.

Cleaning and checking

Check

Check the exhaust system by spraying a soap solution on all joints and connections between the cylinder head and the rear heated oxygen sensor (HO2S). Only very small and slow bubbles are permissible.

Finishing

Removing tools

Remove:

- pressure regulator 999 5544 tool 999 7085.

Installing components

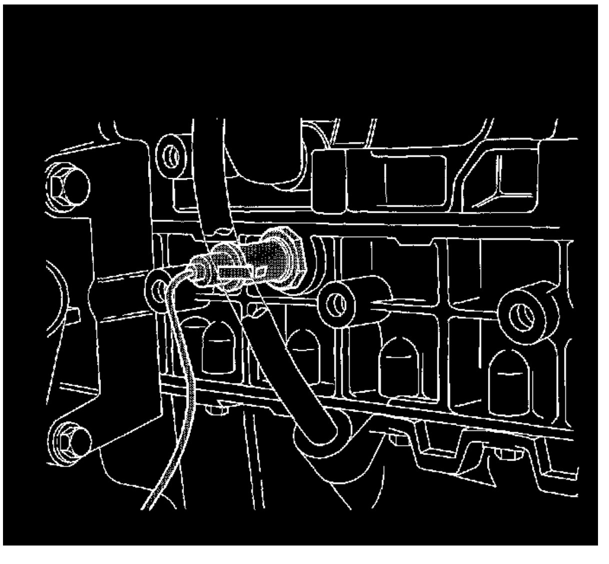
Install:

- a new gasket where the exhaust system and three-way catalytic converter (TWC) divide
- a new nut for the exhaust system. Tighten.

Start the engine. Check for leaks where the threeway catalytic converter (TWC) and the exhaust system divide.

Checking Oil Pressure

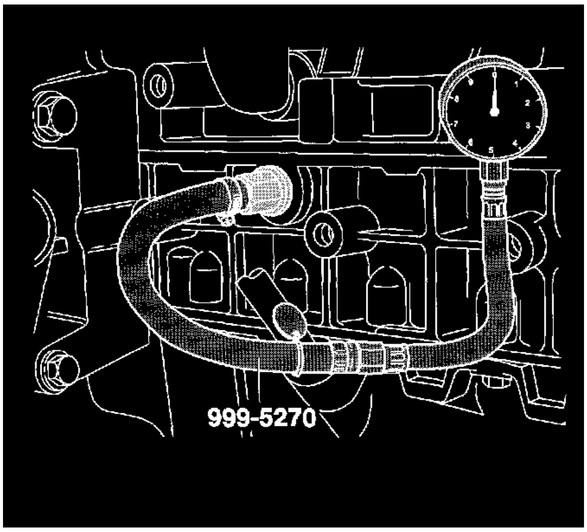
Checking Oil Pressure



Use oil pressure gauge kit 999 5270.

Adapter 999 5273, hose 999 5272 and gauge 999 5271.

Connect these items to the hole on the cylinder block for the oil pressure sensor.



Start the engine. Read off the oil pressure at different engine speeds **(RPM)**.

13.3 r/s (800 r/min)	0.10 MPa
14.2 r/s (850 r/min)	0.10 MPa
66.7 r/s (4000 r/min) minimum	0.35 MPa
66.7 r/s (4000 r/min) maximum	0.70 MPa

Oil Pressure At RPM

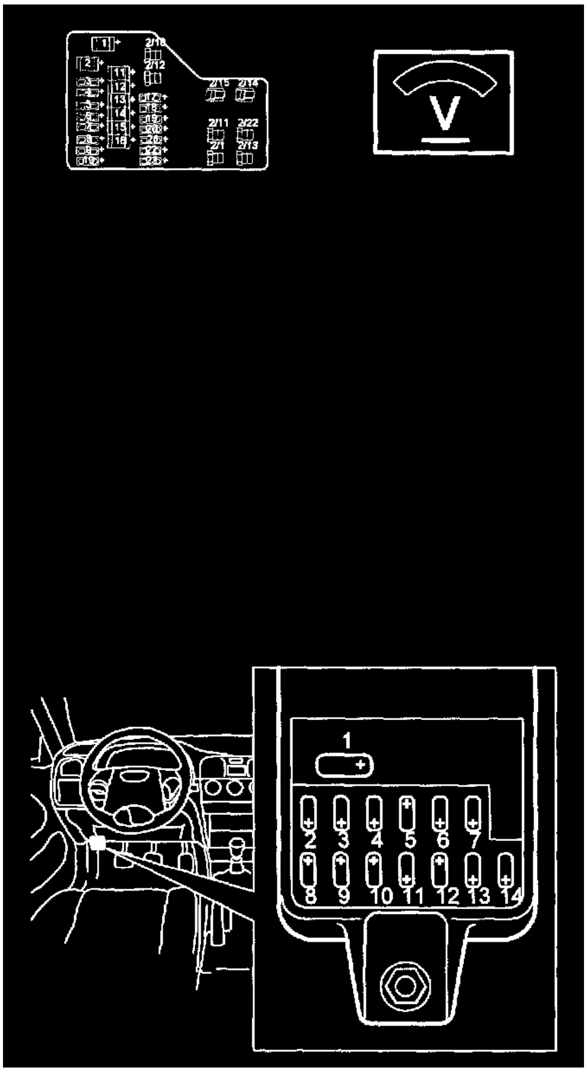
Minimum oil pressure table

Note: The relief valve begins to open at 0.5 MPa.

Remove the tools.
Use a new gasket when installing the oil pressure sensor.
Tighten to **25 Nm**.

Checking Power and Ground Terminals

Checking Power Supply and Ground Terminal, Engine Control Module (ECM)



Checking the power supply

- Check fuse 11 the integrated relay/fusebox in the passenger compartment. If the fuse is blown, check the circuit after the fuse for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**
- Check fuse 13 the integrated relay/fusebox in the engine compartment. If the fuse is blown, check the circuit after the fuse for a short-circuit to ground according to **Checking wiring and terminals - Permanent faults**
- Check the power supply to terminal 29. The voltage should be approximately battery voltage with the ignition on
- Check the power supply to terminal 66. The voltage should be approximately battery voltage for **2 seconds** after the ignition is switched on
- Check the power supply to terminal 30. The voltage should be approximately battery voltage for **2 seconds** after the ignition is switched on
- Remedy as necessary.

Checking the ground terminal

- Check the ground lead at engine control module (ECM) terminals 3, 28, 33 and 67 for an open-circuit according to **Checking wiring and terminals - Permanent faults**
- Check the ground terminal on the engine control module (ECM) for contact resistance and oxidation according to **Checking wiring and terminals - Permanent faults**.

Remedy as necessary

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

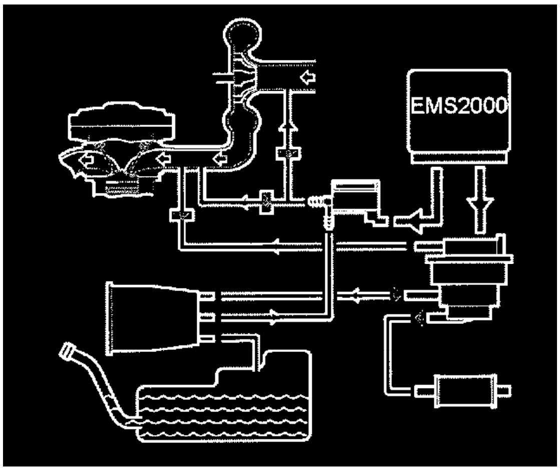
Other information

- For information about signals, See: Pinout Values and Diagnostic Parameters/Signal Specifications, ECM
- To connect the breakout box, See: Reading and Clearing Diagnostic Trouble Codes/Scan Tool Connecting/Connecting the Breakout Box, ECM (EMS 2000)
- For further information about the circuit, see the relevant wiring diagram.

Leak Diagnostics

LEAK DIAGNOSTIC

General



Vapor from the fuel in the fuel tank is routed to and stored in the EVAP canister. It is then guided into the combustion process via the canister purge (CP) valve and the negative pressure in the intake manifold. A leakage diagnostic has been introduced to ensure that the fuel tank system is not leaking. This diagnostic is designed so that the system is able to detect a leak / hole 0.5 mm or larger. Diagnostics are also carried out on the EVAP system.

The fuel tank system consists of the fuel tank, fuel filler pipe, roll-over valve, EVAP canister, canister purge (CP) valve and all cables between these components. In order to perform diagnostics, the fuel tank system is equipped with a leak diagnostic pump. The leak diagnostic pump is vacuum driven and pressurizes the fuel tank system. The vacuum that operates the leak diagnostic pump comes from the intake manifold via a non-return valve. The engine control module (ECM) activates I deactivates a three-way valve in the leak diagnostic pump (vacuum / atmospheric pressure). The pump action is obtained using a spring loaded diaphragm.

A position sensor is mounted on the diaphragm. This allows the control module to determine when the three-way valve should be activated. The position sensor acts on a contact breaker. The contact breaker transmits a high or low signal to the engine control module (ECM). The control module activates the three-way valve when the diaphragm is in the resting position. A vacuum is generated. The diaphragm is switched to the active position. The three-way valve is deactivated when the control module determines that the diaphragm has reached the activated position. The atmospheric pressure is allowed to enter and the diaphragm returns to the resting position. In order to detect leakage in the fuel tank system, the leak diagnostic pump is used according to the description in "Leak diagnostic" below.

The diagnostic takes place once per operating cycle if the following criterion are met:

- The battery voltage must be correct
- The engine coolant temperature (ECT) and intake air temperature (IAT) must be 4-60°C
- The engine coolant temperature (ECT) must have dropped by at least 15°C since the previous operating cycle
- The atmospheric pressure must remain constant.

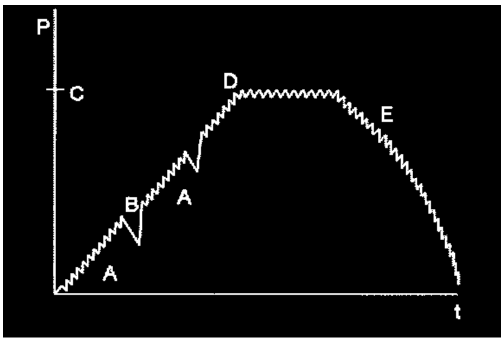
Function test

The diagnostic is divided into different phases in which the components involved are tested before the actual leak diagnostic begins. The diagnostic is cancelled and a diagnostic trouble code (DTC) is stored if a fault is detected in any of the phases.

The diagnostic test works as follows:

- The system must be depressurized. The control module checks that the pump diaphragm is in the resting position. Diagnostic trouble code (DTC) ECM-65, faulty signal, is stored if the control module registers that the position is active
- When the engine is started, a vacuum is generated in the intake manifold. The three-way valve opens a connection to the intake manifold via the non-return valve. The diaphragm is moved to the activated position by the vacuum. Diagnostic trouble code (DTC) ECM-65, high signal, is stored if the control module registers that the diaphragm is still in the resting position
- The three-way valve closes the connection with the intake manifold. The non-return valve closes. A connection to the atmospheric pressure opens. The spring-loaded diaphragm must then return to resting position. Diagnostic trouble code (DTC) ECM 65, low signal, is stored if the diaphragm does not return to the resting position.

Leak diagnostic



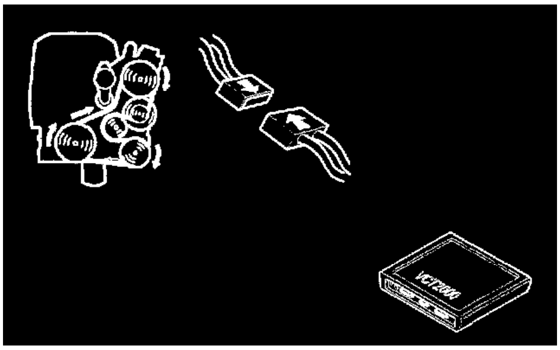
- The leak diagnostic pump is pulsed (A) rapidly at a rapid frequency. This is to pressurize the fuel tank system to the desired pressure (C)
- This rapid pulsing is interrupted regularly (B). This is to check that the correct pressure in the fuel tank system is reached. This is done by

gauging the time taken for the pump to switch from active to resting position using the switch in the leak diagnostic pump. The constant pulse (A) and pressure check (B) alternate until the desired pressure (C) in the fuel tank system is obtained. If vehicle speed exceeds 40 km/h there is no pressure check (B). The pump is activated and deactivated a fixed number of times instead. If the pressure (C) is not reached, the control module interprets it as a leakage. Diagnostic trouble code (DTC) ECM6A, fuel tank filler cap missing, is stored

- When the pressure in the fuel tank is detected by the control module using the leak diagnostic pump, the control module begins to check for smaller leaks (D). To do this, the control module measures the time the diaphragm takes from active to resting position. Diagnostic trouble code (DTC) ECM-68, large leak, or ECM- 68, small leak, is stored if this time is too short
- If no leakage is detected in the fuel tank system, the flow in the evaporative emission (EVAP) system is checked for blockage. This is done by pulsing both the canister purge (CP) valve and the leak diagnostic pump at the same time. The control module checks that the pressure in the fuel tank drops (E). If the pressure does not drop, the control module interprets it as a blockage in the evaporative emission (EVAP) system. Diagnostic trouble code (DTC) ECM-6A is stored. The canister purge (CP) valve is pulsed until the fuel tank system is depressurized. The diagnostic takes place in the next operating cycle.

Checking Torque Limiting - DSA

Fault-tracing Information

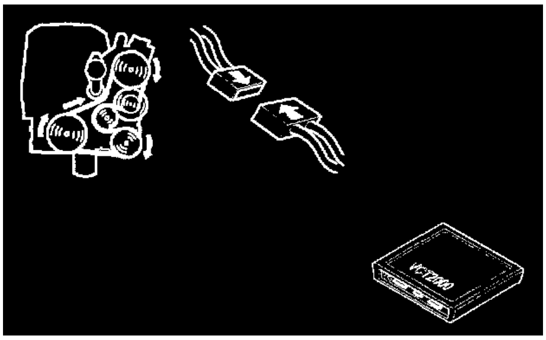


Hint: After carrying out the repair, check that the fault has been remedied as follows:

- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Start the engine.
- Activate torque limiting by clicking on the VCT 2000 symbol.
- Check that the engine is uneven when idling.

Checking the DSA Warning Lamp

Fault-tracing Information



Hint: After carrying out the repair, check that the fault has been remedied as follows:

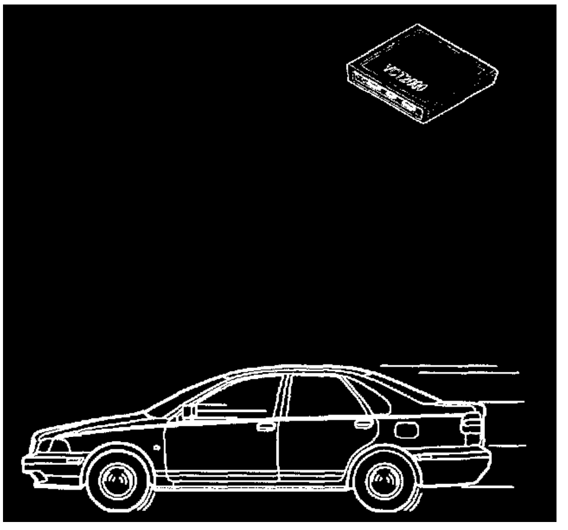
- Ignition off.
- Reconnect the connectors, reinstall components etc.
- Start the engine.
- Activate the DSA warning lamp by clicking on the VCT 2000 symbol.
- Check that the warning lamp flashes at a frequency of **1.8Hz**.

Testing Components and Functions - DSA

Resetting The Wheel Adaptation

If, for example, a tire is suddenly punctured while driving or the air pressure in a tire rapidly deviates, there will be deviation between the wheels. The DSA control module adaptation will then quickly adapt the wheel speed to even out the speed of all wheels. This is so the DSA control module can base its calculation on the same wheel speed levels.

When the punctured tire is repaired, or the air pressure returns to normal, the wheel adaptation values will no longer be correct. Before the DSA control module has had time to re-adapt the wheel speed, the anti-spin control may start slightly earlier or later than normal. If these symptoms occur, the wheel adaptation must be reset and the car test driven. This is in order to give the DSA control module the chance to adapt the wheel speed signals.



- Ignition on.
- Use the Reset adaptation function to reset the wheel adaptation.

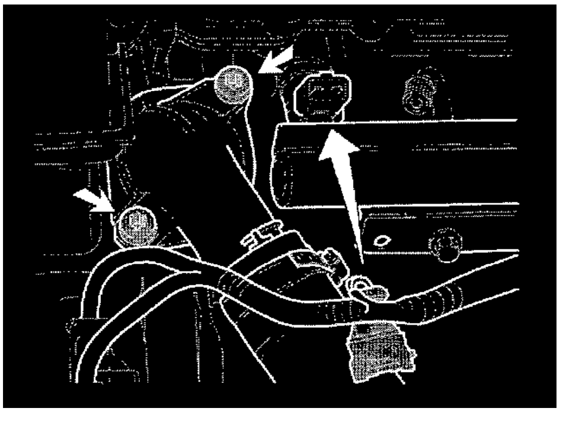
Test drive the car: Drive slowly. Then accelerate rapidly for approximately **4 seconds**. Then release the accelerator pedal (AP) quickly. Let the car engine brake for approximately **4 seconds**. Repeat this one more time.

The wheel speed signals have now been adapted.

Component Access/Replace Procedures

Checking / Replacing the Thermostat

Draining coolant

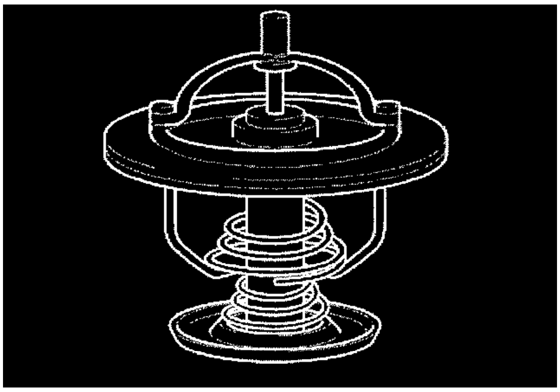


Drain off approximately 2 liters of coolant.

Removing the Thermostat

Turbocharged engines: remove the throttle body (TB) cover.
Remove the cover over the fuel rail.
Remove the upper timing cover.
Remove the thermostat housing cover (Torx 40 screws). Lift out the thermostat and the gasket.

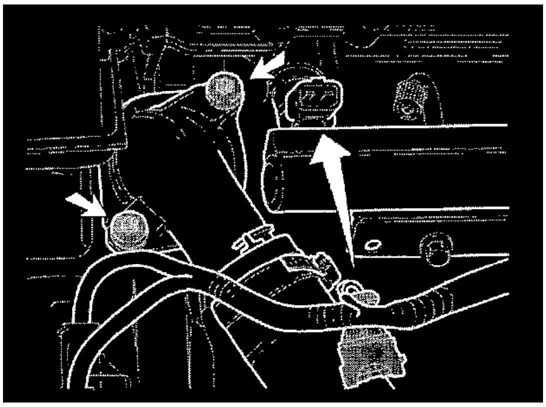
Checking the Thermostat



The function of the thermostat can be tested using hot water.
When the water temperature corresponds to the opening temperature of the thermostat, the thermostat should open fully within two minutes.

Marking: 90
Starts to open at: 90°C
Fully open at: 105°C

Installing the Thermostat



Clean the mating surfaces on the thermostat housing.
Install a new gasket on the thermostat.
Install the thermostat in the housing. Install the cover.
Tighten the cover. Tighten to **17 Nm.**
Install the upper timing cover.
Install the cover over the fuel rail.

Turbocharged engines: install the throttle body cover.

Fill with coolant

Description of Activation

No.	Component	Function
1	Fuel pump / system relay.	The fuel pump (FP) is activated for 2 seconds. The system relay "clicks". The fuel pump (FP) "buzzes".
2	the canister purge (CP) valve.	The canister purge (CP) valve is activated once for 1 second. The valve clicks.
3	Turbocharger (TC) control valve.	The turbocharger (TC) control valve is activated 4 times for 1 seconds. The valve clicks.
4	Engine cooling fan (FC), low-speed.	Engine cooling fan (FC) low-speed, the fan runs for 3 seconds. The fan can be heard clearly.
5	Engine cooling fan (FC), high-speed.	Engine cooling fan (FC) high-speed, the fan runs for 3 seconds. The fan can be heard clearly.
6	A/C fan.	Air conditioning (A/C) condenser cooling fan, the fan runs for 3 seconds. The fan can be heard clearly.
7	Air conditioning (A/C) relay.	Air conditioning (A/C) relay, the relay is activated once for 4 second. A clicking noise is heard from the compressor clutch.
8	Injector 1.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
9	Injector 2.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
10	Injector 3.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
11	Injector 4.	The injector clicks for a total of 10 seconds. A ticking noise is heard from the injector.
12	Idle air control (IAC) valve.	The idle air control (IAC) valve is activated and deactivated at a frequency of 0.2 Hz. A buzzing noise is heard from the valve.
13	Malfunction indicator lamp (MIL).	The malfunction indicator lamp (MIL) goes out for 1 second then lights up again.
14	Front heated oxygen sensor (HO2S).	Front heated oxygen sensor (HO2S) preheating, the heating is on for 1 second. Connect a voltmeter between connector terminal #1 (control module side) and ground. Check the signal.
15	Rear heated oxygen sensor (HO2S).	Rear heated oxygen sensor (HO2S) preheating, the heating is on for 1 second. Connect a voltmeter between connector terminal #1 (control module side) and ground. Check the signal.

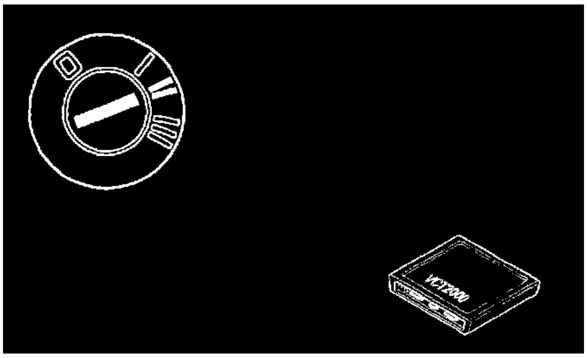
Hint: Activate components and/or functions by clicking the VCT2000 symbol.

Note! Components cannot be activated when the engine is running.

Many of these activations will cause the Fuel Pump **(FP)** to start. This is because the system relay is activated to supply the components with power.

Parameter, Digital Display DSA

Parameter, Digital Display DSA



- Ignition on or start the engine.

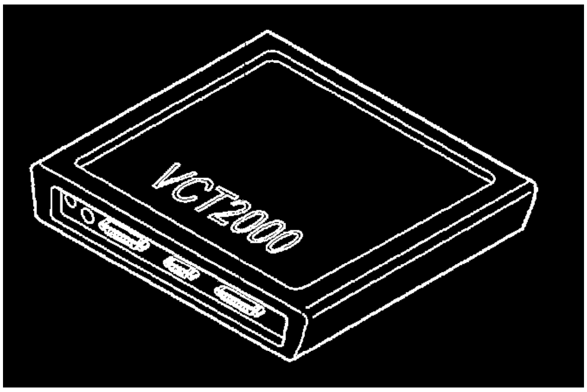
Read off the parameters by clicking on the symbol for VCT 2000.
For information about the different parameters See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display

Less than 0 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Communication Fault

Greater than 0 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Communication Fault

Communication Fault

Communication Fault



Communication has been interrupted for one of the following reasons:
- Ignition switched off.
- The switch is **not** in position for VCT 2000.
- VCT 2000 disconnected from data link connector (DLC).
- VCT 2000 disconnected from VIDA cart/switch.
- Communication problems in VIDA application or in car.

Check therefore:
- that the ignition is on and switch is in correct position for VCT 2000.
- that battery voltage (system voltage) is normal (approximately **12 V**). If necessary a battery charger can be connected during the test. For information about charge currents and the battery, See: Starting and Charging/Battery
- that VCT 2000 is correctly connected to VIDA cart/switch and data link connector (DLC).
- that VCT 2000 and wiring is fault-free.

Try to establish communication again or exit reading off diagnostic trouble codes (DTCs). Depending on the communication fault, select one of the following alternatives.
- Try again.
- Fault-trace more comprehensively for the communication problem that has occurred.
- Exit fault-tracing/Read off from next system.

Which alternative is requested?

1 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Parameter, Digital Display DSA

2 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Selecting the Model

3 - Test Complete

Selecting the Model

Selecting the model

Select the car model to obtain the relevant fault tracing data.

Select one of the following model options
- V70 2000-, S60 and S80
- V70 -2000 and S70/C70
- S40/V40

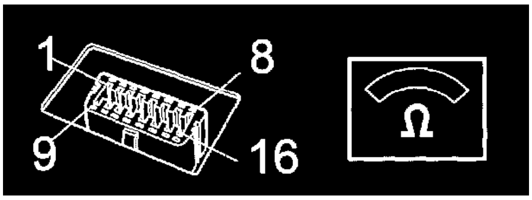
1 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Checking Communication Faults, Model V70 2000-, S60 and S80

2 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Checking Communication Problems, V70 - 2000 and S70/C70 Models

3 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display/Checking Communication Problems, S40/V40 Models

Checking Communication Faults, Model V70 2000-, S60 and S80

Checking Communication Faults, Model V70 2000-, S60 And S80



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)
- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables
- Check the communication cable between the data link connector (DLC) terminal #7 and central electronic module (CEM) terminal #D6 and with other connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

CAUTION
If there is a fault in the communication cable, it will not be possible to establish communication on either the low or high speed network. The first time there is communication on this cable, the low and high speed network cables are connected between the data link connector (DLC) and central electronic module (CEM) to the other network in the car. This is controlled via a relay in the central electronic module (CEM).

- For communication problems with control modules on the **high speed network**, check the communication cables between data link connector (DLC) terminals #6 and #14 and central electronic module (CEM) terminals #B7 and #B8. For, communication problems with control modules on the **low speed network**, check the communication cables between data link connector (DLC) terminals #3 and #11 and central electronic module (CEM) terminals #B19 and #B20. Check these cables for an open-circuit, a short-circuit to ground and a short-circuit to supply voltage according to the references above
- Also check the communication cables for the low and high speed networks between the central electronic module (CEM) and the other connected control modules according to the above fault-tracing.

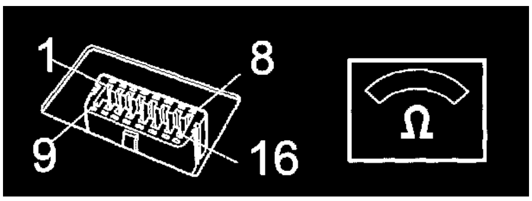
Control modules
- Check that the control module power supply and ground terminal are fault-free.

CAUTION
If none of the above checks help, try reading off the diagnostic trouble codes (DTCs) in the central electronic module. This is carried out via VIDA vehicle communication.

VCT2000 and wiring
- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Checking Communication Problems, V70 - 2000 and S70/C70 Models

Checking Communication Problems, V70 - 2000 And S70/C70 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)

- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cable between the data link connector (DLC) terminal #7 and combined instrument panel terminal #B4 and with other connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

CAUTION
If there is a fault in the communication cable, it will not be possible to establish communication on the high speed network. The first time there is communication on this cable, the high speed network cables are connected between the data link connector (DLC) and the combined instrument panel to the high speed network in the car. This is controlled via a relay in the combined instrument panel.

- Check the communication cables between data link connector (DLC) terminals #6 and #14 and combined instrument panel terminals #A19 and #A20. Check the cables for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references
- Also check the communication cables for the high speed network between the combined instrument panel and the other connected control modules according to the above fault-tracing.

Communication cable for the cruise control as an independent system (not integrated)

- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Communication cable for engine management system Fenix 5.2

- Check the communication cable between data link connector (DLC) terminal #3 and the engine control module (ECM). Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules

- Check that the control module power supply and ground terminal are fault-free.

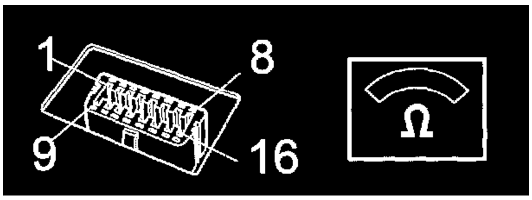
CAUTION
If none of the above checks help, try reading off the diagnostic trouble codes (DTCs) in the combined instrument panel. This is carried out via VIDA vehicle communication.

VCT2000 and wiring

- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Checking Communication Problems, S40/V40 Models

Checking Communication Problems, S40/V40 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)

- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cables between data link connector (DLC) terminal #7 and the connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Communication cable for the cruise control as an independent system (not integrated)
- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

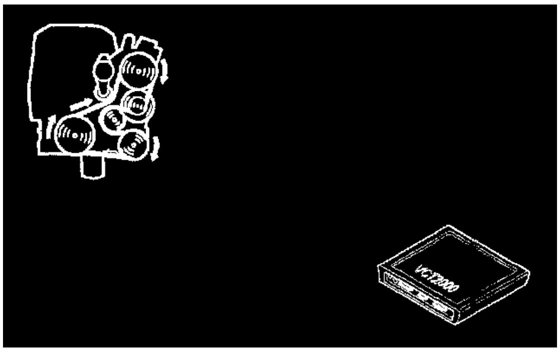
Communication cable for engine management system Fenix 5.1 and diesel (not Lucas)
- Check the communication cables between the data link connector (DLC) terminal #11/#15 and the engine control module (ECM). Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules
- Check that the control module power supply and ground terminal are fault-free.

VCT2000 and wiring
- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Parameter Read-Out - Graphic Display

Parameter Read Off - Graphic Display



- Start the engine.

Activate reading off the parameters: Click on the VCT2000 symbol.

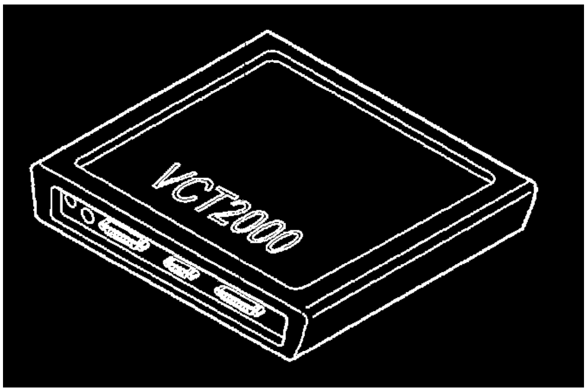
For information about the different parameters, See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read Off - Digital Display

Less than 0 - See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Communication Fault

Greater than 0 - See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Communication Fault

Communication Fault

Communication Fault



Communication has been interrupted for one of the following reasons:
- Ignition switched off.
- The switch is **not** in position for VCT 2000.
- VCT 2000 disconnected from data link connector (DLC).
- VCT 2000 disconnected from VIDA cart/switch.
- Communication problems in VIDA application or in car.

Check therefore:

- that the ignition is on and switch is in correct position for VCT 2000.
- that battery voltage (system voltage) is normal (approximately **12 V**). If necessary a battery charger can be connected during the test. For information about charge currents and the battery, See: Starting and Charging/Battery
- that VCT 2000 is correctly connected to VIDA cart/switch and data link connector (DLC).
- that VCT 2000 and wiring is fault-free.

Try to establish communication again or exit reading off diagnostic trouble codes (DTCs). Depending on the communication fault, select one of the following alternatives.

- Try again.
- Fault-trace more comprehensively for the communication problem that has occurred.
- Exit fault-tracing/Read off from next system.

Which alternative is requested?

1 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Parameter Read-Out - Graphic Display

2 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Selecting the Model

3 **-** **Test Complete**

Selecting the Model

Selecting The Model

Select the car model to obtain the relevant fault tracing data.

Select one of the following model options

- V70 2000-, S60 and S80
- V70 -2000 and S70/C70
- S40/V40.

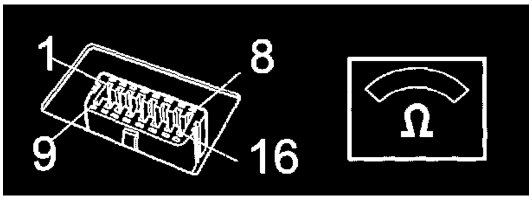
1 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Checking Communication Faults, Model V70 2009-, S60 and S80

2 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Checking Communication Problems, V70 - 2000 and S70/C70 Models

3 **-** See: Scan Tool Testing and Procedures/Graphical Plotters/Parameter Read-Out - Graphic Display/Checking Communication Problems, S40/V40 Models

Checking Communication Faults, Model V70 2009-, S60 and S80

Checking Communication Faults, Model V70 2009-, S60 And S80



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)

- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cable between the data link connector (DLC) terminal #7 and central electronic module (CEM) terminal #D6 and with other connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

CAUTION
If there is a fault in the communication cable, it will not be possible to establish communication on either the low or high speed network. The first time there is communication on this cable, the low and high speed network cables are connected between the data link connector (DLC) and central electronic module (CEM) to the other network in the car. This is controlled via a relay in the central electronic module (CEM).

- For communication problems with control modules on the **high speed network**, check the communication cables between data link connector (DLC) terminals #6 and #14 and central electronic module (CEM) terminals #B7 and #B8. For, communication problems with control modules on the **low speed network**, check the communication cables between data link connector (DLC) terminals #3 and #11 and central electronic module (CEM) terminals #B19 and #B20. Check these cables for an open-circuit, a short-circuit to ground and a short-circuit to supply voltage according to the references above
- Also check the communication cables for the low and high speed networks between the central electronic module (CEM) and the other connected control modules according to the above fault-tracing.

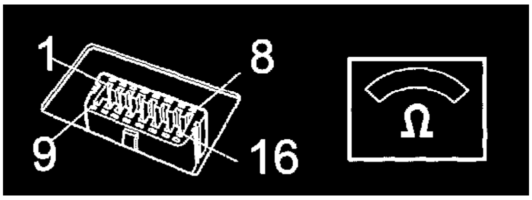
Control modules
- Check that the control module power supply and ground terminal are fault-free.

CAUTION
If none of the above checks help, try reading off the diagnostic trouble codes (DTCs) in the central electronic module. This is carried out via VIDA vehicle communication.

VCT2000 and wiring
- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Checking Communication Problems, V70 - 2000 and S70/C70 Models

Checking Communication Problems, V70 - 2000 And S70/C70 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)
- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables
- Check the communication cable between the data link connector (DLC) terminal #7 and combined instrument panel terminal #B4 and with other connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

CAUTION
If there is a fault in the communication cable, it will not be possible to establish communication on the high speed network. The first time there is communication on this cable, the high speed network cables are connected between the data link connector (DLC) and the combined instrument panel to the high speed network in the car. This is controlled via a relay in the combined instrument panel.

- Check the communication cables between data link connector (DLC) terminals #6 and #14 and combined instrument panel terminals #A19 and #A20. Check the cables for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references
- Also check the communication cables for the high speed network between the combined instrument panel and the other connected control modules according to the above fault-tracing.

Communication cable for the cruise control as an independent system (not integrated)
- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Communication cable for engine management system Fenix 5.2
- Check the communication cable between data link connector (DLC) terminal #3 and the engine control module (ECM). Check the cable for

an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules

- Check that the control module power supply and ground terminal are fault-free.

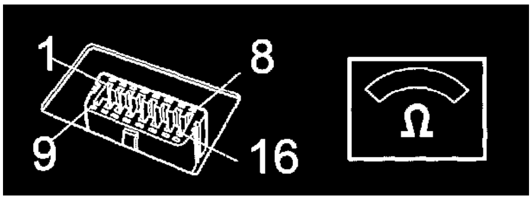
CAUTION
If none of the above checks help, try reading off the diagnostic trouble codes (DTCs) in the combined instrument panel. This is carried out via VIDA vehicle communication.

VCT2000 and wiring

- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Checking Communication Problems, S40/V40 Models

Checking Communication Problems, S40/V40 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)

- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cables between data link connector (DLC) terminal #7 and the connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Communication cable for the cruise control as an independent system (not integrated)

- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Communication cable for engine management system Fenix 5.1 and diesel (not Lucas)

- Check the communication cables between the data link connector (DLC) terminal #11/#15 and the engine control module (ECM). Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules

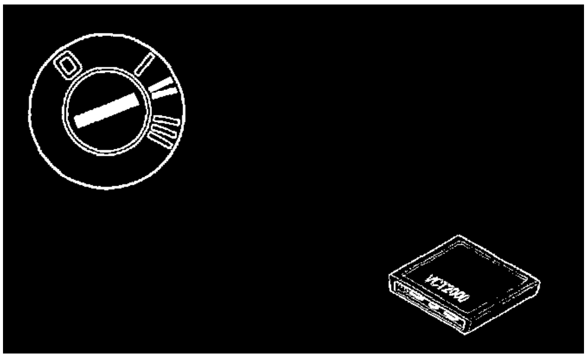
- Check that the control module power supply and ground terminal are fault-free.

VCT2000 and wiring

- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Reading Off the DSA Control Module Part Number

Reading Off The DSA Control Module Part Number



- Ignition on.

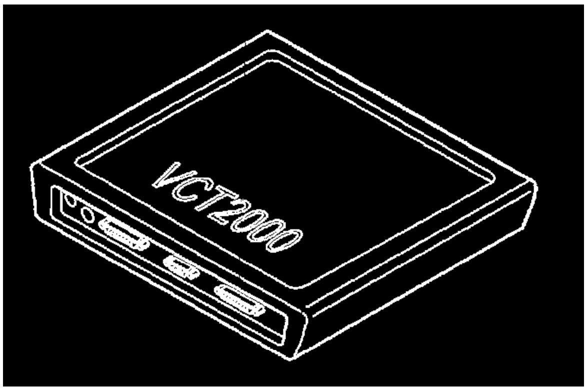
Read off the P/N of the DSA control module: Click on the VCT 2000 symbol.

Less than 0 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Part Number/Communication Fault

Greater than 0 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Part Number/Communication Fault

Communication Fault

Communication Fault



Communication has been interrupted for one of the following reasons.
- Ignition switched off.
- The switch is **not** in position for VCT 2000.
- VCT 2000 disconnected from data link connector (DLC).
- VCT 2000 disconnected from VIDA cart/switch.
- Communication problems in VIDA application or in car.

Check therefore:
- that the ignition is on and switch is in correct position for VCT 2000.
- that battery voltage (system voltage) is normal (approximately **12 V**). If necessary a battery charger can be connected during the test. For information about charge currents and the battery, See: Starting and Charging/Battery
- that VCT 2000 is correctly connected to VIDA cart/switch and data link connector (DLC).
- that VCT 2000 and wiring is fault-free.

Try to establish communication again or exit reading off diagnostic trouble codes (DTCs). Depending on the communication fault, select one of the following alternatives.
- Try again.
- Fault-trace more comprehensively for the communication problem that has occurred.
- Exit fault-tracing/Read off from next system.

Which alternative is requested?

1 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Part Number/Reading Off the DSA Control Module Part Number

2 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Part Number/Selecting the Model

3 - Test Complete

Selecting the Model

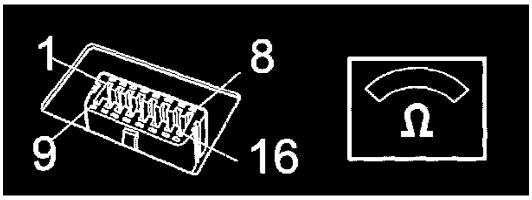
Selecting the model

Select the car model to obtain the relevant fault tracing data.

Refer to Checking Communication Problems. See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Part Number/Checking Communication Problems

Checking Communication Problems

Checking Communication Problems, S40/V40 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)
- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables
- Check the communication cables between data link connector (DLC) terminal #7 and the connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Communication cable for the cruise control as an independent system (not integrated)
- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

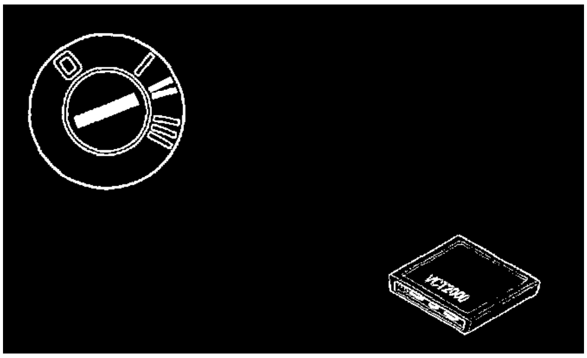
Communication cable for engine management system Fenix 5.1 and diesel (not Lucas)
- Check the communication cables between the data link connector (DLC) terminal #11/#15 and the engine control module (ECM). Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules
- Check that the control module power supply and ground terminal are fault-free.

VCT2000 and wiring
- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Reading Off the Control Module ID, EMS 2000

Reading Off The Control Module ID, EMS 2000



- Ignition on.

Read off the control module ID by clicking on the VCT 2000 symbol.

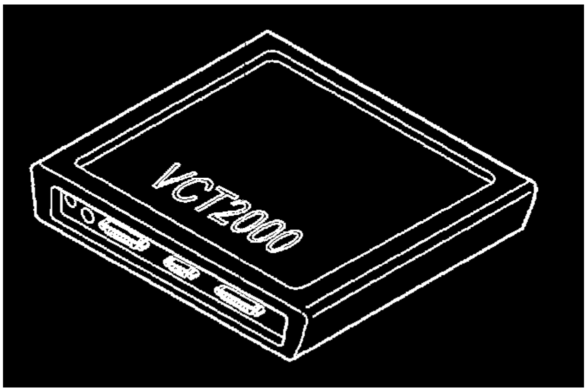
Equal to 0 - Test Complete

Less than 0 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Control Module ID/Communication Fault

Greater than 0 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Control Module ID/Communication Fault

Communication Fault

Communication Fault



Communication has been interrupted for one of the following reasons:
- Ignition switched off
- The switch is **not** in position for VCT 2000.
- VCT 2000 disconnected from data link connector (DLC).
- VCT 2000 disconnected from VIDA cart/switch.
- Communication problems in VIDA application or in car.

Check therefore:
- that the ignition is on and switch is in correct position for VCT 2000.
- that battery voltage (system voltage) is normal (approximately **12 V**). If necessary a battery charger can be connected during the test. For information about charge currents and the battery, See: Starting and Charging/Battery
- that VCT 2000 is correctly connected to VIDA cart/switch and data link connector (DLC).
- that VCT 2000 and wiring is fault-free.

Try to establish communication again or exit reading off diagnostic trouble codes (DTCs). Depending on the communication fault, select one of the following alternatives.
- Try again.
- Fault-trace more comprehensively for the communication problem that has occurred.
- Exit fault-tracing/Read off from next system.

Which alternative is requested?

1 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Control Module ID/Reading Off the Control Module ID, EMS 2000

2 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Control Module ID/Selecting the Model

3 - Test Complete

Selecting the Model

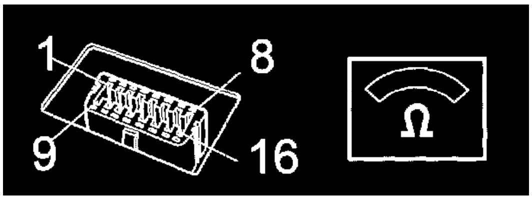
Selecting The Model

Select the car model to obtain the relevant fault tracing data

Refer to Checking Communication Problems. See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off the Control Module ID/Checking Communication Problems

Checking Communication Problems

Checking Communication Problems, S40/V40 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)

- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage
- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cables between data link connector (DLC) terminal #7 and the connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Communication cable for the cruise control as an independent system (not integrated)

- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Communication cable for engine management system Fenix 5.1 and diesel (not Lucas)

- Check the communication cables between the data link connector (DLC) terminal #11/#15 and the engine control module (ECM). Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules

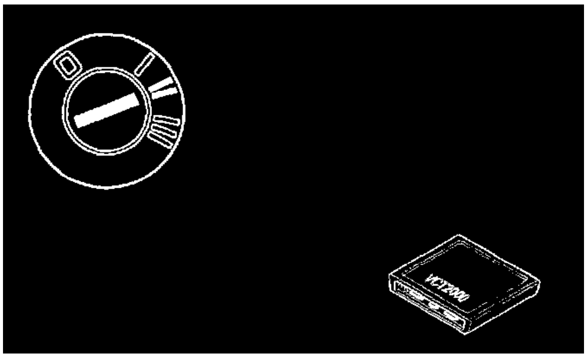
- Check that the control module power supply and ground terminal are fault-free.

VCT2000 and wiring

- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Reading Off VIN Learned, EMS 2000

Reading Off VIN LEARNED, EMS 2000



- Switch off the ignition for **30 seconds** and then switch it on again. (If the engine cooling fan (FC) is running wait, until it has stopped. Then wait a further **30 seconds**).

Read off VIN LEARNED by clicking the VCT 2000 symbol.

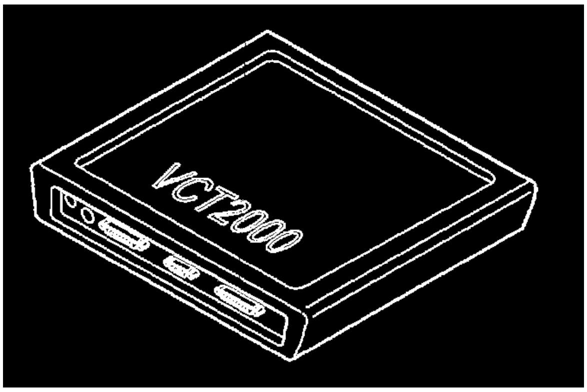
When the parameter displays NO, switch off ignition and disconnect engine control module (ECM). Do not restart the engine because the engine control module (ECM) will relearn the VIN code.
If the NO parameter is not displayed, return to VIN code erasing in VIDA vehicle communication Immobilizer system Section 3(36) S40/V40.

Less than 0 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off VIN Learned/Communication Fault

Greater than 0 - See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off VIN Learned/Communication Fault

Communication Fault

Communication Fault



Communication has been interrupted for one of the following reasons:
- Ignition switched off.
- The switch is **not** in position for VCT 2000.
- VCT 2000 disconnected from data link connector (DLC).
- VCT 2000 disconnected from VIDA cart/switch.
- Communication problems in VIDA application or in car.

Check therefore:
- that the ignition is on and switch is in correct position for VCT 2000.
- that battery voltage (system voltage) is normal (approximately **12 V**). If necessary a battery charger can be connected during the test. For information about charge currents and the battery, See: Starting and Charging/Battery
- that VCT 2000 is correctly connected to VIDA cart/switch and data link connector (DLC).
- that VCT 2000 and wiring is fault-free.

Try to establish communication again or exit reading off diagnostic trouble codes (DTCs). Depending on the communication fault, select one of the following alternatives.
- Try again.
- Fault-trace more comprehensively for the communication problem that has occurred.
- Exit fault-tracing/Read off from next system.

Which alternative is requested?

1 **-** See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off VIN Learned/Reading Off VIN Learned, EMS 2000

2 **-** See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off VIN Learned/Selecting the Model

3 - Test Complete

Selecting the Model

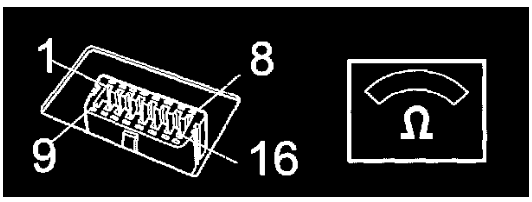
Selecting the model

Select the car model to obtain the relevant fault tracing data.

Refer to Checking Communication Problems. See: Scan Tool Testing and Procedures/Read Vehicle Information/Reading Off VIN Learned/Checking Communication Problems

Checking Communication Problems

Checking Communication Problems, S40/V40 Models



Hint: For current information about the relevant circuit and signals, see the wiring diagram and signal specification for each system.

Data Link Connector (DLC)
- Check the power supply to the data link connector (DLC) terminal #16. The voltage must be approximately battery voltage

- Check the cable for power ground and signal ground to the data link connector (DLC) terminals #4 and #5.

Hint: When the VCT2000 is connected to the data link connector (DLC) (is powered up) the indicator LED lights green. The indicator LED then flashes during communication with a control module. In the event of certain internal faults, the VCT2000 indicator LED will be red!

Communication cables

- Check the communication cables between data link connector (DLC) terminal #7 and the connected control modules. Check for an open-circuit. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to ground. See **Checking wiring and terminals - Permanent faults.** Check for a short-circuit to supply voltage. See **Checking wiring and terminals - Permanent faults.**

See: Diagnostic Trouble Code Tests and Associated Procedures/Related Tests, Information and Procedures/Checking Wiring and Terminals

Communication cable for the cruise control as an independent system (not integrated)

- Check the communication cable between the data link connector (DLC) terminal #13 and the cruise control control module. Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Communication cable for engine management system Fenix 5.1 and diesel (not Lucas)

- Check the communication cables between the data link connector (DLC) terminal #11/#15 and the engine control module (ECM). Check the cable for an open-circuit, short-circuit to ground and a short-circuit to supply voltage according to the above references.

Control modules

- Check that the control module power supply and ground terminal are fault-free.

VCT2000 and wiring

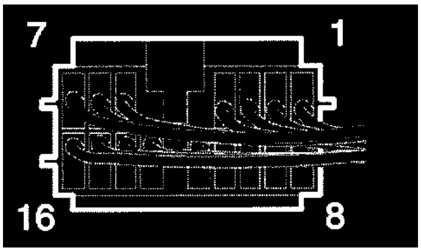
- Try new wiring and/or a new VCT2000 if no faults are detected after the above fault-tracing.

Signal Specification

DSA signal description

All the values given below are between the terminal in column 1 and terminal 9 (ground), unless otherwise indicated in brackets. DSA control module terminals 1 - 16 correspond to terminals 31 - 46 on the breakout box.

Note! It is important to connect the breakout box and check the ground terminal before taking readings.



U=	DC voltage in volts (V)	f =	frequency in Hertz (Hz)
Ubat=	battery voltage	% duty =	duty cycle (pulse ratio) as a percentage (%)
Ulow =	voltage approximately 0 V		

Termi	Signal type	Ignition on	Engine idling	Other	Parameter read off
#1	Power supply (from the ignition switch)	Ubat		-	
#2	Signal, wheel speed left front wheel (from the ABS control module)	U ≈ 0 V - Ubat depending on the position of the wheel. The frequency (f) increases with the speed of the wheel.		A pulsed signal (0 V - Ubat with a fixed pulse ratio (% duty ≈ 50 %).	
#3	Signal, wheel speed right front wheel (from the ABS control module)	U ≈ 0 V - Ubat depending on the position of the wheel. The frequency (f) increases with the speed of the wheel.		A pulsed signal (0 V - Ubat with a fixed pulse ratio (% duty ≈ 50 %).	
#4	Signal, wheel speed left rear wheel (from the ABS control module)	U ≈ 0 V - Ubat depending on the position of the wheel. The frequency (f) increases with the speed of the wheel.		A pulsed signal (0 V - Ubat with a fixed pulse ratio (% duty ≈ 50 %).	
#5	Signal, throttle position (TP) sensor (from the engine control module (ECM))	%duty ≈ 15 % at closed throttle position (CTP) (idling). f ≈ 50 Hz		Pulsed signal (0 V - Ubat) with fixed frequency and variable pulse ratio (% duty). Pulse ratio (%duty) increases with increased throttle.	3
#6	Signal, DSA switch	Switch unaffected: U ≈ 0 - 3 V below Ubat Switch affected: U ≈Ulow		The signal is grounded when the switch is pressed.	8
#7	Signal, stop (brake) light switch	Open: U ≈Ulow Closed: U = 0 - 1.5 V below Ubat		Stop (brake) light switch closes when braking and the control module	11

Terminal #1 - #7

			receives a signal.	
#8	-	-	-	
#9	Ground (for FENIX 5.1 ground via the engine control module (ECM), measured at the battery negative terminal)	Ulow	-	
#10	-	-	-	
#11	-	-	-	
#12	Signal, wheel speed right rear wheel (from the ABS control module)	U ≈ 0 V - Ubat depending on the position of the wheel. The frequency (f) increases with the speed of the wheel.	A pulsed signal (0 V - Ubat with a fixed pulse ratio (% duty ≈ 50 %).	
#13	Signal, load (TQ) (from the engine control module (ECM))	U ≈Ulow f ≈ 33 Hz	Pulsed signal (0 V - Ubat) with variable frequency and pulse ratio (% duty). The frequency increases with engine speed (RPM), the pulse ratio (% duty) increases with load.	
#14	Diagnostic lead	U = 1 - 4 V below Ubat Other values apply if the fault-tracing instrument is connected to the data link connector (DLC).	-	
#15	Signal, request for torque limiting (to the engine control module (ECM))	f ≈ 200 Hz	Pulsed signal (0 - 5 V) with fixed frequency and variable pulse ratio (% duty).	
#16	Control signal, DSA warning lamp	Lamp lit: U =0-0.5 V Lamp not lit: Ubat	-	9, 10

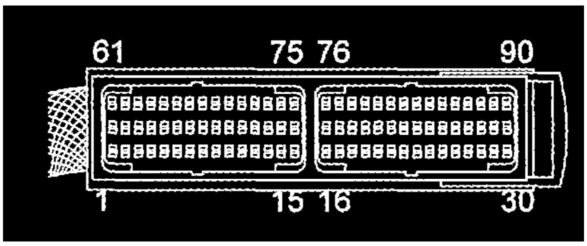
Terminal #7 - #16

Signal Specifications, ECM

Signal Specification

Hint: All the values given below are measured between the relevant terminal in column I and terminal #3, unless otherwise indicated in brackets. The values specified in the table apply with the engine unloaded and at normal operating temperature.

Note! It is important that the breakout box is connected according to cog EMS 2000, before the readings are taken.



Part 1 Of 10

U=	DC voltage in volts (V)	U_{AC} =	AC voltage in volts (V)
U_{bat} =	Battery voltage	f =	Frequency in Hertz (Hz)
U_{low} =	Voltage near 0 V or 0 V	% Pulse ratio	Duty cycle (pulse ratio) as a percentage (%)
t =	Cyclic time in milliseconds (ms)		

Part 2 Of 10

Terminal (Engine control module (ECM) Breakout box)	Signal type	Ignition on	Engine idling	Notes
1/A1	Ignition coil cyl. 2/3 Control signal	U_{bat} (for 1 second after the ignition is switched on)	Low pulse for 3 milliseconds from U_{bat} to U_{low}, then a voltage peak greater than or equal to 100 V	Frequency 13 Hz at idling speed
2/A2	-	-	-	-
3/A3	Power ground terminal #4	U_{low}	-	-
4/A4	Canister purge (CP) valve, control signal	U_{bat} for 1 second after the ignition is switched on	-	During control: the voltage oscillates between U_{low} and U_{bat}

Part 3 Of 10

5/A5	Turbocharger (TC) control valve, control signal	U_{bat} (for 1 second after the ignition is switched on)	U_{bat}	During control, a pulsed signal between U_{bat} and U_{low} with a fixed frequency of 32 Hz and variable pulse ratio (%duty)
6/A6	-	-	-	-
7/A7	-	-	-	-
8/A8	Engine cooling fan (FC) high-speed, control signal	Engine cooling fan (FC) off = U_{bat} Engine cooling fan (FC) on = U_{low}	-	-
9/A9	-	-	-	-
10/A10	System relay, control signal	U_{low} (after 1 second U_{bat})	U_{low}	-
11/A11	Engine coolant temperature (ECT) sensor signal to the combined instrument panel	f=45 Hz at +25 °C f=20 Hz at +100 °C	-	A pulsed signal between 0 V and 5 V with variable frequency and fixed pulse ratio (% duty) f increases with decreasing temperature
12/A12	-	-	-	-
13/A13	Boost pressure sensor 2, signal	U = 1.8 V	U=0.7 V	The voltage increases with increased pressure in the intake manifold.
14/A14	Air conditioning (A/C) system pressure sensor, signal	U = 0.9 V	U = 0.9 V (when the air conditioning (A/C) has not been on)	The voltage depends on the pressure in the system 1.4-1.8 V when the air conditioning (A/C) is activated
15/A15	Mass air flow (MAF) sensor, ground	U_{low}	-	-

16/B1	Mass air flow (MAF) sensor, signal	U_{low}	U = 0.6 V	U increases with engine speed (RPM) and load
17/B2	-	-	-	-
18/B3	Atmospheric pressure sensor, signal (model year -00)	U=4.6 V	U=4.6 V	The voltage varies with the atmospheric pressure
19/B4	Knock sensor (KS) ground screen	U_{low}	-	-
20/B5	Torque limiting signal from DSA to ECM	U =5 V	U=2 V (with DSA) U=5 V (without DSA)	Pulsed signal with fixed frequency of 200 Hz and fixed pulse ratio of 3 ms pulse with factor Tr=0
21/B6	-	-	-	-
22/B7	-	-	-	-
23/B8	-	-	-	-
24/B9	Engine speed (RPM) sensor, signal (-)	U = 1.8 V	U DC = 1.8 V U AC = 2.5 Vt-t	Sine signal retained over DC Frequency and amplitude depend on engine speed (RPM)
25/B10	-	-	-	-
26/B11	-	-	-	-
27/B12	CAN-H to / from TCM	U=2-3 V average voltage	U=2-3 V average voltage	-
28/B13	Power ground terminal #1 Measured to the battery negative terminal (-)	U_{low}	-	-
29/B14	15 supply (+12 V, when the ignition is on)	U_{bat}	-	-
30/B15	30 supply (+12 V, battery voltage)	U_{bat}	-	-
31/A16	-	-	-	-
32/A17	Ignition coil cylinder 1/4 control signal	U_{bat} (for 1 second after the ignition is switched on)	Low pulse for 3 milliseconds from U_{bat} to U_{low}, then a voltage peak greater than or equal to 100 V	Frequency 13 Hz at idling speed

33/A18	Power ground terminal #3 Measured to the battery negative terminal (-)	-	-	-
34/A19	Malfunction indicator lamp (MIL), control signal (to the combined instrument panel)	U_{low} =lamp lit U_{bat} =Lamp not lit	-	-
35/A20	The leak diagnostic pump valve, control signal (Certain markets only)	U_{low}	U_{low}	During the leak diagnostic the voltage oscillates between U_{low} and U_{bat}
36/A21	Throttle position (TP) sensor output signal from ECM to DSA	pulse ratio = 5% (closed throttle position (CTP)) pulse ratio = 80% (open)	pulse ratio = 5% (closed) pulse ratio = 80% (open) f = 50 Hz	A pulsed signal between 0 V and 9 V with fixed frequency and variable pulse ratio (% duty)
37/A22	-	-	-	-
38/A23	Engine cooling fan (FC) low-speed, control signal	Engine cooling fan (FC) off: U_{bat} Engine cooling fan (FC) on=	-	-
39/A24	-	-	-	-
40/A25	Fuel consumption signal to the combined instrument panel.	With infocenter: U_{stable} Without infocenter: U_{low}	Pulse train at 500 ms intervals; 1-10 x 1 ms pulses depending on engine coolant temperature (ECT), engine speed (RPM) and load. Pulses between 0 V and 5 V.	-
41/A26	The leak diagnostic pump, signal (Certain markets only)	U_{low}	-	During the leak diagnostic the voltage oscillates between U_{low} and U_{bat}
42/A27	-	-	-	-

43/A28	Throttle position (TP) sensor, signal	U = 0.6-0.7 V with unaffected throttle position (TP) sensor	-	U = 0.6-4.5 V depending on the position of the accelerator pedal (AP)
44/A29	Rear heated oxygen sensor (HO2S) signal measured to terminal #75	U = 0.5 V	U = oscillates between 0.1 V - 1 V, cold three-way catalytic converter (TWC). U = fixed value 0.4 V - 0.6 V, hot three-way catalytic converter (TWC).	-
45/A30	Front heated oxygen sensor (HO2S) signal measured to terminal #75	U = 0.5 V	The voltage fluctuates between 0 - 1 V	High voltage = Rich Low voltage = Lean
46/B16	-	-	-	-
47/B17	Engine coolant temperature (ECT) sensor, signal	$U_{average}$= 2.6 V (+25°C) $U_{average}$= 0.6 V (+100° C)	$U_{average}$= 2.6 V (+25° C) $U_{average}$= 0.6 V (+100°C)	Voltage decreases with increasing temperature
48/B18	Intake air temperature (IAT) sensor, signal intake air	U=2 V at +25 °C U = 0.25 V at +100 °C	-	-
49/B19	-	-	-	-
50/B20	-	-	-	-
51/B21	Knock sensor (KS), signal	U_{low}	-	-
52/B22	Speed signal from the ABS control module	U_{bat}	U_{bat} (-1 V)	Pulsed signal between U_{low} and U_{bat} when the front left wheel is rotating
53/B23	-	-	-	-
54/B24	Engine speed (RPM) sensor, signal (+) Measured to terminal #24	U_{low}	U_{AC} = 5Vt-t f = 775 Hz (current rpm)	DC 1.8 Volts with retained sine signal amplitude and frequency increase with engine speed
55/B25	-	-	-	-
56/B26	Diagnostic lead K	U_{bat} -1 - 2 V	If the fault tracing-instrument is connected the other values apply	-

57/B27	CAN-L to / from TCM	U=2-3 V average voltage	U=2-3 V average voltage	-
58/B27	Camshaft position (CMP) sensor, signal	U=0 V or 5 V depending on position of the camshaft	-	Variable pulse ratio at constant engine speed due to the design of the camshaft position (CMP) sensor.
59/B29	Injector 1, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load
60/B30	Injector 3, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load
61/A31	-	-	-	-
62/A32	Camshaft reset valve, control signal	U_{bat} for 1 second after the ignition is switched on	f = 250 Hz	A pulsed signal with fixed duty cycle and variable frequency.
63/A33	Front heated oxygen sensor (HO2S), preheating, control signal	U = 0 V U_{bat} when the system relay is on	Preheating off: U_{bat} Preheating on: U = 0.5-4.5 V	Pulsed signal from U_{bat} to U_{low}. The pulse ratio reduces as the temperature in the heated oxygen sensor (HO2S) increases
64/A34	Idle air control (IAC) valve, control signal	U_{bat} for 1 second after the ignition is switched on	U_{low}	A pulsed signal with fixed duty cycle and variable frequency.
65/A35	Rear heated oxygen sensor (HO2S), preheating, control signal	U = 0 V U_{bat} when the system relay is on	Preheating off: U_{bat} Preheating on: U = 0.5-4.5 V	Pulsed signal from U_{bat} to U_{low}. The pulse ratio reduces as the temperature in the heated oxygen sensor (HO2S) increases

66/A36	Power supply from the system relay	U_{bat} (for 1 second after the ignition is switched on)	U_{bat}	-
67/A37	Power ground terminal #2 Measured to the battery negative terminal (-)	U_{low}	-	-
68/A38	A/C relay, control signal	U_{bat}	U_{bat} when the relay is not on U_{low} when the relay is on	-
69/A39	A/C fan, control signal	U_{low}	$_{bat}$ when the engine cooling fan (FC) is running U_{low} when the engine cooling fan (FC) is not running	-
70/A40	Engine speed (RPM) signal to the combined instrument panel	U_{low}	f = 25 Hz (current rpm/30)	Pulsed signal between 0 V and 10 V with variable frequency and fixed pulse ratio (% duty)
71/A41	Torque signal from ECM to DSA	U_{low}	No pulses when the engine is idling	Pulsed signal between 0 V and U_{bat} with a length of up to 100 [mu] seconds during throttle opening and engine without load
72/A42	Boost pressure sensor 1, signal (applies to model year 2001-)	U = 1.8 V	U = 1.8 V	-
73/A43	Sensor, ground	U_{low}	U_{low}	-
74/A44	Power supply, sensor	U =5 V	U =5 V	Boost pressure sensor, boost pressure sensor 2, air conditioning (A/C) pressure sensor
75/A45	Front + rear heated oxygen sensor (HO2S), ground	-	-	-
76/B31	Knock sensor (KS) ground	U_{low}	-	-

77/B32	Sensor, ground	U_{low}	U_{low}	-
78/B33	Power supply, throttle position (TP) sensor	U =5 V	U =5 V	-
79/B34	Sensor, ground	U_{low}	U_{low}	Intake air temperature (IAT) sensor, boost pressure sensor 2, air conditioning (A/C) pressure sensor
80/B35	-	-	-	-
81/B36	-	-	-	-
82/B37	-	-	-	-
83/B38	Power supply, camshaft position (CMP) sensor	U =5 V	-	-
84/B39	-	-	-	-
85/B40	-	-	-	-
86/B41			-	-
87/B42	-	-	-	-
88/B43	Air conditioning (A/C) request from MCC or ECC	U_{low}	Air conditioning (A/C) relay not activated: U_{low} Air conditioning (A/C) relay activated: U_{bat}	Applies when the air conditioning (A/C) and blower fan switch buttons are in the on position
89/B44	Injector 4, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load
90/B45	Injector 2, control signal	U_{bat}	t = approximately 2 ms	Pulsed signal from U_{bat} to U_{low}, then a voltage peak of 60 V. The pulse length varies with engine speed (RPM) and load

Part 10 Of 10

Generic Drive Cycle

Readiness Code Resetting Procedure (Generic Drive Cycle)

Readiness Monitors and Drive Cycles

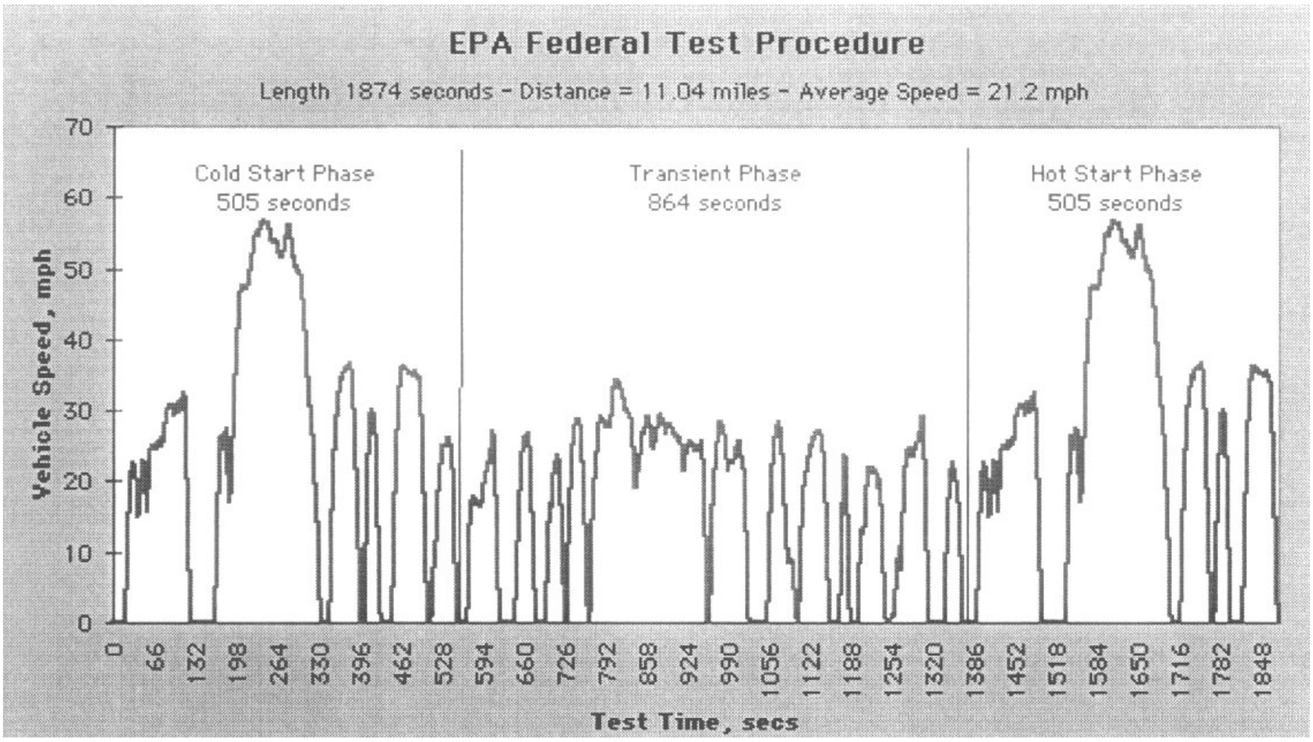
"Readiness Monitors" are indicators that demonstrate whether or not emission system components are being monitored (checked) by the OBD-II system. If a monitor is set to "Ready" the monitor is checking its assigned component and, if no DTC's are present, the vehicle should pass an emissions test.

NOTE: If the appropriate number of Readiness Monitors (codes) are not flagged as "Ready", in most cases, the vehicle can not pass an emissions test. See State and Federal Laws.

The status of all readiness monitors is reset to **"Not Ready"**:

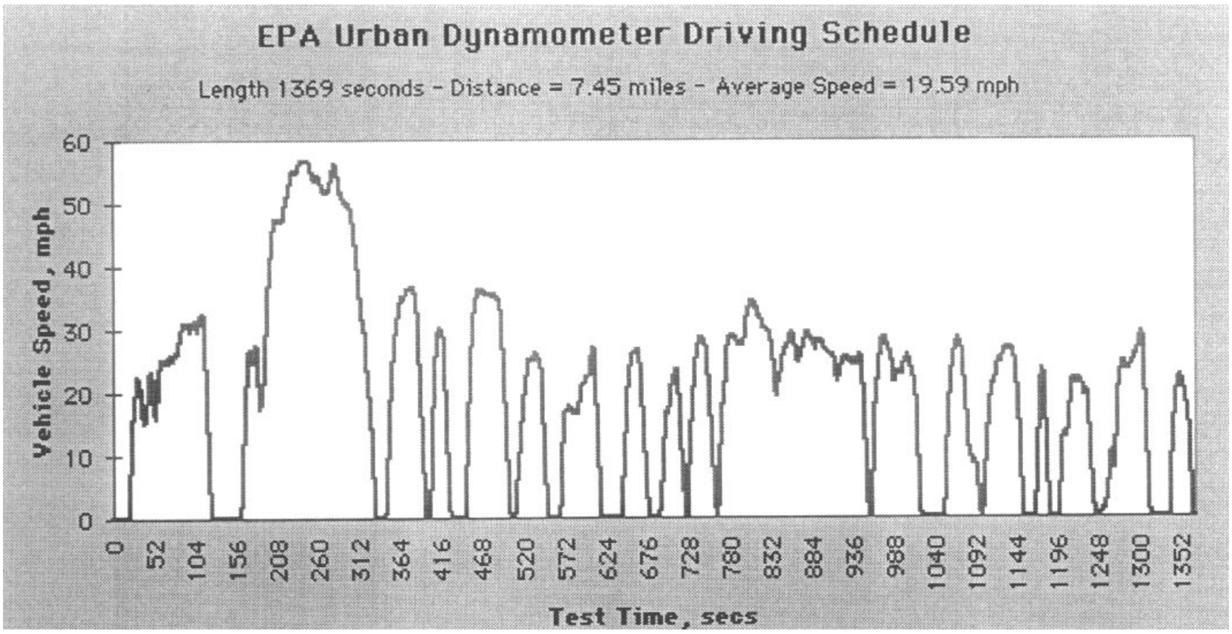
Each time DTC's are cleared.
The battery is disconnected.
The ECM is disconnected.

The status of all readiness monitors is reset to **"Ready"**:
After DTC's are cleared and the appropriate drive cycle(s) is successfully completed.



EPA Federal Test Procedure

Manufacturers are required to validate monitors during the first 23 minutes (1372 seconds) of the Federal Test Procedure Drive Cycle.



EPA Urban Dynamometer Driving Schedule

Completing the Drive Cycle successfully one (1) time should reset most drive cycle monitors to a "Ready" status. However, there are "two trip" monitors, which require that the drive cycle be successfully completed two (2) times, to achieve a "Ready" status. Furthermore, systems which use averaging, may require the drive cycle to be completed more than 2 times.

Verify the status of the readiness monitors with the appropriate function of your scan tool.

NOTE: Certain vehicles have known OBD-II Readiness issues. Please be sure to review TSB's for special circumstances and or exceptions to readiness monitor resetting procedures.

Before Beginning the Drive Cycle

Check the status of the Readiness Monitors, check for DTC's, correct faults, clear DTC's before beginning the Drive Cycle.

Begin Drive Cycle
The vehicle should be driven approximately 7.5 miles within a period of approx. 23 minutes (1372 seconds) from a cold start. However, due to manufacture variations, it is necessary to perform only as much of the Drive Cycle as is necessary to reset the required monitors to a "Ready" status. Operate the throttle smoothly to obtain best results. **Do not shut the engine off** during the drive cycle.

CAUTION: Obey all traffic laws and drive in a safe manner!

NOTE: Extreme driving conditioning such as very high/low temperatures, rough roads and high altitudes may prevent some monitors from attaining a "Ready" status.

Step 1 **(Engine Cold)** Start engine, idle 20 seconds. Accelerate gradually and drive at 20-25 mph for 1 minute, varying speed.

Step 2 Accelerate gradually to 32 mph within 35 seconds. Decelerate to 0 mph in 10 seconds. Idle for 40 seconds.

Step 3 Accelerate at part throttle to 25 mph in 10 seconds. Cruise at 17-25 mph for 15 seconds. Accelerate gradually to 57 mph in 45 seconds. Cruise at 50-56 mph for 1 minute. Decelerate gradually to 0 mph in 40 seconds. Idle for 15 seconds.

Step 4 Accelerate at part throttle to 36 mph and maintain for 10 seconds. Decelerate to 0 mph in 15 seconds. Idle for 5 seconds.

Step 5 Accelerate to 30 mph and back to 0 mph within 30 seconds. Idle for 20 seconds.

Step 6 Accelerate to 36 mph in 20 seconds. Drive at 35 mph for 20 seconds. Decelerate to 0 mph in 15 seconds. Idle 5 seconds.

Step 7 Accelerate gradually to 26 mph and decelerate to 0 within 40 seconds. Idle 15 seconds.

Step 8 Accelerate to 27 mph in 40 seconds. Decelerate to 0 mph in 10 seconds. Idle 25 seconds.

Step 9 Accelerate to 26 mph in 15 seconds, maintain speed for 10 seconds, decelerate to 0 mph in 10 seconds. Idle 15 seconds.

Step 10 Accelerate to 23 mph in 20 seconds, decelerate to 0.5 mph in 10 seconds (no complete stop). Accelerate to 28 mph and back to 0 mph (momentary stop 1 second) within 35 seconds.

Step 11 Accelerate gradually to 34 mph in 45 seconds. Vary speed between 34 and 19 mph for 2 minutes. Decelerate from 25 to 0 mph in 25 seconds. Idle for 5 seconds.

Step 12 Accelerate to 29 mph in 15 seconds, decelerate gradually to 0 mph in 45 seconds. Idle for 30 seconds.

Step 13 Accelerate gradually to 28 mph and back to 0 mph (momentary stop 1 second) within 50 seconds. Accelerate gradually to 27 mph and back to 0 mph within 55 seconds. Idle for 15 seconds.

Step 14 Accelerate to 24 mph and back to 0 mph within 18 seconds. Idle for 10 seconds. Accelerate gradually to 22 mph and back to 0 mph within 50 seconds. Idle for 8 seconds.

Step 15 Accelerate gradually to 30 mph within 50 seconds. Decelerate to 0 mph in 10 seconds. Idle for 25 seconds.

Step 16 Accelerate to 23 mph and back to 0 mph within 30 seconds. Idle for 10 seconds.

Step 17 Repeat steps 1 - 16 once again. Recheck the status of the "Readiness Monitors".

NOTE: Remember, clearing DTC's or interrupting power to the ECM after the readiness monitors have been reset to **"Ready"** will require that the Drive Cycle be repeated.

Completing the Drive Cycle successfully one (1) time should reset most drive cycle monitors to a "Ready" status. However, there are "two trip" monitors, which require that the drive cycle be successfully completed two (2) times, to achieve a "Ready" status. Furthermore, systems which use averaging, may require the drive cycle to be completed more than 2 times. It is necessary to perform only as much of the Drive Cycle as is necessary to reset the required monitors to a "Ready" status.

End Drive Cycle

Volvo Drive Cycle/Readiness Code

VERIFICATION OF REPAIR

General

Verification of repair is intended as an aid if you are not sure if there is a fault or if you wish to check that diagnostic functions have been carried out.

Tips:

After repair, it may be necessary to check that the fault has actually been remedied. One way to do so is to check that the control module has carried out diagnostics for the repaired function/component without the diagnostic trouble code being regenerated. If fault tracing points to an obvious fault, it is not necessary to verify the repair.

Carrying out a TRIP

If all diagnostic functions are to be carried out as quickly as possible, the vehicle should be run following the driving procedure below.

Obs! When checking certain functions/components, the driving procedure does not need to be carried out in its entirety. The section "Diagnostic functions of the driving procedure" below describes the diagnostic functions.

General guidelines

^ The test should be performed on a road with light traffic where it is possible to drive slowly and pull over to the shoulder.

Warning! The test drive must always be executed in a safe and controlled manner. Follow applicable traffic and speed regulations.

^ Engine temperature level is of decisive importance to the first elements of the driving procedure.

Tips: Check engine temperature in VIDA Vehicle communication: Parameter readout during execution.

^ Make sure there are no diagnostic trouble codes (DTCs) stored in the engine control module (ECM) before starting the test drive. Stored diagnostic trouble codes can block diagnostic functions.

^ The total test drive time should be **at least 15 minutes** with an engine temperature of **at least 90° C** in order for all diagnostic functions to be carried out.

Driving procedure:

1. Start and warm up the engine until the temperature is **at least 65°C**. Then run at **approx. 2000 rpm** for **at least 5 minutes** (only applies to the diagnostic function for the tank system).
2. Turn off the engine and allow it to cool to a temperature **between +4°C and +40°C.**
3. Ignition on for **at least 2 seconds** (only applies to US market MY-00).
4. Start the engine when the temperature is **between +4°C and +40°C**, shift the selector lever to the "D" position, accelerate with light throttle application to **60-80 km/h (max 40-50 mph)**, then run at low load for **5 minutes** at **max 60-80 km/h (max 40-50 mph).**
5. Stop the car and allow the engine to idle for **30 seconds.**
6. Accelerate with light throttle application and then run with steady throttle for **5 minutes** at **max 60-80 km/h (max 40-50 mph).**
7. Stop the car again and allow the engine to idle for **30 seconds.**
8. Accelerate with **at least 50%** throttle application and then run with steady throttle for **5 minutes** at **max 60-80 km/h (max 40-50 mph).**
9. Stop the car again and allow the engine to idle for **1 minute.**
10. Ignition off.

Diagnostic functions in the driving procedure

For each element listed in the t1Driving procedure" section above, a corresponding description of which diagnostic function/functions is being carried out in that element is found below.

The parameter name of the diagnostic function that can be read in the VIDA Vehicle communication input is indicated in parenthesis (and bold text): Readout of diagnostic operating cycle. The following parameters/diagnostic functions can be read out:

^ Misfire.
^ Tank system.
^ Catalytic converter.
^ Heated oxygen sensor.
^ Fuel system.
^ Components.

Obs! The engine control module (ECM) continually performs the Misfire diagnostic function after engine start and is not found below.

For information on which diagnostic trouble codes (DTCs) are part of each diagnostic function, see the section "Diagnostic trouble codes (DTCs) included in the diagnostic function" below.

Diagnostic functions for each element of the driving procedure

1. EVAP control activated. Completed EVAP control is a condition that must be met before leakage diagnostics can start for the tank system.
2. Condition for the start of leakage diagnostics for the tank system (Tank system), EVAP control (Tank system), CVVT control (Components) and thermostat (Components).
3. Diagnostics for atmospheric pressure sensor (components) performed.
4. During acceleration: Leakage diagnostics for tank system (Tank system), EVAP control (Tank system), CVVT control and thermostat (Components) provided that points 1-2 are fulfilled.

During travel: Diagnostics for fuel control in load range (Fuel system) and turbo control (Components).
Diagnostics are active even if points 1-2 are not fulfilled.
5. Diagnostics for fuel control at idle speed (Fuel system) and idle control (Components).
6. Diagnostics for fuel control in load range (Fuel system), catalytic converter (Catalytic converter), heated oxygen sensors (Heated oxygen sensor) and thermostat (Components).
7. Diagnostics for fuel control at idle speed (Fuel system) and idle control (Components).
8. During acceleration: Diagnostics for turbo control and knock control (Components).
At steady throttle: Diagnostics for fuel control in load range (Fuel system), catalytic converter (Catalytic converter), heated oxygen sensors (Heated oxygen sensor).
9. Diagnostics for fuel control at idle speed (Fuel system) and idle control (Components).
10. Operating cycle completed.

Diagnostic trouble codes (DTCs) included in the diagnostic function

Misfire
Diagnostic trouble code ECM-44, ECM-45 and ECM-4D

Fuel system
Diagnostic trouble code ECM-25

Catalytic converter
Diagnostic trouble code ECM-5A

Tank system
Diagnostic trouble code ECM-65, ECM-66, ECM-68 and ECM-6A

Heated oxygen sensor
Diagnostic trouble code ECM-28

Components
Other diagnostic trouble codes that activate the malfunction indicator lamp (MIL) plus ECM-41 and 43.

Technical Service Bulletins

All Technical Service Bulletins:

Number	Date	Name
00-196	Jan 00	Vehicle - Service Information Strategy
00202	Jul 01	Policy - Service Upgrade Campaigns
00205	Oct 01	Interior Safety Products - Reuse/Disposal
08111	Jan 03	Recall - Trailer Hitch Defect
1801	Apr 00	Chemical Additives - Policy
2198	Apr 00	Campaign - Engine Oil Filler Grate Inspection
2210027	Mar 00	Engine Oil Filler Grate - Works Loose
2210042	Apr 03	Engine - In-Car Piston Replacement
2210049	Apr 03	Engine - Updated Rear Crankshaft Seal Replacement
2220005	Nov 00	Engine - Piston Cooling Valve Replacement
2230045	Dec 99	Emissions - Canister Purge Valve Ticking Noise
2230050	Mar 00	Tools - Fuel pressure EMS 2000, measuring/fualt tracing
2230052	Nov 00	Fuel System - Quick Release Connector
2250023	Jul 01	Electronic Throttle Module - Uneven Idle
2250026	May 01	Exhaust Manifold - Retaining Nuts Loose, Missing
2250040	Oct 04	Emissions - PCV System PTC Nipple Replacement
2260011	Feb 04	Cooling System - Cooling Fan Resistor Replacement
230045	Dec 99	Canister Purge (CP) Valve - Ticking Noise
23109	May 02	Recall - EVAP System/PCM Software Upgrades
3360021	May 02	Windshield Washer - Poor Performance
3360022	Oct 02	Wipers/Washers - Wipers Shudder/Noisy
3370008	Oct 00	Headlamps - Auxiliary Resistor Wire Harness
5520011	Mar 04	Recall - Brake Vacuum Replacement
81-0011	Oct 04	Body - Rear Lamp Housing/Gusset Panel Repair
83-0039	May 03	Body - Securing/Changing Lock Motors
84-0034	Oct 04	Body - Checking Rubber Seals and Seams
881A	Jul 00	Seat Belt - Extensions
8830037	Jan 01	Tailgate/Trunk - Lock Repair Kit
8830039	May 03	Power Locks - Door Central Locking Motor Replacement
8840031	Apr 01	Front Door Window - Excessive Noise
8840033	Apr 04	Body - PUR Bond(R) Window Bonding
8850010	Nov 01	Power Seat - Intermittent Lateral Movement
8850019	Jan 01	Interior - Manual Front Seat Whining/Creaking Noises
8870024	Jul 02	A/C - Unpleasant Odors
8870025	Feb 04	A/C - Unpleasant Odors From Vents
8880030	Apr 04	SRS - Cable Harness Repair/Replacement
8890013	Apr 04	Recall - Trailer Hitch Replacement
NHTSA03V474000	Nov 03	Recall 03V474000: Brake Vacuum Pump Replacement
TJ19292	Jun 08	A/C - Cleaning for System Odors
TJ19425	Jun 08	Vehicle - Type and Platform Identification
TNN20-04	Jan 07	Engine Controls - Engine Management Software Usage
TNN20-05	Jan 07	Engine - Lubrication System Contamination Cleaning
TNN21-21	Aug 05	Engine - Runs Rough/MIL ON/Misfire DTC's/Low Power
TNN25-14	Jan 03	Engine - Inconsistent Idle With A/C ON
TNN25-16	Jul 03	Engine Controls - DTC ECM 16
TNN25-17	Mar 04	Engine Controls - ECM DTC A1
TNN25-18	May 04	Cooling/Engine Controls - ECM DTC A1Set
TNN28-61	Sep 05	Engine Controls - ECM Reprogramming Procedure
TNN30-04	Oct 05	Engine Controls - Software Download Fault Prevention
TNN36-45	Jul 04	Ignition Systems - Failed Ignition Key Programming
TNN36-58	May 07	Antitheft - Immobilizer Lamp ON/DTC 321 Set
TNN37-22	Dec 01	Computers/Controls - CANbus Network Information
TNN37-39	Mar 07	Computers/Controls - CEM Recovery after SWDL Interrupt
TNN39-51	Apr 08	Audio System - Stuck CD's in Audio Units
TNN39-58	Feb 07	DVD Player - Won't Accept/Eject DVD's/Inoperable
TNN40-04	Oct 05	A/T, M/T, AWD - Approved Lubricants
TNN43-47	Nov 05	M/T - 1st/Reverse Gear Difficult to Engage
TNN43-48	Dec 05	A/T - Engine Coolant Contamination Detection
TNN43-56	Apr 08	A/T - Cooler/Line Flushing When Replacing A/T
TNN60-07	Aug 03	Steering/Suspension - Vehicle Pulls Left or Right
TNN61-04	Jul 03	Drivetrain/Frame - Clunking Noise When Shifting
TNN72-05	Aug 02	Suspension - Rear Suspension Knocking/Squeaking Noises
TNN76-02	Jan 03	Suspension - Rear Shock Absorber Noise
TNN77-18	May 07	Tires - Pressure Requirements/Recommendations

Technical Service Bulletins

All Technical Service Bulletins:

Number	Date	Name
TNN88-33	Jul 03	Restraints - SRS Lamp ON/Side Impact Sensor DTC Set
TNN88-41	Jul 06	Air Bag System - System Life Expectancy

Vehicle: Technical Service Bulletins

How to Find Technical Service Bulletins by Category/Symptom

Selecting TSB's "By Symptom"

If you have a vehicle which displays system-related symptoms, ALLDATA provides a way to quickly search for any relevant Technical Service Bulletins (TSB's). When you select TSB's "By Symptom," all relevant TSB's display at the top of the TSB title list. Viewing TSB's by Symptom is helpful when the vehicle displays a distinct, system related, malfunction. You may also wish to review the symptom list with your customer to uncover additional information that was not indicated on the Driveability Worksheet.

You can view TSB's by Symptom at any System or Sub-System level of the TurboView hierarchy. For example, a Symptom list will appear when selecting Powertrain Management or Computers and Control Systems. Symptoms will not appear when selecting a component (such as Mass Air Flow Sensor).

To view TSB's by Symptom:

1. Select the desired System or Sub-System and click the TSB icon.
2. Select "By Symptom" from the TSB list.
3. Select the symptom you wish to display.
4. Click on the desired TSB to display the article

Example:

Your customer complains of a noise in his 1989 Toyota Corolla (1.6L DOHC). The noise seems to be coming from the automatic transmission. To find TSB's related to transmission noise:

1. Select Transmission and Drivetrain, then Automatic Transmission.
2. Click the TSB icon and select "Noise" from the TSB symptom list.
3. Notice that TSB's related to transmission noise are now located at the top of the TSB title list while non-related TSB's for the transmission are listed below.

Technical Service Bulletin # **23109** Date: **020511**

Recall - EVAP System/PCM Software Upgrades

GROUP:
23

NO:
109

ISSUING DEPARTMENT:
Warranty

CAR MARKET:
U.S. and Canada

DATE:
YEAR
2002

MONTH
05

DAY
11

TITLE:
Service Campaign - 109: EMS 2000 Software Upgrade / Evap System Leakage Diagnostics

S40/V40 MY001 - MY01

REFERENCE BULLETINS:
SB23-0058
PB23-109

Supercedes SMB23-109 dated 2002-04-08

BULLETIN REFERENCE

A. SERVICE UPGRADE 109 DESCRIPTION

B. VEHICLES INVOLVED

C. PARTS INFORMATION/PARTS RETURN

D. OWNER NOTIFICATION

E. NEW VEHICLES IN RETAILER INVENTORY

F. RETAILER RESPONSIBILITY

G. CAMPAIGN REIMBURSEMENT PROCEDURES

A. SERVICE UPGRADE 109 DESCRIPTION

Volvo Cars of North America, LLC and Volvo Cars of Canada Ltd. have determined that a Service Upgrade is required on certain model year 2000 and 2001 S40 and V40 vehicles.

It has come to our attention that certain model year 2000 and 2001 S40 and V40 cars have experienced an unusual number of dashboard "Check Engine" light illuminations (in Canada: Refer to Image). The Check Engine light will illuminate if your vehicle's diagnostic system senses an engine, transmission, electrical or emissions system condition that potentially needs correcting

Volvo has determined that a software upgrade will alleviate unnecessary Check Engine lights without affecting the system's diagnostic capabilities. In some cases, a new diagnostic vacuum pump check valve will also be installed.

71,746 vehicles in the US and 4,696 vehicles in Canada are affected.

B. VEHICLES INVOLVED

NOTE:
RETAILER MUST CONFIRM VEHICLE ELIGIBILITY PRIOR TO BEGINNING REPAIR FOR THIS UPGRADE CAMPAIGN.

Vehicle eligibility should be confirmed:

Refer to DCS/VEN Vehicle Inquiry

RETAILER VEHICLE CAMPAIGN LIST

A "Retailer Vehicle Campaign List" will be sent separately identifying the specific vehicles eligible for this campaign. This list details all affected vehicles that are on record as being retailed or currently in stock at your facility. This Vehicle Campaign List will be the only written material you will receive from Volvo.

All vehicles should be checked for any other incomplete recalls or service campaigns.

Part Number	Part Description	Model	Qty	
30630251	Non-return valve	S40/V40	1	* if applicable
9139873	Software upgrade	S40/V40	1	

*** Non-Return Valve replacement**: Refer to Service Bulletin 23-0058, page 3 for the correct non-return valve identification and replacement procedure. **Incorrect replacement of the non-return valve will result in a claim debit.**

C. PARTS INFORMATION / PARTS RETURN

PARTS RETURN

THE REPLACED ONE-WAY VALVE SHOULD NOT BE RETURNED TO THE TMA DEPARTMENT.

INSTEAD, THE ONE-WAY VALVE SHOULD BE HELD FOR THE MANDATORY 30-DAY PERIOD, AFTER WHICH TIME THE RETAILER SHOULD SCRAP IT IN A RESPONSIBLE MANNER.

RANDOM CLAIM AUDITS WILL BE MADE FOR EACH RETAILER. INCORRECT REPLACEMENT OF THE NON-RETURN VALVE WILL RESULT IN A CLAIM DEBIT.

D. OWNER NOTIFICATION

Owner mailing is expected to begin during the week of April 8, 2002.

E. NEW VEHICLES IN RETAILER INVENTORY

All new vehicles in retailer's inventory and qualifying for Service Campaign 109 should be repaired prior to a customer taking possession of the vehicle.

F. RETAILER RESPONSIBILITY

Retailers are to perform this upgrade on eligible vehicles regardless of mileage/Kilometers or vehicle age. The campaign work covered under Service Campaign 109 is free of charge to the owner.

In the event that the original announcement letter is lost or misplaced, the owner is not to be refused this important campaign work. Your After sales Area Manager will follow up to ensure that this campaign is proceeding smoothly.

All claims should be submitted using the **short form application**

Model	**Type**	**Code**	**Description**	**Time**	**MY**	**Parts Amount**	
						U.S.	**Canada**
S40/V40	109	02	Software upgrade **ONLY**	0.5 0.6	**2000** **2001**	$ 19.08 $ 19.08	$ 33.60 $ 33.60
S40/V40	109	03	Replace non-return valve **AND** software upgrade	0.5 0.6	**2000** **2001**	$ 41.83 $ 41.83	$ 61.42 $ 61.42

G. CAMPAIGN REIMBURSEMENT PROCEDURES

Technical Service Bulletin # **2198** Date: **000401**

Campaign - Engine Oil Filler Grate Inspection

BULLETIN NUMBER:
2198

GROUP:
21

NO:
98

DATE:
April, 2000

TITLE:
Service Campaign 98 - Oil Filler Grate: Inspect

MODELS:
(9892970) VOLVO S80
(9892969) VOLVO S70/V70/C70
(9892968) VOLVO S40/V40

ISSUING DEPARTMENT:
Warranty

REFERENCE BULLETINS:
SB 21-0027
SB 21-0028
SB 21-0029

CAR MARKET:
U.S. and Canada

SUPERSEDES: SMB 21-98 dated March, 2000. Claim Type numbers corrected on page 3.

BULLETIN REFERENCE

A. SERVICE CAMPAIGN 98 DESCRIPTION

B. VEHICLES INVOLVED

C. RETAILER VEHICLE CAMPAIGN LIST

D. PARTS INFORMATION

E. OWNER NOTIFICATION

F. VEHICLES IN RETAILER INVENTORY

G. RETAILER RESPONSIBILITY

H. CAMPAIGN REIMBURSEMENT PROCEDURES

I. RETAILER ALLOWANCE

A. SERVICE CAMPAIGN 98 DESCRIPTION

Volvo Cars of North America, Inc. and Volvo Cars of Canada Ltd. have announced a service campaign affecting certain 2000 model year Volvos. Approximately 20,817 vehicles in the US and 600 vehicles in Canada are affected.

This campaign involves the engine oil filler grate located in the engine oil filler neck of certain model year 2000 Volvos. In rare instances, this grate may become loose. On vehicles that qualify for this campaign, an inspection of this grate will be performed.

All owners of these affected vehicles will by notified by mail beginning the week of April 3, 2000.

B. VEHICLES INVOLVED

NOTE: RETAILER MUST CONFIRM VEHICLE ELIGIBILITY PRIOR TO BEGINNING THIS CAMPAIGN.

Vehicle eligibility should be confirmed:

1) Refer to DCS Vehicle Inquiry

2) Refer to the Vehicle Campaign Listing

Service Campaign 98 was performed on vehicles within the affected chassis range prior to release from the PORT. On these vehicles this campaign has been marked as PERFORMED in DCS, and no further action is required.

C. RETAILER VEHICLE CAMPAIGN LIST

"A Retailer Vehicle Campaign List" will be sent separately identifying the specific vehicles eligible for this campaign. This list details all affected vehicles that are on record as being retailed or currently in stock at your facility. This Vehicle Campaign List will be the only written material you will receive from Volvo.

D. PARTS INFORMATION

Parts are NOT required for this Service Campaign.

E. OWNER NOTIFICATION

During the week of April 3, 2000 an announcement letter will be sent directly to Volvo owners. A copy of this letter is attached.

F. STOCK VEHICLES

All vehicles in retailer's inventory and qualifying for this service campaign must he repaired prior to a customer taking possession of the vehicle.

G. RETAILER RESPONSIBILITY

Retailers are to perform this campaign on eligible vehicles regardless of mileage/kilometers or vehicle age. The campaign work covered under Service Campaign 98 is free of charge to the owner.

In the event that the original announcement letter is lost or misplaced, the owner is not to be refused this important campaign work. Your Aftersales Specialist will follow up to ensure that this campaign is proceeding smoothly.

H. CAMPAIGN REIMBURSEMENT PROCEDURES

ONLY ONE CLAIM PER VEHICLE WILL BE ACCEPTED.

All claims should be submitted using the short form application. Separate repair codes have been established for the S80, the S70/V70/C70 and the S40/V40 that Will automatically reimburse the retailer for the proper labor for each claim. Replacement parts are not required for this Service Campaign.

Claim Type	Repair Code	Repair Description	Labor Time	Part Amount
9892968	02	OIL GRATE - INSPECT ONLY Model S40/V40	0.3	US N/A CA N/A
9892969	02	OIL GRATE - INSPECT ONLY Model S70/V70/C70	0.3	US N/A CA N/A
9892970	02	OIL GRATE - INSPECT ONLY Model S80	0.3	US N/A CA N/A
9892968	03	OIL GRATE - INSPECT/REMOVE Model S40/V40	0.3	US N/A CA N/A
9892969	03	OIL GRATE - INSPECT/REMOVE Model S70/V70/C70	0.3	US N/A CA N/A
9892970	03	OIL GRATE - INSPECT/REMOVE Model S80	0.3	US N/A CA N/A

I. RETAILER ALLOWANCE

Technical Service Bulletin # **08111** Date: **030110**

Recall - Trailer Hitch Defect

NO:
111

GROUP:
08

ISSUING DEPARTMENT:

CAR MARKET:
North America

DATE:

YEAR	MONTH	DAY
2003	01	10

TITLE:
Recall Campaign 111 Trailer Hitch

MY 1993-2002

REFERENCE BULLETINS:

SMB 00-170
SMB 00-170c
SB 89-0011
PB 89-111 (Pending)

BULLETIN REFERENCE

A. RECALL CAMPAIGN 111 DESCRIPTION

B. TRAILER HITCHES INVOLVED

C. PARTS INFORMATION

D. REPAIR OPTIONS/PARTS RETURN

E. CUSTOMER INFORMATION

F. RETAILER RESPONSIBILITY

G. CAMPAIGN REIMBURSEMENT PROCEDURES

H. RETAILER ALLOWANCE

I. CUSTOMER REIMBURSEMENT

A. RECALL CAMPAIGN 111 DESCRIPTION

Volvo, in agreement with its supplier Brink Sverige AB, has determined that a defect exists in the Generation 3.0 Trailer Hitch manufactured in Sweden for use on Volvo cars. Between September 1998 and September 2000, approximately 900 of the affected trailer hitches were delivered to Volvo retailers and subsequently sold to customers in the US and Canada.

B. TRAILER HITCHES INVOLVED

In an attempt to locate the owners of the affected trailer hitches, Volvo is asking retailers to check their records, for the time period between September 1998 and September 2000 for sales of the seven (7) affected part numbers*:

9451997	9481235
9451998	9481216
9481232	9499598
30889232	

* **Note**:

Not every trailer hitch with one of the part numbers listed above is affected by the Recall. Please confirm that the trailer hitch is included in Recall 111 by ensuring that the part number is on the list and that the hitch has ALL THREE of the following distinguishing features:

^ a green release handle

^ a key-lock

^ the area around the locked/unlocked red indicator pin is round

US	CANADA
Asset Management & Control	Volvo Cars of Canada Ltd.
ATTN: TMA Department	ATTN: TMA Department
55 Riverview Drive	175 Gordon Baker Road
Marlboro, NY 12542	North York, Ontario M2H 2N7

C. PARTS INFORMATION

Part Number	Part Description	Qty
8698774	Service Kit	1

D. REPAIR OPTIONS / PARTS RETURN

The supplier is expected to provide Volvo with replacement trailer hitches within 90 days. At this time, no customers have been contacted regarding this Recall Campaign. If in the course of business, one of the affected trailer hitches is encountered, please inform the customer that the hitch is part of Volvo Recall Campaign 111 and offer the following options:

1. If the customer agrees to surrender the affected part (see description of affected parts in Section B. TRAILER HITCHES INVOLVED):

    (a) Remove the detachable tow bar portion of the affected trailer hitch and return only the green handle to TMA. The balance of the parts are to be scrapped by the retailer. The mailing procedures for TMA can be found in SMB 00-170 for the US and SMB 00-170C for Canada, the addresses are:

    (b) Inform the customer that he/she will be notified by letter when a replacement hitch is available;

    (c) Send the customer's name, address and VIN to VCNA (as indicated in Section E. CUSTOMER INFORMATION).

2. If the customer does not want to surrender the affected part (see Section B. TRAILER HITCHES INVOLVED):

(a) Permanently affix the detachable tow bar to the receiver (bumper mount) using Service Kit 8698774 and the instructions in Service Bulletin 89-0011, Trailer Hitch - Permanently Affixing, available on the VEN Intranet;

(b) Inform the customer that he/she will be notified by letter when a replacement is available;

(c) Send the customer's name, address and VIN to VCNA (see Section E. CUSTOMER INFORMATION).

E. CUSTOMER INFORMATION

If sales records for the affected parts are located, please submit the customer's name, address and VIN by mail to:

Volvo Cars of North America, LLC
1 Volvo Drive (Bldg. B)
Rockleigh, NJ 07647

F. RETAILER RESPONSIBILITY

Retailers are to perform this campaign on eligible vehicles regardless of mileage/kilometers or vehicle age. The campaign work covered under Recall Campaign 111 is free of charge to the owner.

G. CAMPAIGN REIMBURSEMENT PROCEDURES

All Recall Campaign 111 claims should be submitted using the short form application. A repair code has been established for this repair that will automatically reimburse the retailer for the proper labor and parts amount for each claim.

Claim Type	Repair Code	Repair Description	Labor Time	Part Amount
111	02	Identify and secure detachable tow hitch	0.3	US: $4.37 CA: $6.82

H. RETAILER ALLOWANCE

I. RETAILER ALLOWANCE

Please follow the instructions as outlined in the WARRANTY POLICY & PROCEDURES MANUAL, Chapter 6, Page 6.4.

Technical Service Bulletin # **8890013** Date: **040401**

Recall - Trailer Hitch Replacement

850/S40(-04)/V40/S70/V70(-01)/V70XC(-01)/S80 -2000
V70(01-)/V70XC(01-)/S80 2001-

Cars

Section:
8

Group:
89

No.:
0013

Year:
04

Month:
04

Reference:

This bulletin replaces Service Bulletin 89-0011 from December 2002 which must be discarded.

Recall Campaign No. 111A - Trailer Hitch Replacement

Background

Volvo, in agreement with its supplier Brink Sverige AB, has determined that a defect exists in the Generation 3.0 Trailer Hitch manufactured in Sweden for use on Volvo cars.

Competence requirement
Volvo Level 1 Technician

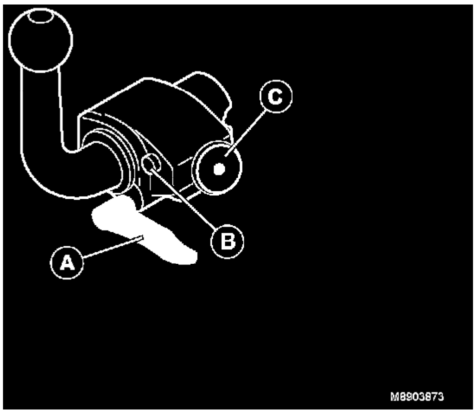
Material

Description	Quantity	P/N
Mechanism	1	See table below

Towing unit

Detachable Tow Hitch Replacement

Identifying tow hitch type 1

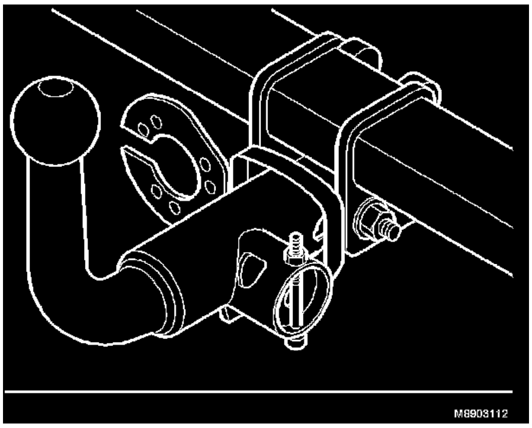


The trailer hitch covered by this method is recognizable by the following features:

Alternative 1

- Green handle (A)
- Key-lock (B)
- Area around indicator pin is circular (C).

Alternative 2



Tow hitch is mounted temporarily as shown in illustration, step 2.

Removing temporarily mounted tow hitch 2

Remove bolt securing tow hitch. Remove washers, spring and locking cylinder.

Replacing tow hitch 3

Remove cover (if fitted) on connecting pin. Check tow hitch P/N.

The number is stated after PART NO. on the type designation plate, which is located on the left-hand side of the tow hitch.

CAR MODEL		OLD PART NUMBERS				REPLACEMENT PARTS
Model year		Type designation plate	Kit number	Remarks	Ball (A) (tolerance 0 – /+4 mm)	Mechanism
-2000	855, S70, V70, V70XC	9481216	9451998	1 7/8" ball	81.25	8698893
-2000	855, S70, V70, V70XC	9451997	9451997	2" ball	81.25	8698894
-2000	S40, V40	30889232	30889232	1 7/8" ball	99.25	8698920
1999-	S80	9166575	9166575	2" ball	N/A	8698933
-2002	S80	8623085	9499507	2" ball	127.8	8698935
2001-	V70	9481216	9481216	2" ball	150.8	30664193
2001-	V70	9499598	9499598	1 7/8" ball	150.8	30664194
2001-	V70XC	9481232 9481235	9481232 9481235	2" ball 1 7/8" ball	144.3 N/A	8682306, 8682170, 8682171

Unpack the new tow hitch and connecting pin with the P/N in the table shown.

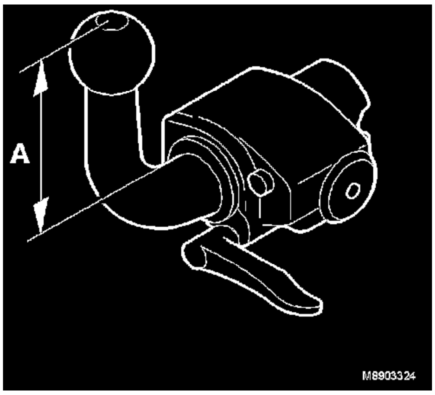
Note!
If the type designation plate is absent, the tow hitch can be identified by measuring the ball height as described in the following operation and cross-referencing with the values specified in the table.

Remove the existing decal in the luggage compartment describing the operation of the tow hitch.

The location of the decal will vary depending on the model and version.

Attach the decal included in the material kit.

Measuring the ball height 4



The ball height (A) is measured between the top of the ball and the top of the horizontal section of the tow hitch (see illustration).

Checking tow hitch 5

Mount tow hitch on connecting pin.

Ensure that tow hitch locks in position and that the key-lock is working.

Remove tow hitch.

Fit cover to connecting pin (if available).

Placing tow hitch in car 6

Complete registration card provided with tow hitch. Handled according to separate routine.

Place tow hitch in bag.

Place tow hitch and keys in car in location specified for model in question.

Replace existing manual with new manual from kit. Discard old manual and keys.

Mechanism, connecting pin and type designation plate must be scrapped according to separate instruction.

Technical Service Bulletin # **NHTSA03V474000** Date: **031103**

Recall 03V474000: Brake Vacuum Pump Replacement

DEFECT: On certain passenger vehicles, water can enter the electrical brake vacuum pump, causing the pump to fail, resulting in loss of power assist and an increase in needed brake pedal force, which could result in a crash.

REMEDY: Dealers will replace the pump with a new and improved version and move the pump to a new location. The manufacturer has not yet provided an owner notification schedule for this campaign. Owners may contact Volvo at 1-800-458-1552.

Technical Service Bulletin # **5520011** Date: **040301**

Recall - Brake Vacuum Replacement

S40 (-04)/V40
2000

Section:
5

Group:
52

No.:
0011

Year:
04

Month:
03

Background:

Volvo Cars North America LLC (Volvo) has decided that a defect related to motor vehicle safety exists in certain model year 2000 S40 and V40 vehicles. Under certain circumstances, water may enter the electrical brake vacuum pump, causing the pump to not function. This will require more brake force to stop the vehicle. However, this is primarily noticed at cold start. This limited braking power can affect the vehicle's stopping performance.

The corrective action will be to replace the vacuum pump with a new pump of a modified design. This new pump will be placed in a new location to prevent water intrusion.

Competence requirement

Volvo Level 2 Technician

Description	Quantity	Part No.
Vacuum pump service kit	1	30641411
Vacuum hose	1	30620958
Anti rust spray	0.1	1161480

Material

Vacuum pump

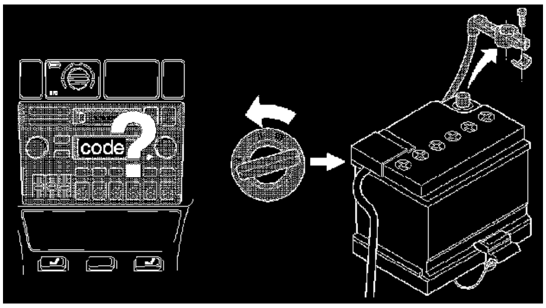
Additional vacuum pump, replacing

1. Preparatory work

   Make a note of the anti-theft radio code.

   Switch off the ignition.

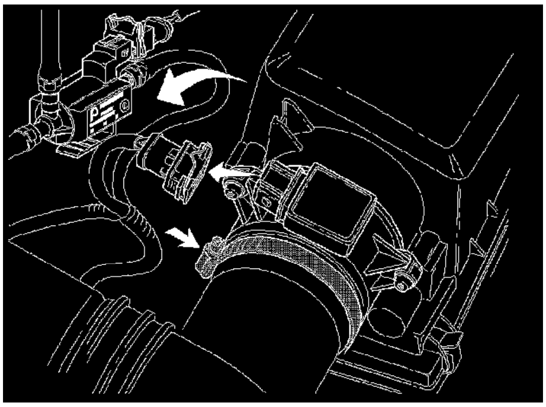
Caution!
Press down the brake pedal a few times until there is no longer any negative pressure (vacuum) in the brake servo.



Remove:

- the battery negative lead
- the battery positive lead
- the protective cover over the battery
- the battery clamp and the battery.

2. Removing the air cleaner (ACL)



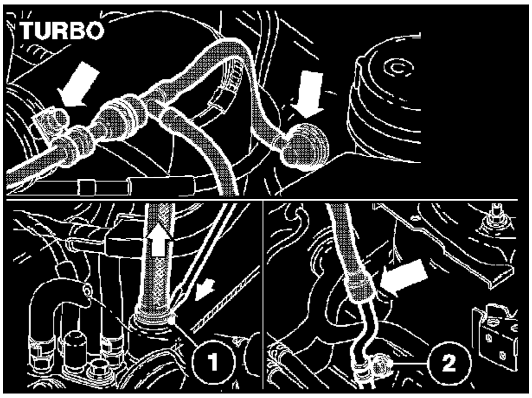
Remove:

- the connector for the mass air flow (MAF) sensor
- the turbocharger (TC) control valve from the air cleaner (ACL)
- the air inlet hose on the mass air flow (MAF) sensor side
- the 2 mountings for the cable harness from the air cleaner (ACL) housing
- the air intake at inner fender
- the mounting screws
- the air cleaner (ACL).

Note!
Plug off the air inlet hose.

3. Removing the vacuum hose

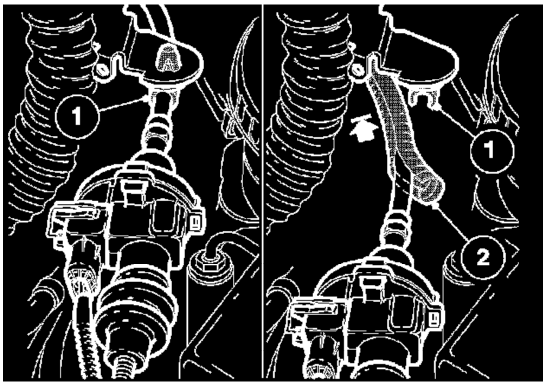
Note!
Clean the area around the vacuum hose terminal before removal.



Remove:

- the connection from the brake servo
- the bolt and clamp from the vacuum hose (will be re-used)
- the protective cover for the throttle housing
- the vacuum hose from the intake manifold by pressing in the locking ring (1) while pulling the vacuum hose out
- the quick-release connector for the vacuum hose to the additional vacuum pump
- the vacuum hose. This will not be re-used
- the bolt (2) from the vacuum pipe on the side member.

4. Installing the protective sleeve for the throttle cable



Remove:

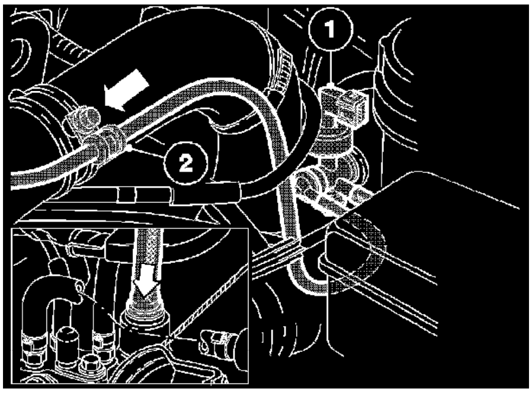
- the protective cover from the connector bracket fire wall
- the throttle cable out from the clip (1).

Install:

- the protective sleeve (2) over the throttle cable. Slide the protective sleeve as far as possible towards the firewall.
- the throttle cable in the clip (1).

5. Installing the new vacuum hose

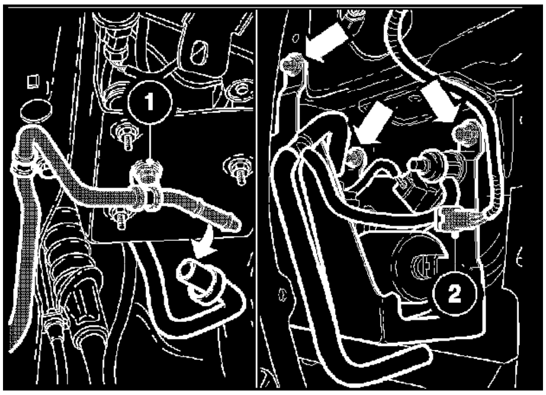
Position the vacuum hose between the intake manifold and the brake servo.



Install:

- the vacuum hose in the manifold. Check the locking by pulling on the vacuum hose
- the vacuum hose control valve (1) in the brake servo
- the clamp (2) and bolt on the vacuum hose. Tighten to 6 Nm

6. Removing the complete additional vacuum pump assembly

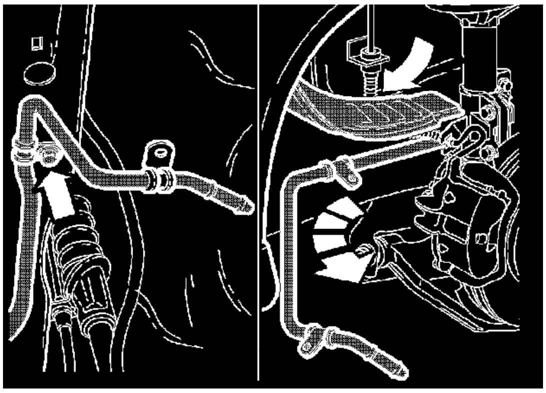


Remove:

- the left front wheel
- the front fender liner. Bend the fender liner backwards
- the vacuum hose from the vacuum pipe
- the clamp (1) from the vacuum pipe
- the connector (2)
- the three mounting screws
- the vacuum pump assembly. This vacuum pump assembly will not be re-used.

Route the wiring and connector (2) via the existing inner fender hole into the engine compartment.

7. Removing the vacuum pipe from the side member

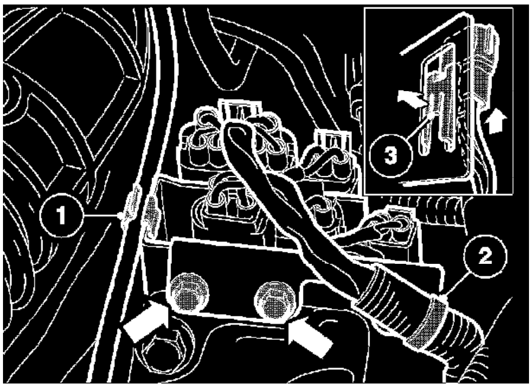


Remove:

- the clamp from the vacuum pipe at the side member
- the vacuum pipe.

Note!
The vacuum pipe must be bent before it can be removed. This vacuum pipe will not be re-used.

Clean the vacuum pipe and pump assembly screw positions. Apply rust proofing agent P/N 1161480.



Install:

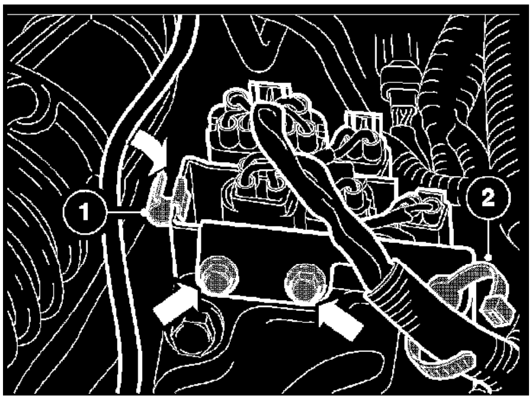
- the front fender liner
- the left front wheel.

8. Removing the connector bracket from the transmission (to lower the position of the connectors)

Remove:

- the shifting cable out off the clip (1)
- the clip (1) from the bracket
- the upper tie strap (2) from the cable harness
- the two mounting screws
- the connectors by lifting the catches (3) and slide it from the bracket. Note the position of the connectors on the bracket
- the bracket and remove at the side the cable harness.

9. Installing the new connector bracket on the transmission



Install:

- the connectors on the bracket in their original positions and check the locking
- the cable harness tie strap on the side
- the bracket on the transmission. Tighten to 10 Nm
- the clip (1) for the shifting cable
- the shifting cable in the clip (1)
- the new tie strap (2) and cable harness.

10. Installing the extra cable harness

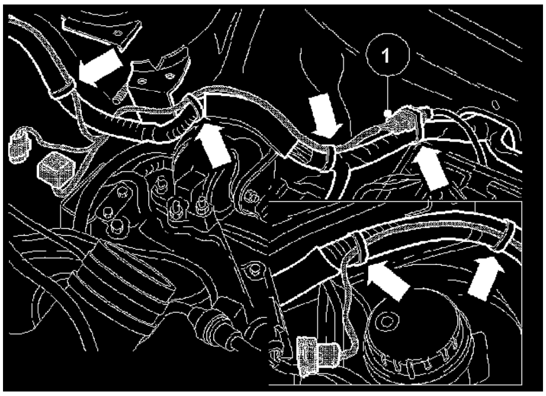
Remove:

- the relay/fuse box from the bracket
- the rear clamp from the cable harness.

Move the relay/fuse box to one side.

Position the connector (1) at the front. Route the new cable harness over the engine compartment cable harness.

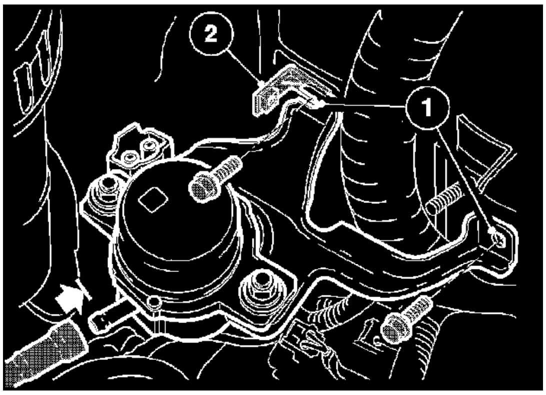
Connect the connector (1) to the connector from the old vacuum pump.



Use tie straps to clamp the wiring as illustrated.

Note!
Ensure that the cable harness is not trapped or in contact with moving components or sharp edges.

11. Installing a new additional vacuum pump and bracket



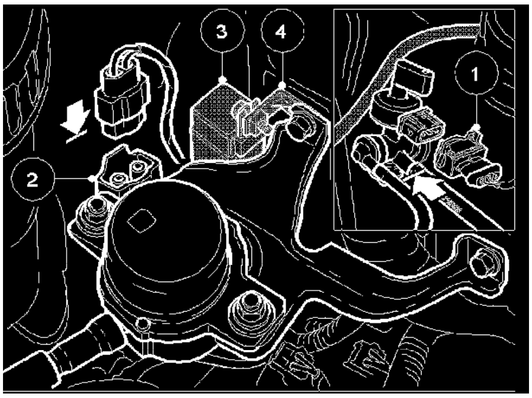
Note!
Check that the existing nuts (1) are in good assembly conditions.

Position the vacuum pump bracket and relay bracket (2) on the inner fender by two screws.

Tighten to 21 Nm.

Press the quick release connector of the vacuum hose on the vacuum pump. Check the locking.

12. Installing the new cable harness and relay



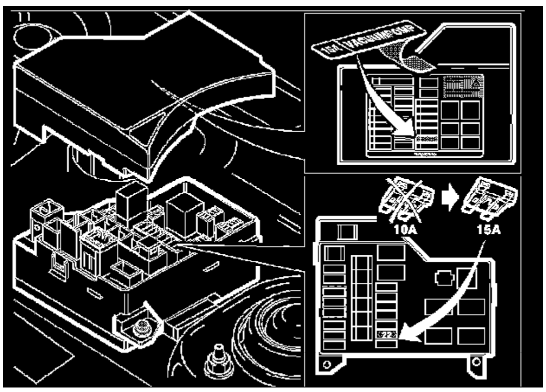
Connect:

- the connector (1) to the vacuum hose control valve on the brake servo
- the extra cable harness connector (2) to the vacuum pump
- the relay (3) to the connector on the extra cable harness.

Install the relay (3) on the bracket (4). Tighten to 5 Nm.

13. Installing the relay/fuse box

Reinstall the relay/fuse box.

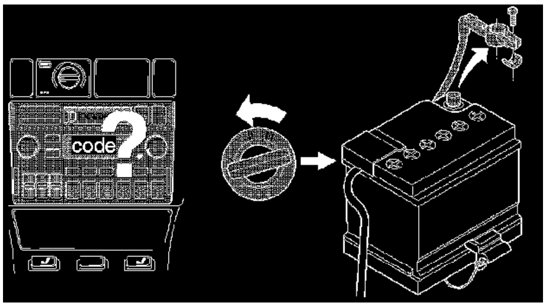


Replace fuse no. 22 (10 A) with the 15 A fuse. Clean the area where the label will be applied. Install the label on the inside of the cover

Reinstall the cover on the fuse box.

14. Installing components

Note!
Do not connect the battery negative lead.



Install:

- the air cleaner (ACL)
- the protective cover for the throttle housing
- the protective cover from the connector bracket fire wall
- the battery and battery clamp
- the protective cover over the battery
- the battery positive lead.

15. Connecting the battery and checking function

Turn the ignition to position II.

Warning!
Ensure that no one is in the car when the battery is connected.

Connect the battery negative lead.

Re-enter the radio code.

Set the car clock to the correct time.

Function test:

Turn the ignition off press down the brake pedal a few times until there is no longer any negative pressure (vacuum) in the brake servo.

Turn the ignition key to position II and listen for the operation of the additional vacuum pump. The vacuum pump stops after a short time.

Start the engine and let it idle.

Press down the brake pedal a few times and check whether the additional vacuum pump starts working.

Technical Service Bulletin # **TNN21-21** Date: **050815**

Engine - Runs Rough/MIL ON/Misfire DTC's/Low Power

NO: 21-21

DATE: 8-15-2005

MODEL/CHASSIS: See Table Below

M.YEAR: 2004

SUBJECT:
Engine may have a rough idle, DTC ECM misfire codes, rough running or lack of power.

REFERENCE:
VADIS/VIDA

This tech note supersedes the previous 21-21 dated 7-29-05. Please update your files. Update to LABOR OPS - correction is shown with bold text.

Type	Chassis Range
S40 / V40	080000 - 125313
S40 (04-)	004506 - 025161
S60	386580 - 411538
C70	048000 - 050951
V70	416073 - 442589
XC70	151672 - 166901
S80	367089 - 379386
XC90	088045 - 119869

Worn valve face

Affected Vehicles Table

DESCRIPTION:

The Customer may have a complaint of a rough idle, rough running, lack of power or the MIL on.

SERVICE:

^ Read out DTC's

^ Check compression and do a leak down test with the engine cold.

^ Check valve clearance on the cylinders with low compression.

^ Remove the cylinder head and check the condition of the valve face.

^ If the valve face is worn, replace ALL the intake valves, even if some look okay.

^ Use ONLY intake valves with P/N 30637059.

Material **B4204Tx**	Quantity	Part No.
Intake valve	8	30637059
Valve seals, Service kit	1	274344
Gasket	1	9404725
Screw	10	6842347
Gasket	1	11996
Cover	1	1397381
Seal ring	1	9440651
Seal ring	1	9458309
Seal ring	1	9443310
Seal ring	4	1397525
Flange screw	3	975207
Flange screw	1	968163
Gasket	1	1236119
O-ring	1	976045
Gasket	1	1366787
Hose clamp	1	978177
Hose clamp	1	976561
Gasket	2	947282
Gasket kit	1	272461
Sems nut	8	982297
Lock nut	4	977209
Gasket	1	8642277
Gasket	6	947282
Gasket	1	3514546

Material **B5244Sx (New S40)**	Quantity	Part No.
Intake valve	10	30637059
Valve seals, Service kit	1	274344
Gasket	1	8642629
Screw	12	6842347
Gasket	1	11996
Seal ring	5	1397525
Seal ring	2	30612805
Seal ring	2	1275365
Cover	2	1397381
Flange screw	4	968881
Flange screw	2	30683684
Flange screw	2	965227
Gasket	1	8699467
Flange nut	12	948645
Gasket	1	1270505
Flange nut	4	945408
Gasket	1	30677525
Gasket	5	30637438
Hose clamp	1	978172

Material **B5254Tx (New S40)**	Quantity	Part No.
Intake valve	10	30637059
Valve seals, Service kit	1	274344
Gasket	1	30637067
Screw	12	6842347
Gasket	1	11996
Valve lifter	1	274150
Seal ring	5	1397525
Seal ring	2	30612805
Seal ring	2	1275365
Cover	2	1397381
Plug	2	8699496
Flange screw	4	968881
Flange screw	**2**	**30683684**
Flange screw	2	965227
Gasket	1	8699467
Flange nut	12	948645
Gasket	4	947621
Hose clamp	1	978173
Washer	12	419401
Gasket	1	30677190
Flange screw	3	30614458
Gasket	2	947621
Gasket	1	30637800
Gasket	1	30650074
Gasket	5	30637438
Gasket	2	11994
Hose clamp	1	976561

Material **B52x4Tx**	Quantity	Part No.
Intake valve	10	30637059
Gasket	1	9458534
Gasket	2	30731212
Gasket	1	11996
Gasket B5254T2 s/n -2979610	1	30637336
Gasket B5254T2 s/n 2979611-	1	30637066
Gasket B5244T3	1	9404726
Gasket B5204T5, B5234T3/T7, B5244T4/T5	1	9443896
Screw	12	6842347
Valve lifter kit	1	274150
Valve seals, Service kit	1	274344
Seal ring	5	1397525
Cover	1	1397381
Seal	1	9443310
Seal	1	9458309
Seal	1	9440651
Hose clamp	2	989879
Hose clamp	2	978171
O-ring	1	976045

Gasket, **All turbochargers except B5254T4, B5244T4/T5**	4	947282
Gasket **B5254T4, B5244T4/T5**	2	947282
Gasket **B5254T4, B5244T4/T5**	2	947621
Gasket	1	1236119
Clamp	1	976561
Screw	2	946934
Gasket	4	947282
Cable tie	2	983750
Flange nut	2	945408
Flange nut	10	948645
Gasket	1	9179056
Gasket	1	8642449
Gasket kit	1	271802
Gasket	1	8642450
Lock nut	7	977209
Seal ring	1	30637866
Gasket, **All turbochargers except B5254T4, B5244T4/T5**	1	3514546
Gasket **B5254T4, B5244T4/T5**	1	30650296
Gasket	2	947282
Gasket	2	18671
Clamp	1	989879

Material **B52x4S**	Quantity	Part No.
Intake valves	10	30637059
Valve seal kit	1	274344
Gasket	1	11996
Screw	12	6842347
Valve lifter kit	1	274150
Gasket	1	9404726
Gasket	1	9463274
Gasket kit	1	271802
Flange nut	10	948645
Gasket	1	8627203
Flange nut	4	945408
Seal ring	5	1397525
Gasket	1	30731212
Hose clamp	1	978180
Hose clamp	1	978173
Seal ring	1	9443310
Seal ring	1	9440651
Seal ring	1	9458309
Cover	1	1397381
Hose clamp	1	978165
Gasket	2	947282
Gasket	1	9458534
Flange screw	2	946934
Band clamp	2	983750

Material **B6294T**	Quantity	Part No.
Intake valves	12	30637059
Valve seal kit	1	274344
Gasket	1	11996
Screw	14	6842347
Valve lifter kit	1	274150
Gasket	1	8675251
O-ring	5	1397525
Gasket	2	30731212
Seal ring	1	9440651
Seal ring	1	9458309
Cover	1	1397381
Seal ring	1	9443310
Gasket	1	9142697
Gasket	4	947282
Gasket	1	9458535
Gasket	1	8675251
Clamp	1	1346542
Flange screw	2	946934
Gasket	1	1236119
Gasket kit	1	272395
Flange nut	12	948645
Gasket	1	9179056
Gasket	2	30677358
Flange nut	2	945408
Flange nut	8	946470
Lock nut	6	977209
Gasket	2	3514546
Gasket	3	947621
Gasket	4	947281
Gasket	8	947282
Sems screw	1	981771
Cable tie	2	983750

Material **B6294S**	Quantity	Part No.
Intake valves	12	30637059
Valve seal kit	1	274344
Gasket	1	11996
Screw	14	6842347
Valve lifter kit	1	274150
Gasket	1	9404727
Gasket	1	9458535
Gasket	1	9497519
Seal ring	6	1397525
Gasket	1	30731212
Gasket	1	1236119
Nut	12	948645
Gasket kit	1	271734
Flange screw	1	979780
Gasket	1	9497519
Seal ring	1	9440651
Seal ring	1	9458309
Seal ring	1	9443310
Cover	1	1397381
Gasket	1	9142697
Gasket	2	8627203
Flange screw	8	946470
Hose clamp	1	989879
Hose clamp	1	978165
Band clamp	2	983750

See list shown for all materials needed.

NOTE:
Machining, grinding or lapping of valve seats or valve sealing surface must not be done.

Do not forget to check and adjust valve clearances for the new valves.

Note:
Valve Lifter Kit contains numerous lifters; Claim submitted should only have individual lifters used for the repair.

Intake valve replacement 1

Worn valve face

Note!
Replace all intake valves.

For cylinder head removal and installation, see:

Removal, replacement, installation

Engine

Cylinder head

Cylinder head/gasket, replacing

For valve replacement, see:

Overhaul

Engine

Cylinder head

Cylinder head, assessment/overhaul

Adjust valve play as described in the link:

Valve play, setting/adjusting

Important!
Machining, grinding or lapping of the valve seat or the valve sealing surface must not be performed.

WARRANTY CLAIM INFORMATION			
LABOR OP	LABOR DESCRIPTION		LABOR TIME
99284-3	Inlet valve replacement	X40 B4204T MY04	1.1 hr
		S40, V50 B52X4X MY04	1.1 hr
		C70 MY04	1.1 hr
		S60 MY04	1.1 hr
		V70 MY04	1.1 hr
		S80 B52X4T MY04	1.1 hr
		S80 B6294T MY04	1.3 hr
		XC90 B5254T MY04	1.1 hr
		XC90 B6294T MY04	1.3 hr
36001-2	DTC read and reset		0.2 hr
21003-2	Cylinder leakage test		See VSTG (Volvo Service Time Guide)
21433-3	Valve clearance check		See VSTG (Volvo Service Time Guide)
21102-2	Cylinder head gasket replace		See VSTG (Volvo Service Time Guide)

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY INFORMATION

Technical Service Bulletin # **8870025** Date: **040201**

A/C - Unpleasant Odors From Vents

S40(-04)/V40 2000-

Section
8

Group
87

No.
0025

Year
04

Month
02

Control module for the blower fan motor, installing

Background:

To minimize the risk of unpleasant odors from occuring in the heating/ventilation system, a kit can be installed that activates the blower fan for set periods after the ignition is switched off.

Important:
This control module may not be used if the vehicle is equipped with an ultra sonic alarm.

Description	Quantity	Part No.
Kit	1	30623435
Cable Tie	10	983750

Special tools

Description	Special Tool Bulletin #	Part No.
Terminal Removal tool	From Terminal repair kit 951 2946 or 951 2647 (STB 95)	951 2636 Blue

Materials

Climate control unit
Control module blower fan motor, installing

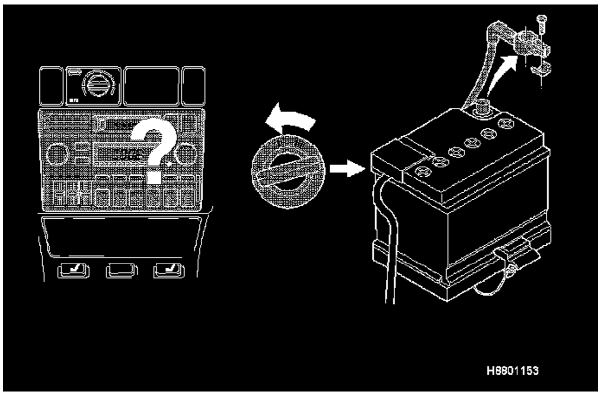
System background 1

Note!
The system stops functioning if the battery voltage falls below 12.5 Volts. This is to prevent the battery from discharging.

To activate the system, the ambient temperature must be at least 16°C. The system activation is dependant upon ambient temperature and not air conditioning usage.
The fan runs at full speed for 10 seconds, starting 30 seconds after the ignition is turned off.
After 10 minutes the fan starts again and runs for 10 seconds.

Note!
This cycle is repeated for approximately two hours.

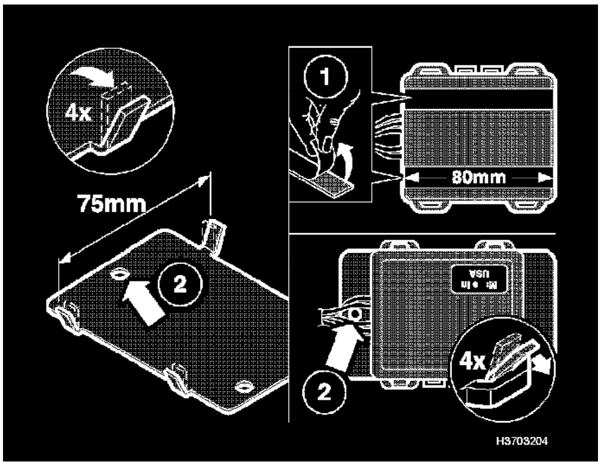
During this time, the fan motor will run at full speed for a maximum of two minutes in total.
If the engine is started during this time, the start system is always reset.



Preparations 2

Make a note of the radio code.
Switch off the ignition.
Disconnect the battery negative lead.
Remove:
- the soundproofing panels on the driver and passenger sides
- the side panels on the center console.

Note!
Set the blower fan switch to 0.

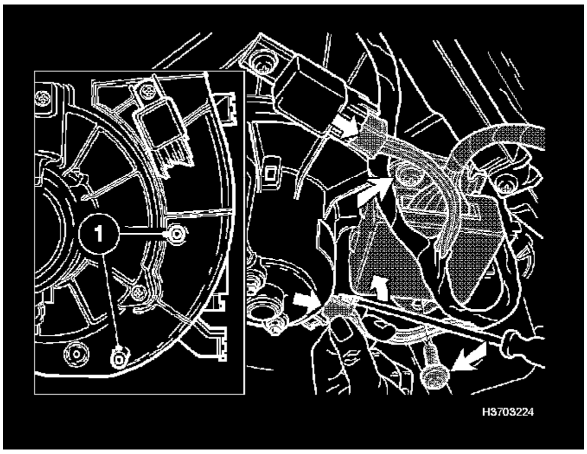


Assembling a new control module from the kit 3

Take out the new control module and the mounting plate.
If necessary, bend out the flanges on the mounting plate so that the distance between the edges of the flanges is 75 mm.
Remove the backing from the tape on the control module.

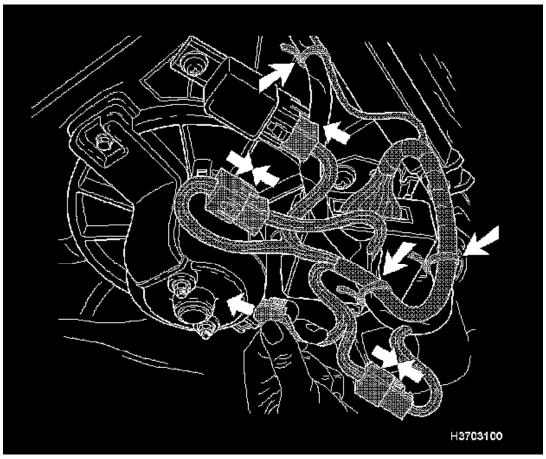
Note!
Ensure that the hole (2) is aligned with the wiring going into the control module as illustrated.

Install the mounting plate on the control module as illustrated. If necessary, bend the flanges outwards to secure the control module on the mounting plate.



Installing the new control module on the blower fan housing 4

Disconnect the connector on the blower fan motor.
Carefully bend the connector downwards and press the catch upwards using a small screwdriver. Pull the connector out at the same time.
Position the new control module under the fan shroud.
Install the screw and washers supplied into the two hollow shafts (1) on the housing as illustrated.
Remove the connector from the relay.

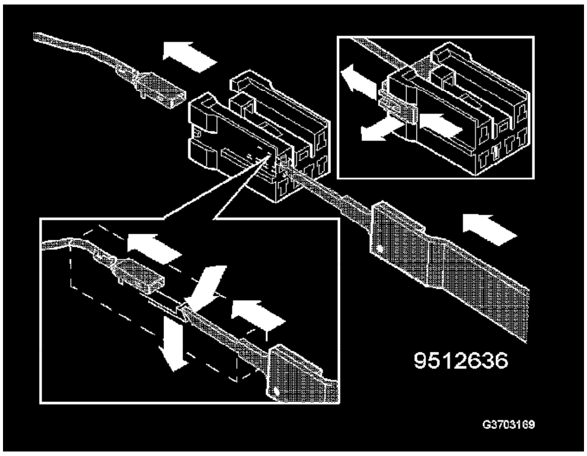


Connecting the cable harness 5

Connect the cable harness to the relay and the fan motor.
Position the long cable on the underside of the dashboard behind the center console and route it towards to the driver's side.
Secure the cable harness with the tie straps.

Note!

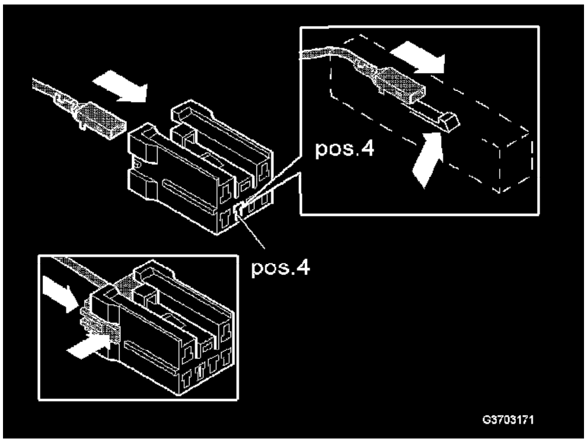
The wiring must not be stretched or positioned where it could come into contact with moving components or sharp objects.



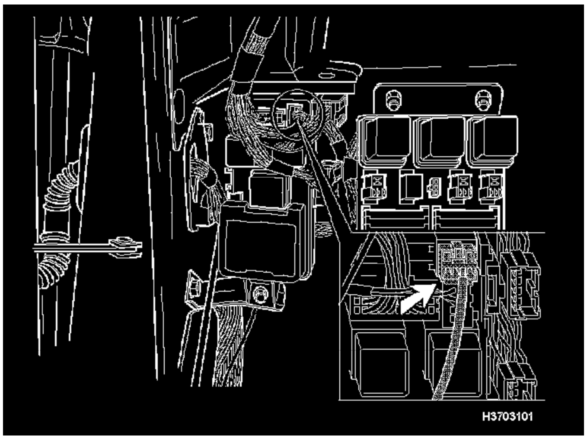
Connecting the cable to the junction box (model year 2000) 6

Route the cable along the existing cable harness under the steering column and onwards to the junction box.
Remove the junction box from the dashboard mounting bracket.
Disconnect the two upper connectors from the central electronic module (CEM) to get better access.

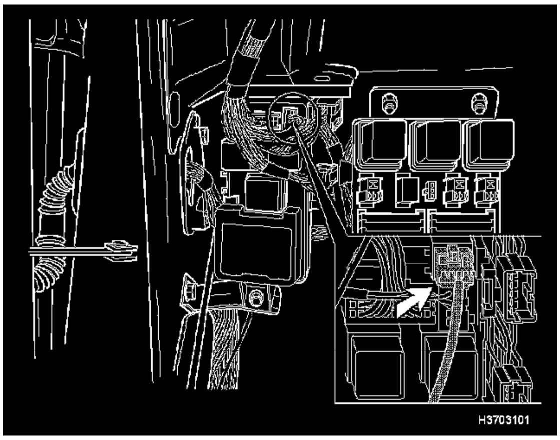
A: Remove the connector from kit cable.
Open the secondary lock from the connector (from the kit) by moving it upwards.
Remove the cable by pressing down the locking tab (see illustration) using terminal removal tool 951 2636 on the cable terminal while pulling the cable out of the connector at the same time.



B: Install the terminal in the existing connector.
Remove the connector from the junction box at the top right front side.
Open the secondary lock from the existing connector by moving it upwards.
Install the cable in position (4) in the existing connector.
Pull the cable to ensure that it is secured. Close the secondary lock.

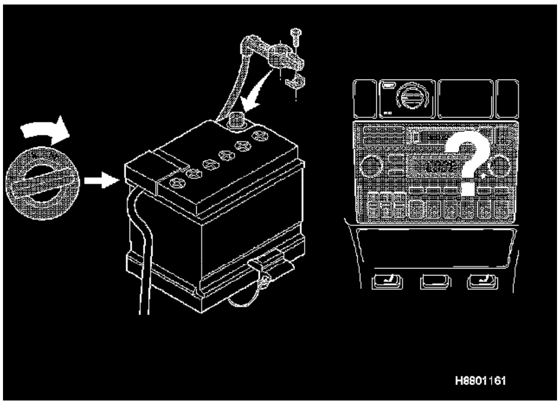


C: Connect the cable to the junction box.
Connect the cable to the junction box at the top right front side. See the illustration.
Secure the cable harness. The wiring must not be stretched or positioned where it could come into contact with moving components or sharp objects.
Reconnect the connectors to the central electronic module (CEM).
Install the junction box and secure it at the dashboard bracket.



Connecting the cable to the junction box

Route the cable along the existing cable harness under the steering column and onwards to the junction box.
Remove the junction box from the mounting for the dashboard-mounting bracket.
Disconnect the two upper connectors from the central electronic module (CEM) (or remove) to gain better access.
Connect the cable to the junction box at the top right front side. See the illustration.
Secure the cable harness with tie straps. The wiring must not be stretched or positioned where it could come into contact with moving components or sharp objects.
Reconnect the connectors to the central electronic module (CEM) and reinstall (if removed).
Install the junction box and secure it at the dashboard bracket.



Activating and checking the ventilation system 8

Turn the ignition to position II.

Caution!
Ensure that no one is in the car when connecting the battery.

Connect the battery negative lead. Wait at least 10 seconds.

Caution!
Switch off the ignition after 10 seconds. After approximately 20 seconds, the blower fan motor starts and runs at full speed for approximately two seconds.

Note!
If the ambient temperature is above 16°C the blower fan motor will start and run two times after another 30 seconds.

Enter the radio code. Set the clock.
Check that the ventilation system is working normally by starting the motor. Check the functions of the ventilation system.

Finishing work 9

Install:
- the soundproofing panel on the driver's side
- the two side panels for the center console
- the soundproofing panel on the passenger side.

Operation No.	Labor description	Time allowance
87948-2	Blower fan motor module installing	1.1 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **8870024** Date: **020701**

A/C - Unpleasant Odors

S40/V40
2000-2001

Section:
8

Group:
87

No:

0024

Year:
02

Month:
07

Vehicles involved:
S40/V40 LHD

Evaporator, application of a protective coating

Background:

To prevent droplets of water becoming attached to the evaporator, a protective coating must be applied. This protective coating also ensures that the growth of bacteria is minimized, to preventing unpleasant odors.

Model	Factory	Chassis No.
S40,V40 LHD		415.000 – 756.100

Affected vehicle

Description	Quantity	Part No.
Odor remover A/C	1	1161570

Materials

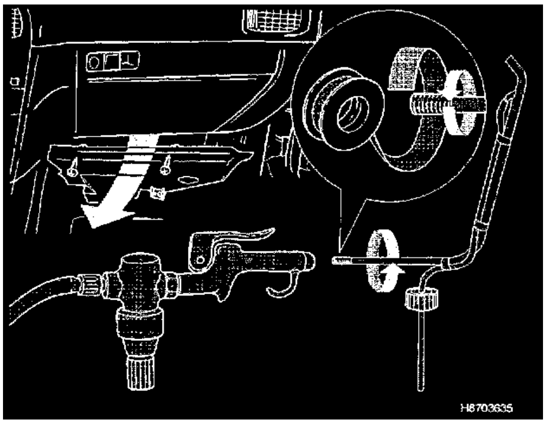
Description	Part No.
Pressure regulator/gun	999 7065
Spray gun nozzle	999 7064

Special tool

Cool unit

Evaporator, application of a protective coating

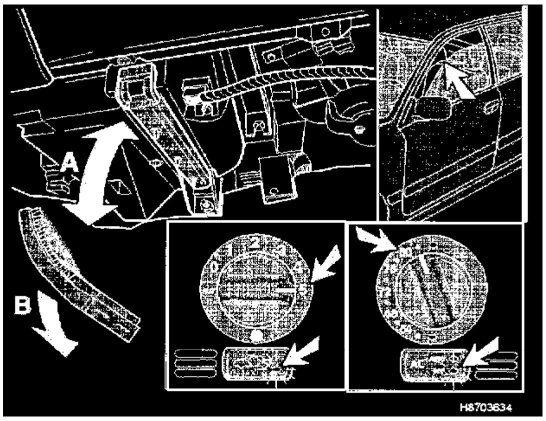
Assemble special equipment 1



Assemble the special tool 999 7065 and 999 7064 and connect the spray gun to the workshop compressed air system. Remove the panel below the dashboard on the passenger side, see VADIS:

Repair and Installation Function Group 88 Interior equipment Instrument and radio panel Removing the dashboard.

Remove the pollen filter and dry the evaporator 2

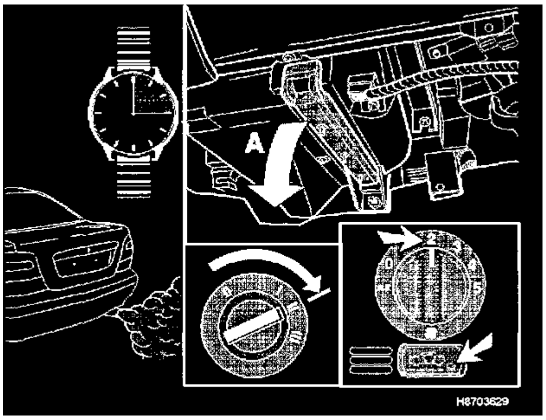


Remove the pollen filter cover (A). Pull the pollen filter (B) carefully outwards. If necessary, clean the housing and the evaporator. Install the cover (A). Open the front windows about 10 cm. Turn the A/C switch to off. Set the heating temperature to maximum. Set the fan to the highest setting. Select recirculation. Start the engine and let it idle for 15 minutes.

Note!

Be sure to connect an exhaust hose.

Prepare the vehicle for application of the protective coating 3



After 15 minutes, switch off the engine. Remove the cover (A) of the pollen filter. Turn the ignition switch to position 2. Set the fan switch to position 2. This ensures complete and thorough coverage when applying the coating. Switch off recirculation. Open the vehicle's doors and ensure that there is sufficient ventilation. Connect the bottle Part No. 1161570 to the suction line of the special tool.

Note!

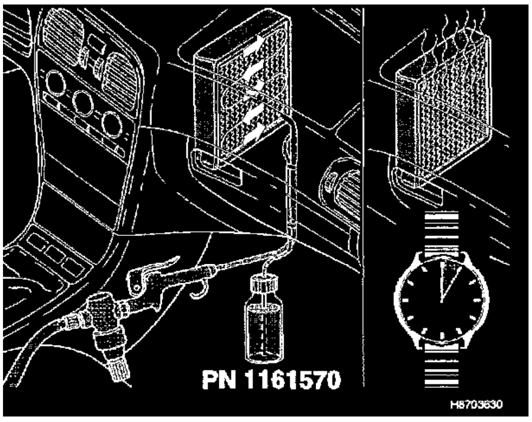
Be sure to shake the bottle first.

Apply protective coating to the evaporator 4

Protect the interior and the floor covering with cloths. Close all dashboard air vents. Use rags to cover floor vents.

Warning!

Wear safety glasses, mouth protection and gloves. Ensure that there is sufficient ventilation.



Insert the nozzle through the opening of the pollen filter. Using the special equipment, completely spray the evaporator with the protective agent as shown in the drawing.

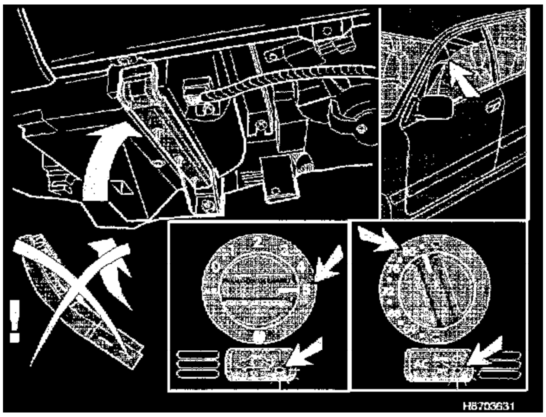
Move the nozzle with a forwards and backward motion from the top to the bottom of the evaporator.

Note!
Be sure to use all the contents of the bottle.

Caution!
Now let the protective coating dry for five minutes so that it adheres to the evaporator.

Clean the tool after use by flushing thoroughly with water.

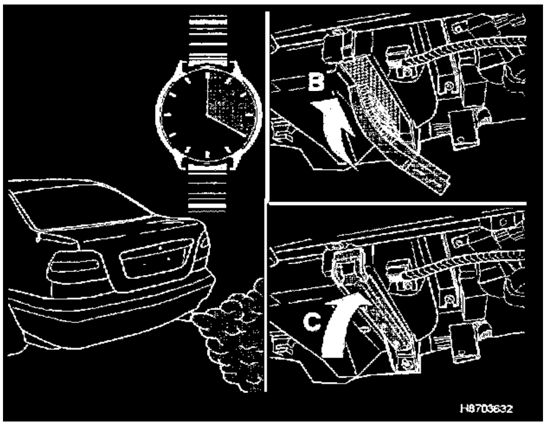
Dry the protective coating on the evaporator 5



Install cover to the pollen filter. Close the doors and open the front windows about 10 cm. Set the heating temperature to maximum. Set the fan to the highest setting. Select recirculation. Start the engine and let it idle for 20 minutes (connect an exhaust hose). Turn the A/C switch to off.

Note!
Be sure that the pollen filter is removed and that the front windows are open.

Install parts 6



After 20 minutes, switch off the engine and return the switches to their original positions. Install the pollen filter (B). Install the cover (C). Install the panel below the dashboard see VADIS;

Repair and Installation Function Group 88 Interior equipment Instrument and radio panel Removing the dashboard Remove cloths from the interior and close the windows. Open air vents and uncover floor vents.

Note!
If the pollen filter is discolored (grey/black) this does not mean that it must be replaced. For replacement, see maintenance chart.

Operation No.	Labor description	Time allowance
87947-2	Protection seal condensor apply	0.9 hr

Warranty Information

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN25-18** Date: **040521**

Cooling/Engine Controls - ECM DTC A1Set

NO: 25-18

DATE: 5-21-2004

MODEL:
2000-2003

M.YEAR:
S/V 40

CHASSIS:
415000-992378

SUBJECT:
DTC ECM A1

REFERENCE:
VADIS, VEMS

DESCRIPTION:

Under certain engine warm up conditions ECM DTC A1 may set. Extreme cold temperature and a long engine idle time from cold start could trigger the code.

SERVICE:

If ECM DTC A1 is set in a vehicle monitor the operation of the engine thermostat using VADIS. At normal operating temperature the engine coolant temperature should be approximately 90°C. If the engine is not reaching proper operating temperature verify operation of the thermostat and replace if necessary.

Perform the current VEMS download using VADIS version B or later. If the DTC returns, fault trace in accordance to VADIS.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36004-2	Software Control Module Download	0.3 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information
Technical Service Bulletin # **TNN25-14** Date: **030109**

Engine - Inconsistent Idle With A/C ON

NO: 25-14

DATE: 1-9-2003

MODEL:
All Models Equipped with Turbo Charged Engine and Electronic Throttle Module (ETM)

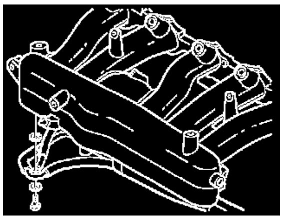
SUBJECT:
Inconsistent Idle Speed, A/C On

REFERENCE:
VADIS

DESCRIPTION:

Carbon deposits can form in the coolant nipple (vacuum side), located on the underside of the intake manifold, and the Electronic Throttle Module (ETM) bore on cars frequently driven short distances. This residue can cause idle speed to become uneven and noticeable to the driver especially with the increased load produced by the air conditioning compressor cycling on and off. This Tech Net Note describes how to clean the coolant-heated nipple in the intake manifold and the ETM bore.

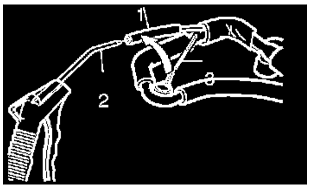
1. Intake manifold, removing



Remove the intake manifold, see VADIS:

Repair and Installation Function group 25 Replacing the intake manifold/gasket. Remove the banjo bolt. Lift out the intake manifold.

2. Nipple Cleaning



Disconnect the hose (1) from the nipple.

Blow the hose clean using compressed air (2). Loosen hose from opposite end and ensure air is flowing through hose. If the hose is blocked, use a welding rod (approximately 250 mm) to clean the hose (1). Clean the nipple using a 2 mm drill bit (3). Install the hose on the nipple.

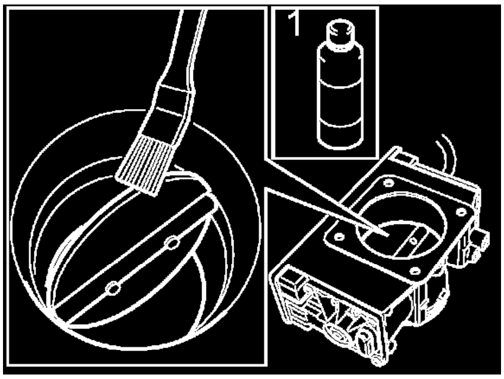
3. Preparations, ETM Cleaning

Remove the ETM from the intake manifold

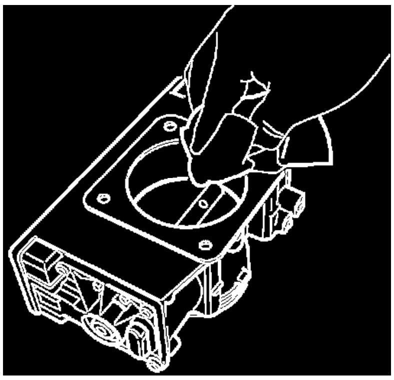
4. Cleaning the ETM

Warning!
Use a fume hood or ensure that ventilation is good. DO NOT submerge throttle unit in cleaning solvent. ONLY use cleaning solvent recommended in this bulletin.

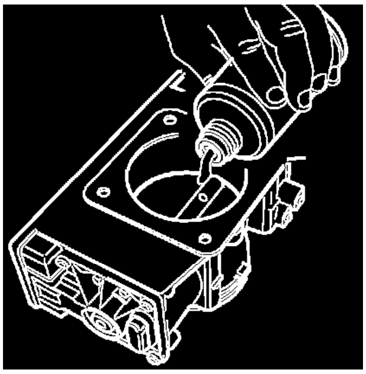
Important!
Do not scrape or use a rotary wire brush to clean the unit.



Clean the ETM bore using cleaner H (P/N 1161436-9) and a soft bristle brush. Ensure that all the residue is removed from the surfaces shown in the illustration.



5. Carefully wipe the bore clean on both sides of the throttle plate.

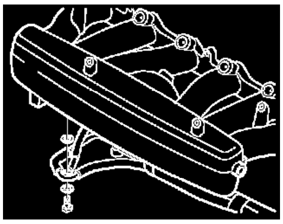


6. Flush the ETM bore using cleaner H on both sides of the throttle plate.

   Check that there is no residue in the bore or on the throttle plate. Any remaining residue can promote new residue build up.

   Repeat the procedure if necessary.

   Install the throttle body (TB) on the intake manifold using a new gasket.



7. Intake manifold, installing

   Install the new gasket for the intake manifold. Lift in the intake manifold. Install the banjo bolt with the new sealing washers

   Install the intake manifold, see VADIS:

   Repair and Installation Function group 25 Replacing the intake manifold/gasket.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	SYM. CODE	CAUSE CODE	LABOR TIME
02520-6	Cleaning PCV intake nipple and ETM	5M	26	
	S/V/XC 70 1999-2000 Turbo			2.6 hr.
	C 70 1999-			2.6 hr.
	S60 Turbo			3.0 hr.
	V/XC 70 2001- Turbo			3.0 hr.
	S80 Turbo			3.2 hr.

Claims may be submitted under the New Car Warranty when there is a documented customer complaint using claim type: 01

Warranty Information Technical Service Bulletin # **2250026** Date: **010501**

Exhaust Manifold - Retaining Nuts Loose, Missing

S40/V40
2000-2001

Section
2

Group
25

No.
0026

Year

01

Month
05

Vehicles involved:
B4204T2, T3

Exhaust manifold, retaining nuts

Background

If the retaining nuts for the exhaust manifold are found missing or loose during the scheduled maintenance service, all the flange nuts must be replaced by a nut with captive washer. The new nut with captive washer has been introduced as a running change in production.

This condition may also be evident in the following circumstances:

Exhaust noise from under the hood.

Customer concern about noise from the exhaust system.

Model	Chassis number
S40/V40	-600137

Affected cars

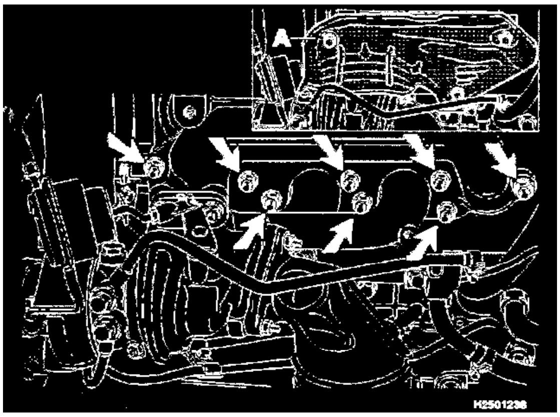
Description	Quantity	P/N
Nut	8	982297

Materials

Exhaust manifold, retaining nuts
Check the tighting torque of the flange nuts

Retaining nuts, check tightening torque and leakage 1

Remove:



- heat deflector plate (A) over the exhaust manifold.

Check the tightening torque of all retaining flange nuts securing the exhaust manifold to the cylinder head.

Tighting torque 25 Nm (18 ft lbs.)

If the tighting torque is too low or there is a flange nut(s) missing, but there is no leakage from the exhaust between the cylinder head and the exhaust manifold:

Method A: Replace the flange nuts

If there is exhaust leakage between the exhaust manifold and the cylinder head:

Method B: Replace the gasket check that the exhaust manifold is not distorted

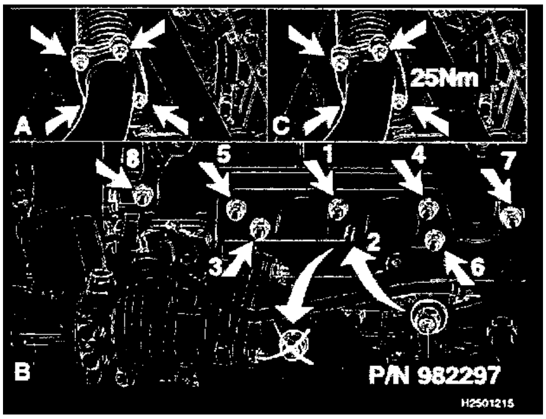
Correct tighting torque:

No further action required.

Install:

- heat deflector plate, tighten to 25 Nm (18 ft lbs).

A: Installing new retaining nuts and tighten



Detach the front exhaust pipe from the turbo charger.

Slacken off the stay between the exhaust manifold and the cylinder block.

Slacken off all the flange nuts securing the exhaust manifold to the cylinder head to finger tight.

Remove the old nuts one by one. Replace them with new nuts with captive washer, P/N 982297. Finger tighten the new nuts.

Tighten the new nuts to 32 Nm (24 ft.lbs), starting from the center and working toward the outside of the exhaust manifold.

Position the stay. Tighten to 25 Nm (18 ft.lbs.).

Position the front exhaust pipe. Use a new gasket.

Tighten the nuts to 25 Nm (18 ft.lbs).

NOTE:
Ensure that exhaust components are not under stress during installation.

Check for leakage.

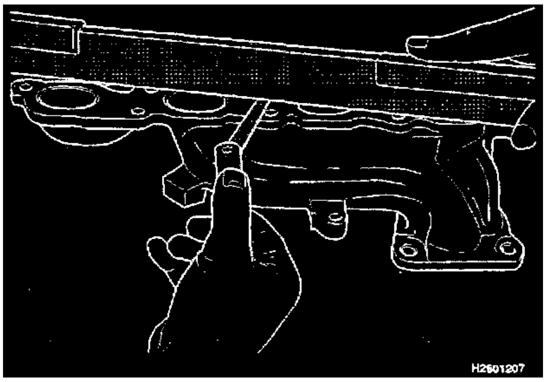
Install the heat deflector plate. Tighten to 25 Nm (18 ft.lbs).

B: Replacing exhaust manifold gasket and checking exhaust manifold for distortion.

Remove the exhaust manifold from the cylinder head.

See VADIS: Replacing the exhaust manifold. Model year 2000-.

Clean the mating surfaces between the manifold and the cylinder head.



Check that the exhaust manifold is not distorted.

Use a straightedge and a feeler gauge.

Readings:

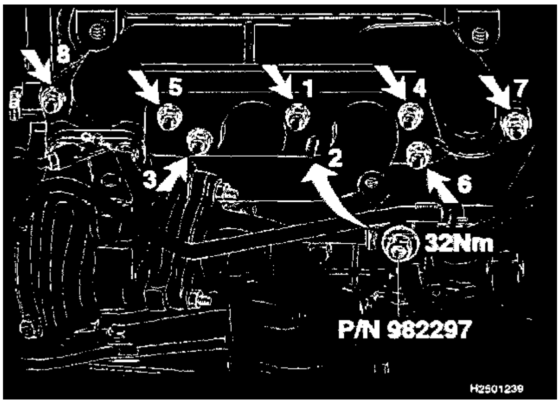
- Less than 0.15 mm (0.006"): Replace gasket.
- 0.15 mm (0.006") or more. Replace exhaust manifold.

Exhaust manifold, installing 2

Install the exhaust manifold on the cylinder head, use new gasket.

See VADIS: Replacing the exhaust manifold. Model year.

NOTE:
Always use new nuts, P/N 912297.



Tighten nuts to 32 Nm (24 ft.lbs.), starting from the center and working toward the outside of exhaust manifold.

NOTE:
Ensure that exhaust components are not under stress during installation.

Carry out a function and leak test.

Install the heat deflector plate on the exhaust manifold.

Tighten to 25 Nm (18. ft.lbs).

Operation No.	Labor description	Time allowance
25925-2	Exhaust manifold nuts, checking torque	0.5 hr
25926-3	Exhaust manifold nuts, replace	1.0 hr
25927-3	Exhaust manifold gasket, replace	2.7 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN61-04** Date: **030724**

Drivetrain/Frame - Clunking Noise When Shifting

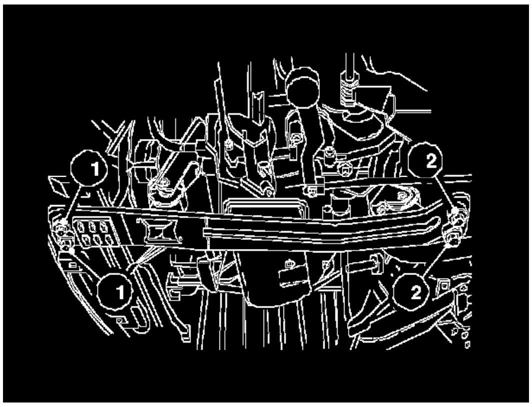
NO: 61-04
DATE: 7-24-2003
MODEL: SN 40
M. YEAR: 2000, 2001, 2002, 2003, 2004
CHASSIS: All
SUBJECT: Front Center Member Bushings
REFERENCE: Vadis

DESCRIPTION:
A clunking noise may be heard during gear changes between drive and reverse.

SERVICE:

Front center member steel bushing could be at fault. Follow the procedure below to fault trace and replace the bushings it necessary.

Checking and replacing front center member Bushings.



Re-torque the front center member bolts. 1.

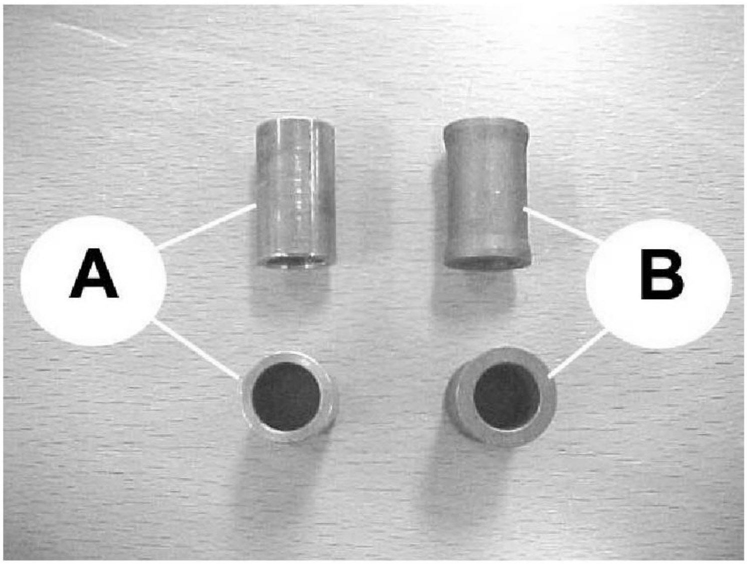
Loosen the two front center member bolts (1) and Re-torque to 52 ft lbs (70 Nm).

Loosen the two rear center member bolts (2) and Re-torque to 52 ft lbs (70 Nm).

Test drive and check if the noise is still present. If the noise is gone; Then you should replace the four center member steel bushings, as per the procedure shown below

If the noise is still present, fault trace as required.

Steel bushings in front center member. 2.



A: Production fitted steel bushings.

B: Service kit fitted steel bushings (this bushing has a larger surface contact).

Service kit P/N 30652081
(consist of 4x steel bushings).

Replace the four steel bushings. 3.

Remove:

- the front engine cover plate(s).
- the heat shield lower rear mount.
- the nuts (1) from the front and rear lower mounts

Loosen the front and rear bolts (2).

Front side: center member.

Remove:

- the two bolts (2) and the bolt (1).
- the bushings and check the rubbers (3) for damage.
- (Replace rubber bushings as needed)

Install:

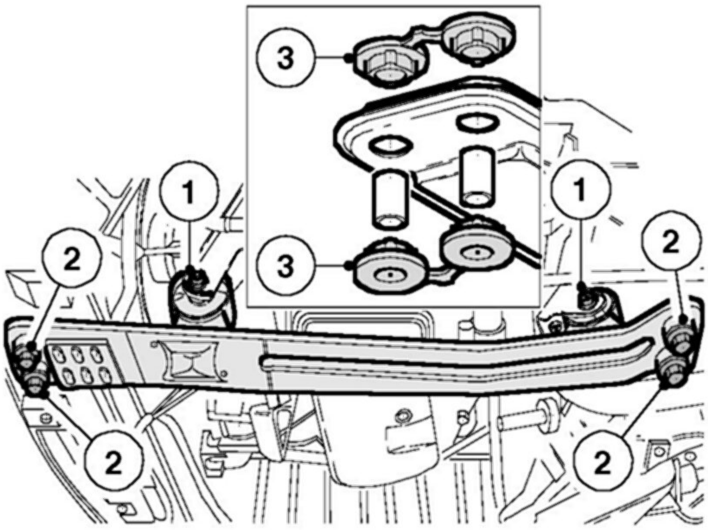
- the rubbers (3) and new steel bushings (4), on the center member, install the bolts and hand tighten

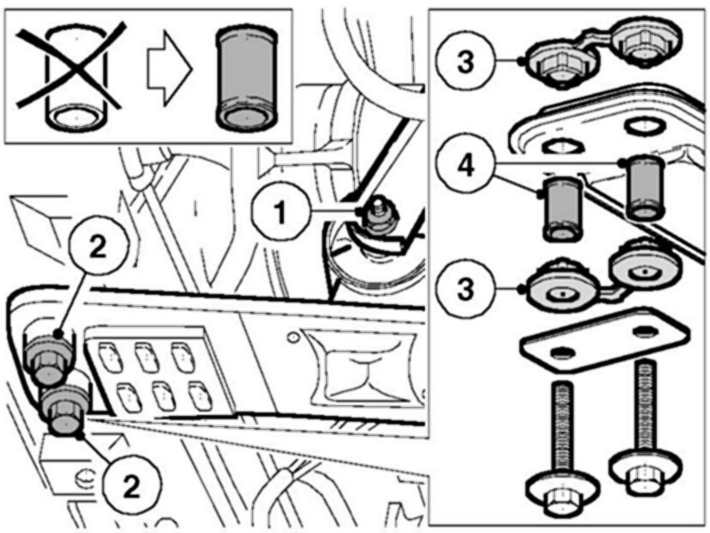
Note! correct position rubbers, see illustration.

- the lower mount bolt (1) and place the nut hand tighten.

Rear side: center member

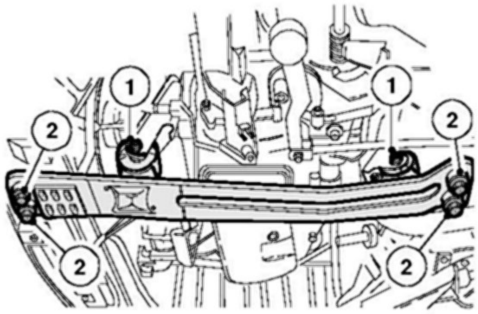
Use the same method as at the front side.





Note! correct position rubbers, see illustration. The rear and front side must be in similar position.

Finishing. 4.



Tighten the (4x) bolts (2) to 52 ft lbs (70 Nm). First tighten the rear lower mount (1) to 41 ft lbs (55 Nm), then the front lower mount (1) to 41 ft lbs (55 Nm)

Install:

- the heat shield (tighten to 7.5ft lbs)(10 Nm)
- the front engine cover plate(s)

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
99066-2	Screws axle cross member front check	0.1 hr
99067-2	Bushings axle cross member front replace	0.7 hr

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Claim Information

Technical Service Bulletin # **TNN76-02** Date: **030106**

Suspension - Rear Shock Absorber Noise

NO: 76-02
DATE: 1-6-2003
MODEL/YEAR: SN 40 MY 2000-2003
SUBJECT: Noise from Rear Shock Absorbers

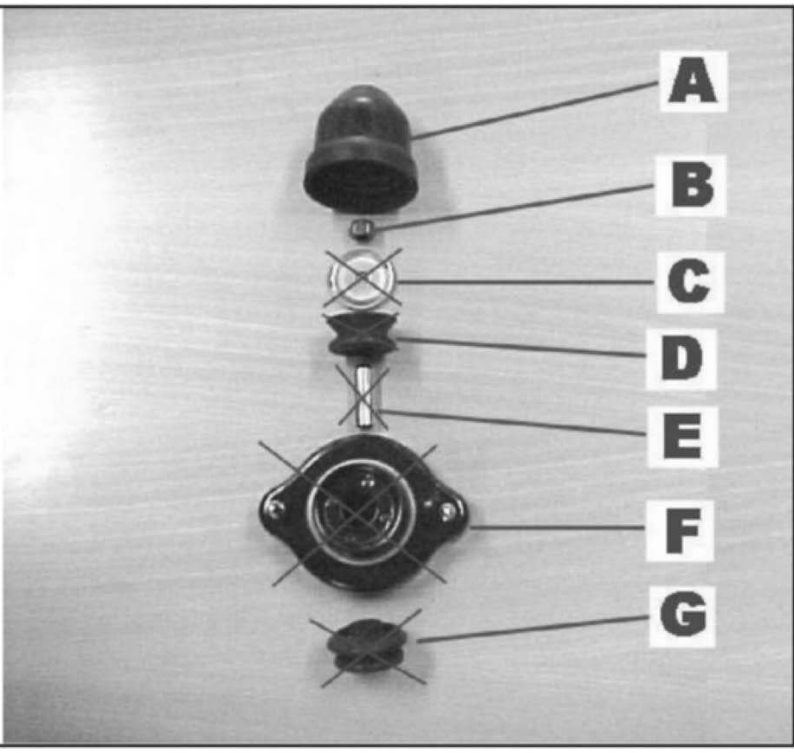
CHASSIS: 0415000-919999
REFERENCE: VADIS

DESCRIPTION:
Noise from the rear shock can transfer into the body of the vehicle. A new improved rear upper shock mount has been introduced MY 2003 starting with ch. no. 920000.

SERVICE:

If an excessive shock noise is transferring into the body replace both rear upper shock mounts with PN 30620916. Follow the instructions in VADIS.

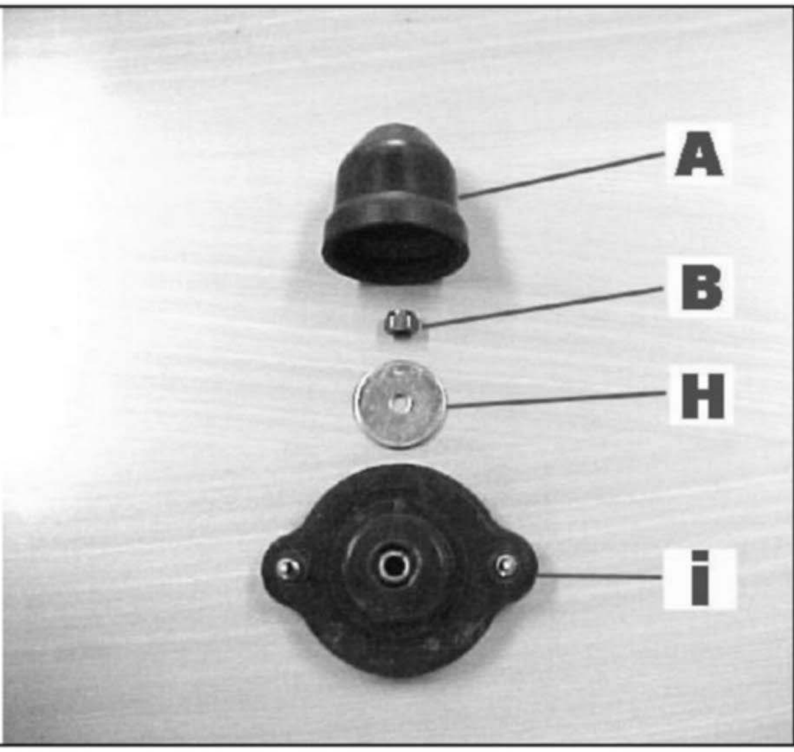
See pictures for differences in early and late mounts.



1) Remove the following parts on

A) Rubber cap P/N 30870
B) Lock nut P/N 96392
C) Washer P/N 30870
D) Upper rubber P/N 30870
E) Take-up sleeve P/N 30870
F) Upper mount P/N 30818
G) Lower rubber P/N 30865
P/N 30874

The following parts will not be used

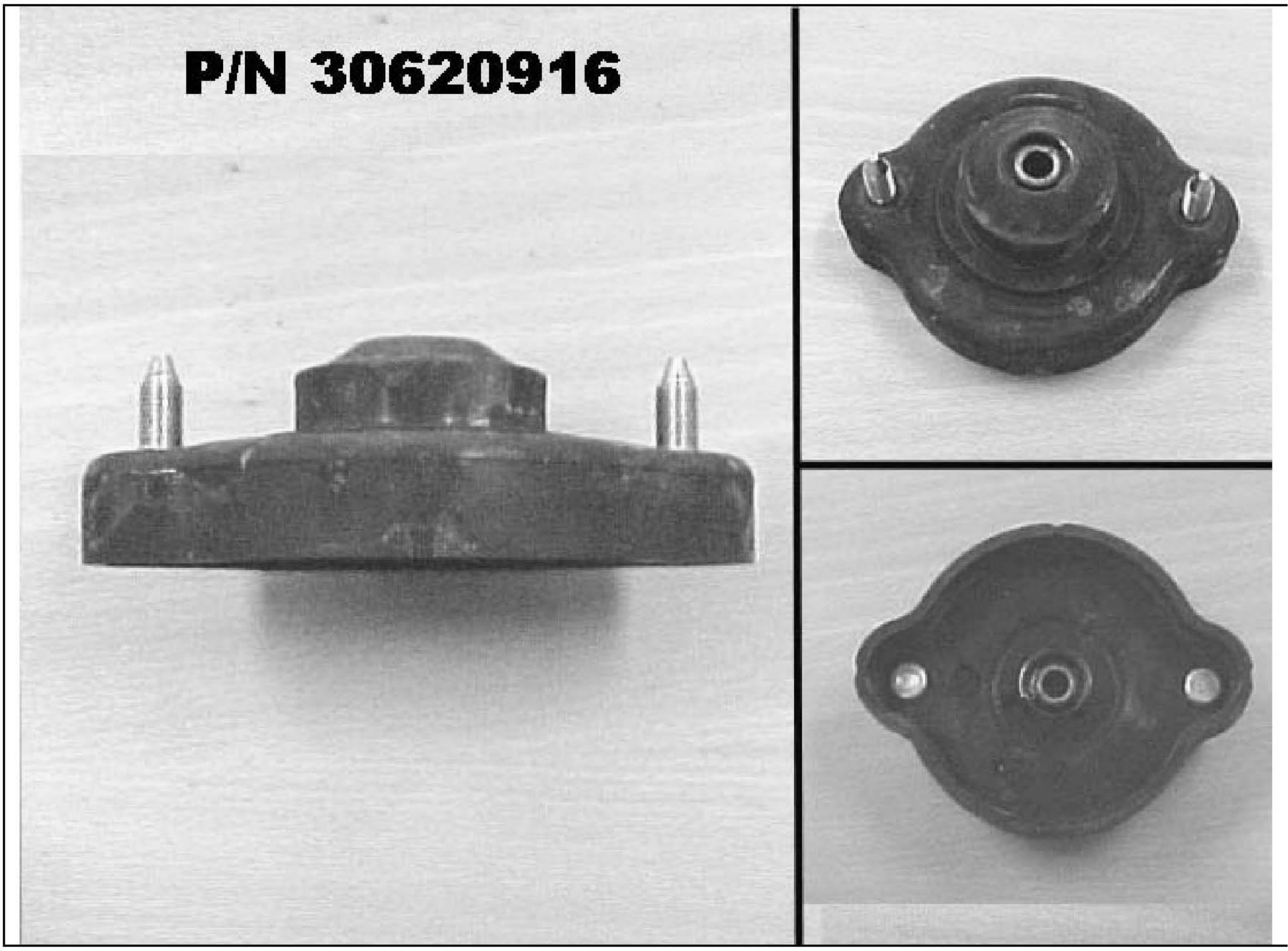


2) Install the following parts on b

A) Rubber cap P/N 30870
B) New lock nut P/N 96392
H) New washer P/N 30623
I) New upper mount P/N 30620

NOTE!

It installing rear upper shock mount do BOTH sides.



New rear upper shock mount.

Technical Service Bulletin # **8850019** Date: **010101**

Interior - Manual Front Seat Whining/Creaking Noises

Section
8

Group
85

No.
0019

Year
01

Month
01

Front seat (manual adjustment), noise

Background

In most cases a customer complaint about noise from the front seats can be reduced by applying lubricant according to the methods in this service Bulletin.

Description	Number	P/N
Lubricant spray	1	1161030

Materials

Front seat (manual adjustment, lubrication

Lubricating the front seat (manual adjustment)

1

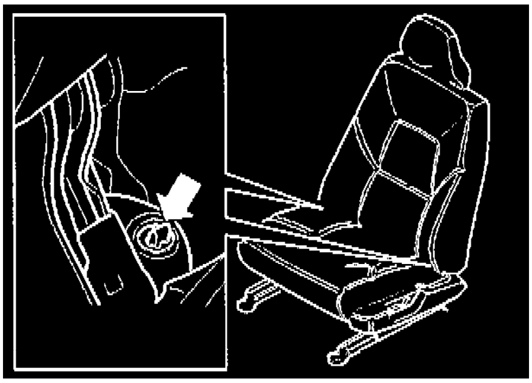
Preparations before lubrication

Ensure that the unprotected areas of the seat / carpet are not exposed when applying the lubricant.

2

Whining noise when cornering

Complaint



Whining noise from the rear edge of the seat cushion when cornering. The noise could originate from the upper mounting in the seat frame for the gas strut (positioned under the lower section of the seat cushion).

Corrective action

Push the rear corner of the seat cushion to one side. Spray lubricant P/N 1161030 onto the retaining washer under the seat cushion, also on the lower mounting at the rail side from underneath.

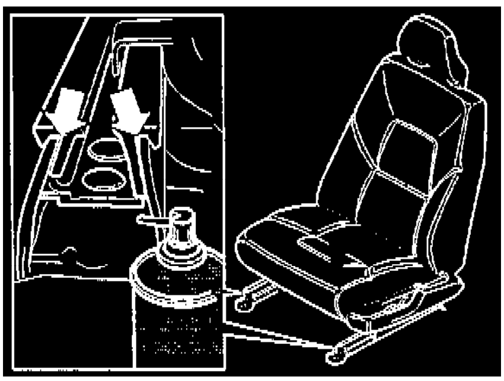
3

Creaking noise during cornering and driving in "stop and go" traffic

Complaint

Creaking noise when cornering and driving in stop and go traffic.

The noise can originate from the mounting for seat rails in the floor.



The noise occurs between the compressed components (as arrowed in the illustration).

Corrective action

Spray lubricant P/N 1161030 in the gap between the compressed components

Allow the agent to work for a few minutes.

Check that the noise has disappeared. Sit on the seat. Test drive the car in a manner that would cause the noise.

Note!
It is important that the seat is readjust to the customer settings.

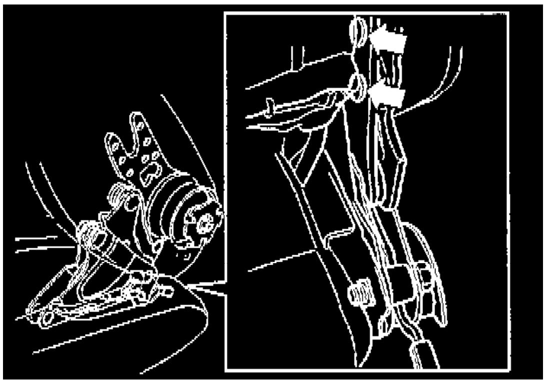
4

Creaking noise when driving in stop and go traffic

Complaint

Creaking noise from the rear edge / release mechanism of the backrest when driving in stop and go traffic.

The noise can occur when sitting on the seat and pressing the upper section of the backrest backwards.



The noise appears to come from the upper section of the backrest.

Corrective action

Detach the "long-load catches". Fold the backrest forwards.

Spray lubricant P/N 1161030 between the rivets and the plate towards the centre of the seat by the adjustment mechanism.

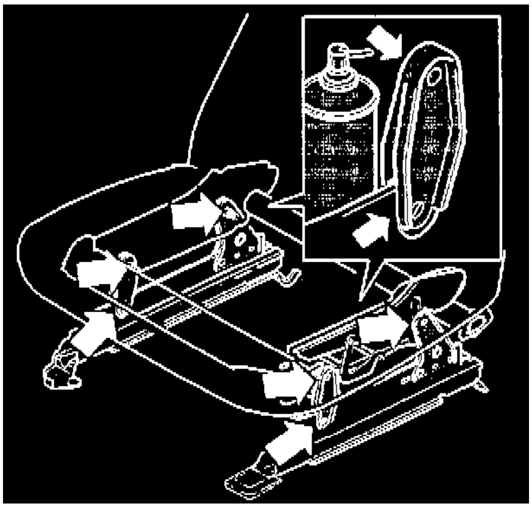
5

Noise or play in the height adjuster

Complaint

Check whether the customer complaints about noise or play in the height adjuster.

Corrective action



If only noise is noticed spray the links of the height adjuster using lubricant P/N 1161030.

If there is play in the height adjuster replace the height adjuster according to the method in VADIS: Section 8 Bodywork and interior, Repairing and installation, Removing, replacing and installing, group of functions 85 Interior, Front seat cushion.

Operation No.	Labor description	Time allowance
85253-2	Replacing the seat rails	1.2 hr
85946-2	Lubricating the front seat	0.2 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN25-16** Date: **030731**

Engine Controls - DTC ECM 16

NO: 25-16

DATE: 7-31-2003

MODEL:
S/V 40

M. YEAR:
2000, 2001, 2002, 2003, 2004

CHASSIS:
415000-030337

SUBJECT:
DTC ECM 16

REFERENCE:
VADIS

THIS TECH NOTE SUPERSEDES THE PREVIOUS TNN DATED 7-25-03. PLEASE UPDATE YOUR FILES.

DESCRIPTION:

DTC ECM 16 could appear in 2000 to 2004 model year S/V 40 vehicles. The root cause is contamination of the reference air for the front oxygen sensor. An adapter cable will prevent the contamination from affecting the sensor.

SERVICE:

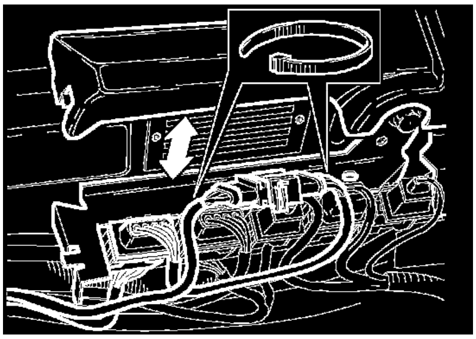
If DTC ECM 16 is detected please follow the instructions below.

1. Install extra adapter cable.

   Read out and erase the fault code. Refer to Resetting Adaptive Values as described.

   Remove the connector cover. Remove the black connector for the front oxygen sensor (four wires) at the connector stay.

   Install the adapter cable PN 30650686 in between the disconnected connectors. Route the adapter cable under the other cables.



   Place the new connector as shown in the illustration and tie-up the wiring. Install the connector cover. When routing cables make sure the cover stays in place.

   Verify that DTC has not returned. If the fault has returned replace the front lambda sond as per VADIS.

   Note:

Do not remove the adapter cable it replacing the oxygen sensor is necessary.

Resetting Adaptive Values

Instructions for resetting adaptive values are found in the fault tracing instructions for DTC ECM 16 Front Oxygen Sensor.

1. DTC ECM-16. Select signal too high. Permanent fault.

2. Checking the terminal. Were any faults found? Answer yes.

3. Verification. Does the value oscillate between approximately 0 and 1 V? Answer yes.

4. Resetting adaptation. Follow the instructions on the screen.

If submitting a warranty claim for the VEMS download, PN 9139873 should be used as the failed part number.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36001-2	Read/Erase DTC Codes	0.3 hr.
99081-2	Adapter cable install	0.2 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information

Technical Service Bulletin # **TNN25-17** Date: **040318**

Engine Controls - ECM DTC A1

NO: 25-17

DATE: 3-18-2004

MODEL:
2000-2003

M.YEAR:
S/V 40

CHASSIS:
415000-952893

SUBJECT:
DTC ECM A1

REFERENCE:
VADIS, VEMS

DESCRIPTION:

Under certain engine warm up conditions ECM DTC A1 may set. Extreme cold temperature and a long engine idle time from cold start could trigger the code.

SERVICE:

If ECM DTC A1 is set in a vehicle perform the current VEMS download as the first step in diagnostics/repair. If the DTC returns, fault trace according to VADIS.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36004-2	Software Control Module Download	0.4 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information

Technical Service Bulletin # **2250023** Date: **010701**

Electronic Throttle Module - Uneven Idle

S70/V70 1999-2000/C70 1999-
S80 1999-/V70/S60 2001-

Section
2

Group
25

No.
0023

Year
01

Month
07

Reference:
Vehicles involved: All equipped with Electronic Throttle Module

Electronic Throttle Module (ETM), Cleaning

Background:

Carbon deposits can form in the throttle module bore on cars frequently driven short distances. This residue can cause idle speed to become uneven and noticeable to the driver especially with the increased load produced by the air conditioning compressor cycling on and off. This Service Bulletin describes how to clean the throttle module bore.

Materials:

Description	Quantity	Part no.
Cleaner H	1	1161436

Electronic Throttle Module (ETM), Cleaning

1

Preparations

Removing and installing the throttle unit see VADIS:

Replacement and installation

Function group 25

"Replace the throttle unit".

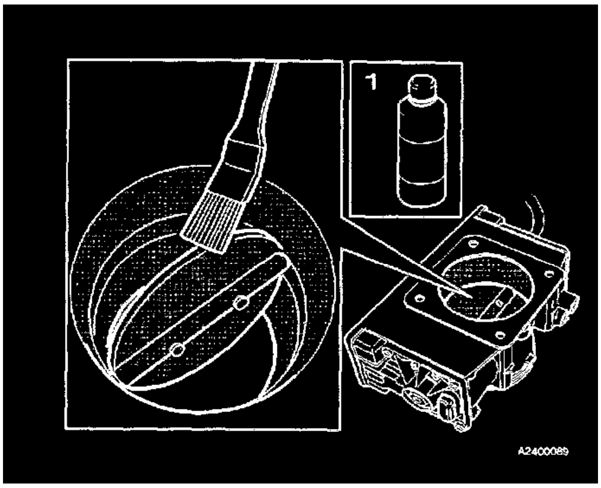
2

Cleaning the ETM

Warning!
Use a fume hood or ensure that ventilation is good. DO NOT submerge throttle unit in cleaning solvent. ONLY use cleaning solvent recommended in this bulletin.

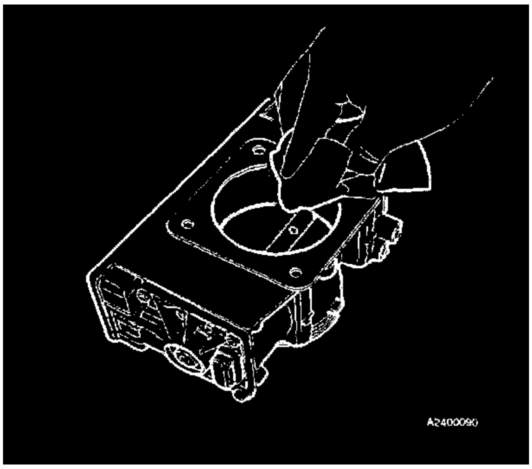
Caution!
Do not scrape or use a rotary wire brush to clean the unit.

Clean the ETM bore using cleaner H (P/N 1161436-9) and a soft bristle brush.



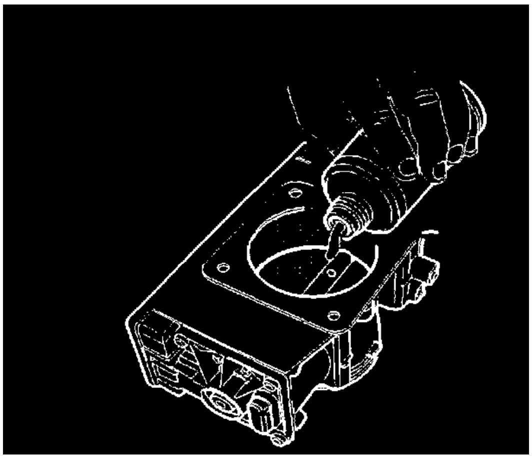
Ensure that all the residue is removed from the shaded surfaces shown in the illustration.

3



Carefully wipe the bore clean on both sides of the throttle plate.

4



Flush the ETM bore using cleaner H on both sides of the throttle plate.

Check that there is no residue in the bore or on the throttle plate. Any remaining residue can promote new residue build up.

Repeat the procedure if necessary.

Install the throttle body (TB) see VADIS:

Replacement and installation

Function group 25

"Replace the throttle unit".

Operation No.	Labor description	Time allowance
25121-2	Cleaning the intake pipe in the throttle body (TB).	
25121-2	S80 Non Turbocharged Engine	1.0 hr
25121-2	S80 Turbocharged Engine	1.2 hr
25121-2	V70 2001- Non Turbocharged Engine	1.0 hr
25121-2	V70 2001- Turbocharged Engine	1.3 hr
25121-2	S60 Non Turbocharged Engine	1.0 hr
25121-2	S60 Turbocharged Engine	1.2 hr
25121-2	S/V70 1999-2000 Non Turbocharged Engine	0.9 hr
25121-2	S/V70 1999-2000 Turbocharged Engine	1.2 hr
25121-2	C70 Turbocharged Engine	1.2 hr

WARRANTY STATEMENT: Claims may be submitted under New Car Warranty ONLY one time per vehicle when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **2230045** Date: **991201**

Emissions - Canister Purge Valve Ticking Noise

S40/40
2000-

Section:
2

Group:
23

No.:
0045

Year:
99

Month:
12

Vehicles involved:
B4xx4T2/S2 200-

Canister purge (CP) valve, ticking noise

Background

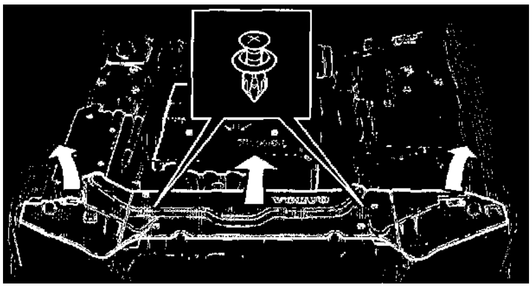
A ticking noise may be heard from the canister purge (CP) valve. The noise increases in cold weather. A rubber-covered clamp that dampens the noise has been introduced as a service solution.

Engine	Model year	Chassis number
B4xx4T2	2000-	415000-

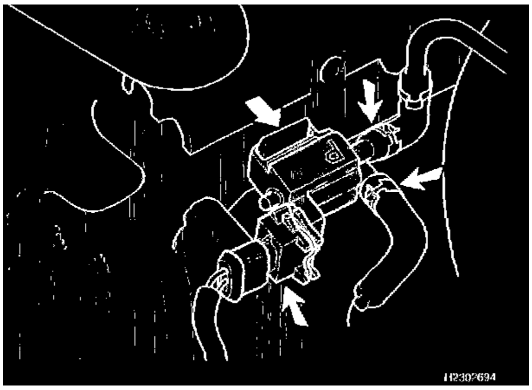
Materials	Number	Replacement part number
Clamp	1	981143

Canister purge (CP) valve, ticking noise

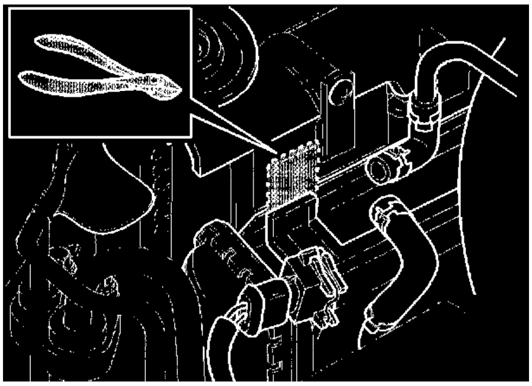
Installing the clamp on the canister purge (CP) valve (turbocharged engines) 1



Remove the outer covers. Remove the inner cover (4 screws) 2

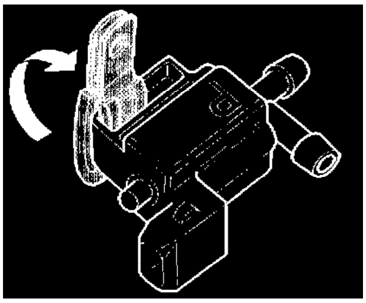


Remove the canister purge (CP) valve from the mounting on the fan shroud.

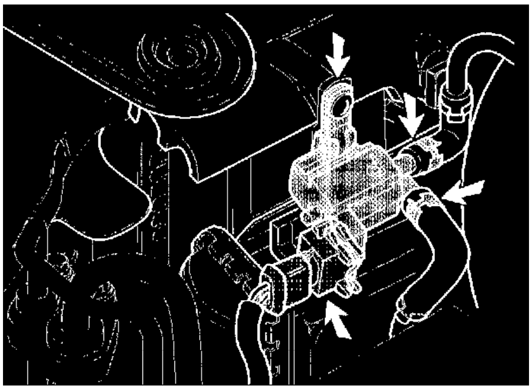


Cut off the mounting for the canister purge (CP) valve to 3

avoid contact with the new mounting.



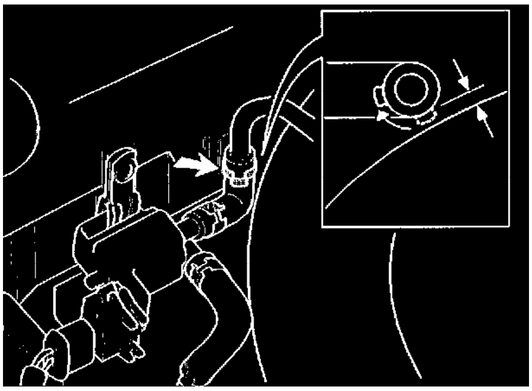
Install the clamp on the canister purge (CP) valve. 4



Remove the existing screw on the charge air cooler (CAC). 5

Install the canister purge (CP) valve. Tighten the screw.

Check 6



Check that the clamp is not in contact with the charge air hose. Turn the clamp if necessary. Install the inner and outer covers.

Operation No.	Labor description	Time allowance
25924-2	Replacing the mounting for the canister purge (CP) valve	0.3 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint using claim type 01.

Technical Service Bulletin # **TNN88-33** Date: **030729**

Restraints - SRS Lamp ON/Side Impact Sensor DTC Set

NO: 88-33

DATE: 7-29-2003

MODEL: S/V 40

M. YEAR:
2000, 2001, 2002, 2003, 2004

CHASSIS:
0415000-

SUBJECT:
Moisture in B-pillar Side Impact Sensor.

REFERENCE:
VADIS

DESCRIPTION:

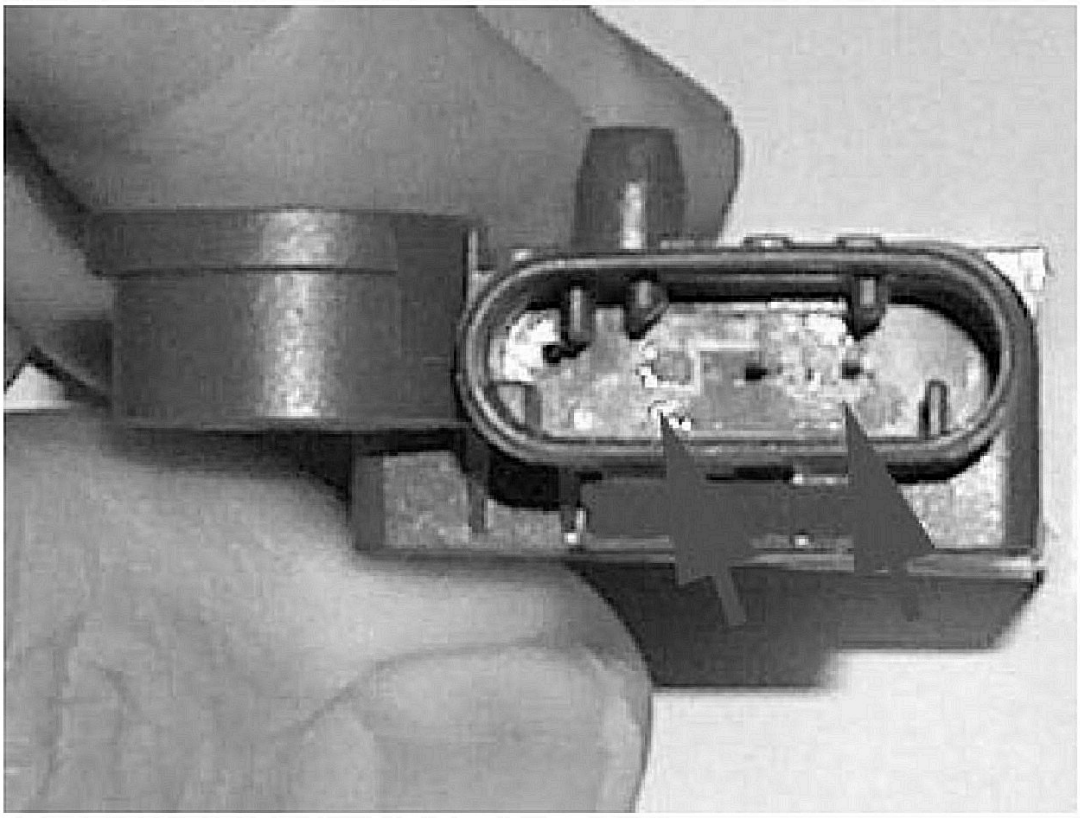
If the SRS warning lamp is on and the stored SRS-DTC indicates a fault in one of the Side Impact Sensors you should carefully check to see if traces of moisture are visible in the sensor connector.

It has been found that moisture can enter the B-pillar via the grommet for the harness to the rear door.

The grommet for the rear door harness is fitted in the B-pillar with special care from the chassis listed above.

SERVICE:

If customer complaint is consistent with the above description and within the chassis break perform the following:



Note:
Refer to picture shown.

If traces of moisture in the connector are detected you must replace the SIPS Sensor and find the root cause (location) of the water leak and seal it.

After removing the SIPS-Sensor perform a visual inspection of the connector.

If any corrosion residue is visible (see photo) this is an indication that moisture has intruded into the sensor.

Note:
If any kind of water intrusion is identified, the sensor must be replaced.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
88452-2	: Replace B-pillar SIPS Sensor	0.3 hrs
99085-2	: Check B-pillar SIPS Sensor for water leak and seal leakage area.	0.3 hrs

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information
Technical Service Bulletin # **TNN43-47** Date: **051101**

M/T - 1st/Reverse Gear Difficult to Engage

NO:	43-47
DATE:	11-01-2005
MODEL:	Vehicles with 5 or 6 Speed Manual Transmissions
M. YEAR:	1999-2005
SUBJECT:	Difficult to Engage 1st and/or Reverse Gear

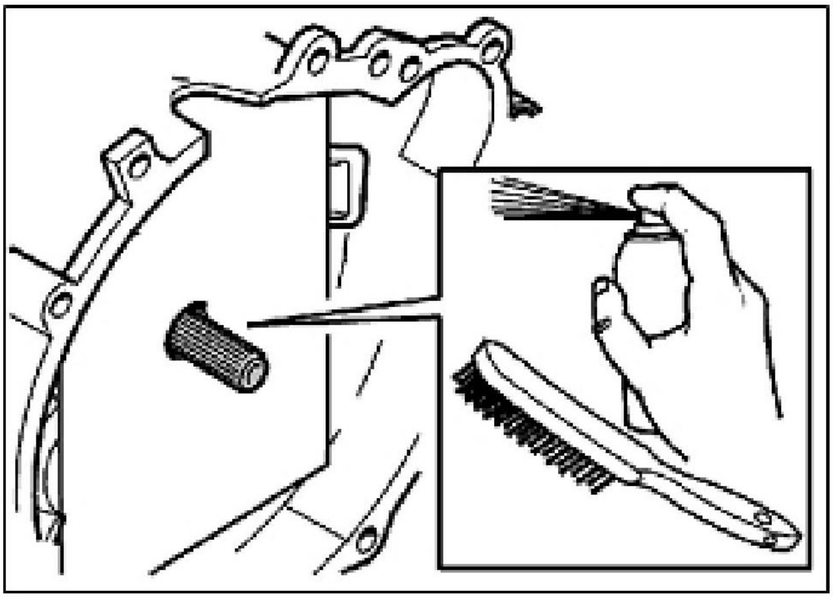
This Tech Net Note supersedes the previous 43-47, dated 8/5/04. Please update your files.

This applies to all 1999 S/V/C 70 cars, as well as S40/V50/S60/V70 cars built before:
544 -053404
545 -048974
384 -425275
285 -459438

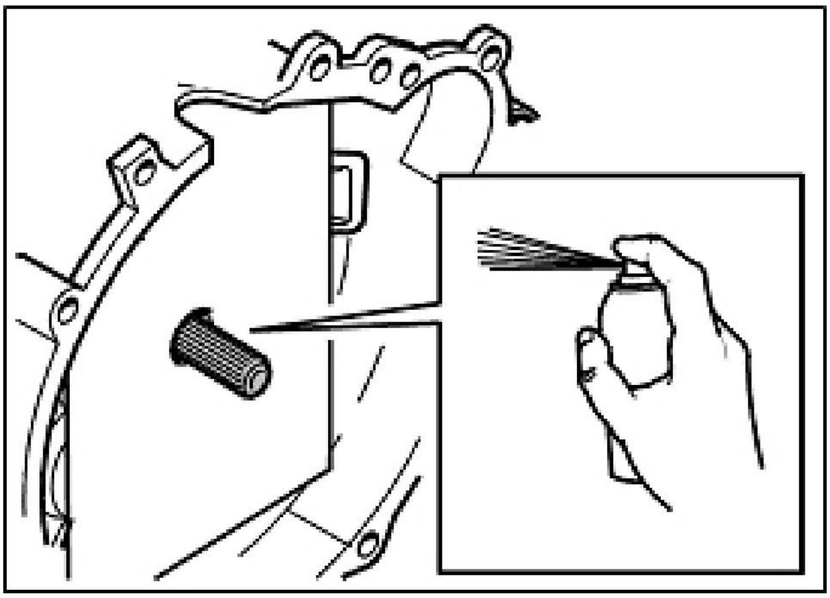
The grease was introduced in production on cars built after this point.

DESCRIPTION:
Some customers may complain that it is difficult to engage 1st and/or reverse gear, especially after the car has been sitting overnight.

SERVICE:
If a customer complains of this symptom, verify that there is no air in the clutch hydraulic system and that the gearshift cable is correctly adjusted. If the symptom persists, clean and lubricate the input shaft splines according to the following procedure. Place a piece of cardboard over the input shaft as shown below; to protect the slave cylinder and input shaft seal during the procedure:



1. Clean the Input Shaft thoroughly using universal oil (PN 1161657) and a wire brush. Wipe the splines off with a rag. Check that there is no dirt left on the shaft.



2. Spray the Input Shaft with a thin layer of PN 30759651. Wipe off any excess.

Technical Service Bulletin # **TNN72-05** Date: **020801**

Suspension - Rear Suspension Knocking/Squeaking Noises

NO: 72-05
DATE: 8-01-2002
MODEL/YEAR: S/V40
SUBJECT: Rear suspension noises
CHASSIS: See Below
REFERENCE: VADIS

DESCRIPTION:
When diagnosing a rear suspension noise on S/V 40 cars the following items could be the source.

SERVICE:

1. A knocking noise during large suspension movements could be caused by movement of the rear spring on the spring seat.

^ Install rubber spring insulator P/N 30620557 between the rear coil spring and the spring seat.

^ Follow instructions for rear spring replacement in VADIS.

2. Noise from parking brake cable where it slides through the retaining bracket located next to the rear trailing arm front attaching point.

^ Lubricate the brake cable where it slides though the retaining bracket.

^ Use silicone grease PIN 1161325 or similar.

^ The cable must be able to slide in and out of the bracket freely.

Technical Service Bulletin # **TNN36-45** Date: **040716**

Ignition Systems - Failed Ignition Key Programming

NO: 36-45
DATE: 7-16-2004
MODEL: S/V40 MY2000-2004; S/V70 MY1999-2000; C70 MY1999-2004
SUBJECT: Failed Ignition Key Programming
REFERENCE: VADIS

DESCRIPTION:

Cases are reported that new correctly cut spare part ignition keys can't be programmed to the immobilizer ECU. VADIS may indicate that one or more DTC's are present related to the failed programming.

The most frequent cause of failed ignition key programming is that the immobilizer ECU memory has reached its maximum capacity. The memory of the immobilizer can be cleared by disconnecting the battery negative lead for at least one minute.

This TNN provides some guidelines on the programming of ignition keys with an integrated transponder for the S/V40 MY2000-2004, S/V70 MY1999-2000 and C70 MY1999-2004. These vehicles have a similar immobilizer system and ignition key with integrated transponder.

SERVICE:

Establish the correct vehicle profile, and order the ignition key application software according to the established routine in VADIS.

Obtain radio code.

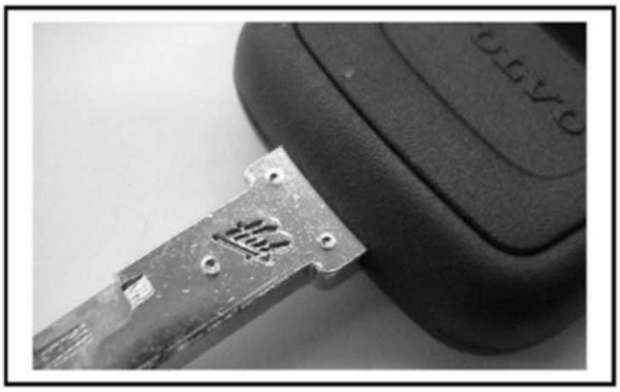
Disconnect the battery negative lead as described in VADIS Information Manager, Function Group 3, for at least one minute.

Complete the procedure by reconnecting the battery negative lead, downloading the software and programming the key.

Additional tips on ignition key programming

^ If you plan to program more than one key and one of the keys fails, perform the battery reset procedure as mentioned above and try to program the key again.

^ To avoid interference, no other ignition key should be near the ignition key being programmed.

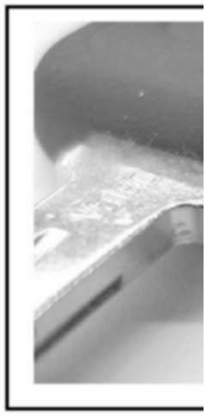


S40 V40 M.Y. 00-04

Supplier name HUF on key

S/ V 70 M.Y. 99-00
C70 M.Y. 99-04

Spare parts key marked with blue



RE

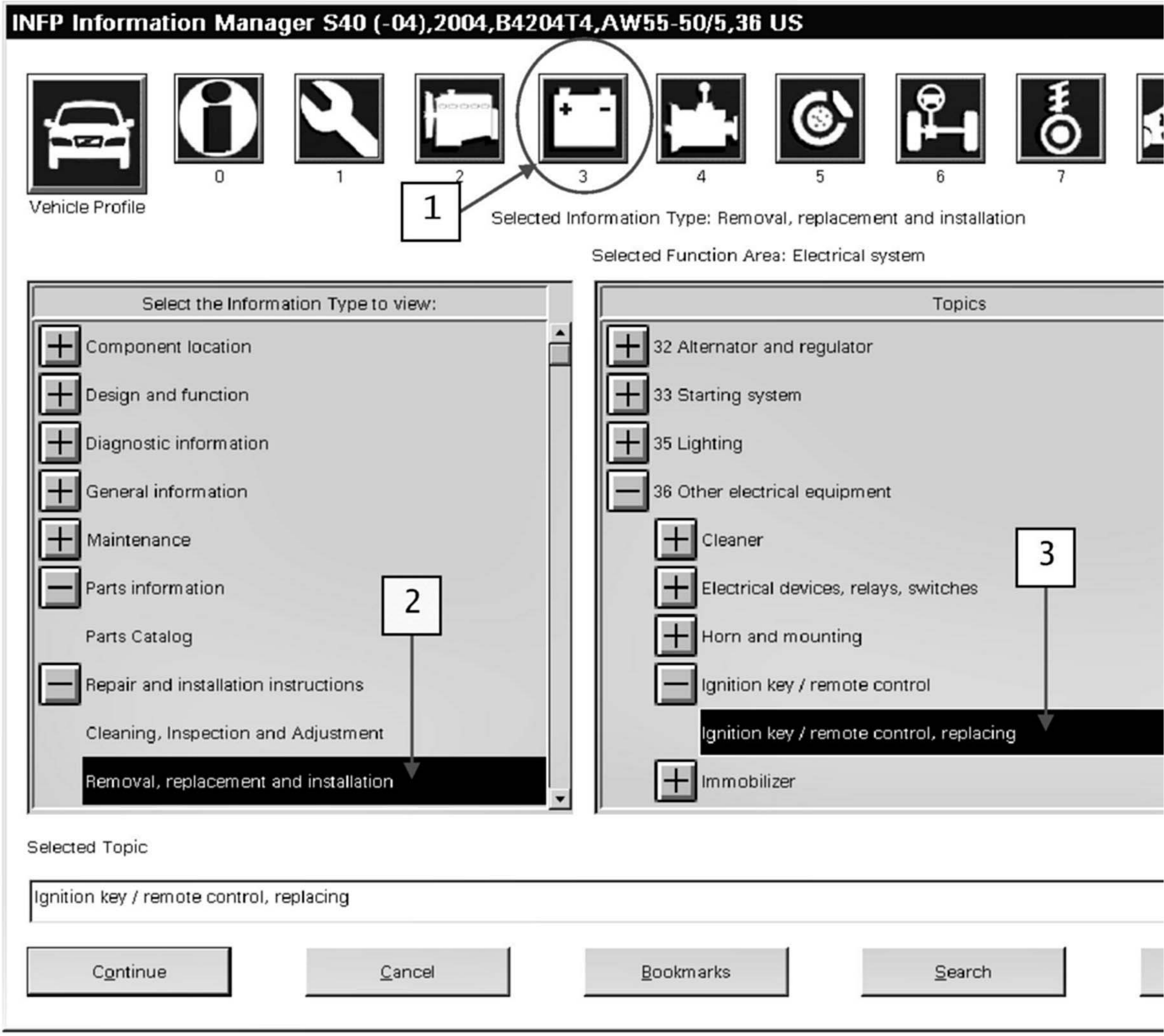
S60
V7

^ It's not necessary to replace the keys when an immobilizer antenna ring is replaced. The spare part keys can be recognized as below:

^ The key for X40 MY03- has the transponder and remote built into the same housing. It is called KIR (Key Integrated Remote).

^ The key blade from an X40 MY03- KIR does not need to be replaced if the remote or transponder is faulty.

Method to replace the key blade:



Logon to VADIS as usual and profile the car using the complete VIN and then proceed with the following steps in the VADIS information manager:

1. Select: Function Group 3
2. Select: Repair and installation instructions Removal, replacement and installation
3. Select: 36 Other electrical equipment --> Ignition key/remote control --> Ignition key/remote control, replacing

Technical Service Bulletin # **3360022** Date: **021001**

Wipers/Washers - Wipers Shudder/Noisy

S40/V40/S60/C70/S70/V70/V70/ XC/S80
1998-

Section:
3

Group:
36

No.:

0022

Year:
02

Month:
10

Adjusting wiper arm

Background:

This Service Bulletin describes how to adjust the angle of the wiper arm correctly to address issues of shuddering and noise during operation

Special Tools

Description	P/N
Measuring tool	951 2931

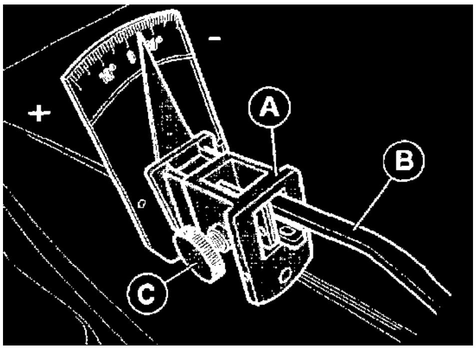
Other electrical equipment

Adjusting the wiper arm 1

Check that the wipers are in the parked position. Switch the wipers on and off again with the ignition switched on.

Fold out the wiper arm.

Remove the wiper blade.



Install the tool (A) loosely on the wiper arm (B), as illustrated.

Carefully fold the wiper arm and tool towards the windshield.

NOTE:
The base of the tool must be in contact with the windshield.

Tighten the tool (A) to the wiper arm (B) using screw (C).

S60/C70/S70/V70/V70XC/S80 2

Read the angle of the wiper arm to the windshield for both the driver and passenger side from the scale on the tool.

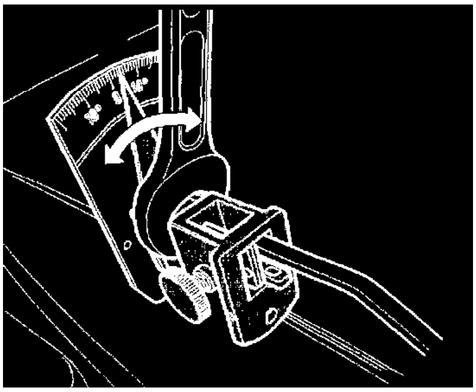
Correct angle:

- 4 degrees.

Caution:
Do not use excessive force when adjusting the wiper arm.

Adjust the:

- angle of the wiper arm as necessary



- wiper arm as illustrated.

Fold the wiper arm out and remove the tool.

Install new wiper blades and carefully fold the wiper arm down.

Test the function.

S40/V40 3

Read the angle of the wiper arm to the windshield for both the driver and passenger side from the scale on the tool.

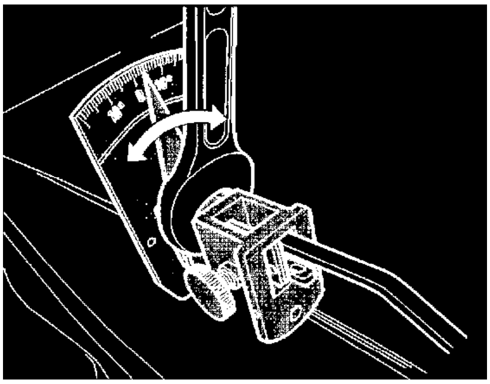
The correct angle is within the following range:

- 3 to - 5 degrees.

Caution:
Do not use excessive force when adjusting the wiper arm.

Adjust the:

- angle of the wiper arm as necessary



- wiper arm as illustrated.

Fold the wiper arm out and remove the tool. Install new wiper blades and carefully fold the wiper arm down.

Test the function.

Operation No.	Labor description	Time allowance
36928-2	Wiper arm 2 sides adjustment	0.2 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **3360021** Date: **020501**

Windshield Washer - Poor Performance

S40/V40
2000-2001

Section

3

Group
36

No.
0021

Year
02

Month
05

Checking and re-routing windscreen washer hoses

Background

This Service Bulletin describes how the windscreen washer hoses should be checked/adjusted when having decreased washer function.

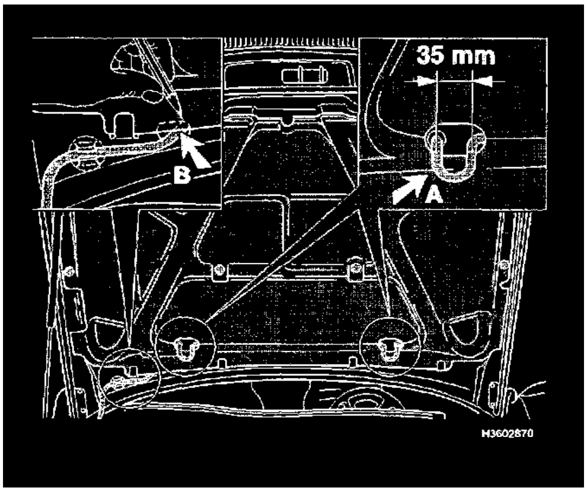
Model	Factory	Chassis No.
S40,V40		415000- 729651

Affected vehicles

Description	Quantity	Part No.
Nipple (For vehicles **without** headlamp wash/wipe)	1	1369856
Hose	±150 cm (~ 59 in)	949931
Clip (MY 2000 vehicles **only**)	1	30899356

Materials

Checking position of hose and hose routing 1



Check the hose on the left and right side nozzle: it should not be kinked and should form a loop (A) of not less than 35 mm (~1-3/8 in.).

Note! The hose must in no way be pinched or kinked, nor have any tendency to kink.

On the right side, check if the hose is pinched by the hood insulation panel (B). If necessary, mark where material needs to be removed.

If the hose is pinched by the hood insulation only:

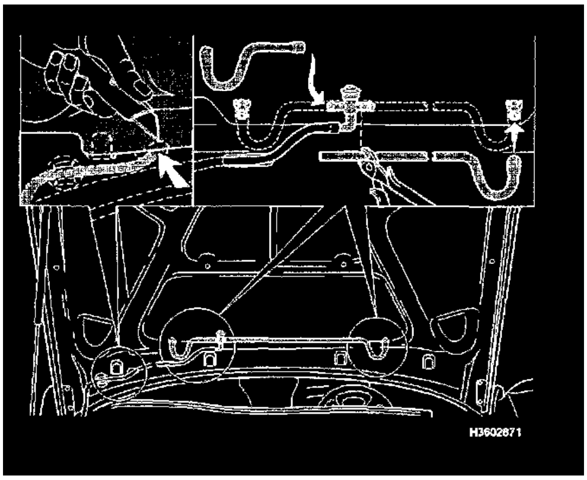
Remove material from the hood insulation panel as marked to ensure that the hose lies in place freely.

If further obstructions, such as pinching or kin king, are found elsewhere, see the following method.

Rectify nozzle connections if necessary 2

Remove hood insulation panel completely.

Note! Always replace existing hoses with new hose. Fit so that pinching cannot occur when hood insulation panel is refitted.



Cut hose to the correct length:

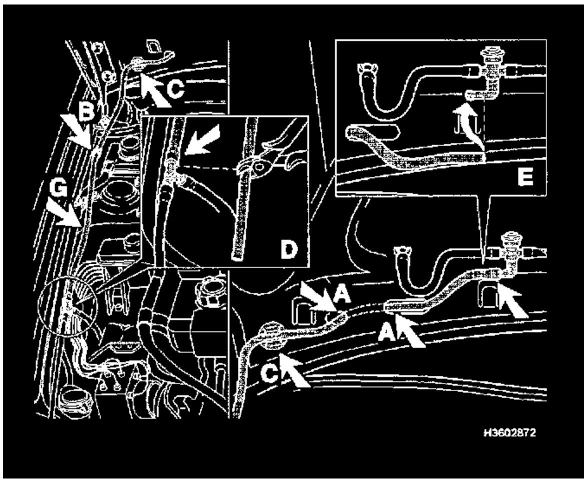
Left: +/- 560 mm (~22-1/16 in).

Right: +/- 160 mm (~6-5/16 in).

Affected vehicles: 3

2000-2001, cars with headlamp wash/wipe

Replacing hose from T-valve on inner fender to T-valve on hood



Remove:

- hose bend (C) from its fastening on the hood (MY 2000)
- hose (G) that runs from connection (D) along the inner fender to connection (E).

Install new clip (C) (MY 2000 vehicles).

Slide new hose (G) through the mounted clip (C) and through openings (A) in hood by the T-connector (E) and connect.

Push hose (G) into clip (B) on inner fender and pull straight through to the front.(do not bend)

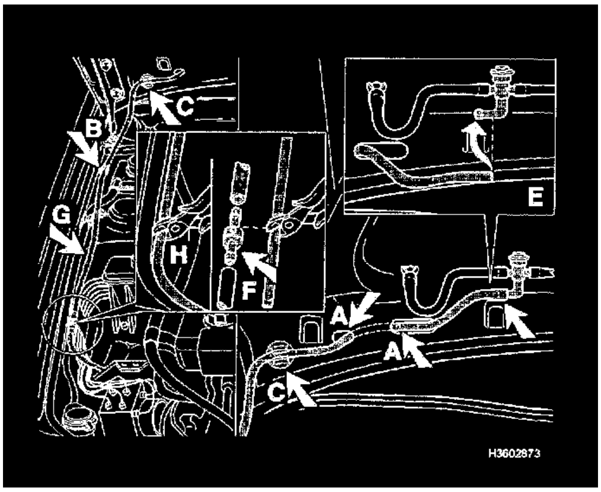
Measure off a length of hose (G) sufficient to reach T-connector (D), and cut to length. Connect the hose to the T-connector.

Note! Verity that the hose fits snug along the inner fender and does not kink or pinch when closing the hood.

Operation No.	Labor description	Time allowance
36932-3	Hoses windshield washers hood replace	0.2 hr
36933-2	Hoses windshield washers control replace	0.4 hr

Affected vehicles: 4
2000-2001, cars without headlamp wash/wipe

Replacing hose on inner fender to T-valve on hood



Remove:

- hose bend (C) from its fastening on the hood (MY 2000)
- hose (G) from connection (E).

Place a rag over the ABS unit.

Cut through and remove hose (G) above ABS unit (H).

Install new clip (C) (MY 2000 vehicles).

Slide new hose (G) through clip (C) and openings (A) in bonnet by T-connector (E) and connect.

Push hose (G) into clip (B) on inner fender and pull it straight through to the front.(do not bend)

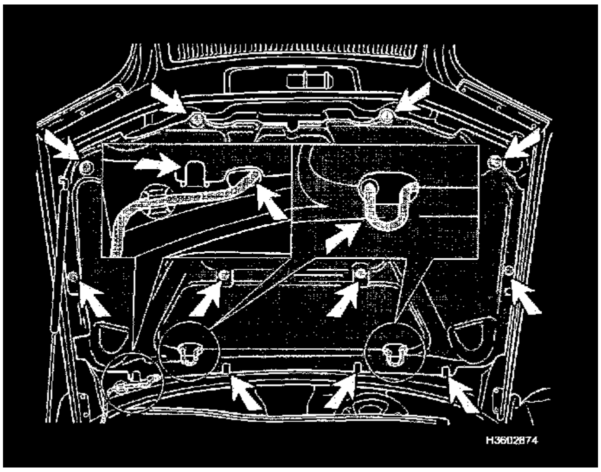
Install nipple (F) into the hose coming from windscreen washer reservoir.

Measure off a length of hose (G) sufficient to reach nipple (F), and cut to length. Install hose to the nipple.

Remove rag from the ABS unit.

Note! Verify that the hose fits snug along the inner fender and does not kink or pinch when closing the hood.

Installing and function check 5



Ensure that the hose lies in place freely.

Reinstall hood insulation panel. Be sure to fit behind recess and fix in place with clip. Recheck run of hose to windscreen washer nozzles.

Close the hood.

Check windscreen washer function.

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **2210027** Date: **000301**

Engine Oil Filler Grate - Works Loose

Section
2

Group
21

No.
0027

Year
00

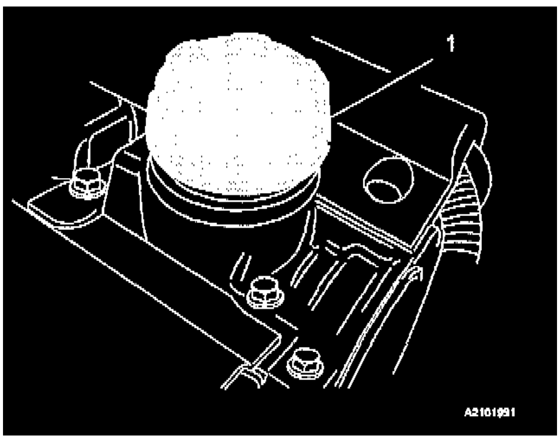
Month
03

S40/V40
2000 Partly

Campaign No. 98
Engine oil filler grate, inspection

Background

An oil filler grate is located in the engine oil filler neck of certain model year 2000 vehicles. In rare in- stances this grate may become loose. The following inspection must be performed to check the oil filler grate.



Remove Oil Filler Cap 1

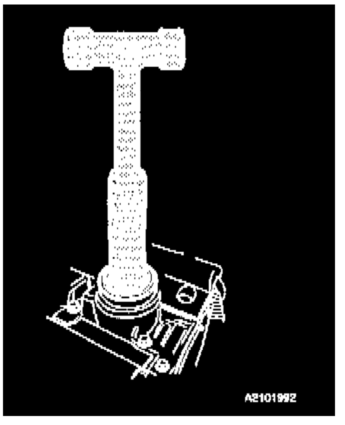
Inspect: look to see if oil filler grate is visible.

If VISIBLE: proceed to next step.

If NOT visible - take a magnet and insert it into the filler neck. Move magnet in all directions including passing the magnet over oil puddles. Remove magnet and check magnet for metal shavings.

If the oil filler grate is not visible and metal shavings are present contact your Regional FTS or the Technical Hot-line.

If the oil filler grate is not visible, and no metal shavings are present inspection completed. Using tire chalk, place an X across the top of the oil filler cap.



Checking the oil filler grate 2

Tool Needed: Hammer with a rubber handle. Handle diameter must be 30-40 mm (1.16-1.57 inches).

Note!
Do not hit the oil filler grate with the hammer.

Insert the handle into the filler neck.

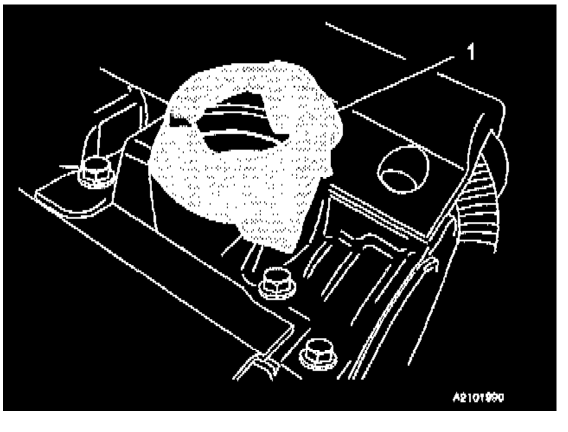
Push down on hammer, and at the same time observe grate to see/feel if loose.

If necessary, repeat a second time.

If grate is NOT loose - inspection is complete. Using tire chalk, place an X across the top of the oil filler cap.

If grate IS loose - proceed to the next step.

Engine oil filler grate, inspection Inspection of Oil filler grate



Removing the oil filler grate 3

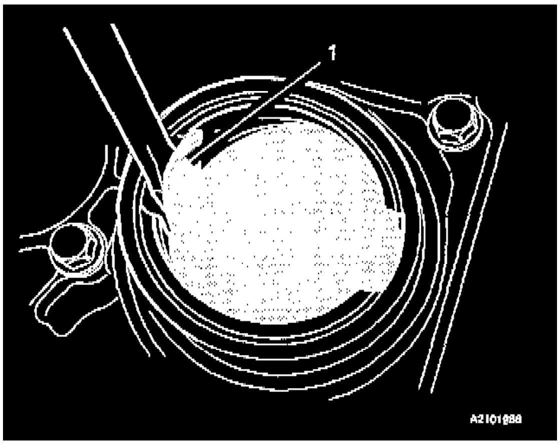
Covering the oil filler sleeve

Install tape on the filler neck to protect cap sealing surface. Use two layers of duct tape.

When performing this operation, take all precautions necessary to protect the cap sealing surface.

Caution!

Failure to cover the oil filler neck could result in damage to the sealing surface and require its replacement.

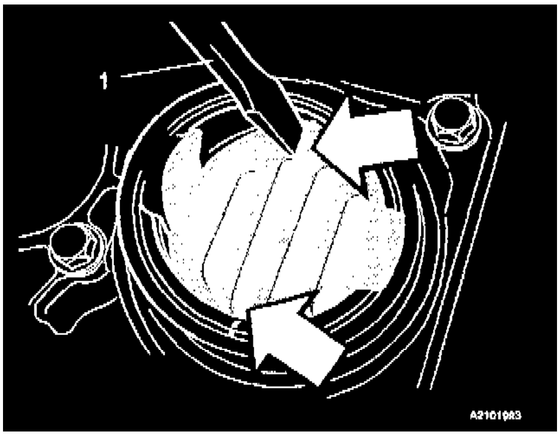


Bending attachment 4

Note!

The following illustrations do not show the protective tape. The tape must remain in place throughout the entire procedure.

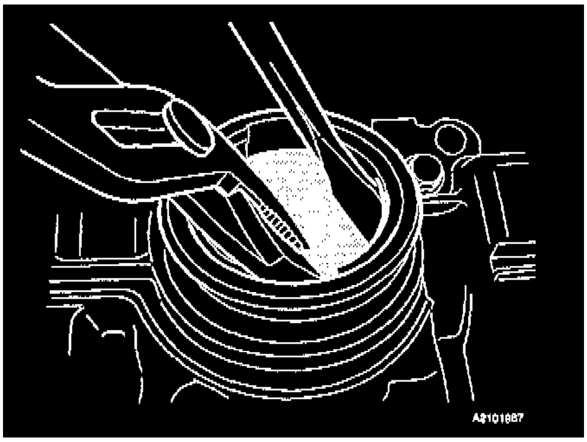
Insert screwdriver behind the attachment. Bend attachment 45 degrees inward.



Making kinks 5

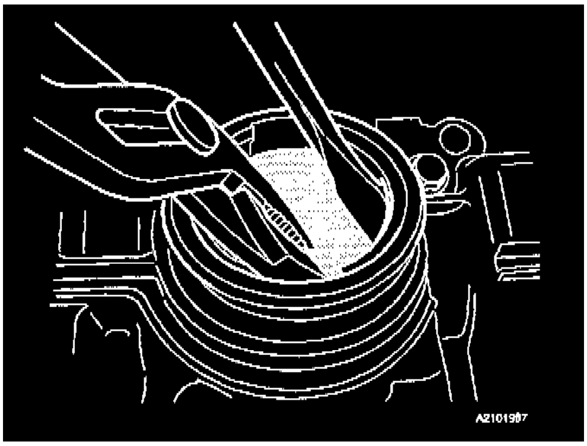
Using a small chisel, make a mark on both sides of the center louver. Mark should be in-line with the straight cut side of the louver.

See Illustration.



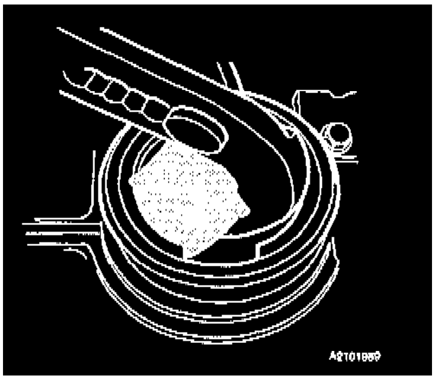
Grab attachment with a pair of channel locks. 6

Using a flat blade screwdriver, press down on one of the marks, at the same time, bend grate over with channel locks.



Folding the oil filler grate 7

Move screwdriver to other side if necessary. Fold grate in half.



Removing the oil filler grate and masking tape 8

Grab grate with channel locks. Carefully move the grate up and down and from side to side until second attachment loosens.

Remove grate.

Remove protective tape. Carefully inspect cap sealing surface for damage.

Check for any metal shavings, remove using a magnet. Using tire chalk, place an X across the top of the oil filler cap.

Technical Service Bulletin # **3370008** Date: **001001**

Headlamps - Auxiliary Resistor Wire Harness

S40/V40
2000-

Section
3

Group
37

No
0008

Year
00

Month
10

Auxiliary harness, head lights

Background
A new resistor wire harness has been introduced to extend the life of the low-beam headlight bulbs. The new harness is available as a spare part Following these procedures, resolve customer complaints about low-beam lifespan by installing the new harness in line with the existing wire harness and replacing both low beam bulbs.

Model	Factory	Chassis No.
S40,V40	Nedcar=F	415000-600137

Affected Vehicles

Description	Quantity	Part No.
Cable harness	1	30621291
Bulb (H7)	2	981465
Strip Clamp	0.02	948211-8

Materials

Special tools	Quantity	Part No.
Terminal removal tool	1	9512636

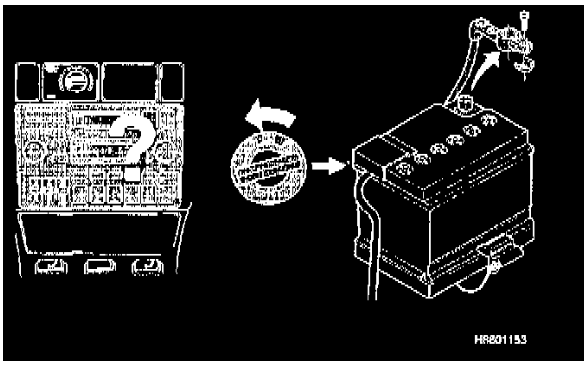
Special tools

Auxiliary harness, head lights

Installation of an extra wire harness and new bulbs

1

Preparatory work



Make a **note** of the radio code.

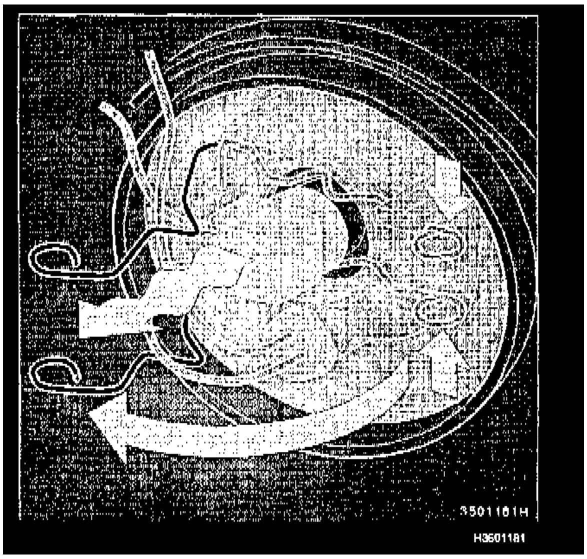
Turn off the ignition.

Open the bonnet.

Disconnect the battery negative lead.

2

Replacing left and right low beam bulbs



Turbo versions: remove the protective covers over the headlamp bulbs if applicable.

Caution!

Do not touch the bulb glass.

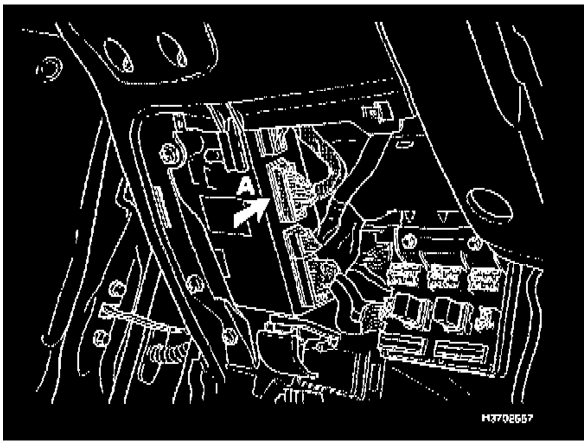
Squeeze the retaining clips as pictured. Remove the electrical connector and bulb from the headlight assembly.

Remove old bulb and discard.

Install new bulb in the connector and reverse the procedure to complete installation.

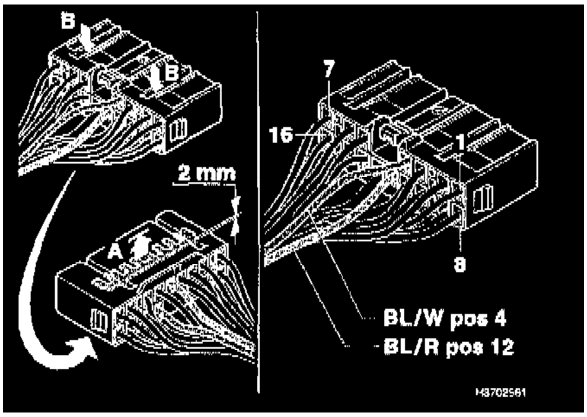
3

Removing panel

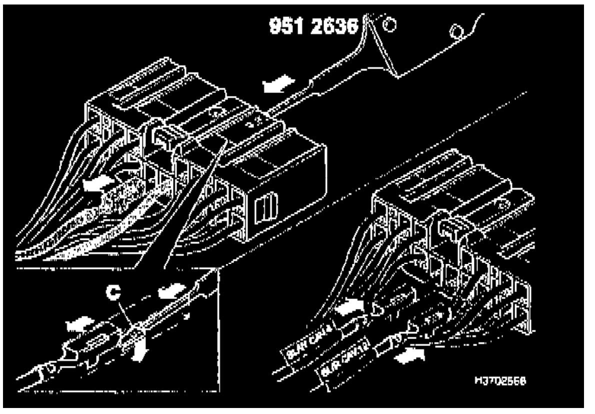


Remove the driver side, under-dash panel covering the central electronic module (CEM).

Remove the connector (A) from the CEM.



Connecting the cable harness to the CEM



Open the catch (A) by pushing it out (approximately 2 mm) on the other side at points (B).

Insert terminal removal tool 951 2636 in terminal slot 4 and terminal slot 12 respectively as indicated in the illustration. Push the catch (C) to one side.

Remove the wire from the connector.

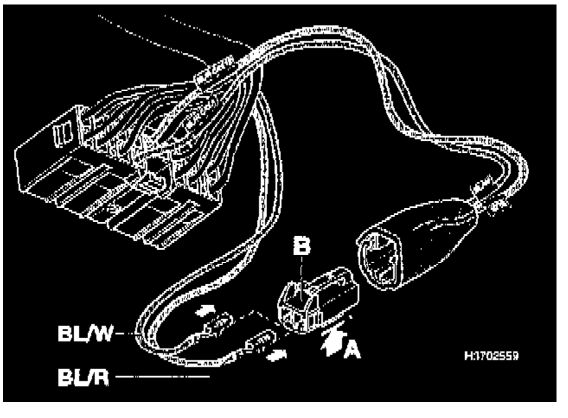
Connect the two wires from the auxiliary harness to slot 4 and 12 in the CEM connector as per illustration.

Carefully pull on the wire to check that it is secured. Push the catch (A) back into place. Reinstall the connector in the CEM. Check that the connector is secure.

Reinstall the connector in the CEM. Check that the connector is secure.

5

Installing the wires into the connector



Check if the catch (A) is open. Open if necessary by pressing the lock out.

Position the new connector (B).

Insert the two wires from the auxiliary harness in the connector.

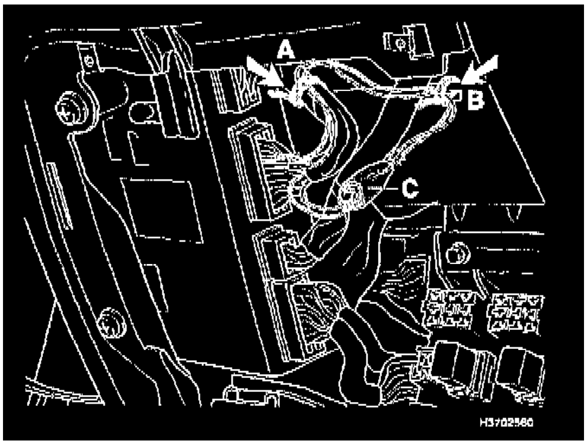
Note!

Ensure that the wiring to slot 4 in the (B) connector is also connected to slot 4 in the CEM connector

Pull carefully on the wire to check that it is secured. Push in the lock catch (A).

6

Securing the cable harness



Assemble the new cable harness in the connector (C).

Secure the cable harness in as large a loop as possible to the existing cable harness (A) and to the support bracket (B).

Use the supplied clips.

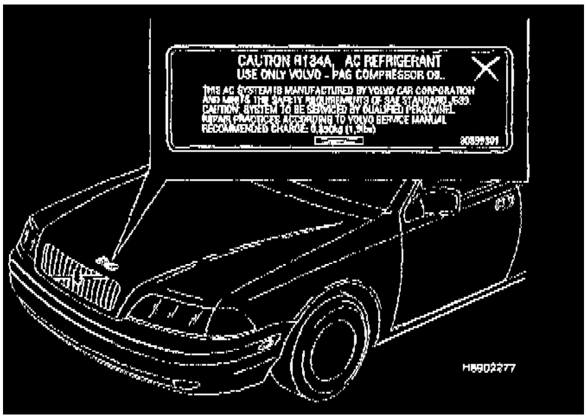
Caution!
Ensure that the wiring is not chafing or/and pinched at any point.

Reinstall the cover panel(s) on the dashboard.

7

Identify vehicles with harness Installed

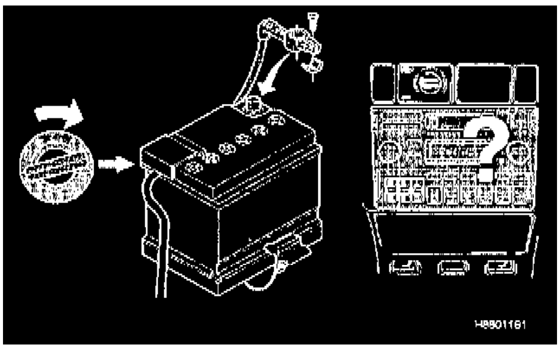
To identify which vehicles within the chassis range listed on the cover page have a harness installed, the vehicle should be marked.



Place an X as pictured on the A/C label under the hood with a black permanent marker.

8

Checking the function



Turn the ignition key to position I.

Warning!
Ensure that nobody is in the car when connecting the battery.

Connect the battery negative lead.

Wait at least 10 seconds.

Check the function of the low beams.

Enter the radio code.

Set the clock to the correct time.

Operation No.	Labor description	Time allowance
90026-2	Install extra cable harness	0.3 hr
35125-2	Replace 2x bulb	0.1 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **8840031** Date: **010401**

Front Door Window - Excessive Noise

Section
8

Group
84

No.
0031

Year
01

Month
04

S40/V40

2000-

Front door window, replacement

Background

New windows have been introduced for the front doors to improve quality and to prevent excessive noise. Because of a new lift bar, the door glass appears to be larger because the glass does not fully drop into the door in the "down" position. The additional inside guide rail on the lock side has also been removed.

The guide molding for the window is unchanged, but will be shortened when a new protective cap for the inner lock is introduced. The mounting of the windows on the window mechanism now uses two M6 bolts. The window lift bar is bonded to the door window and does not need to be installed.

Only the new window version is available as a spare part and can be installed in the older versions of cars without any changes.

Model	Chassis No.
S40, V40	489897-

Affected vehicles

Description	Quantity	Part No.
Window left side	1	30859681
Window right side	1	30859682
M6 Bolts	2	955269

Parts List

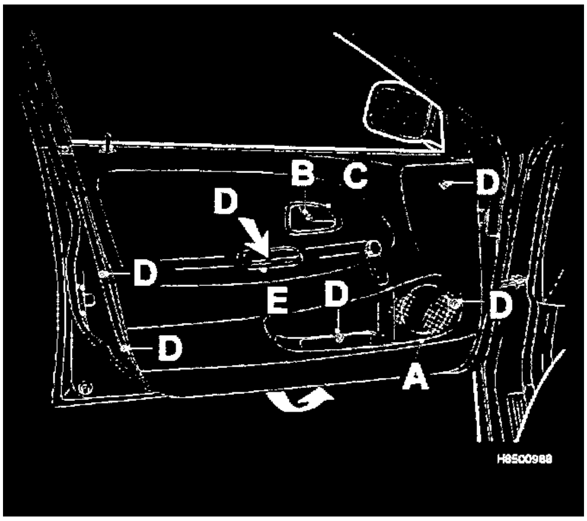
Front door window, replacing 1

Front door panel, removing

Close the door window.

Remove:

- cover panel from the door mirror

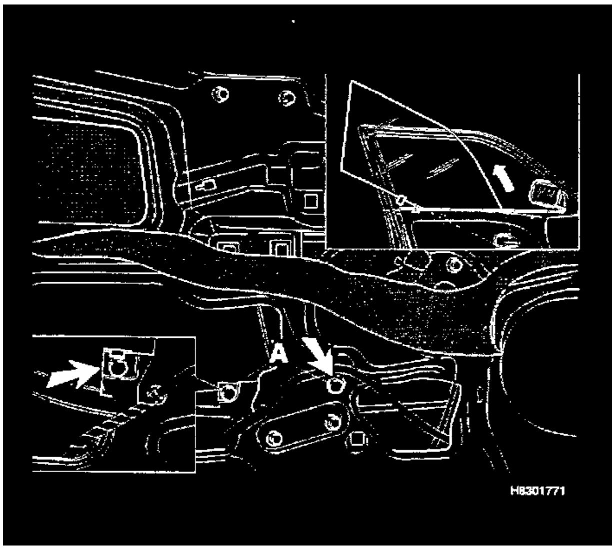


- speaker panel (A) and self-tapping screw
- self-tapping screw at the opener (B). Remove the housing (C) by pulling it forward
- caps and screws (D)
- handgrip tray (E) (disconnect the connector for the power window)
- pull the door panel off at the bottom by detaching the clips
- panel working from the bottom to the top.

Front door window, removing 2

Remove:

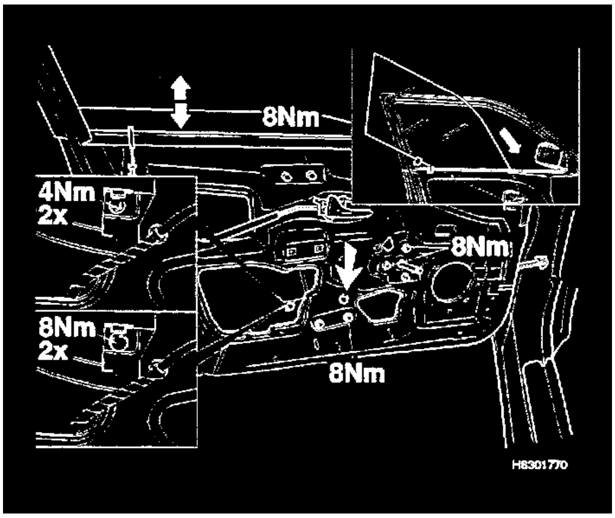
- part of the insulation panel to access the bolts



- window opened; the two mounting bolts (A)

- window, move the window upwards and turn it at the front side downwards and take it out (do not damage other parts while removing).

Front door window, installing 3



Install the window (starting from the front) in the front door. Position the window in the guide molding using a twisting movement. Do not damage any components.

Lower the window so that the mounting holes in the window lift bar are opposite the holes in the fixed arm in the window mechanism.

Finger-tighten the bolts.

Wind the window up and down a few times and secure the window by the bolts. Tighten to 8 Nm (6 ft.lb).

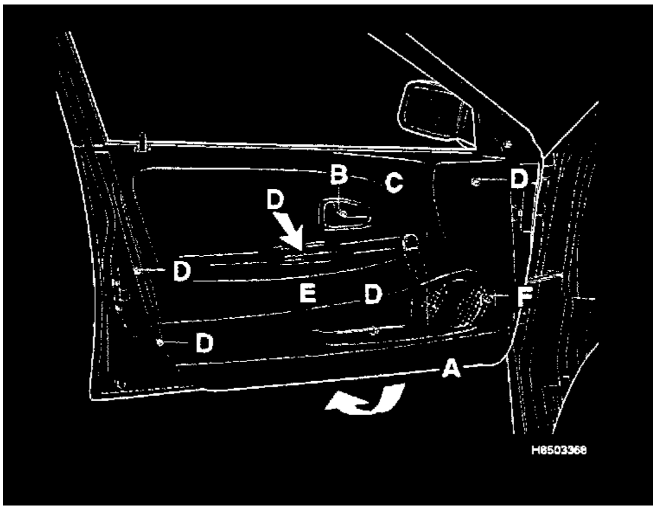
Warning!

When replacing an old type of front door window with a new one, take care to use the right bolts and tightening torque 8 Nm (6 ft.lb). If the old window is used be aware that the tighten torque of the screws is 4 Nm (3 ft.lb).

Open the window.

Install the insulation panel. If necessary, apply a new mounting strip (P/N 277253).

Front door panel, installing 4



Check the panel clips.

If necessary apply the weatherstrip.

Position the panel at the top (thread through the wiring for power windows). Press the door panel down so that the clips at the bottom engage.

Connect the wiring to the switch (power windows). Position the inner handle (E). Install the cover.

Position the housing for the opener (C). Hook the housing into the door panel. Install the screw (B).

Install the screws (D). Install the caps.

Install the screw (F). Position the loudspeaker panel (A).

Position the cover for the door mirror.

Close the window.

Clean the window.

Operation No.	Labor description	Time allowance
84406-2	Power window front door replace	0.7 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **8850010** Date: **011101**

Power Seat - Intermittent Lateral Movement

S40/V40
2000

Section:
8

Group:
85

No.:
0010

Year:
01

Month:
11

Reference:
This Service Bulletin replaces the previous SB 85-0010 dated April 2000, which should be discarded.

Purpose:
The time allowance is changed.

Electrically operated seat, minimizing lateral movement

Background

Intermittently the customer might experience minimal lateral movement during acceleration and deceleration, when driving a car equipped with power seats.

Cars Involved

Model	Factory	Chassis no.
S40, V40	F	130001-614999

Materials

Description	Quantity	Part No.
Power seat kit LH side	1	8619314
Power seat kit	1	8619338

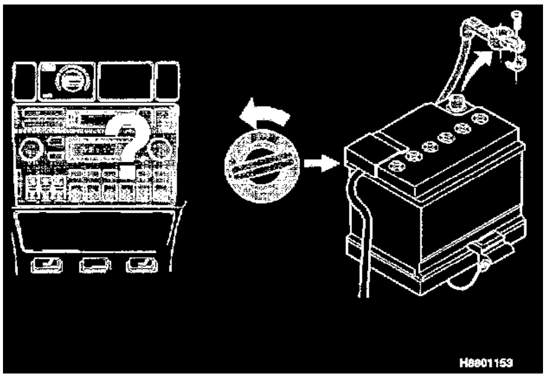
Rh side

Tools

Description	Part No.
Ground lead	9511522

Minimizing the free travel in the power seat

Preparations 1



Make a note of me anti-theft radio code.

Detach the negative lead from the battery.

Position the seat to access and release all the mounting points.

The front edge of the seat must be in the uppermost position before the seat can be removed.

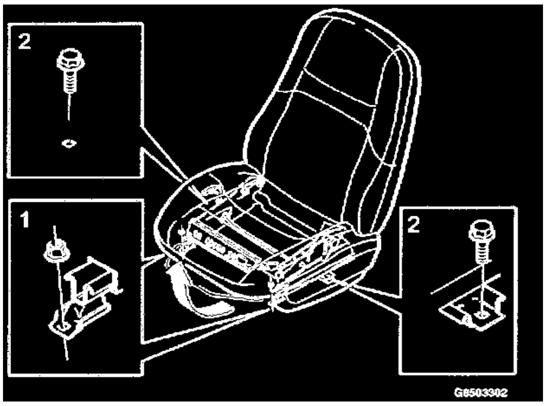
Note!
when removing a seat from a car with side airbags, the seat must be grounded. This is due to the Possibility of static electricity.

When the seat has been removed from its mounting position attach ground lead 9511522 or connect a suitable length of wire (stripped at both ends) to the rear mounting.

Secure the other end to a suitable ground point in the car.

Removing and tilting the seat 2

Remove



- Move seat to forward most position.
- The left side mounting screw protective cover.

Note!
On right side it is possible to remove the rear mounting screw without removing the center console.

- Move the seat to the rear most position.
- The front mounting protective covers by sliding the protective covers forwards, the nuts (1).

Angle, tip and tilt the seat backwards towards the rear seat.

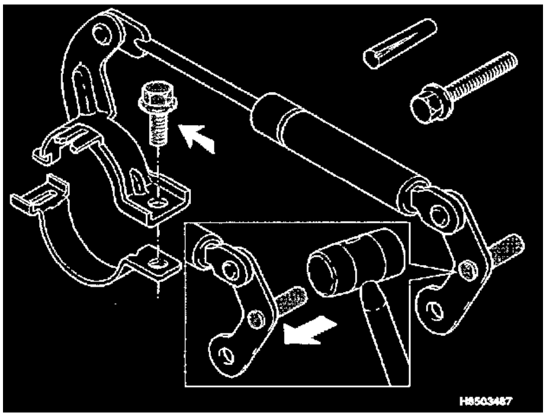
Note!

Secure the seat.

Note!

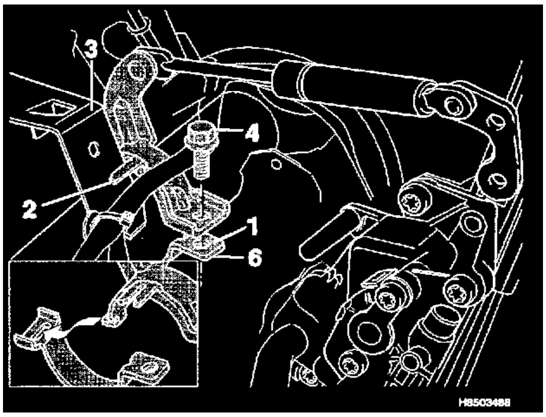
Do not damage the components.

Unpacking the kit 3



Unpack the kit. Remove the damp bolt and separate the bracket. Remove the lock pin from the bracket, as shown in the picture.

Installing the clamp 4



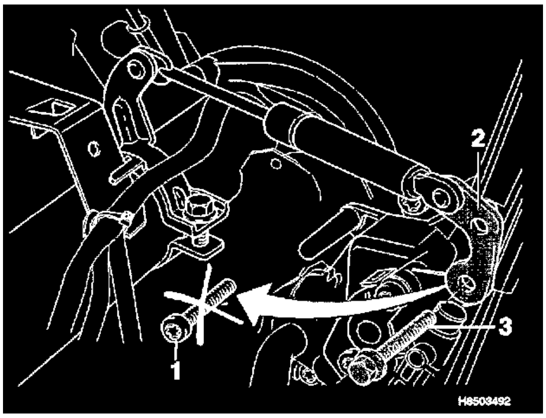
Position the damp (6), with gas strut attached, around the SIPS pipe. Ensure that the locator (2) is placed over the bracket (3) on the SIPS rail. Be sure that the locator is completely seated in the bracket.

Note:

Move the wiring beside and avoid clamping between the bracket.

Secure the screw in the hole (1). Tighten the screw (4) to 10 Nm (7 ft.lb).

Installing the lower bracket 5



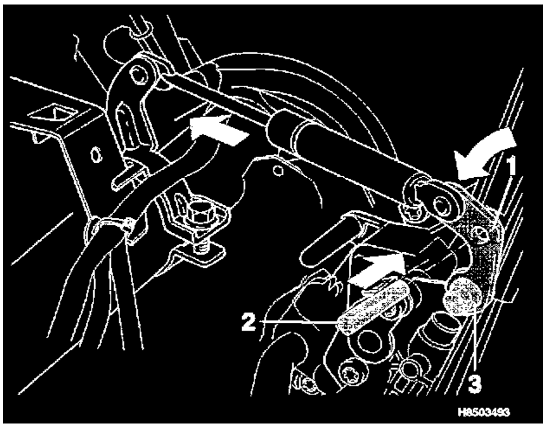
Remove the screw (1). Use a standard torx socket. Discard the screw.

Position the bracket (2) ensuring that the circlip is properly positioned. Secure the bracket using the new screw (3). Finger tighten the screw.

Positioning the bracket 6

Note!
Check that the hole in the seat motor is not obstructed.

Angle the bracket (1) and the gas strut upwards into place. High forces are needed to press the gas strut in and move the bracket into position. Use a large pair of pliers to compress strut and position bracket.



Place and tap the lock pin (2) into position (see picture) to lock the bracket. The head of the lock pin must be flush with the surface of the bracket.

Tighten the screw (3) to 8 Nm (6 ft.lb).

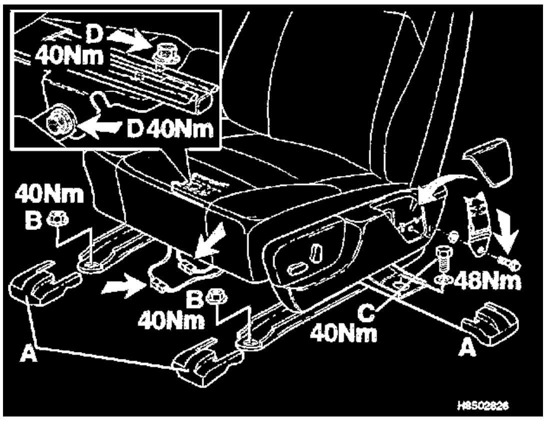
NOTE:
Check that the bracket and mounting of the upper clamp are in a straight line.

NOTE:
Check that circlips are locked/secured in their groves.

Installing seats 7

Install the front seat in the car.

Connect the disconnected connectors. Screw the seat into place.



Tighten to the torque specifications illustrated.

Reinstall the other removed components.

Test the function of the seat.

Operation No.	Labor description	Time allowance
85923-2	Gas strut front seat, install	0.9 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint. using claim type 01.

Technical Service Bulletin # **TNN60-07** Date: **030829**

Steering/Suspension - Vehicle Pulls Left or Right

NO: 60-07
DATE: 8-29-2003

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

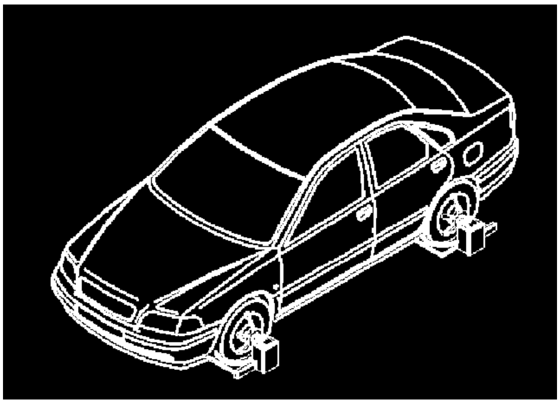
MODEL: S40 V40
M. YEAR: 2000, 2001, 2002, 2003, 2004
CHASSIS: 415000-
SUBJECT: Front End Pulls Left or Right (Camber Adjustment)
REFERENCE: VADIS

DESCRIPTION:
If a front-end pull exists it is now possible to adjust the front camber using camber kit PN 30630515.

SERVICE:
Follow the procedure listed below only after all of the normal fault tracing has been completed.

Installing adjustable camber bolts to restrict pulling to the left or right.

General 1.



First - check the following steps before installing the adjustable camber bolts.

1) Road test the car to verity the complaint.

2) Check the air pressures in all the tires.

3) The tires should all be in good condition with even wear patterns.

4) Check front and rear suspension for wear.

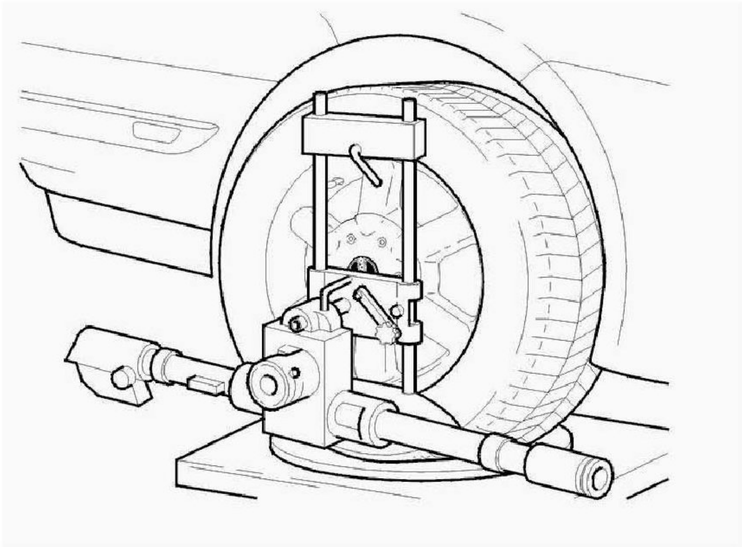
5) Pulling problems can also be caused by the power steering or brakes.

6) Check the four-wheel alignment always start at the rear (see wheel alignment specifications).

Install the adjustable camber kit only after the steps listed above have been ruled out as a fault.

Use adjustable camber bolts service kit
P/N 30630515

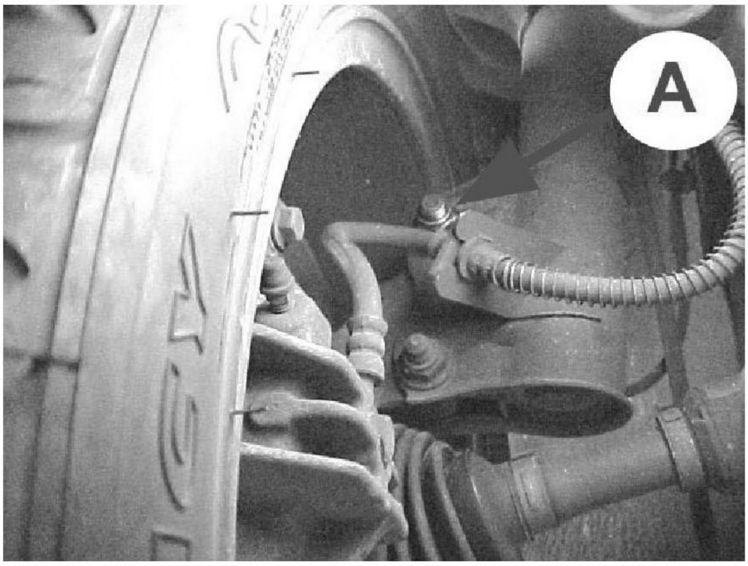
Car pulls to one side during driving. 2.



- Install and calibrate the alignment equipment according to the user manual.

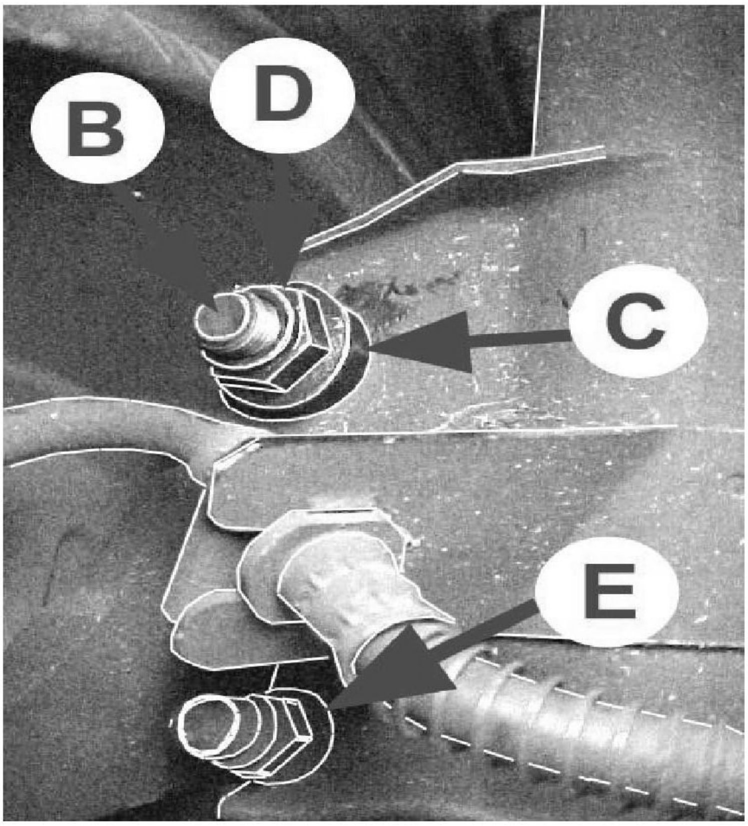
Note! Always use four wheel alignment equipment.

- Raise the car.



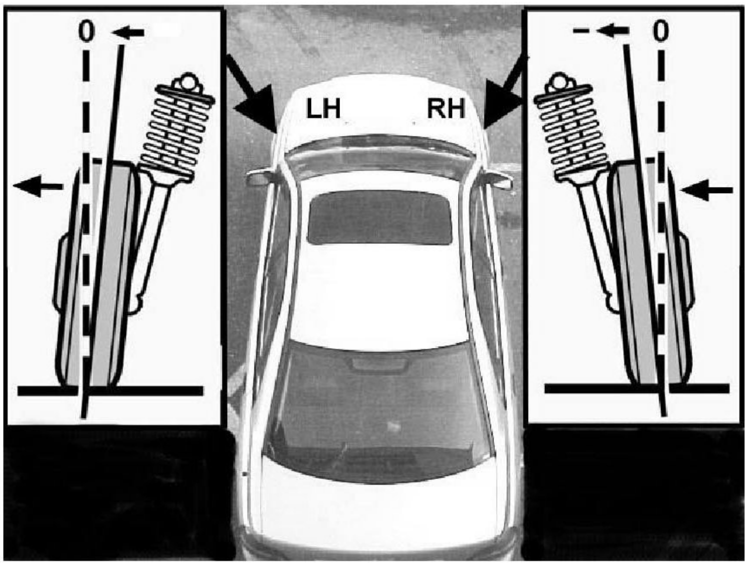
Preparations.

- Remove the upper shock bolt (A) from both sides.



Installing the adjustable camber bolts on both sides.

- Install the bolt (B) from the service kit (the direction of the thread pointing forward in the car) on both sides.
- Install spacer 8-mm (C) and new flange lock nut (D) on both sides. Hand-tighten connection.
- Loosen the lower bolt connection (E) from the left and right front shock absorbers.
- If the car pulls to the RIGHT during driving see step 3.
- If the car pulls to the LEFT during driving



Car pulls to the right during driving. 3.

RH (right hand side) camber adjustment.

- Before tightening the shock absorber connections on the RH side PUSH the upper side of the wheel to the inside so that the camber value is maximum negative see camber specification below.

Torque the shock bolts to 67 ft lbs. (90 Nm).

Model year	Max negative Camber Degrees
2000	(-1º)
2001-	(-0.66º)

RH side values maximum permitted negative camber.

LH (left hand side) camber adjustment.

- Before tightening the shock absorber connection on the LH side PULL the upper side of the wheel to the outside so that the camber value is (0.66°) more positive than the RH side.

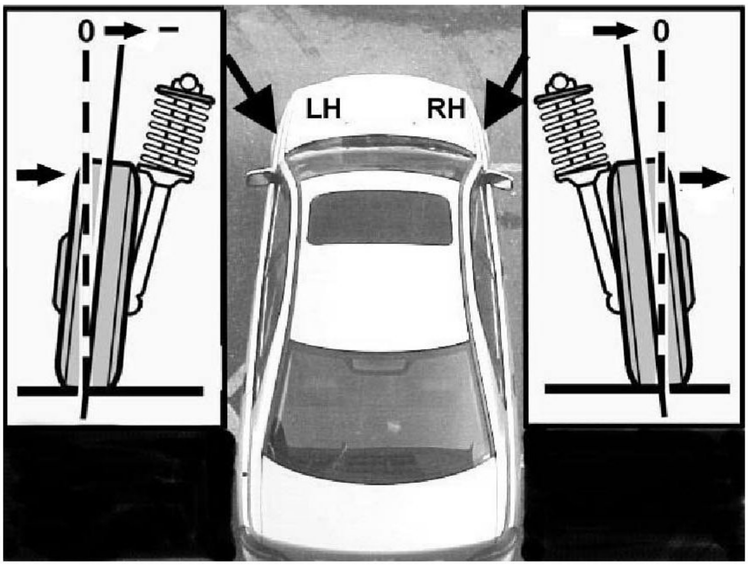
Torque the shock bolts to 67 ft lbs. (90 Nm).

Model year	Camber value Degrees
2000	(-0.34º)
2001-	(0º)

LH side values maximum permitted negative camber.

Road test the car and check the driving properties.

- If the car pulls to the left during driving lower the permitted camber value on the LH side.



Car pulls to the left during driving. 4.

LH (left hand side) camber adjustment.

- Before tightening the shock absorber connections on the LH side PUSH the upper side of the wheel to the inside so that the camber value is maximum negative see camber specification below.

Torque the shock bolts to 67 ft lbs. (90 Nm).

Model year	Max negative Camber Degrees
2000	(-1°)
2001-	(-0.66°)

LH side values maximum permitted negative camber.

RH (right hand side) camber adjustment.

- Before tightening the shock absorber connection on the RH side PULL the upper side of the wheel to the outside so that the camber value is (0.660) more positive than the LH side.

Torque the shock bolts to 67 ft. lbs. (90 Nm).

Model year	Camber value Degrees
2000	(-0.34°)
2001-	(0°)

RH side values maximum permitted negative camber.

Road test the car and check the driving properties.

- If the car pulls to the right during driving lower the permitted camber value on the RH side.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
60110-2	Wheel alignment 4 wheels check	1.1 hr
60133-2	Camber angle front 1 side adjust	0.3 hr

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Claim InformationTechnical Service Bulletin # **881A** Date: **000701**

Seat Belt - Extensions

GROUP:
88

NO:
1A

ISSUING DEPARTMENT:
Parts Support

CAR MARKET:
U.S. and Canada

DATE:
July 2000

TITLE:
SEAT BELT EXTENDER

200, 700/900, 850, S/V/C70, S/V90, S80, S/V40

REFERENCE BULLETINS:

Supersedes: SMB 88-1A, Jan. 2000

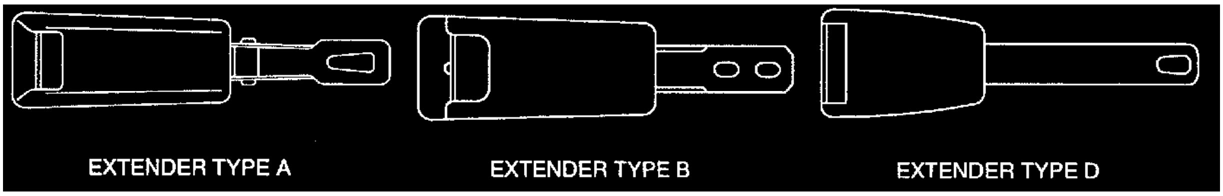
A front seat belt extender is available for owners who require one.

Seat Belt Extender forms must be faxed to Parts Support. In the U.S., fax to (201) 784-4551. In Canada, fax to (416) 493-8754. The original signed order form should be kept in the retailer's file.

WARNING:
Seat belt extenders MUST NOT BE USED FOR THE REAR SEATS.

NOTE:
This is not a comfort item. It is intended only for persons who are physically unable to use the standard seat belt assembly. The extender is strictly for use by these persons only, and can be ordered only by using the special ordering form attached.

Before ordering, please be certain that all seat adjustment possibilities have been considered. Also check for proper operation of the retractor and latch before and after installing the extender.



Three seat belt and extender combinations are available.

APPLICATION:

Seatbelt	L/H	3513285	R/H	3513286
Catch	L/H	1370057	R/H	1370060

240
From 1975 MY to 1987 MY (244 chassis No. ->257599, chassis No. ->750769), use Extender Type A. **NOTICE**: Seatbelt and catch must be changed to:

240
From MY 1987 and up (244 chassis No.257600->, 245 chassis No. 750770->), use Extender Type A.

740/760
From 1983 MY to 1990 MY, (744 chassis No.-> 396999, 745 chassis No.-> 242699, 764 chassis No.->76899 and 765 chassis No.-> 31199) use Extender Type A or B. (see part number below).

NOTE:
If the car has a single-retractor belt, a dual-retractor seat belt system must be installed according to instructions found on page 338 of Service Manual TP 31127/1; Body, Interior, Climate.

From 1990 MY (744, Chassis No.397000->, 745 Chassis No.242700->, 764 Chassis No. 76900->, 765 Chassis No. 31200->)and up, use Type D.

780
From 1987 MY, up to and including part of 1990 MY (780 Chassis No.-> 9964), use Extender Type A.

From part of 1990 MY (780 Chassis No.9965->) and up, use Extender Type D.

900
From 1991 and up, use Extender Type D.

850
From 1993 and up, use Extender Type D.

Note: For MY93 850 cars with Chassis Nos. below 44448, where an extender is needed, belt catches must be changed. Pivot type catch P/N 9136184 (driver's side) and P/N 9136185 (passenger's side) must always be used in combination with the extender. New catches will be provided with the extender if the Chassis No. is below 44448.

S/V40, S/V/C70, S/V90, S80
From 1998 and up, use Extender Type D.

MODEL		P/N		P/N
240	L/H	3513285	R/H	3513286
740/760	L/H	1349971	R/H	1349972
740/760	L/H	1373246	R/H	1373247
740/760	L/H	3548890	R/H	3548891
780	L/H	1396072	R/H	1396073

Extender Type A can be used in conjunction with the seat belts shown.

MODEL		P/N		P/N
740/760	L/H	1370146	R/H	1370147

Extender Type B can be used in conjunction with the belts shown.

MODEL		P/N		P/N
740/760900	L/H	3525479	R/H	3525480
780	L/H	1374913*	R/H	1374914*
780	L/H	3406310	R/H	3406311
740/900	L/H	3548750	R/H	3548751
850	L/H	6818114**	R/H	6818115***

* Only production P/N
** Belt catch P/N 9136184 must be used with extender
*** Belt catch P/N 9136185 must be used with extender

Extender Type D can be used in conjunction with the seat belts shown.

Extender Type D can also be used in conjunction with all front seat belts in the following models: S/V/C7O, S80, S/V90

Seat Belt P/N Labeling:

DOT
IMPORTED BY VOLVO NORTH
AMERICA CORP. ROCKLEIGH N.J.

BELT NO. 3548751
VOLVO GOTHENBURG
MADE IN SWEDEN

Part numbers of seat belts are on labels sewn onto the belt webbing (see illustration). At the time of installation, the retailer is responsible for testing the extender in the customer's vehicle to be sure that the correct extender/seat belt combination is used.

ORDERING PROCEDURES:

1. The retailer should complete the attached order form and secure the customer's signature, then FAX the form to Parts Support. Hand or mail a photocopy of the completed form to the customer. You must retain the original form for the retailer file for legal purposes.

   Note:
   No extenders will be shipped without a completed order form, properly signed by the customer.

2. Parts Support will enter the order, which will then be sent to the retailer on a "drop ship" basis from the distribution center.

VOLVO

SEAT BELT EXTENDER

ORDER FORM

Separate order form required for each extender ordered!

Vehicle Information:

Model: ____________ Year: ____________

VIN: ____

Extender Type: **A** **B** **D** (circle one)

By signing below, I agree that I have read, understand, and agree to abide by the warnings and Rules for Use of a Volvo Front Seat Belt Extender printed on the back of this order form or on a separate piece of paper:

Customer Name: ____
(print full name)

Customer Signature: ____

Customer Address: ____

Retailer Name: ____ Retailer Code: __________

Retailer Address: ____

Retailer Fax No.: ____

Retailer Signature: ____

Printed Name and Title: ____

FAX TO

(U.S.)
Attn: Parts Support
Volvo Cars of North America, Inc.
Rockleigh, NJ 07647
(201) 784-4551

(Canada)
Retailer Support
Volvo Cars of Canada, Ltd.
Willowdale, Ontario M2H 2N7
(416) 493-8754

SEAT BELT EXTENDER ORDER FORM

SEAT BELT EXTENDER SAFETY WARNINGS

NOTICE!

The Volvo front seat belt extender is intended for use only by persons who are physically unable to use the standard seat belt assembly. Even when the seat belt extender is properly installed and in use, the vehicle's safety restraint system may provide the user with less protection than when the standard seat belt assembly alone is used.

RULES FOR USE OF A VOLVO FRONT SEAT BELT EXTENDER

The Volvo front seat belt extender must be used only as described below:

^ The seat belt extender may be used only for the vehicle and seat for which the extender was purchased.

The extender is not designed to work in any other make or model of vehicle or with any other seat.

^ The seat belt extender may be used only by the intended user. Use by other persons may result in decreased protection to them in the event of a collision.

^ The seat belt extender must not be used for rear seats. Extenders are not designed to work with rear seats or seat belts.

^ When the extender is installed, the intended user seated in that position must buckle his or her seat belt, whether required by local law or not.

^ When not in use by the intended user, the seat belt extender must be removed from the seat belt buckle.

SEAT BELTS, SEAT BELT EXTENDERS, AND THE VOLVO SUPPLEMENTAL SAFETY RESTRAINT SYSTEM

From model year 1998 and up, the Volvo Supplemental Safety Restraint System (SRS) uses a two-threshold airbag deployment system that relies upon information provided by sensors linked to the front seat belt buckles. These sensors tell the SRS whether or not the seat belt is buckled. In a frontal collision, the airbag of an unbuckled seat position may deploy even if the airbag of a buckled seat position does not.

If either a seat belt or seat belt extender tab is inserted into the the seat belt buckle, the SRS will believe that a seat belt is in proper use. Therefore, in a frontal collision, if the extender is installed and the seat belt is not properly used, the affected airbag may not deploy or may not deploy with appropriate force!

VOLVO STRONGLY URGES YOU AND ALL ADULT OCCUPANTS OF YOUR CAR TO PROPERLY WEAR SEAT BELTS AND TO ENSURE THAT CHILDREN ARE PROPERLY RESTRAINED IN THE REAR SEAT.

Technical Service Bulletin # **TNN39-58** Date: **070214**

DVD Player - Won't Accept/Eject DVD's/Inoperable

NO: 39-58

DATE: 02-14-2007

MODEL: All with Factory Equipped RSE (Rear Seat Entertainment Systems)

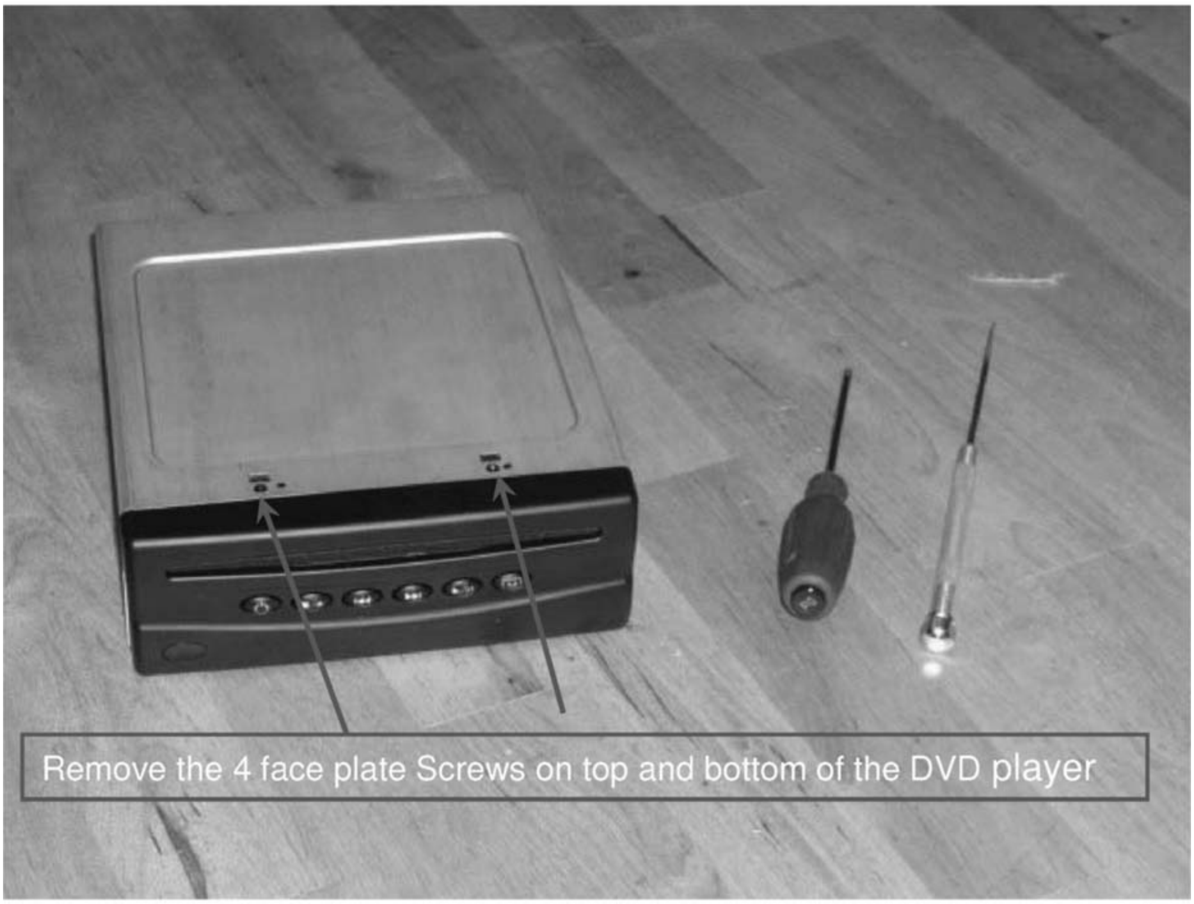
SUBJECT:
Multiple discs inserted into RSE DVD player

REFERENCE:
VIDA fault tracing information

DESCRIPTION:

Customers may report that their RSE Rear Seat Entertainment DVD Player will not accept DVDs (DVD player will not allow DVD discs to be inserted; DVD Player is inoperable or will not eject the DVD disc).

One possibility for this condition is that there may be 2 or more discs inserted into the DVD player. If multiple discs are found in the DVD player please do not submit the unit for warranty. If a DVD player is returned for warranty with 2 discs inside, the claim and part will be denied.



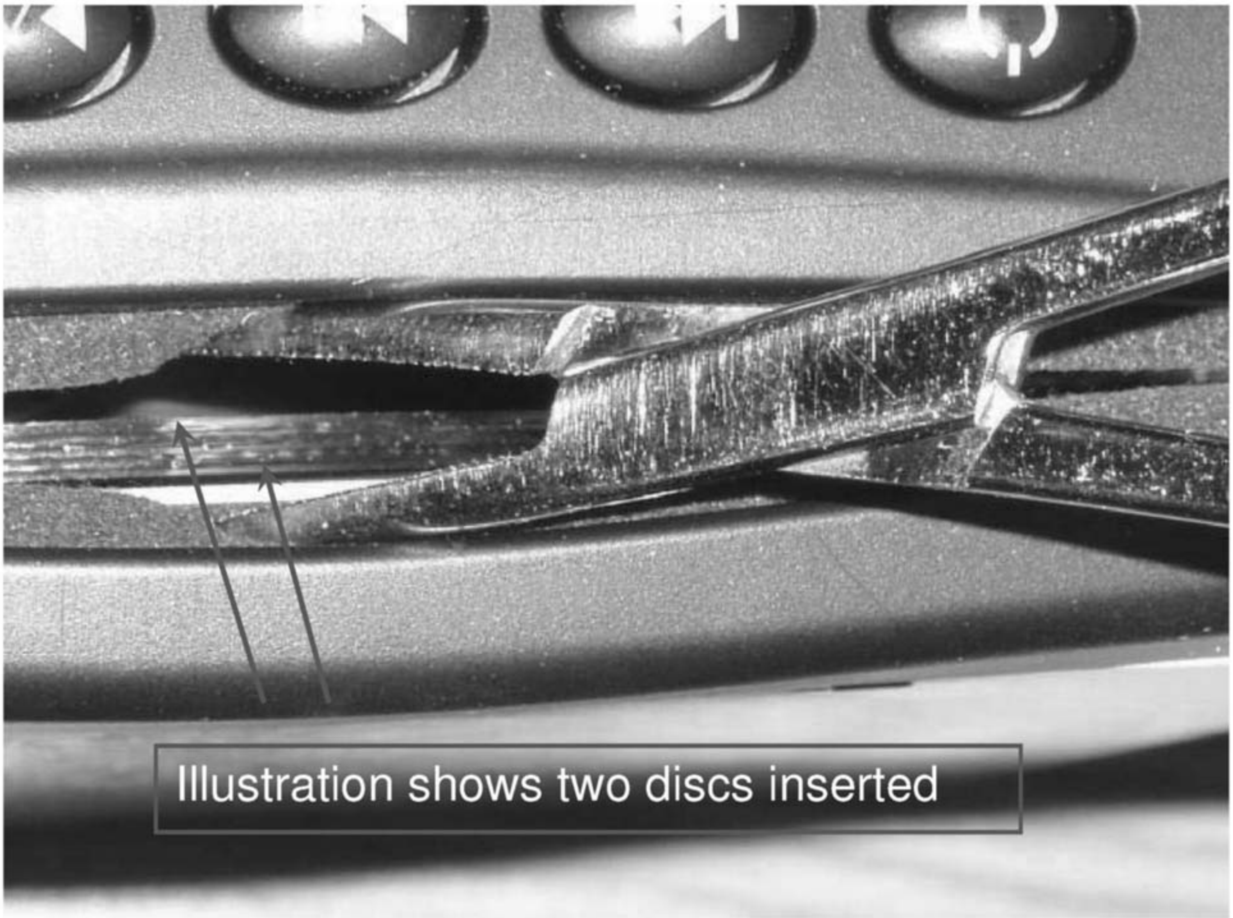
Refer to the illustration for a method to remove stuck multiple discs with customer approval.

Note:
Any DVD Players returned to TMA disassembled or tampered with, will not be covered under warranty.

This TNN describes the method to inspect the DVD player for multiple disc insertion.

It is not necessary to remove the DVD player for inspection.

Carefully spread the protective dust cover apart using a hemostat or similar tool as described in this procedure. Be careful not to scratch the unit or damage the opening of the DVD Player or damage the customer's DVDs inside the unit.



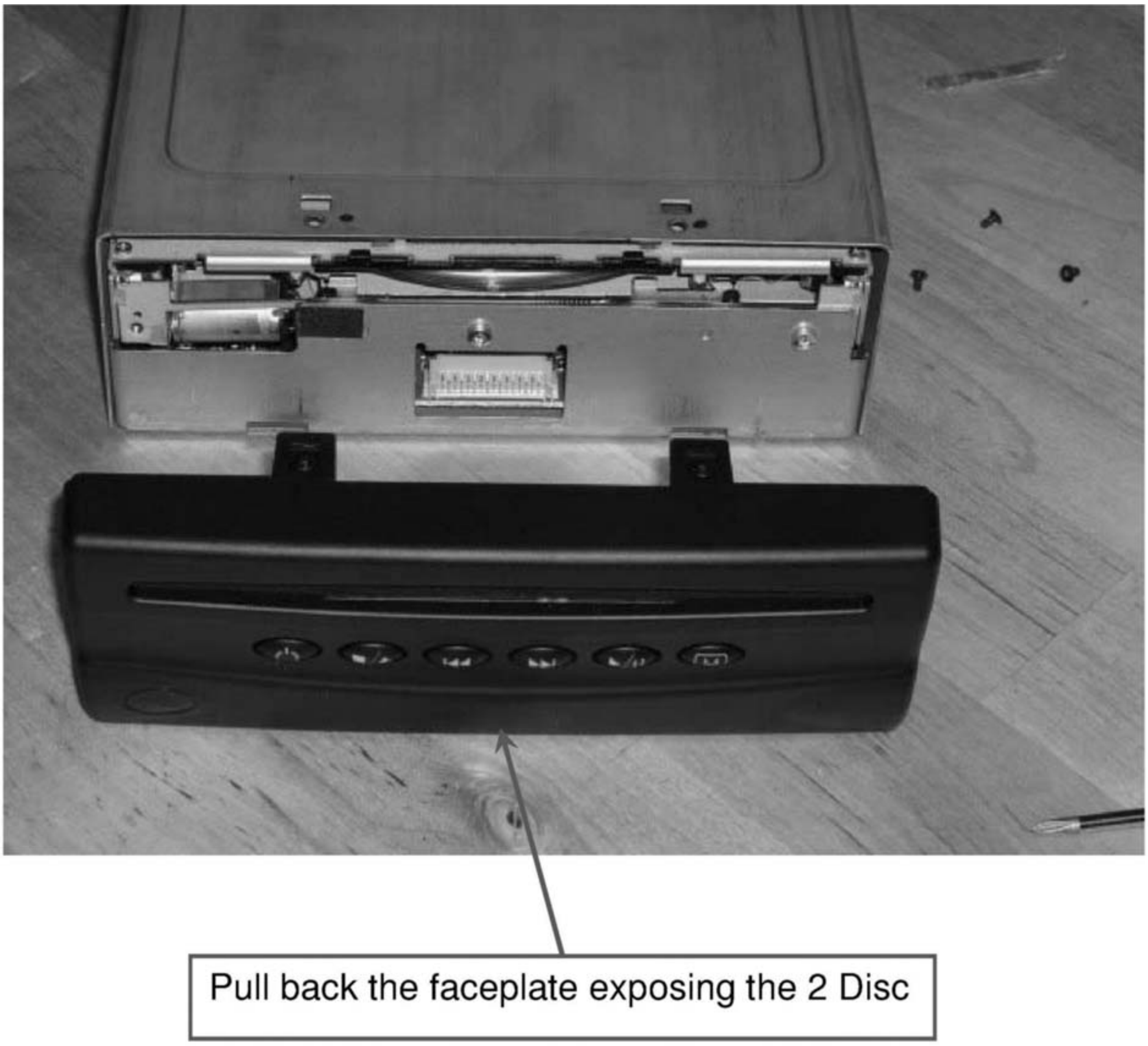
DO NOT ATTEMPT TO REMOVE THE DISCS WITH THE TOOL ABOVE. THE DVD PLAYER AND THE DISCS WILL BE DAMAGED

If there is one DVD stuck inside the unit and you were not able to eject the discs using the player's external control buttons, leave the disc in the unit and return the DVD Player to TMA under the normal warranty return program. Disc will be removed and returned to the Retailer.

The procedure below describes the method to remove the stuck DVDs from the player that has had multiple disc insertion if the customer so decides.

Note:

If you decide to remove the stuck Discs, please follow the procedure below. (DVD player must be removed to perform this operation)



Important:

Once the unit is opened it is no longer covered under warranty and will be denied if submitted. Please advise your customer of this before proceeding. Volvo Cars of North America assumes no responsibility for damage to the player or discs if this method is used.

^ Carefully Insert pick as shown (without scratching the disc surface) below the spindle.

^ Gently lift up on the discs close the center hole so they will clear the spindle.

^ Grip the discs with your fingers and pull back to remove from player.

Return Discs to customers.

Technical Service Bulletin # **TNN36-58** Date: **070501**

Antitheft - Immobilizer Lamp ON/DTC 321 Set

NO: 36-58

DATE: 5-1-2007

MODEL:
S40, V40

MODEL YEAR:
2000-2004

SUBJECT:
Immobilizer Warning Lamp Lit or Flashing, IMMO-DTC 321

REFERENCE:
VIDA

DESCRIPTION:

In S40 and V40 cars, the Immobilizer warning lamp may be lit after a successful cold start.

After a restart, or after switching ignition off and on, the warning lamp is not lit any more.

While the warning lamp is lit (engine is still running), Immobilizer Diagnostic Trouble Code IMMO-DTC 321 is stored. This DTC indicates a communication problem between IMMO-ECU and ECM (Engine Control Module). When the warning lamp is not lit, there are no IMMO or ECM DTCs stored.

The customer may also experience intermittent no crank (starter motor not activated) and flashing Immobilizer warning lamp in the DIM. In most cases the engine will crank normally if the ignition is switched off and a new start attempt is made. In a few cases, several start attempts are needed to get the engine running.

SERVICE:

Install service harness P/N 30652280 according to the method below.

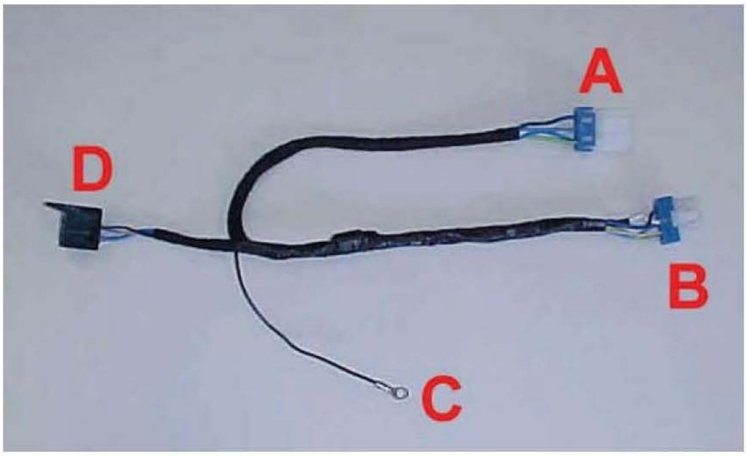


Photo 1

1. Required parts. Refer to Photo 1.
2. Remove driver side dashboard sound proofing.

   Refer to VIDA.
3. Remove steering column covers.

   Refer to VIDA.
4. Remove connector from starter switch.

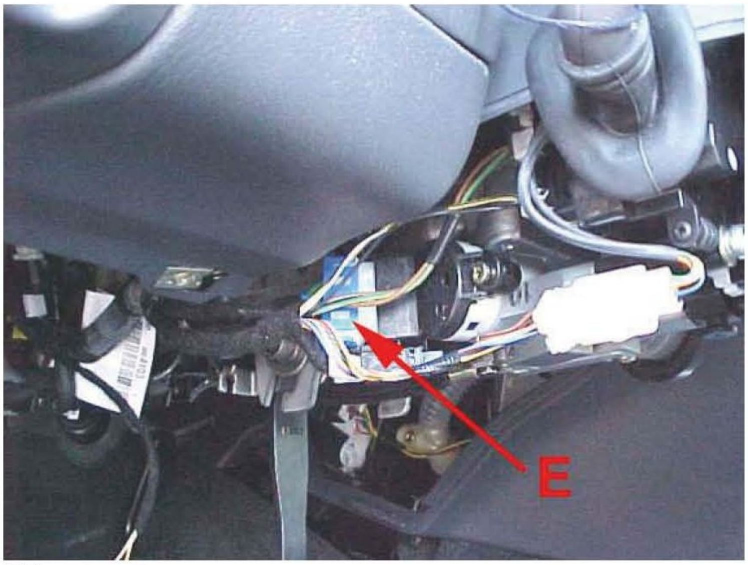


Photo 2

   Refer to Photo 2.

   ^ Push the white plastic connector unlocking latch at the rear side of the connector.

   ^ While pushing the unlocking latch, pull connector E from the starter switch.
5. Install relay

   Refer to Photo 1.

Install the relay (P/N 3472210) in relay socket D of the service harness.

6. Install service harness

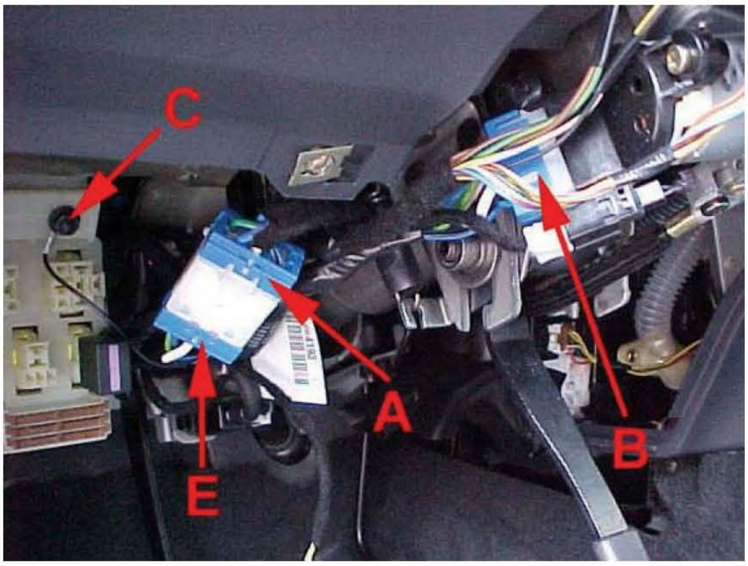


Photo 3

Refer to Photo 3.

^ Install connector A from the service harness to connector E (that was removed from the starter switch).

^ Install connector B from the service harness to the starter switch.

^ Place the service harness in its mounting position and fasten it with the two cable ties to the existing harness. Make sure the routing avoids potential chafing of the harness.

^ Remove one of the Junction Box upper fixation nuts, and install ground terminal C on the threaded stud. Tightening torque of the fixation nut 4.5 Nm (3.3 lb-ft).

^ Check the resistance to ground through terminal C with an ohmmeter. The resistance shall be less than 1 Ohms.

7. Test function

^ Switch ignition on.

^ The relay located in relay socket D must switch on with ignition on.

^ Crank engine; engine must start.

^ Check if Immobilizer warning lamp switches off.

^ Switch ignition off; relay located in relay socket D must switch off.

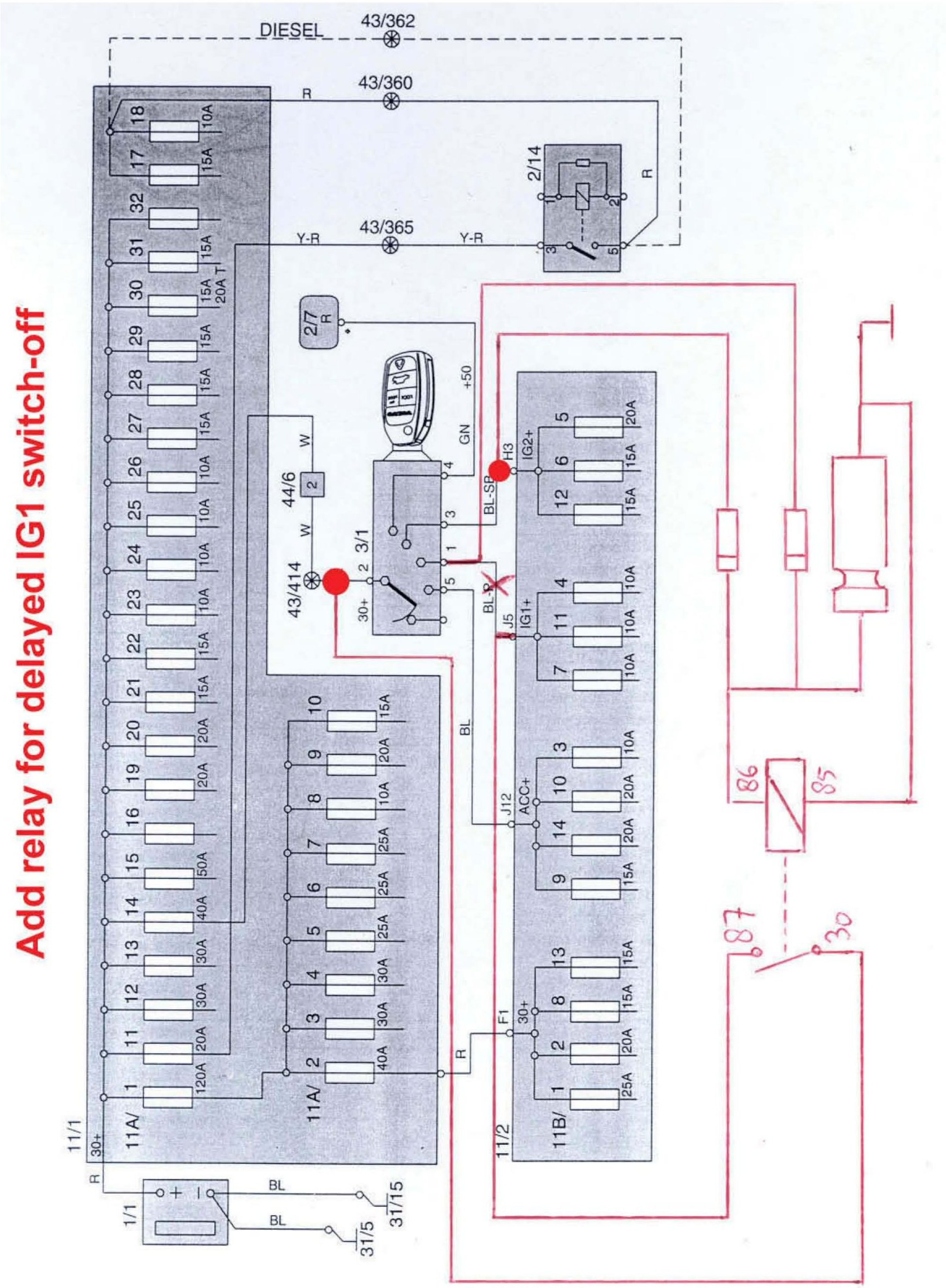
8. Re-install steering column covers

Refer to VIDA.

9. Install driver side dashboard soundproofing

Refer to VIDA.

The wiring diagram after installation of the service harness is shown below.



The wiring diagram after installation of the service harness is shown.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
99191-2	Cable harness starter switch install S40, V40	0.5 h

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY CLAIM INFORMATION

Technical Service Bulletin # **TNN43-56** Date: **080421**

A/T - Cooler/Line Flushing When Replacing A/T

NO: 43-56
DATE: 4-21-08
MODEL: All
MODEL YEAR: All
CHASSIS: N/A
SUBJECT:
Automatic Transmission Cooler/Lines Flushing
REFERENCE: VIDA, TNN 43-08, TNN 43-48

Note!

If this is a printed version of a TNN, first check for the latest online version.

Description:
The purpose of this Tech Net Note is to work as a guideline for technicians when an automatic transmission is being replaced. In order for modern automatic transmissions to properly adapt to transmission wear while maintaining comfortable shift quality, the pressure control is closely monitored. For this reason, the automatic transmission fluid (ATF) must meet the transmission manufacturer's specifications.

A faulty transmission often has debris in the ATF, the coolers, the lines, and throughout the transmission. This debris must be properly flushed out before a new transmission is installed. Flushing the ATF using the transmission oil pump of the newly installed transmission will not suffice and can possibly cause damage to the new unit. Depending on the condition of the ATF, the transmission coolers and lines may need to be replaced. The information below is copied directly from VIDA.

Service:
Once a transmission is properly diagnosed to be faulty and needs to be replaced, it is important that the proper procedures are followed for flushing out the used ATF from the ATF coolers and lines. Note that some vehicles have two coolers; the cooler in the side of the radiator and the auxiliary cooler.

When an automatic transmission is replaced, follow TNN 43-08 to properly fill out the Automatic Transmission Diagnostic Sheet and follow VIDA to reset adaptive memory. Simply disconnecting the TCM (Transmission Control Module) or power from the TCM does not reset adaptive memory!

On all vehicles, always flush the radiator, coolers, and lines before installing the new transmission. The guidelines and procedures for flushing vary with each model.

There is a procedure for flushing coolers and lines found in a hyperlink in the VIDA transmission/gearbox installation procedure called Transmission, preparations before installing for AW (Aisin Warner) 5- and 6- speed automatics and in the VIDA transmission replacement procedure for the AW 4-speed automatic.

The guidelines for flushing coolers on a GM 4165 4-speed automatic are in VIDA/Information/Repair/Transmission, removing and there is a hyperlink in
VIDA/Information/Repair/Transmission, installing for a flushing procedure called Oil cooler; flush cleaning. The guidelines for the 1999-2005 S80 will be updated to match the XC90. More details about these guidelines can be found below.

On a GM 4165 (2003-2005 XC90 16 and 1999-2005 580 6-cyl), if there is:

^ glycol in the transmission fluid (refer to TNN 43-48 for more information on checking for glycol contamination), this would indicate an internal leak in the radiator requiring radiator replacement and flushing of the auxiliary cooler (if applicable) and cooler lines.

^ metal in the transmission fluid, this would indicate an internal transmission problem.

Note!

Metal in the ATF is nearly impossible to flush out completely. In order to be rid of all metal particles, complete replacement of the ATF cooling system (radiator, auxiliary cooler [if applicable], and cooler lines) is required. See photo. Black sediment on the pan magnet is normal. See photo.

^ dirty oil or oil that has surpassed its temperature limits, this would indicate friction component (band or clutch disc) breakdown and in order to be sure all of the debris is out of the ATF cooling system, complete replacement of the ATF cooling system (radiator, auxiliary cooler [if applicable], and cooler lines) is required. See photo.

Labor operation code 43720 should be used when the oil pan is removed for diagnostic purposes. Labor operation code 49115 should be used when the ATF cooling system is flushed, not replaced.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
43720	Sump automatic gearbox remove-install	See VSTG
49115	Oil cooler and piping clean	See VSTG

Warranty Claim Information

Technical Service Bulletin # **230045** Date: **991201**

Canister Purge (CP) Valve - Ticking Noise

Section
2

Group
23

No.
0045

Year
99

Month
12

S40/V40
2000-

Vehicles Involved: B4xx4T2/S2 200-

Canister purge (CP) valve, ticking noise

Background

A ticking noise may be heard from the canister purge (CP) valve. The noise increases in cold weather. A rubber-covered clamp that dampens the noise has been introduced as a service solution.

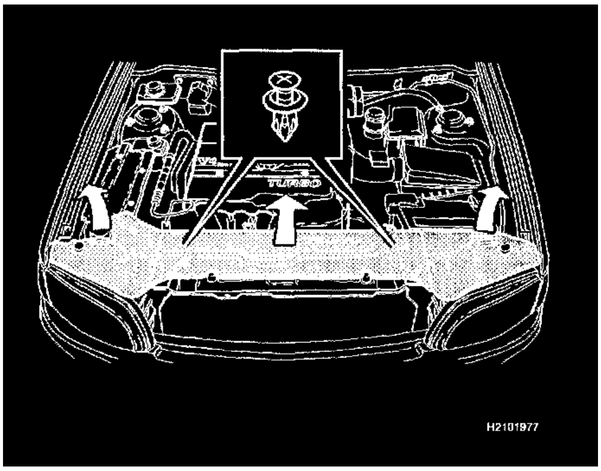
Engine	Model year	Chassis number
B4xx4T2	2000-	415000-

Materials	Number	Replacement part number
Clamp	1	981143

Canister purge (CP) valve, ticking noise

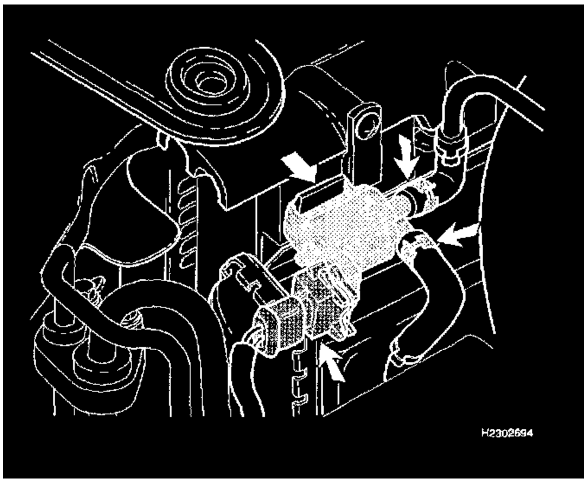
Installing the clamp on the canister purge (CP) valve (turbocharged engines)

1



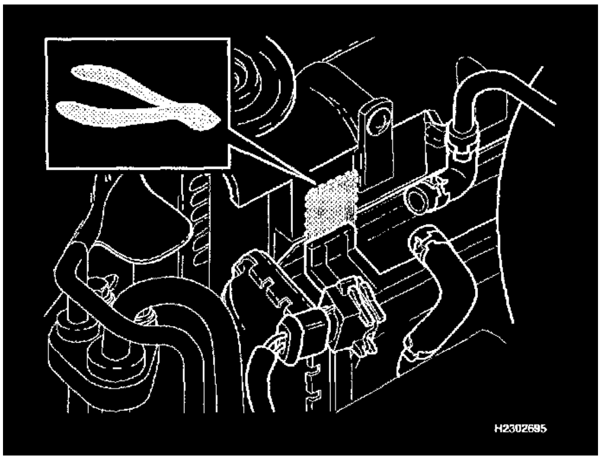
Remove the outer covers.
Remove the inner cover (4 screws)

2



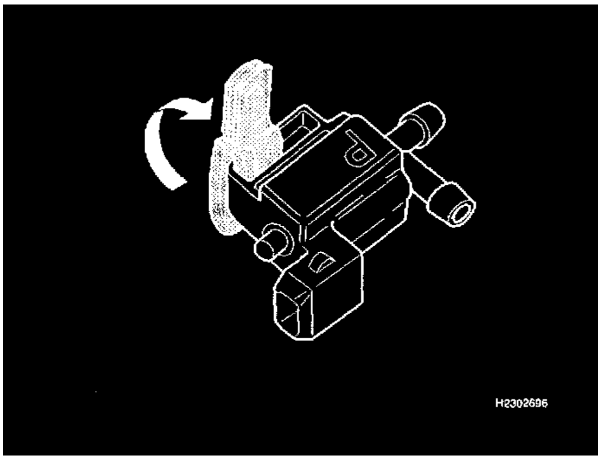
Remove the canister purge (CP) valve from the mounting on the fan shroud.

3



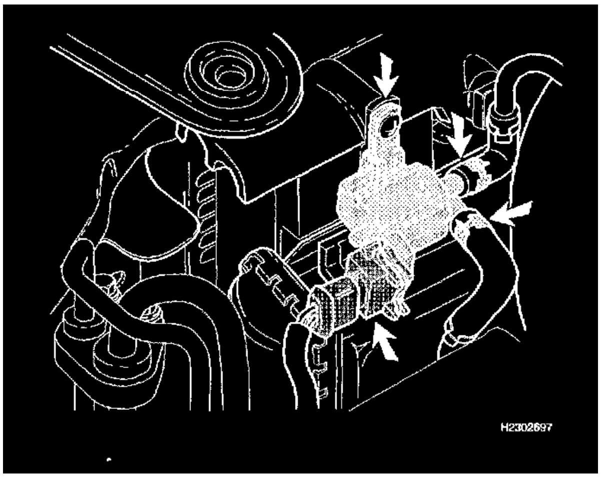
Cut off the mounting for the canister purge (CP) valve to avoid contact with the new mounting.

4



Install the clamp on the canister purge (CP) valve.

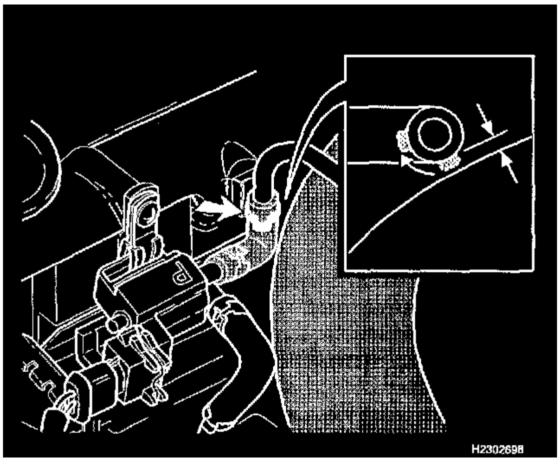
5



Remove the existing screw on the charge air cooler (CAC).
Install the canister purge (CP) valve. Tighten the screw.

6

Check



Check that the clamp is not in contact with the charge air hose. Turn the clamp if necessary.

Install the inner and outer covers

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Operation No.	Labor description	Time allowance
25924-2	Replacing the mounting for the canister purge (CP) valve	0.3hr

Technical Service Bulletin # **230045** Date: **991201**

Canister Purge (CP) Valve - Ticking Noise

Section
2

Group
23

No.
0045

Year
99

Month
12

S40/V40
2000-

Vehicles Involved: B4xx4T2/S2 200-

Canister purge (CP) valve, ticking noise

Background

A ticking noise may be heard from the canister purge (CP) valve. The noise increases in cold weather. A rubber-covered clamp that dampens the noise has been introduced as a service solution.

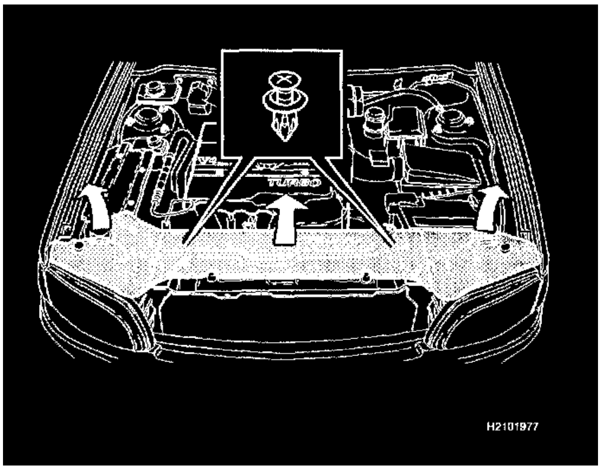
Engine	Model year	Chassis number
B4xx4T2	2000-	415000-

Materials	Number	Replacement part number
Clamp	1	981143

Canister purge (CP) valve, ticking noise

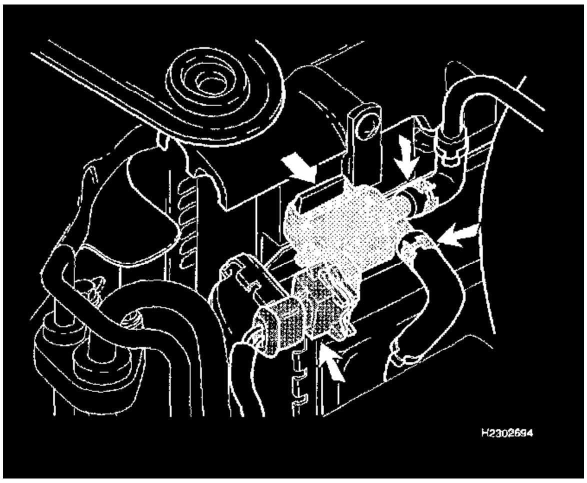
Installing the clamp on the canister purge (CP) valve (turbocharged engines)

1



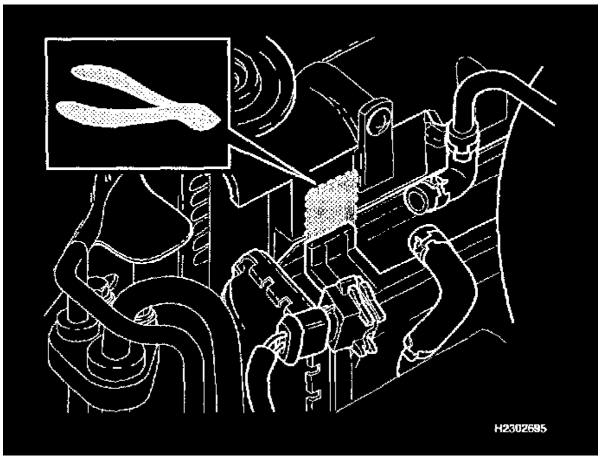
Remove the outer covers.
Remove the inner cover (4 screws)

2



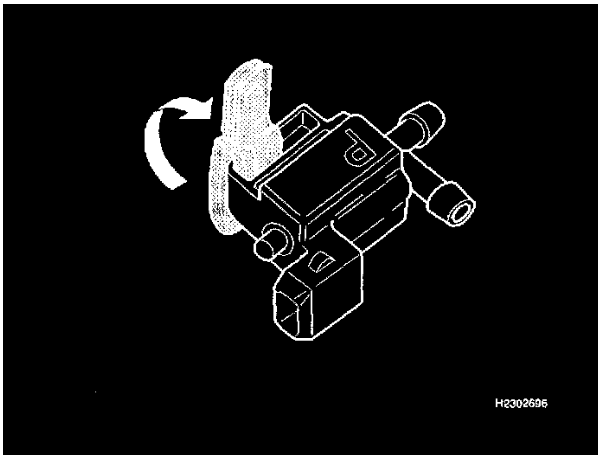
Remove the canister purge (CP) valve from the mounting on the fan shroud.

3



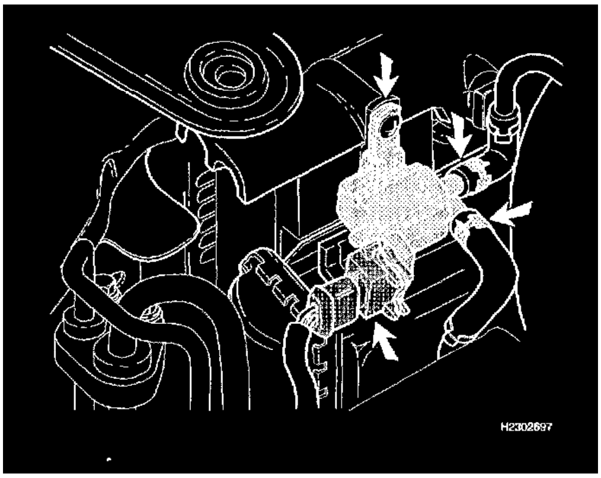
Cut off the mounting for the canister purge (CP) valve to avoid contact with the new mounting.

4



Install the clamp on the canister purge (CP) valve.

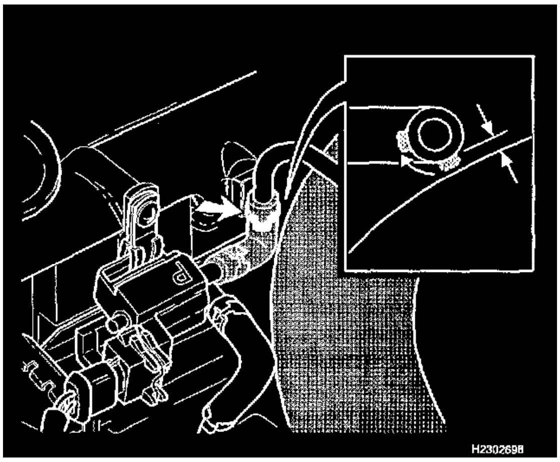
5



Remove the existing screw on the charge air cooler (CAC).
Install the canister purge (CP) valve. Tighten the screw.

6

Check



Check that the clamp is not in contact with the charge air hose. Turn the clamp if necessary.

Install the inner and outer covers

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Operation No.	Labor description	Time allowance
25924-2	Replacing the mounting for the canister purge (CP) valve	0.3hr

Technical Service Bulletin # **TNN37-22** Date: **011130**

TNN37-22 - 11/30/01

This TSB number TNN37-22, dated 11/30/01 has been superceded by TSB number TNN37-22 , dated 12/07/01

Technical Service Bulletin # **TNN37-39** Date: **070321**

TNN37-39 - 03/21/07

This TSB number TNN37-39, dated 03/21/07 has been superceded by TSB number TNN37-39 , dated 03/23/07

Technical Service Bulletin # **TNN20-04** Date: **030922**

TNN20-04 - 09/22/03

This TSB number TNN20-04, dated 09/22/03 has been superceded by TSB number TNN20-04 , dated 01/22/07

Technical Service Bulletin # **TNN40-02** Date: **060621**

TNN40-02 - 06/21/06

This TSB number TNN40-02, dated 06/21/06 has been superceded by TSB number TNN40-02 , dated 12/18/07

Technical Service Bulletin # **TNN30-04** Date: **051011**

TNN30-04 - 10/11/05

This TSB number TNN30-04, dated 10/11/05 has been superceded by TSB number TNN30-04 , dated 10/13/05

Technical Service Bulletin # **TNN25-16** Date: **030725**

TNN25-16 - 07/25/03

This TSB number TNN25-16, dated 07/25/03 has been superceded by TSB number TNN25-16 , dated 07/31/03

Technical Service Bulletin # **88-1A** Date: **990101**

88-1A - 01/01/99

This TSB number 88-1A, dated 01/01/99 has been superceded by TSB number 881A , dated 07/01/00

Technical Service Bulletin # **2230058** Date: **020301**

2230058 - 03/01/02

This TSB number 2230058, dated 03/01/02 has been superceded by TSB number 23109 , dated 05/11/02

Technical Service Bulletin # **2230058** Date: **020501**

2230058 - 05/01/02

This TSB number 2230058, dated 05/01/02 has been superceded by TSB number 23109 , dated 05/11/02

Technical Service Bulletin # **2230052** Date: **001001**

2230052 - 10/01/00

This TSB number 2230052, dated 10/01/00 has been superceded by TSB number 2230052 , dated 11/01/00

Technical Service Bulletin # **890011** Date: **021201**

890011 - 12/01/02

This TSB number 890011, dated 12/01/02 has been superceded by TSB number 8890013 , dated 04/01/04

Technical Service Bulletin # **8850010** Date: **000401**

Power Seats - Minimal Lateral Movement

This TSB number 8850010, dated 04/01/00 has been superceded by TSB number 8850010 , dated 11/01/01

Technical Service Bulletin # **TNN39-51** Date: **051010**

Audio System - CD Stuck in Audio Unit

This TSB number TNN39-51, dated 10/10/05 has been superceded by TSB number TNN39-51 , dated 04/16/08

Technical Service Bulletin # **TNN36-53** Date: **051219**

Keyless Entry - Intermittent Remote Operation

This TSB number TNN36-53, dated 12/19/05 has been superceded by TSB number TNN36-53 , dated 01/19/07

Technical Service Bulletin # **88-1A** Date: **000101**

Seat Belt Extender - Front Seat Only

This TSB number 88-1A, dated 01/01/00 has been superceded by TSB number 881A , dated 07/01/00

Technical Service Bulletin # **23109** Date: **020408**

Recall - EVAP System/ECM Software Upgrade

This TSB number 23109, dated 04/08/02 has been superceded by TSB number 23109 , dated 05/11/02

Technical Service Bulletin # **TNN40-02** Date: **070212**

A/T, Engine Controls - Software Upgrades

This TSB number TNN40-02, dated 02/12/07 has been superceded by TSB number TNN40-02 , dated 12/18/07

Technical Service Bulletin # **TNN40-02** Date: **060925**

Engine/A/T Controls - ECM/TCM Upgrade for Various Issues

This TSB number TNN40-02, dated 09/25/06 has been superceded by TSB number TNN40-02 , dated 12/18/07

Technical Service Bulletin # **TNN40-02** Date: **060707**

Engine, A/T Controls - DEM and TCM Software Updates

This TSB number TNN40-02, dated 07/07/06 has been superceded by TSB number TNN40-02 , dated 12/18/07

Technical Service Bulletin # **2198** Date: **000301**

Campaign - Oil Filler Grate Inspection, Removal

This TSB number 2198, dated 03/01/00 has been superceded by TSB number 2198 , dated 04/01/00

Technical Service Bulletin # **TNN21-21** Date: **050729**

Engine - Runs Rough/MIL ON/Misfire DTC's Set

This TSB number TNN21-21, dated 07/29/05 has been superceded by TSB number TNN21-21 , dated 08/15/05

Technical Service Bulletin # **TNN21-21** Date: **050708**

Engine - Rough Idle/Misfire DTC's/Low Power/MIL ON

This TSB number TNN21-21, dated 07/08/05 has been superceded by TSB number TNN21-21 , dated 08/15/05

Technical Service Bulletin # **TNN21-21** Date: **050512**

Engine - MIL ON/Misfire DTC's Set/Rough Idle/Low Power

This TSB number TNN21-21, dated 05/12/05 has been superceded by TSB number TNN21-21 , dated 08/15/05

Technical Service Bulletin # **2220005** Date: **991201**

Piston Cooling Valve - Replacement

This TSB number 2220005, dated 12/01/99 has been superceded by TSB number 2220005 , dated 11/01/00

Technical Service Bulletin # **TJ19425** Date: **080620**

Vehicle - Type and Platform Identification

Retailer Technical Journal 19425

Vehicle type and platform identification

Date: 06-20-2008

Note!

If using a printed copy of this Retailer Technical Journal, first check for the latest online version.

Background:

In our Service Literature, a vehicle is often referred to by its "type", not its "model".

For example: The S80 is type "184". You may also see the designation. For example: "P2X". This is referring to a platform type or vehicle family.

PLATFORM	MODEL (badged)	TYPE	MODEL YEARS	COMMENTS
P1X	S40	544	2004-	
	V50	545	2005-	
	C30	533	2008-	
	C70	542	2006-	
P2X	S80	184	1999-2006	
	V70	285	2001-2007	
	XC70	295	2007-2007	
	S60	384	2001-	
	XC90	275	2003-	
P3X				
	S80	124	2007-	
	V70	135	2008-	
	XC70	136	2008-	
	XC60	156	2010-	
40 series (nedcar)				
	S40	644	2000-2004	
	V40	645	2000-2004	

PLATFORM	MODEL (badged)	TYPE	MODEL YEARS	COMMENTS
900 series	940	944	1991-1995	four cylinders, four door
	940	945		four cylinders, five door
	960/V90	965	1992-1998	six cylinders, five door; badged V-90 in 1998
	960/S90	964	1992-1998	six cylinders, four door; badged S-90 in 1998
800 series	850	854	1993-1997	five cyl, four door
	850	855	1994-1997	five cyl five door
	S70	874	1998-200	four door
	V70	875	1998-2000	five door
	XC70	876	1998-2000	Cross Country
	C70	872	1998-2002	Coupe
	C70	873	1998-2004	Convertible
700 series	740	744	1985-1992	four cyl, four door
	740	745	1985-1992	four cyl, five door
	760	764	1983-1990	four or six cyl, four door
	760	765	1985-1990	four or six cyl, five door
	780	782	1987-1991	"Bertone" four or six cyl 2 door coupe
200 series	242	242	1975-1984	four cyl, 2 door
	244	244	1975-1993	four cyl, four door
	245	245	1975-1993	four cyl, five door
	262	262	1976-1981	six cyl two door and "Bertone"
	264	264	1976-1982	six cyl, four door
	265	265	1976-1982	six cyl five door
100 series	142	142	1967-1974	four cyl, two door
	144	144	1967-1975	four cyl, four door
	145	145	1967-1976	four cyl, five door
	164	164	1968-1974	six cylinders, four door

The charts will help to clarify the vehicle type and platform designations.

Technical Service Bulletin # **00202** Date: **010719**

Policy - Service Upgrade Campaigns

GROUP:
00

NO:
202

ISSUING DEPARTMENT:
Warranty

CAR MARKET:
U.S. and Canada

DATE:

YEAR	MONTH	DAY
2001	07	19

TITLE:
Service Upgrade - New Campaign Category

BULLETIN REFERENCE

A. SERVICE UPGRADE CAMPAIGN DESCRIPTION

A. SERVICE UPGRADE CAMPAIGN DESCRIPTION

A Service Upgrade repair will be performed when Volvo Cars of North America and Volvo Cars of Canada Ltd. decide to provide a revision or upgrade to a vehicle. Vehicles eligible for this type of upgrade are, model year 2000 and newer. The Warranty and Service Records Information booklet (MY00 and MYO1 - pages 8 and 64) provides specific information on this type of repair coverage. The specific repair should be made at the customer's next visit to an authorized Volvo retailer, regardless of whether a customer complaint is received.

Service Upgrades will not be used to perform safety-related or emission-related inspections and/or repairs.

B. VEHICLE ELIGIBILITY

Vehicle eligibility can only be determined by referring to the VEN-WARRANTY INQUIRY (DCS INQUIRY) screen. Announcement of a Service Upgrades will be via DCS-Gram and service literature (Service Bulletin, Service Manager Bulletin, and Parts Bulletin) posted on the VEN Intranet.

C. PARTS INFORMATION

There will not he a parts allocation for Service Upgrade Campaigns. Volvo will, however, continue to ensure that the necessary parts quantities are available in distribution centers prior to launching a Service Upgrade Campaign

D. OWNER NOTIFICATION

Owners of vehicles that qualify for a Service Upgrade will not receive a notification letter. It will be the responsibility of the retailer to check DCS Inquiry and inform the customer of the vehicle's eligibility. In all instances, the retailer must reference the upgrade on the repair order (R.O.). The Service Manager Bulletin for each Service Upgrade will contain the recommended reference to be included in the R.O.

E. VEHICLES IN RETAILER INVENTORY

The upgrade should be completed on all qualifying vehicles in the retailer's inventory and prior to a customer taking possession of the vehicle.

F. RETAILER RESPONSIBILITY

Retailers are to perform Service Upgrades on eligible vehicles regardless of mileage/kilometers or vehicle age. The Service Upgrade campaign work is free of charge to the owner.

G. CAMPAIGN REIMBURSEMENT PROCEDURES

As with other VCNA campaigns, Service Upgrade campaigns will be completed at no cost to the customer. Reimbursement procedures will be outlined in the published Service Manager Bulletin associated with the Service Upgrade campaign.

Technical Service Bulletin # **00-196** Date: **000101**

Vehicle - Service Information Strategy

GROUP:
00

NO:
196

DATE:
JANUARY 2000

TITLE:
Service Information Strategy

In an effort to minimize confusion when it comes to finding repair information, we thought it would be helpful to point out the strategy behind Volvo Service information. When looking for a repair or diagnostic method, there are three places to look, in the following order:

TECH NET NOTES (in Canada: Tech DCS Grams)
Tech Net Notes/ Tech DCS Grams provide the latest service information developed by VCNA in Rockleigh. These bulletins (different in format only) are intended to provide fast, brief information about a product issue. Usually, unless the information is very short-lived. Tech Net Notes/ Tech DCS Grams are usually replaced by Service Bulletins.

For retailers already up and running on VEN Stage II, check out Tech Net Notes on the Retailer Intranet on VEN (Volvo Enterprise Network), found on your networked VADIS cart. Hit the Service button, then click on Technical Service Information.

HINT

Want to be really up to date? Get in the habit of hitting the "What's New " button in the VEN Retailer Intranet Home Page every morning to see information posted within the last 10 days.

SERVICE BULLETINS

This is global service information developed by Volvo Cars in Sweden. It provides more detailed and thorough information than Tech Net Notes. Service Bulletins are distributed in paper form and via the Technical Service information icon on the VEN Retailer Intranet.

VADIS

This is global service information developed by Volvo Cars in Sweden. It is updated via CDs approximately seven (7) times per year. This is the official service information source which has replaced service manuals (on MY99 and later cars) It has the advantage of being updated more frequently, but you must remember to update your system with the latest CD as soon as it arrives!

These avenues of information have been established in an effort to provide you with repair and diagnostic information needed to repair cars right the first time. Of course, it is also important that technicians have had the appropriate technical training for the vehicle and systems they are working on.

For especially difficult to diagnose problems, if you cannot find what you need in the areas described above, you can turn to the Volvo Technical Hotline at 1-800-500-5570.

However, call the hotline only of the technical has had the appropriate technical training and after you have checked in the areas described above, otherwise too many unnecessary calls only result in long wait times to speak with a hotline specialist.

HINT

Check out the Tech Hotline area under the Technical Service Information button VEN, there you can find the pre-call-in form, FAQs (Frequently Asked Questions) and other hotline information. FAQs may help eliminate your need to call!

Other information available on VEN under Technical Service Information:

SPECIAL TOOL BULLETINS

Information on new mandatory Volvo Special Tools, and modifications to existing special tools are published in Special Tool Bulletins.

SERVICE MANAGER BULLETINS

Information intended for Service Managers regarding service and warranty policies, service campaigns and recalls.

VADIS Information

Contains information and hints about VADIS CD releases, news, quick reference guide, etc.

Technical Service Bulletin # **2230050** Date: **000301**

Tools - Fuel pressure EMS 2000, measuring/fualt tracing

Bulletin:
2230050

Group:
23

Date:
03/01/2000

Fuel pressure EMS 2000, measuring/fault tracing

Models:
S40/V40
2000-

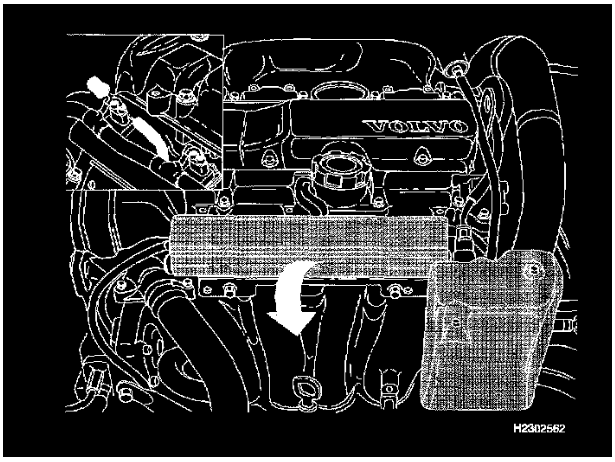
Tools

Description	Quantity	Part No.
Fuel Pressure Gauge	1	9995011
Vacuum/Pressure Pump	1	9995757
Fuel Pressure Adapter Hose (Kent Moore item, ref. STB 97)	1	J-41031-A

Fuel pressure EMS 2000, measuring Measuring fuel pressure EMS 2000

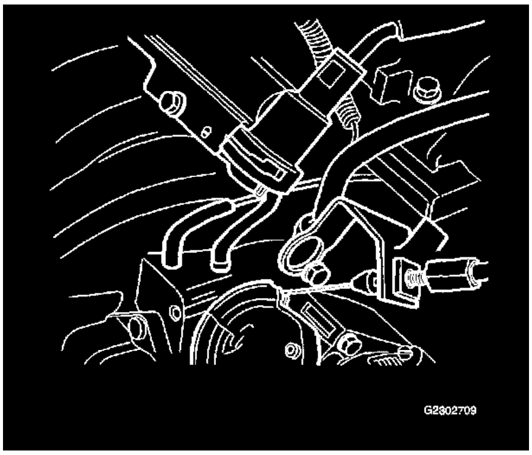
Removal

Remove:



- The cover over the throttle pulley.
- The aluminium plate, (on turbocharged engines).
- The protective cap on the Schrader valve.

Checking the vacuum system:



Disconnect the vacuum hose from the pressure regulator and the intake pipe.

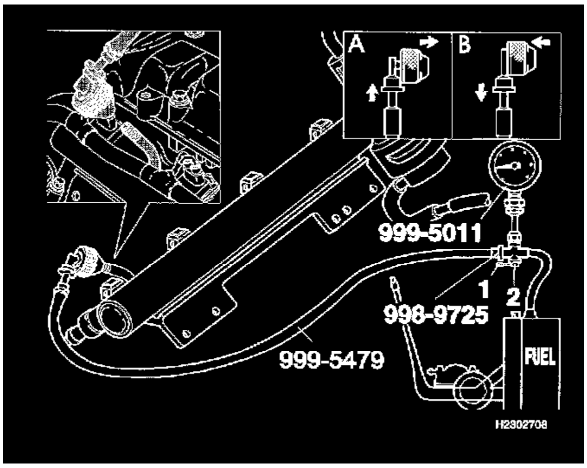
Check that the vacuum hose is undamaged and not clogged.

Replace the front pressure regulator if there is fuel in the vacuum hose.

Check the vacuum hose nipple on the intake pipe, clean if necessary.

Continue with "Connect the test equipment" (3).

Connect the test equipment:



Assemble 999-5011 and 998-9725 with J-41031-A

Avoid fuel spillage.

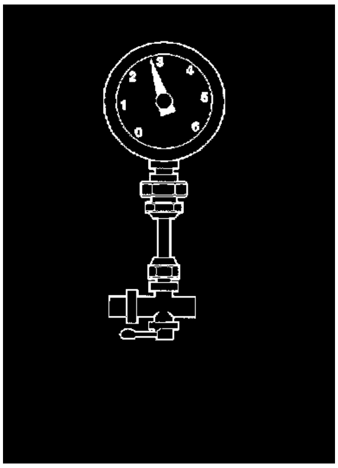
Connect the open end of the hose from the fuel gauge to the fuel draining unit.

Warning: Secure the hose onto the fuel draining unit to prevent fuel leakage

Screw nipple J-41031-A into place on the Schrader valve.

Hang the gauge on the hood catch or the safety catches. Turn the cock to position (1).

Fuel pressure measurement:



Note: Note the measurement value at this step.The result might be needed as a reference in step 12.

Disconnect the vacuum hose from the pressure regulator.

Note: Position the gauge so that the movement of the needle can be read when the engine is started.

Start the engine.

The pressure should rise to approximately 309 kPa (45psi) immediately.

If the pressure is correct, continue measuring the "Front pressure regulator" (5) or (6).

A: The pressure rises slowly to the correct pressure:

Switch off the engine.

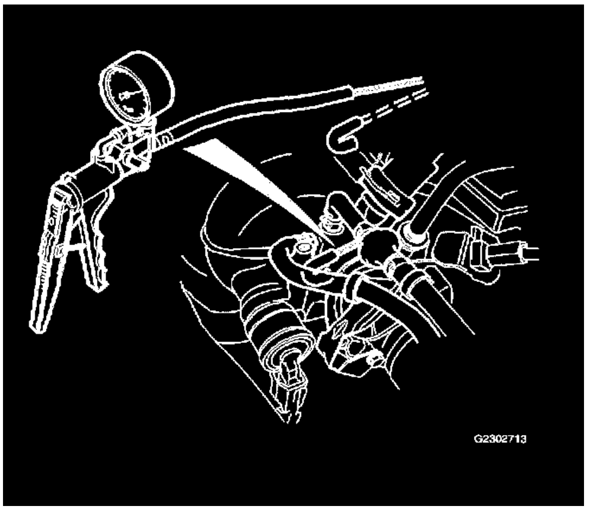
Continue with " Check the rear fuel pressure" (8).

B: Too low or too high pressure.

Switch off the engine.

Continue with " Check the rear fuel pressure" (8).

Front pressure regulator, B4XX4T



Caution! When applying vacuum or pressure to the regulator, do not exceed the pressure values stated. Damage to the diaphragm in the regulator may occur.

Connect pump 999 5757 to the regulator.

Pump up a vacuum.

The pressure reading should go down.

Fuel pressure must not be lowered below 240 kpa.

Release the vacuum.

The pressure should rise to approximately 309 kPa immediately.

Pump up the pressure.

The pressure reading should go up.

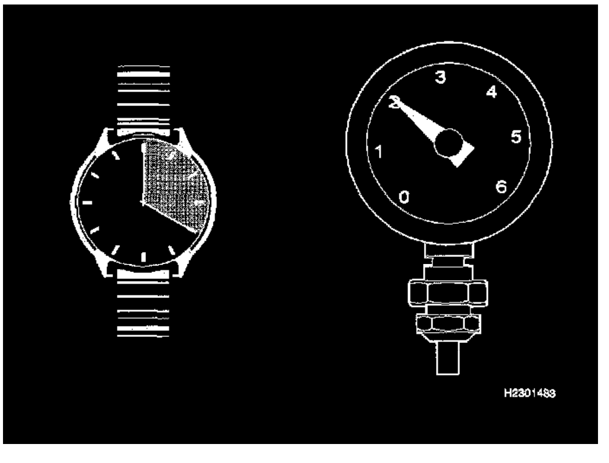
Fuel pressure must not be raised above 380 kPa

Release the pressure.

The pressure should return to approximately 309 kPa immediately.

Continue with "Check the residual pressure"(7). If the pressure regulator is not functioning correctly, replace the front pressure regulator.

Checking the residual pressure:



The starting pressure is 309 kPa

Switch off the engine.

Note the time.

The fuel pressure must not be lower than 200 kPa for 20 minutes.

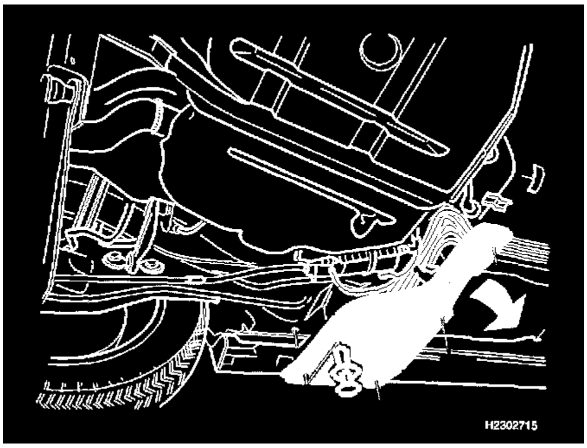
Hint: Too low residual pressure can be caused by leakage in the injectors, the check valve in the fuel pump or leakage in the pressure regulators.

Remove the test equipment from the car. Return the equipment to the tool board.

Reinstall the removed components and the cap on the Schrader valve.

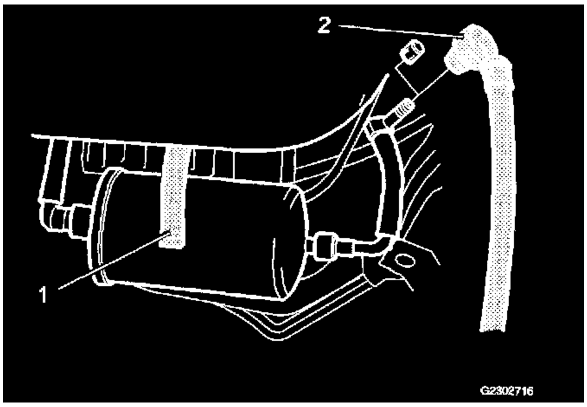
Note! The rear fuel pressure measurement test must only be carried out if the result of step 4 is in accordance with A or B.

Raise the car.



Remove the guard.

Warning! The fuel filter must not hang from the fuel lines during this test. Secure the fuel filter using tie straps.



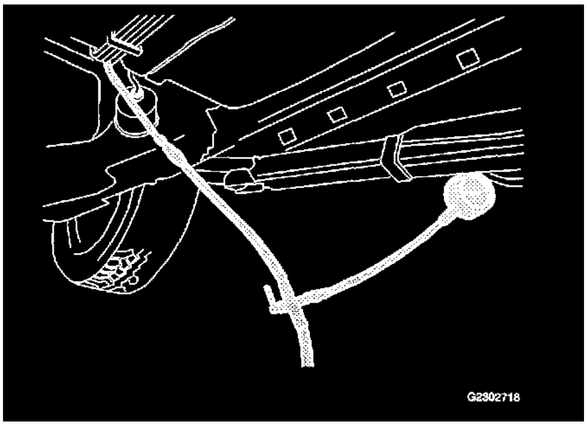
Slacken off and open the clamp for the fuel filter (1)

Carefully work the filter downwards.

Remove the cap on the Schrader valve.

Screw nipple J-41 031-A (2) into place on the Schrader

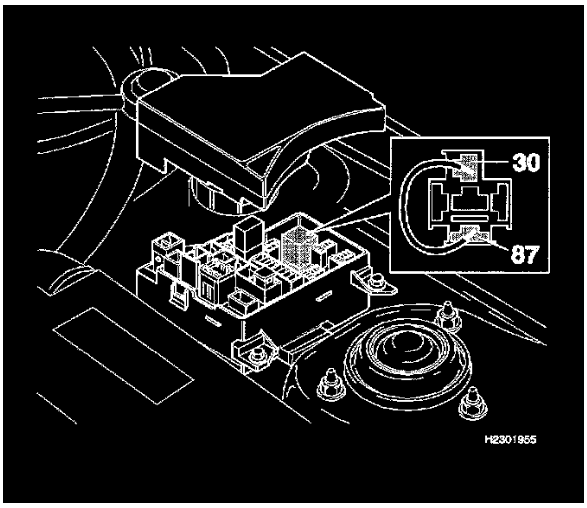
valve, see 3.



Note: Hang the pressure gauge so that the value can be read off easily when the car has been lowered.

Lower the car.

Starting the fuel pump (FP)

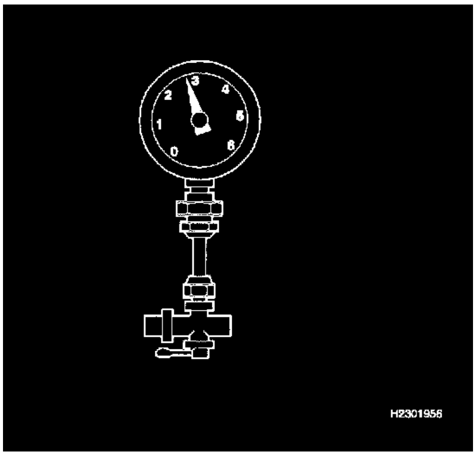


Remove relay 2/14.

Make up a bridging cable.

Bridge terminals 30 and 87. The fuel pump (FP) starts.

Rear fuel pressure:



The pressure must rise to approximately 430 kPa immediately.

If the rear fuel pressure is incorrect, replace the rear pressure regulator which is integrated in the fuel pump (FP).

If the rear fuel pressure is correct and the fuel pressure is incorrect in step 4, select the fault tracing path. See note below.

A: The rear fuel pressure is normal but in step 4 rose slowly to appr. 309 kPa. Check if the fuel line is damaged or pinched. It the fuel line is intact, replace the fuel filter.

The fault Is remedied.

B: The rear fuel pressure is normal but in step 4 the pressure immediately rose to a too low/high value. Replace the front pressure regulator.

The fault is remedied.

Disconnect the test equipment.

Reinstall the components in reverse order.

Operation No.	Labor description	Time allowance
23811-3	Fuel pressure EMS 2000, measuring/fault tracing	0.5 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN43-48** Date: **051220**

A/T - Engine Coolant Contamination Detection

NO: 43-48

DATE: 12-20-2005

MODEL:
All Models with Automatic Transmissions

SUBJECT:
Coolant contamination in automatic transmissions

BACKGROUND:

The root cause for some automatic transmission failures is glycol contamination from the engine cooling system. Severe cases of contamination are easy to detect by a visual inspection: The transmission oil will have a milky appearance and there may be signs of oil in the coolant reservoir. Less severe cases are impossible to detect without doing a chemical analysis of the transmission oil. This slight contamination is easy to overlook and will result in a repeat transmission failure.

A small leak from the cooling system into the transmission can cause driveability problems long before there are any visual signs of contamination.

MATERIAL:

When used correctly, the following kit will accurately detect even very low levels of glycol contamination in transmission oil. The kit is not available as a Volvo spare part or tool, but can be purchased directly from the manufacturer. Each kit includes material to test 10 transmissions.

Nelco Company LLC
Glyt-Tek Test Kit
1047 McKnight Rd S
Saint Paul MN 55119
Phone: 651.738.2014
Fax: 651.738.9447
E-mail: Cvnelco@aol.com
mwww.aviceda.comlne/colindex.htm

SYMPTOMS OF COOLANT CONTAMINATION:

The most common symptom of coolant contamination is shudder; a high frequency vibration.

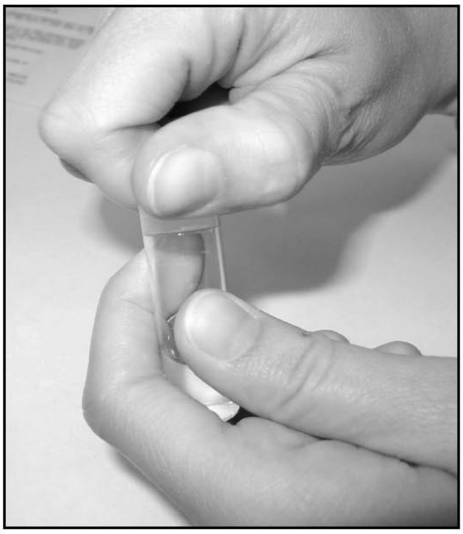
^ On AW55 transmissions, the shudder normally occurs while in torque converter slipping lock-up mode. It is most easily reproduced by driving slightly uphill at about 40 MPH in 4th or 5th gear with light pedal at 50-70°C transmission oil temperature.

^ On the GM4T65 transmission, the shudder normally occurs during upshifts.

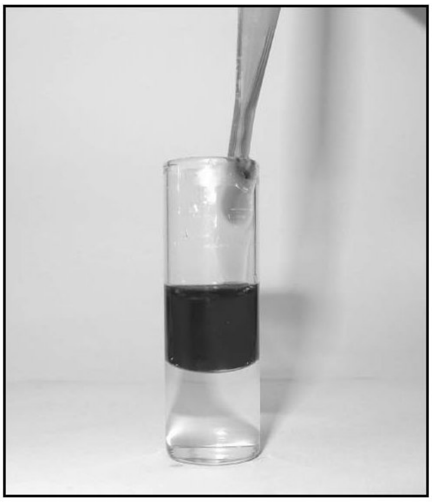
^ On all transmissions, other symptoms such as harsh shifts, slipping, loss of drive, etc..., are also possible.

TESTING FOR GLYCOL CONTAMINATION:

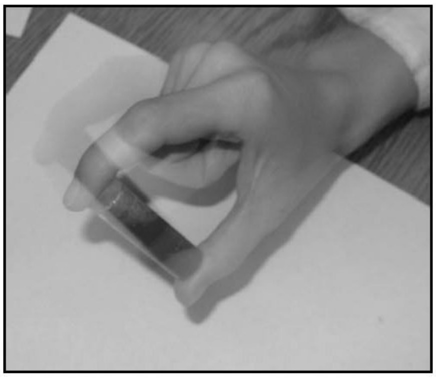
1. Let the vehicle sit for several minutes. Using a clean bottle, take a small sample of oil from the sump via the drain plug.



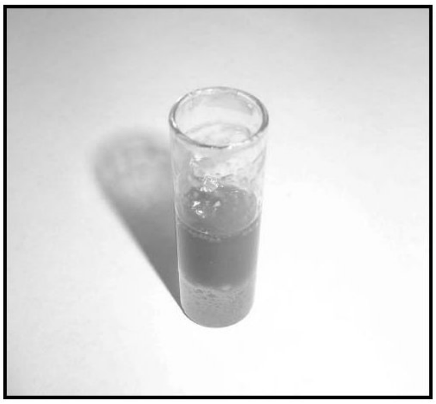
2. Open one vial. Twist the cap while removing it. Do not use the one with the red cap (it is a sample already containing glycol).



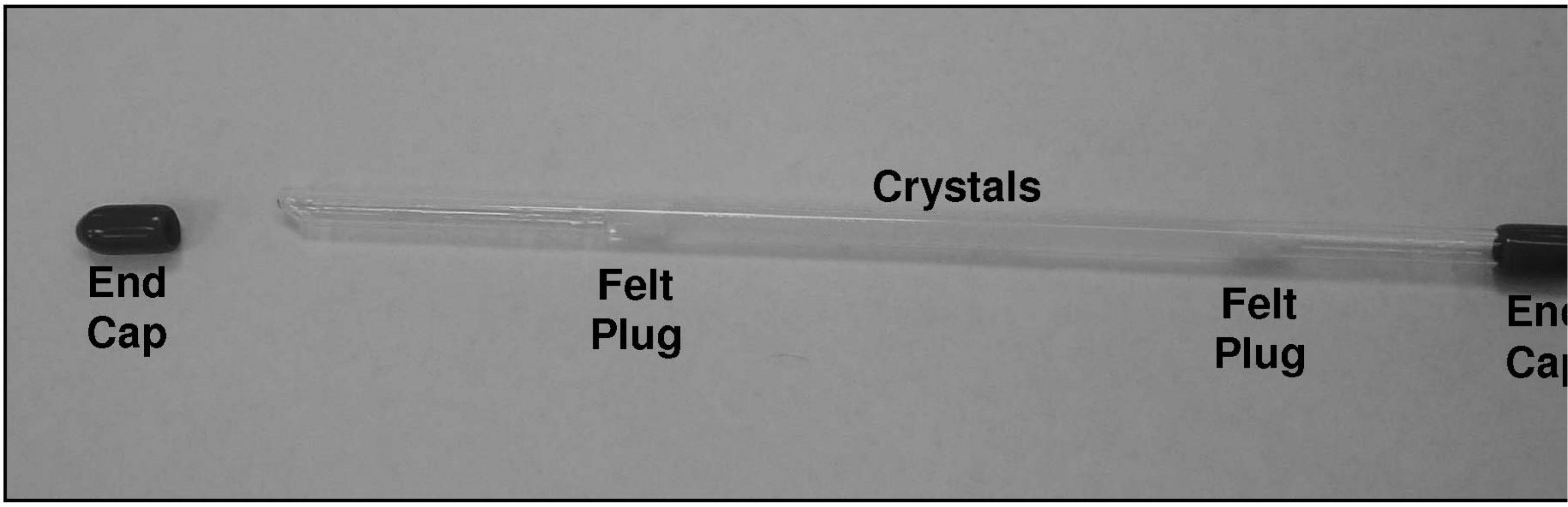
3. Using a new syringe, add oil to the vial. The vial should now have about 50% oil, 50% clear liquid.



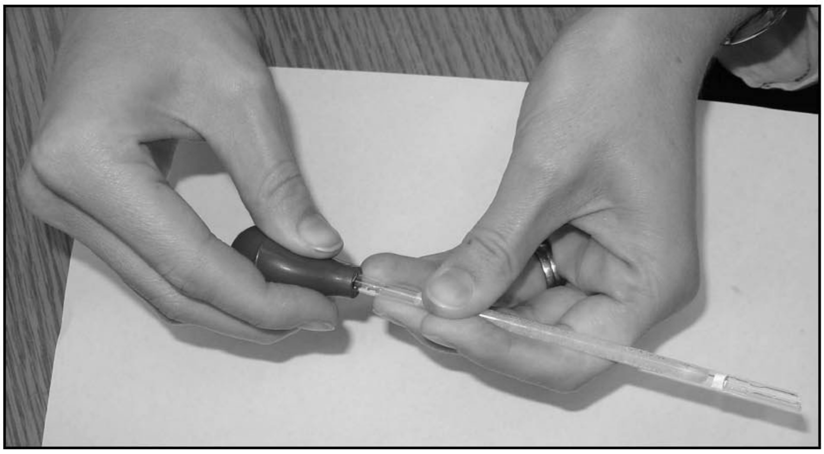
4. Cap the vial and shake it vigorously for 20 seconds.



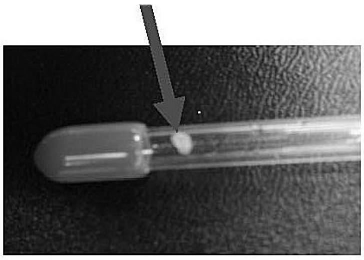
5. Remove the cap and let the vial sit until the liquids separate.



6. Remove the red caps from both ends of one glass tube. Note that for the remaining steps (7-1 2), care must be taken not to allow the crystals or felt plugs from coming out of the tube.

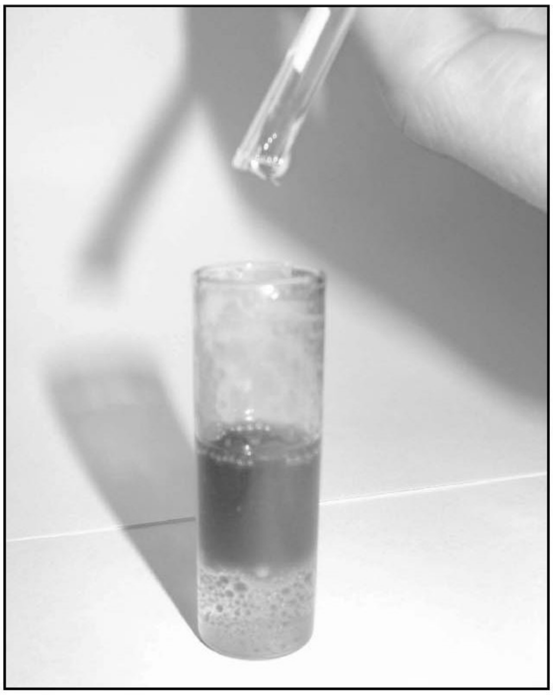


7. Protect your eyes and hands from any small pieces of glass by wrapping the tube in a paper towel. While holding the tube horizontally, break off both ends at the score marks.

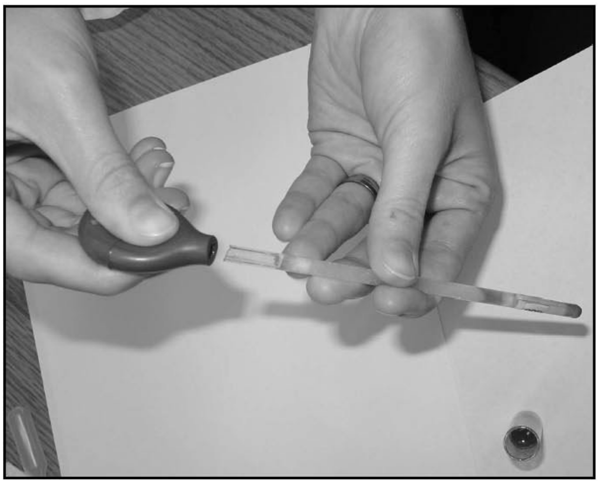


8. While holding the tube horizontally, install the rubber bulb onto one end. Twist it while pushing it on.

9. While holding the tube horizontally, slowly squeeze the bulb to remove the majority of the liquid from the crystals.



10. With the bulb squeezed, insert the open end of the tube into the bottom of the vial (through the oil, into the clear liquid).

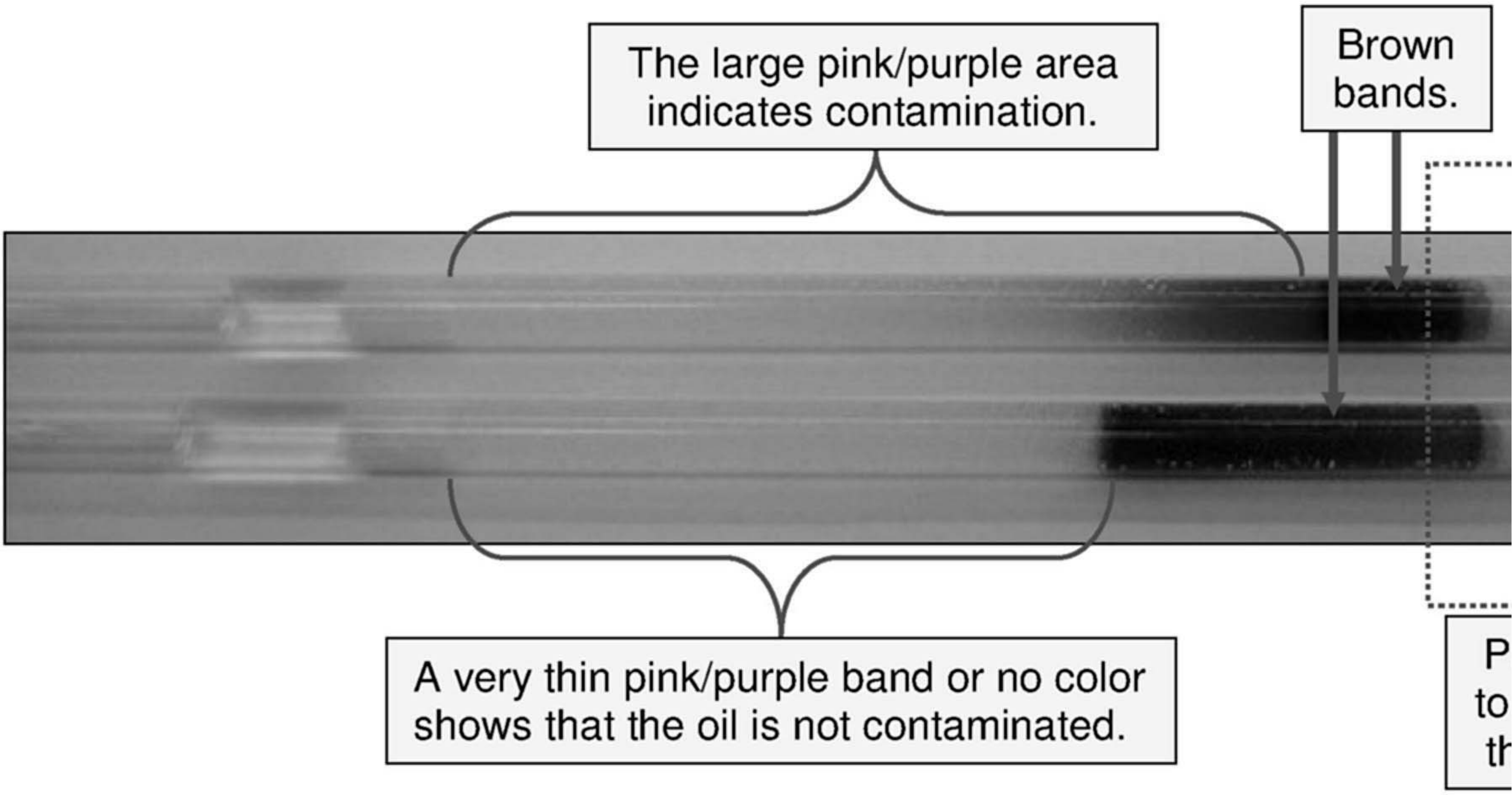


11. Slowly release the bulb to draw liquid into the tube. Stop when the liquid is just past the top felt plug and remove the bulb. Do not draw

liquid into the rubber bulb, as it will need to be kept clean for future tests.

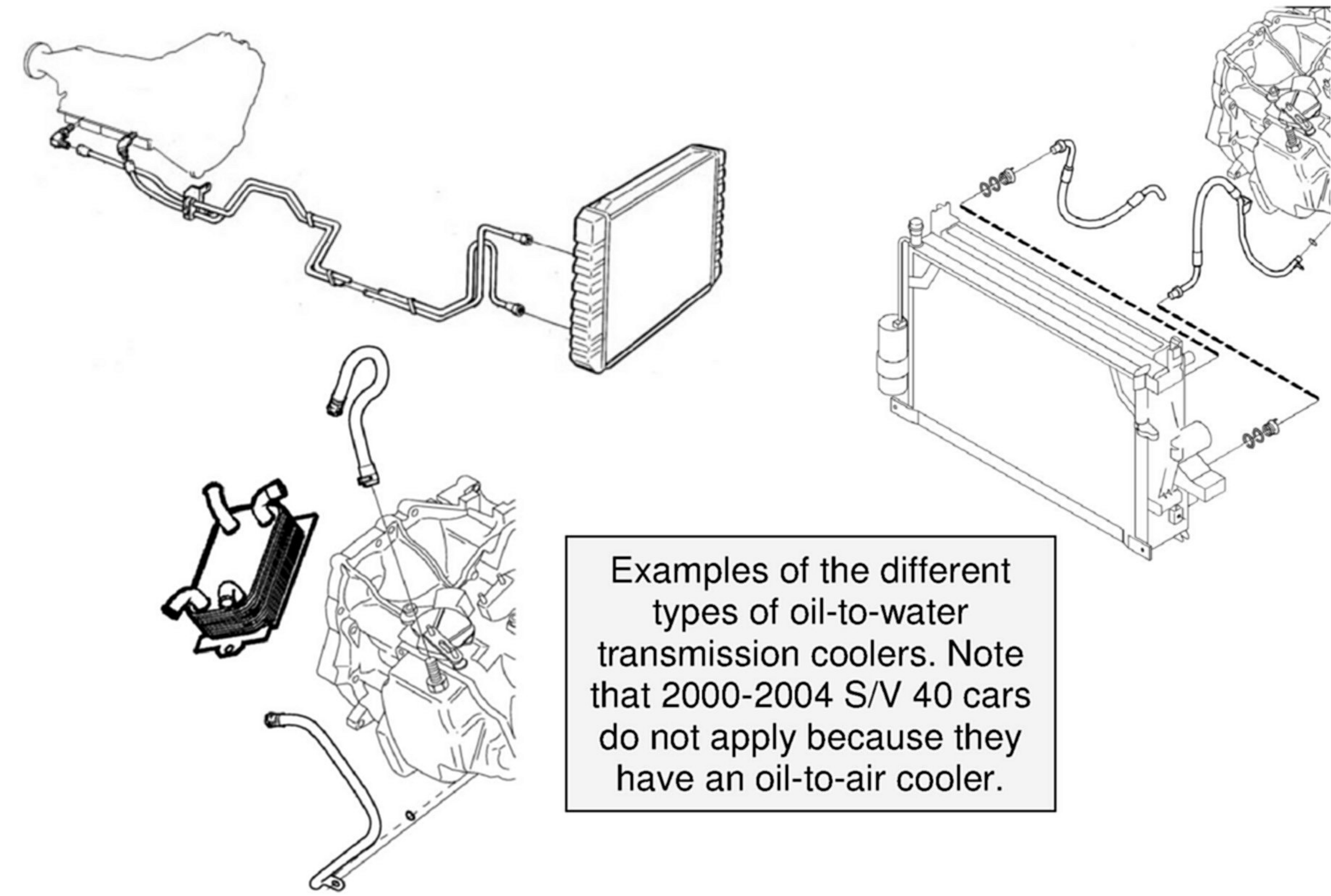
12. Immediately lay the tube down flat and let it sit for 15 minutes.

ANALYZING THE RESULTS:



After the tube has been laying flat for 15 minutes a brown band will have formed in the crystals above the bottom felt plug. A large pink/purple area above this brown band indicates the presence of glycol. A very thin pink/purple band or no color above this brown band shows that the oil is not contaminated.

SERVICE:



If the sample tests positive for glycol, the transmission and cooler will need to be replaced. The cooler hoses will need to be flushed with clean transmission oil.

In the event of needing to test for coolant contamination as part of a warranty repair, the following labor and part description can be used. Any radiator replaced under warranty for this issue must be returned to IMA for analysis via the routine specified on pages 4-6 of Service Manager Bulletin 00-170.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
04732-6	Coolant Contamination Test	0.2 hr
MATERIAL PART NUMBER	**MATERIAL DESCRIPTION**	**COST**
16	Test Kit	1/10th of the kit cost ($7)

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY CLAIM INFORMATION Technical Service Bulletin # **TNN21-21** Date: **050815**

Engine - Runs Rough/MIL ON/Misfire DTC's/Low Power

NO: 21-21

DATE: 8-15-2005

MODEL/CHASSIS: See Table Below

M.YEAR: 2004

SUBJECT:
Engine may have a rough idle, DTC ECM misfire codes, rough running or lack of power.

REFERENCE:

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

VADIS/VIDA

This tech note supersedes the previous 21-21 dated 7-29-05. Please update your files. Update to LABOR OPS - correction is shown with bold text.

Type	Chassis Range
S40 / V40	080000 - 125313
S40 (04-)	004506 - 025161
S60	386580 - 411538
C70	048000 - 050951
V70	416073 - 442589
XC70	151672 - 166901
S80	367089 - 379386
XC90	088045 - 119869

Worn valve face

Affected Vehicles Table

DESCRIPTION:

The Customer may have a complaint of a rough idle, rough running, lack of power or the MIL on.

SERVICE:

^ Read out DTC's

^ Check compression and do a leak down test with the engine cold.

^ Check valve clearance on the cylinders with low compression.

^ Remove the cylinder head and check the condition of the valve face.

^ If the valve face is worn, replace ALL the intake valves, even if some look okay.

^ Use ONLY intake valves with P/N 30637059.

Material **B4204Tx**	Quantity	Part No.
Intake valve	8	30637059
Valve seals, Service kit	1	274344
Gasket	1	9404725
Screw	10	6842347
Gasket	1	11996
Cover	1	1397381
Seal ring	1	9440651
Seal ring	1	9458309
Seal ring	1	9443310
Seal ring	4	1397525
Flange screw	3	975207
Flange screw	1	968163
Gasket	1	1236119
O-ring	1	976045
Gasket	1	1366787
Hose clamp	1	978177
Hose clamp	1	976561
Gasket	2	947282
Gasket kit	1	272461
Sems nut	8	982297
Lock nut	4	977209
Gasket	1	8642277
Gasket	6	947282
Gasket	1	3514546

Material **B5244Sx (New S40)**	Quantity	Part No.
Intake valve	10	30637059
Valve seals, Service kit	1	274344
Gasket	1	8642629
Screw	12	6842347
Gasket	1	11996
Seal ring	5	1397525
Seal ring	2	30612805
Seal ring	2	1275365
Cover	2	1397381
Flange screw	4	968881
Flange screw	2	30683684
Flange screw	2	965227
Gasket	1	8699467
Flange nut	12	948645
Gasket	1	1270505
Flange nut	4	945408
Gasket	1	30677525
Gasket	5	30637438
Hose clamp	1	978172

Material **B5254Tx (New S40)**	Quantity	Part No.
Intake valve	10	30637059
Valve seals, Service kit	1	274344
Gasket	1	30637067
Screw	12	6842347
Gasket	1	11996
Valve lifter	1	274150
Seal ring	5	1397525
Seal ring	2	30612805
Seal ring	2	1275365
Cover	2	1397381
Plug	2	8699496
Flange screw	4	968881
Flange screw	**2**	**30683684**
Flange screw	2	965227
Gasket	1	8699467
Flange nut	12	948645
Gasket	4	947621
Hose clamp	1	978173
Washer	12	419401
Gasket	1	30677190
Flange screw	3	30614458
Gasket	2	947621
Gasket	1	30637800
Gasket	1	30650074
Gasket	5	30637438
Gasket	2	11994
Hose clamp	1	976561

Material **B52x4Tx**	Quantity	Part No.
Intake valve	10	30637059
Gasket	1	9458534
Gasket	2	30731212
Gasket	1	11996
Gasket B5254T2 s/n -2979610	1	30637336
Gasket B5254T2 s/n 2979611-	1	30637066
Gasket B5244T3	1	9404726
Gasket B5204T5, B5234T3/T7, B5244T4/T5	1	9443896
Screw	12	6842347
Valve lifter kit	1	274150
Valve seals, Service kit	1	274344
Seal ring	5	1397525
Cover	1	1397381
Seal	1	9443310
Seal	1	9458309
Seal	1	9440651
Hose clamp	2	989879
Hose clamp	2	978171
O-ring	1	976045

Gasket, **All turbochargers except B5254T4, B5244T4/T5**	4	947282
Gasket **B5254T4, B5244T4/T5**	2	947282
Gasket **B5254T4, B5244T4/T5**	2	947621
Gasket	1	1236119
Clamp	1	976561
Screw	2	946934
Gasket	4	947282
Cable tie	2	983750
Flange nut	2	945408
Flange nut	10	948645
Gasket	1	9179056
Gasket	1	8642449
Gasket kit	1	271802
Gasket	1	8642450
Lock nut	7	977209
Seal ring	1	30637866
Gasket, **All turbochargers except B5254T4, B5244T4/T5**	1	3514546
Gasket **B5254T4, B5244T4/T5**	1	30650296
Gasket	2	947282
Gasket	2	18671
Clamp	1	989879

Material **B52x4S**	Quantity	Part No.
Intake valves	10	30637059
Valve seal kit	1	274344
Gasket	1	11996
Screw	12	6842347
Valve lifter kit	1	274150
Gasket	1	9404726
Gasket	1	9463274
Gasket kit	1	271802
Flange nut	10	948645
Gasket	1	8627203
Flange nut	4	945408
Seal ring	5	1397525
Gasket	1	30731212
Hose clamp	1	978180
Hose clamp	1	978173
Seal ring	1	9443310
Seal ring	1	9440651
Seal ring	1	9458309
Cover	1	1397381
Hose clamp	1	978165
Gasket	2	947282
Gasket	1	9458534
Flange screw	2	946934
Band clamp	2	983750

Material **B6294T**	Quantity	Part No.
Intake valves	12	30637059
Valve seal kit	1	274344
Gasket	1	11996
Screw	14	6842347
Valve lifter kit	1	274150
Gasket	1	8675251
O-ring	5	1397525
Gasket	2	30731212
Seal ring	1	9440651
Seal ring	1	9458309
Cover	1	1397381
Seal ring	1	9443310
Gasket	1	9142697
Gasket	4	947282
Gasket	1	9458535
Gasket	1	8675251
Clamp	1	1346542
Flange screw	2	946934
Gasket	1	1236119
Gasket kit	1	272395
Flange nut	12	948645
Gasket	1	9179056
Gasket	2	30677358
Flange nut	2	945408
Flange nut	8	946470
Lock nut	6	977209
Gasket	2	3514546
Gasket	3	947621
Gasket	4	947281
Gasket	8	947282
Sems screw	1	981771
Cable tie	2	983750

Material **B6294S**	Quantity	Part No.
Intake valves	12	30637059
Valve seal kit	1	274344
Gasket	1	11996
Screw	14	6842347
Valve lifter kit	1	274150
Gasket	1	9404727
Gasket	1	9458535
Gasket	1	9497519
Seal ring	6	1397525
Gasket	1	30731212
Gasket	1	1236119
Nut	12	948645
Gasket kit	1	271734
Flange screw	1	979780
Gasket	1	9497519
Seal ring	1	9440651
Seal ring	1	9458309
Seal ring	1	9443310
Cover	1	1397381
Gasket	1	9142697
Gasket	2	8627203
Flange screw	8	946470
Hose clamp	1	989879
Hose clamp	1	978165
Band clamp	2	983750

See list shown for all materials needed.

NOTE:
Machining, grinding or lapping of valve seats or valve sealing surface must not be done.

Do not forget to check and adjust valve clearances for the new valves.

Note:
Valve Lifter Kit contains numerous lifters; Claim submitted should only have individual lifters used for the repair.

Intake valve replacement 1

Worn valve face

Note!
Replace all intake valves.

For cylinder head removal and installation, see:

Removal, replacement, installation

Engine

Cylinder head

Cylinder head/gasket, replacing

For valve replacement, see:

Overhaul

Engine

Cylinder head

Cylinder head, assessment/overhaul

Adjust valve play as described in the link:

Valve play, setting/adjusting

Important!
Machining, grinding or lapping of the valve seat or the valve sealing surface must not be performed.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION		LABOR TIME
99284-3	Inlet valve replacement	X40 B4204T MY04	1.1 hr
		S40, V50 B52X4X MY04	1.1 hr
		C70 MY04	1.1 hr
		S60 MY04	1.1 hr
		V70 MY04	1.1 hr
		S80 B52X4T MY04	1.1 hr
		S80 B6294T MY04	1.3 hr
		XC90 B5254T MY04	1.1 hr
		XC90 B6294T MY04	1.3 hr
36001-2	DTC read and reset		0.2 hr
21003-2	Cylinder leakage test		See VSTG (Volvo Service Time Guide)
21433-3	Valve clearance check		See VSTG (Volvo Service Time Guide)
21102-2	Cylinder head gasket replace		See VSTG (Volvo Service Time Guide)

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY INFORMATION

Technical Service Bulletin # **8870025** Date: **040201**

A/C - Unpleasant Odors From Vents

S40(-04)/V40 2000-

Section
8

Group
87

No.
0025

Year
04

Month
02

Control module for the blower fan motor, installing

Background:

To minimize the risk of unpleasant odors from occuring in the heating/ventilation system, a kit can be installed that activates the blower fan for set periods after the ignition is switched off.

Important:
This control module may not be used if the vehicle is equipped with an ultra sonic alarm.

Description	Quantity	Part No.
Kit	1	30623435
Cable Tie	10	983750

Special tools

Description	Special Tool Bulletin #	Part No.
Terminal Removal tool	From Terminal repair kit 951 2946 or 951 2647 (STB 95)	951 2636 Blue

Materials

Climate control unit
Control module blower fan motor, installing

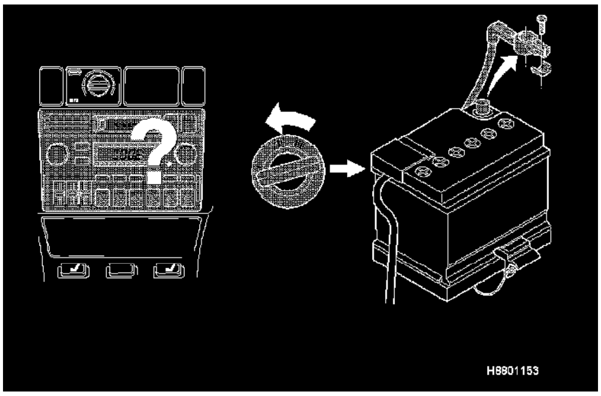
System background 1

Note!
The system stops functioning if the battery voltage falls below 12.5 Volts. This is to prevent the battery from discharging.

To activate the system, the ambient temperature must be at least 16°C. The system activation is dependant upon ambient temperature and not air conditioning usage.
The fan runs at full speed for 10 seconds, starting 30 seconds after the ignition is turned off.
After 10 minutes the fan starts again and runs for 10 seconds.

Note!
This cycle is repeated for approximately two hours.

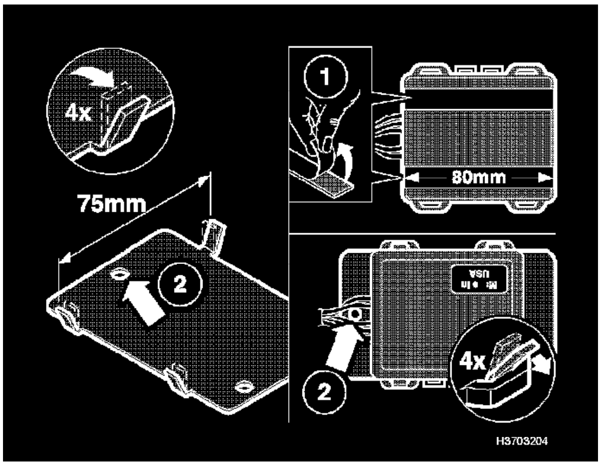
During this time, the fan motor will run at full speed for a maximum of two minutes in total.
If the engine is started during this time, the start system is always reset.



Preparations 2

Make a note of the radio code.
Switch off the ignition.
Disconnect the battery negative lead.
Remove:
- the soundproofing panels on the driver and passenger sides
- the side panels on the center console.

Note!
Set the blower fan switch to 0.

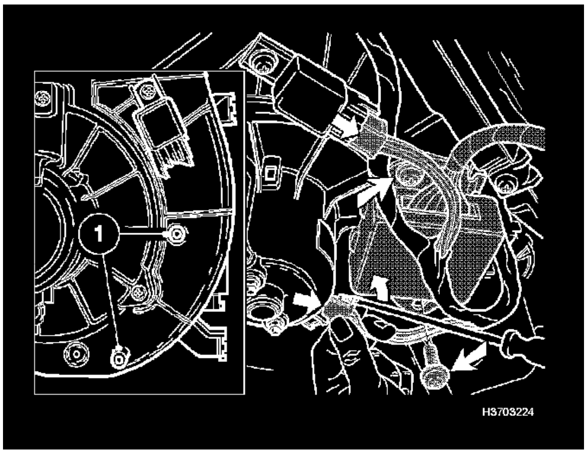


Assembling a new control module from the kit 3

Take out the new control module and the mounting plate.
If necessary, bend out the flanges on the mounting plate so that the distance between the edges of the flanges is 75 mm.
Remove the backing from the tape on the control module.

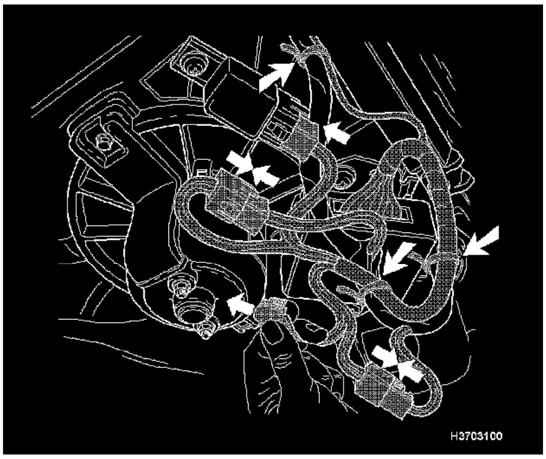
Note!
Ensure that the hole (2) is aligned with the wiring going into the control module as illustrated.

Install the mounting plate on the control module as illustrated. If necessary, bend the flanges outwards to secure the control module on the mounting plate.



Installing the new control module on the blower fan housing 4

Disconnect the connector on the blower fan motor.
Carefully bend the connector downwards and press the catch upwards using a small screwdriver. Pull the connector out at the same time.
Position the new control module under the fan shroud.
Install the screw and washers supplied into the two hollow shafts (1) on the housing as illustrated.
Remove the connector from the relay.

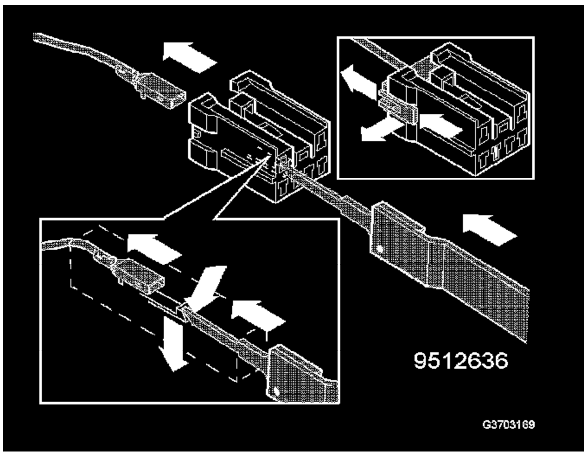


Connecting the cable harness 5

Connect the cable harness to the relay and the fan motor.
Position the long cable on the underside of the dashboard behind the center console and route it towards to the driver's side.
Secure the cable harness with the tie straps.

Note!

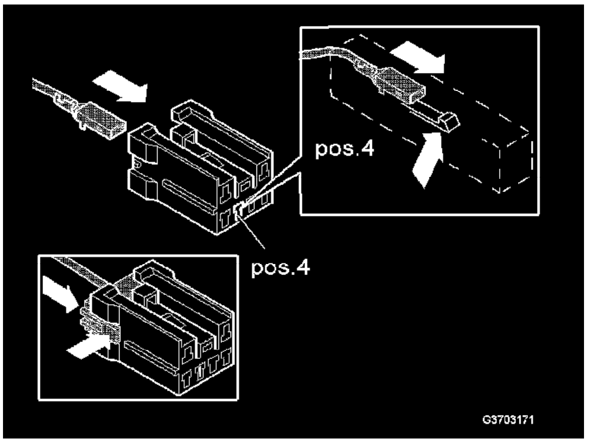
The wiring must not be stretched or positioned where it could come into contact with moving components or sharp objects.



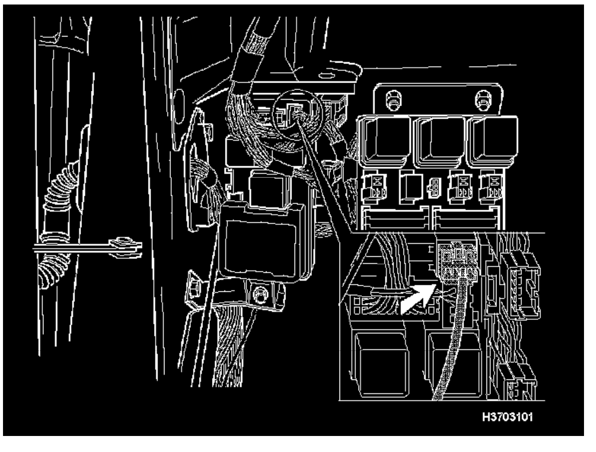
Connecting the cable to the junction box (model year 2000) 6

Route the cable along the existing cable harness under the steering column and onwards to the junction box.
Remove the junction box from the dashboard mounting bracket.
Disconnect the two upper connectors from the central electronic module (CEM) to get better access.

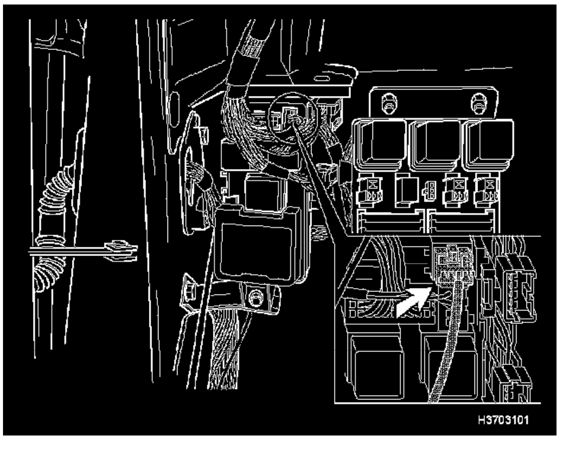
A: Remove the connector from kit cable.
Open the secondary lock from the connector (from the kit) by moving it upwards.
Remove the cable by pressing down the locking tab (see illustration) using terminal removal tool 951 2636 on the cable terminal while pulling the cable out of the connector at the same time.



B: Install the terminal in the existing connector.
Remove the connector from the junction box at the top right front side.
Open the secondary lock from the existing connector by moving it upwards.
Install the cable in position (4) in the existing connector.
Pull the cable to ensure that it is secured. Close the secondary lock.

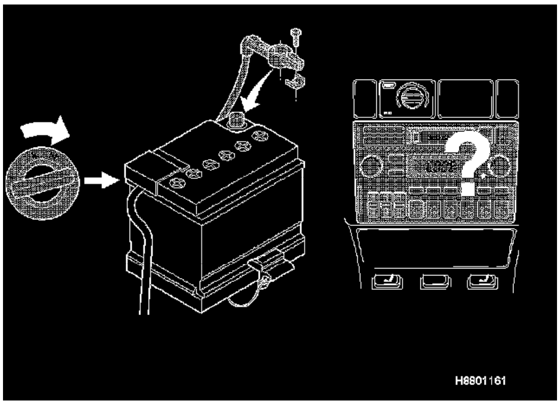


C: Connect the cable to the junction box.
Connect the cable to the junction box at the top right front side. See the illustration.
Secure the cable harness. The wiring must not be stretched or positioned where it could come into contact with moving components or sharp objects.
Reconnect the connectors to the central electronic module (CEM).
Install the junction box and secure it at the dashboard bracket.



Connecting the cable to the junction box

Route the cable along the existing cable harness under the steering column and onwards to the junction box.
Remove the junction box from the mounting for the dashboard-mounting bracket.
Disconnect the two upper connectors from the central electronic module (CEM) (or remove) to gain better access.
Connect the cable to the junction box at the top right front side. See the illustration.
Secure the cable harness with tie straps. The wiring must not be stretched or positioned where it could come into contact with moving components or sharp objects.
Reconnect the connectors to the central electronic module (CEM) and reinstall (if removed).
Install the junction box and secure it at the dashboard bracket.



Activating and checking the ventilation system 8

Turn the ignition to position II.

Caution!
Ensure that no one is in the car when connecting the battery.

Connect the battery negative lead. Wait at least 10 seconds.

Caution!
Switch off the ignition after 10 seconds. After approximately 20 seconds, the blower fan motor starts and runs at full speed for approximately two seconds.

Note!
If the ambient temperature is above 16°C the blower fan motor will start and run two times after another 30 seconds.

Enter the radio code. Set the clock.
Check that the ventilation system is working normally by starting the motor. Check the functions of the ventilation system.

Finishing work 9

Install:
- the soundproofing panel on the driver's side
- the two side panels for the center console
- the soundproofing panel on the passenger side.

Operation No.	Labor description	Time allowance
87948-2	Blower fan motor module installing	1.1 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **8870024** Date: **020701**

A/C - Unpleasant Odors

S40/V40
2000-2001

Section:
8

Group:
87

No:

0024

Year:
02

Month:
07

Vehicles involved:
S40/V40 LHD

Evaporator, application of a protective coating

Background:

To prevent droplets of water becoming attached to the evaporator, a protective coating must be applied. This protective coating also ensures that the growth of bacteria is minimized, to preventing unpleasant odors.

Model	Factory	Chassis No.
S40,V40 LHD		415.000 – 756.100

Affected vehicle

Description	Quantity	Part No.
Odor remover A/C	1	1161570

Materials

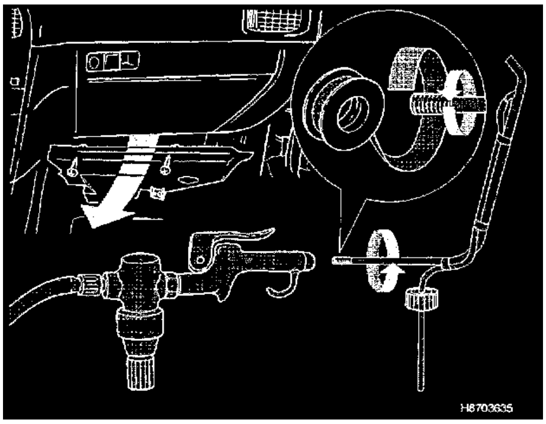
Description	Part No.
Pressure regulator/gun	999 7065
Spray gun nozzle	999 7064

Special tool

Cool unit

Evaporator, application of a protective coating

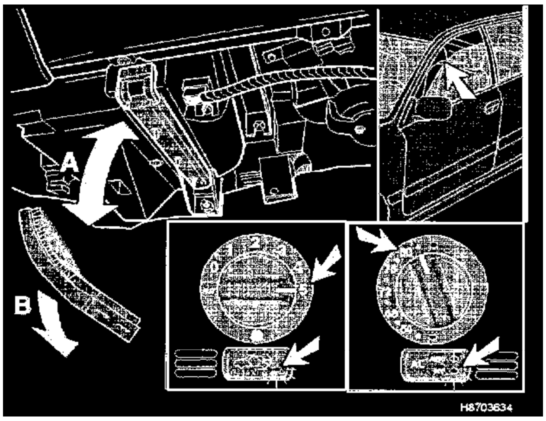
Assemble special equipment 1



Assemble the special tool 999 7065 and 999 7064 and connect the spray gun to the workshop compressed air system. Remove the panel below the dashboard on the passenger side, see VADIS:

Repair and Installation Function Group 88 Interior equipment Instrument and radio panel Removing the dashboard.

Remove the pollen filter and dry the evaporator 2

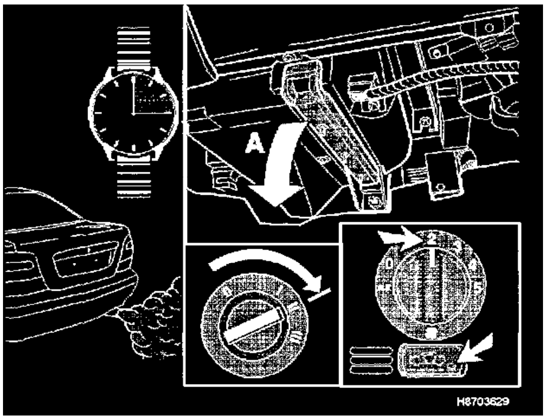


Remove the pollen filter cover (A). Pull the pollen filter (B) carefully outwards. If necessary, clean the housing and the evaporator. Install the cover (A). Open the front windows about 10 cm. Turn the A/C switch to off. Set the heating temperature to maximum. Set the fan to the highest setting. Select recirculation. Start the engine and let it idle for 15 minutes.

Note!

Be sure to connect an exhaust hose.

Prepare the vehicle for application of the protective coating 3



After 15 minutes, switch off the engine. Remove the cover (A) of the pollen filter. Turn the ignition switch to position 2. Set the fan switch to position 2. This ensures complete and thorough coverage when applying the coating. Switch off recirculation. Open the vehicle's doors and ensure that there is sufficient ventilation. Connect the bottle Part No. 1161570 to the suction line of the special tool.

Note!

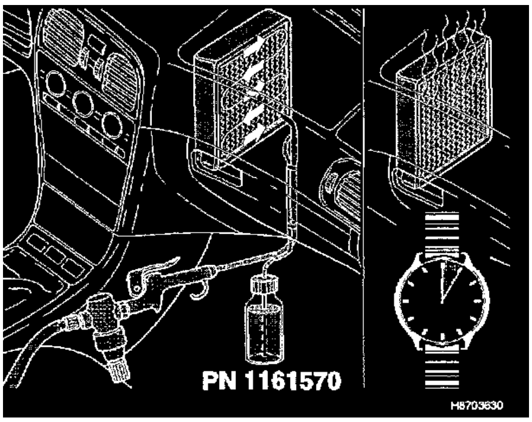
Be sure to shake the bottle first.

Apply protective coating to the evaporator 4

Protect the interior and the floor covering with cloths. Close all dashboard air vents. Use rags to cover floor vents.

Warning!

Wear safety glasses, mouth protection and gloves. Ensure that there is sufficient ventilation.



Insert the nozzle through the opening of the pollen filter. Using the special equipment, completely spray the evaporator with the protective agent as shown in the drawing.

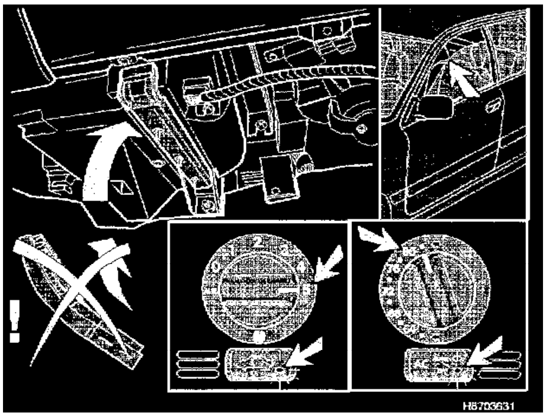
Move the nozzle with a forwards and backward motion from the top to the bottom of the evaporator.

Note!
Be sure to use all the contents of the bottle.

Caution!
Now let the protective coating dry for five minutes so that it adheres to the evaporator.

Clean the tool after use by flushing thoroughly with water.

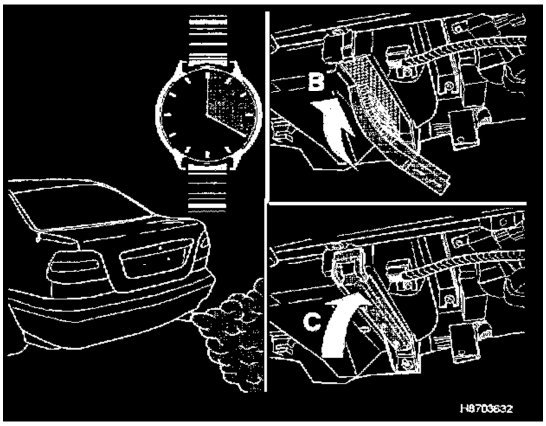
Dry the protective coating on the evaporator 5



Install cover to the pollen filter. Close the doors and open the front windows about 10 cm. Set the heating temperature to maximum. Set the fan to the highest setting. Select recirculation. Start the engine and let it idle for 20 minutes (connect an exhaust hose). Turn the A/C switch to off.

Note!
Be sure that the pollen filter is removed and that the front windows are open.

Install parts 6



After 20 minutes, switch off the engine and return the switches to their original positions. Install the pollen filter (B). Install the cover (C). Install the panel below the dashboard see VADIS;

Repair and Installation Function Group 88 Interior equipment Instrument and radio panel Removing the dashboard Remove cloths from the interior and close the windows. Open air vents and uncover floor vents.

Note!
If the pollen filter is discolored (grey/black) this does not mean that it must be replaced. For replacement, see maintenance chart.

Operation No.	Labor description	Time allowance
87947-2	Protection seal condensor apply	0.9 hr

Warranty Information

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **2220005** Date: **001101**

Engine - Piston Cooling Valve Replacement

S40/V40
2000

Section
2

Group
22

No.
0005

Year
00

Month
11

Reference:
This Service Bulletin replaces the previous Service Bulletin 220005 from December 1999, which should be discarded.

Purpose:
New time allowance

Piston cooling valve, replacement

Background
Oil cooling of the pistons has been introduced for all Volvo manufactured gasoline engines. This Service Bulletin describes how to replace the piston cooling valve.

Description	Quantity	Part No.
Piston cooling valve	1	9497918
Seal washer	1	11998

Materials

Replacement of the piston cooling valves

Piston cooling valves, replacement

1

Removing the timing belt/mechanical timing belt tensioner

Remove the timing belt, see VADIS.. Function group 2. Repair/Removal, replacement and installation, Section 21 Engine.

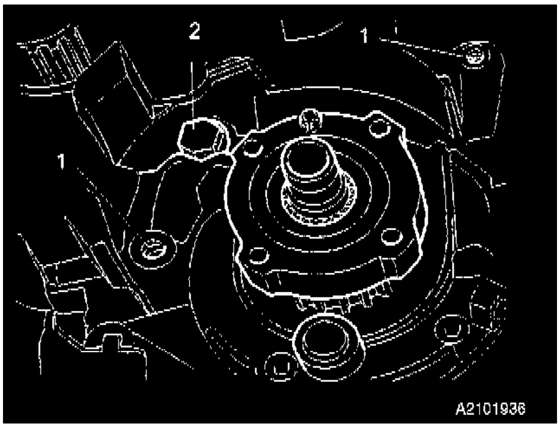
Remove the timing belt tensioner. Remove the idler pulley. Remove the screw securing the inner timing cover to the cylinder head.

Raise the car. Continue with VADIS method:

Remove the vibration damper, see VADIS: Function Group 2. Repair/Removal, replacement and installation, Section 22 Lubrication and oil system, Replacing components.

2

Removing components

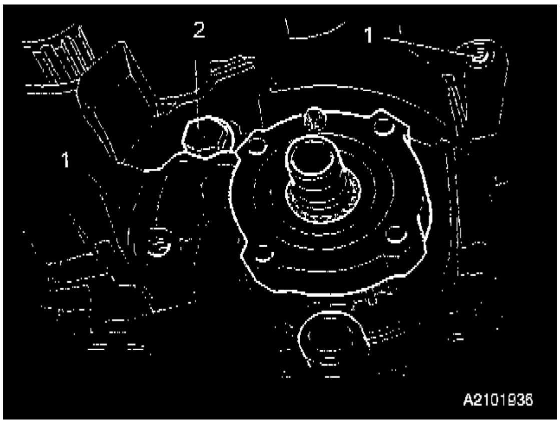


Remove:

- the two screws (1) securing the inner timing cover to the cylinder block.
- the lower belt guard at the oil pump housing. Press the inner timing cover off the flange around the coolant pump. Start at the lower edge of the pump. Hold the cover out of the way. Remove the piston cooling valve (2) and the seal washer.

3

Installing components

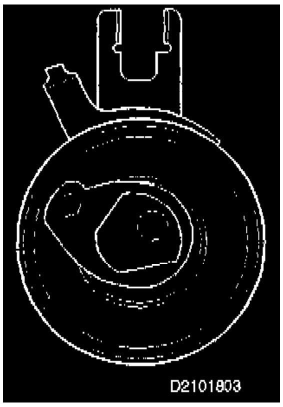


Install:

- a new piston cooling valve (2) with a new seal washer. Tighten to 35 Nm (26 ft.lb).
- the inner timing cover. First press the cover into place over the flange at the top of the coolant pump. Then press the remaining section of the cover into place over the flange around the pump. Check that he cover is correctly positioned.
- the two screws (1) securing the inner timing cover to the cylinder block.
- the lower belt guard.

4

Installing the timing belt



Install:

- the screw securing the inner timing cover to the cylinder head.
- the idler pulley. Tighten to 25 Nm (18 ft.lb).
- the timing bell tensioner. Screw in the center screw by hand. Ensure that he fork on the tensioner centers above the cylinder block rib. Check that the Allen hole on the eccentric is at "10 O'CLOCK".
- the vibration damper. see VADIS:

Continue with the method in VADIS: from and including the section installing the timing belt.

Operation No.	Labor description	Time allowance
22907-2	Replacing piston cooling valve	2.7 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **2210042** Date: **030401**

Engine - In-Car Piston Replacement

S40/V40
2000-

Section
2

Group
21

No.
0042

Year
03

Month
04

Pistons! replacing

Background

This method describes how to replace the pistons with the engine in the car.

Description	P/N
Engine Lifting Hook (used with 9995716, See Special Tool Bulletin 71 and 114)	9995460
Lifting Beam (See Special Tool Bulletin 114)	9995716
Piston Holder (Suggested, available from SPX)	9995746
Piston Ring Compressor	Generic

Special Tools Required

Cylinder liner and piston Piston, replacement

1

Ensure that necessary special tools are available to carry out this work. Attention to detail and cleanliness is required to ensure proper repair.

2

Removing the oil sump

Remove the oil sump, see VADIS:

Repair and Installation

Function group 21

Oil sump, replace

3

Removing the cylinder head

All variants:

Remove the cylinder head, see VADIS:

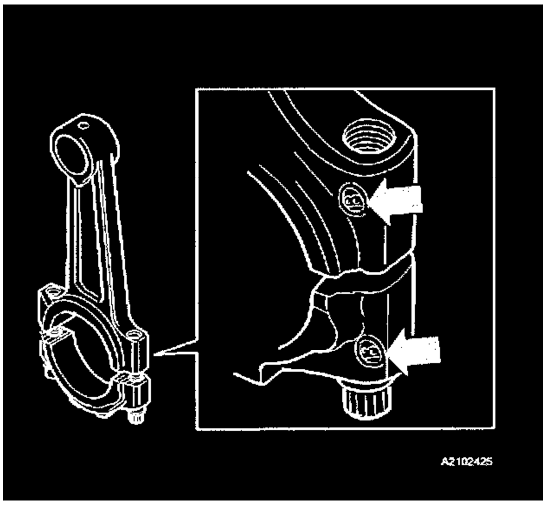
Installation Function

Function group 21

Replacing the cylinder head/gasket.

4

Removing the pistons

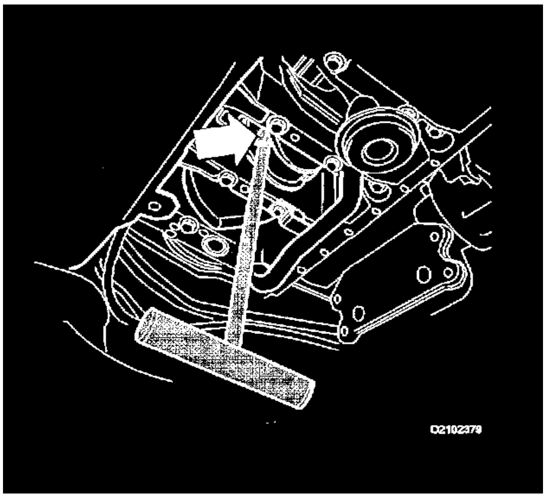


Note! On later version engines the connecting rod and the end cap mating surfaces are aligned by a dedicated fracture surface. Note the markings on the connecting rod and the end caps and the direction in which they are installed, forward, rearward, left, right.

On earlier version engines the connecting rod and end cap mating surfaces are aligned by serrations. NOT all connecting rods and end caps may be marked as described above. If markings are in place then note location as described above. If NO markings exist stamp or etch the appropriate cylinder number on each all facing the same direction.

Turn the crankshaft to bottom dead center to access the two connecting rod cap bolts.

Remove the end cap bolts.



5

Carefully press the pistons upwards. Use special tool 990 5746.

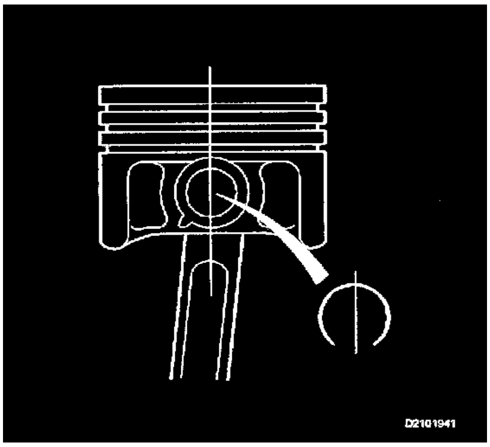
Ensure that the connecting rod and end cap is marked as described previously.

Remove the remaining connecting rods and pistons in the same manner.

Check for vertical abrasions or other damage in the cylinder liner.

6

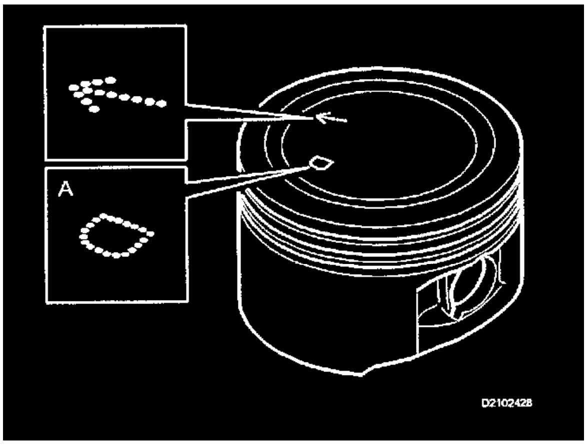
Removing the piston from the connecting rod



Note the direction of the arrow on top of the piston in relationship to the markings on the connecting rod and end cap. Arrow location may vary from that shown in the illustration.

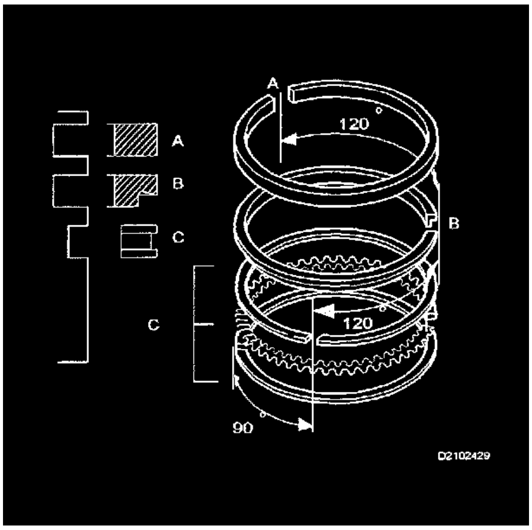
Remove the circlips and press out the wrist pin. Clean the connecting rods and bearing caps before installing new pistons.

Warning!
The circlips can easily spring out. Wear appropriate eye protection when removing circlips.



Note the piston classification for each cylinder and on each piston (A). The cylinder classification is etched into the cylinder block deck in the right rear.

The arrows should always point at the timing belt transmission.



Installing the piston rings

Note!
The new pistons must have the same for each cylinder

Use piston ring pliers.

Turn the piston rings so that the piston ring gaps are positioned as illustrated.

A = Compression ring. The text on the piston ring

faces upwards.

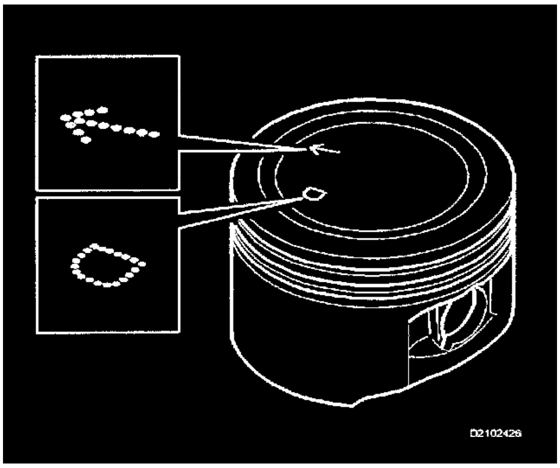
B = Scraper ring. Bevelling facing downwards.

C = Oil ring. Separated three ways equilaterally.

Caution!
Ensure that the piston ring scan
rotate freely in the piston ring grooves.

Note!
The position of the rings is critical!
Incorrect positioning can result in high oil consumption

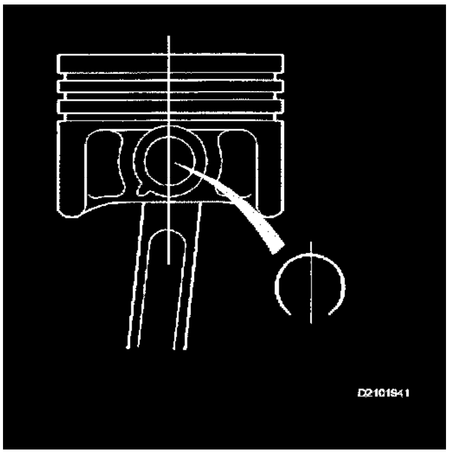
Assembling the pistons and connecting rods



Note the location of the arrow on top of the piston
and the markings on the connecting rod and end cap.
Install the piston with the arrow in the same
relationship to the markings as when disassembled in
step 6. Assemble the connecting rod and the piston
using the new wrist pin supplied with the piston.
The wrist pin should slide through the connecting rod
small end bearing with light thumb pressure.

Press in the wrist pin by hand.

Check the class of each cylinder/piston diameter.
Check that any markings / numbering of the connecting
reds correspond.



Install both circlips for the wrist pin. Check that
the circlips are correctly positioned in the piston.
The gap must be vertical.

Warning!

The circlips can easily spring out off. Wear
appropriate eye protection when installing
circlips.

Wipe clean the bearing recess in the connecting rod
and cap.

Install new bearing shells.

Installing the pistons in the cylinder bores

Using a piston ring compressor install piston and
connecting rod assembly. Follow manufactures recommended

procedures for proper use of ring compressor

Lubricate the cylinder bore, the pistons and the bearing shells with engine oil.

Turn the crankshaft so the connecting rod is at bottom dead center for the cylinder piston.

Note!
The arrow on top of the piston should point forward. Ensure that the classification corresponds.

Carefully press / tap the piston downwards (using a hammer handle).

When the piston clears the ring compressor and is at head surface level stop. Put ring compressor aside. Install holder 999 5746 in the connecting rod.

Pull the connecting rod downwards until it lies against the crankshaft connecting rod bearing journals. Remove 999 5746.

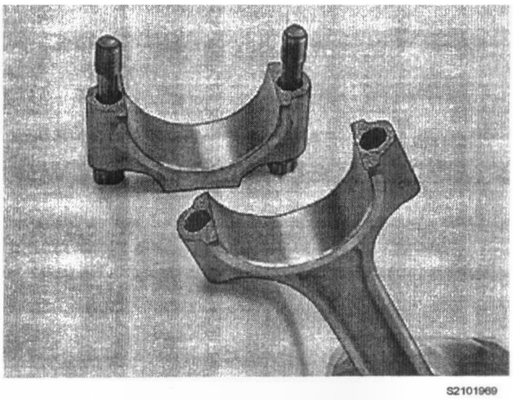
10

Tightening the cap for the connecting rod

Install the end cap. Check that markings correspond. On late types of connecting rods the mating surface between the cap and the connecting rod are not machined. It is aligned through a dedicated fracture surface.

Earlier types have serrated surfaces that only align one way.

Caution!
If the cap is turned the wrong way and tightened, the structure of the fracture surface will be damaged and the connecting rod must then be discarded.



Note!
Blow the fracture surfaces of the connecting rod and end cap dean using compressed air before installing the cap.

Lubricate and install the new screws. Tighten in two stages:

1 20 Nm

2 Angle-tighten 90°

Check that the connecting rod con be moved laterally.

Note!
The crankshaft must not be rotated before the connecting rod cap has been tightened.

11

Installing the cylinder head

Install the cylinder head, see VADIS:

Repair and Installation

Function group 21

Replacing the cylinder head/gasket.

12

Installing the oil sump

Install the oil sump, see VADIS:

Repair and Installation

Function group 21

Oil sump, replace

13

Topping up

Top up the oil and coolant.

Run the engine to operating temperature.

Check coolant and oil levels.

Check for leakage

Operation No.	Labor description	Time allowance
21391-2	Pistons replacing	
21391-2	B4204T	11.5 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN25-18** Date: **040521**

Cooling/Engine Controls - ECM DTC A1Set

NO: 25-18

DATE: 5-21-2004

MODEL:
2000-2003

M.YEAR:
S/V 40

CHASSIS:
415000-992378

SUBJECT:
DTC ECM A1

REFERENCE:
VADIS, VEMS

DESCRIPTION:

Under certain engine warm up conditions ECM DTC A1 may set. Extreme cold temperature and a long engine idle time from cold start could trigger the code.

SERVICE:

If ECM DTC A1 is set in a vehicle monitor the operation of the engine thermostat using VADIS. At normal operating temperature the engine coolant temperature should be approximately 90°C. If the engine is not reaching proper operating temperature verify operation of the thermostat and replace if necessary.

Perform the current VEMS download using VADIS version B or later. If the DTC returns, fault trace in accordance to VADIS.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36004-2	Software Control Module Download	0.3 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information

Technical Service Bulletin # **2210049** Date: **030401**

Engine - Updated Rear Crankshaft Seal Replacement

84 0/S40 / V40/C7 0/S70 /V7 0 (-00)/V7 0 X C
S60/V70 (00-)/V70 XC (01-)/S80

Section
2

Group
21

No.
0049

Year
03

Month
04

Reference:
This Service Bulletin applies to three different subscriptions. The Service Bulletin must be inserted in the relevant subscription systems.

Vehicles involved: B41 xx, B52xx, B62xx, BB3xx, D5254T

Rear crankshaft seal, replacing

Background

Updated method for replacing the rear crankshaft seal.

Description	Quantity	Part No.
Emery cloth	1/3	9511024
Screw flywheel, manual gearbox	10	9454743
Screw carrier plate, automatic gearbox	10	1275375

Materials

Description	Part No.
Extractor	999 5651
Gear sector	999 5112
Seal installation tool	999 5676
Handle	999 1801
Special screw	999 5678

Special tools

Crank mechanism Rear crankshaft seal, replacing

1

Note!

As the illustrations in this service information are used for different model years and / or models, may occur. However, the essential the illustrations is always correct.

2

Removing the flywheel and carrier plate

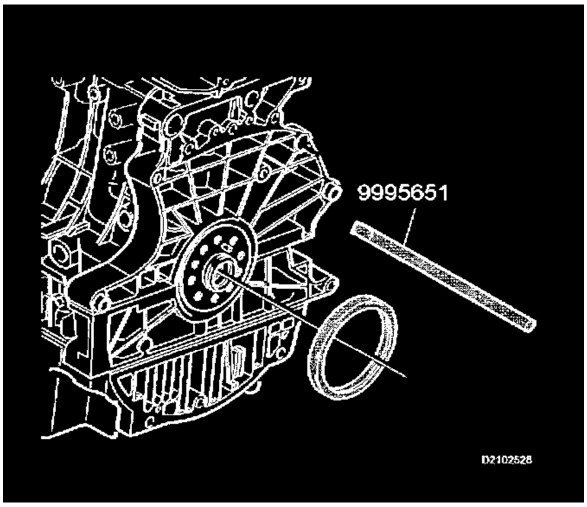
Remove the transmission:

see VADIS, Transmission Removing

Remove the flywheel / carrier plate. Use gear sector 999 5112 as a counterhold when slackening off the screws.

3

Replacing the seal

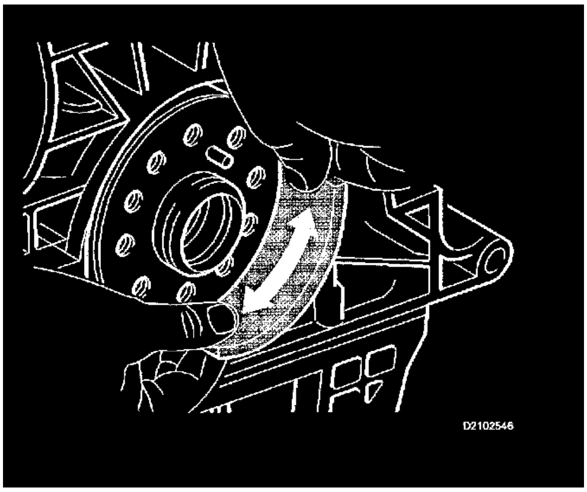


Remove the old seal using extractor 999 5651.

Do not damage the mating surfaces of the and cylinder block

4

Cleaning



Clean around the crankshaft flange, insure that crankshaft seal mating surface is free from dirt and old sealant.

Remove any thread sealant residue from the screw holes.

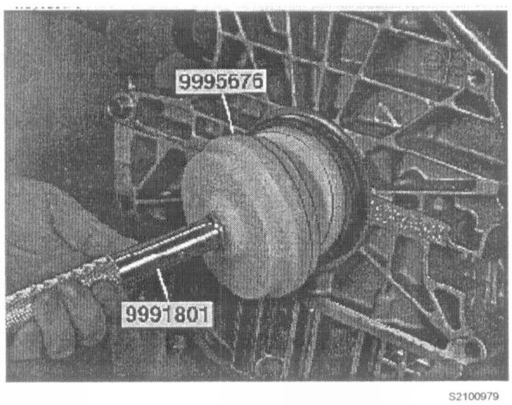
Hint:
Emery cloth 951 1024 can be used to clean the crankshaft.

Caution!
Clean around the flange in a circular

It is extremely important that there is no remaining thread sealant residue or other dirt. This could cause leakage

5

Installing the sealing ring



Lubricate the mating surface of the sealing ring against the cylinder block and the lips of the seal.

Caution!
Only Volvo approved engine oil may be used. Grease must not be used at all. It attracts dirt and results in the build up of debris.

Twist the seal onto the beveled section of inner section of tool 999 5676 with the felt side of the seal outwards.

Install the drift on the crankshaft.

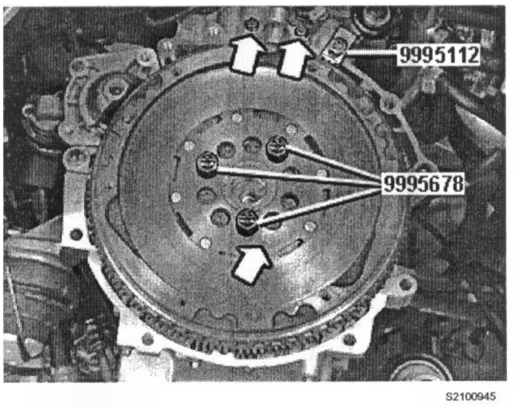
Tap in the seal using the outer section of drift 999 5676. Use handle 999 1801.

The seal is in position when the outer drift bottoms out against the inner drift.

Caution!

Hold the drift straight when installing so that the sealing ring is pressed in to the same depth all the way around, reducing the likelihood of leakage.

Installing the flywheel and carrier plate



Caution!
Ensure that the surface of the crankshaft and the mating surfaces for the flywheel / carrier plate are clean. Ensure that there is no thread sealant residue in the screw holes.

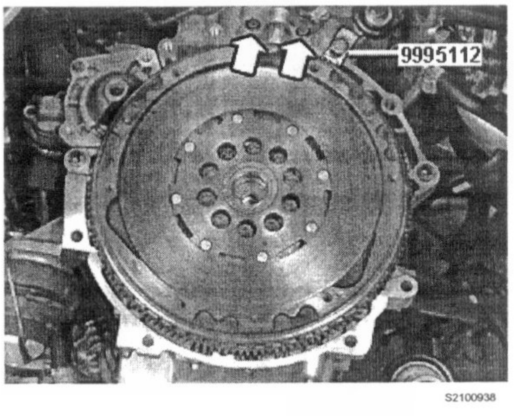
Install:

- the flywheel and carrier plate
- the 3 studs 999 5678, position as illustrated. Turn the short thread length towards the crankshaft.

Note!
Check that the locating pin on the crankshaft is positioned opposite the hole in the flywheel / carrier plate. The position of the guide hole is marked.

7

Tightening the flywheel/carrier plate



Install gear sector 999 5112.

Pull the flywheel towards the crankshaft using the 3 nuts on tool 999 5678. The turned section of the nut must be facing the flywheel/carrier plate.

Caution!
It is important that the flywheel and carrier plate bear on the crankshaft flange before the other screws are installed.

Caution!
Always use new screws. Ensure that the thread sealant on the new screws is intact. If not apply a few drops of

sealant 116 1056 to the thread.

Install the other screws. Tighten crosswise to 45 Nm.
Replace the three special screws with new standard screws.
Tighten crosswise to 45 Nm.

Then angle-tighten all 10 screws crosswise. Use tool
999 2050.

For the flywheel: 65°.

For flex plate: 50°.

Ensure that the flywheel sensor and bracket are installed.
Install the dutch disc and pressure plate.

8

Installing the transmission

Install the transmission:

see VADIS, Transmission installing

Operation No.	Labor description	Time allowance
21644-2	Crankshaft seal, rear replace	

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN25-14** Date: **030109**

Engine - Inconsistent Idle With A/C ON

NO: 25-14

DATE: 1-9-2003

MODEL:
All Models Equipped with Turbo Charged Engine and Electronic Throttle Module (ETM)

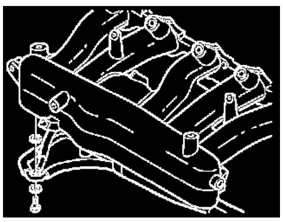
SUBJECT:
Inconsistent Idle Speed, A/C On

REFERENCE:
VADIS

DESCRIPTION:

Carbon deposits can form in the coolant nipple (vacuum side), located on the underside of the intake manifold, and the Electronic Throttle Module (ETM) bore on cars frequently driven short distances. This residue can cause idle speed to become uneven and noticeable to the driver especially with the increased load produced by the air conditioning compressor cycling on and off. This Tech Net Note describes how to clean the coolant-heated nipple in the intake manifold and the ETM bore.

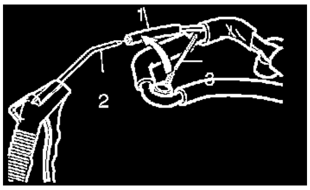
1. Intake manifold, removing



Remove the intake manifold, see VADIS:

Repair and Installation Function group 25 Replacing the intake manifold/gasket. Remove the banjo bolt. Lift out the intake manifold.

2. Nipple Cleaning



Disconnect the hose (1) from the nipple.

Blow the hose clean using compressed air (2). Loosen hose from opposite end and ensure air is flowing through hose. If the hose is blocked, use a welding rod (approximately 250 mm) to clean the hose (1). Clean the nipple using a 2 mm drill bit (3). Install the hose on the nipple.

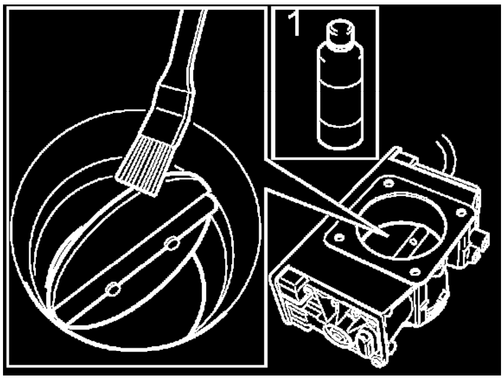
3. Preparations, ETM Cleaning

   Remove the ETM from the intake manifold

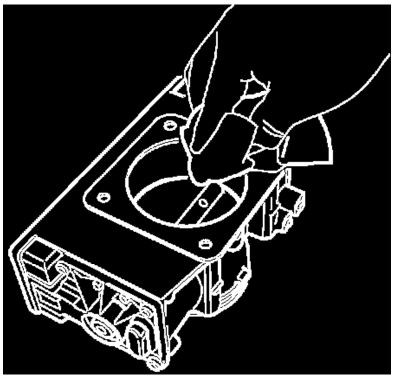
4. Cleaning the ETM

   Warning!
   Use a fume hood or ensure that ventilation is good. DO NOT submerge throttle unit in cleaning solvent. ONLY use cleaning solvent recommended in this bulletin.

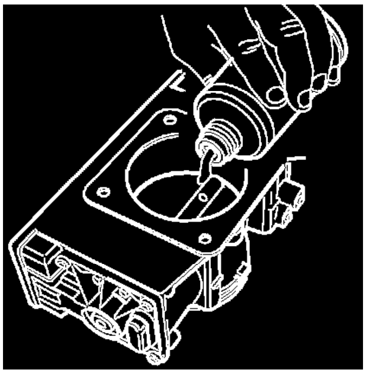
   Important!
   Do not scrape or use a rotary wire brush to clean the unit.



Clean the ETM bore using cleaner H (P/N 1161436-9) and a soft bristle brush. Ensure that all the residue is removed from the surfaces shown in the illustration.



5. Carefully wipe the bore clean on both sides of the throttle plate.

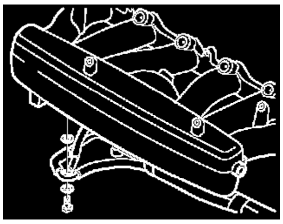


6. Flush the ETM bore using cleaner H on both sides of the throttle plate.

   Check that there is no residue in the bore or on the throttle plate. Any remaining residue can promote new residue build up.

   Repeat the procedure if necessary.

   Install the throttle body (TB) on the intake manifold using a new gasket.



7. Intake manifold, installing

   Install the new gasket for the intake manifold. Lift in the intake manifold. Install the banjo bolt with the new sealing washers

   Install the intake manifold, see VADIS:

   Repair and Installation Function group 25 Replacing the intake manifold/gasket.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	SYM. CODE	CAUSE CODE	LABOR TIME
02520-6	Cleaning PCV intake nipple and ETM	5M	26	
	S/V/XC 70 1999-2000 Turbo			2.6 hr.
	C 70 1999-			2.6 hr.
	S60 Turbo			3.0 hr.
	V/XC 70 2001- Turbo			3.0 hr.
	S80 Turbo			3.2 hr.

Claims may be submitted under the New Car Warranty when there is a documented customer complaint using claim type: 01

Warranty Information Technical Service Bulletin # **2250026** Date: **010501**

Exhaust Manifold - Retaining Nuts Loose, Missing

S40/V40
2000-2001

Section
2

Group
25

No.
0026

Year
01

Month
05

Vehicles involved:
B4204T2, T3

Exhaust manifold, retaining nuts

Background

If the retaining nuts for the exhaust manifold are found missing or loose during the scheduled maintenance service, all the flange nuts must be replaced by a nut with captive washer. The new nut with captive washer has been introduced as a running change in production.

This condition may also be evident in the following circumstances:

Exhaust noise from under the hood.

Customer concern about noise from the exhaust system.

Model	Chassis number
S40/V40	-600137

Affected cars

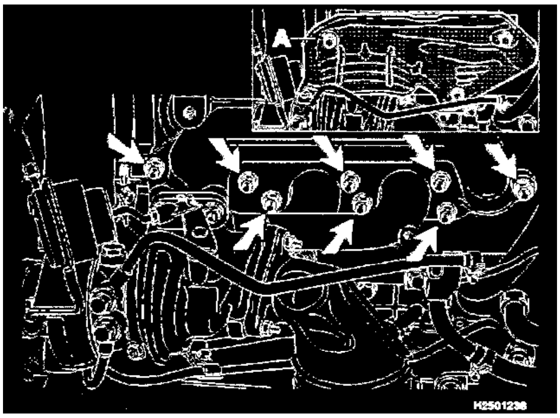
Description	Quantity	P/N
Nut	8	982297

Materials

Exhaust manifold, retaining nuts
Check the tighting torque of the flange nuts

Retaining nuts, check tightening torque and leakage 1

Remove:



- heat deflector plate (A) over the exhaust manifold.

Check the tightening torque of all retaining flange nuts securing the exhaust manifold to the cylinder head.

Tighting torque 25 Nm (18 ft lbs.)

If the tighting torque is too low or there is a flange nut(s) missing, but there is no leakage from the exhaust between the cylinder head and the exhaust manifold:

Method A: Replace the flange nuts

If there is exhaust leakage between the exhaust manifold and the cylinder head:

Method B: Replace the gasket check that the exhaust manifold is not distorted

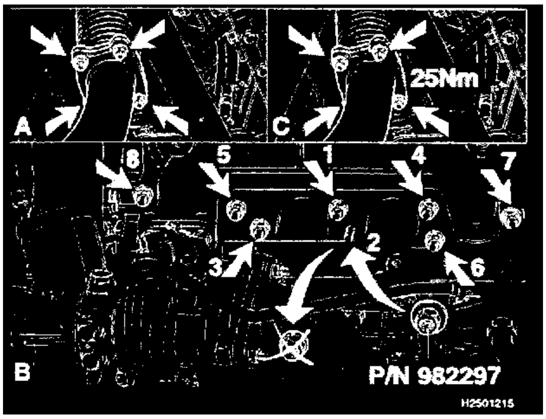
Correct tighting torque:

No further action required.

Install:

- heat deflector plate, tighten to 25 Nm (18 ft lbs).

A: Installing new retaining nuts and tighten



Detach the front exhaust pipe from the turbo charger.

Slacken off the stay between the exhaust manifold and the cylinder block.

Slacken off all the flange nuts securing the exhaust manifold to the cylinder head to finger tight.

Remove the old nuts one by one. Replace them with new nuts with captive washer, P/N 982297. Finger tighten the new nuts.

Tighten the new nuts to 32 Nm (24 ft.lbs), starting from the center and working toward the outside of the exhaust manifold.

Position the stay. Tighten to 25 Nm (18 ft.lbs.).

Position the front exhaust pipe. Use a new gasket.

Tighten the nuts to 25 Nm (18 ft.lbs).

NOTE:
Ensure that exhaust components are not under stress during installation.

Check for leakage.

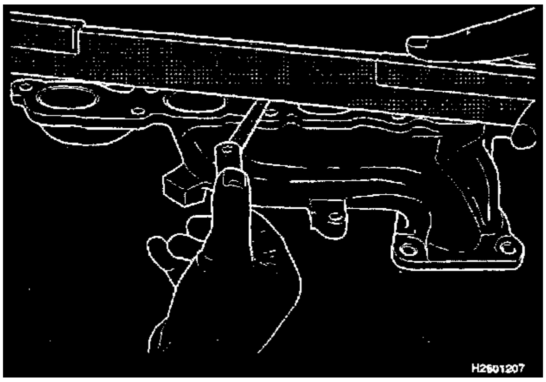
Install the heat deflector plate. Tighten to 25 Nm (18 ft.lbs).

B: Replacing exhaust manifold gasket and checking exhaust manifold for distortion.

Remove the exhaust manifold from the cylinder head.

See VADIS: Replacing the exhaust manifold. Model year 2000-.

Clean the mating surfaces between the manifold and the cylinder head.



Check that the exhaust manifold is not distorted.

Use a straightedge and a feeler gauge.

Readings:

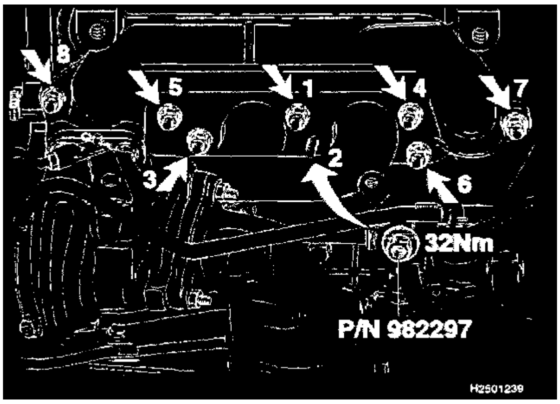
- Less than 0.15 mm (0.006"): Replace gasket.
- 0.15 mm (0.006") or more. Replace exhaust manifold.

Exhaust manifold, installing 2

Install the exhaust manifold on the cylinder head, use new gasket.

See VADIS: Replacing the exhaust manifold. Model year.

NOTE:
Always use new nuts, P/N 912297.



Tighten nuts to 32 Nm (24 ft.lbs.), starting from the center and working toward the outside of exhaust manifold.

NOTE:
Ensure that exhaust components are not under stress during installation.

Carry out a function and leak test.

Install the heat deflector plate on the exhaust manifold.

Tighten to 25 Nm (18. ft.lbs).

Operation No.	Labor description	Time allowance
25925-2	Exhaust manifold nuts, checking torque	0.5 hr
25926-3	Exhaust manifold nuts, replace	1.0 hr
25927-3	Exhaust manifold gasket, replace	2.7 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN61-04** Date: **030724**

Drivetrain/Frame - Clunking Noise When Shifting

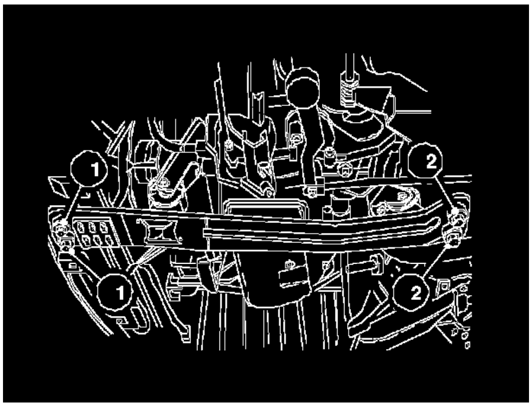
NO: 61-04
DATE: 7-24-2003
MODEL: SN 40
M. YEAR: 2000, 2001, 2002, 2003, 2004
CHASSIS: All
SUBJECT: Front Center Member Bushings
REFERENCE: Vadis

DESCRIPTION:
A clunking noise may be heard during gear changes between drive and reverse.

SERVICE:

Front center member steel bushing could be at fault. Follow the procedure below to fault trace and replace the bushings it necessary.

Checking and replacing front center member Bushings.



Re-torque the front center member bolts. 1.

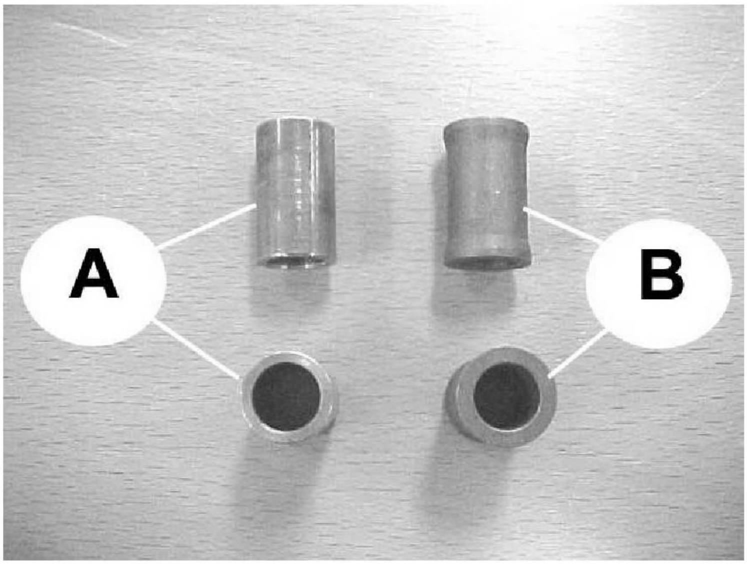
Loosen the two front center member bolts (1) and Re-torque to 52 ft lbs (70 Nm).

Loosen the two rear center member bolts (2) and Re-torque to 52 ft lbs (70 Nm).

Test drive and check if the noise is still present. If the noise is gone; Then you should replace the four center member steel bushings, as per the procedure shown below

If the noise is still present, fault trace as required.

Steel bushings in front center member. 2.



A: Production fitted steel bushings.

B: Service kit fitted steel bushings (this bushing has a larger surface contact).

Service kit P/N 30652081
(consist of 4x steel bushings).

Replace the four steel bushings. 3.

Remove:

- the front engine cover plate(s).
- the heat shield lower rear mount.
- the nuts (1) from the front and rear lower mounts

Loosen the front and rear bolts (2).

Front side: center member.

Remove:

- the two bolts (2) and the bolt (1).
- the bushings and check the rubbers (3) for damage.
- (Replace rubber bushings as needed)

Install:

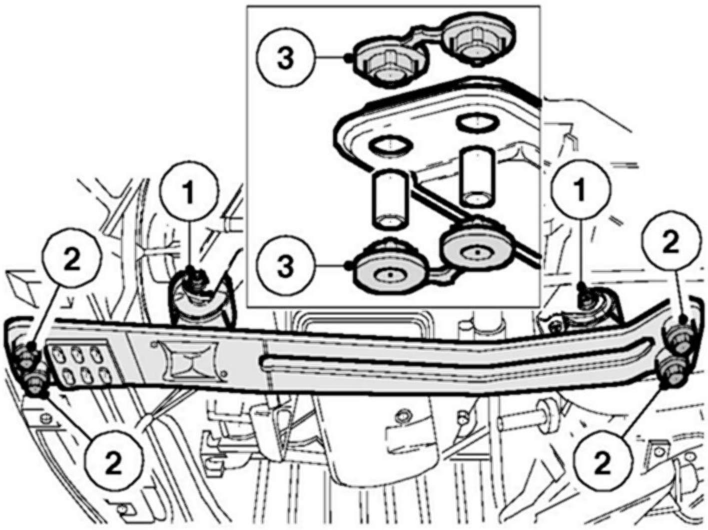
- the rubbers (3) and new steel bushings (4), on the center member, install the bolts and hand tighten

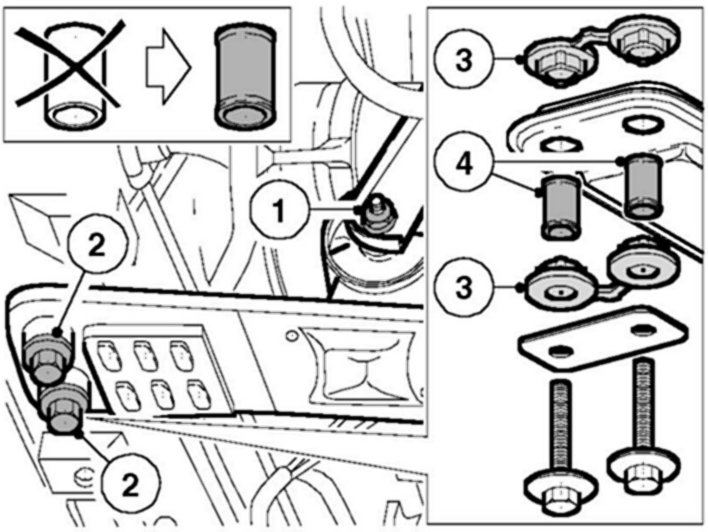
Note! correct position rubbers, see illustration.

- the lower mount bolt (1) and place the nut hand tighten.

Rear side: center member

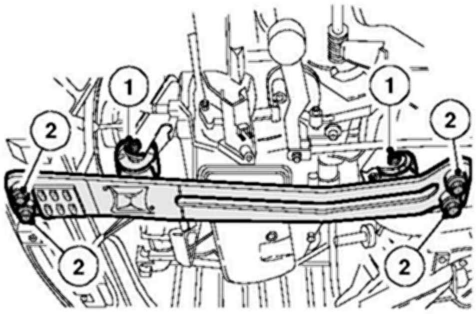
Use the same method as at the front side.





Note! correct position rubbers, see illustration. The rear and front side must be in similar position.

Finishing. 4.



Tighten the (4x) bolts (2) to 52 ft lbs (70 Nm). First tighten the rear lower mount (1) to 41 ft lbs (55 Nm), then the front lower mount (1) to 41 ft lbs (55 Nm)

Install:

- the heat shield (tighten to 7.5ft lbs)(10 Nm)
- the front engine cover plate(s)

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
99066-2	Screws axle cross member front check	0.1 hr
99067-2	Bushings axle cross member front replace	0.7 hr

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Claim Information

Technical Service Bulletin # **TNN76-02** Date: **030106**

Suspension - Rear Shock Absorber Noise

NO: 76-02
DATE: 1-6-2003
MODEL/YEAR: SN 40 MY 2000-2003
SUBJECT: Noise from Rear Shock Absorbers

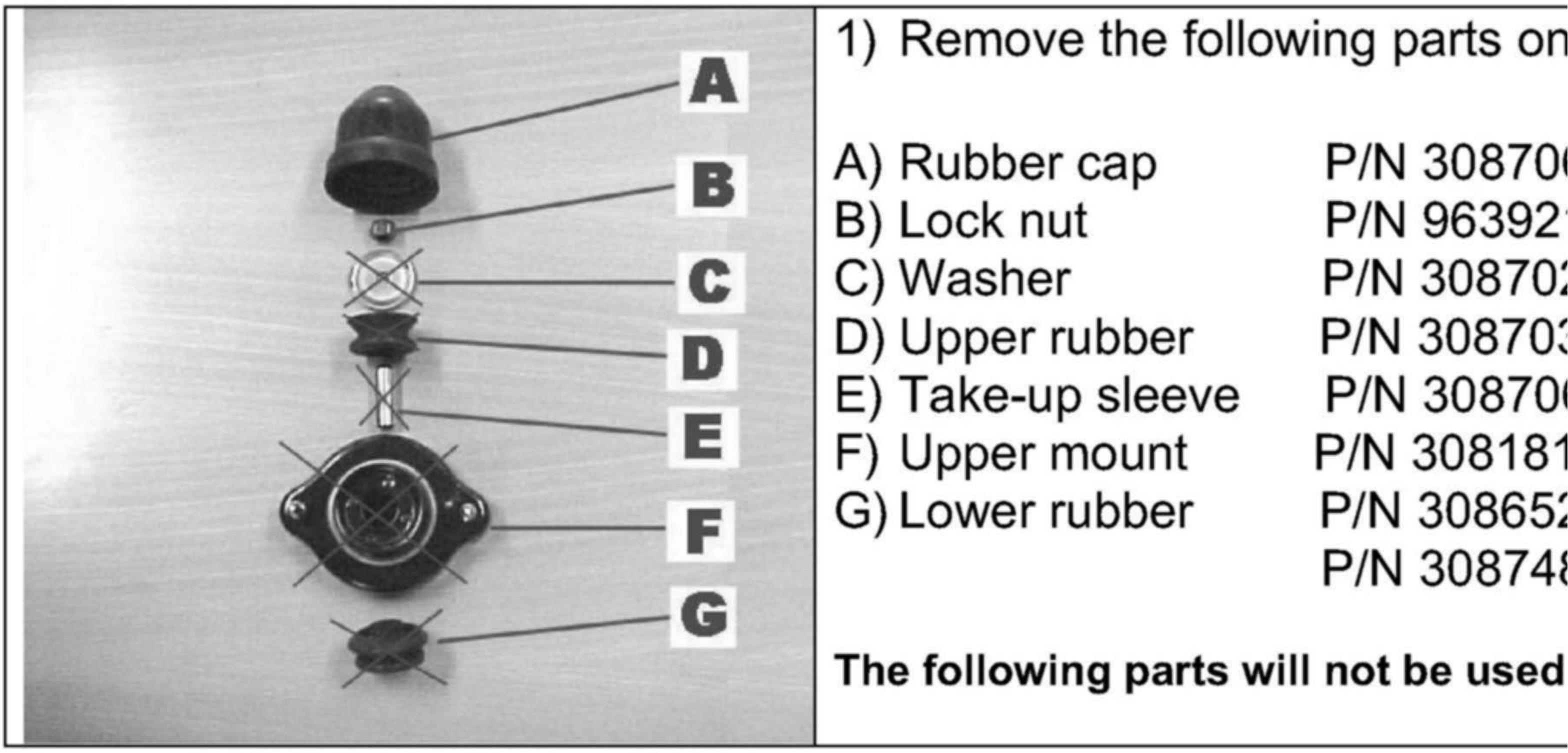
CHASSIS: 0415000-919999
REFERENCE: VADIS

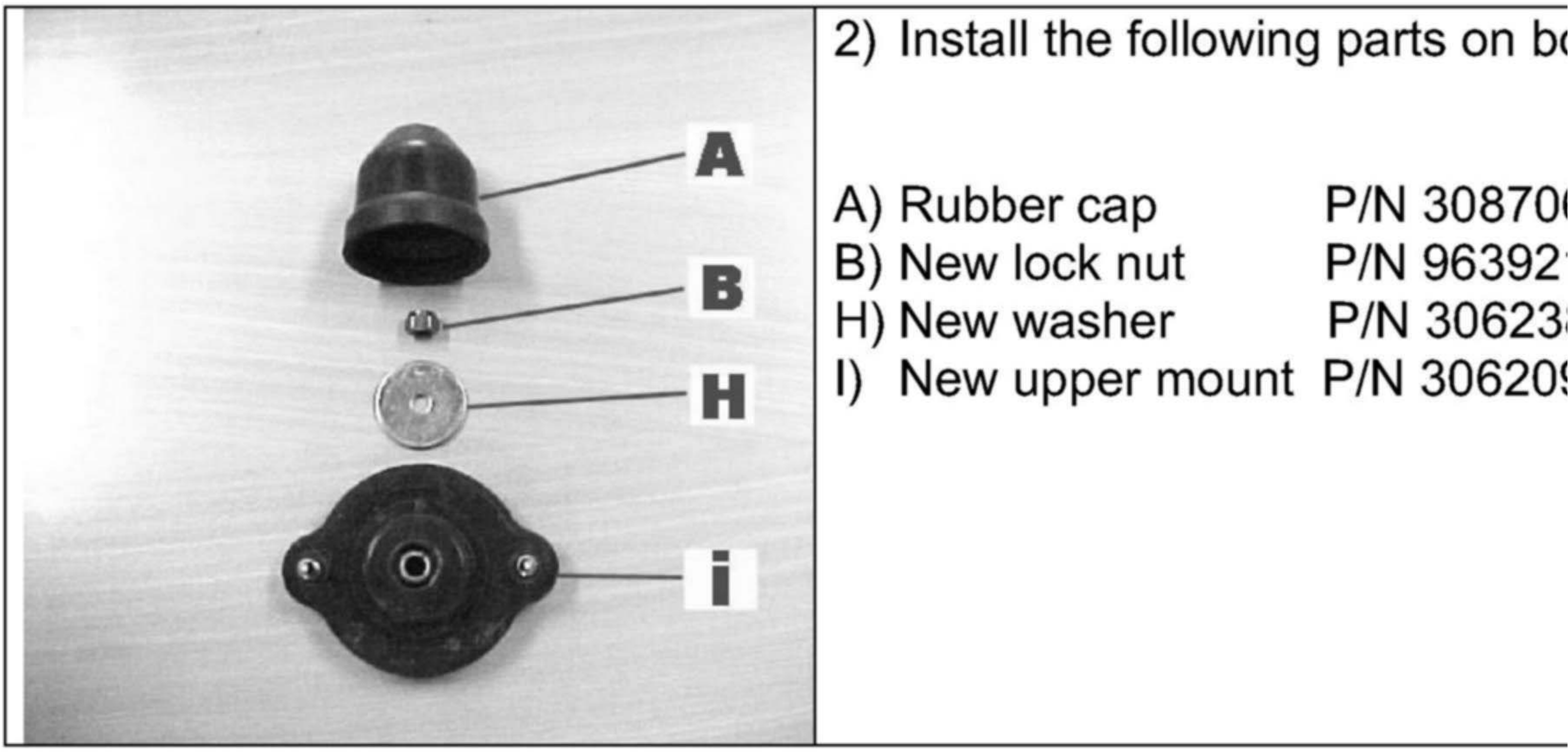
DESCRIPTION:
Noise from the rear shock can transfer into the body of the vehicle. A new improved rear upper shock mount has been introduced MY 2003 starting with ch. no. 920000.

SERVICE:

If an excessive shock noise is transferring into the body replace both rear upper shock mounts with PN 30620916. Follow the instructions in VADIS.

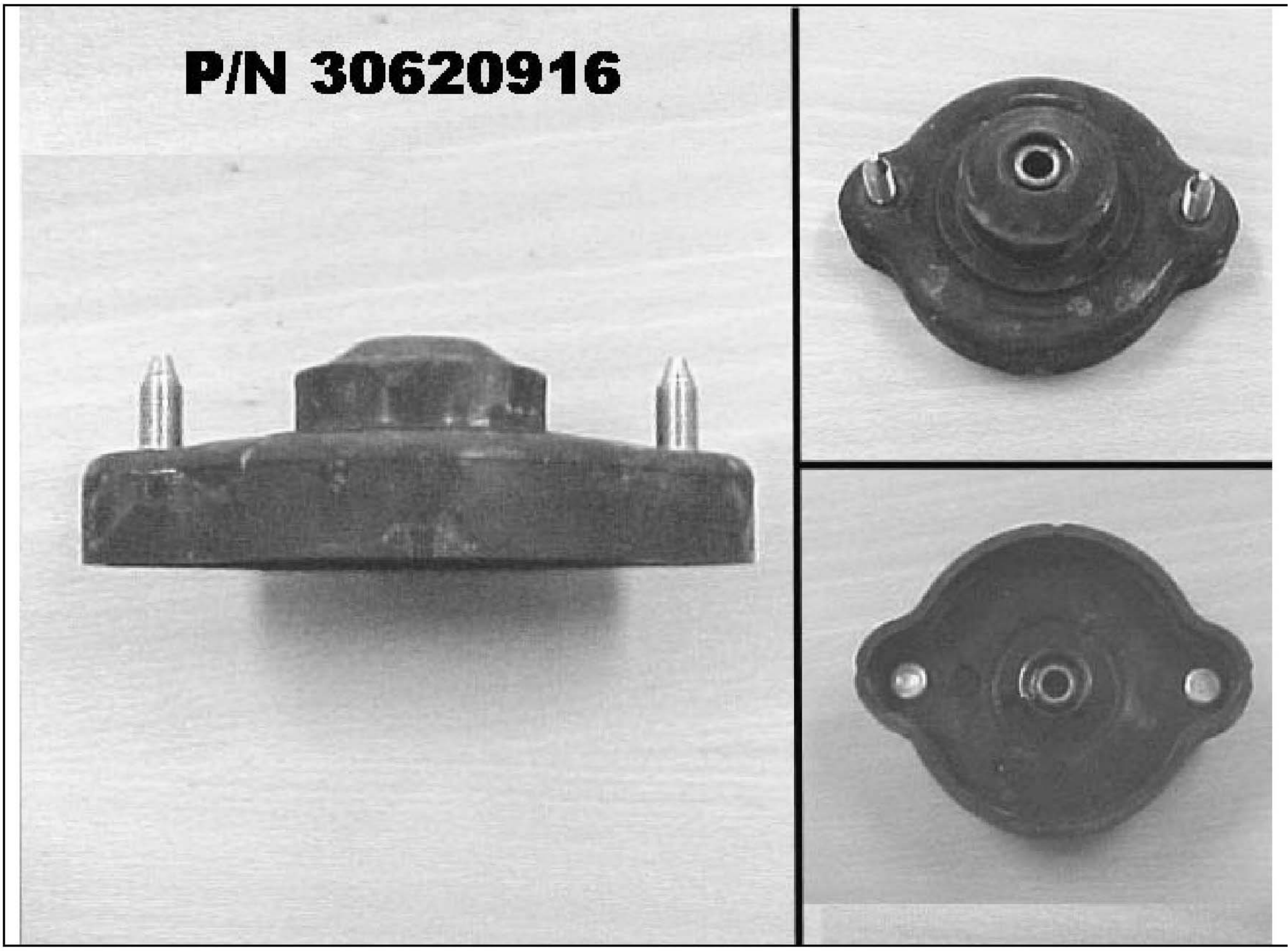
See pictures for differences in early and late mounts.





NOTE!

It installing rear upper shock mount do BOTH sides.



New rear upper shock mount.

Technical Service Bulletin # **8850019** Date: **010101**

Interior - Manual Front Seat Whining/Creaking Noises

Section
8

Group
85

No.
0019

Year
01

Month
01

Front seat (manual adjustment), noise

Background

In most cases a customer complaint about noise from the front seats can be reduced by applying lubricant according to the methods in this service Bulletin.

Description	Number	P/N
Lubricant spray	1	1161030

Materials

Front seat (manual adjustment, lubrication

Lubricating the front seat (manual adjustment)

1

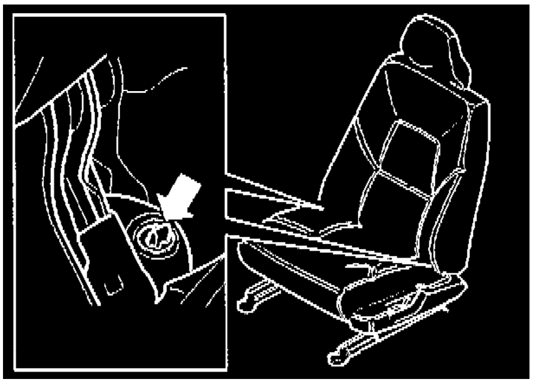
Preparations before lubrication

Ensure that the unprotected areas of the seat / carpet are not exposed when applying the lubricant.

2

Whining noise when cornering

Complaint



Whining noise from the rear edge of the seat cushion when cornering. The noise could originate from the upper mounting in the seat frame for the gas strut (positioned under the lower section of the seat cushion).

Corrective action

Push the rear corner of the seat cushion to one side. Spray lubricant P/N 1161030 onto the retaining washer under the seat cushion, also on the lower mounting at the rail side from underneath.

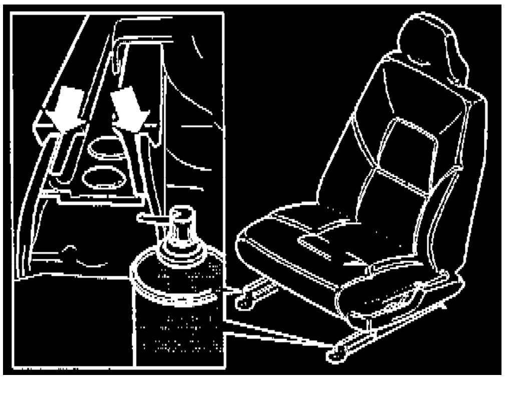
3

Creaking noise during cornering and driving in "stop and go" traffic

Complaint

Creaking noise when cornering and driving in stop and go traffic.

The noise can originate from the mounting for seat rails in the floor.



The noise occurs between the compressed components (as arrowed in the illustration).

Corrective action

Spray lubricant P/N 1161030 in the gap between the compressed components

Allow the agent to work for a few minutes.

Check that the noise has disappeared. Sit on the seat. Test drive the car in a manner that would cause the noise.

Note!
It is important that the seat is readjust to the customer settings.

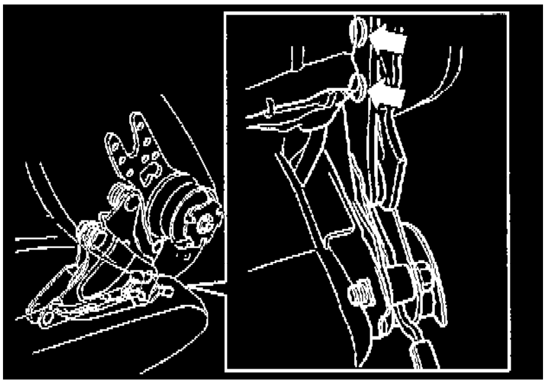
4

Creaking noise when driving in stop and go traffic

Complaint

Creaking noise from the rear edge / release mechanism of the backrest when driving in stop and go traffic.

The noise can occur when sitting on the seat and pressing the upper section of the backrest backwards.



The noise appears to come from the upper section of the backrest.

Corrective action

Detach the "long-load catches". Fold the backrest forwards.

Spray lubricant P/N 1161030 between the rivets and the plate towards the centre of the seat by the adjustment mechanism.

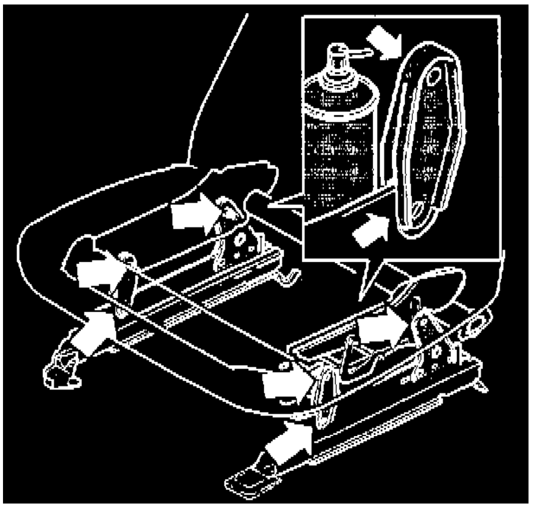
5

Noise or play in the height adjuster

Complaint

Check whether the customer complaints about noise or play in the height adjuster.

Corrective action



If only noise is noticed spray the links of the height adjuster using lubricant P/N 1161030.

If there is play in the height adjuster replace the height adjuster according to the method in VADIS: Section 8 Bodywork and interior, Repairing and installation, Removing, replacing and installing, group of functions 85 Interior, Front seat cushion.

Operation No.	Labor description	Time allowance
85253-2	Replacing the seat rails	1.2 hr
85946-2	Lubricating the front seat	0.2 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN28-61** Date: **050930**

Engine Controls - ECM Reprogramming Procedure

NO: 28-61

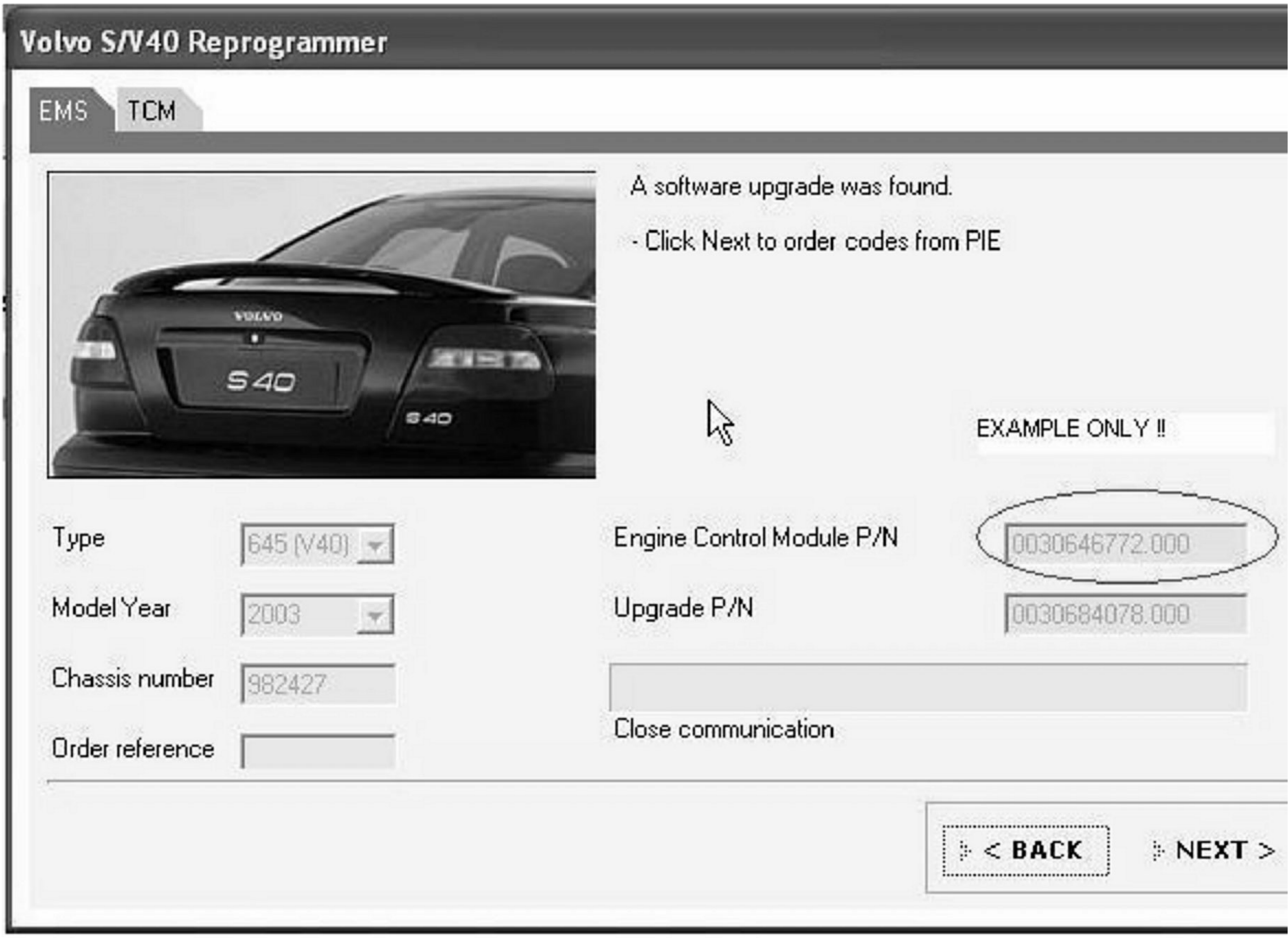
DATE: 9-30-2005

MODEL: S40, V40

M. YEAR: 2000 - 2004

SUBJECT:
ECM Reprogrammer procedure through VIDA

When using VIDA to perform the S or V 40 ECM Reprogrammer (VEMS) upgrade the method is somewhat different than VADIS.



After the ECM Reprogrammer procedure is started and before doing anything else write down and save the entire number that appears in the box labeled Engine Control Module P/N. This number will be required if the download attempt fails for any reason. This number is visible in the box after the car profile is entered and VIDA communicates with the ECM

Model year 2000: 0030684459.000 or 0030684460.000
Model year 2001...>: 0030670303.000 or 0030670302.000 or 0030684078.000 or 0030684070.000

If none of these numbers are shown, the ECM will require an ECM programming update.

If any of the part numbers shown are visible, the ECM already has the most recent software and does not require an upgrade:

NOTE:
BATTERY CHARGER MUST BE CONNECTED; VOLTAGE SHOULD BE MONITORED, AND SHOULD NOT EXCEED 14 VOLTS DURING THE DOWNLOAD. CHARGER SHOULD NEVER BE SET TO HIGH DURING A DOWNLOAD TO ANY VEHICLE.

After the ECM number is recorded, proceed with the ECM Reprogrammer download as usual. Please note that it is possible that the status bar may not fill in as the download progresses, instead only an hour glass will appear. This is normal do not exit from the download until the status bar does fill in and FINISHED appears in the dialog box. It may take several minutes for the ECM Reprogrammer download to finish.

If during the download, the process stops and/or you receive an "UNHANDLED EXCEPTION" error close all open windows until you are back at the desktop. Remove the key and disconnect the car from PC. Reconnect the car to the PC, turn the key on, restart the VIDA application then restart the ECM Reprogrammer process. When you are asked if the ECM part number is corrupt, say YES. Profile the car as usual then add the 13 digit ECM part number that was recorded in the beginning paragraph into the ECM part number box.

Continue with the ECM Reprogrammer download as usual, and please note that the status bar may not fill in as the download progresses, only an hour glass may appear. This is normal, do not exit from the download until the status bar fills in and FINISHED appears in the dialog box. This may take several minutes.

MY 2000 ECM number	MY 2000 ECM number	MY 2001------> ECM number	MY 2001------> ECM number	MY 2001------> ECM number	MY 2001------> ECM number
30614736	30644229	30614884	30644192	30646295	30644193
30614838		30658838		30646916	
30614840		30614913		30646772	
30614888		30614223		30670304	
30614232		30614294			
30614305		30614378			
30614405		30614408			
30614562		30614345			
		30646775			
Use 0030614888.000	**Use 0030644229.000**	**Use 0030614408.000**	**Use 0030644192.000**	**Use 0030646772.000**	**Use 0030644193.000**

If you did not record the ECM part number as requested in the first paragraph, and you have received the message that the ECM part number is corrupt, access the ECM and record the part number from the label on it. Use the chart to find the correct part number to enter in the ECM part number box in VIDA shown.

Technical Service Bulletin # **TNN25-16** Date: **030731**

Engine Controls - DTC ECM 16

NO: 25-16

DATE: 7-31-2003

MODEL:
S/V 40

M. YEAR:
2000, 2001, 2002, 2003, 2004

CHASSIS:
415000-030337

SUBJECT:
DTC ECM 16

REFERENCE:
VADIS

THIS TECH NOTE SUPERSEDES THE PREVIOUS TNN DATED 7-25-03. PLEASE UPDATE YOUR FILES.

DESCRIPTION:

DTC ECM 16 could appear in 2000 to 2004 model year S/V 40 vehicles. The root cause is contamination of the reference air for the front oxygen sensor. An adapter cable will prevent the contamination from affecting the sensor.

SERVICE:

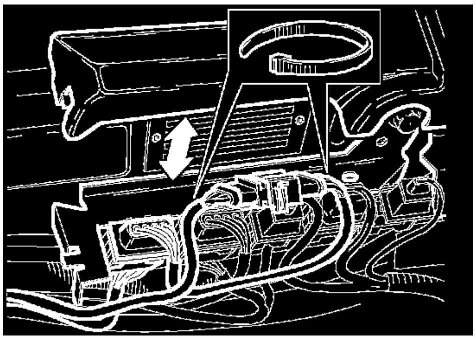
If DTC ECM 16 is detected please follow the instructions below.

1. Install extra adapter cable.

   Read out and erase the fault code. Refer to Resetting Adaptive Values as described.

   Remove the connector cover. Remove the black connector for the front oxygen sensor (four wires) at the connector stay.

   Install the adapter cable PN 30650686 in between the disconnected connectors. Route the adapter cable under the other cables.



   Place the new connector as shown in the illustration and tie-up the wiring. Install the connector cover. When routing cables make sure the cover stays in place.

   Verify that DTC has not returned. If the fault has returned replace the front lambda sond as per VADIS.

   Note:
   Do not remove the adapter cable it replacing the oxygen sensor is necessary.

Resetting Adaptive Values

Instructions for resetting adaptive values are found in the fault tracing instructions for DTC ECM 16 Front Oxygen Sensor.

1. DTC ECM-16. Select signal too high. Permanent fault.
2. Checking the terminal. Were any faults found? Answer yes.
3. Verification. Does the value oscillate between approximately 0 and 1 V? Answer yes.
4. Resetting adaptation. Follow the instructions on the screen.

If submitting a warranty claim for the VEMS download, PN 9139873 should be used as the failed part number.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36001-2	Read/Erase DTC Codes	0.3 hr.
99081-2	Adapter cable install	0.2 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information

Technical Service Bulletin # **TNN30-04** Date: **051013**

Engine Controls - Software Download Fault Prevention

NO: 30-04

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

DATE: 10-13-2005

MODEL: All Vehicles

M. YEAR: All

SUBJECT:
Midtronics PSC-550 Vehicle Power Supply use required during Software Download. Includes Mobile Technician Program

REFERENCE:
Special tool bulletin no. 111-A // VADIS/VIDA repair instruction

This Tech Note supercedes the previous TNN 30-04 dated 10-11-05. Please update your files.

DESCRIPTION:
Software Download failure due to too high or too low voltage

When performing a software download as well as electronic diagnostics, activations and quick tests within VIDA, it is imperative that the vehicle's system voltage is maintained between apx. 13.0V and 14.0V.

We have found that certain SWDL (Software Download) faults may occur due to too high or too low a voltage. Among them are; Half loaded nodes and check sum errors.

Too high a voltage can be caused by using commonly available Constant current type chargers. These are the type used in most automotive shops. This type of charger will increase the charging voltage to maintain a constant current setting. Therefore, the Voltage may increase up to 17 Volts or higher depending on the condition (internal resistance) of the battery to maintain the current setting. While the higher voltages can be advantageous for charging batteries, it can also be the reason for failed Software Downloads, one or more nodes stuck in Program mode and misleading results while fault tracing certain circuits.

Too low a voltage can also cause nodes to become stuck in programming mode. Therefore, Battery Booster Packs are not acceptable for use during Software Downloads.

Fast chargers, Boost chargers, standard battery chargers, especially when set to "boost" should never be used during software downloads due to the excessive voltage and current they can supply under certain conditions.

Volvo now requires the use of the Midtronics PSC 550 when performing SWDLs and during fault tracing. This includes downloads performed by your Mobile technician if your retailer is using one. The Midtronics PSC 550 is a constant voltage power supply capable of 55 Amperes max while regulating the voltage to 13.6. The use of this power supply will prevent over voltages during SWDLs and fault tracing.

The Midtronics PSC-550 is classified as a mandatory tool and will be allocated to all US and Canadian retailers by SPX/Kent-Moore during October 2005. Please refer to Special Tool Bulletin 111-A for more information.

FOR MOBILE TECHNICIAN RETAILERS:

The Midtronics PSC-550 power supply unit is also required for all SWDLs in the field. As a Mobile Technician retailer you are required to add this mandatory tool to your inventory. This power supply supersedes the previous 20 AMP battery charger previously required.

Note:
The unit purchased for Mobile Technician use will be in addition to your allocated requirement.

Important Note:
Connection procedure:

Install the clamps at the battery before connecting the unit to the 115VAC outlet.

Technical Service Bulletin # **TNN25-17** Date: **040318**

Engine Controls - ECM DTC A1

NO: 25-17

DATE: 3-18-2004

MODEL:
2000-2003

M.YEAR:
S/V 40

CHASSIS:
415000-952893

SUBJECT:
DTC ECM A1

REFERENCE:
VADIS, VEMS

DESCRIPTION:

Under certain engine warm up conditions ECM DTC A1 may set. Extreme cold temperature and a long engine idle time from cold start could trigger the code.

SERVICE:

If ECM DTC A1 is set in a vehicle perform the current VEMS download as the first step in diagnostics/repair. If the DTC returns, fault trace according to VADIS.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36004-2	Software Control Module Download	0.4 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information

Technical Service Bulletin # **2250023** Date: **010701**

Electronic Throttle Module - Uneven Idle

S70/V70 1999-2000/C70 1999-
S80 1999-/V70/S60 2001-

Section
2

Group
25

No.
0023

Year
01

Month
07

Reference:
Vehicles involved: All equipped with Electronic Throttle Module

Electronic Throttle Module (ETM), Cleaning

Background:

Carbon deposits can form in the throttle module bore on cars frequently driven short distances. This residue can cause idle speed to become uneven and noticeable to the driver especially with the increased load produced by the air conditioning compressor cycling on and off. This Service Bulletin describes how to clean the throttle module bore.

Materials:

Description	Quantity	Part no.
Cleaner H	1	1161436

Electronic Throttle Module (ETM), Cleaning

1

Preparations

Removing and installing the throttle unit see VADIS:

Replacement and installation

Function group 25

"Replace the throttle unit".

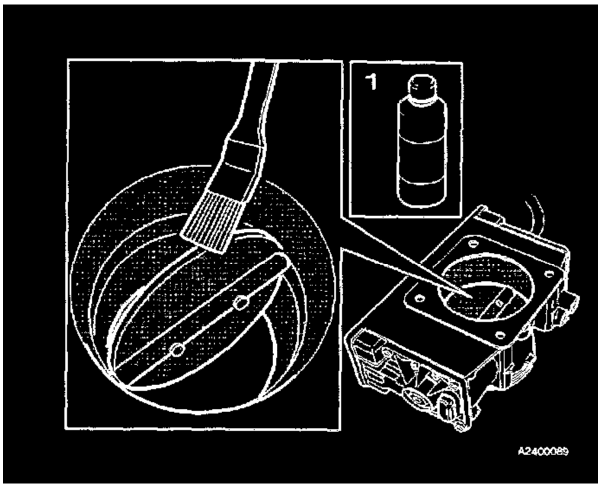
2

Cleaning the ETM

Warning!
Use a fume hood or ensure that ventilation is good. DO NOT submerge throttle unit in cleaning solvent. ONLY use cleaning solvent recommended in this bulletin.

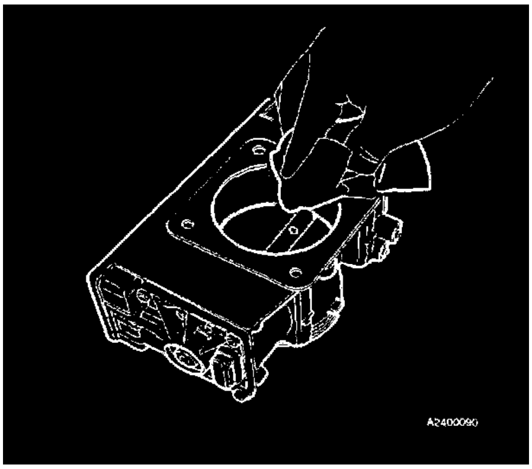
Caution!
Do not scrape or use a rotary wire brush to clean the unit.

Clean the ETM bore using cleaner H (P/N 1161436-9) and a soft bristle brush.



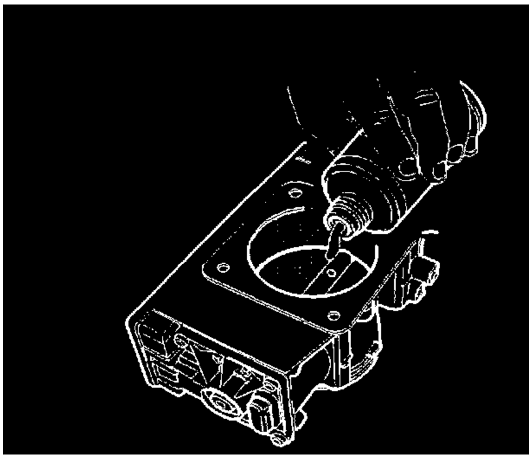
Ensure that all the residue is removed from the shaded surfaces shown in the illustration.

3



Carefully wipe the bore clean on both sides of the throttle plate.

4



Flush the ETM bore using cleaner H on both sides of the throttle plate.

Check that there is no residue in the bore or on the throttle plate. Any remaining residue can promote new residue build up.

Repeat the procedure if necessary.

Install the throttle body (TB) see VADIS:

Replacement and installation

Function group 25

"Replace the throttle unit".

Operation No.	Labor description	Time allowance
25121-2	Cleaning the intake pipe in the throttle body (TB).	
25121-2	S80 Non Turbocharged Engine	1.0 hr
25121-2	S80 Turbocharged Engine	1.2 hr
25121-2	V70 2001- Non Turbocharged Engine	1.0 hr
25121-2	V70 2001- Turbocharged Engine	1.3 hr
25121-2	S60 Non Turbocharged Engine	1.0 hr
25121-2	S60 Turbocharged Engine	1.2 hr
25121-2	S/V70 1999-2000 Non Turbocharged Engine	0.9 hr
25121-2	S/V70 1999-2000 Turbocharged Engine	1.2 hr
25121-2	C70 Turbocharged Engine	1.2 hr

WARRANTY STATEMENT: Claims may be submitted under New Car Warranty ONLY one time per vehicle when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **2230045** Date: **991201**

Emissions - Canister Purge Valve Ticking Noise

S40/40
2000-

Section:
2

Group:
23

No.:
0045

Year:
99

Month:
12

Vehicles involved:
B4xx4T2/S2 200-

Canister purge (CP) valve, ticking noise

Background

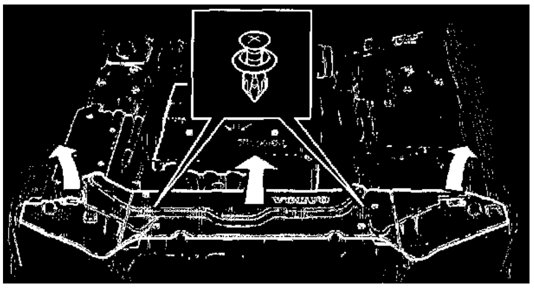
A ticking noise may be heard from the canister purge (CP) valve. The noise increases in cold weather. A rubber-covered clamp that dampens the noise has been introduced as a service solution.

Engine	Model year	Chassis number
B4xx4T2	2000-	415000-

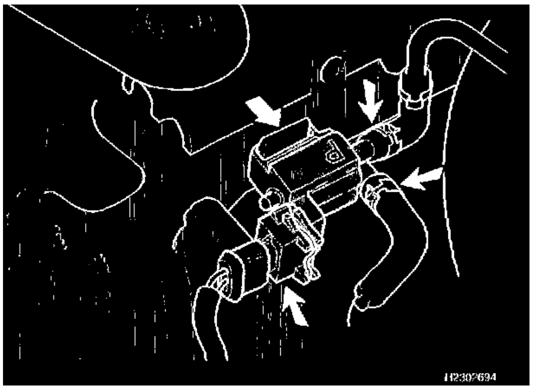
Materials	Number	Replacement part number
Clamp	1	981143

Canister purge (CP) valve, ticking noise

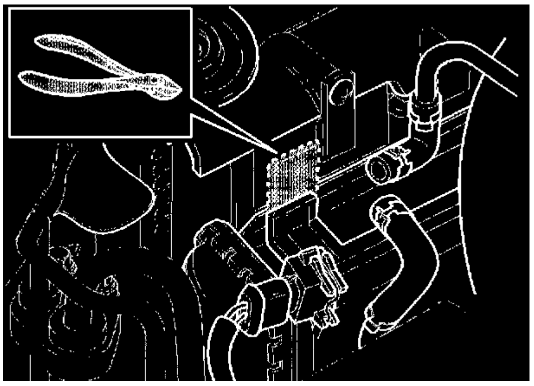
Installing the clamp on the canister purge (CP) valve (turbocharged engines) 1



Remove the outer covers. Remove the inner cover (4 screws) 2

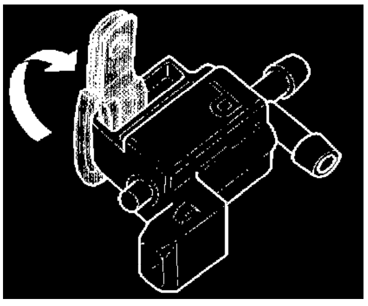


Remove the canister purge (CP) valve from the mounting on the fan shroud.

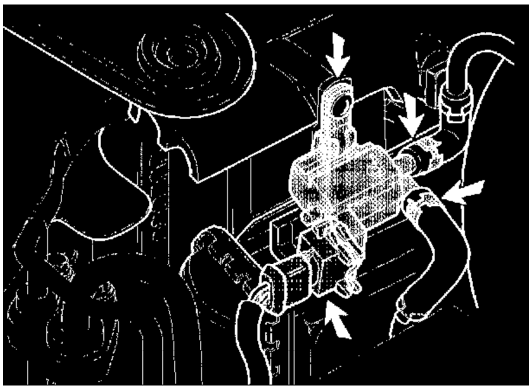


Cut off the mounting for the canister purge (CP) valve to 3

avoid contact with the new mounting.



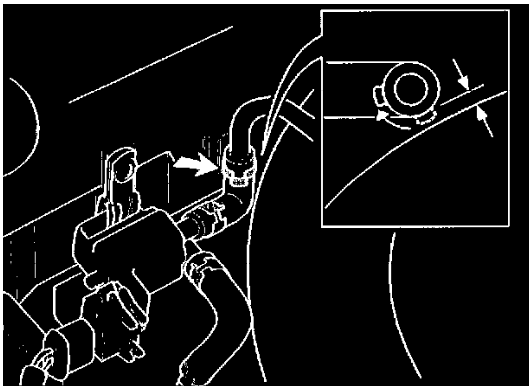
Install the clamp on the canister purge (CP) valve. 4



Remove the existing screw on the charge air cooler (CAC). 5

Install the canister purge (CP) valve. Tighten the screw.

Check 6



Check that the clamp is not in contact with the charge air hose. Turn the clamp if necessary. Install the inner and outer covers.

Operation No.	Labor description	Time allowance
25924-2	Replacing the mounting for the canister purge (CP) valve	0.3 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint using claim type 01.

Technical Service Bulletin # **TNN88-33** Date: **030729**

Restraints - SRS Lamp ON/Side Impact Sensor DTC Set

NO: 88-33

DATE: 7-29-2003

MODEL: S/V 40

M. YEAR:
2000, 2001, 2002, 2003, 2004

CHASSIS:
0415000-

SUBJECT:
Moisture in B-pillar Side Impact Sensor.

REFERENCE:
VADIS

DESCRIPTION:

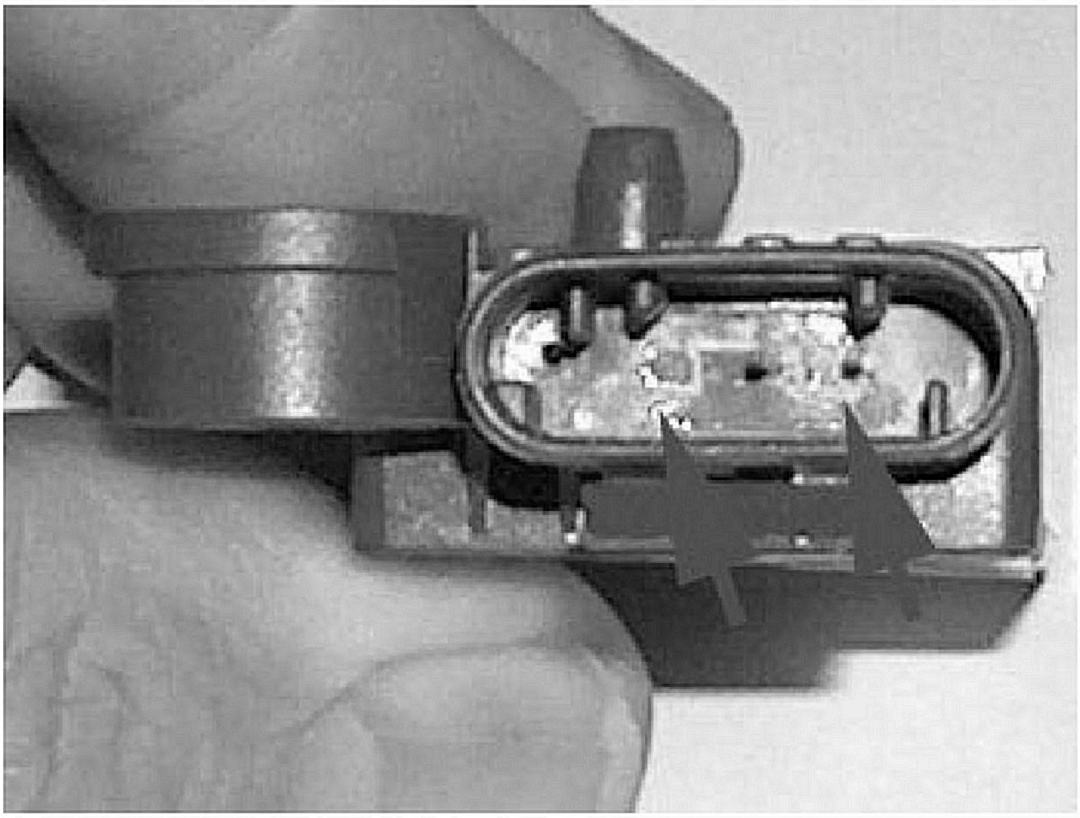
If the SRS warning lamp is on and the stored SRS-DTC indicates a fault in one of the Side Impact Sensors you should carefully check to see if traces of moisture are visible in the sensor connector.

It has been found that moisture can enter the B-pillar via the grommet for the harness to the rear door.

The grommet for the rear door harness is fitted in the B-pillar with special care from the chassis listed above.

SERVICE:

If customer complaint is consistent with the above description and within the chassis break perform the following:



Note:
Refer to picture shown.

If traces of moisture in the connector are detected you must replace the SIPS Sensor and find the root cause (location) of the water leak and seal it.

After removing the SIPS-Sensor perform a visual inspection of the connector.

If any corrosion residue is visible (see photo) this is an indication that moisture has intruded into the sensor.

Note:
If any kind of water intrusion is identified, the sensor must be replaced.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
88452-2	: Replace B-pillar SIPS Sensor	0.3 hrs
99085-2	: Check B-pillar SIPS Sensor for water leak and seal leakage area.	0.3 hrs

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Information
Technical Service Bulletin # **TNN43-47** Date: **051101**

M/T - 1st/Reverse Gear Difficult to Engage

NO:	43-47
DATE:	11-01-2005
MODEL:	Vehicles with 5 or 6 Speed Manual Transmissions
M. YEAR:	1999-2005
SUBJECT:	Difficult to Engage 1st and/or Reverse Gear

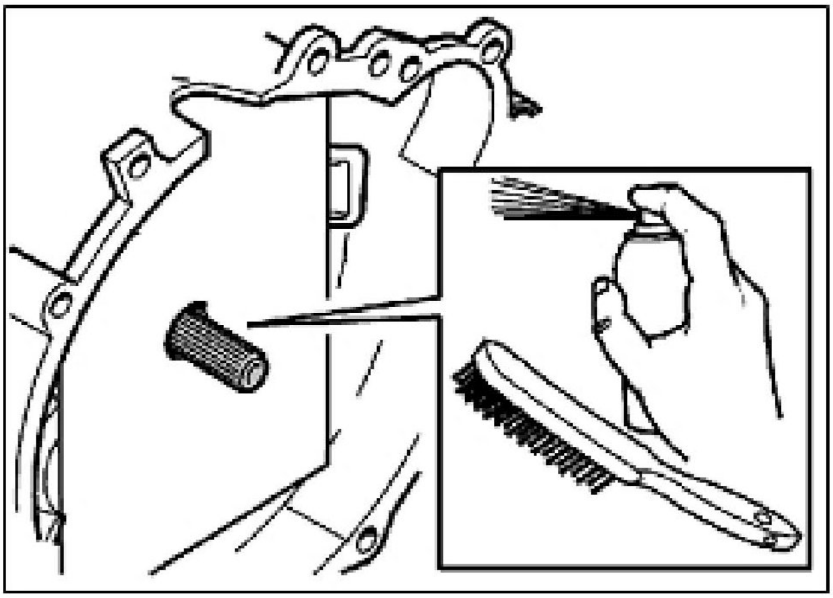
This Tech Net Note supersedes the previous 43-47, dated 8/5/04. Please update your files.

This applies to all 1999 S/V/C 70 cars, as well as S40/V50/S60/V70 cars built before:
544 -053404
545 -048974
384 -425275
285 -459438

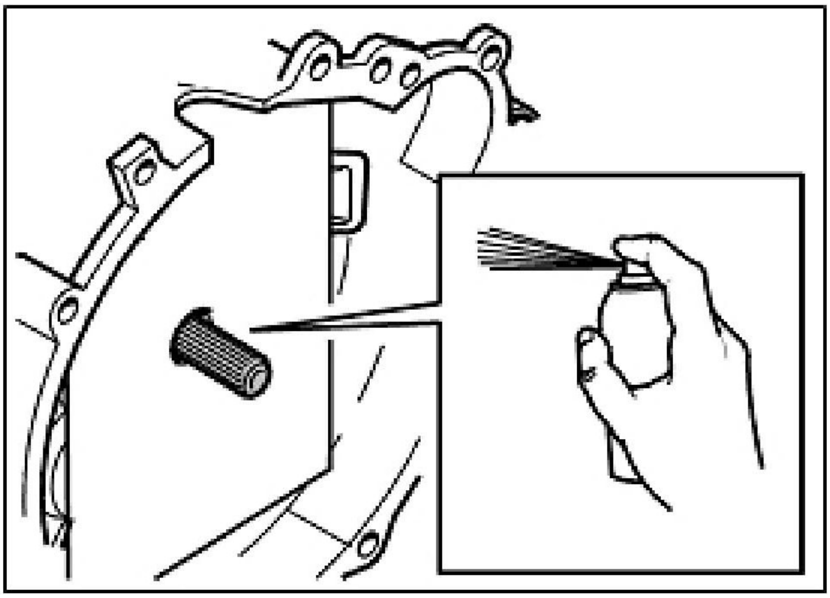
The grease was introduced in production on cars built after this point.

DESCRIPTION:
Some customers may complain that it is difficult to engage 1st and/or reverse gear, especially after the car has been sitting overnight.

SERVICE:
If a customer complains of this symptom, verify that there is no air in the clutch hydraulic system and that the gearshift cable is correctly adjusted. If the symptom persists, clean and lubricate the input shaft splines according to the following procedure. Place a piece of cardboard over the input shaft as shown below; to protect the slave cylinder and input shaft seal during the procedure:



1. Clean the Input Shaft thoroughly using universal oil (PN 1161657) and a wire brush. Wipe the splines off with a rag. Check that there is no dirt left on the shaft.



2. Spray the Input Shaft with a thin layer of PN 30759651. Wipe off any excess.

Technical Service Bulletin # **TNN72-05** Date: **020801**

Suspension - Rear Suspension Knocking/Squeaking Noises

NO: 72-05
DATE: 8-01-2002
MODEL/YEAR: S/V40
SUBJECT: Rear suspension noises
CHASSIS: See Below
REFERENCE: VADIS

DESCRIPTION:
When diagnosing a rear suspension noise on S/V 40 cars the following items could be the source.

SERVICE:

1. A knocking noise during large suspension movements could be caused by movement of the rear spring on the spring seat.

^ Install rubber spring insulator P/N 30620557 between the rear coil spring and the spring seat.

^ Follow instructions for rear spring replacement in VADIS.

2. Noise from parking brake cable where it slides through the retaining bracket located next to the rear trailing arm front attaching point.

^ Lubricate the brake cable where it slides though the retaining bracket.

^ Use silicone grease PIN 1161325 or similar.

^ The cable must be able to slide in and out of the bracket freely.

Technical Service Bulletin # **81-0011** Date: **041001**

Body - Rear Lamp Housing/Gusset Panel Repair

Section
8

Group
81

No.
0011

Year
2004

Month
10

Outer rear lamp housing/gusset panel, paint or body repair

Background:
This Service Bulletin describes how the protective film is applied when a paint or body repair is carried out on the outer rear lamp housing/gusset panel.

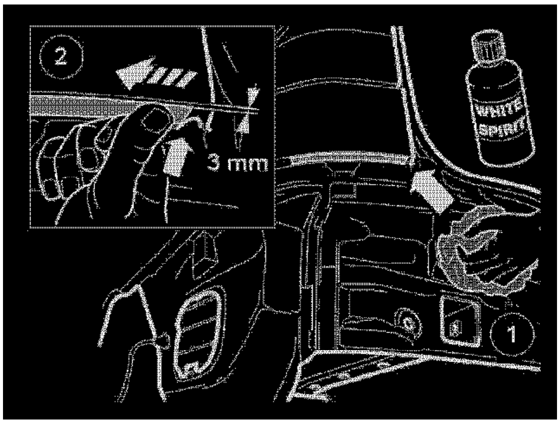
Competence requirement
Volvo Level 1 Technician

Material

Description	Quantity	P/N
Film S40 (-04)	2	30652163
Film V40	1	30652163

1
Information
When the rear panel is replaced or needs to be painted after repairs an extra film must be applied (left and right side).This is to prevent damage to the bumper and body caused by moving the bumper.

2
Installing the film



Note! Must be carried out after painting.

Clean the lower side of the sunface.
Cut the film in the middle to a size of 10 x 100 mm:
- for V40 apply two pieces
- for S40 apply two pieces
Attach the film to the underside.
Follow the bracket curve as illustrated.
Position the film 3 mm to the inside. Start at the inner side and follow the body curve. Press the film firmly to the body.

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint using claim type 01.

Operation No.	Labor description	Time allowance
86114-3	Masking tape bumper cover rear install	0.1 hr

Technical Service Bulletin # **84-0034** Date: **041001**

Body - Checking Rubber Seals and Seams

Section
8

Group
84

No.
0034

Year
2004

Month
10

Checking and adjusting rubber seals and seams

Background:

This Service Bulletin describes how to check and adjust rubber seals and seams in the rear section of the vehicle.

Competence requirement

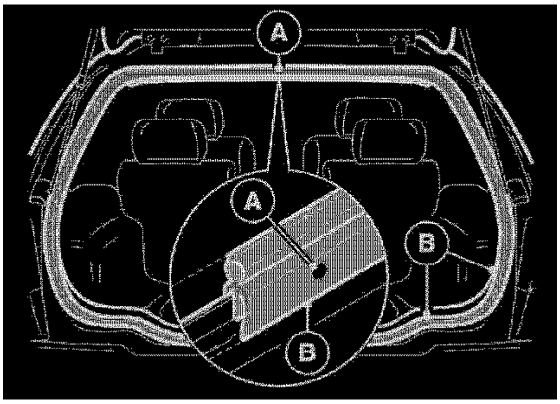
Volvo Level 1 Technician

Materials

Description	Quantity	P/N
Sprayable seamsealer	0.1 litre	1161651
Sealing strip	0.5 m	1161616

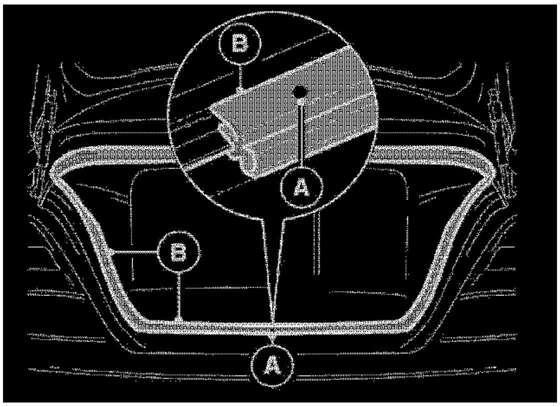
Rubber seals and seams, check and adjust

1
Rubber seal, check



Check the rubber seal for the following:

- that it is not damaged
- that the air valves are open
- that the profile is properly installed the entire way across the body seam and is not open
- V40: that the white dot (A) points up
- S40: that the white dot (A) points down
- that the wide lip (B) is installed on the inside Check the closing/adjustment of the tailgate/trunk lid. See method in VADIS function group 8.



If the above is not OK:

Check where the water leakage is coming from along the rubber seal. See step 2.

If there is water leakage along the rubber seal continue with step 9.

If the above is OK:

If there is no water leakage along the rubber seal continue with step 3.

2
Water leak, check

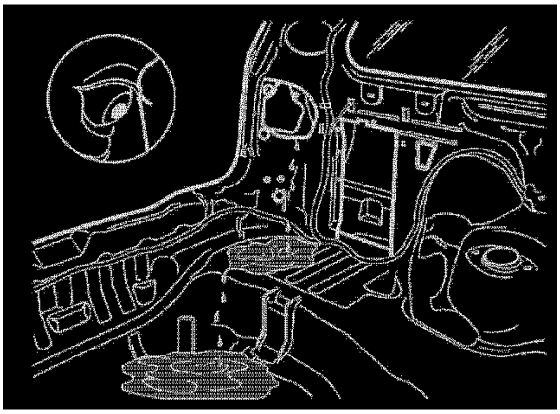
Adjust the tailgate/trunk lid correctly.

Check for water leaks by using a hose to spray water on the rear bumper and around the openings for the rear doors/boot lid. Check the inside to see if any water penetrated the rubber seal.

If there is water leakage through the rubber seal continue with step 9.

If there is no water leakage through the rubber seal continue with step 3.

3
Water leak, check (cont.)

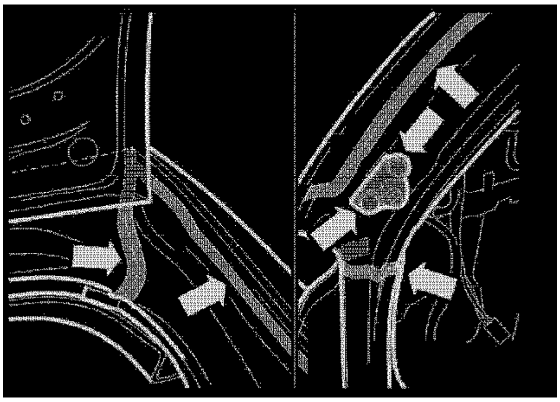


Keep the tailgate/trunk lid closed.

Remove the interior side panels. Spray water on the rear bumper and around the openings for the rear doors/boot lid. Check to see if any water penetrated into the vehicle.

Continue with step 4 (V40) or step 5 (S40 (-04)).

4
Seals, drainage channels and seams, check - V40



Remove the rubber seal and the panels.

Clean:
- the drainage channel
- the mountings for adjustment and impact stop.

Check:
- that the flange is not bent or damaged. Wipe the flange clean (do not remove the sealing putty in the seam)
- the sealing putty over the seams especially in the spots indicated (see arrows in the illustration).

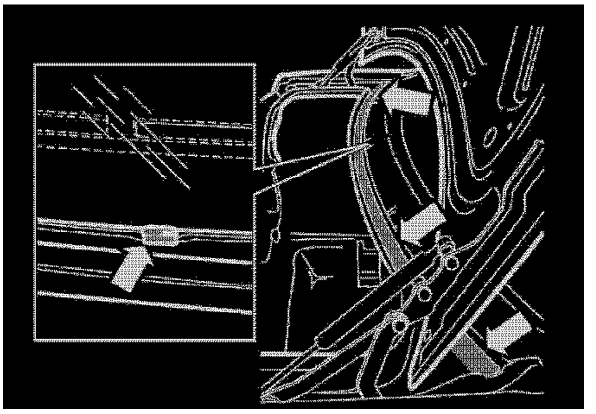
Use sealing putty to seal the openings. Apply and spread the sealing putty correctly.

Apply the original paint colour after the sealing putty has hardened.

Check that the adjuster remains flat. Apply sealing putty if necessary.

Continue with step 6.

5
Rear window glue seam, check - S40 (-04)



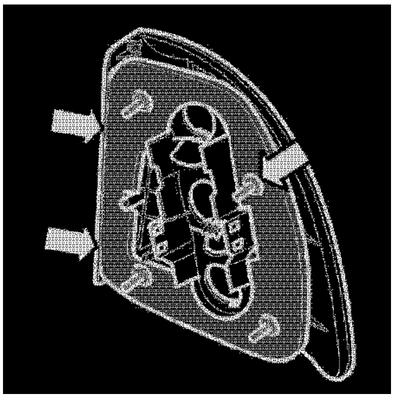
Check:
- the seams at the bottom of the rear windshield
- installation of the spacer clips for the rear window. Remove the clips as necessary apply sealing putty and refit the clips.

Use body putty to seal the openings. Apply and spread the sealing putty correctly.

Apply the original paint colour after the sealing putty has hardened.

Continue with step 6.

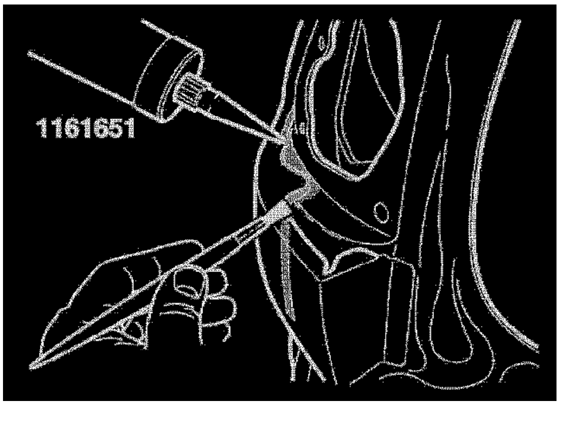
6
Parts of the body, internal, sealing - S40 (-04)/V40



Remove the tail lamp. See method in VADIS function group 3.

Check that the rubber seal at the tail lamp is properly fitted. The rubber seal must sit over the mounting pins and must be in contact with the raised edge of the tail lamp.

Remove the bumper. See method in VADIS function group 8.



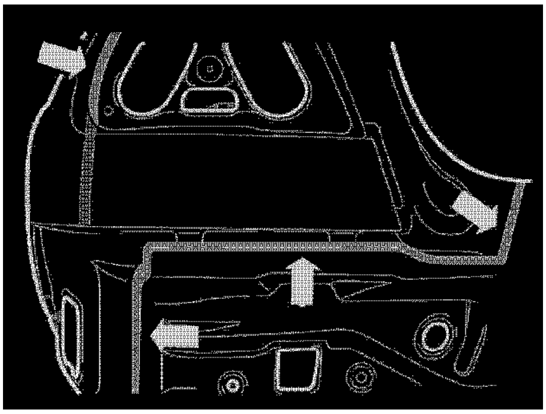
Clean the inside of the panel. Allow the panel to dry. Apply sealing putty (P/N 1161651) to the internal seam

all the way out toward the outer end plate. Brush on the sealing putty to make sure it is in the correct spot. Use a small brush. Wipe off any excess sealing putty.

Apply the original paint colour after the sealing putty has hardened.

Continue with step 7.

7
Seams, check - S40 (-04)/V40

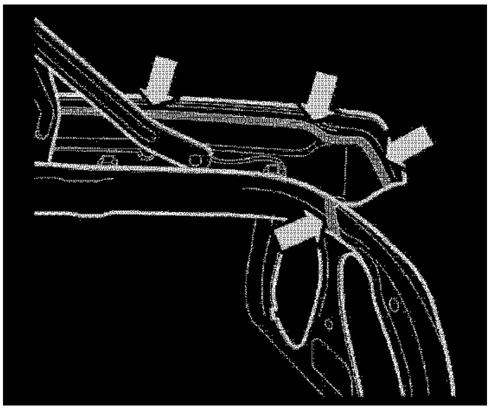


Begin by removing the bumper and tail lamp. Use sealing putty to seal the openings. Apply and spread the sealing putty correctly.

Wipe off any excess sealing putty.

Apply the original paint colour after the putty has hardened.

8
Seams, check (cont.) - S40 (-04)



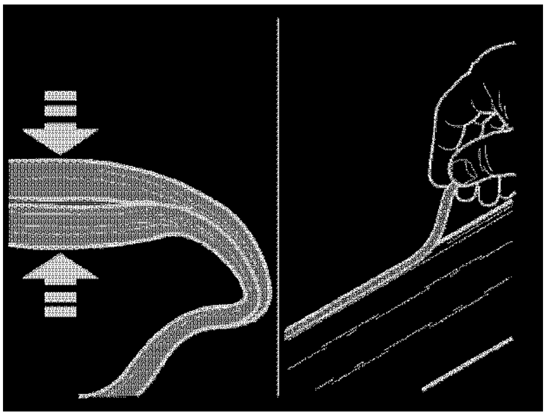
Check the sealing putty over the seams especially in the spots indicated (see arrows in the illustration).

Check that the adjuster remains flat. Apply sealing putty if necessary.

Use body putty to seal the openings. Apply and spread the sealing putty correctly.

Apply the original paint colour after the sealing putty has hardened.

9
Rubber seal, before installation , check



Remove the rubber seal from the tailgate/trunk lid opening.

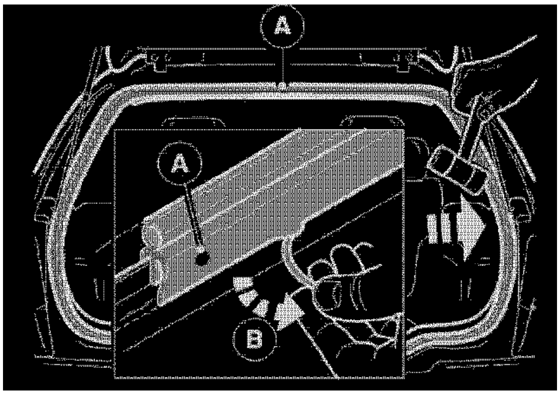
Check:
- that there are traces of sealing putty along the entire rubber seal which indicates proper installation
- the rubber seal for damage (replace if necessary)
- that the air valves are open.

Caution! If the rubber seal is to be reused the sealing putty must be applied to the body seam to ensure that the seam is properly sealed. Use weatherstrip P/N 1161616. Position the weatherstrip on the body edge.

Check that the rubber seal is not open anywhere in the seam. Press the seam together if necessary.

Install the rubber seal as described in step 10.

10
New rubber seal, installation



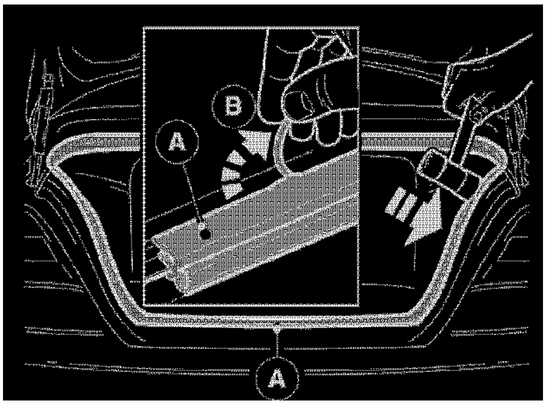
Remove the rubber seal from the tailgate/trunk lid opening.

Note! First carry out step 9 if the old rubber seal isto be reused.

Check that the flange is not bent or damaged. Wipe the flange clean (do not remove the sealing putty from the seam).

Clean the drainage channels.

Install:
- for V40: The white dot (A) on the rubber seal must face up in the centre. The seam should face down near the lock. The wide lip must be positioned on the inside.
- for S4O(-04): The white dot (A) on the rubber seal must face down in the centre. The seam should face up in the centre. The wide lip must be positioned on the inside.



Start by installing the rubber seal at the white dot (A). Press the rubber seal onto the seam as straight as possible. Follow the edge and exercise care at the corners.

Do not stretch out the rubber seal.

Use a rubber mallet to make sure that the rubber seal is completely pressed in along its entire length. Do not damage the rubber.

If a new rubber seal is used:
- position the rubber seal on the inside. Pull the assembly cord (B) out of the rubber seal in one movement. (Put the flap over the panels where necessary).

If a used rubber seal is used:

- position the rubber seal on the inside and properly install the lip. Position the lip over the panels where necessary.

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint using claim type 01.

Operation No.	Labor description	Time allowance
84933-2	Water leak weatherstrip boot lid check	0.1 hr
84934-3	Weatherstrip boot lid replace	0.2 hr
84935-2	Water leak cargo compartment check S40 (-04)	0.5 hr
84935-2	Water leak cargo compartment check V40	0.8 hr
84936-3	Water leak rear adjustment	0.7 hr

Technical Service Bulletin # **00205** Date: **011019**

Interior Safety Products - Reuse/Disposal

GROUP:
00

NO:
205

ISSUING DEPARTMENT:
Warranty

CAR MARKET:
U.S. and Canada

DATE:

YEAR	MONTH	DAY
2001	10	19

TITLE:
Reuse of Interior Explosive Products and SRS Disposal

REFERENCE BULLETINS:
SMB 00-170

1. REUSE OF INTERIOR EXPLOSIVE SAFETY PRODUCTS

   Volvo Cars of North America, LLC does not endorse the re-use of interior safety components from salvaged or scrapped vehicles. The integrity of used parts cannot be guaranteed. It is impossible to determine the conditions to which these components may have been exposed. Undisclosed activation, violent disassembly, excessive heat or cold, high humidity, improper transport, and other adverse factors can all render safety components ineffective.

Concerned Products:

^ Safety belts, including pretensioners

^ Airbags, including front and side airbags for driver and front passenger, and inflatable curtains.

^ Crash sensors and igniters.

^ Whiplash Protection System (WHIPS) components

2. SRS DISPOSAL

   Pyrotechnic (explosive) safety components are hazardous materials. Disposal or scrapping of any hazardous material, not requested from the retailer via the Volvo Service Transaction Statement,1 must be made in accordance with all applicable Local, State and Federal Regulation.

Technical Service Bulletin # **TNN36-45** Date: **040716**

Ignition Systems - Failed Ignition Key Programming

NO: 36-45
DATE: 7-16-2004
MODEL: S/V40 MY2000-2004; S/V70 MY1999-2000; C70 MY1999-2004
SUBJECT: Failed Ignition Key Programming
REFERENCE: VADIS

DESCRIPTION:

Cases are reported that new correctly cut spare part ignition keys can't be programmed to the immobilizer ECU. VADIS may indicate that one or more DTC's are present related to the failed programming.

The most frequent cause of failed ignition key programming is that the immobilizer ECU memory has reached its maximum capacity. The memory of the immobilizer can be cleared by disconnecting the battery negative lead for at least one minute.

This TNN provides some guidelines on the programming of ignition keys with an integrated transponder for the S/V40 MY2000-2004, S/V70 MY1999-2000 and C70 MY1999-2004. These vehicles have a similar immobilizer system and ignition key with integrated transponder.

SERVICE:

Establish the correct vehicle profile, and order the ignition key application software according to the established routine in VADIS.

Obtain radio code.

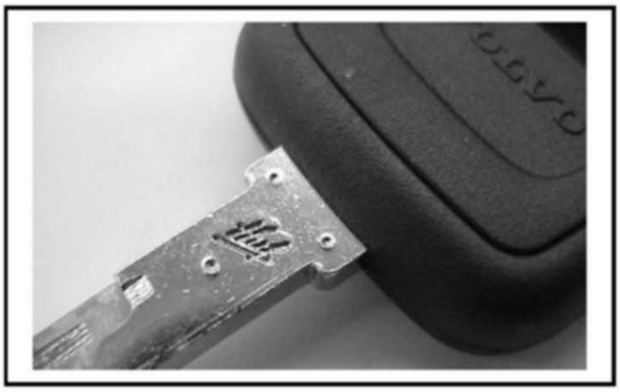
Disconnect the battery negative lead as described in VADIS Information Manager, Function Group 3, for at least one minute.

Complete the procedure by reconnecting the battery negative lead, downloading the software and programming the key.

Additional tips on ignition key programming

^ If you plan to program more than one key and one of the keys fails, perform the battery reset procedure as mentioned above and try to program the key again.

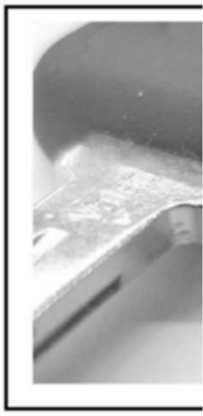
^ To avoid interference, no other ignition key should be near the ignition key being programmed.



S40 V40 M.Y. 00-04

Supplier name HUF on key

S/ V 70 M.Y. 99-00
C70 M.Y. 99-04
Spare parts key marked with blue



RE

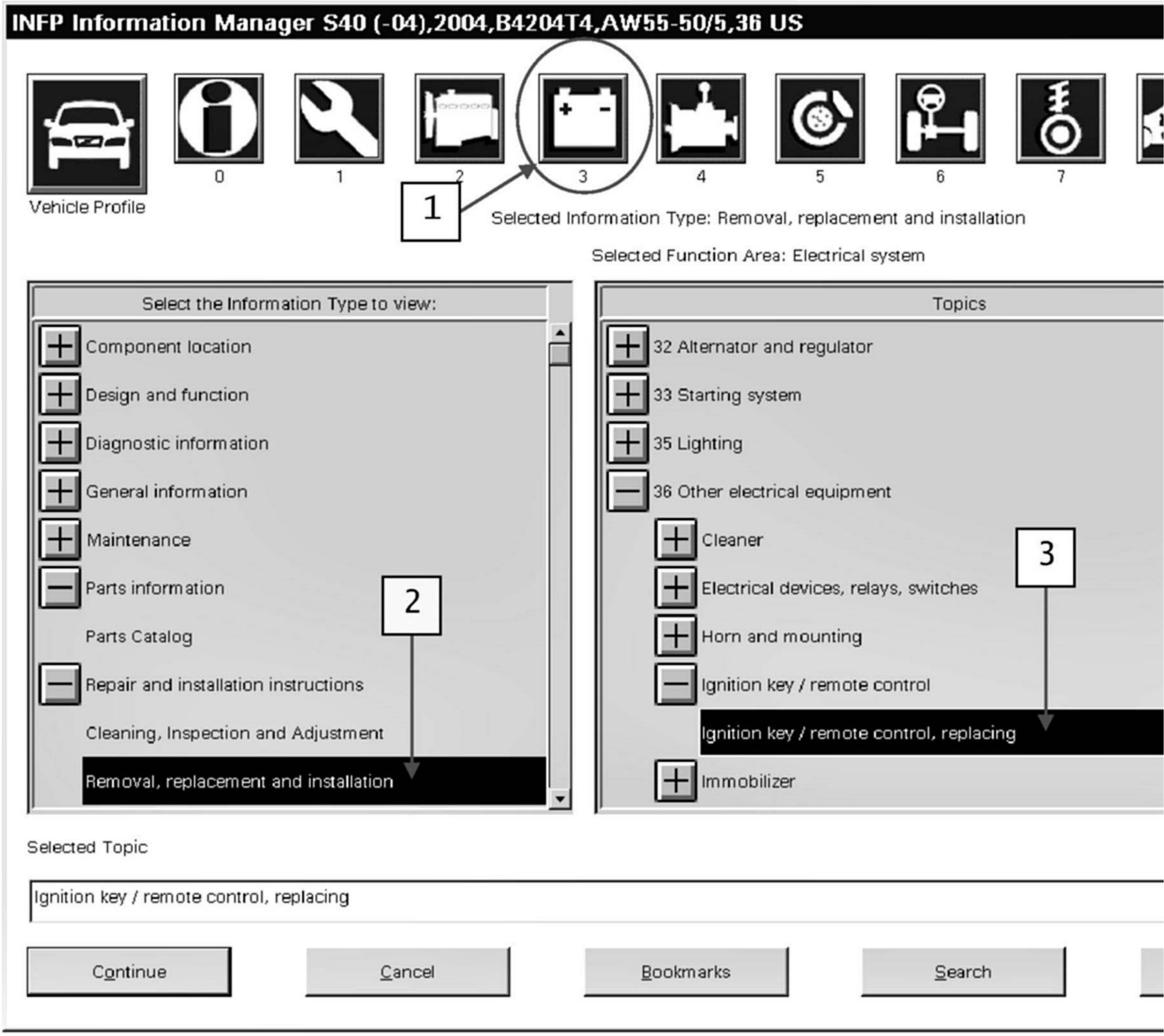
S60
V7

^ It's not necessary to replace the keys when an immobilizer antenna ring is replaced. The spare part keys can be recognized as below:

^ The key for X40 MY03- has the transponder and remote built into the same housing. It is called KIR (Key Integrated Remote).

^ The key blade from an X40 MY03- KIR does not need to be replaced if the remote or transponder is faulty.

Method to replace the key blade:



Logon to VADIS as usual and profile the car using the complete VIN and then proceed with the following steps in the VADIS information manager:

1. Select: Function Group 3
2. Select: Repair and installation instructions Removal, replacement and installation
3. Select: 36 Other electrical equipment --> Ignition key/remote control --> Ignition key/remote control, replacing

Technical Service Bulletin # **230045** Date: **991201**

Canister Purge (CP) Valve - Ticking Noise

Section
2

Group
23

No.
0045

Year

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

99

Month
12

S40/V40
2000-

Vehicles Involved: B4xx4T2/S2 200-

Canister purge (CP) valve, ticking noise

Background

A ticking noise may be heard from the canister purge (CP) valve. The noise increases in cold weather. A rubber-covered clamp that dampens the noise has been introduced as a service solution.

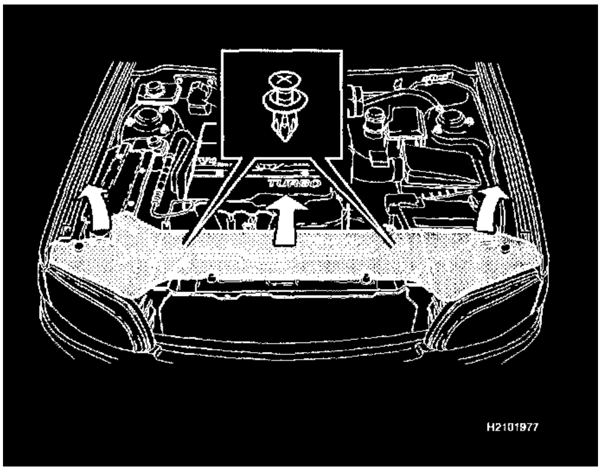
Engine	Model year	Chassis number
B4xx4T2	2000-	415000-

Materials	Number	Replacement part number
Clamp	1	981143

Canister purge (CP) valve, ticking noise

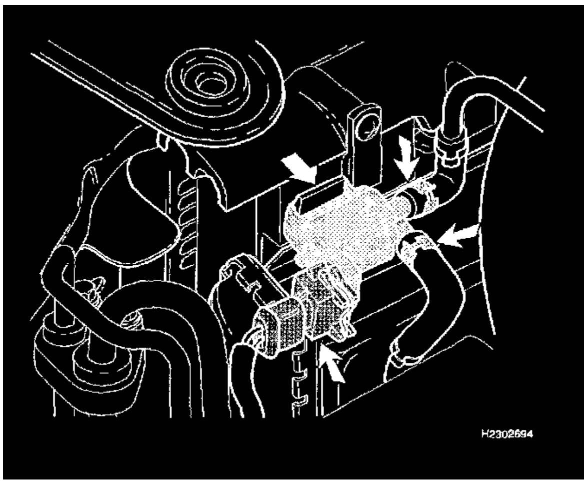
Installing the clamp on the canister purge (CP) valve (turbocharged engines)

1



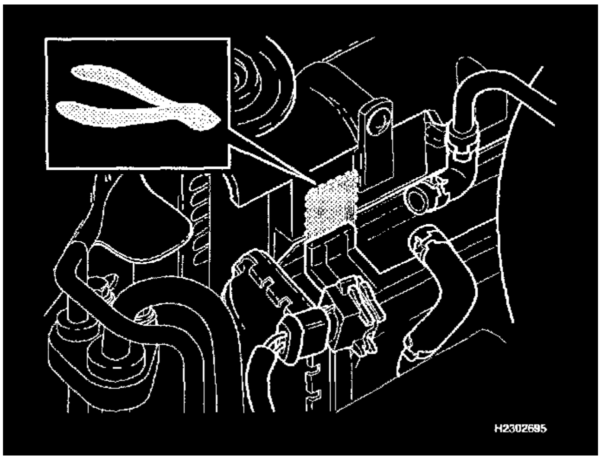
Remove the outer covers.
Remove the inner cover (4 screws)

2



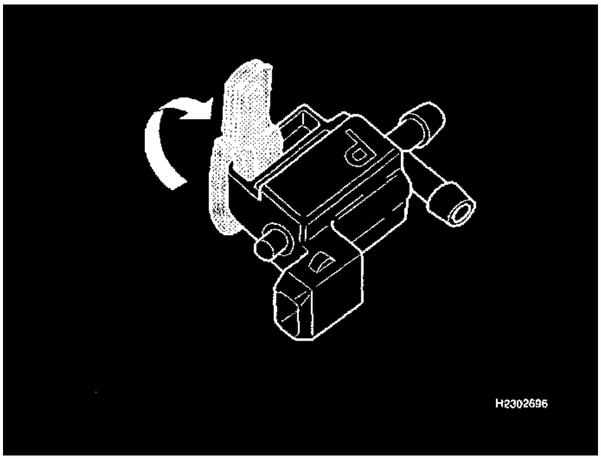
Remove the canister purge (CP) valve from the mounting on the fan shroud.

3



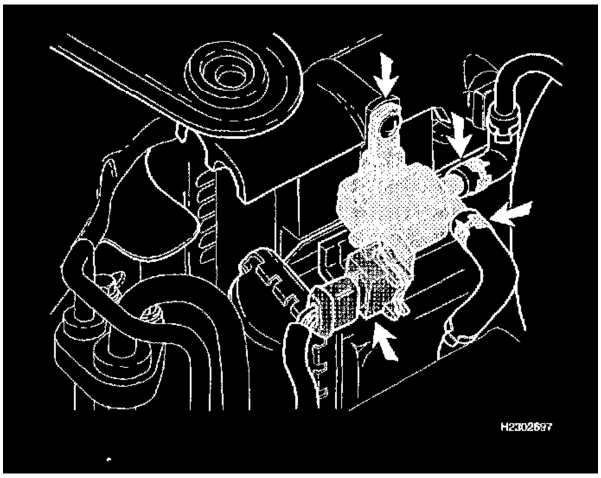
Cut off the mounting for the canister purge (CP) valve to avoid contact with the new mounting.

4



Install the clamp on the canister purge (CP) valve.

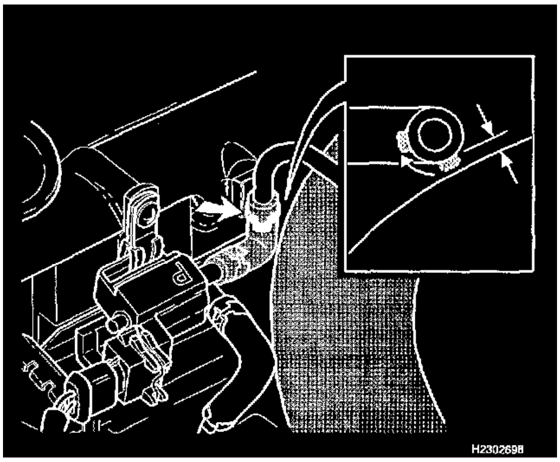
5



Remove the existing screw on the charge air cooler (CAC).
Install the canister purge (CP) valve. Tighten the screw.

6

Check



Check that the clamp is not in contact with the charge air hose. Turn the clamp if necessary.

Install the inner and outer covers

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Operation No.	Labor description	Time allowance
25924-2	Replacing the mounting for the canister purge (CP) valve	0.3hr

Technical Service Bulletin # **23109** Date: **020511**

Recall - EVAP System/PCM Software Upgrades

GROUP:
23

NO:
109

ISSUING DEPARTMENT:
Warranty

CAR MARKET:
U.S. and Canada

DATE:
YEAR
2002

MONTH
05

DAY
11

TITLE:
Service Campaign - 109: EMS 2000 Software Upgrade / Evap System Leakage Diagnostics

S40/V40 MY001 - MY01

REFERENCE BULLETINS:
SB23-0058
PB23-109

Supercedes SMB23-109 dated 2002-04-08

BULLETIN REFERENCE

A. SERVICE UPGRADE 109 DESCRIPTION

B. VEHICLES INVOLVED

C. PARTS INFORMATION/PARTS RETURN

D. OWNER NOTIFICATION

E. NEW VEHICLES IN RETAILER INVENTORY

F. RETAILER RESPONSIBILITY

G. CAMPAIGN REIMBURSEMENT PROCEDURES

A. SERVICE UPGRADE 109 DESCRIPTION

Volvo Cars of North America, LLC and Volvo Cars of Canada Ltd. have determined that a Service Upgrade is required on certain model year 2000 and 2001 S40 and V40 vehicles.

It has come to our attention that certain model year 2000 and 2001 S40 and V40 cars have experienced an unusual number of dashboard "Check Engine" light illuminations (in Canada: Refer to Image). The Check Engine light will illuminate if your vehicle's diagnostic system senses an engine, transmission, electrical or emissions system condition that potentially needs correcting

Volvo has determined that a software upgrade will alleviate unnecessary Check Engine lights without affecting the system's diagnostic capabilities. In some cases, a new diagnostic vacuum pump check valve will also be installed.

71,746 vehicles in the US and 4,696 vehicles in Canada are affected.

B. VEHICLES INVOLVED

NOTE:
RETAILER MUST CONFIRM VEHICLE ELIGIBILITY PRIOR TO BEGINNING REPAIR FOR THIS UPGRADE CAMPAIGN.

Vehicle eligibility should be confirmed:

Refer to DCS/VEN Vehicle Inquiry

RETAILER VEHICLE CAMPAIGN LIST

A "Retailer Vehicle Campaign List" will be sent separately identifying the specific vehicles eligible for this campaign. This list details all affected vehicles that are on record as being retailed or currently in stock at your facility. This Vehicle Campaign List will be the only written material you will receive from Volvo.

All vehicles should be checked for any other incomplete recalls or service campaigns.

Part Number	Part Description	Model	Qty	
30630251	Non-return valve	S40/V40	1	* if applicable
9139873	Software upgrade	S40/V40	1	

* **Non-Return Valve replacement**: Refer to Service Bulletin 23-0058, page 3 for the correct non-return valve identification and replacement procedure. **Incorrect replacement of the non-return valve will result in a claim debit.**

C. PARTS INFORMATION / PARTS RETURN

PARTS RETURN

THE REPLACED ONE-WAY VALVE SHOULD NOT BE RETURNED TO THE TMA DEPARTMENT.

INSTEAD, THE ONE-WAY VALVE SHOULD BE HELD FOR THE MANDATORY 30-DAY PERIOD, AFTER WHICH TIME THE RETAILER SHOULD SCRAP IT IN A RESPONSIBLE MANNER.

RANDOM CLAIM AUDITS WILL BE MADE FOR EACH RETAILER. INCORRECT REPLACEMENT OF THE NON-RETURN VALVE WILL RESULT IN A CLAIM DEBIT.

D. OWNER NOTIFICATION

Owner mailing is expected to begin during the week of April 8, 2002.

E. NEW VEHICLES IN RETAILER INVENTORY

All new vehicles in retailer's inventory and qualifying for Service Campaign 109 should be repaired prior to a customer taking possession of the vehicle.

F. RETAILER RESPONSIBILITY

Retailers are to perform this upgrade on eligible vehicles regardless of mileage/Kilometers or vehicle age. The campaign work covered under Service Campaign 109 is free of charge to the owner.

In the event that the original announcement letter is lost or misplaced, the owner is not to be refused this important campaign work. Your After sales Area Manager will follow up to ensure that this campaign is proceeding smoothly.

All claims should be submitted using the **short form application**

Model	Type	Code	Description	Time	MY	Parts Amount	
						U.S.	Canada
S40/V40	109	02	Software upgrade **ONLY**	0.5 0.6	**2000** **2001**	$ 19.08 $ 19.08	$ 33.60 $ 33.60
S40/V40	109	03	Replace non-return valve **AND** software upgrade	0.5 0.6	**2000** **2001**	$ 41.83 $ 41.83	$ 61.42 $ 61.42

G. CAMPAIGN REIMBURSEMENT PROCEDURES

Technical Service Bulletin # **8830039** Date: **030501**

Power Locks - Door Central Locking Motor Replacement

S40/V40
2000-

Section
8

Group
83

No.
0039

Year
03

Month
05

Central locking motor in the front and rear doors, securing/changing

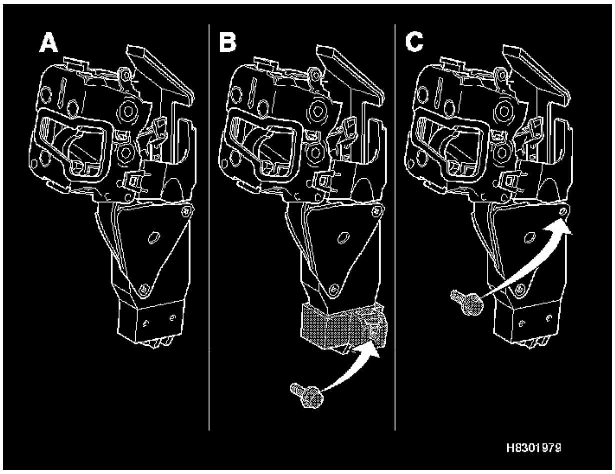
Background:

This Service bulletin describes a new method for the installation or replacement of the central locking motors and a corrective action to the locks when replacing the doors.

Affected vehicles

Model	Factory	Chassis No.
S40, V40		000001 - 942620

Lock, handle Central locking motor, installation

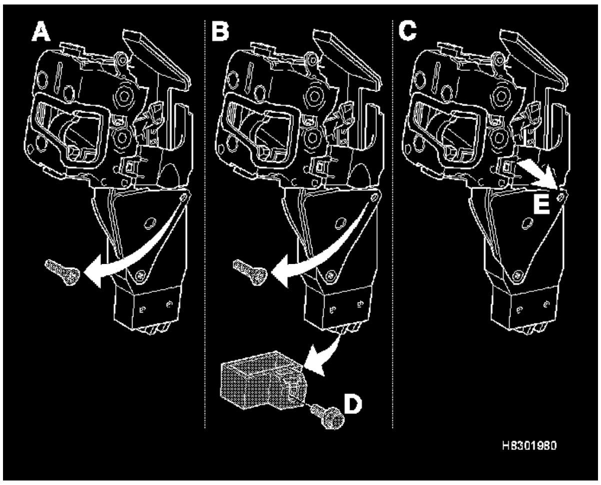


Description of the central locking motors, front and rear doors 1

The inner lock assembly must be removed if the motor is to be replaced.

Note!
Use the illustrations to determine which version applies!

Version A: No extra mounting for the motor.
Version B: (chassis no -94 2619): from the 2000 onwards, a bracket was installed at the bottom of the motor. The bracket is secured in the door panel.
Version C: (chassis no 94 2620-): The motor is secured by a screw in the door panel.



Removing/installing the central locking motor 2

If the entire lock must be removed, the bracket (D) on the door must be removed first, if applicable.
When the motor is replaced, the top bolt (E) should not be fitted in version (C).
Assemble in the same way as described in VADIS. The support should be secured last.

Corrective action to locks when replacing the doors 3

Note!
Because of a new design the following must be carried out when replacing a door.

When a new door is fitted, the bracket in version (B) is not used.
In the case of version (A) and (B) the top motor screw must be removed.
Securing the lock to the door should then be carried out with the new screw at (E).

Technical Service Bulletin # **83-0039** Date: **030501**

Body - Securing/Changing Lock Motors

Section
8

Group
83

No:

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

0039

Year
03

Month
05

Central locking motor in the front and rear doors, securing/changing

Background:

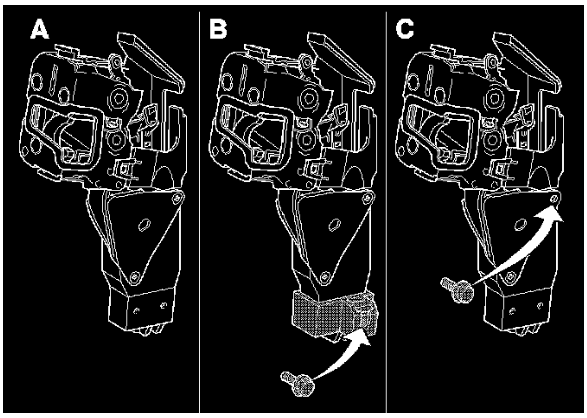
This Service bulletin describes a new method for the installation or replacement of the central locking motors and a corrective action to the locks when replacing the doors.

Affected vehicles

Model	Chassis No.
S40, V40	000001 - 942620

Lock, handle
Central locking motor, installation

1
Description of the central locking motors, front and rear doors



The inner lock assembly must be removed if the motor is to be replaced.

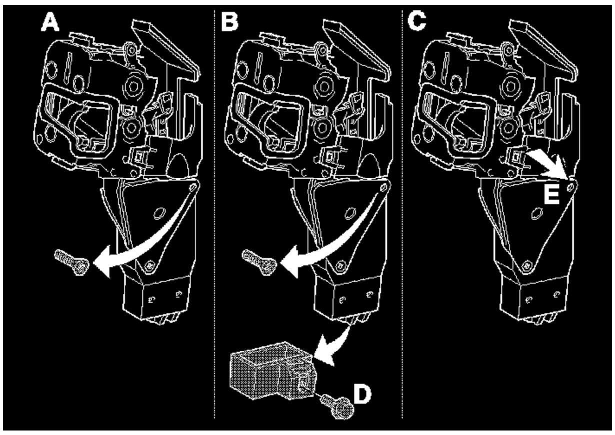
Note! Use the illustrations to determine which version applies!

Version A: No extra mounting for the motor

Version B (chassis no -94 2619): from the 2000 onwards a bracket was installed at the bottom of the motor The bracket is secured in the door panel.

Version C (chassis no 94 2620-): The motor is secured by a screw in the door panel.

2
Removing/installing the central locking motor



If the entire lock must be removed the bracket (D) on the door must be removed first if applicable.

When the motor is replaced the top bolt (E) should not be fitted in version (C).

Assemble in the same way as described in VADIS. The support should be secured last.

3
Corrective action to locks when replacing the doors

Note! Because of a new design the following must be carried out when replacing a door

When a new door is fitted the bracket in version (B) is not used.

In the case of version (A) and (B) the top motor screw must be removed.

Securing the lock to the door should then be carried out with the new screw at (E).

Technical Service Bulletin # **8830037** Date: **010101**

Tailgate/Trunk - Lock Repair Kit

Section
8

Group
83

No.
0037

Year
01

Month
01

Tailgate/trunk, lock repair

Background:

If for any reason a repair to the tailgate/trunk look assembly is needed, a service repair kit has been developed and is now available as a spare part. This service bulletin describes how to perform the repair.

Model	Chassis no.
S40/V40 2000-	415000-

Material	Quantity	P/N
Grease	1	1161417
Repair kit, 2000-	1	30899346

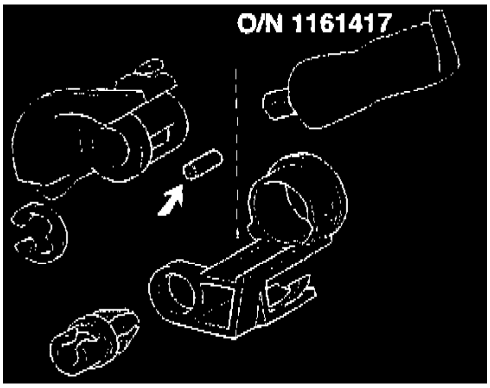
Parts Information

Tailgate/trunk lid, lock repair

Tailgate/trunk, lock assembly, replacing

Tailgate/trunk panel, removing

- Remove the tailgate/trunk panel see Vadis Group 83, tailgate or trunk lid.



- Grease the parts in the repair kit using P/N 1161417. Ensure that the steel lock pin slides into the casing.

Note!

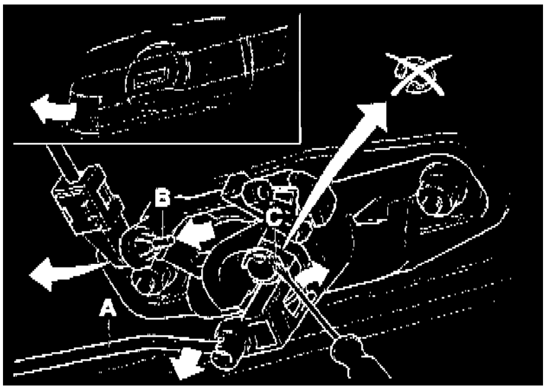
Mark the position of the existing rotating section before removal.

- Position the new rotating section in the same position as the old.

2

Lock mechanism, removing

- Apply tape to the lock cylinder so the lock cylinder cannot tall out.

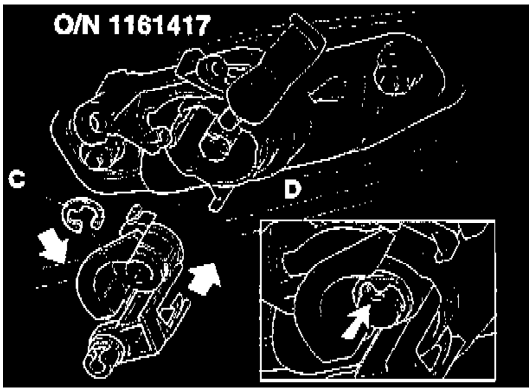


- Remove the link rod (A) for the central locking system from the lock assembly.
- Push out the lock pin (B) that is locking the clip out through the rear of the clip. Press the lips together and take the clip out of the lock.
- Remove the retaining clip (C) from the shaft using a screwdriver. If necessary press the lock in.
- Remove the complete rotating section from the lock.

3

Lock mechanism, installing

- Apply a little grease to the pin of the lock cylinder.



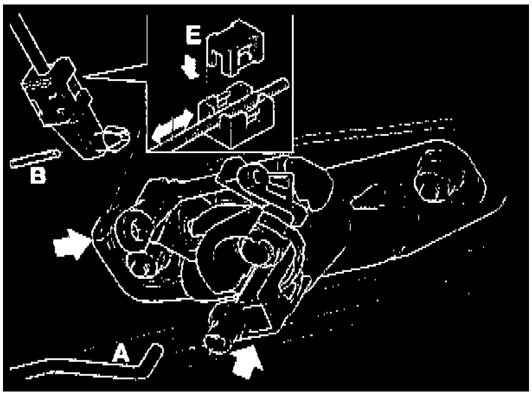
- Press the lock in so the pin section (D) comes out.

- Position the rotating section (kit) over the pin of the lock cylinder.

- Hold the lock cylinder in position. Install the retaining clip (C) over the pin of the lock cylinder. Press clip into position, with the middle lug over the cut-out, on the pin. See the inset in the illustration.

4

Control link rods, installing, adjusting



- Press the control rod (A) for the central locking system in the clip of the rotating section, ensure that the link rod is locked into position.

- Position the clip with the lock pull link rod in the rotating section of the lock. Install the lock pin.

- Check the lock function. If necessary adjust the pull link rod by removing the lock (E). Reinstall the lock (E) after positioning the pull link rod.

- Install the tailgate or trunk panel.

See Vadis Group 83 tailgate or trunk.

Operation No.	Labor description		Time allowance
83411-2	Replacing lock assembly lock	S40	0.5 hr
		V40	0.3 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **3360022** Date: **021001**

Wipers/Washers - Wipers Shudder/Noisy

S40/V40/S60/C70/S70/V70/V70/ XC/S80
1998-

Section:
3

Group:
36

No.:
0022

Year:
02

Month:
10

Adjusting wiper arm

Background:

This Service Bulletin describes how to adjust the angle of the wiper arm correctly to address issues of shuddering and noise during operation

Special Tools

Description P/N

Measuring tool 951 2931

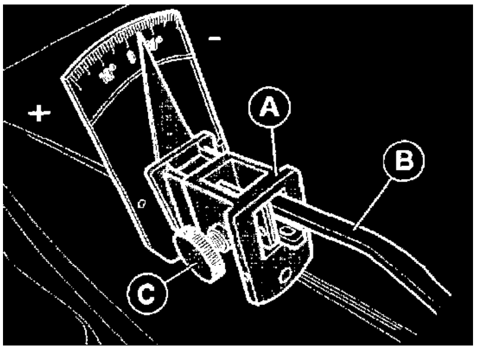
Other electrical equipment

Adjusting the wiper arm 1

Check that the wipers are in the parked position. Switch the wipers on and off again with the ignition switched on.

Fold out the wiper arm.

Remove the wiper blade.



Install the tool (A) loosely on the wiper arm (B), as illustrated.

Carefully fold the wiper arm and tool towards the windshield.

NOTE:
The base of the tool must be in contact with the windshield.

Tighten the tool (A) to the wiper arm (B) using screw (C).

S60/C70/S70/V70/V70XC/S80 2

Read the angle of the wiper arm to the windshield for both the driver and passenger side from the scale on the tool.

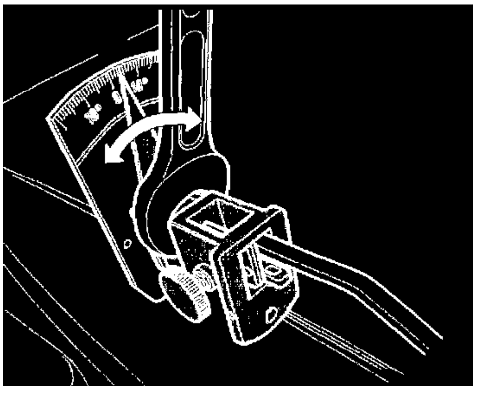
Correct angle:

- 4 degrees.

Caution:
Do not use excessive force when adjusting the wiper arm.

Adjust the:

- angle of the wiper arm as necessary



- wiper arm as illustrated.

Fold the wiper arm out and remove the tool.

Install new wiper blades and carefully fold the wiper arm down.

Test the function.

Read the angle of the wiper arm to the windshield for both the driver and passenger side from the scale on the tool.

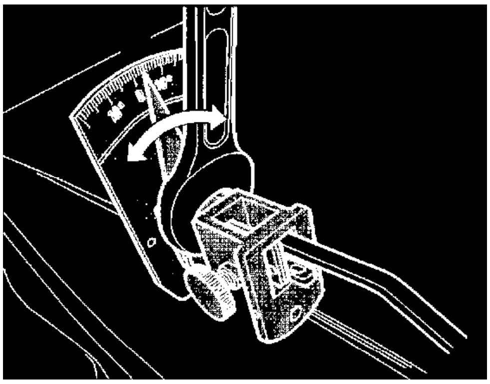
The correct angle is within the following range:

- 3 to - 5 degrees.

Caution:
Do not use excessive force when adjusting the wiper arm.

Adjust the:

- angle of the wiper arm as necessary



- wiper arm as illustrated.

Fold the wiper arm out and remove the tool. Install new wiper blades and carefully fold the wiper arm down.

Test the function.

Operation No.	Labor description	Time allowance
36928-2	Wiper arm 2 sides adjustment	0.2 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **3360021** Date: **020501**

Windshield Washer - Poor Performance

S40/V40
2000-2001

Section
3

Group
36

No.
0021

Year
02

Month
05

Checking and re-routing windscreen washer hoses

Background

This Service Bulletin describes how the windscreen washer hoses should be checked/adjusted when having decreased washer function.

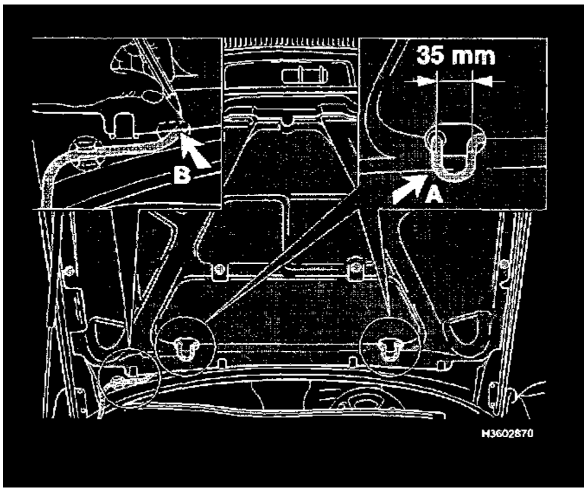
Model	Factory	Chassis No.
S40,V40		415000- 729651

Affected vehicles

Description	Quantity	Part No.
Nipple (For vehicles **without** headlamp wash/wipe)	1	1369856
Hose	±150 cm (~ 59 in)	949931
Clip (MY 2000 vehicles **only**)	1	30899356

Materials

Checking position of hose and hose routing 1



Check the hose on the left and right side nozzle: it should not be kinked and should form a loop (A) of not less than 35 mm (~1-3/8 in.).

Note! The hose must in no way be pinched or kinked, nor have any tendency to kink.

On the right side, check if the hose is pinched by the hood insulation panel (B). If necessary, mark where material needs to be removed.

If the hose is pinched by the hood insulation only:

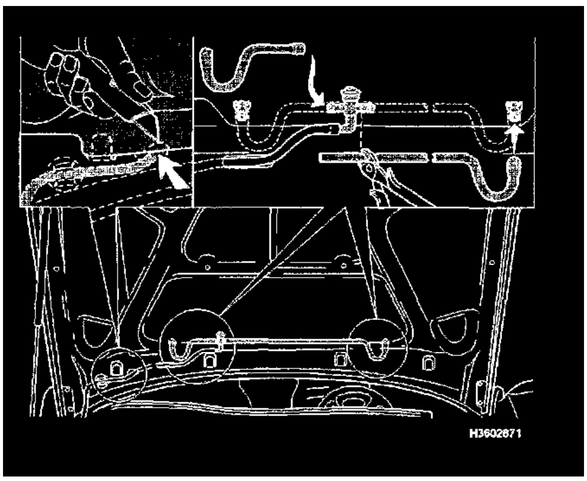
Remove material from the hood insulation panel as marked to ensure that the hose lies in place freely.

If further obstructions, such as pinching or kin king, are found elsewhere, see the following method.

Rectify nozzle connections if necessary 2

Remove hood insulation panel completely.

Note! Always replace existing hoses with new hose. Fit so that pinching cannot occur when hood insulation panel is refitted.



Cut hose to the correct length:

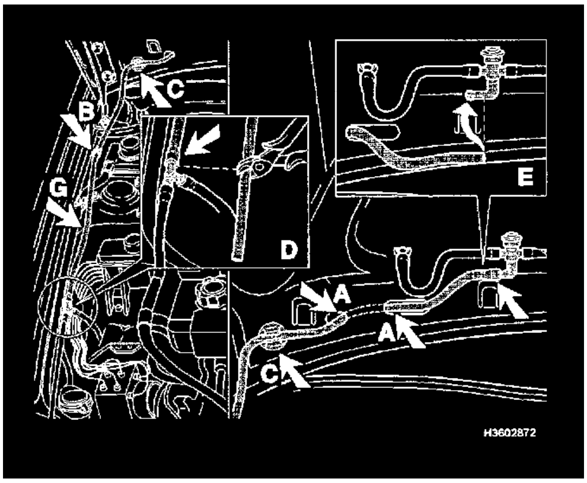
Left: +/- 560 mm (~22-1/16 in).

Right: +/- 160 mm (~6-5/16 in).

Affected vehicles: 3

2000-2001, cars with headlamp wash/wipe

Replacing hose from T-valve on inner fender to T-valve on hood



Remove:

- hose bend (C) from its fastening on the hood (MY 2000)
- hose (G) that runs from connection (D) along the inner fender to connection (E).

Install new clip (C) (MY 2000 vehicles).

Slide new hose (G) through the mounted clip (C) and through openings (A) in hood by the T-connector (E) and connect.

Push hose (G) into clip (B) on inner fender and pull straight through to the front.(do not bend)

Measure off a length of hose (G) sufficient to reach T-connector (D), and cut to length. Connect the hose to the T-connector.

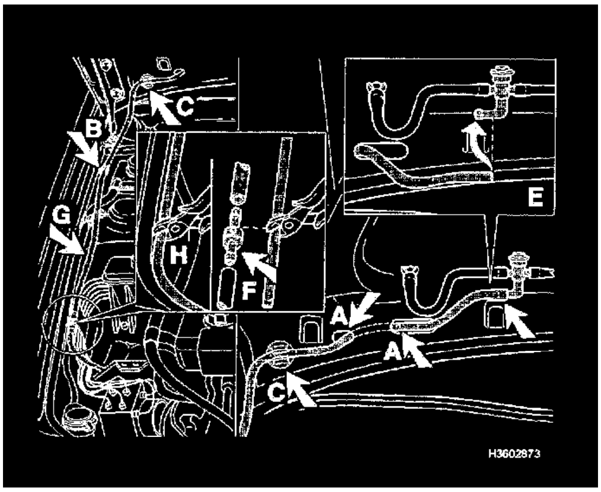
Note! Verity that the hose fits snug along the inner fender and does not kink or pinch when closing the hood.

Operation No.	Labor description	Time allowance
36932-3	Hoses windshield washers hood replace	0.2 hr
36933-2	Hoses windshield washers control replace	0.4 hr

Affected vehicles: 4

2000-2001, cars without headlamp wash/wipe

Replacing hose on inner fender to T-valve on hood



Remove:

- hose bend (C) from its fastening on the hood (MY 2000)
- hose (G) from connection (E).

Place a rag over the ABS unit.

Cut through and remove hose (G) above ABS unit (H).

Install new clip (C) (MY 2000 vehicles).

Slide new hose (G) through clip (C) and openings (A) in bonnet by T-connector (E) and connect.

Push hose (G) into clip (B) on inner fender and pull it straight through to the front.(do not bend)

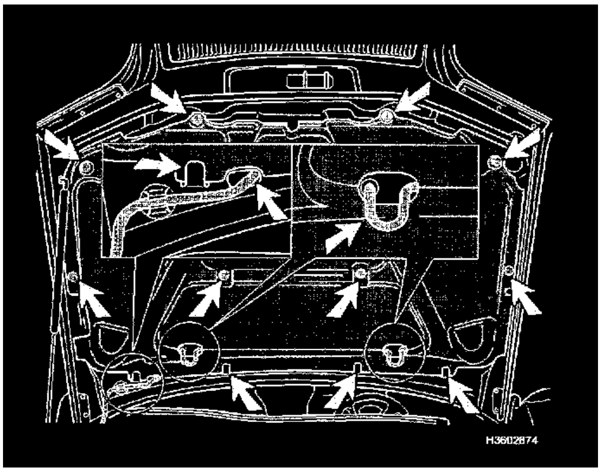
Install nipple (F) into the hose coming from windscreen washer reservoir.

Measure off a length of hose (G) sufficient to reach nipple (F), and cut to length. Install hose to the nipple.

Remove rag from the ABS unit.

Note! Verify that the hose fits snug along the inner fender and does not kink or pinch when closing the hood.

Installing and function check 5



Ensure that the hose lies in place freely.

Reinstall hood insulation panel. Be sure to fit behind recess and fix in place with clip. Recheck run of hose to windscreen washer nozzles.

Close the hood.

Check windscreen washer function.

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Chemical Additives - Policy

BULLETIN NUMBER:
1801

GROUP:
18

N0:
01

DATE:
April, 2000

TITLE:
Chemical Additive Policy

ISSUING DEPARTMENT:
Technical Service

REFERENCE BULLETINS:
SMB 22-03: Recommended Engine Oils

CAR MARKET:
U.S. and Canada

Volvo's policy concerning additives is as follows.

UNLESS SPECIFICALLY INSTRUCTED IN OFFICIAL SERVICE INFORMATION, NO ADDITIVES 0F ANY TYPE ARE TO BE USED IN VOLVO SYSTEMS.

Volvo does not approve of any additives to: engine oil. gasoline, engine coolant. transmission oil/fluid, refrigerant and final drive oil. Only engine oils from Volvo's approved engine oil list may he used for any warranty and/or service maintenance/repair.

The only time there is an exception to this policy is if Volvo communicates to a retailer in written form that it is appropriate to use a given additive in a given system. Examples of this are the use of a dye in A/C refrigerant for the purpose of leak detection, and Volvo gas line anti-freeze during extremely cold weather to help avoid frozen fuel lines.

Fuel Injector Maintenance and Cleaning: Today's gasolines are higher in quality than gasolines of the past. The Clean Air Act Amendments include a requirement that all gasoline sold must contain additives to prevent the accumulation of deposits in engines and fuel supply systems. Today, the issue of sufficient quantities of appropriate detergents is addressed through these EPA regulations.

As a result, Volvo no longer recommends or supports the use of gasoline additives or external fuel injector cleaning systems. Additive over-treatment may have an adverse effect on fuel system performance and may cause engine oil thickening.

Technical Service Bulletin # **2260011** Date: **040201**

Cooling System - Cooling Fan Resistor Replacement

S40/V40
1998-

Section
2

Group
26

No.
0011

Year
04

Month
02

Replacing engine cooling fan resistor

Background:

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

This service bulletin describes the replacement of the resistor for engine cooling fan (for speed 1) in the vehicle.

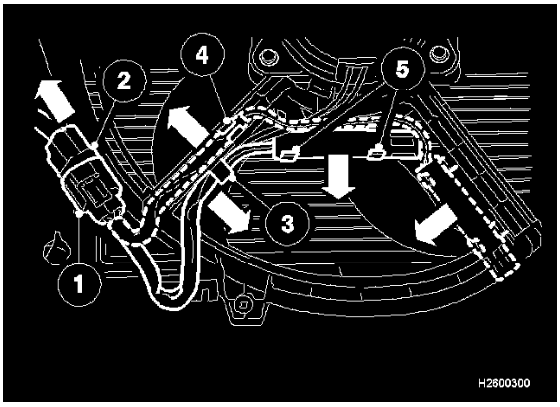
Material

Description	Quantity	Part No.
Resistor	1	30644121
Splicing sleeve	2	9130476
Tie strap	2	98 3750

Special tools

Description	Special Tool Bulletin #	Part No.
Wire Stripping Tool	From Terminal repair kit 951 2946 or 951 2647 (STB 95). Available from SPX	951 2620
Crimping Tool	From Terminal repair kit 951 2946 or 951 2647 (STB 95). Available from SPX	951 2656
Hot air gun	Refer to STB 139	951 2850
Nozzle	Refer to STB 139 part of nozzle kit 951 2778	951 2780

Fan, fan shroud and clutch Cooling fan resistor; replacement



Detaching the resistor 1

Remove:

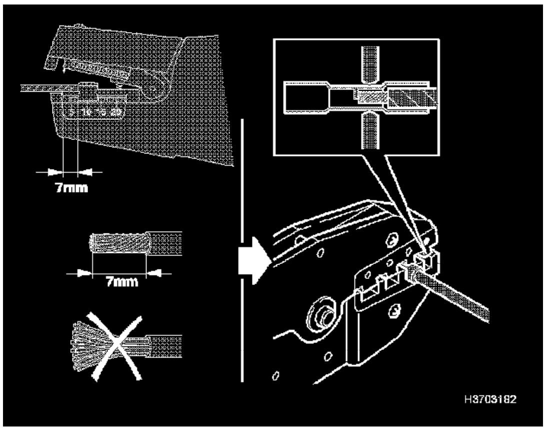
- the front engine splashguard
- the connector (1) from the assembly by sliding it upwards
- the connector (2) from the cable harness for the fan motor
- the resistor from the clamps (5).

Note!
The resistor is positioned either horizontally below the fan motor or vertically to the right (diagonally).

Remove:

- the clamp (4) in front of the cable harness inside the cooling fan assembly
- the cable harness from guide (3) outside the cooling fan assembly.

Pull the cable harness with the resistor downwards as far as possible.
Move the clamp (5) from the horizontal to the vertical position as shown in illustration.

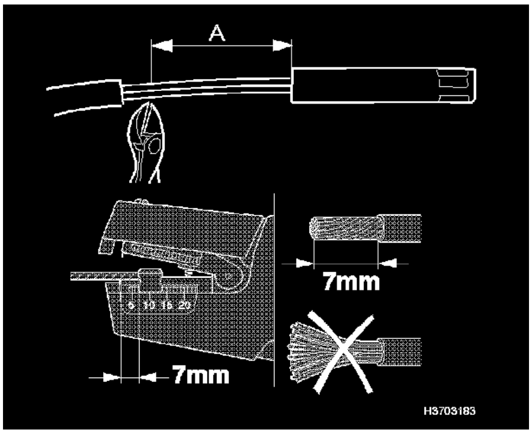


Installing splicing sleeve 2

Cut off the wirings as close to the existing resistor as possible.
Strip the ends 7 mm using stripping tool 951 2620.
Twist the ends of the wires. Insert the wires in the splicing sleeves.

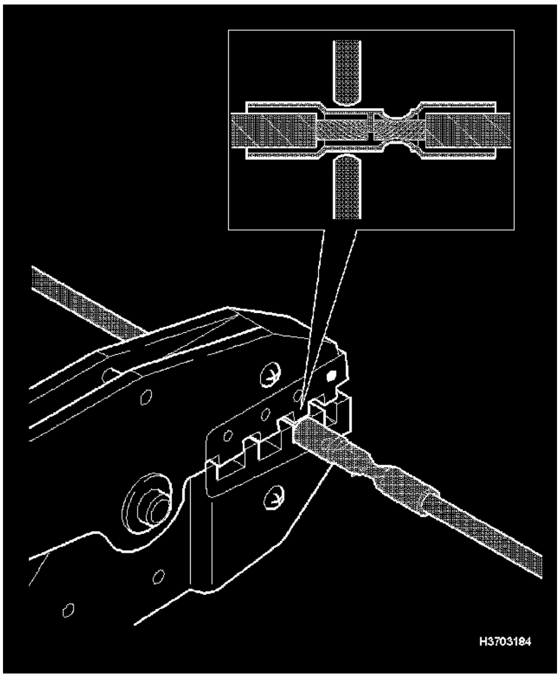
Note!
Be sure that the wire is deep enough in the splicing sleeve.

Press the splicing sleeves to the wires using crimping tool 951 2656. Use opening No. 2.
Pull the wires to ensure a good connection.



Preparing the resistor 3

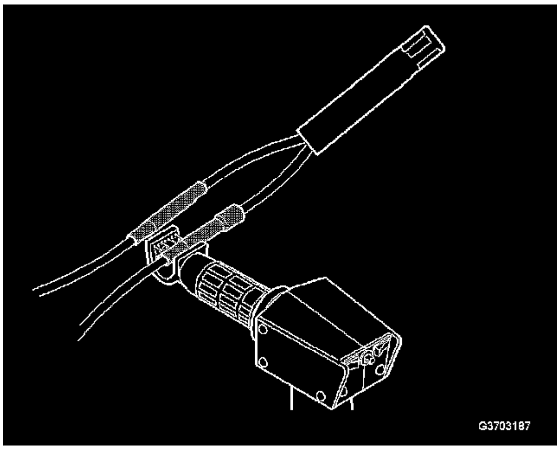
Remove the clamp from the resistor.
If the original resistor was mounted horizontally, the wires should be cut ca. 75 mm (A) from the resistor.
If the original resistor was mounted vertically, the wires should be cut ca. 110 mm (A) from the resistor.
Remove the insulating sleeve.
Strip the ends 7 mm using stripping tool 951 2620.
Twist the ends of the wires.



Connecting the new resistor 4

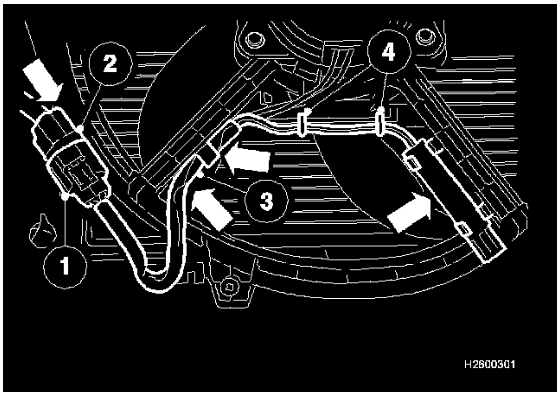
Caution!
Join the red wires together and the blue wire to the black wire on the new resistor

Twist the ends of the wires. Insert the wires in the splicing sleeves as described above. Press the splicing sleeves to the wires using crimping tool 951 2656. Use opening No. 2.
Pull the wires to ensure a good connection.



Shrinking the splice sleeves 5

Use hot-air gun 951 2850 and nozzle 951 2780.
Set the hot air gun to flow 2 and set the temperature between 2 and 3 (69°C). Protect the surrounding components from heat. Position the splice sleeve in nozzle 951 2780 and heat the joint so that the adhesive melts and begins to emerge from each end.



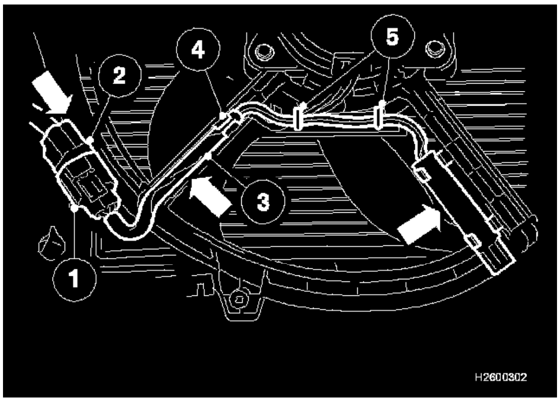
Reinstalling the cable harness at the outer side of the fan assembly 6

Slide the connector (1) to the cooling fan assembly. Do not connect the connector (2).
Slide the protective sleeve up as high as possible.
Guide the wiring (3) into the fan assembly.
Feed the wiring along the bottom side of the fan shroud assembly. See drawing.
Press the resistor into the clamp.
Fix the wiring using tie straps (4), as close to the splicing sleeves as possible.
Ensure that the wirings cannot chafe or be damaged.

Install:

- the connector (2)
- lower splash guard.

Check the cooling fan function according to VADIS.



Reinstalling the cable harness inside the fan assembly 7

Slide connector (1) to the cooling fan assembly. Do not connect the connector (2).
Slide the protective sleeve into place.
Position the wiring in the fan assembly (3). Press the resistor into the clamp. Close the clamp (4).
Feed the wiring into the fan assembly with a loop. Install two tie straps (5) to secure the wiring.
Ensure that the wirings cannot chafe or be damaged.

Install:

- the connector (2)
- lower splash guard.

Check the cooling fan function according to VADIS.

Operation No.	Labor description	Time allowance
26914-2	Resistor engine cooling fan replace	0.7 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **2250040** Date: **041001**

Emissions - PCV System PTC Nipple Replacement

S40 (-04)/V40
2000-

Section
2

Group
25

No.
0040

Year
2004

Month
10

Replacing the PTC nipple in positive crankcase ventilation (PCV) system

Background

This service bulletin is a supplement to VADIS. It describes how to replace the PTC nipple in the PCV system.

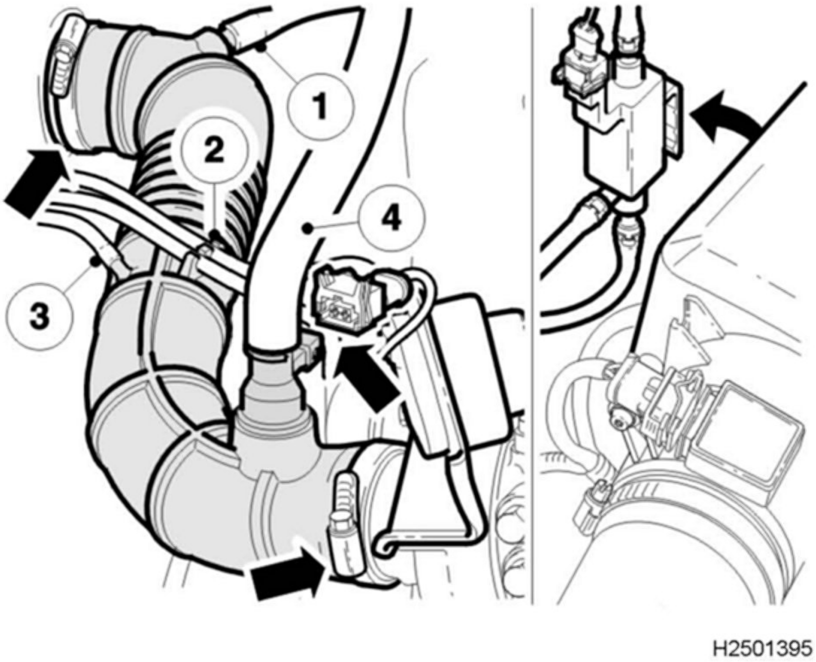
Description	Quantity	P/N
Nipple	1	30670269

Material

PTC nipple, replacing

Remove

Remove the air intake hose 1

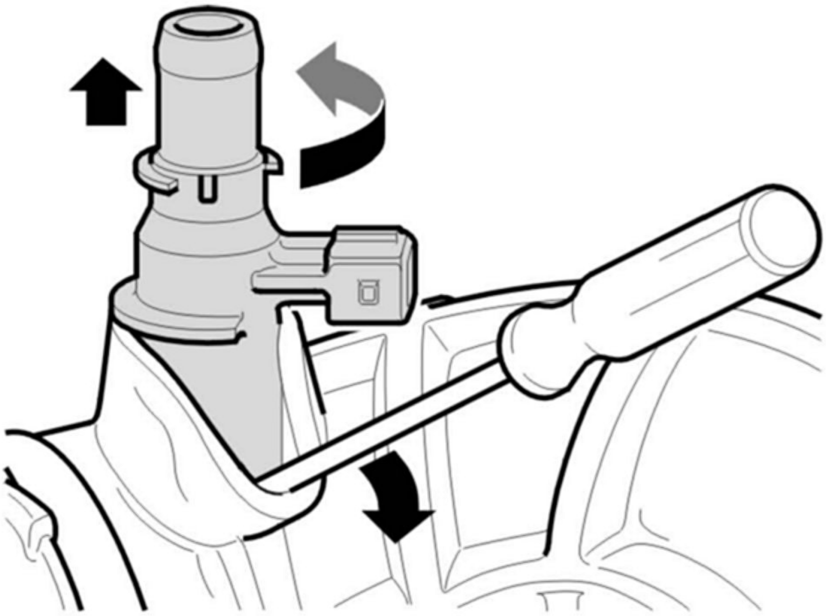


Remove:

- EVAP connection (1) from the air intake hose
- turbo control valve from the air cleaner housing
- hoses turbo control valve from the hose clamps (2)
- nipple with hose for the turbo control valve (3)
- connector from the PTC nipple
- air intake hose (tie strap) from the air cleaner
- heat shield from the cowl panel
- air intake hose (hose clamp) from the turbo charger
- hose (4) from the positive crankcase ventilation (PTC) nipple

- air intake hose.

Remove PTC nipple 2



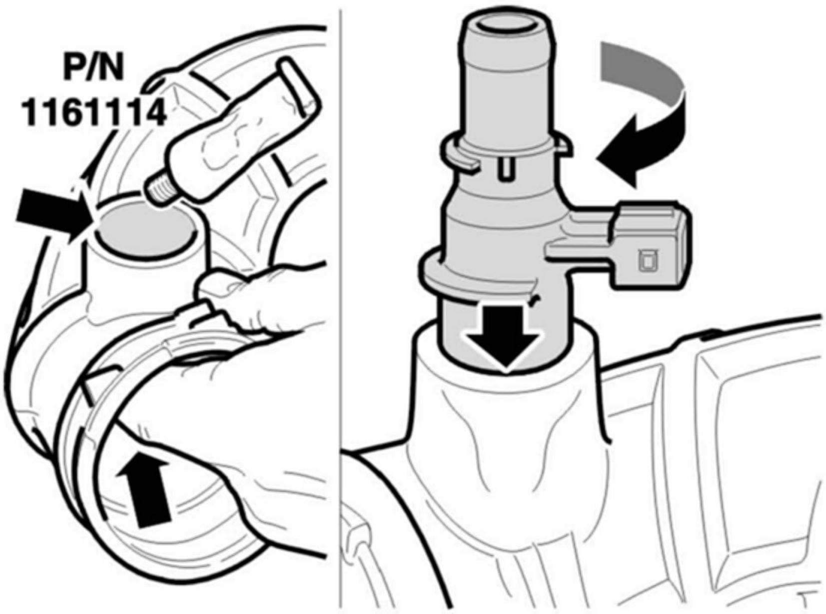
H2501396

Remove:

- the PTC nipple. Remove the PTC nipple out of the hose with a twisting movement. Use a (blunt) screwdriver.

Install

Install PTC nipple 3



H2501399

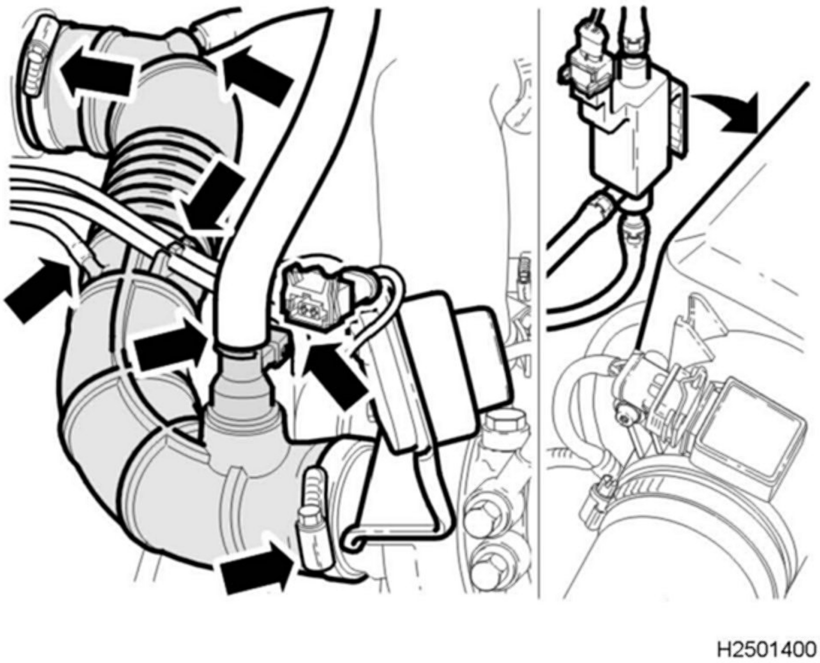
Apply grease P/N 1161114 to the hole in the hose. Support the inside of the hose where the hole is located while inserting the valve.

Install:

- the PTC nipple in the hole with a twisting movement. Press the PTC nipple securely into the hose. Use a (blunt) screwdriver if necessary. Position the PTC nipple.

Install air intake hose 4

Clean the hose connections carefully.



Install:

- a new hose clamp on the positive crankcase ventilation (PCV) hose.

Insert the air intake hose. Position the air intake hose on the turbocharger and the air cleaner housing.

Secure the air intake hose at both sides.

Secure the positive crankcase ventilation hose.

Install:

- the connector on the PTC nipple
- turbo pressure regulator to the nipple. Press the other hoses into the hose clamps
- the EVAP hose.

Install:

- the heat shield.

Operation No.	Labor description	Time allowance
25948-2	Nipple PTC Fresh air intake hose filter-turbocharger replace	0.5 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **TNN40-04** Date: **051013**

A/T, M/T, AWD - Approved Lubricants

NO: 40-04

DATE: 10-13-2005

MODEL/YEAR: All Models

SUBJECT:

Application	Note	Part Number
• 5 and 6 Speed Automatic Transmissions -AW55 -TF80-SC This fluid is also recommended to address two complaints on the AW 50-42: •Harsh Lock-Up engagement/disengagement (SB 43-0029) •Squeaking noise during low speed turns (TNN 43-11)	JWS 3309 The only oil approved for the 5 and 6 speed automatic transmissions is JWS 3309. None of the other fluids available on the market have been evaluated by Volvo to meet the requirements of these specific transmissions regarding: • Shift quality • Slipping lock-up functionality • Transmission durability	1161540 (1 liter) 1161640 (4 liter)
• 4 Speed Automatic Transmissions -GM4T65EV -AW50-42 -AW30-40/43 -AW70/71/72 -ZF22	Dexron IIIG or IIIH	1161621 (4 liter)
• 5 and 6 Speed Manual Transmissions -M56 -M66 • Chain Housing -XC90 T6	API GL4, Synthetic	1161745 (1liter)
• Angle Gears (All)	API GL5, BOT	1161648 (1 liter)
• AOC (Active On-Demand Coupling)	Specific oil for the AWD clutch	1161641 (300 ml)
• Rear Differential (200/700/900 with optional limited slip)	API GL5, with limited slip additive	1161619 (1 liter)
• Rear Differential (All Others)	API GL5, low friction	1161620 (1 liter)
• Cleaning Manual Transmission Input Shafts	Sprayable mineral based grease	1161657 (200 ml)
• Lubricating Manual Transmission Input Shafts	Sprayable PFPE grease	30759651 (150 ml)
• Lubricating AWD spline interface -splines between transmission and angle gear	Lithium grease with PAO base	1161748 (10 ml)

Transmission and AWD Lubricants

REFERENCE: Owners Manual and VIDA

Technical Service Bulletin # **2198** Date: **000401**

Campaign - Engine Oil Filler Grate Inspection

BULLETIN NUMBER:
2198

GROUP:
21

NO:
98

DATE:
April, 2000

TITLE:

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

Service Campaign 98 - Oil Filler Grate: Inspect

MODELS:
(9892970) VOLVO S80
(9892969) VOLVO S70/V70/C70
(9892968) VOLVO S40/V40

ISSUING DEPARTMENT:
Warranty

REFERENCE BULLETINS:
SB 21-0027
SB 21-0028
SB 21-0029

CAR MARKET:
U.S. and Canada

SUPERSEDES: SMB 21-98 dated March, 2000. Claim Type numbers corrected on page 3.

BULLETIN REFERENCE

A. SERVICE CAMPAIGN 98 DESCRIPTION

B. VEHICLES INVOLVED

C. RETAILER VEHICLE CAMPAIGN LIST

D. PARTS INFORMATION

E. OWNER NOTIFICATION

F. VEHICLES IN RETAILER INVENTORY

G. RETAILER RESPONSIBILITY

H. CAMPAIGN REIMBURSEMENT PROCEDURES

I. RETAILER ALLOWANCE

A. SERVICE CAMPAIGN 98 DESCRIPTION

Volvo Cars of North America, Inc. and Volvo Cars of Canada Ltd. have announced a service campaign affecting certain 2000 model year Volvos. Approximately 20,817 vehicles in the US and 600 vehicles in Canada are affected.

This campaign involves the engine oil filler grate located in the engine oil filler neck of certain model year 2000 Volvos. In rare instances, this grate may become loose. On vehicles that qualify for this campaign, an inspection of this grate will be performed.

All owners of these affected vehicles will by notified by mail beginning the week of April 3, 2000.

B. VEHICLES INVOLVED

NOTE: RETAILER MUST CONFIRM VEHICLE ELIGIBILITY PRIOR TO BEGINNING THIS CAMPAIGN.

Vehicle eligibility should be confirmed:

1) Refer to DCS Vehicle Inquiry

2) Refer to the Vehicle Campaign Listing

Service Campaign 98 was performed on vehicles within the affected chassis range prior to release from the PORT. On these vehicles this campaign has been marked as PERFORMED in DCS, and no further action is required.

C. RETAILER VEHICLE CAMPAIGN LIST

"A Retailer Vehicle Campaign List" will be sent separately identifying the specific vehicles eligible for this campaign. This list details all affected vehicles that are on record as being retailed or currently in stock at your facility. This Vehicle Campaign List will be the only written material you will receive from Volvo.

D. PARTS INFORMATION

Parts are NOT required for this Service Campaign.

E. OWNER NOTIFICATION

During the week of April 3, 2000 an announcement letter will be sent directly to Volvo owners. A copy of this letter is attached.

F. STOCK VEHICLES

All vehicles in retailer's inventory and qualifying for this service campaign must he repaired prior to a customer taking possession of the vehicle.

G. RETAILER RESPONSIBILITY

Retailers are to perform this campaign on eligible vehicles regardless of mileage/kilometers or vehicle age. The campaign work covered under Service Campaign 98 is free of charge to the owner.

In the event that the original announcement letter is lost or misplaced, the owner is not to be refused this important campaign work. Your Aftersales Specialist will follow up to ensure that this campaign is proceeding smoothly.

H. CAMPAIGN REIMBURSEMENT PROCEDURES

ONLY ONE CLAIM PER VEHICLE WILL BE ACCEPTED.

All claims should be submitted using the short form application. Separate repair codes have been established for the S80, the S70/V70/C70 and the S40/V40 that Will automatically reimburse the retailer for the proper labor for each claim. Replacement parts are not required for this Service Campaign.

Claim Type	Repair Code	Repair Description	Labor Time	Part Amount
9892968	02	OIL GRATE - INSPECT ONLY Model S40/V40	0.3	US N/A CA N/A
9892969	02	OIL GRATE - INSPECT ONLY Model S70/V70/C70	0.3	US N/A CA N/A
9892970	02	OIL GRATE - INSPECT ONLY Model S80	0.3	US N/A CA N/A
9892968	03	OIL GRATE - INSPECT/REMOVE Model S40/V40	0.3	US N/A CA N/A
9892969	03	OIL GRATE - INSPECT/REMOVE Model S70/V70/C70	0.3	US N/A CA N/A
9892970	03	OIL GRATE - INSPECT/REMOVE Model S80	0.3	US N/A CA N/A

I. RETAILER ALLOWANCE

Technical Service Bulletin # **2210027** Date: **000301**

Engine Oil Filler Grate - Works Loose

Section
2

Group
21

No.
0027

Year
00

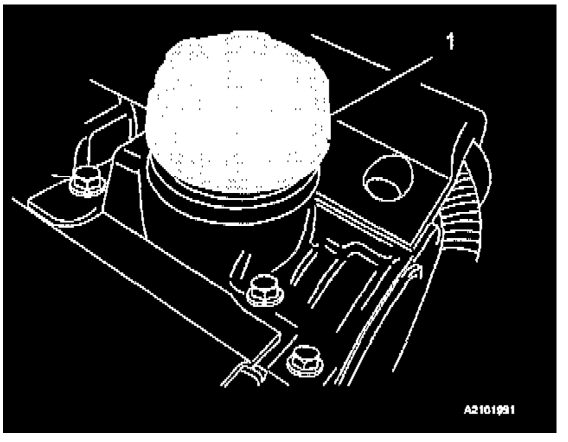
Month
03

S40/V40
2000 Partly

Campaign No. 98
Engine oil filler grate, inspection

Background

An oil filler grate is located in the engine oil filler neck of certain model year 2000 vehicles. In rare in- stances this grate may become loose. The following inspection must be performed to check the oil filler grate.



Remove Oil Filler Cap 1

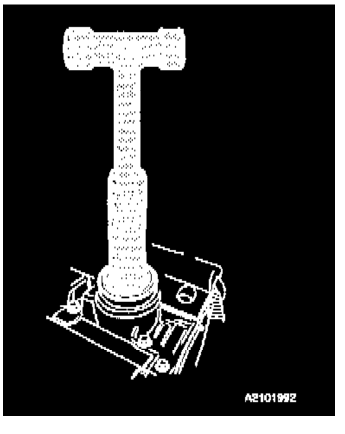
Inspect: look to see if oil filler grate is visible.

If VISIBLE: proceed to next step.

If NOT visible - take a magnet and insert it into the filler neck. Move magnet in all directions including passing the magnet over oil puddles. Remove magnet and check magnet for metal shavings.

If the oil filler grate is not visible and metal shavings are present contact your Regional FTS or the Technical Hot-line.

If the oil filler grate is not visible, and no metal shavings are present inspection completed. Using tire chalk, place an X across the top of the oil filler cap.



Checking the oil filler grate 2

Tool Needed: Hammer with a rubber handle. Handle diameter must be 30-40 mm (1.16-1.57 inches).

Note!
Do not hit the oil filler grate with the hammer.

Insert the handle into the filler neck.

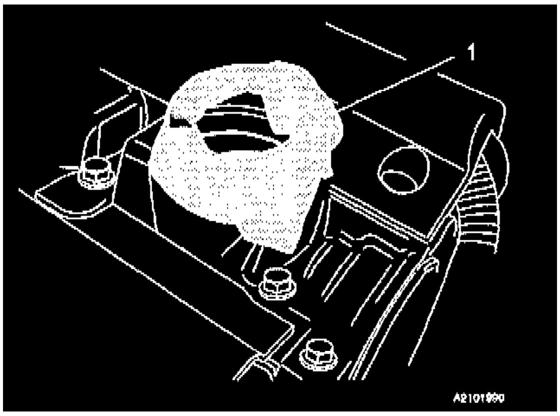
Push down on hammer, and at the same time observe grate to see/feel if loose.

If necessary, repeat a second time.

If grate is NOT loose - inspection is complete. Using tire chalk, place an X across the top of the oil filler cap.

If grate IS loose - proceed to the next step.

Engine oil filler grate, inspection Inspection of Oil filler grate



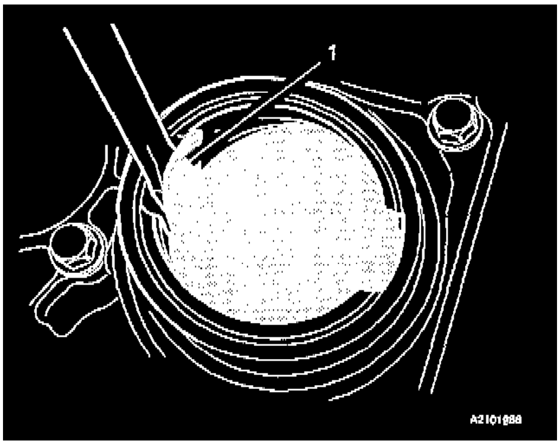
Removing the oil filler grate 3

Covering the oil filler sleeve

Install tape on the filler neck to protect cap sealing surface. Use two layers of duct tape.

When performing this operation, take all precautions necessary to protect the cap sealing surface.

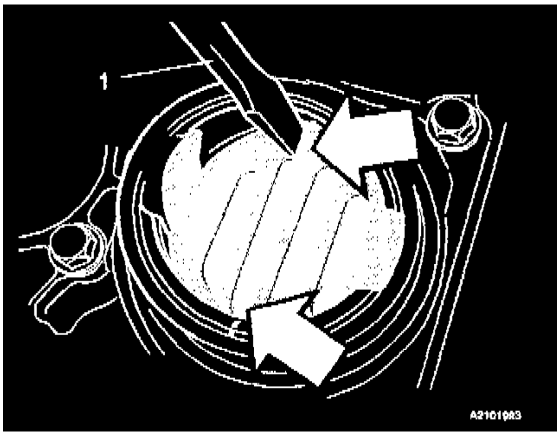
Caution!
Failure to cover the oil filler neck could result in damage to the sealing surface and require its replacement.



Bending attachment 4

Note!
The following illustrations do not show the protective tape. The tape must remain in place throughout the entire procedure.

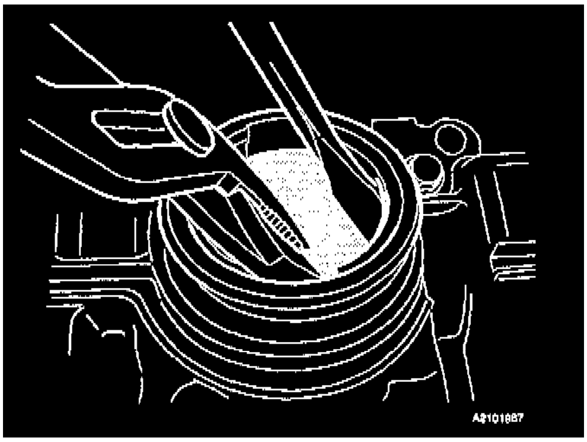
Insert screwdriver behind the attachment. Bend attachment 45 degrees inward.



Making kinks 5

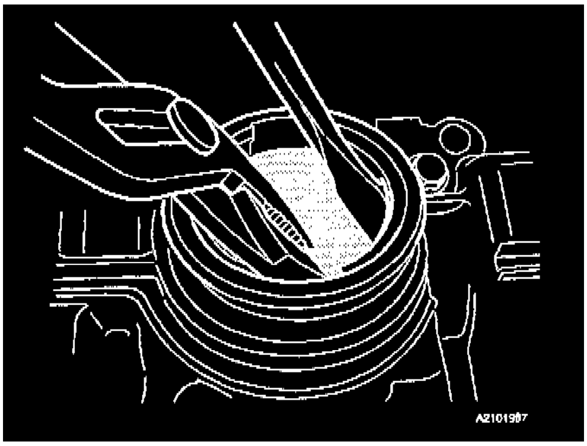
Using a small chisel, make a mark on both sides of the center louver. Mark should be in-line with the straight cut side of the louver.

See Illustration.



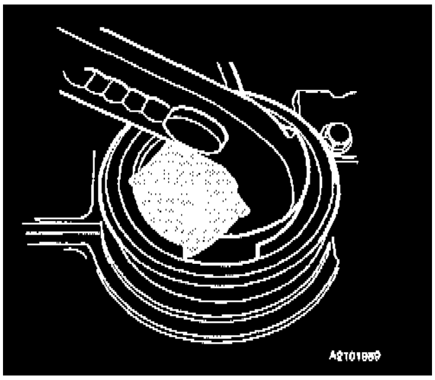
Grab attachment with a pair of channel locks. 6

Using a flat blade screwdriver, press down on one of the marks, at the same time, bend grate over with channel locks.



Folding the oil filler grate 7

Move screwdriver to other side if necessary. Fold grate in half.



Removing the oil filler grate and masking tape 8

Grab grate with channel locks. Carefully move the grate up and down and from side to side until second attachment loosens.

Remove grate.

Remove protective tape. Carefully inspect cap sealing surface for damage.

Check for any metal shavings, remove using a magnet. Using tire chalk, place an X across the top of the oil filler cap.

Technical Service Bulletin # **3370008** Date: **001001**

Headlamps - Auxiliary Resistor Wire Harness

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

S40/V40
2000-

Section
3

Group
37

No
0008

Year
00

Month
10

Auxiliary harness, head lights

Background
A new resistor wire harness has been introduced to extend the life of the low-beam headlight bulbs. The new harness is available as a spare part Following these procedures, resolve customer complaints about low-beam lifespan by installing the new harness in line with the existing wire harness and replacing both low beam bulbs.

Model	Factory	Chassis No.
S40,V40	Nedcar=F	415000-600137

Affected Vehicles

Description	Quantity	Part No.
Cable harness	1	30621291
Bulb (H7)	2	981465
Strip Clamp	0.02	948211-8

Materials

Special tools	Quantity	Part No.
Terminal removal tool	1	9512636

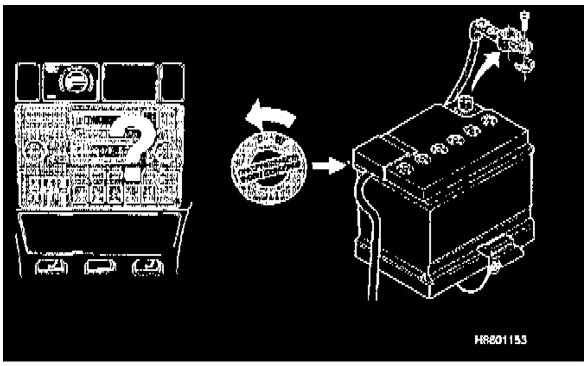
Special tools

Auxiliary harness, head lights

Installation of an extra wire harness and new bulbs

1

Preparatory work



Make a **note** of the radio code.

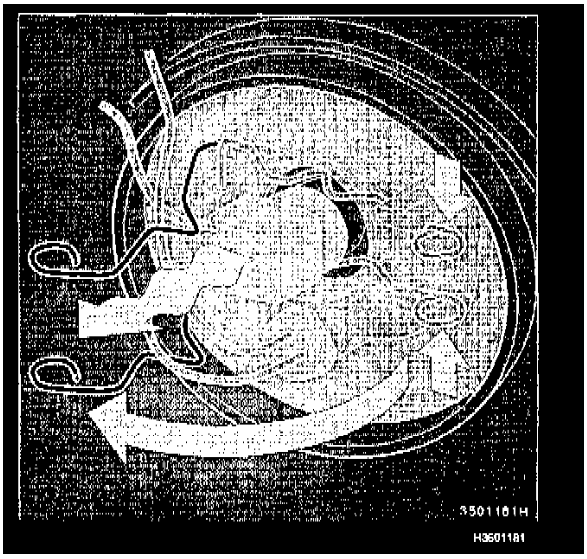
Turn off the ignition.

Open the bonnet.

Disconnect the battery negative lead.

2

Replacing left and right low beam bulbs



Turbo versions: remove the protective covers over the headlamp bulbs if applicable.

Caution!
Do not touch the bulb glass.

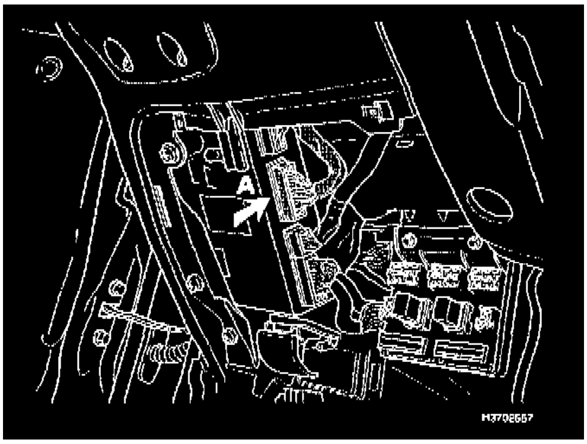
Squeeze the retaining clips as pictured. Remove the electrical connector and bulb from the headlight assembly.

Remove old bulb and discard.

Install new bulb in the connector and reverse the procedure to complete installation.

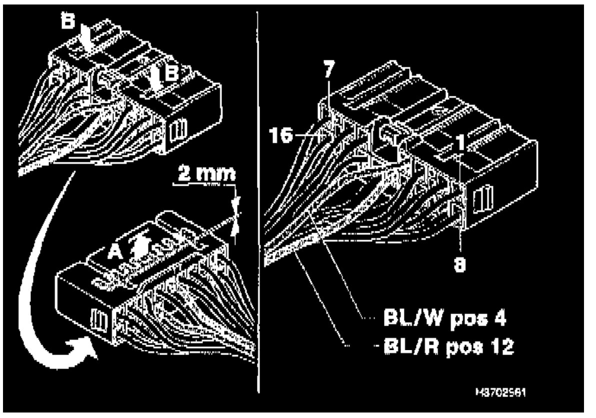
3

Removing panel



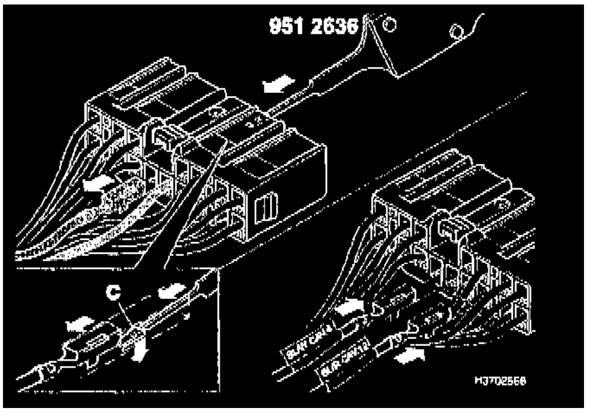
Remove the driver side, under-dash panel covering the central electronic module (CEM).

Remove the connector (A) from the CEM.



4

Connecting the cable harness to the CEM



Open the catch (A) by pushing it out (approximately 2 mm) on the other side at points (B).

Insert terminal removal tool 951 2636 in terminal slot 4 and terminal slot 12 respectively as indicated in the illustration. Push the catch (C) to one side.

Remove the wire from the connector.

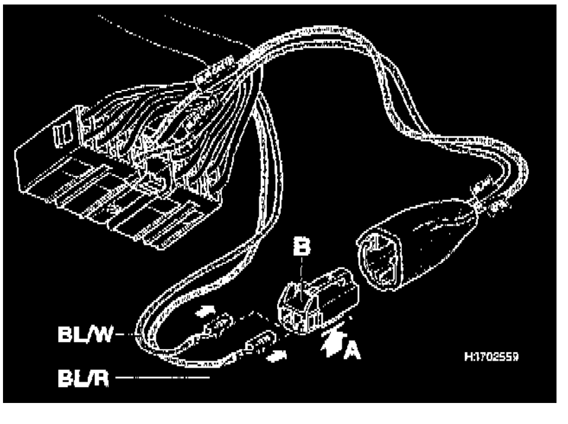
Connect the two wires from the auxiliary harness to slot 4 and 12 in the CEM connector as per illustration.

Carefully pull on the wire to check that it is secured. Push the catch (A) back into place. Reinstall the connector in the CEM. Check that the connector is secure.

Reinstall the connector in the CEM. Check that the connector is secure.

5

Installing the wires into the connector



Check if the catch (A) is open. Open if necessary by pressing the lock out.

Position the new connector (B).

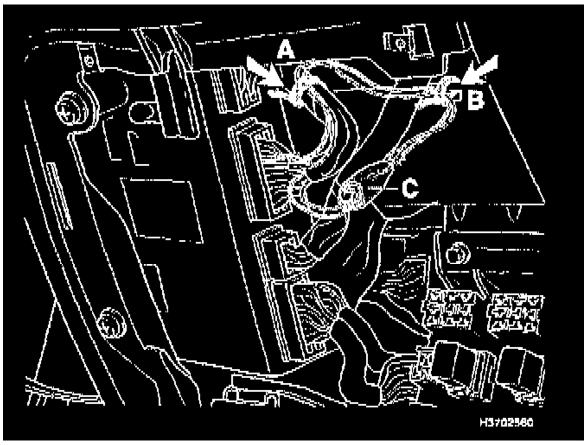
Insert the two wires from the auxiliary harness in the connector.

Note!
Ensure that the wiring to slot 4 in the (B) connector is also connected to slot 4 in the CEM connector

Pull carefully on the wire to check that it is secured. Push in the lock catch (A).

6

Securing the cable harness



Assemble the new cable harness in the connector (C).

Secure the cable harness in as large a loop as possible to the existing cable harness (A) and to the support bracket (B).

Use the supplied clips.

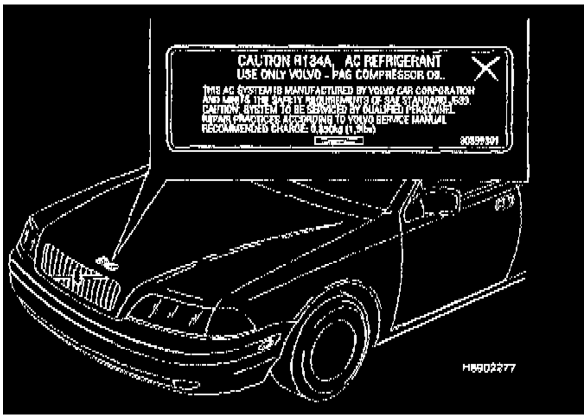
Caution!
Ensure that the wiring is not chafing or/and pinched at any point.

Reinstall the cover panel(s) on the dashboard.

7

Identify vehicles with harness Installed

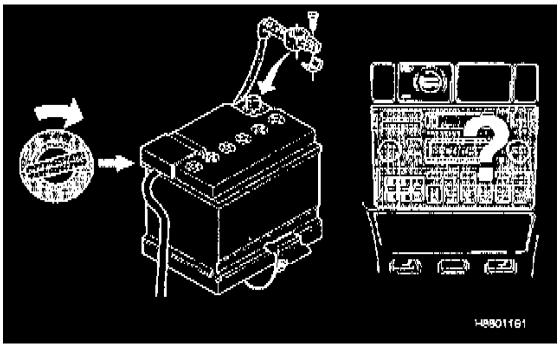
To identify which vehicles within the chassis range listed on the cover page have a harness installed, the vehicle should be marked.



Place an X as pictured on the A/C label under the hood with a black permanent marker.

8

Checking the function



Turn the ignition key to position I.

Warning!
Ensure that nobody is in the car when connecting the battery.

Connect the battery negative lead.

Wait at least 10 seconds.

Check the function of the low beams.

Enter the radio code.

Set the clock to the correct time.

Operation No.	Labor description	Time allowance
90026-2	Install extra cable harness	0.3 hr
35125-2	Replace 2x bulb	0.1 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **8840031** Date: **010401**

Front Door Window - Excessive Noise

Section
8

Group
84

No.
0031

Year
01

Month
04

S40/V40

2000-

Front door window, replacement

Background

New windows have been introduced for the front doors to improve quality and to prevent excessive noise. Because of a new lift bar, the door glass appears to be larger because the glass does not fully drop into the door in the "down" position. The additional inside guide rail on the lock side has also been removed.

The guide molding for the window is unchanged, but will be shortened when a new protective cap for the inner lock is introduced. The mounting of the windows on the window mechanism now uses two M6 bolts. The window lift bar is bonded to the door window and does not need to be installed.

Only the new window version is available as a spare part and can be installed in the older versions of cars without any changes.

Model	Chassis No.
S40, V40	489897-

Affected vehicles

Description	Quantity	Part No.
Window left side	1	30859681
Window right side	1	30859682
M6 Bolts	2	955269

Parts List

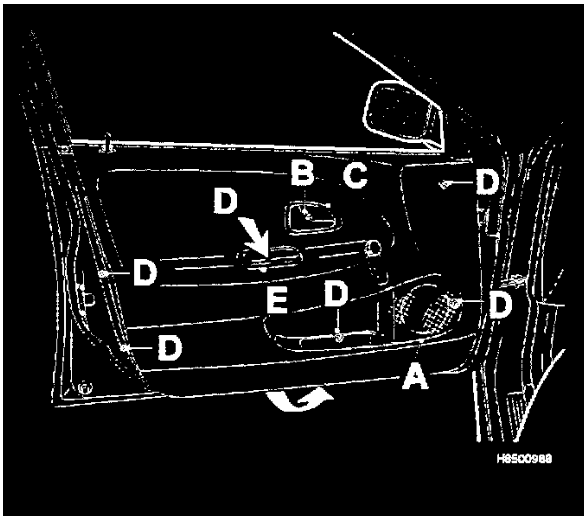
Front door window, replacing 1

Front door panel, removing

Close the door window.

Remove:

- cover panel from the door mirror

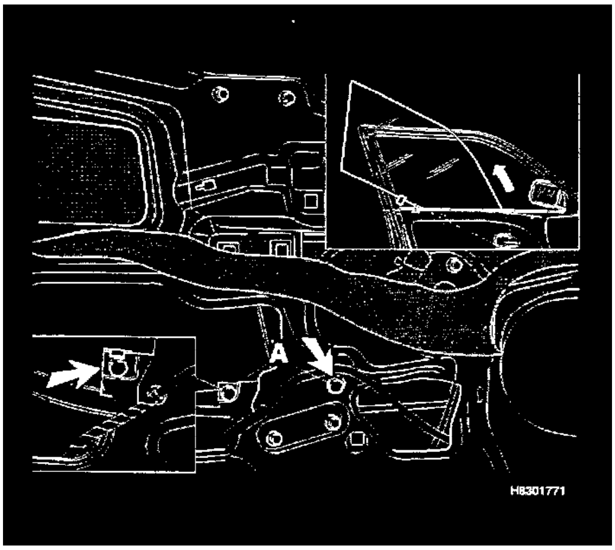


- speaker panel (A) and self-tapping screw
- self-tapping screw at the opener (B). Remove the housing (C) by pulling it forward
- caps and screws (D)
- handgrip tray (E) (disconnect the connector for the power window)
- pull the door panel off at the bottom by detaching the clips
- panel working from the bottom to the top.

Front door window, removing 2

Remove:

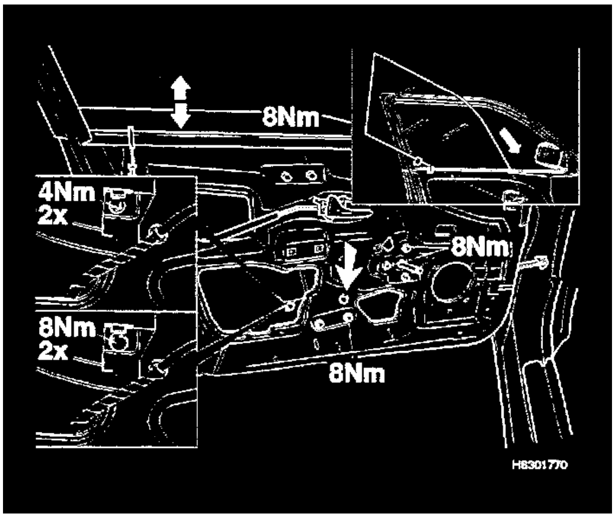
- part of the insulation panel to access the bolts



- window opened; the two mounting bolts (A)

- window, move the window upwards and turn it at the front side downwards and take it out (do not damage other parts while removing).

Front door window, installing 3



Install the window (starting from the front) in the front door. Position the window in the guide molding using a twisting movement. Do not damage any components.

Lower the window so that the mounting holes in the window lift bar are opposite the holes in the fixed arm in the window mechanism.

Finger-tighten the bolts.

Wind the window up and down a few times and secure the window by the bolts. Tighten to 8 Nm (6 ft.lb).

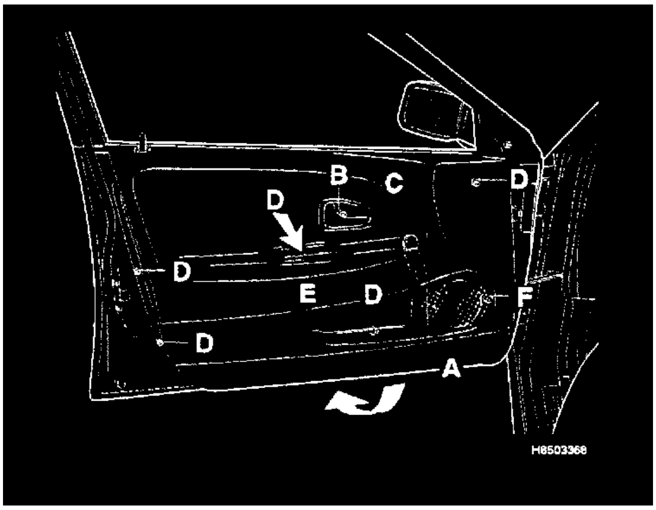
Warning!

When replacing an old type of front door window with a new one, take care to use the right bolts and tightening torque 8 Nm (6 ft.lb). If the old window is used be aware that the tighten torque of the screws is 4 Nm (3 ft.lb).

Open the window.

Install the insulation panel. If necessary, apply a new mounting strip (P/N 277253).

Front door panel, installing 4



Check the panel clips.

If necessary apply the weatherstrip.

Position the panel at the top (thread through the wiring for power windows). Press the door panel down so that the clips at the bottom engage.

Connect the wiring to the switch (power windows). Position the inner handle (E). Install the cover.

Position the housing for the opener (C). Hook the housing into the door panel. Install the screw (B).

Install the screws (D). Install the caps.

Install the screw (F). Position the loudspeaker panel (A).

Position the cover for the door mirror.

Close the window.

Clean the window.

Operation No.	Labor description	Time allowance
84406-2	Power window front door replace	0.7 hr

WARRANTY STATEMENT: Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

Technical Service Bulletin # **8840033** Date: **040401**

Body - PUR Bond(R) Window Bonding

Cars
All models
1992-

Section:
8

Group:
84

No.:
0033

Year:
04

Month:
04

Vehicles involved:
All with PUR bonded windows

PUR bonded windows, new adhesive kit

Background

This Service Bulletin describes the specifications of the type of adhesive which must be used on the body flange when bonding windows. Other adhesive kit replacements are also described.

The quantity of adhesive has been reduced from 580 ml (19.61 fl oz) to 450 ml (15.22 fl oz). This amount is the required amount to be applied.

Description	Quantity	P/N
Adhesive kit (replaced by previous adhesive, P/N 1161381)	1	1161693

Materials

Glass and weather-strip for windshield and rear windshield

Application of the PUR adhesive

Information 1

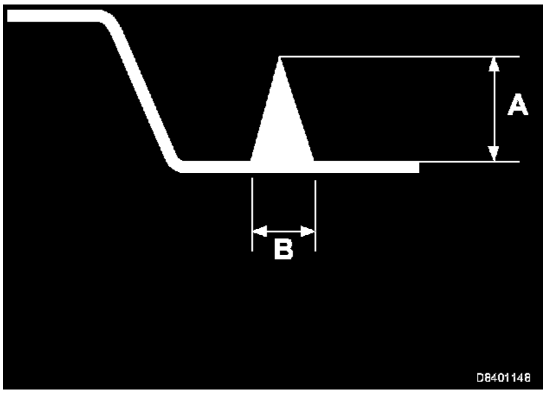
Note!
When bonding windows, only Volvo PUR adhesive must be used. This PUR adhesive is continually tested to satisfy Volvo's demands on the vehicle in the aftermarket environment.

Note!
The adhesive must cure for three hours before the vehicle can be driven away.

Vehicles with a driver's airbag (SRS) and/or passenger airbag (SRS) must be bonded using 2-component adhesive.

If it is suspected that the window has been bonded using non-approved Volvo adhesive, the adhesive must be removed.

Adhesive bed requirements 2



When applying PUR adhesive to the body flange, a PUR adhesive bed is required. See the illustration.

The following apply to the S40/V40/C70/S70/V70 (-00)/V70 XC (-00)/S60/V70 (00-)/V70 XC (01-)/XC70/S80/XC90:

A = min. 13 mm

B = mm. 7 mm

The following apply to the 850:

(Use the blue pipe supplied with the kit. Alternatively cut a pipe as follows.)

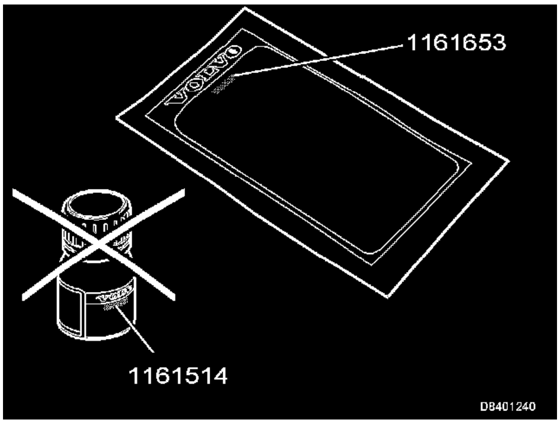
A = min. 18 mm

B = mm. 7 mm

Hint:
If the old PUR bed is complete and is a maximum of 4 mm high, it does not need to be cut further. Reduce the application of adhesive to achieve dimension A.

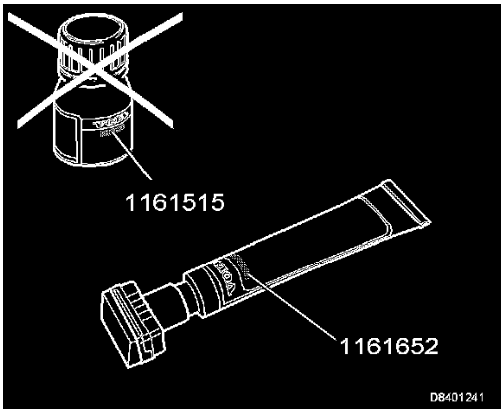
Note!
The amount of adhesive in the kit is sufficient for all Volvo models, even with clean body flanges.

Glass cleaner 3



Glass activator, P/N 1161514 (yellow top) have been replaced by glass cleaner, P/N 1161653.

Primer for glass 4



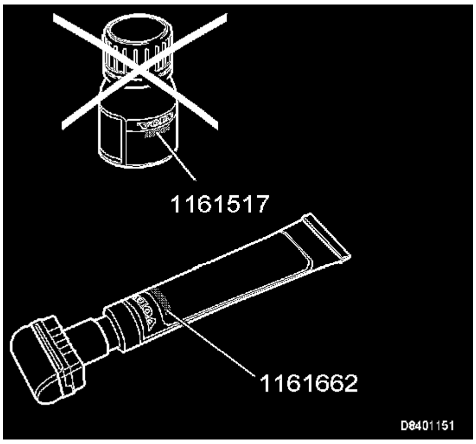
Glass primer, P/N 1161515 (green top) have been replaced by primer, P/N 1161652 (marked green).

The primer must always be applied to the window.

Shake before use.

Allow the primer to dry for 10 minutes.

Activator for plastic and PUR 5



PUR/RIM activator, P/N 1161517 (blue cap), is replaced by activator, P/N 1161662 (marked blue).

The activator is applied to the plastic housing to ensure the bonding of the PUR adhesive. E.G. (rear windshield on the 854 and S70).

If the old adhesive bed has been exposed/opened for more than 8 hours, it must be treated with activator before bonding.

Shake before use.

Allow the primer to dry for 10 minutes.

Enamel primer 6

Enamel primer, P/N 1161516 (red cap), has not changed.

Applied for adhesion on painted body flanges.

Shake before use.

Allow the enamel primer to dry for 10 minutes.

Technical Service Bulletin # **08111** Date: **030110**

Recall - Trailer Hitch Defect

NO:
111

GROUP:
08

ISSUING DEPARTMENT:

CAR MARKET:
North America

DATE:

YEAR	MONTH	DAY
2003	01	10

TITLE:
Recall Campaign 111 Trailer Hitch

MY 1993-2002

REFERENCE BULLETINS:

SMB 00-170
SMB 00-170c
SB 89-0011
PB 89-111 (Pending)

BULLETIN REFERENCE

A. RECALL CAMPAIGN 111 DESCRIPTION

B. TRAILER HITCHES INVOLVED

C. PARTS INFORMATION

D. REPAIR OPTIONS/PARTS RETURN

E. CUSTOMER INFORMATION

F. RETAILER RESPONSIBILITY

G. CAMPAIGN REIMBURSEMENT PROCEDURES

H. RETAILER ALLOWANCE

I. CUSTOMER REIMBURSEMENT

A. RECALL CAMPAIGN 111 DESCRIPTION

Volvo, in agreement with its supplier Brink Sverige AB, has determined that a defect exists in the Generation 3.0 Trailer Hitch manufactured in Sweden for use on Volvo cars. Between September 1998 and September 2000, approximately 900 of the affected trailer hitches were delivered to Volvo retailers and subsequently sold to customers in the US and Canada.

B. TRAILER HITCHES INVOLVED

In an attempt to locate the owners of the affected trailer hitches, Volvo is asking retailers to check their records, for the time period between September 1998 and September 2000 for sales of the seven (7) affected part numbers*:

9451997	9481235
9451998	9481216
9481232	9499598
30889232	

* **Note**:

Not every trailer hitch with one of the part numbers listed above is affected by the Recall. Please confirm that the trailer hitch is included in Recall 111 by ensuring that the part number is on the list and that the hitch has ALL THREE of the following distinguishing features:

^ a green release handle

^ a key-lock

^ the area around the locked/unlocked red indicator pin is round

US	CANADA
Asset Management & Control	Volvo Cars of Canada Ltd.
ATTN: TMA Department	ATTN: TMA Department
55 Riverview Drive	175 Gordon Baker Road
Marlboro, NY 12542	North York, Ontario M2H 2N7

C. PARTS INFORMATION

Part Number	Part Description	Qty
8698774	Service Kit	1

D. REPAIR OPTIONS / PARTS RETURN

The supplier is expected to provide Volvo with replacement trailer hitches within 90 days. At this time, no customers have been contacted regarding this Recall Campaign. If in the course of business, one of the affected trailer hitches is encountered, please inform the customer that the hitch is part of Volvo Recall Campaign 111 and offer the following options:

1. If the customer agrees to surrender the affected part (see description of affected parts in Section B. TRAILER HITCHES INVOLVED):

   (a) Remove the detachable tow bar portion of the affected trailer hitch and return only the green handle to TMA. The balance of the parts are to be scrapped by the retailer. The mailing procedures for TMA can be found in SMB 00-170 for the US and SMB 00-170C for Canada, the addresses are:

   (b) Inform the customer that he/she will be notified by letter when a replacement hitch is available;

   (c) Send the customer's name, address and VIN to VCNA (as indicated in Section E. CUSTOMER INFORMATION).

2. If the customer does not want to surrender the affected part (see Section B. TRAILER HITCHES INVOLVED):

(a) Permanently affix the detachable tow bar to the receiver (bumper mount) using Service Kit 8698774 and the instructions in Service Bulletin 89-0011, Trailer Hitch - Permanently Affixing, available on the VEN Intranet;

(b) Inform the customer that he/she will be notified by letter when a replacement is available;

(c) Send the customer's name, address and VIN to VCNA (see Section E. CUSTOMER INFORMATION).

E. CUSTOMER INFORMATION

If sales records for the affected parts are located, please submit the customer's name, address and VIN by mail to:

Volvo Cars of North America, LLC
1 Volvo Drive (Bldg. B)
Rockleigh, NJ 07647

F. RETAILER RESPONSIBILITY

Retailers are to perform this campaign on eligible vehicles regardless of mileage/kilometers or vehicle age. The campaign work covered under Recall Campaign 111 is free of charge to the owner.

G. CAMPAIGN REIMBURSEMENT PROCEDURES

All Recall Campaign 111 claims should be submitted using the short form application. A repair code has been established for this repair that will automatically reimburse the retailer for the proper labor and parts amount for each claim.

Claim Type	Repair Code	Repair Description	Labor Time	Part Amount
111	02	Identify and secure detachable tow hitch	0.3	US: $4.37 CA: $6.82

H. RETAILER ALLOWANCE

I. RETAILER ALLOWANCE

Please follow the instructions as outlined in the WARRANTY POLICY & PROCEDURES MANUAL, Chapter 6, Page 6.4.

Technical Service Bulletin # **8890013** Date: **040401**

Recall - Trailer Hitch Replacement

850/S40(-04)/V40/S70/V70(-01)/V70XC(-01)/S80 -2000
V70(01-)/V70XC(01-)/S80 2001-

Cars

Section:
8

Group:
89

No.:
0013

Year:
04

Month:
04

Reference:

This bulletin replaces Service Bulletin 89-0011 from December 2002 which must be discarded.

Recall Campaign No. 111A - Trailer Hitch Replacement

Background

Volvo, in agreement with its supplier Brink Sverige AB, has determined that a defect exists in the Generation 3.0 Trailer Hitch manufactured in Sweden for use on Volvo cars.

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

Competence requirement
Volvo Level 1 Technician

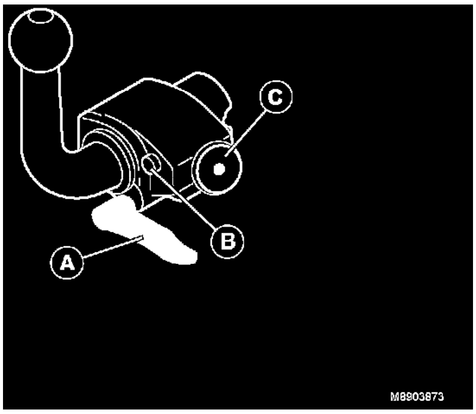
Material

Description	Quantity	P/N
Mechanism	1	See table below

Towing unit

Detachable Tow Hitch Replacement

Identifying tow hitch type 1

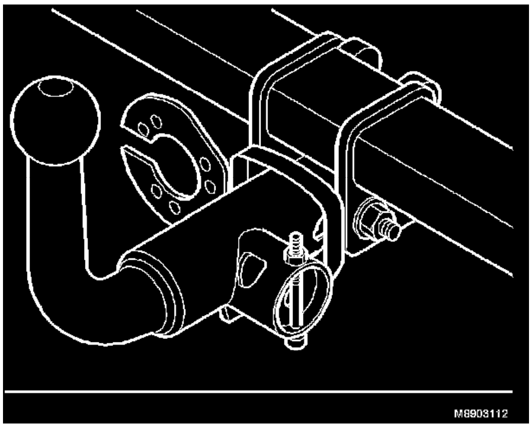


The trailer hitch covered by this method is recognizable by the following features:

Alternative 1

- Green handle (A)
- Key-lock (B)
- Area around indicator pin is circular (C).

Alternative 2



Tow hitch is mounted temporarily as shown in illustration, step 2.

Removing temporarily mounted tow hitch 2

Remove bolt securing tow hitch. Remove washers, spring and locking cylinder.

Replacing tow hitch 3

Remove cover (if fitted) on connecting pin. Check tow hitch P/N.

The number is stated after PART NO. on the type designation plate, which is located on the left-hand side of the tow hitch.

CAR MODEL		OLD PART NUMBERS				REPLACEMENT PARTS
Model year		Type designation plate	Kit number	Remarks	Ball (A) (tolerance 0 – /+4 mm)	Mechanism
-2000	855, S70, V70, V70XC	9481216	9451998	1 7/8" ball	81.25	8698893
-2000	855, S70, V70, V70XC	9451997	9451997	2" ball	81.25	8698894
-2000	S40, V40	30889232	30889232	1 7/8" ball	99.25	8698920
1999-	S80	9166575	9166575	2" ball	N/A	8698933
-2002	S80	8623085	9499507	2" ball	127.8	8698935
2001-	V70	9481216	9481216	2" ball	150.8	30664193
2001-	V70	9499598	9499598	1 7/8" ball	150.8	30664194
2001-	V70XC	9481232 9481235	9481232 9481235	2" ball 1 7/8" ball	144.3 N/A	8682306, 8682170, 8682171

Unpack the new tow hitch and connecting pin with the P/N in the table shown.

Note!

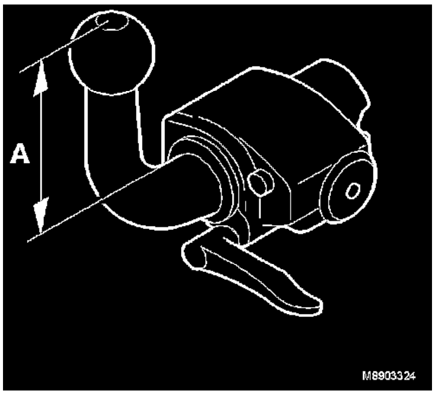
If the type designation plate is absent, the tow hitch can be identified by measuring the ball height as described in the following operation and cross-referencing with the values specified in the table.

Remove the existing decal in the luggage compartment describing the operation of the tow hitch.

The location of the decal will vary depending on the model and version.

Attach the decal included in the material kit.

Measuring the ball height 4



The ball height (A) is measured between the top of the ball and the top of the horizontal section of the tow hitch (see illustration).

Checking tow hitch 5

Mount tow hitch on connecting pin.

Ensure that tow hitch locks in position and that the key-lock is working.

Remove tow hitch.

Fit cover to connecting pin (if available).

Placing tow hitch in car 6

Complete registration card provided with tow hitch. Handled according to separate routine.

Place tow hitch in bag.

Place tow hitch and keys in car in location specified for model in question.

Replace existing manual with new manual from kit. Discard old manual and keys.

Mechanism, connecting pin and type designation plate must be scrapped according to separate instruction.

Technical Service Bulletin # **NHTSA03V474000** Date: **031103**

Recall 03V474000: Brake Vacuum Pump Replacement

DEFECT: On certain passenger vehicles, water can enter the electrical brake vacuum pump, causing the pump to fail, resulting in loss of power assist and an increase in needed brake pedal force, which could result in a crash.

REMEDY: Dealers will replace the pump with a new and improved version and move the pump to a new location. The manufacturer has not yet provided an owner notification schedule for this campaign. Owners may contact Volvo at 1-800-458-1552.

Technical Service Bulletin # **8850010** Date: **011101**

Power Seat - Intermittent Lateral Movement

S40/V40
2000

Section:
8

Group:
85

No.:
0010

Year:
01

Month:
11

Reference:
This Service Bulletin replaces the previous SB 85-0010 dated April 2000, which should be discarded.

Purpose:
The time allowance is changed.

Electrically operated seat, minimizing lateral movement

Background

Intermittently the customer might experience minimal lateral movement during acceleration and deceleration, when driving a car equipped with power seats.

Cars Involved

Model	Factory	Chassis no.
S40, V40	F	130001-614999

Materials

Description	Quantity	Part No.
Power seat kit LH side	1	8619314
Power seat kit	1	8619338

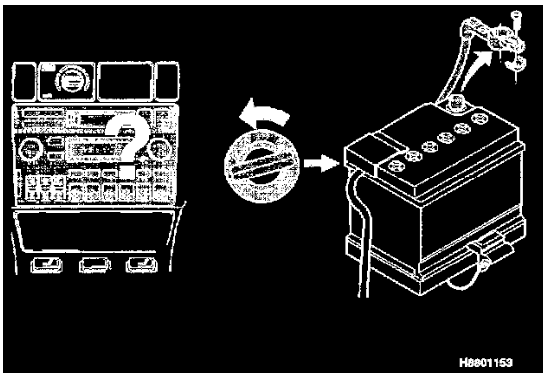
Rh side

Tools

Description	Part No.
Ground lead	9511522

Minimizing the free travel in the power seat

Preparations 1



Make a note of me anti-theft radio code.

Detach the negative lead from the battery.

Position the seat to access and release all the mounting points.

The front edge of the seat must be in the uppermost position before the seat can be removed.

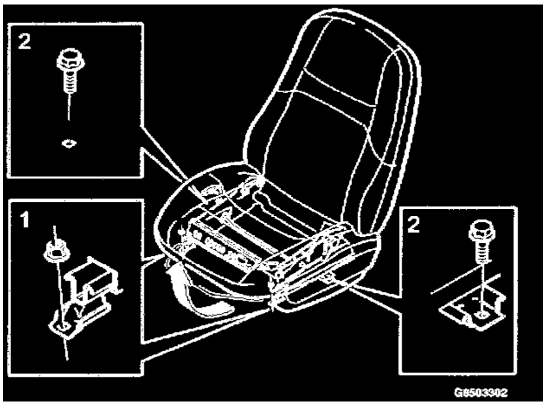
Note!
when removing a seat from a car with side airbags, the seat must be grounded. This is due to the Possibility of static electricity.

When the seat has been removed from its mounting position attach ground lead 9511522 or connect a suitable length of wire (stripped at both ends) to the rear mounting.

Secure the other end to a suitable ground point in the car.

Removing and tilting the seat 2

Remove



- Move seat to forward most position.

- The left side mounting screw protective cover.

Note!
On right side it is possible to remove the rear mounting screw without removing the center console.

- Move the seat to the rear most position.

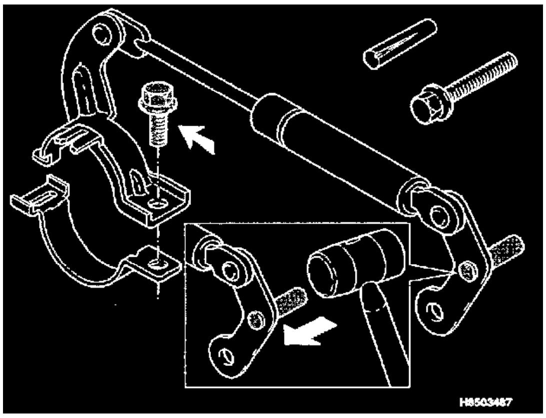
- The front mounting protective covers by sliding the protective covers forwards, the nuts (1).

Angle, tip and tilt the seat backwards towards the rear seat.

Note!
Secure the seat.

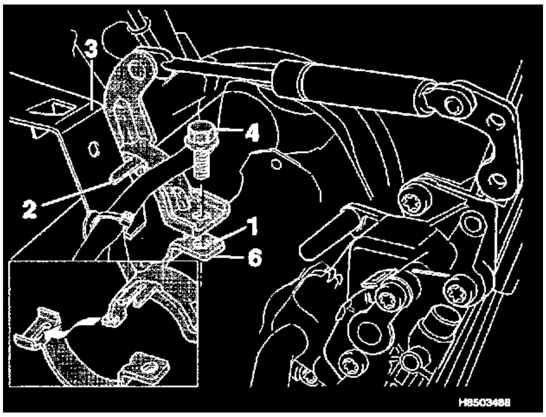
Note!
Do not damage the components.

Unpacking the kit 3



Unpack the kit. Remove the damp bolt and separate the bracket. Remove the lock pin from the bracket, as shown in the picture.

Installing the clamp 4



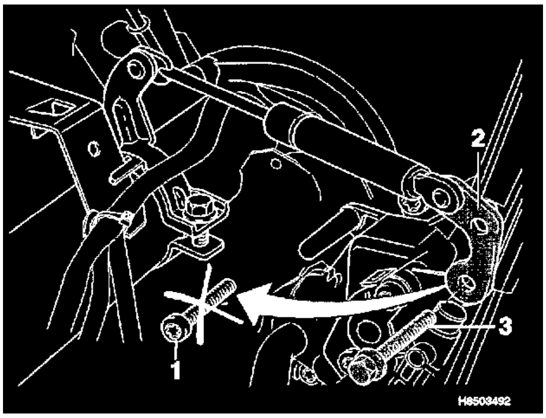
Position the damp (6), with gas strut attached, around the SIPS pipe. Ensure that the locator (2) is placed over the bracket (3) on the SIPS rail. Be sure that the locator is completely seated in the bracket.

Note:

Move the wiring beside and avoid clamping between the bracket.

Secure the screw in the hole (1). Tighten the screw (4) to 10 Nm (7 ft.lb).

Installing the lower bracket 5



Remove the screw (1). Use a standard torx socket. Discard the screw.

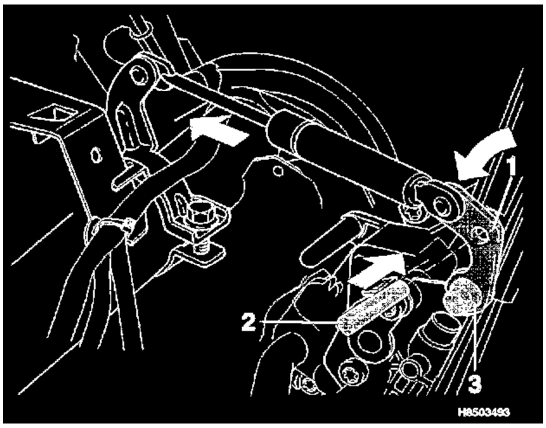
Position the bracket (2) ensuring that the circlip is properly positioned. Secure the bracket using the new screw (3). Finger tighten the screw.

Positioning the bracket 6

Note!

Check that the hole in the seat motor is not obstructed.

Angle the bracket (1) and the gas strut upwards into place. High forces are needed to press the gas strut in and move the bracket into position. Use a large pair of pliers to compress strut and position bracket.



Place and tap the lock pin (2) into position (see picture) to lock the bracket. The head of the lock pin must be flush with the surface of the bracket.

Tighten the screw (3) to 8 Nm (6 ft.lb).

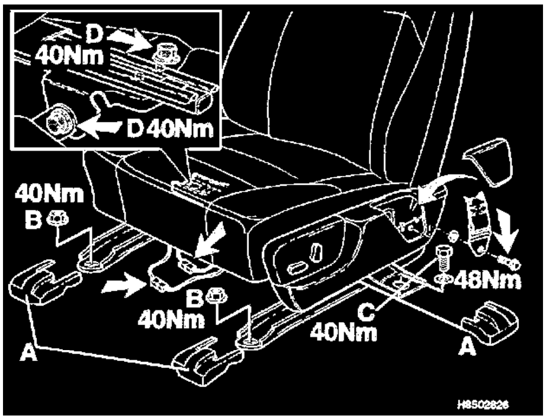
NOTE:
Check that the bracket and mounting of the upper clamp are in a straight line.

NOTE:
Check that circlips are locked/secured in their groves.

Installing seats 7

Install the front seat in the car.

Connect the disconnected connectors. Screw the seat into place.



Tighten to the torque specifications illustrated.

Reinstall the other removed components.

Test the function of the seat.

Operation No.	Labor description	Time allowance
85923-2	Gas strut front seat, install	0.9 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint. using claim type 01.

Technical Service Bulletin # **8880030** Date: **040401**

SRS - Cable Harness Repair/Replacement

Cars
S40 (-04)/V40
2000-

Section:
8

Group:

88

No.:
0030

Year:
04

Month:
04

Miscellaneous:

Competence requirement: Volvo Level 2 Technician

SRS Cable Harness, Replacing and Repairing Cable Harnesses Based on SRS Diagnostic Trouble Codes (DTCs)

Background:

This Service Bulletin describes repair methods for various SRS cable harnesses. The described repairs should only be performed after the proper fault tracing has indicated a fault with the wire harness.

Model	Chassis number
S40 (-04)/V40	315 000 -

Affected cars

Description	Quantity	P/N
Service cable harness	10	see separate table
Tape	As required	9511074
Splicing sleeve	2	9512783
Tie strap	As required	983750

Material

Description	Special Tool Bulletin #	P/N
Wire Stripping Tool	From Terminal repair kit 9512946 or 9512647 (STB 95)	951 2620
Terminal Removal tool	From Terminal repair kit 9512946 or 9512647 (STB 95)	951 2636 Blue 951 2638 Gray
Crimping tool	From Terminal Repair Kit 9512669 (STB 95-B US or STB 95-C Canada)	951 2785
Hot air gun	Refer to STB 139	951 2850
Nozzle Kit	Refer to STB 139	951 2778

Special tool

Contents:

A: General

B: Installing the service cable harnesses

C: Replacing the terminals in the connector for the supplemental restraint system control module (SRS)

D: Repairing SRS wiring

E: Final check

General information

A fault in the SRS (supplemental restraint system) may be caused by faults in the wiring. Examples of this are:

^ All diagnostic trouble codes (DTCs) with the description "high resistance". Possible cause: loose connections in a connector.

^ All diagnostic trouble codes (DTCs) with the description "low resistance". Possible causes: short-circuit (damage) to the wiring, poorly connected or damaged connector.

^ All diagnostic trouble codes (DTCs) with the description "high voltage". Possible cause: short-circuit (damage) in the wiring.

Note!
The possible causes of these faults are always listed in the description of SRS diagnostic trouble codes (DTCs) in VADIS. References are often given to cables.

It is not necessary to replace the entire existing cable harness. The fault can be remedied by replacing only the faulty cables.

This can be done in two different ways:

1 By using service cable harnesses, according to method B.

2 By using a section of the service cable harness, see method D.

Note!
If there is physical damage to the SRS wiring or the connectors between the Supplemental Restraint System control module (SRS) and one of the SRS components (except for the drivers and passengers airbag) the damaged part of the cables can be replaced instead of the entire service cable harness.

In method D there is a description of how to splice cables using splicing sleeves P/N 951 2783.

Note!
The damaged part including the connector must always be replaced between two connections. Do not repair the cable between two connections.

Note!
The ignitor connector has changed color. It is now yellow.

Cable harness 1: between the Supplemental Restraint System control module (SRS) and the passenger airbag (dashboard harness).

2000	P/N 3063 8647
2001 –	P/N 3063 8649

Cable harness 2: between the Supplemental Restraint System control module (SRS) and the contact reel at the drivers airbag).

2000	P/N 3063 8646
2001 –	P/N 3063 8648

Cable harness 3: between the Supplemental Restraint System control module (SRS) and the left-hand seat, side impact sensor (B-post) and pre-tensioner.

2000	P/N 3062 3454
2001 –	P/N 3063 8650

Cable harness 4: between the Supplemental Restraint System control module (SRS) and the right-hand seat, side impact sensor (B-post) and pre-tensioner.

2000	P/N 3062 3455
2001 –	P/N 3063 8651

Cable harness 5: between the Supplemental Restraint System control module (SRS) and the left-hand side impact sensor (C-post) and the inflatable curtain.

2001 –	P/N 3063 8654	S40
2001 –	P/N 3062 3428	V40

Cable harness 6: between the Supplemental Restraint System control module (SRS) and the right-hand side impact sensor (C-post) and the inflatable curtain.

2001–	P/N 3063 8655	S40
2001–	P/N 3062 3427	V40

Service cable harness, part numbers shown.

Operation No.	Labor description	Time allowance
37940-2	Wiring harness control unit SRS – airbag passenger replace	0.8 hr
37941-2	Wiring harness control unit SRS – airbag drivers side replace	1.0 hr
37942-2	Wiring harness control unit SRS – SIPS bag replace	1.2 hr
37943-2	Wiring harness control unit SRS – SIPS sensor B-pillar replace	1.2 hr
37944-2	Wiring harness control unit SRS – belt tensioner replace	1.2 hr
37945-2	Wiring harness control unit SRS – SIPS sensor C-pillar replace	0.8 hr
37946-2	S40 Wiring harness control unit SRS – inflatable curtain replace	1.6 hr
37946-2	V40 Wiring harness control unit SRS – inflatable curtain replace	1.7 hr

WARRANTY STATEMENT:
Claims may be submitted under the New Car Warranty when there is a documented customer complaint, using claim type 01.

A. General

A: General

General 1

The color of the cables in the service cable harness is the same as for the existing SRS cable harness.

When replacing a cable in the existing cable harness, a cable of the same color must be used.

Caution!
After installing a service cable harness, unused cables must be insulated using tape and secured to the cable harness. This is to avoid any damage.

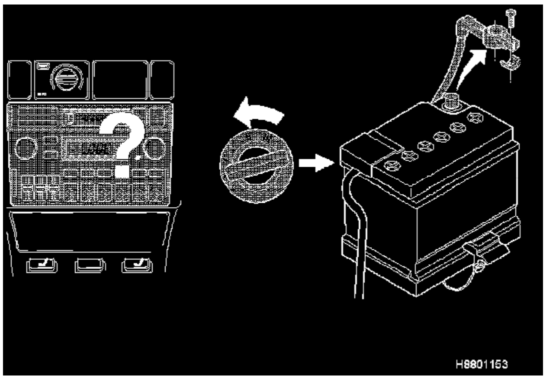
B. Installing the Service Cable Harness

B: Installing the service cable harnesses

Preparations 1

Make a note of the radio code.

Switch off the ignition.



Disconnect the battery negative lead

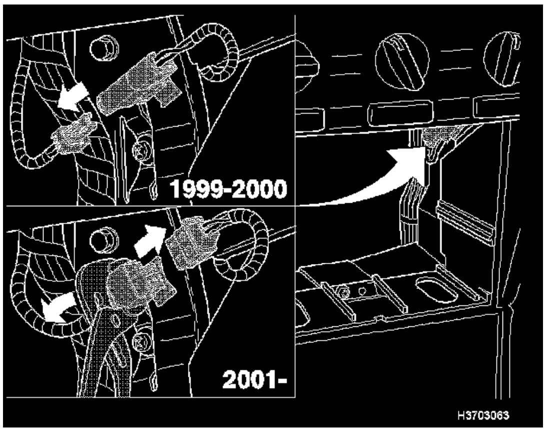
B1: Replacing the cable harness between the SRS control module and the passenger airbag, service cable harness 1 (a section of a cable may not be repaired)

Removing the cable harness from the dashboard bracket and 2

positioning the service cable

Remove the:

- rear center console
- center console locker and/or the radio
- panel on the right-hand side of the center console.



Separate the connector to the passenger airbag side. Disconnect the connector and the clip from the dashboard bracket.

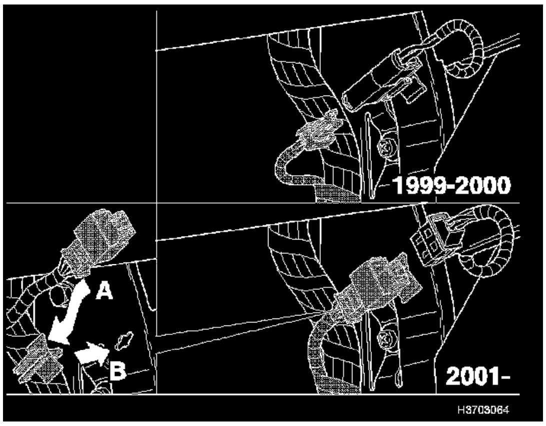
Position the new service cable harness along the existing cable harness under the center console against the dashboard bracket.

Installing the cable harness 3

MY 2000 - vehicles: Position the connector at the same height as the terminal.

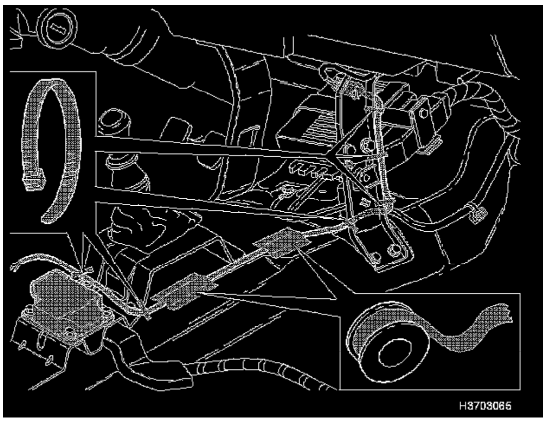
MY 2001 - vehicles: Install the new service cable harness and clip in the mounting on the dashboard bracket.

Remove both of the cable terminals from the SRS control module connector, see method C: Removing and installing the service cable harness from the connector to the supplemental restraint system control module (SRS).



Note the colors and positions of the cables. Position the cable terminals of the new service cable harness in the control module connector in the same position as the old cable terminals were removed as illustrated. See method C.

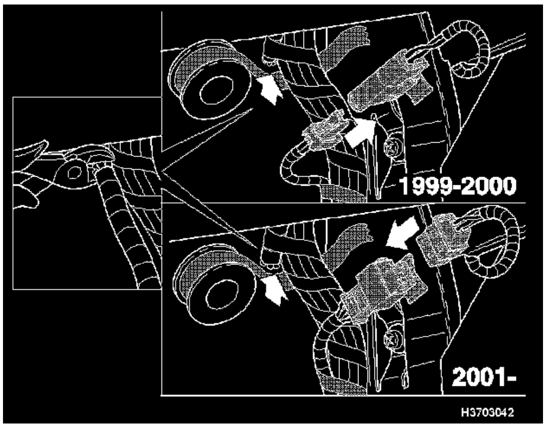
Caution!
Ensure that the colored cables are reinstalled in the same positions.



Secure the cable harness using tape and tie straps as illustrated.

Note!
Ensure that there is no tension in the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.

Connecting the cable harness and installing removed components 4



Reconnect the connector for the airbag. Check the connection by gently pulling the cable.

Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.

Press the cut-off cables into the casing without damage or sticking other parts. Tape if necessary.

Install the:

- panel on the right-hand side of the center console
- center console locker and/or the radio
- connector to the SRS control module
- rear center console.

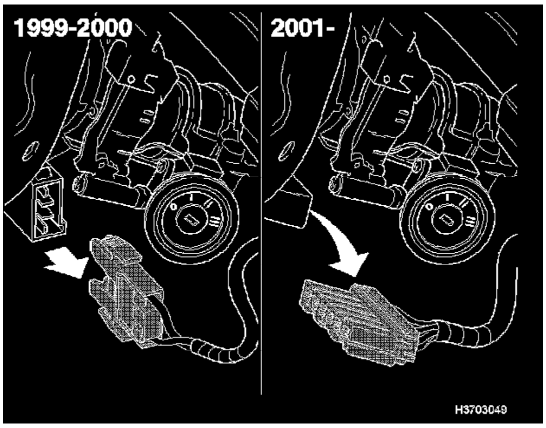
Carry out a final check according to method E.

B2: Replacing the cable harness between the SRS control module and the driver's airbag, service cable harness 2 (a section of a cable may not be repaired)

Disconnecting the cable harness from the contact reel 5

Remove the:

- rear center console
- driver's side sound proofing panel
- side panel
- steering column covers
- lever for the windshield wipers.

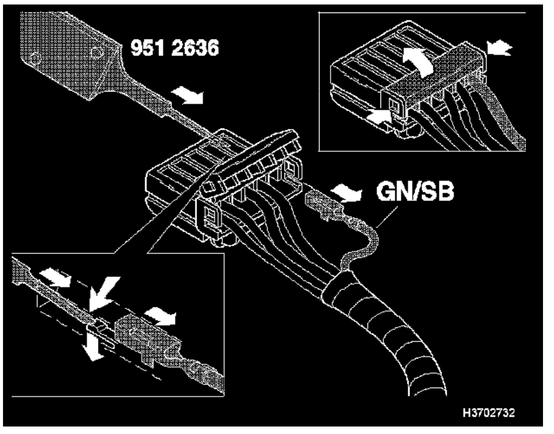


Disconnect the connector via the contact reel on the steering column and slide it downwards between the housings.

Position the new cable harness on the floor and under the console as far along the old cable harnesses towards the connector for the contact reel as possible.

Removing the cable for the horn, (affects model year 2001-) 6

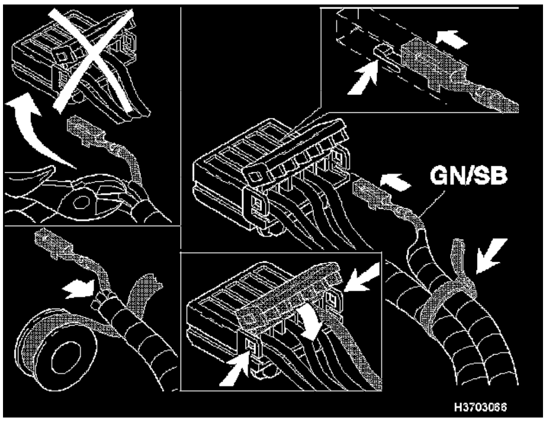
Open the secondary lock from the existing connector by moving it upwards.



Remove the green/black (GN/SB) cable by pressing down the locking tab (see illustration) using terminal removal tool 951 2636 on the cable terminal while pulling the cable out of the connector at the same time.

Note!
The green/black (GN/SB) cable must not be cut off.

Connecting the cable for the horn, (affects model year 2001-) 7



Open the secondary lock from the connector on the new cable harness by moving it upwards.

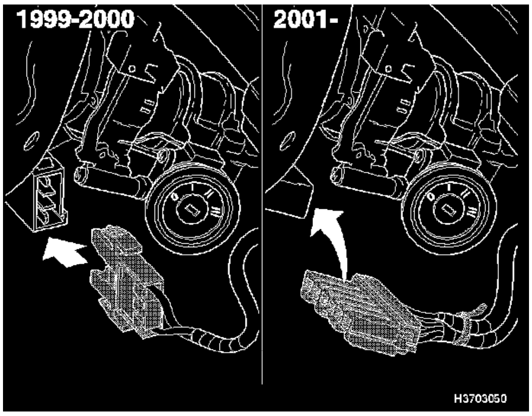
Install the green/black (GN/SB) cable in terminal 6 in the new connector. Gently pull the cable to ensure that it is secured. Close the secondary lock.

Pull the old cables as far out from the cable harness casing as possible. Cut off all the cables except for the green/black (GN/SB) as close to the casing as possible.

Press the cut-off cables into the casing without damage or sticking other parts. Tape if necessary.

Connecting the cable harness to the contact reel and the SRS 8

control module

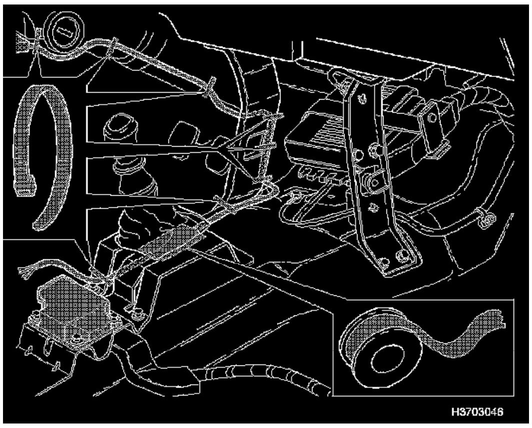


Insert the cable harness between the housings and connect the connector to the contact reel.

Remove both the cables from the control module connector See method C, step 4 or 5. Note the color and position.

Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Securing the cable harness and installing removed components 9



Secure the cable harness using tape and tie straps as illustrated.

Note!

Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.

Install the:

- lever for the windshield wipers
- steering column covers
- sound proofing panel
- side panel
- connector to the SRS Control module
- rear center console.

Carry out a final check according to method E.

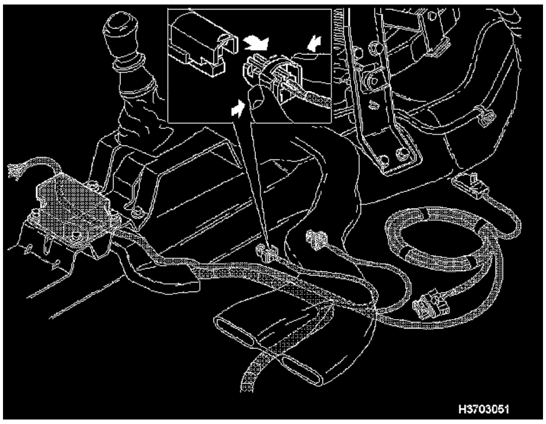
B3: Replacing the cable harness between the Supplemental Restraint System Control Module (SRS) and the side airbag on the driver or passenger side, service cable harness 3 or 4.

Replacing the cable harness 10

Remove the:

- rear center console
- front seat, see VADIS.

Fold the carpet out of the way at the rear (if needed remove sill trim panel).



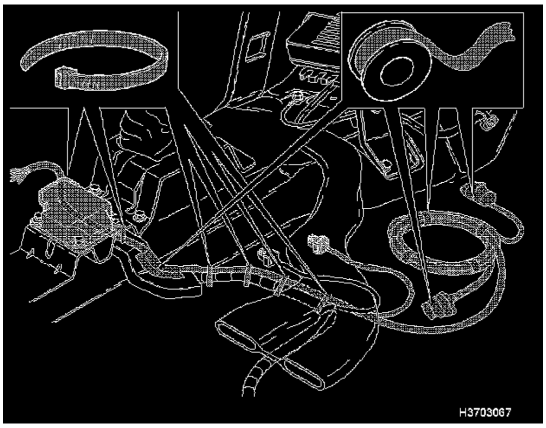
Route the new cable harness under the bracket alongside the existing cable harness as illustrated.

Remove both the cables from the control module connector. See method C, step 4 or 5. Note the colors and positions.

Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Caution!

Ensure that the colored cables are reinstalled in the same positions.

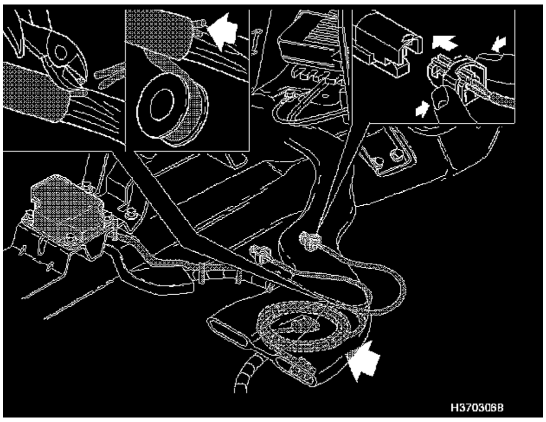


Secure the cable harness using tape and tie straps as illustrated.

Note!

Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.

Secure unused wiring so that it will not be damaged.



Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.

Press the cut-off cables into the casing without damage or other parts. Tape if necessary.

Fold the carpet back into position.

Install the:

- seat, see VADIS
- connector to the SRS control module
- rear center console.

Carry out a final check according to method E.

B4: Replacing the cable harness between the Supplemental Restraint System control module (SRS) and the side impact sensor on the B-post, service cable harness 3 or 4

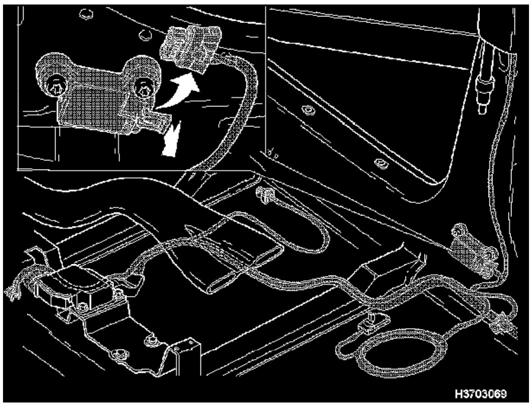
Replacing the cable 11

Remove the:

- rear center console
- front seats, see VADIS
- front and rear sill trim panels
- lower panel at the B-post
- insulation at the B-post.

Fold the carpet out of the way at the rear.

Disconnect the connector from the side impact sensor (do not bend the securing clip to far).

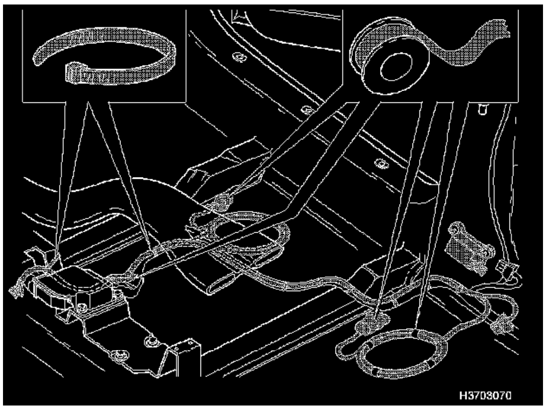


Route the new cable harness under the bracket alongside the existing cable harness as illustrated.

Remove both the cables from the control module connector. See method C, step 4 or 5. Note the colors and positions.

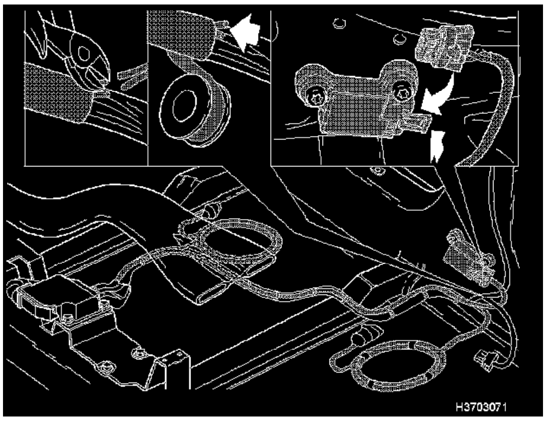
Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Caution!
Ensure that the colored cables are reinstalled in the same positions.



Route the cable harness along the existing cable harness. Secure the cable harness using tape and tie straps as illustrated.

Note!
Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.



Connect the connector to the side impact sensor. Secure unused wiring so that it will not be damaged. Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.

Press the cut-off cables into the casing without damage or sticking other parts. Tape if necessary.

Fold the carpet back into position.

Install the:

- insulation panel at B-post
- B-post panel
- sill trim panels
- seats, see VADIS
- connector to the SRS control module
- rear center console.

Carry out a final check according to method E.

B5: Replacing the cable harness between the Supplemental Restraint System control module (SRS) and the pre-tensioner at the B-post, service cable harness 3 or 4

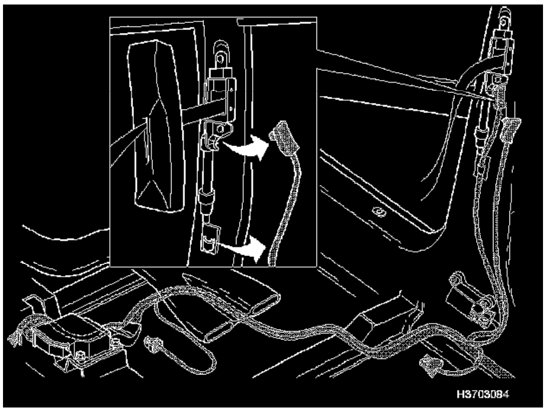
Replacing the cable harness 12

Remove the:

- rear center console
- seat, see VADIS
- front and rear sill trim panels

- lower panel at the B-post
- insulation panel at the B-post.

Fold the carpet out of the way at the rear.

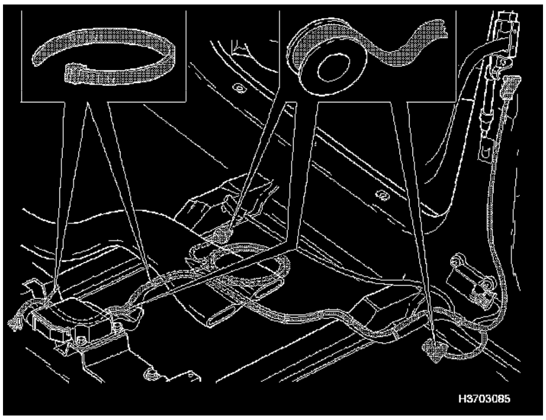


Disconnect the connector from the pre-tensioner Route the new cable harness under the bracket alongside the existing cable harness as illustrated.

Remove both the cables from the control module connector. See method C, step 4 or 5. Note the colors and positions.

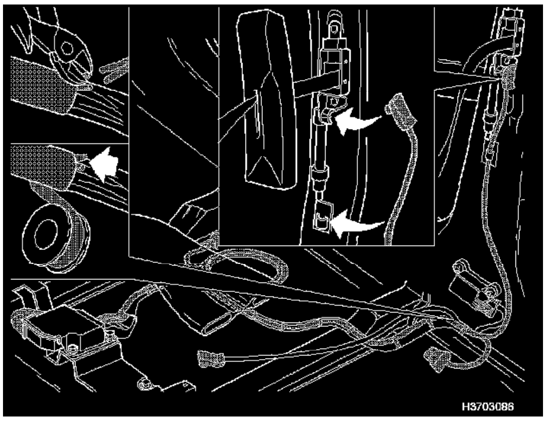
Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Caution!
Ensure that the colored cables are reinstalled in the same positions.



Route the cable harness along the existing cable harness. Secure the cable harness using tape and tie straps as illustrated.

Note!
Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.



Connect the connector to the pre-tensioner. Insert the cable into the cable duct and secure it to the existing cable harness.

Secure unused wiring so that it will not be damaged. Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.

Press the cut-off cables into the casing without damage or sticking other parts. Tape if necessary.

Fold the carpet back into position.

Install the:

- insulation panel at the B-post
- B-post panel
- sill trim panels
- seat, see VADIS
- connector to the SRS control module
- rear center console.

Carry out a final check according to method E.

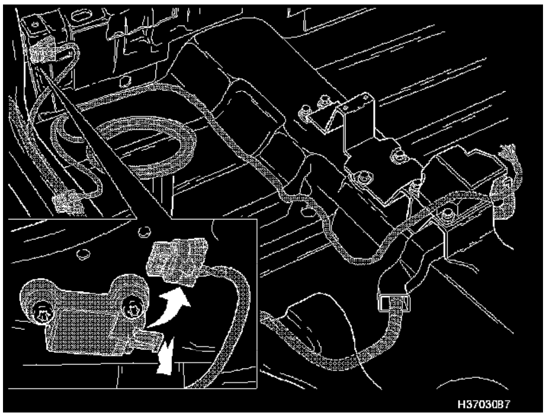
B6: Replacing the cable harness between the Supplemental Restraint System control module (SRS) and the side impact sensor on the C-post, service cable harness 5 or 6

Replacing the cable harness	13

Remove the:

- rear center console
- complete rear seat
- side cushion for the backrest
- rear sill trim panels
- side impact sensor

Disconnect the connector from the side impact sensor.

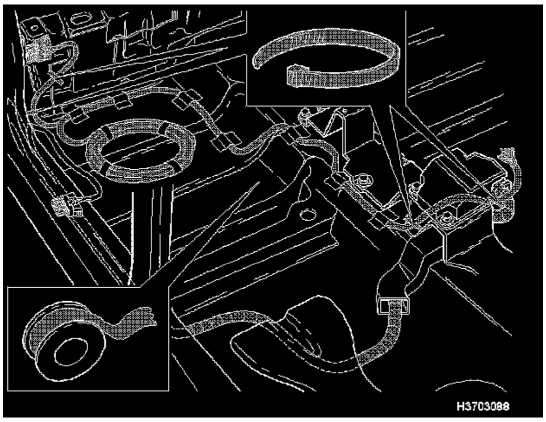


Route the new cable harness under the rear floor carpet, along and under the center console towards the Supplemental Restraint System control module (SRS). Guide the cable harness around the seat fixating bolt as illustrated. Lift up the floor carpet.

Remove both the cables from the control module connector. See method C, step 4 or 5. Note the colors and positions.

Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Caution!
Ensure that the colored cables are reinstalled in the same positions.



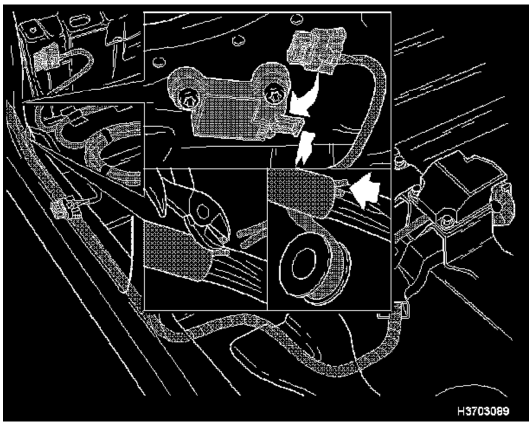
Route the cable harness along the existing cable harness. Secure the cable harness using tape and tie straps as illustrated, deep in the rear corner.

Install the side impact sensor, tighten to 10 Nm.

Note!

Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.

Secure unused wiring so that it will not be damaged. Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.



Press the cut-off cables into the casing without damage or sticking other parts Tape if necessary.

Install the:

- carpet back into position
- rear seat
- side cushion for the backrest
- sill trim panels
- connector to the SRS control module
- center console.

Carry out a final check according to method E.

B7: Replacing the cable harness between the Supplemental Restraint System control module (SRS) and the inflatable curtain, service cable harness 5 or 6 (applies to V40)

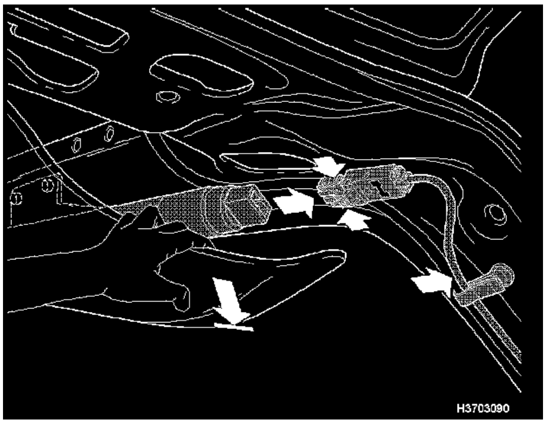
Replacing the cable harness

Remove the:

- rear center console
- complete rear seat
- side cushion for the backrest

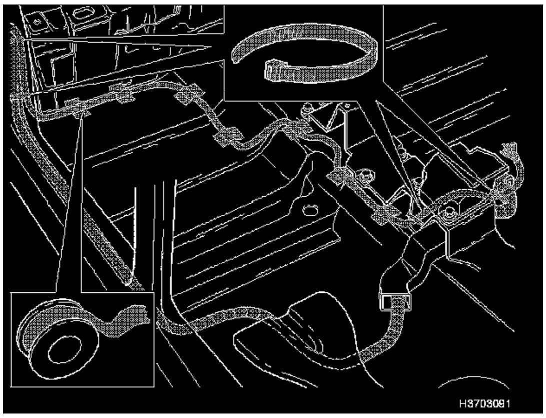
- rear sill trim panels, left and rear
- D-post panel
- panel in the cargo compartment.

Detach the headlining at the rear edge by removing the clips at the side and in the center. See VADIS.



Disconnect the connector from the side impact sensor by pressing in the catches using circlip pliers.

Note!
Do not bend the headlining.



Route the new cable harness under the rear floor carpet, along and under the center console bracket towards the Supplemental Restraint System control module (SRS). Guide the cable harness around the seat fixating bolt as illustrated. Lift up the floor carpet.

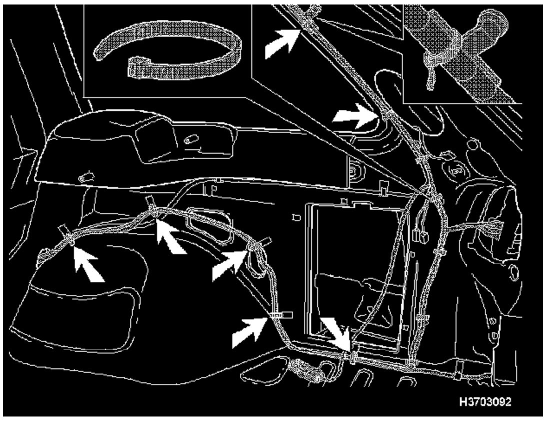
Remove the insulation block in the cargo compartment. Route the cable harness along the existing cable harness towards the inflatable curtain.

Remove both the cables from the control module connector. See method C, step 4 or 5. Note the colors and positions.

Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Caution!
Ensure that the colored cables are reinstalled in the same positions.

Connect the connector to the inflatable curtain.



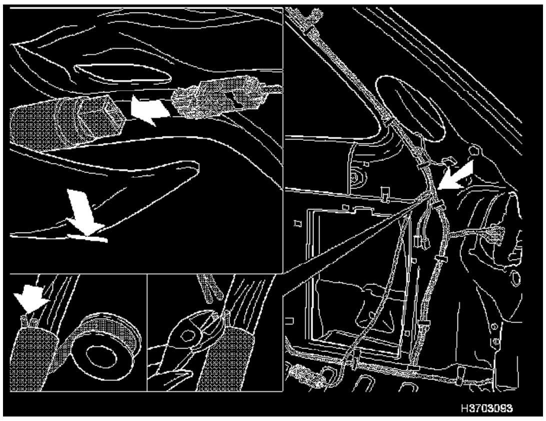
Route the cable harness along the existing cable harness. Secure the cable harness using tape and tie straps as illustrated, deep in the rear corner.

Note!
Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.

Secure unused wiring so that it will not be damaged. Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.

Press the cut-off cables into the casing without damage or sticking other parts. Tape if necessary.

Place the carpet back into position



Install the:

- headlining in position
- insulation block
- panels in the cargo compartment
- panel on the D-post
- rear seat
- side cushion backrest
- sill trim panels
- connector to the SRS control module
- center console.

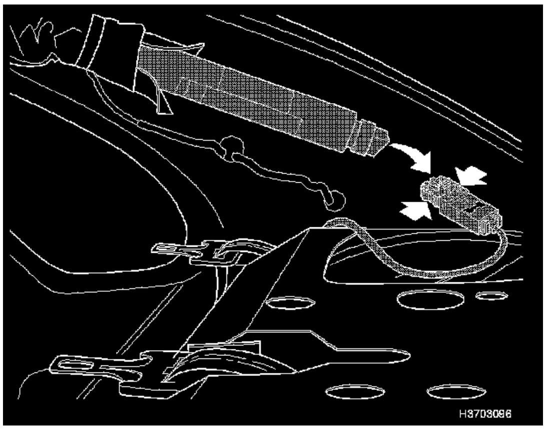
Carry out a final check according to method E.

B8: Replacing the cable harness between the Supplemental Restraint System control module (SRS) and the inflatable curtain, service cable harness 5 or 6 (applies to S40)

Replacing the cable harness

Remove the:

- rear center console
- complete rear seat
- side cushion for the backrest
- rear sill trim panels, left and right
- C-post panel.



Disconnect the control module connector from the inflatable curtain by pressing in the catches using circlip pliers.

Route the new cable harness under the rear floor carpet, along under the center console bracket towards the Supplemental Restraint System control module (SRS). Guide the cable harness around the seat fixating bolt. Lift up the carpet.

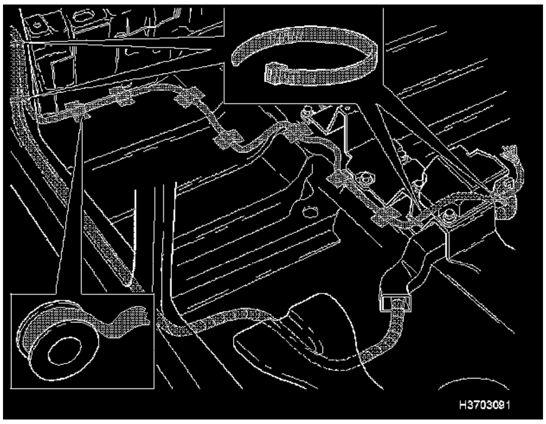
Route the cable harness from the side impact sensor along the aerial cable to the inflatable curtain.

Remove both the cables from the control module connector. See method C, step 4 or 5. Note the colors and positions.

Install the cables from the new cable harness in the control module connector in the same positions from which the old cables were removed. See method C.

Caution!
Ensure that the colored cables are reinstalled in the same positions.

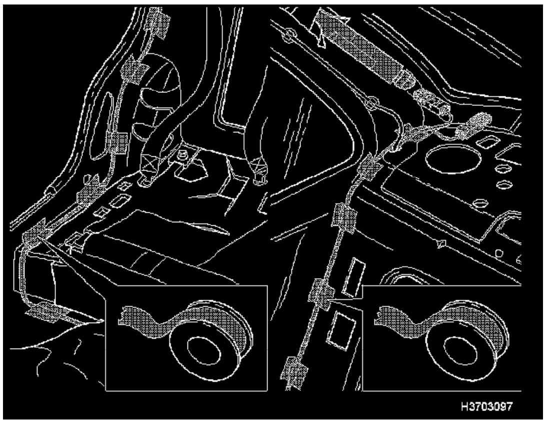
Connect the connector to the inflatable curtain.



Route the cable harness along the existing cable harness. Secure the cable harness using tape and tie straps as illustrated.

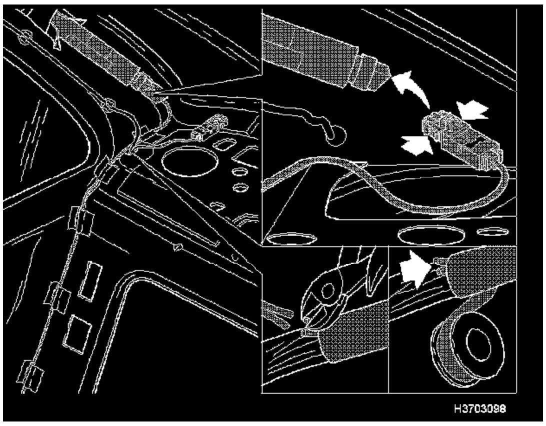
Note!
Ensure that there is no tension at the cables. Ensure that the cables are not trapped or in contact with moving components or sharp objects.

Secure unused wiring so that it will not be damaged. Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.



Press the cut-off cables into the casing without damage or sticking other parts. Tape if necessary.

Place the carpet back into position.



Install the:

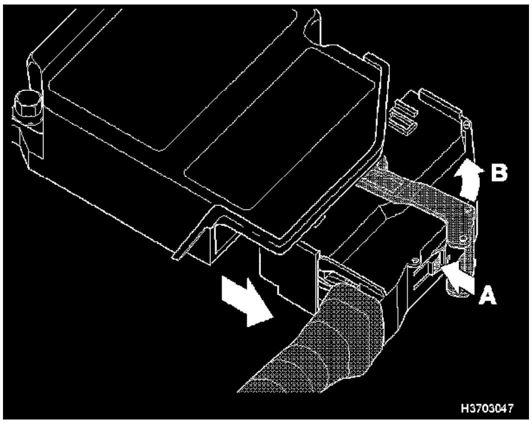
- C-post panel
- rear seat
- connector to the SRS control module
- rear center console
- side cushion for the backrest
- sill trim panels.

Carry out a final check according to method E.

C. Repl. Termin. In the Connector For the (SRS) Control Module

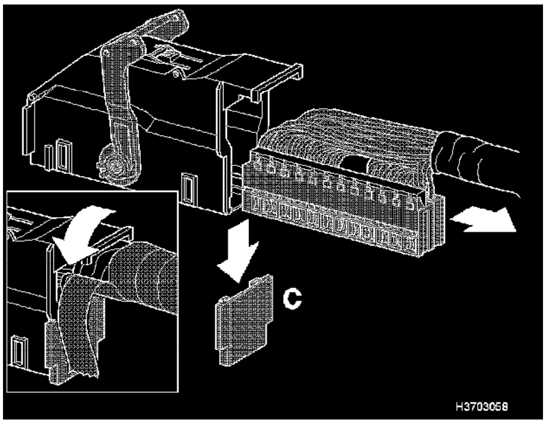
C: Removing and installing the service cable harness from the connector to the supplemental restraint system control module (SRS)

Removing the SRS control module connector



First press in the catch (A). Then fold the lock (B) forward. Remove the connector.

Disassembling the connector 2

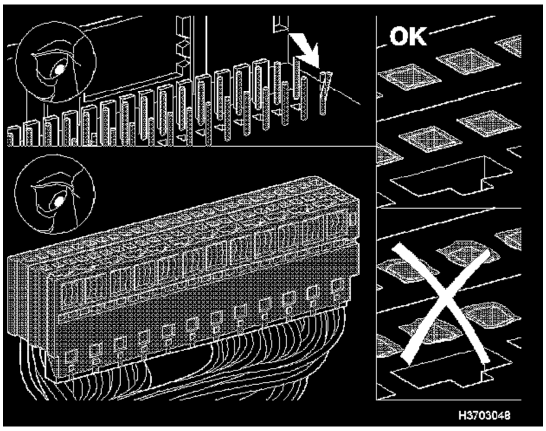


Partially remove the insulation tape from the connector and cable harness.

Slide the locking tab (C) out.

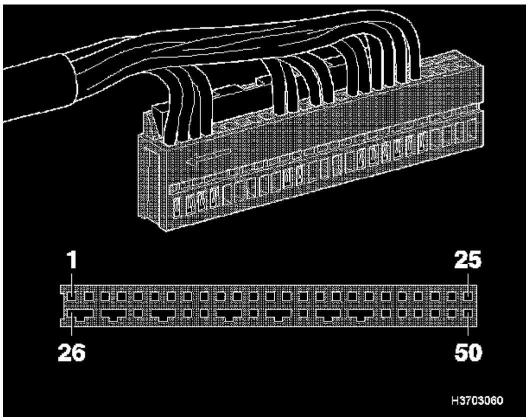
Pull the cable harness and connector out of the housing.

Checking the connectors and terminals 3



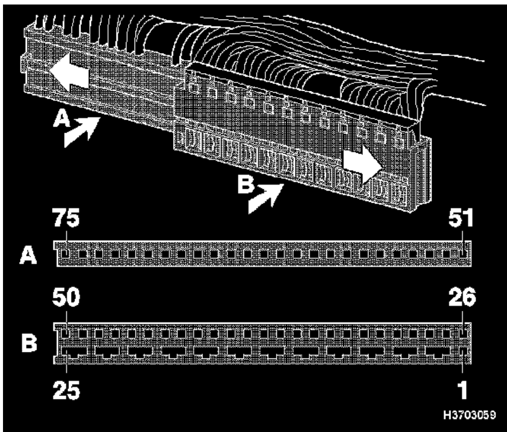
Check whether the openings in the connectors are damaged. The holes must be square. If one or more opening is deformed, the cable terminals must be checked more closely. To remove cable terminals, see method C step 6.

Check if the cable terminals are damaged. Compare all visible cable terminals. If one or more cable terminals look damaged, the entire cable harness must be replaced. See method B and/or D.



Left-hand side			Right-hand side		
No	Color	Application	No	Color	Application
01	BL (blue)	Pre-tensioner	03	OR (orange)	Pre-tensioner
02	P (pink)	Pre-tensioner	04	SB (black)	Pre-tensioner
10	OR (orange)	Driver's airbag	13	GN (green)	Airbag passenger side
11	SB (black)	Driver's airbag	14	W (white)	Passenger airbag
16	BL/P (blue/pink)	SIPS -bag	18	OR/W (orange/white)	SIPS -bag
17	P/W (pink/white)	SIPS -bag	19	BN/SB (brown/black)	SIPS -bag
20	BN (brown)	SIPS -sensor B-post	21	Y/GR (yellow/grey)	SIPS -sensor B-post
45	GR (grey)	SIPS -sensor B-post	46	BN/GR (brown/grey)	SIPS -sensor B-post

Connection overview, affects MY 2000



Left-hand side			Right-hand side		
No	Color	Application	No	Color	Application
27	BL/OR (blue/ orange)	Driver's airbag	31	SB (black)	Pre-tensioner
28	OR/SB (orange/ black)	Driver's airbag	32	OR (orange)	Pre-tensioner
29	BL (blue)	Pre-tensioner	33	GN (green)	Passenger airbag
30	P (pink)	Pre-tensioner	34	W (white)	Passenger airbag
37	BL/P (blue/ pink)	SIPS -bag	35	BN/SB (brown/ black)	SIPS -bag
38	P/W (pink/ white)	SIPS -bag	36	OR/W (orange/ white)	SIPS -bag
43	GN/OR (green/ orange)	Driver's airbag	47	BL/W (blue/ white)	IC
44	Y/W (yellow/ white)	Driver's airbag	48	BL/R (blue/ red)	IC
45	BL (blue)	IC	49	VO (violet)	Passenger airbag
46	BN (brown)	IC	50	VO/W (violet/ white)	Passenger airbag
57	Y/BN (yellow/ brown)	SIPS -sensor B-post	59	BN/GR (brown/ grey)	SIPS -sensor B-post
58	GR (grey)	SIPS -sensor B-post	60	Y/GR (yellow/ grey)	SIPS -sensor B-post
61	R/W (red/ white)	SIPS -sensor C-post	66	GN/BN (green/ brown)	SIPS -sensor C-post
62	GN/SB (green/ black)	SIPS -sensor C-post	72	R (red)	SIPS -sensor C-post

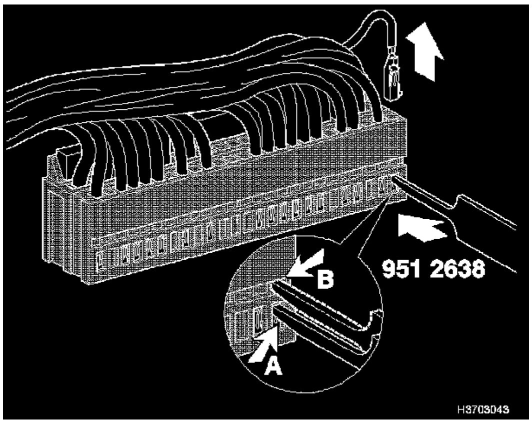
Connection overview, affects MY 2001- 5

Removing the cable terminals from the connectors 6

Note!

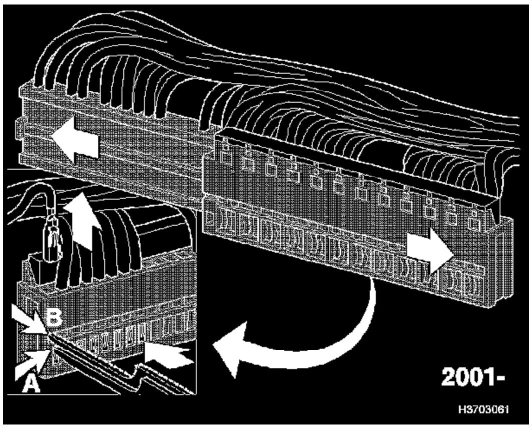
To avoid mixing up the cables, remove one cable at a time.

Note the position and color of the cable terminals for the connections being replaced.



Use terminal removal tool 951 2638 to extract the cable terminals.

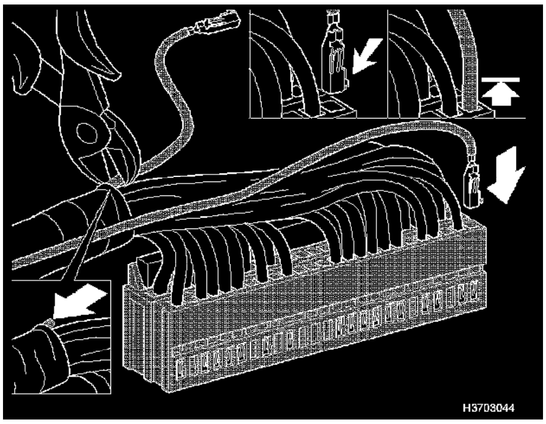
Narrow connector: Remove the cable terminal by first pressing in the lock (A) and then pulling the cable slightly. Then press in the lock (B) and pull out the cable.



Wide connector (2001-): Disassemble the connector by sliding the halves apart. This is necessary to be able to remove the cable terminals.

Installing new cable terminals in the connectors 7

Use the cables in the service cable harness which are the same color as the cables being replaced. Position the cable terminals in the connector in the same terminals that they were in prior to removal.



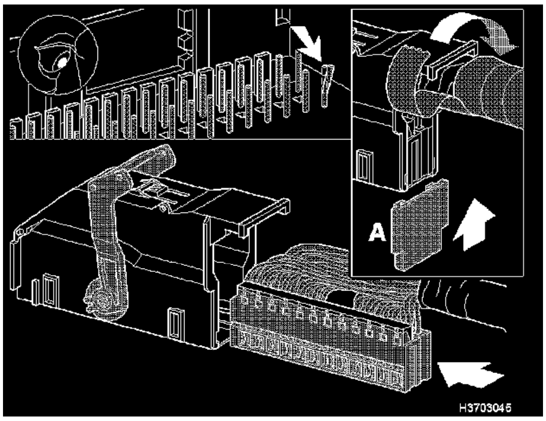
Place the terminal in the right position in the housing, see illustration.

Check that the cable terminals are secure by pulling the cable gently.

Slide the connectors together, (applies to MY 2001-). Pull the old cables as far out from the cable harness casing as possible. Cut off the cables as close to the casing as possible.

Press the cables into the casing without damage or sticking other parts.

Assembling the connector 8



Check that the terminal pins on the supplemental restraint system control module (SRS) are undamaged. These must not be damaged or bent.

Slide the connector into the housing. Slide the locking tab (A) into place.

Replace the insulation and add extra tape to secure the cable harness to the housing.

Caution!
Do not connect the connector to the SRS control module.

D. Repairing SRS Wiring

General 1

Note!
If physical damage is discovered in the wiring for the driver and/or passenger airbag circuits, the complete wiring harness (from the SRS Unit to the airbag) containing the damage must be replaced.

Except for the driver and passenger airbag wiring, it is possible to replace only the damaged portion of the cable instead of installing the entire service cable harness for Supplemental Restraint System (SRS) wiring or to the connector for one of the SRS components and the SRS control module.

Caution!
If a connection to an air-bag or pretensioner is repaired, the air-bag has to be disconnected before starting the wire repair

Note!
The damaged part must always be replaced including the nearest connector. Do not repair between the connections.

Joining cables using splicing sleeve 2

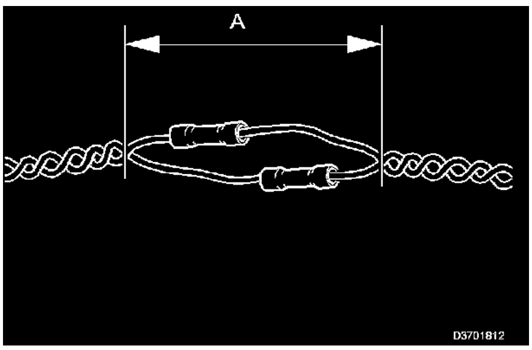
Cut off the damaged section of the SRS cable.

Note!
There should never be two splicing sleeves on the same wire.

Use a new pair of service cables that have the same colors as the cables that were removed.

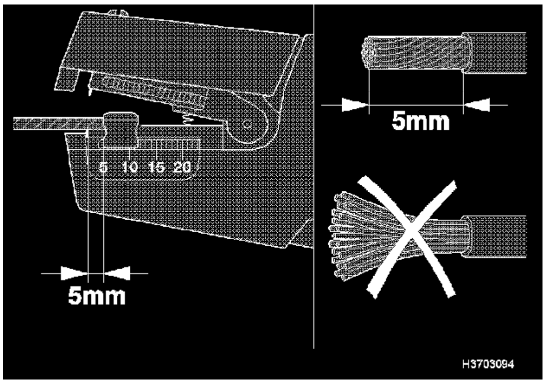
Cut off the same amount from the service cable harness and connect it as described below.

The splicing sleeves must always be positioned so that they are offset in relation to each other.



Note!
A maximum of 100 mm (A) of the cable can be untwisted at the joint.

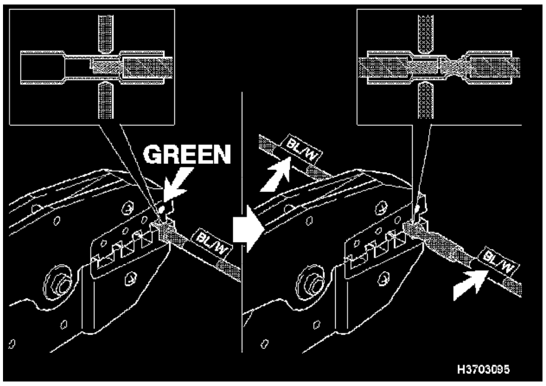
Stripping the cables 3



Remove approximately 5 mm of insulation from the ends of the cable. Use cable stripping tool 951 2620. Twist the ends of the cables.

Crimping the splicing sleeve 4

Caution!
Join the cables with matching colors in the splicing sleeve.

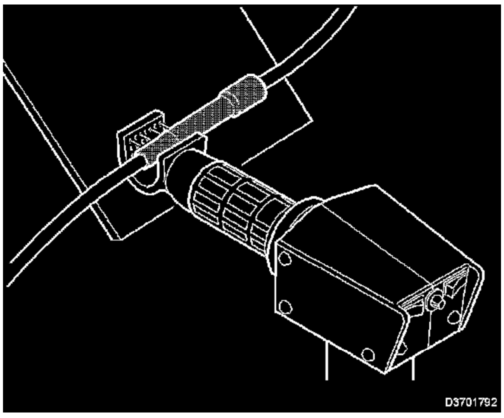


Position splicing sleeve P/N 951 2783 in crimping tool 951 2785 in the green opening. Press the splicing sleeve together with the cables inserted.

Pull the cables to ensure that none are loose.

Shrinking the splice sleeve 5

Use hot air gun 9512850 and nozzle 9512779. Set the hot air gun to flow 2 and set the temperature between 2 and 3 (69 ° C).



Be sure to protect the surrounding components from heat. Position the splice sleeve in nozzle 9512779 and heat the joint so that the adhesive melts and begins to emerge from each end.

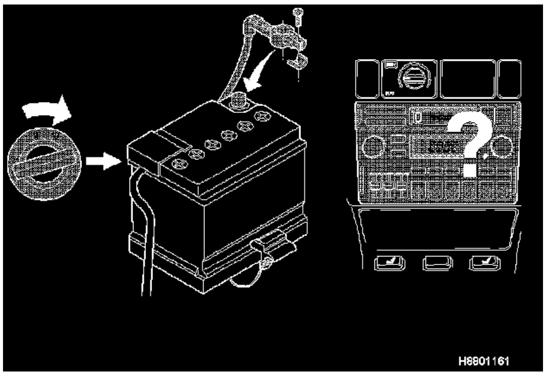
E. Final Check

E. Final Check

Checking function 1

Switch on the ignition.

Caution!
Ensure that nobody is in the car when the battery is connected.



Connect the battery negative lead.

Wait at least 10 seconds.

Enter the anti-theft radio code.

Set the clock.

Reading and erasing diagnostic trouble codes (DTCs) 2

Read out and erase any diagnostic trouble codes (DTCs). Switch of the ignition.

Turn the ignition to position II and check that the SRS control lamps goes out after a few seconds.

Technical Service Bulletin # **2230052** Date: **001101**

Fuel System - Quick Release Connector

850, S70/V70/C70, S90/V90, S40/V40, S60, S80
1993-

Section
2

Group
23

No.
0052

Year
00

Month
11

Reference:
This Service Bulletin replaces the previous Service Bulletin 230052 from October 2000, which should be discarded.

Connecting the Quick release connector, updated method

Background
This Service Bulletin describes an updated method for connecting the quick-release connectors in the fuel injection system.

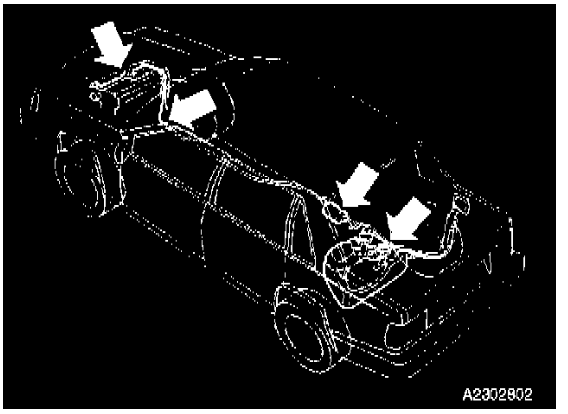
Description	Part No.
Lubricant	1161580

Material

Connecting the quick-release connector, updated method

1

Quick-release connector, fuel system



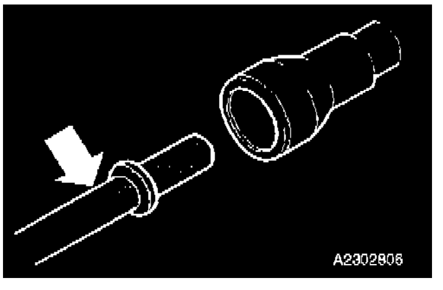
There are a number of quick-release connectors on the fuel injection system the fuel tank, the fuel filter and the intake manifold. In addition, a quick-release connector can be found on certain cars at the rear edge of the sub-frame.

These quick-release connectors are of differing designs and are taken apart in different ways. For certain quick-release connectors special tools are required.

All quick-release connectors have O-rings as seals

2

Lubricating when connecting quick-release connectors



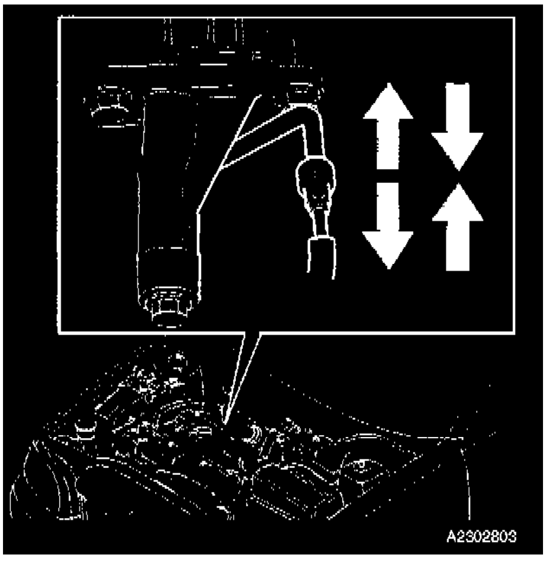
The quick-release connectors in the marked area (arrow in the illustration) on the fuel line must be lubricated using lubricant p/n 1161580 before connection.

Note!

Engine oil (mineral oil) may also be used. Do not use synthetic engine oil.

3

Checking that connection is secure



Check that the quick-release connector has locked. Try pulling the connector apart by hand firmly using approximately 10-20 lb of force.

Ensure that there is some ploy in the connector. Press the connector together and pull the connector apart.

The illustration displays an example of the connection.

Technical Service Bulletin # **TNN60-07** Date: **030829**

Steering/Suspension - Vehicle Pulls Left or Right

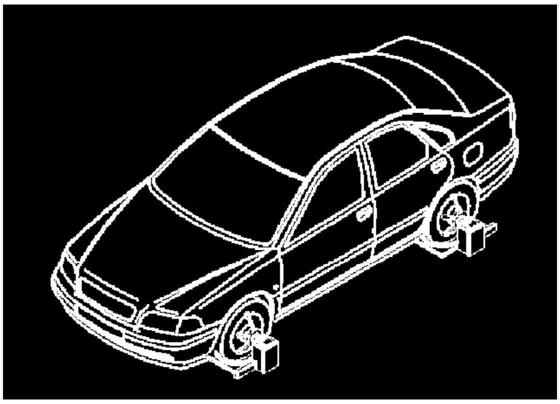
NO: 60-07
DATE: 8-29-2003
MODEL: S40 V40
M. YEAR: 2000, 2001, 2002, 2003, 2004
CHASSIS: 415000-
SUBJECT: Front End Pulls Left or Right (Camber Adjustment)
REFERENCE: VADIS

DESCRIPTION:
If a front-end pull exists it is now possible to adjust the front camber using camber kit PN 30630515.

SERVICE:
Follow the procedure listed below only after all of the normal fault tracing has been completed.

Installing adjustable camber bolts to restrict pulling to the left or right.

General 1.



First - check the following steps before installing the adjustable camber bolts.

1) Road test the car to verity the complaint.

2) Check the air pressures in all the tires.

3) The tires should all be in good condition with even wear patterns.

4) Check front and rear suspension for wear.

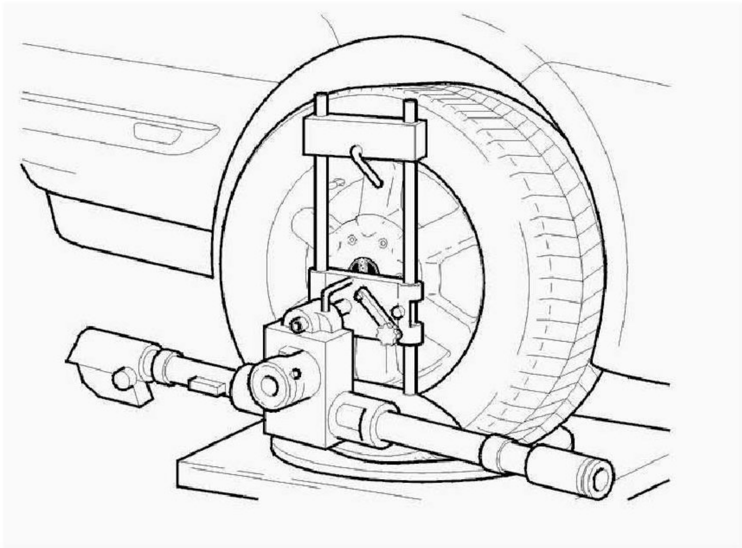
5) Pulling problems can also be caused by the power steering or brakes.

6) Check the four-wheel alignment always start at the rear (see wheel alignment specifications).

Install the adjustable camber kit only after the steps listed above have been ruled out as a fault.

Use adjustable camber bolts service kit
P/N 30630515

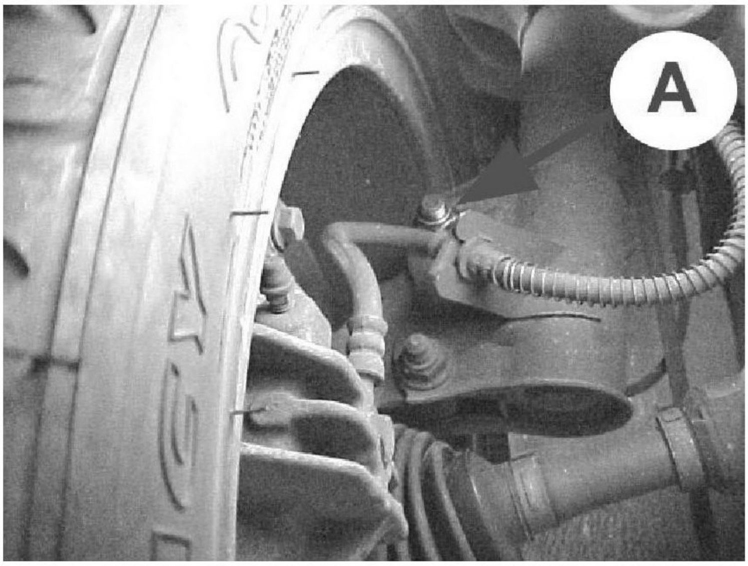
Car pulls to one side during driving. 2.



- Install and calibrate the alignment equipment according to the user manual.

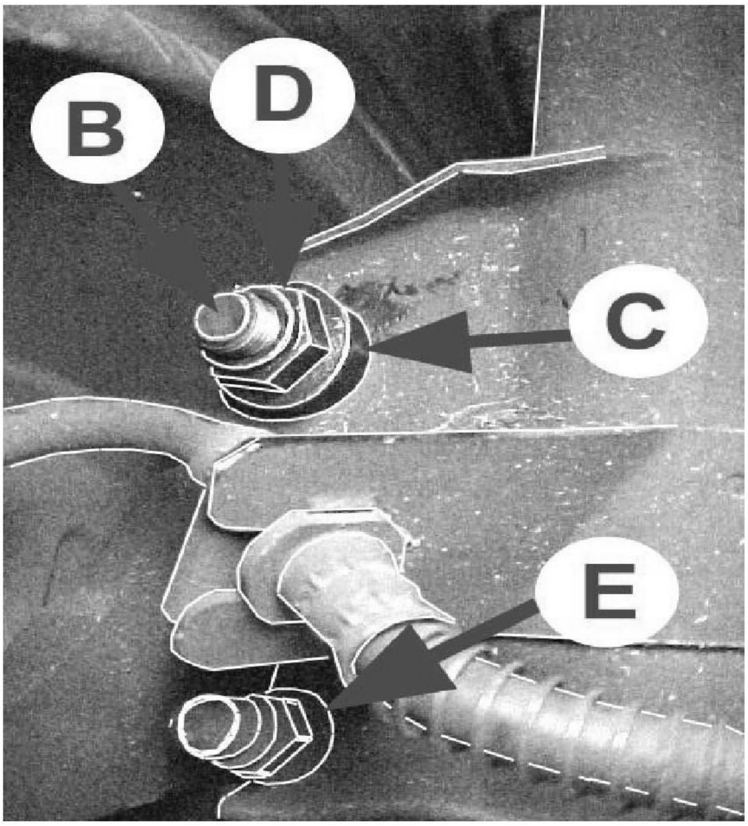
Note! Always use four wheel alignment equipment.

- Raise the car.



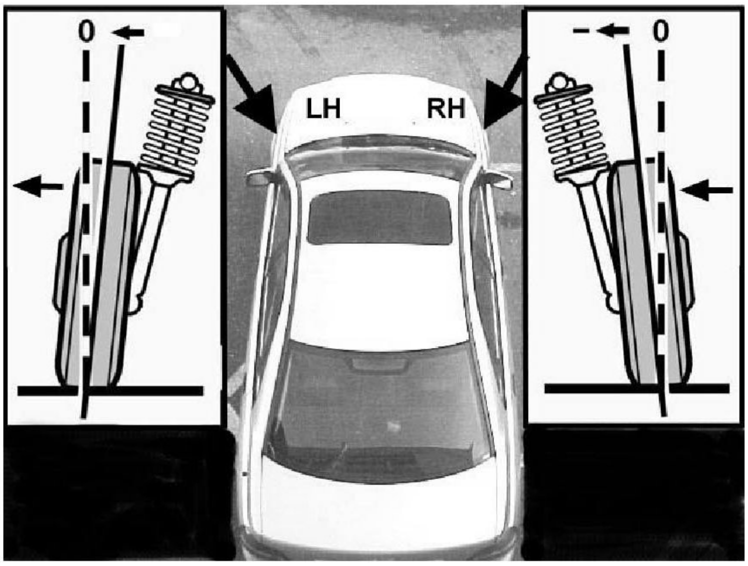
Preparations.

- Remove the upper shock bolt (A) from both sides.



Installing the adjustable camber bolts on both sides.

- Install the bolt (B) from the service kit (the direction of the thread pointing forward in the car) on both sides.
- Install spacer 8-mm (C) and new flange lock nut (D) on both sides. Hand-tighten connection.
- Loosen the lower bolt connection (E) from the left and right front shock absorbers.
- If the car pulls to the RIGHT during driving see step 3.
- If the car pulls to the LEFT during driving



Car pulls to the right during driving. 3.

RH (right hand side) camber adjustment.

- Before tightening the shock absorber connections on the RH side PUSH the upper side of the wheel to the inside so that the camber value is maximum negative see camber specification below.

Torque the shock bolts to 67 ft lbs. (90 Nm).

Model year	Max negative Camber Degrees
2000	(-1º)
2001-	(-0.66º)

RH side values maximum permitted negative camber.

LH (left hand side) camber adjustment.

- Before tightening the shock absorber connection on the LH side PULL the upper side of the wheel to the outside so that the camber value is (0.66°) more positive than the RH side.

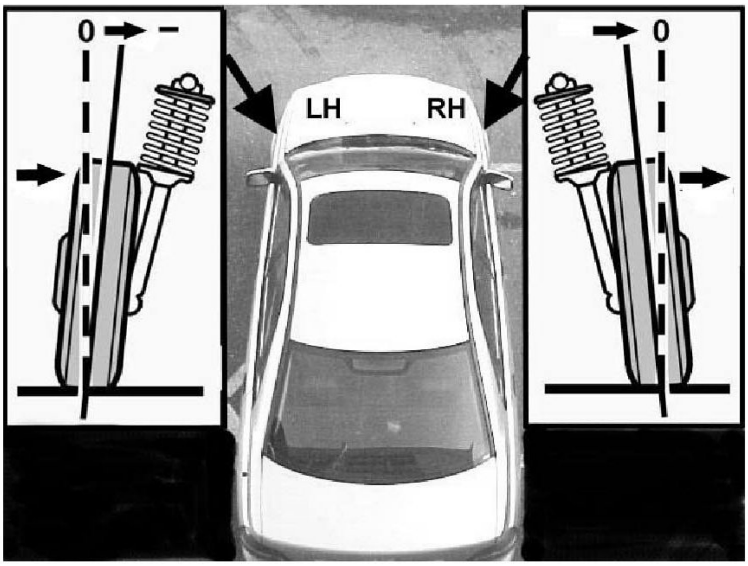
Torque the shock bolts to 67 ft lbs. (90 Nm).

Model year	Camber value Degrees
2000	(-0.34º)
2001-	(0º)

LH side values maximum permitted negative camber.

Road test the car and check the driving properties.

- If the car pulls to the left during driving lower the permitted camber value on the LH side.



Car pulls to the left during driving. 4.

LH (left hand side) camber adjustment.

- Before tightening the shock absorber connections on the LH side PUSH the upper side of the wheel to the inside so that the camber value is maximum negative see camber specification below.

Torque the shock bolts to 67 ft lbs. (90 Nm).

Model year	Max negative Camber Degrees
2000	(-1°)
2001-	(-0.66°)

LH side values maximum permitted negative camber.

RH (right hand side) camber adjustment.

- Before tightening the shock absorber connection on the RH side PULL the upper side of the wheel to the outside so that the camber value is (0.660) more positive than the LH side.

Torque the shock bolts to 67 ft. lbs. (90 Nm).

Model year	Camber value Degrees
2000	(-0.34°)
2001-	(0°)

RH side values maximum permitted negative camber.

Road test the car and check the driving properties.

- If the car pulls to the right during driving lower the permitted camber value on the RH side.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
60110-2	Wheel alignment 4 wheels check	1.1 hr
60133-2	Camber angle front 1 side adjust	0.3 hr

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

Warranty Claim Information Technical Service Bulletin # **881A** Date: **000701**

Seat Belt - Extensions

GROUP:
88

NO:
1A

ISSUING DEPARTMENT:
Parts Support

CAR MARKET:
U.S. and Canada

DATE:
July 2000

TITLE:
SEAT BELT EXTENDER

200, 700/900, 850, S/V/C70, S/V90, S80, S/V40

REFERENCE BULLETINS:

Supersedes: SMB 88-1A, Jan. 2000

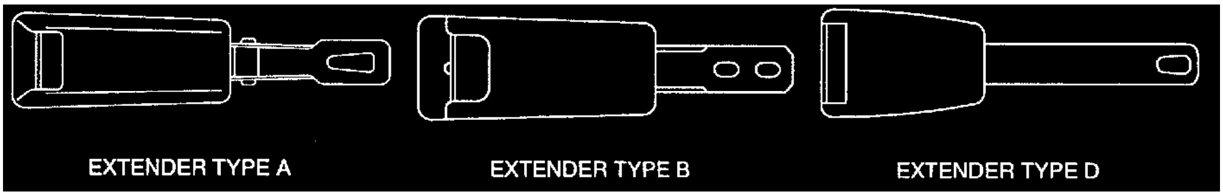
A front seat belt extender is available for owners who require one.

Seat Belt Extender forms must be faxed to Parts Support. In the U.S., fax to (201) 784-4551. In Canada, fax to (416) 493-8754. The original signed order form should be kept in the retailer's file.

WARNING:
Seat belt extenders MUST NOT BE USED FOR THE REAR SEATS.

NOTE:
This is not a comfort item. It is intended only for persons who are physically unable to use the standard seat belt assembly. The extender is strictly for use by these persons only, and can be ordered only by using the special ordering form attached.

Before ordering, please be certain that all seat adjustment possibilities have been considered. Also check for proper operation of the retractor and latch before and after installing the extender.



Three seat belt and extender combinations are available.

APPLICATION:

Seatbelt	L/H	3513285	R/H	3513286
Catch	L/H	1370057	R/H	1370060

240
From 1975 MY to 1987 MY (244 chassis No. ->257599, chassis No. ->750769), use Extender Type A. **NOTICE**: Seatbelt and catch must be changed to:

240
From MY 1987 and up (244 chassis No.257600->, 245 chassis No. 750770->), use Extender Type A.

740/760
From 1983 MY to 1990 MY, (744 chassis No.-> 396999, 745 chassis No.-> 242699, 764 chassis No.->76899 and 765 chassis No.-> 31199) use Extender Type A or B. (see part number below).

NOTE:
If the car has a single-retractor belt, a dual-retractor seat belt system must be installed according to instructions found on page 338 of Service Manual TP 31127/1; Body, Interior, Climate.

From 1990 MY (744, Chassis No.397000->, 745 Chassis No.242700->, 764 Chassis No. 76900->, 765 Chassis No. 31200->)and up, use Type D.

780
From 1987 MY, up to and including part of 1990 MY (780 Chassis No.-> 9964), use Extender Type A.

From part of 1990 MY (780 Chassis No.9965->) and up, use Extender Type D.

900
From 1991 and up, use Extender Type D.

850
From 1993 and up, use Extender Type D.

Note: For MY93 850 cars with Chassis Nos. below 44448, where an extender is needed, belt catches must be changed. Pivot type catch P/N 9136184 (driver's side) and P/N 9136185 (passenger's side) must always be used in combination with the extender. New catches will be provided with the extender if the Chassis No. is below 44448.

S/V40, S/V/C70, S/V90, S80
From 1998 and up, use Extender Type D.

MODEL		P/N		P/N
240	L/H	3513285	R/H	3513286
740/760	L/H	1349971	R/H	1349972
740/760	L/H	1373246	R/H	1373247
740/760	L/H	3548890	R/H	3548891
780	L/H	1396072	R/H	1396073

Extender Type A can be used in conjunction with the seat belts shown.

MODEL		P/N		P/N
740/760	L/H	1370146	R/H	1370147

Extender Type B can be used in conjunction with the belts shown.

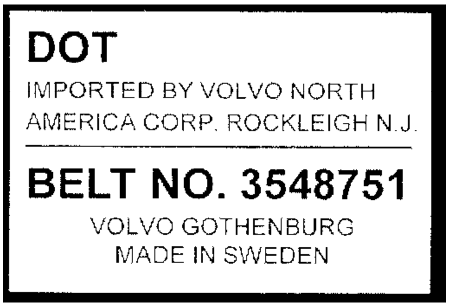
MODEL		P/N		P/N
740/760900	L/H	3525479	R/H	3525480
780	L/H	1374913*	R/H	1374914*
780	L/H	3406310	R/H	3406311
740/900	L/H	3548750	R/H	3548751
850	L/H	6818114**	R/H	6818115***

* Only production P/N
** Belt catch P/N 9136184 must be used with extender
*** Belt catch P/N 9136185 must be used with extender

Extender Type D can be used in conjunction with the seat belts shown.

Extender Type D can also be used in conjunction with all front seat belts in the following models: S/V/C7O, S80, S/V90

Seat Belt P/N Labeling:



Part numbers of seat belts are on labels sewn onto the belt webbing (see illustration). At the time of installation, the retailer is responsible for testing the extender in the customer's vehicle to be sure that the correct extender/seat belt combination is used.

ORDERING PROCEDURES:

1. The retailer should complete the attached order form and secure the customer's signature, then FAX the form to Parts Support. Hand or mail a photocopy of the completed form to the customer. You must retain the original form for the retailer file for legal purposes.

   Note:
   No extenders will be shipped without a completed order form, properly signed by the customer.

2. Parts Support will enter the order, which will then be sent to the retailer on a "drop ship" basis from the distribution center.

VOLVO

SEAT BELT EXTENDER

ORDER FORM

Separate order form required for each extender ordered!

Vehicle Information:

Model: ___________ Year: ___________

VIN: ____

Extender Type: **A** **B** **D** (circle one)

By signing below, I agree that I have read, understand, and agree to abide by the warnings and Rules for Use of a Volvo Front Seat Belt Extender printed on the back of this order form or on a separate piece of paper:

Customer Name: ____
(print full name)

Customer Signature: ____

Customer Address: ____

Retailer Name: ________________________________ Retailer Code: __________

Retailer Address: ____

Retailer Fax No.: ____

Retailer Signature: ____

Printed Name and Title: ____

FAX TO

(U.S.)
Attn: Parts Support
Volvo Cars of North America, Inc.
Rockleigh, NJ 07647
(201) 784-4551

(Canada)
Retailer Support
Volvo Cars of Canada, Ltd.
Willowdale, Ontario M2H 2N7
(416) 493-8754

SEAT BELT EXTENDER ORDER FORM

SEAT BELT EXTENDER SAFETY WARNINGS

NOTICE!

The Volvo front seat belt extender is intended for use only by persons who are physically unable to use the standard seat belt assembly. Even when the seat belt extender is properly installed and in use, the vehicle's safety restraint system may provide the user with less protection than when the standard seat belt assembly alone is used.

RULES FOR USE OF A VOLVO FRONT SEAT BELT EXTENDER

The Volvo front seat belt extender must be used only as described below:

^ The seat belt extender may be used only for the vehicle and seat for which the extender was purchased.

The extender is not designed to work in any other make or model of vehicle or with any other seat.

^ The seat belt extender may be used only by the intended user. Use by other persons may result in decreased protection to them in the event of a collision.

^ The seat belt extender must not be used for rear seats. Extenders are not designed to work with rear seats or seat belts.

^ When the extender is installed, the intended user seated in that position must buckle his or her seat belt, whether required by local law or not.

^ When not in use by the intended user, the seat belt extender must be removed from the seat belt buckle.

SEAT BELTS, SEAT BELT EXTENDERS, AND THE VOLVO SUPPLEMENTAL SAFETY RESTRAINT SYSTEM

From model year 1998 and up, the Volvo Supplemental Safety Restraint System (SRS) uses a two-threshold airbag deployment system that relies upon information provided by sensors linked to the front seat belt buckles. These sensors tell the SRS whether or not the seat belt is buckled. In a frontal collision, the airbag of an unbuckled seat position may deploy even if the airbag of a buckled seat position does not.

If either a seat belt or seat belt extender tab is inserted into the the seat belt buckle, the SRS will believe that a seat belt is in proper use. Therefore, in a frontal collision, if the extender is installed and the seat belt is not properly used, the affected airbag may not deploy or may not deploy with appropriate force!

VOLVO STRONGLY URGES YOU AND ALL ADULT OCCUPANTS OF YOUR CAR TO PROPERLY WEAR SEAT BELTS AND TO ENSURE THAT CHILDREN ARE PROPERLY RESTRAINED IN THE REAR SEAT.

Technical Service Bulletin # **TNN88-41** Date: **060712**

Air Bag System - System Life Expectancy

No: 88-41

DATE: 7-12-2006

MODEL:
All Models with Supplemental Restraint System (SRS)

MODEL YEAR:
All Model Years with Supplemental Restraint System (SRS)

SUBJECT:
Extended Supplemental Restraint System (SRS) Lifetime

REFERENCE: SMB 88-0017

DESCRIPTION:

BACKGROUND:

Based on testing and experience since the 1980's, Volvo has extended the lifetime of the Supplemental Restraint System (SRS) components to be the same as the lifetime of the car.

This lifetime extension supersedes all previous publications concerning Supplemental Restraint System (SRS) component lifetime. Periodic inspections and servicing of the Supplemental Restraint System (SRS) components, based solely on the age of the vehicle, are no longer required.

The lifetime extension applies to all pyrotechnic components in vehicles equipped with Supplemental Restraint System (SRS):

^ Driver airbag module

^ Passenger airbag module

^ Seat belts with pyrotechnic seat belt pretensioners

^ SIPS (Side Impact Protection System) airbag module

^ IC (Inflatable Curtain) airbag module

^ Adaptive Steering Column (ASC)

^ Adaptive Load Limiter (ADLL)

Note:
Equipment is different for different car models.

SERVICE:

Note!
If the vehicle has been involved in a collision, regardless of crash severity, or if the SRS warning lamp is lit, immediately contact an authorized Volvo dealer for further action and inspection.

TEMPORARY SOLUTION:

For customers who want to make an appointment for an inspection, explain the situation using this Tech Net Note.

For customers who still want to have an inspection, carry out the inspection and remove the SRS Airbag Service Decal from the vehicle according to the SRS Airbag Service Decal Removal Instruction below. Explain that no further inspection is necessary.

In case replacement of components is required, remove the SRS Airbag Service Decal from the vehicle according to the SRS Airbag Service Decal Removal Instruction below and explain that no further inspection is necessary after the replacement.

FINAL SOLUTION:

VIDA will be updated with information about the service life of pyrotechnic components on a running basis. All vehicles equipped with Supplemental Restraint System (SRS) are affected.

Path for general information in VIDA:

Information / Repair / General information / 8 Body and interior / 88 Interior equipment / General / Service life pyrotechnic components

VIDA will be updated regarding Supplemental Restraint System (SRS) components in the service programs on a running basis. All vehicles equipped with Supplemental Restraint System (SRS) are affected.

Path for service and maintenance in VIDA:

Information / Repair / 1 Service programs / 17 Standard parts, service and maintenance material / Service and maintenance / Maintenance service / Service program A + B

VIDA will be updated regarding repair methods from MY 2007 onward.

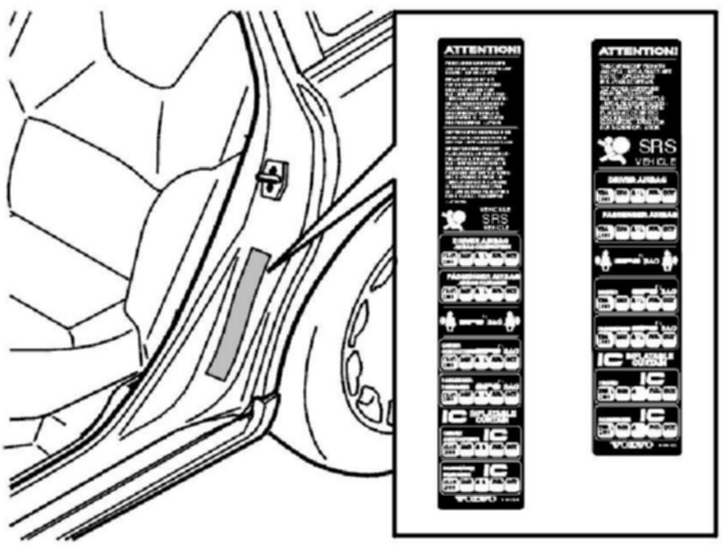
Path for repair methods in VIDA:

Information / Repair / Removal, replacement and installation / 8 Body and interior / 88 Interior equipment / Seat belts and other retention systems

Note!
From MY 2007, the SRS Airbag Service Decal on the B or C pillar will no longer be fitted at Volvo (concerns all models/variants).

SRS Airbag Service Decal Removal Instruction

General



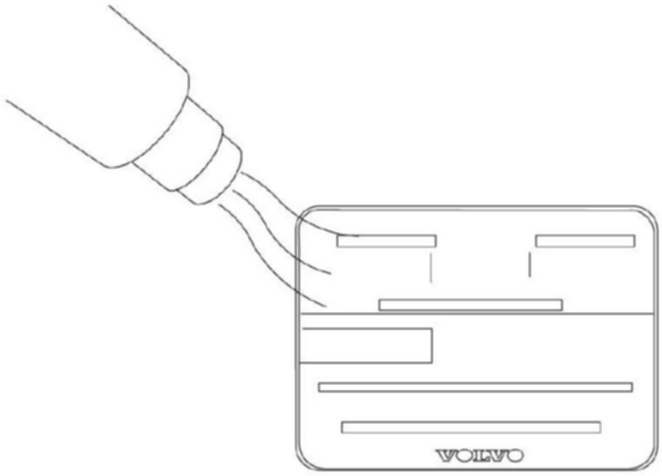
M8802638

Note!
Since the illustrations are used for different model years and/or model variants, there may be certain deviations. However, the essential

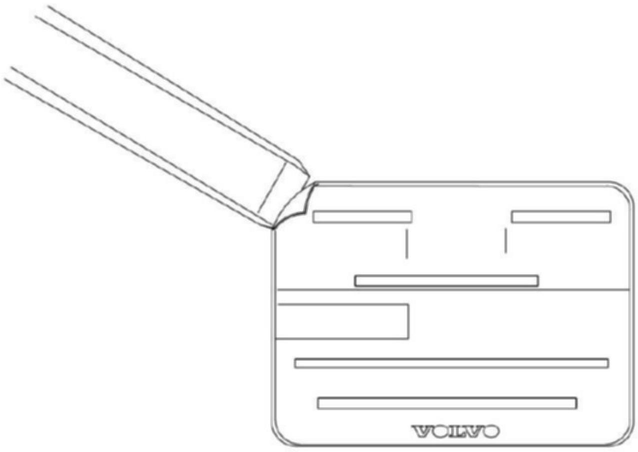
information in the illustrations is always correct.

The SRS Airbag Service Decal is found on either the B or the C pillar, depending on model/variant.

Removal

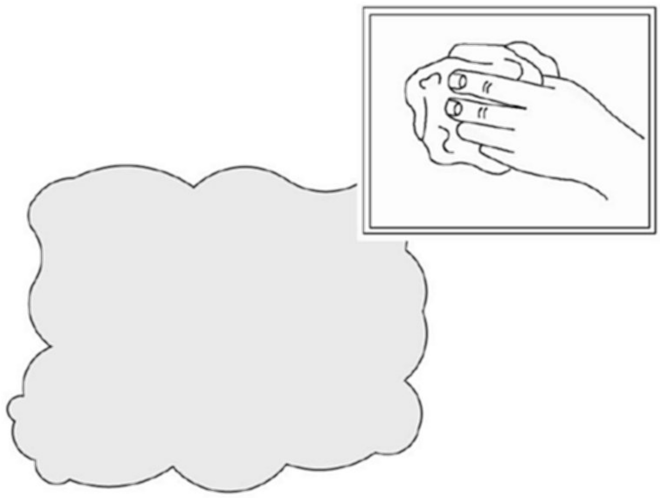


Warm the SRS Airbag Service Decal carefully using a hot air gun.



Scrape up a corner using a plastic scraper and pull off the SRS Airbag Service Decal.

Cleaning



Clean the area using a mixture of 50% isopropanol and 50% water.

Technical Service Bulletin # **TNN20-04** Date: **070122**

Engine Controls - Engine Management Software Usage

2000 Volvo S40 L4-1.9L Turbo VIN 25 B4204T2

NO: 20-04
DATE: 1-22-2007
MODEL: C70, V70, S70, S60, S80, XC90, XC70, S40 (All new), V50, C30.
M. YEAR: 1999-
SUBJECT: Engine Management Software Usage
REFERENCE: VIDA

This TNN supersedes the previous TNN 20-04 dated 9-22-2003, please update your files

Description

In 2003 VADIS migrated from the PIE1 software ordering system to the PIE 2 software ordering system. Subsequently VIDA has replaced VADIS as the workshop diagnostic tool and information center, and has continued to use the PIE 2 software ordering system.

Service information that pre dated the migration to PIE 2 (e.g. TNN's, Service Bulletins), still refer to software ordering in the PIE 1 environment using software part numbers and Function ID's (FID). Where older service information indicates that a software upgrade should be performed for an engine management control unit (e.g. ECM, ETM), the PIE 2 software product number for that nodes software upgrade should be ordered. PIE 1 part numbers and function ID's will not be recognized by VIDA.

One software product number will be used for each control unit across all variants in a product platform. E.g. ECM upgrade for S60, S80, XC70 2001-, V70 2001- all share the same SW product number, 30677021, as they are all on the P2 platform.

Software product numbers for engine management upgrades:

C70	ECM	30677000	1999-2004
C70	ETM	30677001	1999-2002
X70	ECM	30677005	
X70	ETM	30677007	
P1	ECM	30668282	
P2	ECM	30677021	
P2	ETM	30677023	1999-2001/2
P3	ECM	30785201	

An ECM/ETM upgrade is not an incremental upgrade to part of the control modules software, or to only parts of the control module memory, but a complete replacement of the control modules operating software. A confirmed download of an upgrade assures that all of the latest software for the specified control module has been delivered to the vehicle.

If a customer's vehicle required more than one service specifying an upgrade to the ECM or any other control module in the vehicle, the software download of an upgrade would only need to be done once, as an upgrade contains ALL changes or enhancements that were in prior software versions.

A "Reload" software product should only be used when installing a brand new control module in a vehicle, and at the direction of the Volvo Technical Hotline, or a Volvo Field Technical Specialist.

Technical Service Bulletin # **TNN39-58** Date: **070214**

DVD Player - Won't Accept/Eject DVD's/Inoperable

NO: 39-58

DATE: 02-14-2007

MODEL: All with Factory Equipped RSE (Rear Seat Entertainment Systems)

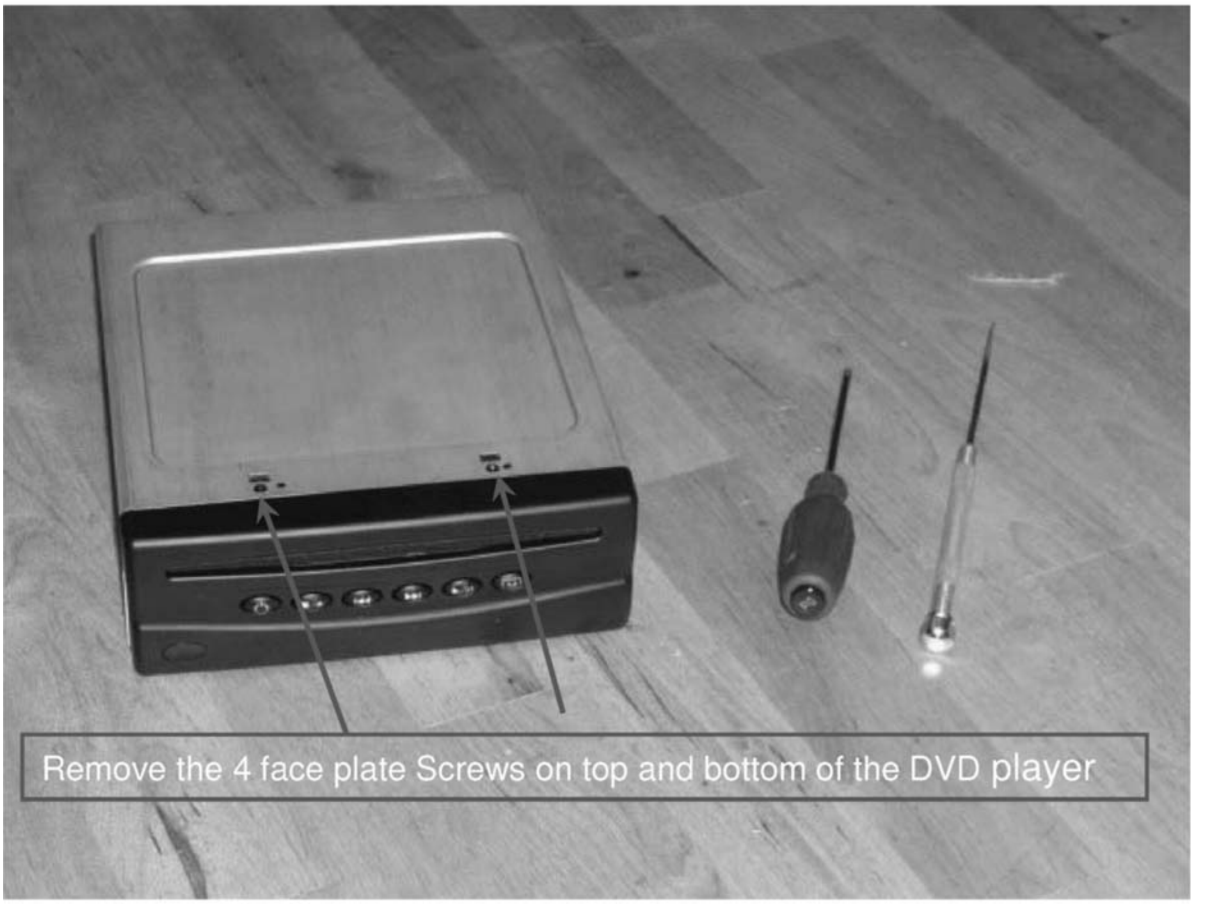
SUBJECT:
Multiple discs inserted into RSE DVD player

REFERENCE:
VIDA fault tracing information

DESCRIPTION:

Customers may report that their RSE Rear Seat Entertainment DVD Player will not accept DVDs (DVD player will not allow DVD discs to be inserted; DVD Player is inoperable or will not eject the DVD disc).

One possibility for this condition is that there may be 2 or more discs inserted into the DVD player. If multiple discs are found in the DVD player please do not submit the unit for warranty. If a DVD player is returned for warranty with 2 discs inside, the claim and part will be denied.



Refer to the illustration for a method to remove stuck multiple discs with customer approval.

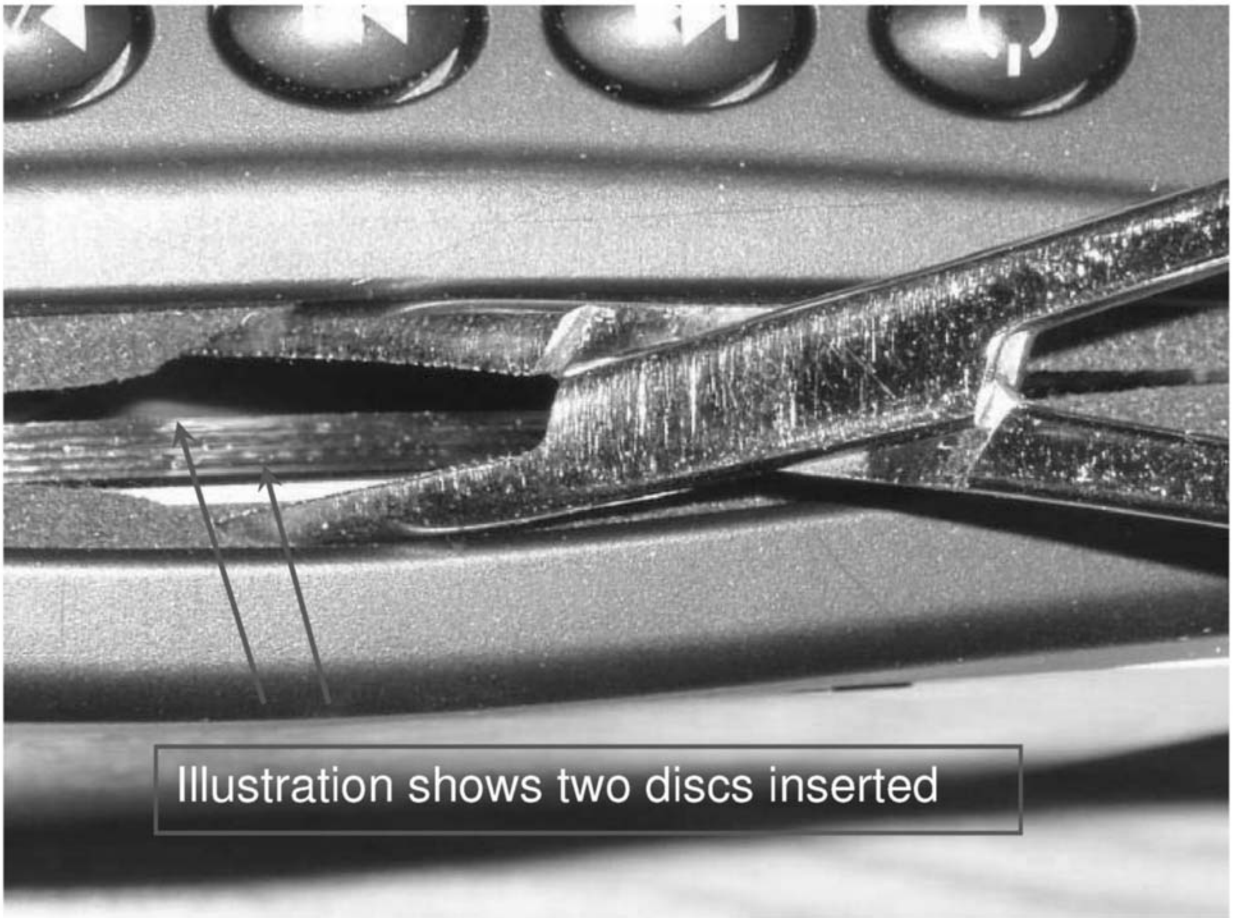
Note:

Any DVD Players returned to TMA disassembled or tampered with, will not be covered under warranty.

This TNN describes the method to inspect the DVD player for multiple disc insertion.

It is not necessary to remove the DVD player for inspection.

Carefully spread the protective dust cover apart using a hemostat or similar tool as described in this procedure. Be careful not to scratch the unit or damage the opening of the DVD Player or damage the customer's DVDs inside the unit.

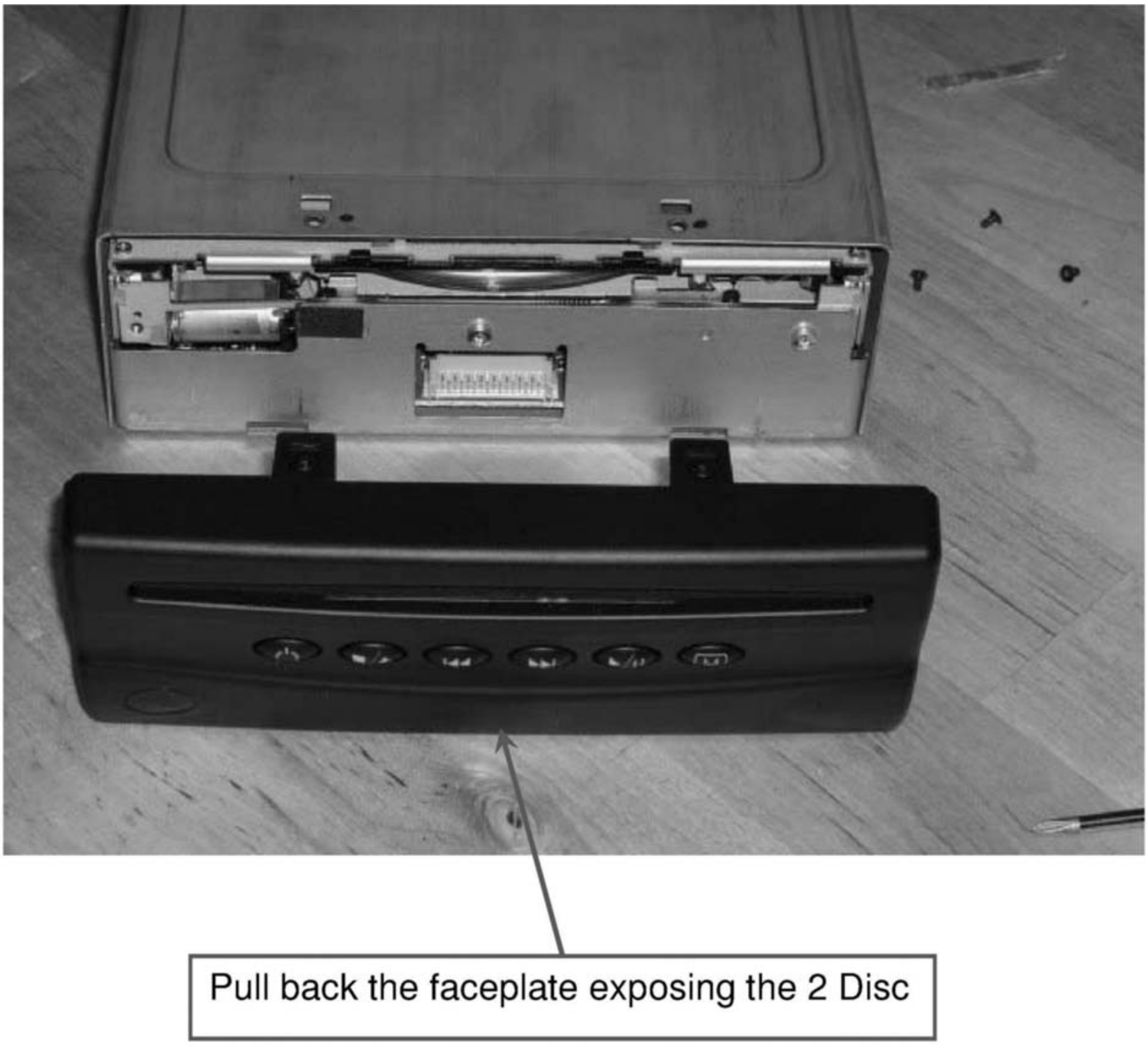


DO NOT ATTEMPT TO REMOVE THE DISCS WITH THE TOOL ABOVE. THE DVD PLAYER AND THE DISCS WILL BE DAMAGED

If there is one DVD stuck inside the unit and you were not able to eject the discs using the player's external control buttons, leave the disc in the unit and return the DVD Player to TMA under the normal warranty return program. Disc will be removed and returned to the Retailer.

The procedure below describes the method to remove the stuck DVDs from the player that has had multiple disc insertion if the customer so decides.

Note:
If you decide to remove the stuck Discs, please follow the procedure below. (DVD player must be removed to perform this operation)



Important:

Once the unit is opened it is no longer covered under warranty and will be denied if submitted. Please advise your customer of this before proceeding. Volvo Cars of North America assumes no responsibility for damage to the player or discs if this method is used.

^ Carefully Insert pick as shown (without scratching the disc surface) below the spindle.

^ Gently lift up on the discs close the center hole so they will clear the spindle.

^ Grip the discs with your fingers and pull back to remove from player.

Return Discs to customers.

Technical Service Bulletin # **TNN77-18** Date: **070515**

Tires - Pressure Requirements/Recommendations

NO: 77-18

DATE: 5-15-2007

MODEL:
All

MODEL YEAR:
All

SUBJECT:
Tire Pressures, Requirements and Recommendations

REFERENCE:
VIDA, SMB 17-006, owners' manuals

Description

Tire pressure is a critical element of vehicle performance. Correct tire pressure is important for:

^ achieving good fuel economy

^ achieving optimum comfort and good driving characteristics

^ helping to prevent flat-spotted tires due to low tire pressures

As stated in the Model Year 2007 owners' manuals:

^ Under-inflation is the most common cause of tire failure and may result in severe tire cracking, tread separation, or 'blow-out,' with unexpected loss of vehicle control and increased risk of injury.

^ Under-inflated tires reduce the load carrying capacity of your vehicle.

Over-inflation is also undesirable. Over-inflated tires can be stiff and unyielding, and will cause the vehicle to ride more harshly and loudly.

Under-inflation or over-inflation may cause uneven treadwear patterns.

There are many opportunities for the Volvo retailer to check and maintain proper tire pressure, from new vehicle storage, to delivery, through the service life of the vehicle. This TNN is designed to summarize and highlight Volvo's requirements and recommendations regarding tire pressures.

Service

GENERAL:

Tire pressures should always be checked cold. Tires are considered to be cold when they have the same temperature as the surrounding (ambient) air. This temperature is normally reached after the vehicle has been parked for at least 3 hours.

After driving a distance of approximately 1 mile (1.6 km), tires are considered to be hot.

When the weather temperature changes, tire inflation pressures also change. A 10-degree F (5-degree C) temperature drop causes a corresponding drop of 1 psi (7 kPa) in inflation pressure.

TRANSPORT PRESSURE:

All new Volvo vehicles are delivered from the port to the retail facility with tires at 'transport pressure', which is 43 psi (300 kPa). As indicated in Service Manager Bulletin 17-006, Retail Car Delivery Process, Stock Maintenance checks require that tire pressure be checked every 60 days, and be maintained at 43 psi (300 kPa). This is also true for vehicles on static display, such as the showroom or outside display areas. This transport pressure must be maintained until just before retail delivery.

Note!
Failure to maintain transport pressure in tires may result in tire damage not covered by the tire manufacturer's warranty.

CPS (CUSTOMER PREPARATION SERVICE):

SMB 17-006 also gives detailed information regarding operations to conduct during the CPS (Customer Preparation Service).

Note!
CPS should only be completed just prior to actual retail delivery of the vehicle to the customer.

Model Year 2007 U.S. specification vehicles have only one recommended tire pressure. This is the case whether the vehicle is equipped with a Tire Pressure Monitoring System (TPMS) or not. It is critical during CPS (and whenever tire pressures are checked and set) that all 4 tires be set exactly to the tire pressure indicated on the tire pressure label. This will assure that the customer has the best combination of ride, handling, and tire life.

Canadian specification vehicles continue to use labels with both a cold tire pressure and an optional tire pressure.

In all cases:

Use the recommended cold inflation pressure for optimum tire performance and wear.

NITROGEN:

There have been reports in the industry regarding the use of nitrogen for inflating tires. Volvo's position is that nitrogen is not required when servicing tires. While it is not harmful to use, it is also not necessary. This is true even for vehicles with TPMS.

CALIBRATION OF TIRE PRESSURE MEASURING EQUIPMENT:

VIDA can be used to check a vehicle's tire pressures.

This is the path in VIDA to follow:

Diagnostics > Vehicle communication > UEM> Advanced > Quick Test

As the tire pressure displayed in VIDA is extremely accurate, this display can be used to 'calibrate' tire pressure measuring equipment in the service workshop. Compare the VIDA reading with a tire pressure gauge, and compensate accordingly.

TPMS (TIRE PRESSURE MONITORING SYSTEM):

TPMS (Tire Pressure Monitoring System) was optional on certain Model Year 2005 and 2006 vehicles fitted with SST (self-supporting tires). TPMS is standard equipment on all U.S. specification Model Year 2007 S60 (except S60R), V70 (except V70R), XC70, XC90, and S80 vehicles. It is planned to be standard equipment on 100% of the U.S. specification Model Year 2008 vehicles. TPMS is optional on Model Year 2007 Canadian specification vehicles.

The system must be regarded as a driver aid to maintain the correct tire pressure. TPMS does not take the place of good vehicle maintenance which requires that tire pressure be checked on a regular basis. The owners' manual recommends to the owner that tire pressures be checked monthly. When inflating the tire with air, you must, as much as possible, ensure that the tires are at same temperature as the outside temperature. When inflating with air, the tires must be filled to the pressure stated on the decal located on the car body. These pressures MUST be followed.

Technical Service Bulletin # **TNN36-58** Date: **070501**

Antitheft - Immobilizer Lamp ON/DTC 321 Set

NO: 36-58

DATE: 5-1-2007

MODEL:
S40, V40

MODEL YEAR:
2000-2004

SUBJECT:
Immobilizer Warning Lamp Lit or Flashing, IMMO-DTC 321

REFERENCE:
VIDA

DESCRIPTION:

In S40 and V40 cars, the Immobilizer warning lamp may be lit after a successful cold start.

After a restart, or after switching ignition off and on, the warning lamp is not lit any more.

While the warning lamp is lit (engine is still running), Immobilizer Diagnostic Trouble Code IMMO-DTC 321 is stored. This DTC indicates a communication problem between IMMO-ECU and ECM (Engine Control Module). When the warning lamp is not lit, there are no IMMO or ECM DTCs stored.

The customer may also experience intermittent no crank (starter motor not activated) and flashing Immobilizer warning lamp in the DIM. In most cases the engine will crank normally if the ignition is switched off and a new start attempt is made. In a few cases, several start attempts are needed to get the engine running.

SERVICE:

Install service harness P/N 30652280 according to the method below.

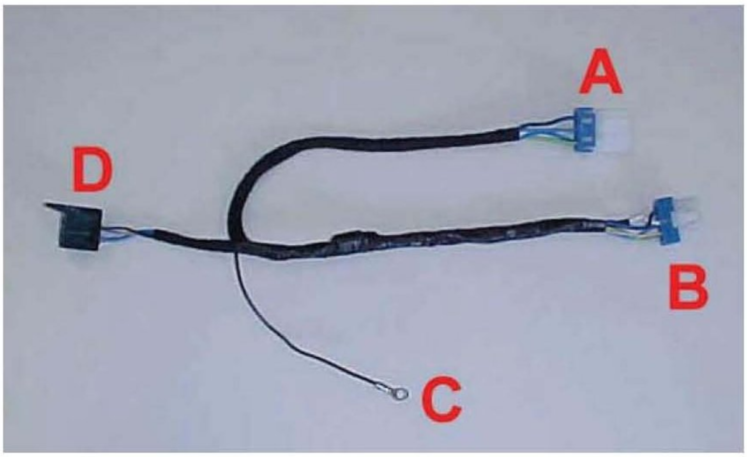


Photo 1

1. Required parts. Refer to Photo 1.

2. Remove driver side dashboard sound proofing.

   Refer to VIDA.

3. Remove steering column covers.

   Refer to VIDA.

4. Remove connector from starter switch.

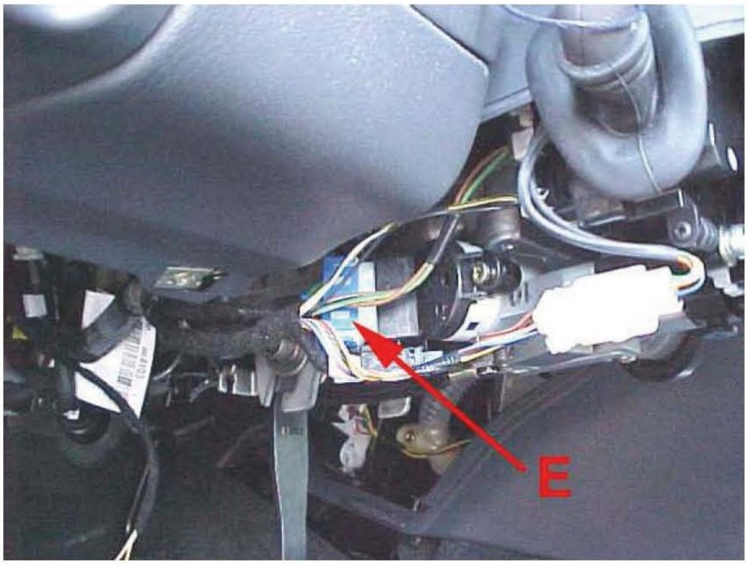


Photo 2

   Refer to Photo 2.

   ^ Push the white plastic connector unlocking latch at the rear side of the connector.

   ^ While pushing the unlocking latch, pull connector E from the starter switch.

5. Install relay

   Refer to Photo 1.

   Install the relay (P/N 3472210) in relay socket D of the service harness.

6. Install service harness

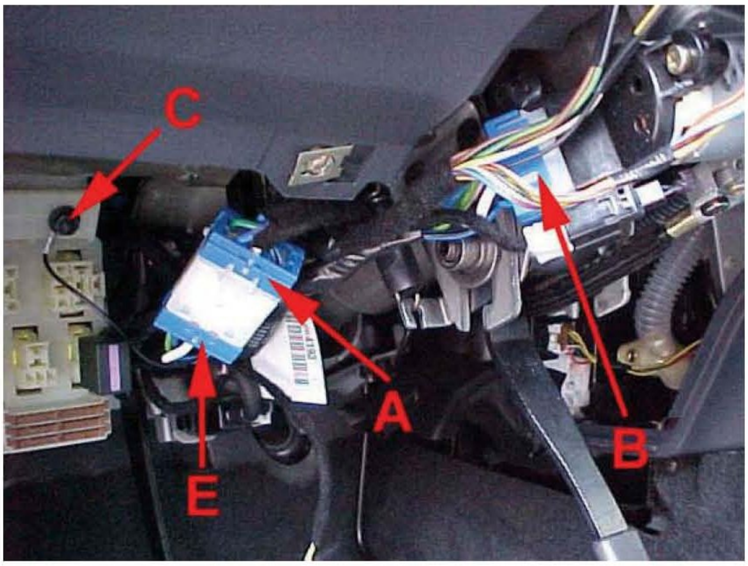


Photo 3

Refer to Photo 3.

^ Install connector A from the service harness to connector E (that was removed from the starter switch).

^ Install connector B from the service harness to the starter switch.

^ Place the service harness in its mounting position and fasten it with the two cable ties to the existing harness. Make sure the routing avoids potential chafing of the harness.

^ Remove one of the Junction Box upper fixation nuts, and install ground terminal C on the threaded stud. Tightening torque of the fixation nut 4.5 Nm (3.3 lb-ft).

^ Check the resistance to ground through terminal C with an ohmmeter. The resistance shall be less than 1 Ohms.

7. Test function

^ Switch ignition on.

^ The relay located in relay socket D must switch on with ignition on.

^ Crank engine; engine must start.

^ Check if Immobilizer warning lamp switches off.

^ Switch ignition off; relay located in relay socket D must switch off.

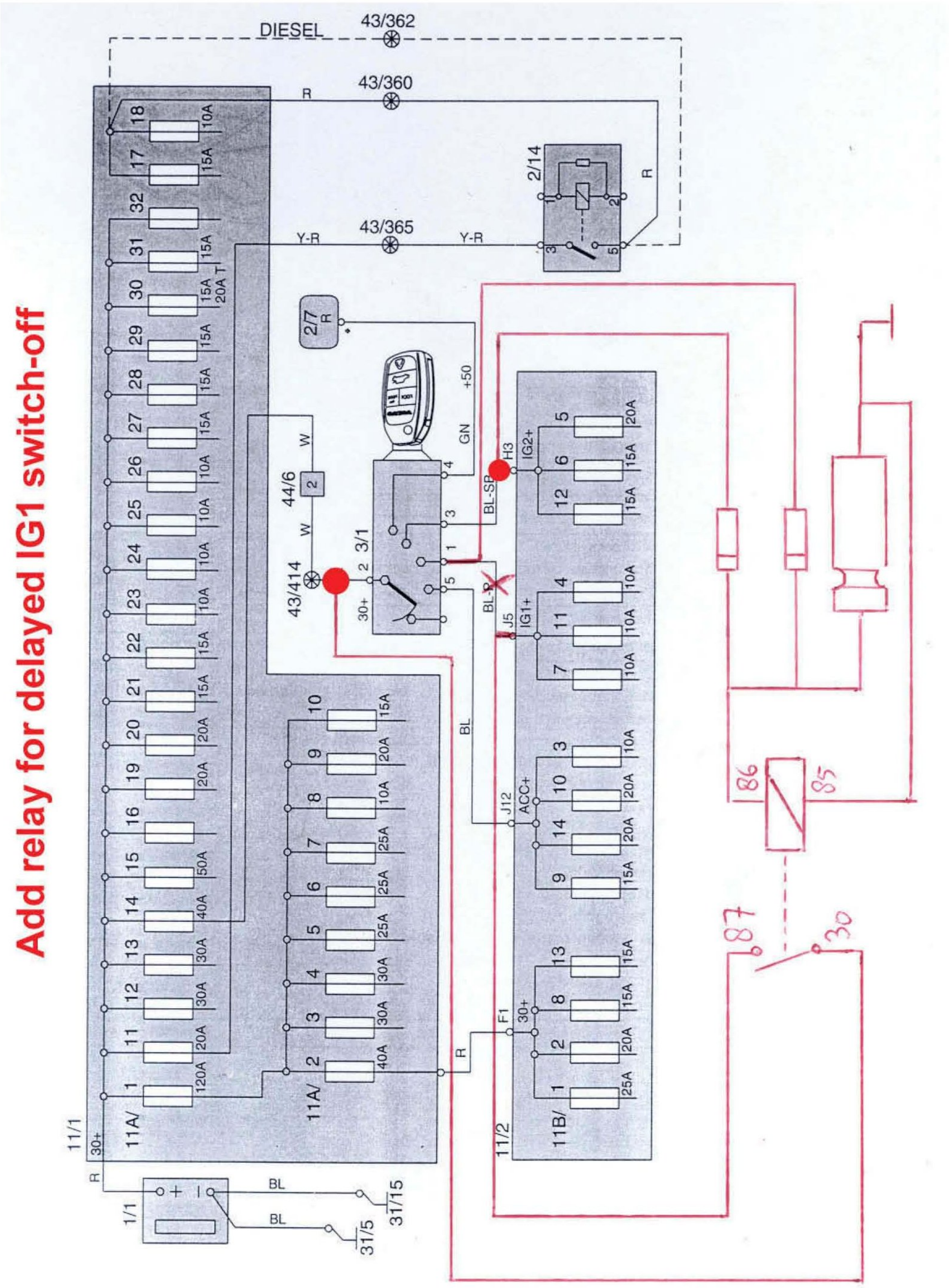
8. Re-install steering column covers

Refer to VIDA.

9. Install driver side dashboard soundproofing

Refer to VIDA.

The wiring diagram after installation of the service harness is shown below.



The wiring diagram after installation of the service harness is shown.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
99191-2	Cable harness starter switch install S40, V40	0.5 h

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY CLAIM INFORMATION

Technical Service Bulletin # **TNN37-39** Date: **070323**

Computers/Controls - CEM Recovery after SWDL Interrupt

NO: 37-39
DATE: 03-23-2007
MODEL: All S40 / V50 / C70 / C30 (Pix)

SUBJECT:
CEM Recovery after SWDL Interrupt

This Tech Note supersedes the previous 37-39 dated 3-21-07. Please update your files. Updates include changes to make sure the key position is correct during the process

DESCRIPTION:
We have received reports where the software download (SWDL) has been interrupted and it is not possible to download the CEM (Central Electronic Module). This can occur with the download of any software package.

SYMPTOM:
Software download is interrupted and CEM download failed message may be seen.

The CEM has two processors and if either of them is not in PHOG (program) mode the download will not be possible. This condition can occur during any software download. CEM (40) is the low speed processor and CEM (50) is the high speed side. The method described in this TNN will force both processors into PHOG mode. The steps must be followed exactly as stated.

REQUIRED EQUIPMENT:

External power supply for the VCT2000.

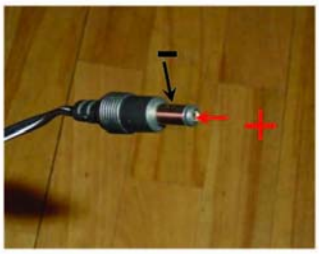
See below, or use Power supply from an Idle Panasonic Toughbook CF-29

Note; If a CF-29 toughbook is being used for this procedure, make sure it is not being used on battery power alone.

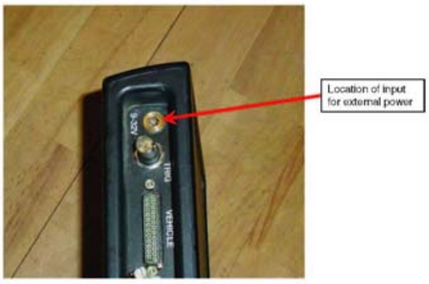
1. Info external power supply. Commercially available power supplies may be used if they meet the following requirements

   Voltage: 12 Volt DC
   Current: 1 Ampere minimum

   Connector:
   Outside diameter: 5.5 mm (Negative pole)
   Inside diameter: 2.1 mm, (Positive pole)



2. How to connect the external power supply to the VCT2000



When VCT 2000 is properly connected to external power, the Green LED will be illuminated

RECOVERY METHOD (follow these steps exactly as stated)

As usual, the key shall be in position 2 anytime vehicle communication is taking place

1. Log out of VIDA and shut down the VIDA application.

2. Disconnect the battery charger. Disconnect the vehicle battery. VCT 2000 green LED should go out. (If the VCT is not de-powered in this step, the recovery will fail)

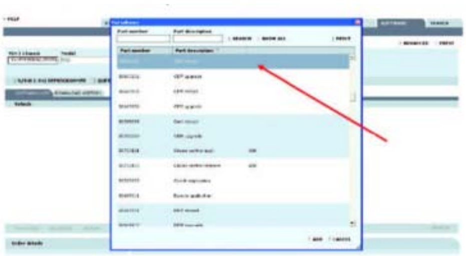
3. Connect an external power supply to the VCT 2000 as described. VCT 2000 green LED should be lit.

4. Reconnect vehicle battery without the charger connected.

5. Start VIDA application and log in.

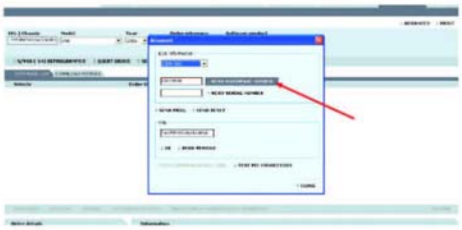
6. Choose Vehicle Profile tab and select the car from the list of last identified vehicles and press "OK". If the car is not in the list, manually enter the VIN number and press "OK". The VIN number should now be seen in the Windows header (see arrow).

(The VIN number may not appear because one of the CEM microprocessors is not responding as a result of the SWDL failure. It is important that the VIN is entered manually in this step or the recovery will fail)



7. Choose the Software tab and purchase CEM reload.

8. Select Advanced and Press "SEND PROC"



9. Choose ECU CEM (40) and read the hardware part number. Choose ECU CEM (50) and read hardware part number. Be aware of which side of the CEM does not respond 40 or 50? (i.e. can the HW p/n be read?).

10. Disconnect the vehicle battery. Make sure the charger is not connected to the battery cables.

    (The vehicle must not have power and the VCT 2000 must be powered with the external power supply during the next step or the recovery attempt will fail)

11. Send "PROG" command.

12. Reconnect vehicle battery
    (key must be in position "N" before the battery is re-connected)

13. Choose ECU CEM (40) and read hardware part number. Choose ECU CEM (50) and read hardware part number. If you can read the HW on both CEM 40 and CEM 50 the CEM has been recovered and will be able to be loaded. Proceed to step 14.

Note;
If the Hardware cannot be read on either CEM 40 or CEM 50 repeat Steps 10 through 13 until you can read the HW part number on both CEM 40 and 50. If after several attempts, there is no response on either CEM 40 or CEM 50 the CEM will not be able to be loaded.

14. Install Battery Charger. Download CEM reload.

15. Download the original software package that was interrupted.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
36004-2	Software download	0.3 hr
99400-2	Control and adjustment procedure	0.1 hr.

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY CLAIM INFORMATION

Technical Service Bulletin # **TNN37-22** Date: **011207**

Computers/Controls - CANbus Network Information

NO: 37-22
DATE: 12/07/2001
MODEL: All Models 1998 -->
SUBJECT: CANbus Network Information
REFERENCE:
CHASSIS: N/A:

This Tech Notes supercedes the previous 37-22 dated 11/30/2001. Please update your files.

DESCRIPTION:
This Tech Net Note is an explanation of how the CAN network is set up and functioning, including network diagnostics. It also describes conditions for DTCs to be set and some tips on how to fault trace the CANbus. CANbus errors are often complicated to fault-trace simply because it is a distributed system and error codes may be or may not be set in multiple nodes.

This information is best used as background information to understand the CANbus or system diagnostics and to fault trace the CAN network, and may not help to immediately find the root cause of a specific problem. This document will supplement the normal training material and it is recommended for technicians who have completed and thoroughly understand the training on "Volvo Automotive Networks"

The structure of this document is: general information on what role the CEM plays in CANbus faults, then each of the major types of DTCs are described. Each type of DTC has a description, explanatory picture, and some typical scenarios when it can be set.

SERVICE:

CEM diagnostic functionality

The CEM is the only node that truly monitors the voltage levels on the CANbus. Only the CEM can post the diagnostic trouble codes for CANbus short-circuit to ground or 12V (e.g. DTC CEM-DF14), even though many nodes can post codes caused by the short circuit, e.g. E003 (this is a very subtle, but important difference).

Note:
> The fact that the CEM has more diagnostics for the CANbus faults does not mean that the CEM is the root cause of the fault! Do NOT replace the CEM for CANbus failure unless there is a confirmed hardware internal error based on the fault tracing in VADIS and this TNN.

The CEM also has the functionality of detecting the absence of other nodes.

All nodes on the CANbus need to send and receive information. More specifically, all other nodes need to receive information from the CEM, and the CEM needs to receive information from all other nodes. If a node does not receive information from the CEM, it will set the code DTC-E003, and if the CEM does not receive information from a node it will post a code CEM-1A51 to CEM-1A64 for that node.

As an example, if the CCM does not receive information from CEM it will post DTC CCM-E003, and if the CEM does not receive information from CCM it will post DTC CEM-1A55. Further, if the DDM does not receive information from CEM, it will post DDME003, and if the CEM does not receive information from DDM it will post the code CEM-1A52.

If there is an open circuit on the CANbus, codes are thus posted in pairs, one in the CEM and one in the corresponding node. Note that this can mean that the CEM posts a lot of codes reaching its maximum number of codes (10).

These codes will be explained in detail under sections DTC CEM-1A51 to CEM-1A64.

Fault-codes for CANbus errors

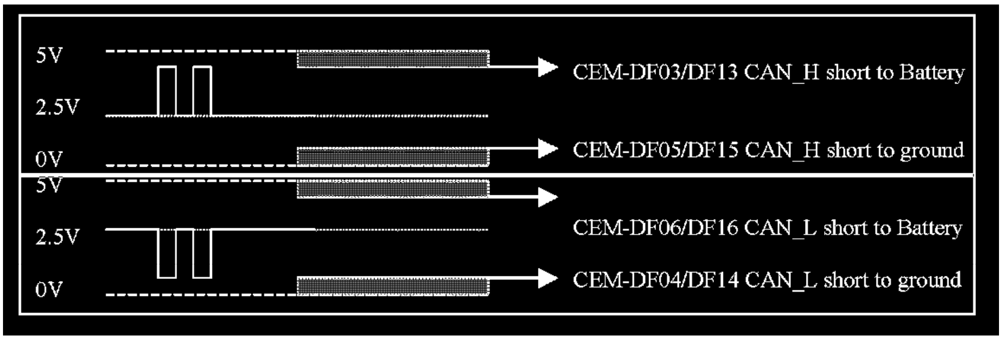
A list of different DTCs most related to CANbus errors can be found at the end of this TNN.

DTC CEM-DF03 to CEM-DF16.

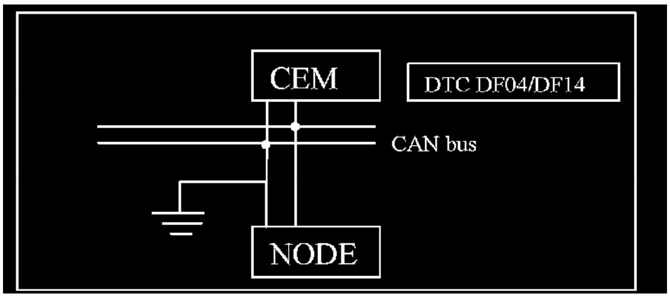
The CEM is the only node that has diagnostic functions to detect short circuit to ground or short circuit to voltage (B+). This is done by monitoring the electrical signal levels on the CANbus by an internal voltage measurement circuit in the CEM, and the DTCs CEM-DF03 to CEM-DF16 can be set.

Note. There are separate codes for low speed and high speed network. DF03, DF04, DF05, DF06 refer to the low speed net work and DF13, DF14, DF15, DF16 refer to the high speed network.

There is no strict electrical detection function for open circuit, but there will be a number of codes posted as a result of an open circuit.
DTCs CEM-DF03 to CEM-DF16 are the strongest evidence for a network fault, but the code does not locate the fault. Due to the detection criteria for these codes, they can in rare cases also be posted when driving in very high electromagnetic field areas.



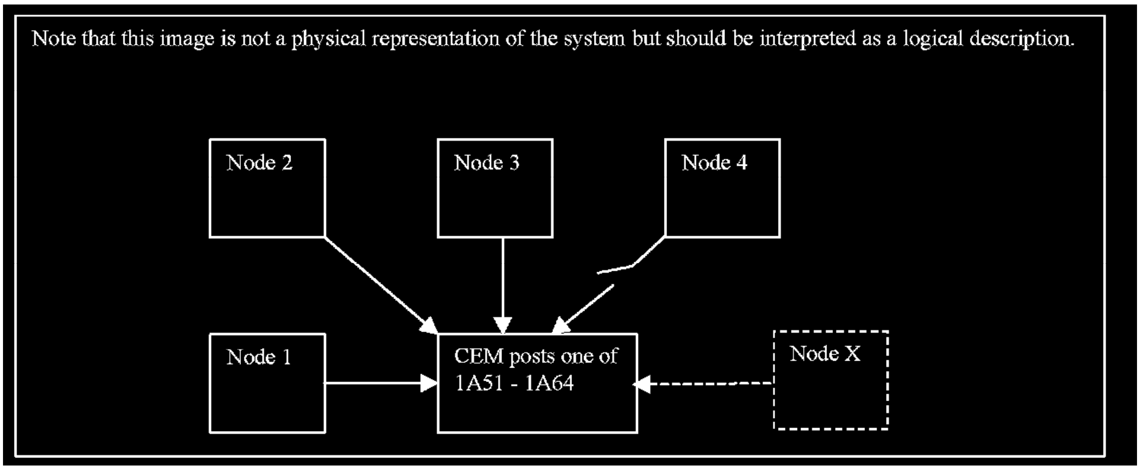
The detection for these codes is continuous. The detection time for a permanent fault can be up to 10 sec. CEM-DF03 to CEM-DF16 are posted when the voltage on the CAN lines are more than 4.5V or less than 0.5V respectively. See graph below.



A typical scenario when these codes are set is a pinched CAN wire to either ground or pinched together with a 12V wire, see illustration below.

Different combinations of codes are possible, and the codes mentioned in the graph are only examples.

DTC CEM-1A51 to CEM-1A64.

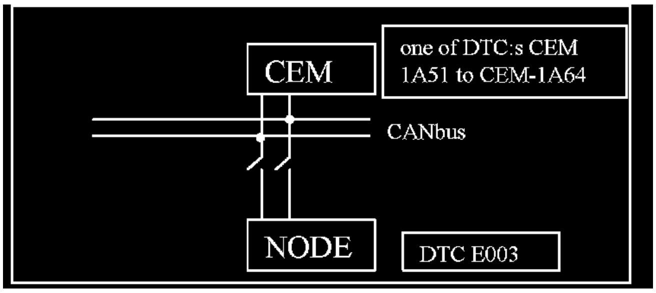


The CEM expects a signal sent from every node on the network. The CEM will post a code for communication with control module, or "Node not alive", if there is no communication from the concerned node for more than 10 seconds. See illustration.

Typically these codes come together with DTC E003 in the corresponding node. Depending on where the error occurs, there may be many CEM-1A51 to CEM-1A64 codes posted at the same time and the CEM reaches maximum number of DTCs stored (10). In this case not all codes will be represented even if the criteria for posting the code was met.

The codes will generally be posted when network is open-circuit, short-circuit, node is not powered, or if a node stops communicating to the CEM for other reasons.

Combinations of CEM-1A51 to CEM-1A64 codes are very useful for locating open circuit faults, see "Multiple codes and extended diagnostic (counters and Freeze Frames.)".



If there are intermittent CEM-1A51 to CEM-1A64 codes but not the corresponding E003 codes, first verify that, at the time of repair, communication can be established with all nodes. Then look at the power supply for the nodes. The reason is that the node will of course not post the E003 code if it lacked power when the intermittent fault occurred. The CEM however will post the CEM-1A5x code even if the other node lacks power or has a CAN communication problem. See illustration below for an example.

Different combinations of codes are possible, and the codes mentioned in the illustration are only examples.

DTC E003 set in nodes other than CEM

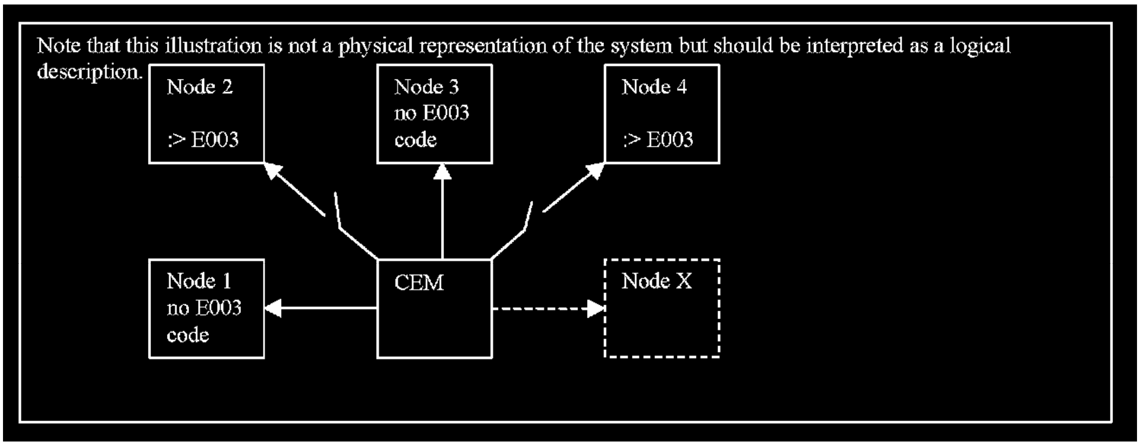
The DTC E003 code is posted when the incorrect CAN Configuration ID is received during 5 sec after Power up. This means that the nodes do not receive the data frame containing the correct master configuration ID from the CEM. Normally this is due to the CANbus has an open circuit or other disturbance.

This code is intended to detect if the CEM has the wrong software, but is more common for a network/power error. Combinations of E003 codes are useful to locate the fault, see section about multiple faults. However not all nodes set this code at the same fault time due to different power-on conditions as e.g. X / 15 / 15I / 30 powered nodes.

An E003 can be the result if a node gets the wrong signal configuration downloaded to it or as a result of swapping a node from another car. That is one of the reasons that swapping of nodes is prohibited.
If several or all nodes have E003 it can be a result of an incorrect signal configuration being downloaded to the CEM. In practice, this is however not likely to happen, it is more commonly a physical CANbus fault.

X / 15I / 15 powered nodes detect the fault 5 second after the node is powered up (IGN ON).
The nodes compare their internal CAN configuration ID (SW version) with CAN configuration ID continuously sent out from CEM. If the CEM ID is missing or not equal to the expected value at 5 sec after powered up, the E003 code is set. A wrong ID may come from swapping node between vehicle types, but most often this code is due to signal missing completely.
A node that has battery (30) feed does not get that hardwired power up, but gets its information about ignition position via CAN bus. This means that a 30 fed node will not post the E003 at that time if the error is permanent at power up. Instead it will be posted after an approximate 10 min timeout.

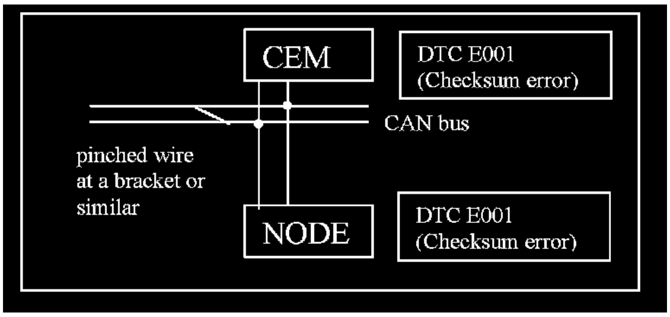
NOTE:
This means that for a 30 fed node the code may or may not be posted, all depending on when the error occurred.



The typical scenario when this code is set is an open circuit in the CANbus, and often together with the CEM-1A51 to CEM-1A64 codes.
See the illustration under "CEM-DTC CEM-1A51 to CEM-1A64." above.

E000 and E001 DTCs set in any node (E000=HS-CAN / E001=LS-CAN).

E001 code is an error in the data communication. It can be due to any disturbance on the CANbus or if a node is not sending correct data. The detection for these codes is continuous. It is originally designed to detect contact bouncing fault and corrupted message, but are also posted when there is a short circuit between CAN H and CAN L or when there is communication on only one of the two CANbus wires. Detection time for a permanent fault is within a few seconds.



Different combinations of codes are possible, and the codes mentioned in the illustration are only examples.

Other common causes for these DTCs is if a node is disconnected without first disconnecting the battery (Does not help if IGN key is out), or if CAN-message is "weak" or disturbed. That can happen if only one of the two CAN wires is operational or if one of the two network resistors is inoperative. Low speed network resistors are located in the UEM and REM. For the high speed network, the resistors are located in the ABS/BCM and
ETM, except for Bosch EMS MY02 and later where the resistors are in BCM and ECM.

Special cases with permanent E000/E001 exist, e.g. if one node is transmitting with slightly wrong baud rate, or if the crystal in a node is faulty.

Codes posted due to signal missing, quick detection of CANbus error

Some nodes, typically ECM, ETM, ABS and TCM, are checking each other's presence and are setting codes for absent signals. These codes are driving condition dependent and often combinations of codes can be set which may confuse fault-tracing. When trying to duplicate the driving condition / fault, it is not necessarily the same combination of codes that are set.
These are often more sensitive and are set more quickly than 1A51 - 1A64 or DF03 DF16 codes and can therefore be an indication that an intermittent quick error condition has occurred on the CAN bus.

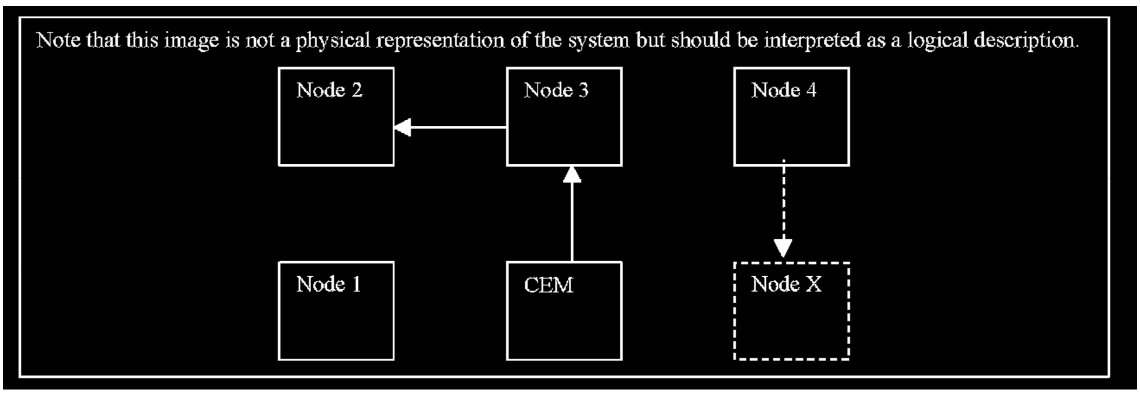
Below you will find a sample of codes that may or may not be set in case of a CAN intermittent failure:

ECM 928C (Bosch), 922A (Denso), only with running engine. The codes are for cruise control signal missing and indicate that the cruise control signals were not received by ECM.

ECM 901A, 901E, 902A, 911A, 912A 913F for Bosch and 901A, 902A, 902B, 911A 912A, for Denso
SRS 00D6, Buckle signal timeout, indicate that the SRS have not received the buckle status from the CEM. (The buckle sensor is hardwired to the CEM)
SRS 00D5 bulb status signal from DIM.

ECM Bosch.		
	959F	AP12T APU (Analog Pedal Unit) Analog/PWM (via ETM) comparison fault
ECM DENSO		
	9520	ETS, APM, PWM, Electrical fault, low
ECM monitoring:		
Bosch:		
	510F	Vehicle speed signal
Denso:		
	510D	Vehicle speed signal missing
	A02B	Signal missing from ABS/BCM
	902A	Throttle Communication signal missing

Pedal sensor signal discrepancy between hardwired signal and CAN signal:



See the illustration below for a rough picture of how signals may or may not involve several nodes.

Multiple codes and extended diagnostic (counters and freeze frames)

The detection time for CANbus error DTCs differ for different codes. This means that for a specific error condition there may be a number of DTCs set in different nodes. Multiple codes in different systems can be confusing, but should be reviewed at the beginning of fault tracing to find a common link between all the codes.

Now it is possible in VADIS to read off extended diagnostics, typically counters and freeze frames. This is valuable also for CANbus diagnostics since it gives a possibility to determine which faults were posted at the same time. Remember that the counters are implemented in different ways in different control units which may make a comparison of driving cycles between different nodes difficult.

When fault-tracing a vehicle with many intermittent E003 and CEM-1A51 to CEM-1A64 codes it is useful to identify which nodes are affected. Print a copy of the "Data communication" wiring diagram in the appendix and write down all the DTCs and counters at each node. Analyze if there is a pattern that can describe where the fault can be located e.g. if the codes are grouped at one end of the CANbus. That will give a good indication where the fault is.

Limp home modes and characteristics of CAN faults

When a node does not receive any data frames from the CEM, it will enter a limp home mode. This mode may have different level of functionality depending on node.

If the error has occurred after the startup of the nodes, the nodes will normally keep the last recorded values as limp home values. Exceptions do exist though, e.g. fuel gauge for DIM.

For the Low speed network there are some distinct characteristics:

DIM: Since the DIM is a display of signals on the CANbus, it will quickly be visible if signals are missing. Depending on the filtering of signals internally in DIM, the displayed information will disappear at slightly different times. Normally the gauges freeze for 10 seconds and then they go to 0 and the DIM goes dark.

If only one node has disappeared, the DIM may give the first indication of that. An example is if the REM stops communicating, the first indication would be that the fuel gauge goes to zero.

CCM: This module has to keep a certain functionality in the absence of CAN communication. It is also a very good indicator that the CAN communication is lost, since it will light the diodes exactly ten seconds after ignition position 1 or 2 is chosen.
Other symptoms: if the AC-compressor is not cycling, except for the initial 1 sec activation controlled by ECM on power up, it can indicate a communication problem in the chain CCM>CEM>ECM. An obvious symptom is also that fan is running for one to ten minutes when IGN key turned off. This is due to that CCM is powered by Extended-X from CEM and it normally turns fan and other functionality off based on a CAN command from CEM notifying ignition key out. If there is no CAN communication, the CCM will run
until the power is lost.

DDM: The DDM will operate the functions in the driver's door but not in other areas of the car such as window lifts for rear windows and door locks for rear and passenger doors. Also the memory mirror will not work but it will be possible to maneuver the driver side mirror with the knob.

PSM: The seat memory functionality will not work. Stored seat and mirror locations will not function for the remote and seat memory.

UEM: Buckle up is displayed even when the seat belts are buckled if no communication from CEM to UEM. Also no remote function since there is no communication UEM to CEM.

AUM: Audio has most functionality left, except e.g. steering wheel switches control.

PDM: Windows and locks will not operate from driver side switches.

REM: The fuel gauge does not function and the rear doors will not lock with the central lock button. Also Defroster and foldable headrests will be inoperative.

SAS: No DSTC functionality

SWM: The steering wheel switches and turn signals do not work, but the horn works due to a redundant hardwired signal to CEM.

And for high speed network:
Engine: no start can be caused by no communication CEM>ECM+TCM.

ETM: has three levels of limp home:
Level 1. Cruise inoperative
Level 2. Throttle dull, no quick response.
Level 3. Default limp home. The RPM is controlled by means of the injectors.

TCM: GSM functions inoperative, only certain gears active. Note that once the TCM goes into its limp home mode for no CAN communication, it will not come back in that driving cycle even if the error disappears.

ABS/BCM: Generally limp home modes depend on fault. AYC sensor fault gives loss of DSTC and lamp lit. Wheel sensor fault gives lamp lit, loss of anti-lock but power assist still functions. May lose diagnostic possibility if in limp home mode.

CEM: Major loss of functionality. Note that the CEM has separate buses for CAN H and CAN L, which means that it is possible to communicate to e.g. the CEM via high speed bus even if the low speed network has an interruption.

Tips for fault-tracing

If the CEM has DTC CEM-DF14, CAN low short to ground, it does NOT mean that the CEM is shorting the CANbus. The short is from any point on CAN low to ANY grounding point, either in the wiring harness, which is most common, or in any control unit. Note that an E001 can be set in certain nodes but not others, and the short-circuit can still be far from the control unit.

Statistically there is a high likelihood it is a cable harness problem (check behind radio, by the SRS control unit, TCM/ECM CANbus female terminals).

Note that a male terminal p/n 9441394 can successfully be used to probe the tension at the female CANbus terminals. If the female terminal does not provide the proper tension it should be replaced by p/n 9442486.

If E001 occurs permanently and the cable harness is OK, a good tip is to remove all nodes having E001 in them (except the CEM) , clear the codes in the remaining nodes and read them again to see if the code disappears. Then reinstall them one by one until the code reappears. If it is possible to communicate with the vehicle in ignition position 0 and 1 but not in 2, look for a 15 fed node corrupting the CANbus.

The above method is also useful in another error scenario. At rare occasions a node can start sending irrelevant information on the CAN bus. This may block the correct messages from coming through. The result may be one or more E003 or 1A51 to 1A64 codes. It is very difficult to know which node is disturbing so the above method can be the only way to find the root cause.

If there is no response from any of the low speed nodes, but the high speed nodes respond...

The CEM protects the CANbus from short-circuits occurring by the Data Link Connector. This is achieved by four relays internally in the CEM, one for each wire on CAN high speed bus and CAN low speed bus. The relays are closed when CEM receives a command on the K-line from VADIS.

So if you encounter this, check the following:

1. VCT2000 cable, this has caused problems before. Try another cable and VCT200.

2. Continuity and signal level of K-line wire.

3. Continuity on CAN wires between Data Link Connector and CEM.

If 1-3 check OK, there is most likely a permanent CANbus failure in the wires or a node. Continue fault-tracing according to CANbus hardware and measurement below.

CANbus hardware and measurement

The CAN network system is set up with network resistors of 120 Ohms placed inside some nodes, and connected between the two CAN wires (Green(GN) for CAN low and White(W) for CAN high)

The two nodes in the low speed network (basically passenger compartment) that have the network resistors are REM and UEM. For the high speed network (basically engine compartment) it depends on engine type and model year. For MY99-MY01 the nodes that have the network resistor are ABS and ETM. From MY02 and later vehicles with Bosch EMS, the ETM is no longer on the high speed network.

Instead that end resistor is in the ECM.

Method

To identify a permanent fault condition in the CANbus it is possible to measure the CANbus resistance. The CANbus must be measured with the negative battery cable off and should be close to 60 Ohms. An open in one or both of the CAN wires will result in a reading of 120 Ohms. It is recommended to measure the resistance with the CEM breakout box connected. That gives the following advantages:

1. The networks will be tested including the CEM. Note however that open circuits in ABS/BCM, SAS, PSM, PDM, DDM and AUM will still not affect the 60 Ohm measurement since these nodes are not connected in series. A short between the green and white will however be detected.

2. You will have easy access to the low-speed network, high-speed network and the wires between CEM and the data link connector.

3. Having the multimeter in the footwell area, wiggle the cables/connectors in the bulkhead above the CEM and look for changes in Ohm reading.

4. As under 3. wiggle also the cables/splice behind radio where radio cables meet firewall harness.

5. As under 3. wiggle cables/connector at A pillar that connects the roof harness.

6. As under 3. have someone wiggle the cables under the coolbox for ECM and TCM.

If for some reason the CEM breakout box can not be used, the low speed network can either be measured using a breakout box or on the cable side of the connector to the PSM, with the PSM disconnected.

These measurements are particularly useful when CEM-1A51to CEM-1A64 and E003 or E001 codes are present without CEM-DF03 to CEM-DF16 codes.

When making the resistance measurement, also verify that none of the wires has a short-circuit to ground or battery which could post the CEM-DF03 to CEM-DF16 codes. That resistance should be > kOhms.

For intermittent faults and for CEM-DF03 to CEM-DF16 codes, the oscilloscope is useful. This measurement should be made with all nodes powered up and using a breakout box. Verify that the CAN H voltage does not at any point exceed 4.5V and that the CAN L voltage does not go under 0.5V. Note that the VADIS oscilloscope is not useful (too slow sampling rate) for detailed CANbus data measurement but it will give an indication of voltage levels and whether there is communication or not.

Note:

NEVER test any female terminal with a multimeter probe. This may result in damage to the female terminal, causing an improper contact when the connection is reinstalled. It is often useful to use the male pin mentioned in this TNN to probe.

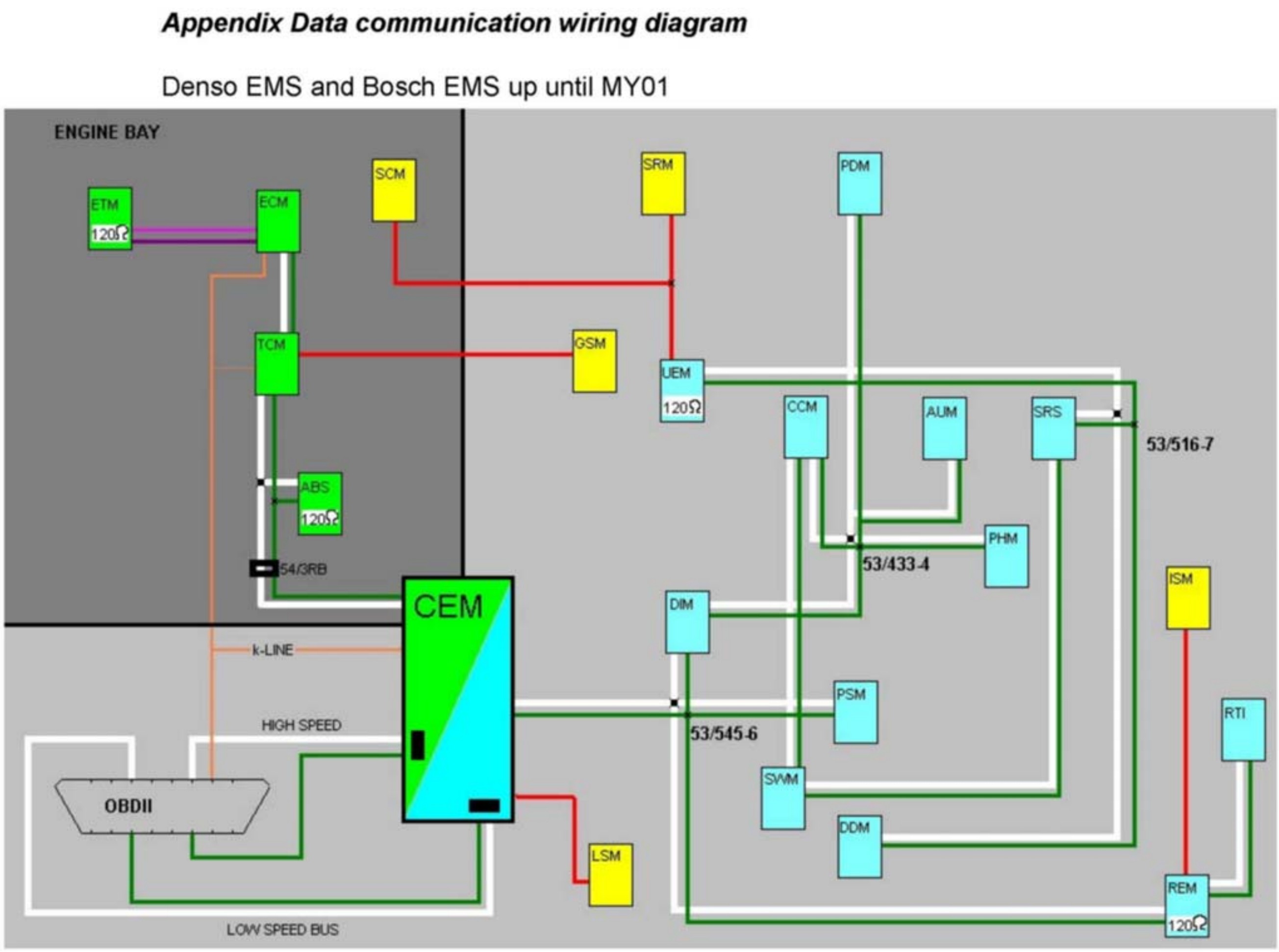
Appendix. List of DTC codes for CAN bus errors[1]:

NODE	Code	Comment
CEM	1A51	Communication with SRS control unit
CEM	1A52	Communication with DDM
CEM	1A53	Communication with PDM
CEM	1A54	Communication with Power Seat Module
CEM	1A55	Communication with CCM
CEM	1A56	Communication with DIM
CEM	1A57	Communication with RTI
CEM	1A58	Communication with PHM
CEM	1A59	Communication with AUM
CEM	1A5A	Communication with Rear Electronic Module
CEM	1A5B	Communication with Steering Wheel Module
CEM	1A5C	Communication with UEM
CEM	1A5D	Communication with Electronic Throttle Module
CEM	1A5E	Communication with SAS
CEM	1A5F	Communication with ABS
CEM	1A61	Communication with TCM
CEM	1A62	Communication with ECM
CEM	1A64	Communication with DEM
CEM	DF03	CAN_H (or CAN_L) short to battery low speed network
CEM	DF04	CAN_L short to ground, low speed network
CEM	DF05	CAN_H short to ground, low speed network
CEM	DF06	CAN_L or CAN_H short to battery , low speed network
CEM	DF13	CAN_H or CAN_L short to battery, high speed network
CEM	DF14	CAN_L short to ground, high speed network
CEM	DF15	CAN_H short to ground, high speed network
CEM	DF16	CAN_L or CAN_H short to battery, high speed network
CEM	E000	Communication with the control module, (CAN High speed checksum error)
CEM	E001	Communication with the control module, (CAN Low speed checksum error)
PSM	E001, E003	Communication problems with control module
AUM, DDM, PDM, AEM, DIM, CCM, REM, RTI, SRS, SWM, UEM	E001	Control module communication (LS CAN transmit / receive error)
AUM, DDM, PDM, AEM, DIM, CCM, REM, RTI, SRS, SWM, UEM	E003	Configuration fault ("Control module communication" for RTI)
ABS	0090	Control module communication
ABS	0091	Control module communication
ABS	0092	Control module communication
ABS	0093	Control module communication
ABS	0094	Control module communication
ABS	0095	Control module communication
SAS	E000	Communication fault with control unit
SAS	E003	Communication fault with control unit
TCM	E000	Control module communication
TCM	E003	Configuration fault
ECM	E000	Control module internal fault (CAN High speed checksum error)
ECM	E003	Control module internal fault (CAN configuration fault)

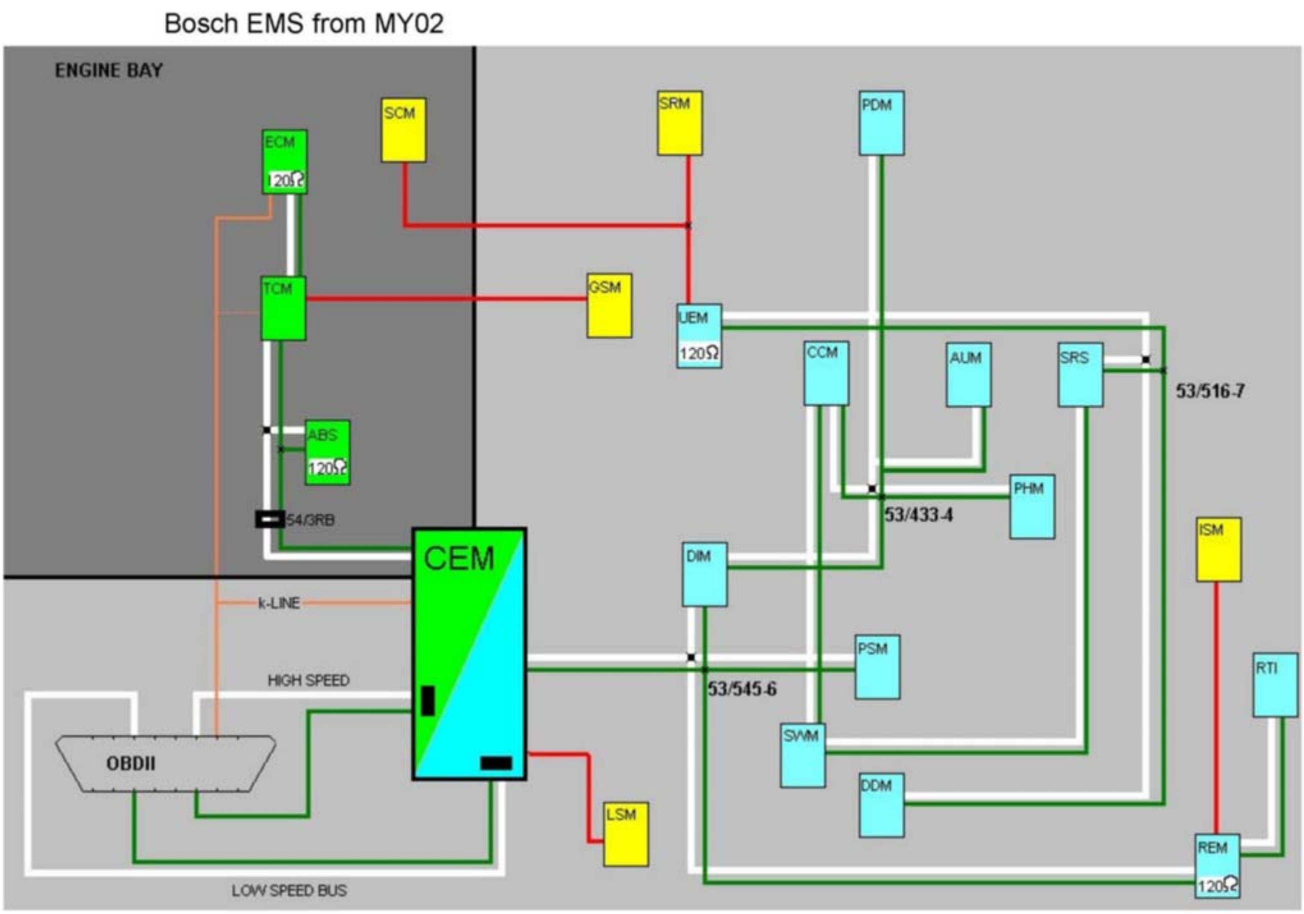
Note that the description in "Comment" is not always consistent. They are mostly taken from the Vadis description.

[1] Not including the codes that are posted as a consequence of lack of communication, e.g. 928C.

Appendix List of DTC Codes for CAN Bus Errors



Appendix Data Communication Wiring Diagram



Bosch EMS From MY02

Technical Service Bulletin # **5520011** Date: **040301**

Recall - Brake Vacuum Replacement

S40 (-04)/V40
2000

Section:
5

Group:
52

No.:
0011

Year:
04

Month:
03

Background:

Volvo Cars North America LLC (Volvo) has decided that a defect related to motor vehicle safety exists in certain model year 2000 S40 and V40 vehicles. Under certain circumstances, water may enter the electrical brake vacuum pump, causing the pump to not function. This will require more brake force to stop the vehicle. However, this is primarily noticed at cold start. This limited braking power can affect the vehicle's stopping performance.

The corrective action will be to replace the vacuum pump with a new pump of a modified design. This new pump will be placed in a new location to prevent water intrusion.

Competence requirement

Volvo Level 2 Technician

Description	Quantity	Part No.
Vacuum pump service kit	1	30641411
Vacuum hose	1	30620958
Anti rust spray	0.1	1161480

Material

Vacuum pump

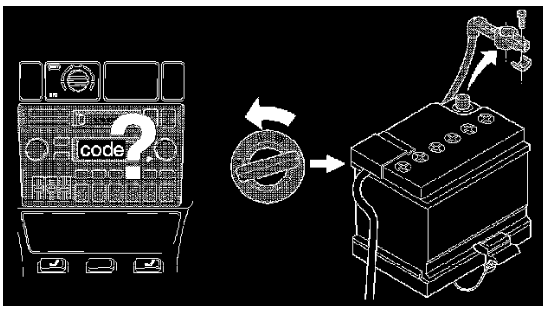
Additional vacuum pump, replacing

1. Preparatory work

   Make a note of the anti-theft radio code.

   Switch off the ignition.

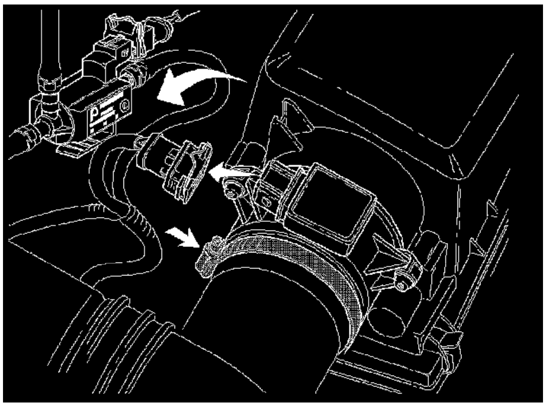
   Caution!
   Press down the brake pedal a few times until there is no longer any negative pressure (vacuum) in the brake servo.



   Remove:

- the battery negative lead
- the battery positive lead
- the protective cover over the battery
- the battery clamp and the battery.

2. Removing the air cleaner (ACL)



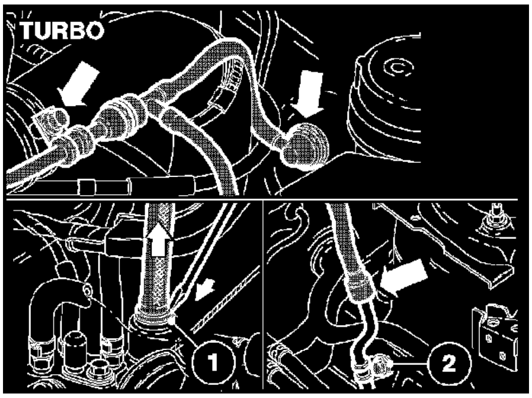
Remove:

- the connector for the mass air flow (MAF) sensor
- the turbocharger (TC) control valve from the air cleaner (ACL)
- the air inlet hose on the mass air flow (MAF) sensor side
- the 2 mountings for the cable harness from the air cleaner (ACL) housing
- the air intake at inner fender
- the mounting screws
- the air cleaner (ACL).

Note!
Plug off the air inlet hose.

3. Removing the vacuum hose

Note!
Clean the area around the vacuum hose terminal before removal.

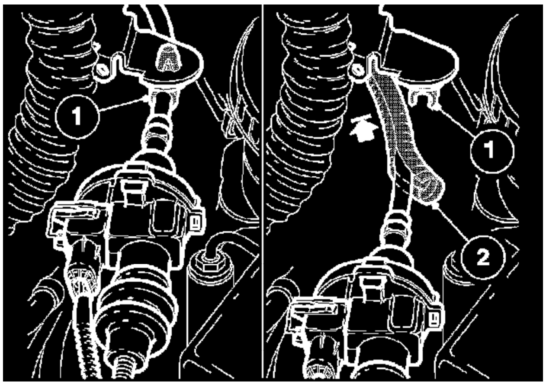


Remove:

- the connection from the brake servo
- the bolt and clamp from the vacuum hose (will be re-used)
- the protective cover for the throttle housing

- the vacuum hose from the intake manifold by pressing in the locking ring (1) while pulling the vacuum hose out
- the quick-release connector for the vacuum hose to the additional vacuum pump
- the vacuum hose. This will not be re-used
- the bolt (2) from the vacuum pipe on the side member.

4. Installing the protective sleeve for the throttle cable



Remove:

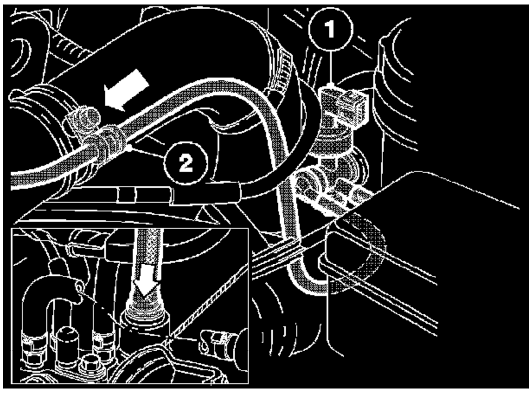
- the protective cover from the connector bracket fire wall
- the throttle cable out from the clip (1).

Install:

- the protective sleeve (2) over the throttle cable. Slide the protective sleeve as far as possible towards the firewall.
- the throttle cable in the clip (1).

5. Installing the new vacuum hose

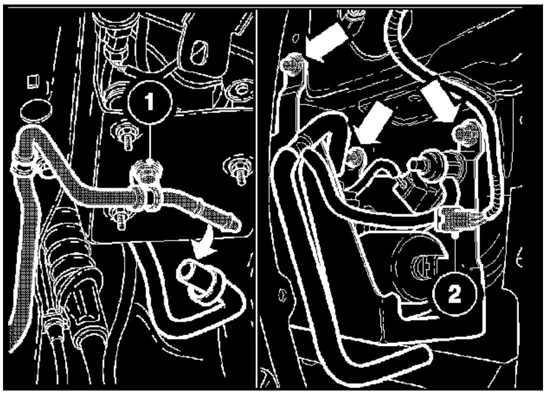
Position the vacuum hose between the intake manifold and the brake servo.



Install:

- the vacuum hose in the manifold. Check the locking by pulling on the vacuum hose
- the vacuum hose control valve (1) in the brake servo
- the clamp (2) and bolt on the vacuum hose. Tighten to 6 Nm

6. Removing the complete additional vacuum pump assembly

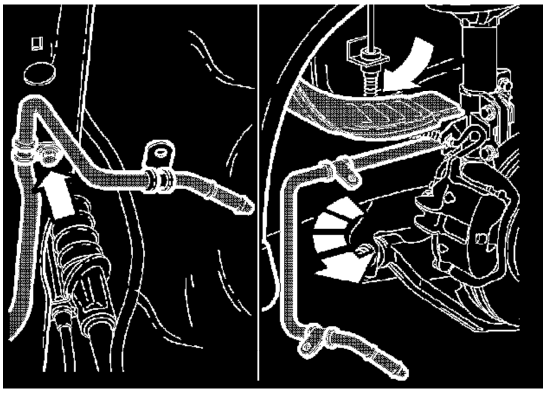


Remove:

- the left front wheel
- the front fender liner. Bend the fender liner backwards
- the vacuum hose from the vacuum pipe
- the clamp (1) from the vacuum pipe
- the connector (2)
- the three mounting screws
- the vacuum pump assembly. This vacuum pump assembly will not be re-used.

Route the wiring and connector (2) via the existing inner fender hole into the engine compartment.

7. Removing the vacuum pipe from the side member

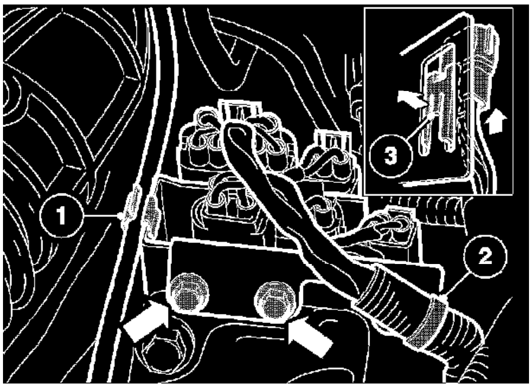


Remove:

- the clamp from the vacuum pipe at the side member
- the vacuum pipe.

Note!
The vacuum pipe must be bent before it can be removed. This vacuum pipe will not be re-used.

Clean the vacuum pipe and pump assembly screw positions. Apply rust proofing agent P/N 1161480.



Install:

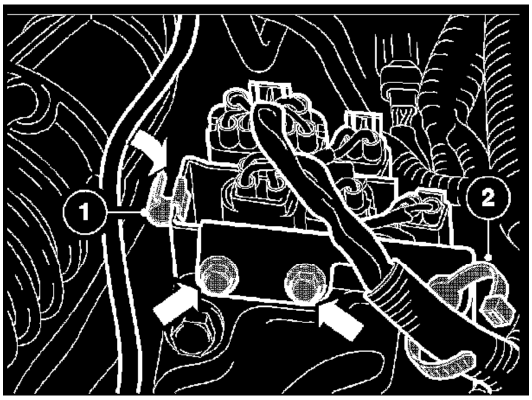
- the front fender liner
- the left front wheel.

8. Removing the connector bracket from the transmission (to lower the position of the connectors)

Remove:

- the shifting cable out off the clip (1)
- the clip (1) from the bracket
- the upper tie strap (2) from the cable harness
- the two mounting screws
- the connectors by lifting the catches (3) and slide it from the bracket. Note the position of the connectors on the bracket
- the bracket and remove at the side the cable harness.

9. Installing the new connector bracket on the transmission



Install:

- the connectors on the bracket in their original positions and check the locking
- the cable harness tie strap on the side
- the bracket on the transmission. Tighten to 10 Nm
- the clip (1) for the shifting cable
- the shifting cable in the clip (1)
- the new tie strap (2) and cable harness.

10. Installing the extra cable harness

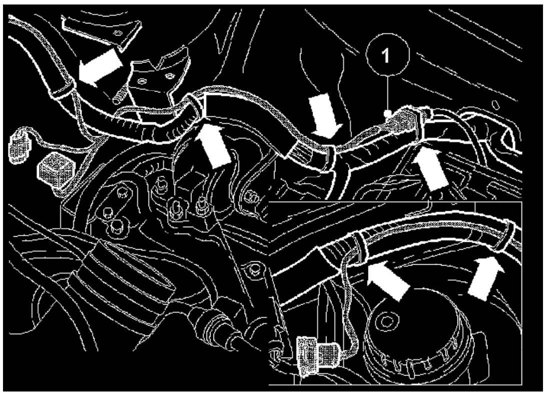
Remove:

- the relay/fuse box from the bracket
- the rear clamp from the cable harness.

Move the relay/fuse box to one side.

Position the connector (1) at the front. Route the new cable harness over the engine compartment cable harness.

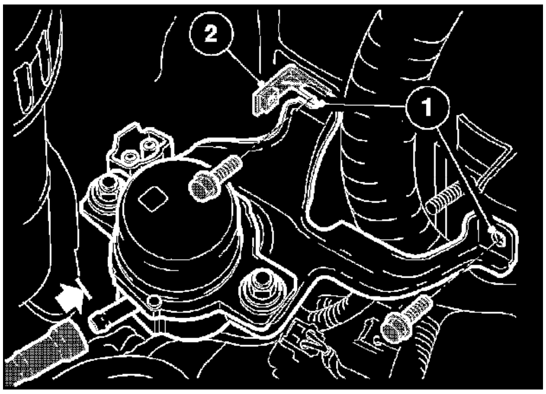
Connect the connector (1) to the connector from the old vacuum pump.



Use tie straps to clamp the wiring as illustrated.

Note!
Ensure that the cable harness is not trapped or in contact with moving components or sharp edges.

11. Installing a new additional vacuum pump and bracket



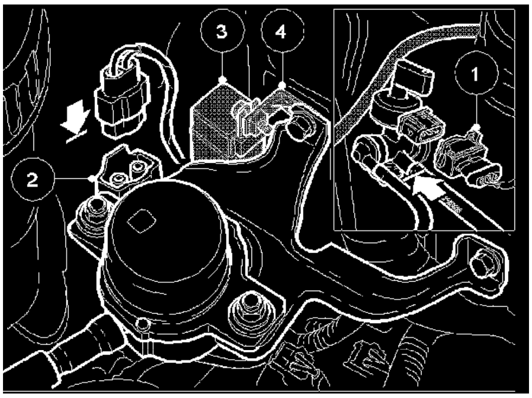
Note!
Check that the existing nuts (1) are in good assembly conditions.

Position the vacuum pump bracket and relay bracket (2) on the inner fender by two screws.

Tighten to 21 Nm.

Press the quick release connector of the vacuum hose on the vacuum pump. Check the locking.

12. Installing the new cable harness and relay



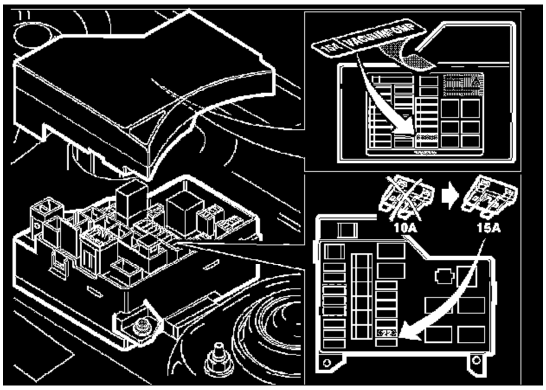
Connect:

- the connector (1) to the vacuum hose control valve on the brake servo
- the extra cable harness connector (2) to the vacuum pump
- the relay (3) to the connector on the extra cable harness.

Install the relay (3) on the bracket (4). Tighten to 5 Nm.

13. Installing the relay/fuse box

Reinstall the relay/fuse box.

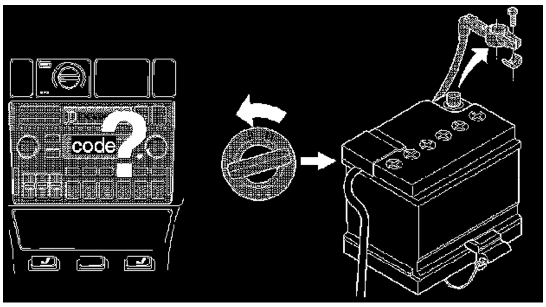


Replace fuse no. 22 (10 A) with the 15 A fuse. Clean the area where the label will be applied. Install the label on the inside of the cover

Reinstall the cover on the fuse box.

14. Installing components

Note!
Do not connect the battery negative lead.



Install:

- the air cleaner (ACL)
- the protective cover for the throttle housing
- the protective cover from the connector bracket fire wall

- the battery and battery clamp
- the protective cover over the battery
- the battery positive lead.

15. Connecting the battery and checking function

Turn the ignition to position II.

Warning!
Ensure that no one is in the car when the battery is connected.

Connect the battery negative lead.

Re-enter the radio code.

Set the car clock to the correct time.

Function test:

Turn the ignition off press down the brake pedal a few times until there is no longer any negative pressure (vacuum) in the brake servo.

Turn the ignition key to position II and listen for the operation of the additional vacuum pump. The vacuum pump stops after a short time.

Start the engine and let it idle.

Press down the brake pedal a few times and check whether the additional vacuum pump starts working.

Technical Service Bulletin # **TNN20-05** Date: **070131**

Engine - Lubrication System Contamination Cleaning

NO: 20-05
DATE: 1-31-2007
MODEL: All Models
YEAR: 1999-
SUBJECT:
Procedure for Cleaning Engine Oil System Contamination.
REFERENCE: VIDA

DESCRIPTION:

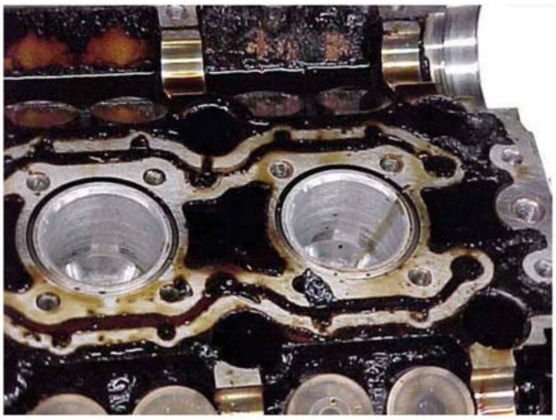
Material	Quantity	Part No.
ACEA A1/B1,SAE 5W-30 Synthetic oil	*	
Oil filter	1	*
Oil decal	1	30748024
Oil trap	**	*
Hose, oil trap/engine block	**	*
Oil sump	**	*
Big-end bearing	**	*
Cylinder head gasket	**	*
Liquid gasket	**	*
Camshaft seal	**	*
Induction gasket	**	*
Manifold gasket	**	*
Valve stem seal	**	*
VVT solenoid filter	**	*
Oil suction line	**	*
Oil pressure switch	**	*
Pressure oil line (turbo)	**	*

* depending on variant
** depending on diagnosis and variant

This TNN provides the customer with an alternative lower cost repair rather than engine replacement. It may be required to perform such cleaning if the engine has been contaminated due to the use of engine oil additives, use of engine oils that do not meet the manufacture's requirements, or not following the manufacture's recommended oil change intervals. Any engine related damage caused by the conditions stated is not considered warrantable.

SERVICE:

Introduction



One or more of the following conditions could cause the engine oil to thicken and leave deposits in the engine:

- wrong oil grade, quality and/or viscosity
- cars driven too many miles between oil changes
- cars frequently driven short distances with many cold starts
- excessive idling
- fuels of low quality and/or with high alcohol content
- additives added to oil or fuel
- high ambient temperature
- high air humidity

Symptom

Possible symptoms are indicated as follows:

- Illuminated oil pressure lamp. Due to clogged oil suction strainer to oil pump and/or oil filter (see illustration)

- Noise (whistling)
  Noise due to high pressure in crankcase. Stops when the oil filler cap is removed. For model year 99-02, see TNN 25-149B

- Poor driveability
  Clogged crankcase ventilation can reduce the engine performance

- Uneven/oscillating idling
  Caused by clogged crankcase ventilation.

- Oil leak
  from engine seals due to restricted crankcase ventilation

- Noise (knocking)
  Low oil pressure can cause premature bearing wear

- High oil consumption / noise from turbo.
  Damaged bearing or seals in the turbo can cause these symptoms

If one or more of these symptoms presents itself, and an extremely dirty oil filler cap or screen is found, troubleshoot in the following order.

Diagnostics

IMG-245347

The first step is to inspect the oil filter to see if it is abnormally dirty.
An abnormally dirty filter is easily recognized by its thick, black deposits.
Engines with spin-on oil filters can be inspected by sawing the filter in half.

Oil trap check

IMG-245348

If the engine has a problem with carbon deposits, the passageways in the engine block and oil trap may be completely or partially clogged. See illustration. Remove and check the oil trap, hoses and their passageways in the engine block. There should not be any major collections of carbon deposits in the hoses or in the passageways in the block.

Oil sump/crankcase check

See information in VIDA for engine variant in question.
Drain the engine oil.
Remove the oil sump and check the oil sump and crankcase for deposits.
Normally, there should not be any deposits. A slight light brown discoloration is however normal.

IMG-245349

IMG-245350

The figures show an engine with heavy deposits.
Check the suction strainer on the oil suction line for contaminants and deposits.

If no trace of deposits has been found, no further checks are necessary and fault tracing can be considered complete.

If deposits have been detected in any of the above steps, follow the instructions below to remedy the problem.

Checking big-end bearings

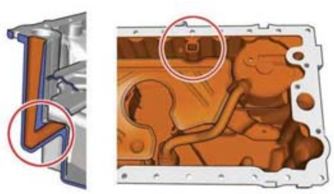
See information in VIDA for engine variant in question.

Note!
Mark the position of the big-end bearing caps.

Remove and check the big-end bearings for cylinder 2.
If the bearings are undamaged, reinstall the bearings and caps as marked.
If big-end bearing no.2 is damaged, replace all big-end bearings.

Note!
If any bearing is damaged, check the crankshaft for scratches.

If the crankshaft is damaged, discontinue troubleshooting and replace the engine.



Cleaning the oil sump

Clean the inside of the oil sump by removing any loose deposits.

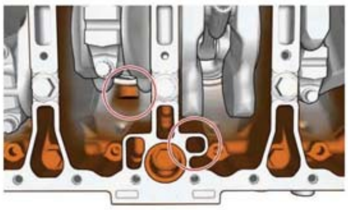
Note!
Make sure that the oil sump passageway from the oil trap is fully cleaned. See illustration. Blow clear with compressed air to ensure the duct is thoroughly cleaned.

Then clean the oil sump as described in the next step.
If it is not possible to properly clean the oil sump, oil sump replacement should be considered.

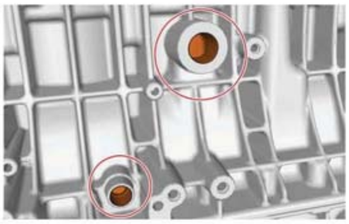
Cleaning/Washing

Washing should be done in a parts cleaning machine at no less than 70°C / 158°F for at least 30 minutes. Repeat if necessary. It is a good idea to change the position of the components several times during the cleaning/washing procedure.

Blow dry with compressed air after washing.



IMG-245353



IMG-245354

Cleaning the engine block

Clean the engine block passageway from the oil trap and the oil trap passageway in the block.
Use a screwdriver or similar small scraping tool and blow the passageways clean with compressed air.
Perform a general cleaning of the crankcase to remove all the carbon deposits. All loose deposits must be thoroughly cleaned.

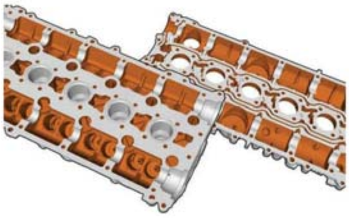
Cleaning cylinder head

Note!
Remove the cylinder head from the engine before cleaning.

With the cylinder head removed from the engine. Use the information in VIDA for the variant in question.

Remove:

- valves
- springs
- valve stem seals.



Remove carbon deposits with a suitable tool, knife, scraper or the like. Then wash the cylinder head and cam carrier cover in a parts cleaning machine as described in step 8.

Note!
The VVT (Variable Valve Timing) unit and VVT solenoid must not be washed in a parts cleaning machine. Blow clean only.

Caution!
Be sure to lubricate the valve guides after washing in a parts cleaning machine to prevent the risk of corrosion!

Install the cylinder head

Install

- new valve stem seals
- valves
- springs
- new filter for VVT solenoid. (Does not apply to S40 (04-)/V50).

Install the cylinder head. Use information in VIDA for the variant in question.

Rebuilding the engine

Note!
Use new components.

Install:

- new oil suction line
- well cleaned or new oil sump
- new oil trap with new hoses and clamps
- new oil pressure switch
- new oil delivery line for turbocharger when applicable.

Engine oil, first change

Clean the oil filter casing and install the new oil filter.
Fill with new Synthetic Oil; this will assist in continuing the cleaning process. ACEA A1/B1, viscosity SAE 5W-30

Note:
Engines subjected to extreme driving conditions are to be filled with ACEA A1/B3, viscosity SAE 5W-30 Synthetic oil.
"Extreme" regards driving conditions that generate abnormally high oil temperature or oil consumption, such as driving in mountains with a lot of engine braking or when driving at high speeds on highways.
ACEA A3/B3, viscosity SAE 5W-30 Synthetic oil.

Customer information

Affix the oil decal (part no.30748024) on the upper radiator member. Remove any existing decal.

Caution!
Make sure that the customer is aware of the importance of following the prescribed oil change intervals and the benefits of using Synthetic oil to prevent engine oil deposits from reoccurring. Use the Synthetic oil grades specified in step 13.

Follow up oil and filter change

Drive 2,000 km/1,200 miles and then replace the oil and filter. Use one of the Synthetic oil grades specified at step 13.

Caution!
Follow the recommended oil change interval that applies to the vehicle in question.

Technical Service Bulletin # **TNN43-56** Date: **080421**

A/T - Cooler/Line Flushing When Replacing A/T

NO: 43-56
DATE: 4-21-08
MODEL: All
MODEL YEAR: All
CHASSIS: N/A
SUBJECT:
Automatic Transmission Cooler/Lines Flushing
REFERENCE: VIDA, TNN 43-08, TNN 43-48

Note!
If this is a printed version of a TNN, first check for the latest online version.

Description:
The purpose of this Tech Net Note is to work as a guideline for technicians when an automatic transmission is being replaced. In order for modern automatic transmissions to properly adapt to transmission wear while maintaining comfortable shift quality, the pressure control is closely monitored. For this reason, the automatic transmission fluid (ATF) must meet the transmission manufacturer's specifications.

A faulty transmission often has debris in the ATF, the coolers, the lines, and throughout the transmission. This debris must be properly flushed out before a new transmission is installed. Flushing the ATF using the transmission oil pump of the newly installed transmission will not suffice and can possibly cause damage to the new unit. Depending on the condition of the ATF, the transmission coolers and lines may need to be replaced. The information below is copied directly from VIDA.

Service:
Once a transmission is properly diagnosed to be faulty and needs to be replaced, it is important that the proper procedures are followed for flushing out the used ATF from the ATF coolers and lines. Note that some vehicles have two coolers; the cooler in the side of the radiator and the auxiliary cooler.

When an automatic transmission is replaced, follow TNN 43-08 to properly fill out the Automatic Transmission Diagnostic Sheet and follow VIDA to reset adaptive memory. Simply disconnecting the TCM (Transmission Control Module) or power from the TCM does not reset adaptive memory!

On all vehicles, always flush the radiator, coolers, and lines before installing the new transmission. The guidelines and procedures for flushing vary with each model.

There is a procedure for flushing coolers and lines found in a hyperlink in the VIDA transmission/gearbox installation procedure called Transmission, preparations before installing for AW (Aisin Warner) 5- and 6- speed automatics and in the VIDA transmission replacement procedure for the AW 4-speed automatic.

The guidelines for flushing coolers on a GM 4165 4-speed automatic are in VIDA/Information/Repair/Transmission, removing and there is a hyperlink in
VIDA/Information/Repair/Transmission, installing for a flushing procedure called Oil cooler; flush cleaning. The guidelines for the 1999-2005 S80 will be updated to match the XC90. More details about these guidelines can be found below.

On a GM 4165 (2003-2005 XC90 16 and 1999-2005 580 6-cyl), if there is:

^ glycol in the transmission fluid (refer to TNN 43-48 for more information on checking for glycol contamination), this would indicate an internal leak in the radiator requiring radiator replacement and flushing of the auxiliary cooler (if applicable) and cooler lines.

^ metal in the transmission fluid, this would indicate an internal transmission problem.

Note!
Metal in the ATF is nearly impossible to flush out completely. In order to be rid of all metal particles, complete replacement of the ATF cooling system (radiator, auxiliary cooler [if applicable], and cooler lines) is required. See photo. Black sediment on the pan magnet is normal. See photo.

^ dirty oil or oil that has surpassed its temperature limits, this would indicate friction component (band or clutch disc) breakdown and in order to be sure all of the debris is out of the ATF cooling system, complete replacement of the ATF cooling system (radiator, auxiliary cooler [if applicable], and cooler lines) is required. See photo.

Labor operation code 43720 should be used when the oil pan is removed for diagnostic purposes. Labor operation code 49115 should be used when the ATF cooling system is flushed, not replaced.

WARRANTY CLAIM INFORMATION		
LABOR OP	LABOR DESCRIPTION	LABOR TIME
43720	Sump automatic gearbox remove-install	See VSTG
49115	Oil cooler and piping clean	See VSTG

Warranty Claim Information

Technical Service Bulletin # **TNN39-51** Date: **080416**

Audio System - Stuck CD's in Audio Units

NO: 39-51
DATE: 04-16-2008
MODEL: ALL
M. YEAR: ALL
SUBJECT:
STUCK CD's IN AUDIO UNITS (ALL MODELS)

This Tech Note supersedes the previous 39-51 dated 10-10-05. Please update your files.

ATTENTION: PARTS MANAGERS, SERVICE MANAGERS AND WARRANTY ADMINISTRATORS

Description:
This document describes the process for returning audio units diagnosed with stuck CDs. Below are two basic procedures to use as applicable.

IMPORTANT:

IF A COMPACT DISC UNIT HAS BEEN DIAGNOSED WITH A DEFECT OTHER THAN STUCK CD'S, PLEASE BE SURE TO EJECT THE CD'S FROM THE UNIT WHILE IT IS STILL CONNECTED TO THE VEHICLE BEFORE RETURNING TO TMA OR YOUR LOCAL DC. PLEASE ENSURE THAT THE CD'S ARE PROMPTLY RETURNED TO THE CUSTOMER.

Procedure # 1: TMA WARRANTY RETURNS
For all audio units that are requested to be returned to TMA for testing and analysis.

Compact Discs may get stuck in the CD-Changer drive. If this occurs, DO NOT ATTEMPT to remove them.

Please fill out the attached CD Return Form completely and legibly. The form must be visible inside the audio box. It is mandatory that you fill in the customer's full name and complete address on the CD Return Form.

Return the CD return form and the audio unit to TMA per established shipping instructions as detailed in SMB 00-170.
Upon removal, customers CDs will be mailed to the Customer per the information on the CD Return Form within 2-3 weeks of receipt.

IMPORTANT NOTE:

IT IS IMPORTANT THAT YOU INCLUDE THE CD RETURN FORM WITH THE DEFECTIVE UNIT. IF THE CD RETURN FORM IS NOT INCLUDED WITH AN AUDIO UNIT DIAGNOSED WITH STUCK CD'S, AND YOU DO NOT INCLUDE THE CUSTOMERS RETURN ADDRESS, YOU WILL BE RESPONSIBLE FOR REIMBURSING THE CUSTOMER FOR THEIR CD'S. VOLVO WILL ONLY OPEN AND REMOVE CD'S FROM CHANGERS THAT ARE RETURNED WITH THE CD REMOVAL FORM.

Note:

Audio units tampered with or opened, or damaged from foreign objects inserted into mechanism drives (e.g. coins, business cards or visibly evident peeling CD-R labels) will not be covered under warranty.

IMPORTANT:

Please wait for the TMA Parts Return Request before returning these units.
Please ensure that all TMA Warranty claims, TMA Warranty Core reports and the CD Form are included with the unit.

Procedure # 2: STRAIGHT CORE RETURNS
For returning a non-requested or non-warranty audio core unit to you local Distribution Center with a CD Changer diagnosed with stuck CD's.

Please fill out the attached CD Return Form completely and legibly. The form must be visible inside the audio box.
It is mandatory that you fill in the customer's full name and complete address on the CD Return Form.

Continue to include all applicable Core Reports with the units. Return the unit to your local Distribution Center.

The local Distribution Center will process the units and forward the units to the refurbishment facility. CDs will be removed by the refurbishment facility. The CDs will be returned to the customer per the information on the CD Return Form. This process may require more than 3 weeks, depending upon the audio unit type and the refurbishment facility.
In order for this process to be successful, the attached CD Return form must be filled out and visible inside of the audio box with the audio unit and the customer's name and complete address filled out.

IMPORTANT NOTE:

IT IS IMPORTANT THAT YOU INCLUDE THE CD RETURN FORM WITH THE DEFECTIVE UNIT. IF THE CD RETURN FORM IS NOT INCLUDED WITH AN AUDIO UNIT DIAGNOSED WITH STUCK CD'S, AND YOU DO NOT INCLUDE THE CUSTOMERS RETURN ADDRESS, YOU WILL BE RESPONSIBLE FOR REIMBURSING THE CUSTOMER FOR THE COST OF THEIR CD'S. VOLVO WILL ONLY OPEN AND REMOVE CD'S FROM CHANGERS THAT ARE RETURNED WITH THE CD REMOVAL FORM.

Note:

Audio units damaged from foreign objects inserted into mechanism drives (e.g.. coins, business cards or visibly evident peeling CD-R labels) may result in a loss of core credit.

ATTENTION PARTS MANAGER

CUSTOMER CD RETURN FORM

For Audio Components Diagnosed with Stuck CDs

Please ensure all information is filled out and attach to the defective unit

Retailer Code ____________________ RO# ____________________

VIN ____________________ Part # ____________________

Contact Person ____________________ Phone ____________________

PLEASE FILL IN THE CUSTOMER'S SHIPPING ADDRESS BELOW

Customer Return Shipping address

____

____

____

IMPORTANT NOTE!
IT IS IMPORTANT THAT YOU INCLUDE THE CD RETURN FORM WITH THE DEFECTIVE UNIT.

IF THE CD RETURN FORM IS NOT INCLUDED WITH AN AUDIO UNIT DIAGNOSED WITH STUCK CDs, AND YOU DO NOT INCLUDE THE CUSTOMERS RETURN ADDRESS, YOU WILL BE RESPONSIBLE FOR REIMBURSING THE CUSTOMER FOR THE COST OF THEIR CDs. VOLVO WILL ONLY OPEN AND REMOVE CDs FROM CHANGERS THAT ARE RETURNED WITH THE CD REMOVAL FORM.

Customer CD Return Form

Technical Service Bulletin # **TJ19292** Date: **080623**

A/C - Cleaning for System Odors

Retailer Technical Journal 19292
Climate control system, cleaning

Date 6-23-2008

Reference: VIDA, Special Tools Bulletin 163

Note!

If using a printed copy of this Retailer Technical Journal, first check for the latest online version.

AFFECTED VEHICLES:

Models	Type	Model year	Chassis range
ALL	ALL	ALL	ALL

AFFECTED VEHICLES:

DESCRIPTION:

A new tool and cleaning treatment designed to disinfect the climate system
has been introduced. Should a customer report a climate system odor the below should be treated, checked, and replaced. Included in this document is information related to the tool, treatment and how to locate the instructions for use.

- Ensure the odor is not from some other source and all other A/C system checks have been completed. (No water standing underneath the floor carpets.)

- There are no refrigerant leakages (not PAG oil causing the odor).

- Climate housing drain hose is installed correctly, not clogged - drains sufficiently.

MATERIAL:

Description	Quantity	Part Number
Cleaning Agent	1 per vehicle treatment*	1161837

NOTE: Each retailer will receive four (4) cases (12 bottles / per case) of the cleaning agent on or about 7-1-2008. To order additional use the part number listed above, stock order only, quantity 1 equals 1 case.

TOOLS:

Description	Quantity	Part Number
Aircomatic II	1	9814105

NOTE: Each retailer will receive one (1) tool on or about 7-1-2008.

- Aircomatic treatment; tool and treatment agent listed.

- After the treatment is completed; replace the climate system (pollen) filter.

- Engage the Afterblow function on applicable vehicles, see separate instructions for afterblow engagement.

S60	2001 -
S80	1999 - 2006
V70, XC70	2001 - 2007
XC90	2003 –

Up through 2002 Afterblow was activated from the factory, 2003 and later Afterblow will be Retailer activated only.

NOTE:
At the time of this writing afterblow, is applicable to the vehicles listed:

For reference here are pictures of the cleaning agent and tool.

SERVICE:

To complete the treatment with the Airomatic unit and cleaning agent see VIDA instructions:

- Vehicle Profile / choose the appropriate vehicle - select OK
- Information
- Cleaning, Inspection and Adjustment
- 8 Body and Interior
- 87 Climate units
- 870 general
- Climate control system, general
- Climate control system, cleaning

NOTE:
This treatment is designed to last 6 - 12 months and may need to be completed again sometime in the future.

As noted in VIDA: "An odor is present for a few days after cleaning, which is usual". The odor is of a perfume type and be sure to advise the customer of this.

WARRANTY CLAIM INFORMATION

LABOR OP	LABOR DESCRIPTION	LABOR TIME
87376	Climate control system, cleaning	
	C30, S40 (2004.5 -), V50, C70 (2006 -)	0.3 hrs
	S60	0.5 hrs
	XC90, S80 (1999 – 2006), V70 (2000 – 2007), XC70 (2001 – 2007)	0.6 hrs
	All New S80 (2007 -), All New V70 & XC70 (2008 -)	0.3 hrs

Claims may be submitted under the new car warranty when there is a documented customer complaint using claim type: 01

WARRANTY CLAIM INFORMATION