Engine Management and Emission System (2,0 Litre Cosworth Variants) 29L

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IMPORTANT NOTE - INTERIOR COURTESY LIGHT DELAY FUSE

When performing breakout box checks, in addition to ensuring all electrical loads are switched off, it is essential to remove the interior light delay fuse, located in the fuse box. Failure to remove this fuse will cause erroneous resistance readings. Ensure the fuse is refitted on completion of the breakout box checks.

RS COSWORTH

The SIERRA RS COSWORTH is fitted with turbocharger and a new electronically controlled injection/ig tion system.

This injection/ignition system plays an important part in achieving the high degree of performance and reliability in the Cosworth engine, by giving an increased precision in the metering of the air-fuel ratio and by optimising the control of the engine timing.

The injection/ignition system comprises

- the engine management module
- the control sensors (signal transmitters) supplying engine operating data to the module and the injectors, ignition amplifier module and speed control valve which are controlled by the module.

Effects of the air-fuel ratio and engine timing.

Accurate control of the air-fuel ratio and ignition timing are essential to achieve full performance of the SIERRA RS COSWORTH engine. Ideal air-fuel ratio will ensure optimum combustion. An incorrect air-fuel ratio will result in the mixture being too lean or too rich which will impair engine performance, fuel consumption and ultimately exhaust emissions.

The electronically controlled injection/ignition system optimises engine efficiency under all opera g conditions (start-up in cold weather, driving off, part-throttle and full-load operation).

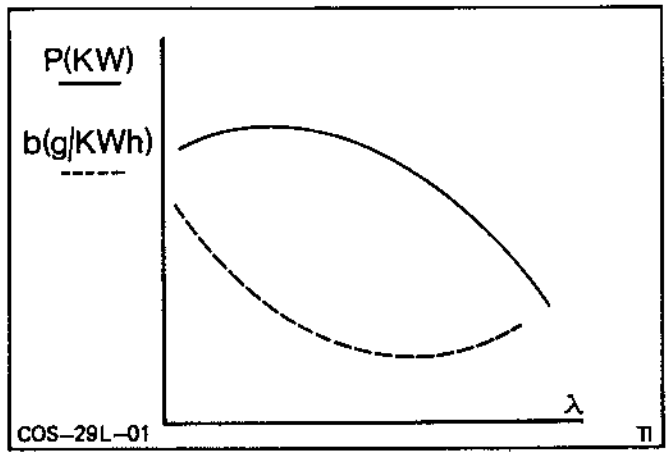


Fig.1 Effect of the air-fuel ratio on performance and specific fuel consumption.
P - Performance
b - Specific fuel consumption
λ - Air fuel ratio

Effect of the air-fuel ratio on performance and specific fuel consumption.

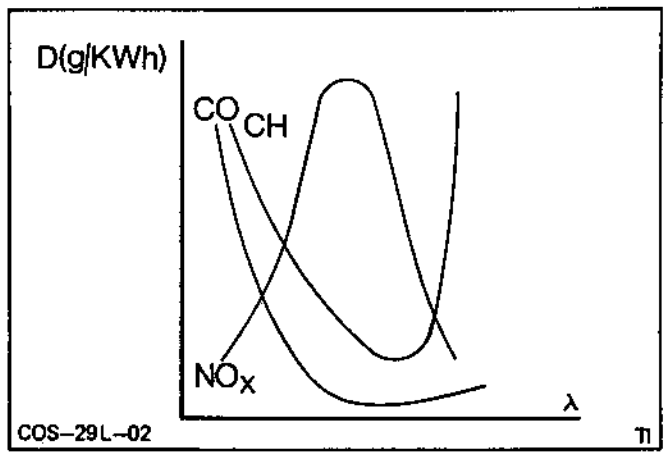


Fig.2 Effect of the air-fuel ratio exhaust emission.
D - Exhaust emissions
CO - Carbon monoxide
CH - Hydrocarbon
NOx - Oxides of nitrogen
λ - Air fuel ratio

Effect of the air-fuel ratio exhaust emissions.

To measure the intake-air volume, the SIERRA RS COSWORTH injection/ignition system uses engine speed and air density. On the basis of the known air volume, the quantity of fuel is metered to achieve the desired air-fuel mixture. Sensors in the system are used to adjust the basic air-fuel mixture to all specific operating conditions.

Engine speed and intake-air density data enables the module to calculate the optimum ignition timing in all operating conditions.

The air-intake volume for each cylinder and working stroke is dependent on the following parameters:
- air density in the inlet manifold and swept volume.

The module calculates the air density from the pressure and temperature of the intake air. This data is stored in the module and the injectors are controlled in relation to the engine combustion sequence Depending on engine load, the delivery of fuel to each cylinder may commence before the intake stroke starts and continue until the power stroke has begun. The duration of the injection process is determined by the module.

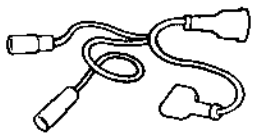
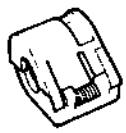
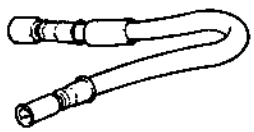
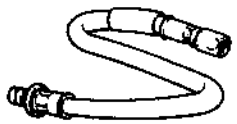
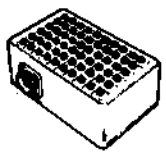
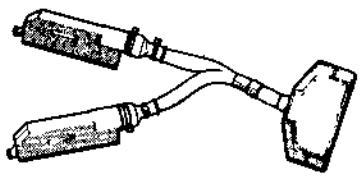
The overall system comprises three sub-systems:

- fuel system
- air intake/exhaust and turbo system
- injection/ignition system

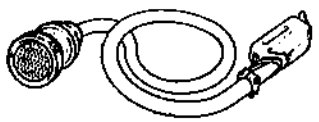
Fuel system	Comprising: tank, pump, filter, fuel rail, pressure regulator, fuel injectors. Fuel is injected into the intake port of each cylinder upstream of the inlet valve.
Air system	The system comprises: air cleaner, turbocharger, intercooler, intake manifold, throttle plenum butterfly assembly and idle speed control valve. Manifold absolute pressure (MAP) sensor, fuel pressure regulator, speed control valve and air temperature sensor are connected to the inlet plenum.
Electrical circuits (Sensor, general power supply)	Input signals are supplied to the module by the following sensors: MAP sensor, air temperature sensor, throttle butterfly potentiometer (to determine throttle opening), phase sensor (ignition distributor), coolant temperature sensor and engine speed/TDC sensor. Power is supplied to the module via: battery, ignition switch, power relay and fuse. Power is supplied to the fuel pump via: battery, ignition switch, power relay, fuel pump relay and fuse Ignition voltage is generated in the ignition coil by the ignition amplifier module, the precise ignition timing being controlled by the engine management module. The low tension side of the ignition coil is supplied via: battery and ignition switch. The high tension generated in the coil is fed to the spark plugs via the distributor. The fuel injectors are opened and closed by output signals fro the module.

SPECIAL SERVICE TOOL RECOGNITION

RS COSWORT

Tool	Tool Name
 23-021	Pressure gauge and hose
 23-022	Adaptor cable
 23-023A	Fuel hose remover
 23-024	Fuel pressure gauge
 23-024-02	Adaptor pipe
 23-024-03	Adaptor pipe
 29-001	Breakout box
 29-005	Test lead 'Y' cable

SPECIAL SERVICE TOOL RECOGNITION (cont'd) RS COSWORTH

Tool	Tool Name
 33-002	Test lead No.2

GENERAL EQUIPMENT

- Hand vacuum pump with gauge
- Tachometer
- CO meter
- Multimeter - a good quality electrical multimeter is essential for the breakout box test covered in this section. Use a multimeter recommended by the Ford Dealer Equipment Programme.

INTRODUCTION TO FAULT FINDING

When a fault occurs in the engine management system, it is easy to assume that pinpointing the fault must be a difficult task. This assumption sometimes leads to replacement of components unnecessarily in the hope that the fault may be rectified.

Fault finding techniques used on the 2,0 litre Cosworth system differ from those used on mechanically adjusted fuel and ignition systems. With mechanically adjusted systems, fault finding is generally based on first hand experience of problems previously encountered, and inspection of components for confirmation. This is not the case with electronic systems, but this does not mean fault finding is more complicated. In fact it is simpler, because a fault can be pinpointed exactly, providing the test procedures detailed in this section are followed.

When carrying out checks on a Cosworth system, it is vital to remember that the module relies on correct information from its sensors and correct operation of its actuators, to perform efficiently.

It is worth pointing out that effective fault finding in modern electronic equipment does not necessitate a detailed understanding of electronics. It is essential however, when carrying out fault finding, that you should follow rigidly the procedures laid down in this section. Do not follow hunches. Following the procedure will ensure that all faults are traced. If a fault is found, continue through the complete routine as more than one fault may be present. This will prevent repeat repairs.

Complaints are broken down into various engine or drive faults. Carry out the appropriate fault finding procedure as listed below for the relevant drive/engine fault. Do not deviate from the fault finding procedure in an attempt to diagnose the concern with greater accuracy.

One important aspect of fault finding on this system, is to gain as much information as possible from the customer in order to categorise the complaint. Fault Finding procedures detailed in this section are divided into six categories.

These Categories are:

- Engine cranks but will not start.
- Poor driveability/performance.
- Engine misfires/cuts out.
- Poor fuel economy (vehicle drives O.K.).
- Erratic idle/incorrect idle.
- Engine difficult to start.

Having decided into which category the complaint falls, reference must be made to the fault finding procedure. Do not immediately assume that the fault is electrical. The fault finding procedures will identify whether it is a mechanical or electrical fault.

W A R N I N G

- High tension voltage produced by a breakerless ignition system is approximately 25% higher than for a conventional ignition system. When carrying out service operations on a vehicle equipped with breakerless ignition, it is important to be aware of this as well as all the usual safety measures, to prevent the possibility of electric shocks.
- Certain procedures require the use of a fuel pressure gauge. It should be noted that the system remains pressurised. When removing fuel lines, ensure that adequate safety precautions are taken to prevent fuel spillage.

BREAKOUT BOX CHECKS

The Ford Breakout Box (Special Tool No. 29 001) and Test Lead (Special Tool No. 33 002) are to be used in conjunction with a suitable multimeter (Keithley, Siemens or AVO available from the FDEP) for electrical checks on the Engine Management System. The multimeter must have an input impedance of at least 20,000 ohms/V and should be capable of measuring voltage and resistance.

NOTE: It is essential that the basic engine checks for the relevant drive engine concern are carried out before the breakout box checks.

Care should be exercised when using a multimeter to measure resistance. Resistance measurements MUST NOT be made on electronic control assemblies unless otherwise directed, as this could damage their internal circuitry. It is good practice when working with a multimeter to work from a higher range downwards to avoid damaging the instrument.

IMPORTANT NOTE: ALL PIN NUMBERS SHOWN IN FAULT FINDING CHARTS WITHIN FORD WORKSHOP MANUALS REFER TO THE PIN NUMBERS OF THE BREAKOUT BOX, NOT THE MULTIPLUG. IT IS IMPORTANT TO NOTE THIS FEATURE AS THE NUMBERS ON THE MULTIPLUGS AND THE BREAKOUT BOX DO NOT NECESSARILY CORRESPOND.

When performing the breakout box checks, the following should be adhered to:

- Carry out complete breakout box procedure
- Checks are to be carried out without disturbing connectors, except where specified
- Wiggle associated connectors on the circuit being checked whilst the multimeter is connected. If readings fluctuate, this indicates a connector failure which may cause an intermittent fault.
- When checking wiring continuity between a connector and the breakout box, care must be taken when probing the connector to avoid damaging the pins. Only use suitable test probes.

To assist you in tracing wiring faults when carrying out the test procedures, a vehicle schematic can be found on the fold-out immediately preceding the checks. If left folded out, the wiring diagram can be used as reference on the following checks.

IMPORTANT NOTE:

Remove interior light delay fuse from fuse box, before performing breakout box checks, refer to illustration. Failure to remove the fuse WILL cause erronious resistance readings. Ensure all electrical loads are 'off' e.g. radio, lights, etc.

Ensure fuse is refitted on completion of breakout box checks.

INDEX FOR FAULT FINDING CHARTS

Condition:

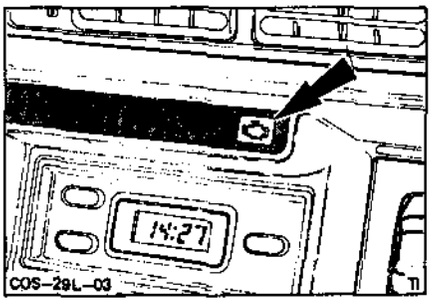
1. Engine cranks but will not start .. ..
2. Poor driveability/performance .. ..
3. Engine misfires/cuts out .. ..
4. Poor fuel economy (vehicle drives o.k.) .. ..
5. Erratic idle/incorrect idle speed .. ..
6. Engine difficult to start .. ..

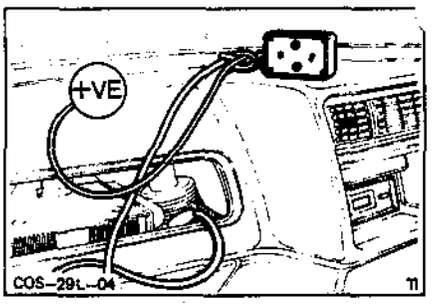
FAULT FINDING CHARTS

RS COSWORTH

Condition 1: ENGINE CRANKS BUT WILL NOT START

TEST	RESULT	ACTION
1		
• **Is engine management warning light continuously on?**	YES	Go to 2
	NO	Go to 3
2		
• **Does self test give an indication of system failure?**	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.





Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

NOTE: If the warning light on the instrument *panel does not remain* illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

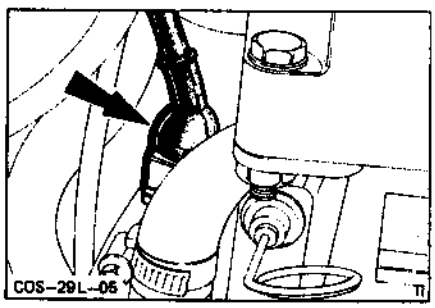
- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more *1 second on/off pulses.*
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

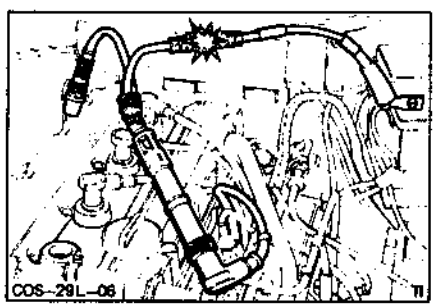
FAULT FINDING CHARTS

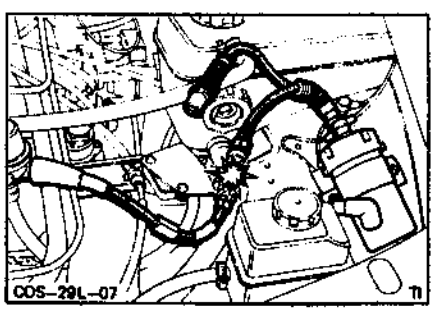
RS COSWORTH

Condition 1: ENGINE CRANKS BUT WILL NOT START

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is battery voltage above 7V when cranking?	NO	Tighten loose connections. Charge battery if necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		
4		
• Is fuel pump functioning correctly?	YES	Go to 5
	NO	Carry out breakout box test procedures.
Disconnect multiplug from engine coolant temperature sensor.		
Switch ignition 'on', do not start engine. Fuel pump should run for more than 1 second.		
5		
• Is HT available to all spark plugs?	YES	Go to 7
	NO	Go to 6
Remove No.1 spark plug lead from spark plug, connect safe-gap on plug lead and ground.		
Crank engine - spark should jump air gap, refit plug lead.		
6		
• Is coil producing HT?	YES	Check distributor cap for wear or cracks. Check rotor and resistance of coil and HT leads. Fit new parts as necessary, go to 7.
Remove ignition coil HT lead from coil, connect safe-gap lead into coil and onto a good ground, crank engine.		
Spark should jump air gap.	NO	If fault still evident, carry out breakout box procedure.
Remove safe-gap lead and reconnect HT lead into distributor.		





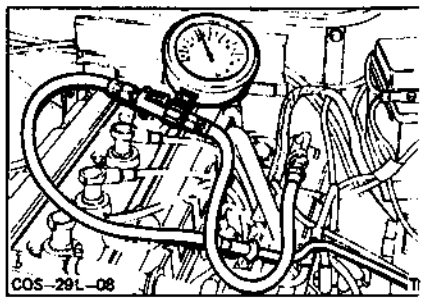


FAULT FINDING CHARTS

RS COSWORT

Condition 1: ENGINE CRANKS BUT WILL NOT START

TEST	RESULT	ACTION
7		
• **Is fuel system pressure to specification?** Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	YES	Go to 8
	NO	Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. Fit new fuel pump if fault still evident.
8		
• **Does engine start?**	YES	Remove pressure test equipment. Reconnect engine coolant temperature sensor. System O.K.
	NO	Go to 9
9		
• **Remove pressure test equipment. Reconnect engine coolant temperature sensor. Disconnect multiplug from engine management module and connect breakout box using the appropriate test lead.**		Carry out breakout box test procedures. (Refer to page 42).

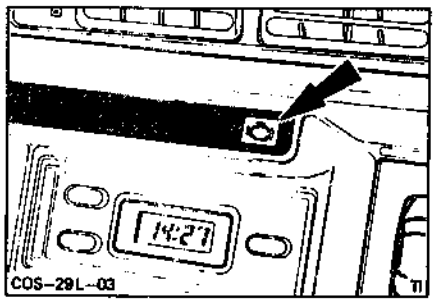


FAULT FINDING CHARTS

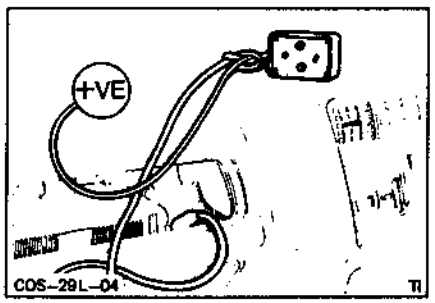
RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
1		
• **Is engine management warning light continuously on?**	YES	Go to 2
	NO	Go to 3



2		
• **Does self test give an indication of system failure?** Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground. NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given. Codes are read by counting the number of electrical pulses as follows: • LED will flash rapidly for 5 seconds, followed by a 1 second pause. • The first digit of the code will be one or more 1 second on/off pulses. • There will then be a 3 second pause. • The second digit of the code will be one or more 1 second on/off pulses. • LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.	YES	**For any code given refer to page 32.**
	NO	**Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.**

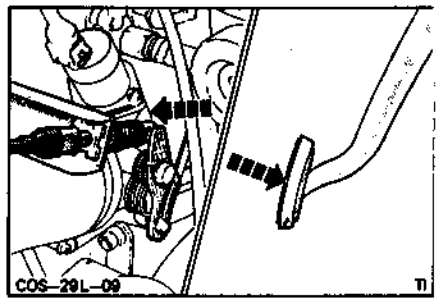


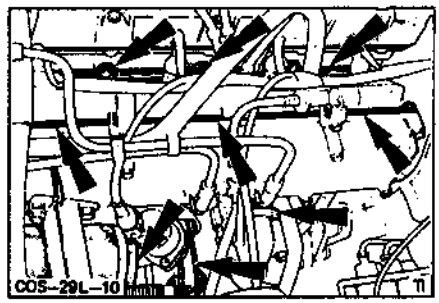
FAULT FINDING CHARTS

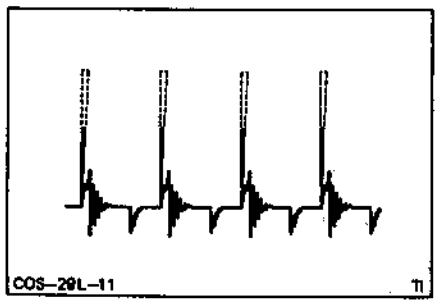
RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		
4		
• Is air intake system free from leaks and is air filter clean?	YES	Go to 5
Start engine and check for air leaks. Check air filter element.	NO	Rectify air leaks as necessary. Fit new air filter if required.
5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		
6		
• Is HT available to all spark plugs?	YES	Go to 7
Start engine and observe oscilloscope for HT output.	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.





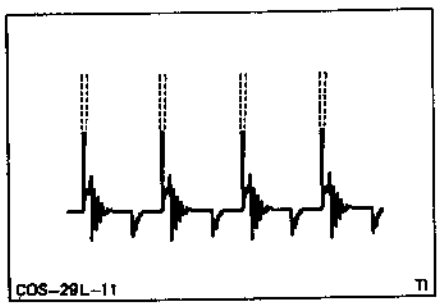


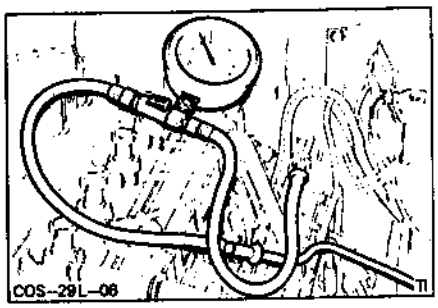
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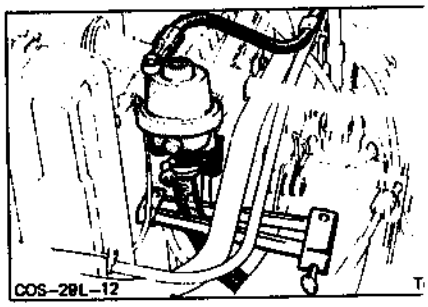
RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
7		
• Is spark plug voltage within limits? Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	YES NO	Switch 'off' engine and go to 8. Fit new spark plugs.
8		
• Is fuel system pressure to specification? Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	YES NO	Go to 9 Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.
9		
• Does fuel system maintain pressure? Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	YES NO	Go to 11 Go to 10
10		
• Does fuel pressure drop when fuel return line is clamped? Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line. Fuel pressure should not drop.	YES NO	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required. Fit new pressure regulator.





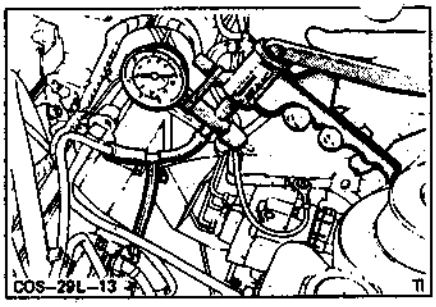


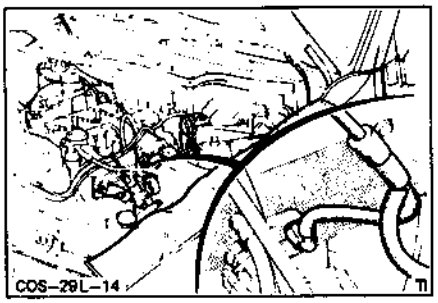
FAULT FINDING CHARTS

RS COSWORTH

Condition 2: POOR DRIVEABILITY/PERFORMANCE

TEST	RESULT	ACTION
11		
• Is fuel pressure correct at idle? Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm). Pressure should be 2,7 to 3,3 bar	YES NO	Go to 13 Go to 12
12		
• Is intake vacuum sufficient? Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.	YES NO	Fit new pressure regulator. Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.
13		
• Is idle CO% within specification? Connect CO meter, start engine and allow to idle. Check CO content in the normal way. CO% should be 1% to 2%.	YES NO	Go to 14 Adjust CO% as required, refer to Service Microfiche.
14		
• Is Turbo boost pressure to specification? Connect boost pressure test gauge. Road test vehicle and check boost pressure. Refer to the procedure on page 56.	YES NO	If there is still a drive/performance concern, carry out breakout box checks. Adjust boost pressure as required.



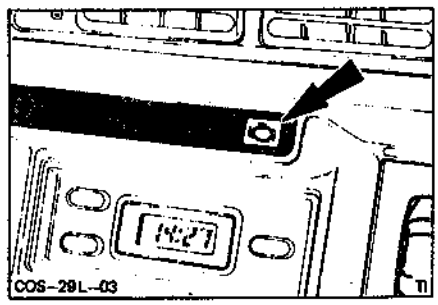


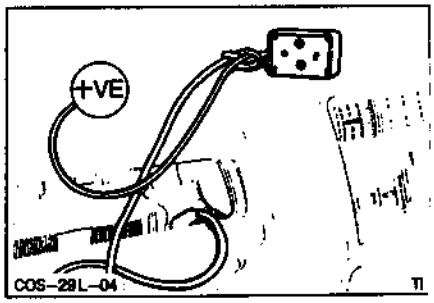
FAULT FINDING CHARTS

RS COSWORTH

Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
1		
• Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3
2		
• Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.





Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on' and switch LED to ground.

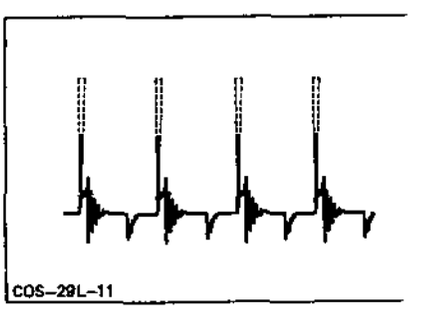
NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
3		
• **Are all electrical system connections clean and secure?**	YES	**Go to 4**
• **Is battery voltage above 7V when cranking?**	NO	**Tighten loose connections. Charge battery if necessary.**
• **Are vacuum and fuel lines in good condition?**		**Fit new fuel or vacuum lines as necessary.**
4		
• **Are all electrical connections in good condition?**	YES	**Go to 5**
	NO	**Repair loose wiring connections.**
Start engine and wiggle all electrical connections. Engine should continue to run smoothly.		
Do not wiggle HT connections.		
5		
• **Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.**		**Go to 6**
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		
6		
• **Is HT available to all spark plugs?**	YES	**Go to 7**
	NO	**Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.**
Start engine and observe oscilloscope for HT output.		

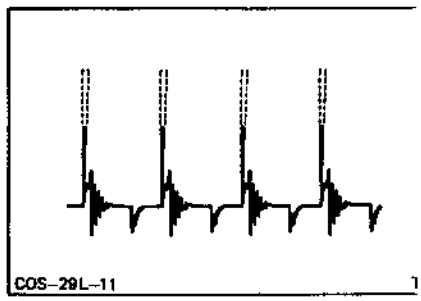

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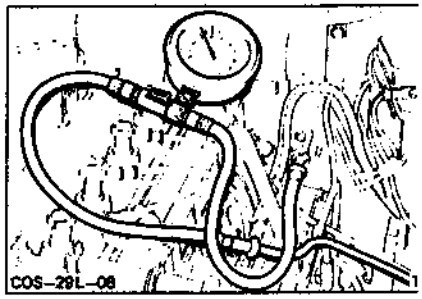
FAULT FINDING CHARTS

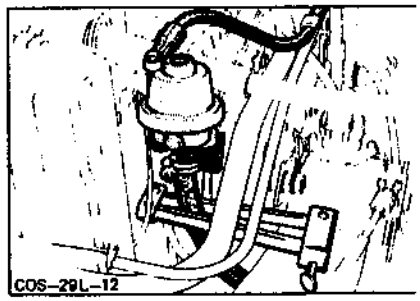
RS COSWORT

Condition 3: ENGINE MISFIRES/CUTS OUT

TEST	RESULT	ACTION
7		
• Is spark plug voltage within limits? Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	YES NO	Switch 'off' engine and go to 8. Fit new spark plugs.
8		
• Is fuel system pressure to specification? Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	YES NO	Go to 9 Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and Repeat test. If fault still evident, fit new fuel pump.
9		
• Does fuel system maintain pressure? Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	YES NO	Go to 11 Go to 10
10		
• Does fuel pressure drop when fuel return line is clamped? Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line. Fuel pressure should not drop.	YES NO	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required. Fit new pressure regulator.


COS-29L-11


COS-29L-08

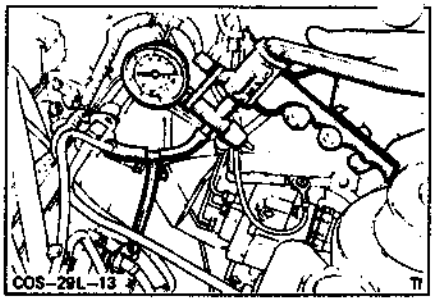

COS-29L-12

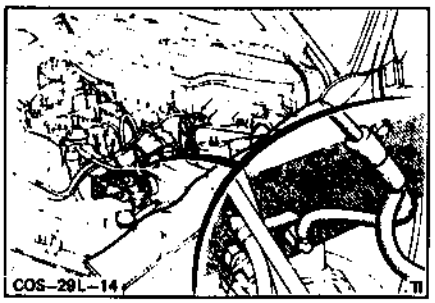
FAULT FINDING CHARTS

RS COSWORTH

Condition 3: ENGINE MISFIRES/CUTS OUT

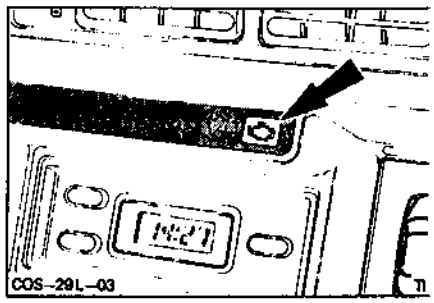
TEST	RESULT	ACTION
11		
• **Is fuel pressure correct at idle?**	YES	Go to 13
	NO	Go to 12
Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm). Pressure should be 2,7 to 3,3 bar		
12		
• **Is intake vacuum sufficient?**	YES	**Fit new pressure regulator.**
Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.	NO	**Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.**
13		
• **Is idle CO% within specification?**	YES	Go to 14
	NO	**Adjust CO% as required, refer to Service Microfiche.**
Connect CO meter, start engine and allow to idle. Check CO content in the normal way. CO% should be 1% to 2%.		
14		
• **Is Turbo boost pressure to specification?**	YES	**If there is still a misfire/cut out concern, carry out breakout box checks.**
Connect boost pressure test gauge. Road test vehicle and check boost pressure. Refer to the procedure on page 56.	NO	**Adjust boost pressure as required.**

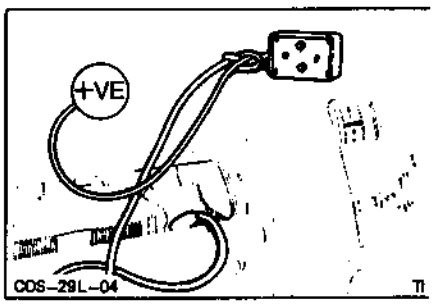




Condition 4: POOR FUEL ECONOMY (VEHICLES DRIVES O.K.)

TEST	RESULT	ACTION
1		
• Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3
2		
• Does self test give an indication of system failure?	YES	For any code given refer to page 32.
	NO	Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.





Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

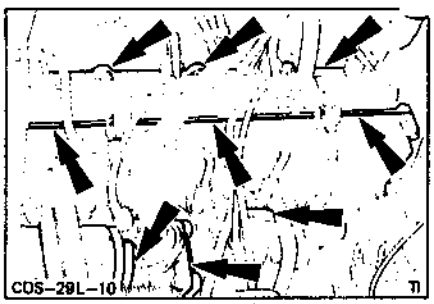
- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

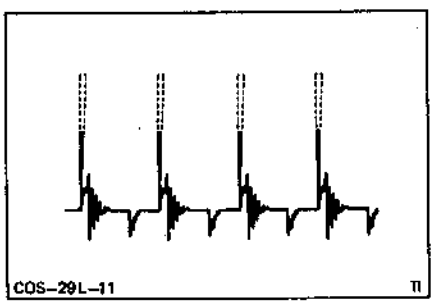
FAULT FINDING CHARTS

RS COSWORTH

Condition 4: POOR FUEL ECONOMY (VEHUCLE DRIVES O.K.) (cont'd)

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained? • Are vacuum and fuel lines in good condition?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
4		
• Is air intake system free from leaks and is air filter clean? Start engine and check for air leaks. Check air filter element.	YES	Go to 5
	NO	Rectify air leaks as necessary. Fit new air filter if required.
5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature. NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		Go to 6
6		
• Is HT available to all spark plugs? Start engine and observe oscilloscope for HT output.	YES	Go to 7
	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.



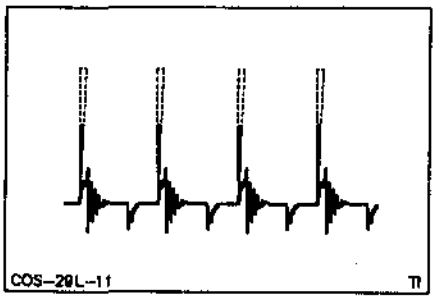


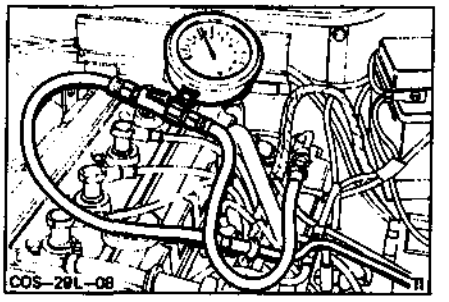
FAULT FINDING CHARTS

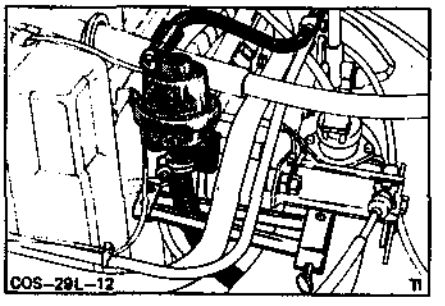
RS COSWORTH

Condition 4: POOR FUEL ECONOMY (VEHICLE DRIVES O.K.) (cont'd)

	TEST	RESULT	ACTION
7			
	• Is spark plug voltage within limits? Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	YES NO	Switch 'off' engine and go to 8. Fit new spark plugs.
8			
	• Is fuel system pressure to specification? Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	YES NO	Go to 9 Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.
9			
	• Does fuel system maintain pressure? Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	YES NO	Go to 11 Go to 10
10			
	• Does fuel pressure drop when fuel return line is clamped? Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line. Fuel pressure should not drop.	YES NO	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required. Fit new pressure regulator.

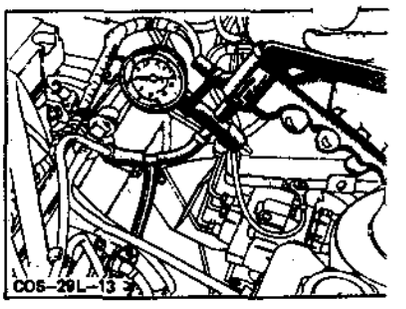


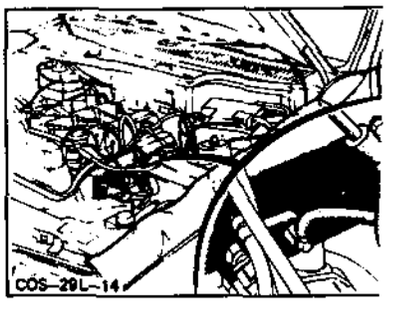




Condition 4: POOR FUEL ECONOMY (VEHICLE DRIVES O.K.) (cont'd)

TEST	RESULT	ACTION
11		
• Is fuel pressure correct at idle? Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm). Pressure should be 2,7 to 3,3 bar	YES NO	Go to 13 Go to 12
12		
• Is intake vacuum sufficient? Disconnect vacuum pipe from *fuel pressure regulator.* Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum *should be 40 to 60 cm Hg.*	YES NO	Fit new pressure regulator. Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder *compressions, rectify* as necessary.
13		
• Is idle CO% within specification? Connect CO meter, start engine and allow to idle. Check CO content in the normal way. CO% should be 1% to 2%.	YES NO	Go to 14 Adjust CO% as required, refer to Service Microfiche.
14		
• Is fuel consumption still high? Road test vehicle to determine fuel consumption.	YES NO	Carry out breakout box procedures. System O.K.



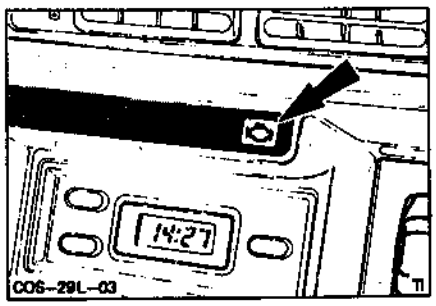


FAULT FINDING CHARTS

RS COSWORTH

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED

TEST	RESULT	ACTION
1		
• Is engine management warning light continuously on?	YES	Go to 2
	NO	Go to 3



2

• Does self test give an indication of system failure?

Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

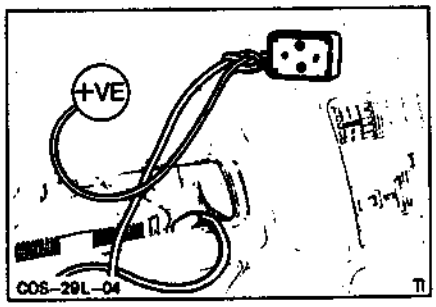
NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

YES — For any code given refer to page 32.

NO — Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.

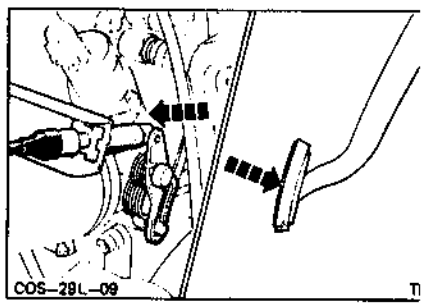


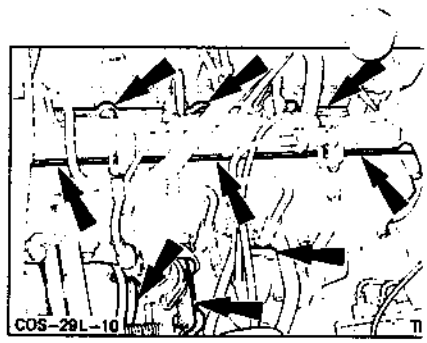
FAULT FINDING CHARTS

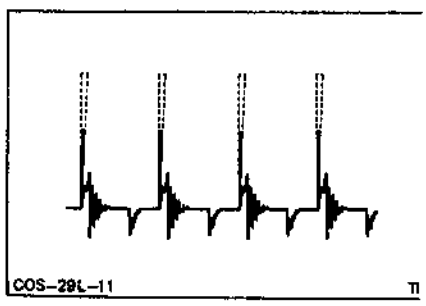
RS COSWORT

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		
4		
• Is air intake system free from leaks and is air filter clean?	YES	Go to 5
Start engine and check for air leaks. Check air filter element.	NO	Rectify air leaks as necessary. Fit new air filter if required.
5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		
6		
• Is HT available to all spark plugs?	YES	Go to 7
Start engine and observe oscilloscope for HT output.	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.



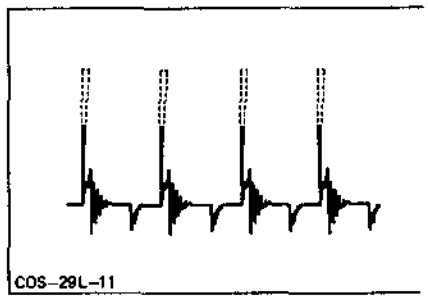


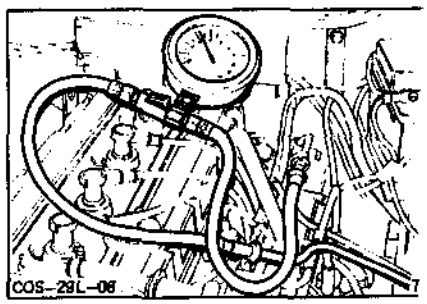


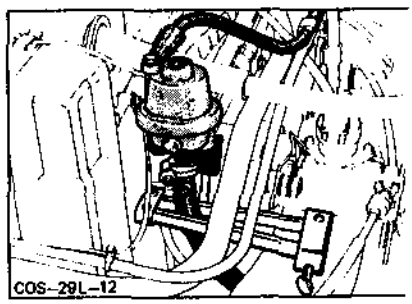
FAULT FINDING CHARTS

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

TEST	RESULT	ACTION
7		
• **Is spark plug voltage within limits?** Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	YES NO	Switch 'off' engine and go to 8. *Fit new spark plugs.*
8		
• **Is fuel system pressure to specification?** Connect pressure test equipment to fuel rail inlet, refer to illustration. Ensure valve on gauge is open and engine coolant temperature sensor is disconnected. Switch ignition 'on'. System pressure should be 3,2 bar to 3,8 bar.	YES NO	Go to 9 Check fuel system for leaks or damage. Fit *new filter/fuel lines* as necessary and repeat test. If fault still evident, fit new fuel pump.
9		
• **Does fuel system maintain pressure?** Visually check for leaks *before commencing* test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	YES NO	Go to 11 Go to 10
10		
• **Does fuel pressure drop when fuel return line is clamped?** Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line. Fuel pressure should not drop.	YES NO	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required. Fit new pressure regulator.


COS-29L-11

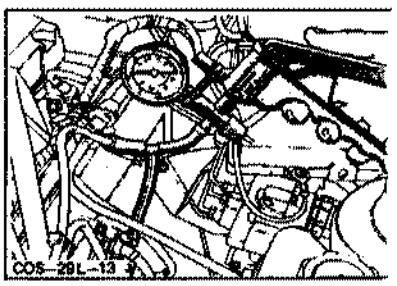

COS-29L-06


COS-29L-12

FAULT FINDING CHARTS

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

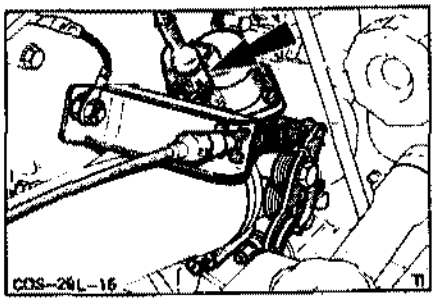
TEST	RESULT	ACTION
11		
• Is fuel pressure correct at idle?	YES	Go to 13
	NO	Go to 12
Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm). Pressure should be 2,7 to 3,3 bar		
12		
• Is intake vacuum sufficient?	YES	Fit new pressure regulator.
Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. With engine warm, vacuum should be 40 to 60 cm Hg.	NO	Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.
13		
• Is idle CO% within specification?	YES	Go to 14
	NO	Adjust CO% as required, refer to Service Microfiche.
Connect CO meter, start engine and allow to idle. Check CO content in the normal way. CO% should be 1% to 2%.		



FAULT FINDING CHARTS

Condition 5: ERRATIC IDLE/INCORRECT IDLE SPEED (cont'd)

TEST	RESULT	ACTION
14		
• Is base idle speed correct (850 rpm)?	YES	If engine idle is still erratic, carry out breakout box checks.
With engine at normal operating temperature, disconnect idle speed control valve. Start engine and measure base idle speed. Engine should idle at 850 rpm.	NO	Slacken locknut, adjust screw until correct engine idle speed is achieved. Tighten locknut and reconnect idle speed control valve. Note: When multipug is reconnected, idle speed may increase before return to 850 rpm.

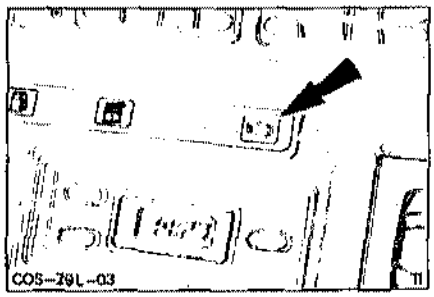


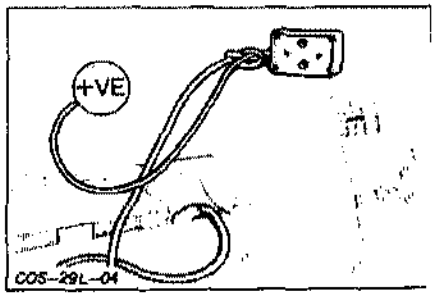
FAULT FINDING CHARTS

RS COSWORTH

Condition 6: ENGINE DIFFICULT TO START

TEST	RESULT	ACTION
1		
• **Is engine management warning light continuously on?**	**YES**	**Go to 2**
	NO	**Go to 3**
2		
• **Does self test give an indication of system failure?**	**YES**	**For any code given refer to page 32.**
	NO	**Switch ignition 'off', wait 5 seconds. Switch ignition 'on', codes should now be given.**





Remove cover above glove box. Connect LED tester to self test connection, connect red lead of tester to battery positive terminal. Switch ignition 'on', switch LED to ground.

NOTE: If the warning light on the instrument panel does not remain illuminated after the five second bulb check, no self test codes will be given.

Codes are read by counting the number of electrical pulses as follows:

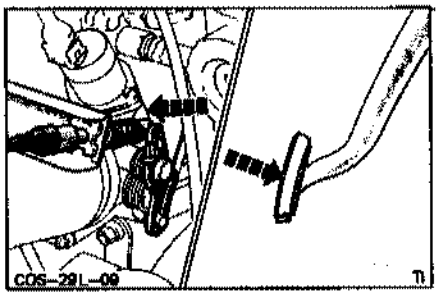
- LED will flash rapidly for 5 seconds, followed by a 1 second pause.
- The first digit of the code will be one or more 1 second on/off pulses.
- There will then be a 3 second pause.
- The second digit of the code will be one or more 1 second on/off pulses.
- LED will flash rapidly, before the series is repeated or a second code is given. Allow codes to be repeated at least twice to ensure all detected faults are given.

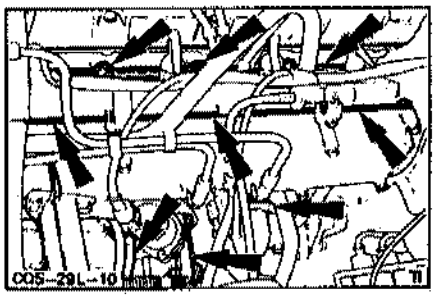
FAULT FINDING CHARTS

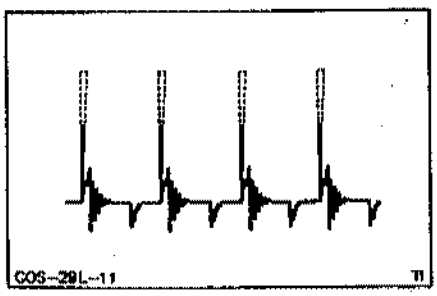
RS COSWORTH

Condition 6: ENGINE DIFFICULT TO START (cont'd)

TEST	RESULT	ACTION
3		
• Are all electrical system connections clean and secure?	YES	Go to 4
• Is accelerator cable moving freely and can full throttle be obtained?	NO	Tighten loose connections. Check, adjust or fit new throttle cable as necessary. Fit new fuel or vacuum lines as necessary.
• Are vacuum and fuel lines in good condition?		
4		
• Is air intake system free from leaks and is air filter clean?	YES	Go to 5
Start engine and check for air leaks. Check air filter element.	NO	Rectify air leaks as necessary. Fit new air filter if required.
5		
• Connect test set to engine in accordance with manufacturers' instructions. Start engine and allow to warm to normal operating temperature.		Go to 6
NOTE: For test set without oscilloscope, refer to manufacturers' procedures.		
6		
• Is HT available to all spark plugs?	YES	Go to 7
Start engine and observe oscilloscope for HT output.	NO	Examine distributor cap, rotor and coil tower for cracks or wear. Measure resistance of coil and HT leads, fit new parts as necessary.



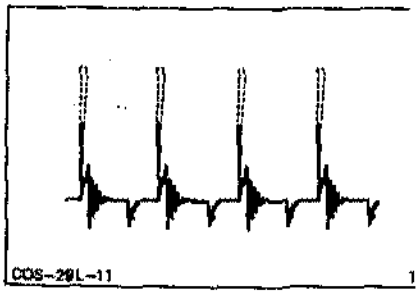


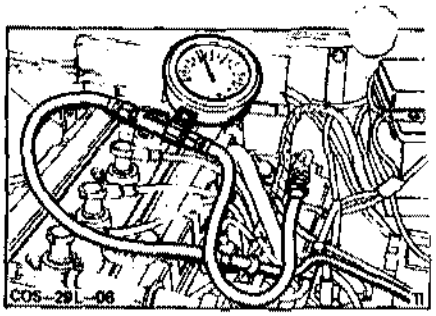


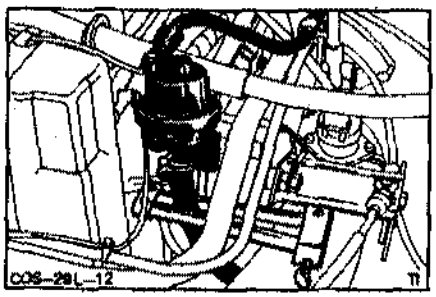
FAULT FINDING CHARTS

Condition 6: ENGINE DIFFICULT TO START (cont'd)

TEST	RESULT	ACTION
7		
• Is spark plug voltage within limits? Start engine and allow to idle, check plug voltage. All should be of equal length, approx. 8 to 14kV. Snap open throttle to increase engine speed to 3000 rpm. Check all are balanced and give an output of less than 20 kV.	YES NO	Switch 'off' engine and go to 8. Fit new spark plugs.
8		
• Is fuel system pressure to specification? Connect pressure test equipment to fuel rail inlet, refer to illustration. Disconnect ECT sensor. Ensure valve on gauge is open. Switch ignition 'on System pressure should be 3,2 bar to 3,8 bar.	YES NO	Go to 9 Check fuel system for leaks or damage. Fit new filter/fuel lines as necessary and repeat test. If fault still evident, fit new fuel pump.
9		
• Does fuel system maintain pressure? Visually check for leaks before commencing test. Switch ignition 'off' then 'on' again. Switch 'off' ignition and observe gauge. Maximum pressure drop: - 0,2 bar after 10 minutes - 0,3 bar after 20 minutes	YES NO	Go to 11 Go to 10
10		
• Does fuel pressure drop when fuel return line is clamped? Ensure valve on gauge is open. Switch ignition 'on' then 'off'. Using a suitable tool, clamp off fuel return line. Fuel pressure should not drop.	YES NO	Check fuel pump non-return valve, fit new pump if necessary. Remove injectors and examine for evidence of leakage. Fit new injector/s where required. Fit new pressure regulator.



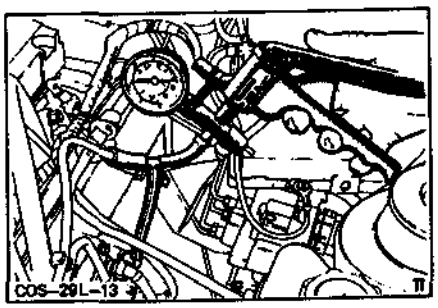




FAULT FINDING CHARTS

Condition 6: ENGINE DIFFICULT TO START (cont'd)

TEST	RESULT	ACTION
11		
• Is fuel pressure correct at idle? Reconnect engine coolant temperature sensor. Start engine and allow to idle (850 rpm). Pressure should be 2,7 to 3,3 bar	YES NO	Go to 13 Go to 12
12		
• Is intake vacuum sufficient? Disconnect vacuum pipe from fuel pressure regulator. Using a 'Y' connector connect vacuum pump to pipe and regulator. Start engine and allow to idle. *With engine warm, vacuum* should be 40 to 60 cm Hg.	YES NO	Fit new pressure regulator. Check vacuum pipe for blockage. Check intake manifold. Repair as necessary. Repeat test. If fault still evident, check engine cylinder compressions, rectify as necessary.
13		
• Is idle CO% within specification? Connect CO meter, start engine and allow to idle. Check CO content in the normal way. CO% should be 1% to 2%.	YES NO	Go to 14 Adjust CO% as required, refer to Service Microfiche.
14		
• Is engine still difficult to start?	YES NO	Carry out breakout box procedures. System O.K.



Self Test Codes

The module may emit one or more of the following codes when the self test is initiated. The codes given indicate that the module has detected a fault in a particular circuit. The code/s are to be used only as an indication of the possible failure. It does not necessarily mean that a particula sensor is faulty.

If a code is given indicating a fault in the MAP sensor, DO NOT CHANGE the sensor. Follow the che detailed on the pages listed below as it may be a faulty wiring connection or a wiring short/break which the module will detect as a failure. Following the full list of checks will ensure that the cause of the failure is found, do not attempt to short circuit the check list.

The following is a list of the codes that may be given from the module and the pages on which the check lists can be found. Before turning to the check list, ensure the code has been read correct Repeat the self test operation to confirm the code.

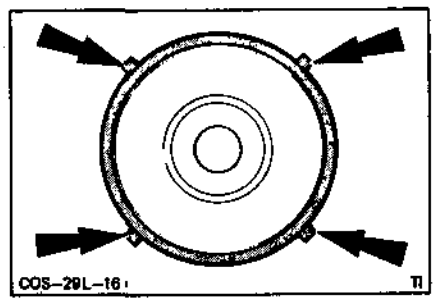
CODE	FAULT DETECTED	PAGE
1+1	Engine speed/TDC sensor circuit	33
1+2	Distributor phase sensor circuit	34
1+3	Signal generation and phasing between engine speed/TDC sensor and distributor phase sensor	35
2+1	Short circuit in air charge temperature sensor circuit	36
2+2	Open circuit in air charge temperature sensor circuit	36
2+3	Short circuit in engine coolant temperature sensor circuit	37
3+1	Open circuit in engine coolant temperature sensor circuit	37
3+2	Short circuit in MAP sensor or sensor wiring	38
3+3	Open circuit in MAP sensor or sensor wiring	38

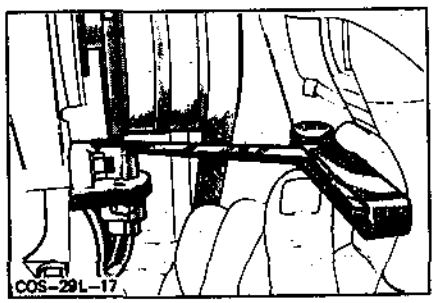
FAULT FINDING CHARTS

RS COSWORTH

Code 1+1 - Engine speed/TDC sensor circuit

TEST	RESULT	ACTION
1		
• Are there 4 teeth on crankshaft pulley? Inspect crankshaft pulley.	YES NO	Go to 2 Fit new crankshaft pulley
2		
• Is sensor in good condition and set at the correct clearance? Inspect sensor for damage, check sensor distance from pulley teeth (should be 0,6 to 1,0 mm)	YES NO	Go to 3 Fit new sensor if damaged. Adjust sensor to obtain correct clearance.
3		
• Is resistance of sensor within specification? Disconnect module and connect to breakout box, using lead 33-002. Measure resistance across pins 4 and 3, reading should be 600 to 1k ohms.	YES NO	Reconnect module and repeat self test. If fault still evident, fit new module. Check wiring for short/open circuit, repair as necessary. Fit new sensor if necessary.



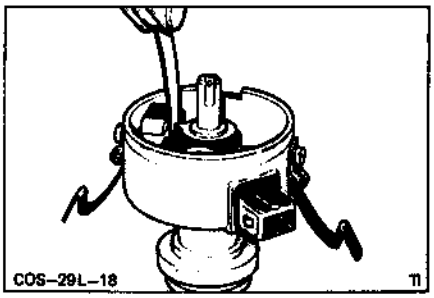


FAULT FINDING CHARTS

RS COSWORTH

Code 1+2 - Distributor phase sensor circuit

TEST	RESULT	ACTION
1		
• Is sensor in good condition and set at the correct clearance? Inspect sensor for damage, check sensor distance from distributor cams (should be 0,2 to 0,3 mm)	YES	Go to 2
	NO	Fit new sensor if damaged. Adjust sensor to obtain correct clearance.
2		
• Is resistance of sensor within specification? Disconnect module and connect to breakout box, using lead 33-002. Measure resistance across pins 23 and 5, reading should be 700 to 1,2k ohms.	YES	Reconnect module and repeat self test. If fault still evident, fit new module.
	NO	Check wiring for short/open circuit, repair as necessary. Fit new sensor if necessary.

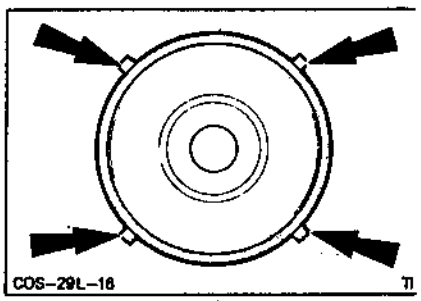


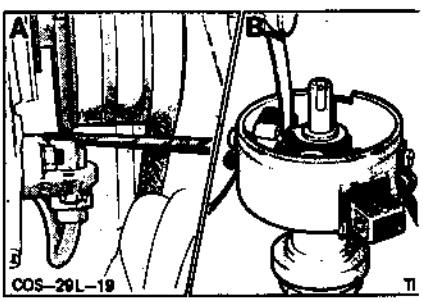
FAULT FINDING CHARTS

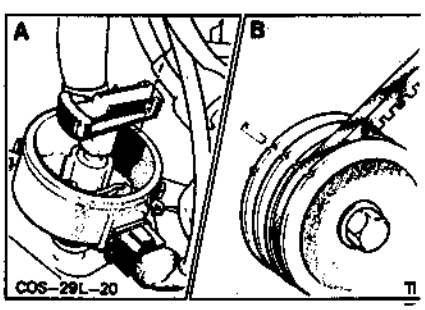
RS COSWORTH

Code 1+3 - Signal generation and phasing between engine speed/TDC sensor and distributor phase sensor

TEST	RESULT	ACTION
1		
• Are there 4 teeth on crankshaft pulley? Inspect crankshaft pulley.	YES	Go to 2
	NO	Fit new crankshaft pulley.
2		
• Are sensors in good condition and set at the correct clearance? Inspect sensors for damage, check clearance of both sensors. Distributor cam to sensor 0,2 to 0,3 mm. Speed/TDC to pulley teeth 0,6 to 1,0 mm.	YES	Go to 3
	NO	Fit new sensor/s if damaged. Adjust sensor/s to obtain correct clearance.
3		
• Is distributor correctly timed? Turn engine until No.1 cylinder is at TDC. Remove distributor cap and check alignment of rotor with mark on body, refer to illustration.	YES	Go to 4
	NO	Slacken distributor clamp bolt and rotate distributor until marks align.
4		
• Is resistance of sensors within specification? Disconnect module and connect breakout box, using lead 33-002. Check sensor resistances. Distributor sensor Pins 23 to 5 - should be 700 to 1,2k ohms. Speed/TDC sensor Pins 4 to 3 - should be 600 to 1k ohms.	YES	Repeat self test. If fault still evident, fit new module.
	NO	Check wiring for short/open circuit, repair as necessary. Fit new sensor/s if necessary.







FAULT FINDING CHARTS

2,0 EEC IV

Codes 2+1 and 2+2: Air charge temperature sensor circuit

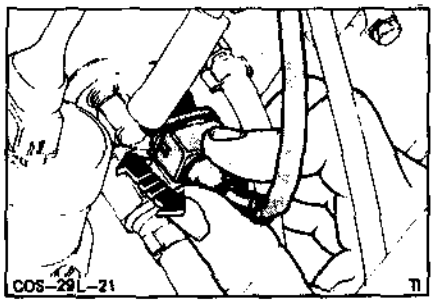
TEST	RESULT	ACTION

1

- **Is multiplug connection on air charge temperature sensor clean and secure?**

Disconnect multiplug from sensor. Clean contacts using contact spray. Refit multiplug ensuring locking clip 'snaps' into position.

Go to 2



2

- *Is sensor within* **specification?**

Remove module multiplug and connect to breakout box. Check resistance of sensor between pins 11 and 31.

Temperature °C	*Resistance* (k ohms)
10	6,00
20	3,75
40	1,60

YES — **Go to 4**

NO — **Go to 3**

3

- **Is wiring between module multiplug and sensor short/open circuit?**

Remove multiplug from sensor and check continuity of wiring as follows. Pin 11 to one of the multiplug connections. Check other pin for wiring short. *Pin 31 to other connection.*

YES — **Locate and rectify wiring fault.**

NO — **Fit new sensor and go to 4.**

4

- **Is fault still evident?**

Reconnect module to vehicle and recheck self test output.

YES — **Fit new engine management module.**

NO — **System O.K.**

FAULT FINDING CHARTS

2,0 EEC IV

Codes 2+3 and 3+1: Engine coolant temperature sensor circuit

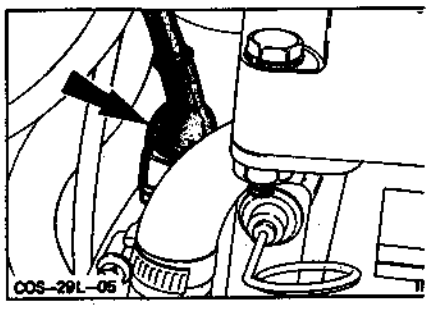
TEST	RESULT	ACTION

1

- **Is multiplug connection on coolant temperature sensor clean and secure?**

  Disconnect multiplug from sensor. Clean contacts using contact spray. Refit multiplug ensuring locking clip 'snaps' into position.

Disconnect module and connect breakout box, go to 2.



2

- **Is sensor within specification?**

  Check resistance of sensor between pins 11 and 29.

Temperature °C	Resistance (k ohms)
10	6,00
20	3,75
40	1,60
60	0,75
80	0,38

YES — **Go to 4**

NO — **Go to 3**

3

- **Is wiring between module multiplug and sensor short/open circuit?**

  Remove multiplug from sensor and check continuity of wiring as follows. Pin 11 to one of the multiplug connections. Check other pin for wiring short. Pin 29 to other connection.

YES — **Locate and rectify wiring fault.**

NO — **Fit new sensor and go to 4.**

4

- **Is fault still evident?**

  Reconnect module to vehicle and recheck self test output.

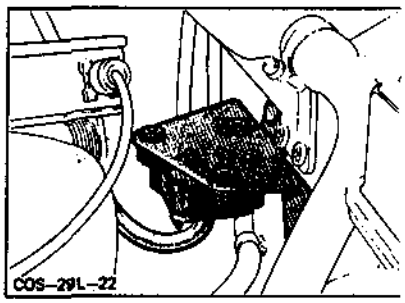
YES — **Fit new engine management module.**

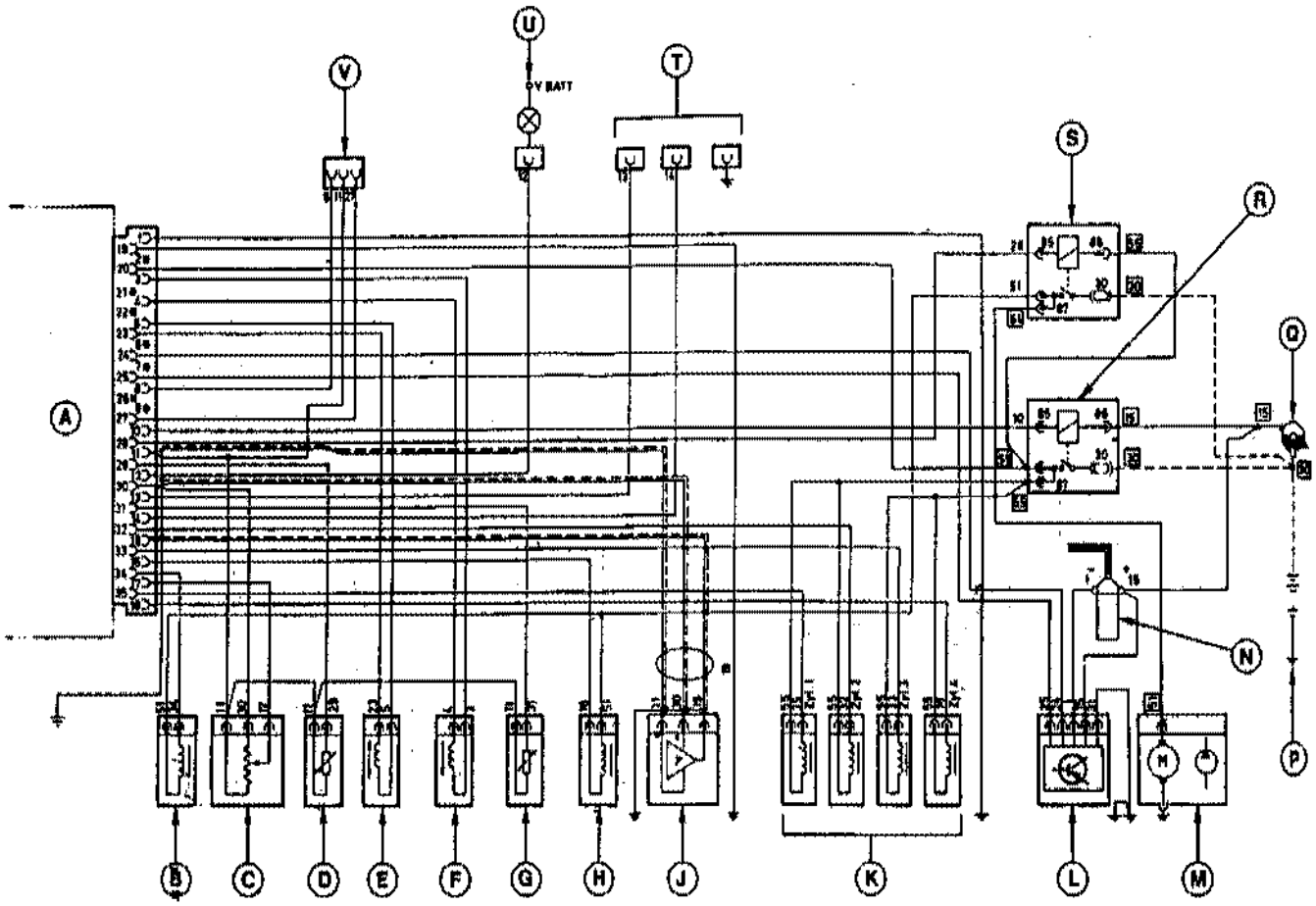
NO — **System O.K.**

FAULT FINDING CHARTS 2,0 EEC

Codes 3+2 and 3+3: MAP sensor circuit

TEST	RESULT	ACTION
1		
• Is multiplug connection on sensor clean and secure? Disconnect multiplug from sensor. Clean contacts using contact spray. Refit multiplug ensuring locking clip 'snaps' into position.		Disconnect module and connect breakout box, go to 2.
2		
• Is sensor within specification? Check resistance of sensor between pins 30 and 11, should be 50 to 600 ohms. Check resistance of sensor between pins 30 and 15, should be 500 to 6k ohms.	YES NO	Go to 4 Go to 3
3		
• Is wiring between module multiplug and sensor short/open circuit? Remove multiplug from sensor and check continuity of wiring. Check pin to pin combinations for possible short/open circuit. Illustration shows breakout box pin numbers in relation to multiplug.	YES NO	Locate and rectify wiring fault. Fit new sensor and go to 4.
4		
• Is fault still evident? Reconnect module to vehicle and recheck self test output.	YES NO	Carry out MAP sensor voltage checks, contained in the active breakout box checks. System O.K.





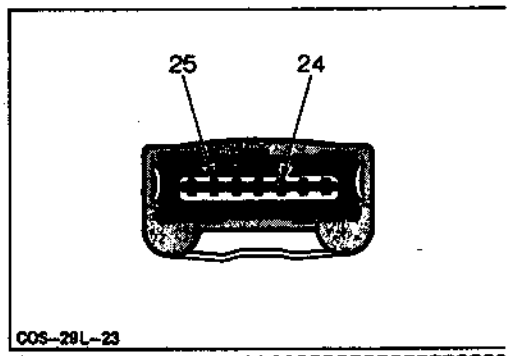
SRS-29-101

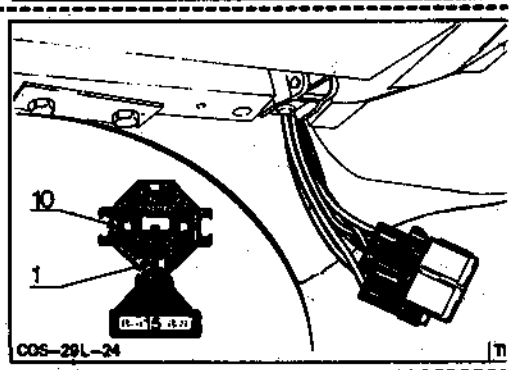
Circuit diagram.
A - Engine management module
B - Speed control valve
C - Idle throttle butterfly potentiometer
D - Coolant temperature sensor
E - Phase sensor (distributor)
F - Engine speed/TDC sensor
G - Air temperature sensor
H - Solenoid control valve
J - MAP sensor
K - Fuel injectors
L - Ignition amplifier module
M - Fuel pump
N - Ignition coil
P - Battery
Q - Ignition switch
R - Power relay
S - Fuel pump relay
T - Ignition timing adjustment connection
U - Module test display
V - Engine timing diagnosis connection

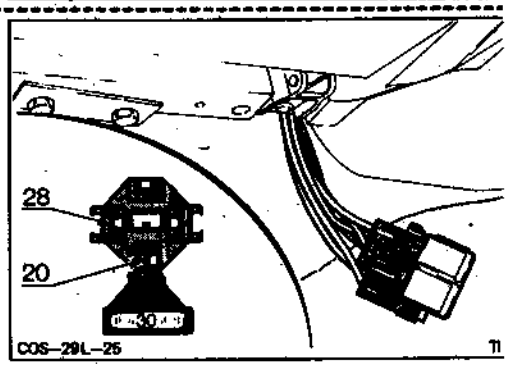
RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
1	Module to ground	1	BATT -	R	OFF
2	Module to ground	19	BATT -	R	OFF
3	Ignition amplifier module and wiring	25	24	R	OFF
4	Module power supply relay and associated wiring	10	1	R	OFF
5	Fuel pump relay and associated wiring	28	20	R	OFF

CORRECT RESULT	ACTION FOR INCORRECT RESULT
0 to 2,5	Check and clean module ground. Locate and rectify wiring fault
0 to 2,5	Check and clean module ground. Locate and rectify wiring fault
More than 700	Remove multiplug and check wiring for short/open circuit. Fit new amplifier module if no fault found.
60 to 120	Remove relay and check, fit new relay if necessary. Check continuity of wiring, repair as necessary.
60 to 120	Remove relay and check, fit new relay if necessary. Check continuity of wiring, repair as necessary.



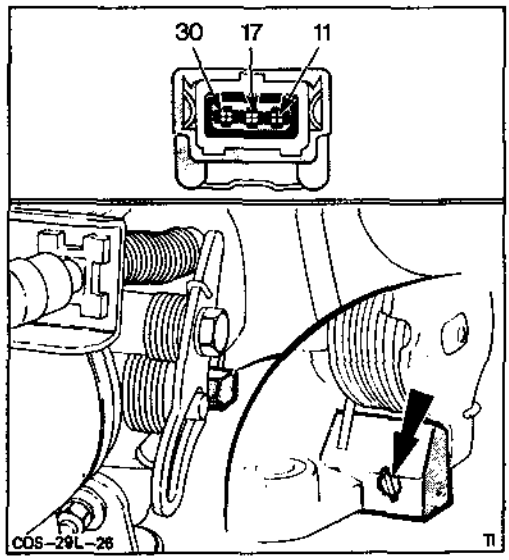




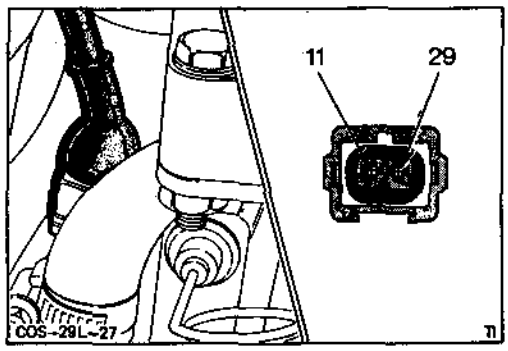
RS COSWORTH

TEST NO	TEST DESCRIPTION	PIN CONNECTIONS +	-	METER SETTING	IGNITION POSITION
6	Throttle positon sensor and wiring (Measures complete sensor track resistance)	11	30	R	OFF
7	Throttle position sensor and wiring (Measures resistance at rest position)	30	17	R	OFF
		30 Slowly open throttle whilst observing meter	17	R	OFF
8	Engine coolant temperature sensor and wiring	11	29	R	OFF
9	Air charge temperature sensor and wiring	11	31	R	OFF
10	Distributor phase sensor and wiring	23	5	R	OFF

CORRECT RESULT	ACTION FOR INCORRECT RESULT
300 to 600	Remove multiplug from throttle position sensor. Check wiring from sensor multiplug to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.
Open Circuit	Check throttle stop screw, if screw has been adjusted renew throttle housing. If screw has not been adjust, slacken sensor screws and adjust until no resistance is measured. If resistance still measured fit new throttle position sensor.
300 to 600	If no resistance is measure, remove multiplug from sensor. Check wiring from sensor multiplug to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.

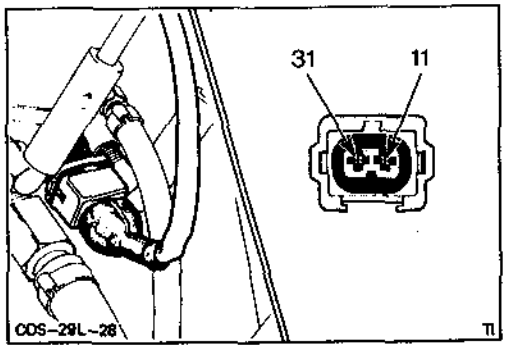


0,3k to 5k *	Remove multiplug from sensor and check wiring from sensor to breakout box, repair as necessary. Fit new sensor if necessary.



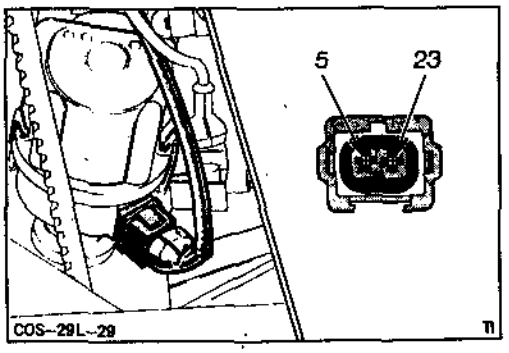
* *Refer to Technical Data, page 60, for full resistance range.*

0,3k to 5k**	Remove multiplug from sensor and check wiring from sensor to breakout box, repair as necessary. Fit new sensor if necessary.



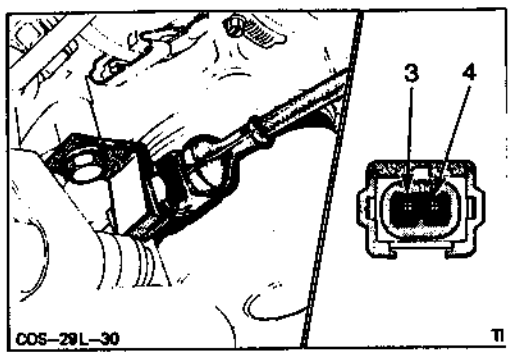
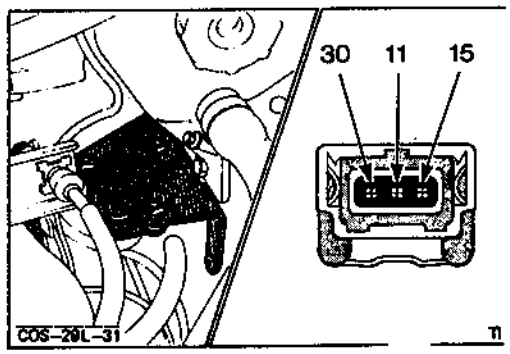
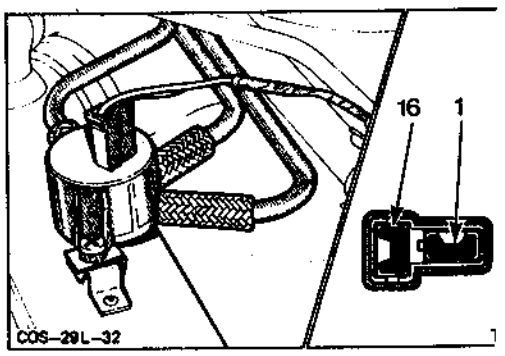
** Refer to Technical Data, page 60, for full resistance range.

700 to 1,2k	Disconnect phase sensor multiplug and check wiring from sensor to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.



RS COSWORTH

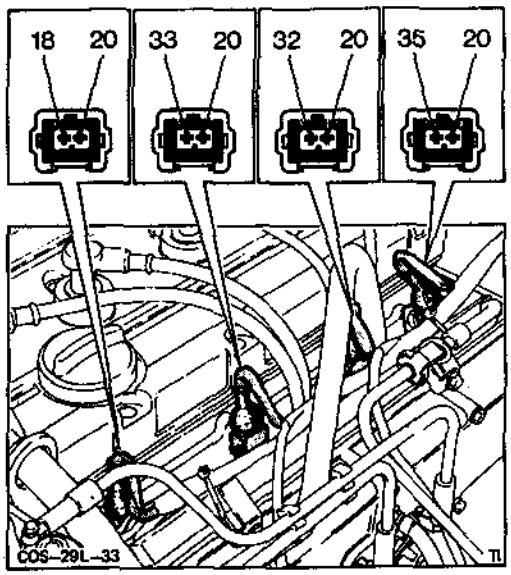
TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
11	Engine speed/TDC sensor and wiring	4	3	R	OFF
12	MAP sensor and associated wiring (Input circuit)	30	11	R	OFF
13	MAP sensor and associated wiring (Output circuit)	30	15	R	OFF
14	MAP sensor wiring (Ground screening for sensor wiring)	11	BATT -	R	OFF
		30	BATT -	R	OFF
		15	BATT -	R	OFF
15	Turbo charger boost control valve and wiring	16	1	R	OFF

CORRECT RESULT	ACTION FOR INCORRECT RESULT	
600 to 1k	Remove multiplug from speed/TDC sensor and check wiring from multiplug to breakout box, repair as necessary. Fit new sensor if no fault found in wiring.	
50 to 600	Remove multiplug from MAP sensor and check wiring from multiplug to breakout box, repair as necessary. Fit new sensor in no fault found in wiring.	
500 to 6k	Remove multiplug from MAP sensor and check wiring from multiplug to breakout box, repair as necessary. Fit new sensor in no fault found in wiring.	
Open Circuit	Locate and repair wiring fault	
Open Circuit	Locate and repair wiring fault	
Open Circuit	Locate and repair wiring fault	
20 to 50	Remove multiplug from control valve and check wiring from multiplug to breakout box, repair as necessary. Fit new valve if no fault found in wiring.	

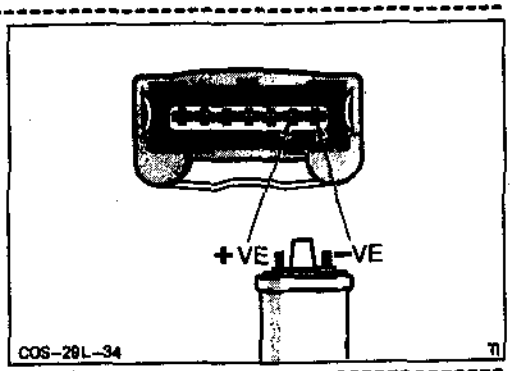
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TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
16	No.1 injector and wiring	35	20	R	OFF
17	No.2 injector and wiring	32	20	R	OFF
18	No.3 injector and wiring	33	20	R	OFF
19	No.4 injector and wiring	18	20	R	OFF
	DISCONNECT IGNITION COIL LT WIRES FROM COIL, CARRY OUT THE FOLLOWING CHECK AT LT TERMINALS.				
20	Ignition amplifier module and wiring (Coil switching circuit)	Coil wiring + (15)	Coil wiring - (1)	R	OFF
	RECONNECT IGNITION COIL LT WIRING.				
	DISCONNECT IGNITION AMPLIFIER MODULE AND CARRY OUT THE FOLLOWING CHECK AT MULTIPLUG.				
21	Ignition amplifier module to ground connection	Multiplug pin A, refer to illustration	BATT -	R	OFF
	RECONNECT IGNITION AMPLIFIER MODULE MULTIPLUG.				
	DISCONNECT IDLE SPEED CONTROL VALVE AND CARRY OUT THE FOLLOWING CHECK AT THE VALVE.				
22	Idle speed control valve	Measure resistance across idle speed control vlave		R	OFF

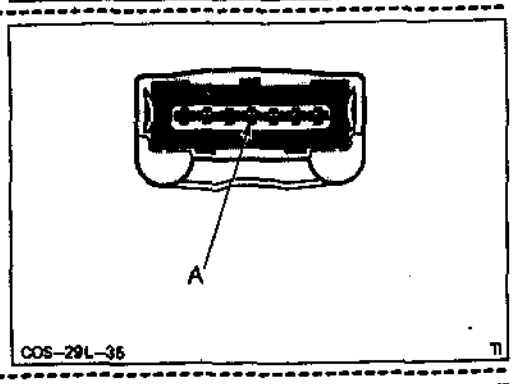
CORRECT RESULT	ACTION FOR INCORRECT RESULT
2 to 4	Remove multiplug from No.1 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary.
2 to 4	Remove multiplug from No.2 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary.
2 to 4	Remove multiplug from No.3 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary.
2 to 4	Remove multiplug from No.4 injector and check wiring between multiplug and breakout box, repair as necessary. Fit new injector if necessary.



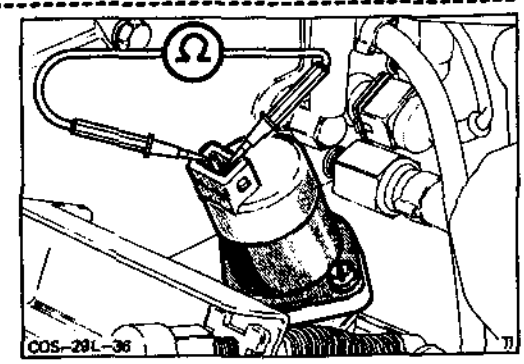
4,5k *(approx)*	Remove multiplug from ignition amplifier module and check wiring between multiplug and breakout box, repair as necessary. Fit new amplifier module if no fault found.



0 to 0,5	Locate and rectify wiring fault.



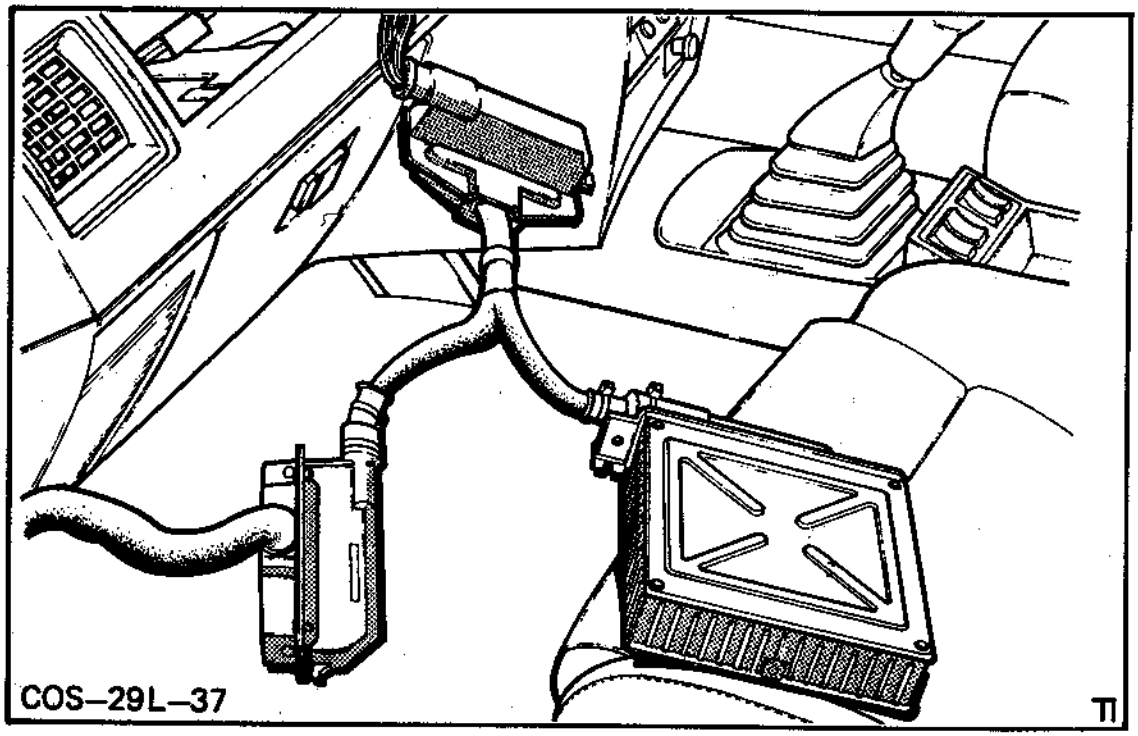
6 to 9	Fit new idle speed control valve.



ACTIVE BREAKOUT BOX CHECKS

The preceeding breakout box checks must be performed and any faults rectified before commencing the active checks. Care must be taken when connecting the multimeter to the breakout box, to avoid shorting the module.

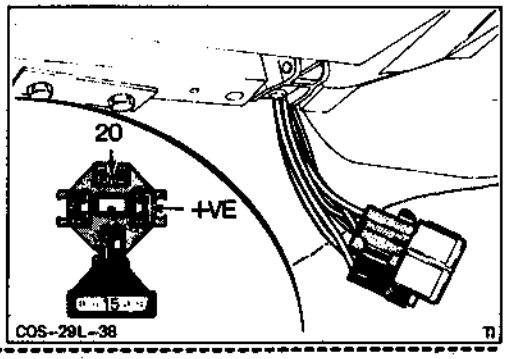
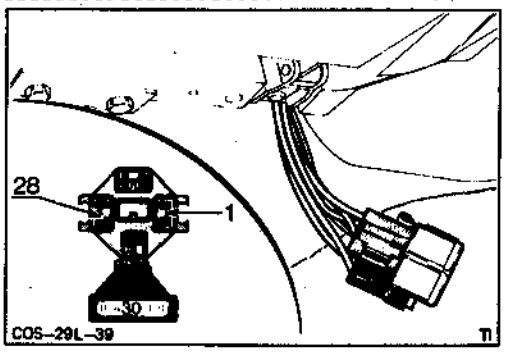
Disconnect the test lead from the module and connect the 'Y' cable (Special Service Tool 29-005) to the module, vehicle wiring loom and breakout box lead. With the 'Y' cable connected, the engine can be started and will run as normal.



Connection of the Y-cable (Special Tool No. 29-005) and the test lead (Special Tool No. 33-002) to the engine management module.

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TEST NO	TEST DESCRIPTION	PIN CONNECTIONS +	-	METER SETTING	IGNITION POSITION
23	*Module power supply and relay* operation	20	1	V	OFF
		20	1	V	ON
24	Power supply to fuel pump relay	28	1	V	ON
25	*Throttle position sensor operating* voltage	17	11	V	ON
26	Engine coolant temperature sensor operating voltage	29	1	V	ON
27	Air charge temperature sensor operating voltage	31	1	V	ON
28	Turbocharger boost control valve operating voltage	Disconnect solenoid connection and measure voltage across connector		V	ON (Start engine and idle)
29	MAP sensor supply voltage	30	11	V	ON
		30	11	V	ON (Start engine and idle)

CORRECT RESULT	ACTION FOR INCORRECT RESULT	
Open Circuit	Fit new relay	
10,5 to 14,5	Check fuse (15 A), fit new fuse if necessary. Check wiring from battery positive terminal to relay and repair as necessary. Fit new relay if required.	
10,5 to 14,5	Locate and rectify wiring fault.	
4,5 to 5,5	Fit new engine management module.	
0,3 to 3,0	Fit new engine management module.	
0,3 to 3,0	Fit new engine management module.	
10,0 to 14,5	Fit new engine management module.	
4,0 to 5,5	Fit new engine management module.	
Remove vacuum hose from air intake, engine should stop	Fit new engine management module.	

RS COSWORTH

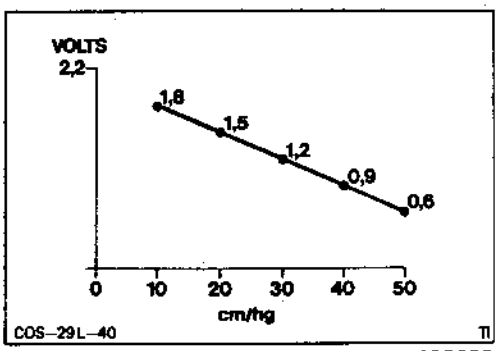
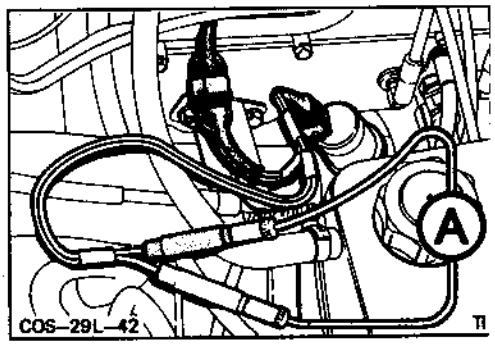
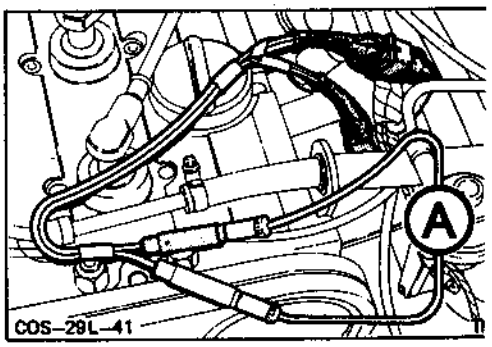
TEST NO	TEST DESCRIPTION	PIN +	CONNECTIONS -	METER SETTING	IGNITION POSITION
30	MAP sensor output voltage	15	11	V	ON

THE FOLLOWING ARE CURRENT DRAW CHECKS USING ADAPTER CABLE 23-022. CONNECT CABLE INTO VEHICLE WIRING AS SHOWN IN THE RELEVANT ILLUSTRATION.

		Terminal Colour			
31	Idle speed control valve	Yellow	Red	A	Start engine and allow to idle
32	Injectors to voltage reference supply	Yellow	Red	A	Start engine and allow to idle

Repeat test on all 4 injectors.

Reconnect engine management module direct to vehicle loom and road test vehicle.
If fault still evident, fit new engine management module.

CORRECT RESULT	ACTION FOR INCORRECT RESULT	
Apply vacuum to MAP sensor and take voltage reading. Refer to illustration for correct voltage to specific vacuum reading	Fit new MAP sensor	
300mA to 600mA	Apply 12 volts direct to idle speed control valve terminals. If valve does not 'click', fit new idle speed control valve. If valve does 'click', fit new engine management module.	
Reading is unstable. A reading of 17 to 23mA should be indicated for a short period	Fit new engine management module.	

23 601 0 BOOST PRESSURE - ADJUST

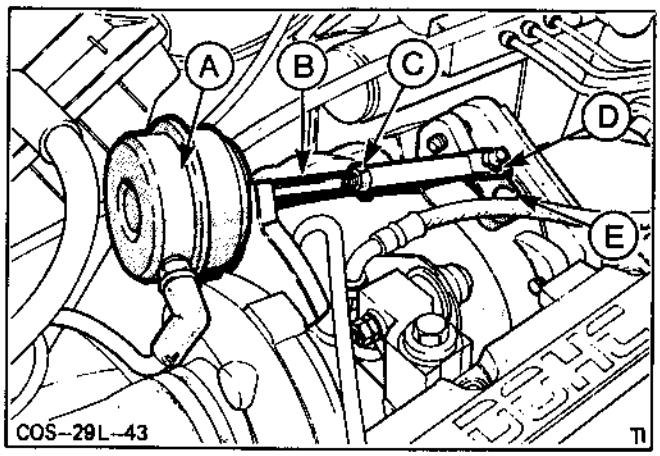
SPECIAL TOOLS REQUIRED:

Pressure Gauge and Hose 23-021
Cooling System Pressure Tester

NOTE: After fitment or replacement parts to the Turbocharger, the boost pressure will require resetting.

This operation is divided into two sections: initial 'static' adjustment and final adjustment during/after road test.

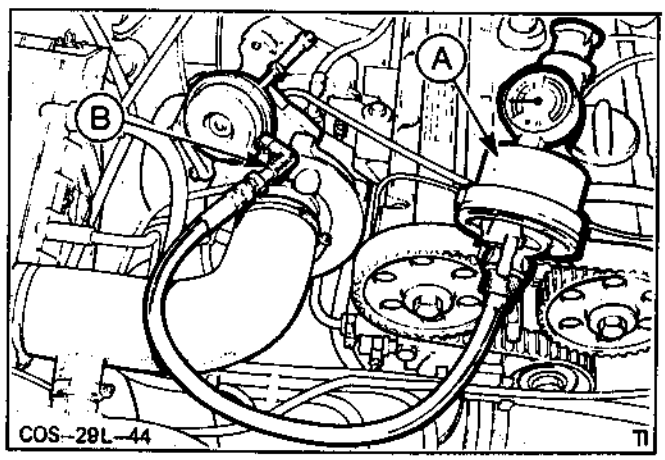
IMPORTANT NOTE: Roller testing is not recommended as the temperatures generated by the engine and brakes and the inadequate cooling available on a roller test.



Actuator rod and waste gate.
A - Waste gate actuator
B - Actuator rod
C - Locknut
D - Circlip
E - Operating lever

Initial Static Adjustment

1. With the actuator rod disconnected from the waste gate operating lever, connect the cooling system pressure tester to the waste gate actuator and apply a pressure of 0,45 bar (max. 0,48 bar).

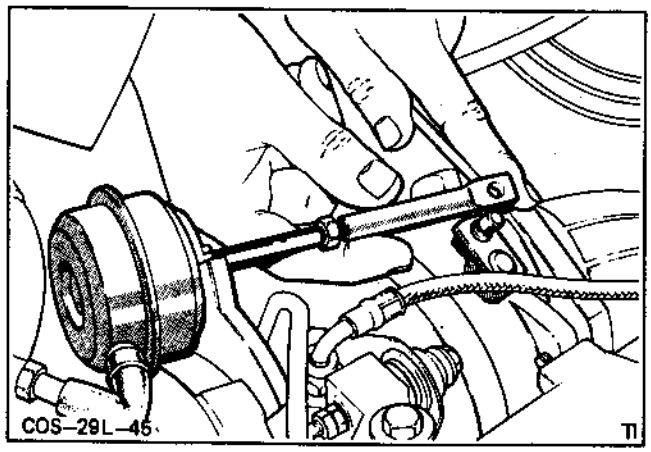


A - Cooling system pressure tester
B - Waste gate actuator hose

2. Move the operating lever to fully close the waste gaste valve.

3. With the 0,45 bar (max. 0,48 bar) pressure still applied to the actuator, adjust the rod length so that it just slips onto the waste gate lever.

4. Fit a new circlip to retain the rod and tighten the locknut ensuring that the rod eye is not twisted and allows the waste gate to move freely when the pressure is released.



Adjust the rod length so that it just slips onto the waste gate lever.

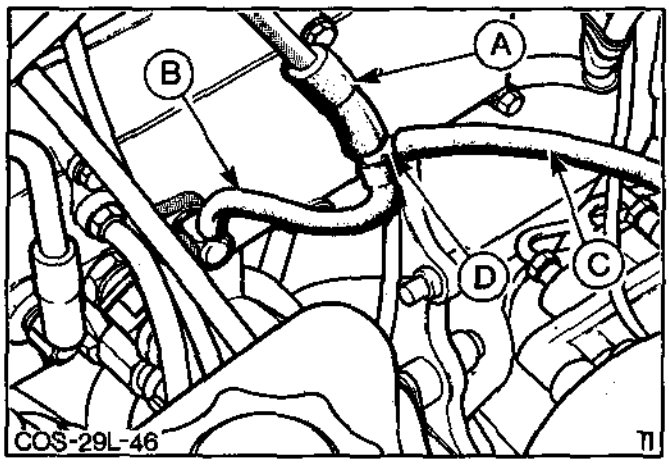
Boost Testing

NOTE: When performing this operation, the duration of the actual boost test itself should be no more than 3 - 5 seconds.

The boost pressure is measured via a gauge and connecting pipe work as detailed below:

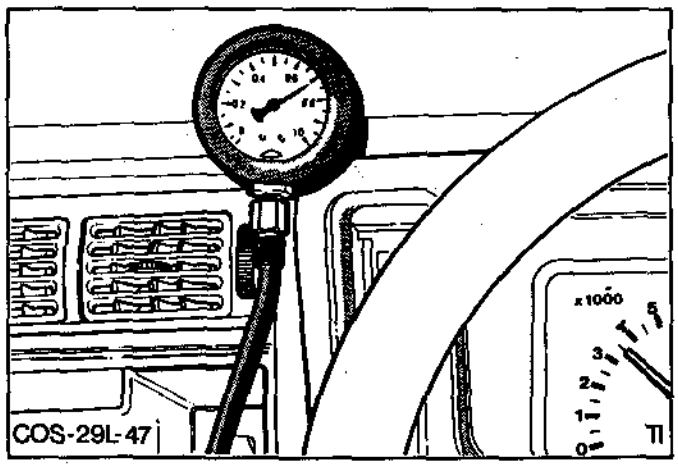
5. Pull off the hose of the turbocharger boost pressure gauge. Connect the pressure gauge, using a 2,0 metre length of 6 mm diameter neoprene tubing.

NOTE: It is essential for correct readings that the pressure gauge is securely fixed to the driver's side vent nozzle in an upright position.



'T' piece and hose installation.
A - Hose to bypass valve C - Hose to gauge
B - Hose to air chamber D - 'T' piece

6. Drive the vehicle until normal operating temperature is reached.



Gauge installation hose routing (LHD shown), RHD symmetrically opposite.

7. With a clear, straight road ahead and behind (preferably without junctions). Select 4th gear and drive along at an engine speed of approximately 1500 rpm.

8. Fully depress the throttle pedal.

9. Keeping the throttle pedal fully depressed, fully apply the brakes when the engine reaches 3500 rpm - DO NOT EXCEED THE TEST DURATION (MAX 5 SECS).
With both throttle and brake fully depressed read the boost pressure from the gauge.

   Specification: 0,7 bar (max. 0,9)

NOTE: After taking reading, drive the car for at least 1 mile to allow the brakes to cool.

10. *If the reading obtained is within specification*, apply a small amount of paint to the actuator rod threads and locknut to lock into position.

11. If the reading obtained was outside the specification, the actuator rod should be adjusted as follows:

12. Loosen locknut nut at rod eye, remove the circlip and detach the rod from the waste gate operating lever.

- Boost Pressure Low

  Shorten rod one half turn for every 0,02 bar of pressure below that specified.

- Boost Pressure High

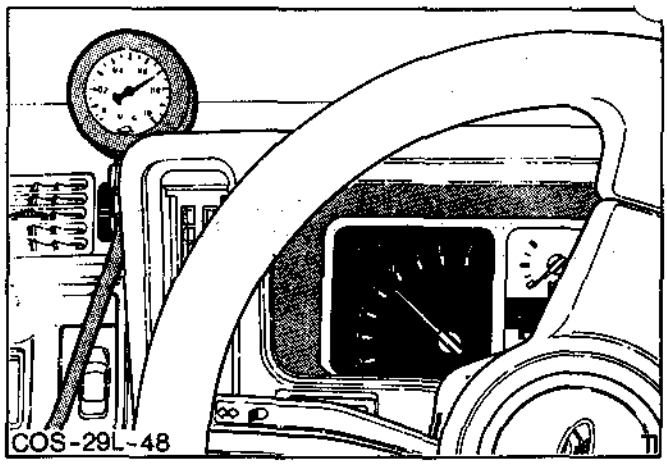
  Lengthen rod one half turn for every 0,02 bar of pressure above that specified.

13. After adjustment, refit rod and circlip and tighten locknut ensuring the rod eye does not bind on the waste gate lever.

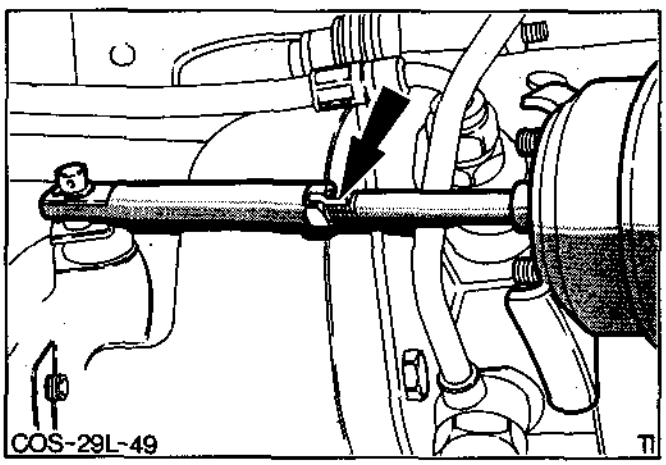
14. Repeat test.

15. If boost pressure is now within specification, apply paint to the actuator rod threads and locknut to lock in position.

16. Remove the test equipment and reconnect turbocharger boost pressure gauge hose to the 'T' piece.



Readings with full load induced.



Paint mark over threads and locknut of waste gate actuator rod.

Coil

Manufacturer	Bosch
Type	High output breakerless ignition coil
Output	25,0 kilovolt (minimum) - open circuit condition
Primary resistance	0,7 to 0,9 ohms
Secondary resistance	4500 to 7000 ohms

Spark Plugs

	Production and Service
Type - 2.0 litre HC (EFI)	AGPR 901C
Electrode gap - all territories	0,75 mm (0,030 in)
Firing order	1-3-4-2

Distributor

Manufacturer	Marelli
Type	Breakerless
Drive	Skew gear from idle shaft
Rotation (viewed from top)	Clockwise
Dwell angle	It is totally governed by the module and cannot be adjusted
Static advance (initial)	16° BTDC at idle speed 850 rpm (not adjustable)
Sensor to cam clearance	0,2 to 0,3 mm
Heat sink compound	81SF-12103-AA

Idle Speed

Idle speed	850 rpm
Idle CO%	1,0% to 2,0%

HT Leads

Resistance	15,000 ohms maximum per lead

Engine Speed/TDC Sensor

Clearance to crankshaft pulley	0,6 to 1,0 mm

Module

Manufacturer	Weber/Marelli

Fuel System

Injectors

Manufacturer	Weber
Type	Electronically operated
Grease for seals	ESEM 1C171A

Fuel Pump

Manufacturer	Bosch
Type	Roller cell
Output pressure	In excess of 10 bars (do not measure)

Pressure Regulator

Manufacturer	Weber
System pressure	3,2 - 3,8 bar (when ignition is switched on)
System pressure	2,7 - 3,3 bar (at idle speed)

Turbocharger

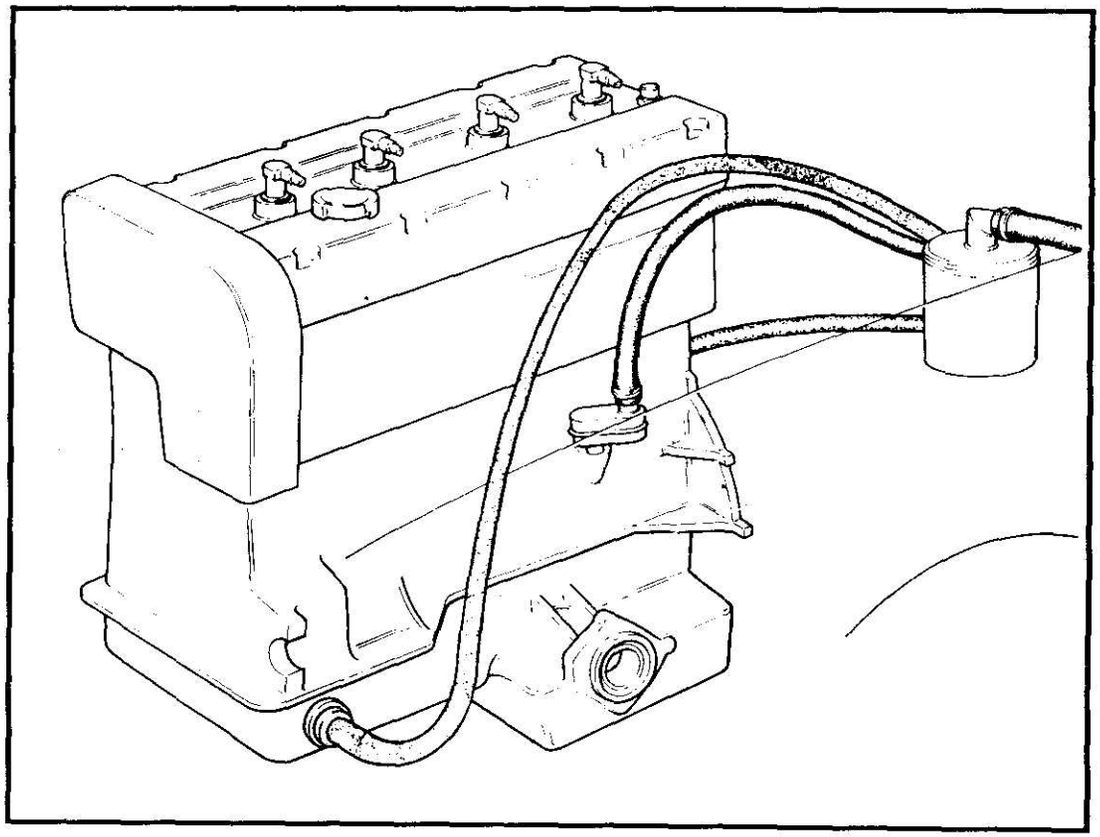
Nominal boost pressure	0,7 bar (max. 0,9 bar) - module controlled

Sensor Resistance

Air Charge Temperature Sensor and
Engine Coolant Temperature Sensor

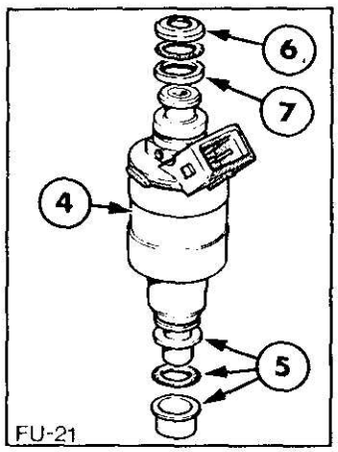
Temp °C	Resistance k ohms
0	9,75
10	6,00
20	3,75
30	2,42
40	1,60
50	1,08
60	0,75
70	0,53
80	0,38
90	0,27

ENGINE



The basic engine is virtually a carry over from the Sierra Cosworth 4x4, but with a larger turbo, and a water-cooled intercooler. Water injection (I.S.S) is also fitted to the initial production runs. This can only be activated with the correct EPROM.

It is strongly recommended that the group 'A' engine is built by a professional tuning company who will optimise the compression ratio and cam timing on a dynomometer. Fit the recommended injectors, spark plugs, map sensor and fuel pump. Set the boost to (TBE) bar peak. Excessive boost will raise the water temperature and shorten turbo and gasket life. The turbocharger will normally last for 800km between rebuilds. Ensure air filter element is replaced regularly in dusty conditions or if wet. Seal gaps around radiator/ intercooler with tape.



	Description	Finis Code	Comments	Qty.
1	Restrictor Turbo	9095445	38mm diameter	1
2	CHRA Turbo Core	9095477	Balanced	1
3	Compressor Hsg.	9095446	To suit restrictor	1
4	Fuel Injector	9092402	Grey	4
5	Fitting Kit Injector	9092400		4
6	Adaptor Ring, Injector,	9092397	Upper	4
7	Adaptor Ring Injector,	9092396	Lower	4
8	Eprom, Rally	TBE	Level '8' ECU	1
	or			
9	Eprom, Rally	TBE	P8 ECU (Alt.)	1
10	Spark Plug	9094884	AGP 601	4
11	Cyl. Head Gasket	9092431		1
12	Bolt – Turbo Mounting	9095143	Quick release	1
13	Nut – Turbo Mounting	9095144	Quick release	3
14	Fuel Rail	TBE		1
15	*Bracket – Regulator*	TBE		1
16	Fuel Regulator	9095101		1
17	Piston Ring Pack	9093153		4
18	Flywheel	9095548	Modified	1
19	Seal Kit	9095561	Turbo O/Haul	1

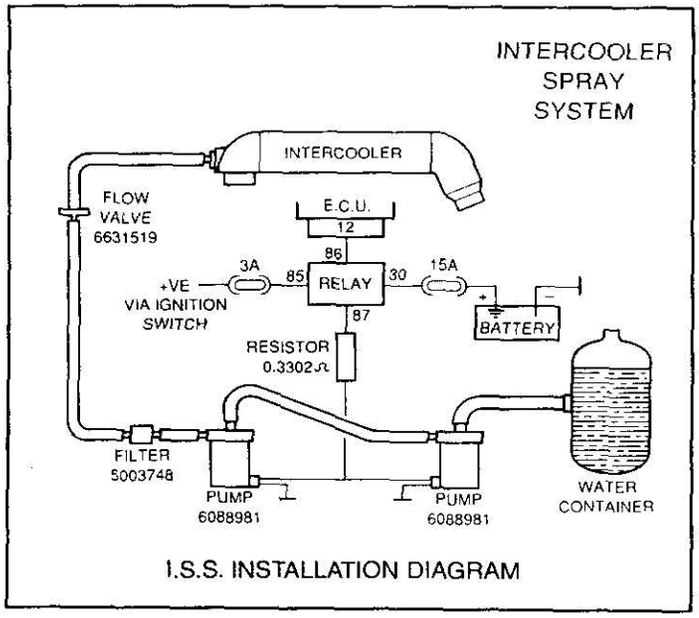
ONLY SUPER UNLEADED FUEL (98 OCTANE) SHOULD BE USED

	Wastegate Setting	:	TBE
	Max. Boost	:	TBE (Overboost)
†	Fuel Pressure (Idle)	:	3.5 Bar
	Engine Oil	:	*Mobil 1 (Change after 1000km)*

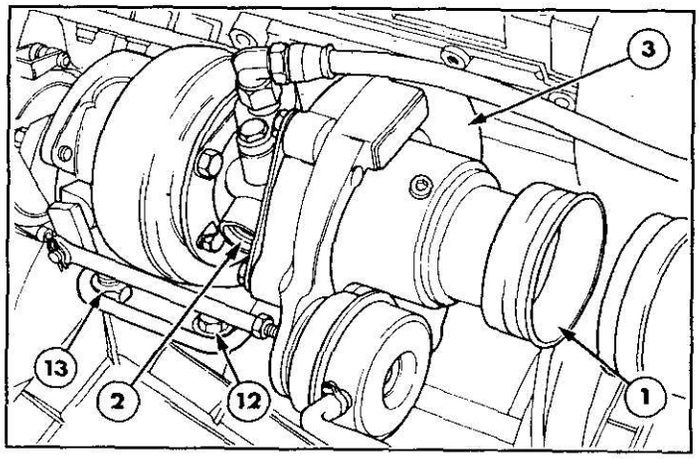
† Sensor pipe removed

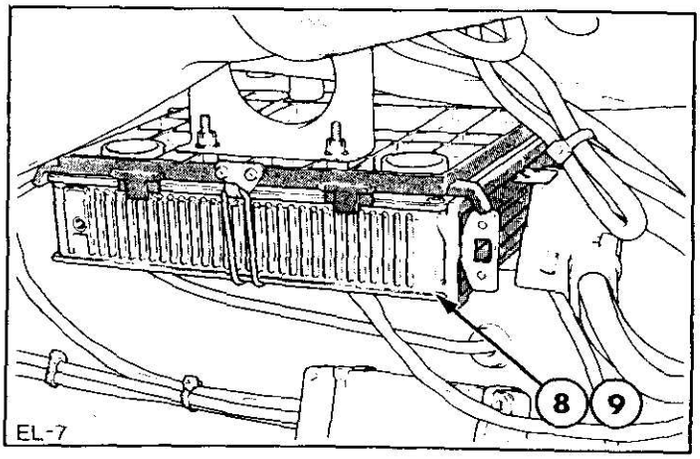
The water temperature should be approx. 90°C at 20°C ambient. In warm climates, run the radiator fans continuously (fit an override switch). The intercooler spray system (ISS) will keep the plenum temperature at 40°C (ensure container is refilled at service points) The thermostat can be modified or replaced. Use new cylinder head bolts at each rebuild.

The turbocharger exhaust housing can be modified by slotting three holes to help quick removal. Use one bolt and three studs.

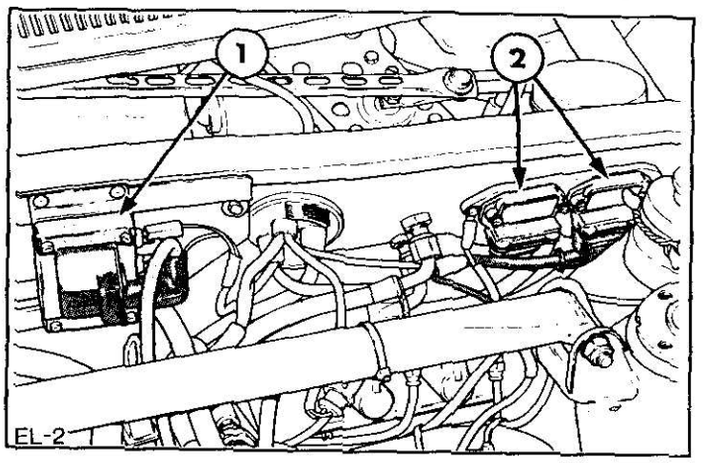


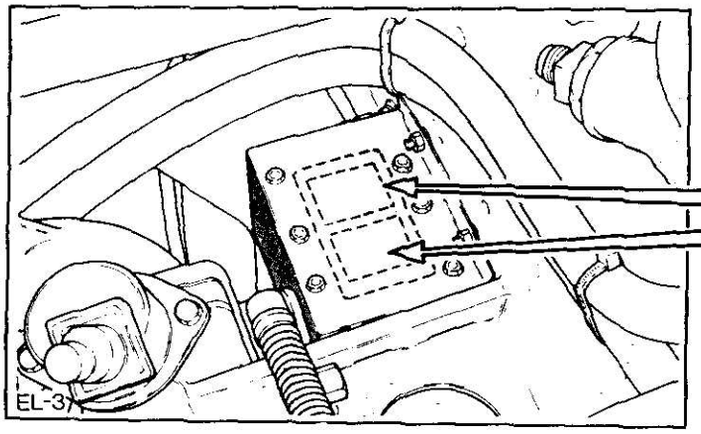
I.S.S. INSTALLATION DIAGRAM

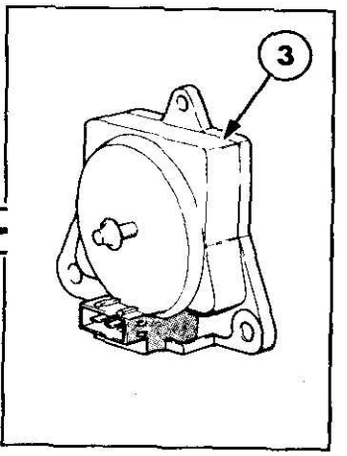




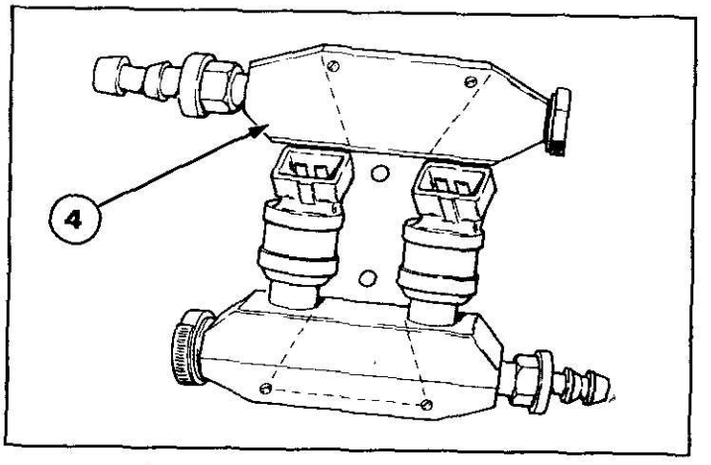
	Description	Finis Code	Comments	Qty.
1	Ignition Coil	9095085		1
2	TFI – Ignition	*1637546	Earth to engine	2
3	MAP Sensor	9092433	3.0 Bar	2
4	Kit – Wastegate Control	9095147		1

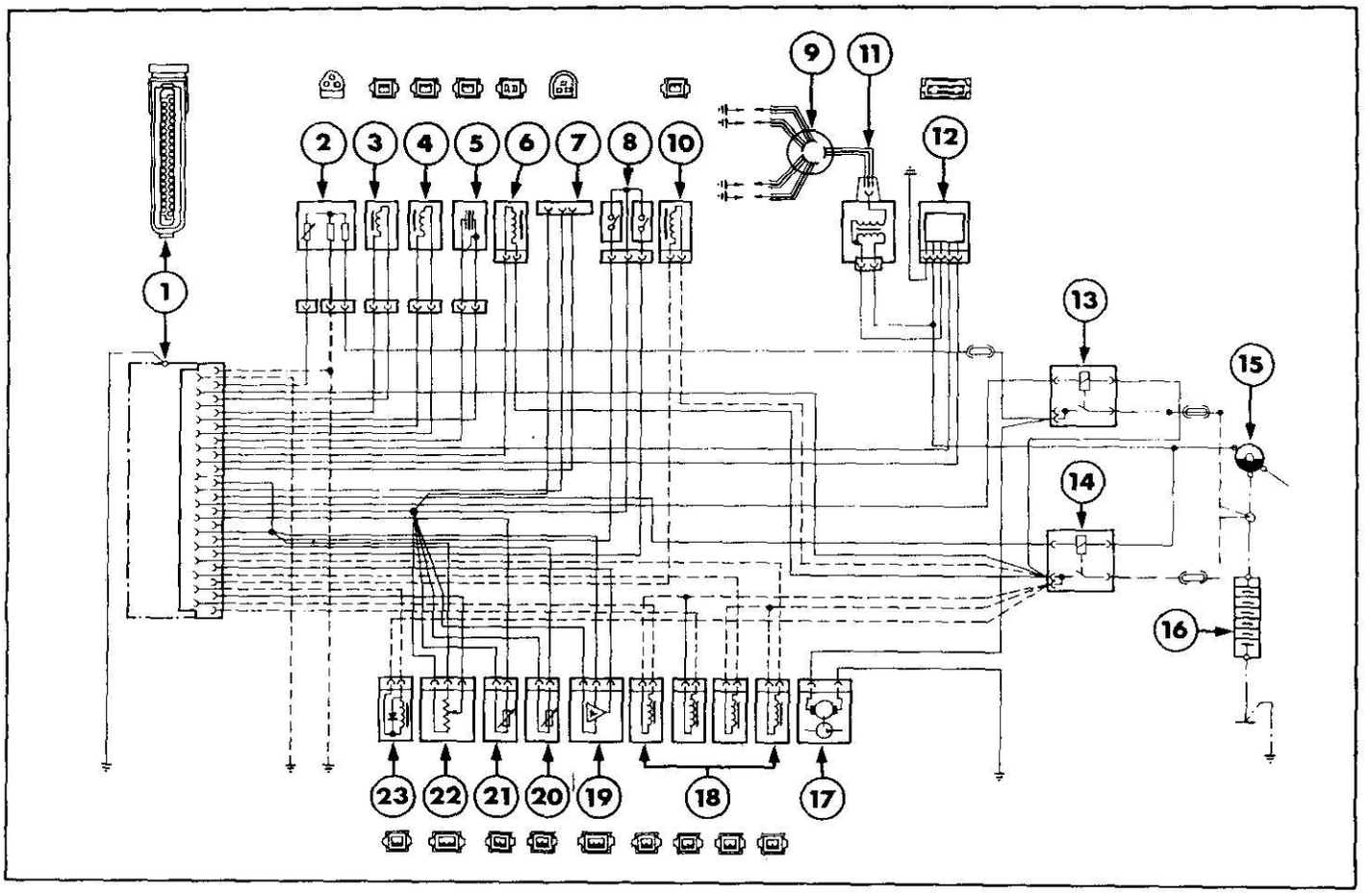






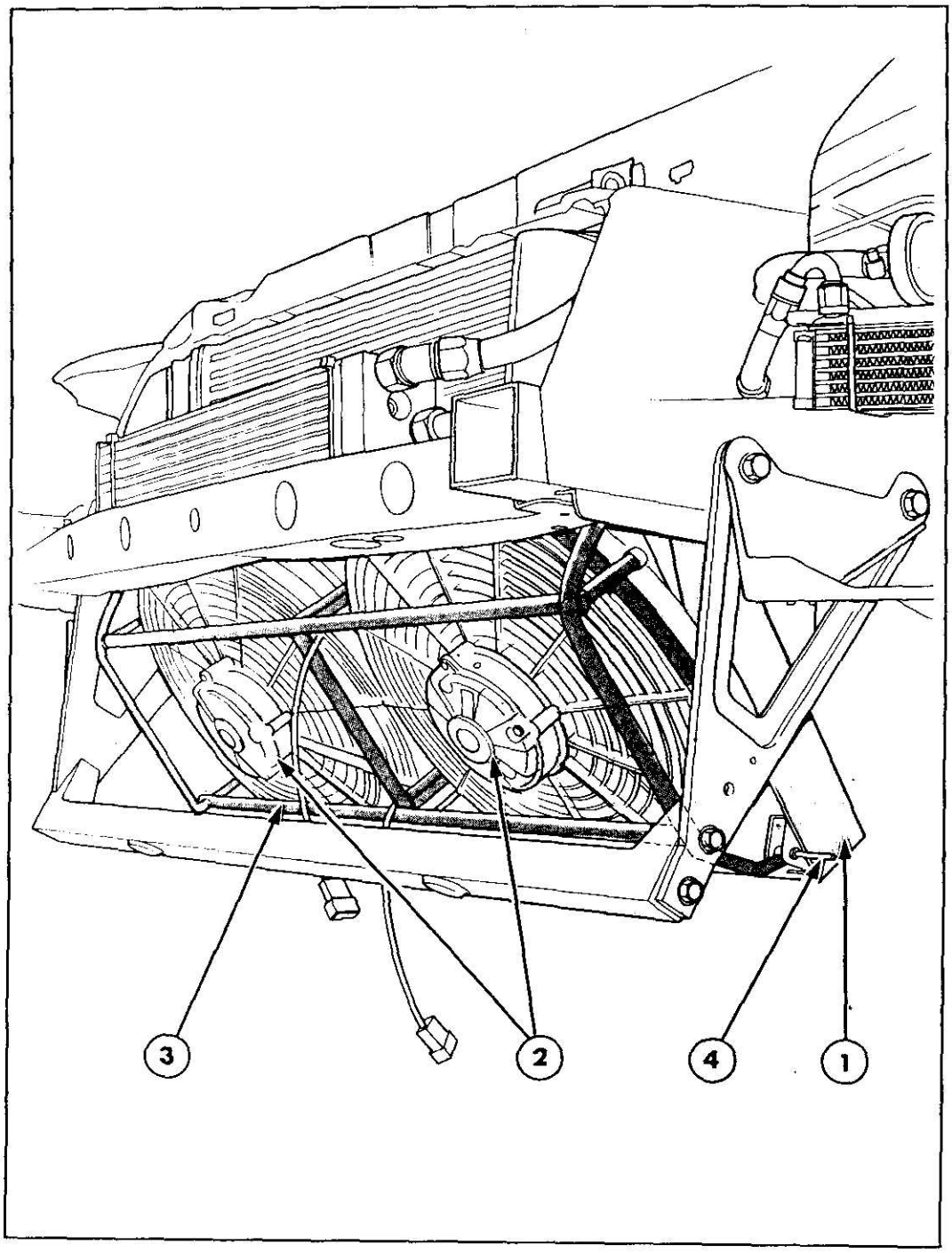
NOTE:
The HT leads must NOT be allowed to make contact with any sensor wires.
Fit the 2 MAP sensors inside a metal box as shown, to reduce the possibilty of electronic interference.





1 ECU
2 Lambda Sensor
3 Vehicle Speed Sensor (VSS)
4 Phase Sensor
5 Knock Sensor
6 Canister Purge Solenoid Valve
7 Diagnostic
8 Octane Adjustment
9 Ignition Distribution
10 Wastegate Control
11 Ignition Coil
12 TFI Module
13 Fuel Pump Relay
14 ECU Relay
15 Ignition Switch
16 Battery
17 Fuel Pump
18 Injectors
19 Manifold Pressure Sensor
20 Air Temperature Sensor
21 Coolant Temperature Sensor
22 Throttle Position Sensor
23 Idle Speed Control Valve with Diode

NOTE 1: The ECU body should be connected to the chassis making sure of a perfect electrical connection. A RF connection is allowed. Max length = 150mm.
NOTE 2: These connections should be made at a different location. Max distance = 150mm.
NOTE 3: Chassis connection. Max length = 100mm.
NOTE 4: Joint is inside ECU connector.
NOTE 6: This connector must have the indicated polarity to avoid damage at the ECU module.



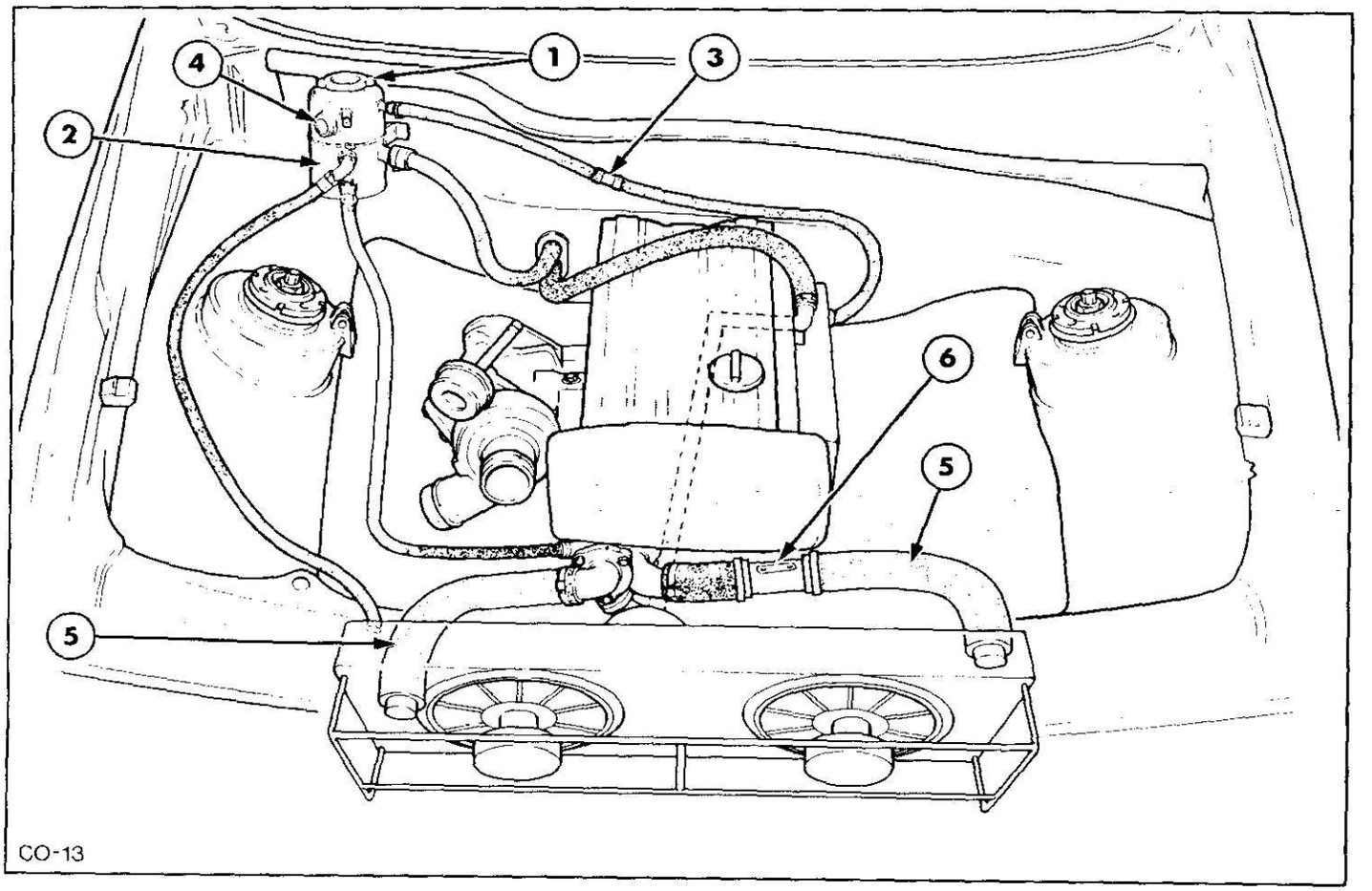
	Description	Finis Code	Comments	Qty.
1	Radiator	9095521		1
2	Fan	9095524		2
3	Fan Mounting Frame	9095523		1
4	Pin – Fan Mounting	9095522		4

The water system is piped up as shown.

The sensor tube carries the fan switch and the engine coolant temperature sensor if no thermostat is fitted.

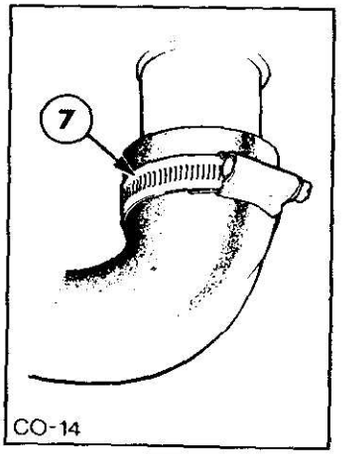
Use a mix of 50% water / 50% antifreeze and fill to the centre of the window. Keep all hoses clear of the belts. The system is fully pressurised using engine boost (or via the shrader valve).

Do not remove cap when engine is hot!

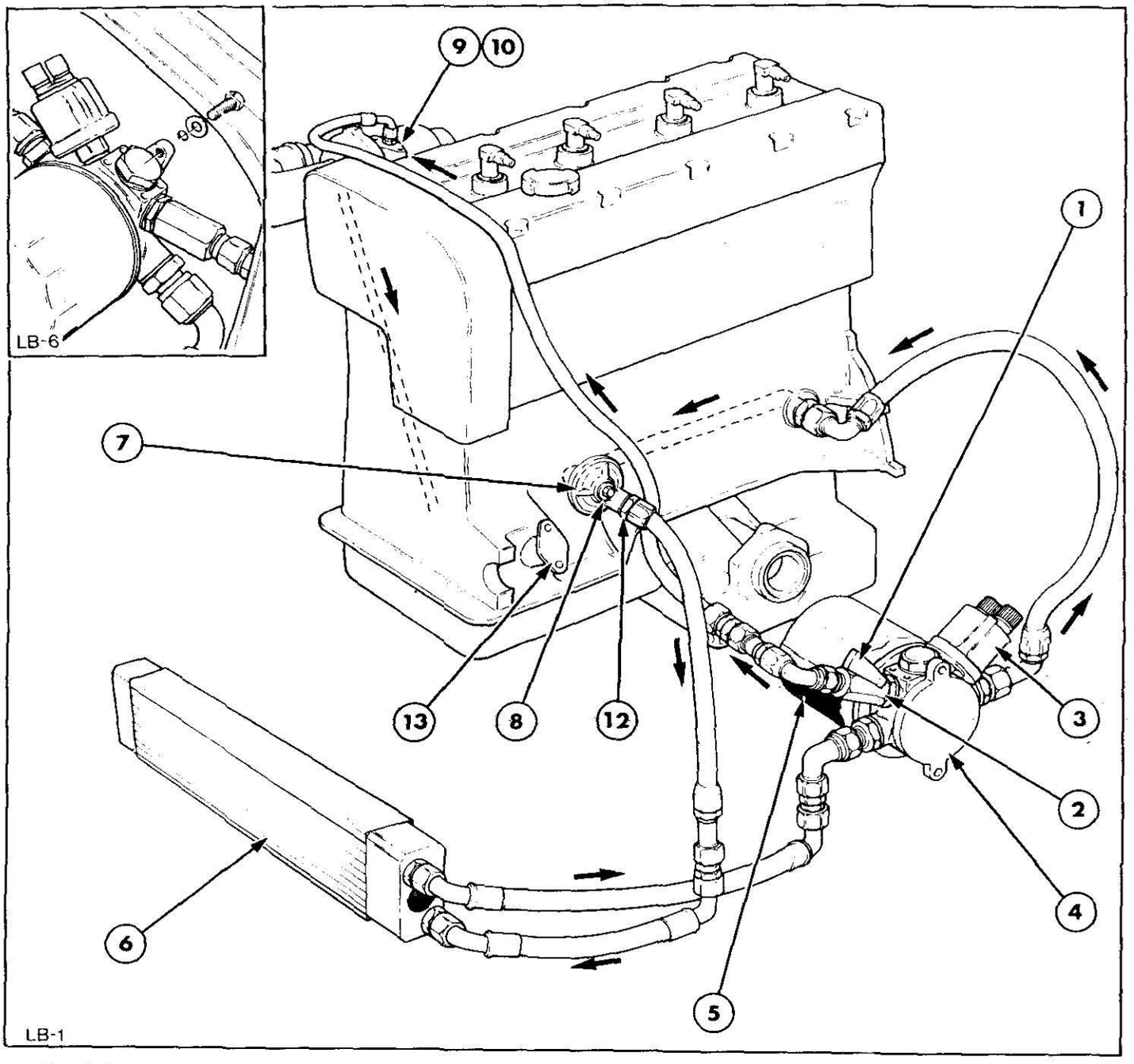


CO-13

	Description	Finis Code	Comments	Qty.
1	Cap – Header Tank	9095183	2 Bar	1
2	Header Tank	9095195		1
3	Valve – one Way	9095182	Manifold boost	1
4	Window – Header	9095197		1
	Seal – window	9095196		1
5	Hose – water	9095159	*Cut to length*	2
6	Tube – sensor	9095343		1
7	Clip – hose	5007669		A/R
	Alt.	5007666		A/R
	Alt.	5007665		A/R

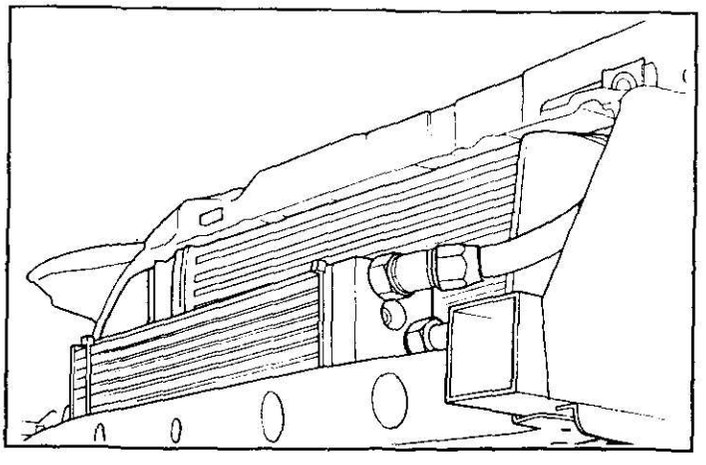


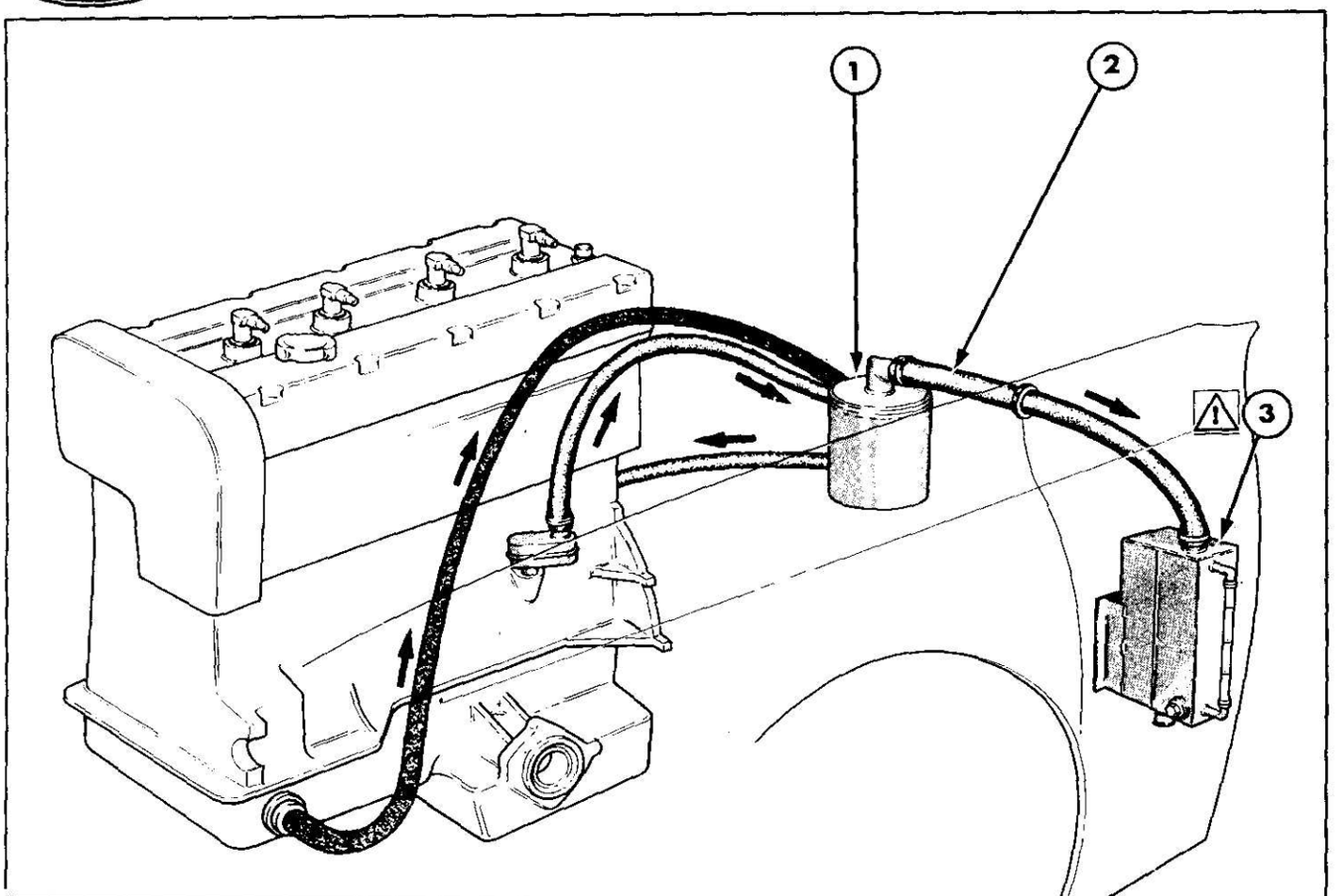
CO-14

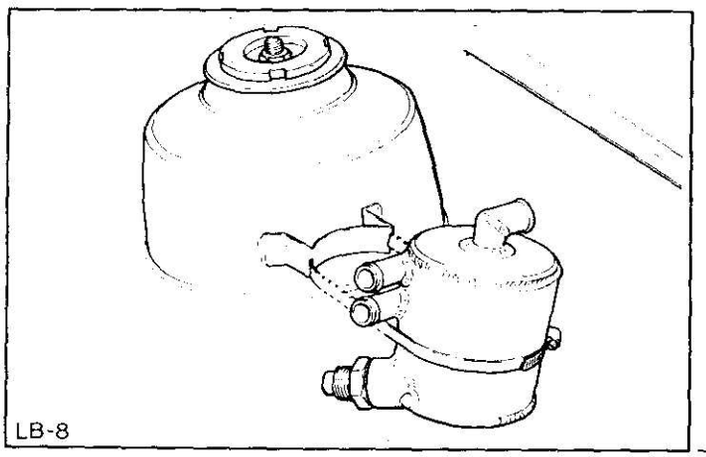


	Description	Finis Code	Comments	Qty.
1	Turbo Cut Off Valve	9094842		1
2	Union	9094841		1
3	Sender – *Oil* Pressure	9091956		1
4	Bracket – Oil Filter	9094920		1
5	Oil Filter	9094911		1
6	Oil Cooler	9093258		1
7	Adaptor Plate	9094901	(Use seal 1579875)	1
8	Nut – Blind	9094880		1
	Seal 'O' Ring	9094887		1
9	*Connecting* Flange	9095367		1
10	'O' Ring Connecting Flange	9095369		1
11	Seal	9095071	Service	1
12	Union Adaptor	9094882		1
13	Plate – Fuel Pump	9095151	Blanking plate	1
14	Spring – Oil Pump	9095139	Increased pressure	1
15	Oil Pick Up	9095140	Including spray rail	1

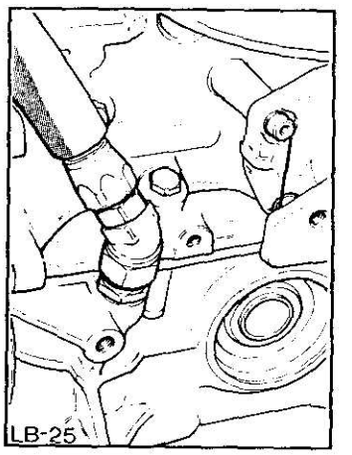
Note: For sump see P57 (Front Axle).

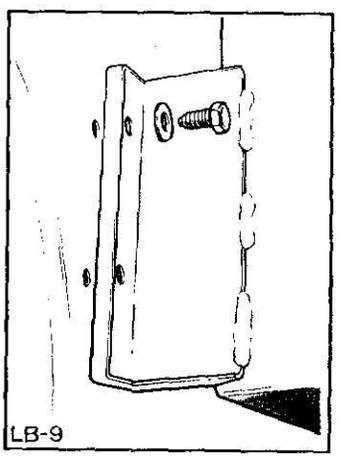


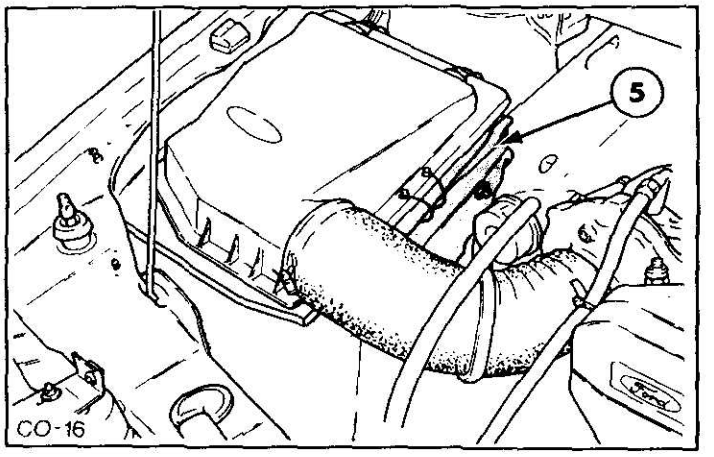


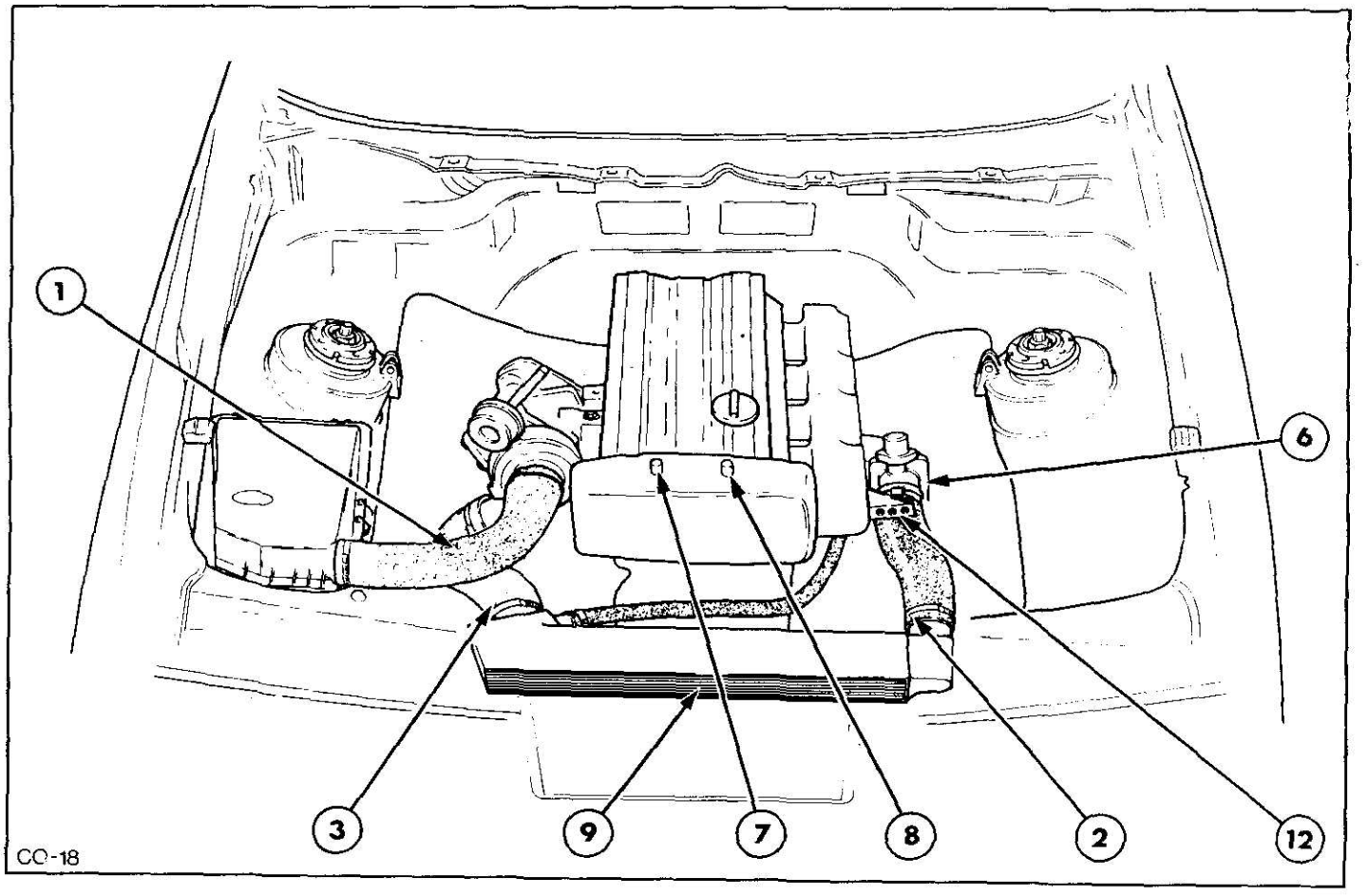


	Description	Finis Code	Comments	Qty.
1	Tank Oil Separator	TBE		1
2	Hose – Breather	TBE		1
3	Oil Catch Tank	9095081		1

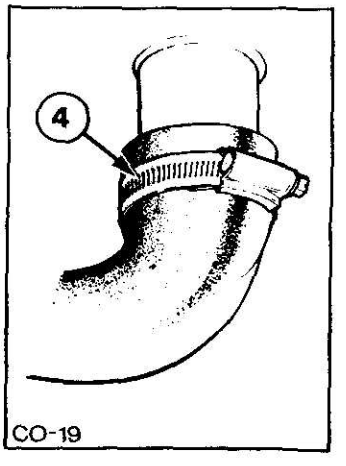




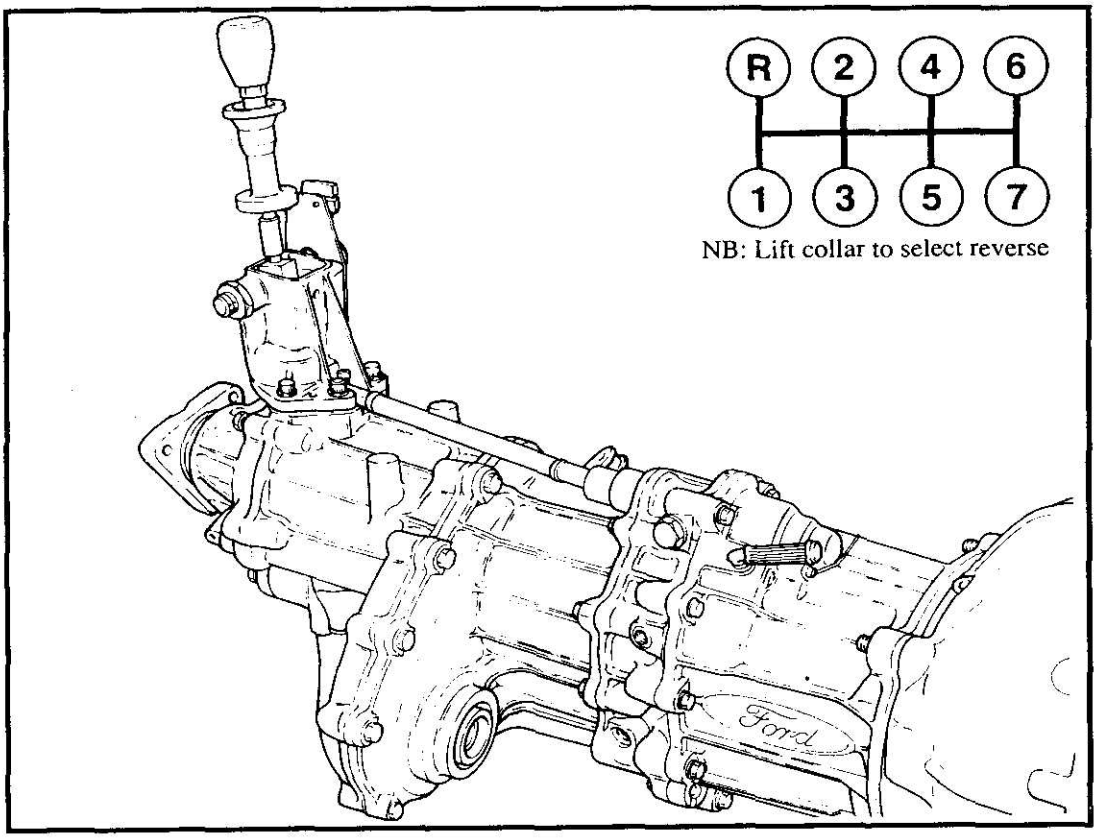




	Description	Finis Code	Comments	Qty.
1	Hose – A/C to Turbo	*6698040		1
2	Hose – I/C to Engine	9093652		1
3	Hose – Turbo to I/C	*6883520		1
4	Hose Clip	*6130115		A/R
5	Heat Shield	9092616	Air Cleaner	1
6	*Throttle Body*	*9095234*	*Modified lever*	1
7	Spacer – Cover	9095149		1
8	Spacer – Cover	9095150	Threaded	1
9	Intercooler	*6683878		1
10	Camshaft In	9094773	Virgin Lobes	1
11	Camshaft Ex	9094774	Virgin Lobes	1
12	Throttle Bracket	9094892	Modified	1



TRANSMISSION



The transmission homologated for use in the Escort RS Cosworth group 'A' is the MS90.

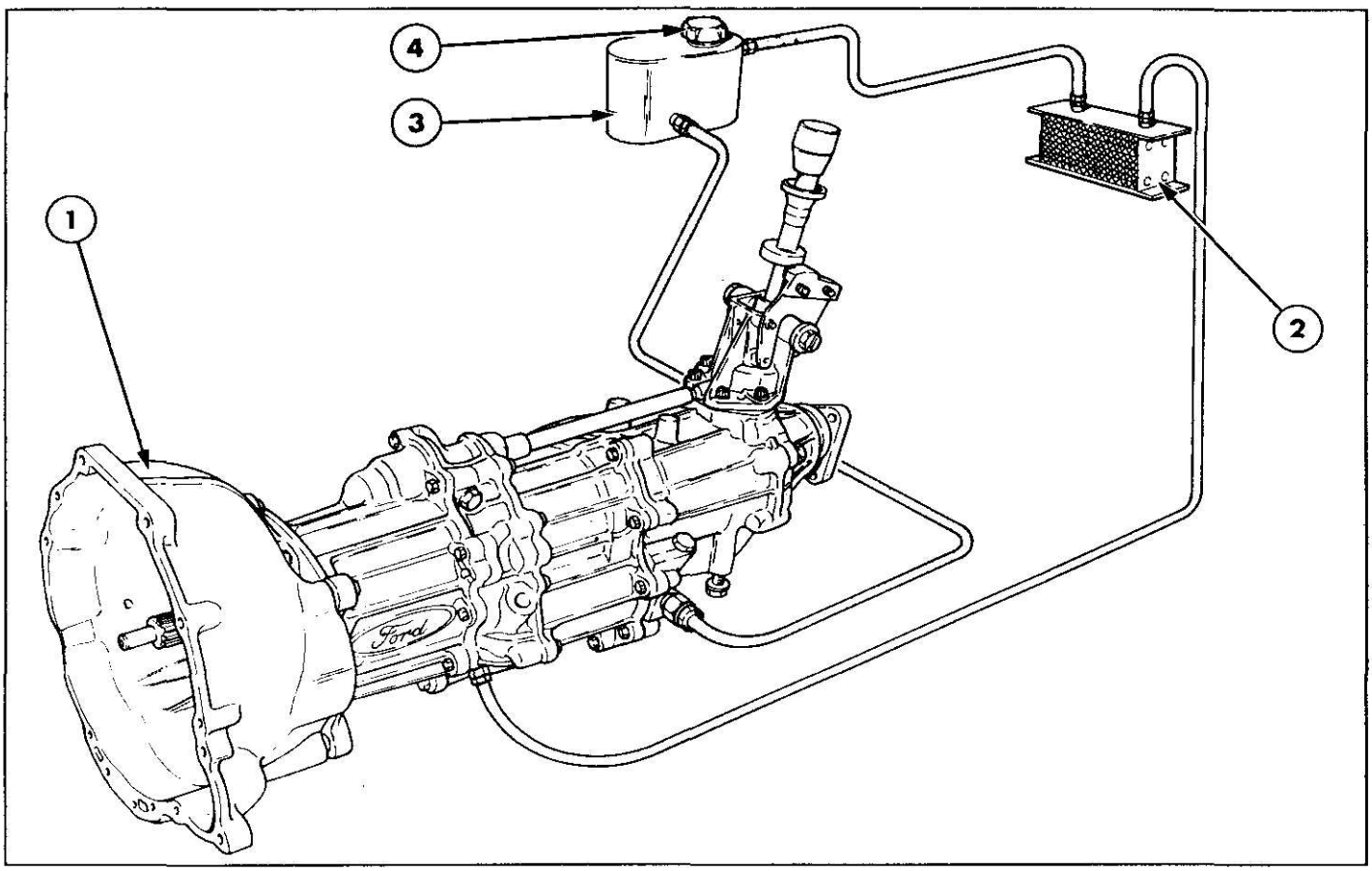
This is a seven speed unit with dry sump lubrication via a built-in oil pump, and remote reservoir. The gears are selected by clutch rings ("dogs"). There is no synchromesh available.

The MS90 transmission is supplied with a detachable (four bolts) clutch housing. Clutch actuation is normally hydraulic.

The overall ratio can be changed by replacing the primary gearset. The MS90 is supplied with the torque split set at 50% front, 50% rear, Alternative torque splits are also available.

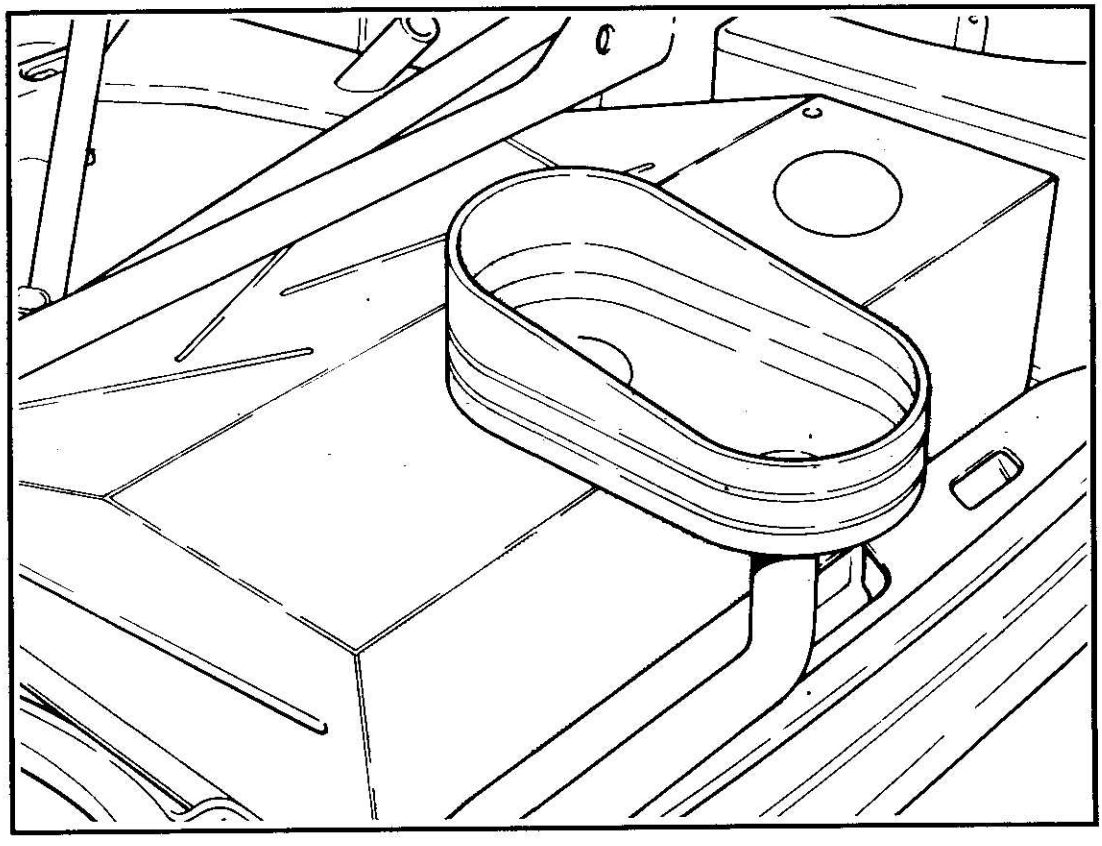
GEAR	RATIO	TEETH
1	2.071	14/29
2	1.529	17/26
3	1.200	20/24
4	0.955	22/21
5	0.792	24/19
6	0.654	26/17
7	0.536	28/15
REV.	2.143	14/30

INPUT RATIOS	TOP SPEED (640 Dia TYRES)
17/26 Standard Rally	149 mph (240 kph)
16/27 Alt. Rally	135 mph (217 kph)
18/25 Race	164 mph (264 kph)
19/24 Race	180 mph (290 kph)



	Description	Finis Code	Comments	Qty.
1	Transmission Assy.	9095326	MS90	1
	Service details for 9095326 available from:			
	F.F. Developments Ltd.			
	Wolston Business Park			
	Main Street			
	Wolston			
	Coventry CV8 3LR			
	Tel: 44 (0) 203 544 048			
2	Cooler - Transmission	9095084		1
3	Oil Tank - Transmission	9095520		1
4	Cap - Oil Tank	*5005508		1

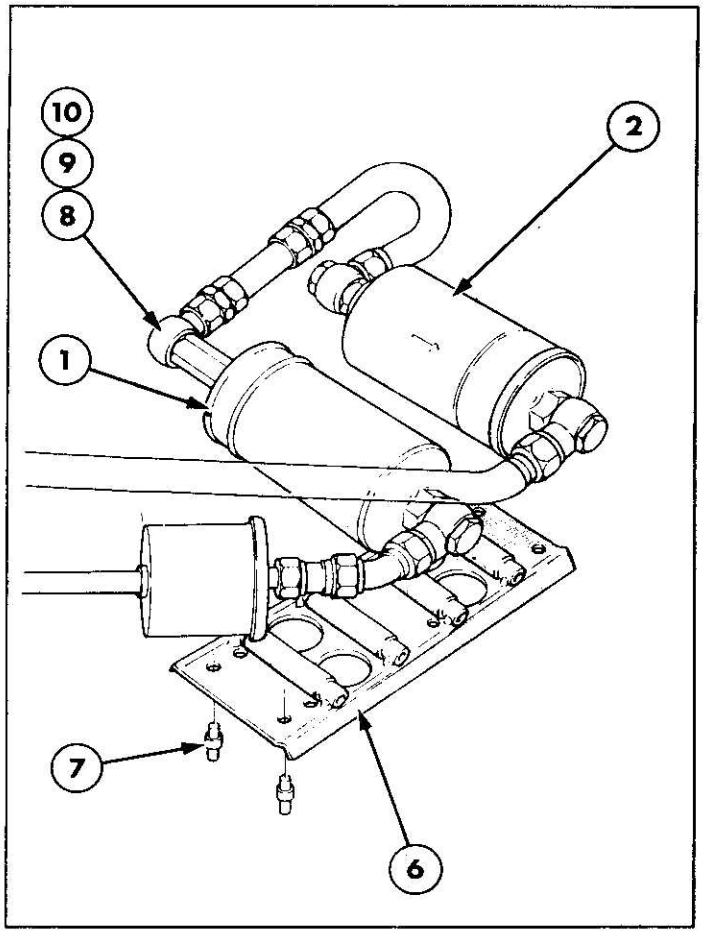
FUEL SYSTEM



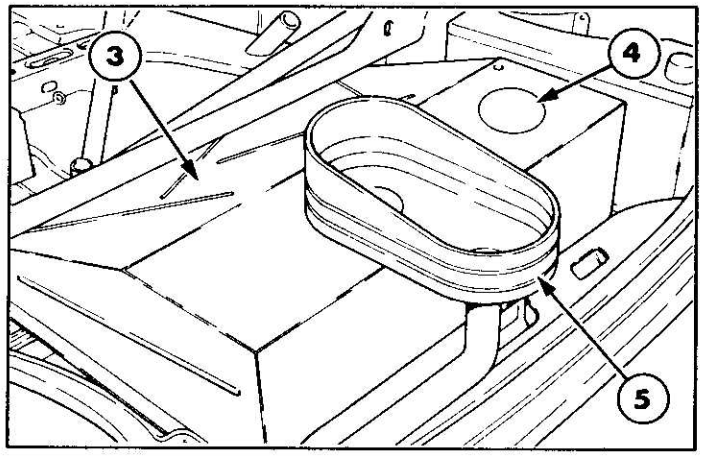
The fuel system comprises an FT3 fuel tank mounted in the luggage compartment, with an electric pump and filter situated near the base of the tank.

To enable the tank to be fitted, the detachable hatch on the right side of the luggage compartment floor is removed and the edges of the opening turned down to prevent damage to the rubber tank. The fuel tank must be enclosed in a fire and liquid proof cover (usually aluminium).

The pump and filter can be mounted on the underside of the floor and both fuel tank and pumps protected by a stone shield. Fuel lines must be aviation type with protective braiding and should be routed through the vehicle.



	Description	Finis Code	Comments	Qty.
1	Fuel pump	9092162	FT3 Tank	1
2	Filter	9090275	FT3 Tank	1
3	Fuel Tank	T B E	FT3 Tank	1
4	Fuel Sender	9094750	FT3 Tank	1
5	Fuel Filler	9094851	FT3 Tank	1
6	Bracket – Fuel Pump	9095235		1
7	Insulator – Bracket	*1570495		4
8	Banjo – Fuel Pump	—		1
9	Banjo Bolt	6054980		1
10	Washer M14	—		1



The standard alternator fitted to the Escort Cosworth is rated at 90 amps.

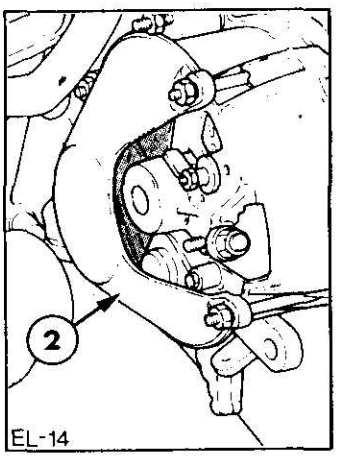
This can be replaced by a 150 amp alternator which will have enough capacity for a lamp pod, heated screen etc.

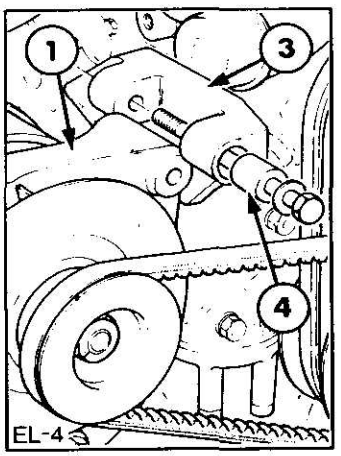
The alternator should be earthed to the bodyshell.

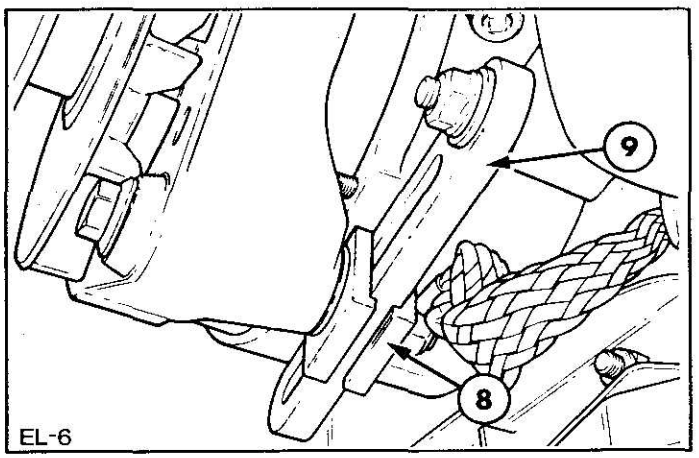
The battery can be fitted inside the car but must be enclosed in a box with ventilation to the atmosphere.

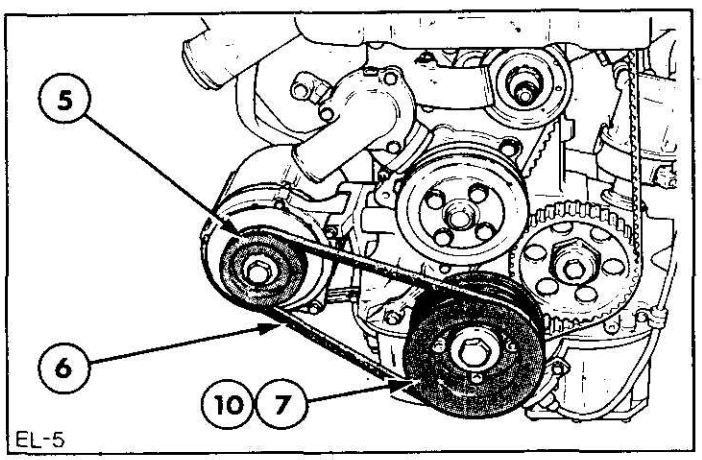
Use a sealed racing-type battery, and fit heavy duty jack-plugs to allow quick-change.

Disconnect battery and engine control unit when welding on car.





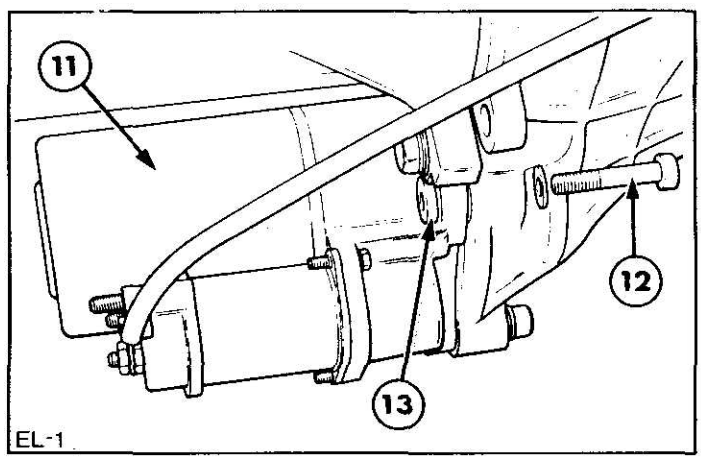




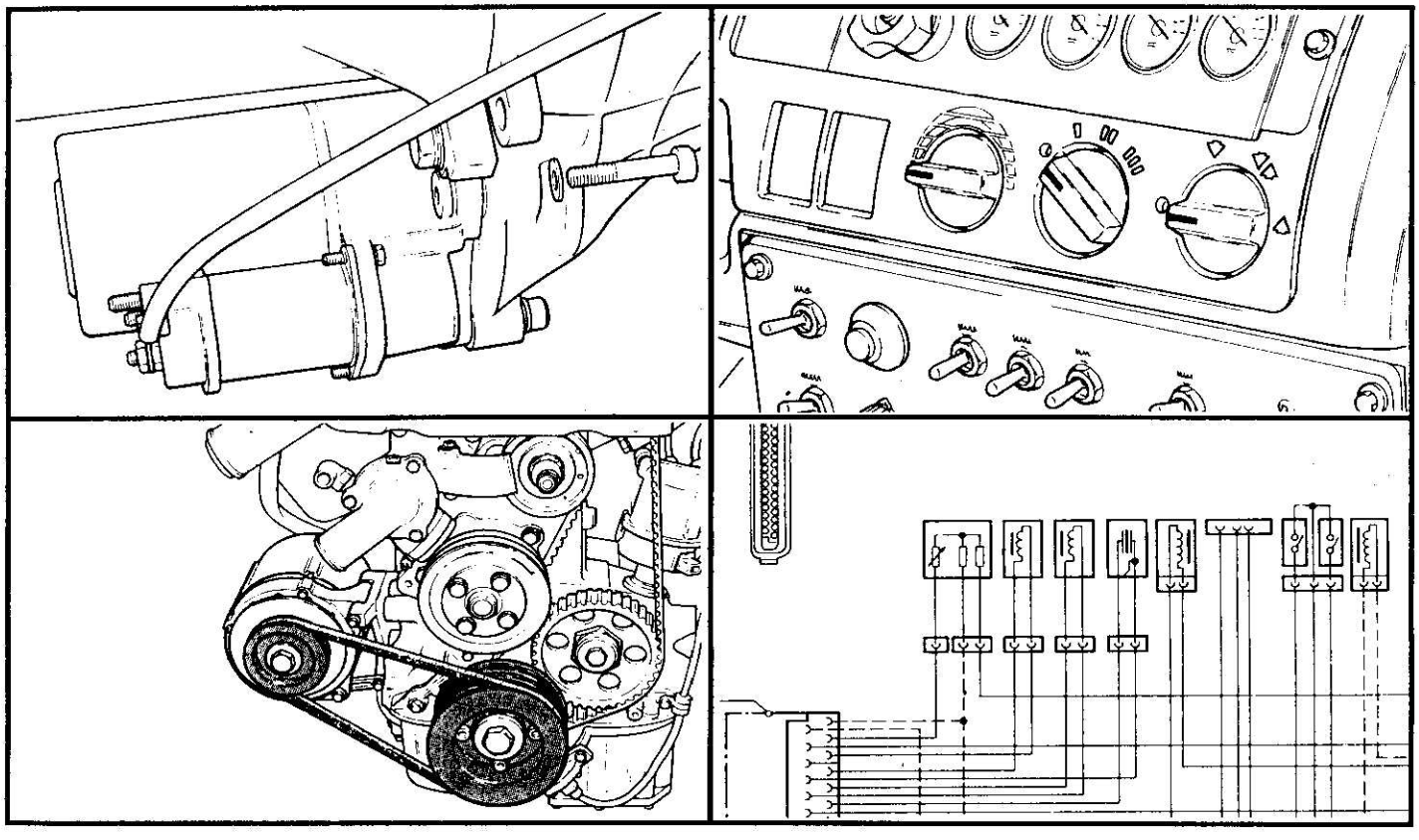
NOTE:
This starter motor has been modified to enable ease of removal as follows:

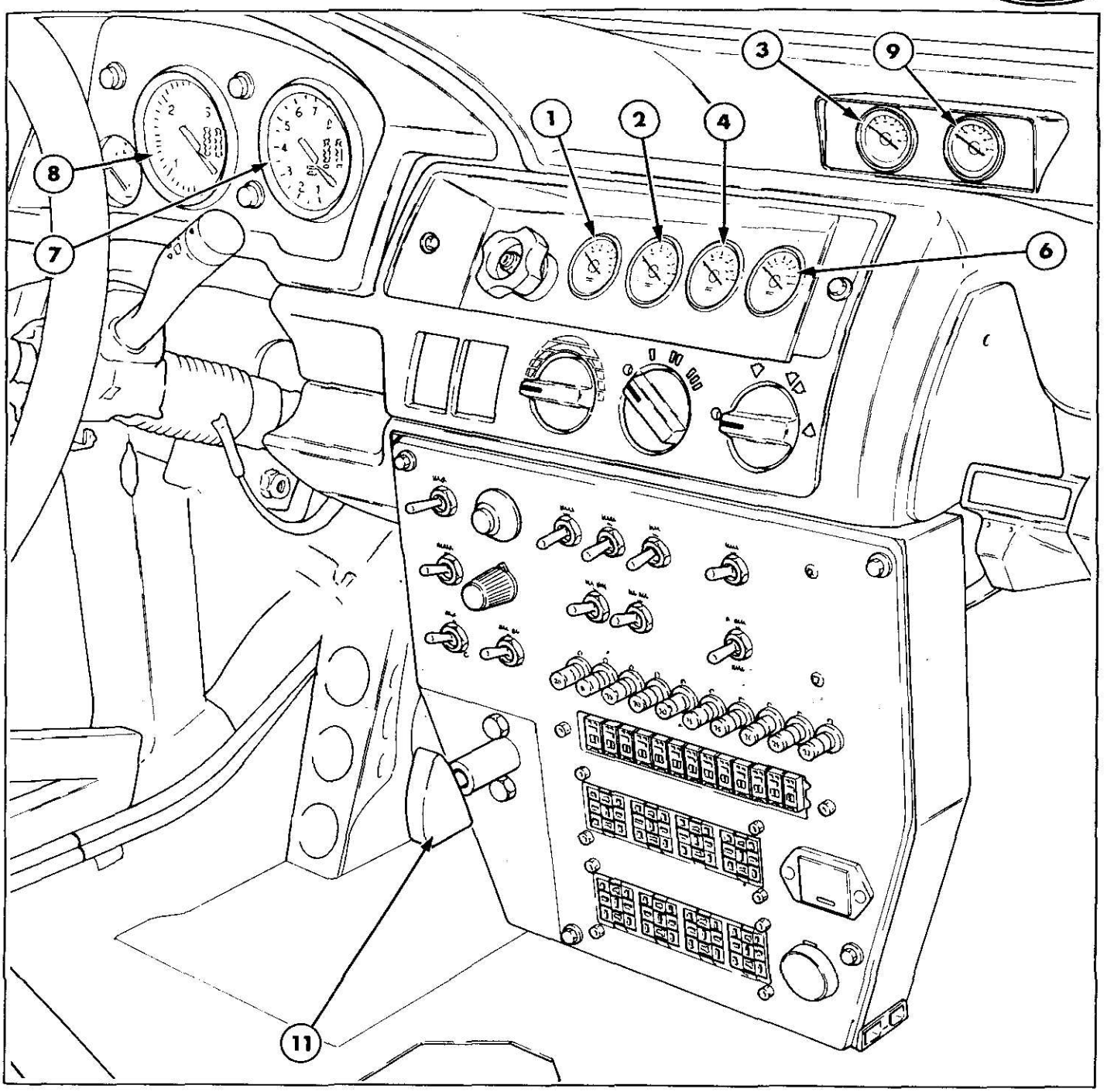
- Clutch housing drilled out to remove thread.
- Starter motor mounting flange tapped to accept mounting bolts from the rear of the bell housing.

	Description	Finis Code	Comments	Qty.
1	Alternator	9092574	150 Amp	1
2	Heatshield – Alternator	*6553448		1
3	Bracket – Alternator	9094793		1
4	Bush – Alternator Mounting	9093115		2
5	Pulley – Alternator	9095110		1
6	Belt – Pulley Alternator	9092933		2
7	Pulley – Crankshaft	9095107		1
8	Clamp – Alternator Strap	9091941		2
9	Strap – Alternator Adjust	9092600		1
10	Adaptor – Crank	9095067		1
11	Starter Motor	*1659138		1
12	Bolt – Starter	*1515841		3
13	Insert – Starter	9093121		2



ELECTRICAL





	Description	Finis Code	Comments	Qty.
1	Gauge – Oil Pressure	9091435	0 – 10 bar	1
	Oil Pressure Sender	9091956		1
2	Gauge – Water Temperature	9090777		1
3	Gauge – Turbo Boost	9090788		1
4	Gauge – Fuel Pressure	9091435		1
5	Fuel Pressure Sender	9091956		1
6	Gauge – Fuel Level	9090776		1
7	Tachometer	9091326		1
8	Speedometer	9091407		1
9	Voltmeter	9090779		1
10	Kit – Air Horns	*5006122		1
11	Switch – Master Cut-off	9092629		1

Additional Auxiliary gauges "may be freely installed, provided that their fitting is not likely to create any danger".

The horn may be changed or an additional one added "possibly for passenger use". The air horn kit is ideal for this purpose, with a foot operated button on the navigators footrest.

Ensure any additional lamps are wired through separate relays to avoid overloading the standard wiring. Problems are caused by chafing wires or radio interference. Keep radio equipment away from engine electronics.

⚠ WARNING

Disconnect battery and engine control module **before** commencing any welding on the vehicle.

MS NUMBERS APPLICABLE TO STICKERS, BADGES AND LITERATURE

STICKERS:

MS13	3"	Ford Oval
MS14	8"	Ford Oval
MS15	10"	Ford Oval
MS16	14"	Ford Oval
MS17	20"	Ford Oval
MS18	30"	Ford Oval
MS19	40"	Ford Oval
MS23	4½"	Ford Oval
MS24	6"	Ford Oval
MS30	6" x 3"	Ford Motorsport
MS31	8" x 4"	Ford Motorsport
MS32	4" x 1¾"	Ford Motorsport

BADGES:

MS26	Oval Cloth
9091528	Rectangular with Ford in Oval

LITERATURE:

MS36	Escort Group 'N' Preparation Manual (Illustrated)
MS37	Escort Group 'A' Preparation Manual (Illustrated)

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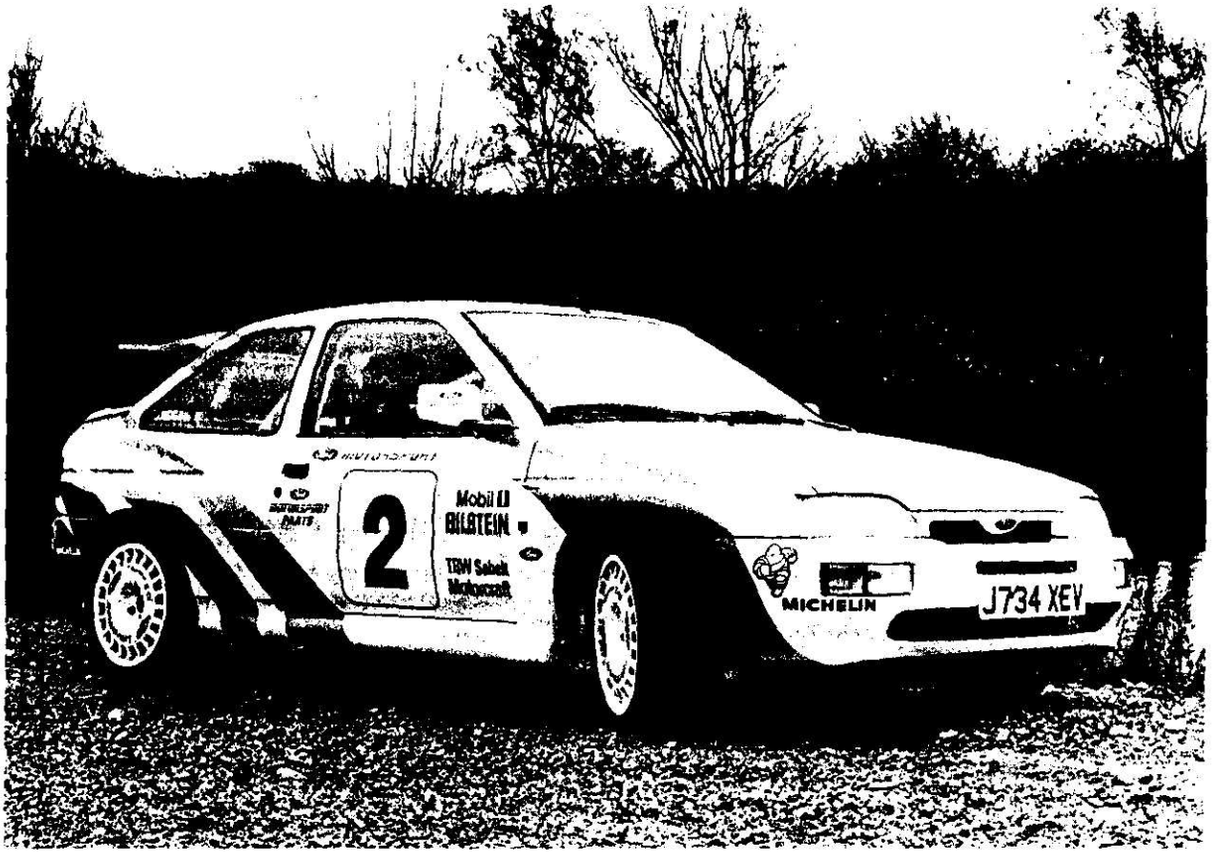
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Fax: 0582-471914

Motorsport



Group 'N' Rally Preparation Manual

Escort RS Cosworth

MS 36

ISSUE 2 – 05/93

Motorsport

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This publication covers parts available for the Ford Escort RS Cosworth. Ford Motor sport continues to work on the design and development of new parts for Escort Cosworth 4x4 motorsport cars. These will initially be announced in Ford's PERFORMANCE NEWS service, but will then be included in the next issue of this publication.

Note: Finis Codes identified with an asterisk (*) are standard Ford Production car items, and should be ordered through any Ford dealer, who will acquire them either from Daventry in the U.K. (U.K dealers) or from Merkenich in Germany (Ford dealer in Europe).

DISCLAIMER

In certain countries some Ford Motorsport parts, installation, and recommended changes in this manual may not meet national type approval laws or construction and use regulations. At all times it is the responsibility of the customer to ensure compliance in a particular country. The eligibility of any part for use in Motorsport must be determined, by the customer, by reference to the relevant up-to-date homologation form, and (where applicable) championship regulations.

Ford cannot accept responsibility for any problems arising from failure to comply with these recommendations.

ESCORT RS COSWORTH GROUP 'N'



The Ford Escort RS Cosworth was Homologated into group 'A' and 'N' on Jan. 1st 1993. This publication details the modifications necessary or recommended for group 'N' competition. It should be read in conjunction with the F.I.S.A. yearbook and bulletins for international events. A copy of the standard workshop manual "Ford Sierra RS Cosworth and Escort RS Cosworth" (order code No CG1503/EN) is also useful and can be ordered via a Ford dealer, this covers normal service and repair procedures. The Homologation number for group 'N' is N5466.

Ford Motorsport have developed and tested the Group 'N' Escort during 1992. The car has been driven by Ford Works Drivers on Tarmac at Boreham and in Wales, and on gravel in Wales, Yorkshire and Cordoba in Spain. A wide range of parts have been tested in all conditions to determine component 'Life' as well as performance. Where possible an indication of safe working life will be shown as a guide, but it must be stressed that this varies widely with conditions and driving technique. In any case, every critical component should be checked regularly during the event, and replaced if wear or damage is evident. A system of preventative maintenance will help avoid costly failure.

The Escort RS. Cosworth is based mechanically on the Sierra RS Cosworth 4x4 with minor changes to engine and driveline. The bodyshell is unique, with interior trim based on the Escort model range. The 'Roadsport' version is sold without radio, sunroof and electric windows to provide an ideal base vehicle for the competitor. The front spoiler incorporates an airsplitter which should be retracted for use on gravel and extended for Tarmac/race. The optional fog lamps can be fitted - there is no cooling advantage to be gained in fitting the grilles in group 'N'.

It is recommended that users register with the Ford Motorsport 'Performance News' service by contacting:
Graham Robson
Girt House,
Burton Bradstock,
Bridport, Dorset DT6 4QFUK
Fax: 0308 897416.

BODYSHELL

The Motorsport Escort RS Cosworth bodyshells are seam welded, strengthened and fitted with a welded in safety roll cage to give high torsional rigidity, long life and inherent safety.

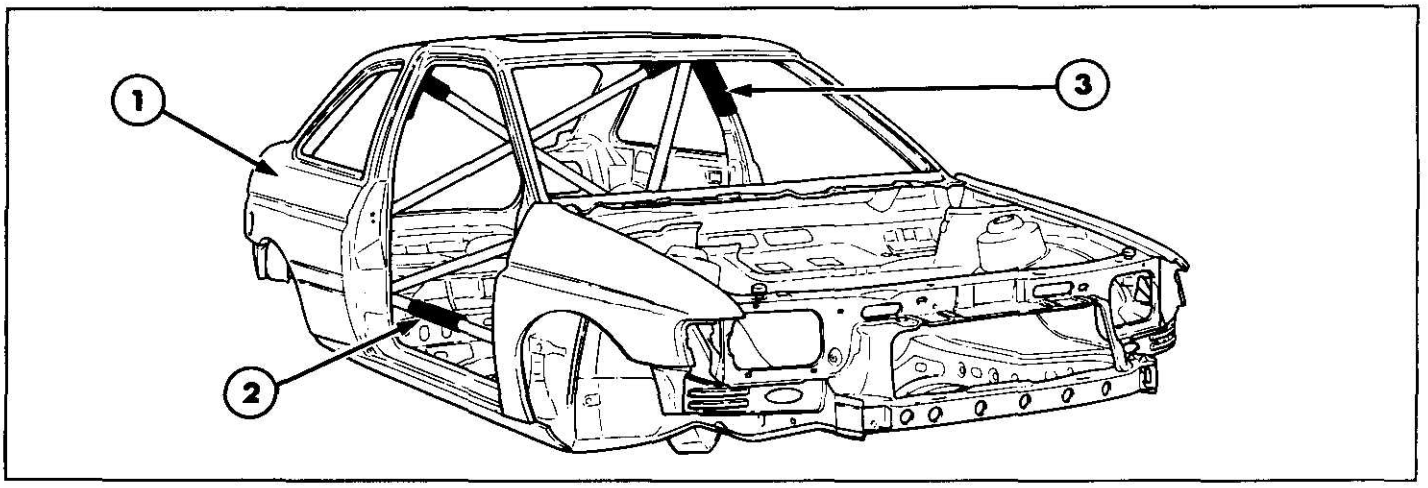
Bonnet locking pins should be fitted to the hood top and the tailgate. The best location for the tailgate fixing is on the rear window pillars, below the upper spoiler.

Roll cage sleeving is available in two sizes. Use 9092652 on door bars, and 9095218 on the main roll hoop near the occupant's head.

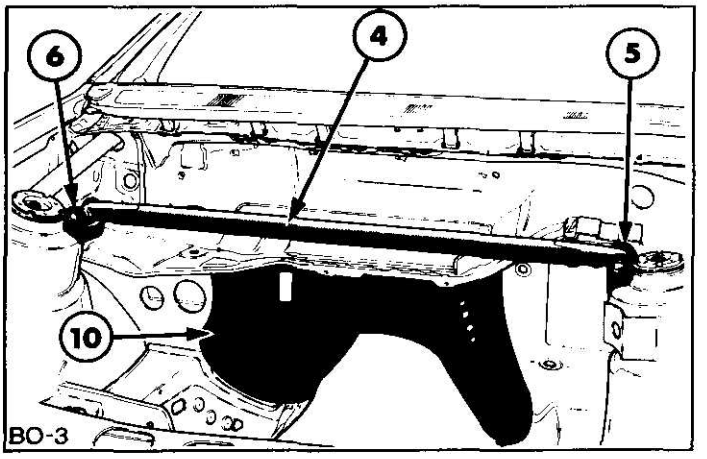
The netting is useful for carrying helmets and jackets in the rear, or as a map container on the navigator's door.

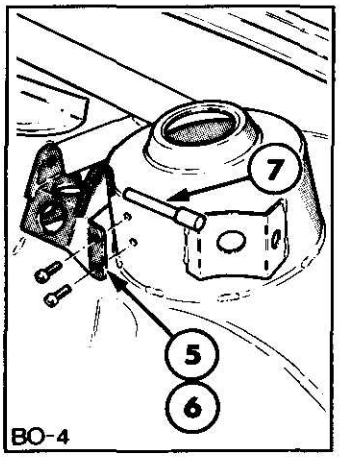
The trimmed bodyshells include glass, lights, instrument panel, heater and some interior trim but do not include seats or mechanical parts.

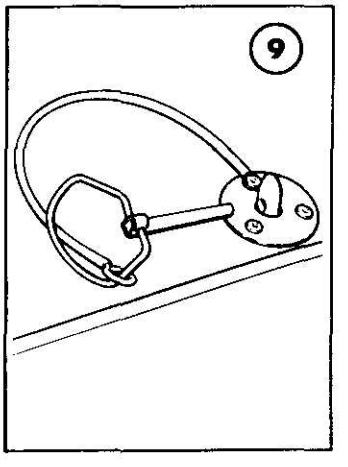
Note: The 1994 rollcage changes proposed by FISA will not be applied retrospectively to bodyshells bought during 1993.



	Description	Finis Code	Comments	Qty.
1	Bodyshell - RHD	9095475	Fully prepared including	1
	Bodyshell - LHD	9095476	Welded in Roll Cage	1
	Bodyshell - LHD	9095315	Primer - no Cage	1
	Bodyshell - RHD	9095316	Primer - no Cage	1
	Bodyshell - LHD	9095579	Trimmed	1
	Bodyshell - RHD	9095585	Trimmed	1
2	Sleeving, Roll Cage	9092652	2 x 2 metre lengths	1
3	Sleeving, Roll Cage	9095218	54mm 1 x 2M length	1
4	Crossbrace, Turret	9093717	Lightweight Support	1
5	Bracket, Crossbrace, LH	9094871	Use with Crossbrace 9093717	1
6	Bracket, Crossbrace, RH	9094875	Use with Crossbrace 9093717	1
7	Pin, Turret Brace Fixing (Quick Releasing)	9094870	Use with 9093717 9094871 and 9094875	2
8	Netting, Side Storage	*6122596		2
9	Bonnet Pin Set	9095221	Aluminium	2
10	Heatshield - Transmission Tunnel	9094778		1
11	Seat Rail	9092968		4
12	Front Plate	9095412	Seat Mounting	4
13	Rear Plate	9095411	Seat Mounting	4



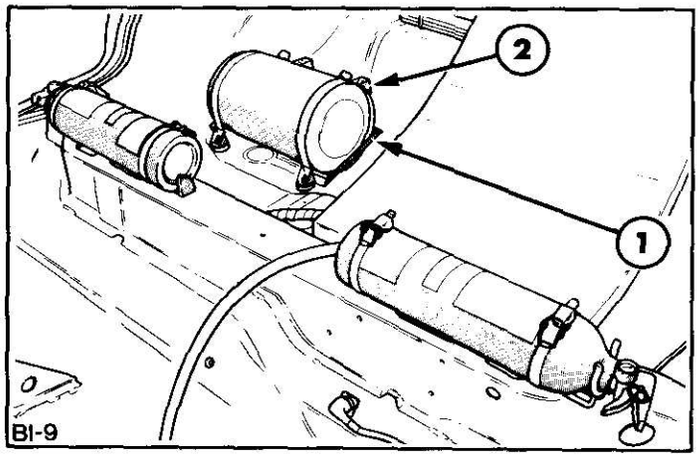


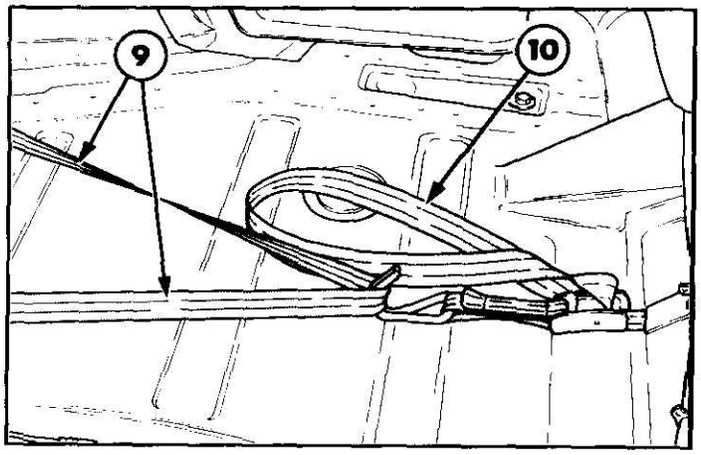


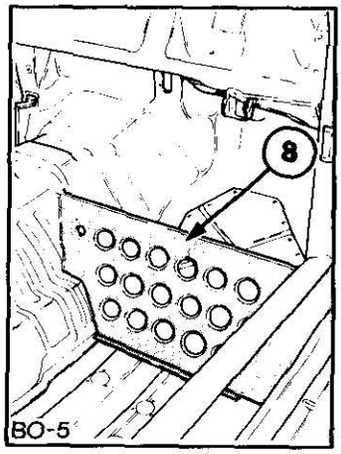
FISA recommend an automatic 'plumbed in' extinguisher system of 71/2KG. (2.5kg cockpit, 5kg engine). The system should be "powder or an agent of similar efficiency and non-toxicity". Currently, halon 1211 or 1301 (BCF-BTM) is common. New regulations concerning extinguishants are currently under review by FISA.

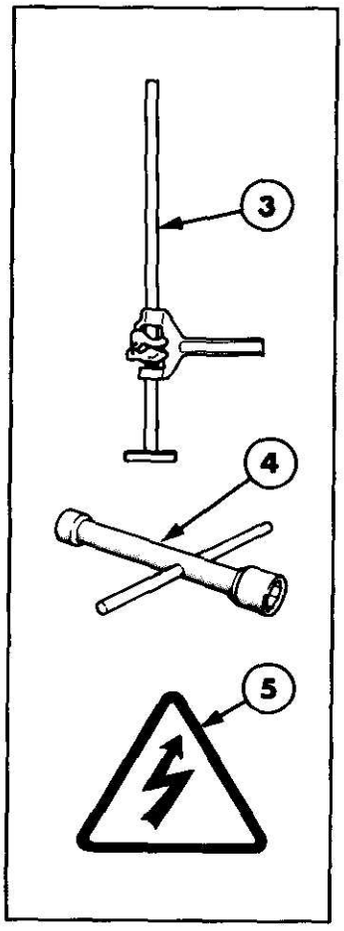
In addition, the car must be equipped with one or two hand held bottles containing 4kg minimum extinguishant.

Rally cars must carry First Aid kit and warning triangles in most European countries to comply with traffic laws.

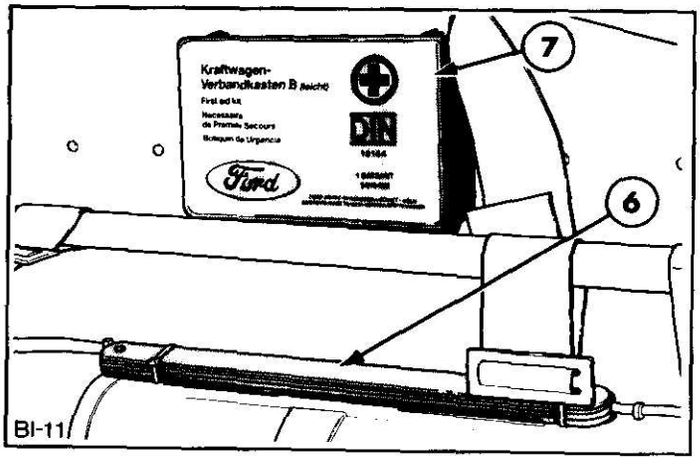








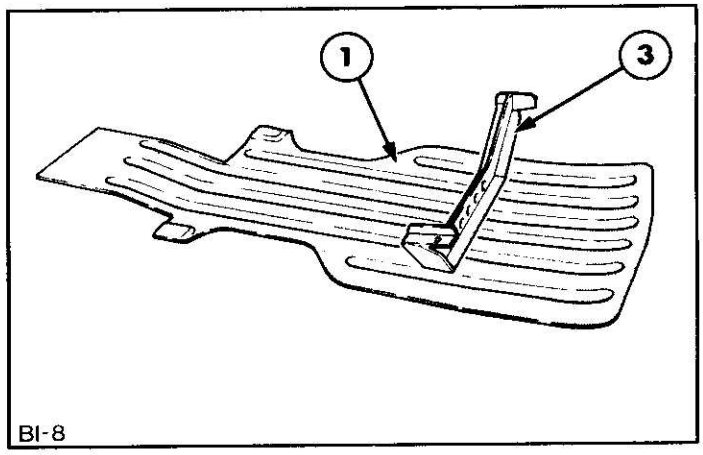
	Description	Finis Code	Comments	Qty.
1	Bracket, Fire Extinguisher	9092884		2
2	Strap, Fire Extinguisher	9092938		2
3	Jack, Short, (Quicklift) Complete with Handle	9091324		1
4	Wheelbrace - High Speed Spinner Type	9090628		1
5	Decal - Ignition Cut - Out	9092875		1
6	Warning Triangle	*5027194		1
7	First Aid Kit	*5010466		1
8	*Footrest LHD*	9095258	*Kevlar (alt.)*	1
9	Spare Wheel Strap	9090630		1
10	Spare Wheel Strap	9090631		1



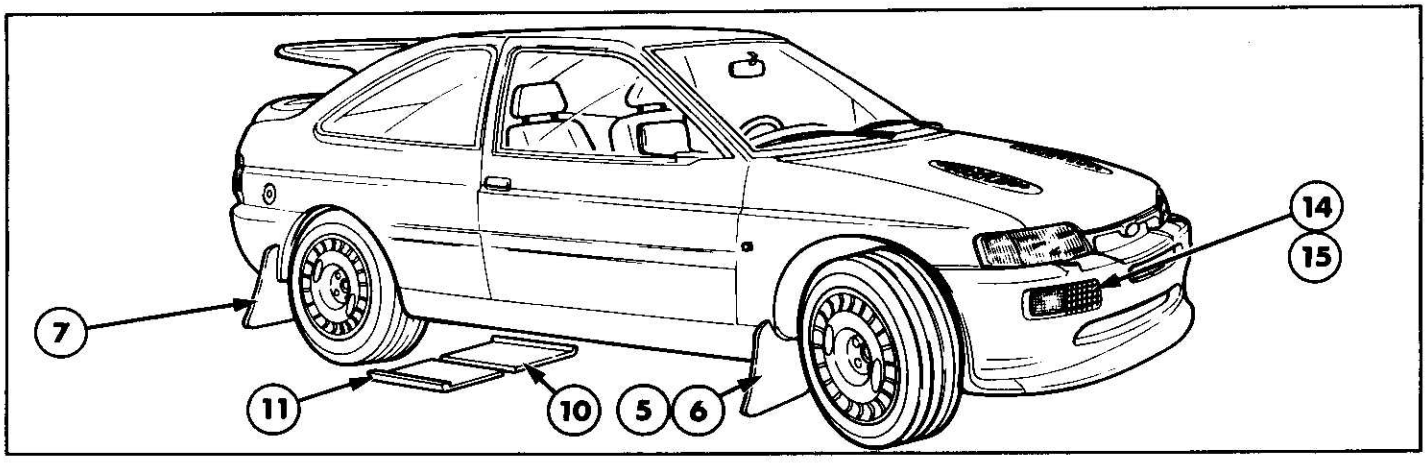
The under shield is mounted onto a front bracket supported by two aluminium side brackets, a centre support fitted just ahead of the suspension crossmember, and two bolts into the chassis rails. A foam pad should be fitted between the undershield and the suspension cross member/sump.

Shields are also available to protect the rear floor pan, windscreen washer bottle, rear axle and production fuel tank.

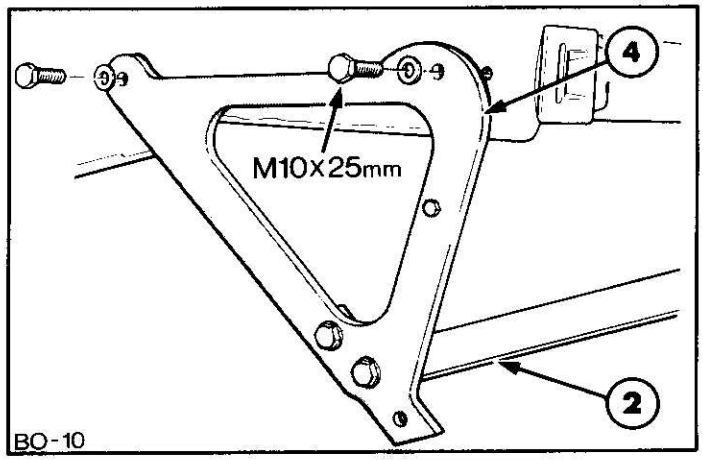
On gravel events mudflaps are recommended.



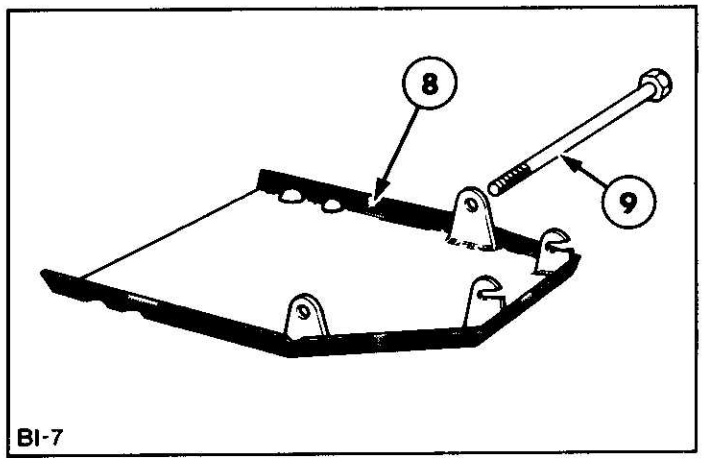
BI-8



	Description	Finis Code	Comments	Qty.
1	Undershield, Front Kevlar	9095489	Tarmac or Gravel	1
2	Undershield Support Bracket, Front	9095504		1
3	Undershield Support	9094697	Gold	1
4	Bracket, Sump Shield, Side	9095503		2
5	Mudflap Front LH	9095618		1
	Mudflap Front RH	9095619		1
6	Bracket - Mudflap	9095709		2
7	Mudflap - Rear LH	9095616		1
	Mudflap - Rear RH	9095617		1
8	Undershield, 7" Axle	9095014	Use with standard 7" axle	1
9	Bolt - Axle	9093217		1
10	Floor Pan Shield LH	TBE	Gravel use	1
11	Floor Pan Shield RH	TBE	Gravel use	1
12	Kit - Fuel Tank Guard	9095499	For std. tank	1
13	Shield - Washer Bottle	9095501	Kevlar	1
14	Grille LH	9092971		1
15	Grille RH	9092972		1



BO-10

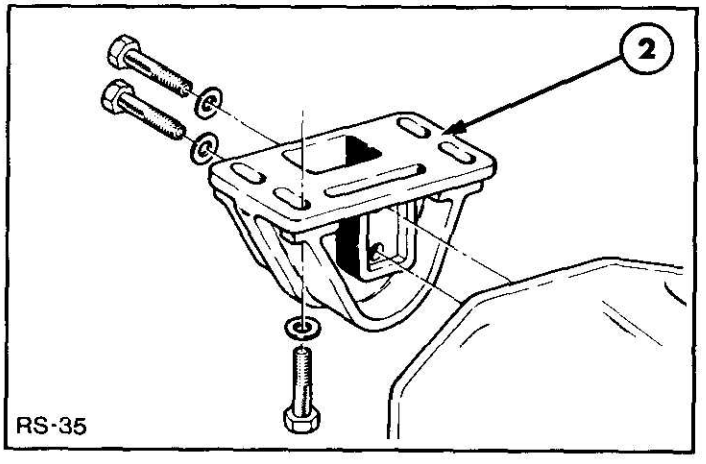


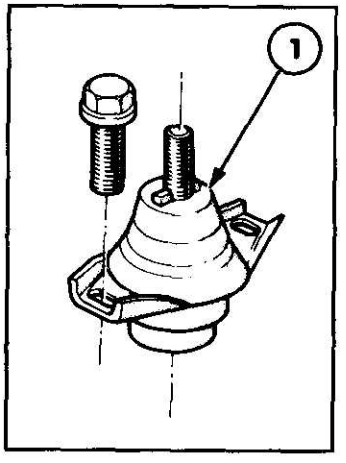
BI-7

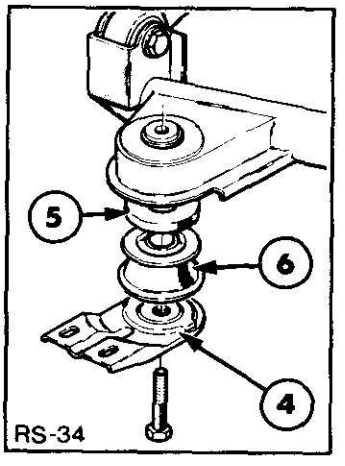
It is important to check the front and rear engine mounts regularly on rough gravel events or where the car is jumping.

The standard engine mount heatshield must be fitted on the R.H.S. near the turbocharger to avoid heat damage to the rubber and consequential failure.

Engine mount failure can cause the driveshafts to pull out. Ensure the bolts to the engine block are as long as possible and correctly torqued, as block castings can crack.



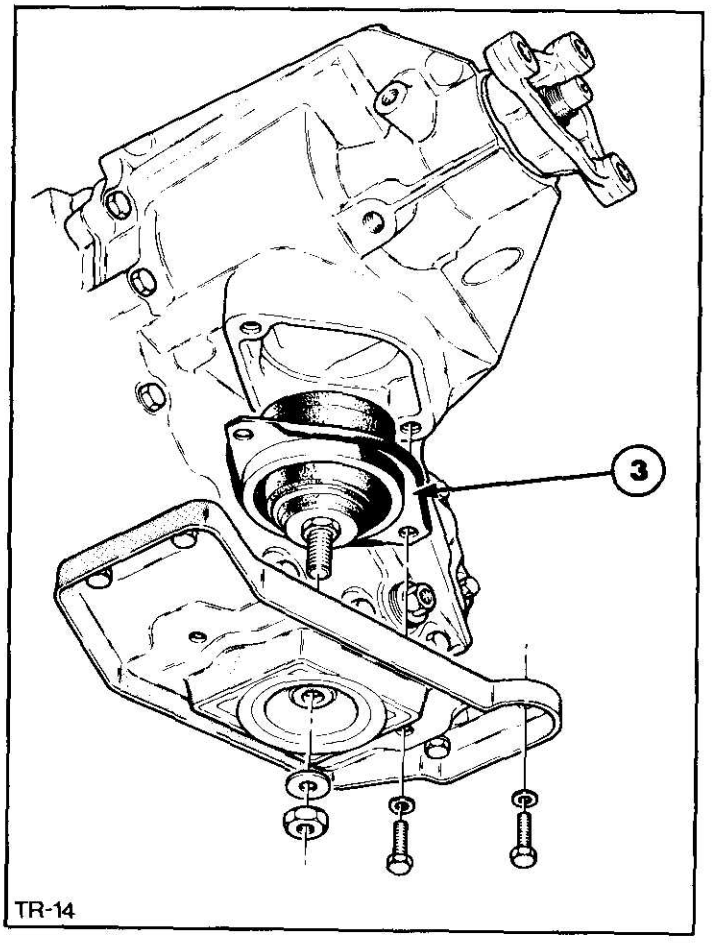




	Description	Finis Code	Comments	Qty.
1	Insulator Engine Mount	9095171	'Selected'	2
2	Insulator, Rear Diff..	9094679	'Selected'	2
3	Insulator - Engine Rear	9094771	'Selected'	1
4	Plate Assembly, Rear Suspension Steady	9094799	Reinforced	2
5	Reinforcement, Body to Rear Crossmember	9094694	Weld to bodyshell	2
6	Insulator - Rear Beam	9094678	'Selected'	2

Torques

1	Front Engine Mount to Arm	90 Nm
2	Engine Mount to Front X MBR	55 Nm
3	Rr Axle Mount to Axle	50 Nm
4	Rr Axle Mount to Floor	25 Nm
5	Transmission Mount to X MBR	65 Nm
6	Rear Beam Mountings	88 Nm



ENGINE

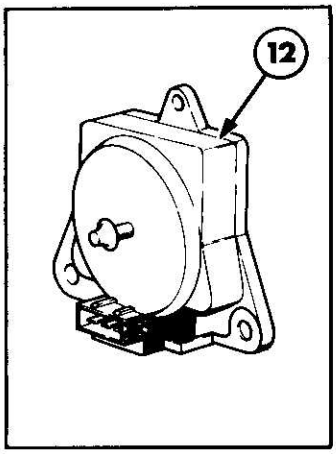
The basic engine is virtually a carry over from the Sierra Cosworth 4x4, but with a larger turbo, and a water-cooled intercooler. Water injection (I.S.S) is also fitted to the first 2500 cars. This can only be activated with the correct EPROM.

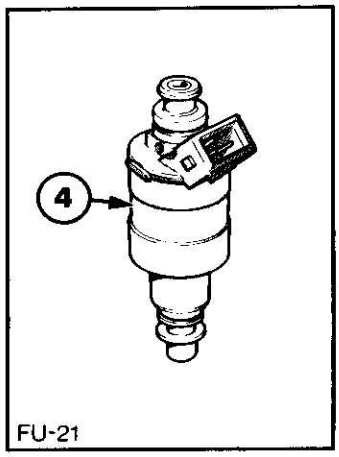
As the car was homologated with water injection, the system MUST be fitted in the car to comply with group 'N'.

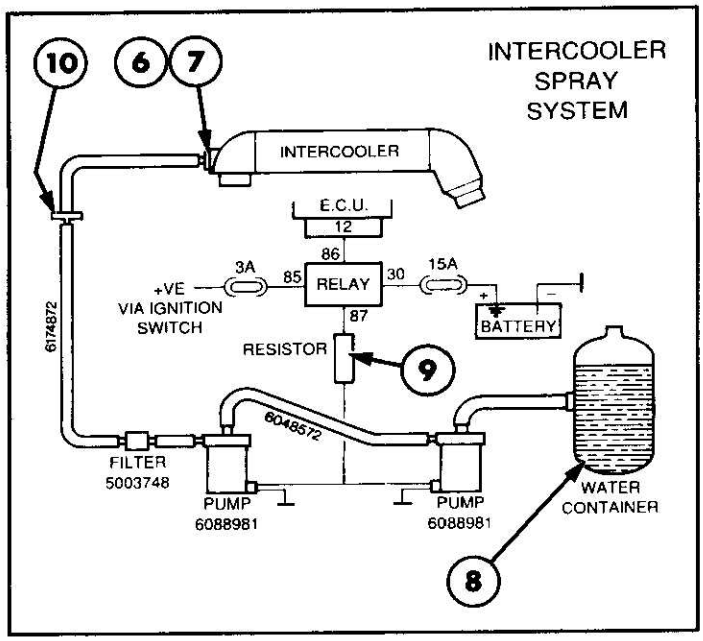
Fit the recommended injectors, and spark plugs, map sensor and fuel pump. Set the boost to 1.5 bar peak. Excessive boost will raise the water temperature and shorten turbo and gasket life. The turbocharger will normally last for 800km between rebuilds. Ensure air filter element is replaced regularly in dusty conditions or if wet. Seal gaps around radiator/intercooler with tape.

The EPROM board asy. 9095877 can be used with or without a catalyst, but the production lambda (HEGO) sensor must be connected.

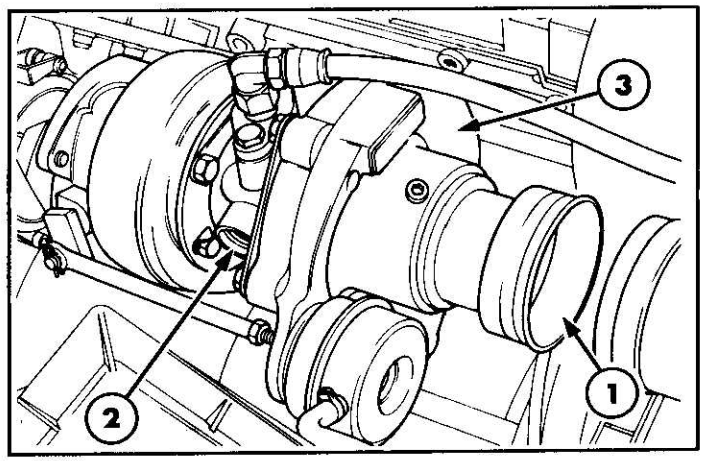
The water temperature should be approx. 90°C at 20°C ambient. In warm climates, restrict the intercooler pre-cooler water flow and run the radiator fans continuously (fit an override switch). The intercooler spray system (ISS) will keep the plenum temperature at 40°C (ensure container is filled at service points) The thermostat can be modified or replaced. Use new cylinder head bolts at each rebuild. The sump can be baffled to reduce oil surge.





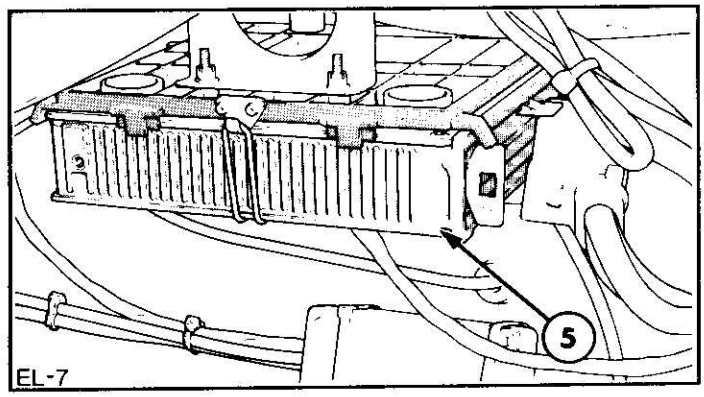


	Description	Finis Code	Comments	Qty.
1	Restrictor Turbo	9095484	36mm diameter gold	1
2	CHRA Turbo Core	9095477	Balanced	1
3	Compressor Hsg.	9095446	To suit restrictor	1
4	Fuel Injector	9095156	'Green'	4
5	EPROM Board	9095877	Level P8	
6	Adaptor - Jet	9095677		1
7	Jet - I.S.S.	9095584		1
8	Water Bag	9095582		1
9	Resistor	—	R22 Ohms 100W	1
10	Flow Valve	9095871		1
11	Sparking Plug	9094884	AGP 601	4
12	Air Pressure Sensor	9092433	3.0 Bar	1
13	Cyl. Head Gasket	9092431		1



ONLY SUPER UNLEADED FUEL (98 OCTANE) SHOULD BE USED

Wastegate Setting	:	9 P.S.I.
Max. Boost	:	1.5 Peak (Overboost)
Fuel Pressure (Idle)	:	3 Bar ± 0.2
Engine Oil	:	Mobil 1 (Change after 1000km)
Inlet Timing (Max. opening)	:	110° ATDC
Exhaust Timing (Max. opening)	:	110° BTDC
Crank Sensor Gap at Pulley	:	1.1 – 1.3mm
Spark Plug Gap	:	0.5mm
Wastegate Restrictor	:	0.8mm



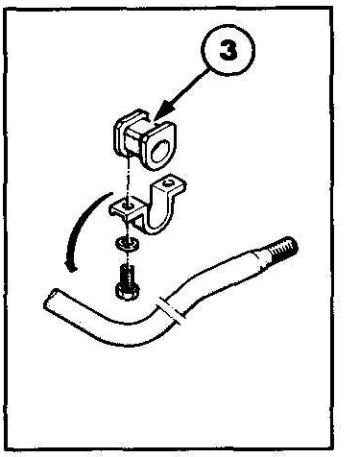
The standard front anti roll bar is 29mm on the Escort. The roll bar nuts must be checked for tightness regularly. The ends can be drilled and fitted with 'R' pins for added security. Tighten suspension bolts when car is on the ground to avoid 'wind-up', in the bushes.

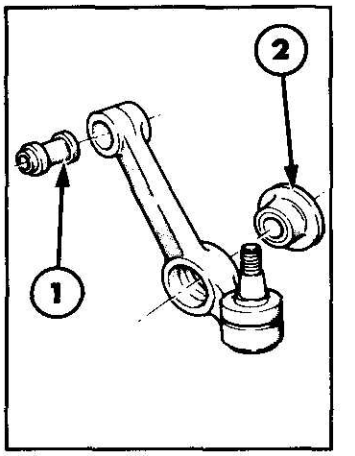
Track control arms and upright castings must be changed frequently - as any wear can cause failure of the T.C.A. ball pin.

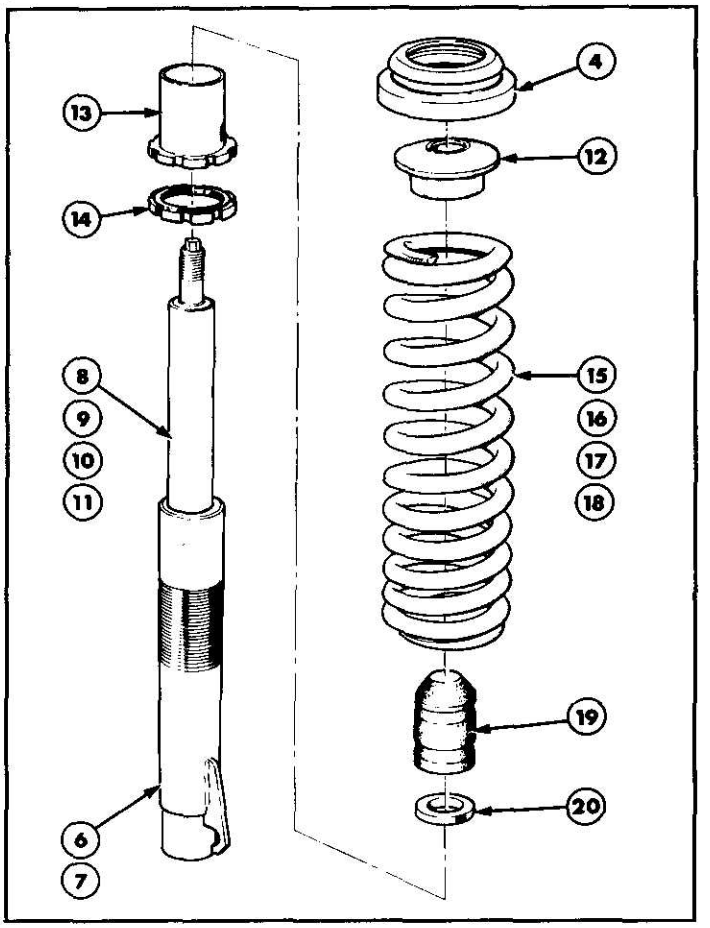
Front hubs should be checked regularly and renewed after 500km. Shotpeening will help to avoid fatigue cracking.

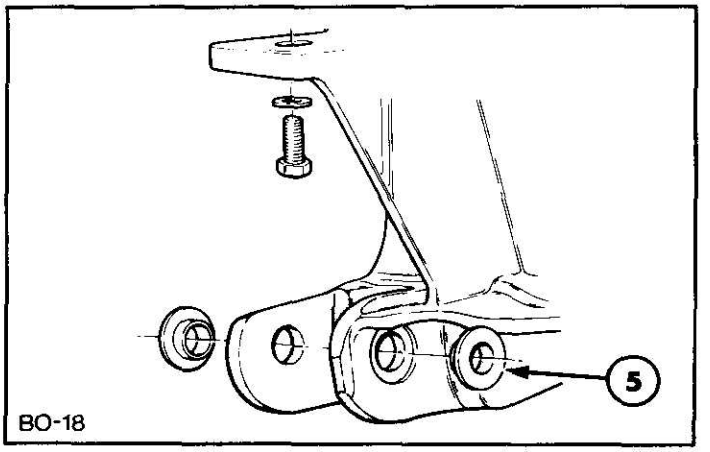
Front bumpstop length is critical to the handling of the car (see spec. sheets).

Ensure the crossmember bushes (5) are flush with the inside face of the crossmember or the TCA will jam in position making removal difficult.









	Description	Finis Code	Comments	Qty.
1	Bush, Track Control Arm, Inner	9092364	'Selected'	2
2	Bush, Track Control Arm, Outer	9092349	'Selected'	4
3	Bush, Anti-Roll Bar Mounting	9092347	'Selected' Suits 29mm anti-roll bar	2
4	Mounting, Front Suspension, Upper	9095389	'Selected'	2
5	Bush, Crossmember To Track Control Arm	9094758	Press into crossmember	4
6	Body, Front Strut or	9095488	Optimised camber	2
7	Body, Front Strut	9094682	Gravel and tarmac (Alt.)	2
8	Insert, Front Strut	9094683	Gravel 360/140	2
9	Insert, Front Strut	9095479	Gravel 380/160	2
10	Insert, Front Strut	9095161	Tarmac 500/200	2
11	Insert, Front Strut	9094860	Tarmac 325/150	2
12	Upper Spring Seat	9095502		2
13	Lower Spring Seat	9093328		2
14	Locking Ring, Lower	9093179	Use with 9093328	2
15	Road Spring, Front	9095481	85 N/mm Tarmac	2
16	Road Spring, Front	9094856	90 N/mm Tarmac (Alt.)	2
17	Road Spring, Front	9095480	Gravel, 72 N/mm &	2
18	Road Spring, Front	9094687	Gravel, 80 N/mm (Alt.)	2
19	Bumpstop-Front	9094714	Cut to required length.	2
20	Spacer-Bumpstop	9095297	6mm	2

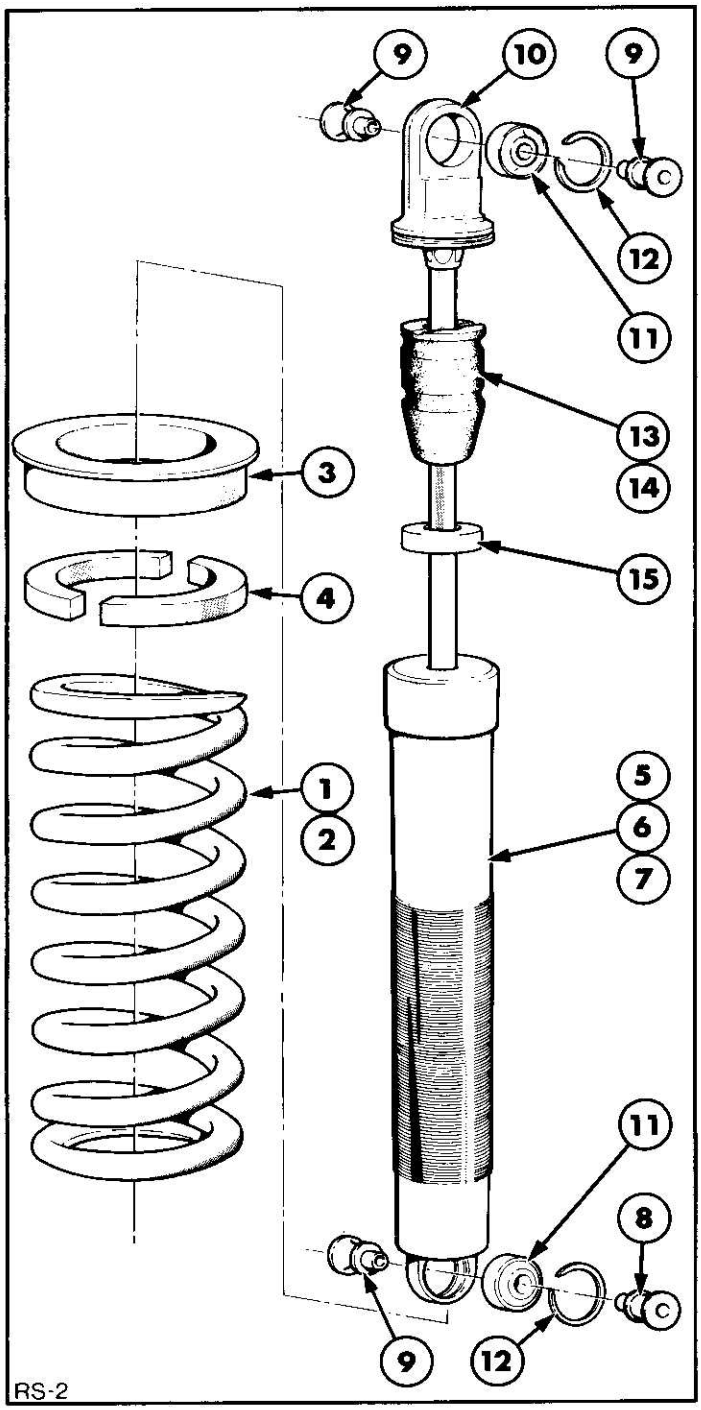
Torques

Hub Nut	350 Nm
Top Mount	52 Nm
Anti Roll Bar to Chassis	97 Nm
Anti Roll Bar to Track Control Arm	110 Nm

When building up the rear suspension, check the tracking which should be 3mm toe-in. If required, slot inner joint mounting holes to achieve correct figure and weld reinforcing washers in correct location. The rear springs are designed to give the lowest ride heights required. For some events it will be necessary to fit one or more spacers (item 4) above spring to avoid 'bottoming out' of the suspension.

The production semi trailing arms on the Escort are stronger than Sierra and fitted with uniball joints. On rough gravel events check regularly for bending and cracking around flanges. Similarly, check rear hubs. Shotpeening will help prevent fatigue cracking.

The rear beam and semi-trailing arms can be reinforced by the addition of material. In the case of the rear beam, any reinforcement must follow the original shape and be in contact with it.



RS-2

	Description	Finis Code	Comments	Qty.
1	Road Spring, Rear	9095482	Gravel, 78 N/mm	2
2	Road Spring, Rear	9095483	Tarmac, 85 N/mm	2
3	Upper Spring Seat	9094800	Bolt to bodyshell	2
4	Spacer, Upper Spring Seat	9094861	Optional, for 15mm ride height increase	4
5	Shock Absorber, Rear	9095478	Tarmac 400/170	2
6	Shock Absorber, Rear	9093519	Tarmac 340/160	2
7	Shock Absorber, Rear	9095163	Gravel 350/130	2
8	Insert, Damper	9094859	Lower inner	2
9	Insert, Damper	9092545	Top & lower outer	6
10	Damper Top	9093257		2
11	Spherical Bearing, Rear Damper	9092816	Use with recommended shock absorbers	2
12	Circlip, Rear Damper	9092815	Use with 9092816	4
13	Bump Stop	9092536	Off road use 75mm	2
14	Bump Stop	9092517	Tarmac use 50mm	2
15	Spacer, Bump Stop 6mm	9095298		2

Torques

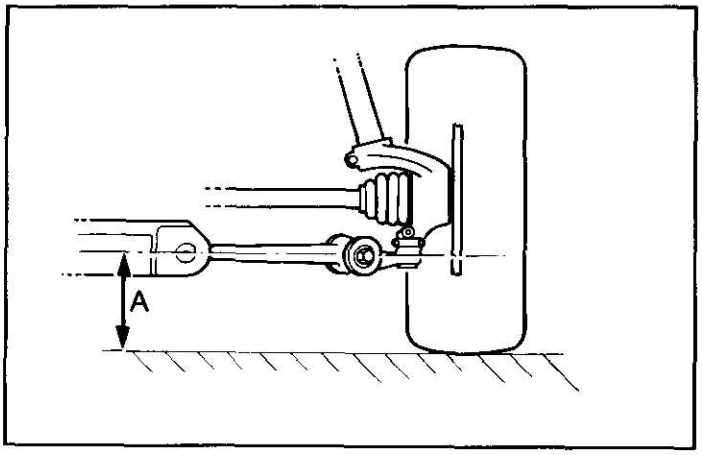
Hub Nuts	300 Nm
Trailing Arm to Beam	95 Nm
Damper Mountings	95 Nm

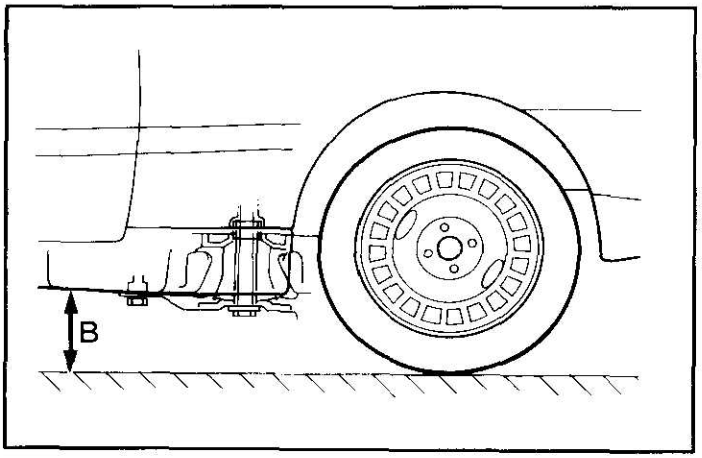
FORD MOTORSPORT VEHICLE BUILD SPECIFICATION

EVENT	TARMAC		GRAVEL	
SPECIFICATION	**FRONT**	**REAR**	**FRONT**	**REAR**
SUSPENSION				
Springs	85 N/mm	85 N/mm	72 N/mm	78 N/mm
Dampers	500/200	400/170	380/160	350/130
Bump Rubbers	70mm + 6mm	50mm	94mm + 6mm	75mm + 6mm
Anti-Roll Bar	Ø 29mm	Ø 22mm	Ø 29mm	Ø 22mm
Blade Position	–	–	–	–
CASTOR	3° 30'	–	3° 30'	–
CAMBER	3° 00'	2° 00'	2° 25'	1° 00'
TOE IN	2mm	3mm	2mm	3mm
RIDE HEIGHT	160mm	170mm	215mm	220mm
BRAKES	Ø 278mm	Ø 273mm	Ø 278mm	Ø 273mm
Master Cylinder	Disconnect ABS		Disconnect ABS	
Brake PAd Material	Blue Carbon	Red Carbon	Red Carbon	Blue Carbon
CLUTCH	9½" Paddle		9½" Paddle	
WHEELS	8" x 16"	8" x 16"	7" x 16"	7" x 16"
Tyre	Ø 620 x 225mm	Ø 620 x 225mm	Ø 660mm	Ø 660mm
Compound	–	–	–	–
Pressure	2.0 Bar	2.0 Bar	2.0 Bar	2.0 Bar

GEARBOX SPEC. NUMBER	9095468		
CENTRE DIFF. CHAIN RATIO	34% Front	66% Rear	50 Nm V.C.
FRONT AXLE.	9095165		
REAR AXLE LSD	9095164		180 Nm V.C.

NOTE: Front ride height is measured from centre line T.C.A. joint to ground on recommended tyre (A). Rear ride height is measured from steady plate mounting face to ground on recommended tyre (B). Camber/castor figures quoted are within production tolerances of ±1°. Ride heights should be increased by 10 – 15mm on rough gravel or bumpy tarmac.

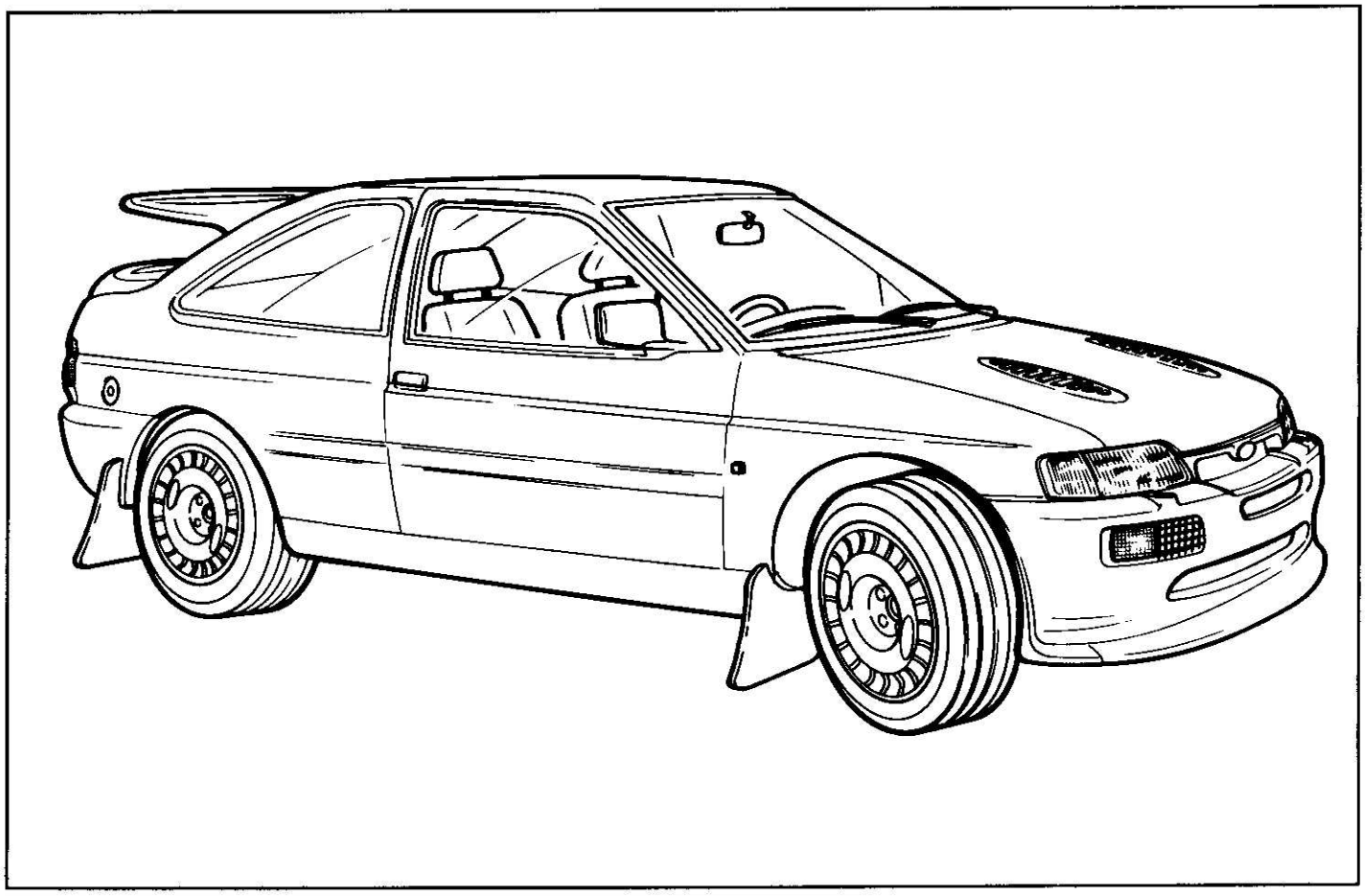




The standard wheel size fitted to the Ford Escort RS Cosworth is 8" x x16" with 25mm offset.

For gravel, 6" x 16" or 7" x 16" is recommended with a maximum tyre size of 660 diameter.

For Tarmac 7" x 16" or 8" x 16" is recommended with a tyre diameter of 620mm. Maximum tyre width in 1993 is unrestricted. Longer studs are available to suit competition wheels, if required.



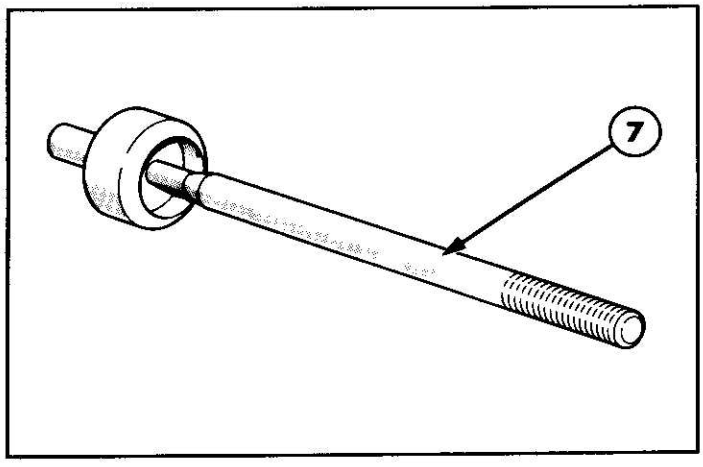
	Description	Finis Code	Comments	Qty.
1	Wheel 16" x 7"	9095498	Aluminium	5
2	Wheel 16" x 6"	T.B.E.		
3	Wheel 16" x 8"	*6647997	Std. (Tarmac)	5
4	Wheel Stud	9095118	Longer than std.	16
5	Wheel Nut	9095122	Use with 9095498	16
6	Wheel Brace	9090628	(Shown on page 3)	1
7	Steering Track Rod	9095344	H.D. Joint	2

Tyre Pressures: 2.0 Bar

Torques

Wheel Nuts	90 Nm
Track Rod Inner Joint	88 Nm
Track Rod to Stg. Arm	30 Nm
Steering Rack Mounting	45 Nm

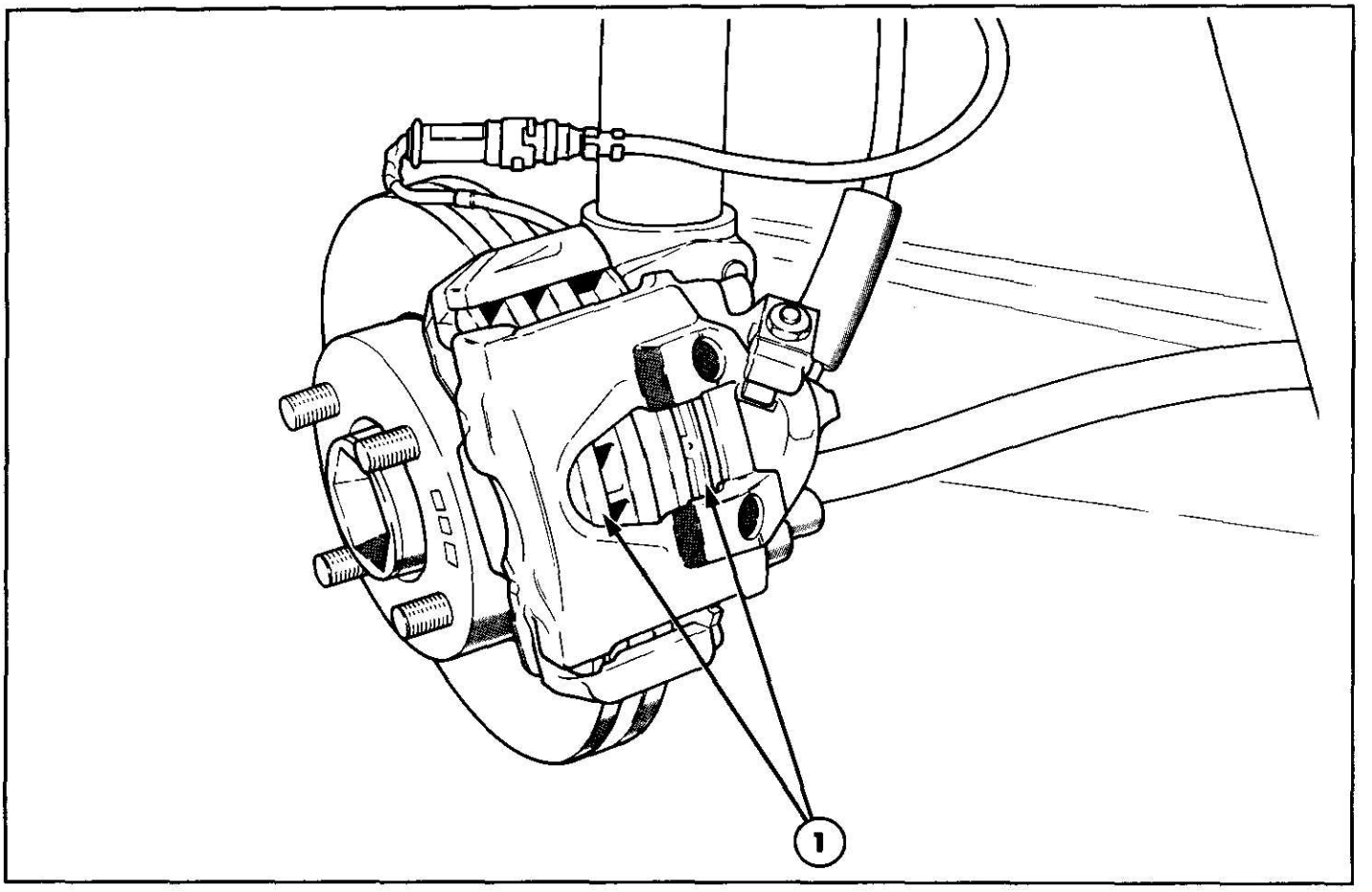
NOTE: Remove steering lock from steering column.



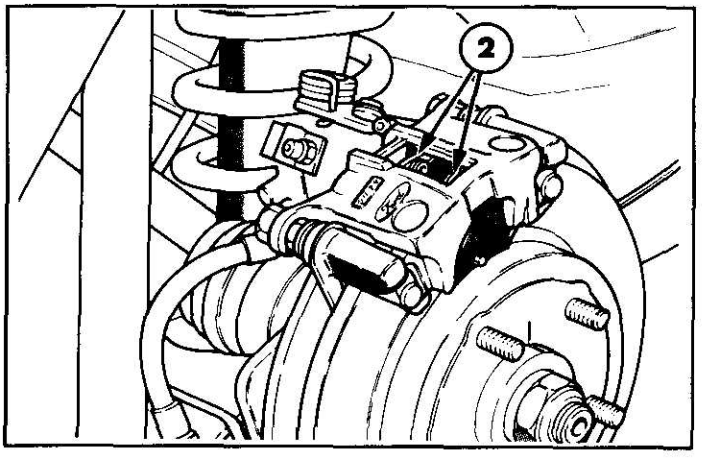
Two grades of carbon brake pads are now available. Blue carbon has the higher friction. The 'red' carbon material is less prone to brake 'grab' and not so aggressive to the discs. A change in balance can be achieved by using different material front and rear (i.e. red at the rear on Tarmac will avoid rear brake lockup.)

To bed in: Make a few gentle stops to remove high spots, then several hard applications from high speed down to 30 kph with recovery in between. Continue until fade is no longer apparent. Drive until brakes cool down. Bed new discs with used pads and vice versa. Check discs regularly during events. Disconnect ABS module inside car.

For additional cooling the optional lower grille end shields and duct covers should not be fitted.



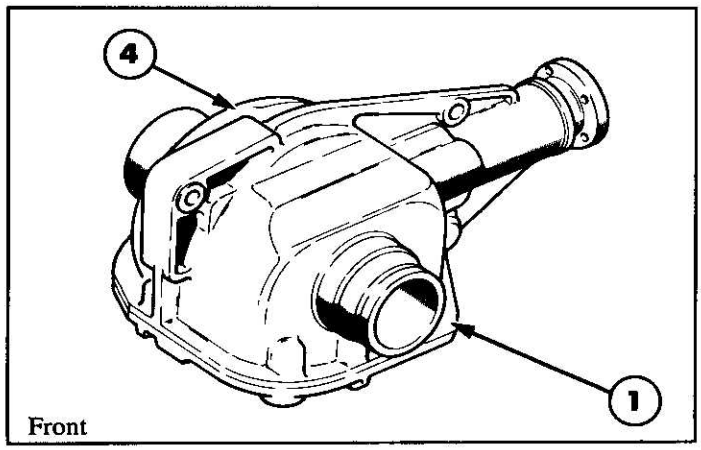
	Description	Finis Code	Comments	Qty.
1	Brake Pads, Front Carbon	9094826	Blue	4
	or	9095473	Red (Alt.)	4
2	Brake Pads, Rear Carbon	9095333	Blue	4
	or	9095472	Red (Alt.)	4
	Recommended Fluid:	AP 600		
	Torques			
	Caliper Mounting Bolts:		61 Nm	



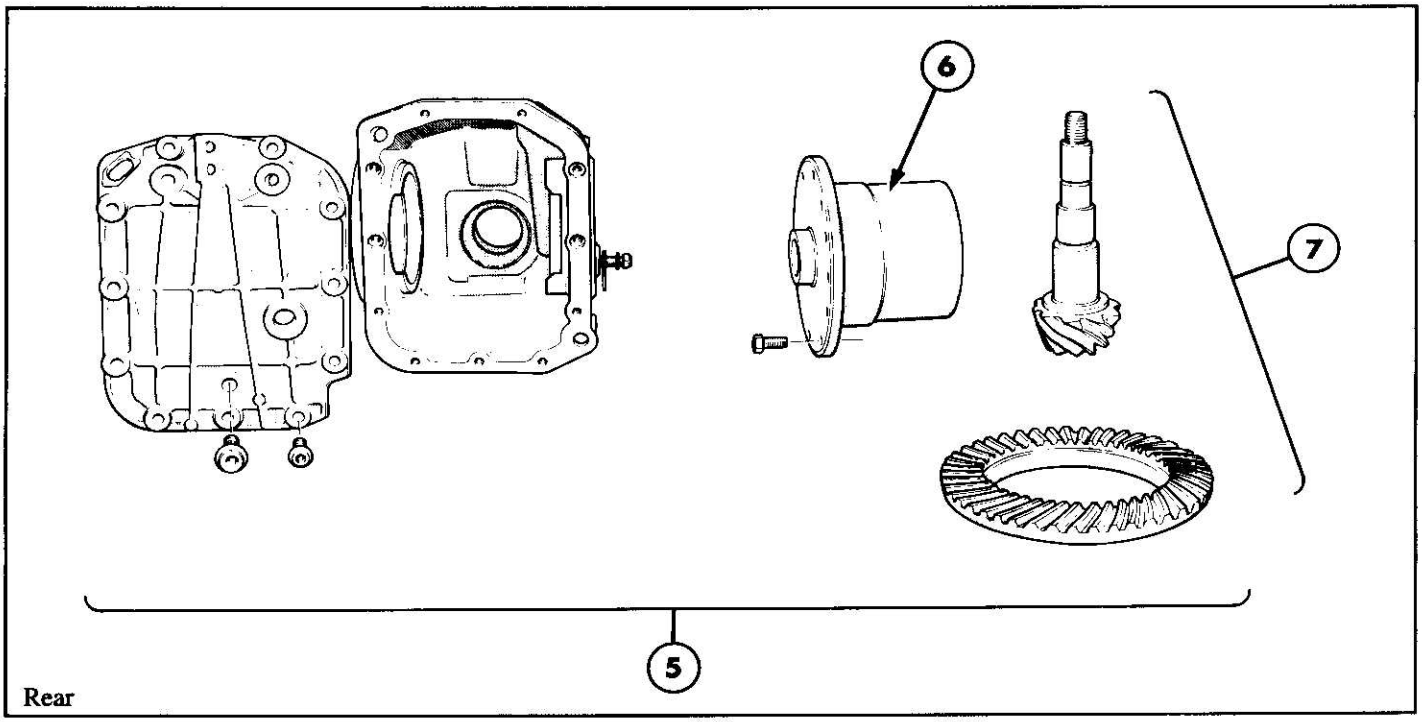
5 The Motorsport front and rear axles have been dismantled, crack tested, shotpeened and carefully reassembled to improve their service life. In normal rally conditions the axles should be overhauled after 600km, but if the car has had a puncture or broken shaft, the axle should be changed as soon as possible. The rear VC. can be overhauled by F.F.D. at Coventry.

Crack test all gears at each rebuild and change casings after 1200km to avoid fatigue cracks. See workshop manual for rebuild procedures. Note that the front R.H. driveshaft joint is normally retained in the axle by a circlip.

The optional case for the front axle is selected for maximum wall thickness to give added security on gravel events.



Front



Rear

	Description	Finis Code	Comments	Qty.
1	Front Axle Assembly Complete	9095165		1
	Service Parts for 9095165			
2	Crown Wheel and Pinion Set, Front Differential	9094796	Selected and shotpeened	1
3	Differential Assembly, Front 3.62:1	9094798	Selected gears	1
4	Case - Front Axle (not included in 9095165)	9095239	Selected thickness	1

	Description	Finis Code	Comments	Qty.
5	Rear Axle Assembly 7"	9095164	Selected	1
	Service Parts for 9095164 Include:			
6	Differential Assembly (Rear) Including Viscous Coupling,	9094797	Selected gears 180 Nm setting	1
7	Crown Wheel and Pinion	9094794	Selected and shotpeened	1

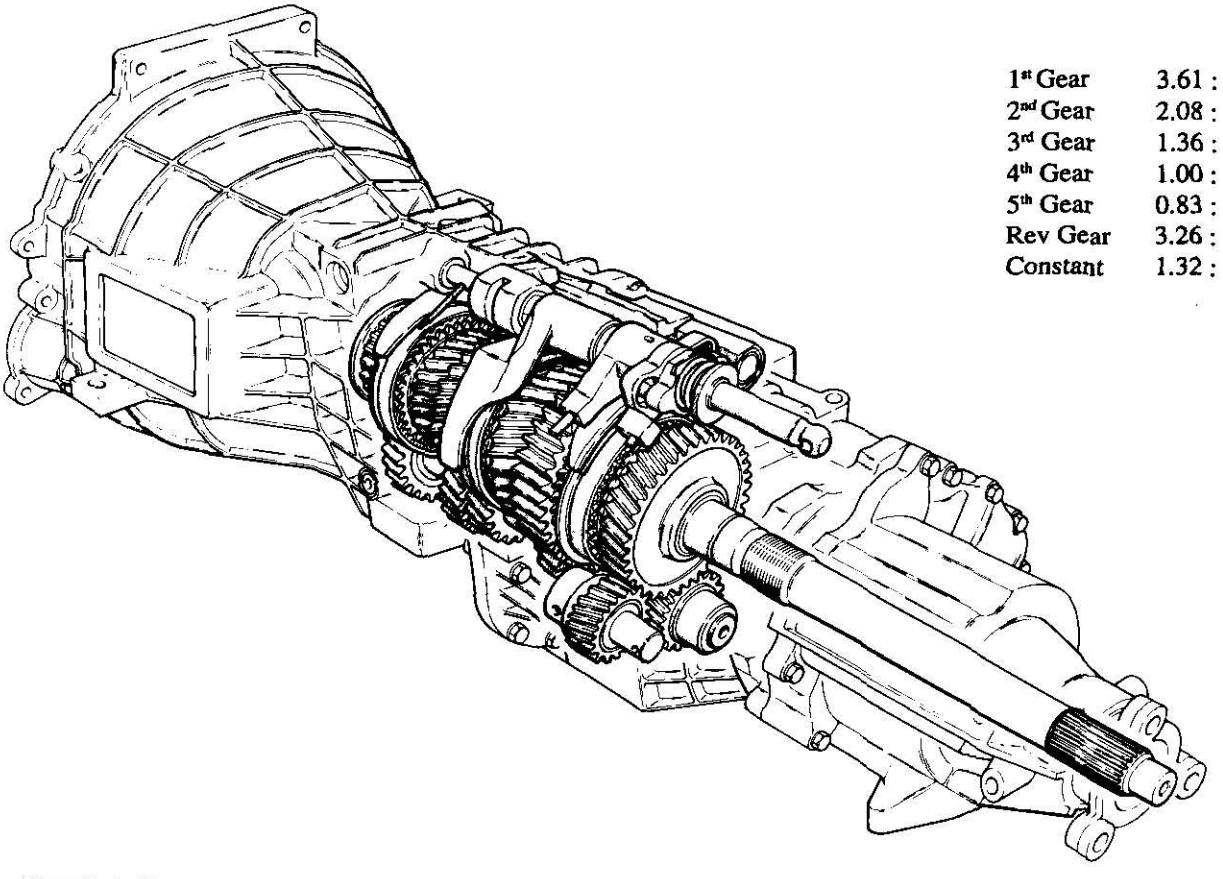
The Escort RS Cosworth transmission is very similar to the Sierra 4x4, but with a slightly longer output shaft to suit the new rubber propshaft coupling.

Considerable attention has been paid to gears to ensure reliability, and the Motorsport gearbox is now fitted with the highest quality production gears available. The centre VC. is set at 50nm.

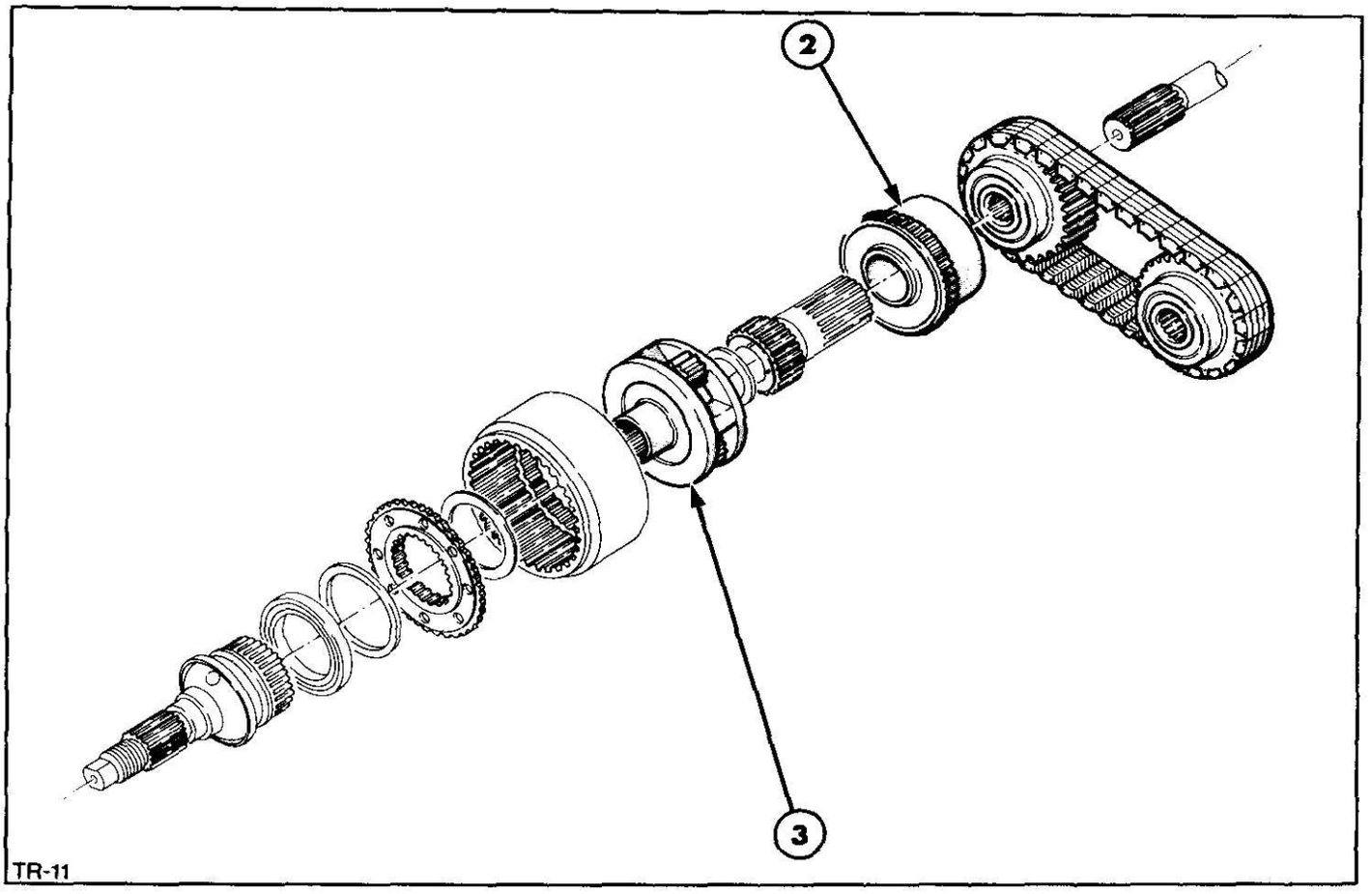
The recommended service interval is 500 km stage mileage in normal conditions. At each rebuild cracktest all gears, replace 3rd gear bearing and sleeve (6152807). Warm sleeve before fitting to shaft. Check selector forks for wear or bending. Tighten countershaft bearing housing while rotating transmission, until shaft is locked, then slacken off by one tooth to ensure bearing preload.

Use a good quality synthetic gear oil. For full repair procedure see the workshop manual (MT75 transmission publication No. CG1502/EN).

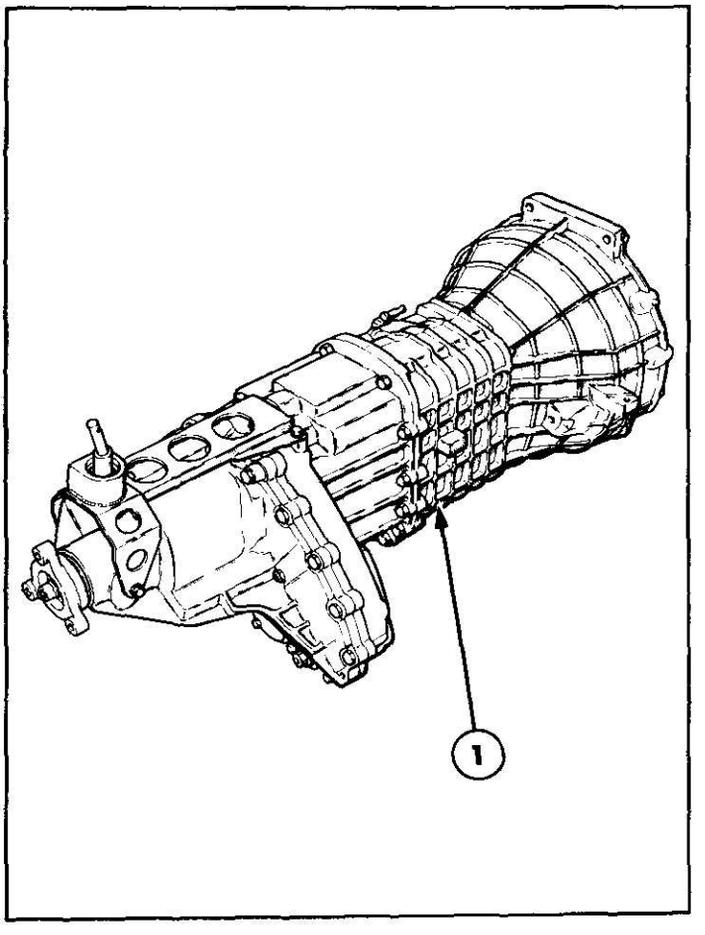
Check driveshaft and propshaft joints regularly and repack with grease. When building the car, check front driveshaft plunge in all suspension positions (no spring fitted and inner gaiter rolled back) To ensure that the driveshaft joint will not pull-out, plunge must be within 3-15mm measured at the hub stub shaft (with nut removed).

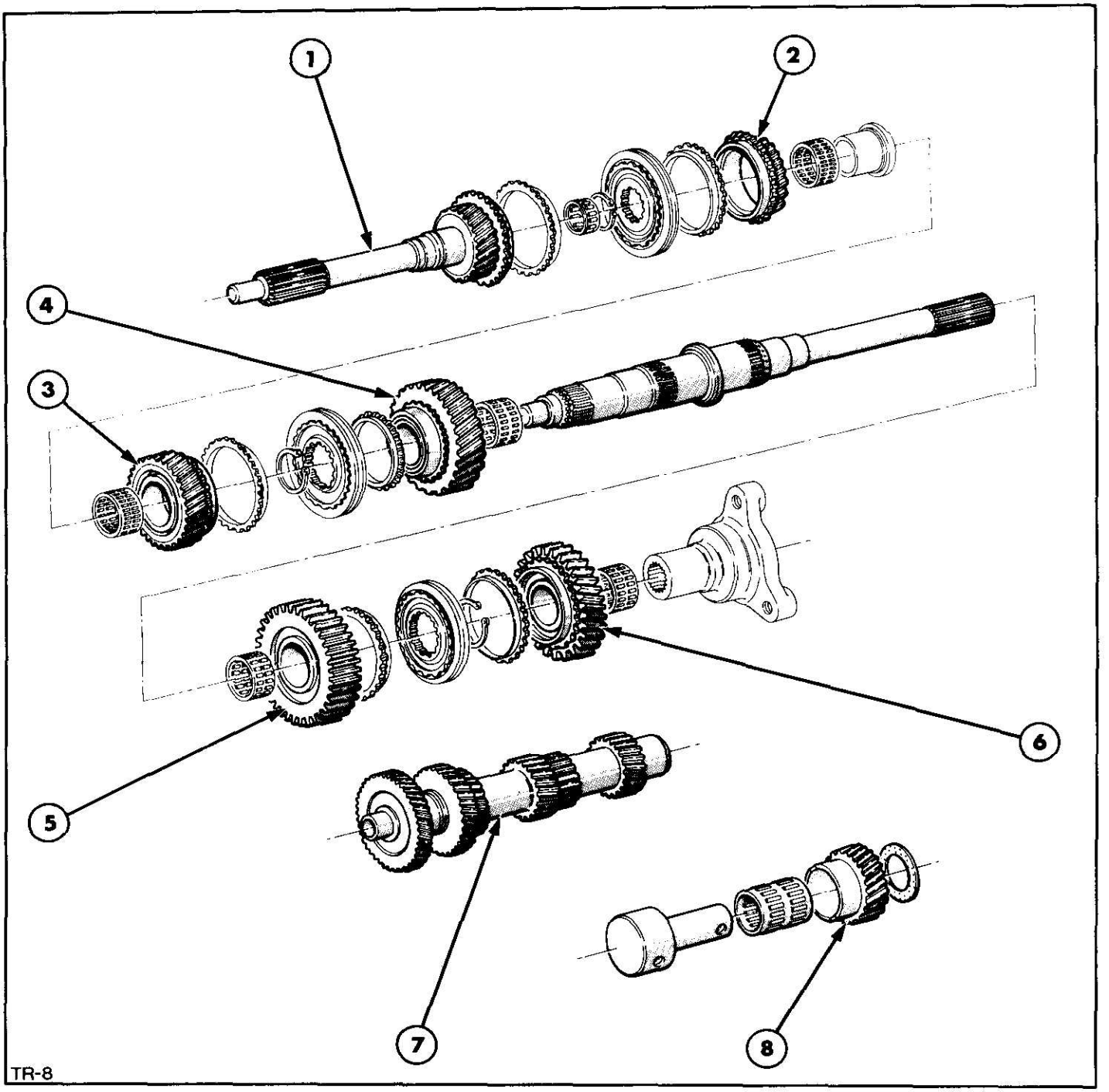


1st Gear	3.61 : 1
2nd Gear	2.08 : 1
3rd Gear	1.36 : 1
4th Gear	1.00 : 1
5th Gear	0.83 : 1
Rev Gear	3.26 : 1
Constant	1.32 : 1



	Description	Finis Code	Comments	Qty.
1	Transmission and Transfer Gearbox Assembly	9095468	Complete transmission, fitted with selected gears and centre VC 9095486	1
2	Viscous Coupling Centre Differential	9095486	Selected 50 N/m setting	1
3	Carrier, Centre Differential Planet Gears	9094668	Selected standard items, crack tested	1



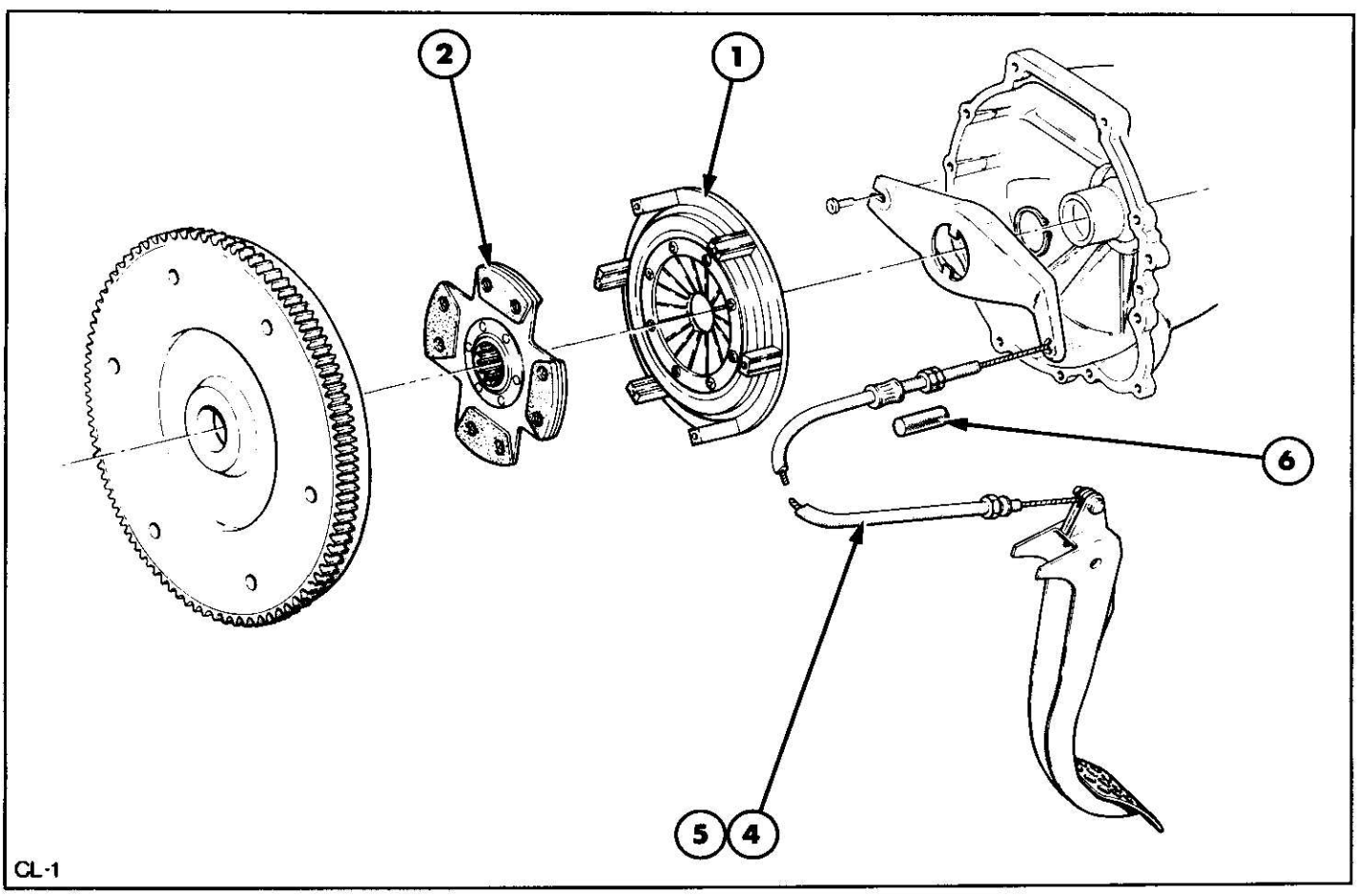


	Description	Finis Code	Comments	Qty.
1	Input Shaft	9095172		1
2	3rd Gear Main	9095507		1
3	2nd Gear Main	9095509		1
4	1st Gear Main	9095510		1
5	Reverse Gear	9095574		1
6	5th Gear Main	9095178		1
7	Countershaft	9095512		1
8	Reverse Gear Idler	9095575		1

NOTE: THESE GEARS SUIT TRANSMISSION 9095468 ONLY

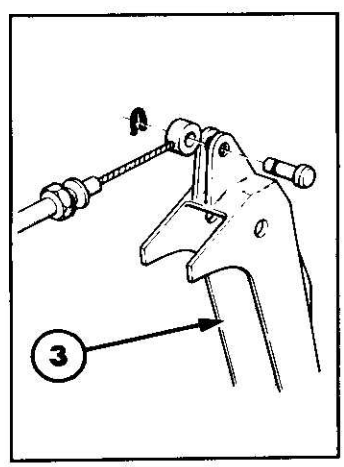
The clutch recommended for group 'N' is a cerrametallic 4 paddle with sprung centre and has proved to be very reliable in the Sierra. The standard cable is replaced with an adjustable version.

Large pedal pads can be welded to the standard pedals and should be fitted with nonslip material.

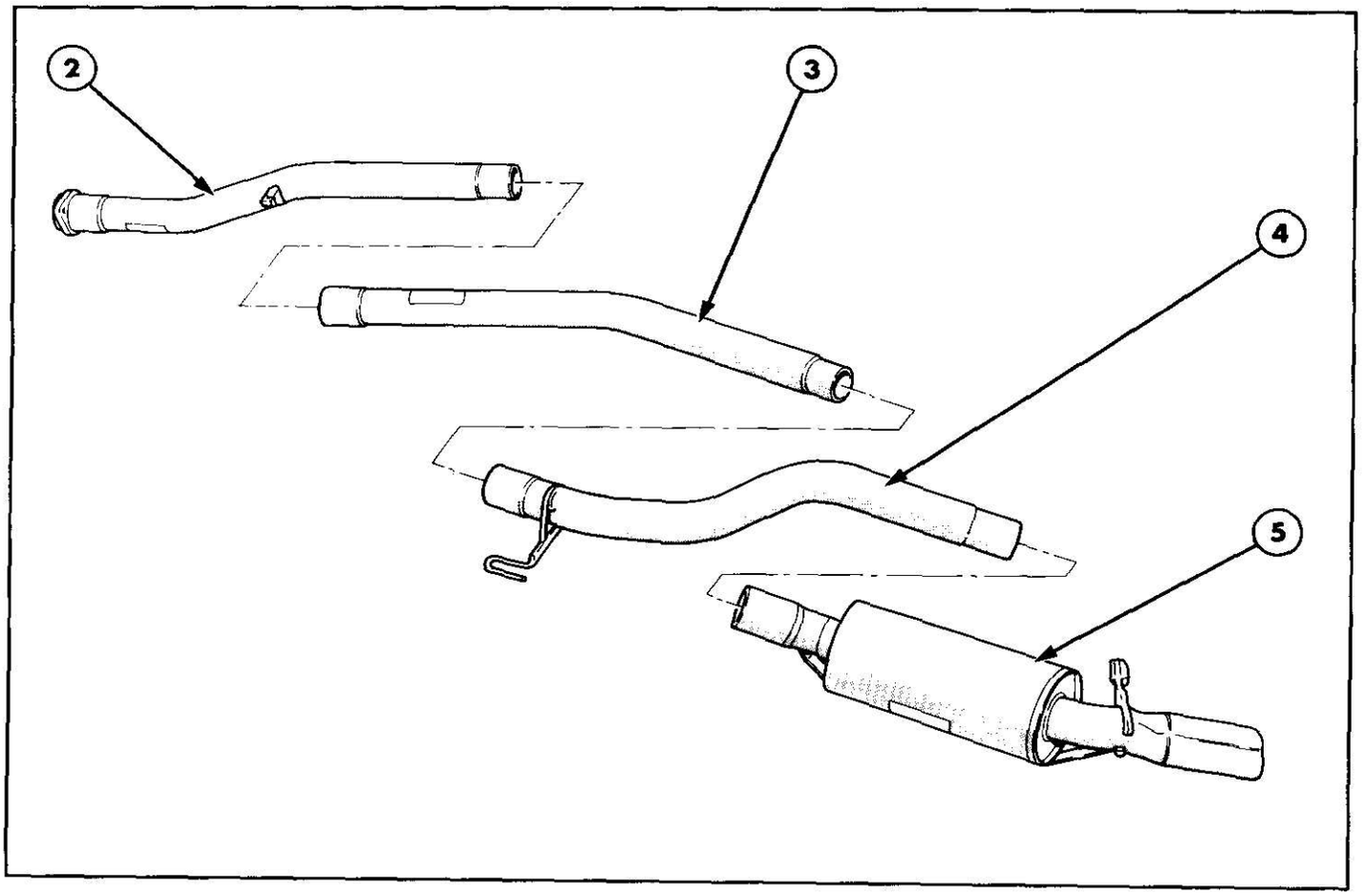


CL-1

	Description	Finis Code	Comments	Qty.
1	Clutch Cover Assembly	9092484	Use with 9095154 and standard release bearing	1
2	Clutch Driven Plate	9095154	With sprung centre	1
3	Clutch Pedal Assembly	9093132	Extended pad and no self-adjuster	1
4	Cable Assembly LHD	9093711	Adjustable	1
5	Cable Assembly RHD	9093712	Adjustable	1
6	Spacer, Clutch Cable	9093715	Use with 9093711 or 9093712	1
7	Accel. Pedal	9094822	High ratio with pedal stop	1



The exhaust system can be modified (replaced) from the first silencer providing that the diameter is not increased. The 'first silencer' is the catalyst fitted to the downpipe - so the non-catalyst downpipe is substituted. The Motorsport exhaust system is routed above the rear beam to avoid damage, and exits through the bumper.

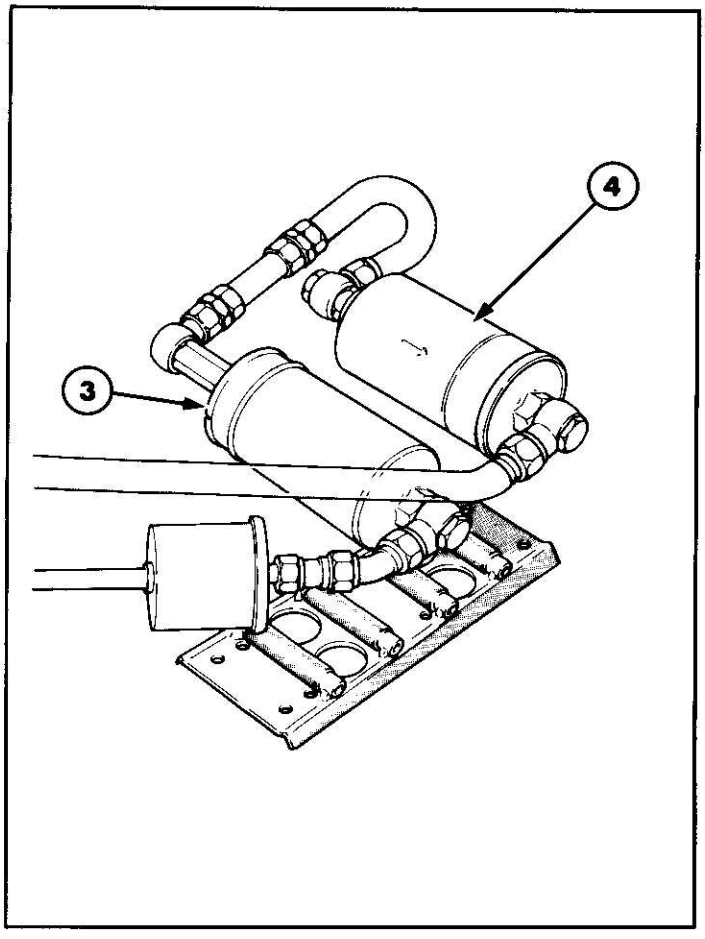


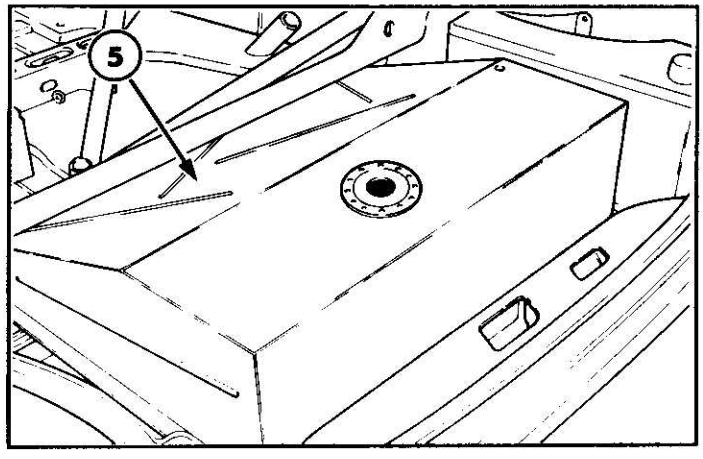
	Description	Finis Code	Comments	Qty.
1	Downpipe	*6494220	Std.	1
2	Front Pipe	9095490	Stainless	1
3	Intermediate Pipe	9095491	Stainless	1
4	Intermediate Pipe RR	9095494	Stainless	1
5	Silencer	9095495	Stainless	1
6	Catalyst	TBE	Fit to downpipe	1

The standard fuel tank can be retained, but it is necessary to ensure that the recommended Bosch Pump is fitted rather than the AC Delco. The pump is attached to the in-tank sender unit. A new sender unit with Bosch pump fitted is available from Motorsport.

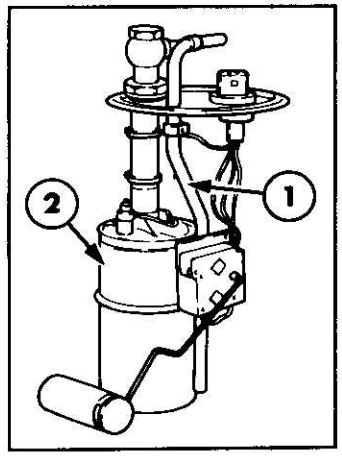
Disconnect fuel pump inertia switch situated in the drivers side lower panel.

A 65 litre FT3 safety tank is now available. This will fit in the boot space after removal of the access panel on the R.H.S. (in some models this panel is fixed and must be cut out). The metal edges must be turned and covered to protect the fuel tank. The complete tank must be enclosed in a fuel and fire proof cover (usually aluminium). The fuel pump and filter can be positioned under the floor, aviation type fuel lines must be used.





	Description	Finis	Comments	Qty.
1	Fuel pump and sender	9095517	STD Tank only	1
2	Fuel pump	9095466	Service part	1
3	Fuel pump	9092162	FT3 Tank (Alt.)	1
4	Filter	9090275	FT3 Tank	1
5	Fuel Tank	9095576	FT3 Tank	1



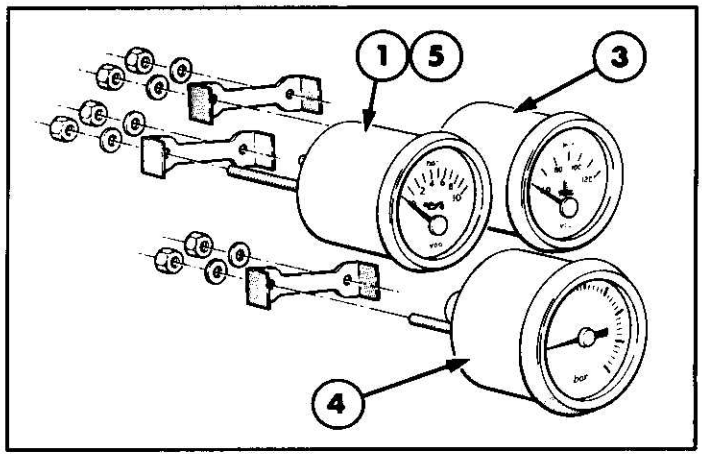
Additional auxiliary gauges "may be freely installed, provided that their fitting is not likely to create any danger".

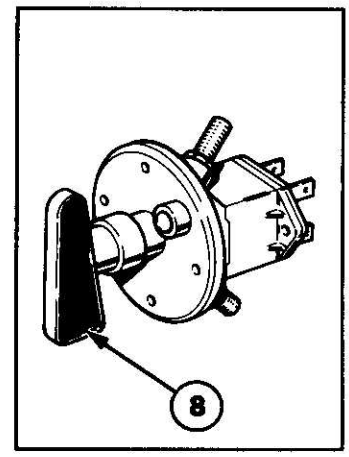
The horn may be changed or an additional one added "possibly for passenger use". The air horn kit is ideal for this purpose, with a foot operated button on the navigators footrest.

Ensure any additional lamps are wired through separate relays to avoid overloading the standard wiring. Problems are caused by chafing wires or radio interference. Keep radio equipment away from engine electronics.

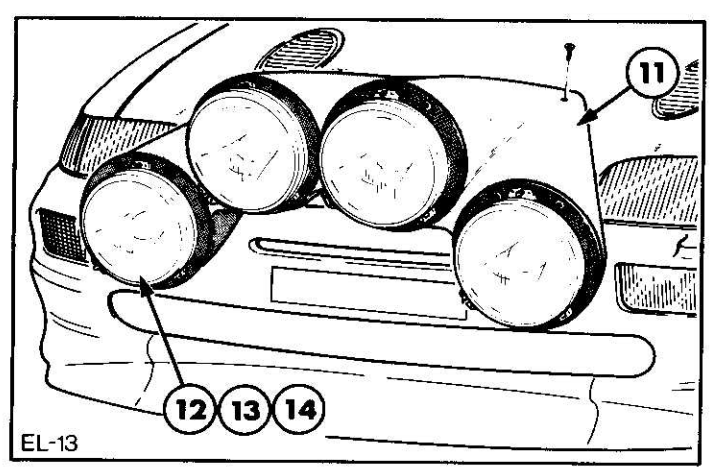
⚠ WARNING

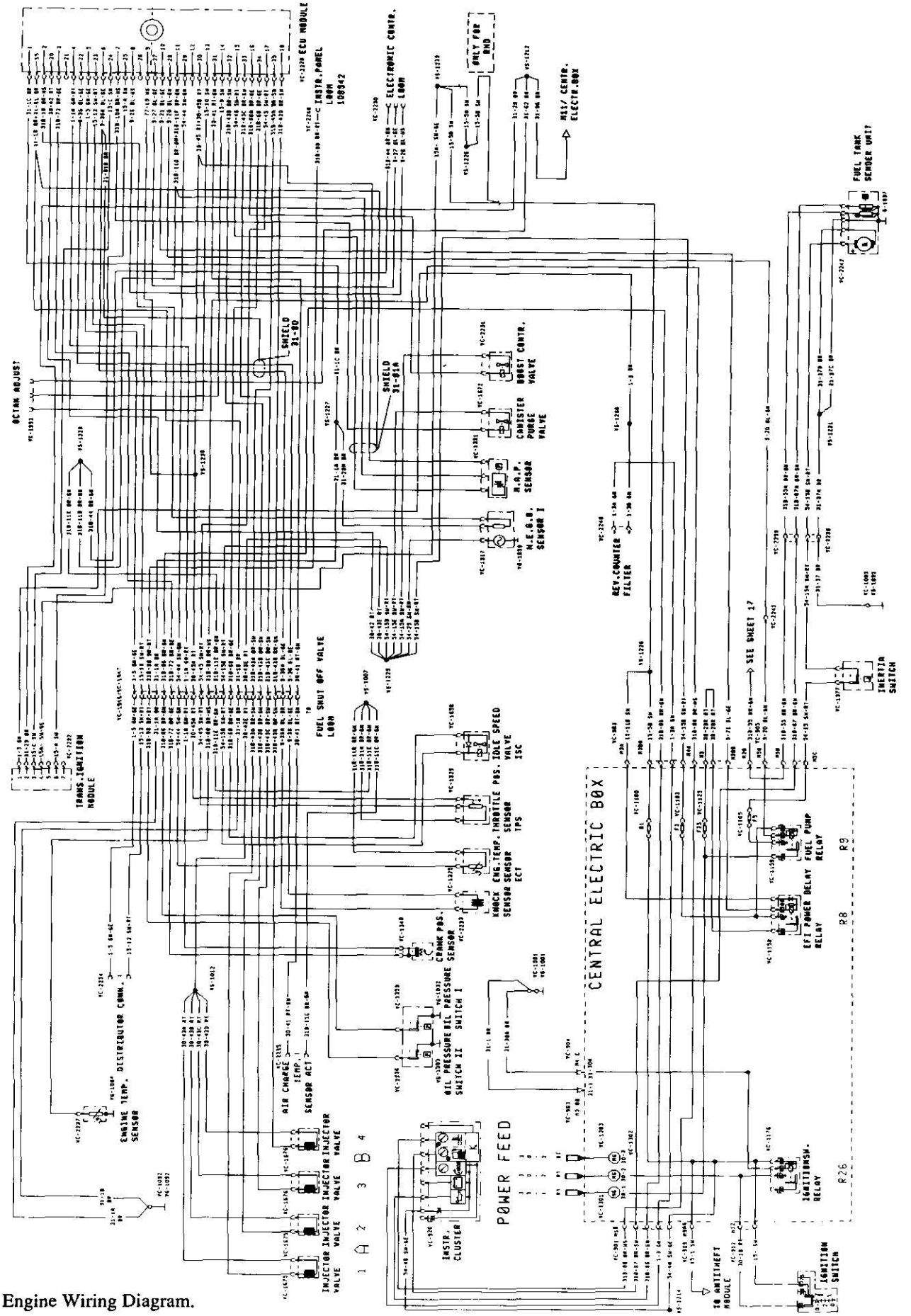
Disconnect the battery **before** conducting electrical work on the vehicle to avoid any damage to the electrical system. Disconnect the E.C.U. before welding.



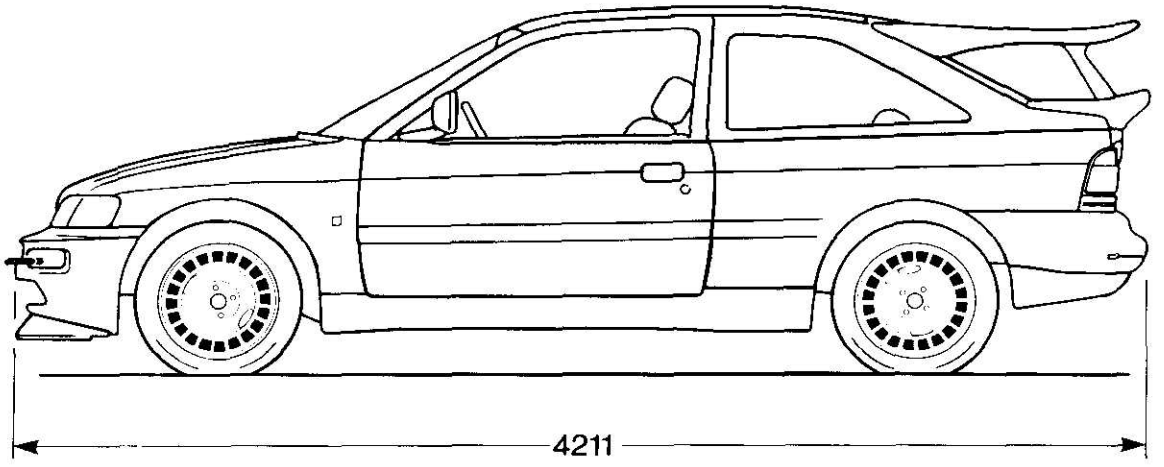


	Description	Finis Code	Comments	Qty.
1	Gauge - Oil Pressure	9090780		1
2	Gauge, Water Temperature	9090777		1
3	Gauge, Turbo Boost	9090778	1.5 Bar	1
4	Gauge, Fuel Pressure	9091435		1
5	Gauge, Fuel Level	9090776		1
6	Pressure Sender	9091956	Oil and fuel	1
7	Switch, Master Cut Off	9092629		1
8	Kit, Air Horns	*5006122		1
9	Alternator, 150 Amp	9092574		1
10	Map Reading Lamp	9095676		1
11	Lamp - Pod	9095590	4 Lamp - bonnet mounting	1
12	Lamp - Fog	9095979		2
13	Lamp - Driving	9095977		2
14	Lamp - Long range	9095978		2

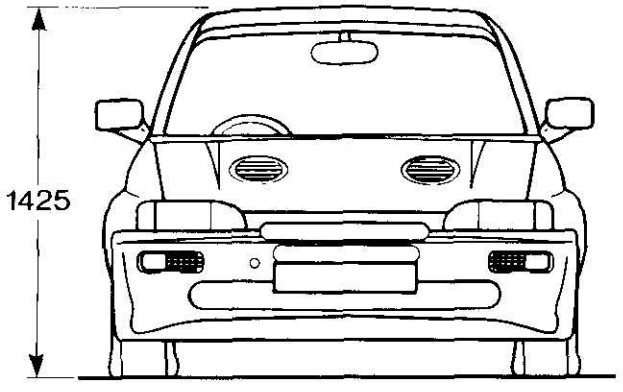




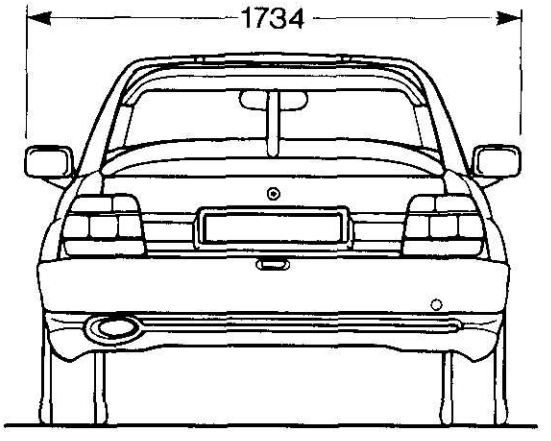
Engine Wiring Diagram.



Homologated minimum weight 1185Kg (no rollcage) 1215Kg (with rollcage)



Maximum front track 1490mm



Maximum rear track 1505mm

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MS NUMBERS APPLICABLE TO STICKERS, BADGES AND LITERATURE

STICKERS:

MS13	3"	Ford Oval
MS14	8"	Ford Oval
MS15	10"	Ford Oval
MS16	14"	Ford Oval
MS17	20"	Ford Oval
MS18	30"	Ford Oval
MS19	40"	Ford Oval
MS23	4½"	Ford Oval
MS24	6"	Ford Oval
MS38	4" x 2"	Ford Motorsport
MS39	6" x 3"	Ford Motorsport
MS40	8" x 4"	Ford Motorsport
MS41	12" x 6"	Ford Motorsport

BADGES:

MS26	Oval Cloth
9091528	Rectangular with Ford in Oval

LITERATURE:

MS36	Escort Group 'N' Preparation Manual (Illustrated)
MS37	Escort Group 'A' Preparation Manual (Illustrated)

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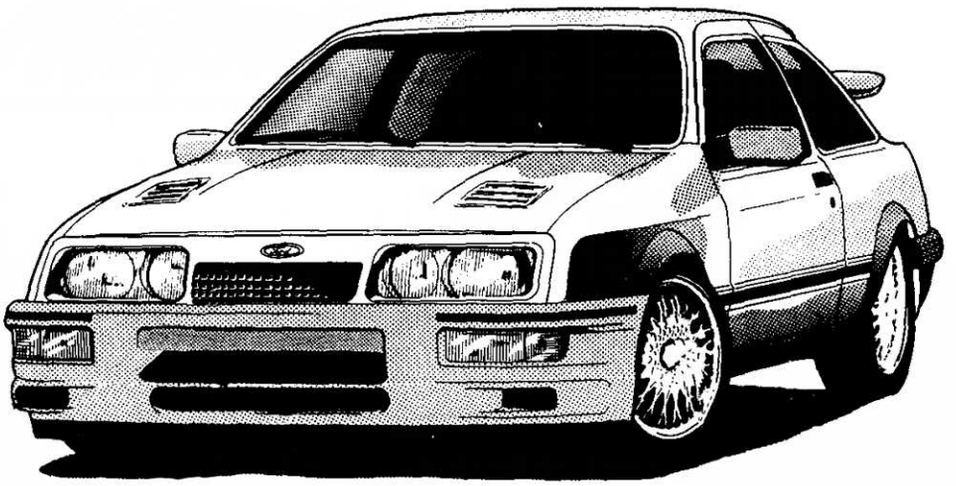
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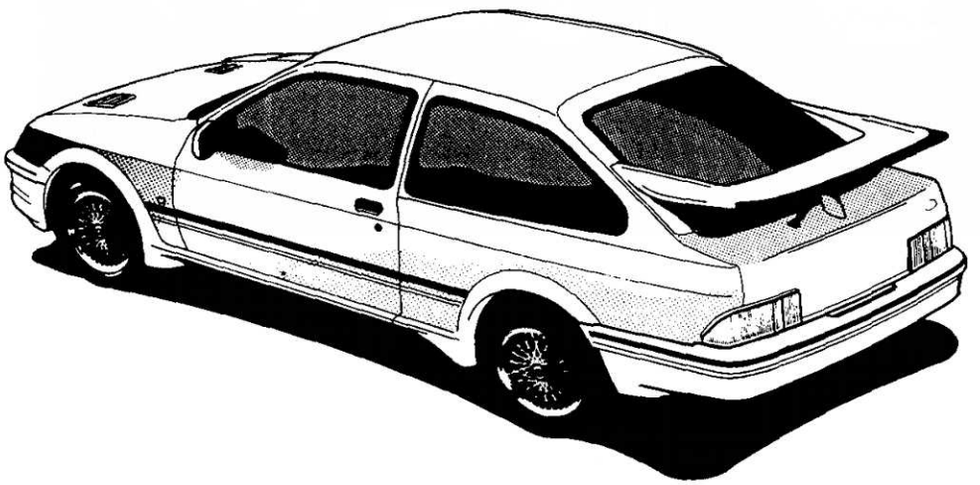
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RS Cosworth





Ford

Foreword

The Sierra RS Cosworth is the latest product of Ford's long and fruitful collaboration with Cosworth, developers of some of the worlds most famous competition engines.

In addition to the 16 valve engine the Sierra RS Cosworth includes a considerable number of new components and systems, all designed to make it the most exciting and exhilarating saloon car ever sold by Ford.

This Technician Information has been developed to inform you, the Service Technician, about these new components and systems and their maintenance requirements.

More detailed information is included in the Special Workshop Manual on the Cosworth RS Sierra.

Service Training Programmes October 1985

D–P/GK–T–1

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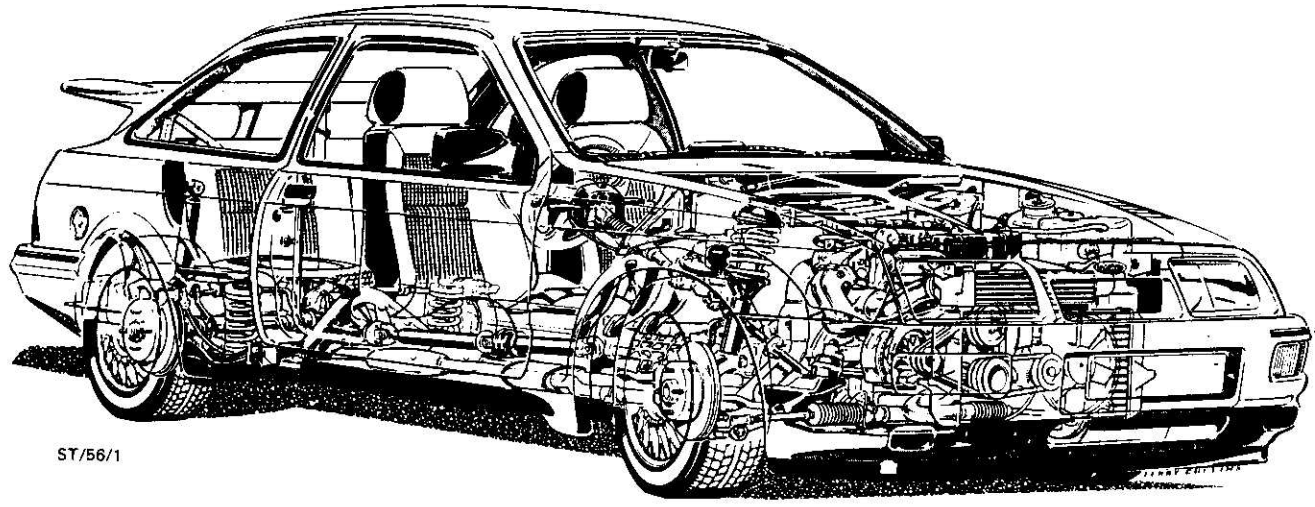
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General

The Sierra RS Cosworth is available as a 3 door Saloon car and is instantly recognisable from the way it sits low on the road and from its unique body panels. Front and rear wheel arch extensions cover the extra wide tyres mounted on 15" x 7" racing style light alloy road wheels. A new front grill panel with a single large cooling slot; a unique bumper with air dam; brake cooling pick-up point and louvres in the hood for optimum air flow are the main features of the front end.

A single plane areofoil/rear wing generates the positive down force required for traction and handling.



ST/56/1

(RHD-Version shown)

General (cont'd.)

The 16 valve Cosworth engine presents the key element of the Sierra RS Cosworth. It uses the engine block from the proven Ford OHC engine but is completed with a host of new components and systems such as

- The new cylinder head with its two camshafts to actuate the 4 valves of each cylinder
- A water cooled Garret turbo charger
- A Weber electronic fuel injection system and
- an ignition system made by Marelli.

However, in addition to its unique power plant, Sierra RS Cosworth houses a host of other new or modified components and systems a Service Technician needs to be familiar with and these are

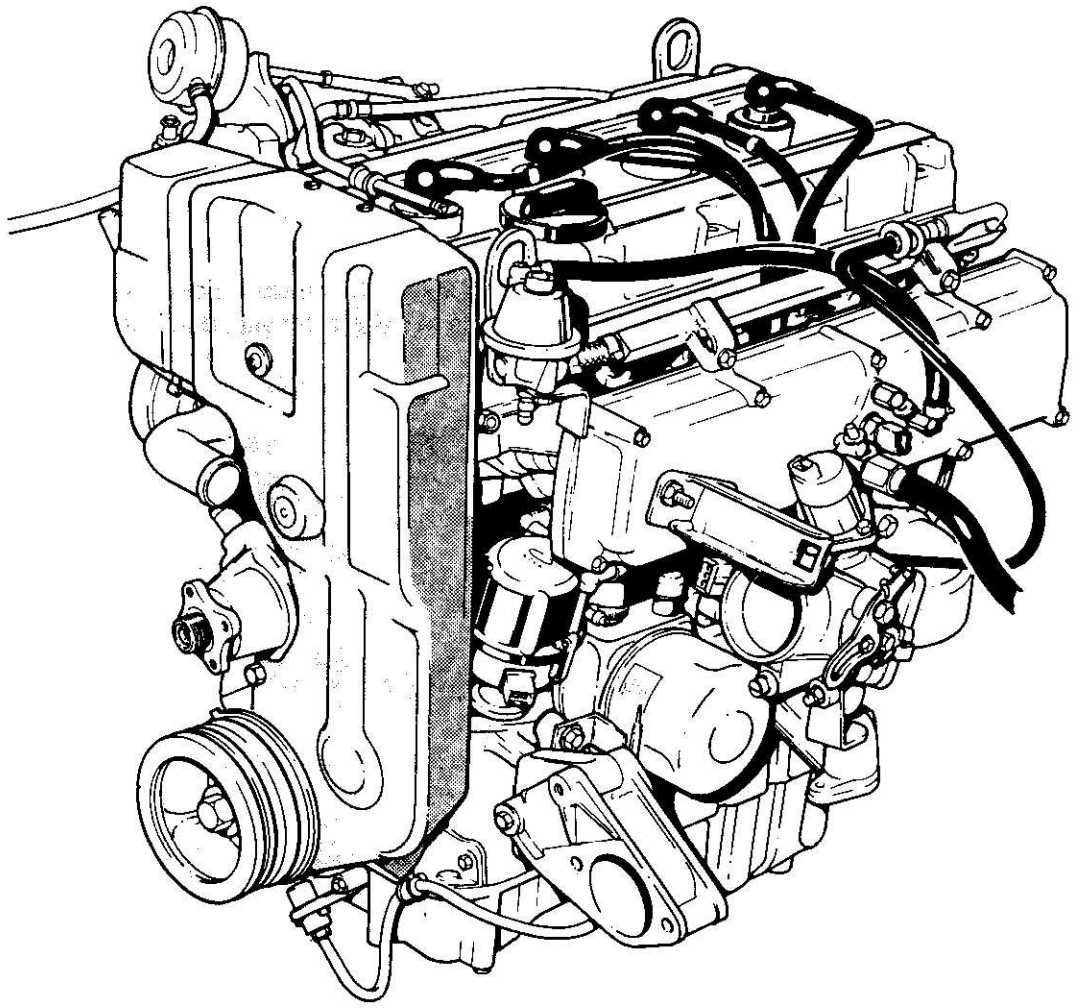
- A close ratio 5 speed transmission
- New clutch and driveshaft
- Limited slip differential similar to Scorpio
- Revised rear axle mounting
- Revised front and rear suspension with power steering and specially tuned shock absorbers and springs to meet Sierra RS Cosworths demands on road holding and road adhesion
- Teves ABS braking system similar to the system used on Scorpio.

In addition to this exciting list of features the interior has been redesigned to match the vehicles sporty appearance and to provide the driver with the environment required for a car of this class.

PART A – Engine, Engine Management and Turbocharger

1. The Ford Cosworth Engine

General Information



ST/56/3

ACM

The Ford Cosworth 2.0 litre 16 valve D OHC Engine with Turbocharger

PART A – Engine, Engine Management and Turbocharger

1. The Ford Cosworth Engine

General Information (cont'd.)

- Sierra's high performance 16 valve engine has been developed by Cosworth in England, a company well known for its racing car engines.

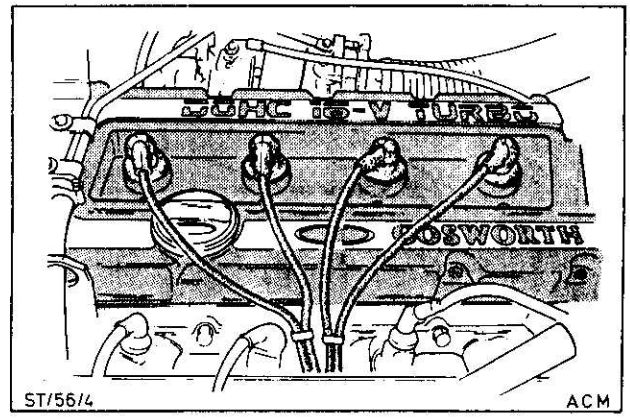
  The Ford 2.0 ltr. OHC regular production cylinder block forms the mainstay of this engine.

- The valve cover bears the following identifications:

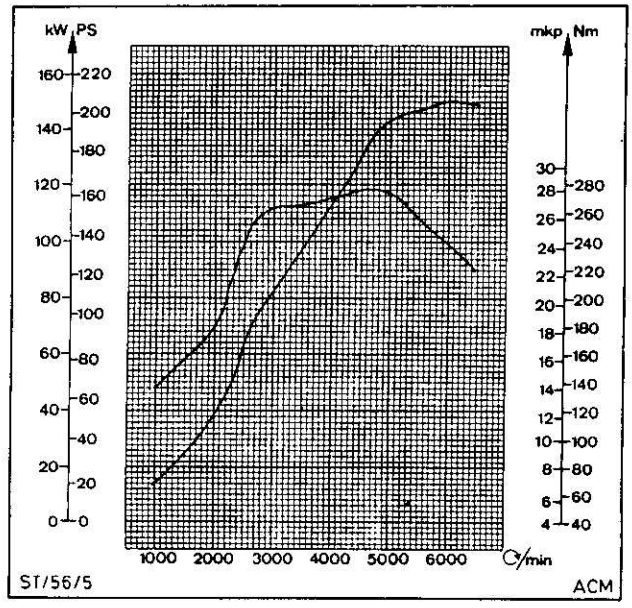
  D OHC = Double Overhead Camshaft – indicating that the engine has two overhead camshafts

  16 V = 16 valves

  Turbo = Turbocharger



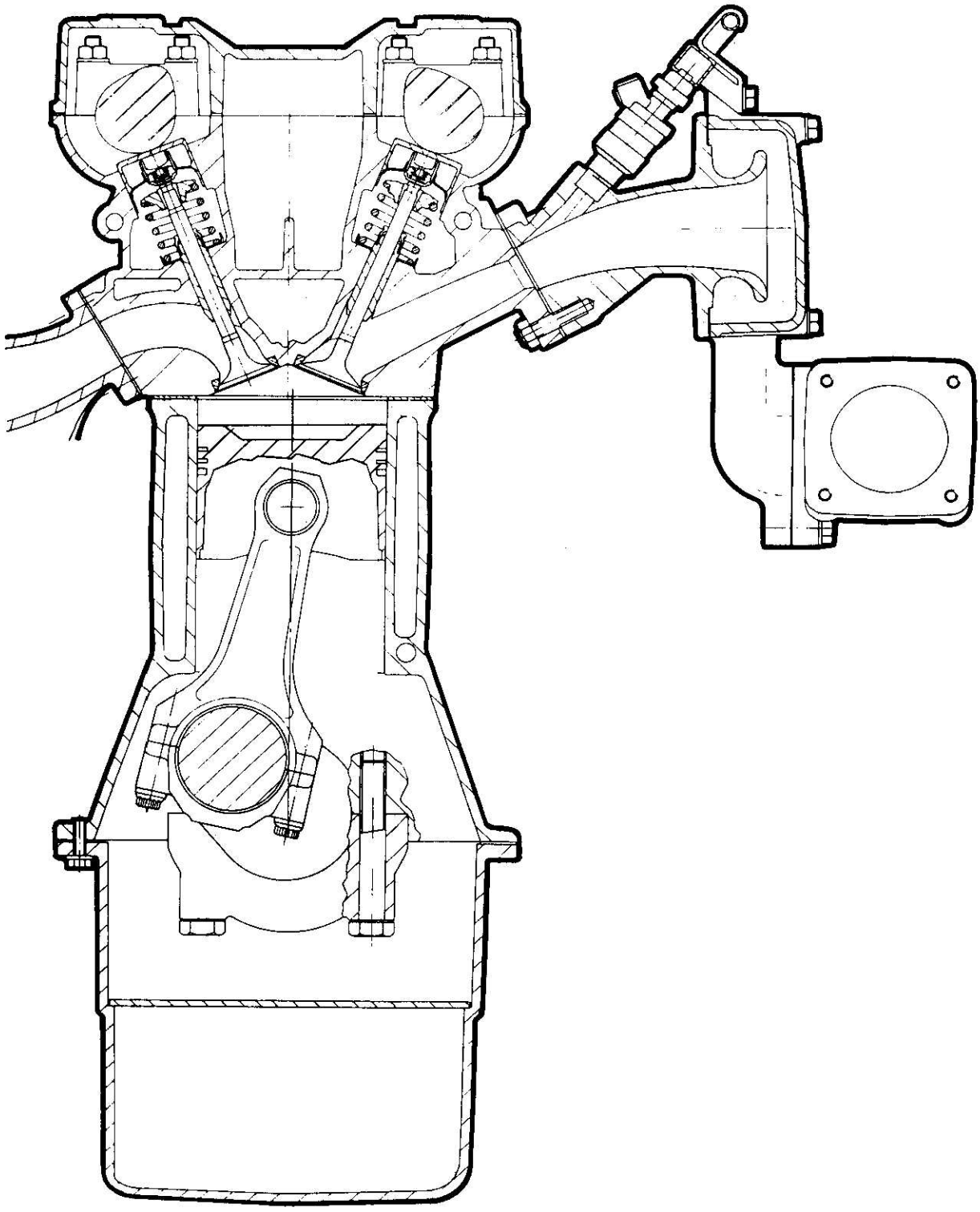
- Power = 150 kW (204 PS) at 6000 rpm
- Max. Torque = 278 Nm at 4500 rpm
- Max. Engine speed
  - continued running : 6500 rpm
  - intermittent running: 6800 rpm



- Apart from the cylinder block, which has been selected from regular production, all other major components of the engine have been newly developed by either Ford or Cosworth or have been uprated to suit the engines high performance. Main feature of the engine is the 16 valve aluminium cylinder head with its two camshafts specially developed for this engine by Cosworth.

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components



ST/56/11

ACM

Engine – front cross section

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components (cont'd.)

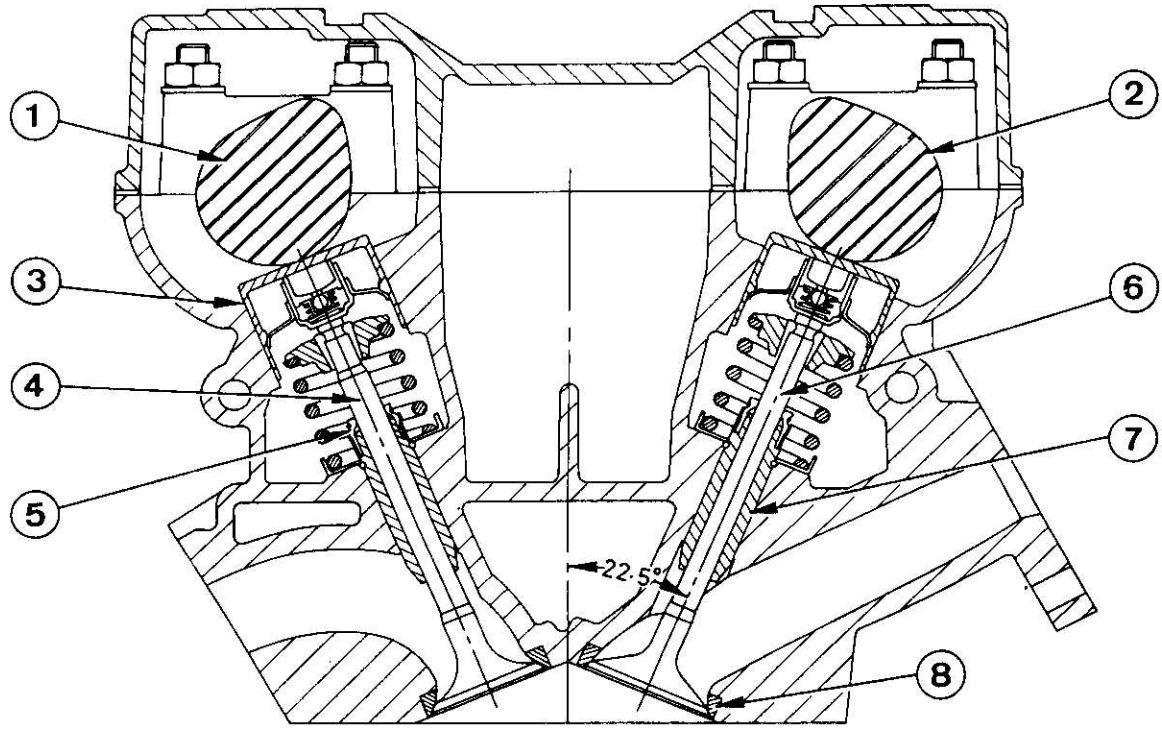
The Cylinder Head

- The Cosworth light-alloy cylinder head has two overhead camshafts – one for the inlet side and one for the exhaust side.
- A better volumetric efficiency is achieved by two inlet and two exhaust valves for each cylinder.
- The valves are inclined and their "V" arrangement has an angle of 22,5°.

  Valve stem diameter – inlet valve 7.0 mm
  – exhaust valve 8.0 mm
  The exhaust valve stems are sodium filled for optimum cooling.

  The exhaust valve stem is stepped and its upper end is 7.0 mm to enable identical valve retainers and collets to be used.
- The valves are actuated directly via hydraulic valve tappets. This eliminates the need for valve gap adjustment in service.
- Valve seats and guides are fitted in production by shrinking. Replacement can be done by specialists for this type of work.

  Valve guides – inlet : Copper-alloy inner dia. 7.0 mm
  exhaust : Copper-alloy inner dia. 8.0 mm



ST/56/12 ACM

1 = Camshaft – outlet side
2 = Camshaft – inlet side
3 = Hydraulic valve tappets
4 = Exhaust valves – sodium filled
5 = Valve stem seals
6 = Inlet valves
7 = Valve guides
8 = Valve seats

PART A – Engine, Engine Management and Turbocharger

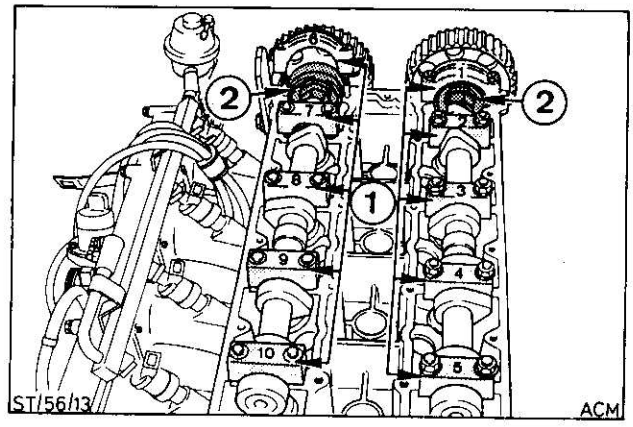
1.1 Engine Components (Cylinder Head, cont'd.)

- The valve stem seals have a press fit on the valve guides. Removal is done with special pliers, for installation a special installer tool is required (refer section "Cylinder head – remove and install").

- Each camshaft is supported in five bearings with bolt-on bearing caps.

- The cam bearings are machined in such a manner, that bearing liners are not required.

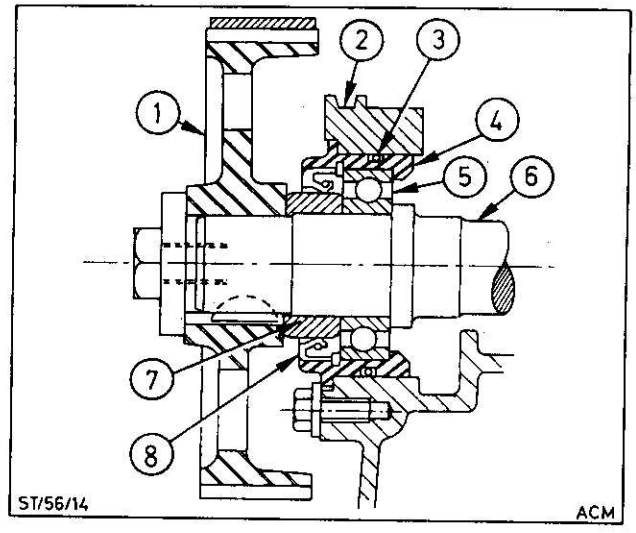
- The bearing caps are marked 1 to 5 on the exhaust side and 6 to 10 on the inlet side with the counting starting from the front on both sides.



Camshaft support bearing

1 = Bearing cap
2 = Bearing retainer with bearing

- The front end of each camshaft is supported in a ball bearing to reduce the high start up torque transmitted through the timing belt of the sprocket wheel.



Camshaft front bearing

1 = Camshaft sprocket wheel
2 = Bearing cap
3 = O-Ring
4 = Bearing retainer
5 = Ball bearing
6 = Camshaft
7 = Oil seal race
8 = Oil seal

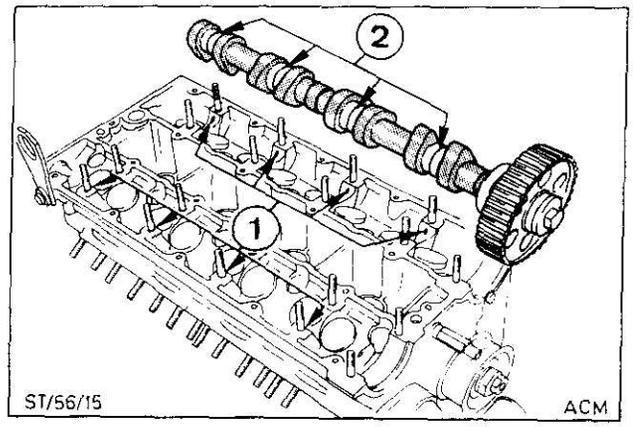
PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components (Cylinder Head, cont'd.)

- The oil feed bores are located on the side of the support bearings.

  The camshaft for the inlet valves has bearing journals with oil grooves to ensure complete lubrication of the bearing surface.

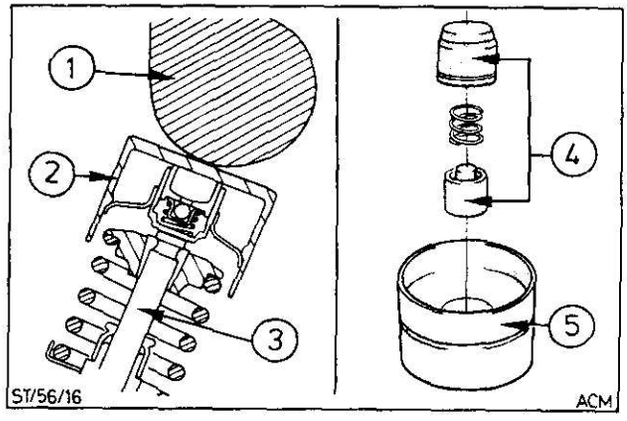
  The camshaft for the exhaust valves does not need this oil groove because of the position of the oil feed bore.



Lubrication of the camshaft

1 = Oil supply bore
2 = Lubrication groove

- The hydraulic valve tappets (bucket type) are supplied as an assembly. They should not be disassembled and must always be fitted into their original location.



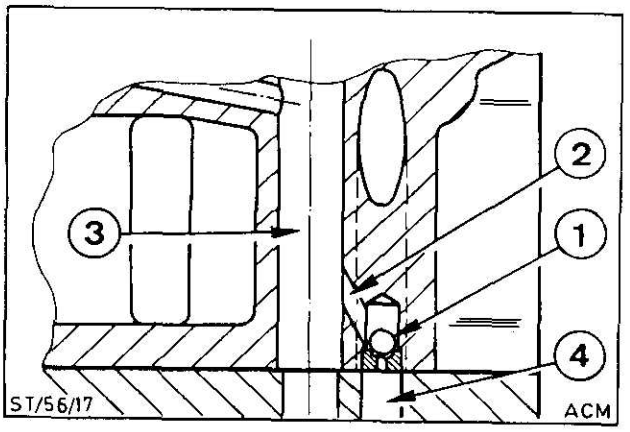
Hydraulic valve tappets

1 = Camshaft
2 = Hydraulic valve tappets
3 = Valve stem
4 = Piston, cylinder and spring of the hydraulic valve tappet
5 = Tappet housing with oil chamber

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components (Cylinder Head, cont'd.)

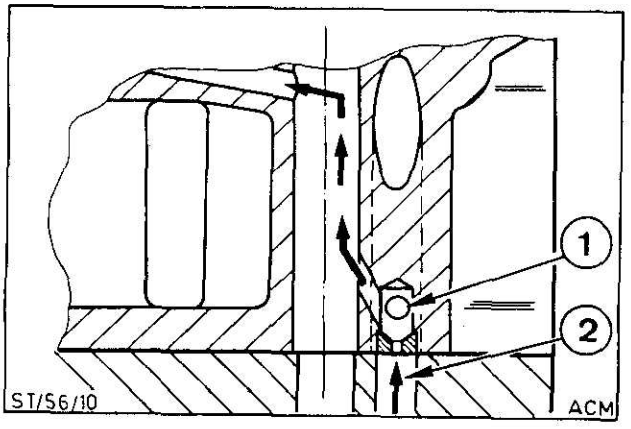
- The oil gallery of the cylinder head is fitted with a non-return valve which eliminates oil drain back after the engine is switched off



Anti-drain back valve in cylinder head

1 = Ball in closed position
(engine switched off)
2 = Cross drilling
3 = Cylinder head bolt drilling (oil gallery)
4 = Main oil gallery

When starting the engine the anti-drain back valve opens for immediate lubrication of the camshaft journals and hydraulic tappets.



Anti-drain back valve in cylinder head

1 = Ball in open position
(with engine in operation)
2 = Direction of oil flow

- The cylinder head gasket differs from the standard OHC gasket in that it has revised openings to match the Cosworth cylinder head.

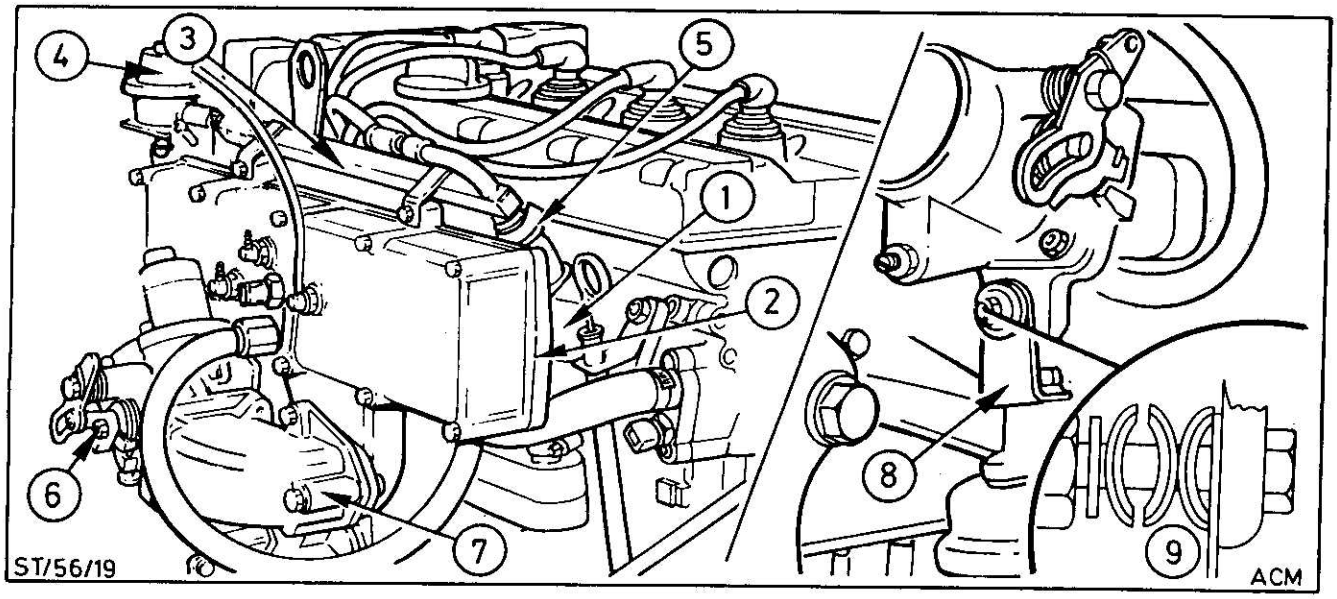
PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components

Components fitted to the Cylinder Head

Inlet side:

- Inlet manifold (1)
- Air chamber (2) with bolted on fuel rail (3), pressure regulator (4) and push fit fuel injectors (5).
- Throttle housing (6) and elbow (7).

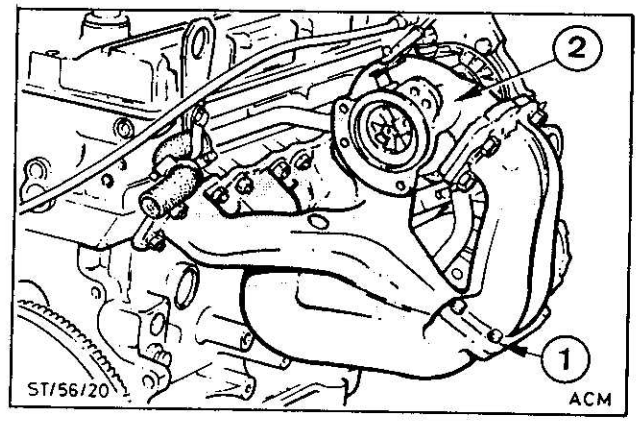


- The elbow is supported by a bracket (8) from the engine mounting. The elbow is fastened to the bracket by three pairs of special dished washers (9). This flexible mounting eliminates vibrations from the engine, which could affect the throttle position sensor. When disassembling, the position of the dished washers should be noted to ensure correct reassembling.

Outlet side:

- Two piece exhaust manifold (1) consisting of the primary manifold and the secondary manifold. Because of the high exhaust temperature, the manifold material consists of a heat-resistent cast iron (Ni-resist).

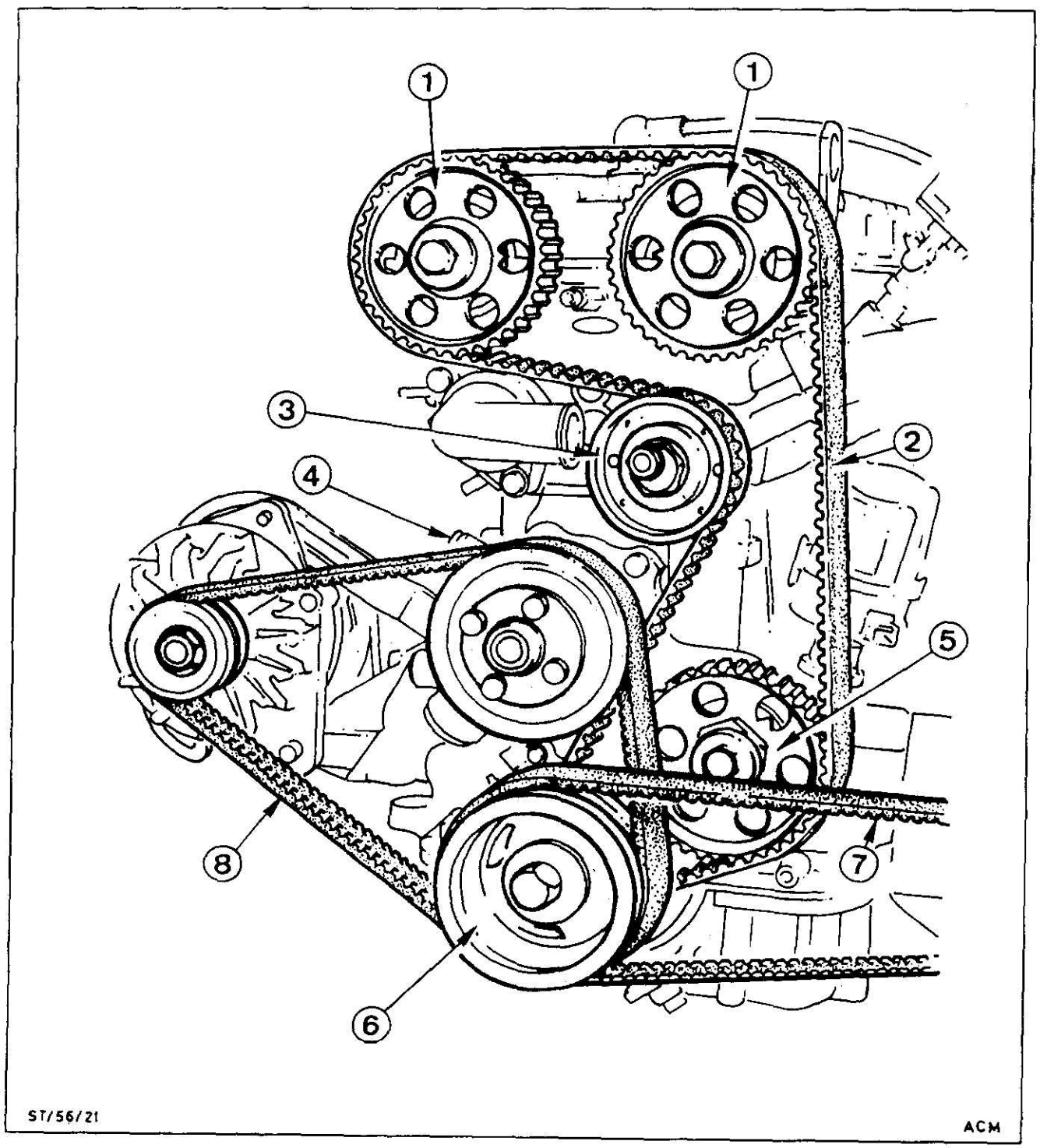
- The turbocharger is water-cooled and bolted to the exhaust manifold.



PART A – Engine, Engine Management and Turbocharger

1.1 *Engine Components*

Front Belt Drive



1 = Camshaft sprocket gear
2 = *Timing belt*
3 = Tensioner – timing belt
4 = Water pump
5 = Sprocket gear – auxiliary shaft
6 = Three belt pulley
7 = V-belt – power steering pump
8 = V-belt – alternator and water pump

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components (Front Belt Drive, cont'd.)

- The overhead camshafts and the auxiliary shaft are driven by a toothed timing belt directly from the crankshaft sprocket gear. The timing belt must be replaced in service every 80.000 km (50.000 miles).

- The sprockets for the camshafts and the auxiliary shaft are located by keys.

- In contrast to the standard OHC-engine the Cosworth engine has a TDC marking on the sprocket gear for the auxiliary drive.

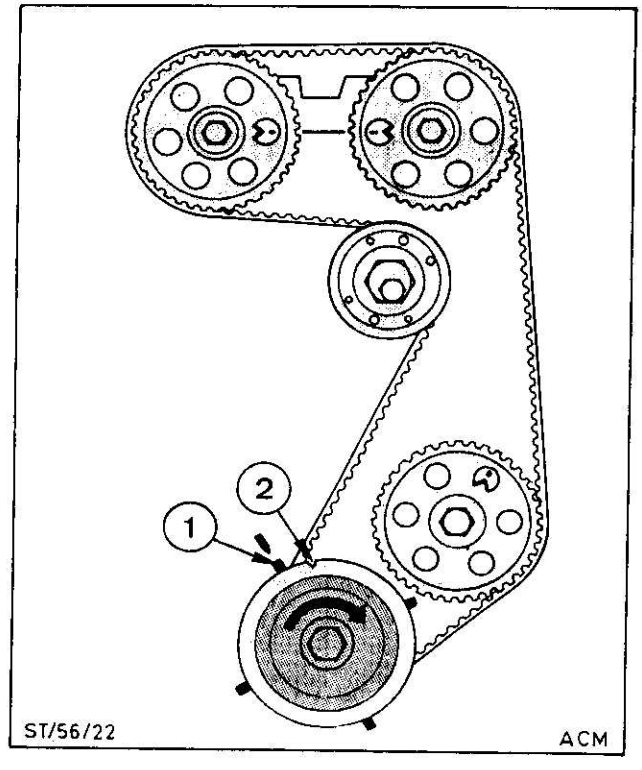
- The eccentric type belt tensioner allows a very precise setting of the timing belt tension.

- The fan belt pulley on the crankshaft drives three belts, a matched pair for the alternator and the water pump and a single belt for the power steering pump.

- Tensioning of the "V" belts for the alternator and the water pump is done on the bracket for the alternator. The procedure is similar to the one for the standard OHC-engine. Tension of the "V" belt for the power steering pump is achieved by tilting the power steering pump.

- There are 4 teeth on the "V" belt pulley nearest to the engine. These teeth are separated by exactly 90°. They initiate the pulses for the speed sensor (see "Engine Management").

  The tooth next to the ignition timing mark identifies the TDC position of piston No. 1. This position is reached when the flank of the tooth aligns with the marking on the front cover (see illustration). The TDC position for the camshafts and the auxiliary shaft is set using the timing marks on the sprocket gears and the markings on the housing.



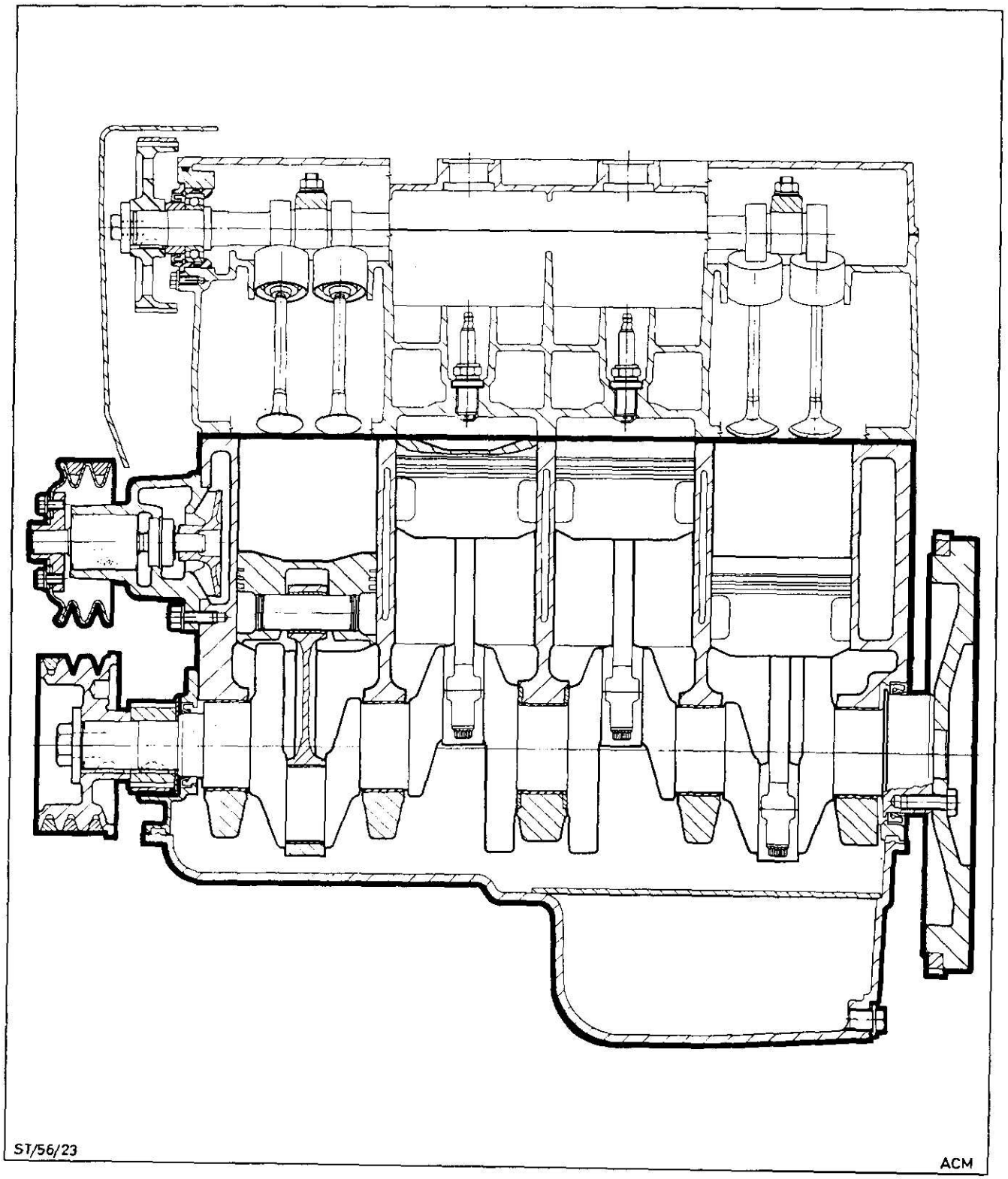
TDC Markings

1 = TDC position of cylinder "1"
2 = Ignition timing (16° BTDC)

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components

Crank Case Assembly



Engine – side cross section

PART A – Engine, Engine Management and Turbocharger

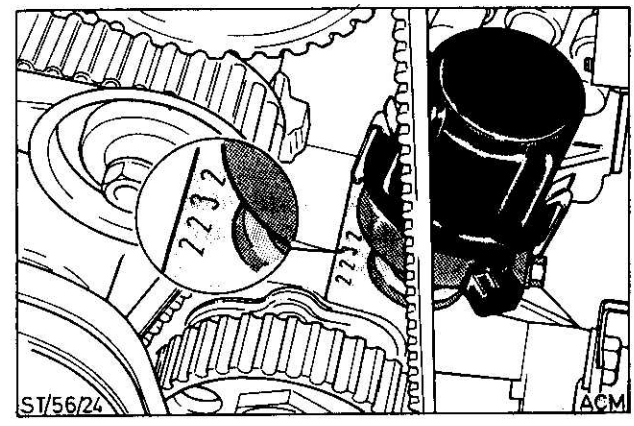
1.1 Engine Components (Crank Case Assembly, cont'd.)

Cylinder Block

- The cylinder block is a specially selected standard production OHC block.

- **Cylinder blocks selected have either a standard bore grade 2 or 3.**

- The bore size of the individual cylinders (either class 2 or 3) is stamped into the cylinder block behind the distributor, starting with cylinder No. 1.



Identification of cylinder bores and piston grades

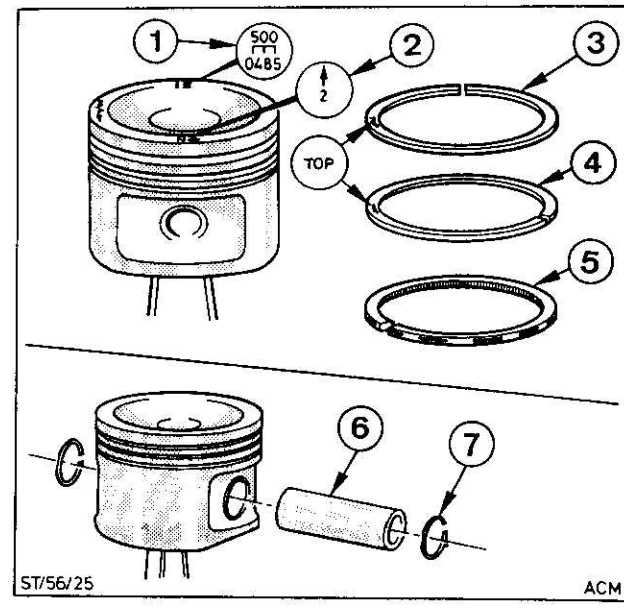
Crank Case Assembly

- The aluminium alloy pistons are either standard class 2 or 3.

- The pistons have a combustion bowl.

- The upper compression ring is chrome-plated.
  Both compression rings are marked "TOP".

- The piston pin is fully floating and secured by snap rings.



Piston, Piston Rings and Piston Pin

1 = Production date and Manufacturer sign
2 = Piston-standard class and arrow – engine front
3/4 = Compression rings with "TOP" mark
5 = Oil control rings
6 = Piston pin
7 = Snap ring

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components (Crank Case Assembly, cont'd.)

- The connecting rods have been redesigned to suit high performance engine.

- The crankshaft is dimensionally similar with the standard OHC crankshaft. However, the crankshaft is forged steel and bearing journals are specially hardened.

- The crankshaft is supported in five main bearings similar to the standard OHC engine. The centre main bearing is fitted with thrust half washers to control crankshaft endfloat, as on standard OHC engine.

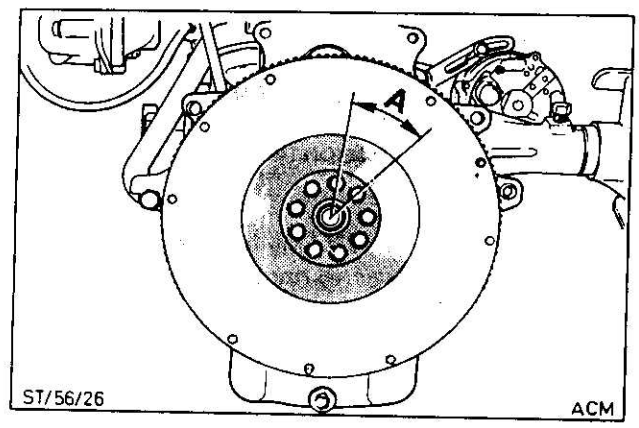
- The main and connecting rod bearings are similar to the standard OHC engine but with improved bearing surface material. The procedure to measure bearing clearance is also similar. **Note:** The main bearing shells in the block have an oil groove.

- The crankshaft sprocket gear and the front and rear oil seals are similar to the standard OHC engine, but reinforced.

- Most special tools for removal and installation are also carry over from the OHC engine. The installation tool for the rear oil seal has two additional fastening holes to suit the revised hole circle in the flywheel.

- The flywheel is new and it is fastened to the crankshaft by 9 instead of 6 bolts. The diameter of the flywheel is approx. 25 mm larger than on the OHC engine (without ring gear).

  The flywheel and the crankshaft are balanced together during manufacture. The correct position of the flywheel to the crankshaft is ensured by unequal spacings between the fastening holes. The space between the fastening holes "A" is smaller than between the others.



Hole circle in the flywheel

A = Smaller spacing

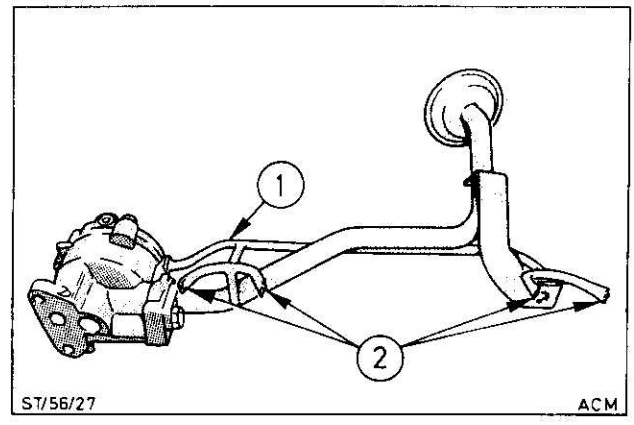
PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components

Oilpump and Lubrication Circuit

- The oilpump is similar in design and operation to the pump fitted to the OHC engine.

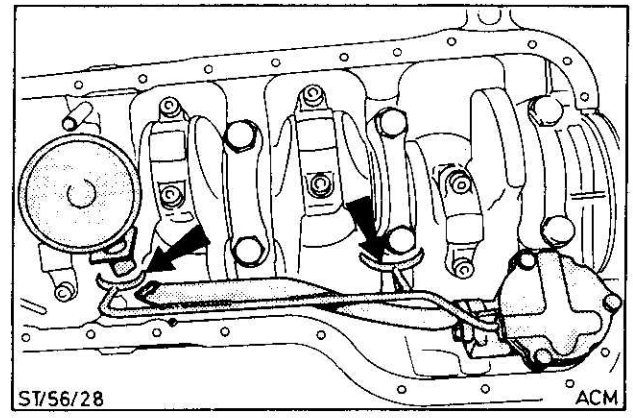
- The cover of the pump has been revised to connect an additional oil pipe.



Oilpump

1 = Oilpipe
2 = Four spray pipes

- There are four spray pipes, one for each cylinder, which allow piston cooling by oil spray.

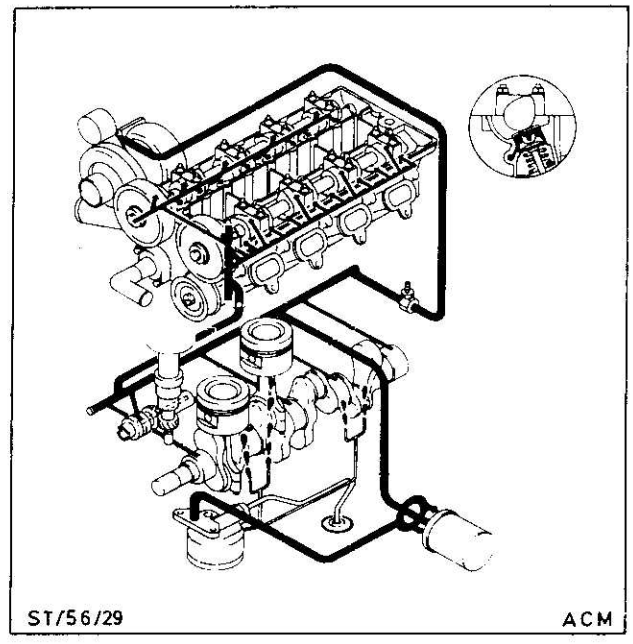


Position of the oilpump with spray pipe

- The oil pump draws oil from the sump and feeds it through an oil cooler and the full-flow filter into the main oil gallery which distributes the lubricant into the oil galleries in the same manner as on the standard OHC engine.

An oil gallery at the front end of the engine block feeds oil to the valve train and the hydraulic tappets.

A non return valve in the oil gallery of the cylinder head eliminates oil drain back after the engine is switched off.



Lubrication circuit

PART A – Engine, Engine Management and Turbocharger

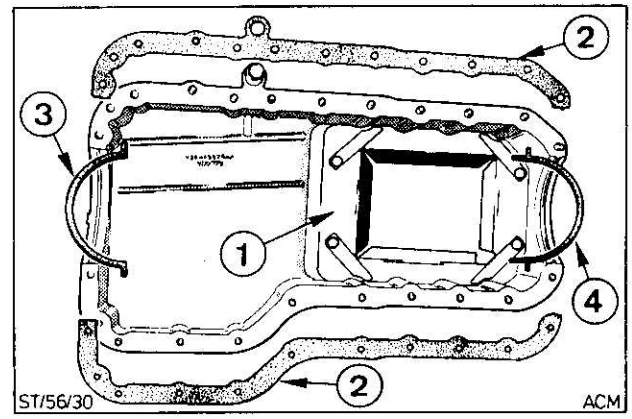
1.1 Engine Components

The Oilpan

- The Ford Cosworth engine has an aluminium oilpan with internal baffle plate.

- The gasket set for the oilpan is new. The gasket features two cork layers with an aluminium gasket sandwiched between them and 2 additional rubber gaskets.

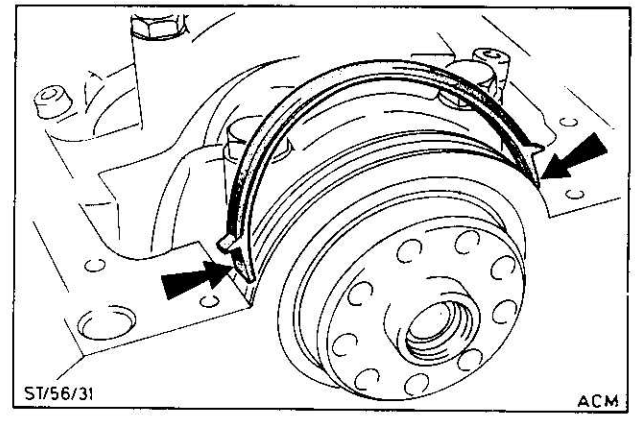
  Since the aluminium oil pan gives the engine block additional strength, the cork/aluminium gaskets must be used.



Oilpan and gasket

1 = Oil baffle
2 = Cork/aluminium gasket
3 = Front rubber gasket
4 = Rear rubber gasket

- The sealing wedges of the rear main bearing are part of the rubber seal and not separated as on the standard OHC engine.

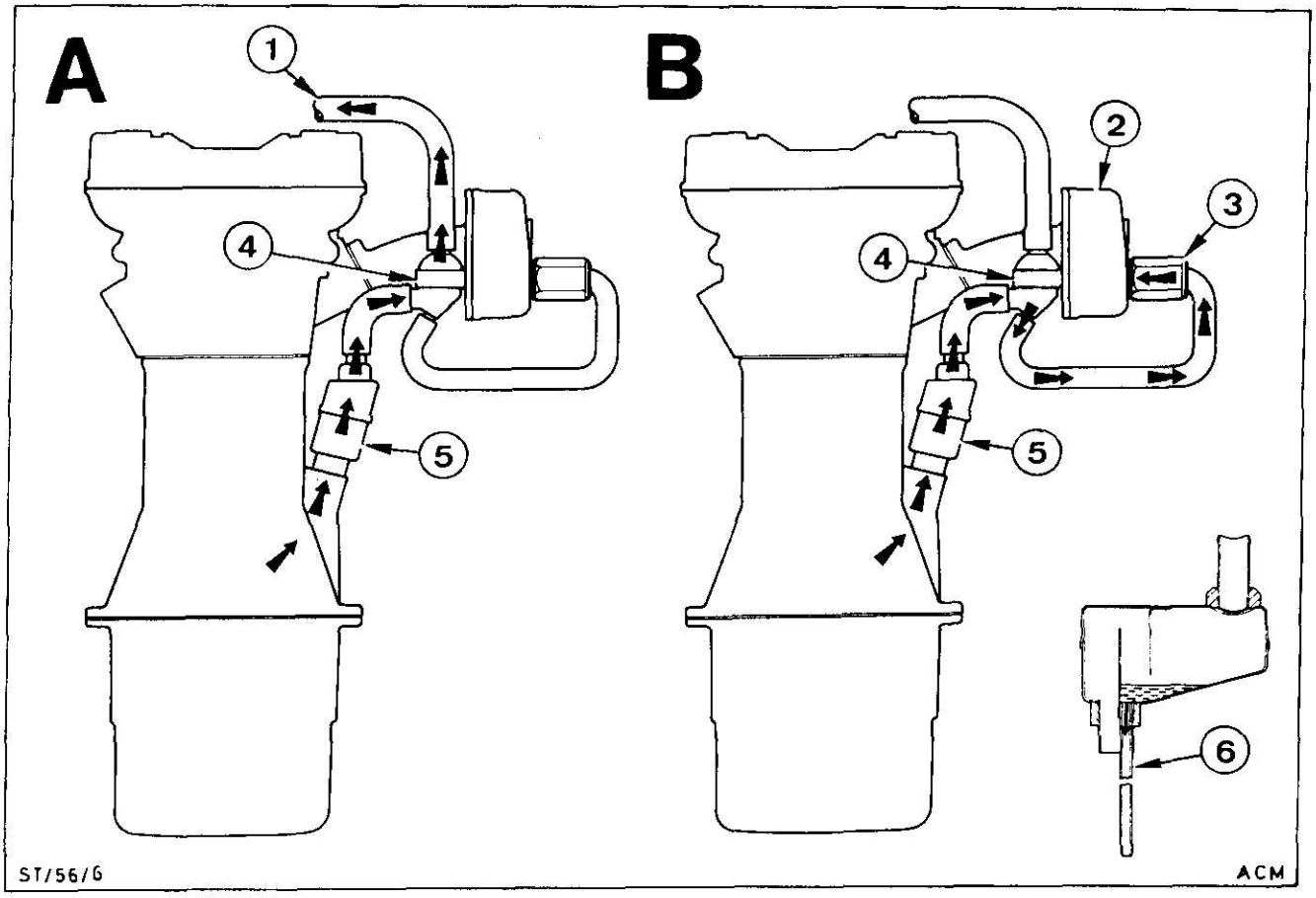


Rubber seal – rear main bearing

PART A – Engine, Engine Management and Turbocharger

1.1 Engine Components

Engine Crankcase Ventilation



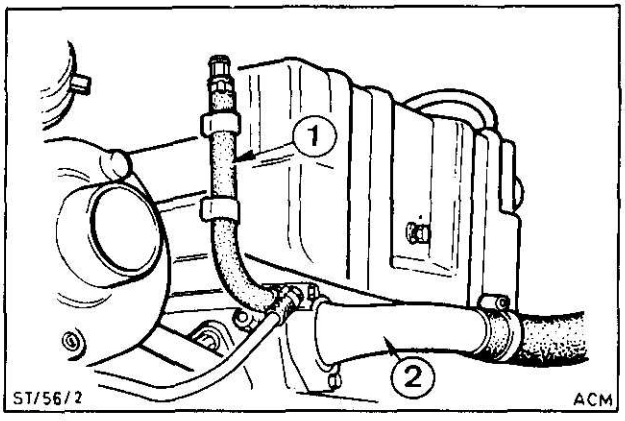
A = Throttle plate in fully open position
B = Throttle plate in closed position

1 = To aircleaner
2 = Airchamber
3 = Non return valve
4 = Filter
5 = Oil separator
6 = Oil drain pipe in oil separator

Waterpump and Thermostat Housing

- The water pump has been carried – over from the Sierra 2,0 Ltr. OHC engine.
- Connected to the thermostat housing are the bleed hose for the cooling system and the coolant feed pipe to the turbocharger.
- Thermostat nominal temperature rating: 88° C

  Opening temperature: 88° ... 94° C



Thermostat Housing

1 = Bleed hose
2 = Connection for coolant feed pipe to turbocharger

PART A – Engine, Engine Management and Turbocharger

1.2 Repair Information

General

This part of the brochure covers some important points on repair procedures. Complete and detailed procedures like engine disassembling and assembling are covered in the Sierra RS Cosworth Workshop Manual.

Most of the special tools are already available from the standard OHC engine. Additional new special tools are detailed below.

New or modified special tools:

New Special Tools	Tool No.
Adaptor for valve spring compressor	21-024-06
Cylinder head alignment studs	21-128
Installer – valve stem oil seal (exhaust)	21-129
Installer – valve stem oil seal (intake)	21-130
Remover – fuel feed hose	23-023

Modified Special Tools	Tool No.
Crankshaft rear oil seal installer	21-011 D
Remover – crankshaft sprocket gear	21-028 A

PART A – Engine, Engine Management and Turbocharger

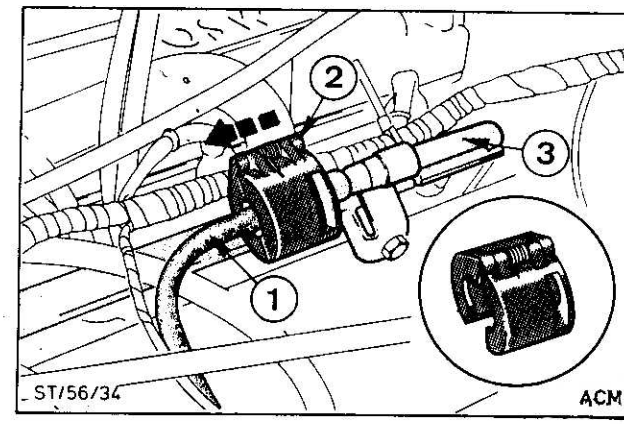
1.2 Repair Information

Important Notes on Cylinder Head – Removal and Installation

Note: Before slackening the head bolts the engine should be allowed approx. 2 hours to cool off.

- The fuel feedpipe can be removed using the new special tool 23-023.

  Open special tool and slide over the fuel pipe as shown in illustration. Push tool against pipe fitting.

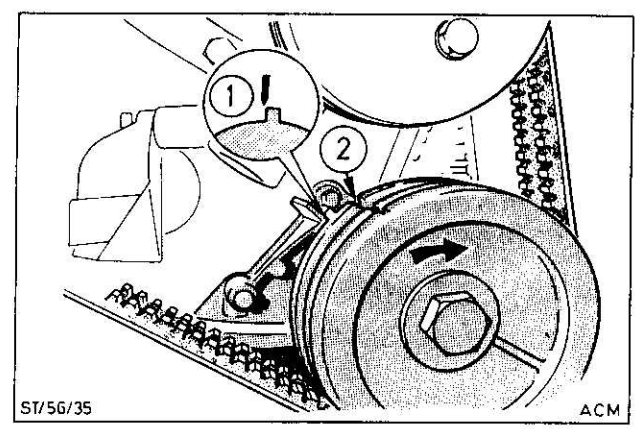


Removal of fuel feed pipe
1 = Fuel feed pipe
2 = Special tool 23-023
3 = Fuel rail

- Remove the timing belt cover. There are
  – two spacers fitted between the valve cover and the timing belt cover,
  – one spacer (with washer) screwed into the cylinder head
  – and one spacer screwed into the engine block.

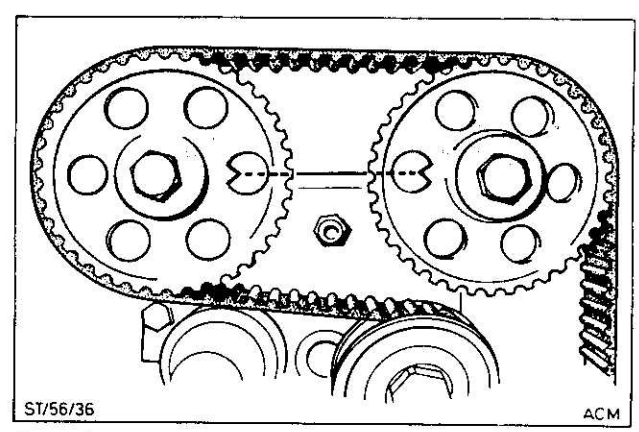
- Before removing the timing belt the first cylinder should be set to TDC as follows:

  – Turn crankshaft to a position where the flank of the tooth on the V-Belt pulley (1) aligns with the TDC marking on the cover.



Crankshaft in TDC position
1 = TDC marking
2 = Ignition timing mark (16° BTDC)

  – The timing marks of the two camshaft sprocket gears must align with the cylinder head upper edge.

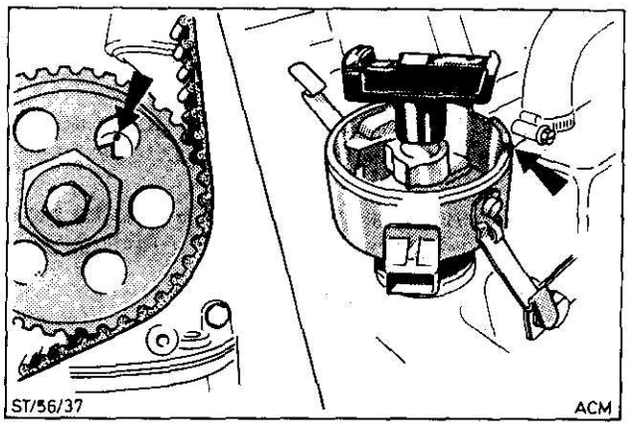


Camshafts in TDC position

1.2 Repair Information (Important Notes on Cylinder Head – Removal and Installation, cont'd.)

– The timing mark on the sprocket gear for the auxiliary shaft must align with the marking on the engine block.

In this position, the distributor rotor will be in No. 1 TDC position.

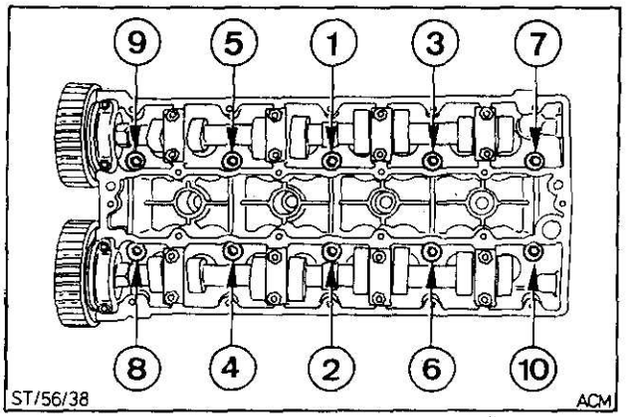


Auxiliary shaft and distributor rotor in TDC position

- Slacken timing belt tensioner (one nut) and remove timing belt.

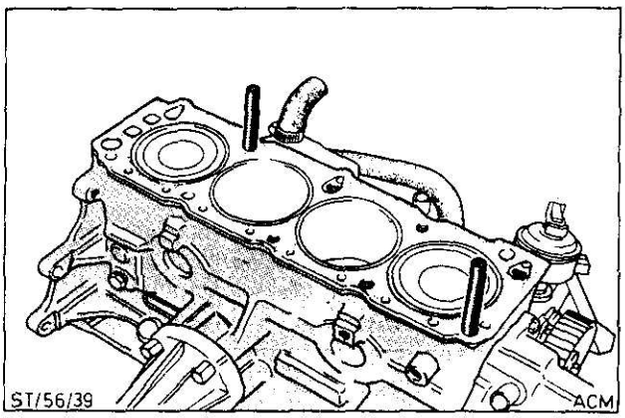
Important: Do not crank the engine with the timing belt removed. This will cause serious damage to the valve train and the pistons.

- Slacken cylinder head bolts starting from the middle of the head. Remove bolts with washers.



Slackening and tightening sequence for the head bolts

- When installing the cylinder head gasket fit alignment studs as shown.



Alignment studs

PART A – Engine, Engine Management and Turbocharger

1.2 Repair Information (Important Notes on Cylinder Head – Removal and Installation, cont'd.)

- Lubricate head bolts at threads and under bolt head and install bolts together with washers.
  Tighten cylinder head bolts as follows.
  Stage 1 requires to tighten all bolts 30–35 Nm.
  Stage 2 requires to tighten all bolts to 67–70 Nm following the sequence.
  Stage 3 requires the bolts to be tighten in degrees of rotating using a special gauge tool.
  Following the sequence, each bolt is turned 80° – 90° of rotation.

- Check and ensure that the crankshaft, the camshafts, the auxiliary shaft and the distributor rotor are still in TDC position. Fit the timing belt in counter – clockwise direction starting at the auxiliary gear.

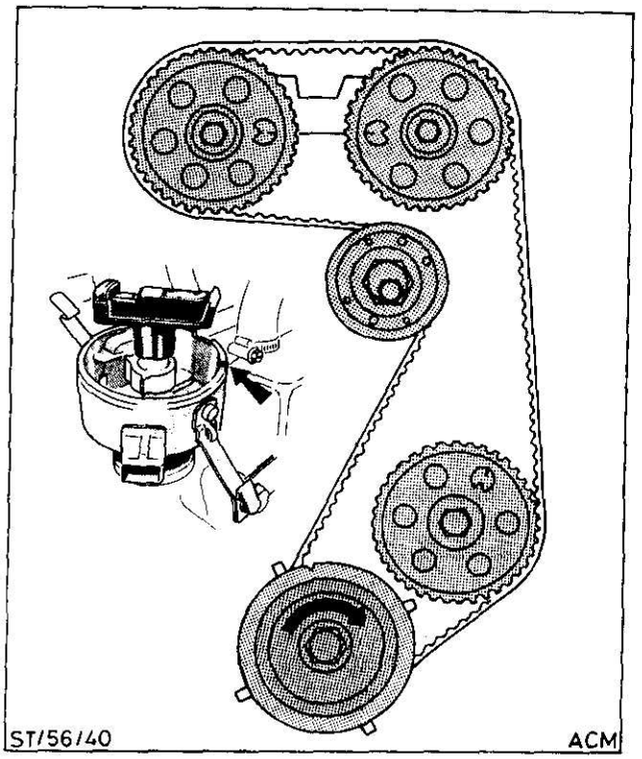
- Pull belt tensioner by hand in clockwise direction against the timing belt and tighten fastening nut.

- Crank engine several times in clockwise direction and subsequently one full turn counter – clockwise to TDC position.

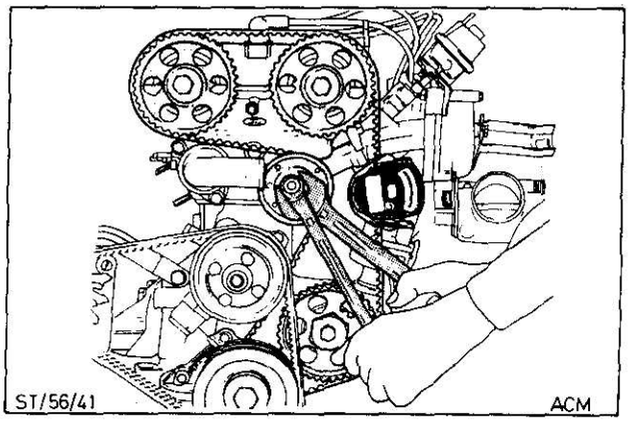
  Note: The engine must not be cranked beyond TDC position.

- Using the belt tension gauge 21–113, check belt tension at the longest straight section (see illustration). If necessary adjust belt tensioner so that the specified tension of 9,5 to 10,5 is achieved.

- Repeat complete procedure and recheck belt tension.



Crankshaft, camshafts, auxiliary shaft and distributor in TDC position



Checking and adjusting belt tension

- Fit valve cover using a new, dry gasket. Then finger tighten all bolts. Subsequently torque bolts to specification, beginning with the inner bolts and ending with the outer bolts. Then tighten the flange bolts to specification.

- Install timing belt cover making sure the spacers and washers are correctly installed.

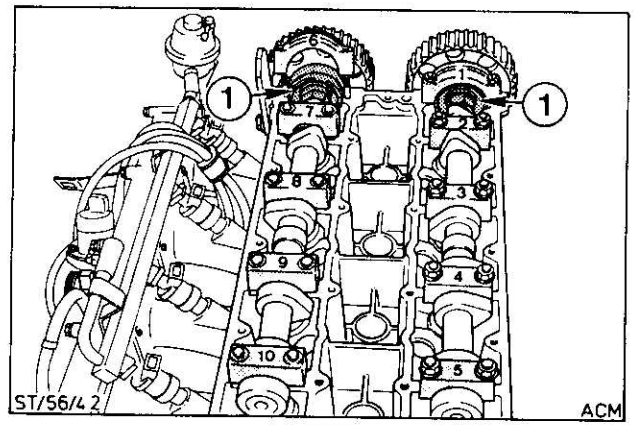
PART A – Engine, Engine Management and Turbocharger

1.2 Repair Information

Cylinder Head – Important Notes on Disassembly and Assembly

- To remove the camshafts, untighten bearing caps carefully in equal steps, remove caps and then lift the camshafts from the supports.
- The bearing caps are marked by numbers starting at the front ball bearing 1 to 5 on the exhaust side and 6 to 10 on the inlet side.
- The bearing journals of the camshaft for the inlet side have oil grooves.

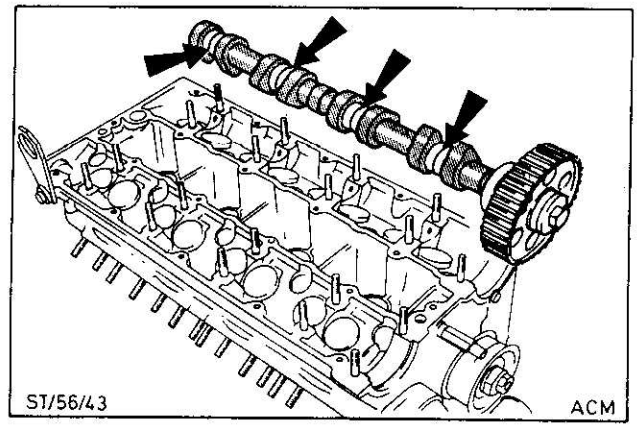
  The camshafts must not be interchanged



Identification of bearing caps

1 = Support with ball bearing

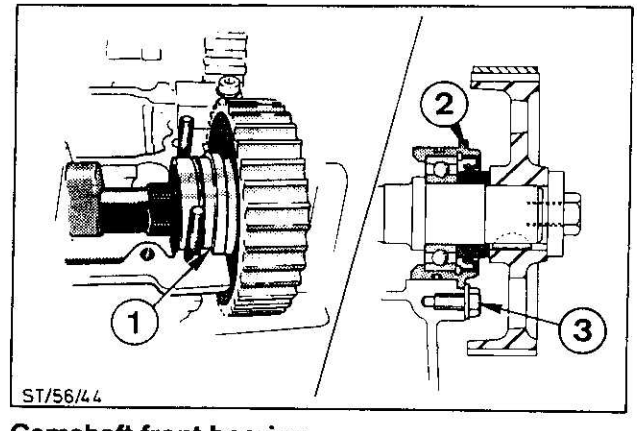
- The bearing caps will fit one way only – incorrect installation is therefore not possible.



Camshaft for the inlet valves

Bearing journal with oil groove

- When fitting the camshafts, make sure that the front bearing retainers are flush with the bore in the cylinder head. The bearing retainers are prevented from tilting by a screw and washer from below (see illustration).
- First fit bearing caps 2 to 5 and 7 to 10 and tighten them equally starting with the inner ones.
- Ensure both front bearing retainers are still flush before fitting the caps 1 and 6. Subsequently torque all nuts with the specified torque (see Technical Data).



Camshaft front bearing

1 = Retainer in flush position
2 = Bearing retainer
3 = Securing screw

PART A – Engine, Engine Management and Turbocharger

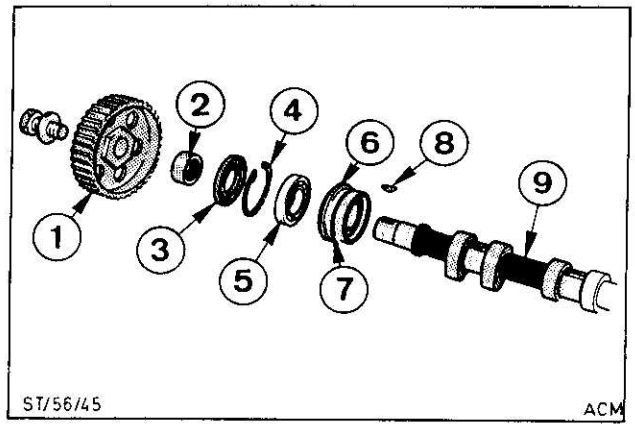
1.2 Repair Information (Important Notes on Cylinder Head – Disassembly and Assembly, cont'd.)

The camshaft once removed from the cylinder head can be disassembled as follows:

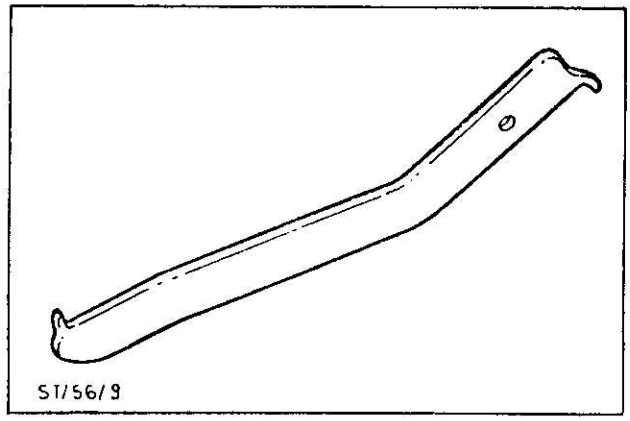
- The camshaft sprocket gear is fixed on the camshaft by a keyway with key (8).
- Unscrew fastening bolt and remove the sprocket gear (1). Remove key (8) and pull oil seal race (2) and bearing retainer (6) from the camshaft (9).
- Leaver off oil seal (3) from the bearing retainer (6).
- The ball bearing (5) has a press – fit in the retainer (6) and is secured by a snap ring.
- The bearing can easily be pushed out of the retainer (if necessary with light hammer blow on the bearing outer ring or by using the handle of a hammer).
- New rubber 'O' rings (7) should be used when reinstalling the camshaft.
- The oil seal can also be replaced with the camshaft in situ. This requires removal of the sprocket gear and the oil seal race. Then, the oil seal can be removed using the special tool 21-096.
- The hydraulic valve tappets are supplied as an assembly and must not be dismantled.
- Removal of a hydraulic tappet can be done easily using a suitable sucker.

  Note: Removal of hydraulic tappets should **not** be done with a magnet.

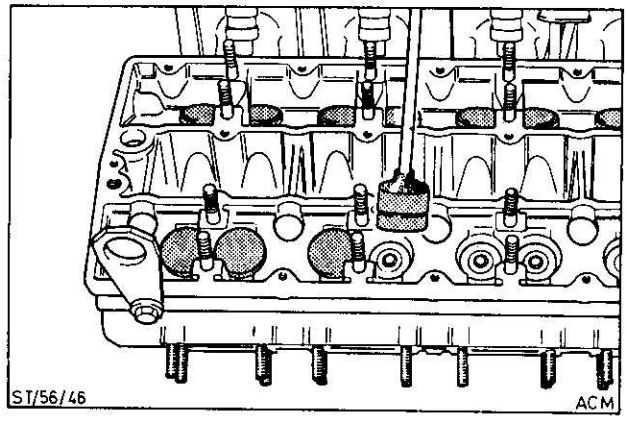
  Tappets should not be mixed up and should always be installed in their original sequence.
- When installing, tappets should be lubricated.
- When applying pressure to the hydraulic plungers some tappets may feel "soft" due to air in their hydraulic chamber. This may be ignored because it will disappear once the engine is running again.



Camshaft assembly



Special Tool 21-096

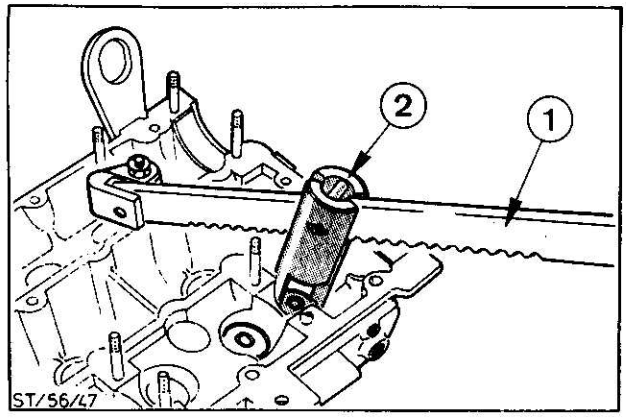


Removal of a hydraulic tappet

PART A – Engine, Engine Management and Turbocharger

1.2 Repair Information (Important Notes on Cylinder Head – Disassembly and Assembly, cont'd.)

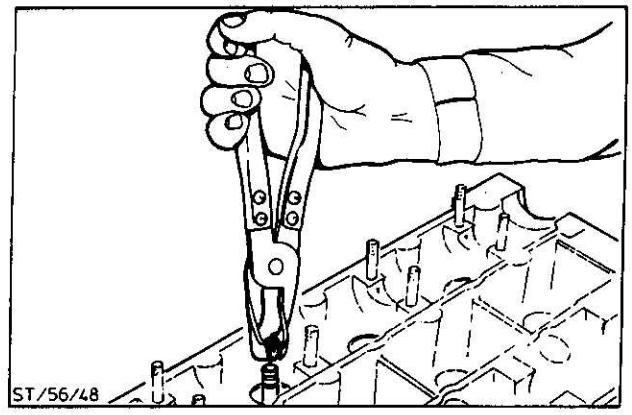
- To remove the valves, the new adaptor 21-024-06 for the valve spring compressor 21-024 must be used. Make sure that the valves stems are not damaged by the valve spring retainer when it is pressed down to remove or install the valve collets.
- Remove the valve retainers, the springs and the valves.



Removal of valves

1 = Valve spring compressor 21-024
2 = Adaptor 21-024-06

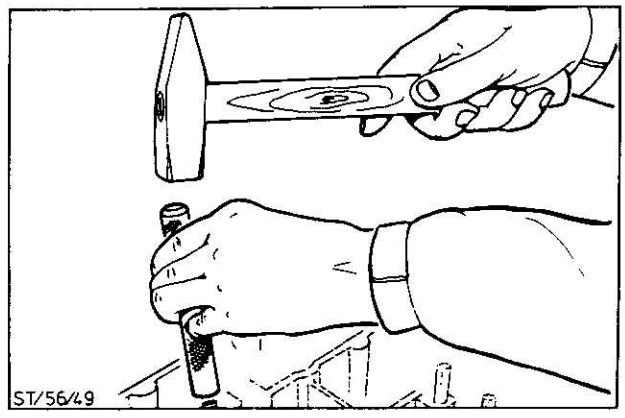
- Remove the valve stem seals using a suitable tool (as known from the 1600 Diesel engine) as shown. Subsequently remove the lower spring retainer.



Removal of valve stem seals

- When assembling, first fit the lower spring retainers.
- Then lubricate the new valve stem seals and press them onto the valve guides using the special tool 21-130 for the inlet side and the special tool 21-129 for the outlet side as shown.

  Please remember, that the valve stem seals have different diameters (inlet side – 7,0 mm, outlet side – 8,0 mm).
- Lubricate the valve stems before inserting the valves into the valve guides.



Installation of valve stem seals

- In the case of replacing the valve stem seals with cylinder head in situ, a suitable adapter for the pressure hose should be used.

  Note: For this procedure crank engine by hand, that all pistons are in the same position in the cylinder bores and then lock the crankshaft.

PART A – Engine, Engine Management and Turbocharger

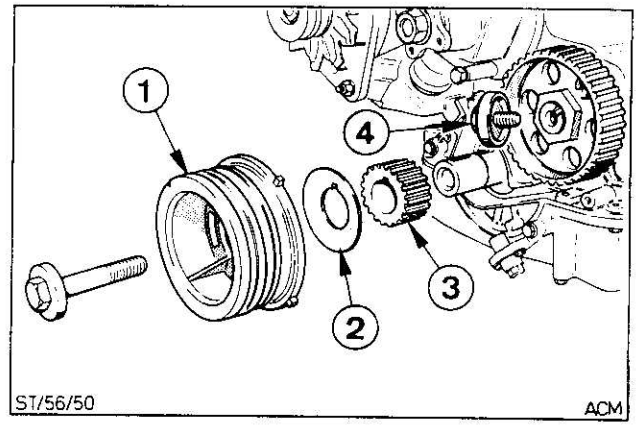
1.2 Repair Informations

Further important Repair Notes

- The crankshaft V-belt pulley, the thrust washer and the sprocket gear can be pulled off the crankshaft by hand. If the sprocket gear has a tight fit the special tool 21-028 A should be used.

- When fitting the sprocket gear the tapered side of the gear should face the camshaft. The V-belt pulley should be fitted with its teeth closest to the engine.

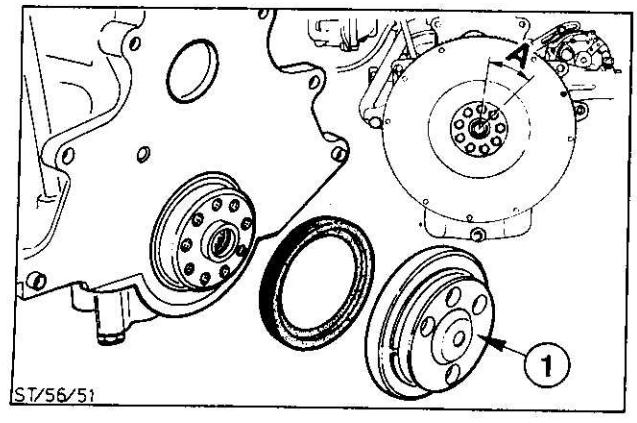
- The thread of the fastening bolt for the auxiliary shaft gear is plastic coated. When reinstalling always use a new bolt.



1 = V-belt pulley with teeth
2 = Thrust washer
3 = Crankshaft sprocket gear
4 = Fastening bolt-auxiliary shaft gear. Bolt thread is plastic coated.

- The flywheel is balanced together with the crankshaft.
  The position of the flywheel to the crankshaft is fixed through unequal spacings between bolt holes i.e. the space "A" between two holes is smaller than between the others.

- The installer for the crankshaft rear oil seal is from the tool set for the standard OHC engine. However, the tool has two additional fastening holes to suit the revised bolt hole circle.



Flywheel fastening to crankshaft

A = Reduced spacing
1 = Special tool with two additional fastening holes

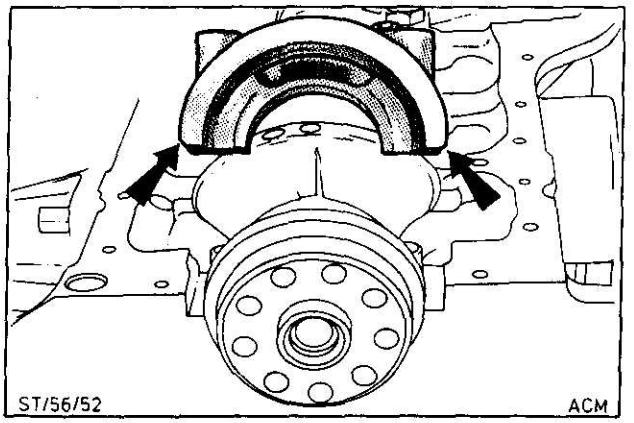
PART A – Engine, Engine Management and Turbocharger

1.2 Repair Informations (Further important Repair Notes, cont'd.)

- Crankshaft bearing clearance should be measured using "Plastigage" as on the standard OHC engine.

- The main bearing caps are marked with an arrow which should point to the front of the engine.

- The rear main bearing cap is chamfered on both sides to ensure correct seating on the cylinder block. When installing the bearing cap, the chamfered edge should be coated with sealer (Loctite 518). Make sure the sealer is not applied to the flat contact area.



Rear main bearing cap

Sealer to be applied only to the chamfered edge.

- Crankshaft endfloat is controlled by thrust half washers. Their respective position must be marked when removing.

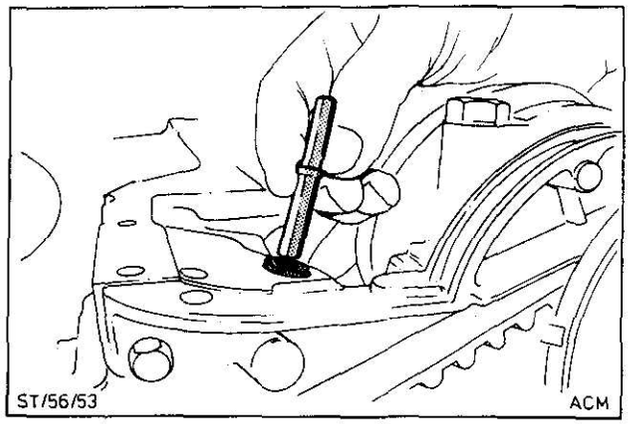
- The connecting rod big ends and -bearing caps are numbered. These numbers should be noted before removing the bearing caps and the caps should always be installed in their original position.

- When installing the pistons to the connecting rods the arrow on the piston crown must point to the front of the engine. The bearing retainer groove in the connecting rod should point to the auxiliary shaft.

PART A – Engine, Engine Management and Turbocharger

1.2 Repair Informations (Further important Repair Notes Other Repairs, cont'd.)

- Before installing the oil pump, fit the oil pump driveshaft. The longer end of the shaft should point to the distributor (see illustration).

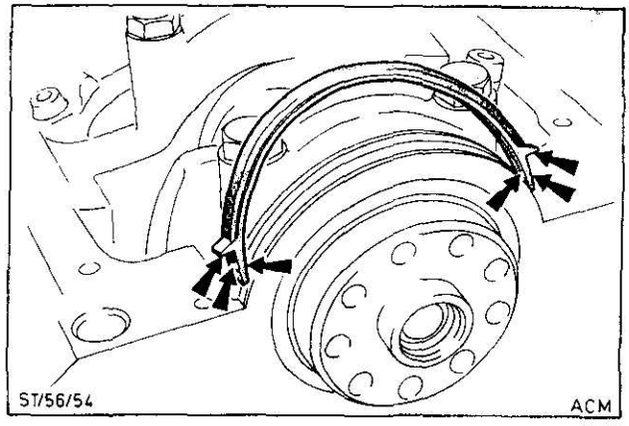


Oil pump driveshaft

- Fit oil pan gasket as follows: Coat sealing wedges with sealer (Loctite 518, see illustration), insert them into the groove of the rear main bearing cap and press them fully home.

- Apply sealer to the ends of the front rubber seal and the cork gasket and install. Slide the ends of the cork gasket under the ends of the rubber gasket.

- Coat the threads of the oil pan fastening bolts with Loctite 270 and tighten them in three stages to the specified torque (see technical data).



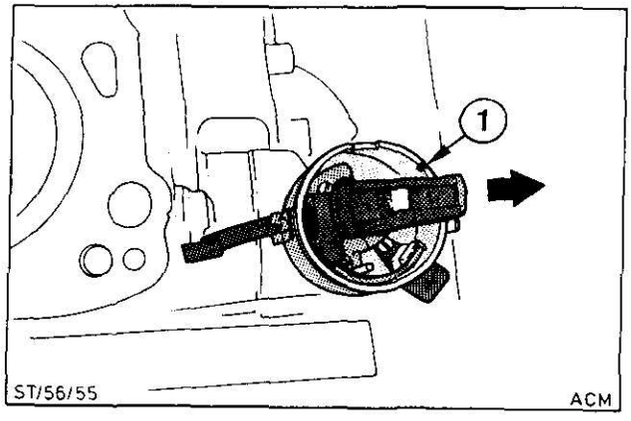
Coat sealing wedges with sealer

- If the distributor was removed, installation should proceed as follows:

  – Hold distributor so that the spring clip points to the engine and that the distributor rotor points away from the engine (see illustration).

  – When inserting the distributor the rotor will turn to its correct position and point to the marking for cylinder No. 1

  Note: When installing the distributor, the crankshaft, the camshafts and the auxiliary shaft must all be in TDC position.



Position of the distributor rotor when installing the distributor

1 = Marking cylinder No. 1

PART A – Engine, Engine Management and Turbocharger

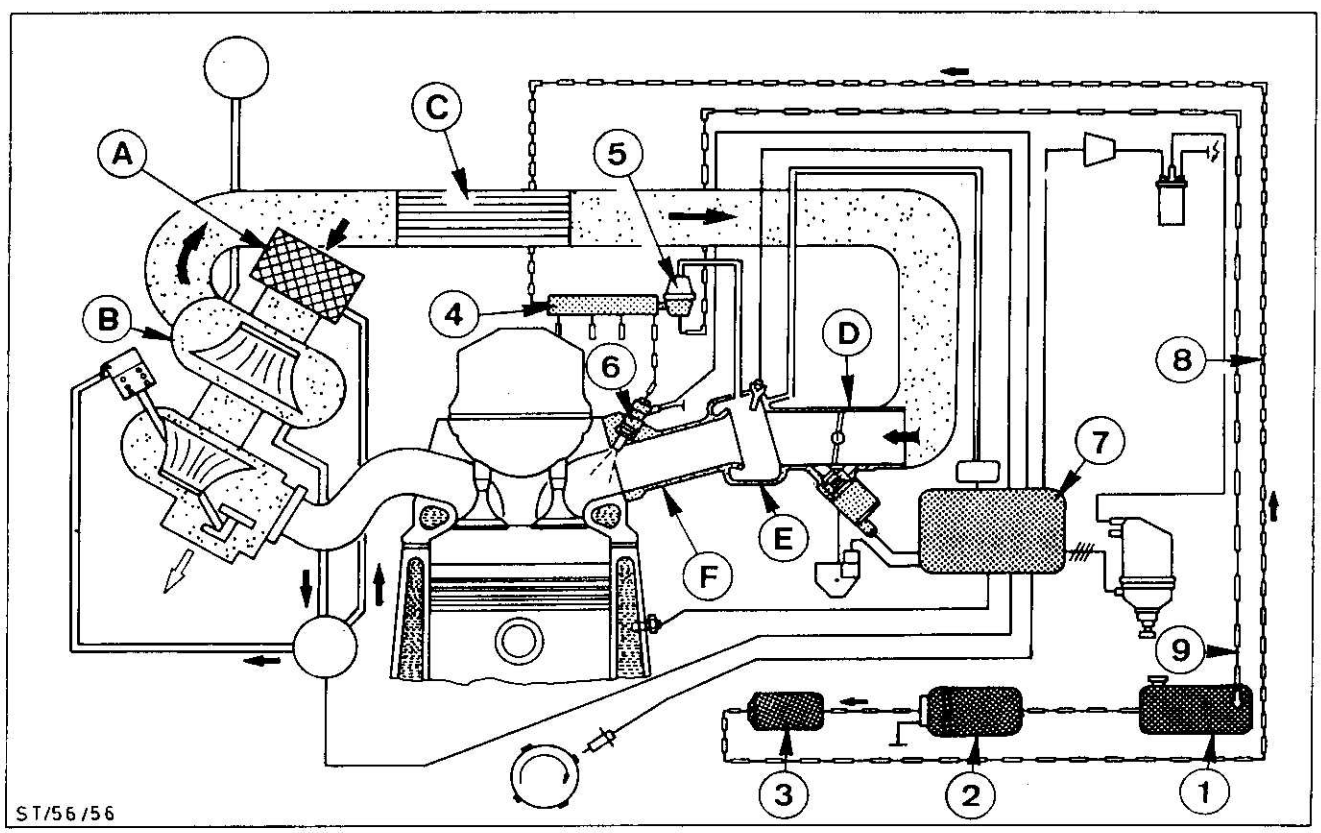
2. Electronic Engine Management

2.1 General Description

The Sierra Cosworth is fitted with a combined Electronic Engine Management System with fuel injection from Weber and ignition system from Marelli.

The electronic fuel injection system is in many respects very similar to the EFI system available for Scorpio and Sierra vehicles.

- An electric fuel pump feeds fuel from the fuel tank through a fuel filter to the fuel rail with its four injectors (one per cylinder).
- The injector "on" time is individually controlled for **each** cylinder by the Electronic Control Unit ECU.
- Inlet air passes from the aircleaner through the turbocharger, the air to air charge cooler, the throttle body, the airchamber and inlet manifold to the individual cylinders.



Electronic Engine Management – Fuel and Air System

1 = Fuel tank
2 = Fuel pump
3 = Fuel filter
4 = Fuel rail
5 = Pressure regulator
6 = Fuel injector
7 = Electronic Control Unit (ECU)
8 = Pressurised fuel
9 = Non-pressurised fuel

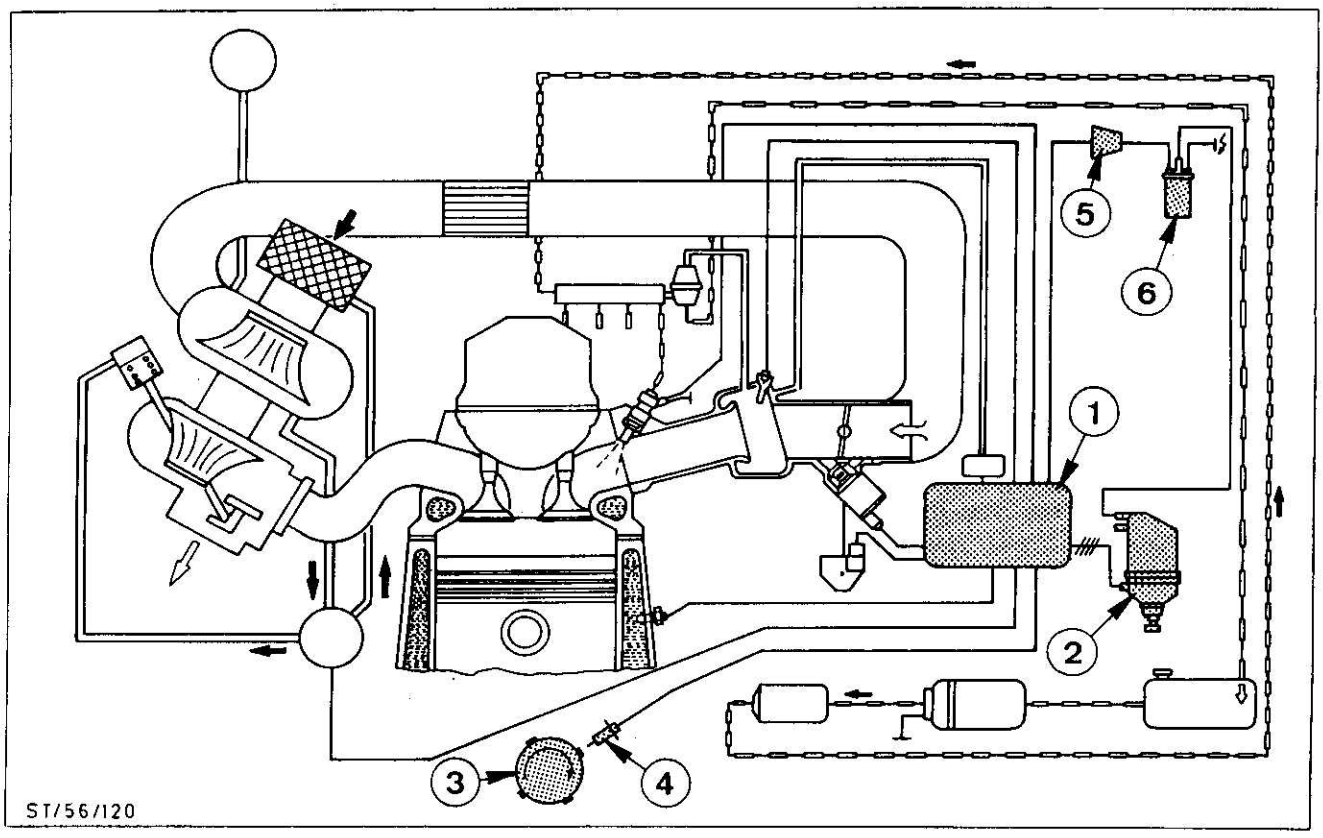
A = Air cleaner
B = Turbocharger
C = Air to air charge cooler (intercooler)
D = Throttle body
E = Air chamber
F = Inlet manifold

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.1 General Description (cont'd.)

The ignition is of the inductive discharge type with dwell control in the ignition module and the advance curves are stored by the ECU.



Electronic Engine Management – Ignition System

1 = Electronic Control Unit (ECU)
2 = Distributor with Phase sensor
3 = Crankshaft pulley
4 = RPM/TDC-Sensor
5 = Ignition module
6 = Ignition coil

A number of sensors feed a continuous stream of information signals to the ECU module thereby enabling the ECU to determine the required air fuel ratio and the spark timing.

The individual components of the engine management system are described on the following pages.

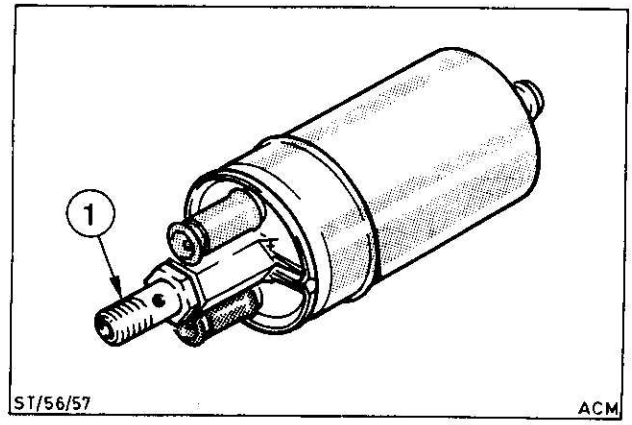
PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

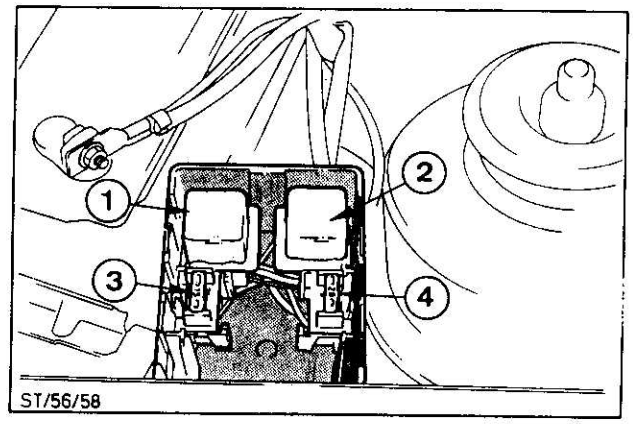
2.2 System Components – Fuel System

The Fuel Pump

- The electric fuel pump is of roller type and is controlled by the ECU.
- The pump incorporates a non-return valve which can be replaced in service.
- The non-return valve maintains the system pressure during cranking.
- Fuel pump operation is controlled by a relay which switches the pump on and off when the engine is started or stalls.
- The pump cannot be repaired and must be replaced as a unit when defective.
- Both, the power relay for the ECU and the fuel pump relay as well as the Fuses are located in a special box in the engine compartment.



Fuel pump
1 = Non-return valve



Relay location

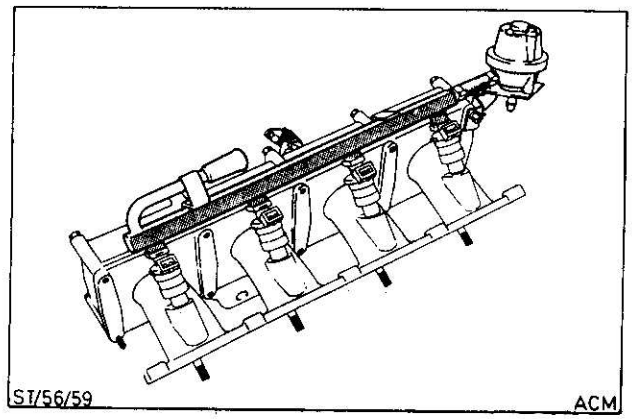
1 = Power relay (brown socket)
2 = Fuel pump relay (yellow socket)
3 = Fuse – Power relay 15 A
4 = Fuse – Fuel pump relay 20 A

The Fuel Filter

- All fuel passes through a fuel filter. The filter must be replaced at regular intervals as detailed in the service voucher booklet.

The Fuel Rail

- All fuel from the filter passes to the fuel rail which is connected to all the injectors and ensures that they are supplied with fuel at the same pressure.



Fuel rail and pressure regulator

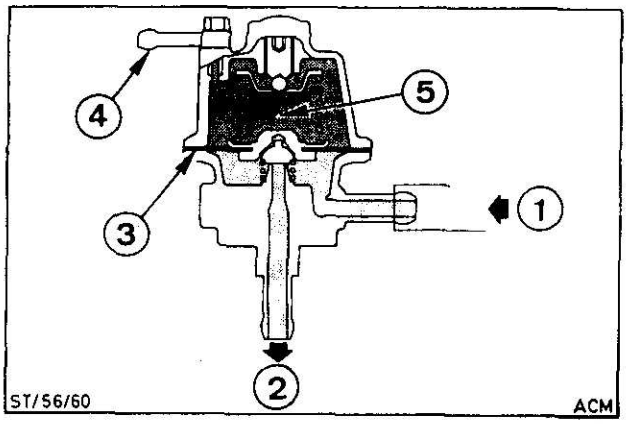
PART A – Engine, Engine Management and Turbocharger

2. *Electronic Engine Management*

2.2 System Components – Fuel System (cont'd.)

The Pressure Regulator

- To ensure accurate fuel metering and extend the capacity of the injectors it is necessary to reduce the fuel rail pressure at idle and low power usage whilst increasing the fuel rail pressure under boost conditions. This is achieved by feeding a inlet manifold pressure signal to the fuel pressure regulator.

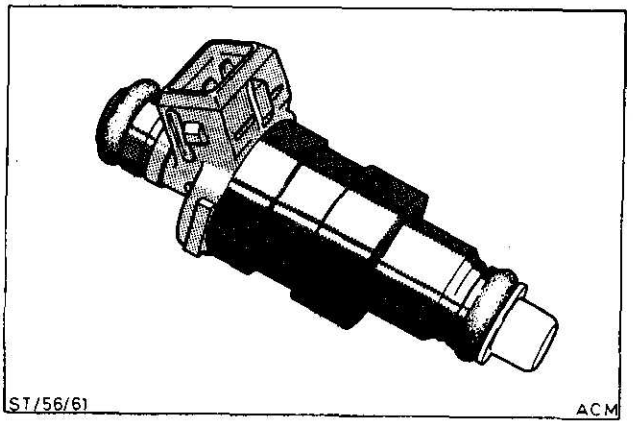


Pressure regulator cross section

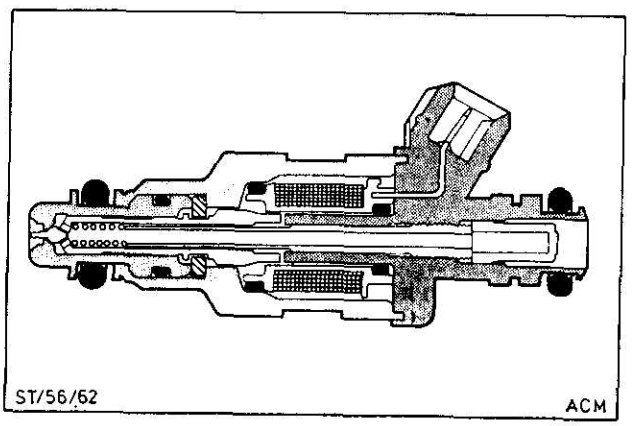
1 = Fuel from fuel tank
2 = Fuel return
3 = *Diaphragm*
4 = Connection – inlet manifold pressure
5 = Inlet manifold *pressure*

The Fuel Injector

- The injectors are solenoid operated valves.
- *The quantity of fuel injected depends* only on injector open time and fuel rail pressure.
- Injection is in a cone shape and the feed pressure 3,0 bar (modified by manifold pressure acting on the diaphragm of the pressure regulator), sufficient to cause a very fine spray.
- Injectors cannot be adjusted or repaired and have to be replaced as a unit when defective.



Fuel injector



Fuel injector cross section

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.2 System Components – The Air System

The Air Cleaner

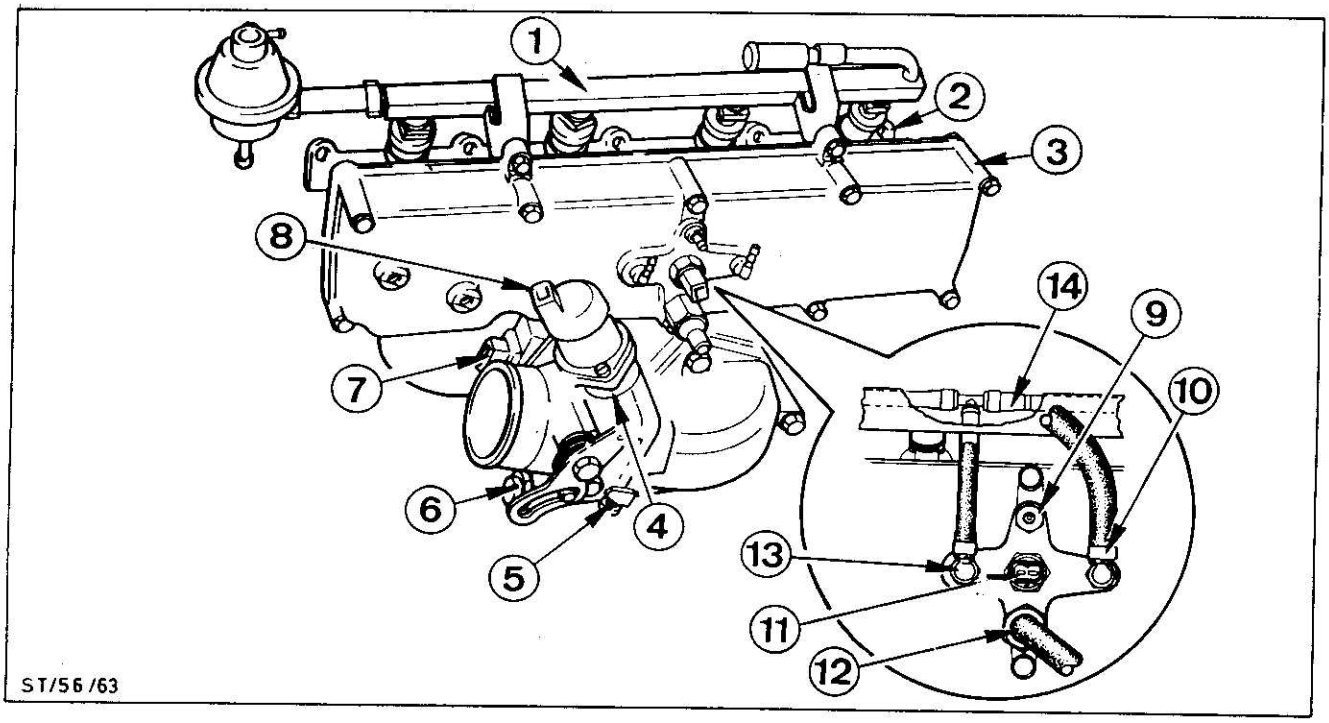
- The air cleaner has a replaceable filter cartridge which can easily be removed in service.

The Throttle Body

- The throttle body (4) includes the throttle plate. The throttle plate setting screw (5) is factory set and sealed. It should not be altered in service. If the engine idle speed is not to specifications at the first servicing (1500 km), it can be adjusted by means of the basic idle speed control screw (see "Service Adjustments").
- Bolted on to the throttle body are the idle speed control valve (8) and the throttle position sensor (7). These are explained in the section covering "Sensors and Actuators".

The Air Chamber and Inlet Manifold

- The throttle body is bolted on to the air chamber (3). Also fitted to the air chamber are
  - the inlet air temperature sensor (11),
  - the vacuum connector for the Manifold Absolute Pressure sensor (9),
  - the vacuum connector for the fuel pressure regulator (10),
  - the vacuum connector for the aircharge by-pass valve (13),
  - and the vacuum connector for the crankcase ventilation filter (12).
- The air chamber is bolted on to the inlet manifold (2). The fuel rail with the plug-in fuel injectors (1) are fitted to the inlet manifold.



1 = Fuel rail with injectors
2 = Inlet manifold
3 = Air chamber
4 = Throttle body
5 = Throttle plate setting screw
6 = Basic idle speed control screw
7 = Throttle position sensor
8 = Idle speed control valve
9 = Connector – manifold absolute pressure sensor
10 = Connector – fuel pressure regulator
11 = Inlet air temperature sensor
12 = Connector – crankcase ventilation filter
13 = Connector – aircharge by-pass valve
14 = Connection – boost pressure gauge

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

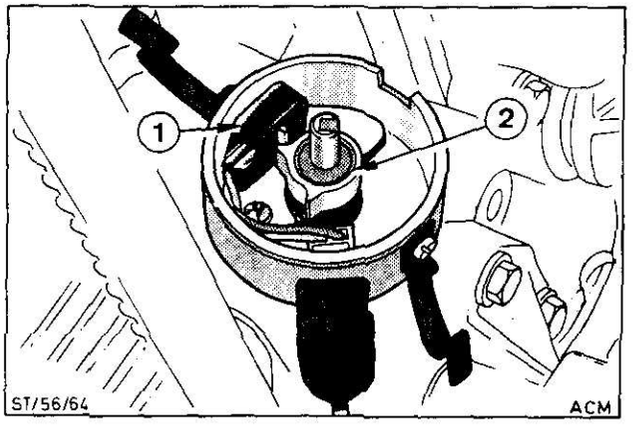
2.2 System Components – The Ignition System

The Distributor

- The distributor – make Marelli – is driven by the auxilliary shaft as on the standard OHC engine.

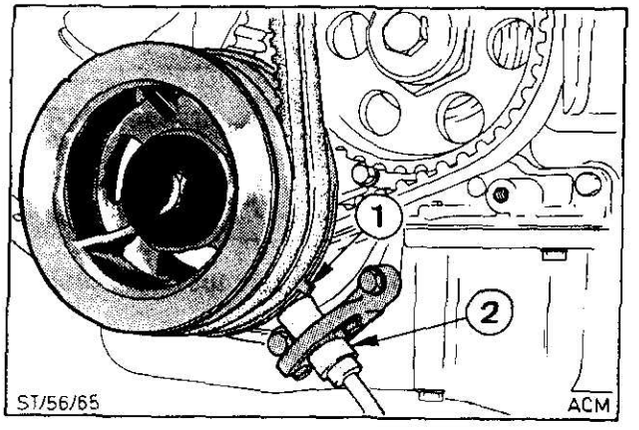
- A Phase sensor, located opposite a cam having two teeth separated at 90° to each other, is fitted inside the distributor. At the passing of a tooth the sensor delivers a signal to the ECU. This signal is similar to the signal supplied by an RPM/TDC-sensor fitted at the crankshaft pulley

- Both the signal from the distributor and the RPM/TDC-sensor enable the module to identify the phase of each cylinder. This information forms the basis on which the ECU module decides on spark timing and fuel injection.



Distributor

1 = Phase sensor
2 = Cam with two teeth



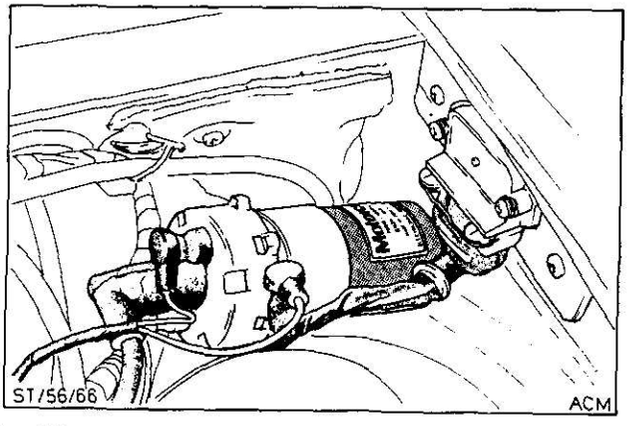
RPM/TDC-Sensor

1 = Tooth on crankshaft pulley
2 = Sensor

The Ignition Coil and Ignition Module

- The Motorcraft ignition coil and the ignition module (make Marelli) are both fitted to the left fender apron

- The ECU sends a Spark-out (SPOUT) signal to the ignition module to trigger an H.T. pulse by switching the coil primary circuit off.



Ignition Coil and Ignition Module

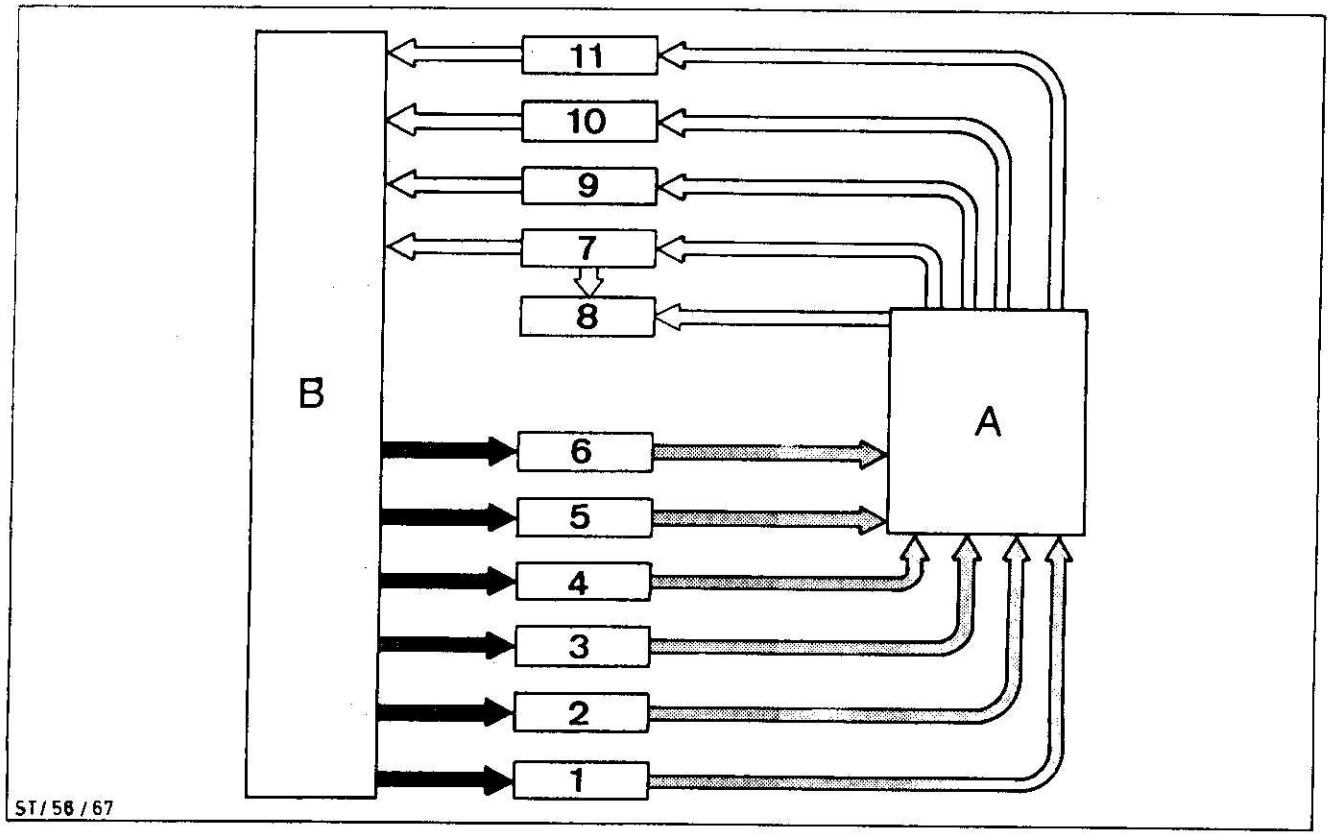
The Spark Plugs

- The Sierra RS Cosworth is fitted with Motorcraft spark plugs AGPR 901 C.

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.3 System Sensors and Actuators



System Sensors (input) and Actuators (outputs)

A = ECU
B = Engine

Sensors

1 = Throttle Position Sensor (TPS)
2 = Manifold Absolute Pressure Sensor (MAP)
3 = Air Charge Temperature Sensor (ACT)
4 = Engine Coolant Temperature Sensor (ECT)
5 = Engine RPM/TDC-Sensor
6 = Distributor-Phase Sensor

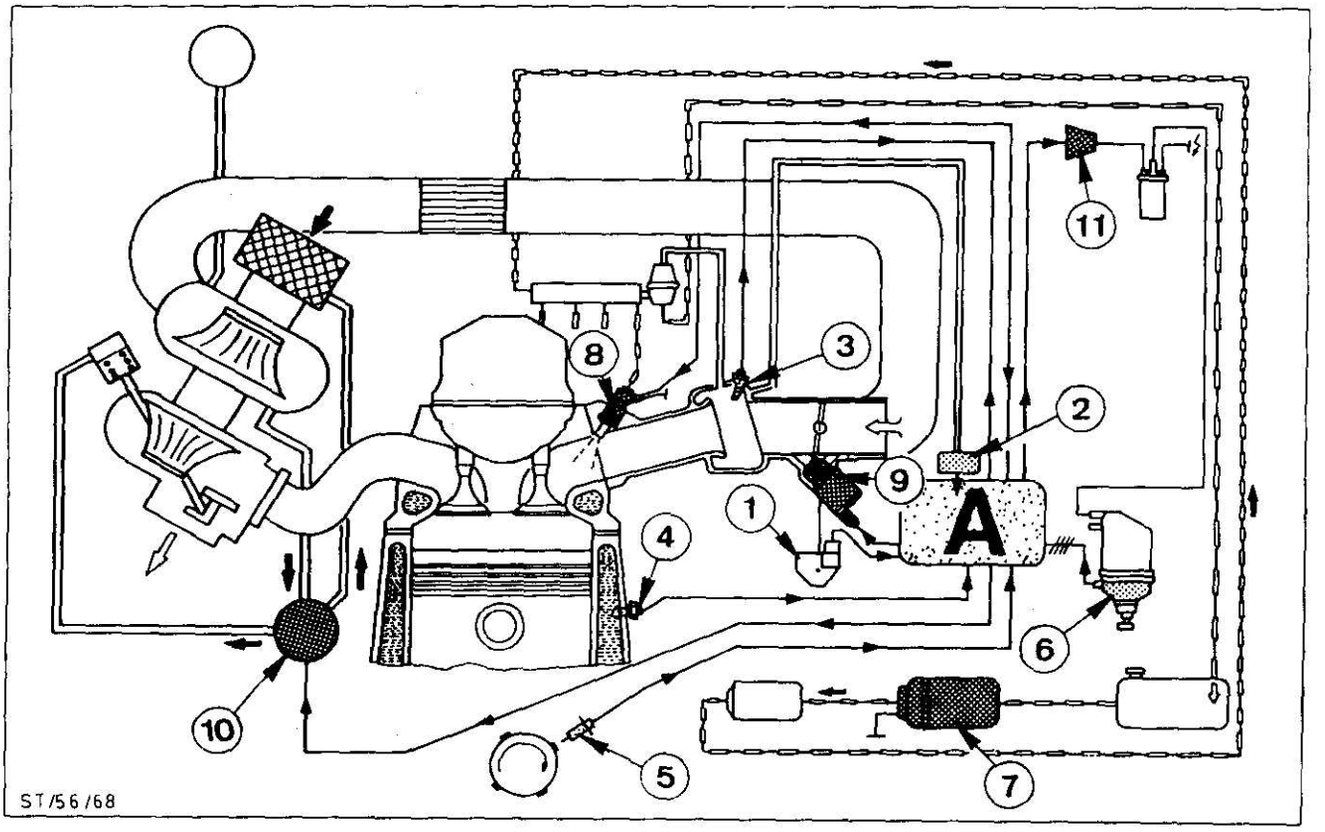
Actuators

7 = Fuel Pump
8 = Fuel Injectors
9 = Idle Speed Control Valve (ISC)
10 = Boost Pressure Control Valve
11 = Ignition Modul

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.3 System Sensors and Actuators



General Description

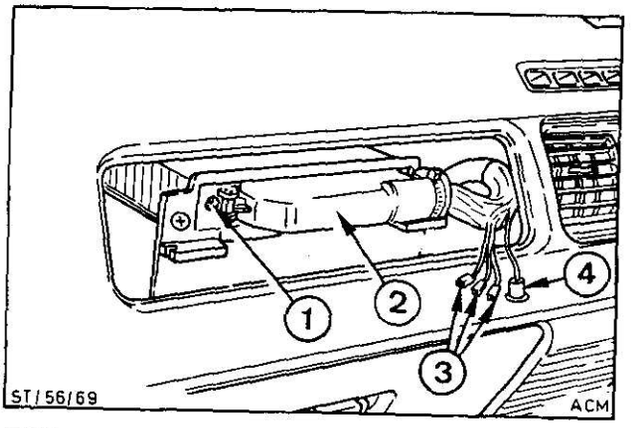
- The ECU module controls all fuel and ignition requirements of the engine by receiving, computing and comparing sensor signals with its own permanent memory. Then it sends out signals to a series of actuators which control spark timing and fuel release.

- The ECU is fitted behind the glove box and can be reached easily through a separate access lid. A 35 pin plug connects the ECU to the wiring loom.

- Power to the ECU is supplied with a feed from the battery, via a relay.

- Located next to the module are:
  – the CO adjusting screw,
  – a green, a blue and white cable for retarding the spark timing to meet fuels with lower octane rating
  – and a self test connector.

For details see "Maintenance, Service Adjustments and System Checks".



ECU

1 = CO adjusting crew
2 = Module with multiplug
3 = Cable for retarding the spark timing
4 = Self test connector

PART A – Engine, Engine Management and Turbocharger

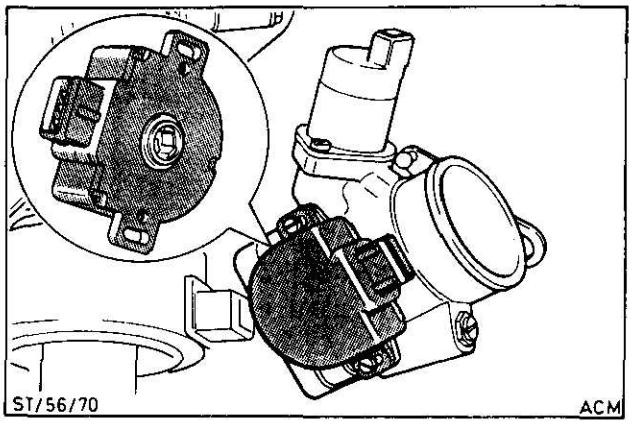
2. Electronic Engine Management

2.3 System Sensors and Actuators (cont'd.)

The system sensors (inputs) are:

The Throttle Position Sensor (TPS)

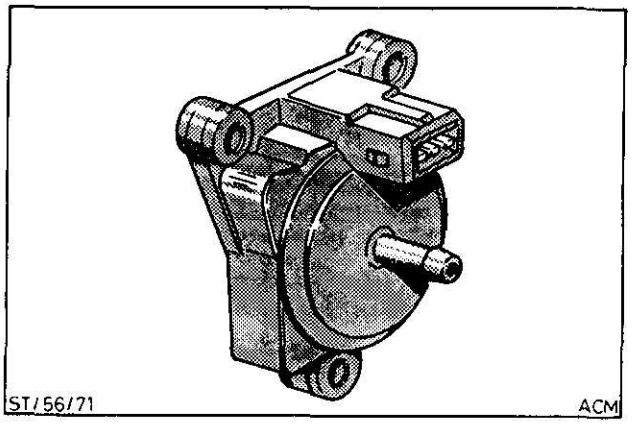
- This unit is fitted to the throttle shaft and senses the throttle position. At idle speed voltage is 5.0–4.5 volts and at full throttle the voltage drops to 0.5 volt.
- The switch can be adjusted within the limits of its elongated fastening holes. (See "Service Adjustments".)



Throttle Position Sensor (TPS)

The Manifold Absolute Pressure (MAP) Sensor

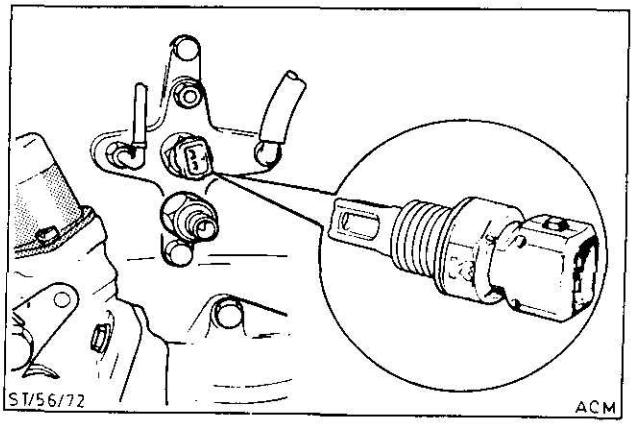
- The MAP-Sensor is fitted to the left fender apron and connected to the air chamber by a hose.
- Depending on the manifold pressure, the Sensor regulates between 0.25 to 4.75 volts. If manifold pressure exceeds 0.9 bar, the sensor signals the ECU to cut-off fuel discharge by the injector valves.
- The sensor cannot be adjusted or repaired.



Manifold Absolute Pressure Sensor (MAP)

The Air Charge Temperature (ACT) Sensor

- This sensor is of the NTC resistor type, its resistance decreases as temperatures increase.
- The ACT is screwed into the air chamber and can only be replaced as a unit if defective.
- At 0° C, for example, the resistance is 9.75 kOhm and at 70° C the reading is 0.53 kOhm. Depending on the signal received from the ACT, the ECU module will vary the injection and ignition timing and also affect operation of the Turbocharger. (For further details see section "Turbocharger".)



Air Charge Temperature Sensor (ACT)

PART A – Engine, Engine Management and Turbocharger

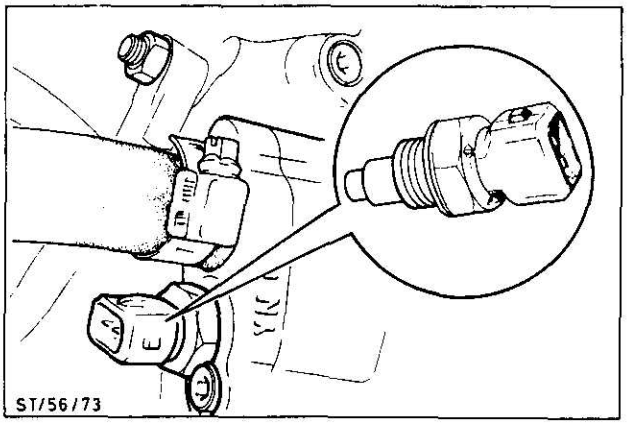
2. Electronic Engine Management

2.3 System Sensors and Actuators (cont'd.)

Engine Coolant Temperature (ECT) Sensor

- The ECT is also of NTC resistor type and its operating range is identical to that of the ACT.

- The ECT is screwed into the cylinder-head and its signal to the module affects injector open time and idle speed.

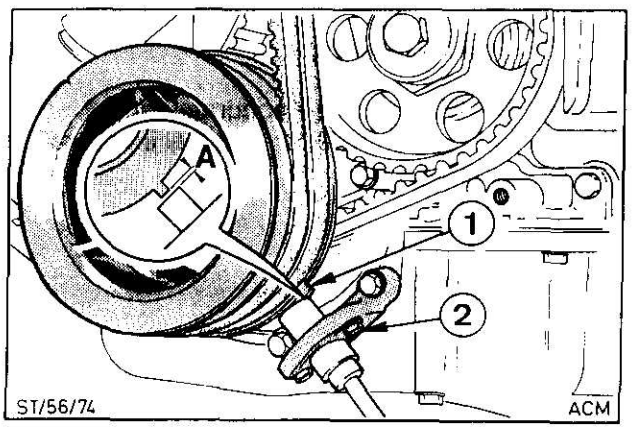


Engine Coolant Temperature Sensor (ECT)

Engine RPM and TDC Sensor

- This sensor is bolted to the engine front end. The crankshaft pulley has 4 identical teeth spaced at precisely 90°. The sensor sends a signal to the module whenever a tooth passes the sensor. From this signal the module determines engine speed (RPM) and the TDC-position of each piston (crankshaft position).

- The gap between the sensor and the teeth on the crankshaft pulley is 0.4 to 1.0 mm and is factory set (see service adjustments).



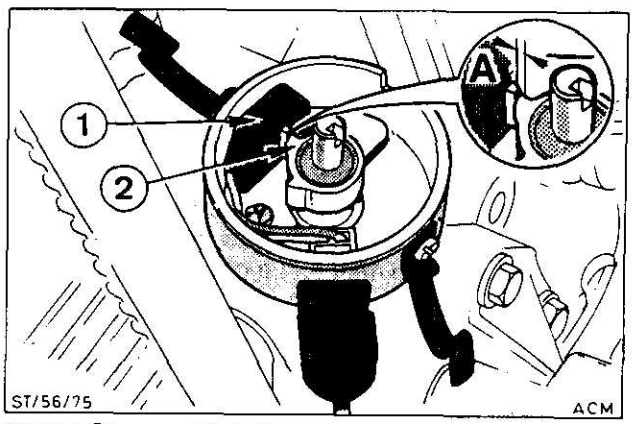
RPM/TDC-Sensor

1 = Tooth on crankshaft pulley
2 = Sensor
A = 0.4 to 1.0 mm

The Phase Sensor-Distributor

- This sensor is located inside the distributor. It signals (and the signals from the RPM/TDC sensor) enable the ECU to identify the phase of each cylinder following the firing order.

- The gap between the sensor and the teeth of the distributor cam is 0.2 to 0.3 mm and is factory set (see service adjustments).



Phase Sensor-Distributor

1 = Sensor
2 = Tooth
A = 0.2 to 0.3 mm

PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

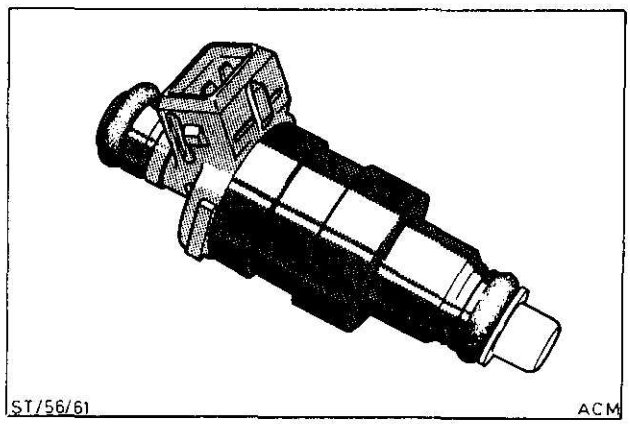
2.3 System Sensors and Actuators (cont'd.)

After comparing sensor signals with its own permanent memory, the ECU sends out signals to a number of actuators (outputs).

These actuators are:

The Fuel Pump

- The fuel pump is switched on and off via a relay when the engine is started or stalled.



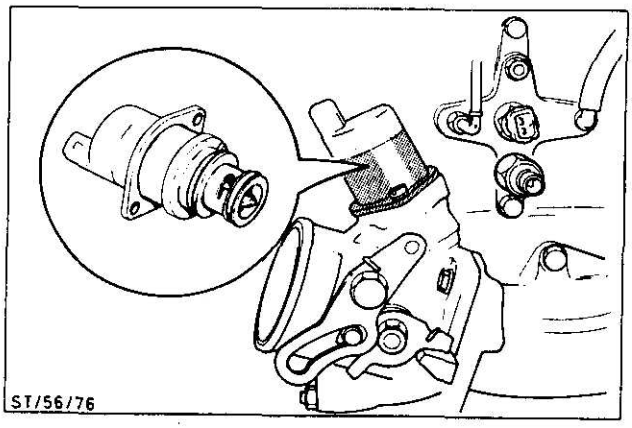
Fuel Injector

The Fuel Injectors

- The ECU provides accurate control of the solenoid operated fuel injectors to discharge fuel.

The Idle Speed Control (ISC) Valve

- This unit regulates the engine demand for air depending on engine temperature, engine load, or switched on accessories.
- When the throttle plate is in the closed position and engine speed is within the controlled idle speed range, air is allowed to bypass by means of the idle speed control valve. The valve, which is controlled by a variable current from the ECU, adjusts the air flow into the engine in order to maintain a constant idle speed.
- With cold engine, the valve regulates speed above 1200 RPM.
- With hot engine, the valve regulates speed below 1200 RPM only.
- The valve is non-adjustable.



Idle Speed Control (ISC) Valve

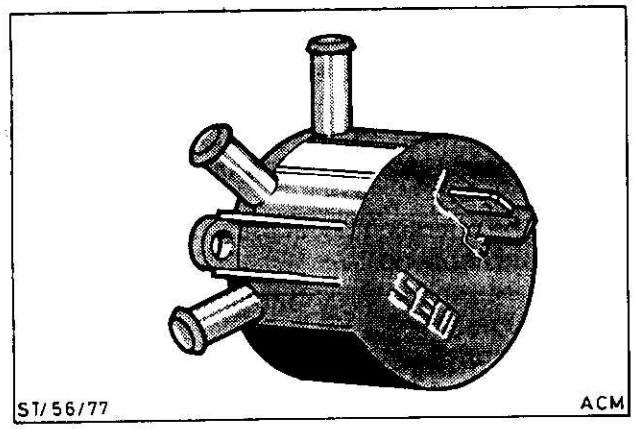
PART A – Engine, Engine Management and Turbocharger

2. Electronic Engine Management

2.3 System Sensors and Actuators (cont'd.)

The Boost Pressure Control Valve

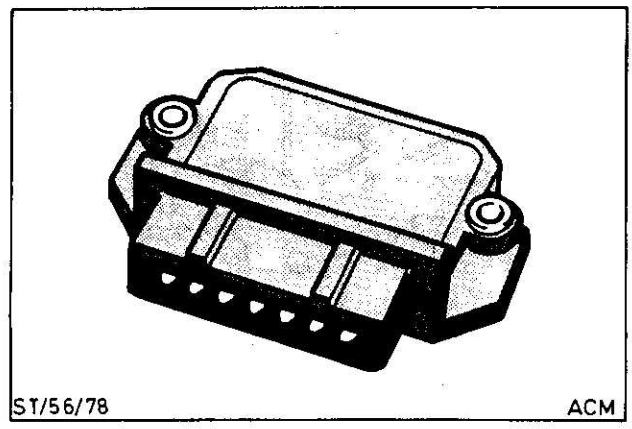
- This solenoid valve is directly connected to the high pressure side of the turbocharger by a hose. Depending upon whether the valve is open or closed it will either "vent-off" a portion of the boost to the inlet side of the compressor (valve open) or direct it to the waste gate actuator (valve closed). For further information see section "Turbocharger".



Boost Pressure Control Valve

The Ignition Module

- This module receives a signal from the ECU module to release a spark.



Ignition Module

2.4 Further Important Notes on Electronic Engine Management

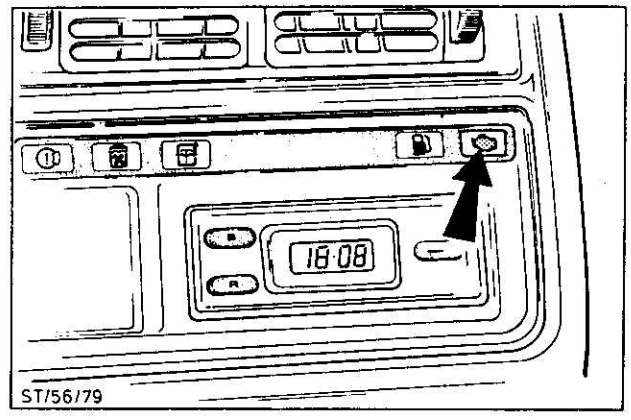
Limitation on Engine Revolutions

- For information see section "The Turbocharger".

Warning Light-Engine Management Failure

- This warning light is located next to the auxiliary warning lights.

- When the light switches on, the driver will be informed, that a failure in the engine management system have occured. For further information see section "Maintenance, Service Adjustments and System Checks".



Warning Light – Engine Management failure

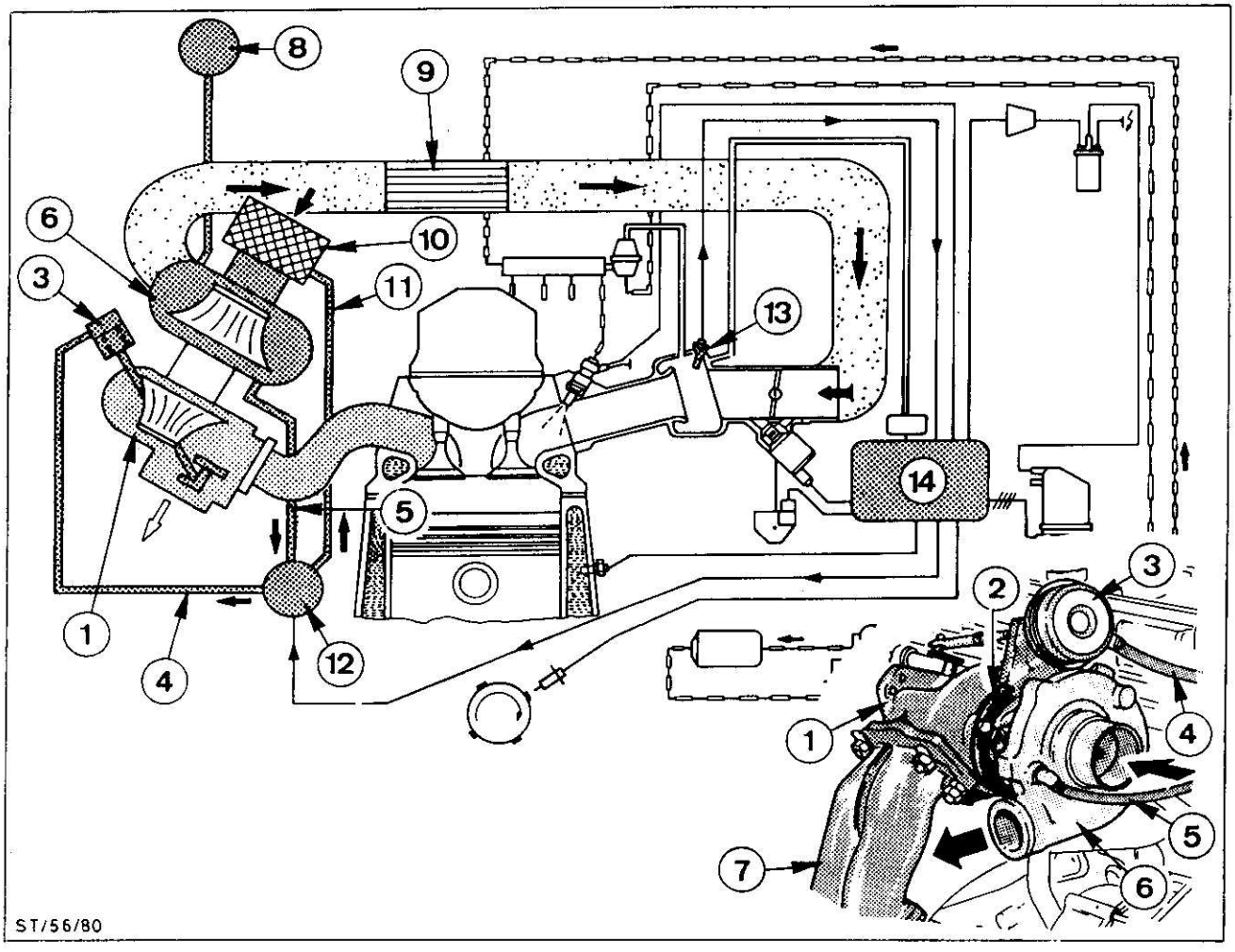
PART A – Engine, Engine Management and Turbocharger

3. The Turbocharger

3.1 General Description

The turbocharger (make Garrett, type T3) with integral wastegate and intercooler, used for the Sierra Cosworth engine, is similar to the turbocharger that is fitted to the Escort RS Turbo engine. In addition, the Sierra Cosworth turbocharger is watercooled. The principle of operation of both turbochargers are similar and described in the Escort RS Turbo Workshop Manual.

- The turbocharger is designed to give boost pressure at relatively low engine speeds, thus giving a useful increase of torque under normal driving conditions.
- The operation boost pressure is 0.7 bar. Maximum boost pressure is limited to 0.9 bar above atmospheric.



Turbocharger assembly

1 = Turbine housing with integral waste gate
2 = Watercooled intermediate housing
3 = Wastegate actuator
4 = Connection – boost pressure control Valve to Wastegate actuator
5 = Connection – Compressor to boost pressure control valve
6 = Compressor housing
7 = Exhaust manifold assy.
8 = Boost pressure gauge
9 = Intercooler
10 = Air cleaner
11 = Relief connection (vent)
12 = Boost pressure control valve
13 = Air Charge Temperature (ACT) Sensor
14 = ECU

PART A – Engine, Engine Management and Turbocharger

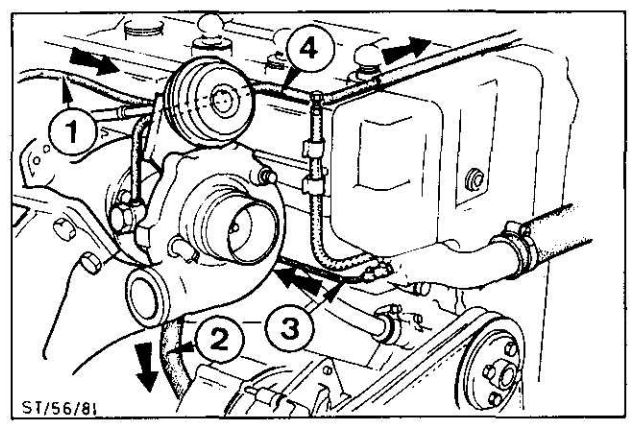
3. The Turbocharger

3.1 General Description (cont'd.)

- The lubricating oil for the turbocharger is taken from the main oil pressure system of the engine (the oil feed pipe is connected to the oil pressure switch). The return oil flows back to the sump through a pipe of relatively large cross-section.

- The watercooled intermediate housing of the turbocharger prevents overheating of the turbine shaft bearings and the turbocharger housing. After switch-off the coolant will prevent excessive temperature build-up of the unit.

  The coolant feed pipe for the turbocharger intermediate housing is connected to the thermostat housing. The return coolant flows back to the expansion tank.

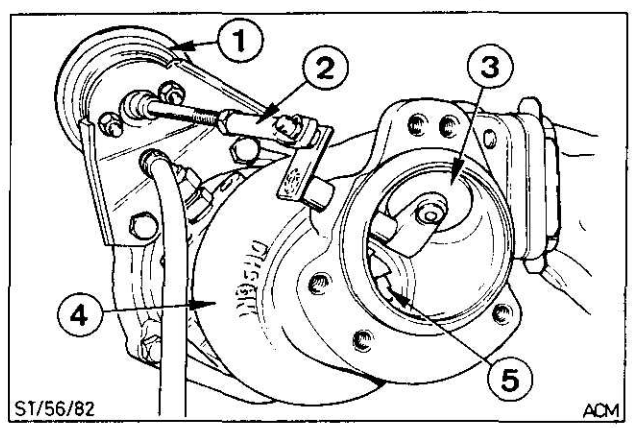


Pipe connections

1 = Oil feed pipe
2 = Oil return pipe
3 = Coolant feed pipe
4 = Coolant return pipe

- The integral wastegate regulates the flow of exhaust gases. Due to the engine's demand for boost the exhaust gases are either allowed to the exhaust turbine or through the bypass duct into the vehicle exhaust system circumventing the exhaust turbine.

  The wastegate actuator, which is connected to the wastegate by a rod, is controlled by the ECU via a boost pressure control valve.



1 = Wastegate actuator
2 = Actuator rod
3 = Wastegate
4 = Turbine housing
5 = Turbine impeller

- An intercooler (air to air radiator) is fitted to cool the charge air.

- The turbocharger is maintenance-free.

PART A – Engine, Engine Management and Turbocharger

3. The Turbocharger

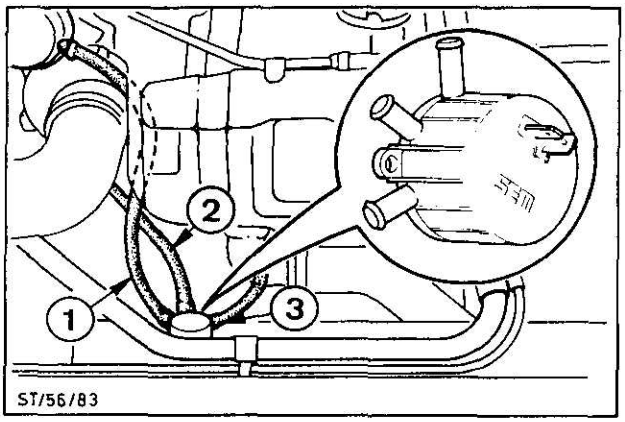
3.2 Boost Pressure Control

The Sierra RS Cosworth is equipped with electronic/mechanical boost pressure control.

The ECU is programmed to control boost via a solenoid operated control valve on receipt of sensor signals.

- The boost pressure control valve is *directly connected to the high pressure* side of the turbocharger by a hose.

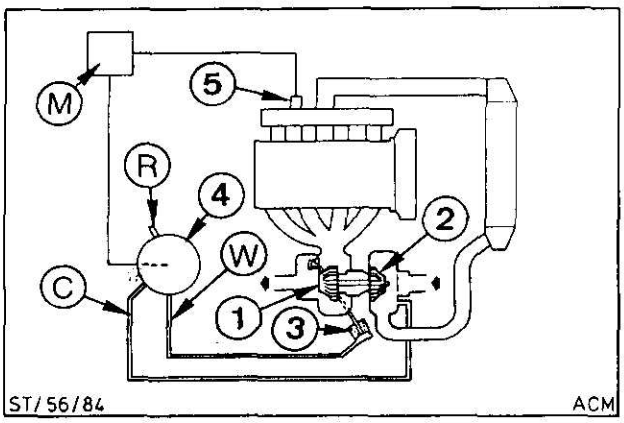
Depending upon whether the valve is open or closed it will either "vent off" a portion of the boost to the inlet side of the compressor (aircleaner) or direct it to the wastegate actuator.



Boost pressure control valve in situ

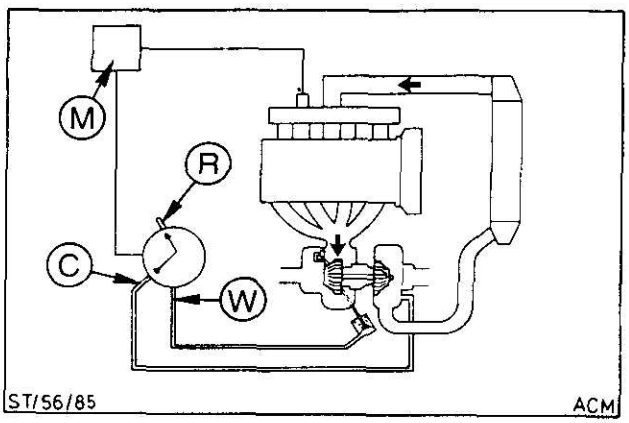
1 = Hose – Wastegate Actuator
2 = Hose – Turbocharger high pressure side
3 = Hose to aircleaner ("vent off")

1 = Exhaust turbine
2 = Compressor impeller
3 = Wastegate actuator
4 = Boost pressure control valve
5 = Air charge temperature (ACT) sensor
W = *Wastegate connection*
C = Compressor connection
R = Relief connection (vent)
M = ECU



Boost pressure control valve

- With engine in operation, the boost pressure control valve is open, allowing air charge to "vent off", depending on receipt of signals from the ECU.



Boost pressure control valve open, allowing air charge to "vent off". The wastegate is closed.

PART A – Engine, Engine Management and Turbocharger

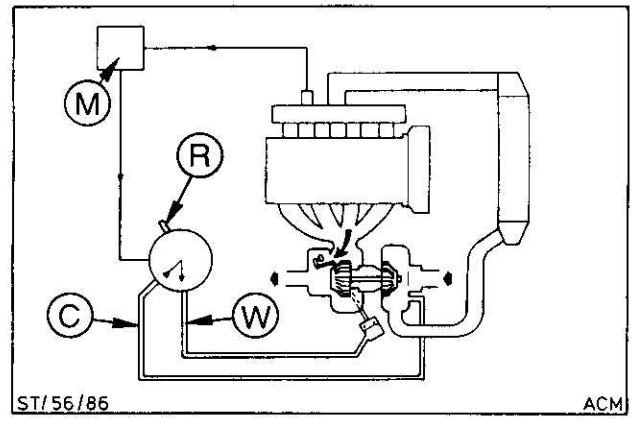
3. The Turbocharger

3.2 Boost Pressure Control (cont'd.)

- The boost pressure control valve will be closed gradually when the engine speed is above 6000 RPM or when the air charge temperature exceeds 70° C.

- When these signals from the RPM/TDC-sensor and the Air Charge Temperature (ACT) sensor are received by the ECU, it closes the solenoid control valve gradually applying full turbo pressure to the wastegate actuator which then fully opens the wastegate. A high amount of the exhaust gases are allowed through the bypass duct into the vehicle exhaust system circumventing the exhaust turbine. The boost pressure is reduced to approximately 0.3 bar.

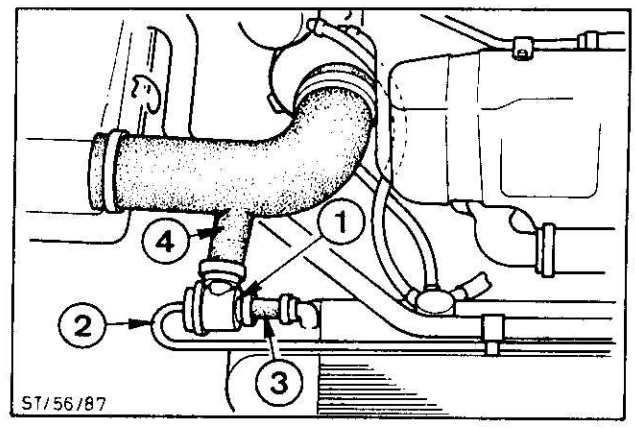
  The reduction in boost pressure will reduce the temperature to acceptable working level.



Boost pressure control valve closed allowing air charge to open the wastegate via the actuator

The By-pass Valve

A special by-pass valve (located next to the intercooler) is directly connected to the air chamber, the intercooler and the inlet trunking by hoses. The by-pass valve prevents a pressure build up of air charge in front of the throttle plate when the throttle plate is suddenly closed. With the throttle plate in closed position, the vacuum in the air chamber opens the by-pass valve and an amount of charged air will be by-passed from the intercooler back to the inlet trunking.



By-pass Valve

1 = Valve
2 = Connection to air chamber
3 = Connection to intercooler
4 = Connection to inlet trunking

Limitation on Engine Revolutions

- In case the boost pressure exceeds 0.9 bar, the fuel injection at the injector valves will be interrupted.

- At 6500 to 6800 engine RPM, the boost pressure is reduced to approximately 0.3 bar by the boost pressure control valve.

- At 6800 to 7000 engine RPM, the ECU is programmed in such a way to interrupt every second injection (the engine will remain in performance but without increase of engine RPM).

- At speeds above 7000 RPM, injection will cut off totally, controlled by the ECU.

PART A – Engine, Engine Management and Turbocharger

4. Maintenance, Service Adjustments and System Checks

4.1 Maintenance

The routine service schedule for the Sierra RS Cosworth is similar to the Sierra with the standard OHC-engine:

- First free Service at 1500 km
- Interim Service at 10.000 km and
- Standard Service at 20.000 km.

There are some exceptions which are included in the Sierra Service Voucher Booklet.

- The timing belt must be replaced at 80.000 km.

4.2 Service Adjustments

Throttle Plate Setting Screw

- This screw is factory set and sealed and **must not be altered in service.**

Basic Idle Speed Control Screw

If the engine idle speed is not to specifications at the first servicing (1500 km), it can be adjusted by means of the basic idle speed control screw.

- Disconnect multiplug from idle speed control valve, untighten locknut and adjust idle speed screw to achieve correct idle rpm with warm engine.

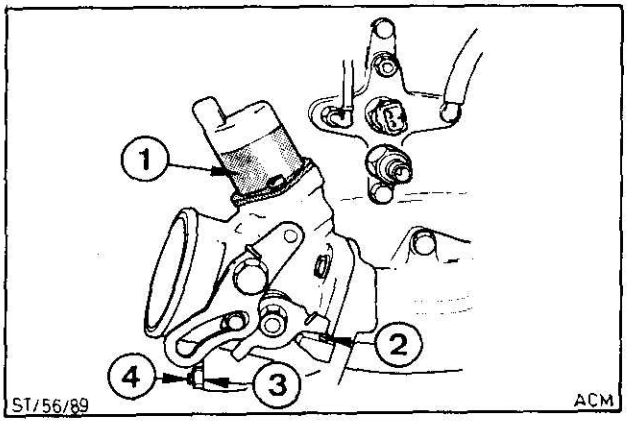
  Idle speed: 850 rpm.

  Note: After refitting the multiplug, the engine will raise to high engine rpm for a short period of time.

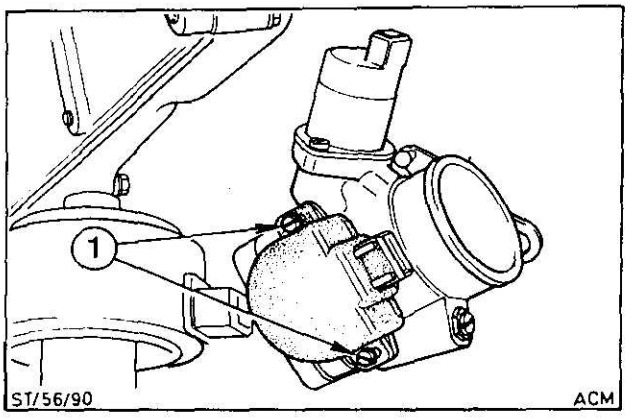
Throttle Position Sensor (TPS)-Adjust

After disassembling and re-assembling the switch can be adjusted within the limits of its elongated fastening holes.

- Loosen fastening screws so that the housing snaps back by spring pressure to the original factory set throttle plate adjustment.



1 = Idle speed control valve (ISC)
2 = Throttle plate setting screw
3 = Lock nut
4 = Basic idle speed control screw



Throttle position sensor

1 = Fastening screws

PART A – Engine, Engine Management and Turbocharger

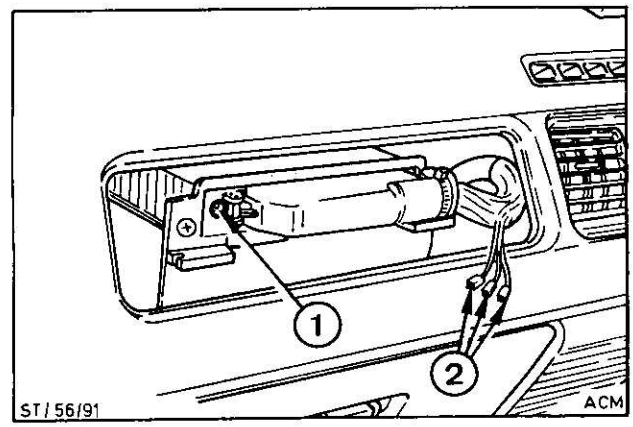
4. Maintenance, Service Adjustments and System Checks

4.2 Service Adjustments (cont'd.)

Adjustment of Idle Mixture

Specified mixture CO at idle: 1–1.5% CO

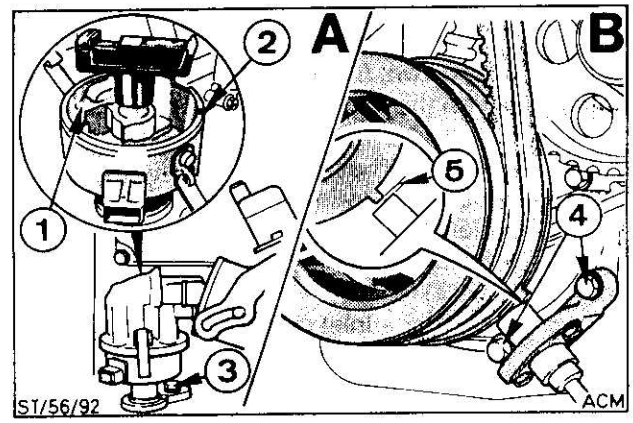
- The CO adjuster screw is located on the left hand side of the module multi plug.
- Using a suitable tool carefully remove the tamper-proof plug thereby making sure that the tool does not penetrate the plug by more than 3 mm. Excessive penetration may cause damage to the potentiometer located behind the adjuster screw.
- To adjust CO the adjuster screw can be turned from stop to stop.
  After correct adjustment the screw should be protected with a tamper proof plug.



1 = Mixture control screw
2 = Cable for octane adjust

Ignition Timing

The ignition timing (16 BTDC) **cannot** be adjusted in Service. The ignition timing is controlled by the ECU module and depends on engine temperature, load and manifold absolut pressure.
When replacing the distributor, the distributor must be inserted with the rotor aligning correctly with the TDC marking for cylinder No. 1 on the housing. A diviation of up to 4° will be compensated by the ECU module.



A = Distributor

1 = Phase-sensor
2 = TDC marking – cyl. No. 1
3 = Fastening bolt

B = RPM/TDC-Sensor

4 = Fastening bolt
5 = 0.4–1.0 mm

Retarding the Ignition Timing

To meet fuels with lower octane rating the ignition timing can be retarded electronically by 2, 4 or 6° by connecting the cable connectors (near the RH side of the ECU module) in various ways.

Connections

- Green plug to white plug = ignition retarded by 2°
- Blue plug to white plug = ignition retarded by 4°
- Green and blue plug to white plug = ignition retarded by 6°

(The white plug connects to chassis earth).

Adjusting the RPM/TDC Sensor

The air gap between the sensor and the cam should be 0.4 to 1.0 mm.

- To adjust the air gap, the fastening bolt for the sensor must be untightened to enable resetting of the sensor.

PART A – Engine, Engine Management and Turbocharger

4. Maintenance, Service Adjustments and System Checks

4.3 System Checks

Quick Test

- The ECU module includes an internal selftest facility.

- A warning light on the instrument panel will switch on if there is a defect in one of the sensor circuits.

- Simultaneously a coded signal is fed to the test connector near the RH side of the ECU module.

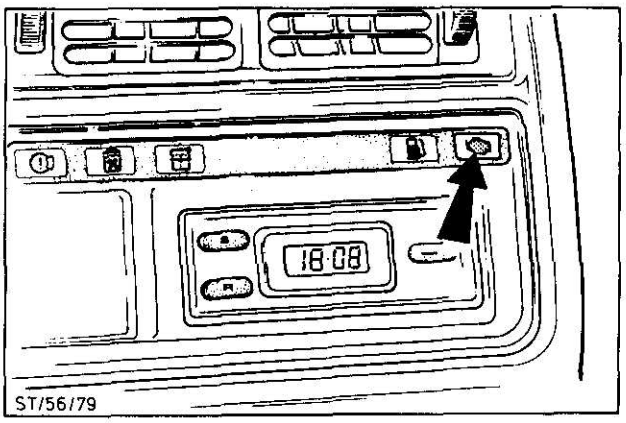
- Connecting an LED tester to this test plug allows a quick test to be carried out on the following sensor circuits:

  – RPM/TDC sensor
  – Sensor – cylinder phase (distributor)
  – Sensor – inlet air temperature (ACT)
  – Sensor – engine coolant temperature (ECT)
  – Sensor – inlet manifold absolute pressure (MAP)

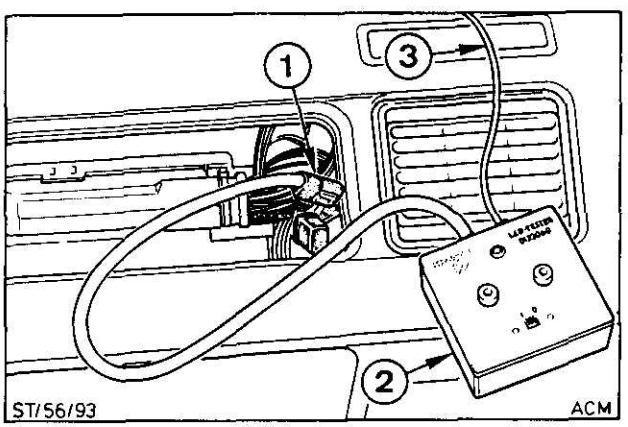
- The LED tester for the EEC IV-system (Loewener tool No. 013 20 60 or Churchil tool No. 047 20 60) may be used.

- The quick test is carried out with the engine not running but with the ignition switched on.

- During the quick test the ECU module transmits codes in the form of electrical pulses.



Warning Light – Engine Management failure



Quick Test

1 = Test connector
2 = LED Tester
3 = Cable – battery plus

PART A – Engine, Engine Management and Turbocharger

4. Maintenance, Service Adjustments and System Checks

4.3 System Checks (cont'd.)

Quick Test (cont'd.)

- The coded signals are displayed as follows:

  – Start of test: Indicated by a series of short on – off pulses.

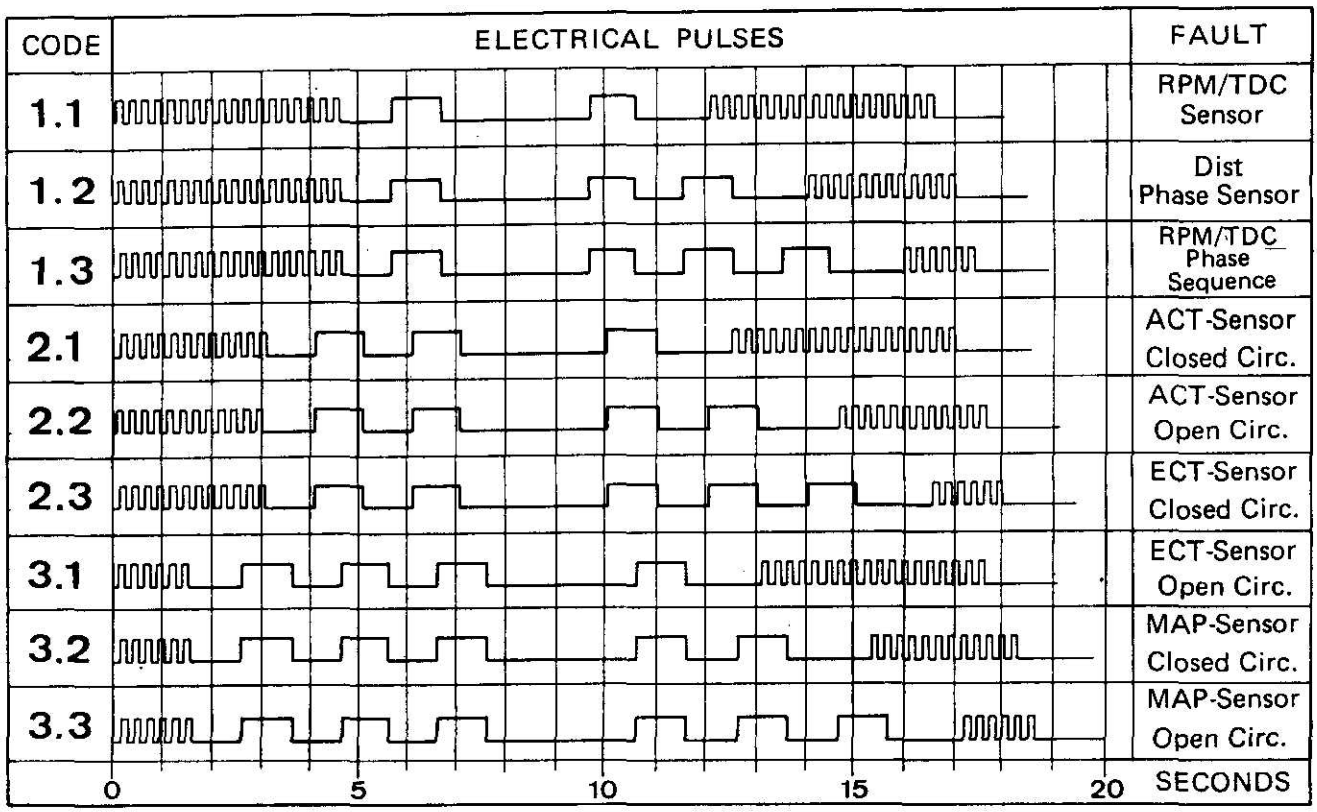
  – Pause

  – Codes: These are indicated by a series of on – off pulses each of them having a duration of one second.
  Each code is made up of two figures seperated by a pause.
  These two figures identify a defect in a sensor circuit.

  – End of test: Indicated by a series of short on – off pulses.

- During the quick test more than one defect code may be displayed.

- The quick test repeats itself until the ignition is switched off.



Test codes

PART A – Engine, Engine Management and Turbocharger

4. Maintenance, Service Adjustments and System Checks

4.3 System Checks (cont'd.)

Basic Checks

- A detailed Diagnosis can be performed using the diagnostic guide contained in the Sierra RS Cosworth Workshop Manual.

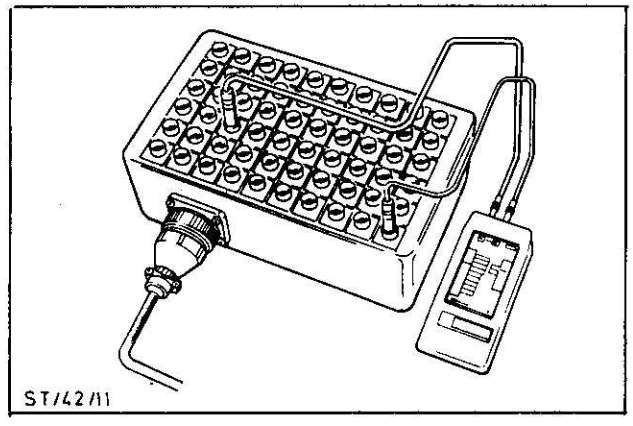
- The following test equipment is required:

  – FE 60 Breakout Box
  – Multimeter (Siemens, AVO or Keithly)
  – Test lead No. 2 (33–002)
  – New test lead No. 7 (29–005)

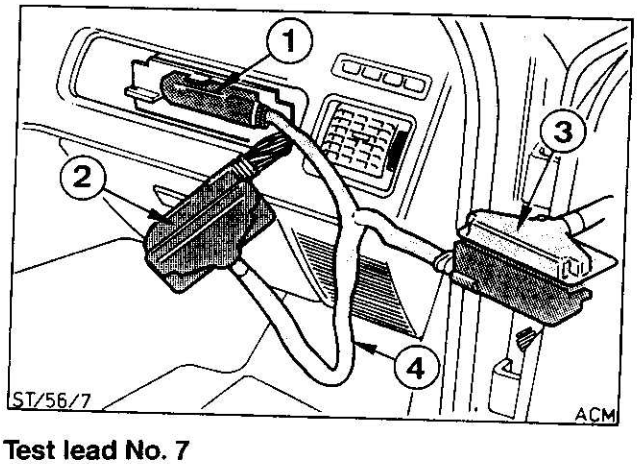
- The Test lead No. 2 allows an overall check to be performed on the engine management system like the resistance of the sensors and electronic actuators, the wiring loom and the plug connections.

- The new test lead No. 7 has to be connected to the ECU module, the multi-plug for the module and Test lead No. 2.

  Connected in this way, the complete system can be tested i.e. the ECU module itself, and the voltages and current supplies for the various sensors and other electronic components.



FE 60 Breakout Box with Multimeter and Test lead No. 2



Test lead No. 7

1 = Connection to ECU
2 = Connection to multiplug of ECU
3 = Connection to Test lead No. 2
4 = Test lead No. 7

Fuel System

For pressure- and leak tests on the fuel system the available pressure tester 23–011 A/B should be used. Using suitable adaptors the pressure tester can be connected between the fuel rail and the pressure regulator. More detailed information is contained in the Sierra RS Cosworth Workshop Manual.

Turbocharger

Detailed instruction for checking and adjusting the boost pressure are included in the Sierra RS Cosworth Workshop Manual.

PART A – Engine, Engine Management and Turbocharger

5. Technical Data – Part A

Engine – General

Engine Code	N5A
Bore	90.82 mm
Stroke	77.00 mm
Cubic capacity	1995 cm³ effectiv
Poweroutput	150 kW (DIN) at 6000 rpm
Torque	278 Nm (DIN) at 4500 rpm
Firing order	1 – 3 – 4 – 2
Compression ratio	8.0 : 1
Idle speed	850 rpm
Maximum engine speed	
– continued running	6500 rpm
– intermittent running	6800 rpm
Operation boost pressure	7.0 bars
Maximum boost pressure limited to	9.0 bars
Spark plugs	AGPR 901 C
Ignition timing (cannot be adjusted in service)	16° BTDC at idle

Engine Lubrication

Oil specification	API/SF-CC
Oil change intervall	10.000 km
Oil change capacity	3.0 litres without filter 3.4 litres including oil filter
Minimum oil pressure (with SAE 20 W-50 oil at 80° C)	1.8 bars at 850 rpm 2.4 bars at 2000 rpm

Tightening Torques – Cylinder Head		Nm	Note
Cylinder head bolts	– Stage 1	30–35	
	– Stage 2	65–70	
	– Stage 3	Rotate extra 80°–90°	
Camshaft bearing caps	– 6 mm	8–10	
	– 8 mm	19–23	
Valve cover to cylinder head		8–10	
Camshaft sprocket gear-fastening bolt		59–63	
Thermostat housing to cylinder head		18,5–21,5	
Inlet manifold to cylinder head		18,5–21,5	
Exhaust manifold to cylinder head		19–23	
Spark plug		28–33	
Plenum chamber to inlet manifold		8–10	
Elbow to plenum chamber		18,5–21,5	
Throttle body to elbow		8–10	
Air temperature sensor to plenum chamber		23–25	Loctite 242
Turbocharger to exhaust manifold		40–48	
Oil feed pipe adaptor to turbocharger		25–35	Loctite 242
Turbocharger oil feed pipe to adaptor		25	
Oil return pipe to turbocharger		18,5–21,5	
Coolant feed- and return pipes to turbocharger		19–23	

For detailed Technical Data and Tightening Torques see Sierra RS Cosworth Workshop Manual.

PART B – Transmission and Rear Axle

1. Transmission

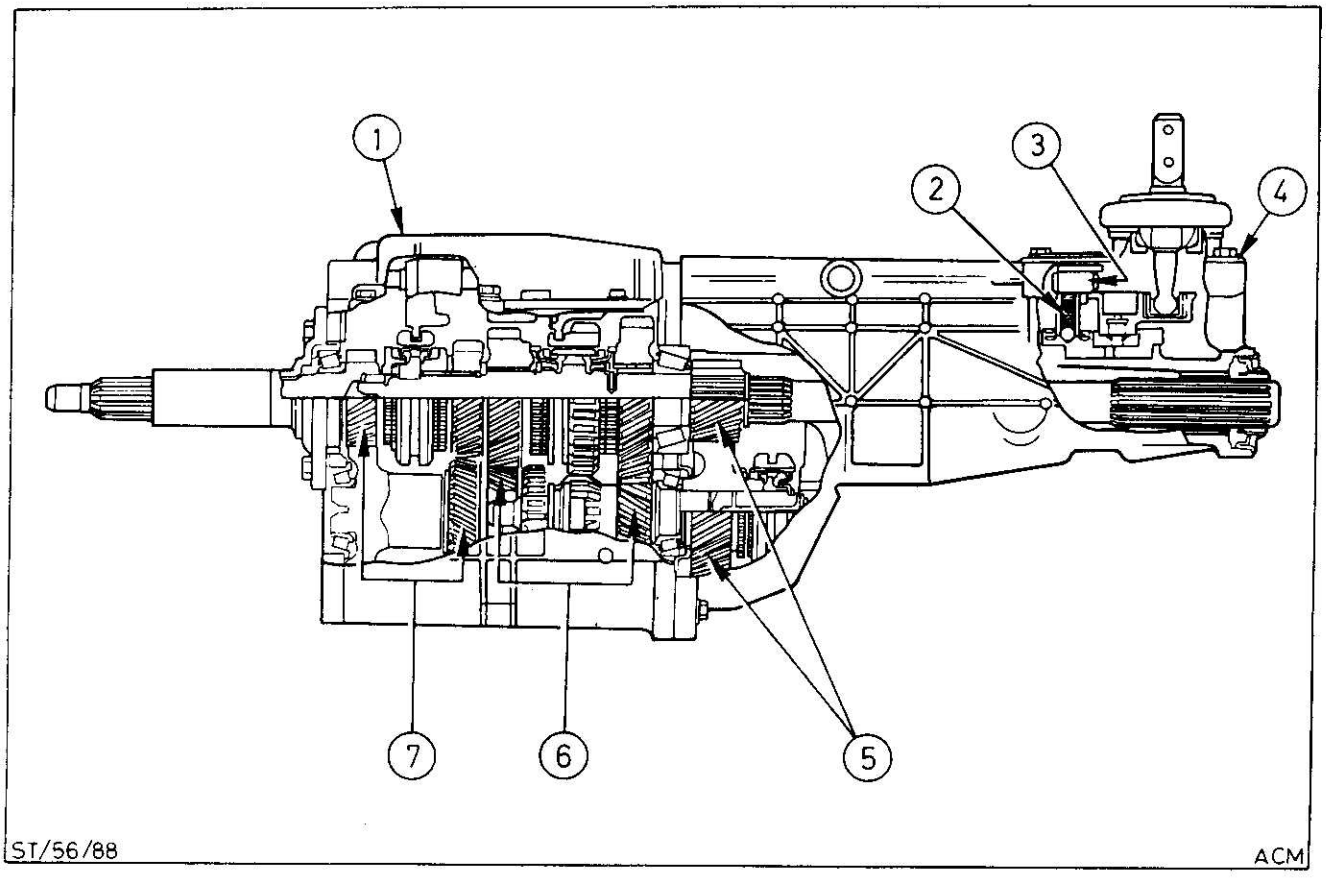
1.1 General Description

- The transmission fitted to the Sierra RS Turbo is a five speed manual transmission with close ratios and with fifth gear as overdrive.

- The complete transmission housing is made from aluminium.

- First trough fourth and reverse gears mesh within the transmission housing. The fifth speed gears and synchroniser are located on the back of the housing in the extension housing.

- The first-second and third-fourth shift forks are mounted in the shift cover. The shift cover with shift forks and the shift rail, which extends from the extension housing turret to the shift cover, are an assembly.



1 = Shift cover with 1st/2nd and 3rd/4th shift forks and shift rail
2 = Shift detent
3 = Shift rail
4 = Turret cover
5 = Fifth speed gears and synchroniser
6 = 1st/2nd speed gears and synchronisers (reverse gear)
7 = 3rd/4th speed gears and synchronisers

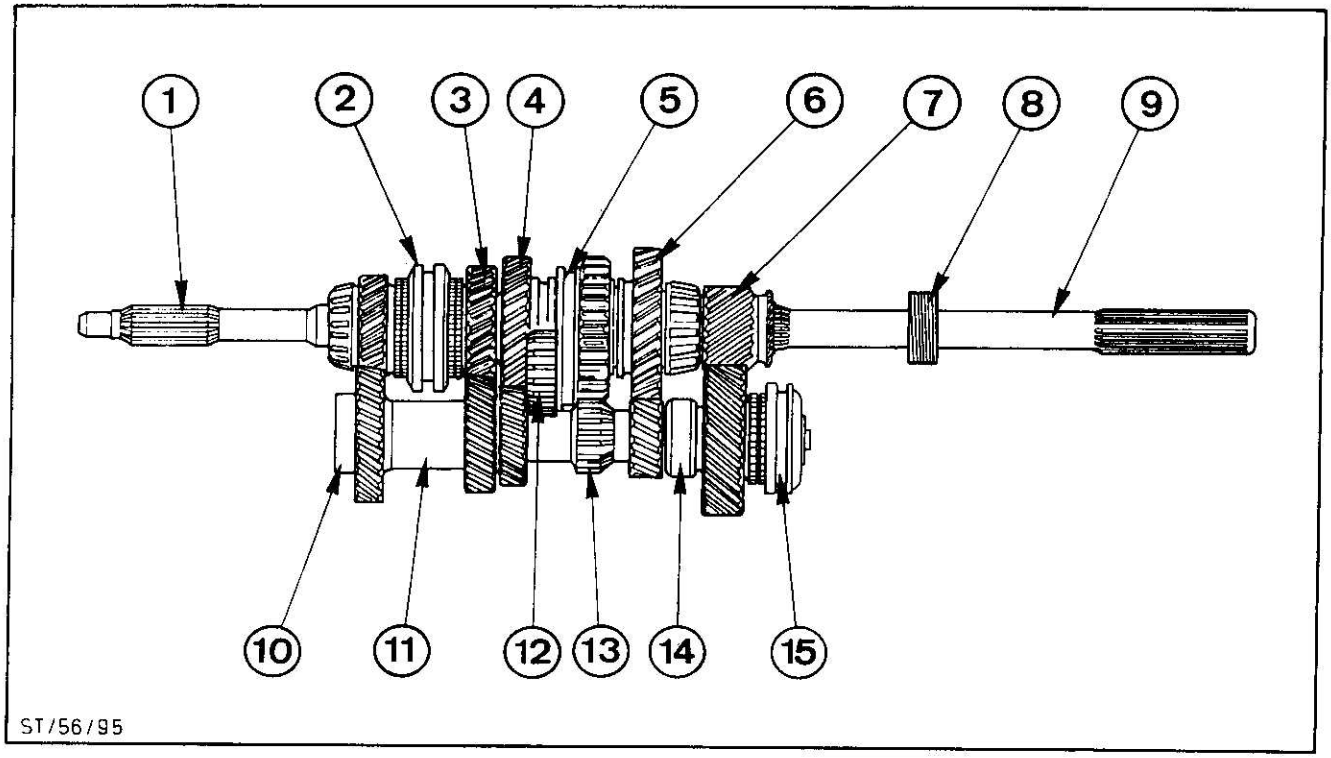
PART B – Transmission and Rear Axle

1. Transmission

1.1 General Description (cont'd.)

- The fifth speed synchroniser and reverse idler gear are shifted by an intermediate lever mounted on a pivot pin in the transmission housing.

- The shift detent is located in the extension housing turret.

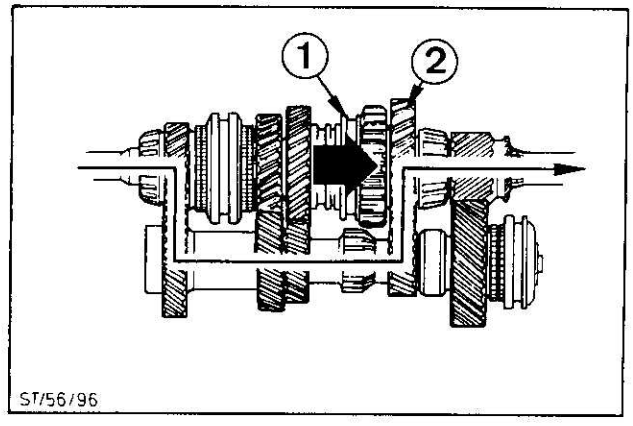


1 = Input shaft
2 = 3rd/4th synchroniser
3 = Third gear unit
4 = Second gear unit
5 = 1st/2nd synchroniser (reverse driven gear)
6 = First gear unit
7 = Fifth gear unit
8 = Speedometer gear
9 = Output shaft (main shaft)
10 = Bearing assembly
11 = Countershaft
12 = Reverse idler gear
13 = Reverse gear
14 = Bearing assembly
15 = Fifth gear synchroniser

PART B – Transmission and Rear Axle

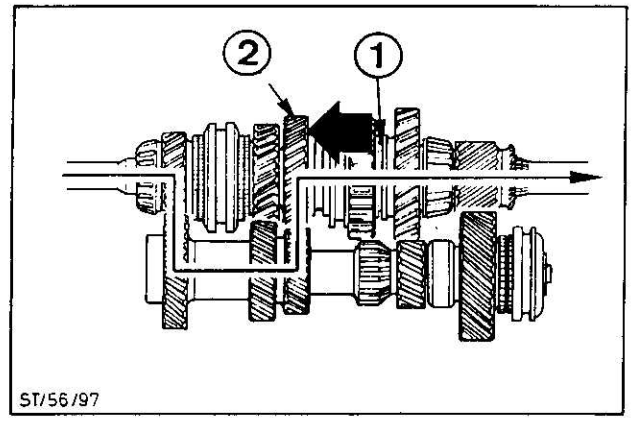
1. Transmission

1.2 Power flow



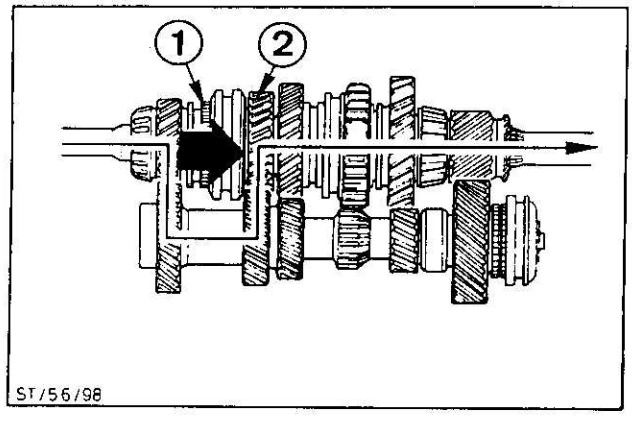
First Gear

Ratio: 2.96 : 1
1 = 1st / 2nd synchroniser
2 = First gear unit



Second Gear

Ratio: 1.94 : 1
1 = 1st / 2nd synchroniser
2 = Second gear unit



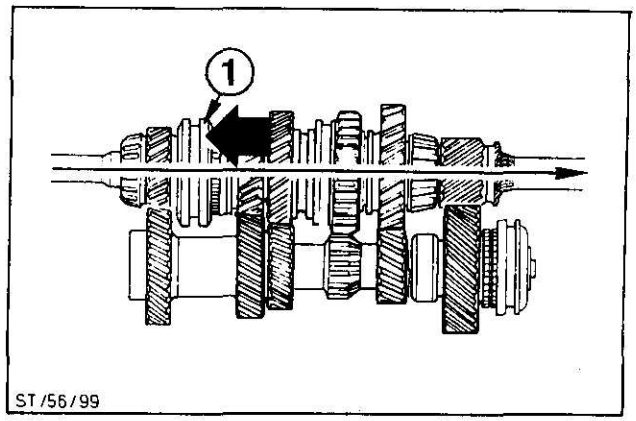
Third Gear

Ratio: 1.34 : 1
1 = 3rd / 4th synchroniser
2 = Third gear unit

PART B – Transmission and Rear Axle

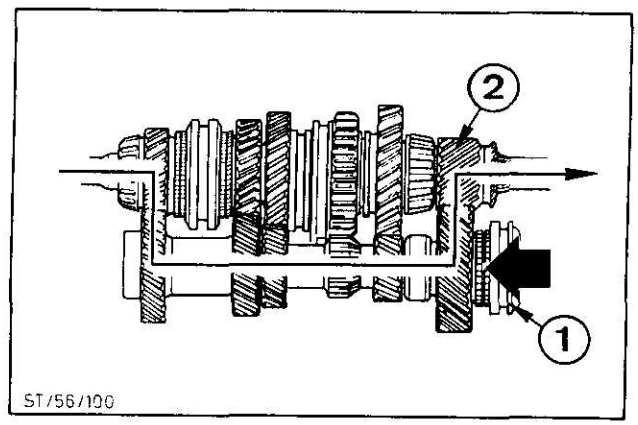
1. Transmission

1.2 Power flow (cont'd.)



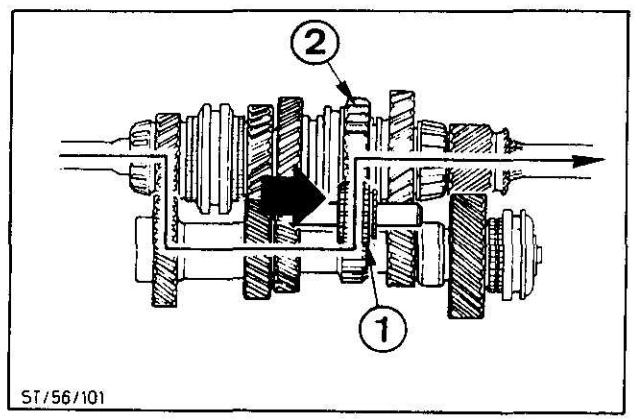
Fourth Gear

Ratio: 1 : 1
1 = 3rd / 4th synchroniser



Fifth Gear

Ratio: 0.8 : 1
1 = Fifth gear synchroniser
2 = Fifth gear unit



Reverse Gear

Ratio: 2.76 : 1
1 = Reverse idler gear
2 = Reverse gear unit

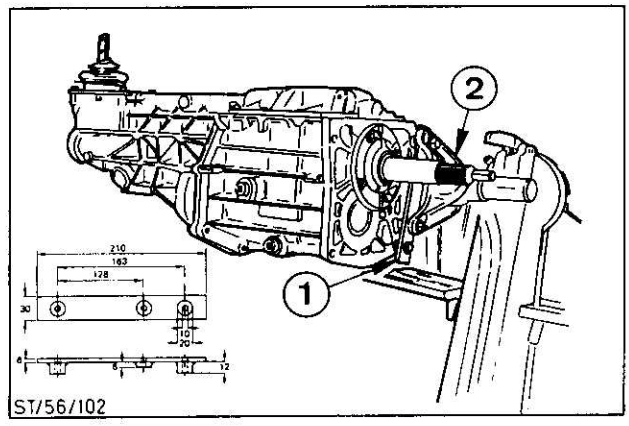
PART B – Transmission and Rear Axle

1. Transmission

1.3 Important Notes on Disassembly and Assembly

Transmission disassembly and assembly operations are explained in detail in the Sierra RS Cosworth Workshop Manual. This part of the brochure covers some important points only.

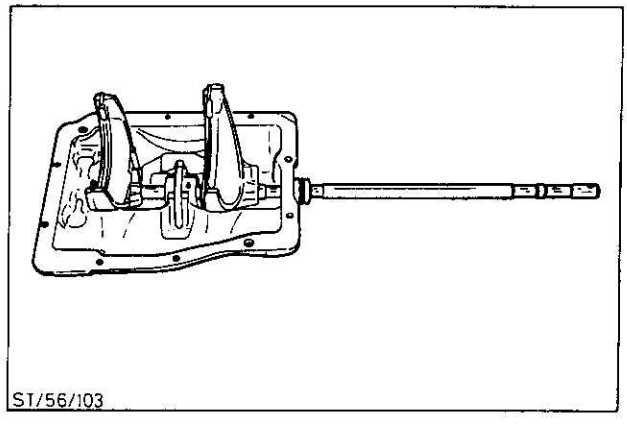
- No new special tools are required.
- The transmission has to be mounted in a repair stand using a dealer manufactured adaptor bracket.
- The extension housing and the selector crank of the shift detend should be removed from the transmission housing as an assembly.
  The selector crank can not be removed with the extension housing in position, because this is prevented by a lug, located on the bottom of the selector crank which meshes with the detend plate.



Transmission on stand

1 = Adaptor bracket (dimensions in mm)
2 = Mounting bracket 16–009

- The shift cover, the 1st/2nd and 3rd/4th shift forks and the shift rail have to be removed from the housing as an assembly.

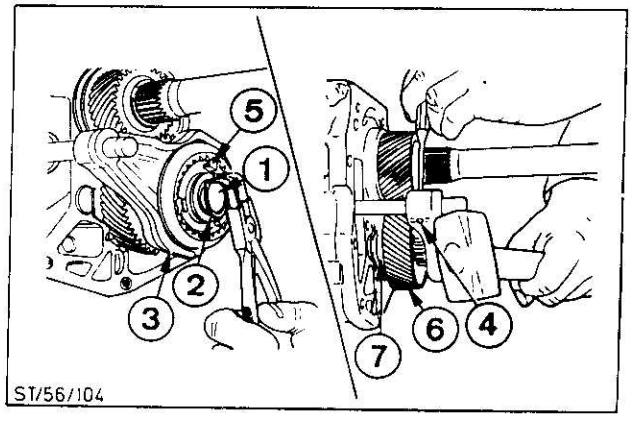


Shift cover

- The 5th gear, 5th gear synchroniser and shift fork have to be removed from the countershaft as an assembly.

1 = Snap ring
2 = Spacer
3 = Shift fork
4 = Roll pin
5 = Synchroniser
6 = 5th gear
7 = Countershaft retainer

Note: Selective washers are located between the countershaft retainer and the rear countershaft bearing race to adjust the end float of the countershaft to specification.



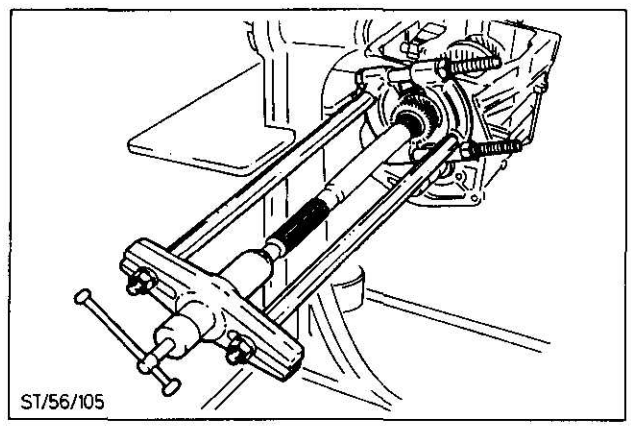
PART B – Transmission and Rear Axle

1. Transmission

1.3 Important Notes on Disassembly and Assembly (cont'd.)

- After removing the snap ring the fifth gear can be pulled off from the main shaft using a proprietary puller.

  Note: The 5th gear cannot be reused.

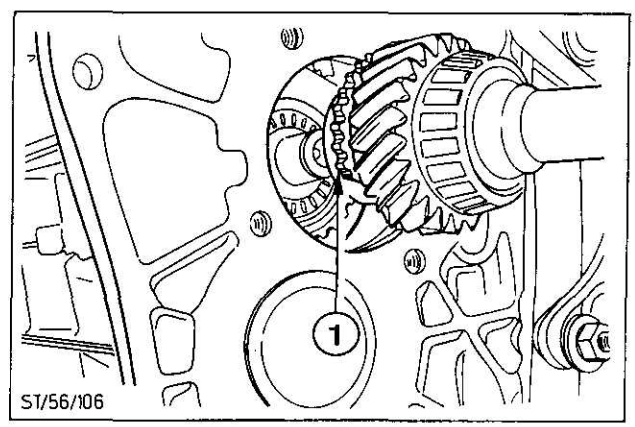


Remove 5th gear from main shaft

- The transmission shafts have to be removed in the following order

  – Input shaft
  – Main shaft
  – Countershaft

- To remove the input shaft, the flat section of the synchroniser tooth ring must first be positioned above the countershaft gear.



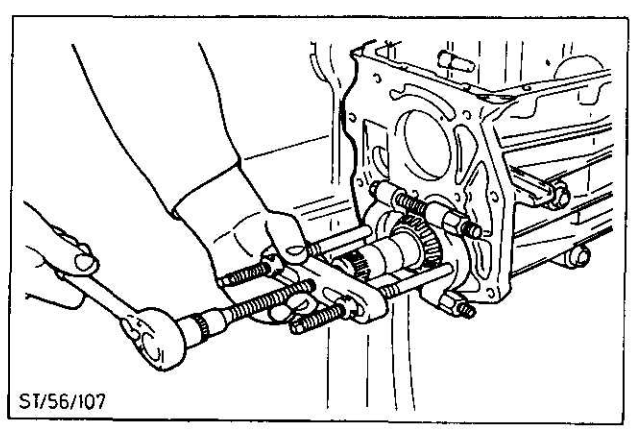
Remove the input shaft

1 = Flat section of tooth ring

- To remove the main shaft, first remove the rear bearing cup. To do this pull the main shaft to the rear until the first gear stops against the transmission housing. Removal of the main shaft is from the top of the housing.

- Before removing the taper roller bearing from the countershaft, remove the oil collector for the fifth gear from the end of the shaft.

- To remove the countershaft, pull out the rear bearing cup and then pull off the taper roller bearing using a suitable puller.
  The countershaft can then be removed from above.



Remove bearing from countershaft

PART B – Transmission and Rear Axle

1. Transmission

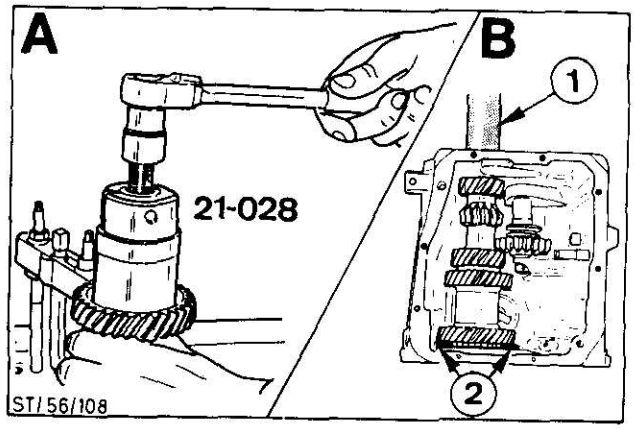
1.3 Important Notes on Disassembly and Assembly (cont'd.)

- Using special tool 21-028 pull off the input shaft bearing.

  Press new bearing onto shaft and bearing cup into housing.

- With the countershaft in situ, install rear bearing using a press and a suitable piece of tubing.

  Note: Support countershaft using two suitable steel bars (thickness 6–8 mm) to prevent damage to the transmission housing.

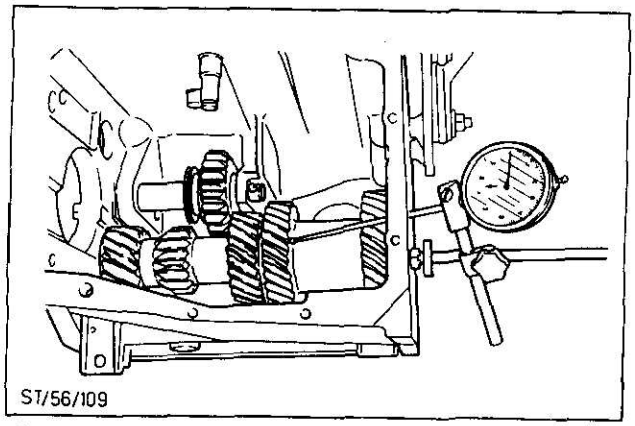


A = **Removal of the front bearing from the countershaft**
B = **Installing the rear bearing**
1 = Tubing
2 = Steel bars

- End play of the countershaft is adjusted by shims between the bearing outer ring and the bearing retainer.

  Specified end float 0.025 – 0.127 mm

  Measure end float using a thin shim. If necessary remove bearing retainer and add shims as required. (Shim sizes – see Technical Data).



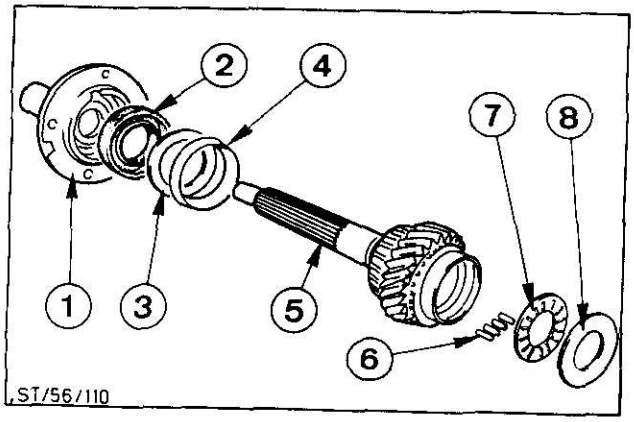
Measuring countershaft end float

- Install main shaft

- End play of the main shaft is controlled by shims between the bearing outer ring and the retainer of the input shaft bearing.

  This end play is measured after the transmission has been completely assembled.

  For this reason, no shims should be fitted when installing the input shaft and the bearing retainer.



1 = Bearing retainer
2 = Oil seal
3 = Shim
4 = Bearing outer ring
5 = Input shaft
6 = 15 needle rollers
7 = Thrust bearing
8 = Bearing race

PART B – Transmission and Rear Axle

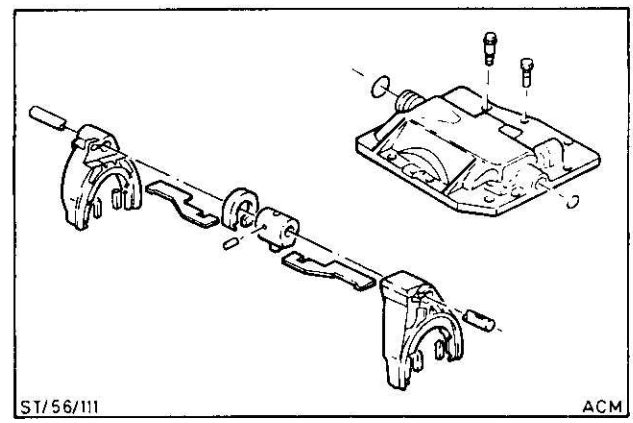
1. Transmission

1.3 Important Notes on Disassembly and Assembly (cont'd.)

- To fit the 5th gear to the main shaft, the gear should be heated up to approx. 600° C using a hot air blower.

- When disassembling the gear shift cover make sure to mark the shift forks and to set the shift segments and the shift lever in neutral position.

  Further detailed instructions on "dismantling and assembling of the gear shift cover" are contained in the Sierra RS Cosworth Workshop Manual.

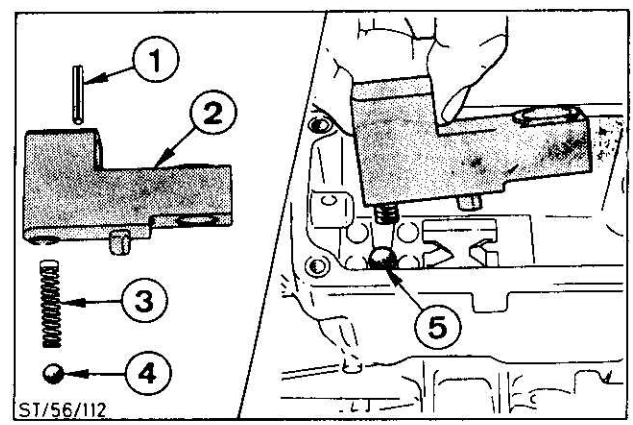


Gear shift cover – disassembled

- Before fitting the transmission extension, the cranked selector lever with detend ball and spring have to be fitted.

  1 = Roll pin
  2 = Cranked selector lever
  3 = Detend spring
  4 = Detend ball
  5 = In neutral position install detend ball into detend plate.

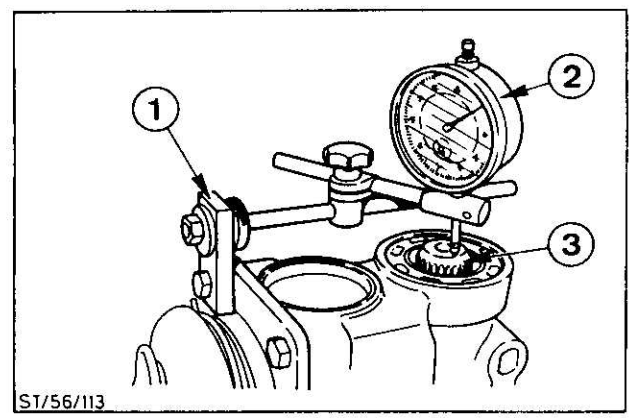
  Secure cranked selector lever by the roll pin after fitting the transmission extension.



Install cranked shift rod

- Before fitting the gear shift cover, measure end play of the main shaft as follows

  – Install dial indicator gauge (see illustration), turn the input shaft and watch deflection of pointer on gauge. Set gauge to zero.
  – Using a suitable piece of wood force input shaft upwards and note dial gauge reading.
  – Dial reading = shim pack required
  Specified end float: 0±0,5 mm
  – Fit required shim pack between bearing outer ring and input shaft bearing retainer. (For selection of shims see Technical Data).



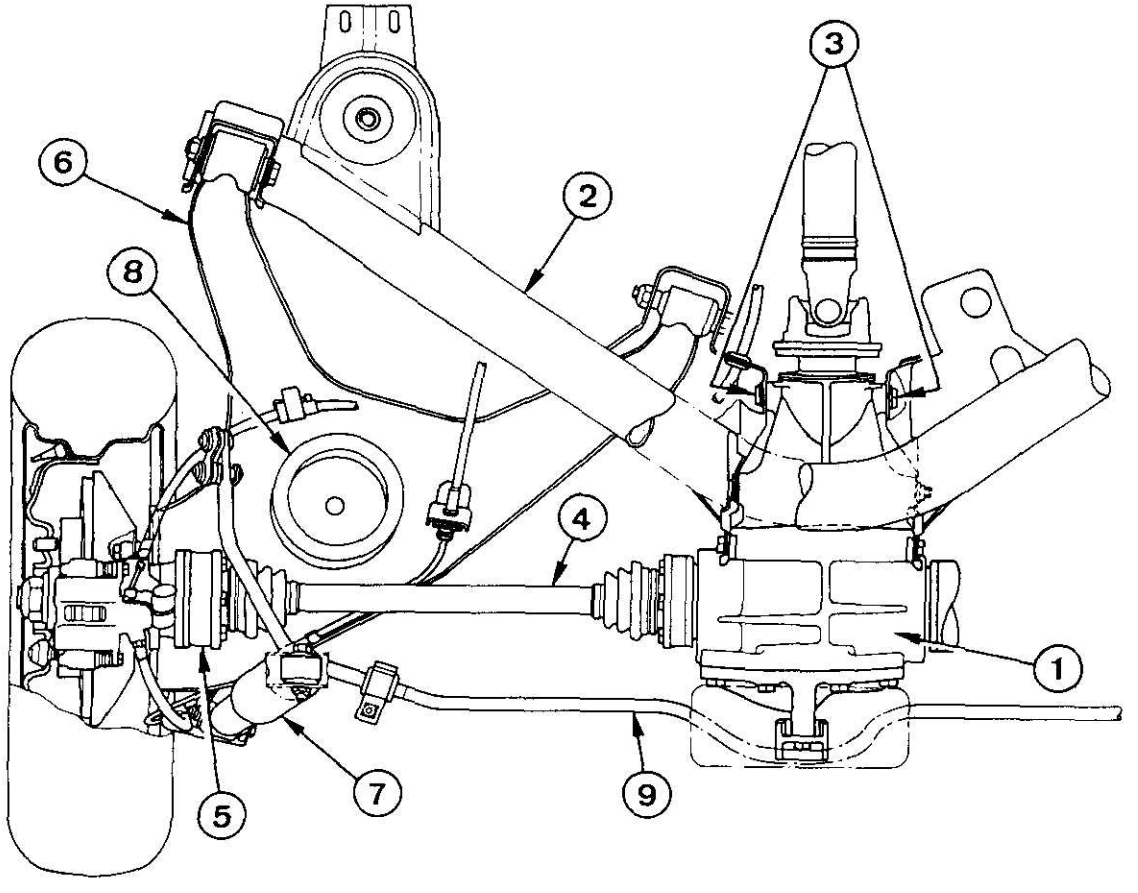
Check end float of the main shaft

1 = Bracket – Indicator gauge
2 = Indicator gauge
3 = Main shaft

PART B – Transmission and Rear Axle

2. Rear Axle and Suspension

- The Sierra RS Cosworth is fitted with the independent semi-trailing arm rear axle, coil springs and double-acting telescopic shock absorbers as known from the Sierra vehicles.
- The rear axle incorporates a viscous-coupling limited-slip differential, which gives full control over wheel-spin and greatly improve traction and roadholding in all driving conditions.
- All components of the Sierra RS Cosworth rear axle which have been modified in comparison to the Sierra are mentioned on the next page.
- **No new special tools are required.**



ST/56/18

PART B – Transmission and Rear Axle

2. Rear Axle and Suspension (cont'd.)

The following components have been carried over from Scorpio:

1 = 7,5" rear axle assembly with viscous limited-slip differential.
The ratio, 3.64 : 1, is special to the Sierra RS Cosworth.

2 = Rear axle crossmember

3 = Fastening – rear axle assembly to crossmember.

The following components have been modified in comparison to the Sierra:

4 = Rear axle shafts.

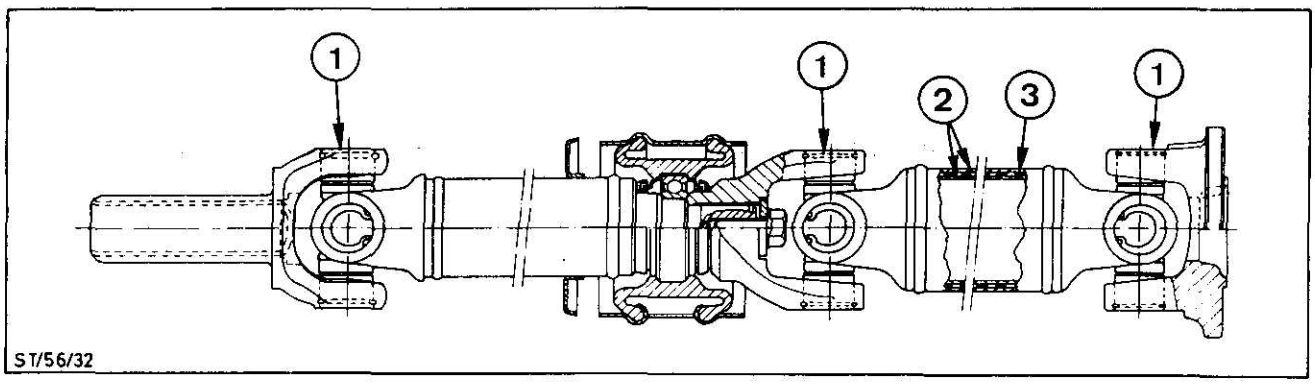
5 = Driveshaft stubs.

6 = Lower suspension arm.

7 = Shock absorbers (as Sierra XR 4x4)

8 = Coil springs

9 = Stabiliser assembly (as Sierra XR 4x4)



Driveshaft

1 = Heavy-duty universal joints
2 = Doppel tube
3 = Rubber elements

For details see Sierra RS Cosworth Workshop Manual.

PART B – Transmission and Rear Axle

3. Technical Data

Transmission

Ratios

1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	Reverse Gear
2.95 : 1	1.94 : 1	1.34 : 1	1 : 1	0.8 : 1	2.76 : 1

Selective Washers – mm (inch)

0.30 (0.012)	0.61 (0.024)	0.79 (0.031)	0.97 (0.038)
0.36 (0.014)	0.64 (0.025)	0.81 (0.032)	0.99 (0.039)
0.41 (0.016)	0.66 (0.026)	0.84 (0.033)	1.02 (0.040)
0.46 (0.018)	0.69 (0.027)	0.86 (0.034)	1.04 (0.041)
0.51 (0.020)	0.71 (0.028)	0.89 (0.035)	1.07 (0.042)
0.56 (0.022)	0.74 (0.029)	0.91 (0.036)	1.09 (0.043)
0.58 (0.023)	0.76 (0.030)	0.94 (0.037)	1.12 (0.044)

End float – countershaft (mm) = 0.025 – 0.127

– *mainshaft (mm)* = 0 ± 0.05

Oil capacity (Ltrs.) = 2.6

FORD Specification = SQM 2C 9010 A

For detailed Technical Data and Tightening Torques see Sierra RS Cosworth Workshop Manual.

PART B – Transmission and Rear Axle

3. Technical Data (cont'd.)

Rear Axle

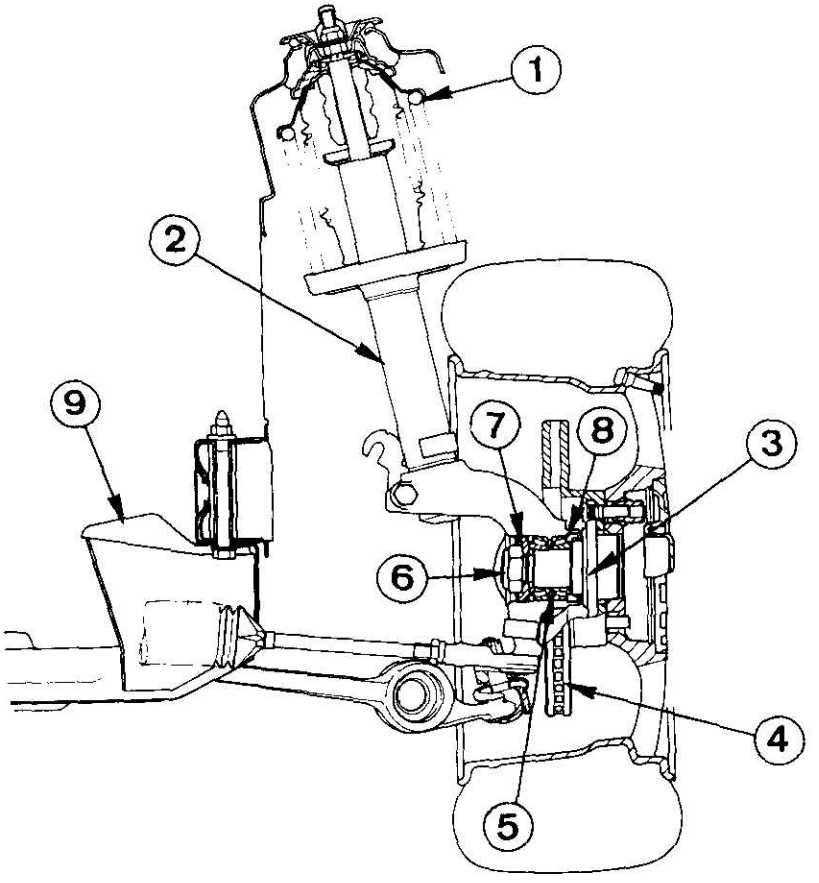
Typ: Independent semi-trailing arm rear axle

Ratio	3.64 : 1
Oil capacity (Ltrs.)	1.3
Hypoidoil SAE 90	FORD specification SQM 2C 9002 AA
Liquid sealant – rear axle case (1110 B)	FORD specification SQM 4G 9523 A
Grease – bearing housing	FORD specification ESEAM 1C 1014 A
Grease – driveshaft centre bearing	FORD specification SM 1C 4515 A
Wheel bearing grease	FORD specification SAM 1C 9111 A
Grease capacity – tripod drive joints – FORD specification	100 ± 10 g S-M1 C75-A or SQM-1C 9004 A or Mobil Rex E 22 grease

For detailed Technical Data and Tightening Torques see Sierra RS Cosworth Workshop Manual.

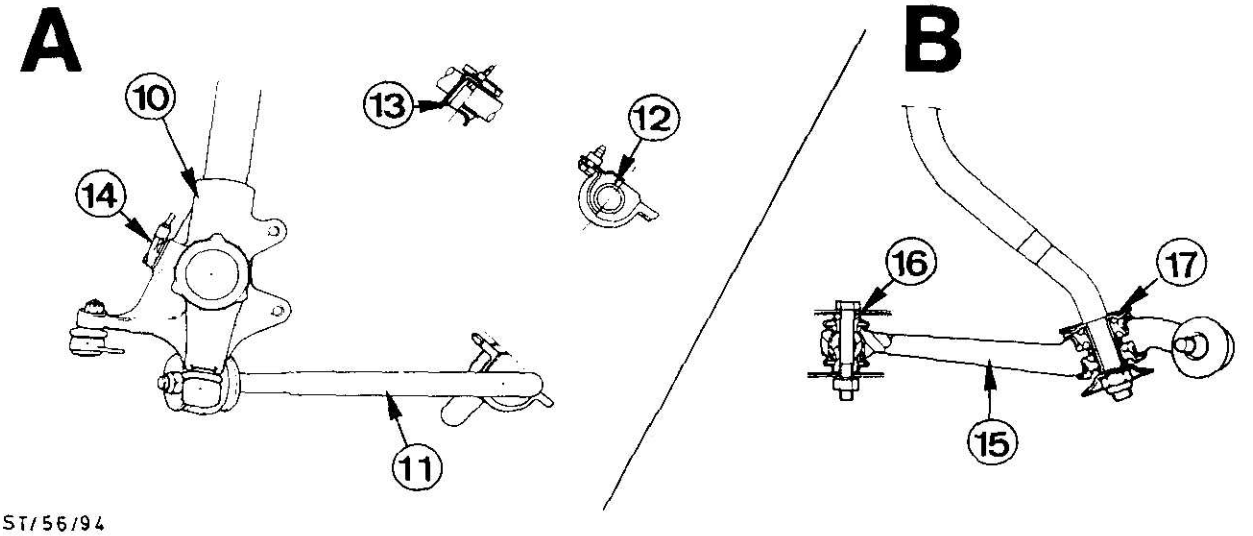
PART C – Front Axle and Suspension

The Sierra RS Cosworth has McPherson strut front suspension, similar to that used in Sierra and Scorpio model ranges.



ST/56/33 ACM

Front axle and suspension – cross section



ST/56/94

A = Spindle carrier and stabiliser mounting B = Lower arm mounting

PART C – Front Axle and Suspension

- Some parts of the front axle and suspension have been reinforced or modified in order to meet with the increased requirements of road holding.
- The front wheel alignment should be checked as described in the Sierra Workshop Manual.
- *Only toe setting is adjustable.*
- **No new special tools are required.**
- In the list below, front axle and suspension components, which are reinforced or modified in comparison to the Sierra, are marked with "Sierra RS Cosworth". Scorpio components which have been carried over to the Sierra RS Cosworth are marked with "Scorpio" (refer to illustration on page 66).

1 = *Spring*	*Sierra RS Cosworth*
2 = Strut	Sierra RS Cosworth
3 = Hub	Sierra RS Cosworth
4 = Brake disc	Sierra RS Cosworth
5 = Front wheel bearings	Scorpio
6 = Protection cap	Scorpio
7 = Toothed rotor (ABS)	Scorpio
8 = Grease seal	Scorpio
9 = Crossmember	Sierra RS Cosworth
10 = *Spindle carrier*	*Sierra RS Cosworth*
11 = Stabiliser bar, 28 mm diameter	Sierra RS Cosworth
12 = Bush	Scorpio
13 = U-Clamp and fixing	Sierra RS Cosworth
14 = Anti-lockwheel sensor with fixing	Scorpio
15 = Lower arm	Sierra RS Cosworth
16 = Attachment-lower arm to crossmember	Scorpio
17 = *Rear cover*	*Scorpio*

Wheel Alignment (unladen)

Toe setting (toe-in)	1,0 mm ± 1,0 mm
Castor	2° 30' ± 0° 30'
Camber	–1° 15' ± 0° 30'

Maximum variation Left hand to Right hand:

Castor	1° 0'
Camber	1° 15'
Front wheel bearing grease	Ford Spezifikation SAM 1C 9111 A

For detailed Technical Data and Tightening Torques see Sierra RS Cosworth Workshop Manual.

PART D – Anti-Lock Braking System (ABS)

1. General Description

- The Sierra RS Cosworth is fitted with the Anti-Lock Braking System (ABS), which is similar to the system used on the Sierra XR 4x4.

- *The principle of operation of these systems are described in detail in the following publications:*

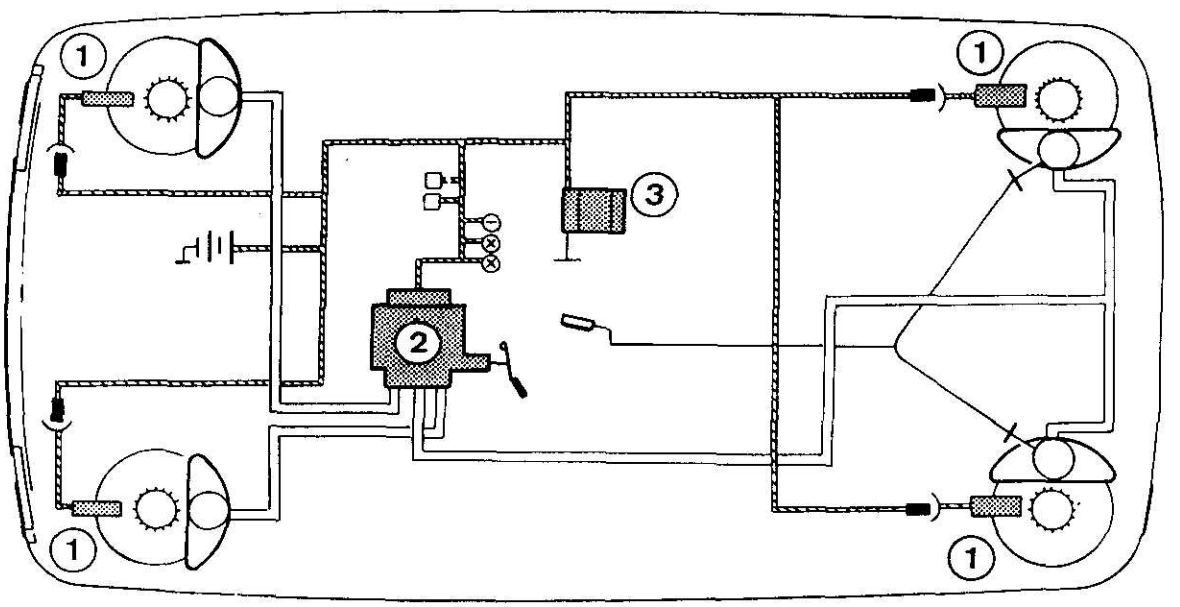
  – Technicians Information CG 7216,

  – A Technical Introduction for Workshop Staff (Scorpio/Granada),

  – Sierra XR 4x4 Workshop Manual.

- No new special tools and test equipment are required for the Sierra RS Cosworth Anti-Lock Braking System.

- This part of the brochure includes a brief summary about the principles of operation of the ABS and informs you about the modified components of the Sierra RS Cosworth Anti-Lock Braking System.



1 = Wheel Sensors 2 = Actuation Assembly 3 = ABS-Module

PART D – Anti-Lock Braking System (ABS)

1. General Description (cont'd.)

Principles of Operation

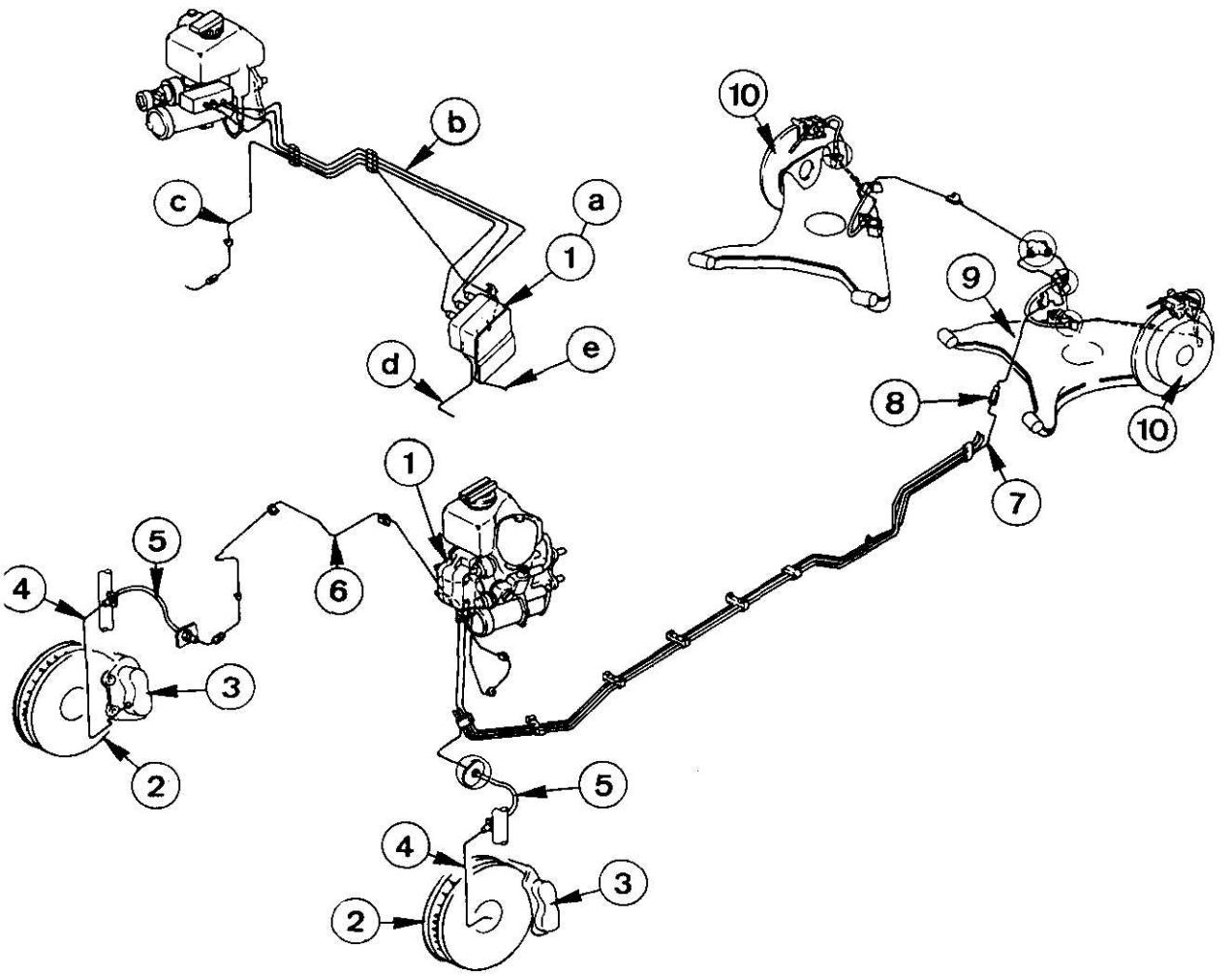
- A dual circuit braking system is used, with the front wheels on a separate circuit to the rear wheels.
- The brake system does not operate with vacuum boost but with an integral hydraulic booster by using accumulator pressure.
- The heart of ABS is the actuation assembly.
- The front wheel brakes are activated by a single piston master cylinder.
- The rear wheel brakes are activated by controlled accumulator pressure.
- The accumulator pressure is produced by an electric pump forcing brake fluid against the diaphragm of a gas filled pressure accumulator which forms part of the actuation assembly.
- ABS uses an electronically controlled system to sense any tendency for a wheel to lock and instantly adjusts brake line fluid pressure to the affected wheel to maintain optimum braking.
- The system has all round power assisted disc brakes with ventilated front discs and solid rear discs.
- Each brake assembly has a sensor which constantly monitors the rotational speed of the wheel.
- A magnetic field within the sensor is interrupted by a toothed rotor which turns with the wheel of the car. This produces an electrical signal.
- The sensors send a constant stream of signals to the ABS module which contains two identical micro-processors. These constantly monitor and compare incoming signals from all four wheel sensors.
- If during braking lock-up of one wheel becomes imminent, the sensor signal from that wheel will differ from signals from other wheels.
- The ABS module reads this difference and instructs the actuation assembly to adjust hydraulic pressure to the affected wheel.
- Constant adjustment of pressure at this wheel is maintained until the module interpretes the same rate of deceleration by all four wheels.

PART D – Anti-Lock Braking System (ABS)

2. The Sierra RS Cosworth Anti-Lock Braking System

Modified Components

The following components have been modified to suit Sierra RS Cosworth.



ST/56/115

1 = Valve block
Due to lack of space the valve block on **RHD-versions** is fitted separately to the left fender apron and connected to the actuation assembly by brake lines.

2 = Front brake discs

3 = Front caliper assembly and brake pads

4 = LH/RH front brake line

5 = LH/RH front brake hose

PART D – Anti-Lock Braking System (ABS)

2. The Sierra RS Cosworth Anti-Lock Braking System

Modified Components (cont'd.)

6 = Front brake line (connection from RH front brake line to actuation assembly)

7 = Brake line (from actuation assembly to brake pressure regulator valve)

8 = Brake pressure regulator valve
This valve is new. It has been fitted in the rear braking circuit in order to prevent premature pressure build up to the rear brakes.

9 = Brake line (from brake pressure regulator valve to T-connector)

10 = Rear brake discs and brake pads.

- All other components are carried over from Sierra XR 4x4 or Scorpio.

Components for the RHD-Version, which differ from those fitted to the LHD-Version, are shown in illustration on page 70 and listed below:

a) Valve block

b) Three brake lines between actuation assembly and valve block

c) Front brake line (from valve block to RH-brake hose)

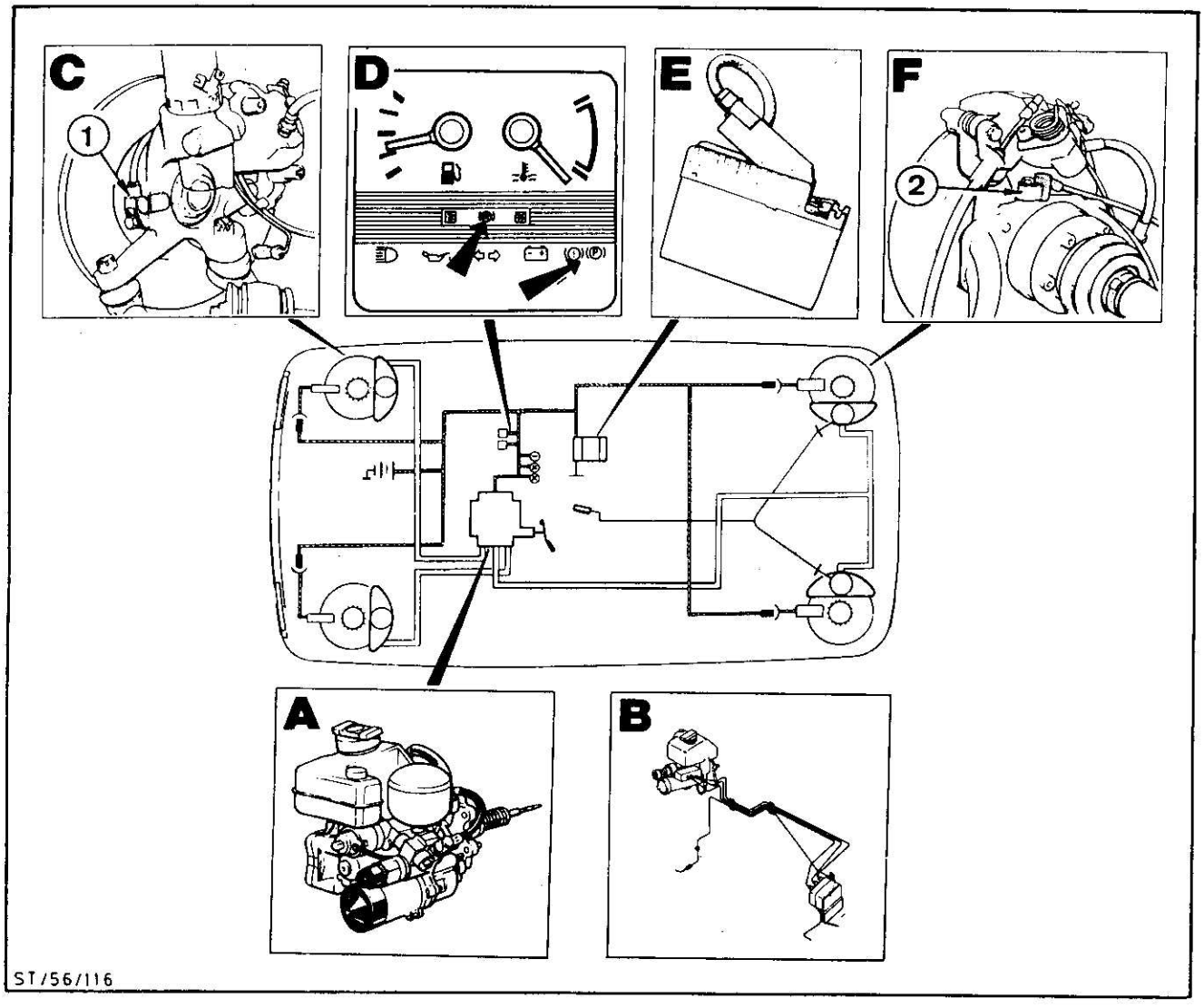
d) Front brake line (from valve block to LH-brake hose)

e) Rear brake line (from valve block to brake pressure regulator valve)

PART D – Anti-Lock Braking System (ABS)

2. The Sierra RS Cosworth Anti-Lock Braking System (cont'd.)

System Components and Location



A = Actuation assembly (LHD-Version).
Installed in the engine compartment on the bulk head.

B = Actuation assembly (RHD-Version).
The valve block of the actuation assembly is fitted separately to the left fender apron.

C = Front wheel brake system.
The wheel sensors (1) are fitted to the front spindle carrier.

D = Warning and safety system.

PART D – Anti-Lock Braking System (ABS)

2. The Sierra RS Cosworth Anti-Lock Braking System

System Components and Location (cont'd.)

Two warning lights are situated on the facia panel.

- The ABS and brake warning lights (low brake fluid level, low accumulator pressure).
- The handbrake warning light.

E = ABS-Module.
This sealed "black box" is located behind the instrument trim panel on the driver side of the vehicle. When defective it must be renewed.

F = Rear wheel brake system.
The wheel sensors (2) are mounted in the end castings of the rear suspension arms.

3. Technical Data

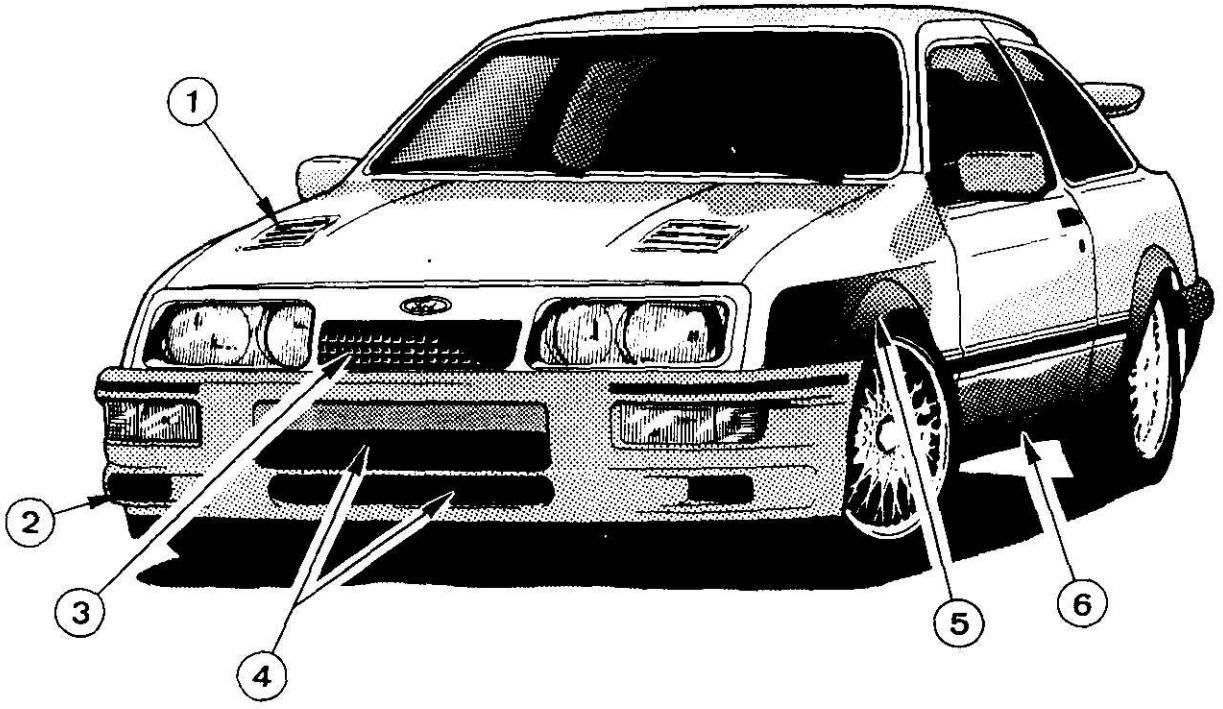
Dual circuit braking system	
– front wheel	left/right separately controlled
– rear wheels	controlled together

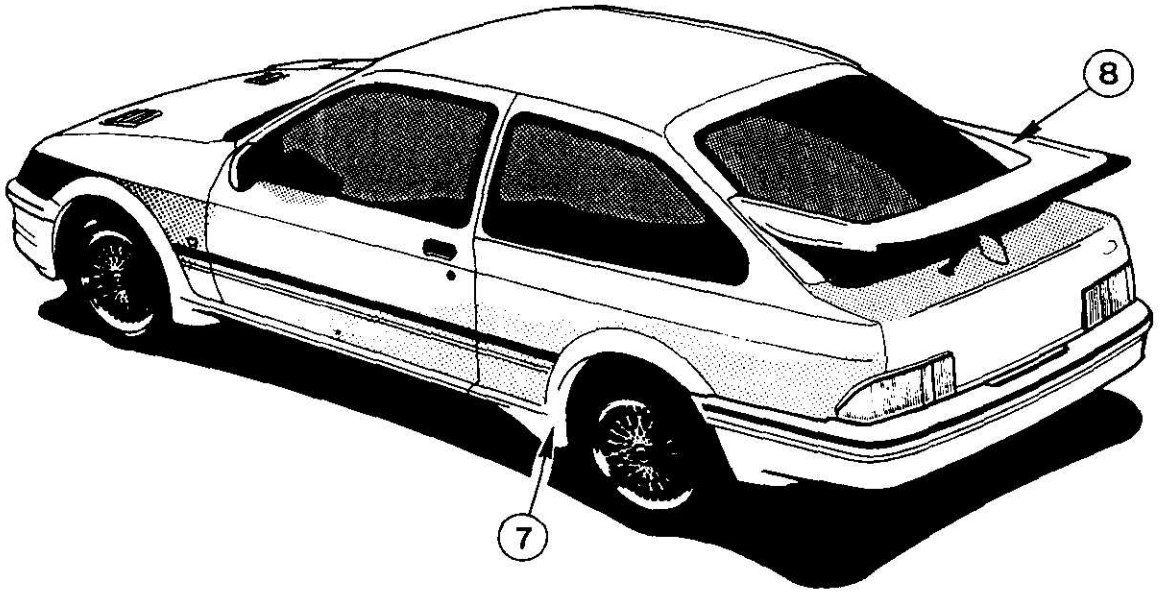
Brake discs	**Front**	**Rear**
Typ	ventilated discs	solid discs
Disc diameter	260.0 mm	254.0 mm
Disc run out	0.15 mm	0.01 mm
Minimum disc thickness	22.7 mm	8.9 mm
Maximum thickness variation	0.01 mm	0.01 mm
Brake fluid-amber	SAM-6C-9101-A or C	

For detailed Technical Data and Tightening Torques see Sierra RS Cosworth Workshop Manual.

PART E – Body Features, Wheels and Tyres

1. Exterior dress up, Wheels and Tyres





PART E – Body Features, Wheels and Tyres

1. Exterior dress up, Wheels and Tyres (cont'd.)

1 = Air extraction grilles for improved cooling.

2 = Slots for brake cooling.

3 = New radiator grill with a single large cooling slot for the intercooler.

4 = Large cooling slots for the radiator.

5 = Extension for front wheelarches.

6 = Moulding-rocker panel.

7 = Extension for rear wheelarches.

8 = Special rear spoiler with three mounting points to tailgate.

Important:

- Because of the special configuration of some body/trim panels, in particular the special rear-spoiler, the vehicle must under no circumstances be driven through an automatic car wash.
- The stone deflector of the frontbumber will not be installed during production, to avoid shipping damage. It should be installed during PDI.

Wheels and Tyres

15" x 7" racing style light alloy road wheels with lockable hub cover.

205/50 VR 15 – tyres

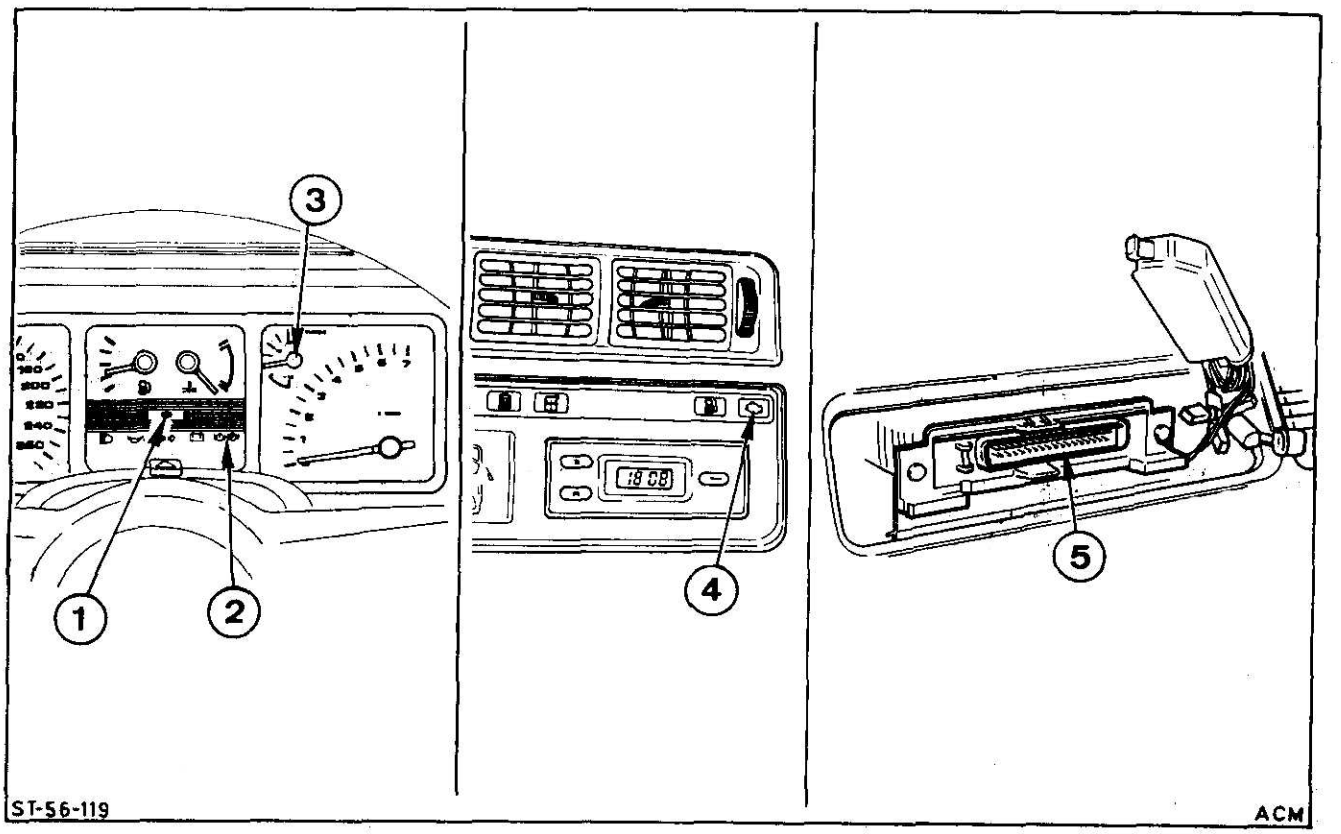
Cold Tyre Pressure		**Front**	**Rear**
Normal laden and normal usage	(Bar)	2.1	2.3
Fully laden and normal usage	(Bar)	2.3	2.5

When operating at sustained high speed, in the normal laden condition, the tyre pressure must be increased by 0.1 Bar for every 10 km/h (6 mph) above 160 km/h (100 mph).

PART E – Body Features, Wheels and Tyres

2. Interior features

- Recaro front bucket seats.
- Sport steering wheel.
- Modified instrument panel.



1 = ABS/Brake warning light
2 = Handbrake warning light
3 = Boost pressure gauge
4 = Electronic engine control system-warning light
5 = Location of ECU with CO adjusting screw, cable for octane adjust and self test connector

SIERRA SAPPHIRE RS COSWORTH TECHNICAL & FUEL INJECTION DIAGNOSIS INFORMATION

THE FUEL INJECTION SYSTEM USED IS THE WEBER MARELLI MULTI POINT INJECTION SYSTEM.

RECOMMENDED TOOLS.

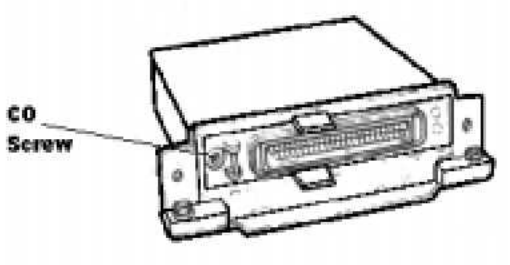
FAULT CODE READER OR LED TESTER
FUEL PRESSURE GAUGE
MULTIMETER
SCOPE
BREAKOUT BOX
CO METER
HAND VACUUM PUMP

IT IS POSSIBLE TO REPAIR THE VEHICLE WITHOUT SOME OF THE TOOLS LISTED ABOVE BUT IT MAKES LIFE A LITTLE EASIER IF YOU DO HAVE THEM.

INPUTS TO ENGINE MANAGEMENT ECU

AIR TEMPERATURE, WATER TEMPERATURE, MANIFOLD PRESSURE, CRANKSHAFT POSITION AND SPEED, THROTTLE POSITION AND PHASE SENSOR.





OUTPUTS FROM ENGINE MANAGEMENT ECU

BOOST CONTROL VALVE, IGNITION MODULE, INJECTORS AND IDLE SPEED CONTROL.

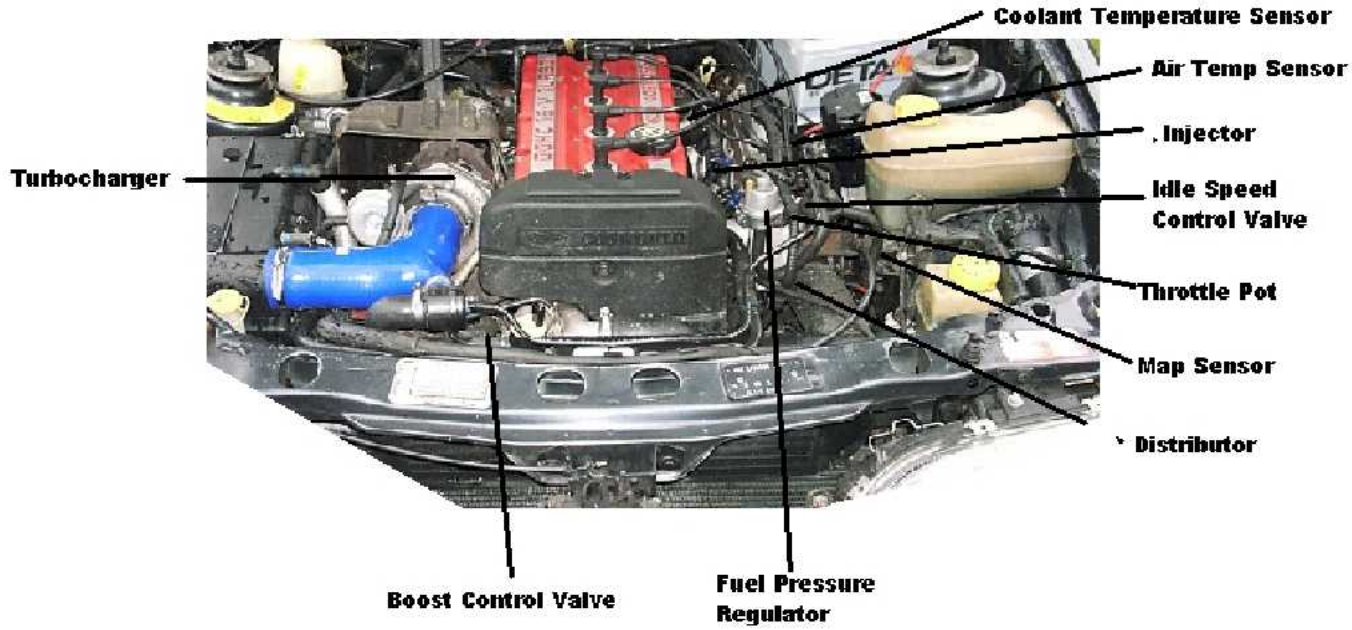
TECHNICAL DATA

SPARK PLUG GAP	1MM
FIRING ORDER	1-3-4-2
IDLE SPEED	850 RPM
CO	1-2% @ IDLE
ALTERNATOR POWER	70/90 AMP
ALTERNATOR VOLTAGE	13.7 TO 14.6 VOLT
COIL	**BOSCH**
PRIMARY RESISTANCE	0.7 TO 0.9 OHMS
SECONDARY RESISTANCE	4500 TO 7000 OHMS
DISTRIBUTOR	**MERELLI**
TYPE	BREAKERLESS
ROTATION	CLOCKWISE
STATIC ADVANCE	16 DEG @IDLE (NOT ADJUSTABLE)
IDLE SPEED	850-900RPM
HT LEAD RESISTANCE	30,000 OHMS MAXIMUM
ENGINE SPEED/TDC SENSOR	
CLEARANCE TO CRANKSHAFT PULLEY	0.6-1.0MM
INJECTORS	**WEBER**
TYPE	ELECTRONICALLY OPERATED
FUEL PUMP	**BOSCH**
TYPE	ELECTRIC ROLLER CELL
PRESSURE	OVER 10 BAR
PRESSURE REGULATOR	**WEBER**
SYSTEM PRESSURE, IGN ON	3.2-3.8 BAR
SYSTEM PRESSURE AT IDLE	2.7-3.3 BAR
TURBOCHARGER	
BOOST PRESSURE 4X4 (STD)	0.8-0.9 BAR
BOOST PRESSURE 2WD (STD)	0.7 BAR

COOLANT TEMP SENSOR / AIR TEMP SENSOR RESISTANCE

10 DEG C	6	K OHMS
20 DEG C	3.75	K OHMS OR 3 VOLTS
30 DEG C	2.42	K OHMS
40 DEG C	1.6	K OHMS
50 DEG C	1.08	K OHMS OR 1 VOLT
60 DEG C	0.75	K OHMS
70 DEG C	0.53	K OHMS
80 DEG C	0.38	K OHMS OR 0.3-0.5 VOLTS
90 DEC C	0.27	K OHMS

COMPONENT LOCATIONS



Engine Management Control Unit - Behind N/S Dash (above g/box)
Fuel Filter and Fuel Pump - L/H rear





SENSORS

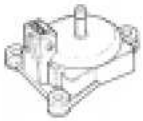


AIR TEMPERATURE SENSOR
THE SENSOR HAS TWO WIRES, TO CHECK THE RESISTANCE, FIRST UN-PLUG THE SENSOR AND CHECK BY PUTTING A OHM METER BETWEEN THE TERMINALS.
TO CHECK THE VOLTAGE READING YOU NEED TO PLUG IN THE SENSOR, AND CONNECT A VOLT METER BETWEEN ONE OF THE SENSOR WIRES AND EARTH.
CHECK THE RESISTANCE AND VOLTAGE VALUES AT DIFFERENT TEMPERATURES AND MAKE SURE THAT THEY ARE WITHIN THE REQUIRED LIMITS.
IF IT IS NOT WITHIN LIMITS THEN THE SENSOR WILL NEED TO BE REPLACED.
IF YOU GET A READING OF AROUND 5 VOLTS THEN THERE IS AN OPEN CIRCUIT, IF YOU GET A READING OF 0 VOLTS THEN THERE IS A SHORT TO EARTH.



COOLANT TEMPERATURE SENSOR
SAME TESTS AS AIR TEMP SENSOR.

CO POTENTIOMETER
THIS IS PART OF THE ECU AND IF IT IS FOUND TO BE FAULTY THE ECU WILL HAVE TO BE REPLACED.



MAP SENSOR
TERMINAL (2WD) 4WD IS THE SAME BUT THE TERMINALS ARE IN A DIFFERENT ORDER.

1	EARTH	0.25 V MAX
2	SUPPLY VOLTAGE	5V +/- 0.1V
3	SIGNAL VOLTAGE	(SEE BELOW)

THE BEST WAY TO TEST THIS SENSOR IS TO USE A HAND HELP VACUUM PUMP.

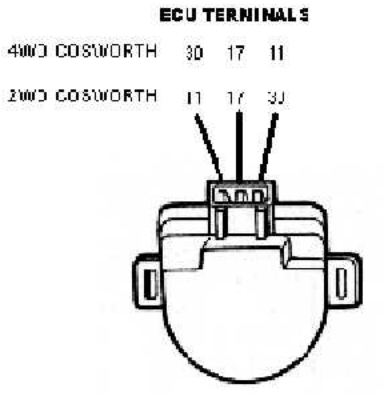
VACUUM APPLIED	VOLTS
280 MM HG	0.66 – 0.76
500 MM HG	1.36 – 1.45
650 MM HG	1.81 – 1.91
750 MM HG	2.11 – 2.20

IF YOU DO NOT HAVE A VACUUM PUMP THEN CHECK THESE VALUES.

IGNITION ON	2.2 V
IDLE	0.25 – 0.6 V

ALSO CHECK THAT THE VOLTAGE CHANGES WHEN YOU INCREASE ENGINE SPEED.

THROTTLE POSITION SWITCH



TERMINAL **(2WD)**

11	EARTH	0.25 V MAX
17	SIGNAL VOLTAGE	(SEE BELOW)
30	SUPPLY VOLTAGE	5V +/- 0.1V

RESISTANCE CHECKS (MULTI-PLUG DISCONNECTED)

TERMINALS 1 AND 2	THROTTLE CLOSED	40-150 OHMS
TERMINALS 1 AND 2	THROTTLE FULLY OPEN	300-600 OHMS
TERMINALS 2 AND 3	THROTTLE CLOSED	300-600 OHMS
TERMINALS 2 AND 3	THROTTLE FULLY OPEN	40-150 OHMS

VOLTAGE CHECKS (MIDDLE TERMINAL, MULTI-PLUG CONNECTED)

CONNECT A VOLTMETER BETWEEN THE CENTRE TERMINAL AND EARTH.
AT IDLE YOU SHOULD HAVE AROUND 5 VOLTS.
WHEN THE THROTTLE IS SLOWLY OPENED UNTIL IT IS FULLY OPEN THE VOLTAGE SHOULD SLOWLY CHANGE TO 0.5 VOLTS.

RESISTANCE CHECKS **(4WD)**

LEAVE THE SENSOR CONNECTED, UNPLUG THE ENGINE MANAGEMENT ECU.
CONNECT AN OHMMETER BETWEEN THE MULTIPLUG TERMINALS:

11 AND 30		300-600 OHMS
30 AND 17		300-600 OHMS
30 AND 17	WHILE OPENING THROTTLE	FROM 600 TO 40 OHMS

VOLTAGE CHECKS

CONNECT A VOLTMETER BETWEEN THE CENTRE TERMINAL AND EARTH.
AT IDLE YOU SHOULD HAVE AROUND 0.6 VOLTS.
WHEN THE THROTTLE IS SLOWLY OPENED UNTIL IT IS FULLY OPEN THE VOLTAGE SHOULD SLOWLY CHANGE TO 4.5 VOLTS.

ENGINE SPEED/TDC SENSOR

THE SENSOR IS LOCATED ADJACENT TO THE CRANKSHAFT PULLEY WHICH HAS 4 REFERENCE TEETH. THE SENSOR SENDS A SIGNAL TO THE ENGINE MANAGEMENT ECU AS EACH REFERENCE POINT PASSES, THE ECU USES THIS INFORMATION TO DETERMINE ENGINE SPEED.

FIRST CHECK THAT ALL 4 TEETH ARE ON THE CRANKSHAFT PULLEY AND THEY AND THE SENSOR ARE IN GOOD CONDITION.

THEN MAKE SURE THE DISTANCE BETWEEN THE PULLEY TEETH AND SENSOR, AND CHECK WITH THE REQUIRED VALUE.

IF CORRECT THEN MEASURE THE RESISTANCE BETWEEN PINS 3 AND 4 OF THE ENGINE MANAGEMENT ECU MULTIPLUG (ECU DISCONNECTED), IT SHOULD BE BETWEEN 600-1K OHMS.



DISTRIBUTOR PHASE SENSOR

THE SENSOR IS USED BY THE ENGINE MANAGEMENT ECU TO ESTABLISH WHEN TO START AND STOP EACH SEQUENCE OF THE INJECTION CYCLE.

FIRST MAKE SURE THAT THE SENSOR IS NOT DAMAGED, AND SET THE SENSOR DISTANCE FROM THE DISTRIBUTOR CAMS, THIS SHOULD BE BETWEEN 0.2 AND 0.3 MM.

IF THIS IS CORRECT THEN CHECK THE RESISTANCE OF THE SENSOR (PINS 23 AND 5 OF ENGINE MANAGEMENT ECU MULTIPLUG) IT SHOULD BE BETWEEN 700-1.2K OHMS. IF IT NOT CORRECT THEN CHECK THE WIRING AND SENSOR.

LAMBDA (HEGO, OXYGEN) SENSOR (IF FITTED)

CHECK THAT THE SENSOR MULTIPLUG IS CLEAN AND THE CONTACTS ARE IN GOOD CONDITION.

THE SENSOR HAS 3 WIRES, 12V POSITIVE, EARTH AND SIGNAL WIRE.

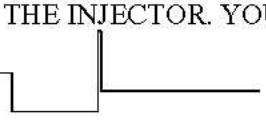
FIRST CHECK THAT THE LIVE AND EARTH ARE PRESENT.

THEN RUN THE ENGINE UNTIL IT HAS REACHED NORMAL OPERATING TEMPERATURE AND WITH A MULTIMETER (A SCOPE IS BETTER IF YOU HAVE ONE) CONNECT 1 LEAD TO THE SIGNAL WIRE OFF OF SENSOR AND THE OTHER TO EARTH. YOU SHOULD GET A SWITCHING VOLTAGE READING OF BETWEEN 0 AND 1 VOLT.



INJECTORS

THE INJECTORS ARE SUPPLIED WITH BATTERY VOLTAGE FROM THE MAIN RELAY AND ARE SWITCHED EARTH BY THE ENGINE MANAGEMENT ECU. IF YOU HAVE A SCOPE CONNECT ONE WIRE TO EARTH, THE OTHER TO THE INJECTOR. YOU SHOULD SEE A SIGNAL SIMULAR TO THE FOLLOWING.



CHECK THE RESISTANCE OF THE INJECTORS BETWEEN THE 2 TERMINALS WITH THE MULTI PLUG DISCONNECTED, IT SHOULD BE APPROXIMATELY 2 – 2.5 OHMS.

IDLE SPEED CONTROL VALVE

THIS VALVE IS A SOLENOID TYPE. THE ECU RAPIDLY SWITCHES THE EARTH CIRCUIT TO ALLOW THE VALVE TO ADOPT THE REQUIRED POSITION TO REGULATE THE IDLE SPEED.

IN THIS SYSTEM THE VALVE IS USED TO RAISE THE ENGINE SPEED WHEN THE VEHICLE IS COLD AND ALSO WHEN A LOAD IS APPLIED ON THE VEHICLE.

THE BEST WAY TO TEST THIS VALVE IS TO USE A OSCILLOSCOPE, IT HAS TWO TERMINALS, ONE OF THEM SHOULD HAVE A BATTERY +VE AND THE OTHER IS AN EARTH SWITCHED BY THE ECU. TO CHECK THIS CONNECT AN OSCILLOSCOPE.

USING A PERCENT SCALE ON THE OSCILLOSCOPE WHEN THE ENGINE IS WARM WITH NO LOAD YOU SHOULD HAVE A READING OF AROUND 32%.

WHEN YOU APPLY AN ELECTRICAL LOAD ON THE ENGINE IT SHOULD INCREASE I.E HEATED REAR WINDOW AND HEADLIGHTS ON, YOU SHOULD NOW HAVE A READING OF AROUND 40%.

IF THERE IS NO READING FIRST CHECK THE SUPPLY VOLTAGE TO THE VALVE, THEN THE SIGNAL OUT OF THE ECU. ALSO CHECK THE RESISTANCE OF THE VALVE, A READING OF BETWEEN 6 TO 8 OHMS.

FUEL PRESSURE

CONNECT A SUITABLE PRESSURE GUAGE BETWEEN THE FUEL PRESSURE REGULATOR AND THE FUEL RAIL AND CHECK THAT THE PRESSURE IS WITHIN THE REQUIRED VALUE.

IF THE PRESSURE IS TOO HIGH, FIRST CHECK THAT THE RETURN LINE IS NOT BLOCKED, THE BEST WAY TO CHECK THIS IS TO REMOVE THE RETURN LINE FROM THE PRESSURE REGULATOR AND CONNECT YOUR OWN PIPE FROM THE REGULATOR TO A JUG AND THEN RE-TEST THE PRESSURE.

IF THIS DOES NOT CURE THE PROBLEM THEN THE REGULATOR WILL EITHER NEED TO BE ADJUSTED OR REPLACED.

FUEL DELIVERY

TO TEST THE FUEL PUMP DELIVERY FIRST DISCONNECT THE MAIN FUEL LINE AND PUT THE PIPE INTO A MEASURING JUG AND RUN THE FUEL PUMP.

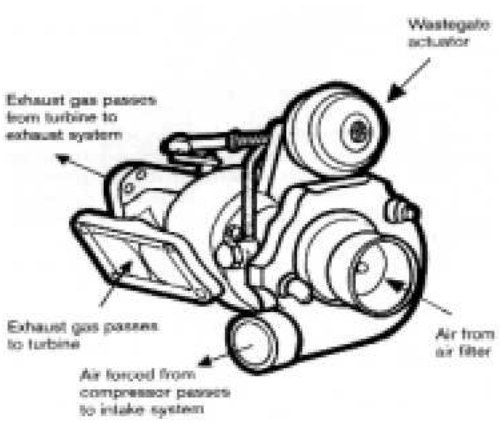
MEASURE THE AMOUNT FOR 1 MINUITE AND YOU SHOULD GET APPROXIMATELY 2.5 LITRES (OR CHECK FOR 30 SECONDS AND HALF THE AMOUNT).

IF THE PUMP DELIVERY IS LOW DO ANOTHER CHECK STREIGHT OUT OF THE PUMP (BEFORE THE FILTER) IF IT IS STILL LOW SUSPECT THE PUMP (ALSO CHECK THE SUPPLY VOLTAGE TO THE PUMP) IF THE DELIVERY IS NOW CORRECT THEN REPLACE THE FUEL FILTER.

IGNITION MODULE

THE IGNITION MODULE IS TRIGGERED BY A REFERENCE SIGNAL FROM THE ENGINE MANAGEMENT ECU

TURBOCHARGER INFORMATION





BOOST PRESSURE CONTROL SOLENOID

THE TWO ELECTRICAL CONNECTIONS ON THE SOLENOID PROVIDE A POWERSUPPLY AND EARTH .THE EARTH IS SWITCHED BY THE ECU.
YOU CAN CHECK THE SOLENOID WINDING ACROSS THE TWO TERMINALS WITH A OHM METER, THE RESISTANCE SHOULD BE BETWEEN 20 AND 50 OHMS, IF THIS IS INCORRECT THEN IT WILL NEED REPLACING.
THE 3 PORTS ARE CONNECTED TO THE :
COMPRESSOR OUTPUT, WASTE GATE ACTUATOR AND THE RETURN TO LOW PRESSURE SIDE (AIR FILTER)
THE ECU CONTROLS THE TURBO BOOST PRESSURE BY SENDING A PULSED SIGNAL (ON/OFF) TO THE SOLENOID, DEPENDING ON HOW MUCH BOOST PRESSURE THERE IS IT CAN CHANGE THE SIGNAL TO ALLOW MORE OR LESS PRESSURE TO THE WASTE GATE ACTUATOR TO EITHER INCREASE OR DECREASE THE BOOST PRESSURE.

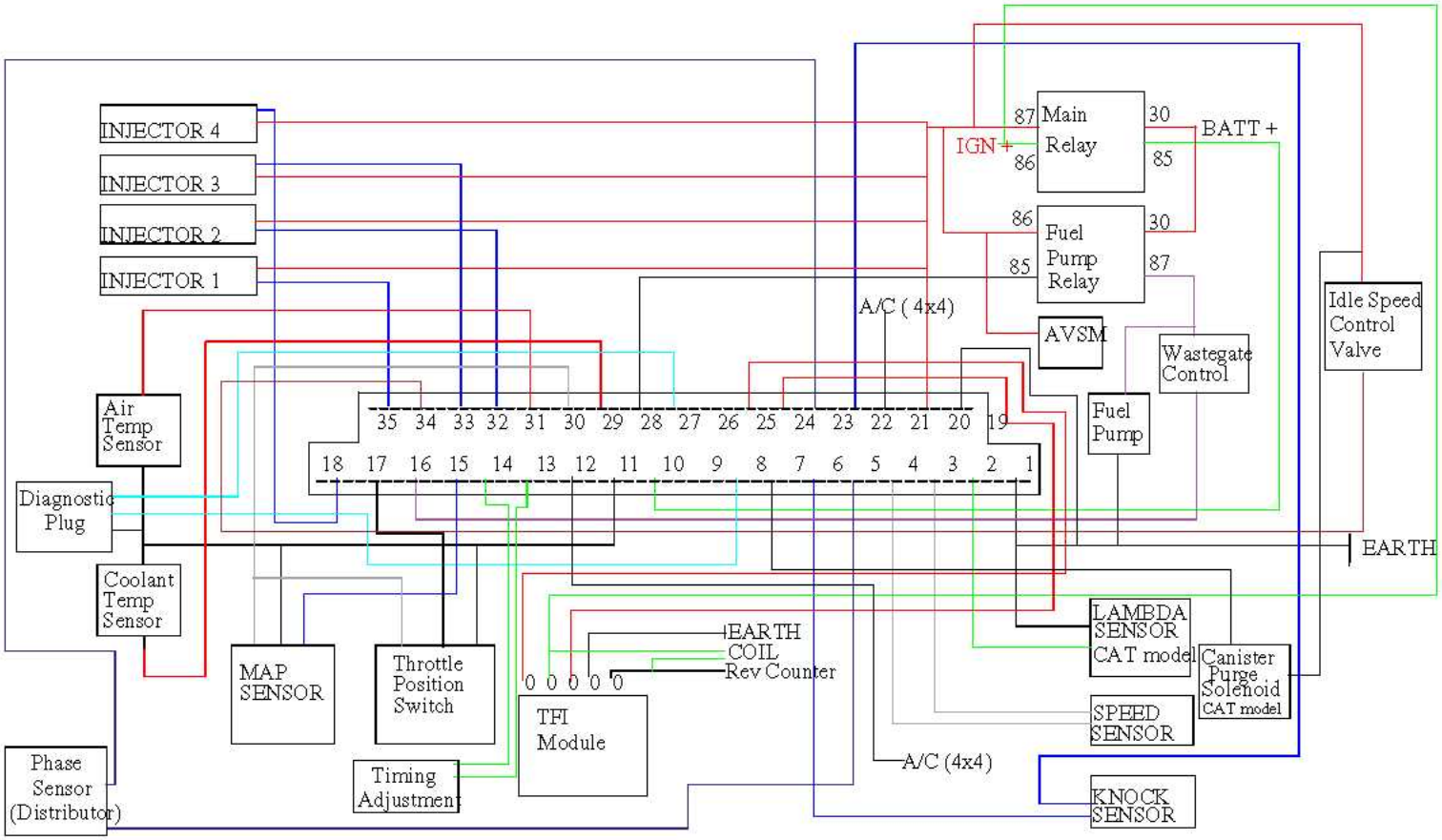
ADJUSTING THE BOOST PRESSURE

YOU CAN ADJUST THE TURBO BOOST PRESSURE BY EITHER FITTING AN UPRATED ACTUATOR OR ADJUSTING THE STANDARD ONE.
TO ADJUST IT YOU HAVE TO EITHER LENGTHEN THE ACTUATOR ROD (UNDO LOCKNUT AND TURN ADJUSTING SLEEVE) TO REDUCE THE PRESSURE OR SHORTEN THE ACTUATOR ROD TO INCREASE THE BOOST PRESSURE.
NOTE. IF THE BOOST IS ADJUSTED MORE THAN THE MAXIMUM LIMIT THE ECU WILL HAVE TO BE CHIPPED.

I HOPE YOU FIND THIS INFORMATION USEFUL, PLEASE NOTE EVERY EFFORT HAS BEEN MADE TO INSURE ALL OF THE INFORMATION IN THIS DOCUMENT IS CORRECT BUT IT CANNOT BE GUARANTEED.

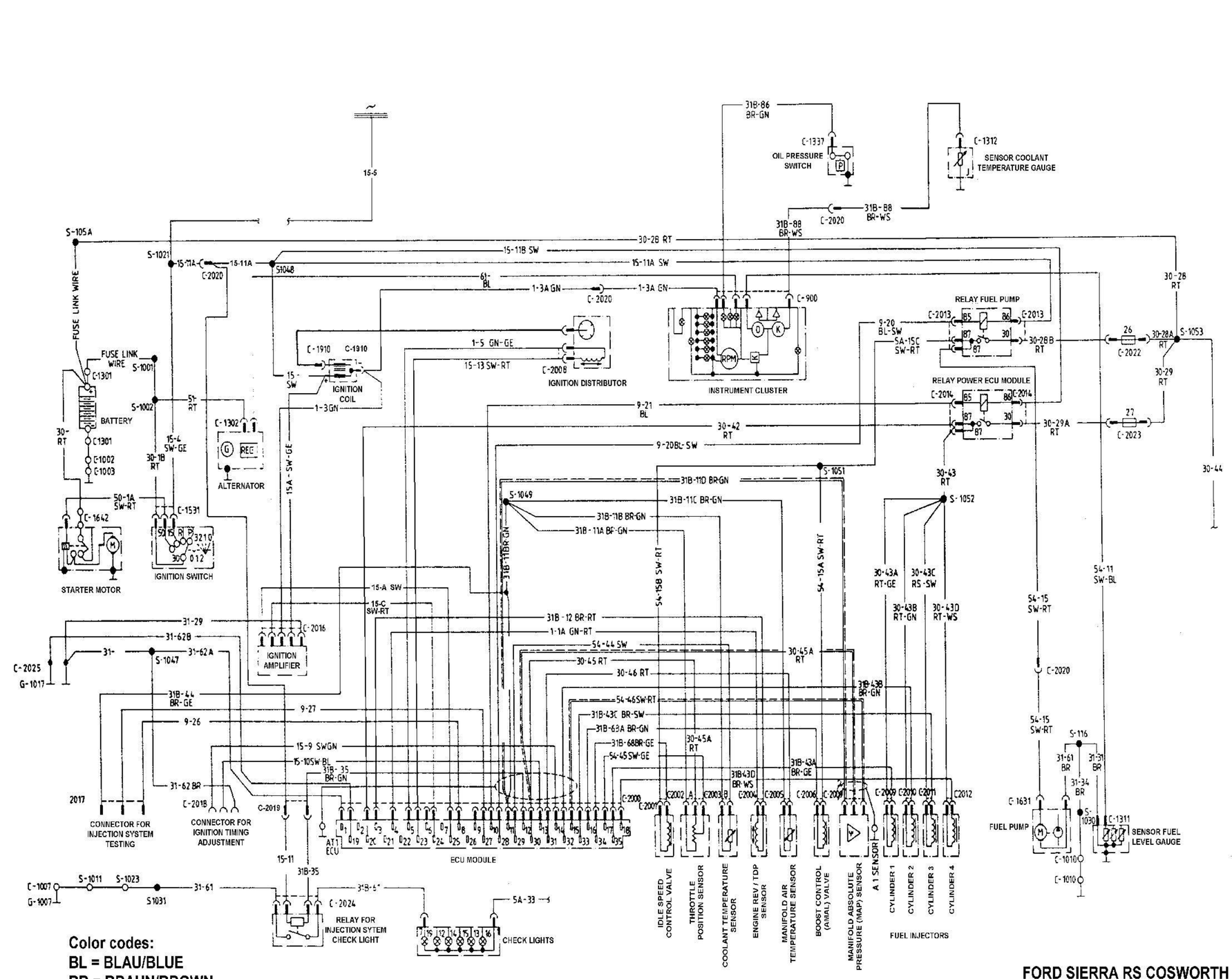
BELOW IS A WIRING DIAGRAM

IT COVERS BOTH THE 2WD AND THE 4WD COSWORTH.



EARTH TERMINALS 1 AND 19. CHECK MAXIMUM OF 0.5 VOLT DROP BETWEEN TERMINAL AND BATTERY NEGATIVE.

Wiring Diagrams	Diagram No.
Explanatory notes	1
Explanatory notes - LHD variants	1A
Explanatory notes - RHD variants	1B
Power distribution	2
Starting and charging system (including Diesel)	3
Starting and charging system - Automatic transmission	3A
Starting and charging system - 2,0 DOHC engines with EFI fuel injection and automatic transmission	3B
Starting and charaging system 1. - 1,6 CVH/CFI engines with double fan 2. - 2,0 DOHC engines	3C
Engine management - 2V carburettor - 1,6 OHC with emission level 15,04 (code E, G, 7) and 'New EEC' (code X, 3, T)	4
Engine management - 2V carburettor - 1,8 CVH with manual transmission and emission level 15,04 (code E, G, 7)	4A
Engine management - 2V carburettor - 1,8 CVH with double fan, automatic transmission and emission level 15,04 (code E, G, 7)	4B
Engine management - 2V carburettor - 1,8 CVH with manual transmission and emission level 'New EEC' (code X, 3, T)	4C
Engine management - 2V carburettor - 2,0 DOHC with emission level 15,04 (code E, G, 7)	4D
Engine management - 2V carburettor - 2,0 DOHC 2V with emission level 'New EEC' (code X, 3, T)	4E
Engine management - CFI fuel injection - 1,6 CVH with emission level 83 US (code U, D, V, Q, 4, 5)	5
Engine management - EFI fuel injection - 2,0 OHC with emission level 83 US (code U, D, V, Q, 4, 5)	5A
Engine management - EFI fuel injection - 2,0 DOHC with emission level 15,04 (code E, G, 7)	5B
Engine management - EFI fuel injection - 2,0 DOHC with emission level 83 US (code U, D, V, Q, 4, 5)	5C
Engine management - EFI fuel injection - 2,9 V6 with emission level 15,04 (code E, G, 7)	5D
Engine management - EFI fuel injection - 2,9 V6 with emission level 83 US (code U, D, V, Q, 4, 5)	5E
Engine management - EFI fuel injection - Sierra Cosworth with emission control 15,04 (code E, G, 7) and 83 US (code U, D, V, Q, 4, 5)	5F
Engine management - 1,8 Turbo Diesel with double fan and emission level 15,04 (code E, G, 7)	6
Engine management - 1,8 Turbo Diesel with double fan and emission level 87 US (code U, D, V, Q, 4, 5)	6A
Exterior lighting - LHD C, CL, XR4 variants	7
Exterior lighting - LHD CLX, GL, GLS variants	7A
Exterior lighting - RHD variants	7B
Exterior lighting - Norway/Sweden/Finland/Iceland	7C
Graphic warning display for bulb monitor - LHD Ghia variants	7D
Graphic warning display for bulb monitor - RHD Ghia and XR4x4 variants	7E
Graphic warning display for bulb monitor - Ghia for Sweden/Finland/Norway	7F
Front and rear fog lamps - High-series for Germany/Denmark/Italy	8
Front and rear fog lamps - High-series for Austria/Belgium/Spain/ Greece/Iceland/Portugal	8A
Front and rear fog lamps - RHD	8B
Front and rear fog lamps - High-series for Norway/Sweden	8C
Front and rear fog lamps - High-series for Finland	8D
Front and rear fog lamps - Netherlands	8E
Rear fog lamps - Low-series for Austria/Belgium/Switzerland/Germany/ Denmark/Spain/France/Greece/Italy/ Portugal	8F
Rear fog lamps - Low-series for Sweden/Norway/Finland/Iceland	8G
Signal and warning systems including trailer lights (turn indicator, horn, hazard warning, reversing lamp, starter inhibitor switch for automatic transmission, warning lights for handbrake and brake fluid level) - LHD variants	9



Color codes:
BL = BLAU/BLUE
BR = BRAUN/BROWN
GE = GELB/YELLOW
GN = GRUN/GREEN
RT = ROT/RED
SW = SCHWARTZ/BLACK
WS = WEISS/WHITE

FORD SIERRA RS COSWORTH
3-DOOR
LEFT HAND DRIVE
GERMANY

ENGINE CONTROL DIAGRAM

C-900 14401
1 58-6 + 58-6M BR-GN
2 31B-88 BR-WS
3 31-13 BR
4 1-3A GN
5 31B-17 BR-GE
6 54-4 SW-GE
7 61- + 61-C BL
8
9 RD
10 LD
11 31B-86 BR-GN
12 56A-3 BL-WS
13 54-11 SW-BL
INSTRUMENT CLUSTER

C-1112 14401
30-26 — 30-4, 30-22C, 30-16
FUSE 12

C-1120
FUSE 20 14401
32-11A BL-WS — 32-11B BL-GE

C-1301 14K011
BATTERY: 30- RT, 31- BR

C-1302 14401
ALTERNATOR: 51-A RT, 61- BL

C-1350 14401
RADIATOR FAN SWITCH: 31B-18 BR-WS, 31-18 BR

C-1531
50-SW-BL — 50- SW-BL 14401
30-18 RT — 30-1B RT
15-4 SW-GE — 15-4 SW-GE
STEERING COLUMN

C-1642 14300
STARTER MOTOR: 30- RT 14401, 50-1A SW-RT

C-1910 14K011
IGNITION COIL: 16-SW, 16A-SW-GE, 1-3 GN, 1-3A GN

C-1312 14K011
SENSOR COOLANT TEMPERATURE GAUGE: 31B-88 BR-WS

C-1337 14K011
OIL PRESSURE SWITCH: 31B-86 BR-GN

C-2000 14K011
ECU MODULE: 31-61A BR, 31-61B BR, 30-42 RT, 31B-72 BR-RT, 1-1A GN-RT, 1-5 GN-GE, 15-13 SW-RT, 15-C SW-RT, 15-A SW, 9-21 BL, 9-20 BL-SW, 31B-11BR-GN, 54-44 SW, 31B-25BR-GN, 30-45RT, 30-45A RT, 15-10 SW-BL, 30-46 RT, 15-9 SW-GN, 31B-43B BR-GN, 54-46 SW-RT, 31B-43C BR-SW, 31B-69A BR-GN, 31B-68 BR-GE, 54-45 SW-GE, 31B-43A BR-GE, 31B-43D BR-WS

C-2001 14K011
IDLE SPEED CONTROL VALVE: 31B-68GRG GR-GE, 54-15B SW-RT

C-2002 14K011
THROTTLE POSITION SENSOR: 31B-11A BR-GN, 54-45 SW-GE, 30-45A RT

C-2003 14K011
COOLANT TEMPERATURE SENSOR: 54-44 SW, 31B-11C BR-GN

C-2004 14K011
ENGINE REV/TDP SENSOR: 1-1A GN-RT, 31B-72 BR-RT

C-2005 14K011
MANIFOLD AIR TEMPERATURE SENSOR: 31B-11C BR-GN, 30-46 RT

C-2006 14K011
BOOST CONTROL (AMAL) VALVE: 31B-68A BR-GN, 54-15A SW-RT

C-2007 14K011
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR: 54-46 SW-RT, 31B-11D BR-GN, 30-45 RT

C-2008 14K011
IGNITION DISTRIBUTOR: 15-13 SW-RT, 1-5 GN-GE

C-2009 14K011
FUEL INJECTOR CYLINDER 1: 30-43A RT-GE, 31-B-43A BR-GE

C-2010 14K011
FUEL INJECTOR CYLINDER 2: 30-43B RT-GN, 31B-43B BR-GN

C-2011 14K011
FUEL INJECTOR CYLINDER 3: 30-43C RT-SW, 31B-43C BR-SW

C-2012 14K011
FUEL INJECTOR CYLINDER 4: 30-43D RT-WS, 31B-43D BR-WS

C-2013 14K011
RELAY FUEL PUMP: 54-15 SW-RT, 30-28A RT, 54-15C SW-RT, 15-11A SW, 9-20 BL-SW

C-2014 14K011
POWER RELAY ECU MODULE: 30-28B RT, 30-42 RT, 30-43 RT, 15-11B SW, 9-21 BL

C-2015 14401
RADIATOR FAN (2): 32-11B BL-GE, 31-16B BR

C-2016 14K011
IGNITION AMPLIFIER: 15-A SW, 15A SW-GE, 15C-CSWRT, 31-29 BR, 1-3 GN

C-2017 14K011
9-26 — 9-27, 31B-44
CONNECTOR FOR INJECTION SYSTEM TESTING (CABLE CLOSE TO ECU MODULE)

C-2018 14K011
CONNECTOR FOR IGNITION TIMING ADJUSTMENT (CABLE CLOSE TO ECU MODULE): 31-61BR, 15-9 SW-GN, 15-10SW-BL

C-2019 14K011 14401
31B-35 BR-GN — 15-11A
9-22 BL — 30-35 RT
RELAY BRACKET

C-2020 14K011 14401
31B-88 BR-WS — 1-3A GN
54-15 SW-RT — 15-11 SW 15-11A
RELAY BRACKET

C-2024
31B-35 — 31-61
30-35 — 31B-61
MODULE BRACKET

C-2023 14K011
30-29A RT — 30-29 RT
FUSE 20

C-2022 14K011
30-28B RT — 30-28A RT
FUSE

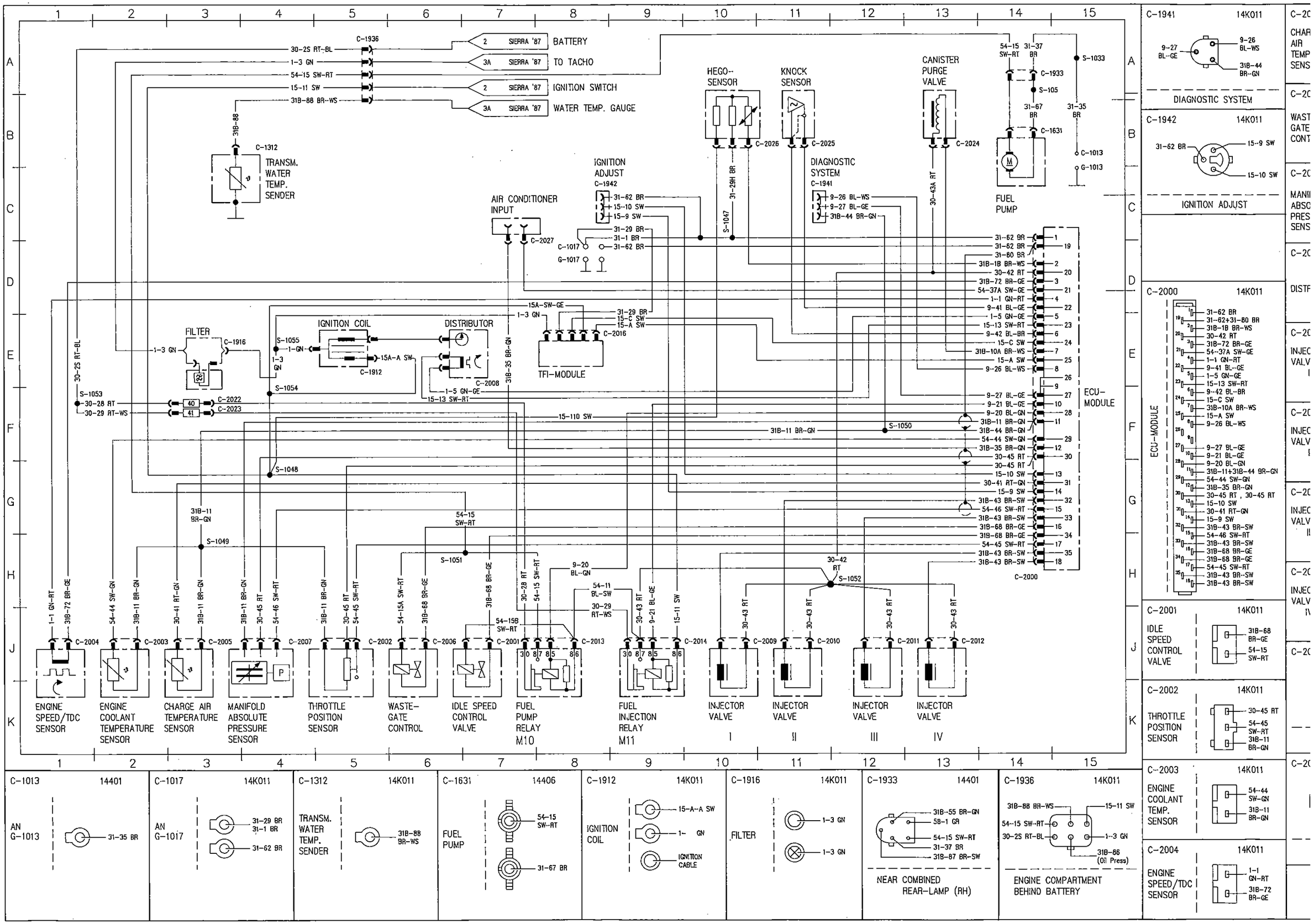
SOLDERING POSITION CODES

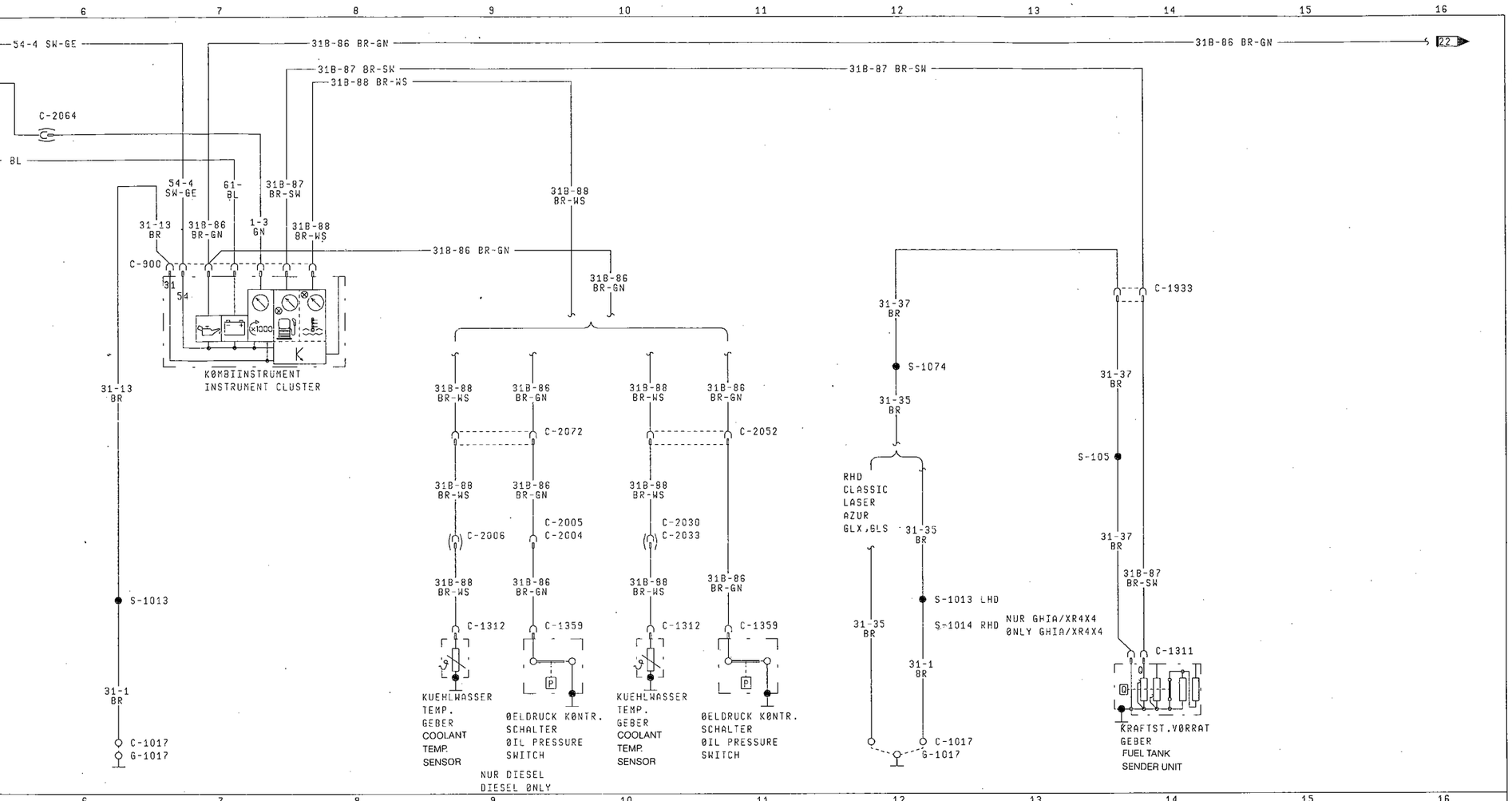
S-116	14401	CLOSE TO FUEL PUMP CONNECTION
S-1001	14401	CLOSE TO BATTERY CONNECTION
S-1002	14401	CLOSE TO ALTERNATOR CONNECTION
S-1021	14401	CLOSE TO IGNITION SWITCH CONNECTION
S-1030	14401	CLOSE TO FUEL LEVEL SENSOR CONNECTION
S-1041	14K011	CLOSE TO ECU MODULE CONNECTION
S-1048	14K011	CLOSE TO ECU MODULE CONNECTION
S-1049	14K011	CLOSE TO WIRING PROTECTION SLEEVE CONNECTION
S-1050	14K011	CLOSE TO ECU MODULE CONNECTOR CONNECTION
S-1051	14K011	CLOSE TO FUEL INJECTORS CONNECTION
S-1052	14K011	CLOSE TO FUEL INJECTORS CONNECTION
S-1053	14K011	CLOSE TO FUSE/RELAY BOX CONNECTION
S-1054	14K011	CLOSE TO BATTERY CONNECTION

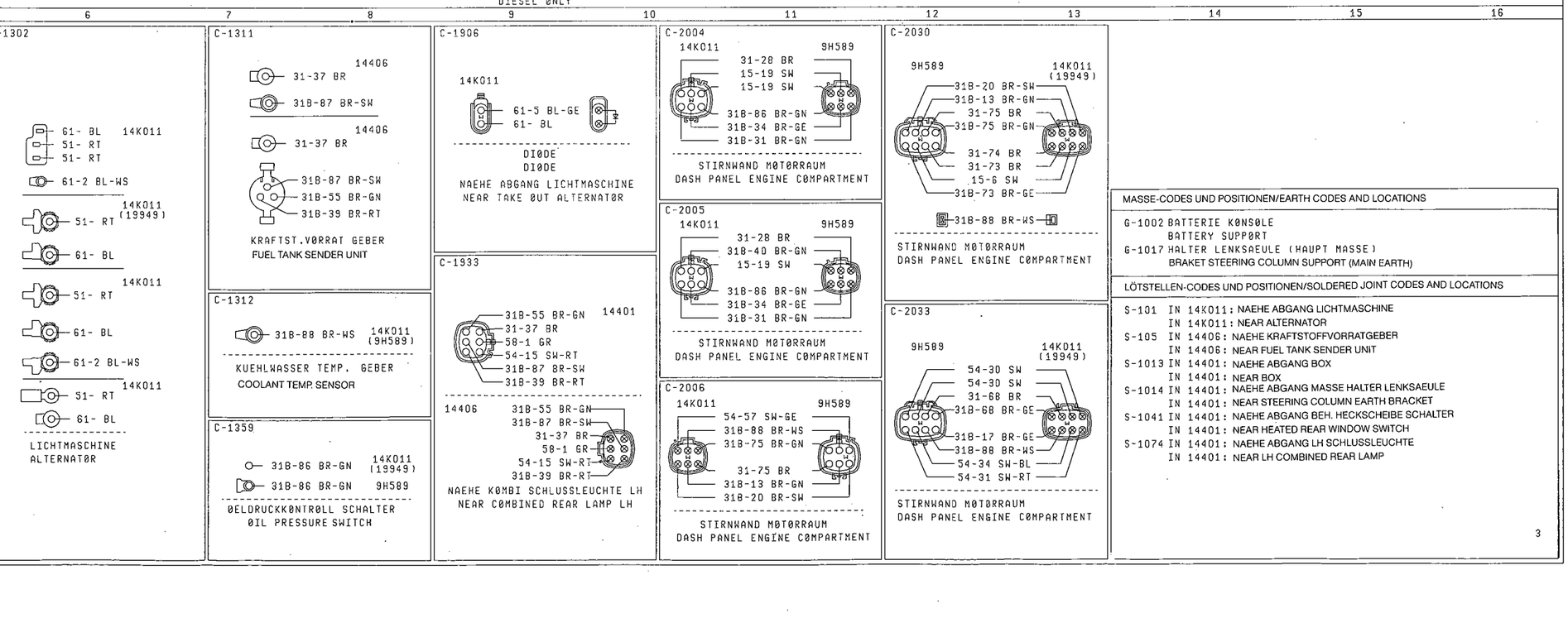
GROUND CONNECTION CODES

G-1002	CLOSE TO BATTERY
G-1005	CLOSE TO LEFT HEAD LIGHT
G-1010	CLOSE TO TAILGATE LOCK
G-1017	TO THROTTLE CABLE MOUNT

SHIELDED CABLE WITH GROUND CONNECTION ON BOTH SIDES


C-1936
30-2S RT-BL
1-3 GN
54-15 SW-RT
15-11 SW
31B-88 BR-WS
2 SIERRA '87 BATTERY
3A SIERRA '87 TO TACHO
2 SIERRA '87 IGNITION SWITCH
3A SIERRA '87 WATER TEMP. GAUGE
C-1312
TRANSM. WATER TEMP. SENDER
HEGO-SENSOR
C-2026
KNOCK SENSOR
C-2025
CANISTER PURGE VALVE
C-2024
C-1933
S-105
C-1631
S-1033
C-1013
G-1013
FUEL PUMP
IGNITION ADJUST
C-1942
31-62 BR
15-10 SW
15-9 SW
31-29 BR
31-1 BR
C-1017
G-1017
AIR CONDITIONER INPUT
C-2027
DIAGNOSTIC SYSTEM
C-1941
9-26 BL-WS
9-27 BL-GE
31B-44 BR-GN
31-29 BR
S-1047
30-43A RT
FILTER
C-1916
IGNITION COIL
C-1912
DISTRIBUTOR
C-2008
TFI-MODULE
C-2016
15A-SW-GE
1-3 GN
15A-A SW
1-5 GN-GE
15-13 SW-RT
31B-35 BR-GN
S-1053
30-28 RT
30-29 RT-WS
C-2022
C-2023
S-1054
S-1048
15-110 SW
31B-11 BR-GN
S-1050
ECU-MODULE
S-1049
S-1051
54-15B SW-RT
30-28 RT
54-15 SW-RT
31B-68 BR-GE
9-20 BL-GN
54-11 BL-SW
30-29 RT-WS
30-42 RT
S-1052
C-2004
C-2003
C-2005
C-2007
C-2002
C-2006
C-2001
C-2013
C-2014
C-2009
C-2010
C-2011
C-2012
ENGINE SPEED/TDC SENSOR
ENGINE COOLANT TEMPERATURE SENSOR
CHARGE AIR TEMPERATURE SENSOR
MANIFOLD ABSOLUTE PRESSURE SENSOR
THROTTLE POSITION SENSOR
WASTE-GATE CONTROL
IDLE SPEED CONTROL VALVE
FUEL PUMP RELAY M10
FUEL INJECTION RELAY M11
INJECTOR VALVE I
INJECTOR VALVE II
INJECTOR VALVE III
INJECTOR VALVE IV
C-2000
C-1941 14K011
9-27 BL-GE
9-26 BL-WS
31B-44 BR-GN
DIAGNOSTIC SYSTEM
C-1942 14K011
31-62 BR
15-9 SW
15-10 SW
IGNITION ADJUST
C-2000 14K011
ECU-MODULE
C-2001 14K011
IDLE SPEED CONTROL VALVE
C-2002 14K011
THROTTLE POSITION SENSOR
C-2003 14K011
ENGINE COOLANT TEMP. SENSOR
C-2004 14K011
ENGINE SPEED/TDC SENSOR
C-1013 14401
AN G-1013
C-1017 14K011
AN G-1017
C-1312 14K011
TRANSM. WATER TEMP. SENDER
C-1631 14406
FUEL PUMP
C-1912 14K011
IGNITION COIL
C-1916 14K011
FILTER
C-1933 14401
NEAR COMBINED REAR-LAMP (RH)
C-1936 14K011
ENGINE COMPARTMENT BEHIND BATTERY



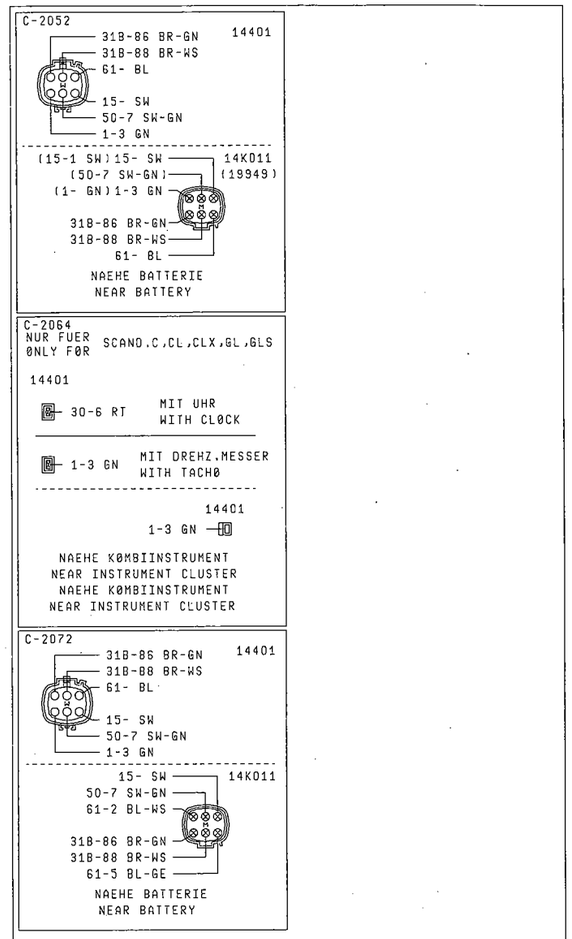


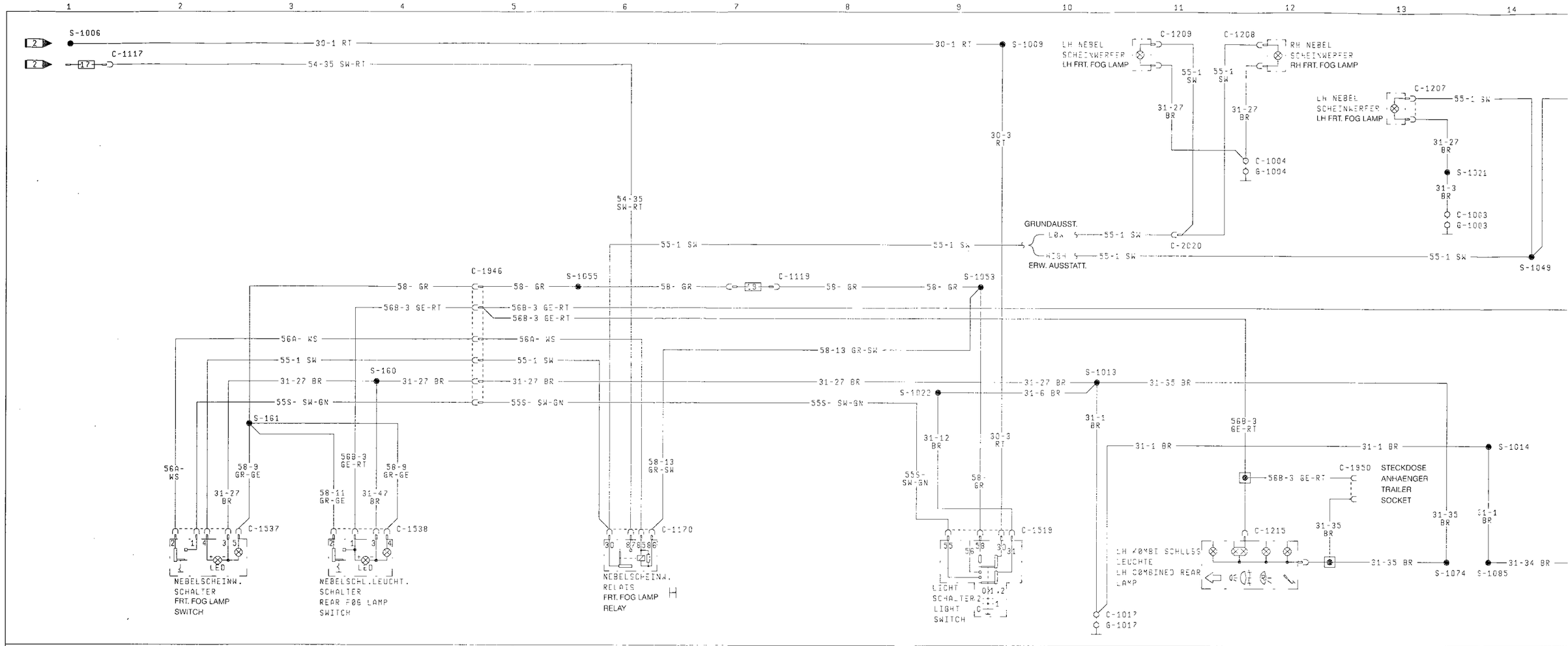
MASSE-CODES UND POSITIONEN/EARTH CODES AND LOCATIONS

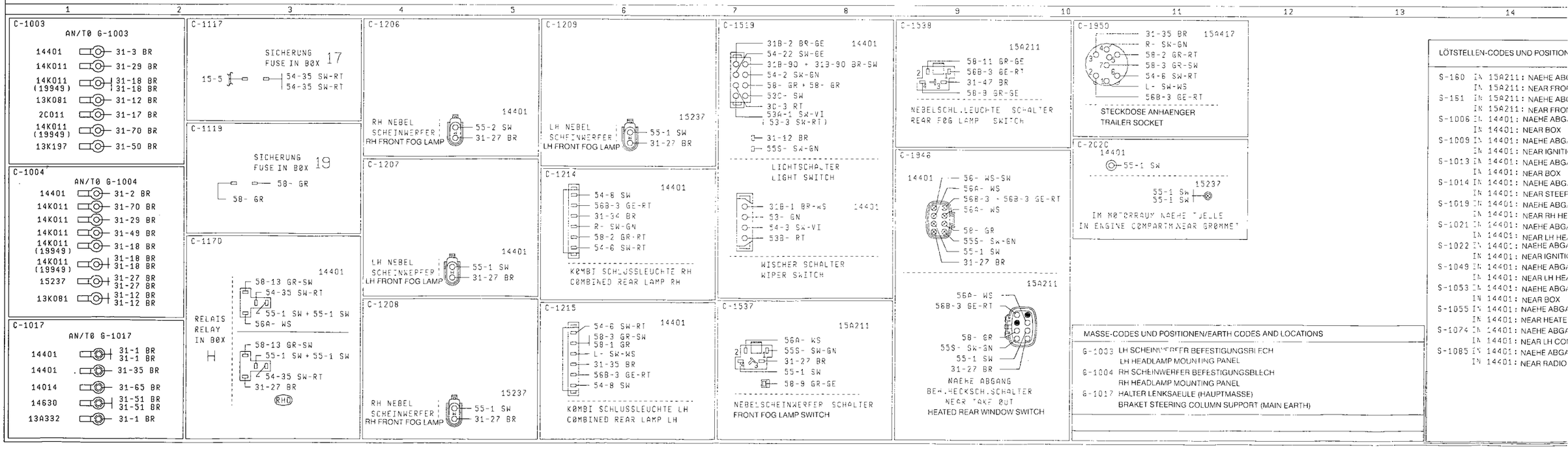
G-1002 BATTERIE KØNSØLE
BATTERY SUPPØRT
G-1017 HALTER LENKSAEULE (HAUPT MASSE)
BRAKET STEERING COLUMN SUPPORT (MAIN EARTH)

LÖTSTELLEN-CODES UND POSITIONEN/SOLDERED JOINT CODES AND LOCATIONS

S-101 IN 14KØ11: NAEHE ABGANG LICHTMASCHINE
IN 14KØ11: NEAR ALTERNATOR
S-105 IN 14406: NAEHE KRAFTSTOFFVORRATGEBER
IN 14406: NEAR FUEL TANK SENDER UNIT
S-1013 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1014 IN 14401: NAEHE ABGANG MASSE HALTER LENKSAEULE
IN 14401: NEAR STEERING COLUMN EARTH BRACKET
S-1041 IN 14401: NAEHE ABGANG BEH. HECKSCHEIBE SCHALTER
IN 14401: NEAR HEATED REAR WINDOW SWITCH
S-1074 IN 14401: NAEHE ABGANG LH SCHLUSSLEUCHTE
IN 14401: NEAR LH COMBINED REAR LAMP





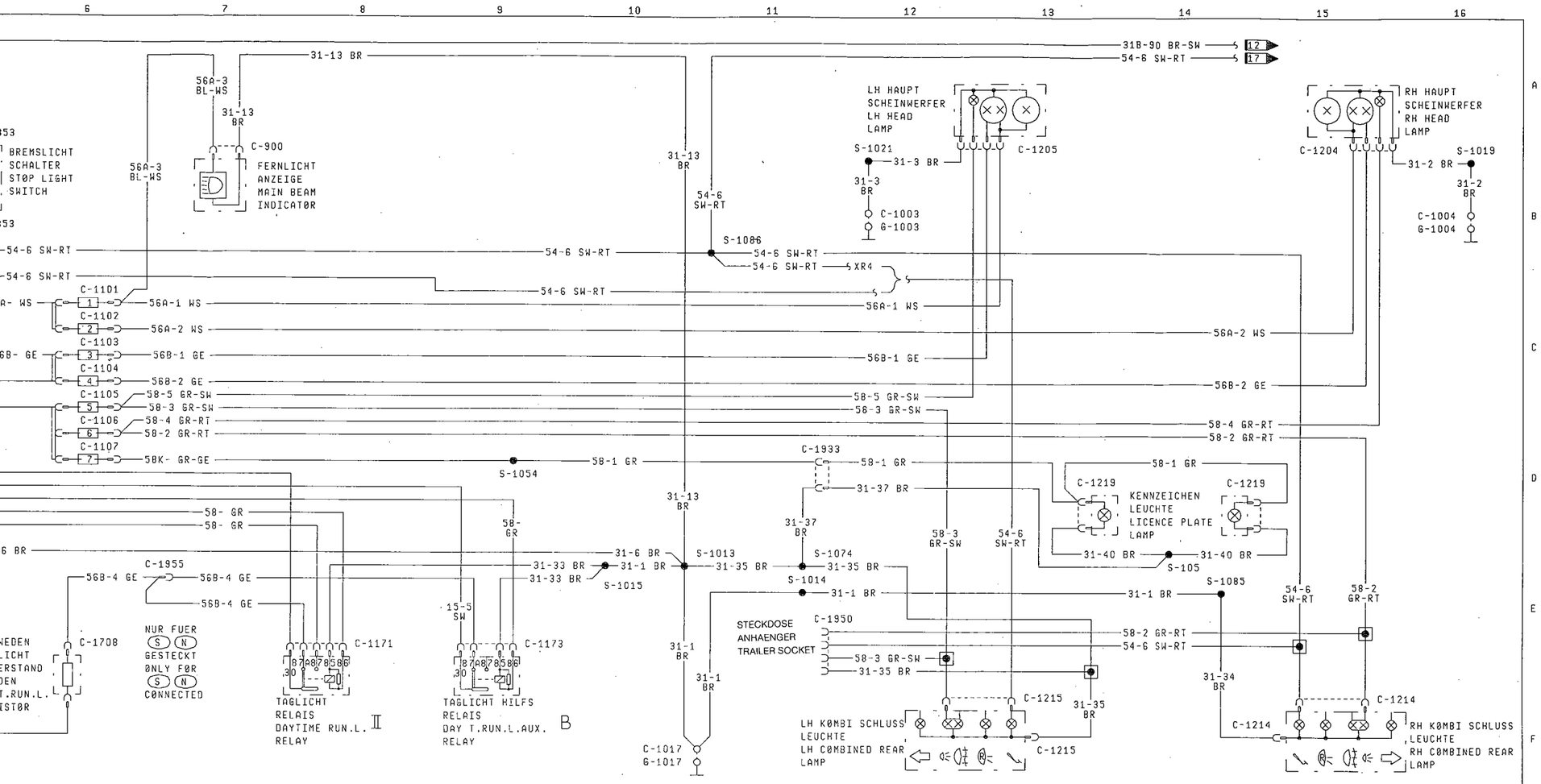


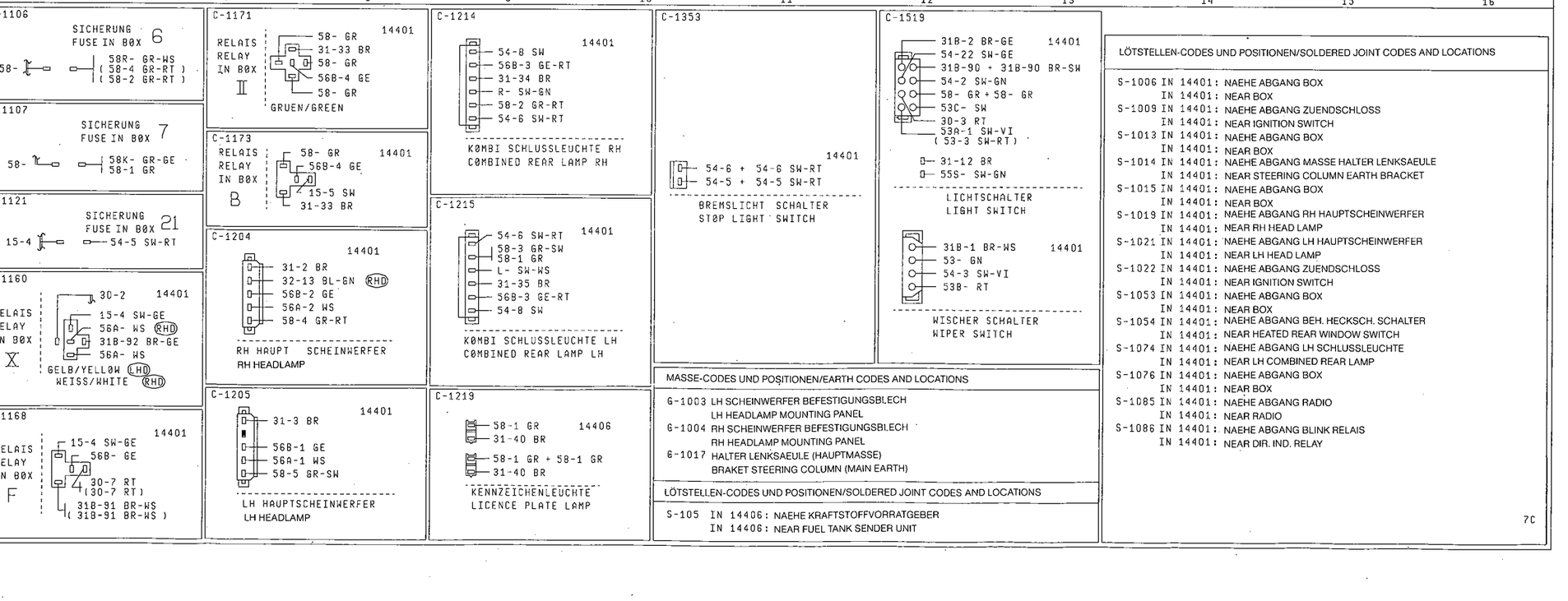
LÖTSTELLEN-CODES UND POSITION

S-160 IN 15A211: NAEHE ABG
IN 15A211: NEAR FRO
S-161 IN 15A211: NAEHE ABG
IN 15A211: NEAR FRO
S-1006 IN 14401: NAEHE ABG
IN 14401: NEAR BOX
S-1009 IN 14401: NAEHE ABG
IN 14401: NEAR IGNITI
S-1013 IN 14401: NAEHE ABG
IN 14401: NEAR BOX
S-1014 IN 14401: NAEHE ABG
IN 14401: NEAR STEEP
S-1019 IN 14401: NAEHE ABG
IN 14401: NEAR RH HE
S-1021 IN 14401: NAEHE ABG
IN 14401: NEAR LH HE
S-1022 IN 14401: NAEHE ABG
IN 14401: NEAR IGNITI
S-1049 IN 14401: NAEHE ABG
IN 14401: NEAR LH HE
S-1053 IN 14401: NAEHE ABG
IN 14401: NEAR BOX
S-1055 IN 14401: NAEHE ABG
IN 14401: NEAR HEATE
S-1074 IN 14401: NAEHE ABG
IN 14401: NEAR LH CO
S-1085 IN 14401: NAEHE ABG
IN 14401: NEAR RADIO

MASSE-CODES UND POSITIONEN/EARTH CODES AND LOCATIONS

G-1003 LH SCHEINWERFER BEFESTIGUNGSBLECH
LH HEADLAMP MOUNTING PANEL
G-1004 RH SCHEINWERFER BEFESTIGUNGSBLECH
RH HEADLAMP MOUNTING PANEL
G-1017 HALTER LENKSAEULE (HAUPTMASSE)
BRAKET STEERING COLUMN SUPPORT (MAIN EARTH)





MASSE-CODES UND POSITIONEN/EARTH CODES AND LOCATIONS

G-1003 LH SCHEINWERFER BEFESTIGUNGSBLECH
LH HEADLAMP MOUNTING PANEL
G-1004 RH SCHEINWERFER BEFESTIGUNGSBLECH
RH HEADLAMP MOUNTING PANEL
G-1017 HALTER LENKSAEULE (HAUPTMASSE)
BRAKET STEERING COLUMN (MAIN EARTH)

LÖTSTELLEN-CODES UND POSITIONEN/SOLDERED JOINT CODES AND LOCATIONS

S-105 IN 14406: NAEHE KRAFTSTOFFVORRATGEBER
IN 14406: NEAR FUEL TANK SENDER UNIT

LÖTSTELLEN-CODES UND POSITIONEN/SOLDERED JOINT CODES AND LOCATIONS

S-1006 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1009 IN 14401: NAEHE ABGANG ZUENDSCHLOSS
IN 14401: NEAR IGNITION SWITCH
S-1013 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1014 IN 14401: NAEHE ABGANG MASSE HALTER LENKSAEULE
IN 14401: NEAR STEERING COLUMN EARTH BRACKET
S-1015 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1019 IN 14401: NAEHE ABGANG RH HAUPTSCHEINWERFER
IN 14401: NEAR RH HEAD LAMP
S-1021 IN 14401: NAEHE ABGANG LH HAUPTSCHEINWERFER
IN 14401: NEAR LH HEAD LAMP
S-1022 IN 14401: NAEHE ABGANG ZUENDSCHLOSS
IN 14401: NEAR IGNITION SWITCH
S-1053 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1054 IN 14401: NAEHE ABGANG BEH. HECKSCH. SCHALTER
IN 14401: NEAR HEATED REAR WINDOW SWITCH
S-1074 IN 14401: NAEHE ABGANG LH SCHLUSSLEUCHTE
IN 14401: NEAR LH COMBINED REAR LAMP
S-1076 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1085 IN 14401: NAEHE ABGANG RADIO
IN 14401: NEAR RADIO
S-1086 IN 14401: NAEHE ABGANG BLINK RELAIS
IN 14401: NEAR DIR. IND. RELAY

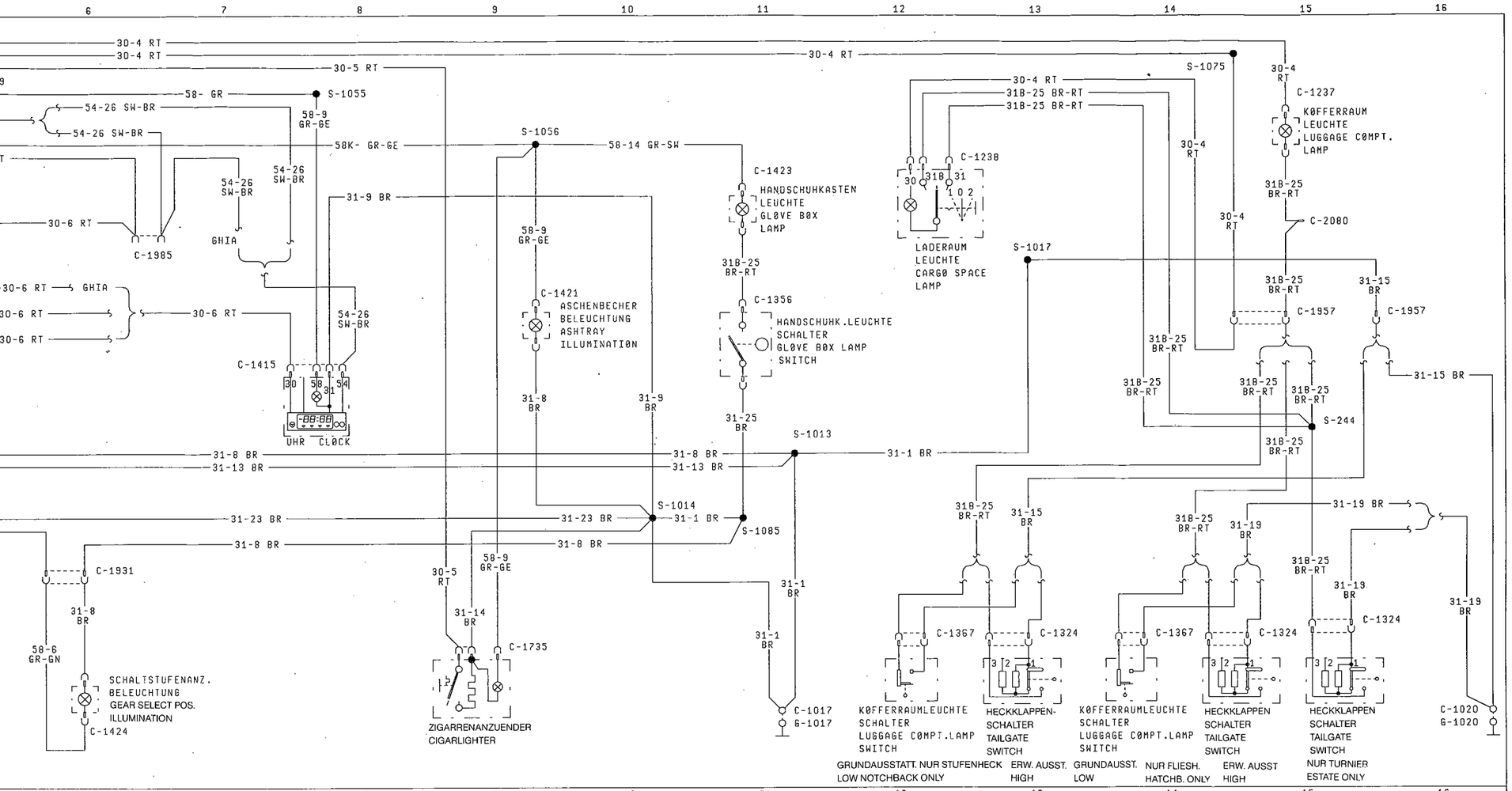
C-1520
30-9 RT 14401
49-2 SW-RT
49A- SW-WS
L- SW-WS
R- SW-GN
49- SW
31B-90 BR-SW
31B-90 BR-SW
31B-91 BR-WS
31B-92 BR-GE
31-33 BR
ABBLENDSCHALTER DIMMER SWITCH

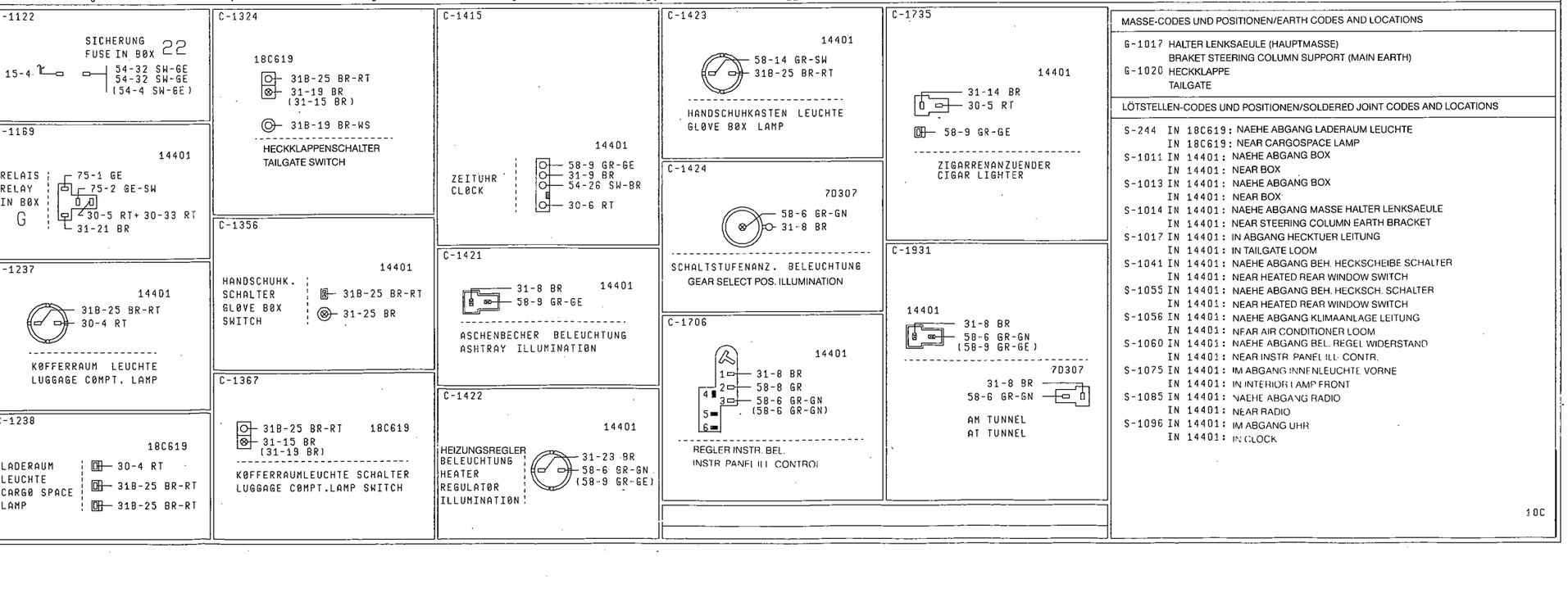
C-1708
56B-4 GE 14401
56B-5 GE 14401
WIDERSTANDSLEITUNG RESISTØR WIRE

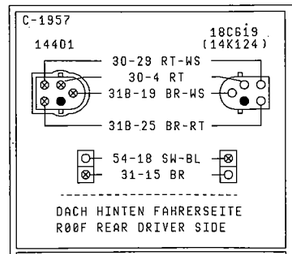
C-1933
31B-55 BR-GN 14401
31-37 BR
58-1 GR
54-15 SW-RT
31B-87 BR-SW
31B-39 BR-RT
14406
31B-55 BR-GN
31B-87 BR-SW
31-37 BR
58-1 GR
54-15 SW-RT
31B-39 BR-RT
NAEHE KØMBI SCHLUSSLEUCHTE LH NEAR CØMBINED REAR LAMP LH

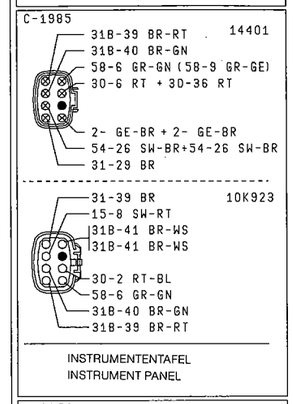
C-1950
31-35 BR 15A417
R- SW-GN
58-2 GR-RT
58-3 GR-SW
54-6 SW-RT
L- SW-WS
56B-3 GE-RT
STECKDOSE ANHAENGER TRAILER SOCKET

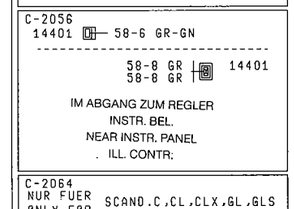
C-1955
56B-4 + 56B-4 GE 14401
14401 56B-4 GE
STIRNWAND MØTØRRAUM DASH PANEL ENGINE CØMPARTMENT

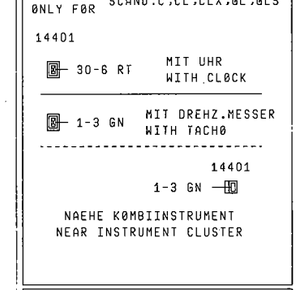

30-4 RT
30-5 RT
58- GR
S-1055
54-26 SW-BR
58-9 GR-GE
58K- GR-GE
54-26 SW-BR
30-6 RT
C-1985
GHIA
31-9 BR
S-1056
58-14 GR-SW
58-9 GR-GE
C-1423
HANDSCHUHKASTEN LEUCHTE GLØVE BØX LAMP
C-1421
ASCHENBECHER BELEUCHTUNG ASHTRAY ILLUMINATIØN
C-1415
UHR CLØCK
C-1356
HANDSCHUHK.LEUCHTE SCHALTER GLØVE BØX LAMP SWITCH
31-25 BR
S-1013
31-8 BR
31-13 BR
31-1 BR
S-1014
31-23 BR
S-1085
C-1931
58-6 GR-GN
SCHALTSTUFENANZ. BELEUCHTUNG GEAR SELECT POS. ILLUMINATION
C-1424
30-5 RT
31-14 BR
C-1735
ZIGARRENANZUENDER CIGARLIGHTER
C-1238
LADERAUM LEUCHTE CARGØ SPACE LAMP
S-1075
C-1237
KØFFERRAUM LEUCHTE LUGGAGE CØMPT. LAMP
C-2080
S-1017
C-1957
S-244
C-1367
C-1324
KØFFERRAUMLEUCHTE SCHALTER LUGGAGE CØMPT.LAMP SWITCH
HECKKLAPPEN-SCHALTER TAILGATE SWITCH
C-1017
G-1017
C-1020
G-1020
GRUNDAUSSTATT. NUR STUFENHECK LOW NOTCHBACK ONLY
ERW. AUSST. HIGH
GRUNDAUSST. LOW
NUR FLIESH. HATCHB. ONLY
ERW. AUSST HIGH
HECKKLAPPEN SCHALTER TAILGATE SWITCH NUR TURNIER ESTATE ONLY

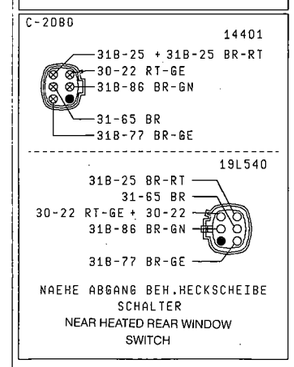

C-1122
SICHERUNG FUSE IN BØX 22
54-32 SW-GE
54-32 SW-GE
(54-4 SW-GE)
C-1169
RELAIS RELAY IN BØX G
75-1 GE
75-2 GE-SW
30-5 RT+ 30-33 RT
31-21 BR
C-1237
KØFFERRAUM LEUCHTE LUGGAGE CØMPT. LAMP
C-1238
LADERAUM LEUCHTE CARGØ SPACE LAMP
30-4 RT
31B-25 BR-RT
C-1324
18C619
31-19 BR (31-15 BR)
31B-19 BR-WS
HECKKLAPPENSCHALTER TAILGATE SWITCH
C-1356
HANDSCHUHK. SCHALTER GLØVE BØX SWITCH
31-25 BR
C-1367
31-15 BR (31-19 BR)
KØFFERRAUMLEUCHTE SCHALTER LUGGAGE CØMPT.LAMP SWITCH
C-1415
ZEITUHR CLØCK
58-9 GR-GE
31-9 BR
54-26 SW-BR
30-6 RT
C-1421
31-8 BR
58-9 GR-GE
ASCHENBECHER BELEUCHTUNG ASHTRAY ILLUMINATIØN
C-1422
HEIZUNGSREGLER BELEUCHTUNG HEATER REGULATØR ILLUMINATIØN
31-23 BR
58-6 GR-GN
(58-9 GR-GE)
C-1423
58-14 GR-SW
31B-25 BR-RT
HANDSCHUHKASTEN LEUCHTE GLØVE BØX LAMP
C-1424
7D307
58-6 GR-GN
31-8 BR
SCHALTSTUFENANZ. BELEUCHTUNG GEAR SELECT POS. ILLUMINATION
C-1706
31-8 BR
58-8 GR
58-6 GR-GN
(58-6 GR-GN)
REGLER INSTR. BEL. INSTR PANEL ILL CONTROL
C-1735
31-14 BR
30-5 RT
58-9 GR-GE
ZIGARRENANZUENDER CIGAR LIGHTER
C-1931
31-8 BR
58-6 GR-GN
(58-9 GR-GE)
AM TUNNEL AT TUNNEL
MASSE-CODES UND POSITIONEN/EARTH CODES AND LOCATIONS
G-1017 HALTER LENKSAEULE (HAUPTMASSE)
BRAKET STEERING COLUMN SUPPORT (MAIN EARTH)
G-1020 HECKKLAPPE
TAILGATE
LÖTSTELLEN-CODES UND POSITIONEN/SOLDERED JOINT CODES AND LOCATIONS
S-244 IN 18C619: NAEHE ABGANG LADERAUM LEUCHTE
IN 18C619: NEAR CARGOSPACE LAMP
S-1011 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1013 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1014 IN 14401: NAEHE ABGANG MASSE HALTER LENKSAEULE
IN 14401: NEAR STEERING COLUMN EARTH BRACKET
S-1017 IN 14401: IN ABGANG HECKTUER LEITUNG
IN 14401: IN TAILGATE LOOM
S-1041 IN 14401: NAEHE ABGANG BEH. HECKSCHEIBE SCHALTER
IN 14401: NEAR HEATED REAR WINDOW SWITCH
S-1055 IN 14401: NAEHE ABGANG BEH. HECKSCH. SCHALTER
IN 14401: NEAR HEATED REAR WINDOW SWITCH
S-1056 IN 14401: NAEHE ABGANG KLIMAANLAGE LEITUNG
IN 14401: NEAR AIR CONDITIONER LOOM
S-1060 IN 14401: NAEHE ABGANG BEL. REGEL WIDERSTAND
IN 14401: NEAR INSTR. PANEL ILL. CONTR.
S-1075 IN 14401: IM ABGANG INNENLEUCHTE VORNE
IN 14401: IN INTERIOR LAMP FRONT
S-1085 IN 14401: NAEHE ABGANG RADIO
IN 14401: NEAR RADIO
S-1096 IN 14401: IM ABGANG UHR
IN 14401: IN CLOCK
10C

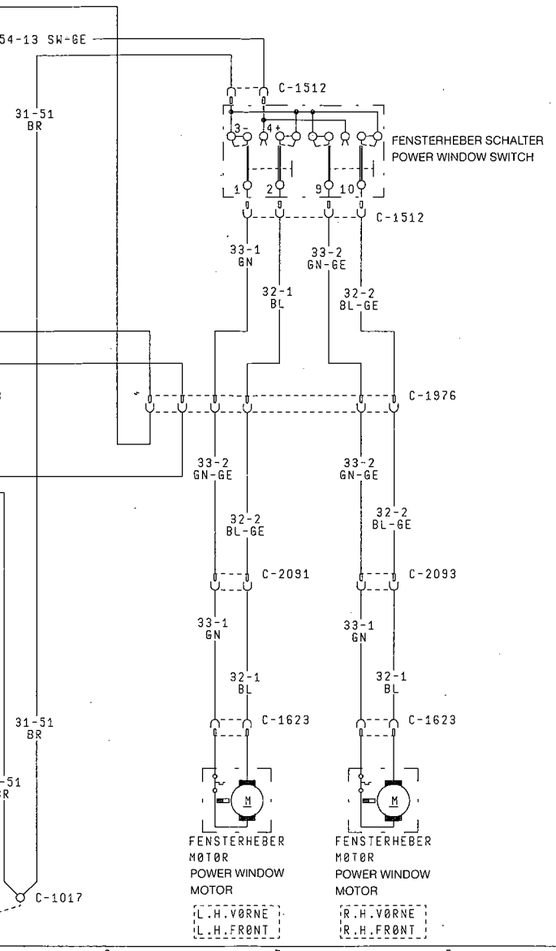

C-1957
14401
18C619 (14K124)
30-28 RT-WS
30-4 RT
31B-19 BR-WS
31B-25 BR-RT
54-18 SW-BL
31-15 BR
DACH HINTEN FAHRERSEITE
R00F REAR DRIVER SIDE

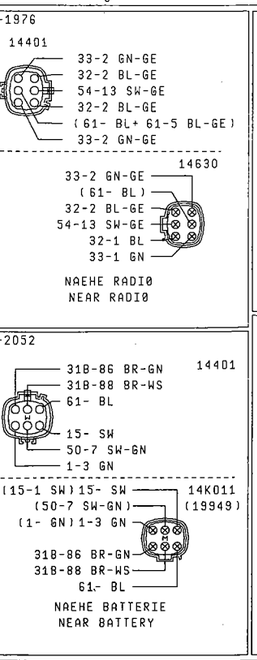

C-1985
14401
31B-39 BR-RT
31B-40 BR-GN
58-6 GR-GN (58-9 GR-GE)
30-6 RT + 30-36 RT
2- GE-BR + 2- GE-BR
54-26 SW-BR+54-26 SW-BR
31-29 BR
10K923
31-39 BR
15-8 SW-RT
31B-41 BR-WS
31B-41 BR-WS
30-2 RT-BL
58-6 GR-GN
31B-40 BR-GN
31B-39 BR-RT
INSTRUMENTENTAFEL
INSTRUMENT PANEL

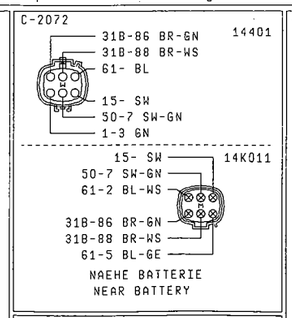

C-2056
14401
58-6 GR-GN
58-8 GR
58-8 GR
14401
IM ABGANG ZUM REGLER
INSTR. BEL.
NEAR INSTR. PANEL
ILL. CONTR.

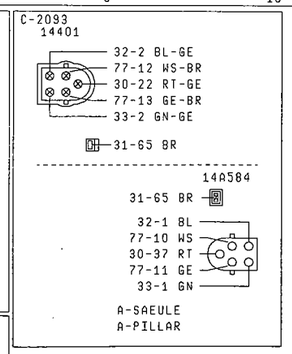

C-2D64
NUR FUER ØNLY FØR
SCAND.C,CL,CLX,GL,GLS
14401
30-6 RT
MIT UHR
WITH CLØCK
1-3 GN
MIT DREHZ.MESSER
WITH TACHØ
14401
1-3 GN
NAEHE KØMBIINSTRUMENT
NEAR INSTRUMENT CLUSTER

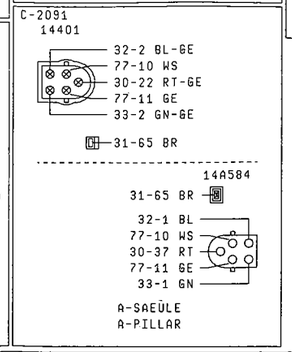

C-2D80
14401
31B-25 + 31B-25 BR-RT
30-22 RT-GE
31B-86 BR-GN
31-65 BR
31B-77 BR-GE
19L540
31B-25 BR-RT
31-65 BR
30-22 RT-GE + 30-22
31B-86 BR-GN
31B-77 BR-GE
NAEHE ABGANG BEH.HECKSCHEIBE SCHALTER
NEAR HEATED REAR WINDOW SWITCH











MASSE-CODES UND POSITIONEN/EARTH CODES AND LOCATIONS

G-1017 HALTER LENKSAEULE (HAUPTMASSE)
BRAKET STEERING COLUMN SUPPORT (MAIN EARTH)

LÖTSTELLEN-CODES UND POSITIONEN/SOLDERED JOINT CODES AND LOCATIONS

S-1006 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1013 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX
S-1015 IN 14401: NAEHE ABGANG BOX
IN 14401: NEAR BOX

FORD

SIERRA RS COSWORTH
and
ESCORT RS COSWORTH

Workshop Manual

Ford

Volume I
Volume II

This Workshop Manual reproduces pages from the Ford Sierra RS Cosworth and Ford Escort RS Cosworth service microfiche and details technical service information required for components not already covered in previously issued Dealer literature. Note that, unlike the previous issue, CG473, covering the Sierra RS Cosworth only, this manual does not include system test sections. For vehicle system tests, reference should be made to the appropriate Vehicle System Test Manual.

The manual is designed primarily for use by Ford dealerships and gives repair and adjustment procedures to-gether with component illustrations, technical data and details of special tools or equipment which may be required. The repair and adjustment procedures are intended as a guide for both the fully qualified and the less experienced technician.

The repair operations numbering sequence used in all Sections corresponds to that used in the Ford Car Labour Time Schedule.

FOR ALL REPAIR OPERATIONS AND PROCEDURES WHICH ARE NOT DESCRIBED IN THIS MANUAL, REFERENCE SHOULD BE MADE TO THE FORD SIERRA '87 ONWARDS SERVICE MICROFICHE (CG1464), FORD SIERRA RS COSWORTH SERVICE MICROFICHE (CG534) OR THE FORD ESCORT/ORION '91 SERVICE MICROFICHE (CG1524) AS NECESSARY.

OWNERS AND OPERATORS ARE ADVISED TO ALLOW ONLY AUTHORISED FORD DEALERSHIPS TO CARRY OUT THE MORE COMPLEX REPAIRS SUCH AS THE OVERHAUL OF A TRANSMISSION OR DIFFERENTIAL ASSEMBLY, PARTICULARLY THOSE REQUIRING SPECIALISED TOOLING AND KNOWLEDGE.

REPLACEMENT PARTS

Behind all FORD and MOTORCRAFT products are the vast resources of the worldwide Parts Supply Operations which can supply replacement parts made to the same exacting standards as the original factory fitted components.

FOR THIS REASON, INSIST THAT ONLY GENUINE FORD OR MOTORCRAFT PARTS ARE USED AS SERVICE REPLACEMENTS.

SPECIAL TOOLS

The Special Service Tool recognition chart given at the start of each section shows all European sourced tools desirable or necessary to carry out a satisfactory repair. When possible, illustrations are given to assist in identifying the tool needed.

Special Service Tools may be ordered from:

V.L. Churchill Ltd.
P.O. Box No.3
London Road
Daventry
Northants NN11 4NF
ENGLAND

V. Löwener
W 4018 Langenfeld
Postfach 2262
Industriestrasse 67
GERMANY

O.P.T.O.M. S.A.
Polígono Industrial Del Henares
(Ampliacion)
Parcela No. 58
19080 Guadalajara
SPAIN

FORD

SIERRA RS COSWORTH
and
ESCORT RS COSWORTH

Workshop Manual

Ford

Volume I

VOLUME I

00 INTRODUCTION

01 FORMAT AND USAGE
02 VEHICLE IDENTIFICATION
04 FUEL CONSUMPTION
05 HEALTH AND SAFETY PRECAUTIONS
06 STANDARD PRACTICES
07 APPLICATION AND USE OF SPECIFICATIONS
08 SOLVENTS AND SEALERS
09 ROAD OR ROLLER TESTING

11 WHEELS AND TYRES

12 BRAKING SYSTEM - ESCORT
12C BRAKING SYSTEM - SIERRA

13A POWER ASSISTED STEERING - ESCORT
13B POWER ASSISTED STEERING - SIERRA

14A FRONT AXLE AND SUSPENSION - SIERRA
14B FRONT AXLE, SUSPENSION AND DRIVESHAFTS - MT75/4x4
14C FRONT AXLE AND SUSTENSION - ESCORT

15 REAR AXLE, SUSPENSION AND DRIVESHAFT

16A MANUAL TRANSMISSION AND CLUTCH - BORG WARNER
16B MANUAL TRANSMISSION AND CLUTCH - MT75

VOLUME II

21A Engine - Sierra
21B Engine - Sierra 4x4
21C Engine - Escort

22 Ignition System

23 Fuel System

24A Cooling System
24B Cooling System - 4x4

25A Exhaust System
25B Exhaust System - 4x4

26 Starting System

29L Engine Management and Emission System - Sierra
29T Engine Management and Emission System - Sierra 4x4
29W Engine Management and Emission System - Escort

31 Charging System

32 Exterior Lights, Direction Indicators, Horn and Windscreen Wipers - Sierra
32A Exterior Lights, Direction Indicators, Horn and Windscreen Wipers - Escort

33 Interior Lights, Instruments, Instrument Panel Controls - Escort

34A Heating and Ventilation - Sierra
34B Air Conditioning - Escort

43 Interior and Exterior Trim

54 Pre-Delivery and Maintenance Procedures

For operations and sections not included in this manual, refer to either the Sierra '87 Microfiche or the Escort/Orion '91 Microfiche, as appropriate.

FORMAT AND USAGE 01

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Format 2

Usage 2

787

FORMAT

Groups

The manual is divided into six main groups:

0 - General Information	2 - Engine	4 - Body
1 - Chassis	3 - Electrical	5 - Maintenance

Sections

Each group is then sub-divided into section, eg:

Group 2 - Engine comprises:

21 - Engine	23 - Fuel System	25 - Exhaust System	29 - Engine Management
22 - Ignition System	24 - Cooling System	26 - Starting System	

USAGE

Section Contents

Where applicable, each section comprises the following:

Index This will be frame one of the section and is an itemised list and page location of the content of the section. It also includes a list and page location of each operation covered in the section.

Technical Data - A listing of essential information required during service and repair operations, eg. tightening torques, ignition timings, critical dimensions etc.

Special Service Tool Recognition - This is an illustrated list of special tools and suitable equipment required to carry out the repair procedures described.

Service and Repair Operations - A series of procedures selected to give coverage of the normal repairs undertaken in the workshop.

The removal and installation of some components is not covered in detail because the procedure is essentially simple and straight forward. Where a repair procedure is not covered, it may be for one of the following reasons:

1. The component may have been introduced after the repair operations were issued.
2. The component may be classed as not repairable due to the requirement for specialist equipment to ensure its correct function and adjustment after repair. (Non-service Item).
3. The component may be classed as not economical to repair, with renewal being less costly than dismantling and overhaul.
4. The repair may be of specialist nature, possibly covered in another FORD publication. For instance: Tyre repairs, fuel injection equipment testing, overhaul and calibration.

VEHICLE IDENTIFICATION 02

Index Page

Code Definition 2

CODE DEFINITION (cont'd)

(Box 13) VERSION Provision for locally required codes by certain territories.

(BOX 14) BODY COLOUR

A - Black '69 (XSC 632)
B - Diamond White '73 (XSC 691)
C -
D - Galaxy Blue '87 (XSC 2101A)
E - Burgundy '87 (XSC 2079A)
F - Maritime Blue '91 (XSC 2009A)
G -
H -
J - Pacifica Blue (XSC 2360CM)
K - Tasman '86 (XSC 1903C)
L - Aqua Jade '91 (XSC 2240C)
M -
N - Verona Green '91 (XSC 2398C) Polaris Grey (XCS 2455C)
P - Radiant Red '89 (XSC 2251A)
Q - Mercury Grey '87 (XSC 2076C)
R -
S -
T - Flint Grey '89 (XSC 2228C)
U - Crystal Blue '87 (XSC 2028C)
V - Strato Silver '91 (XSC 1056C)
W -
X -
Y - Special Vehicles
Z -
0 - Aztec Gold '91 (XSC 2387C)
1 - Magenta '89 (XSC 2159CM)
2 -
3 - Biscayne Blue
4 - Mallard Green (XSC 2683 CM)
5 - Moonstone Blue '89 (XSC 1903C)
6 - Moondust Silver '91 (XSC 2431C)
7 -
8 - Olympic Gold '91 (XSC 2231C)
9 -

For vehicles built in Britain the second digit of the paint code denotes the current model year. For vehicles built on the continent the second digit of the paint code denotes the model year the colour was introduced.

Box 15 EXHAUST EMISSIONS

Code	7	U	
Exhaust Emission Level	15:04	83 US	

CODE DEFINITION

(Box 7) STEERING

Code	1 or A	2 or B
Drive	Left-hand drive	Right-hand drive

(Box 8) ENGINE

Code	N 5	
Type	DOHC/I-4 EFI Turbo	
Capacity	litres 2,0	
Power	kw (DIN) 4 x 2 150,0 4 x 4 161,0	

(Box 9) TRANSMISSION

Code	J	L	8
Type	Man (5-speed) Borg Warner T5	Man (5-speed) Borg Warner	Man (5 speed) MT-75

(Box 10) AXLE

Code	3	U	
Axle ratio	3,64	3,62	

(Box 11) INTERIOR TRIM

Code	J	L	M	S	
Colour	Bluestone	Shadow	Mace	Raven	

(Box 12) TYPE

1st letter	2nd letter	3rd letter	4th & 5th letter	6th & 7th letter
Model	Body Type	Year of Homologation	20 = 2,0 litre	-
A = Escort B = Sierra	B = 3 Door F = 4 Door	G = 1986	Belgium & Luxemburg only	Identification not required

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CODE DEFINITION

(Box 1) NATIONAL TYPE APPROVAL NUMBER

A unique code required by certain territories.

(Box 2) VEHICLE IDENTIFICATION NUMBER (VIN)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
*	W	F	0	F	X	X	G	B	B	F	K	C	1	2	3	4	5	*

eg Sierra 4-door saloon, manufactured in Genk, West Germany during September 1989.

(Digit 1): Constant asterisk - (*)

A) (Digit 2 - 4): World Manufacturer Indicator

Ford Werke A.G. - West Germany - WF0 (European vehicles) - WF1 (Federal vehicles)

B & G) (Digit 5 & 11): Model Variant:- BB - Saloon 3 door saloon BF - Sierra 4 door saloon
AM - Escort Cosworth

C) (Digit 6 & 7): Constant X

D) (Digit 8): Product Source Company:- G - Ford of Germany - Own assembly

E) (Digit 9): Assembly Plant:- B - Genk

F) (Digit 10): Model Range:- A - Escort B - Sierra

H) (Digit 12): Date of Manufacture - Year:- G - 1986 H - 1987 J - 1988
K - 1989 L - 1990 M - 1991
N - 1992 P - 1993

I) (Digit 13): Date of Manufacture - Month

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1988	B	R	A	G	C	K	D	E	L	Y	S	T
1989	J	U	M	P	B	R	A	G	C	K	D	E
1990	L	Y	S	T	J	U	M	P	B	R	A	G
1991	C	K	D	E	L	Y	S	T	J	U	M	P
1992	B	R	A	G	C	K	D	E	L	Y	S	T
1993	J	U	M	P	B	R	A	G	C	K	D	E

J) (Digit 14 - 18): Vehicle Sequence Number:- Five digits.

(Digit 19): Constant asterisk - (*)

(Box 3) GROSS VEHICLE MASS Indicates maximum legal laden mass, in territories where this is required.

(Box 4) GROSS TRAIN MASS Indicates the maximum combined mass of vehicle and trailer or caravan.

(Box 5) PERMITTED FRONT AXLE LOADING Maximum permissible load on the front wheels of the vehicle.

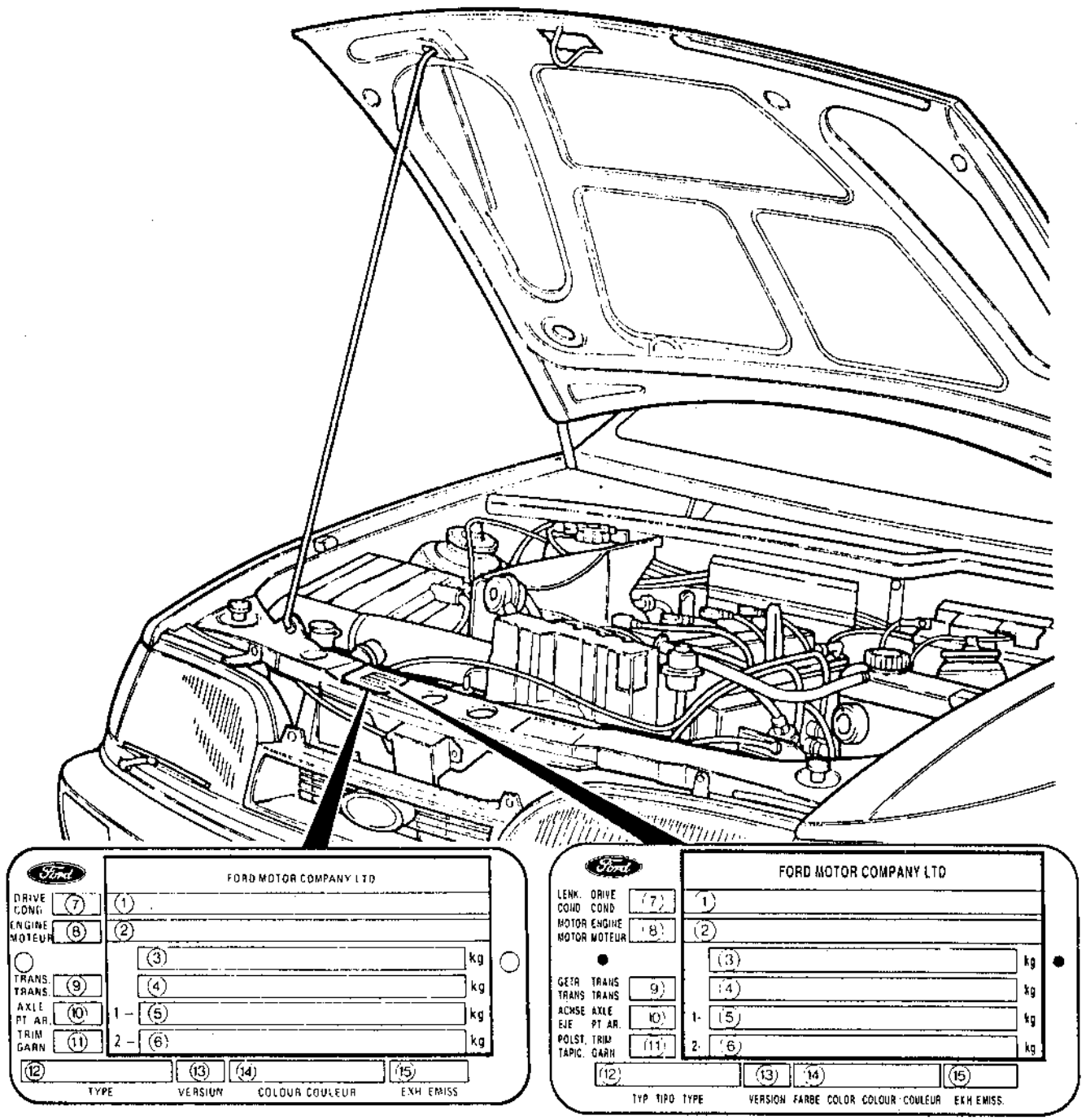
(Box 6) PERMITTED REAR AXLE LOADING Maximum permissible load on the rear wheels of the vehicle.

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CODE DEFINITION

Vehicle Identification (VIN) Plate Location

The vehicle identification plate which is rivetted to the front upper cross-member of each vehicle has embossed alpha-numerical codes which are explained on the following page. These codes indicate details of vehicle specifications in respect of type, permissible loading weights, engine, gear ratio, body paint colour, trim within the vehicle etc. They are therefore useful when procuring replacement parts. During production the two-language plate was replaced by a four-language plate. Both versions are shown in Fig.1.



COS-06-02 T

Fig.1 VIN Plate Location (Both two and four-language versions shown - Sierra illustrated).

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FUEL CONSUMPTION 04

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Fuel Consumption 2
Simulated Urban Driving 2
Consumption Data 3

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FUEL CONSUMPTION

Legal requirements in certain territories require that, for new passenger cars, official fuel consumption figures are included in service literature intended for presentation to the first purchaser of the vehicle.

A copy of the official fuel consumption figures for Sierra RS Cosworth models is published on page 04-03.

The fuel consumption of each class of car is determined in accordance with specified test procedures and three sets of data are given.

a) Simulated Urban Driving (ECE 15 cycle, see below for details)

b) Constant Speed Driving at 90 km/h (56 mph)

c) Constant Speed Driving at 120 km/h (75 mph)

A passenger car prepared for testing shall have been run-in and driven for at least 3000 km (1875 miles). It shall be clean, have its windows and air intakes closed, have any manually controlled device on the carburettor inlet in the "Summer" position, have in use only the equipment necessary for normal operation, have its heating system or air conditioner system switched off and have any temperature controlled radiator fan or any supercharger in the normal operating condition. The tyres shall be of atype normally fitted and inflated to the manufacturer's recommended pressures.

In addition to the above, the driving weight of the car, the type of fuel used, the lubricants used and the ambient air conditions during the test are controlled by the Regulations.

SIMULATED URBAN DRIVING

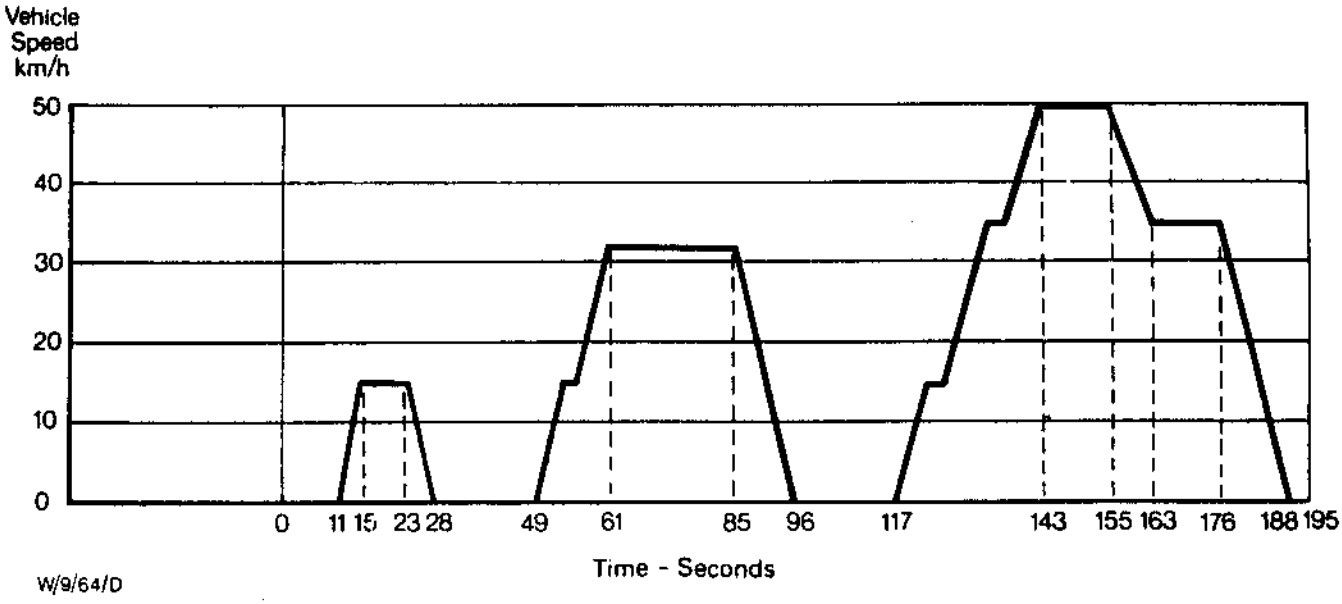


Fig.1. Simulated Urban Driving (ECE 15 Cycle).

The test cycle shown in Fig.1. can be described as follows:

Idle for 11 seconds, accelerate in 1st gear to 15 km/h (9,4 miles/h) in 4 seconds, maintain this for 8 seconds, decelerate to rest in 5 seconds. Idle for 21 seconds, accelerate to 32 km/h (20 miles/h) in 12 seconds (changing from 1st to 2nd gear at 15 km/h) hold this speed for 24 seconds, decelerate to rest in 11 seconds. Idle for 21 seconds, accelerate to 50 km/h (31,2 miles/h) in 26 seconds (changing from 1st to 2nd gear at 15 km/h and 2nd to 3rd gear at 35 km/h), hold this speed for 12 seconds, decelerate to 35 km/h (21,9 miles/h) in 8 seconds and hold this speed for a further 13 seconds, change to 2nd gear and decelerate to rest in 12 seconds. Idle for a final 7 seconds. This cycle should be carried out five times to ensure that the vehicle is at normal operating temperature. The complete fuel consumption test check comprises six consecutive test cycles, after the engine is at normal operating temperature, carried out without interruption. The total test cycle time is 19,5 minutes, the average speed is 19 km/h (11,9 miles/h) and the distance covered is 6,075 km (3,77 miles).

OWNER LITERATURE

To comply with the requirements of certain territories, Owner Handbooks contain official fuel consumption figures.

FUEL CONSUMPTION FIGURES

For reference purposes, the official fuel consumption figures for Sierra RS Cosworth vehicles are provided below. These figures were correct at the time of going to press. The consumption figures are the same for all trim levels of a particular engine variant, except where otherwise stated.

NOTE: All references to 'gallons' are Imperial gallons (1,2 U.S. Gallons).

The results do not express or imply any guarantee of the fuel consumption of any particular car. Individual vehicles are not tested and there are inevitably differences between different cars of the same model. In addition, any car may incorporate particular modifications. Furthermore the driver's style and road and traffic conditions, as well as the extent to which the car has been driven and the standard of maintenance, will all affect its fuel consumption.

MODEL/ ENGINE	BODY STYLE	TRANS-MISSION	FINAL DRIVE	TYRE SIZE	EMISS. LEVEL	FUEL CONSUMPTION Miles per Gallon A	B	C	Litres per 100 km A	B	C
2,0 Sierra DOCH Turbo	Saloon Hatch.	Man 5-sp	3,64	205/50VRx15	15:04	22,8	38,2	30,1	12,4	7,4	9,4
2,0 Sierra DOHC Turbo	Saloon Notch.	Man 5-sp	3,64	205/50VRx15	15:04	22,1	35,3	27,7	12,8	8,0	10,2
2,0 Sierra DOHC Turbo 4x4	Saloon Notch.	Man 5-sp	3,64	205/50VRx15	15:04	22,1	37,2	30,4	12,8	7,6	9,3
2,0 Sierra DOHC Turbo 4x4	Saloon Notch.	Man 5-sp	3,64	205/50VRx15	83 US	20,8	34,5	28,3	13,6	8,2	10,0
Escort 2,0 DOHC Turbo 4x4	Saloon Hatch.	Man 5-sp	3,64	205/50VRx15	83 US	22,8	33,6	30,1	12,4	8,4	9,4

A - Simulated Urban Driving (ECE 15 cycle)
B - Constant Speed Driving at 56 mph (90 km/h)
C - Constant Speed Driving at 75 mph (120 km/h)

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HEALTH AND SAFETY PRECAUTIONS 05

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HEALTH AND SAFETY PRECAUTIONS

Many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health. This section lists, alphabetically, some of these hazardous operations and the materials and equipment associated with them. The precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures, and the handling of materials, should be carried out with health and safety in mind.

ACIDS AND ALKALIS - See also Battery acids.

eg. caustic soda, sulphuric acid.

Used in batteries and cleaning materials.

Irritant and corrosive to the skin, eyes, nose and throat. Causes burns.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective gloves and goggles. Can destroy ordinary protective clothing. Do not breathe mists.

Ensure access to water and soap is readily available for use after splashing accidents.

ADHESIVES AND SEALERS - See Fire, Chemical materials - General

Highly Flammable, Flammable, Combustible.

Generally should be stored in "No Smoking" areas; cleanliness and tidiness in use should be observed e.g. disposable paper covering benches; should be dispensed from applicators where possible; containers, including secondary containers, should be labelled appropriately.

Solvent based adhesives/sealers - See Solvents

Follow manufacturers instructions.

Water based adhesives/sealers

Those based on polymer emulsions and rubber lattices may contain small amounts of volatile toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Follow manufacturers instructions.

Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns, and health hazards may arise from the inhalation of toxic fumes.

Use thermostatically controlled heaters with thermal cut-out, adequate extraction and appropriate protective clothing.

Resin-based adhesives/sealers e.g. epoxide and formaldehyde resin based.

Mixing should only be carried out in well ventilated areas as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation; dermatitis; and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact. Follow manufacturers instructions.

Anaerobic, cyanoacrylate and other acrylic adhesives.

Many are irritant, sensitizing or harmful to the skin. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturers instructions followed.

Cyanoacrylate adhesives (super-glues) must not contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and get medical attention. Do not attempt to pull tissue apart. Use in well ventilated areas as vapours can cause irritation of the nose and eyes.

For two-pack systems see Resin based and Isocyanate adhesives/sealers.

Isocyanate (polyurethane) adhesives/sealers See Resin based adhesives.

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Any spraying should preferably be carried out in exhaust ventilated booths removing vapours and spray droplets from the breathing zone.

Individuals working with spray applications should wear air-fed respirators.

ANTIFREEZE - See Fire, Solvents e.g. isopropanol, ethylene glycol, methanol.

Highly Flammable, Flammable, Combustible.

Used in vehicle coolant systems, brake air pressure systems, screenwash solutions.

Vapours may be given off from coolant antifreeze (glycol) when heated. Avoid breathing these vapours.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze, if swallowed, can be fatal and medical attention should be sought immediately.

These products must not be used in any cooling or industrial water system which is connected or linked to general, food preparation or drinking water supplies.

ARC-WELDING - See Welding.

ASBESTOS - See also Warning Symbols.

Breathing asbestos dust may cause lung damage or, in some cases, cancer.

Used in Brake and Clutch linings, Transmission brake bands and gaskets. Ford original production and replacement items for this model are asbestos free.

The use of drum cleaning units, vacuum cleaning or damp wiping is preferred.

Asbestos dust waste should be dampened, placed in a sealed container and marked to ensure safe disposal. If any cutting or drilling is attempted on materials containing asbestos the items should be dampened and only hand tools or low speed power tools used.

BATTERY ACIDS - See also Acids and Alkalis.

Gases released during charging are explosive. Never use naked flames or allow sparks near charging or recently charged batteries.

Ensure adequate ventilation.

BRAKE AND CLUTCH FLUIDS (polyalkylene glycols) - See Fire

Splashes to the skin and eyes are slightly irritating. Avoid skin and eye contact as far as possible. Inhalation vapour hazards do not arise at ambient temperatures because of the very low vapour pressure.

BRAZING - See Welding.

CHEMICAL MATERIALS - GENERAL - See Legal Aspects

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, brake fluids, fuels, oils and grease should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly inflammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life-expectancy.

DO'S

Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.

Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, poster or other instructions. Material health and safety data sheets can be obtained from Manufacturers.

Do organise work practices and protective clothing to avoid soiling of the skin and eyes; breathing vapours/aerosols/dusts/fumes; inadequate container labelling; fire and explosion hazards.

Do wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.

Do keep work areas clean, uncluttered and free of spills.

Do store materials and parts according to national and local regulations.

Do keep chemical materials out of the reach of children.

DO NOTS

Do not mix chemical materials except in accordance with the manufacturers instructions; some chemicals can form other toxic or harmful chemicals; give off toxic or harmful fumes; become explosive, when mixed together.

Do not spray chemical materials, particularly those based on solvents, in confined spaces e.g. when people are inside a vehicle.

Do not apply heat or flame to chemical materials except in accordance with the manufacturers' instructions. Some are highly inflammable and some may release toxic or harmful fumes.

Do not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas, pits etc.

Do not transfer chemical materials to unlabelled containers.

Do not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels will dry the skin and may cause irritation and dermatitis. Some can be absorbed through the skin in toxic or harmful quantities.

Do not use emptied containers for other materials except when they have been cleaned under supervised conditions.

Do not sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be toxic or harmful.

CHLOROFLUOROCARBONS (CFC)

There is concern in the scientific community that CFC's and Halons are depleting the upper ozone layer which filters out harmful ultraviolet radiation. Decreased filtration of ultraviolet radiation may result in increases in skin cancer, cateracts and immune system suppression in humans, as well as decreased productivity of crops and aquatic systems.

CFC's are used primarily as a refrigerant in vehicle air conditioning systems and as an aerosol propellent. Halons are used as fire extinguishants.

Ford supports worldwide elimination of CFC usage and it is recommended that Company subsidiaries and affilliates should phase out CFC usage as soon as acceptable substitutes are commercially available.

CLUTCH FLUIDS - See Brake and clutch fluids.

CLUTCH LININGS AND PADS - See Asbestos.

CORROSION PROTECTION MATERIALS - See Solvents, Fire.

Highly flammable, flammable

These materials are varied and the manufacturers instructions should be followed. They may contain solvents, resins, petroleum products etc. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

CUTTING - See Welding

DEWAXING - See Solvents and Fuels (Kerosene)

DUSTS

Powder, dusts or clouds may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard in high concentrations and in the presence of sources of ignition.

ELECTRIC SHOCK

Electric shocks can result from the use of faulty electrical equipment or from the misuse of equipment even in good condition.

Ensure that electrical equipment is maintained in good condition and frequently tested.

Ensure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged.

Ensure that electric equipment is protected by a fuse of the correct rating.

Never misuse electrical equipment and never use equipment which is in any way faulty.
The results could be fatal.
Ensure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Use air operated mobile equipment where possible in preference to electrical equipment.

In cases of electrocution:

- switch off electricity before approaching victim
- if this is not possible, push or drag victim from source of electricity using dry non-conductive material
- commence resuscitation if trained to do so
- SUMMON MEDICAL ASSISTANCE

ENGINE OILS - See Lubricants and Greases

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EXHAUSTS

Acids - See Acids and Alkalis

Catalytic systems may be subject to the build up of a small amount of sulphuric acid inside the converter. Care should be taken when removing converters so that no spillage occurs.

Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should only be run under conditions of adequate extraction or general ventilation and not in confined spaces.

Systems

Catalytic systems operate at extremely high temperatures. Care should be taken when handling these systems by the use of heat resistant gloves.

Gasolene (petrol) engine

There may not be adequate warning properties of odour or irritation before immediate and delayed toxic or harmful effects arise.

Diesel engine

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

FIBRE INSULATION - See Dusts

Used in noise and sound insulation

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organisation of work practices and the use of gloves.

FIRE - See Welding, Foams, Legal Aspects

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Ensure before using electrical or welding equipment, that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

FIRST AID

Apart from meeting any legal requirements, it is desirable for someone in the workshop to be trained in first aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

Individuals affected by inhalation of gases, fumes etc. should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertantly, consult a doctor giving him the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

FLUOROELASTOMER - See 'Viton'.

FOAMS - POLYURETHANE - See Fire

Used in sound and noise insulation. Cured foams used in seat and trim cushioning. Closed cell rigid foam used in lower 'A' pillars.

Follow manufacturers instructions

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases, should not work with or near uncured materials.

The components, vapours, spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapours and spray mists must not be breathed. These materials must be applied with adequate ventilation and respiratory protection. Do not remove respirator immediately after spraying, wait until vapour/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, open flames or the use of electrical equipment during foaming operations and until vapours/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation (see Body Section 44 Legal and Safety aspects).

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FUELS - See Fire, Legal Aspects, Chemicals - General, Solvents

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

Gasolene (petrol)

Highly flammable. Observe "NO SMOKING" signs.

Swallowing can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs e.g. through vomiting, is a very serious hazard.

Gasolene dries the skin and can cause irritation and dermatitis on prolonged or repeated contact. Liquid in the eye causes severe smarting.

Motor gasolene may contain appreciable quantities of benzene, which is toxic upon inhalation, and the concentration of gasolene vapours must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Ensure there is adequate ventilation when handling and using gasolene. Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasolene storage tanks.

Gasolene should not be used as a cleaning agent. It must not be siphoned by mouth. See First Aid.

Kerosene (paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable. Observe "NO SMOKING" signs.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs. Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances, the low volatility does not give rise to harmful vapours. Exposure to mists and vapours from kerosene at elevated temperatures should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and ensure there is adequate ventilation.

Gas-oil (Diesel fuel) - See Fuels (Kerosene)

Combustible

Gross or prolonged skin contact with high boiling gas-oils may also cause serious skin disorders including skin cancer.

GAS CYLINDERS - See Fire

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 2000 lb/in^2, (13,790 kn/m^2) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow, or direct sunlight. Fuel gases (e.g. acetylene and propane) should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines, and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

GASES - See Gas Cylinders

GASKETS (Flouroelastner) - See 'Viton'

GAS SHIELDED WELDING - See Welding

GAS WELDING - See Welding

GENERAL WORKSHOP TOOLS AND EQUIPMENT

It is essential that all tools and equipment are maintained in good condition, and the correct safety equipment used where required.

Never use tools or equipment for any purpose other than that for which they were designed. Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiselling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment, working with asbestos based materials or using spraying equipment.

Ensure adequate ventilation to control dusts, mists and fumes.

GLUES - See Adhesives and Sealers.

HALON - See CFC's

HIGH PRESSURE AIR, LUBRICATION AND OIL TEST EQUIPMENT. See Lubricants and Greases.

Always keep high pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high pressure nozzle, eg diesel injector, at the skin as the fluid may penetrate to the under-lying tissue etc. and cause serious injury.

LEGAL ASPECTS

Many laws and regulations make requirements relating to health and safety in the use of materials and equipment in workshops. Some of these laws which apply in the U.K. are listed. Similar laws exist for other territories:

- The Factories Act (1961)
- The Asbestos Regulations (1969)
- Highly Flammable Liquids and Liquified Petroleum Gases Regulations (1972)
- Control of Pollution Act (1974)
- Health and Safety at Work Act (1974)
- The Classification, Packaging and Labelling of Dangerous Substances Regulations (1978, 1981,1983, 1984)
- Control of Lead at Work Regulations (1980)
- Control of Substances Hazardous to Health (COSHH) Regulations (1989)
- Abrasive Wheels Regulations (1970)

Workshops should be familiar, in detail, with these and associated laws and regulations. Consult local factory inspectorate if in any doubt.

LUBRICANTS AND GREASES

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

Used Engine Oils

Prolonged and repeated contact with mineral oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

There are publications describing the problems and advising on precautionary measures. For the U.K. a typical Health and Safety Executive publication is:

SHW 397 : Cautionary Notice: Effects of mineral oil on the skin.

Health protection precautions

- Avoid prolonged, excessive or repeated skin contact with used engine oils - where necessary wear protective clothing
- Wear protective clothing, including impervius gloves where practicable.
- Do not pull oily rags in pockets.
- Avoid contaminating clothes, particularly underpants, with oil.
- Heavily soiled clothing and oil-impregnated footwear should not be worn. Overalls must be cleaned regularly.
- First Aid treatment should be obtained immediately for open cuts and wounds.
- Use barrier creams, applying them before each work period, to help the removal of oil from the skin.
- Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.

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LUBRICANTS AND GREASES (Cont'd)

- Do not use gasolene (petrol), kerosene (paraffin), diesel fuel (gas oil), thinners or solvents for cleaning skin.
- If skin discorders develop, obtain medical advice without delay.
- Where practicable, degrease components prior to handling.
- Where there is a risk of eye contact, eye protection should be worn, for example, chemical goggles or face shields; in addition an eye wash facility should be provided.

Environmental Precautions

Burning used engine oil in small space heaters or boilers can be recommended only for units of approved design. In the UK the heating system must meet the requirements of HM Inspectorate of Pollution for small burners of less than 0,4 MW. If in doubt check with the appropriate local authority and/or manufacturer of approved appliance.

Dispose of used oil and used oil filters through authorised waste disposal contractors to licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the relevant local authority for advice on disposal facilities.

It is illegal to pour used oil on to the ground, down sewers or drains, or into water courses.

NOISE

Some operations e.g. sawing, discing, proximity to engines under load, or at high speeds, may produce high noise levels which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

NOISE INSULATION MATERIALS - See Foams, Fibre Insulation.

'O' RINGS (Fluorolastomer) - See 'Viton'

PAINTS - See Solvents. Chemical Materials - General.

Highly flammable, Flammable. Observe "NO SMOKING" signs.

One Pack. Can contain harmful or toxic pigments, driers and other components as well as solvents. Spraying should only be carried out with adequate ventilation.

Two-Pack. Can also contain harmful and toxic unreacted resins and resin hardening agents. The manufacturers instructions should be followed and the section on page 05-02 covering Resin Based Adhesives, Isocyanate containing Adhesives and Foams, should be consulted.

Spraying should preferably be carried out in exhausted ventilated booths removing vapour and spray mists from the breathing zone. Individuals working in booths should wear respiratory protection. Those doing small scale repair work in the open workshop should wear air-fed respirators.

PAINT THINNERS - See Solvents

PETROL - See Fuels (gasolene)

PRESSURISED EQUIPMENT - See High Pressure Air, Lubrication and Oil test equipment.

RESISTANCE WELDING - See Welding

SEALS AND SEALERS - See Adhesives, Sealers and 'Viton'

SOLDER - See Welding

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be evolved.

Some fumes may be produced by the application of any flame to surfaces coated with grease etc. and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to ensure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

SOLVENTS - See Chemical materials - General Fuels (kerosene), Fire.

e.g. acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning materials, dewaxing, paints, plastics, resins, thinners etc.

Some may be highly flammable or flammable.

SOLVENTS (cont'd)

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure to high concentrations of vapours or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and in the worst circumstances unconciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapours or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs (e.g. through vomiting) is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Ensure good ventilation when in use, avoid breathing fumes, vapours and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, e.g. paints, adhesives, coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers' instructions.

SOUND INSULATION See Fibre Insulation. Foams.

SPOT WELDING - See Welding.

SUSPENDED LOADS.

There is always a danger when loads are lifted or suspended. Never work under an unsupported suspended or raised load e.g. suspended engine, etc.

Always ensure that lifting equipment such as jacks, hoists, axle stands, slings, etc. are adequate and suitable for the job, in good condition and regularly maintained.

Never improvise lifting tackle.

UNDERSEAL - See Corrosion Protection.

VITON

In common with many other manufacturers vehicles, some components fitted to the FORD range have 'O' rings, seals or gaskets which contain a material known as 'Viton'.

Viton is a fluorolastomer, that is a synthetic rubber type which contains Fluorine. It is commonly used for 'O' rings, gaskets and seals of all types. Although Viton is the most well known fluorolastomer, there are others, including Fluorel and Tecmoflon.

When used under design conditions fluorolastomers are perfectly safe. If, however, they are exposed to temperature in excess of 400°C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and almost impossible to remove once it has contaminated the skin.

'O' rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT, under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluorolastomer has been used in the affected 'O' ring, seal or gasket. If they are of natural rubber or nitrile then there is no hazard. If in doubt, assume the material may be Viton or another fluorolastomer.

The affected area should be decontaminated before commencing any work. Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralize the acid before disposing of the residue.

After use, the plastic gloves should be discarded carefully and safely.

WELDING - See Fire. Electric Shock. Gas Cylinders.

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultra-violet radiation which may cause arc-eye and skin burns to the welder and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.

Gas Welding (and cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright, and eye protection should be used, but the ultra-violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be evolved from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event, particular care must be taken to avoid inhalation of fumes and expert advice may be required.

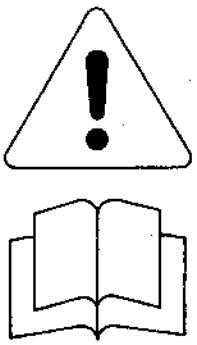
SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, E.G. BOILING OR STEAMING OUT OF FUEL TANKS.

WHITE SPIRIT - See Solvents.

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WARNING SYMBOLS

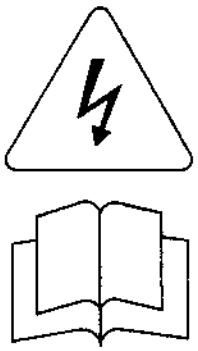
Vehicle displaying the warning triangle and open book symbol, Fig.1., advise consultation of the relevant section of the owners handbook before touching or attempting adjustments of any kind.



CE14-05-1 T

Fig.1. Warning symbol - consult handbook.

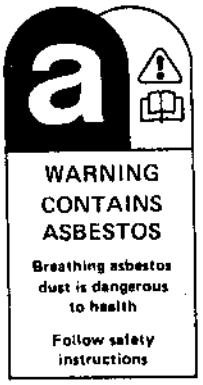
Vehicles displaying the warning triangle with the 'electrified' arrow and open book symbol, Fig.2, give warning of components with inherent high voltages. Never touch these with the engine running or the ignition switch 'on'.



CE14-05-2 T

Fig.2. Warning symbol - high voltage - consult handbook.

Ford vehicles and replacement parts which contain asbestos are identified by a symbol, Fig.3. See Asbestos.



CE14-05-3 T

Fig.3. Warning symbol on parts containing asbestos - consult handbook.

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STANDARD PRACTICES 06

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VEHICLE IN WORKSHOP

When working on a vehicle in the workshop always ensure that:

- The hand brake is applied or the wheels are securely chocked to prevent the vehicle moving forwards or backwards.
- If the engine is to be run, there is adequate ventilation, or an extraction hose to remove exhaust gases.
- There is adequate room to jack up the vehicle and remove the wheels if necessary.
- The battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is jacked up.
- If using welding equipment on the vehicle, a suitable fire extinguisher is readily available.

CAUTION: When electric arc welding on a vehicle, always disconnect the alternator wiring and the battery to prevent the possibility of a surge of current causing damage to the internal components of the alternator. It is not necessary to disconnect electronic modules.

JACKING UP THE VEHICLE - GENERAL

If possible always position the vehicle on a hard level surface. If the vehicle must be jacked up on a soft surface, use load spreading blocks under the jack, and the axle or chassis stands. Always ensure that the jack is of sufficient capacity to lift the load.

Always securely chock the wheels remaining on the ground to prevent the vehicle rolling forwards or backwards. Do not rely on the hand brake as this may have to be released during the repair procedures.

Always install suitable axle or chassis stands before working under a jacked up vehicle.

When reversing onto some ramps, it may be necessary to raise the front of the vehicle to prevent damage to the front spoiler and/or the exhaust flange connection.

USING CHASSIS STANDS

Chassis stands must always be used to support a jacked up vehicle when working underneath it. See Figs.1. and 2 for correct positioning of jacks, hoists and stands.

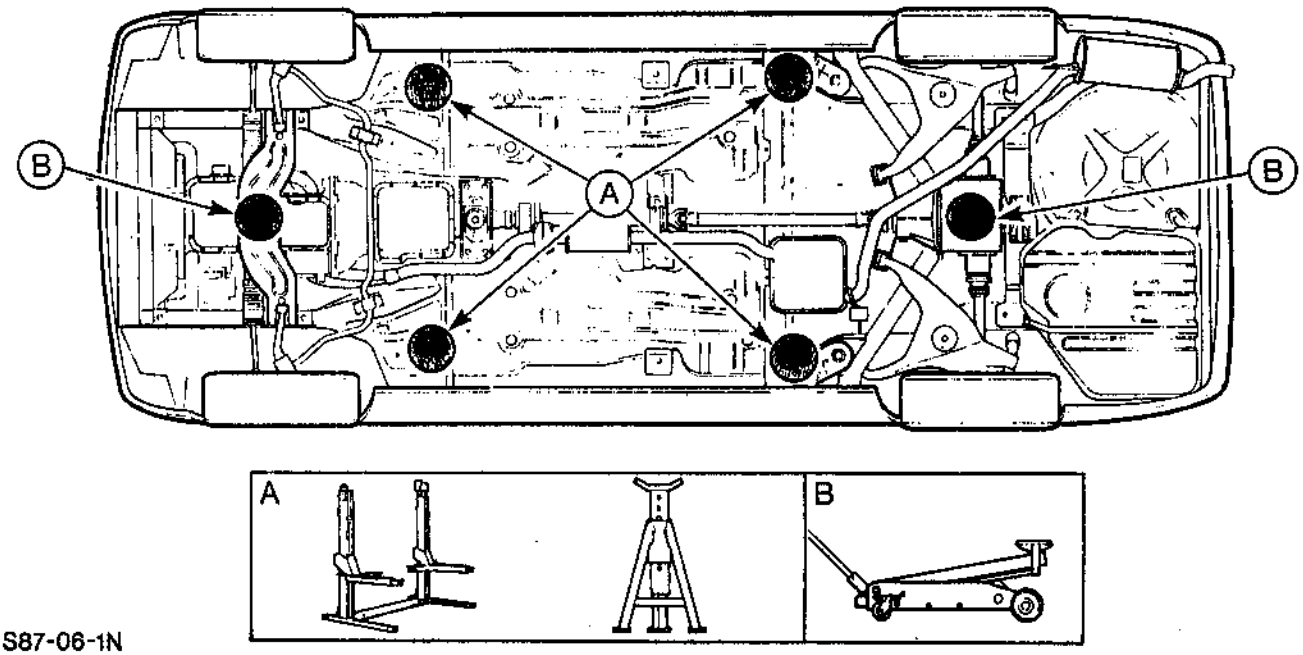
- Position the service jack centrally under the jacking point to be raised, ensuring that the jack saddle locates securely, and if it is a trolley jack, that the wheels are free to roll. Do not jack vehicle under suspension arms, links etc.
- Securely chock the wheels at the other end of the vehicle.
- Operate the jack to raise the vehicle, keeping watch on the jack saddle to ensure that it remains correctly positioned and does not slip.
- Place chassis stands in position ensuring that they locate correctly without fouling other components, especially brake tubing or electrical wiring.
- Lower the jack carefully and ensure that all the legs of the stands remain firmly in contact with the grouund and their heads remain correctly located.

Only the correct design adjusting pins should be used in the chassis stands and these should be regularly checked for straightness and damage. Never use non-standard pins or other materials in lieu of the correct adjusting pins.

NOTE: All workshop jacking, hoisting and use of support stands is only acceptable with the vehicle at maximum kerb weight or less, i.e. no luggage or passengers.

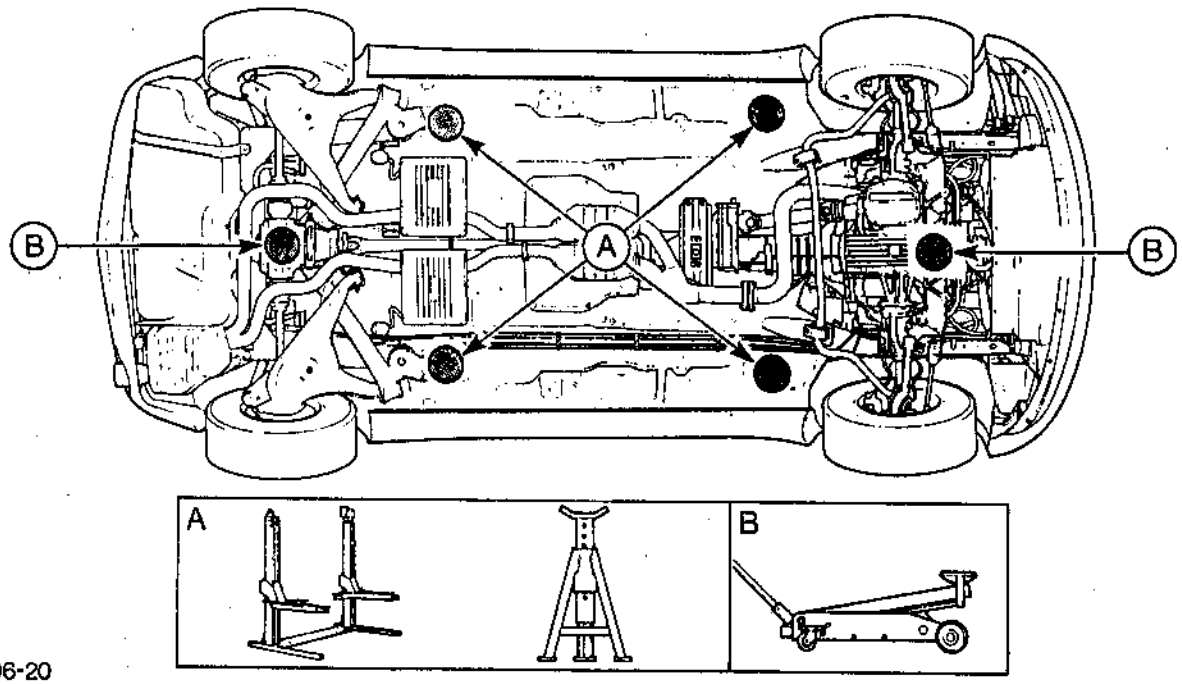
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JACKING AND SUPPORT LOCATIONS



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Fig.1. Jacking locations - Sierra



COS-06-20

Fig.2. Jacking locations - Escort.

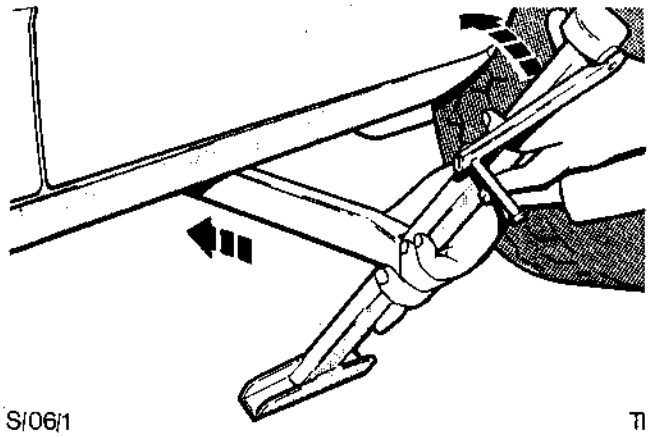
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OWNER JACKING

Wherever possible, ensure that the vehicle is on firm ground and that you are working from the kerb-side. Before attempting to jack up the vehicle, make sure that the ground is sufficiently solid to take the jack and any additional supports used.

Apply the handbrake and engage 1st or reverse gear. If jacking the vehicle on a slope cannot be avoided, both wheels on the opposite side of the car must be securely chocked.

Two jacking points are provided on both sides of the car. Select the jacking point adjacent to the wheel which is to be changed.



S/06/1 TI

Fig.3. Slide the Sierra jack arm into the jacking point as far as possible.

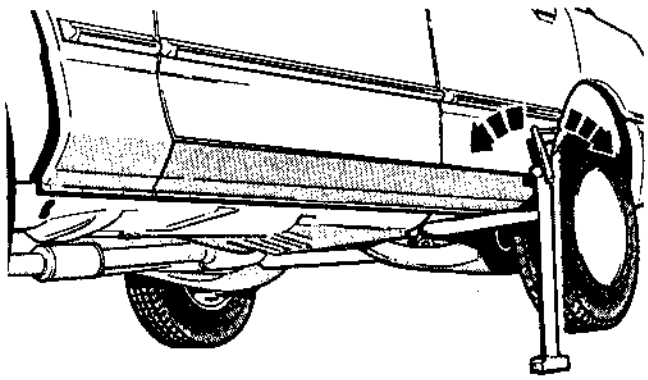
Sierra

Slide the arm of the owner jack into the jacking point hole AS FAR AS POSSIBLE. Fig.1.

Pivot the top of the jack as close as possible to the side of the car and operate the jack crank handle, Fig.2.

NOTE: A stop is provided on the jack to prevent paintwork damage, when the jack is operated.

THE SIERRA RS COSWORTH JACK MUST NOT BE USED ON ANY OTHER MAKE OR MODEL OF VEHICLE.



S–06–2N TI

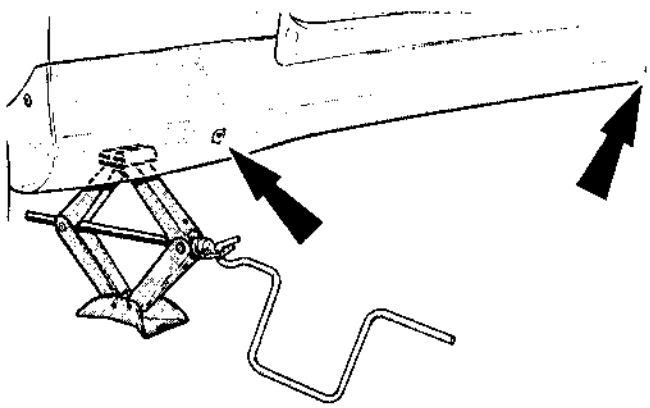
Fig.4. Operating the Sierra owner jack.

Escort

The positions for locating the owner jack are easily recognised as they correspond with indentical markings on the rocker panel.

The channel in the head of the jack locates on the flange under the rocker panel, Fig.5.

NOTE: Owner jacks must not be used on any other part of the vehicle. SUPPORTS MUST BE USED WHEN WORKING UNDER THE VEHICLE.



COS-06-21 TI

Fig.5. Locating the Escort owner jack.

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TOWING THE VEHICLE

When towing is necessary, the vehicle towing eyes should be used. The rope must be securely fastened to the towing eye and attached to the other vehicle such that the rope will not foul the bodywork.

CAUTION: When the vehicle is being towed, the ignition switch must be in position II (steering lock released and warning lights illuminated). Only then will the steering, direction indicators, horn and stop lights be operational.

Alternatively the vehicle can be transported on a Low Loader.

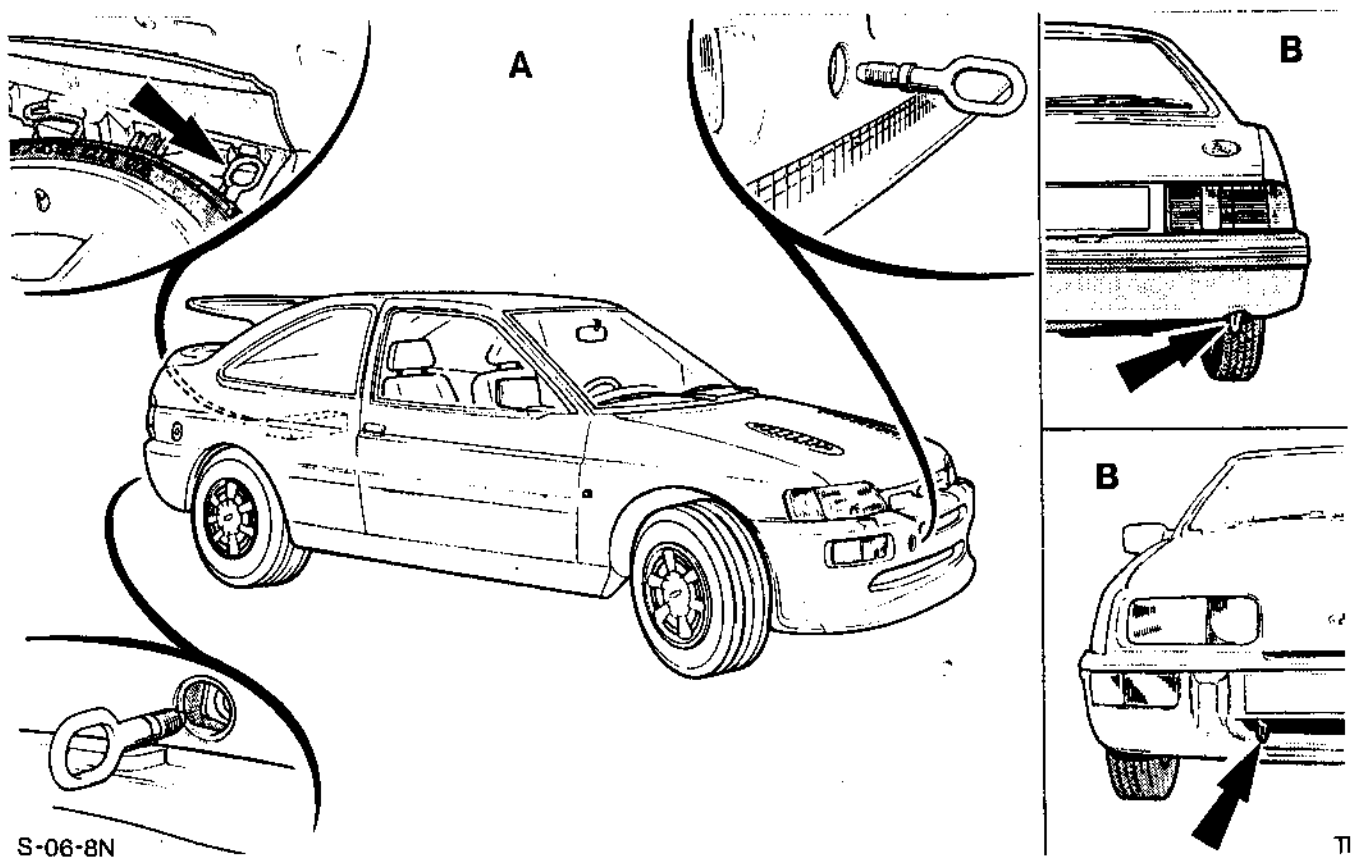


Fig.4. Towing eyes (arrowed)
A - Escort
B - Sierra

DISCONNECTING THE BATTERY

Always stop the engine before disconnecting the battery.

Always disconnect the battery before commencing repair operation which require:

- The vehicle to be jacked up
- Work on the engine
- Work underneath the vehicle
- Arc-welding

Always disconnect the battery negative (-) lead first.

NOTE: Before disconnecting the battery ensure that the radio keycode is known and, on vehicles fitted with EEC IV ignition systems, make sure that no further data is required from the module as battery disconnection will erase the 'Keep Alive Memory' (KAM) contained in this system. It is not necessary to disconnect or remove electronic control modules.

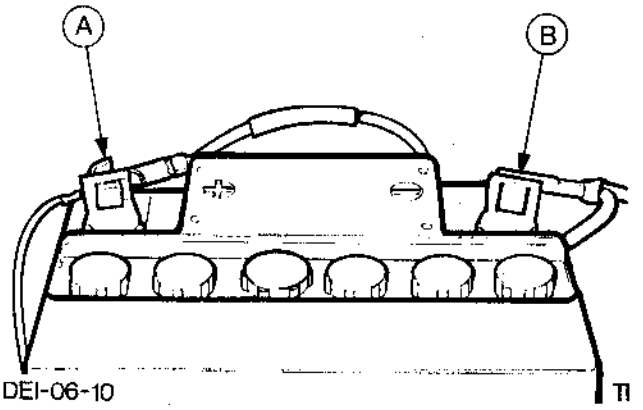


Fig.5. Battery Connections.
A - Positive Terminal (+)
B - Negative Terminal (-)

RECONNECTING THE BATTERY

WARNING: If the battery has been on bench charge the cells may be giving off explosive hydrogen gas. Avoid creating sparks, and if in doubt cover the vent plugs or covers with damp cloth.

Always ensure that all electrical systems are switched OFF before reconnecting the battery, to avoid causing sparks or damage to sensitive electrical equipment.

Always reconnect the battery positive (+) lead first and the negative (-) last, ensurig that there is a good electrical contact and the battery terminals are secure.

Restart the clock (where fitted) and set it to the correct time.

Re-enter the radio 'pre-set' frequencies, if known.

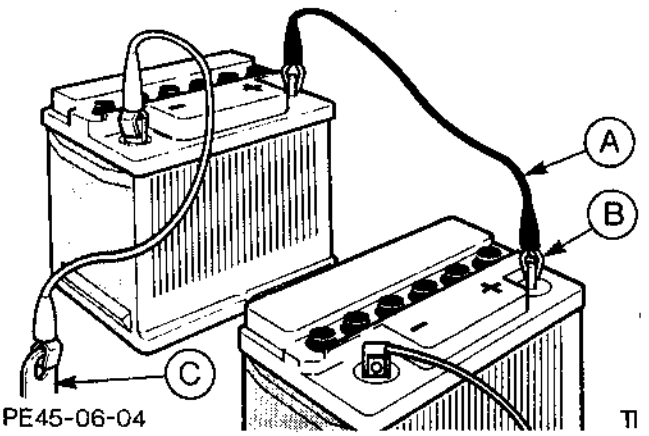


Fig.9. Jump lead connections to battery.
A - Slave lead clamp
B - Positive terminal
C - Engine lifting bracket

CONNECTING A SLAVE BATTERY USING JUMP LEADS.

- Always ensure that the jump leads are adequate for the task. Heavy cables must be used if the starter motor is to be used, but light leads may be adequate if only testing electrical circuits.
- Always ensure that the slave battery is of the same voltage as the vehicle battery and is only connected in parallel. (Positive to positive and negative to negative terminals).
- Always ensure that the electrical circuits are switched OFF before connecting jump leads. This reduces the risk of sparks occuring when the final connection is made.

CAUTION: The 'flat battery' condition may have been caused by an electrical 'short circuit'. If this condition exists there will be an apparently 'live' circuit on the vehicle even when all normal circuits are switched OFF. This can casue 'arcing' to occur when the jump leads are connected.

WARNING: If the slave battery has recently been charged and is 'gassing', cover the vent plugs or covers with a damp cloth to reduce the risk of explosion should 'arcing' occur when connecting the jump leads.

Always connect the jump leads in the following sequence:

- Booster battery positive first then vehicle battery positive.

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CONNECTING A SLAVE BATTERY USING JUMP LEADS (Cont'd)

- Booster battery negative next and then vehicle earth (at least 12 inches (300 mm) from the battery terminal, e.g. engine lifting bracket.)

WARNING: Ensure that the ends of the jump leads do not touch each other, or earth (the vehicle body or chassis frame), at any time while the leads are attached to the battery. A fully charged battery, if 'shorted' through jump leads, can discharge at a rate well above 1000 amps causing violent 'arcing', very rapid heating of the jump leads and terminals, and even cause the battery to explode.

- Always reduce the engine speed to idling before disconnecting the jump leads.
- Always disconnect the jump leads in the reverse order to the connecting sequence and take great care not to 'short' the ends of the leads.

CHARGING OF SEALED FOR LIFE BATTERIES (OFF THE VEHICLE)

If a Sealed For Life Battery has a low open circuit terminal voltage having been in stock for some time or failed to crank an engine satisfactorily, it can be fast charged off the vehicle.

The batteries selected for recharge must be charged in an area which is well ventilated and it is recommended that the British Standard Code of Practice for the safe operation of starter batteries is used as a guide.

Constant Voltage Charging

In order to avoid unnecessary supervision of the charge process, a nominally constant voltage charger should be used so that the charge current is automatically cut back as the battery's state of charge improves. The charging equipment should control the voltage maximum limit to 14,4 $\pm$ 0,5 volts and ensure that the maximum current is not greater than 25 amperes through any one battery at any time. The one charging equipment would, therefore be suitable for all the range of common car batteries in use now and in the forseeable future. Charge should be terminated when the current remains unchanged over 2 hours.

NOTE: Before disconnecting the charger, always switch the unit off, to avoid sparks.

This procedure will FULLY charge a battery in about 2-3 days. However, it will raise the state of charge from flat to a workable value within 3 hours if the battery is the normal car starter size.

Constant Current Charging

Constant Current Fast Charging is possible but requires constant supervision, otherwise electrolyte will be lost and will leak from the casing. It is not recommended to use this as a regular charging method.

The charge should be started at 25 to 30 Amperes and adjusted so that voltage is 14,0 to 14,4 volts. It should then be adjusted to maintain a voltage of 14,0 to 14,4 volts as the battery's state of charge increases and ensures that terminal voltage does not rise above 15,0 volts.

The battery is at a workable state of charge when the current is accepted at the normal bench charge rate or less and the terminal voltage is 14,4 volts.

NOTE: Before disconnecting the charger, always switch the unit off, to avoid sparks.

Batteries in storage, even on vehicles, must be charged at least once a month to prevent deterioration. When charging a battery, the charger unit manufacturer's instructions should be followed.

NEVER SMOKE OR IGNITE A NAKED FLAME near a battery which is being charged, as the charging process causes highly inflammable hydrogen gas to be given off. For this reason, the charging operation should e carried out off the vehicle, in a well ventilated area, to prevent a build-up of hydrogen.

It is safe to charge a battery on the vehicle provided the previous paragraph is observed during the charging period and for at least 15 minutes after. It has the advantage that after charging, no reconnection to vehicle systems is required (with current vehicles this inevitably causes a spark due to radio memory, clock etc.) and therefore eliminates the chance of an explosion due to the connection being made.

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COMPONENT CLEANING

To prevent ingress of dirt, accumulations of loose dirt and greasy deposits should be removed before disconnecting or dismantling components or assemblies.

Components should be thoroughly cleaned before being inspected prior to reassembly.

CLEANING METHODS

Dry Cleaning:

Remove loose dirt with soft or wire brush. Scraping dirt off with a piece of metal or wood. Wiping off with a rag or metal or wood. Blowing dirt off with compressed air. (Eye protection should be worn when using this method).

Vacuum Extraction:

Removal of dry dust using vacuum equipment. This method should always be used to remove friction lining material dust, (asbestos particles).

Steam Cleaning:

This method of cleaning can be used on most vehicle components except electrical assemblies. Exposed metal surface should be protected immediately after steam cleaning, to prevent corrosion.

Solvent Cleaning:

Various solvents are available which are suitable for component cleaning. Some components such as brake hydraulic parts and electrical assemblies should be cleaned only with recommended solvents - refer to Section 08 or to the section of the manual relevant to the component.

WARNING: Most solvents require careful handling and some are harmful. Refer to Section 05 and to the manufacturers literature for safety precautions.

COMPONENT INSPECTION

CAUTION: The information contained in this section is intended as a general guide to inspection of components. It does not supersede the detailed information given in SPECIFICATIONS or in the text of REPAIR PROCEDURES which must always take precedence.

Components may be inspected during repair or overhaul for the following reasons:

- To examine for damage
- To measure wear
- To assess whether the component is likely to function satisfactorily until its next probable overhaul.

DAMAGE

Damage should be assessed under the headings:

Broken:

The component or a vital part of it may be fractured in such a way as to make it unusable or irreparable.

Distorted:

The component may be bent, twisted, dented or misaligned.

Scored:

The function of the component must be taken into account when assessing the effects of scoring on working surfaces. For instance minor surface scratches or light scoring will cause a brake hydraulic cylinder to fail, but will have little effect in an engine cylinder bore. At the other extreme, robust, heavy duty components such as suspension spring bushes will still function satisfactorily even with very deep scores in their surface.

Cracked:

In some components, cracks may be difficult to find, such as in a cylinder head or block where the crack may widen when the engine is hot, and close up again when cool. It may be necessary to use special equipment such as penetrant dye or magnetic flux to detect the presence and extent of a suspected crack.

Corroded, Eroded or Pitted:

This is the deterioration of the surface of components usually as a result of chemical action. Chemical action can also cause non-metallic materials to swell up or soften, such as brake hydraulic seals damaged by contaminated brake fluid.

Torn or Cut:

Damage to non-metallic components such as oil seals, gaiters, weatherstrips, etc.

WEAR

Where the amount of wear allowable on a component is important, limits of wear will usually be given under SPECIFICATIONS in the relevant section of the manual. Where no wear limits are given, then the component should be inspected with regard to whether the amount of wear apparent on the working surfaces is such that it will seriously affect the function or operation of the component.

ASSESSMENT OF THE FUTURE USEFUL LIFE OF A COMPONENT

If a component has been removed from a high mileage vehicle and a further high mileage is anticipated, this factor should be taken into account when the component is inspected.

When the wear, damage or deterioration of a component is such that it is likely to have only a limited future life, even after overhaul, it may be more economical to renew it.

Where wear, damage or deterioration is apparent on a component which is critical to the safe operation of the vehicle, such as brakes or steering, to the extent that its future life is obviously limited, then that component or assembly must be renewed and not overhauled.

LICENCE PLATE MOUNTING

The necessary parts required for fixing licence plates to unregistered vehicles will be found in a plastic bag placed in the vehicle glove box or luggage compartment.

All models have two guide bosses in the front bumper and two pierced holes in the rear panel. Two waterproof plugs are fitted into the rear panel holes.

FITTING INSTRUCTIONS

U.K., GERMANY and territories not specified below

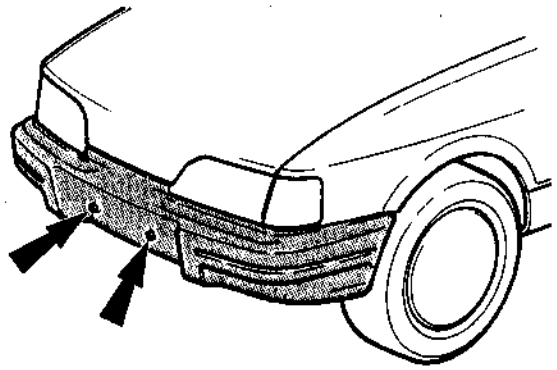
Drill or pierce front and rear licence plates, with two 6,5 mm holes, on the horizontal centre line symmetrically about the vertical and horizontal centre lines at 230 mm between hole centres. Letters and numerals should be arranged on the licence plate, where possible, to avoid these holes.

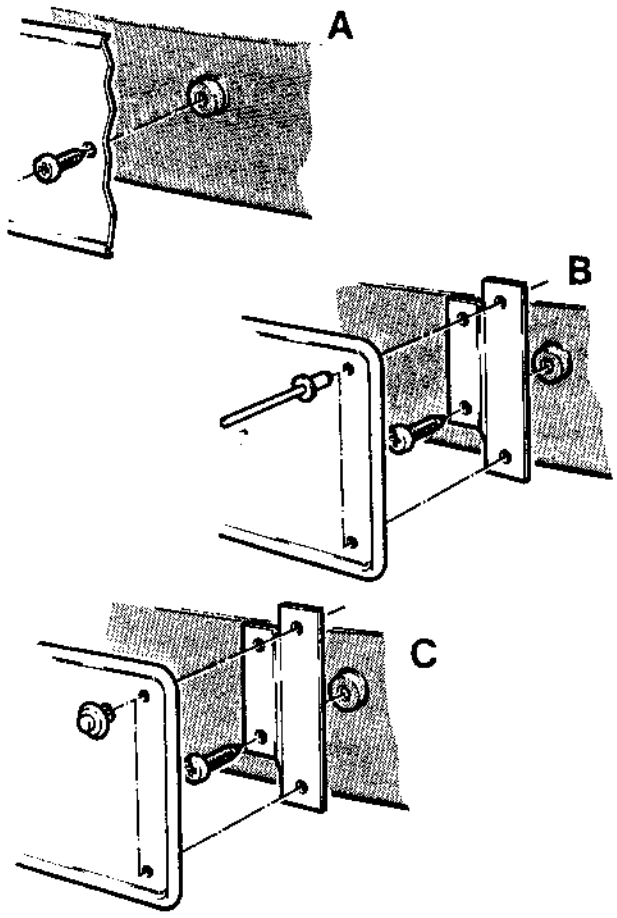
Front: - Fig.7A.

Drill two 3,8mm holes 15 mm into the guide bosses in the front bumper. Fasten the licence plate to the bumper with two AB 10 x 16mm screws.

Rear: - Fig.8.

Check to ensure that the waterproof plugs are firmly pressed into position in the body panel holes. Failure to ensure a correct fit could lead to water leaks. Offer the licence plate to the mounting plugs and pierce the sealing membrane by screwing two AB 10 x 16 mm screws carefully into the plugs until the plate is secure.





S187-06-6

Fig.7.

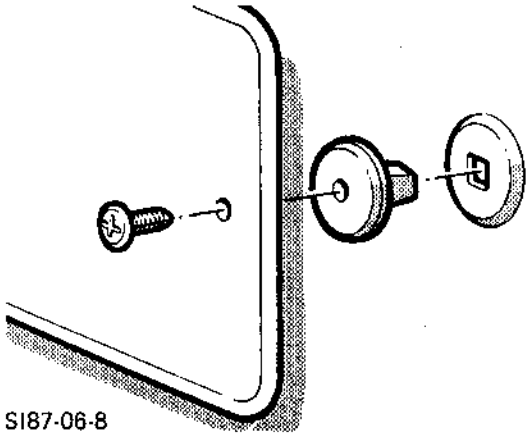
LICENCE PLATE MOUNTING (cont'd)

Italy only

Front: - Fig.7B.

Drill two 3,8mm holes 15mm into the guide bosses in the front bumper. Fasten brackets supplied to the bumper with two AB 10 x 16 mm screws. Drill the licence plate with 4,5 mm holes to coincide with the holes in the mounting bracket. Fix the plate in place by passing plastic rivets through the plate into the bracket. Set the rivets by pushing the rivet stem firmly into the rivet body.

Rear:- As U.K., Germany and others.



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Fig.8.

France only

Front:- Fig.7C.

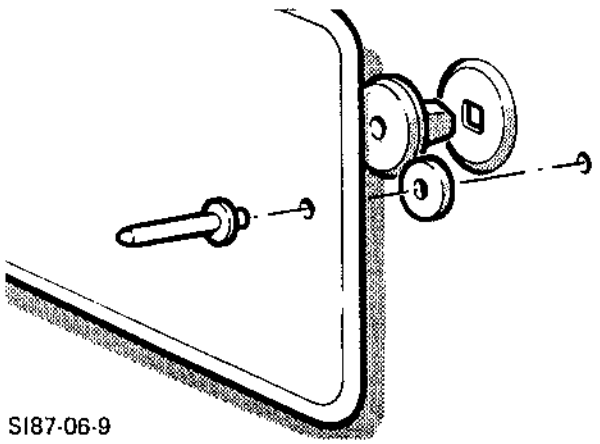
Drill two 3,8mm holes 15mm into the guide bosses in the front bumper. Fasten brackets supplied to the bumper with two AB 10 x 16 mm screws. Drill four 4,85 mm holes in the licence plate to line up with the two holes in each mounting bracket.

NOTE: These holes must be offset vertically from the horizontal centre line by 8mm, see Fig.8.

Fasten licence plate to brackets by passing four 4,8 mm blind rivets through plate and brackets and secure plate by setting rivets.

Rear:- Fig.9.

Ensure plug is secure. Failure to do so could lead to water leaks. Offer the licence plate to the mounting area and drill two 4,85 mm holes through the plate and body panel/tailgate, symmetrically along the horizontal line of the plate, avoiding letters. Fix plate by passing two 4,8 mm blind rivets through the plate and a spacer washer into the body panel and setting in place.



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Fig.9.

APPLICATION AND USE OF SPECIFICATIONS 07

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Tightening Torques 2
Finishes applied to Standard Parts 3
Bolt Head Identification Marks 4
Strength Grade Identification of Prevailing Torque Nuts 4
Basic Conversion Tables 5

TIGHTENING TORQUES

Metric Bolt Torques

Bolt Strength: Grade 8,8 Thread fit: 6g

Finish: S 72 zinc plate, chromate passivated plus lubricant

Size	Nm	kgm	lbft
M4	2,5 to 3,0	0,2 to 0,3	1,8 to 2,2
M5	5,0 to 6,0	0,5 to 0,6	3,7 to 4,4
M6	8,5 to 10	0,9 to 1,1	6,3 to 7,4
M8	20 to 25	2,0 to 2,5	15 to 18
M10	40 to 51	4,1 to 5,2	30 to 38
M12	70 to 90	7,1 to 9,2	52 to 66
M14	114 to 146	11,6 to 14,9	84 to 108
M16	175 to 220	17,8 to 22,4	129 to 162
M18	252 to 317	25,7 to 32,3	186 to 233
M20	345 to 430	35,2 to 43,8	254 to 317
M22	470 to 590	47,9 to 60,1	347 to 435
M24	600 to 750	61,2 to 76,5	443 to 553

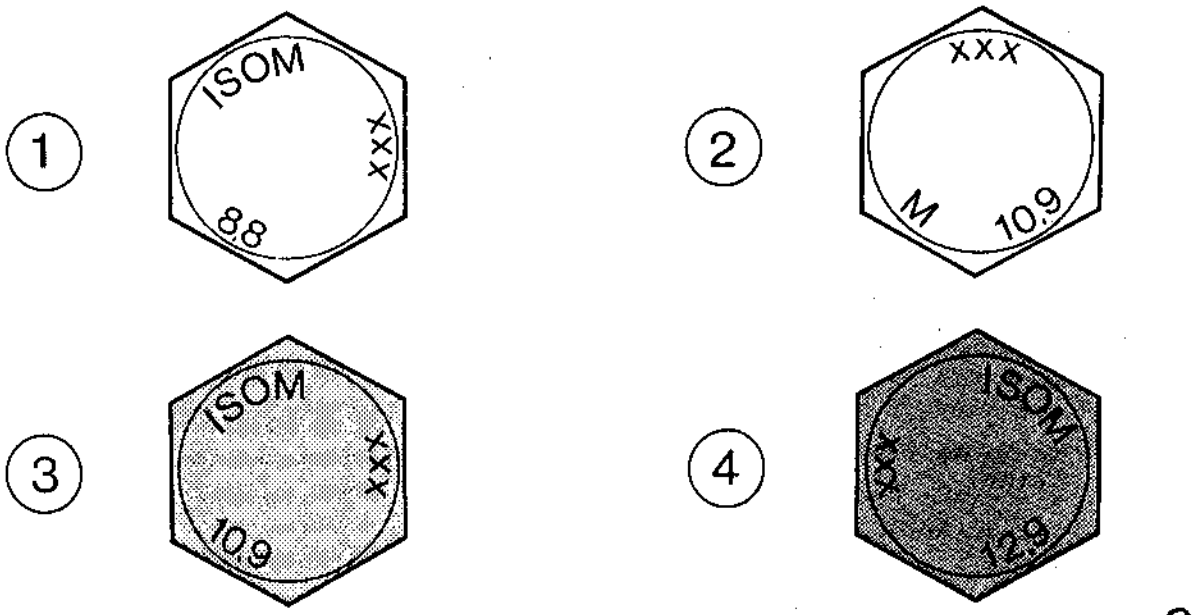
Pipe Union and Connector Torques

	Nm	kgm	lbft
Pipe Unions into Connectors:			
6 mm tube to M10 thread	15 to 18	1,5 to 1,8	11 to 13
9 mm tube M16 thread	30 to 34	3,1 to 3,5	22 to 25
12 mm tube M18 thread	45 to 49	4,6 to 5,0	33 to 36
Bundy Tube Unions and Connectors:			
4,7 mm tube diameter M10 thread	15 to 18	1,5 to 1,8	11 to 13
6,0 mm tube diameter M12 thread	20 to 24	2,0 to 2,4	15 to 18
8,0 mm tube diameter M16 thread	27 to 31	2,8 to 3,2	20 to 23
10,0 mm tube diameter M16 thread	30 to 34	3,1 to 3,5	22 to 25
12,0 mm tube diameter M18 thread	45 to 49	4,6 to 5,0	33 to 36

FINISHES APPLIED TO STANDARD PARTS

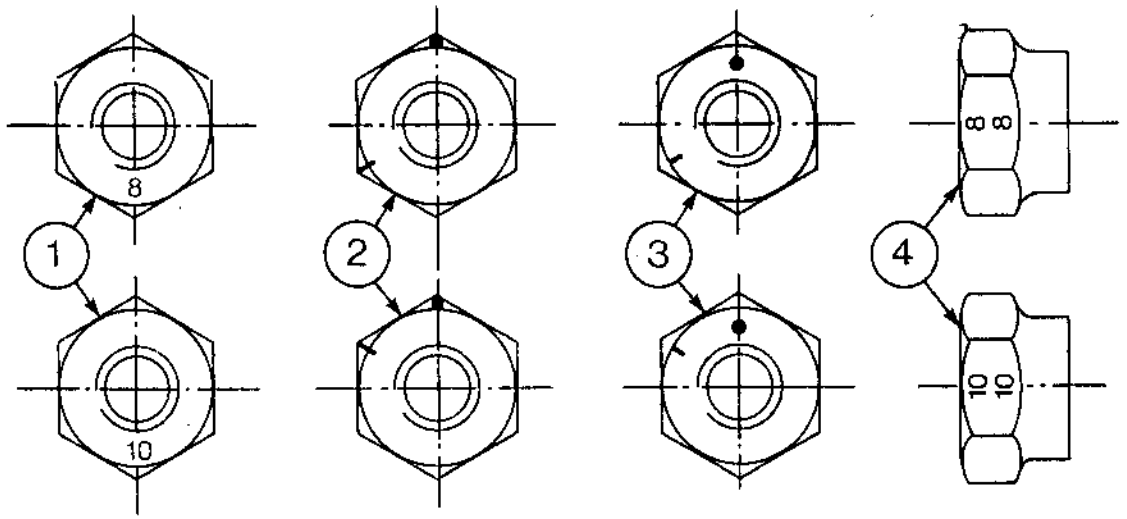
Code	Finish	Remarks
S	Plain	Same for ISO metric and inch parts Take care with identification.
S5	Copper Plate	Used only for exhaust system applications.
S16	Lead Plate	Used only for battery connections.
S71	Zinc Plate - Chromate Passivated	Used on ISO metric parts. Identified by gold or bronze colour.
S72	Zinc Plate - Chromate Passivated - Plus Lubricant	
S74	Zinc Plate - Black - Interior	
S75	Chromium Plate - Bright - Exterior	
S76	Phosphate Coat - Plus Lubricant	
S78	Chromium Plate - Bright - Interior	
S79	Zinc Plate - Clear Chromate Passivated	Used on inch parts to differentiate from ISO metric.
S80	Zinc Plate - Clear Chromate Passivated - Plus Lubricant	
S81	Enamel - Black	
S82	Zinc Plate	Used primarily in applications where limited corrosion resistance is acceptable. Take care to identify whether ISO metric or inch parts.
S83	Zinc Plate - Chromate Passivated - Plus Lubricant - Blue Dyed or Lacquered	Blue colour is intended primarily to distinguish bolts and screws of strength grade 10,9 and nuts of strength grade 10 from those of other grades. NOTE: Only mechanical plating is permissible for bolts and screws.
S86	Zinc Plate - Chromate Passivated - Plus Lubricant - Red Dyed or Lacquered	Red colour is intended primarily to distinguish bolts and screws of stregth grade 12,9 and nuts of strength grade 12 from those of other grades. NOTE: Only mechanical plating is permissible for bolts and screws.
S100 Series	Special Finishes	
S200 Series	Common Finishes for Special Purposes	
S-X	Wax Sealer	The letter 'X' used as a suffix to other finish codes indicates the addition of a wax or thermoplastic material to provide a moisture resistant seal.
S-M	Mechanical Plating	The letter 'M' used as a suffix to other finish codes indicates that mechanical plating only is permissible.

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Fig.1. Bolt Head Identification Marks - Standard Hardware
(XXX Denotes Manufacturers Identification Mark).
1. ISO Metric Bolt Standard Marking
2. ISO Metric Bolt Alternative Marking
3. ISO Metric Bolt Strength Grade 10,9 - Coloured Blue
4. ISO Metric Bolt Standard Grade 12,9 - Coloured Red



DE1-07-1

Fig.2. Strength Grade Identification of Prevailing Torque Nuts
1. Strength Grade Number Indented into Face
2. 'Clock Face' Identification Marks Embossed on Shoulders
(Dot = 12 O'clock; Line = Strength Grade
3. 'Clock Face' Identification Marks Indented into Face
4. Number Indented into one Hexagon Flat

BASIC CONVERSION TABLES

	Abbrev	From	To	Multiply By
Length	mm	Millimetres	Inches	0,0394
	in	Inches	Millimetres	25,400
	m	Metres	Feet	3,281
	ft	Feet	Metres	0,304
	Km	Kilometres	Miles	0,621
	mi	Miles	Kilometres	1,609
Area	mm^2	Millimetres 2	$Inches^2$	0,00155
	in^2	$Inches^2$	$Millimetres^2$	645,2
	m^2	$Metres^2$	$Feet^2$	10,764
	ft^2	$Feet^2$	$Metres^2$	0,0929
Volume (Liquid capacity)	cm^3	$Centimetres^3$	$Inches^3$	0,061
	in^3	$Inches^3$	$Centimetres^3$	16,387
	l	Litres	Pints	1,760
	Pt	Pints	Litres	0,570
	l	Litres	Gallons	0,220
	gal	Gallons	Litres	4,546
Mass (Weight)	gm	Grams	Ounces	0,035
	oz	Ounces	Grams	28,350
	kg	Kilograms	Pounds	2,205
	lb	Pounds	Kilograms	0,454
	t	Tonne	Ton	1,1
	Ton	Ton	Tonne	0,907
Force	kg	Kilograms	Newtons	9,807
	N	Newtons	Kilograms	0,102
	oz	Ounces	Newtons	0,278
	N	Newtons	Ounces	3,6
	lb	Pounds	Newtons	4,448
	N	Newtons	Pounds	0,224
Pressure/Stress	kPa	Kilopascals	$Pounds/Inch^2$	0,145
	lb/in^2	$Pounds/Inch^2$	Kilopascals	6,895
	bar	Bar	$Pounds/Inch^2$	14,5038
	lb/in^2	$Pounds/Inch^2$	Bar	0,06895
Torque	Nm	Newton Metres	Pound Inches	8,85
	lbin	Pound Inches	Newtons Metres	0,11298
	Nm	Newton Metres	Pound Feet	0,73756
	lbft	Pound Feet	Newton Metres	1,35582
	Nm	Newton Metres	Kilogram Metres	0,101972
	kgm	Kilogram Metres	Newton Metres	9,80665

SOLVENTS AND SEALERS 08

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Solvents, Sealers and Adhesives 2

SOLVENTS AND SEALERS

This section lists some of the solvents and sealers commonly used in the maintenance and repair of components and assemblies. The list is not exhaustive and does not preclude the use of other brands or types of solvents or sealers provided that they conform to the Ford Specification.

CAUTION: If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information regarding storage, handling and application.

WARNING: Always handle all solvents, sealers and adhesive with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.

Section 05 refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken. Some of these chemicals may be included in the following list either in their own right or as an ingredient in a sealer or adhesive.

Application	Ford Specification	Manufacturer and Identification	
ANTI SEIZE COMPOUND		ROCOL	KS PAUL
	SAM 1C 9107A	Foliac J166 Kluber Unimoly	PBCD or PBC 492 Tac 2
GENERAL PURPOSE ADHESIVES		BOSTIK	PLUS PRODUCTS
Grommets	SM 2G 4612A	-	A 2080
Rubber Parts	SM 2G 4610A	NE 186	A 1042
Mats	ESEBM 2G 1003A	(1GA 516 (4GA 95415	A 1088
Weatherstrip	ESEBM 2G 1004A	1320	-
"SUPERGLUE"		LOCTITE	
Plastic/Rubber etc	SKM 2G 9518A	414/424 Henkel Sicomet	8300
Plastic/Rubber/Metal	SKM 2G 9526A	415	
THREAD LOCKING AND SEALING		LOCTITE	
Pipe unions	SJM 4G 9102A	575 (572)	
Studs and bolts	SDM 4G 9107A	270	
JOINTING COMPOUNDS		LOCTITE	MARSTON LUBRICANTS
Setting	SDM 4G 9105A	275	-
Non-setting	SPM 4G 9112F	-	Hylomar PL32M

Application	Ford Specification	Manufacturers Identification	
BODY SEALERS		BOSTIK	W R GRACE/TEROSON
Weld-through	SM 4G 4636A	P34 44S	-
Caulking strips	SM 4G 4632AB		323
General	ESK-M4G245-A		1K91PU
General (Hi Ht Cure)	EM 4G 69	10GC 192	
WINDSHIELD GLASS TO WEATHERSTRIP SEALER	SM 4G 4631A	BOSTIK or EXPANDITE	W R GRACE/TEROSON 1841
		Bostic	P 3444S
GLASS-TO-METAL ADHESIVE SYSTEM		LOCTITE	
Adhesive	ESF M2G153A	317	
Activator	SM 97B1003A	736	

ROAD OR ROLLER TESTING 09

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ROAD OR ROLLER TESTING

Road or roller testing may be carried out for the following reasons:

- As part of regular or scheduled maintenance procedures to check that all vehicle systems function correctly and perform satisfactorily. These procedures are detailed in GROUP 5 of the manual/microfiche.

- As part of a fault diagnosis procedure to ascertain or confirm a fault. Reference should be made to FAULT DIAGNOSIS in the relevant section/s of the manual/microfiche.

- After completion of repairs, to prove the effectiveness of the repair, and to check that the function and performance of the vehicle is satisfactory.

This section follows a road or roller test procedure from pre-test checks, through engine starting and stopping, pre-driving checks, on-test checks to final checks on completion of the test procedure.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those sections particularly relevant to the system/s being checked can be extracted.

It is suggested that pre-test checks, and functional tests of those systems/circuits which affect the safe and legal operation of the vehicle, such as brakes, lights, and steering should always be carried out.

Vehicles fitted with four wheel drive should not be tested on a two wheel drive dynamometer.

PRE-TEST CHECKS

- Engine oil level

- Engine coolant level

- Tyres, for correct pressures, compatible types and tread patterns, and wear within limits.

- There is sufficient fuel in the tank to complete the test.

- All round the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks. Make a note of any apparent leaks and wipe off the surrounding area to make it easier to identify the extent of the leak on completion of the test.

WARNING: If the brake system hydraulic fluid level is low or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low level is found or the leak is rectified.

STARTING THE ENGINE

Pre-starting checks:

With the ignition switch OFF, check:

- The handbrake is applied.

- The gear lever is in neutral.

- Instrument gauges (except fuel gauge) read zero.

- Fuel gauge registers a reading appropriate to the fuel level in the tank.

With the ignition switch ON, check:

- Ignition controlled warning lights come on.

- Engine temperature gauge registers a reading compatible with the engine temperature.

- The operation of the handbrake warning light and fluid level warning indicator light.

NOTE:
a) On initial drive away from cold and within the first 1,5 km (1 mile), do not depress accelerator beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or full throttle whilst the engine is cold.

STARTING THE ENGINE (cont'd)

STARTING A COLD PETROL ENGINE

1. Fully depress the clutch.

2. Without touching the accelerator pedal, turn the ignition key to position III to crank the engine until it starts. Once the engine starts, release the key, which will return to position II.

3. If the engine does not start after 10 seconds, turn the key to position I, pause and repeat step 2.

4. If the engine does not start after three attempts, wait 10 seconds and then proceed as described under 'STARTING A FLOODED PETROL ENGINE.

STARTING A WARM PETROL ENGINE.

1. Slowly depress the accelerator pedal to about half its maximum travel, hold it in this position and turn the ignition key to position III to crank the engine until it starts.

2. Once the engine starts, release the key, which will return to position II. If the engine does not start after three attempts, wait 10 second then proceed as described under 'STARTING A FLOODED PETROL ENGINE'.

STARTING A FLOODED PETROL ENGINE

1. Slowly depress the accelerator pedal to the floor and hold it in this position.

2. Turn the ignition key to position III to crank the engine until it starts, then gradually release the accelerator pedal.

3. If the engine fails to start, proceed as described under 'STARTING A WARM PETROL ENGINE'.

ON ROAD OR ROLLER TEST

- Clutch pedal operation is not stiff or heavy.
- Initial gear engagement is smooth and there is no evidence of clutch drag.
- Handbrake control operates smoothly and the handbrake releases quickly and completely.
- Clutch takes up the drive smoothly, without slip or judder.

CAUTION: If road testing, check the brake operation while still travelling at low speed before continuing with the test. If the brakes pull to one side or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

- Gear changing is smooth, and there is no abnormal noise or vibration from the transmission.
- The engine power output is satisfactory, full power is achieved, acceleration is smooth and pedal operation not stiff or heavy, and returns to idle position correctly.
- There is no excessive or abnormally coloured smoke from the exhaust in normal driving, under heavy load or on the overrun.
- Steering operation is smooth, accurate, not eccessively heavy or with excessive free play or vibration. Does not pull to one side and self centres smoothly after cornering.
- Speedometer, coolant temperature gauge, tachometer register the correct readings or operate correctly.
- Switches and controls operate smoothly and positively, warning or indicator lights operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.
- Heating and ventilation systems work correctly and efficiently.
- Brake operation and efficiency:

If the vehicle is being tested on the road, brake testing should preferably be carried out on a dry, clean and reasonably smooth level surface, with the vehicle laden to a minimum of 75% GVM.

Avoid brake testing on busy roads where it can cause inconvenience or danger to other road users.

If the vehicle is being tested specifically for performance and efficiency of the brakes, install a suitable brake efficiency meter in the vehicle prior to starting the test.

NOTE: Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs or linings/drums until the components have 'bedded-in'. New brake friction components will not reach full efficiency until the 'bedding-in' process is complete.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake drum temperature. A drum which feels hot, or appreciably hotter than the other, indicates the brake is binding.

WARNING: Avoid breathing the smoke or fumes from hot brakes, this may contain asbestos dust which is injurious to health, see Section 05.

AFTER COMPLETION OF THE TEST CHECK FOR:

- Oil, coolant, hydraulic, air and fuel leaks.
- Abnormal temperature of any moving components or assemblies, e.g. wheel hubs, transmission, axle etc, which might indicate overtightness or lack of lubrication.

WHEELS AND TYRES 11

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TECHNICAL DATA:

Tyre Pressures 2

Wheels - Tightening Torques 3

Tyre Identification 4

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TECHNICAL DATA

RECOMMENDED TYRE PRESSURES (Cold - see Note 4)

TYRE SIZE	NORMALLY LADEN AND NORMAL USAGE (See Notes 1 and 3)				FULLY LADEN AND NORMAL USAGE (See Notes 2 and 3)			
	Front		Rear		Front		Rear	
	bar	lb/in^2	bar	lb/in^2	bar	lb/in^2	bar	lb/in^2
205/50 VR15 195/55 R15 Winter Tyre	2,1	31	2,3	34	2,3	34	2,5	37
225/45 ZR16 205/55 R15 Winter Tyre	2,0	29	2,2	32	2,2	32	2,4	35

Temporary Spares

T125/80 R15 95M T125/80 R16 97M	4,2 bar 62 lb/in^2 (For all conditions - Max. Speed 80 Km/h (50 mph)

NOTES:

1. Normal laden tyre pressures apply when vehicle is loaded with up to 3 additional passengers or the driver and 170 kg.
2. Fully laden tyre pressures apply when vehicle is loaded in excess of the normal condition and up to the maximum rated loaded condition.
3. Normal usage is defined as usage on all roads at all speeds where high speed is not sustained for more than approximately 30 minutes at any one time.
4. The tyre pressures shown should be used when the tyre is cold, i.e. when approximately at ambient temperature (not warm to the touch as is usual after operation).
5. When operating at sustained speeds above 160 Km/h (100 mph) the following tyre pressures must be used:

TYRE SIZE	NORMALLY LADEN AT SUSTAINED HIGH SPEED (See Notes 1 and 5)				FULLY LADEN AT SUSTAINED HIGH SPEED (See Notes 2 and 5)			
	Front		Rear		Front		Rear	
	bar	lb/in2	bar	lb/in2	bar	lb/in2	bar	lb/in2
205/50 VR15 195/55 R15 Winter Tyre	2,3	34	2,5	37	2,6	38	3,0	44
225/45 ZR16 205/55 R15 Winter Tyre	2,2	32	2,4	35	2,5	37	2,9	43

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TECHNICAL DATA (cont'd)

WHEELS

Sierra Cosworth			Escort Cosworth		
Alloy wheels	..	7 x 15	Alloy wheels	..	8 x 16
Steel wheels	..	5½ x 15 winter tyre	Steel wheels	..	5½ x 15 winter tyre 3½ x 16 temporary spare

NOTE: If Dunlop Performa 8000 tyres are fitted to the Escort Cosworth it must be noted that these tyres are directional and must be fitted as indicated by green or red markings on the inside of the tyre. A green marking indicates a right-hand side tyre and a red marking indciates a left-hand side tyre.

Tightening torques	Nm	lbf.ft
Wheel nuts - steel/alloy wheels	100,0	74

NOTE: Two types of wheel nut are used, one for steel wheels and another for alloy wheels. The nuts used on alloy wheels incorporate a rotating conical washer to prevent wheel damage. Ensure that the correct nuts are used for each type of wheel as they are not interchangeable.

Wheel Balancing

The diameter of spigot required on the balancing machine is 63,25 mm to 63,28 mm and this diameter must project above the wheel mounting surface by 15 mm.

The balance weights used for steel and alloy wheels differ in cross-section as they have been designed to match the contours of the specific wheel. It is therefore, important that the correct balance weights are always used.

- The rear wheels should NOT be balanced on the vehicle, as the drive system used on such balancing equipment could damage the viscous limited slip differential.

Snow Chains

For winter operation with snow chains, special 15 x 5½ steel wheels should be used. On four wheel drive vehicles snow chains should be fitted to all road wheels. If only two snow chains are available, for four wheel drive vehicles, they must be fitted to the front road wheels. On two wheel drive vehicles snow chains must only be fitted to the driving wheels, i.e. rear wheels on Sierra and front wheels on Escort.

Vehicle Jacking

It is important that any vehicle jacking complies with Section 06 of this microfiche.

Temporary Spare

Certain Escort Cosworth variants, depending on territory, carry a temporary spare. When the temporary spare is in use the following points must be adhered to:

- Drive with caution
- Do not exceed maximum speed limit of 80 km/h (50 mph)
- Only use spare on a temporary basis
- Replace temporary spare with normal wheel as soon as possible
- Do not drive vehicle with more than one temporary spare at a time

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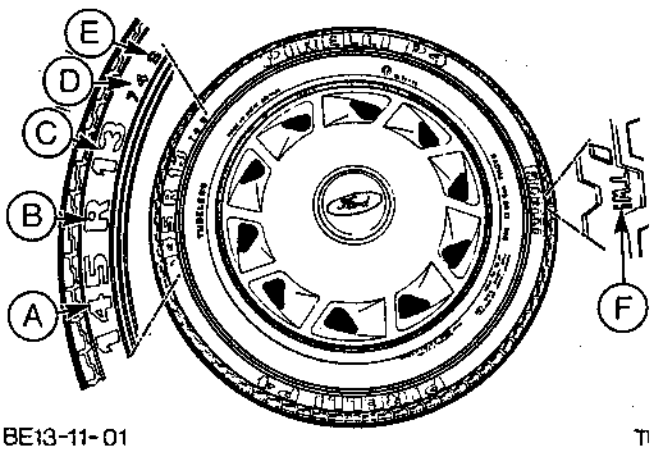
TYRE IDENTIFICATION

Tyre sizes are identified by a combination of letters and numbers using both metric and imperial dimensions.

Fig.1. illustrates a wheel and tyre assembly with the information required to determine tyre size and type.

A -'145' means the tyre is 145mm wide across its maximum overall width.

NOTE: This dimension is with the tyre mounted on a specifically designed measuring rim. Actual width of tyre may vary if the size of rim being used on the vehicle is different to the specific measuring rim.



BE13-11-01

Fig.1. Tyre identification marks.

An '/' after the tyre size (eg. 155/70) indicates the aspect ratio or height of the tyre, given as a percentage of max. width, i.e /70 = 70% of max. width.

NOTE: This is not given on all tyres - the normal height is 82% of max. width. Other common heightsare 70%, 65% and 60%, these are the so-called "low profile" tyres.

B -'R' indicates that the tyre is of radial construction.

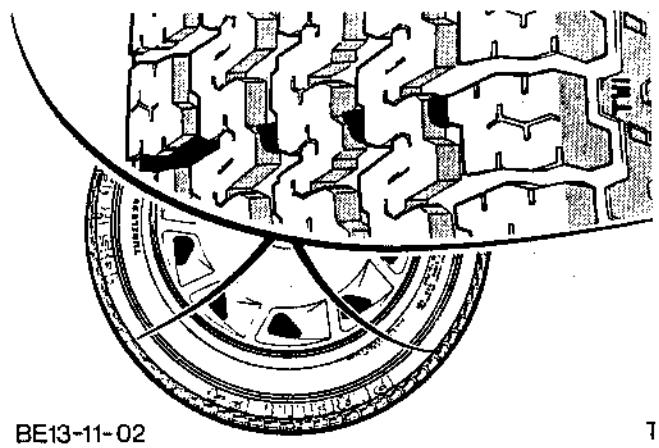
C -'13' indicates the wheel diameter in inches.

D -'74' indicates the load index. This code relates to the maximum load the tyre can carry.

E -The letter is a speed symbol - it indicates the max. speed at which the tyre can be used.

M - Up to 130 km/h (81 mph)
N - Up to 140 km/h (87 mph)
P - Up to 150 km/h (93 mph)
Q - Up to 160 km/h (99 mph)
R - Up to 170 km/h (106 mph)
S - Up to 180 km/h (112 mph)
T - Up to 190 km/h (118 mph)
H - Up to 210 km/h (130 mph)
V - Up to 240 km/h (149 mph)
Z - Unspecified limits, high performance vehicles

F -Around the edge of the tyre there may be a mark at regular intervals. This mark could be an arrow, manufacturer's symbol or the letters 'TWI'. They indicate the position of 'Tread Wear Indicators', which are raised rubber sections across the tread of the tyre (See Fig.2.). If the tread wears down to the level of the 'Tread Wear Indicator' then the tyre should be replaced.



BE13-11-02

Fig.2. Tyre tread wear indicator.

BRAKING SYSTEM 12

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Exploded views

Front caliper assembly .. .. - 24
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Hydraulic unit assembly .. .. - 38

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Front and rear disc brakes

	mm	Inches
Front disc diameter	278	10,95
New front disc nominal thickness	24,15	0,95
Worn front disc discard thickness *	22,2	0,87
Rear disc diameter	27	10,75
New rear disc nominal thickness	20,0	0,79
Worn rear disc discard thickness *	18,0	0,71

Lubricants

General grease	EM-1C-18
Handbrake lever yoke/clevis pin and brake pedal shaft/bushes	S-M1C-75A

Brake fluid

Brake fluid	SAM-6C9103-A (DOT 4) or ESD-M6C57-A (Super DOT 4)

Tightening torques

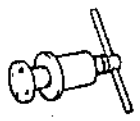
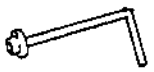
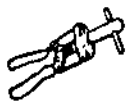
	Nm	lbf.ft
Caliper anchor bracket to spindle carrier	51 to 61	37 to 45
Piston housing to anchor bracket hexagon bolts	20 to 25	15 to 19
Caliper anchor bracket to carrier plate (rear)	51 to 61	37 to 45
Caliper piston housing slide in bolt (rear)	31 to 35	23 to 26
Wheel nuts	70 to 100	50 to 74

Hydraulic Unit: (Teves Mk II)

Hydraulic unit to bulkhead	41 to 51	30 to 38
Accumulator to pump body	34 to 46	25 to 34
Pump mounting bolt	7 to 9	5 to 7
High pressure hose banjo bolts	16 to 24	12 to 18
Reservoir mounting bolt	4 to 6	3 to 4

* When the discard thickness has been reached the disc must be replaced. Particular care must be taken when re-facing discs that the minimum thickness dimensions are not exceeded.

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 12-006	Rear caliper piston wrench
 12-007	Rear caliper spring compressor
 12-008	Wrench A.B.S. pressure switch
 12-009	Gauge A.B.S. pressure tester
 15-022	Dial indicator holding fixture
 15-046	Metric dial indicator gauge
 GE-2031	Piston spreader
 MS-94	Hexagon key adaptor
 MS-100	Medium two legged puller (Swivel legs)

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12 141 0 BRAKE SYSTEM - BLEED

SPECIAL SERVICE TOOLS REQUIRED: NONE

CAUTION: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

NOTE: When carrying out service bleed or, filling the system from dry the following points must be observed:

- Always use brake fluid, to the correct specification, from a new can. Never re-use brake fluid.

- Top up reservoir as necessary during bleeding to prevent the hydraulic pump running dry.

- Ensure brake bleed tube is in good condition and secure when fitted to bleed valve.

- The hydraulic pump motor running sound will alter once fluid has purged through it from a high pitched buzz to a lower pitched sound. (Do NOT allow pump motor to run for more than 2 minutes. If pump does run for more than 2 minutes, switch 'off', ignition position '0', and allow motor to cool for 10 minutes).

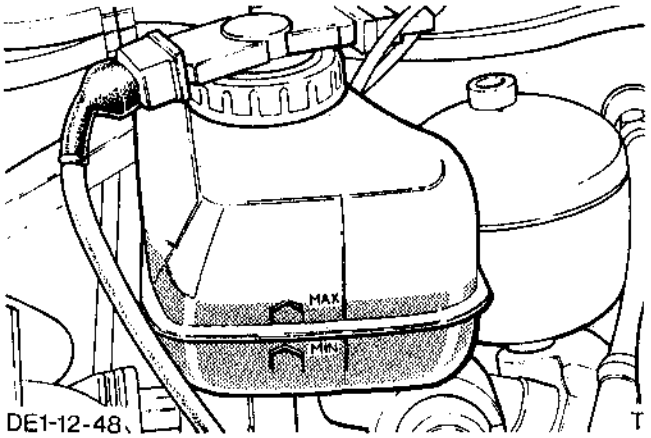


Fig.1. Reservoir 'Max and 'Min' markings.

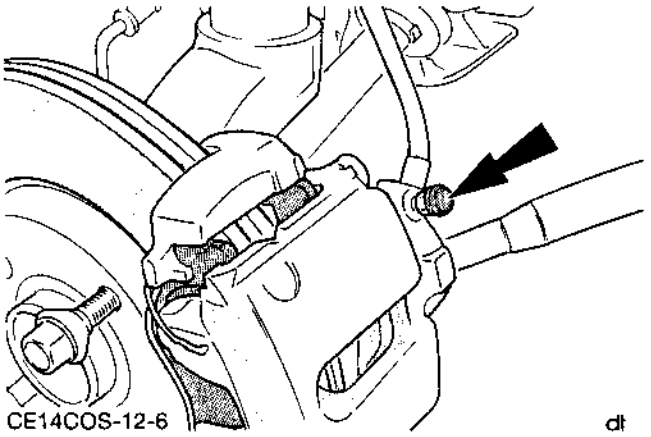


Fig.2. Front caliper bleed valve.

WARNING: CARE MUST BE TAKEN WHEN BLEEDING THE REAR BRAKE CIRCUIT AS HYDRAULIC FLUID WILL BE SUBJECTED TO EXTREMELY HIGH PRESSURE.

1. Disconnect multiplugs and remove reservoir cap. Top up reservoir, (Fig.1).

2. Open front left hand caliper bleed valve one full turn, (Fig.2).

3. Depress brake pedal to full travel and hold down.

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4. Close bleed valve, release brake pedal.

5. Repeat sub operations 2 to 4 until brake fluid flows air-free from bleed valve.

6. Bleed front right hand caliper in same manner as left hand caliper, (Fig.3).

7. Open rear left hand caliper bleed valve one full turn.

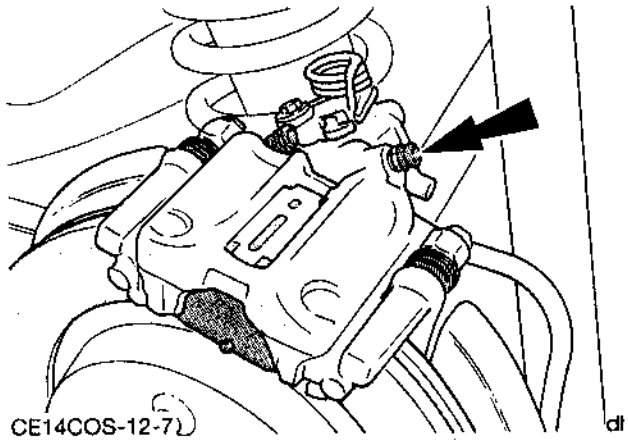


Fig.3. Rear caliper bleed valve.

8. Actuate foot brake. Retain foot brake in full travel position.

9. Switch 'on' ignition, position 'II'.

10. Allow fluid to flow from left hand bleed valve, allow fluid to continue to flow until air-free fluid flows.

11. Close bleed valve.

12. Release brake pedal and wait until hydraulic pump has stopped (switched 'off').

13. Actuate foot brake to half pedal travel and retain in this position.

14. Open rear right hand bleed valve one full turn, leave in this 'open' position until fluid flows free of air.

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15. Close bleed valve.

16. Release brake pedal, wait until hydraulic pump has stopped (switched 'off').

17. Top up reservoir to 'max' mark on reservoir.

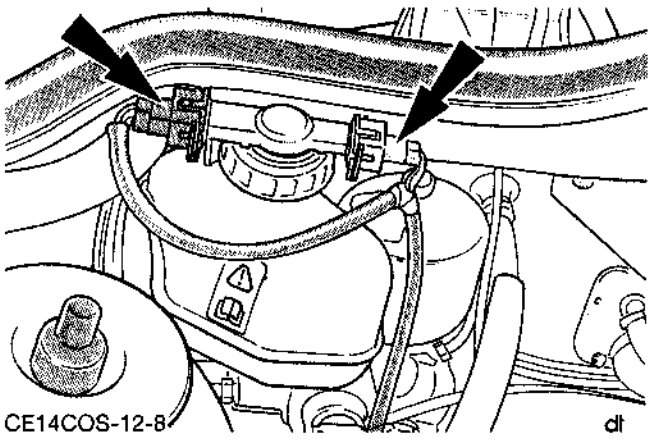


Fig.4. Reconnect reservoir warning switch multiplugs.

18. Switch 'off' ignition (position '0').

19. Replace reservoir cap ensuring locating peg on reservoir is correctly located to reservoir cap.

20. Reconnect wiring connections, (Fig.4).

21. Check for correct function of anti-lock warning lamps.

22. Check system for leakages, function and efficiency.

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12 154 0 BRAKE SYSTEM - HYDRAULIC FLUID - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Caliper piston expander	..	GE-2031
Hexagon key adaptor	..	MS-94

NOTE: This procedure details how old brake fluid can be purged from the system by draining both front calipers circuits of fluid and replenishing with new fluid. Rear brakes can be replenished in the normal method as described in operation 12 141 0.

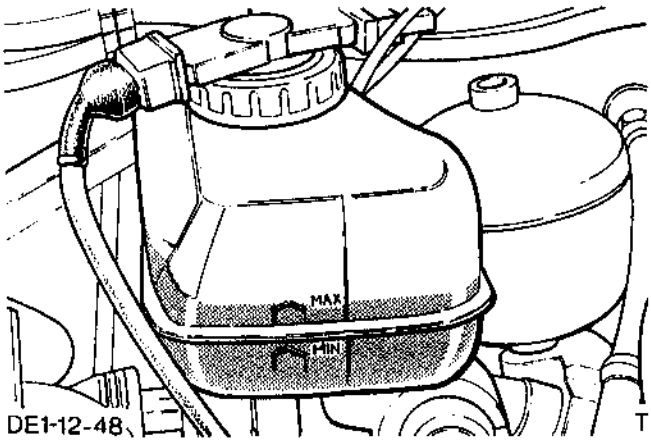


Fig.1. Reservoir 'Max' and 'Min' markings.

CAUTION: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

WARNING: CARE MUST BE TAKEN WHEN BLEEDING THE REAR BRAKE CIRCUIT AS HYDRAULIC FLUID WILL BE SUBJECTED TO EXTREMELY HIGH PRESSURE.

1. Open hood, fit fender covers. Remove ignition key.

2. Remove hydraulic unit fluid reservoir filler cap.

3. Jack up vehicle and fit chassis stands or raise on wheel-free hoist.

4. Connect bleed tubes to both front caliper bleed valves. Place other ends of tubes into suitable container to collect the purged fluid. Unscrew bleed valves one full turn, (Fig.2).

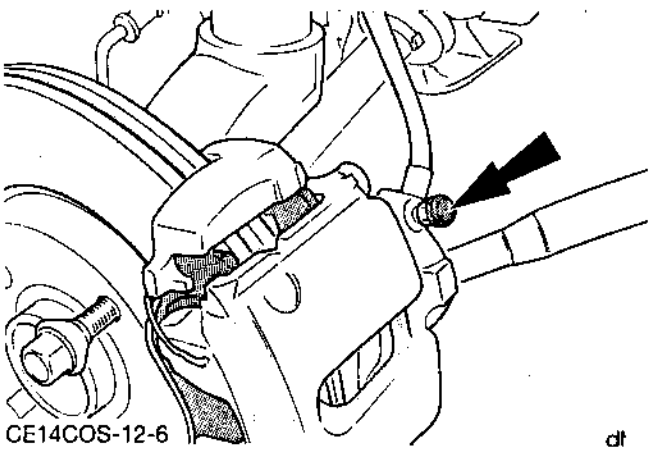


Fig.2. Front caliper bleed valve.

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5. Depress brake pedal fully and allow it to return quickly to rest. Continue to pump brake pedal until all fluid is purged from calipers and air is being pumped into containers, (pause between strokes to allow master cylinder to recuperate).

6. Remove both front road wheels.

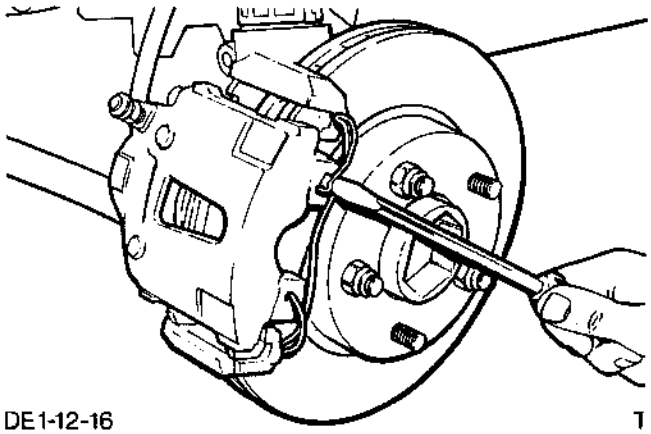


Fig.3. Front caliper retaining clip.

7. Remove retaining clip from left hand caliper housing, (Fig.3.).

8. Using 7 mm hexagonal socket. Withdraw piston housing sliding bolts until piston housing is free from anchor bracket, (Fig.4).

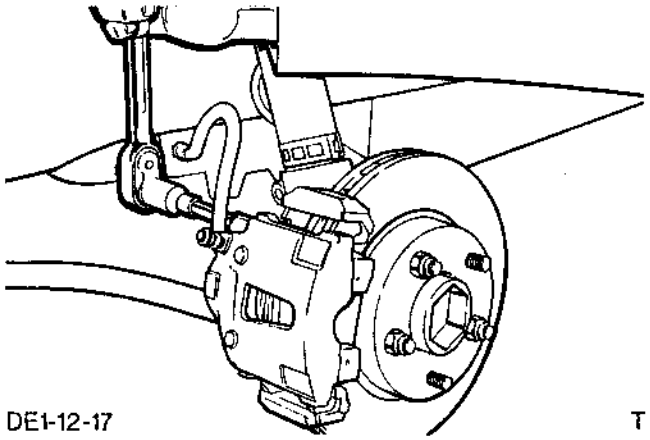


Fig.4. Using 7 mm hexagonal socket remove piston housing slide bolts.

9. Lift caliper piston housing from anchor bracket and lift out brake pad from piston, (leave opposite pad attached to piston housing).

10. Fit piston expander into jaw of piston housing. Actuate piston expander to fully retract piston, (Fig.5). Pump brake pedal until only air is being pumped out. Tighten bleed valve.

NOTE: When first caliper has been purged, loosely refit brake pads and fit to anchor bracket to prevent the piston being forced out of its housing when second side is being purged.

11. Repeat sub operations 7 to 10 for the right hand caliper.

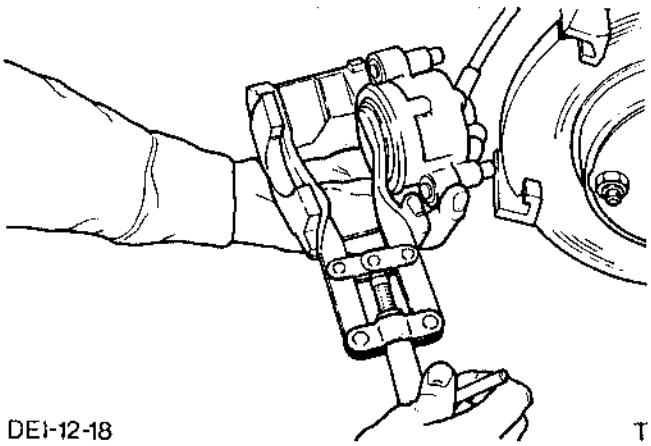


Fig.5. Retract caliper piston using piston expander.

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12. Position bleed tube into clean glass jar, containing a small quantity of approved brake fluid. Position jar at least 300 mm above bleed nipple to ensure that the bleed valve itself is subjected to fluid pressure thereby preventing the possibility of air leaking past the threads of the bleed valve and into the brake system, (Fig.6).

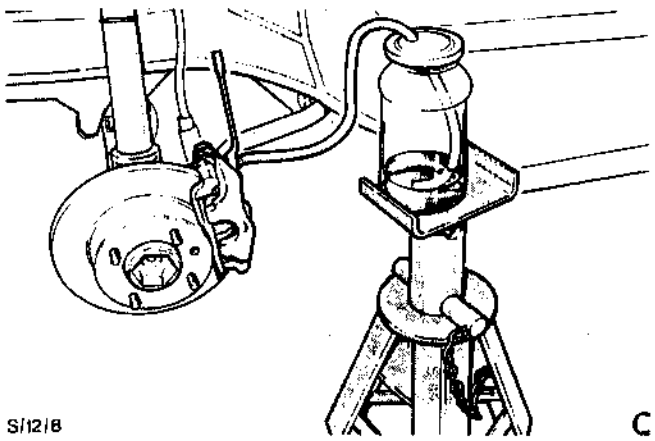


Fig.6. Position bleed jar at least 300 mm above bleed valve.

13. Fill reservoir with new fluid from a new container. Continue pumping the brake pedal, pausing after each stroke until air-free fluid is seen passing through the bleed tube. Hold brake pedal fully depressed and tighten bleed valve. Release brake pedal.

14. Top up reservoir. Carefully unscrew piston expander while applying the brake pedal, so moving the caliper piston to its fully extended position, (Fig.7). With the pedal still depressed unscrew bleed valve. Force caliper piston back to its fully retracted position by screwing in the piston expander.

15. Retighten bleed valve once piston is fully retracted. Remove piston expander, refit pad.

16. Assemble piston housing to anchor bracket, secure with 7 mm hexagonal slide bolts. Torque to specification. Refit caliper retaining clip.

17. Repeat sub operations 14 to 16 for left hand caliper.

18. Top up reservoir to 'max' mark, continue to top up reservoir as required.

19. Open rear left hand caliper bleed valve one full turn.

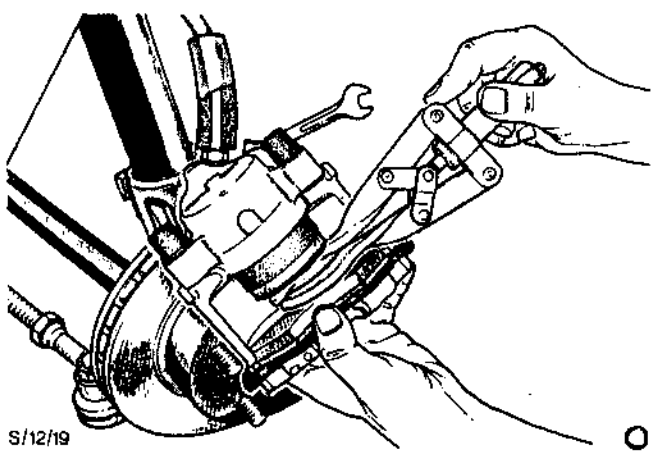


Fig.7. Caliper piston at fully extended position.

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20. Actuate foot brake. Retain foot brake in full travel position.

21. Switch on ignition, position 'II'.

22. Allow fluid to flow from left hand bleed valve, continue to allow fluid to flow until clean air free fluid flows.

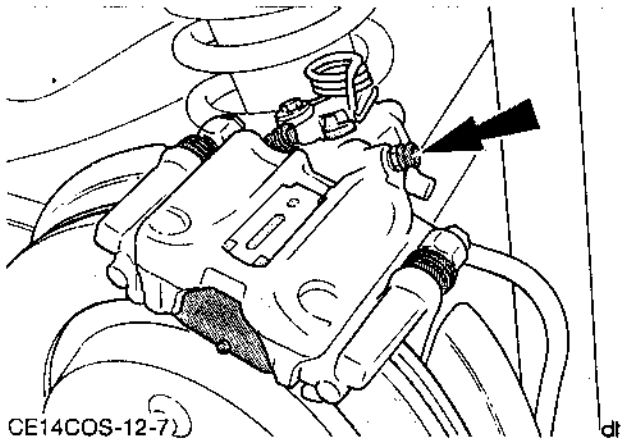


Fig.8. Rear caliper bleed valve.

23. Close bleed valve.

24. Release brake pedal and wait until hydraulic pump has stopped (switched 'off').

25. Actuate foot brake to half pedal travel and retain in this position.

26. Open rear right hand bleed valve one full turn, leave in this open position until clean fluid flows free of air.

27. Close bleed valve.

28. Release brake pedal, wait until hydraulic pump has stopped (switched 'off').

29. Switch 'off' ignition (position '0'), and top up reservoir.

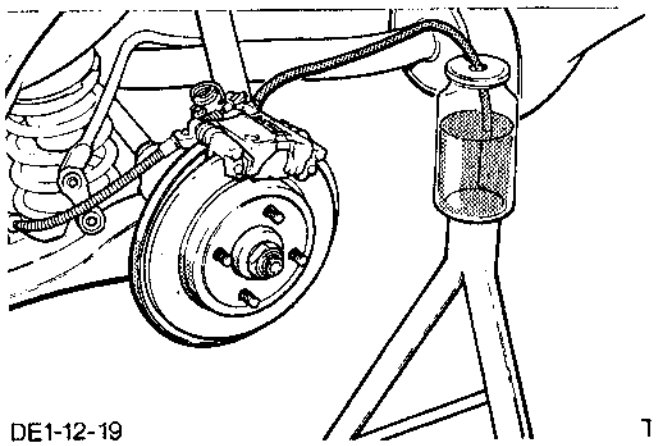


Fig.9. Position bleed jar at least 300 mm above bleed valve.

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30. Check for correct function of anti-lock warning lamps.

31. Refit front road wheels and tighten wheel nuts to specification.

32. Check system for leakage, function and efficiency.

33. Remove fender covers and close hood. Lower vehicle.

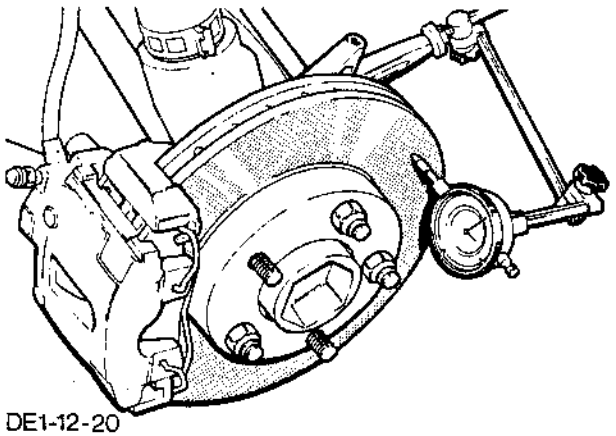
12 221 0 BRAKE DISC - CHECK RUN-OUT - FRONT AND REAR

SPECIAL SERVICE TOOLS REQUIRED:

Dial indicator holding fixture	..	15-022
Metric dial indicator gauge	..	15-046

1. Jack up vehicle fit chassis stands.

2. Remove front and/or rear road wheels. (Remove disc retaining clip before fitting wheel nuts). Refit wheel nuts to hold the discs in place on hub. Tighten nuts to specification.



DE1-12-20 T

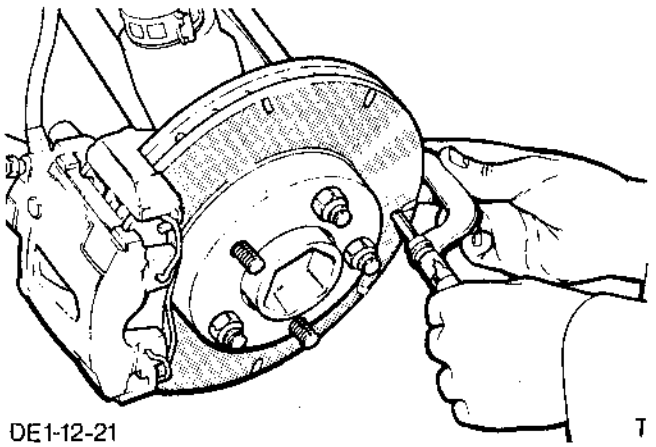
Fig.1. Measure front disc run-out.

Front brake disc check

3. Using dial gauge holding fixture, Special Service Tool No. 15-022 and gauge, attached to the steering arm measure disc run-out.

   This figure must be within 0,10 mm run-out of total indicator reading.

4. Using a suitable micrometer measure disc thickness at eight positions, 45° apart and 15 mm in from the outer edge of the disc, (Fig.16). If any of these readings vary by 0,01 mm or more or, if the minimum thickness of the disc is below 22,2 mm the disc should be replaced. See operation 12 224 0.



DE1-12-21 T

Fig.2. Measure disc thickness using suitable micrometer.

0492

Rear brake disc check

5. Using dial gauge and holding fixture attached to the lower arm measure disc run-out, (Fig.3).

   This figure must be within 0,10 mm run-out of total indicator reading.

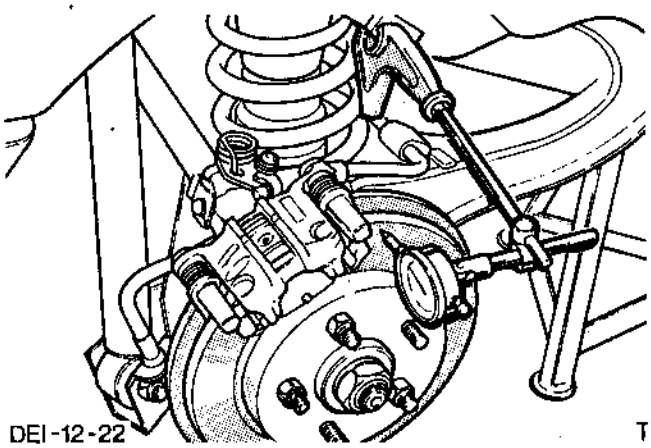


Fig.3. Measure outer face of rear disc for run-out.

6. Using suitable micrometer measure disc thickness at eight positions 45° apart and 15 mm in from the outer edge of the disc.

   If any of these eight readings vary by 0,01 mm or more or if the readings are less than the specified minimum thickness, the disc should be replaced. See operation 12 225.

7. Replace road wheels and torque wheel nuts to correct specification.

8. Remove chassis stands and lower vehicle.

12 224 0 DISC - FRONT BRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Jack up vehicle and fit chassis stands.

2. Remove road wheels.

3. Remove caliper retaining bolts, suspend caliper from inner fender to prevent damage to brake hose.

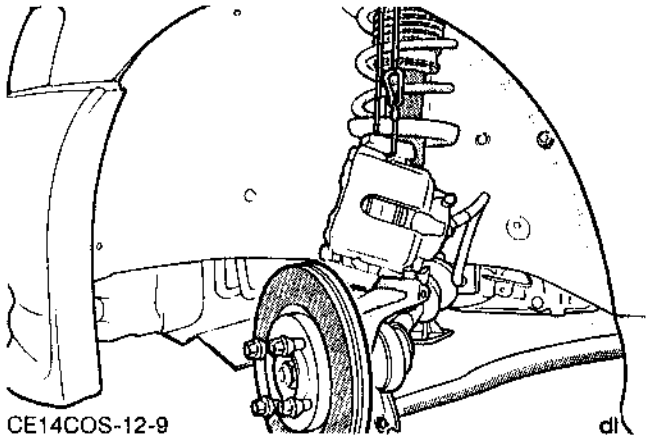


Fig.1. Suspend caliper from inner fender.

4. Mark disc and hub relative position. Remove disc securing clip, and remove disc off hub.

To Install

NOTE: If original disc is to be refitted ensure match marks are aligned.

5. Refit disc onto hub. Ensure hub and disc alignment marks are in line.

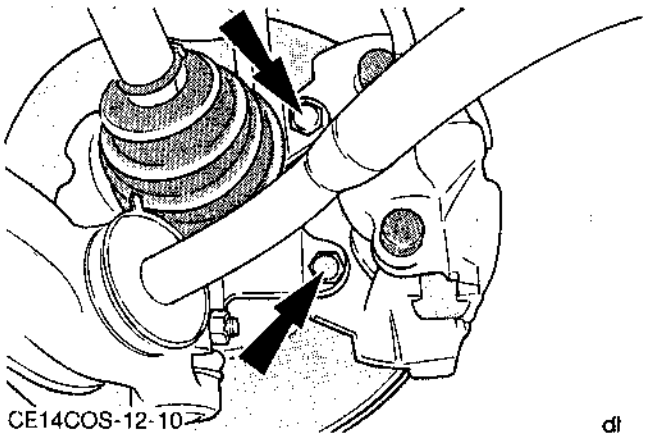


Fig.2. Refit caliper retaining bolts.

6. Relocate caliper onto spindle carrier, refit caliper retaining bolts and torque to specification.

NOTE: Turn steering from lock to lock and check that brake hose does not twist up causing damage to hose by chafing.

7. Refit road wheels and tighten.

8. Remove chassis stands and lower vehicle. Apply foot brake to bring brake pads in the correct adjustment with disc.

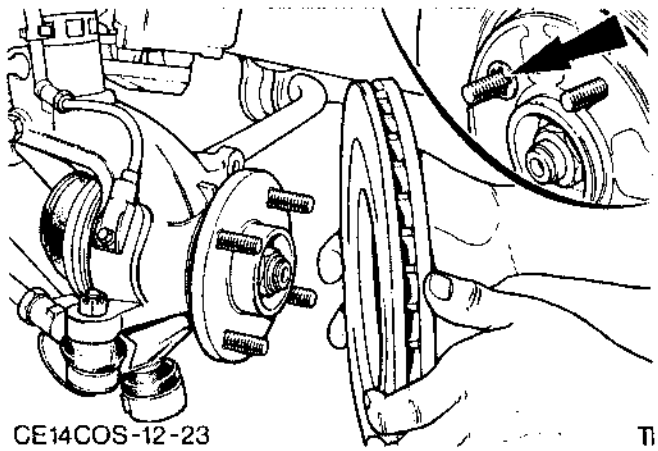


Fig.3. Disc removal.

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12 225 0 DISC - REAR BRAKE - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: REAR BRAKE SYSTEM IS SUBJECTED TO HIGH HYDRAULIC PRESSURE. DO NOT APPLY FOOT BRAKE ONCE CALIPER HAS BEEN REMOVED.

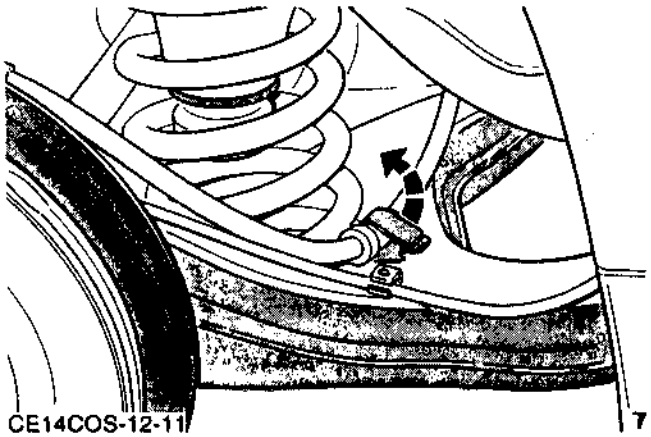


Fig.1. Handbrake lower arm retaining clip.

To Remove

1. Slacken rear wheel nuts.
2. Jack up vehicle and fit chassis stands.
3. Remove road wheel and release handbrake.
4. Detach handbrake cable from lower arm retaining clip.

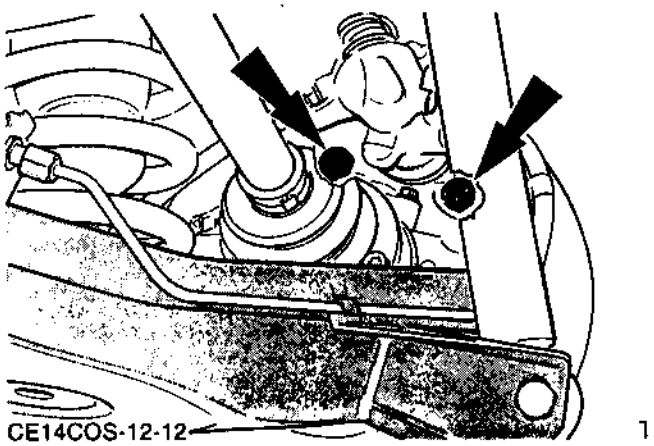


Fig.2. Remove caliper anchor bracket retaining bolts.

5. Remove caliper anchor bracket retaining bolts. Suspend caliper clear of disc preventing any stress to flexible hose, Fig.3.
6. Remove disc retaining clip from wheel stud. Mark disc and hub relative position, remove disc from hub.

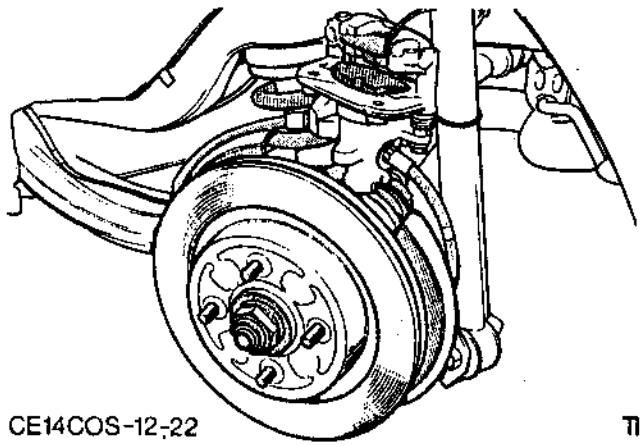


Fig.3. Rear caliper shown suspended.

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To Install

NOTE: If original disc is to be refitted ensure match marks are aligned.

7. Refit disc onto hub align match marks, refit clip.

8. Reposition caliper over disc and fit retaining bolts, torque to specification.

9. Relocate handbrake cable into lower arm clip and secure.

10. Apply handbrake and refit road wheel/s.

11. Remove chassis stands, lower vehicle and fully tighten road wheels.

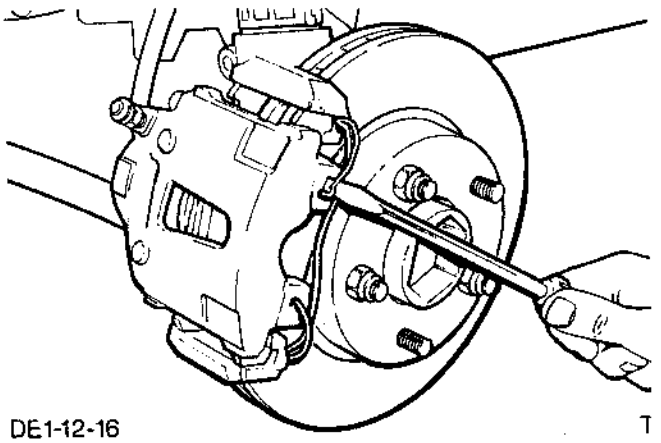
12 233 0 DISC PADS - FRONT - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Caliper piston expander	..	GE-2031
Hexagon key adaptor	..	MS-94

To Remove

1. Jack up front of vehicle, and fit chassis stands.

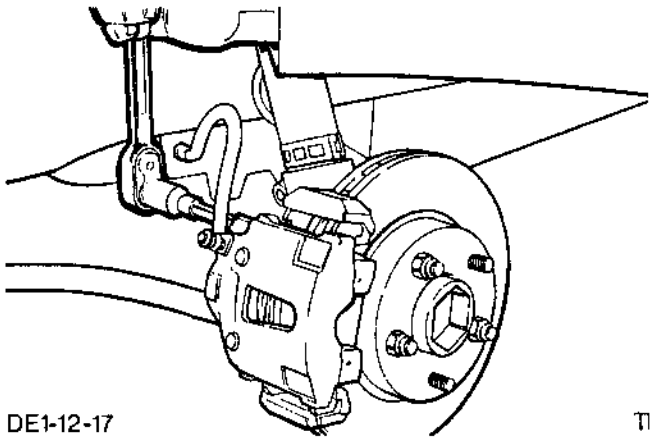


DE1-12-16 T

Fig.1. Remove caliper spring clip.

2. Remove road wheels.

3. Remove spring retaining clip from caliper housing.

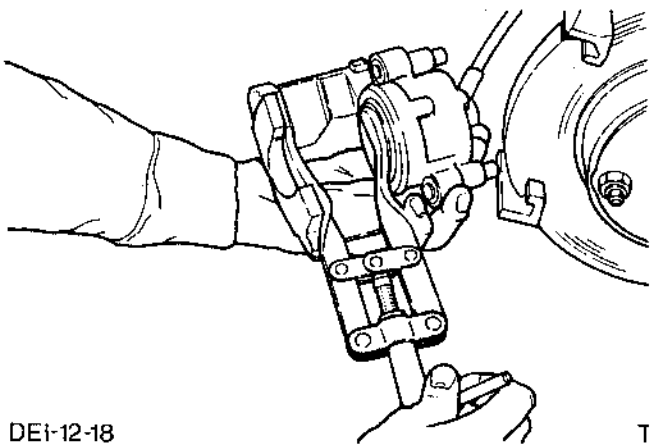


DE1-12-17 T

Fig.2. Using 7 mm Hexagon key socket, remove slide bolts.

4. Using hexagon key adaptor 7 mm socket, unscrew bolts until piston housing is free from anchor bracket.

5. Separate piston housing from anchor bracket, remove inner pad from piston. Using caliper piston expander, carefully force piston back in to housing.



DE1-12-18 T

Fig.3. Carefully force piston back into piston housing using piston expander.

6. Remove outer brake pad from housing jaw.

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To Install

7. Fit pad into caliper piston housing. Peel off sticky back paper from non piston pad and locate onto pad guide of anchor bracket.

8. Ensure pads and disc are free from any grease or dirt contamination.

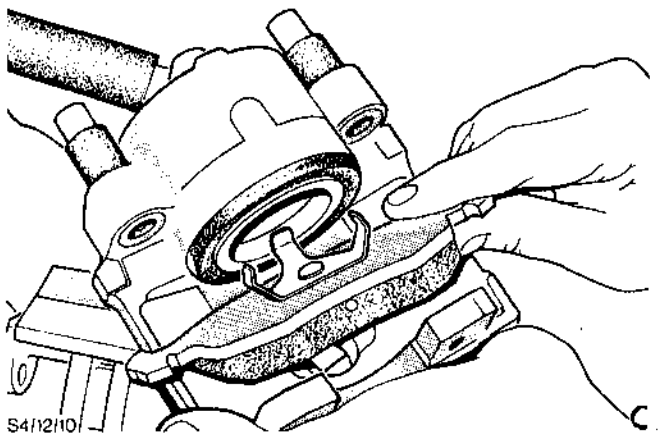


Fig.4. Locate brake pads into piston housing.

9. Assemble pistons housing to anchor bracket, secure with 7 mm hexagon bolts. Torque to specification.

10. Reconnect caliper piston housing spring.

11. Refit road wheels remove chassis stands and lower vehicle.

12. Apply foot brake several times to ensure brakes are correctly adjusted before moving off.

0492

12 237 0 DISC PADS - REAR - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Piston wind back 12-006

CAUTION: Rear brake system is subjected to high hydraulic pressure. Do NOT apply foot brake once caliper has been removed from anchor bracket.

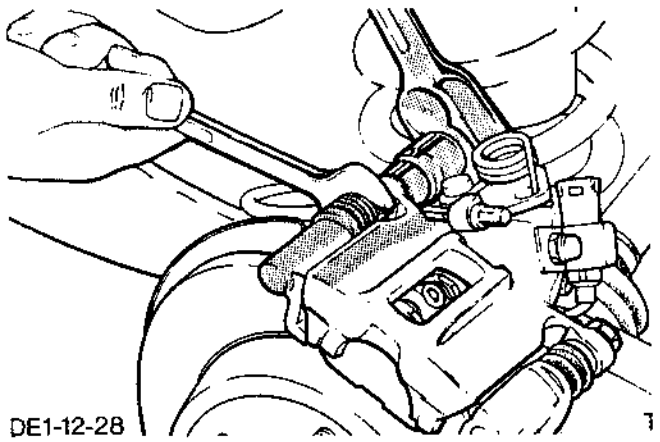


Fig.1. Remove front slide pin bolt.

To Remove

1. Slacken rear wheel nuts. Release handbrake.

2. Raise vehicle and fit chassis stands. Remove road wheels.

3. Detach handbrake cable from lower arm retaining clip.

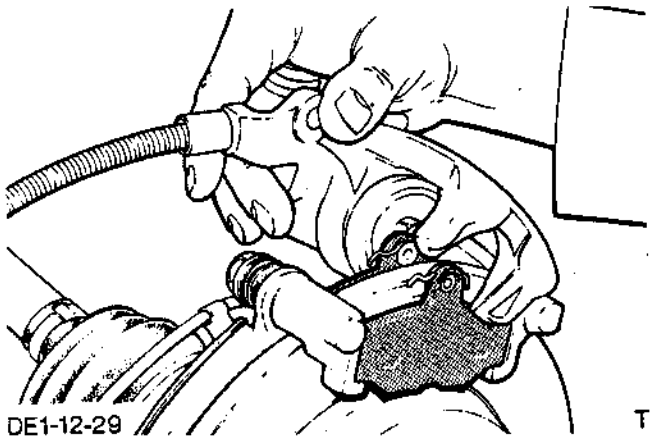


Fig.2. Lift out brake pads.

4. Remove forward bolt securing piston housing to carrier anchor bracket. Swing piston assembly away from brake disc.

5. Remove brake pads from carrier bracket.

6. Using Special Service Tool 12-006 wind back piston clockwise into housing.

NOTE: Ensure one slot in piston face is positioned so that it will engage with key on brake pad backing plate.

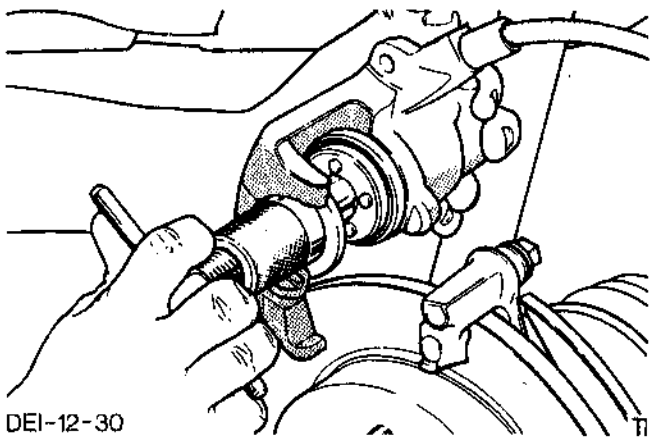


Fig.3. Wind back piston using Special Service Tool 12-006.

0492

To Install

7. Position brake pads in carrier bracket.

8. Swing piston housing over disc positioning slot in piston over key in brake pad backing plate. Ensure brake pad anti rattle springs are correctly positioned in piston housing, refit bolt to caliper anchor bracket slide pin, torque to specification.

9. Relocate handbrake cable into lower arm securing clip.

10. Apply foot brake, to bring pads into contact with disc, ensuring correct adjustment.

11. Refit road wheels, remove chassis stands and lower vehicle.

12. Fully torque road wheels.

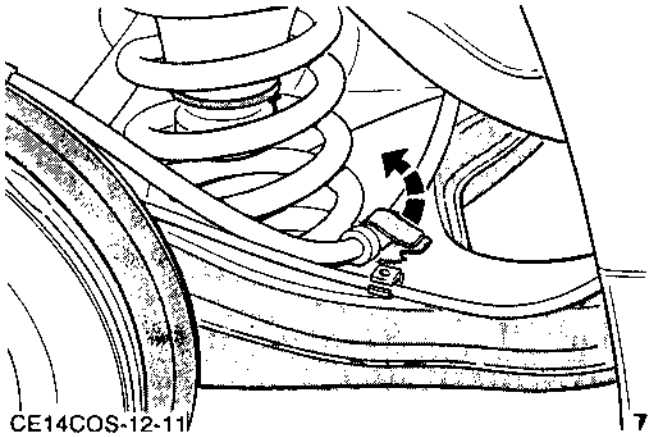


Fig.4. Lower arm handbrake cable clip.

12 243 0 CALIPER ASSEMBLY - FRONT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Hexagonal key adaptor .. MS-94

WARNING: SWITCH OFF IGNITION (POSITION '0'), AND APPLY FOOT BRAKE AT LEAST 20 TIMES OR UNTIL PEDAL BECOMES HARD TO DE-PRESSURISE THE SYSTEM.

NOTE: If brake fluid is spilt on paintwork the affected area must be washed down with cold water immediately.

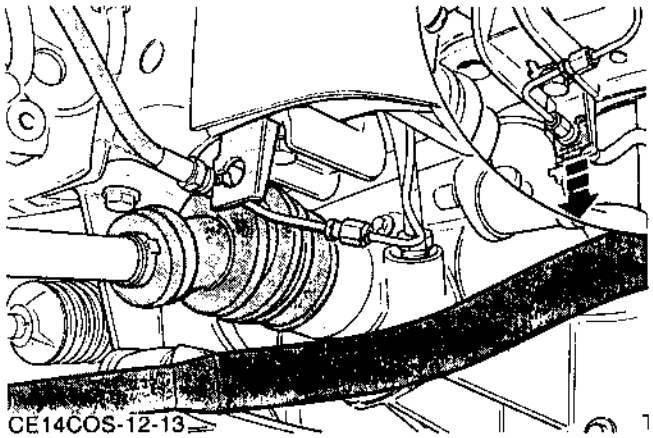


Fig.1. Remove flexible hose/brake pipe securing clip.

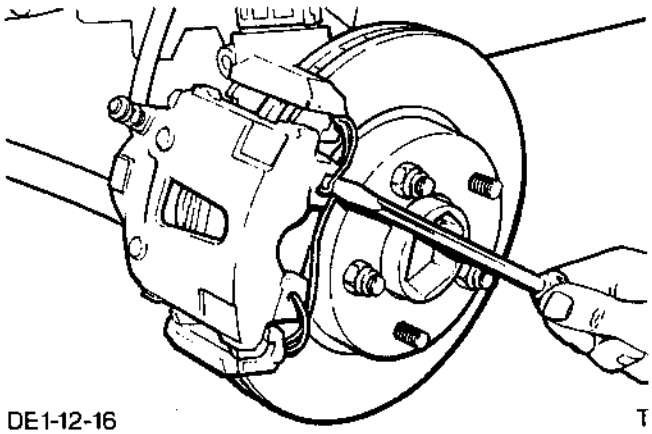


Fig.2. Remove piston housing spring clip.

To Remove

1. Jack up vehicle, fit chassis stands and remove front wheels.

2. Remove clip securing brake pipe/flexible hose to front crossmember, (Fig.1).

3. Disconnect brake pipe and flexible hose, fit blanking plugs to brake pipe and flexible hose to prevent excessive fluid loss.

4. Remove spring retaining clip from caliper housing, (Fig.2).

0492

5. Using hexagonal key adaptor 7 mm socket. Unscrew bolts until piston housing is free from anchor bracket.

6. Remove bolts securing anchor bracket to spindle carrier.

7. Remove brake pads and flexible hose from caliper piston housing.

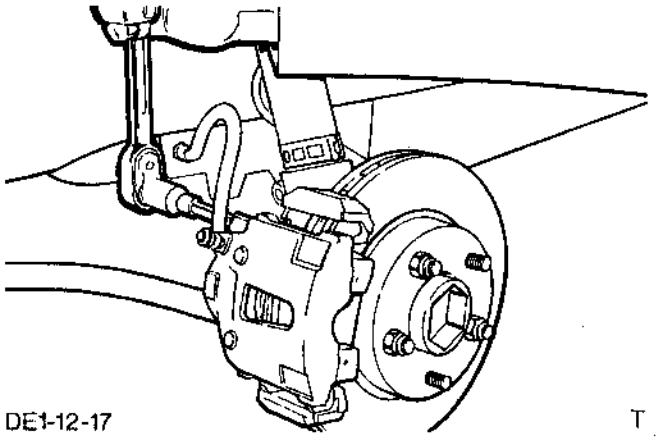


Fig.3. Remove piston housing slide bolts.

To Install

8. Secure anchor bracket to spindle carrier, torque bolts to 51 to 61 Nm.

9. Fit brake pad into caliper piston. Peel off sticky backing paper from non piston pad and secure onto housing jaw.

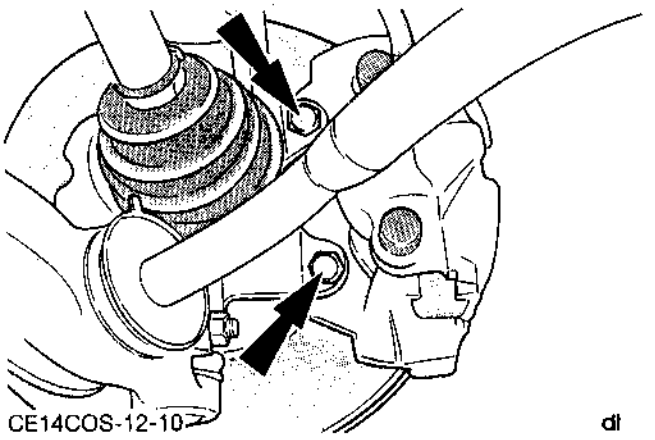


Fig.4. Refit anchor bracket to spindle housing.

10. Reconnect flexible hose to caliper housing and tighten.

11 Ensure pads and disc are free from any grease or dirt contamination.

12. Assemble piston housing to anchor bracket, secure with 7 mm hexagonal bolts, torque to 20 to 25 Nm.

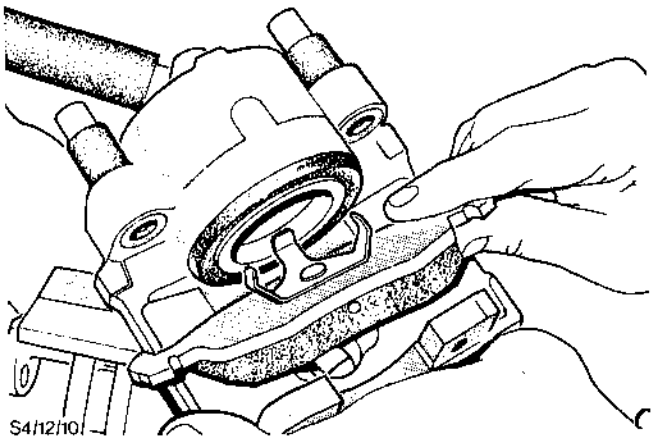


Fig.5. Refit brake pads into piston housing.

0492

13. Remove blanking plugs from hose connection and reconnect flexible hose to brake pipe. Reclip brake pipe to front crossmember.

14. Bleed front brake circuit. Once brakes have been bled apply foot brake several times to ensure correct adjustment.

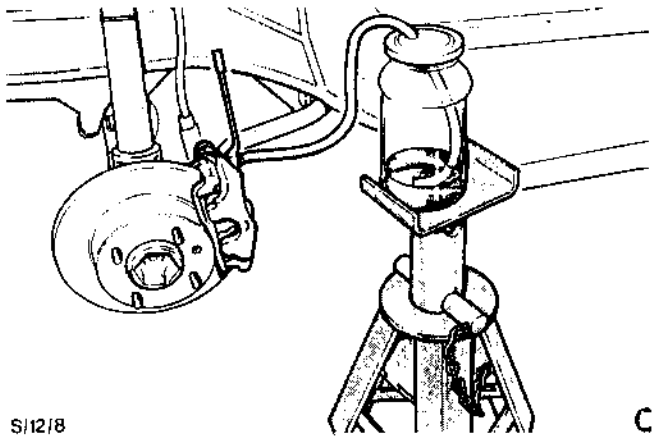


Fig.6. Position bleed jar at least 300 mm above bleed valve.

15. Turn road wheels from lock to lock, checking that the flexible hose dose not 'wind-up'.

16. Refit front wheels, remove chassis stands and lower vehicle.

17. Fully tighten road wheels.

0492

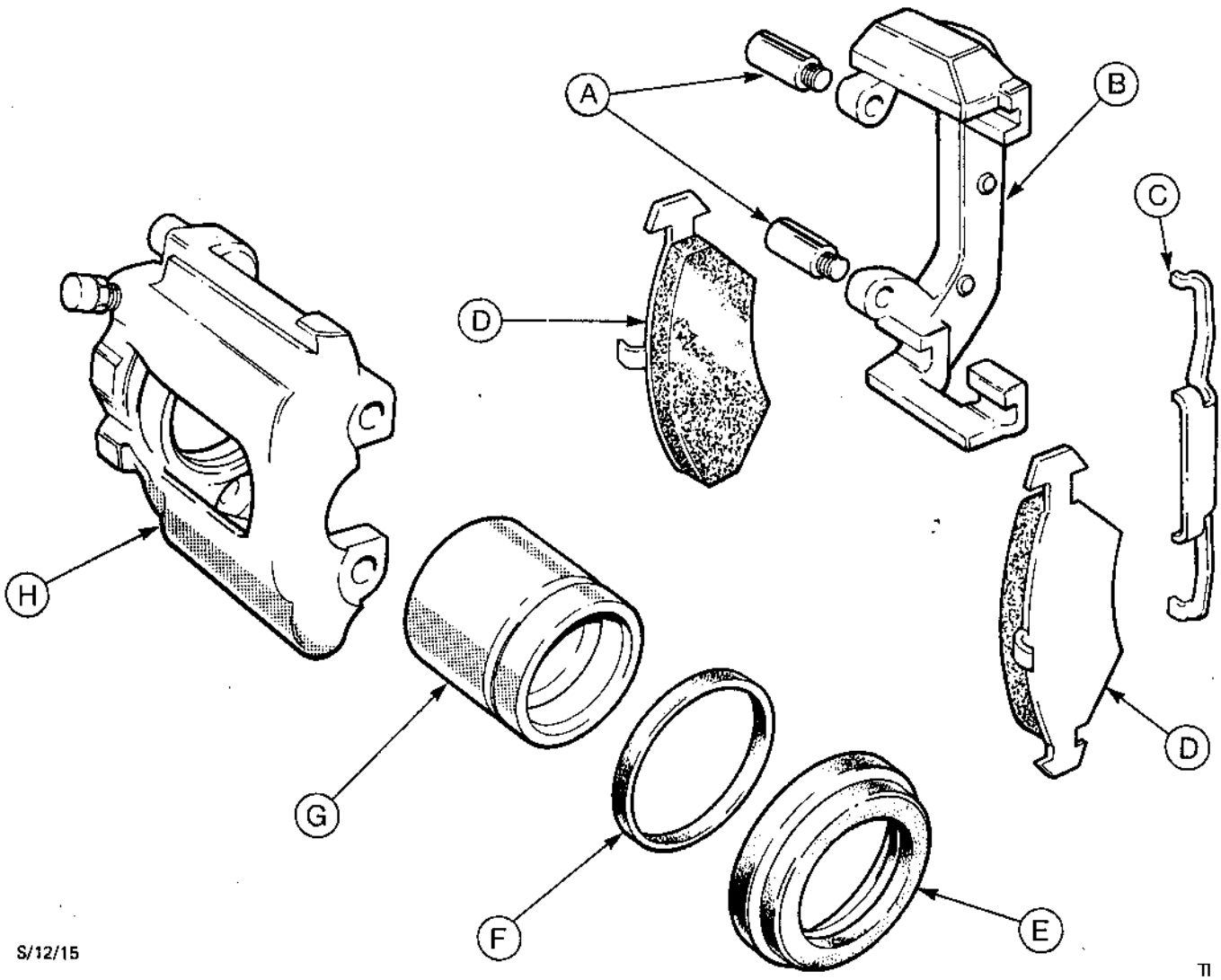


Fig.7. Front caliper exploded view.

A - Retaining bolts	C - Retaining clip	E - Dust seal	G - Piston
B - Anchor bracket	D - Brake pads	F - Piston seal	H - Piston housing

0492

12 247 4 PISTON - FRONT CALIPER - REMOVE AND INSTALL (Caliper piston housing removed)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Apply low hydraulic or low air pressure to caliper piston inlet port until piston is removed. Use a suitable spacer (wood) between piston and piston jaw preventing damage to piston face.

NOTE: The piston dust cover cannot be removed until the piston is removed.

2. Hook out piston seal and dust cover.

3. Wash piston and cylinder bore in commercial alchol, methylated spirits.

4. Check piston and cylinder bore for sign of damage, scuffing, scores or corrosion.

   If cylinder bore body is corroded use wire wool to clean. Do not attempt to clean piston surface.

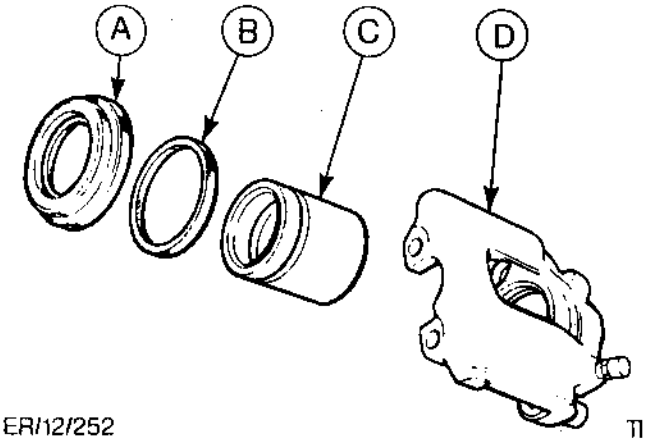


Fig.1. Piston housing assembly.
A - Dust cover C - Piston
B - Piston seal D - Caliper

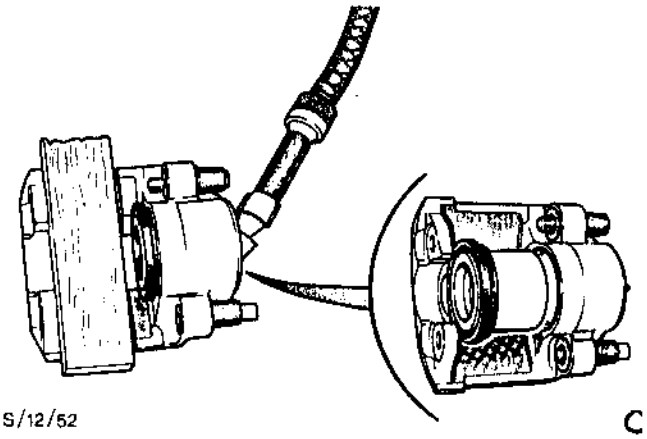


Fig.2. Remove piston from piston housing using low air pressure.

To Install

5. Lubricate cylinder bore and new piston seal with brake fluid.

6. Locate new piston seal in cylinder bore groove.

7. Stretch dust cover over piston and assemble piston into cylinder bore.

8. Carefully push piston fully home into cylinder bore. Refit brake pads and assemble caliper assembly to anchor bracket.

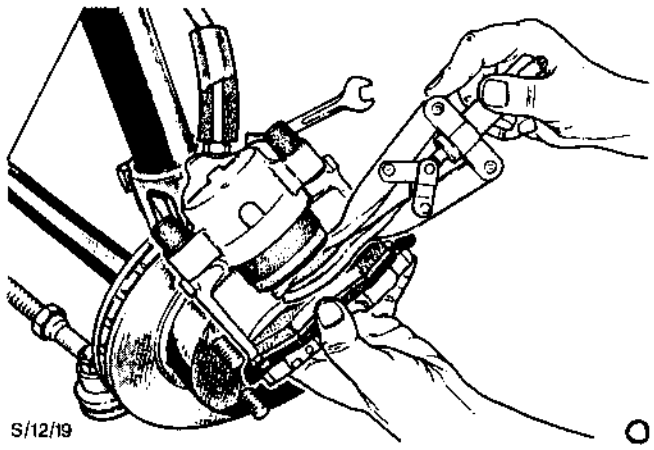


Fig.3. Stretch dust cover over piston assembly and push piston into housing.

0492

12 253 0 CALIPER ASSEMBLY - REAR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: SWITCH OFF IGNITION (POSITION '0'), AND APPLY FOOT BRAKE AT LEAST 20 TIMES OR UNTIL PEDAL BECOMES HARD TO DE-PRESSURISE THE SYSTEM.

NOTE: If brake fluid is spilt on paintwork the affected area must be washed down with cold water immediately.

To Remove

1. Open hood and fit fender covers.
2. Jack up vehicle and fit chassis stands.
3. Remove road wheels.
4. Release handbrake lever.

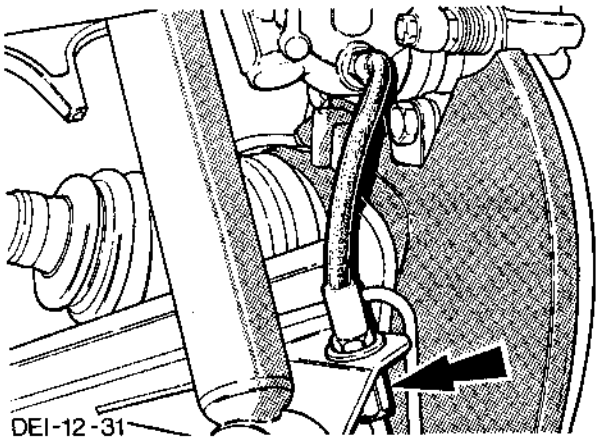


Fig.1. Disconnect flexible hose from brake pipe.

5. Disconnect flexible hose from brake pipe, fit blanking plugs to prevent excessive fluid loss.
6. Remove caliper anchor bracket retaining bolts.

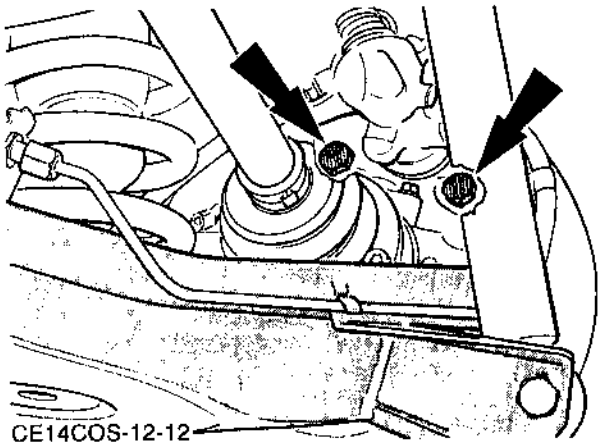


Fig.2. Remove anchor bracket retaining bolts.

0492

7. Unhook handbrake cable from lever, lift out caliper assembly.

8. Remove brake flexible hose from caliper.

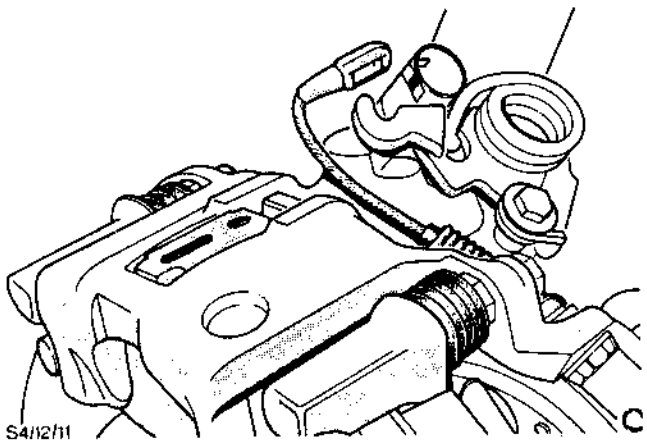


Fig.3. Unhook handbrake cable from lever.

To Install

9. Connect handbrake cable to caliper lever.

10. Mount caliper into position and secure. Tighten mounting bolts.

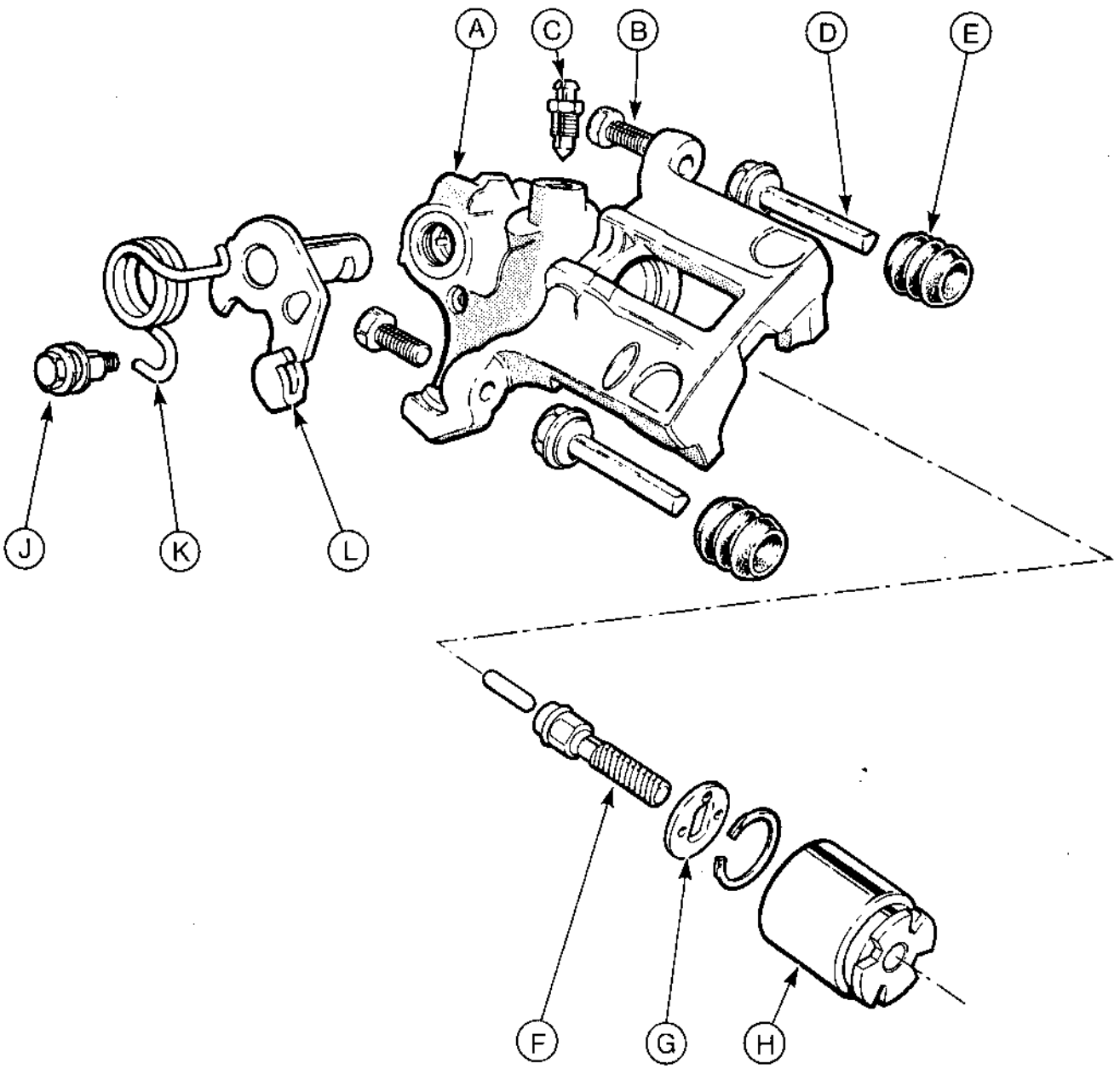
11. Reconnect hydraulic flexible hose to brake pipe.

12. Bleed brake circuit and check for fluid leaks.

13. Refit road wheels remove chassis stands and lower vehicle.

14. Fully tighten road wheels.

0492



DE1-12-32

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Fig.5. Rear caliper, (exploded view).

A - Piston housing	D - Slide pin	G - Locating washer	K - Return spring
B - Retaining bolt	E - Gaiter	H - Piston assembly	L - Handbrake lever
C - Bleed valve	F - Fast thread	J - Bolt	

0492

12 253 8 CALIPER ASSEMBLY - REAR - OVERHAUL - CALIPER REMOVED

SPECIAL SERVICE TOOLS REQUIRED:

Rear caliper piston wrench	..	12-006
Rear caliper spring compressor	..	12-007

To Dismantle

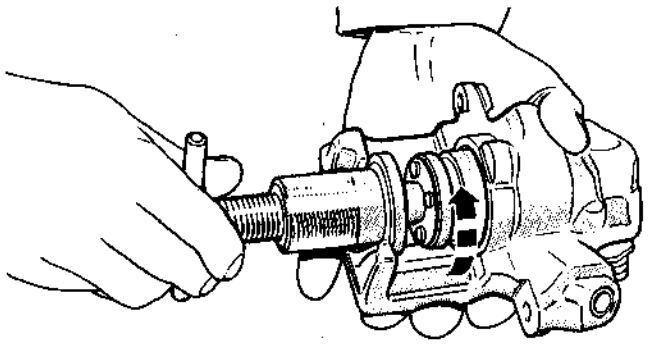
1. Throughly clean caliper body, removing all brake dust and road dirt. Remove slide pin bolts from anchor bracket and remove slide pins.

2. Mount caliper in vice, use soft vice jaw protectors.

3. Using Special Service Tool 12-006 piston wrench, wind back caliper piston anti-clock wise until it protrudes approximately 20 mm. Disengage piston protective cover gaiter from groove in piston.

4. Remove piston wind back tool and reposition tool, winding piston fully out of engagement with adjuster nut.

5. Remove piston and protective gaiter. Check condition of piston seal contact area, if scored or corroded this must be replaced.



DE1-12-33 C

Fig.1. Using Special Service Tool 12-006 wind back piston.

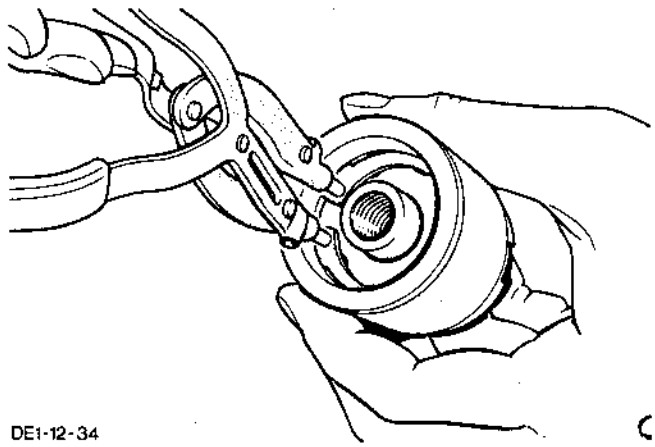
Piston overhaul

6. Remove circlip from piston body, pull out adjuster nut with thrust washers, wave washers and thrust bearing.

7. Hook off seal from adjuster nut, noting direction of sealing lip.

8. Throughly clean all caliper piston components:

   - Adjuster nut clutch surface
   - Piston breather port in piston groove is clean and clear.



DE1-12-34 C

Fig.2. Remove circlip from piston body.

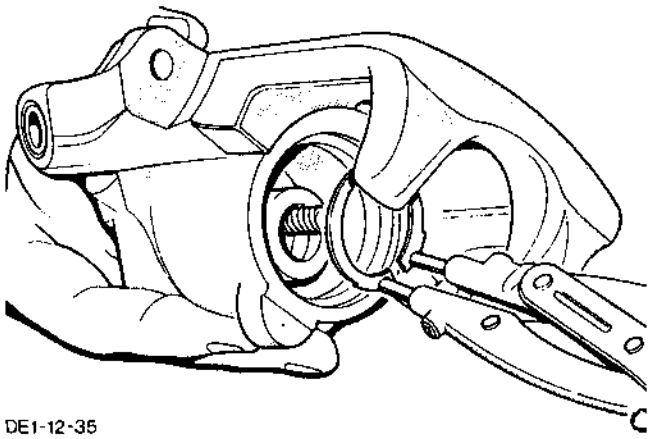
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Caliper body overhaul

9. Remove piston hydraulic seal from caliper body.

10. Using Special Service Tool 12-007 spring compressor, screw spring compressor onto fast thread adjuster. Remove circlip securing spring cover housing.

NOTE: DO NOT over compress spring as damage to spring cover housing will result.



DE1-12-35

Fig.3. Remove circlip from caliper body using Special Service Tool 12-007.

11. Remove circlip retaining key plate, pull adjuster fast thread and key plate from caliper body. Remove 'O' ring from adjuster fast thread.

12. Remove handbrake strut from bore.

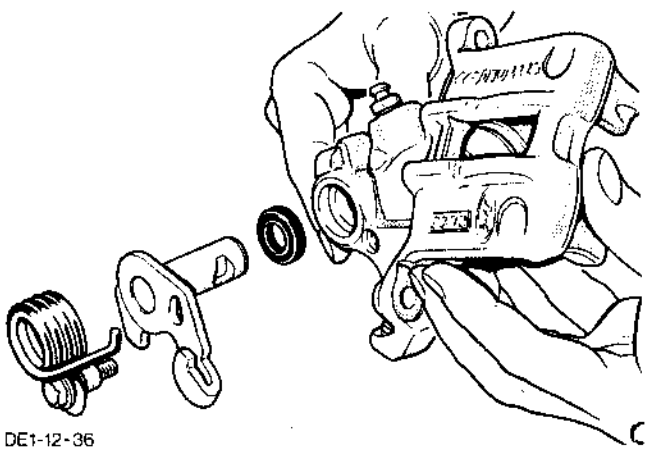
13. Disconnect handbrake lever return spring from lever and remove. Remove stop bolt.

14. Slide lever and shaft from bore. Remove shaft seal using suitable lever (screwdriver).

15. Throughly clean all caliper body components:

- Examine handbrake shaft, light corrosion on shaft may be cleaned using wire wool. If heavily corroded or scored fit new lever assembly.

16. If new lever is to be fitted examine lever shaft bush for damage, if damaged remove bush using suitable internal puller.



DE1-12-36

Fig.4. Handbrake lever assembly.

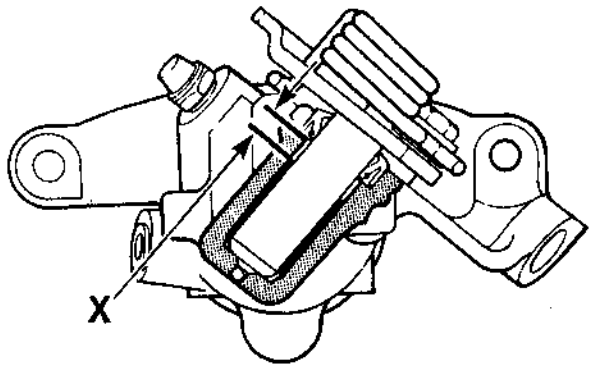
0492

To Reassemble

17. Fit new handbrake lever bush, press into housing to a depth of 7,5 mm from lower seal lip. Ensure cutout in side of bush is aligned with push rod bore.

18. Lightly coat surface of lever shaft and bush with brake grease.

19. Press in shaft seal into housing until it seats on shoulder. Slide lever into housing through seal ensuring seat lip is not damaged during assembly.



DEI-12-61 T

Fig.5. Press in bush to a depth of 7,5 mm (X) from seal lower lip.

20. Fit handbrake stop bolt and spring.

21. Locate handbrake strut into caliper bore, lubricate bore around strut with brake grease.

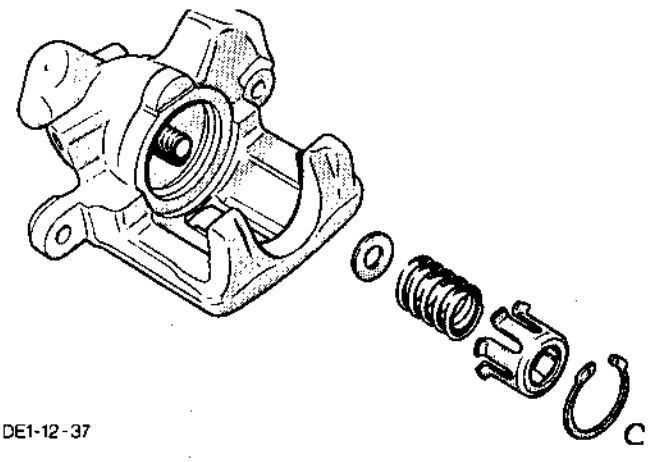
22. Fit new 'O' ring seal to fast thread adjuster. Refit adjuster into caliper bore, fit key plate, ensure dimple on plate is correctly located in caliper drilling. Refit circlip.

23. Slide spring seating washer, spring and cover housing over adjuster thread.

NOTE: Ensure cover housing tang feet are not distorted or bent.

24. Using Service Tool 12-007 carefully compress spring and fit retaining circlip.

NOTE: Care must be exercised when fitting circlips otherwise auto adjuster will fail to function.



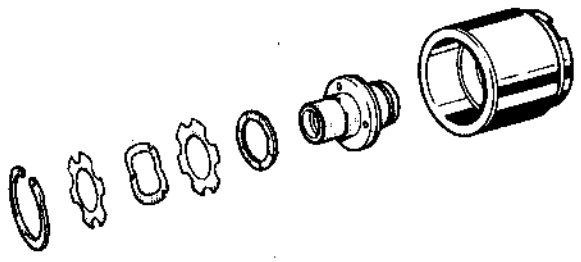
DE1-12-37

Fig.6. Assemble fast thread adjuster and spring assembly.

0492

25. Lubricate bore of caliper body with hydraulic fluid and fit piston seal into groove.

26. Reassemble piston assembly. Fit new seal to adjuster nut, ensure seal is correctly fitted.



DE1-12-38 C

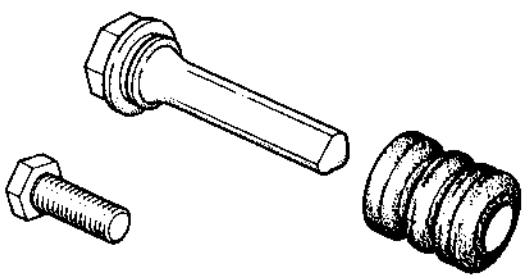
Fig.7. Piston and adjuster nut assembly.

27. Lightly lubricate piston adjuster nut contact face with brake grease and assemble, fitting thrust bearing, washers and wave washer. Secure with circlip.

28. Fit piston protective gaiter into caliper body groove.

29. Stretch piston protective gaiter over piston and start thread of adjuster nut onto fast thread.

30. Using Service Tool 12-007 screw piston into caliper base. Locate piston protective cover into piston groove.



31. Refit slide pins to anchor bracket locate gaiters in grooves. Lubricate slide pins and gaiters using specified brake grease.

DE1-12-39 C

Fig.8. Guide pin assembly.

0492

12 259 4 SPLASH SHIELD - REAR - REMOVE AND INSTALL (Caliper Removed)

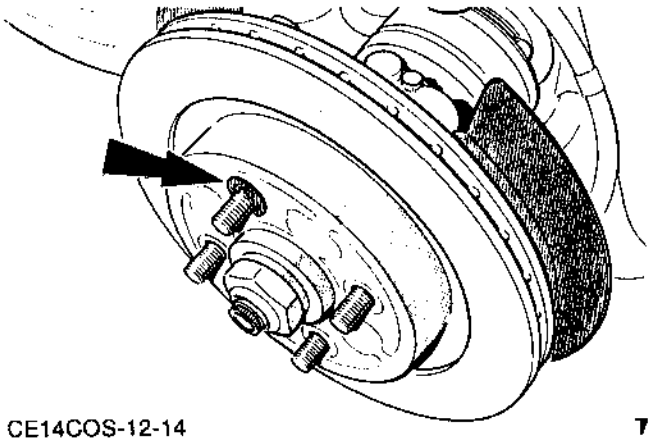
SPECIAL SERVICE TOOLS REQUIRED:

MS 100 Medium two legged puller (swivel legs).

To Remove

1. Slacken rear hub nut.

NOTE: Hub retaining nuts are handed.
L.H. thread on left hand side of vehicle and
R.H. thread on right hand side of vehicle.

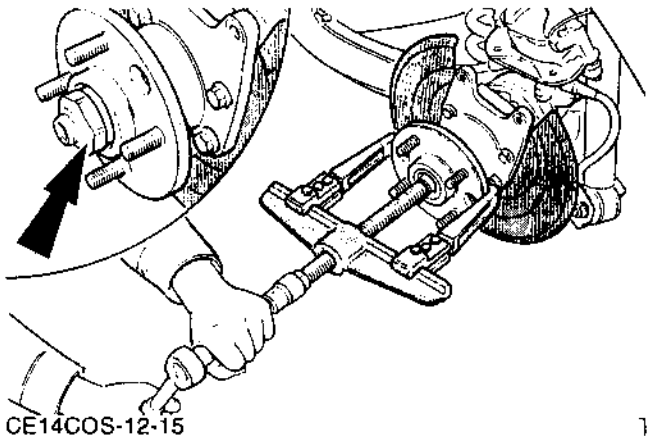


CE14COS-12-14

Fig.1. Remove spring clip retaining disc to hub.

2. Remove spring clip retaining disc to hub. Mark hub and disc relative positions.

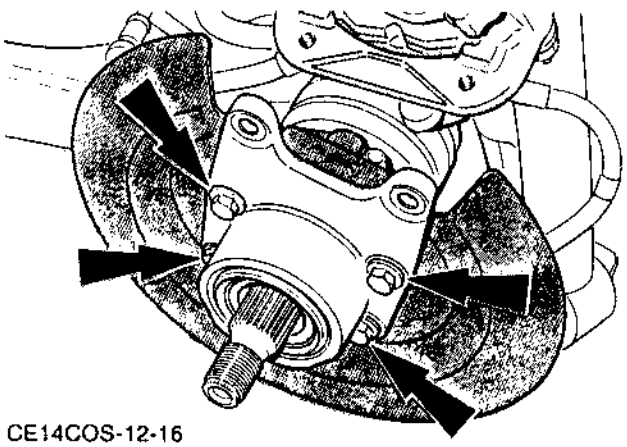
3. Remove rear hub nut and pull off drive flange, Fig.2.



CE14COS-12-15

Fig.2. Drive flange removal.

4. Remove four bolts securing splash shield and bearing carrier plate.



CE14COS-12-16

Fig.3. Remove splash shield caliper plate retaining bolts.

0492

To Install

5. Ensure all contact faces are clean. Refit splash shield and caliper carrier plate. Torque retaining bolts.

6. Slide hub flange onto drive shaft spigot and fit nut and torque to specification.

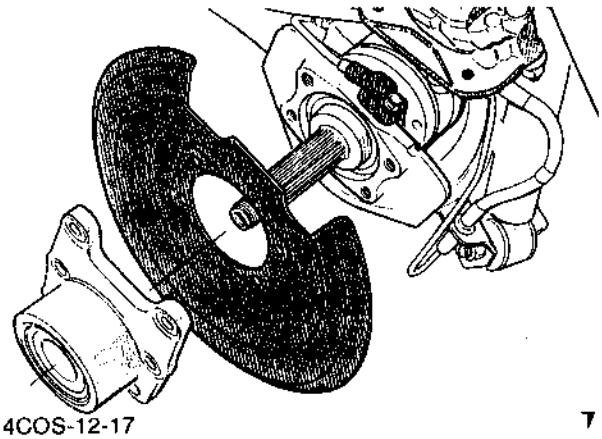


Fig.4. Splash shield assembly.

7. Refit brake disc and spring retaining clip.

NOTE: Once vehicle brake assembly is reassembled and vehicle is lowered to the ground, check torque of hub retaining nut.

0492

12 333 0 BRAKE PEDAL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood fit fender covers and disconnect battery earth lead.

2. Remove pedal cross-shaft circlip and brake pedal servo connecting rod retaining clip, Fig.1.

3. Remove brake light switch/pedal position sensor from bracket, Fig.2. Refer to Section 33 Operation 33 584 0. Disconnect multiplug before removing switch.

4. Push pedal pivot shaft out of pedal box assembly sufficient to release brake pedal. Remove pedal and spacers from vehicle.

To Install

5. Examine pedal bushes and replace as necessary.

6. Position brake pedal over servo connecting rod, replace spacers and push cross-shaft through pedal and locate 'D' section end in pedal box, see Fig.3.

Fig.3. A - Pedal pivot shaft
B - Spacer
C - Pedal bush
D - Pedal bush
E - Washer
F - Clip

7. Replace circlip, servo connecting rod clip and brake light switch/pedal position sensor (refer to Section 33, Operation 33 584 0). Reconnect multiplug.

8. Reconnect battery, remove fender covers and close hood.

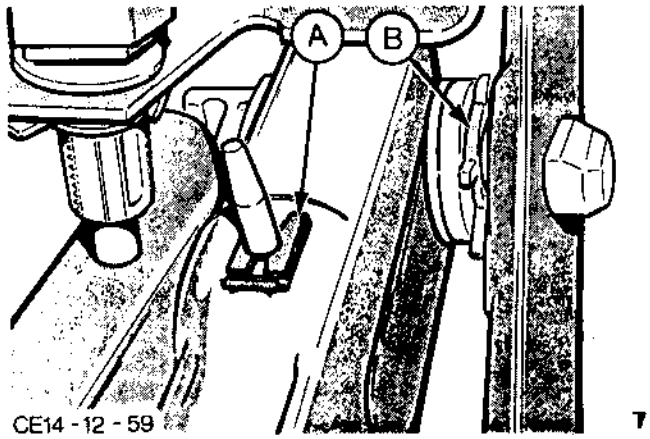


Fig.1. Remove underdash cover panel.

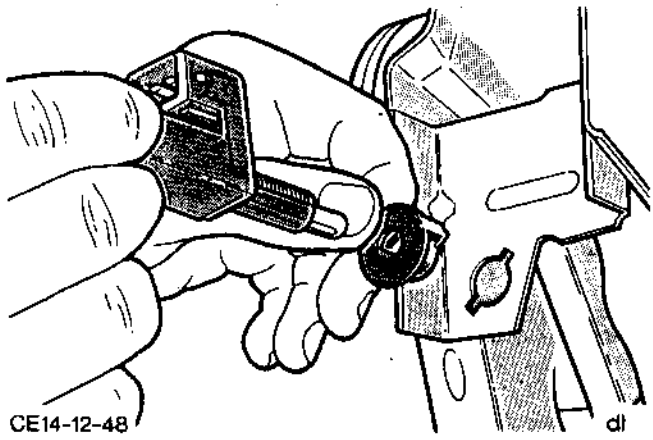


Fig.2. Remove brake light switch/pedal position sensor.

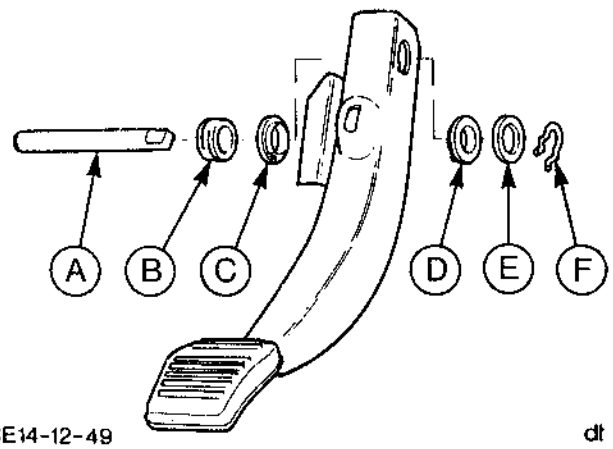


Fig.3. Brake pedal assembly.

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12 341 0 BRAKE FLUID RESERVOIR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: If brake fluid is spilt on paintwork the affected area must be washed down with cold water immediately.

WARNING: SWITCH OFF IGNITION (Position '0'). Apply foot brake at least 20 times or until pedal becomes hard to de-pressurise the system.

To Remove

1. Open hood fit fender covers and disconnect battery earth lead.
2. Ensure braking system pressure is fully discharged.
3. Detach brake fluid reservoir filler cap multi-plugs. Remove filler cap.
4. Remove screw and clip securing reservoir to hydraulic unit.
5. Remove spring clip releasing low pressure pipe from electric pump. Drain hydraulic fluid into suitable container.
6. Carefully remove reservoir from hydraulic unit.
7. Remove reservoir seals from hydraulic unit.
8. Remove low pressure hose from reservoir.

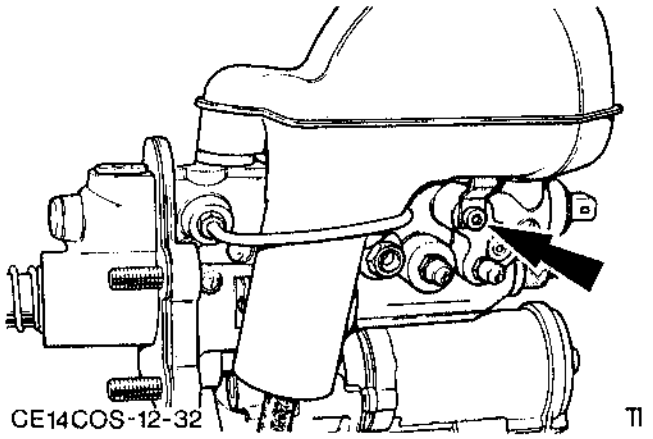


Fig.1. Remove reservoir securing screw and clip.

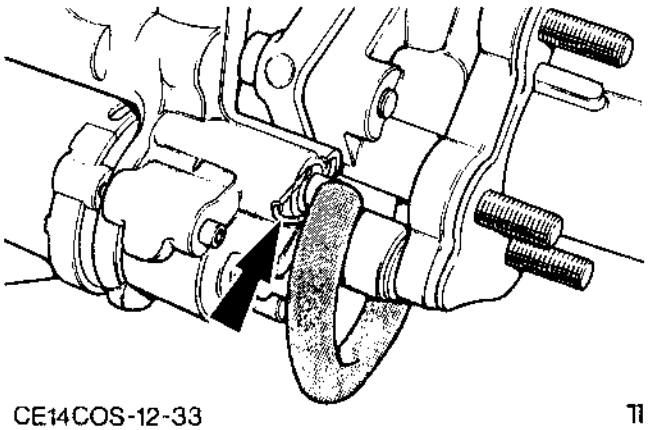


Fig.2. Remove spring clip releasing low pressure pipe.

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To Install

9. Replace both reservoir seals. Ensure that rear seal is aligned correctly in hydraulic unit bores.

10. Refit low pressure hose to reservoir.

11. Lubricate seals and reservoir connections with brake fluid. Fit reservoir to hydraulic unit.

12. Secure reservoir to hydraulic unit with screw and clip.

13. Reconnect low pressure hose to electric hydraulic pump, refit locking clip.

NOTE: Ensure that hose elbow connections are firmly pushed into pump assembly before fitting locking clip.

14. Top up reservoir with new brake fluid.

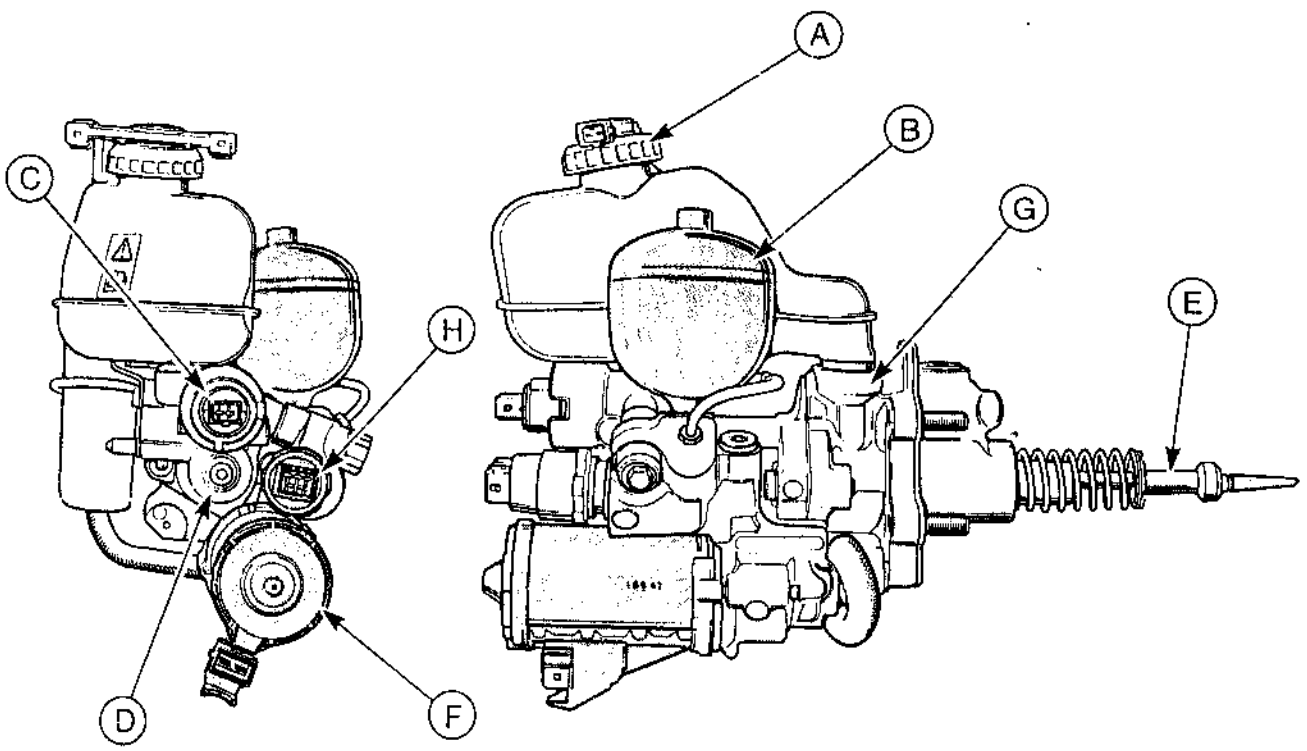
15. Reconnect battery. Ensure ignition switch is off (position '0').

16. Bleed braking system, check for leaks. Reconnect fluid level multiplug connections.

17. Remove fender covers and close hood.

18. Check operation of braking system.

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Fig.6. Hydraulic unit assembly.

A - Reservoir and fluid level warning indicator
B - Accumulator
C - Main valve
D - Master cylinder
E - Push rod assembly
F - Electric motor and hydraulic pressure pump
G - Booster assembly
H - Pressure switch

0492

12 580 0 HYDRAULIC UNIT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

WARNING: SWITCH OFF IGNITION (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to de-pressurise the system.

To Remove

1. Open hood, fit fender covers and disconnect battery earth lead.

WARNING:
Ensure braking system pressure is fully discharged.

2. Disconnect electrical connections from hydraulic unit, (pressure switch, main valve, reservoir filler cap, electric hydraulic pump and earth connection).

3. Disconnect hydraulic pipes from hydraulic unit valve body, fit blanking caps to prevent dirt ingress.

4. Remove under dash trim panel from around the brake pedal, where applicable.

5. Remove brake pedal push rod clip.

6. Remove hydraulic unit mounting nuts.

NOTE: The aid of a second technician should be used to support the hydraulic unit when removing mounting nuts.

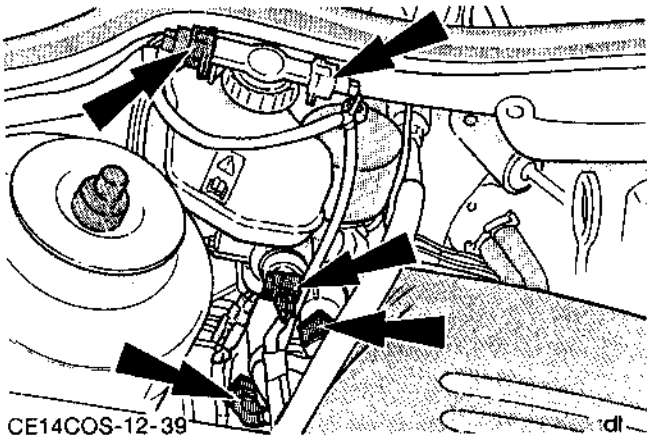


Fig.1. Disconnect electrical connections from hydraulic unit.

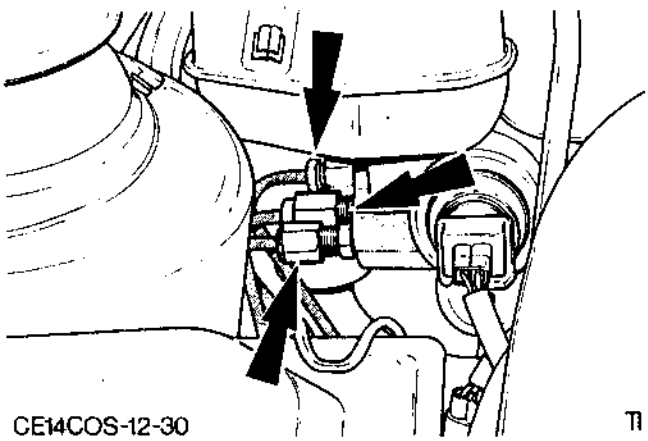


Fig.2. Disconnect hydraulic pipes from hydraulic unit.

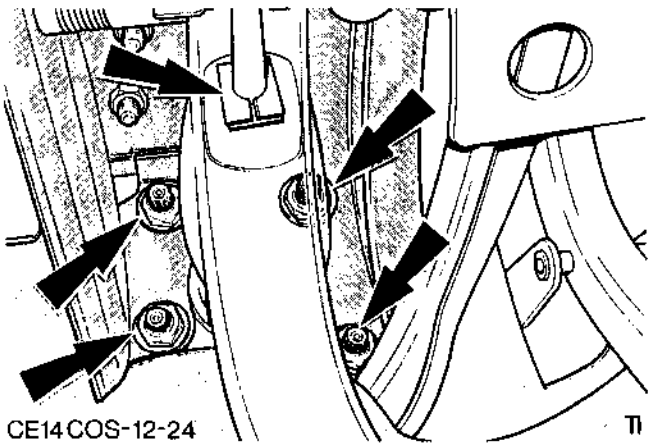


Fig.3. Remove hydraulic unit mounting nuts and pedal push rod clip.

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7. Lift out hydraulic unit from vehicle and drain reservoir.

NOTE: Do not lift hydraulic unit by its hoses, reservoir or push rod.

DO NOT ATTEMPT TO ACTUATE HYDRAULIC UNIT BY PUSHING PUSH ROD.

8. Remove sealing gasket material from hydraulic unit and body fixing.

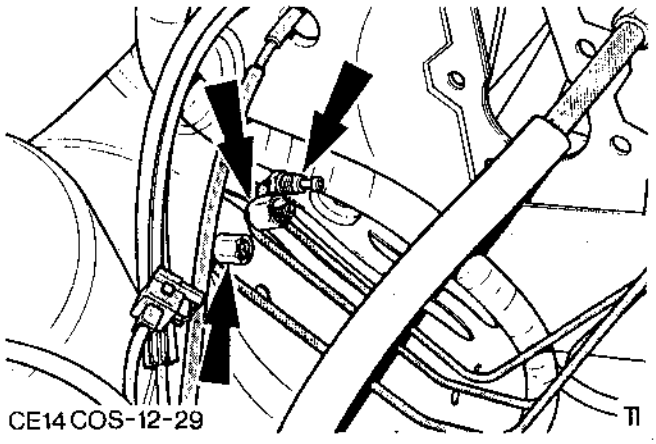


Fig.4. Brake pipes.

To Install

9. Fit new sealing gasket material to hydraulic unit and body avoiding fixing studs.

10. Fit spherical ball to push rod. Carefully install hydraulic unit into vehicle ensuring push rod enters brake pedal. Care should be taken not to force push rod from its natural position.

11. Support hydraulic unit while second technician secures hydraulic unit and with four nuts. Torque to specification.

12. Reconnect brake pedal to hydraulic unit push rod clip.

13. Remove blanking caps and reconnect brake pipes to hydraulic unit, Figs 4 and 5.

WARNING: ENSURE BRAKE PIPES ARE CONNECTED TO CORRECT PORTS. SEE FIG.5.

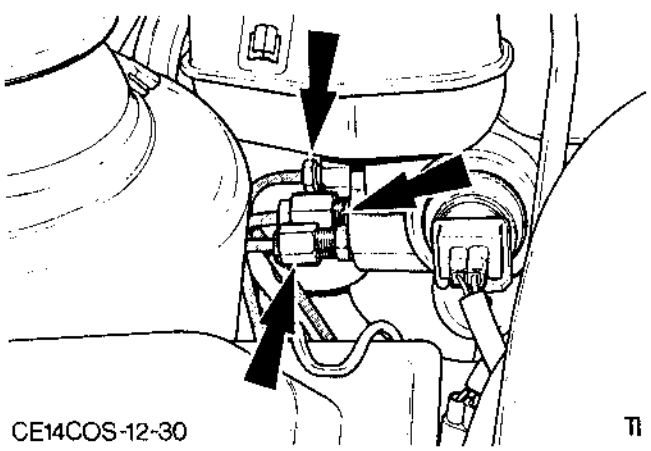


Fig.5. Brake pipe connections.

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14. Reconnect electrical multiplugs to main valve, pressure switch electrical hydraulic pump and earth connection.

15. Fill reservoir with new brake fluid.

16. Bleed front brake circuits.

17. Reconnect battery.

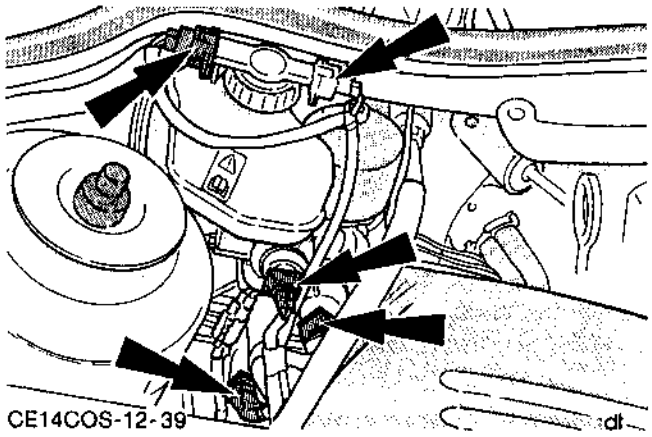


Fig.6. Reconnect all multiplugs.

18 Switch 'on' ignition and check pump operation.

NOTE: Do not allow electrical hydraulic pump to operate for more than 2 minutes. (If pump does run for more, switch 'off' ignition position '0' and allow motor to cool for 10 minutes.

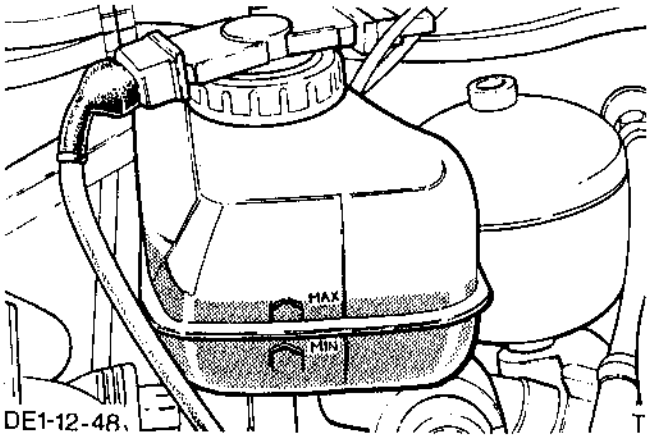


Fig.7. Top up reservoir to 'Max' mark.

19. Bleed rear brake circuit check system for fluid leaks.

20. Refit under dash trim panel, where applicable.

21. Reconnect reservoir fluid filler cap multiplugs.

22. Remove fender covers and close hood.

23. Check operation of boost and anti-lock function.

0492

12 581 0 VALVE BLOCK - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove wheel. Remove 3 retaining nuts from under wheelarch, Fig.1.

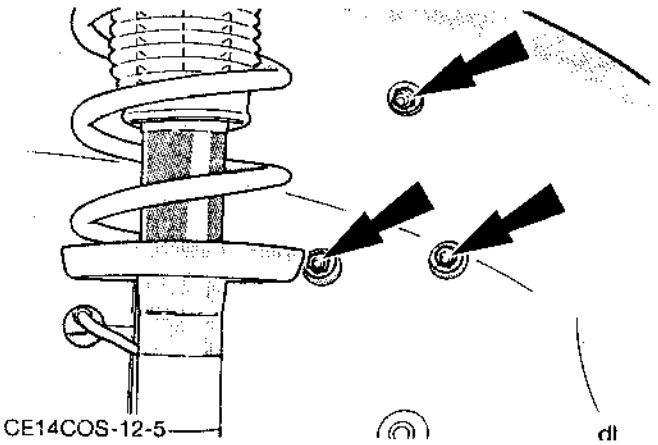


Fig.1. Valve block bracket retaining nuts.

2. Detach 6 brake pipes from underneath valve block, Fig.2.

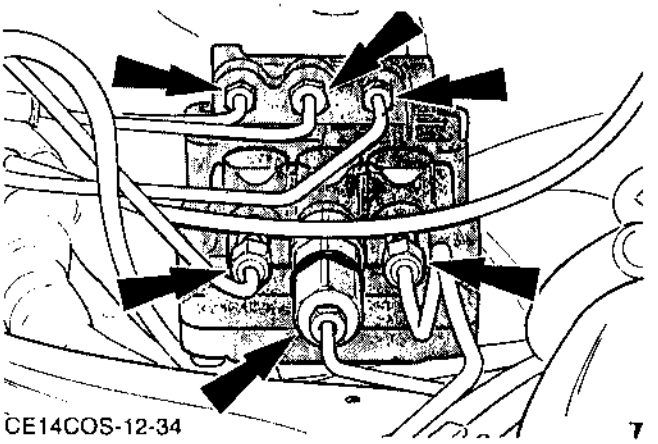


Fig.2. Valve block brake pipe unions.

3. Disconnect multiplug and carefully lift and remove valve block assembly, Fig.3.

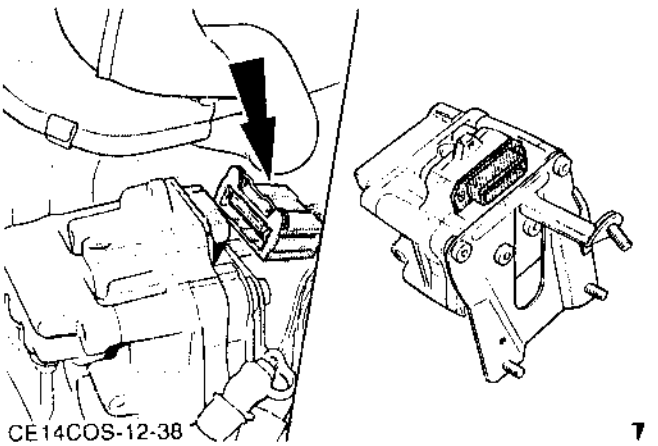


Fig.3. Valve block multiplug and assembly.

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4. Locate valve block assembly in a vice to remove pressure control regulator valve, Fig.4, (where required).

5. Remove 3 torx bolts, detach and remove valve block from bracket.

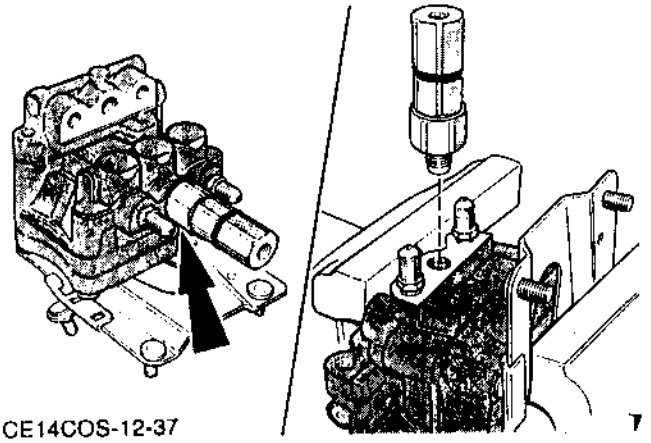


Fig.4. PCRV removal.

To Install

6. Fit valve block to bracket and secure with 3 torx bolts. Locate and fit PCRV to valve block assembly in a vice and tighten to secure, (where required).

7. Locate valve block assembly into position in engine compartment.

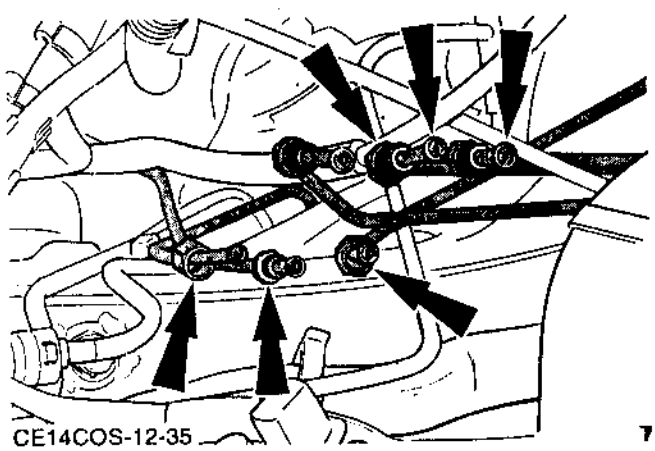


Fig.5. Valve block brake pipes.

8. Locate and secure brake pipes to valve block, Fig.5.

9. Secure valve block assembly to wheelarch with 3 nuts and refit multiplug.

10. Bleed entire braking system and check operation of anti-lock function.

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12 582 0 ACCUMULATOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Hexagon Key adaptor .. MS-94

WARNING: SWITCH OFF IGNITION (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to de-pressurise the system.

NOTE: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

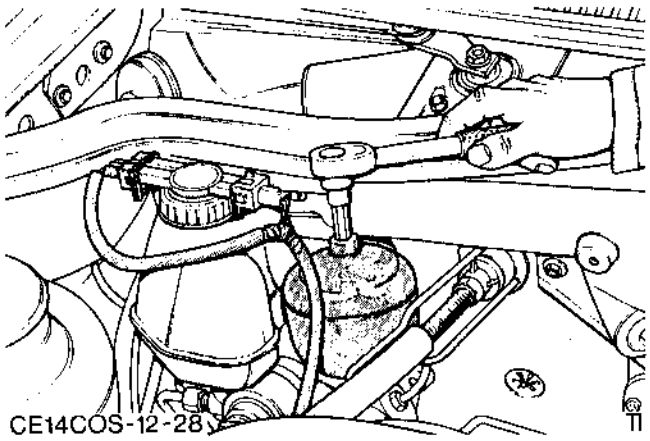


Fig.1. Slacken accumulator, cover base of accumulator with clean cloth.

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Ensure braking system pressure is fully discharged.
3. Carefully remove accumulator from hydraulic unit using the hexagon key adaptor. Cover base of accumulator with a clean rag to prevent any dirt ingress.

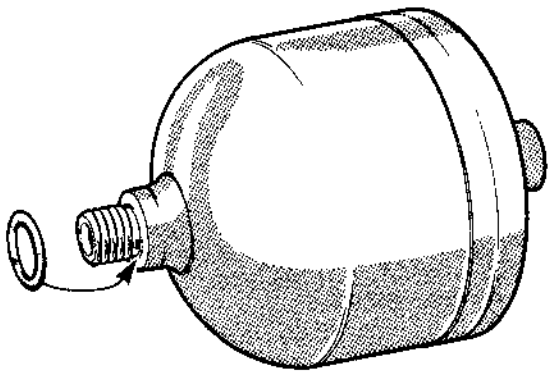


Fig.2. Fit new 'O' ring seal to accumulator.

To Install

4. Ensure 'O' ring is fitted and in good condition.
5. Fit accumulator to hydraulic unit and torque to specification.
6. Reconnect battery.
7. Switch on ignition and check accumulator charge time, (should be less than 60 seconds).
8. Bleed braking system in accordance with Operation No. 12 141 0. Check for leaks.
9. Remove fender covers and close hood.
10. Check operation of boost and anti-lock function.

0492

12 586 0 HYDRAULIC PUMP and MOTOR ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Hexagon Key adaptor .. MS-94

WARNING: SWITCH OFF IGNITION (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to de-pressurise the system.

NOTE: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

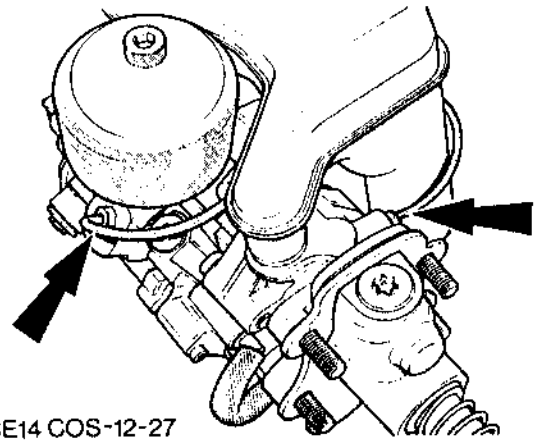


Fig.1. Remove high pressure pipe nuts.

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Ensure braking system pressure is fully discharged.

NOTE: It may be necessary to remove the hydraulic unit following Op. No. 12 580 0.

3. Undo pipe nuts securing high pressure pipe to pump body and remove pipe.

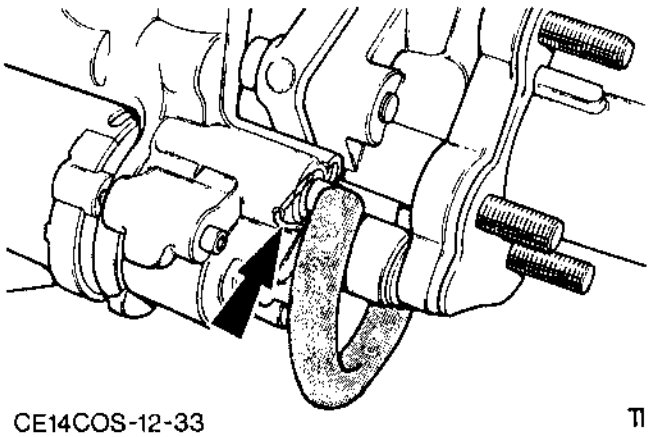


Fig.2. Remove spring clip releasing low pressure pipe from hydraulic pump.

4. Using hexagon key adaptor remove accumulator from pump body.

5. Disconnect multiplug connection from pressure switch, Fig.3.

6. Disconnect multiplug from pump motor, Fig.3.

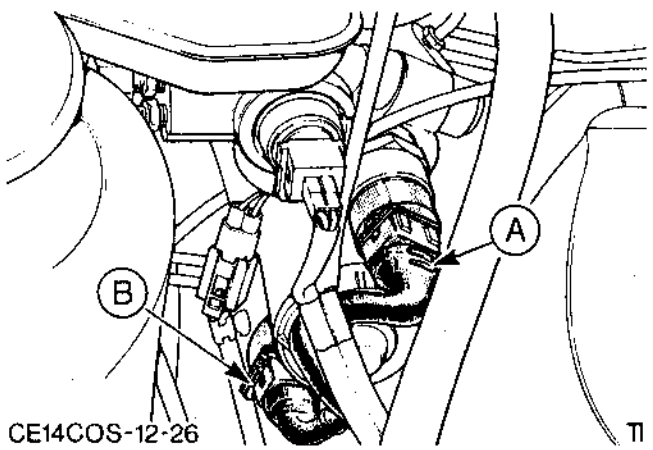


Fig.3. Pressure switch (A) and pump (B) multiplug.

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7. Remove pump housing to hydraulic unit mounting bolt.

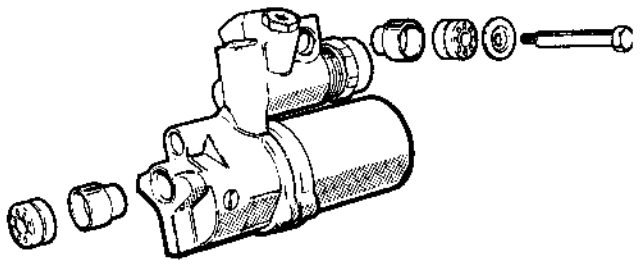
8. Remove pump housing assembly from hydraulic unit.

WARNING: Do not use anything other than a properly designed and manufactured hose clamp. Unseen damage to the fabric of the hose will result if unsuitable tools are used.

9. Remove spring clip to release low pressure pipe from hydraulic pump. Clamp low pressure hose using suitable hose clamp to prevent excessive fluid loss.

10. Remove pressure switch from pump housing.

11. Prise out pump mounting insulators and tubes from pump body.



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Fig.4. Pump housing mounting assembly.

To Install

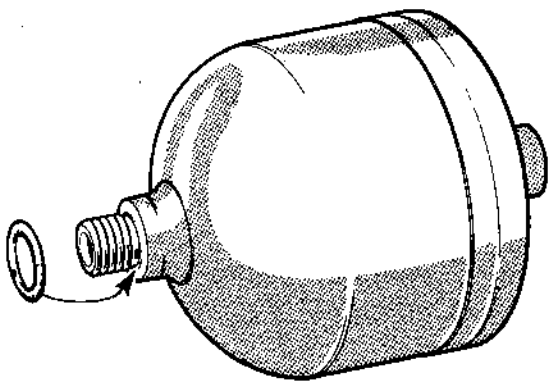
12. Fit mounting tubes and insulators to pump housing.

13. Refit pressure switch into pump housing, ensure sealing 'O' ring is in good condition. Adjust plastic collar so that drain tube is facing pump motor.

14. Connect low pressure hose and secure with spring clip. Locate pump onto hydraulic unit. Pass mounting bolt through bushes and torque to specification.

15. Reconnect high pressure pipe.

16. Fit new 'O' ring onto accumulator and fit to pump housing tighten accumulator.



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Fig.5. Fit new accumulator 'O' ring.

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17. Reconnect multiplugs to pump and pressure switch ensure sealing boots are correctly fitted.

18. Top up reservoir with new brake fluid.

19. Reconnect battery.

20. Switch 'on' ignition, check for hydraulic fluid leaks allow pump to run until switch 'off'.

    Do not allow hydraulic pump to operate for more than 2 minutes (if pump does run for more switch 'off' ignition position '0' and allow pump motor to cool for 10 minutes).

21. Bleed brake system.

22. Remove fender covers and close hood.

23. Check operation of anti-lock system.

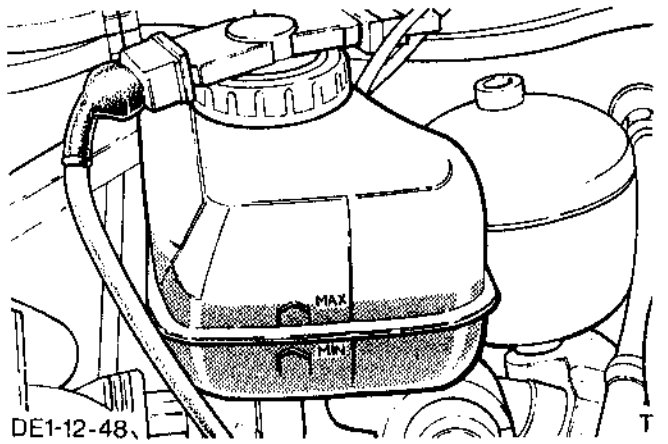


Fig.6. Top up reservoir to 'Max' mark.

0492

12 589 0 PRESSURE SWITCH - REMOVE AND INSTALL REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Pressure switch wrench .. 12-008

WARNING: SWITCH OFF IGNITION (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to de-pressurise the system.

NOTE: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

To Remove

1. Open hood, fit fender covers and disconnect battery,

2. Ensure braking system pressure is fully discharged.

3. Disconnect pressure warning switch multiplug.

4. Using Special Service Tool 12-008 remove pressure warning switch.

To Install

5. Fit new '0' ring seal to pressure warning switch.

6. Screw in switch and tighten using Special Service Tool 12-008. Adjust plastic band until drain tube in band is facing pump body.

7. Reconnect pressure warning switch multiplug.

8. Reconnect battery, switch on ignition and check switch and pump operation.

9. Bleed brake system in accordance with Operation No. 12 141 0.

10. Remove fender covers and close hood.

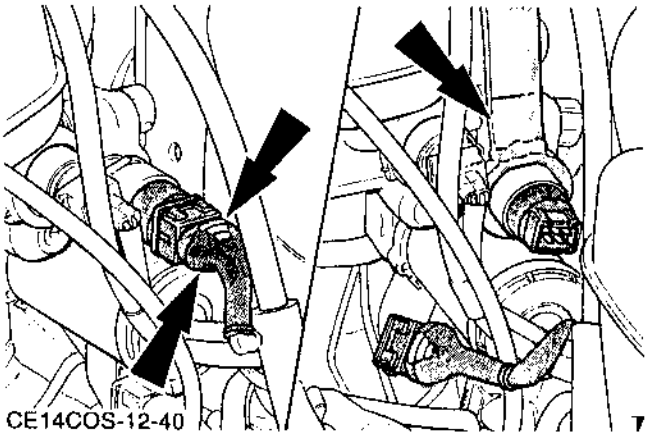


Fig.1. Disconnect multiplug.
Special Service Tool 12-008 shown in place.

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12 590 0 HIGH PRESSURE HOSE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: SWITCH OFF IGNITION (position '0').
Apply foot brake at least 20 times or until the brake pedal becomes hard to de-pressurise the system.

NOTE: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

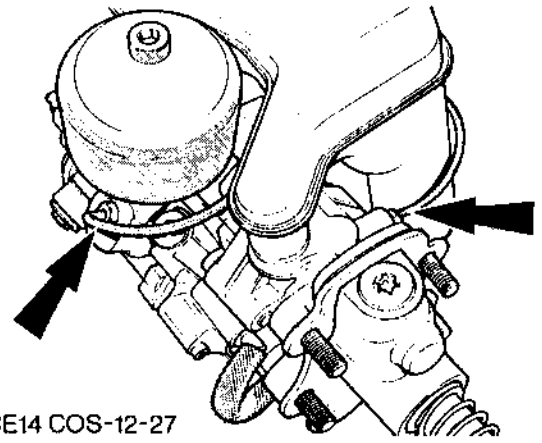


Fig.1. Remove high pressure pipe nuts.

To Remove

1. Open hood, fit fender covers and disconnect battery earth lead.

2. Ensure braking system pressure is fully discharged.

NOTE: It may be necessary to remove the hydraulic unit following Op. No. 12 580 0.

3. Undo high pressure pipe nuts and remove pipe from hydraulic unit.

To Install

4. Fit high pressure pipe to hydraulic unit.

5. Reconnect battery.

6. Bleed braking system in accordance with Operation No. 12 141 0, and check for hydraulic fluid leaks.

7. Remove fender covers and close hood.

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12 591 0 LOW PRESSURE HOSE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: SWITCH OFF IGNITION (position '0'). Apply foot brake at least 20 times or until the brake pedal becomes hard to de-pressurise the system.

NOTE: If brake fluid is spilt on paintwork, the affected area must be washed down with cold water immediately.

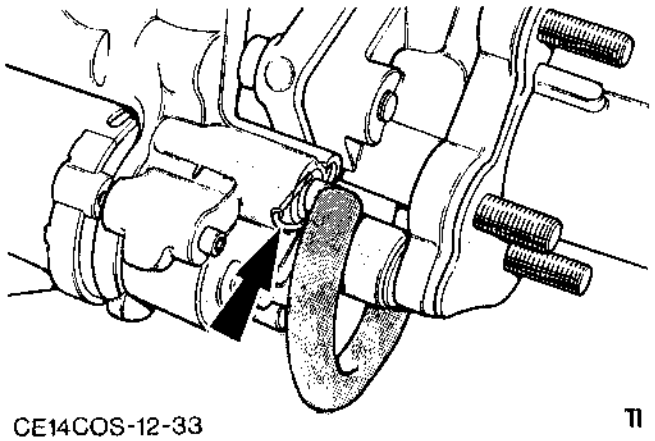


Fig.1. Remove spring clip to release low pressure hose from pump body.

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Ensure braking system pressure is fully discharged.

NOTE: It may be necessary to remove the hydraulic unit following Op. No. 12 580 0.

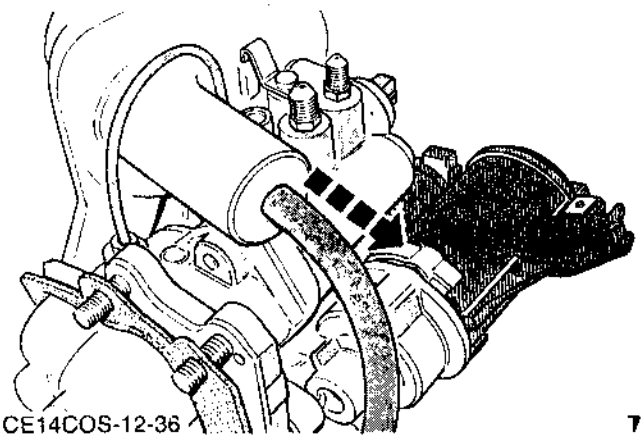


Fig.2. Remove low pressure hose from reservoir.

3. Remove spring clip to release low pressure pipe from hydraulic pump.

   Allow hydraulic fluid to drain into suitable container.

4. Pull off hose from reservoir filter connection.

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To Install

5. Connect low pressure hose to reservoir filter connection push on fully.

6. Connect hose to hydraulic pump, secure with spring clip, once fitted check security of hose in pump.

7. Top up reservoir with new brake fluid check or leaks.

8. Reconnect battery.

9. Bleed braking system and check for hydraulic fluid leaks.

10. Remove fender cover and close hood

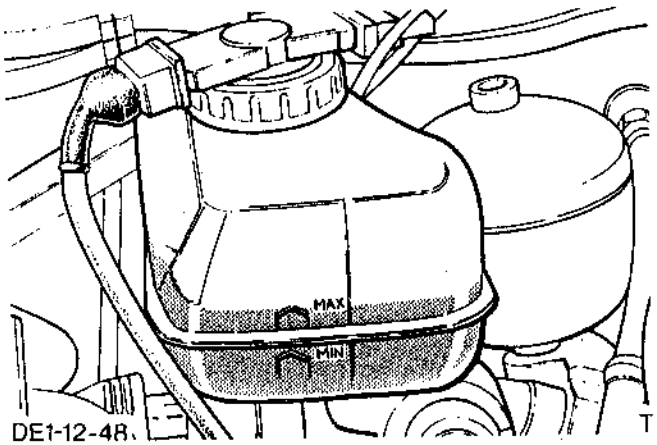


Fig.3. Top up reservoir to 'Max' mark.

0492

12 662 0 HANDBRAKE CABLE - ADJUST

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Adjust

1. Raise vehicle on ramp or jack up and fit chassis stands. Release handbrake lever.

2. Remove locking pin from adjuster. Slacken adjuster locknut and adjuster until both handbrake levers on caliper have fully returned to stop.

3. Paint alignment white line on lever and caliper body.

4. Adjust handbrake cable adjuster against body abutment bracket until either handbrake caliper lever starts to move from the alignment line.

5. Apply handbrake to equalise cable.

6. Tighten handbrake cable locknut onto adjusting sleeve, finger tight, then using suitable wrench, tighten locknut to a minimum of three 'clicks' and a maximum of six 'clicks'. Finally fit a new adjuster locking pin.

NOTE: One complete turn of the adjuster represents six 'clicks'.

7. Lower vehicle to ground.

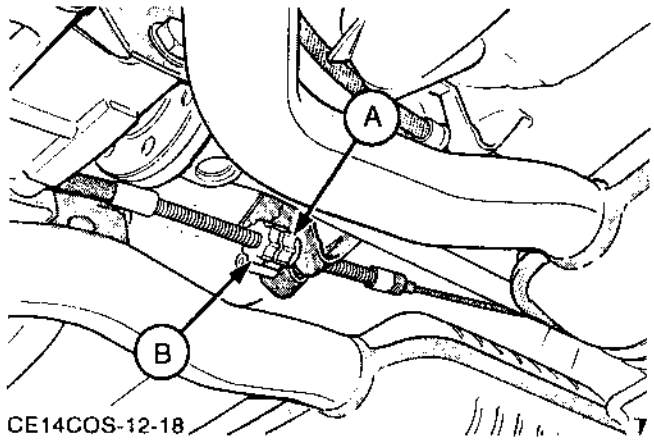


Fig.1. Handbrake adjuster assembly.
A - Locknut
B - Adjuster

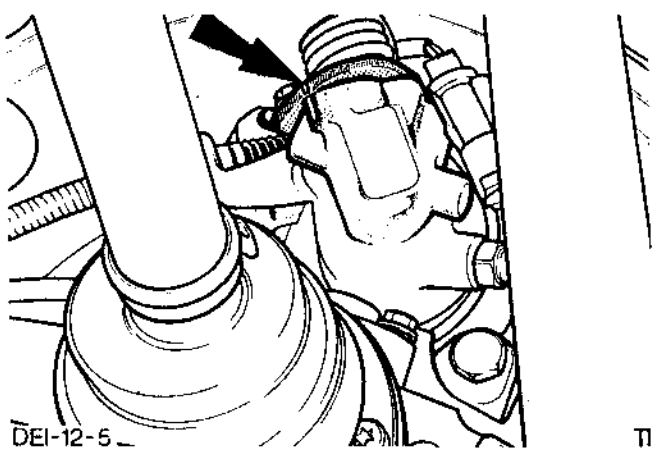


Fig.2. Caliper handbrake lever adjustment alignment marking.

0492

12 644 0 LEVER ASSEMBLY - HANDBRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

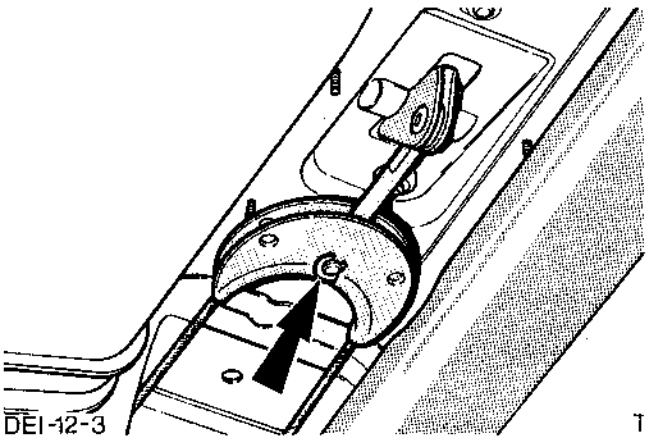


Fig.1. Disconnect handbrake equaliser yoke.

To Remove

1. Raise vehicle on ramp or jack up and fit chassis stands.
2. Open hood fit fender covers and disconnect battery.
3. Disconnect equaliser yoke from handbrake actuating rod. Remove circlip and clevis pin.
4. Remove sections of centre console where necessary.
5. Disconnect handbrake warning switch multiplug.
6. Remove handbrake mounting bolts, lift out handbrake lever and remove handbrake warning switch.

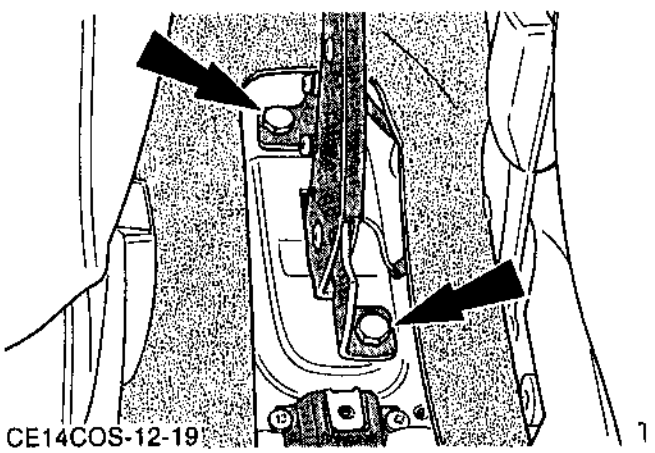


Fig.2. Handbrake lever assembly.

0492

To Install

7. Refit handbrake warning light switch to handbrake lever.

8. Locate handbrake push rod through rubber floor gaiter and secure. Reconnect warning light multiplug.

9. Refit centre console where applicable.

10. Reconnect handbrake cable equaliser yoke to actuating rod.

11. Lower vehicle. Reconnect battery, remove fender covers and close hood.

0492

12 675 0 CABLE HANDBRAKE - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Raise vehicle on ramp or jack up vehicle and fit chassis stands.

2. Remove both rear wheels.

3. Slacken handbrake adjuster locknut and adjuster.

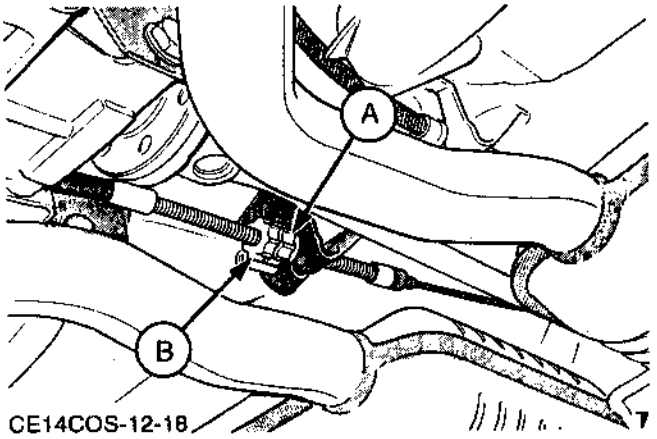


Fig.1. Slacken handbrake cable adjuster and locknut.
A - Locknut B - Adjuster

4. Remove circlip and clevis pin from handbrake equaliser yoke.

5. Detach handbrake cable from both calipers, remove cable from caliper guide sleeve.

6. Prise open lower arm cable clip.

7. Remove circlip securing outer cable (non adjuster side) and remove cable from body fixings.

8. Pull cable through lower arm rear axle sub-frame. Remove cable from vehicle.

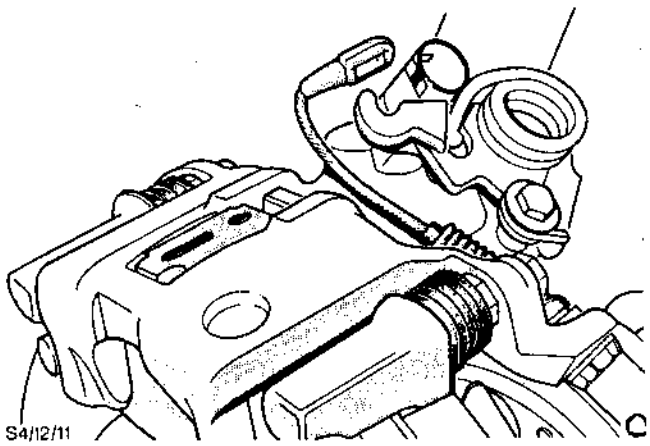


Fig.2. Detach cable from rear caliper.

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To Install

9. Reposition cable, ensure cable is correctly located through lower arm rear axle sub-frame.

10. Route cable over lower arms and slide end of cable through caliper cable guide sleeve. Attach cable to caliper handbrake levers.

11. Locate outer cable into body location fit circlip to secure non-adjuster side of cable to body.

12. Reconnect cable equaliser yoke to handbrake lever rod, fit clevis pin and circlip.

13. Adjuster cable as described below:

- Paint alignment line onto caliper body and lever.
- Ensure both caliper handbrake levers are fully returned to their stops.
- Adjust handbrake cable adjuster against body abutment bracket until either lever starts to move from the alignment line.
- Apply handbrake to equalise cable.
- Tighten handbrake cable locknut onto adjusting sleeve finger tight, using a suitable wrench tighten locknut to a minimum of three 'clicks' and a maximum of six 'clicks'.

14. Secure outer cable to lower arm retaining clips.

15. Refit road wheels and tighten wheel nuts.

16. Lower vehicle to ground.

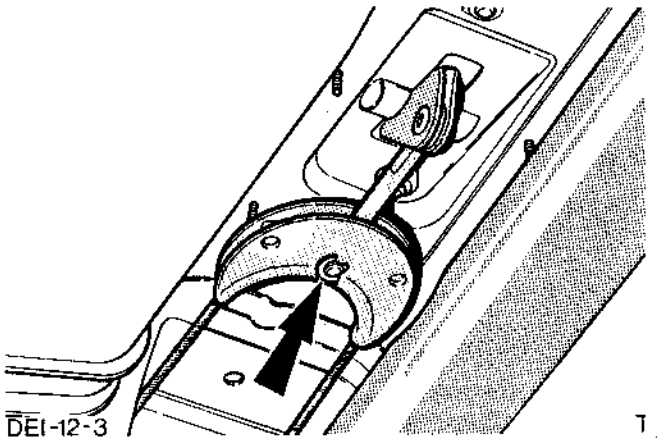


Fig.3. Reconnect equaliser yoke to handbrake lever rod.

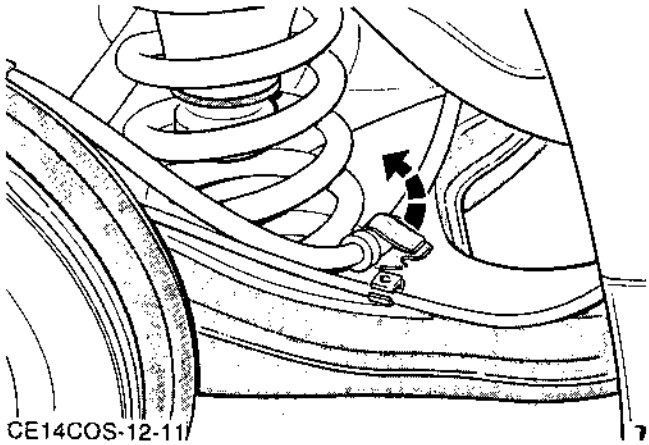


Fig.4. Lower arm retaining clips.

0492

12 780 0 MODULE - ANTI-LOCK BRAKING SYSTEM - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove load space trim panel as described in Operation No. 43 746 0.

2. Remove 3 module retaining nuts and carefully ease module assembly away, Fig.1.

3. Pull locking lever away, Fig.2, and disconnect multiplug. Remove top bracket from module.

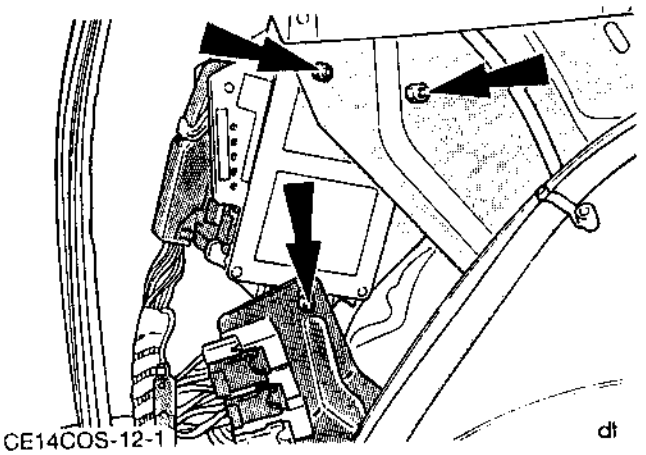


Fig.1. Module retaining nuts.

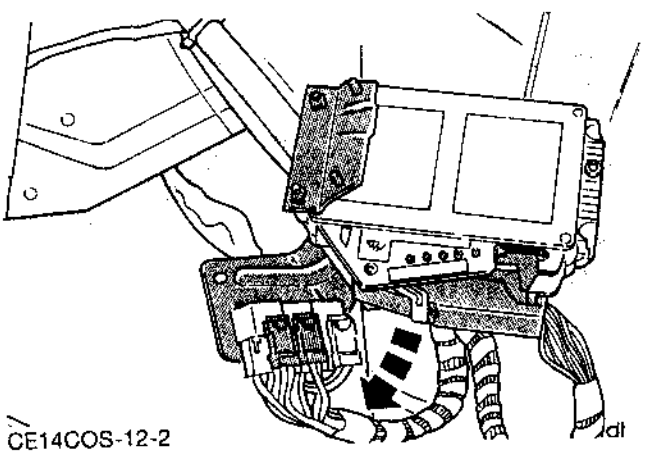


Fig.2. Multiplug removal.

To Install

4. Refit top bracket to module. Reconnect multiplug and secure by lowering locking lever.

5. Locate module assembly and secure with 3 retaining nuts.

6. Refit load space trim panel as described in Operation No. 43 746 0.

0492

12 785 0 WHEEL SENSOR - REMOVE AND INSTALL - FRONT

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Jack up vehicle and fit chassis stands.
2. Open hood, and fit fender covers.
3. Unclip from chassis side rail. Disconnect wheel sensor multiplug.
4. Remove bolt securing wheel sensor to spindle carrier. Carefully pull out sensor.
5. Unclip sensor loom from cable supports.

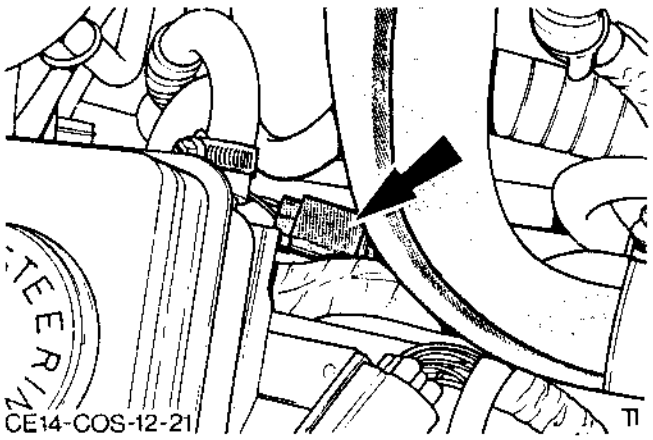


Fig.1. Front wheel sensor loom multiplug.

To Install

Before refitting, ensure wheel spindle sensor carrier bore and sensor mounting face is clean and free from rust, or rough edges.

6. Liberally coat sensor spindle carrier bore and chamfer with wheel bearing grease.
7. Fit new 'O' ring to wheel sensor.
8. Coat sensor with grease and push sensor firmly into spindle carrier bore until flush. Secure with bolt and washer.
9. Refit sensor loom into cable supports.
10. Reconnect sensor loom to main loom and secure to side rail clip. Ensure connector 'O' ring is correctly seated.
11. Remove fender covers, and close hood.
12. Lower vehicle and check anti-lock operation.

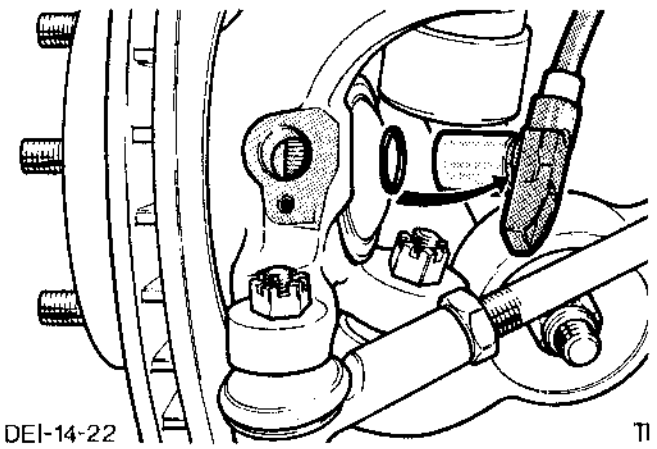


Fig.2. Remove wheel sensor.

0492

12 785 0 WHEEL SENSOR - REMOVE AND INSTALL - REAR

SPECIAL SERVICE TOOLS REQUIRED: NONE

CAUTION: Rear brake system is subjected to high hydraulic pressure. DO NOT apply foot brake once caliper has been removed from anchor bracket.

To Remove

1. Jack up vehicle and fit chassis stands.

2. Remove road wheels.

3. Release handbrake cable lever.

4. Remove two torx bolts and rear seat cushion, Fig.1.

5. Disconnect wheel sensor plug from main loom, Fig.2.

6. Prise out grommet and pass sensor cable through floor panel, Fig.3.

7. Remove handbrake cable from lower arm securing clip.

8. Remove forward bolt of caliper slide pin, swing caliper up and retain in position.

9. Remove bolt securing wheel sensor to mounting bracket, carefully remove wheel sensor.

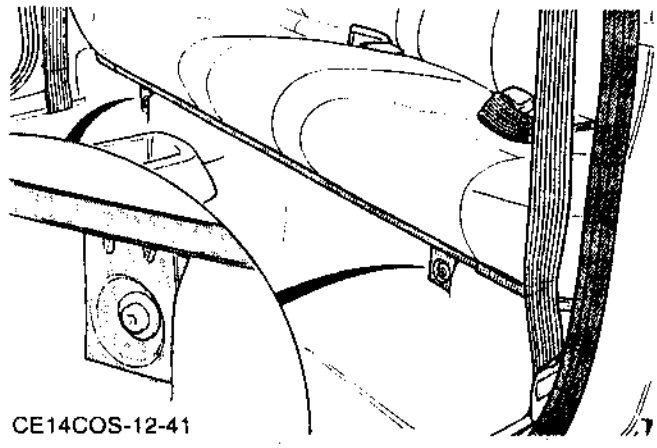


Fig.1. Seat cushion retainers (torx bolts).

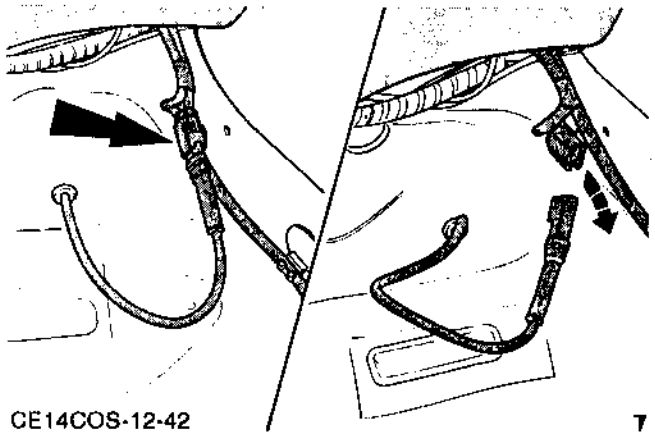


Fig.2. Disconnect wheel sensor loom plug.

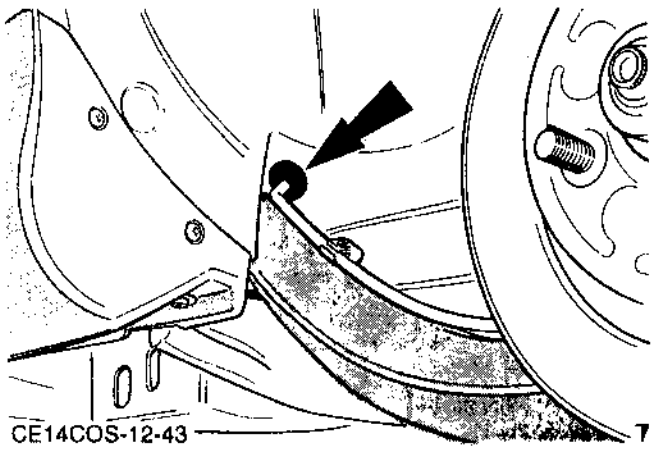


Fig.3. Sensor loom grommet.

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To Install

Before refitting wheel sensor, check bore area around sensor mounting for damage, rust or rough edges. Rotate road wheel and check toothed wheel for damage.

10. Fill wheel sensor mounting bracket bore with wheel bearing grease.

11. Fit new 'O' ring to wheel sensor.

12. Coat wheel sensor with grease and push sensor firmly into mounting bracket bore until flush, secure with bolt and washer, Fig.4.

NOTE: Sensor mounting bolt and washer are unique (bolt 28 mm long and washer 1,5 thick).

13. Refit caliper mounting bolt and torque to specification.

14. Secure handbrake cable into lower arm bracket, Fig.5.

15. Route wheel sensor cable along suspension lower arm and clip in position, feed thread through floor panel and refit grommet, Fig.6.

16. Reconnect wheel sensor loom to main loom. Ensure 'O' ring in connector is correctly located and pushed fully home.

17. Refit seat cushion and secure with 2 torx bolts.

18. Apply handbrake, refit road wheels.

19. Lower vehicle and check operation of anti-lock.

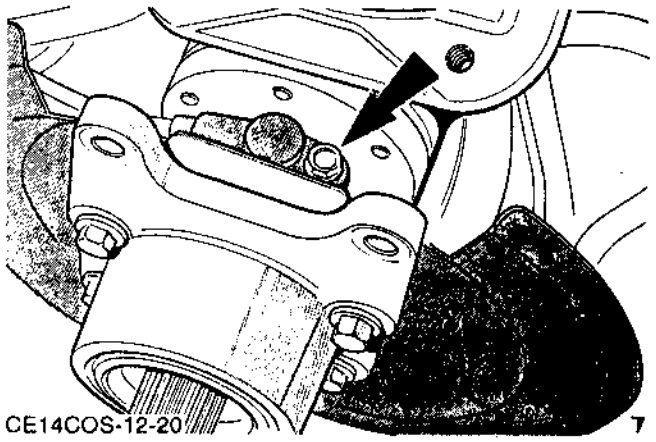


Fig.4. Wheel sensor retaining bolts.

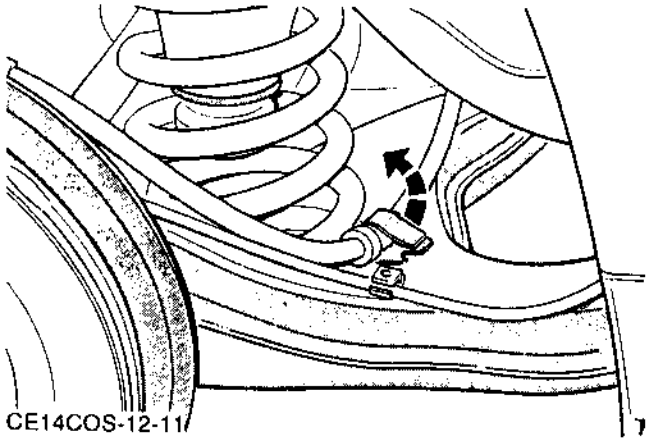


Fig.5. Secure handbrake cable in lower arm.

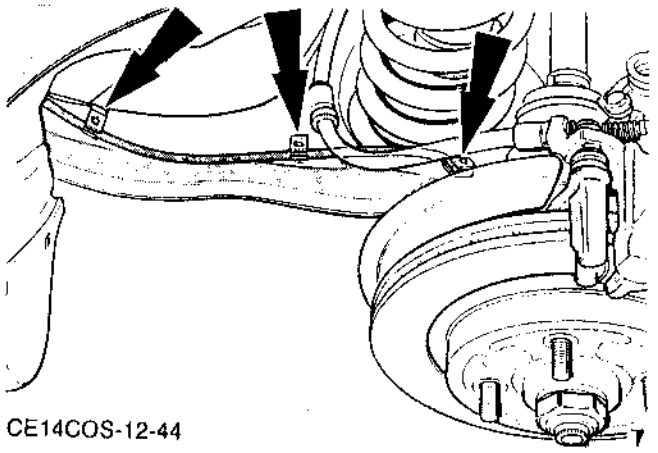


Fig.6. Sensor loom clips.

0492

12 792 0 'G' SWITCH - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

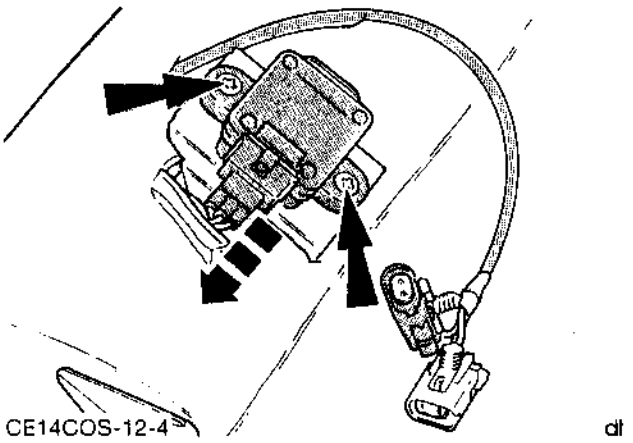


Fig.1. 'G' switch location and retaining screws. (seat removed)

To Remove

1. Slide the front right-hand seat back to its maximum travel.

2. Remove the two screws holding the 'G' switch to the floor and remove it from the vehicle, Fig.1.

3. Remove the multiplug from the 'G' switch.

To Install

4. Refit the multiplug.

5. Locate the 'G' switch in position and secure it with the two screws.

6. Check for correct operation of the ABS warning light.

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Anti-Lock Brake System (ABS) 12C

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TECHNICAL DATA

System	Teves mark 2 electronic anti-lock system. Dual circuit with front/rear split.
Type	Front: Two-wheel drive - ventilated discs with four piston calipers Four-wheel drive - ventilated discs with single piston calipers Rear: Two-wheel drive - solid discs with single piston calipers Four-wheel drive - ventilated discs and single piston calipers
Handbrake	Manual lever, located between front seats, operating on rear wheels only. Manual cable adjustment.

Lubricants

General grease	EM-1C-18
Handbrake lever yoke/clevis pin and brake pedal shaft/bushes	S-M1C-75A
Brake pad backing plates to carrier plate	Wolfrakote grease

Brake Fluid

Brake fluid (amber)	SAM-6C-9103-A

Anti-lock Braking System Accumulator Pressures	Bar
Hydraulic pressure pump switch 'off' pressure ..	160 to 190
Hydraulic pressure pump switch 'on' pressure ..	130 to 150
ABS warning light switch 'on' pressure	110 to 100

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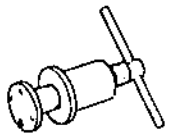
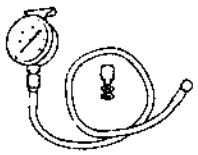
TECHNICAL DATA

Front disc brakes - ventilated	mm	in
Disc diameter (Two-wheel drive)	283,0	11,14
(Four-wheel drive)	278,0	10,95
Disc run out	0,15	0,006
Minimum disc thickness	22,8	0,9
Maximum thickness variation	0,01	0,0004

Rear disc brakes	mm	in
Disc diameter (Two-wheel drive)	273,0	10,75
(Four-wheel drive)	273,0	10,75
Disc run out	0,15	0,006
Minimum disc thickness (Two-wheel drive)	8,9	0,35
(Four-wheel drive)	18,0	0,71
Maximum thickness variation	0,01	0,0004

Tightening torques	Nm	Kgf.m	lbf.ft
Caliper (front)	51 to 61	5,1 to 6,1	37 to 45
Caliper (front) caliper bolts (M9)	20 to 25	2,0 to 2,5	15 to 19
Rear caliper anchor bracket bolts	51 to 61	5,1 to 6,1	37 to 45
Rear caliper slide pin bolts	31 to 35	3,1 to 3,5	23 to 26
Hydraulic unions	6,8 to 9,5	0,6 to 0,9	5 to 7
Bleed valve	10,2	1,0	7
Hydraulic Actuation Assembly:			
Hydraulic Actuation Assembly to bulkhead	14 to 51	4,1 to 5,1	30 to 37
Accumulator to pump housing	34 to 46	3,4 to 4,6	25 to 34
Pump mounting bolt	7 to 9	0,7 to 0,9	5 to 7
High pressure pipe union	7 to 12	0,7 to 1,2	5 to 9
Wheel sensor fixing bolt - front	8,5 to 11	0,85 to 1,1	6 to 8
rear	8,5 to 11	0,85 to 1,1	6 to 8

SPECIAL SERVICE TOOL RECOGNITION

Tool	Tool Name
12-006 	Rear caliper piston wrench
12-008 	Wrench A.B.S. pressure switch
12-009 	Gauge A.B.S. pressure tester
15-022A 	Dial indicator holding fixture
15-046 	Metric dial indicator gauge

12 141 0 BRAKE SYSTEM - BLEED

SPECIAL SERVICE TOOLS REQUIRED: NONE

CAUTION: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

NOTE: When carrying out service bleed or filling the system from dry, the following points must be observed:

- Always use recommended brake fluid from a new can. Never re-use brake fluid.
- Top up reservoir as necessary during bleeding to prevent the hydraulic pump running dry.
- Ensure brake bleed tube is in good condition and secure when fitted to bleed valves.
- The hydraulic pump motor running sound will alter from a high pitched buzz to a lower pitched sound once fluid has purged through it. (DO NOT allow pump motor to run continuously for more than 2 minutes. If pump does run for more than 2 minutes, switch 'off' ignition, position '0', and allow motor to cool for 10 minutes).

WARNING: CARE MUST BE TAKEN WHEN BLEEDING THE REAR BRAKE CIRCUIT AS HYDRAULIC FLUID WILL BE SUBJECTED TO EXTREMELY HIGH PRESSURE.

1. Open hood and fit fender covers. Using Ford recommended brake fluid top up reservoir.
2. Open front left hand caliper bleed valves one full turn.
3. Pump brake pedal to full travel and hold down.

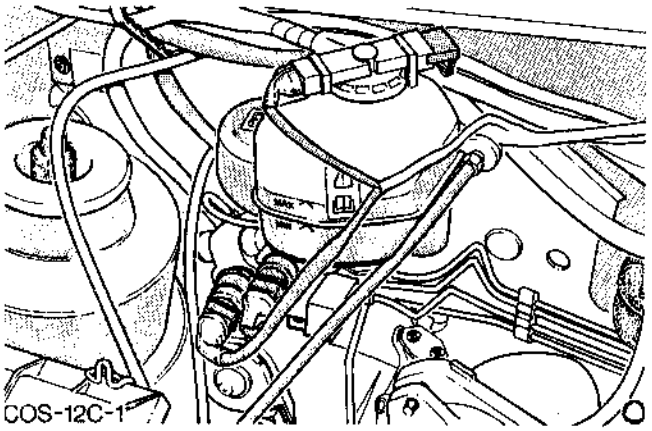


Fig.1. Reservoir 'Max' and 'Min' markings.

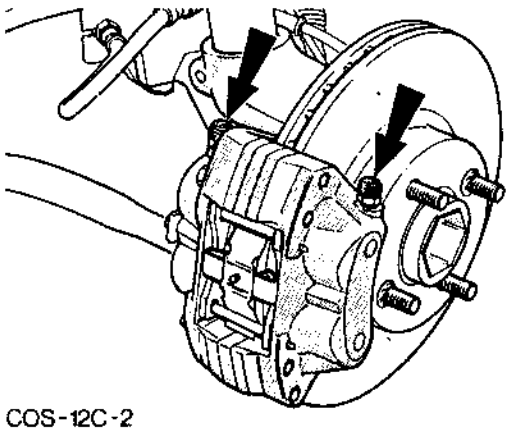


Fig.2. Front caliper bleed valves.

12 141 0

4. Close bleed valves, release brake pedal.

5. Repeat sub operations 2 to 4 until brake fluid flows air free from bleed valves.

6. Bleed front right hand caliper in same manner as left hand caliper.

7. Open rear left hand caliper bleed valve one full turn.

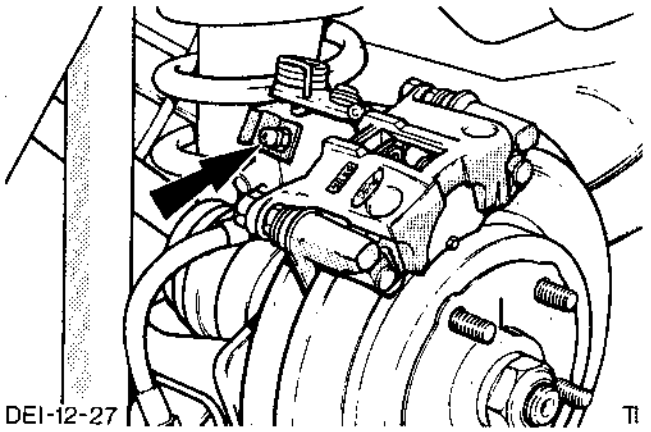


Fig.3. Rear caliper bleed valve.

8. Actuate foot brake. Retain foot brake in full travel position.

9. Switch 'on' ignition, position 'II'.

10. Allow fluid to flow from left hand bleed valve, for at least 15 seconds, ensuring air free fluid flows.

11. Close bleed valve.

12. Release brake pedal and wait until hydraulic pump has stopped (switched 'off').

13. Open rear right hand bleed valve one full turn.

14. Actuate foot brake to half pedal travel and retain in this position. Allow fluid to flow until air free for at least 15 seconds.

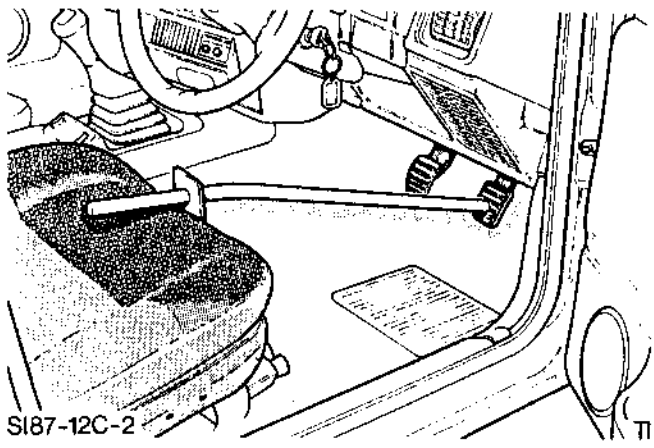


Fig.4. Using suitable tool, fully depress brake pedal.

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12 141 0

15. Close bleed valve.

16. Release brake pedal, wait until hydraulic pump has stopped (switched 'off').

17. Switch 'off' ignition (position '0').

18. Top up reservoir to 'max' mark on reservoir.

19. Replace reservoir cap ensuring locating peg on reservoir cap is correctly located in reservoir.

20. Reconnect wiring connections.

21. Check for correct function of anti-lock warning lamps.

22. Check braking system for leakages, function and efficiency.

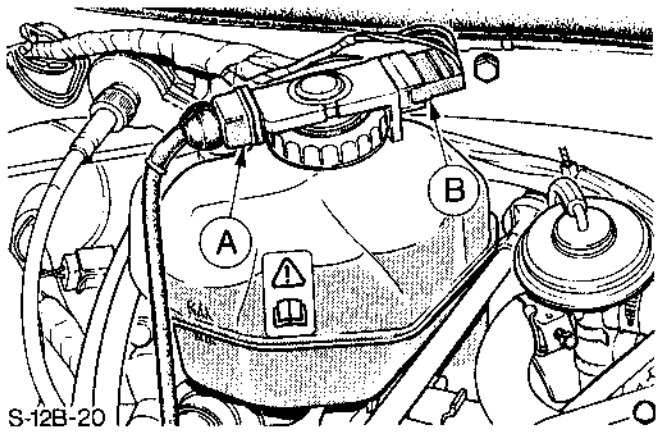


Fig.5. Reconnect reservoir warning switch multiplugs.
A - ABS multiplug
B - AWS multiplug

12 154 0 BRAKE SYSTEM - HYDRAULIC FLUID - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

This operation should be used in conjunction with the Brake System Bleed, Operation No. 12 141 0.

To purge the brake system, continue to actuate the brake pedal until all old brake fluid is pumped out and new clean brake fluid can be seen entering the bleed jar.

CAUTION: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

NOTE: When carrying out service bleed, purging, or filling the system from dry, the following points must be observed:

- Always use recommended brake fluid from a new can. Never re-use brake fluid.
- Top up reservoir as necessary during bleeding to prevent the hydraulic pump running dry.
- Ensure brake bleed tube is in good condition and secure when fitted to bleed valves.
- The hydraulic pump motor running sound will alter from a high pitched buzz to a lower pitched sound once fluid has purged through it. (DO NOT allow pump motor to run continuously for more than 2 minutes. If pump does run for more than 2 minutes, switch 'off' ignition, position '0', and allow motor to cool for 10 minutes).

NOTE: If difficulty is experienced with purging the hydraulic actuation assembly, apply foot brake and release with ignition 'ON'. Continue to apply foot brake until pump motor running sound changes.

WARNING: CARE MUST BE TAKEN WHEN BLEEDING THE REAR BRAKE CIRCUIT AS HYDRAULIC FLUID WILL BE SUBJECTED TO EXTREMELY HIGH PRESSURE.

12 221 0 BRAKE DISC - CHECK RUN-OUT - FRONT AND REAR

SPECIAL SERVICE TOOLS REQUIRED:

Dial indicator holding fixture	..	15-022
Metric dial indicator gauge	..	15-046

1. Jack up vehicle and fit chassis stands.

2. Remove front and/or rear road wheels.

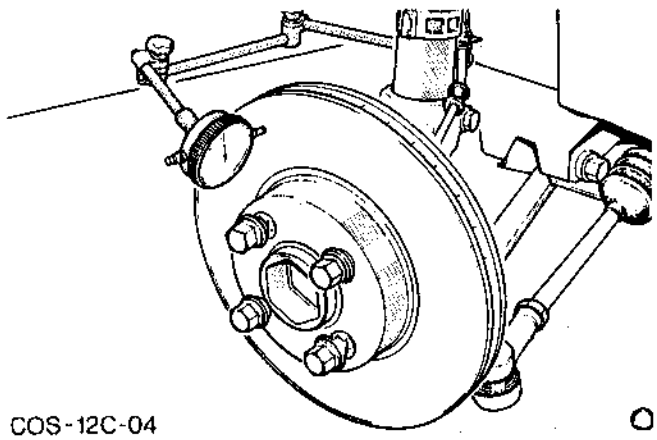


Fig.1. Check front disc run-out.

Front brake disc check

3. Using dial gauge holding fixture, Special Service Tool No. 15-022 and gauge, measure disc run-out.

   The total dial gauge indicator reading should be less than 0,15 mm variation.

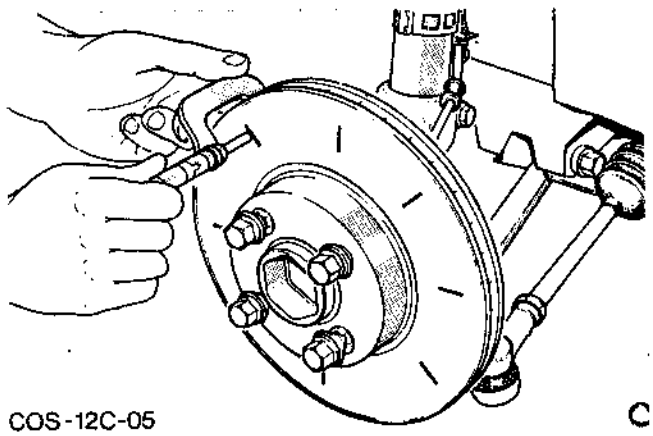


Fig.2. Measure thickness variation at eight equally spaced positions.

4. Using a suitable micrometer, measure disc thickness at eight positions, 45° apart at mid-pad contact area, 15 mm in from the outer edge of the disc. If any of these readings vary by 0,01 mm or more, or if the minimum thickness of the disc is below 22,8 mm, the disc should be replaced.

Rear brake disc check

5. Using dial gauge and holding fixture attached to the lower arm measure, disc run-out.

   The total dial gauge indicator reading should be less than 0,15 mm variation.

6. Using suitable micrometer, measure disc thickness at eight positions, 45° apart at mid-pad contact area 15 mm in from the outer edge of the disc.

   If any of these eight readings vary by 0,01 mm or more, or if the readings are less than the permissible minimum thickness of the disc (8,9 mm), the disc should be replaced.

7. Replace road wheels and torque wheel nuts to specification.

8. Remove chassis stands and lower vehicle.

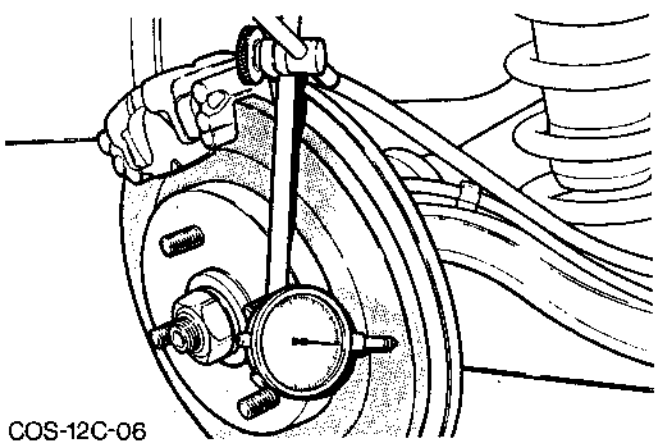


Fig.3. Check rear disc run-out.

12 224 0 DISC - FRONT BRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Slacken wheel nuts, jack-up vehicle and fit chassis stands.
2. Remove front road wheels, (note position of wheels on hubs).
3. Remove caliper to knuckle retaining bolts. Release brake pipe clip from suspension strut and suspend caliper to prevent damage to flexible hose.
4. Remove disc to hub retaining clips and remove disc.

NOTE: If original disc is to be refitted, mark position of hub and disc to ensure original alignment.

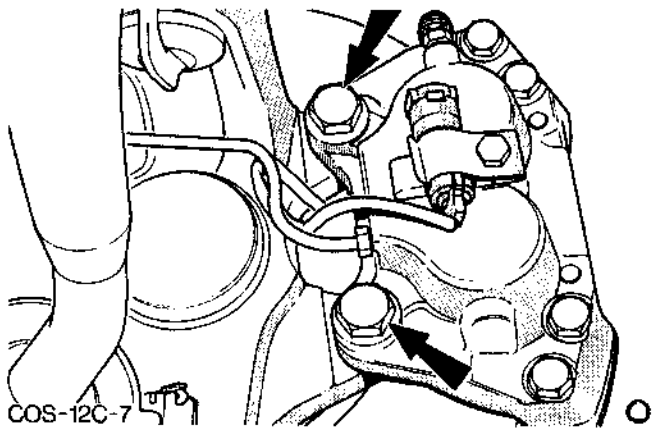


Fig.1. Remove front caliper retaining bolts. (Two-wheel drive illustrated)

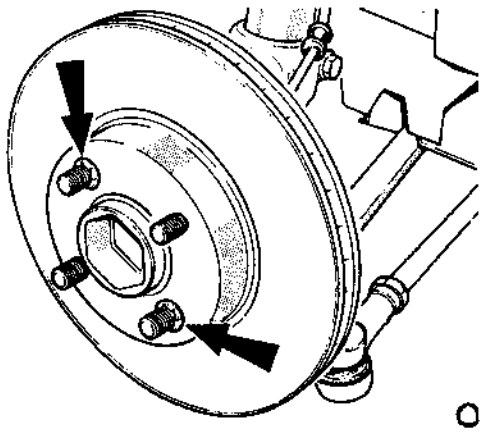


Fig.2. Disc retaining clips.

To Install

5. Thoroughly clean hub and disc mating faces ensuring no dirt or corrosion is present before refitting.
6. Re-align disc to hub (if original is to be refitted) and secure disc to hub using spring clips.
7. Reposition caliper onto knuckle assembly, refit bolts and torque to specification.
8. Reclip brake pipe to suspension strut.
9. Refit front road wheels, remove chassis stands and lower vehicle. Torque wheel nuts to correct specification.
10. Apply foot brake to ensure front brake pads are correctly auto-adjusted.

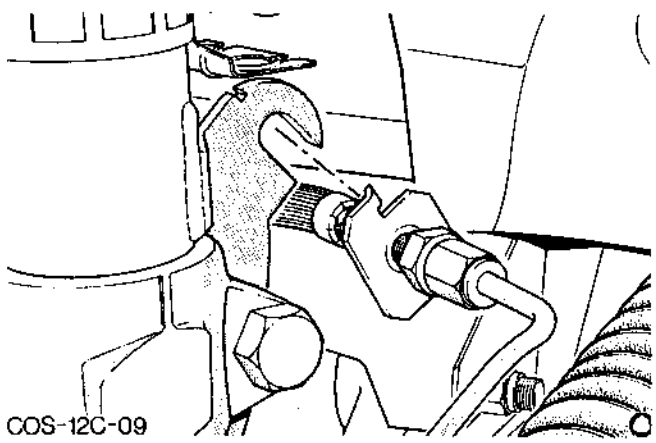


Fig.3. Reconnect brake pipe to strut retaining clip.

12 225 0 DISC - REAR BRAKE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Slacken road wheel nuts, jack-up rear of vehicle and remove road wheels.

2. Release handbrake and detach handbrake cable from lower arm clip. Remove caliper anchor bracket retaining bolts and lift off caliper. Suspend caliper clear of disc, preventing any stress to flexible hose.

3. Remove disc retaining clip from wheel stud and remove disc.

NOTE: Mark disc and hub if original disc is to be refitted.

To Install

4. Throughly clean disc and hub mating faces, ensure both are clean and free from dirt or corrosion.

5. Re-position disc onto hub and refit retaining clip.

NOTE: If original disc is to be refitted, align mating marks.

6. Refit caliper and secure anchor bracket to mounting plate, torque bolts to specification.

7. Re-apply handbrake, refit road wheel and lower vehicle.

8. Torque road wheel nuts, release handbrake and then apply foot brake to ensure disc pads are correctly auto-adjusted.

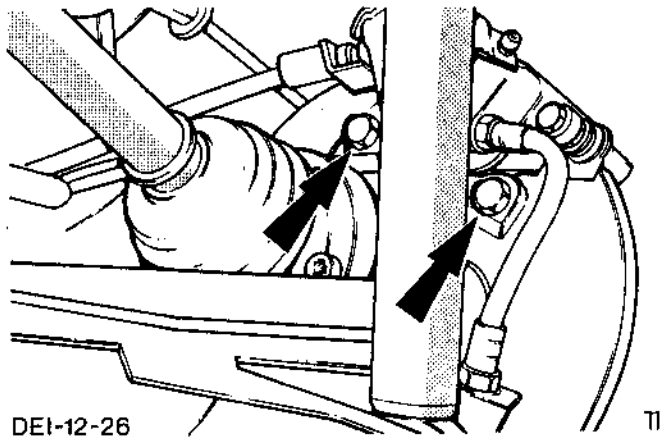


Fig.1. Remove caliper retaining bolts.

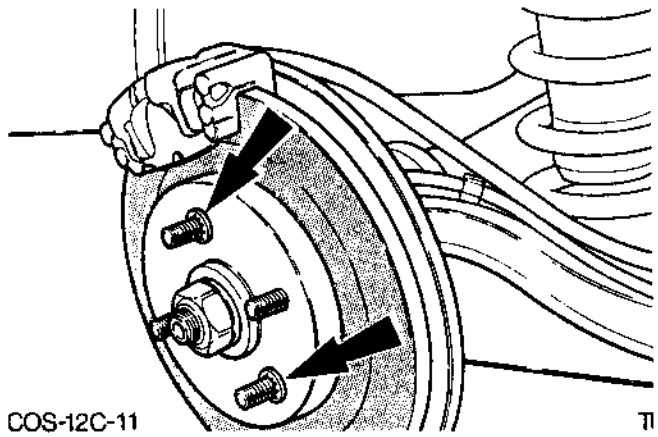


Fig.2. Disc retaining clip.

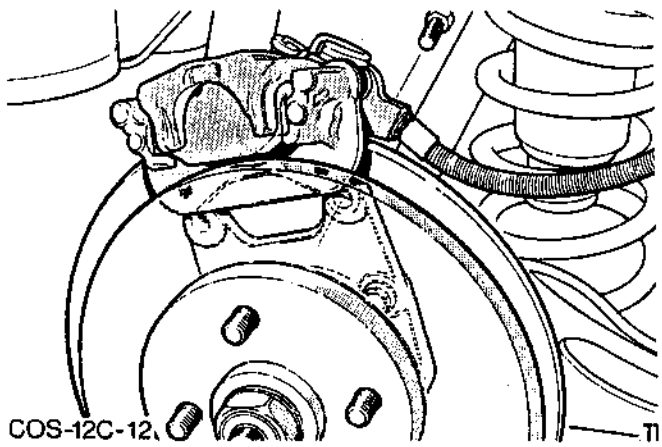


Fig.3. Lift caliper assembly clear and remove disc.

12 233 0 DISC PADS - FRONT - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

Two-Wheel Drive Variants

To Remove

1. Slacken wheel nuts, jack-up front of vehicle and fit chassis stands.
2. Remove front road wheels.
3. Using suitable thin pin punch, remove lower brake pad retaining pin.
4. Remove brake pad anti-vibration clip.
5. Remove upper brake pad retaining pin.
6. Carefully extract the brake pads from piston housing.
7. Lever back pistons into caliper piston housing. Care should be taken not to damage piston dust gaiters.

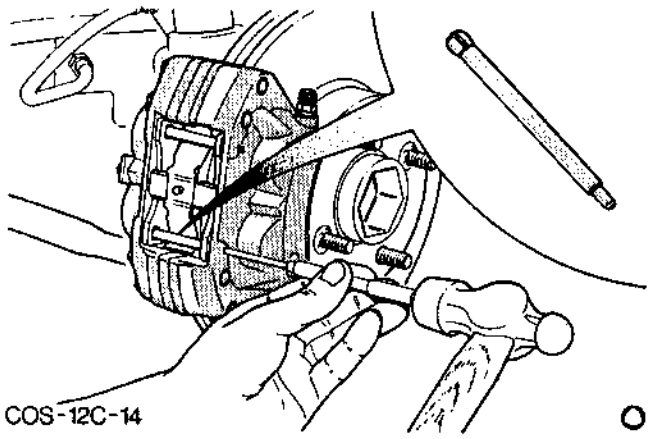


Fig.1. Remove lower pad retaining pin. Insert - retaining pin

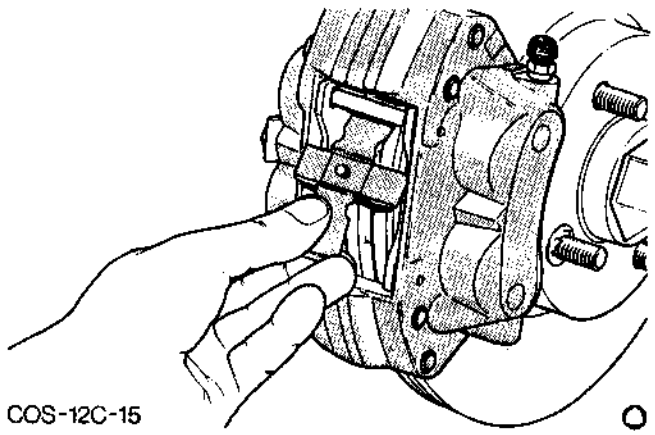


Fig.2. Remove anti-rattle clip.

To Install

8. Clean dust and any dirt contamination from caliper housing.
9. Locate brake pads into caliper piston housing.
10. Fit upper brake pad retaining clip, locate anti-vibration clip to upper retaining clip. Push clip towards brake pads and refit lower retaining pin.
11. Once all brake pads have been installed, apply foot brake to bring brake pads into contact with the disc.
12. Refit road wheels and tighten wheel nuts, lower vehicle and torque wheel nuts to correct specification.

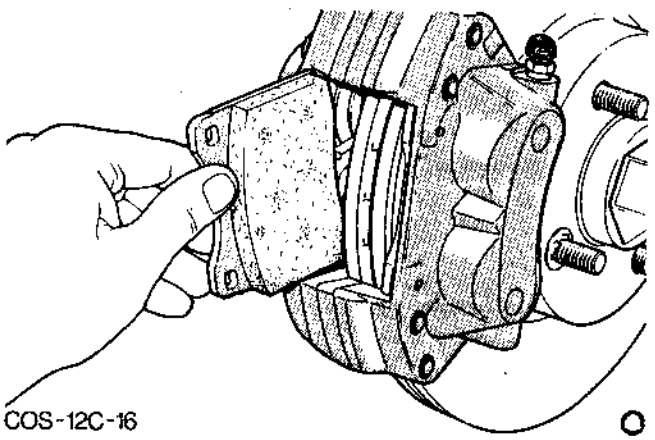


Fig.3. Remove brake pad from caliper piston body.

12 233 0

Four-Wheel Drive Variants

To Remove

1. Slacken wheel nuts, jack-up front of vehicle and remove road wheels.

2. Remove caliper spring clip, Fig.4.

3. Remove protective plugs and slacken piston housing retaining Allen bolts until piston housing is free from anchor bracket, Fig.5.

4. Remove pad from caliper piston and, using a suitable tool, lever fixed pad off caliper housing fingers, Fig.6.

To Install

5. Clean dust and dirt from caliper piston housing, observing safety precautions relating to dust generated from friction surfaces.

6. Push piston fully back into housing. Locate new brake pad in piston. Remove backing paper from fixed pad and locate in caliper housing.

7. Refit caliper piston housing to anchor bracket. Tighten Allen bolts and replace pump. Refit caliper spring clip.

8. Apply footbrake vigorously to bring pads into contact with disc.

9. Refit road wheels and tighten wheel nuts. Lower vehicle to ground and fully tighten wheel nuts.

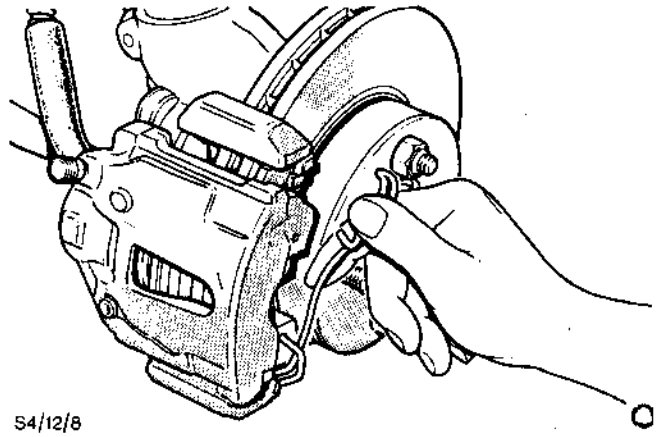


Fig.4. Remove caliper spring clip.

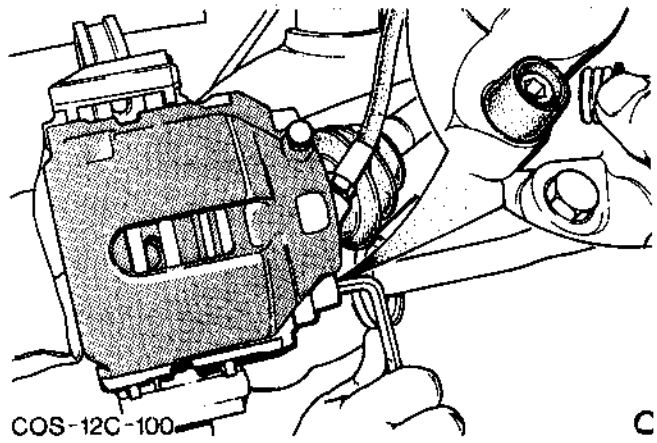


Fig.5. Slacken Allen bolts.

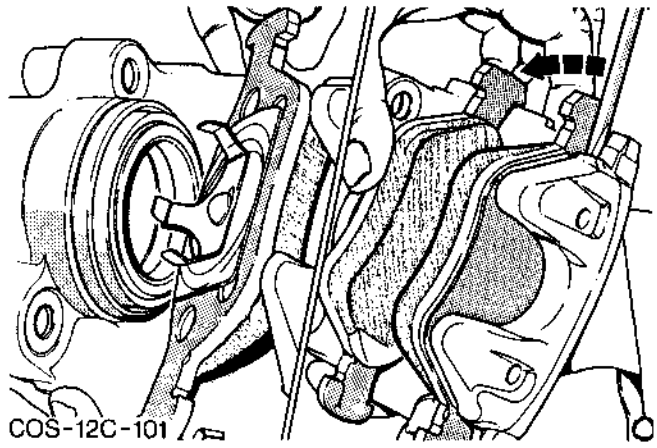


Fig.6. Remove pads from caliper piston housing.

12 237 0 DISC PADS - REAR - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Piston Wind Back Tool .. 12-006

CAUTION: Rear brake system is subjected to high pressure. DO NOT apply footbrake once the caliper has been removed from the anchor bracket.

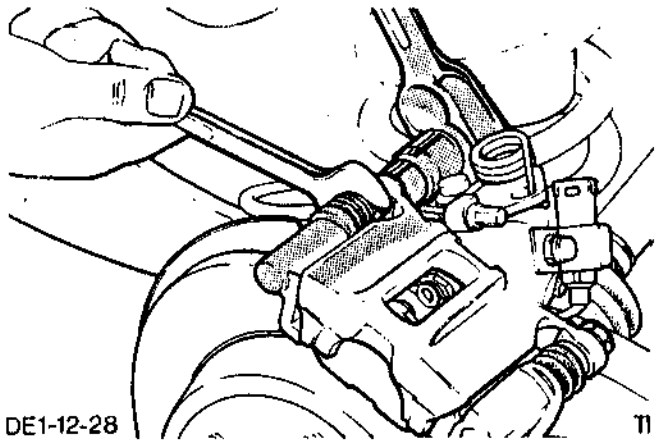


Fig.1. Remove front slide pin bolts.

To Remove

1. Slacken wheel nuts, jack-up vehicle and fit chassis stands. Release handbrake.
2. Remove road wheel.
3. Detach handbrake cable from lower arm retaining clip.
4. Remove forward piston housing retaining bolt from anchor bracket. Swing piston housing assembly upwards away from brake disc.
5. Remove brake pads from carrier bracket.
6. Using Special Service Tool 12-006, wind back piston into piston housing.

NOTE: Ensure slot in piston face is positioned so that inner pad backing plate will engage in piston face.

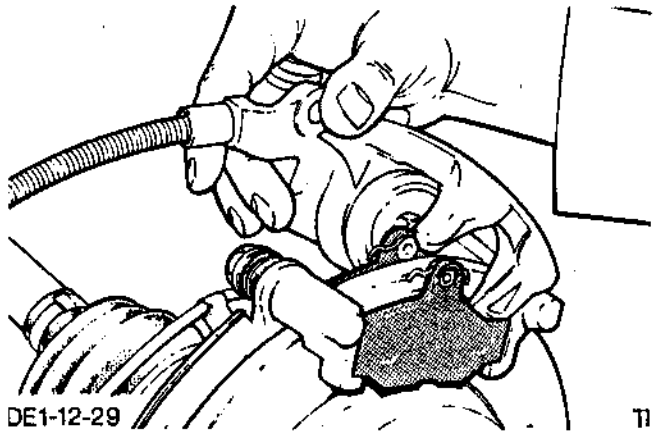


Fig.2. Lift out brake pads.

To Install

7. Locate brake pads in anchor bracket.
8. Swing piston housing over disc, positioning slot in piston over peg of brake pad. Ensure brake pad anti-rattle springs are correctly positioned in piston housing.
9. Refit forward piston housing to anchor retaining bolt, torque bolt to specification.
10. Re-secure handbrake cable to lower arm assembly.
11. Apply footbrake to ensure correct brake pad disc auto-adjustment.
12. Refit road wheel, fit and tighten wheel nuts.
13. Lower vehicle and torque wheel nuts to specification.

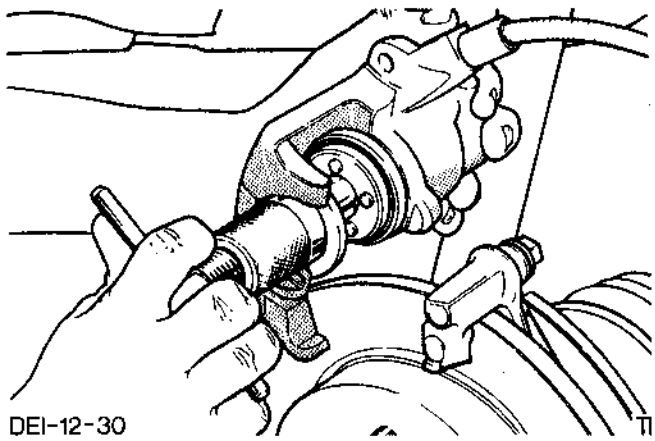


Fig.3. Wind back piston using Special Service Tool 12-006.

990

12 243 0 CALIPER ASSEMBLY - FRONT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Switch 'off' ignition Position '0', apply footbrake at least 20 applications or until the pedal effort increases and becomes hard.

To Remove

1. Jack up front of vehicle, fit chassis stands, open hood and fit fender covers. Remove road wheel.
2. Remove clip retaining brake pipe flexible hose from suspension strut.
3. Disconnect brake pipe from caliper piston housing, fit blanking plugs to prevent excessive fluid loss or dirt entry into caliper piston housing.
4. Remove bolts securing caliper to knuckle assembly, and lift off caliper assembly.

To Install

5. Locate caliper assembly to knuckle and tighten bolts to specification (see Technical Data).
6. Reconnect brake pipe to caliper piston housing. Tighten union to specification.
7. Re-secure flexible hose connection to suspension strut mounting bracket.
8. Bleed front brake circuit.
9. Refit road wheel and lower vehicle, torque wheel nuts to specification.
10. Remove fender covers and close hood.

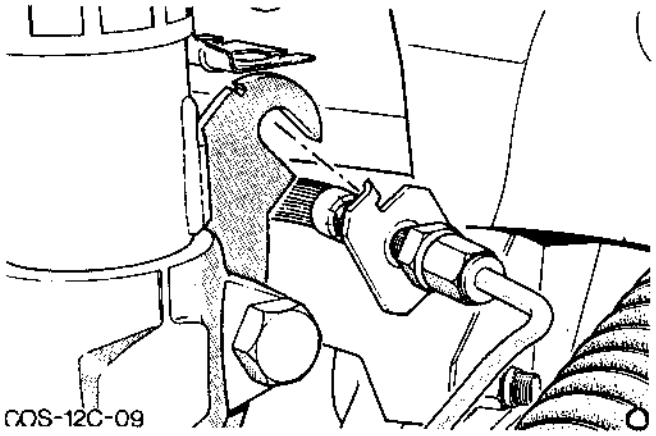


Fig.1. Release retaining clip from suspension strut.

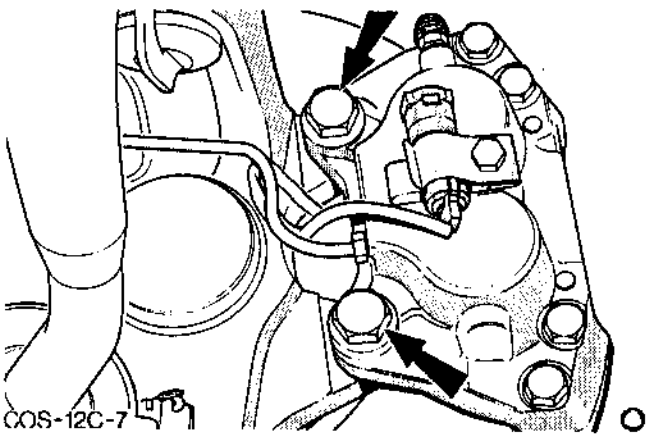


Fig.2. Remove caliper to knuckle securing bolts. (Two-wheel drive illustrated)

12 247 4 PISTON - FRONT CALIPER - REMOVE AND INSTALL (Four-wheel drive variants only)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Apply low hydraulic or low air pressure to caliper piston inlet port to eject from bore. Use a suitable spacer (wood) between piston and caliper fingers to prevent damage to piston face.

NOTE: The piston dust cover cannot be removed until the piston is removed.

2. Hook out piston seal and dust cover.

3. Wash piston and cylinder bore in commercial alcohol or methylated spirits. Do not use mineral-based fluids such as petrol or paraffin as brake failure may subsequently occur.

4. Check piston and cylinder bore for sign of damage, scuffing, scores or corrosion. If the piston or cylinder bore is corroded, then that component must be replaced.

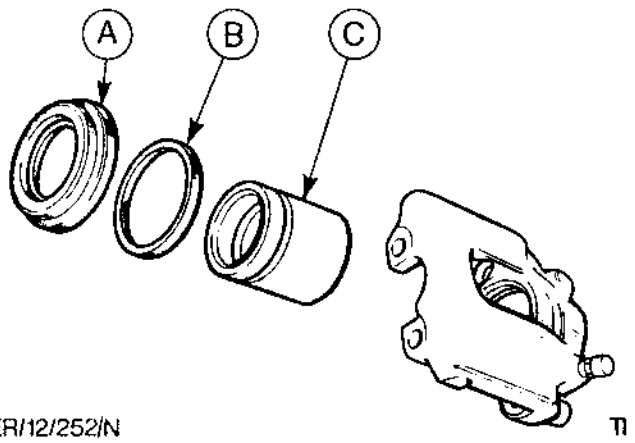


Fig.1. Piston housing assembly.
A - Dust cover C - Piston
B - Piston seal

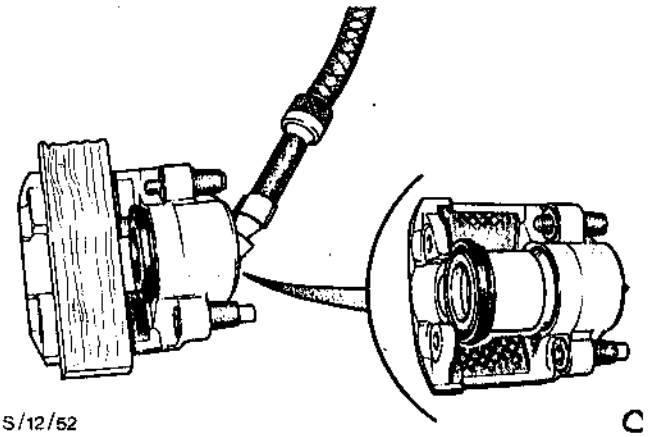


Fig.2. Remove piston from piston housing using low air pressure.

To Install

5. Lubricate cylinder bore with new brake fluid.

6. Locate new piston seal in cylinder bore groove.

7. Stretch dust cover over piston and assemble piston into cylinder bore.

8. Carefully push piston fully home into cylinder bore. Refit brake pads and assemble caliper assembly to anchor bracket.

12 253 0 CALIPER ASSEMBLY - REAR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Switch 'off' ignition Position '0', apply footbrake at least 20 applications or until the pedal effort increases and becomes hard.

To Remove

1. Open hood and fit fender covers.
2. Slacken wheel nuts, jack-up vehicle and fit chassis stands.
3. Remove road wheels.
4. Release handbrake lever.
5. Disconnect flexible hose from brake pipe, fit blanking plugs to prevent excessive fluid loss or dirt entry.
6. Remove caliper anchor bracket retaining bolts.
7. Unhook handbrake cable from lever and lift caliper assembly.
8. Remove hydraulic brake flexible hose from caliper piston housing.

To Install

9. Reconnect hydraulic brake flexible hose to caliper piston housing.
10. Connect handbrake cable to caliper actuating lever.
11. Mount caliper onto support bracket and secure. Torque bolts to specification.
12. Bleed rear brake circuit as detailed in Operation No. 12 141 0.
13. Refit road wheel and secure, remove chassis stands and lower vehicle.
14. Fully tighten road wheel nuts.

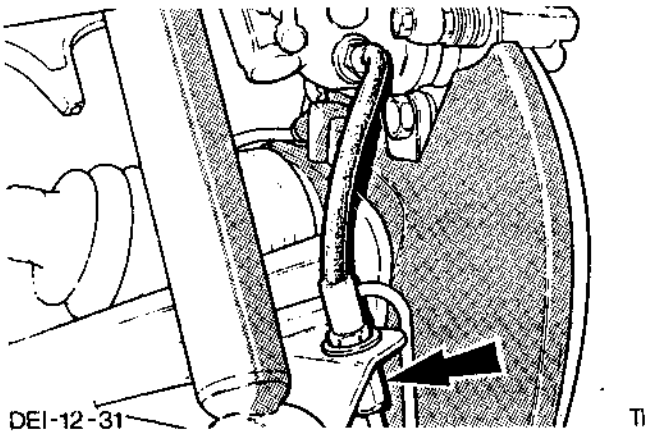


Fig.1. Disconnect flexible hose from brake pipe.

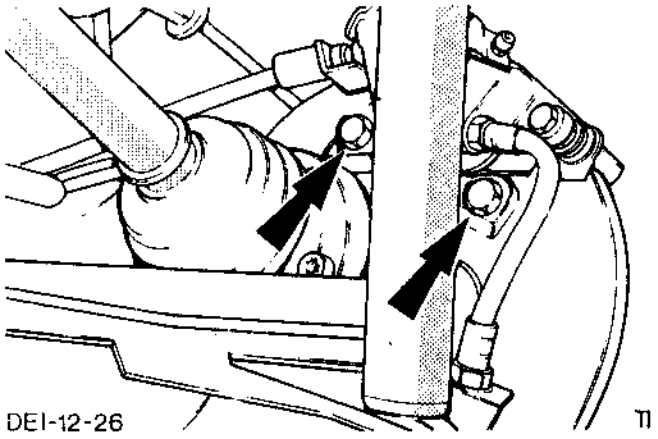


Fig.2. Remove anchor bracket retaining bolts.

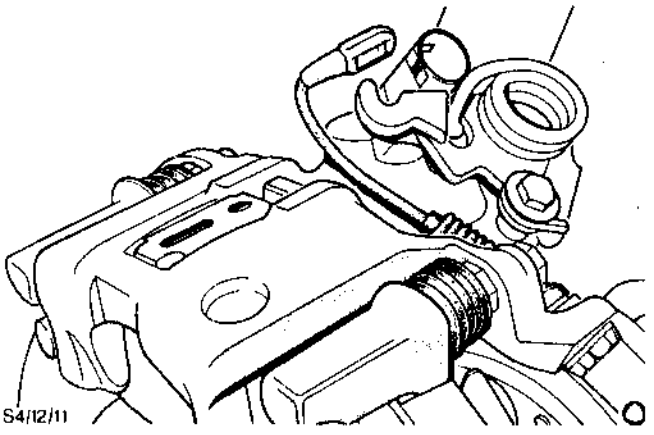


Fig.3. Remove handbrake cable from caliper actuation lever.

12 333 0 BRAKE PEDAL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Remove under dash trim panel from around brake pedal.

3. Using suitable hook, remove circlips securing cross shaft. Slide shaft out towards clutch pedal sufficiently to release brake pedal. Note position of spacer tubes and washers.

4. Remove brake pedal from vehicle, remove shaft bushes and, if necessary, brake pedal rubber.

Fig.27. A - Hook tool
B - Cross shaft circlip
C - Servo push rod clip

To Install

5. Fit new pedal shaft bushes into brake pedal, refit brake pedal rubber.

6. Reposition brake pedal in vehicle, slide cross shaft through until 'D' on shaft locates in pedal bracket housing. Ensure all spacers and washer are correctly fitted. Refit shaft securing circlips.

7. Reconnect hydraulic actuation assembly push rod to brake pedal retaining clip.

8. Adjust stop lamp switch.

9. Refit under dash panels.

10. Reconnect battery, remove fender cover and close hood.

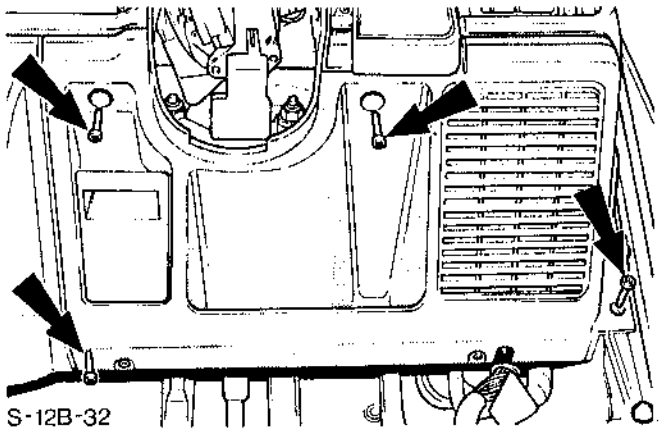


Fig.1. Remove under dash trim.

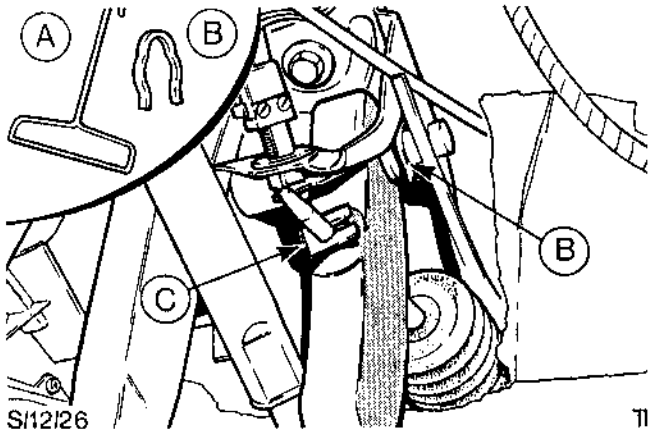


Fig.2. Remove circlip from cross shaft and clip from brake pedal push rod.

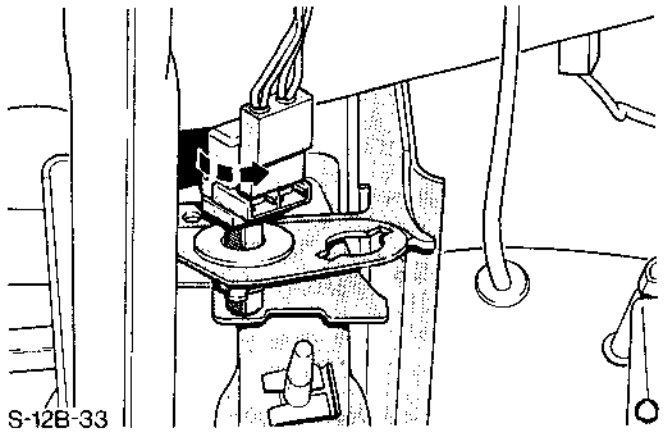


Fig.3. Adjust stop lamp switch.

12 341 0 BRAKE FLUID RESERVOIR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Switch off ignition (Position '0'). Apply foot brake at least 20 times or until pedal becomes hard to ensure brake pressure is fully discharged.

NOTE: If brake fluid is spilt on paintwork, the affected area must be immediately washed down with cold water.

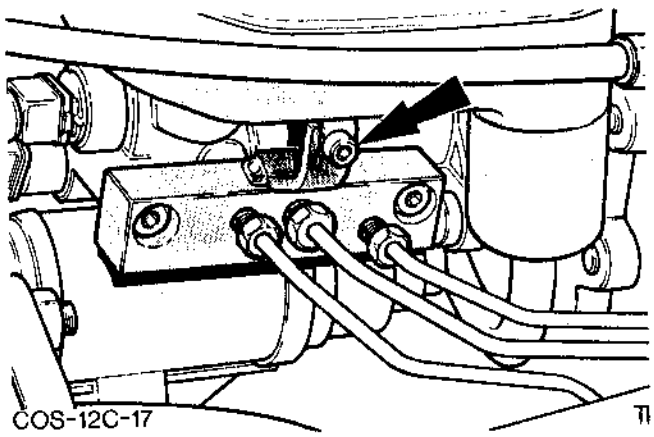


Fig.1. Remove reservoir securing screw and clip.

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Ensure braking system pressure is fully discharged.
3. Disconnect brake fluid reservoir filler cap multiplugs.
4. Remove screw and clip securing reservoir to hydraulic unit.
5. Remove spring clip securing low pressure hose to electric hydraulic pump. Drain brake fluid into suitable container.
6. Carefully remove reservoir from hydraulic unit.
7. Remove reservoir seals from booster and master cylinder assemblies.
8. Remove low pressure hose from reservoir.

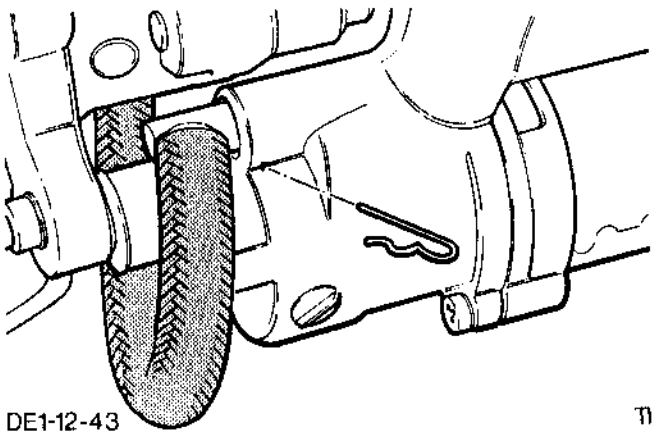


Fig.2. Remove spring clip releasing low pressure pipe.

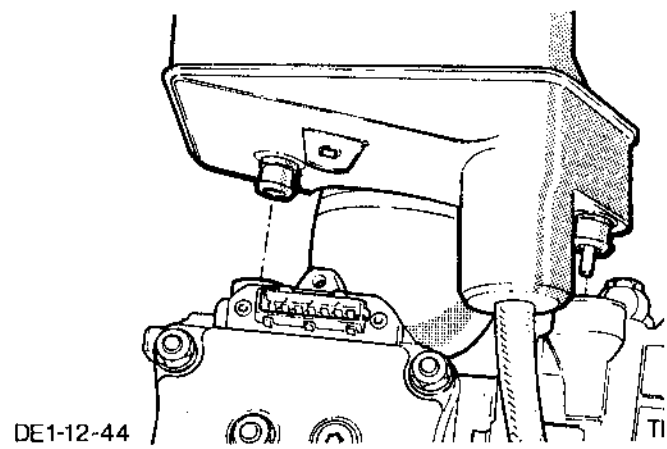


Fig.3. Lift off reservoir.

12 341 0

To Install

9. Replace reservoir seals. Ensure that rear seal is aligned correctly in booster and master cylinder.

10. Refit low pressure hose to reservoir.

11. Lubricate seals and reservoir connections with clean brake fluid. Fit reservoir to hydraulic unit.

12. Secure reservoir to hydraulic unit with screw and clip.

NOTE: Ensure clip is fitted correctly to support clutch cable. (Right hand drive variants only).

13. Reconnect low pressure hose to hydraulic pump, refit locking clip.

NOTE: Ensure that hose elbow connection is firmly pushed into pump assembly before fitting locking clip.

14. Top up reservoir with new brake fluid.

15. Ensure ignition switch is 'off' (position 0). Reconnect battery.

16. Bleed braking system as detailed in Operation No. 12 141 0, check for leaks. Reconnect fluid level multiplug connections.

17. Remove fender covers and close hood.

18. Check operation of braking system.

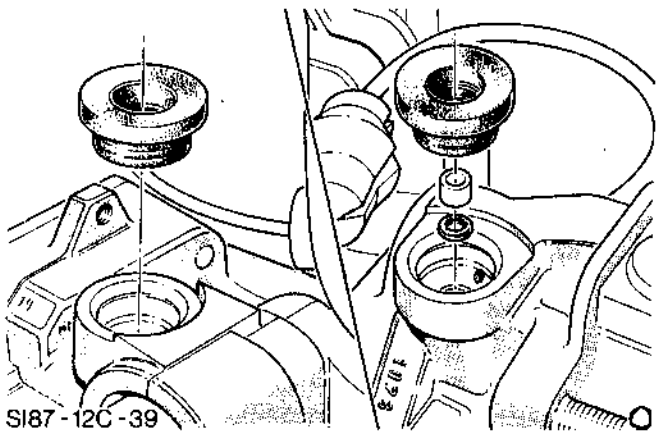


Fig.4. Fit new reservoir seals.

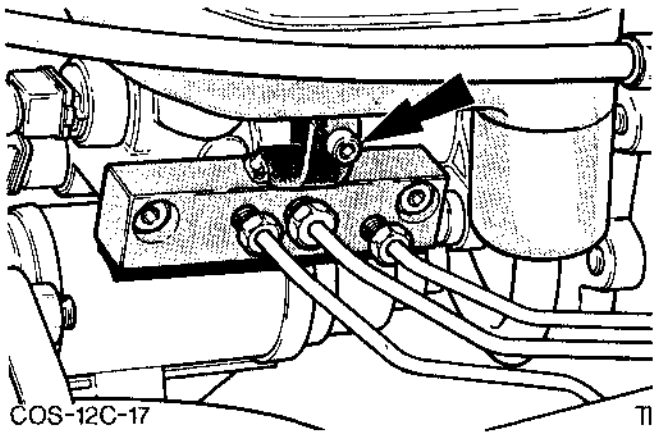


Fig.5. Secure reservoir to hydraulic unit.

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12 341 0

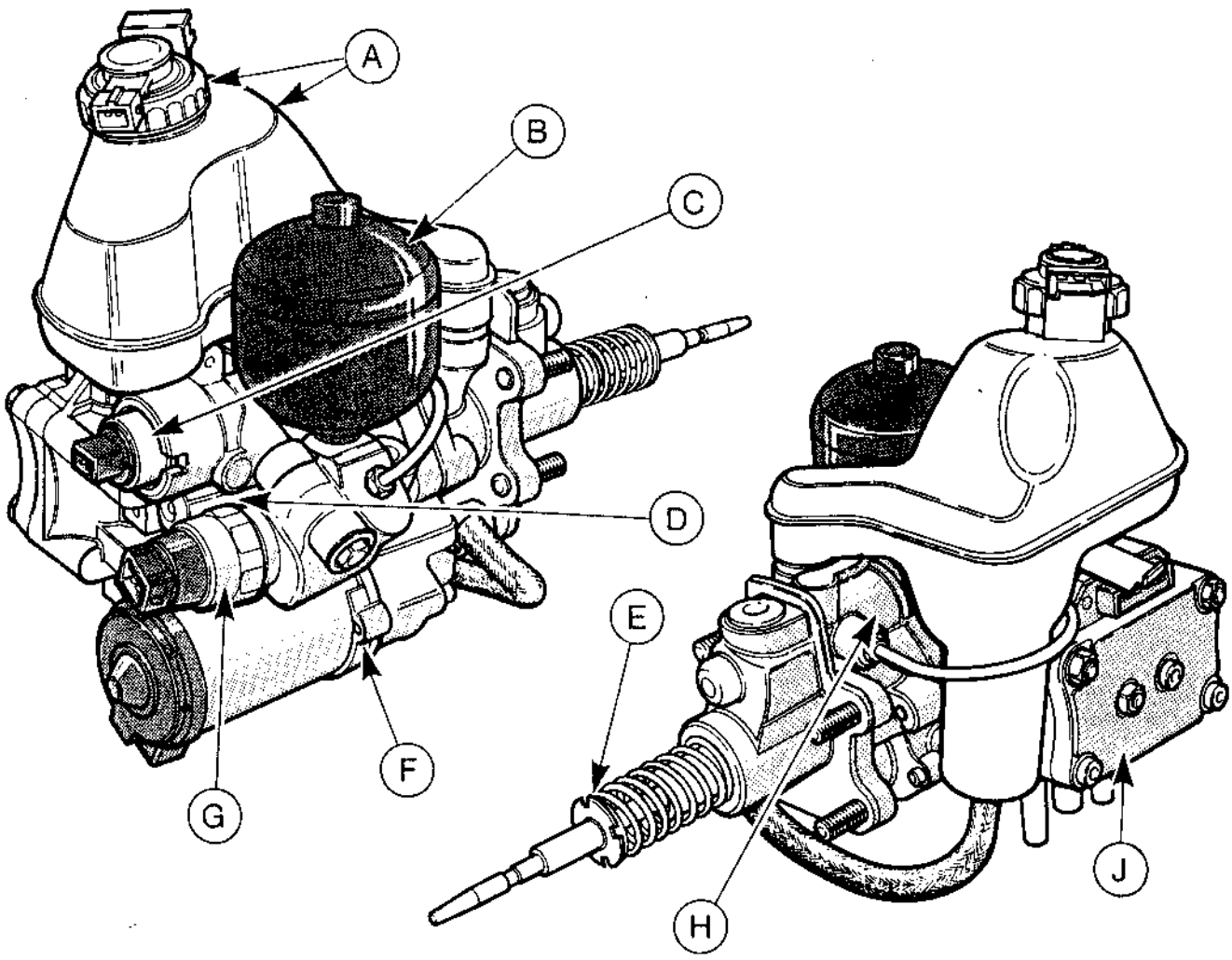


Fig.6. Hydraulic actuation unit assembly.

A - Reservoir and fluid level warning indicator
B - Accumulator
C - Main valve
D - Master cylinder
E - Push rod assembly
F - Electric motor and hydraulic pressure pump
G - Pressure switch
H - Booster assembly
J - Valve block

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12 580 0 HYDRAULIC UNIT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Switch off ignition (position '0'). Apply foot brake at least 20 times or until the brake pedal becomes hard to ensure brake pressure is fully discharged.

NOTE: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

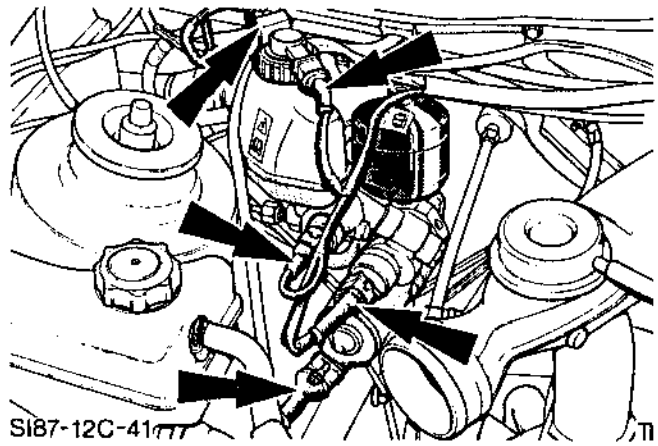


Fig.1. Disconnect electrical connections from hydraulic unit.

To Remove

1. Open hood, fit fender covers and disconnect battery.

WARNING: Ensure braking system pressure is fully discharged.

2. Disconnect electrical connections from hydraulic unit, (pressure switch, main valve, valve block, reservoir filler cap, electric hydraulic pump and earth connection).

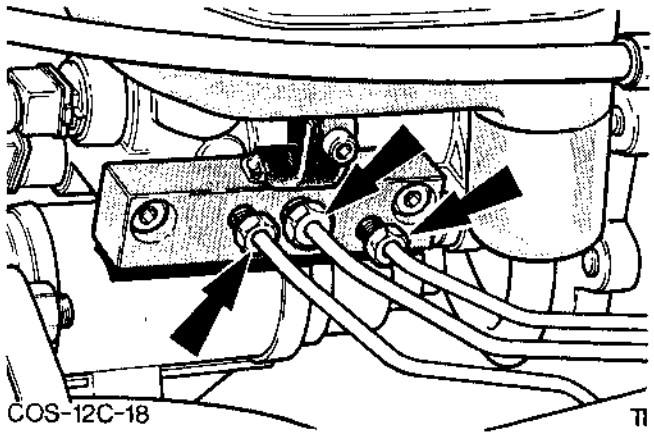


Fig.2. Disconnect hydraulic pipes from hydraulic unit.

3. Disconnect hydraulic pipes from hydraulic unit or valve body, fit blanking caps to prevent dirt ingress or excessive fluid loss.

4. Remove under dash trim panel from around the brake pedal.

5. Remove brake pedal push rod clip.

6. Remove hydraulic unit mounting nuts.

NOTE: The assistance of a second technician should be used to support the hydraulic unit when removing mounting nuts.

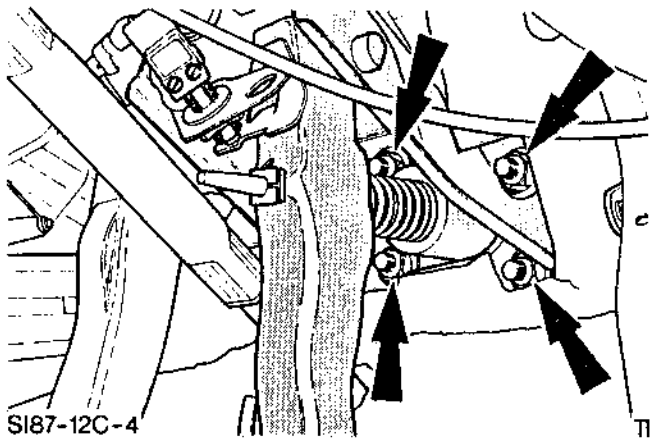


Fig.3. Remove hydraulic unit mounting nuts and pedal push rod clip.

12 580 0

7. Lift out hydraulic actuation unit from vehicle and drain reservoir. Remove spherical ball from push rod.

NOTE: Do not lift hydraulic actuation unit by hoses, reservoir or push rod.

DO NOT ATTEMPT TO ACTUATE HYDRAULIC UNIT BY PUSHING PUSH ROD ONCE REMOVED FROM VEHICLE.

8. Remove sealing gasket from hydraulic unit.

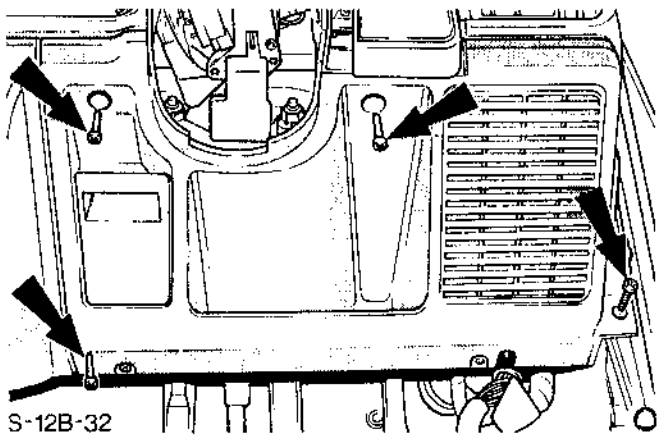


Fig.4. Refit under dash trim panel.

To Install

9. Fit new sealing gasket to hydraulic unit.

10. Fit spherical ball to push rod. Carefully install hydraulic unit into vehicle ensuring push rod enters brake pedal. Care should be taken not to force push rod from its natural position.

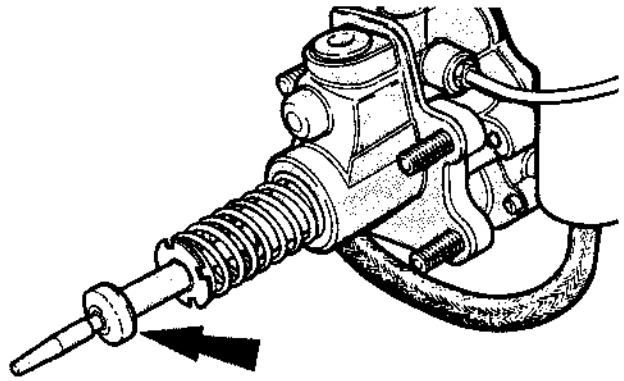


Fig.5. Fit spherical ball to push rod.

11. Support hydraulic unit while second technician secures the hydraulic actuation unit with four nuts to the bulkhead. Torque to specification.

12. Reconnect brake pedal to hydraulic unit push clip.

13. Remove blanking caps from valve block and brake pipes, reconnect brake pipes to hydraulic unit.

WARNING: ENSURE BRAKE PIPES ARE CONNECTED TO CORRECT PORTS.

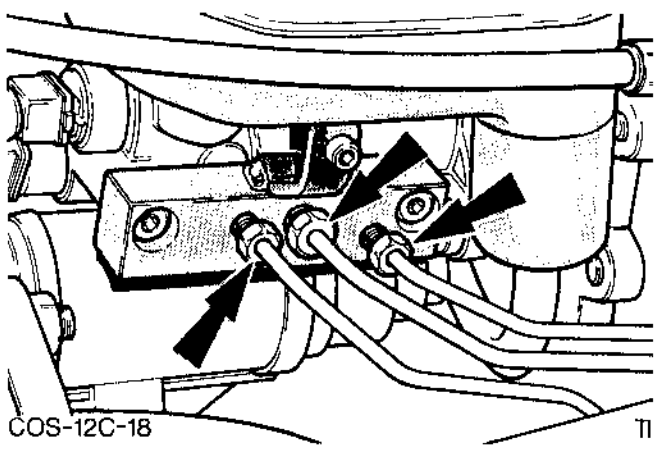


Fig.6. Brake pipe connection.

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12 580 0

14. Reconnect electrical multiplugs to valve block, main valve, pressure switch, electrical hydraulic pump and earth connection.

15. Fill reservoir with new brake fluid.

16. Bleed front brake circuits as detailed in Operation No. 12 141 0.

17. Reconnect battery.

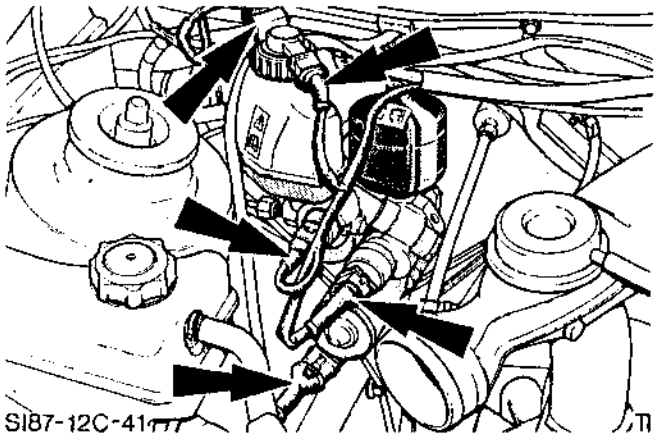


Fig.7. Reconnect all multiplugs.

18. Switch 'on' ignition and check pump operation.

NOTE: Do not allow electrical hydraulic pump to operate for more than 2 minutes. (If pump does run for more, switch 'off' ignition, position '0', and allow motor to cool for 10 minutes.

NOTE: If difficulty is experienced with purging the hydraulic actuation unit, apply foot brake and release with ignition 'ON', continue to apply foot brake until pump motor running sound changes.

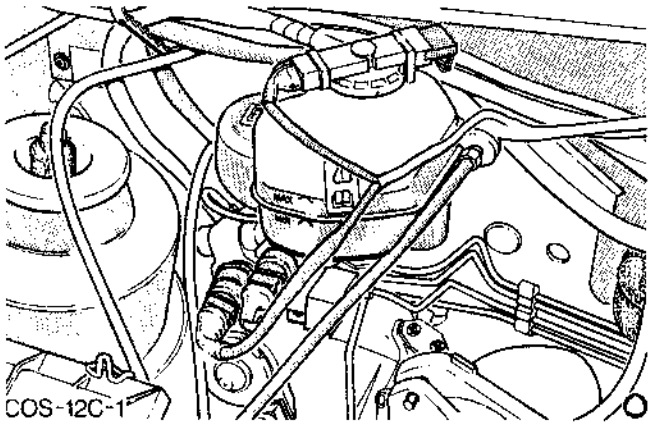


Fig.8. Top up reservoir to 'Max' mark.

19. Bleed rear brake circuit as detailed in Operation 12 141 0. Check system for fluid leaks.

20. Refit under dash trim panel.

21. Reconnect reservoir fluid filler cap multiplugs.

22. Remove fender covers and close hood.

23. Check operation of boost and anti-lock/brake function.

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12 581 0 VALVE BLOCK - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Pump brake pedal at least 20 times until brake pedal becomes hard to discharge pressure from braking system.

Right Hand Drive Variants

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Ensure braking system pressure is fully discharged.
3. Jack up vehicle and fit chassis stands. Remove the passenger side front wheel.
4. Remove the six plastic fasteners securing the wheelarch shield (see Fig.43).
5. Separate the wheel arch shield lower catch and remove shield by pulling down and rotating in a clockwise direction.
6. Place drain tray beneath vehicle and disconnect hydraulic fluid pipes from valve block. Fit blanking caps to pipes and valve block connections to prevent excessive fluid loss and dirt entry.
7. Disconnect valve block multiplug and earth cable.
8. Remove valve block mounting bracket retaining nuts from inner fender and lift out valve block.

To Install

9. Locate valve block and bracket onto inner fender and secure.
10. Remove blanking plugs from pipes and valve block and reconnect brake pipes. Ensure pipes are connected in their correct positions.

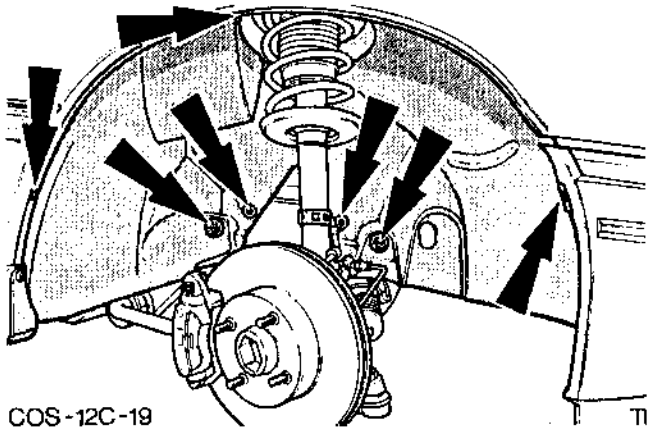


Fig.1. Wheel arch shield fasteners.

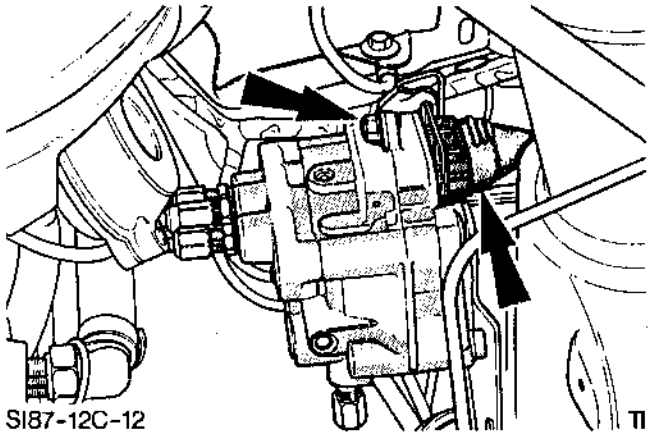


Fig.2. Disconnect multiplug and earth cable.

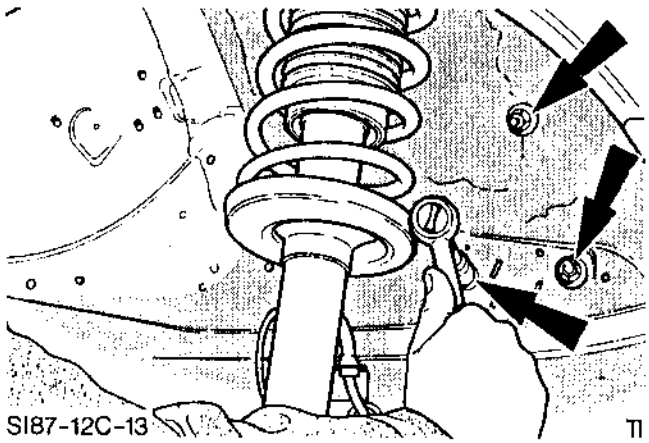


Fig.3. Remove valve block bracket securing nuts.

12 581 0

11. Reconnect valve block multiplugs and earth connections.

12. Refit wheel arch shield and engage lower catch.

13. Align wheel arch shield and refit plastic clips.

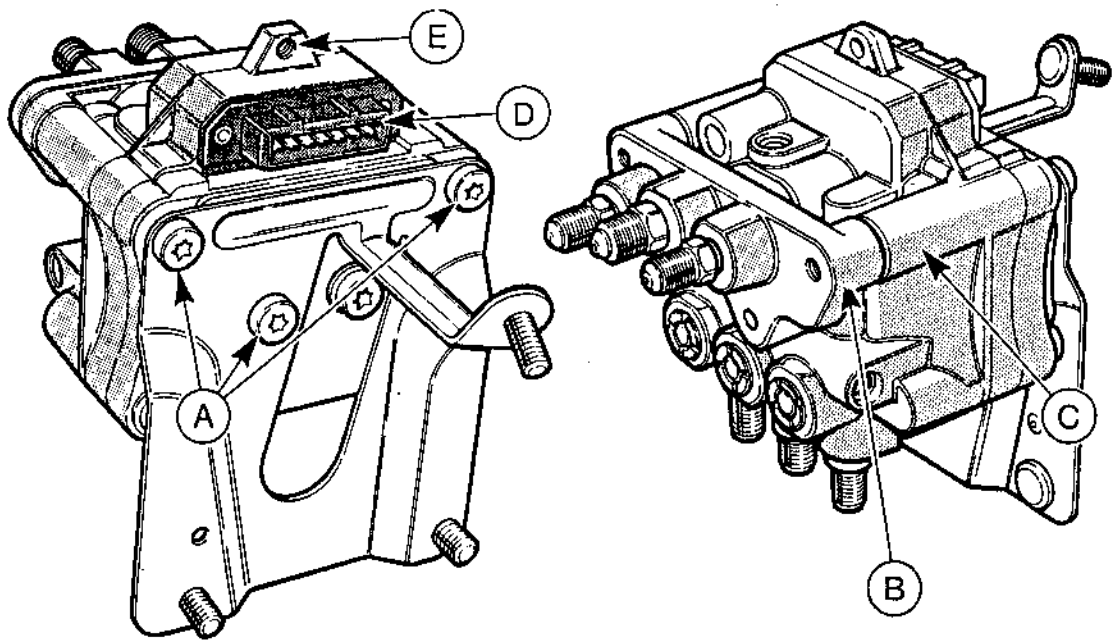
14. Refit road wheel and lower vehicle to ground. Fully tighten wheel nuts.

15. Reconnect battery.

16. Bleed braking system as detailed in Operation No. 12 141 0.

17. Check operation of valve block assembly by carrying out Diagnostic Procedure shown in Section 12C, Condition 10, step d) of the Vehicle System Test.

18. Road test vehicle and check operation of braking system.



SI87–12C–14 TI

Fig.4. A - Bracket to valve block mounting bolts
B - Adaptor plate
C - Valve block
D - Multiplug connections
E - Earth cable connections

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12 582 0 ACCUMULATOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Switch off ignition (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard, to ensure brake pressure is fully discharged.

NOTE: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

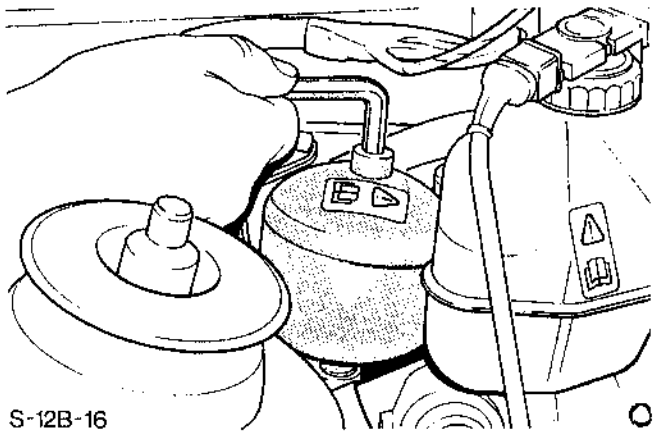


Fig.1. Slacken accumulator, cover base of accumulator with clean cloth.

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Ensure braking system pressure is fully discharged.
3. Carefully remove accumulator from hydraulic unit, using a suitable hexagon key. Cover base of accumulator with clean cloth to prevent any dirt ingress.

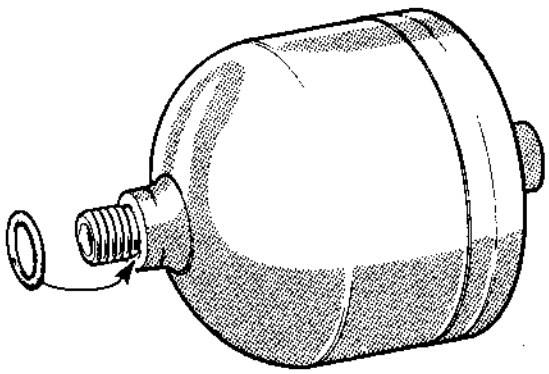


Fig.2. Fit new 'O' ring seal to accumulator.

To Install

4. Ensure 'O' ring is fitted and in good condition.
5. Fit accumulator to hydraulic unit and torque to specification.
6. Reconnect battery.
7. Switch 'on' ignition and check accumulator charge time, (should be less than 60 seconds).
8. Bleed braking system as detailed in Operation No. 12 141 0. Check for leaks.
9. Remove fender covers and close hood.
10. Check operation of boost and anti-lock function.

12 586 0 HYDRAULIC PUMP AND MOTOR ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Pressure Switch Wrench .. 12 008

WARNING: Switch off ignition (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to ensure brake pressure is fully discharged.

NOTE: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Ensure braking system pressure is fully discharged.
3. Remove high pressure pipe from pump body.
4. Using hexagon key adaptor, remove accumulator from pump body.
5. Disconnect multiplug connection from pressure switch.
6. Disconnect hydraulic pump electric motor multiplug.

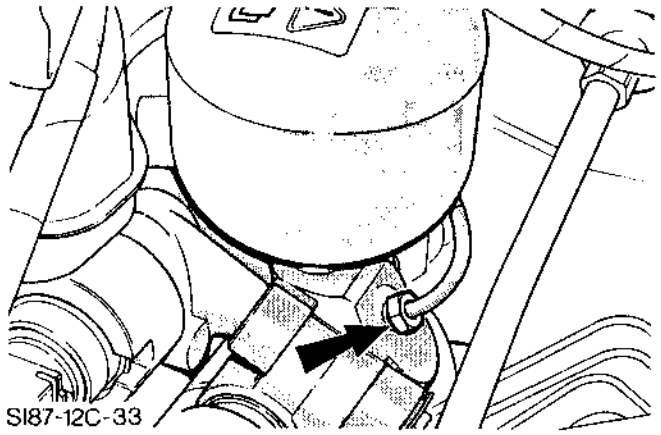


Fig.1. Remove high pressure pipe from pump body.

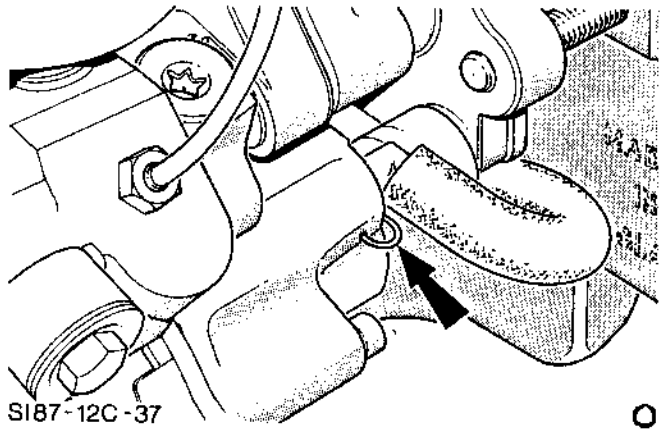


Fig.2. Remove spring clip releasing low pressure pipe from hydraulic pump.

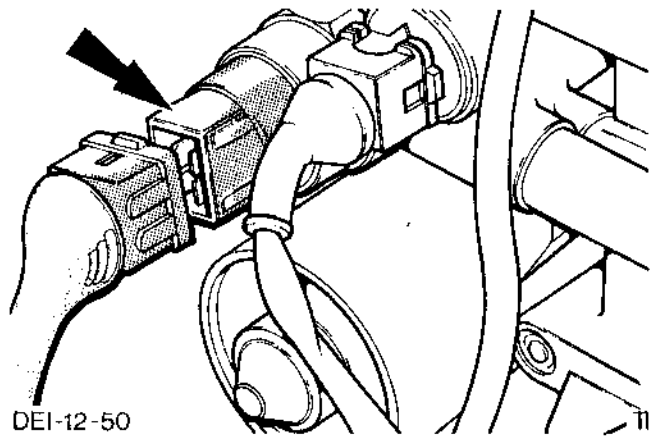


Fig.3. Disconnect multiplug from pressure switch.

12 586 0

7. Remove pump housing to hydraulic actuation assembly mounting bolt.

8. Remove pump housing assembly from hydraulic unit.

9. Remove spring clip retaining low pressure hose to hydraulic pump. Clamp low pressure hose using suitable clamp to prevent excessive fluid loss.

10. Remove pressure switch from pump housing.

11. Prise out pump mounting insulators and tubes from pump body.

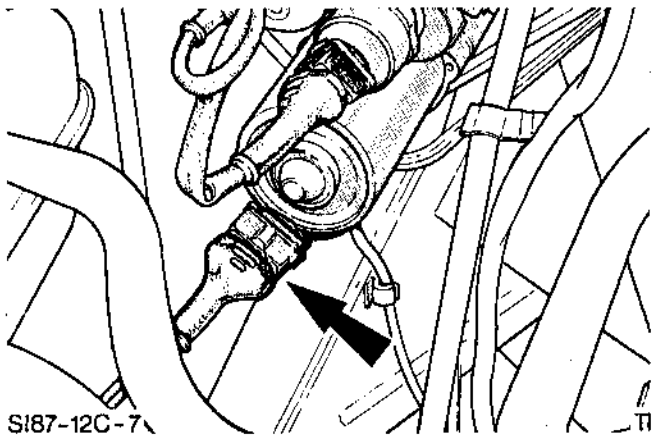


Fig.4. Disconnect pump motor multiplug.

To Install

12. Fit mounting tubes and insulators to pump housing.

13. Refit pressure switch into pump housing, ensure sealing 'O' ring is in good condition.

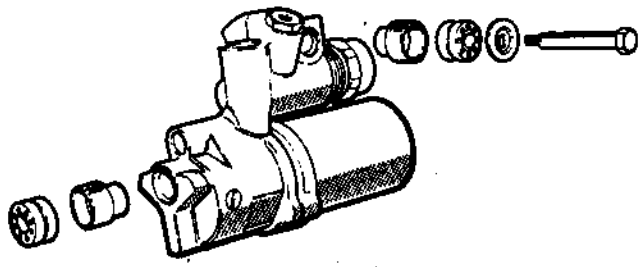


Fig.5. Pump housing mounting assembly.

14. Connect low pressure hose and secure with spring clip. Locate pump onto hydraulic unit. Fit mounting bolt through bushes and torque to specification.

15. Reconnect high pressure pipe, torque pipe union to specification.

16. Fit new 'O' ring to accumulator and fit to pump housing tighten accumulator.

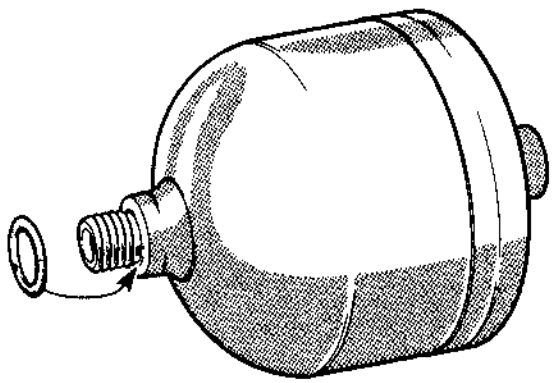


Fig.6. Fit new accumulator 'O' ring.

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12 586 0

17. Reconnect multiplugs to pump motor and pressure switch.

18. Top up reservoir with new brake fluid.

19. Reconnect battery.

20. Switch 'on' ignition, check for hydraulic fluid leaks, allow pump to run until switch 'off'.

    Do not allow hydraulic pump to operate for more than 2 minutes (if pump does run for longer, switch 'off' ignition position '0' and allow pump motor to cool for 10 minutes).

21. Bleed brake system as detailed in Operation No. 12 141 0.

22. Remove fender covers and close hood.

23. Check operation of anti-lock system.

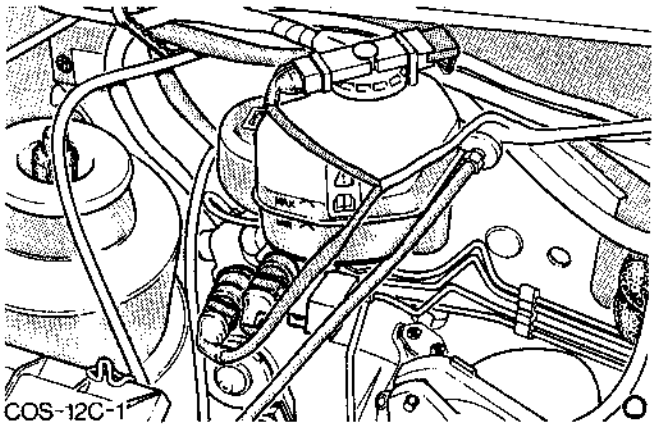


Fig.7. Top up reservoir to 'Max' mark.

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12 589 0 PRESSURE SWITCH - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Pressure switch wrench .. 12-008

WARNING: Switch off ignition (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to ensure pressure is fully discharged.

NOTE: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

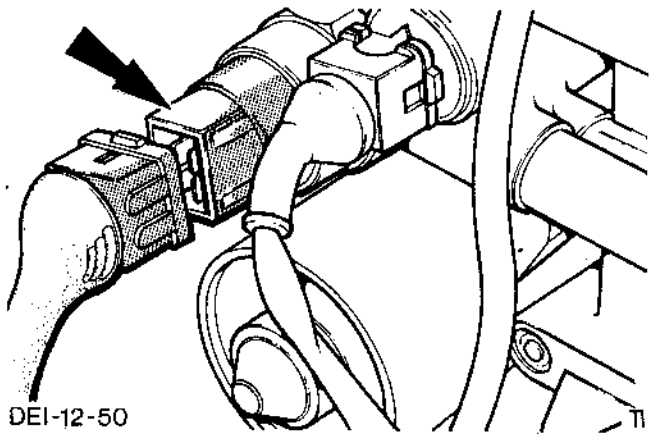


Fig.1. Disconnect pressure warning switch.

To Remove

1. Open hood, fit fender covers and disconnect battery,
2. Ensure braking system pressure is fully discharged.
3. Disconnect pressure warning switch multiplug.
4. Using Special Service Tool 12-008, remove pressure warning switch.

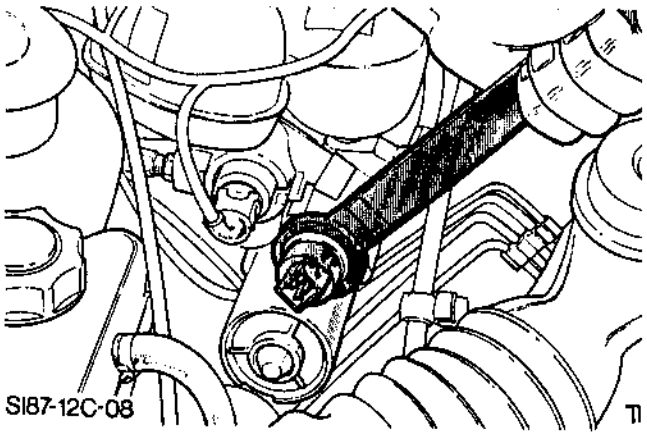


Fig.2. Remove pressure warning switch using Special Service Tool 12-008.

To Install

5. Fit new 'O' ring seal to pressure warning switch.
6. Screw in switch and tighten using Special Service Tool 12-008.
7. Reconnect pressure warning switch multiplug.
8. Reconnect battery, switch 'on' ignition and check switch and pump operation.
9. Bleed brake system as detailed in Operation No. 12 141 0.
10. Remove fender covers and close hood.

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12 591 0 LOW PRESSURE HOSE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: Switch off ignition (position '0') Apply foot brake at least 20 times or until the brake pedal becomes hard to ensure pressure is fully discharged.

NOTE: If brake fluid is spilt on paintwork, the affected area must immediately be washed down with cold water.

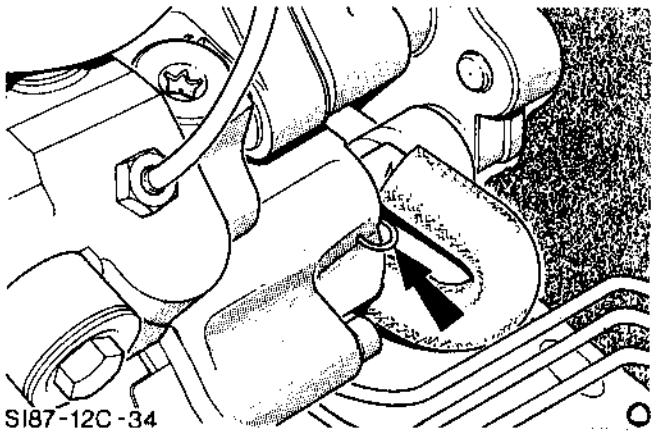


Fig.1. Remove spring clip releasing low pressure hose from pump body.

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Ensure braking system pressure is fully discharged.

3. Remove hydraulic actuation protective heat shield.

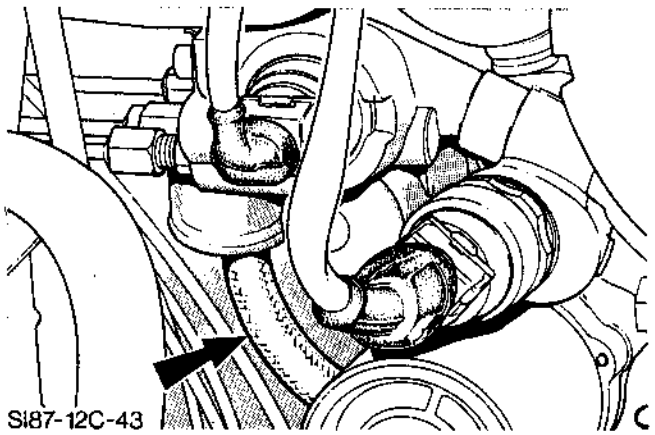


Fig.2. Remove low pressure hose from reservoir.

4. Remove spring clip retaining low pressure pipe to electric hydraulic pump.

   Allow hydraulic fluid to drain into suitable container.

5. Pull off hose from reservoir filter connection.

12 591 0

To Install

6. Connect low pressure hose to reservoir filter connection. Push on fully.

7. Connect hose to hydraulic pump, secure with spring clip. Once fitted, check security of hose in pump.

NOTE: Ensure low pressure hose is correctly routed around lower pump insulator.

8. Top up reservoir with new brake fluid. Check for fluid leaks.

9. Refit heat shield.

10. Reconnect battery.

11. Bleed braking system as detailed in Operation No. 12 141 0 and check for hydraulic fluid leaks.

12. Remove fender cover and close hood

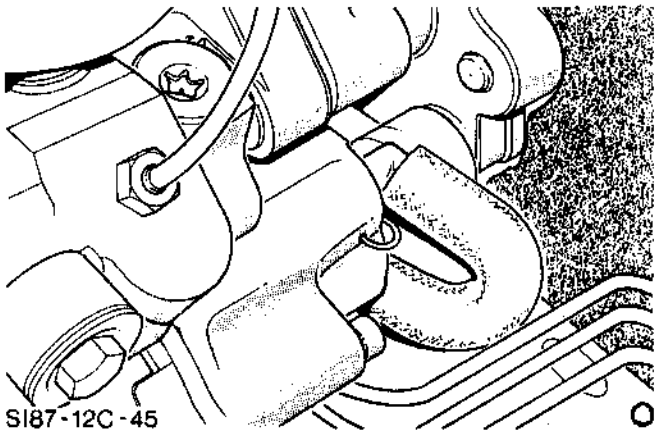


Fig.3. Route low pressure hose below lower insulator.

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12 755 0 BRAKE PRESSURE CONTROL VALVE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Pump brake pedal at least 20 times until pedal becomes hard to ensure pressure is fully discharged.
3. Jack-up rear of vehicle and fit chassis stands.
4. Disconnect rear brake pipes from brake pressure control valve. Fit blanking plugs to prevent excessive fluid loss or dirt ingress.

NOTE: DO NOT attempt to dismantle valve assembly.

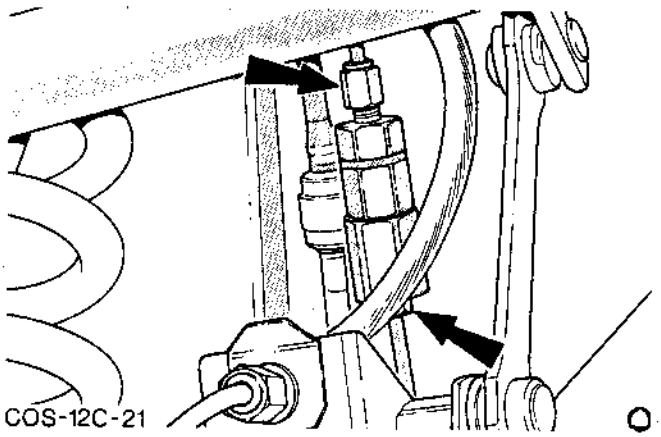


Fig.1. Disconnect brake pressure control valve from brake pipes.

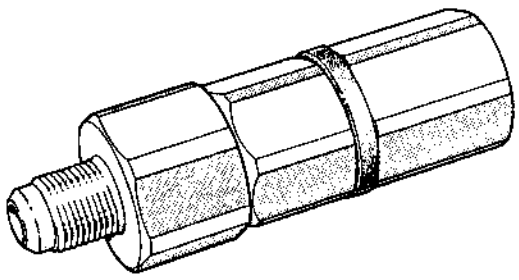


Fig.2. Brake pressure control valve.

To Install

5. Remove blanking plugs and reconnect brake pipes to pressure control valve.
6. Reconnect battery.
7. Bleed rear brake circuit as detailed in Operation No. 12 141 0, check for fluid leaks.
8. Remove fender covers and close hood.

12 780 0 MODULE ANTI-LOCK BRAKING SYSTEM - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Remove passenger side crash pad trim panel.
3. Carefully remove anti-lock module from bracket.
   - Push module inwards releasing securing catch.
   - Pull out module and disconnect multi-plug.

To Install

4. Reconnect multiplug to module, ensure multi-plug is fully engaged.
5. Refit module into bracket and secure.
6. Refit trim panel to passenger side crash pad.
7. Reconnect battery, remove fender covers and close hood.
8. Check operation of anti-lock warning light functions.

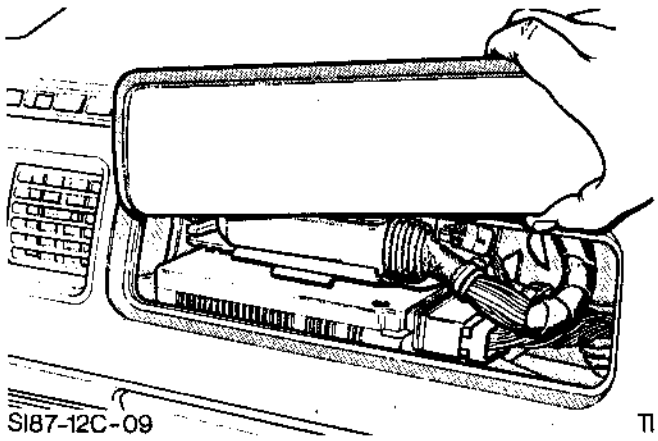


Fig.1. Remove crash pad to gain access to the anti-lock module

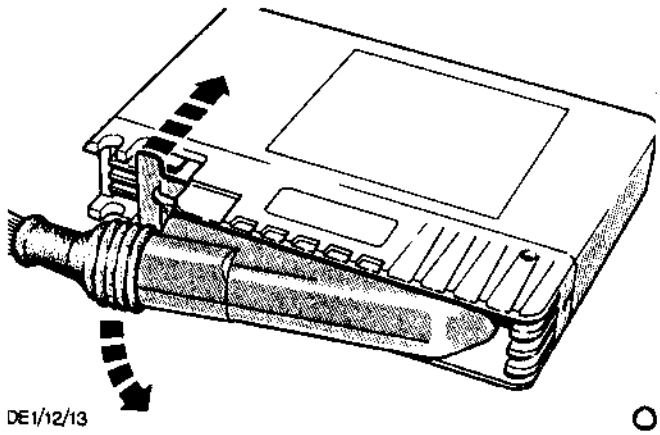


Fig.2. Disconnect anti-lock module.

12 785 0 WHEEL SENSOR - REMOVE AND INSTALL - REAR

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Jack up vehicle and fit chassis stands.
2. Open hood, and fit fender covers.
3. Unclip anti-lock loom from chassis side rail. Disconnect wheel sensor multiplug.
4. Remove bolt securing wheel sensor to spindle carrier. Carefully pull out sensor.
5. Unclip sensor loom from cable supports.

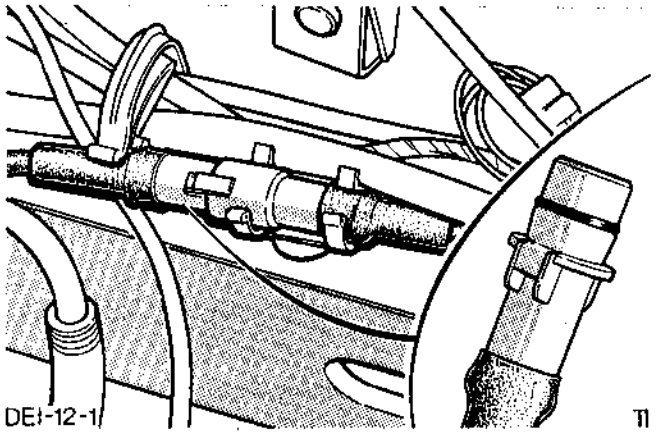


Fig.1. Front wheel sensor loom multiplug.

To Install

Before refitting, ensure wheel sensor spindle carrier bore and sensor mounting face is clean and free from rust, or rough edges. Check condition of toothed rotor.

6. Liberally coat sensor spindle carrier bore and chamfer with wheel bearing grease.
7. Fit new 'O' ring to wheel sensor.
8. Coat sensor with grease and push sensor firmly into spindle carrier bore until flush. Secure with bolt and washer.
9. Refit sensor loom into cable supports.
10. Reconnect sensor loom to main loom and secure to side rail clip. Ensure connector 'O' ring is correctly seated.
11. Remove fender covers, and close hood.
12. Lower vehicle and check anti-lock operation.

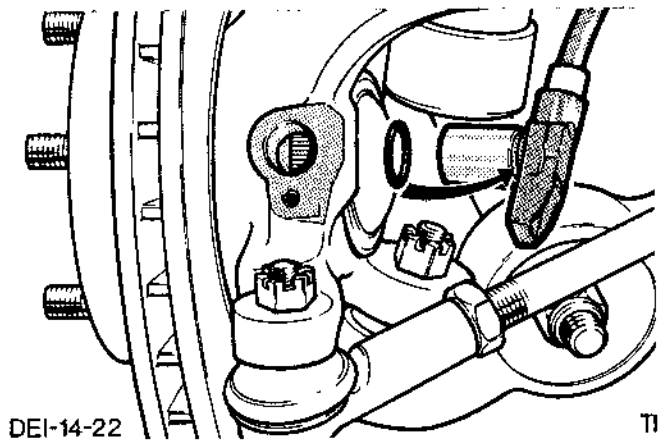


Fig.2. Remove wheel sensor.

12 785 0 WHEEL SENSOR - REMOVE AND INSTALL - REAR

SPECIAL SERVICE TOOLS REQUIRED: NONE

CAUTION: Rear brake system is subjected to high hydraulic pressure. DO NOT apply foot brake once caliper has been removed from anchor bracket.

To Remove

1. Jack up vehicle and fit chassis stands.
2. Remove road wheels.
3. Release handbrake cable lever.
4. Raise rear seat cushion.
5. Remove side kick panel and fold carpet forward to gain access to wheel sensor plug connection.
6. Remove wheel sensor plug from clip and disconnect from main loom.
7. Prise out grommet and pass sensor cable through floor panel.
8. Remove handbrake cable from lower arm securing clip.
9. Remove forward bolt of caliper slide pin, swing caliper up and retain in position.
10. Remove bolt securing wheel sensor to mounting bracket, carefully remove wheel sensor.

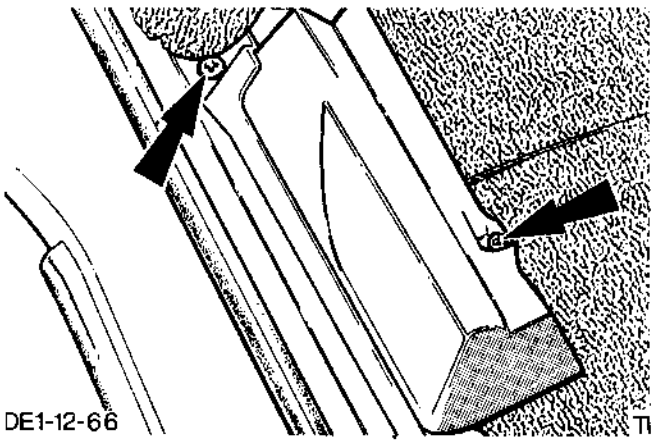


Fig.1. Remove side kick panel and fold carpet forward.

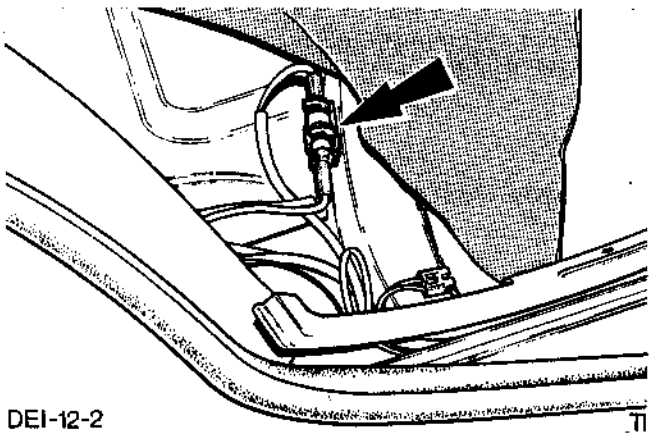


Fig.2. Disconnect wheel sensor loom plug.

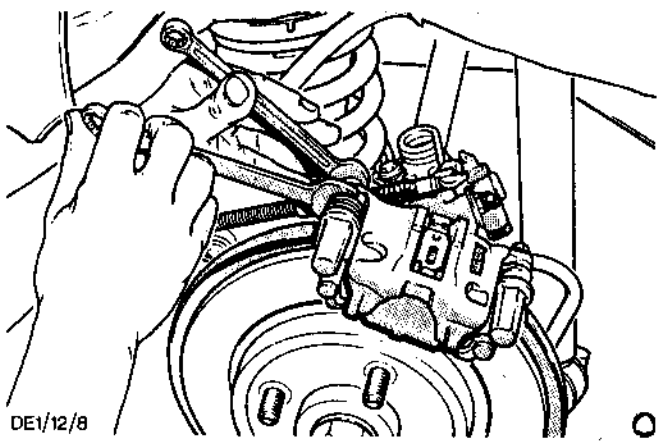


Fig.3. Remove forward bolt of caliper slide pin.

12 785 0

To Install

Before refitting wheel sensor, check bore area around sensor mounting for damage, rust or rough edges. Rotate road wheel and check toothed rotor for damage.

11. Fill wheel sensor mounting bracket bore with wheel bearing grease.

12. Fit new 'O' ring to wheel sensor.

13. Coat wheel sensor with grease and push sensor firmly into mounting bracket bore until flush, secure with bolt and washer.

NOTE: Sensor mounting bolt and washer are unique (bolt 28 mm long and washer 1,5 mm thick).

14. Refit caliper mounting bolt and torque to specification.

15. Relocate handbrake cable into lower arm bracket.

16. Route wheel sensor cable along suspension lower arm and clip in position. Push sensor loom through floor panel and refit grommet.

17. Reconnect wheel sensor loom to main loom, and secure into retaining clip. Ensure 'O' ring in connector is correctly located and pushed fully home.

18. Replace carpet and refit side kick panel and secure.

19. Return seat cushion to its correct position.

20. Apply handbrake, refit road wheels.

21. Lower vehicle and check operation of anti-lock.

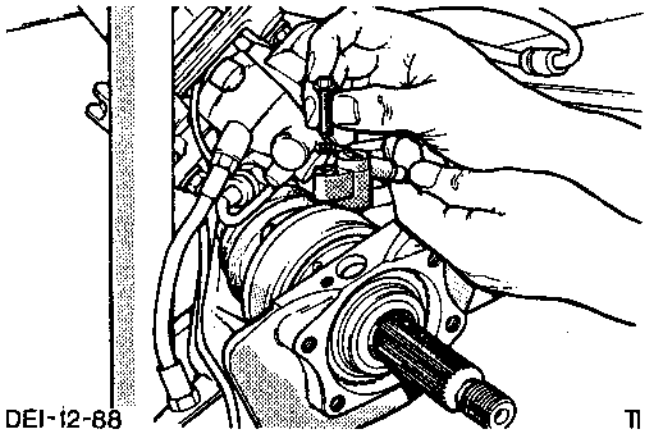


Fig.4. Remove wheel sensor and check toothed wheel for damage.

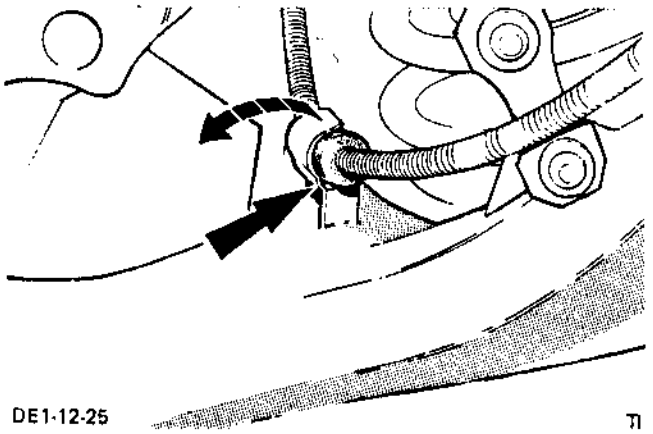


Fig.5. Secure handbrake cable in lower arm.

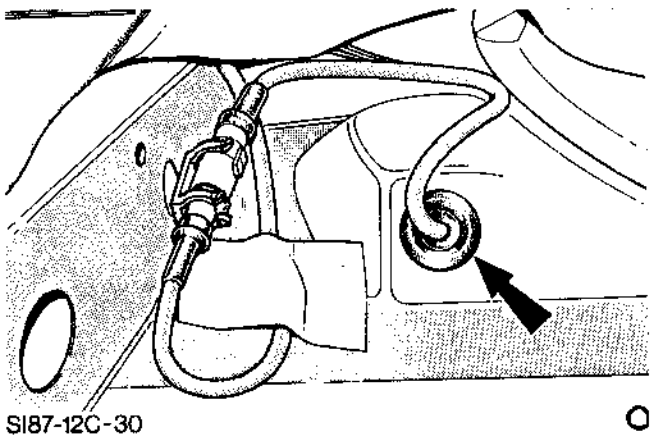


Fig.6. Ensure correct grommet fitment.

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POWER ASSISTED STEERING (Cam Gears) 13A

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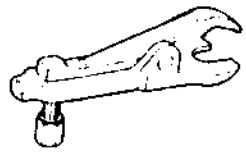
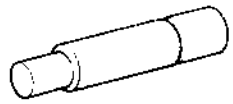
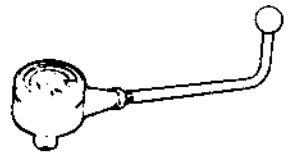
TECHNICAL DATA

Escort RS Cosworth

Type	Power assisted variable rack and pinion
Turns lock to lock	2,84
Rack slipper adjustment	Screw-in plug
Power steering lubricant	Calipsol Grease type SF3-131
Power steering fluid	ESPM-2C-166H
Loctite 270	5003600

Tightening Torques	Nm	lbf,ft
Steering coupling clamp bolts	20,0 to 28,0	15 to 21
Steering coupling pinch bolts/nuts	24,0 to 26,0	18 to 19
Lower pinion securing nut	37,0 to 47,0	27 to 34
Tie rod end lock nuts	57,0 to 68,0	42 to 50
Tie rod end to steering arm	25,0 to 30,0	18 to 22
Tie rod inner ball joint	72,0 to 88,0	53 to 65
Pressure hose to pump	26,0 to 31,0	19 to 22
Bolt - PAS pump pulley	10,0 to 12,0	7 to 8
Steering column clamp and brace nuts	17,0 to 24,0	13 to 17
Bolt - P.A.S. pump bracket to block	52,0 to 64,0	38 to 47
Bolt - PAS pump	21,0 to 28,0	15 to 21
Adjustable steering through bolt	6,0 to 8,0	4 to 6
Steering wheel retaining bolt	45,0 to 55,0	33 to 40
Valve body clamp plate bolt	22,0 to 24,0	16 to 17
Steering rack to crossmember bolts	35,0 to 45,0	26 to 33

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Tool	Tool Name
13-004 	Steering pinion socket
13-006 	Ball joint separator
13-010 	Pinion oil seal/bush installer
15-041 	Preload gauge

13 116 0 STEERING GEAR ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator 13-006

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Align steering in the straight ahead position.

3. Raise vehicle on ramp and remove sump shield. Remove lower pinch bolt securing flexible coupling to steering gear pinion shaft.

4. Disconnect tie rods from spindle body steering arms using Special Service Tool 13-006, Fig.1.

5. Remove clamp plate bolt securing high and low pressure pipes from steering gear valve body. Remove screw securing pressure hose clamp to steering gear housing. Pull pipes clear of steering gear and allow fluid to drain into suitable container.

6. Blank off all pipe connections and valve body to prevent dirt entry.

7. Remove two bolts securing steering gear to engine front crossmember, Fig.2.

Remove steering assembly from crossmember as detailed in Fig.3:

Fig.3. A - Slide steering gear towards driver's side of vehicle
B - Swing non-pinion end of steering rack out from crossmember
C - Rotate steering gear clockwise disengaging lower pinion bearing cap from crossmember
Lift out steering gear

To Install

8. Position steering gear assembly onto engine front crossmember, fit mounting bolts and tighten to specification (see Technical Data).

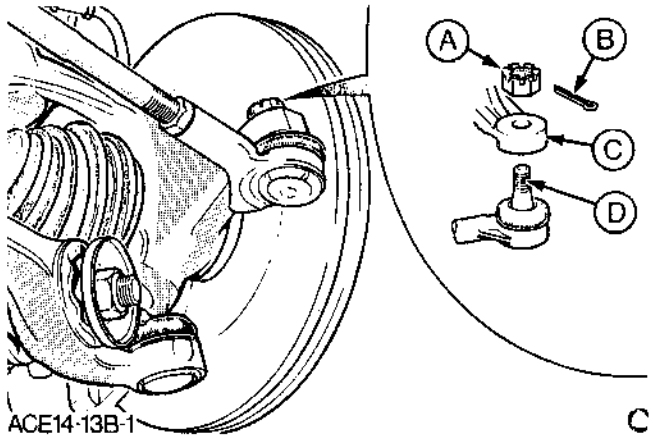


Fig.1. Steering tie rod end.
A - Castellated nut
B - Split pin
C - Steering arm
D - Ball joint

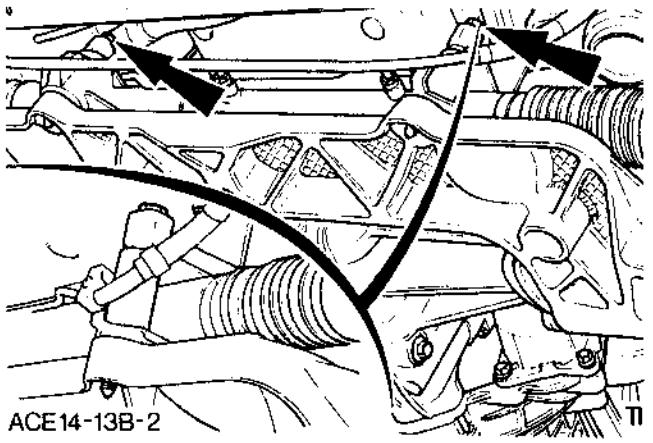


Fig.2. Steering gear mounting bolts.

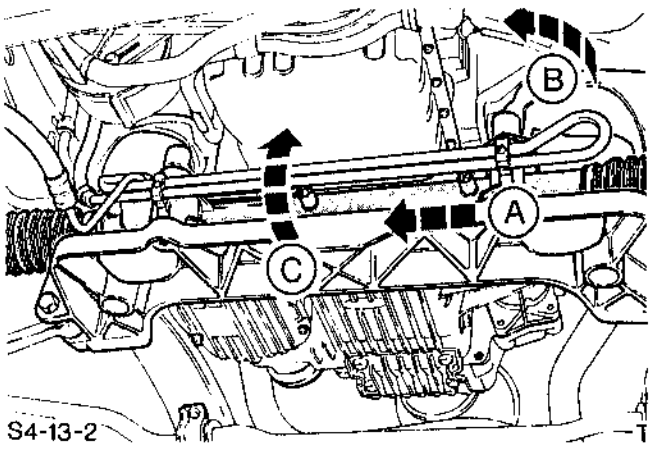


Fig.3. Remove steering gear in correct sequence.

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9. Remove hose and valve body blanking plugs. Replace 'O' rings on pressure and return hoses. Refit clamp plate and fit securing bolt, Fig.4, tighten retaining bolt to specification, (see Technical Data).

10. Reconnect tie rods to spindle carrier steering arms, tighten castellated nut and fit new split pins.

11. Align block splines of steering gear and flexible coupling, reconnect coupling to pinion shaft and fit pinch bolt, Fig.5. Tighten pinch bolt to specification, (see Technical Data). Refit sump shield and lower vehicle.

12. Reconnect battery.

13. Refill power steering reservoir and bleed as described below:

- Using clean, non-aerated fluid, top up reservoir to the 'max' mark.
- Disconnect negative lead from coil. Crank engine (short two second bursts) and slowly turn steering wheel from lock to lock three or four times.

NOTE: Ensure fluid in reservoir does not fall below 'minimum' mark and air bubbles no longer appear.

- Reconnect negative lead to coil, start engine, turn steering from lock to lock. Switch 'off' ignition.
- Re-check fluid level, replace cap and check steering gear for fluid leaks.

14. Check and adjust front wheel toe alignment. Refer to Section 14 in this microfiche.

15. Remove fender covers and close hood.

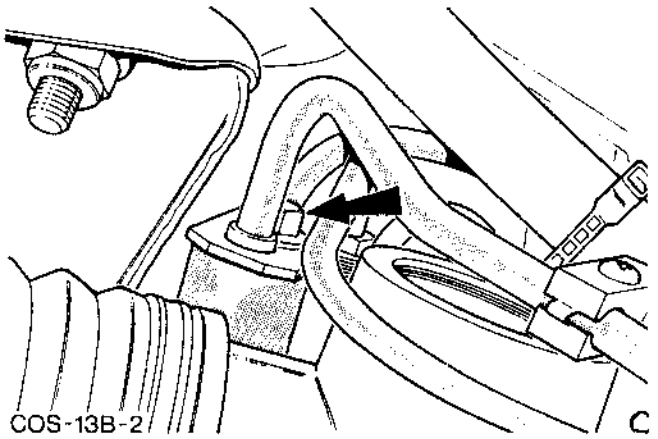


Fig.4. Power steering pipe seals and clamp plate.

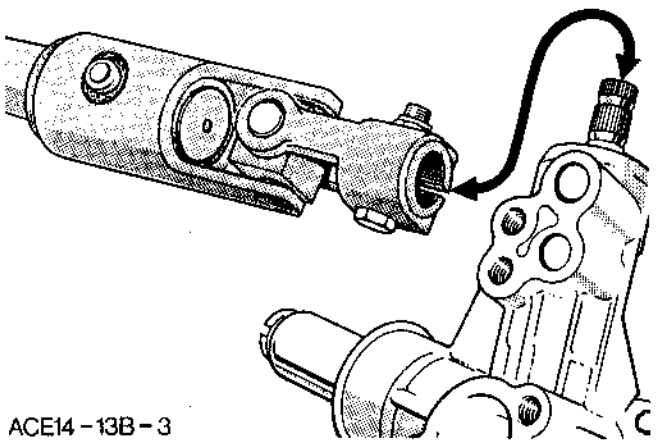


Fig.5. Pinion block spline and flexible coupling.

13 116 8 STEERING GEAR ASSEMBLY - OVERHAUL

SPECIAL SERVICE TOOLS REQUIRED:

Pinion oil seal/bush installer ..	13-010
Steering pinion socket	13-004
Pre-load gauge	15-041

To Remove

1. Mount steering gear in vice using soft jaw protectors, support steering gear at pinion housing. Slowly traverse steering rack from lock to lock draining fluid from valve body.

2. Remove track rod ends and lock nuts noting the number of turns required to remove each track rod end. Remove and discard gaiter retaining clips, slide off gaiter.

3. Traverse steering rack so that rack teeth are visable, reposition steering gear so that rack teeth are held in vice, Fig.1. Use vice jaw protectors to ensure no damage to steering rack teeth occurs.

4. Using suitable wrench, unscrew inner ball joints.

NOTE: The steering rack must be held securely when the tie rods are removed, otherwise damage to the pinion may occur.

5. Remove yoke pinion cover using suitable hexagonal bar (28mm), Fig.2. Remove yoke spring.

6. Reposition steering gear in vice, holding pinion housing. Centralise steering gear (mid-position of total turns lock to lock). Mark pinion to valve body position, measure steering rack projection from end of steering rack tube.

7. Remove core plug from pinion valve housing, remove pinion locknut, Fig.3.

8. Remove pinion input shaft dust cover, remove circlip and carefully pull pinion valve shaft assembly out of valve body, Fig.4. (A twisting action will aid removal).

NOTE: Care should be taken during this operation, to prevent dirt entering the valve body or sleeve assembly.

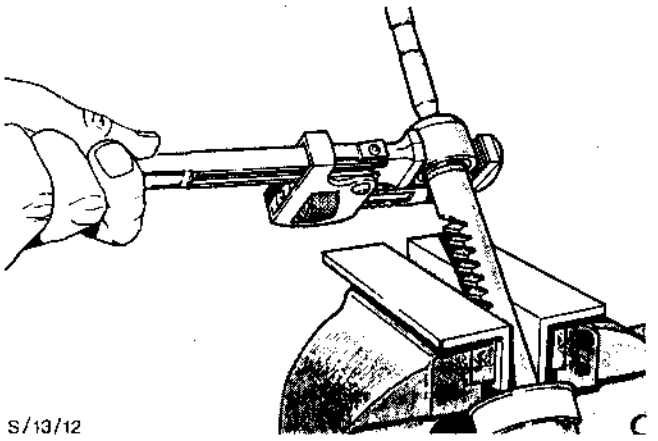


Fig.1. Secure steering rack teeth to prevent damage to pinion.

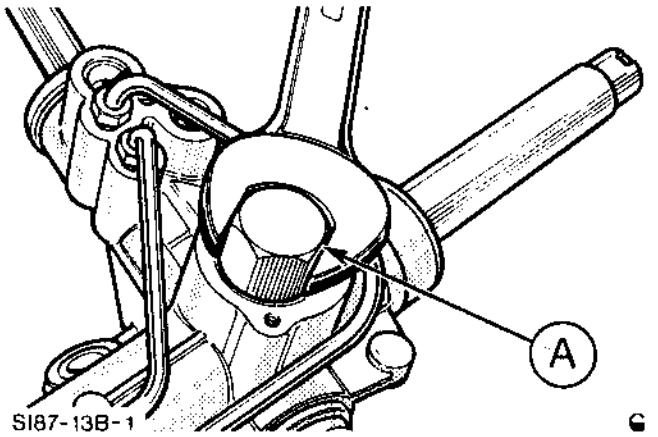


Fig.2. Remove pinion yoke cover.
A - Hexagonal bar

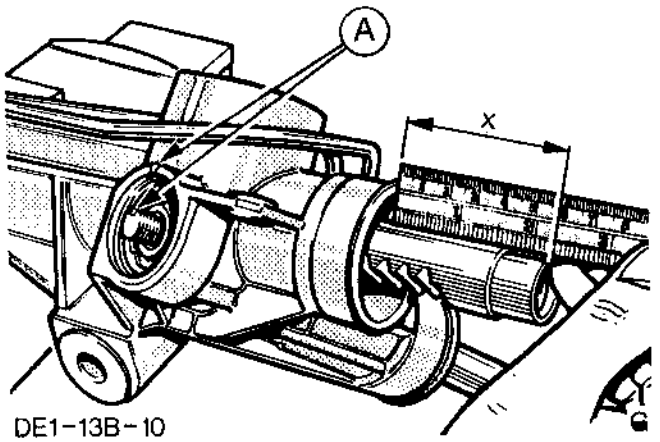


Fig.3. Remove pinion locknut, mark central position of pinion to steering rack.

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9. Slide seal and bearing off pinion shaft. Do not dismantle valve assembly.

10. Remove steering rack support bearing and seal.

- Rotate the support bearing locking collar anti-clockwise until the end of the locking wire is visible in the rack tube slot.

- Prise end of locking wire out of slot, continue to rotate locking collar until the wire is removed from the annular groove.

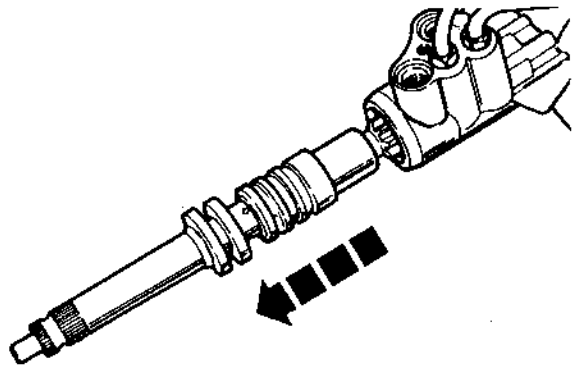
11. Carefully withdraw rack from rack tube.

NOTE: At this stage the remaining steering gear fluid will be released.

12. Slide rack support bearing and seal off steering rack shaft, Fig.5.

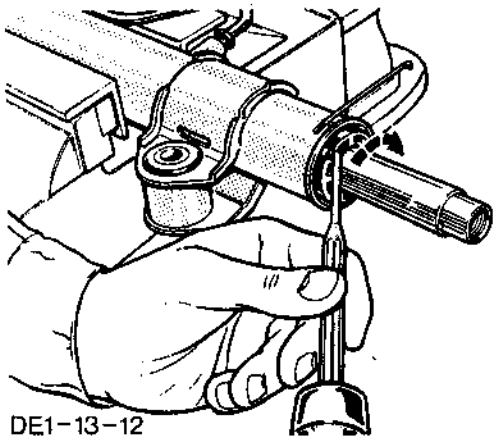
13. Remove pinion support bearing and seal from pinion housing using suitable punch.

14. Remove rack inner seal and support ring using suitable drift (26 mm diameter) in direction of rack tube, Fig.6.



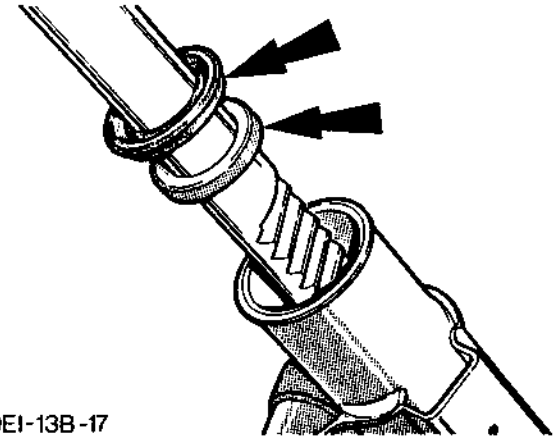
DEI-13B-15B

Fig.4. Remove pinion assembly.



DE1-13-12

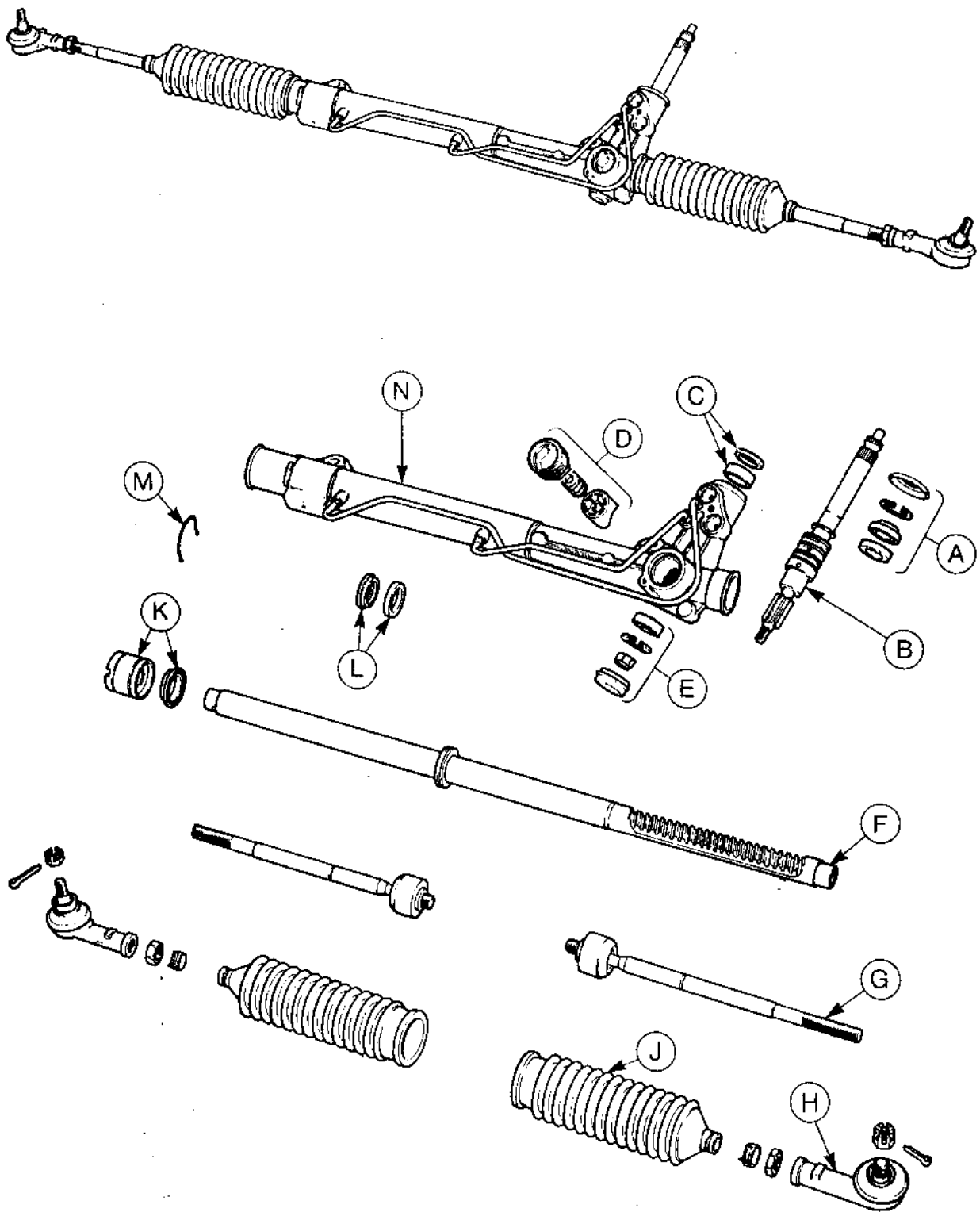
Fig.5. Remove rack support bearing, rotate locking collar anti-clockwise.



DEI-13B-17

Fig.6. Remove rack inner seal and support ring.

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DEI-13B-30

Fig.7. Steering rack exploded view.

A - Pinion bearing
B - Pinion
C - Pinion bearing and seal
D - Yoke assembly
E - Lower pinion bearing
F - Rack
G - Tie rod
H - Tie rod end
J - Bellows
K - Rack support bush and seal
L - Inner rack seal
M - Support bush securing wire
N - Rack tube

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To Reassemble

Before reassembly, all parts must be inspected for damage and thoroughly cleaned:

a) Check all contact faces of radial lip seals on valve body and steering shaft.

b) Check pinion teeth, support bearing and valve body roller bearing for wear.

c) Check rack teeth and inner ball joint threads for wear or damage.

d) Check yoke contact area on rack and yoke for wear.

e) Ensure all rack feed pipes are free from any obstruction or damage.

f) Check lower pinion bearing and pinion contact face for damage or wear.

g) Check all P.T.F.E. contact faces for damage.

h) Ensure that rack air bypass tube is free from any obstruction and grease.

j) If any damage to pinion or valve sleeve is evident, a new valve assembly must be fitted.

NOTE: If new P.T.F.E. seals are to be fitted, following procedure should be adopted:

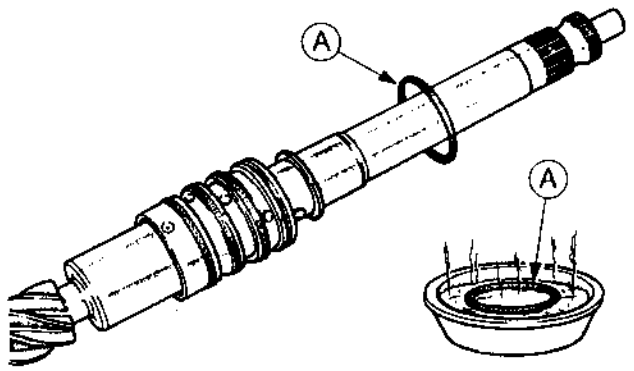
Submerge seals in boiling water before fitting to valve assembly.

After fitting to valve assembly a short period of time should be allowed for the seals to recover their natural shape.

k) All radial lip seals should be packed with Calipsol grease (see Technical Data).

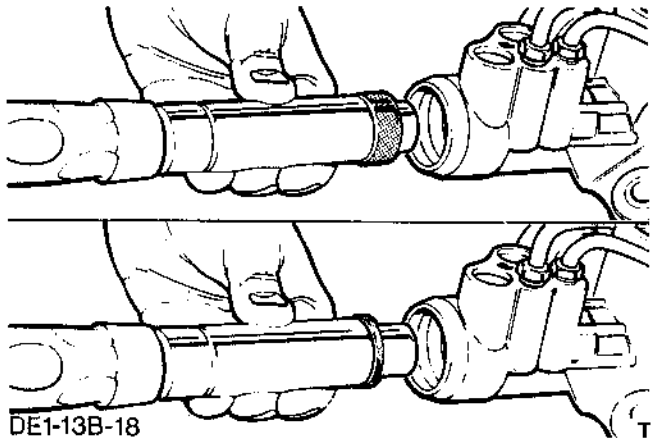
If there is any damage to pinion or valve sleeve, a new valve assembly must be fitted.

15. Fit new pinion seal. Using Special Service Tool 13-010, Fig.9, press in until seal is seated on pinion housing seat. Using same tool, press in plain pinion bush until groove in Special Service Tool is level with top of pinion housing.



S/13B/16 C

Fig.8. Assemble P.T.F.E. seals (A) onto sleeve valve using boiling water to aid recovery time of P.T.F.E. seals.



DE1-13B-18 T

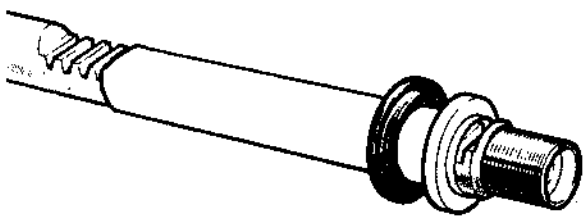
Fig.9. Fit new pinion seal using Special Service Tool 13-010.

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16. Slide inner seal and rack support onto the rack from the toothed end, insert the rack into the rack tube and pull through until the seal and washer have located on their seats. Coat rack teeth with 40 cc Calipsol semi-fluid grease, (see Technical Data).

NOTE: To avoid damaging non-metallic components, they should be installed by covering rack end teeth with paper, Fig.10, sliding seals onto paper and then sliding seal and paper over rack teeth to plain section of rack.

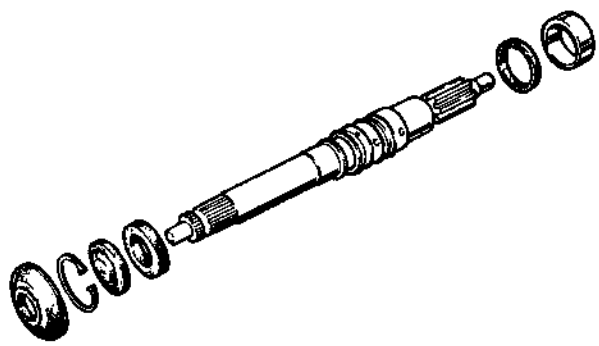
17. Fit new rack support bearing, seal and locking collar over rack into the rack tube.



GL/13B/118 TI

Fig.10. Protect seal by covering rack teeth with stiff card or paper.

18. Rotate the locking collar until the hole in the annular groove is visible. Insert the hooked end of the locking wire in the hole and rotate the collar clockwise until the end of the wire disappears. Fill the slot in rack tube with grease.



DEI-13B-16 T

Fig.11. Pinion assembly.

19. Fit lower pinion support bearing into rack housing and secure with circlip.

20. Fit upper pinion bearing and seal over pinion input shaft.

21. Centralise steering rack and refit pinion assembly, secure upper pinion bearing and seal in valve housing with circlip. Fill pinion input shaft with grease and fit over pinion shaft.

22. Fit locknut to lower pinion shaft, tighten to specification (see Technical Data), replace blanking plug.

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23. Assemble steering rack yoke and spring and adjust as described below:

- Centralise steering rack, assemble yoke and spring into pinion housing.
- Coat thread of yoke plug with suitable sealant, (Loctite 542 or equivalent) and screw into housing.
- Tighten plug to a torque of 3,4 to 4 Nm, using a 28 mm hexagonal bar.
- Rotate pinion from lock to lock, re-centralise steering gear to the straight ahead position.
- Check yoke plug torque, retighten as necessary to 3,4 to 4 Nm.
- Check pinion turning torque is not less than 1,35 Nm (12 lb in), using Special Service Tool 15-041.
- Back-off yoke plug 22° to 27°.
- Check pinion rotation turning torque does not exceed 1,7 Nm (15 lb in).
- If pinion torque exceeds 1,7 Nm, the yoke plug may be backed off an additional 5°.
- Stake yoke plug to threads in three places.

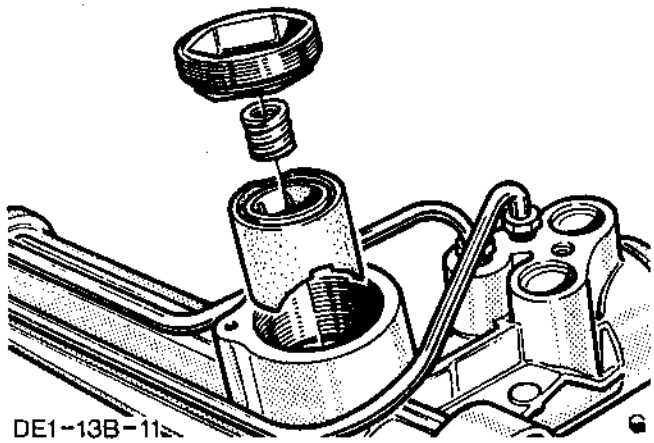


Fig.12. Steering rack yoke assembly.

24. Traverse steering rack until rack teeth are visible, clamp teeth in vice using soft jaw protectors. Coat inner ball joint threads with 'Loctite 270', Fig.13, screw ball joints into steering rack and torque joints to specification (see Technical Data).

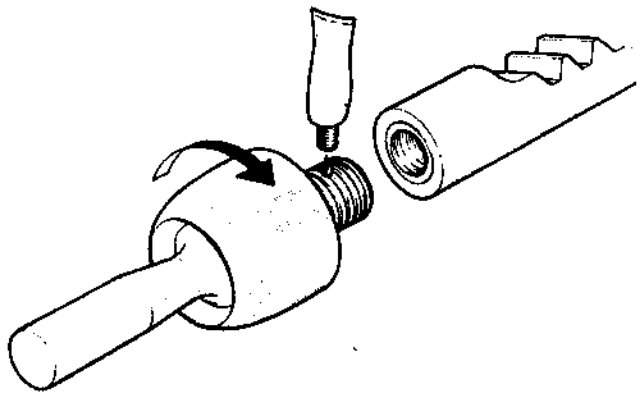


Fig.13. Seal tie rod assemblies with loctite.

25. Replace gaiters over tie rods, ensure gaiters locate in corresponding grooves, Fig.14. Ensure rack support bearing end gaiter covers slot in tube. Use new screwed clamps for housing ends.

NOTE: Fit outer clips loosely over tie rod until toe setting has been adjusted.

26. Refit locknuts and tie rod ends, screw on same amount as required to remove.

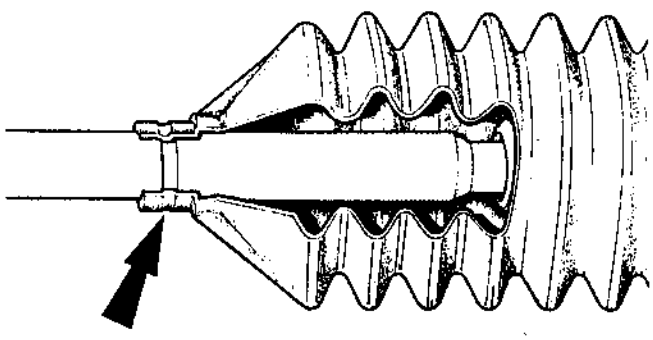


Fig.14. Replace gaiters, ensure gaiters are correctly located in tie rod grooves.

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13 134 0 BELLOWS - STEERING RACK - REPLACE (ONE) (steering gear in situ)

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator 13-006

To Remove

1. Raise vehicle on ramp and remove sump shield. Slacken locknut on tie rod end, remove castellated nut from ball joint, and disconnect tie rod end from steering arm, using ball joint separator, 13-006, Fig.1.

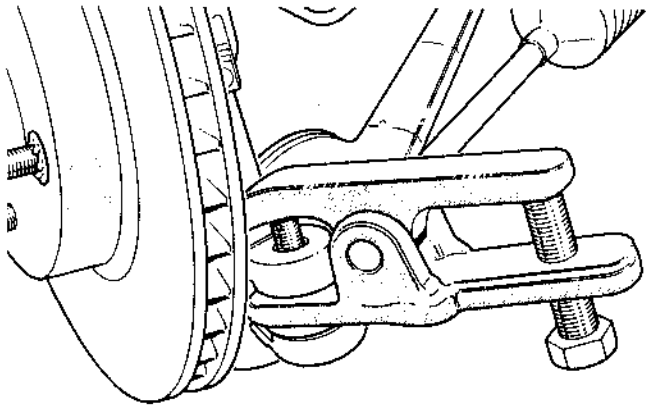


Fig.1. Use ball joint separator 13-006, to release ball joint taper.

2. Remove tie rod end and locknut from tie rod noting the number of turns required to remove. Remove tie rod locknut, Fig.2.

3. Release clips from gaiter, slide off steering rack gaiter. Discard clip securing gaiter to housing.

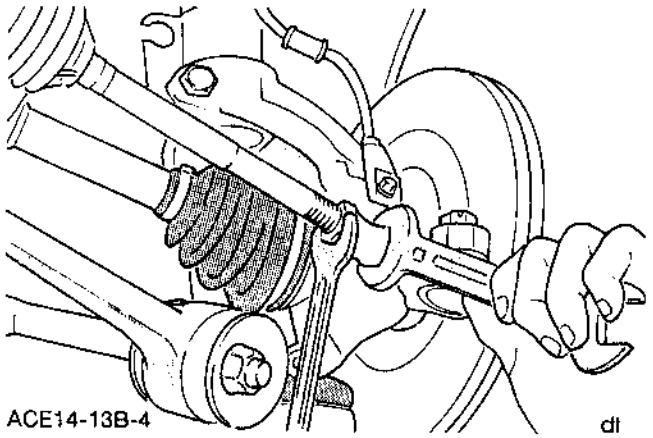


Fig.2. Remove tie rod ends and locknuts.

To Install

4. Refit gaiter over tie rod, locating gaiter in tie rod grooves, Fig.3. Ensure gaiter covers slot in support end of rack tube, fit new screw type gaiter clips.

5. Fit outer clip over tie rod, do not tighten clip until steering toe setting has been adjusted.

6. Refit locknuts and tie rod end. Screw on the same number of turns as to remove, (see sub-operation 2). Refit tie rod end to steering arm and fit new split pin. Refit sump shield and lower vehicle.

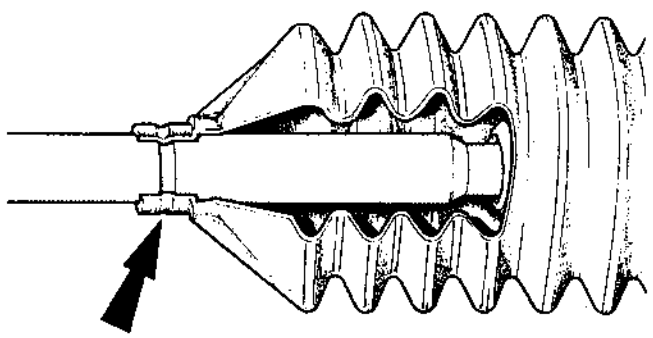


Fig.3. Ensure gaiters are correctly located into tie rod groove.

7. Adjust toe setting, align steering wheel, refer to Operation No. 14 111 3. Tighten outer gaiter clips.

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13 416 1 POWER STEERING SYSTEM - BLEED

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: When filling or topping up the power steering reservoir, care should be taken to ensure the fluid is not agitated prior to use. The fluid must be poured slowly into the reservoir to minimise the possibility of fluid aeration.

1. Open hood and fit fender covers.

2. Using clean non-aerated fluid, top up reservoir to the 'max' mark, Fig.1.

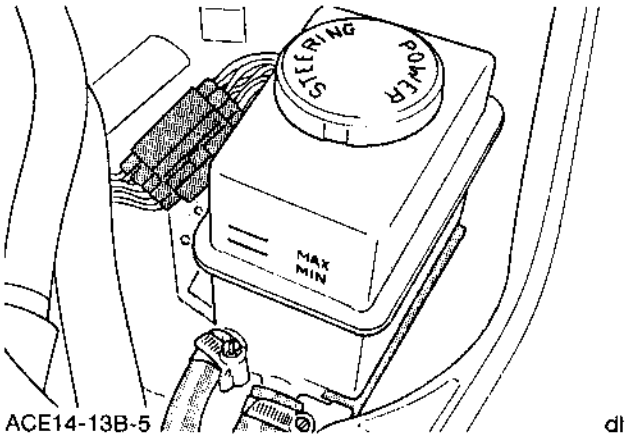


Fig.1. Fluid reservoir 'max' mark level.

3. Disconnect negative lead from coil, Fig.2.

4. Crank engine (short two second bursts) and slowly turn steering wheel from lock to lock three or four times.

NOTE: Ensure fluid in reservoir does not fall below minimum mark and air bubbles no longer appear. On no account must the fluid level in the reservoir be allowed to drop sufficiently for air to enter the system while cranking the engine.

5. Reconnect negative lead to coil.

6. Start engine and run for a few seconds, switch 'off' engine and re-check fluid level. Top up if necessary.

7. Check system for leaks. Examine hose connections, steering rack gaiters and valve body for external leaks.

8. Remove fender covers and close hood.

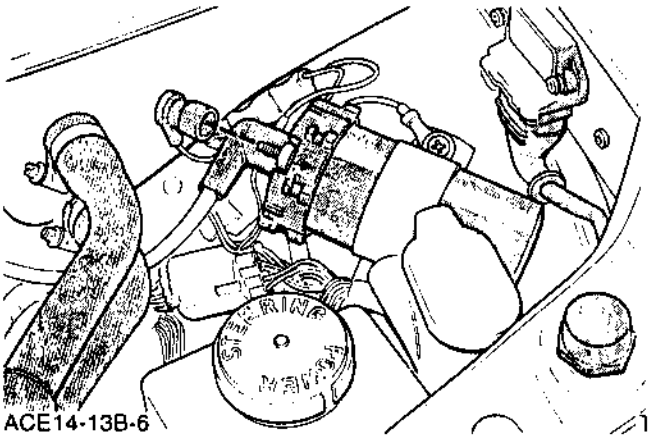


Fig.2. Disconnect negative lead from coil.

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13 424 0 BELT - POWER STEERING - PUMP DRIVE - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

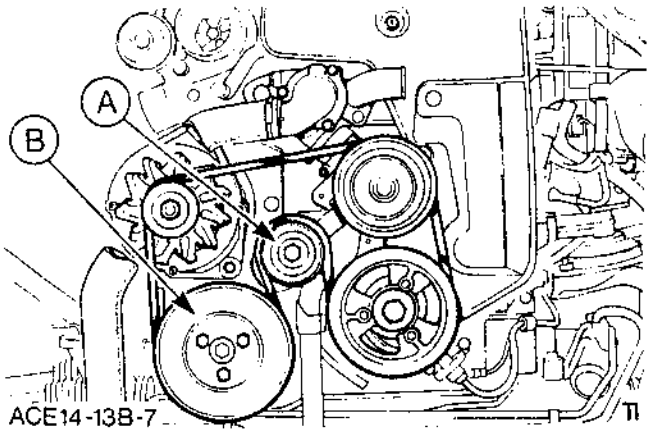


Fig.1. Auxiliary drive belt routing.
A - Auto-tensioner
B - Power steering pump

2. Rotate belt tensioner in a clockwise direction to release belt tension, remove drive belt after noting route around pulleys and release belt tensioner, Fig.1.

To Install

3. Rotate belt tensioner in a clockwise direction, refit drive belt, ensuring routing around pulleys is as shown in Fig.1 and release belt tensioner.

4. Reconnect battery, remove fender covers and close hood.

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13 434 0 PUMP ASSEMBLY - POWER STEERING - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery. Raise vehicle on ramp and remove sump shield.

2. Rotate belt tensioner in a clockwise direction to release belt tension. Remove drive belt and release belt tensioner, Fig.1.

3. Disconnect fluid pipes from power steering pump, Fig.2, and allow fluid to drain from pump and reservoir into a suitable drain tray, Fig.2.

4. Hold pump pulley with a 9 mm Allen key and remove three bolts. Remove pump pulley.

5. Remove three bolts securing pump, Fig.3, and remove pump.

To Install

6. Locate pump onto mounting bracket and secure with three bolts. Tighten bolts to specification (see Technical Data).

7. Align pump pulley with pump and secure with three bolts, whilst holding pulley with a 9 mm Allen key. Tighten bolts to specification (see Technical Data).

8. Reconnect the fluid pipes to power steering pump.

9. Rotate onto tensioner in a clockwise direction, refit drive belt as shown in Fig.1, and release belt tensioner. Refit sump shield and lower vehicle.

10. Top up power steering fluid reservoir and reconnect battery.

11. Bleed power steering system, (Operation No. 13 416 1).

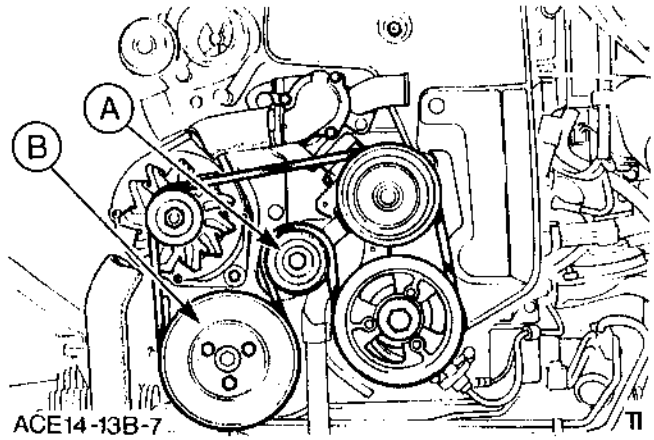


Fig.1. Auxiliary drive belt routing.
A - Auto-tensioner
B - Power steering pump

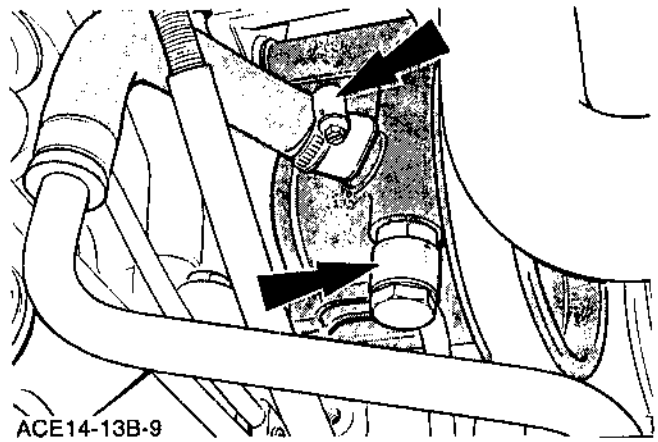


Fig.2. Power steering pump hoses.

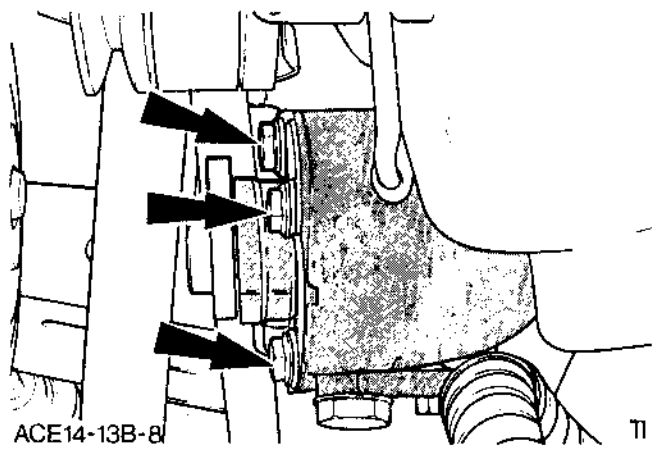


Fig.3. Power steering pump mounting bolts.

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13 434 8 PUMP ASSEMBLY - POWER STEERING - OVERHAUL

SPECIAL SERVICE TOOLS REQUIRED: NONE

'TC' series type pump assembly.

To Dismantle

1. Thoroughly clean exterior, ensuring dirt does not enter the inlet or outlet ports.

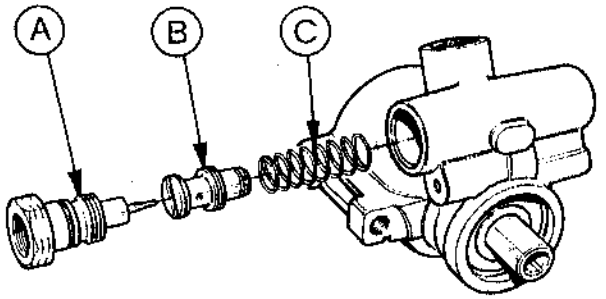
2. Remove pressure control valve assembly from pump housing, Fig.1.

3. Using suitable puller, carefully remove pump drive flange.

4. Remove driveshaft circlip, Fig.2, and pull out driveshaft and bearing assembly.

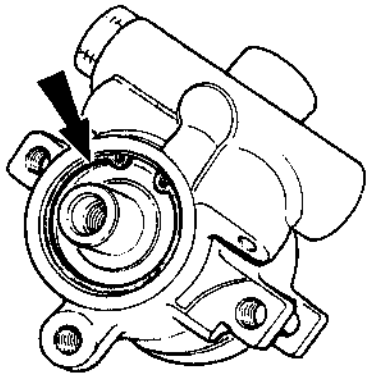
5. Press off bearing from pump driveshaft.

6. Using suitable lever (screwdriver), prise out seal from pump housing.



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Fig.1. Remove control valve.
A - Union B - Control valve
C - Spring



S/13B/63 C

Fig.2. Remove driveshaft circlip.

7. Rotate wire spring clip until access hole is open, using a suitable pin punch, remove the retaining plate spring clip, Fig.3.

8. Using a 13 mm bar or drift, press on pressure plate hub (from driveshaft side of pump) until thrust plate can be removed.

9. Remove thrust plate 'O' ring.

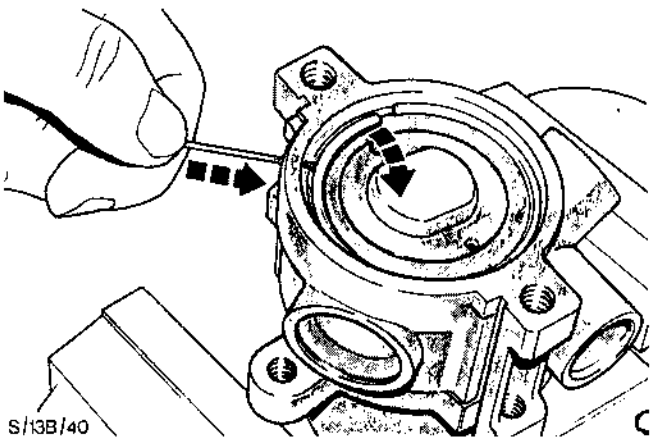


Fig.3. Remove pressure plate spring clip.

10. Remove pump ring rotor and vane assembly and pressure plate from housing, Fig.4 (it may be necessary to press out the thrust plate from pump housing).

Fig.4.
A - Thrust plate
B - Dowel pins
C - Vane and rotor
D - Pump ring
E - Pressure plate
F - 'O' ring
G - Pressure plate spring
H - Dowel pin.

11. Remove pressure plate 'O' ring seal, dowel pin and driveshaft 'O' ring seal.

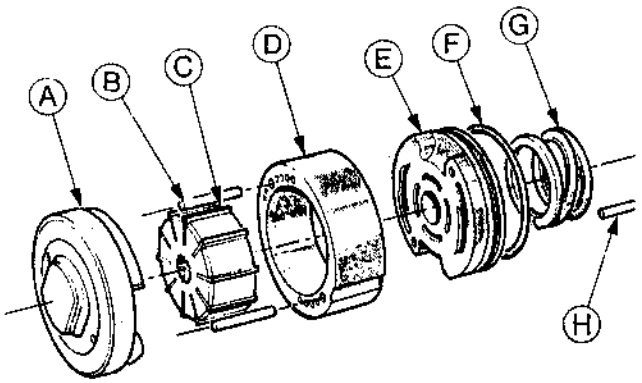


Fig.4. Rotor assembly.

12. Using suitable punch, carefully remove sleeve assembly.

To Reassemble

NOTE: Before re-assembly, clean and inspect all components. Discard all oil seals and 'O' rings. New seals and 'O' rings must be lubricated with power steering fluid before refitting.

13. Using suitable socket, press sleeve assembly into pump housing from pressure plate side, Fig.5. Ensure sleeve is fully located and seated in housing.

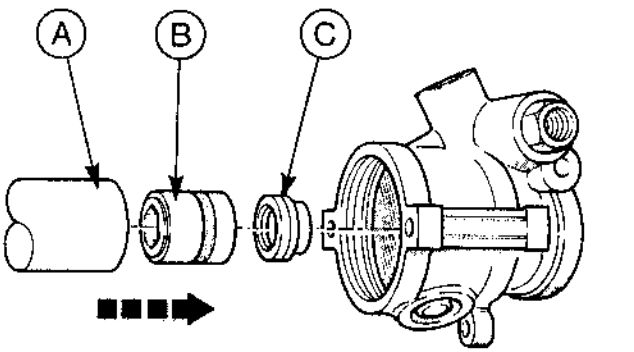


Fig.5. Press sleeve into pump housing.
A - Press
B - Suitable socket
C - Sleeve assembly

14. Fit 'O' ring seal into sleeve assembly.

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15. Insert dowel pin into pump housing and install spring over sleeve assembly, Fig.6.

16. Fit 'O' ring over pressure plate and locate over dowel pin. Ensure pressure plate is correctly engaged.

NOTE: To aid fitment, mark opposite side of pressure plate and dowel hole.

17. Install the two pumping ring dowel pins in pressure plate.

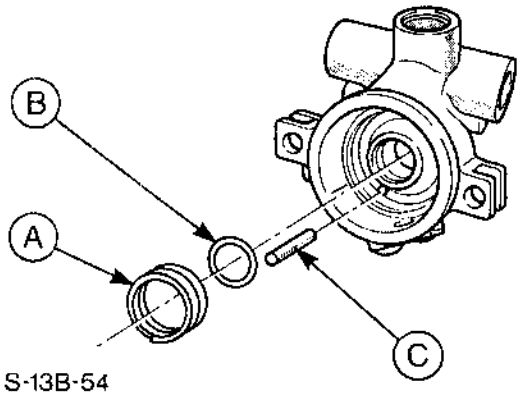
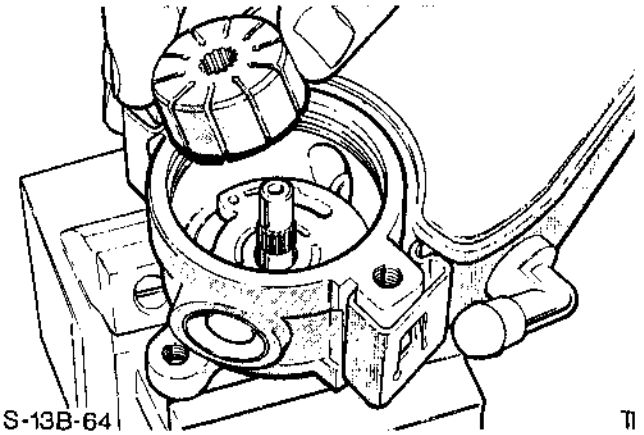


Fig.6. Fit pressure plate dowel pin.
A - Pressure plate spring
B - 'O' ring C - Dowel pin

18. Slide pumping ring over the two dowel pins with the identification marks on pump ring face upwards.

19. Install rotor and vanes into pump ring, Fig.7, with splined bore uppermost.



20. Fit thrust plate 'O' ring into housing.

Fig.7. Install rotor and vane assembly. Ensure rotor is fitted with counter bore facing driveshaft flange end of housing.

21. Fit thrust plate in housing, ensuring that the two dimples in plate line up with the bolt holes in pump housing and the thrust plate engages with pump ring dowel pins.

22. Using a press, press on the thrust plate far enough to install the retaining spring clip, Fig.8. Fit spring clip with opening of the clip centred with bolt hole in pump housing nearest to access hole.

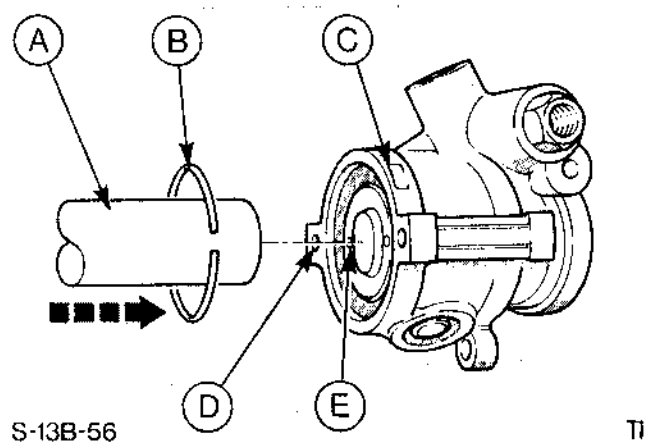


Fig.8. Refit thrust plate.

Fig.8.
A - Press D - Bolt holes
B - Retaining clip E - Dimples
C - Access hole

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23. Using a suitable socket, press driveshaft seal into pump housing.

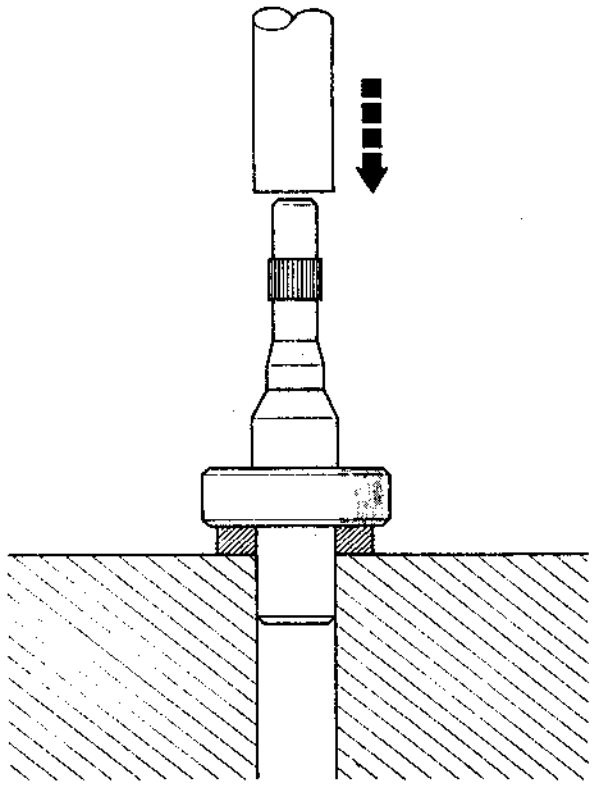
24. Press new bearing onto driveshaft, Fig.9.

25. Insert driveshaft and bearing into pump housing. Rotate driveshaft to engage splines of shaft in pump rotor. Ensure bearing is correctly located in housing.

26. Install retaining circlip with beveled edge outwards.

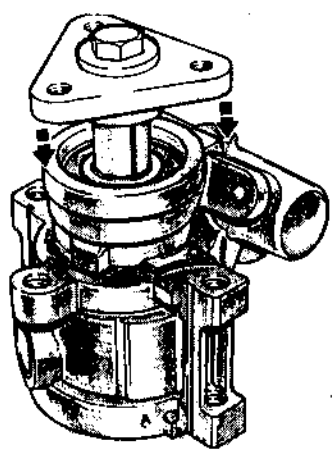
27. Fit control valve assembly, spring valve, 'O' ring and adaptor.

28. Pull on driveshaft flange using slave bolts, Fig.10.



S-13B-55 TI

Fig.9. Press on new driveshaft bearing.



S-13B-46 C

Fig.10. Pull on driveshaft flange using slave bolt.

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13 442 0 FLUID HOSES - POWER STEERING - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Disconnect hydraulic pressure hose connections from steering rack valve body, Fig.1, and allow fluid to drain from power steering pump.

3. Disconnect pressure pipes from power steering pump and reservoir, Fig.2. Lift out hoses.

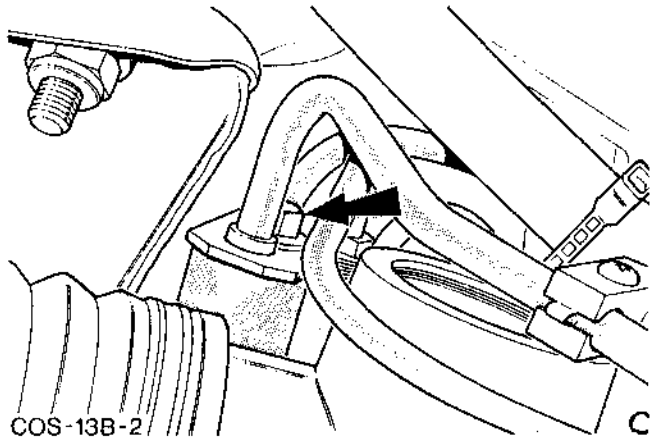


Fig.1. Hydraulic pressure and return pipes secured to valve body with single bolt.

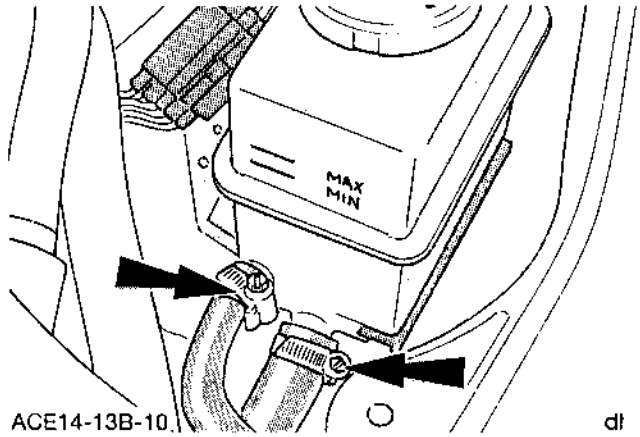


Fig.2. Disconnect hydraulic hoses from remote reservoir.

To Install

4. Fit new 'O' ring seals to high pressure and return hoses.

5. Connect hoses to steering gear valve body and secure with single bolt.

6. Reconnect hoses to power steering pump and reservoir, Fig.3, ensuring that hoses follow the correct routing.

7. Top up fluid in reservoir with specified fluid, (see Technical Data).

8. Reconnect battery and bleed power steering system as detailed in Operation 13 416 1.

9. Check for leaks, remove fender covers and close hood.

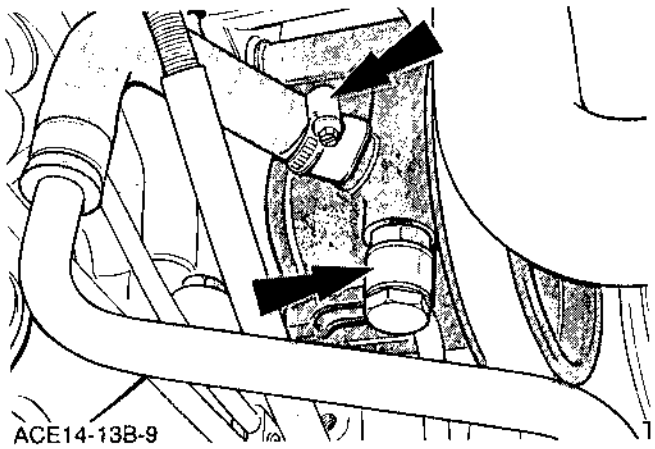


Fig.3. Refit hoses to power steering pump.

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13 523 0 STEERING WHEEL - CENTRALISE

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure details adjustments where misalignment of the steering wheel is less than 30°.

For steering wheel misalignment of more than 30° remove steering wheel and initially re-align to less than 30° misalignment.

1. Drive the vehicle in a straight line on a level surface, note the angular position (misalignment) of the steering wheel spokes, Fig.1.

2. Raise vehicle on ramp.

3. Mark position of track rods and track rod ends.

4. Slacken both track rod end lock nuts and release bellows outer clips.

5. Rotate both track rods in the same direction approximately 30° for every 1° of steering wheel misalignment angular error, see Fig.2.

   - If the steering wheel has an anti-clockwise angular error, both track rods must be rotated clockwise, when viewed from the left-hand side of the vehicle.

   - If the steering wheel has a clockwise angular error, both track rods must be rotated anti-clockwise when viewed from the left-hand side of the vehicle.

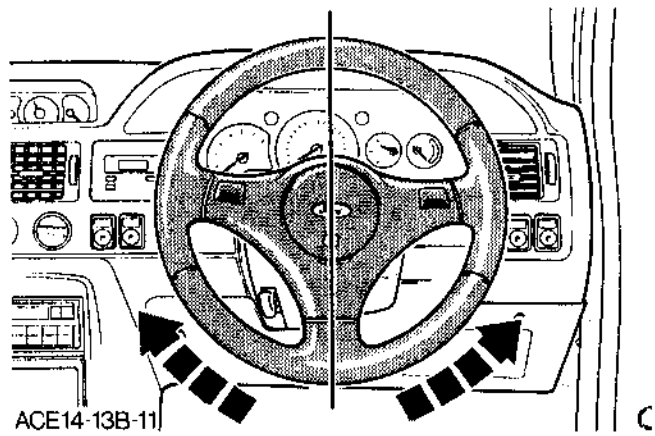


Fig.1. Note steering wheel angular error.

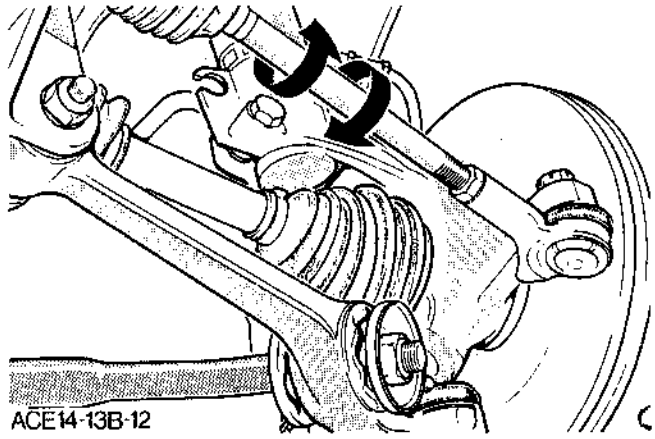


Fig.2. Rotate track rods either clockwise or anti-clockwise to eliminate steering wheel error.
Anti-clockwise for clockwise error
Clockwise for anti-clockwise error

IMPORTANT NOTE: It is vitally important that both track rods are rotated by the same amount in the same direction otherwise the toe setting will be disturbed.

Example:
Steering wheel angular error = 3° clockwise (to the right).

1° = 30° track rod
3° = 3 x 30 = 90° total rotation

NOTE: Track rods must be rotated in a clockwise direction when viewed from the left-hand side of the vehicle.

6. Tighten track rod end locknuts (Fig.3.) and re-secure bellows clips.

7. Lower vehicle.

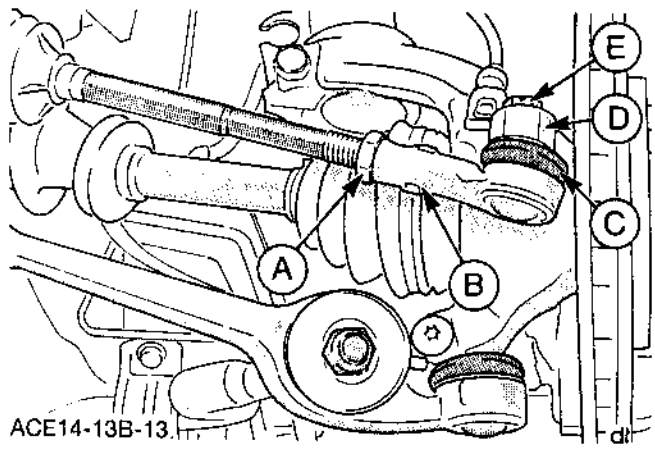


Fig.3. Tighten ball joint end locknuts.
A - Locknut
B - Track rod end
C - Seal
D - Spindle carrier
E - Castellated nut

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13 543 0 STEERING COLUMN - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery and centralise steering wheel.

2. Remove steering wheel centre hub and disconnect horn connections, with ignition lock in position 'I' remove steering wheel bolt and steering wheel, Fig.1.

3. Remove upper and lower steering column shrouds (6 screws).

4. Remove multi-function switches and disconnect multiplugs. Remove loom guide and ignition switch loom.

5. Disconnect hood release cable and remove lever.

6. Disconnect bolt securing upper steering coupling universal joint to steering column shaft, Fig.2.

7. Slacken lower steering column securing nuts and remove upper column securing nuts, Fig.3. Remove steering column assembly.

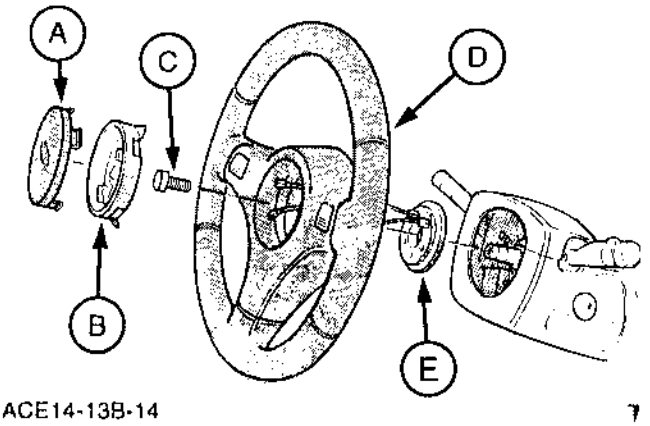


Fig.1. Steering wheel assembly.
A - Centre hub
B - Switch
C - Retaining bolt
D - Steering wheel
E - Slip ring

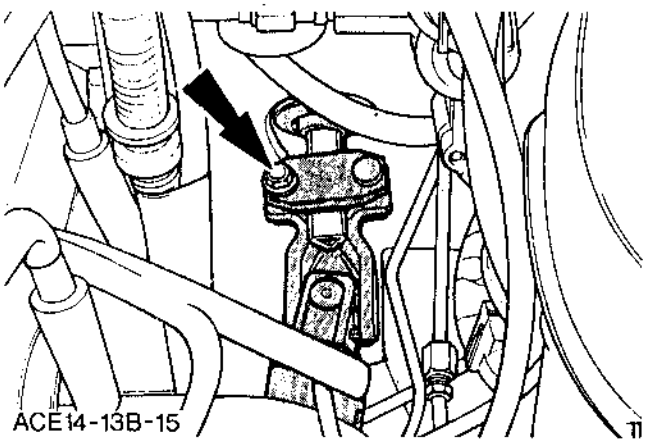


Fig.2. Upper steering coupling universal joint clamp bolt.

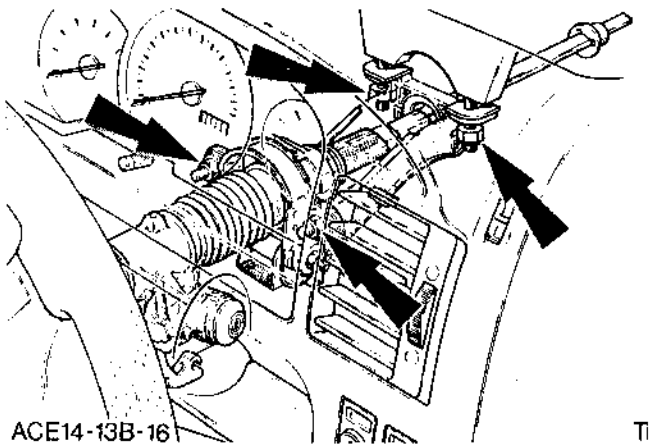


Fig.3. Steering column fixings.

0492

8. Mount steering column assembly in vice, using vice jaw protectors to prevent damage.

9. Slide upper thrust bearing tolerance ring off shaft and remove column shaft from column tube.

10. With ignition key in 'position 1' depress plunger on side of lock barrel and withdraw ignition lock.

11. Slide spring off column shaft.

12. Prise out lower and upper thrust bearings from column tube and ignition lock body.

13. Remove adjustable steering through bolt and locknut, handle and locking plates, Fig.4.

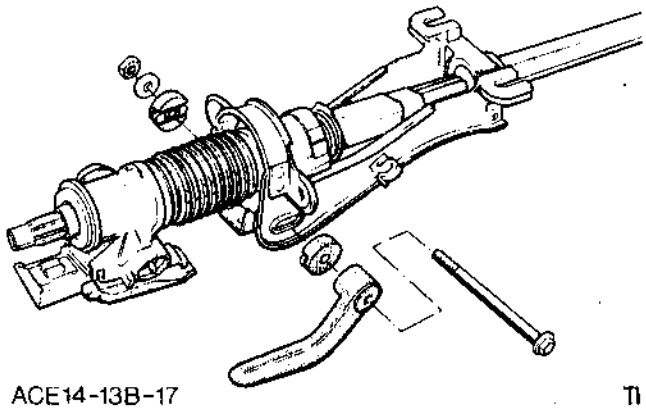


Fig.4. Adjustable steering column - exploded view.

To Install

14. Locate adjustable steering locking plates and handle (in locked position), and secure with through bolt (thread coated with loctite, see Technical Data) and new locknut. Tighten to specification (see Technical Data).

15. Carefully fit lower thrust bearing into column tube and upper bearing into ignition lock body.

16. Slide spring onto column shaft.

17. Refit ignition lock barrel into steering lock housing.

NOTE: Key must be in 'position 1'. Slight movements clockwise and anti-clockwise of the ignition key may be necessary to align the key barrel and the steering lock housing drive.

18. Slide column shaft into column tube. Refit upper thrust bearing tolerance ring (tapered end into bearing).

19. Locate column assembly into vehicle, ensuring that upper and lower fixings engage. Fit and tighten upper securing nuts and tighten lower nuts to specification, Fig.5, (see Technical Data).

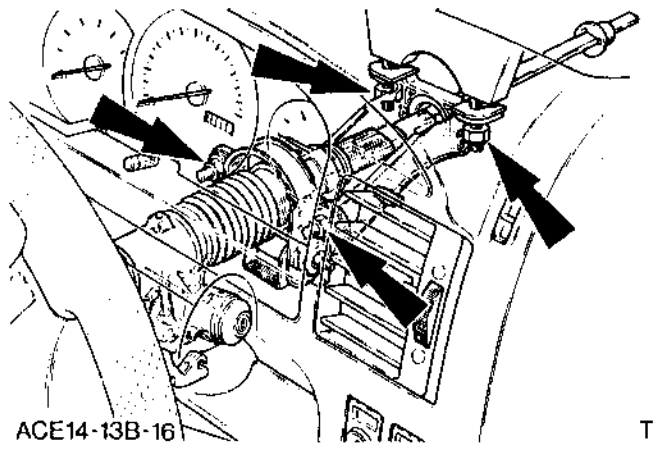


Fig.5. Steering column Fixings.

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20. Refit steering wheel and secure with retaining bolt. Reconnect horn connections and refit steering wheel centre cap, Fig.6.

21. Reconnect upper steering coupling universal joint to steering column shaft, Fig.7, and tighten securing bolt to specification,(see Technical Data).

22. Refit hood release cable to lever and refit lever.

23. Refit ignition switch loom and secure with loom guide. Reconenct multiplugs and refit multi-function switches.

24. Refit upper and lower steering column shrouds.

25. Reconnect battery, remove fender covers and close hood.

26. Check operation of multi-function switches.

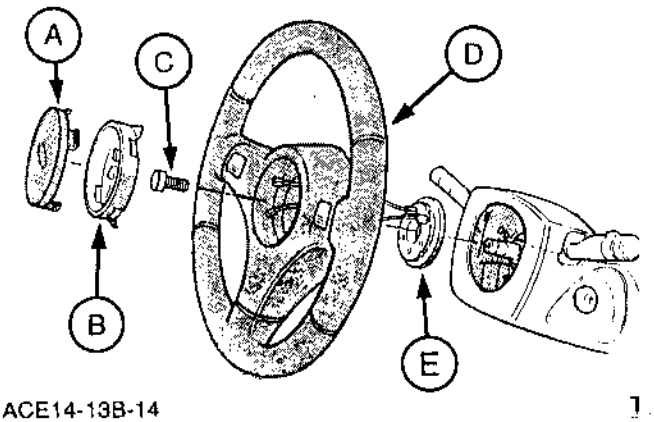


Fig.6. Steering wheel assembly.
A - Centre hub
B - Switch
C - Retaining bolt
D - Steering wheel
E - Slip ring

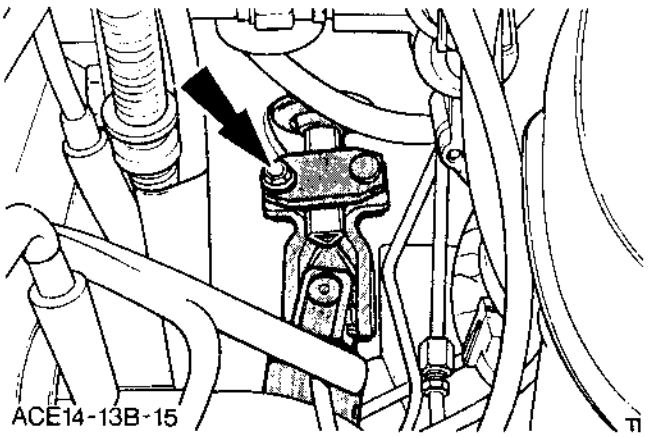


Fig.7. Upper steering coupling universal joint.

13 566 0 FLEXIBLE COUPLING - STEERING COLUMN - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Raise vehicle on ramp and remove sump shield. Remove bolt securing upper universal joint to steering column shaft, swing clamp plate to one side and allow coupling shaft to hang free.

2. Remove pinch bolt and nut from lower flexible coupling, pull off coupling shaft from pinion, Fig.1.

To Install

3. Engage coupling shaft onto steering gear pinion shaft, ensure that block spline is correctly located. Refit pinch bolt and lock nut. Tighten to correct specification, (see Technical Data).

4. Connect upper universal joint to steering shaft, swing clamp plate and fit new lock bolt to secure, Fig.1, (see Technical Data). Lower vehicle and refit sump shield.

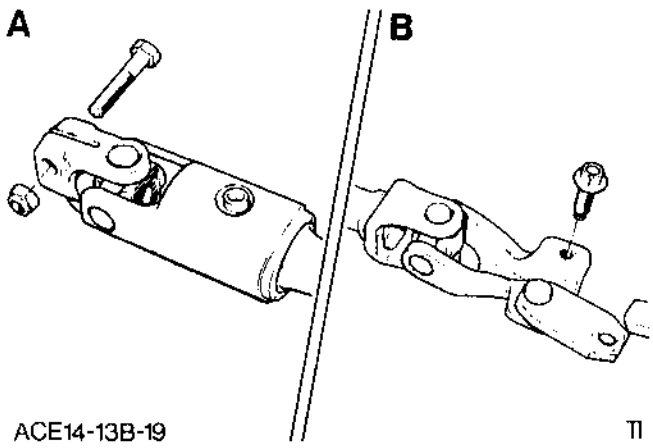


Fig.1. A - Flexible coupling pinch bolt
B - Universal joint clamp plate and bolt

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POWER ASSISTED STEERING (Cam Gears) 13B

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TECHNICAL DATA

Type	Power assisted variable rack and pinion
Turns lock to lock	2,84
Rack slipper adjustment	Screw-in plug
Power steering lubricant	Calipsol Grease type SF3-131
Power steering fluid	ESPM-2C-166H

Power steering pump belt tension

New	450 to 550 N
Used	350 to 450 N

NOTE: A used belt is one that has been run for at least 10 mins. All tensions refer to a cold belt.

Tightening Torques	Nm	lbf,ft
Steering coupling clamp bolts	20,0 to 28,0	15 to 21
Steering coupling pinch bolts/nuts	24,0 to 26,0	18 to 19
Lower pinion securing nut	37,0 to 47,0	27 to 34
Tie rod end lock nuts	57,0 to 68,0	42 to 50
Tie rod end to steering arm	25,0 to 30,0	18 to 22
Tie rod inner ball joint	72,0 to 88,0	53 to 65
Pressure hose to pump	26,0 to 31,0	19 to 22
Pulley hub retaining bolt	10,0 to 12,0	7 to 8
Steering column clamp and brace nuts	17,0 to 24,0	13 to 17
Bolts - Altr assy and adjusting arm	20,0 to 25,0	15 to 18
Bolt - P.A.S. pump bracket to block	52,0 to 64,0	38 to 47
Valve body clamp plate bolt	22,0 to 24,0	16 to 17
Steering rack to crossmember bolts	15 Nm plus 90°	12 + 90°
Steering rack to crossmember bolts (4x4 variants)	35,0 to 45,0	26 to 33

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SPECIAL SERVICE TOOL RECOGNITION

Tool	Tool Name
13-004 	Steering pinion socket
13-006 	Ball joint separator
13-010 	Pinion oil seal/bush installer
15-041 	Preload gauge

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13 116 0 STEERING GEAR ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator 13-006

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Align steering in the straight ahead position.

3. Remove lower pinch bolt securing flexible coupling to steering gear pinion shaft.

4. Disconnect tie rods from spindle body steering arms using Special Service Tool 13-006, Fig.1.

5. Remove clamp plate bolt securing high and low pressure pipes from steering gear valve body. Remove screw securing pressure hose clamp to steering gear housing. Pull pipes clear of steering gear and allow fluid to drain into suitable container.

6. Blank off all pipe connections and valve body to prevent dirt entry.

7. Remove two bolts securing steering gear to engine front crossmember, Fig.2. Lift out steering gear.

4x4 variants

Remove steering assembly from crossmember as detailed in Fig.3:

Fig.3. A - Slide steering gear towards driver's side of vehicle
B - Swing non-pinion end of steering rack out from crossmember
C - Rotate steering gear clockwise disengaging lower pinion bearing cap from crossmember
Lift out steering gear

To Install

8. Position steering gear assembly onto engine front crossmember, fit mounting bolts and tighten to specification (see note overleaf).

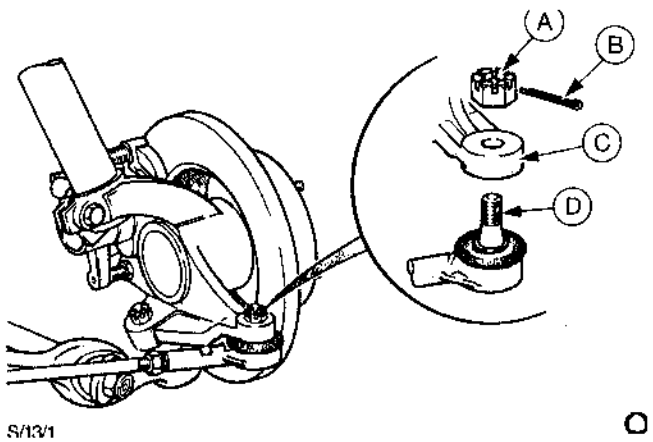


Fig.1. Steering tie rod end.
A - Castellated nut
B - Split pin
C - Steering arm
D - Ball joint

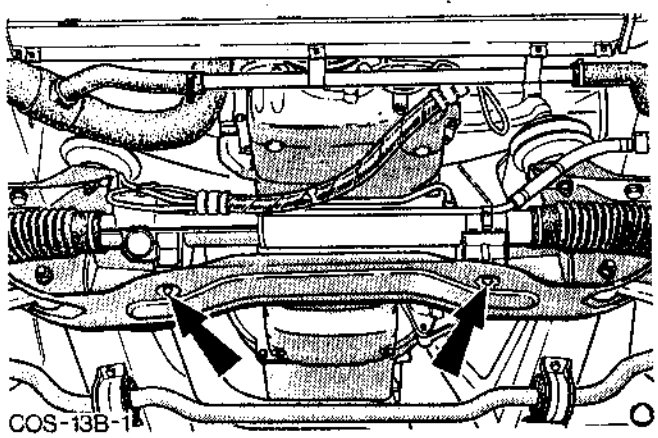


Fig.2. Steering gear mounting bolts.

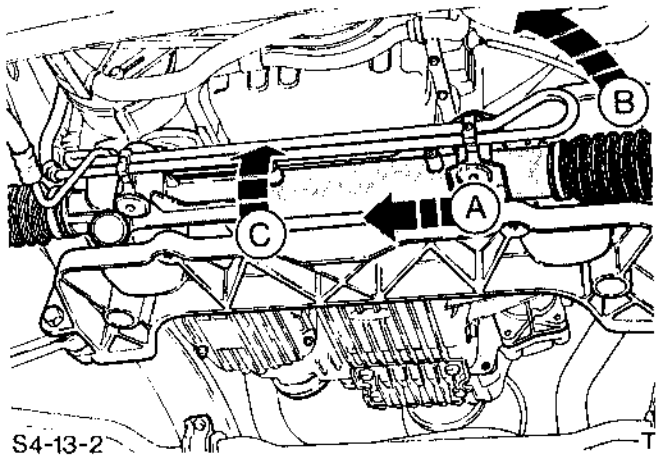


Fig.3. Remove steering gear in correct sequence.

13 116 0

NOTE: Steering gear mounting bolts are torqued to yield. Tighten bolts to 15 Nm, then turn a further 90°. No subsequent tightening is required.

To re-check, slacken bolts 'off' (zero torque) and repeat above.

9. Remove hose and valve body blanking plugs. Replace 'O' rings on pressure and return hoses. Refit clamp plate and fit securing bolt, Fig.4, tighten retaining bolt to specification.

10. Reconnect tie rods to spindle carrier steering arms, tighten castellated nut and fit new split pins.

11. Align block splines of steering gear and flexible coupling, reconnect coupling to pinion shaft and fit pinch bolt, Fig.6. Tighten pinch bolt to specification.

12. Reconnect battery.

13. Refill power steering reservoir and bleed as described below:

- Using clean, non-aerated fluid, top up reservoir to the 'max' mark.
- Disconnect negative lead from coil. Crank engine (short two second bursts) and slowly turn steering wheel from lock to lock three or four times.

NOTE: Ensure fluid in reservoir does not fall below 'minimum' mark and air bubbles no longer appear.

- Reconnect negative lead to coil, start engine, turn steering from lock to lock. Switch 'off' ignition.
- Re-check fluid level, replace cap and check steering gear for fluid leaks.

14. Check and adjust front wheel toe alignment. Refer to Section 14 in this microfiche.

15. Remove fender covers and close hood.

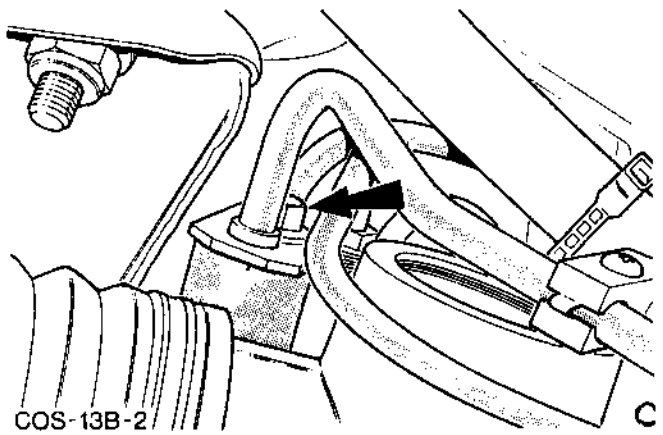


Fig.4. Power steering pipe seals and clamp plate.

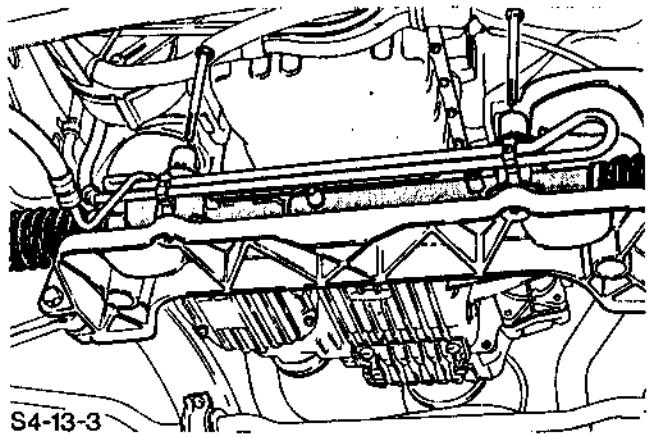


Fig.5. Refit steering gear to crosmember (4x4 variants).

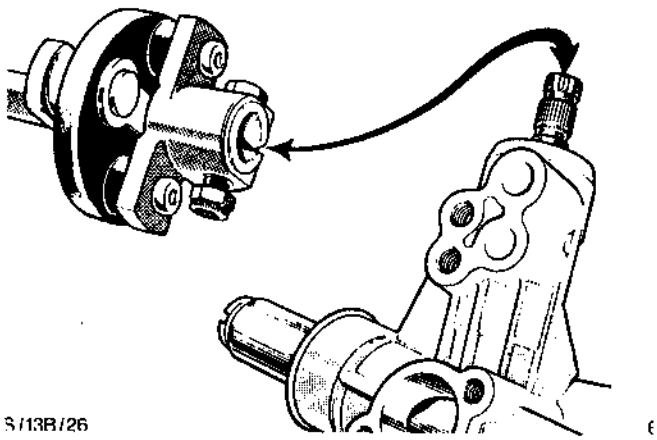


Fig.6. Pinion block spline and flexible coupling.

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13 116 8 STEERING GEAR ASSEMBLY - OVERHAUL

SPECIAL SERVICE TOOLS REQUIRED:

Pinion oil seal/bush installer ..	13-010
Steering pinion socket	13-004
Pre-load gauge	15-041

To Remove

1. Mount steering gear in vice using soft jaw protectors, support steering gear at pinion housing. Slowly traverse steering rack from lock to lock draining fluid from valve body.

2. Remove track rod ends and lock nuts noting the number of turns required to remove each track rod end. Remove and discard gaiter retaining clips, slide off gaiter.

3. Traverse steering rack so that rack teeth are visable, reposition steering gear so that rack teeth are held in vice, Fig.1. Use vice jaw protectors to ensure no damage to steering rack teeth occurs.

4. Using suitable wrench, unscrew inner ball joints.

NOTE: The steering rack must be held securely when the tie rods are removed, otherwise damage to the pinion may occur.

5. Remove yoke pinion cover using suitable hexagonal bar (28mm), Fig.2. Remove yoke spring.

6. Reposition steering gear in vice, holding pinion housing. Centralise steering gear (mid-position of total turns lock to lock). Mark pinion to valve body position, measure steering rack projection from end of steering rack tube.

7. Remove core plug from pinion valve housing, remove pinion locknut, Fig.3.

8. Remove pinion input shaft dust cover, remove circlip and carefully pull pinion valve shaft assembly out of valve body, Fig.4. (A twisting action will aid removal).

NOTE: Care should be taken during this operation, to prevent dirt entering the valve body or sleeve assembly.

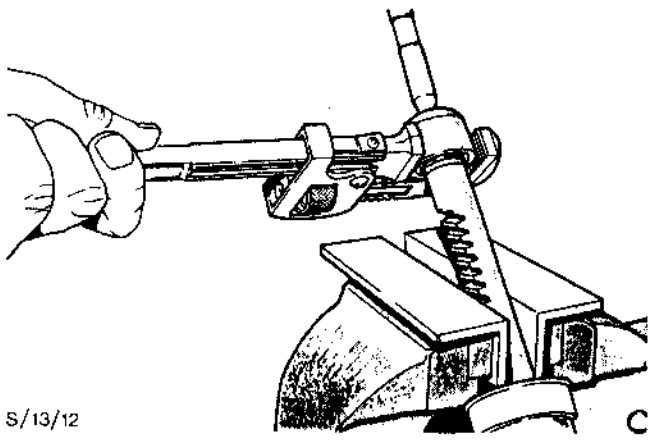


Fig.1. Secure steering rack teeth to prevent damage to pinion.

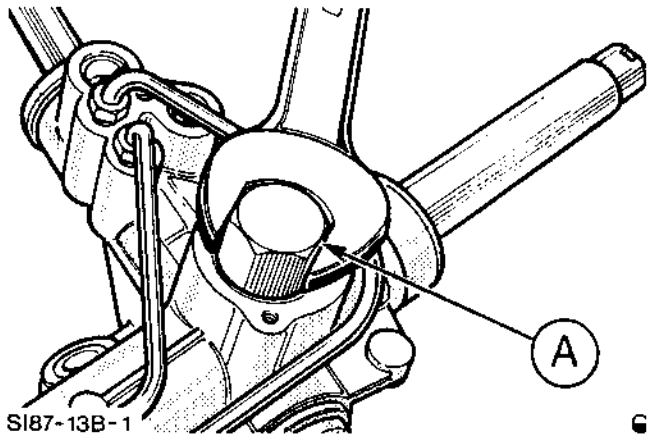


Fig.2. Remove pinion yoke cover.
A - Hexagonal bar

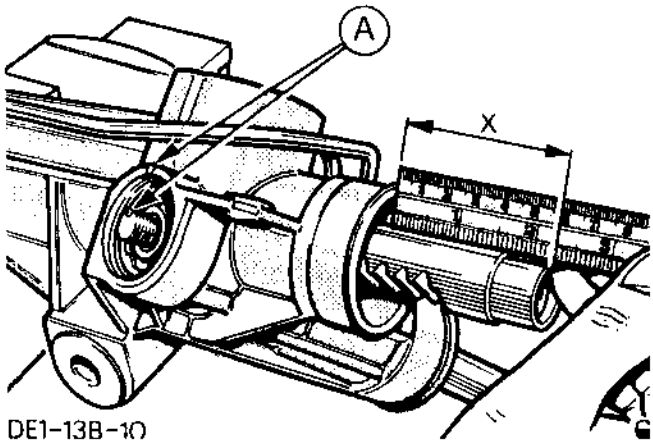


Fig.3. Remove pinion locknut, mark central position of pinion to steering rack.

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9. Slide seal and bearing off pinion shaft. Do not dismantle valve assembly.

10. Remove steering rack support bearing and seal.

- Rotate the support bearing locking collar anti-clockwise until the end of the locking wire is visible in the rack tube slot.

- Prise end of locking wire out of slot, continue to rotate locking collar until the wire is removed from the annular groove.

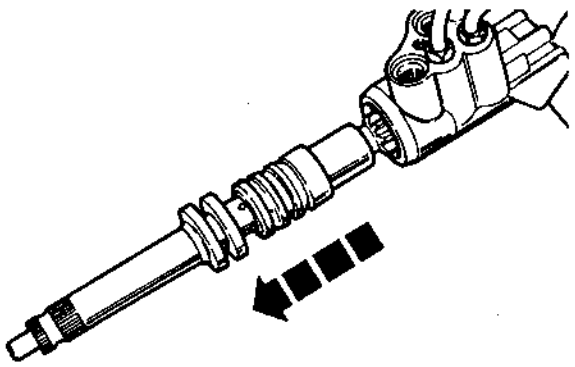
11. Carefully withdraw rack from rack tube.

NOTE: At this stage the remaining steering gear fluid will be released.

12. Slide rack support bearing and seal off steering rack shaft, Fig.5.

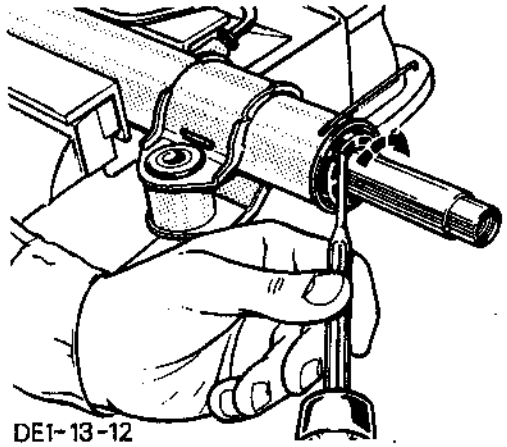
13. Remove pinion support bearing and seal from pinion housing using suitable punch.

14. Remove rack inner seal and support ring using suitable drift (26 mm diameter) in direction of rack tube, Fig.6.



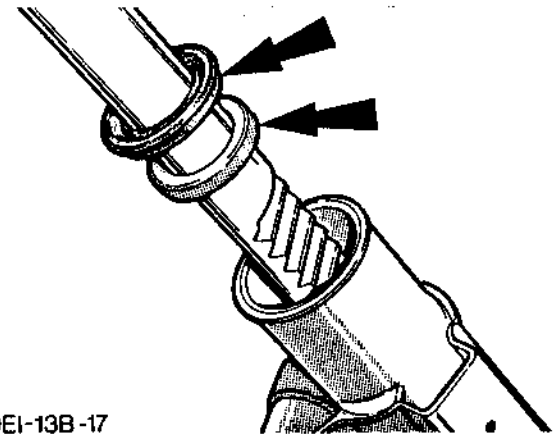
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Fig.4. Remove pinion assembly.



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Fig.5. Remove rack support bearing, rotate locking collar anti-clockwise.

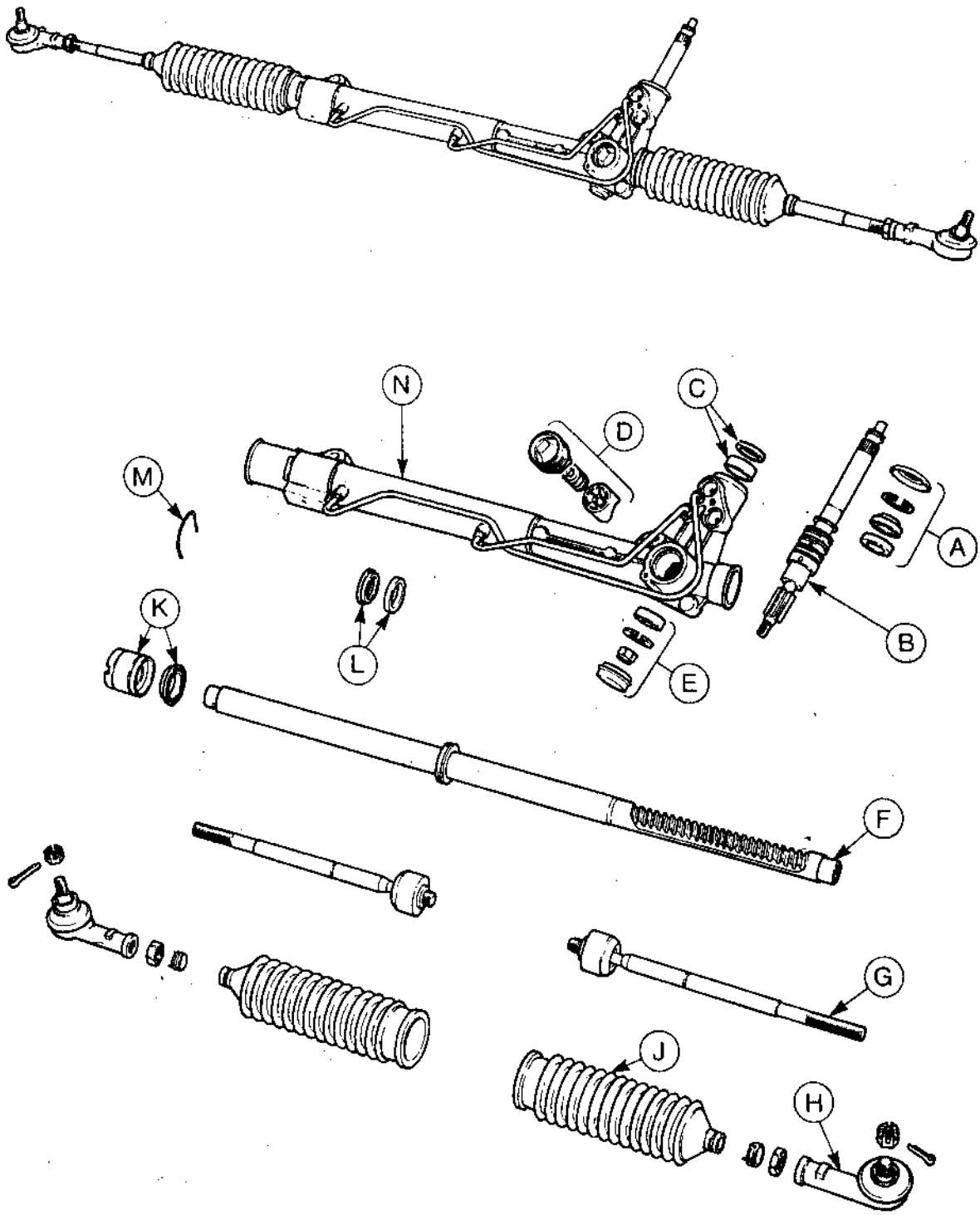


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Fig.6. Remove rack inner seal and support ring.

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Fig.7. Steering rack exploded view.

A - Pinion bearing	F - Rack	K - Rack support bush and seal
B - Pinion	G - Tie rod	L - Inner rack seal
C - Pinion bearing and seal	H - Tie rod end	M - Support bush securing wire
D - Yoke assembly	J - Bellows	N - Rack tube
E - Lower pinion bearing		

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To Reassemble

Before reassembly, all parts must be inspected for damage and thoroughly cleaned:

a) Check all contact faces of radial lip seals on valve body and steering shaft.

b) Check pinion teeth, support bearing and valve body roller bearing for wear.

c) Check rack teeth and inner ball joint threads for wear or damage.

d) Check yoke contact area on rack and yoke for wear.

e) Ensure all rack feed pipes are free from any obstruction or damage.

f) Check lower pinion bearing and pinion contact face for damage or wear.

g) Check all P.T.F.E. contact faces for damage.

h) Ensure that rack air bypass tube is free from any obstruction and grease.

j) If any damage to pinion or valve sleeve is evident, a new valve assembly must be fitted.

NOTE: If new P.T.F.E. seals are to be fitted, following procedure should be adopted:

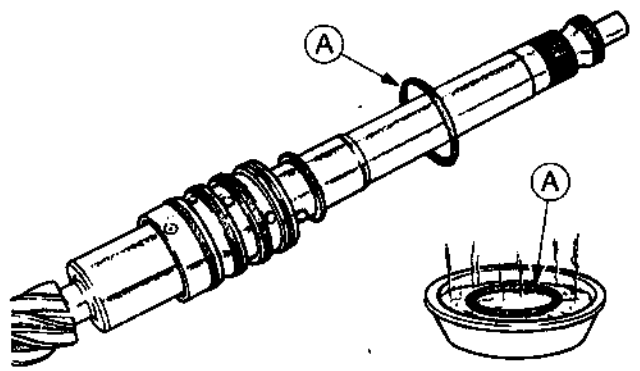
Submerge seals in boiling water before fitting to valve assembly.

After fitting to valve assembly a short period of time should be allowed for the seals to recover their natural shape.

k) All radial lip seals should be packed with Calipsol grease (see Technical Data).

If there is any damage to pinion or valve sleeve, a new valve assembly must be fitted.

15. Fit new pinion seal. Using Special Service Tool 13-010, Fig.9, press in until seal is seated on pinion housing seat. Using same tool, press in plain pinion bush until groove in Special Service Tool is level with top of pinion housing.



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Fig.8. Assemble P.T.F.E. seals (A) onto sleeve valve using boiling water to aid recovery time of P.T.F.E. seals.

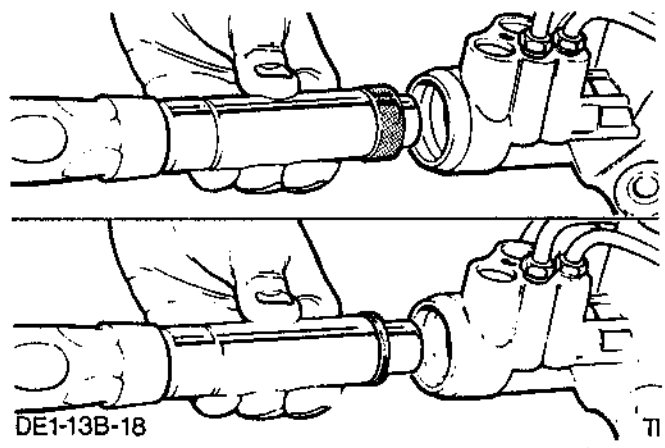


Fig.9. Fit new pinion seal using Special Service Tool 13-010.

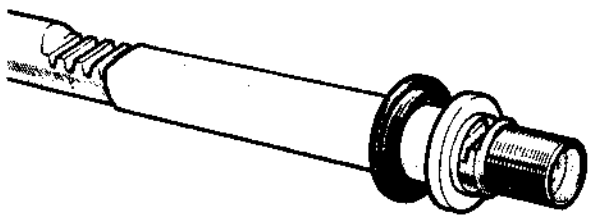
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16. Slide inner seal and rack support onto the rack from the toothed end, insert the rack into the rack tube and pull through until the seal and washer have located on their seats. Coat rack teeth with 40 cc Calipsol semi-fluid grease, (see Technical Data).

NOTE: To avoid damaging non-metallic components, they should be installed by covering rack end teeth with paper, Fig.10, sliding seals onto paper and then sliding seal and paper over rack teeth to plain section of rack.

17. Fit new rack support bearing, seal and locking collar over rack into the rack tube.

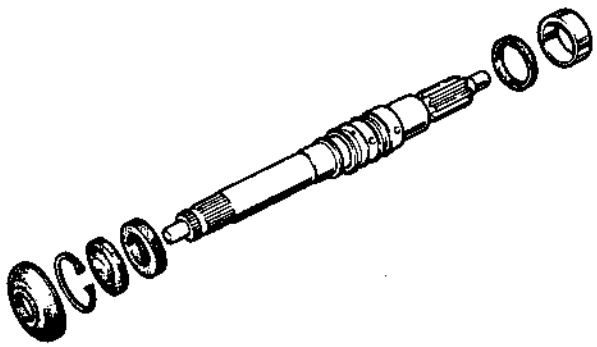


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Fig.10. Protect seal by covering rack teeth with stiff card or paper.

18. Rotate the locking collar until the hole in the annular groove is visible. Insert the hooked end of the locking wire in the hole and rotate the collar clockwise until the end of the wire disappears. Fill the slot in rack tube with grease.

19. Fit lower pinion support bearing into rack housing and secure with circlip.



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Fig.11. Pinion assembly.

20. Fit upper pinion bearing and seal over pinion input shaft.

21. Centralise steering rack and refit pinion assembly, secure upper pinion bearing and seal in valve housing with circlip. Fill pinion input shaft with grease and fit over pinion shaft.

22. Fit locknut to lower pinion shaft, tighten to specification (see Technical Data), replace blanking plug.

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23. Assemble steering rack yoke and spring and adjust as described below:

- Centralise steering rack, assemble yoke and spring into pinion housing.
- Coat thread of yoke plug with suitable sealant, (Loctite 542 or equivalent) and screw into housing.
- Tighten plug to a torque of 3,4 to 4 Nm, using a 28 mm hexagonal bar.
- Rotate pinion from lock to lock, re-centralise steering gear to the straight ahead position.
- Check yoke plug torque, retighten as necessary to 3,4 to 4 Nm.
- Check pinion turning torque is not less than 1,35 Nm (12 lb in), using Special Service Tool 15-041.
- Back-off yoke plug 22° to 27°.
- Check pinion rotation turning torque does not exceed 1,7 Nm (15 lb in).
- If pinion torque exceeds 1,7 Nm, the yoke plug may be backed off an additional 5°.
- Stake yoke plug to threads in three places.

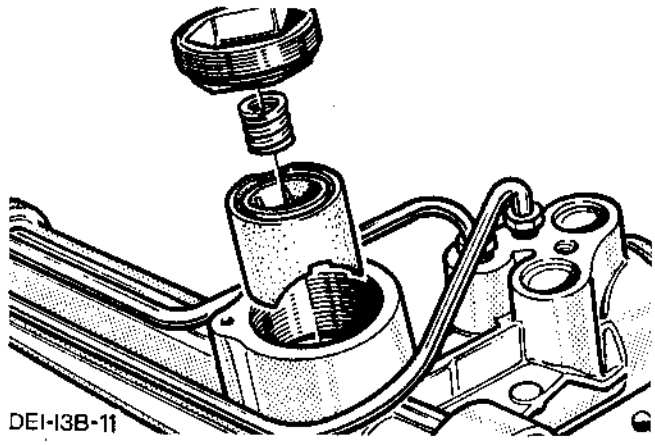


Fig.12. Steering rack yoke assembly.

24. Traverse steering rack until rack teeth are visible, clamp teeth in vice using soft jaw protectors. Coat inner ball joint threads with 'Loctite 270', Fig.13, screw ball joints into steering rack and torque joints to specification (see Technical data).

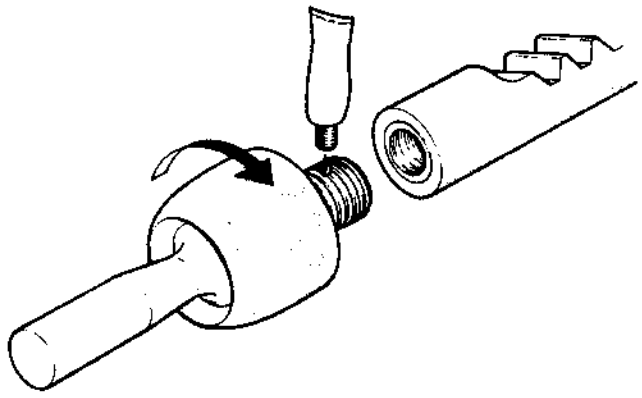


Fig.13. Seal tie rod assemblies with loctite.

25. Replace gaiters over tie rods, ensure gaiters locate in corresponding grooves, Fig.14. Ensure rack support bearing end gaiter covers slot in tube. Use new screwed clamps for housing ends.

NOTE: Fit outer clips loosely over tie rod until toe setting has been adjusted.

26. Refit locknuts and tie rod ends, screw on same amount as required to remove.

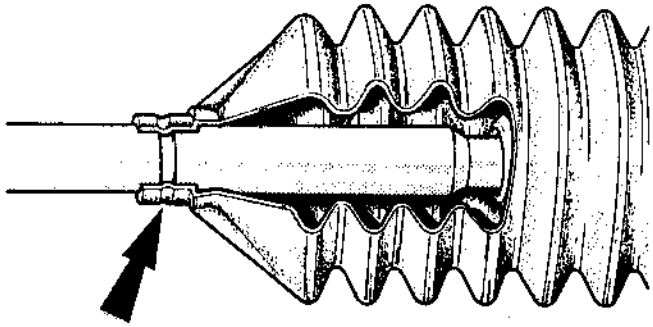


Fig.14. Replace gaiters, ensure gaiters are correctly located in tie rod grooves.

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13 134 0 BELLOWS - STEERING RACK - REPLACE (ONE) (steering gear in situ)

SPECIAL SERVICE TOOLS REQUIRED:

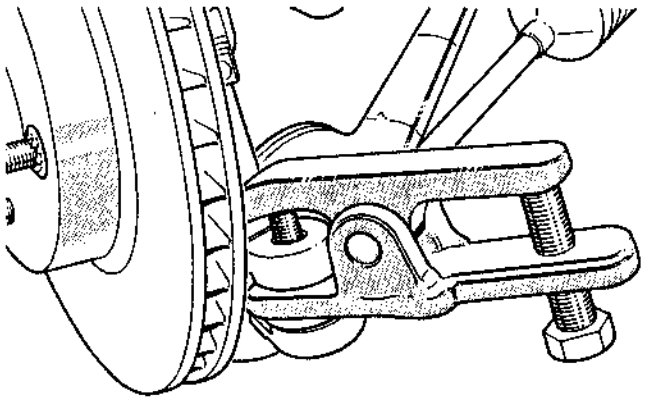
Ball joint separator 13-006

To Remove

1. Slacken locknut on tie rod end, remove castellated nut from ball joint, and disconnect tie rod end from steering arm, using ball joint separator, 13-006, Fig.1.

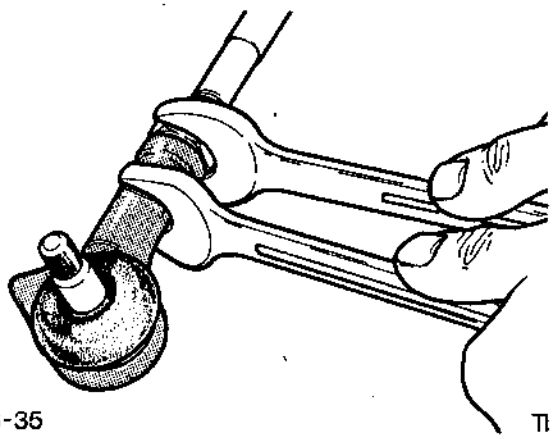
2. Remove tie rod end and locknut from tie rod noting the number of turns required to remove. Remove tie rod locknut, Fig.2.

3. Release clips from gaiter, slide off steering rack gaiter. Discard clip securing gaiter to housing.



COS-13B-5

Fig.1. Use ball joint separator 13 -006, to release ball joint taper.



DE1-13B-35

Fig.2. Remove tie rod ends and locknuts.

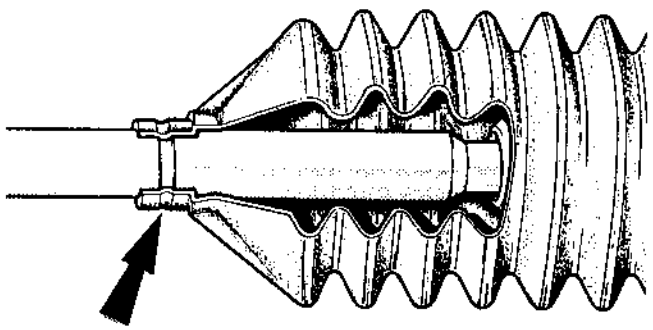
To Install

4. Refit gaiter over tie rod, locating gaiter in tie rod grooves, Fig.3. Ensure gaiter covers slot in support end of rack tube, fit new screw type gaiter clips.

5. Fit outer clip over tie rod, do not tighten clip until steering toe setting has been adjusted.

6. Refit locknuts and tie rod end. Screw on the same number of turns as to remove, (see sub-operation 2). Refit tie rod end to steering arm and fit new split pin.

7. Adjust toe setting, align steering wheel, refer to Operation No. 14 111 3. Tighten outer gaiter clips.



DEI-13-28

Fig.3. Ensure gaiters are correctly located into tie rod groove.

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13 416 1 POWER STEERING SYSTEM - BLEED

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: When filling or topping up the power steering reservoir, care should be taken to ensure the fluid is not agitated prior to use. The fluid must be poured slowly into the reservoir to minimise the possibility of fluid aeration.

1. Open hood and fit fender covers.

2. Using clean non-aerated fluid, top up reservoir to the 'max' mark, Fig.1.

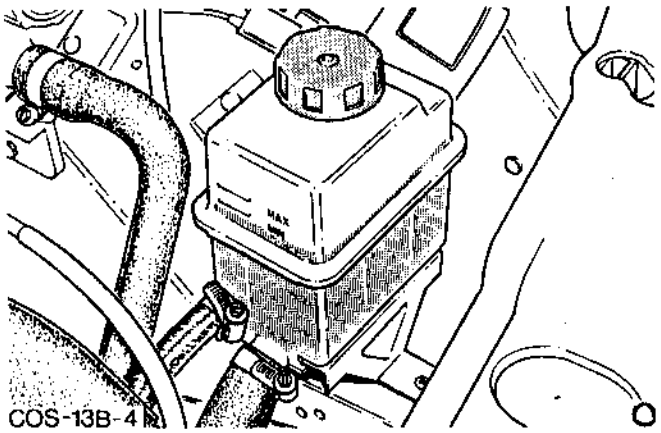


Fig.1. Fluid reservoir 'max' mark level.

3. Disconnect negative lead from coil, Fig.2.

4. Crank engine (short two second bursts) and slowly turn steering wheel from lock to lock three or four times.

NOTE: Ensure fluid in reservoir does not fall below minimum mark and air bubbles no longer appear. On no account must the fluid level in the reservoir be allowed to drop sufficiently for air to enter the system while cranking the engine.

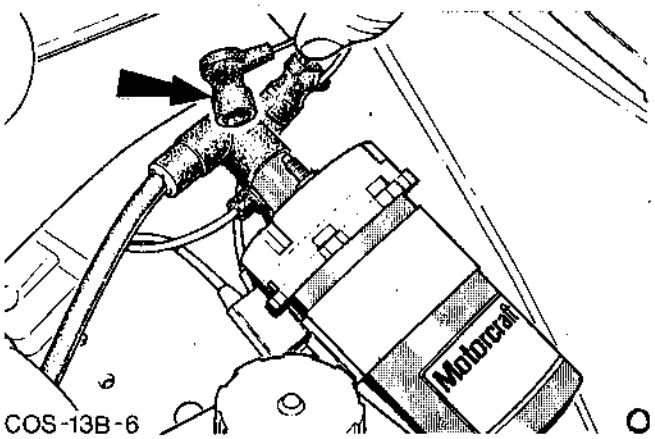


Fig.2. Disconnect negative lead from coil.

5. Reconnect negative lead to coil.

6. Start engine and run for a few seconds, switch 'off' engine and re-check fluid level. Top up if necessary.

7. Check system for leaks. Examine hose connections, steering rack gaiters and valve body for external leaks.

8. Remove fender covers and close hood.

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13 424 0 BELT - POWER STEERING - PUMP DRIVE - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

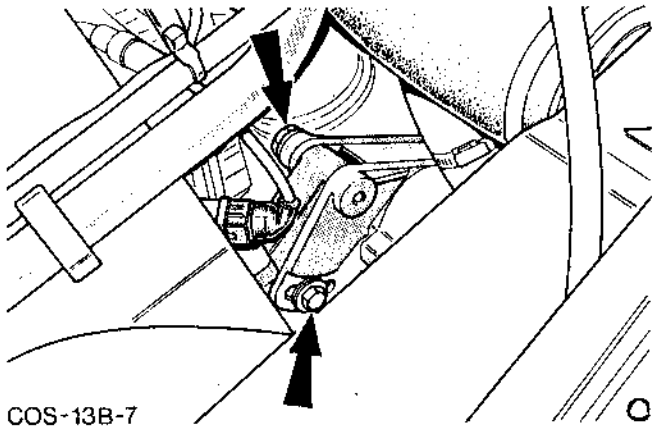


Fig.1. Power steering pump, pivot and adjusting bolts.

2. Slacken power steering pump pivot and adjuster bolts, Fig.1, and turn power steering pump towards engine.

3. Remove drive belt.

To Install

4. Locate drive belt over pulley.

5. Swing power steering pump away from engine and tighten adjuster bolt.

6. Check belt tension, see Technical Data.

7. Tighten pivot bolt to specification.

8. Reconnect battery, remove fender covers and close hood.

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13 434 0 PUMP ASSEMBLY - POWER STEERING - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Slacken power steering pump pivot and adjuster bolts and remove drive belt, Fig.1.
3. Disconnect fluid pipes from power steering pump assembly and allow fluid to drain from pump and reservoir.
4. Remove power steering pump rear mounting bolts and lift out pump assembly, Fig.2.
5. Remove pump drive pulley retaining bolts.

To Install

6. Fit drive pulley to pump flange, tighten bolts to specification.
7. Locate power steering pump onto mounting bracket and secure, tighten bolts to specification.
8. Reconnect the fluid pipes to power steering pump.
9. Refit drive belt and adjust tension, Fig.3. A belt tension tool should be used to measure the belt tension. For belt tensions refer to Technical Data. Alternatively, belt tension can be checked by measuring the free play at the mid point of the longest span of the belt, which should be 13 mm (0,5 in).

NOTE: When checking belt free play, it is important to ensure that excessive pressure is not applied to the belt, otherwise effective belt tension will be too high. This could result in an increase in the rate of wear of the bearings. Sufficient tension can be achieved using normal finger tip pressure. Fully tighten pivot and adjuster bolts.

10. Top up power steering fluid reservoir. Reconnect battery.
11. Bleed power steering system.
12. Remove fender covers and close hood.

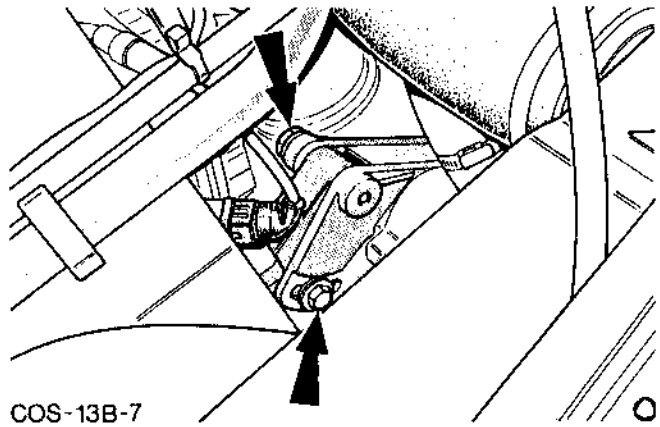


Fig.1. Slacken pivot and adjuster bolts.

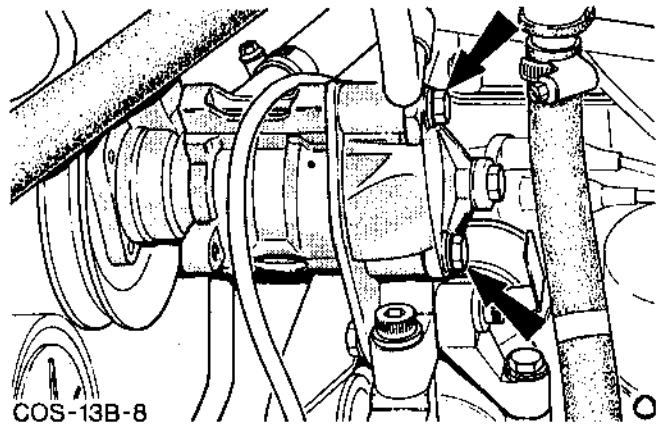


Fig.2. Remove power steering pump mounting bolts.

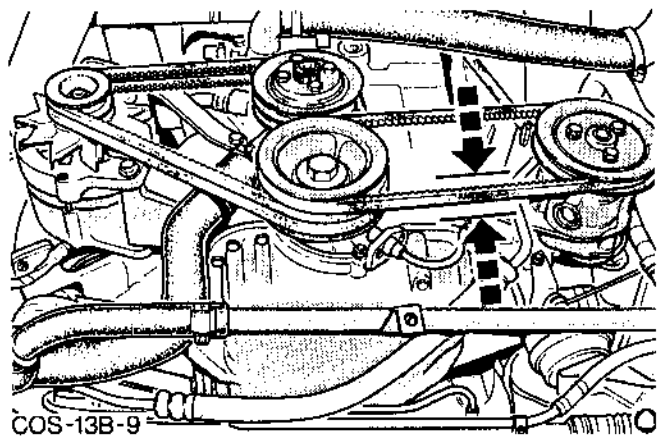


Fig.3. Adjust drive belt tension.

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13 434 8 PUMP ASSEMBLY - POWER STEERING - OVERHAUL

SPECIAL SERVICE TOOLS REQUIRED: NONE

'TC' series type pump assembly.

To Dismantle

1. Thoroughly clean exterior, ensuring dirt does not enter the inlet or outlet ports.

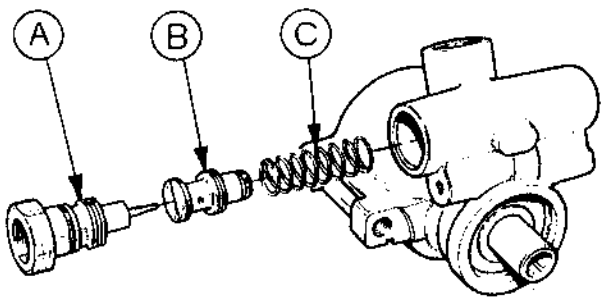
2. Remove pressure control valve assembly from pump housing, Fig.1.

3. Using suitable puller, carefully remove pump drive flange.

4. Remove driveshaft circlip, Fig.2, and pull out driveshaft and bearing assembly.

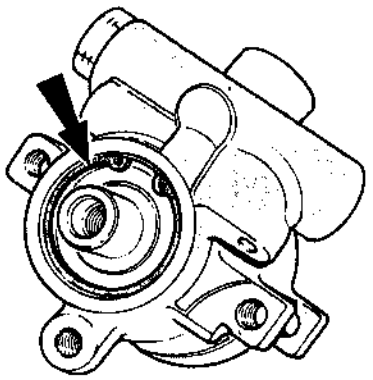
5. Press off bearing from pump driveshaft.

6. Using suitable lever (screwdriver), prise out seal from pump housing.



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Fig.1. Remove control valve.
A - Union B - Control valve
C - Spring



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Fig.2. Remove driveshaft circlip.

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13 434 8

7. Rotate wire spring clip until access hole is open, using a suitable pin punch, remove the retaining plate spring clip, Fig.3.

8. Using a 13 mm bar or drift, press on pressure plate hub (from driveshaft side of pump) until thrust plate can be removed.

9. Remove thrust plate 'O' ring.

10. Remove pump ring rotor and vane assembly and pressure plate from housing, Fig.4 (it may be necessary to press out the thrust plate from pump housing).

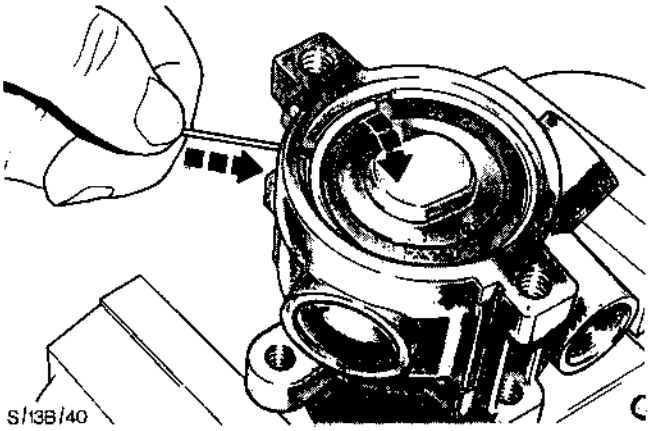


Fig.3. Remove pressure plate spring clip.

Fig.4.
A - Thrust plate
B - Dowel pins
C - Vane and rotor
D - Pump ring
E - Pressure plate
F - 'O' ring
G - Pressure plate spring
H - Dowel pin.

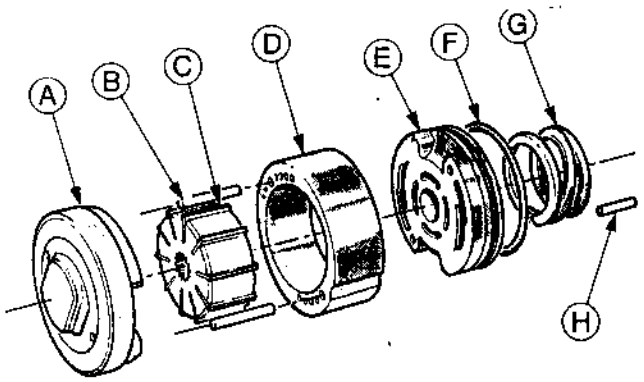


Fig.4. Rotor assembly.

11. Remove pressure plate 'O' ring seal, dowel pin and driveshaft 'O' ring seal.

12. Using suitable punch, carefully remove sleeve assembly.

To Reassemble

NOTE: Before re-assembly, clean and inspect all components. Discard all oil seals and 'O' rings. New seals and 'O' rings must be lubricated with power steering fluid before refitting.

13. Using suitable socket, press sleeve assembly into pump housing from pressure plate side, Fig.5. Ensure sleeve is fully located and seated in housing.

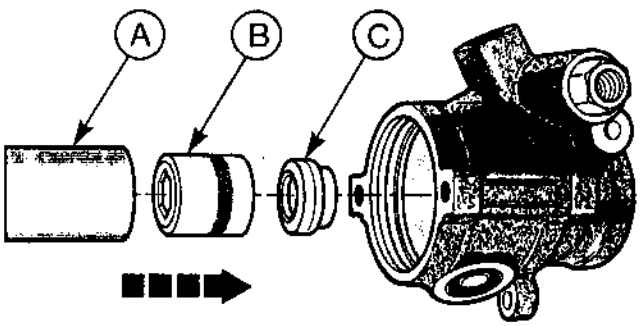


Fig.5. Press sleeve into pump housing.
A - Press
B - Suitable socket
C - Sleeve assembly

14. Fit 'O' ring seal into sleeve assembly.

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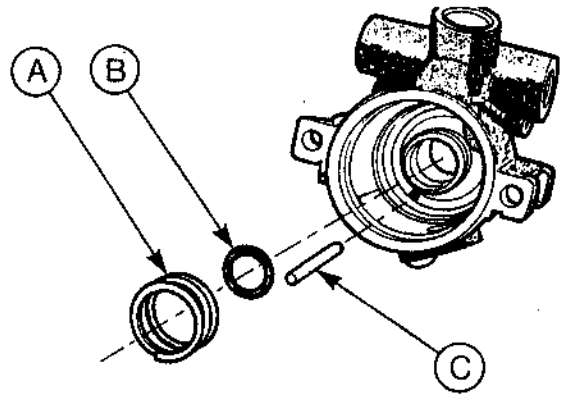
13 434 8

15. Insert dowel pin into pump housing and install spring over sleeve assembly, Fig.6.

16. Fit 'O' ring over pressure plate and locate over dowel pin. Ensure pressure plate is correctly engaged.

NOTE: To aid fitment, mark opposite side of pressure plate and dowel hole.

17. Install the two pumping ring dowel pins in pressure plate.

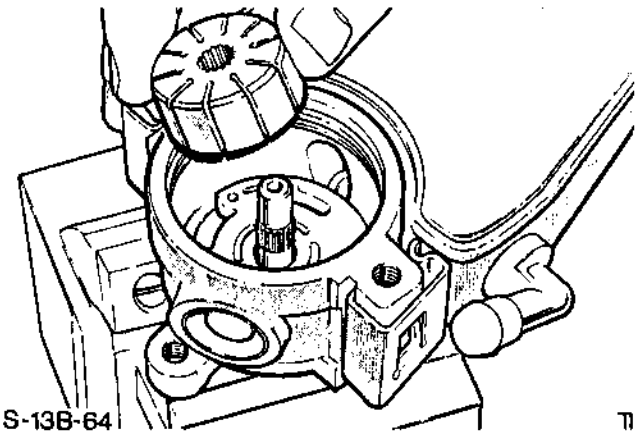


S/13B/54 H

Fig.6. Fit pressure plate dowel pin.
A - Pressure plate spring
B - 'O' ring C - Dowel pin

18. Slide pumping ring over the two dowel pins with the identification marks on pump ring face upwards.

19. Install rotor and vanes into pump ring, Fig.7, with splined bore uppermost.



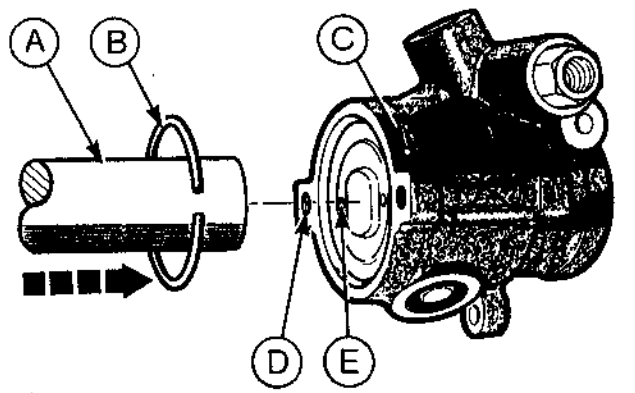
S-13B-64 TI

20. Fit thrust plate 'O' ring into housing.

Fig.7. Install rotor and vane assembly. Ensure rotor is fitted with counter bore facing driveshaft flange end of housing.

21. Fit thrust plate in housing, ensuring that the two dimples in plate line up with the bolt holes in pump housing and the thrust plate engages with pump ring dowel pins.

22. Using a press, press on the thrust plate far enough to install the retaining spring clip, Fig.8. Fit spring clip with opening of the clip centred with bolt hole in pump housing nearest to access hole.



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Fig.8.
A - Press D - Bolt holes
B - Retaining clip E - Dimples
C - Access hole

Fig.8. Refit thrust plate.

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23. Using a suitable socket, press driveshaft seal into pump housing.

24. Press new bearing onto driveshaft, Fig.9.

25. Insert driveshaft and bearing into pump housing. Rotate driveshaft to engage splines of shaft in pump rotor. Ensure bearing is correctly located in housing.

26. Install retaining circlip with beveled edge outwards.

27. Fit control valve assembly, spring valve, 'O' ring and adaptor.

28. Pull on driveshaft flange using slave bolts, Fig.10.

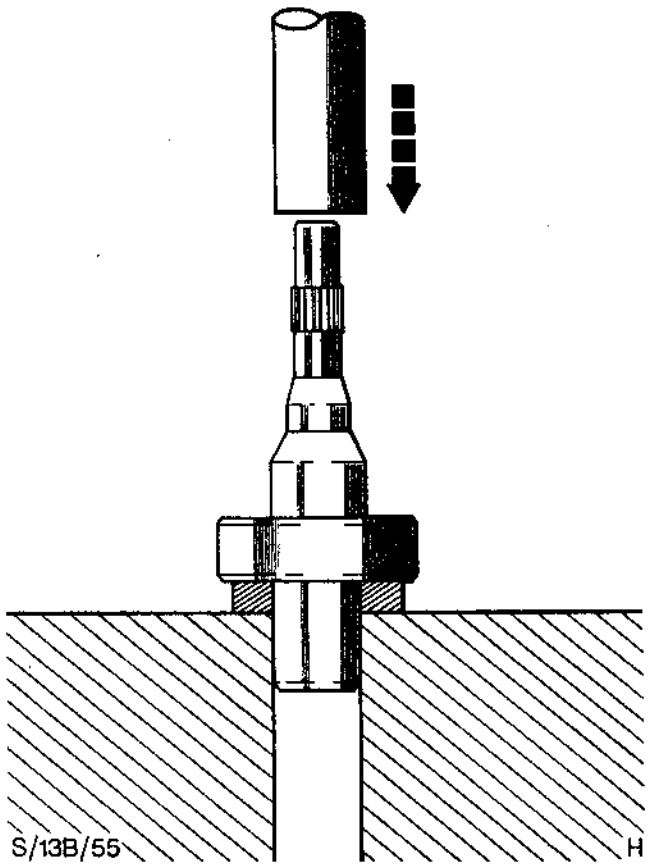


Fig.9. Press on new driveshaft bearing.

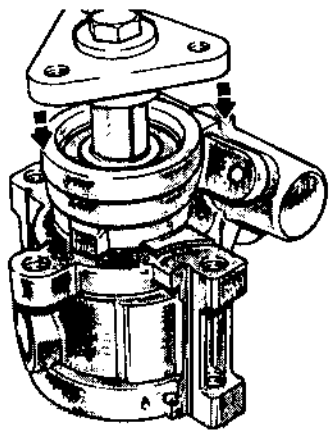


Fig.10. Pull on driveshaft flange using slave bolt.

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13 442 0 FLUID HOSES - POWER STEERING - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Disconnect hydraulic pressure hose connections from steering rack valve body, Fig.1, and allow fluid to drain from power steering pump.

3. Disconnect pressure pipes from power steering pump and reservoir, Fig.2. Lift out hoses.

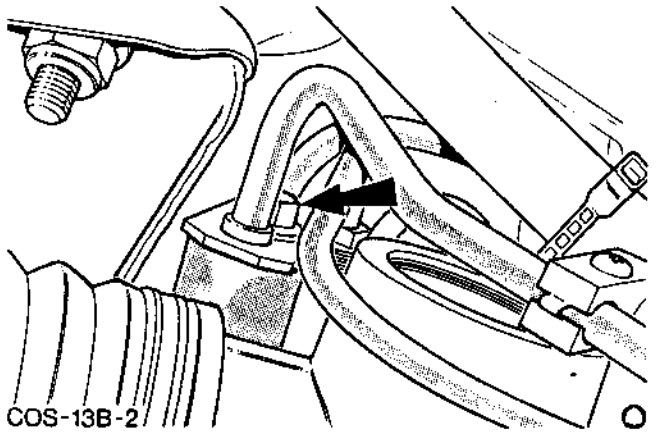


Fig.1. Hydraulic pressure and return pipes secured to valve body with single bolt.

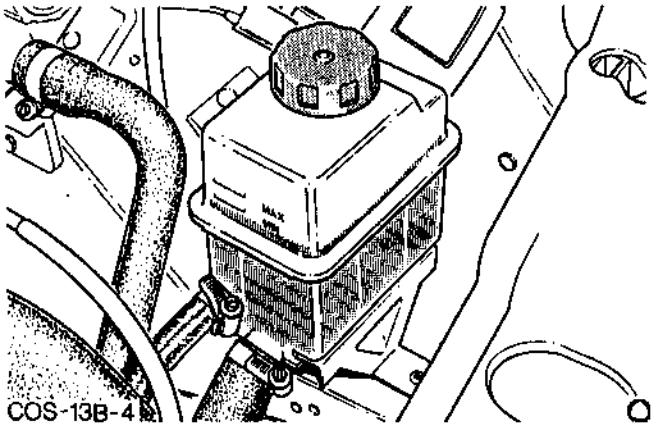


Fig.2. Disconnect hydraulic hoses from remote reservoir.

To Install

4. Fit new 'O' ring seals to high pressure and return hoses.

5. Connect hoses to steering gear valve body and secure with single bolt.

6. Reconnect hoses to power steering pump and reservoir, Fig.3, ensuring that hoses follow the correct routing.

7. Top up fluid in reservoir with specified fluid, (see Technical Data).

8. Reconnect battery and bleed power steering system as detailed in Operation 13 416 1.

9. Check for leaks, remove fender covers and close hood.

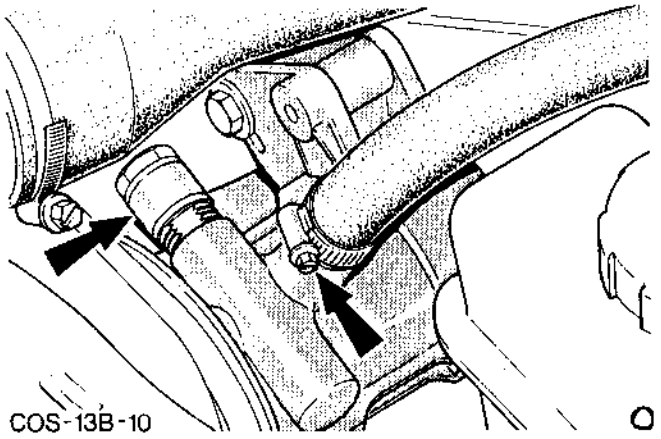


Fig.3. Refit hoses to power steering pump.
A - High pressure supply hose
B - Low pressure return hose

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13 523 0 STEERING WHEEL - CENTRALISE

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This operation is for fine adjustment only up to 60°. For any angular error of more than 60°, remove the steering wheel and position as near to correct centralised position as possible.

1. Drive vehicle in a straight line on a level surface and note the angular position of the steering wheel spokes, Fig.1.

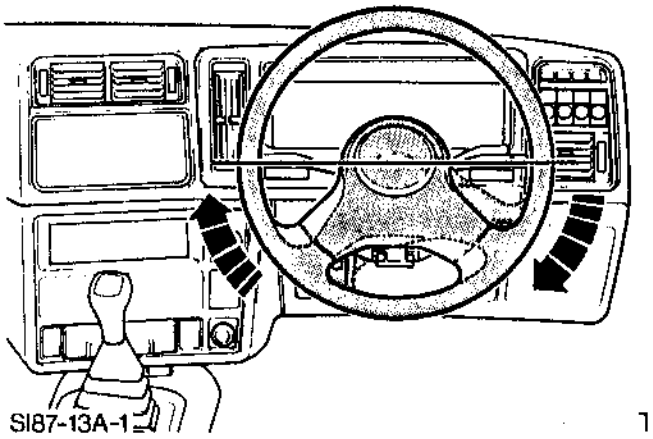


Fig.1. Note angular error/position of the steering wheel spokes.

2. Raise the vehicle on ramp.

3. Mark the relative position of the tie rod end ball joints, Fig.2.

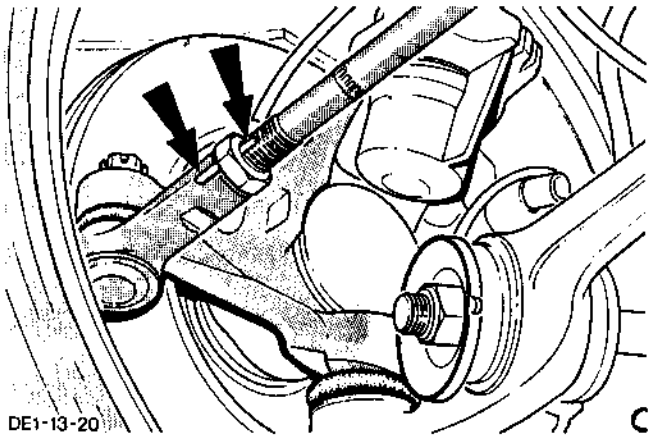


Fig.2. Mark relative position of tie rod end ball joints to tie rods.

4. Slacken both tie rod end locknuts and remove bellows clips at tie rod.

5. Rotate both tie rods in the same direction approximately 19° for every 1° of steering wheel angular error.

   - For steering wheel with a clockwise angular error, rotate both tie rods in an anti-clockwise direction when viewed from the left hand side of the vehicle.

   - For steering wheel with an anti-clockwise angular error, rotate both tie rods in a clockwise direction when viewed from the left hand side of the vehicle.

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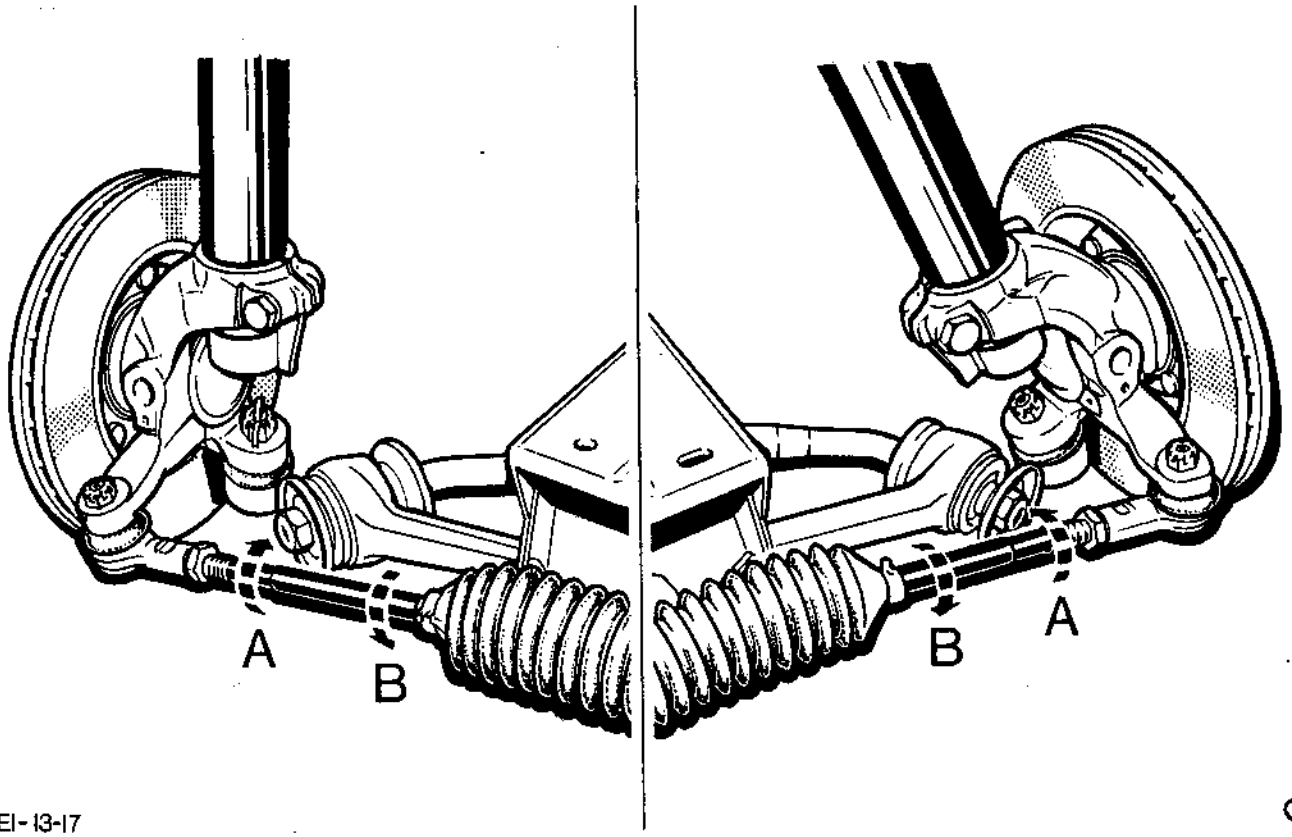
13 523 0

IMPORTANT NOTE: Both tie rods must be rotated the same amount in the same direction otherwise the toe setting will be disturbed.

EXAMPLE: Steering wheel with an angular error of 3° to the right (clockwise). Both tie rods must be rotated 3 x 19° - 57° in an anti-clockwise direction when viewed from the left hand side of the vehicle.

6. Tighten tie rod end locknuts to specification (see Technical Data), and replace bellows clips.

7. Lower vehicle to the ground.



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Fig.3. A - Clockwise steering wheel error, rotate tie rods anti-clockwise
B - Anti-clockwise steering wheel error, rotate tie rods clockwise

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13 543 0 STEERING COLUMN - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

1. Centralise steering wheel.

2. Remove under dash cover panel, lower crash pad and cowl side panel.

3. Remove upper and lower steering column shrouds, disconnect multifunction switches and bonnet release lever.

4. Disconnect upper steering coupling universal joint from steering shaft.

5. Remove nuts securing column tube to facia panel. Slide out steering column assembly from vehicle.

6. Mount steering column assembly in vice using soft jaw protectors.

7. Prise out steering wheel centre insert, remove retaining nut and pull off steering wheel, (ensure steering lock is disengauged) slide off indicator cam and upper bearing thrust washer.

8. Separate steering column and shaft assembly.

9. Using suitable lever, prise out upper and lower ball races from column tube, remove lower thrust washer and spring from shaft.

10. Clamp triangular section of steering shaft in vice and pull off lower nylon bush.

NOTE: The steering lock assembly is an integral part of the column tube and cannot be separated.

CAUTION: CARE MUST BE TAKEN NOT TO COLLAPSE THE STEERING SHAFT. ONCE SHAFT HAS BEEN COLLAPSED, A NEW SHAFT MUST BE FITTED.

11. Insert ignition key and turn to position I, depress spring clip and pull out ignition barrel.

12. Remove two grub screws securing ignition switch and loom to lock housing.

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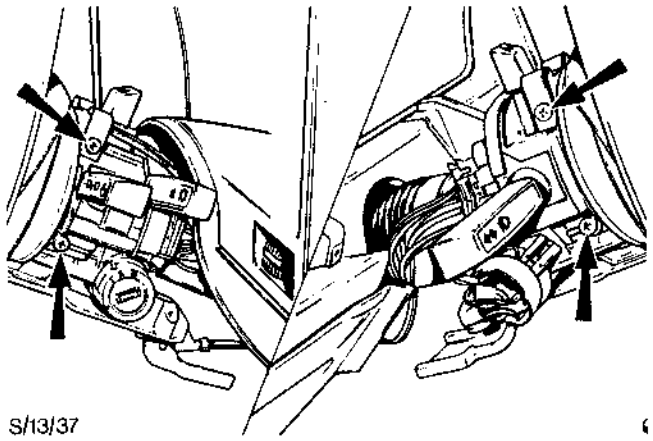
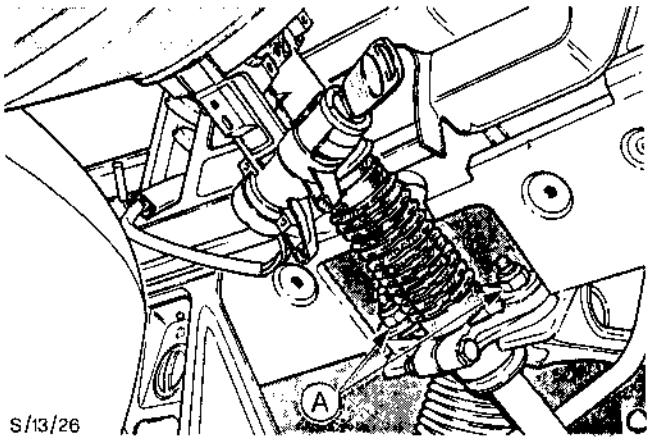
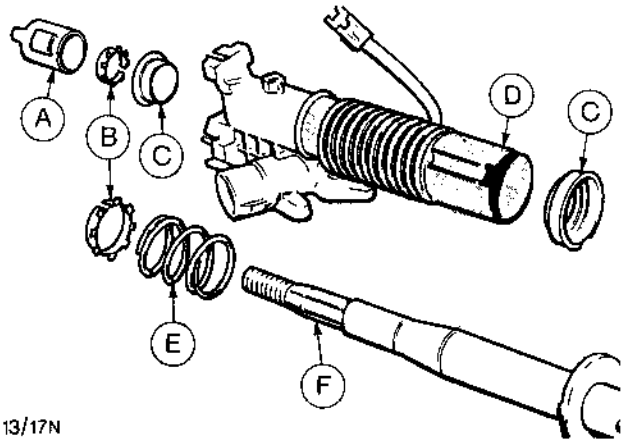

S/13/37

Fig.1. Screw fixing multi-function switches.



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Fig.2. Steering column upper mounting.
A - Adjustable flange



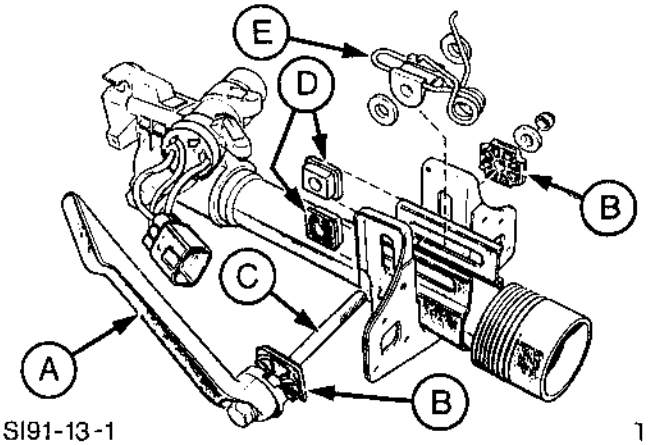
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Fig.3. Steering column tube assembly.
A - Indicator cam D - Lock and tube
B - Thrust washers E - Spring
C - Bearings F - Shaft

13 543 0

Vehicles fitted with Steering Column Adjust assembly

13. Remove lock nut and washer securing through bolt. Remove through bolt, adjuster handle, locking plates, sliders and washers, Fig.4. Unclip spring assembly.



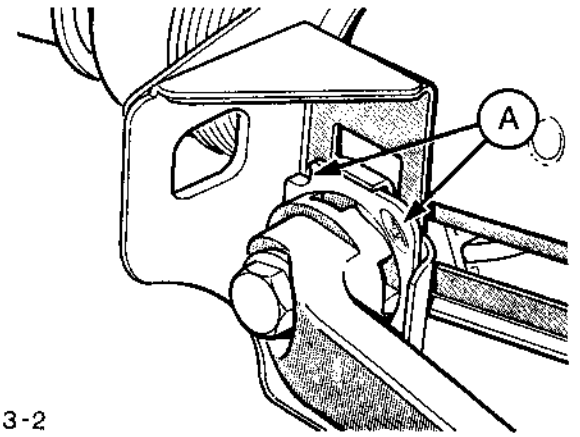
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Fig.4. Steering column adjust assembly.
A - Handle
B - Locking plates
C - Through bolt
D - Sliders
E - Spring

To Install

Vehicles fitted with Steering Column Adjust assembly

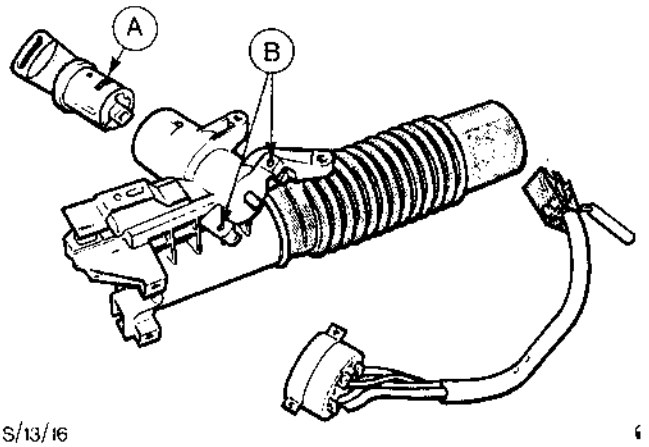
14. Refit spring to adjust assembly bracket. Align washers, sliders and locking plates, ensuring handle locking plate is fitted so that the cut out and FORD logo are as shown in Fig.5. Coat through bolt thread with locking compound (see Technical Data) and refit through bolt and adjust handle, ensuring all components are engaged. Secure through bolt with a new lock nut and washer (see Technical Data), with handle in locked position.



SI91-13-2

Fig.5. Handle locking plate.
A - Cut out and logo

15. Reassemble steering column tube, replacing upper and lower bearings. Slide spring and thrust washer onto steering shaft.



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Fig.6. Steering lock barrel and switch.
A - Lock barrel securing clip
B - Switch securing grub screws

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13 543 0

16. Holding triangular section of shaft push on nylon bush, replace bulkhead bush, push onto correct dimension of 52 mm from end of shaft, see Fig.7.

17. Slide column tube over steering shaft, replace upper bearing thrust washer and indicator cam.

18. Refit steering wheel ensuring correct location of cam, fit retaining nut and tighten to specification (see Technical Data).

NOTE: HEXAGONAL SECTION OF STEERING SHAFT AND WHEEL MUST BE FREE FROM ANY OIL OR GREASE.

19. Measure distance between weld washer on shaft and lower bearing. If spring is 'coil bound' a new shaft must be fitted. Check measurement is 12mm ± 1mm.

20. Reposition shaft and column assembly in vehicle, secure upper mountings finger tight, slacken upper mounting pinch bolt. Refit upper column shroud.

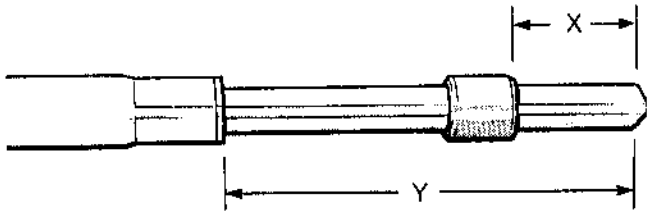
21. Adjust steering column position until a 5 mm clearance is obtained between shroud and facia panel, Fig.8. Once dimension has been obtained, tighten pinch bolt and upper mounting nuts.

22. Remove upper column shroud and reconnect multi function switches. Refit ignition switch and loom and secure two grub screws, replace ignition barrel.

23. Refit bonnet release lever, replace steering column shrouds.

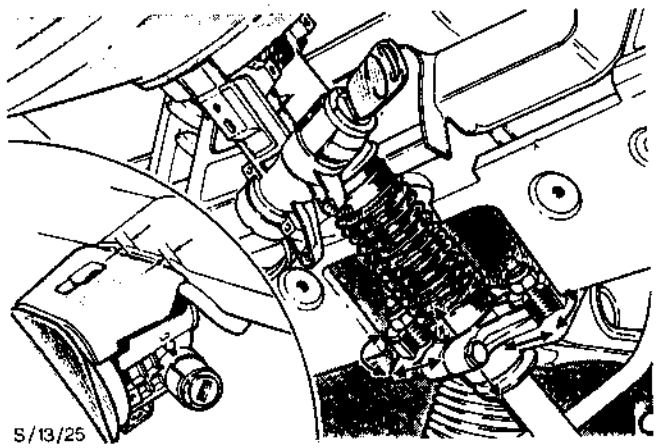
24. Refit under dash cover panel and cowl side panel. Refit lower crash pad

25. Centralise steering wheel, reconnect coupling shaft joint to steering shaft, torque bolt to specification.



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Fig.7. Lower steering shaft bush dimension.
X = 52 mm
Y = 189 ± 3 mm



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Fig.8. 5 mm clearance betwwen facia and upper shroud.

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13 566 0 FLEXIBLE COUPLING - STEERING COLUMN - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove bolt securing upper universal joint to steering shaft, swing clamp plate to one side and allow coupling shaft to hang free.

2. Remove pinch bolt and nut from lower flexible coupling, pull off coupling shaft from pinion, Fig.1.

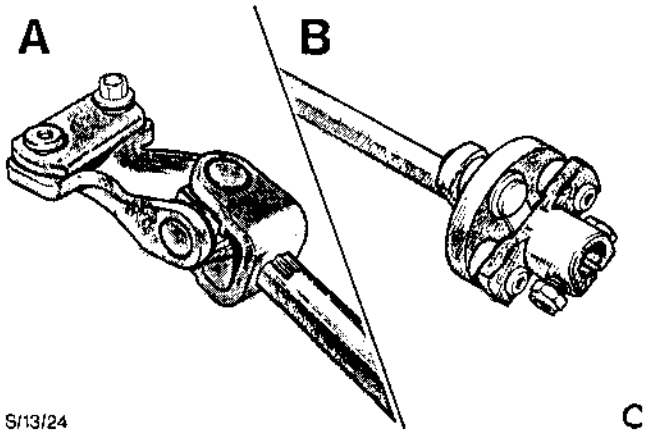


Fig.1. A - Universal joint clamp plate and bolt
B - Flexible coupling pinch bolt

To Install

3. Engage coupling shaft onto steering gear pinion shaft, ensure that block spline is correctly located. Refit pinch bolt and lock nut. Tighten to correct specification.

4. Connect upper universal joint to steering shaft, swing clamp plate and fit new lock bolt to secure, Fig.1.

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FRONT AXLE AND SUSPENSION 14A

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TECHNICAL DATA

Front axle suspension

Type	Independent McPherson strut
Lateral control	Lower arm
Longitudinal control	Stabiliser bar
Shock absorbers	Telescopic, hydraulic double-acting

Wheel alignment (unladen)

(Nominal figures quotd are with 3,0 litres of fuel in tank)

Toe Setting:

Tolerance Band

Tolerance band before setting is required: -2,5 mm (toe out) to 2,5 mm (toe in)

Setting Dimension 0,0 mm (toe in) ± 1,0 mm

	CASTOR		CAMBER	
Derivative	Nominal	Tolerance Range	Nominal	Tolerance Range
Cosworth 4x4	2°58'	4°28' to 1°58'	-1°17'	-0°17' to -2°17'
Cosworth	1°52'	3°22' to 0°52'	-0°21'	0°39' to -1°21'

Maximum permissible difference between left and right side (unladen)

Castor .. .. 1° Camber .. .. 1° 15'

Tightening torques	Nm	lbf.ft
Hub retaining nut	310 to 350	229 to 258
Lower arm ball joint nut to spindle carrier	65 to 85	48 to 63
Top mount retaining nut	40 to 52	30 to 38
Suspension strut to spindle carrier	77 to 92	57 to 68
Stabiliser bar clamp to chassis (10 mm)	57 to 70	42 to 52
Stabiliser bar clamp to chassis (12 mm)	70 to 97	52 to 72
Stabiliser bar to lower arm (compliance)	70 to 110	52 to 81
Caliper anchor bracket to spindle carrier	65 to 75	48 to 55
Engine cross member to chassis	70 to 90	52 to 66
Engine mounting to cross member nut	50 to 70	37 to 52
Lower arm pivot nut	Tighten to 45 Nm (33 lbf.ft.),then slacken off nut to zero and re-torque to 15 Nm + 90°	

NOTE: When checking the tightness of bolts that have been tightened by the torque to yield method, the nut or bolt must not be subjected to further rotation as this could result in the nut or bolt failing. The bolt must be backed off (slackened) to zero torque and then re-torqued as detailed below.

Procedure for tightening torque to yield bolts during repair operations:

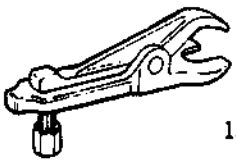
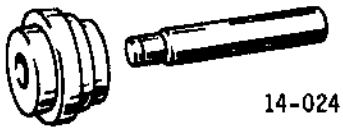
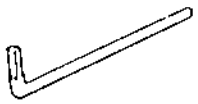
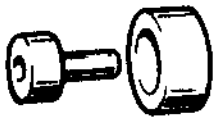
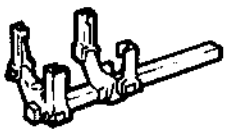
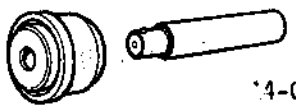
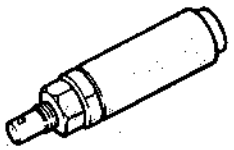
- Tighten to the specified clamping torque.
- Back off to zero torque.
- Re-tighten to the "snug" torque, then tighten through the specified angle of rotation.

Lubricant

Front wheel bearings	Grease conforming to Ford Specification SAM-1C-9111-A

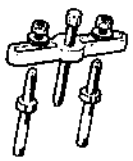
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SPECIAL SERVICE TOOL RECOGNITION

Tool	Tool Name
 13-006	Ball joint separator
 14-024	Bearing cup and grease retainer installer
 14-026	Spindle carrier lever
 14-027	Bush remover/installer
 21-051	Seal extractor
 MS-1516	Front spring compressor
 14-029	Installer, bearing cup and seal
 14-037	Installer, hub flange
 14-037-01	Threaded spindle, left-hand thread

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SPECIAL SERVICE TOOL RECOGNITION (Cont'd)

Tool	Tool Name
 15-069	Separator
 GV-1506	Puller assembly

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SERVICE AND REPAIR OPERATIONS

14 111 0 FRONT WHEEL ALIGNMENT - CHECK

This operation should be carried out in accordance to the particular wheel alignment gauges used (Dunlop-Optiflex etc.).

For steering geometry (castor/camber and toe angle) specification, see Technical Data.

Before carrying out any steering geometry check, the following checks must be made.

- Examine suspension and steering components to ensure there are no signs of damage or wear
- Check and if necessary adjust tyre pressures to specification
- Ensure vehicle is at kerb weight. Spare wheel, jack and wheel brace should be stowed in their designated position but any additional tools or goods should be removed from vehicle
- Bounce vehicle body to ensure suspension is in its natural position

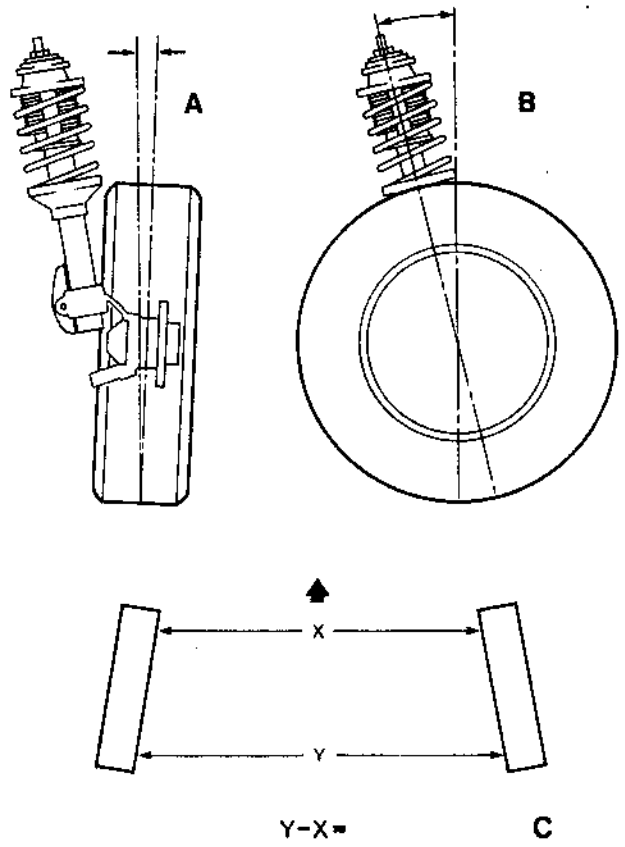


Fig.1. Suspension steering geometry alignment.
A - Camber B - Castor
C - Toe setting

14 117 0 TOE-IN - CHECK AND ADJUST

SPECIAL SERVICE TOOLS REQUIRED: NONE

1. Slacken track rod end locknuts and outer ends of bellow retaining clips, Fig.2.
2. Using suitable toe-in gauge, measure toe setting and if necessary adjust by rotating the track rods by equal amounts inwards or outwards.

NOTE: Track rods must be adjusted in equal amounts, otherwise steering wheel will be misaligned. (Refer to Section 13 Steering wheel alignment).

3. Replace snapper or screw type clips to bellows, tighten track rod locknuts.

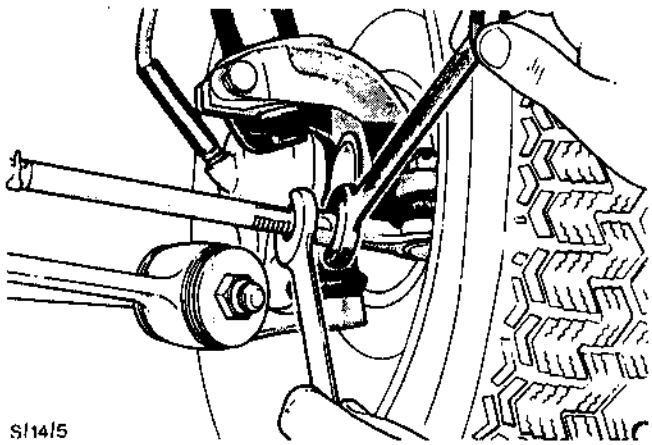


Fig.2. Track rod end and locknut.

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14 234 0 FRONT CROSSMEMBER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator 13-006

To Remove

1. Support engine on jack, remove engine mounting nuts, jack up engine to relieve compression on engine mountings, Fig.1.
2. Remove steering gear as detailed in Section 13 of this Publication.
3. Remove locknut, washer and pivot bolts from lower arm, pull arms away from crossmember.
4. Disconnect brake pipes from crossmember retaining clips.
5. Remove four bolts securing crossmember to vehicle and remove from vehicle.

To Install

6. Position front crossmember into vehicle and secure, tighten bolts to specified torque.
7. Locate lower arms in crossmember, refit bolts, washers and locknuts. DO NOT TIGHTEN AT THIS STAGE.

NOTE: If locknuts are tightened at this stage inner bush wind up can occur. Lower arms must be horizontal before tightening locknuts.

8. Refit steering gear assembly as described in Operation 13 116 0 of this Publication.
9. Resecure brake pipes to crossmember.
10. Lower engine onto crossmember, refit mounting nuts and tighten to specification, (see Technical Data), Fig.1. Ensure engine mounting brackets are correctly seated on locating pegs of mountings.

NOTE: Do not tighten beyond the specified torque otherwise damage to mounting will occur.

11. Lower vehicle to ground and tighten lower arm inner locknuts to specification.
12. Check and adjust steering toe alignment (see Technical Data).

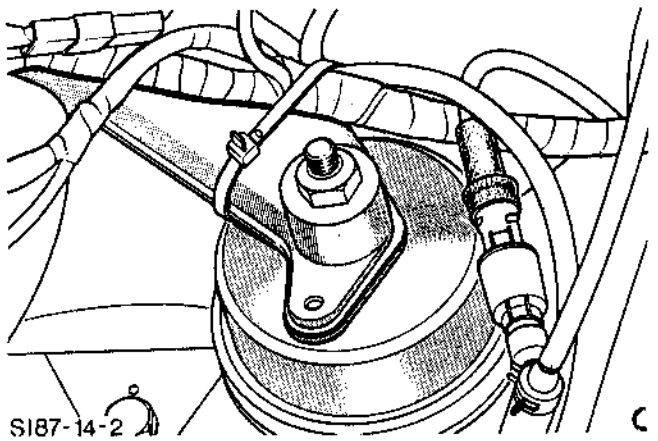


Fig.1. Engine mounting securing locknut.

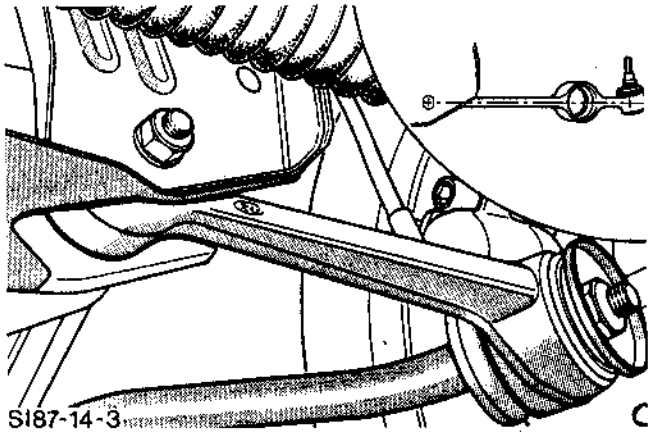


Fig.2. Lower arm fixing to front crossmember. Ensure centre of ball joint is in line with centre of fixing bolt.

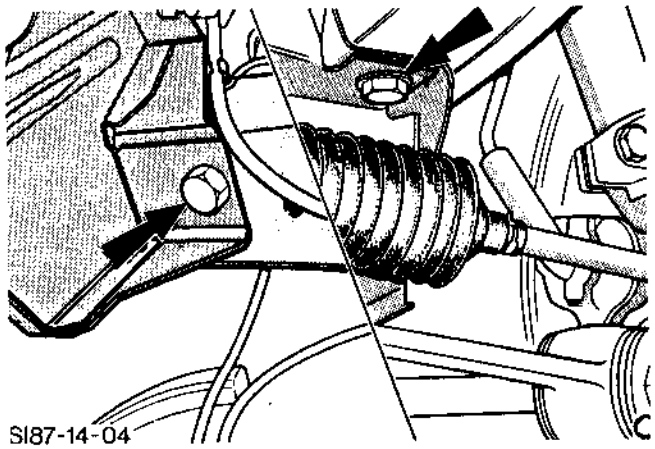


Fig.3. Front crossmember to chassis bolts.

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14 343 0 SPINDLE CARRIER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator	.. ..	13-006
Spindle carrier lever	.. ..	14-026

To Remove

1. Slacken front road wheel nuts, jack-up vehicle and fit chassis stands.

2. Remove road wheel.

3. Remove split pin and castellated nut securing steering tie rod end to spindle carrier. Using Special Service Tool 13-006, release ball joint taper.

NOTE: Care should be taken when using Special Service Tool 13-006 not to damage ball joint gaiters.

4. Slacken lock nut securing brake pipe flexible hose to suspension strut.

5. Remove bolts securing caliper to spindle carrier. Suspend caliper clear of spindle carrier to prevent strain on flexible hose.

6. Remove pinch bolt from knuckle lower ball joint connection, lever down lower arm and disconnect lower arm ball joint from spindle carrier.

7. Disconnect anti-lock wheel sensor from spindle carrier.

8. Remove spring clip securing disc to hub, remove disc.

9. Remove pinch bolt securing spindle carrier to suspension strut. Using Special Service Tool 14-026, insert into knuckle slot, and rotate through 90°. Slide spindle carrier and hub assembly off suspension unit.

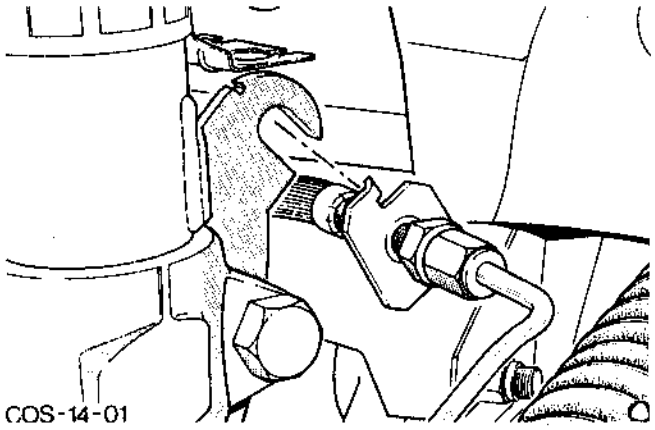


Fig.1. Brake pipe flexible hose securing clip.

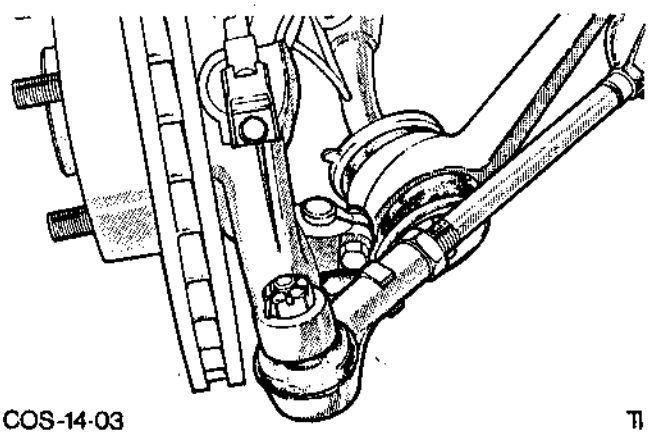


Fig.2. Lower arm to knuckle pinch bolt.

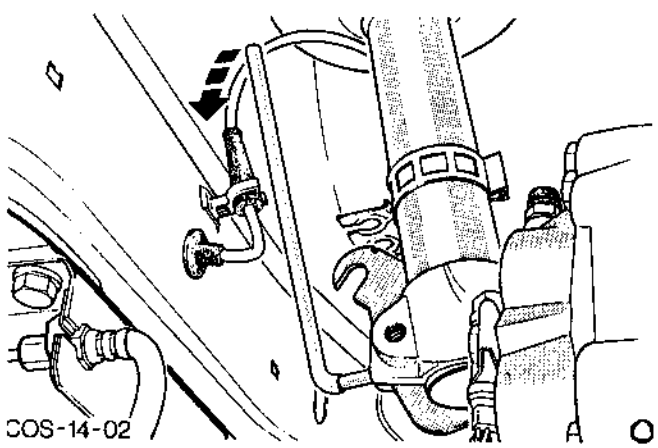


Fig.3. Release suspension strut from knuckle assembly.

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14 343 0

To Install

10. Slide spindle carrier onto suspension unit, align bolt hole and loosely fit a new pinch bolt. Remove Special Service Tool 14-026. Fully tighten pinch bolt to specification.

11. Lever down lower arm and align ball joint stud into spindle carrier. Fit new pinch bolt and tighten to specification.

12. Reconnect tie rod end to steering arm, refit castellated nut and tighten to specification. Fit new split pin.

13. Refit disc to hub and refit clips.

14. Remove caliper support and attach caliper to spindle carrier and secure. Tighten bolts to specification.

15. Reconnect flexible brake hose to suspension unit bracket.

16. Refit anti-lock wheel sensor, tighten bolt to specification.

NOTE: Coat wheel sensor with grease and ensure 'O' ring is in good condition.

17. Refit road wheel. Lower vehicle to ground and fully tighten road wheel.

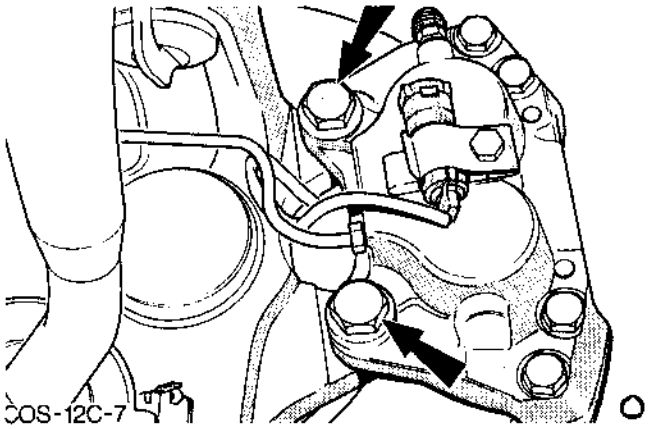


Fig.4. Caliper retaining bolts.

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14 411 0 WHEEL BEARINGS - FRONT INNER AND OUTER - REPLACE (SPINDLE CARRIER ASSEMBLY REMOVED) (Non interference fit wheel bearings)

SPECIAL SERVICE TOOLS REQUIRED:

Wheel bearing and seal installer	14-024
Seal extractor	21-051

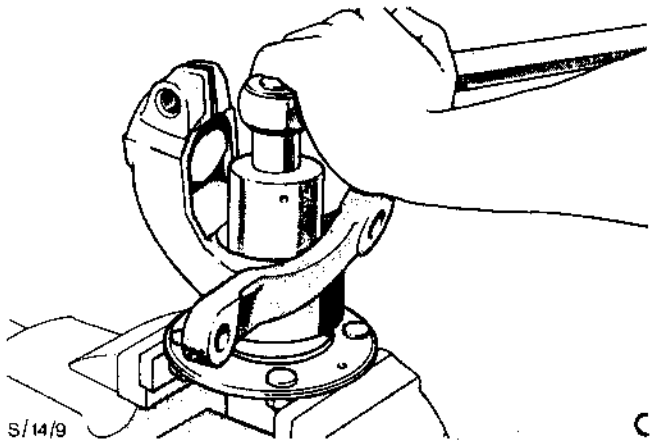


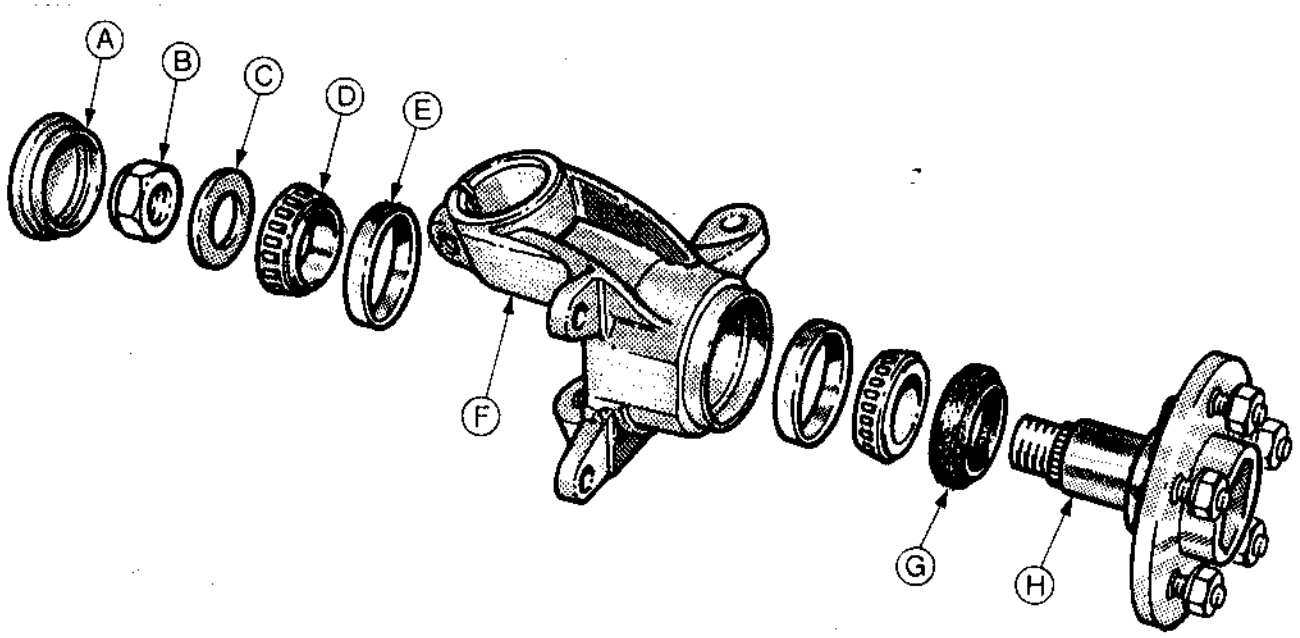
Fig.1. Mount spindle carrier in vice.

To Remove

1. Remove spindle carrier as described in Operation 14 343 0 of this Section.
2. Reverse wheel nuts and replace wheel nuts onto studs. Ensure nuts are wound on fully to avoid damage to wheel studs. Mount spindle carrier in vice. DO NOT OVERTIGHTEN VICE, Fig.1.
3. Lever out plug from spindle carrier. Remove hub retaining nut and splined washer, lift off spindle carrier. Remove taper bearing.

NOTE: The hub retaining nut with the blue nylon insert has a right hand thread, and the hub retaining nut with the yellow nylon inset has a left hand thread.

4. Remove grease seal using Service Tool 21-051 and lift out inner bearing.
5. Carefully drift out bearing cups using flat ended punch (brass or similiar material). Ensure punch is in good condition and take care not to raise burrs on bearing cup seats as this may prevent new bearing cups from seating correctly (affecting bearing preload).
6. Clean spindle carrier, removing all old grease.



S-14-11

Fig.2. Spindle carrier assembly.

A - Cap	D - Taper bearing	G - Seal
B - Locknut	E - Cup	H - Flange shaft
C - Splined washer	F - Spindle carrier	

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14 411 0

To Install

NOTE: The bearings fitted are of tapered roller design and run in matched cups. The bearing cups, hub and spindle carrier are all machined to very close tolerances enabling the bearings to be self-setting on assembly. They require NO subsequent adjustment.

7. Support spindle carrier on block of wood and using Service Tool 14-024 drive in new bearing cups. Ensure that bearing cups are correctly seated by turning spindle carrier over and viewing cup seat from rear, Fig.3.

8. Repeat operation 7 for remaining bearing cup.

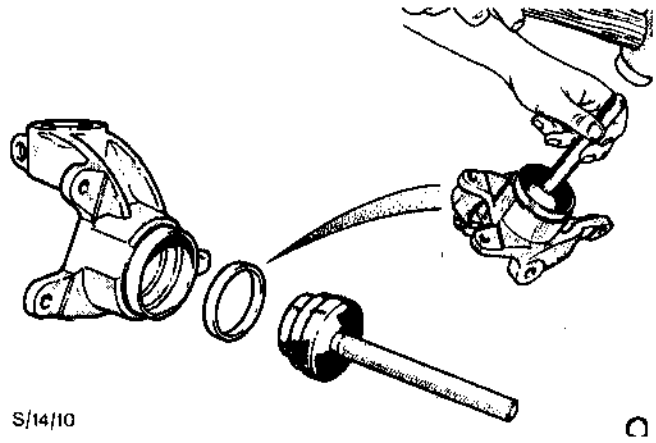


Fig.3. Refit bearing cup using Special Service Tool 14-024.

9. Pack new bearing with suitable grease ensuring that all cavities between rollers are filled. Use high melting point lithium grease to Ford specification SAM1C-9111-A

NOTE: Do not pack space between bearing assemblies. Over filling hubs will result in leakage from grease retainer.

10. Insert bearing to outer side of spindle carrier and fit grease retainer, Fig.4.

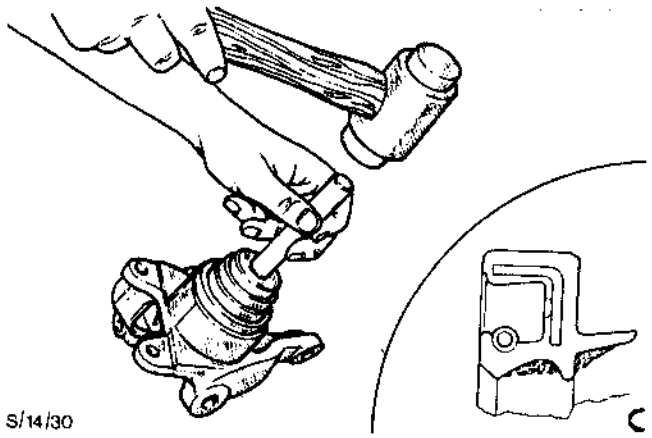


Fig.4. Refit grease retainer using Service Tool 14-024. A fillet of grease will prevent rapid seal wear.

NOTE: Before fitting a new grease retainer, a fillet of grease must be applied in the cavities between the sealing lips, to act as a lubricant reservoir for the lips, Fig.4. This will substantially reduce lip wear rate.

11. Reposition spindle carrier over flange shaft, fit inner taper bearing, locate splined flat washer onto shaft, fit locknut and torque to correct specification. Refit grease retainer plug

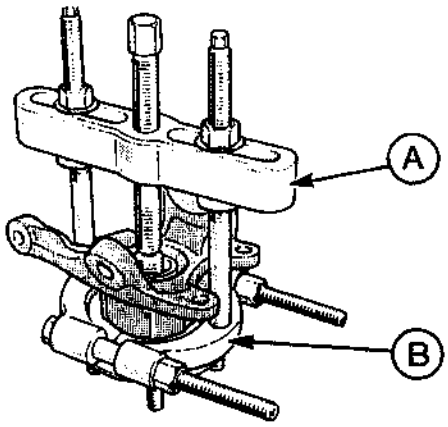
12. Remove spindle carrier from vice, remove wheel nuts and fit spindle carrier to vehicle as described in Operation 14 343 0.

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14 111 4 WHEEL BEARING - FRONT INNER AND OUTER - REPLACE (SPINDLE CARRIER ASSEMBLY REMOVED) (Interference fit wheel bearings)

SPECIAL SERVICE TOOLS REQUIRED:

Installer, bearing cup and seal ..	14-029
Installer, hub flange	14-037
Threaded spindle, left-hand thread	14-037-01
Separator	15-069
Puller assembly	GV-1506



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Fig.1. Remove spindle carrier from hub spindle assembly.
A - GV-1506 bearing puller
B - 15-069 separator

To Dismantle

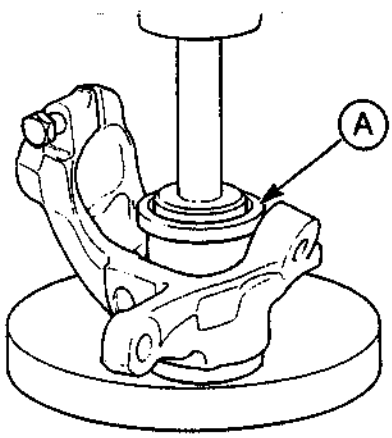
1. Screw wheel nuts fully onto wheel studs.
2. Mount spindle carrier in vice across wheel studs, tighten vice sufficient to secure, do not overtighten vice.
3. Remove protective cap covering the hub retaining nut.
4. Remove hub retaining nut and toothed rotor.

NOTE: Hub retaining nuts are handed left and right hand threads.

5. Using Special Service Tools 15-069 and GV-1506 draw spindle carrier and inner bearing off hub spindle, Fig.1, leaving outer bearing and seal still attached to the hub spindle.
6. Reposition Special Service Tool 15-069 and GV-1506 to draw outer bearing off hub spindle.

NOTE: Damage to the bearing will result.

7. Remove grease seal. Discard both bearings, grease seal and hub retaining lock nut.
8. Carefully remove bering outer tracks from spindle carrier using a soft brass drift.
9. Clean all parts and inspect for damage in spindle carrier housing.

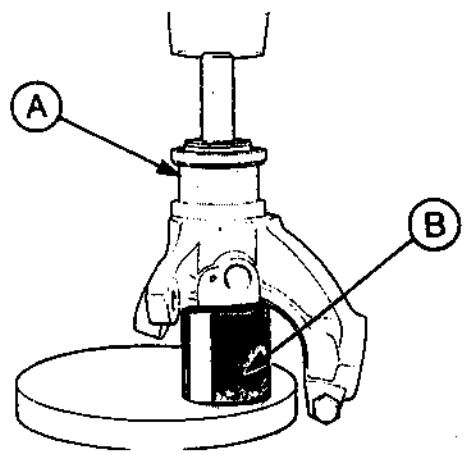


TS/9/88 d

Fig.2. Fit inner bearing track.
A - Special Service Tool 14-029

To Assemble

10. Using Special Service Tool 14-029, fit new outer bearing track into spindle carrier housing. Use a press to ensure correct fitment (see Fig.2). Reverse spindle carrier and check that bearing track has seated correctly.
11. Mount spindle carrier onto a suitable tube and press in outer bearing track using Special Service Tool 14-029 and a press. Once fitted, remove Special Service Tool 14-029 and check correct installation of bearing track onto spindle carrier seat, Fig.3.



TS/9/87 d

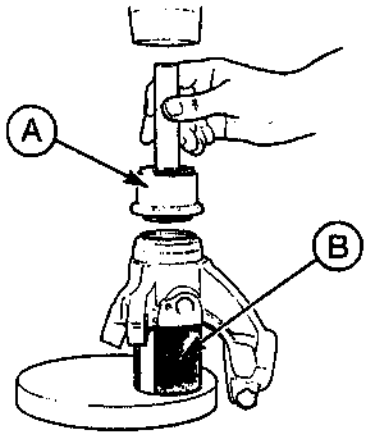
Fig.3. Fit outer bearing track.
A - Special Service Tool 14-029
B - Suitable tube support

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12. Coat new bearing track with specified grease and locate into knuckle.

13. Locate new seal into Special Service Tool 14-029 and press seal into knuckle, Fig.4.

NOTE: In the following operation it will be necessary to use 14-037-01 for hub spindles with left hand thread.

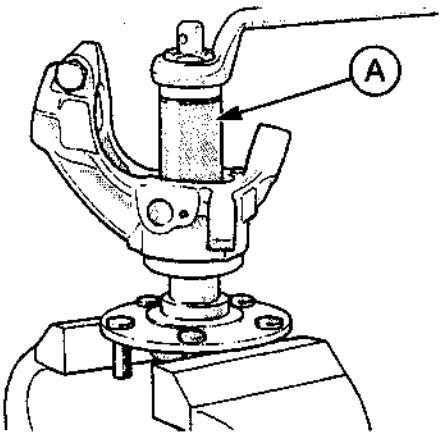


TS/9/91 d

Fig.4. Fit new grease seal.
A - Special Service Tool 14-029
B - Suitable tube spacer

14. Position hub spindle in spindle carrier. Assemble Special Service Tool 14-037 to hub spindle and pull hub spindle through spindle carrier assembly, Fig.5.

NOTE: Rotate spindle carrier during this operation to ensure correct bearing installation.



TS/9/89 c

Fig.5. Pull hub spindle through spindle carrier using Special Servfce Tool.
A - Special Service Tool 14-037

15. Remove Special Service Tool and fit inner bearing over hub spindle, reassemble Special Service Tool 14-037 and press bearing onto hub spindle, Fig.6. Rotate spindle carrier whilst fitting bearing. Tighten nut fully to ensure bearing is correctly located onto hub spindle.

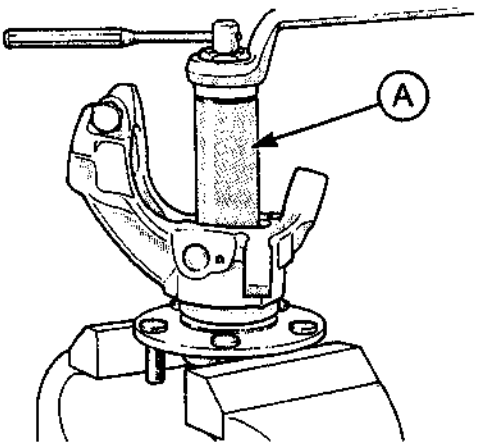
16. Refit toothed washer and fit new locknut.

17. Tighten lock nut to specified torque (390 to 450 Nm).

NOTE: Whilst tightening locknut, rotate spindle carrier to ensure bearings are correctly seated and loaded.

18. Remove torque wrench and socket. Rotate spindle carrier 20 times to settle the bearings. Recheck hub retaining nu torque.

19. Refit protective cap and remove hub/spindle carrier from vice.



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Fig.6. Press inner bearing onto hub spindle.
A - Special Service Tool 14-037

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14 707 0 ARM ASSEMBLY - LOWER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Front suspension bush installer .. 14-027

To Remove

1. Raise vehicle on ramp (DO NOT jack up at this stage).

2. Remove lower arm to crossmember inner pivot bolt.

3. Remove stabiliser bar to lower arm retaining nut and dished washer with plastic cover.

4. Jack up vehicle and fit chassis stands to support vehicle.

5. Remove split pin and castellated nut from lower arm ball joint. Release taper from spindle carrier. Remove lower arm from vehicle.

6. Using thin edged chisel, carefully remove compliance bushes.

7. Assemble bush remover Special Service Tool 14-027 and suitable tube in vice with lower arm. Push out inner pivot bush into tube.

To Install

8. Lubricate new lower arm inner pivot bush with suitable soap or glycerine to ease assembly. Assemble new inner pivot bush, lower arm and bush installer Special Service Tool 14-027 in vice, push bush into position.

NOTE: It is important that the vice is wound in quickly with a continuous action so that the bush deforms for a short time only.

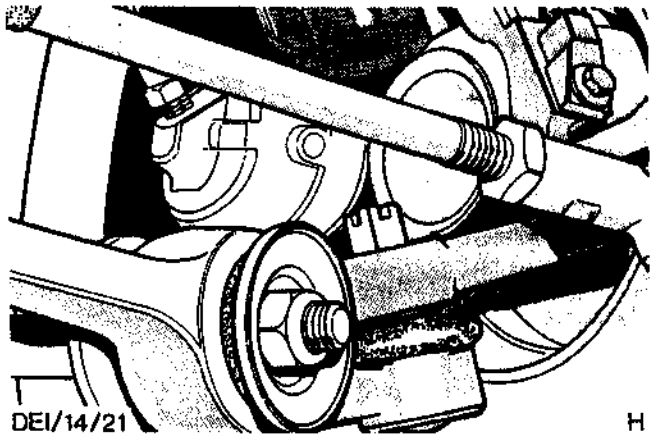


Fig.1. Remove stabiliser bar lower arm retaining nuts and washers.

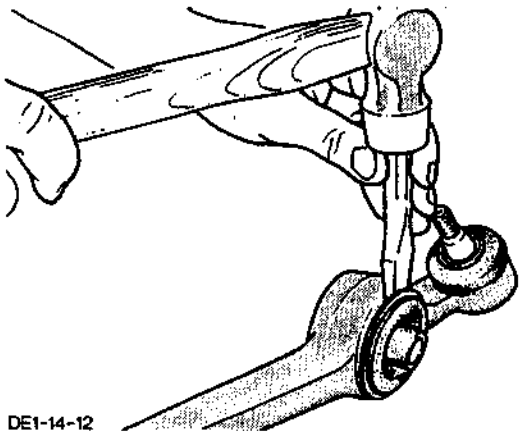


Fig.2. Remove compliance bush from lower arm using a thin edged chisel.

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14 707 0

9. Using suitable large socket or tube (with thick wall), carefully tap compliance bush into lower arm.

NOTE: Ensure that the outer lip of compliance bush is not distorted when refitting into lower arm, and no gap exists between lip of bush and lower arm.

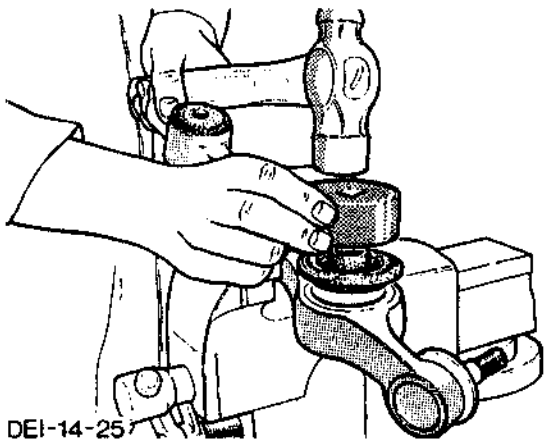


Fig.3. Refit compliance bush to lower arm.

10. Ensure that the correct compliance dished washer is fitted to inner face (shallow washer) and plastic cover washer is fitted. Slide lower arm over stabiliser bar. Fit forward deep dished washer, cover and securing nut. DO NOT TIGHTEN AT THIS STAGE.

NOTE: Dished washers fitted to the compliance bushes are colour coded. The shallow dished washer is green in colour and fitted to the rear of the lower arm compliance bush. The forward dished washer is deeper in profile and is black in colour.

11. Locate lower arm ball joint taper into spindle carrier, refit castellated nut and tighten. Fit new split pin.

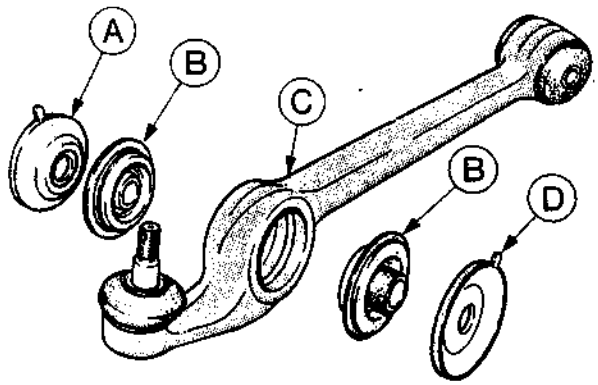


Fig.4. Lower arm assembly.
A - Deep dished washer and cover
B - Compliance bush
C - Lower arm
D - Shallow dished washer and cover

12. Remove chassis stands. Locate inner pivot bush into jaw of front crossmember. Push outer rim of road wheel to align inner pivot of lower arm with crossmember. Refit pivot bolt, washer and nut. DO NOT FULLY TIGHTEN AT THIS STAGE.

13. Lower vehicle to ground. Bounce vehicle to settle suspension. Fully tighten lower arm inner pivot bolt and compliance fixing nut to correct specification.

NOTE: Compliance bushes are designed with a low stiffness to permit significant fore and aft wheel movement.

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14 752 0 STABILISER BAR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove four bolts securing 'U' clamps to body.
2. Remove stabiliser bar to lower arm securing nuts, remove washers and covers.
3. Detach one lower arm inner pivot bolt, nut and washer. Pull out lower arm from crossmember.
4. Pull stabiliser bar out of lower arm fixing. Remove rear washers and covers.
5. Remove insulators from stabiliser bar.

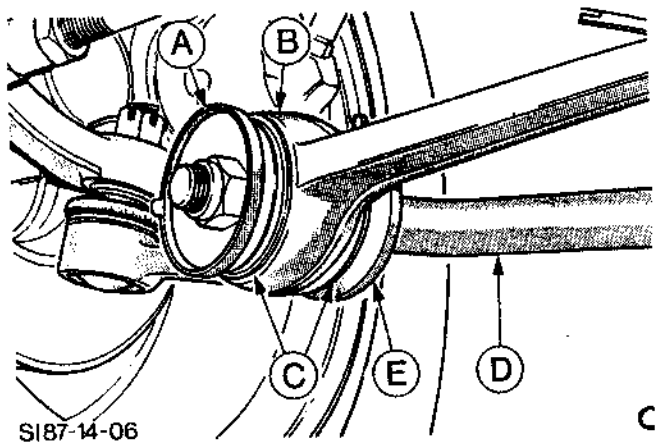


Fig.1. Stabiliser to lower arm fixing.
A - Front washer
B - Lower arm
C - Compliance bush
D - Stabiliser bar
E - Rear cup washer

To Install

NOTE: Dished washers fitted to the compliance bushes are colour coded. The shallow dished washer is green in colour and fitted to the rear of the lower arm compliance bush. The forward dished washer is deeper in profile and is black in colour.

6. Refit insulators to stabiliser bar.
7. Refit rear dished washers and covers to stabiliser bar. Reposition stabiliser bar into lower arms, refit forward washers and covers. Secure with new locknuts, DO NOT FULLY TIGHTEN AT THIS STAGE.

NOTE: Ensure washers are fitted with dished side away from bush.

8. Reconnect lower arm to crossmember and secure with bolt, washer and lock nut. DO NOT FULLY TIGHTEN AT THIS STAGE.
9. Secure stabiliser bar to body mountings, DO NOT FULLY TIGHTEN AT THIS STAGE.
10. Lower vehicle to ground, bounce vehicle to settle suspension. Tighten stabiliser/lower arm lock nut, lower arm to engine crossmember nut and stabiliser bar to body mounting bolts.

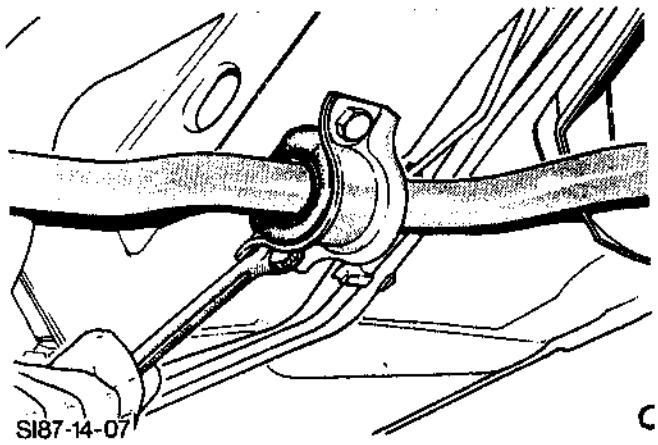


Fig.2. Stabiliser bar mounting to chassis.

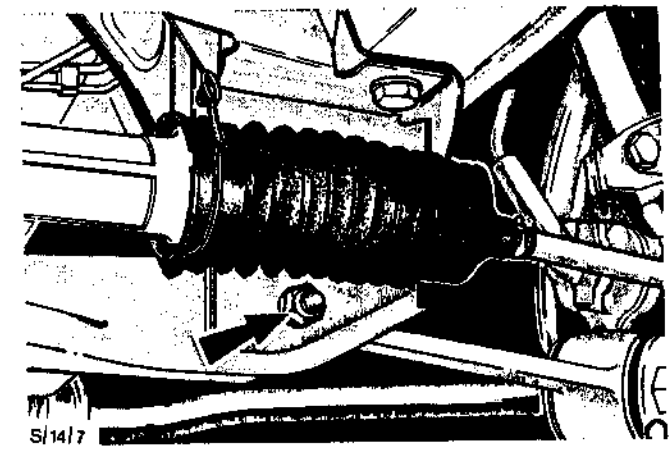


Fig.3. Lower arm pivot bolt.

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14 759 0 BUSHES - STABILISER BAR TO LOWER ARM - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: If difficulty is experienced when removing the compliance bushes, refer to Operation 14 707 0 of this section.

To Remove

1. Remove stabiliser bar to lower arm compliance bush locknuts.
2. Remove dished washer and plastic cover.
3. Using small thin chisel, carefully remove forward compliance bush.
4. Remove lower arm to crossmember pivot bolt. Lever lower arm from crossmember fixing. Swing lower arm inner end forward free from stabiliser bar. Remove rear dished washer and cover from stabiliser bar.
5. Using small thin chisel, remove rear compliance bush.

To Install

NOTE: Dished washers fitted to the compliance bushes are colour coded. The shallow dished washer is green in colour and fitted to the rear of the lower arm compliance bush. The forward dished washer is deeper in profile and is black in colour.

6. Using suitable socket or tube carefully fit rear compliance bush into lower arm.
7. Locate shallow dished washer (green colour code) and cover over stabiliser bar.
8. Swing lower arm rearwards and locate compliance bush over stabiliser bar and inner pivot bush into crossmember. Refit bolt, washer and locknut to inner pivot bush. DO NOT FULLY TIGHTEN.
9. Using suitable socket or tube, carefully fit forward compliance bush into lower arm.
10. Refit plastic cover and deep dished washer (black colour code) over stabiliser bar. Refit locknut, DO NOT fully tighten.
11. Lower vehicle to ground. Bounce vehicle to settle suspension. Fully tighten lower arm inner pivot bolt and stabiliser bar compliance bush to correct specification.

NOTE: Compliance bushes are designed with a low stiffness to permit significant fore and aft wheel movement.

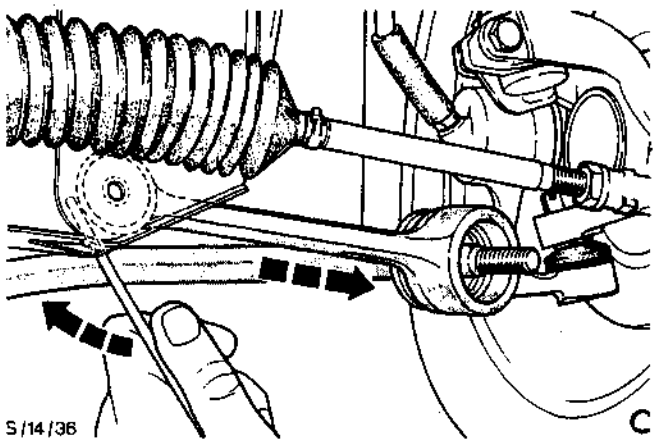


Fig.1. Pivot lower arm away from crossmember.

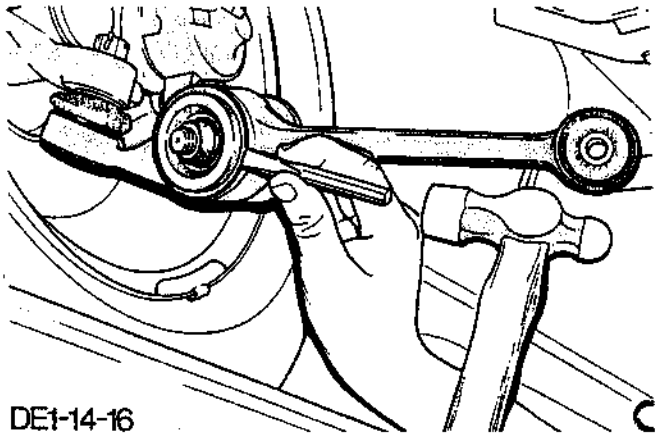


Fig.2. Remove compliance bush from lower arm.

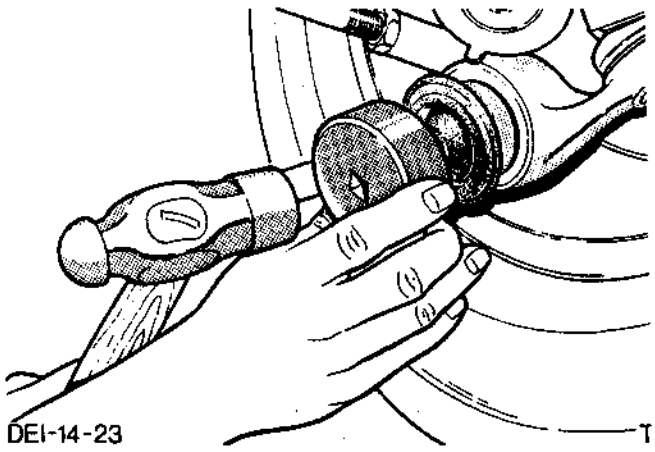


Fig.3. Refit compliance bushes to lower arm.

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14 781 0 SUSPENSION UNIT - FRONT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Spindle carrier lever	.. ..	14-026
Front spring compressor	.. ..	MS-1516

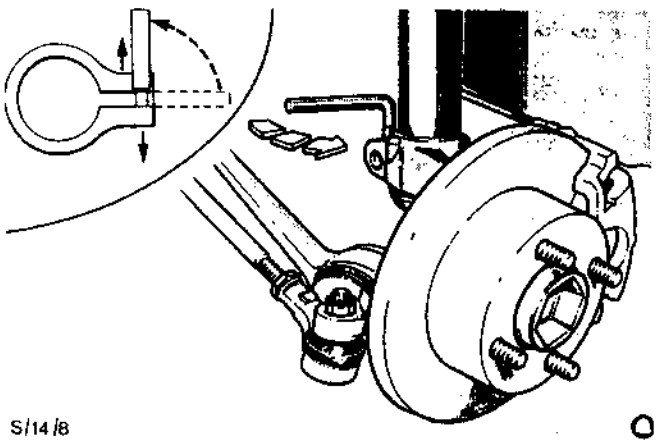


Fig.1. Release spindle carrier from strut using Special Service Tool 14-026.

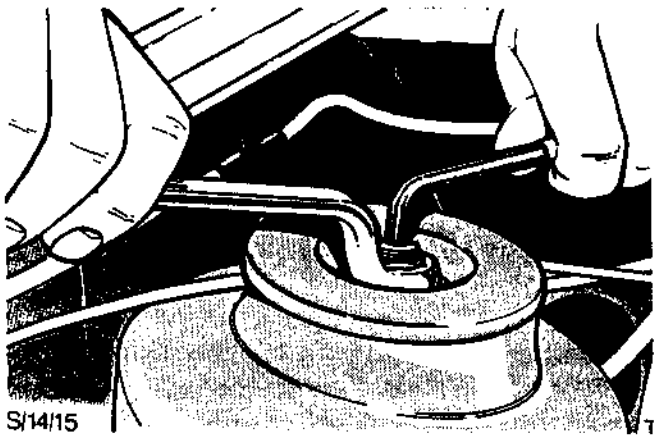


Fig.2. The 6mm hexagonal key to hold strut on removal and installation of top mount nut.

To Remove

1. Slacken wheel nuts, jack up vehicle and fit chassis stands.

2. Remove front road wheels. Open hood and fit fender covers.

3. Remove bolt securing suspension strut to spindle carrier.

4. Remove anti-lock wheel sensor from spindle carrier and detach wire from suspension strut clip, (if fitted).

5. Insert Special Service Tool 14-026 into slot of spindle carrier and rotate through 90°.

6. Using suitable lever, push down spindle carrier and lower arm until suspension strut is seperated from spindle carrier.

NOTE: When releasing spindle carrier from suspension strut, care must be taken not to damage the brake flexible hose.

7. Remove cap from top of strut, using a 6 mm hexagon key in end of strut to prevent strut piston rod from turning, remove top mount retaining locknut and cup washer.

8. Remove suspension strut assembly from vehicle.

9. Mount suspension strut in vice, do not overtighten otherwise damage to strut assembly may occur.

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10. Using Special Service Tool MS-1516 carefully compress spring until spring is clear of spring seats.

11. Remove plain nut and lower cup, slide off thrust bearing and remove upper spring seat, gaiter and spring.

12. Slide bump stop off piston rod.

To Install

13. Clean spring seats and spring tail ends ensuring they are clean and free from rust/dirt etc.

14. Refit bump stop over suspension strut piston shaft and plastic gaiter. Ensure gaiter is fitted over bump stop.

15. Locate compressed spring over suspension strut. Refit upper spring seat, thrust bearing and lower cup.

16. Fit plain nut and tighten.

17. Carefully release spring tension ensuring spring tails and bearing locate correctly in shaped portions of spring seats.

18. Remove suspension strut assembly from vice, locate into vehicle through upper mount insulator. Refit cup washer and locknut.

19. Lever down lower arm and locate strut into spindle carrier. Remove Special Service Tool 14-026. Refit spindle body bolt and fully tighten.

20. Tighten suspension strut piston upper locknut. Prevent piston shaft from turning during tightening operation by using a 6 mm hexagonal key.

21. Refit anti-lock wheel sensor, (if fitted).

22. Refit road wheels, and fully tighten.

23. Remove fender covers and lower vehicle.

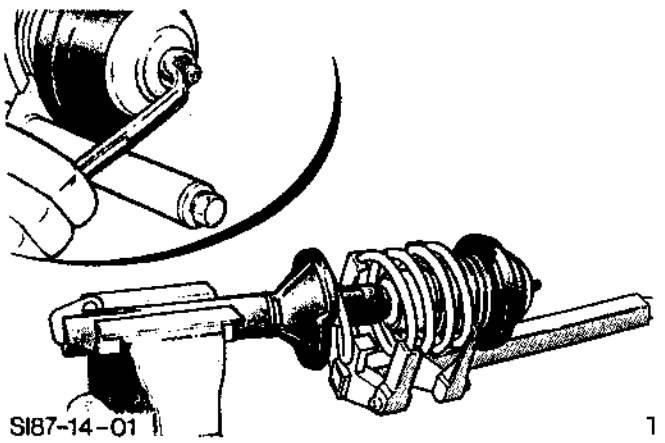


Fig.3. Clamp suspension leg in vice, using soft jaw protectors. Compress spring using MS-1516, remove plian nut securing insulating cup and bearing.

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14 785 0 TOP MOUNT - FRONT SUSPENSION UNIT - REPLACE - (ONE SIDE)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove cap from top of strut, using 6 mm hexagonal key to prevent piston rod from turning, remove top mount locknut and cup washer.

2. Carefully lever down suspension leg, care must be taken not to damage brake flexible hose or anti-lock wheel sensor if fitted.

3. Remove top mounting insulator rubber.

Fig.1. Top mount insulator assembly.
A - Cap
B - Cup washer
C - Insulator
D - Lower cup
E - Spring seat
F - Bump stop
G - Bearing
H - Gaiter
J - Plain nut
K - Locknut

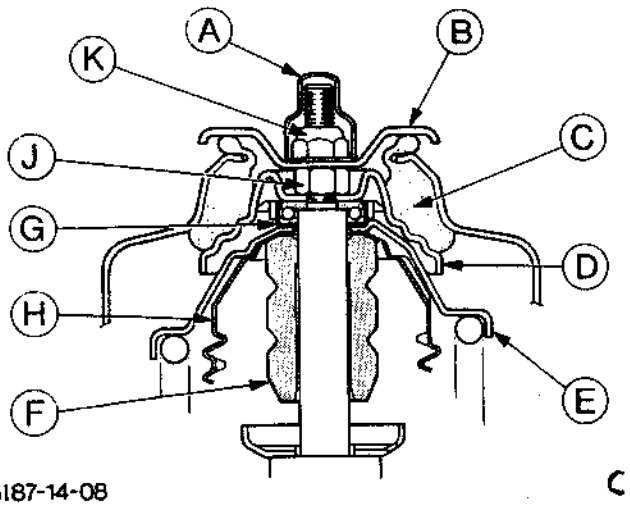


Fig.1. Top mount insulator assembly.

To Install

4. Refit insulator into inner fender panel, ensure correct location.

5. Refit top mount cup washer and secure with new locknut. Prevent piston from rotating during tightening by using 6 mm hexagonal key.

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FRONT AXLE, SUSPENSION AND DRIVESHAFTS (MT-75/4x4) 14B

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Front Wheel Alignment (vehicle unladen with 3 litres of fuel in tank)

Toe setting

Tolerance	1,0 mm (toe out) to 1,0 mm (toe in)
Setting	0,0 mm ± 1,0 mm

	Nominal	Tolerance range
Castor angle	3° 42'	2° 42' to 5° 12'
Maximum permissible difference between left and right hand sides		1° 0'
Camber angle	-1° 38'	-0° 38' to -2° 38'
Maximum permissible difference between left and right hand sides		1° 15'

Front Differential Assembly - Oils, Lubricants, Sealers, Thread Locking Paint

• SAE-90 hypoid oil	Ford Specification	SQM-2C9002-A
• Fill capacity - SAE-90 oil		1,0 litre
• Bearing housing grease	Ford Specification	ESEAM 1C1014A
• Intermediate shaft bearing grease	Ford Specification	S-M1C 4515-A
• Front differential housing sealer	Ford Specification	SAM-1C 9111-A
• Thread locking compound for drive flange nut		Loctite 242

Front Differential Assembly - Tightening Torques

	Nm
Front differential housing cover	9 to 11
Oil filler plug	35 to 45
Crown wheel to differential housing	78,5 to 85,6
Drive pinion bearing nut	Minimum 120
Drive pinion turning torque when adjusting with Special Tool 15-041	2,45 to 2,75*

* Aim for lower torque value when re-using old bearings

	Nm
Drive pinion flange nut	100 to 120
Locking plate bearing housing - right hand side	23 to 27
Locking plate bearing housing - left hand side	23 to 27

Front Differential Assembly - Adjustment

Backlash - crown wheel and pinion	Nominal overall mm	0,10 to 0,17
Empirical value for crown wheel run out (Measured at 3 points) per set of gears must not exceed	mm	0,05
Differential bearing pre-load	Teeth	4 to 5
Width of collapsible spacer	mm	11,5 to 11,7

Oils

Power steering	Ford Specification	SQM-2C9010-A
Engine oil	Ford Specification	Mobil 1 or synthetic oil to specification API SG/CD only
Fill capacity	Excl. filter	3,7 litres
	Incl. filter	4,2 litres

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Tightening Torques	Nm
Front differential assembly to sump mounting	40 to 48
Front differential assembly mounting bracket to cylinder block	19 to 21
Driveshaft to front differential assembly drive flange	30 to 40
Speedometer drive housing cover to sump	19 to 21
Speedometer drive cable union nut	6 to 9
Front differential assembly cover	9 to 11
Lower suspension arm ball joint to spindle carrier	70 to 90
Lower suspension arm to front axle/engine crossmember	51 to 64
Stabiliser bar mounting bracket to side member	70 to 90
Castellated nut of track rod end to drop arm	57 to 68
Spindle carrier to suspension strut assembly	80 to 90
Oil filler/level check plug	35 to 45
Lower engine cover to side members and front axle/engine crossmember	18 to 22
Wheel bolts	100
Nuts - engine mounting to engine mounting bracket	70 to 90
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10
Steering gear to front axle/engine crossmember	35 to 45
Retaining bolts of engine lifting eyes	19 to 21
Turbocharger heat shield to fender/bulkhead brackets	9 to 11
Pressure pipe from steering gear to power steering pump	26 to 31
Brake caliper to spindle carrier	50 to 60

TECHNICAL DATA (cont'd) — Front Axle, Suspension and Driveshafts

Tightening Torques (cont'd)

	Nm
Suspension	
Hub retaining nut (thread greased)	205 to 235
Suspension strut to spindle carrier	80 to 90
Nut of suspension strut top mounting	40 to 50
Top mounting to body	20 to 24
Stabiliser to lower suspension arm (resilient)	70 to 110
Engine mounting to front axle/engine crossmember	41 to 55
Front axle/engine crossmember to side members	70 to 90
Steering intermediate shaft to steering shaft and to steering gear	17 to 20
Pressure and return pipe retaining plate to steering gear	21 to 26
ABS sensor to spindle carrier	9 to 11

Lubricants	
Grease for front wheel bearings	FORD Specification SAM-1C9111-A
Grease for constant velocity joints	FORD Specification S-M1C75-A/SQM-1C9004-A
Grease fill capacity - outer constant velocity joints	80 ± 10 ml in each joint
Grease fill capacity - inner constant velocity joints	180 ± 5 ml in each joint
Grease for speedometer drive worm gear	FORD Specification SM-1C4515-A
Sealer	
Speedometer drive housing cover	FORD Specification SQM-4G9523-A

GENERAL DESCRIPTION

Front Axle, Suspension and Driveshafts

The essential components of the Sierra Cosworth 4x4 front four wheel drive system, are the engine crossmember and the front differential assembly. The front four wheel drive system is as on the Sierra XR4x4 except for a few modifications.

- The front differential assembly is fixed to the cylinder block with two additional brackets (on the right hand side) to strengthen the flanged connection.
- The driveshaft to the front differential assembly is hollow for increased torsional rigidity.
- The right hand side driveshaft constant velocity joint is secured in the front differential by means of a snap ring. To remove the driveshaft constant velocity joint, the front differential housing cover must be removed and the oil drained.

For further information and detailed modifications please refer to the publication entitled "Sierra Cosworth 4x4" in the "Product Training for Technicians" series (publication No. CG 7330D 12/89). However, this training publication must not be used for repair purposes since the Service Microfiche only is updated as required.

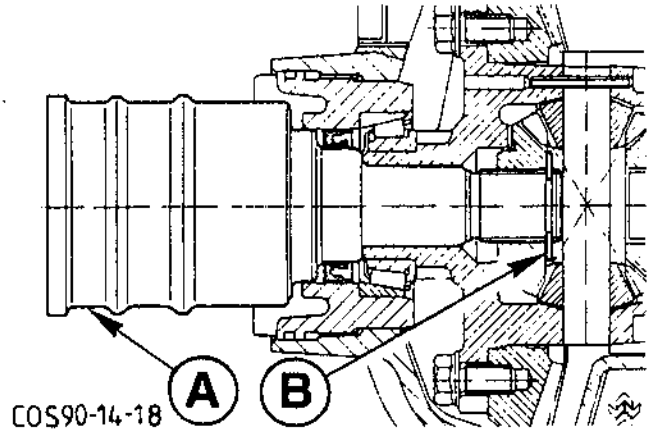


Fig.A. Right hand side driveshaft constant velocity joint.
A - Constant velocity joint
B - Snap ring

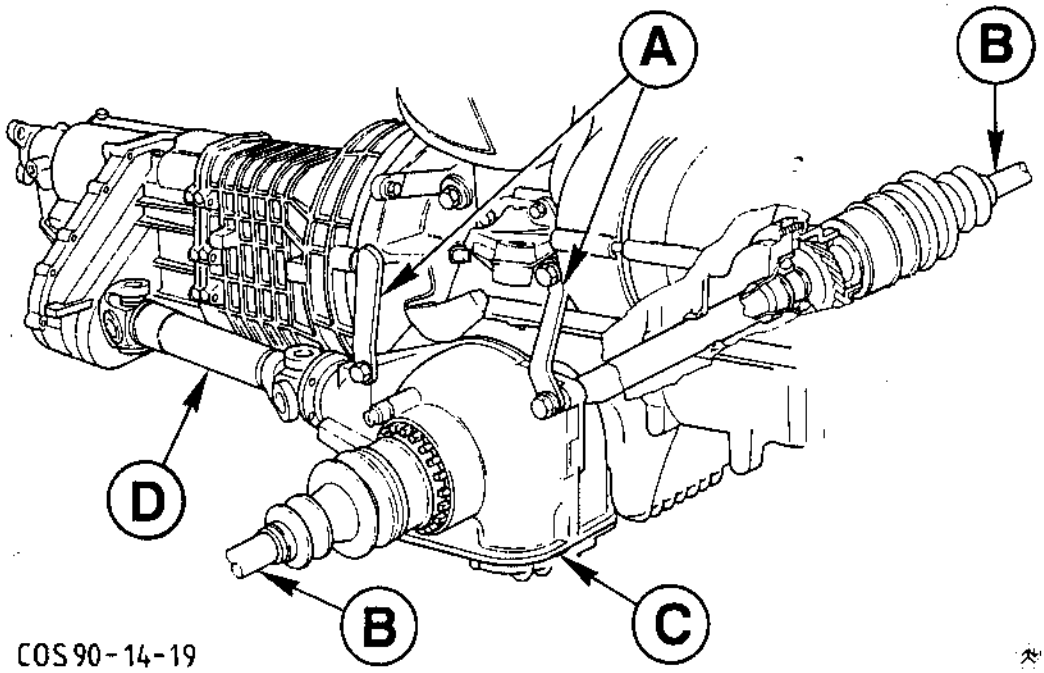
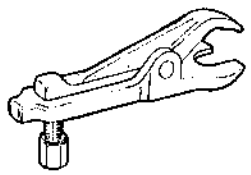
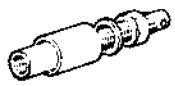
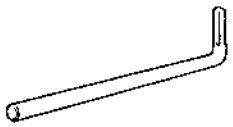
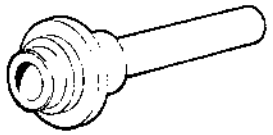
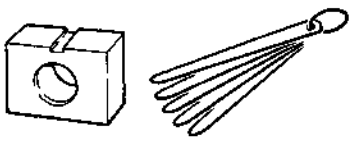
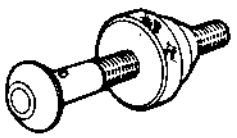
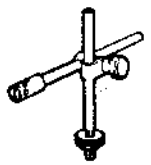
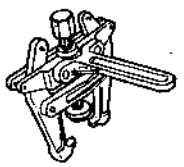


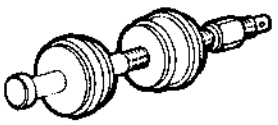
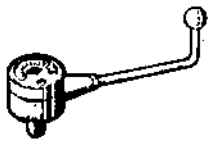
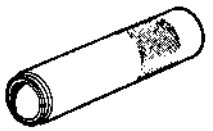
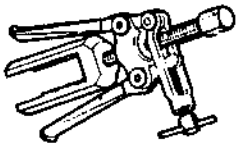
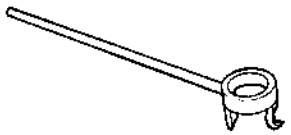
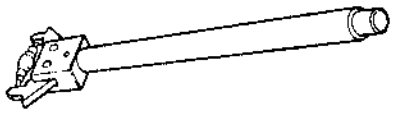
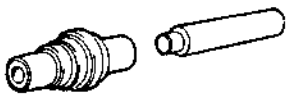
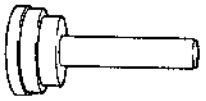
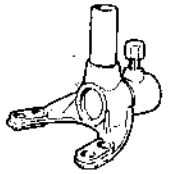
Fig.B. View of Sierra Cosworth 4x4 front four wheel drive system.
A - Front differential assembly mounting brackets
B - Driveshafts - right and left hand sides
C - Front differential assembly
D - Driveshaft to front differential assembly

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	13-006	Ball joint separator
	14-022	Driveshaft installer
	14 024	Oil seal installer
	14-026	Spindle carrier lever
	14-030	Drive pinion oil seal installer
	14-033	Step gauge
	15-008-01	Dial indicator holding fixture adaptor
	15-019	Gauge bar
	15-022-A	Dial indicator holding fixture
	15-026-A	Differential bearing installer

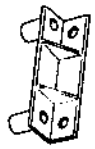
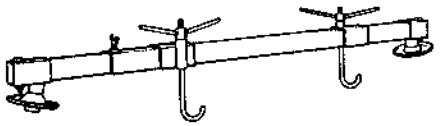
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SPECIAL SERVICE TOOLS (cont'd)

	15-033	Bearing cup installer
	15-033-01	Adaptor - bearing cup installer
	15-041	Torque gauge
	15-042	Drive pinion bearing installer
	15-048	Pinion oil seal remover
	15-072	Oil seal extractor
	15-074	Bearing cup remover
	15-076	Oil seal installer
	15-085	Spindle carrier bearing cup installer
	16-009	Transmission mounting bracket

0492

SPECIAL SERVICE TOOLS (cont'd)

	16-009-01	Adaptor - mounting bracket
	21-051	Oil seal remover
	21-140	Engine support bar

PROPRIETARY TOOLS

Puller (drive pinion flange)

Puller (inner taper roller bearing)

Puller (wheel hub)

Dial indicator

14 215 0 FRONT DIFFERENTIAL ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball Joint Separator 13-006

To Remove

1. Disconnect the battery earth cable.

2. Slacken the front wheel nuts.

3. Raise the vehicle.

4. Remove the front wheels.

5. Remove the lower engine cover retaining bolts (6) and remove cover.

6. Drain off the engine oil.

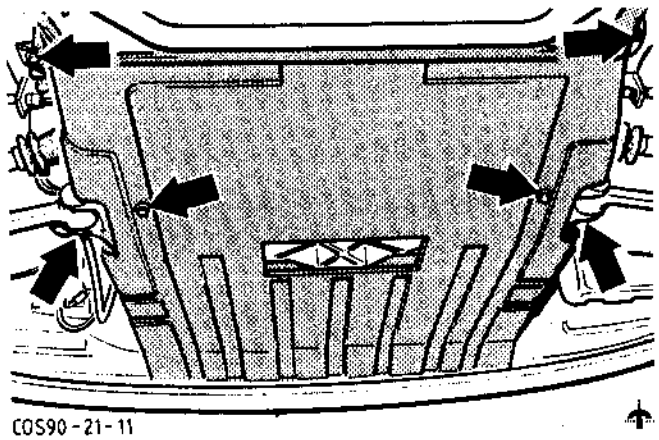
7. On both sides disconnect the tie rod from the steering arm. Withdraw the split pin and slacken the castellated nut on the tie rod end.

   Press the tie rod end out of the spindle carrier using Special Tool 13-006, Fig.2 (A, B, C). Unscrew the castellated nut and disconnect the tie rod end from the spindle carrier.

Fig.2. Front suspension.
- A - Tie rod
- B - Special Tool 13-006
- C - Spindle carrier
- D - Retaining bolt of lower suspension arm
- E - Lower suspension arm (left hand side shown)

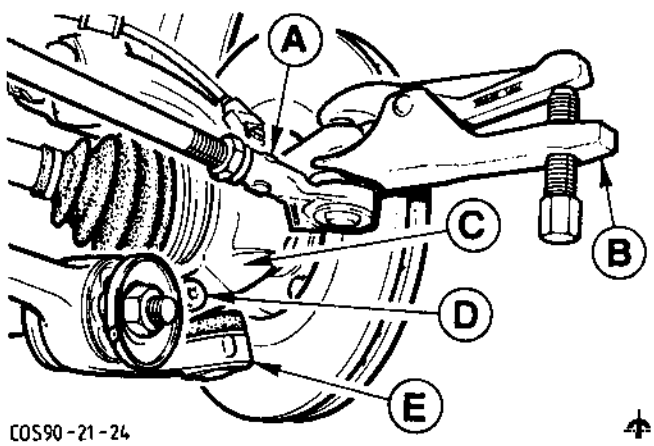
8. Unscrew the stabiliser bar brackets from the side members on the left and right hand sides (4 bolts), Fig.3.

9. On both sides remove the Torx bolt and nut and lever the lower suspension arm downwards away from the spindle carrier, Fig.2. (C, D, E).



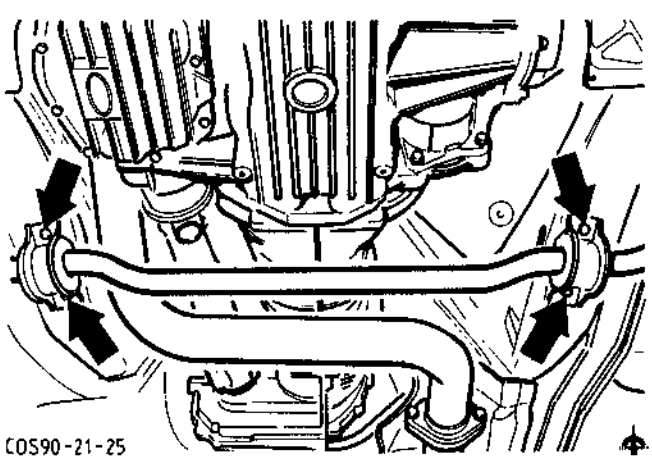
COS90-21-11

Fig.1. Retaining bolts of lower engine cover.



COS90-21-24

Fig.2. Front suspension (left hand side shown).



COS90-21-25

Fig.3. Retaining bolts of stabiliser bar bracket.

10. Position an oil drain container under the front differential, unbolt the housing cover (8 bolts), Fig.4 and drain off the oil.

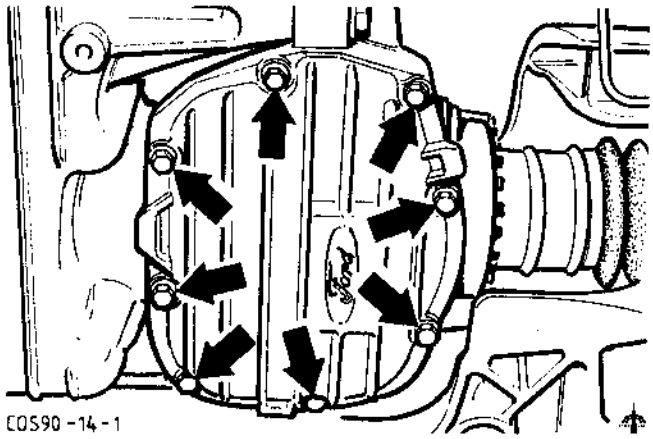

COS90-14-1

Fig.4. Retaining bolts of front differential housing cover.

11. Disconnect the right hand side driveshaft from the front differential, Fig.5.

- Remove the snap ring securing the drive shaft in the front differential.
- Pull the driveshaft constant velocity joint out of the front differential and suspend it with wire.

NOTE: The inner constant velocity joints must not be bent at more than 20° and the other constant velocity joints must not be bent at more than 45° (on both sides).

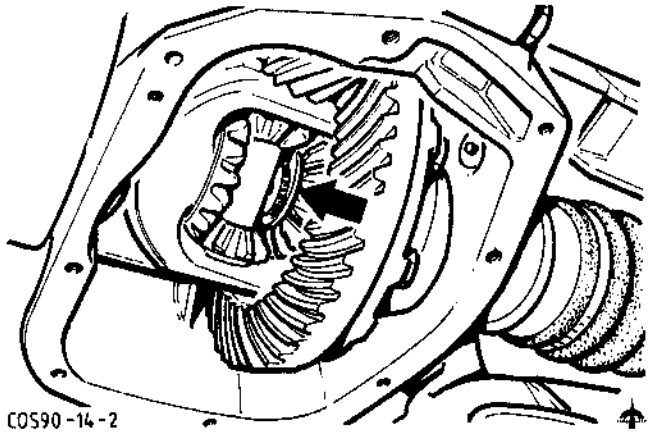

COS90-14-2

Fig.5. Snap ring securing driveshaft in front differential.

12. Withdraw the left hand side driveshaft constant velocity joint from the intermediate driveshaft and suspend it with wire, Fig.6.

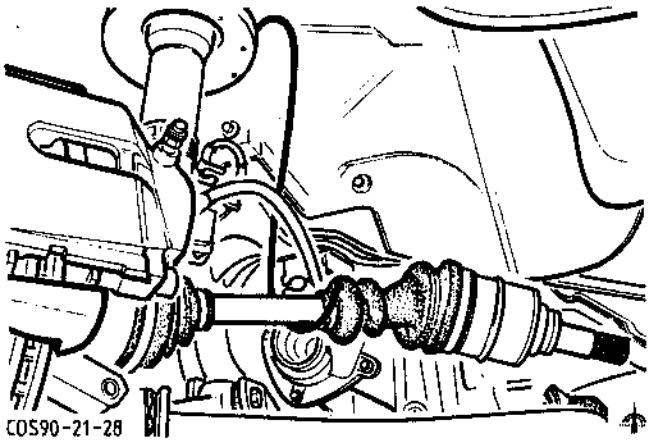

COS90-21-28

Fig.6. Driveshaft suspended (left hand side shown).

13. Unscrew the speedometer drive cable union nut from the intermediate driveshaft housing cover and withdraw the speedometer drive cable, Fig.7. (A).

14. Unscrew the intermediate driveshaft housing cover from the front differential assembly (4 bolts), Fig.7. (B).

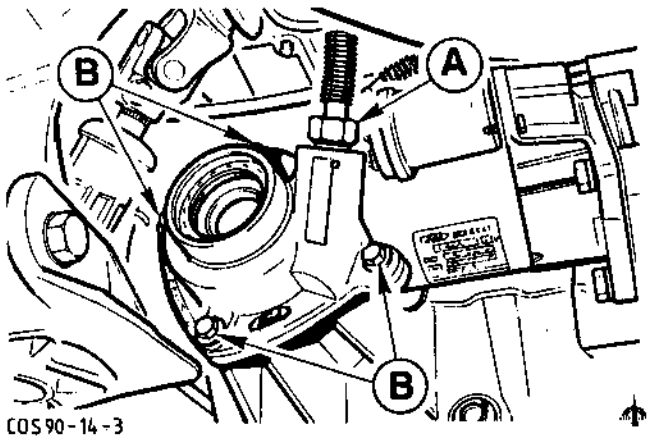


Fig.7. Intermediate driveshaft housing cover.
A - Speedometer drive cable union nut
B - Retaining bolts

15. Remove the circlip securing the speedometer drive worm gear to the intermediate driveshaft and remove the worm gear, Fig.8. (A).

16. Remove the intermediate driveshaft retaining circlip from the front differential housing and withdraw the intermediate driveshaft with the bearing, Fig.8. (B).

NOTE: The bearing is not a press fit.

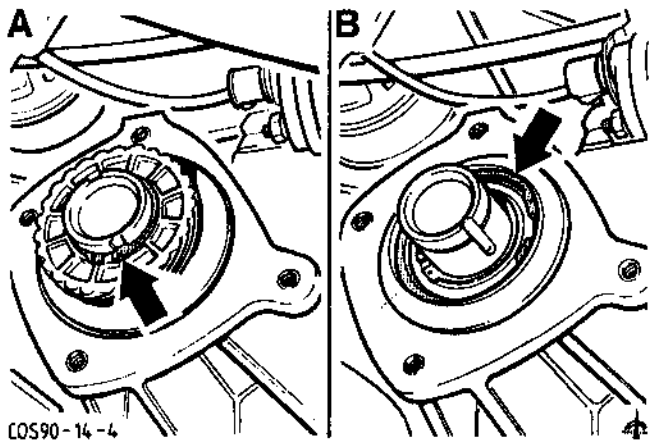


Fig.8. Circlips.
A - Speedometer drive worm gear
B - Intermediate driveshaft

17. Unscrew the driveshaft to the front differential assembly from the front differential assembly drive pinion flange (4 Torx bolts), Fig.9.

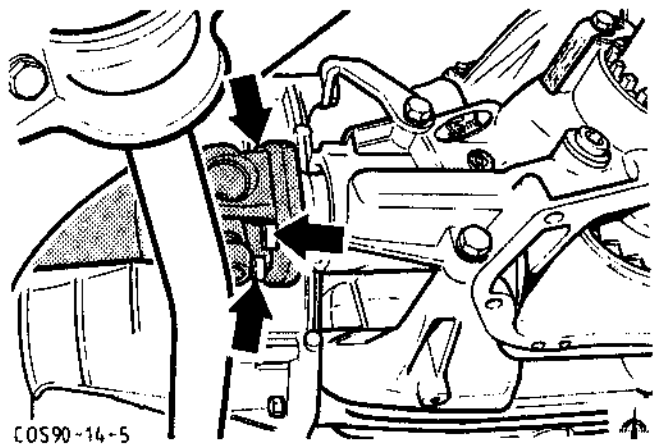


Fig.9. Bolts securing driveshaft to front differential assembly.

18. Unscrew the retaining bolt of the front differential rear bracket from the front differential, slacken the engine/transmission flange bolt and swing the bracket up out of the way, Fig.10. (A, B, E).

Fig.10. Front differential assembly attachment
A - Rear bracket
B - Retaining bolts of front differential
C - Retaining bolt of front bracket
D - Front bracket
E - Engine/transmission flange bolt

19. Unscrew the front differential front bracket from the engine mounting and the front differential (2 bolts) and remove the bracket, Fig.10. (B, C, D).

20. Unscrew the front differential from the sump mounting (1 bolt), Fig.10. (B), prise off and remove front differential.

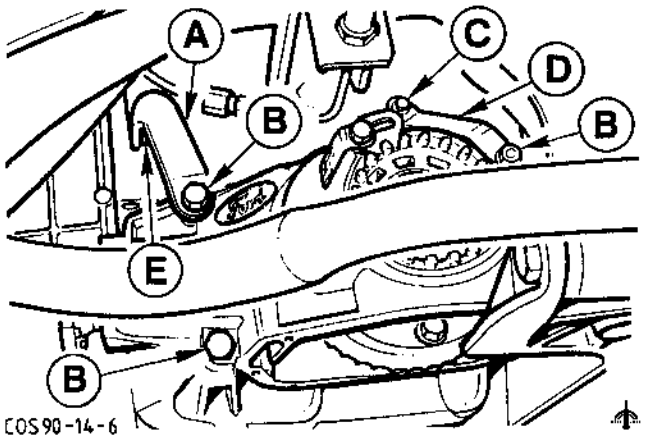


Fig.10. Front differential assembly attachment.

To Install

NOTE: When installing, tighten the nuts and bolts to the specified tightening torques (see Technical Data).

21. Fit a new inner O-ring in the bearing housing and a new outer O-ring on the front differential housing and lubricate them with the appropriate oil, Fig.11.

22. Locate the front differential in position and draw it into the sump mounting using 3 retaining bolts, Fig.10. (B).

23. Unscrew the 2 upper retaining bolts again, attach the front differential front and rear brackets to the engine mounting and front differential and tighten the bolts, Fig.10.

24. Connect the driveshaft to the drive pinion flange on the front differential assembly.

25. Insert the intermediate driveshaft and bearing in the front differential housing and secure it with the circlip, Fig.12. (B).

26. Slide the speedometer drive worm gear onto the intermediate driveshaft and secure with the circlip, Fig.12. (A).

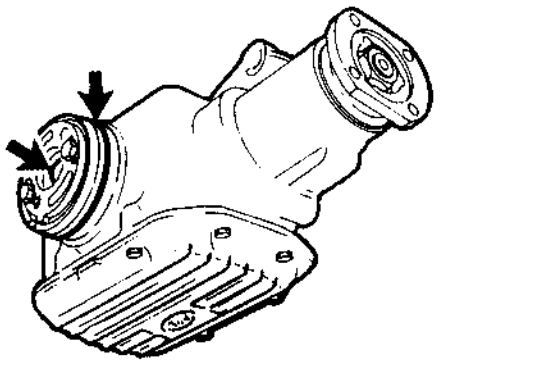


Fig.11. Front differential O-ring.

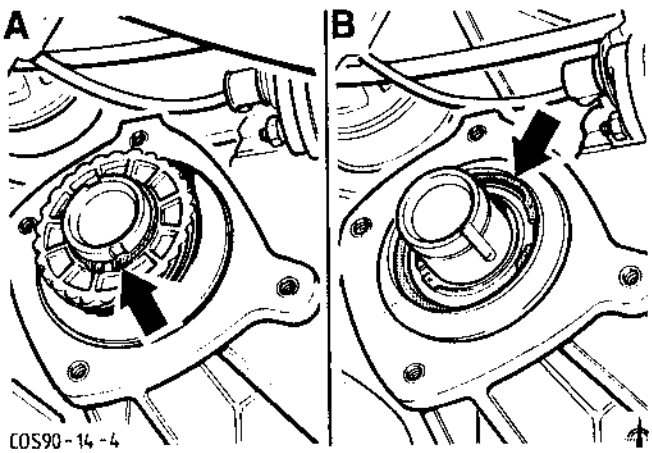


Fig.12. Circlips.
A - Speedometer drive worm gear
B - Intermediate driveshaft

27. Apply sealer (see Technical Data for specification) and fit the intermediate driveshaft housing cover to the front differential, Fig.13. (B).

28. Insert the speedometer drive cable in the intermediate driveshaft housing cover, fit the union nut and tighten it, Fig.13. (A).

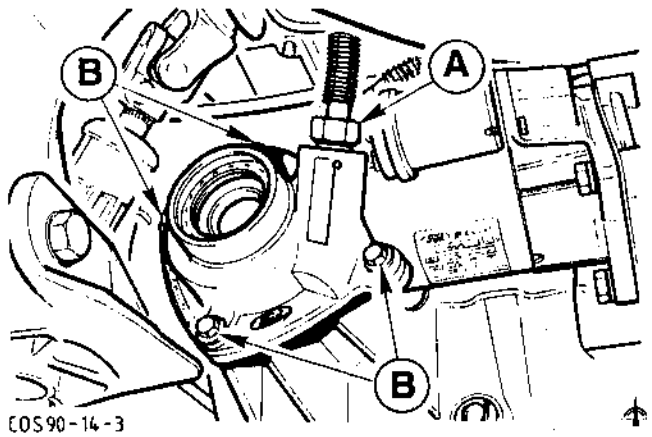


Fig.13. Intermediate driveshaft housing cover.
A - Speedometer drive cable union nut
B - Retaining bolts

29. Fit the left hand side driveshaft constant velocity joint into the intermediate driveshaft using a new snap ring.

30. Fit the right hand side driveshaft constant velocity joint into the front differential and secure using a new snap ring, Fig.14.

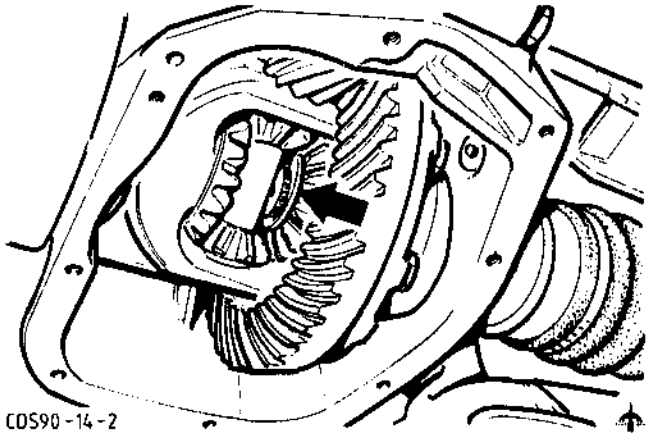


Fig.14. Snap ring securing driveshaft in front differential.

31. Apply sealer (see Technical Data for specification) and fit the front differential housing cover, Fig.15.

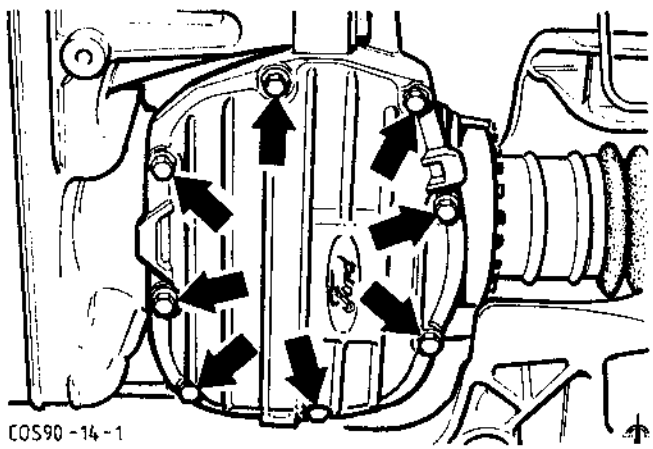


Fig.15. Retaining bolts of front differential housing cover.

32. Connect the lower suspension arm to the spindle carrier (both sides), Fig.16.

33. Fit the stabiliser bar brackets to the side members on the right and left hand sides.

NOTE: Make sure the rubber bushes are seated correctly.

34. Connect the tie rod to the steering arm. Fit the castellated nut on the tie rod end, tighten it and lock it with the split pin (both sides).

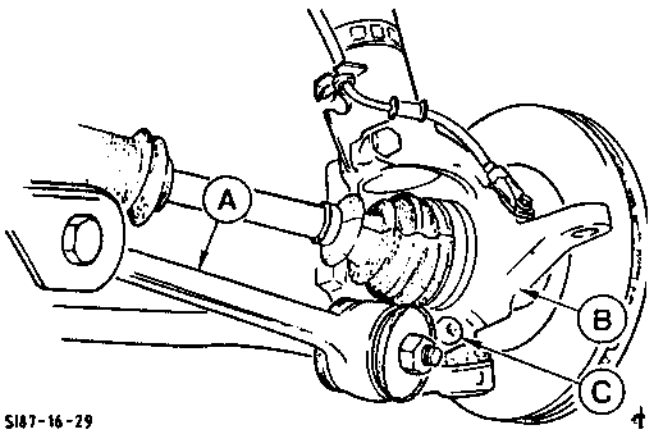


Fig.16. A - Lower suspension arm
B - Spindle carrier
C - Torx bolt and nut

35. Fill the front differential with oil (see Technical Data for quantity and specification) Fig.17.

36. Fit the front wheels.

37. Fit the lower engine cover to the side members and the front axle/engine crossmember (6 bolts), Fig.18.

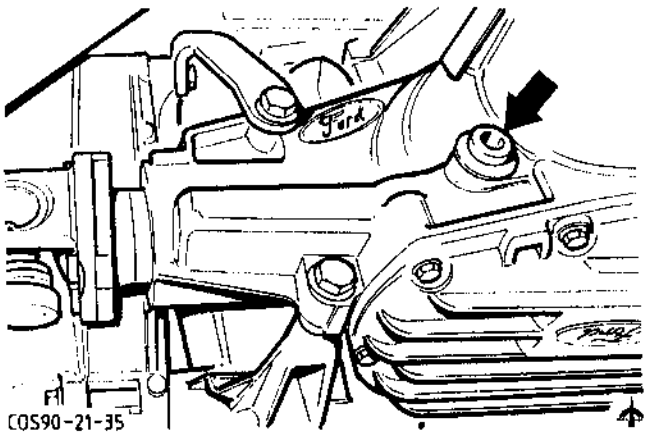


Fig.17. Front differential oil filler plug.

38. Lower the vehicle to the ground.

39. Tighten the front wheel nuts.

40. Fill the engine with oil (see Technical Data for quantity and specification).

41. Connect the battery earth cable.

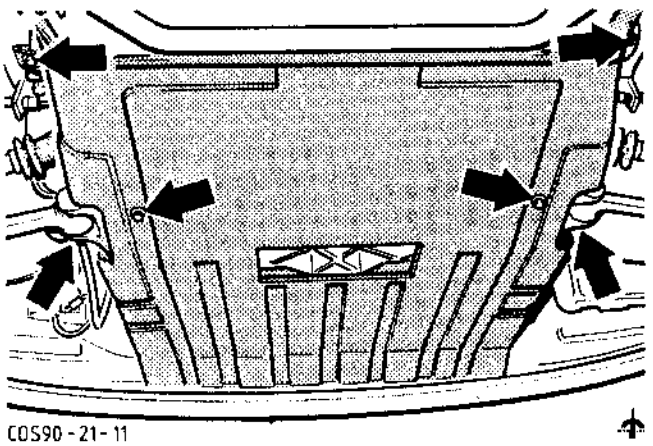


Fig.18. Retaining bolts of lower engine cover.

14 215 8 FRONT DIFFERENTIAL ASSEMBLY - OVERHAUL (Front differential removed)

SPECIAL SERVICE TOOLS REQUIRED:

Front drive pinion oil seal installer	14-030
Step gauge	14-033
Dial indicator holding fixture adaptor	15-008-01
Gauge bar	15-019
Dial indicator holding fixture	15-022-A
Differential bearing remover	15-026-A
Pinion bearing cup installer	15-033
Adaptor - pinion bearing cup installer	15-033-01
Torque gauge	15-041
Pinion bearing installer	15-042
Pinion oil seal remover	15-048
Pinion bearing cup remover	15-074
Driveshaft oil seal installer	15-076
Transmission mounting bracket	16-009
Adaptor-mounting bracket	16-009-01
Oil seal remover	21-051

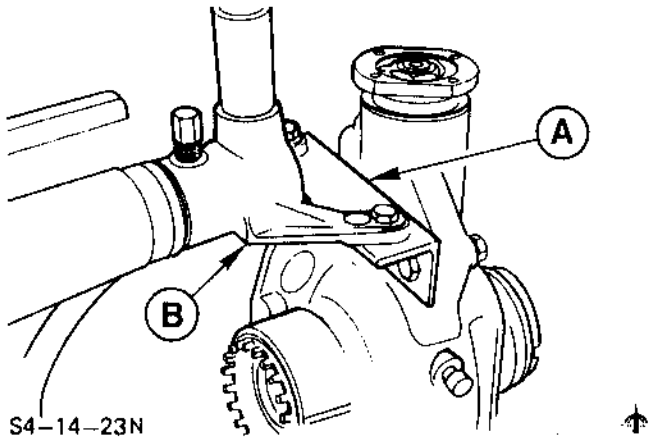


Fig.1. Front differential assembly on stand.
A - Adaptor mounting bracket 16-009-01
B - Transmission mounting bracket 16-009

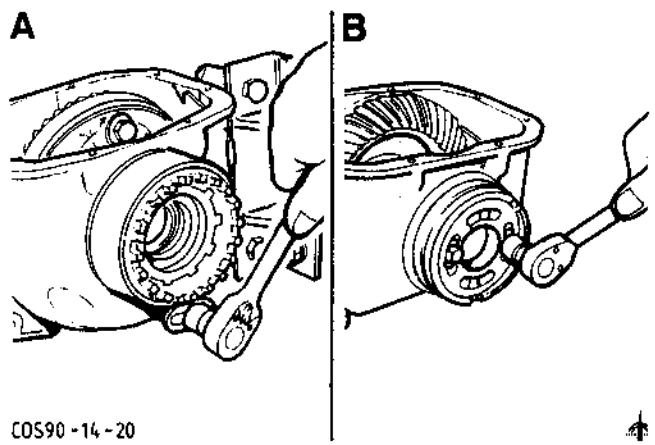


Fig.2. Bearing housing locking plates.
A - Right hand side
B - Left hand side (2)

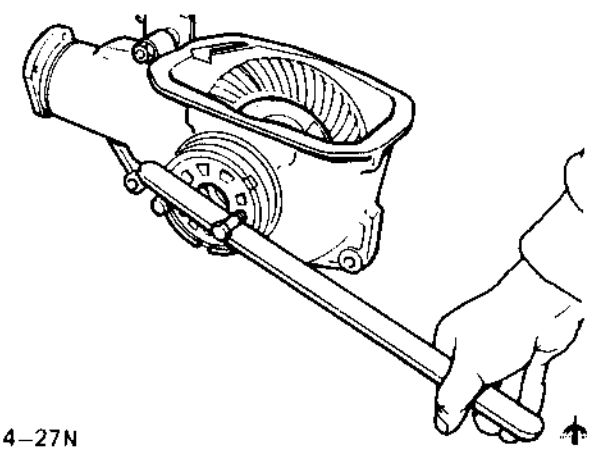


Fig.3. Unscrew left hand side bearing housing.

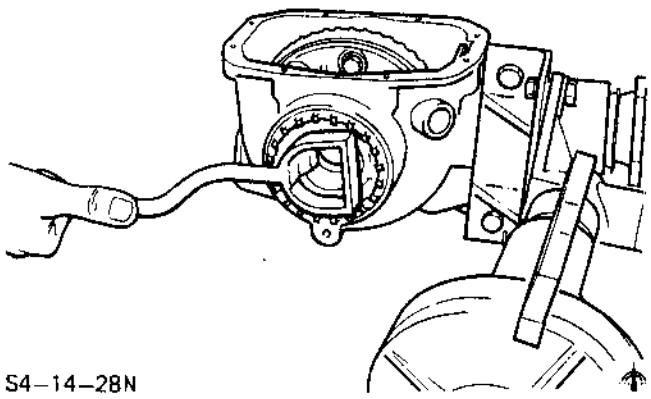
To Dismantle

1. Assembly Special Tool 16-009-01 to the front differential assembly and mount on stand using mounting bracket 16-009, Fig.1.

2. Remove the differential gear assembly

- Remove the bearing housing locking plates on the right and left hand sides, Fig.2.
- On the left hand side screw two M10 x 50 bolts into the threaded holes used for the bearing housing lock plates. Using a flat bar as a lever unscrew the bearing housing. Remove and discard 'O' rings.

- Remove the radial oil seal from the right hand side bearing housing using Special Tool 21-051, Fig.4.

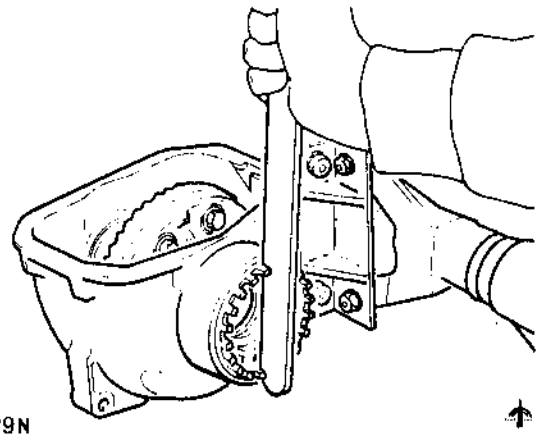


S4-14-28N

Fig.4. Remove radial oil seal from bearing housing, right hand side.

- Unscrew the bearing housing on the right hand side using a flat bar as a lever, Fig.5. Remove and discard 'O' ring.

- Remove differential gear assembly.

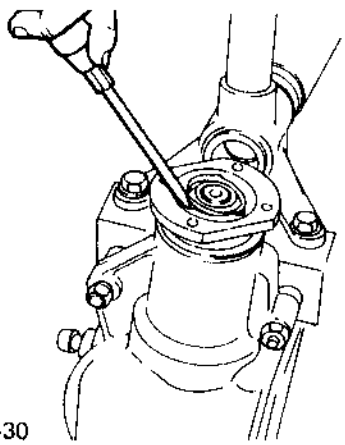


S4-14-29N

Fig.5. Unscrew bearing housing, right hand side.

3. Remove drive pinion flange and drive pinion assembly.

- Lever out drive pinion flange nut locking plate, Fig.6.



S4-14-30

Fig.6. Lever out drive pinion flange nut locking plate.

- Screw two M10 x 50 bolts into the threaded holes in the drive pinion flange. Using a flat bar between the bolts, hold the flange and unscrew the drive pinion flange nut, Fig.7.

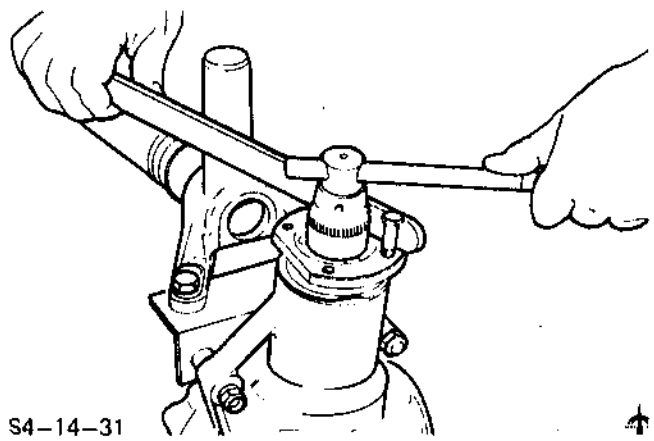


Fig.7. Remove drive pinion flange nut.

- Using a suitable puller, remove the drive pinion flange from the drive pinion shaft and drive out the pinion shaft, Fig.8.

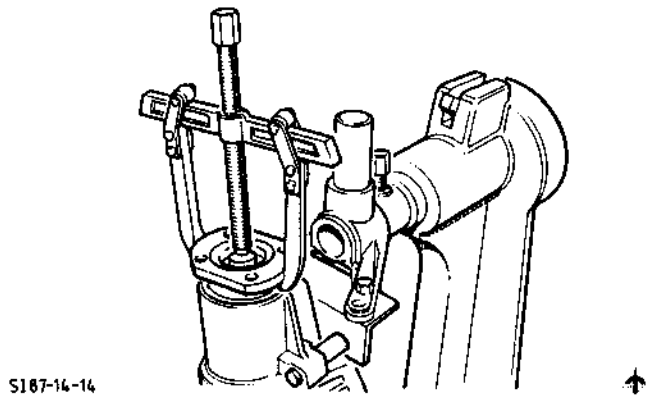


Fig.8. Remove drive pinion flange.

4. Remove the drive pinion radial oil seal

Remove the drive pinion radial oil seal using Special Tool 21-051 and remove the outer taper roller bearing, Fig.9.

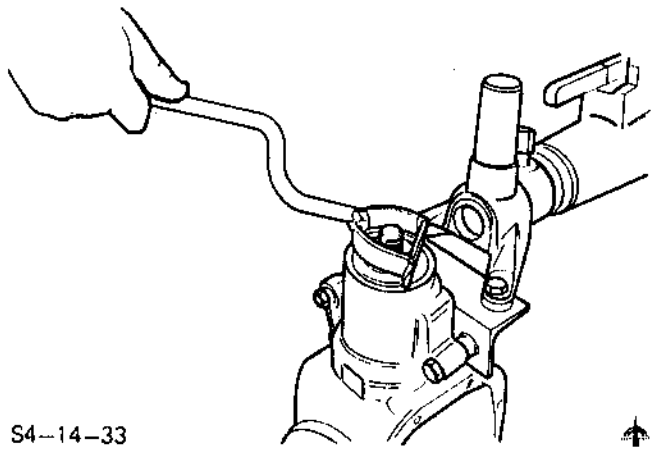


Fig.9. Remove radial oil seal using Special Tool 21-051.

5. Dismantle the differential

Position Special Tool 15-026-A on the taper roller bearing of the differential housing and clamp one leg of the tool in a vice. Remove the bearing, Fig.10 and repeat the operation for the other side. Mark the taper roller bearings for refitting.

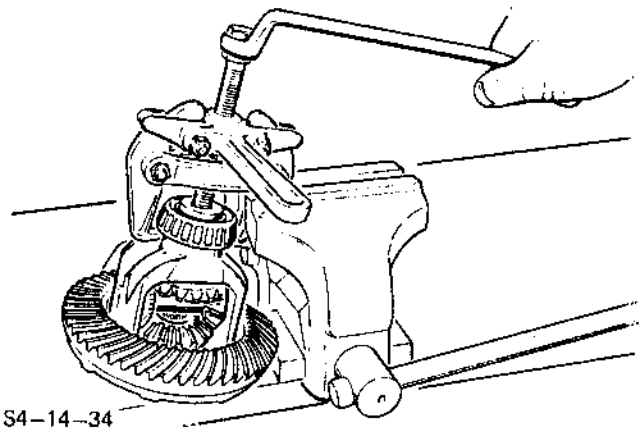


Fig.10. Remove taper roller bearings from differential housing, using Special Tool 15-026-A.

6. Remove the crown wheel

Unscrew 4 diagonally opposite bolts. Slacken the 4 remaining bolts three turns. Tap the bolt heads uniformly working diagonally to detach the crown wheel from the differential housing. Unscrew the bolts and remove the crown wheel, Fig.11.

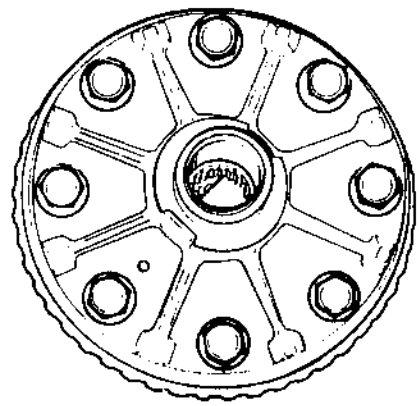


Fig.11. Crown wheel attachment to differential housing.

7. Check the clearance of the driveshaft gears

Check the clearance of the driveshaft gears one at a time using a feeler gauge, Fig.12. If the clearance is more than the specified maximum value of 0,15 mm it must be reduced by fitting new shims (see Parts Microfiche for the different thicknesses).

NOTE: If the clearance is less than 0,15 mm, dismantling the differential gear is unnecessary, provided the differential gears and driveshaft gears are in good condition. If this is the case, omit sub operations 8 and 9.

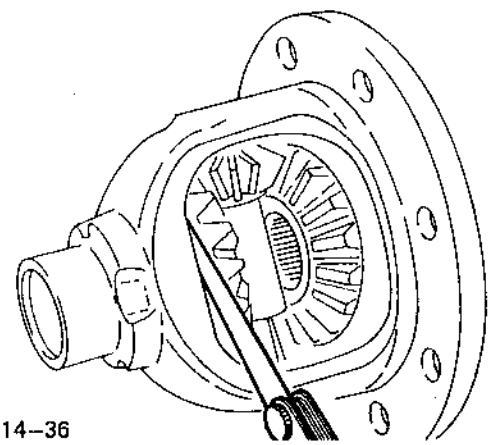
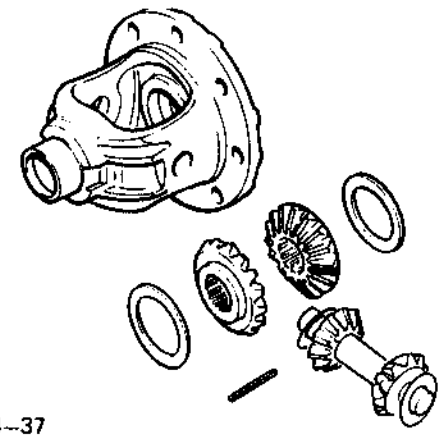


Fig.12. Check clearance of the driveshaft gears.

8. Remove the differential pinon gears and front driveshaft gears from the differential housing

Using a suitable drift, drive out the roll pin which secures the differential gear shaft in the housing. Remove shaft, differential pinion gears and driveshaft gears, Fig.13.



S4-14-37

Fig.13. Differential - exploded view.

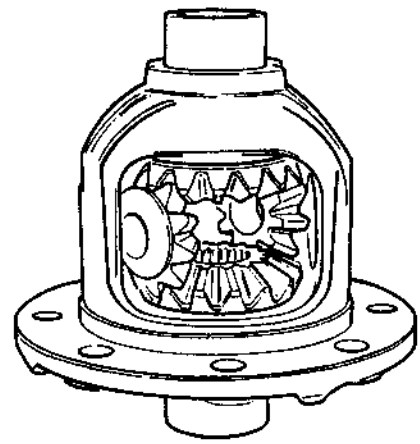
9. Reassemble differential gear assembly

Insert the driveshaft gears, with the appropriate shims, into the differential housing.

Simultaneously rotate the two differential pinion gears, each with a thrust washer, between the driveshaft gears, Fig.14. Push in the shaft, making sure that the roll pin hole is aligned.

NOTE: When using new shims, check clearance of driveshaft gears (0,15 mm max.) as described in sub-operation 7. If necessary, dismantle the differential again and install thicker shims.

Secure the differential gear shaft with a roll pin, Fig.15.

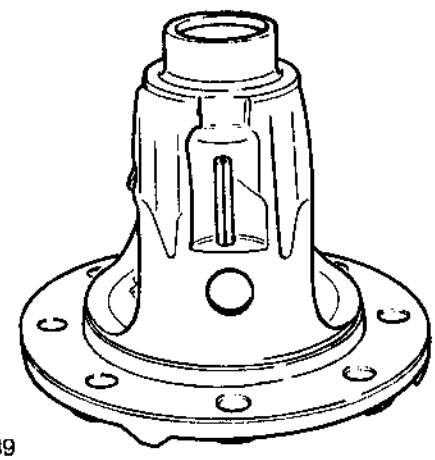


S4-14-38

Fig.14. Rotate differential pinion gears into the differential housing.

10. Fit crown wheel

NOTE: To aid assembly, place crown wheel in boiling water or on a hot plate for about 10 minutes. Refit crown wheel into differential housing using four of the original bolts and pull on uniformly. Remove the old bolts, insert new bolts and tighten to specified torque (do not press on taper roller bearings at this stage).



S4-14-39

Fig.15. Differential gear shaft roll pin.

11. Replace drive pinion bearing cups

NOTE: Because of the aluminium housing, the two bearing cups must never be extracted at the same time, so that the remaining bearing cup can serve as a guide.

- Remove the outer bearing cup from the front differential housing with Special Tool 15-048. Place a piece of flat iron bar underneath the tool, Fig.16.

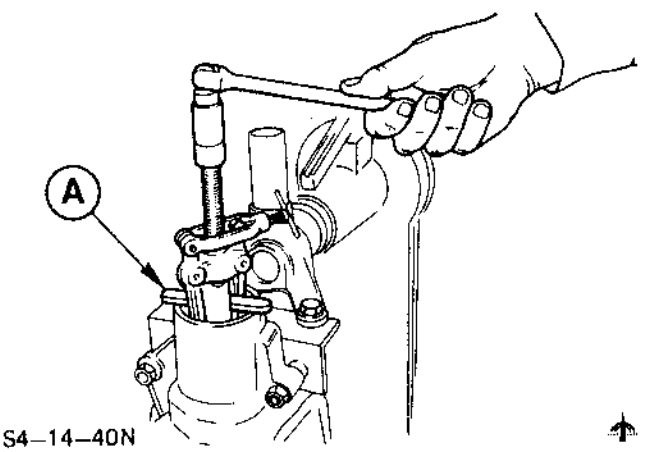


Fig.16. Remove outer bearing cup using Special Tool 15-048.
A - Piece of flat iron bar

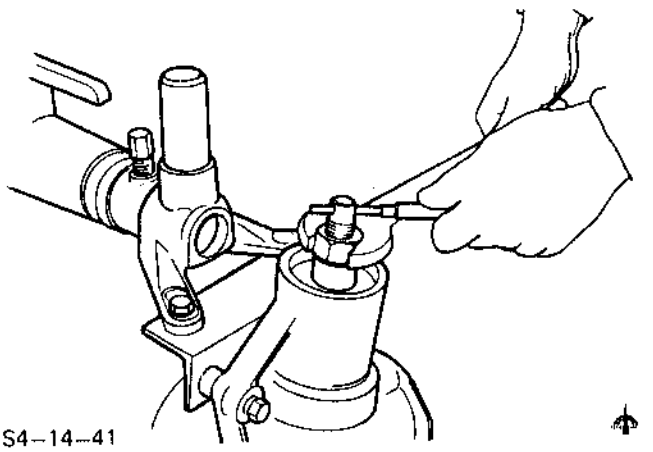


Fig.17. Fit outer bearing cup using Special Tools 15-033 and 15-033-01.

- Install the outer bearing cup using Special Tools 15-033 and 15-033-01, Figs.17 and Fig.18, holding Special Tool 15-003 with a drift to prevent turning.

NOTE: Lubricate housing and bearing cups with specified hypoid oil prior to fitment.

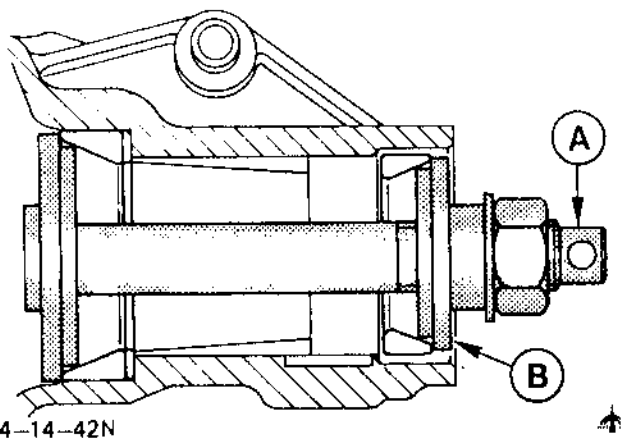
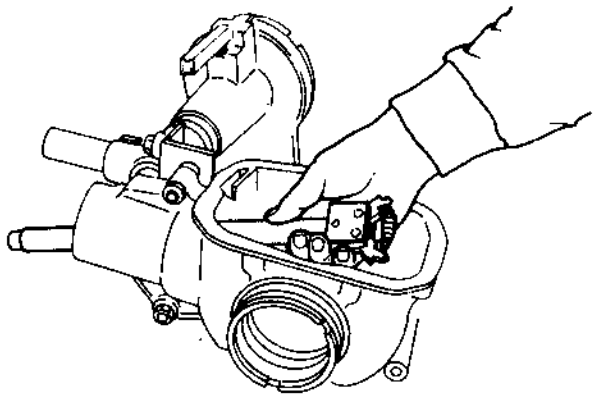


Fig.18. Sectional view of fitment of outer bearing cap.
A - Special Tool 15-033
B - Special Tool 15-033-01

12. Remove the inner bearing cup

Remove the inner bearing cup from the front differential housing.

- Insert Special Tool 15-074 into the neck of the housing from inside the housing.

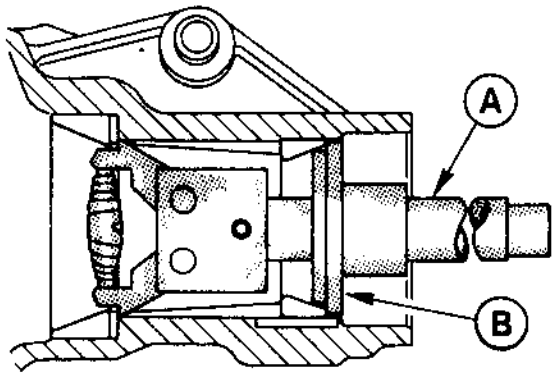


S4-14-43N

Fig.19. Insert Special Tool 15-074.

- Insert Special Tool 15-033-01 Fig.20. (B) to guide in Special Tool 15-074 Fig.20. (A).

- Drive out the inner bearing cup. Remove the shim, measure and note the thickness.

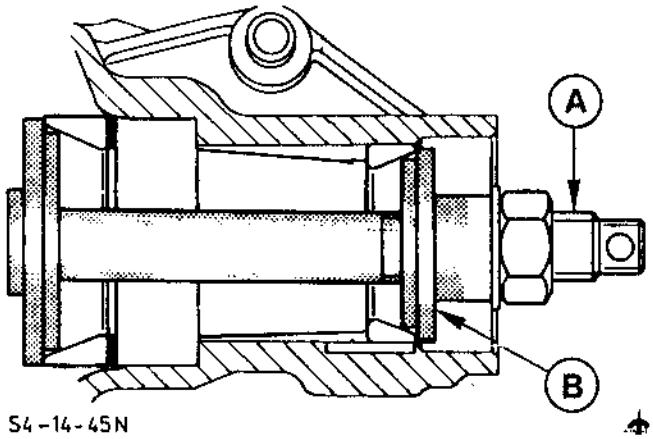


S4-14-44N

Fig.20. Remove inner bearing cup.
A - Special Tool 15-074
B - Special Tool 15-033-01

- Install inner bearing with appropriate new standard shim (2 mm) and Special Tools 15-033 and 15-033-01, Fig.21.

NOTE: Production shim must be replaced by a 2 mm service shim.

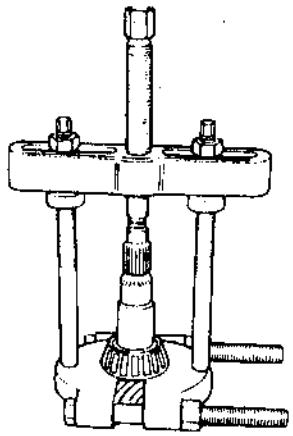


S4-14-45N

Fig.21. Install inner bearing cup.
A - Special Tool 15-033
B - Special Tool 15-033-01

13. Remove the inner taper roller bearing

Remove the collapsible spacer from the drive pinion. Remove the inner taper roller bearing off the drive pinion with a conventional puller, Fig.22.



S4-14-46

Fig.22. Remove taper roller bearing off drive pinion.

14. Determine drive pinion shim thickness

Fit a new taper roller bearing and shim onto the drive pinion using Special Tool 15-042, Fig.23.

Determine the shim thickness as follows.

When refitting the original drive pinion: The shim thickness determined at the time of removal minus 2 mm (for the service shim) gives the thickness of shim to be placed under the drive pinion.

Example:

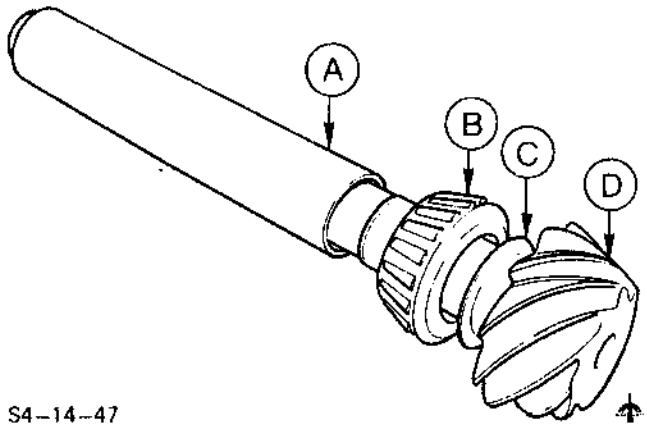
Thickness of shim removed:	3,75 mm
New service shim:	-2,00 mm
Shim to be fitted:	1,75 mm

When fitting a new drive pinion: The shim thickness determined at the time of removal minus 2 mm (for the service shim) plus or minus the figure on the old drive pinion as indicated.

Examples

Thickness of shim removed:	3,75 mm
New service shim:	-2,00 mm
Figure on old pinion (-10):	-0,10 mm
Shim to be fitted:	1,65 mm

Thickness of shim removed:	3,75 mm
New service shim:	-2,00 mm
Figure of new pinion (+10):	+0,10 mm
Shim to be fitted:	1,85 mm



S4-14-47

Fig.23. Fit new taper roller bearing.

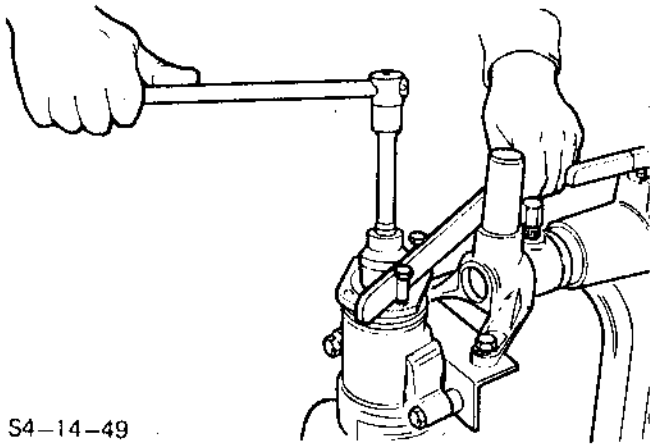
Fig.51. Fit new taper roller bearing.
A - Special Tool 15-042
B - Taper roller bearing
C - Measured shim
D - Drive pinion

15. Fit drive pinion

Insert the drive pinion in the front differential. Fit the outer taper roller bearing.

16. Fit drive flange

Fit the drive flange and hold it with a lever or a flat iron bar. Tighten the drive pinion nut until the specified turning torque (see Technical Data) is obtained, Fig.24.



S4-14-49

Fig.24. Tighten drive pinion nut.

Use torque gauge 15-041 to check the turning torque (bearing pre-load), Fig.25.

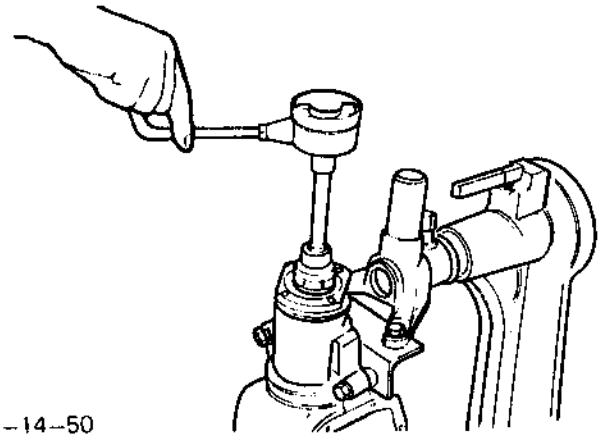


Fig.25. Check drive pinion turning torque using Special Tool 15-041.

17. Centralise drive pinion

Secure a dial indicator and holding fixture (Special Tool 15-022-A) to the front differential using an alternator adjusting strap. Position the plunger of the dial indicator on the outer edge of the end face of the drive pinion in the immediate vicinity of the gauge bar, Fig.26.

Slowly turn the drive pinion through one complete revolution and note the total deflection of the pointer on the dial indicator.

Then turn the drive pinion until the dial indicator reading is half the total deflection.

Do not turn the drive pinion any more after this (mark its position). Remove the dial indicator.

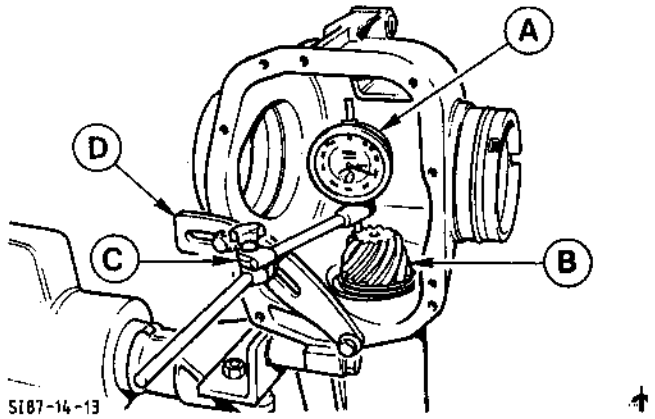


Fig.26. Centralise drive pinion.
A - Dial indicator
B - Drive pinion
C - Special Tool 15-022-A
D - Alternator adjusting strap

18. Fit gauge bar (Special Tool 15-019)

Fit the left and right hand bearing housings (without the seals) in the front differential with the bearings and the gauge bar.

NOTE: Only screw in the bearing cups and bearings in pairs.

Lubricate the bearings with hypoid oil. Screw in the bearing housings uniformly finger tight until they come into contact with the bearing cups.

Hold the gauge bar with a suitable drift, Fig.27, and screw out the gauge bar adjusting nut until the gauge bar can still just be turned by hand (after removal of the drift). Rotate the gauge bar a number of times to settle the bearings.

NOTE: Turn the adjusting nut until it makes contact with the bearings, Apply hypoid oil and fit the bearings.

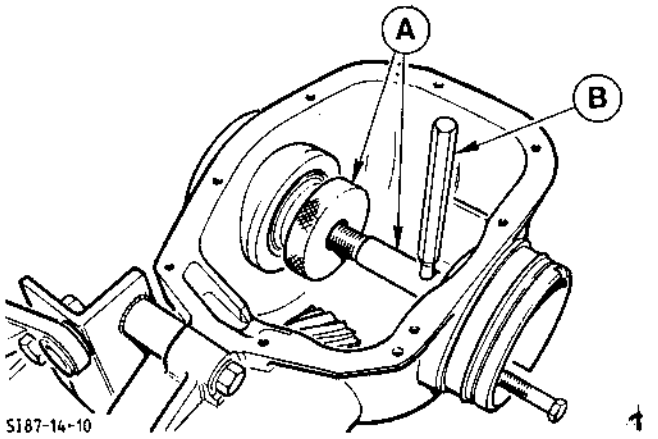


Fig.55. Fit gauge bar.
A - Special Tool 15-019
B - Drift to turn gauge bar

19. Centralise gauge bar (Special Tool 15-019)

Secure a dial indicator with holding fixture (Special Tool 15-022-A) and an alternator adjusting strap so that the plunger of the dial indicator is positoned exactly in the middle of the gauge bar, Fig.28. Then turn the gauge bar till the dial indicator reads half the value of the measured deflection. Do not turn the gauge bar any more afterwards (mark its position).

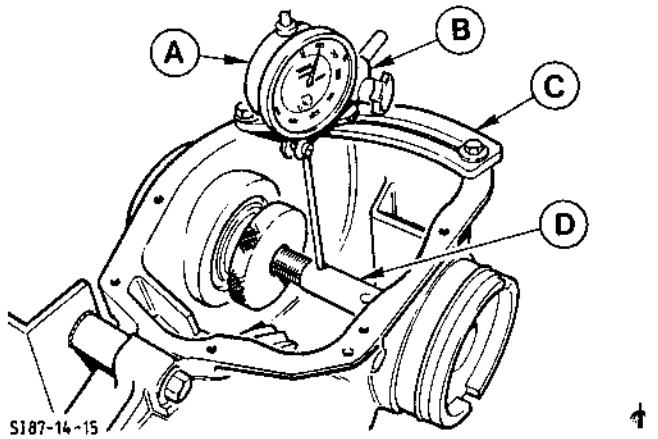


Fig.56. Centralise gauge bar.
A - Dial indicator
B - Special Tool 15-022-A
C - Alternator adjusting strap
D - Special Tool 15-019

Check the setting (0,10 mm) between the step gauge and the gauge bar and determine the thickness of the new shim for the drive pinion:

20. Position Special Tool 14-033 with step I between the drive pinion and the gauge bar. Measure the gap between the step gauge and the gauge bar with a feeler gauge.

- New drive pinion fitted:
  The correct setting is obtained for the zero drive pinion (service drive pinion) when a 0,10 mm feeler gauge can just be slid through. If the gap is more than 0,10 mm, select a shim which is thicker by the amount in excess of 0,10 mm.

  Example:

Setting	0,10 mm
Gap	-0,08 mm
	0,02 mm

  i.e. select a shim 0,02 mm thinner.

  If the gap is less than 0,10 mm the shim placed under the drive pinion must be thinner by the amount less than 0,10 mm.

  Example:

Setting	0,12 mm
Gap	-0,10 mm
	0,02 mm

  i.e. select a shim 0,02 mm thicker.
- Original drive pinion fitted:
  When the original drive pinion is used again, the distance between the drive pinion and the gauge bar is composed as follows:

  Height of step I of Special Tool 14-033 plus 0,10 mm feeler gauge (the value printed on the drive pinion must be subtracted from or added to that of the feeler gauge).

  If it is different, proceed as described above, i.e. use a thicker or thinner shim depending on whether the measured gap is smaller or greater.

NOTE: If the gap between the drive pinion and the gauge bar is too small, step II must be used to establish the approximate drive pinion gap.

To do this, proceed as follows:

- Position Special Tool 14-033 with step II between the drive pinion and the gauge bar.
- Measure the gap between the tool and the gauge bar with a feeler gauge.
- Measure the size of step II and the feeler gauge with a micrometer gauge.
- Subtract this amount from the total of step I + 0,10 mm.
- This value gives the thickness which is deducted from that of the shim under the drive pinion.

Then carry out the measuring procedure as described above.

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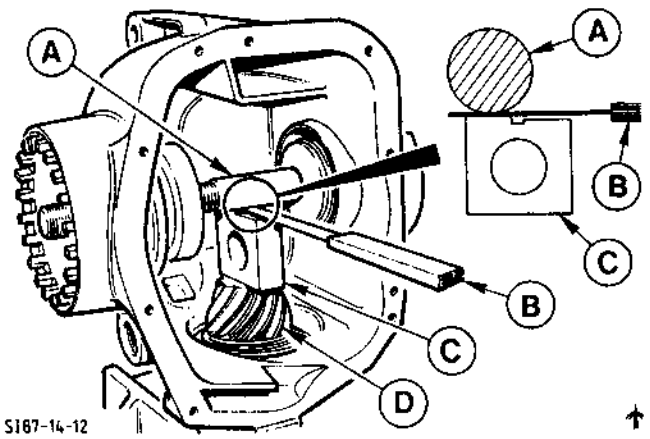


Fig.29. Check setting between drive pinion and gauge bar.
A - Special Tool 15-019
B - Feeler gauge
C - Special Tool 14-033
D - Drive pinion

21. Remove the gauge bar.

22. Remove the drive pinion as described in sub-operation 4 (except for levering out the drive pinion nut retainer). Remove the outer taper roller bearing.

23. Pull the taper roller bearing off the drive pinion shaft, Fig.30.

24. Check to determine the thickness of the taper roller bearing shim. Measure a shim of the size established in sub-operation 20 with the micrometer (refer to the Parts Microfiche for shim part numbers).

25. Slide the established thickness of shim onto the drive pinion shaft and press on the taper roller bearing with Special Tool 15-042, Fig.31.

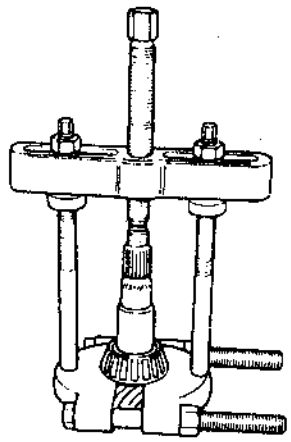
26. Fit the drive pinion, outer taper roller bearing, radial oil seal and drive flange with the nut as described in sub-operations 15 and 16.

NOTE: Lubricate the drive pinion shaft with hypoid oil.

Fig.31. Press taper roller bearing and shim onto drive pinion shaft.
A - Special Tool 15-042
B - Taper roller bearing
C - Shim
D - Drive pinion

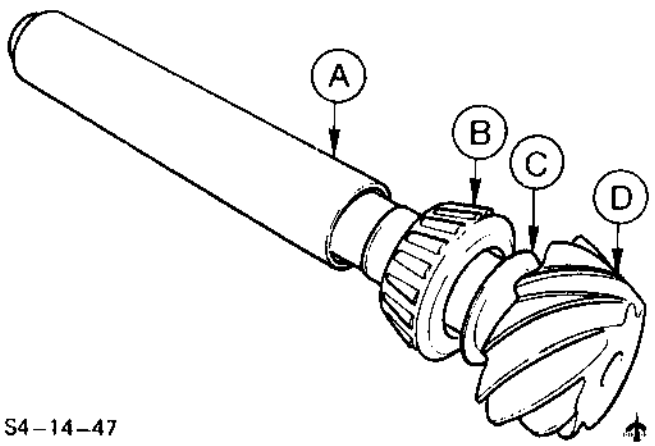
27. Centralise the drive pinion as described in sub-operation 17, Fig.32.

Fig.32. Centralise drive pinion.
A - Dial indicator
B - Drive pinion
C - Special Tool 15-022-A
D - Alternator adjusting strap



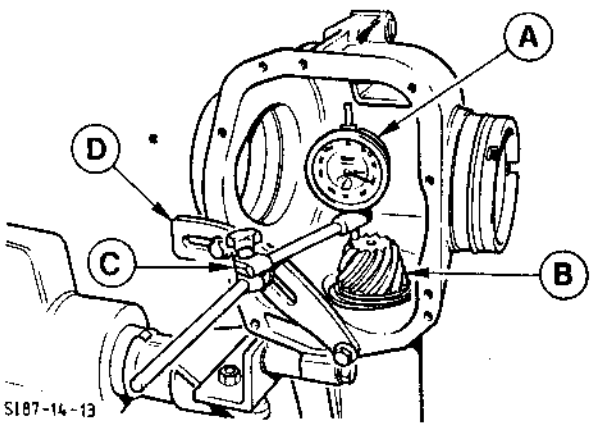
S4-14-46

Fig.30. Remove taper roller bearing off drive pinion shaft.



S4-14-47

Fig.31. Press taper roller bearing and shim onto drive pinion shaft.



S187-14-13

Fig.32. Centralise drive pinion.

28. Fit the gauge bar as described in sub-operation 18, Fig.33.

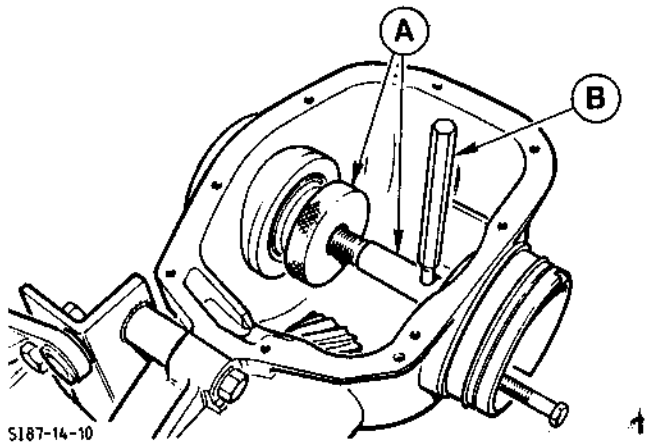


Fig.33. Fit gauge bar.
A - Special Tool 15-019
B - Drift to turn gauge bar

29. Centralise the gauge bar as described in sub-operation 19, Fig.34.

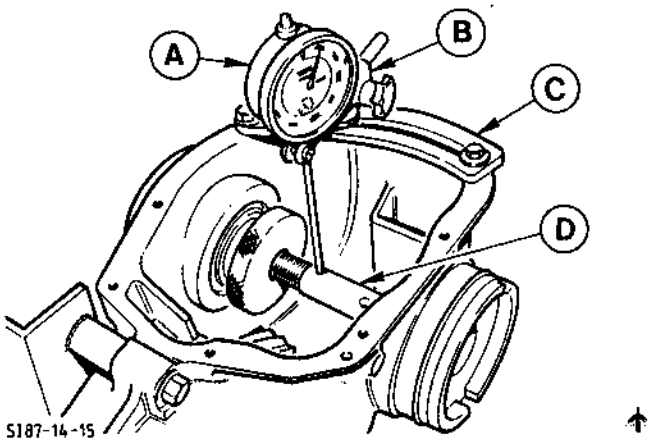


Fig.34. Centralise gauge bar.
A - Dial indicator
B - Special Tool 15-022-A
C - Alternator adjusting strap
D - Special Tool 15-019

Fig.34. Centralise gauge bar.

30. Check the setting as described in sub-operation 20, Fig.35.

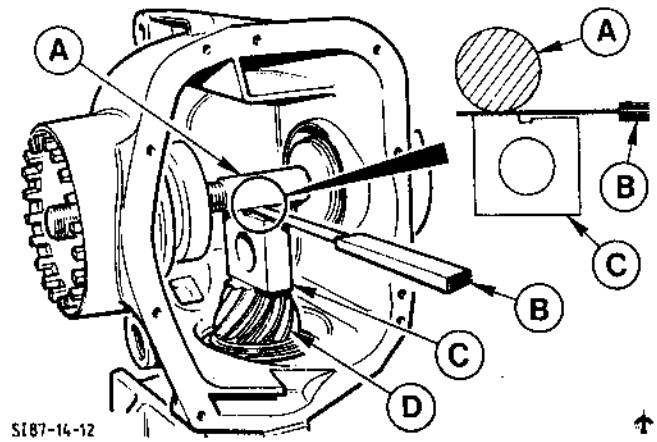


Fig.35. Check setting between drive pinion and gauge bar.
A - Special Tool 15-019
B - Feeler gauge
C - Special Tool 14-033
D - Drive pinion

Fig.35. Check setting between drive pinion and gauge bar.

31. Once the correct shim has been selected, remove the differential bearing housing, bearings and bar gauge.

NOTE: After removal, do not interchange the taper roller bearings and bearing housings with one another and ensure that they are refitted to the same side of the front differential.

32. Remove the drive pinion shaft, radial oil seal and outer taper roller bearing.

33. To Install the Drive Pinion Assembly

Insert the drive pinion shaft with a new collapsible spacer and the outer taper roller bearing into the front differential. Lubricate the bearings with the specified hypoid oil.

Install the drive pinion radial oil seal using Special Tool 15-030, Fig.36.

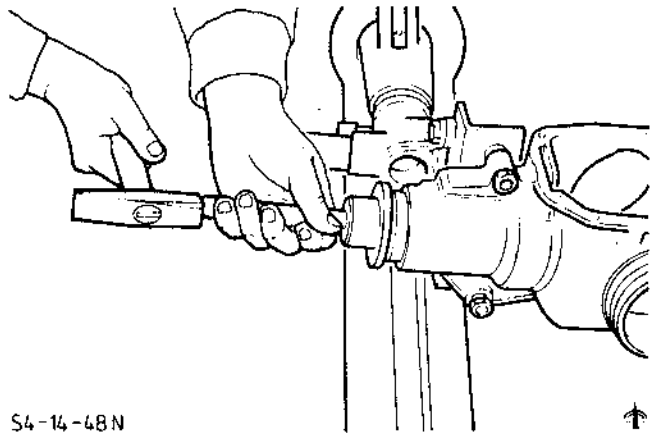

S4-14-48N

Fig.36. Install the drive pinion radial oil seal.

NOTE: The radial oil seal is greased during manufacture and this grease must not be removed.

Fit the drive pinion flange.

Position the flange and prevent it rotating with a flat bar. Tighten the drive pinion nut until the specified turning torque (see Technical Data) is obtained, Fig.37.

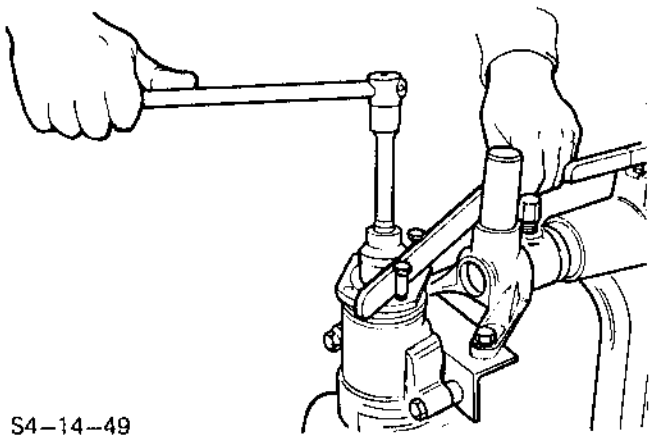

S4-14-49

Fig.37. Tighten the drive pinion nut.

NOTE: Drive flange nut to be assembled with thread locking compound (see Technical Data).

To check the turning torque use torque gauge Special Tool 15-041, Fig.38.

NOTE: If the specified torque is exceeded, the drive pinion assembly must be removed and the procedure described above repeated using a new collapsible spacer. Correction of the turning torque by slackening the pinion nut is not permissible.

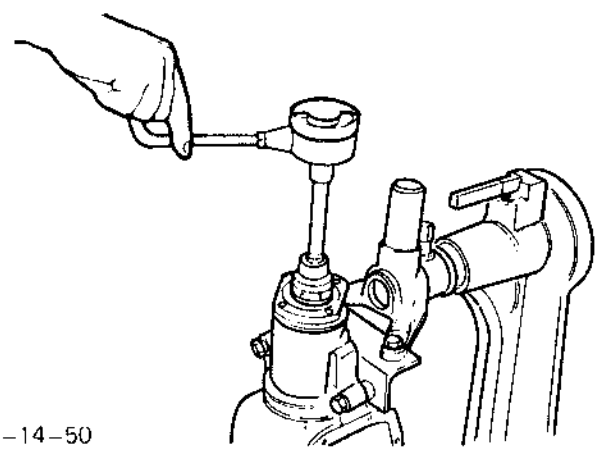
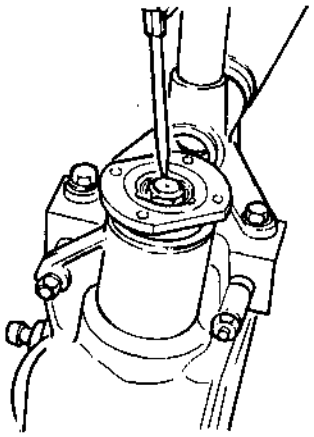

S4-14-50

Fig.38. Check the drive pinion turning torque.

34. Fit the new drive flange nut lock ring and stake it, Fig.39.

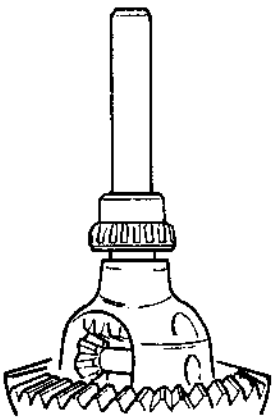


S4-14-146

Fig.39. Stake new lock ring.

35. Fit taper roller bearings

Press both taper roller bearings into the differential gear housing using Special Tool 15-022-A, Fig.40.



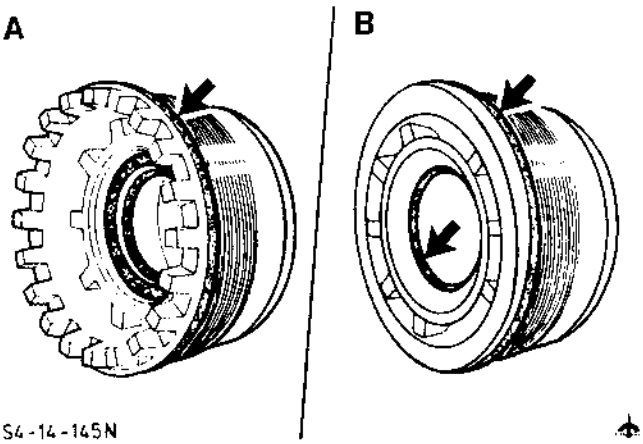
S4-14-56

Fig.40. Taper roller bearing.

36. To Install the Differential

Insert the differential in the front differential housing and fit the bearing housings complete with new 'O' rings on the right and left hand sides, Fig.41, having first lubricated the threads of both bearing housings with grease (for specification, see Technical Data). Screw in the bearing housings uniformly until they make contact with the differential taper roller bearings. Turn the drive pinion a number of times to settle the bearings. There must be a perceptible backlash between the drive pinion and the crown wheel.

NOTE: New differential bearing cups are only available complete with the bearing housings.



S4-14-145N

Fig.41. Bearing housing 'O' rings.
A - Crown wheel side
B - Intermediate driveshaft side

37. Set backlash

Secure the dial indicator to the front differential with holding fixture Special Tool 15-022-A and adaptor Special Tool 15-008-01 and position the plunger of the dial indicator on a tooth of the crown wheel at right angles to the tooth flank, Fig.42.

Tighten and loosen the bearing housing on the crown wheel side or the opposite side accordingly until a backlash of 0,01 mm is obtained.

Tighten the bearing housing on the differential side until the specified backlash of 0,10 - 0,17 mm is obtained.

Rotate the bevel gear and crown wheel several times and check the backlash measurement again at three points. The backlash must not vary by more than 0,05 mm.

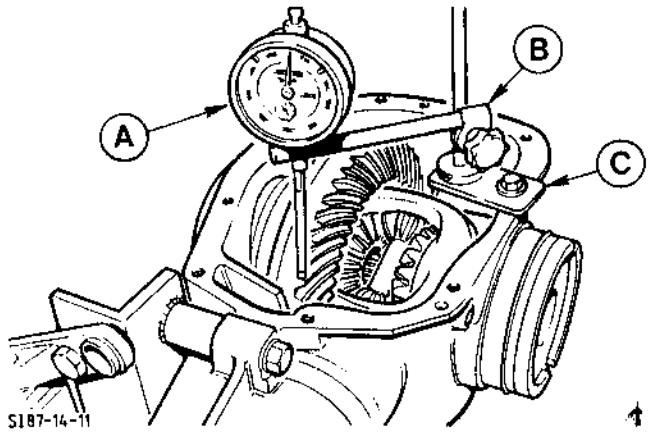


Fig.42. Position plunger of dial indicator at right angles to tooth on crown wheel.

Fig.42. Position plunger of dial test indicator at right angles to tooth on crown wheel.
A - Dial indicator
B - Special Tool 15-022-A
C - Special Tool 15-008-01

38. Fit the bearing housing locking plates on the right and left hand side, Fig.43, and tighten to specified torque (see Technical Data).

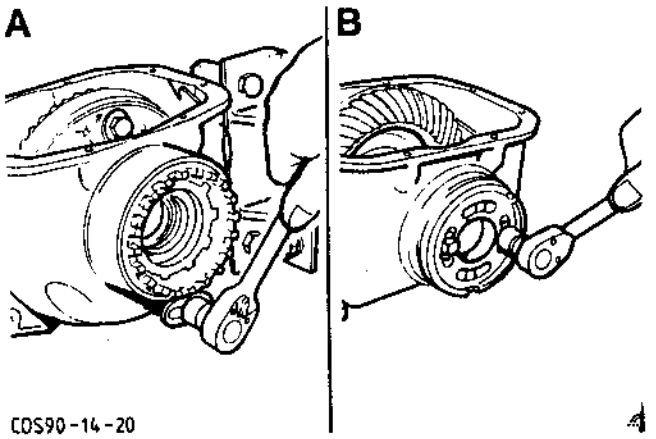


Fig.43. Bearing housing locking plates
A - Right hand side
B - Left hand side (2)

39. Fit a new constant velocity joint radial oil seal into the bearing housing on the crown wheel side using Special Tool 15-076, Fig.44.

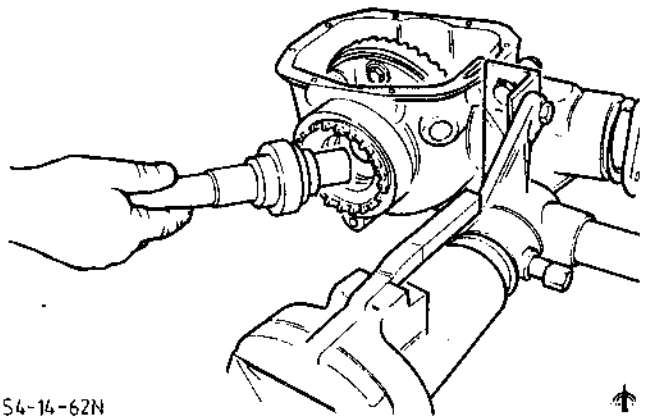


Fig.44. Fit radial oil seal in bearing housing.

40. Remove the differential asembly from stand.

14 234 0 FRONT CROSSMEMBER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Ball Joint Separator	.. ..	13-006
Engine Support Bar	.. ..	21-140

To Remove

1. Disconenct the battery earth cable.

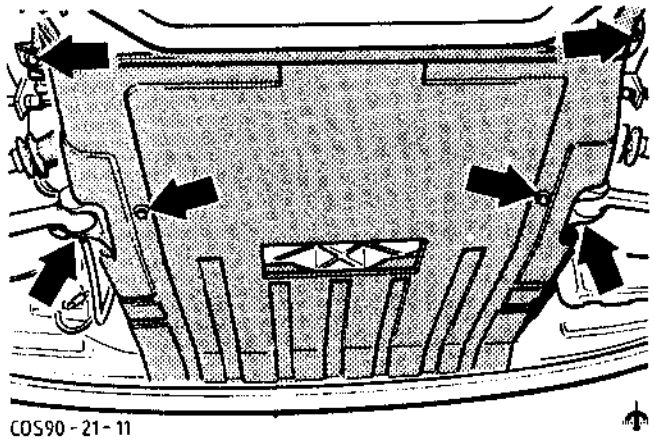

COS90-21-11

Fig.1. Retaining bolts of lower engine cover.

2. Raise the vehicle.

3. Remove the lower engine cover retaining bolts (6) and remove cover, Fig.1.

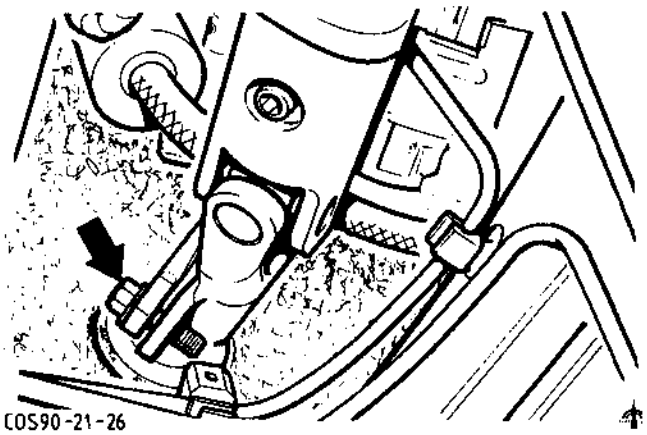

COS90-21-26

Fig.2. Clamp bolt of steering intermediate shaft.

4. Lower the vehicle to the ground.

5. Disconnect the steering intermediate shaft from the steering column shaft (1 clamp bolt), Fig.2.

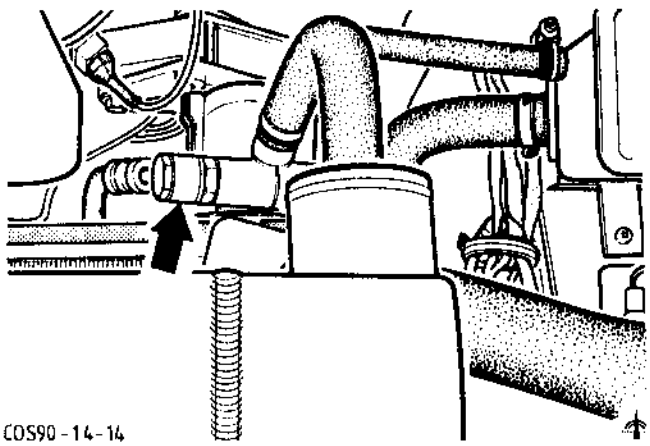

COS90-14-14

Fig.3. High pressure oil pipe to power steering pump.

6. Disconnect the high pressure oil pipe to the steering gear from the power steering pump (1 hollow screw), Fig.3.

7. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect multiplug, Fig.4. (B).

Fig.4. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

8. Unscrew the turbocharger heat shield and bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove heat shield Fig.4. (A, C, D).

9. Slacken and unscrew the right hand engine mounting nut. Slacken the self-locking nut on the throttle housing vibration damper and slacken and unscrew the nut on the left hand engine mounting, Fig.5.

Fig.5. Engine mounting nuts.
A - Right
B - Left
C - Self-locking nut on throttle housing vibration damper

10. Remove the dust caps from the shock absorber top mountings and fit engine support bar Special Tool 21-140. Slacken the bolts of the engine lifting eyes, angle the engine lifting eyes towards the engine support bar and tighten the bolts again. Attach the 2 chains to the spindles on the engine support bar and to the engine lifting eyes, Fig.6. Turn the spindles on the engine support bar to take the weight of the engine.

NOTE: Position the left hand spindle on the engine support bar at the front and the right hand spindle at the rear.

Fig.6. Engine support bar Special Tool 21-140 in position.
A - Right hand spindle at rear
B - Left hand spindle at front
C - Angled engine lifting eyes

11. Slacken the front wheel nuts.

12. Raise the vehicle.

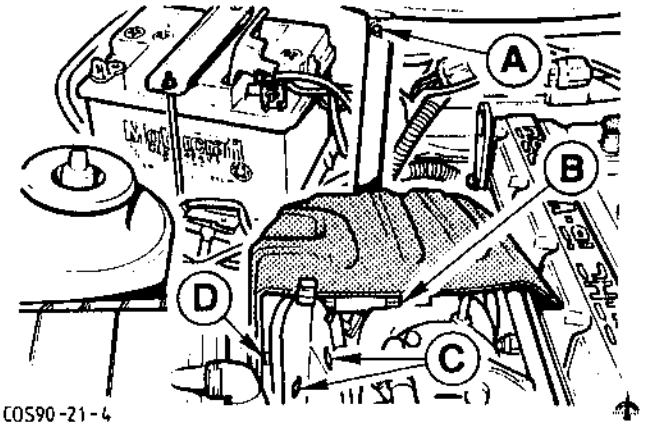


Fig.4. Turbocharger heat shield.

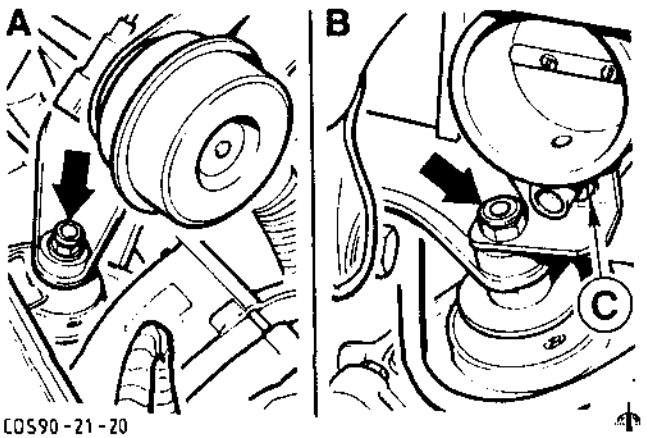


Fig.5. Engine mounting nuts.

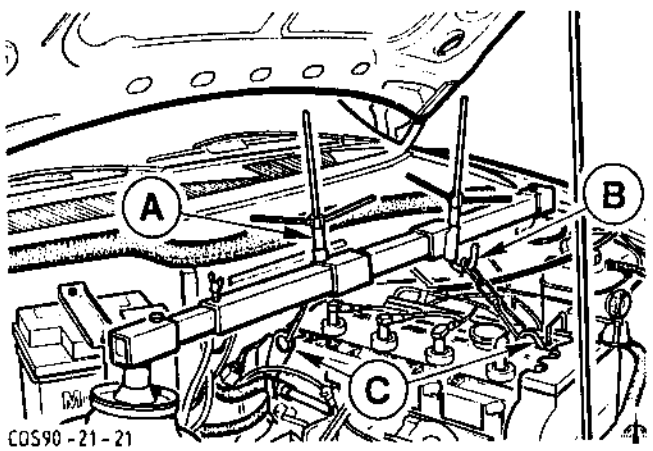


Fig.6. Engine support bar Special Tool 21-140 in position.

13. Remove the front wheels.

14. Disconnect the oil hose from the power steering pump cooling circuit, Fig.7.

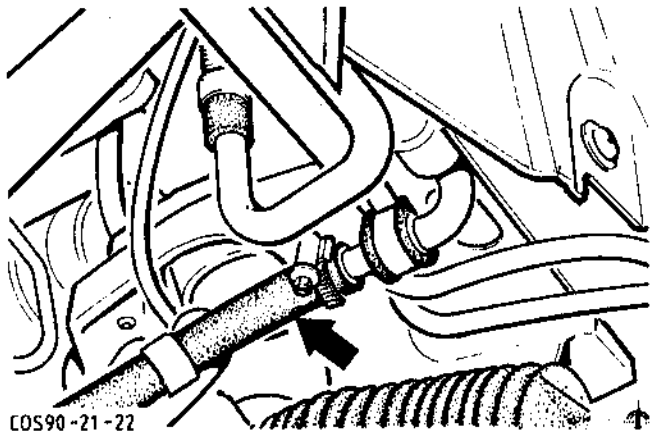


Fig.7. Oil hose to power steering pump cooling circuit.

15. On both sides disconnect the tie rod from the steering arm. Remove the split pin and slacken the castellated nut on the tie rod end. Press the tie rod end out of the spindle carrier using Special Tool 13-006, Fig.8. (A, B, C). Unscrew the castellated nut and disconnect the tie rod end from the spindle carrier.

Fig.8. Front suspension.
A - Tie rod
B - Special Tool 13-006
C - Spindle carrier
D - Retaining bolt of lower suspension arm
E - Lower suspension arm (left hand side shown)

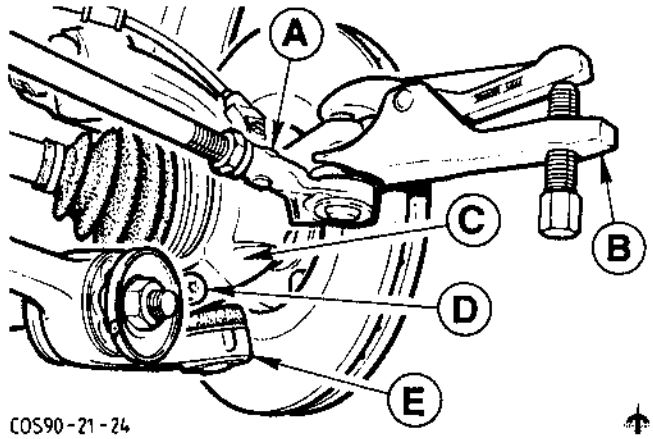


Fig.8. Front suspension (left hand side shown).

16. On both sides remove the Torx bolt and nut and lever the lower suspension arm downwards away from the spindle carrier, Fig.8. (C, D, E).

17. Unscrew the 2 steering gear retaining bolts, Fig.9. (A). Slide the steering gear to the left and remove it.

18. On both sides disconenct the lower suspension arm from the front axle/engine crossmember (1 bolt and nut in each case). Fig.9. (B).

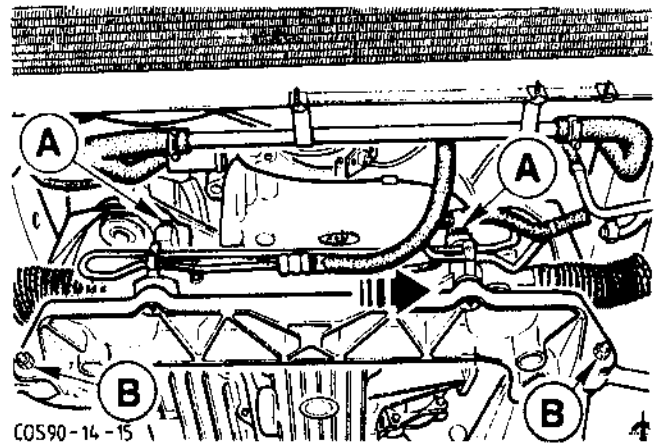


Fig.9. Front axle/engine crossmember.
A - Steering gear attachment
B - Lower suspension arm attachment

19. Position an oil drain container under the front differential, remove the housing cover (8 bolts), Fig.10. and drain off the oil.

20. Remove the snap ring securing the driveshaft in the front differential, Fig.11.

21. Release the brake pipes from the brackets on the left and right hand sides (2 U-shaped retainers), Fig.12. (A, D).

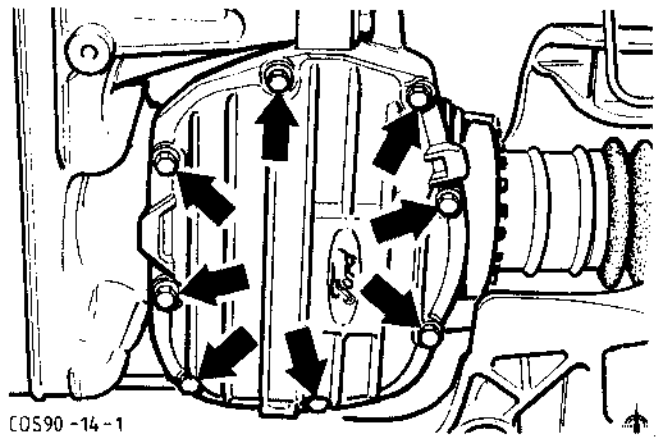


Fig.10. Retaining bolts of front differential housing cover.

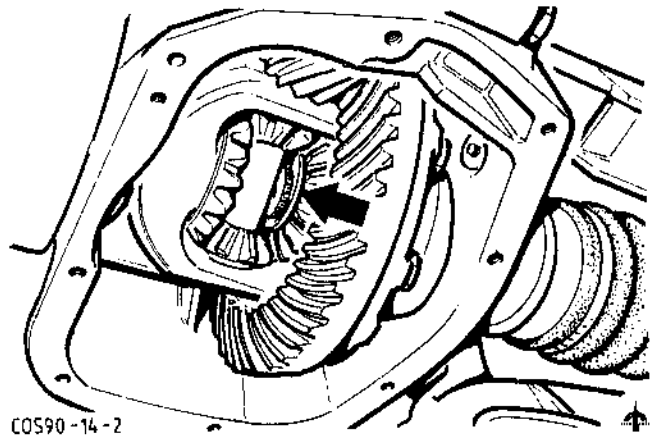


Fig.11. Snap ring securing driveshaft in front differential.

Fig.12. U-shaped brake pipe retainers and driveshafts.
A - Right hand U-shaped retainer
B - Right hand drive driveshaft
C - Left hand drive driveshaft
D - Left hand U-shaped retainer

22. Pull the right hand side driveshaft constant velocity joint out of the front differential and the left hand side driveshaft constant velocity joint out of the intermediate driveshaft, Fig.12. (B, C).

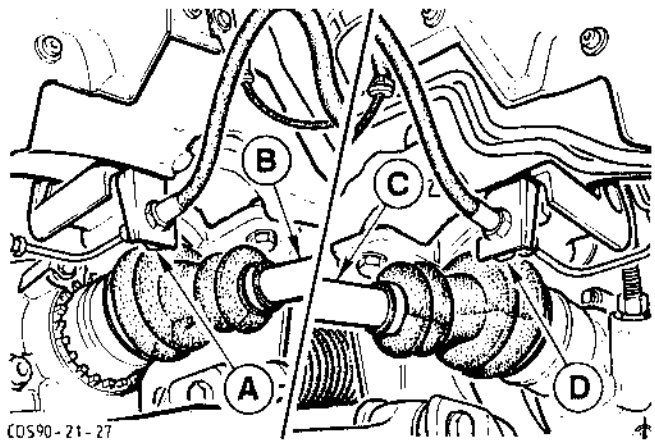


Fig.12. U-shaped brake pipe retainers and driveshafts.

23. Suspend the left and right hand side driveshaft constant velocity joints with wire, Fig.13.

NOTE: The inner constant velocity joints must not be bent at more than 20° and the outer constant velocity joints must not be bent at more than 45°.

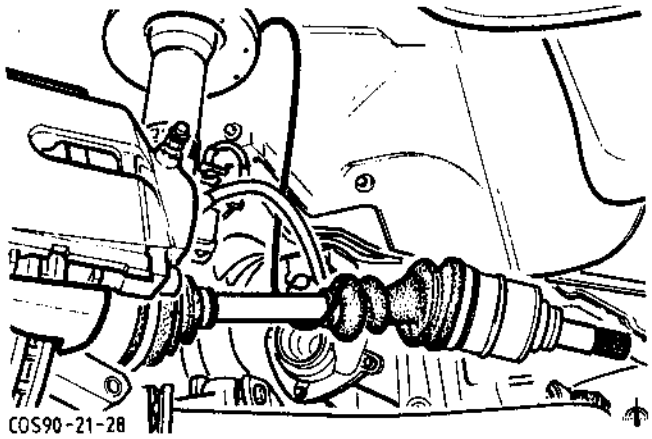


Fig.13. Driveshaft suspended (left hand side shown).

24. Support the front axle/engine crossmember on a jack, unbolt crossmember from the side members with the brake pipe brackets (4 bolts), Fig.14 lower support and remove crossmember.

25. Unbolt the 2 engine mountigns from the front axle/engine crossmember (2 bolts on each side), Fig.15.

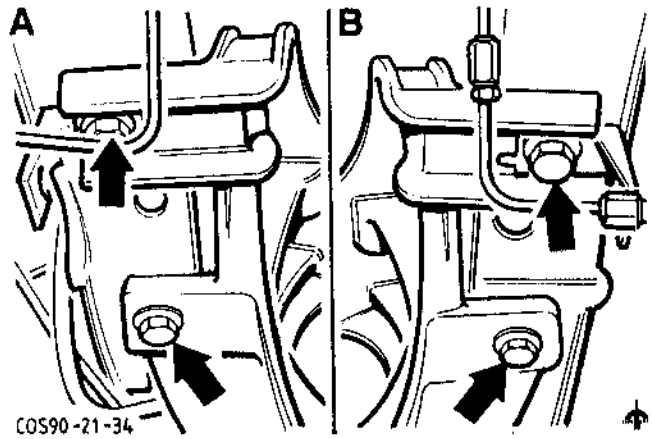


Fig.14. Retaining bolts of front axle/engine crossmember.
A - Left hand side
B - Right hand side

To Install

NOTE: When installing, tighten the nuts, bolts and pipes to the tightening torque specified in Technical Data.

26. Bolt the 2 engine mountings to the front axle/engine crossmember, Fig.15.

27. Locate the front axle/engine crossmember in position on a jack. Guide the engine mounting studs into the mounting brackets on the left and right hand sides. Fit the engine mounting nuts and tighten finger tight. Bolt the front axle/engine crossmember to the side members, Fig.14. Remove the jack.

NOTE: Guide the throttle housing supporting bracket over the engine mounting stud.

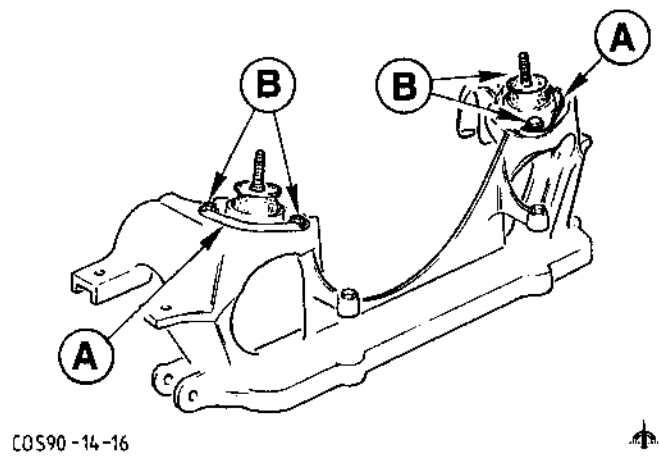


Fig.15. Engine crossmember removed.
A - Engine mountings
B - Engine mounting retaining bolts

28. Fit the left hand side driveshaft constant velocity joint in the intermediate driveshaft using a new snap ring, Fig.16. (C).

Fig.16. U-shaped brake pipe retainers and driveshafts.
A - Right hand U-shaped retainer
B - Right hand side driveshaft
C - Left hand side driveshaft
D - Left hand U-shaped retainer

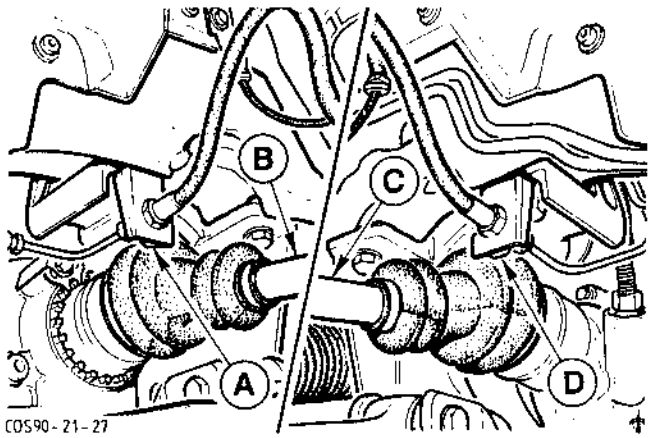


Fig.16. U-shaped brake pipe retainers and driveshafts.

29. Fit the brake pipes to the brackets on the left and right hand sides and secure them with the U-shaped retainers, Fig.16. (A, D).

30. Fit the right hand side driveshaft constant velocity joint in the front differential and secure it using a new snap ring, Fig.16, (B) and Fig.17.

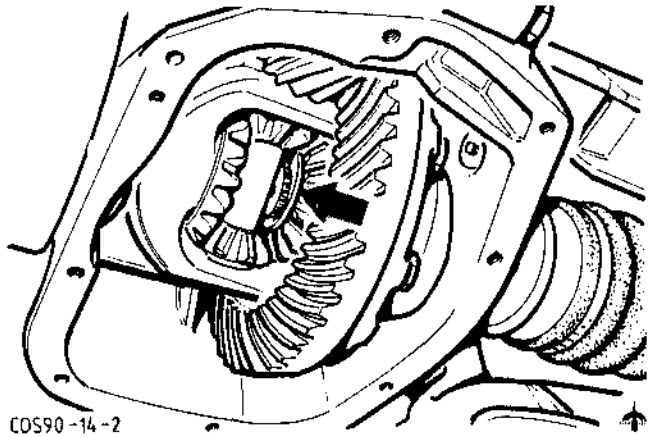


Fig.17. Snap ring securing driveshaft in front differential.

31. Apply sealer (see Technical Data for specification) and fit the cover to the front differential housing, Fig.18.

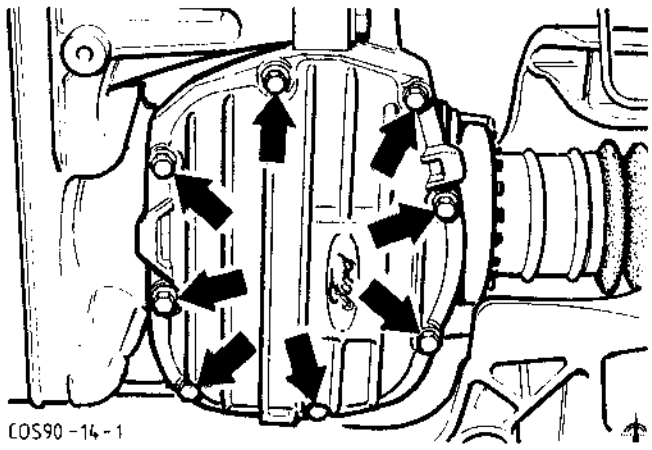


Fig.18. Retaining bolts of front differential housing cover.

32. Fit the lower suspension arm to the front axle/engine crossmember on both sides, Fig.19. (B).

33. Insert the steering gear from the left hand side, locate it in position and secure it to the front axle/engine crossmember, Fig.19. (A).

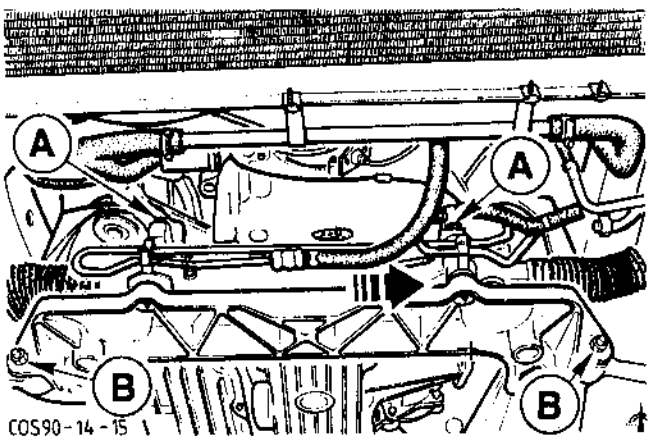


Fig.19. Front axle/engine crossmember.
A - Steering gear attachment
B - Lower suspension arm attachment

34. Connect the lower suspension arm to the spindle carrier (both sides), Fig.20.

35. Connect the tie rod to the steering arm. Fit the castellated nut on the tie rod end, tighten it and lock it using a new split pin (both sides).

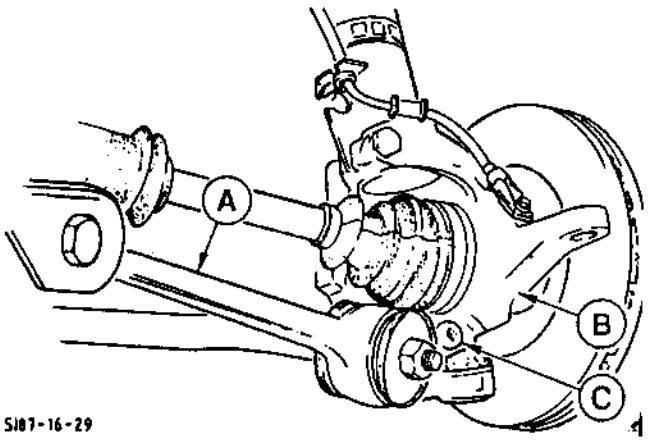


Fig.20. A - Lower suspension arm
B - Spindle carrier
C - Torx bolt and nut

36. Connect the oil hose to the power steering pump cooling circuit, Fig.21.

37. Fit the front wheels.

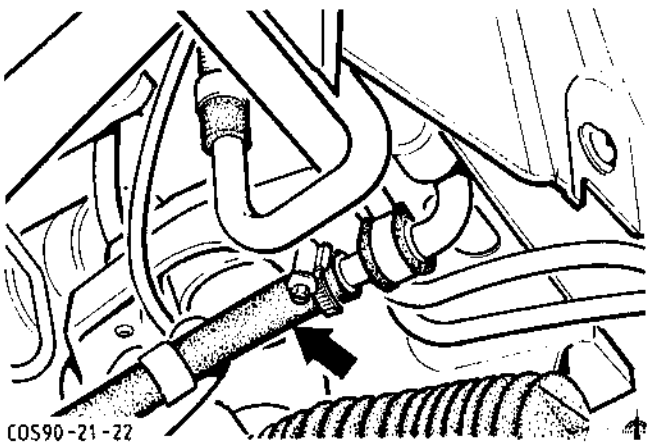


Fig.21. Oil hose to power steering pump cooling circuit.

38. Fill the front differential with oil (see Technical Data for quantity and specification), Fig.22.

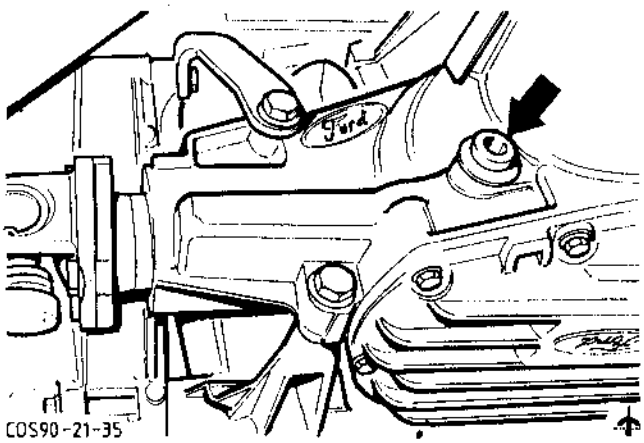


Fig.22. Front differential oil filler plug.

39. Screw the lower engine cover to the side members and the front axle/engine crossmember, Fig.23.

40. Lower the vehicle to the ground.

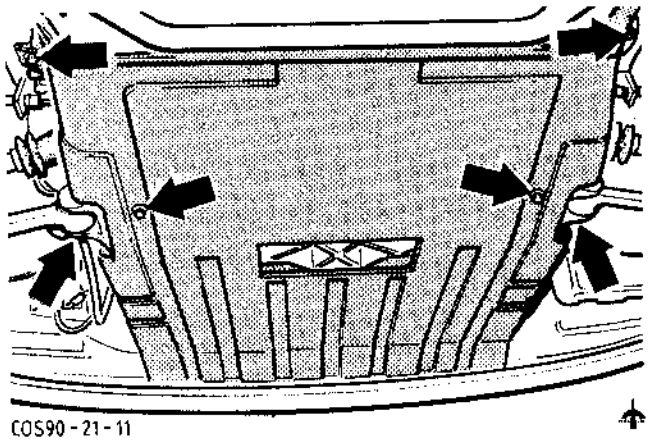


Fig.23. Retaining bolts of lower engine cover.

41. Tighten the front wheel nuts.

42. Slacken the spindles on the engine support bar and disconnect the chains. Remove the engine support bar. Slacken the retaining bolts of the engine lifting eyes, align the engine lifting eyes upright and tighten the retaining bolts. Fit the dust caps over the shock absorber top mountings, Fig.24.

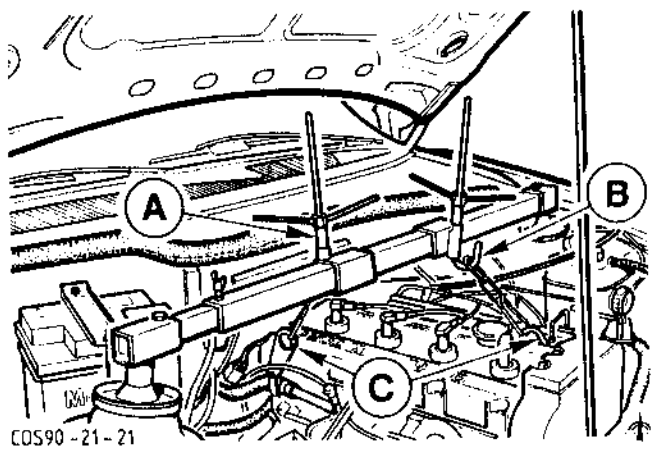


Fig.24. Engine support bar Special Tool 21-140 in position.
A - Right hand spindle to the rear
B - Left hand spindle to the front
C - Angled engine lifting eyes

Fig.24. Engine support bar Special Tool 21-140 in position.

43. Screw a new self-locking nut on the throttle housing vibration damper but do not tighten it.
Tighten the 2 engine mounting nuts, Fig.25. (A, B, C).
Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken it half a turn.

NOTE: Note the arrangement of the spring washers, Fig.25. (D).

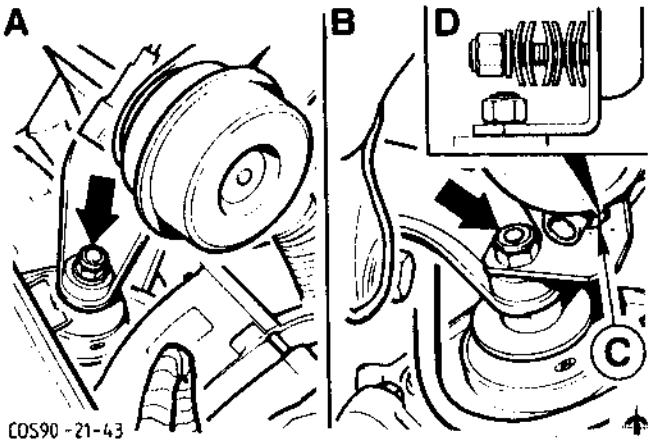


Fig.25. Engine mounting and vibration damper nuts.
A - Right
B - Left
C - Self-locking nut on throttle housing vibration damper
D - Spring washer arrangement

44. Locate the turbocharger heat shield in position and push it into the 2 lower clips. Secure the turbocharger heat shield and bracket to the bulkhead and to the bracket on the fender, Fig.26. (A, C, D).

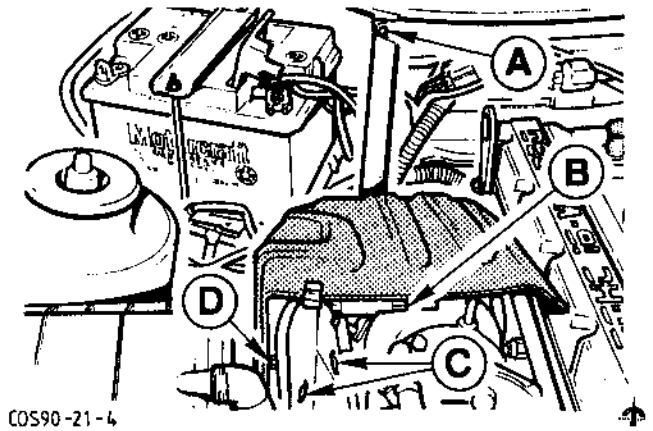


Fig.26. Turbocharger heat shield.
A - Retaining bolt
B - HEGO sensor multiplug
C - Heatshield clips
D - Retaining nut

45. Connect the HEGO sensor multiplug and clip it to the heat shield, Fig.26. (B).

46. Connect the high-pressure oil pipe running to the steering gear to the power steering pump, Fig.27.

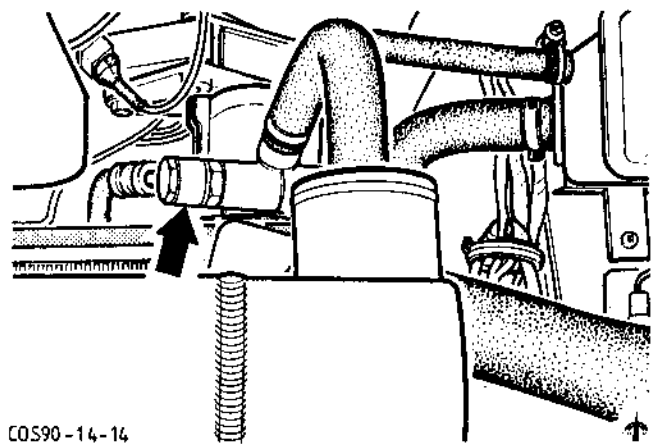


Fig.27. High-pressure oil pipe to power steering pump.

47. Centralise the steering wheel and the steering gear. Connect the steering intermediate shaft to the steering column shaft.

48. Fill the power steering pump reservoir with hydraulic fluid and bleed the steering system as indicated in Operation 13 416 1.

49. Connect the battery earth cable.

14 301 0 SEAL - DRIVESHAFT INNER - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Ball Joint Separator	.. ..	13-006
Driveshaft Oil Seal Installer	.	15-076
Oil Seal Extractor	.. ..	21-051

To Remove

1. Slacken the nuts of the right hand front wheel.

2. Raise the vehicle.

3. Remove the right hand front wheel.

4. Remove the lower engine cover retaining bolts (6) and remove cover.

5. On the right hand side disconnect the tie rod from the steering arm. Remove the split pin and slacken the castellated nut on the tie rod end.
Press the tie rod end out of the spindle carrier using Special Tool 13-006, Fig.2. (A, B, C). Unscrew the castallated nut and disconnect the tie rod end from the spindle carrier.

Fig.2. Front suspension.
A - Tie rod
B - Special Tool 13-006
C - Spindle carrier
D - Lower suspension arm retaining bolt
E - Lower suspension arm

6. Unscrew the stabiliser bar brackets from the side members on the left and right hand sides (4 bolts), Fig.3.

7. On the right hand side remove the Torx bolt and nut and prise the lower suspension arm downwards away from the spindle carrier, Fig.2. (C, D, E).

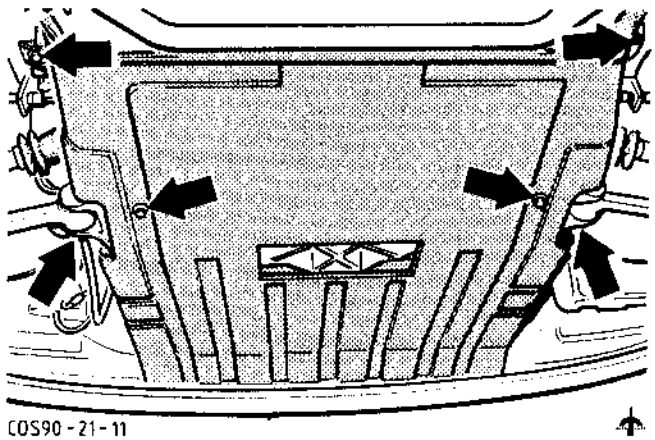


Fig.1. Retaining bolts of lower engine cover.

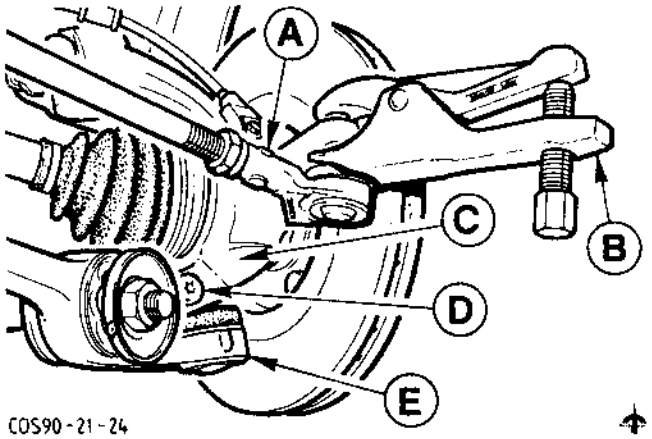


Fig.2. Front suspension.

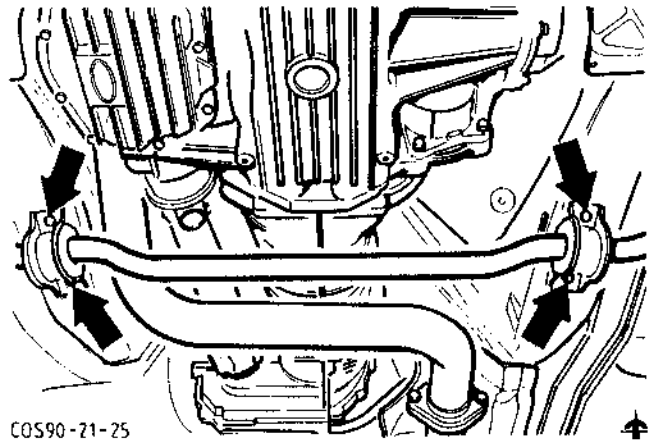


Fig.3. Retaining bolts of stabiliser bar bracket.

8. Position an oil drain container under the front differential, unscrew the cover (8 bolts), Fig.4. and drain off the oil.

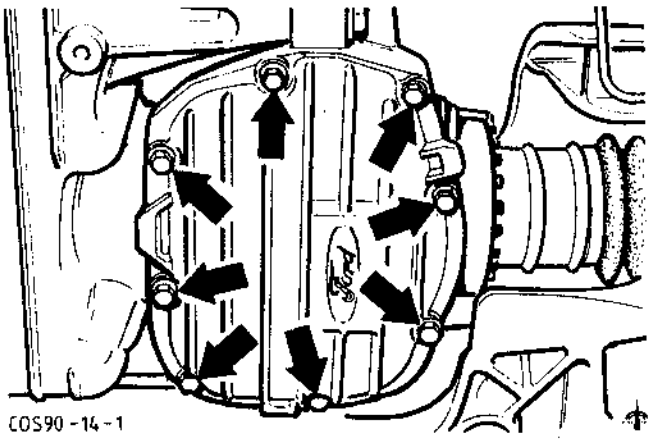


Fig.4. Retaining bolts of front differential housing cover.

9. Remove the right hand side driveshaft from the front differential, Fig.5.

- Remove the snap ring securing the driveshaft in the front differential.
- Pull the right hand side driveshaft constant velocity joint out of the front differential and suspend it with wire.

NOTE: The inner constant velocity joint must not be bent at more than 20° and the outer constant velocity joint must not be bent at more than 45°.

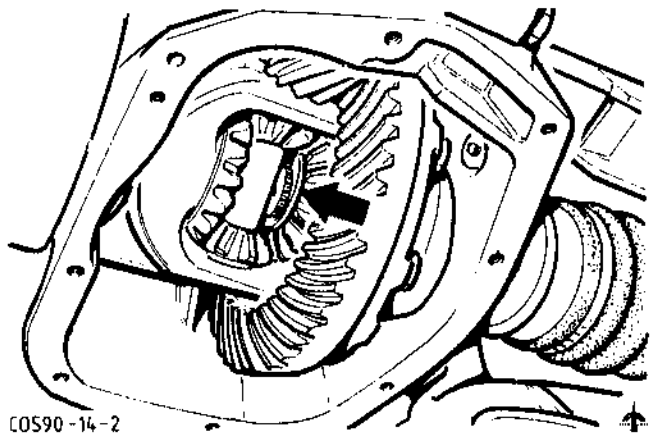


Fig.5. Snap ring securing driveshaft in front differential.

10. Remove the constant velocity joint oil seal from the front differential using Special Tool 21-051, Fig.6.

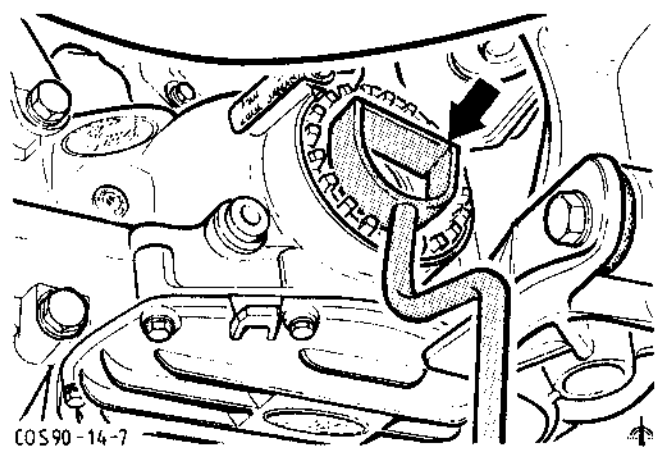


Fig.6. Remove radial oil seal using Special Tool 21-051.

To Install

NOTE: When installing, tighten the nuts and bolts to the specified tightening torques (see Technical Data).

11. Fit the constant velocity joint oil seal in the front differential using Special Tool 15-076, Fig.7.

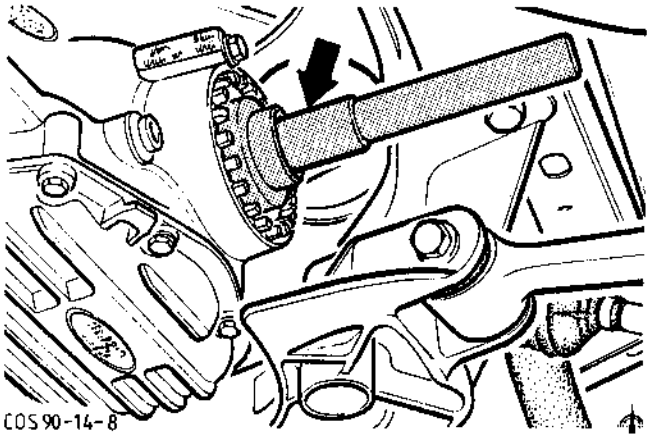


Fig.7. Fit radial oil seal using Special Tool 15-076.

12. Insert the right hand side driveshaft constant velocity joint in the front differential and secure it using a new snap ring, Fig.8.

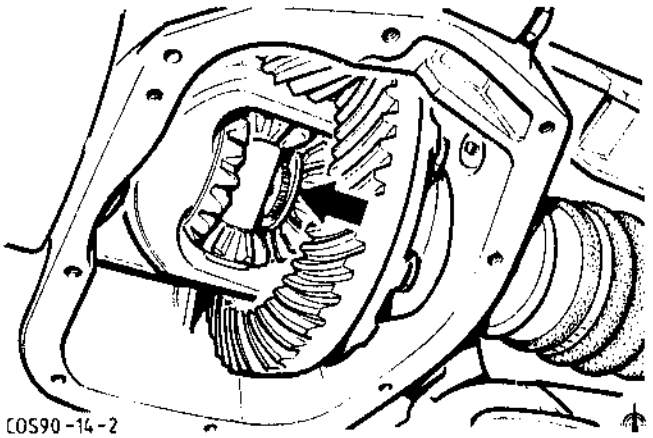


Fig.8. Snap ring securing driveshaft in front differential.

13. Apply sealer (see Technical Data for specification) and fit the front differential housing cover, Fig.9.

14. Connect the lower suspension arm to the spindle carrier (right hand side).

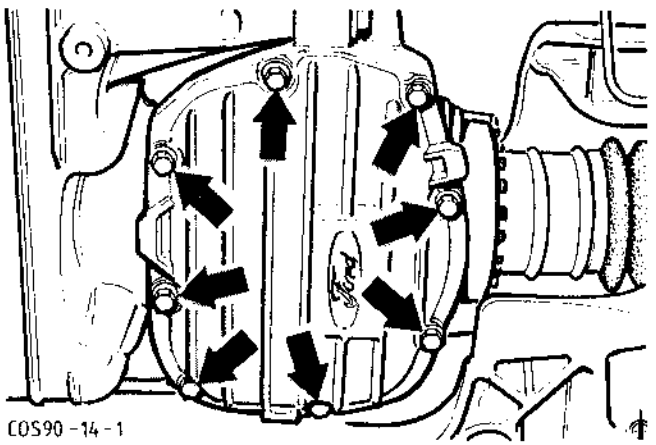


Fig.9. Retaining bolts of front differential housing cover.

15. Fit the stabiliser bar brackets to the side members on the left and right hand sides, Fig.10.

NOTE: Make sure the rubber bushes are seated correctly.

16. Connect the tie rod to the steering arm. Fit the castellated nut on the tie rod end (right hand side), tighten it and secure it with a split pin.

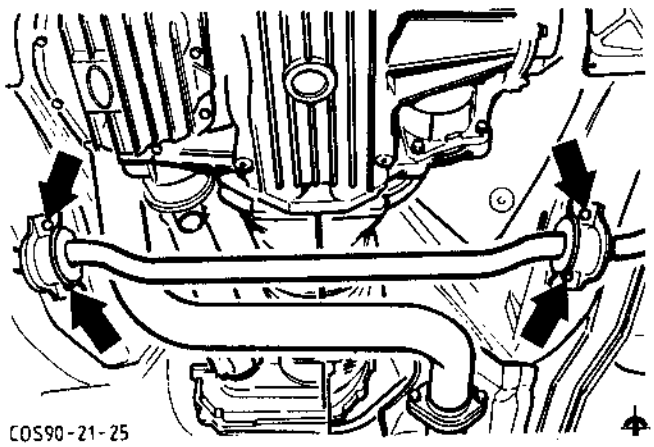


Fig.10. Retaining bolts of stabiliser bar brackets.

17. Fit the right hand front wheel.

18. Fill the front differential with oil (see Technical Data for quantity and specification), Fig.11.

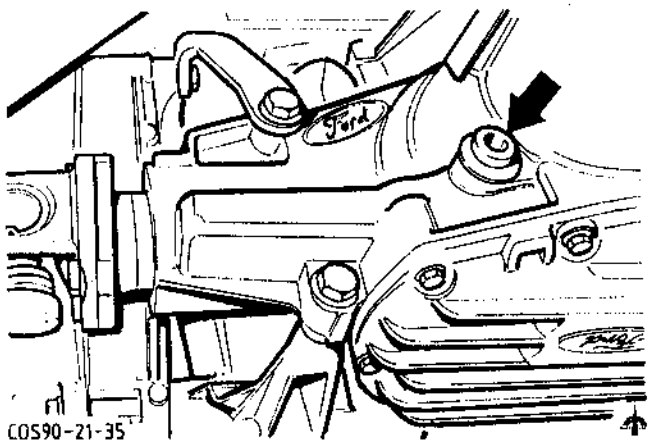


Fig.11. Front differential oil filler plug.

19. Screw the lower engine cover to the side members and the front axle/engine crossmember, Fig.12.

20. Lower the vehicle to the ground.

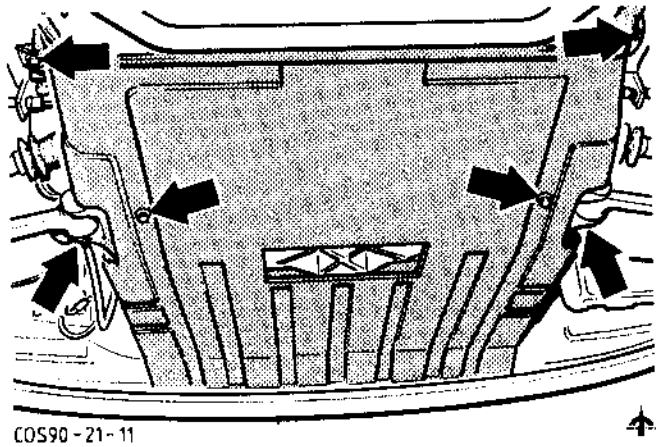


Fig.12. Retaining bolts of lower engine cover.

21. Tighten the wheel nuts of the right hand front wheel.

14 321 0 DRIVESHAFT - FRONT - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Ball Joint Separator 13-006

To Remove

1. Slacken the front wheel nuts.

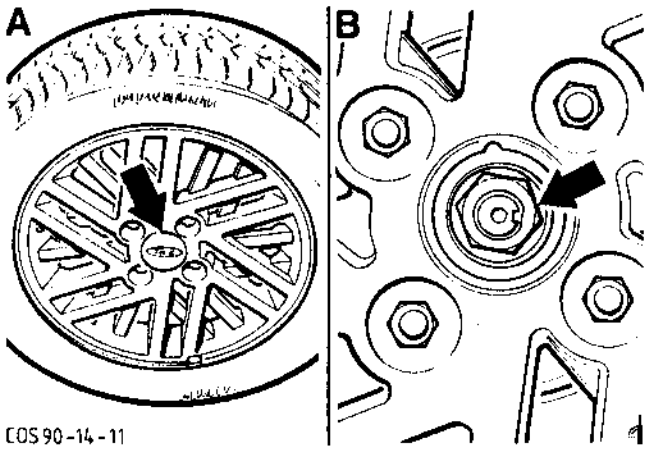


Fig.1. A - Hub cap
B - Stud axle nut

2. Remove the hub cap and unlock and slacken the stub axle nut, Fig.1.

3. Raise the vehicle.

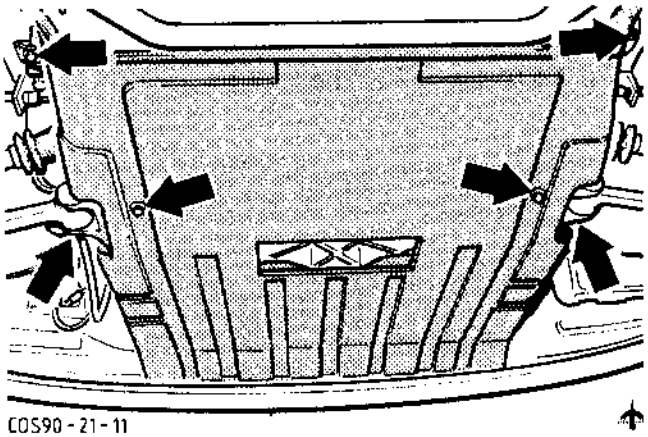


Fig.2. Retaining bolts of lower engine cover.

4. Remove lower engine cover retaining bolts (6) and remove cover, Fig.2.

5. Remove the front wheel.

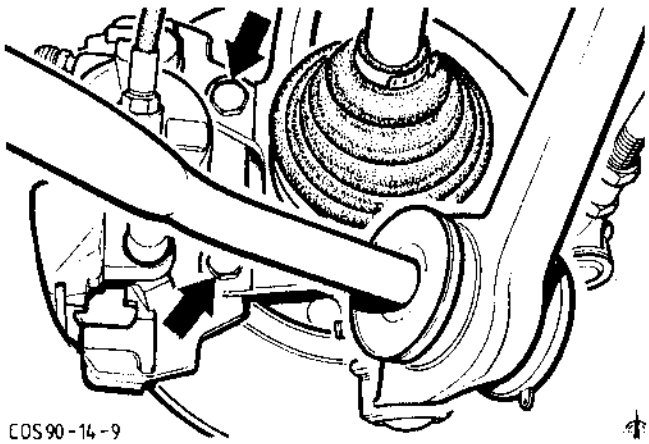


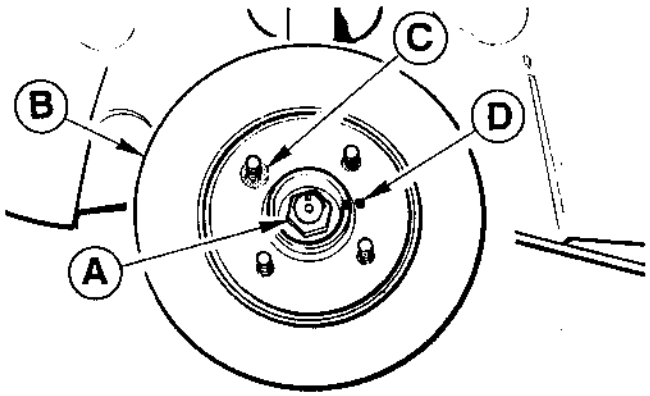
Fig.3. Retaining bolts of brake caliper assembly.

6. Unscrew the brake caliper assembly, from the spindle carrier (2 bolts), Fig.3.

NOTE: Suspend the brake caliper assembly with wire.

7. Mark the position of the brake disc in relation to the wheel hub. Unscrew the serrated lock washer and remove the brake disc, Fig.4. (B, C, D).

Fig.4. Brake disc and wheel hub.
A - Stud axle nut
B - Brake disc
C - Serrated lock washer
D - Mark showing position of hub relative to brake disc

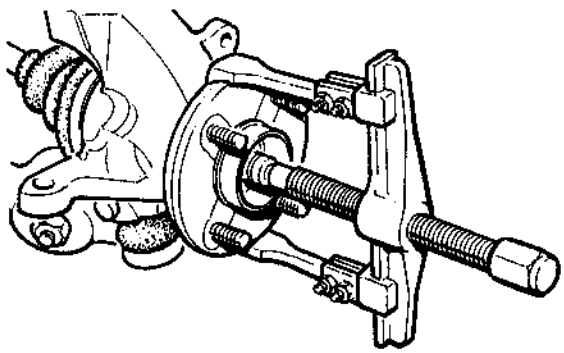


COS90-14-10

Fig.4. Brake disc and wheel hub.

8. Unscrew the stub axle nut and remove the washer, Fig.4. (A).

9. Remove the wheel hub using a suitable puller, Fig.5.

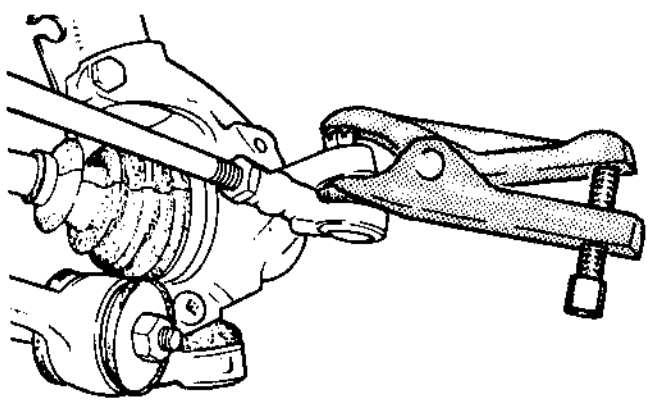


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Fig.5. Remove wheel hub.

10. Disconnect the tie rod from the steering arm. Remove the split pin and slacken the castellated nut on the tie rod end.

Press the tie rod end out of the spindle carrier using Sepcial Tool 13-006, Fig.6. Unscrew the castellated nut and disconnect the tie rod end from the spindle carrier.



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Fig.6. Press out tie rod using Special Tool 13-006.

11. Unscrew the stabiliser bar brackets from the side members on the left hand right hand sides (4 bolts), Fig.7.

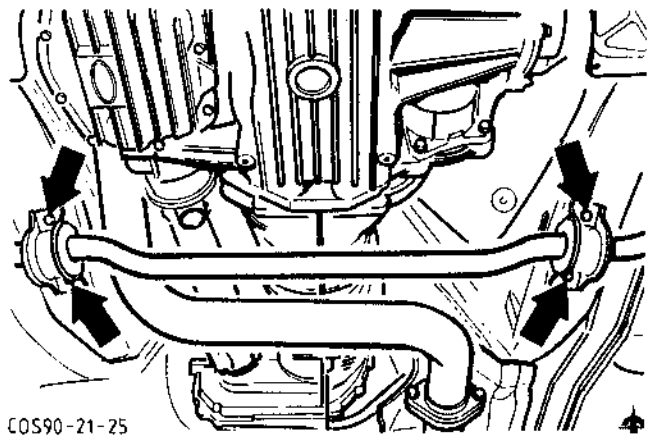


Fig.7. Retaining bolts of stabiliser bar brackets.

12. Disconnect the lower suspension arm from the spindle carrier (1 Torx bolt and nut), Fig.8.
Prise the lower suspension arm downwards away from the spindle carrier.

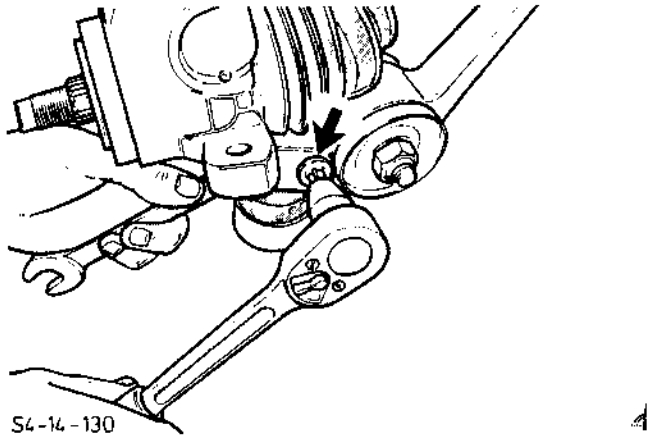


Fig.8. Disconnect lower suspension arm.

13. Left hand side driveshaft only

Pull the spindle carrier outwards until the stub axle is free. Pull the driveshaft constant velocity joint out of the intermediate driveshaft and remove constant velocity joint.

14. Right hand side driveshaft only

Position an oil drain container under the front differential, remove the differential housing cover (8 bolts), Fig.9, and drain off the oil.

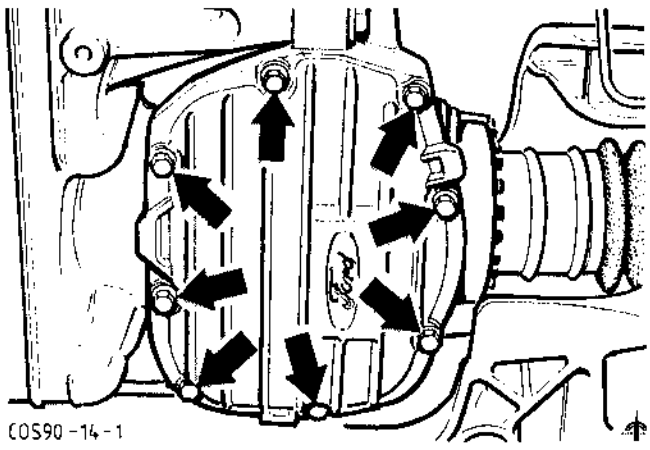


Fig.9. Retaining bolts of front differential housing cover.

15. Right hand side driveshaft only

Remove the snap ring securing the right hand side driveshaft in the front differential, Fig.10.
Pull the spindle carrier outwards until the stub axle is free.
Withdraw the driveshaft constant velocity joint from the front differential and remove it.

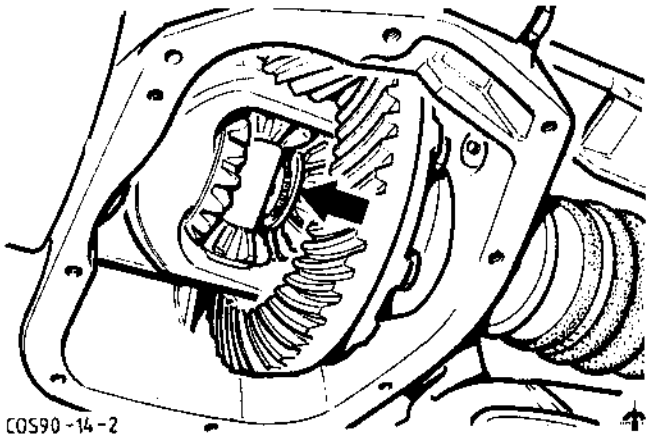


Fig.10. Snap ring securing driveshaft in front differential.

To Install

NOTE: When installing, tighten the nuts and bolts to the tightening torques specified in Technical Data.

16. Left hand side driveshaft only

Fit the left hand side driveshaft constant velocity joint in the intermediate driveshaft using a new snap ring, Fig.12. (B). Pull the spindle carrier outward and guide the stub axle (greased - see Technical Data for grease specification) into the spindle carrier.

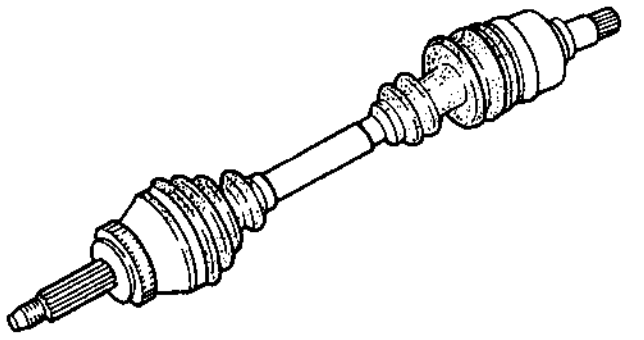


Fig.11. Driveshaft assembly.

17. Right hand side driveshaft only

Fit the right hand side driveshaft constant velocity joint in the front differential, Fig.12. (A). Pull the spindle carrier outward and guide the stub axle (greased - see Technical Data for grease specification) into the spindle carrier.

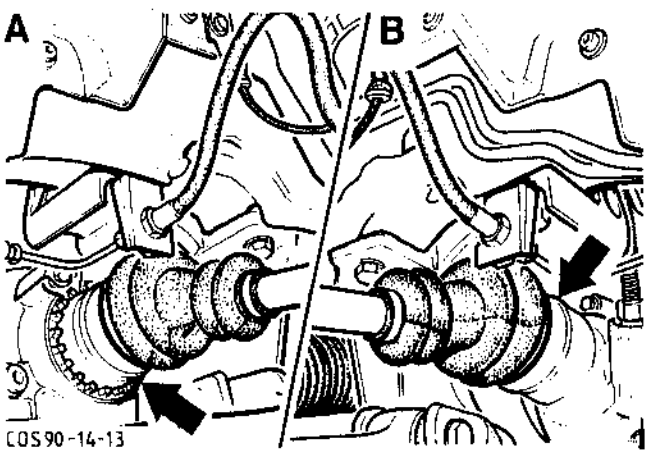


Fig.12. Driveshaft fitted.
A - Right hand side driveshaft in front differential
B - Left hand side driveshaft in intermediate driveshaft

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18. Right hand side driveshaft only

Secure the right hand side driveshaft constant velocity joint in the front differential using a new snap ring, Fig.13.

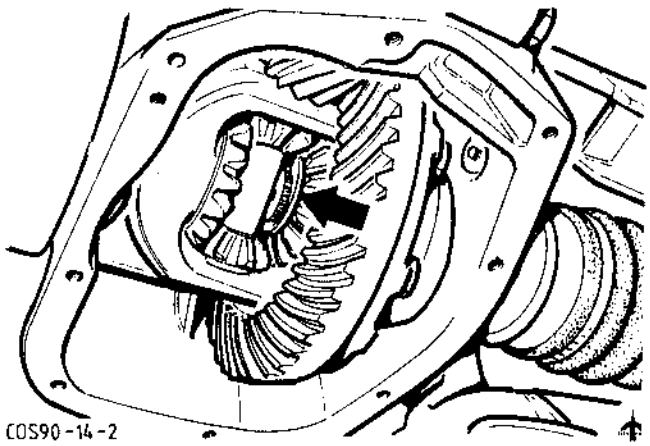


Fig.13. Snap ring securing driveshaft in front differential.

19. Right hand side driveshaft only

Apply sealer (see Technical Data for specification) and fit the front differential housing cover, Fig.14.

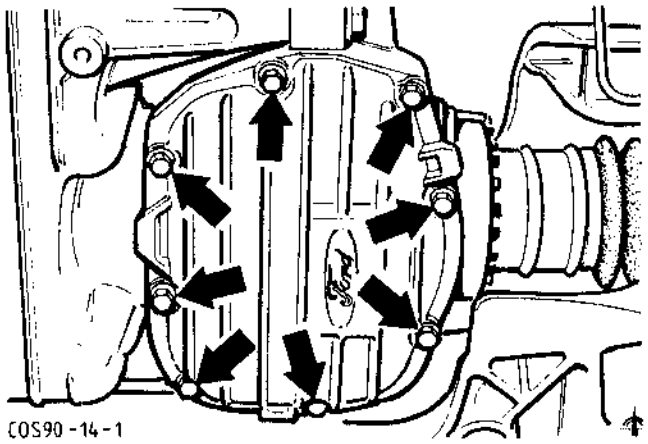


Fig.14. Retaining bolts of front differential housing cover.

20. Connect the lower suspension arm to the spindle carrier (both sides), Fig.15. (A).

21. Fit the stabiliser bar brackets to the side members on the left and right hand sides.

NOTE: Make sure the rubber bushes are seated correctly.

22. Connect the tie rod to the steering arm, Fig.16. (B). Fit the castellated nut on the tie rod end, tighten it and lock it using a new split pin (both sides).

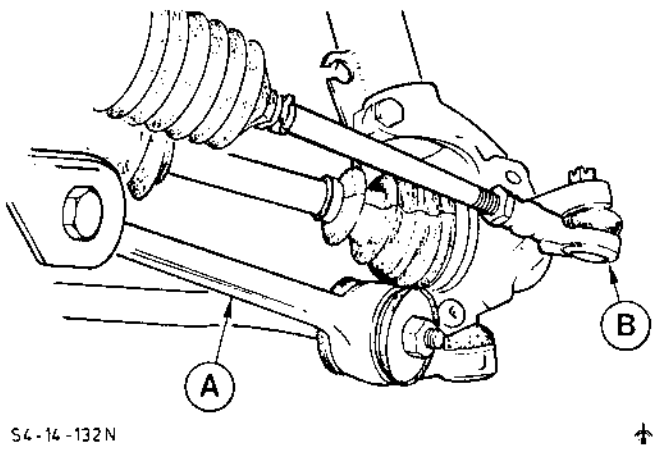


Fig.15. A - Lower suspension arm
B - Tie rod

23. Draw the wheel hub onto the stub axle, using Special Tool 14-022, Fig.16.

Fig.16. A - Spindle carrier
B - Wheel hub
C - Special Tool 14-022
D - Stub axle

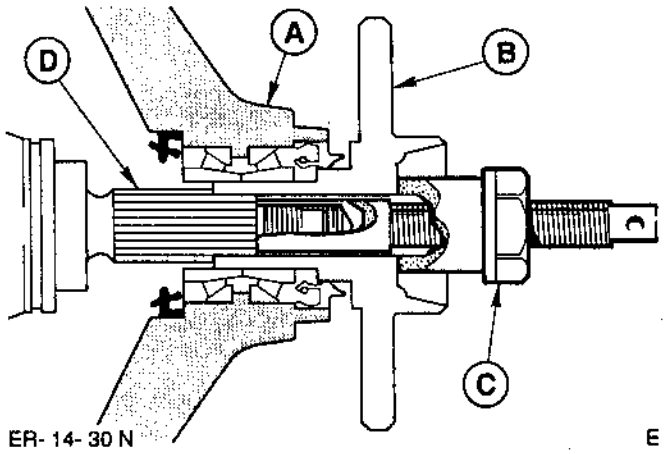


Fig.16. Draw wheel hub onto stub axle using Special Tool 14-022.

23a. Fit the washer and a new nut (but do not torque).

24. Fit the brake disc in the marked position and secure it with the serrated lock washer.

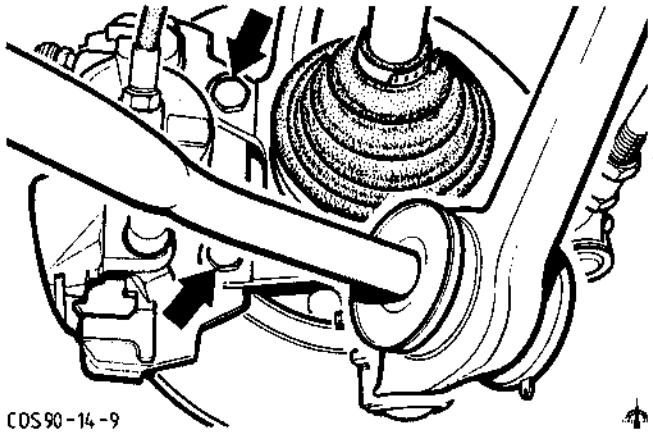


Fig.17. Retaining bolts of brake caliper assembly.

25. Fit the brake caliper assembly to the spindle carrier, Fig.17.

26. Right-hand side driveshaft only

Fill the front differential with oil (see Technical Data for quantity and specification), Fig.18.

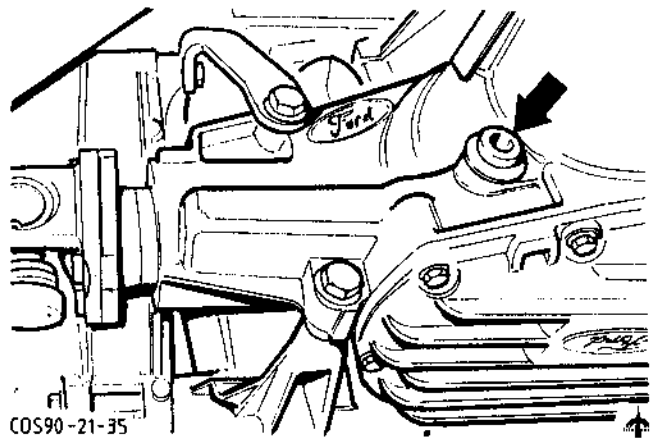


Fig.18. Front differential oil filler plug.

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27. Screw the lower engine cover to the side members and the front axle/engine crossmember, Fig.19.

28. Lower the vehicle sufficiently to allow the foot brake pedal to be operated.

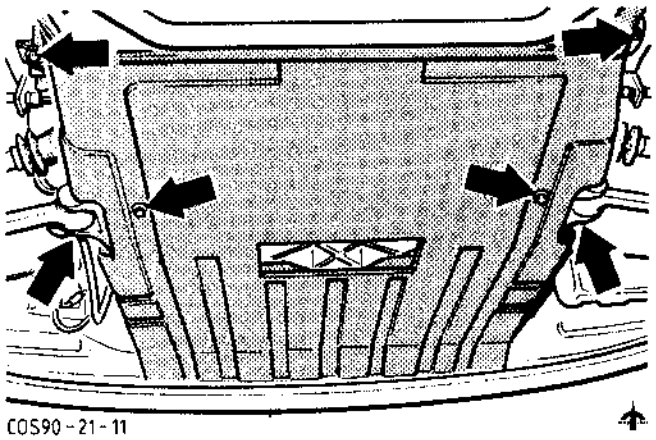


Fig.19. Retaining bolts of lower engine cover.

29. Tighten the stub axle nut to the specified torque (see Technical Data) and stake the nut to lock it, Fig.20. (B).

NOTE: Operate the brakes.

30. Fit the front wheel, tighten the wheel nuts and fit the hub cap, Fig.20 (A).
Lower the vehicle to the ground.

31. Connect the battery earth cable.

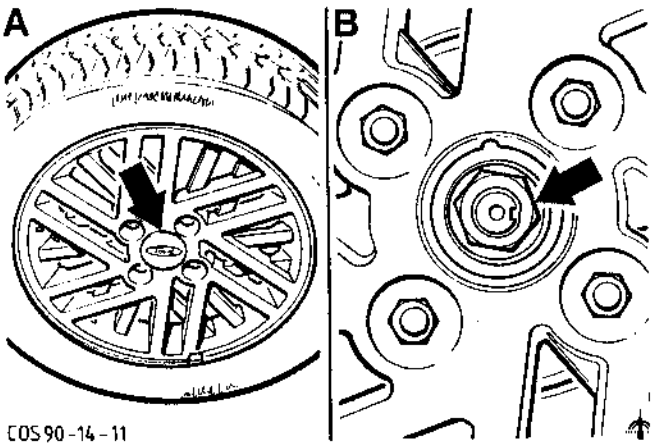


Fig.20. A - Hub cap
B - Stub axle nut

14 330 0 INTERMEDIATE DRIVESHAFT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball Joint Separator 13-006

To Remove

1. Disconnect the battery earth cable.

2. Slacken the nuts of the left hand front wheel.

3. Raise the vehicle.

4. Remove the left hand front wheel.

5. Remove the lower engine retaining bolts (6) and remove cover, Fig.1.

6. On the left hand side disconnect the tie rod from the steering arm. Remove the split pin and slacken the castallated nut on the tie rod end.

   Press the tie rod end out of the spindle carrier using Special Tool 13-006, Fig.2. (A, B, C). Unscrew the castellated nut and disconnect the tie rod end from the spindle carrier.

Fig.2. Front suspension.
- A - Tie rod
- B - Special Tool 13-006
- C - Spindle carrier
- D - Lower suspension arm retaining bolt
- E - Lower suspension arm (left hand side shown)

7. Unscrew the stabiliser bar brackets from the side members on the left and right hand sides (4 bolts), Fig.3.

8. On the left hand side remove the Torx bolt and nut and prise the lower suspension arm downwards away from the spindle carrier, Fig.2. (C, D, E).

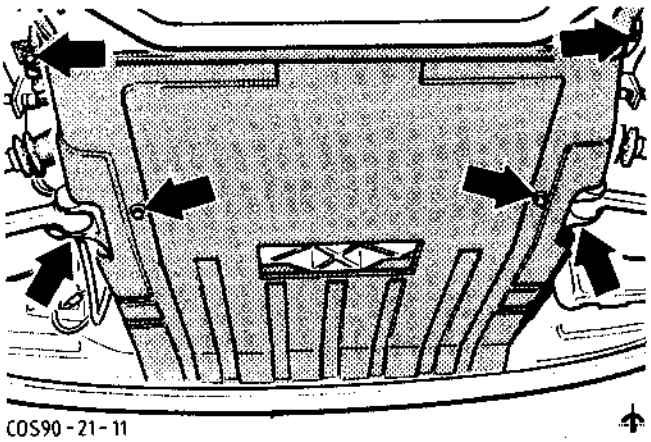


Fig.1. Retaining bolts of lower engine cover.

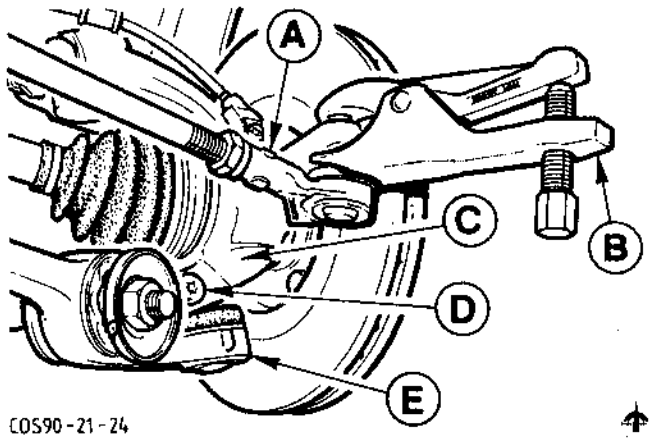


Fig.2. Front suspension (left hand side shown).

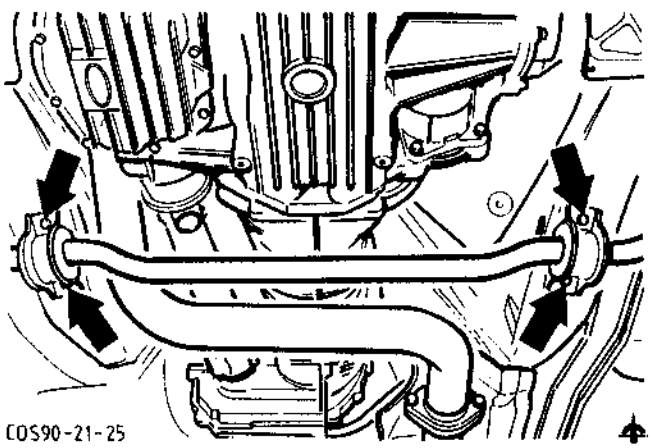


Fig.3. Retaining bolts of stabiliser bar brackets.

9. Pull the left hand side driveshaft constant velocity joint out of the intermediate driveshaft and suspend it with wire, Fig.4.

NOTE: The inner constant velocity joint must not be bent at more than 20° and the outer constant velocity joint must not be bent a more than 45°.

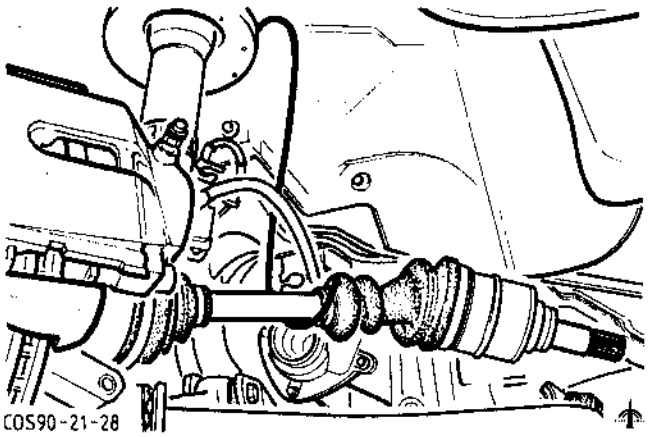


Fig.4. Driveshaft suspended (left hand side shown).

10. Unscrew the speedometer drive cable union nut from the intermediate driveshaft housing cover and withdraw the speedometer drive cable, Fig.5. (A).

11. Remove the intermediate driveshaft housing cover (4 bolts), Fig.5. (B).

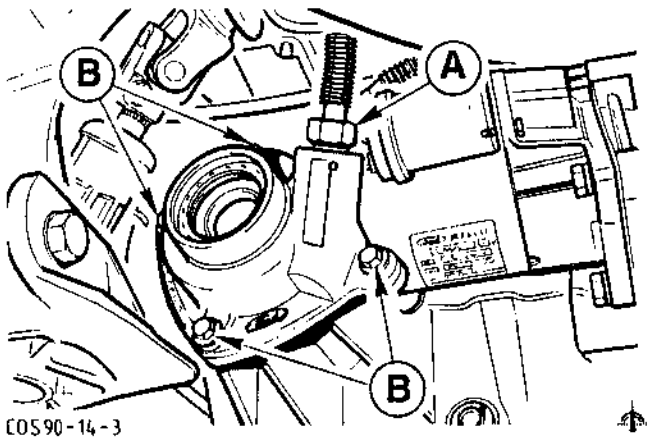


Fig.5. Intermediate driveshaft housing cover.
A - Speedometer drive cable union nut
B - Retaining bolts

12. Release the circlip securing the speedometer drive worm gear on the intermediate driveshaft and remove the worm gear, Fig.6. (A).

13. Remove the circlip from the intermediate driveshaft and withdraw the intermediate driveshaft with the bearing, Fig.6 (B).

NOTE: The bearing is not a press fit.

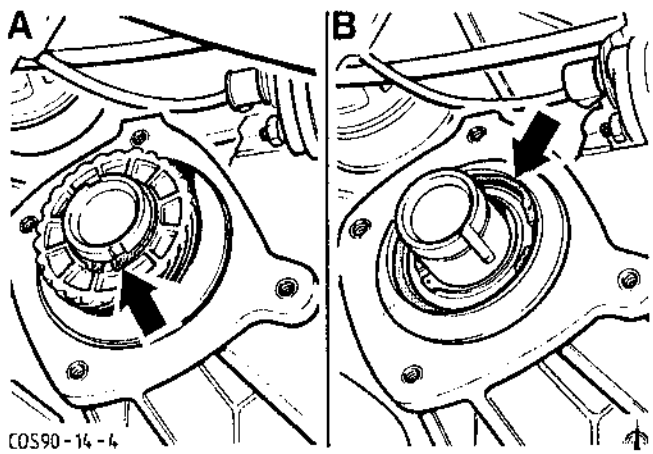
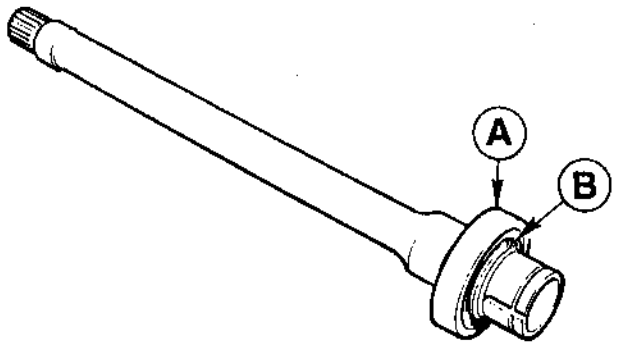


Fig.6. Circlips.
A - Speedometer drive worm gear
B - Intermediate driveshaft

14. Remove the circlip securing the bearing on the intermediate driveshaft and remove the bearing, Fig.7.

NOTE: The bearing is not a press fit.



COS90-14-17

Fig.7. Intermediate driveshaft removed.
A - Bearing
B - Circlip

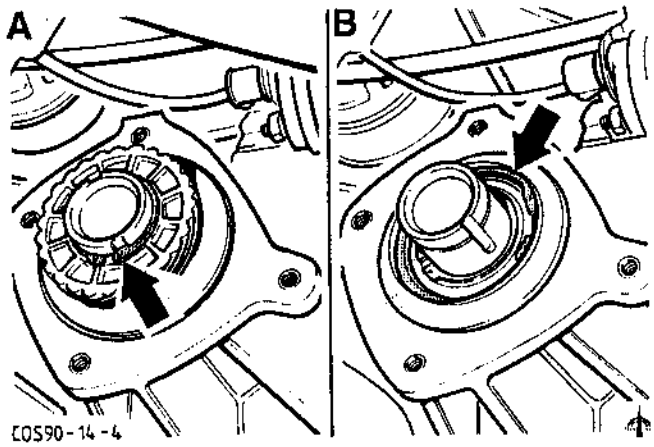
To Install

NOTE: When installing, tighten the nuts and bolts to the tightening torques specified in Technical Data.

15. Slide the bearing onto the intermediate driveshaft and secure bearing with a circlip, Fig.7.

16. Fit the intermediate driveshaft and bearing in the front differential housing and secure both with a circlip, Fig.8. (B).

17. Slide the speedometer drive worm gear onto the intermediate driveshaft and secure drive worm gear with a circlip, Fig.8. (A).

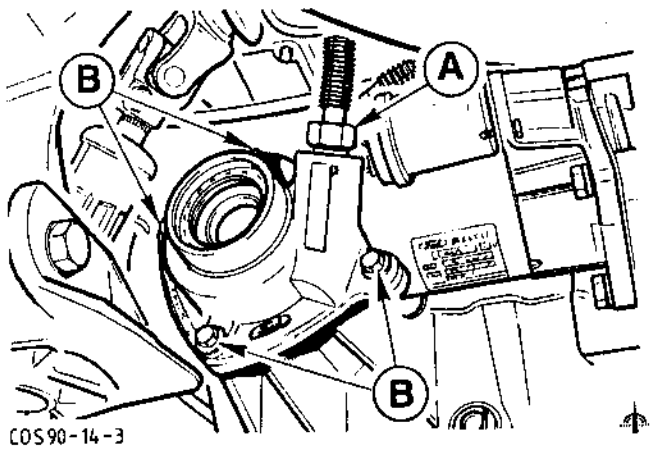


COS90-14-4

Fig.8. Circlips.
A - Speedometer drive worm gear
B - Intermediate driveshaft

18. Apply sealer (see Technical Data for specification) and fit the intermediate driveshaft housing cover, Fig.9. (B).

19. Insert the speedometer drive cable in the intermediate driveshaft housing cover, fit and tighten the union nut, Fig.9. (A).



COS90-14-3

Fig.9. Intermediate driveshaft housing cover.
A - Speedometer drive cable union nut
B - Retaining bolts

20. Fit the left hand side driveshaft constant velocity joint in the intermediate driveshaft using a new snap ring.

21. Connect the lower suspension arm to the spindle carrier, Fig.10.

22. Fit the stabiliser bar brackets to the side members on the left and right hand sides.

NOTE: Make sure that rubber bushes are seated correctly.

23. Connect the tie rod to the steering arm. Fit the castellated nut on the tie rod end, tighten it and lock it with a split pin.

24. Check the level of the oil in the front differential and top up as necessary (see Technical Data for specification), Fig.11.

25. Screw the lower engine cover to the side members and the front axle/engine crossmember Fig.12.

26. Fit the left hand front wheel.

27. Lower the vehicle to the ground.

28. Tighten the nuts of the left hand front wheel.

29. Connect the battery earth cable.

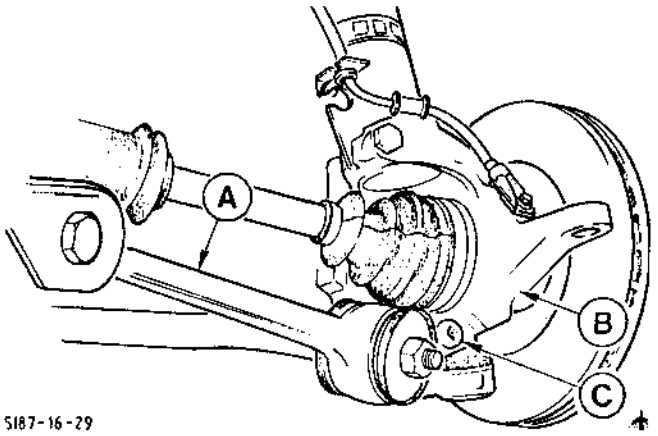


Fig.10. A - Lower suspension arm
B - Spindle carrier
C - Torx box and nut

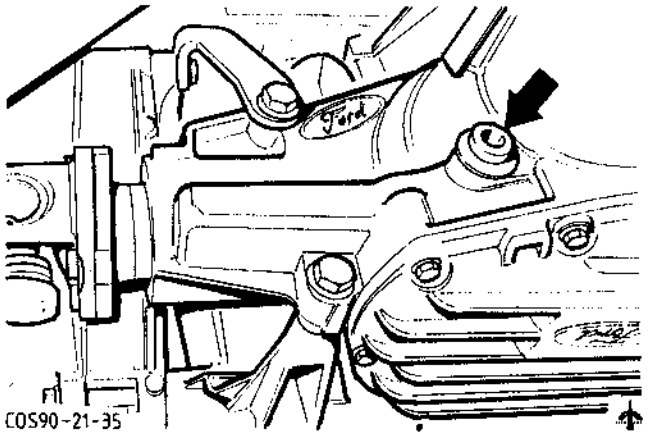


Fig.11. Front differential oil filler plug.

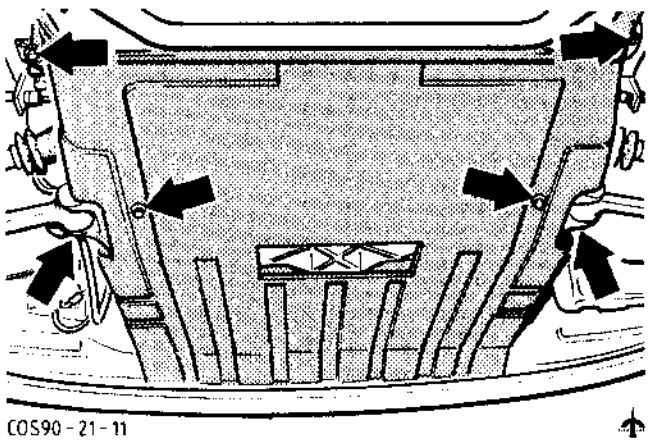


Fig.12. Retaining bolts of lower engine cover.

14 343 0 SPINDLE CARRIER - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Ball Joint Separator	.. ..	13-006
Spindle Carrier Lever	.. ..	14-026

To Remove

1. Disconnect the battery earth cable.

2. Slacken the front wheel nuts.

3. Remove the hub cap and unlock and slacken the nut on the stud axle, Fig.1.

4. Raise the vehicle.

5. Remove the front wheel.

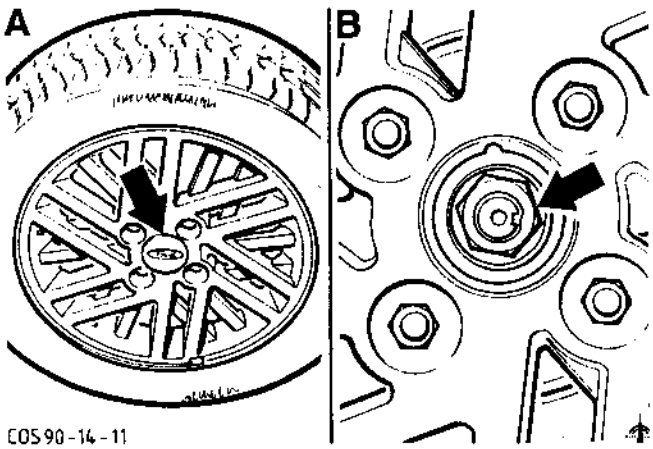
6. Unscrew the brake caliper assembly from the spindle carrier (2 bolts), Fig.2.

NOTE: Suspend the brake caliper assembly with wire.

7. Mark the position of the brake disc in relation to the wheel hub, unscrew the serrated lock washer and remove the brake disc, Fig.3. (B, C, D).

Fig.3. Brake disc and wheel hub.
A - Stub axle nut
B - Brake disc
C - Serrated lock washer
D - Mark showing position of hub relative to brake disc

8. Unscrew the stub axle nut and remove the washer, Fig.3. (A).



COS90-14-11

Fig.1. A - Hub cap
B - Stud axle nut

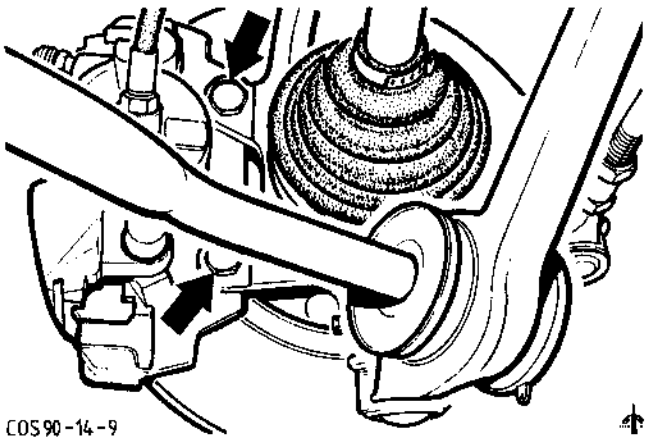
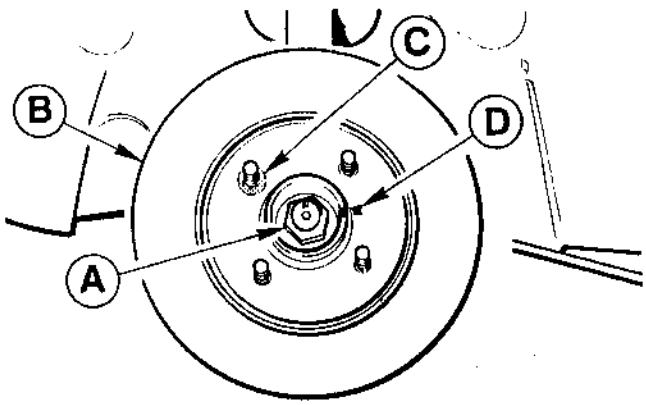

COS90-14-9

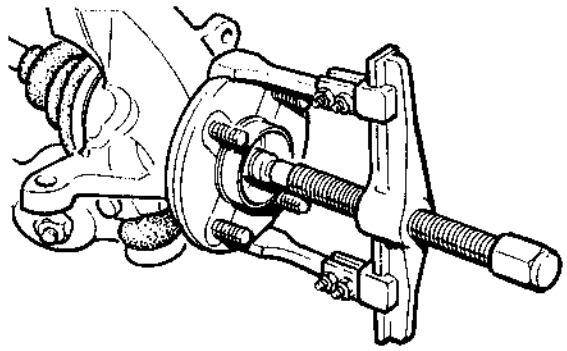
Fig.2. Brake caliper retaining bolts.



COS90-14-10

Fig.3. Brake disc and wheel hub.

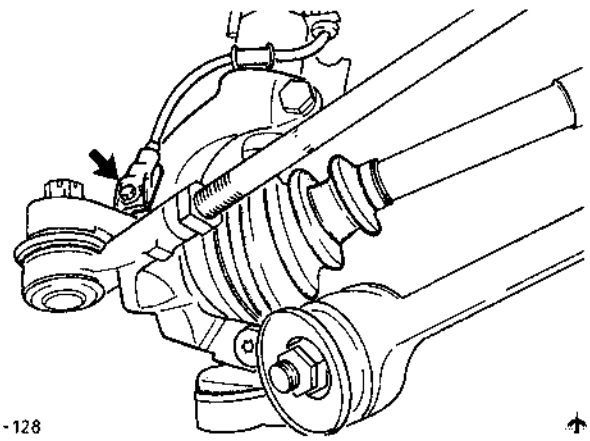
9. Remove the wheel hub using a suitable puller, Fig.4.



COS90-14-12

Fig.4. Remove wheel hub.

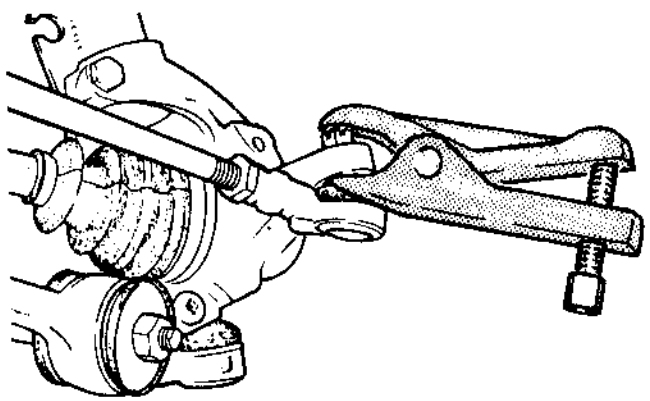
10. Unscrew the ABS sensor from the spindle carrier (1 bolt), Fig.5.



S4-14-128

Fig.5. ABS sensor.

11. Disconnect the tie rod from the steering arm. Remove the split pin and slacken the castellated nut on th tie rod end. Press the tie rod end out of the spindle carrier using Special Tool 13-006, Fig.6. Unscrew the castellated nut and disconnect the tie rod end from the spindle carrier.



S4-14-129N

Fig.6. Press out tie rod using Special Tool 13-006.

12. Unscrew the stabiliser bar brackets from the side members on the left and right hand sides (4 bolts), Fig.7.

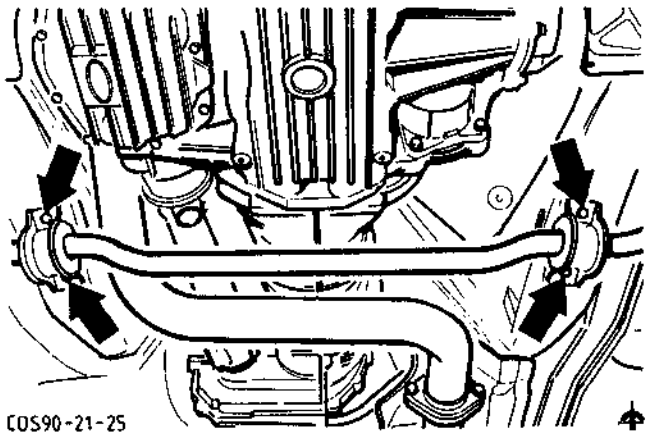


Fig.7. Retaining bolts of stabiliser bar brackets.

13. Disconnect the lower suspension arm from the spindle carrier (i Torx bolt and nut), Fig.8. prise the lower suspension arm downwards away from the spindle carrier.

14. Pull the spindle carrier outwards until the stub axle is free.

NOTE: Suspend the driveshaft with wire. The inner constant velocity joint must not be bent at more than 20° and the outer constant velocity joint must not be bent at more than 45°.

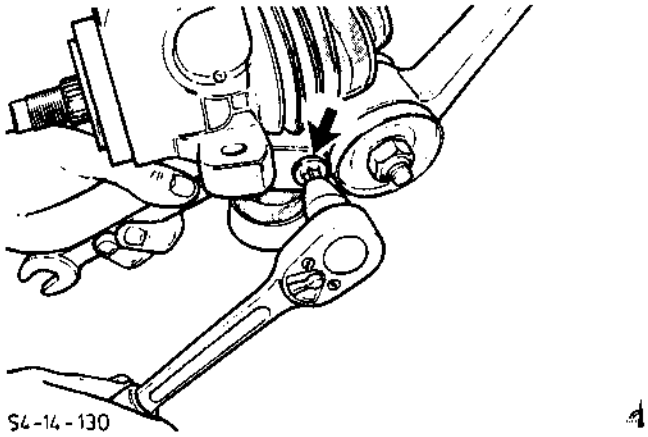


Fig.8. Disconnect lower suspension arm.

15. Remove the spindle carrier. Unscrew the spindle carrier/suspension strut clamp bolt. Lever the spindle carrier clamp open using Special Tool 14-026, Fig.9. Pull the spindle carrier downwards off the suspension strut.

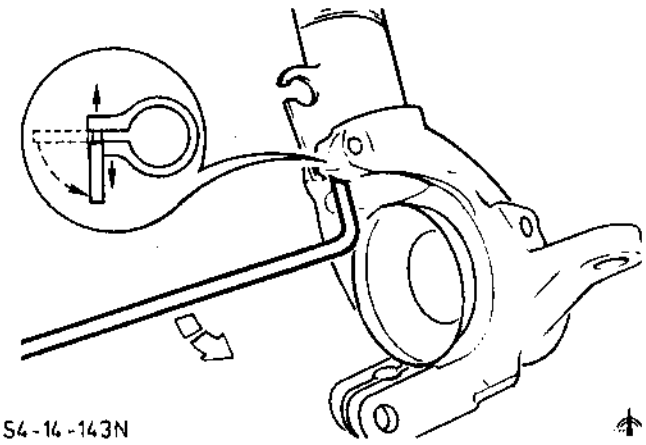


Fig.9. Detach spindle carrier from suspension strut using Special Tool 14-026.

To Install

NOTE: When installing, tighten the nuts and bolts to the tightening torques specified in Technical Data.

16. Fit the spindle carrier on the suspension strut. Remove Special Tool 14-026. Tighten the spindle carrier/suspension strut clamp bolt to the specified torque (see Technical Data).

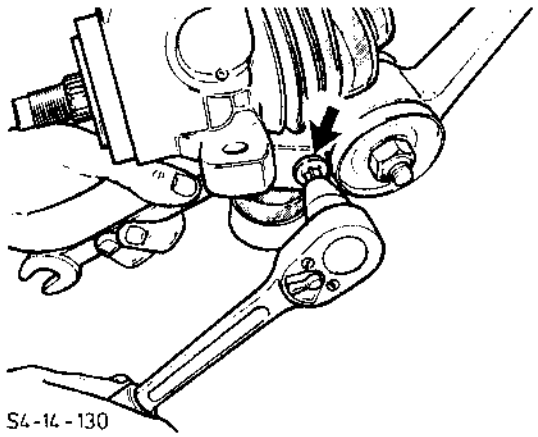


Fig.10. Fit lower suspension arm.

17. Pull the spindle carrier outwards and guide the stub axle (greased - see Technical Data for grease specification) into the spindle carrier.

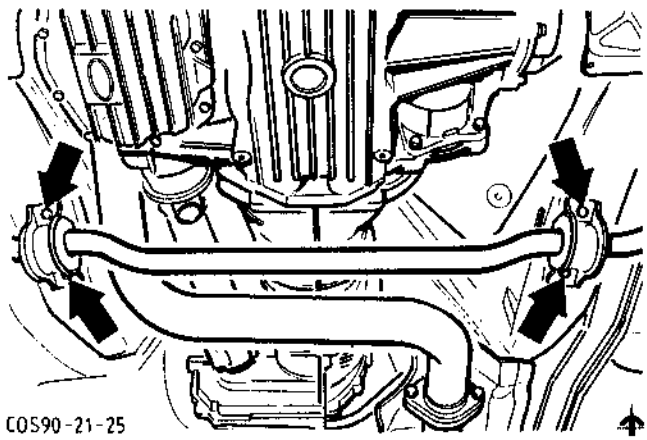


Fig.11. Retaining bolts of stabiliser bar brackets.

18. Connect the lower suspension arm to the spindle carrier, Fig.10.

19. Fit the stabiliser bar brackets to the side members on the left and right hand sides, Fig.11.

NOTE: Make sure the rubber bushes are seated correctly.

20. Connect the tie rod to the steering arm. Fit the castellated nut on the tie rod end, tighten it and lock it using a new split pin, Fig.12.

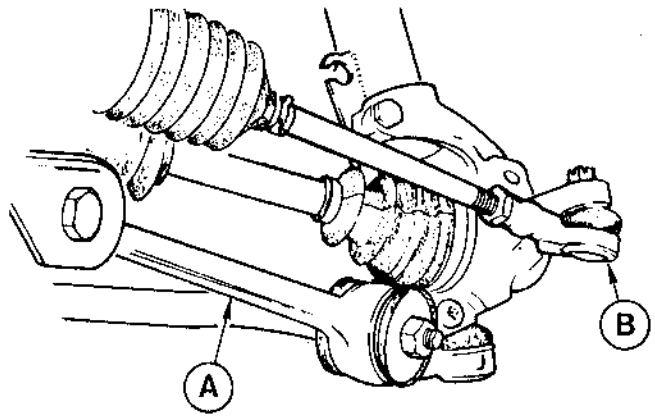


Fig.12. A - Lower suspension arm
B - Tie rod

21. Clean the ABS sensor and check and clean the hole in the spindle carrier.

22. Draw the wheel hub onto the stud axle using Special Tool 14-022, Fig.13.

Fig.13. A - Spindle carrier
B - Wheel hub
C - Special Tool 14-022

22a. Fit the washer and a new nut (but do not torque).

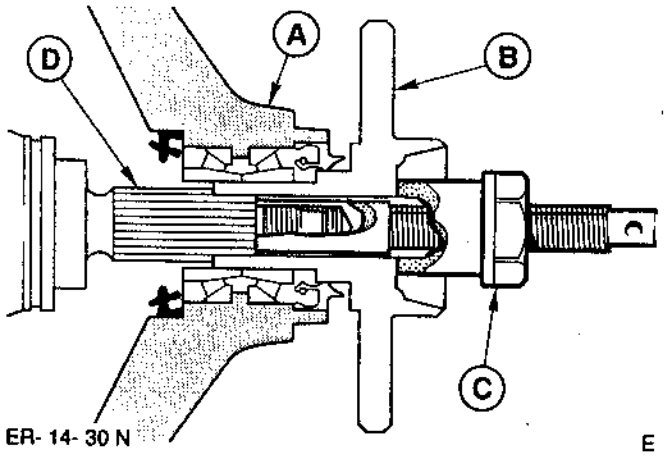


Fig.13. Draw wheel hub onto stub axle using Special Tool 14-022.

23. Fit the brake disc in the marked position and secure it using the serrated lock washer.

24. Fit the brake caliper assembly to the spindle carrier, Fig.14.

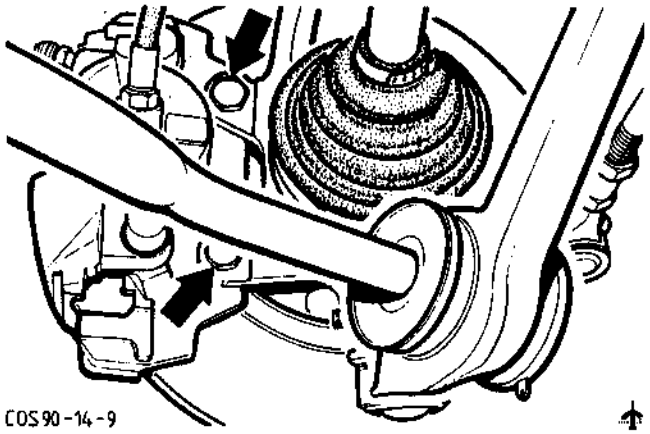


Fig.14. Brake caliper retaining bolts.

25. Lower the vehicle sufficiently to allow the front brake pedal to be operated.

26. Tighten the stub axle nut to the specified torque (see Technical Data) and stake the nut to lock it, Fig.15 (B).

NOTE: Operate the brakes.

27. Fit the front wheel, tighten the nuts and fit the hub cap Fig.15 (A).

28. Connect the battery earth cable.

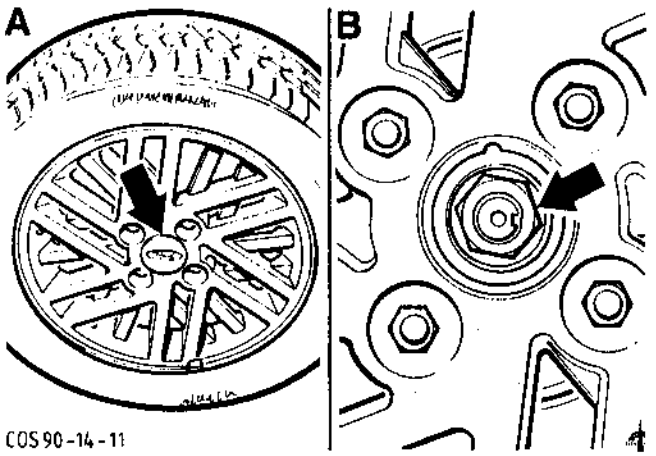


Fig.15. A - Hub cap
B - Stub axle nut

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14 411 0 WHEEL BEARINGS - FRONT INNER AND OUTER - REPLACE (4x4) (Spindle Carrier Removed)

SPECIAL SERVICE TOOLS REQUIRED:

Oil seal installer	14-024
Oil seal extractor	15-072
Spindle carrier bearing cup installer ..	15-085

To Remove

1. Remove the spindle carrier as described in Operation No. 14 343 0.

2. Clamp the spindle carrier in a vise and remove the dust cap, Fig.1.

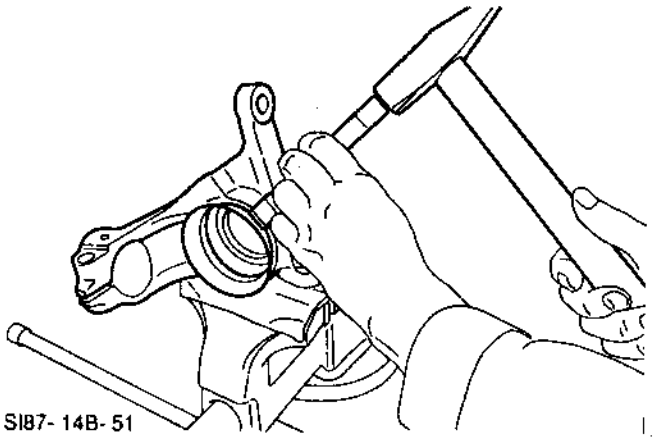


Fig.1. Remove dust cap.

3. Remove the inner and outer radial oil seals using Special Tool 15-072, Fig.2.(A). Remove the taper roller bearings.

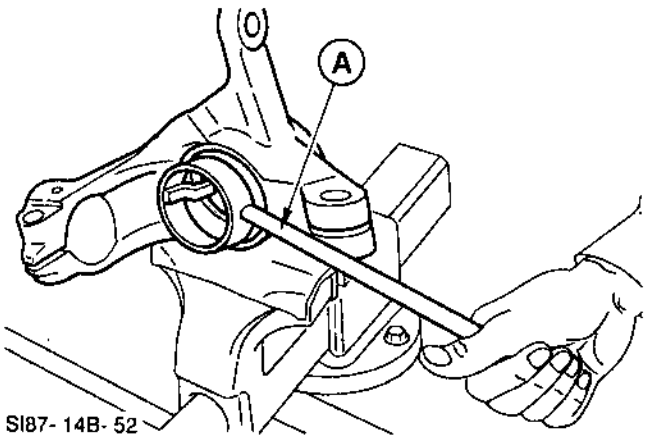


Fig.2. Remove radial oil seals using Special Tool 15-072.

4. Carefully drive out the bearing cups using a brass drift, Fig.3.

NOTE: The drift must be in good condition to avoid damaging the seating faces of the bearing cups.

5. Clean the spindle carrier, removing all the grease residues.

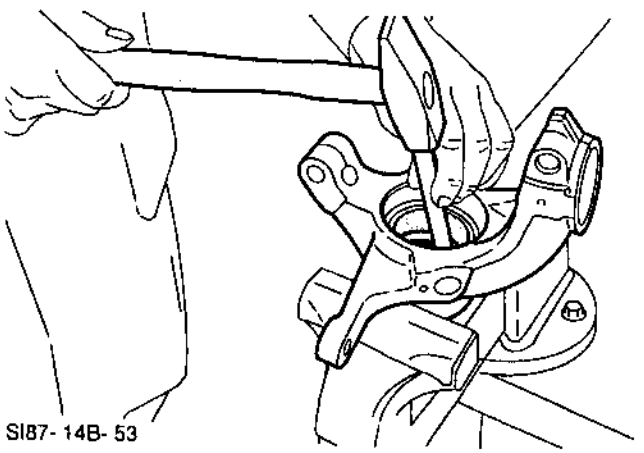


Fig.3. Remove bearing cups.

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6. Fit the bearing cups using Special Tool 15-085, Fig.4.(A).

NOTE: The bearings, outer cups, hub and spindle carrier are made to close tolerances, eliminating the need for adjustment of the bearings later.

7. Pack the taper roller bearings with high melting point grease to Ford specification SAM-1C-9111-A. Make sure that the cavities between the rollers are filled with grease.

NOTE: Do not fill the space between the bearings with grease.

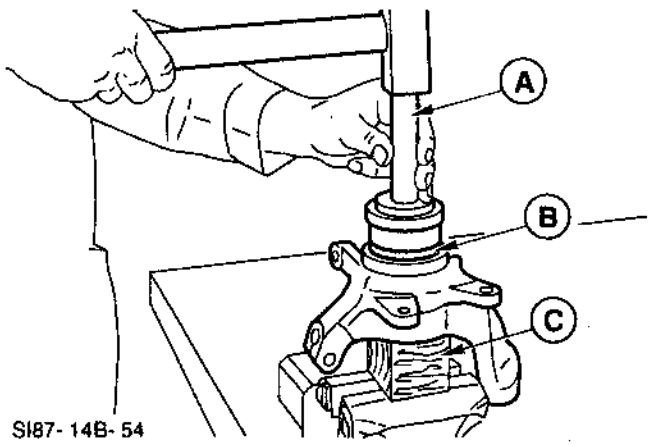


Fig.4. A -Special Tool 15-085
B - Bearing cup
C - Wooden block

8. Insert the outer bearing and fit the radial oil seal using Special Tool 14-024, Fig.5.

NOTE: The cavities between the sealing lips must be filled with grease.

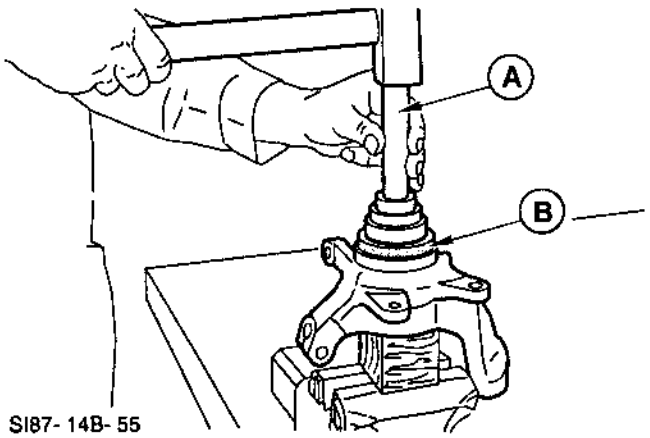


Fig.5. A - Special Tool 14-024
B - Radial oil seal
C - Wooden block

9. Insert the inner bearing. Fit the radial oil seal using Special Tool 14-024 and fit the dust cap.

10. Refit the spindle carrier as indicated in Operation No. 14 343 0.

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FRONT AXLE AND SUSPENSION 14C

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TECHNICAL DATA — Escort RS Cosworth

Front axle suspension

Type	Independent McPherson strut
Lateral control	Lower arm
Longitudinal control	Stabiliser bar
Shock absorbers	Telescopic, hydraulic double-acting

Lubricant

Front wheel bearings	Grease conforming to Ford Specification SAM-1C-9111-A

Wheel alignment (unladen)

(Nominal figures quotd are with 3,0 litres of fuel in tank)

Toe Setting:

Setting Dimension	0,0 mm (toe in) ± 1,0 mm

	CASTOR		CAMBER	
Derivative	Nominal	Tolerance Range	Nominal	Tolerance Range
Cosworth 4x4	2°58'	4°28' to 1°58'	-1°17'	-0°17' to -2°17'

Maximum permissible difference between left and right-side (unladen)

Castor .. .. 1° Camber .. .. 1° 15'

Tightening torques

	Nm	lbf.ft
Hub retaining nut	310 to 350	229 to 258
Lower arm ball joint pinch bolt to spindle carrier	65 to 85	40 to 63
Top mount retaining nut	40 to 52	30 to 38
Suspension strut to spindle carrier	77 to 92	57 to 68
Stabiliser bar clamp to chassis	70 to 97	52 to 72
Stabiliser bar to lower arm (compliance)	70 to 110	52 to 81
Caliper anchor bracket to spindle carrier	65 to 75	48 to 55
Engine cross member to chassis	70 to 90	52 to 66
Engine mounting to cross member nut	50 to 70	37 to 52
Anti-lock wheel sensor bolt	8 to 11	6 to 8
Tie rod to steering arm	25 to 30	18 to 32
Right-hand engine mounting heat shield bolt	6 to 8	4 to 6
Lower arm pivot nut	Tighten to 45 Nm (33 lbf.ft.), then slacken off nut to zero and re-torque to 15 Nm + 90°	

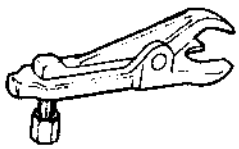
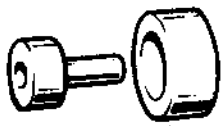
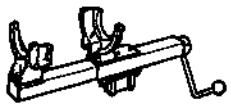
NOTE: When checking the tightness of bolts that have been tightened by the torque to yield method, the nut or bolt must not be subjected to further rotation as this could result in the nut or bolt failing. The bolt must be backed off (slackened) to zero torque and then re-torqued as detailed below.

Procedure for tightening torque to yield bolts during repair operations:

- Tighten to the specified clamping torque.
- Back off to zero torque.
- Re-tighten to the "snug" torque, then tighten through the specified angle of rotation.

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SPECIAL SERVICE TOOL RECOGNITION

Tool	Tool Name
 13-006	Ball joint separator
 14-026A	Spindle carrier lever
 14-027	Bush remover/installer
 14-023 MS-1516A	Front spring compressor

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14 111 0 FRONT WHEEL ALIGNMENT - CHECK

This operation should be carried out in accordance to the particular wheel alignment gauges used (Dunlop-Optiflex etc.).

For steering geometry (castor/camber and toe angle) specification, see Technical Data.

Before carrying out any steering geometry check, the following checks must be made.

- Examine suspension and steering components to ensure there are no signs of damage or wear.
- Check and if necessary adjust tyre pressures to specification.
- Ensure vehicle is at kerb weight. Spare wheel, jack and wheel brace should be stowed in their designated position but any additional tools or goods should be removed from vehicle.
- Bounce vehicle body to ensure suspension is in its natural position.

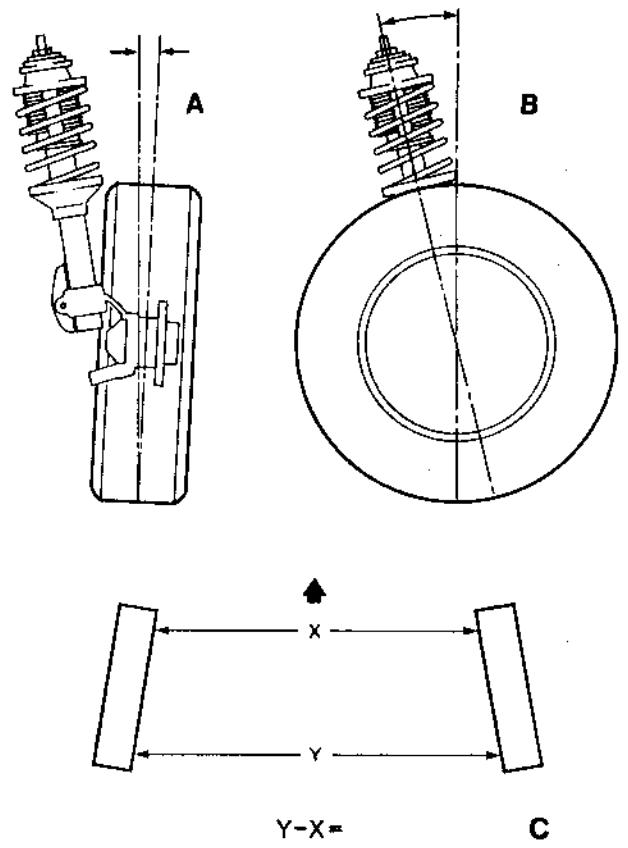


Fig.1. Suspension steering geometry alignment.
A - Camber B - Castor
C - Toe setting

14 117 0 TOE-IN - CHECK AND ADJUST

SPECIAL SERVICE TOOLS REQUIRED: NONE

1. Slacken track rod end locknuts and outer ends of bellow retaining clips, Fig.2.
2. Using suitable toe-in gauge, measure toe setting and if necessary adjust by rotating the track rods by equal amounts inwards or outwards.

NOTE: Track rods must be adjusted in equal amounts, otherwise steering wheel will be misaligned. (Refer to Section 13 Steering wheel alignment).

3. Replace snapper or screw type clips to bellows, tighten track rod locknuts.

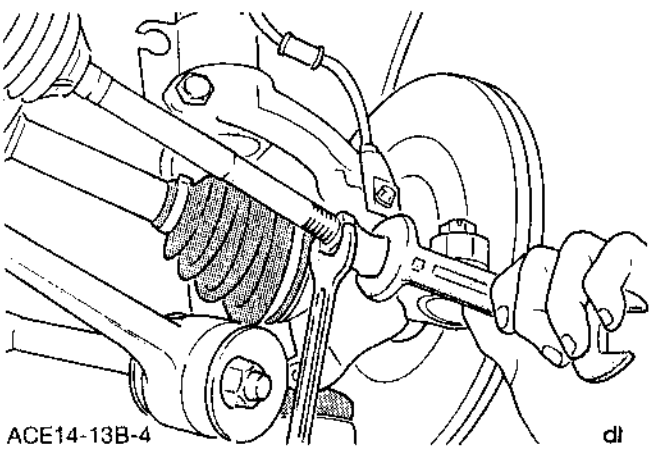


Fig.2. Track rod end and locknut.

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14 234 0 FRONT CROSSMEMBER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator 13-006

To Remove

1. Support engine on jack, remove right-hand engine mounting heat sheild, and remove engine mounting nuts, Fig.1. Jack up engine to relieve compression on engine mountings. Where fitted, remove sump shield.

2. Remove steering gear as detailed in Section 13 of this Publication.

3. Remove locknut, washer and pivot bolts from lower arm, pull arms away from crossmember.

4. Disconnect brake pipes from crossmember retaining clips.

5. Remove four bolts securing crossmember to vehicle and remove from vehicle.

To Install

6. Position front crossmember into vehicle and secure, tighten bolts to specified torque, (see Technical Data).

7. Locate lower arms in crossmember, refit bolts, washers and locknuts. DO NOT TIGHTEN AT THIS STAGE.

NOTE: If locknuts are tightened at this stage inner bush wind up can occur. Lower arms must be horizontal before tightening locknuts.

8. Refit steering gear assembly as described in Operation 13 116 0 of this Publication.

9. Resecure brake pipes to crossmember.

10. Lower engine onto crossmember, refit mounting nuts and tighten to specification, (see Technical Data), Fig.1. On right-hand mounting refit heat shield, tightening bolts to specification, (see Technical Data). Ensure engine mounting brackets are correctly seated on locating pegs of mountings. Where necessary refit sump shield.

NOTE: Do not tighten beyond the specified torque otherwise damage to mounting will occur.

11. Lower vehicle to ground and tighten lower arm inner locknuts to specification, (see Technical Data).

12. Check and adjust steering toe alignment (see Technical Data).

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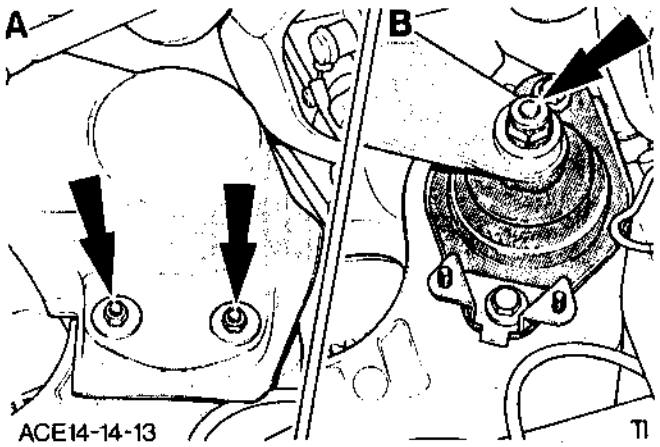


Fig.1. Right-hand engine mounting.
A - Heat shield nuts
B - Mounting lock nut

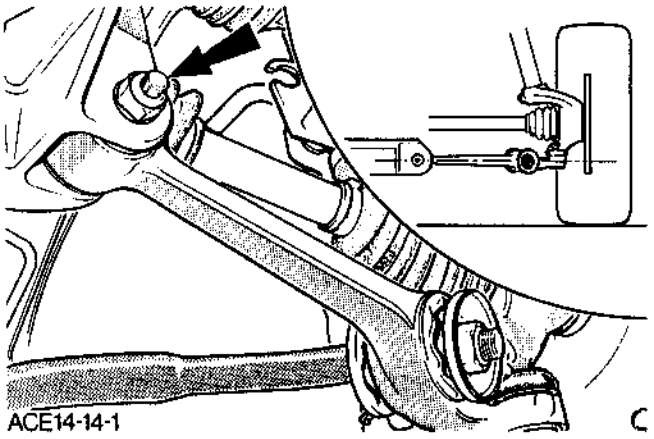


Fig.2. Lower arm fixing to front crossmember. Ensure lower arm is horizontal before tightening locknut.

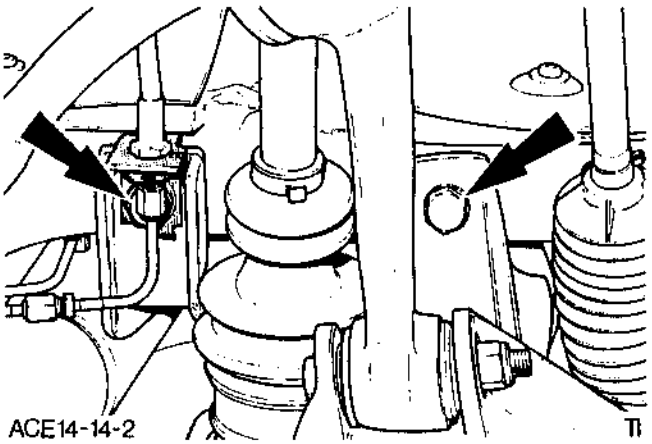


Fig.3. Front crossmember to chassis bolts.

14 343 0 SPINDLE CARRIER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator	.. ..	13-006
Spindle carrier lever	.. ..	14-026

To Remove

1. Slacken front road wheel nuts and driveshaft centre retaining nut, jack-up vehicle and fit chassis stands.

2. Remove road wheel.

3. Remove split pin and castellated nut securing steering tie rod end to spindle carrier, Fig.1. Using Special Service Tool 13-006, release ball joint taper.

NOTE: Care should be taken when using Special Service Tool 13-006 not to damage ball joint gaiters.

4. Remove bolts securing caliper to spindle carrier. Suspend caliper clear of spindle carrier to prevent strain on flexible hose.

5. Remove pinch bolt from spindle carrier lower ball joint connection, lever down lower arm and disconnect lower arm ball joint from spindle carrier, Fig.2.

6. Disconnect anti-lock wheel sensor from spindle carrier.

7. Mark position of brake disc relative to hub. Remove spring clip securing disc to hub and remove disc.

8. Remove driveshaft retaining nut. Detach hub using suitable puller, Fig.3.

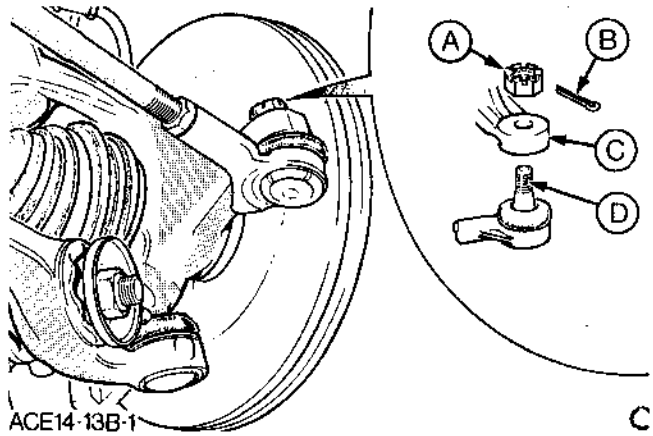


Fig.1. Steering tie rod end.
A - Castelated nut C - Steering arm
B - Split pin D - Ball joint

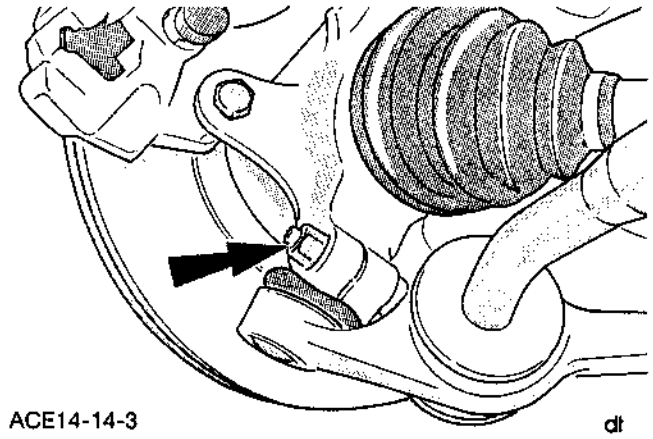


Fig.2. Lower arm to spindle carrier pinch bolt.

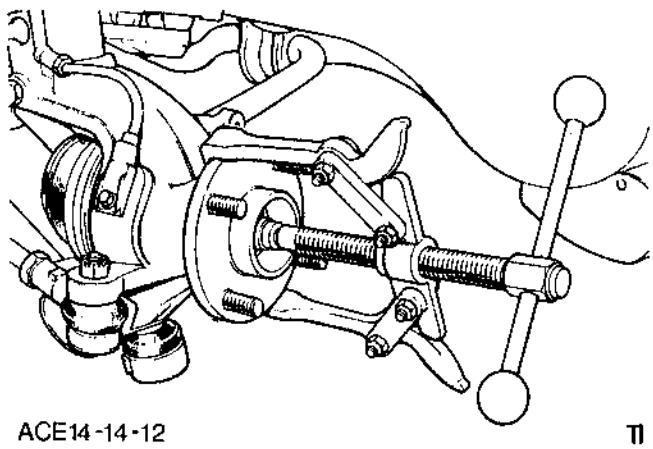


Fig.3. Pull off wheel hub.

9. While supporting driveshaft pull spindle carrier outwards until clear of driveshaft. Move driveshaft to one side and suspend with wire.

NOTE: Angular deflection of driveshaft inner joint must not exceed 20°, centre joint 45°.

10. Remove pinch bolt securing spindle carrier to suspension strut, Fig.4. Using Special Service Tool 14-026, insert into knuckle slot, and rotate through 90°. Slide spindle carrier and hub assembly off suspension unit.

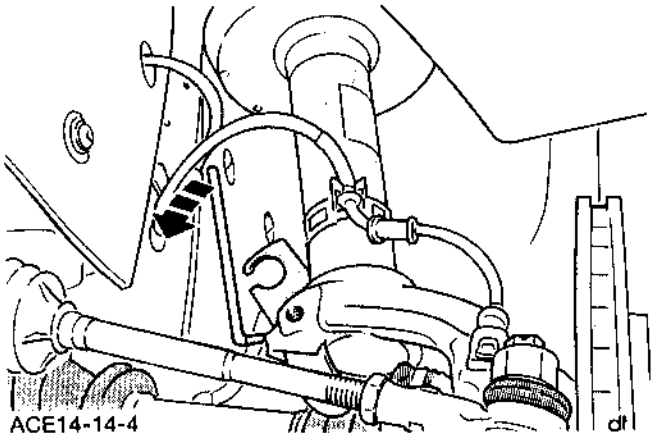


Fig.4. Release suspension strut from knuckle assembly.

To Install

11. Slide spindle carrier onto suspension unit, align bolt hole and loosely fit a new pinch bolt. Remove Special Service Tool 14-026. Fully tighten pinch bolt to specification, (see Technical Data).

12. Lever down lower arm and align ball joint stud into spindle carrier. Fit new pinch bolt and tighten to specification, (see Technical Data).

13. Reconnect tie rod end to steering arm, refit castellated nut and tighten to specification, (see Technical Data). Fit new split pin.

14. Refit hub and pull on with a new driveshaft centre retaining nut, (see Technical Data). Refit disc to hub in previously marked position and refit clips.

15. Remove caliper support and attach caliper to spindle carrier and secure. Tighten bolts to specification, (see Technical Data).

16. Refit anti-lock wheel sensor, tighten bolt to specification, (see Technical Data).

NOTE: Coat wheel sensor with grease and ensure 'O' ring is in good condition.

17. Refit road wheel. Lower vehicle to ground and tighten driveshaft nut to specification (see Technical Data). Fully tighten road wheel.

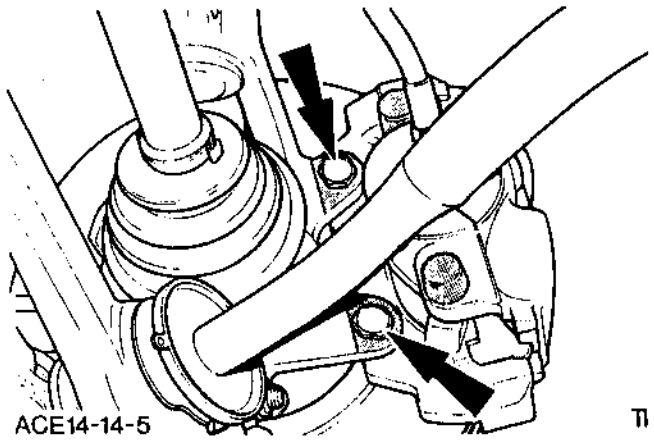


Fig.5. Caliper retaining bolts.

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14 707 0 ARM ASSEMBLY - LOWER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Front suspension bush installer .. 14-027

To Remove

1. Raise vehicle on ramp (DO NOT jack up at this stage). Remove sump shield.

2. Remove lower arm to crossmember inner pivot bolt.

3. Remove stabiliser bar to lower arm retaining nut and dished washer with plastic cover, Fig.1.

4. Jack up vehicle and fit chassis stands to support vehicle.

5. Remove pinch bolt and nut from lower arm ball joint. Release stud from spindle carrier. Remove lower arm from vehicle.

6. Using thin edged chisel, carefully remove compliance bushes, Fig.3.

7. Assemble bush remover Special Service Tool 14-027 and suitable tube in vice with lower arm. Push out inner pivot bush into tube.

To Install

8. Lubricate new lower arm inner pivot bush with suitable soap or glycerine to ease assembly. Assemble new inner pivot bush, lower arm and bush installer Special Service Tool 14-027 in vice, push bush into position.

NOTE: It is important that the vice is wound in quickly with a continuous action so that the bush deforms for a short time only.

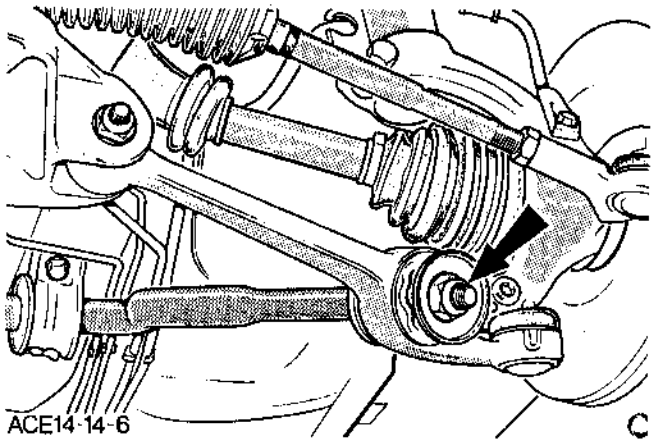


Fig.1. Remove stabiliser bar lower arm retaining nuts and washers.

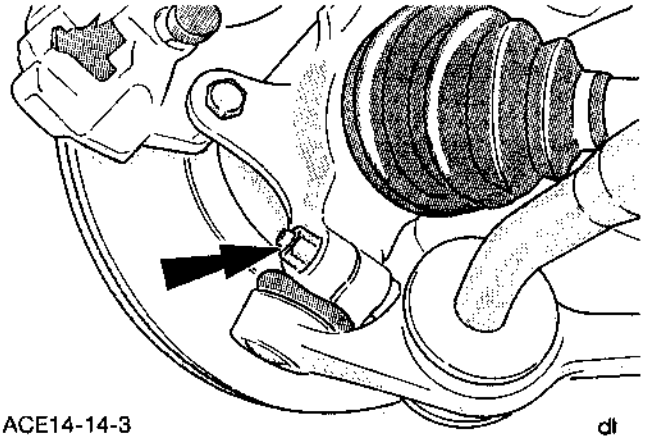


Fig.2. Pinch bolt and nut securing lower arm ball joint to spindle carrier.

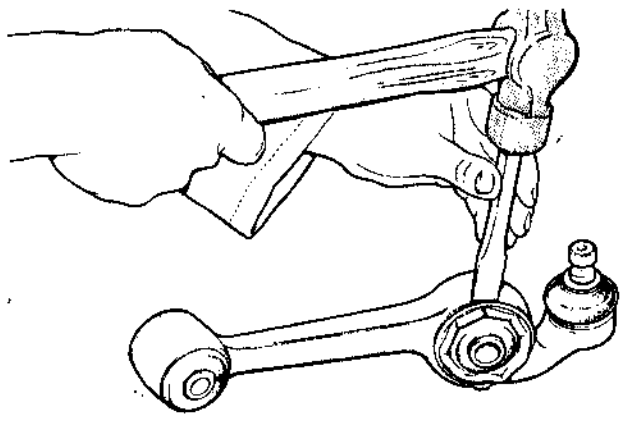
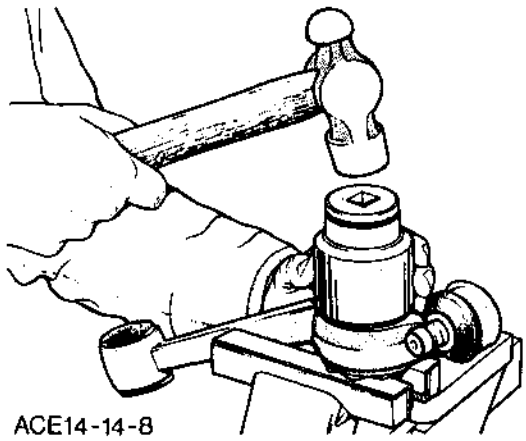


Fig.3. Remove compliance bush from lower arm using a thin edged chisel.

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9. Using suitable large socket or tube (with thick wall), carefully tap compliance bush into lower arm.

NOTE: Ensure that the outer lip of compliance bush is not distorted when refitting into lower arm, and no gap exists between lip of bush and lower arm.



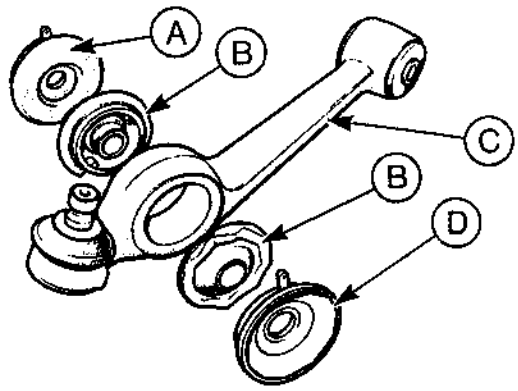
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Fig.3. Refit compliance bush to lower arm.

10. Ensure that the correct compliance dished washer is fitted to inner face (shallow washer) and plastic cover washer is fitted. Slide lower arm over stabiliser bar. Fit forward deep dished washer, cover and securing nut. DO NOT TIGHTEN AT THIS STAGE.

NOTE: Dished washers fitted to the compliance bushes are colour coded. The shallow dished washer is green in colour and fitted to the rear of the lower arm compliance bush. The forward dished washer is deeper in profile and is black in colour.

11. Locate lower arm ball joint stud into spindle carrier, and secure with punch bolt and nut. Tighten to specification (see Technical Data).



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Fig.4. Lower arm assembly.
A - Shallow dished washer and cover
B - Compliance bush
C - Lower arm
D - Deep dished washer and cover

12. Remove chassis stands. Locate inner pivot bush into jaw of front crossmember. Push outer rim of road wheel to align inner pivot of lower arm with crossmember. Refit pivot bolt, washer and nut. DO NOT FULLY TIGHTEN AT THIS STAGE. Refit sump shield.

13. Lower vehicle to ground. Bounce vehicle to settle suspension. Fully tighten lower arm inner pivot bolt and compliance fixing nut to correct specification, (see Technical Data).

NOTE: Compliance bushes are designed with a low stiffness to permit significant fore and aft wheel movement.

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14 752 0 STABILISER BAR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove four bolts securing 'U' clamps to body. Remove sump shield.
2. Remove stabiliser bar to lower arm securing nuts, remove washers and covers.
3. Detach one lower arm inner pivot bolt, nut and washer. Pull out lower arm from crossmember.
4. Pull stabiliser bar out of lower arm fixing. Remove rear washers and covers.
5. Remove insulators from stabiliser bar.

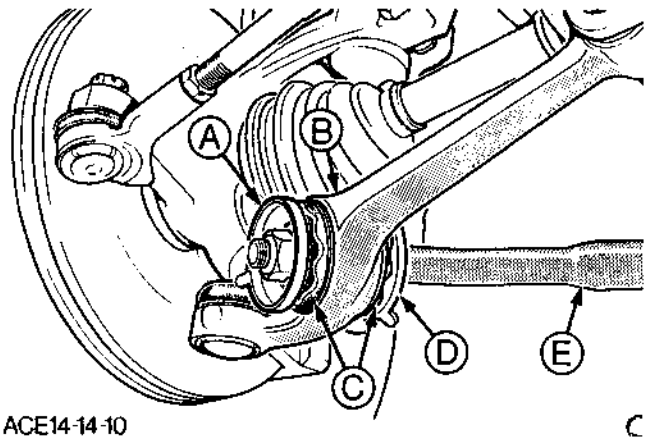


Fig.1. Stabiliser to lower arm fixing.
A - Front washer
B - Lower arm
C - Compliance bush
D - Rear cup washer
E - Stabiliser bar

To Install

NOTE: Dished washers fitted to the compliance bushes are colour coded. The shallow dished washer is green in colour and fitted to the rear of the lower arm compliance bush. The forward dished washer is deeper in profile and is black in colour.

6. Refit insulators to stabiliser bar.
7. Refit rear dished washers and covers to stabiliser bar. Reposition stabiliser bar into lower arms, refit forward washers and covers. Secure with new locknuts, DO NOT FULLY TIGHTEN AT THIS STAGE.

NOTE: Ensure washers are fitted with dished side away from bush.

8. Reconnect lower arm to crossmember and secure with bolt, washer and lock nut. DO NOT FULLY TIGHTEN AT THIS STAGE.
9. Secure stabiliser bar to body mountings, DO NOT FULLY TIGHTEN AT THIS STAGE. Refit sump shield.
10. Lower vehicle to ground, bounce vehicle to settle suspension. Tighten stabiliser/lower arm lock nut, lower arm to engine crossmember nut and stabiliser bar to body mounting bolts to specification (see Technical Data).

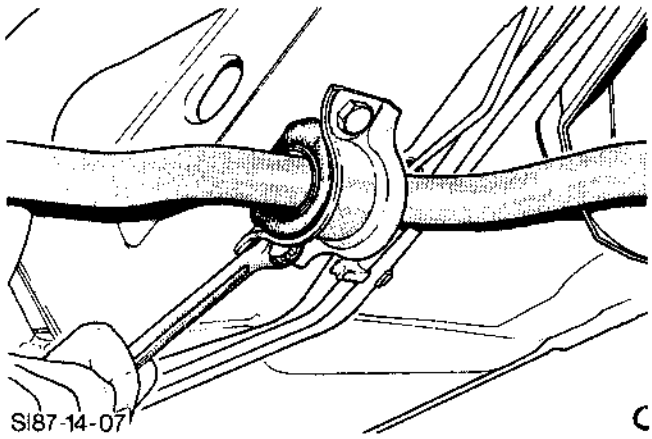


Fig.2. Stabiliser bar mounting to chassis.

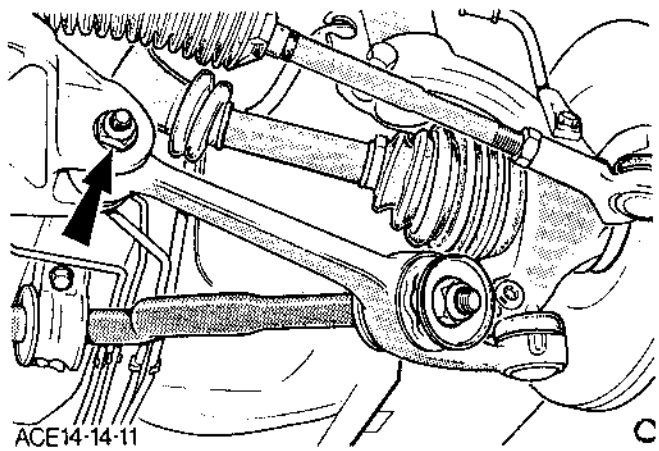


Fig.3. Lower arm pivot bolt.

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14 759 0 BUSHES - STABILISER BAR TO LOWER ARM - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: If difficulty is experienced when removing the compliance bushes, refer to Operation 14 707 0 of this section.

To Remove

1. Remove stabiliser bar to lower arm compliance bush locknuts.
2. Remove dished washer and plastic cover.
3. Using small thin chisel, carefully remove forward compliance bush.
4. Remove lower arm to crossmember pivot bolt. Lever lower arm from crossmember fixing. Swing lower arm inner end forward free from stabiliser bar. Remove rear dished washer and cover from stabiliser bar.
5. Using small thin chisel, remove rear compliance bush.

To Install

NOTE: Dished washers fitted to the compliance bushes are colour coded. The shallow dished washer is green in colour and fitted to the rear of the lower arm compliance bush. The forward dished washer is deeper in profile and is black in colour.

6. Using suitable socket or tube carefully fit rear compliance bush into lower arm.
7. Locate shallow dished washer (green colour code) and cover over stabiliser bar.
8. Swing lower arm rearwards and locate compliance bush over stabiliser bar and inner pivot bush into crossmember. Refit bolt, washer and locknut to inner pivot bush. DO NOT FULLY TIGHTEN.
9. Using suitable socket or tube, carefully fit forward compliance bush into lower arm.
10. Refit plastic cover and deep dished washer (black colour code) over stabiliser bar. Refit locknut, DO NOT fully tighten.
11. Lower vehicle to ground. Bounce vehicle to settle suspension. Fully tighten lower arm inner pivot bolt and stabiliser bar compliance bush to correct specification, (see Technical Data).

NOTE: Compliance bushes are designed with a low stiffness to permit significant fore and aft wheel movement.

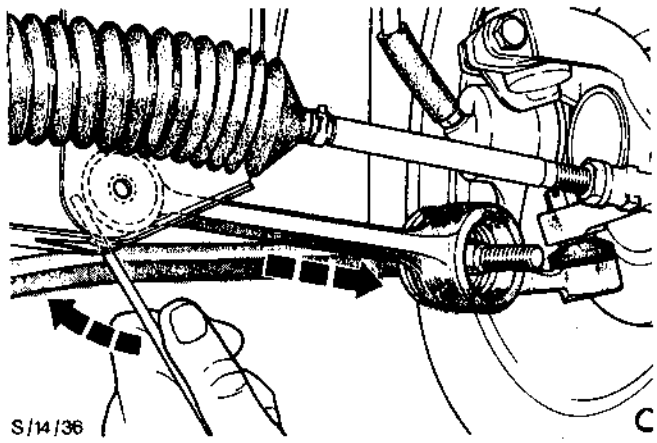


Fig.1. Pivot lower arm away from crossmember. (Two wheel drive shown)

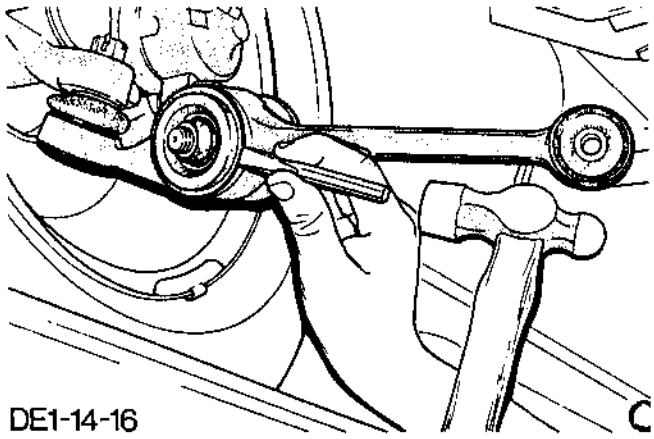


Fig.2. Remove compliance bush from lower arm.

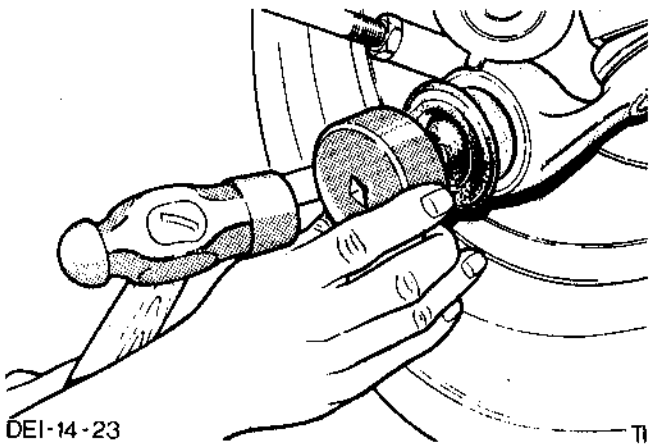


Fig.3. Refit compliance bushes to lower arm.

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14 781 0 SUSPENSION UNIT - FRONT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Spindle carrier lever	.. ..	14-026
Front spring compressor	.. ..	MS-1516

To Remove

1. Slacken wheel nuts, jack up vehicle and fit chassis stands.

2. Remove front road wheels. Open hood and fit fender covers.

3. Remove bolt securing suspension strut to spindle carrier.

4. Remove anti-lock wheel sensor from spindle carrier and detach wire from suspension strut clip.

5. Insert Special Service Tool 14-026 into slot of spindle carrier and rotate through 90°.

6. Using suitable lever, push down spindle carrier and lower arm until suspension strut is seperated from spindle carrier.

NOTE: When releasing spindle carrier from suspension strut, care must be taken not to damage the brake flexible hose.

7. Remove cap from top of strut, using a 6 mm hexagon key in end of strut to prevent strut piston rod from turning, remove top mount retaining locknut and cup washer.

8. Remove suspension strut assembly from vehicle.

9. Mount suspension strut in vice, do not overtighten otherwise damage to strut assembly may occur.

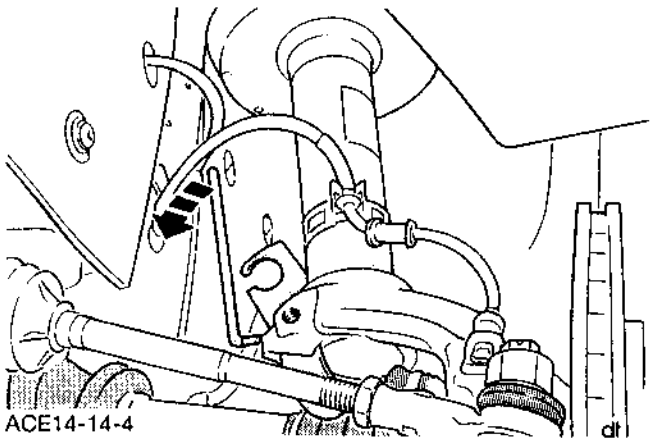


Fig.1. Release spindle carrier from strut using Special Service Tool 14-026.

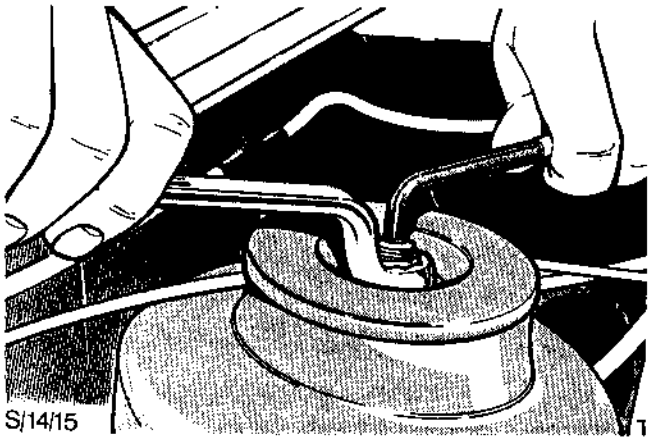


Fig.2. The 6mm hexagonal key to hold strut on removal and installation of top mount nut.

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10. Using Special Service Tool MS-1516 carefully compress spring until spring is clear of spring seats.

11. Remove plain nut and lower cup, slide off thrust bearing and remove upper spring seat, gaiter and spring.

12. Slide bump stop off piston rod.

To Install

13. Clean spring seats and spring tail ends ensuring they are clean and free from rust/dirt etc.

14. Refit bump stop over suspension strut piston shaft and plastic gaiter. Ensure gaiter is fitted over bump stop.

15. Locate compressed spring over suspension strut. Refit upper spring seat, thrust bearing and lower cup.

16. Fit plain nut and tighten.

17. Carefully release spring tension ensuring spring tails and bearing locate correctly in shaped portions of spring seats.

18. Remove suspension strut assembly from vice, locate into vehicle through upper mount insulator. Refit cup washer and locknut.

19. Lever down lower arm and locate strut into spindle carrier. Remove Special Service Tool 14-026. Refit spindle body bolt and fully tighten to specification, (see Technical Data).

20. Tighten suspension strut piston upper locknut to specification (see Technical Data). Prevent piston shaft from turning during tightening operation by using a 6 mm hexagonal key.

21. Refit anti-lock wheel sensor, (if fitted).

22. Refit road wheels, and fully tighten.

23. Remove fender covers and lower vehicle.

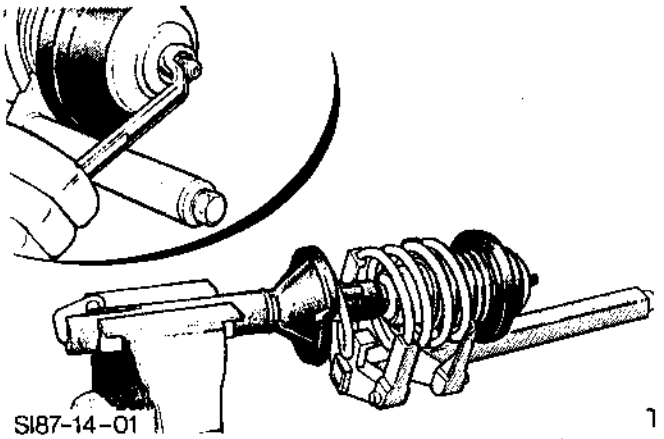
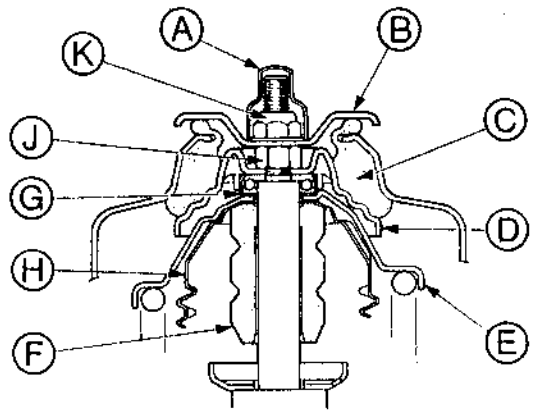


Fig.3. Clamp suspension leg in vice, using soft jaw protectors. Compress spring using MS-1516, remove plain nut securing insulating cup and bearing.

0492

14 785 0 TOP MOUNT - FRONT SUSPENSION UNIT - REPLACE - (ONE SIDE)

SPECIAL SERVICE TOOLS REQUIRED: NONE



SI87-14-08

Fig.1. Top mount insulator assembly.

To Remove

1. Remove cap from top of strut, using 6 mm hexagonal key to prevent piston rod from turning, remove top mount locknut and cup washer.

2. Carefully lever down suspension leg, care must be taken not to damage brake flexible hose or anti-lock wheel sensor if fitted.

3. Remove top mounting insulator rubber.

Fig.1. Top mount insulator assembly.

A - Cap	F - Bump stop
B - Cup washer	G - Bearing
C - Insulator	H - Gaiter
D - Lower cup	J - Plain nut
E - Spring seat	K - Locknut

To Install

4. Refit insulator into inner fender panel, ensure correct location.

5. Refit top mount cup washer and secure with new locknut, (see Technical Data). Prevent piston from rotating during tightening by using 6 mm hexagonal key.

0492

REAR AXLE, SUSPENSION AND DRIVESHAFT (Sierra and Escort) 15

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Service and Repair Operations not listed above are identical to those of the Sierra '87 or Escort/ Orion '91 and should therefore be referred to in the corresponding Service Microfiche.

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TECHNICAL DATA

Rear axle

Backlash, between crown wheel and drive pinion - nominal value overall: ..	0,10 to 0,17 mm
Emperical value (crown wheel runout) per set of gears must not exceed: ..	0,05 mm
Differential bearing preload	4 to 5 teeth
Breadth of collapsible spacer	11,5 to 11,7 mm
Oil capacity, SAE-90 hypoid oil	1,0 Litre
Oil level check	lower edge of oil plug bore
Hypoid oil SAE-90	FORD-Specification SQM2C-9002-AA
Bearing housing grease	FORD-Specification ESEAM-1C1014A
Driveshaft centre bearing grease	FORD-Specification SAM-1C-9111-A
Rear axle casing liquid sealant (1110B)	FORD-Specification SQM-4G9523-A
Drive joints - grease capacity	70 ± 10 g
- grease specification	S-M1C75-A or SQM-1C9004-A or Mobil Rex E22
Sealer for drive joints	FORD-Specification ESK-M4G275-A
Wheel bearing grease	FORD-Specification SAM-1C-9111-A

Tightening torques

Rear axle	Nm
Axle casing cover	45 to 60
Oil filler plug	35 to 45
Crown wheel to differential housing bolts	78,5 to 85,6
Pinion bearing nut	min 140
Drive pinion turning torque - adjustment with Special Service Tool 15-041	1,6 to 2,1 *
Self locking nut - drive pinion flange	110 to 130
Locking plate-bearing housing	19 to 25
Axle nut	250 to 290
Rear axle casing to rear axle crossmember	70 to 90
Rear axle shafts to driveshaft flange	38 to 43
Rear axle shafts to driveshaft stub	38 to 43
Wheel hub (4 bolts)	80 to 100
ABS wheel sensor fixing bolt	8,5 to 11

* When assembling with used bearings, the lower torque value is preferred.

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TECHNICAL DATA (cont'd)

Suspension

Rear axle mounting to floor assembly	20 to 25
Rear axle mounting to rear axle casing cover	40 to 50
Guide plate to floor assembly	41 to 51
Guide plate insulator	68,5 to 88
Lower suspension arm to crossmember	80 to 95
Brake caliper to lower suspension arm	51 to 61
Stabiliser bar to crossmember	20 to 25
Shock absorber upper mounting	73 to 97
Shock absorber lower mounting	68 to 92

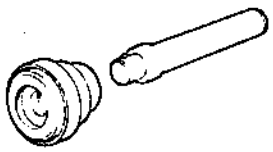
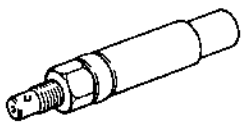
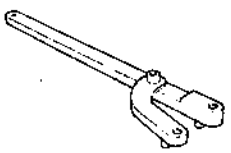
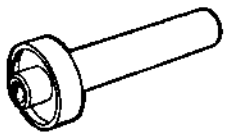
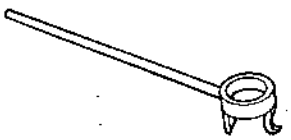
Driveshaft

Driveshaft to drive pinion flange	57 to 67
Driveshaft centre bearing to floor assembly	18 to 23

Exhaust system

Downpipe to exhaust system flange bolts	35 to 40
Left hand muffler insulator bracket bolts	45 to 56

SPECIAL SERVICE TOOL RECOGNITION

 14-019	Oil seal and bearing cup installer
 14-041	Driveshaft installer
 15-030	Universal flange holding wrench
 15-047-A	Pinion oil seal installer
 15-072	Pinion oil seal remover

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GENERAL DESCRIPTION

The SIERRA COSWORTH is fitted with an independent semi-trailing arm rear suspension with universal jointed driveshafts. The following list details rear suspension components of the SIERRA COSWORTH '86 and '88 Model Years which differ from other SIERRA variants. It also indicates the origin of these parts i.e. if they come from an existing model or have been developed or modified for SIERRA COSWORTH.

PART	COSWORTH '86 ORIGIN	COSWORTH '88 ORIGIN
• Lower suspension arm with unique inner and outer bushes	unique SIERRA COSWORTH	unique SIERRA COSWORTH
• Shock absorber	SIERRA XR 4X4	unique SIERRA COSWORTH
• Rear spring	unique SIERRA COSWORTH	unique SIERRA COSWORTH
• Stabiliser bar and retaining brackets	SIERRA XR 4X4	unique SIERRA COSWORTH
• Rear axle shaft	unique SIERRA COSWORTH	unique SIERRA COSWORTH
• Driveshaft stub	unique SIERRA COSWORTH	unique SIERRA COSWORTH
• Rear axle crossmember	SCORPIO	SCORPIO
• Attachment bolts, rear axle gear to crossmember	SCORPIO	SCORPIO
• Rear axle assembly	unique SIERRA COSWORTH	unique SIERRA COSWORTH

The rear axle gear design and function corresponds to the 7 1/2" SCORPIO rear axle.
The following points have been modified for the SIERRA COSWORTH:

- Ratio 3,64:1
- Drive flange/rear axle shaft mating dimensions

NOTE: The rear wheels should not be balanced on the vehicle because the drive system used on such balancing equipment could damage the viscous limited slip differential fitted to this vehicle.

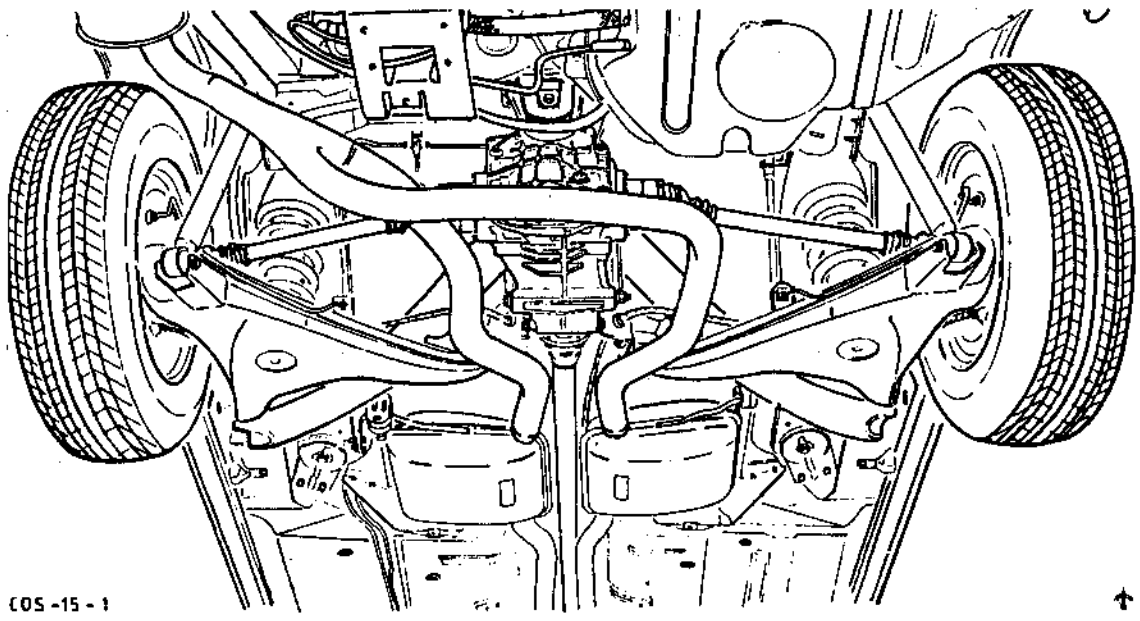


Fig.1. Rear axle and suspension - SIERRA COSWORTH '88.

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GENERAL DESCRIPTION (cont'd)

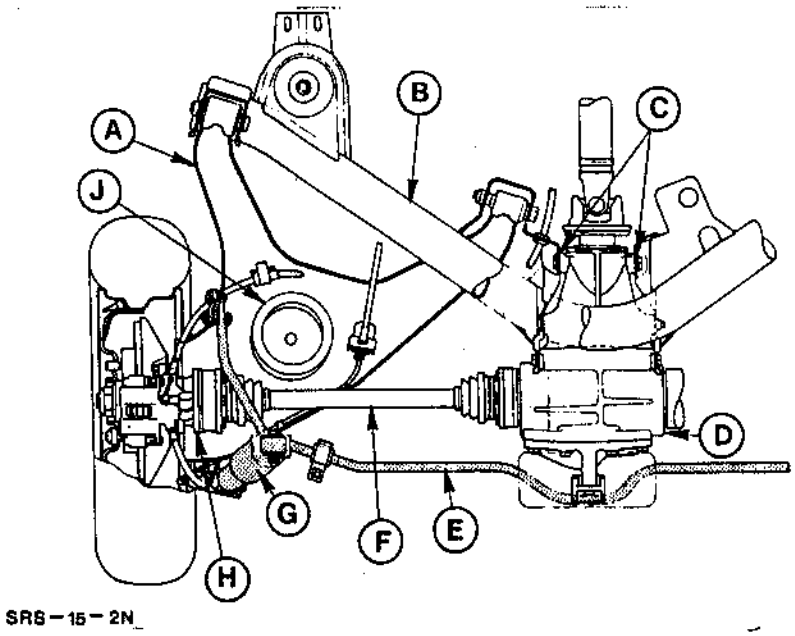


Fig.2. Rear axle and suspension, SIERRA COSWORTH '86 *

A - Semi trailing arm	D - Rear axle assembly	* G - Shock absorber
B - Rear axle crossmember	* E - Stabiliser bar	H - Driveshaft stub
C - Rear axle assembly to crossmember retaining bolts	F - Rear axle shaft	J - Spring

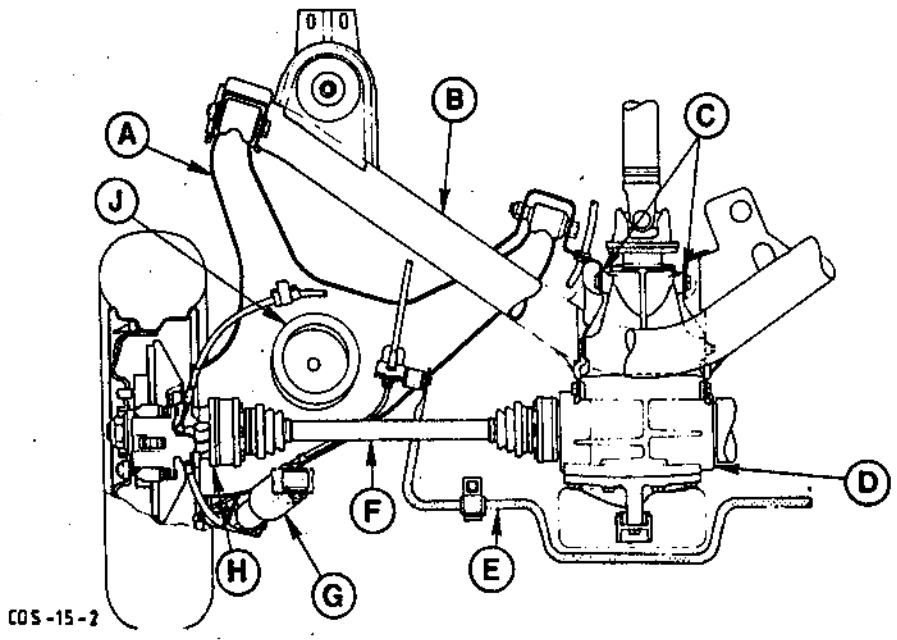
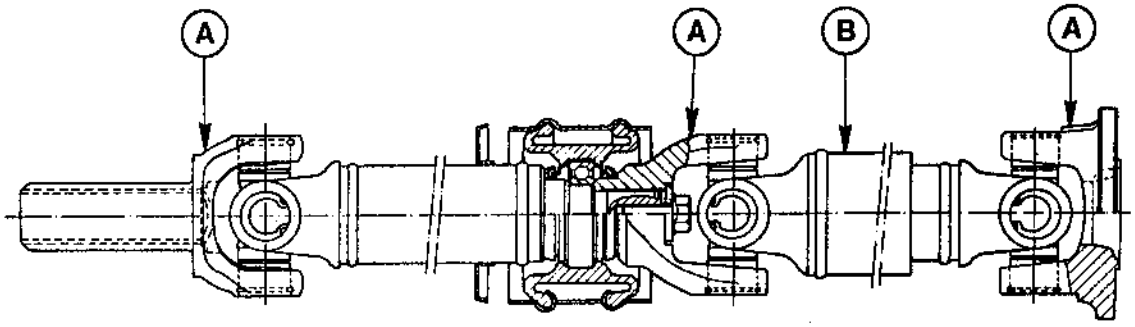


Fig.3. Rear axle and suspension, SIERRA COSWORTH '88 *

A - Semi trailing arm	D - Rear axle assembly	* G - Shock absorber
B - Rear axle crossmember	* E - Stabiliser bar	H - Driveshaft stub
C - Rear axle assembly to crossmember retaining bolts	F - Rear axle shaft	J - Spring

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GENERAL DESCRIPTION (cont'd)



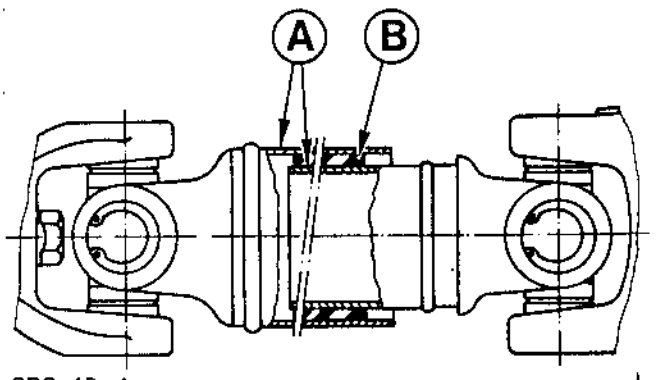
SRS-15-3

Fig.4. Driveshaft, SIERRA COSWORTH.
A - Universal joints (c/o TRANSIT)
B - Reinforced part

The split driveshaft has three heavy-duty universal joints (c/o TRANSIT) and is supported in the middle by a ball bearing encased in a rubber insulator, the housing of which is secured to the floor assembly.

The rear section of the driveshaft has been reinforced, making the assembly unique to SIERRA COSWORTH.

To reduce driveshaft noise the driveshaft rear section is of a sandwich construction; an inner and outer tube joined by four rubber elements.



SRS-15-4

Fig.5. Cross section - Reinforced part of driveshaft.
A - Tube
B - Rubber element

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SERVICE AND REPAIR OPERATIONS

15 212 0 REAR AXLE AND SUSPENSION ASSEMBLY - REMOVE AND INSTALL

WARNING: SWITCH OFF IGNITION (position '0')

Apply foot brake repeatedly until the brake pedal becomes "hard" to ensure that the hydraulic system pressure is completely discharged.

To Remove

1. Raise the vehicle and support it under the rear side members.

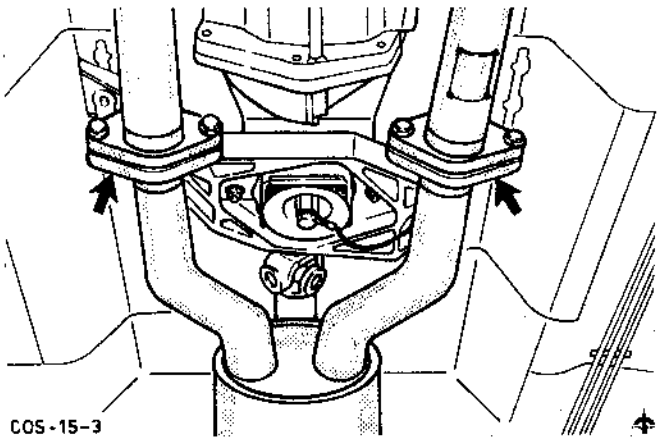


Fig.6. Downpipe flanged joints.

2. Remove the exhaust system:
   - disconnect the exhaust system from the downpipes (4 bolts).
   - unscrew the left hand exhaust muffler insulator bracket (2 bolts).
   - unhook the right hand and rear muffler insulators and remove the system.

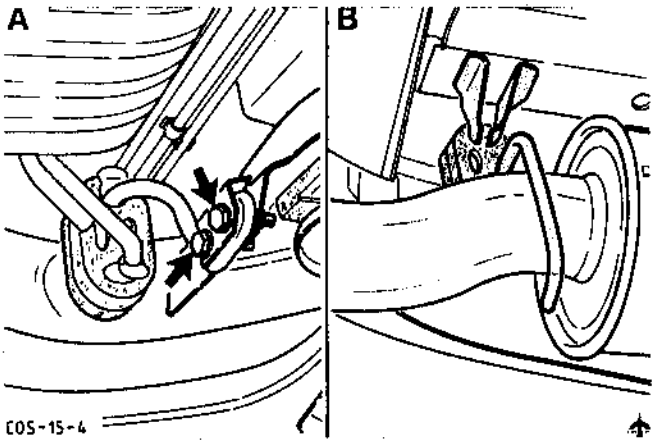


Fig.7. Exhaust system attachment.
A - Left hand muffler insulator
B - Rear muffler insulator

3. Unbolt the driveshaft from the pinion flange (4 bolts) and the driveshaft centre bearing from the floor assembly (2 bolts, 2 washers, 2 spacers).

4. Remove the driveshaft.

NOTE: Plug transmission with a plastic sleeve to prevent oil loss.

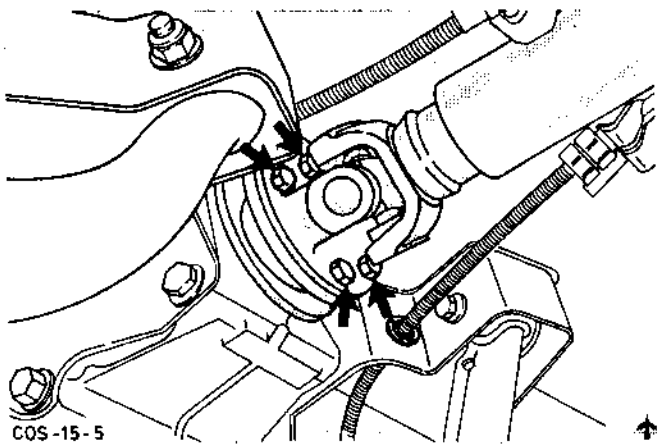


Fig.8. Driveshaft to pinion flange retaining bolts.

5. Detach the handbrake cable from the handbrake lever by releasing the circlip on the handbrake lever pin.

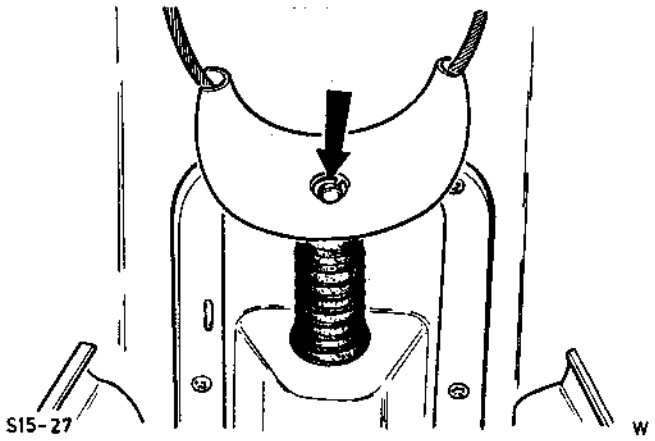


Fig.9. Handbrake lever circlip.

6. Release the brake cable sleeves from the bracket on the floor assembly.

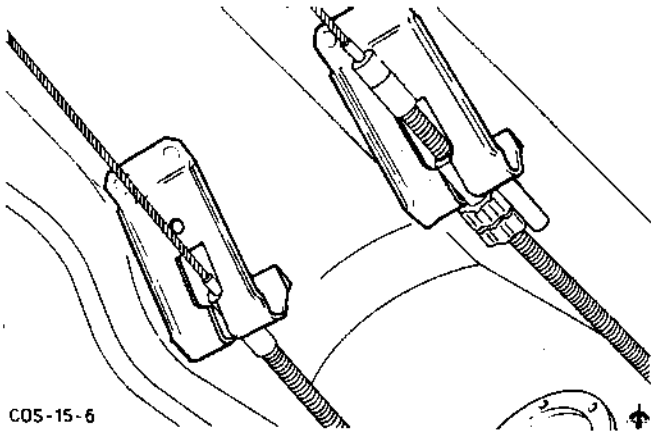


Fig.10. Brake cable brackets on floor assembly.

7. Remove U-shaped clips and disconnect the brake hoses from the brake pipes (brackets on left and right-hand side members).

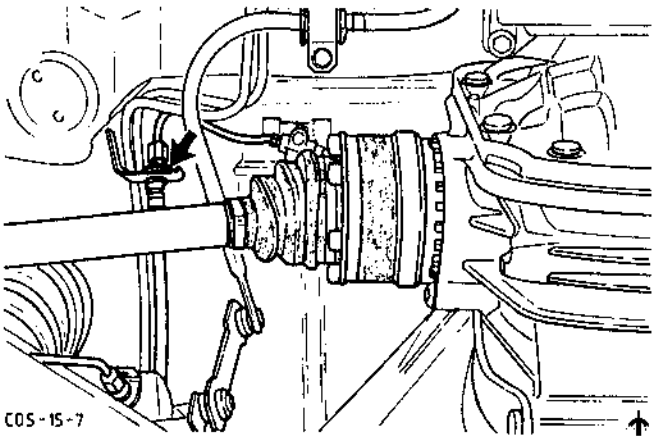


Fig.11. Brake hose/pipe bracket.
(arrow shows U-shaped clip)

15 212 0

8. Remove the ABS wheel sensor (from both sides). Remove bolt and carefully pull out sensor. Unclip cable from lower arm.

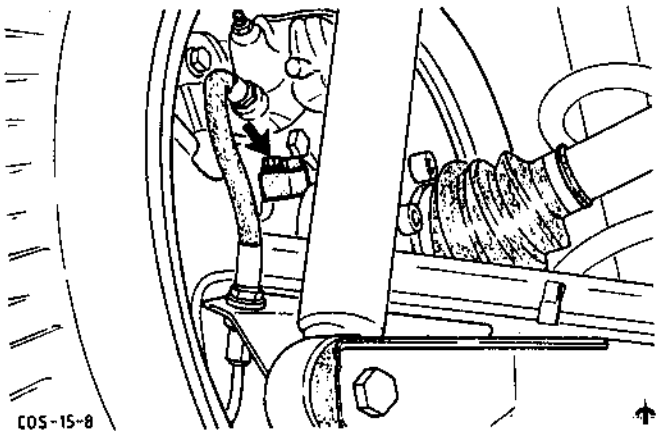


Fig.12. ABS wheel sensor - left hand side shown.

9. Unbolt the stabiliser bar from the floor assembly crossmember (2 bolts).

10. Lower the vehicle onto its wheels so that the coil springs are placed under a light load.

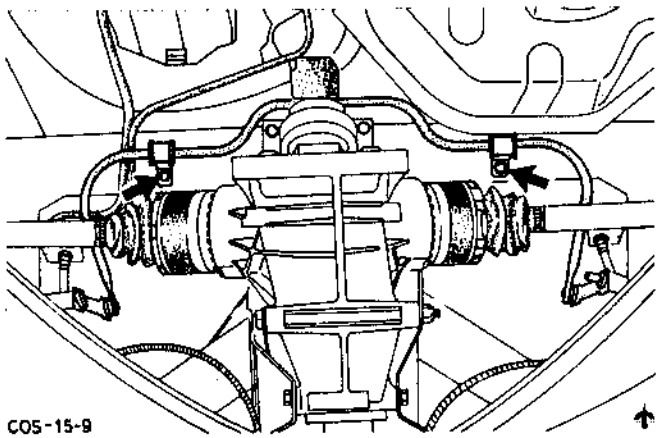


Fig.13. Stabiliser bar.

11. Support the rear axle casing with a trolley jack.

12. Detach the rear axle crossmember front mountings. Remove the locating bolt and two guide bolts (each side).

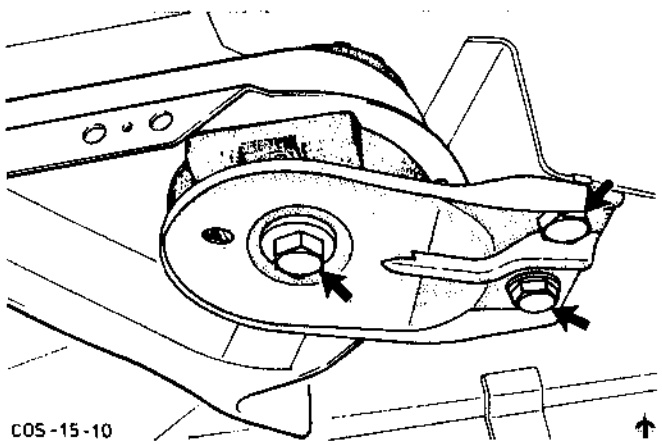


Fig.14. Rear axle crossmember front mounting (guide plate).

1087

15 212 0

13. Unbolt the axle rear mounting from the crossmember (4 bolts).

14. Fold back the luggage compartment side trim on both sides and unscrew the shock absorber top mounts (1 nut and bolt each).

15. Raise the vehicle and withdraw the complete axle assembly rearwards with the jack until it is clear of the vehicle.

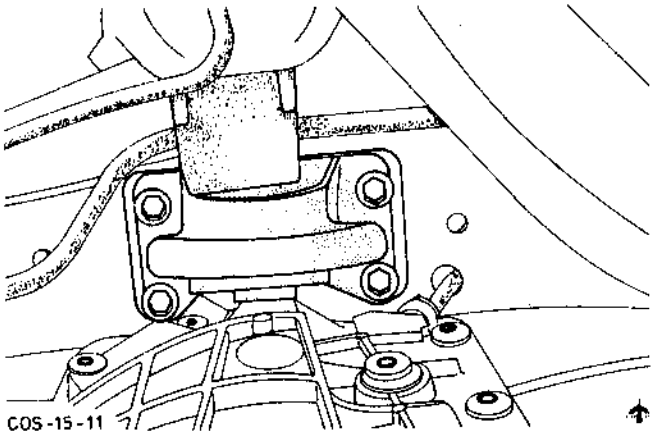


Fig.15. Rear axle to crossmember mounting.

To Install

During installation, tighten all nuts and bolts to the torque specified in Technical Data.

16. Position the complete rear axle assembly under the vehicle with the aid of a jack. With the axle correctly located, lower the vehicle until the coil springs are under a light load.

17. Fit both shock absorbers to the upper mountings. Refit the trim.

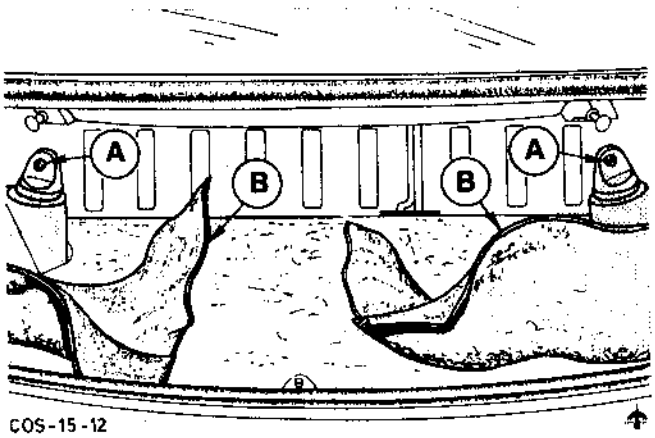


Fig.16. A - Shock absorber attachment
B - Luggage compartment side trim

18. Raise the rear axle assembly until the M12 crossmember mounting locating bolts can be inserted in the floor assembly.

19. Fit the bolts (2 each side) to the guide plates and torque all six bolts to the specified torque.

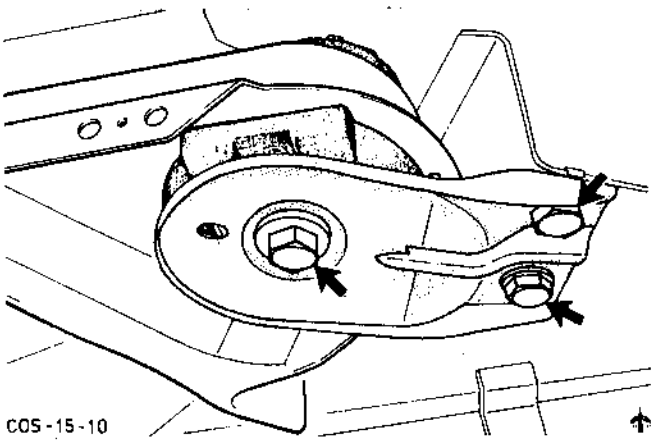


Fig.17. Rear axle crossmember front mounting (guide plate).

1087

15 212 0

20. Secure the axle rear mounting to the crossmember (4 bolts).

21. Bolt the stabiliser bar to the floor assembly crossmember (2 brackets, 2 bolts).

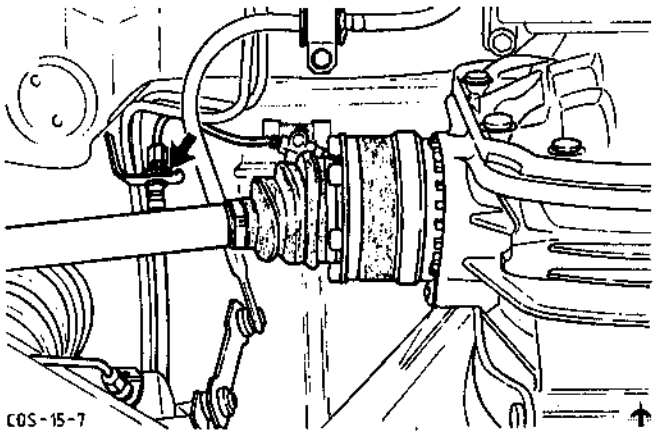


Fig.18. Brake hose/pipe bracket (arrow shows U-shaped clip).

22. Push the rear axle casing breather hose into the crossmember.

23. Connect the brake pipes to the brake hoses and secure them to the brackets with the U-shaped clips.

24. Secure the brake cable sleeves to the floor assembly.

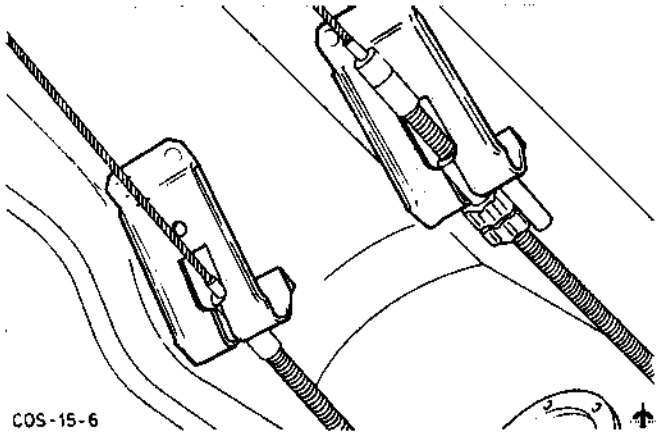


Fig.19. Brake cable brackets on floor assembly.

25. Attach the handbrake cable to the handbrake lever pin using the circlip. Adjust the handbrake cable.

26. Install the ABS wheel sensor and tighten the bolt (both sides). Clip the cables to the lower arms.

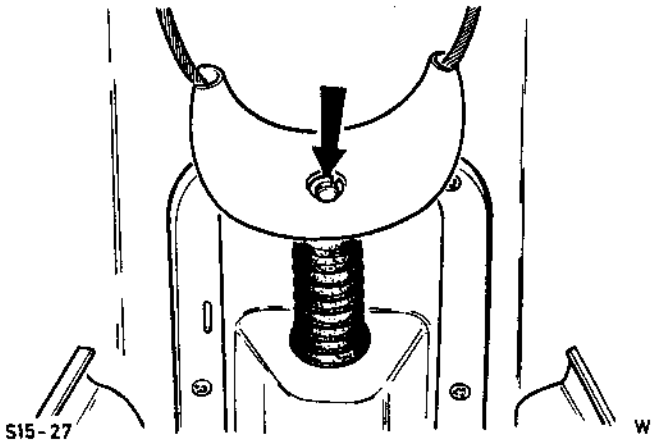


Fig.20. Circlip on handbrake lever.

15 212 0

27. Install the driveshaft:

Remove the plug from the transmission extension housing and guide in the splined end of the driveshaft.

Loosely attach the centre bearing housing to the floor assembly with the two spacers, washers and bolts.
Attach the driveshaft to the pinion gear flange.
Tighten the centre bearing bolts.

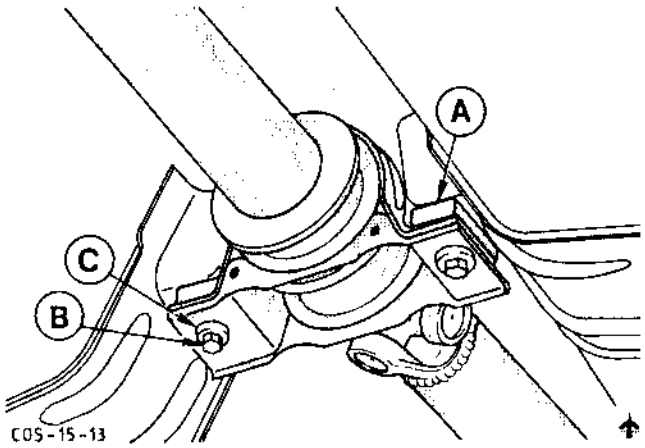


Fig.21. Driveshaft centre bearing.
A - Spacer
B - Bolt C - Washer

28. Locate the exhaust system in place, hook the rear and right hand mufflers into their insulators and fit the left hand insulator bracket bolts. Connect the downpipe flanged joints (2 bolts each).

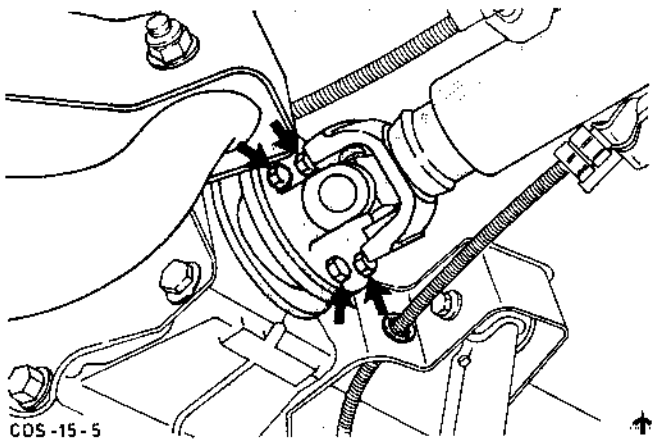


Fig.22. Driveshaft to pinion flange attachment.

29. Bleed the brake system as described in Service and Repair Operation 12 141 0.

30. Lower the vehicle to the ground, check the rear axle oil level and top up if necessary (see Technical Data).

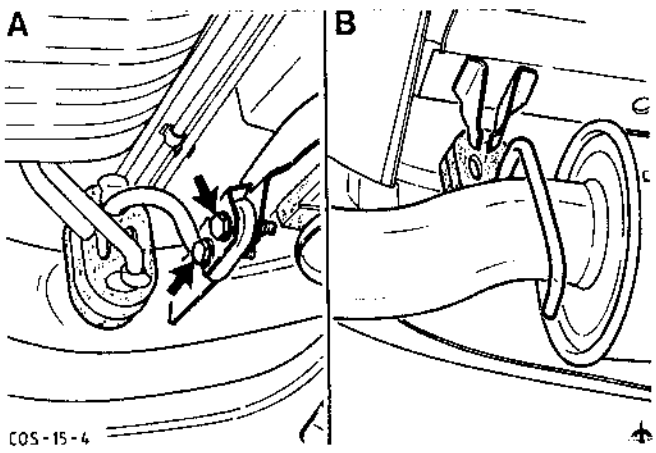


Fig.23. Exhaust system attachment.
A - Left hand muffler insulator
B - Rear muffler insulator

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15 214 0 REAR AXLE ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Raise the vehicle.

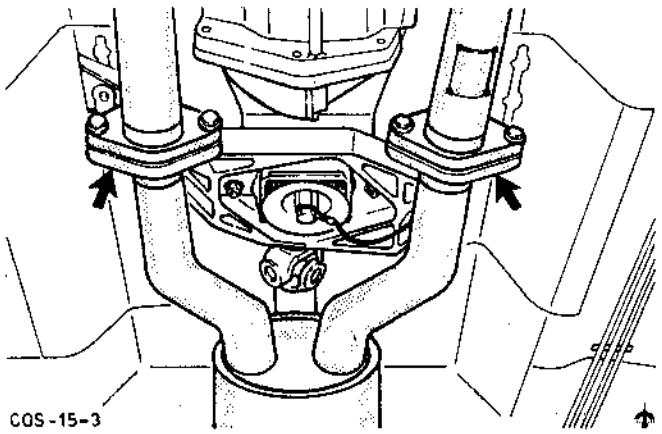


Fig.24. Downpipe flanged joints.

2. Remove the exhaust system:

   - disconnect the exhaust system from the downpipes (4 bolts)
   - unscrew the left hand exhaust muffler insulator bracket (2 bolts)
   - unhook the right hand and rear muffler insulators and remove the system.

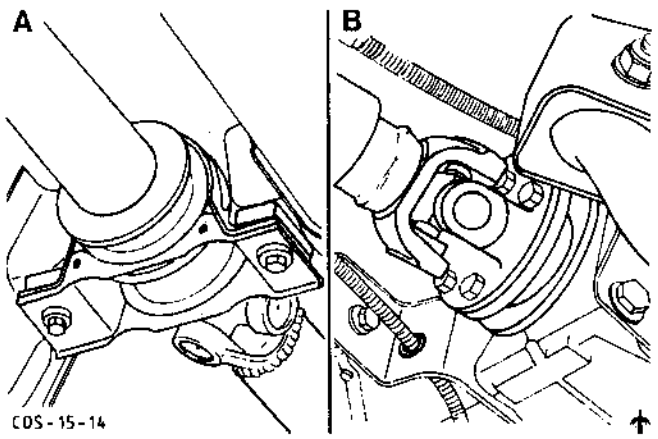


Fig.25. Driveshaft attachment.
A - At centre bearing
B - To pinion flange

3. Unbolt the driveshaft from the pinion flange (4 bolts). Loosen the driveshaft centre bearing housing (2 bolts). Push the driveshaft forwards and let the driveshaft rear section hang down.

4. Detach both rear axle shafts from the inner driveshaft flanges (6 Torx bolts on each side).

   Suspend the driveshafts.

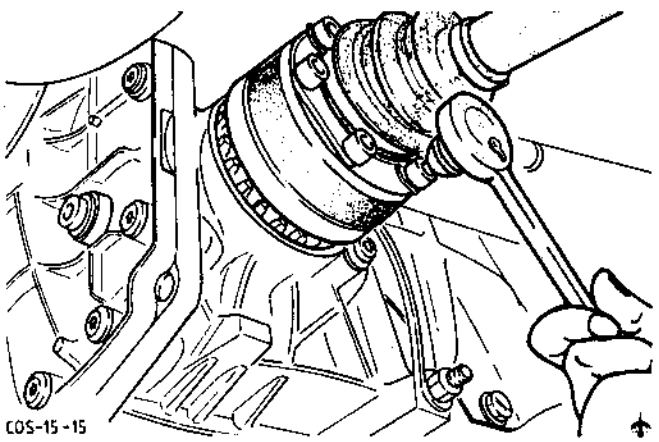


Fig.26. Unbolt rear axle shaft from driveshaft flange.

5. Support the rear axle assembly with a jack.

6. Unbolt the axle rear mounting from the floor assembly crossmember (4 bolts).

7. Push the axle rear mounting insulator forwards and lever out the rubber stop.

8. Lower the rear axle assembly far enough to allow removal of the mounting from the axle casing cover. Remove the axle rear mounting (2 bolts).

9. Unscrew the two front bolts, the two upper bolts, and the through bolt retaining the axle to the axle beam.

10. Remove the rear axle assembly from the axle beam.

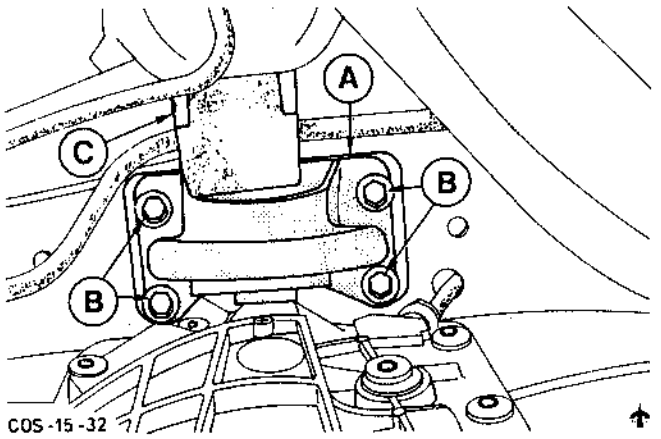


Fig.27. Axle rear mounting.
A - Axle mounting insulator
B - Bolts C - Rubber stop

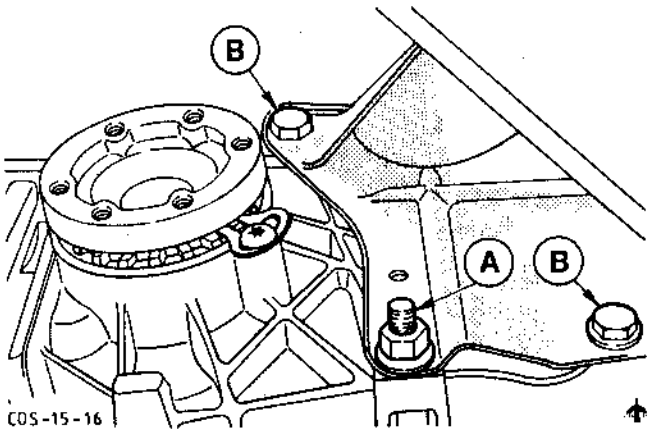


Fig.28. Rear axle attachment to axle beam (right hand side shown)
A - Through bolt B - Bolts

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

11. Place the rear axle assembly in the installation position and insert the through bolt with nut. Screw in the remaining bolts and tighten the bolts and nut to specification.

12. Fit the axle rear mounting to the axle casing cover.

13. Lubricate the rubber stop with glycerine and insert it.

14. Raise the rear axle assembly until the axle mounting insulator butts on the floor assembly crossmember.
Push the axle casing breather hose into the crossmember.

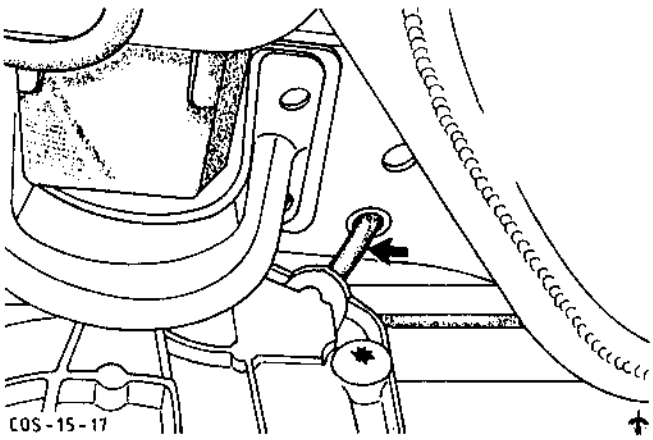


Fig.29. Axle casing breather hose.

15 214 0

15. Bolt the axle rear mounting to the floor assembly crossmember.

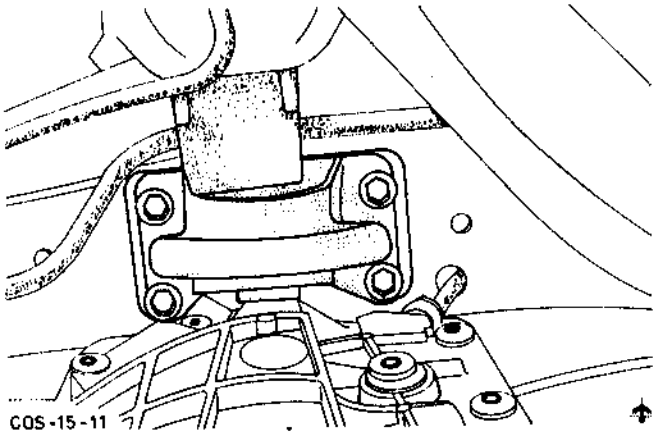


Fig.30. Axle rear mounting.

16. Secure both rear axle shafts to the inner driveshaft flanges.

17. Bolt the driveshaft to the pinion flange and tighten the centre bearing bolts.

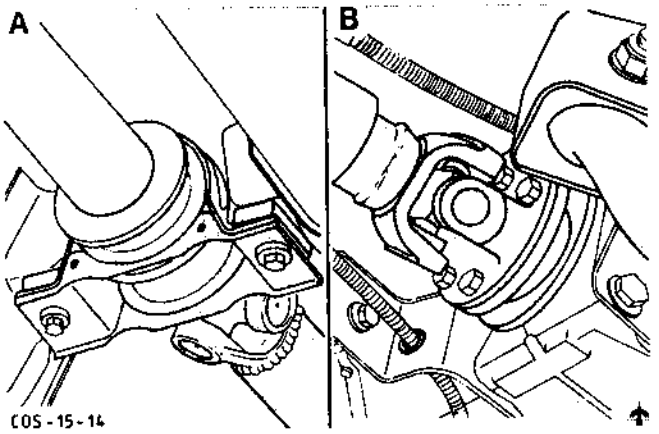


Fig.31. Driveshaft attachment.
A - At centre bearing
B - To pinion flange

18. Locate the exhaust system in place, hook the rear and right hand mufflers into their insulators and fit the left hand insulator bracket bolts. Connect the downpipe flanged joints (2 bolts each).

19. Check the rear axle oil level and top up if necessary (see Technical Data).

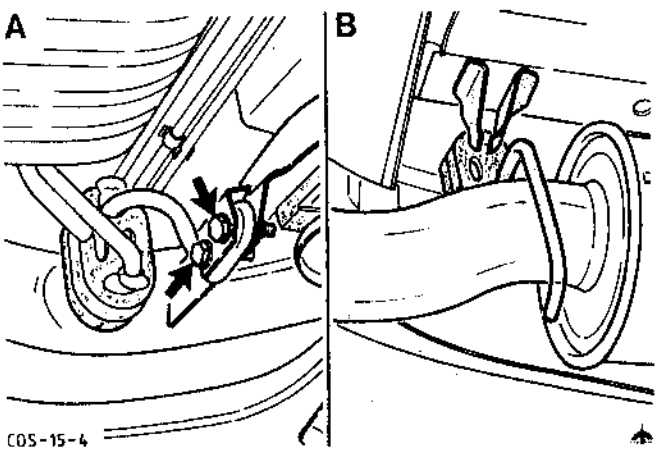


Fig.32. Exhaust insulators
A - Left hand muffler insulator
B - Rear muffler insulator

20. Lower the vehicle.

1087

15 302 0 SEAL - DRIVE PINION - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Universal flange holding wrench	15-030
Pinion oil seal installer	15-047-A
Pinion oil seal remover	15-072

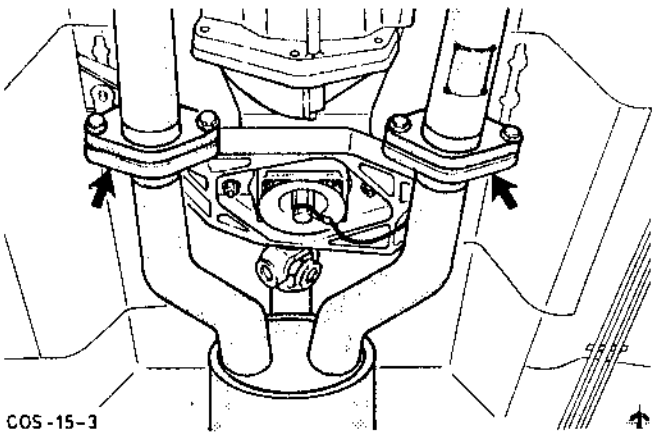


Fig.33. Downpipe flanged joints.

To Remove

1. Raise the vehicle.

2. Remove the exhaust system:
   - disconnect the exhaust system from the downpipes (4 bolts)
   - unscrew the left hand exhaust muffler insulator bracket (2 bolts)
   - unhook the right hand and rear muffler insulators and remove the system.

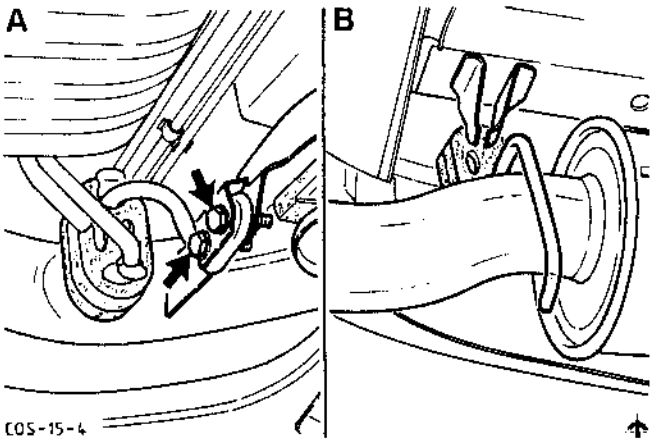


Fig.34. Exhaust insulators
A - Left hand muffler insulator
B - Rear muffler insulator

3. Loosen the driveshaft centre bearing (2 bolts) and unbolt the driveshaft from the pinion flange (4 bolts). Push the driveshaft forwards and let the driveshaft rear section hang down.

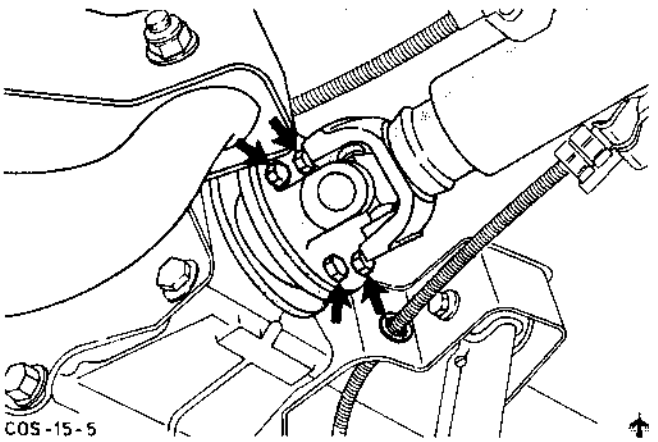


Fig.35. Driveshaft to pinion flange attachment.

15 302 0

4. Hold the pinion flange with special tool 15-030 and unscrew the flange retaining nut.

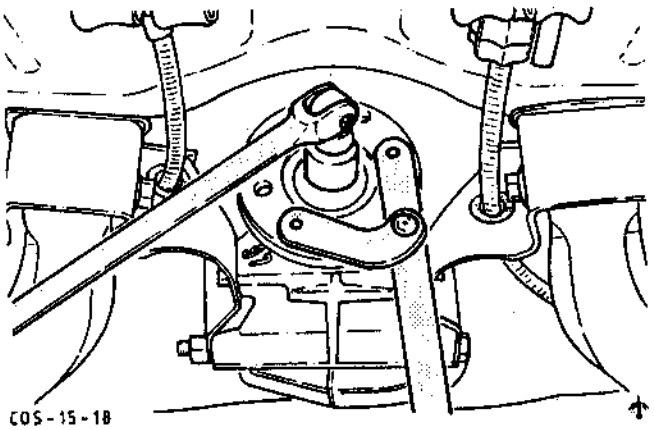


Fig.36. Remove pinion flange nut.

5. Pull the drive flange off the drive pinion using a standard puller.

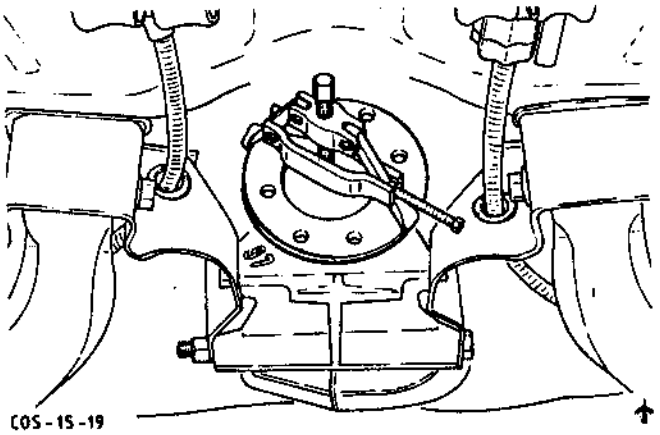


Fig.37. Remove pinion drive flange.

6. Lever the pinion oil seal out of the rear axle casing using special tool 15-072.

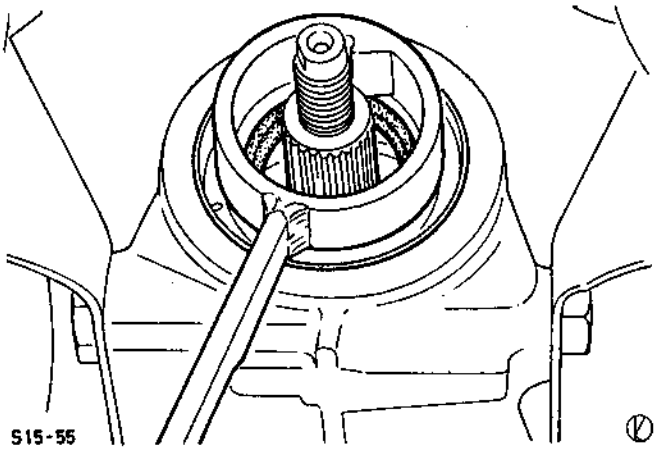


Fig.38. Remove pinion oil seal.

15 302 0

To Install

During installation, tighten all nuts and bolts to the torque specified in Technical Data.

7. Fit the new pinion oil seal using special tool 15-047-A.

NOTE: The grease packing of the new oil seal (as supplied) must not be removed.

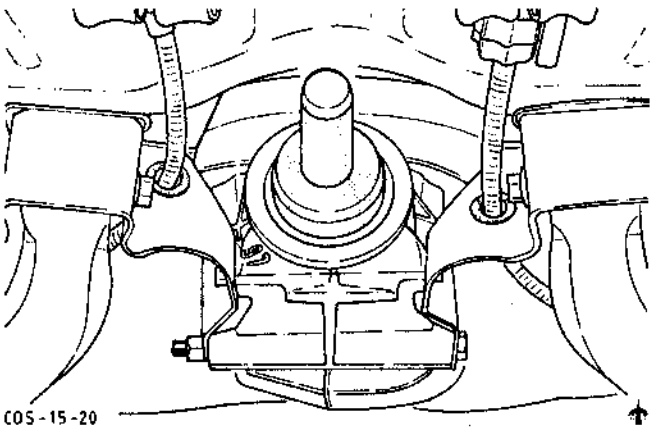


Fig.39. Fit pinion oil seal.

8. Fit the flange onto the drive pinion, hold it using special tool 15-030 and tighten the self-locking nut.

9. Bolt the driveshaft to the pinion flange and tighten the centre bearing bolts.

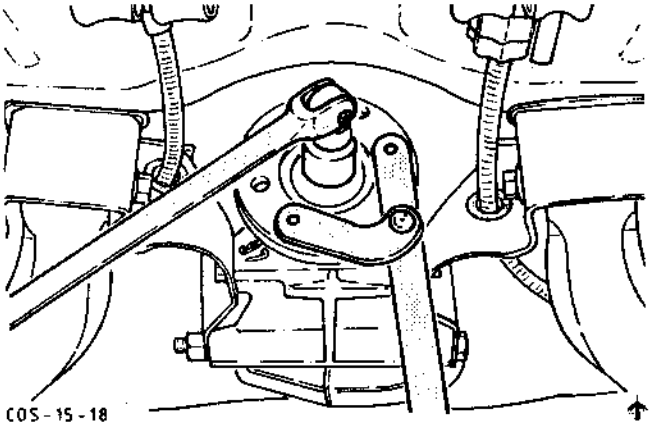


Fig.40. Tighten flange nut.

10. Locate the exhaust system in place, hook the rear and right hand mufflers into their insulators and fit the left hand insulator bracket bolts. Connect the downpipe flanged joints (2 bolts each).

11. Check the rear axle oil level and top up if necessary (see Technical Data).

12. Lower the vehicle.

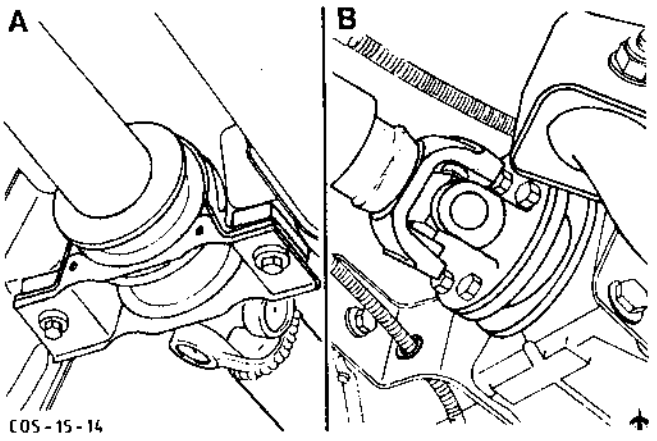


Fig.41. Driveshaft attachment.
A - At centre bearing
B - To pinion flange

1087

15 321 0 SHAFT - REAR AXLE - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Raise the vehicle.

2. Detach the rear axle shaft from the drive flange (6 torx bolts).

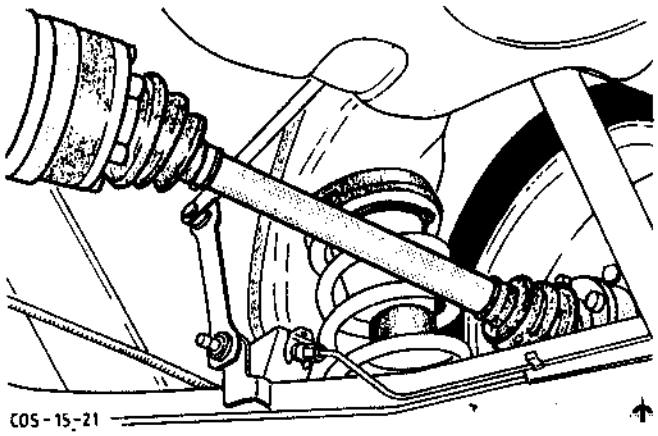


Fig.42. Rear axle shaft in position.

3. Detach the rear axle shaft from the driveshaft stub (6 torx bolts).

   Remove the axle shaft from the vehicle.

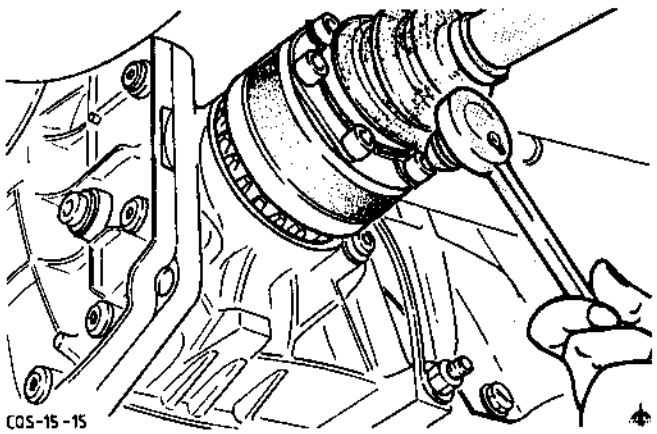


Fig.43. Detach rear axle shaft from drive flange.

To Install

NOTE: The amount of grease in constant-velocity joints must be checked and corrected as necessary before installing. See Technical Data for amount of grease and specification.

4. Locate the rear axle shaft in position and secure it to the driveshaft stub and drive flange. Tighten the bolts to the specified torque (see Technical Data).

5. Lower the vehicle.

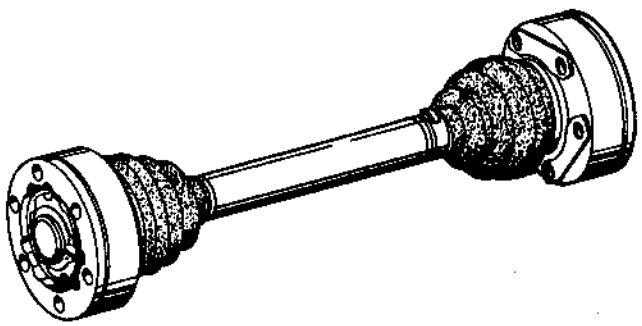
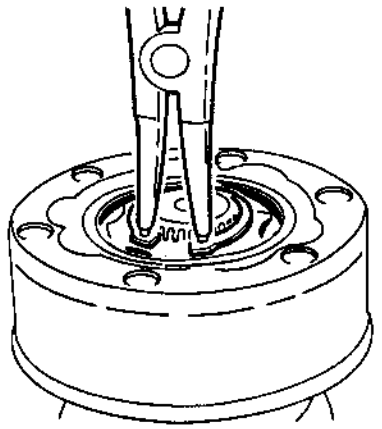


Fig.44. Rear axle shaft.

15 321 8 SHAFT - REAR AXLE - OVERHAUL (rear axle shaft removed)

SPECIAL SERVICE TOOL REQUIRED: NONE

NOTE: The repair instructions only cover the driveshaft stub and drive flange end of the rear axle shaft.



L 15-81 K

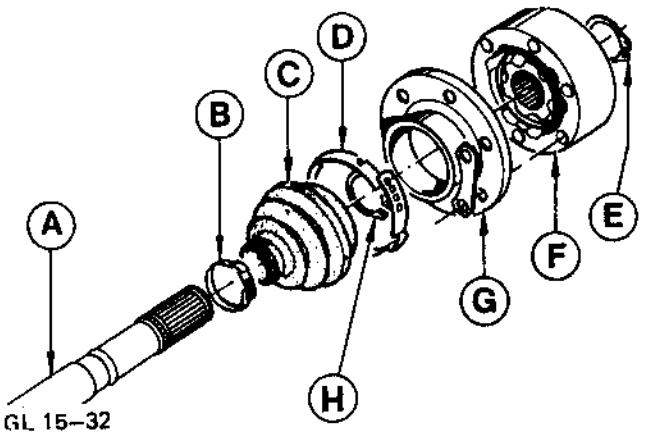
Fig.45. Remove outer circlips.

To Dismantle

1. Release the four clips securing the rubber gaiters and pull off the gaiters.

2. Remove the two outer circlips and pull the two sliding constant-velocity joints off the shaft.

3. Remove the two inner circlips.



GL 15-32

Fig.46. Rear axle shaft (1 side) - exploded view.

A - Shaft
B - Gaiter clip
C - Gaiter
D - Gaiter clip
E - Outer circlip
F - Sliding CV joint
G - End cover
H - Inner circlip

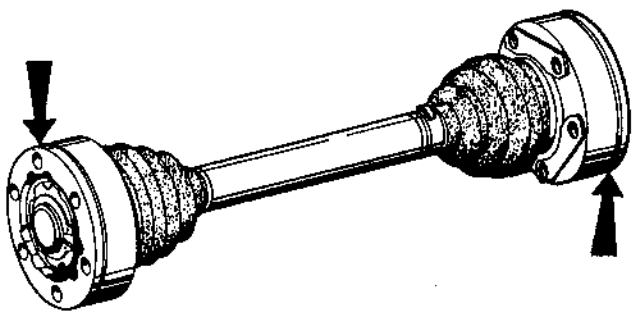
Fig.46. Rear axle shaft (1 side) - exploded view.

To Assemble

4. Slide on the rubber gaiters and the end covers and fit new retaining clips. Apply sealer (see Technical Data) to the end covers at the CV joint contact faces.

5. Fit the inner circlips and slide on the constant velocity joints. The guide groove on the circumference of the joints must be on the outside.

6. Fit the outer circlips.



OE1-15-50 E

Fig.47. Sliding CV joints fitted correctly (guide grooves arrowed).

7. Pack the constant velocity joints with grease (see Technical Data) on either side of the ball bearings.

15 413 0 BEARINGS - REAR WHEEL - INNER AND OUTER - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRE:

Radial oil seal and bearing cup installer	14-019
Driveshaft installer	14-041

To Remove

1. Loosen the wheel nuts.

2. Loosen the hub nut, Fig.49.(A).

3. Raise the vehicle and remove the wheel.

4. Unbolt the brake caliper (2 bolts), Fig.48, and tie it to one side.

NOTE: Do not release the brake pipe.

5. Mark the position of the brake disc in relation to the wheel hub and remove it.

6. Unscrew the hub nuts completely Fig.49.(A), and pull off the hub using a conventional puller.

7. Unscrew the 4 bearing housing retaining bolts, Fig.49.(C). Remove the bearing housing and splash plate.

8. Prise the outer and inner radial oil seals out of the bearing housing using a lever. Remove the 2 taper roller bearings.

9. Carefully drive out the bearing cups using a brass drift.

NOTE: The drift must be in good condition to avoid damaging the seating faces of the bearing cups.

10. Clean the bearing housing and remove all traces of grease.

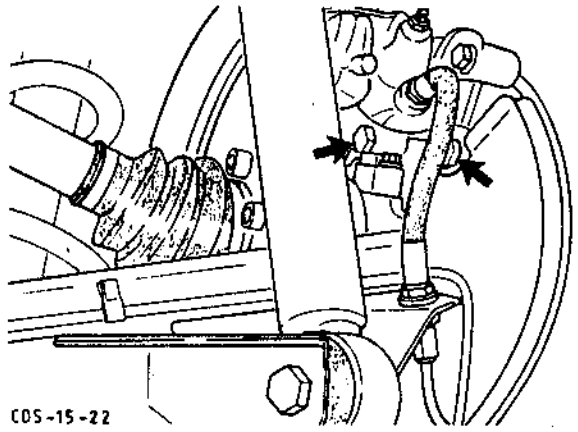


Fig.48. Brake caliper retaining bolts.

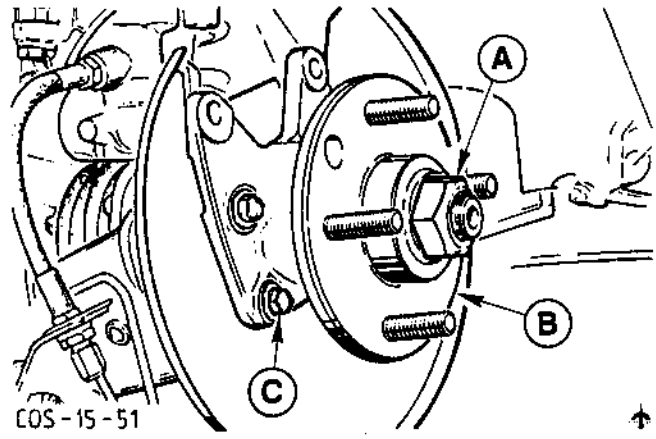


Fig.49. A - Hub nut
B - Hub
C - Bearing housing retaining bolts

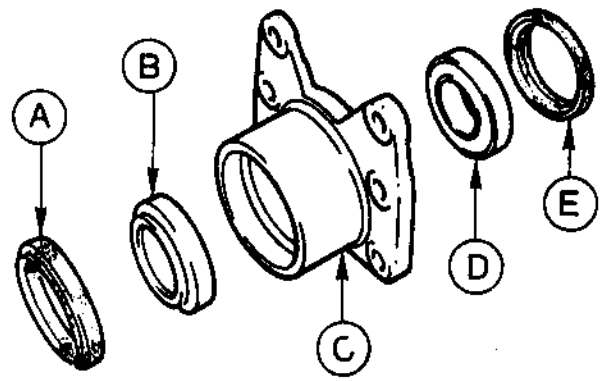


Fig.50. Bearing housing - exploded view.

Fig.50. Bearing housing - exploded view.
A - Outer radial oil seal
B - Outer taper roller bearing
C - Bearing housing
D - Inner taper roller bearing
E - Inner radial oil seal

0492

15 413 0

To Install

11. Fit the bearing cups using Special Tool 14-019.

NOTE: The bearings, cups, hub and bearing housings are made to tight tolerances, eliminating the need for bearing adjustment later.

12. Pack the taper roller bearings with high melting point grease to Ford specification SAM-1C-9111-A and fit them. Make sure that the cavities between the rollers are packed with grease.

NOTE: Do not fill the space between the bearings with grease.

13. Fit the radial oil seals using Special Tool 14-019, Fig.52.

14. Fit the splash plate and bearing housing (4 bolts).

NOTE: When installing, tighten the nuts and bolts to the torques specified in Technical Data.

15. Pull the hub onto the driveshaft stub using Special Tool 14-041, Fig.52.

16. Fit the washer and a new hub nut (but do not torque).

17. Fit the brake disc in the marked position and secure it with the serrated lock washer.

18. Fit the brake caliper.

19. Fit the wheel and lower the vehicle to the ground.

20. Tighten the wheel nuts.

21. Apply the handbrake and tighten the hub nut.

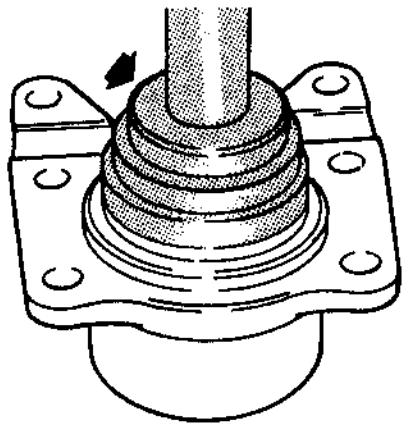


Fig.51. Fit radial oil seal using Special Tool 14-019.

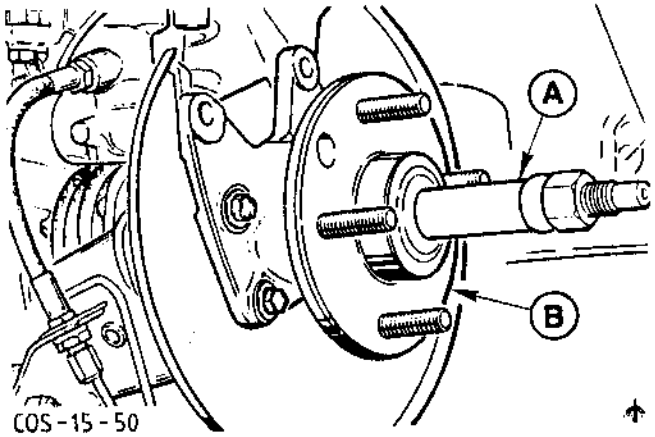


Fig.52. A - Special Tool 14-041
B - Hub

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15 621 0 REAR SPRING ASSEMBLY - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Loosen the road wheel nuts.

2. Raise the vehicle and remove the wheel.

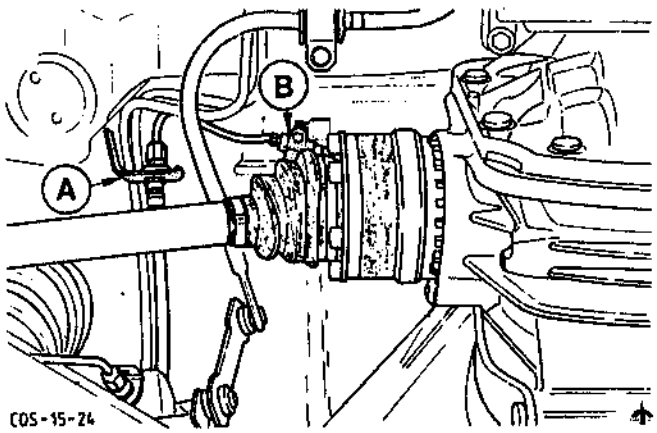


Fig.53. A - Brake hose/pipe retaining clip
B - Brake pipe distributor

3. Unclip the brake pipe/hose connection from the bracket on the floor assembly.

NOTE: When the left hand side rear spring is removed, the brake pipe distributor must be unscrewed from the floor panel.

4. Detach the rear axle shaft from the driveshaft stub (6 Torx bolts).

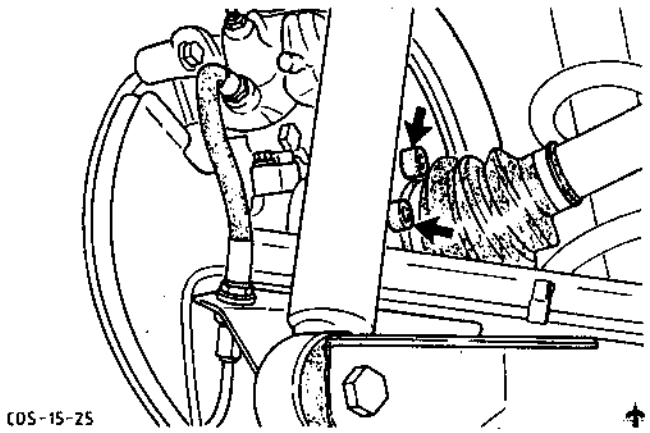


Fig.54. Axle shaft to driveshaft stub bolts.

5. Detach the stabiliser bar from the link rod (lever off with a screwdriver).

6. Support the lower suspension arm, placing the spring under load.

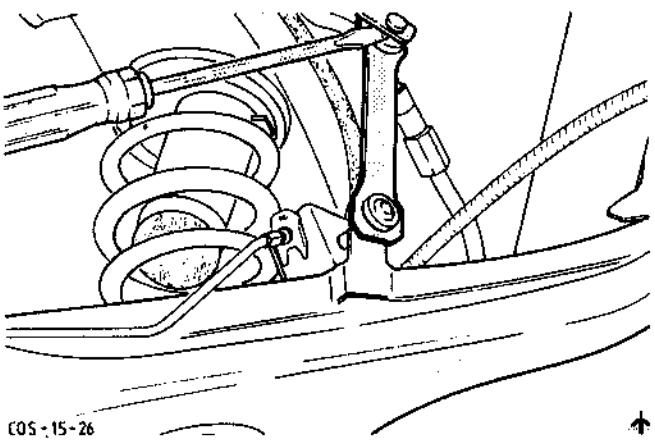
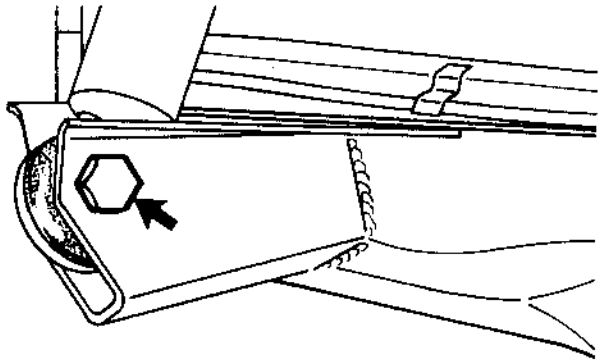


Fig.55. Detach stabiliser bar from link rod.

15 621 0

7. Detach the shock absorber from the lower suspension arm.

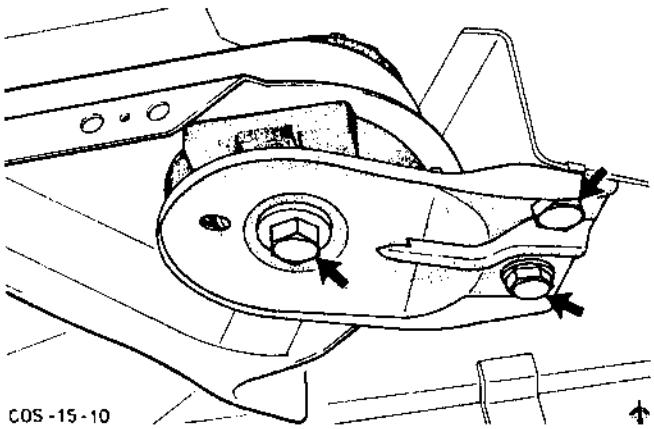


COS-15-27

Fig.56. Shock absorber lower attachment.

8. Unbolt the rear axle crossmember front mounting (guide plate) from the body (3 bolts).

9. Lower the lower suspension arm and remove the rear spring and rubber pad from the vehicle.



COS-15-10

Fig.57. Rear axle crossmember front mounting (guide plate).

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

10. Locate the rear spring and rubber pad in position and raise the lower suspension arm, making sure that the spring is seated correctly.

11. Secure the rear axle crossmember front mounting (guide plate) to the body.

12. Raise the lower suspension arm (placing the spring under load) and secure the shock absorber to the lower arm.

13. Connect the stabiliser bar to the link rod.

    Lower the lower suspension arm.

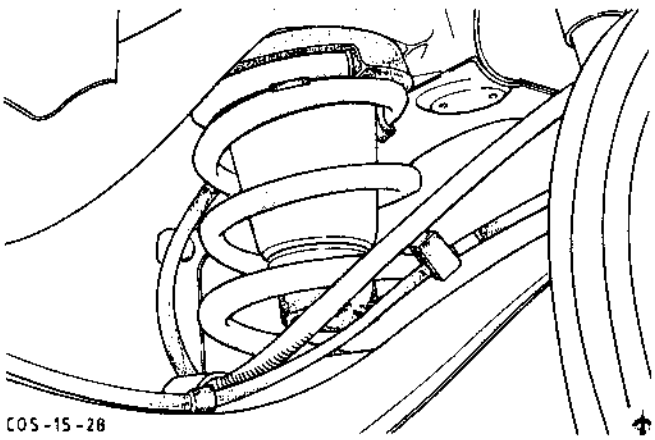
14. Attach the rear axle shaft to the driveshaft stub.

15. Clip the brake pipe/hose connection to the bracket.

NOTE: When fitting the left hand rear spring, screw the brake pipe distributor to the floor panel.

16. Fit the wheel.

17. Lower vehicle and tighten wheel nuts.



COS-15-28

Fig.58. Rear spring in installation position.

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15 686 0 INSULATOR - REAR AXLE CASING - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

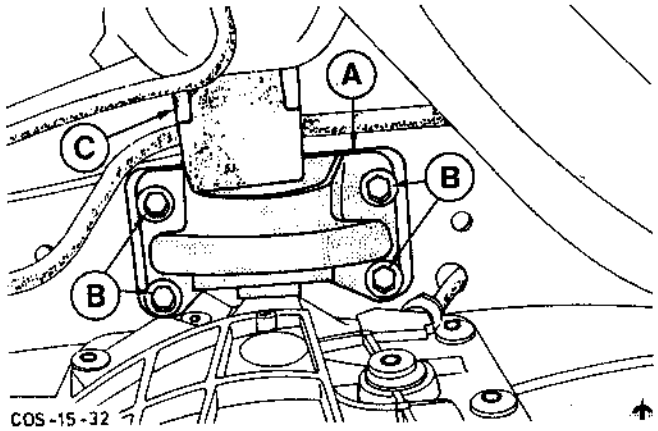


Fig.59. Axle rear mounting.
A - Axle rear mounting insulator
B - Bolts C - Rubber stop

To Remove

1. Raise the vehicle on a lift.
2. Support the rear axle assembly with a jack.
3. Unbolt the axle rear mounting (rubber insulator) from the floor assembly crossmember (4 bolts).
4. Push the axle rear mounting insulator forwards and lever out the rubber stop.
5. Lower the rear axle assembly.
6. Detach the axle rear mounting from the rear axle cover (2 bolts).

To Install

7. Attach the axle rear mounting to the rear axle cover (2 bolts).
8. Lubricate the rubber stop with glycerine and insert it.
9. Raise the rear axle assembly with the jack until the axle mounting meets the floor assembly crossmember.

   Push the axle casing breather hose into the crossmember.

   Attach the axle mounting to the floor assembly crossmember (4 bolts).
10. Remove the jack and lower the vehicle to the ground.

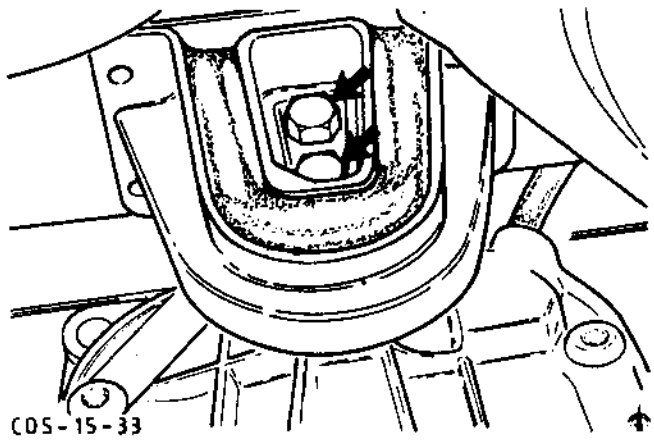


Fig.60. Rear mounting to rear axle cover bolts.

15 705 0 LOWER ARM - REAR AXLE - REMOVE AND INSTALL (one side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

WARNING: SWITCH OFF IGNITION (position '0')

Apply foot brake repeatedly until the brake pedal becomes "hard" to ensure that the hydraulic system pressure is completely discharged.

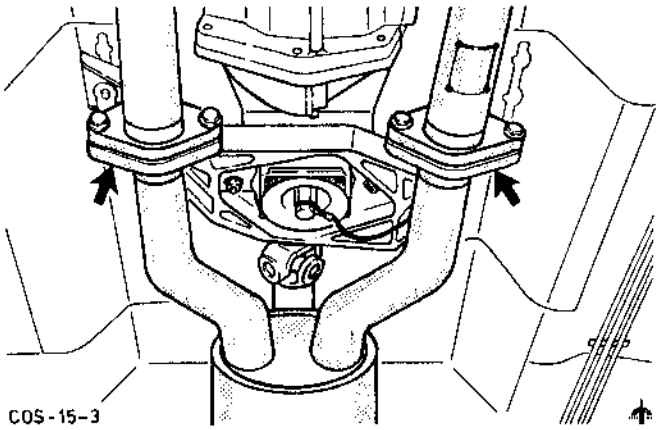


Fig.61. Downpipe flanged joints.

To Remove

1. Loosen the wheel nuts.

2. Raise the rear of the vehicle and remove the wheel.

3. Apply handbrake. Loosen the driveshaft stub nut.

4. Release handbrake and raise complete vehicle.

5. Remove the exhaust system:
   - disconnect the exhaust system from the downpipes (4 bolts)
   - unscrew the left hand exhaust muffler insulator bracket (2 bolts)
   - unhook the right hand and rear muffler insulators and remove the system.

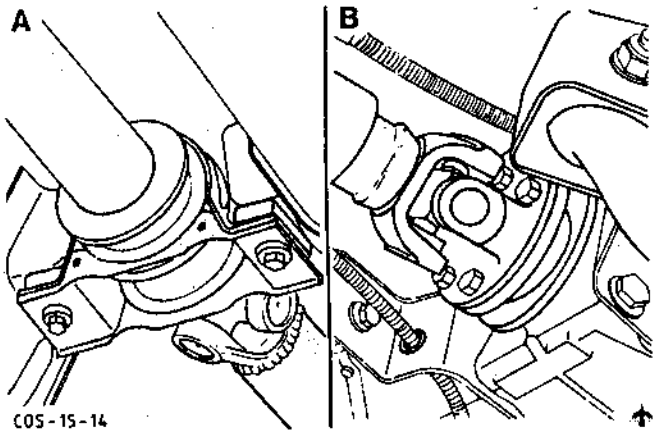


Fig.62. Driveshaft attachment.
A - At centre bearing
B - To pinion flange

6. Loosen the driveshaft centre bearing (2 bolts) and unbolt the driveshaft from the pinion flange (4 bolts). Push the driveshaft forwards and let the driveshaft rear section hang down.

7. Disconnect the brake pipes from the brake hoses and detach the two brake hoses from the brackets on the lower suspension arms.

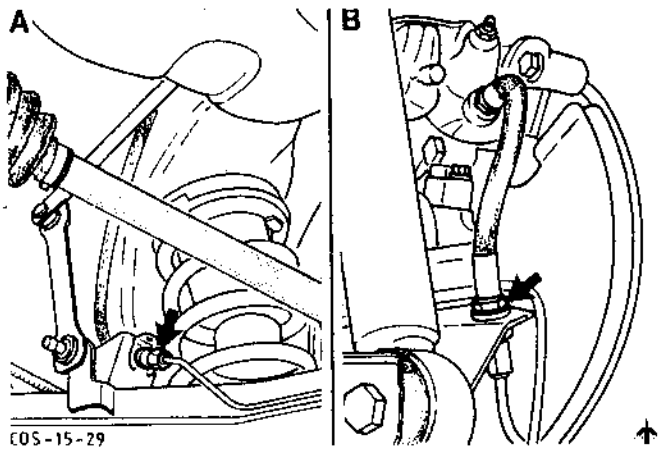


Fig.63. A - Brake hose bracket (left hand side)
B - Brake hose bracket (right hand side)

15 705 0

8. Unbolt the brake caliper (2 bolts) and tie it to one side, Fig.64.

9. Unclip the handbrake cable and the ABS sensor wiring from the lower suspension arm.

10. Mark the position of the brake disc in relation to the hub and remove it.

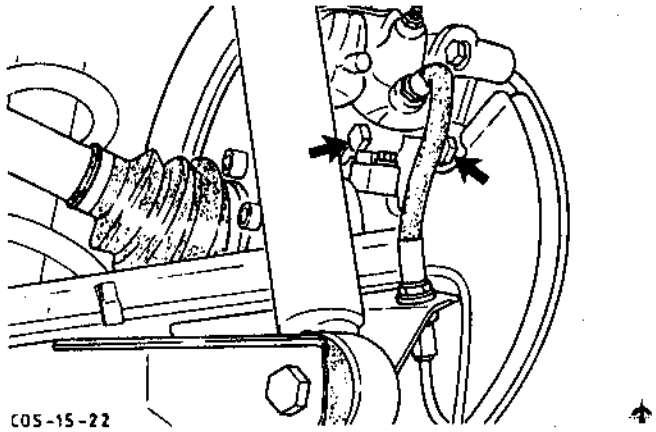


Fig.64. Brake caliper retining bolts.

11. Detach the driveshaft from the stub axle (6 bolts), Fig.65.

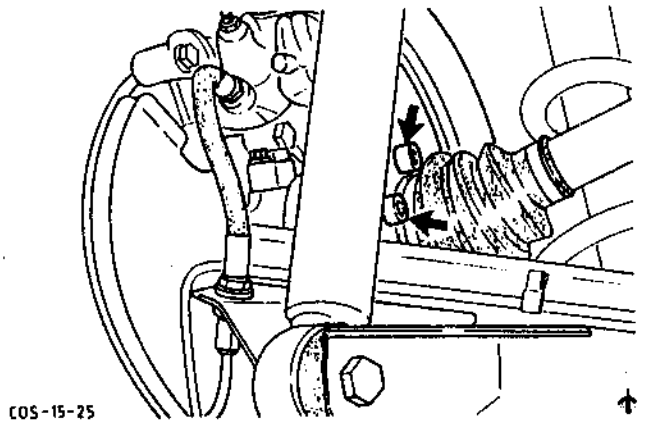


Fig.65. Detach driveshaft from stub axle.

12. Unscrew the hub nut, Fig.66.(A), and pull off the hub using a conventional puller.

13. Unscrew the bearing housing retaining bolt, Fig.66.(C). Remove the bearing housing and splash plate.

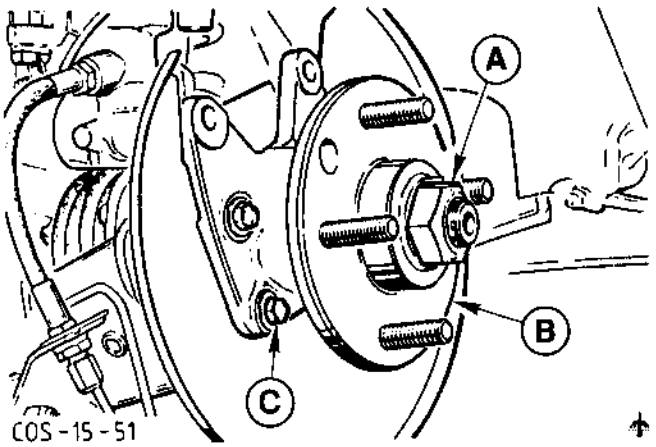


Fig.66. A - Hub nut
B - Hub
C - Bearing housing retaining bolts

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15 705 0

14. Detach the stabiliser bar from the link rod (lever off with screwdriver).

15. Support the lower suspension arm, placing the spring under load.

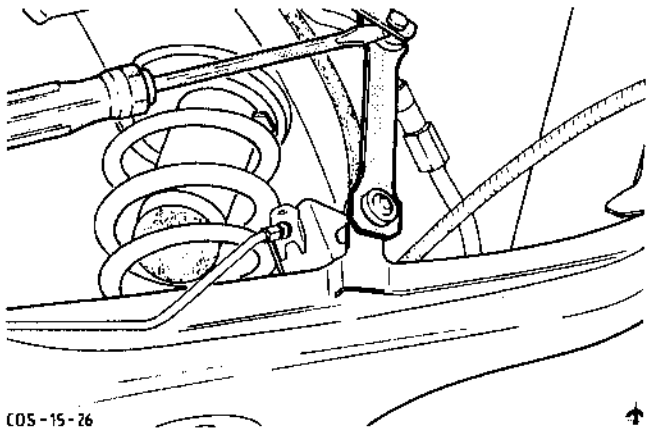


Fig.67. Detach stabilisor bar from link rod.

16. Detach the shock absorber bottom mounting.

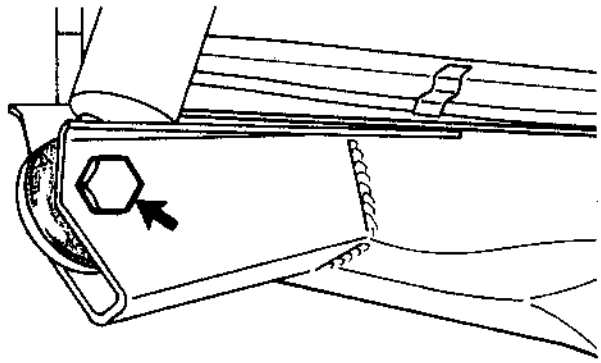


Fig.68. Shock absorber lower mounting.

17. Detach the axle crossmember (guide plate) front mounting (3 bolts).

18. Lower the lower suspension arm and remove the rear spring and rubber pad.

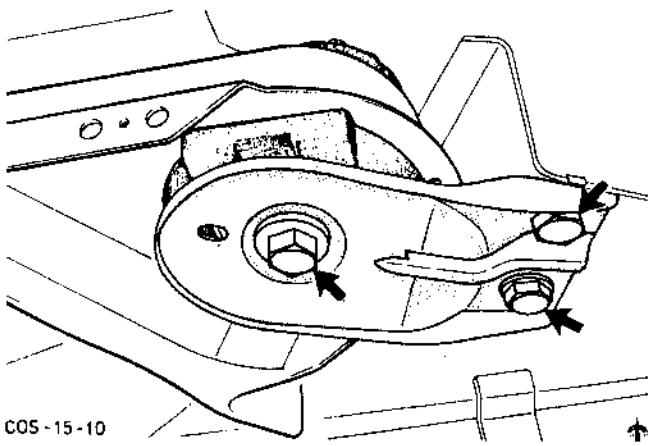


Fig.69. Rear axle crossmember front mounting (guide plate).

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15 705 0

19. Unbolt the lower arm from the crossmember (2 bolts) and remove the lower arm from the vehicle.

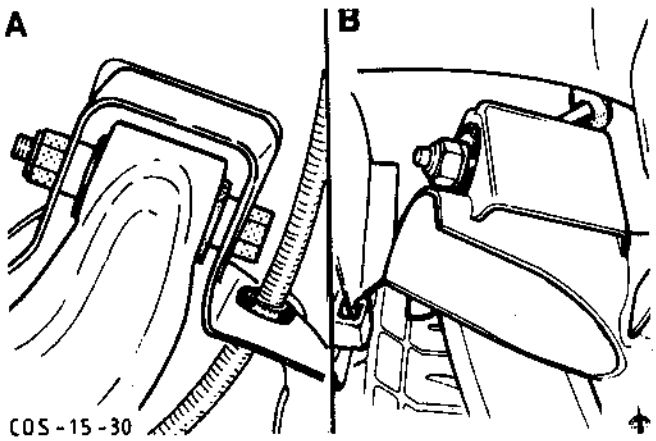


Fig.70. Lower arm to crossmember attachment.
A - inner
B - outer

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

20. Locate the lower suspension arm in position and fit to the crossmember (2 bolts).

21. Place the spring and rubber pad in position and raise the lower arm, making sure that the spring is correctly seated.

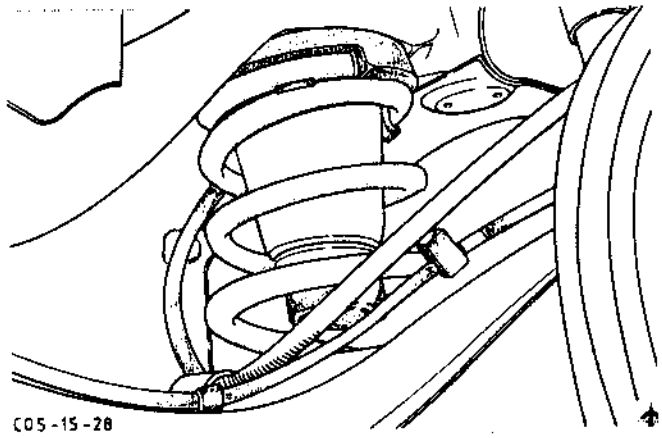


Fig.71. Rear spring installation position.

22. Attach the axle crossmember front mounting (guide plate).

23. Raise the lower arm (place load on spring) and connect shock absorber to lower mount.

24. Connect the stabiliser bar to the link rod.

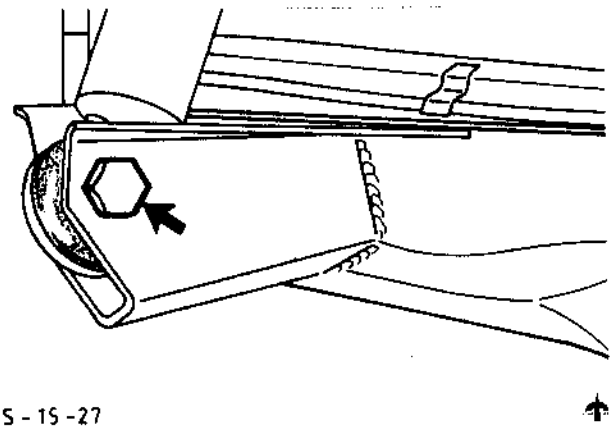


Fig.72. Shock absorber lower mounting.

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15 705 0

25. Fit the splash plate and bearing housing (4 bolts).

26. Draw the hub onto the stub axle using Special Tool 14-041, Fig.73.

27. Fit the washer and a new hub nut (but do not torque).

27a. Fit the brake disc in the marked position and secure it with the serrated lock washer.

28. Attach the driveshaft to the stub axle.

29. Fit the brake caliper.

30. Clip the handbrake cable and ABS sensor wiring to the lower suspension arm.

31. Attach the 2 brake hoses to the brackets and connect the brake pipes to the brake hoses, Fig.75.

32. Connect the driveshaft.

33. Fit the exhaust system.

34. Bleed the brake system as described in Operation No. 12 141.0.

35. Fit the rear wheel.

36. Lower the vehicle to the ground.

37. Tighten the wheel nuts.

38. Apply the handbrake and tighten the hub nut.

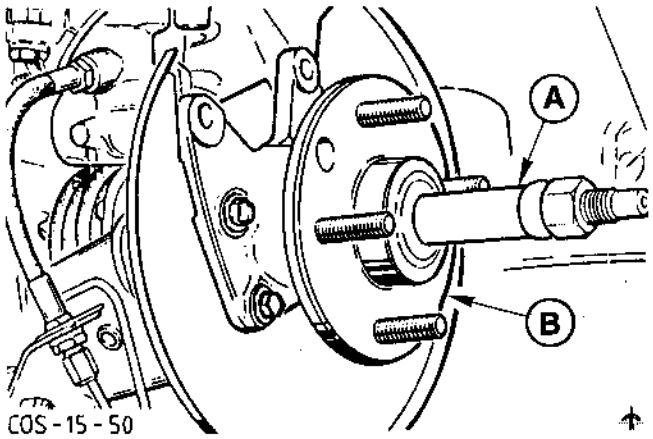


Fig.73. A - Special Tool 15-041
B - Hub

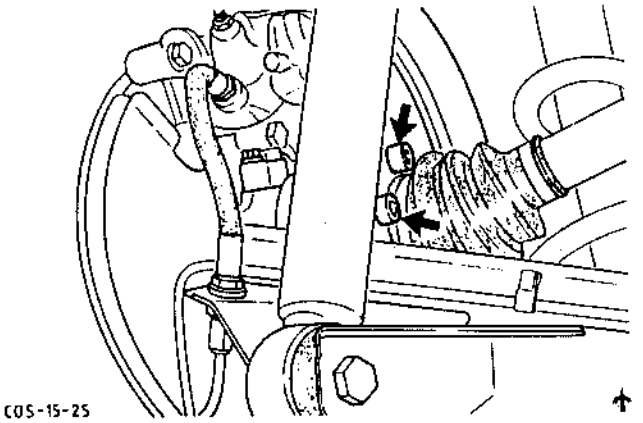


Fig.74. Attach driveshaft to stub axle.

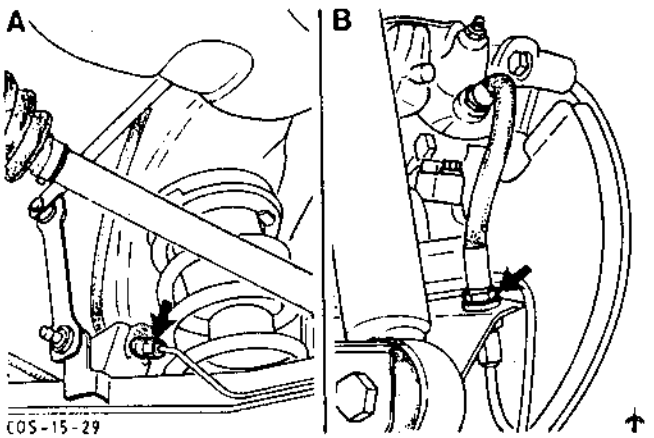


Fig.75. A - Left-hand brake hose/pipe bracket
B - Right-hand brake hose/pipe bracket

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MANUAL TRANSMISSION AND CLUTCH 16A
(Borg Warner Transmission)

Index

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Service and Repair Operations		Contained in Operation	Page
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TECHNICAL DATA — Manual Transmission and Clutch

Tightening Torques

	Nm
Clutch housing to transmission housing	61 to 88
Clutch housing to engine	40 to 51
Clutch release bearing guide sleeve to transmission housing	15 to 27
Extension housing to transmission housing	27 to 61
Selector cover to transmission housing	8 to 15
Driveshaft to rear axle pinion flange	57 to 67
Driveshaft centre bearing to floor assembly	18 to 23
Transmission crossmember to floor assembly	48 to 68
Insulator to transmission crossmember	16 to 20
Insulator to transmission	50 to 57
Reversing light switch	17 to 24
Oil drain plug	20 to 41
Oil filler plug	20 to 41
Gear lever to transmission	31 to 43
Gear lever cover to extension housing	15 to 20
Countershaft rear bearing retainer	15 to 20
Speedometer cable retaining screw	4 to 6
Exhaust downpipe to turbocharger nuts (M8)	19 to 23
Exhaust downpipe to turbocharger nuts (M10)	35 to 47
Left hand muffler insulator bracket bolts	45 to 56
Stabiliser bar clamp to side member	41 to 58
Starter motor to engine block	29 to 41
Clutch housing adaptor plate to engine block	8,5 to 12

Mainshaft axial clearance .. .. 0 ± 0,002" (0 ± 0,05 mm)

Countershaft axial clearance .. .. 0,001 to 0,005" (0,03 to 0,12 mm)

Shims-Mainshaft Axial Clearance (thickness in thousandths of an inch)

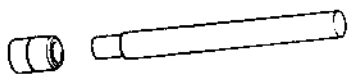
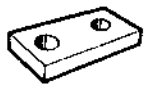
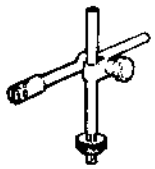
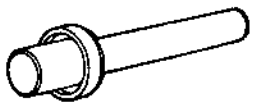
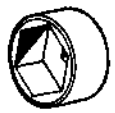
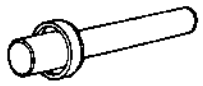
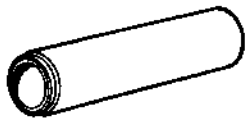
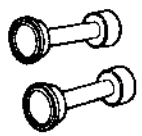
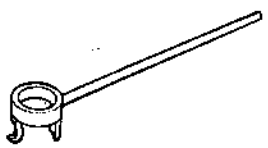
0.012 (0,3048 mm)	0.024 (0,6096 mm)	0.031 (0,7874 mm)	0.038 (0,9652 mm)
0.014 (0,3556 mm)	0.025 (0,635 mm)	0.032 (0,8128 mm)	0.039 (0,9906 mm)
0.016 (0,4064 mm)	0.026 (0,6604 mm)	0.033 (0,8382 mm)	0.040 (1,016 mm)
0.018 (0,4572 mm)	0.027 (0,6858 mm)	0.034 (0,8636 mm)	0.041 (1,0414 mm)
0.020 (0,508 mm)	0.028 (0,7112 mm)	0.035 (0,889 mm)	0.042 (1,0668 mm)
0.022 (0,5588 mm)	0.029 (0,7366 mm)	0.036 (0,9144 mm)	0.043 (1,0922 mm)
0.023 (0,5842 mm)	0.030 (0,762 mm)	0.037 (0,9398 mm)	0.044 (1,1176 mm)

GEAR RATIOS

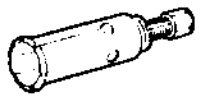
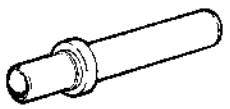
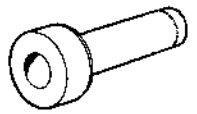
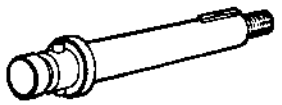
1st	2nd	3rd	4th	5th	Reverse
2,95:1	1,94:1	1,34:1	1,00:1	0,80:1	2,76:1

Oil specification	SQM2C9010A (automatic transmission fluid)	
Oil fill capacity	2,55 litres	
Oil level	0 to 5 mm under oil filler plug bore	
Grease	FORD SPECIFICATION SM-1C1021-A	- polyethylene grease for - mainshaft needle rollers/ caged roller bearing, thrust bearing and thrust washer pivot pin threads (5th/reverse gear)
	Petroleum jelly	- detent spring
Sealer	FORD SPECIFICATION SPM-2G9121-A	- selector housing cover - extension housing to transmission housing - clutch release bearing guide sleeve - gear lever cover
	Loctite 620	- countershaft bearing cup
	FORD SPECIFICATION ESK-M4G243-A	- reversing light switch

1189

* * * 	14-011	Installer
	15-008-01	Dial gauge holding fixture adaptor
	15-022-A	Dial gauge holding fixture
	15-025-A	Installer
* * * 	15-028	Installer
	15-037	Installer
	15-042	Pinion bearing installer
* * * 	15-049-01	Adaptor
	15-072	Pinion oil seal remover
	16-009	Transmission mounting bracket (only used in conjunction with 21-023)

1189

	16-011	Extension housing bush remover
	16-016	Extension housing oil seal and bush installer
* * * 	16-038	Installer
	21-023	Universal spindle (used only in conjunction with engine stand)

* * * If these tools are not available, use suitable pieces of tube and bar.

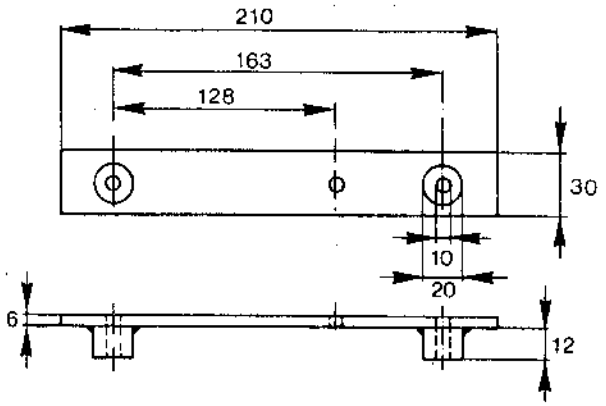
PROPRIETARY TOOLS

Metric dial gauge.
Bearing puller with extension.

LOCALLY FABRICATED TOOLS

1. Steel disc - to support mainshaft when pressing on 5th gear.
20 mm thick, 70 mm in diameter.

2. Steel tube - to press on 5th gear.
365 mm long, i.d. 30 mm, o.d. 36 mm.



COS-16-11

3. Assembly stand adaptor plate, see Fig. 1189

The SIERRA COSWORTH transmission is a five speed manual transmission with a fifth speed ratio of 1:0,80 (overdrive).

The higher 5th gear results is an engine speed which, at any given road speed, is approximately 20 % less than that required in 4th gear, thus reducing engine wear and lowering noise levels.

As with other Ford 5 speed transmissions, the fifth speed gear and synchroniser are in the extension housing located on the back of the main transmission case.

The gear lever operates a shift rod which extends from the extension housing to the selector cover.

The 1st/2nd and 3rd/4th gear selector forks are mounted in the selector cover. The fifth speed synchroniser and reverse idler gear are shifted through an intermediate lever mounted on a pivot pin. A shift interlock system located in the selector cover prevents engagement of more than one gear.

The shift detent is located in the extension housing. It consists of detent plate, selector crank and spring loaded ball. All gears, except reverse, are synchronised.

The transmission case and extension housing are aluminium castings.

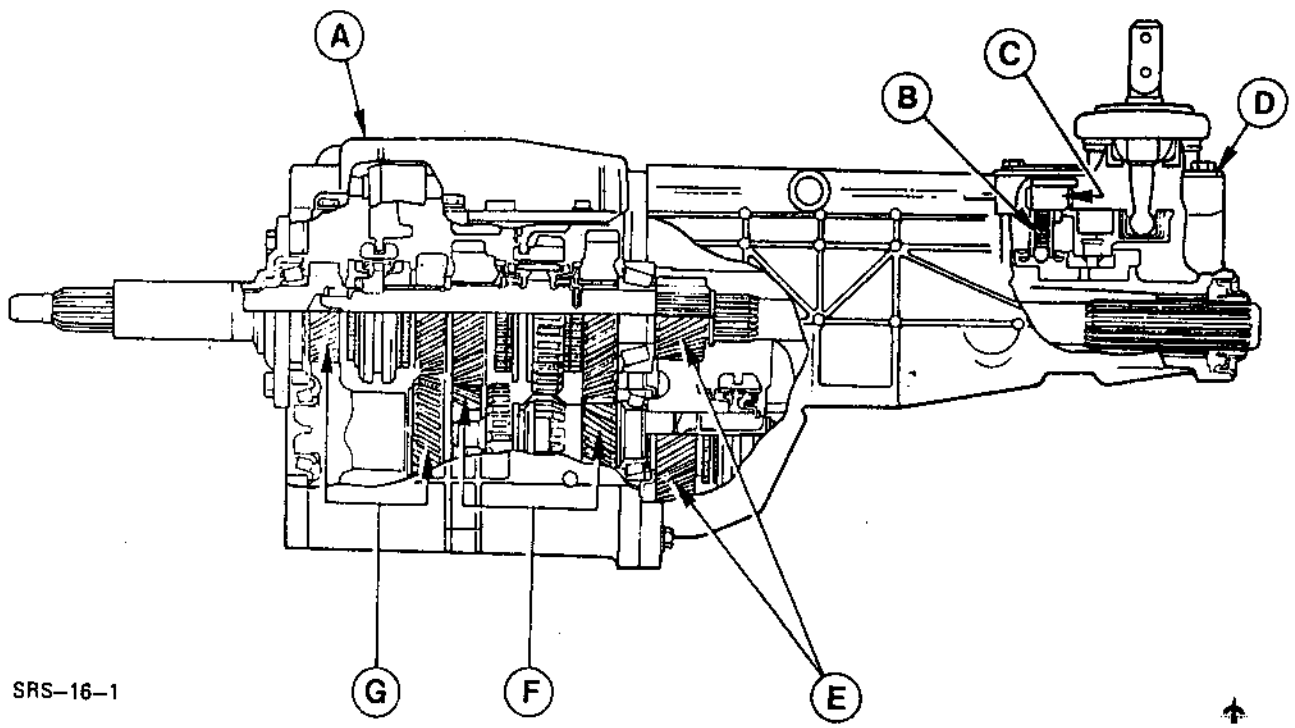
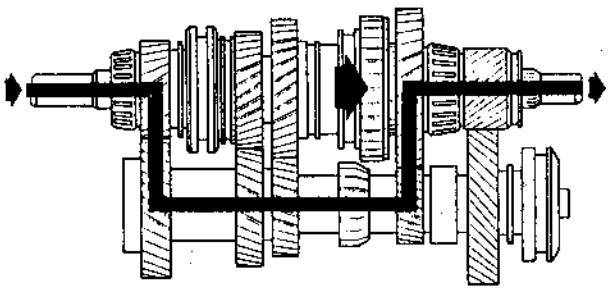


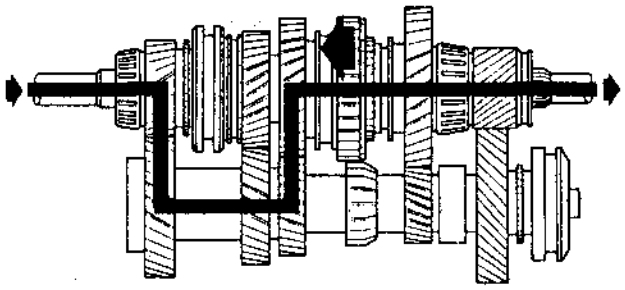
Fig.1. Sectional view of the 5-speed transmission.
- A - Selector cover with 1st/2nd and 3rd/4th selector forks and shift rod
- B - Shift detent
- C - Shift rod
- D - Gear lever cover
- E - 5th speed gears and synchroniser
- F - 1st/2nd speed gears and synchronisers (reverse gear)
- G - 3rd/4th speed gears and synchronisers

Powerflow in transmission



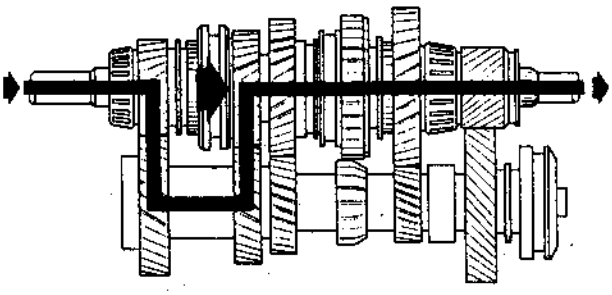
SRS–16–2

Fig.2. Powerflow 1st gear.



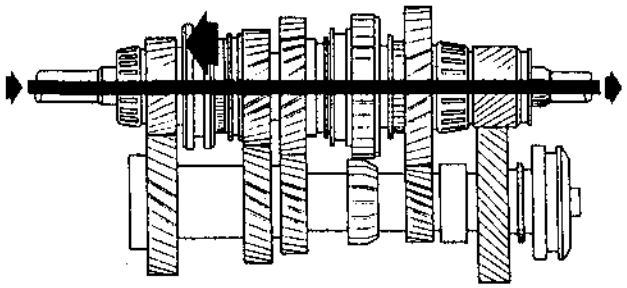
SRS–16–3

Fig.3. Powerflow 2nd gear.



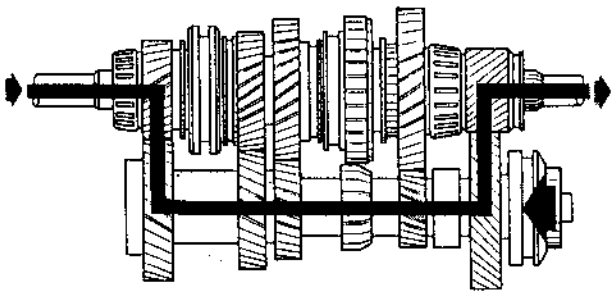
SRS–16–4

Fig.4. Powerflow 3rd gear.



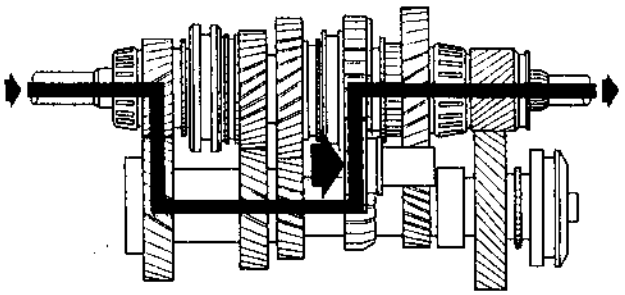
SRS–16–5

Fig.5. Powerflow 4th gear.



SRS–16–6

Fig.6. Powerflow 5th gear.



SRS–16–7

Fig.7. Powerflow reverse gear.

1189

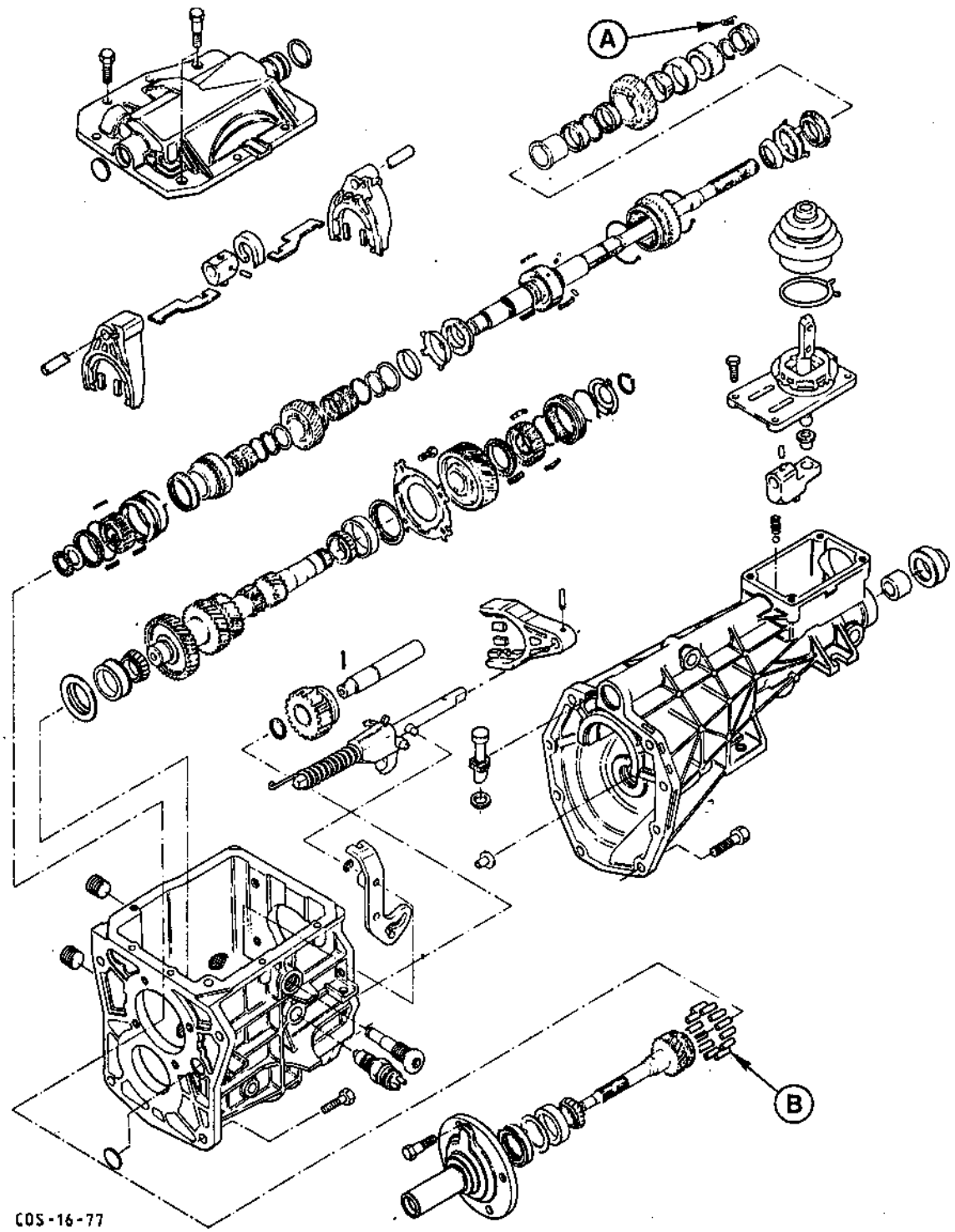


Fig.8. SIERRA COSWORTH '86 transmission - Exploded view
A - Retaining clip - speedometer worm
B - Input shaft bearing - 15 loose needle rollers

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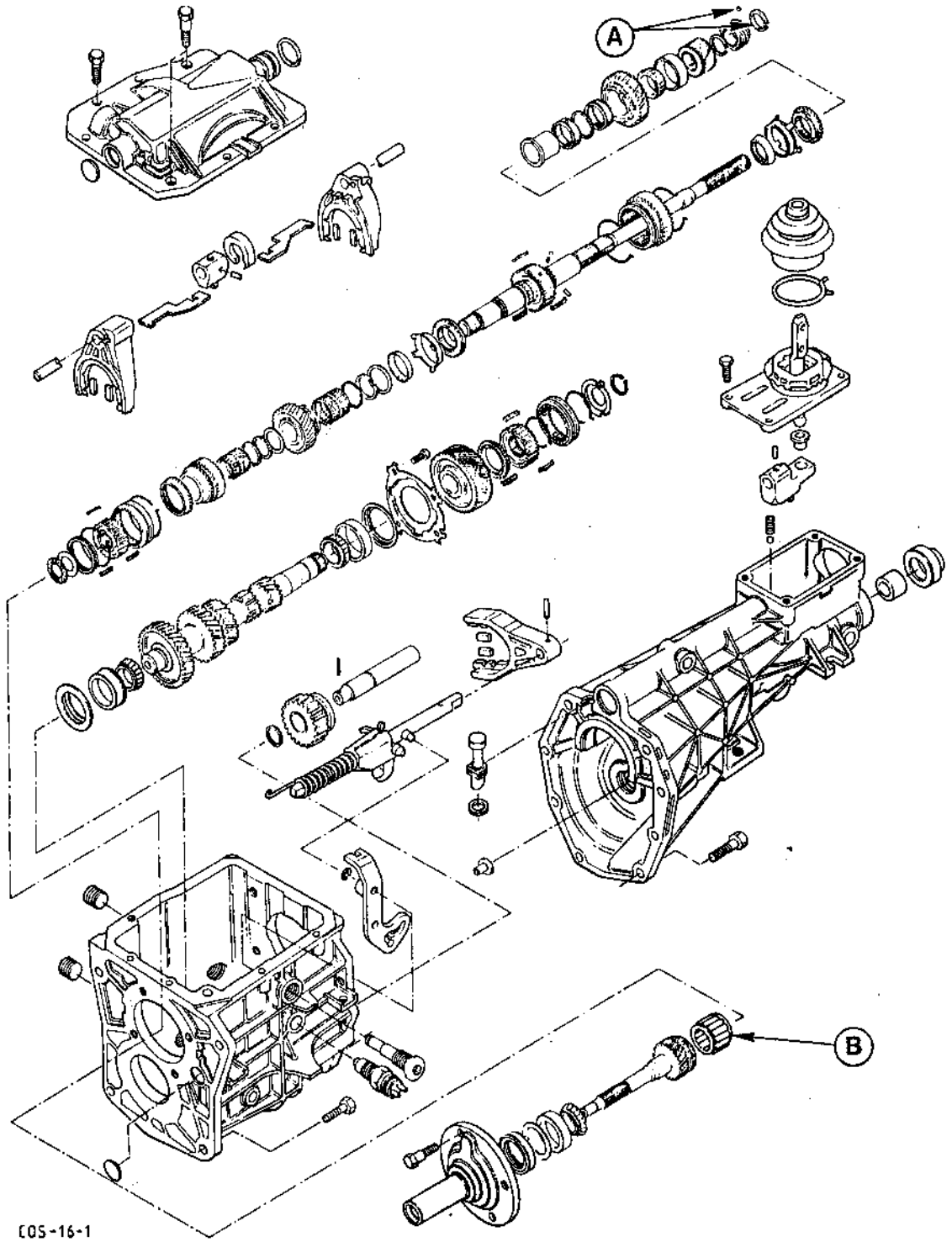


Fig.9. Changes to SIERRA COSWORTH '88 transmission.
A - Circlip and drive ball - speedometer worm
B - Input shaft bearing - caged needle roller bearing

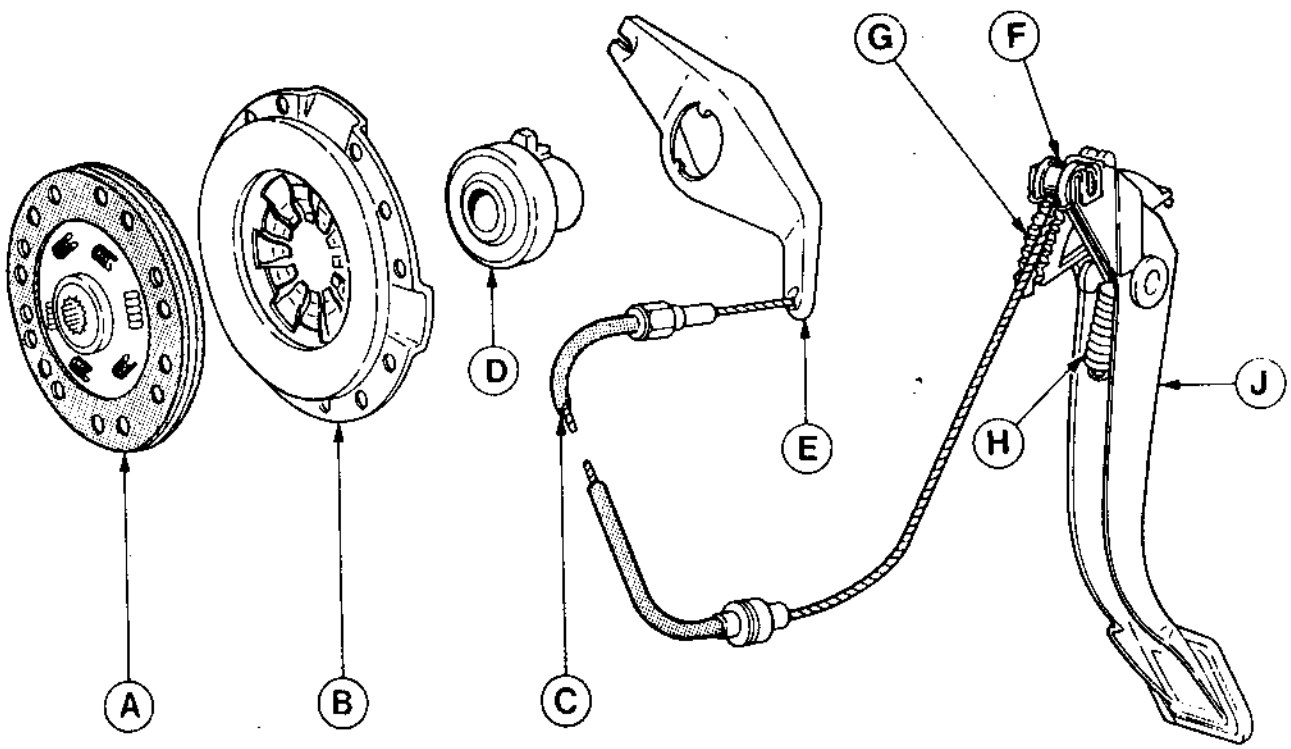
Clutch

To transmit the high power and torque output of the SIERRA COSWORTH engine, an uprated clutch has been fitted, the following component parts being unique SIERRA COSWORTH:

- Clutch pressure plate - with increased clamping pressure.
- Clutch disc - increased diameter/lining area.
- Clutch intermediate plate.

Clutch operation

The clutch operation of the SIERRA COSWORTH left-hand drive is the same as the SIERRA 2,0 ltr. but for RHD variants, a unique cable is used. All are fitted with an automatic adjusting mechanism.



SRS-16-72

Fig.9. A - Clutch disc
B - Pressure plate
C - Clutch cable
D - Thrust bearing and hub
E - Release lever
F - Pawl - automatic adjuster
G - Toothed segment - automatic adjuster
H - Toothed segment tension spring
J - Clutch pedal

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16 114 0 TRANSMISSION ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.

2. '88 Model Year only:
   Remove the turbocharger heat shield (1 bolt, 2 clips).

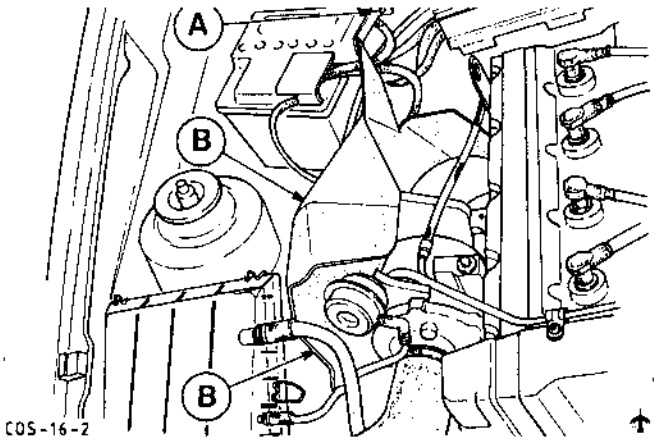


Fig.11. Turbocharger heat shield attachment - '88 Model Year.
A - Bolt B - Clips

3. Remove the exhaust pipe from the turbocharger.

   If nut locking plates are fitted, bend back the tabs, remove the three nuts and lock plates and discard them.

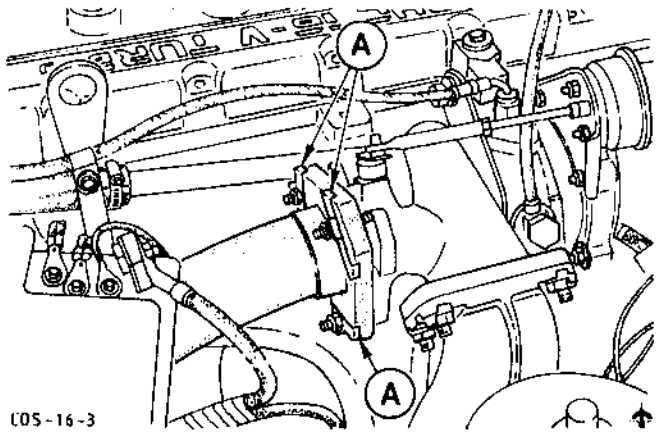


Fig.12. Exhaust pipe to turbocharger attachment
A - lock plates

4. Raise the vehicle.

5. Detach the stabiliser bar from the side members (4 bolts).

6. Remove the complete exhaust system:

   - unscrew the left hand muffler insulator bracket (2 bolts)
   - unhook the right hand and rear muffler insulators and remove the system.

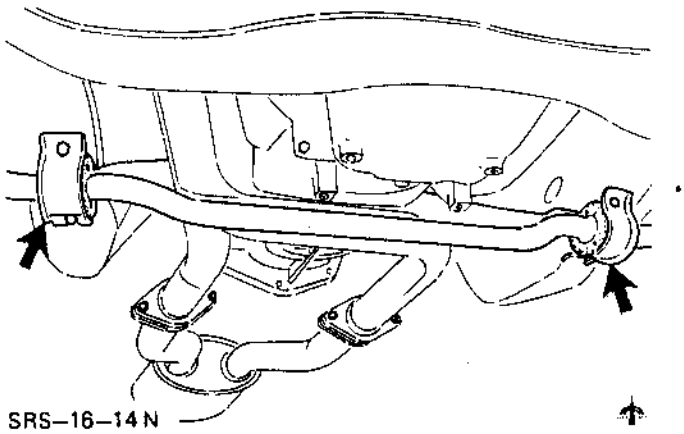


Fig.13. Stabiliser attachment to side members - '86 Model Year shown.

7. Unbolt the driveshaft from the pinion flange (4 bolts) and the driveshaft centre bearing from the floor assembly (2 bolts, 2 washers, 2 spacers).

   Remove the driveshaft.

NOTE: Plug transmission with a plastic sleeve to prevent oil loss.

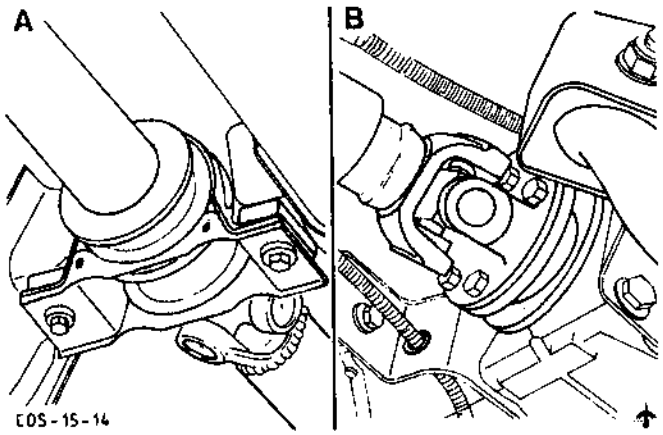


Fig.14. Driveshaft attachment -
A - At centre bearing
B - To pinion flange

8. Support the transmission with a jack.

9. '88 Model Year only:

   Detach from the transmission crossmember; the earth cable (1 bolt, 1 nut) and the speedometer drive cable support (2 nuts).

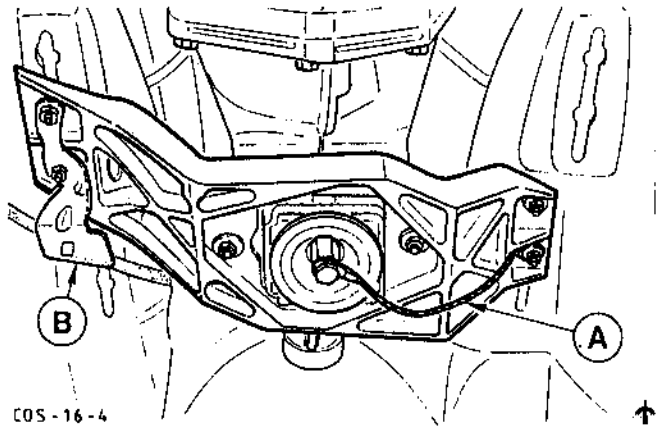


Fig.15. Transmission crossmember ('88 Model Year).
A - Earth cable
B - Speedometer drive cable support

10. Remove the transmission crossmember from the floor assembly (4 nuts, 4 washers) and from the transmission (1 bolt and insulator heat shield).

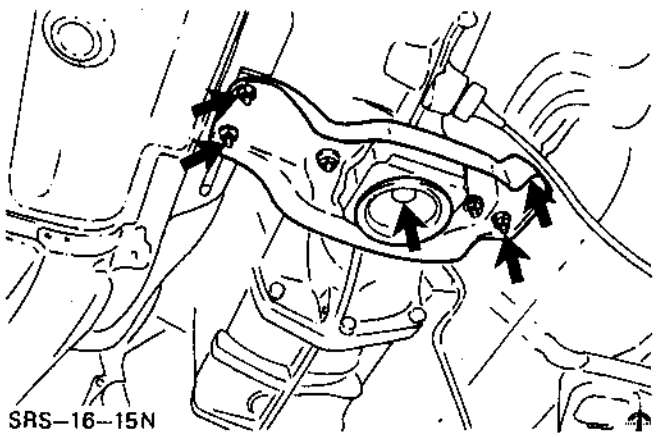


Fig.16. Remove transmission crossmember ('86 Model Year shown).

11. Remove the circlip from the speedometer drive cable and pull out the drive cable.

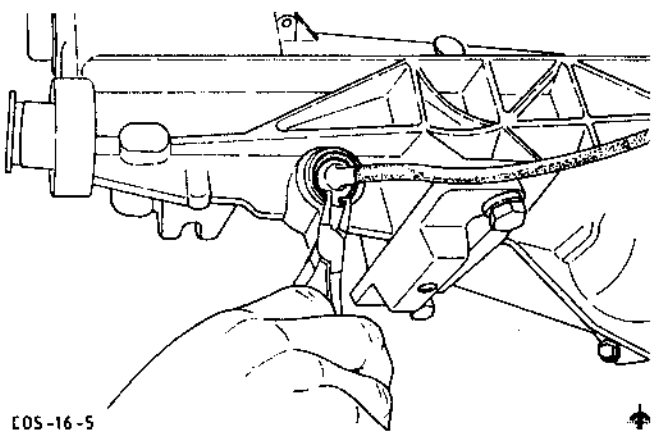


Fig.17. Remove speedometer drive cable circlip.

12. Disconnect the cable from the reversing light switch.

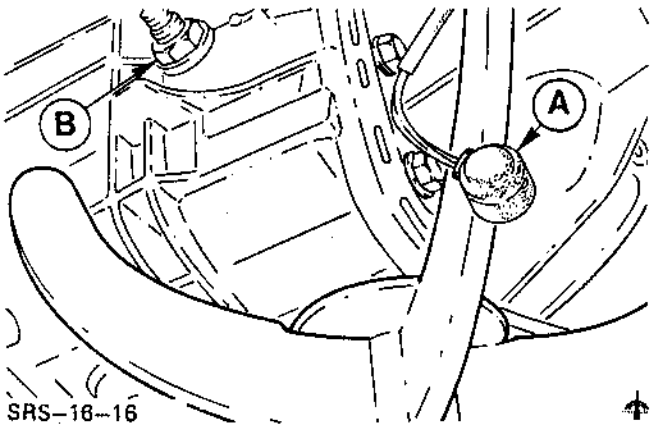


Fig.18. A - Plug
B - Reversing light switch

13. Lower the transmission and disconnect the gear lever from the transmission (2 bolts).

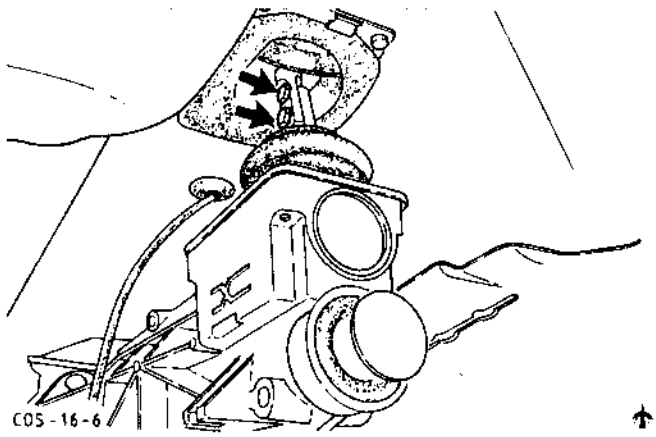


Fig.19. Gear lever connecting bolts.

14. Disconnect the starter motor wiring and remove the starter motor (3 bolts).

15. Remove the clutch cable gaiter and unhook the cable from the release lever.

NOTE: Clutch pedal must be lifted to unhook clutch cable (insert wooden block).

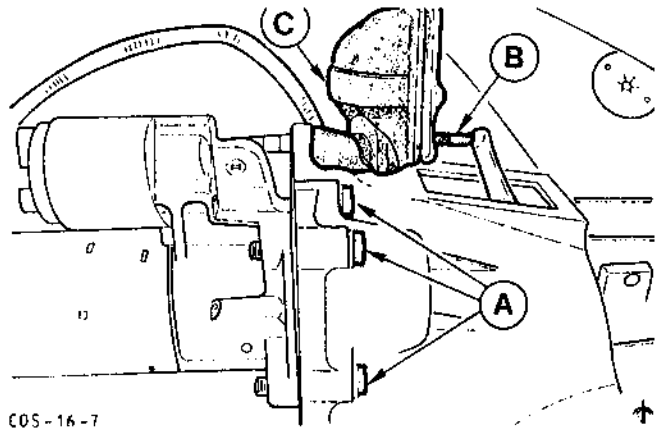


Fig.20. A - Starter motor retaining bolts
B - Clutch cable
C - Gaiter

16. Remove the bolt from the clutch housing adaptor plate.

17. Remove the four lower retaining bolts from the clutch housing/engine mounting flange together with the earth cable.

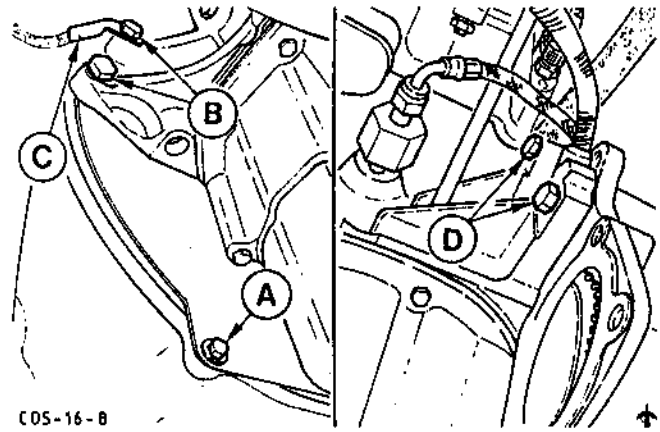


Fig.21. Lower clutch housing/engine mounting flange bolts.
A - Adaptor plate bolt
B - Lower right
C - Earth cable
D - Lower left

18. Remove the two upper retaining bolts from the clutch housing/engine mounting flange together with the battery positive cable and cable holders.

19. Remove the transmission.

20. Remove the clutch housing adaptor plate.

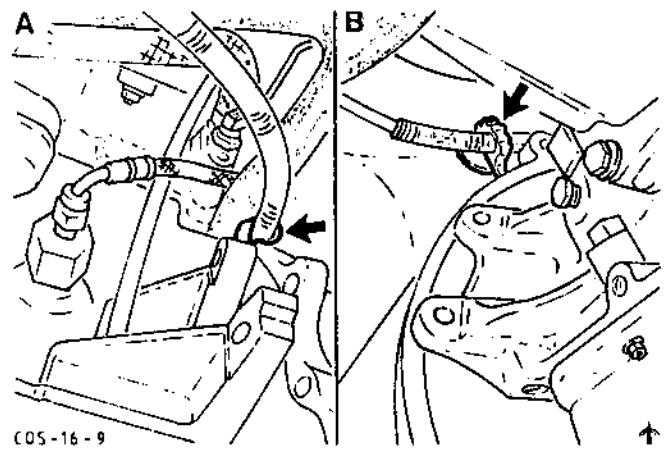


Fig.22. Two upper clutch housing/engine mounting flange retaining bolts.
A - Left hand with battery positive cable holder
B - Right hand with battery positive cable holder

To Install

During Installation, tighten nuts and bolts to the torque specified in Technical Data.

21. If necessary, transfer the clutch housing adaptor plate guide bushes from the clutch housing to the engine and centre the adaptor plate.

22. Bring the clutch release lever into the installation position and lightly grease the input shaft.

NOTE: Secure the clutch release lever with wire to prevent it moving during installation of the transmission assembly.

23. Install the transmission to the engine and support it with a jack. Fit the six retaining bolts together with the battery positive cable, cable holders and the earth cable. Tighten the bolts.

24. Fit the clutch adaptor plate bolt.

25. Attach the clutch cable to the clutch release lever. Remove the wire and fit the gaiter. Remove wood block from under clutch pedal (if used).

26. Fit the starter motor and connect the wiring.

27. Connect the gear lever to the transmission (2 bolts).

28. Fit the speedometer drive cable and connect the reversing light switch.

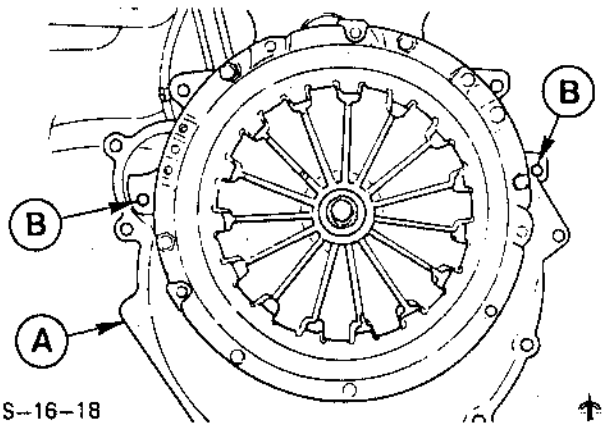


Fig.23. A - Clutch housing adaptor plate
B - Guide bushes

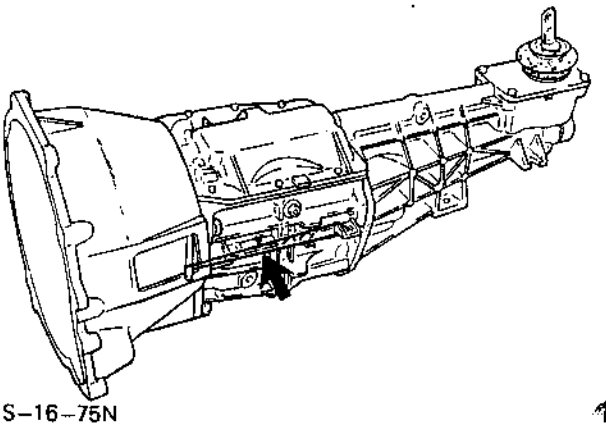


Fig.24. Secure clutch release lever with wire.

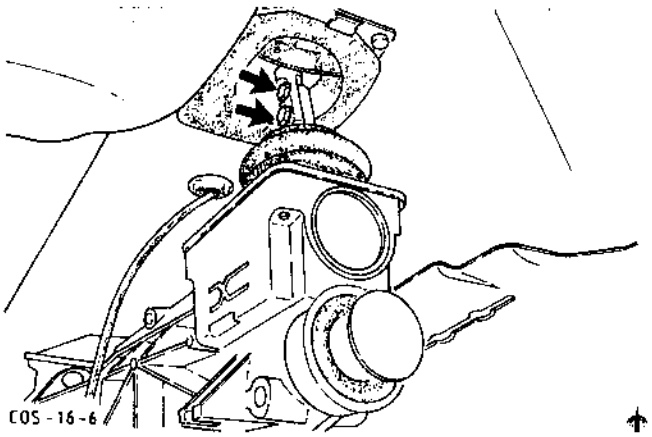


Fig.25. Gear lever connecting bolts.

29. Attach the transmission crossmember to the transmission (1 bolt and heat shield).

30. Raise the transmission assembly and attach the transmission crossmember to the floor assembly (4 bolts and washers).

31. '88 Model Year only:

    Attach the speedometer drive cable support (2 nuts) and the earth cable (1 bolt and nut) to the transmission crossmember.

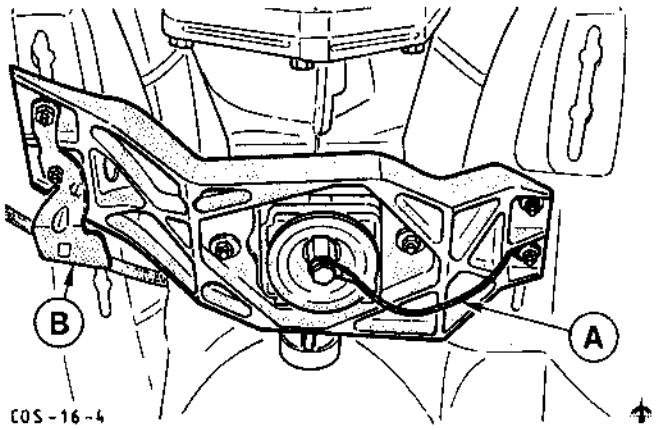


Fig.26. Install transmission crossmember ('88 MY shown). A - Earth cable B - Speedometer drive cable support

32. Install the driveshaft:

    Remove the plug from the transmission extension housing and guide the driveshaft into the extension housing.

    Loosely attach the centre bearing housing to the floor assembly with the two spacers, washers and bolts.

    Attach the driveshaft to the pinion gear flange.

    Tighten the centre bearing bolts.

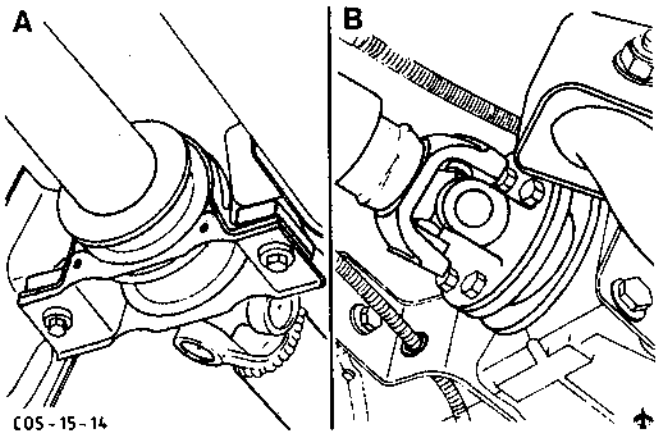


Fig.27. Driveshaft attachment - A - At centre bearing B - To pinion flange

33. Locate the exhaust system in place, hook the rear and right hand mufflers into their insulators and fit the left hand insulator bracket (2 bolts).

34. Attach the stabiliser to the side members (4 bolts).

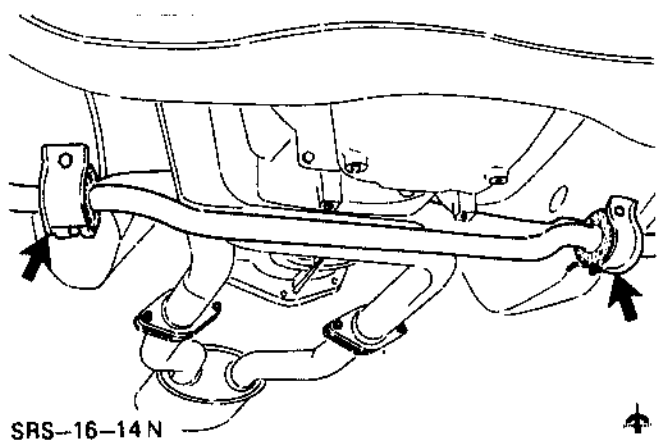


Fig.28. Attach stabiliser ('86 Model Year shown).

35. Check the transmission oil level and if necessary, top up with the specified oil (see Technical Data).

    The correct oil level is 0 to 5 mm under the lower edge of the oil filler plug bore.

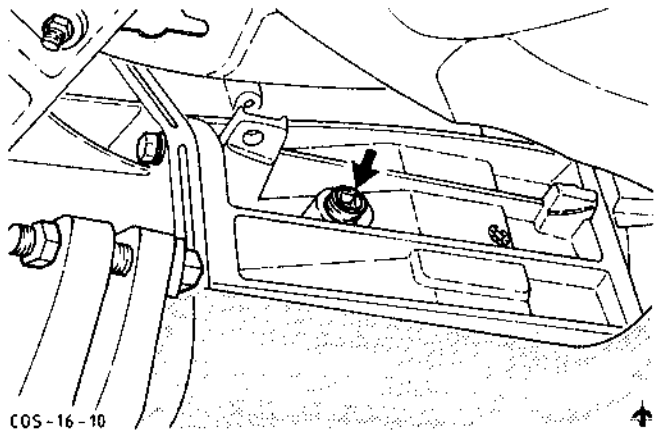


Fig.29. Oil filler plug.

36. Lower the vehicle.

37. Fit the exhaust pipe to the turbocharger using new nuts (earlier models M8, later models M10).

NOTE: Models equipped with M8 should also be fitted with new nut locking plates.

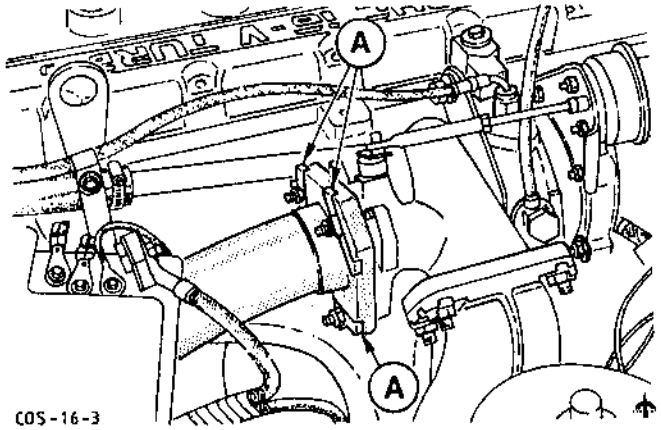


Fig.30. Exhaust pipe to turbocharger attachment
A - Lock plates

38. '88 Model Year only:

    Install the turbocharger heat shield (1 bolt, 2 clips).

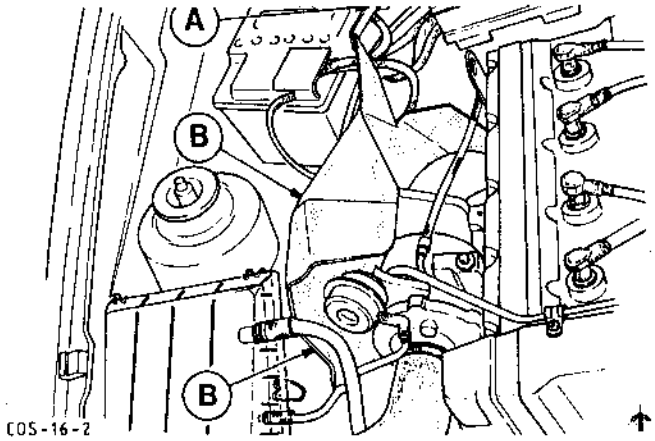


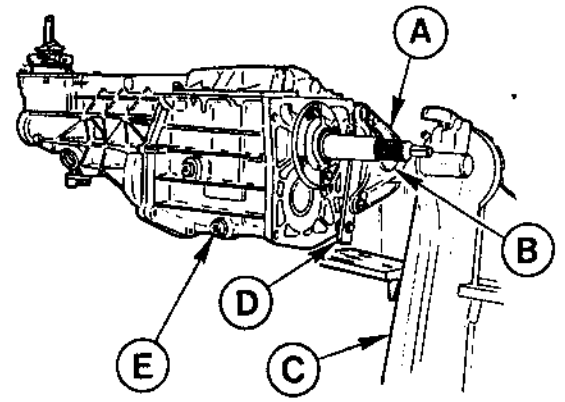
Fig.31. Turbocharger heat shield attachment '88 Model Year.
A - Bolt
B - Clips

39. Connect the battery earth cable.

16 118 8 TRANSMISSION ASSEMBLY - OVERHAUL (transmission assembly removed)

SPECIAL SERVICE TOOLS REQUIRED:

Dial gauge holding fixture adaptor	15-008-01
Dial gauge holding fixture	15-022-A
Installer	15-025-A
Installer	15-028
Installer	15-037
Pinion bearing installer	15-042
Adaptor for 15-049	15-049-01
Pinion oil seal remover	15-072
Transmission mounting bracket .. .. (only in conjunction with 21-023) ..	16-009
Extension housing bush remover ..	16-011
Extension housing oil seal and bush installer	16-016
Installer	16-038
Universal spindle (only in conjunction with engine stand)	21-023



COS-16-12

Fig.32. Transmission on assembly stand.

To Dismantle

1. Remove the clutch release bearing and lever from the clutch housing.
2. Remove the clutch housing from the transmission.
3. Mount the transmission on the assembly stand using Special Tools 16-009 and 21-023, together with an adaptor plate (locally fabricated tool, see frame 4).

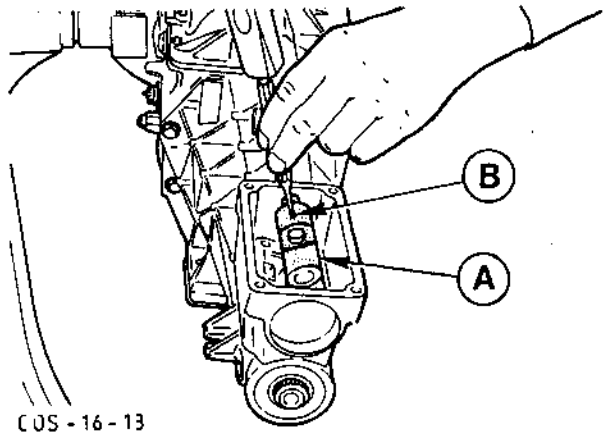
Fig.32. Transmission on assembly stand.
A - Special Tool 16-009
B - Special Tool 21-023
C - Assembly stand
D - Locally fabricated adaptor plate
E - Oil drain plug

4. Remove the drain plug (located on the lower right side of the transmission housing) and drain the oil.
5. Select neutral and remove the gear lever and the gear lever cover (4 bolts).
6. Using a pin punch and hammer, remove the roll pin attaching the selector crank to the shift rod. Remove the damper bush.

NOTE: Do not attempt to remove the selector crank while the extension housing is bolted in place. A lug, located on the bottom of selector crank, meshes with the detent plate preventing sufficient rearward movement of the selector crank to allow removal.

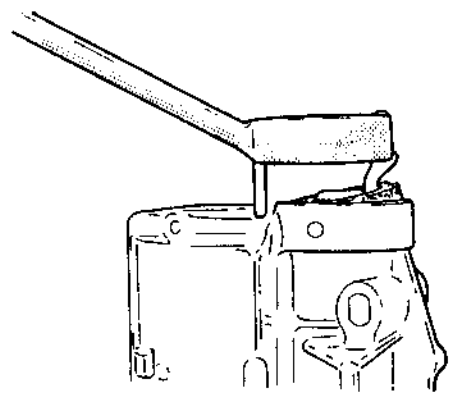
7. Remove the radial oil seal from the extension housing using Special Tool 15-072.

NOTE: Only if the oil seal is to be replaced.



COS-16-13

Fig.33. A - Selector crank
B - Roll pin



COS-16-14

Fig.34. Remove oil seal using Special Tool 15-072.

8. Remove the bush from the extension housing using Special Tool 16-011.

NOTE: Only remove the extension housing bush if it is to be replaced. The bush can only be removed with the extension housing and mainshaft in position.

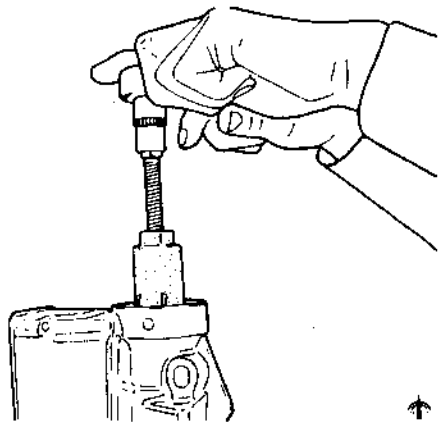


Fig.35. Remove extension housing bush using Special Tool 16-011.

9. Remove the speedometer driven gear from the extension housing (1 bolt and retaining plate). Remove the transmission crossmember mounting (2 bolts).

10. Detach the extension housing together with the selector crank from the transmission (8 bolts). Lift out the selector crank, the roll pin, the detent spring and the detent ball from the extension housing.

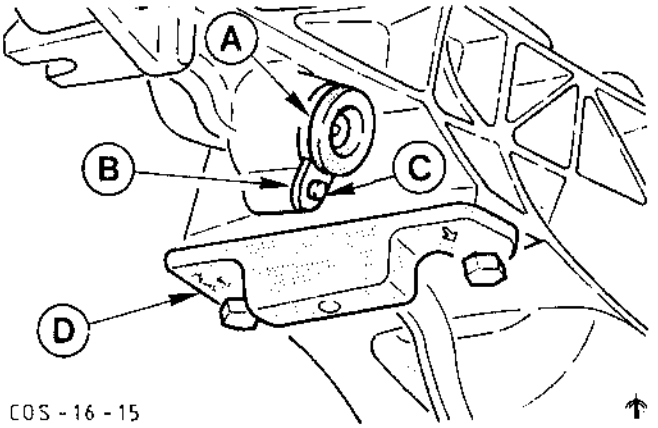


Fig.36. A - Speedometer driven gear
B - Retaining plate
C - Bolt
D - Crossmember mounting

11. Unscrew the ten retaining bolts from the selector cover. Carefully prise the cover loose with a screwdriver.

NOTE: Do not damage sealing faces.

Lift cover slightly and slide it towards the oil filler plug side of the transmission. When the shift mechanism clears the groove in the 5th/reverse gear selector fork, lift off the cover.

12. Lever out the oil funnel from the countershaft.

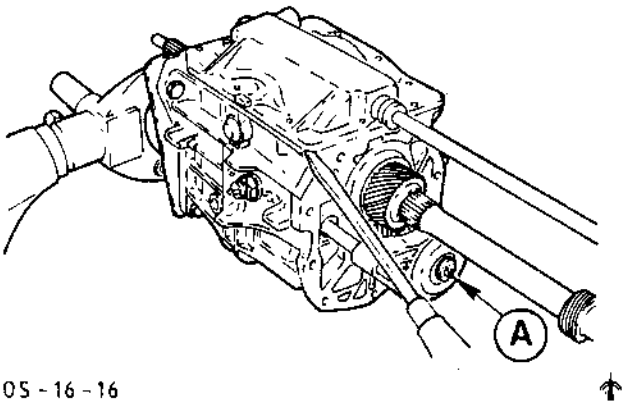


Fig.37. Carefully prise loose transmission cover.
A - Oil funnel

13. Engage 5th gear, support the 5th gear selector fork and drive out the roll pin from the selector fork.

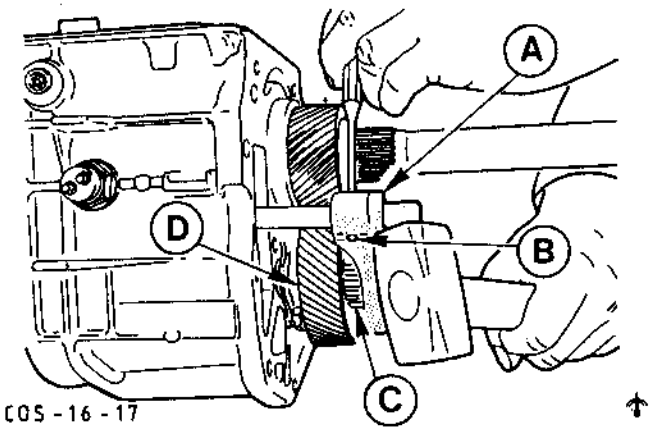


Fig.38. Drive out roll pin from 5th gear selector fork.
A - Selector fork
B - Roll pin
C - Synchroniser
D - 5th gear

Fig.38. Drive out roll pin from 5th gear selector fork.

14. Remove the 5th gear synchroniser circlip and retainer from the rear of the countershaft.

Remove the 5th gear, synchroniser and selector fork as an assembly.

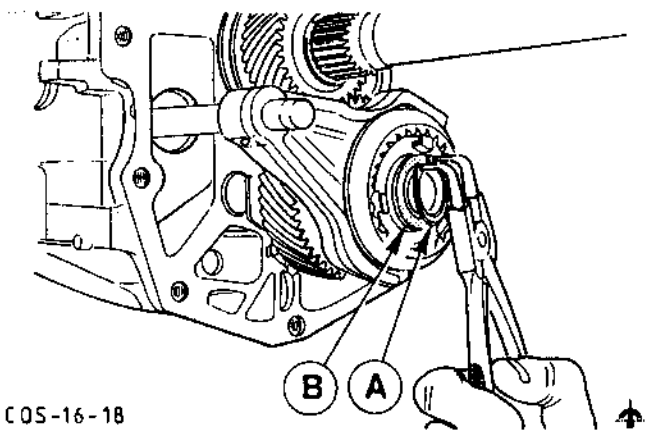


Fig.39. A - Circlip
B - Thrust washer

15. Using a hammer and suitable chisel, release the four tabs on the countershaft bearing retainer. Unscrew the four bolts and remove the countershaft bearing retainer and shim(s).

NOTE: Discard retainer.

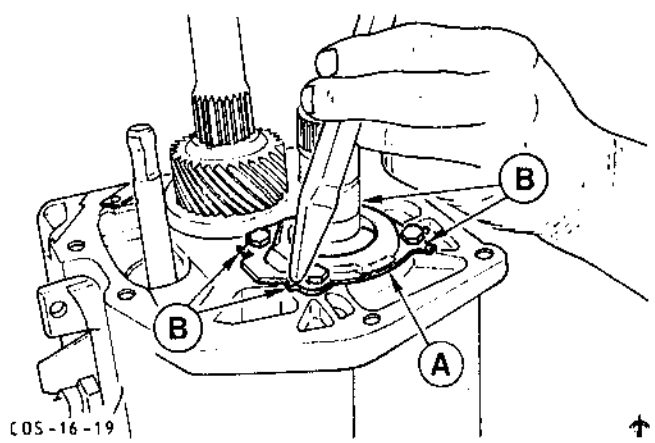


Fig.40. A - Countershaft bearing retainer
B - Tabs

16. Unhook the reverse gear return spring. Remove the 5th/reverse gear shift rod from the transmission housing by simultaneously pulling it rearwards and turning it clockwise.

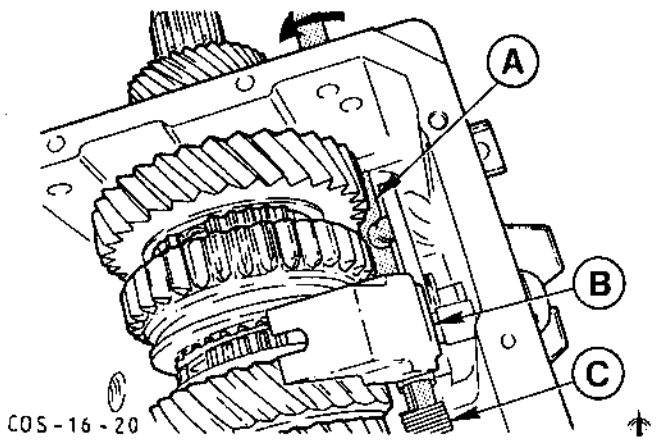


Fig.41. Remove 5th/reverse gear shift rod.
A - Shift rod B - Shift lever
C - Reverse gear return spring

17. Remove the speedometer worm from the mainshaft.

'86 Model Year only:
Press the ends of the speedometer worm retaining clip together and pull the gear and clip from the mainshaft.

'88 Model Year only:
Remove the circlip and pull off the speedometer worm and drive ball.

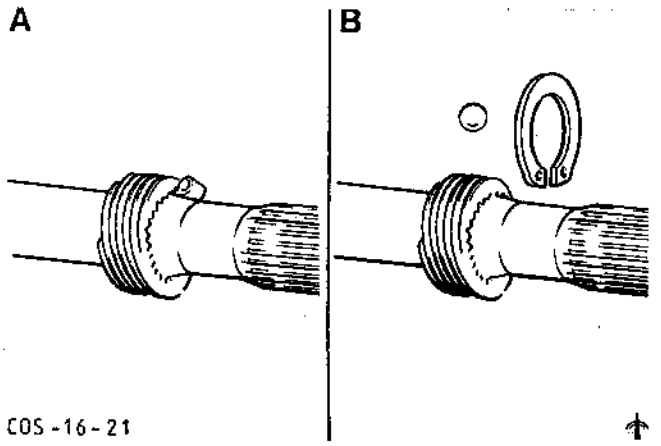


Fig.42. Speedometer worm attachment.
A - '86 MY - Clip
B - '88 MY - Circlip and drive ball

18. Remove the 5th gear cog snap ring. Remove the 5th gear cog from the mainshaft using a proprietary puller.

NOTE: The gear cog will be destroyed in the removal process. Cover the gear cog with a cloth to prevent injury from fragments.

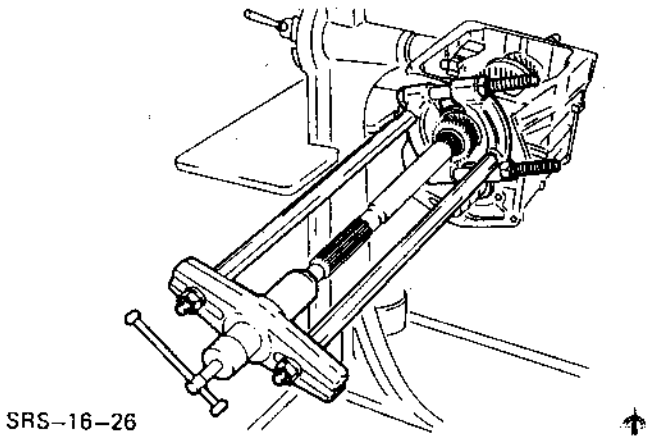


Fig.43. Remove 5th gear cog.

19. Unscrew the four bolts retaining the clutch release bearing guide sleeve. Detach the guide sleeve from the transmission housing. Remove the shim(s) and the bearing cup from the input shaft.

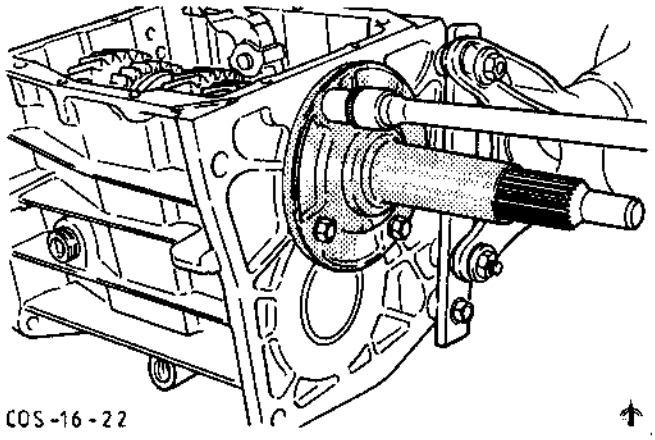


Fig.44. Remove clutch release bearing guide sleeve.

20. Rotate the input shaft until the flat on the synchroniser dogs aligns with the 1st gear cog on the countershaft.

'86 Model Year:
With the input shaft properly aligned, remove the input shaft and the 15 needle rollers from the housing.

'88 Model Year:
With the input shaft properly aligned, remove the input shaft with the caged needle roller bearing.

Remove the thrust bearing, thrust washer and 4th gear synchroniser ring.

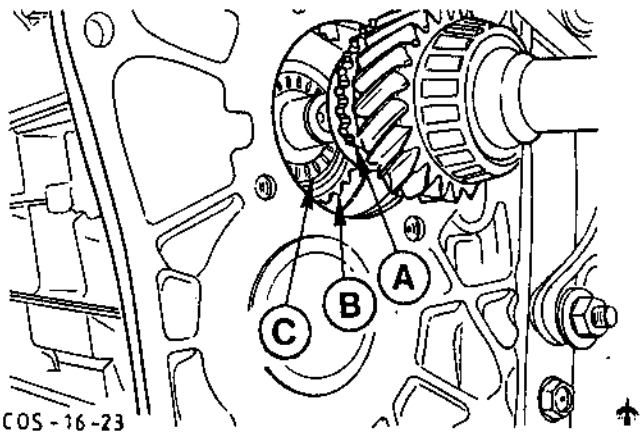


Fig.45. A - Flat on synchroniser dogs
B - 4th gear synchroniser ring
C - Thrust bearing (thrust washer behind)

21. Remove the mainshaft bearing cup from the rear of the transmission housing by pushing und pulling the mainshaft.

22. Tilt the mainshaft assembly upwards and remove it from the housing.

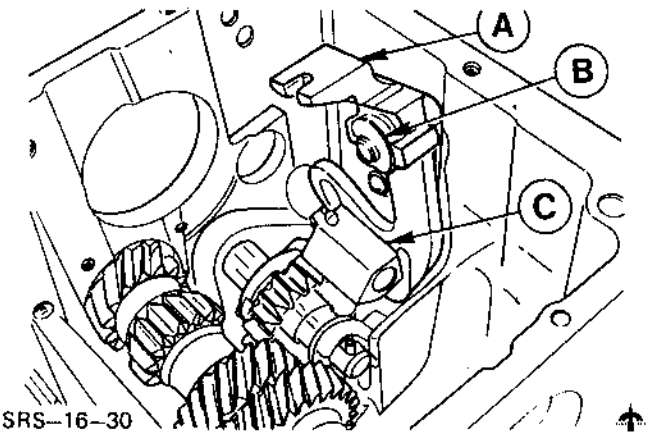


Fig.46. A - 5th/reverse gear shift lever
B - C-clip
C - Reverse gear selector fork

23. Using long needle nose pliers, remove the C-clip attaching the 5th/reverse shift lever to the pivot pin.

24. Remove the countershaft rear bearing cup from the transmission housing (move shaft backwards and forwards).

25. Using a proprietary puller, remove the taper roller bearing from the countershaft.

NOTE: Protect the shaft end with an adaptor piece.

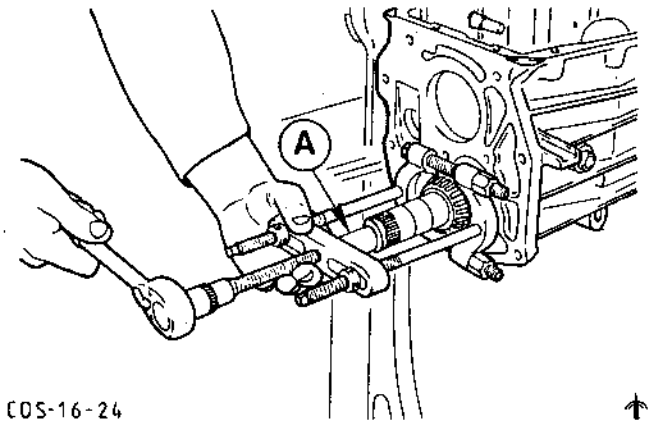


Fig.47. Remove the countershaft taper roller bearing.
A - Adaptor piece

26. Push the countershaft rearwards through the bearing bore. Tilt the shaft upwards and remove it from the housing.

27. Using a pin punch and hammer, drive the roll pin out of the reverse idler shaft.

Remove the reverse idler shaft by sliding it out through the back of the housing. Remove the reverse idler gear and the overtravel stop (O-ring) from the housing.

28. Remove the reversing light switch.

NOTE: Do not remove the magnetic disc.

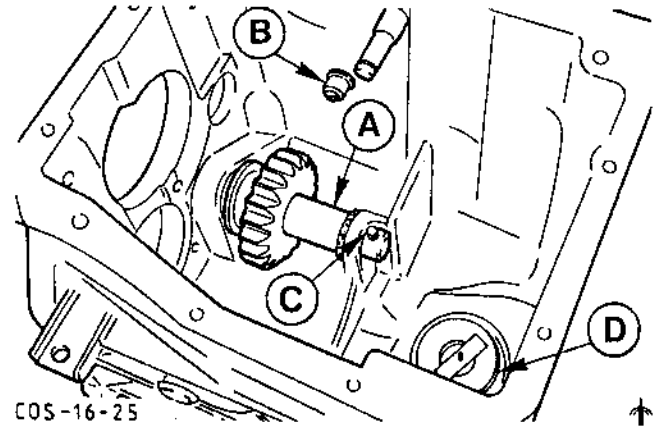


Fig.48. A - Reverse idler shaft
B - Reversing light switch
C - Roll pin D - Magnetic disc

29. NOTE: Remove the countershaft front bearing cup only if it is worn or damaged.

Remove the countershaft front bearing:

- Remove the transmission housing from the assembly stand.
- Place the transmission housing on a press, ensuring that the housing is correctly supported with Special Tools 16-038 and 15-028.
- Press out the bearing cup using Special Tool 15-049-01.

(If these special tools are not available, carefully select suitable tubing and bar.)

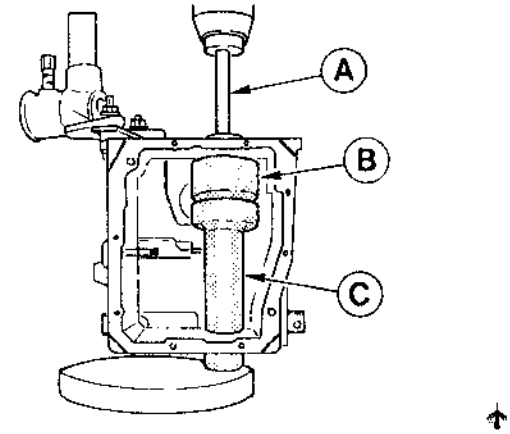


Fig.49. Press out countershaft front bearing cup.
A - Special Tool 15-049-01
B - Special Tool 15-028
C - Special Tool 16-038

Disassemble the Transmission Mainshaft

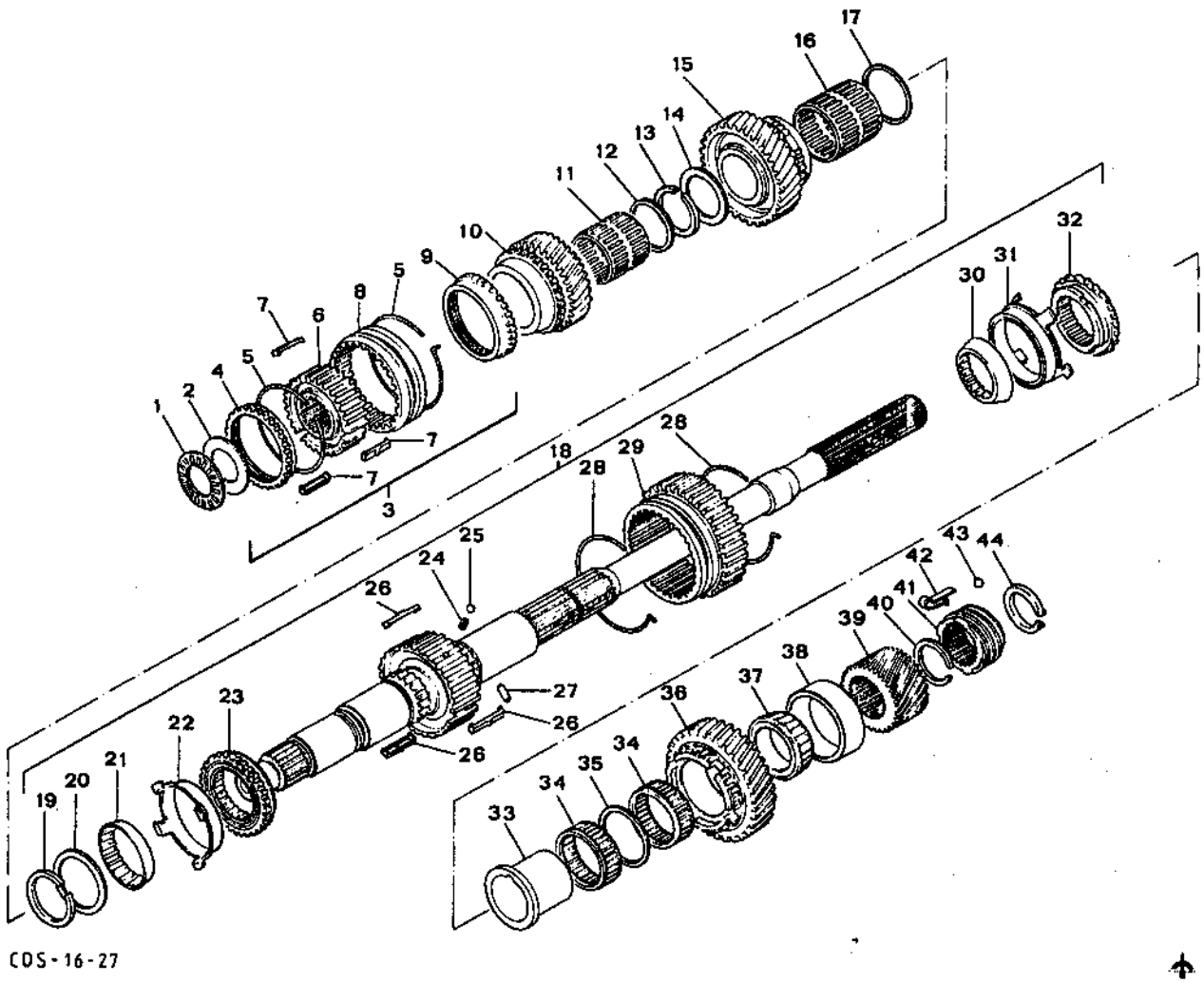


Fig.50. Transmission Mainshaft - Exploded View.

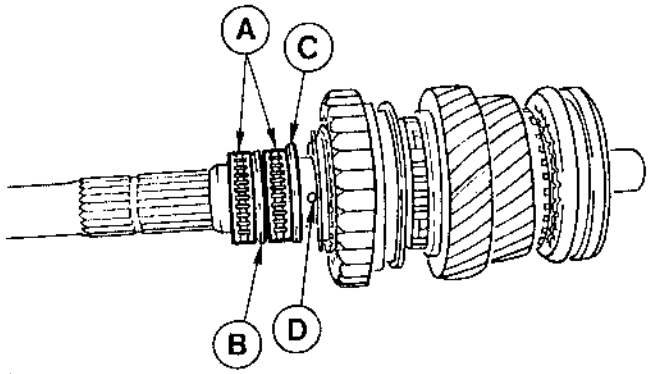
1 - Thrust bearing
2 - Thrust washer
3 - Synchroniser clutch assy. - 3rd/4th gear
4 - Synchroniser ring - 4th gear
5 - Spring clip
6 - Synchroniser hub - 3rd/4th gear
7 - Blocker bar (3 off)
8 - Selector sleeve
9 - Synchroniser ring - 3rd gear
10 - 3rd gear cog
11 - Needle bearing - 3rd gear cog
12 - Spacer
13 - Snap ring - 2nd gear cog
14 - Thrust washer
15 - 2nd gear cog
16 - Needle bearing 2nd gear cog
17 - Spacer
18 - Mainshaft Assy. (includes 1st/2nd gear synchroniser clutch)
19 - Spiral ring
20 - Thrust washer
21 - Inner cone - 2nd gear
22 - Outer cone - 2nd gear
23 - Synchroniser ring, 2nd gear
24 - Detent spring
25 - Detent ball
26 - Blocker bar (3 off)
27 - Pin, retainer
28 - Spring clip
29 - Cog - 1st/2nd selector sleeve
30 - Inner cone - 1st gear
31 - Outer cone - 1st gear
32 - Synchroniser ring, 1st gear
33 - Bearing sleeve, 1st gear
34 - Needle roller bearing
35 - Spacer
36 - 1st gear cog
37 - Taper roller bearing
38 - Bearing cup
39 - 5th gear cog
40 - Snap ring
41 - Speedometer worm
42 - Clip - '86 MY
43 - Ball, drive - '88 MY
44 - Circlip - '88 MY

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30. Remove the rear bearing from the mainshaft.

31. Remove the 1st gear cog. Remove the two needle roller bearings, spacer and bearing sleeve.

32. Using a pencil magnet, remove the retaining pin from the 1st/2nd gear synchroniser hub.



COS-16-28

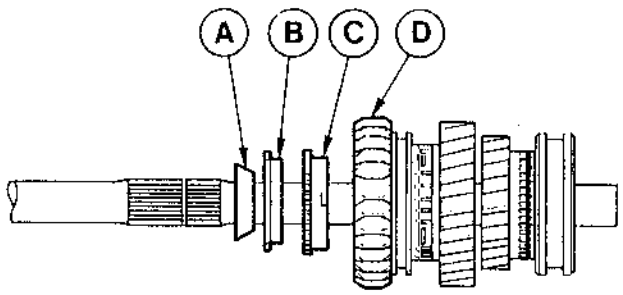
Fig.51. A - Two needle roller bearings
B - Spacer
C - Bearing sleeve D - Retaining pin

33. Remove the 1st gear synchroniser assembly: inner and outer cone rings and synchroniser ring.

34. Mark the relative position of the 1st/2nd gear selector sleeve to the hub.

Wrap a cloth around the 1st/2nd selector sleeve (to catch the detent ball and spring and the blocker bars) and remove it from the mainshaft.

NOTE: The synchroniser hub and mainshaft form a unit. Do not attempt to remove the hub.



COS-16-29

Fig.52. Synchroniser clutch assembly - 1st/2nd gear
A - Inner cone
B - Outer cone
C - Synchroniser ring
D - 1st/2nd gear selector sleeve

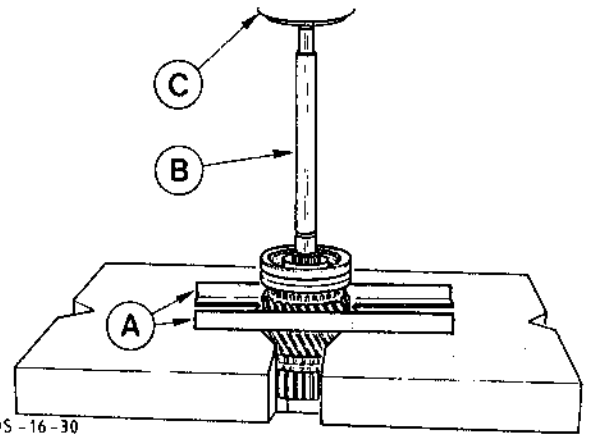
Fig.52. Synchroniser clutch assembly - 1st/2nd gear

35. Press off the 3rd/4th gear synchroniser clutch assembly from the mainshaft together with the hub and the 3rd gear cog.

Use two pieces of angle as a support (25 x 25 x 4 by approx. 300 mm long).

Use Special Tool 14-011 as a press tool (if not available use round bar, 20 mm in diameter and 200 mm long).

NOTE: Catch hold of the mainshaft under the press.



COS-16-30

Fig.53. Press off 3rd/4th gear synchroniser clutch assembly together with 3rd gear cog.
A - Two lengths of angle
B - Special Tool 14-011
C - Press

Fig.53. Press off 3rd/4th gear synchroniser clutch assembly together with 3rd gear cog.

36. Remove the 3rd gear - synchroniser ring, cog, needle roller bearing and spacer.

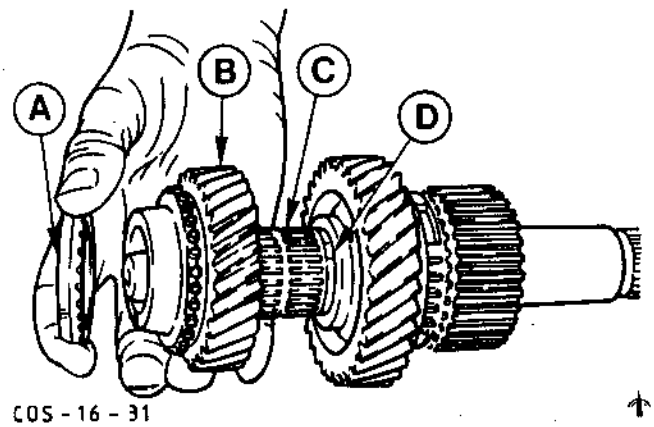


Fig.54. Remove 3rd gear cog.
A - Synchroniser ring
B - 3rd gear cog
C - Needle roller bearing
D - Spacer

Fig.54. Remove 3rd gear cog.

37. Remove the 2nd gear cog from the mainshaft:

Remove the snap ring and thrust washer. Remove the 2nd gear cog, needle roller bearing and spacer.

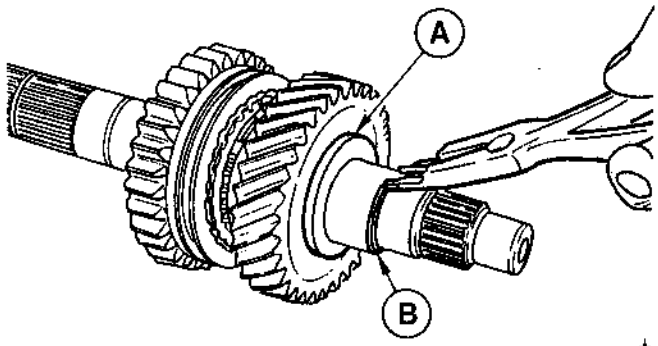


Fig.55. Remove 2nd gear snap ring
A - Thrust washer
B - Snap ring

38. Remove the 2nd gear synchroniser:

Using a small screwdriver, disengage and remove the spiral ring from the slot in the mainshaft. Remove the thrust washer, inner and outer cones and the synchroniser ring.

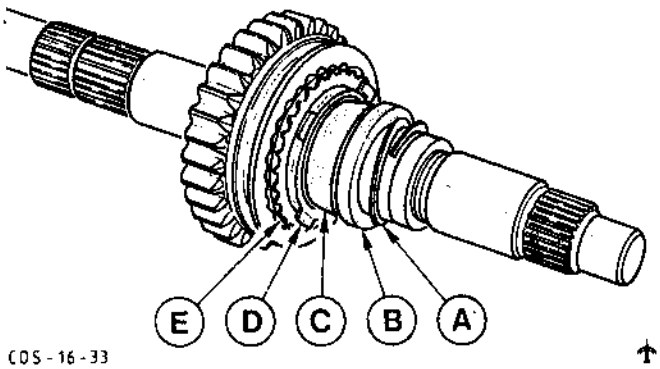


Fig.56. 2nd gear synchroniser.
A - Spiral ring
B - Thrust washer
C - Inner cone
D - Outer cone
E - Synchroniser ring

Fig.56. 2nd gear synchroniser.

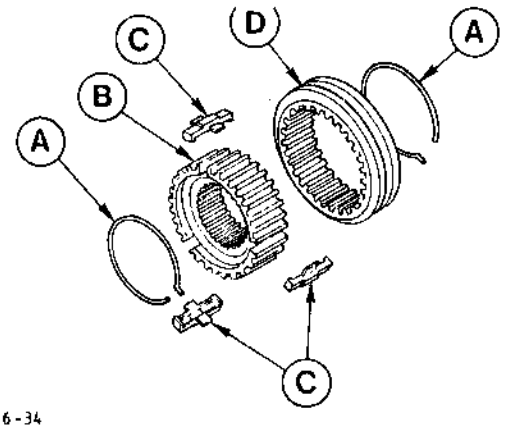
Disassemble the 3rd/4th Gear and 5th Gear Synchroniser Clutches

39. Mark the relative positions of hub and selector sleeve to assist reassembly.

Remove the spring clips with a screwdriver.

Remove the selector sleeve cog from the hub.

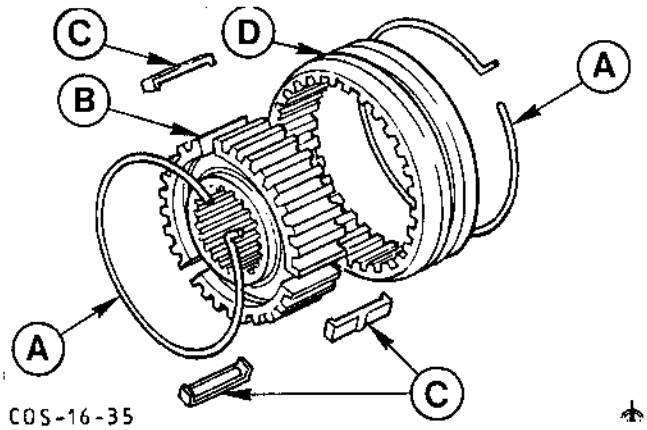
Remove the blocker bars.



COS-16-34

Fig.57. 3rd/4th gear synchroniser clutch.
A - Spring clips
B - Hub
C - Blocker bar (with lugs)
D - Selector sleeve

Fig.57. 3rd/4th gear synchroniser clutch.



COS-16-35

Fig.58. 5th gear synchroniser clutch.
A - Spring clips
B - Hub
C - Blocker bar (without lugs)
D - Selector sleeve

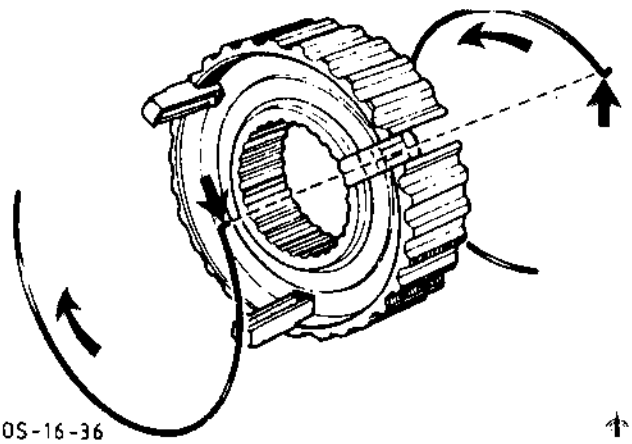
Fig.58. 5th gear synchroniser clutch.

Assemble the 3rd/4th and 5th gear synchroniser clutches

40. Insert the blocker bars.

Fit the selector sleeve onto the hub.

Install the spring clips; the clips engage on the same blocker bar but face opposite directions.



COS-16-36

Fig.59. Fit spring clips facing opposite directions.

Assemble the Transmission Mainshaft

41. Install the detent ball, spring and blocker bars to the 1st/2nd gear synchroniser hub.

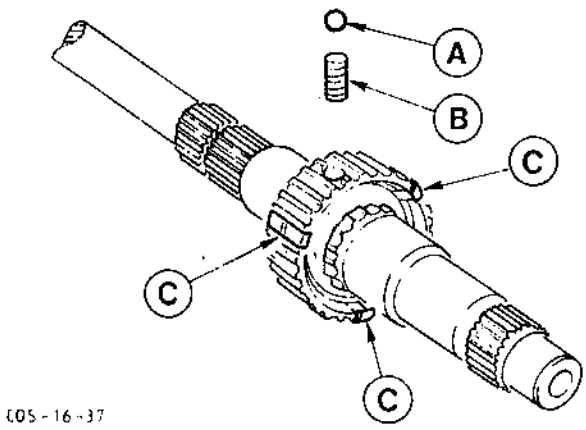


Fig.60. A - Detent ball
B - Spring
C - Blocker bar

42. Fit the 1st/2nd gear selector sleeve:

Align the markings on the sleeve and hub and with the selector fork groove facing forwards, slide on the 1st/2nd gear selector sleeve. Install the spring clips; the clips engage on the same blocker bar but face opposite directions.

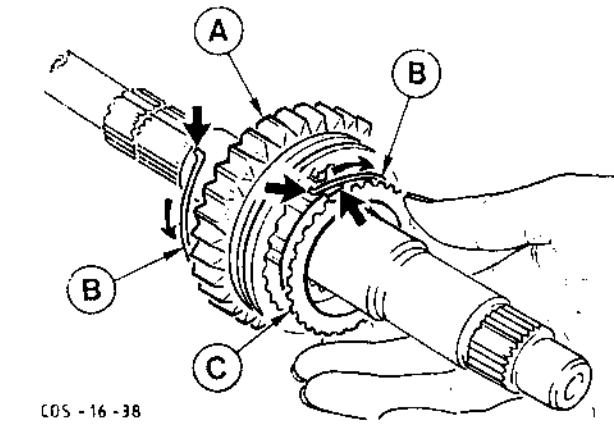


Fig.61. A - 1st/2nd gear selector sleeve
B - Spring clips
C - 2nd gear synchroniser ring

43. Fit the 2nd gear synchroniser ring, outer and inner cones and the thrust washer. Secure with the spiral ring.

NOTE: Check that the spiral ring is correctly seated in the mainshaft groove.

44. Install the 2nd gear thrust washer and needle roller bearing into the 2nd gear cog. Align the cog slots to the tabs on the outer synchroniser cone and push the cog on. Fit the thrust washer and secure with the snap ring.

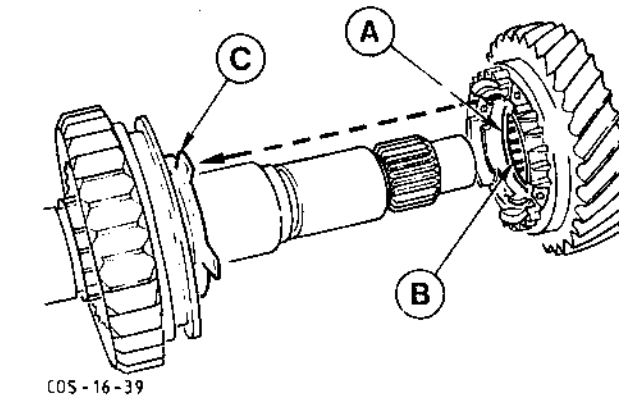


Fig.62. Install 2nd gear cog.
A - Spacer
B - Needle roller bearing
C - Synchroniser outer cone

45. Install the 1st gear inner and outer synchroniser cones and the synchroniser ring. Fit the retaining pin.

46. Fit the two needle roller bearings (separated by the spacer) onto the bearing sleeve.

Align the bearing sleeve with the retaining pin and push the sleeve onto the mainshaft.

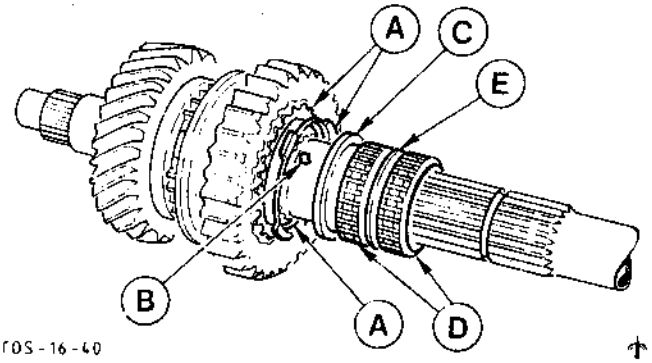


Fig.63. 1st gear synchroniser and bearings.
A - Synchroniser
B - Retaining pin
C - Bearing sleeve
D - Two piece needle roller bearing
E - Spacer

Fig.63. 1st gear synchroniser and bearings.

47. Align slots on the 1st gear cog with the tabs on the outer synchroniser cone and fit the cog.

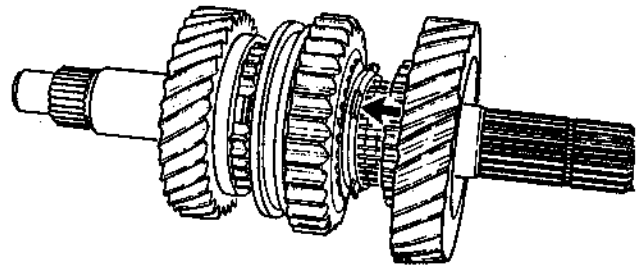


Fig.64. Align 1st gear slots with outer cone tabs.

48. Insert the spacer and needle roller bearing into the 3rd gear cog and fit the cog.

Fit the 3rd gear synchroniser ring.

49. Press the 3rd/4th gear synchroniser clutch assembly onto the mainshaft using Special Tool 15-042.

NOTE: The peripheral groove should face rearwards.

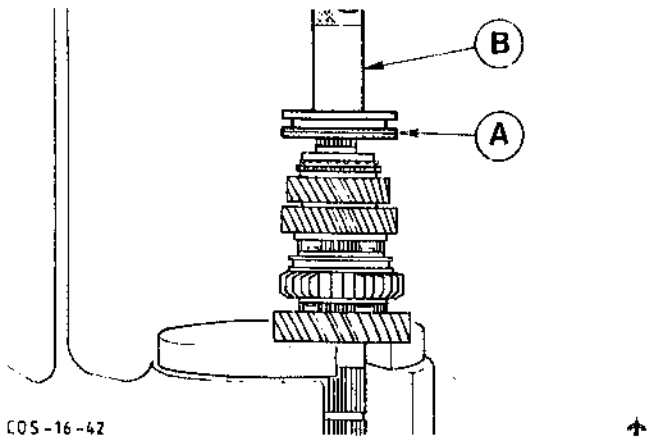


Fig.65. Press on the 3rd/4th gear synchroniser clutch assembly.
A - Peripheral groove
B - Special Tool 15-042

Replace Input Shaft Bearing

50. Remove the input shaft bearing using a proprietary puller.

51. Press the new bearing onto the input shaft using Special Tool 15-042.

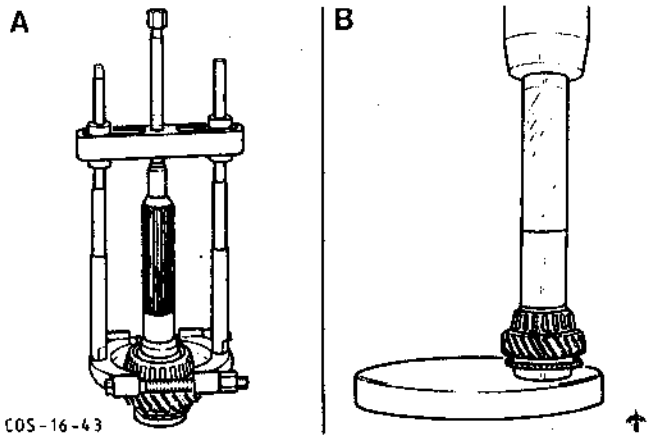


Fig.66. A - Remove input shaft bearing
B - Press on new bearing using Special Tool 15-042

Replace Countershaft Front Bearing

52. Remove the countershaft front bearing using a proprietary puller.

53. Press the new front bearing onto the countershaft using Special Tool 15-042.

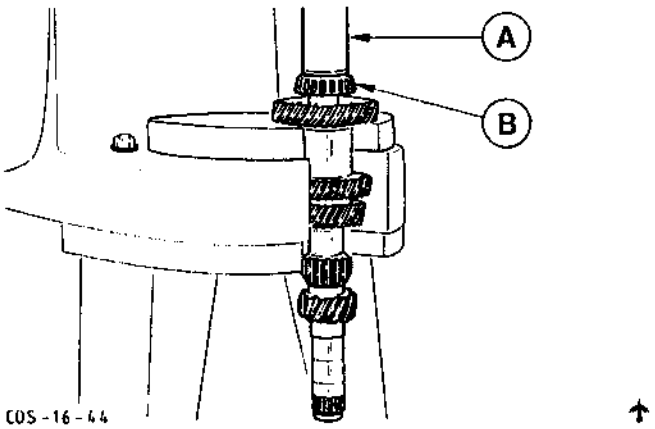


Fig.67. Press on the countershaft new front bearing.
A - Special Tool 15-042 B - Bearing

Replace the Radial Oil Seal on the Clutch Release Bearing Guide Sleeve

54. Remove the radial oil seal from the clutch release bearing guide sleeve.

55. Press the new radial oil seal into the clutch release bearing guide sleeve using Special Tool 15-025-A.

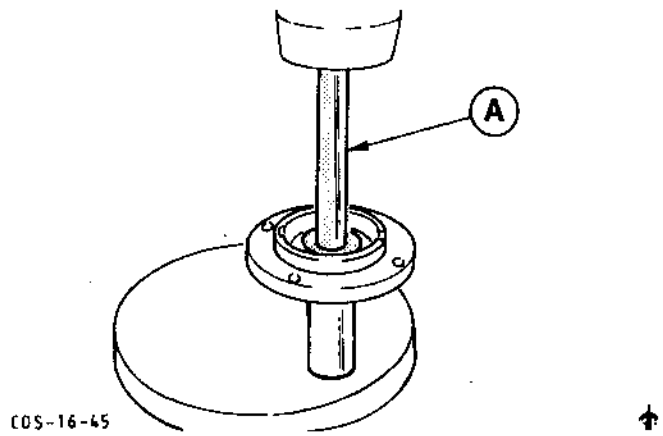


Fig.68. Press the new radial oil into the guide sleeve.
A - Special Tool 15-025-A

Disassemble the Selector Cover

56. Mark the selector forks to assist correct reassembly.

    Position the selector arm plates and selector arm in the neutral position. The gear selector arm plates should now be centred over the control selector arm.

57. Rotate the shift rod anti-clockwise. When the selector arm disengages from the selector arm plate, pull shift rod rearwards. The selector arm roll pin will now be accessible.

    Remove the selector arm roll pin with a pin punch and remove the shift rod (using a twisting motion) from the selector cover.

58. Remove the selector forks, roll pin and selector interlock from the cover.

59. Replace the nylon inserts in the selector forks.

60. Replace the cover O-ring.

Assemble the Selector Cover

61. Assemble the control selector arm and interlock plate (if disassembled).

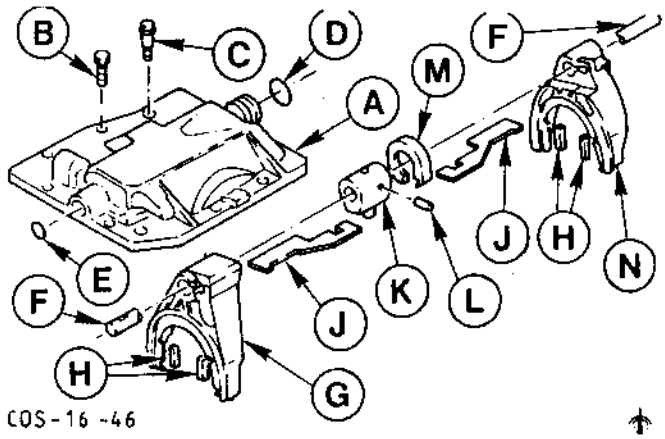
62. Install the control selector arm and interlock plate.

NOTE: The narrow side of the C-shaped selector interlock plate must be positioned in the selector cover slot. The control selector arm roll pin hole must be towards the rear of the cover.

63. Position the selector forks in the cover. Lubricate the shift rod with petroleum jelly. Slide the shift rod through the cover and the selector components until it stops against the front of the cover and the roll pin bores align.

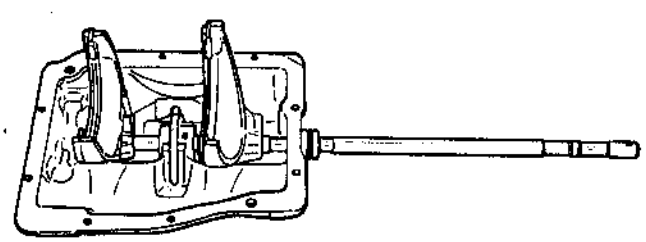
64. Ensure the flat on the shift rod is facing upwards and install the control selector roll pin using a pin punch.

NOTE: Ensure that the roll pin is installed slightly below the selector arm surface.



COS-16-46

Fig.69. Selector cover disassembled.
- A - Selector cover
- B - Hex. head bolt (8 off)
- C - Close tolerance bolt (2 off)
- D - O-ring
- E - Plug
- F - Shift rod
- G - Selector fork, 3rd/4th gear
- H - Nylon inserts, selector fork
- J - Selector plates
- K - Selector arm
- L - Roll pin
- M - Interlock plate
- N - Selector fork, 1st/2nd gear



SRS-16-60

Fig.70. Selector cover assembled.

Assemble the Transmission

During assembly, tighten nuts and bolts to the torque specified in Technical Data.

65. Press the countershaft bearing cup into the transmision housing:

Fit a new O-ring to the bearing cup and coat the outer diameter with sealing compound (see Technical Data). Press in the bearing cup using Special Tools 16-038 and 15-028 until it is flush with the housing.

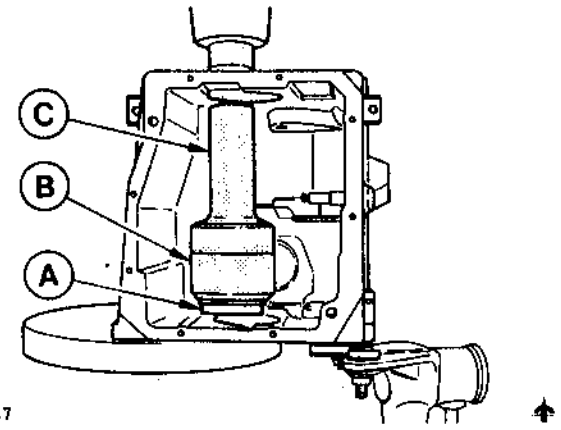


Fig.71. Press in the countershaft bearing cup.
A - Bearing Cup B - Special Tool 15-028
C - Special Tool 16-038

66. Attach the transmission housing to the assembly stand.

67. Apply sealing compound (see Technical Data) to the reversing light switch and install it.

68. Install the reverse idler gear:

Insert the reverse idler shaft from the rear of the housing. Place the reverse idler gear in the housing (shift lever groove facing rear of housing), fit the O-ring between the gear and the shaft and push the shaft completely in. Fit the roll pin.

NOTE: Drive in the roll pin to half of its length only.

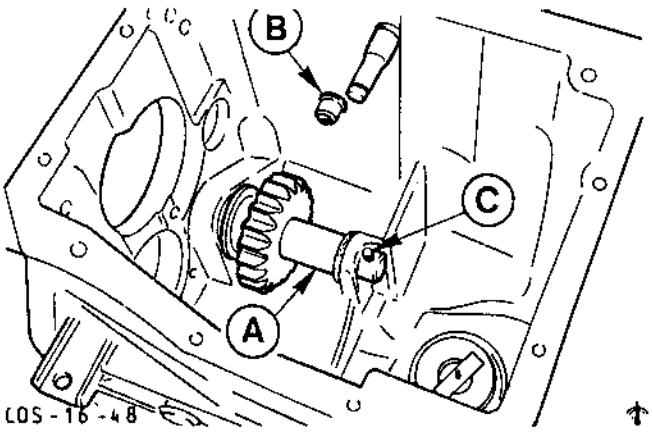


Fig.72. A - Reverse idler shaft
B - Reversing light switch
C - Roll pin

69. Position the countershaft assembly in the transmission housing. Remove the transmission housing from the assembly stand.

70. Press in the countershaft rear bearing using Special Tool 15-042.

NOTE: To prevent damage to the transmission housing, support the countershaft with two pieces of flat steel (20 mm wide by 6 to 8 mm thick).

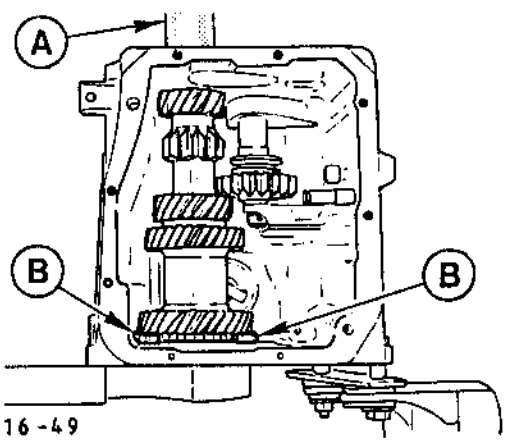


Fig.73. Press in countershaft rear bearing.
A - Special Tool 15-042
B - Flat steel

71. Fit the countershaft rear bearing cup in the housing.

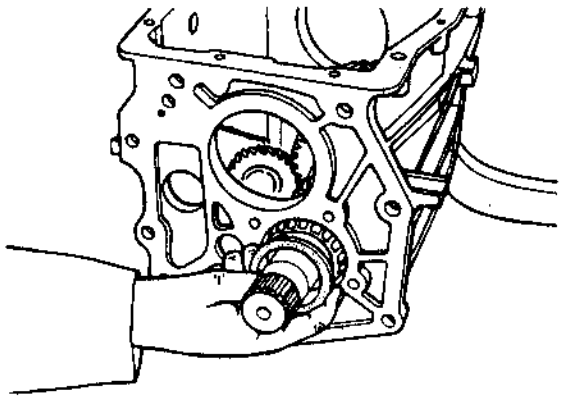


Fig.74. Fit countershaft rear bearing cup.

Measure the Countershaft Axial Clearance and Determine Required Shims

72. Install a new countershaft bearing retainer (without shims) and tighten the four bolts to specification.

73. Place the transmission housing in the vertical position, with the rear end of the countershaft on top.

Fix a dial gauge to the housing using the fixture, Special Tool 15-022-A and adjust the stylus to the end of the countershaft.

74. Raise the countershaft using a screwdriver and note the reading on the dial gauge.

Select suitable shims (see Parts Microfilm) to obtain the correct axial clearance (see Technical Data).

75. Remove the bearing retainer and install the determined shim(s) between the bearing retainer and the bearing cup. Fit the bearing retainer and tighten bolts to specification.

76. Check the countershaft axial clearance and correct if necessary.

77. Remove the dial gauge and holding fixture. Secure the bearing retainer bolts by bending the tabs on the bearing retainer.

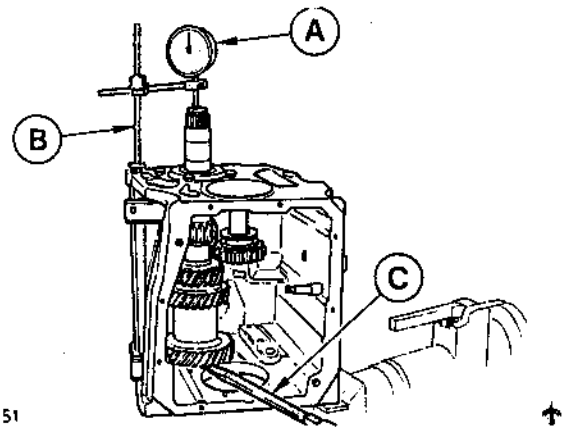


Fig.75. Measure countershaft axial clearance.
A - Dial gauge
B - Special Tool 15-022-A
C - Screwdriver

78. Insert the reverse gear selector fork in the housing.

79. Install the 5th/reverse gear shift rod into the housing and slide it through the reverse gear selector fork.

80. Position the lever return spring in the housing (long end of spring faces rear of housing) and slide the shift rod through the spring. Hook the spring into the reverse gear selector fork and housing.

81. Install the mainshaft assembly in the housing, taking care not to displace the 1st gear cog.

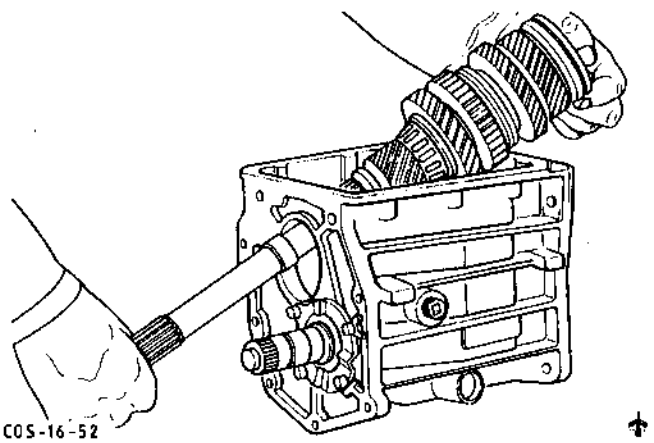


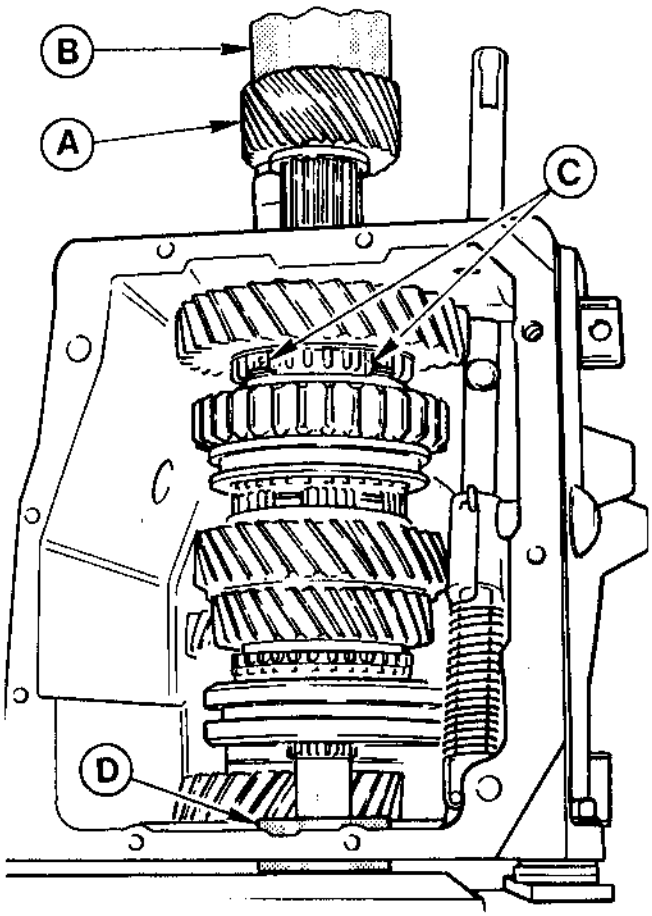
Fig.76. Install mainshaft assembly.

82. Fit the rear bearing to the mainshaft and the bearing cup in the housing.

83. Remove the transmission from the assembly stand.

84. Press a new 5th gear cog onto the mainshaft:

- Place a steel disc (20 mm thick x 70 mm dia.) on the bed of the press.
- Position the transmission housing so that the steel disc is in the bearing bore and the mainshaft rests on the middle of the disc.
- Check that the 1st gear slots are aligned with the synchroniser outer cone tabs.
- Check that the mainshaft rear bearing butts on the 1st gear bearing sleeve and that the bearing cup sits on the bearing.
- Lubricate the inner splines of the 5th gear cog with petroleum jelly and align the splines with the mainshaft splines.
- Place a tube (30 mm i.d., 36 mm o.d., 365 mm long) over the mainshaft onto the 5th gear cog and press on the 5th gear cog.
- Check that the 1st gear cog rotates freely.
- Install the 5th gear cog snap ring.



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Fig.77. Press on 5th gear cog
A - 5th gear cog
B - Tube
C - 1st gear slots aligned with synchroniser outer cone tabs
D - Steel disc

85. Mount the transmission to the assembly stand.

86. Install the input shaft:

Install the 4th gear synchroniser ring into the 3rd/4th gear synchroniser clutch (align notches in ring with blocker bars in clutch). Install the thrust washer. Grease the thrust bearing (see Technical Data) and install.

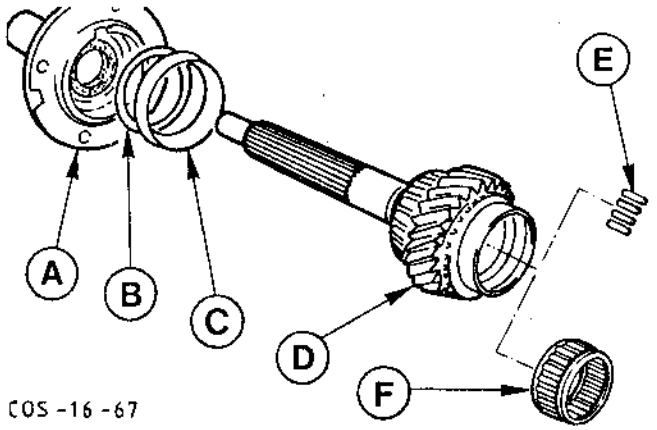


Fig.78. Input shaft and guide sleeve.
A - Clutch release bearing guide sleeve
B - Spacer
C - Bearing cup
D - Input shaft
E - 15 needle rollers ('86 Model Year)
F - Caged needle roller bearing ('88 Model Year)

'86 Model Year only:
Grease the 15 needle rollers (see Technical Data) and fit them to the input shaft. Align the flat on the synchroniser dogs with the countershaft and install the input shaft in the housing.

'88 Model Year only:
Grease the caged needle roller bearing (see Technical Data) and fit it to the input shaft. Align the flat on the synchroniser teeth with the countershaft and install the input shaft in the housing.

Fig.78. Input shaft and guide sleeve.

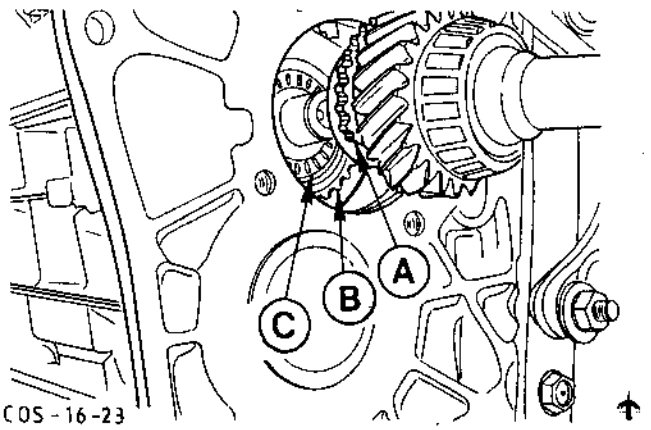


Fig.79. A - Flat on synchroniser dogs
B - Synchroniser ring - 4th gear
C - Thrust bearing (thrust washer behind)

87. Fit the bearing cup into the clutch release bearing guide sleeve.

NOTE: Do not fit spacer at this stage.

88. Temporarily install the guide sleeve (without sealer) with the smaller notch facing upwards. Tighten the bolts to specification.

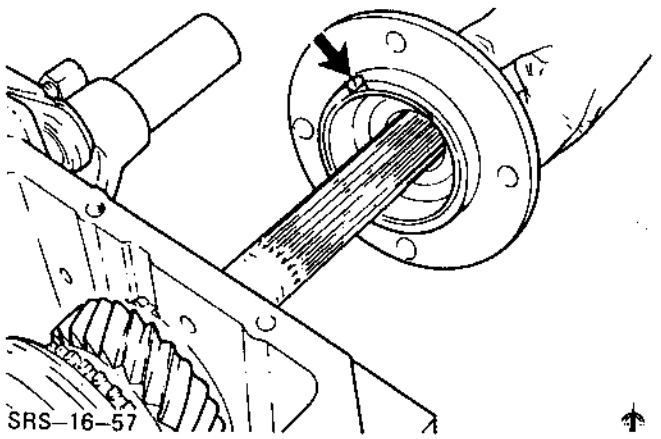


Fig.80. Install guide sleeve (arrow shows smaller notch).

89. Fit the 5th/reverse gear shift lever to the pivot pin and secure with the C-clip.

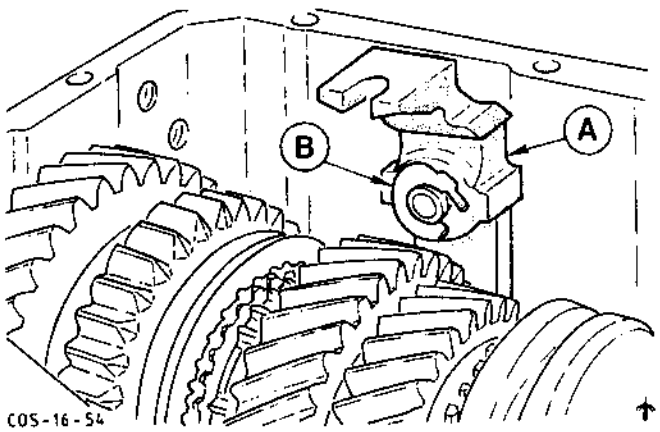


Fig.81. A - 5th/reverse gear shift lever
B - Clip

90. Assemble the 5th Gear Synchroniser Clutch, Cog and Selector Fork to the Shift Rod and Countershaft

Fit the 5th gear cog to the countershaft.

Fit the synchroniser ring in place.

Push the complete 5th gear synchroniser clutch assembly into the selector fork.

Simultaneously fit the selector fork to the shift rod and the synchroniser clutch assembly to the countershaft.

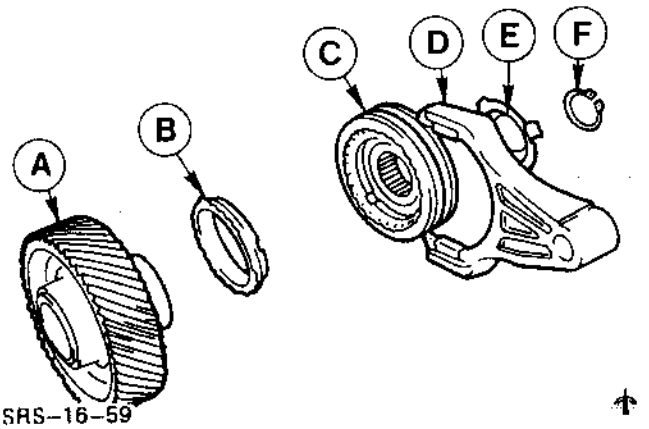


Fig.82. 5th gear cog and synchroniser clutch.

Fig.82. 5th gear cog and synchroniser clutch.
A - 5th gear cog
B - Synchroniser ring
C - Synchroniser clutch
D - Selector fork
E - Retainer
F - Circlip

Fit the retainer to the synchroniser clutch.

Fit the circlip.

Align the roll pin bores in the 5th gear selector fork and shift rod with a pin punch.

Fit the roll pin.

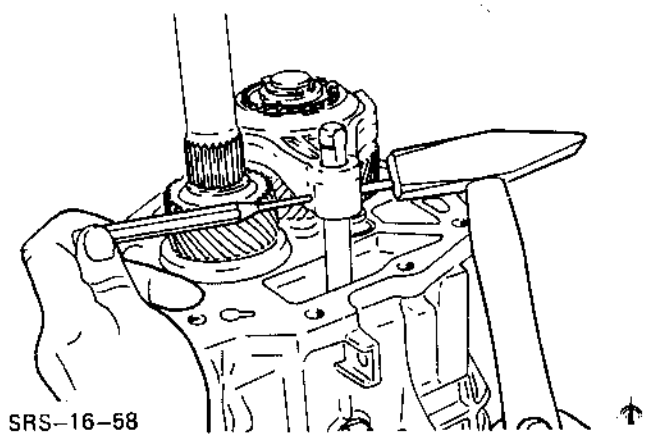


Fig.83. 5th gear selector fork roll pin.

91. Fit the lubrication funnel into the end of the countershaft.

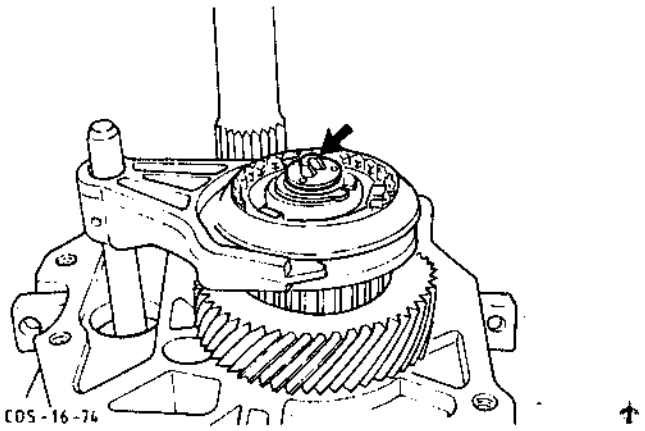


Fig.84. Fit lubrication funnel.

92. Install the speedometer worm on the mainshaft.

'86 Model Year:
Push the speedometer worm and clip onto the mainshaft. The clip tab will engage in the bore in the mainshaft.

'88 Model Year:
Place the ball in the bore on the mainshaft. Push the speedometer worm onto the shaft and locate the worm groove on the ball. Fit the circlip.

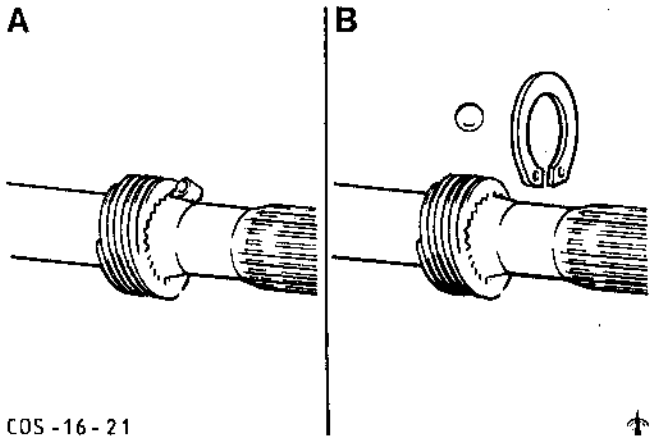


Fig.85. Speedometer worm attachment.
A - '86 MY-Clip
B - '88 MY-Circlip and drive ball

93. Install the Selector Cover Assembly

Apply silicone sealing compound (see Technical Data) to the cover mating face.

NOTE: Do not apply sealing compound to the transmission mating face.

Position the cover to the filler plug side of the transmission and lower it until the selector forks engage the synchroniser sleeves. Continue lowering the cover and move it into position to engage the 5th/reverse gear shift lever.

NOTE: First ensure that all synchronisers are in the neutral position and that the selector forks in the cover are in the neutral position.

Tighten the cover bolts to specification.

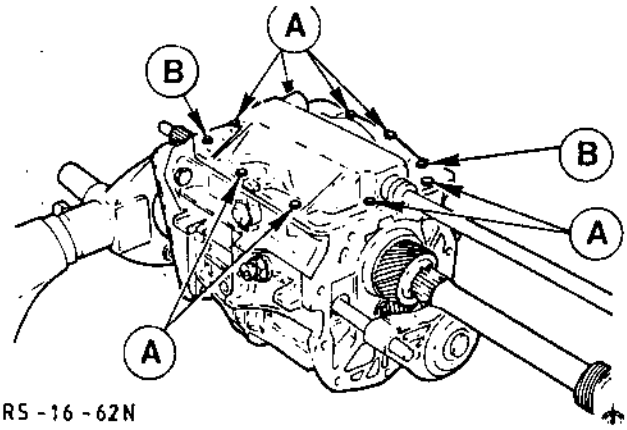


Fig.86. Selector cover bolts.
A - Fixing bolts
B - Close tolerance bolts

94. Assemble the Extension Housing and Selector Crank to the Transmission Housing

Apply silicone sealing compound (see Technical Data) to the extension housing mating face. Locate the extension housing and push it onto the transmission housing until the selector rod enters the gear lever housing.

Coat the detent spring with petroleum jelly and insert it into the selector crank.

Lubricate the detent plate and install the detent ball in the neutral position on the plate. Position the selector crank in the extension housing with the spring over the detent ball.

Press the selector crank downwards so that the selector crank lug locates in the detent plate.

Slide the selector crank and extension housing into position at the same time.

Fit and tighten the extension housing retaining bolts.

NOTE: Apply sealing compound (see Technical Data) to the two upper bolts.

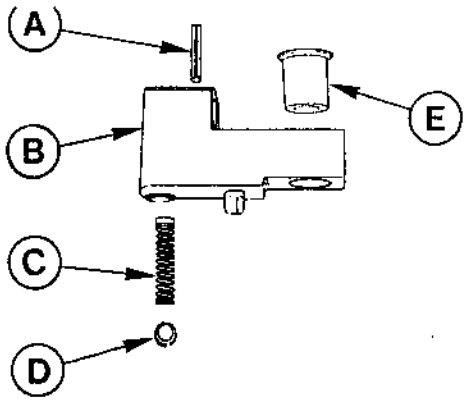


Fig.87. A - Roll pin
B - Selector crank
C - Detent spring
D - Detent ball
E - Gear lever damper bush

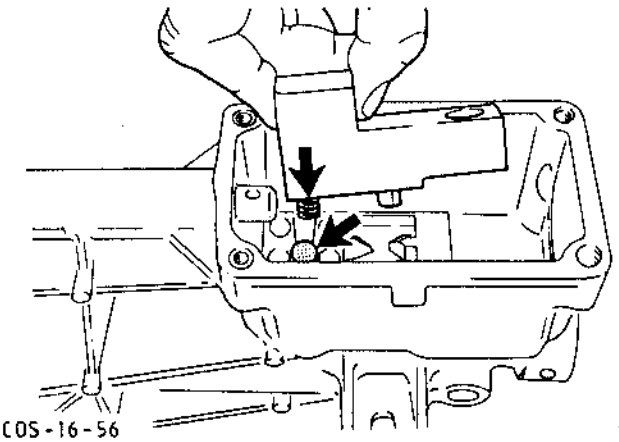


Fig.88. Install the detent ball in the neutral position in the detent plate.

95. Align the roll pin bores in the selector crank and shift rod with a pin punch and fit the roll pin.

Fit the gear lever damper bush into the selector crank.

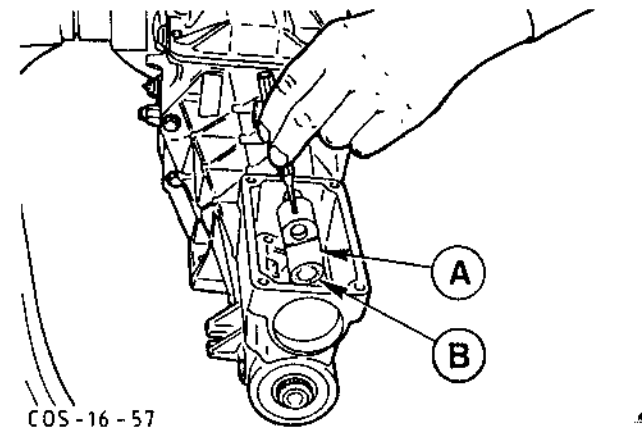


Fig.89. Align selector crank.
A - Selector crank
B - Damper bush, gear lever

96. Measure the Mainshaft Axial Clearance and Determine Shims Required

- Turn the transmission into the vertical plane (extension housing on top).
- Fit the dial gauge fixture adaptor, Special Tool 15-008-01 and the fixture, Special Tool 15-022-A to the extension housing. Fit a dial gauge and adjust stylus to rest on the end of the mainshaft.
- Rotate the input shaft and mainshaft. Set the dial gauge to zero.
- Using a piece of wood, raise the input shaft and note the reading on the gauge.

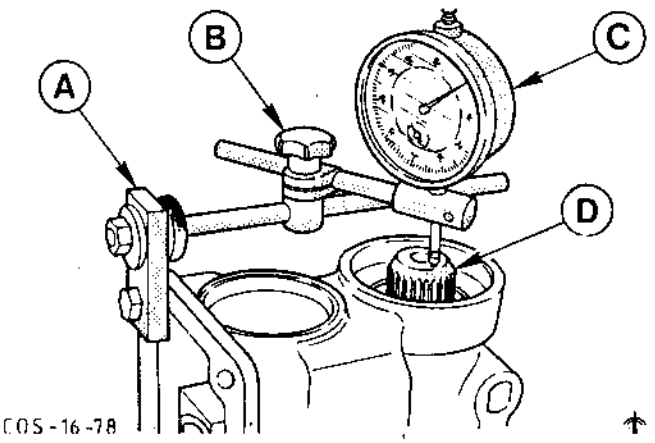


Fig.90. A - Special Tool 15-008-01
B - Special Tool 15-022-A
C - Dial gauge D - Mainshaft

NOTE: The indicated value is the thickness of the required shim(s). Choose and measure the required shims (see the Parts Microfilm). For the specified axial clearance refer to Technical Data.

- Turn the transmission into the horizontal plane.

97. Remove the clutch release bearing guide sleeve. Remove the bearing cup and insert the determined shims. Refit the bearing cup.

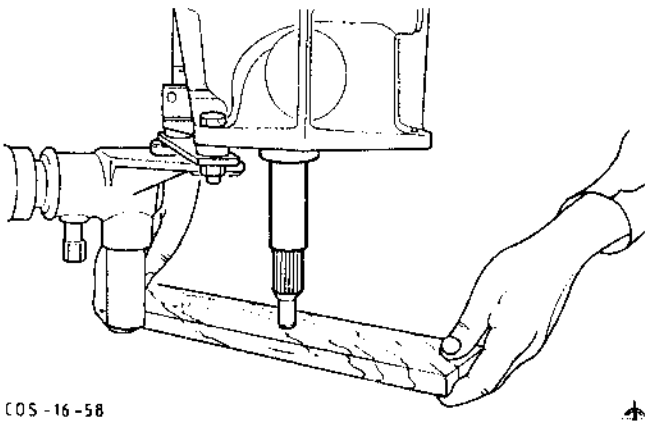


Fig.91. Using a piece of wood, raise input shaft.

98. Apply silicone sealing compound (see Technical Data) to the mating face of the guide sleeve.

NOTE: Do not apply sealer to the notch in the guide sleeve.

Install the guide sleeve and tighten the bolts to specification.

Check the axial clearance once again.

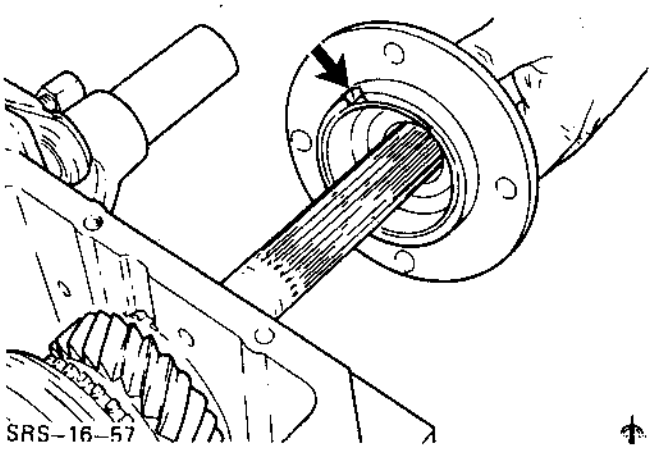


Fig.92. Install guide sleeve (arrow points to notch)

99. Position the extension housing bush in place and align the bush oil feed cut-out with the bore in the extension housing.

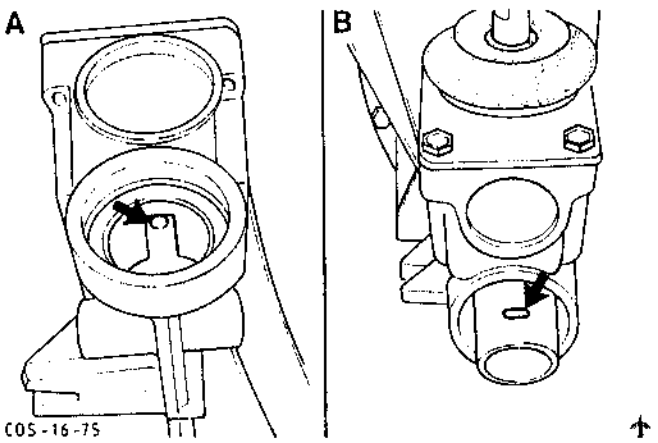


Fig.93. Align lubrication bores.
A - Bore in extension housing
B - Cut-out in bush

100. Install the bush into the extension housing using Special Tools 16-016 and 16-016-01.

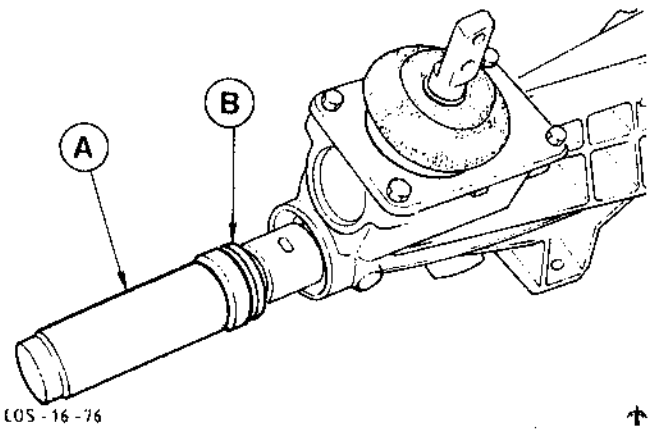


Fig.94. Install extension housing bush.
A - Special Tool 16-016
B - Special Tool 16-016-01

101. Install the radial oil seal into the extension housing using Special Tool 15-037.

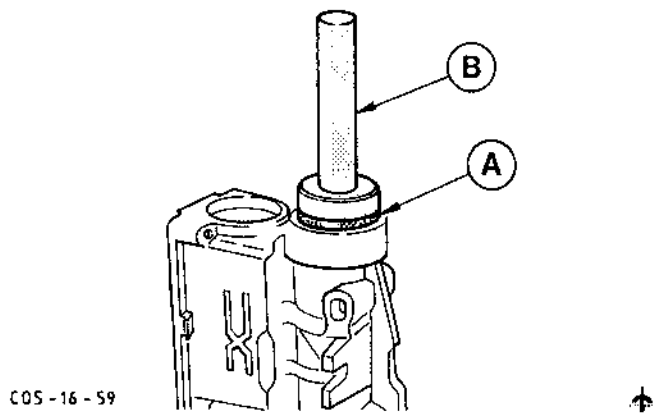


Fig.95. A - Radial oil seal
B - Special Tool 15-037

102. Install the speedometer driven gear complete with a new O-ring.

Fit the transmission crossmember mounting.

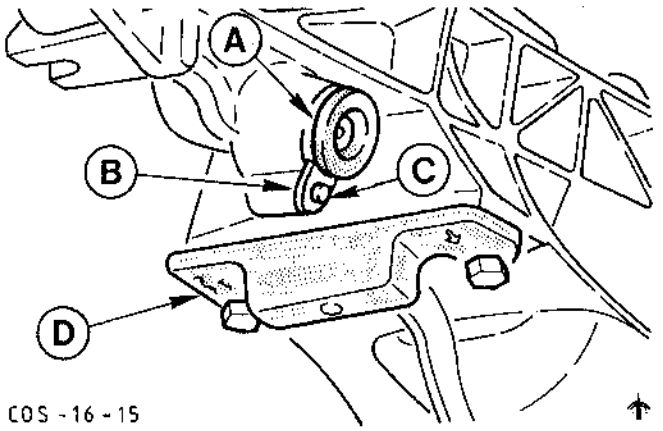


Fig.96. A - Speedometer driven gear
B - Retaining plate
C - Bolt D - Crossmember mounting

103. Fit the oil drain plug.

104. Apply silicone sealing compound (see Technical Data) to the mating face of the gear lever cover. Install the gear lever and gear lever cover and tighten the four bolts.

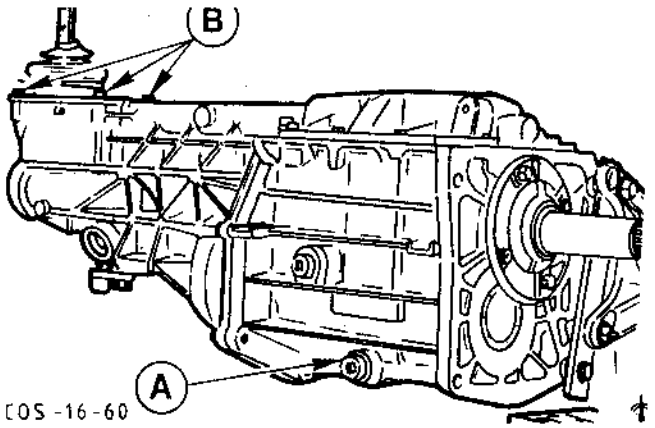


Fig.97. A - Oil drain plug
B - Gear lever cover retaining bolts

105. Remove the transmission from the assembly stand.

106. Fit the clutch housing to the transmission.

107. Fit the clutch release bearing and lever.

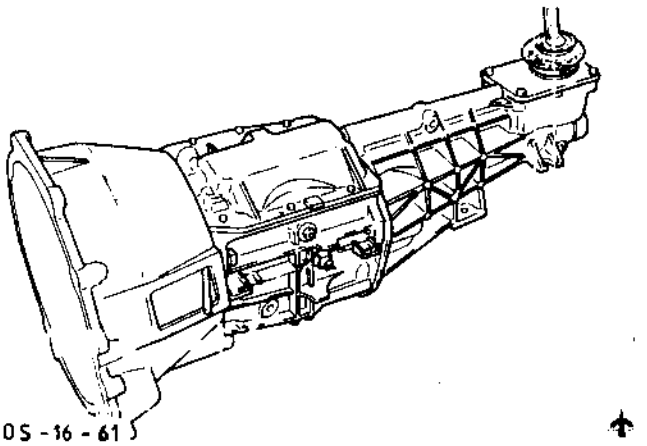


Fig.98. Transmission assembly, complete.

16 172 0 GEAR - SPEEDOMETER DRIVEN - REMOVE AND INSTALL

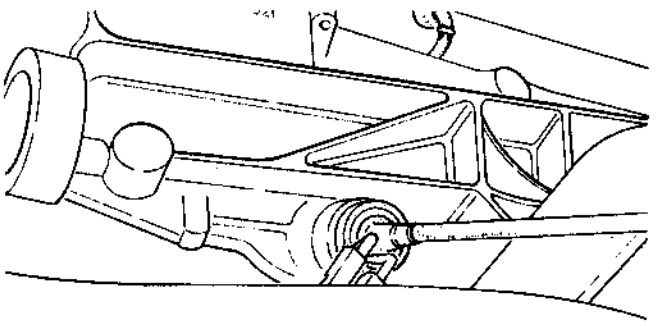
SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Raise the vehicle.

2. Remove the circlip from the speedometer drive cable and pull out the drive cable.

3. Remove the bolt from the speedometer driven gear retaining plate and remove the plate. Carefully lever out the speedometer driven gear with a screwdriver.



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Fig.99. Remove speedometer drive cable circlip.

To Install

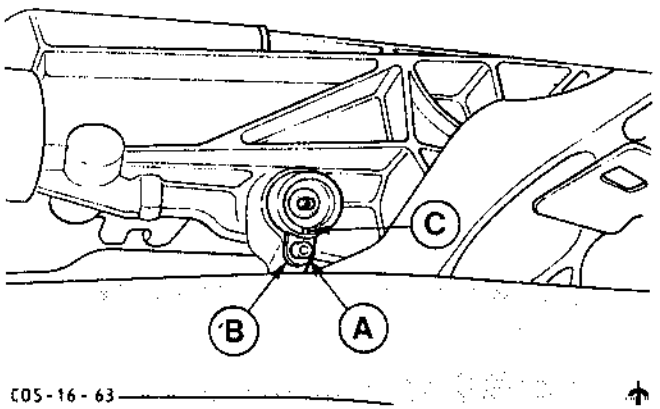
4. Lubricate the O-ring and insert the speedometer driven gear with the indentation on the outside edge facing the bolt hole.

5. Fit the retaining plate and tighten the bolt to the specified torque (see Technical Data).

6. Insert the drive cable and fit the circlip.

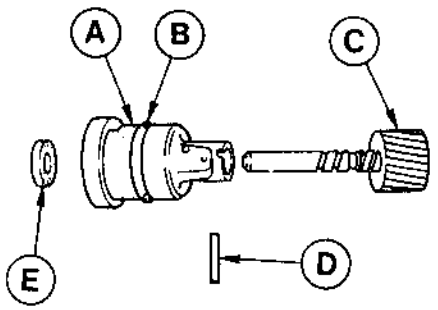
7. Check and if necessary, top up the oil level (for specification see Technical Data). Lower the vehicle.

NOTE: The correct oil level is 0 to 5 mm under the lower edge of the oil filler plug bore.



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Fig.100. Speedometer driven gear attachment.
A - Retaining bolt
B - Retaining plate C - Identation



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Fig.101. Speedometer driven gear removed and disassembled.
A - Guide sleeve
B - O-ring
C - Driven gear
E - Oil seal

Fig.101. Speedometer driven gear removed and disassembled.

16 812 0 CLUTCH PEDAL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure applies to a LHD vehicle. Any reference to the left or right hand side of the vehicle should therefore be reversed when the operation is performed on a RHD vehicle.

1. Remove the trim panel from the left hand footwell (2 clips).

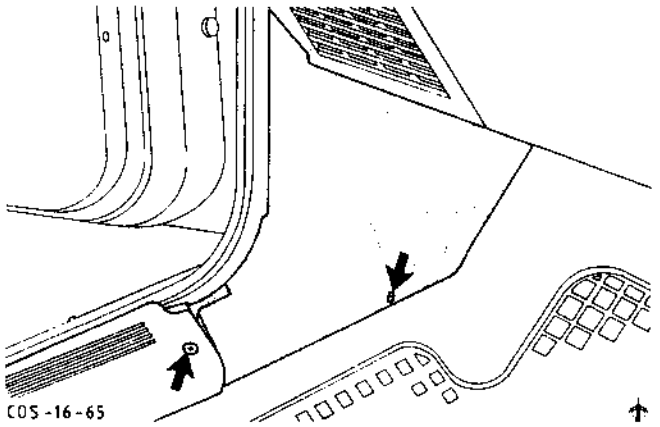


Fig.102. Remove lower side trim panel.

2. Remove the steering column lower shroud (3 screws).

3. Remove the lower side trim panel from the left hand footwell (2 screws).

4. Remove the lower left hand side crash padding (4 screws, 2 clips).

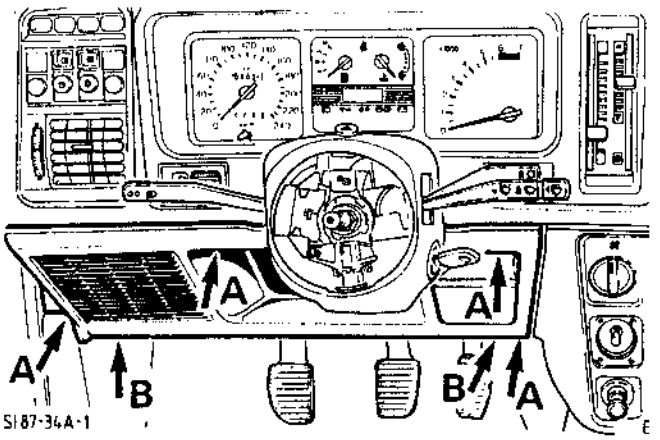


Fig.103. Lower crash padding attachment (steering wheel removed for clarity).
A - Screws
B - Clips

5. Release the tension from the clutch cable automatic adjusting mechanism and unhook the clutch cable from the toothed segment.

6. Remove the clip from the brake actuating rod and separate the brake pedal from the rod.

7. Disconnect the brake light switch multiplug. Twist the brake light switch anti-clockwise and remove it.

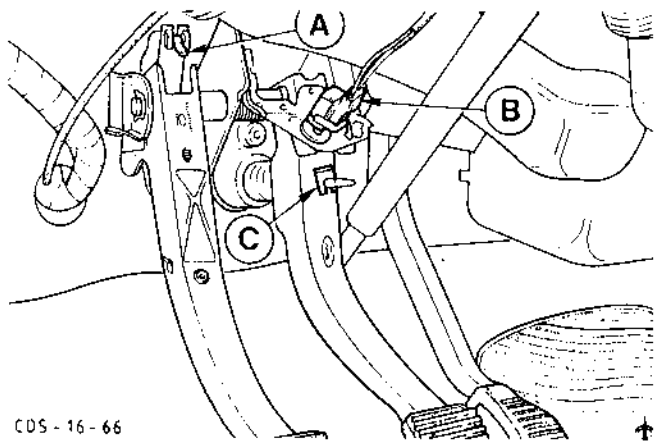


Fig.104. A - Clutch cable
B - Multiplug, brake light switch
C - Clip, brake actuating rod

8. Remove the pedal mounting from the bulkhead (3 nuts, 1 bolt and washer).

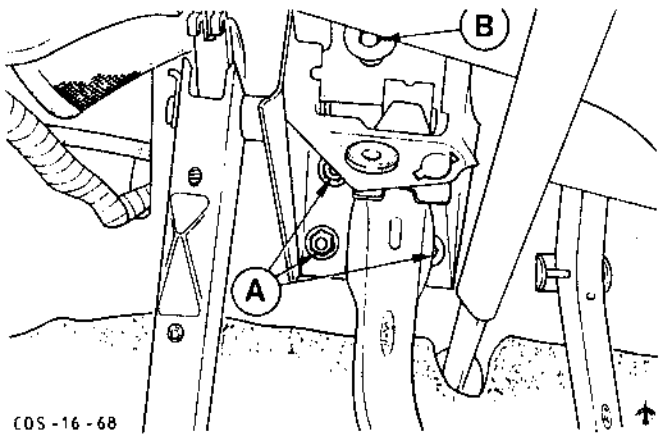


Fig.105. Pedal mounting attachment.
A - Nuts
B - Bolt and washer

9. Remove the clutch pedal from the pedal mounting:

Unhook the toothed segment tension spring.

Remove the clip from the pedal shaft.

Detach the clutch cable guide (2 nuts).

Remove the clutch pedal from the shaft.

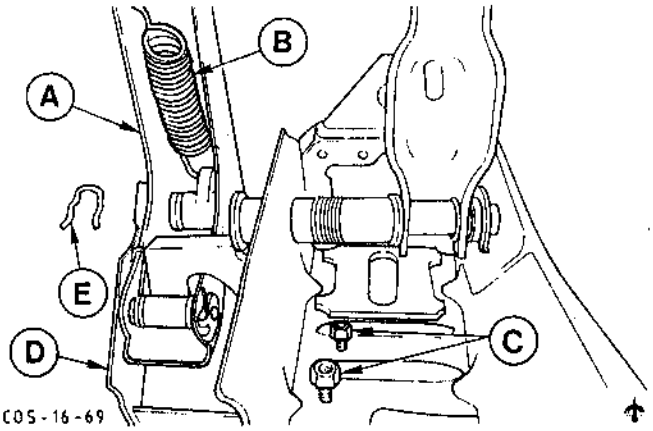


Fig.106. Remove clutch pedal

Fig.106. Remove clutch pedal.
A - Clutch pedal
B - Tension spring, toothed segment
C - Retaining nuts
D - Clutch cable guide
E - Clip

10. Remove the toothed segment:

Unhook and remove the tension spring from the toothed segment. Lever out the bushes from the pedal.
Remove the clip from the pawl retaining pin.
Remove the retaining pin and lift out the pawl and pawl tension spring.

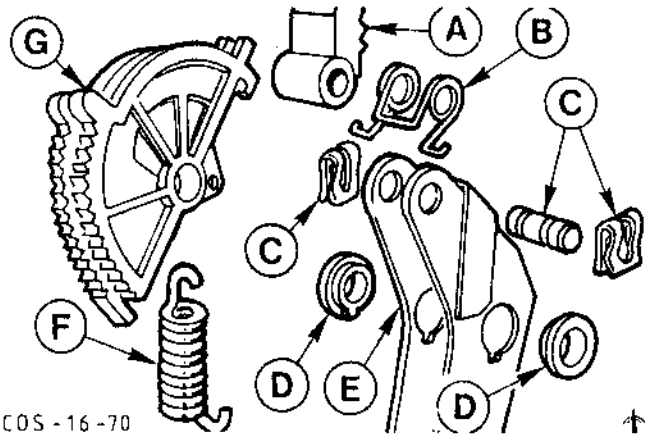


Fig.107. Clutch pedal with automatic adjustment mechanism.

Fig.107. Clutch pedal with automatic adjustment mechanism.
A - Pawl
B - Pawl tension spring
C - Retaining pin with clip
D - Bush
E - Clutch pedal
F - Tension spring - toothed segment
G - Toothed segment

To Install

11. Assemble the clutch pedal:

    Lubricate the bore of the toothed segment and the pawl with graphite grease. Fit the pawl, spring and pin and secure with the clip.

    Attach the spring to the toothed segment and guide the toothed segment into the pedal. Press the bushes into place.

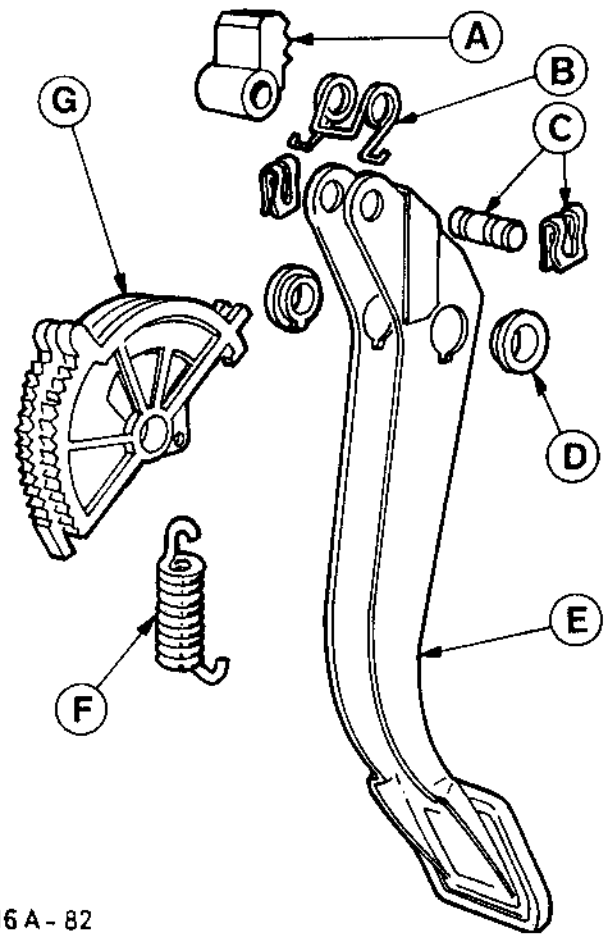
    Lift the pawl and rotate the toothed segment so that the teeth of the pawl rest on the flat face of the segment shown in Fig.109.

NOTE: Hook the toothed segment tension spring into the pedal only after the pedal is assembled to the shaft.

12. Fit the clutch pedal to the pedal mounting: Lubricate the pedal shaft with graphite grease. Slide the clutch pedal complete with the automatic adjustment mechanism and washer onto the pedal shaft. Fit the clutch cable guide and tighten nuts. Fit the retaining clip. Hook the tension spring onto the pedal.

13. Fit the pedal assembly to the bulkhead.

14. Insert the brake light switch and twist it clockwise to secure. Connect the multiplug and check switch operation.



S16A-82

Fig.108. Clutch pedal with automatic adjustment mechanism.
A - Pawl
B - Pawl tension spring
C - Retaining pin with clip
D - Bush
E - Clutch pedal
F - Tension spring - toothed segment
G - Toothed segment

15. Connect the brake actuator rod to the brake pedal.

16. Hook the clutch cable into the toothed segment.

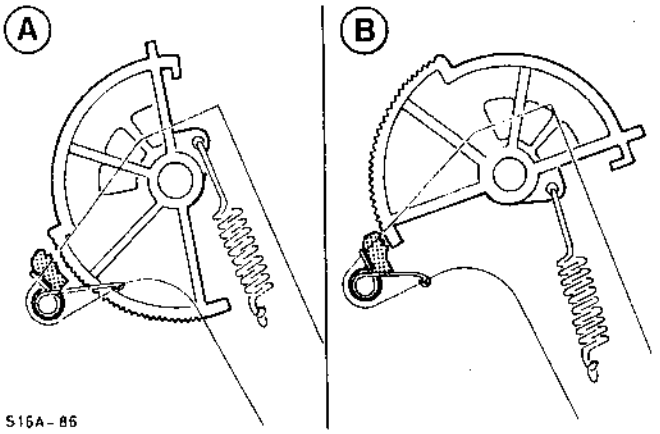
17. Fit the lower crash padding.

18. Fit the lower side trim panel.

19. Fit the steering column lower shroud.

20. Fit the footwell trim panel.

Fig.108. Clutch pedal with automatic adjustment mechanism.



S16A-86

Fig.109. A - Lift pawl and rotate toothed segment
B - Rest pawl on smooth segment face

16 814 0 CABLE - CLUTCH OPERATING - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

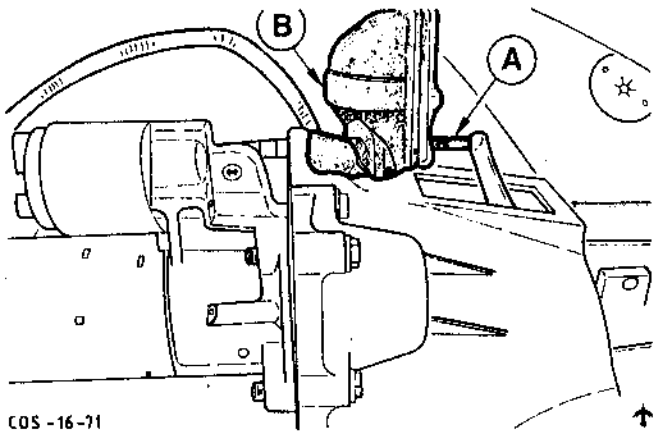


Fig.110. A - Clutch cable
B - Gaiter

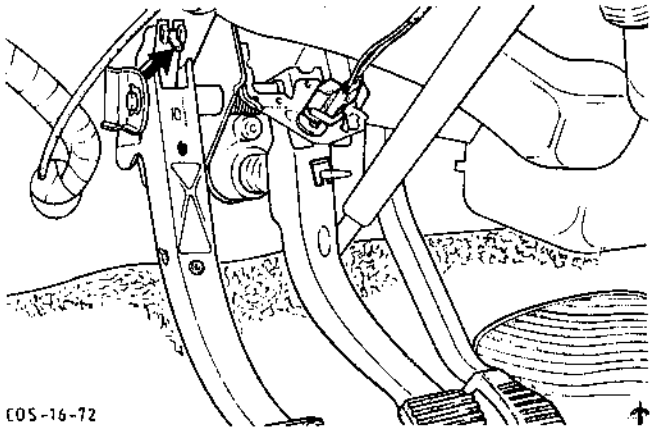


Fig.111. Withdraw clutch cable.

To Remove

1. Place a block under the clutch pedal and separate the pawl from the toothed segment. Pull the gaiter off the clutch release lever. Pull the clutch cable downwards by hand in front of the release lever. Restrain the cable with pliers and unhook it from the release lever. Pull the gaiter off the cable.

2. Remove the lower footwell trim (2 clips).

3. Release the clutch cable from the toothed segment of the automatic adjustment mechanism.

4. Withdraw the clutch cable from the engine compartment.

To Install

5. Pass the clutch cable from the engine compartment through the clutch cable guide.

6. Hook the clutch cable into the toothed segment.

7. Attach the clutch cable to the clutch release lever. Pass the clutch cable through the clutch housing guide and fit the gaiter. Pull the cable out if its sheath, restrain it with pliers and attach it to the clutch release lever. Press the gaiter and its spring retainer into position on the clutch housing.

8. Remove the block from the pedal. Refit the lower footwell trim.

MANUAL TRANSMISSION AND CLUTCH 16B
(MT-75/4x4)
(Sierra and Escort)

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Manual transmission oil filler capacity		1,2 litres
Transfer box oil filler capacity		0,5 litres
Manual transmission oil level		0 to 5 mm below lower edge of oil level check plug
Transfer box oil level		18 mm below lower edge of oil level check plug
Manual transmission fluid	Ford Specification	ESD-M2C186-A
Transfer box fluid	Ford Specification or optionally	SQM-2C9010-B SQM-2C9010-A, ESD-M2C166-A
Grease ..	Ford Specification ESD-M1C220-A	For input shaft splines and clutch release bearing sliding surface on guide sleeve ("Microlube" SC-261 supplied by Messrs Klüber)
	Ford Specification SM-1C1021	Sealing lips of radial oil seals of: - Output flange - Driveshaft to front axle - Selector shaft ball sleeve
	MOLYKOTE FB 180	Annulus/planetary gear carrier thrust washer
Oil	ATF Shell Donax TM	Shim between planetary gear carrier and drive plate
		Plain bearing in short output shaft to guide planetary gear carrier
Thread locking compound	Loctite 242	Output flange nut
		Bolts of bearing housing in transfer box
Thread locking paint	Z115 Blue	Two bolts securing transfer box housing to rear transmission housing
Sealer	Ford Specification ESK-M4G242-A	Front transmission housing to rear transmission housing
	Ford Specification ESK-M4G242-A	Transfer box to rear transmission housing

NOTE: All the running and sliding surfaces of transmission components for which no particular lubrication requirements are specified should be oiled with the appropriate transmission fluid.

Annulus end float in relation to planetary gear carrier	0,5 to 0,7 mm

TECHNICAL DATA (cont'd) MT-75/4x4

Tightening Torques	Escort RS Cosworth Nm	Sierra Cosworth '90 Nm
Cylinder block flange bolts in transmission housing	29 to 41	41 to 58
Transmission housing flange bolts in sump	41 to 58	41 to 58
Gearshift support bracket to transfer box and to rear transmission housing	21 to 29	21 to 29
Transmission crossmember to transmission mounting	52 to 65	50 to 70
Transmission crossmember to floor assembly	21 to 28	20 to 26
Starter motor retaining bolts	29 to 41	58 to 78
Starter motor wiring to starter motor - M6	5 to 6	-
Starter motor wiring to starter motor - M8	5 to 7	-
Driveshaft to front differential assembly drive flange	34 to 46	30 to 40
Torx studs in transmission output flange	70 to 90	70 to 90
Driveshaft to transmission output flange (nuts)	67 to 83	70 to 85
Driveshaft to rear axle	57 to 75	57 to 75
Driveshaft centre bearing to floor assembly	18 to 23	18 to 24
Exhaust mounting bracket to transfer box	39 to 53	41 to 55
Left-hand middle exhaust mounting bracket to rear axle crossmember	21 to 28	45 to 56
Stabiliser bar brackets to side members	70 to 90	70 to 97
Oil filler/oil drain/oil level check plugs	30 to 40	23 to 32
Lower engine cover to side member	-	18 to 22
Front exhaust pipe to turbocharger	31 to 44	35 to 47
Front exhaust pipe to catalytic converter	36 to 49	35 to 47
Turbocharger heat shield to bulkhead/fender brackets	-	9 to 11
Turbocharger heat shield to bracket	9 to 11	-
Turbocharger heat shield to air cleaner casing	5 to 6	-
Turbocharger heat shield to threaded stud or thread stud to fender	20 to 26	-

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TECHNICAL DATA (cont'd)

Tightening Torques

	Nm
Gearshift gate to transmission housing	8 to 11
Front transmission housing to rear transmission housing	20 to 27
Transmission mainshaft bearing retaining plate	20 to 27
Locking plate locking screw to transmission housing	18 to 25
Reverse gear idler shaft to transmission housing	28 to 36
Reversing light switch	10 to 14
Threaded plug of selector shaft locking mechanism	20 to 27
Clutch release bearing guide sleeve	230 to 270
Countershaft bearing housing	15 to 20 then undo 60°
Retaining bolt of locking plate for countershaft bearing housing	9 to 11
Transmission mainshaft nut (nut can only be used once)	500 ± 75
Bolts of oil baffle in transfer box	9 to 12
Carrier of ball bearing of chain driving sprocket	21 to 28
Output flange nut	90 to 115
Transfer box housing to rear transmission housing (bolts and nut)	20 to 27
Transmission crossmember to transmission housing	50 to 70
Front transmission housing (clutch bell housing) to engine	41 to 58
Crossmember to transmission housing	21 to 29
Nuts securing driveshaft to output flange	76 to 82

The modified MT-75/4x4 5-speed transmission is based on the unit fitted in the Sierra XR4x4 until now. The following major modifications have been made for its fitment in the Sierra Cosworth 4x4:

- Flanged connection between transmission, engine and sump (2 longer flange bolts)
- Vent hole for the double-lipped radial oil seal in the transfer box (any damage to the radial oil seal is indicated by oil escaping from the vent hole).
- Gear ratios identical to those of the MT-75/4x4 transmission fitted with the Sierra 2,9 litre V6 engine.

For further information and details of the changes refer to publication CG 7330D 12/89 entitled 'Sierra Cosworth 4x4' in the series 'Product Training for Technicians'.

Operations 16 114 0 and 16 337 0 have been modified accordingly for the Escort RS Cosworth. Otherwise, this section applies to the Sierra Cosworth and the Escort RS Cosworth.
For details of the differences between the Sierra and the Escort refer to publication CG 7458D 2/92 introducing the 'Escort RS Cosworth'.

These training publications must not be used for service repairs as only the Service Microfiche is undated as necessary.

Checking the oil level in the transfer box:

Insert the workshop fabricated dipstick (see Fig.A) into the oil filler hole - the dipstick must lie flat on the thread in the oil filler hole and the tip of the dipstick must be in contact with the housing. If the transmission is filled to the correct level, the tip of the dipstick must be covered with oil.

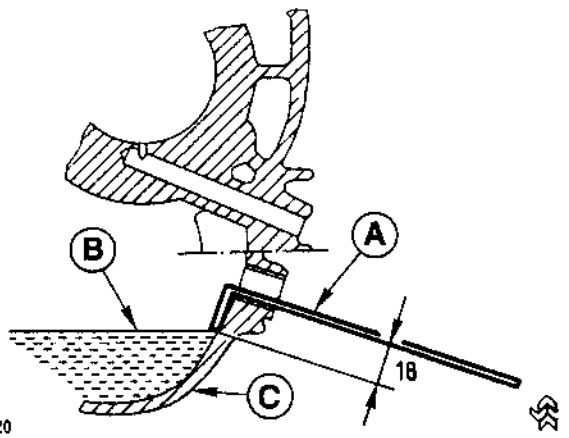
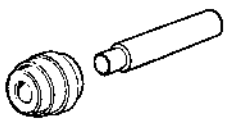
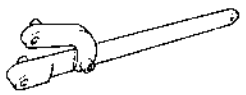
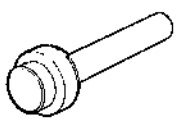
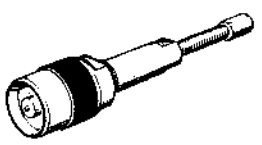
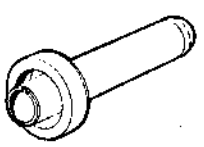
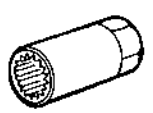
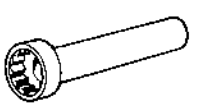
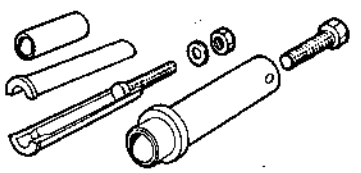
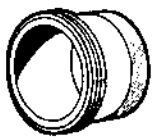
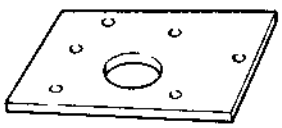
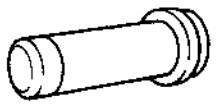
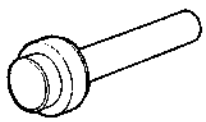
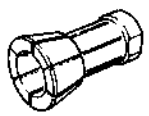
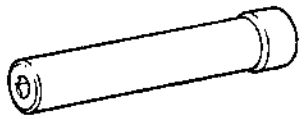
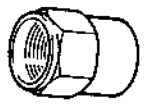
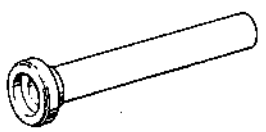


Fig.A. Checking transfer box oil level.
A - Dipstick (bent length of wire)
B - Transmission fluid
C - Transfer box housing

Tool		Tool Name
	14-028	Transfer box oil seal installer
	15-030 A	Universal flange holding wrench
	15-036	Countershaft roller bearing installer
	15-050 A	Remover - basic tool (used in conjunction with Special Tool 16-050)
	15-058	Output flange oil seal installer (used in conjunction with Special Tool 16-043)
	15-064	Installer
	15-073	Input shaft socket wrench
	16-040	Guide sleeve socket wrench
	16-041	Transmission housing remover and installer

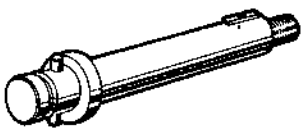
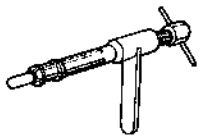
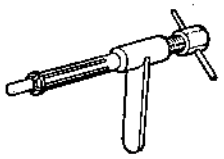
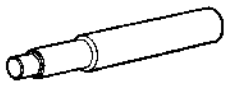
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SPECIAL SERVICE TOOL RECOGNITION (cont'd) MT-75/4x4

Tool	Tool Name
 16-041-01	Adaptor - for removing front transmission housing (used in conjunction with Special Tool 16-041)
 16-041-02	Adaptor - for removing transmission mainshaft
 16-043 A	Adaptor - for output flange oil seal (used in conjunction with Special Tool 15-058)
 16-044	Guide sleeve oil seal installer
 16-050	Countershaft roller bearing inner ring remover (used in conjunction with Special Tool 15-050 A)
 16-051	Transmission mainshaft nut socket wrench
 16-052	Mounting bracket (used in conjunction with Special Tool 21-023)
 16-053	Transmission mainshaft installer
 16-054	Double-lipped radial oil seal installer

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SPECIAL SERVICE TOOL RECOGNITION (cont'd)

Tool	Tool Name
 21-023	Universal spindle - for fitting transmission to assembly stand (used in conjunction with Special Tool 16-045)
 21-036 A	Selector shaft ball sleeve extractor (use with spindle 21-037 B)
 21-037 B	Selector shaft ball sleeve extractor (only use spindle)
 21-044 A	Selector shaft ball sleeve installer
 21-051	Transfer box oil seal extractor

PROPRIETARY TOOLS

Double hexagon socket wrench, 30 mm across flats (e.g. "Hazet 900TZ-30", "Snap on SM30", "Stahlwille 51SW-30")

Torx socket wrench (e.g. "Hazet E11 deep", "Stahlwille 50 TX E11")
17 mm hexagon socket - countershaft bearing housing
Three-legged puller - output flange - output shaft ball bearing
Internal extractor - countershaft roller bearing
Separating tool
Steel rule
Depth gauge

WORKSHOP FABRICATED TOOLS

Bent length of wire to check oil level in transfer box.

0392

16 111 C VISCOUS CONTROL - DIFFERENTIAL - CHECK

SPECIAL SERVICE TOOLS REQUIRED: NONE

1. Bring the transmission up to normal operating temperature. Drive the rear wheels of the vehicle onto the rolling road, Fig.2.

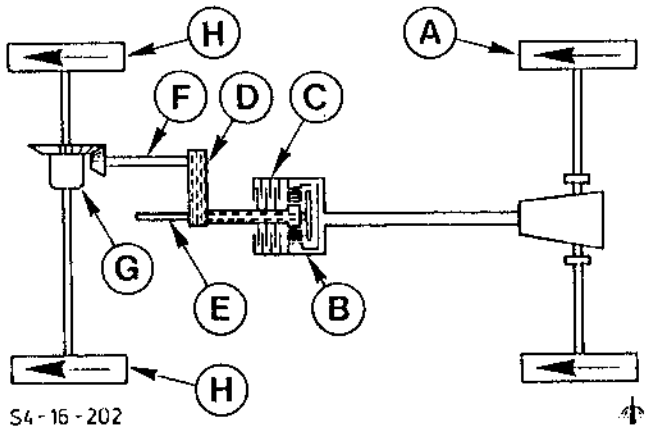


Fig.1. Schematic of viscous coupling check.

Fig.1. Schematic of viscous coupling check.
A - Rear wheels driven by rolling road
B - Epicyclic gear
C - Viscous coupling
D - Drive chain in transfer box
E - Transmission mainshaft
F - Driveshaft to front axle
G - Front axle box
H - Freely rotating front wheels

2. Select neutral and release the handbrake.

3. Raise the front wheels of the vehicle clear of the ground using a workshop jack.

4. Rotate the rollers of the rolling road to simulate a road speed of 5 km/h.

5. If both front wheels rotate, this means that the viscous coupling in the transfer box is in order. If the front wheels do not turn, replace the viscous coupling.

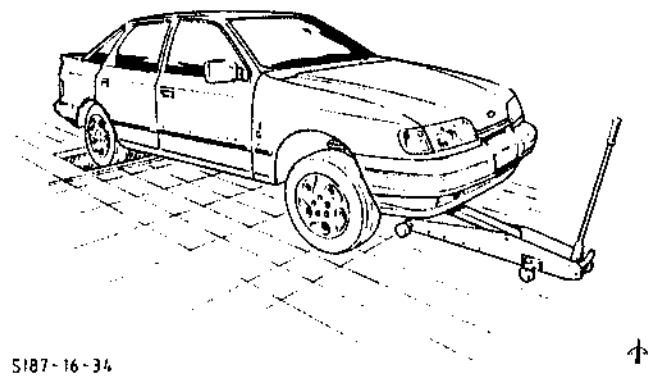


Fig.2. Front wheels of vehicle raised clear of the ground with rear wheels on rolling road (Sierra '87 4x4 shown).

16 114 0 TRANSMISSION ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.

Sub operations 2 to 6 apply to Sierra only:

2. Pull the gear lever knob vertically upwards off the gear lever, Fig.1 (A). Prise off the cover plate. Unclip the electric window switches and disconnect the two multiplugs from the electric window switches, Fig.1 (B, E).

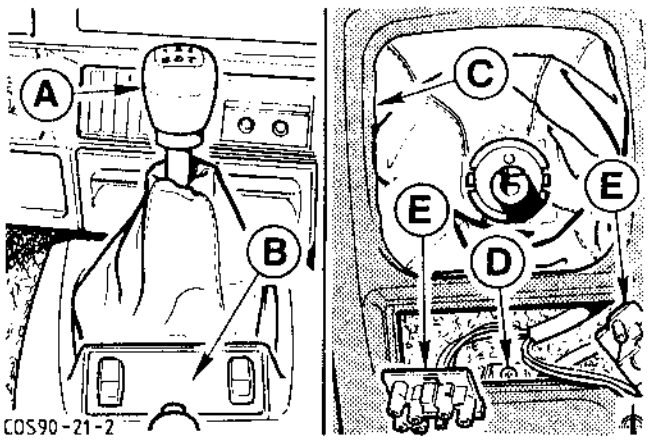


Fig.1. Gear lever with gaiter retaining frame.
A - Gear lever knob
B - Cover plate
C - Retaining frame
D - Retaining frame retaining screw
E - Multiplugs of electric window switches

3. Disconnect the retaining frame from the console (1 screw), Fig.1 (C, D).

4. Pull the outer gear lever gaiter up inside out, cut the cable tie and pull off the gaiter, Fig.2 (A, B).

Fig.2. Gaiters and noise damping pad retaining frame.
A - Outer gaiter
B - Cable tie
C - Inner gaiter
D - Noise damping pad retaining frame
E - Retaining screws
F - Noise damping pad

5. Pull off the inner gear lever gaiter, Fig.2 (C).

6. Remove the retaining frame of the noise damping pad with the pad (4 screws), Fig.2 (D, E, F). Place a suitable block under the clutch pedal.

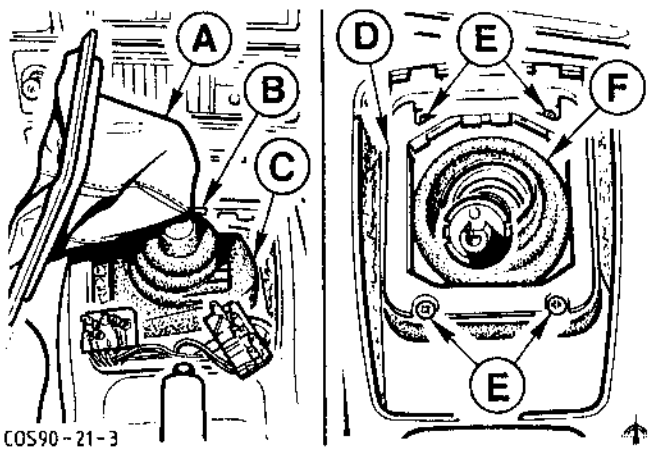


Fig.2. Gaiters and noise damping pad retaining frame.

0392

7. Sierra only:
Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.3 (B).

Fig.3. Turborcharger heat shield.
A - Retaining bolt
B - HEGO sensor multiplug
C - Heat shield clips
D - Retaining nut

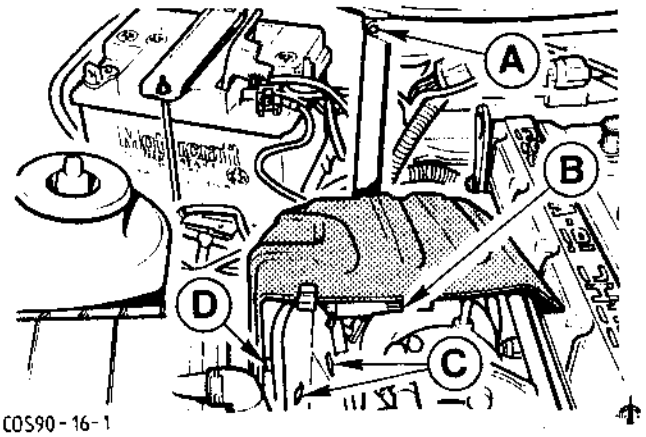


Fig.3. Turbocharger heat shield.
(Sierra shown)

8. Sierra only:
Detach the turbocharger heat shield and bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Withdraw the heat shield from the lower clips and remove it, Fig.3 (A,C,D).

9. Escort only:
Disconnect the multiplug from the HEGO sensor and unclip the wiring, Fig.4.

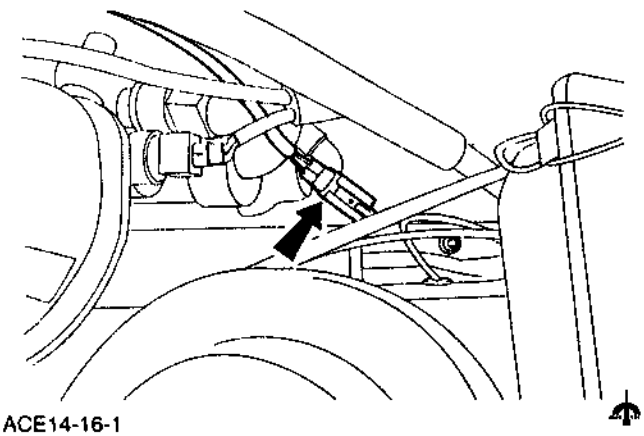


Fig.4. HEGO sensor multiplug.
(Escort shown)

10. Escort only:
Detach the turbocharger heat shield from the bracket, air cleaner casing and fender (2 bolts, 1 nut in the wheelhouse), Fig.5.

Fig.5. Turbocharger heat shield fixture.
(Escort shown)
A - Bolts
B - Nut in wheelhouse

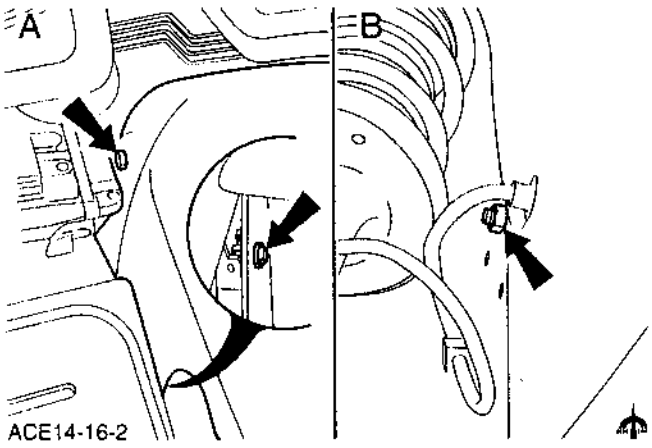


Fig.5. Turbocharger heat shield fixture.
(Escort shown)

0392

11. Disconnect the front exhaust pipe from the turbocharger (3 nuts), Fig.6.

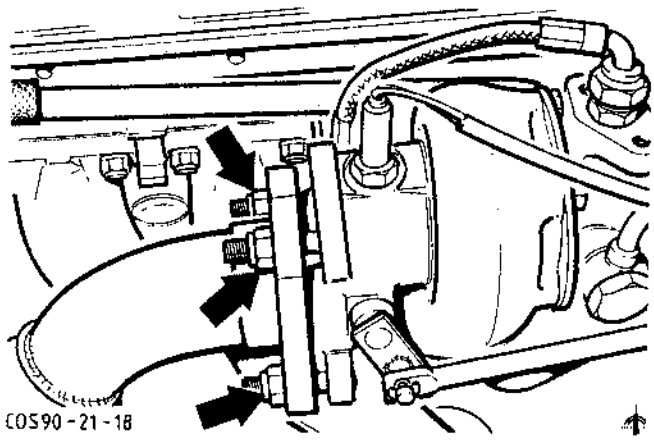


Fig.6. Nuts securing front exhaust pipe to turbocharger.

12. Raise the vehicle.

13. Sierra only:
Detach the lower engine cover from the side members and the front axle/engine crossmember (6 bolts), Fig.7.

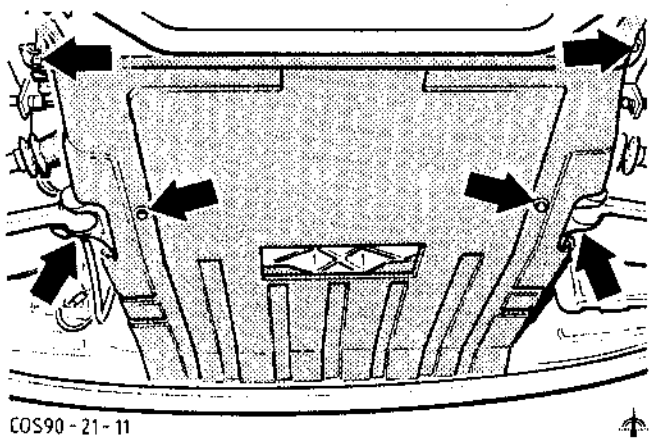


Fig.7. Retaining bolts of lower engine cover. (Sierra shown)

14. Escort only:
Detach the lower engine cover from the side members (4 bolts) and the body (5 bolts), Fig.8.

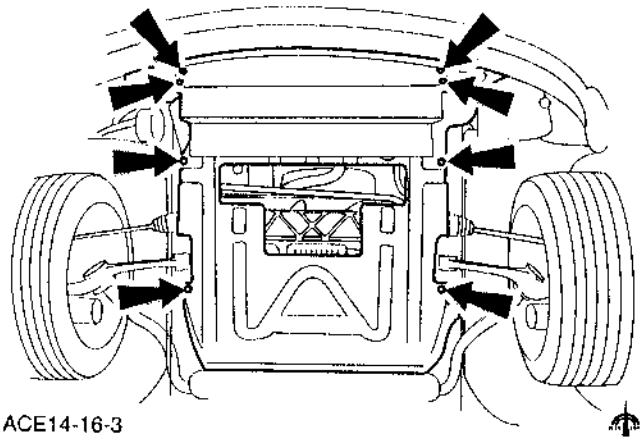


Fig.8. Retaining bolts of lower engine cover. (Escort shown)

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15. Disconnect the stabliser bar brackets from the side members on the left and right-hand sides (4 bolts), Fig.9.

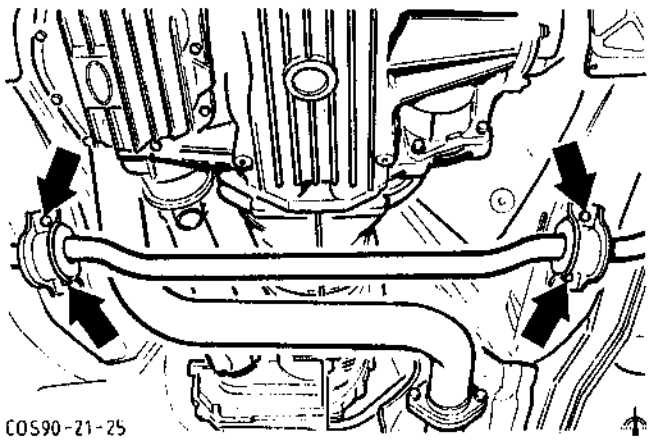


Fig.9. Retaining bolts of stabiliser bar brackets.

16. Sierra only:
Remove the exhaust system complete, Fig.10:

- Unscrew the left hand middle exhaust mounting bracket from the rear axle crossmember (2 bolts).
- Release the exhaust system from the front, middle right and rear mountings and remove it.

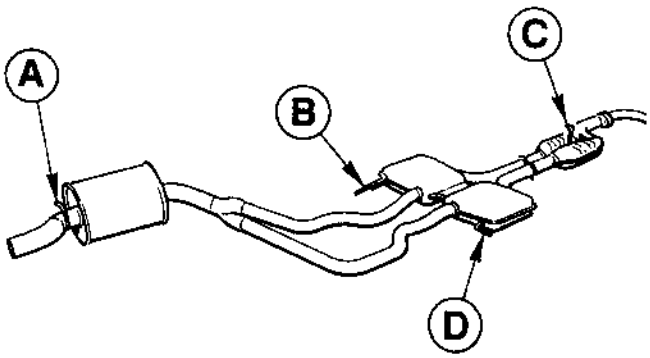


Fig.10. Exhaust system mountings.
(Sierra shown)
A - Rear
B - Middle left (bolted)
C - Front
D - Middle right
(Exhaust system removed for clarity)

Fig.10. Exhaust system mountings.
(Exhaust system removed for clarity)
(Sierra shown)

17. Escort only:
Detach the exhaust system complete, Fig.11:

- Disconnect the exhaust system at the front flange (2 bolts).
- Detach the left-hand middle exhaust mounting bracket from the rear axle crossmember (2 bolts).
- Unhook the exhaust system for the front, right-hand middle and the two rear mountings and remove it.
- Remove the front exhaust pipe.

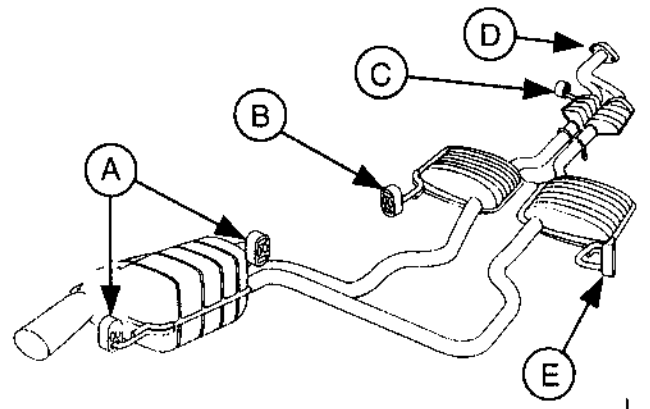


Fig.11. Exhaust mountings.
(Exhaust system removed for clarity)
(Escort shown)
A - Rear
B - Left-hand middle - bolted
C - Front
D - Flange
E - Right-hand middle

Fig.11. Exhaust mountings.
(Exhaust system removed for clarity)
(Escort shown)

0392

18. Detach the exhaust mounting bracket from the transfer box (1 bolt).

19. Release the exhaust system heat shield from the floor assembly (7 clips), Fig.12.

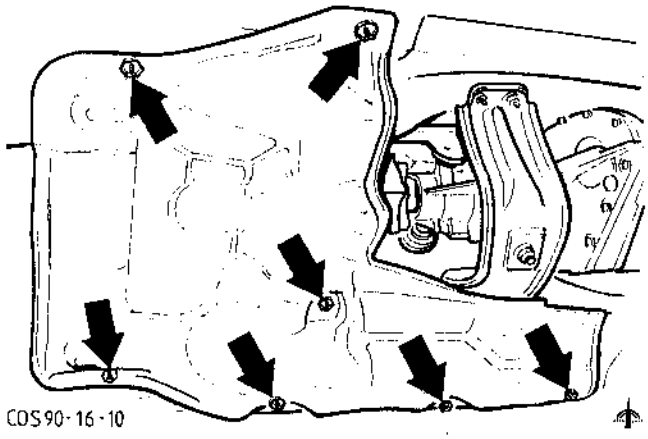


Fig.12. Heat shield fixture.

20. Unscrew the three driveshaft retaining nuts from the Torx studs on the output flange, Fig.13 (B), holding the Torx studs with a Torx socket wrench (see PROPRIETARY TOOLS).

    Unscrew the two centre bearing retaining bolts and remove them with the U-shaped washers, Fig.13 (A).

    Unscrew the four retaining bolts from the rear axle drive flange.

    Remove the driveshaft complete.

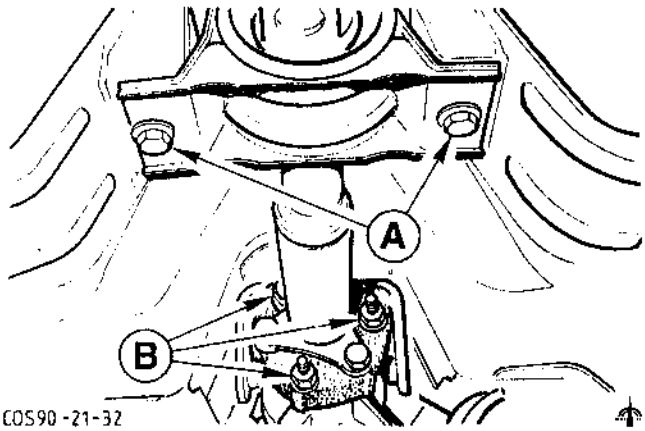


Fig.13. Driveshaft fixture.
A - Centre bearing bolts
B - Output flange nuts

21. Remove the driveshaft to the front axle (4 Torx bolts), Fig.14 (B).

NOTE: To prevent oil escaping, close the opening in the transfer box with a blind plug or, if available, a short length of shaft (old driveshaft), Fig.14 (A).

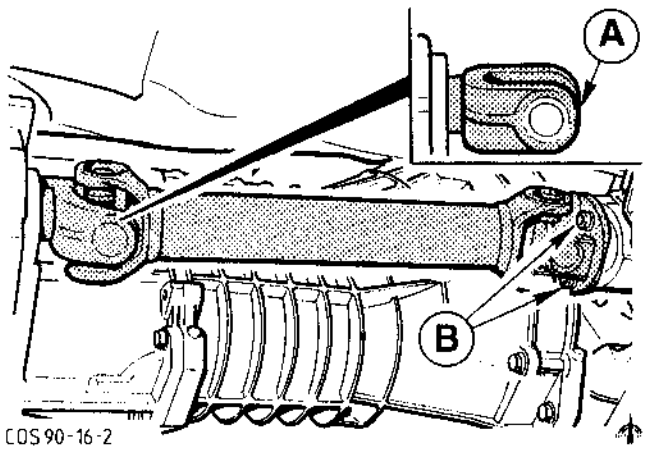


Fig.14. Driveshaft to front axle.
A - Short length of old driveshaft
B - Two retaining bolts (two concealed)

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22. Remove the plastic cap, unscrew the wiring (2 nuts) and remove it, Fig.15 (A).

23. Remove the starter motor (3 bolts), Fig.15 (B).

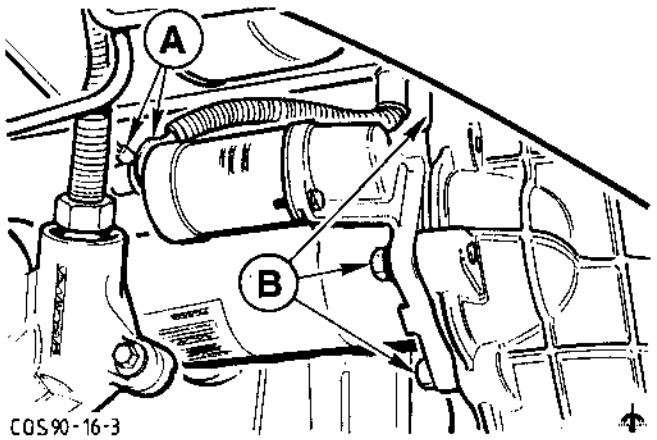


Fig.15. A - Starter motor wiring
B - Starter motor retaining bolts

24. Pull off the rubber gaiter over the clutch cable and disconnect the clutch cable from the clutch release lever, Fig.16.

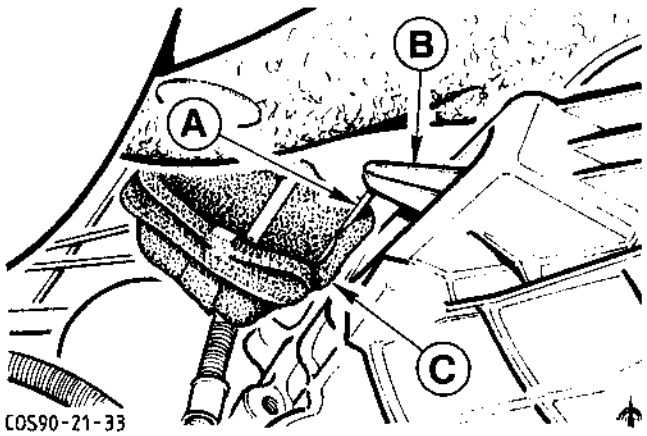


Fig.16. A - Rubber gaiter
B - Clutch cable
C - Clutch release lever

25. Support the transmission assembly on a jack. Unscrew the five transmission mounting/ crossmember retaining nuts and remove the transmission crossmember from the floor assembly, Fig.17.

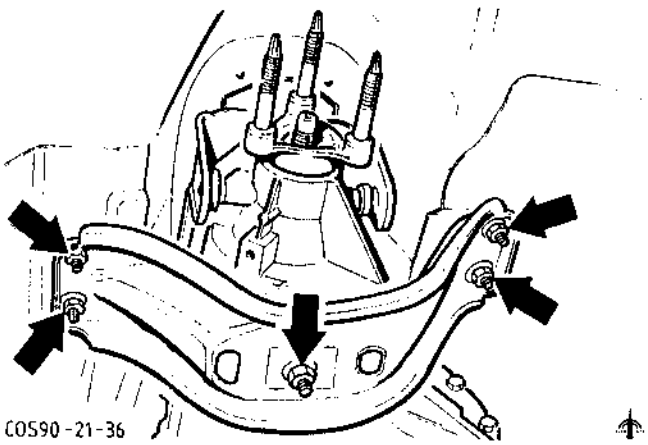


Fig.17. Transmission crossmember retaining nuts.

0392

26. Unscrew the gearshift support bracket from the transfer box and from the rear transmission housing (4 bolts, 2 shims). Prise out the retaining clip and withdraw the shift rod from the coupling, Fig.18.

Fig.18. Gearshift support bracket.
A - Retaining clip
B - Retaining bolts with shims
C - Shift rod
D - Left hand retaining bolt

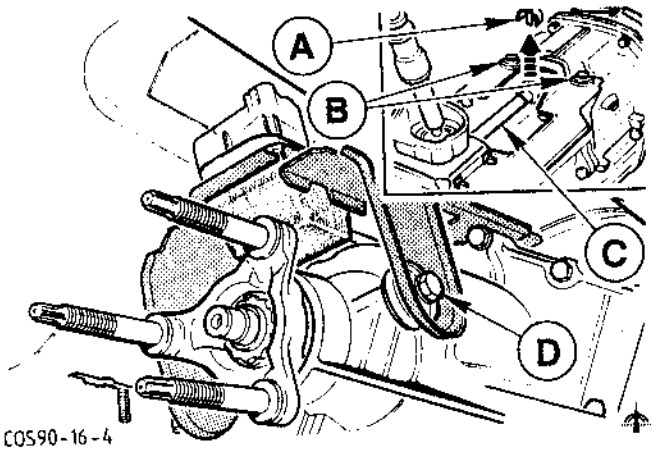


Fig.18. Gearshift support bracket.

27. Hold the gearshift support bracket in position by resting it on a length of bent steel rod, Fig.19.

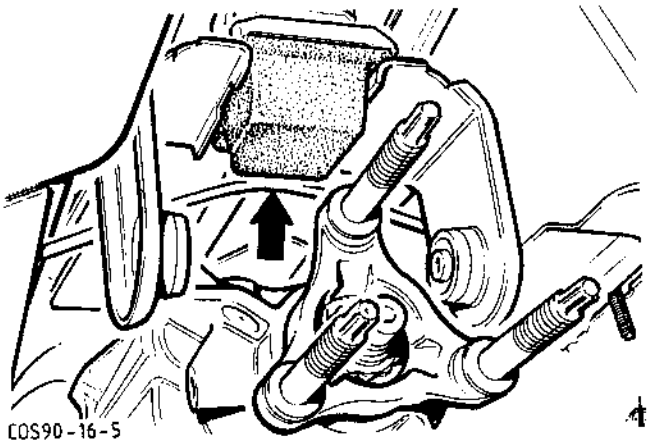


Fig.19. Gearshift support bracket resting on length of steel rod.

28. Disconnect the multiplug from the reversing light switch, Fig.20.

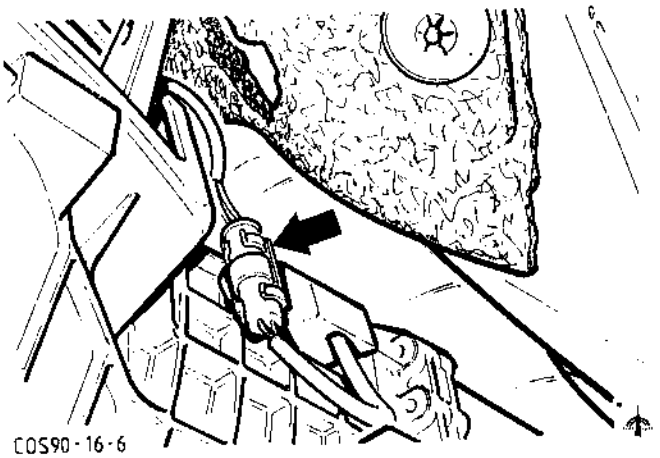


Fig.20. Multiplug of reversing light switch.

0392

29. Unscrew the transmission housing flange bolts from the cylinder block/sump (6 flange bolts) and remove the engine earth lead, Fig.21.

Fig.21. Transmission housing flange bolts in cylinder block/sump.
A - Left-hand side
B - Right-hand side
C - Earth lead

30. Unscrew the cylinder block flange bolts from the transmission housing (4 flange bolts) and remove the two positive lead brackets (Sierra) and the earth lead (Escort) Fig.22.

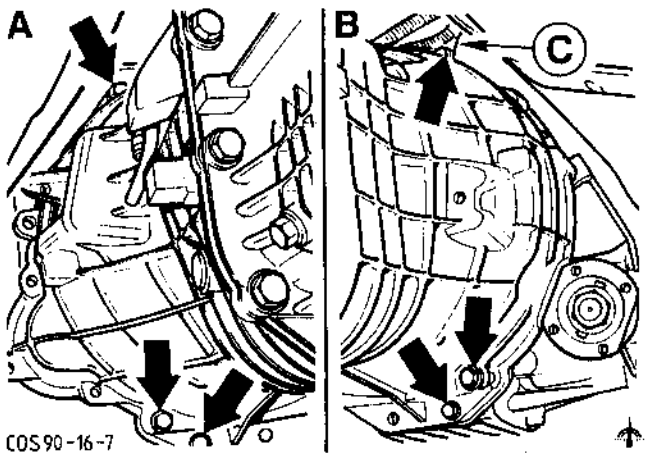


Fig.21. Transmission housing flange bolts in cylinder block/sump.

Fig.22. Cylinder block flange bolts in transmision housing.
A - Left-hand side
B - Right-hand side
C - Positive lead brackets

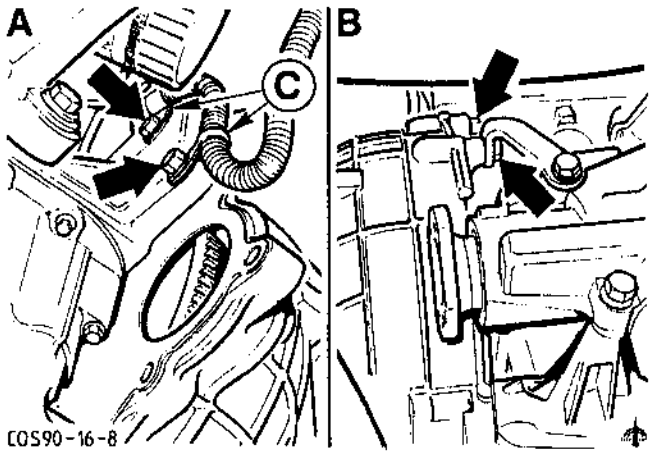


Fig.22. Cylinder block flange bolts in transmission housing.
(Sierra shown)

31. Separate the transmission from the engine.

To Install

NOTE: When installing, tighten the nuts and bolts to the torques specified in Technical Data. Renew all self-locking nuts that were removed.

32. If necessary, transfer the front transmission housing locating sleeves to the cylinder block.

33. Hold the clutch release lever in position and fix it with a rubber band.
Lightly grease the input shaft (see Technical Data for grease specification), Fig.23.

34. Locate the transmission in position on the jack. Bring the transmission flange into contact with the engine flange and insert the flange bolts, connecting the engine earth lead and the two positive lead brackets at the same time, Figs.21 and 22.

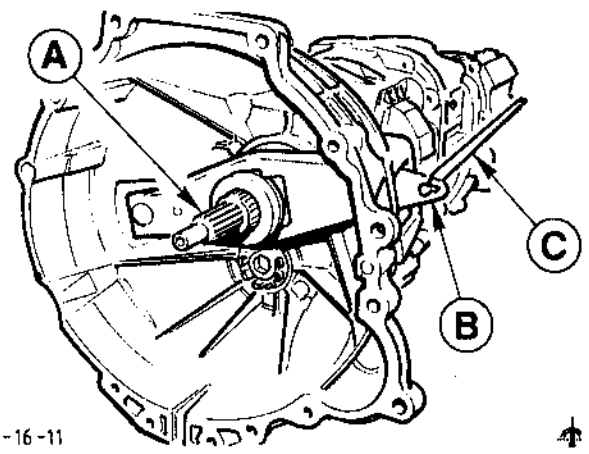


Fig.23. A - Input shaft splines
B - Clutch release lever
C - Rubber band

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35. Connect the multiplug of the reversing light switch, Fig.24.

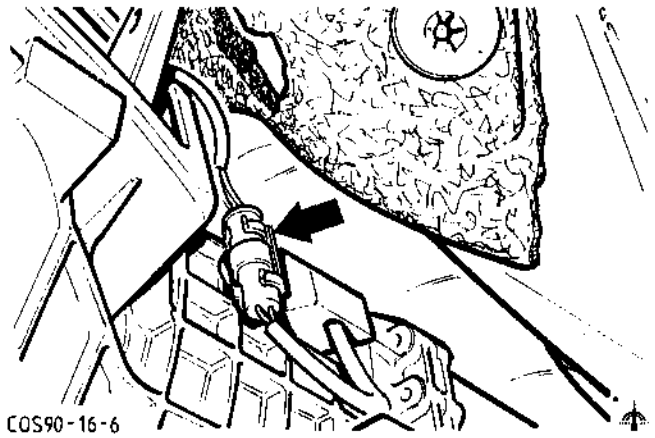


Fig.24. Multiplug of reversing light switch.

36. Remove the steel rod.

Position the gearshift support bracket on the transfer box, guide the shift rod into the coupling and secure it with the retaining clip. Secure the gearshift support bracket to the transfer box and to the rear transmission housing, Fig.25.

Fig.25. Gearshift support bracket.
A - Retaining clip
B - Retaining bolts with shims
C - Shift rod
D - Left-hand retaining bolt

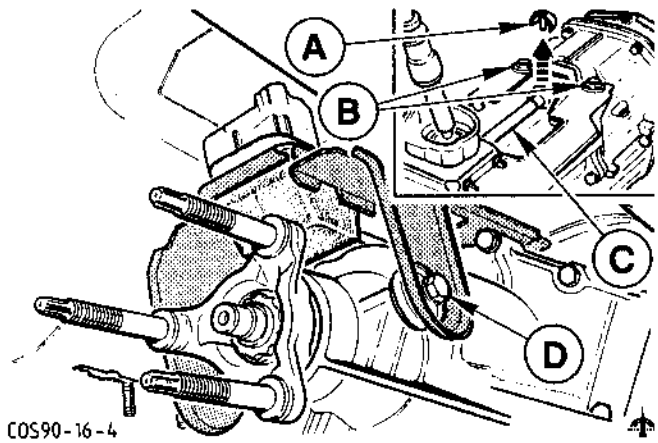


Fig.25. Gearshift support bracket.

37. Lift the transmission on the jack and secure the transmission crossmember to the transmission mounting and the floor assembly, Fig.26.

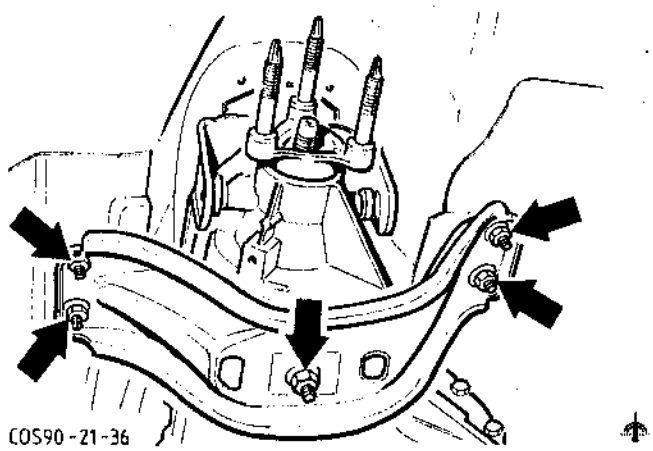


Fig.26. Transmission crossmember retaining nuts.

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38. Connect the clutch cable to the clutch release lever and refit the rubber clutch cable gaiter in the front transmission housing, Fig.27.

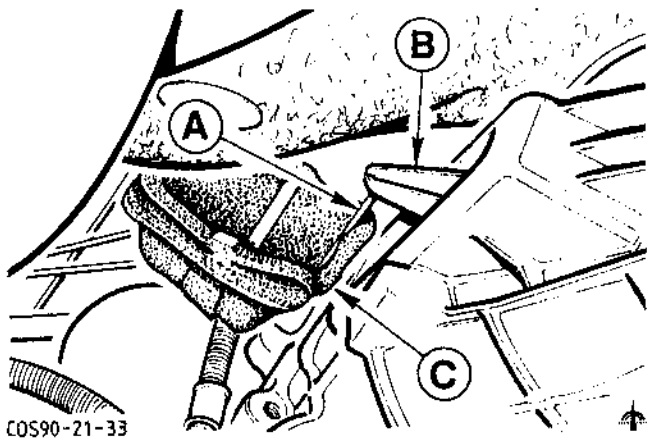


Fig.27. A - Rubber gaiter
B - Clutch cable
C - Clutch release lever

39. Fit the starter motor, Fig.28 (B).

40. Connect the starter motor wiring and the connector and fit the plastic cap over the starter motor terminal, Fig.28 (A).

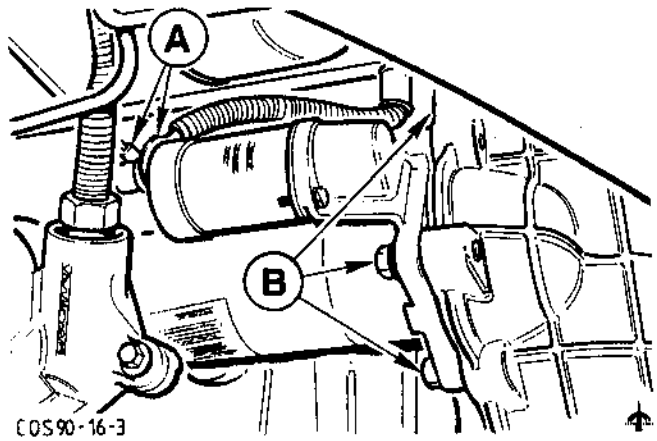


Fig.28. A - Starter motor wiring
B - Starter motor retaining bolts

41. Remove the blind plug or the length of old shaft from the transfer box. Insert the front driveshaft in the transfer box and secure it to the front axle drive flange, Fig.29.

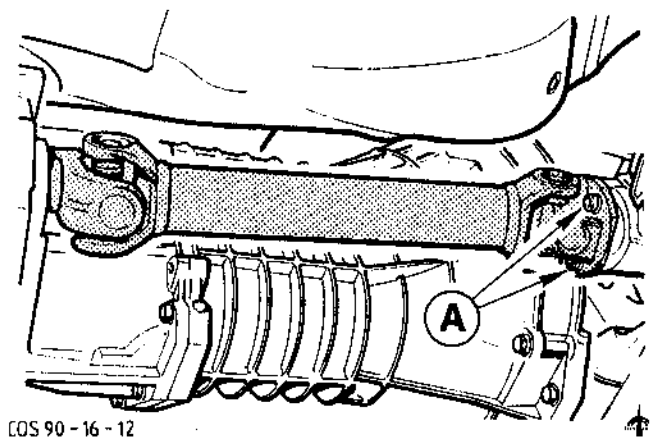


Fig.29. Front driveshaft.
A - Two retaining bolts (two concealed)

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42. Assemble the driveshaft to the rear axle if separated.

NOTE: When assembling, guide the master spline into the double groove, Fig.30.

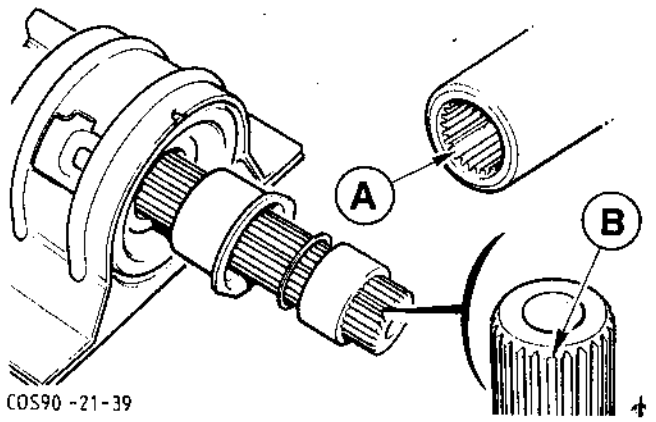


Fig.30. Driveshaft to rear axle separated.
A - Master spline
B - Double groove

43. Before fitting the rubber coupling of the driveshaft to the transmission output flange, check that the studs are seated securely in the transmission output flange. To do this, locate a torque wrench with a Torx socket (see PROPRIETARY TOOLS) on the Torx head and apply the specified torque in the tightening direction. Remove any studs which turn and refit them as follows:

- Clean the threaded holes in the transmission output flange, Fig.31 (C), and the threads of the studs, Fig.31 (A), to remove all traces of grease and dirt.
- Apply two drops of thread-locking compound (see Technical Data) offset at 180° on the flange-end thread of the stud, Fig.31 (B).
- Insert the stud and tighten it to the specified torque.

NOTE: The stud must be tightened completely within a maximum of 5 minutes of applying the thread-locking compound.

- Let the thread-locking compound harden for 30 minutes.

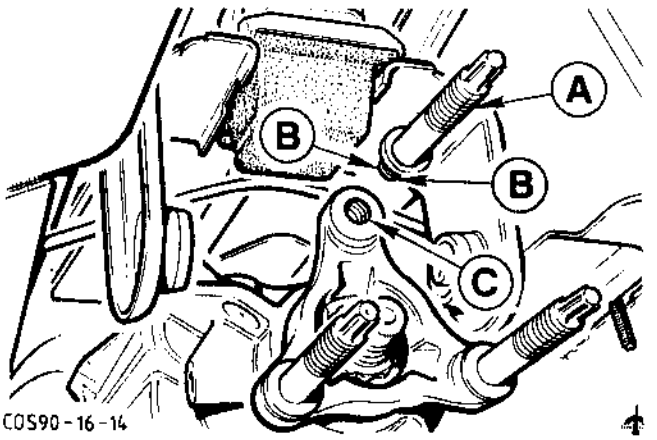


Fig.31. Transmission output flange with Torx studs.
A - Torx stud
B - Thread-locking compound
C - Threaded holes

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44. Locate the driveshaft in position. Fit the driveshaft to the transmission output flange using new nuts. Connect the driveshaft to the rear axle and fit the driveshaft centre bearing to the floor assembly, Fig.32.

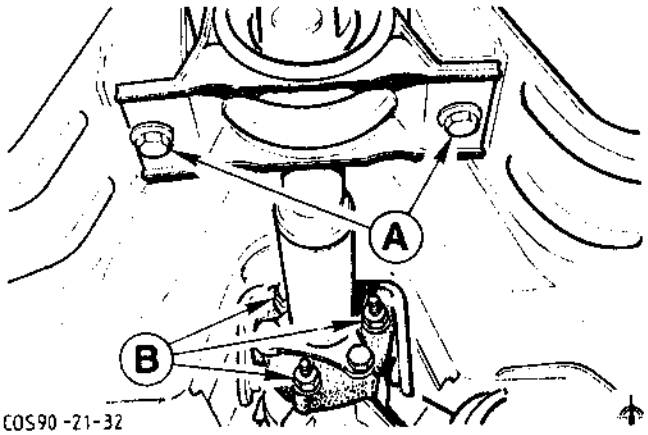


Fig.32. Driveshaft fixture.
A - Centre bearing bolts
B - Output flange nuts

45. Fit the exhaust system heat shield to the floor assembly, Fig.33.

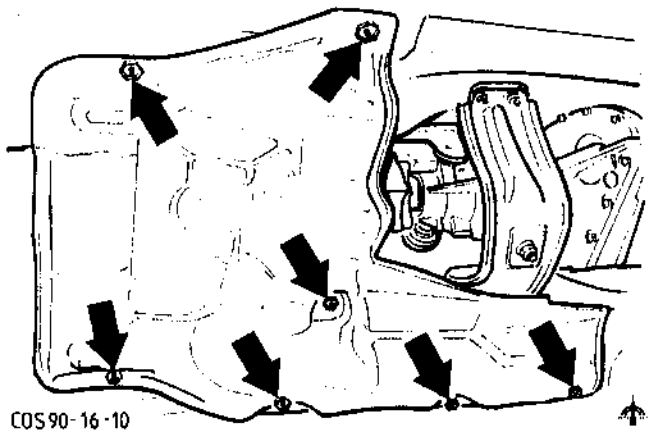


Fig.33. Heat shield fixture.

46. Fit the exhaust mounting bracket to the transmission box, Fig.34.

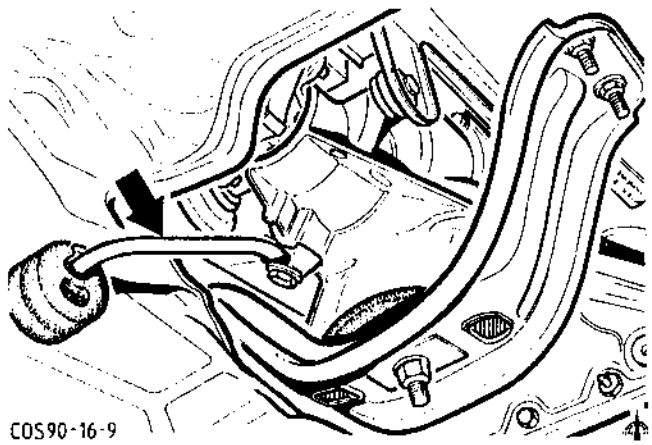
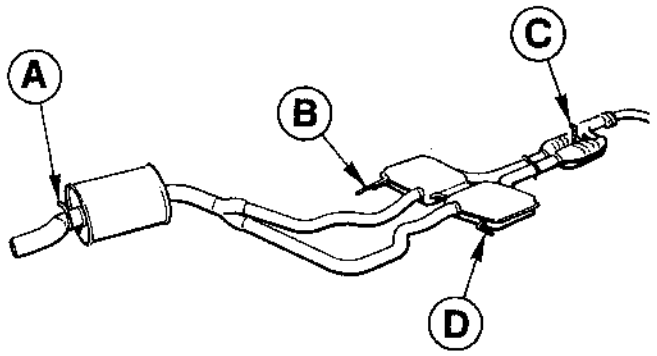


Fig.34. Exhaust mounting bracket on transfer box.

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47. Sierra only:
Fit the exhaust system complete, Fig.35:

- Attach the exhaust system to the rear, right-hand middle and front mountings.
- Fit the left-hand middle exhaust mounting bracket to the rear axle crossmember and attach the exhaust system to the mounting.

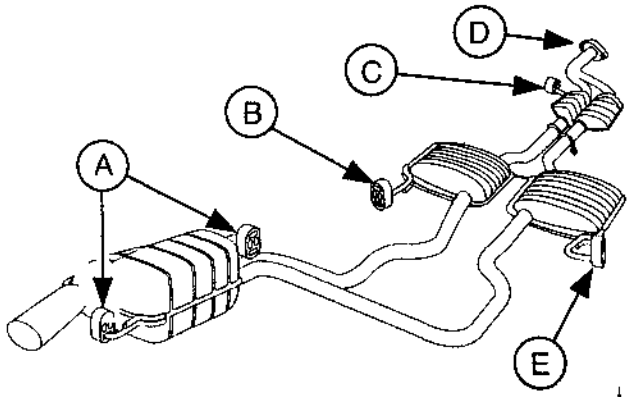


COS90-21-30

Fig.35. Exhaust mountings.
(Exhaust system removed for clarity)
(Sierra shown)
A - Rear
B - Left-hand middle
C - Front
D - Right-hand middle

48. Escort only:
Fit the exhaust system complete, Fig.36:

- Locate the front exhaust pipe in position.
- Attach the exhaust system to the 2 rear, right-hand middle and front mountings.
- Fit the left-hand middle exhaust mounting bracket to the rear axle crossmember and attach the exhaust system to the mounting.
- Connect the exhaust system at the flange.

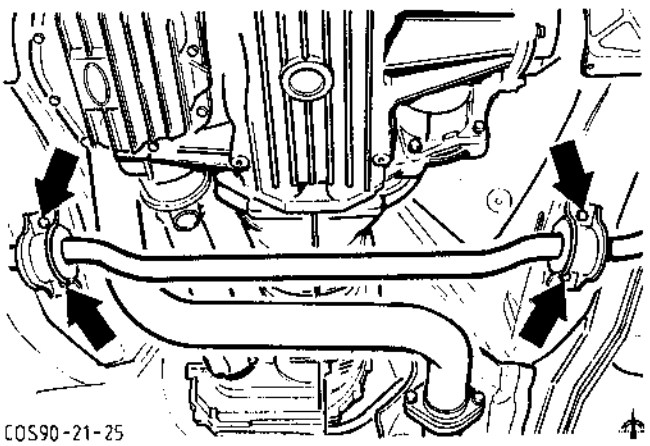


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Fig.36. Exhaust mountings.
(Exhaust system removed for clarity)
(Escort shown)
A - Rear
B - Left-hand middle
C - Front
D - Flange
E - Right-hand middle

49. Fit the stabiliser bracket to the side member on the left and right-hand sides, Fig.37.

NOTE: Make sure the rubber bushes are seated correctly.



COS90-21-25

Fig.37. Retaining bolts of stabiliser bracket.

0392

50. Escort only:
Fit the lower engine cover to the side members and the body, Fig.38.

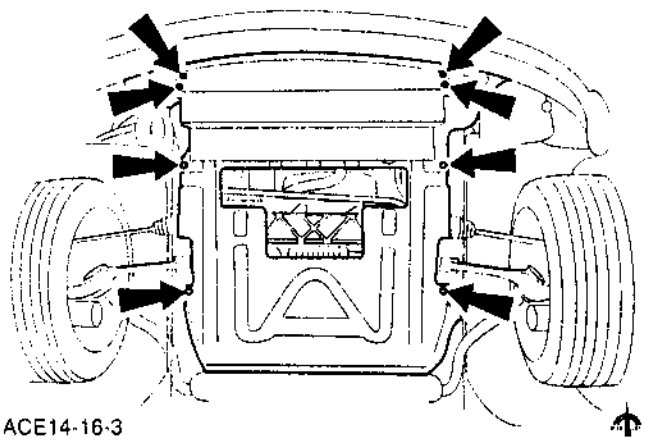


Fig.38. Retaining bolts of lower engine cover. (Escort shown)

51. Sierra only:
Fit the lower engine cover to the side members and the front axle/engine crossmember, Fig.39.

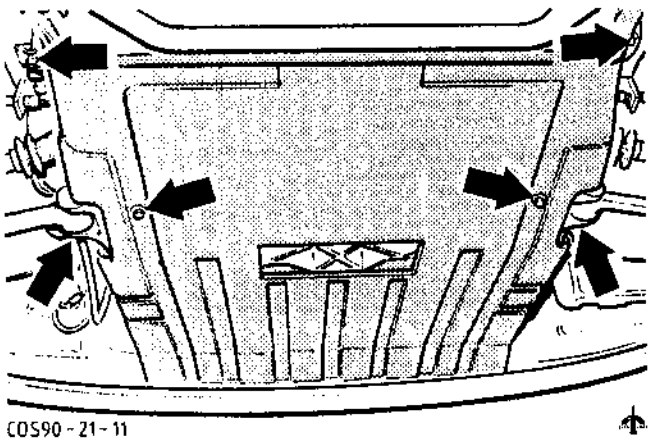


Fig.39. Retaining bolts of lower engine cover. (Sierra shown)

52. Check the oil levels in the transfer box and the transmission and top up as necessary (see Technical Data for quantity and speicfication), Fig.40.

NOTE: To check the oil level in the transmission box take a length of wire 3 mm in diameter and bend 18 mm over at right angles. Insert the wire in the oil level check hole. The end of the wire must point vertically downwards and touch the housing. If the oil level is correct, the end of the wire must be wet with oil.

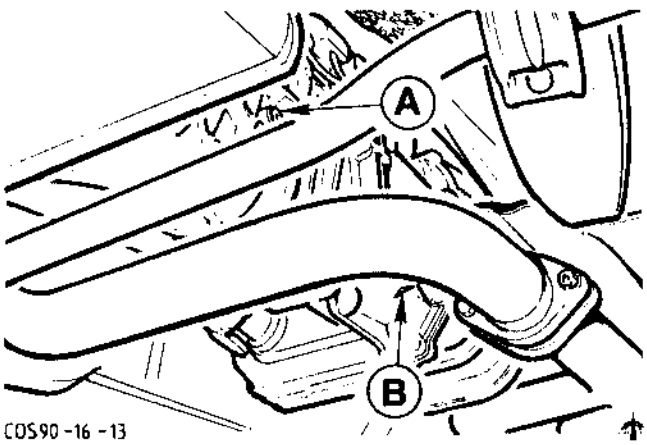


Fig.40. Oil level check plugs.
A - Transmission
B - Transfer box

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54. Connect the front exhaust pipe to the turbocharger, Fig.41.

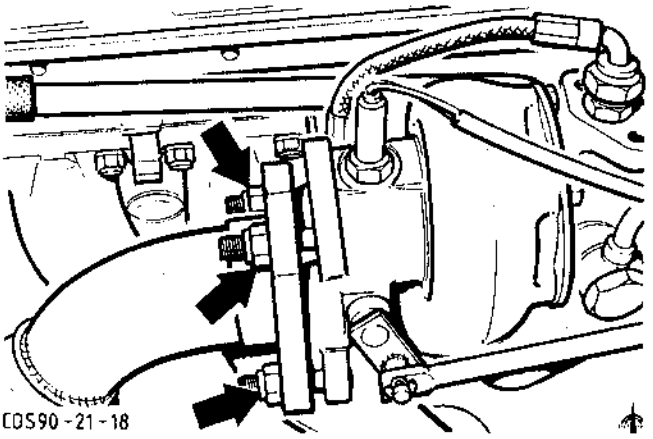


Fig.41. Front exhaust pipe to turbocharger retaining nuts.

55. Sierra only:
Locate the turbocharger heat shield in position and engage it in the 2 lower clips.

Secure the turbocharger heat shield and bracket to the bulkhead and to the bracket on the fender, Fig.42 (A,C,D).

Fig.42. Turbocharger heat shield.
A - Retaining bolt
B - HEGO sensor multiplug
C - Heat shield clips
D - Retaining bolts

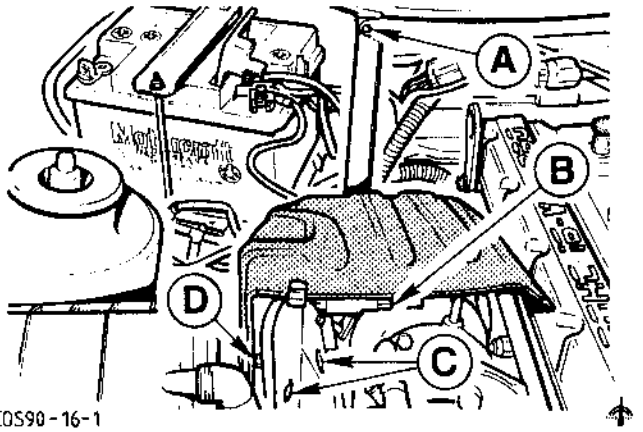


Fig.42. Turbocharger heat shield. (Sierra shown)

56. Sierra only:
Connect the multiplug of the HEGO sensor and clip it to the turbocharger heat shield, Fig.42 (B).

57. Escort only:
Secure the turbocharger heat shield to the bracket, air cleaner casing and fender, Fig.43.

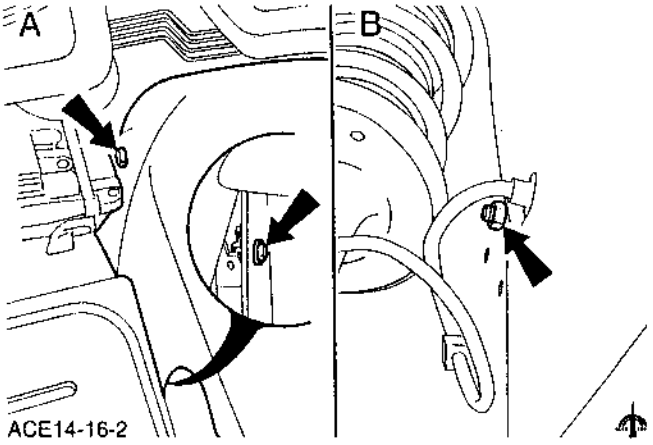


Fig.43. Turbocharger heat sheild fixture. (Escort shown)
A - Bolts
B - Nut in wheelhouse

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58. Escort only:
Connect the HEGO sensor multiplug and clip the wiring in place, Fig.44.

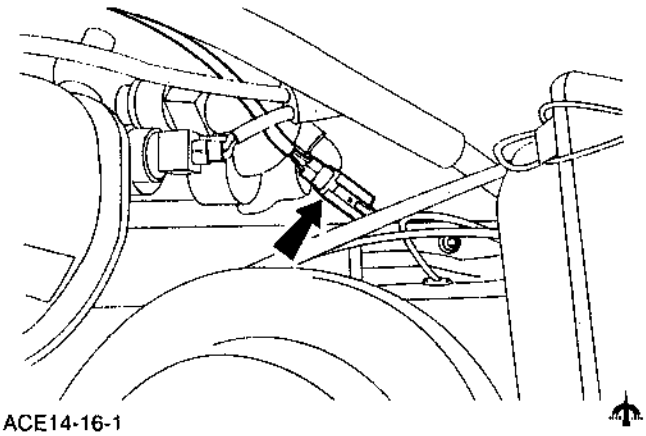


Fig.44. HEGO sensor multiplug. (Escort shown)

Sub-operations 59 to 63 apply to Sierra only:

59. Remove the support from under the clutch pedal. Slip the noise damping pad retaining frame and noise damping pad over the gear lever and secure them, Fig.45 (D, E, F).

Fig.45. Gaiters and noise damping pad retaining frame.
A - Outer gaiter
B - Cable tie
C - Inner gaiter
D - Noise damping pad retaining frame
E - Retaining screws
F - Noise damping pad

60. Slip the inner gear lever gaiter over the gear lever and pull it down onto the retaining frame, Fig.45 (C).

61. Fit the outer gear lever gaiter over the gear lever and pull it up inside out.

Secure the gaiter with a cable tie and refit it in position, Fig.45 (A, B).

62. Secure the retaining frame to the console, Fig.46 (C, D).

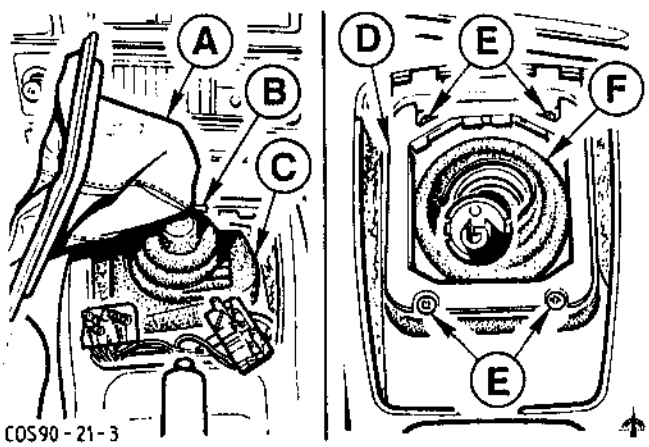


Fig.45. Gaiters and noise damping pad retaining frame.

Fig.46. Gear lever with gaiter retaining frame.
A - Gear lever knob
B - Cover plate
C - Retaining frame
D - Screw securing retaining frame
E - Multiplugs of electric window switches

63. Connect the two multiplugs of the electric window switches and clip the switches into place in the cover plate.

Insert the cover plate in the retaining frame and refit the gear lever knob, Fig.46 (A, B, E).

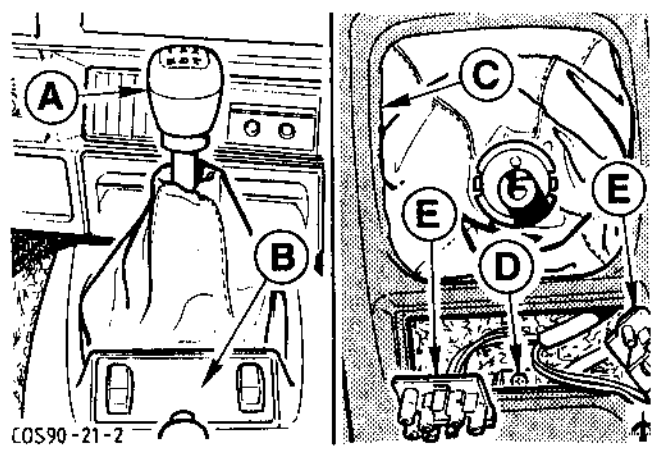


Fig.46. Gear lever with gaiter retaining frame.

56. Connect the battery earth cable.

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16 118 8 TRANSMISSION - OVERHAUL (MT-75/4x4)

SPECIAL SERVICE TOOLS REQUIRED:

Transfer box radial oil seal installer	14-028
Universal flange holding wrench	15-030-A
Counter shaft roller bearing installer	15-036
Remover (basic tool)	15-050
Output flange oil seal installer	15-058
Installer	15-064
Input shaft socket wrench	15-073
Guide sleeve socket wrench	16-040
Transmission housing remover and installer	16-041
Adaptor for front transmission housing	16-041-01
Adaptor for mainshaft removal	16-041-02
Adaptor for output flange oil seal	16-043-A
Guide sleeve oil seal installer	16-044
Roller bearing inner ring remover	16-050
Mainshaft nut socket wrench	16-051
Mounting bracket	16-052
Mainshaft installer	16-053
Installer for double-lipped radial oil seal	16-054
Universal spindle	21-023
Selector shaft ball sleeve extractor	21-036-A
Selector shaft ball sleeve extractor	21-037-B
Selector shaft ball sleeve installer	21-044-A
Transfer box radial oil seal extractor	21-051

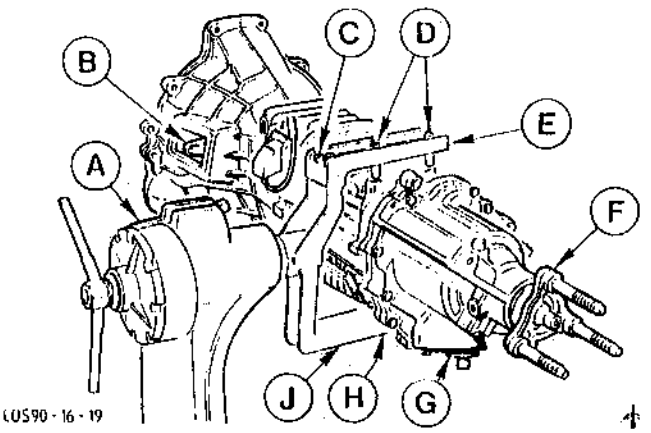


Fig.1. MT-75/4x4 transmission mounted on stand.
- A - Assembly stand
- B - Clutch release lever
- C - Mounting bracket connecting bolts
- D - Mounting bracket retaining bolts
- E - Upper part of mounting bracket
- F - Output flange
- G - Transmission mounting
- H - Clamp bolt of transmission mounting bracket
- J - Mounting bracket

To Dismantle

NOTE: When assembling, replace all the snap rings and circlips and fit replacements of the appropriate thickness so as to eliminate all end float. Refer to the Parts Microfiche for the selection of available snap rings and circlips. Replace all seals.
When assembling, tighten the nuts and bolts to the torques specified in Technical Data.
All running and sliding faces of transmission components and transfer box components for which no particular oil is specified must be lubricated with transmission fluid (for transmission components) or automatic transmission fluid (for transfer box components).

1. Fit the transmission on the assembly stand using mounting bracket 16-052 and universal spindle 21-023.

2. Remove the clutch release lever with the release bearing. Unbolt the transmission mounting (2 bolts), Fig.1. Remove the Torx studs from the output flange using a Torx socket wrench (see "PROPRIETARY TOOLS").

3. Unscrew the oil drain plug and the oil filler plug from the transmission. Drain off the transmission fluid. Unscrew the oil drain plug from the transfer box and drain off the automatic transmission fluid, Fig.2.

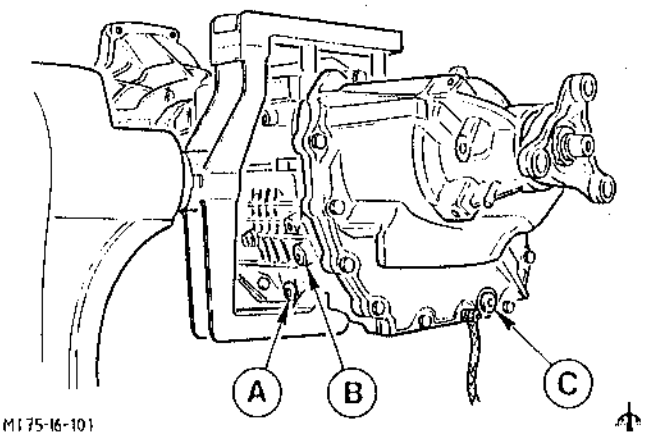


Fig.2. A - Transmission oil drain plug
B - Transfer box oil filler plug
C - Transfer box oil drain plug

4. Remove the output flange nut from the transmission mainshaft using a 30 mm double hexagon socket wrench (see Proprietary Tools). Hold the flange with Special Tool 15-030-A, Fig.3.

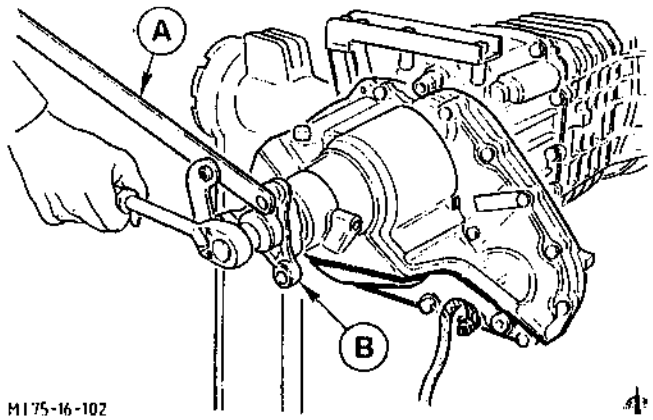


Fig.3. Remove output flange nut.
A - Special Tool 15-030
B - Output flange

5. Hold the output flange with Special Tool 15-030-A and pull it off the transmission mainshaft using a conventional three-legged puller, Fig.4.

Fig.4. Pull off output flange.
A - Output flange
B - Three-legged puller
C - Special Tool 15-030-A

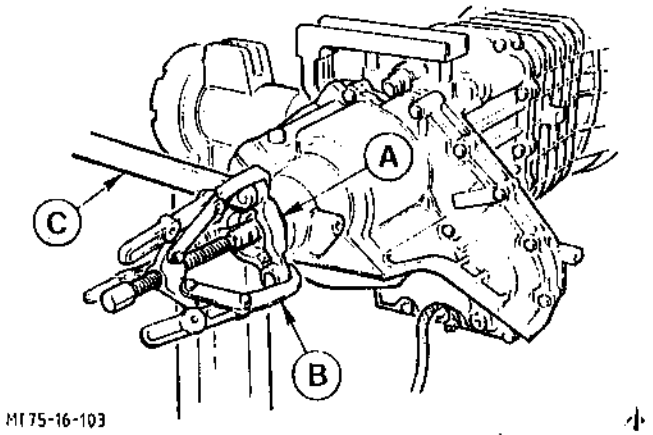


Fig.4. Pull off output flange.

6. Remove the output flange oil seal from the transfer box using Special Tool 21-051, Fig.5.

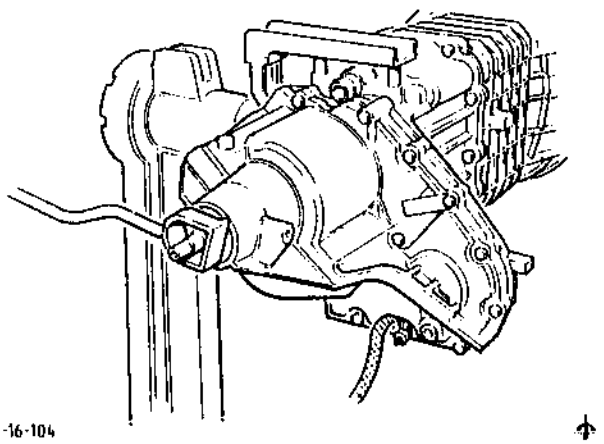


Fig.5. Remove oil seal using Special Tool 21-051.

7. Drive the upper and lower pins out of the transfer box.
Unscrew the 15 transfer box retaining bolts, Fig.6. Unscrew the nuts and remove the earth strap.

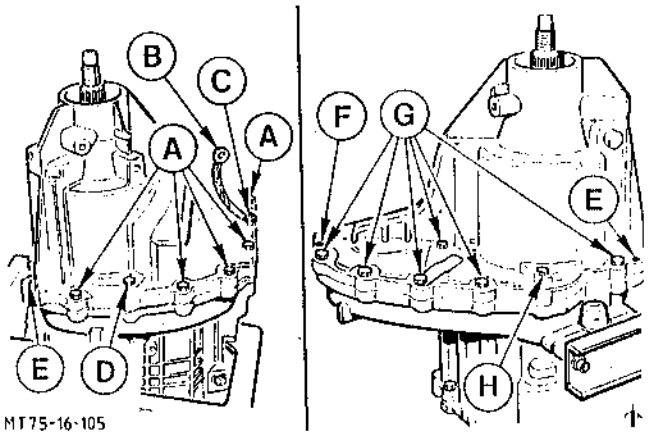


Fig.6. Transfer box retaining bolts.

Fig.6. Transfer box housing/rear transmission housing retaining bolts.
A - Short bolts - left-hand lower half
B - Earth strap
C - 2 nuts, 1 stud
D - Long bolt - left-hand lower half
E - Upper locating dowel
F - Lower locating dowel
G - Short bolt - right-hand upper half
H - Long bolt - right-hand upper half

8. Carefully prise the transfer box housing away from the transmission housing with 2 suitable levers, placing a block of wood under the levers, Fig.7.
Remove the transfer box housing.

NOTE: Do not damage the mating faces.

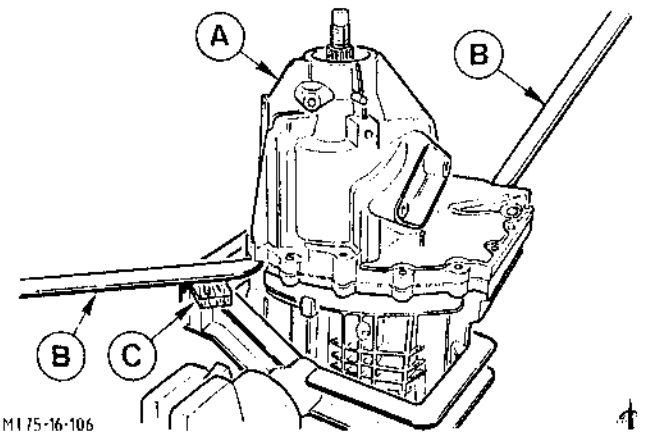


Fig.7. Remove transfer box.

Fig.7. Remove transfer box.
A - Transfer box housing
B - Lever
C - Block

9. Remove the magnetic disc and the shim on the planetary gear carrier, Fig.8.

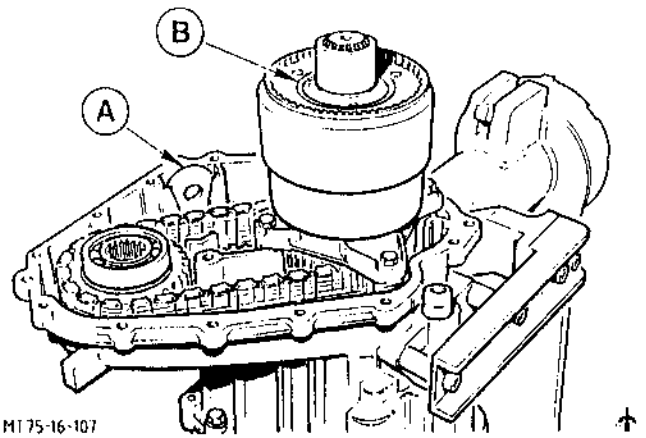


Fig.8. A - Magnetic disc
B - Shim

10. Remove the planetary gear train complete with the viscous coupling and annulus, Fig.9.

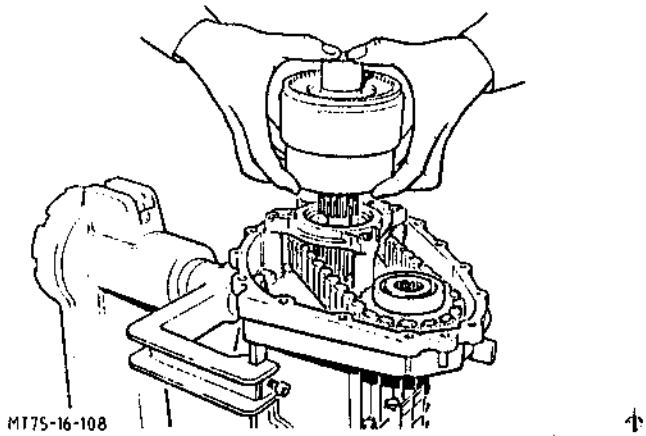


Fig.9. Lift off planetary gear train complete with viscous coupling and annulus.

11. Unscrew the 2 short and the 2 long retaining bolts from the drive sprocket bearing housing, Fig.10, and remove them with the U-shaped washers.

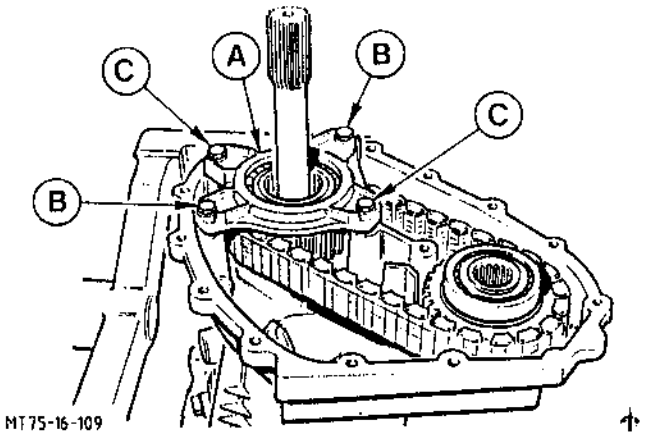


Fig.10. A - Bearing housing
B - Short bolts
C - Long bolts

12. Prise off the drive sprocket bearing housing with 2 levers with hardwood blocks between the levers and the mating face, Fig.11.

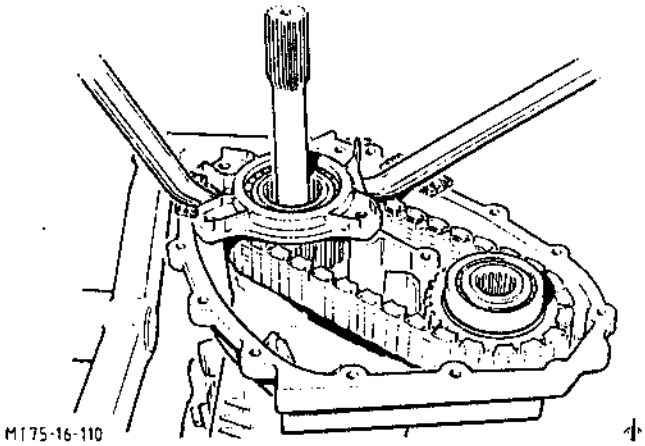


Fig.11. Prise off bearing housing with 2 levers.

13. Withdraw the radial oil seal for the driveshaft to the front axle box using Special Tool 21-051, Fig.12.

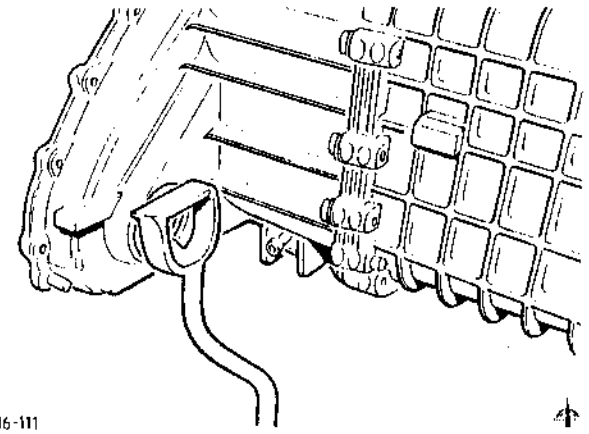


Fig.12. Extract radial oil seal using Special Tool 15-051.

14. Remove the driving and the driven sprocket each with its 2 ball bearings by applying even pressure on the upper ball bearing of the driving sprocket with 2 levers (on hardwood blocks) while simultaneously driving the driven sprocket and its ball bearings out of the housing using Special Tool 16-044, Fig.13.

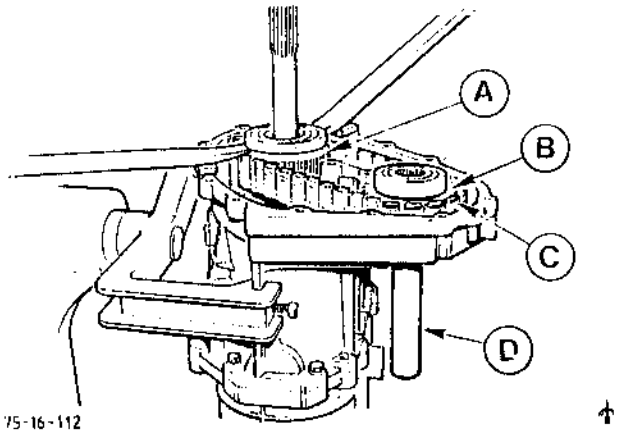


Fig.13. A - Driving sprocket
B - Driven sprocket
C - Chain
D - Special Tool 16-044

15. Press the selector shaft in to engage 4th gear. Unscrew the transmission mainshaft nut using Special Tool 16-051, Fig.14A., while holding the input shaft with Special Tool 15-073 and a spanner, Fig.14B.

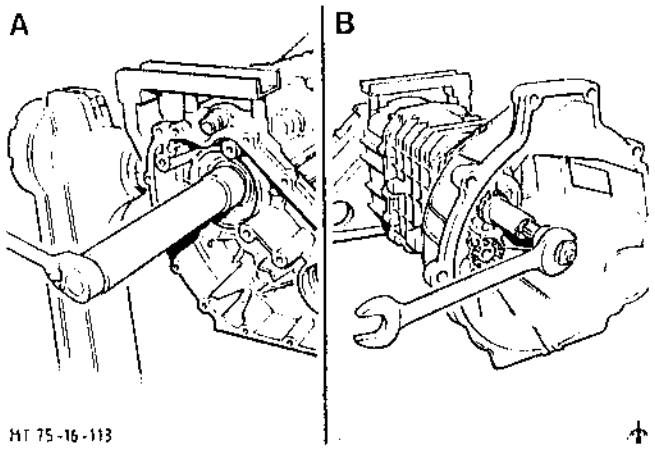


Fig.14. Unscrew transmission mainshaft nut.
A - Unscrew transmission mainshaft nut using Special Tool 16-051
B - Hold input shaft with Special Tool 15-073 and spanner

Fig.14. Unscrew transmission mainshaft nut.

16. Remove the retainer from the countershaft bearing housing (1 bolt), Fig.15A. Remove the countershaft bearing housing using a conventional 17 mm hexagon socket, Fig.15B.

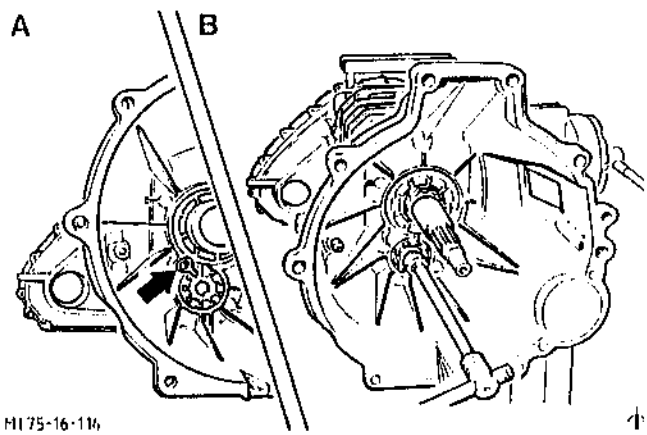


Fig.15. Countershaft bearing housing.
A - Remove circlip
B - Remove bearing housing

17. Remove the clutch release bearing guide sleeve using Special Tool 16-040, Fig.16. Remove the steel washer from the guide sleeve.

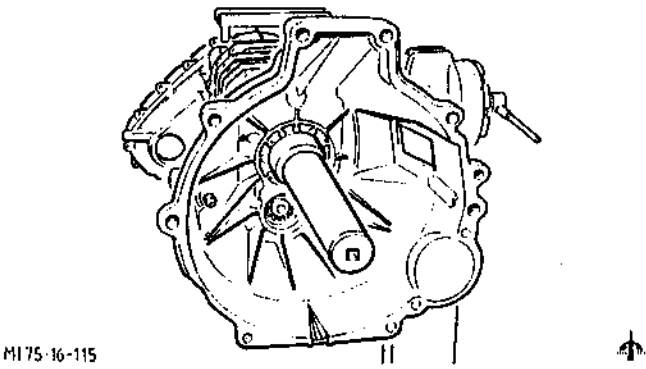


Fig.16. Remove clutch release bearing guide sleeve using Special Tool 16-040.

18. Remove the input shaft inner circlip, Fig.17.

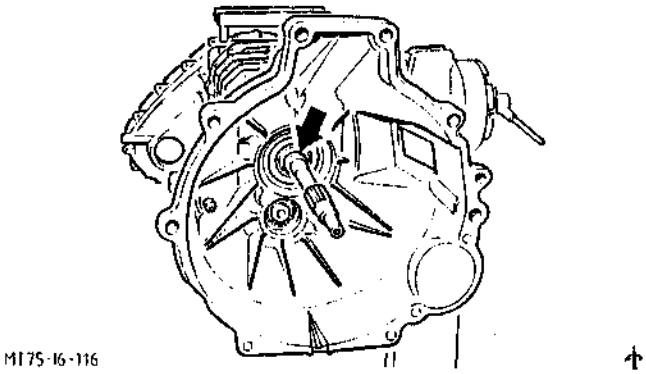


Fig.17. Input shaft inner circlip.

19. Unscrew the threaded plug of the selector detent mechanism. Remove the spring and pin. Extract the sleeve with circlip pliers. Remove the ball, Fig.18.

Fig.18. Selector shaft detent mechanism.
A - Threaded plug
B - Spring
C - Pin
D - Circlip pliers
E - Sleeve
F - Ball

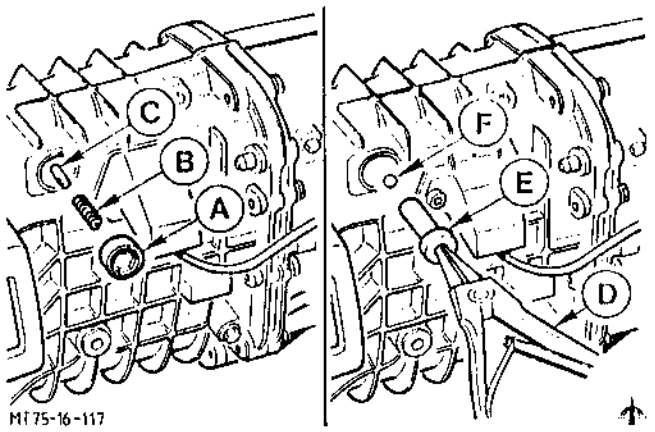


Fig.18. Selector shaft detent mechanism.

20. Remove the locking plate detent screw. Remove the reversing light switch (2 screws).
Loosen the 2 (blue) bolts of the reverse gear idler shaft but only remove the front bolt, Fig.19.

Fig.19. Bolts/screws on left-hand side of transmission.
A - Reversing light switch with retaining screws
B - Detent screw of locking plate/ transmission breather
C - Rear bolt of reverse gear idler shaft
D - Front bolt of reverse gear idler

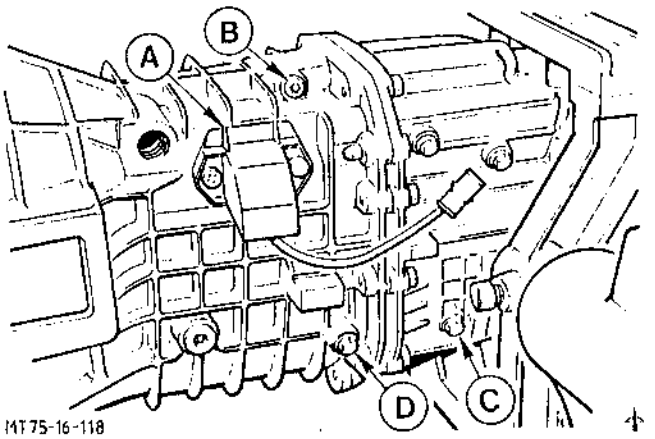


Fig.19. Bolts/screws on left-hand side of transmission.

To Remove Front Transmission Housing

NOTE: Do not hammer back the locating dowels.

21. Undo and remove the 10 transmission housing retaining bolts, Fig.20.

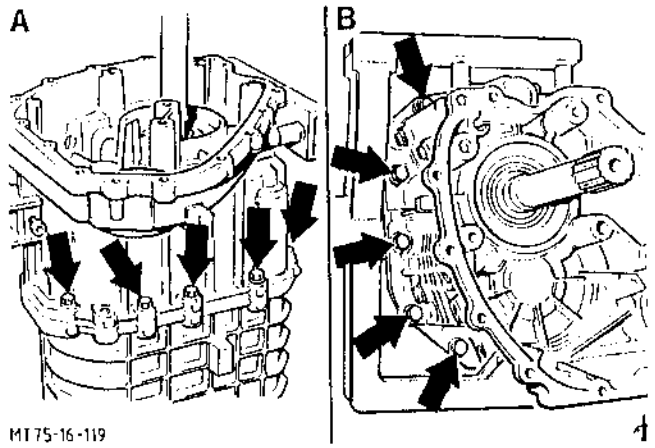


Fig.20. Transmission housing retaining bolts.
A - Right-hand side
B - Left-hand side

22. Separate the transmission housing sections. Screw in a transmission housing retaining bolt part of the way. Position a lever under the bolt. Carefully separate the transmission housing sections using 2 levers, Fig.21.

NOTE: Do not apply the levers on the mating faces.

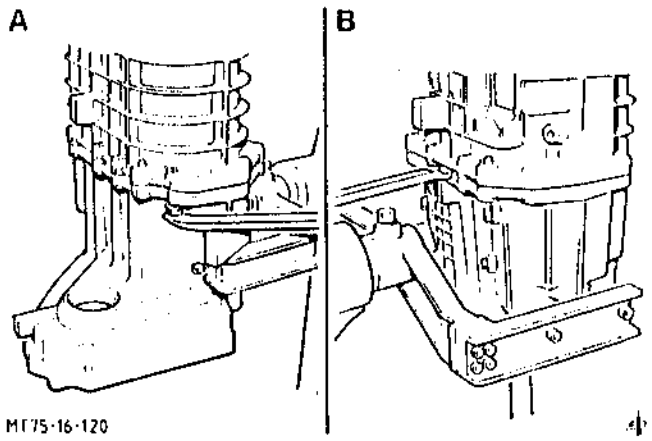


Fig.21. Separate transmission housing sections.
A - Leverage point on right-hand side with inserted bolt and block
B - Leverage point on left-hand side

Fig.21. Separate transmission housing sections.

23. Pull the front transmission housing off the rear transmission housing. To do this, screw Special Tools 16-041 and 16-041-01 into the threaded hole of the guide sleeve. Carefully pull the front transmission housing off the rear transmission housing, Fig.22.

NOTE: Before screwing in the Special Tool, check the threaded hole and the thread of the Special Tool for damage or dirt. After fitting, unscrew the adaptor (16-041-01) a quarter turn by hand. The front transmission housing must come away from the locating dowels easily. Do not apply any appreciable pressure to the input shaft via the Special Tool when separating the housing halves as this could damage the 4th gear synchronizer ring. If necessary, use levers to assist with the separating operation but do not apply the levers on the mating faces.

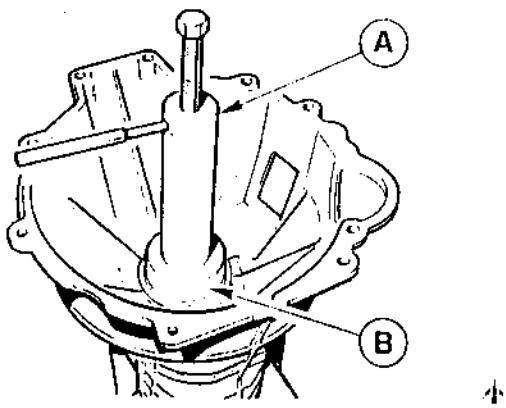


Fig.22. Pull off front transmission housing.
A - Special Tool 16-041
B - Special Tool 16-041-01

To Remove the Transmission Mainshaft and Gear Assembly:

24. Withdraw the auxiliary selector shaft from the 3rd/4th gear selector fork. Remove the 3rd/4th gear selector fork from the 3rd/4th gear synchronizer unit.

Unscrew the second bolt of the reverse gear idler shaft. Remove the magnetic disc from the rear transmission housing, Fig.23.

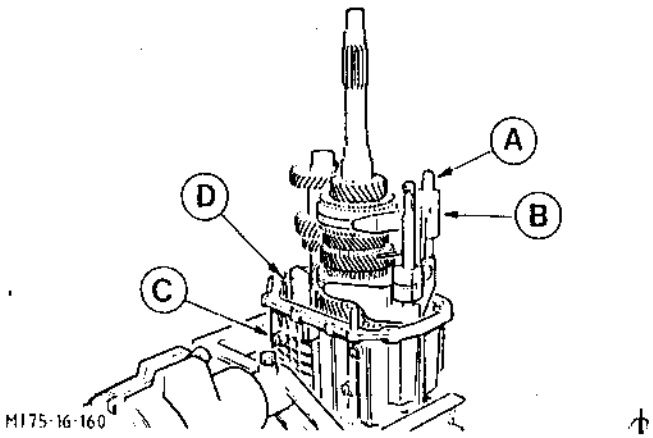


Fig.23. Remove transmission components.
A - Auxiliary selector shaft
B - 3rd/4th gear selector fork
C - Bolt of reverse gear idler shaft
D - Magnetic disc

Fig.23. Remove transmission components.

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NOTE: Before pressing the transmission mainshaft out of the bearing in the rear transmission housing, move the selector shaft to the "neutral position" so that the guide pin cannot be broken off the selector pin holder.

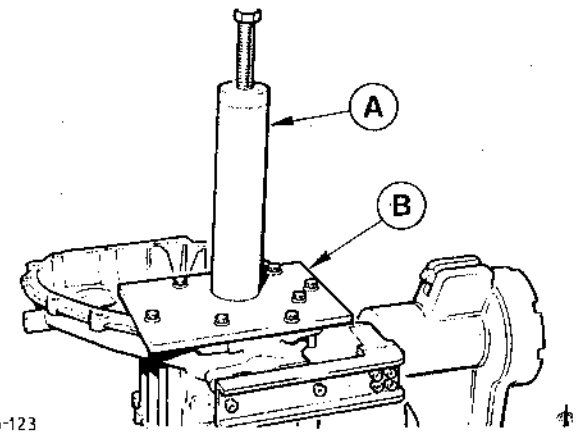


Fig.24. Special Tools attached.
A - Special Tool 16-041
B - Special Tool 16-041-02

25. Turn the transmission housing through 180°. Slide Special Tool 16-041 over the mainshaft. Secure Special Tool 16-041-02 to the rear transmission housing with 7 bolts, Fig.24.

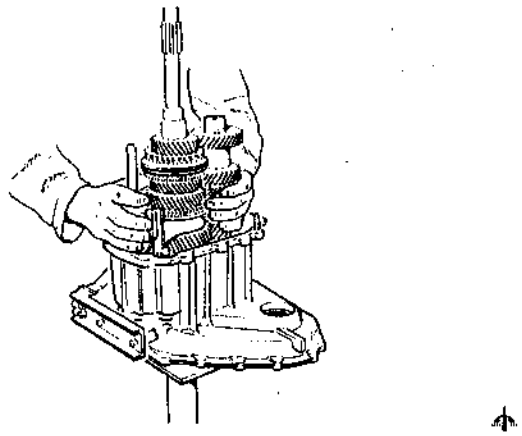


Fig.25. Lift out complete gear assembly with main selector shaft.

26. Swivel the transmission so that the tool is at the bottom. Press the transmission mainshaft upwards out of the bearing in the transfer box using Special Tool 16-041, Fig.24.
Lift the input shaft, transmission mainshaft, countershaft, main selector shaft and reverse gear idler shaft assembly out of the transmission housing, Fig.25.

NOTE: Hold the transmission components together with cable ties to facilitate removal.

Remove the Special Tools from the transfer box.

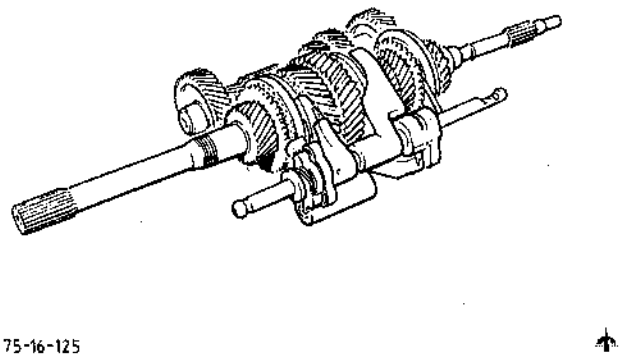


Fig.26. Complete gear assembly removed.

27. Remove the transmission mainshaft spacer sleeve from the transfer box, Fig.27.

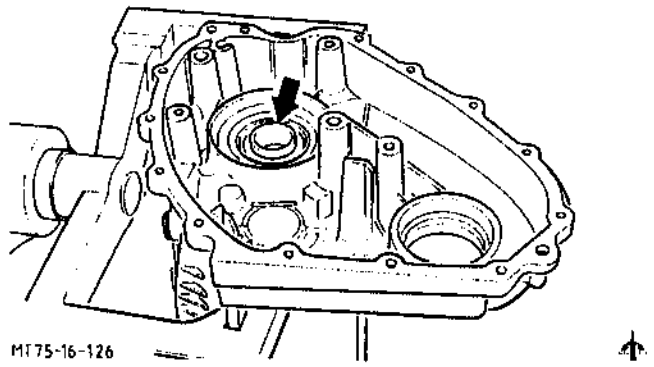


Fig.27. Transmission mainshaft spacer sleeve.

To Dismantle Transfer Box

28. Remove the thrust plate of the transmission mainshaft bearing from the transfer box (3 bolts), Fig.28.

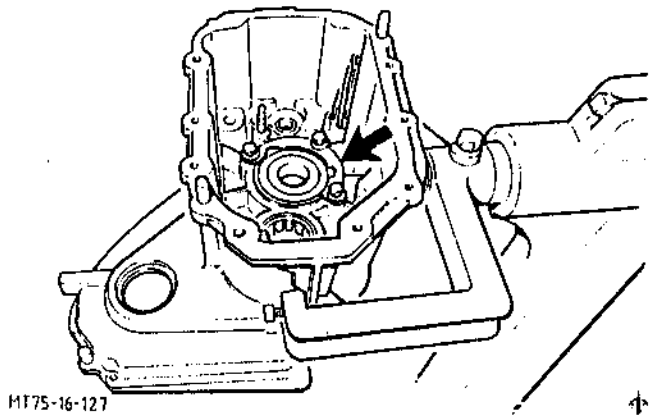


Fig.28. Retaining plate of transmission mainshaft bearing.

29. Drive the transmission mainshaft bearing out of the transfer box towards the inside using Special Tool 16-044, Fig.29.

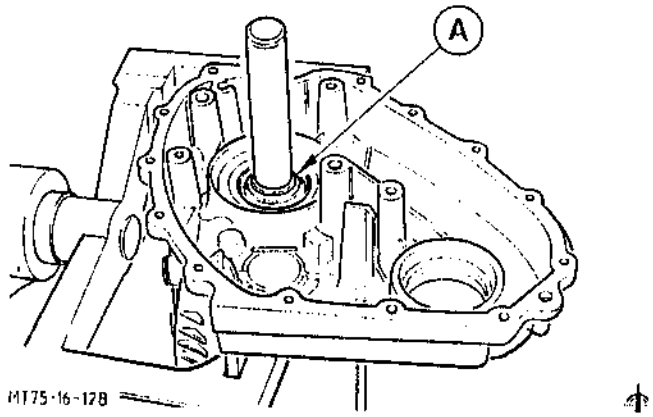


Fig.29. Remove transmission mainshaft bearing.
A - Special Tool 16-044

30. Drive the double-lipped radial oil seal of transmission mainshaft out of the transfer box from the inside using a suitable piece of tube, Fig.30.

NOTE: The radial oil seal has different outside diameters and therefore can only be removed in one direction.

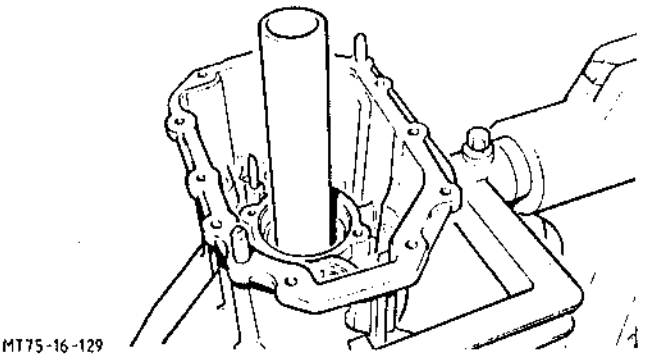


Fig.30. Drive out double-lipped radial oil seal with suitable length of tube.

31. Draw the countershaft roller bearing from the transfer box using a conventional internal extractor, Fig.31.

NOTE: Protect the mating faces of the transmission housing from damage with strips of aluminium.

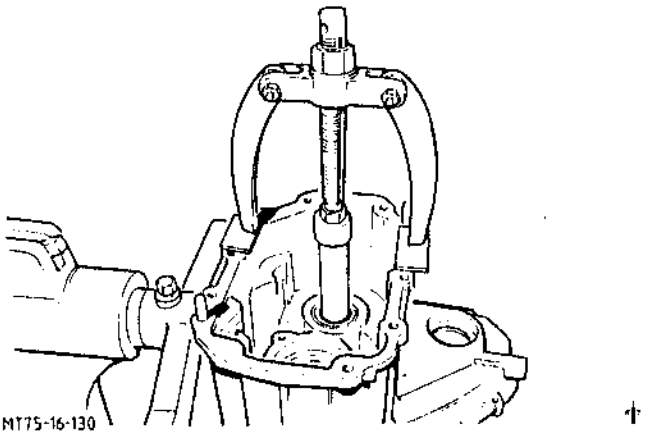


Fig.31. Extract roller bearing with conventional internal extractor.

32. Drive the bearing of the main selector shaft ball sleeve out of the transfer box with the radial oil seal using a suitable drift, Fig.32.

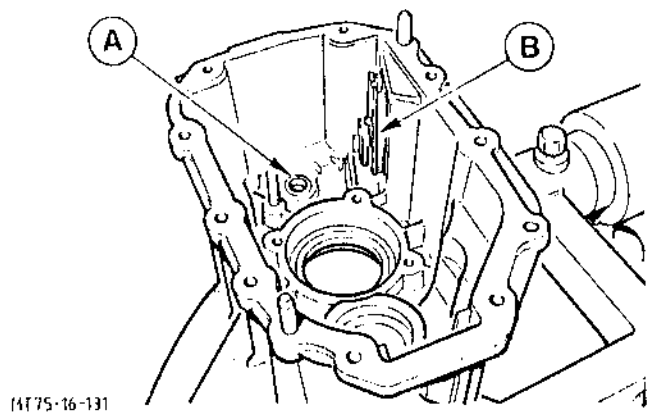


Fig.32. A - Main selector shaft ball sleeve
B - Selector gate

33. Remove the selector gate, Fig.32, from the transfer box (2 fit bolts), Fig.33.

NOTE: Only remove the selector gate if the transfer box is being replaced.

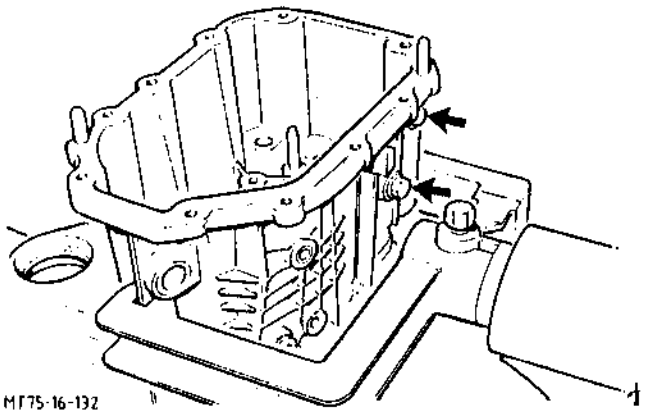


Fig.33. Selector gate special bolts.

To Reassemble Transfer Box

34. Fit the bearing of the main selector shaft ball sleeve bearing flush in the transfer box from the inside using Special Tool 21-044-A, Fig.34.

35. Fit the main selector shaft radial oil seal in the transfer box using an appropriate sleeve.

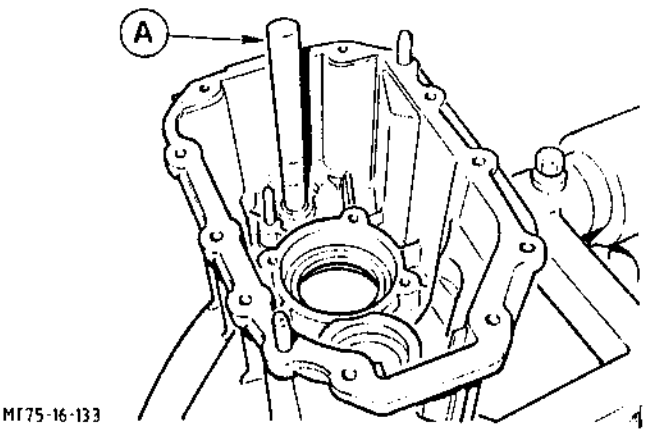


Fig.34. Fit main selector shaft ball sleeve.
A - Special Tool 21-044-A

36. If removed, fit the selector gate, Fig.35, in the transfer box with new special bolts.

37. Fit the countershaft roller bearing and the transmission mainshaft bearing.
To do this, heat the area around the bearing seats in the transfer box to a temperature of 70 to 100°C with a hot air blower.

NOTE: Cool the mainshaft bearing and countershaft bearing before fitting.

Fit the transmission mainshaft ball bearing with the closed side facing upwards and fit the countershaft roller bearing.

Secure the mainshaft bearing retaining plate with the 3 bolts, Fig.35

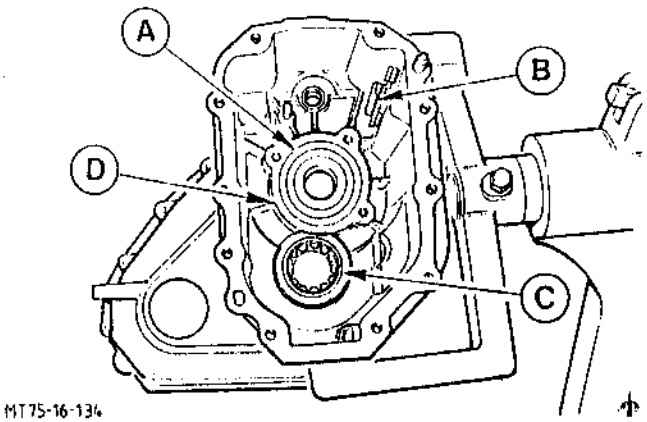


Fig.35. A - Bearing - closed side upwards
B - Selector gate
C - Roller bearing
D - Heated area

38. If the transfer box is being replaced, a new detent pin must be fitted for the gear shift. The distance between the tip of the detent pin and the housing mating face should be 69,0 ± 0,3 mm, Fig.36.

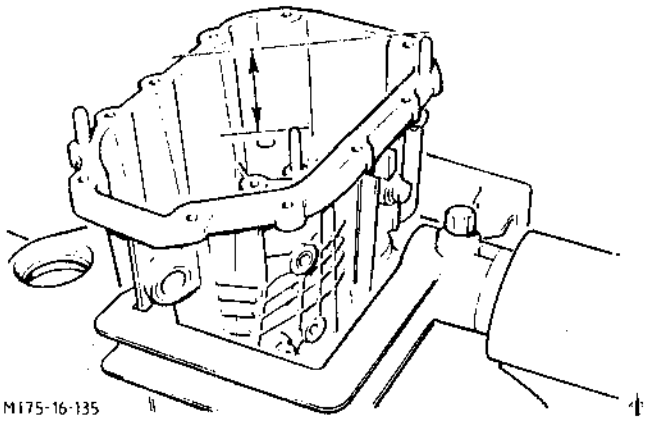


Fig.36. Distance from tip of detent pin to mating face 69,0 ± 0,3 mm.

To Dismantle Front Transmission Housing:

39. Drive the input shaft bearing out forwards, from the front transmission housing, using using a suitable length of tube. Detach the ball bearing circlip and discard the circlip, Fig.37.

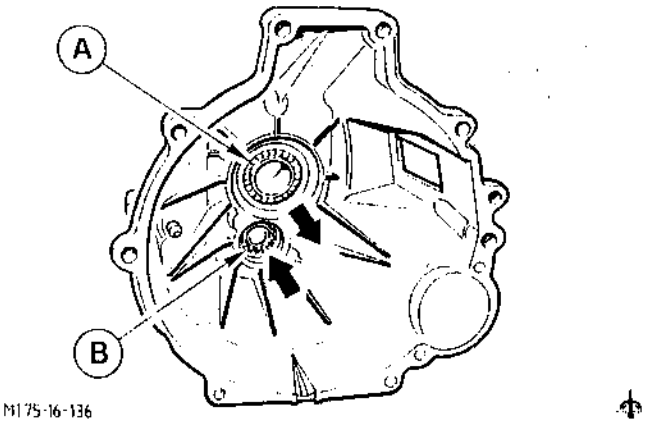


Fig.37. A - Input shaft bearing (removed towards front)
B - Countershaft roller bearing (removed towards rear)

40. Remove the main selector shaft ball sleeve bearing using a suitable internal extractor or, when available, Special Tool 21-036-A with the spindle of 21-037-B and an appropriate thrust element 55 mm in length and 13 mm in diameter, Fig.38

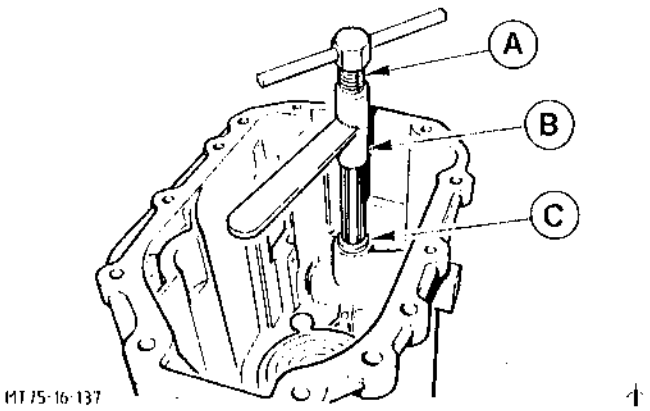


Fig.38. A - Special Tool 21-037-B
B - Special Tool 21-036-A
C - Main selector shaft ball sleeve bearing

To Reassemble Front Transmission Housing:

41. Fit the main selector shaft sleeve bearing flush in the front transmission housing from inside using Special Tool 21-044-A, Fig.39

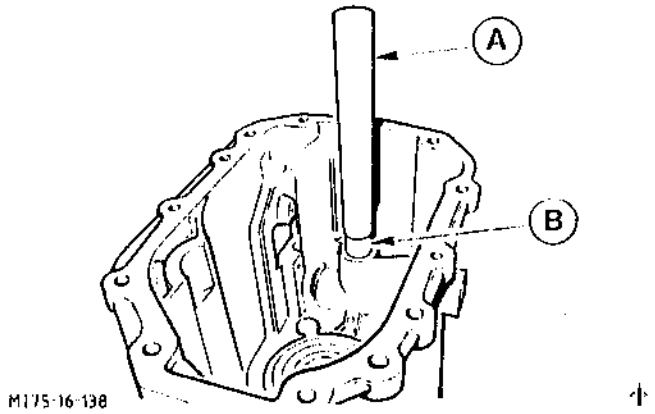


Fig.39. A - Special Tool 21-044-A
B - Main selector shaft sleeve bearing

42. Heat the bearing seat of the countershaft roller bearing in the front transmission housing to a temperature of 70 to 100°C with a hot air blower and fit the roller bearing so that it protrudes 2 mm using Special Tool 15-036, Fig.40.

NOTE: Do not drive the countershaft roller bearing flush into the front transmission housing but let it protrude approximately 2,0 mm, Fig.40.

43. Heat the bearing seat of the input shaft bearing in the front transmission housing to a temperature of 70 to 100°C using a hot air blower and fit the ball bearing flush with a suitable length of tube or, if available, Special Tool 15-064 and a drift from the clutch side, Fig.41.

NOTE: Fit the input shaft ball bearing with a new circlip. Cool the ball bearing before fitting circlip.

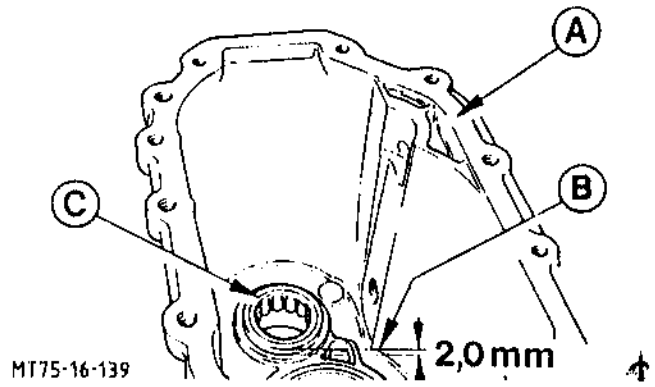


Fig.40. A - Front transmsisson housing
B - Protrusion of 2 mm
C - Countershaft roller bearing

Fig.41. Fit input shaft ball bearing in front transmission housing (shown with Special Tool 15-064)
A - Input shaft bearing
B - Drift
C - Special Tool 15-064

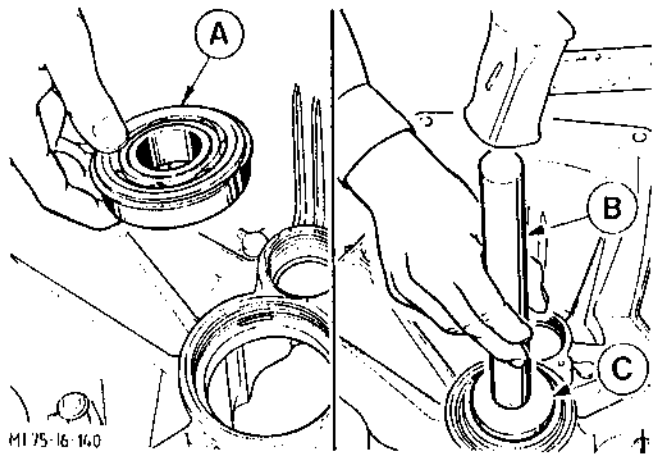


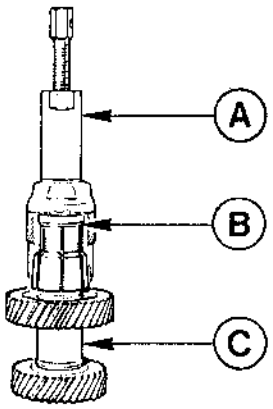
Fig.41. Fit input shaft bearing in front transmission housing (shown with Special Tool 15-064).

44. Pull off the countershaft bearing inner rings using Special Tool 15-050 A in conjunction with Special Tool 16-050, Fig.42.

Fig.42. Pull off countershaft bearing inner rings.
A - Special Tool 15-050 A
B - Special Tool 16-050
C - Countershaft

45. Heat the countershaft bearing inner rings to a temperature of approximately 100°C and draw them onto the countershaft.

NOTE: When the countershaft roller bearings are replaced, the inner rings must also be replaced as the two parts are paired.



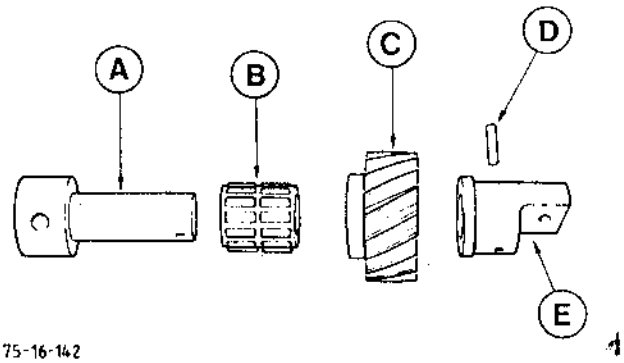
MT75-16-141

Fig.42. Pull off countershaft bearing inner rings.

To Dismantle Reverse Gear Idler Shaft:

46. Drive out the roll pin and remove the bearing block, idler gear and needle roller bearing from the idler shaft.

Fig.43. Reverse gear idler shaft - exploded view.
A - Shaft
B - Needle roller bearing
C - Idler gear
D - Roll pin
E - Bearing block



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Fig.43. Reverse gear idler shaft - exploded view.

To Reassemble Reverse Gear Idler Shaft:

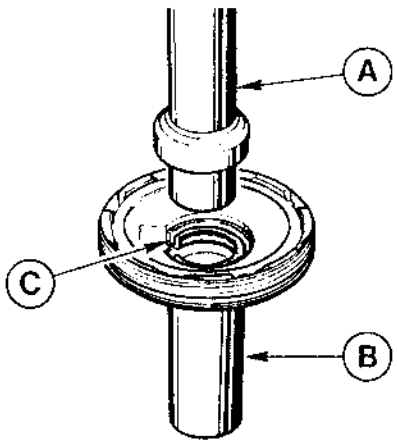
47. Slide the bearing, idler gear and bearing block onto the idler shaft and secure them with the roll pin.

NOTE: Make sure that the bearing block is fitted turned at the right angle. The threaded holes must line up with one another.

48. Remove the radial oil seal from the clutch release bearing guide sleeve.

49. Fit the radial oil seal in the clutch release bearing guide sleeve using Special Tool 16-044.

NOTE: The sealing lip must point towards the tool when the seal is fitted, Fig.44.



MT75-16-16

Fig.44. Fit radial oil seal.
A - Special Tool 16-044
B - Clutch release bearing guide sleeve
C - Radial oil seal in position

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To Dismantle Transmission Mainshaft

50. Remove the input shaft with the 4th gear synchronizer ring and input shaft/transmission mainshaft roller bearing.

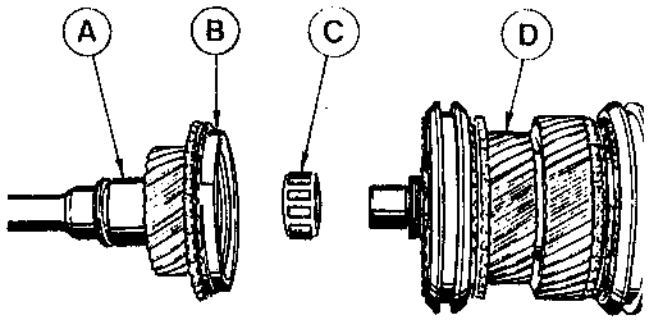


Fig.45. Input shaft removed
A - Input shaft
B - 4th gear synchronizer ring
C - Input shaft/transmission mainshaft roller bearing
D - Transmission mainshaft

Fig.45. Input shaft removed.

51. Remove the 5th gear cog with the synchronizer ring and needle roller bearing from the transmission mainshaft, Fig.46.

52. Clamp the transmission mainshaft in a vice with the output side pointing downwards.

NOTE: Use soft jaws.

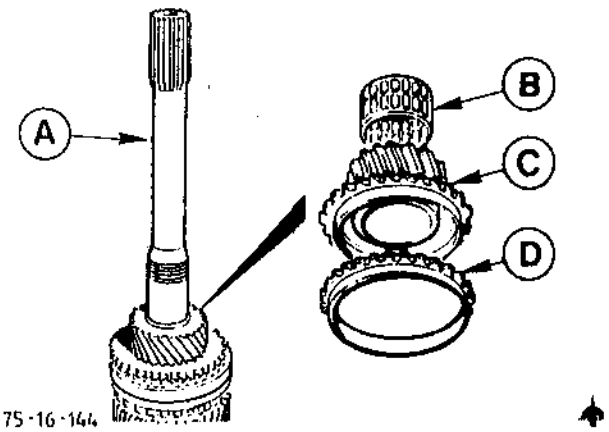


Fig.46. A - Transmission mainshaft
B - Needle roller bearing
C - 5th gear cog
D - Synchronizer ring

Fig.46.

CAUTION: Danger of injury - do not remove the synchronizer unit on its own otherwise it could fall apart.

53. Remove the snap ring for the 3rd/4th gear synchronizer unit from the transmission mainshaft and remove the 3rd/4th gear synchronizer unit complete with the 3rd gear cog and 3rd gear needle roller bearing from the transmission mainshaft, Fig.47.

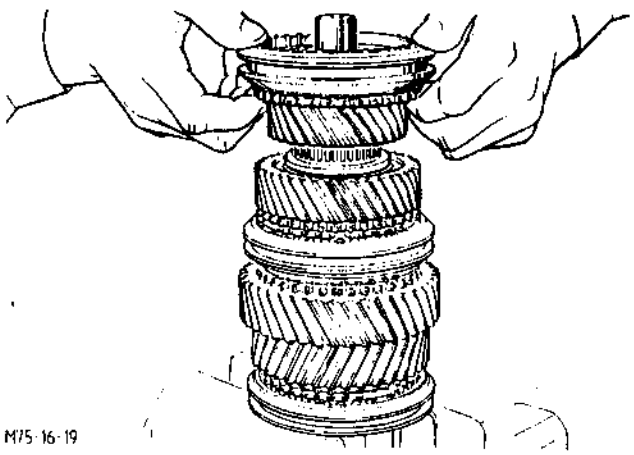


Fig.47. Remove 3rd/4th gear synchronizer unit complete with 3rd gear cog.

54. Heat the 3rd gear bearing bush to approx. 100°C with a hot air blower. Align the 2nd gear oil grooves with the openings in the bearing bush. Lift the bearing off the transmission mainshaft using 2 suitable levers and pull it off using a puller, Fig.48.

    Remove the 2nd gear cog with the needle roller bearing and the 2nd gear synchronizer ring from the transmission mainshaft.

NOTE: Do not mix up the needle roller bearings of the 2nd and 3rd gear cogs. Always keep the bearing with its associated cog.

CAUTION: Danger of injury - do not remove the synchronizer unit on its own otherwise it may fall apart.

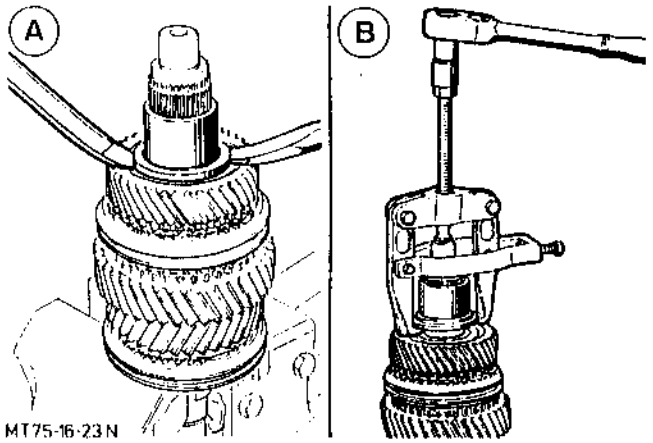


Fig.48. Remove 3rd gear bearing bush.
A - Lift
B - Pull off

55. Remove the snap ring of the 1st/2nd rear synchronizer unit from the transmission mainshaft.
    Remove the 1st/2nd gear synchronizer unit complete with 1st gear cog and 1st gear needle roller bearing from the transmission mainshaft.

56. Release the transmission mainshaft from the vice and clamp it again with the output side pointing upwards.

57. Remove the snap ring of the 5th/reverse gear synchronizer unit from the transmission mainshaft. Remove the 5th/reverse gear synchronizer unit complete with the reverse gear cog and needle roller bearing from the transmission mainshaft.

58. Do not remove the synchronizer unit on its own since there is a danger of it falling apart.

    The 1st/2nd gear and 5th/reverse gear synchronizer units are identical. Do not mix them up when reassembling.

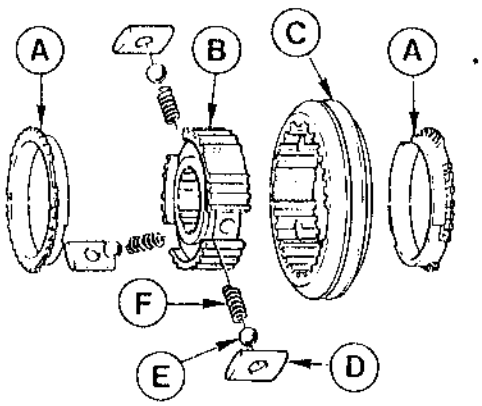


Fig.49. Synchronizer unit - exploded view.

Fig.49. Synchronizer unit - exploded view
A - Synchronizer rings
B - Synchronizer hub
C - Selector ring
D - Inserts
E - Ball
F - Spring

To Reassemble Transmission Mainshaft:

NOTE: Replace all the snap rings and circlips. Select new snap rings and circlips so that they fit in the appropriate groove without any play, Fig.50. Snap rings and circlips are available in different thicknesses (see parts Microfiche). Before assembling, oil all the transmission parts, synchronizer rings and needle roller bearings with the specified transmission fluid (see Technical Data).

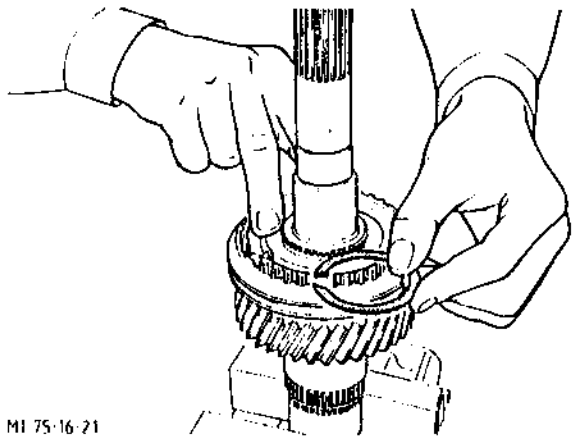


Fig.50. Select circlip (5th/reverse gear synchronizer MT-75 shown without 4x4).

59. Clamp the transmission mainshaft in the vice with the output side pointing upwards.

NOTE: Use soft jaws.

60. Slide the reverse gear needle roller bearing and the reverse gear cog onto the transmission mainshaft. Fit the 5th/reverse gear synchronizer unit and synchronizer ring on the mainshaft and secure them with the circlip.

61. Release the transmission mainshaft from the vice and clamp it again with the output side pointing downwards.

62. Slide the 1st gear needle roller bearing and cog onto the transmission mainshaft. Fit the 1st/2nd gear synchronizer ring, synchronizer unit and cog on the transmission mainshaft and secure them with a snap ring, Fig.51.

63. Slide the 2nd gear synchronizer ring, needle roller bearing and 2nd gear cog onto the transmission mainshaft.

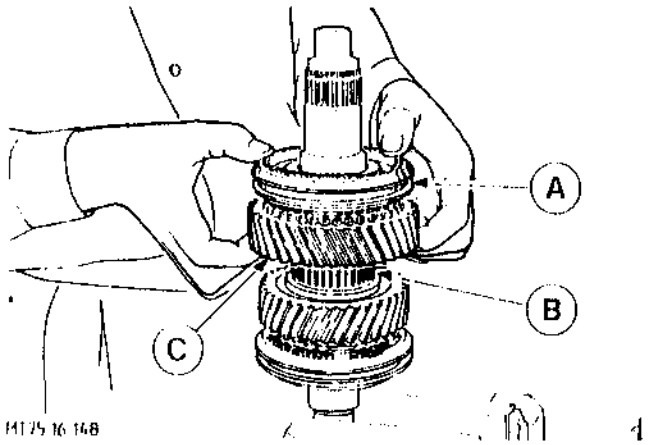


Fig.51. Fit 1st/2nd gear synchronizer unit.
A - 1st gear cog
B - Synchronizer unit
C - 1st gear needle roller bearing

64. Heat the bearing bush of the 3rd gear needle roller bearing to a temperature of approximately 100°C and slide the bearing bush onto the transmission mainshaft.

NOTE: Make sure that the bearing bush is slid fully onto the transmission mainshaft and is in contact with the shoulder on the transmission mainshaft, Fig.52. Only replace the 3rd gear needle roller bearing in conjunction with the bearing bush.

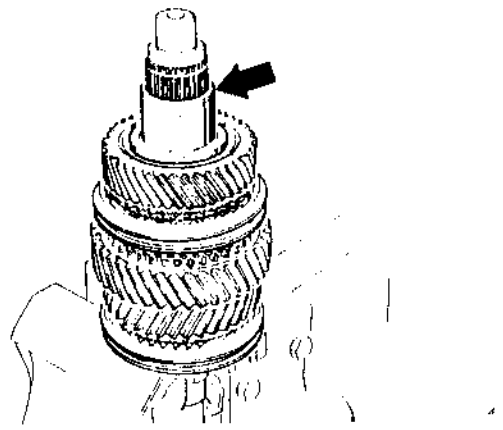


Fig.52. Bearing bush of 3rd gear needle roller bearing.

65. When the bearing bush has cooled, fit the 3rd gear needle roller bearing and cog. Slide the synchronizer ring and the 3rd/4th gear synchronizer unit with the short collar facing upwards, onto the transmission mainshaft and secure them with a snap ring, Fig.53.

66. Remove the transmission mainshaft assembly from the vice. Fit the 5th gear synchronizer ring, 5th gear needle roller and cog on the transmission mainshaft.

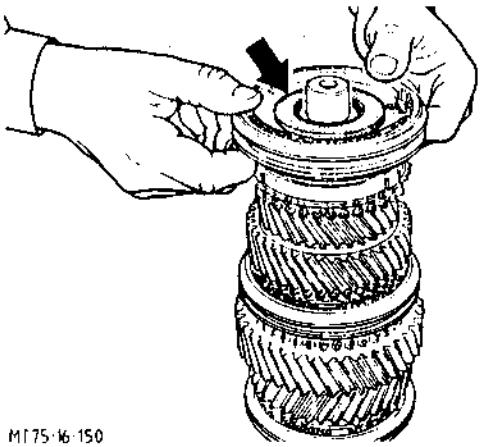


Fig.53. Short collar of 3rd/4th gear synchronizer unit.

To Dismantle Main Selector Shaft:

67. Remove the circlip in front of the spring retainer from the main selector shaft. Remove the spring retainer, spring and spring carrier, Fig.54.

NOTE: Catch the two balls of the spring carrier.

Fig.54. Selector shaft - exploded view
A - Spring retainer
B - Spring carrier
C - Selector pin holder
D - Selector pin
E - Main selector shaft
F - Locking sleeve
G - 1st/2nd gear selector fork
H - Balls
J - Spring
K - Circlip

68. Drive the roll pin out of the selector pin holder and main selector shaft. Pull the selector pin holder off the selector shaft.

69. Remove the 1st/2nd gear selector fork and locking sleeve from the main selector shaft.

70. Drive the roll pin out of the selector pin and main selector shaft and remove the selector pin.

NOTE: Do not remove the actuating pin for the reversing light switch, Fig.54. The main selector shaft is supplied complete with the actuating pin.

To Assemble Main Selector Shaft:

71. Slide the selector pin onto the main selector shaft and secure it with the roll pin. The pin must point in the opposite direction to the actuating pin for the reversing light switch.

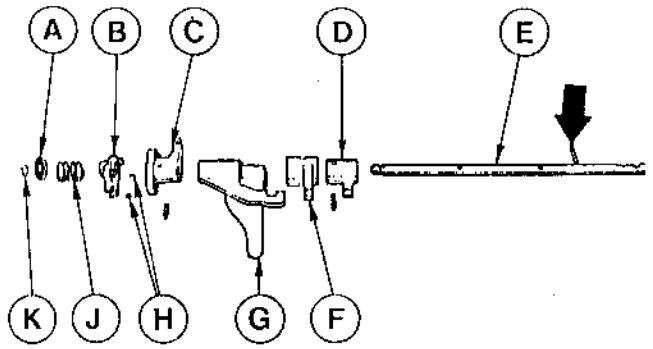
72. Slide the locking sleeve onto the selector shaft and selector pin and fit the 1st/2nd gear selector fork on the selector shaft, Fig.55.

73. Slide the selector pin holder onto the selector shaft and secure it with the roll pin. Press the roll pin in centrally, i.e. so it is countersunk on both sides.

NOTE: The pins on the selector pin holder must point in the same direction as the actuating pin for the reversing light switch, Fig.56.

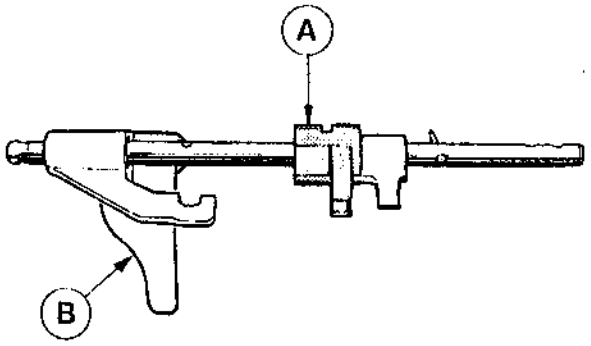
74. Fit the spring carrier with the two balls on the main selector shaft. Fit the spring and spring retainer and secure them with a snap ring.

NOTE: The opening in the spring carrier for the detent pin must face in the opposite direction to the actuating pin for the reversing light switch.



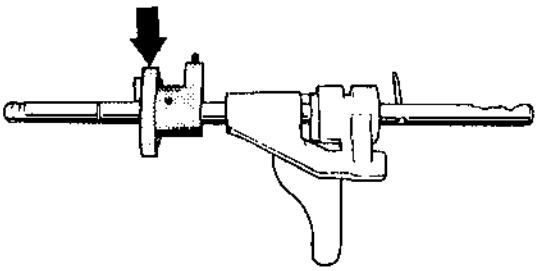
MT75-16-151

Fig.54. Selector shaft - exploded view.



MT75-16-152

Fig.55. Fit selector fork and locking sleeve.
A - Locking sleeve
B - 1st/2nd gear selector fork



MT75-16-153

Fig.56. Selector pin holder.

To Reassemble Transmission

75. Clamp the transmission mainshaft assembly in the vice with the output side pointing downwards.

NOTE: Use soft jaws.

76. Fit the main selector shaft to the transmission mainshaft with the spring carrier at the bottom so that the 1st/2nd gear slector fork engages in the middle 1st/2nd gear synchronizer unit, Fig.57.

77. Fit the input shaft with the 4th gear synchronizer ring and input shaft/transmission mainshaft roller bearing.

NOTE: Lubricate the bearing with transmission fluid (see Technical Data for specification).

78. Assemble the countershaft with the transmission mainshaft and secure the shafts with a cable tie, Fig.58.

Fig.58. Assemble countershaft with transmission mainshaft.
A - Input shaft
B - Transmission mainshaft
C - Countershaft
D - Cable tie

79. Insert the 5th/reverse gear selector fork in the lower (5th/reverse gear) synchronizer unit with the outrigger pointing upwards, to the right of the main selector shaft, Fig.59.

Fig.59. Secure reverse gear idler shaft and 5th/reverse gear selector fork with second cable tie (viewed from two directions).
A - Transmission mainshaft
B - Second cable tie
C - Idler shaft
D - 5th/reverse gear selector

80. Fit the reverse gear idler shaft to the countershaft and the transmission mainshaft with the end with the flat at the top. Secure the reverse gear idler shaft and 5th/reverse selector fork with a second cable tie, Fig.59.

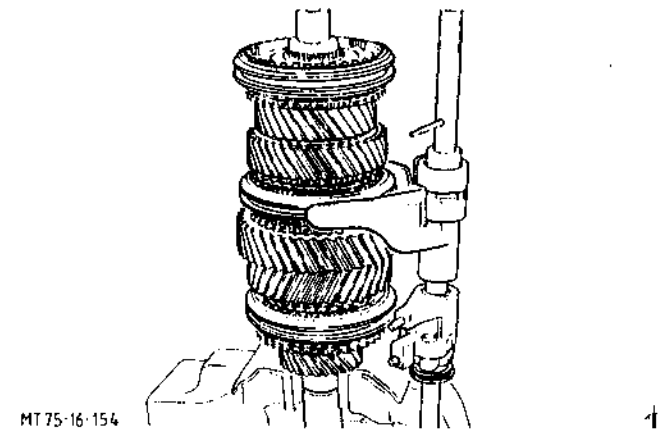


Fig.57. Fit main selector shaft to transmission mainshaft.

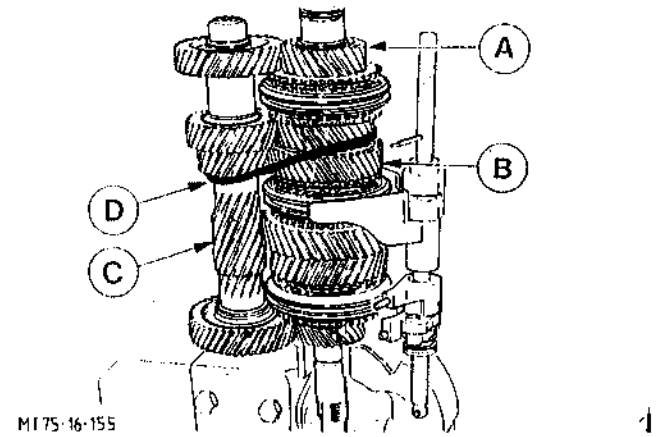


Fig.58. Assemble countershaft with transmission mainshaft.

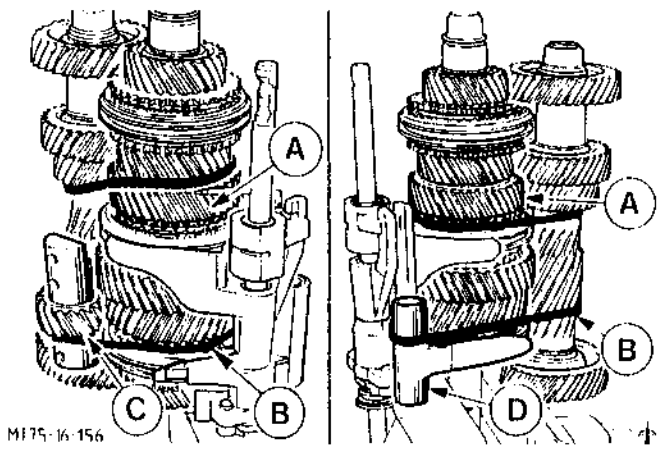


Fig.59. Secure reverse gear idler shaft and 5th/reverse gear selector fork with second cable tie (view from two directions).

81. Position the transfer box upright on the assembly stand with the opening uppermost.

82. Release the complete gear assembly (transmission mainshaft, countershaft, main selector shaft, reverse gear idler, input shaft and 5th/reverse gear selector fork) from the vice and carefully insert it, output end first in the transfer box, Fig.60.

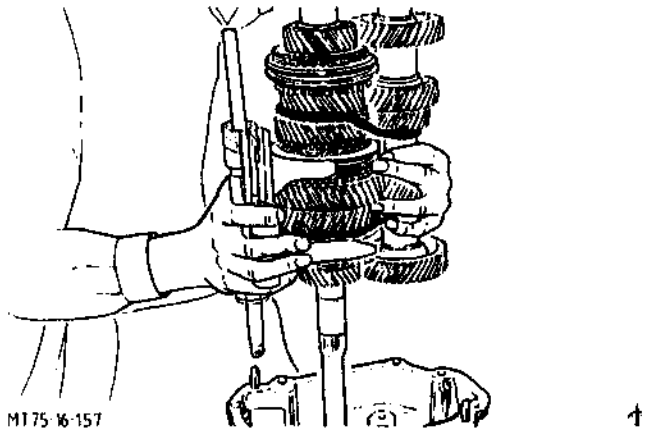


Fig.60. Insert complete drive train in transfer box.

83. Engage 4th gear. Draw the transmission mainshaft into the transfer box using Special Tools 16-053 and 16-051 and hold it with Special Tool 15-073, Fig.61.

NOTE: Fit Special Tool 16-053 with the short collar towards the transmission.

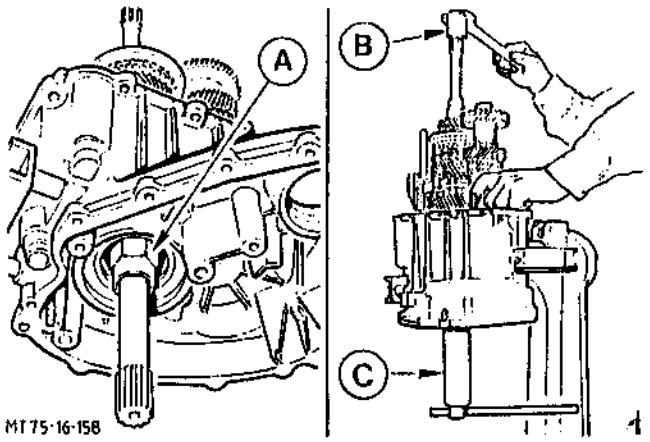


Fig.61. Draw in transmission mainshaft.
A - Special Tool 16-053
B - Special Tool 15-073
C - Special Tool 16-051

84. Unscrew installer Special Tool 16-053. Fit installer with the long collar towards the transmission and pull the transmission mainshaft fully in. Disengage 4th gear.

NOTE: As the mainshaft is drawn in make sure that the countershaft goes into the rear roller bearing (move it gently). The distance "X" between the countershaft gear and the synchronizer cone on the 3rd, gear cog must not be zero, Fig.62.

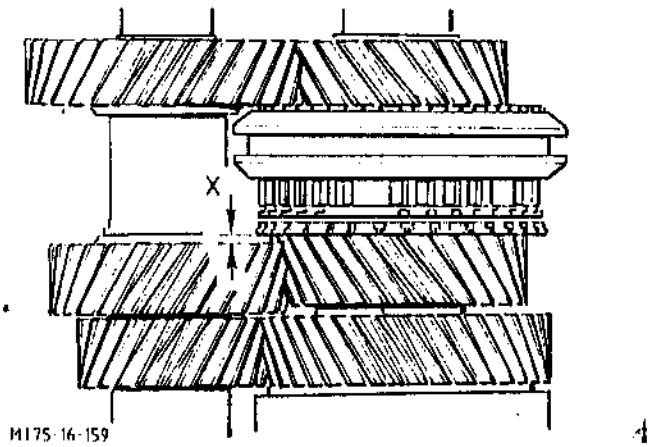


Fig.62. Distance "X" between countershaft gear and synchronizer cone on 3rd gear cog.

85. Insert the rear bolt of the reverse gear idler shaft and screw it in finger tight.

86. Insert the magnetic disc in the transmission housing and remove the cable ties from the gear assembly.

87. Insert the auxiliary selector shaft in the 3rd/4th gear and 5th/reverse gear selector forks and the transfer box, with the chamfered side pointing upwards, Fig.63.

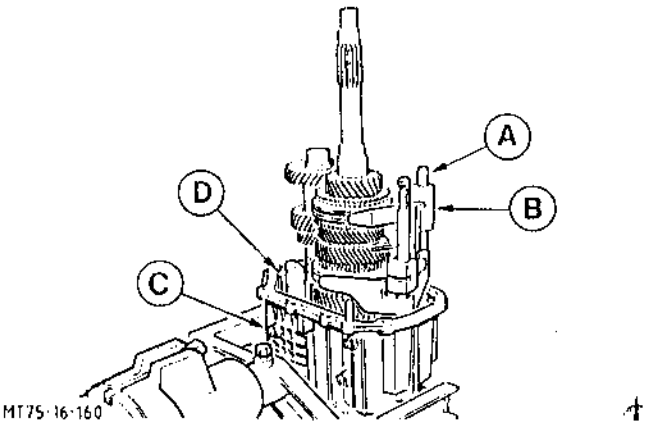


Fig.63. Gear assembly inserted.
A - Auxiliary selector shaft
B - 3rd/4th gear selector fork
C - Bolt
D - Magnetic disc

88. Slip the front transmission housing over the input shaft, transmission mainshaft, countershaft and selector shafts and support it on the transfer box with 3 spacer sleeves approximately 25 mm long, Fig.64.

89. Fit Special Tool 16-041 on the input shaft. Fit the 2-piece sleeve over the input shaft and secure it with the tube; slide the large sleeve over that and unscrew the nut and washer onto the thread.

Apply sealer (see Technical Data) to the transfer box mating face.

NOTE: The mating faces must be clean and free of grease and oil.

90. Remove the spacer sleeves. Draw the front transmission housing onto the transfer box.

NOTE: Do not damage the thread when fitting the Special Tool in the front transmission housing. Do not tilt the countershaft front ball bearing when drawing on the front transmission housing. Observe the assembly process through the bearing hole in the housing.

91. Insert 2 housing bolts on opposite sides and carefully draw the housing halves together. Then insert the remaining 8 housing bolts. Tighten all the bolts to the specified torque, Fig.65. Remove the Special Tool.

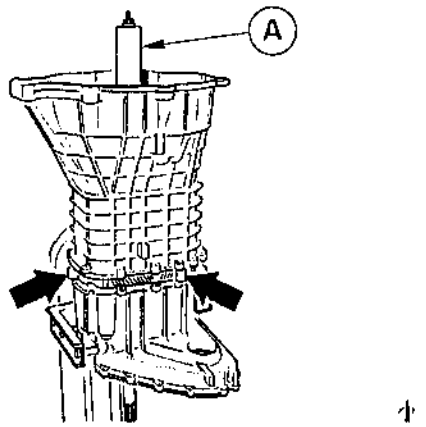


Fig.64. Front transmission housing supported on transfer box with spacer sleeves.
A - Special Tool 16-041

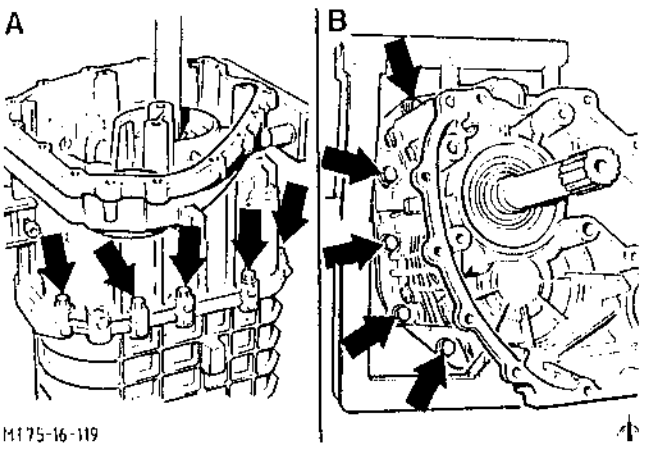


Fig.65. Transmission housing retaining bolts
A - Right-hand side
B - Left-hand side

92. Position the transmission horizontally on the stand.

93. Smear the thread of the locking plate detent screw with sealer (see Technical Data), insert it in the front transmission housing and tighten it to the specified torque, Fig.66.

NOTE: Sealer must not get into the transmission breather hole in the detent screw.

Fig.66. Screw/bolts on left-hand side of transmission.
- A - Reversing light switch with retaining screws.
- B - Detent screw of locking plate/ transmission breather
- C - Rear bolt of reverse gear idler shaft
- D - Front bolt of reverse gear idler shaft

94. Fit the front bolt of the reverse gear idler shaft and tighten the 2 bolts, Fig.66.

95. Fit the reversing light switch with the wiring pointing downwards, Fig.66.

96. Press the sleeve of the selector shaft detent mechanism into the front transmission housing as far as it will go, insert the ball, pin and spring. Smear the thread of the screw plug with sealer (see Technical Data), insert the screw and tighten it, Fig.67.

Fig.67. Selector shaft detent mechanism.
- A - Sleeve
- B - Ball
- C - Pin
- D - Spring
- E - Threaded plug

97. Measure and fit the input shaft inner circlip, Fig.68.

NOTE: Circlips are available in 5 thicknesses. The differences are colour coded.

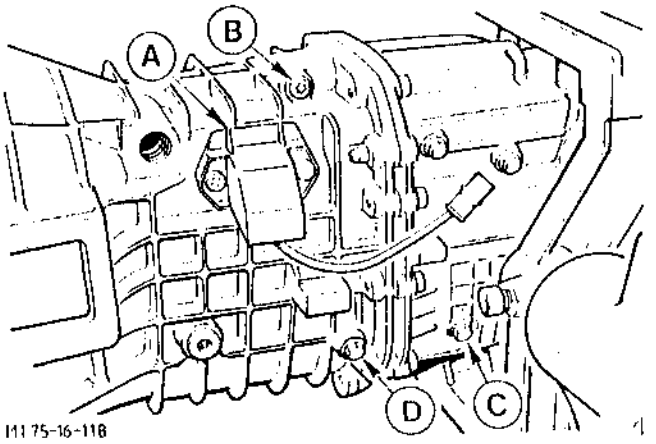


Fig.66. Screws/bolts in left-hand side of transmission.

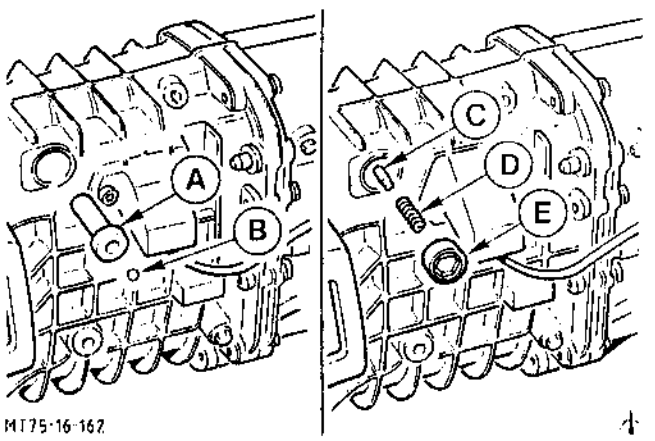


Fig.67. Selector shaft detent mechanism.

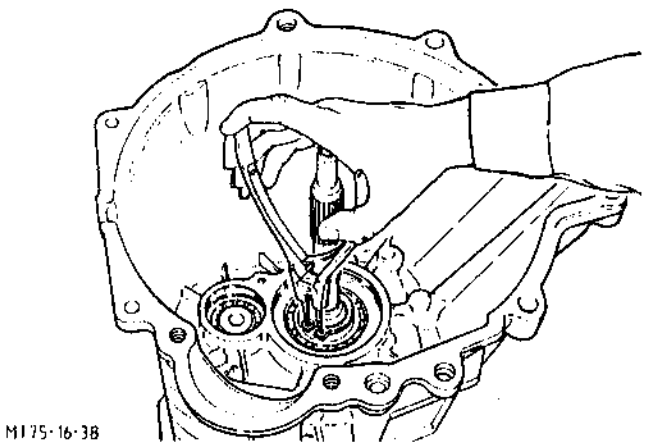


Fig.68. Fit input shaft circlip.

98. Fit the steel washer in the guide sleeve. Grease the thread of the guide sleeve (see Technical Data for grease specification). Screw the locating sleeve into the front transmission housing with a new greased O-ring. Tighten the guide sleeve using Special Tool 16-040, Fig.69.

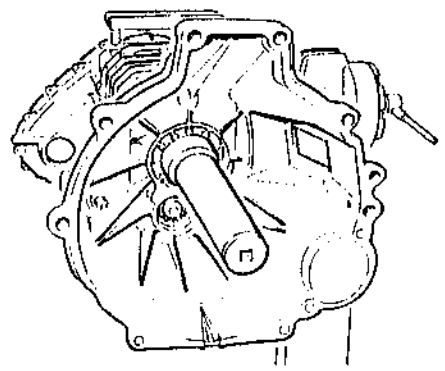


Fig.69. Tighten clutch release bearing guide sleeve with Special Tool 16-040.

99. Fit a new greased O-ring on the countershaft bearing housing. Screw the bearing housing into the front transmission housing and tighten the bearing housing, Fig.70.

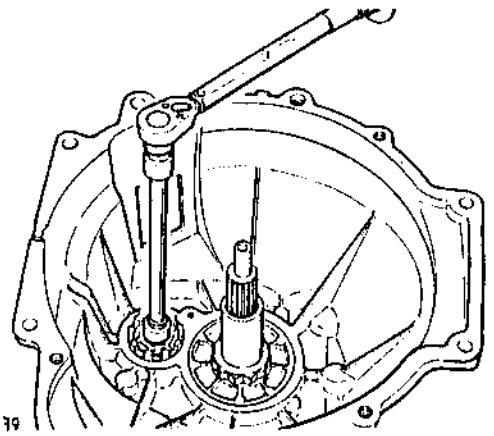


Fig.70. Fit countershaft bearing housing in front transmission housing.

100. Mark the position of the bearing housing in relation to the transmission housing. Slacken the bearing housing 60° from this position, Fig.71.

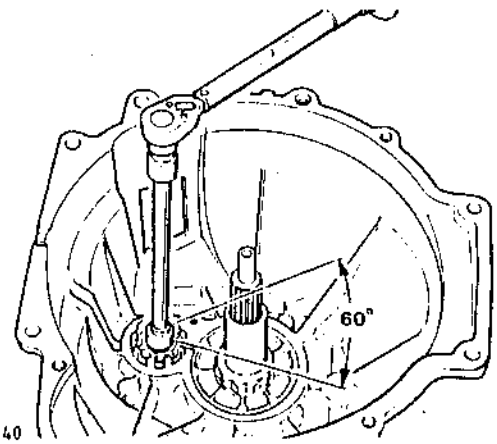


Fig.71 Slacken bearing housing 60° from marked position.

101. Strike two blows on each of the bosses next to the bearing housing using a brass drift and hammer to drive the countershaft bearing against the bearing housing, Fig.72.

102. Check that the countershaft bearing is resting against the bearing housing. The bearing housing must not screw in easily by hand otherwise repeat sub-operation 101.

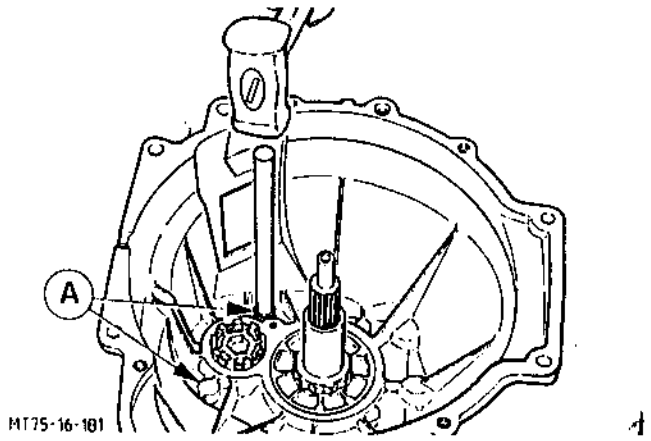


Fig.72. Drive countershaft bearing against bearing housing.
A - bosses

103. Fit the bearing housing retainer and secure it with the bolt.

104. Heat the transmission mainshaft spacer sleeve to a temperature of 70 to 100°C with a hot air blower and shrink it onto the rear end of the transmission mainshaft, Fig.73.

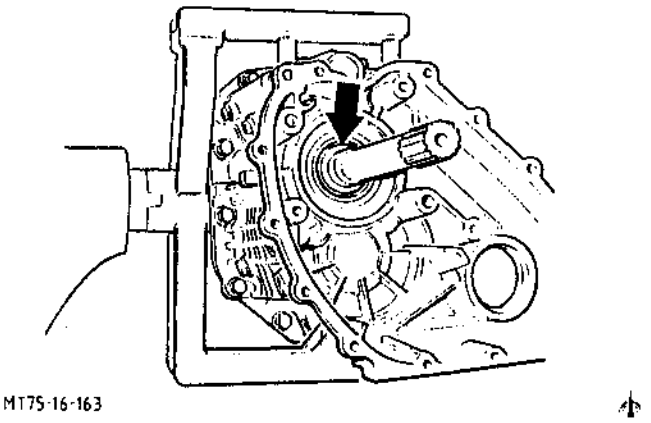


Fig.73. Transmission mainshaft spacer sleeve.

105. Fit the double-lipped radial oil seal of the transmission mainshaft in the rear transmission housing using Special Tool 16-054, Fig.74.

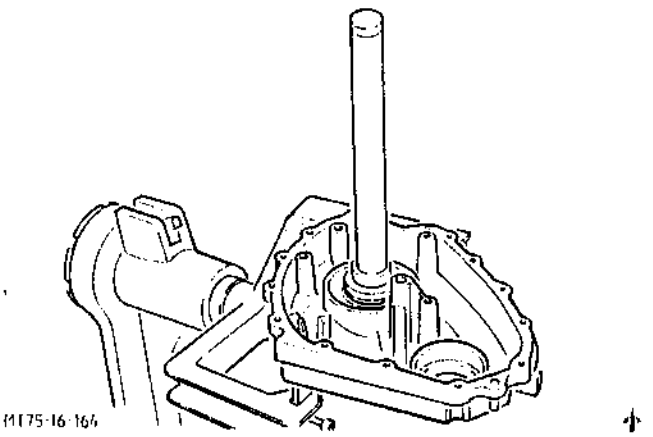


Fig.74. Fit transmission mainshaft transfer box radial oil seal using Special Tool 16-054.

106. Engage 4th gear. Fit the nut to the transmission mainshaft and tighten it with Special Tool 16-051 and a torque wrench, holding the input shaft with Special Tool 15-073 and a spanner, Fig.75.

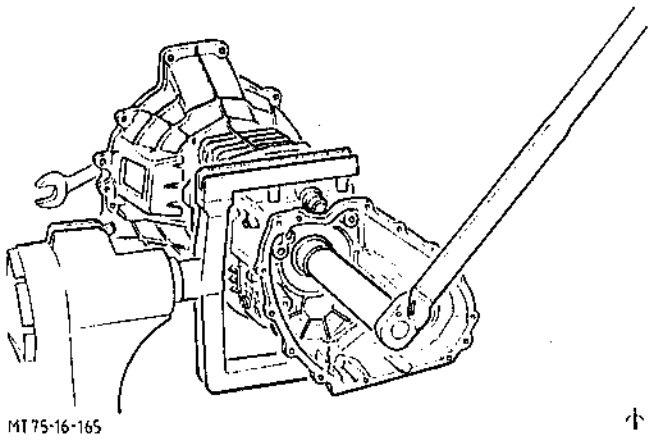


Fig.75. Tighten transmission mainshaft nut using Special Tool 16-051 and torque wrench.

To Dismantle Transfer Box

107. Remove the oil pipe and oil seal from the transfer box.
Detach the oil deflector from the transfer box housing (2 bolts), Fig.76.

Fig.76. Transfer box housing.
A - Oil pipe
B - Seal
C - Oil deflector
D - Output shaft
E - Drive plate

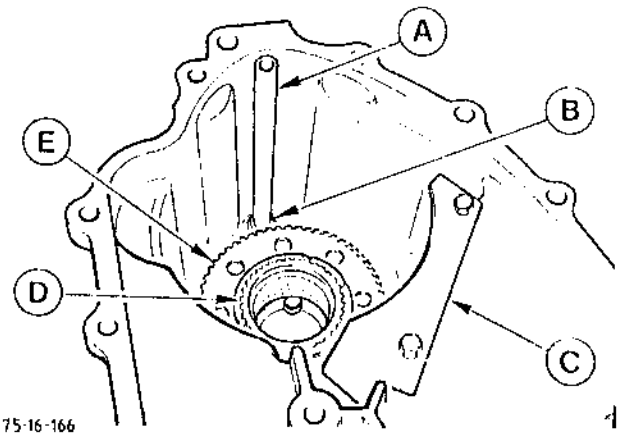
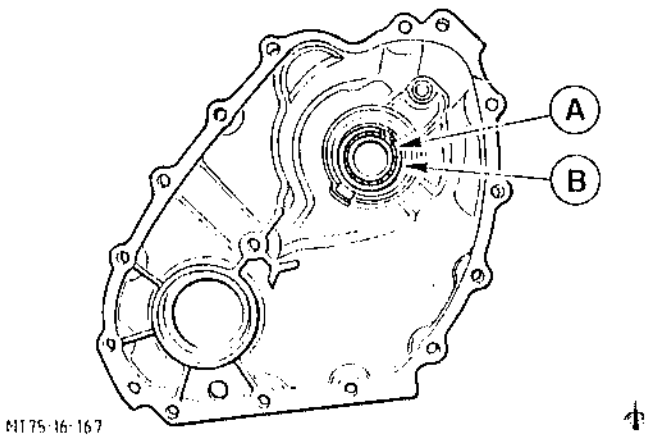


Fig.76. Transfer box.

108. Remove the drive plate and the output shaft shim from the transfer box, Fig.76.

109. Press the output shaft out of the transfer box housing using a press.



110. Remove the circlip of the transfer box housing bearing using a suitable drift, Fig.77.

Fig.77. A - Transfer box bearing
B - Circlip

To Dismantle Output Shaft

111. Clamp the output shaft in a vice and pull off the output shaft ball bearing using a conventional three-legged puller and extension (Special Tool 16-025-01), Fig.78.

NOTE: Use aluminium jaws in the vice.

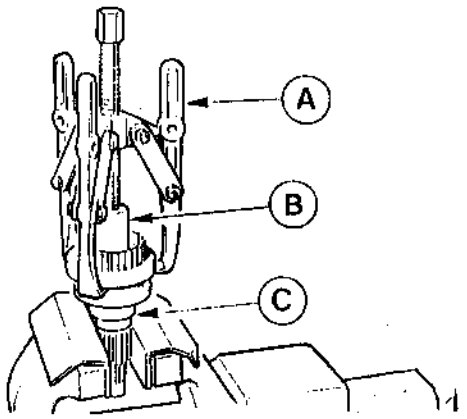


Fig.78. Pull off ball bearing.
A - Three-legged puller
B - Extension - Special Tool 16-025-01
C - Output shaft

Fig.78. Pull off bearing.

To Assemble Output Shaft

112. Heat the output shaft bearing with a hot air blower and shrink it flush onto the bearing seat.

NOTE: Do not fit the drive plate and shim yet because the shim thickness must be measured again.

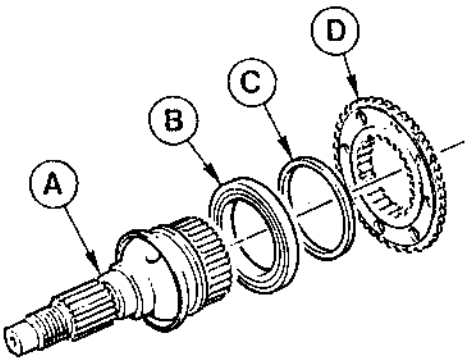


Fig.79. Output shaft components.
A - Output shaft
B - Bearing
C - Shim
D - Drive plate

Fig.79. Output shaft components.

To Assemble Transfer Box

113. Heat the transfer box housing to a temperature of 70 to 100°C with a hot air blower, fit the transfer box housing bearing in the bearing seat and secure the circlip, Fig.80.

114. Drive the output shaft into the bearing in the transfer box housing using a copper drift.

115. Fit the oil baffle in the transfer box (2 bolts).

116. Fit the oil pipe and a new seal in the transfer box.

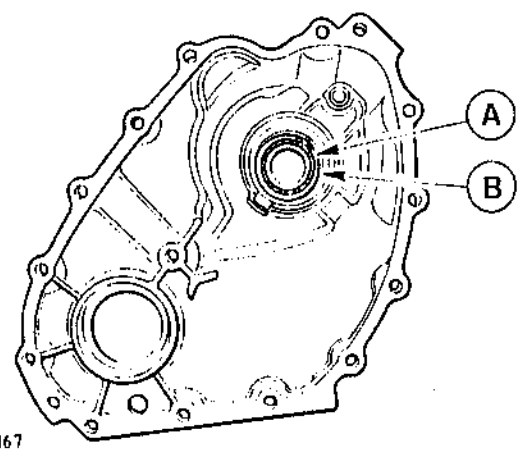


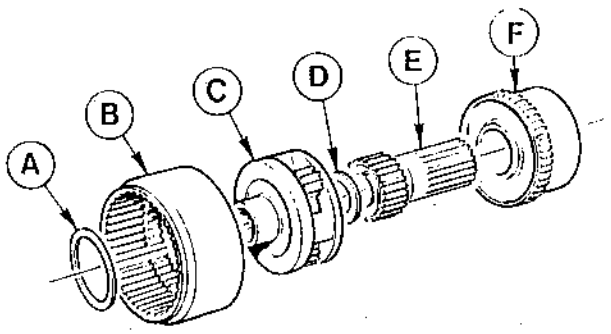
Fig.80. Fit bearing in transfer box housing.
A - Bearing
B - Circlip

117. Remove the annulus, planetary gear carrier and thrust washer from the sun wheel shaft, Fig.81.

Fig.81. Sun wheel shaft with planetary gear train and viscous coupling.
A - Shim (already removed)
B - Annulus
C - Planetary gear carrier
D - Thrust washer
E - Sun wheel shaft
F - Viscous coupling

118. Detach the sun wheel shaft from the viscous coupling by tapping it on a wooden block.

NOTE: Do not dismantle the viscous coupling any further.



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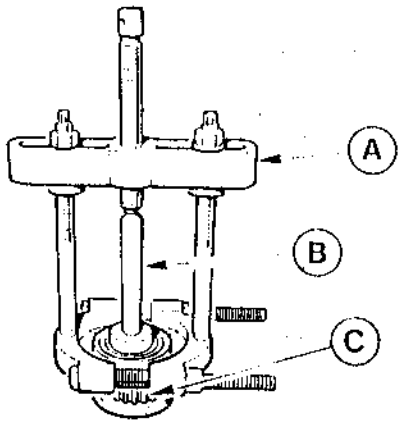
Fig.81. Sun wheel shaft with planetary gear train and viscous coupling.

119. Slide the viscous coupling onto the sun wheel shaft.

120. Slide the thrust washer, planetary gear carrier and annulus onto the sun wheel shaft.

121. Pull off the bearings of the driven and driving chain sprockets using a conventional puller and suitable thrust element, Fig.82.

122. Heat the bearings of the driven and driving chain sprockets to a temperature of approximately 80°C with a hot air blower and fit them onto the sprockets.



MT75-16-172

Fig.82. Pull off bearings
A - Puller
B - Thrust element
C - Driven sprocket

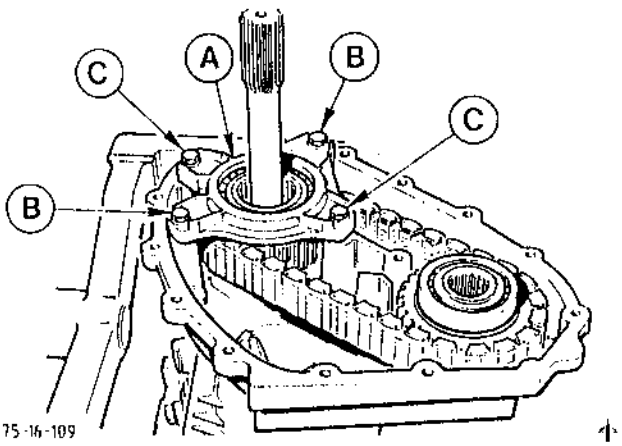
123. Insert the sprockets and chain in the housing.

To do this, heat the area of the housing around the driven sprocket to a temperature of 70 to 100°C with a hot air blower and let the driven sprocket cool for approximately half an hour.

NOTE: Fit the sprocket bearings evenly in the bearing seats in the transmission housing.

124. Fit the driving sprocket bearing housing with the 2 guide sleeves and secure it (2 long and 2 short bolts with U-shaped washers), Fig.83.

NOTE: Coat the threads of the bolts with thread-locking compound (see Technical Data) and insert them.



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Fig.83. Fit bearing housing
A - Bearing housing
B - Short bolts
C - Long bolts

125. Insert the viscous coupling, planetary gear train and annulus complete.

126. Fit the planetary gear carrier shim and the drive plate to the planetary gear train, Fig.84.
Insert the magnetic disc in the housing, Fig.84.

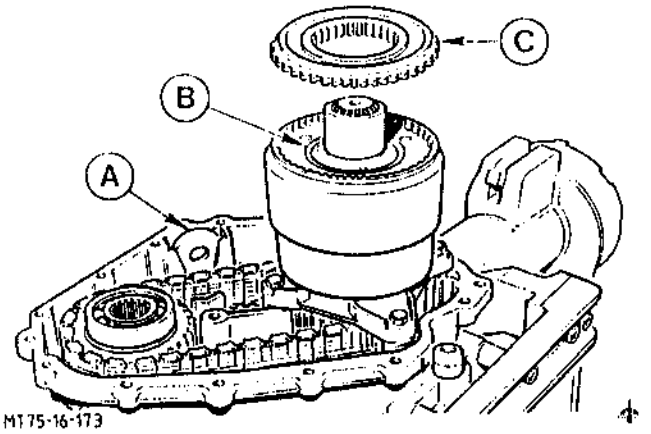


Fig.84. A - Magnetic disc
B - Shim
C - Drive

127. Fit the output flange radial oil seal in the rear transfer box housing using Special Tool 15-058 and adaptor 16-043-A, Fig.85. Grease the sealing lips of the radial oil seal (see Technical Data).

Fig.85. Fit radial oil seal.
A - Special Tool 15-058
B - Special Tool 16-043-A
C - Radial oil seal

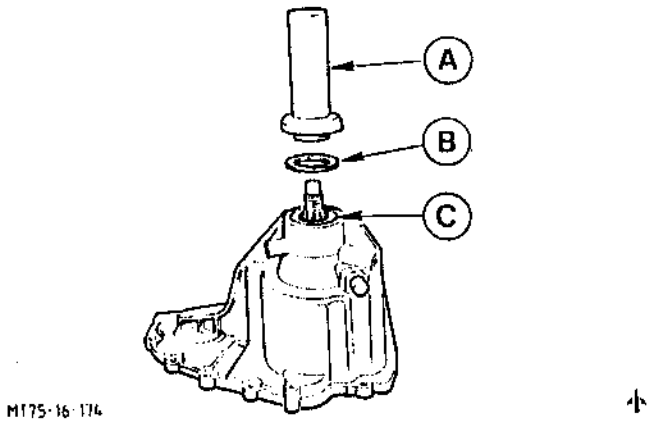


Fig.85. Fit radial oil seal.

128. Fit the output flange to the output shaft. Smear the thread of the output flange nut with sealer (see Technical Data) and fit the nut. Clamp Special Tool 15-030-A in a vice. Fit the output flange in Special Tool 15-030-A and tighten the nut, Fig.86.

Fig.86. Fit output flange.
A - Output flange
B - Special Tool clamped in vice
C - Torque wrench

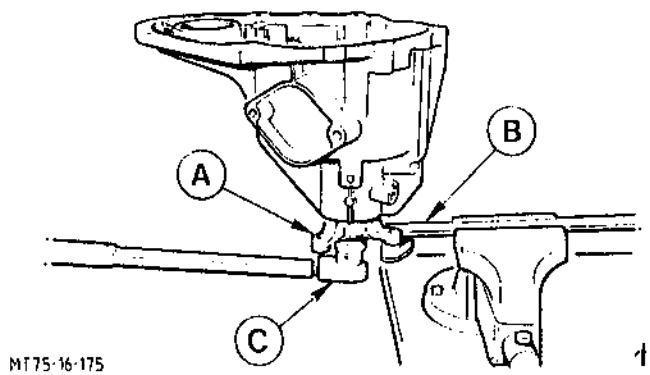


Fig.86. Fit output flange.

129. Measure for shim for transfer box end float:

NOTE: The mating faces must be clean and free of burrs.

Fig.87. Measure end float (distance from mating face of transfer box to bearing inner race shown from above).
A - Steel rule
B - Depth gauge
C - Mating face
D - Ball bearing inner race

Measure the distance from the mating face of the transfer box housing to the bearing inner race with a steel rule and depth gauge at 3 points and note the figures, Fig.87 and Fig.88.

Fig.88. Measure end float (distance from mating face of transfer box housing to bearing inner race shown in partially scrap side view).
A - Steel rule
B - Depth gauge
C - Mating face
D - Bearing inner race

If the values differ, calculate the mean of the measured values, e.g. in the case of 3 measurements.

Measurement 1	158,2 mm
Measurement 2	+158,0 mm
Measurement 3	+158,1 mm

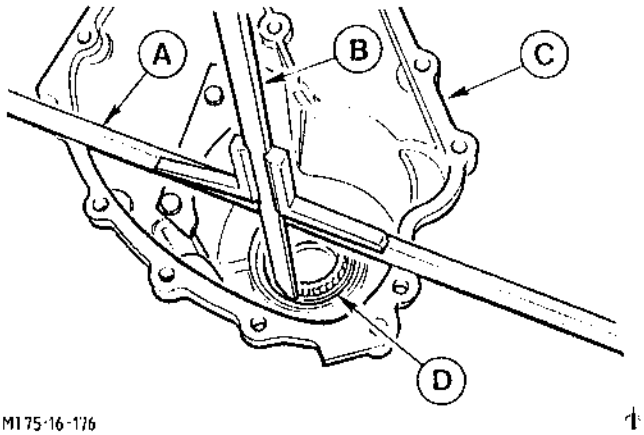
474,3 mm divided by 3 (number of measurements)

= 158,1 mm

Measure the width of the steel rule with a slide caliper and substract this figure from the measured distance.

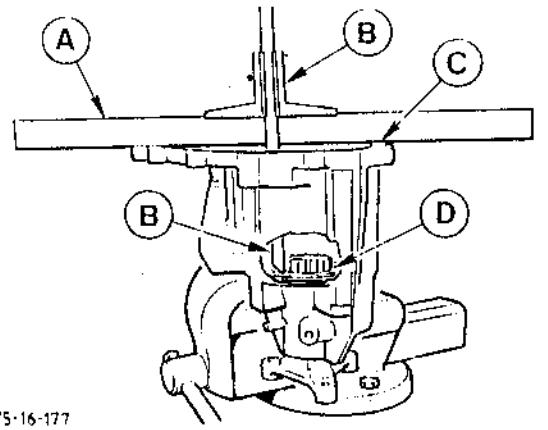
Example

Measured distance	158,1 mm
Width of steel rule	- 29,5 mm
Distance from mating face to bearing inner race	128,6 mm



MT75-16-176

Fig.87. Measure end float (distance from mating face of transfer box to bearing inner race shown from above).



MT75-16-177

Fig.88. Measure end float (distance from mating face of transfer box to bearing inner race shown in partially scrap side view).

130. Measure the distance from the mating face of the transmission housing to the ground face of the drive plate with a steel rule and depth gauge at 2 points and note the figures, Fig.89.

Fig.89. Measure end float (distance from mating face of transmission housing to ground face of drive plate).
A - Depth gauge
B - Ground face of drive plate
C - Transmission housing mating face
D - Steel rule

If the measurements are different, calculate the mean from the measured values:

154,5 mm
+154,7 mm
309,2 mm

309,2 mm divided by 2 (number of measurements)

= 154,6 mm

Example:

Distance measured	154,6 mm
Width of steel rule	-29,5 mm
Distance from drive plate to mating face	125,1 mm

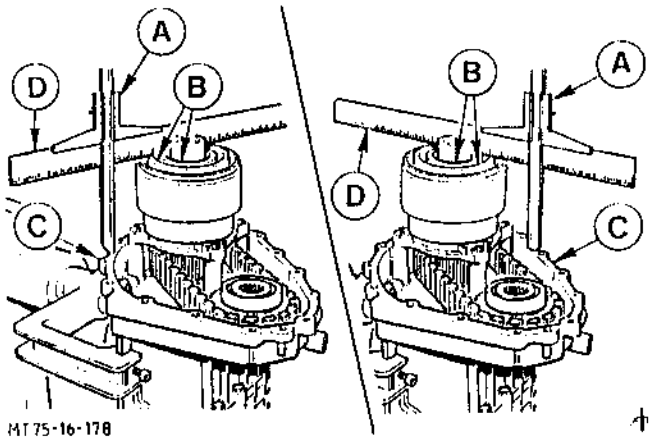


Fig.89. Measure end float (distance from mating face of transmission housing to ground face of drive plate).

To Determine Shim Thickness

131. Calculate the difference between the two measurements and substract 0,5 to 0,7 mm (mean 0,6 mm) for end float from this value. The difference is the size of shim to be fitted (see Parts Microfiche).

Example

Measurement 1	128,6 mm
Measurement 2	-125,1 mm
Difference	3,5 mm
Difference	3,5 mm
End float	- 0,6 mm
Thickness of shim	2,9 mm

132. Fit the required shim and the drive plate in the transfer box housing.

To Fit Transfer Box Housing

133. Heat the bearing seat on the output shaft bearing to a temperature of 70 to 100°C with a hot air blower.

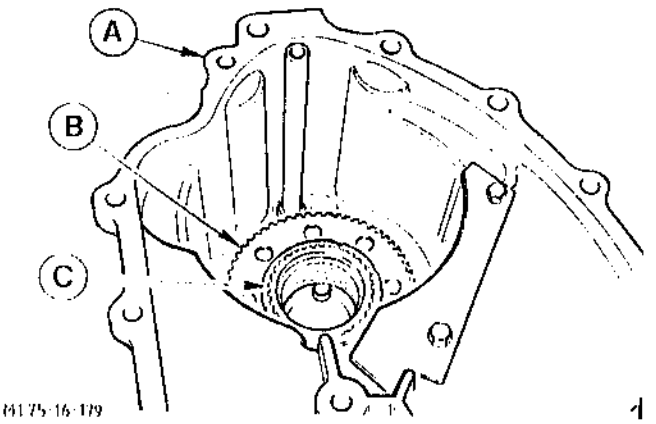


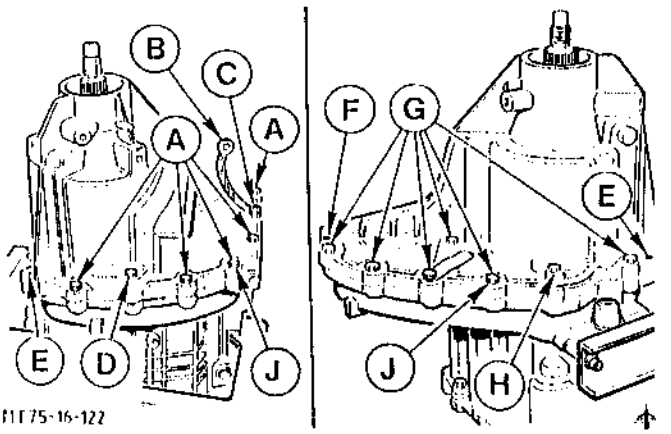
Fig.90. Transfer box housing.
A - Transfer box housing
B - Drive plate (with shim underneath)
C - Output shaft

Fig.90. Transfer box housing.

134. Smear the mating face (free of oil and grease) with sealer (see Technical Data).

135. Fit and align the transfer box housing on the transmission housing.

NOTE: The drive plate teeth must mesh with the teeth of the annulus.



136. Drive the two locating dowels into the transmission housing, Fig.91 (E, F).

Fig.91. Bolts securing transfer box housing to rear transmission housing.

137. Tighten the transfer box housing retaining bolts uniformly, working diagonally. Screw in the stud fit the nut and secure the earth strap with the second nut. Mark the 2 bolts with thread-locking paint (see (Technical Data), Fig.91 (A, B, C, D, G, H, J)

Fig.91. Bolts securing transfer housing to rear transmission housing.
A - Short bolts - left-hand lower half
B - Earth strap - left-hand lower half
C - 2 nuts, 1 stud
D - Long bolts
E - Upper locating dowel
F - Lower locating dowel
G - Short bolts - right-hand upper half
H - Long bolts - right-hand upper hald
J - Bolts with thread-locking paint

138. Fit the radial oil seal of the driveshaft to the front axle box in the transfer box housing using special 14-028, Fig.92. Fit the radial oil seal as far as the shoulder. Smear the sealing lips with grease (see Technical Data).

139. Screw in and tighten the oil drain plugs and the oil filler plug, Fig.93.

140. Fit the vibration damper and tighten the studs to the specified torque using a Torx socket wrench (see Proprietary Tools).

141. Fit the Torx studs in the transmission output flange:

- Clean the threaded holes in the transmission output flange and the threads of the studs (to remove all traces of grease and dirt).
- Apply 2 drops of thread locking compound (see Technical Data) threaded offset at 180° on the flange-end threads of the studs.
- Insert the studs and tighten them to the specified torque.

NOTE: The studs must be tightened completely within a maximum of 5 minutes of applying the thread locking compound.

- Let the thread locking compound harden for 30 minutes.

142. Fit the transmission mounting.

143. Remove the mounting bracket and remove the transmission, Fig.94.

Fig.94. MT-75/4x4 transmission on stand.
A - Stand
B - Clutch release lever
C - Mounting bracket connecting bolts
D - Mounting bracket retaining bolts
E - Upper part of mounting bracket
F - Output flange
G - Transmission mounting
H - Transmission mounting bracket clamp bolt
J - Mounting bracket

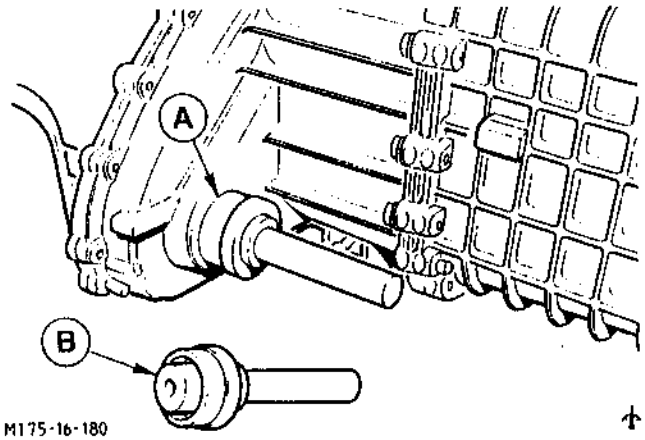


Fig.92. A - Radial oil seal
B - Special Tool 14-028.

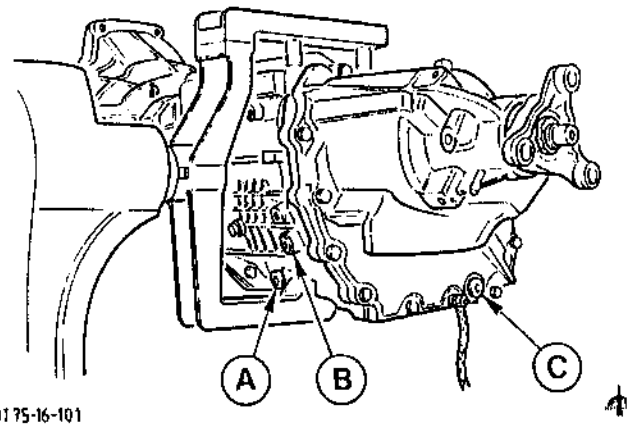


Fig.93. A - Transmission oil drain plug
B - Transfer box oil filler plug
C - Transfer box oil drain plug

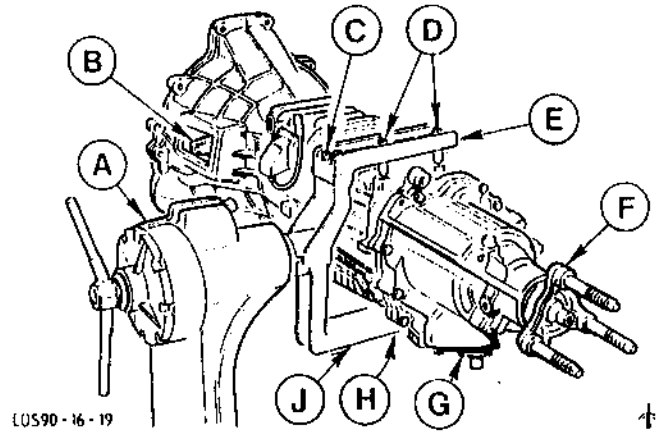


Fig.94. MT-75/4x4 transmission on stand.

16 337 0 SEAL - TRANSFER BOX - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Transfer box oil seal extractor	..	21-051
Transfer box oil seal installer	..	14-028

To Remove

1. Disconnect the battery earth cable.

2. Sierra only:
Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect the multiplug, Fig.1 (B).

Fig.1. Turbocharger heat shield.
A - Retaining bolt
B - HEGO sensor multiplug
C - Heat shield clips
D - Retaining nut

3. Sierra only:
Detach the turbocharger heat shield and bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove heat shield, Fig.1 (A, C, D).

4. Escort only:
Disconnect the multiplug of the HEGO sensor and unclip the wiring, Fig.2.

5. Escort only:
Detach the turbocharger heat shield from the bracket, air cleaner casing and fender (2 bolts, 1 nut in the wheelhouse), Fig.3.

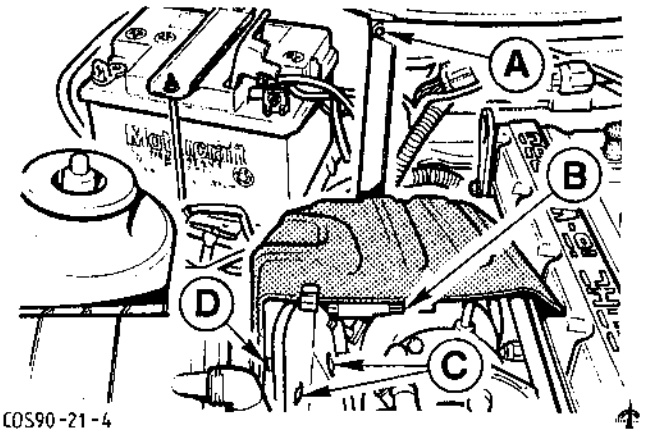


Fig.1. Turbocharger heat shield.
(Sierra shown)

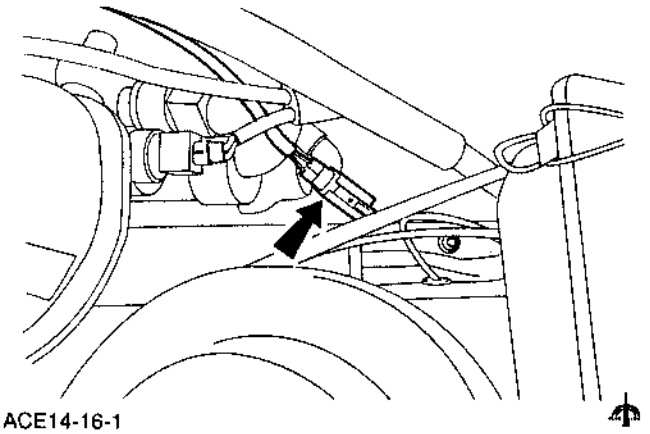


Fig.2. HEGO sensor multiplug.

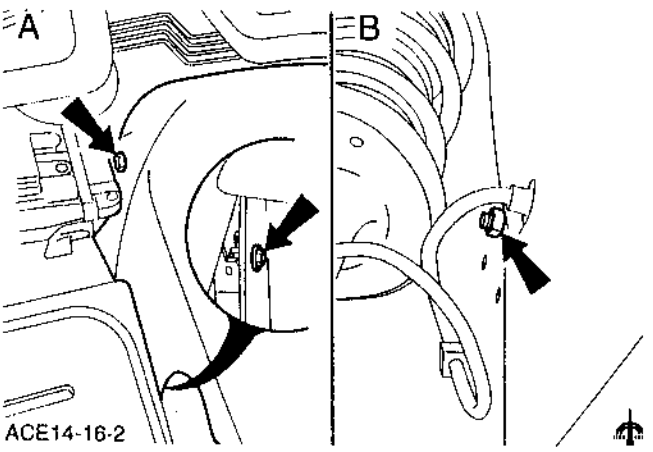


Fig.3. Turbocharger heat shield fixture.
(Escort shown)
A - Bolts
B - Nut in wheelhouse

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6. Detach the front exhaust pipe from the turbocharger (3 nuts), Fig.4.

7. Raise the vehicle.

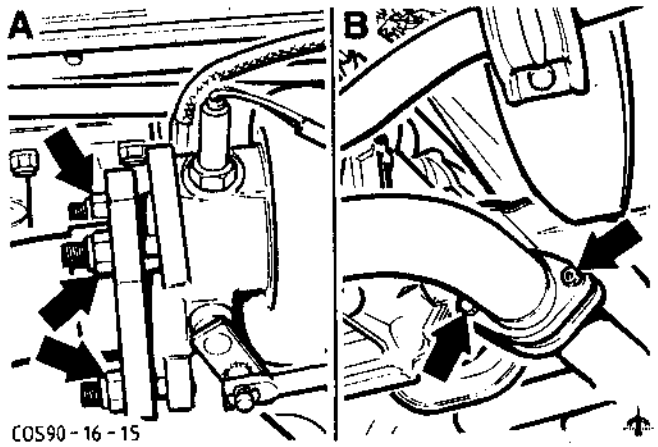


Fig.4. Fixture of front exhaust pipe.
A - To turbocharger
B - To catalytic converter

8. Sierra only:
Detach the lower engine cover from the side members and front axle/engine crossmember (6 bolts), Fig.5.

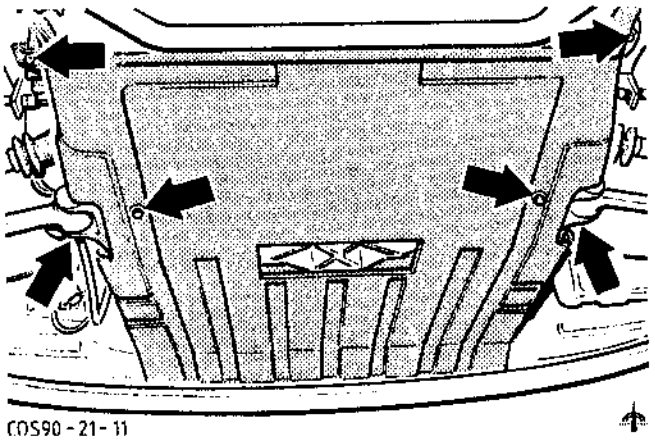


Fig.5. Retaining bolts of lower engine cover. (Sierra shown)

9. Escort only:
Detach the lower engine cover from the side members (4 bolts) and the body (5 bolts), Fig.6.

10. Detach the front exhaust pipe from the catalytic converter (2 bolts and nut), Fig.4 (B).

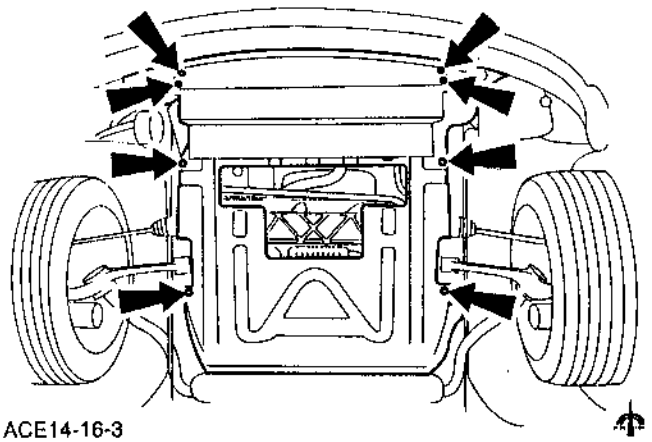


Fig.6. Retaining bolts of lower engine cover. (Escort shown)

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11. Place an oil collecting tray under the transfer box. Disconnect the driveshaft to the front axle from the drive flange on the front axle box (4 Torx bolts), Fig.7. Withdraw the driveshaft from the transfer box and catch the oil that escapes.

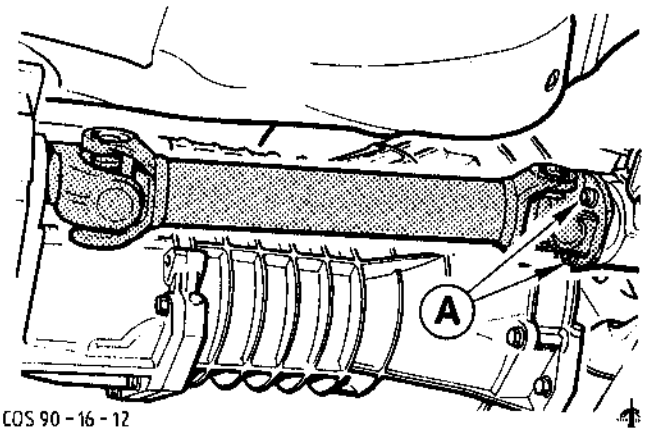


Fig.7. Driveshaft to front axle.
A - Retaining bolts (2 concealed)

12. Remove the transfer box radial oil seal using Special Tool 21-051, Fig.8.

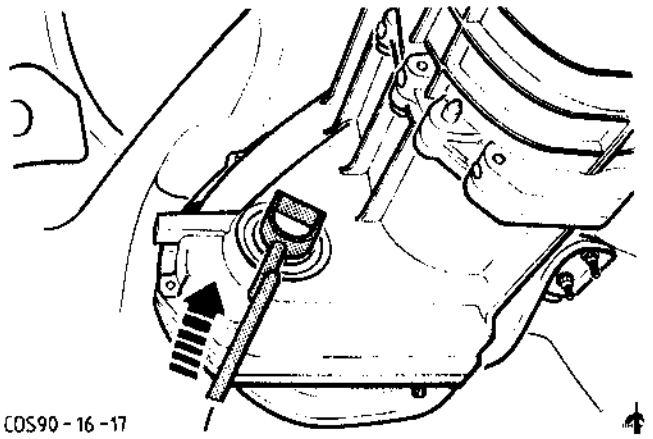


Fig.8. Remove transfer box radial oil seal using Special Tool 21-051.

To Install

NOTE: When installing, tighten the nuts and bolts to the tightening torques specified in Technical Data.

13. Fit the transfer box radial oil seal using Special Tools 14-028, Fig.9.

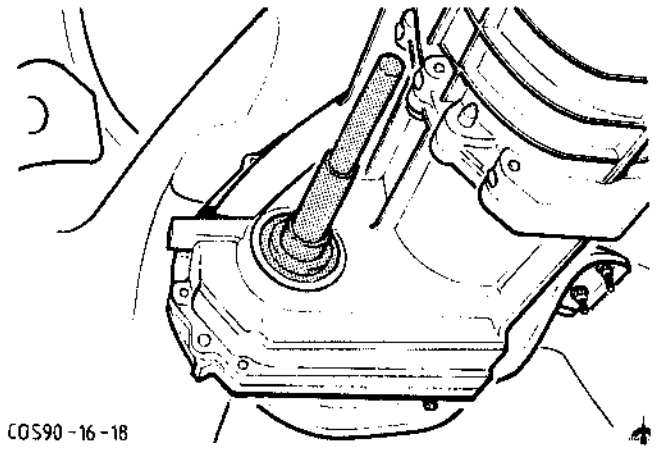


Fig.9. Fit transfer box radial oil seal using Special Tool 14-028.

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14. Insert the driveshaft to the front axle in the transfer box and connect the driveshaft to the front axle drive flange, Fig.10.

15. Connect the front exhaust pipe to the catalytic converter.

16. Fill the transfer box with oil (see Technical Data for quantity and specification), Fig.11

17. Fit the lower engine cover to the side member and front axle/engine crossmember or body.

18. Lower the vehicle.

19. Connect the front exhaust pipe to the turbocharger.

20. Sierra only:
Locate the turbocharger heat shield in position and push it into the 2 lower clips. Secure the turbocharger heat shield and bracket to the bulkhead and to the bracket on the fender, Fig.12 (A, C, D).

Fig.12. Turbocharger heat shield.
A - Retaining bolt
B - HEGO sensor multiplug
C - Heat shield clips
D - Retaining nut

21. Sierra only:
Connect the multiplug of the HEGO sensor and clip the multiplug to the turbocharger heat shield, Fig.12 (B).

22. Escort only:
Secure the turbocharger heat shield to the bracket, air cleaner casing and fender. Connect the HEGO sensor multiplug and clip the wiring in place.

23. Reconnect the battery earth cable.

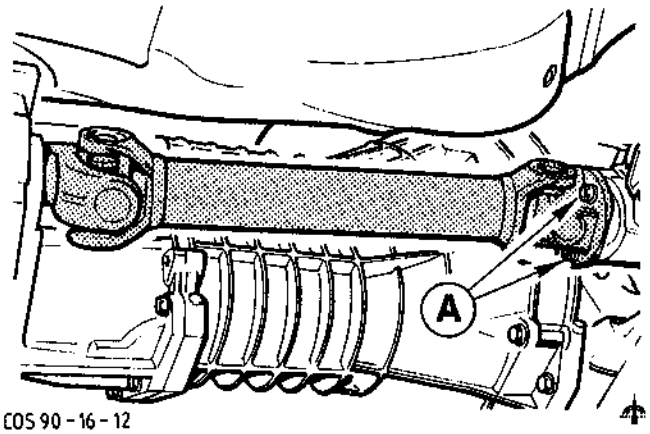


Fig.10. Driveshaft to front axle.
A - 2 retaining bolts (2 concealed)

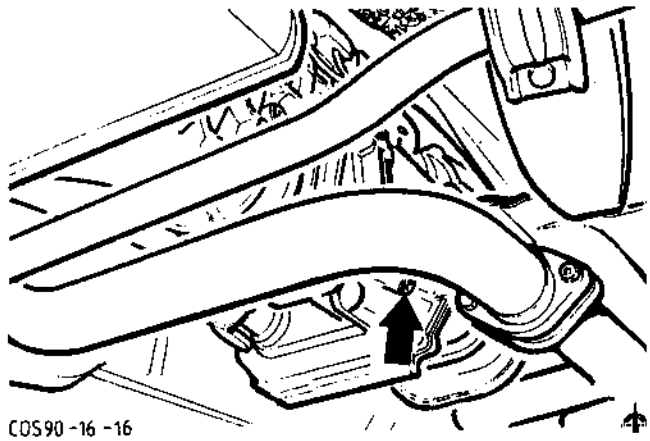


Fig.11. Transfer box oil level check plug.

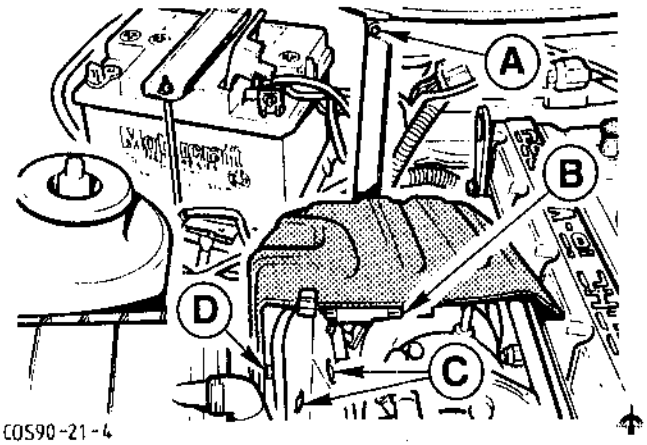


Fig.12. Turbocharger heat shield.
(Sierra shown)

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FORD

SIERRA RS COSWORTH
and
ESCORT RS COSWORTH

Workshop Manual

Ford

Volume II

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For operations and sections not included in this manual, refer to either the Sierra '87 Microfiche or the Escort/Orion '91 Microfiche, as appropriate.

ENGINE
(Cosworth '86/'88) 21A

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TECHNICAL DATA

Engine - General

Engine Code			N5A
Firing order			1-3-4-2
Bore		mm	90,82
Stroke		mm	76,95
Cubic capacity	effective	cm^3	1993
Compression ratio			8,0 : 1
Compression pressure at starter speed		bar	8,5
Boost (nominal)		bar	0,7
Idling speed		rev/min	850
Maximum continuous engine speed		rev/min	6500
Engine power	(DIN)	kW	150
	at	rev/min	6000
Torque	(DIN)	Nm	278
	at	rev/min	4500
Spark plugs			AGPR901C
Ignition point			16° BTDC at idle

Engine Lubrication

Viscosity	below -23°C to -12°C		5W/20
	below -23°C to 0°C		5W/30
	-23°C to +20°C		10W/30
	above -12°C		20W/50
Ford Specification			API/SF-CC
Initial fill capacity	with filter	Litres	3,8
Oil change interval		Km	10,000
Oil change capacity	without filter	Litres	3,0
	with filter change	Litres	3,4
Minimum oil pressure *	at 850 rpm	bar	1,8
	at 2000 rpm	bar	2,4

* With SAE 20W-50 oil at 80°C

Cooling System

Coolant capacity with heater circuit and overflow tank	Litres	7,5
Antifreeze - Type ..... Motorcraft Super Plus 4 antifreeze		
- Specification		ESD-M97B49-A
- a 50/50 solution (by volume) should be used to top up and refill the system		

Cylinder Block

Casting mark			85 HM 6015 AA
Number of main bearings			5
Bore diameter	standard grade 2	mm	90,810 - 90,820
	3	mm	90,820 - 90,830
Centre main bearing width		mm	27,22 - 27,17
Main bearing shells (fitted)			
- internal diameter	Standard	mm	57,000 - 57,038
	Undersize 0,25	mm	56,750 - 56,788
	0,50	mm	56,500 - 56,538
	0,75	mm	56,250 - 56,288
Main bearing parent bore diameter	Standard	mm	60,640 - 60,620

0590

TECHNICAL DATA (cont'd)

Crankshaft

End float			mm	0,1 - 0,254	
Main bearing journal diameter	Standard		mm	56,975 - 56,959	
	Undersize 0,25		mm	56,725 - 56,709	
	0,50		mm	56,475 - 56,459	
	0,75		mm	56,225 - 56,209	
Centre main bearing shoulder width	Standard		mm	32,00 - 32,05	
Thrust - half washers, thickness	Standard		mm	2,3 - 2,35	
Bearing shell to main bearing journal clearance			mm	0,025 - 0,079	
Big-end journal diameter	Standard		mm	51,993 - 51,977	
	Undersize 0,25		mm	51,743 - 51,727	
	0,50		mm	51,493 - 51,477	
	0,75		mm	51,243 - 51,227	
Main bearing journal length	Front centre, rear		mm	32,13 - 31,87	Including fillet
	Intermediate bearings		mm	32,13 - 31,87	
Main bearing shell width	front, centre, rear		mm	23,24 - 23,62	
	Intermediate bearings		mm	23,24 - 23,62	
Big-end bearing journal length			mm	26,0 - 26,1	Including fillet
Big-end bearing shell width			mm	19,61 - 20,00	

Cylinder Head

Cast marking			V 86 HF 6090 AA	
Valve seat angle			45°	
Valve seat width	inlet	mm	1,5 max.	
	exhaust	mm	2,0 max.	
Valve stem bore - inlet	Standard	mm	7,000 - 7,015	
Valve stem bore - exhaust	Standard	mm	8,000 - 8,015	
Camshaft bearing parent bore diameter		mm	28,000 - 28,021	
Distance between underside of valve guide and cylinder head mating face	inlet	mm	33,5	along CL guide
	exhaust	mm	28,0	along CL guide
Cylinder head flatness - upper mating face				
Maximum permissible longitudinal bow (measured along cylinder head centre line)		mm	0,10	
			If exceeded, replace cylinder head	
Cylinder head flatness - lower mating face				
Maximum permissible lateral bow (100 mm straight-edge)		mm	0,02	
Maximum permissible longitudinal bow (100 mm straight-edge)		mm	0,02	
Maximum permissible overall longitudinal bow (measured along cylinder head centre line)		mm	0,08	
			If any limit exceeded, re-machine cylinder head	
Maximum material removal		mm	0,13	
Minimum cylinder head height after machining, measured between mating faces		mm	138,68	

Camshaft

Number of camshafts			2	
Number of bearings			5	
Drive			toothed belt	
Cam lift	inlet	mm	8,544	
	exhaust	mm	8,544	
Cam length (heel to toe)	inlet	mm	46,802 - 46,286	
	exhaust	mm	46,802 - 46,286	
Bearing journal diameter			27,960 - 27,939	
Inlet valve side front	1st plain bearing	mm	27,960 - 27,939	
	2nd plain bearing	mm	27,960 - 27,939	
	3rd plain bearing	mm	27,960 - 27,939	
	4th plain bearing	mm	27,960 - 27,939	
Outlet valve side front	1st plain bearing	mm	27,960 - 27,939	
	2nd plain bearing	mm	27,960 - 27,939	
	3rd plain bearing	mm	27,960 - 27,939	
	4th plain bearing	mm	27,960 - 27,939	
Camshaft end float			clearance in ball bearing	
Valve timing	inlet valve opens before TDC		8°	
	inlet valve closes after BDC		52°	
	exhaust valve opens before BDC		52°	
	exhaust valve closes after TDC		8°	

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TECHNICAL DATA (cont'd)

Valves

Valve operation			O.H.C. direct
Valve clearance (cold)	inlet		hydraulic tappet
	exhaust		hydraulic tappet
Tappet diameter	Standard	mm	34,975 - 34,959
Tappet diameter	Oversize	mm	35,175 - 35,159
Tappet clearance in housing	Standard/Oversize	mm	0,025 - 0,057
Free spring length		mm	39,8
Spring force	valve open	N	620
	valve closed	N	257
Spring length	valve open	mm	23,45
	valve closed	mm	32
Valve spring wire diameter		mm	3,9
Number of turns			5,8
Valve-spring inner diameter		mm	21,6

Inlet Valve

Length		mm	105,68
Head diameter		mm	35,0 - 35,2
Stem diameter	Standard	mm	6,970 - 6,955
Stem/guide clearance		mm	0,03 - 0,06

Exhaust Valve

Length		mm	105,5
Head diameter		mm	31,0 - 31,2
Stem diameter	Standard	mm	7,960 - 7,938
Stem/guide clearance		mm	0,055 - 0,077

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TECHNICAL DATA (cont'd)

Pistons

Diameter	Standard 2	mm	90,758	- 90,772
	3	mm	90,768	- 90,782
Clearance in bore (unused)		mm	0,038	- 0,062
Ring gap (fitted)	top	mm	0,4	- 0,65
	centre	mm	0,4	- 0,65
	bottom	mm	0,3	- 0,6
Ring gap position	top		120° apart	
	centre		120° apart	
Lower scraper ring			120° apart	

Piston Pins

Type			fully floating
Piston pin diameter		mm	24,000 - 23,995
Pin retention			wire circlips

Connecting Rod

Bore diameter (without bearing shells)	big-end	mm	55,00	- 55,02	
	small-end	mm	27,000	- 27,021	
Bearing shells (fitted)					
- inside diameter	Standard	mm	52,006	- 52,044	
	Undersize 0,25	mm	51,756	- 51,794	
	0,50	mm	51,506	- 51,544	
	0,75	mm	51,256	- 51,294	
Bush - inside diameter		mm	24,007	- 24,013	fitted
Big-end bearing clearance		mm	0,013	- 0,067	
Big-end bearing axial float		mm	0,25	- 0,09	

TECHNICAL DATA (cont'd)

Tightening Torques

Cylinder Block	Nm	Note
Main bearing caps to cylinder block	87,5 to 101	Loctite 270
Crankshaft pulley to crankshaft	122 to 135	
Clutch housing to engine	40 to 51	
Clutch housing adaptor plate bolt	8,5 to 12	
Flywheel to crankshaft	63 to 69	
Clutch pressure plate to flywheel	18,5 to 21,5	
Oil pump to cylinder block	18,5 to 21,5	
Auxiliary shaft retainer plate to cylinder block	8 to 10	
Auxiliary shaft pulley to auxiliary shaft	44 to 49	
Con rod caps to con rod	55 to 60	
Sump to cylinder block Stage 1	8 to 10	Bolts-Loctite 270
Stage 2	8 to 10	Gasket - Loctite 518
Water pump to cylinder block M8	18,5 to 21,5	
Water pump to cylinder block M10	40 to 48	
Water pump pulley to water pump	18,5 to 21,5	
Engine mounting bracket to cylinder block	18,5 to 21,5	
Insulator to engine mounting bracket	40 to 48	
Oil drain plug to sump	21 to 27	
Alternator bracket to cylinder block	58 to 79	
Alternator to bracket	18 to 25	
Adjustment strap to alternator	18 to 25	
Adjustment strap to water pump	18 to 25	
TDC sensor bracket studs to sump	4 to 6	Loctite 648
TDC sensor bracket nuts to sump	8 to 10	Gap between sensor and pulley tooth 0,6 to 1,0 mm
TDC sensor bolts to bracket	4 to 6	Loctite 270
Distributor clamp to cylinder block	18,5 to 21,5	
Bolts - power steering pump to mounting bracket	20,5 to 25,5	
Power steering pump bracket to cylinder block	50 to 60	M10 socket head bolt
Power steering pump support bracket to cylinder block	18,5 to 21,5	M8 hex. head bolt - Loctite 518 on mating face
Support bracket to power steering pump bracket	35 to 40	M8 socket head bolt
Power steering pump fixture (belt tension)	20,5 to 25,5	
Crankshaft front seal housing to cylinder block	13 to 17	Fit new self locking bolts ('Scotch Grip' bolts)
Oil pick up pipe to oil pump	8 to 10	
Oil pick up pipe to cylinder block	18,5 to 21,5	
Water drain plug to cylinder block	25	
Sump baffle to sump	8 to 10	Loctite 270
Oil filter	Up to face then tighten one half to threequarters of a turn	Oil sealing ring
Oil cooler to cylinder block	30 - 35	Loctite 270

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TECHNICAL DATA (cont'd)

Cylinder Block (cont'd)	Nm	Note
Hollow bolt to cooler	55 to 60	
Turbocharger oil feed adaptor to main gallery	25+	Loctite
Turbocharger oil feed hose to adaptor	25+	
Oil pressure sender to adaptor	25 to 29	Loctite 518
Timing belt cover to engine - all bolts	8 to 10	
Inlet Manifold		
Plenum cover to inlet manifold	8 to 10	Loctite 518
Plenum intake elbow to plenum cover	18,5 to 21,5	
Throttle body to plenum intake elbow	8 to 10	
Inlet manifold stud to inlet manifold	3,5 to 4,5	Loctite 648
Throttle cable bracket to plenum cover	18,5 to 21,5	Loctite 518
Fuel pressure regulator to bracket	8 to 10	'86 MY only
Fuel pressure regulator bracket to plenum chamber	8 to 10	
Hose clips - fuel pressure regulator	1,5 to 2	
Hose clips - worm drive	3,5 to 4,5	
Fuel rail to plenum cover	8 to 10	
Crankcase breather valve to plenum chamber	8 to 10	
Breather valve intake fitting to plenum chamber	15 to 20	Loctite 242
Air temperature sender to plenum cover	23 to 25	Loctite 518
Signal elbow to plenum cover	5 to 6	Loctite 518
Fuel pressure regulator banjo bolt	1,5 to 2	if fitted
Intake elbow stud (M6)	3,5 to 4,5	Loctite 518
Intake elbow damper assembly	8 to 10 (Back off a half turn)	Loctite 270
Exhaust Manifold		
Secondary exhaust manifold to primary manifold	32 to 36	
Turbocharger to secondary exhaust manifold	40 to 48	
Exhaust downpipe to turbocharger nuts (M8)	19 to 23	
Exhaust downpipe to turbocharger nuts (M10)	35 to 47	
Oil feed adaptor to turbocharger	25 to 35	Oil
Turbocharger oil feed to adaptor	25	
Turbocharger drain pipe to turbocharger	18,5 to 21,5	
Coolant pipe banjo bolt to turbocharger	19 to 23	Oil
Turbocharger, turbine housing inlet studs (M10)	18,5 to 21,5	Oil
Turbocharger, turbine housing outlet studs (M8)	8 to 10	Oil
Turbocharger, damper friction assembly and locknut	See damper adjustment procedure contained in Operation 23 612 0	

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TECHNICAL DATA (cont'd)

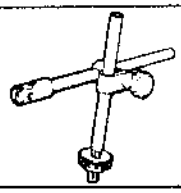
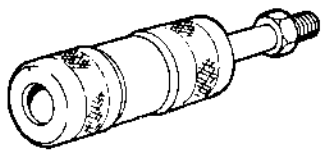
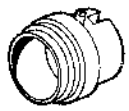
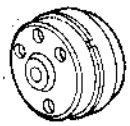
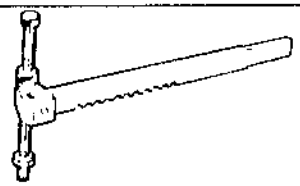
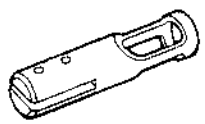
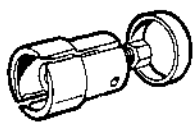
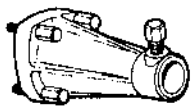
Cylinder Head	Nm	Note
Cam cap stud to cylinder head (M6)	3,5 to 4,5	Loctite 648
Cam cap stud to cylinder head (M8)	3,5 to 4,5	Loctite 648
Cam cap to cylinder head (M6)	8 to 10	Loctite 270
Cam cap to cylinder head (M8)	19 to 23	
Inlet manifold stud to cylinder head	3,5 to 4,5	Loctite 648
Cam bearing retainer screws	8 to 10	
Cam pulley to camshaft	59 to 63	
Idler pulley stud to cylinder head	4,5 to 5,5	Loctite 648
Idler pulley to cylinder head	40 to 48	
Timing belt cover pillar bolt to cylinder head	4,5 to 5,5	Oil
Timing belt cover pillar bolt to camshaft cover	4,5 to 5,5	Loctite
Exhaust manifold stud to cylinder head	3,5 to 4,5	Loctite 648
Thermostat housing to cylinder head	18,5 to 21,5	
Housing, coolant temperature sender to cylinder head	8 to 10	
Coolant temperature sender to housing	23 to 25	Loctite 518
Lifting eyes to cylinder head	18,5 to 21,5	
Cam cover to cylinder head	10 to 15	
Inlet manifold to cylinder head	18,5 to 21,5	
Exhaust manifold to cylinder head	19 to 23	
Cylinder head to cylinder block Stage 1	20 to 25	
Stage 2	45 to 50	
Stage 3	Rotate further 170° to 180°	
Spark plug	28 to 33	
Temperature gauge sender unit to cylinder head	7 to 10	Loctite 518
Turbocharger damper pillar bolt (M8)	18,5 to 21,5	
Oil gallery blanking plugs to cylinder head 1/16 NPTF	5 + 90°	Loctite 518
1/8 NPTF	8 to 10	Loctite 518
Exhaust System - left hand muffler insulator bracket bolts	45 to 56	
Starter Motor - retaining bolts	29 to 41	

Belt Tension		
Alternator/water pump	new belt 400 to 500 N used belt 300 N	
Power steering pump	new belt 450 to 550 N used belt 350 to 450 N	
Timing belt (with special tool 21-113)	9,5 to 10,5 gauge reading	

NOTE: A used V-belt is one that has been run for at least 10 minutes. All tensions refer to a cold belt.

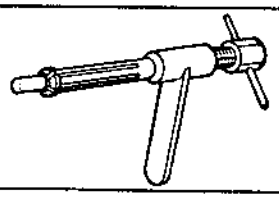
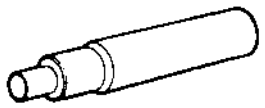
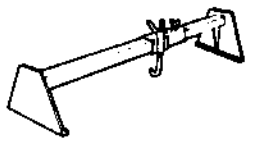
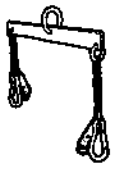
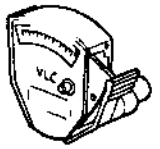
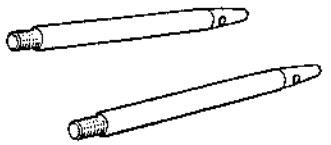
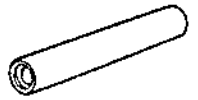
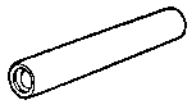
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SPECIAL SERVICE TOOL RECOGNITION

	15-022-A	Dial test indicator holding fixture
	15-046	Metric dial test indicator gauge
	15-053	Slide hammer
	21-009-B	Crankshaft front oil seal installer
	21-011-D	Crankshaft rear oil seal installer
	21-023	Universal spindle (only for use in conjunction with engine stands)
	21-024	Valve spring compressor (main tool)
	21-024-06	Adaptor - valve spring compressor
	21-028-A	Crankshaft timing gear remover
	21-031-B	Engine mounting bracket (only in conjunction with 21-023 and engine stands)

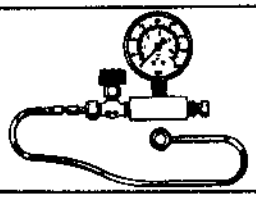
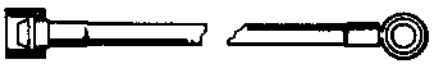
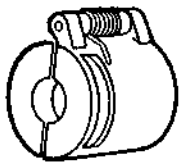
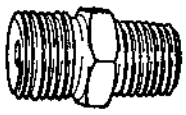
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SPECIAL SERVICE TOOL RECOGNITION (cont'd)

	21-036-A	Crankshaft needle roller bearing remover
	21-044-A	Crankshaft needle roller bearing installer and clutch disc locator
	21-060-A	Engine support bar
	21-068	Engine lifting tackle
	21-113	Toothed belt tension gauge
	21-128	Cylinder head alignment studs
	21-129	Installer - valve stem oil seal (exhaust)
	21-130	Installer - valve stem oil seal (inlet)
	21-142	Remover - valve stem oil seal
	21-143	Crankshaft front and rear oil seal remover

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SPECIAL SERVICE TOOL RECOGNITION (cont'd)

	23-011A	Oil pressure test gauge
	23-011A-09	Connecting hose
	23-023-A	Remover - fuel delivery line
	Ford Part No. 6084322	Reducer fitting

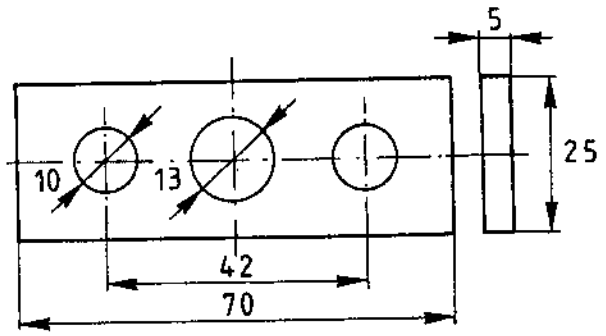
PROPRIETARY TOOLS

Compression Tester

Air line adaptor for spark plug bore.

LOCALLY FABRICATED TOOLS

Support plate - valve spring compressor



COS-21-1

Fig.1. Valve spring compressor support plate.

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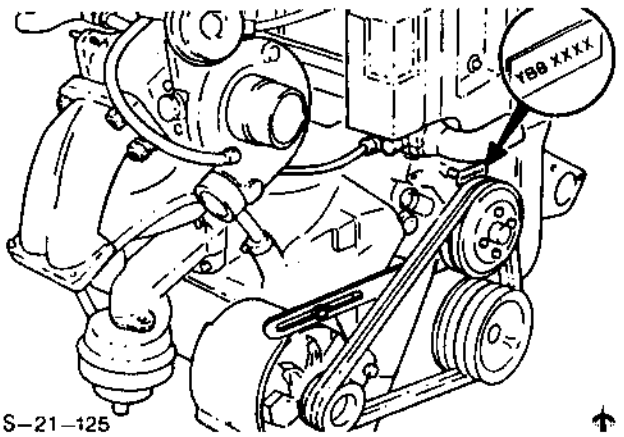
GENERAL DESCRIPTION

The high performance engine fitted to the Sierra Cosworth has been developed in collaboration with COSWORTH in England, a company well known for its high performance engines.

The FORD 2,0 litre OHC regular production cylinder block forms the basis of this engine.

The main feature of this engine is the aluminium cylinder head with its two overhead camshafts. Its four valves per cylinder and backup from an exhaust gas turbocharger provide the basis for optimum cylinder charge.

The engine is distinguished by outstanding torque characteristics even at low speeds enabling the vehicle to accelerate from 0 to 100 kph in under 7,0 secs.



SRS-21-125

Fig.2. Engine number.

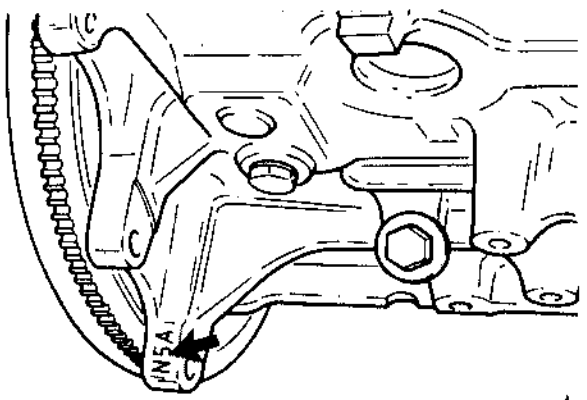
Engine Identification

The identification code and serial number must be stamped on replacement engines in such a way as to be clearly visible to an inspecting authority.

The letters and numbers must have a minimum height of 6 mm.

The engine number consists of a two-digit code for the build year and month and a five-digit serial number.

The three digit engine code indicates cubic capacity, compression ratio and model to which the engine is fitted.



SRS-21-4N

Fig.3. Engine code.

Valve Identification

The valve identification is stamped in 5 mm characters on the rear end of the cylinder head. These numbers indicate details of oversize specifications with respect to valve guide, valve seat and tappet.

IN1234567S1G1 =Inlet valve 1 to 7 seat oversize 1 guide oversize 1

IN8S2 = Inlet valve 8 seat oversize 2

EX678S1G2 = Exhaust valve 6 to 8 seat oversize 1 guide oversize 2

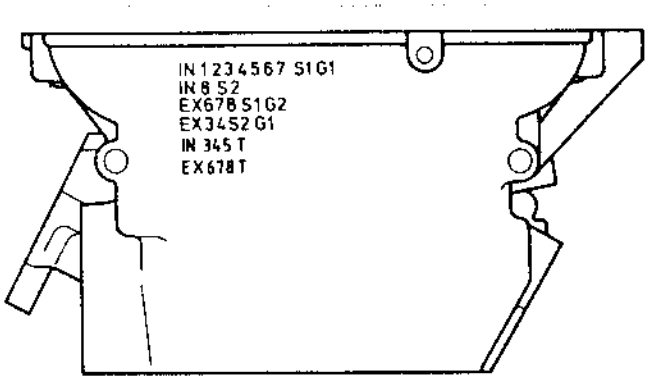
EX34S2G1 = Exhaust valve 3 and 4 seat oversize 2 guide oversize 1

'88 Model Year only

IN 345T = Inlet tappet 3, 4 and 5 oversize

EX 678T = Exhaust tappet 6, 7 and 8 oversize

In the case of oversize tappets, this is also recorded by an 'A' being stamped on the cylinder head adjacent to the tappet bore. The tappets themselves are marked on the underside adjacent to the hydraulic plunger, '+ 0,2'.
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SRS-21-124N

Fig.4. Cylinder head, rear end - oversize valve identification.

GENERAL DESCRIPTION (cont'd)

Modifications

Following parts are changed or modified:

- Cylinder block - c/o Ford 2,0 cast iron block (memo: selected blocks only)
- Cylinder head and gasket - new Cosworth 16-valve design aluminium head. New gasket
- Crankshaft and bearings - new Cosworth design forged steel crankshaft and new bearings
- Flywheel - new Cosworth design steel flywheel
- Pistons and rings - new Mahle design
- Con-rods and piston pins - new Cosworth design steel rods and bolts
- Camshafts, bearings and drive - new Cosworth design
- Hydraulic tappets - new Cosworth design
- Valves, springs, and seats - new Cosworth design
- Intake manifold - new Cosworth design to suit fuel injection
- Exhaust manifold - new Cosworth design to suit turbocharger installation
- Oil pan - new Cosworth design cast aluminium sump
- Oil pump - modified Ford component
- Radiator, fan, shroud and hoses - new to suit increased engine power
- Water pump - c/o 1985 MY Ford design
- Turbocharger system - water cooled Garrett turbocharger with associated wastegate control, lubrication system and intercooler
- Engine mount - left hand side unique
  - right hand side c/o V6 engine

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GENERAL DESCRIPTION (cont'd)

Lubrication System

The oil pump draws oil from the sump via a strainer.

Part of the oil delivered by the pump is fed into an auxiliary spray pipe system which sprays oil directly under the pistons to promote piston crown cooling.

The main oil flow, Fig.6, is fed into a heat exchanger which is coupled to the engine cooling system.

This oil to water heat exchanger, Fig.5, allows rapid warm up of the oil to its normal working temperature. It also maintains an acceptable oil temperature under all operating conditions. After the heat exchanger, the oil is directed through a full flow filter and into the main oil gallery which directly supplies the five main bearings and the eight overhead camshaft plain bearings.

The big-end bearings are supplied through diagonal drillings in the crankshaft from the front and rear main bearings.

The auxiliary shaft is directly connected to the main oil gallery. The distributor drive shaft is supplied intermittently with oil from the drilled auxiliary shaft.

A one way valve is fitted in the feed line to the cylinder head to prevent oil flowing back to the sump when the engine is stopped. This guarantees instant lubrication when the engine is started.

The oil supply to the turbocharger is taken from the main oil gallery via the oil pressure warning switch adaptor.

The oil return line from the turbocharger is connected directly into the sump via a stub pipe.

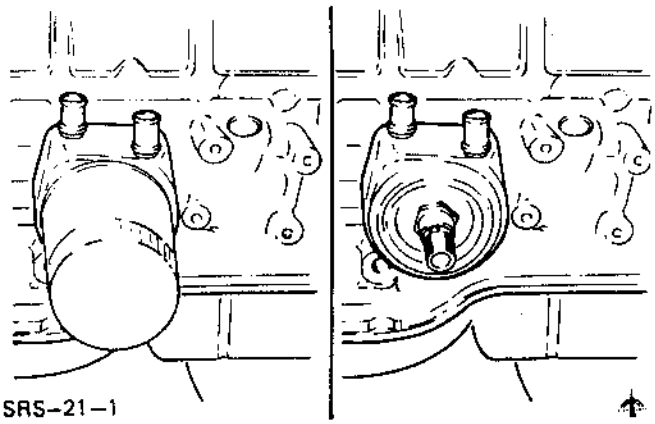


Fig.5. Oil heat exchanger/oil filter connection.

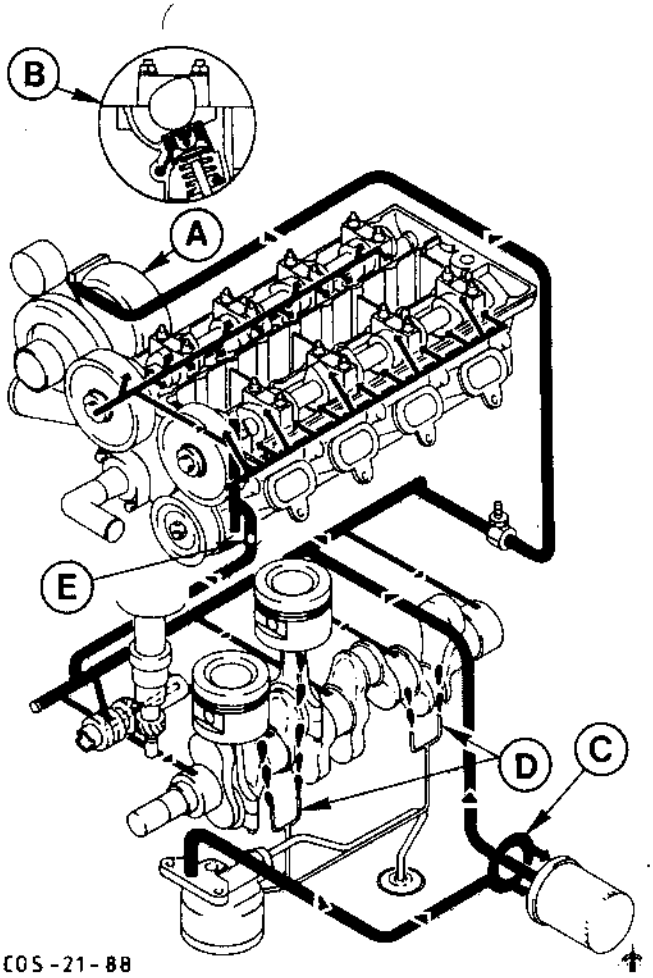


Fig.6. Lubrication circuit.

Fig.6. Lubrication circuit.
A - Turbocharger
B - Hydraulic valve tappets
C - Oil cooler
D - Piston cooling
E - Oil retaining valve

GENERAL DESCRIPTION (cont'd)

Cylinder Block

The SIERRA COSWORTH cylinder block is a standard 2,0 ltr. OHC block which has been specially selected as having only bore sizes 2 or 3. These bore sizes are stamped into the cylinder block in the cylinder sequence, Fig.7.

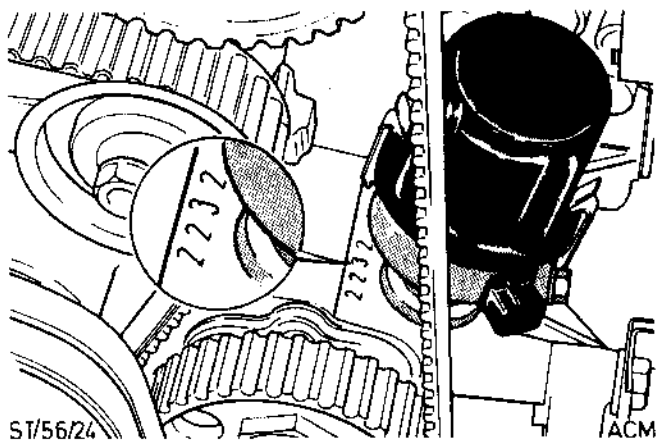


Fig.7. Cylinder bore and piston sizes.

Flywheel

The flywheel differs from the standard 2,0 ltr. OHC engine in that it has an increased diameter, 9 retaining bolts and is balanced as an assembly with the crankshaft.

To ensure that the flywheel can only be assembled in its correct position, one of the bolt holes has an offset drilling, Fig.8.

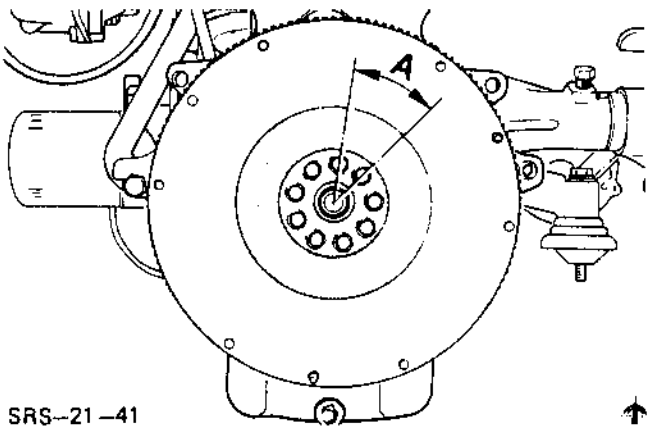


Fig.8. Flywheel.
A - Offset

Cylinder Head

The COSWORTH developed cast aluminium cylinder head is a double overhead camshaft design with four valves per cylinder.

The valves are arranged in V-formation, with inlet and exhaust valves lying opposite to each other and operated by their own respective camshaft.

The valves are directly actuated with hydraulic tappets and therefore require no adjustment.

Both camshafts are supported by five bearings, the front ones being ball bearings. The others are plain bearings and are machined directly into the cylinder head eliminating bearings shells.

The inlet valve camshaft has oil grooves in the journals to ensure uniform lubrication, Fig.9.

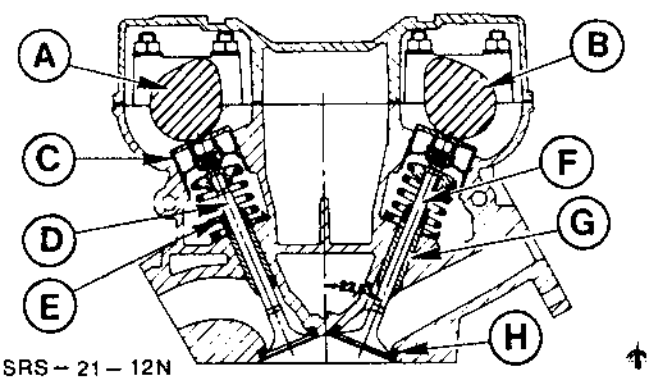


Fig.9. Cylinder head - cross section.

Fig.9. Cylinder head - cross section.
A - Camshaft - exhaust side
B - Camshaft - inlet side
C - Hydraulic valve tappets
D - Exhaust valves - sodium filled
E - Valve stem oil seals
F - Inlet valves
G - Valve guides
H - Valve seats

GENERAL DESCRIPTION (cont'd)

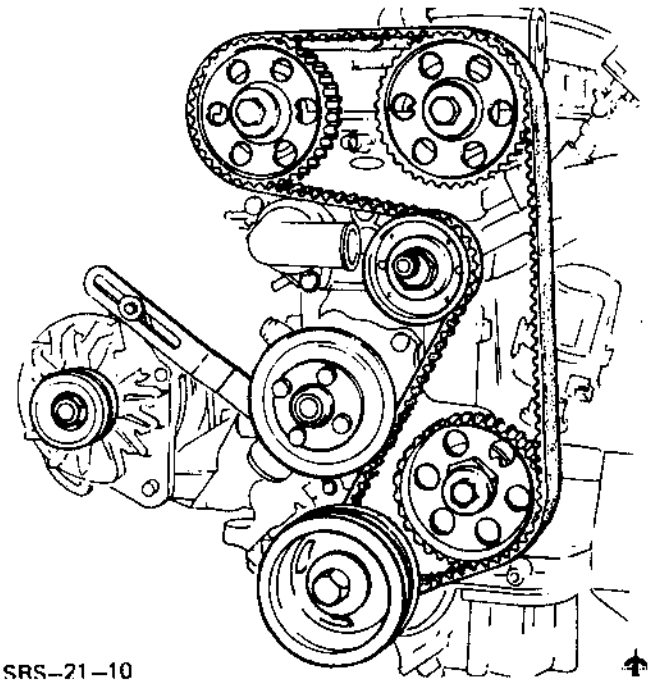
Camshaft Drive

On the front end of each camshaft there is a toothed pulley, both are driven by a toothed pulley wheel mounted on the front end of the crankshaft, the power being transmitted by a common toothed drive belt, Fig.10..

The belt tensioner is situated after the crankshaft pulley wheel in the direction of rotation.

The drive take off for the auxiliary drive shaft is located between the inlet camshaft pulley wheel and the crankshaft pulley wheel.

The whole of this drive mechanism is enclosed by a plastic cover (timing belt cover).



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Fig.10. Toothed drive belt.

Crankshaft

The crankshaft is dimensionally identical to the OHC crankshaft but is manufactured from forged steel. It has specially hardened and moly. coated bearing journals.

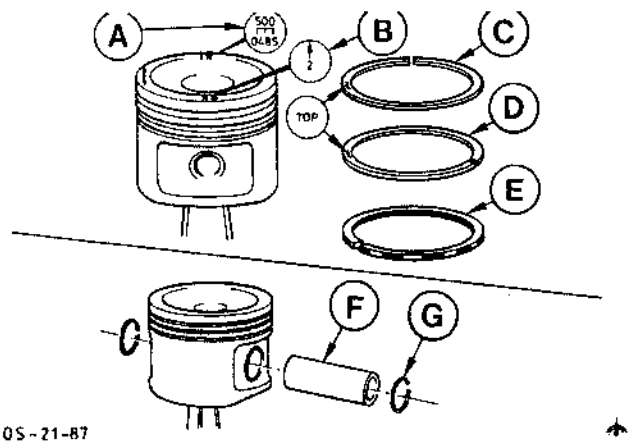
Pistons and Connecting Rods

The pistons are manufactured for COSWORTH by the Mahle company.

In the crown of the piston there is a formed combustion chamber.

Only pistons having the grade classification 2 or 3 are used. These numbers are stamped under the piston crown in the location of the arrow.

Corresponding cylinder size numbers are marked on the cylinder block.



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Fig.11. Piston, piston rings and piston pin.

Fig.11. Piston, piston rings and piston pin.
- A - Production date and manufacturer's code
- B - Piston classification and arrow (to engine front)
- C - 1st compression ring marked 'TOP'
- D - 2nd compression ring marked 'TOP'
- E - Oil control ring
- F - Piston pin
- G - Spring ring

SERVICE AND REPAIR OPERATIONS

21 111 0 ENGINE - CHECK COMPRESSIONS

TEST EQUIPMENT REQUIRED:

Commercially available compression tester

NOTE: In most cases, the differences in compression tester design and varying starter motor speeds only make it possible to check that the compression is uniform in all the cylinders. The actual compression pressure depends on a number of factors and can only be measured when certain preconditions apply.

The engine should be at normal operating temperature.

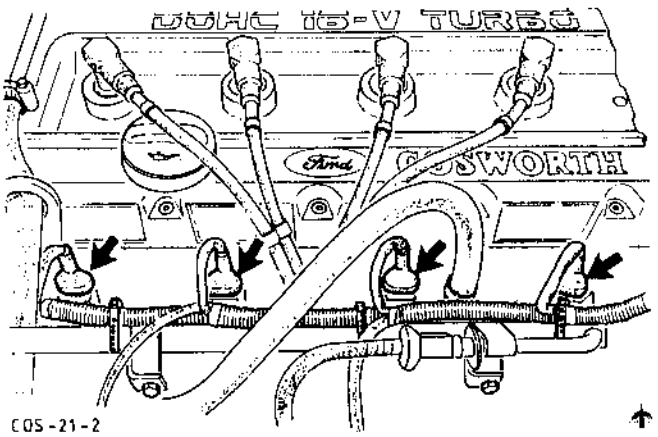


Fig.12. Fuel injector multiplugs.

To Check

1. Disconnect the low tension cable from the ignition coil (terminal 15).

2. Disconnect the multiplugs from the fuel injectors.

3. Disconnect the HT leads and remove the spark plugs.

4. Insert the graph paper in the tester. Connect the tester, pressing the rubber seal firmly into the spark plug bore of cylinder No.1.

   Crank the engine with the throttle fully opened until the pointer on the tester stops rising.

5. Vent the tester, adjust the graph paper for the next cylinder and repeat the procedure described in sub-operation 4 on the remaining cylinders.

6. Screw in the spark plugs and tighten them to the specified torque (see Technical Data). Connect the HT leads in the correct sequence.

7. Connect the fuel injector multiplugs.

8. Connect the low tension lead to the ignition coil.

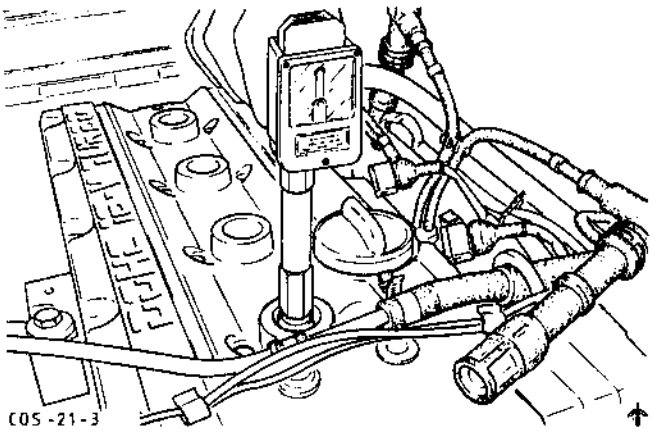
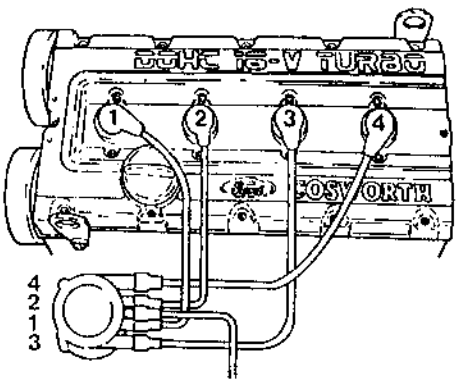


Fig.13. Compression tester.



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Fig.14. HT lead arangement/firing order.

21 112 0 OIL PRESSURE - CHECK

SPECIAL SERVICE TOOLS REQUIRED:

Oil pressure test gauge	23-011A
Connecting hose	23-011A-09
Reducer fitting - Finis Code	6084322

NOTE: The oil pressure depends on various factors (engine speed, oil temperature, oil pump rotor clearance etc.). Measurement should always be carried out with the oil at a temperature of 80 °C. The oil pressure should be at least 1,8 bar at idle speed and 2,4 bar at 2000 rev/min. The maximum oil pressure should not exceed 5 bar at speeds above 2000 rev/min.

These values apply to SAE 20W-50 oil only.

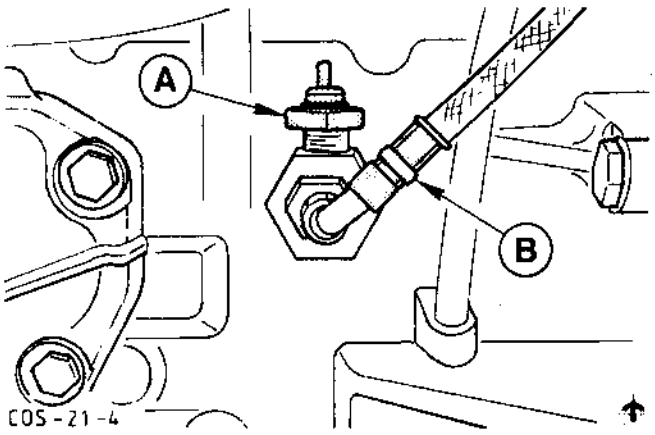


Fig.15. A - Oil pressure switch
B - Turbocharger oil feed line - do not disconnect

To Check

1. Disconnect the wiring from the oil pressure switch and unscrew the switch.

NOTE: Do not disconnect the turbocharger oil feed line. The oil supply to the turbocharger must always be present when the engine is running.

2. Screw the reducer fitting, Finis Code 6084322 into the oil pressure switch bore. Connect the test gauge and hose to the reducer fitting.

3. Start the engine, check the oil pressure at idle speed and above 2000 rev/min.

4. Remove the test gauge, connecting hose and reducer fitting. Fit the oil pressure switch (for sealing compound and tightening torque see Technical Data) and connect the wiring.

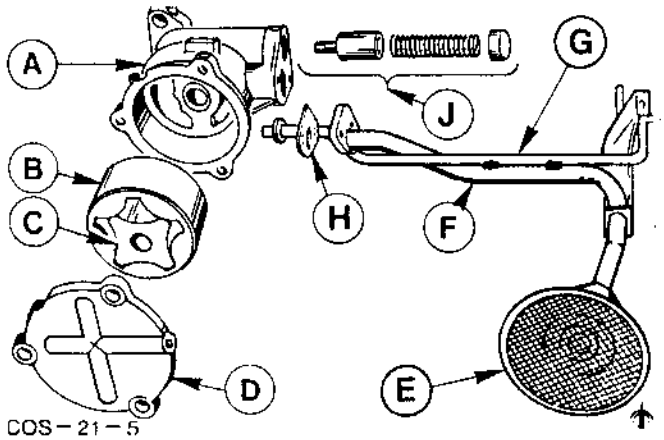


Fig.16. Oil pump - exploded view.
A - Casing
B - Outer rotor
C - Inner rotor
D - Cover
E - Oil intake strainer
F - Intake pipe
G - Spray pipe
H - Gasket
J - Pressure relief valve

If the oil pressures are not to specification, first check the oil pump and pressure relief valve as the possible source of the fault.

The following typical faults can occur:

Pressure too high at speeds above 2000 rev/min: pressure relief valve failing to open due to dirt.

Pressure too low over the entire speed range: oil intake strainer clogged, intake pipe loose or broken, oil pump worn etc.

Pressure too low in the lower speed range: pressure relief valve sticking in the open position due to dirt.

21 134 0 ENGINE ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:
Engine lifting tackle 21-068
Remover, fuel delivery line 23-023-A

NOTE: The engine is removed without the transmission.

To Remove

1. Disconnect the battery earth cable.

2. Disconnect the radio-interference suppression cable fom the hood (1 screw).
Unbolt the hood assembly from the hinges (4 bolts) and remove from vehicle.

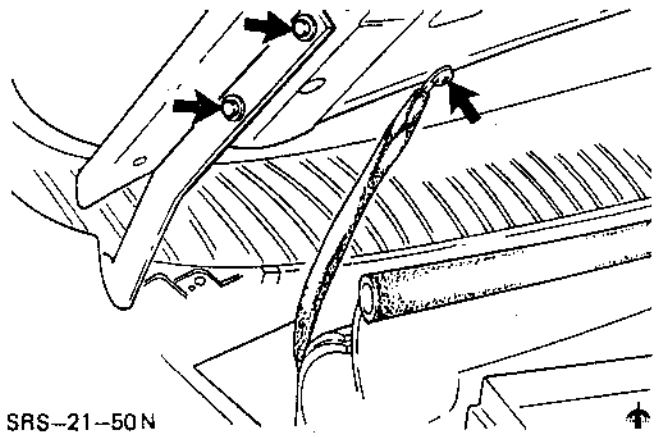


Fig.17. Remove hood.

3. Remove the air cleaner cover by detaching, Fig.18, -

A - the air cleaner to turbocharger hose from the turbocharger
B - the air bypass valve connecting hose from the intercooler
C - the vacuum line from the bypass valve
D - the solenoid control valve line from the air cleaner
E - the engine breather hose from the air cleaner.

Unclip the air cleaner cover and remove it complete with hoses and bypass valve.

Remove the air filter element.

Remove the engine breather hose (disconnect from breather valve and cut cable straps).

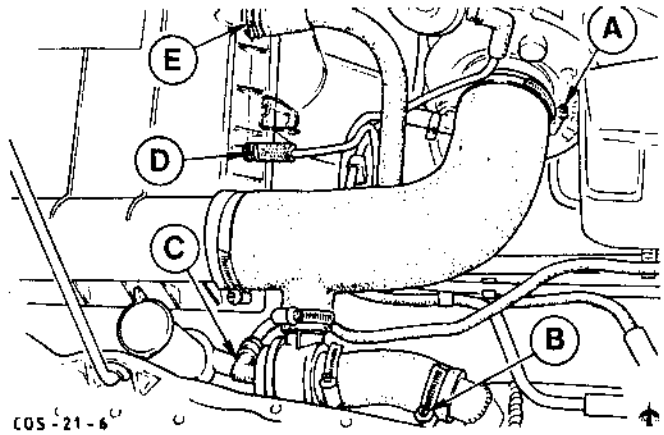


Fig.18. Remove air cleaner cover/hoses.

4. Remove the solenoid control valve complete with lines by detaching, Fig.19:

- the line to the turbocharger
- the line to the waste gate actuator
- the multiplug
- 2 screws

5. Remove the turbocharger to intercooler air hose.

6. Remove the air cleaner intake nozzle (1 clip).

'88 Model Year only:
Remove windscreen washer reservoir filler tube.

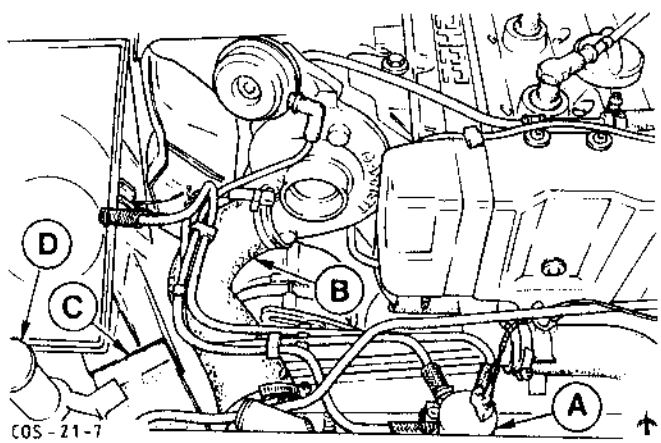


Fig.19. A - Solenoid control valve
B - Turbocharger to intercooler air hose
C - Air cleaner nozzle
D - Windscreen washer filler tube, '88 MY

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7. Remove the radiator grille.

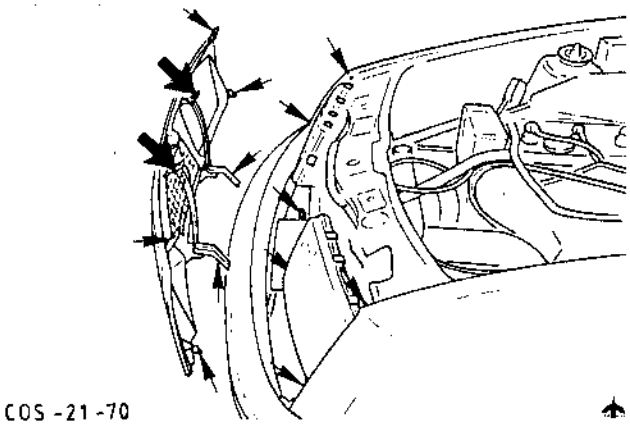


Fig.20. '86 Model Year - 2 screws, clips.

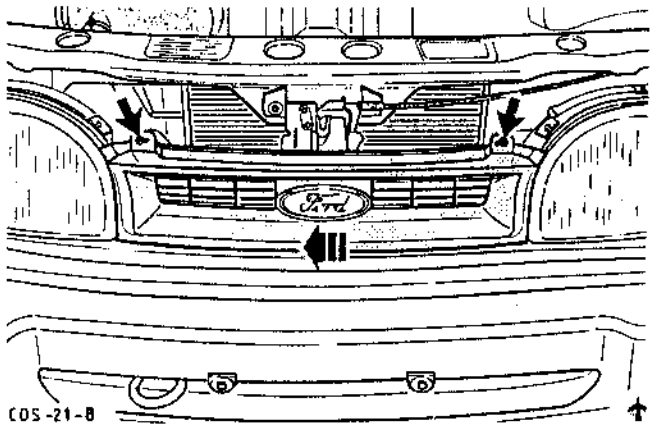


Fig.21. '88 Model Year - 2 screws and sideways located.

8. Detach the air guide plate from the radiator.

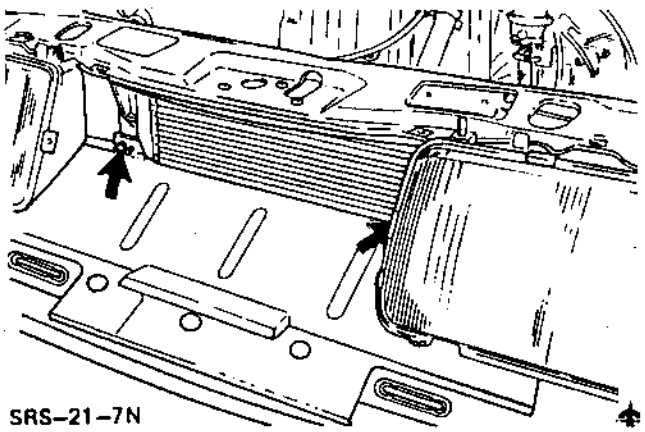


Fig.22. '86 Model Year air guide plate attachment (2 bolts)

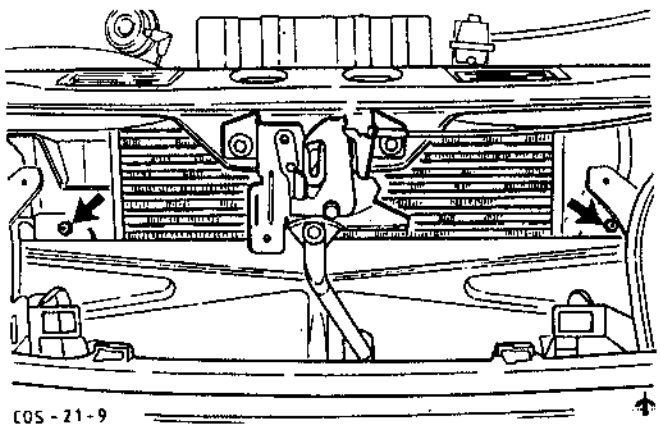


Fig.23. '88 Model Year air guide plate attachment (2 nuts)

9. Drain the coolant by detaching the lower radiator hose from the water pump.

10. Detach the upper radiator hose from the thermostat housing nozzle.

11. Detach the overflow tank hose from the coolant pipe fixed to the bottom of the radiator.

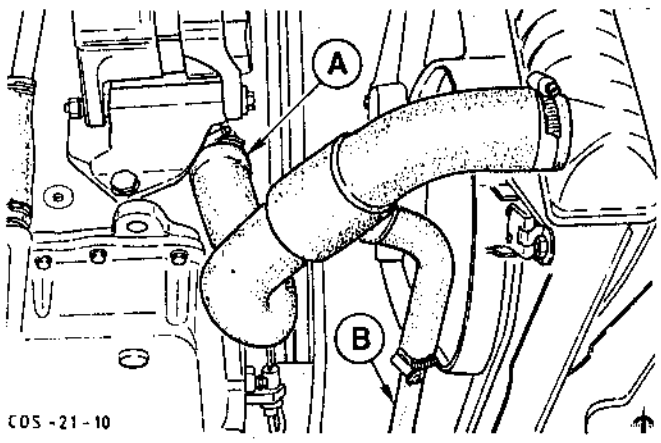


Fig.24. A - Detach radiator hose from water pump
B - Coolant pipe to overflow tank

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12. Remove the intercooler to throttle valve assembly air hose.

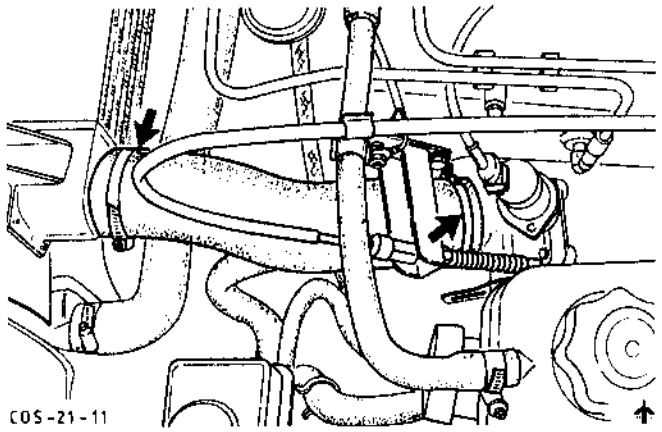


Fig.25. Air hose, throttle valve to intercooler.

13. Disconnect the radiator cooling fan and thermo sensor wiring.

14. Remove the intercooler and radiator assembly downwards (2 screws top rear, 2 screws top front, 2 screws underneath).

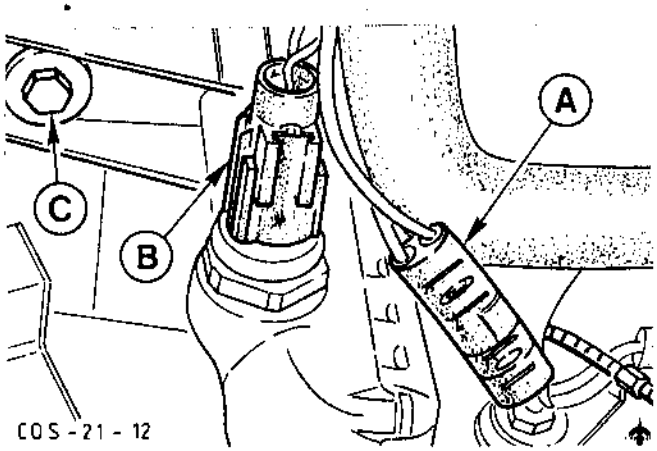


Fig.26. A - Cooling fans supply cable connector
B - Thermo sensor multiplug
C - Lower radiator retaining bolt (LH)

15. Remove the power steering pump V-belt tensioning bolts (2 bolts). Remove the V-belt and tie up oil pump with wire.

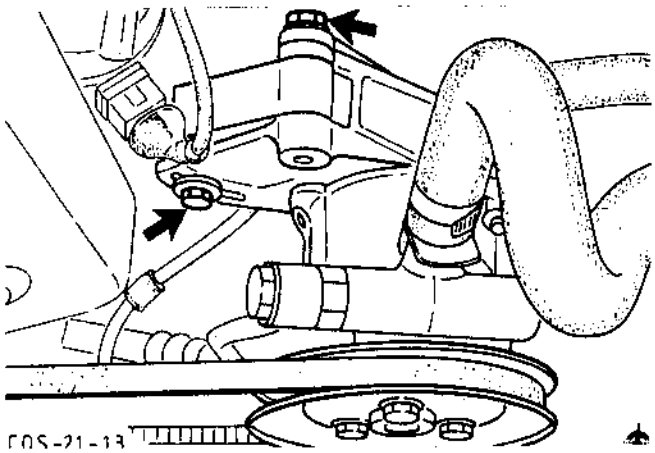


Fig.26. Power steering pump V-belt tensioning bolts.

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16. Detach the overflow tank connecting hose from the turbocharger coolant return pipe and withdraw the hose from the lifting eye.

17. Remove the turbocharger heat shield:

'86 Model Year - 3 bolts
'88 Model Year - 1 bolt and two clips

18. Detach the heater hoses from the heater radiator.

19. Remove the throttle cable from the throttle butterfly and from bracket (1 clip).

NOTE: Do not remove throttle cable bracket from plenum cover (Loctite from initial build may fall inside plenum chamber).

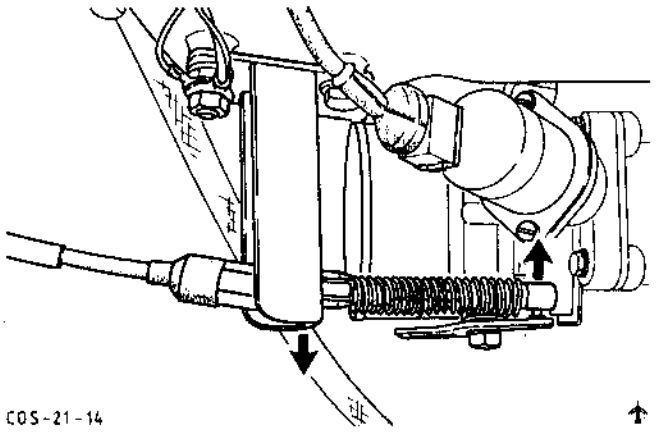


Fig.28. Remove throttle cable.

20. IMPORTANT NOTE: When removing fuel lines, it must be remembered that the system remains pressurised. Take adequate safety precautions to prevent fuel spillage.

Remove the safety clip from the fuel delivery line connection to the fuel rail and using special tool 23-023-A, pull off the delivery line.

Disconnect the fuel return line from the fuel pressure regulator.

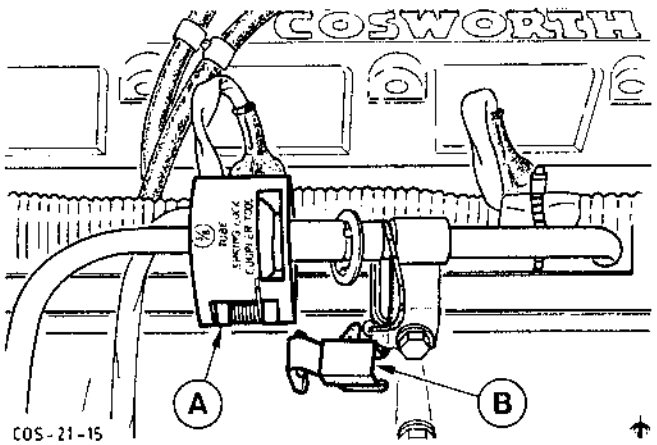


Fig.29. Remove fuel delivery line.
A - Special tool 23-023-A
B - Safety clip

21. Detach the manifold absolute pressure (MAP) sensor line from the plenum chamber.

'86 Model Year:
Detach the bypass valve and boost pressure gauge vacuum lines from the 'T' piece near the inlet manifold and pull them clear of the engine.

'88 Model Year:
Detach the bypass valve vacuum line from the plenum chamber and remove it from the vehicle.

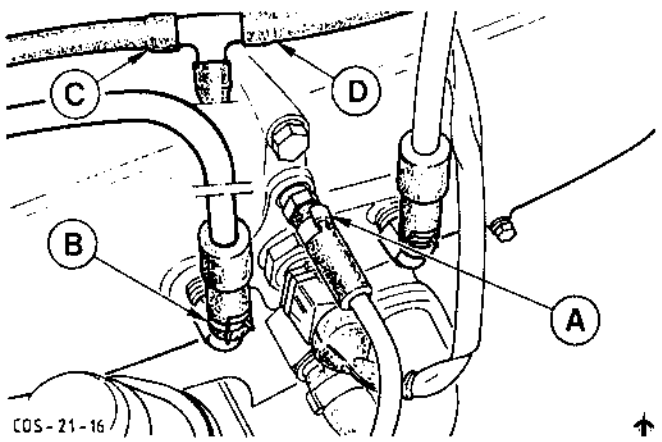


Fig.30. A - To MAP sensor
B - To bypass valve, '88 MY
C - To bypass valve, '86 MY
D - To boost pressure gauge, '86 MY

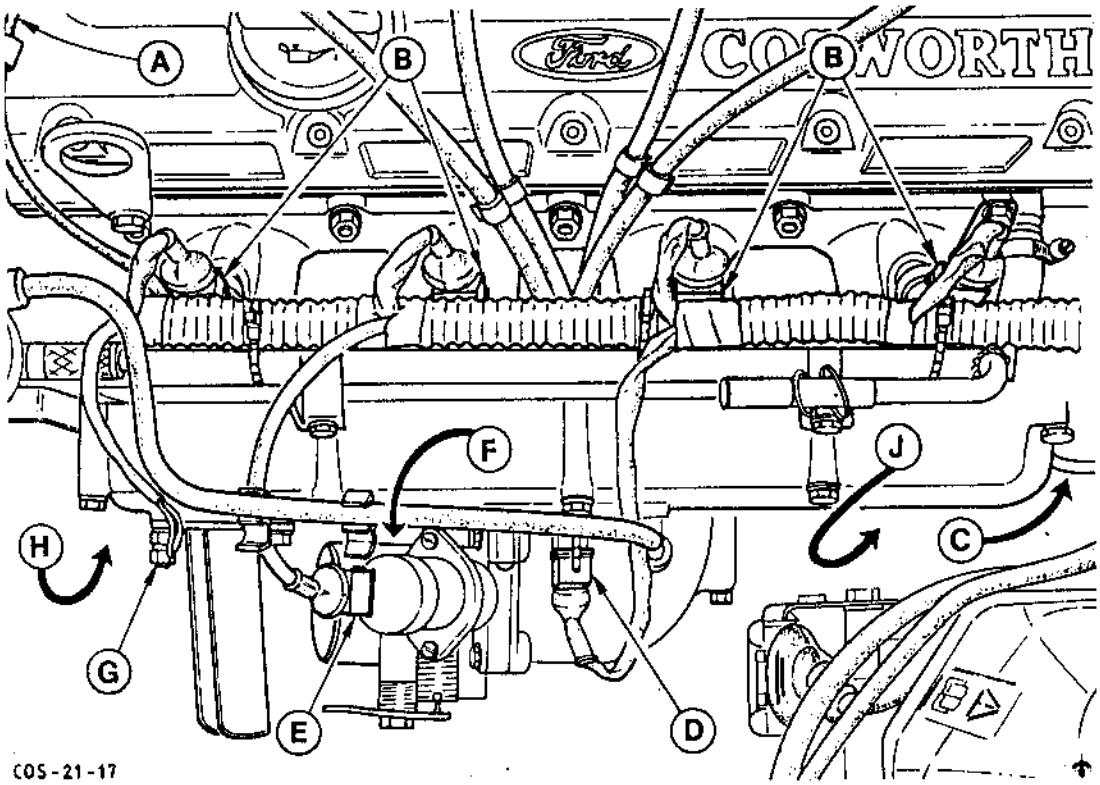


Fig.31. Disconnect wiring.

22. Disconnect wiring from, Fig.31:

A - temperature gauge sender unit
B - injection nozzles
C - coolant temperature sensor
D - air charge temperature sensor
E - idle speed control valve
F - throttle position sensor
G - earth connection on throttle cable bracket
H - engine speed/TDC sensor

Cut engine wiring loom/fuel rail cable straps and pull loom clear of engine.

23. Remove the exhaust pipe from the turbocharger.

24. Disconnect the earth cable from the clutch housing flange and unclip the battery positive cable.

25. Raise the vehicle.

J - oil pressure switch
- alternator
- distributor
- ignition coil HT lead

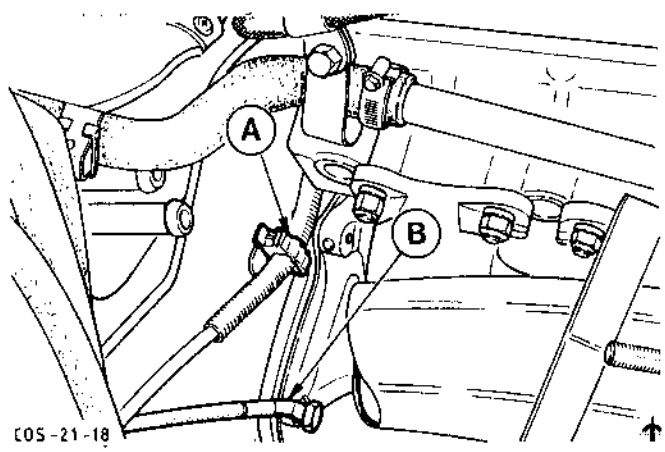


Fig.32.

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26. Unscrew the left hand exhaust muffler insulator bracket (2 bolts). Unhook the right hand and rear muffler insulators and remove the complete exhaust system.

27. Detach starter motor wiring and remove starter (3 bolts).

28. Remove the engine bearer to crossmember nut (both sides).

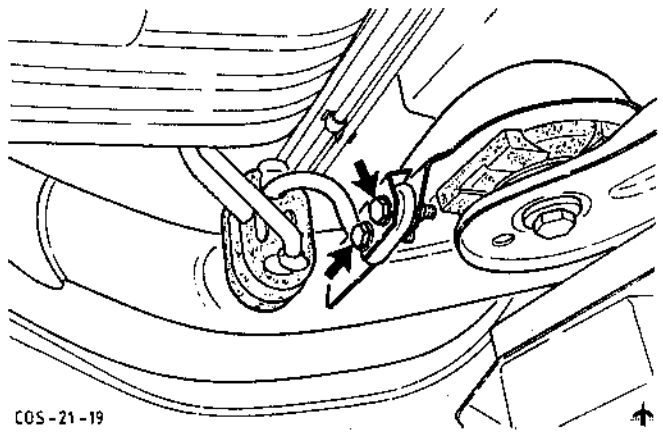


Fig.33. Left hand muffler insulator bracket bolts.

29. Remove bolt from engine adaptor plate, Fig.35.

30. Pull off the clutch release lever gaiter and unhook the clutch cable from the release lever.

31. Remove the remaining clutch housing flange bolts (5 bolts) together with the battery positive cable and cable holders.

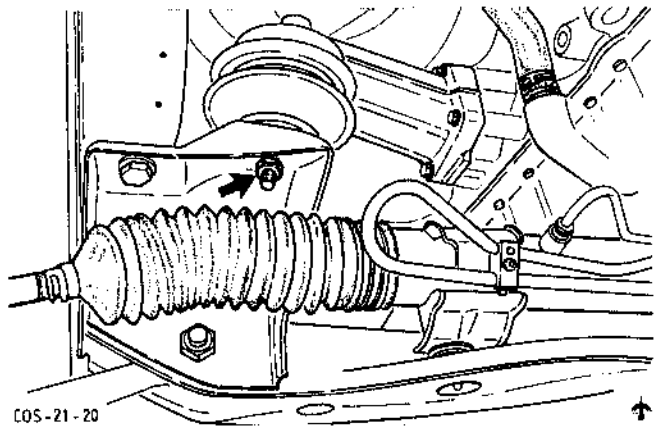


Fig.34. Engine bearer to crossmember nut - right hand shown.

32. Lower the vehicle and support the transmission assembly.

33. Attach engine lifting tackle, special tool 21-068, to the engine. Take weight of engine, pull engine forwards using the lifting tackle and lift it out of the vehicle.

NOTE: Do not pull on turbo actuator rod.

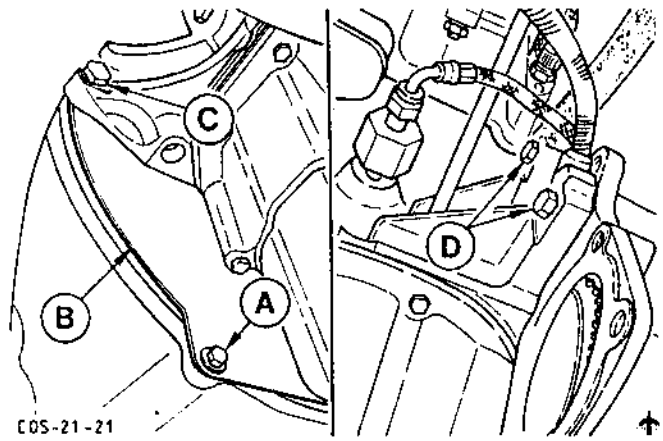


Fig.35. A - Engine adaptor plate bolt
B - Engine adaptor plate
C - Lower RH clutch housing flange bolt
D - Lower LH clutch housing flange bolts

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To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

34. If necessary, transfer the adaptor plate guide bushes from the clutch housing to the engine block, then locate adaptor plate.

35. Lightly grease transmission input shaft and install engine with engine lifting tackle 21-068. Locate engine on input shaft and slide on. Draw the engine evenly onto the clutch housing flange using two bolts.

Remove engine lifting tackle.

Locate both engine bearer studs in the crossmember and lower engine.

36. Install the remaining clutch housing flange bolts and uniformly tighten (install earth cable and battery positive cable/holders at the same time).

37. Fit the engine adaptor plate bolt.

38. Hook the clutch cable into the clutch release lever and fit the rubber gaiter.

39. Fit and tighten the engine bearer to crossmember nut (both sides).

40. Fit the starter motor and connect the wiring.

41. Locate the exhaust system in place, hook the rear and right hand mufflers into their insulators and fit the left hand insulator bracket bolts (2).

42. Lower the vehicle.

43. Fit the exhaust pipe to the turbocharger using new nuts (earlier models M8, later models M10).

NOTE: Models equipped with M8 should also be fitted with new nut locking plates.

44. Connect wiring to
- temperature gauge sender unit
- injection nozzles
- coolant temperature sensor
- air charge temperature sensor
- idle speed control valve
- throttle position sensor
- earth connection on throttle cable bracket
- engine speed/TDC sensor
- oil pressure switch
- alternator
- distributor
- ignition coil HT lead

Fit engine wiring loom/fuel rail cable straps ensuring that the wiring loom cannot chafe on the fuel rail clamps.

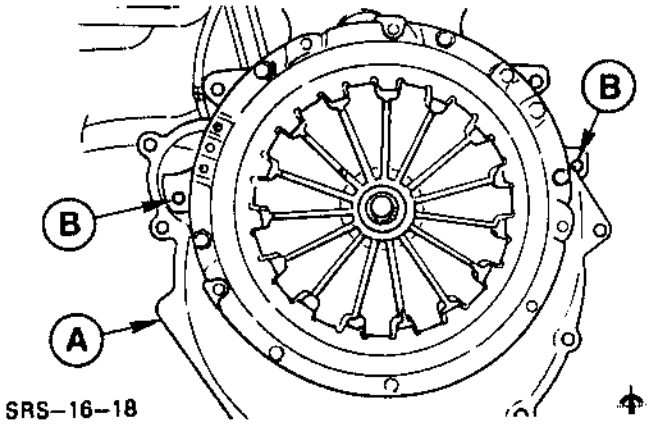


Fig.36. A - Engine adaptor plate
B - Bushes

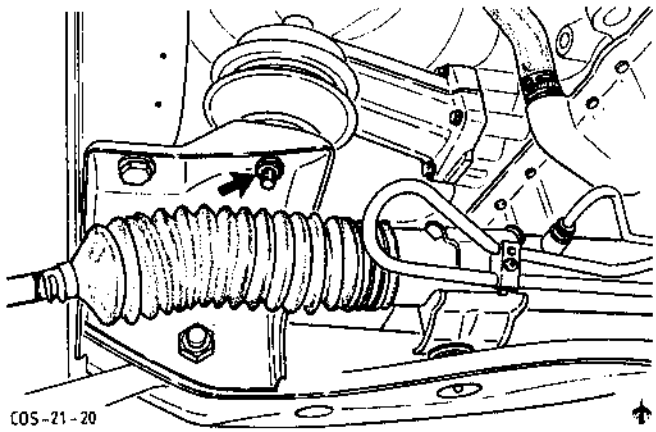


Fig.37. Engine bearer to crossmember nut - right hand shown.

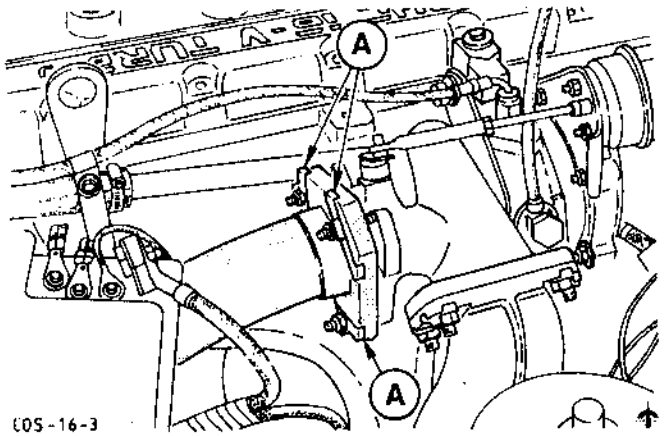


Fig.38. Tighten exhaust pipe to turbocharger
A - lock plates

45. Fit the MAP sensor line to the plenum chamber nozzle.

'86 Model Year:
Connect the bypass valve and boost pressure gauge vacuum hoses to the 'T' piece near the inlet manifold.

'88 Model Year:
Connect the bypass valve line to the plenum chamber.

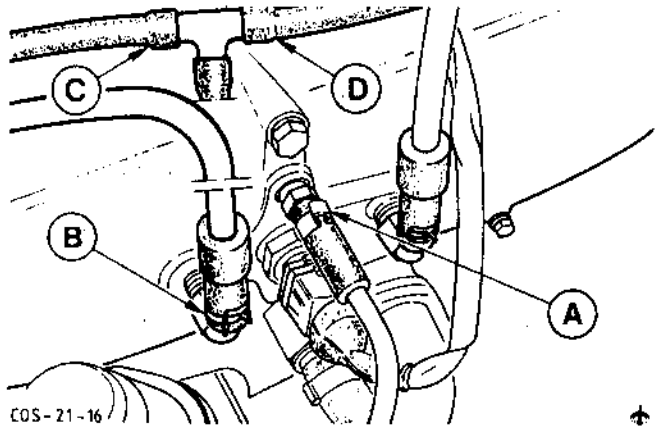


Fig.39. Fit vacuum lines to plenum chamber.

Fig.39. Fit vacuum lines.
A - MAP sensor
B - Bypass valve, '88 MY
C - Bypass valve, '86 MY
D - Boost pressure gauge, '86 MY

46. Fit the fuel delivery line to the fuel rail and the fuel return line to the fuel pressure regulator.

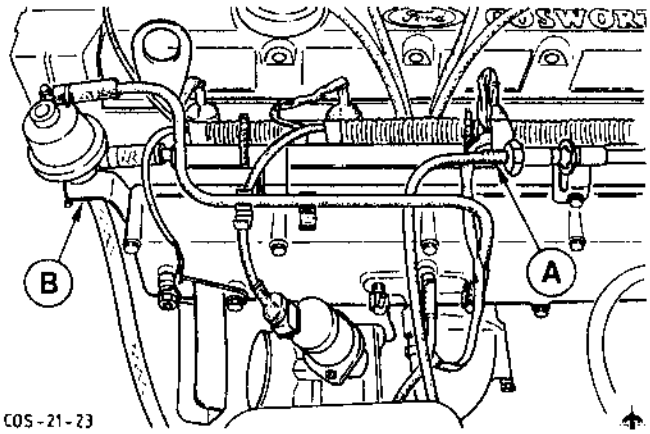


Fig.40. Fit fuel lines.
A - Delivery line
B - Return line

47. Fit the throttle cable to its bracket and the throttle butterfly.

48. Attach the heater hoses to the heater radiator.

49. Fit the turbocharger heat shield.

50. Push the hose from the overflow tank to turbocharger coolant return line through the lifting eye and connect it to the pipe.

51. Fit the power steering pump to its bracket, fit V-belt and adjust tension (see Technical Data).

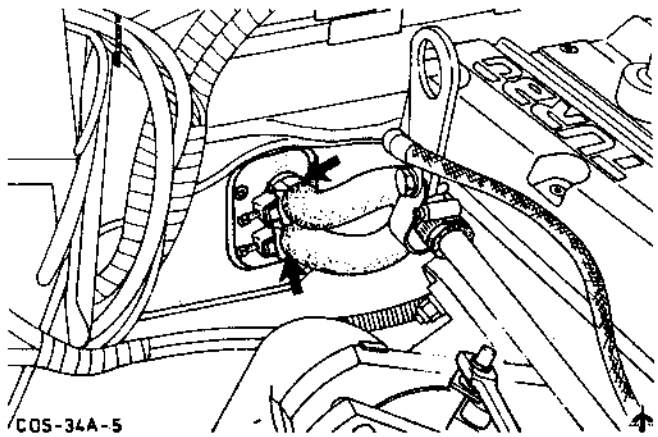


Fig.41. Attach heater hoses.

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52. Fit the air cleaner intake nozzle in place.

53. Install the intercooler/radiator assembly (6 bolts).

    Clip the air cleaner intake nozzle to the intercooler.

    '88 Model Year only:
    Fit windscreen washer reservoir

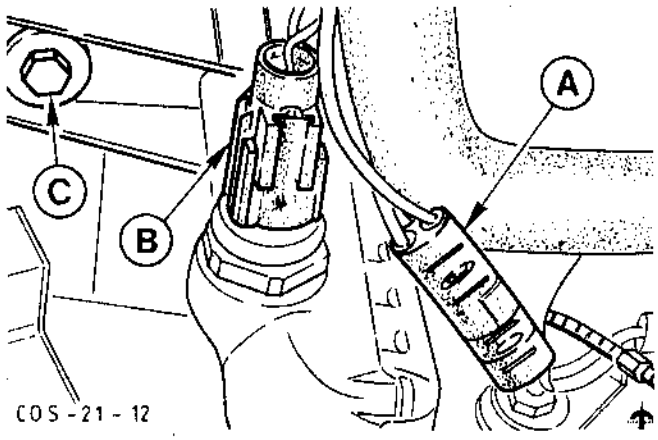


Fig.42. A - Cooling fans supply cable connector
B - Thermo sensor multiplug
C - Lower radiator retaining bolt (LH)

54. Connect the cooling fan and thermo sensor wiring.

55. Attach the overflow tank hose to the coolant pipe at the bottom of the radiator.

56. Fit the air guide plate to the radiator.

57. Install the radiator grille.

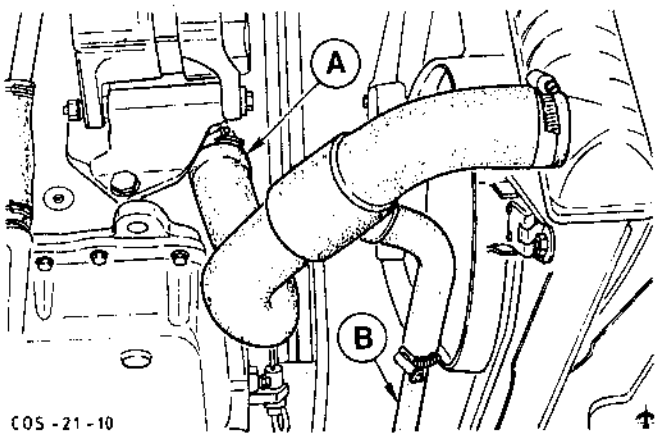


Fig.43. A - Lower radiator hose from water pump
B - Coolant pipe to overflow tank

58. Attach the upper radiator hose to the thermostat housing nozzle.

59. Attach the lower radiator hose to the water pump.

60. Install the air hose from the intercooler to throttle valve assembly.

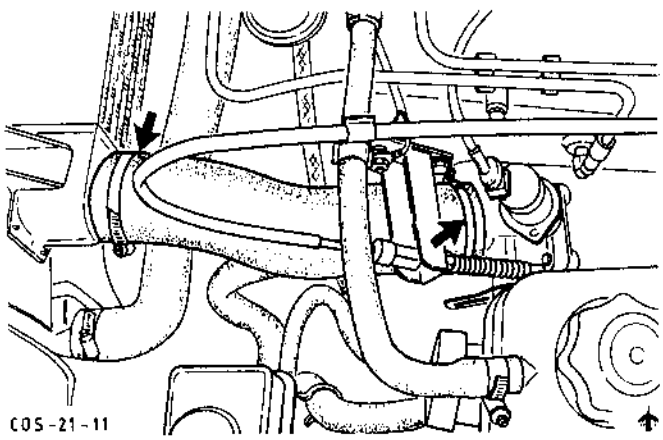


Fig.44. Intercooler to throttle valve assembly hose.

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61. Install the turbocharger to intercooler air hose.

62. Install the solenoid control valve complete with lines to the intercooler by fitting, Fig.45:

- 2 screws
- the multiplug
- the line to the waste gate actuator
- the line to the turbocharger

63. Install the air filter element, clip the air cleaner cover in place and connect, Fig.46:

A - the air cleaner to turbocharger hose
B - the air bypass valve to intercooler hose
C - the vacuum line from the bypass valve
D - the solenoid control valve line to the air cleaner
E - the engine breather hose to the air cleaner

64. Connect the engine breather hose to the breather valve (fit cable straps).

65. Fill the cooling system (see Technical Data).

66. Top up with engine oil (see Technical Data for correct grade).

67. Fit hood.
Attach the hood earth cable.

68. Connect the battery earth cable.

69. To ensure that the oil supply to the turbocharger has been re-established before engine start up: disconnect the injector multiplugs and the low tension terminal from the ignition coil (terminal 15) and crank the engine for 10 seconds, followed by a pause then a further 10 seconds. Reconnect injector multiplugs and ignition coil and start engine.

70. With the engine at normal operating temperature, check the idle speed and CO content (values in Technical Data).

To adjust the CO content, refer to Operation 23 215 0 in this Service Microfiche.

To adjust the idle speed, refer to Condition 5 (Erratic idle/incorrect idle speed) in the Vehicle System Test Manual.

71. Recheck coolant level.

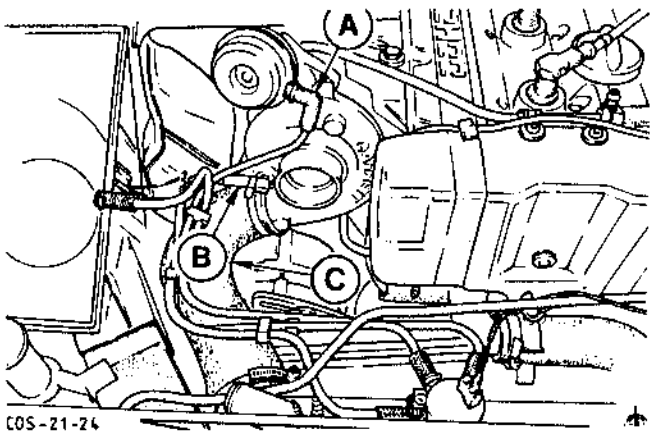


Fig.45. A - Line to waste gate actuator
B - Line to turbocharger
C - Turbocharger to intercooler air hose

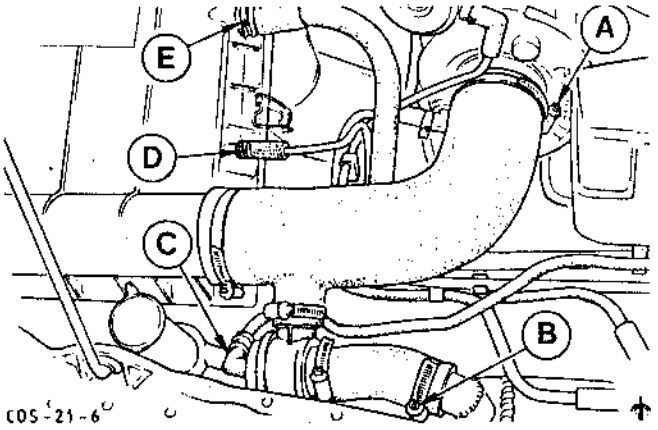


Fig.46. Fit air cleaner cover/hoses.

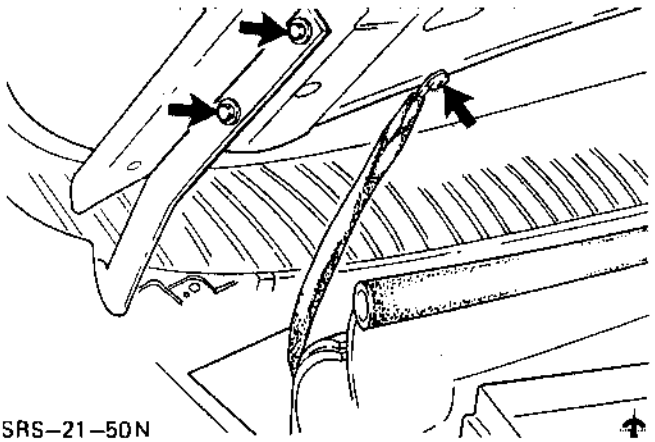


Fig.47. Fit hood.

21 134 8 ENGINE - DISMANTLE AND REASSEMBLE (Engine removed)

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft front oil seal installer ..	21-009-B
Crankshaft rear oil seal installer ..	21-011-D
Universal spindle	21-023
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve Spring compressor ..	21-024-06
Crankshaft timing gear remover	21-028-A
Engine mounting bracket	21-031-B
Crankshaft bearing remover	21-036-A
Crankshaft bearing installer and clutch disc locator	21-044-A
Toothed belt tension gauge	21-113
Cylinder head alignment studs	21-128
Installer - Valve stem oil seal (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130

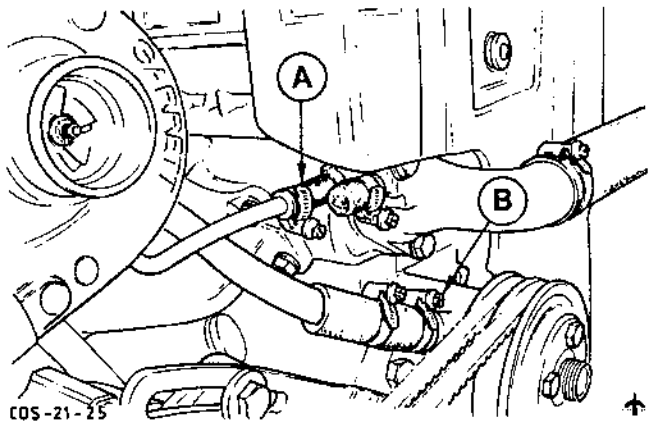


Fig.48. A - Turbocharger coolant feed line
B - Heater return line

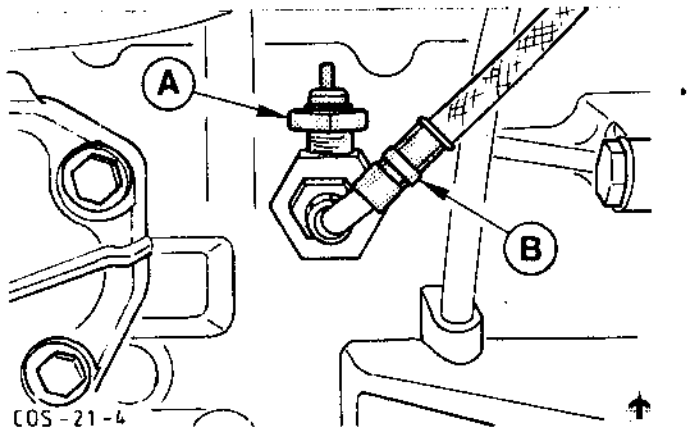


Fig.49. A - Oil pressure switch
B - Turbocharger oil feed line

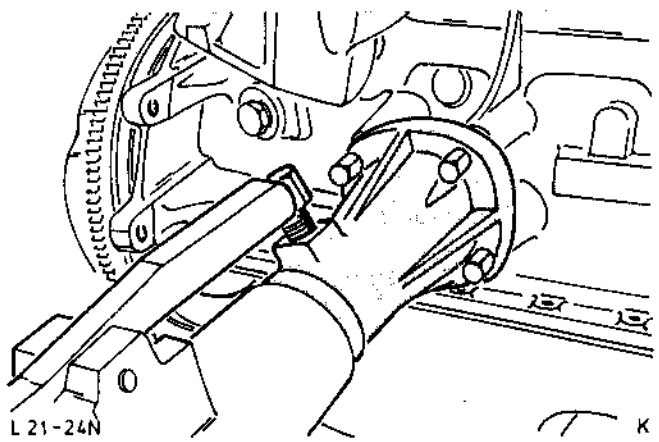


Fig.50. Engine with mounting bracket.

To Dismantle

1. Disconnect the turbocharger coolant feed line from the thermostat housing and the heater return line from the water pump.
   Unclip the turbocharger coolant return line from the top of the timing belt cover.

2. Disconnect the turbocharger oil feed line from the oil pressure switch adaptor and unclip it from the cylinder head (2 clips, refit lifting eye).

   Disconnect the turbocharger oil return hose from the sump stub pipe (1 hose clamp).

3. Remove the turbocharger vibration damper pillar bolt and remove the turbocharger complete with the exhaust manifold (16 nuts).
   Discard the exhaust manifold gaskets.

4. Remove the right hand engine mount (4 bolts).

5. Secure the engine to stand with engine mounting bracket 21-031-B and universal spindle 21-023.

6. Pull out oil dipstick. Drain engine oil. Disconnect oil dip stick holder from the cylinder head.

7. Remove the timing belt cover.

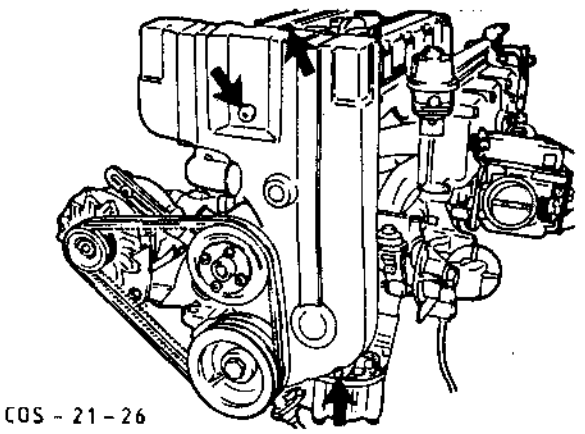


Fig.51. Remove timing belt cover.

8. Pull the HT cables off the spark plugs, detach them from the clip on the plenum chamber and remove them together with the ignition distributor cap.

9. Loosen the alternator adjustment strap, remove V-belt and strap.

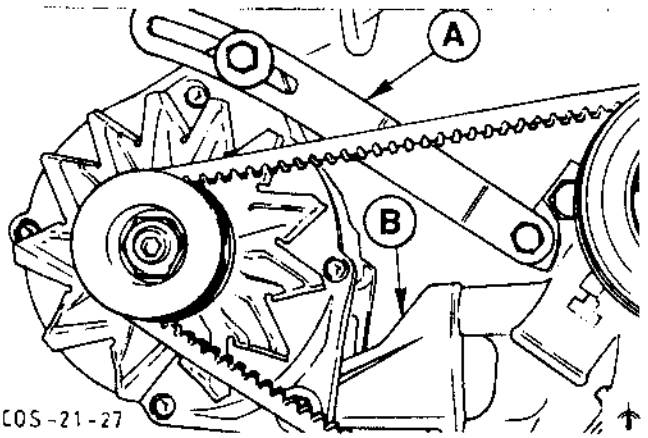


Fig.52. A - Alternator adjustment strap
B - Alternator bracket

10. Remove the alternator and bracket (4 bolts).

11. Remove the cylinder head cover (20 bolts), seals and gaskets.

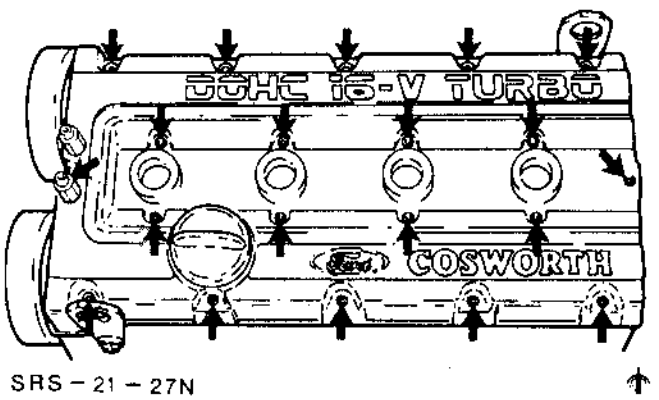


Fig.53. Cylinder head cover retaining bolts.

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12. Remove the crankshaft V-belt pulley and thrust washer (1 bolt).

    Prevent crankshaft from rotating by holding the flywheel with a suitable tool.

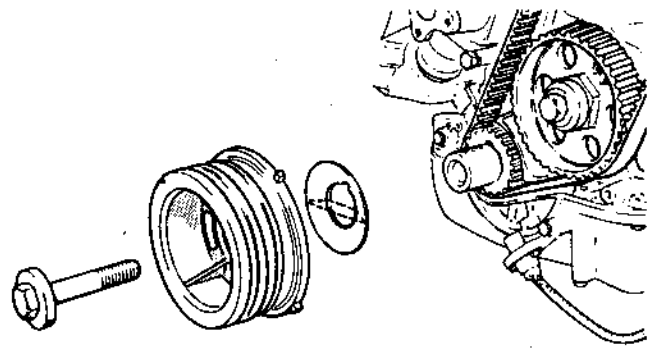


Fig.54. Remove crankshaft V-belt pulley.

13. Loosen the timing belt tensioning pulley and remove the timing belt.

NOTE: Mark running direction of timing belt before removal, in case of re-use.

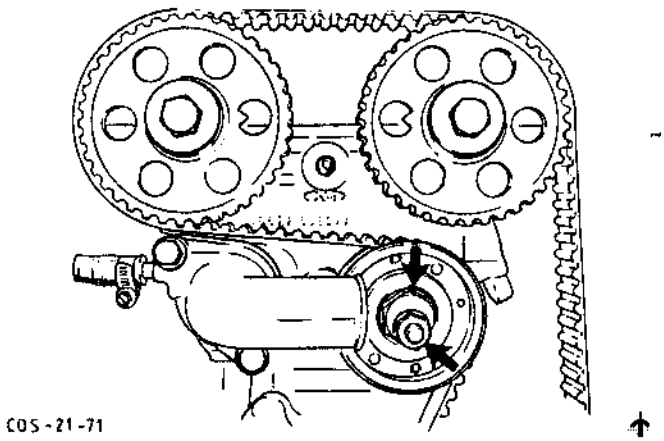


Fig.55. Loosen timing belt tensioner.

14. Disconnect the coolant feed hose from the oil cooler.

15. Disconnect the vacuum hose from the engine breather valve.

16. Detach the engine breather valve (1 nut) from the plenum chamber.

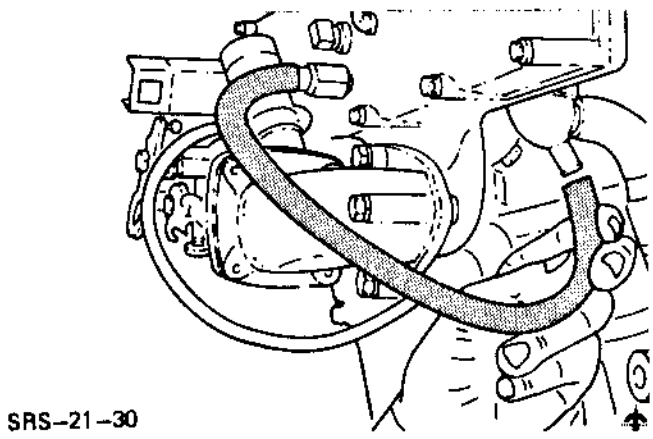


Fig.56. Disconnect vacuum hose from engine breather valve.

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17. Loosen the setting nut on the intake elbow damper and remove the engine mount nut.

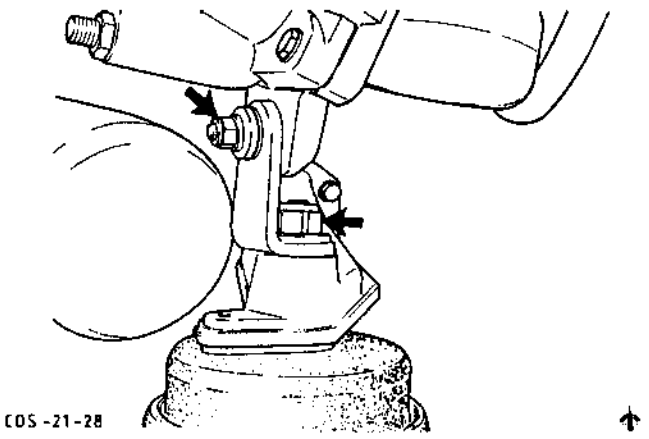


Fig.57. Intake elbow damper.
A - Setting nut
B - Engine mount nut

NOTE: Before removing the cylinder head the engine must have cooled down to about 45 °C.

18. Loosen the cylinder head bolts (10 bolts) in the sequence shown.

Remove the cylinder head bolts and washers. Take off the cylinder head complete with inlet manifold.

Remove the cylinder head gasket.

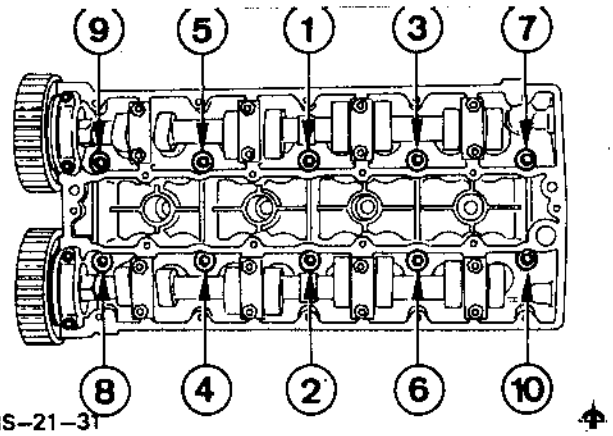


Fig.58. Cylinder head bolts loosening sequence.

NOTE: After removing a cylinder head its mating faces must be subjected to a check for flatness as described in Operation No. 21 163 0.

19. Pull the oil separator and engine breather valve off engine.

20. Unscrew the oil pressure switch from the adaptor.

21. Remove the oil pressure switch adaptor from the cylinder block.

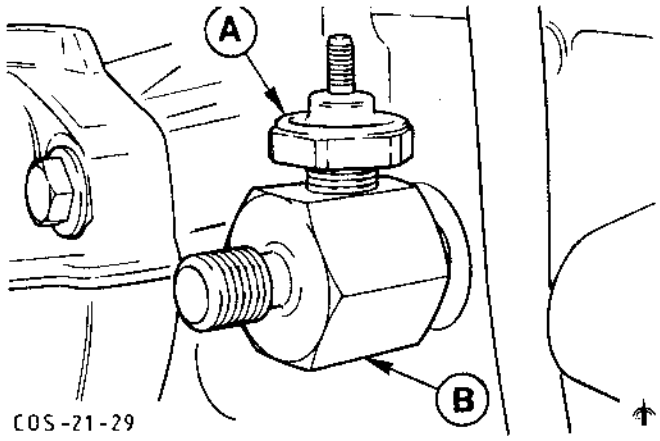


Fig.59. A - Oil pressure switch
B - Adaptor

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22. Remove the oil filter and oil cooler.

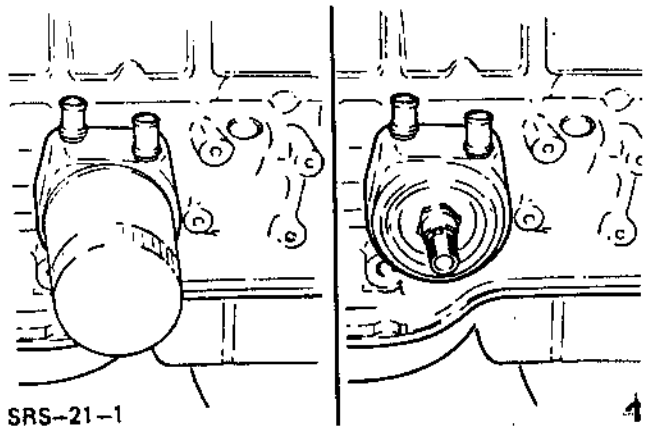


Fig.60. Remove oil filter and oil cooler.

23. Remove the ignition distributor.

24. Remove the engine speed/TDC sensor complete with bracket from the sump and from the clip on the power steering pump support bracket.

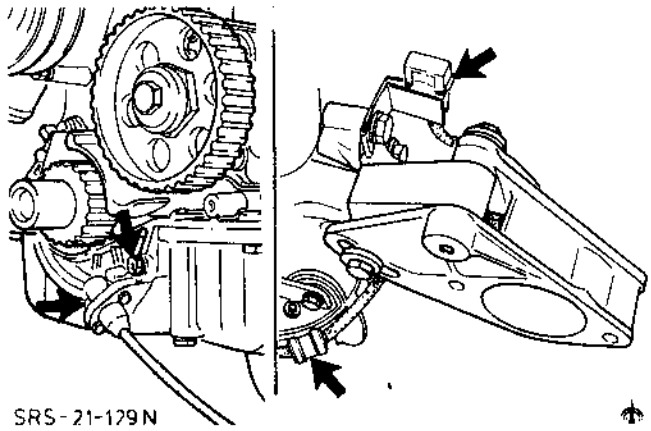


Fig.61. Remove the engine speed/TDC sensor.

25. Remove the power steering pump bracket and support bracket (2 hex. headed bolts, 3 socket headed bolts, 2 brackets) and remove sealant residue from mating faces.

26. Remove the water pump (3 bolts).

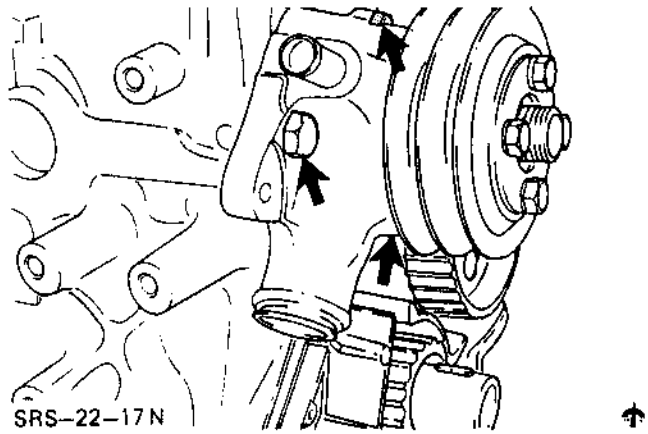


Fig.62. Remove water pump.

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27. Remove the auxiliary shaft toothed pulley.

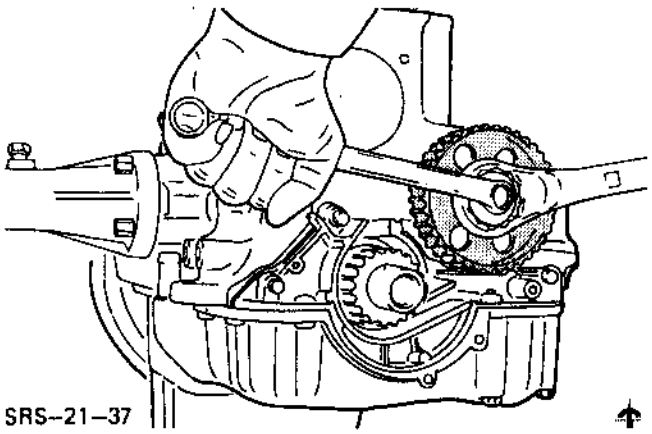


Fig.63. Remove auxiliary shaft toothed pulley.

28. Pull off the crankshaft toothed pulley, using special tool 21-028-A.

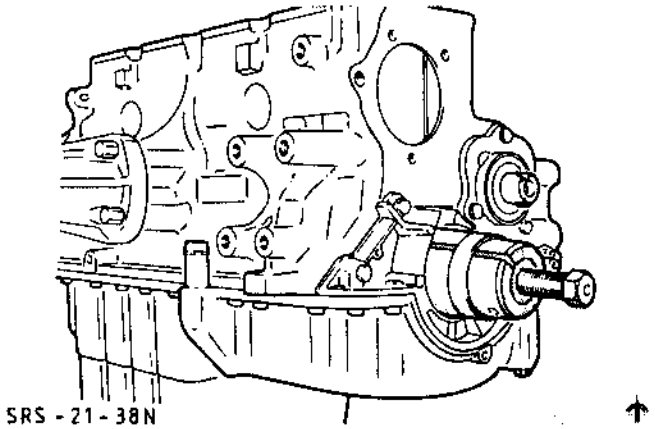


Fig.64. Pull off crankshaft toothed pulley, using special tool 21-028-A.

29. Uniformly loosen the six clutch pressure plate bolts and remove the pressure plate and clutch disc from the flywheel.

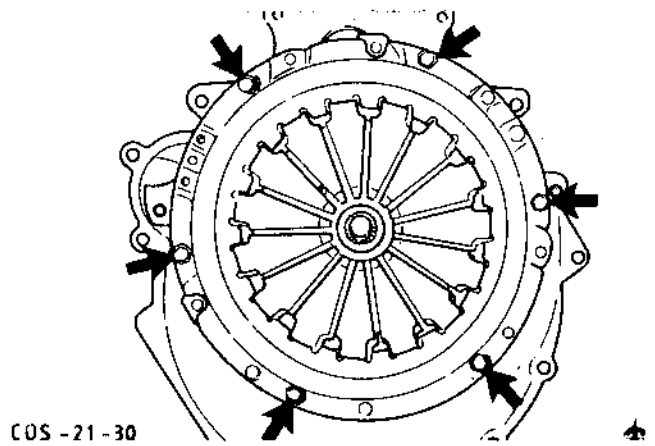


Fig.65. Clutch pressure plate.

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30. Using special tool 21-036-A pull out the crankshaft needle roller bearing (pilot bearing).

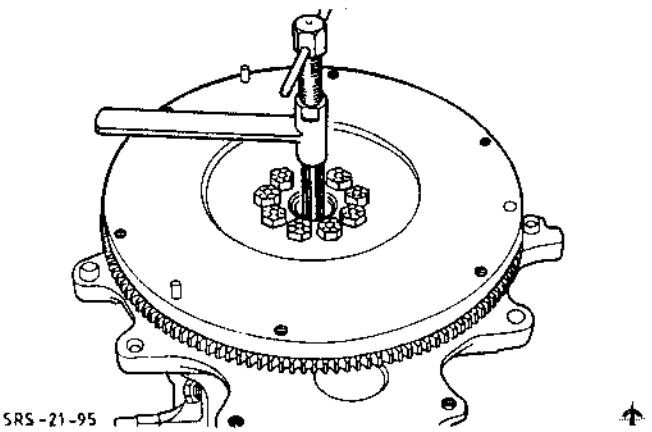


Fig.66. Using special tool 21-036-A pull out crankshaft needle roller bearing.

31. Remove the flywheel (9 bolts).

NOTE: One bolt hole has an offset drilling, therefore, mark the relative position of flywheel to crankshaft with a felt pen to assist reassembly.

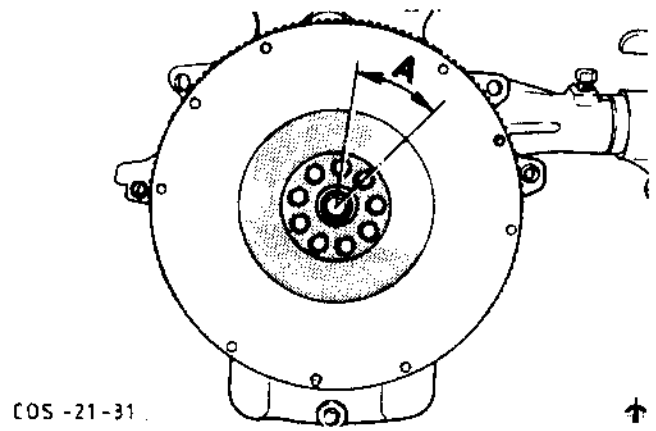


Fig.67. Remove flywheel.
A - Offset

32. Remove the oil sump (22 bolts and washers).

Discard seals and gaskets.

33. Remove the oil pump and oil pump driveshaft.

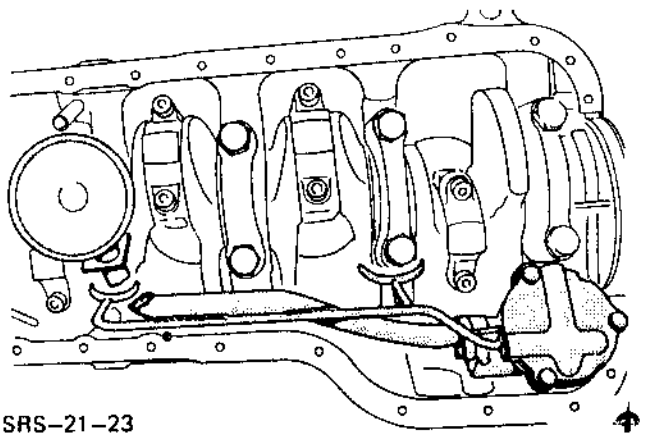


Fig.68. Remove oil pump.

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34. Remove the crankshaft front cover (4 bolts) complete with the crankshaft front oil seal.

    Discard the bolts, gasket and oil seal.

35. Unscrew the auxiliary shaft cover (3 bolts).

36. Remove the auxiliary shaft retaining plate (2 screws) and pull out auxiliary shaft.

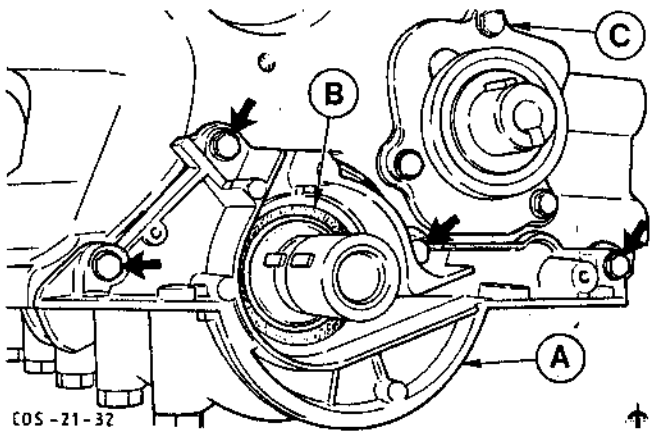


Fig.69. A - Crankshaft front cover
B - Oil seal
C - Auxiliary shaft cover

37. Remove the big-end bearing caps together with their half shells.

NOTE: Identify bearing half shells and caps for correct reassembly.

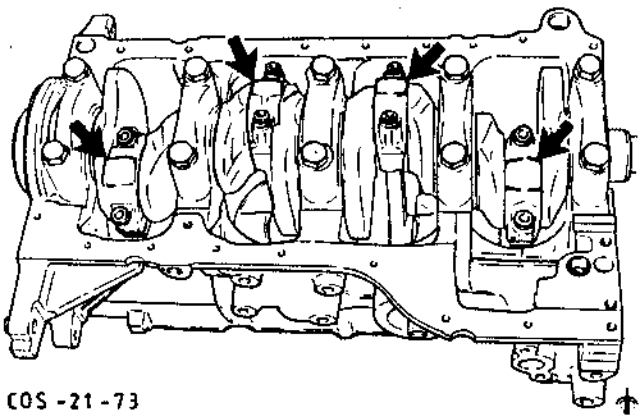


Fig.70. Remove big-end bearing caps.

38. Remove the pistons and connecting rods upwards.

NOTE: First clean the carbon from the cylinders.

39. Remove the main bearing caps.

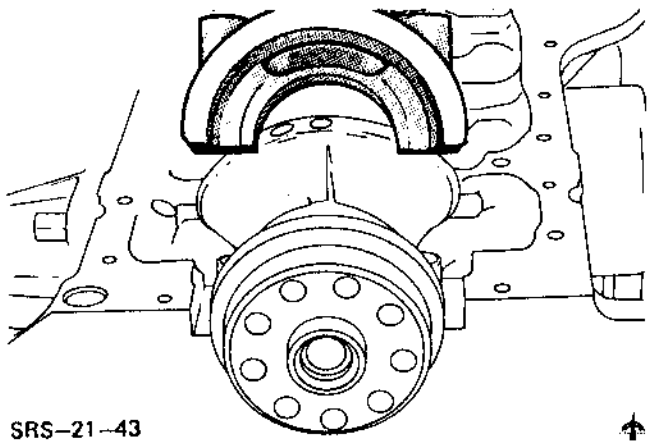


Fig.71. Remove main bearing caps.

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40. Remove the crankshaft and bearing shells.

Remove the crankshaft rear oil seal.

NOTE: Identify bearing shells for correct reassembly.

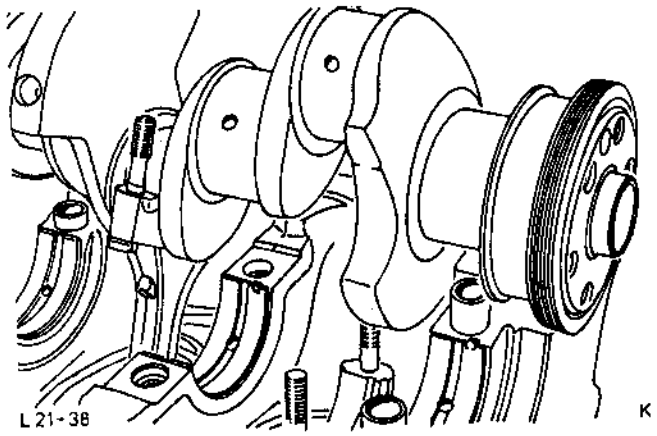


Fig.72. Remove crankshaft from cylinder block.

To Reassemble

During assembly, tighten nuts and bolts to the torque specified in Technical Data.

The extent and nature of the cleaning required before reassembly will depend on running time, the extent of any engine damage and the intended further use of individual parts.
This is particularly true of the cylinder block with its corners, angles and drillings.

Remove all blanking plugs and covers as appropriate and clean their seats with suitable cleaning agents and tools (brushes, scrapers).
In particular, the oil ways of the cylinder block and cylinder head must be free of dirt and swarf.

When press-fit blanking covers and coolant plugs have been removed, these, like all gaskets, must always be replaced whenever engine repairs are carried out.

NOTE: Before installing the following bolts, lubricate the threads and under the bolt heads with engine oil:

Main bearing bolts

Big-end bearing bolts

Flywheel bolts

Cylinder head bolts

Fig.73. Lubrication circuit.
A - Turbocharger
B - Hydraulic valve tappets
C - Oil cooler
D - Piston cooling
E - Oil retaining valve

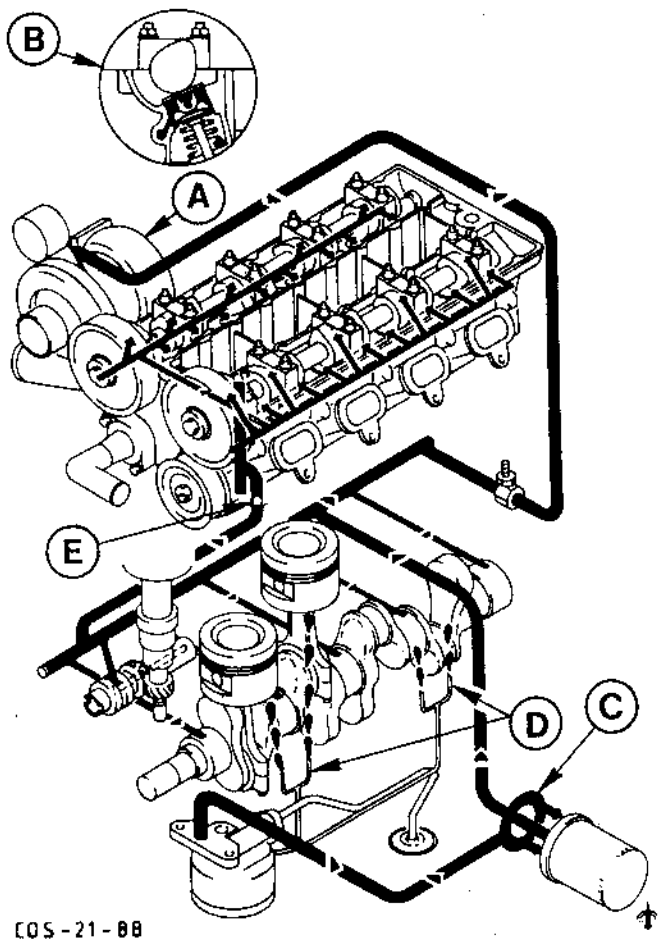


Fig.73. Lubrication circuit.

41. Check the piston clearance in the bores as follows:

a) Fit the main bearing caps without bearing shells and tighten to specified torque.

b) Rotate the used cylinder block through 180° and measure cylinder bores with standard measuring instruments.

c) If the measured diameter of the cylinder bore is too large in relation to the size classification of the piston previously used, the cylinder block must be overhauled or replaced. Fit new pistons of the appropriate cylinder bore size classification.

The specified piston-to-bore clearance applies to unused pistons. The clearance with used pistons is greater due to distortion.

42. Check the main bearing clearance as follows:

The use of "PLASTIGAGE" (Type PG-1) simplifies the measurement of the bearings (even for undersize crankshafts). "PLASTIGAGE" is the brand name of a precisely calibrated plastic filament.

West German Supplier:

K.H. Ern/Motorenteile GmbH
Vinckeweg 16
D-4100 Duisburg 13 (Ruhrort)

Tel:0203/870081
Telex: 8551494

U.K. Supplier:

Replacement Service Limited
30 Euston Street
Freemans Industrial Estate
Leicester
LE2 7ST

Requirements for measurements with "Plastigage":

a) The bearing must be dry and clean.
b) The crankshaft must not be rotated during the measuring operation.
c) The measurement points should be taken at top and bottom dead centres.
d) The bearing caps must not be hammered down.

Place a length of Plastigage across the width of the main bearing journal on the crankshaft and then fit the main bearing cap dry with bearing shell and torque as specified. The plastic filament will be compressed depending on the bearing clearance. Remove bearing cap.

Measure the width of the compressed plastic filament by means of the scale printed on the PLASTIGAGE pack. The reading corresponds to the bearing clearance.

Only use bolts in good condition for the crankshaft bearings. Do not tighten them in excess of the specified torque.

Each main bearing must be measured individually, without other bearing caps being fitted.
If necessary, overhaul the main bearing journals and replace the bearing shells.

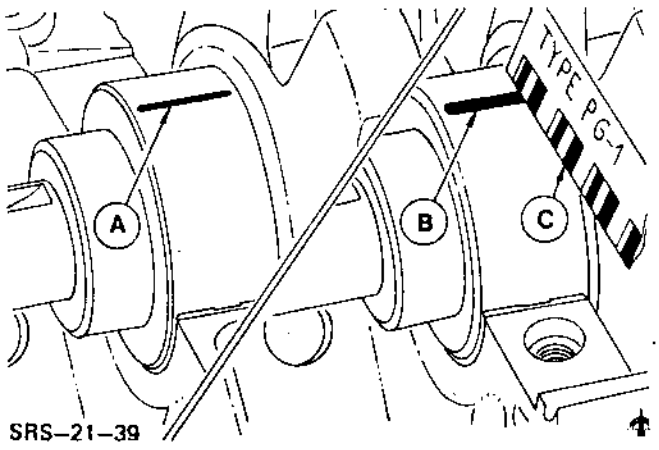


Fig.74. Measuring the bearing clearance.
A - Calibrated plastic filament
B - Squashed plastic filament
C - Measuring scale

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Crankshaft main bearing journals

Standard diameter crankshaft main bearing journals are unmarked. When the bearing journals are 0,25 mm undersize, the crankshaft is marked with a green paint line on the first counterweight.

Crankshaft big-end bearing journals

Standard diameter crankshaft big-end bearing journals are unmarked. When the big-end bearing journals are 0,25 mm undersize, the crankshaft is marked with a green paint spot on the first web adjacent to the big-end bearing.

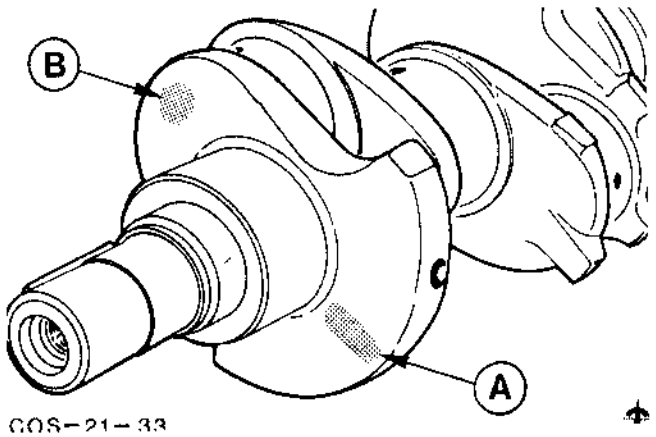


Fig.75. Paint marks on crankshaft.
A - Undersize main bearing journal
B - Undersize big-end bearing journal

Crankshafts, the main and big-end bearing journals of which are ground undersize, have both the paint stripe and paint spot on the front side of the first web.

NOTE: Grooved bearings in block and plain bearings in cap.

Bearing shells

Standard main bearing and big-end bearing shells are unmarked. Bearing shells for undersize crankshafts or oversize cylinder blocks have corresponding inscriptions on the back (see Parts Microfilm) and in the case of production repair sizes they are colour coded on the outside edge, except in the case of main and big-end bearings intended solely for service (0,5 0,75 and 1,0 mm undersize crankshaft journals).

NOTE: Undersize bearings are for dealer repair only - not initial build.

When selecting new bearing shells, always check the Parts Microfilm and also measure, to ensure that they are of the appropriate size.

In order to remain within the specified limits of bearing clearance (see Technical Data), journals, parent bores and bearing shells must be measured individually.

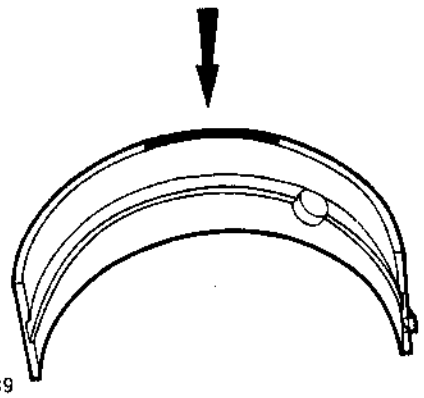


Fig.76. Bearing shell paint marking (production repair).

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43. Fit the cylinder block main bearing shells dry into the cylinder block, then lubricate them with engine oil.

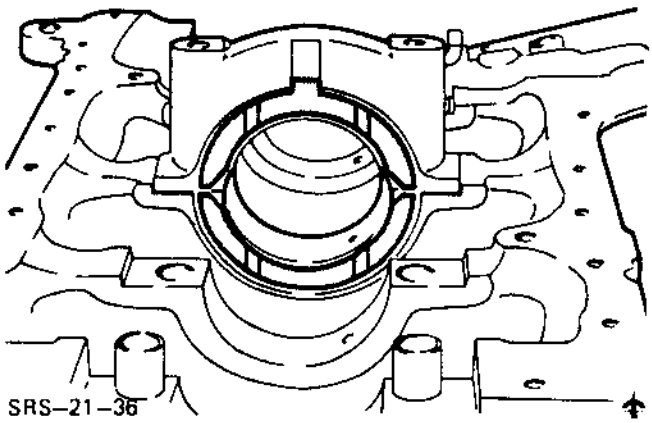


Fig.77. Thrust half washers on centre bearing.

44. Install the crankshaft.

NOTE: Ensure that the thrust half washers of the centre bearing are fitted in the correct position, i.e., copper coloured sides facing outwards.

45. Fit the main bearing caps complete with oiled bearing shells.

NOTE: First coat the contact face and sides of the rear main bearing cap with sealing compound (see Technical Data).

NOTE: Before fitting, lubricate the bearing cap bolts on the threads and under the bolt heads with engine oil.

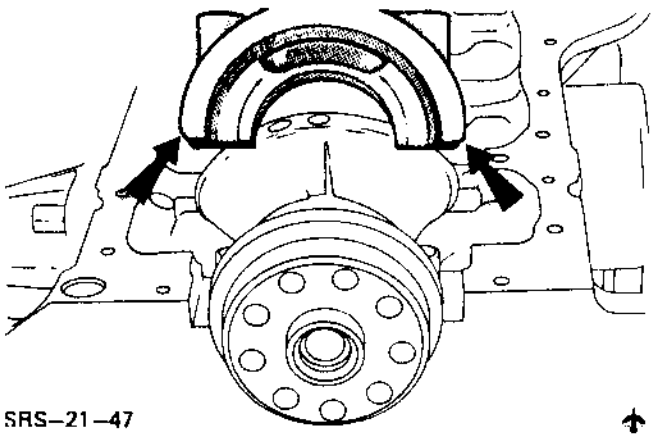


Fig.78. Coat contact face and sides of rear main bearing cap with sealing compound.

46. Check the crankshaft end float (see Technical Data) using a dial test indicator and adjust if necessary by fitting new thrust half washers.

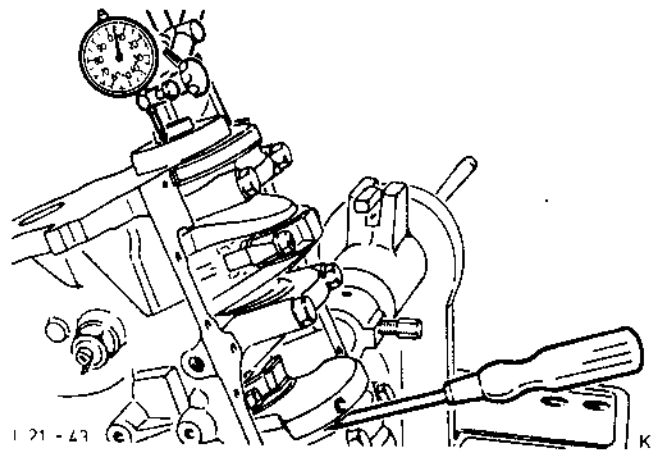


Fig.79. Check crankshaft end float.

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47. Remove the piston rings from the pistons and check the piston ring gaps.

    The stated dimensions (see Technical Data) relate to the gauge ring used in production and can be exceeded by up to 0,15 mm (0,006 in) when measured in the cylinder.

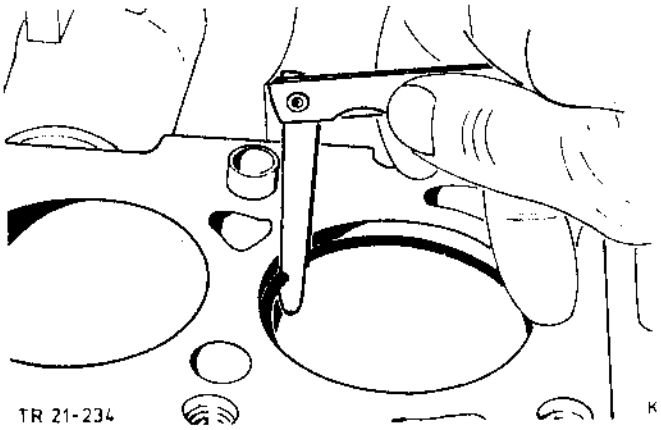


Fig.80. Check piston ring gaps.

48. Fit the piston rings to piston, using standard tool (ring compressor).

    For the relative positions of the piston ring gaps see Fig.81.

NOTE: The first and second rings are marked "TOP".

49. Compress the piston rings using a standard tool (ring compressor). Push oiled pistons into cylinder with a hammer handle, guiding the connecting rods onto the big-end bearing journals with the other hand.

NOTE: When installing the pistons, the "front" mark (arrow) must point towards the front of the engine. Use a plastic guide fork to avoid damage to big-end journals.

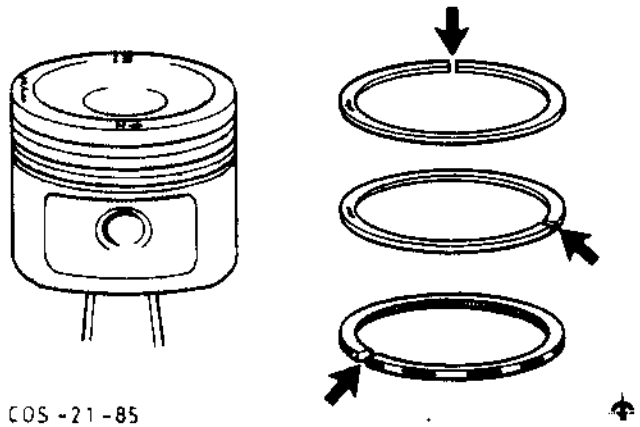


Fig.81. Position of the piston rings gaps.

50. Fit the big-end bearing shells and measure with "PLASTIGAGE" as described in sub-operation 42. Replace the bearings shells if necessary.

51. Fit the big-end bearing caps complete with oiled bearing shells. Apply oil to thread and contact surface of big-end bearing bolts and tighten to specified torque.

    Check that the connecting rods have adequate end float (0,1 mm minimum) on big-end bearing journals.

52. Lubricate the sealing lip of the new rear oil seal. Place the oil seal with the closed side facing upwards on a solid base. Position special tool 21-011-D on the oil seal and press the retaining ring downwards by hand as far as it will go.

    Position the tool and oil seal on engine and draw in oil seal evenly until it butts using three flywheel retaining bolts.

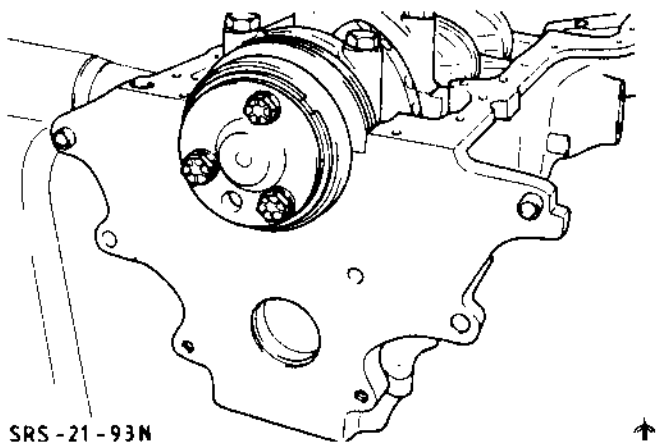


Fig.82. Draw in oil seal, using special tool 21-011-D.

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53. Fit the oil pump driveshaft, short side to oil pump.

54. Fit oil pump.

NOTE: When fitting a new or overhauled oil pump, it must be filled with engine oil and rotated by hand before installation.

NOTE: Rotate the crankshaft 360° by hand and check that there is clearance between the crankshaft journals and the oil spray line.

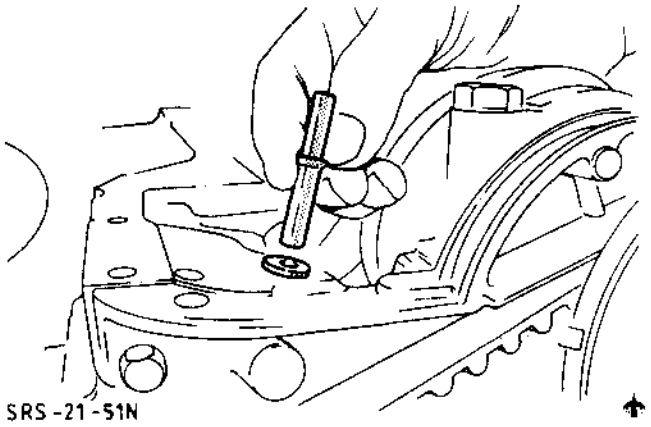


Fig.83. Oil pump driveshaft.

55. Remove the oil seal from the crankshaft front cover.

56. Using new self locking bolts (see Technical Data) and a new gasket fit the crankshaft front cover and torque bolts to specification.

NOTE: The transition of the front cover/oil sump mating flange must be even, see Fig.85.

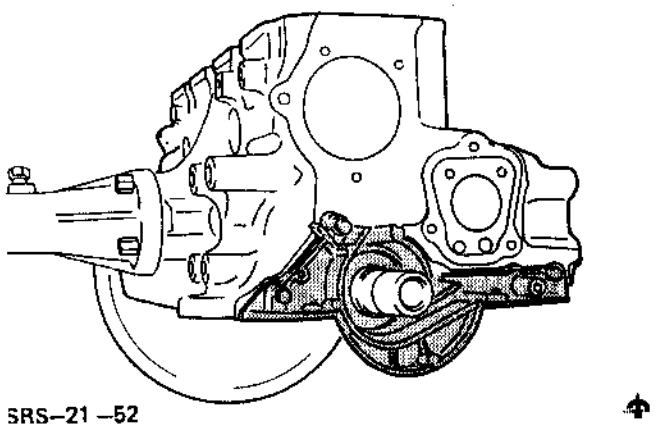


Fig.84. Fit the crankshaft front cover.

57. Wet the crankshaft and the new crankshaft front oil seal lip with fresh engine oil and install the seal using special tool 21-009-B in conjunction with the crankshaft V-belt pulley, the pulley retaining bolt and washer.

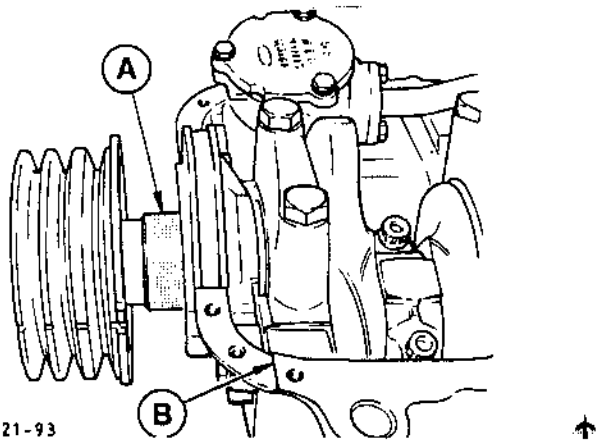


Fig.85. Fit crankshaft front oil seal
A - Special tool 21-009-B
B - Transition of front cover/sump mating flange

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58. Fit the auxiliary shaft and its retaining plate.

59. Remove the oil seal from the auxiliary shaft front cover.

60. Loosely fit the auxiliary shaft front cover then install the new oil seal, using special tool 21-009-B, together with the original washer and a longer bolt than normal. Tighten the front cover bolts.

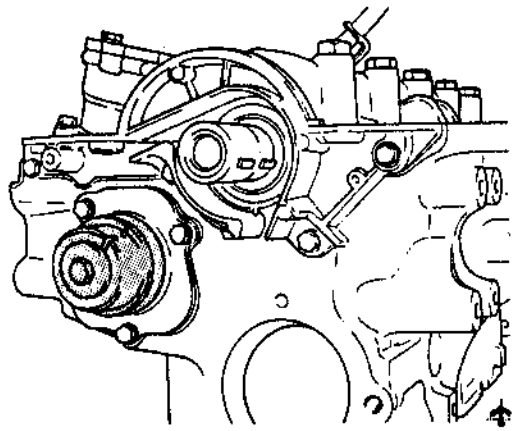


Fig.86. Fit oil seal to auxiliary shaft front cover using special tool 21-009-B.

61. Apply sealing compound (see Technical Data) to the ends of the rubber seals then insert them in the grooves of the rear main bearing cap and in the front bearing cover.

    Apply sealing compound to the cylinder block mating face at the joint with the front bearing cover

    Push the sump gasket under the recess in the rubber seal.

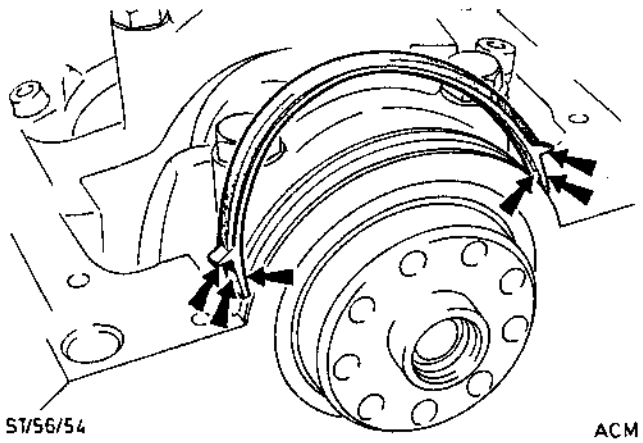


Fig.87. Apply sealing compound to rubber seals (rear main bearing cap shown).

62. Fit the oil sump, apply sealing compound (see Technical Data) to the bolts and torque the bolts to specification using the correct bolt tightening sequence as follows:

    Stage 1: Starting with bolt "A"

    Stage 2: Starting with bolt "B"

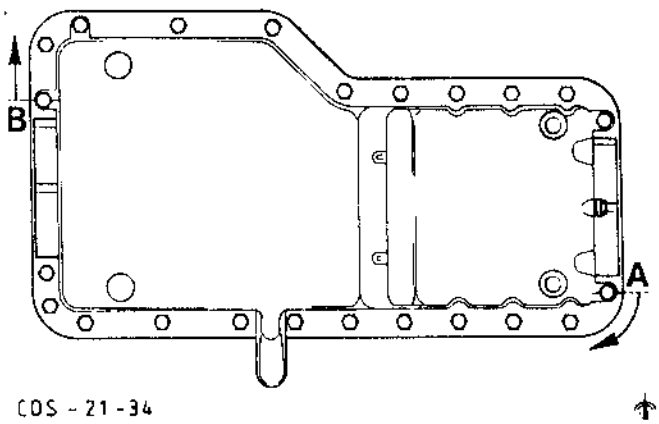


Fig.88. Sump bolt tightening sequence.

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63. Fit the flywheel.

NOTE: Check hole spacing for correct location. One hole has an offset drilling.

NOTE: Lubricate the bolt threads and under the bolt heads with engine oil.

64. Install the crankshaft needle roller bearing, (pilot bearing) using special tool 21-044-A.

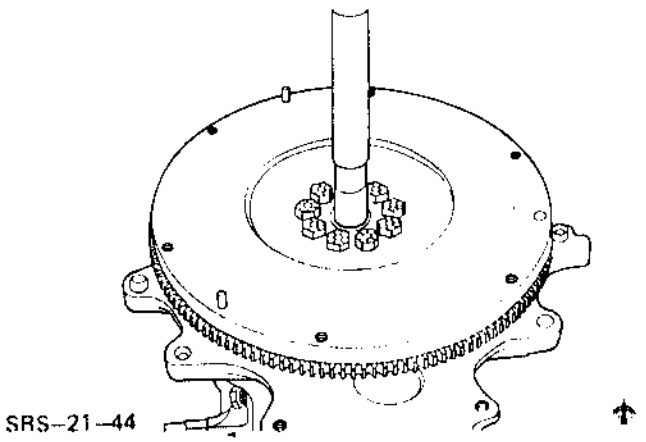


Fig.89. Install crankshaft needle roller bearing, using special tool 21-044-A.

65. Centre the clutch disc using special tool 21-044-A.

Locate the pressure plate over the dowels and uniformly tighten the retaining bolts.

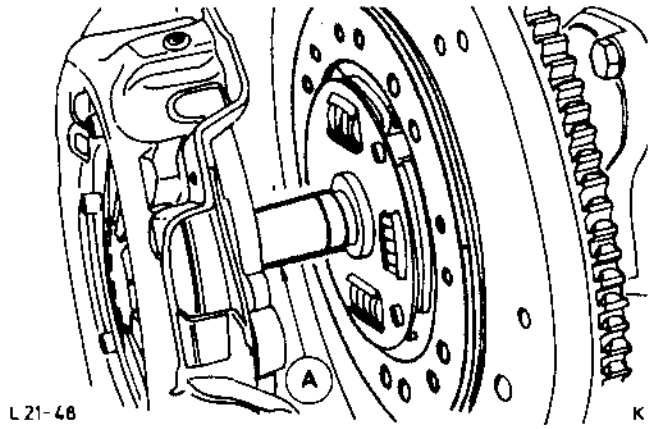


Fig.90. Centre clutch disc.
A - Special Tool 21-044-A

66. Using sealing compound (see Technical Data) fit the oil pressure switch adaptor and oil pressure switch.

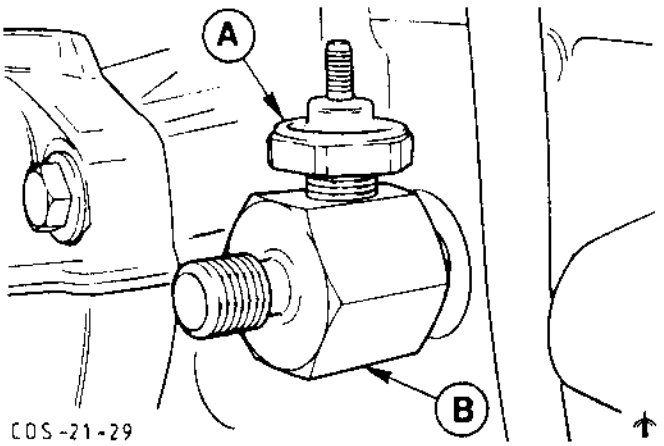


Fig.91. A - Oil pressure switch
B - Adaptor

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67. Insert the oil separator and engine breather valve as far as the stop.

68. Fit the oil cooler.

69. Fit the oil filter (screw in until it makes contact, then tighten a further threequarters of a turn.

NOTE: Lubricate rubber seal.

70. Fit the power steering pump bracket, Fig.93, with two M10 socket headed bolts 'D'. Press the bracket to the rear when tightening the bolts, see arrow, and torque to specification.

71. Fit the power steering pump support bracket, Fig.93:

- Apply sealing compound to the mating face of the support bracket 'G', do not use a gasket.
- Align the support bracket 'B' and engine speed/TDC sensor clip 'C' and screw in two M8 hex. headed bolts finger tight.
- Insert the M8 socket head bolt 'F' connecting the bracket to the support bracket and tighten.
- Tighten the two M8 hex. headed bolts.
- Torque the M8 socket head bolt 'F' and the M8 hex. headed bolts to specification.

Fig.93. Power steering pump bracket and support bracket.
A - Bracket
B - Support bracket
C - Engine speed/TDC sensor clip
D - M10 hex. socket head bolts
E - M8 hex. headed bolts
F - M8 hex. socket head bolt
G - Sealing compound (refer to Technical Data)

72. Fit the water pump und gasket. Fit the bolt with the collar (M8) on the underside of the pump.

73. Fit the auxiliary shaft toothed belt pulley. Align the pulley with the TDC mark, Fig.94.

74. Fit the distributor.

NOTE: Distributor rotor arm must now align with the mark for No.1. cylinder Fig.94.

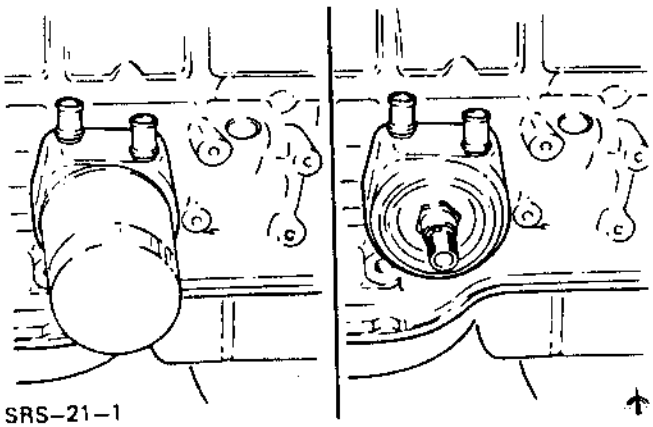


Fig.92. Fit the oil cooler and oil filter.

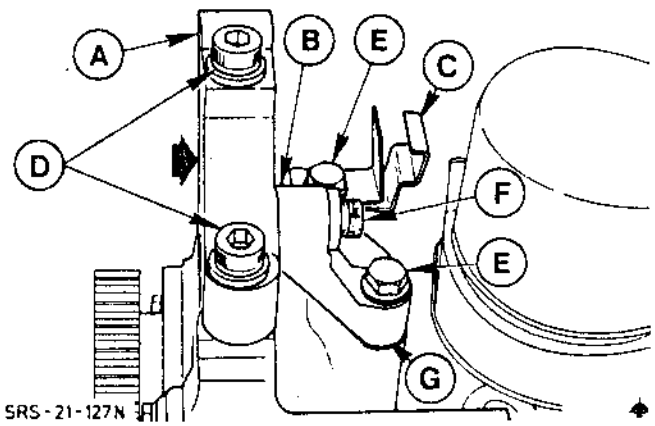


Fig.93. Power steering pump bracket and support bracket.

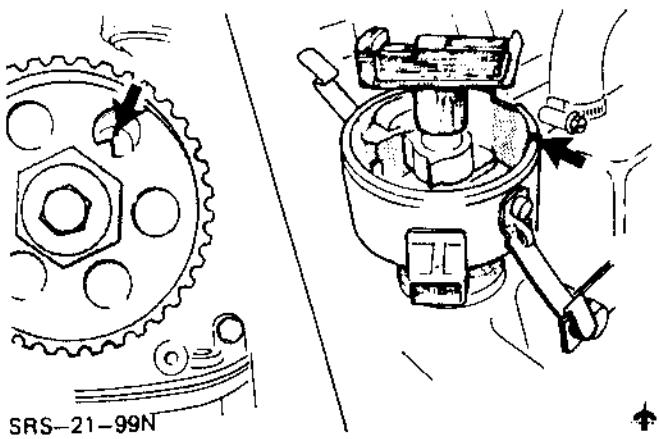


Fig.94. Auxiliary shaft and distributor rotor in TDC position.

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75. Fit the crankshaft toothed belt pulley, side with boss facing engine.

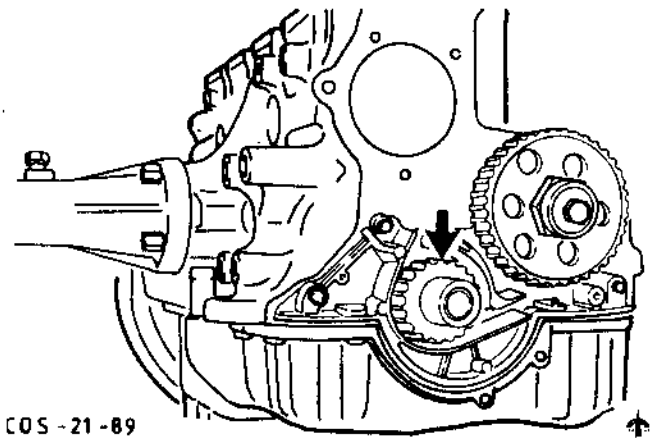


Fig.95. Install crankshaft toothed belt pulley.

76. Install the cylinder head alignment studs, special tool 21-128, in the cylinder block, bolt threads 7 and 8, Fig.96.

NOTE: Before refitting a cylinder head its mating faces must be subjected to a check for flatness as described in Operation No. 21 163 0.

77. Ensure surfaces of cylinder block, cylinder head and new cylinder head gasket are clean.

Locate the cylinder head gasket (marked TOP/OBEN) on the cylinder block.

78. Fit the cylinder head complete with inlet manifold (guide intake elbow damper bracket onto engine mount stud).

NOTE: Lubricate the retaining bolt threads, the washers and under the bolt heads with engine oil.

Insert and finger tighten the bolts, screw out the alignment studs and insert the remaining bolts.

Tighten the bolts in three stages, in the sequence shown, to the torque values as specified in Technical Data.

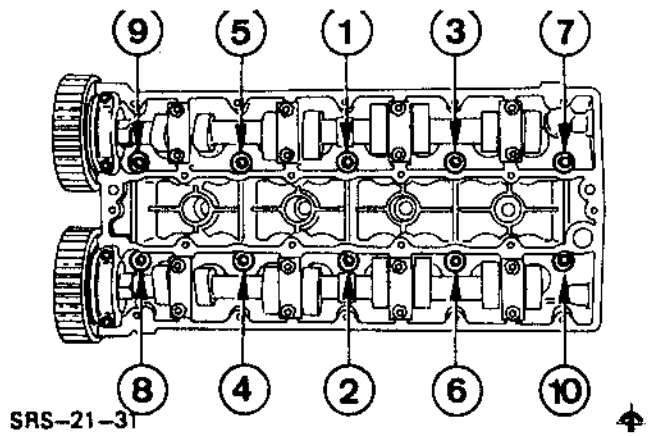


Fig.96. Cylinder head bolt tightening sequence.

79. Tighten the engine mount/intake elbow damper bracket nut.

Adjust damper: using Loctite to secure nut (see Technical Data), tighten nut to 8 - 10 Nm then loosen a half turn.

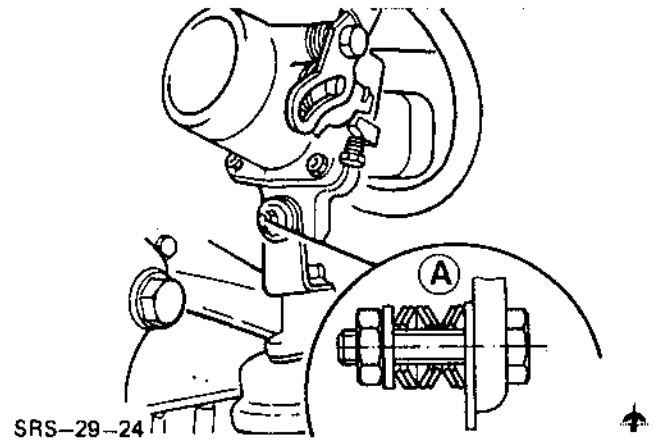


Fig.97. Intake elbow damper
A - 6 dished washers

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80. Fit the engine breather valve (1 nut) to the plenum chamber.

81. Fit the coolant feed hose to the oil cooler.

82. Fit the vacuum hose to the engine breather valve.

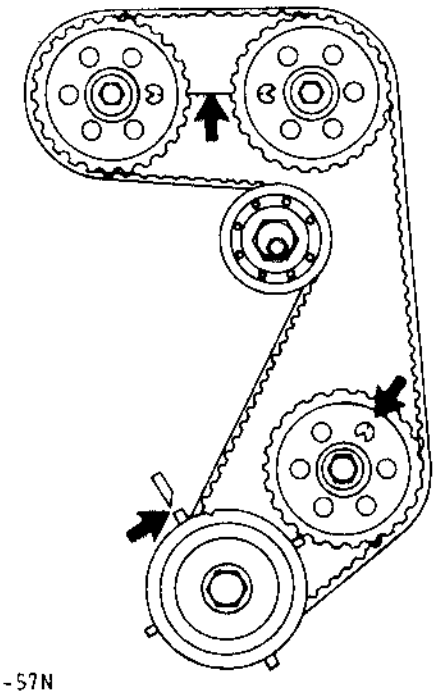
83. Loosely fit the timing belt tension pulley.

84. Fit the timing belt to the crankshaft pulley only.

85. Fit the crankshaft V-belt pulley and thrust washer. The convex side of the thrust washer faces the timing belt pulley.

86. Position the crankshaft, auxiliary shaft and both camshafts on TDC mark and fit the timing belt.

NOTE: Check previous direction of running when fitting a used timing belt.



SRS-21-57N

Fig.98. Position crankshaft, auxiliary shaft and both camshafts on TDC mark and fit timing belt.

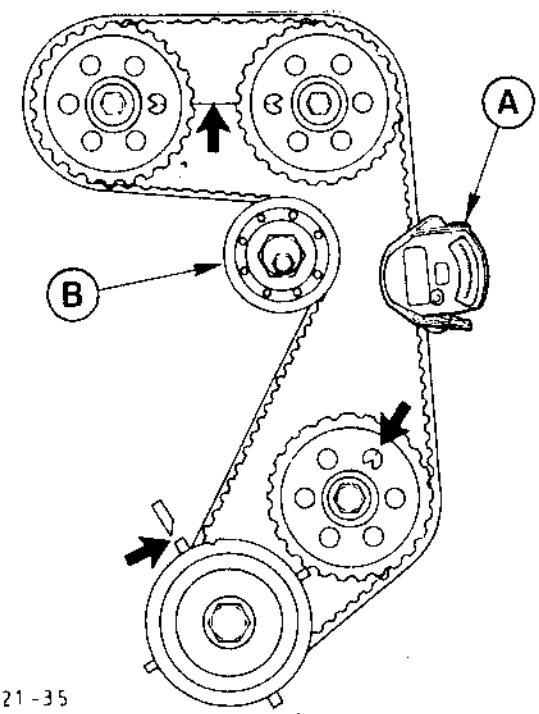
87. Adjust the timing belt tension as follows:

- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and if necessary repeat tensioning procedure.

Crank the engine several times in the direction of rotation and recheck the distributor at TDC.
Torque all pulleys to specification.



COS-21-35

Fig.99. Tension timing belt
A - Special tool 21-113
B - Tensioning pulley

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88. Fit the engine speed/TDC sensor complete with bracket (2 nuts), attach cable to the sump (1 bolt) and clip plug to the power steering pump support bracket.

    Turn crankshaft pulley until a pulley tooth is aligned with the sensor. Adjust sensor to tooth gap, 0,6 to 1,0 mm.

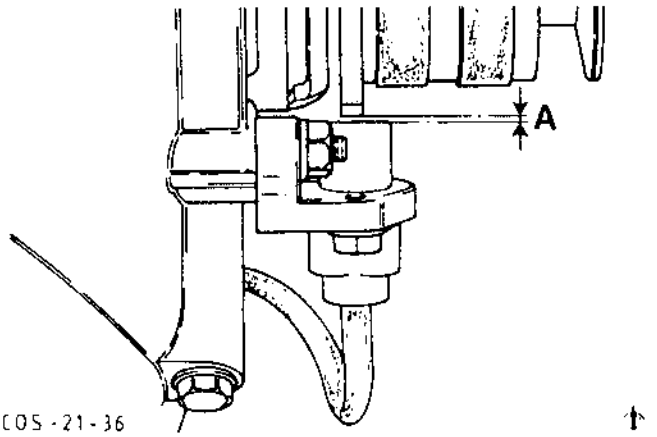


Fig.100. Engine speed/TDC sensor.
A - 0,6 to 1,0 mm

89. Position the cylinder head cover gaskets, 2 rubber seals and cylinder head cover. Insert and tighten bolts to specification (20 bolts).

90. Fit the alternator together with its bracket and adjustment strap. Fit V-belt and adjust V-belt tension (see Technical Data).

91. Fit the ignition distributor cap and HT leads. Clip the HT leads to the plenum chamber.

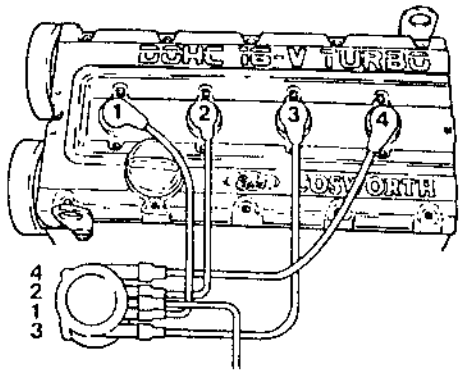


Fig.101. HT lead arrangement/firing order.

92. Fit the timing belt cover ensuring that the spacers are correctly located. Do not tighten top right hand screw.

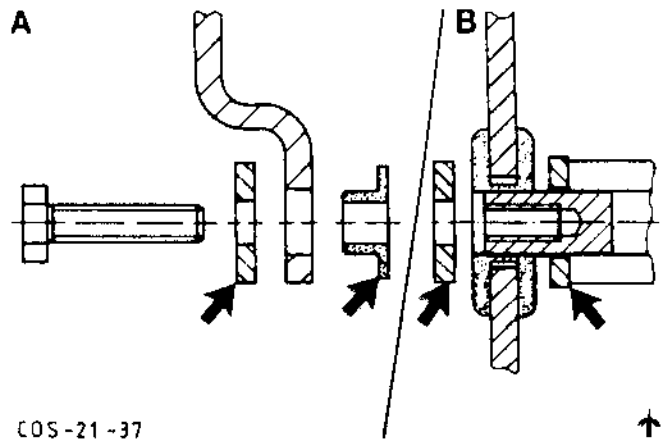


Fig.102. Correct timing cover spacer location.
A - Lower
B - Middle

21 134 8

93. Fit the oil dipstick holder to cylinder head, insert oil dipstick.

94. Fill engine with oil.

95. Remove engine from stand.

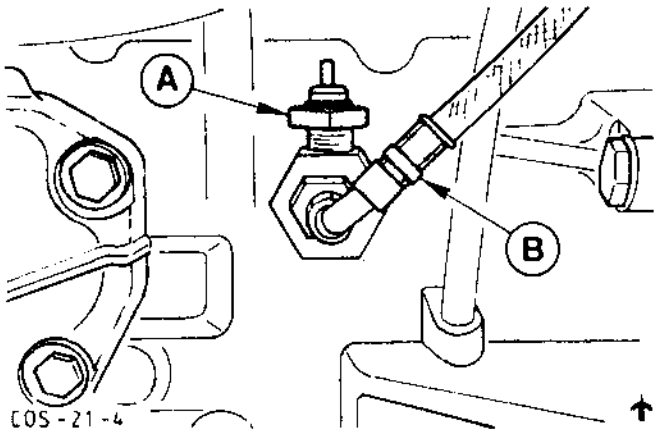


Fig.103. A - Oil pressure switch
B - Turbocharger oil feed hose

96. Fit the turbocharger complete with the exhaust manifold using new gaskets (16 nuts, finger tight).

NOTE: The exhaust manifold must be centred on the studs before tightening the nuts.

Install and adjust the turbocharger damper unit as described in Section 23, Repair Operation 23 612 0, Turbocharger-Remove and Install.

97. Fit the right hand engine mount.

98. Connect the turbocharger oil feed hose to the oil pressure switch adaptor, Fig.103, and clip hose to the cylinder head (2 bolts, 2 clips) together with lifting eye.

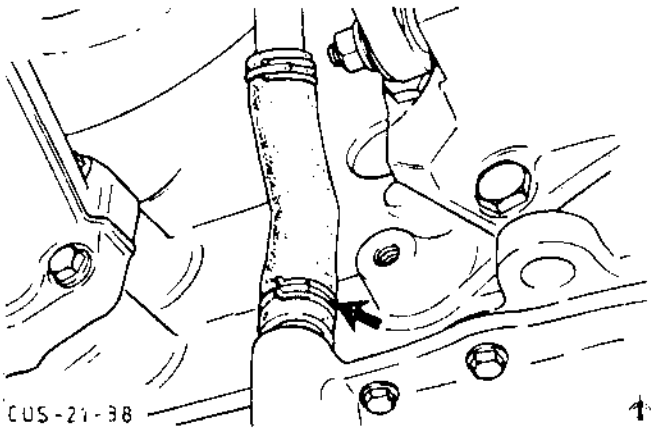


Fig.104. Connect turbocharger oil return hose.

99. Connect the turbocharger oil return hose to the sump stub pipe.

100. Connect the turbocharger coolant feed line to the thermostat housing.

Clip the turbocharger coolant return line to the top of the timing belt cover and tighten screw.

Connect the heater return line to the water pump.

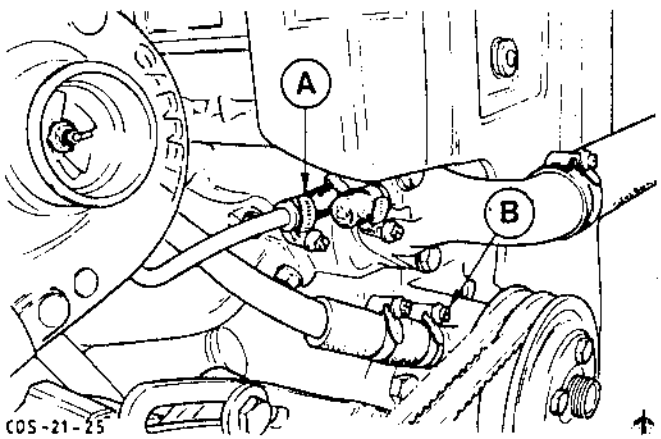


Fig.105. A - Turbocharger coolant feed line
B - Heater return line

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21 154 0 SUMP - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Engine support bar 21-060-A

To Remove

1. Disconnect the battery earth cable.

2. Detach the overflow tank connecting hose from the turbocharger coolant pipe and withdraw the hose from the lifting eye.

3. Fit the engine support bar, special tool 21-060-A. Attach a chain or steel rope to the engine lifting points and slightly raise engine.

4. Raise the vehicle.

5. Detach the intermediate steering shaft from the steering spindle (1 bolt), Fig.106.

6. Detach the power steering oil cooling loop from the body (2 clamps).

   '88 Model Year only:
   Unclip fog light multiplug from cooling loop.

7. Detach the power steering feed line from the steering assembly (1 clamp/screw).

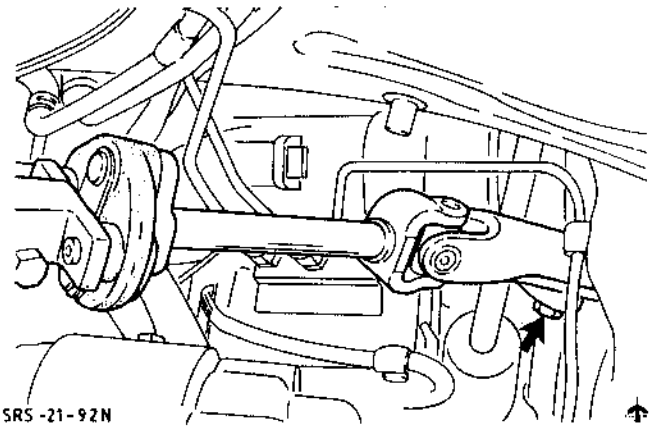


Fig.106. Detach intermediate steering shaft retaining bolt.

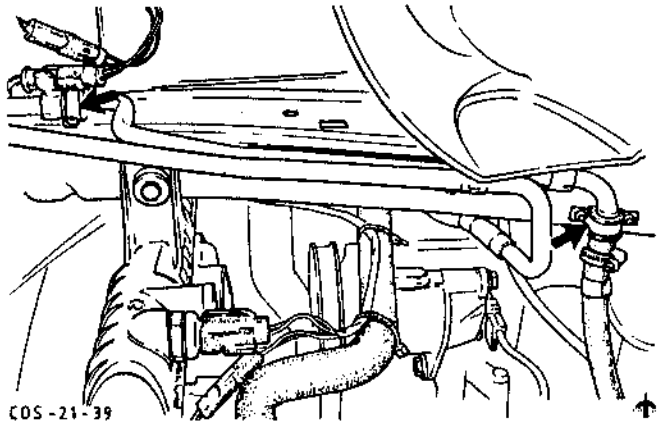


Fig.107. Power steering oil cooling loop clamps.

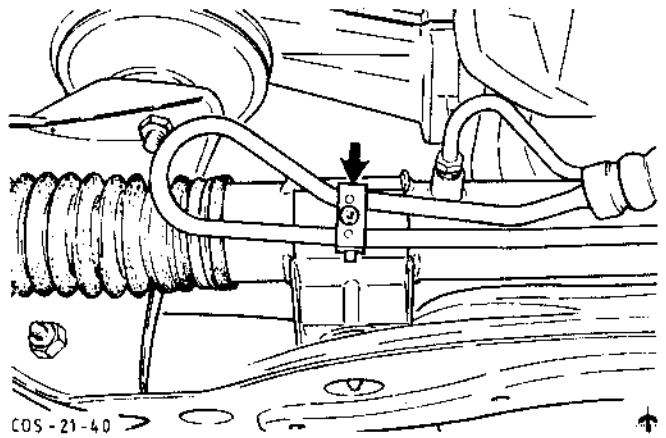


Fig.108. Detach power steering feed line clamp.

21 154 0

8. Remove the brake pipe/hose connection from the engine crossmember on both sides -

   - '86 Model Year:
     Unscrew the brake pipe from the connector, remove the two retaining clips and pull the hose out of the engine crossmember.

   - '88 Model Year:
     Remove the two retaining clips and slide pipe/hose connector out and clear of the engine crossmember.

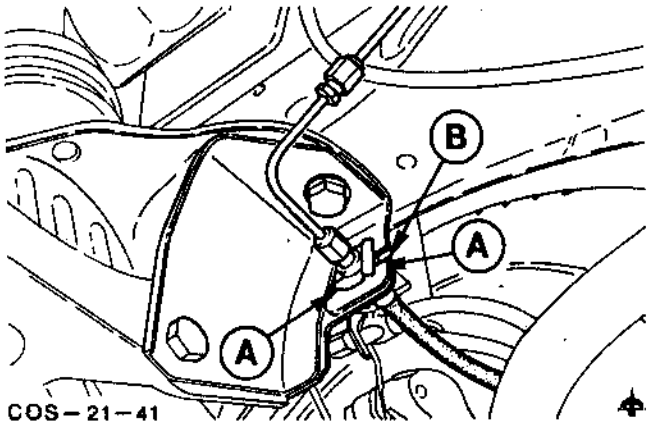


Fig.109. A - Clip
B - Slot - '88 Model Year

9. Remove the engine bearer/crossmember nut on both sides.

10. Detach the engine crossmember from the side members (2 bolts each side).

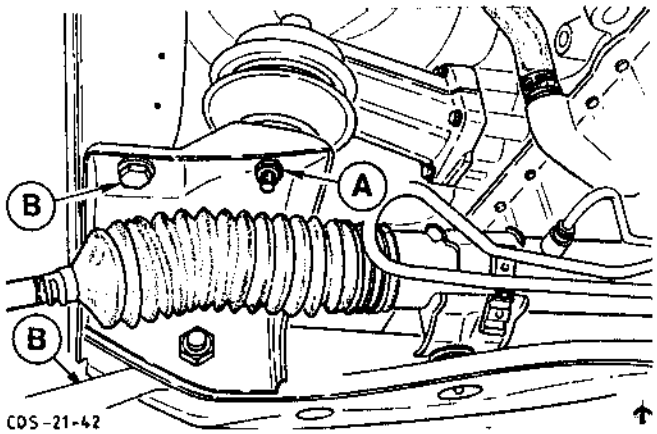


Fig.110. Remove crossmember from side member.
A = Engine bearer nut
B = Bolt

11. Remove the engine speed/TDC sensor from its holder on the sump (2 bolts) and unclip the cable from the sump (1 bolt and clip).

12. Drain the engine oil.

13. Remove the sump (22 bolts and washers).

    Discard seals and gaskets.

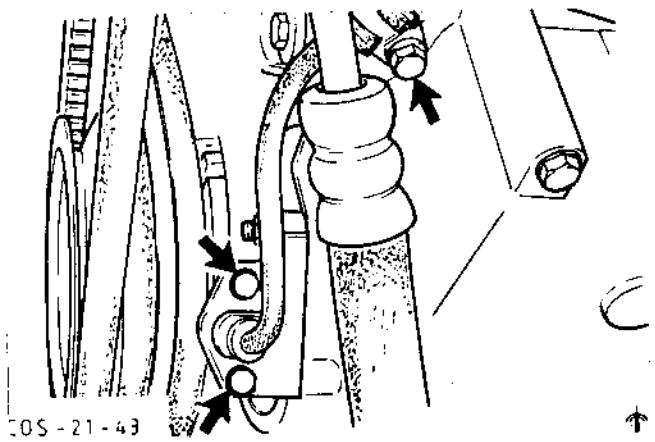


Fig.111. Detach engine speed/TDC sensor.

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To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

14. Ensure mating faces are clean and oil free.

Apply sealing compound (see Technical Data) to the ends of the rubber seals and insert them in the grooves of the rear main bearing cap and front bearing cover.

Apply sealing compound to gaskets and stick gaskets to cylinder block ensuring correct overlap by the rubber seals.

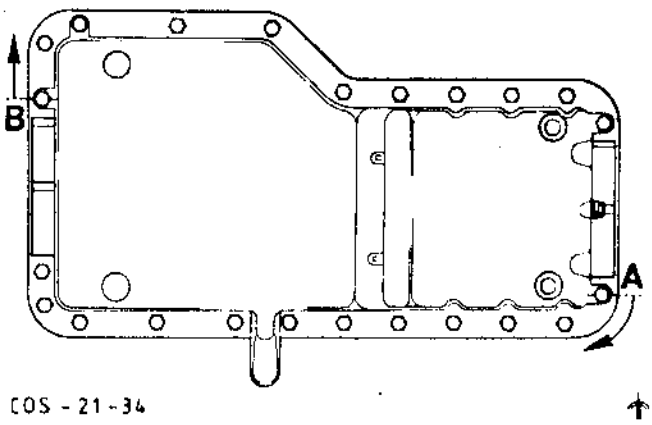


Fig.112. Sump bolt tightening sequence.

15. Apply sealing compound (see Technical Data) to the bolts and fit the sump, together with engine speed/TDC sensor cable clip. Torque the bolts to specification using the correct bolt tightening sequence as follows, Fig.112:

Stage 1: Starting with bolt 'A'

Stage 2: Starting with bolt 'B'

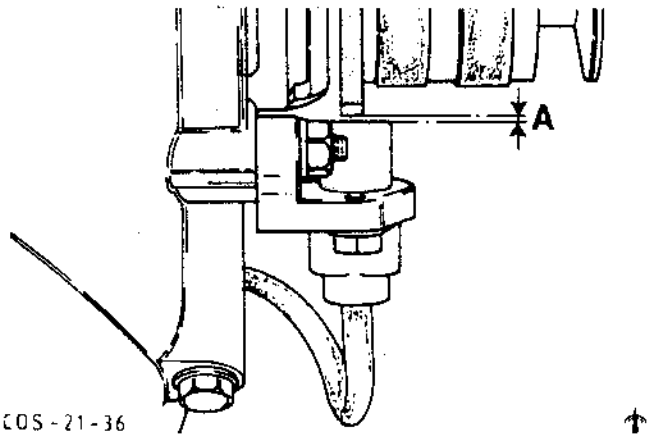


Fig.113. Engine speed/TDC sensor.
A - 0,6 to 1,0 mm

16. Fit the engine speed/TDC sensor to its holder.

Turn the crankshaft pulley until a pulley tooth is aligned with the sensor. Adjust sensor/tooth gap, 0,6 to 1,0 mm.

17. Fit the crossmember to the side members (2 bolts each side), at the same time locating the engine bearer studs.

18. Tighten the engine bearer/crossmember nut on both sides.

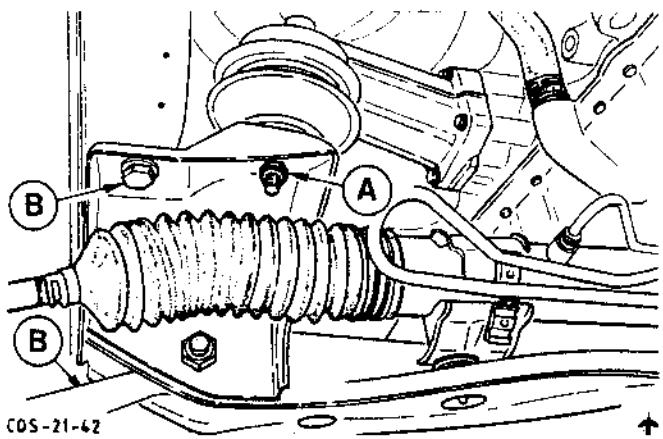


Fig.114. Fit crossmember to side member.
A - Engine bearer nut
B - Bolt

21 154 0

19. Fit the brake pipe/hose connection to the engine crossmember on both sides -

    - '86 Model Year:
      Insert the connector into the crossmember and secure with the clips. Connect the brake pipe to the connector.

    - '88 Model Year:
      Slot pipe/hose connector into crossmember and secure with clips.

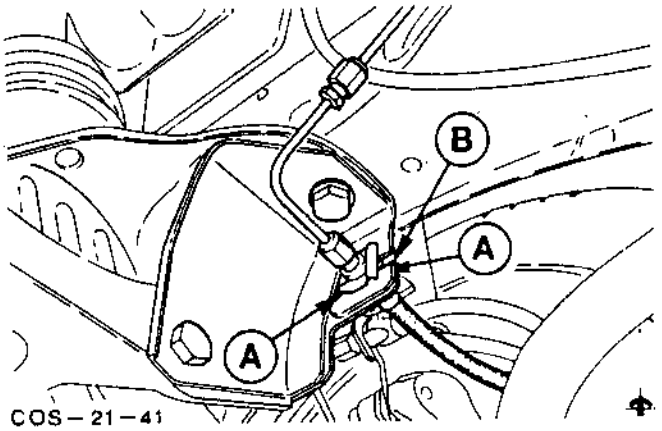


Fig.115. Fit brake pipes.
A - Clip
B - Slot - '88 Model Year

20. Fit the power steering feed line to the steering assembly (1 clamp/screw).

21. Fit the power steering oil cooling loop to the body (2 clamps), Fig.116.

    '88 Model Year only:
    Clip fog light multiplug to cooling loop.

22. Fit the intermediate steering shaft to the steering spindle (1 bolt), Fig.117.

23. Lower the vehicle.

24. Remove the engine support bar.

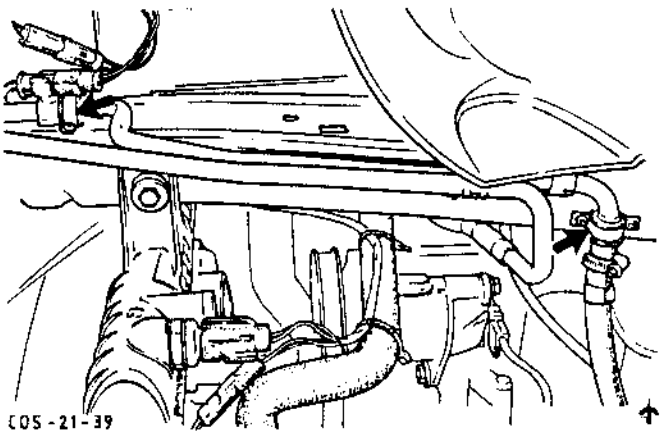


Fig.116. Fit power steering oil cooling loops to body (2 clamps).

25. Push the overflow tank to turbocharger coolant line hose through the lifting eye and connect it.

26. Fill the engine with oil.

27. Connect the battery earth cable.

28. '86 Model Year only:

    Bleed the front brake circuit.
    See Service and Repair Operation 12 141 0.

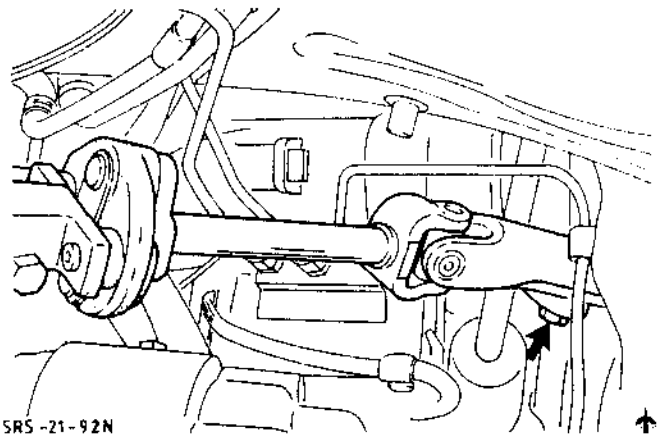


Fig.117. Fit intermediate steering shaft to steering spindle (1 bolt).

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21 163 0 CYLINDER HEAD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Engine lifting tackle	21-068
Belt tension gauge	21-113
Cylinder head alignment studs	21-128
Remover - fuel delivery line	23-023-A

The cylinder head is removed complete with turbocharger and inlet manifold.

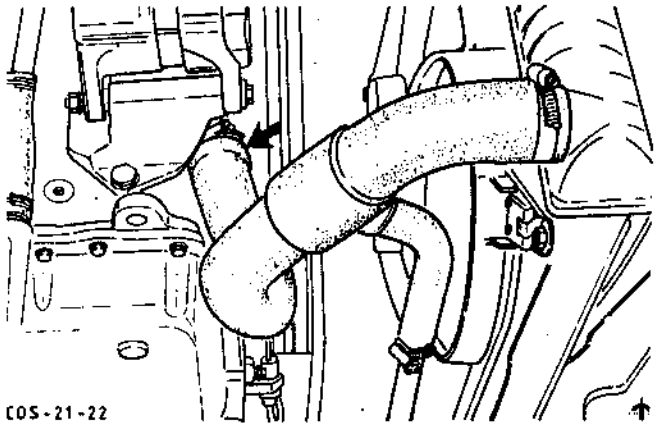


Fig.118. Detach radiator hose from water pump.

To Remove

1. Disconnect the battery earth cable.

2. Drain the coolant by detaching the lower radiator hose from the water pump.

3. Remove the turbocharger heat shield:

   '86 Model Year - 3 bolts
   '88 Model Year - 1 bolt, 2 clips

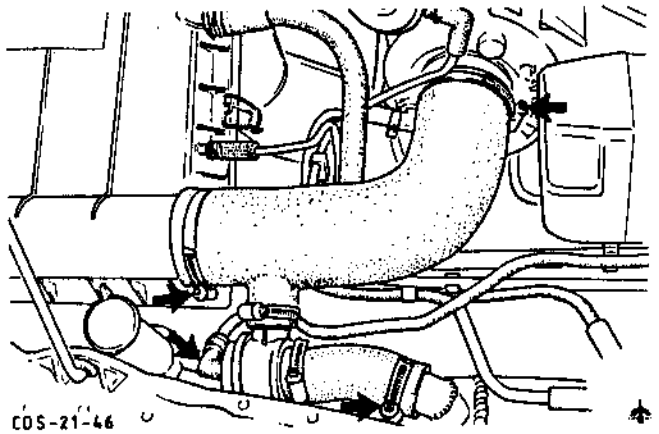


Fig.119. Remove air cleaner to turbocharger hose complete with bypass valve.

4. Disconnect the bypass valve connecting hose from the intercooler and the vacuum line from the bypass valve. Remove the air cleaner to turbocharger hose complete with the bypass valve.

5. Disconnect the solenoid control valve lines from the turbocharger and waste gate actuator.

6. Remove the turbocharger to intercooler air hose.

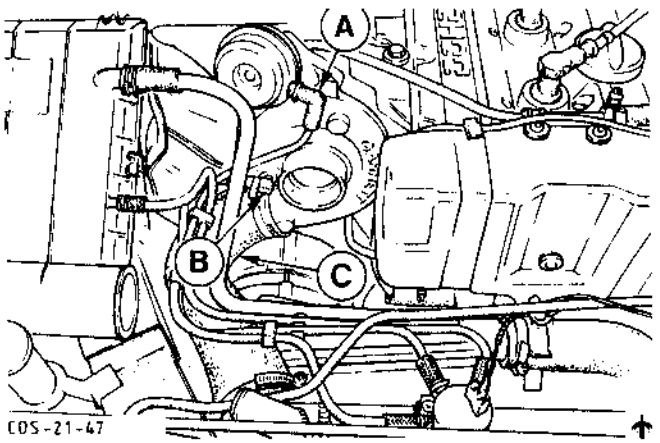


Fig.120. A - Waste gate actuator - solenoid control valve
B - Turbocharger - solenoid control valve
C - Turbocharger to intercooler hose

7. Detach the overflow tank connecting hose from the turbocharger coolant return pipe and withdraw the hose from the lifting eye.

8. Remove the turbocharger coolant return pipe (1 banjo bolt, 1 clip on timing belt cover).

9. Disconnect the turbocharger coolant feed line from the thermostat housing.

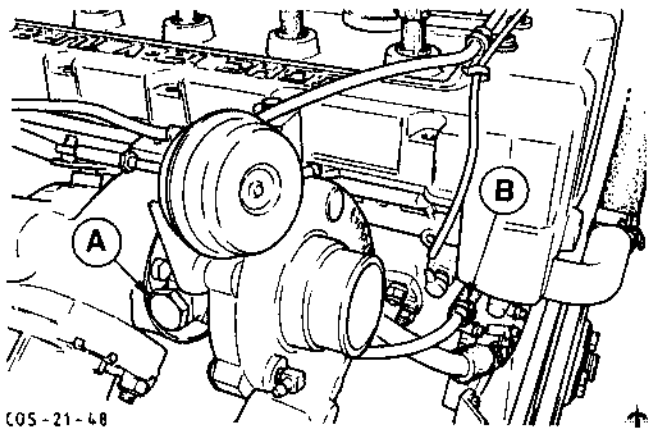


Fig.121. A - Turbocharger coolant return
B - Turbocharger coolant feed

10. Detach the upper radiator hose from the thermostat housing nozzle.

11. Disconnect the heater return line hoses from the heater and the water pump.

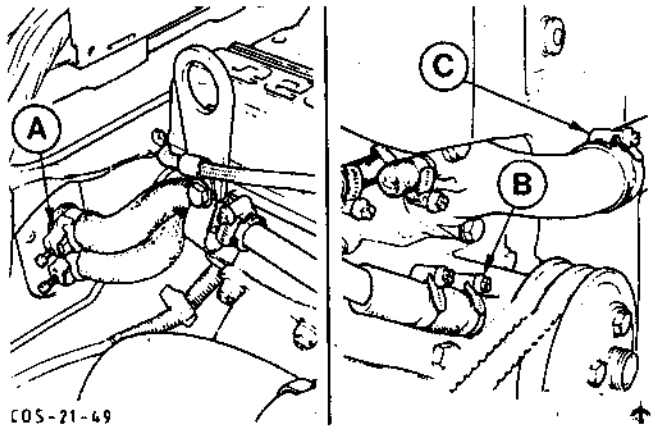


Fig.122. A - Heater return hose
B - Heater/water pump return hose
C - Upper radiator hose

12. Disconnect the exhaust pipe from the turbocharger.

    If nut locking plates are fitted, bend back the tabs, remove the three nuts and lock plates and discard them.

13. Disconnect the plenum cover and air cleaner hoses from the breather valve.
    Detach the breather valve from the plenum chamber (1 nut).

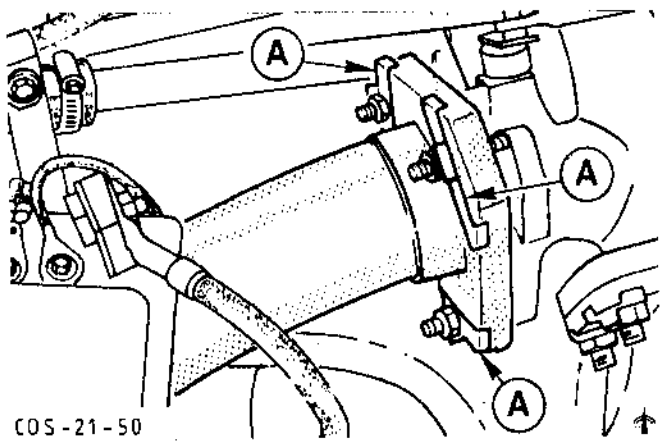


Fig.123. Disconnect exhaust pipe.
A - Lock plates

21 163 0

14. Remove the throttle cable from the throttle butterfly and from bracket (1 clip).

NOTE: Do not remove throttle cable bracket from plenum cover (Loctite from initial build may fall inside plenum chamber).

15. Remove the intercooler to throttle valve assembly air hose.

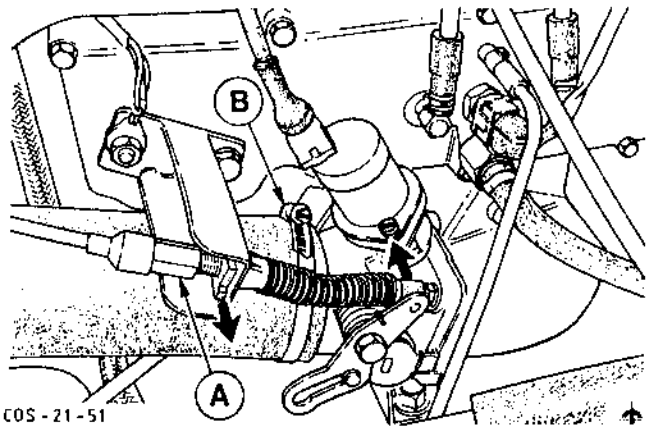


Fig.124. Remove, A - Throttle cable
B - Intercooler to throttle valve hose

16. Loosen the intake elbow damper setting nut and remove the engine mount nut.

17. Disconnect the turbocharger oil feed hose from the oil pressure switch adaptor.

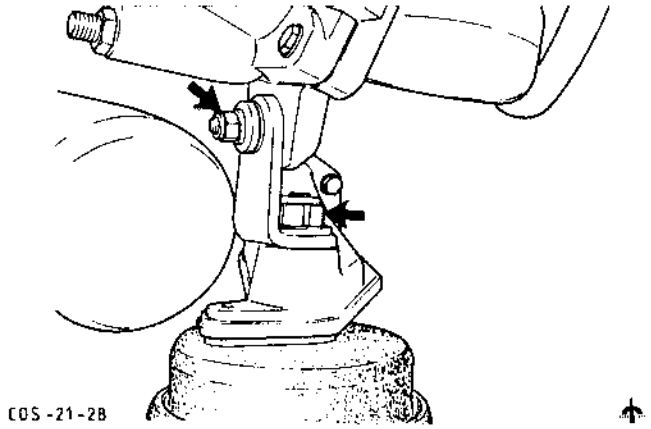


Fig.125. Intake elbow damper.
A - Setting nut
B - Engine mount nut

18. IMPORTANT NOTE: When removing fuel lines, it must be remembered that the system remains pressurised. Take adequate safety precautions to prevent fuel spillage.

Remove the safety clip from the fuel delivery line connection to the fuel rail and using special tool 23-023-A, pull off the delivery line.

Disconnect the fuel return line from the fuel pressure regulator.

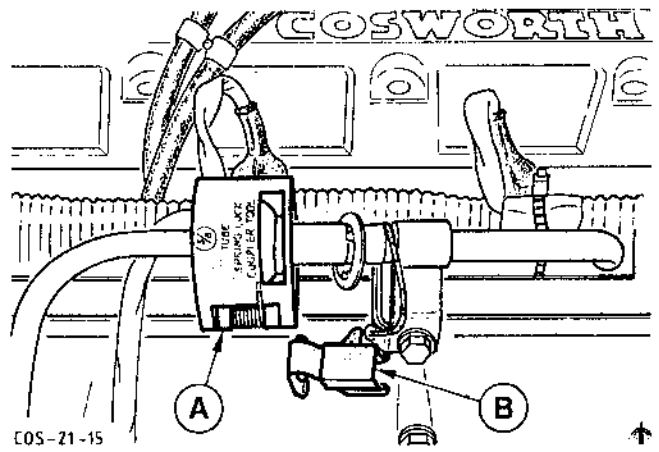


Fig.126. Remove fuel delivery line.
A - Special tool 23-023-A
B - Safety clip

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19. Detach the manifold absolute pressure (MAP) sensor line from the plenum chamber.

'86 Model Year:
Detach the bypass valve and boost pressure gauge vacuum lines from the Tee piece near the inlet manifold and pull them clear of the engine.

'88 Model Year:
Detach the bypass valve vacuum line from the plenum chamber and remove it from the vehicle.

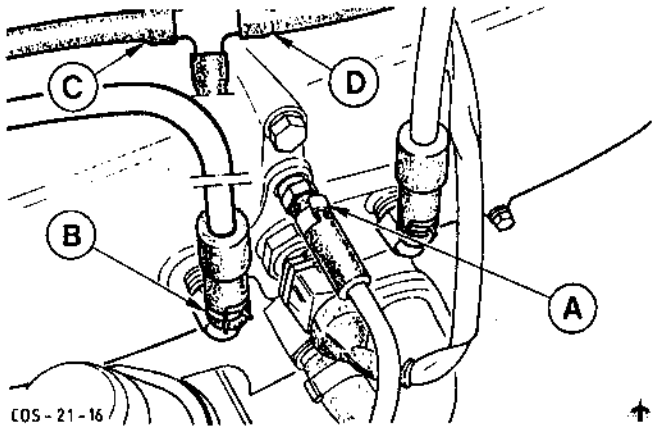


Fig.127. Disconnect vacuum lines.

Fig.127. Disconnect vacuum lines
A - To MAP sensor
B - To bypass valve, '88 MY
C - To bypass valve, '86 MY
D - To boost pressure gauge, '86 MY

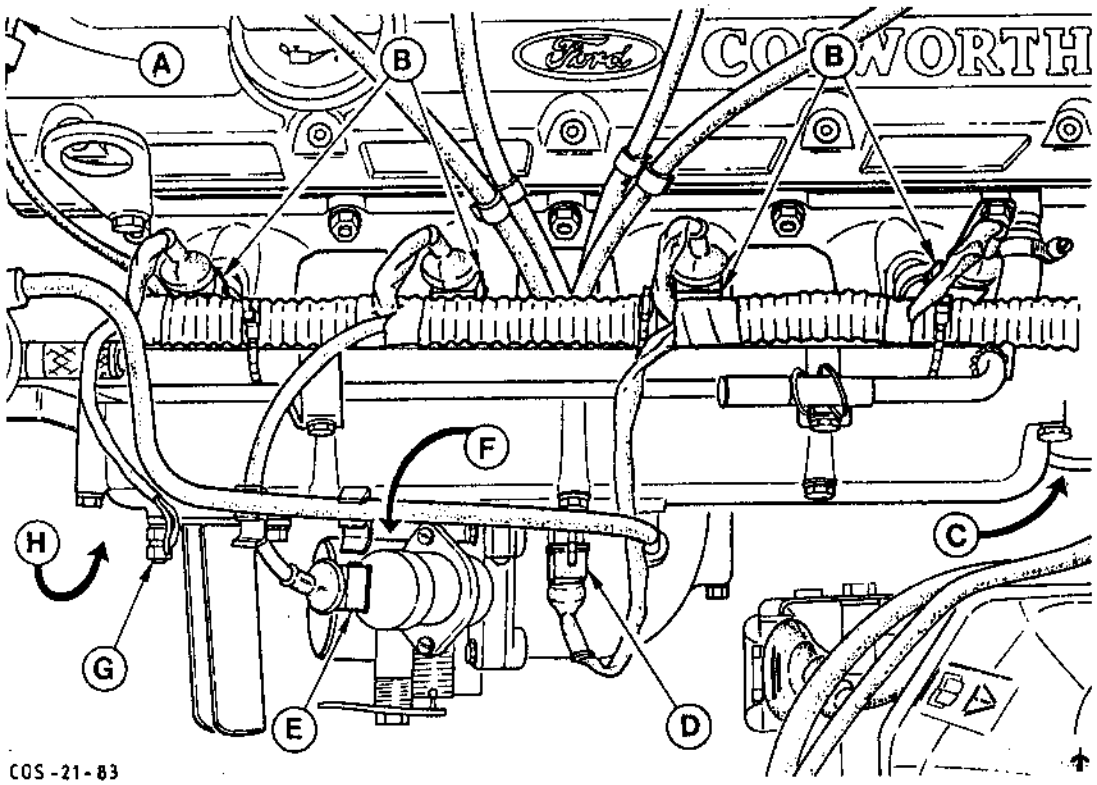


Fig.128. Disconnect wiring.

20. Disconnect wiring from, Fig.128:

Fig.128. Disconnect wiring.
A - temperature gauge sender unit
B - injection nozzles
C - coolant temperature sensor
D - air charge temperature sensor
E - idle speed control valve
F - throttle position sensor
G - earth connection on throttle cable bracket
H - engine speed/TDC sensor - distributor

Cut engine wiring loom/fuel rail cable straps and pull loom clear of engine.

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21. Remove the oil dipstick.

22. Disconnect the coolant feed hose to the oil cooler from the cylinder head flange.

23. Remove the timing belt cover.

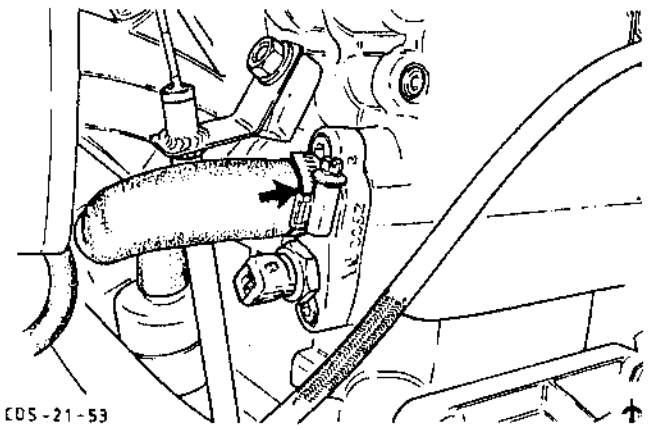


Fig.129. Coolant feed hose to oil cooler.

24. Pull the HT leads from the spark plugs, detach them from the clip on the plenum chamber and remove the distributor cap complete with HT leads.

25. Remove the cylinder head cover (20 bolts), seals and gaskets.

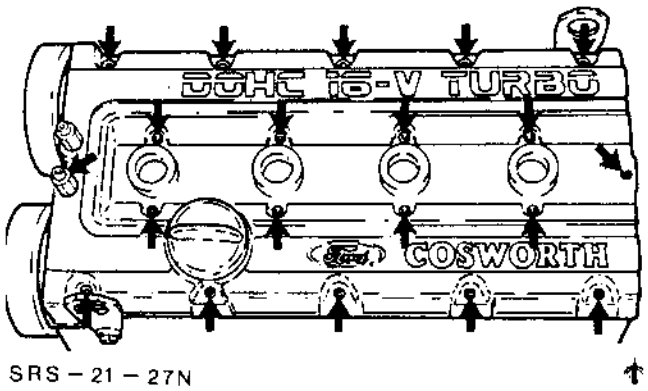


Fig.130. Cylinder head cover bolts.

26. Position No.1 cylinder piston on TDC. To do this, set crankshaft V-belt pulley and distributor rotor arm to TDC marks. Engage 1st gear and apply handbrake to block engine.

27. Loosen the timing belt tensioning pulley and remove the timing belt from the camshafts.

28. Loosen the turbocharger oil drain hose from the sump stub pipe.

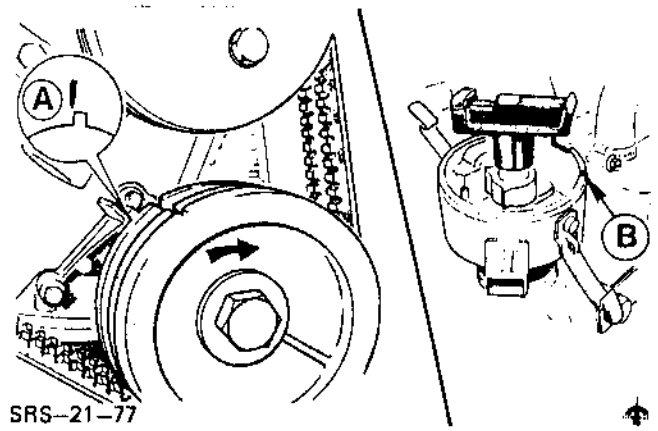


Fig.131. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

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NOTE: Before the cylinder head can be removed, the engine must have cooled down to 45 °C.

29. Loosen the cylinder head bolts (10) in the sequence shown.

    Remove the cylinder head bolts and washers.

    Attach engine lifting tackle, special tool 21-068 to the cylinder head eyes and using an engine removal trolley lift off the cylinder head complete with turbocharger and inlet manifold.

NOTE: If only an overhead crane is available it will be necessary to remove the hood (4 bolts 1 earth strap).

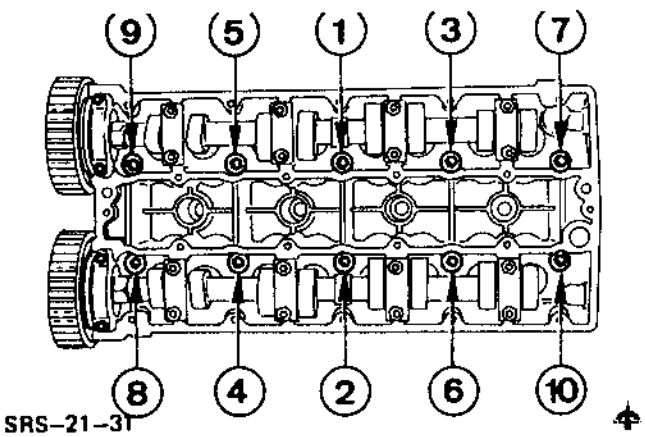


Fig.132. Cylinder head retaining bolt loosening sequence.

To Check the Cylinder Head for Flatness

Each time the cylinder head is removed it should be checked for flatness as follows:

30. Thoroughly clean the cylinder head to cylinder head cover mating face. Position a straight-edge along the cylinder head centre line and using a feeler gauge, Fig.133, check if the cylinder head is flat or convex.

    If the measured bow exceed 0,10 mm the cylinder head has been subjected to overheating and cannot be reused.

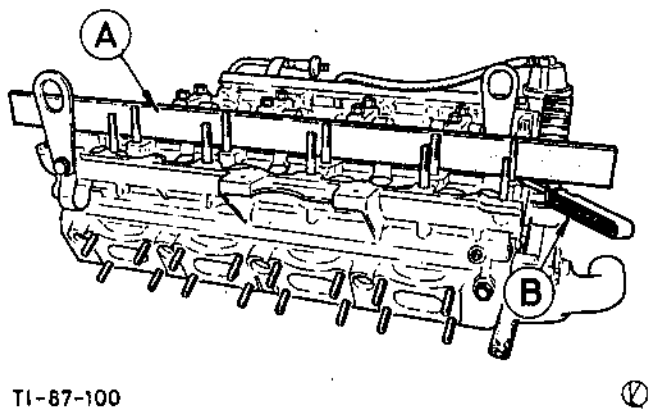


Fig.133. Check cylinder head to cylinder head cover mating face
A - Straight-edge B - Feeler gauge

31. If the bow is 0,10 mm or less, proceed to check the cylinder head at the cylinder block mating face.

32. Thoroughly clean the cylinder head to cylinder block mating face.

    Using a 100 mm long straight-edge, check the cylinder head in the lateral direction between each set of retaining bolt holes (5 places) as shown by 'A' in Fig.134.

    Repeat the check in the longitudinal direction between each set of retaining bolt holes (8 places) as shown by 'B' in Fig.134.

    The maximum permissible deviation is 0,02 mm.

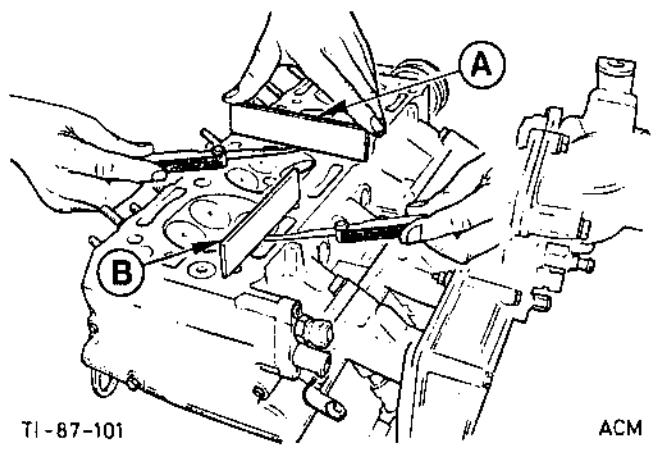


Fig.134. Check cylinder head to cylinder block mating face
A - In the lateral direction
B - In the longitudinal direction

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33. Check along the cylinder head centre line as shown in Fig.135 for overall flatness.

    The maximum permissible bow is 0,08 mm.

34. If either of the maximum permissible limitations of 0,02 or 0,08 mm is exceeded, the cylinder head must be re-machined, whereby the maximum permissible material removal is 0,13 mm.

    After re-machining, the cylinder head height (the distance between the upper and lower mating faces), must not be less than 138.68 mm.

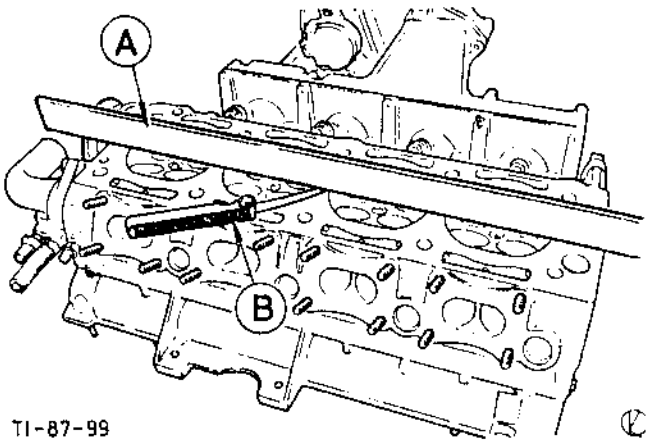


Fig.135. Check overall flatness
A - Straight-edge
B - Feeler gauge

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

35. Ensure surfaces of cylinder block, cylinder head and new cylinder head gasket are clean.

36. Install the cylinder head alignment studs, special tool 21-128, in the cylinder block, bolt threads 7 and 8, Fig.136.

37. Place the cylinder head gasket on the block (marked TOP/OBEN).

38. Fit the cylinder head complete with the turbocharger and inlet manifold. Guide the turbocharger oil return hose onto the sump stub pipe and the intake elbow damper bracket onto the engine bearer stud.

NOTE: Lubricate the cylinder head retaining bolt threads, the washers and under the bolt heads with engine oil.

    Insert and finger tighten the cylinder head bolts.
    Remove the lifting tackle.
    Screw out the alignment studs and fit the remaining bolts.

    Tighten the bolts in three stages, in the sequence shown, Fig.136, to the torque values as specified in Technical Data.

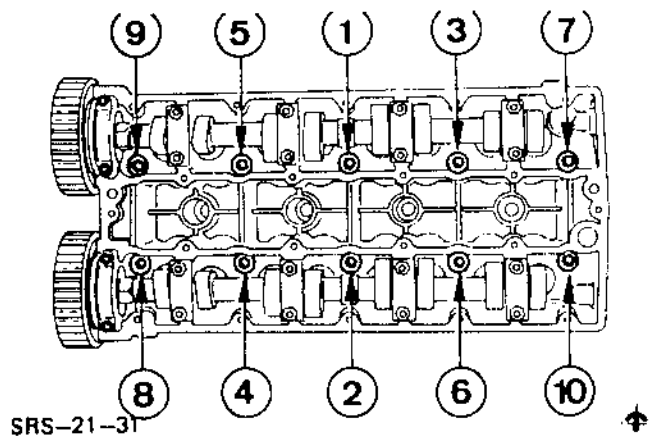


Fig.136. Cylinder head retaining bolt tigtening sequence.

39. Tighten the engine mount/intake elbow damper bracket nut.
    Adjust damper - using Loctite to secure nut (see Technical Data), tighten nut to 8 - 10 Nm then loosen a half turn.

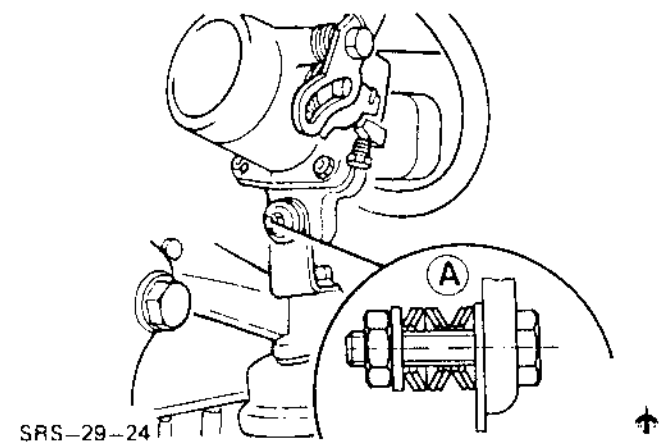
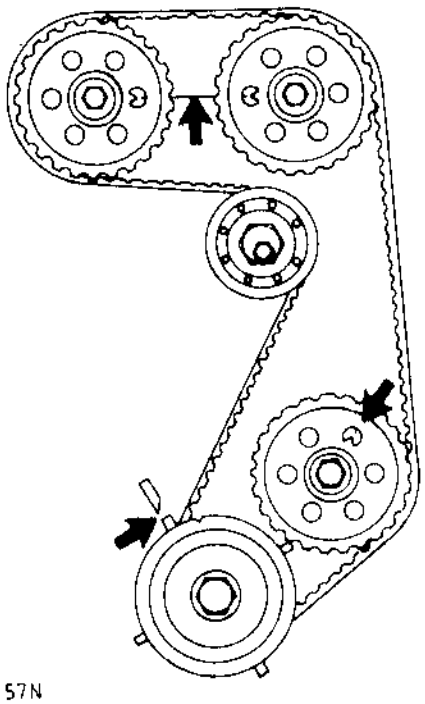


Fig.137. Intake elbow damper.
A - 6 dished washers

21 163 0

40. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC mark.

41. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



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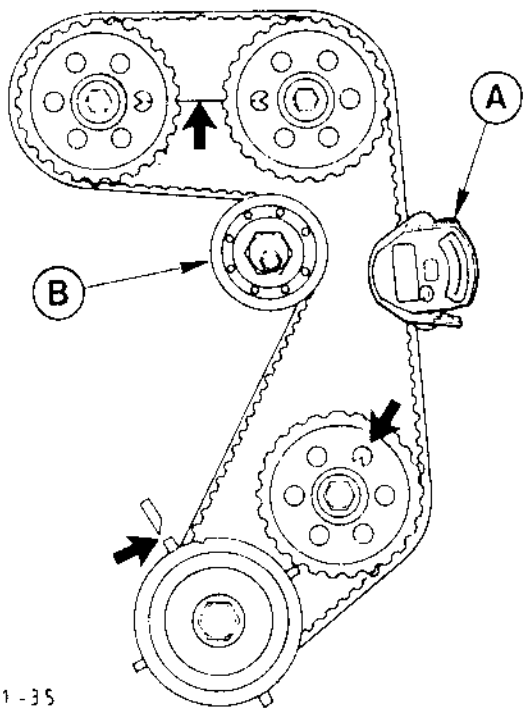
Fig.138. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

42. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



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Fig.139. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

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43. Position the cylinder head cover gaskets, 2 rubber seals and cylinder head cover. Insert and tighten bolts (20) to specification.

44. Fit the distributor cap and connect the HT leads to the spark plugs. Clip the HT leads to the plenum chamber.

45. Fit the timing belt cover, ensuring that the spacers are correctly located.

46. Connect the oil cooler coolant feed hose to the cylinder head flange.

47. Connect the turbocharger oil feed hose to the oil pressure switch adaptor.

48. Fit the oil dipstick.

49. Connect wiring to:
- temperature gauge sender unit
- injection nozzles
- coolant temperature sensor
- air charge temperature sensor
- idle speed control valve
- earth connection on throttle cable bracket
- engine speed/TDC sensor
- distributor

Fit engine wiring loom/fuel rail cable straps ensuring that the wiring loom cannot chafe on the fuel rail clamps.

50. Fit the MAP sensor line to the plenum chamber nozzle.

'86 Model Year:
Connect the bypass valve and boost pressure gauge vacuum hoses to the Tee piece near the inlet manifold.

'88 Model Year:
Connect the bypass valve line to the plenum chamber.

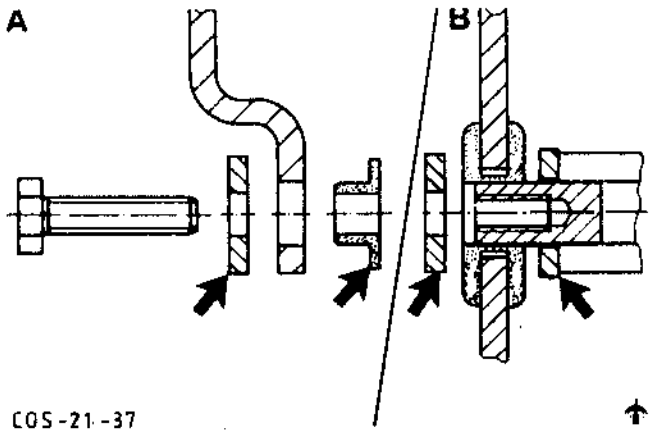


Fig.140. Correct timing cover spacer location.
A - Lower
B - Middle

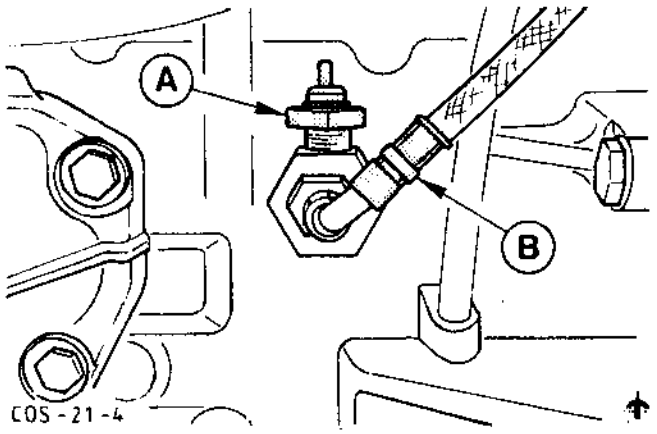


Fig.141. A - Oil pressure switch
B - Turbocharger oil feed hose

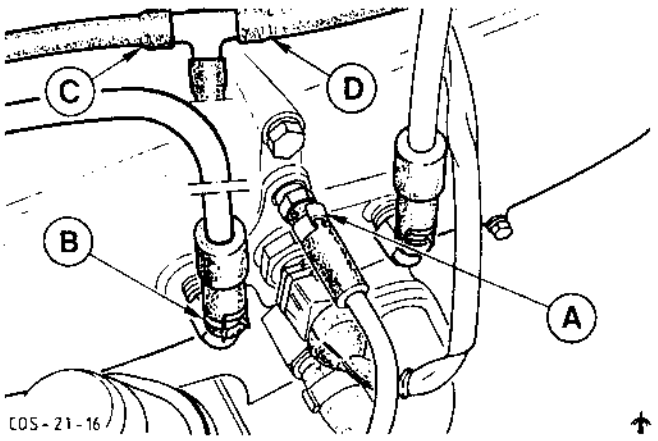


Fig.142. Fit vacuum lines. A - MAP sensor
B - By-pass valve, '88 MY
C - By-pass valve, '86 MY
D - Boost pressure gauge, '86 MY

21 163 0

51. Fit the fuel delivery line to the fuel rail and the fuel return line to the fuel pressure regulator.

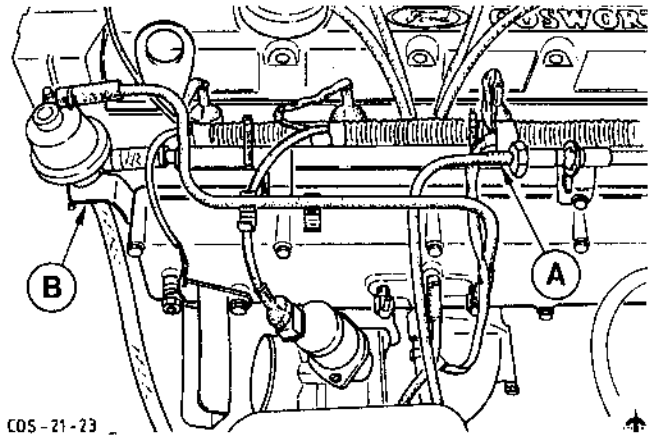


Fig.143. Fit fuel lines.
A - Delivery line
B - Return line

52. Fit the intercooler to throttle valve assembly air hose.

53. Fit the throttle cable to its bracket and the throttle butterfly.

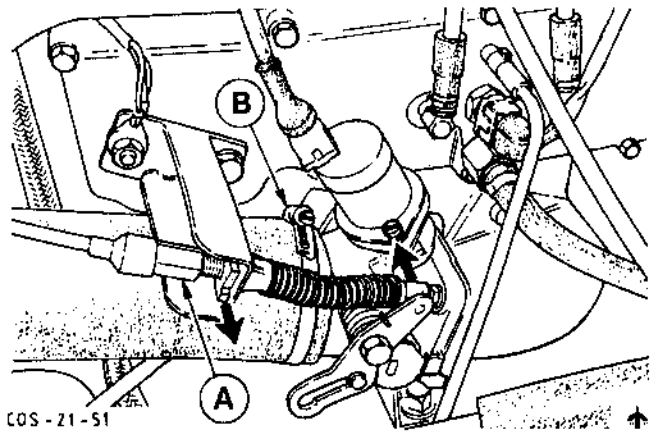


Fig.144. A - Throttle cable
B - Intercooler to throttle valve hose

54. Attach the breather valve to the plenum chamber. Connect the air cleaner and plenum cover hoses to the breather valve.

55. Connect the heater return line hoses to the heater and the water pump.

56. Attach the upper radiator hose to the thermostat housing nozzle.

57. Attach the lower radiator hose to the water pump.

58. Fit the exhaust pipe to the turbocharger using new nuts (earlier models M8, later models M10).

NOTE: Models equipped with M8 should also be fitted with new nut locking plates.

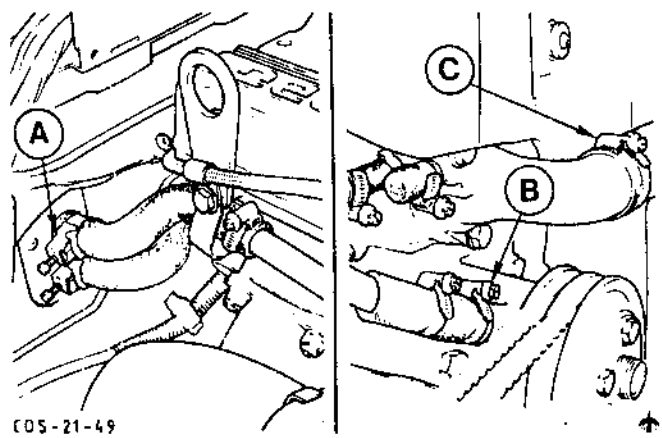


Fig.145. A - Heater return hose
B - Heater/water pump return hose
C - Upper radiator hose

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59. Connect the turbocharger coolant feed line to the thermostat housing.

60. Fit the turbocharger coolant return pipe and clip it to the timing belt cover.

61. Push the overflow tank connecting hose through the lifting eye and connect it to the turbocharger coolant return line.

62. Fit the turbocharger to intercooler air hose.

63. Connect the solenoid control valve lines to the turbocharger and the waste gate actuator.

64. Install the air cleaner to turbocharger hose complete with the bypass valve connection to the intercooler.

65. Connect the vacuum line to the bypass valve.

66. Fit the turbocharger heat shield.

67. Fill the cooling system (see Technical Data).

68. Top up with engine oil (see Technical Data).

69. Connect the battery earth cable.

70. To ensure that the oil supply to the turbocharger has been re-established before engine start up: disconnect the injector multiplugs and the low tension terminal from the ignition coil (terminal 15) and crank the engine for 10 seconds, followed by a pause then a further 10 seconds. Reconnect injector multiplugs and ignition coil and start engine.

71. With the engine at normal operating temperature, check the idle speed and CO content (see Technical Data).

    To adjust the CO content, refer to Operation 23 215 0 in this Service Microfiche.

    To adjust the idle speed, refer to Condition 5 (Erratic idle/incorrect idle speed) in the Vehicle System Test Manual.

72. Recheck coolant level.

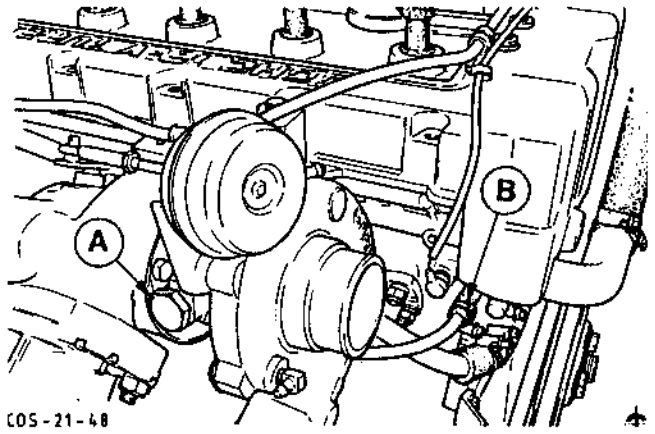


Fig.146. A - Turbocharger coolant return
B - Turbocharger coolant feed

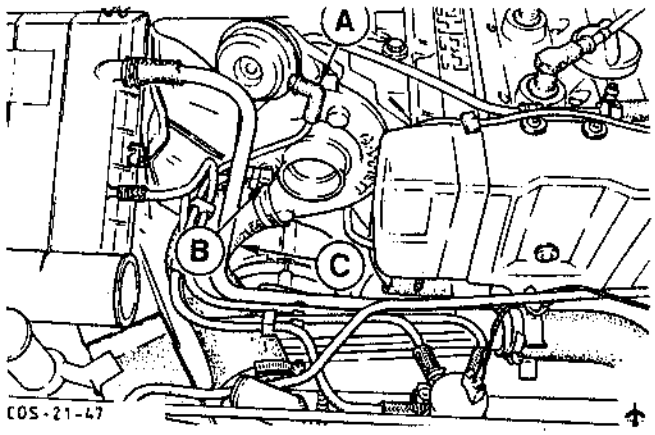


Fig.147. A - Actuator - solenoid control valve
B - Turbocharger - solenoid control valve
C - Turbocharger to intercooler hose

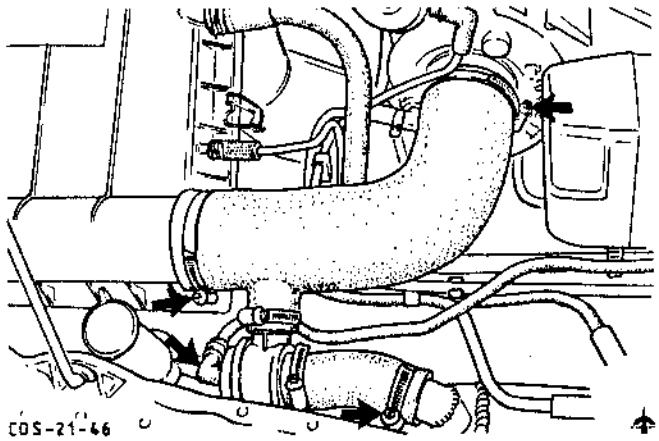


Fig.148. Fit air cleaner to turbocharger hose complete with bypass valve.

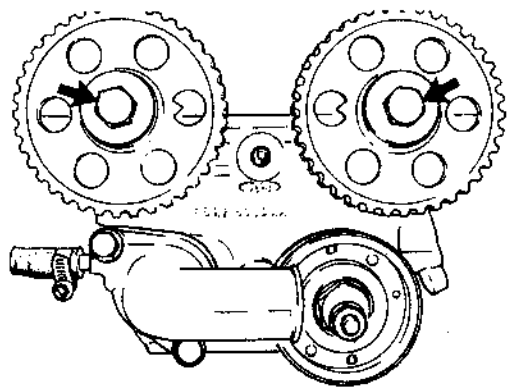
21 165 5 CYLINDER HEAD - REPLACE
(Cylinder head removed)

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer	15-053
Valve spring compressor (main tool)	21-024
Adaptor - Valve spring compressor	21-024-06
Installer - Valve stem oil seal (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130
Remover - Valve stem oil seal	21-142

LOCALLY FABRICATED TOOL:

Support plate	see Fig.1



COS-21-54

Fig.149. Remove camshaft belt pulleys.

To Dismantle

1. Place two wooden blocks of the same size under the front and rear ends of the cylinder head to prevent damage to the valves.

2. Remove the turbocharger complete with exhaust manifold from the cylinder head (16 nuts) and discard the gaskets.

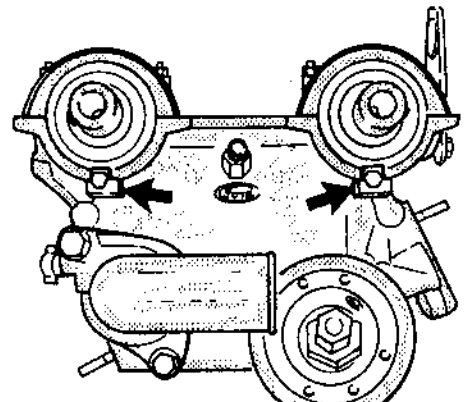
NOTE: This sub-operation only applies subsequent to 21 163 0, Cylinder Head - Remove and Install.

3. Remove the inlet manifold complete with plenum chamber from the cylinder head (9 nuts).

4. Remove the camshaft belt pulleys, Fig.149.

5. Remove the camshaft bearing housing locating plates, Fig.150 and remove the camshaft caps and camshafts (20 nuts).

NOTE: Remove the front caps first.

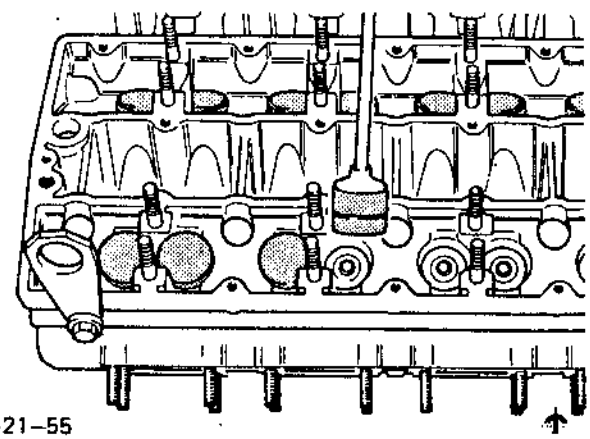


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Fig.150. Remove camshaft bearing housing locating plates.

6. Remove the valve tappets with a suction tool. Store the tappets upside down and also according to removal order to ensure correct subsequent reassembly.

NOTE: Do not use a magnet.



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Fig.151. Remove valve tappets with suction tool.

21 165 5

7. Remove the thermostat housing and seal.

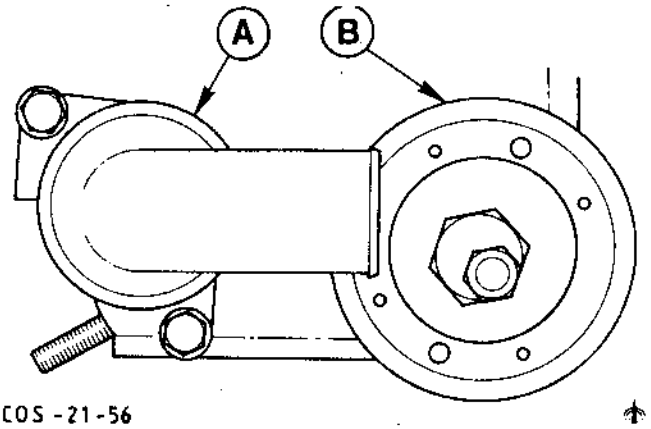


Fig.152. A - Thermostat housing
B - Timing belt tensioner

8. Remove the timing belt tensioner.

9. Remove the temperature gauge sender unit.

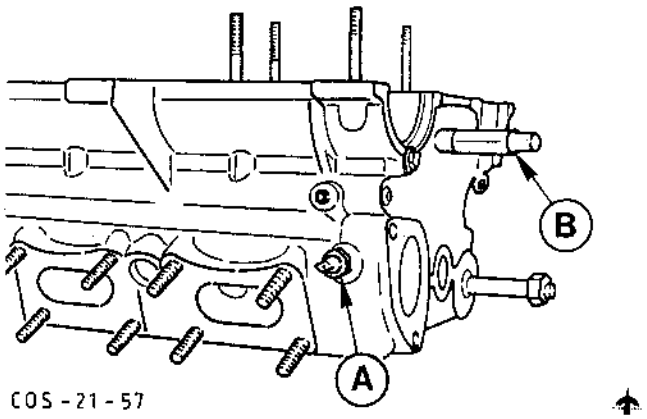


Fig.153. A - Temperature gauge sender unit
B - Pillar bolt

10. Remove the timing belt cover pillar bolt.

11. Remove the coolant temperature sensor housing complete with sensor and, if fitted, the oil cooler feed hose.

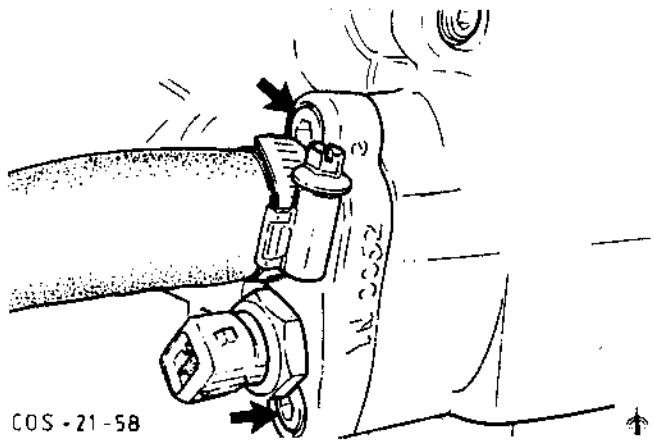


Fig.154. Remove coolant temperature sensor housing.

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21 165 5

12. Unbolt the two lifting eyes.

13. Remove the valves:

- Using a plastic drift, tap valve spring retainers to loosen collets.
- Place suitable pieces of wood in the combustion chambers to support the valves.
- Clamp cylinder head to workbench using a piece of wood under the clamps.
- Remove the valve spring collets using special tools 21-024 and 21-024-06 together with a support plate (see Locally Fabricated Tools), Fig.155. Secure plate with nuts.

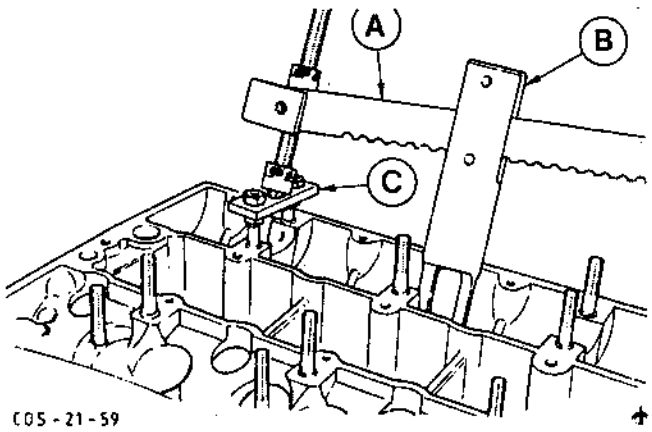
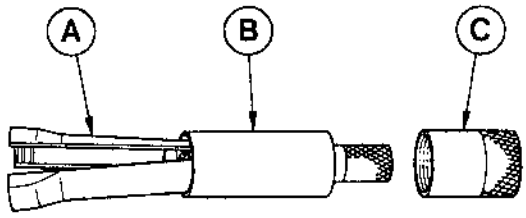


Fig.155. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated plate

- Remove valve spring retainers and springs.



- Remove the valve stem oil seals, using special tools 21-142 and 15-053:
  - engage the collet jaws of special tool 21-142, Fig.156, under the oil seal
  - push the sleeve over the jaws until they are closed
  - screw on the sleeve nut and tighten it by hand
  - screw the slide hammer, special tool 15-053, Fig.157, onto the collet and use the hammer to remove the oil seal, tightening the sleeve nut after each blow
  - remove the lower washer
- Remove valves.

Fig.156. Special tool 21-142
A - Collet
B - Sleeve C - Nut

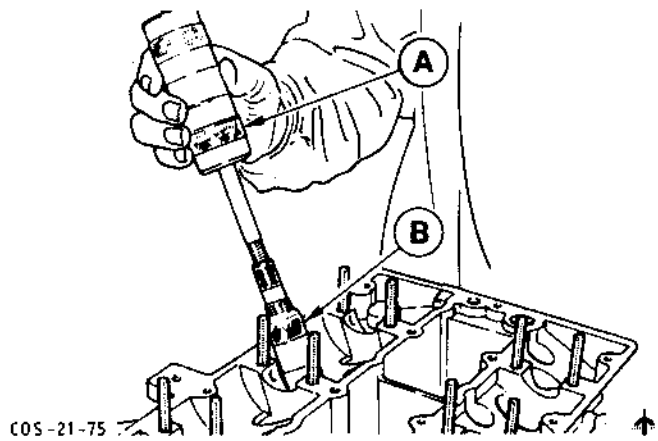


Fig.157. Remove valve stem oil seal
A - Special tool 15-053
B - Special tool 21-142

To Assemble

During assembly, tighten nuts and bolts to the torque specified in Technical Data.

A new cylinder head is delivered without valves.

Check to see that the tappets are compatible with the new cylinder head i. e. standard tappets to standard bores, oversize tappets to oversize bores.
Inspect all moving parts for wear and where necessary replace. Only new oil seals, O-rings and valve seals to be used.
If used valves are to be transferred to the new cylinder head, the valve heads must be re-ground on a valve grinding machine.

14. Grind in the valves to the cylinder head.

NOTE: Ensure that no grinding paste is present on the valve stem or valve guide. On completion, thoroughly clean cylinder head and valves from all traces of grinding paste.

15. Install the valves -

- Fit the valve spring lower washers.
- Oil the valve stems and guides and insert valves.
- Place suitable pieces of wood in the combustion chambers to support the valves.
- Clamp cylinder head to workbench using a piece of wood under the clamps.
- Oil the valve stem and oil seals and fit the seals using special tool 21-129 or 21-130, Fig.158, depending on whether it is an exhaust or inlet valve respectively. Take particular care when the oil seals pass the valve collet grooves.
- Emplace the valve springs and retainers and using special tools 21-024 and 21-024-06 together with the locally fabricated support plate, Fig.159, fit the collets.
- Using a plastic drift, tap valve spring retainers to ensure they are properly seated.

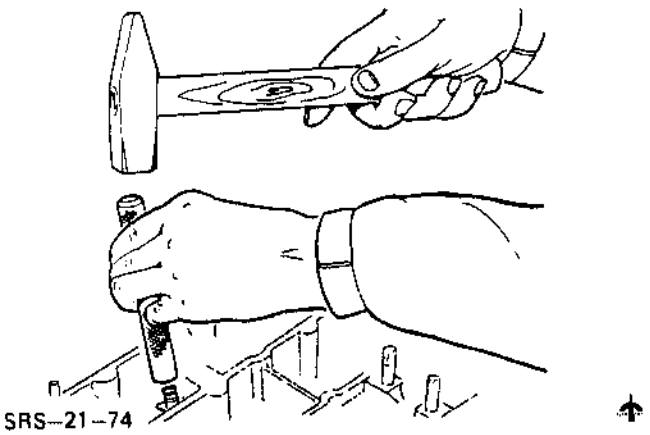


Fig.158. Fit oil seal with special tool 21-129 or 21-130.

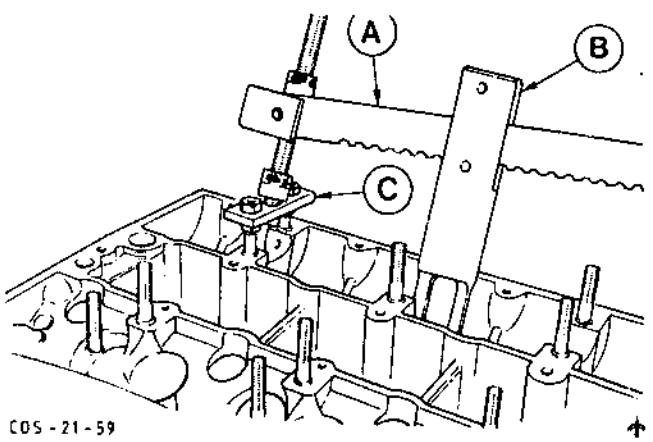


Fig.159. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated tool

21 165 5

16. Fit the two lifting eyes.

17. Fit the timing belt cover pillar bolt with sealing compound (see Technical Data) and tighten.

18. Fit the temperature gauge sender unit with sealing compound (see Technical Data).

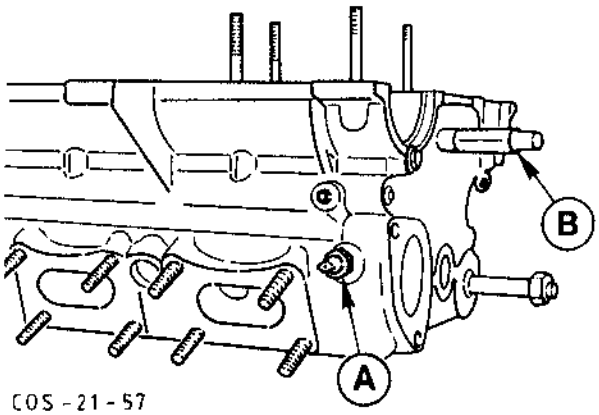


Fig.160. A - Temperature gauge sender unit
B - Pillar bolt

19. Loosely fit the timing belt tensioner.

20. Fit the thermostat housing and seal.

21. Oil and fit the tappets. Ensure correct order.

NOTE. Check tappets to ensure that no air is present (sponginess).

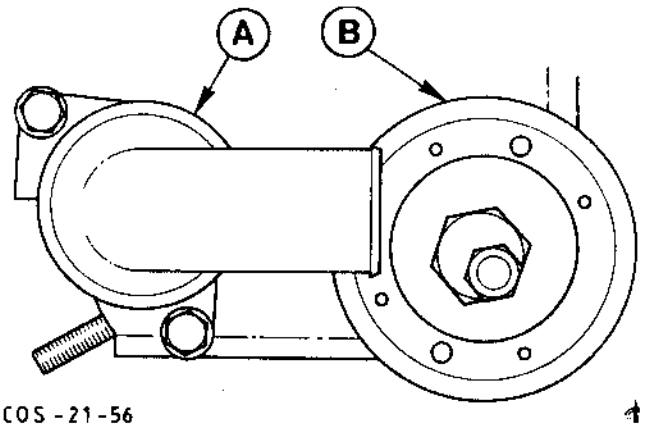


Fig.161. A - Thermostat housing
B - Timing belt tensioner

22. Replace the O-rings and radial oil seals on the front camshaft bearing housings.

23. Locate the camshafts in position.

NOTE: Inlet camshaft has grooved bearing journals.

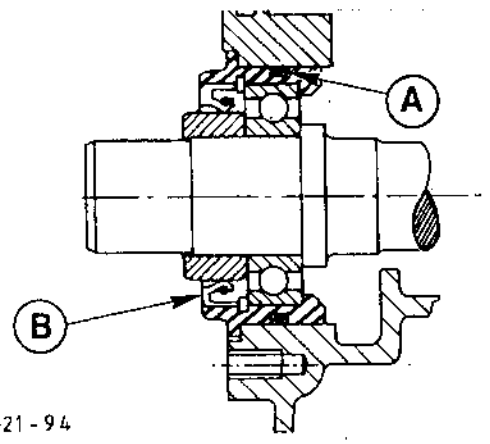


Fig.162. Camshaft bearing housing
A - O-ring
B - Oil seal

21 165 5

24. Oil and fit the camshaft bearing caps 2-5 and 7-10 in the correct order.

NOTE: Cap No. 1 is on the front of the exhaust cam. Cap numbers should face inwards.

Tighten down caps 2-5 and 7-10 evenly then torque to specification.

25. Tap the front bearing housings rearwards to ensure that they are fully home. Apply sealing compound (see Technical Data) to joint faces of caps 1 and 6, fit and torque to specification.

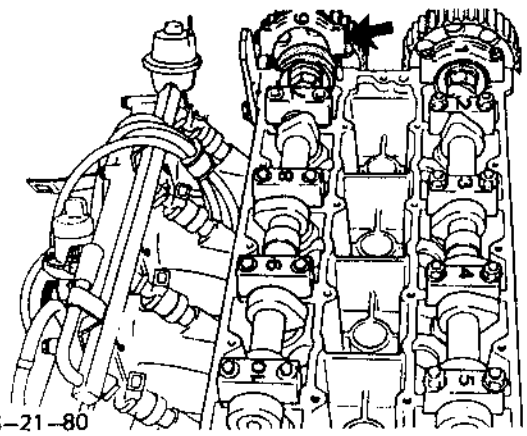


Fig.163. Inlet camshaft front bearing cap

26. Fit the camshaft bearing housing locating plates, Fig.164, and torque bolts to specification.

27. Fit the camshaft pulleys to the camshafts and torque to specification. Set the camshaft pulleys to the TDC position, Fig.165.

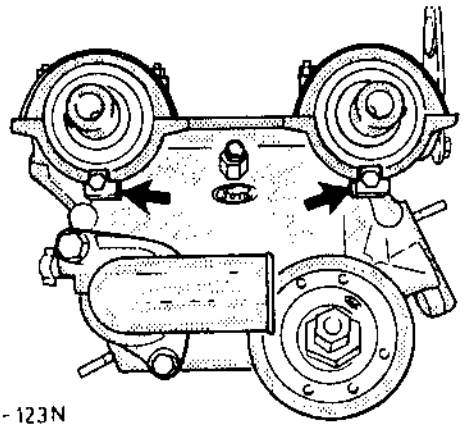


Fig.164. Camshaft bearing housing locating plates.

28. Fit the intake manifold complete with gasket (9 nuts and washers) and torque to specification.

29. This sub-operation only applies in conjunction with 21 163 0, Cylinder Head - Remove and Install.

Fit the turbocharger complete with exhaust manifold and gaskets (16 nuts and washers, finger tight).

NOTE: The exhaust manifold must be centred on the studs before tightening the nuts.

Install and adjust the turbocharger damper unit as described in Section 23, Repair Operation No. 23 612 0, Turbocharger - Remove and Install.

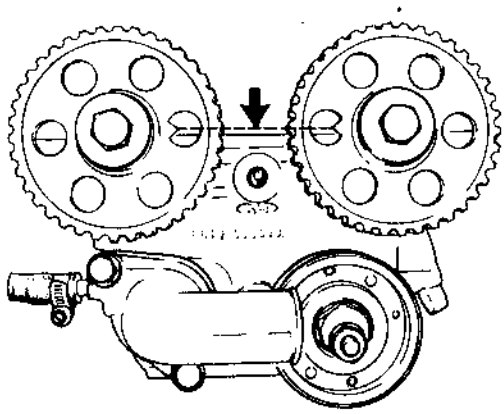


Fig.165. Set camshaft pulleys to TDC.

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21 190 0 COOLANT TEMPERATURE SENSOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

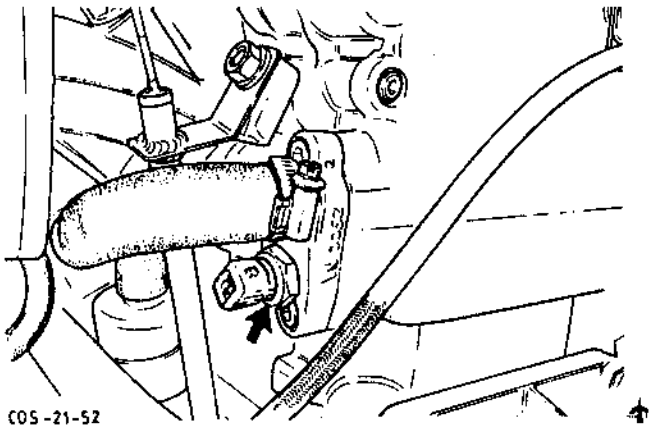


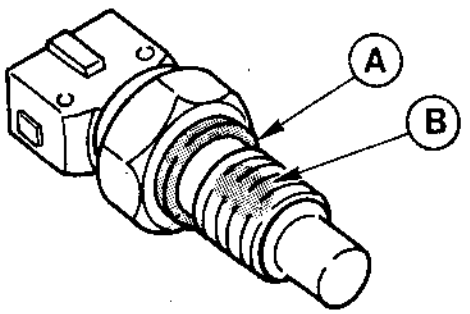
Fig.166. Coolant temperature sensor location.

To Remove

1. Disconnect the battery earth cable.
2. Raise the vehicle.
3. Disconnect the coolant temperature sensor multiplug.
4. Unscrew the coolant temperature sensor from the cylinder head intermediate flange and drain coolant into a clean container.

To Install

5. Fit a new sealing ring to the coolant temperature sensor and coat sensor threads with sealing compound (see Technical Data).
6. Fit the coolant temperature sensor to the cylinder head intermediate flange and tighten to specification (see Technical Data).
7. Connect the coolant temperature sensor multiplug.
8. Lower the vehicle.
9. Top up the cooling system (see Technical Data).
10. Connect the battery earth cable.



SRS-29-54

Fig.167. Coolant temperature sensor.
A - New sealing ring
B - Sealing compound

21 215 4 VALVE - REMOVE AND INSTALL (Cylinder head removed)

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer	15-053
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve spring compressor ..	21-024-06
Installer - Valve stem oil seal (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130
Remover - Valve stem oil seal	21-142

LOCALLY FABRICATED TOOL:

Support plate	see Fig.1

1. Place two wooden blocks of the same size under the front and rear ends of the cylinder head to prevent damage to the valves.

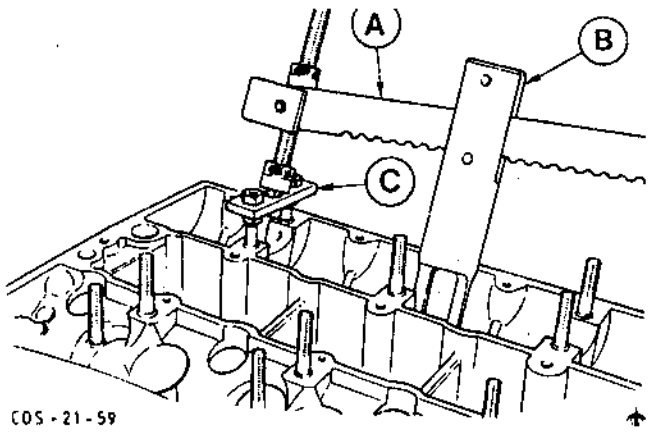


Fig.168. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated plate.

<u>To Remove Valve</u>

2. • Using a plastic drift, tap valve spring retainer to loosen collets.

• Place a suitable piece of wood in the combustion chamber to support the valve.

• Clamp cylinder head to workbench using a piece of wood under the clamps.

• Remove the valve spring collets using special tools 21-024 and 21-024-06 together with a support plate (see Locally Fabricated Tools). Secure plate with nuts.

• Remove the valve spring retainer and spring.

• Remove the valve stem oil seal using special tools 21-142 and 15-053.

- engage the collet jaws of special tool 21-142, Fig.169 under the oil seal
- push the sleeve over the jaws until they are closed
- screw on the sleeve nut and tighten it by hand
- screw the slide hammer, special tool 15-053, Fig.170, onto the collet and use the hammer to remove the oil seal, tightening the sleeve nut after each blow
- remove the lower washer.

• Remove valve.

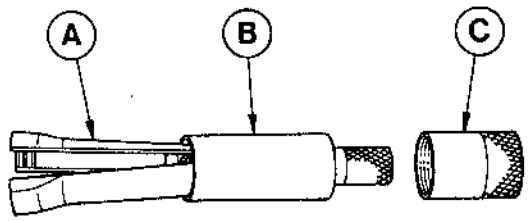


Fig.169. Special tool 21-142
A - Collet
B - Sleeve C - Nut

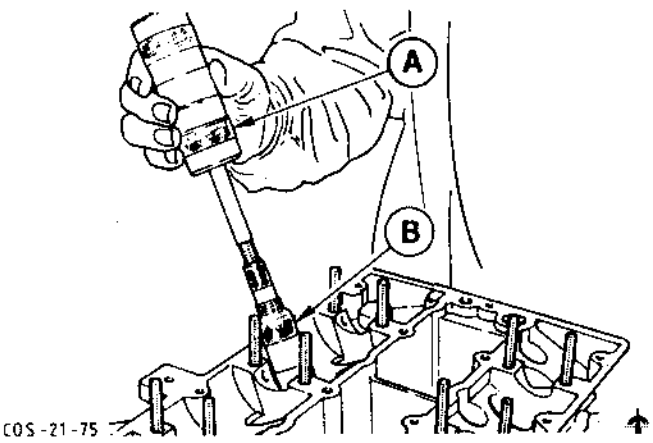


Fig.170. Remove valve stem oil seal.
A - Special tool 15-053
B - Special tool 21-142

21 215 4

3. Grind in the new valve to the cylinder head.

NOTE: Ensure that no grinding paste is present on the valve stem or valve guide.
On completion, thoroughly clean cylinder head and valve from all traces of grinding paste.

To Install Valve

4. • Fit the valve spring lower washer.

• Oil the valve stem and guide and insert valve.

• Place a suitable piece of wood in the combustion chamber to support the valve.

• Clamp cylinder head to workbench using a piece of wood under the clamps.

• Oil the valve stem and oil seal and fit the seal using special tool 21-129 or 21-130 depending on whether it is an exhaust or inlet valve respectively. Take particular care when the oil seal passes the valve collet groove.

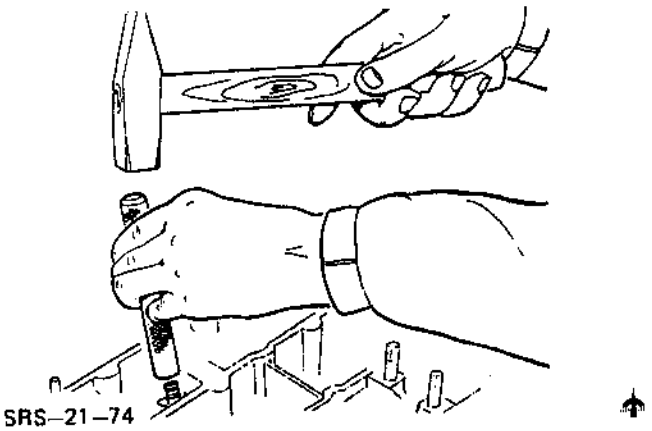


Fig.171. Fit oil seal with special tool 21-129 or 21-130.

• Emplace the valve spring and retainer and using special tool 21-024 and 21-024-06 together with the locally fabricated support plate, fit the collets.

• Using a plastic drift tap valve spring retainer to ensure that it is properly seated.

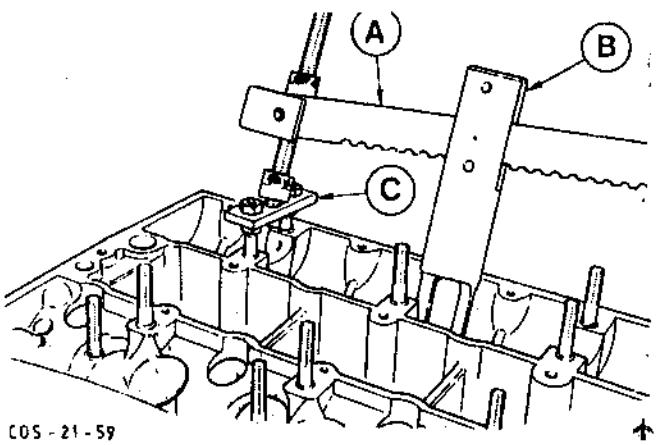


Fig.172. A - Special tool 21-024
B - Specail tool 21-024-06
C - Locally fabricated plate

1087

21 238 0 SEALS - VALVE STEM - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer..	15-053
Valve spring compressor (main tool) ..	21-024
Adaptor - Valve spring compressor ..	21-024-06
Belt tension gauge	21-113
Installer - Valve stem oil seal .. (exhaust)	21-129
Installer - Valve stem oil seal (inlet)	21-130
Remover - Valve stem oil seal	21-142

PROPRIETARY TOOL:

Air line adaptor for spark plug bore

LOCALLY FABRICATED TOOL:

Support plate .. .. see Fig.1

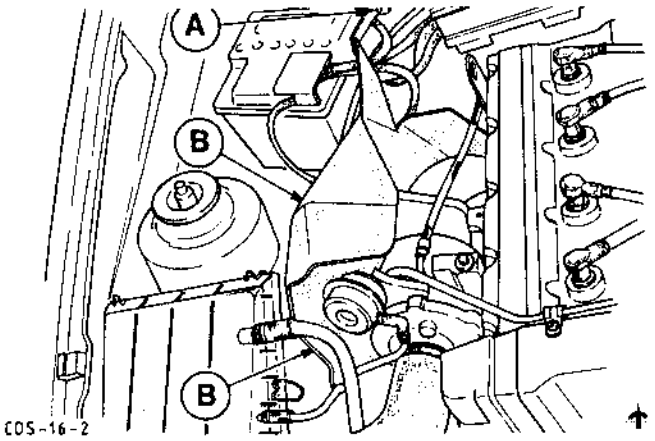


Fig.173. Remove turbocharger heat shield ('88 MY)
A - Bolt
B - Clips

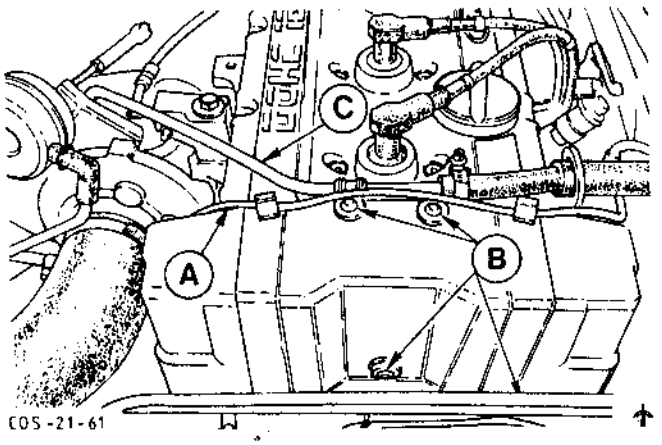


Fig.174. A - Temperature gauge cable
B - Timing belt cover screws
C - Turbocharger coolant return pipe

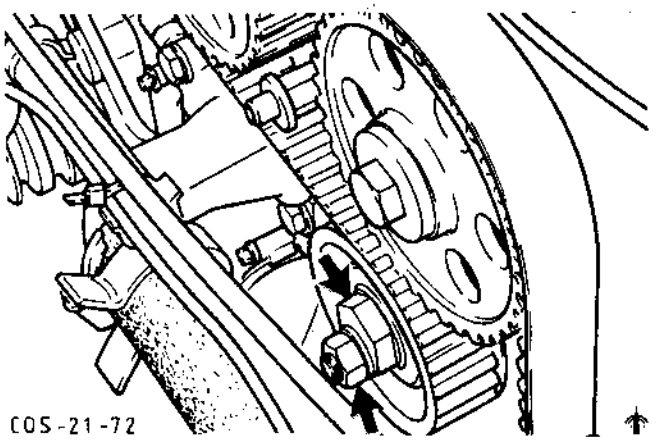


Fig.175. Release timing belt tensioning pulley.

To Remove

1. Disconnect the battery earth cable.

2. '88 Model Year only:
Remove the turbocharger heat shield (1 bolt, 2 clips).

3. Disconnect the temperature gauge sender unit and unclip the cable from the timing belt cover.

4. Remove the timing belt cover (4 screws).

5. Detach the turbocharger coolant return pipe (1 banjo bolt) and lay the turbocharger coolant return pipe/hose to one side (on '88 Model Year only, also unbolt front lifting eye).

6. Detach the HT leads from the spark plugs.

7. Remove the cylinder head cover (20 bolts).

8. Release the timing belt tensioning pulley and remove the timing belt from the camshafts.

21 238 0

9. Loosen the camshaft bearing housing locating plate screws (through the camshaft pulleys).

   Remove both camshafts complete with pulleys (2 nuts per bearing cap).

NOTE: Remove the front caps first.

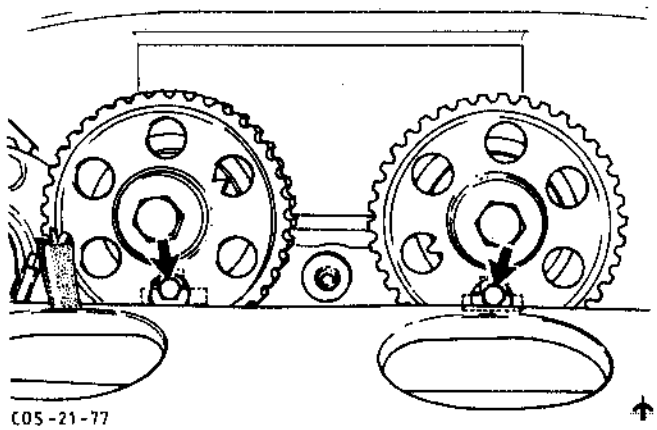


Fig.176. Loosen camshaft bearing housing locating plates.

10. Withdraw the valve tappets with a rubber suction tool. Store the tappets upside down and also according to removal order to ensure correct subsequent reassembly.

NOTE: Do not use a magnet.

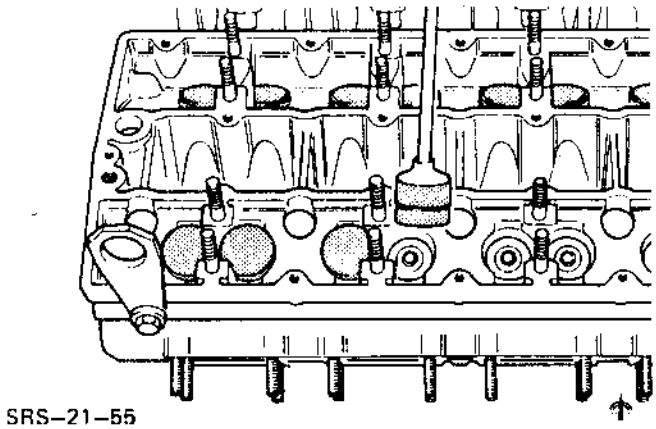


Fig.177. Remove valve tappets with suction tool.

11. Remove the spark plugs and cover holes to prevent dirt ingress.

12. Turn the crankshaft by hand until all pistons are half way up the cylinder. Engage first gear to block engine and apply handbrake.

NOTE: This is a safety precaution to prevent a valve from falling into a cylinder.

   Any two crankshaft pulley teeth must be equidistant from the engine speed/TDC sensor.

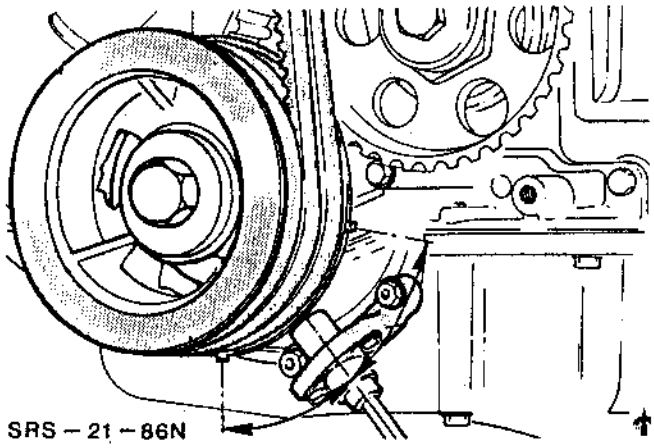


Fig.178. Position of crankshaft V-belt pulley teeth in relation to TDC sensor.

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To Replace the Valve Stem Oil Seals.

13. Screw an air line adaptor into a spark plug thread and apply compressed air (7-10 bar).

14. Replace one valve stem oil seal as follows -

- Using a plastic drift, tap valve spring retainer to loosen collets.
- Remove the valve spring collets using special tools 21-024 and 21-024-06 together with a support plate (see Locally Fabricated Tools). Secure plate with nuts.
- Remove the valve stem oil seal using special tool 21-142 and 15-053, Fig.180:
  - engage the collet jaws of special tool 21-142 under the oil seal
  - push the sleeve over the jaws until they are closed
  - screw on the sleeve nut and tighten it by hand
  - screw the slide hammer, special tool 15-053 onto the collet and use the hammer to remove the oil seal, tightening the sleeve nut after each blow.
- Oil the valve stem and new oil seal and fit the seal using special tool 21-129 or 21-130 depending on whether it is an exhaust or inlet valve respectively. Take particular care when the oil seal passes the valve collet groove.
- Emplace the valve spring and retainer and using special tools 21-024 and 21-024-06 together with the locally fabricated support plate, fit the collets.
- Using a plastic drift, tap valve spring retainer to ensure that is is properly seated.

15. Repeat sub-operation 14 for the other three valves.

16. Repeat sub-operation 13 to 15 for the other three cylinders then remove the air line adaptor.

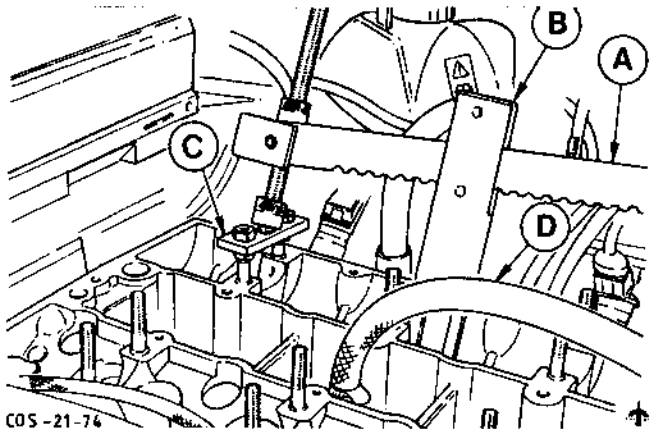


Fig.179. A - Special tool 21-024
B - Special tool 21-024-06
C - Locally fabricated plate
D - Air line adaptor

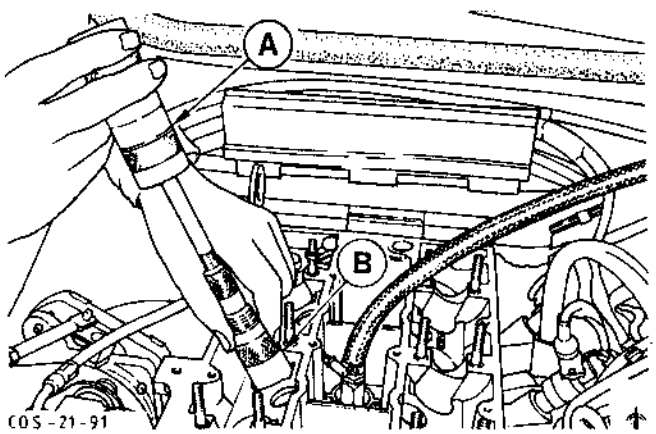


Fig.180. Remove valve stem oil seal.
A - Slide hammer, 15-053
B - Collet, nut, sleeve, 21-142

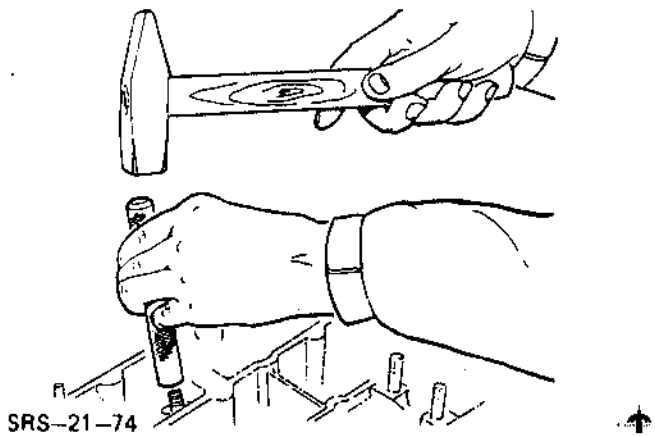


Fig.181. Fit oil seal with special tool 21-129 or 21-130.

21 238 0

To Assemble

17. Oil the tappets and insert them in their original bores.

NOTE: Check tappets to ensure no air is present (sponginess)

18. Remove the distributor cap.

19. Position No.1 cylinder piston to TDC.

To do this, set crankshaft V-belt pulley and distributor rotor arm to TDC marks.

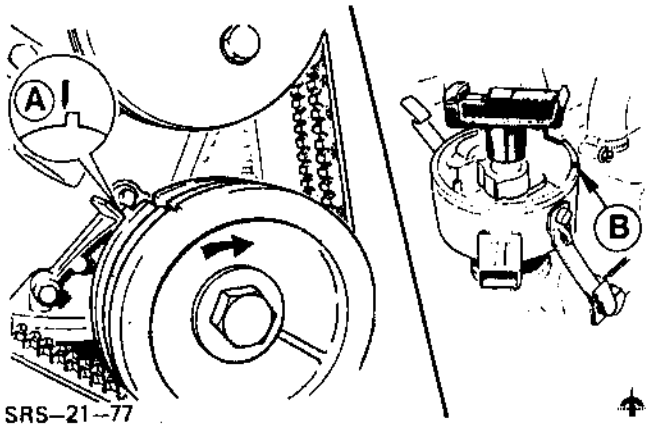


Fig.182. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

20. Fit the spark plugs and tighten to specification.

21. Locate the camshafts in position so that the pulley timing marks are facing each other.

NOTE: The inlet camshaft has grooved bearing journals.

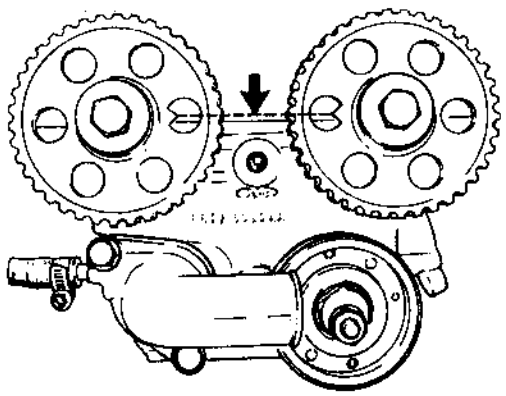


Fig.183. Camshaft pulley marks facing each other.

22. Oil and fit the camshaft bearing caps 2-5 und 7-10 in the correct order.

NOTE: Cap No.1 is on the front of the exhaust cam. Cap numbers should face inwards.

Tighten down caps 2-5 and 7-10 evenly.

Tap the front bearing housings rearwards to ensure they are fully home. Apply sealing compound (see Technical Data) to joint faces of caps 1 and 6 and fit them.

Torque all nuts to specification.

23. Tighten the camshaft bearing housing retaining plate bolts to specification.

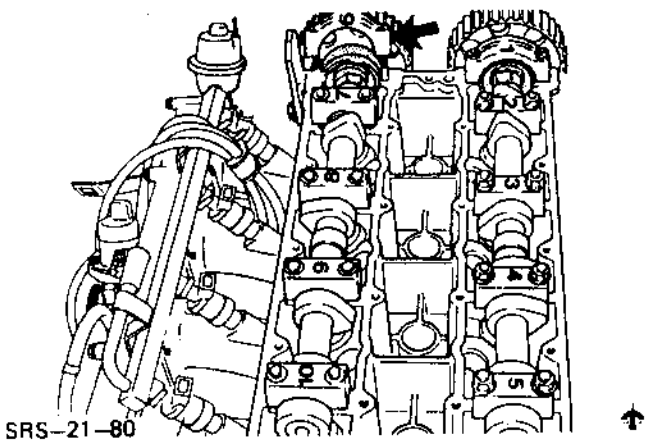
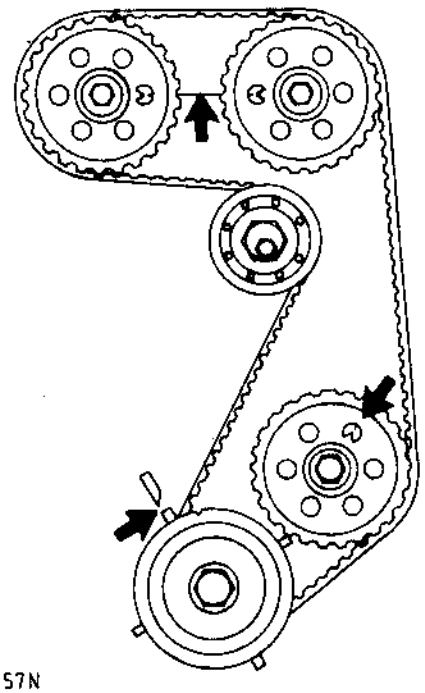


Fig.184. Inlet camshaft front bearing cap.

21 238 0

24. Check that crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC mark.

25. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

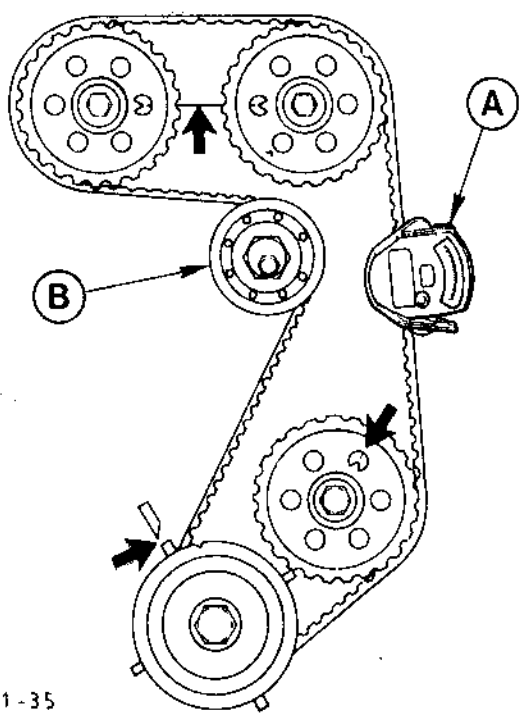
Fig.185. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

26. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



COS-21-35

Fig.186. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 238 0

27. Position the cylinder head cover gaskets, 2 rubber seals and cylinder head cover. Insert and tighten bolts (20) to specification.

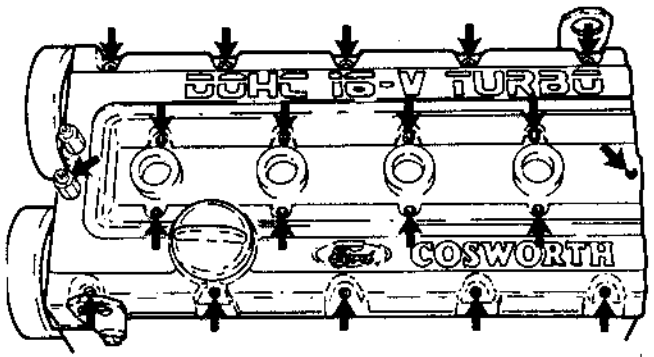


Fig.187. Fit cylinder head cover.

28. Fit the distributor cap and connect the HT leads to the spark plugs.

29. Connect the turbocharger coolant return pipe (1 banjo bolt) and on the '88 Model Year, bolt the front lifting eye in place.

30. Fit the timing belt cover, at the same time securing the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

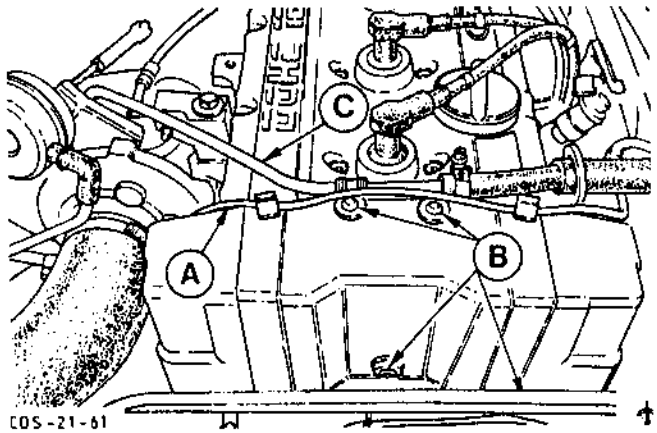


Fig.188. A - Temperature gauge cable
B - Timing belt cover screws
C - Turbocharger coolant return pipe

31. Connect the temperature gauge sender unit and clip the cable to the timing belt cover.

32. '88 Model Year:
Fit the turbocharger heat shield.

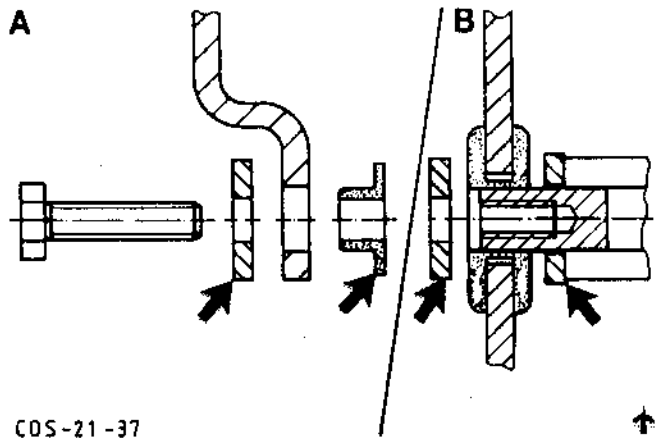


Fig.189. Correct timing cover spacer location.
A - Lower
B - Middle

33. Connect the battery earth cable.

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21 288 0 SEAL - CAMSHAFT - REPLACE (one side)

SPECIAL SERVICE TOOLS REQUIRED:

Timing belt tension gauge 21-113

To Remove

1. Disconnect the battery earth cable.

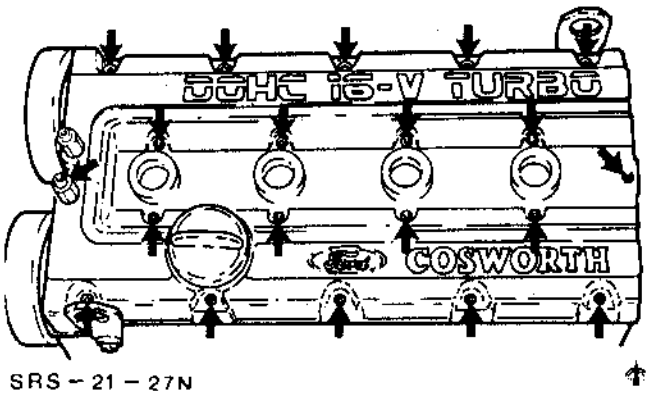


Fig.190. Cylinder head cover retaining bolts.

2. Unclip the temperature gauge sender unit cable from the timing belt cover and remove the cover (4 screws).

3. Remove the HT cables from the spark plugs.

4. Remove the cylinder head cover (20 bolts).

5. Remove the distributor cap.

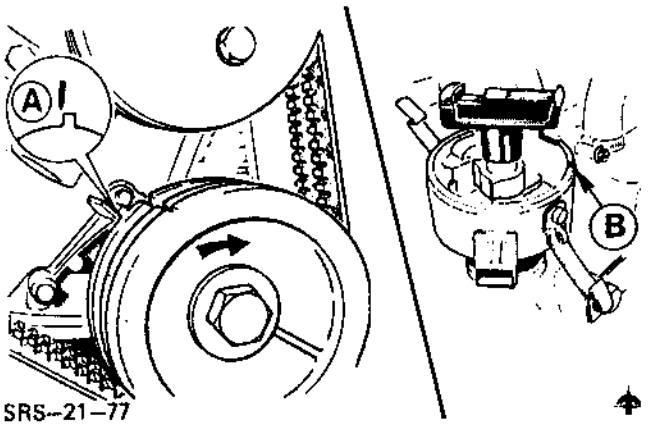


Fig.191. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

6. Position No.1 cylinder piston on TDC. To do this, set crankshaft pulley and distributor rotor arm to TDC marks. Engage 1st gear and apply handbrake to block engine.

7. Release the timing belt tensioning pulley. Remove the timing belt from the camshafts.

8. Remove the spark plugs.

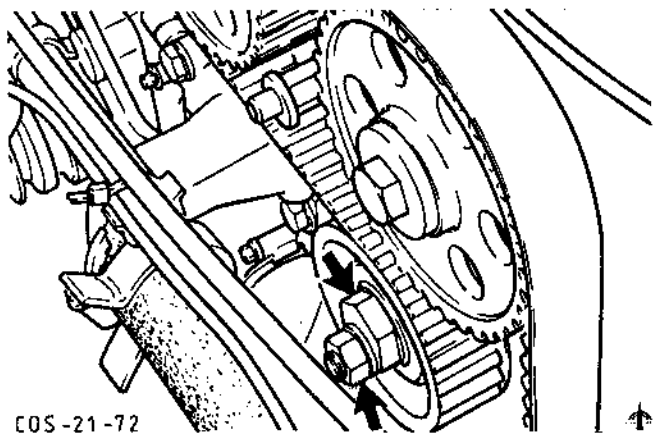


Fig.192. Release timing belt tensioning pulley.

21 288 0

9. Unscrew the camshaft belt pulley retaining bolt and remove the pulley.

10. Remove the woodruff key from the camshaft.

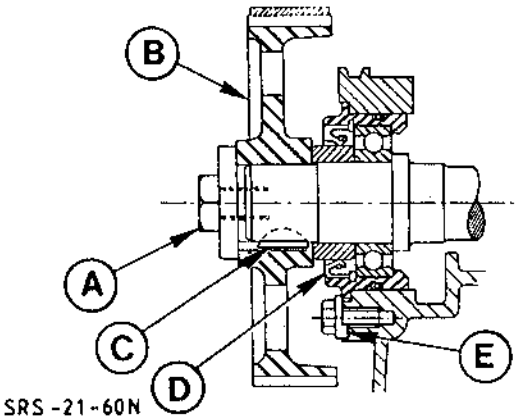
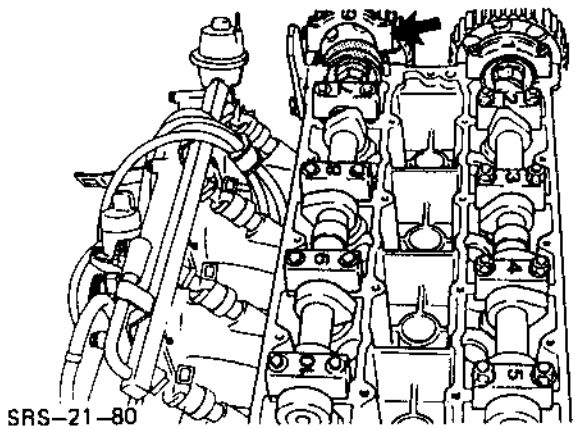


Fig.193. Camshaft - Sectional view
A - Retaining bolt
B - Pulley
C - Woodruff key
D - Seal
E - Camshaft bearing housing locating plate

Fig.193. Camshaft - sectional view.

11. Remove the camshaft bearing housing locating plate.



12. Slacken all the bearing caps. Remove the front camshaft bearing cap only (2 nuts).

Fig.194. Inlet camshaft front bearing cap.

13. Remove the bearing housing complete with bearing.

14. Remove the camshaft seal

- Remove the seal race.
- Remove the seal from the bearing housing.

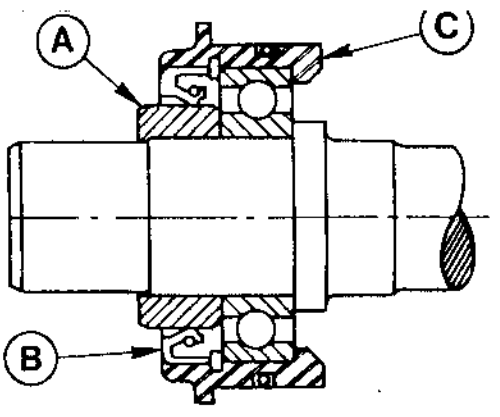


Fig.195. Remove camshaft seal.
A - Seal race
B - Seal
C - Bearing housing

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To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

15. Fit the camshaft oil seal

- Press the oil seal evenly into the bearing housing.
- Insert the oil race.

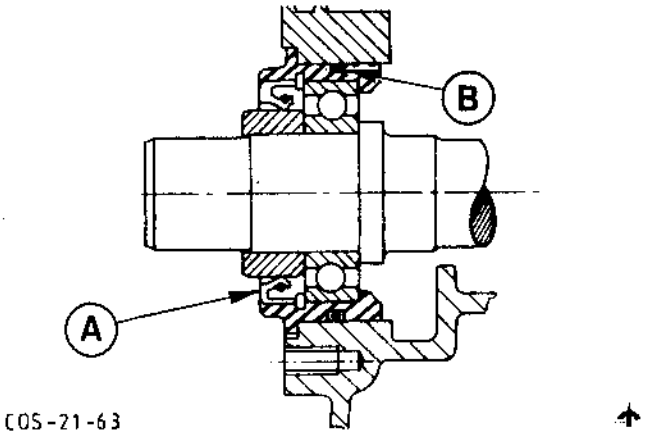


Fig.196. A - Camshaft oil seal
B - Bearing housing O-ring

16. Replace the O-ring on the bearing housing.

Insert the bearing housing complete with bearing and tap rearwards until it is fully home.

17. Apply sealing compound (see Technical Data) to the front camshaft bearing cap faces, fit the cap then torque all bearing caps to specification.

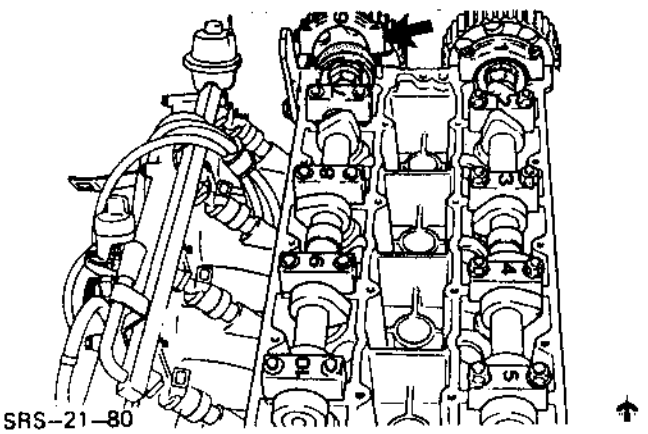


Fig.197. Front inlet camshaft bearing cap.

18. Fit the camshaft bearing housing locating plate and torque bolt to specification.

19. Insert the woodruff key into camshaft.

20. Fit the camshaft belt pulley with thrust washer and tighten bolt to specified torque.

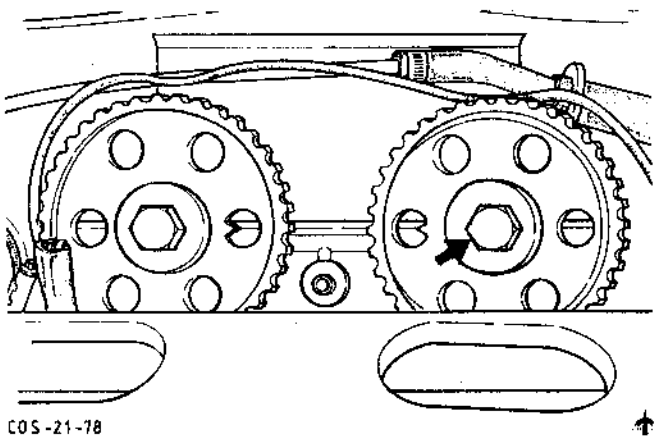
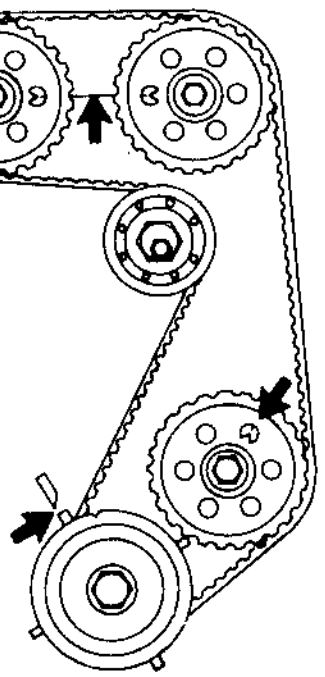


Fig.198. Camshaft toothed belt pulley.

21 288 0

21. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC mark.

22. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

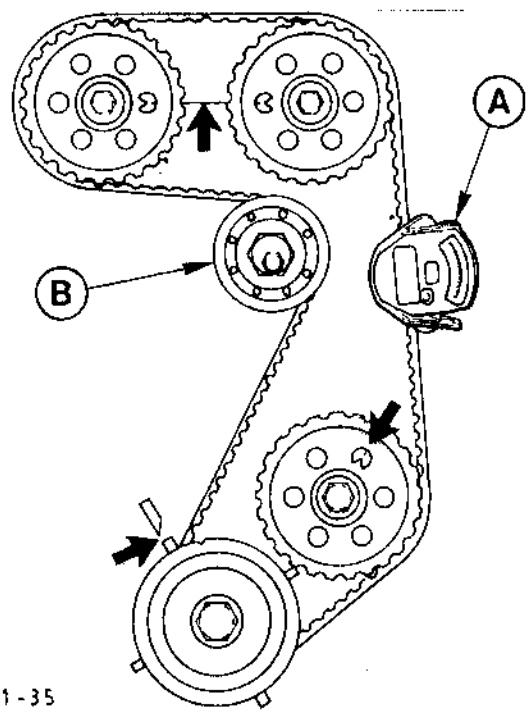
Fig.199. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

23. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



COS-21-35

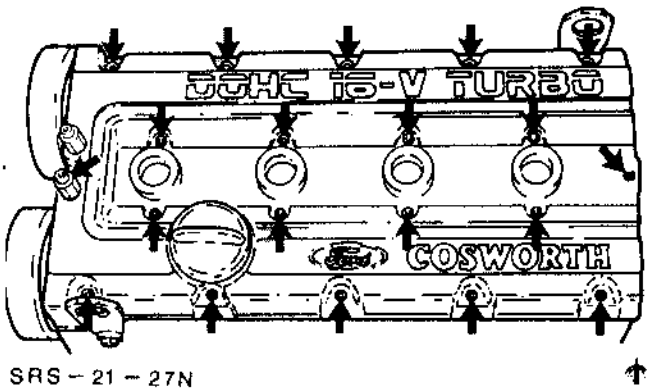
Fig.200. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

1087

21 288 0

24. Fit the distributor cap.

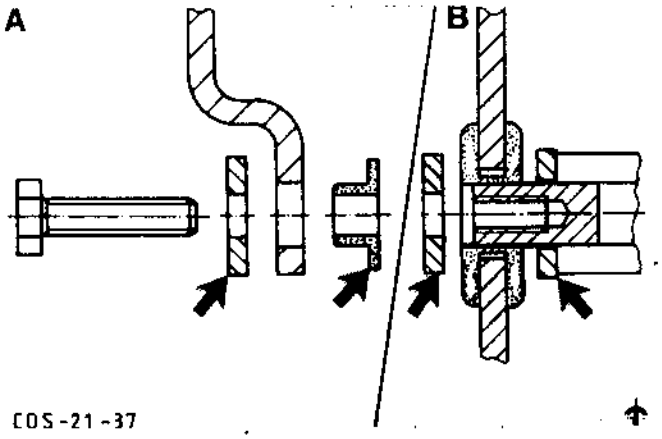
25. Fit the cylinder head cover.



SRS – 21 – 27N

Fig.201. Fit cylinder head cover.

26. Connect the HT cables to spark plugs.

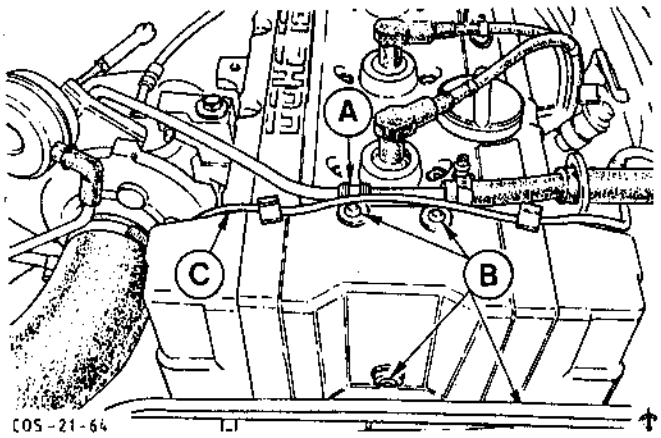


COS-21-37

Fig.202. Correct timing cover spacer location.
A - Lower
B - Middle

27. Fit the timing belt cover, at the same time securing the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

Clip the temperature gauge sender unit cable to the cover.



COS-21-64

Fig.203. Fit timing belt cover.
A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

28. Connect the battery earth cable.

1087

21 332 0 TIMING GEARS - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft timing gear remover	21-028-A
Timing belt tension gauge..	21-113

To Remove

1. Disconnect the battery earth cable.

2. Unclip the temperature gauge sender unit cable from the timing belt cover and remove the cover (4 screws).

3. Engage 1st gear and apply handbrake to block engine.

   Loosen the crankshaft V-belt pulley retaining bolt.

4. Remove the distributor cap.

5. Engage neutral.

   Position No. 1 cylinder piston on TDC. To do this, set crankshaft pulley and distributor rotor arm to TDC marks.

   Engage 1st gear.

6. Raise the vehicle.

7. Slacken the power steering pump fixture bolts and remove the power steering V-belt.

8. Slacken the alternator adjusting strap and remove the alternator V-belts.

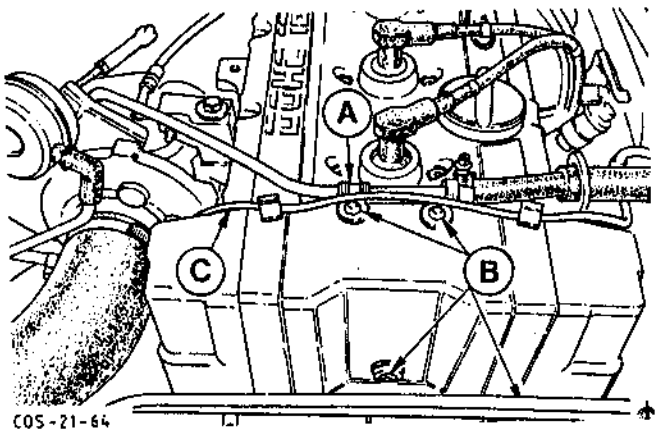


Fig.204. A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

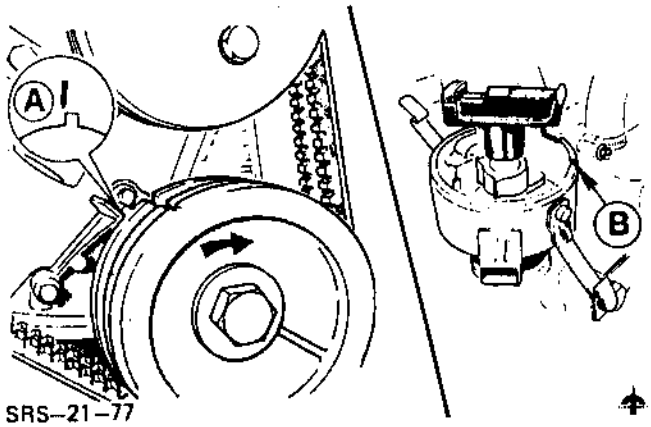


Fig.205. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

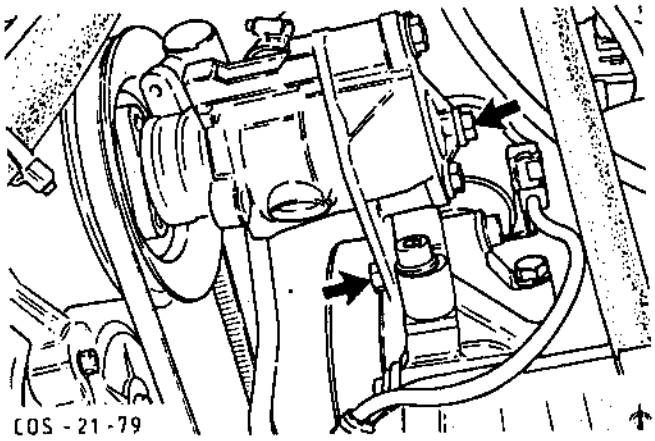
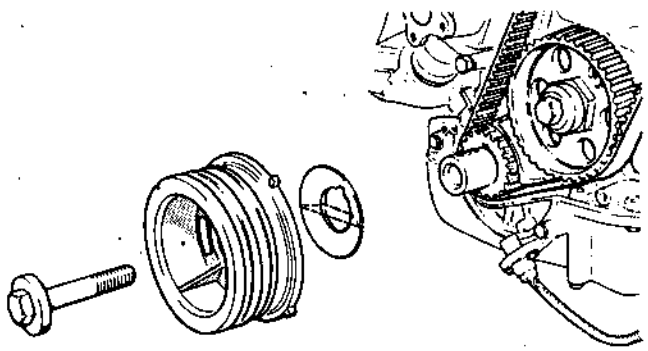


Fig.206. Slacken power steering pump bolts.

9. Remove the crankshaft V-belt pulley and thrust washer.



SRS-21-28N

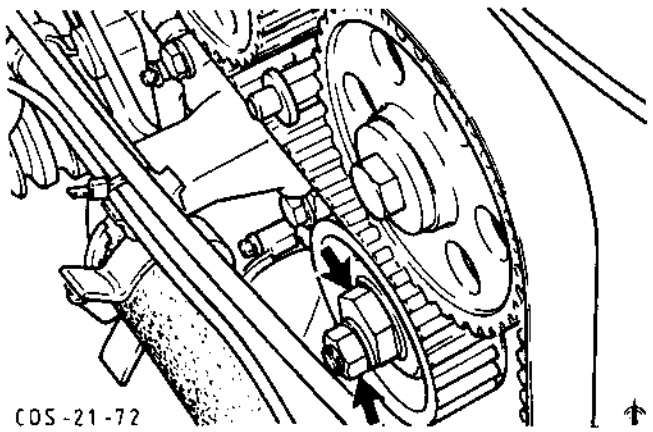
Fig.207. Remove crankshaft V-belt pulley.

10. Loosen the crankshaft, auxiliary shaft and camshaft pulley retaining bolts, Fig.209.

11. Release the timing belt tensioning pulley.

    Remove the timing belt.

NOTE: If timing belt is to be re-used, mark running direction.

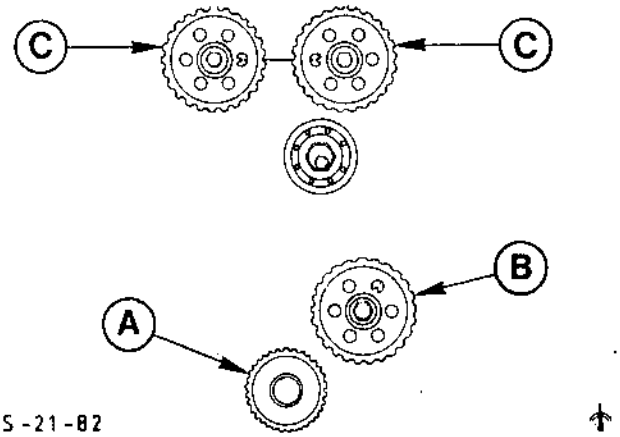


COS-21-72

Fig.208. Release timing belt tensioning pulley.

12. Remove the crankshaft toothed belt pulley by hand. If necessary, use special tool 21-028-A.

13. Remove the auxiliary shaft toothed belt pulley.



COS-21-82

Fig.209. Remove the toothed belt pulleys.
A - Crankshaft toothed belt pulley
B - Auxiliary shaft toothed belt pulley
C - Camshaft toothed belt pulley

14. Remove the camshaft toothed belt pulleys.

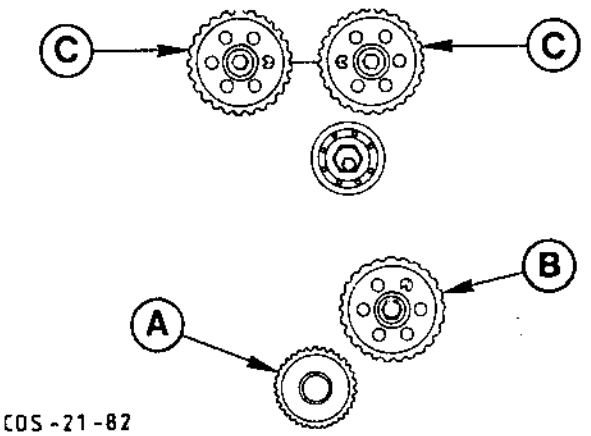
21 332 0

To Install

During installation, tighten all nuts and bolts to the torque specified in Technical Data.

15. Fit the camshaft toothed belt pulleys.

16. Fit the auxiliary shaft toothed belt pulley.

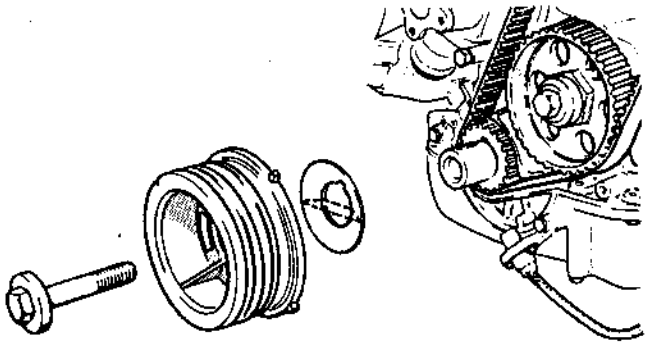


COS-21-82

Fig.210. A - Crankshaft toothed belt pulley
B - Auxiliary shaft toothed belt pulley
C - Camshaft toothed belt pulley

17. Fit the crankshaft toothed belt pulley, side with boss facing engine. Torque to specification. Fit the toothed belt to the crankshaft only.

18. Fit the crankshaft V-belt pulley and thrust washer. The thrust washer convex side faces the timing belt pulley.



SRS-21-28N

Fig.211. Fit thrust washer and crankshaft V-belt pulley.

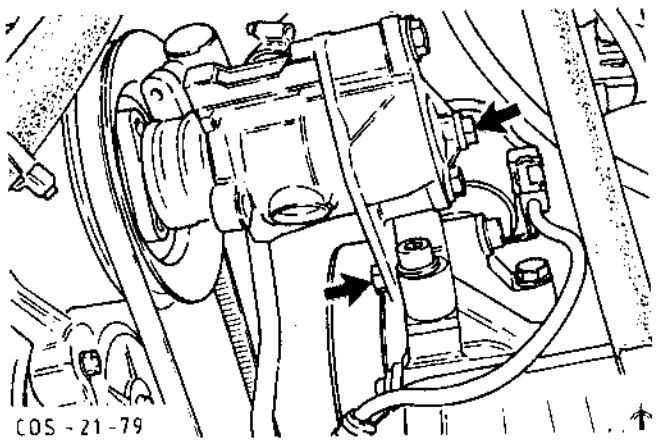
19. Fit the alternator V-belts onto the V-belt pulleys (crankshaft, water pump and alternator). Push the alternator away from engine and tighten adjustment strap bolts.

For V-Belt tension, refer to Technical Data.

20. Fit the power steering V-belt onto the V-belt pulleys (crankshaft, power steering pump). Push the power steering pump away from engine and tighten the pump fixture bolts (2).

For V-belt tension, refer to Technical Data.

21. Lower the vehicle.



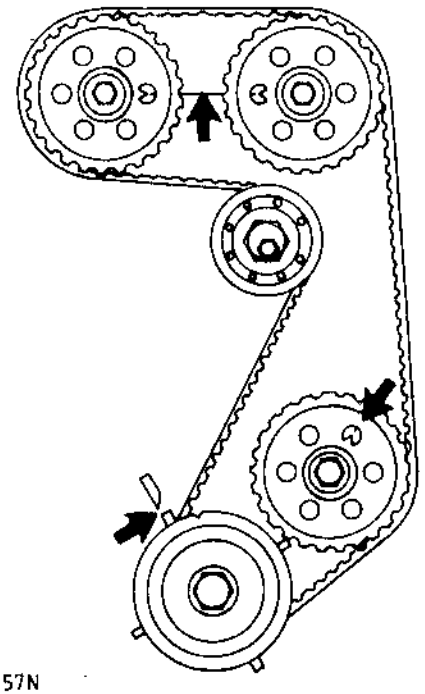
COS-21-79

Fig.212. Power steering pump V-belt tension bolts.

21 332 0

22. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC marks.

23. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

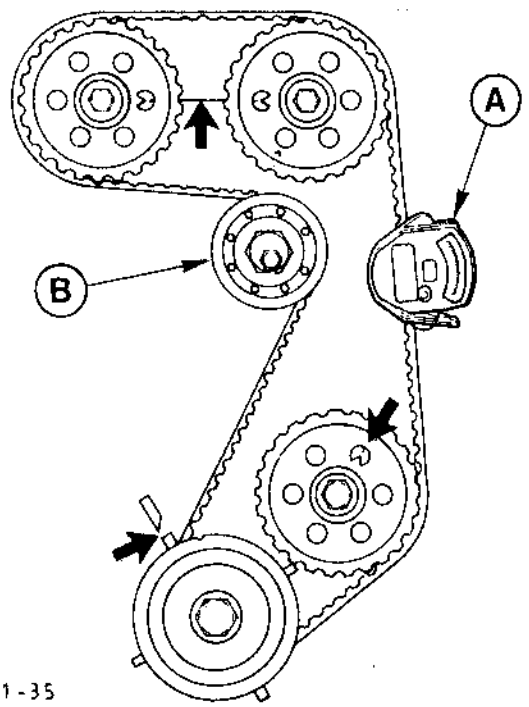
Fig.213. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

24. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



COS-21-35

Fig.214. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 332 0

25. Torque the crankshaft, auxiliary shaft and camshaft pulley retaining bolts to specification.

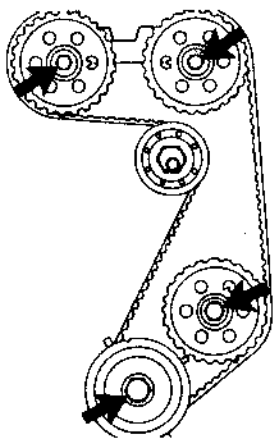


Fig.215. Torque bolts to specification.

26. Fit the distributor cap.

27. Fit the timing belt cover, at the same time secure the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

    Clip the temperature gauge sender unit cable to the cover.

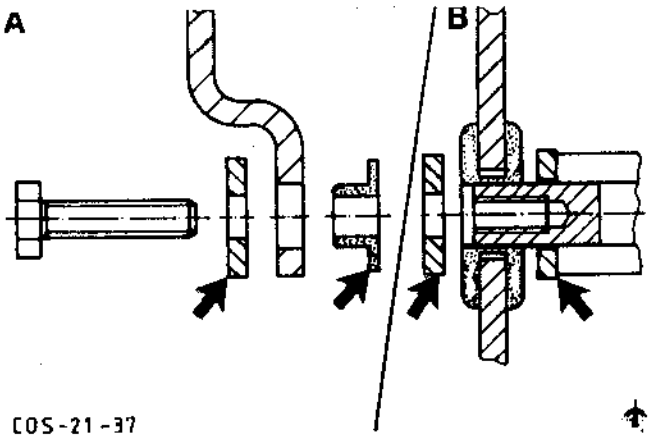


Fig.216. Correct timing cover spacer location.
A - Lower
B - Middle

28. Connect the battery earth cable.

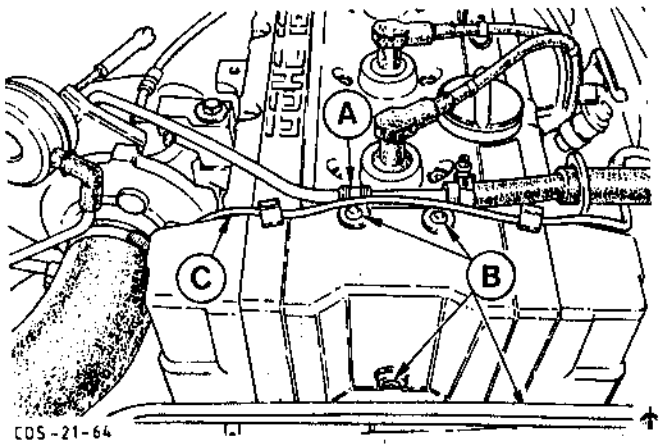


Fig.217. Fit timing belt cover.
A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

1087

21 467 0 SEAL - CRANKSHAFT FRONT - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft timing gear remover	21-028-A
Belt tension gauge	21-113
Crankshaft front seal remover	21-143

To Remove

1. Disconnect the battery earth cable.

2. Unclip the temperature gauge sender unit cable from the timing belt cover and remove the cover (4 screws).

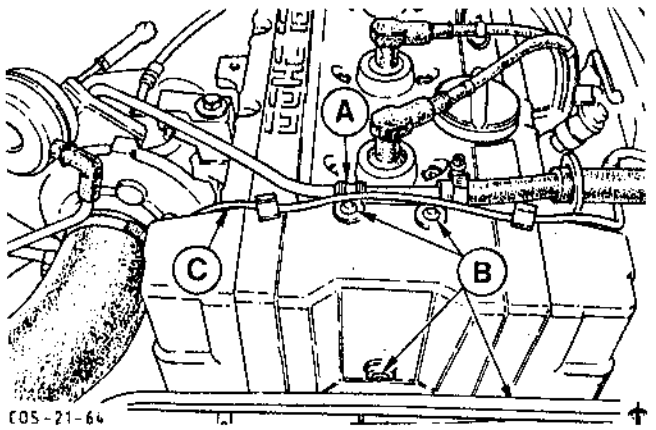


Fig.218. A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

3. Engage 1st gear and apply handbrake to block engine.

   Loosen the crankshaft V-belt pulley retaining bolt.

4. Remove the distributor cap.

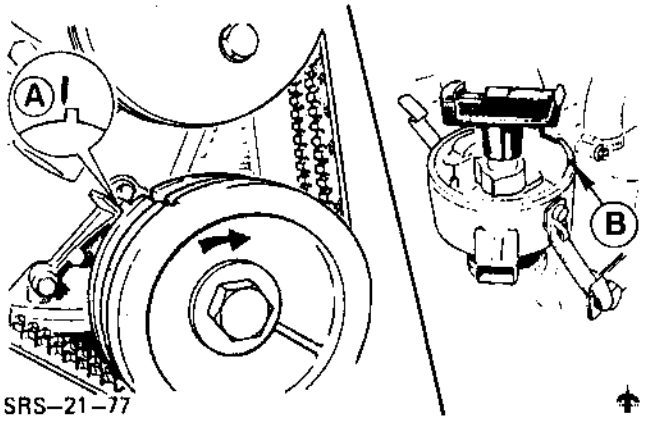


Fig.219. Position No.1 cylinder piston on TDC.
A - TDC mark on crankshaft V-belt pulley
B - TDC mark - distributor rotor arm

5. Engage neutral.

   Position No.1 cylinder piston on TDC. To do this, set crankshaft pulley and distributor rotor arm to TDC marks.

   Engage 1st gear.

6. Release the timing belt tensioning pulley. Remove the timing belt.

NOTE: If timing belt is to be re-used, mark running direction.

7. Raise the vehicle.

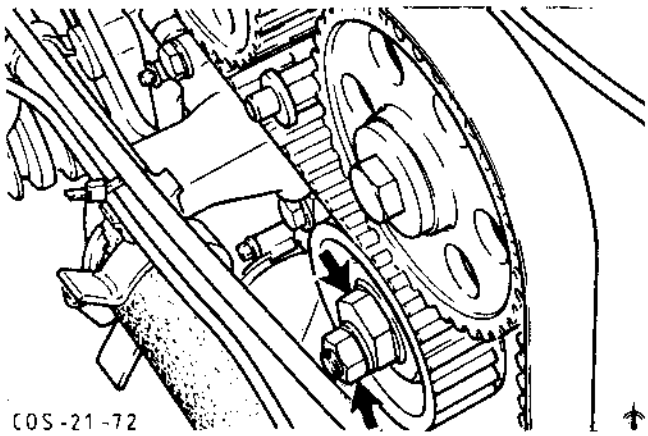


Fig.220. Release timing belt tensioning pulley.

21 467 0

8. Remove the radiator lower bolts (2) push the radiator forwards and secure with wire.

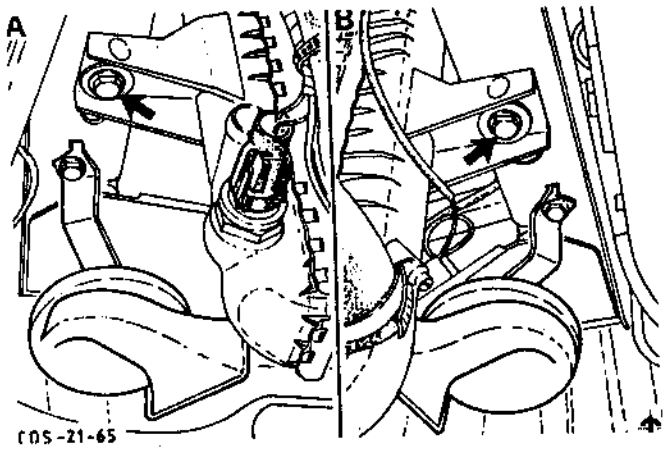


Fig.221. Radiator lower bolts.
A - Left side
B - Right side

9. Slacken the power steering pump fixture bolts and remove the power steering V-belt.

10. Slacken the alternator adjusting strap and remove the alternator V-belts.

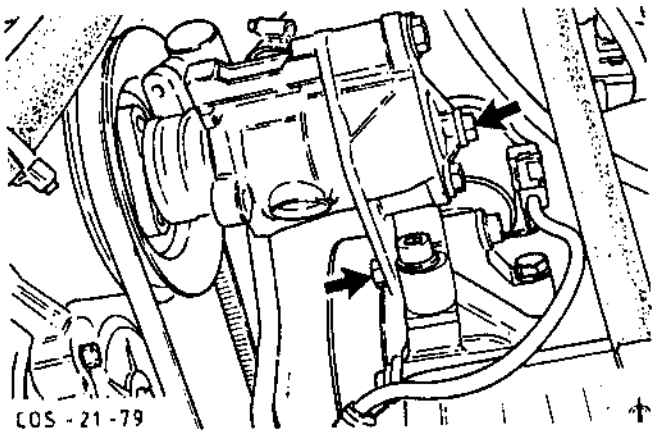


Fig.222. Slacken power steering pump bolts.

11. Remove the crankshaft V-belt pulley and thrust washer.

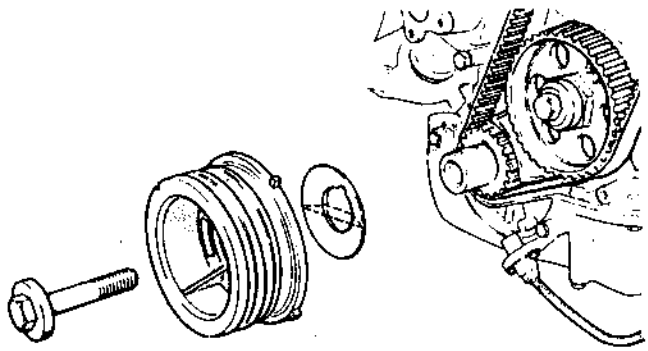


Fig.223. Remove crankshaft V-belt pulley.

21 467 0

12. Remove the crankshaft toothed belt pulley. If necessary, use special tool 21-028-A.

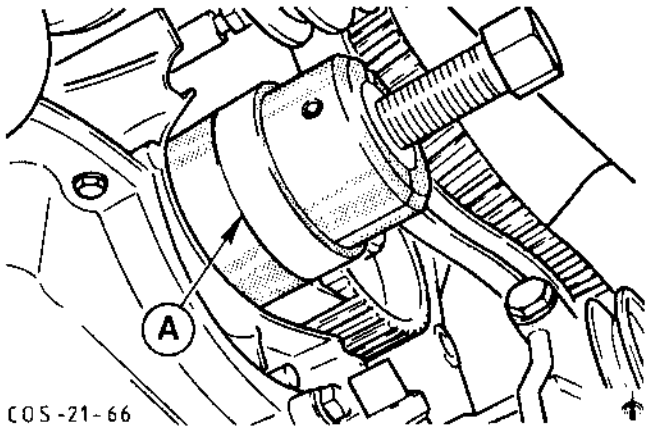


Fig.224. Remove crankshaft toothed belt pulley.
A - special tool 21-028-A

13. Remove the crankshaft front radial oil seal using special tool 21-143, Fig.225.

Insert the remover 'A', into the oil seal. Engage the lever 'B', into the remover and working round the oil seal, remove it in stages.

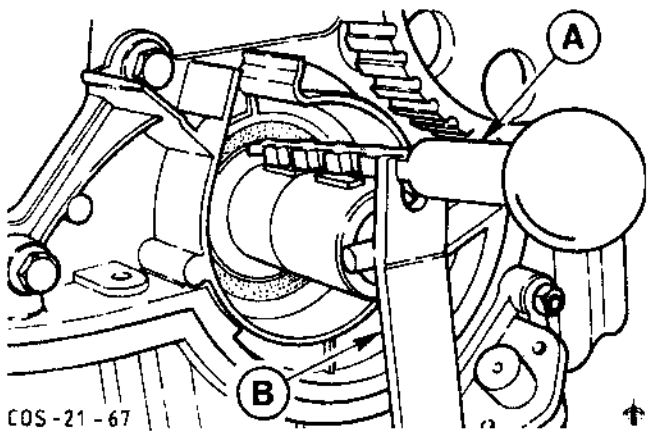


Fig.225. Remove crankshaft front oil seal using special tool 21-143
A - Remover B - Lever

To Install

During installation, tighten all nuts and bolts to the torque specified in Technical Data.

14. Wet the crankshaft and the new oil seal lip with fresh engine oil and install the seal using special tool 21-009-B in conjunction with the crankshaft V-belt pulley, the pulley retaining bolt and washer.

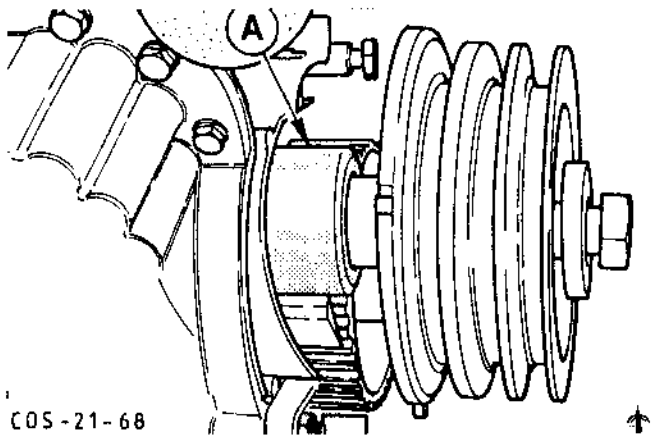


Fig.226. Install crankshaft front oil seal.
A - special tool 21-009-B

21 467 0

15. Fit the crankshaft toothed belt pulley, side with boss facing engine.

    Fit the timing belt to the crankshaft only.

16. Fit the crankshaft V-belt pulley and thrust washer. The thrust washer convex side faces the timing belt pulley.

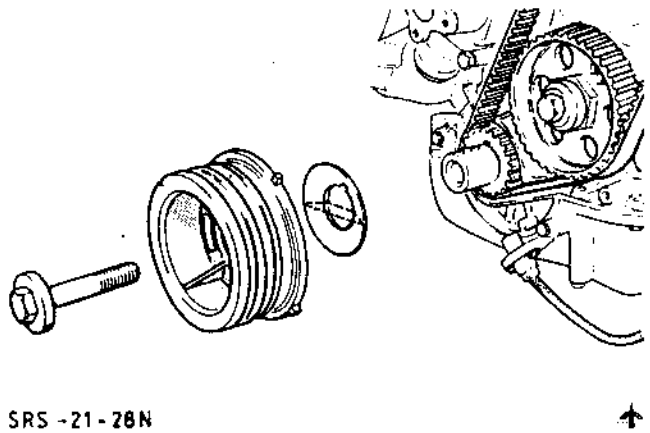


Fig.227. Fit thrust washer and crankshaft V-belt pulley.

17. Fit the alternator V-belts onto the V-belt pulley (crankshaft, water pump and alternator). Push the alternator away from engine and tighten adjustment strap bolts. For V-belt tension, refer to Technical Data.

18. Fit the power steering V-belt onto the V-belt pulleys (crankshaft, power steering pump).

    Push the power steering pump away from engine and tighten the pump fixture bolts (2).

    For V-belt tension, refer to Technical Data.

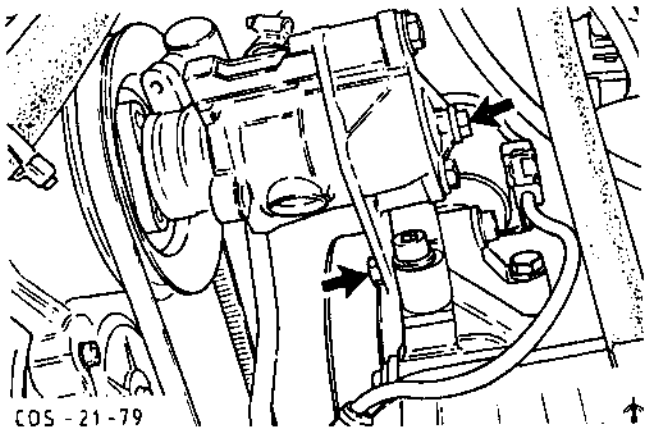


Fig.228. Power steering pump V-belt tension bolts.

19. Fit and tighten the radiator lower bolts (2).

20. Lower the vehicle.

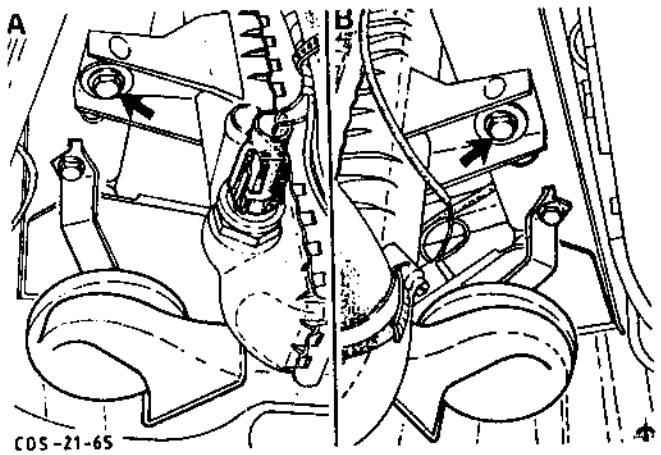


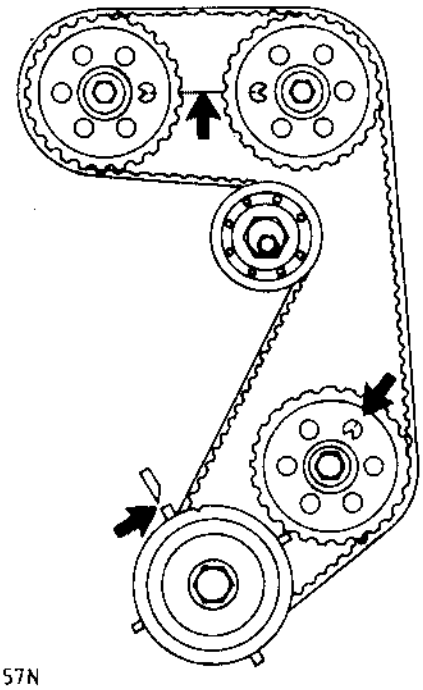
Fig.229. Radiator lower bolts.
A - Left side
B - Right side

1087

21 467 0

21. Check that the crankshaft, auxiliary shaft (or distributor rotor arm) and both camshafts are still on the TDC marks.

22. Beginning at the auxiliary shaft, fit the timing belt in an anti-clockwise direction.



SRS-21-57N

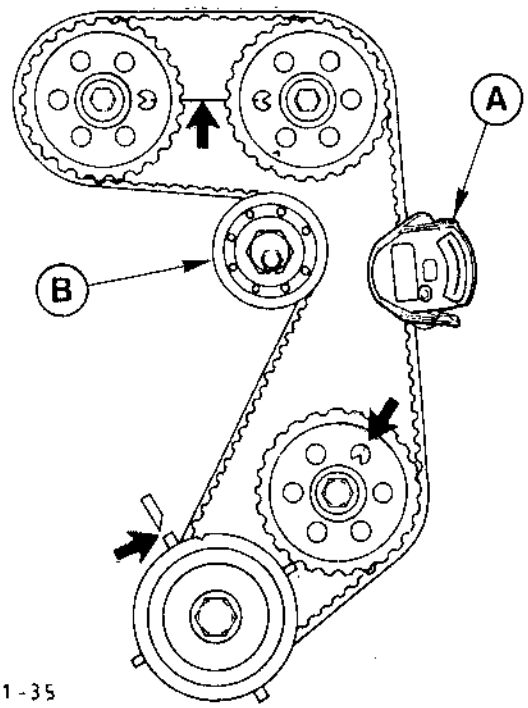
Fig.230. Check crankshaft, auxiliary shaft and both camshafts are on TDC mark and fit timing belt.

29. Adjust the timing belt tension as follows:

- Engage neutral.
- Turn the tensioning pulley clockwise by hand against the timing belt and tighten tension nut.
- Crank engine several times in the direction of rotation. Turn the crankshaft back a complete revolution to the TDC position.

NOTE: Do not turn crankshaft past the TDC position.

- Apply special tool 21-113 to the longest belt span and check the belt tension. If necessary, adjust tensioning pulley to specification (refer to Technical Data).
- Recheck belt tension and timing markings and, if necessary, repeat tensioning procedure.



COS-21-35

Fig.231. Tension timing belt.
A - Special tool 21-113
B - Tensioning pulley

21 467 0

24. Torque the crankshaft V-belt pulley retaining bolt to specification.

25. Fit the distributor cap.

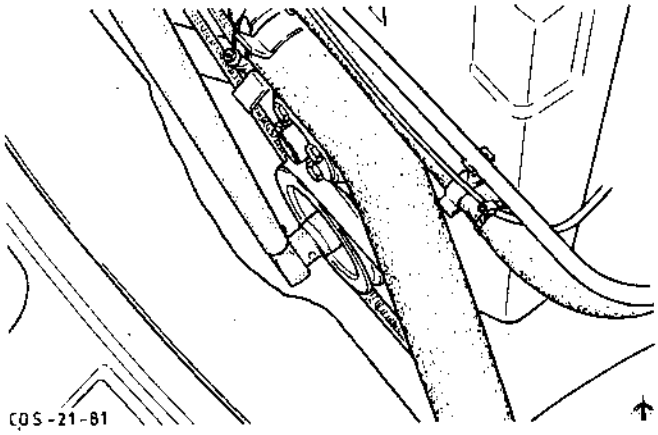


Fig.232. Torque crankshaft V-belt pulley to specification.

26. Fit the timing belt cover, at the same time secure the turbocharger coolant return line. Ensure that the cover spacers are correctly located.

    Clip the temperature gauge sender unit cable to the cover.

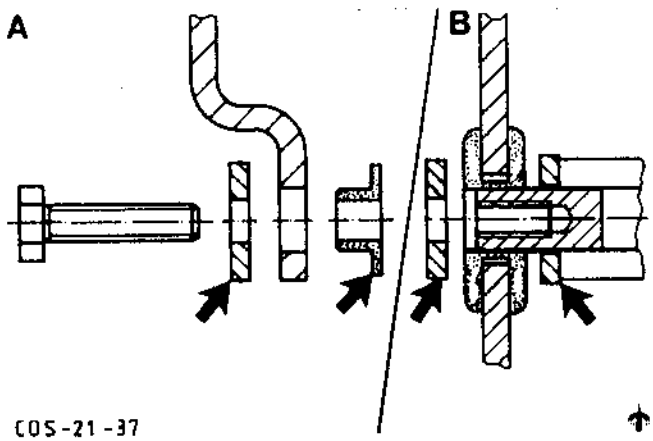


Fig.233. Correct timing cover spacer location.
A - Lower
B - Middle

27. Check the engine oil level and top up if necessary.

28. Connect the battery earth cable.

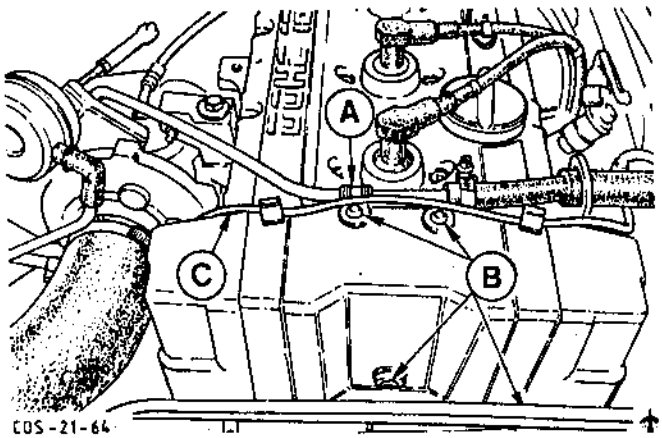


Fig.234. Fit timing belt cover.
A - Turbocharger coolant return line clip
B - Cover retaining screws
C - Temperature gauge cable

1087

21 468 4 SEAL-CRANKSHAFT REAR - REPLACE
(Engine or transmission removed)

SPECIAL SERVICE TOOLS REQUIRED:

Crankshaft rear oil seal installer ..	21-011-D
Clutch disc locator	21-044-A
Crankshaft rear oil seal remover ..	21-143

To Remove

1. Loosen the clutch pressure plate bolts (6) uniformly and remove the pressure plate and clutch disc from the flywheel.

2. Remove the flywheel (9 bolts).

NOTE: One bolt has an offset drilling, therefore, mark the relative position of flywheel to crankshaft with a felt pen to assist reassembly.

3. Extract the radial oil seal using special tool 21-143, Fig.235.
Insert the remover 'A', into the oil seal. Engage the lever 'B', into the remover and working round the oil seal, remove it in stages.

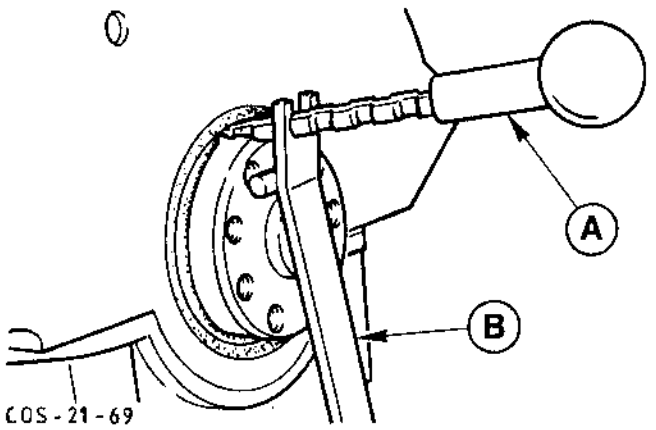


Fig.235. Extract radial oil seal using special tool 21-143
A - Remover B - Lever

To Install

During installation, tighten all bolts to the torque specified in Technical Data.

4. Lubricate the new radial oil seal lip and crankshaft with fresh engine oil.
Place the oil seal with the closed side facing upwards on a solid base. Position special tool 21-011-D on the oil seal and press the retaining ring downwards by hand as far as it will go.

Position the tool and oil seal on engine and using three flywheel retaining bolts, draw in oil seal until it butts.

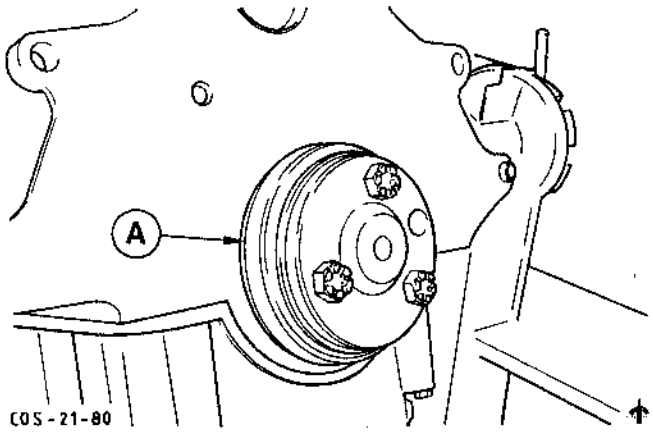


Fig.236. Install radial oil seal.
A - special tool 21-011-D

5. Align the flywheel locating bolt holes and fit the flywheel.

NOTE: Lubricate the bolt threads and under the bolt heads with engine oil.

6. Centre the clutch disc using special tool 21-044-A.
Locate the pressure plate over the dowels and uniformly tighten the retaining bolts.

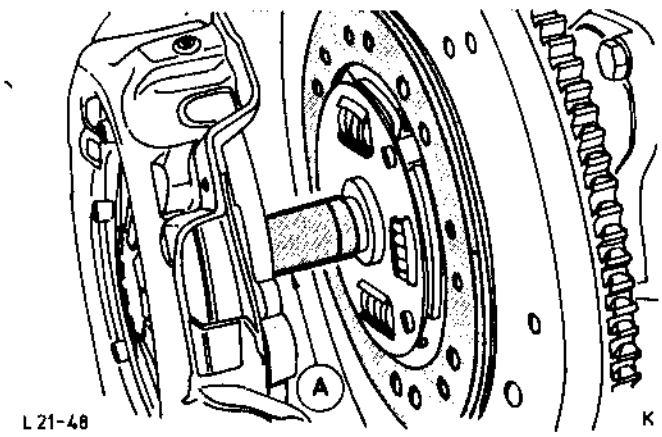


Fig.237. Centre clutch disc.
A - Special tool 21-044-A

21 505 5 PISTON - REPLACE (one) (piston and connecting rod assembly removed)

SPECIAL SERVICE TOOLS REQUIRED: NONE

General Description

The piston and piston pin form a unit and can only be renewed together.

If one cylinder has to be bored oversize by 0,5 mm, the remaining cylinder bores must also be bored oversize by the same amount. If this is not done imbalance problems will be experienced, as the piston for a 0,5 mm oversize bore could weigh as much as 10 g more.

The first and second piston rings are marked "TOP".

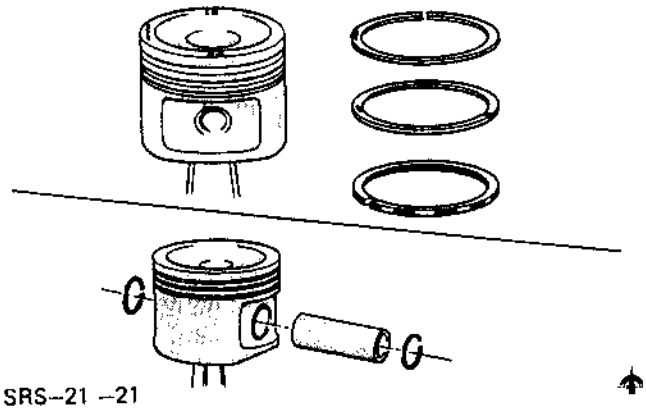

SRS-21-21

Fig.238. Piston, piston rings and piston pin.

To Remove

1. Remove the spring ring, using a small screwdriver.

   For this purpose the piston has a small cut-out on the right hand side piston pin bore. Rotate spring ring and then hook out exposed end with screwdriver.

2. Press out the piston pin.

3. Remove the piston from the connecting rod.

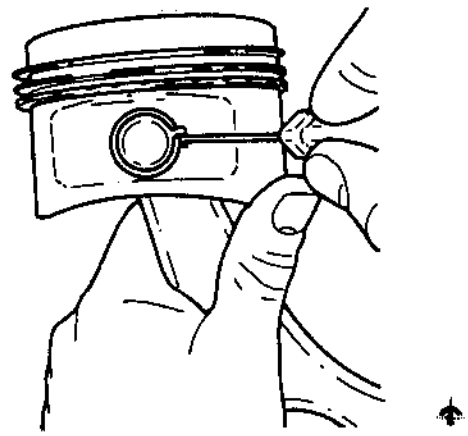

SRS-21-119

Fig.239. Remove spring ring with a small screwdriver.

To Install

NOTE: The connecting rods have 3 grades and are marked on the cap:

Standard	S or no mark
Light	L
Heavy	H

4. Connect the piston and connecting rod with the piston pin.

5. Install spring ring.

NOTE: Spring ring ends must face towards the piston rings.

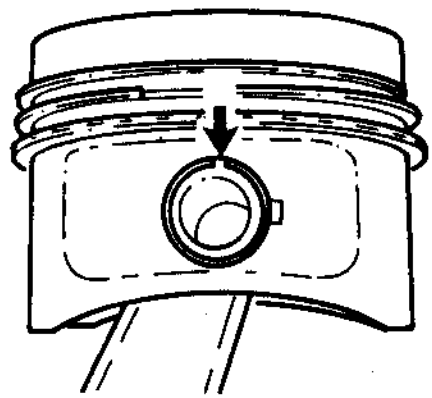

COS-21-86

Fig.240. Position of spring ring gap.

ENGINE
(83 US Emission Standard)
(Sierra and Escort)

21B

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Engine - General

Emission standard		83 US
Identification code		N5C
Firing order		1-3-4-2
Bore	mm	90,82
Stroke	mm	76,95
Cubic capacity .. effective	cc	1993
Compression ratio		8,0 : 1
Compression pressure .. at starter motor speed	bars	8,5
Boost pressure	bars	0,8
Idle speed	rpm	900/950
Max. engine speed .. continuous	rpm	6500
Power output (DIN)	kW	162
.. at	rpm	6000
Torque (DIN)	Nm	290
at	rpm	3500
Spark plugs		AGPR902P
Ignition timing		16° before TDC at idle speed

Engine Lubrication

Viscosity		5W/50
Specification		Mobil 1 or APISG/CD (synthetic oil) only
Initial fill capacity .. incl. filter	litres	4,75
Oil change .. interval	km	10000
.. excl. filter	litres	3,7
.. incl. filter	litres	4,2
Minimum oil pressure * .. at 900/950 rpm	bars	1,8
.. at 2000 rpm	bars	2,4

*with SAE 5W-50 oil at 80°C

Cooling System

Fill capacity incl. heater and degas tank	litres	7,5
Antifreeze - type		Motorcraft Super Plus 4 antifreeze
- specification		ESD-M97B49-A
- use a mixture of 50/50 (% by vlume) when filling and topping up		

Cylinder Block

Cast mark		V 90 HM 6015 AA
Number of main bearings		5
Cylinder bore dia. .. Standard class 2	mm	90,810 to 90,820
.. Standard class 3	mm	90,820 to 90,830
Centre main bearing width	mm	27,22 to 27,17
Fitted main bearing shells		
- vertical inside dia. .. Standard	mm	57,000 to 57,038
.. Undersize 0,25	mm	56,750 to 56,788
.. .. 0,50	mm	56,500 to 56,538
.. .. 0,75	mm	56,250 to 56,288
Main bearing parent bore dia. .. Standard	mm	60,640 to 60,620

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Crankshaft

End float	mm	0,1 to 0,254	
Main bearing journal dia. Standard	mm	56,975 to 56,959	
Undersize 0,25	mm	56,725 to 56,709	
0,50	mm	56,475 to 56,459	
0,75	mm	56,225 to 56,209	
Width of centre main bearing Standard	mm	32,00 to 32,05	
Thickness of thrust half washers Standard	mm	2,3 to 2,35	
Clearance between main bearing journals and bearing shells	mm	0,025 to 0,079	
Big end bearing journal dia. Standard	mm	51,993 to 51,977	
Undersize 0,25	mm	51,743 to 51,727	
0,50	mm	51,493 to 51,477	
0,75	mm	51,243 to 51,227	
Length of main bearing journals front, centre, rear	mm	32,13 to 31,87	incl. radii
intermediate bearings	mm	32,13 to 31,87	
Width of main bearing shells front, centre, rear	mm	23,24 to 23,62	
intermediate bearings	mm	23,24 to 23,62	
Length of big end bearing journals	mm	26,0 to 26,1	incl. radii
Width of big end bearing shells	mm	19,61 to 20,00	

Cylinder Head

Cast mark		V 89 HF 6090 AA	
Valve seat angle		45°	
Valve seat width .. inlet	mm	1,5 max.	
exhaust	mm	2,0 max.	
Inlet valve stem bore dia. Standard	mm	7,000 to 7,015	
Exhaust valve stem bore dia. Standard	mm	8,000 to 8,015	
Camshaft bearing parent bore dia.	mm	28,000 to 28,021	
Distance between lower edge of valve guide and cylinder head mating face .. inlet	mm	33,5	on centre line
exhaust	mm	28	on centre line
Flatness of upper mating face of cylinder head			
Maximum permissible distortion in longitudinal direction (convexity) measured at centre	mm	0,10	Change cylinder head if exceeded
Flatness of lower mating face of cylinder head			
Maximum permissible unevenness in transverse direction (100 mm steel straight edge)	mm	0,02	
Maximum permissible unevenness in longitudinal direction (100 mm steel straight edge)	mm	0,02	
Maimum permissible distortion in longitudinal direction (concavity) measured at centre	mm	0,08	Rework cylinder head if exceeded
Maximum material removal	mm	0,13	
Minimum cylinder head height after machining, measured between mating faces	mm	138,68	

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Camshafts

Number of camshafts		2
Number of camshaft bearings		5
Drive		By toothed belt
Cam lift - Inlet	mm	8,544
Exhaust	mm	8,544
Cam length (between heel and toe) - Inlet	mm	46,802 to 46,286
Exhaust	mm	46,802 to 46,286
Camshaft bearing journal dia.	mm	27,960 to 27,936
Inlet valve side, front - 1st bearing	mm	27,960 to 27,936
2nd bearing	mm	27,960 to 27,936
3rd bearing	mm	27,960 to 27,936
4th bearing	mm	27,960 to 27,936
Exhaust valve side, front - 1st bearing	mm	27,960 to 27,936
2nd bearing	mm	27,960 to 27,936
3rd bearing	mm	27,960 to 27,936
4th bearing	mm	27,960 to 27,936
Camshaft end float		Ball bearing play
Valve timings - Inlet opens BTDC		8°
Inlet closes ABDC		52°
Exhaust opens BBDC		52°
Exhaust closes ATDC		8°

Valves

Valve timing		Direct by OHC
Valve clearances - Inlet		Hydraulic tappets
Exhaust		Hydraulic tappets
Bucket tappet dia. - Standard	mm	34,975 to 34,959
Bucket tappet dia. - Oversize	mm	35,475 to 35,459
Tappet clearance in housing - Standard/Oversize	mm	0,025 to 0,057
Free valve spring length	mm	39,8
Spring force - Valve open	N	620
Valve closed	N	257
Spring height compressed - Valve open	mm	23,45
Valve closed	mm	32
Valve spring wire dia.	mm	3,9
Number of coils		5,8
Valve spring inside dia.	mm	21,6

Inlet Valves

Valve length	mm	105,68
Valve head dia.	mm	35,0 to 35,2
Valve stem dia. - Standard	mm	6,970 to 6,955
Valve stem clearance in guide	mm	0,03 to 0,06

Exhaust Valves

Valve length	mm	105,5
Valve head dia.	mm	31,0 to 31,2
Valve stem dia. - Standard	mm	7,960 to 7,938
Valve stem clearance in guide	mm	0,055 to 0,077

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Pistons

Piston dia.	Standard size 2	mm	90,758 to 90,772
	Standard size 3	mm	90,768 to 90,782
Piston clearance in bore (unused)..		mm	0,038 to 0,062
Piston ring gaps (fitted)	upper	mm	0,4 to 0,65
	middle	mm	0,4 to 0,65
	lower	mm	0,3 to 0,6
Ring gap positions	upper		Offset 120° from one side expander gap
Oil control ring	middle		Offset 120° from opposite side of expander gap Offset 120° from position of gap of middle piston ring

Piston Pins

Type			Floating
Piston pin dia.		mm	24,000 to 23,995
Pin retention			By circlip

Connecting Rods

Bore dia. (excl. bearing shells)	big-end	mm	55,00 to 55,02
	small end	mm	27,000 to 27,021
Fitted big end bearing shells - vertical inside dia.	Standard	mm	52,006 to 52,044
	Undersize 0,25	mm	51,756 to 51,794
	0,50	mm	51,506 to 51,544
	0,75	mm	51,256 to 51,294
Connecting rod bush inside dia. (fitted)		mm	24,007 to 24,013
Big-end bearing clearances		mm	0,013 to 0,067
Big-end bearing axial movement		mm	0,25 to 0,09

Tightening Torques

Checking Compression Pressure (21 111 0)	Nm
Spark plugs	28 to 33

Checking Oil Pressure (21 112 0)	
Oil feed pipe to turbocharger	20 to 25
Turbocharger heat shield to bulkhead bracket and to fender bracket	9 to 11

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Tightening Torques (cont'd)

Installing Engine and Transmission Assembly (21 132 0)	Nm
Front axle/engine crossmember to side members	71 to 95
Transmission crossmember to floor assembly	20 to 26
Torx studs in transmission output flange	70 to 90
Driveshaft to transmision output flange	70 to 85
Driveshaft to rear axle	57 to 75
Driveshaft centre bearing to floor assembly	18 to 24
Exhaust mounting bracket to transfer box	41 to 55
Left-hand exhaust mounting bracket to rear axle crossmember	45 to 56
Speedometer drive cable union nut	6 to 9
Front axle housing cover	9 to 11
Steering intermediate shaft to steering shaft	17 to 20
Stabiliser bar brackets to side members	70 to 97
Lower suspension arms to spindle carrier	70 to 90
Castellated nut of track rod to drop arm	57 to 68
Front axle assembly oil level check plug	35 to 45
Lower engine cover to side members and to front axle/engine crossmember	18 to 22
Wheel bolts	100
Retaining bolts of engine lifting eyes	19 to 21
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10
Engine mounting nuts	70 to 90
Front exhaust pipe to turbocharger	35 to 47
Pressure pipe from steering gear to power steering pump	26 to 31
Turbocharger heat shield to bulkhead bracket and to fender bracket	9 to 11
Vent screw in thermostat housing	7 to 10

Connecting Engine to Transmission (21 134 4)	
Engine/transmission flange bolts	41 to 48
Bolt securing adaptor plate to transmission	9 to 12
Starter motor	58 to 78
Driveshaft to front axle assembly drive flange	30 to 40

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Tightening Torques (cont'd)

Assembling Engine (21 134 8)	Nm	Remarks
Crankshaft main bearing caps	88 to 101	Oil thread
Big-end bearing bolt to connecting rod	55 to 60	Oil thread and underside of bolt head
Oil pump to cylinder block	19 to 21	Oil thread
Crankshaft front cover	13 to 17	Use new self-locking bolts ('Scotch Grip')
Auxiliary shaft thrust plate	13 to 17	Oil thread
Auxiliary shaft front cover	13 to 17	
Sump to cylinder block	8 to 11	"Scotch Grip"
Flywheel to crankshaft	63 to 69	Oil thread
Clutch pressure plate to flywheel	19 to 21	
Auxiliary shaft toothed belt pulley	44 to 49	
Water pump bolts - M8	19 to 21	
Water pump bolts - M10	40 to 48	
Water pump V-belt pulley	19 to 21	
Knock sensor	10 to 15	
Bracket of engine speed/TDC sensor to sump (nuts)	8 to 10	Distance between sensor and tooth on belt pulley
Engine speed/TDC sensor studs in sump	4 to 6	
Engine speed/TDC sensor to bracket (bolts)	4 to 6	Loctite 648
Oil pressure switch in cylinder block	25 to 29	Loctite 270
Nut of oil filter/oil cooler connecting housing	30 to 35	Oil thread
Inlet union screw to oil cooler	47 to 49	Oil thread
Engine mounting bracket to cylinder block	19 to 21	
Oil filter/oil cooler connecting housing to cylinder block	30 to 32	
Oil filter	Screw on finger tight plus 1/2 to 3/4 of a turn	Lubricate seal and thread with engine oil
Cylinder head to cylinder block Stage 1	45 to 50	Oil thread and underside of bolt head
Stage 2	Turn 180° ± 10° more	
Stage 3	Check for 110 Nm	
Spark plugs	28 to 33	
Engine breather valve bracket in plenum chamber	8 to 10	
Cylinder head cover	10 to 15	

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TECHNICAL DATA (cont'd)

Tightening Torques (cont'd)

Assembling Engine (21 134 8) (cont'd)	Nm	Remarks
Distributor bracket	19 to 21	
V-belt pulley/vibration damper to crankshaft	190 to 200	Oil thread and underside of bolt head
Alternator bracket to cylinder block	58 to 79	
Alternator to bracket	20 to 25	
Alternator adjusting strap to cylinder block	20 to 25	
Alternator adjusting strap to alternator	20 to 25	
Toothed belt cover (all bolts)	8 to 10	
Bracket of oil dipstick tube to cylinder head	8 to 10	
Mounting bolts to power steering pump	21 to 25	
Power steering pump carrier support to cylinder block	19 to 21	M8 hexagon bolt, Loctite 518 on mating face
Power steering pump mounting carrier to cylinder block	50 to 60	M10 hexagon socket head cap screw
Power steering pump support/carrier connecting bolt	35 to 40	M8 hexagon socket head cap screw
Power steering pump mounting (V-belt tension)	21 to 25	
Engine mounting bracket to cylinder block	19 to 21	
Front axle assembly to sump mounting	40 to 48	
Front axle assembly mounting bracket to cylinder block	19 to 21	
Oil drain plug	21 to 27	

Additional Tightening Torques for 21 134 8

Oil intake pipe to pump	8 to 10		
Oil intake pipe to cylinder block	19 to 21		
Baffle plate to sump	8 to 10	'Scotch Grip'	
Bracket for multiplugs of engine speed/TDC sensor and knock sensor	19 to 21	M8 hexagon bolt, Loctite 518 on mating face	
Bush of oil cooler inlet union screw in cylinder block	30 to 35		
Coolant drain plug in cylinder block	25 to 30		

Installing Cylinder Head (21 163 0)

Engine lifting eyes to cylinder head	19 to 21		
Cylinder head to cylinder block	Stage 1	45 to 50	Oil thread and undersize of bolt head
	Stage 2	Turn 180° ± 10° more	
	Stage 3	Check for 110 Nm	

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Tightening Torques (cont'd)

Installing Cylinder Head (21 163 0) (cont'd)	Nm	Remarks
Toothed belt tensioning pulley to cylinder head	40 to 48	
Cylinder head cover	10 to 15	
Spark plugs	28 to 33	
Toothed belt cover (all bolts)	8 to 10	
Front exhaust pipe to turbocharger	35 to 47	
Engine mounting nuts	70 to 90	
Self-locking nuts on throttle housing vibration damper (then slacken half a turn)	8 to 10	
Oil dipstick tube bracket to cylinder head	8 to 10	
Turbocharger heat shield to bulkhead brackets	8 to 10	
Turbocharger heat shield to fender bracket		

Assembling Cylinder Head (21 165 5)		
Camshaft front bearing caps to cylinder head (M6 x 35 bolts)	8 to 10	Oil thread
Camshaft bearing caps to cylinder head - M8	19 to 23	Oil thread
Camshaft toothed belt pulleys	59 to 63	
Coolant temperature sensor/coolant hose connecting flange	8 to 10	
Temperature gauge sender unit	7 to 10	
Connection of turbocharger oil feed pipe	17 to 21	
Toothed belt tensioning pulley to cylinder head	40 to 48	
Toothed belt cover spacer stud in cylinder hed cover.	4,5 to 5,5	Oil thread
Toothed belt cover spacer stud to cylinder head cover	4,5 to 5,5	Loctite
Engine lifting eyes to cylinder head	19 to 21	
Inlet manifold (nuts and bolts) to cylinder head	19 to 21	
Exhaust manifold to cylinder head	26 to 28	
Thermostat housing to cylinder head	19 to 21	
Vent screw in thermostat housing	7 to 10	

Additional Tightening Torques for 21 165 5	
Studs of camshaft bearing caps - M8	3,5 to 4,5
Stud of toothed belt tensioning pulley	4,5 to 5,5
Exhaust manifold studs	3,5 to 4,5
Coolant temperature sensor in connector	23 to 25
Oilway blanking plug 1/16 NPTF thread	5 + 90°
1/18 NPTF thread	8 to 10

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TECHNICAL DATA (cont'd)

Tightening Torques (cont'd)

Installing Inlet Manifold (21 183 0)	Nm	Remarks
Inlet manifold retaining bolts	19 to 21	
Inlet manifold retaining nuts	19 to 21	
Engine mounting nuts	70 to 90	
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10	
Oil dipstick tube bracket to cylinder head	8 to 10	
Engine breather valve bracket to plenum chamber	8 to 19	

Additional Tightening Torques for 21 183 0	Nm	Remarks
Plenum chamber to inlet manifold	8 to 10	
Throttle housing to plenum chamber	8 to 10	
Studs in inlet manifold	3,5 to 4,5	
Throttle cable bracket to plenum chamber	18,5 to 21,5	
Fuel pressure regulator to fuel rail	8 to 10	
Hose clips - general	3,5 to 4,5	
Fuel rail to plenum chamber	8 to 10	
Air charge temperature sensor in plenum chamber	23 to 25	Loctite 5
Air hose connections in plenum chamber	5 to 6	Loctite 5
Studs (M6) in plenum chamber elbow	3,5 to 4,5	
Vibration damper of plenum chamber elbow	8 to 10 (then slacken half a turn)	

Installing Exhaust Manifold (21 187 0)	Nm	Remarks
Turbocharger to exhaust manifold	27 to 33	"Never Seeze"
Exhaust manifold to cylinder head	26 to 28	
Alternator adjusting strap to cylinder block	20 to 25	
Alternator adjusting strap to alternator	20 to 25	
Front exhaust pipe to turbocharger	35 to 47	
Oil feed pipe to turbocharger and cylinder head	20 to 25	
Lower engine cover to front axle/engine crossmember and side members	18 to 22	
Turbocharger heat shield to fender/bulkhead brackets	9 to 11	
Vent screw in thermostat housing	7 to 10	

Additional Tightening Torques for 21 187 0	Nm	Remarks
Oil feed pipe adaptor to turbocharger	17 to 21	Oil
Oil return pipe to turbocharger	18,5 to 21,5	
Coolant connector bolts to turbocharger	28 to 33	Oil
HEGO sensor in turbocharger	20 to 25	"Never Seeze"
Turbocharger flange studs in exhaust manifold	18,5 to 21,5	
Exhaust flange studs in turbocharger	18,5 to 21,5	
Vacuum hose adaptor in compressor housing	18 to 22,5	"Never Seeze"

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V-Belt Tension

		N
Alternator/water pump	New	400 to 500
	Used	300
Power steering pump	New	450 to 550
	Used	350 to 450

NOTE: A V-belt is regarded as used when it has been in use for 10 minutes. The tension figures are for a cold belt. If no guage is available, the V-belt should be tensioined so that the maximum deflection in the middle of the longest span is 4 mm.

Toothed Belt Tension

Toothed belt (with Special Tool 21-113)	9,5 to 10,5 reading

NOTE: After tensioning, run the engine for 10 minutes. Let the engine cool for 2 hours and re-check the toothed belt tension.

Oil

Oil for Front Axle Assembly

Fill capacity	Litres	1,0
SAE-90 hypoid oil	Ford specification	SQM-2C9002-AA

Engine oil	Fill capacity (litres)	3,6

Type: Mobil 1 or synthetic oil to API SG/CD

Power steering fluid	Fill capacity (litres)	
Type: Hydraulic fluid	Ford specification	SQM-2C9010-A

Sealers

Vent screw in thermostat housing		Not required
Front axle housing cover	Ford specification	WSK-M2G348-A6
Front bearing caps of camshafts	Ford specification	Hylosil
Ends of rubber seals of cylinder head covers	Ford specification	Hylosil
Crankshaft front cover	Ford specification	Hylosil
Crankshaft rear main bearing cap	Ford specification	Loctite 518
Sump mating face	Ford specification	Hylosil
Temperature gauge sender unit	Ford specification	Loctite 518

Thread Locking Compound

Torx studs in transmission output flange	Loctite 270

Lubricants

'Never Seez' anti-seize compound for spark plug threads

obtainable through:

Snap-on Tools Limited
Palmer House
150/154 Cross Street
Sale, Cheshire
M33 1AQ

Catalogue No. NSBT-8N, 227 g

or

for local Bostik supplier,

Catalogue No. NSN 165

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GENERAL DESCRIPTION

Engine - 83 US

The 2,0 litre OHC in-line 4 cylinder engine of the new Sierra Cosworth 4x4 developing 161 kW (220 PS) is essentially based on the OHC in-line engine of the (rear wheel drive) Cosworth developing 149 kW (204 PS).

Two variants of this engine are available.

- 2,0 litre OHC engine without catalytic converter - engine code YBJ (emission standard 15.04)
- 2,0 litre OHC engine with regulated 3-way catalytic converter - engine code YBG (83 US emission standard).

In the engine compartment, engines equipped to comply with emission standard 15.04 can be recognised by the red cylinder head cover and engines equipped to comply with the 83 US emission standard can be identified by the green cylinder head cover and the HEGO sensor on the heat shield, Fig.A.

The increase in power of 12 kW (16 PS) compared with the previous model has been achieved with the following technical modifications:

- Modified turbocharger
- Larger intercooler
- Modified pistons
- Platinum spark plugs
- Modified ignition characteristics.

Detailed information about the new engine is to be found in the brochure entitled "SIERRA Cosworth 4x4" in the "Production Training for Technicians" series under number CG7330D 12/89. However, this training document must not be used for repair purposes because only the service microfiche is updated when required.

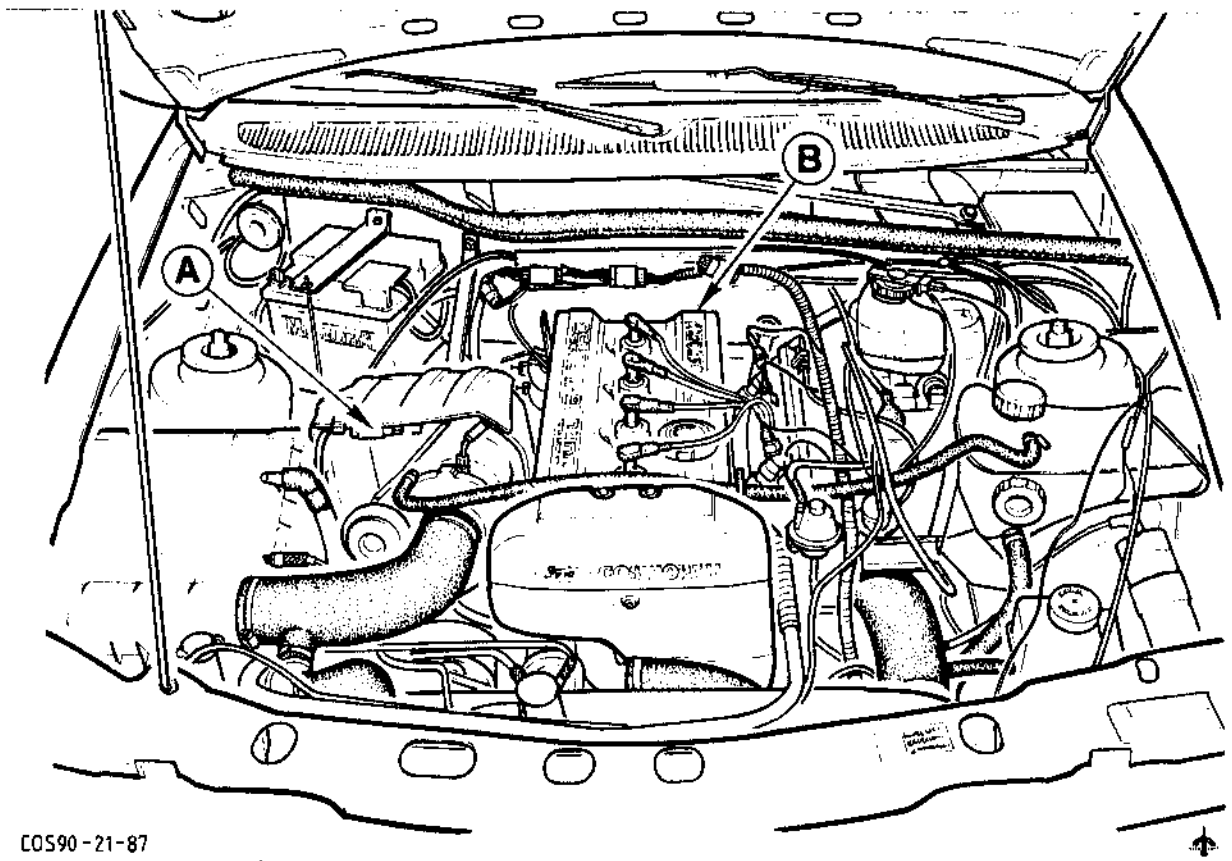
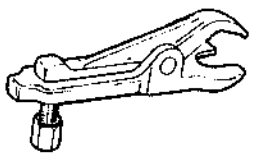
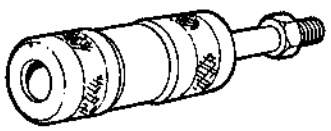
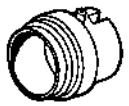
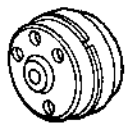
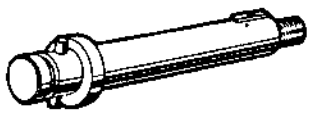
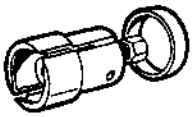
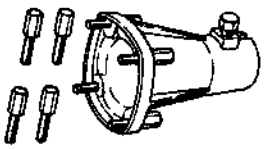
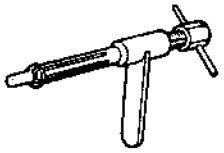
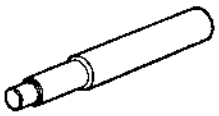
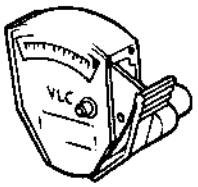


Fig.A. Engine compartment of Sierra Cosworth 4x4 equipped to comply with the 83 US emission standard.
A - Multiplug of HEGO sensor
B - Cylinder head cover.

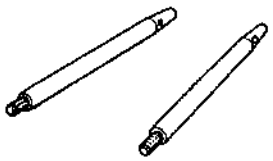
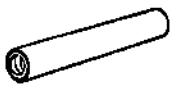
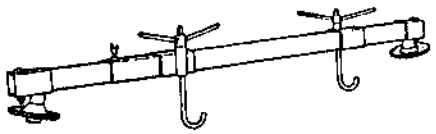
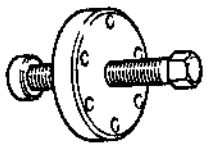
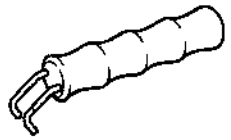
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 13-006	Ball joint separator
 15-053	Slide hammer used in conjunction with 21-142
 21-002	Socket wrench for cylinder head bolts
 21-009 B	Radial oil seal installer
 21-011 D	Crankshaft radial oil seal installer
 21-012	Socket wrench for oil pump bolts
 21-023	Universal spindle (used only in conjunction with engine stand)

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 21-024	Valve spring compressor
 21-024-06	Adaptor for valve spring compressor
 21-028 A	Crankshaft toothed belt pulley remover
 21-031 B	Engine mounting bracket (used only in conjunction with engine stand and 21-023)
 21-036 A	Pilot bearing extractor
 21-044 A	Pilot bearing installer and clutch disc locator
 21-113	Toothed belt tension test gauge

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 21-128	Cylinder head locating studs
 21-129 A	Valve stem oil seal installer (exhaust valves)
 21-130 A	Valve stem oil seal installer (inlet valves)
 21-140	Engine support bar
 21-142	Valve stem oil seal extractor
 21-152	Distributor shaft immobilising tool
 21-153	Crankshaft belt pulley remover
 23-027 A	Fuel pipe disconnector

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Compressor pressure tester

Compressed air adaptor with spark plug thread ("Hazet 3428")

Rubber sucker ("Hazet 795-2")

Torx sockets (e.g. "Hazet E11"; Stahlwille 50 TX E11")

Angle gauge

Torque wrench

Dial indicator (graduated in mm) with holding fixture (use 15-046 and 15-022 A if available)

Oil filter strap wrench

Piston ring compessor

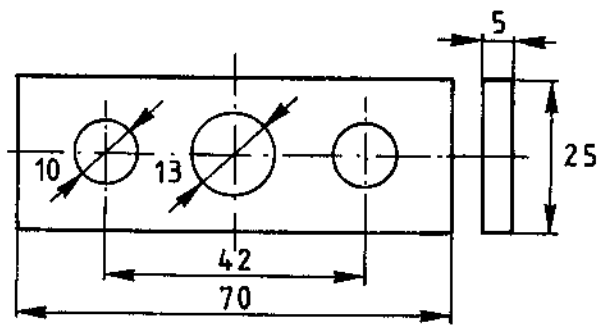
Oil pressure test gauge

Connecting hose between oil pressure test gauge and T-piece

T-piece to measure oil pressure

WORKSHOP FABRICATED TOOLS

Mounting plate for valve spring compressor



COS - 21 - 1

Fig.B. Mounting plate for valve spring compressor.

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21 111 0 ENGINE - CHECK COMPRESSION

PROPRIETARY TOOLS REQUIRED:

Compression pressure tester

NOTE: Generally, differences in design of compression tester and fluctuating starter motor speeds only make it possible to check that the compression is the same in all the cylinders. The actual compression pressure depends on a number of factors and can only be measured if certain pre-conditions apply.

The engine should be at normal operating temperature.

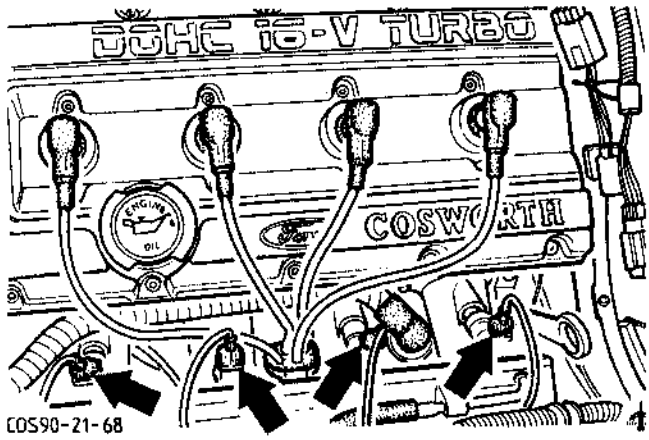


Fig.1. Multiplugs of injectors.

To Check

1. Disconnect the low-tension lead from the ignition coil (terminal 15).
2. Disconnect the multiplugs from the injectors, Fig.1.
3. Disconnect the HT leads and remove the spark plugs.
4. Load the tester with a sheet of graph paper. Press the rubber seal of the tester firmly into the spark plug bore of cylinder No.1, Fig.2. With the throttle fully opened, crank the engine on the starter motor until the pointer on the tester stops rising.
5. Vent the tester, set the sheet of graph paper for the next cylinder and repeat the process as described in sub-operation 4 for the remaining cylinders.
6. Screw in the spark plugs and tighten them to the specified torque (see Technical Data). Connect the HT leads inthe correct sequence (the leads are marked).
7. Connect the multiplugs to the injectors.
8. Connect the low-tension lead to the injection coil.

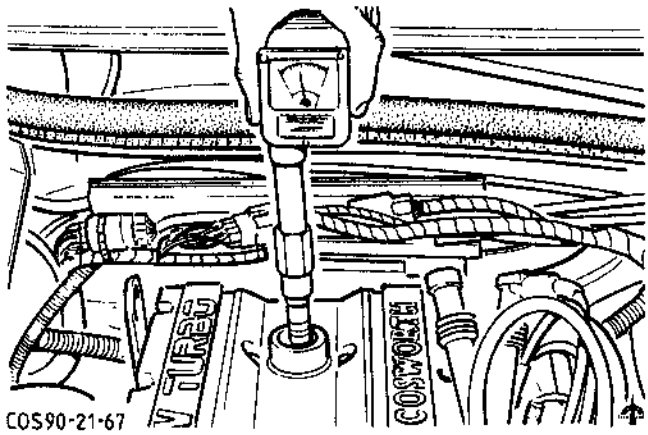


Fig.2. Compression pressure tester.

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21 112 0 OIL PRESSURE - CHECK

PROPRIETARY TOOLS REQUIRED:

Oil pressure test gauge
Connecting hose - between oil pressure test gauge and T-piece
T-piece - to measure oil pressure

NOTE: The oil pressure level depends on a variety of factors (engine speeds, oil temperature, oil pump rotor clearance, etc.). The measurement should always be carried out with the oil at a temperature of 80°C. The oil pressure should be 1,8 bars at idle speed and 2,4 bars at 2000 rpm. However, the maximum pressure should not exceed 5 bars at engine speeds in excess of 2000 rpm.

To Check

1. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.1 (B).

2. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.1 (A, C, D).

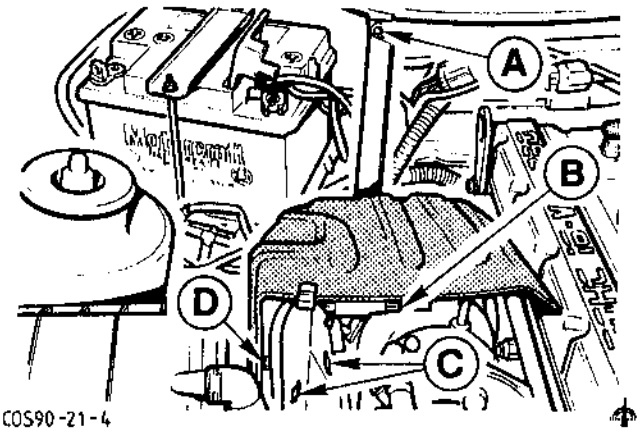


Fig.1. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

3. Unscrew the oil feed pipe from the turbocharger, Fig.2 (C).

4. Screw the T-piece into the turbocharger. Screw the connecting hose to the oil pressure test gauge. Connect the connecting hose with the oil pressure test gauge and the oil feed pipe to the T-piece, Fig.2.

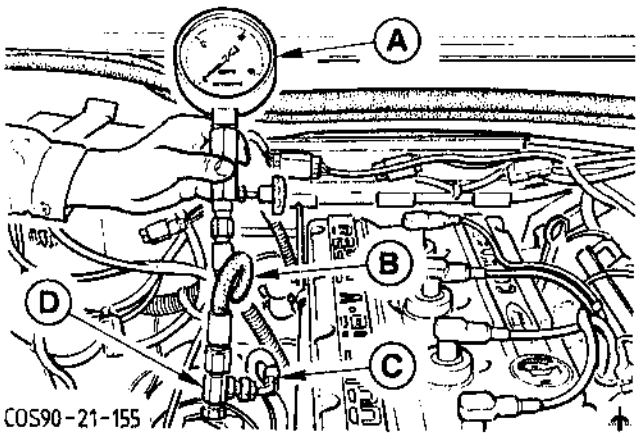


Fig.2. Proprietary tools.
A - Oil pressure test gauge
B - Connecting hose
C - Turbocharger oil feed pipe
D - T-piece

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5. Start the engine, measure the oil pressure at idle speed and at more than 2000 rpm.

6. Remove the proprietary equipment.

7. Connect the oil feed pipe to the turbocharger.

8. Fit the turbocharger heat shield in position and push it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.3 (A, C, D).

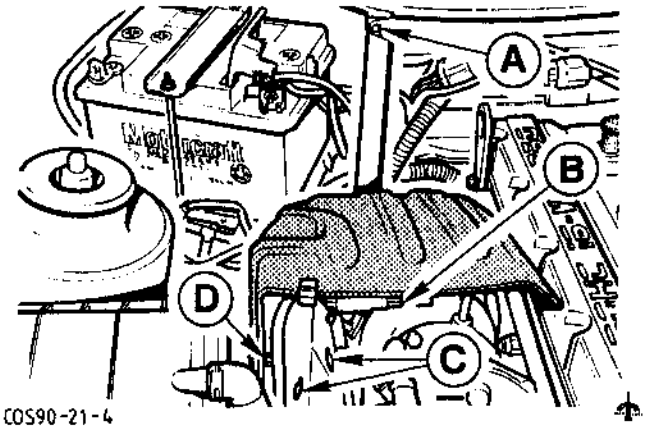


Fig.3. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

9. Connect the multiplug of the HEGO sensor and clip it to the heat shield, Fig.3 (B).

If the pressure is not to specification, first check the oil pump and pressure relief valve as a possible source of the fault. The following typical faults can occur:

Pressure too high at engine speeds over 2000 rpm:

Pressure relief at valve failing to open due to dirt.

Pressure too low over entire engine speed range:

Intake strainer dirty, intake pipe loose or cracked, oil pump worn, etc.

Pressure too low in lower engine speed range:

Pressure relief valve sticking open due to dirt.

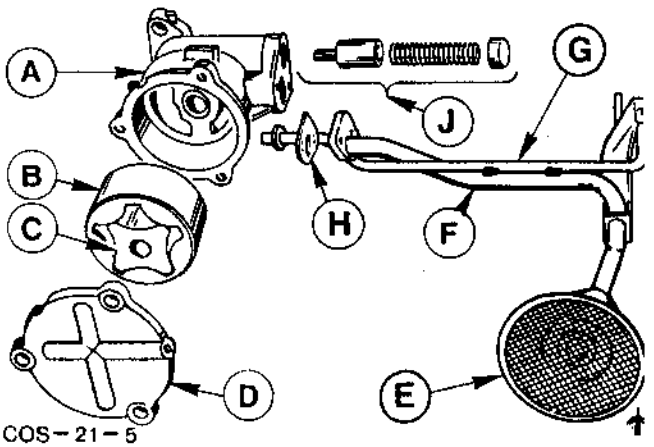


Fig.4. Oil pump - exploded view (Cosworth '86/'88 oil pump shown).
A - Housing
B - Outer rotor
C - Inner rotor
D - Cover
E - Oil intake strainer
F - Intake pipe
G - Splash lubricating pipe
H - Gasket
J - Pressure relief valve

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21 132 0 ENGINE AND TRANSMISSION ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator	13-006
Engine support bar..	21-140
Fuel pipe disconnector	23-027 A

To Remove

NOTE: Remove the engine and transmission assembly from below. Cut the cable ties securing wiring and vacuum lines/hoses as necessary during removal.

1. Disconnect the earth cable and the starter motor positive cable from the battery. Unscrew the earth cable from the battery tray, Fig.1.

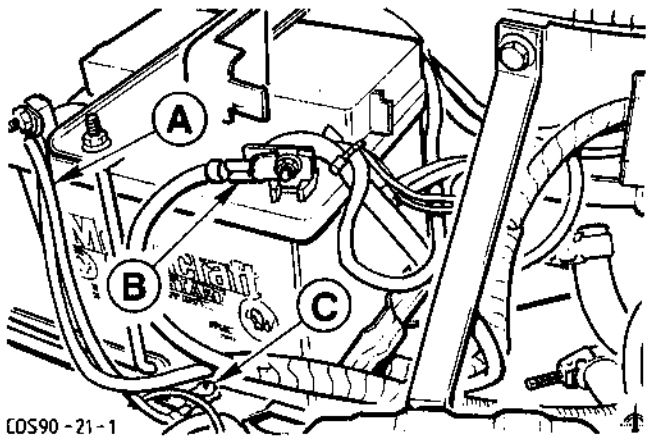


Fig.1. Battery cables.
A - Earth cable
B - Starter motor positive cable
C - Earth cable to battery tray

2. Pull the knob vertically upwards off the gear lever, Fig.2 (A). Prise off the cover plate. Unclip the electric window switches and disconnect the two multiplugs from the electric window switches, Fig.2 (B, E).

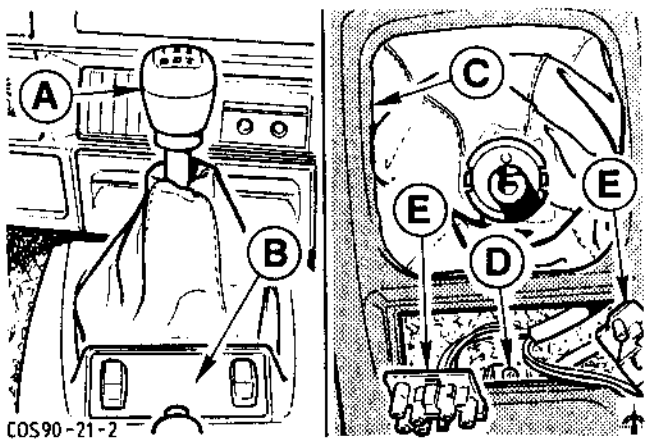


Fig.2. Gear lever with gaiter retaining frame.
A - Gear lever knob
B - Cover plate
C - Retaining frame
D - Screw securing retaining frame
E - Multiplugs of electric window switches

3. Remove the retaining frame from the console (1 screw), Fig.2 (C, D).

4. Pull up the outer gear lever gaiter inside out, cut the cable tie and pull off the gaiter, Fig.3 (A, B).

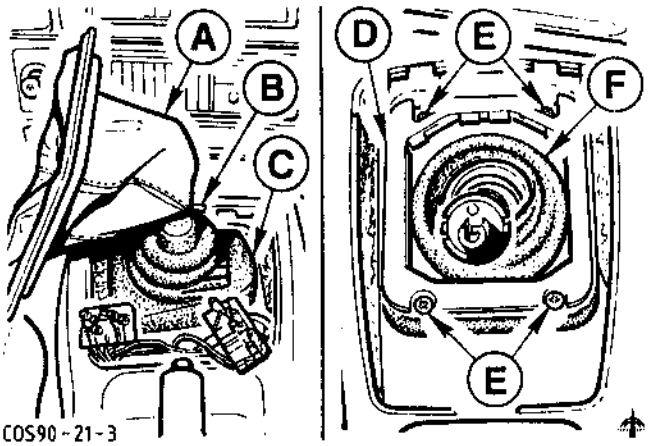


Fig.3. Gaiters and retaining frame of sound damping pad.

Fig.3. Gaiters and retaining frame of noise damping pad.
A - Outer gaiter
B - Cable tie
C - Inner gaiter
D - Retaining frame of noise damping pad
E - Retaining screws
F - Noise damping pad

5. Pull off the inner gear lever gaiter, Fig.3 (C).

6. Remove the retaining frame of the noise damping pad with the damping pad (4 screws), Fig.3 (D, E, F).
Support the clutch pedal.

7. Undo the front wheel bolts.

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8. Unclip the HEGO sensor multiplug from the turbocharger heat shield and disconnect it, Fig.4 (B).

9. Unscrew the turbocharger heat shield and bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.4 (A, C, D).

Fig.4. Turbocharger heat shield.
A - Retaining bolt
B - HEGO sensor multiplug
C - Heat shield clips
D - Retaining nut

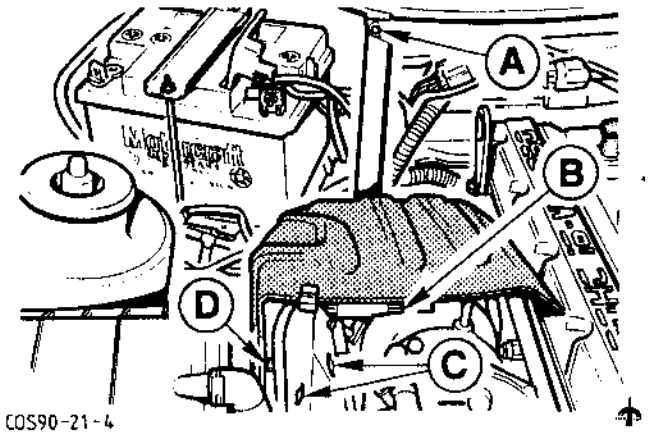


Fig.4. Turbocharger heat shield.

10. Remove the air cleaner cover with the air hoses, Fig.5:

- Disconnect the air pipe to the engine breather valve at the connecting hose and unclip it from the upper crossmember. Disconnect the air pipe from the air cleaner cover at the solenoid control valve.
- Disconnect the air intake hose from the turbocharger.
- Disconnect the air hose from the by-pass valve at the intercooler.
- Disconnect the vacuum pipe from the by-pass valve at the inlet manifold air chamber and unclip it from the upper crossmember.
- Unclip the air cleaner cover (5 clips) and remove it with the air hoses/pipes.
- Remove the air cleaner element from the air cleaner casing.

Fig.5. Air cleaner cover with air hoses/pipes.
A - Air cleaner cover
B - To engine breather valve
C - To turbocharger
D - From solenoid control valve
E - Connecting hose from engine breather valve air pipe
F - By-pass valve to intercooler
G - Clips
H - Vacuum pipe from by-pass valve to inlet manifold air chamber
J - Connection of vacuum pipe from by-pass valve

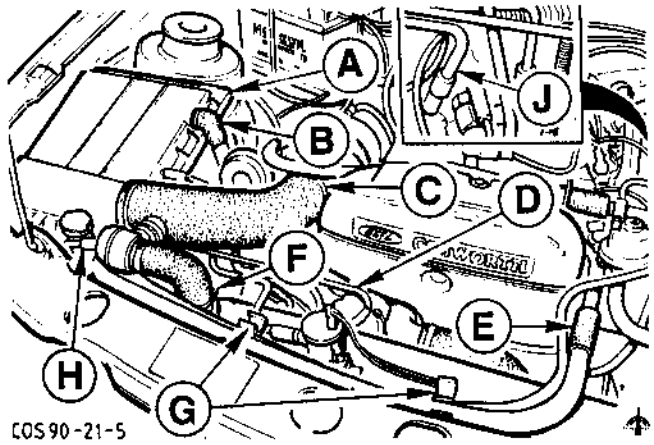


Fig.5. Air cleaner cover with air hoses/pipes.

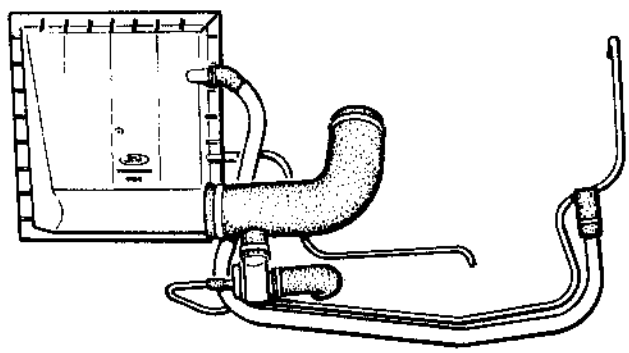


Fig.6. Air cleaner cover and air hoses/pipes removed.

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11. Remove the solenoid control valve from the intercooler:

- Disconnect the vacuum pipe of the solenoid control valve from the turbocharger diaphragm unit, Fig.7 (A), and from the turbocharger compressor casing, Fig.7 (B).
- Disconnect the multiplug of the solenoid control valve, Fig.7 (E).
- Unscrew the solenoid control valve (2 screws), Fig.7 (D, F), and remove it with the vacuum pipes.

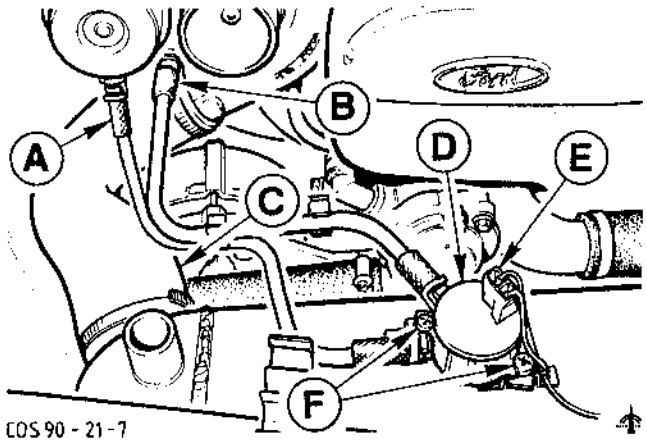


Fig.7. Solenoid control valve and lower air hose to turbocharger.
A - Vacuum pipe to diaphragm unit
B - Vacuum pipe to compressor casing
C - Lower air hose to turbocharger
D - Solenoid control valve
E - Multiplug
F - Retaining screws

12. Disconnect the lower air hose from the turbocharger and from the intercooler, Fig.7 (C).

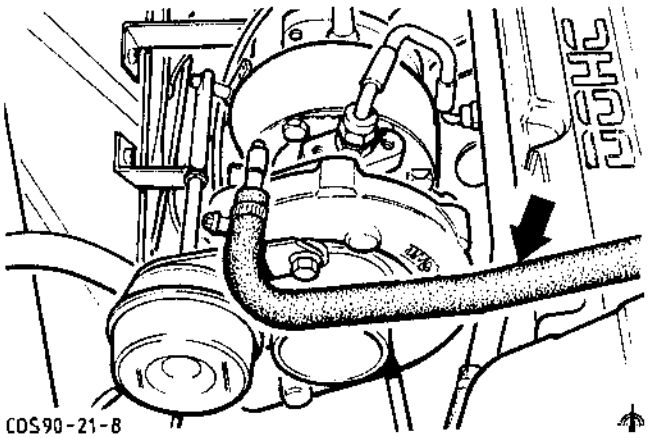


Fig.8. Coolant hose to overflow tank.

13. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.8, withdraw it from the engine lifting eye and place it to one side.

14. Unclip the throttle cable from the throttle linkage (1 clip). Compress two of the sprung tabs of the retaining clip using pliers and disconnect the throttle cable from the bracket, Fig.9.

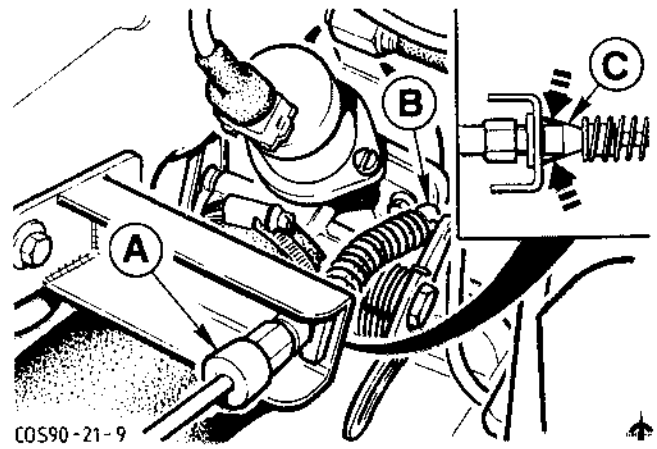


Fig.9. Disconnect throttle cable.
A - Throttle cable
B - Throttle linkage clip
C - Retaining clip

Fig.9. Disconnect throttle cable.

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15. Disconnect the air hose from the intercooler to the throttle housing, Fig.10.

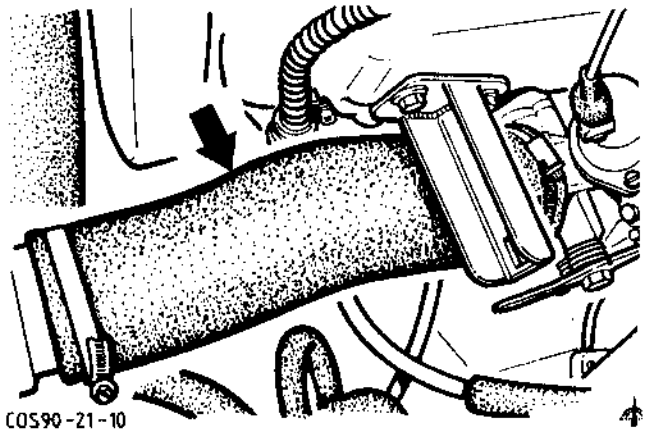

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Fig.10. Air hose from intercooler to throttle housing.

16. Raise the vehicle.

17. Detach the lower engine cover from the side members and the front axle/engine crossmember on the right and left-hand sides (6 bolts), Fig.11.
Remove cover.

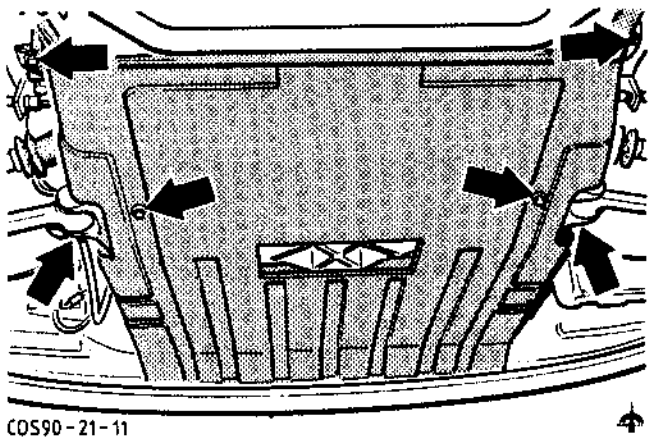

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Fig.11. Retaining bolts of lower engine cover.

18. Place a clean collecting tray under the radiator. Disconnect the lower right-hand coolant hose from the radiator, Fig.12, and drain the coolant.

19. Lower the vehicle to the ground.

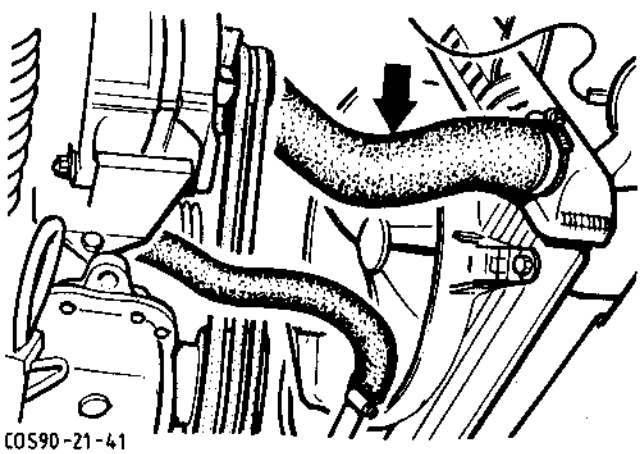

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Fig.12. Lower coolant hose on radiator.

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20. Disconnect the coolant hoses from the thermostat housing and remove the coolant hose running to the lower right-hand connection on the radiator, Fig.13.

Fig.13. Coolant hoses on thermostat housing.
A - To lower right-hand connection on radiator
B - To upper left-hand connection on radiator

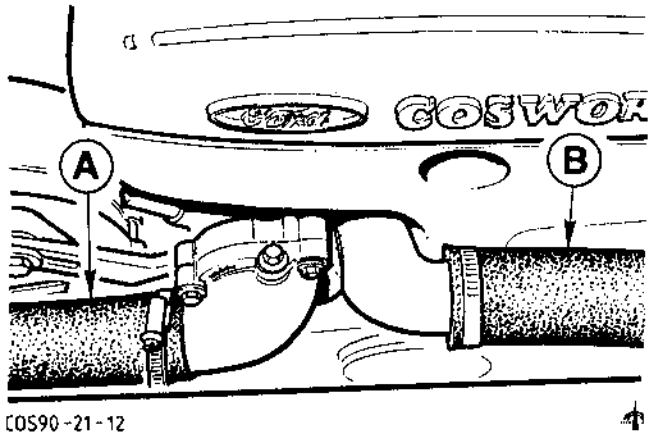


Fig.13. Coolant hoses on thermostat housing.

21. Disconnect the 2 coolant hoses from the heater radiator, Fig.14.

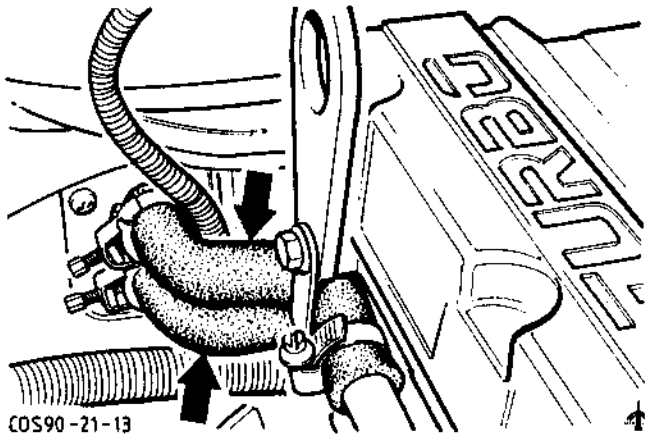


Fig.14. Coolant hoses to heater radiator.

22. Disconnect/unscrew the connector and wiring from the alternator, Fig.15 (A).

23. Disconnect the high tension lead running from the ignition coil to the distributor, Fig.15 (B).

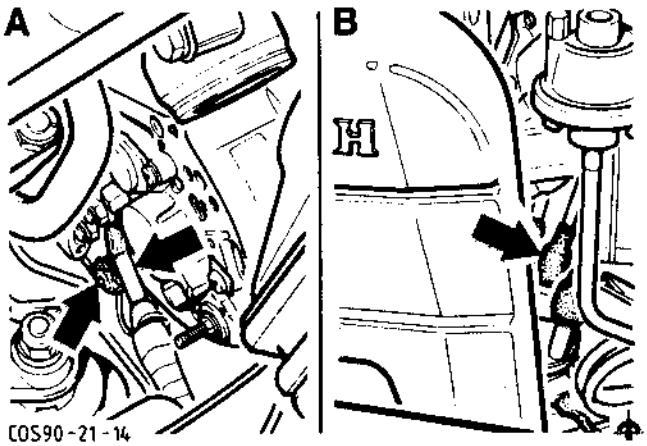


Fig.15. A - Electrical connections of alternator
B - Lead between distributor and ignition coil

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24. Disconnect the 3 engine wiring loom multiplugs and the multiplug of the reversing light switch, Fig.16.

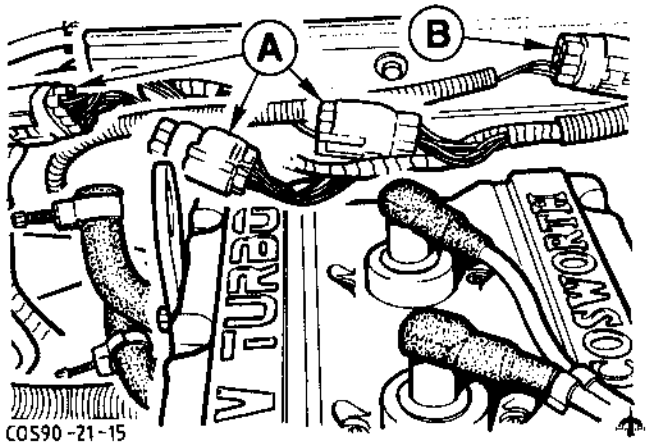


Fig.16. Multiplugs.
A - Engine wiring loom
B - Reversing light switch

25. Disconnect the fuel pipes:
- Insert the steel wire ends of Special Tool 23-027 A in the openings in the connector and press them in, pulling on the other part of the fuel feed pipe, Fig.17, and disconnect it.
- Disconnect the fuel return pipe, Fig.18, as described in sub-operation 25.

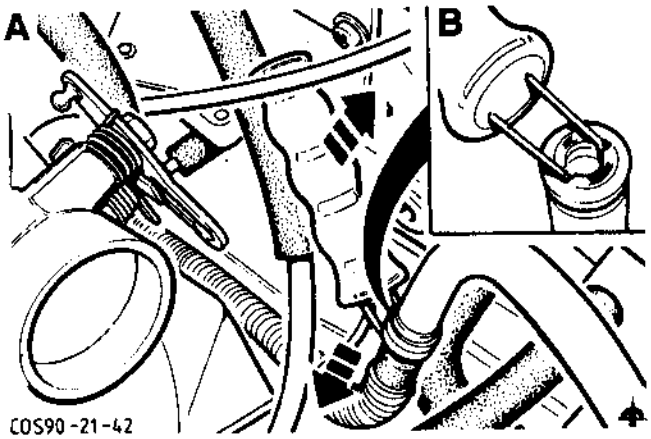


Fig.17. Fuel feed pipe.
A - Disconnect using Special Tool 23-027 A
B - Special Tool inserted (fuel pipes shown disconnected)

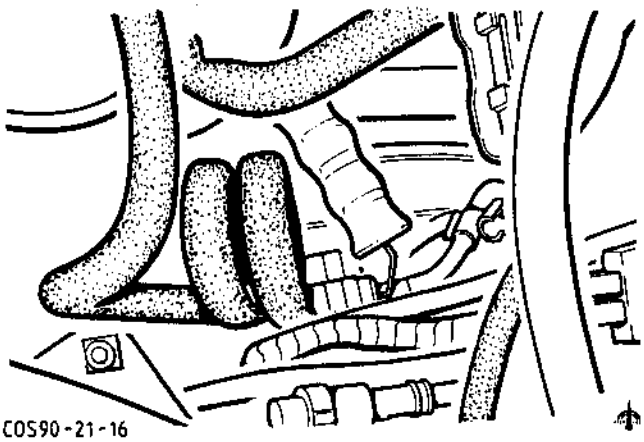


Fig.18. Disconnect fuel return pipe using Special Tool 23-027 A.

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26. Disconnect the oil feed hose from the reservoir and the high pressure pipe to the steering box from the power steering pump (1 banjo bolt, 1 clip), Fig.19 (A, B).

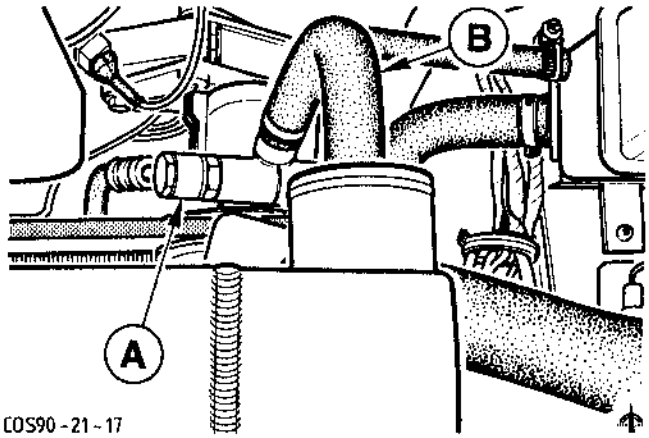


Fig.19. Power steering pump.
A - High-pressure pipe to steering box
B - Oil feed hose from reservoir

27. Unscrew the front exhaust pipe from the turbocharger (3 nuts), Fig.20.

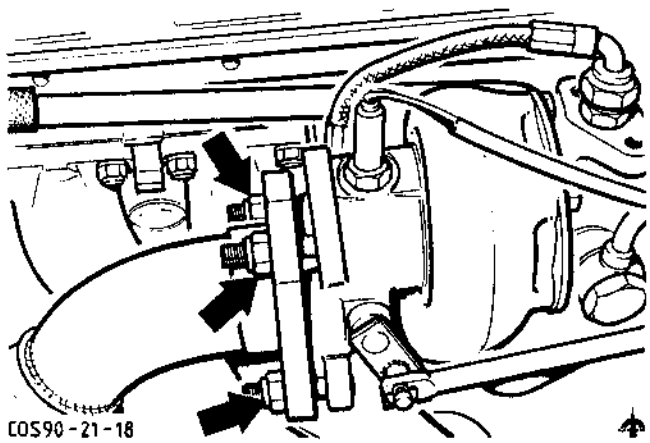


Fig.20. Nuts securing front exhaust pipe to turbocharger.

28. Disconnect the vacuum hose to the MAP sensor from the air chamber and the carbon canister vacuum hose from the T-piece, Fig.21.

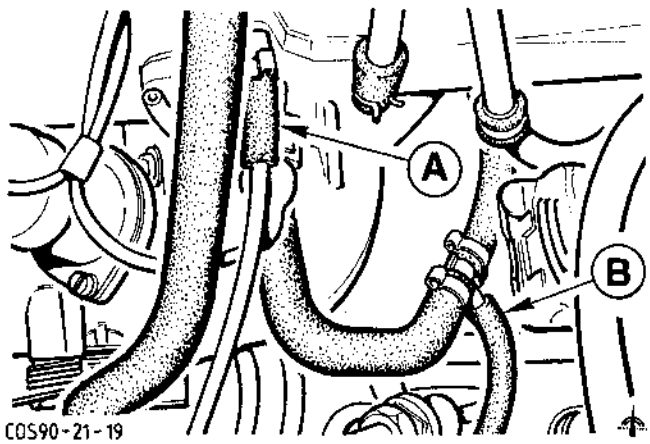


Fig.21. Vacuum hoses.
A - To MAP sensor
B - To carbon canister

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29. Unscrew and remove the nut on the right-hand engine mounting. Unscrew the self-locking nut on the vibration damper on the throttle housing and unscrew and remove the nut on the left-hand engine mounting, Fig.22.

Fig.22. Nuts of engine mountings.
A - Right
B - Left
C - Self-locking nut on vibration damper on throttle housing

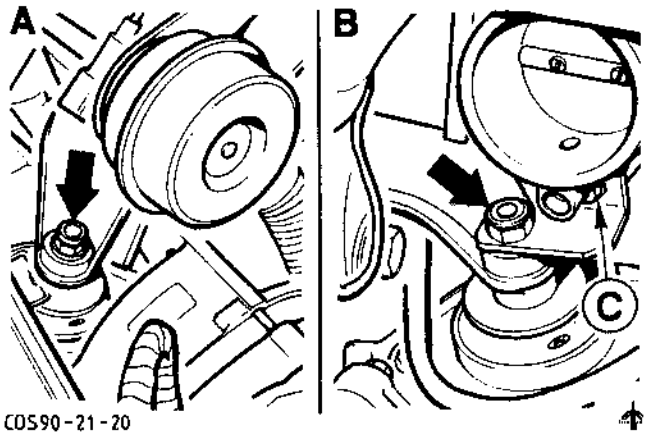


Fig.22. Nuts of engine mountings.

30. Remove the dust caps from the shock-absorber top mountings and fit engine support bar 21-140. Slacken the engine lifting eye bolts, angle the engine lifting eyes towards the engine support bar and tighten the bolts again. Attach the 2 chains to the spindles of the engine support bar and the engine lifting eyes, Fig.23. Turn the spindles on the engine support bar to take up the slack.

NOTE: Position the left-hand spindle of the engine support bar at the front and the right-hand spindle at the rear.

Fig.23. Engine support bar 21-140 in place.
A - Right-hand spindle at rear
B - Left-hand spindle at front
C - Engine lifting eyes angled obliquely

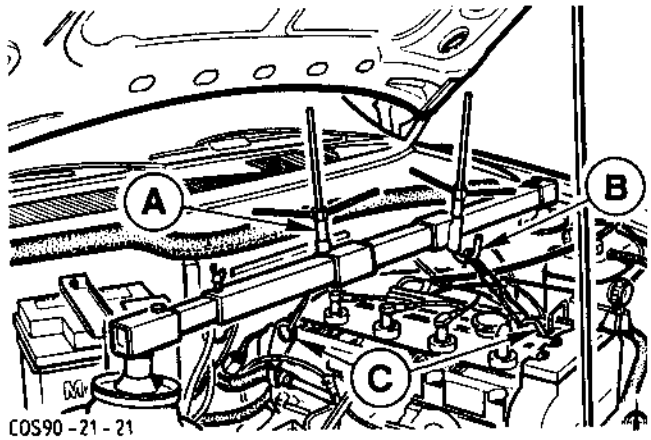


Fig.23. Engine support bar 21-140 in place.

31. Raise the vehicle.

32. Remove the front wheels.

33. Disconnect the oil hose from the power steering pump cooling circuit, Fig.24.

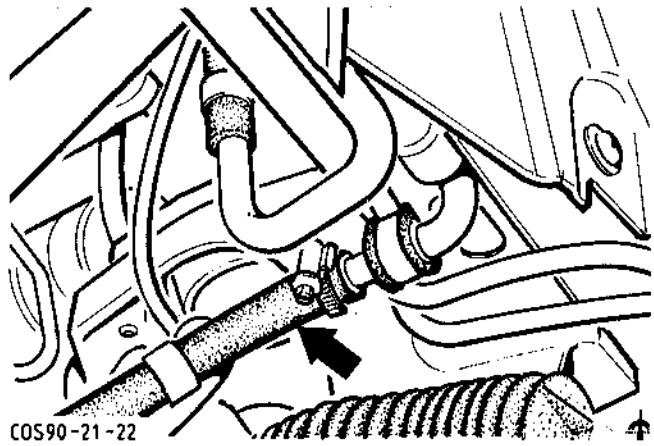


Fig.24. Hose to power steering pump cooling circuit.

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34. Disconnect the lower hose from the water pump, Fig.25.

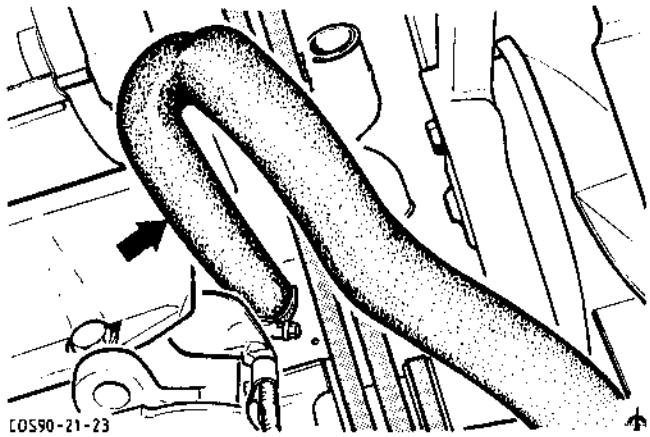


Fig.25. Lower hose to water pump.

35. Disconnect the track rod from the steering arm on both sides. Withdraw the split pin and unscrew the castellated nut on the track rod end. Press the track rod end out of the spindle carrier using Special Tool 13-006, Fig.26 (A, B, C). Remove the castellated nut and separate the track rod end from the spindle carrier.

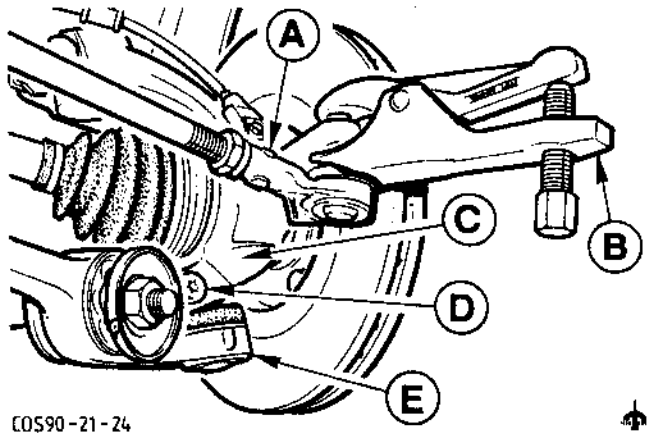


Fig.26. Front suspension.
A - Track rod
B - Special Tool 13-006
C - Spindle carrier
D - Lower suspension arm retaining bolt
E - Lower suspension arm
(Left-hand side shown)

Fig.26. Front suspension (Left-hand side shown).

36. Unscrew the Torx bolt and nut on both sides and lever the lower suspension arm downwards away from the spindle carrier, Fig.26 (C, D, E).

37. Unscrew the stabiliser bar brackets from the side members on the right and left-hand sides (4 bolts), Fig.27.

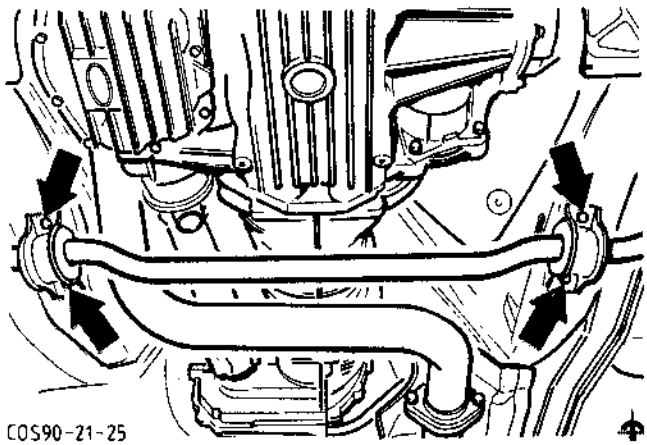


Fig.27. Retaining bolts of stabilizer bar brackets.

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38. Disconnect the intermediate steering shaft from the steering shaft (1 pinch bolt), Fig.28.

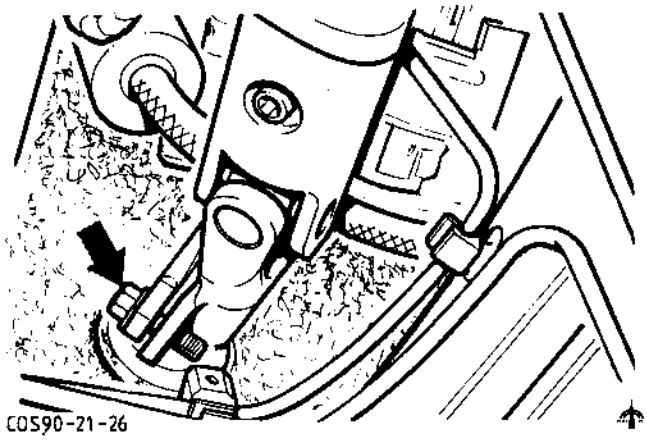


Fig.28. Bolt securing intermediate steering shaft.

39. Place a collecting tray under the front axle assembly, remove the housing cover (8 bolts), Fig.29, and drain off the oil.

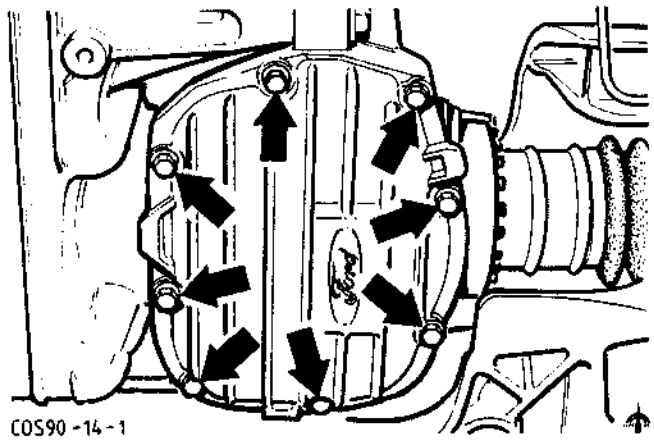


Fig.29. Bolts securing cover of front axle housing.

40. Remove the circlip securing the sideshaft shaft in the front axle assembly, Fig.30.

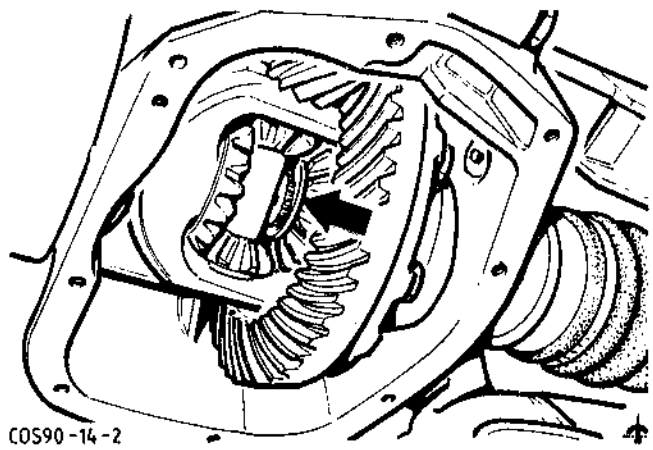


Fig.30. Circlip securing front axle shaft in front axle assembly.

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41. Disconnect the brake pipes from the brackets on the left and right-hand sides (2 U-shaped retainers), Fig.31 (A, D).

Fig.31. U-shaped brake pipe retainers and half shafts.
A - U-shaped retainer on right-hand side
B - Sideshaft on right-hand side
C - Sideshaft on left-hand side
D - U-shaped retainer on left-hand side

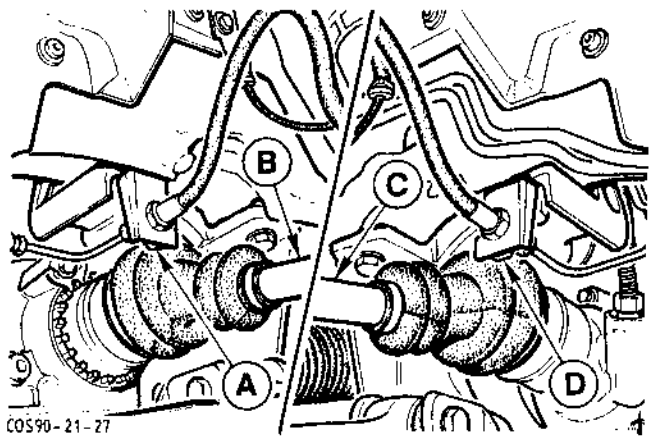


Fig.31. U-shaped brake pipe retainers and half shafts.

42. Pull the drive joint out of the front axle assembly (on the right-hand side) and out of the intermediate shaft (on the left-hand side), Fig.31 (B, C).

43. Suspend the right and left-hand sideshafts with wire, Fig.32.

NOTE: The inner drive joints must not be bent at more than 20° and the outer drive joints must not be bent at more than 45°.

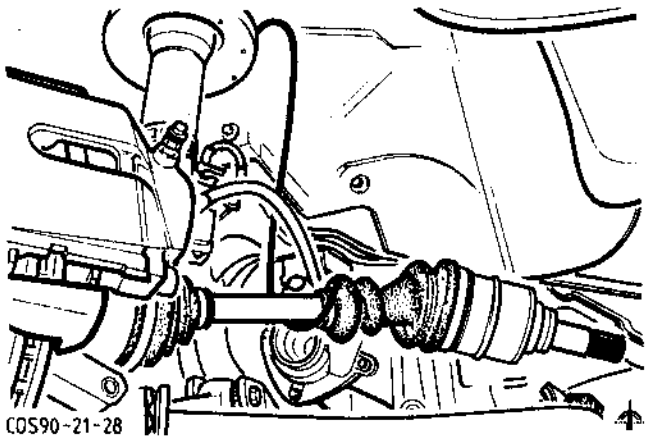


Fig.32. Sideshaft suspended (Left-hand side shown).

44. Pull the connector off the terminal on the starter motor, Fig.33 (A).

45. Unscrew the speedometer drive cable union nut from the intermediate shaft housing cover and withdraw the speedometer drive cable, Fig.33 (B).

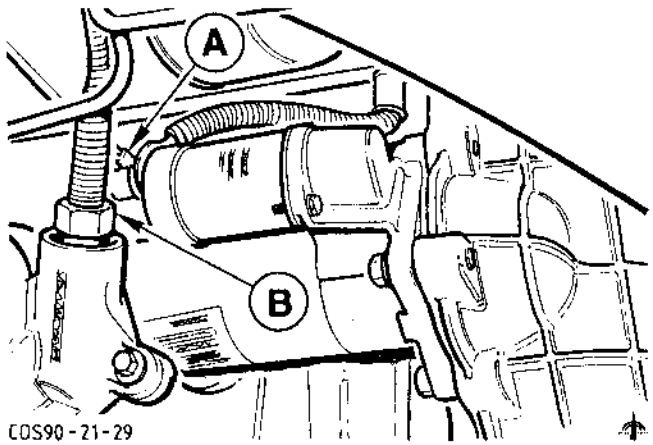


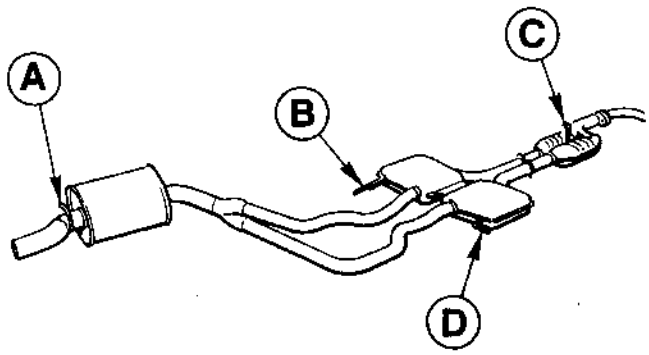
Fig.33. A - Connector on starter motor
B - Speedometer drive cable

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46. Remove the exhaust system complete, Fig.34:

- Unscrew the middle left-hand exhaust mounting bracket from the rear axle crossmember (2 bolts).
- Release the exhaust system from the front, middle right and rear mountings and remove it.

Fig.34. Exhaust system mountings.
A - Rear
B - Middle left (bolts)
C - Front
D - Middle right
(Exhaust system removed for clarity)

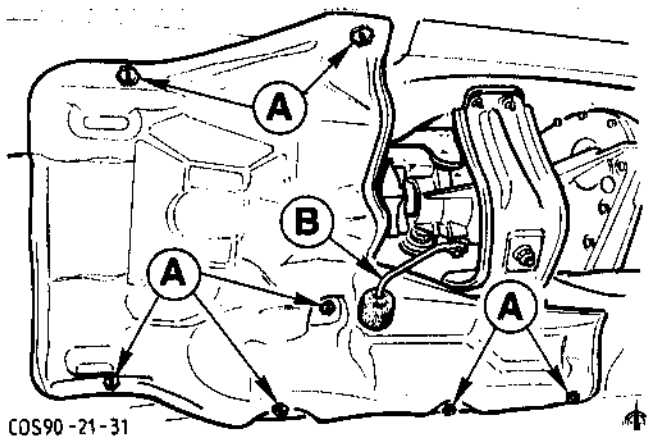


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Fig.34. Exhaust mountings (exhaust system removed for clarity).

47. Unscrew the exhaust mounting bracket from the transfer box (1 bolt), Fig.35 (B).

48. Release the exhaust system heat shield from the floor assembly (7 clips), Fig.35 (A).



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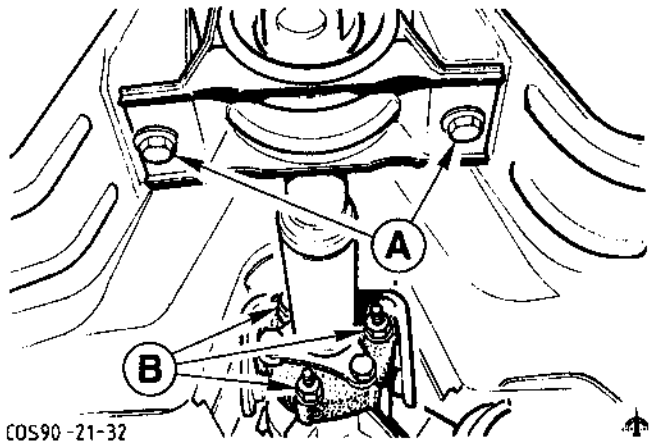
Fig.35. A - Heat shield clips
B - Exhaust mounting bracket

49. Unscrew the 3 nuts securing the driveshaft to the Torx studs on the output flange, Fig.36 (B), holding the Torx studs with a Torx wrench (see PROPRIETARY TOOLS).

Unscrew the 2 centre bearing retaining bolts and remove them with the U-shaped washers, Fig.36 (A).

Unscrew the 4 retaining bolts from the rear axle drive flange.

Remove the driveshaft complete.



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Fig.36. Driveshaft fixture.
A - Centre bearing bolts
B - Output flange nuts

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50. Pull off the rubber gaiter over the clutch cable and disconnect the clutch cable from the clutch release lever, Fig.37.

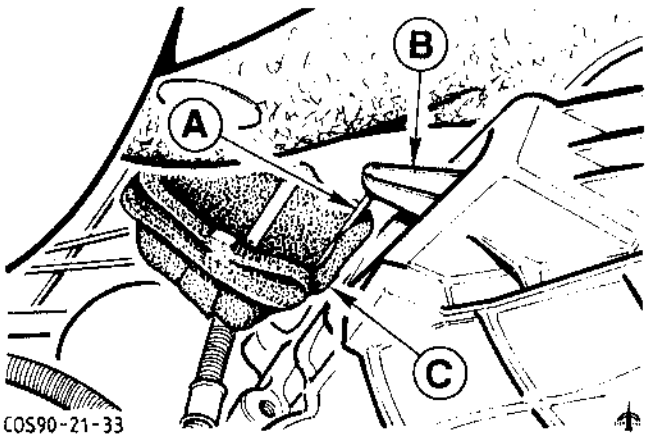


Fig.37. A - Clutch cable
B - Clutch release lever
C - Rubber gaiter

51. Support the front axle/engine crossmember on a jack and disconnect it from the side members together with the brake pipe brackets (4 bolts). Remove the front axle/engine crossmember with the steering gear, lower suspension arms and stabiliser bar, Fig.38.

52. Support the transmission on a jack. Unscrew and remove the transmission mounting retaining nut and 2 diagonally opposed transmission crossmember retaining nuts from the floor assembly. Only slacken the remaining 2 transmission crossmember retaining nuts so that the nuts are still fully engaged on the threads on the studs, Fig.39.

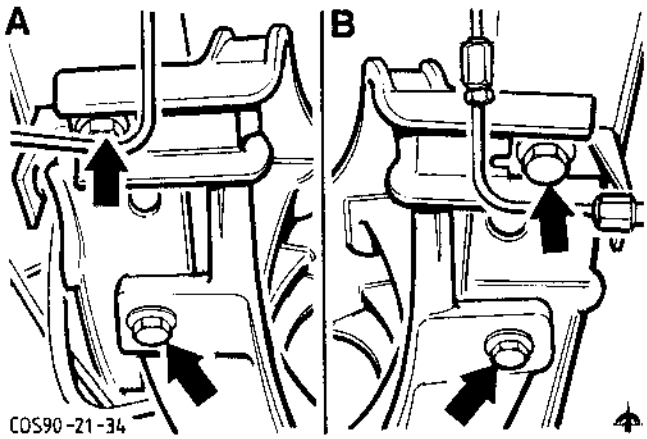


Fig.38. Retaining bolts of front axle/engine crossmember.
A - Left-hand side
B - Right-hand side

53. Position a trolley under the engine and transmission assembly. Lower the vehicle until the engine and transmission assembly is resting on the trolley. Support the engine and transmission assembly on the trolley with blocks.

54. Unscrew the 2 transmission crossmember retaining nuts and separate the transmission crossmember from the floor assembly, Fig.39.

55. Disconnect the engine support bar from the engine lifting eyes and carefully raise the vehicle. Move the engine and transmission assembly out from under the vehicle.

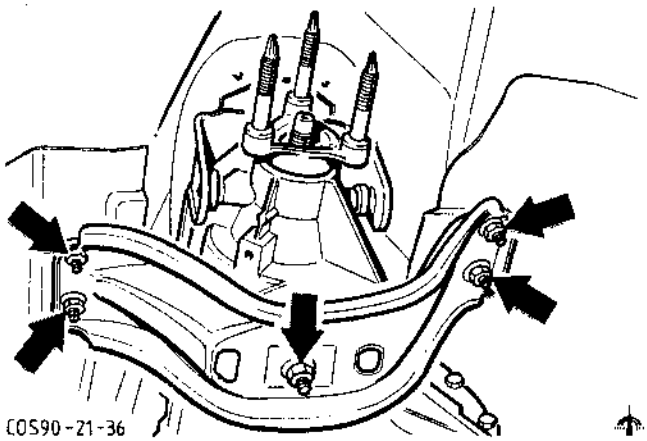


Fig.39. Transmission crossmember retaining nuts.

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To Install

NOTE: When installing, tighten the nuts, bolts and hose/pipe unions as specified in Technical Data. Relay the wiring and vacuum pipes/hoses and secure them with cable ties.

56. Position the engine and transmission assembly under the vehicle on the trolley. Carefully lower the vehicle and attach the engine support bar to the engine lifting eyes.

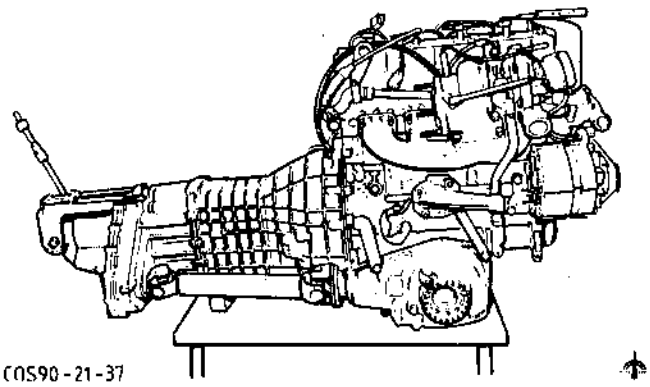


Fig.40. Engine and transmission assembly removed on trolley.

57. Fit the transmission crossmember to the floor assembly. Fit the transmission crossmember retaining nuts and tighten finger tight.

58. Raise the vehicle.

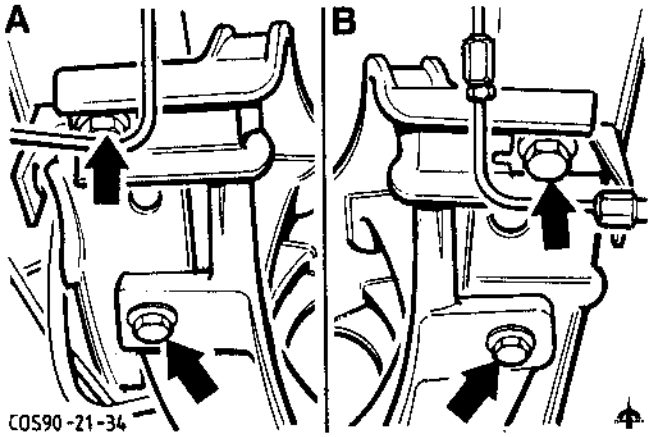


Fig.41. Retaining bolts of front axle/engine crossmember.
A - Left-hand side
B - Right-hand side

59. Locate the front axle/engine crossmember in the correct position with the aid of the jack. Guide the engine mounting studs into the engine mountings on the right and left-hand sides. Fit the engine mounting nuts and do them up finger tight. Bolt the front axle/engine crossmember to the side members, Fig.41.
Remove the jack.

NOTE: Guide the throttle housing support bracket over the engine mounting stud.

60. Tighten the retaining nuts of the transmission crossmember and the transmission mounting.

61. Connect the clutch cable to the clutch release lever and refit the rubber gaiter over the clutch cable, Fig.42.

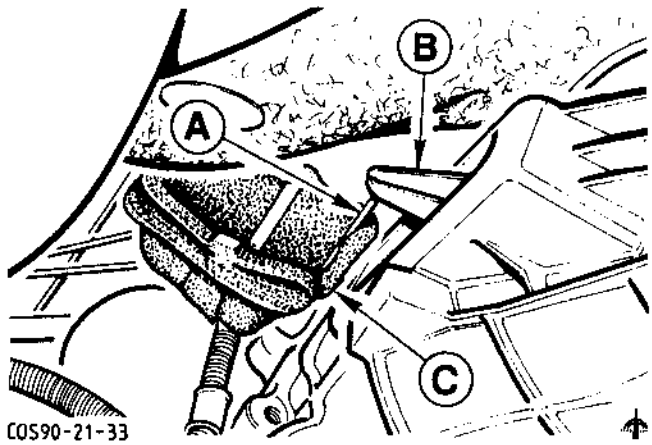


Fig.42. A - Clutch cable
B - Clutch release lever
C - Rubber gaiter

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62. Assemble the driveshaft to the rear axle if separated.

NOTE: When assembling, guide the master spline into the double groove, Fig.43.

63. Before connecting the rubber coupling on the driveshaft to the output flange on the transmission, check that the Torx studs are seated securely in the transmission output flange by placing a torque wrench with a Torx socket (see PROPRIETARY TOOLS) on the Torx head and applying the specified torque in the tightening direction. Remove any studs which turn and refit them as described below.

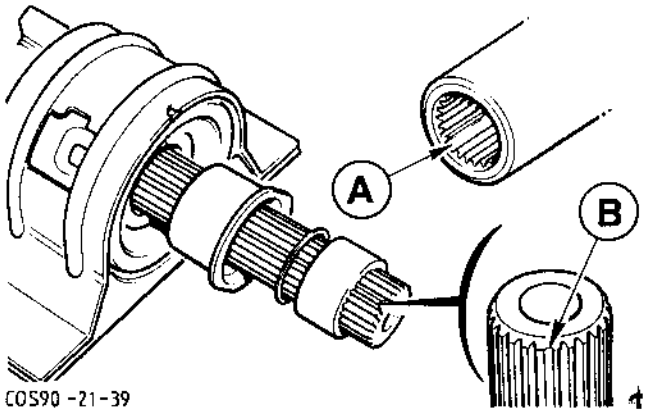


Fig.43. Driveshaft to rear axle separated.
A - Double groove
B - Master spline

- Clean the threaded drillings in the transmission output flange, Fig.44 (C), and the threads of the studs, Fig.44 (A), to remove all traces of grease and dirt.

Fig.44. Transmission output flange with Torx studs.
A - Torx stud
B - Thread-locking compound
C - Threaded drilling

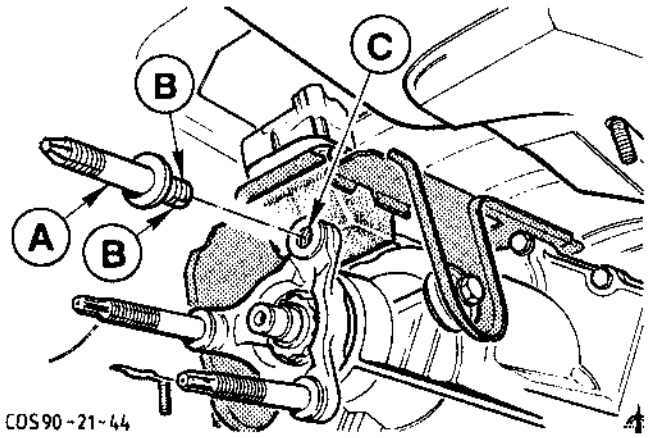


Fig.44. Transmission output flange with studs.

- Apply 2 drops of thread-locking compound (see Technical Data) offset at 180° on the flange-end thread of the stud, Fig.44 (B).
- Insert the stud and tighten it to the specified torque.

NOTE: The stud must be tightened completely within a maximum of 5 minutes of applying the thread-locking compound.

- Let the thread-locking compound harden for 30 minutes.

64. Locate the driveshaft in position.

Connect the driveshaft to the transmission output flange using new nuts. Connect the driveshaft to the rear axle and fit the driveshaft centre bearing to the floor assembly, Fig.45.

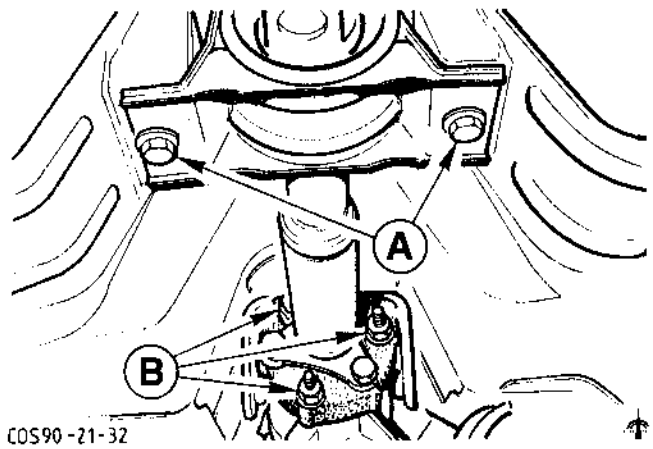


Fig.45. Driveshaft fixture.
A - Centre bearing bolts
B - Output flange nuts

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65. Fit the exhaust system heat shield to the floor assembly, Fig.46 (A).

66. Fit the exhaust mounting bracket to the transfer box, Fig.46 (B).

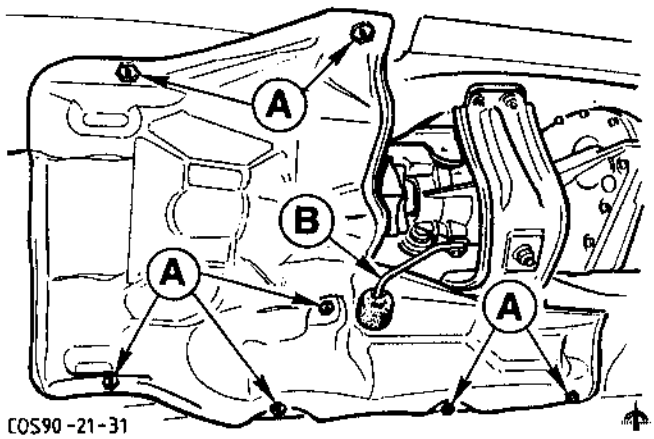


Fig.46. A - Heat shield clips
B - Exhaust mounting bracket

67. Fit the exhaust system complete, Fig.4:

- Attach the exhaust system to the rear, middle right and front mountings.
- Secure the middle exhaust mounting bracket on the left-hand side to the rear axle crossmember and suspend the exhaust system from the middle exhaust mounting bracket on the left-hand side.

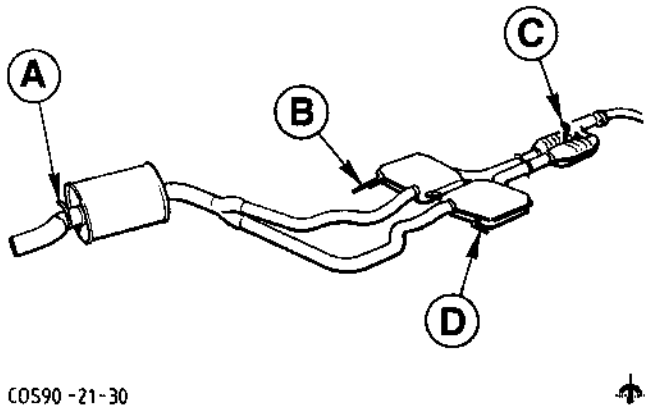


Fig.47. Exhaust system mountings.
A - Rear
B - Middle left
C - Front
D - Middle right
(Exhaust system removed for clarity)

Fig.47. Exhaust system mountings
(Exhaust system removed for clarity).

68. Connect the plug to the starter motor terminal, Fig.48 (A).

69. Insert the speedometer drive cable in the intermediate shaft housing cover and fit and tighten the speedometer drive cable union nut, Fig.48 (B).

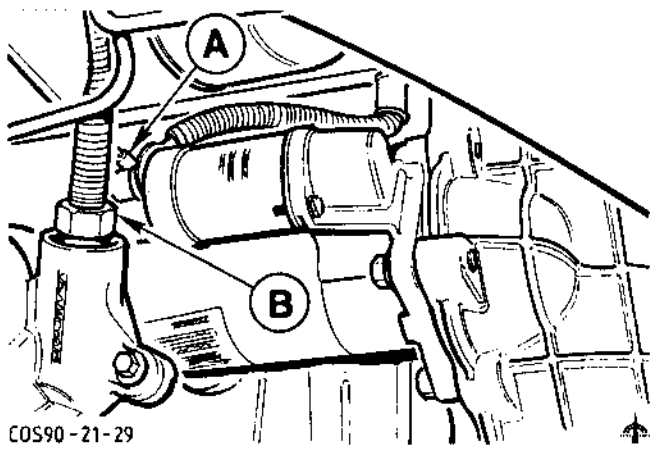


Fig.48. A - Connector on starter motor
B - Speedometer drive cable

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70. Insert the drive joint in the intermediate shaft (on the left-hand side) using a new circlip, Fig.49 (C).

Fig.49. U-shaped brake pipe retainer and side shaft.
A - U-shaped retainer, right
B - Sideshaft, right
C - Sideshaft, left
D - U-shaped retainer, left

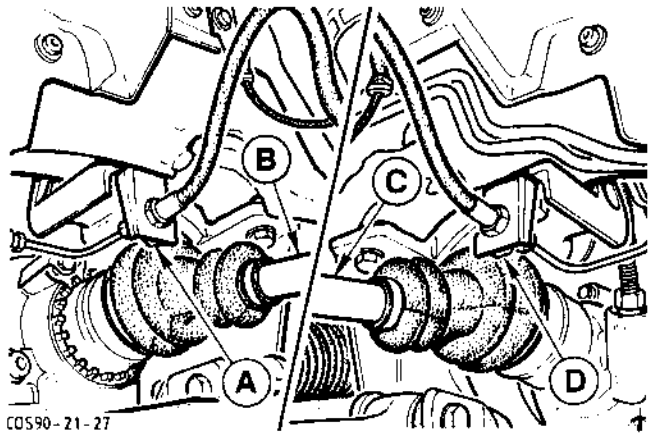


Fig.49. U-shaped brake pipe retainer and sideshaft.

71. Insert the sideshaft drive joint in the front axle assembly (right-hand side), Fig.49 (B), and secure it using a new circlip, Fig.50.

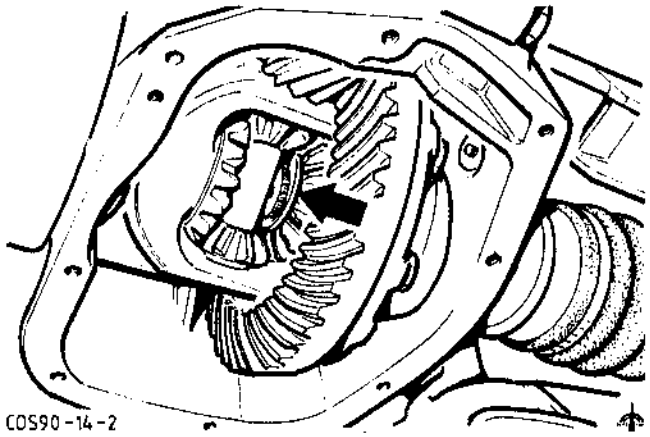


Fig.50. Circlip securing sideshaft in front axle assembly.

72. Fit the cover to the front axle housing using the appropriate sealer (see Technical Data for specification), Fig.51.

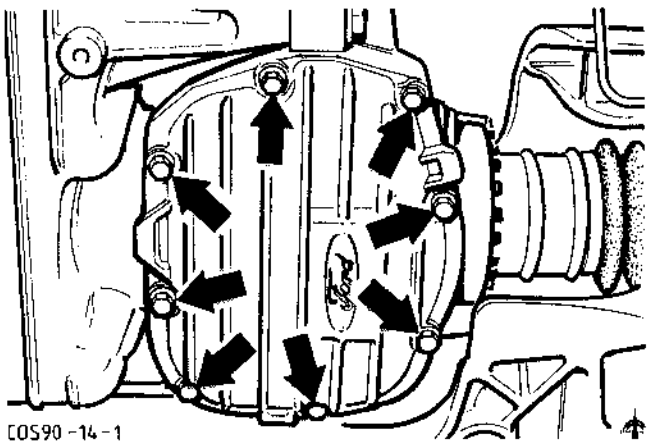


Fig.51. Retaining bolts of cover of front axle housing.

73. Fit the brake pipes to the brackets on the left and right-hand sides and secure them with the U-shaped retainers, Fig.49 (A, D).

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74. Centre the steering wheel and the steering gear. Connect the intermediate steering shaft to the steering shaft, Fig.52.

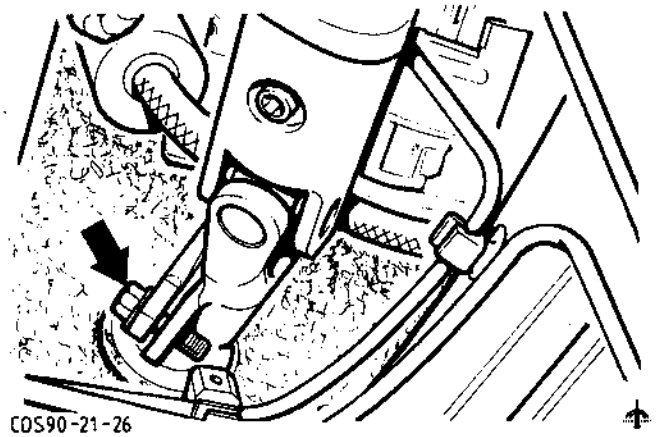


Fig.52. Bolt securing intermediate steering shaft.

75. Fit the stabiliser bar brackets to the side members on the left and right-hand sides, Fig.53.

NOTE: Make sure the rubber bushes are seated correctly.

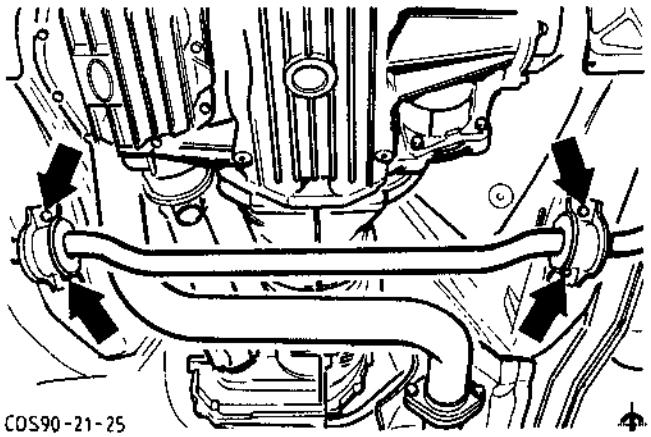


Fig.53. Retaining bolts of stabiliser bar brackets.

76. Fit the lower suspension arm to the spindle carrier (on both sides), Fig.54.

77. Connect the track rod to the steering arm. Fit the castellated nut on the track rod end, tighten and lock it using a new split pin (on both sides).

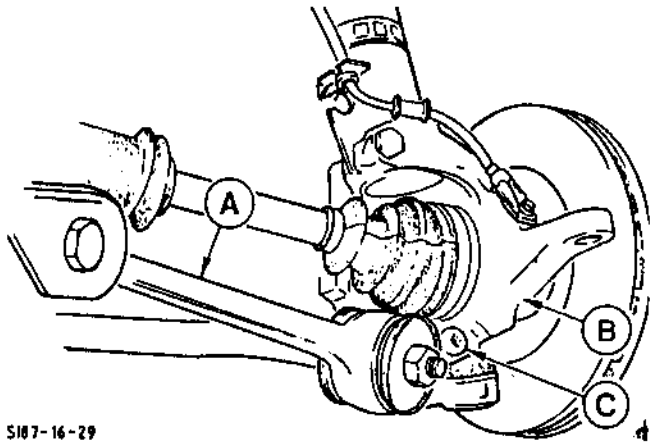


Fig.54. A - Lower suspension arm
B - Spindle carrier
C - Torx bolt and nut

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78. Connect the lower hose to the water pump, Fig.55.

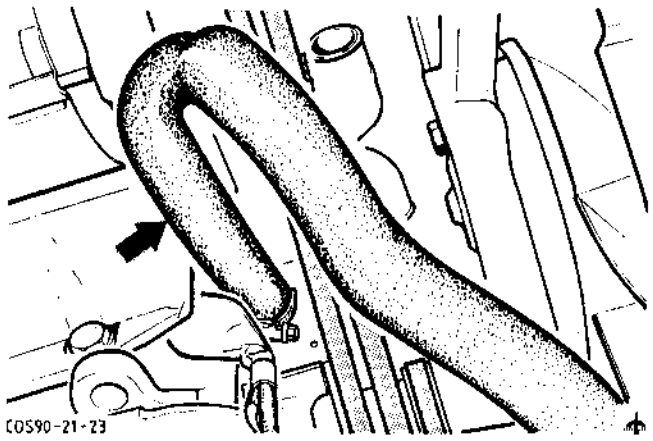


Fig.55. Lower hose to water pump.

79. Connect the lower right-hand coolant hose to the radiator, Fig.56.

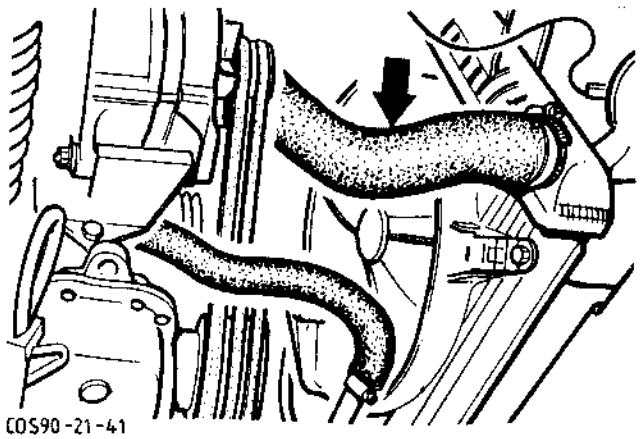


Fig.56. Lower coolant hose to radiator.

80. Connect the oil hose to the power steering pump cooling circuit, Fig.57.

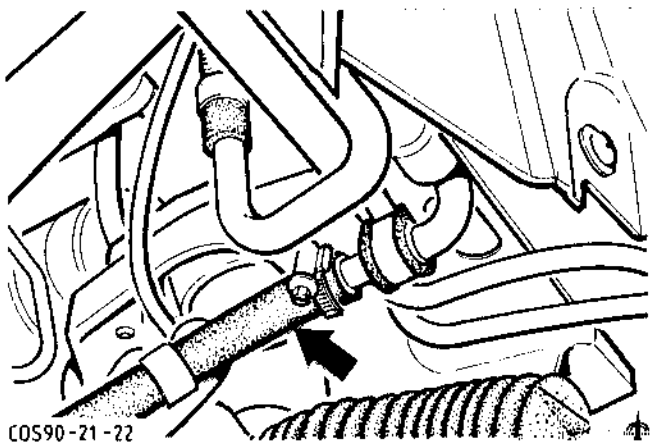


Fig.57. Oil hose to power steering pump cooling circuit.

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81. Fill the front axle assembly with oil (see Technical Data for quantity and specification), Fig.58.

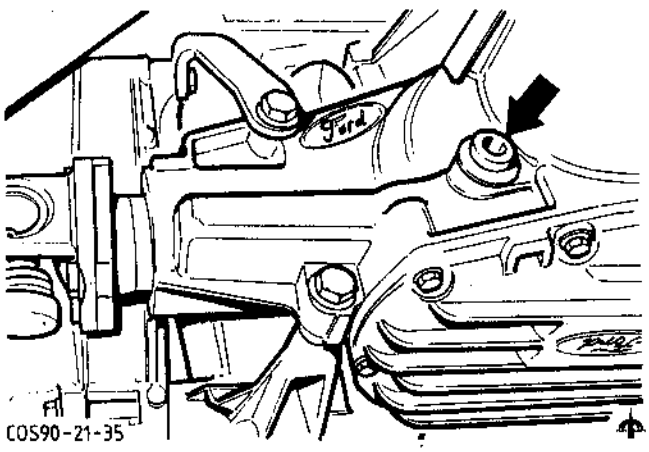


Fig.58. Front axle assembly filler plug.

82. Fit the front wheels.

83. Fit the lower engine cover to the side members and the front axle/engine crossmember, Fig.59.

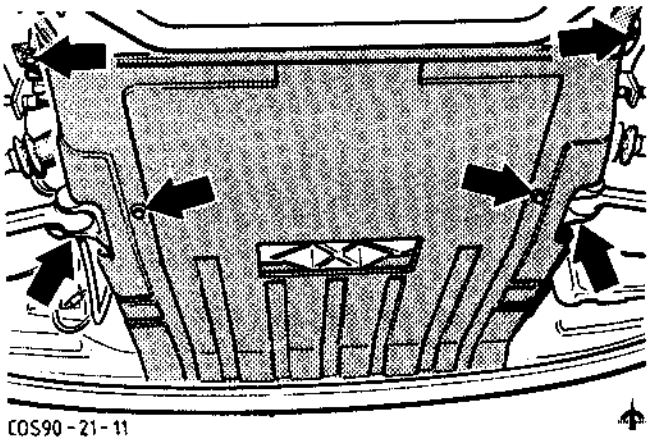


Fig.59. Retaining bolts of lower engine cover.

84. Lower the vehicle to the ground and secure the front wheels.

85. Unscrew the spindles on the engine support bar and disconnect the chains. Remove the engine support bar. Slacken the engine lifting eye retaining bolts, align the engine lifting eyes vertically and tighten the retaining bolts. Refit the dust caps to the shock absorber top mountings, Fig.60.

Fig.60. Engine support bar 21-140 in place.
A - Right-hand spindle at rear
B - Left-hand spindle at front
C - Engine lifting eyes angled obliquely

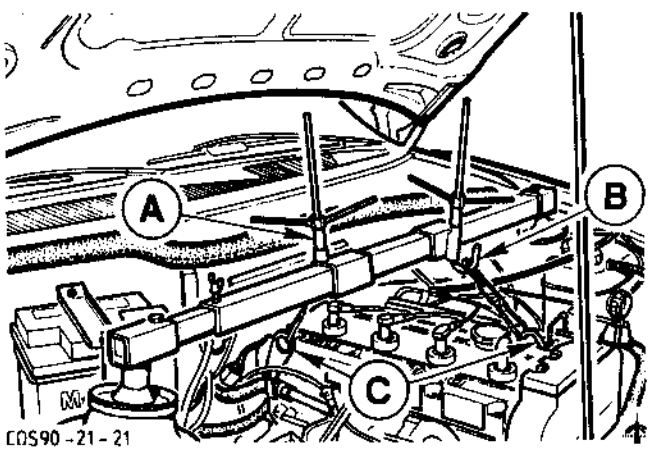


Fig.60. Engine support bar 21-140 in place.

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86. Fit a new self-locking nut on the vibration damper on the throttle housing but do not tighten it.

    Tighten the 2 engine mounting nuts, Fig.61 (A, B, C).

    Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken it half a turn.

NOTE: Make sure the spring washers are fitted correctly, Fig.61 (D).

Fig.61. Nuts of engine mountings and vibration damper.
- A - Right
- B - Left
- C - Self-locking nut on vibration damper on throttle housing
- D - Arrangement of spring washers

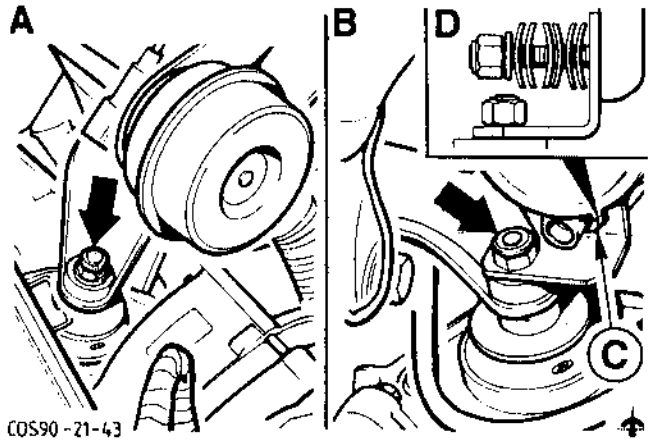


Fig.61. Nuts of engine mountings and vibration damper.

87. Connect the vacuum hose running to the MAP sensor to the air chamber and the vacuum hose of the carbon canister to the T-piece, Fig.62.

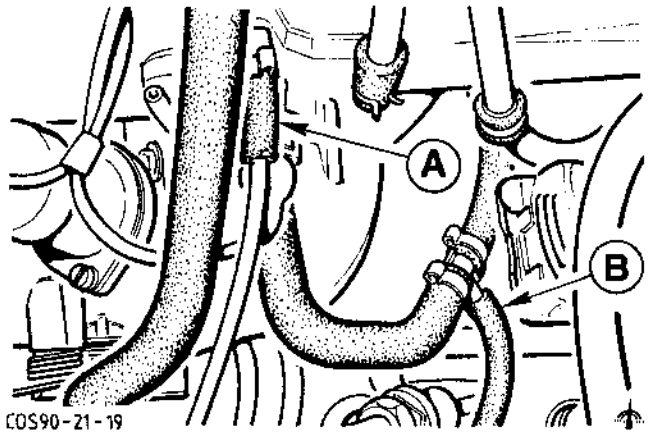


Fig.62. Vacuum hoses.
- A - To MAP sensor
- B - To carbon canister

88. Fit the front exhaust pipe to the turbocharger, Fig.63.

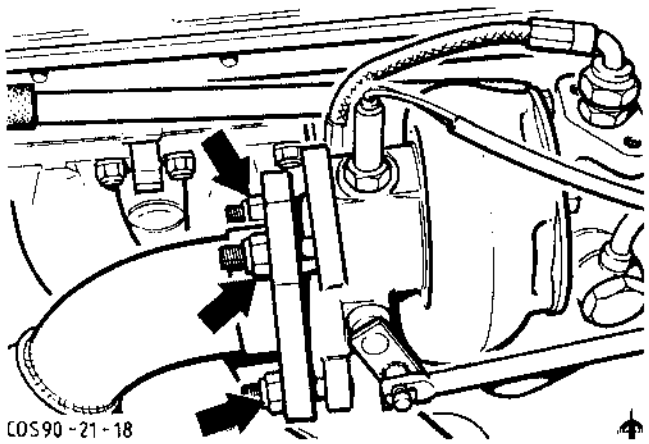


Fig.63. Nuts securing front exhaust pipe to turbocharger.

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89. Connect the oil feed hose from the reservoir and the high-pressure pipe from the steering box to the power steering pump, Fig.64.

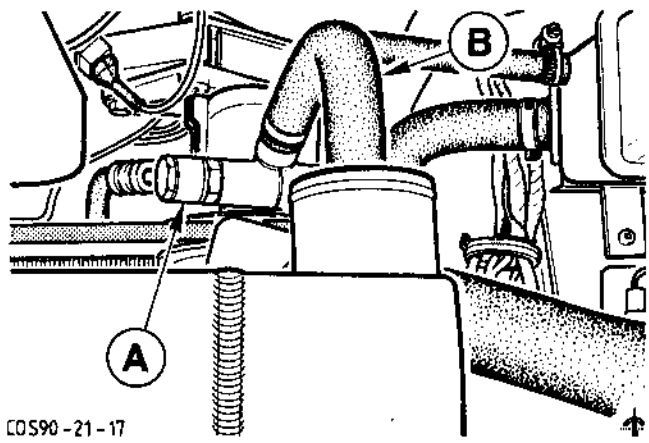


Fig.64. Power steering pump.
A - High-pressure pipe to steering box
B - Oil feed hose from reservoir

90. Connect the fuel feed pipe and fuel return pipe, Fig.65.

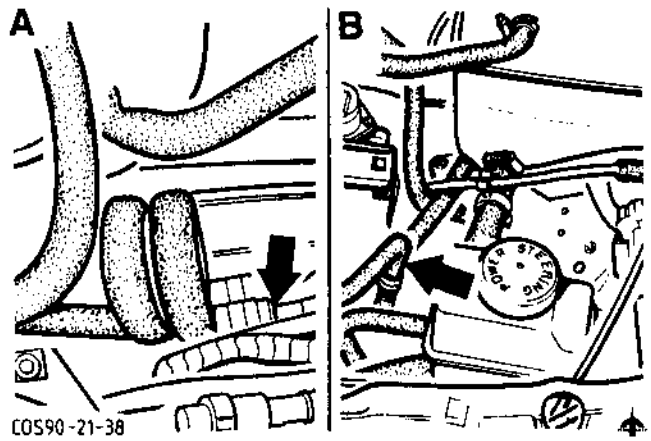


Fig.65. Fuel pipes connected.
A - Feed pipe
B - Return pipe

91. Connect the 3 multiplugs of the engine wiring loom and the multiplug of the reversing light switch, Fig.66.

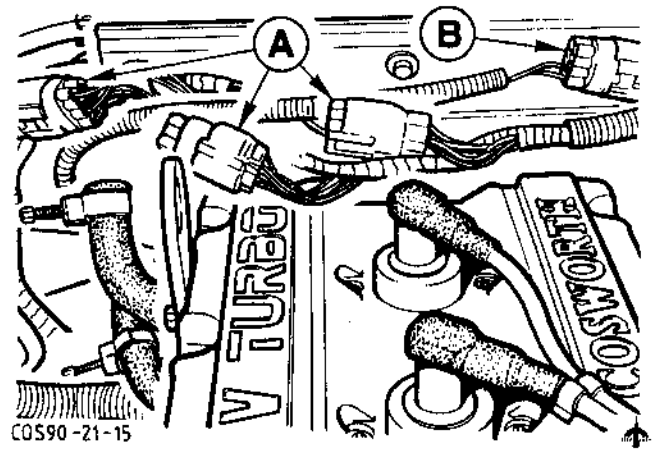
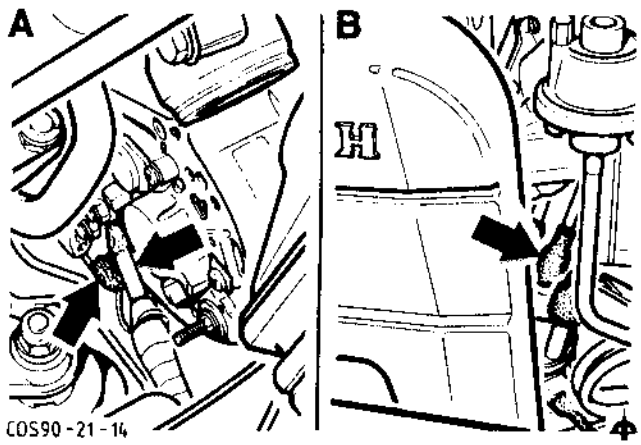


Fig.66. Multiplugs.
A - Engine wiring loom
B - Reversing light switch

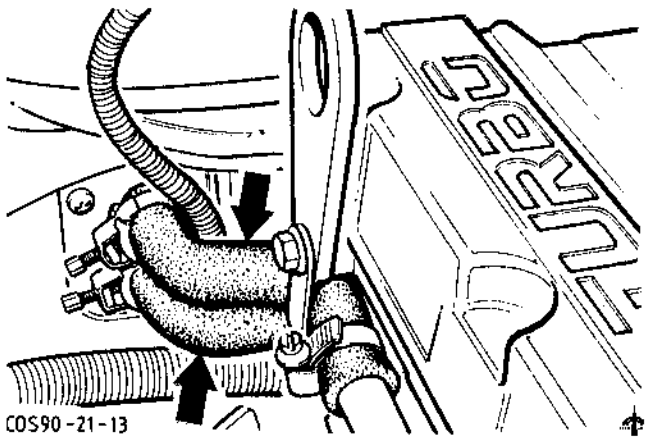
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92. Connect the high tension lead from the ignition coil to the distributor, Fig.67 (B).



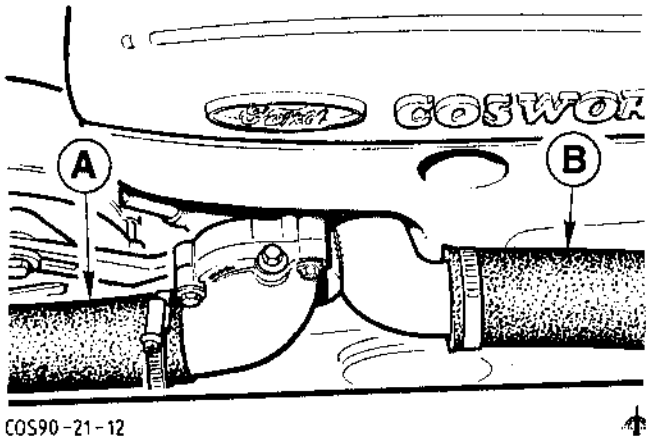
93. Connect the connector and wiring to the alternator, Fig.67 (A).

Fig.67. A - Electrical connections on alternator
B - Lead between distributor and ignition coil



94. Connect the 2 coolant hoses to the heater radiator, Fig.68.

Fig.68. Coolant hoses on heater radiator.



95. Connect the coolant hoses to the thermostat housing, Fig.69.

Fig.69. Coolant hoses on thermostat housing.
A - To lower right connection on radiator
B - To upper left connection on radiator

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96. Connect the air hose running from the intercooler to the throttle housing, Fig.70.

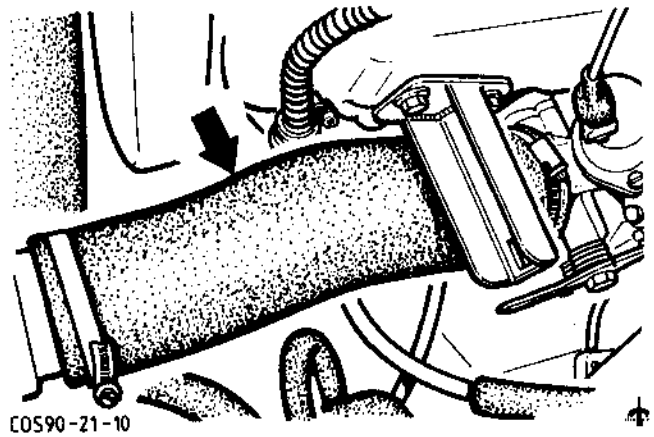


Fig.70. Air hose from intercooler to throttle housing.

97. Guide the throttle cable and retaining clip into the opening in the throttle cable bracket and clip it in place. Clip the throttle cable to the throttle linkage, Fig.71.

NOTE: Position the sprung locking tabs vertically to facilitate removal.

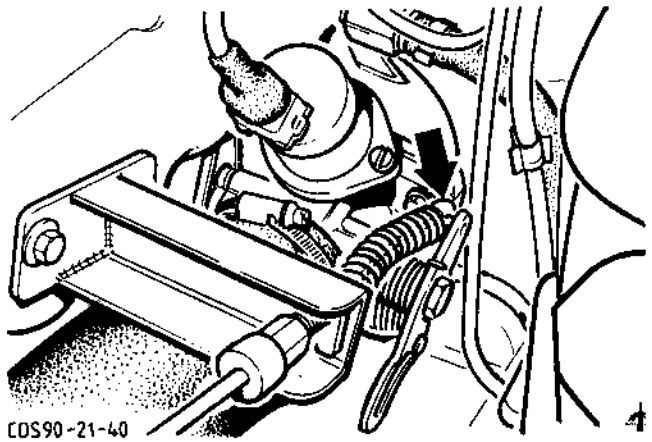


Fig.71. Throttle cable fixture.

98. Run the coolant hose to the degas tank through the engine lifting eye and connect it to the connector on the turbocharger, Fig.72.

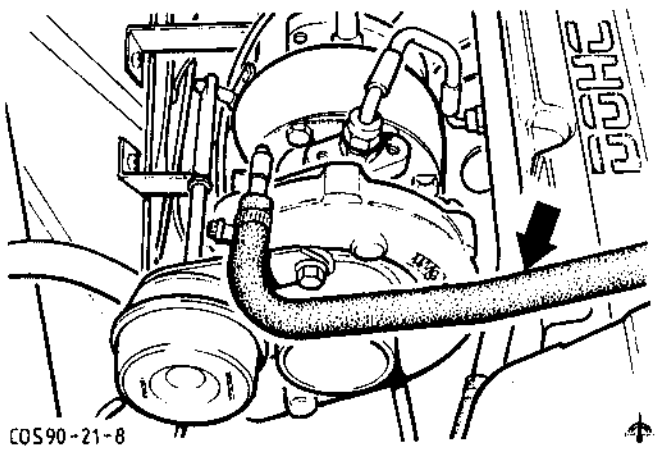


Fig.72. Coolant hose to degas tank.

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99. Connect the lower air hose to the turbocharger and to the intercooler, Fig.73 (C).

Fig.73. Solenoid control valve and lower air hose to turbocharger.
A - Vacuum pipe to diaphragm unit
B - Vacuum pipe to compressor casing
C - Lower air hose to turbocharger
D - Solenoid control valve
E - Multiplug
F - Retaining screws

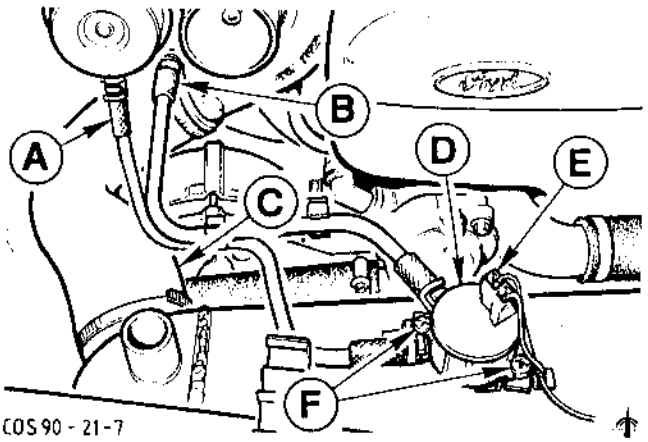
100. Fit the solenoid control valve to the intercooler:

- Fit the solenoid control valve and vacuum hoses to the intercooler, Fig.73 (D, F).
- Connect the vacuum pipe of the solenoid control valve to the turbocharger diaphragm unit, Fig.73 (A), and to the turbocharger compressor casing, Fig.73 (B).
- Connect the multiplug of the solenoid control valve, Fig.73 (E).

101. Fit the air cleaner cover with the air hoses, Fig.75.

- Place the air cleaner element in the air cleaner casing.
- Fit the air cleaner cover and air hoses/pipes to the air cleaner casing and clip it in place.
- Connect the vacuum pipe from the by-pass valve to the inlet manifold air chamber and clip it to the upper crossmember.
- Connect the air hose from the by-pass valve to the intercooler.
- Connect the air intake hose to the turbocharger.
- Connect the air pipe from the engine breather valve to the connecting hose and clip it to the upper crossmember. Connect the air pipe from the air cleaner cover to the solenoid valve.

Fig.75. Air cleaner cover and air hoses.
A - Air cleaner cover
B - To engine breather valve
C - To turbocharger
D - From solenoid control valve
E - Connecting hose from engine breather valve air pipe
F - By-pass valve to intercooler
G - Clips
H - Vacuum pipe from by-pass valve to inlet manifold air chamber
J - Connection of vacuum pipe from by-pass valve



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Fig.73. Solenoid control valve and lower air hose to turbocharger.

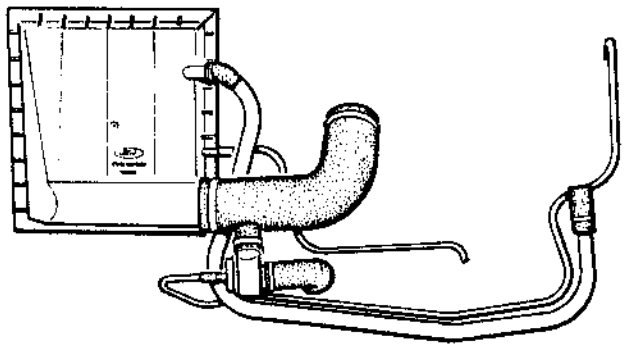
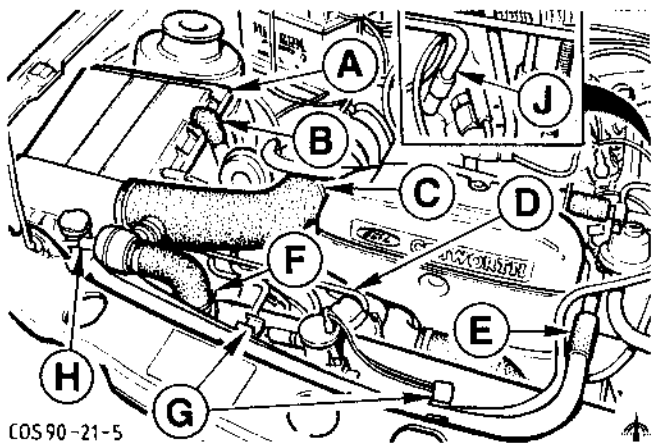

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Fig.74. Air cleaner cover and air hoses/pipes removed.



COS90-21-5

Fig.75. Air cleaner cover with air hoses/pipes.

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102. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.76 (A, C, D).

Fig.76. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

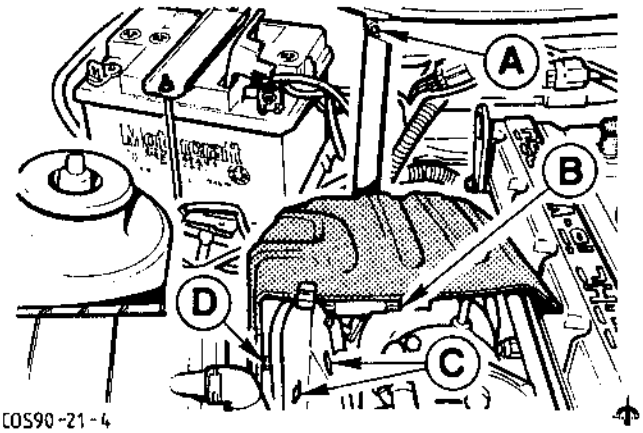


Fig.76. Turbocharger heat shield.

103. Connect the multiplug of the HEGO sensor and clip to the heat shield, Fig.76 (B).

104. Slip the noise damping pad retaining frame and damping pad over the gear lever and secure them, Fig.77 (D, E, F).

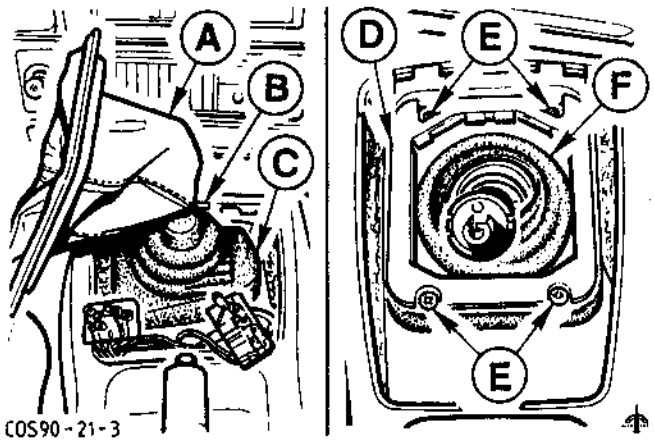


Fig.77. Gaiters and noise damping pad retaining frame.
A - Outer gaiter
B - Cable tie
C - Inner gaiter
D - Noise damping pad retaining frame
E - Retaining screws
F - Noise damping pad

105. Slip the inner gear lever gaiter over the gear lever and pull it down onto the retaining frame, Fig.77 (C).

106. Fit the outer gear lever gaiter over the gear lever and pull it up inside out. Secure the gaiter with a cable tie and pull it down into position, Fig.77 (A, B).

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107. Fit the retaining frame to the console, Fig.78 (C, D).

Fig.78. Gear lever with gaiter retaining frame.
A - Gear lever knob
B - Cover plate
C - Retaining frame
D - Screw securing retaining frame
E - Multiplugs of electric window switches

108. Connect the 2 multiplugs of the electric window switches and clip the switches into the cover plate.

Fit the cover plate in the retaining frame and refit the gear lever knob, Fig.78 (A, B, E). Remove the support from under the clutch pedal.

109. Connect the earth cable and the starter motor positive cable to the battery. Screw the earth cable to the battery tray, Fig.79.

110. Fill the cooling system up to the MAX mark in the overflow tank (see Technical Data for quantity and specification), unscrewing the bleed screw on the thermostat housing to allow air to escape from the cooling system, Fig.80.

Apply sealer (see Technical Data for specification), insert and tighten the bleed screw.

NOTE: Fill the cooling system slowly so that air bubbles can escape.

111. Check the engine oil level and top up with oil as necessary (see Technical Data for specification).

112. Fill the power steering reservoir and bleed the system as indicated in Operation 13 416 1 (see Technical Data for quantity and specification).

113. Start the engine and run it up to normal operating temperature. Check all the coolant/oil hose connections for leaks and top up with coolant and oil as necessary.

114. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.

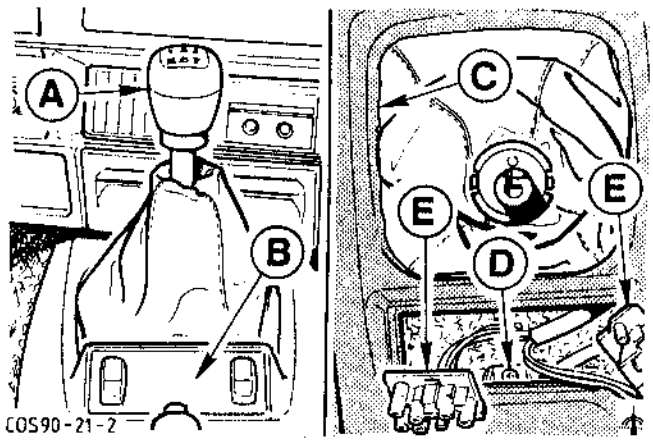


Fig.78. Gear lever with gaiter retaining frame.

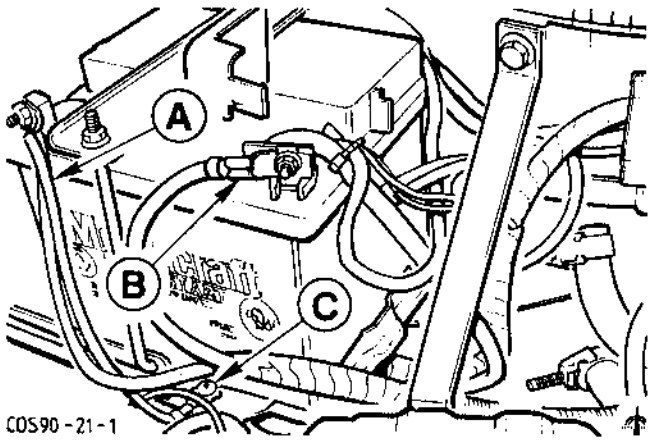


Fig.79. Battery cables.
A - Earth cable
B - Starter motor positive cable
C - Earth cable to battery tray

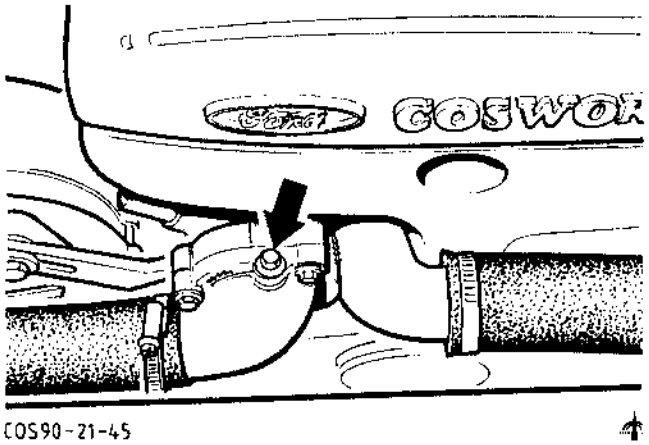


Fig.80. Cooling system bleed screw on thermostat housing.

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21 134 8 ENGINE ASSEMBLY - DISMANTLE AND REASSEMBLE (Engine Removed)

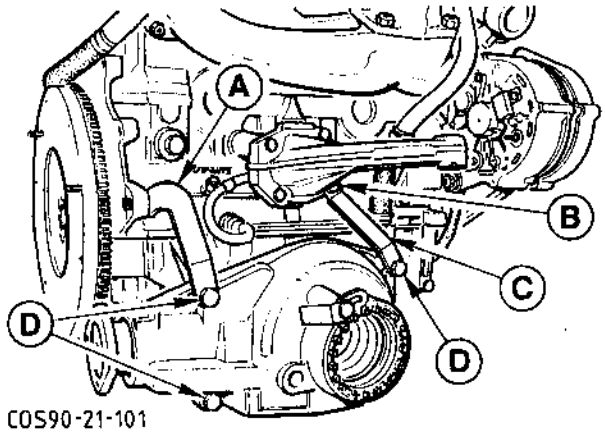
SPECIAL SERVICE TOOLS REQUIRED:

Socket wrench for cylinder head bolts	21-002
Radial oil seal installer	21-009 B
Crankshaft rear oil seal installer ..	21-011 D
Socket wrench for oil pump bolts ..	21-012
Universal spindle	21-023
Crankshaft toothed belt pulley remover	21-028 A
Engine mounting bracket..	21-031 B
Pilot bearing extractor..	21-036 A
Pilot bearing installer and clutch disc locator	21-044 A
Toothed belt tension test gauge ..	21-113
Cylinder head locating studs	21-128
Distributor immobilising tool . ..	21-152
Crankshaft belt pulley remover ..	21-153

PROPRIETARY TOOLS:

Dial test indicator (graduated in mm) with holding fixture - use 15-046 with 15-022 A if available.

Oil filter strap wrench
Piston ring compressor
Angle gauge

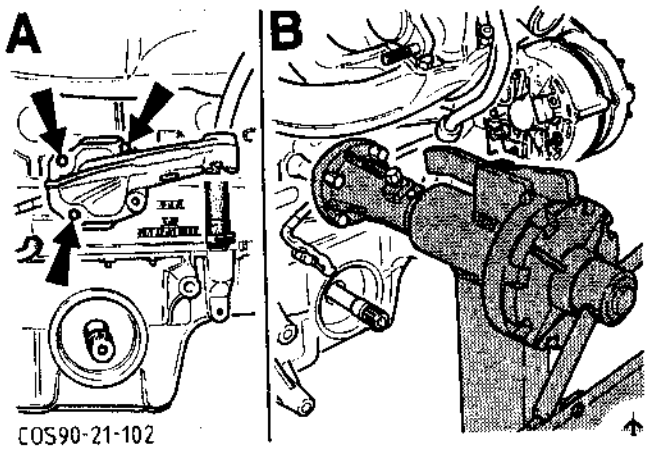


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Fig.1. Front axle assembly.
A - Front bracket
B - Retaining bolt of bracket/engine mounting
C - Rear bracket
D - Retaining bolts of front axle assembly

To Dismantle

1. Remove the front axle assembly, Fig.1:
   - Unscrew the retaining bolt of the rear bracket/engine mounting,
   - Unscrew the retaining bolts of the front axle assembly and remove the 2 brackets,
   - Withdraw the front axle assembly from the sump.
2. Unscrew the remaining 3 bolts from the engine mounting and remove the engine mounting, Fig.2 (A).
3. Secure the engine on an assembly stand using mounting bracket 21-031 B and universal spindle 21-023, Fig.2 (B).



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Fig.2. A - Retaining bolts of engine mounting
B - Engine on assembly stand

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4. Drain off the engine oil, withdraw the oil dipstick and detach the bracket from the oil dipstick tube (1 bolt).

   Remove the oil filter using a proprietary strap wrench.

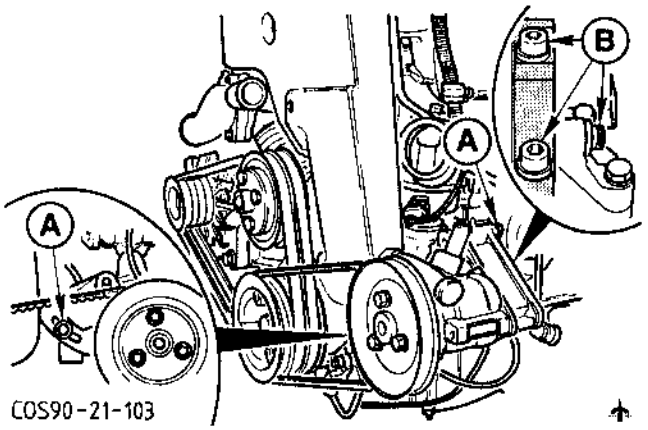


Fig.3. Retaining bolts.
A - Power steering pump
B - Carrier

5. Slacken the 2 hexagon bolts, Fig.3 (A), loosen the V-belt of the power steering pump and remove it. Detach the power steering pump and bracket (2 hexagon bolts), Fig.3 (A). Detach the carrier from the power steering pump (3 bolts), Fig.3 (B).

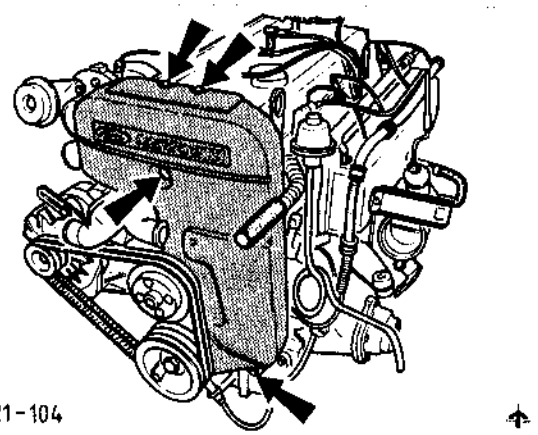


Fig.4. Retaining bolts of toothed belt cover.

6. Remove the toothed belt cover from the cylinder head/cylinder block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.4.

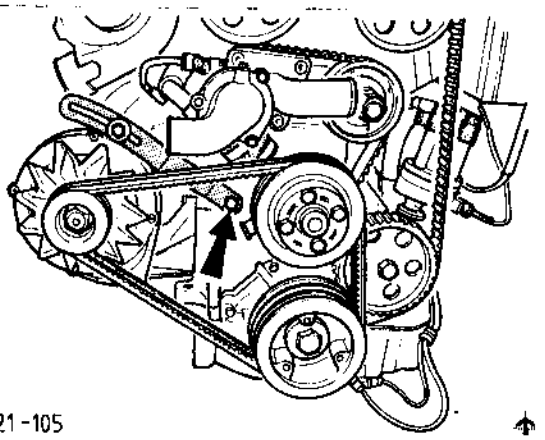


Fig.5. Retaining bolt of alternator adjusting strap.

7. Loosen the alternator V-belt and remove it. Remove the adjusting strap retaining bolt from the cylinder block, Fig.5.

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8. Remove the alternator and bracket from the cylinder head (4 bolts), Fig.6.

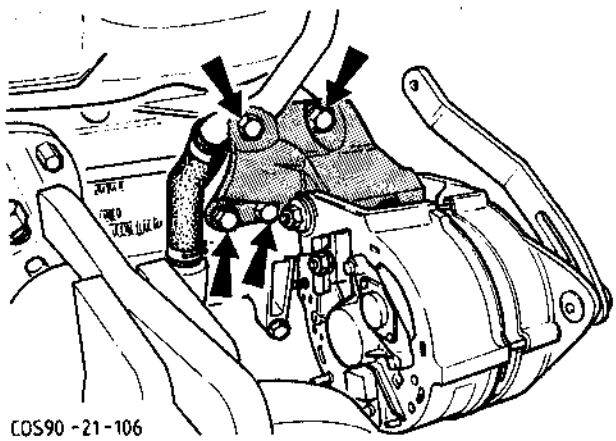


Fig.6. Retaining bolts of alternator bracket.

9. Unscrew and remove the retaining bolt with the washer and pull off the crankshaft vibration damper/V-belt pulley using Special Tool 21-153, Fig.7.

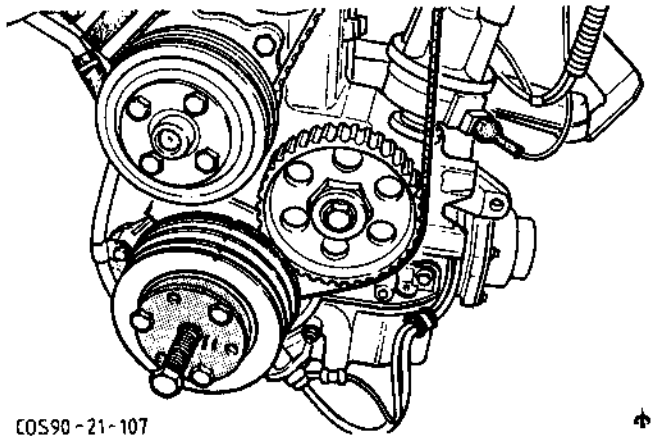


Fig.7. Pull off crankshaft vibration damper/ V-belt pulley using Special Tool 21-153.

10. Remove the thrust washer from the crankshaft, Fig.8 (C).

NOTE: If the toothed belt is to be used again, mark the direction in which it runs before removing it.

Release the toothed belt tensioning pulley and remove the toothed belt, Fig.8 (A, B).

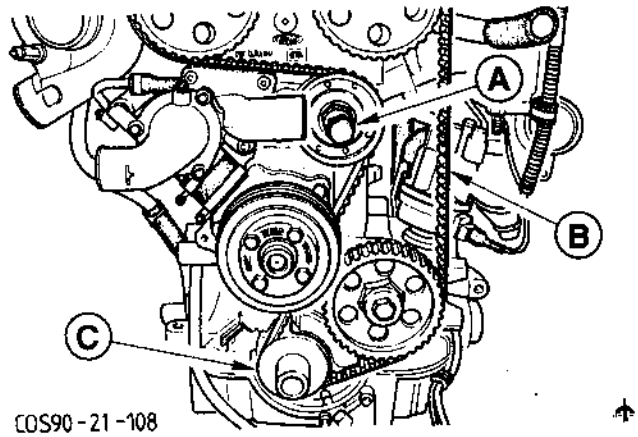


Fig.8. Toothed belt.
A - Retaining bolt of tensioning pulley
B - Toothed belt
C - Thrust washer

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11. Disconnect the plug from the oil pressure switch, Fig.9.

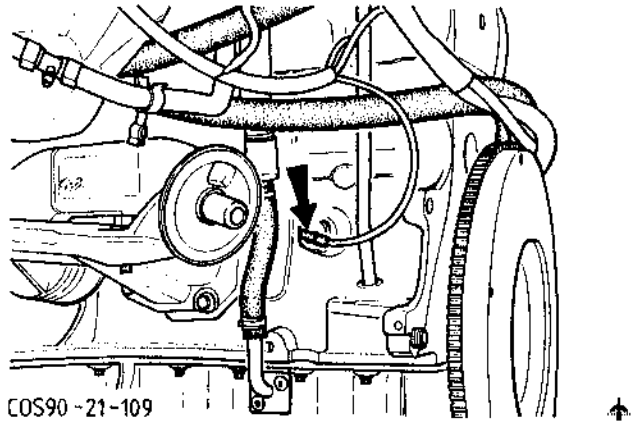


Fig.9. Plug of oil pressure switch.

12. Disconnect the multiplugs from the engine speed/TDC sensor, knock sensor and distributor, Fig.10.

Fig.10. Multiplugs.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

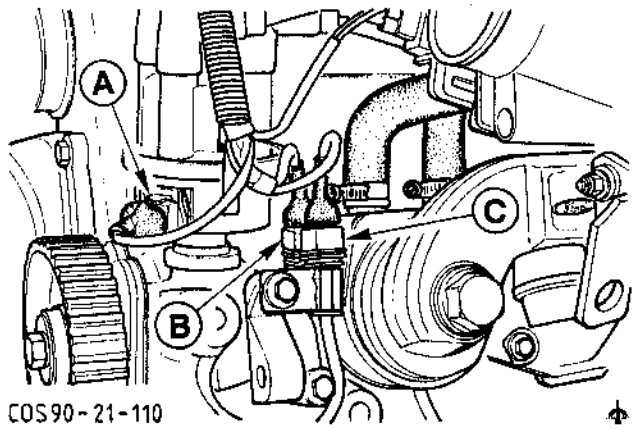


Fig.10. Multiplugs.

13. Disconnect the coolant hose at the rear from the cylinder head connecting flange, Fig.11.

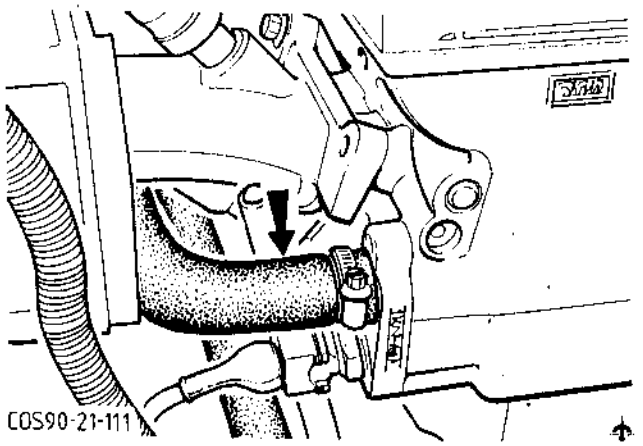


Fig.11. Coolant hose to cylinder head connecting flange at rear.

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14. Disconnect the spark plug connectors from the spark plugs, unclip the distributor cap and remove it with the HT leads.

15. Remove the cylinder head cover (20 bolts), Fig.12.

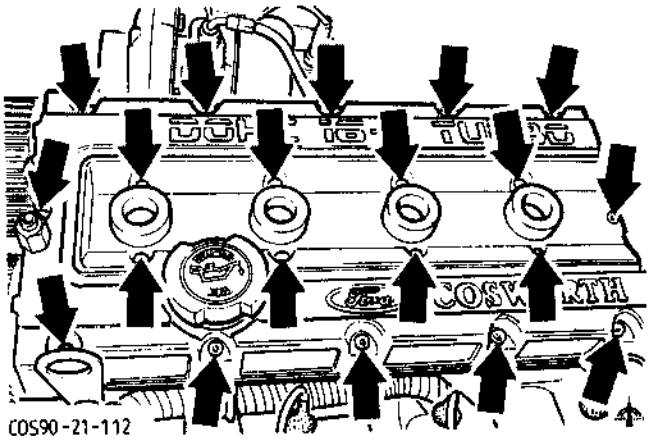


Fig.12. Retaining bolts of cylinder head cover.

16. Detach the engine breather valve bracket from the inlet manifold (1 nut), Fig.13, and disconnect the hose from the engine breather valve.

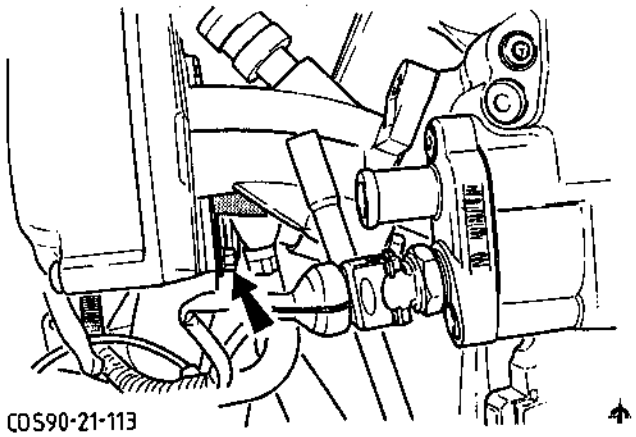


Fig.13. Retaining nut of engine breather valve bracket.

17. Detach the turbocharger oil return hose from the sump, Fig.14 (A).

18. Disconnect the connecting hose running from the thermostat housing at the water pump (1 hose clip), Fig.14 (B).

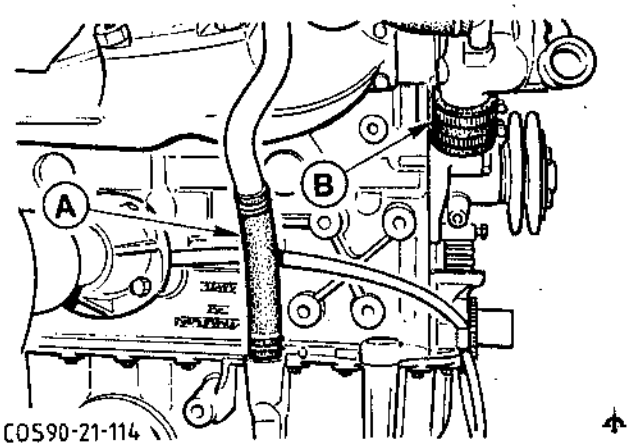


Fig.14. A - Turbocharger oil return hose
B - Coolant hose from thermostat housing to water pump

19. Remove the spark plugs.

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20. NOTE: The engine must have cooled down to below 45°C before the cylinder head is removed.

Unscrew the 10 cylinder head bolts using Special Tool 21-002, Fig.15.

Remove the cylinder head bolts with the washers. Lift of the cylinder head complete with the inlet and exhaust manifolds and the turbocharger, Fig.16.

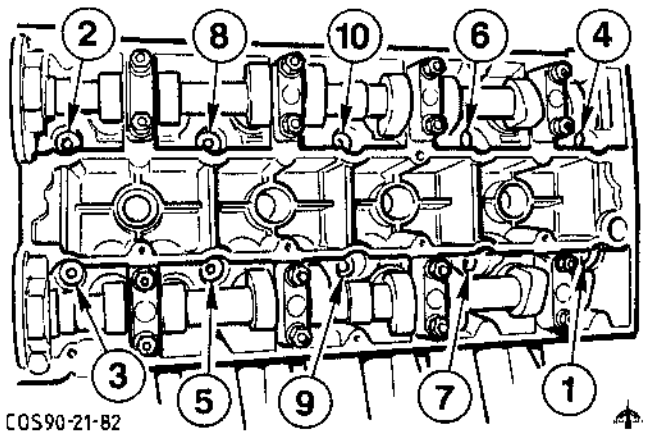


Fig.15. Cylinder head bolt slackening sequence.

Check the flatness or distortion of the cylinder head

Whenever a cylinder head is removed, the flatness of the faces mating with the cylinder block and the cylinder head cover must be checked as follows:

21. Carefully clean the face mating with the cylinder head cover. Place a steel straight edge along the centre line in the longitudinal direction and check the flatness or convex distortion with a feeler gauge, Fig.17.

NOTE: If the distortion is more than 0,1 mm, the cylinder head has overheated and cannot be used again. If the distortion is 0,1 mm or less, check the face mating with the cylinder block.

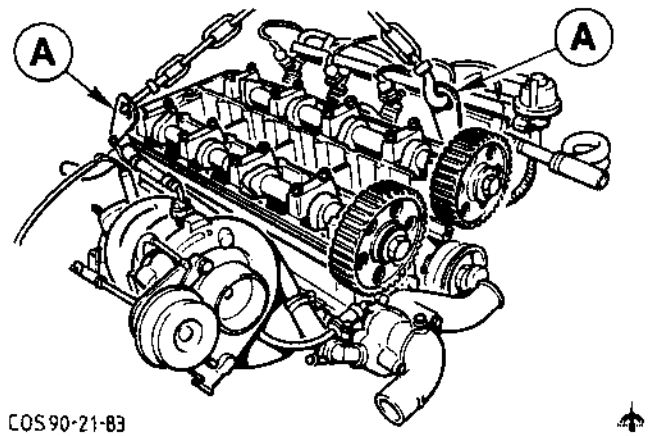


Fig.16. Cylinder head suspended and lifted off.
A - Lifting eyes set at an angle

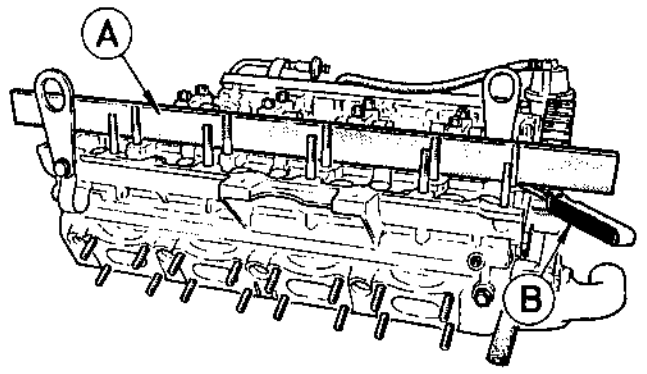


Fig.17. Check flatness of face mating with cylinder head cover.
A - Steel straight edge
B - Feeler gauge

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22. Carefully clean the mating face. Using a 100 mm long steel straight edge, check the flatness in the transverse direction between the holes for the retaining bolts (5 measuring points), Fig.18 (A). Check the flatness in the longitudinal direction between the holes for the retaining bolts (8 measuring points), Fig.18 (B).

Fig.18. Check flatness of face mating with cylinder head.
A - In transverse direction
B - In longitudial direction

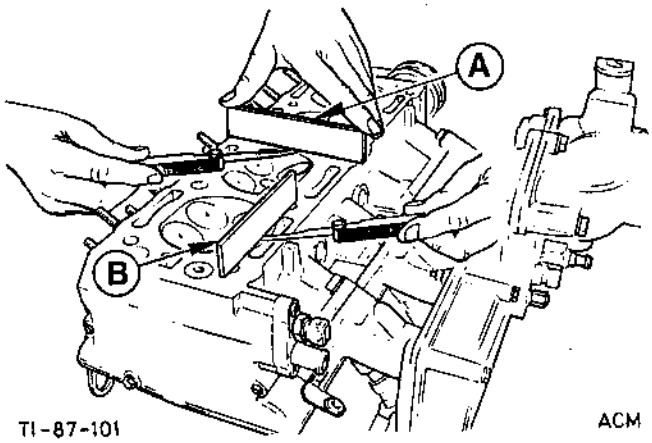


Fig.18. Check flatness of face mating with cylinder block.

NOTE: The maximum permissible deviation is 0,02 mm.

23. Check the flatness or concave distortion in the longitudinal direction along the centre line, Fig.19.

NOTE: The maximum permissible deviation is 0,08 mm.

If the maximum deviations of 0,02 and 0,08 mm are exceeded, the mating face must be skimmed, removing a maximum of 0,13 mm of material.

The minimum cylinder head height (distance between the 2 mating faces) must not be less than 138.68 mm.

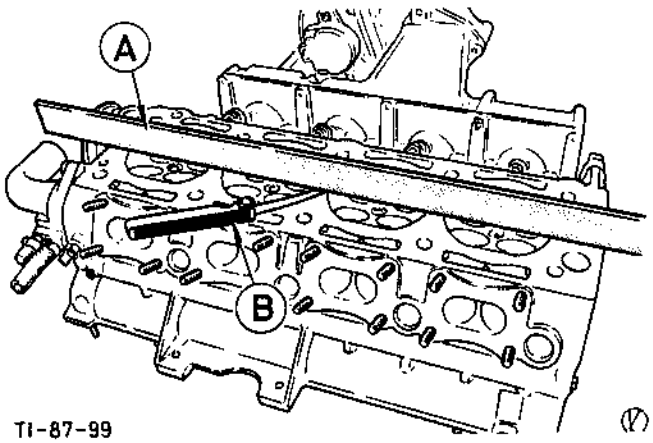


Fig.19. Measure distortion in longitudinal direction.

24. Loosen the nut on the oil cooler inlet union screw. Remove the engine mounting/connecting housing bolt, Fig.20.

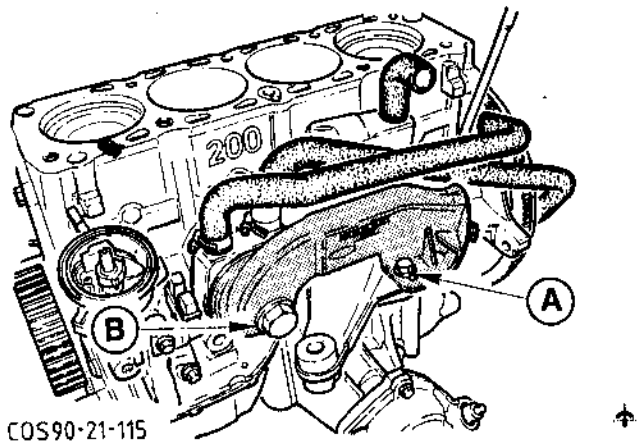


Fig.20. Oil filter/oil cooler connecting housing.
A - Bolt in engine mounting
B - Nut on oil cooler inlet union screw

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25. Swing the oil filter/oil cooler connecting housing up. Detach the engine mounting (4 bolts). Detach the oil filter/oil cooler connecting housing (1 nut). Unscrew the inlet union screw and remove the oil cooler complete with the coolant hoses, Fig.21.

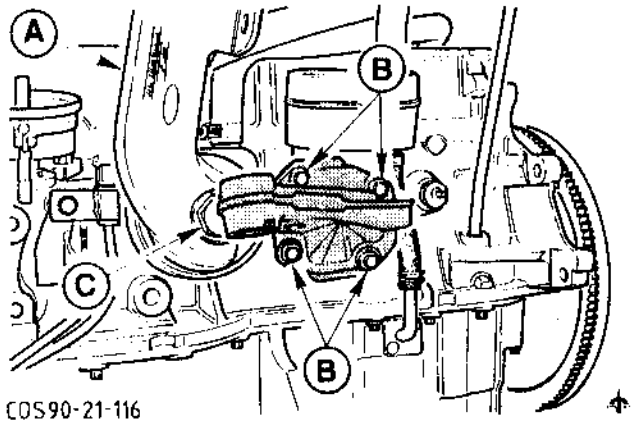


Fig.21. Oil filter/oil cooler connecting housing and engine mounting.
A - Connecting housing swung up
B - Retaining bolts of engine mounting
C - Nut on oil cooler inlet union screw

Fig.21. Oil filter/oil cooler connecting housing and engine mounting.

26. Unscrew the retaining bolt, remove the clamping plate and withdraw the distributor, Fig.22.

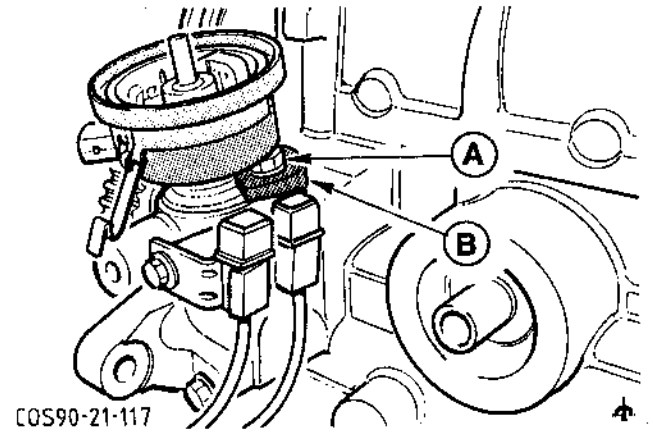


Fig.22. Distributor.
A - Retaining bolt
B - Clamping plate

27. Remove the oil separator with the lower breather hose from the cylinder block/sump, Fig.23 (A).

28. Remove the oil pressure switch, Fig.23 (B).

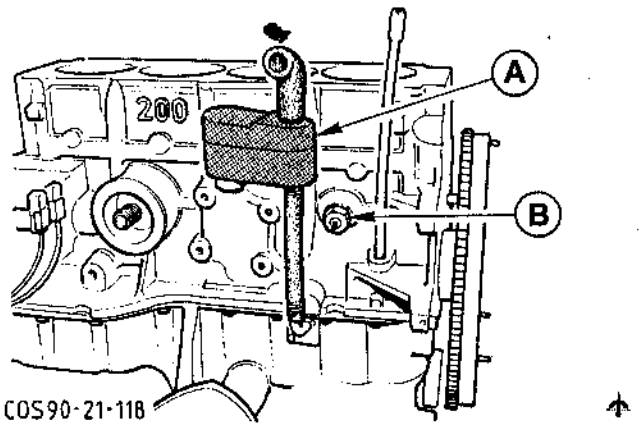


Fig.23. A - Oil separator
B - Oil pressure switch

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29. Detach the bracket for the multiplugs of the knock sensor and the engine speed/TDC sensor from the power steering pump support (1 bolt). Detach the power steering pump support from the cylinder block (1 bolt), Fig.24 (C).

Fig.24. Knock sensor and engine speed/TDC sensor.
A - Retaining bolts of cable brackets
B - Retaining nuts of engine speed/ TDC sensor
C - Retaining bolts of oil pump mounting support
D - Knock sensor

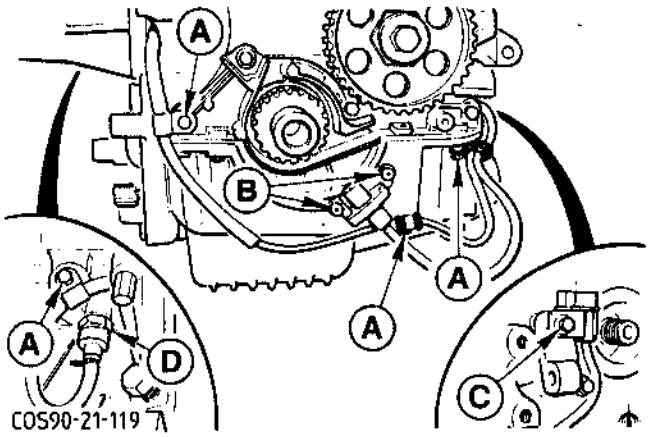


Fig.24. Knock sensor and engine speed/TDC sensor.

30. Remove the knock sensor from the cylinder block, Fig.24 (D), detach the engine speed/ TDC sensor from the sump, Fig.24 (B). Detach the cable brackets from the sump, front cover and cylinder block, Fig.24 (A), and remove the sensor with the cable.

31. Remove the water pump V-belt pulley (4 bolts) and the water pump (3 bolts, 1 bolt with a spacer sleeve), Fig.25.

Fig.25. Water pump.
A - Retaining bolts of V-belt pulley
B - Retaining bolts

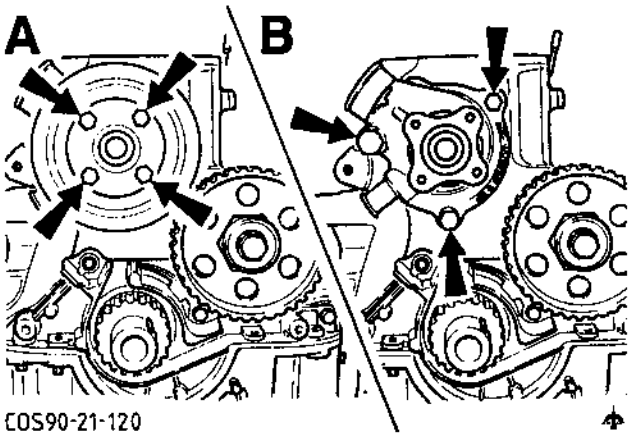


Fig.25. Water pump.

32. Remove the auxiliary shaft toothed belt pulley (1 bolt), Fig.26.

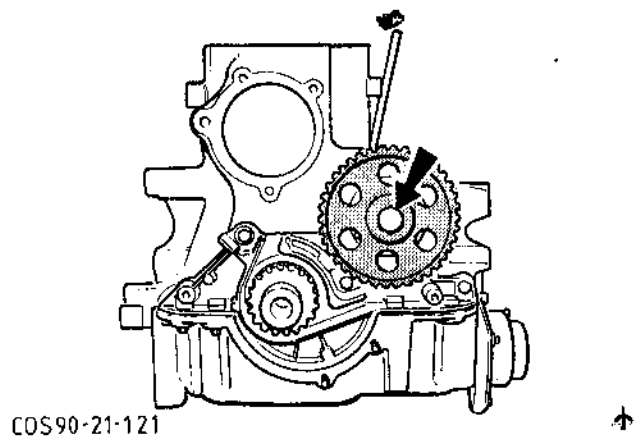


Fig.26. Retaining bolt of auxiliary shaft toothed belt pulley.

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33. Pull off the crankshaft toothed belt pulley using Special Tool 21-028 A, Fig.27.

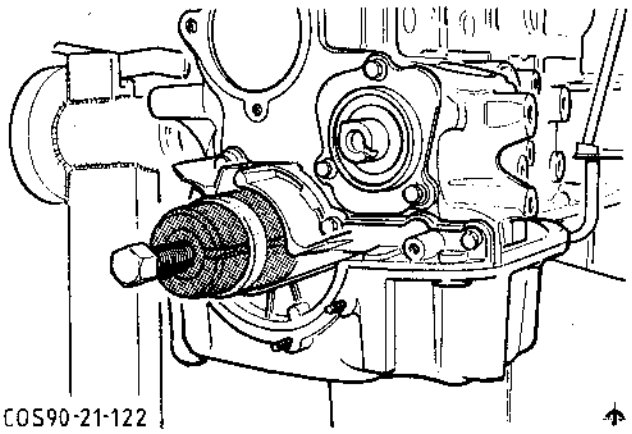


Fig.27. Pull off crankshaft toothed belt pulley using Special Tool 21-028 A.

34. Remove the auxiliary shaft front cover (3 bolts) and the auxiliary shaft thrust plate (2 bolts), Fig.28.

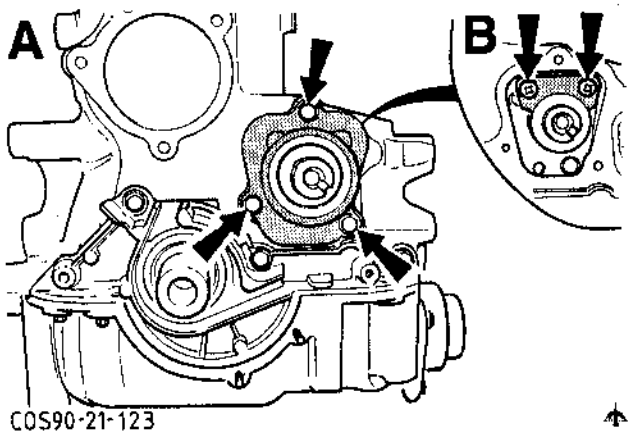


Fig.28. Auxiliary shaft.
A - Retaining bolts of cover
B - Retaining bolts of thrust plate

35. Remove the clutch pressure plate and clutch disc (6 bolts).

36. Extract the pilot bearing from the crankshaft using Special Tool 21-036 A, Fig.29.

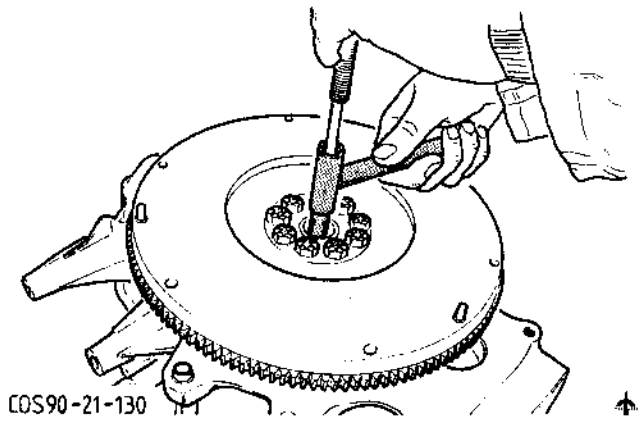


Fig.29. Extract pilot bearing using Special Tool 21-036 A.

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37. Remove the flywheel (9 bolts).

NOTE: Mark the position of the crankshaft in relation to the flywheel before removing it as the retaining bolts are arranged symmetrically, Fig.30.

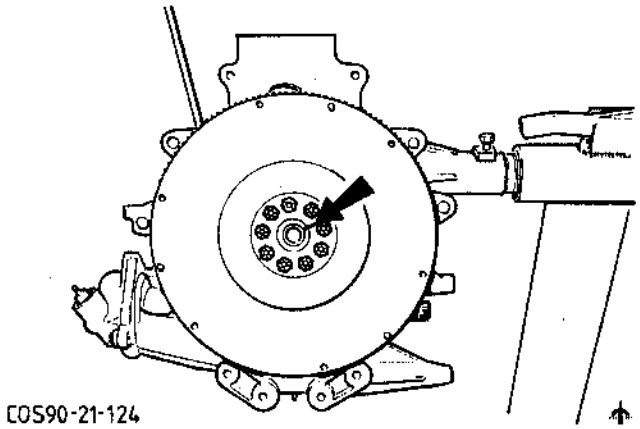
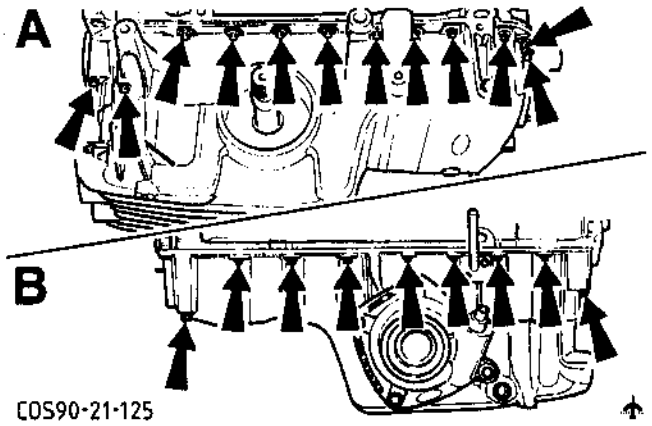

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Fig.30. Mark showing position of flywheel on crankshaft.

38. Remove the sump (21 bolts), Fig.31.



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Fig.31. Retaining bolts of sump.
A - Right-hand side
B - Left-hand side

39. Remove the crankshaft front cover (3 bolts), Fig.32.

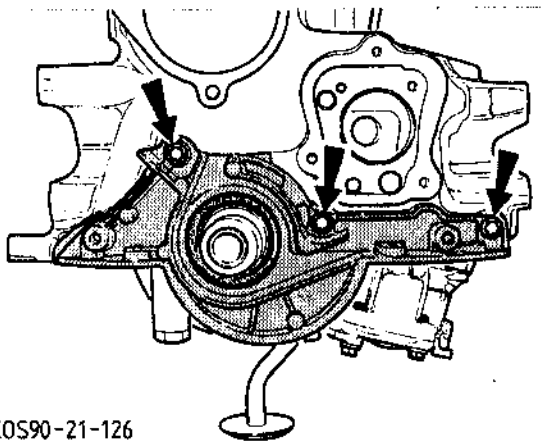

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Fig.32. Retaining bolts of crankshaft front cover.

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40. Remove the oil pump complete with the intake pipe and oil pipes using Special Tool 21-012 (3 bolts), Fig.33.

41. Extract the oil pump driving shaft, Fig.34.

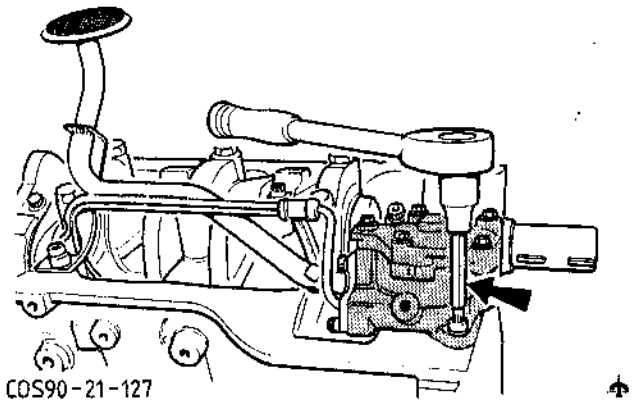


Fig.33. Remove oil pump using Special Tool 21-012.

42. Unscrew the big-end bearing caps and remove them with the bearing shells, Fig.35 (A).

NOTE: Check the markings on the bearing shells and mark the big-end bearing caps and the associated bearing shells.

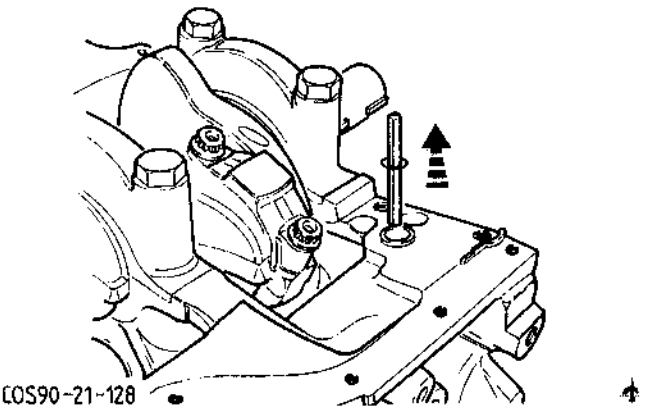


Fig.34. Oil pump driving shaft.

43. Lift out the pistons and connecting rods.

44. Remove the main bearing caps from the cylinder block, Fig.35 (B). Remove the crankshaft with the bearing shells and remove the crankshaft rear oil seal.

NOE: Mark the bearing shells to ensure they are refitted correctly.

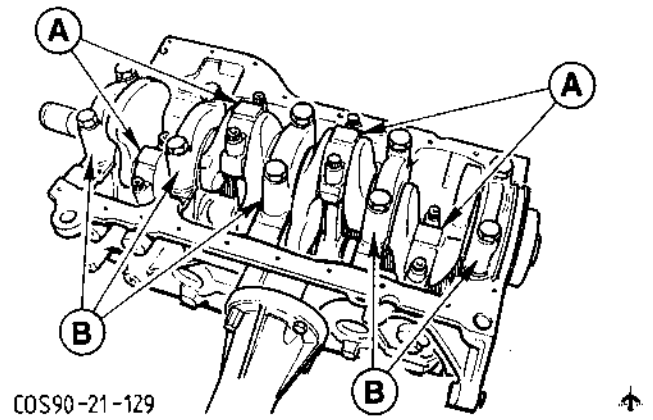


Fig.35. A - Big-end bearing caps
B - Main bearing caps

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To Reassemble

NOTE: When reassembling, tighten the nuts and bolts as specified in Technical Data.

Parts that can be used again should be cleaned thoroughly before refitment. This is particularly true of the cylinder block with its corners, angles and holes. Remove all the blanking plugs and covers as appropriate and clean their seats using suitable cleaning agents and tools (brushes, scrapers). In particular, the oilways, e.g. of the cylinder block, cylinder head, etc., must be free of dirt and swarf. If press-fit blanking covers and water plugs or other seals are removed, these must always be renewed.

NOTE: When reassembling the engine, oil the thread and the underside of the head of the following bolts:

Main bearings bolts
Big-end bearing bolts
Flywheel bolts
Cylinder head bolts

45. Measure the clearance of the pistons in the cylinder bores

a) Fit the main bearing caps without the bearing shells and tighten them down to the specified torque.

b) Swivel the old cylinder block through 180° and measure the cylinder bores using a conventional gauge.

c) If the measured cylinder bore diameter is too much for the class of piston, overhaul or change the cylinder block. Fit the cylinder block with new pistons of the appropriate standard class for the cylinder.

The specified piston-to-bore clearance applies to unused pistons. With used pistons the clearance is greater due to distortion.

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46. Measure the clearance of the crankshaft main bearings

The use of "PLASTIGAGE" (type PG-1) eliminates the need to measure the bearings (even with undersize crankshafts) and makes selection of the required bearing shells much easier.

"PLASTIGAGE" is the brand name of a precisely calibrated plastic thread, Fig.36 (A).

West German Supplier:

K.H. Ern/Motorenteile GmbH
Vinckeweg 16
D-4100 Duisburg 13 (Ruhrort)

U.K. Supplier:

Replacement Service Limited
30 Euston Street
Freemans Industrial Estate
Leicester
LE2 7ST

a) The bearing must be dry and clean.

b) The crankshaft must not be turned during the measuring operation.

c) The measuring point should be right next to the respective dead centre position.

d) Do not hammer the bearing caps down.

Lay a length of "PLASTIGAGE" along the crankshaft main bearing journal across the bearing. Fit the main bearing cap dry with the bearing shell and tighten it down to the specified torque. The plastic thread is compressed to a greater or lesser degree depending on the bearing clearance. Remove the bearing cap again.

Check the width of the squashed plastic thread against the scale printed on the "PLASTIGAGE" pack. The measurment corresponds to the bearing clearance, Fig.36 (B, C).

Always make sure that the bolts used to secure the crankshaft bearings are in good condition. Do not tighten them beyond the specified torque.

Measure each main bearing one at a time, without the remaining bearing caps being fitted.

Overhaul the main bearing journals and renew the bearing shells as necessary.

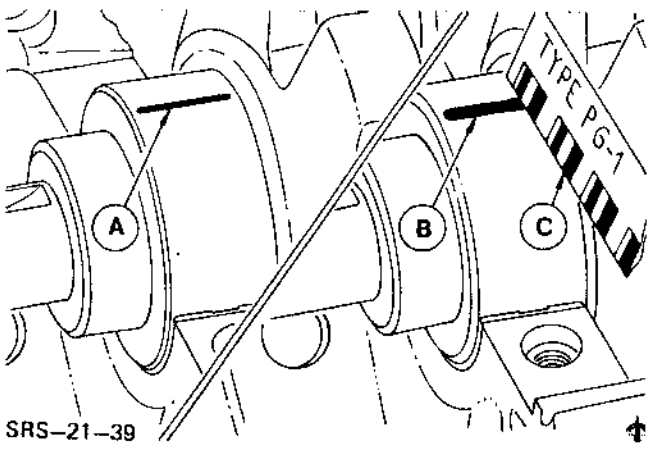


Fig.36. Measuring bearing clearance.
A - Calibrated plastic thread
B - Squashed plastic thread
C - Measuring scale

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Crankshaft Main Bearing Journals

The crankshaft main bearing journals are unmarked.

NOTE: Only standard crankshafts are fitted in production. 0,25 and 0,5 mm oversize crankshafts are available for service (see Parts Microfiche).

Crankshaft Big-End Bearing Journals

The crankshaft big-end bearing journals are unmarked.

NOTE: The grooved bearing shells go in the cylinder block and the smooth bearing shells in the bearing caps.

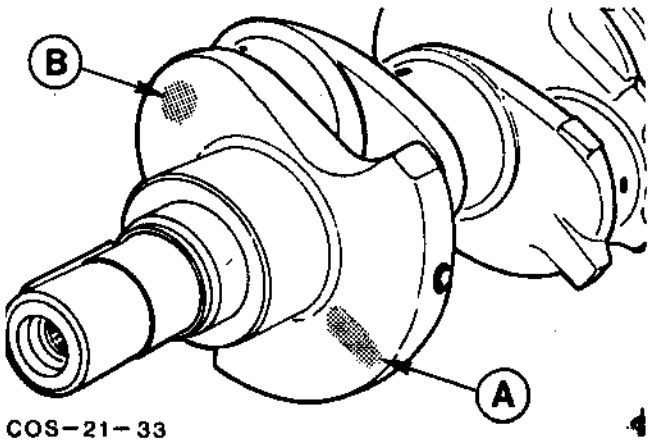


Fig.37. Crankshaft paint marks (eliminated).
A - Undersize main bearing journals
B - Undersize big-end bearing journals

Bearing shells

Standard main and big-end bearings shells have no paint marks. Bearing shells for undersize crankshafts have appropriate inscriptions on the back (see Parts Microfiche) and, in the case of production repair sizes, paint marks, with the exception of the pure service main and big-end bearing shells (0,5/0,75 and 1,0 mm undersize crankshaft journals), Fig.38.

When selecting new bearing shells, always check they are the right ones by referring to the Parts Microfiche and measure them.

Bearing journals and bores and bearing shells must be measured one at a time to remain within the limits of the specified bearing clearance (see Technical Data).

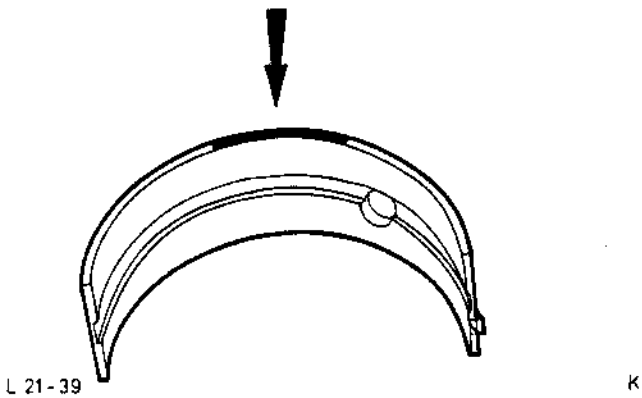


Fig.38. Bearing shell paint marks (production repair size).

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47. Fit the cylinder block main bearing shells dry then lubricate them with engine oil.

48. Fit the crankshaft.

NOTE: Fit the thrust half rings of the guide bearing the right way round, i.e. with the copper-coloured side facing outwards.

49. Oil the bearing shells and fit the main bearing caps.

NOTE: First coat the seating face and the sides of the rear main bearing cap with sealer (see Technical Data), Fig.39.

NOTE: Oil the thread and the underside of the head of all the bearing cap bolts.

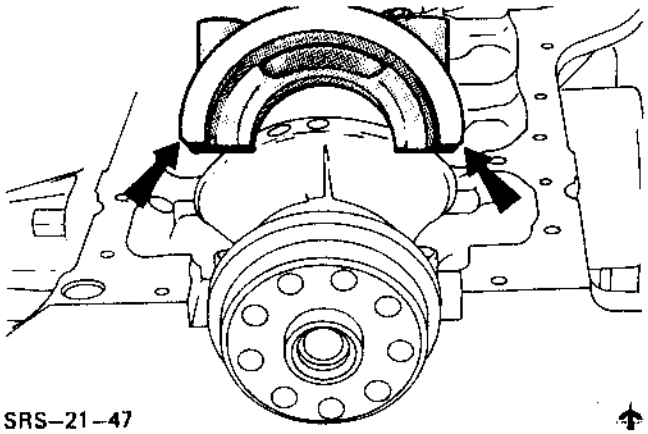


Fig.39. Coat seating face and sides of rear main bearing cap with sealer.

50. Check the crankshaft end float (see Technical Data), using an ordinary dial indicator, Fig.40, and rectify as necessary with thrust half rings or flanged bearing shells (see Parts Microfiche).

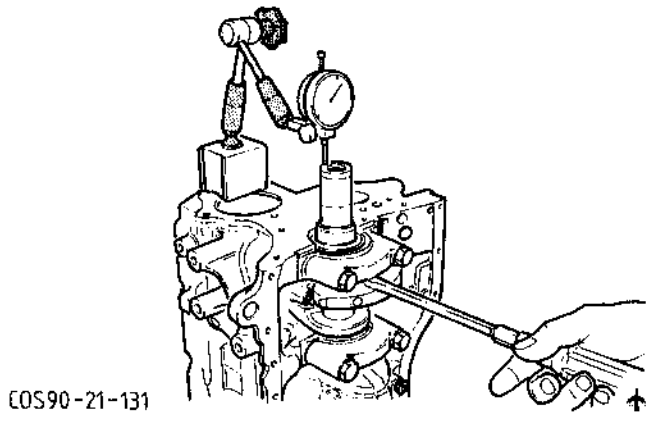


Fig.40. Check crankshaft end float.

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51. Remove the piston rings from the pistons and place back in the corresponding bores to check the piston ring gaps, Fig.41.

    Before fitting the pistons, check the piston ring gaps. The indicated figures (see Technical Data) are for the gauge ring used in production and may be exceeded by 0,15 mm when measured in the cylinder.

52. Fit the piston rings offset on the pistons using a conventional piston ring installer.

    The piston ring gaps should be positioned as shown in Fig.42.

NOTE: The first and the second piston rings are marked "TOP".

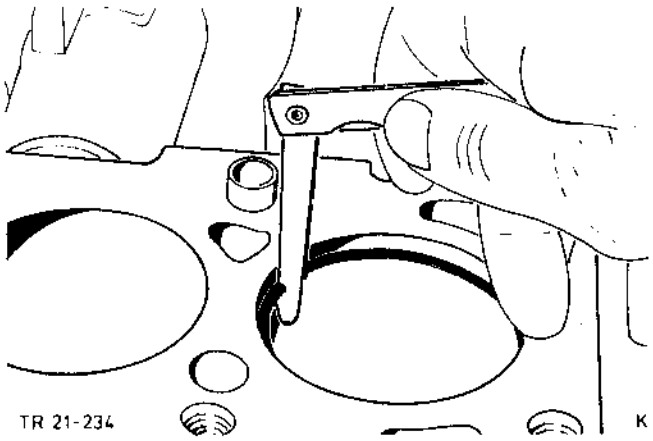


Fig.41. Check piston ring gaps.

53. Compress the piston rings using a conventional tool (piston ring compressor). Press the pistons into the cylinders using the handle of a hammer, guiding the connecting rods onto the big-end bearing journals with the other hand.

NOTE: The pistons must be fitted with the front mark (arrow) pointing towards the front of the vehicle. Use a plastic guide fork to avoid damaging the big-end bearing journals.

54. Fit the big-end bearing shells and measure the clearances using "PLASTIGAGE" as described in sub-opertion 46. Change the bearing shells if necessary.

55. Fit the big-end bearing caps complete with oil bearing shells. Oil the thread and the contact face of the big-end bearing bolts and tighten them to the specified torque.

    Check that the connecting rods have sufficient axial movement on the bearing journal (at least 0,1 mm).

56. Lubricate the sealing lip of the new rear radial oil seal with oil. Place the oil seal (with the closed side facing upwards) on a solid surface. Place Special Tool 21-011 D over the seal and press the retaining ring down by hand as far as it will go.

    Apply the Special Tool with the oil seal to the engine and draw the oil seal in uniformly as far as the stop using 2 flywheel retaining bolts.

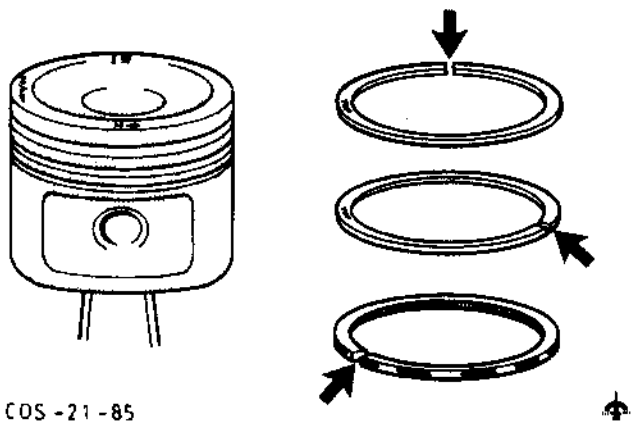


Fig.42. Position of piston ring gaps.

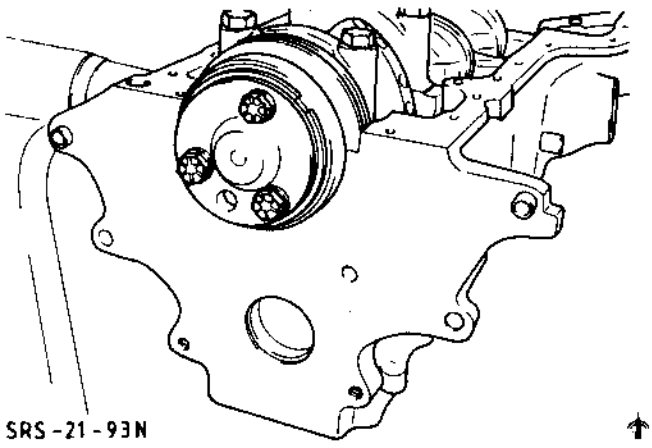


Fig.43. Draw in radial oil seal using Special Tool 21-001 D.

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57. Insert the oil pump driving shaft with the short side towards the oil pump, Fig.44.

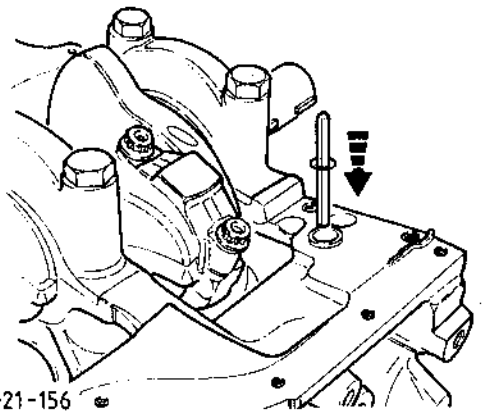


Fig.44. Oil pump driving shaft.

58. Fit the oil pump complete with the intake pipe and the oil pipes using Special Tool 21-012 (3 bolts), Fig.45.

NOTE: When using an overhauled or a new oil pump, this must be filled with engine oil and turned over by hand before it is fitted.

NOTE: Turn the crankshaft through 360° by hand and check that the oil spray pipe is clear of the crankshaft.

59. Remove the radial oil seal from the crankshaft front cover and discard.

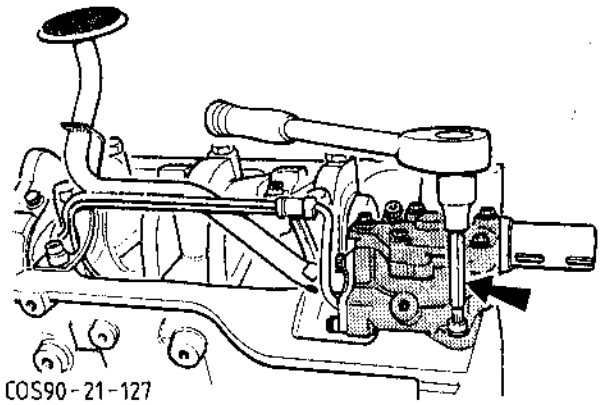


Fig.45. Fit oil pump using Special Tool 21-012.

60. Fit the crankshaft front cover and tighten the bolts to the specified torque (see Technical Data for sealer).

NOTE: The mating surfaces of the front cover and sump flange must be smooth.

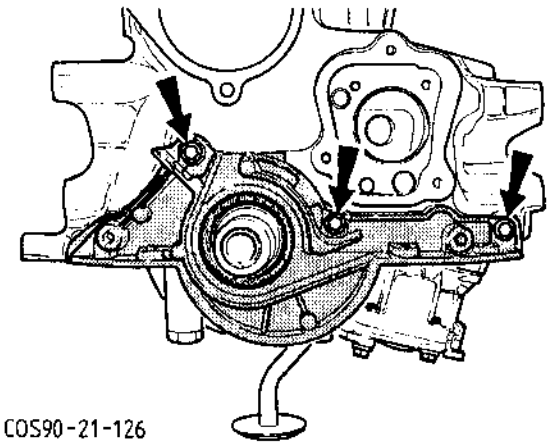


Fig.46. Retaining bolts of crankshaft front cover.

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62. Lubricate the crankshaft journal and the sealing lip of the new front cover oil seal with clean engine oil.

    Draw in the new front cover oil seal using Special Tool 21-009 B and the bolt and washer of the crankshaft V-belt pulley, Fig.47.

63. Fit the auxiliary shaft with the thrust plate, Fig.48 (B).

Fig.48. Auxiliary shaft.
A - Draw in radial oil seal using Special Tool 21-009 B
B - Thrust plate

64. Remove the radial oil seal from the auxiliary shaft front cover and discard.

65. Fit the auxiliary shaft front cover loosely and install a new radial oil seal using Special Tool 21-009 B. Do this using a longer bolt (than the original bolt) with the original washer.
Tighten the front cover retaining bolts.

66. Smear the ends of the rubber seals with sealer (see Technical Data) and insert them in the slot in the rear main bearing cap and the front cover, Fig.49.

    Smear the cylinder block mating face with sealer at the contact point with the front cover.
Slide the sump gasket under the cut out in the rubber seal.

67. Coat the sump mating face with sealer s (see Technical Data). Locate the sump and the cable clip of the engine speed/TDC sensor in position. Screw in the bolts and tighten them to the specified torque.

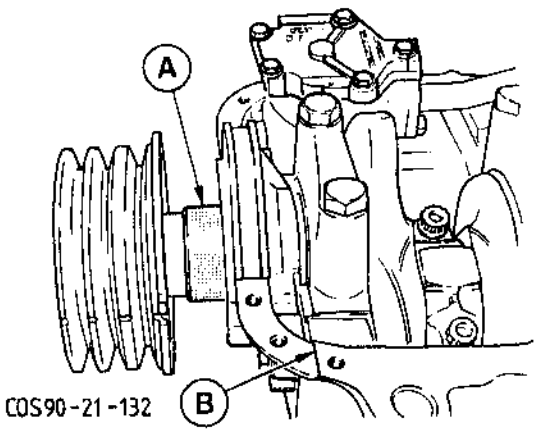


Fig.47. Fit front cover radial oil seal.
A - Special Tool 21-009 B
B - Contact point of front cover and sump

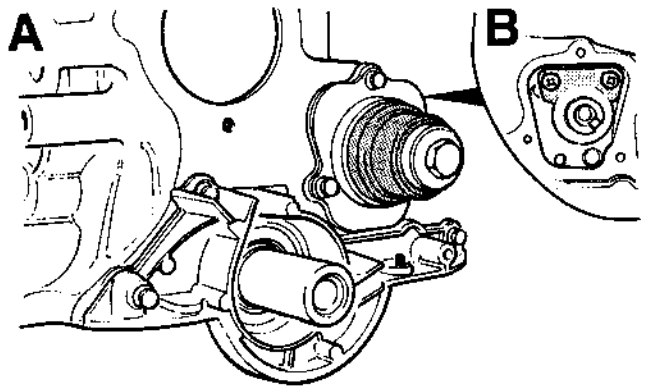


Fig.48. Auxiliary shaft.

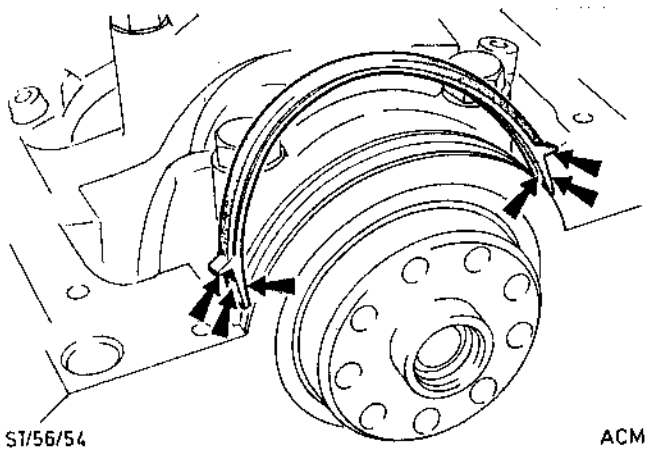


Fig.49. Smear ends of rubber seal of rear main bearing with sealer.

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68. Fit the flywheel in the marked position, Fig.50 (B).

NOTE: Use new bolts.

69. Fit the pilot bearing using Special Tool 21-044 A, Fig.50 (A).

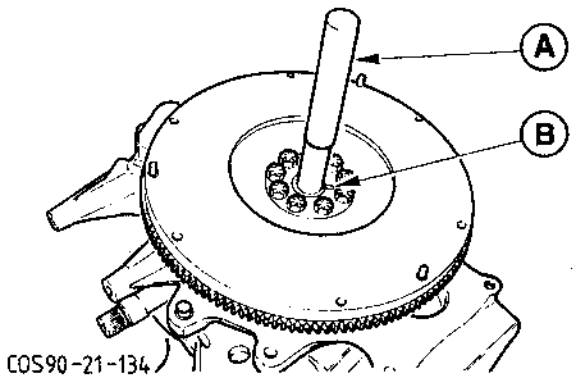


Fig.50. A - Fit pilot bearing using Special Tool 21-044 A
B - Marking

70. Fit the clutch pressure plate and clutch disc, centering the clutch disc using Special Tool 21-044 A.

71. Fit the auxiliary shaft toothed belt pulley, Fig.51 (A).

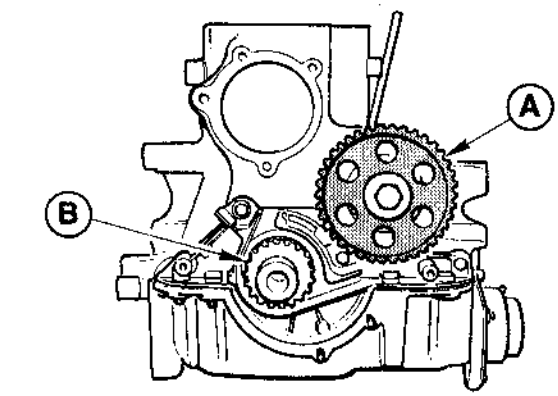


Fig.51. Toothed belt pulleys.
A - Auxiliary shaft
B - Crankshaft

72. Fit the crankshaft toothed belt pulley with the chamfered side facing the engine, Fig.51 (B).

73. Fit the water pump (3 bolts, 1 with a spacer sleeve), Fig.52 (B).

74. Fit the water pump V-belt pulley (4 bolts), Fig.52 (A).

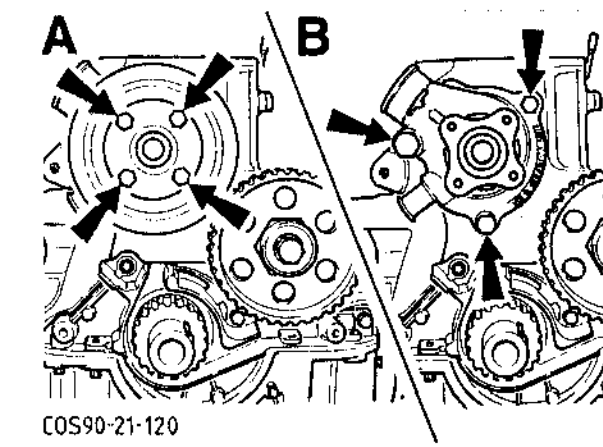


Fig.52. Water pump.
A - Retaining bolt of V-belt pulley
B - Retaining bolts

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75. Locate the wiring of the knock sensor and the engine speed/TDC sensor in position. Screw the knock sensor into the cylinder block and fit the engine speed/TDC sensor to the sump, Fig.53 (B, C). Fit the cable brackets to the sump, front cover and cylinder block, Fig.53 (A).

Fig.53. Knock sensor and engine speed/TDC sensor.
A - Retaining bolts of cable brackets
B - Retaining nuts of engine speed/ TDC sensor
C - Knock sensor

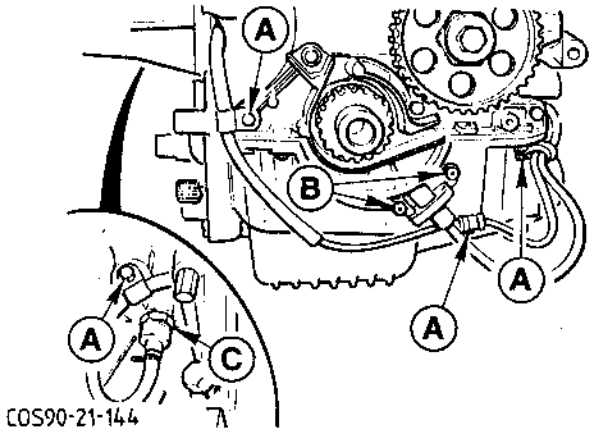


Fig.53. Knock sensor and engine speed/TDC sensor.

76. Fit the oil pressure switch, Fig.54 (B). Fit the oil separator with the lower breather hose to the cylinder block/sump, Fig.54 (A).

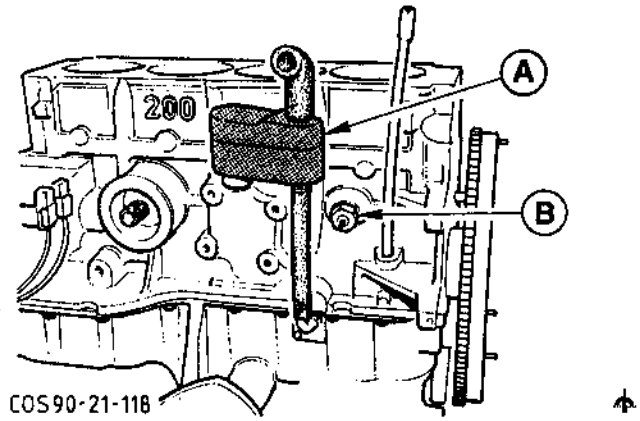


Fig.54. A - Oil separator
B - Oil pressure switch

77. Fit the distributor in conjunction with Special Tool 21-152 and align it roughly as shown in Fig.55.

Fit the clamping plate and the retaining bolt but do not tighten.

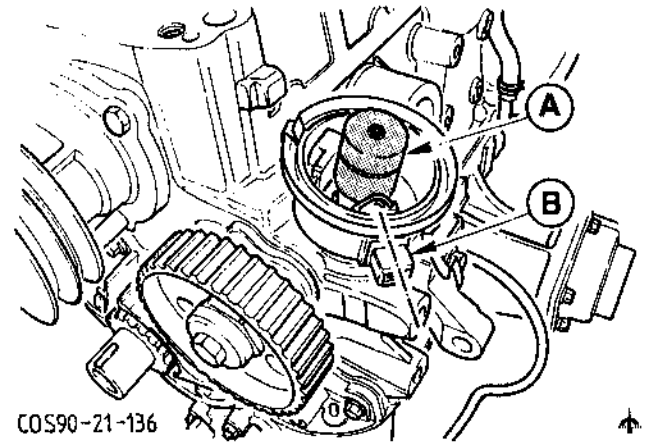


Fig.55. Distributor fitted.
A - Special Tool 21-152
B - Multiplug connector aligned.

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78. Fit the oil cooler complete with the coolant hoses (1 inlet union screw), Fig.56 (C).

Fig.56. Oil filter/oil cooler connecting housing and engine mounting.
A - Connecting housing swung up
B - Retaining bolts of engine mounting
C - Nut on oil cooler inlet union screw

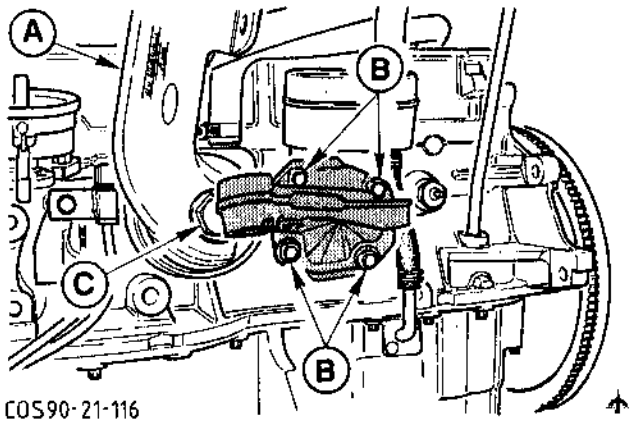


Fig.56. Oil filter/oil cooler connecting housing and engine mounting.

79. Fit the oil filter/oil cooler connecting housing on the oil cooler inlet union screw in the nut and swing it up, Fig.56 (A).

Fit the engine mounting to the cylinder block (4 bolts), Fig.56 (B).

Fit the connecting housing to the engine mounting (1 bolt), Fig.57 (A).

Tighten the nut on the oil cooler inlet union screw, Fig.57 (B).

80. Fit the oil filter (after it makes contact tighten a further half to three-quarters of a turn.

NOTE: Lubricate the rubber seal with oil.

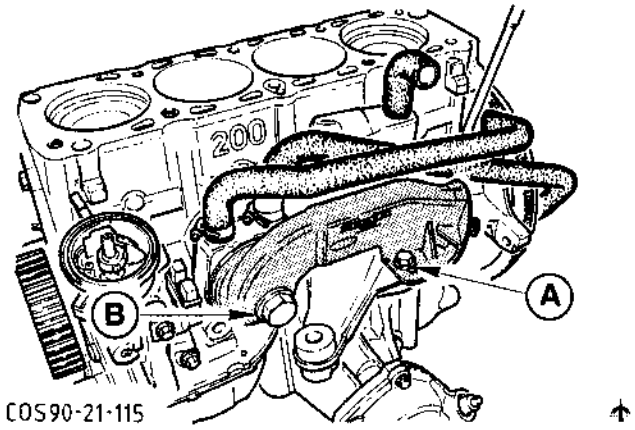


Fig.57. Oil filter/oil cooler connecting housing.
A - Bolt in engine mounting
B - Nut on oil cooler inlet union screw

81. Screw in the cylinder head locating studs, Special Tool 21-128, into the tapped holes in the cylinder head, Fig.58.

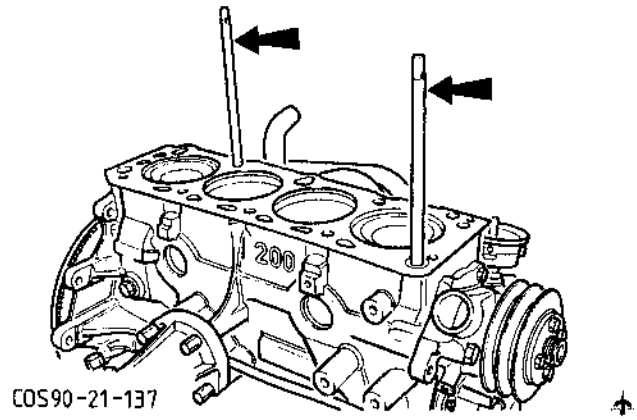


Fig.58. Cylinder head locating studs inserted.

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82. Make sure that the mating faces of the cylinder block and cylinder head and the new gasket are clean. Place the cylinder head gasket on the cylinder block (marked "TOP/OBEN").

83. Fit the cylinder head complete with the inlet and exhaust manifolds and turbocharger and connect the thermostat housing/water pump connecting hose at the same time.

NOTE: Before inserting the cylinder head bolts, lubricate the U-shaped washers, the thread and the underside of the head of the bolts with engine oil.

Insert the bolts and screw them in finger tight. Unscrew the locating studs and insert the remaining bolts.

Tighten the cylinder head bolts to the specified torque in 2 stages (see Technical Data) in the indicated sequence, Fig.59.

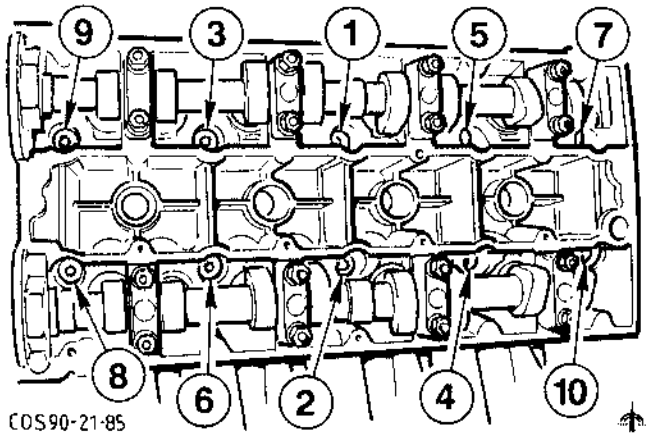


Fig.59. Cylinder head bolt tightening sequence.

84. Turn the cylinder head bolts 180° + 10° more in the same sequence using Special Tool 21-002 and a proprietary angle gauge, and note the tightening torque obtained.

NOTE: A tightening torque of less than 115 Nm is not acceptable and bolts with a torque below this figure must be changed. When all the bolts have been tightened, check that no bolt can be turned any more applying a torque of 110 Nm.

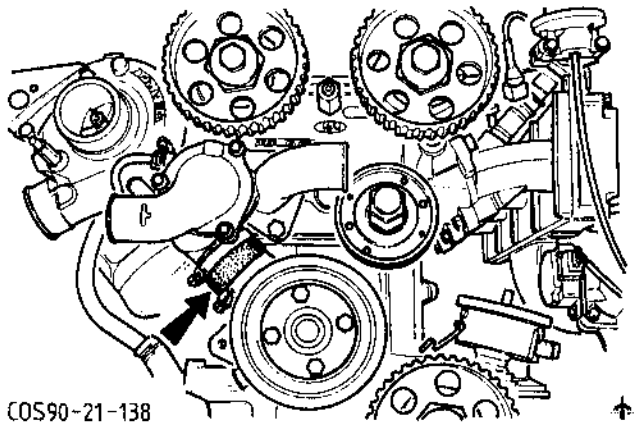


Fig.60. Coolant hose from thermostat housing to water pump fitted.

85. Fit the spark plugs and tighten them to the specified torque.

86. Secure the thermostat housing/water pump connecting hose, Fig.60.

87. Connect the turbocharger oil return hose to the sump.

88. Fit the engine breather valve bracket to the inlet manifold and connect the hose to the engine breather valve, Fig.61.

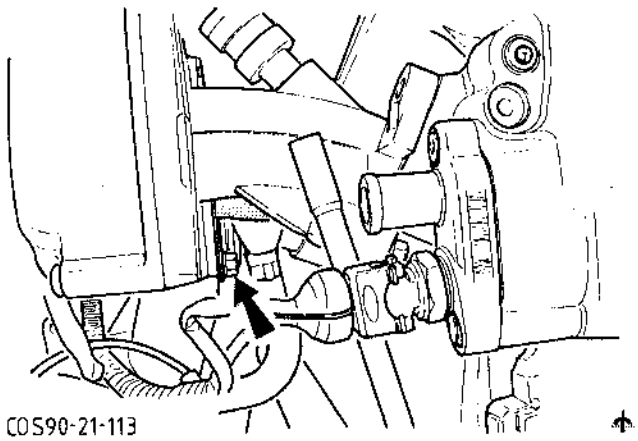


Fig.61. Retaining nut of engine breather valve bracket.

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89. Fit the cylinder head cover (20 bolts), Fig.62.

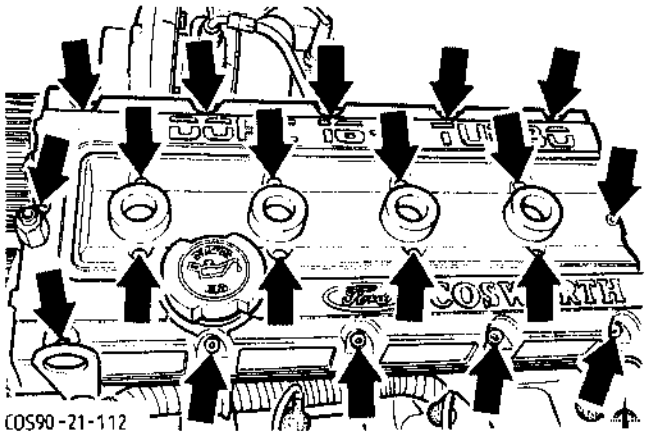


Fig.62. Retaining bolts of cylinder head cover.

90. Connect the coolant hose to the cylinder head connecting flange at the rear, Fig.63.

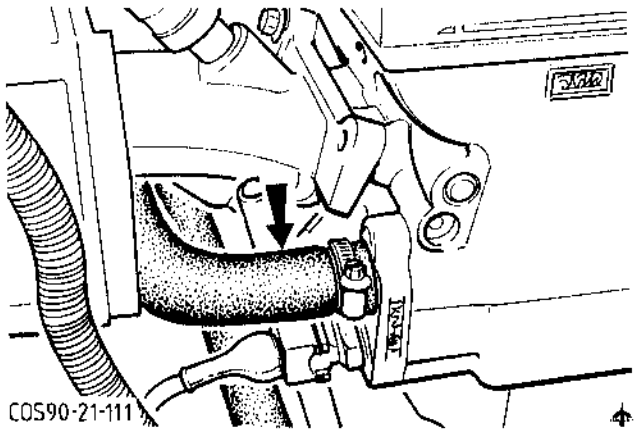


Fig.63. Coolant hose to cylinder head connecting flange at rear.

91. Connect the multiplugs of the engine speed/TDC sensor, knock sensor and distributor, Fig.64.

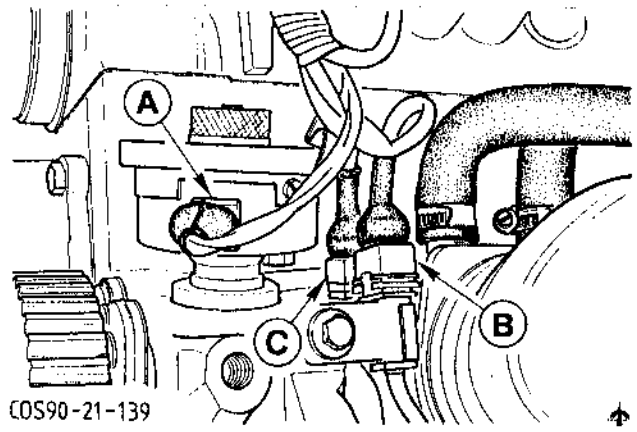


Fig.64. Multiplugs.
A - Distributor
B - Engine speed/TDC sensor
C - Knock sensor

92. Connect the plug to the oil pressure switch.

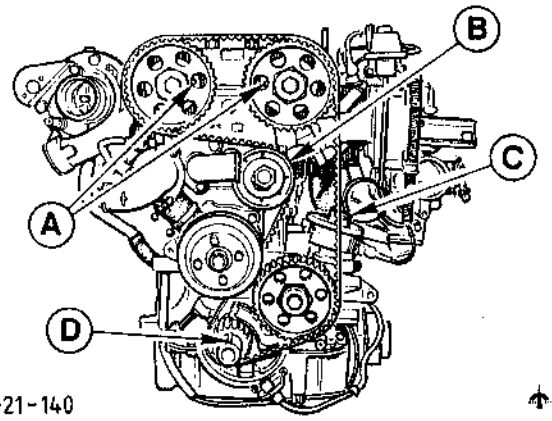
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93. Fit and tension the toothed belt:

- Align the crankshaft and the 2 camshafts on the TDC marks, Fig.65 (A, D).

- Fit the toothed belt and turn the tensioning pulley towards the toothed belt in a clockwise direction by hand and tighten the retaining nut of the tensioning pulley, Fig.65 (B).

NOTE: When using the original toothed belt, note the direction in which it runs.



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Fig.65. Toothed belt fitted.

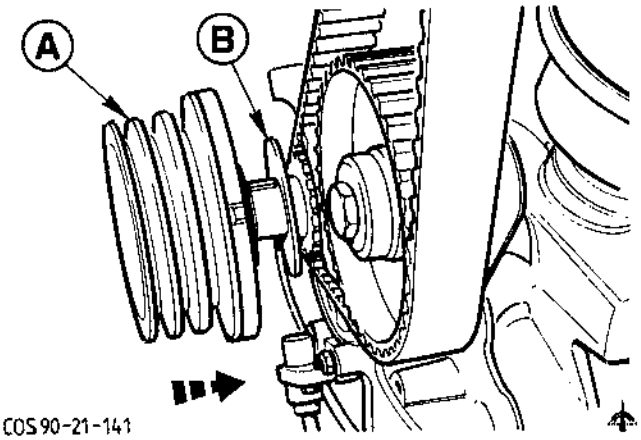
- Remove Special Tool 21-152 from the distributor and tighten the distributor clamping bolt, Fig.65 (C).

Fig.65. Toothed belt fitted.
A - TDC position on camshaft toothed belt pulleys
B - Tensioning pulley
C - Special Tool 21-152
D - TDC positon of cranshaft

- Fit the thrust washer on the crankshaft with the curved side facing inwards and fit the crankshaft vibration damper/ V-belt pulley, Fig.66.

- Turn the engine 2 revolutions in the normal direction of rotation and then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

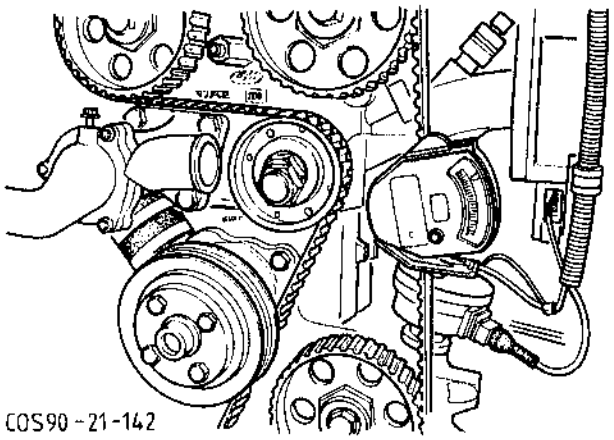


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Fig.66. A - Crankshaft vibration damper/V-belt pulley
B - Thrust washer

- Check the toothed belt tension using Special Tool 21-113 on the longest span, Fig.67. Turn the tensioning pulley to adjust the tension to specification (see Technical Data). Tighten the retaining nut of the tensioning pulley.

- Re-check the toothed belt tension and the TDC positions and repeat the tensioning operation if necessary.



COS90-21-142

Fig.67. Check toothed belt tension using Special Tool 21-113.

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94. Turn the crankshaft until a tooth on the V-belt pulley lines up with the sensor. Set the distance between the sensor and the tooth to 0,6 to 1,0 mm, Fig.68.

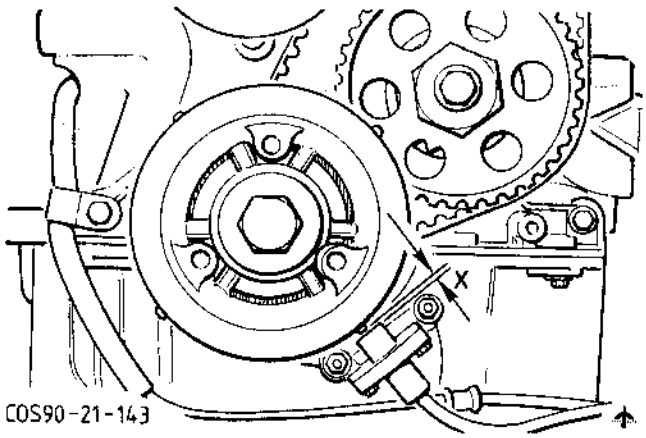


Fig.68. Engine speed/TDC sensor setting.
X = 0,6 to 1,0 mm

95. Fit the rotor arm. Fit the distributor cap with the HT leads, route the HT leads and connecting them to the spark plugs.

96. Fit the alternator and bracket to the cylinder block, Fig.69.

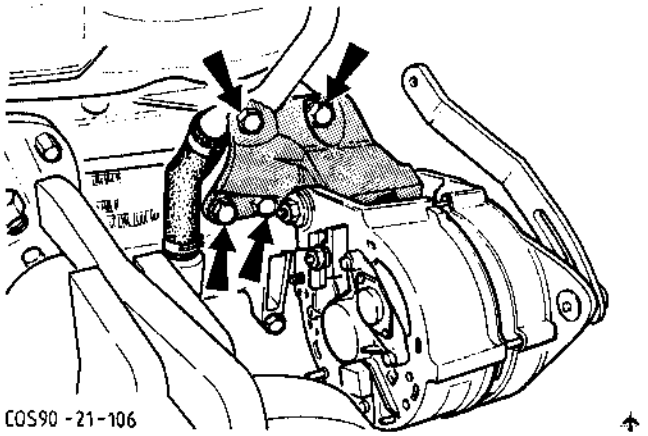


Fig.69. Retaining bolts of alternator bracket.

97. Fit the alternator adjusting strap to the cylinder block. Fit the V-belt and tension it (see Technical Data), Fig.70.

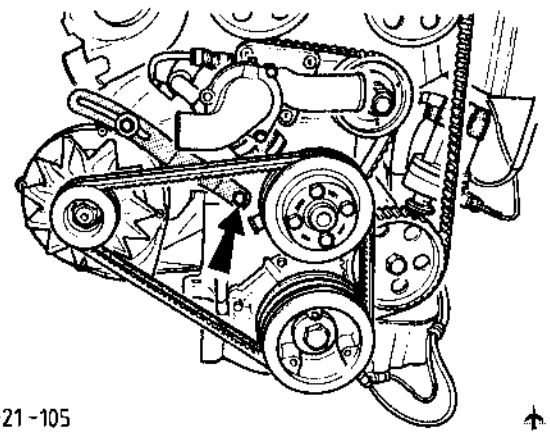


Fig.70. Retaining bolt of alternator adjusting strap.

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98. Fit the toothed belt cover, Fig.71.

99. Fit the bracket of the oil dipstick tube and insert the oil dipstick.

100. Fit the power steering pump mounting carrier, Fig.72 (A), with the 2 hexagon socket head cap screws, Fig.72 (D). Press the carrier to the rear while tightening the screws. Tighten the screws to the specified torque.

Fig.72. Power steering pump mounting carrier and carrier support (Cosworth '86/'88 shown).
A - Mounting carrier
B - Carrier support
C - Clip of engine speed/TDC sensor
D - Hexagon socket head cap screws
E - Hexagon bolts
F - Hexagon socket head cap screws
G - Mating face

101. Fit the power steering pump carrier support, Fig.72.

- Smear the mating face (G) under the carrier support with sealer (see Technical Data). Do not use a paper gasket.
- Locate the carrier support (B) together with the bracket for the multiplugs of the knock sensor and the engine speed/TDC sensor in position and screw in the 2 hexagon bolts (E) finger tight.
- Insert the hexagon socket head cap screw (F) to connect the carrier and support.
- Tighten the 2 hexagon bolts (E) until just tight.
- Tighten the hexagon socket head cap screw (F) to the specified torque.
- Torque the hexagon bolts (E) to the specified torque.

102. Fit the power steering pump and bracket, Fig.73.

103. Fit the V-belt of the power steering pump and tension it (see Technical Data).

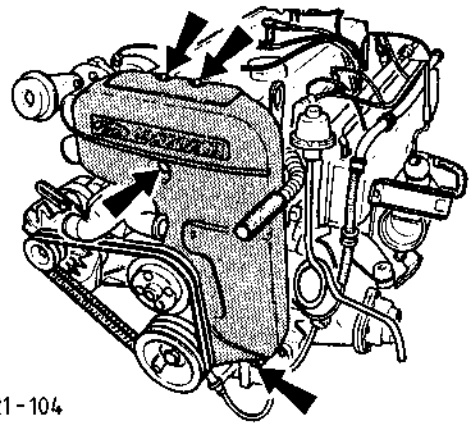
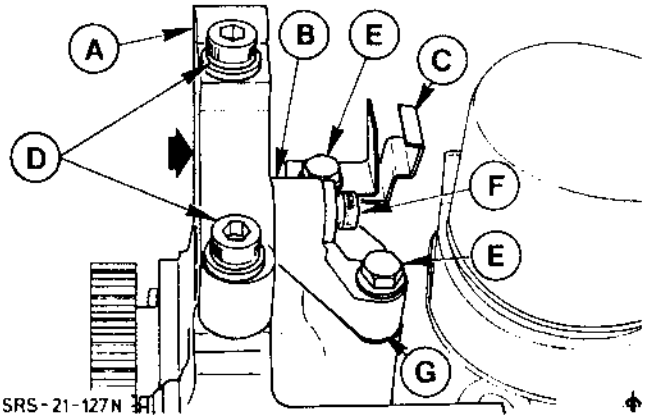

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Fig.71. Retaining bolts of toothed belt cover.



SRS-21-127N

Fig.72. Power steering pump mounting carrier and carrier support (Cosworth '86/'88 shown).

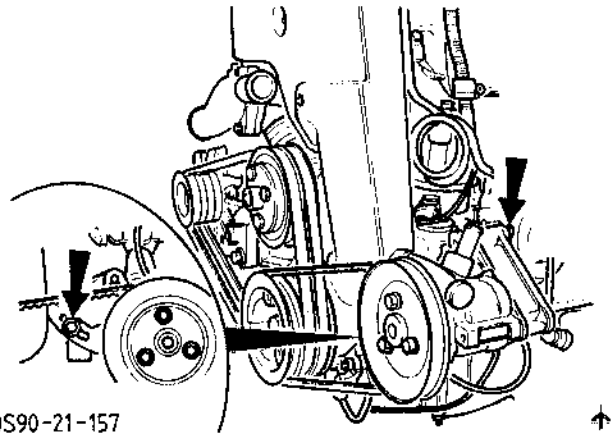

COS90-21-157

Fig.73. Retaining bolts of power steering pump.

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104. Remove the engine from the assembly stand, Fig.74 (B).

105. Secure the engine mounting with the 3 bolts, Fig.74 (A).

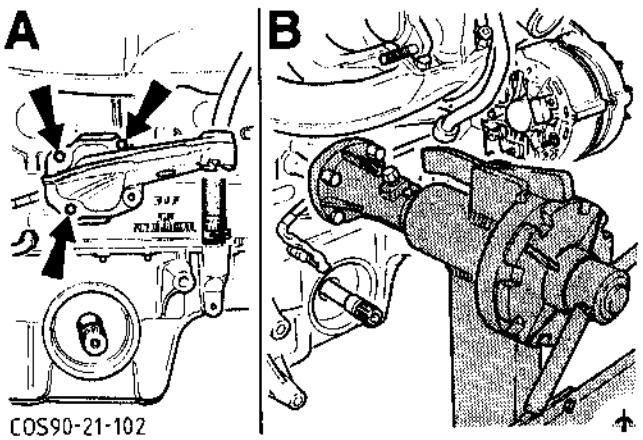


Fig.74. A - Retaining bolts of engine mounting
B - Engine on assembly stand

106. Fit the front axle assembly and brackets to the sump/cylinder block, Fig.75.

NOTE: Use a new 'O'-ring.

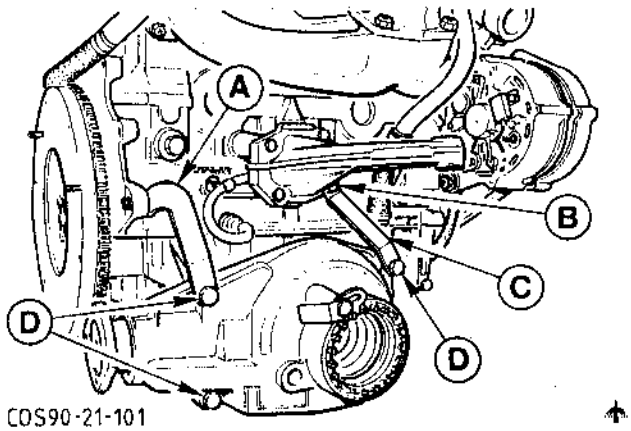


Fig.75. Front axle assembly.
A - Front bracket
B - Rear bracket
C - Retaining bolt of bracket/engine mounting
D - Retaining bolts of front axle assembly

107. Fit the oil drain plug with a new seal. Fill up with engine oil (see Technical Data for quantity and specification).

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21 163 0 CYLINDER HEAD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Socket wrench	21-002
Toothed belt tension test gauge ..	21-113
Cylinder head locating studs	21-128
Fuel pipe disconnector	23-027 A

NOTE: The engine must be allowed to cool completely before removing the cylinder head with the torbocharger and inlet manifold.

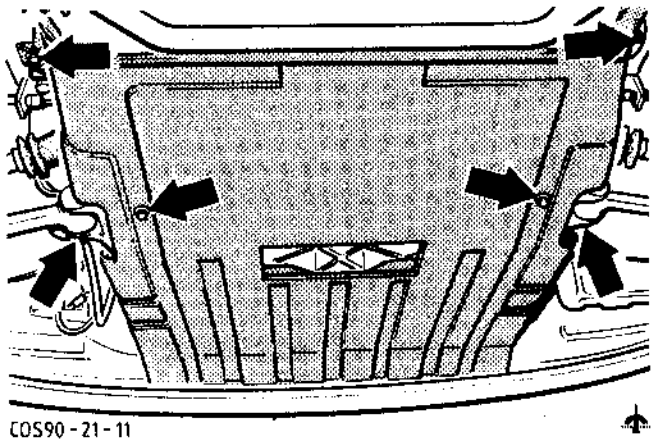


Fig.1. Retaining bolts of lower engine cover.

To Remove

1. Disconnect the battery earth cable.

2. Raise the vehicle.

3. Detach the engine cover from the side members and the front axle/engine crossmember on the left and right-hand sides (6 bolts), Fig.1. Remove the cover.

4. Place a clean collecting tray under the radiator. Disconnect the lower right-hand side coolant hose from the radiator, Fig.2, and drain off the coolant.

5. Lower the vehicle to the ground.

6. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.3 (B).

7. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.3 (A, C, D).

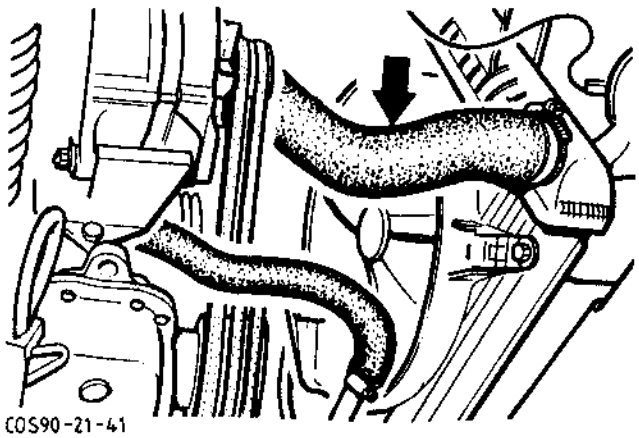


Fig.2. Lower coolant hose on radiator.

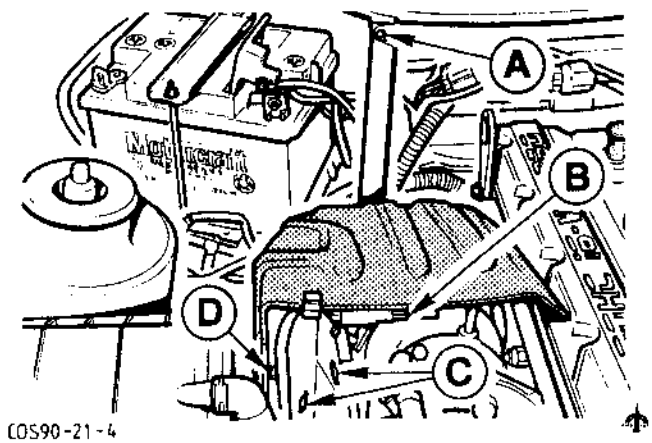


Fig.3. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

Fig.3. Turbocharger heat shield.

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8. Remove the air cleaner cover with the air hoses, Fig.4:

- Disconnect the air pipe to the engine breather valve at the connecting hose and unclip it from the radiator grille panel. Disconnect the air pipe from the air cleaner cover at the solenoid control valve.
- Disconnect the intake air hose from the turbocharger.
- Disconnect the air hose from the by-pass valve at the intercooler.
- Disconnect the vacuum pipe from the by-pass valve at the inlet manifold plenum chamber and unclip it from the radiator grille panel.
- Unclip the air cleaner cover (5 clips) and remove it with the air hoses/pipes.
- Remove the air cleaner element from the air cleaner casing.

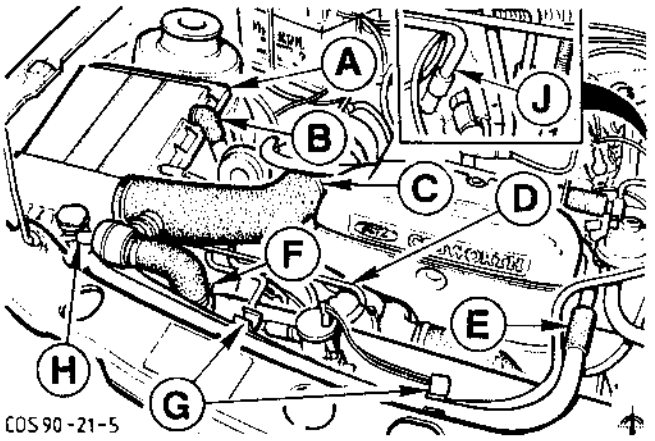


Fig.4. Air cleaner cover with air hoses/pipes.

Fig.4. Air cleaner cover with air hoses/pipes.
A - Air cleaner cover
B - To engine breather valve
C - To turbocharger
D - From solenoid control valve
E - Connecting hose of engine breather valve air pipe
F - By-pass valve to intercooler
G - Clips
H - Vacuum pipe from by-pass valve to inlet manifold plenum chamber
J - Connection of vacuum pipe from by-pass valve

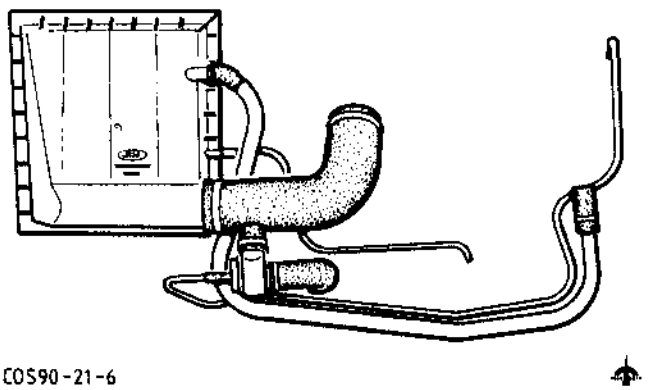


Fig.5. Air cleaner cover and air hoses/pipes removed.

9. Remove the solenoid control valve from the intercooler:

- Disconnect the solenoid control valve vacuum pipe from the turbocharger diaphragm unit, Fig.6 (A), and from the turborchrger compressor housing, Fig.6 (B).
- Disconnect the solenoid control valve multiplug, Fig.6 (E).
- Remove the solenoid control valve retaining screws Fig.6 (D, F), and remove it with the vacuum pipes.

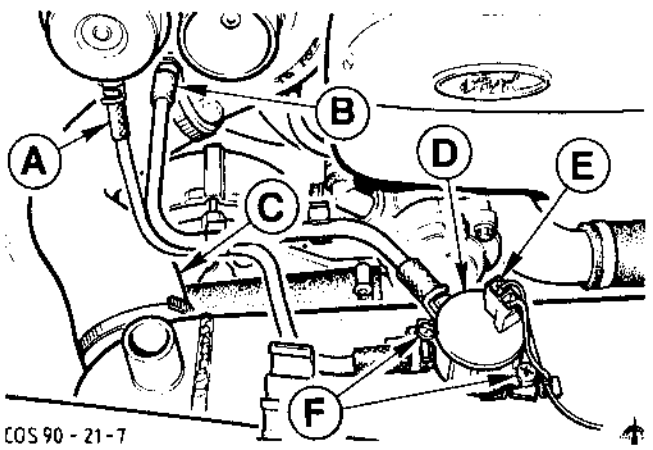


Fig.6. Solenoid control valve and lower air hose.

Fig.6. Solenoid control valve and turbocharger lower air hose.
A - Vacuum pipe to diaphragm unit
B - Vacuum pipe to compressor housing
C - Turbocharger lower air hose
D - Solenoid control valve
E - Multiplug
F - Retaining screws

10. Disconnect the lower air hose from the turbocharger, Fig.6 (C).

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11. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.7, withdraw it from the engine lifting eye and place it to one side.

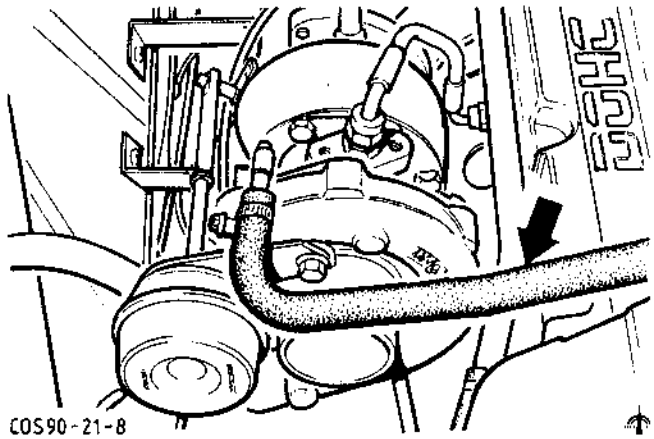


Fig.7. Coolant hose to degas tank.

12. Unclip the throttle cable from the throttle linkage (1 clip). Compress the 2 sprung lugs of the retaining clip using pliers and detach the throttle cable from the bracket, Fig.8.

Fig.8. Detach throttle cable.
A - Throttle cable
B - Throttle linkage clip
C - Retaining clip

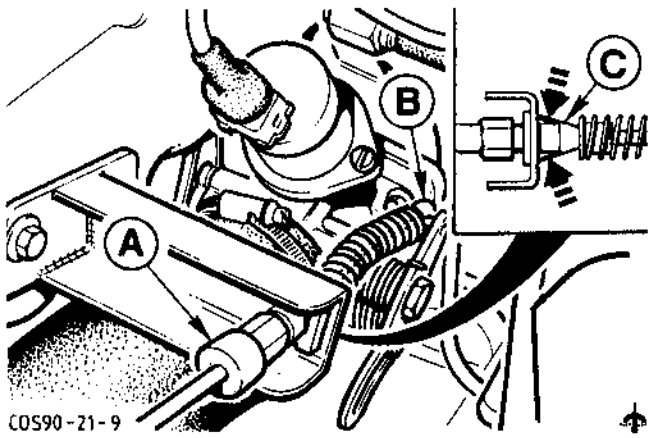


Fig.8. Detach throttle cable.

13. Disconnect the air hose from the intercooler to the throttle housing, Fig.9.

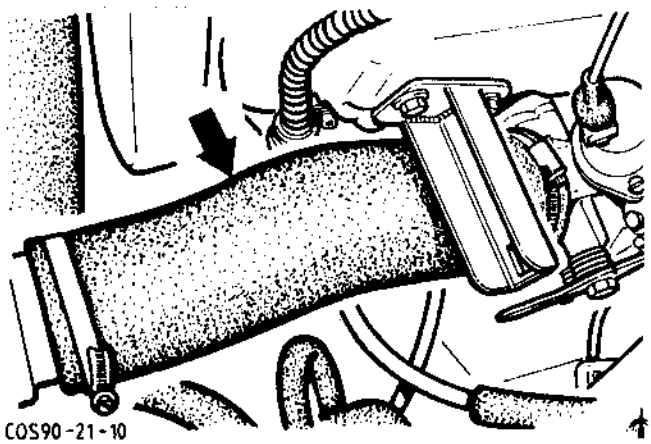


Fig.9. Air hose from intercooler to throttle housing.

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14. Disconnect the coolant hose from the thermostat housing and dismantle and remove the coolant hose to the lower right-hand side of the radiator, Fig.10.

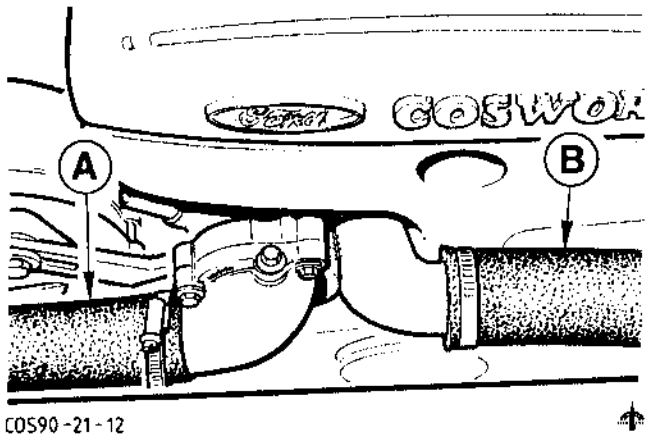


Fig.10. Coolant hoses on thermostat housing.
A - To lower right-hand side of radiator
B - To upper left-hand side of radiator

15. Release the upper hose clip on the coolant hose between the thermostat housing and the water pump, Fig.11 (A).

Fig.11. Hose clips on coolant hose and oil return hose.
A - Upper hose clip on coolant hose between thermostat housing and water pump
B - Hose clip on turbocharger oil return hose

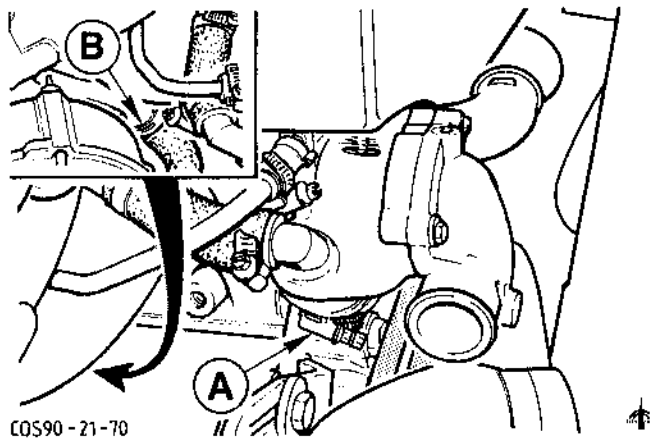


Fig.11. Hose clips on coolant hose and oil return hose.

16. Move the hose clip of the turbocharger oil return hose down on the hose, Fig.11 (B).

17. Disconenct the upper coolant hose from the heater radiator, Fig.12.

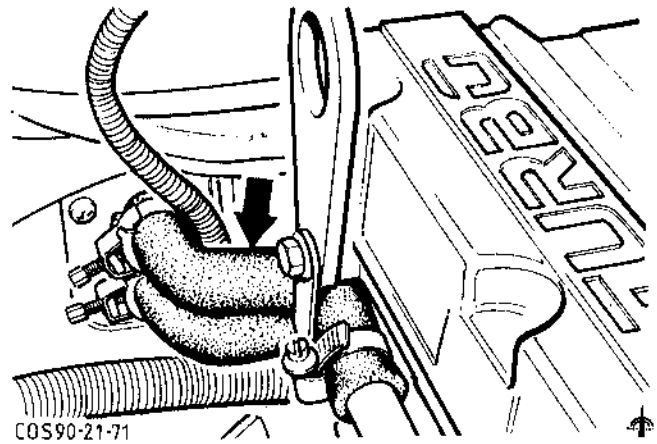


Fig.12. Upper coolant hose to heater radiator.

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18. Disconnect the 3 engine wiring loom multiplugs, Fig.13.

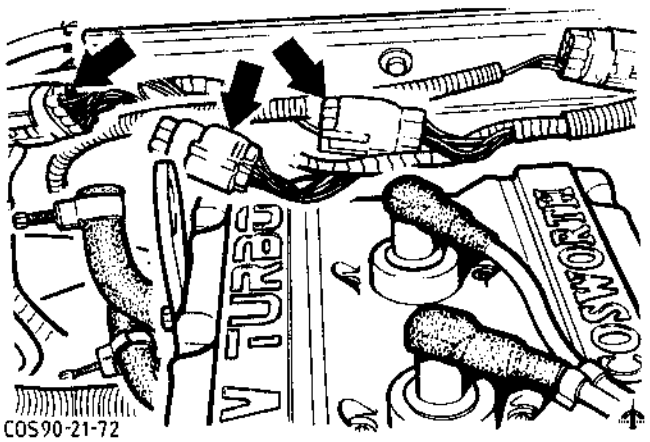


Fig.13. Engine wiring loom multiplugs.

19. Disconnect the distributor multiplug. Disconnect the multiplugs of the knock sensor and the engine speed/TDC sensor, Fig.14.

Fig.14. Multiplugs on distributor.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

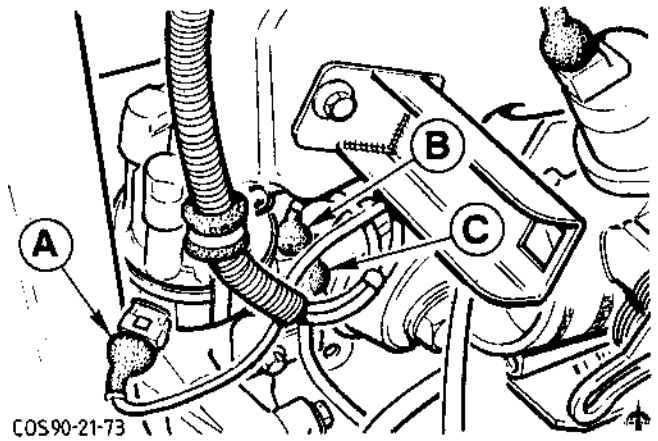


Fig.14. Multiplugs on distributor.

20. Disconnect the plug from the oil pressure switch, Fig.15.

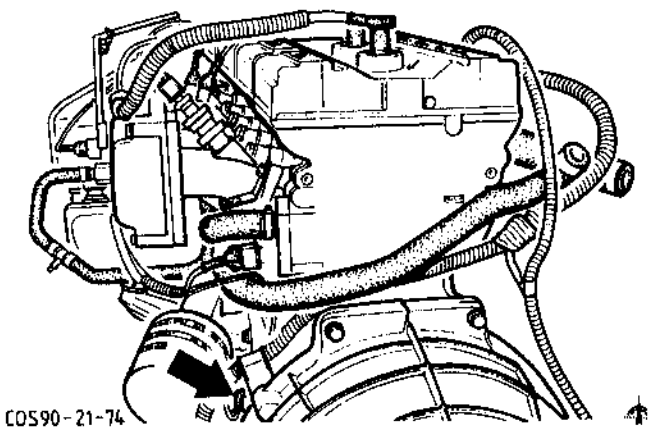


Fig.15. Oil pressure switch plug. (shown with engine removed)

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21. Disconnect the fuel pipes:

- Insert the steel wire ends of Special Tool 23-027 A in the openings in the pipe coupling and press in. Pull on the other part of the fuel feed pipe, Fig.16. and separate the coupling.

- Disconnect the fuel return pipe Fig.17, as described for the feed pipe.

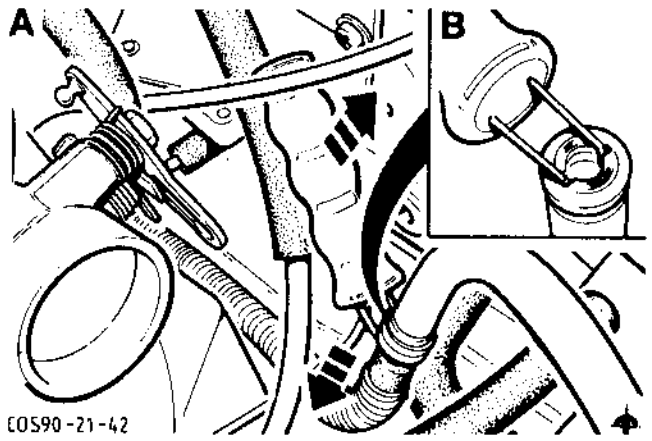


Fig.16. Fuel feed pipe.
A - Disconnect using Special Tool 23-027 A
B - Special Tool inserted (fuel pipe shown disconnected)

Fig.16. Fuel feed pipe.

22. Remove the oil dipstick and detach the bracket of the oil dipstick tube from the cylinder head (1 bolts), Fig.18 (A, C)

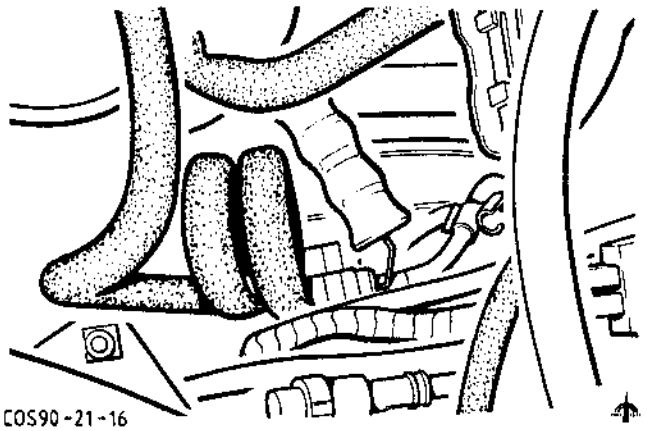


Fig.17. Disconnect the fuel feed pipe using Special Tool 23-017 A.

23. Disconnect the coolant hose to the oil cooler from the cylinder head, Fig.18 (B).

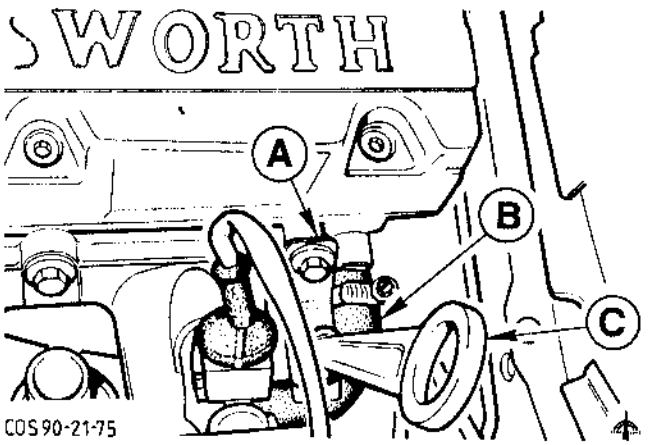


Fig.18. A - Bracket of oil dipstick tube
B - Coolant hose to oil cooler
C - Oil dipstick

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24. Unscrew the self-locking nut on the throttle housing vibration damper, Fig.19. Release and unscrew the nut on the engine mounting (on the left-hand side).

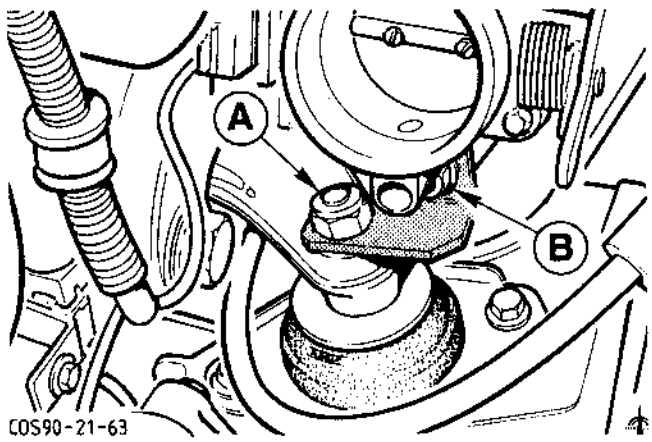


Fig.19. Throttle housing vibration damper.
A - Engine mounting nut
B - Self-locking nut with spring washers

Fig.19. Throttle housing vibration damper.

25. Disconnect the carbon canister vacuum hose from the T-piece, Fig.20.

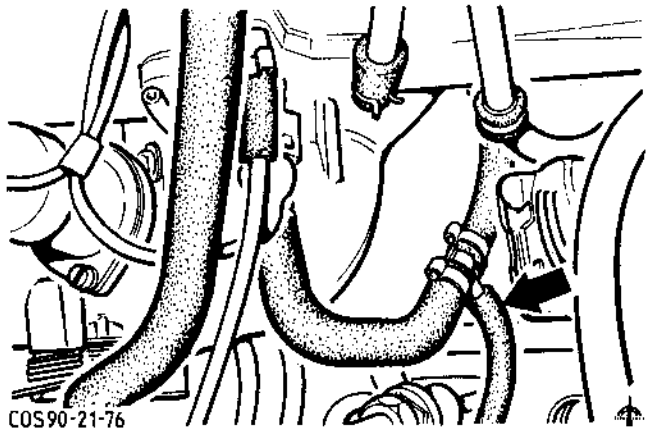


Fig.20. Vacuum hose to carbon canister.

26. Disconnect the front exhaust pipe from the turbocharger (3 nuts), Fig.21.

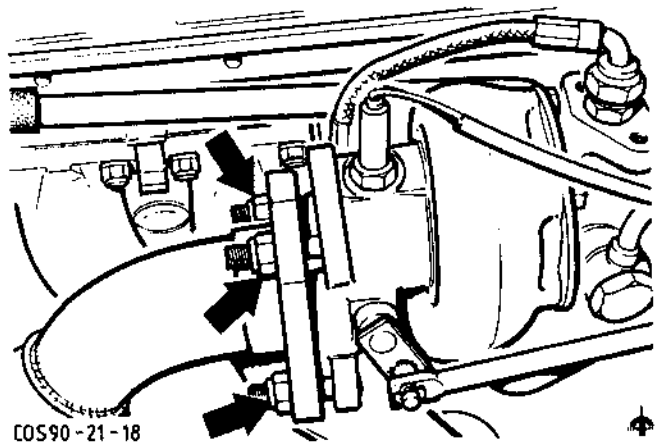


Fig.21. Retaining nuts on front exhaust pipe.

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27. Remove the toothed belt cover from the cylinder head/block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.22.

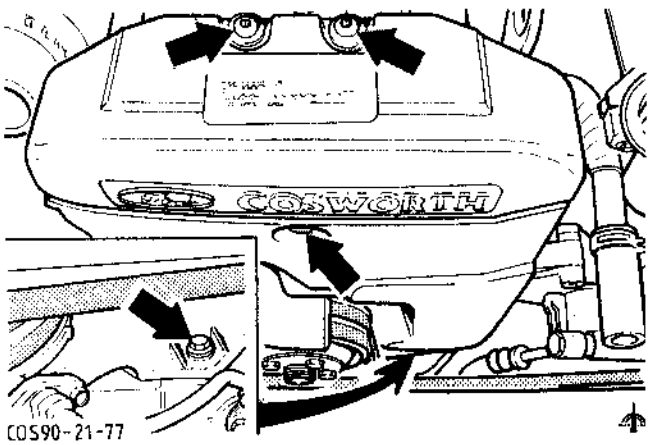


Fig.22. Retaining bolts of toothed belt cover. (inset shows detail from below)

28. Turn the crankshaft in the normal direction of rotation using a proprietary socket wrench until the 2 camshaft toothed belt pulleys line up on the TDC mark, Fig.23.

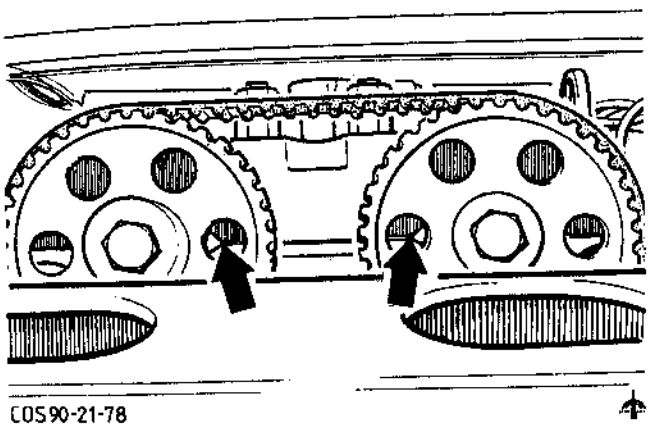


Fig.23. Camshaft toothed belt pulleys lined up to TDC marks.

29. Hold the eccentric and release the lock nut. Turn the eccentric and slacken the toothed belt, Fig.24. Remove the toothed belt.

NOTE: Mark the direction in which the toothed belt runs.

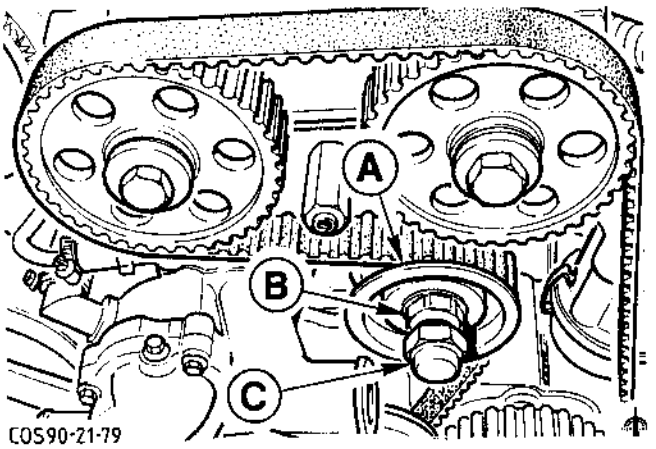


Fig.24. Toothed belt tensioning pulley.
A - Tensioning pulley
B - Eccentric
C - Locknut

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30. Disconnect the spark plug connectors from the spark plugs and remove the spark plugs. Disconnect the ignition coil lead from the distributor cap. Pull the HT leads with the rubber guide downwards out of the HT lead bracket and remove the distributor cap and rotor arm, Fig.25.

Fig.25. Distributor and leads.
A - Bracket for HT leads with rubber guide
B - Ignition coil lead
C - Distributor cap

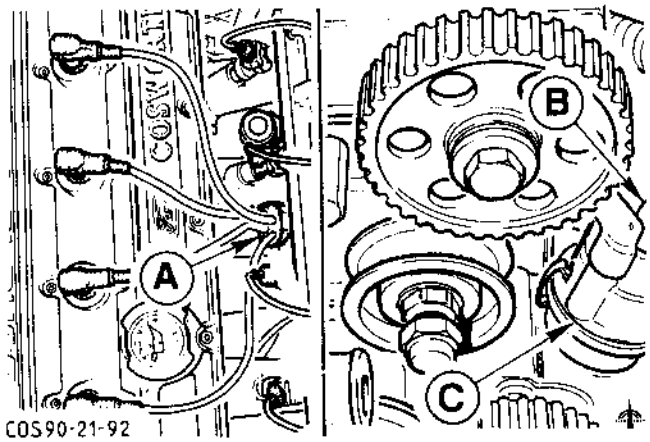


Fig.25. Distributor and leads.

31. Remove the cylinder head cover from the cylinder head (20 hexagon socket head bolts), Fig.26.

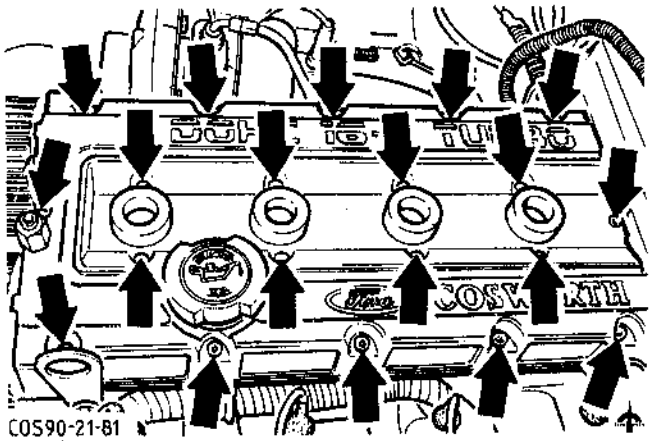


Fig.26. Retaining bolts of cylinder head cover.

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32. Loosen the bolts of the engine lifting eyes, angle the engine lifting eyes towards the centre of the cylinder head and tighten the bolts again, Fig.28 (A).

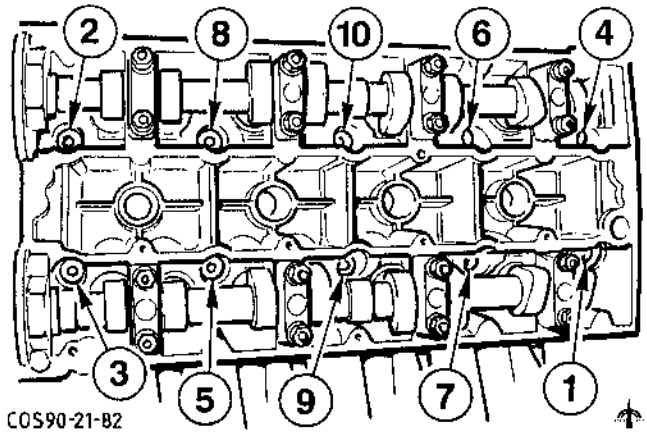


Fig.27. Cylinder head bolt loosening sequence.

33. Unscrew the 10 cylinder head bolts in the indicated loosening sequence using Special Tool 21-002, and remove them, Fig.27.

NOTE: **The engine must be allowed to cool to below 45°C before the cylinder head bolts are undone.**

34. Attach the hooks on the chain to the engine lifting eyes. Lift the cylinder head complete with the turbocharger and inlet manifold off the cylinder block using a hoist, Fig.28, disconnect the oil pipe from the turbocharger oil return hose, the thermostat housing connector from the coolant hose and the hose from the oil separator.

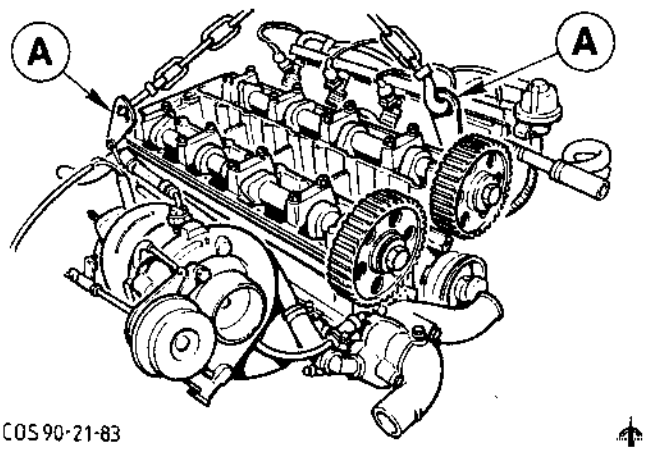


Fig.28. Cylinder head suspended and lifted clear.
A - Lifting eyes angled

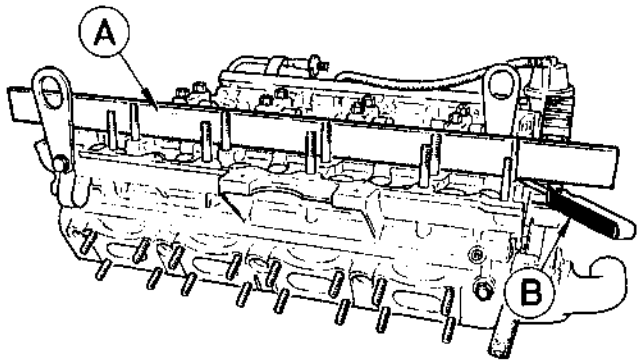
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Check the flatness or distortion of the cylinder head

Whenever a cylinder head is removed, the flatness of the faces mating with the cylinder block and cylinder head cover must be checked as follows:

35. Carefully clean the face mating with the cylinder head cover. Place a steel straight edge along the centre line in the longitudinal direction and check the flatness or convex distortion with a feeler gauge, Fig.29.

NOTE: If the distortion is more than 0,1 mm, the cylinder head has overheated and cannot be used again.
If the distortion is 0,1 mm or less, check the face mating with the cylinder block.

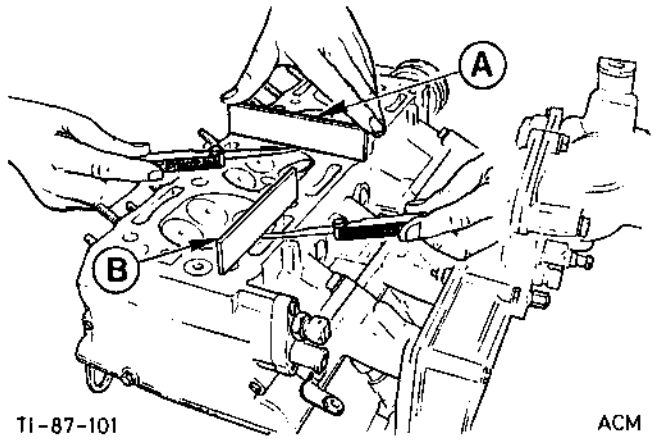


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Fig.29. Check flatness of face mating with cylinder head cover.
A - Steel straight edge
B - Feeler gauge

36. Carefully clean the mating face. With a 100 mm long steel straight edge, check the flatness in the transverse direction between the holes for the retaining bolts (5 points), Fig.39 (A). Check the flatness in the longitudinal direction between the holes for the retaining bolts (8 points), Fig.30 (B).

NOTE: The maximum permissible deviation is 0,02 mm.



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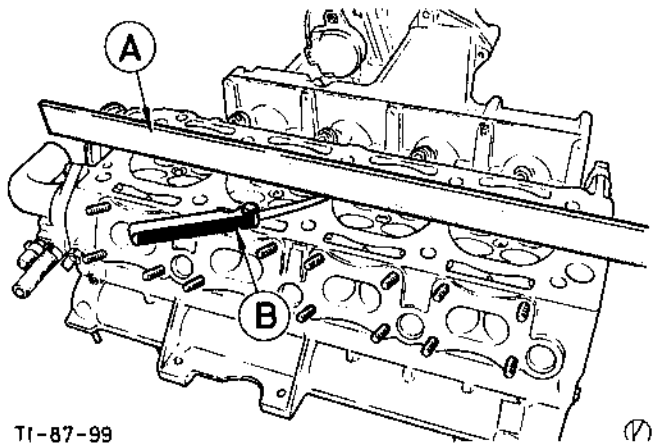
Fig.30. Check flatness of face mating with cylinder block.
A - In transverse direction
B - In longitudinal direction

37. Check the flatness or concave distortion in the longitudinal direction along the centre line, Fig.31.

NOTE: The maximum permissible deviation is 0,08 mm.

If the maximum figures of 0,02 mm and 0,08 mm are exceeded, the mating face must be skimmed, removing a maximum of 0,13 mm of material.

The minimum cylinder head height (distance between the 2 mating faces) must not be less than 138.68 mm.



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Fig.31. Measure distortion in longitudinal direction.

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To Install

NOTE: When installing, tighten the nuts and bolts as specified as in Technical Data. Make sure that the mating faces of the cylinder head/block and the new gasket are clean.

38. Screw the locating studs, Special Tool 21-128, onto the tapped holes for the cylinder head bolts and fit the cylinder head gasket, Fig.32 (A, B).

39. Lift the cylinder head using a hoist and lower it onto the cylinder block, guiding the locating studs into the corresponding holes in the cylinder head.

NOTE: Guide the supporting bracket of the throttle housing vibration damper onto the engine mounting stud. Connect the turbocharger oil return hose to the oil pipe and secure it with the hose clip. Connect the coolant hose running to the water pump to the connector on the thermostat housing and secure it with the hose clip. Connnect the engine breather hose to the oil separator connector, Fig.32 (C, D, E, F).

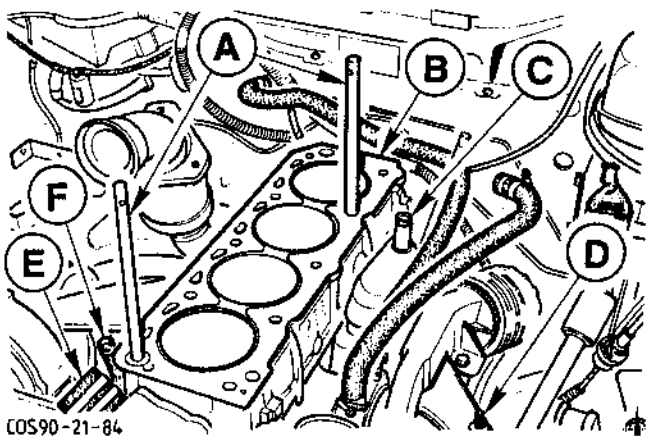


Fig.32. Cylinder head removed.
A - Special Tool 21-128
B - Cylinder head gasket
C - Oil separator connector
D - Engine mounting stud
E - Coolant hose to water pump
F - Turbocharger oil return hose

40. Disconnect the hooks on the chain from the cylinder head lifting eyes and remove the hoist. Straighten the lifting eyes and secure them.

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41. Fit new cylinder head bolts and tighten finger tight, unscrew the locating studs and fit the last 2 cylinder head bolts.

NOTE: Before fitting the cylinder head bolts, lubricate the U-shaped washers and the underside of the head and thread of the bolts with engine oil.

42. Tighten the cylinder head bolts in the specified sequence using Special Tool 21-002 (see Technical Data), Fig.33.

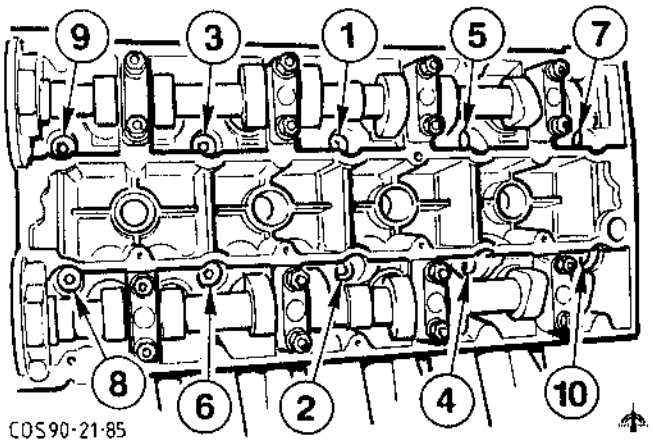


Fig.33. Cylinder head bolt tightening sequence.

43. Then turn the cylinder head bolts through a further 180° + 10° in the same sequence using Special Tool Z1-002 and a proprietary angle gauge and note the tightening torque obtained, Fig.34.

NOTE: A tightening torque of less than 115 Nm is not acceptable and bolts with a torque below this figure must be changed. When all the bolts have been tightened, check that no bolt can be turned any further applying a torque of 110 Nm.

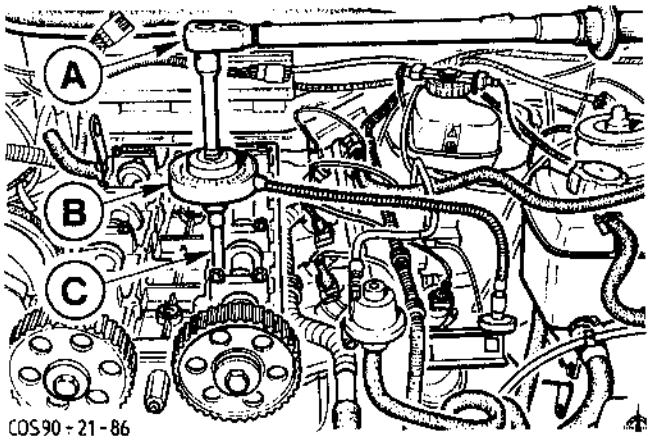


Fig.34. Tighten cylinder head bolts further.

Fig.34. Tighten cylinder head bolts further.
A - Torque wrench
B - Proprietary angle gauge
C - Special Tool 21-002

44. Check that the crankshaft vibration damper/V-belt pulley is in the TDC position, Fig.35.

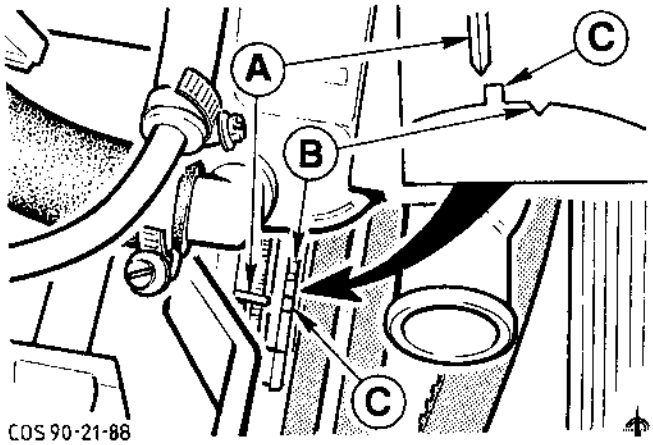


Fig.35. Crankshaft vibration damper/V-belt pulley TDC position.

Fig.35. Crankshaft vibration damper/V-belt pulley in TDC position.
A - Tooth on cylinder block
B - Notch in V-belt pulley
C - Cam on V-belt pulley

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45. Turn the 2 camshaft toothed belt pulleys to the TDC position, Fig.36.

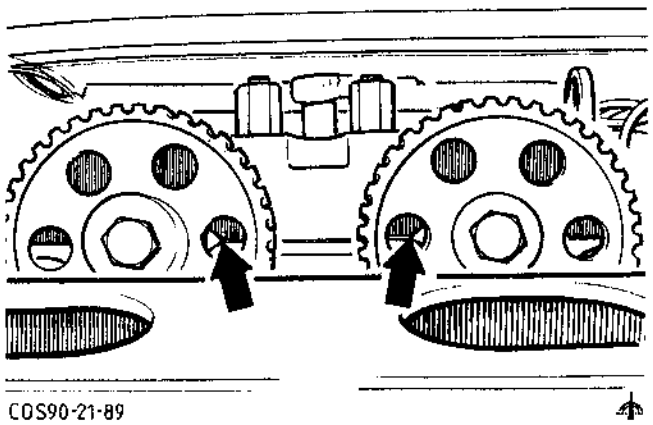


Fig.36. Camshaft toothed belt pulleys in TDC position.

46. Working in an anti-clockwise direction, fit the toothed belt starting at the distributor shaft.

NOTE: Note the direction in which the toothed belt runs.

47. Adjust the toothed belt tension as follows:

- Turn the toothed belt tensioning pulley in a clockwise direction towards the toothed belt by hand and tighten the toothed belt tensioning pulley lock nut.

- Turn the engine several revolutions in the normal direction of rotation then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

Check the toothed belt tension by applying Special Tool 21-113 to the longest span of the toothed belt, Fig.37.
If necessary, adjust the toothed belt tensioning pulley until the specified tension is obtained (see Technical Data).

Re-check the toothed belt tension and the TDC positions and repeat the tensioning operation if necessary.

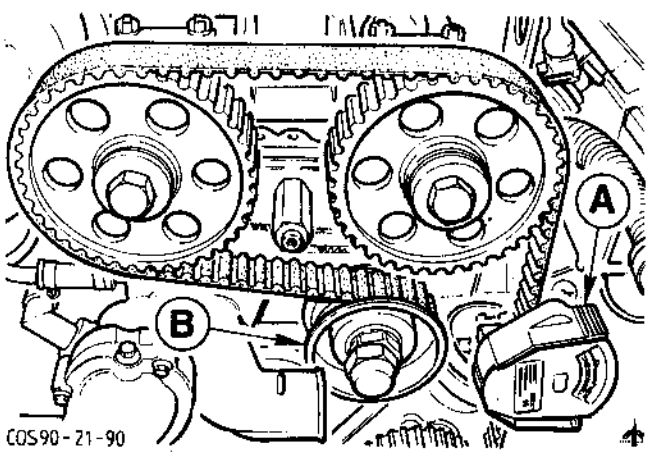


Fig.37. Tension toothed belt.
A - Special Tool 21-113
B - Toothed belt tensioning pulley

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48. Place the cylinder head cover gasket on the cylinder head and the 2 rubber seals on the front camshaft bearing caps, Fig.38.

NOTE: Coat the ends of the rubber seals with sealer (see Technical Data).

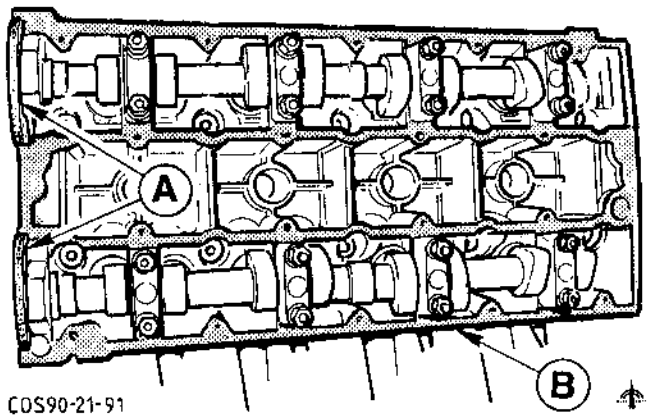


Fig.38. A - Rubber seals
B - Cylinder head cover gasket

49. Fit the cylinder head cover, screw in the 20 hexagon socket head bolts and tighten them.

50. Fit the spark plugs and tighten them to the specified torque. Fit the rotor arm in the distributor. Fit the distributor cap with the HT leads and connect the ignition coil lead to the connection on the distributor cap. Run the HT leads from below between the inlet manifold and cylinder head, insert the rubber guide in the bracket and connect the spark plug connectors to the spark plugs, Fig.39.

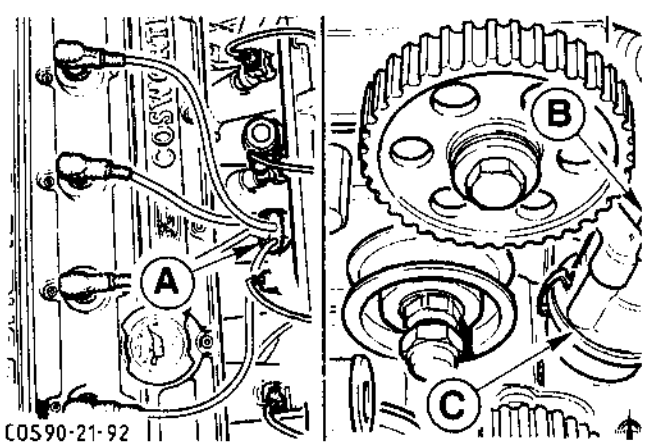


Fig.39. Distributor and leads.

Fig.39. Distributor and leads.
A - Bracket for HT leads with rubber guide
B - Ignition coil lead
C - Distributor cap

51. Fit the toothed belt cover to the cylinder head/block, Fig.40.

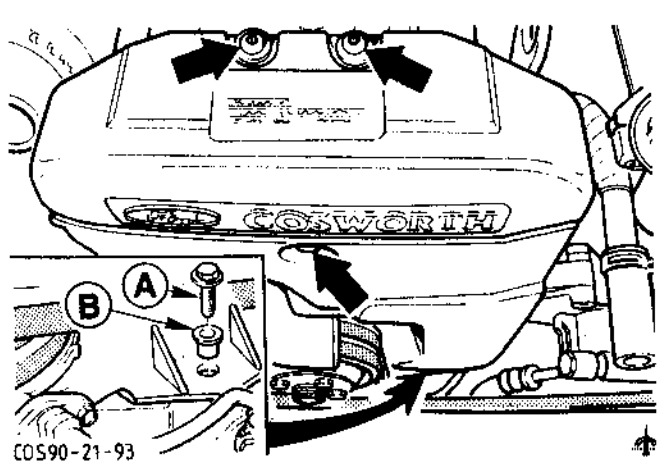


Fig.40. Retaining bolt of toothed belt cover. (detail shown from below)
A - Bolt
B - Bush

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52. Connect the front exhaust pipe to the turbocharger, Fig.41.

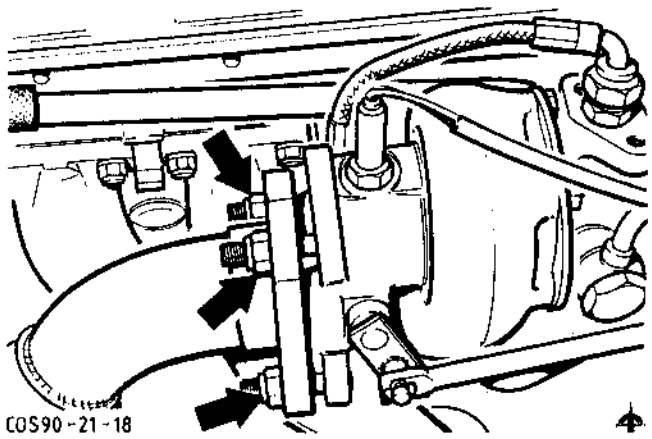


Fig.41. Retaining nuts of front exhaust pipe.

53. Connect the carbon canister vacuum hose to the T-piece, Fig.42.

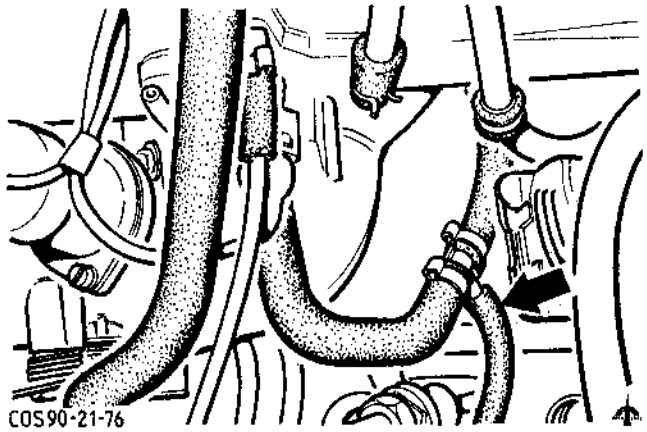


Fig.42. Vacuum hose to carbon canister.

54. Fit a new self-locking nut on the throttle housing vibration damper, but do not tighten it.
Tighten the nut on the engine mounting.
Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken if half a turn, Fig.43.

NOTE: Note the arrangement of the spring washers.

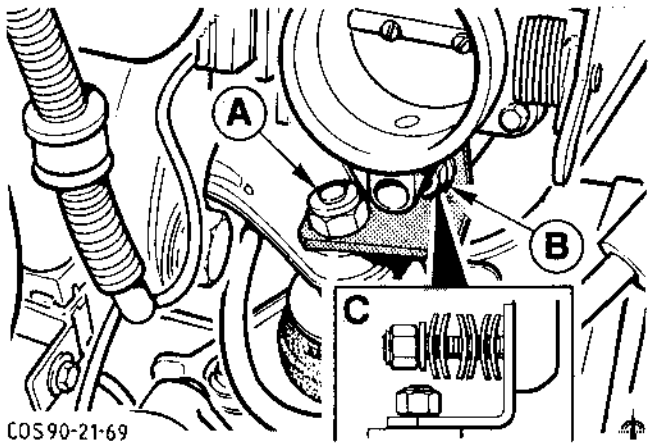


Fig.43. Throttle housing vibration damper.
A - Engine mounting nut
B - Self-locking nut
C - Arrangement of spring washers

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55. Connect the coolant hose running to the oil cooler to the cylinder head, Fig.44 (B).

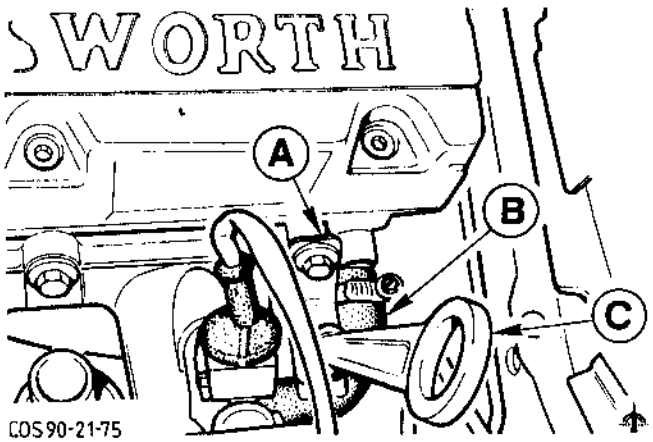


Fig.44. A - Oil dipstick tube bracket
B - Coolant hose to oil cooler
C - Oil dipstick

56. Fit the bracket of the oil dipstick tube to the cylinder head and insert and oil dipstick, Fig.44 (A, C).

57. Connect the fuel feed pipe and the fuel return pipe, Fig.45.

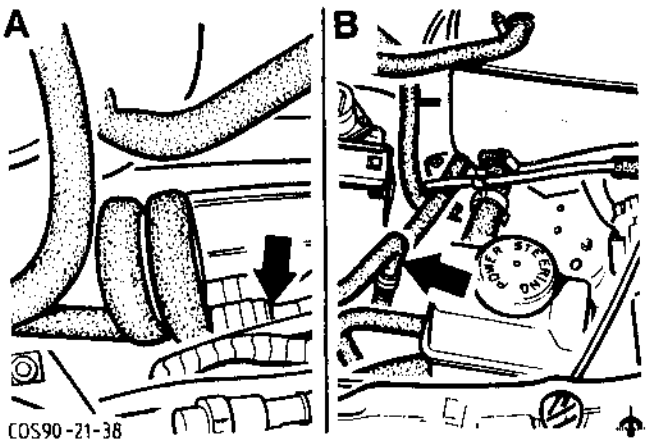


Fig.45. Fuel pipes connected.
A - Fuel pipe
B - Return pipe

58. Connect the plug of the oil pressure switch.

59. Connect the distributor multiplug and connect the multiplugs of the knock sensor and the engine speed/TDC sensor, Fig.46.

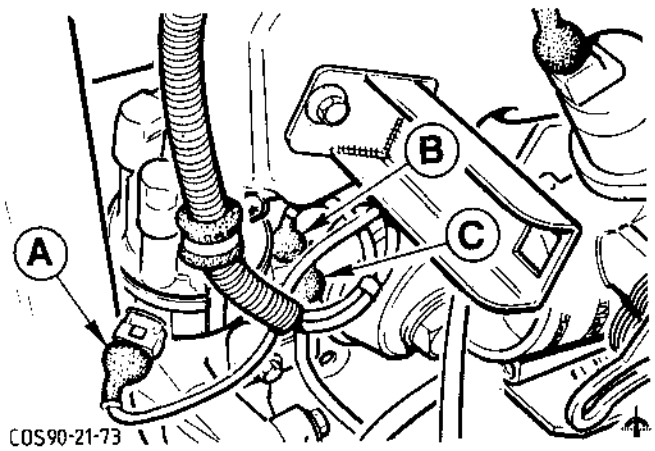


Fig.46. Multiplugs on distributor.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

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60. Connect the 3 engine wiring loom multiplugs, Fig.47.

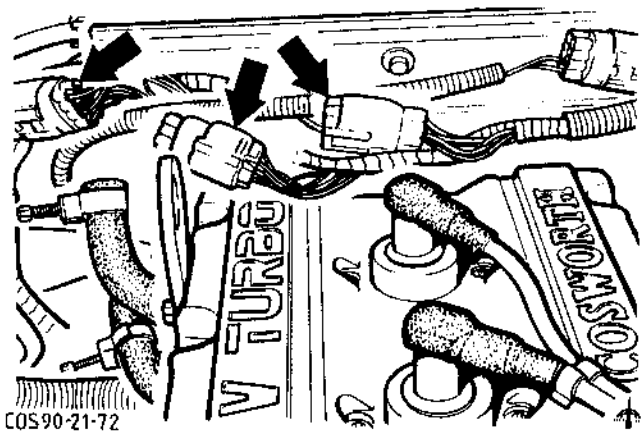


Fig.47. Engine wiring loom multiplugs.

61. Connect the upper coolant hose to the heater radiator, Fig.48.

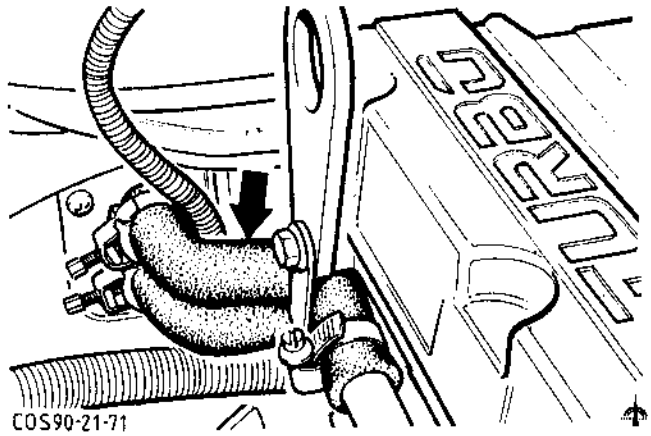


Fig.48. Upper coolant hose to heater radiator.

62. Connect the coolant hose to the thermostat housing. Fit the coolant hose running to the lower right-hand side of the radiator and connect it to the thermostat housing, Fig.49.

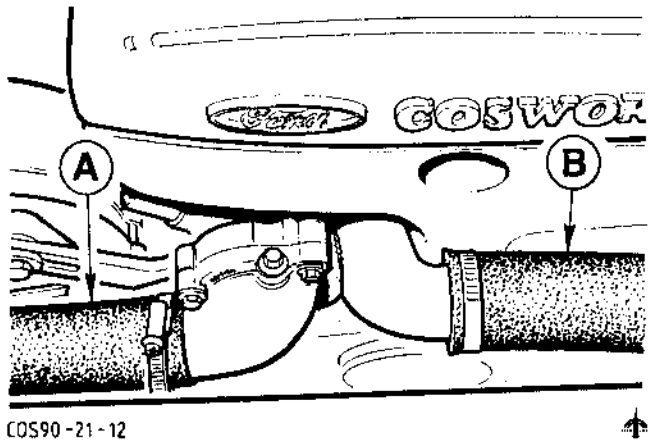


Fig.49. Coolant hoses on thermostat housing.
A - To lower right-hand side of radiator
B - To upper left-hand side of radiator

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63. Connect the air hose from the intercooler to the throttle housing, Fig.50.

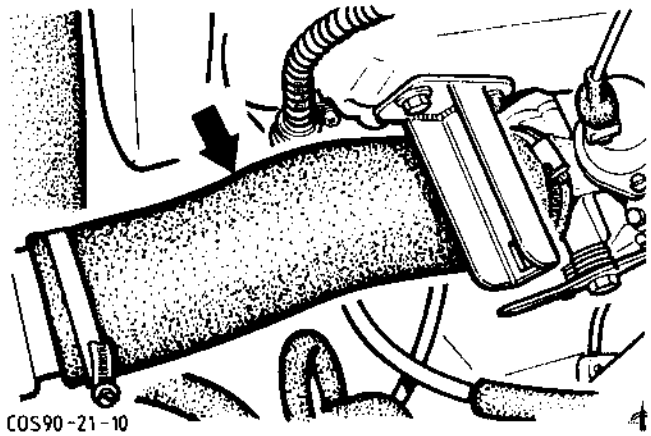


Fig.50. Air hose from intercooler to throttle housing.

64. Guide the throttle cable and retaining clip into the opening in the throttle cable bracket and clip it in place. Clip the throttle cable to the throttle linkage, Fig.51.

NOTE: Position the sprung lugs vertically to facilitate removal.

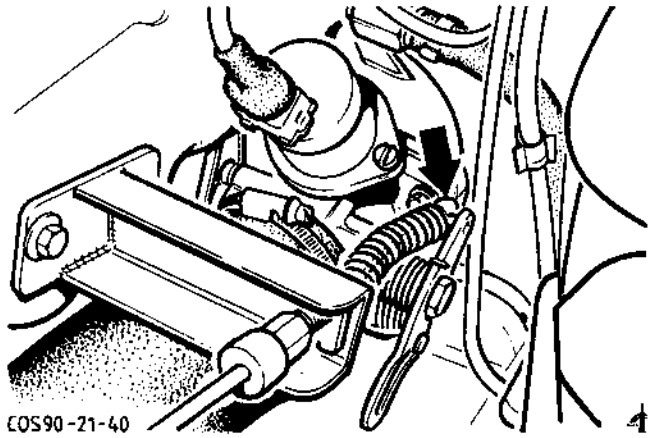


Fig.51. Throttle cable fixture.

65. Pass the coolant hose running to the degas tank through the engine lifting eye and connect it to the turbocharger connector, Fig.52.

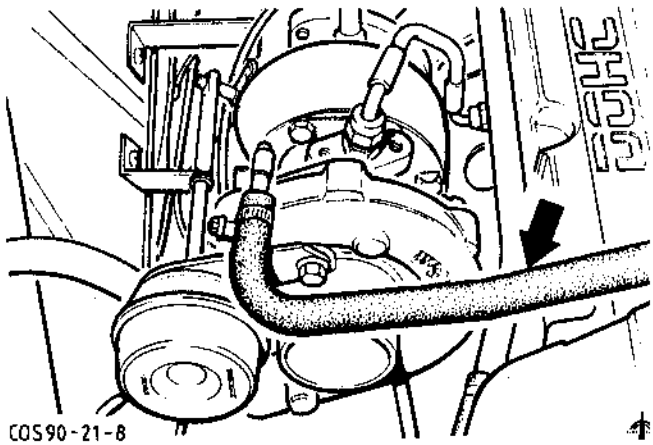


Fig.52. Coolant hose to degas tank.

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66. Connect the lower air hose to the turbocharger and to the intercooler, Fig.53 (C).

Fig.53. Solenoid control valve and turbocharger lower air hose.
A - Vacuum pipe to diaphragm unit
B - Vacuum pipe to compressor housing
C - Turbocharger lower air hose
D - Solenoid control valve
E - Multiplug
F - Retaining screws

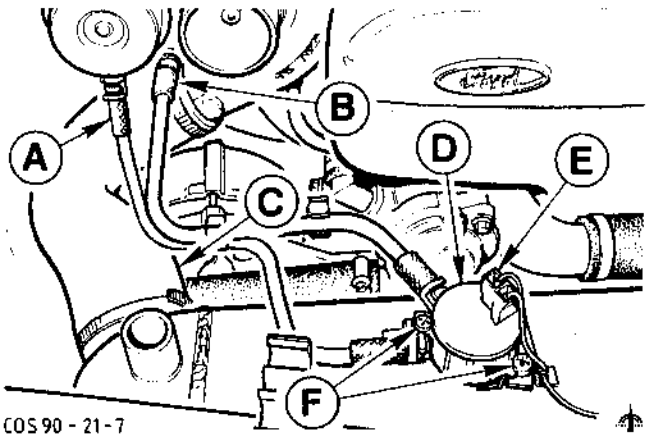


Fig.53. Solenoid control valve and turbocharger lower air hose.

67. Fit the solenoid control valve to the intercooler:

- Fit the solenoid control valve and vacuum hoses to the intercooler, Fig.53 (D, F).
- Connect the solenoid control valve vacuum pipe to the turbocharger diaphragm unit, Fig.53 (A), and to the turbocharger compressor housing, Fig.53 (B).
- Connect the solenoid control valve multiplug, Fig.53 (E).

68. Fit the air cleaner with the air hoses, Fig.54:

- Place the air cleaner element in the air cleaner casing.
- Fit the air cleaner cover with the air hoses/pipes on the air cleaner casing and clip it in place.
- Connect the vacuum pipe from the by-pass valve to the inlet manifold plenum chamber and clip it to the radiator grille panel.
- Connect the air hose from the by-pass valve to the intercooler.
- Connect the intake air hose to the turbocharger.
- Connect the air pipe running to the engine breather valve to the connecting hose and clip it to the radiator grille panel. Connect the air pipe from the air cleaner cover to the solenoid valve.

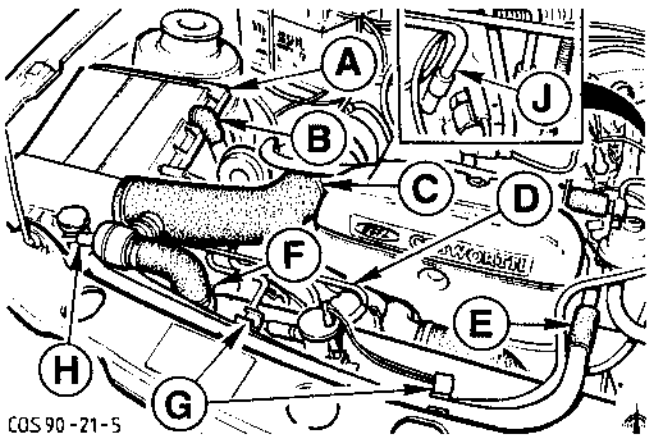


Fig.54. Air cleaner cover with air hoses/pipes.
A - Air cleaner cover
B - To engine breather valve
C - To tuborcharger
D - From solenoid control valve
E - Connecting hose of engine breather valve air pipe
F - By-pass valve to intercooler
G - Clip
H - Vacuun pipe from by-pass valve to inlet manifold plenum chamber
J - Connecting vacuum pipe from by-pass valve

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69. Locate the turbocharger heat shield in position and press it into the 2 lower clips.
Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.55 (A, C, D).

Fig.55. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

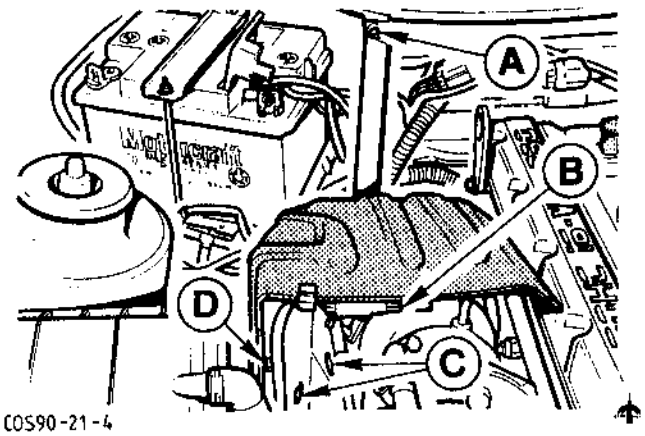


Fig.55. Turbocharger heat shield.

70. Connect the multiplug of the HEGO sensor and clip it to the heat shield, Fig.55 (B).

71. Connect the earth cable and the starter motor positive cable to the battery. Screw the earth cable to the battery tray, Fig.56.

72. Fill the cooling system up to the MAX mark on the degas tank (see Technical Data for quantity and specification). Unscrew the vent screw on the thermostat housing to allow air to escape from the cooling system. Smear the vent screw with sealer (see Technical Data for specification), refit and tighten, Fig.57.

NOTE: Introduce the coolant slowly so that air bubbles can escape.

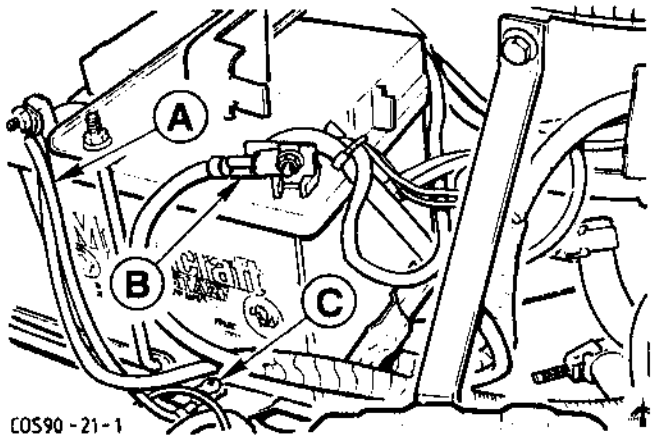


Fig.56. Battery cables.
A - Earth cable
B - Starter motor positive cable
C - Earth cable to battery tray

73. Check the engine oil level and top up as necessary (see Technical Data for quantity and specification).

74. Start the engine and run it up to normal operating temperature. Check all the coolant/oil hose connections for leaks and tighten as necessary. Top up with coolant and oil as necessary.

75. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.

76. Raise the vehicle.

77. Fit the lower engine cover to the side members and the front axle/engine crossmember on the left and right-hand sides.

78. Lower the vehicle to the ground.

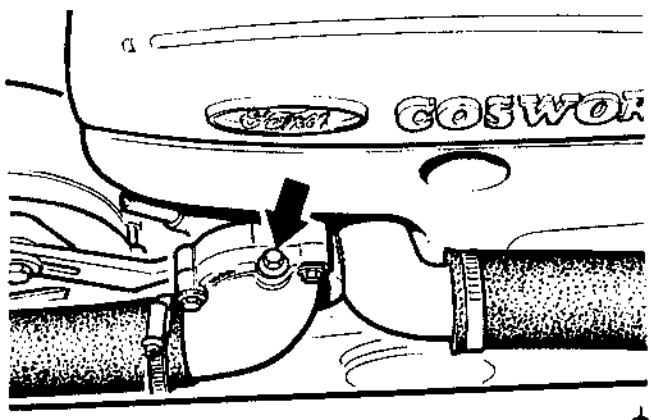


Fig.57.

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21 165 5 CYLINDER HEAD - REPLACE (Cylinder Head Removed)

SPECIAL SERVICE TOOLS REQUIRED:

Valve spring compressor	21-024
Adaptor for valve spring compressor	21-024-06
Valve stem oil seal installer (exhaust valves)	21-129 A
Valve stem oil seal installer (inlet valves)	21-130 A

WORKSHOP FABRICATED TOOLS:

Mounting plate (see Fig.B in Technical Data)

To Dismantle

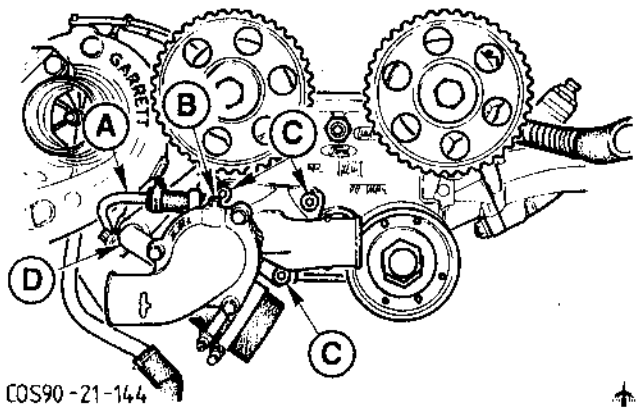
1. Place 2 blocks of wood of the same size under the front and rear ends of the cylinder head to avoid damage.

2. Remove the thermostat housing, Fig.1:

- Disconnect the turbocharger coolant return hose (1 hose clip).
- Unscrew the vent screw from the thermostat housing.
- Unscrew the 3 retaining bolts and remove the thermostat housing with the coolant pipe.

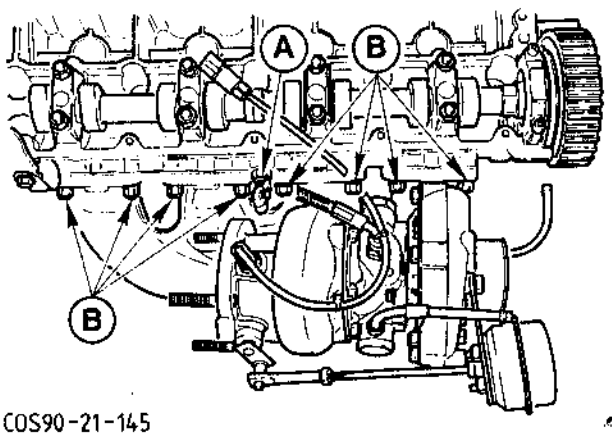
3. Remove the exhaust manifold, Fig.2:

- Unscrew the turbocharger oil feed pipe from the cylinder head (1 union nut).
- Unscrew the retaining nuts (16) and remove the exhaust manifold with the turborcharger.
- Remove the 4 gaskets.



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Fig.1. Thermostat housing.
A - Turbochrger coolant return hose
B - Vent screw
C - Retaining bolts
D - Coolant pipe



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Fig.2. A - Turbocharger oil pipe
B - Exhaust manifold upper retaining nuts

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4. Remove the inlet manifold, Fig.3:

- Disconnect the multiplug from the engine coolant temperature sensor and the plug from the temperature gauge sender unit.
- Unscrew the upper retaining bolts (4), unscrew the lower retaining nuts (4) and remove the inlet manifold.

Fig.3. Inlet manifold (shown from below).
A - Retaining bolts
B - Multiplug of engine coolant temperature sensor
C - Plug of temperature gauge sender unit
D - Retaining nuts

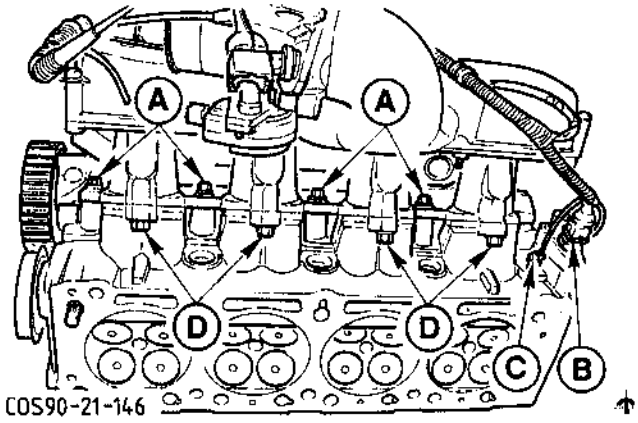


Fig.3. Inlet manifold (shown form below).

5. Remove the engine lifting eyes (2 bolts).

6. Unscrew the tensioning pulley nut and remove the tensioning pulley, Fig.4 (B).

7. Unscrew the toothed belt cover spacer stud, Fig.4 (A).

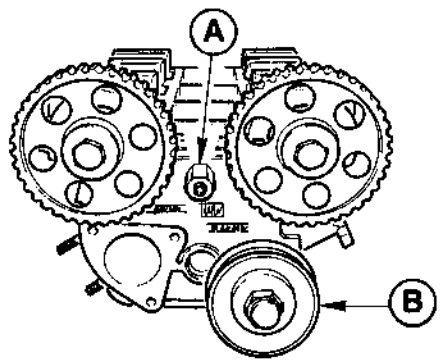


Fig.4. A - Toothed belt cover spacer stud
B - Tensioning pulley

8. Unscrew the connector of the turbocharger oil feed pipe, Fig.5 (A).

Fig.5. Parts attached to cylinder head.
A - Connector of turborcharger oil feed pipe
B - Temperature gauge sender unit
C - Coolant hose connecting flange with engine coolant temperature

9. Unscrew the temperature gauge sender unit, Fig.5. (B).

10. Detach the coolant hose connecting flange with the engine coolant temperature sensor, Fig.5 (C).

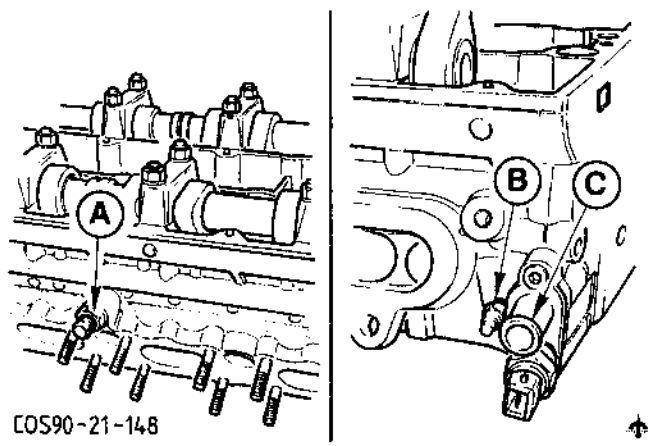


Fig.5. Parts attached to cylinder head.

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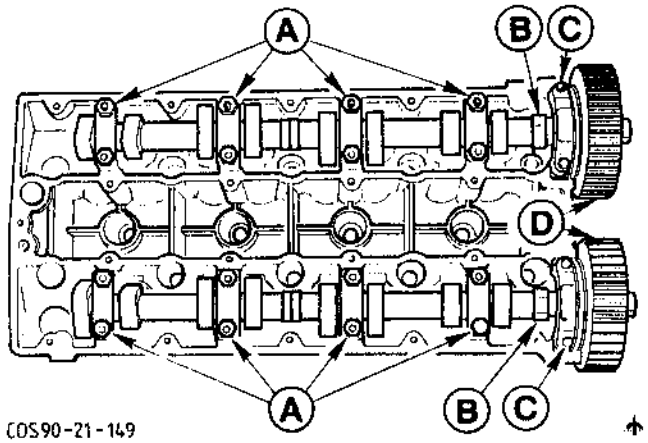
11. Remove the camshafts, Fig.6:

- Release the toothed belt pulley retaining bolt, holding the camshaft with the aid of an open-ended wrench.
- Unscrew the retaining bolts and remove the toothed belt pulleys.
- Release the 8 nuts of the 4 rear bearing caps and the 2 hexagon socket head bolts of the front bearing cap of each camshaft uniformly. Unscrew the nuts, remove the washers and bearing caps. Unscrew the bolts and lift off the front bearing caps vertically.

NOTE: The bearing caps are numbered.

- Lift off the camshafts vertically.

NOTE: Do not transpose the camshafts for the inlet and exhaust valves.



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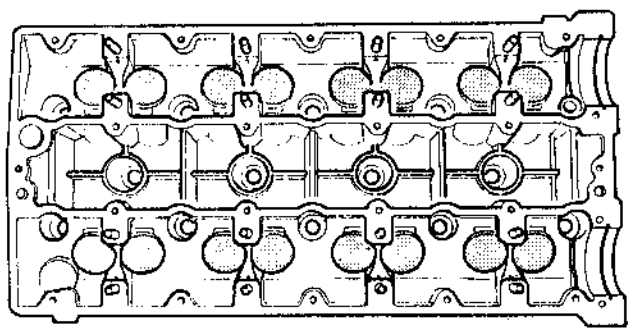
Fig.6. Camshafts.
A - Bearing caps with nuts
B - Hexagon
C - Front bearing caps with cylinder head bolts
D - Toothed belt pulleys

12. Withdraw the hydraulic bucket tappets from the cylinder head using a proprietary rubber sucker, Fig.7.
Stand the bucket tappets on their upper ends.

NOTE: Do not use a magnet.

13. Transfer the exhaust manifolds studs (16) or fit new studs.

14. Transfer the tensioning pulley stud or fit a new stud.



COS90-21-150

Fig.7. Bucket tappets.

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To Reassemble

When reassembling tighten the nuts and bolts as specified in Technical Data.

A new cylinder head is supplied without the valves. Always fit new valves.

Check that the bucket tappets are compatible with the new cylinder head, e.g. standard bucket tappets go with standard bores, oversize bucket tappets go with oversize bores.

Check all the moving parts for wear and renew as necessary. Renew all the seals.

15. Fit the valves:

- Fit the lower spring retainers.
- Oil the valve stem and guides and insert the valves.
- Place suitably shaped blocks of wood in the combustion chambers to support the valves.
- Secure the cylinder head to the work bench using screw clamps. Place pieces of wood between the clamps and the cylinder head.
- Mask the valve collet grooves with adhesive plastic tape. Oil the valve stems and valve stem oil seals with clean engine oil. Fit the valves using Special Tool 21-129 A (exhaust valves) and 21-130 A (inlet valves). Carefully fit the valve stem oil seals, Fig.8.
- Fit the mounting plate, Fig.9 (C), (see WORKSHOP FABRICATED TOOLS) to Special Tool 21-024.
- Screw 2 flat nuts (M8, DIN 936) onto 2 camshaft bearing studs as far as the end of the thread by hand or fit 2 suitable spacer sleeves. Fit Special Tool 21-024 with the mounting plate and secure it with 2 further flat nuts.
- Fit the valve springs and valve spring retainers. Compress the valve springs using Special Tools 21-024 and 21-024-06. Insert the valve spring collets, Fig.9.
- Make sure the valve spring collets are seated correctly by tapping the valve spring retainers using a plastic drift.

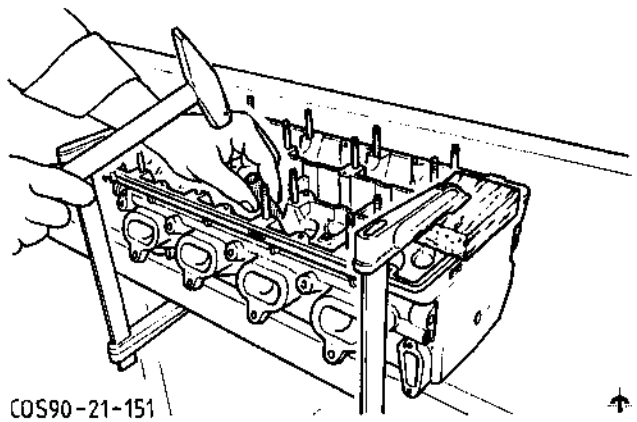


Fig.8. Fit valve stem oil seals using Special Tool 21-129 A or 21-130 A.

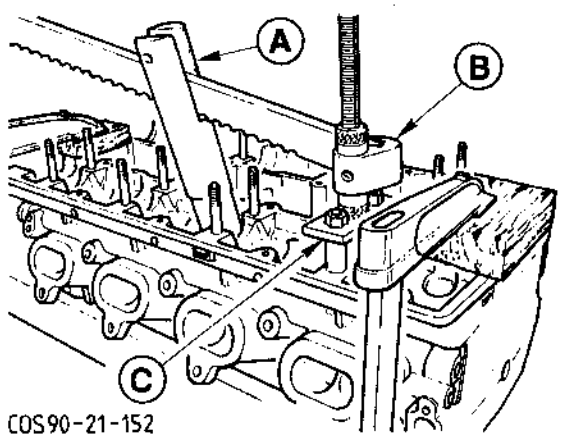


Fig.9. Fit valve spring collets.
A - Special Tool 21-024-06
B - Special Tool 21-024
C - Workshop fabricated mounting plate

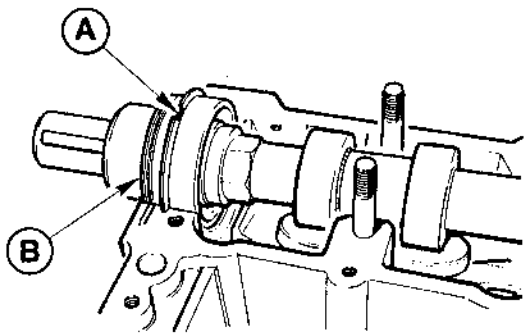
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16. Lubricate the bucket tappets with engine oil and insert them. Note the sequence.

NOTE: After fitment, check that no air is trapped under the tappets.

Lubricate new camshaft radial oil seals with oil and slide them onto the camshafts as far as the stop by hand, Fig.10 (B).

17. Place the 2 camshafts in the cylinder head. The gap in the camshaft retaining ring must be at the top, Fig.10 (A).



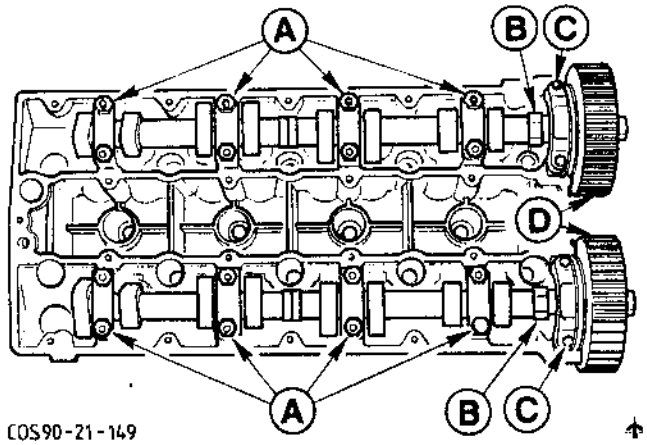
COS90-21-153

Fig.10. A - Gap in camshaft retaining ring
B - Radial oil seal

18. Oil the camshaft bearing caps and fit them in the correct sequence, starting with the front bearing caps (1 and 6). Tighten them down uniformly to the specified torque, Fig.11.

Coat the mating faces of the front bearing caps with sealer (see Technicla Data), Fig.12.

NOTE: Bearing caps 1 to 5 go on the exhaust side and bearing caps 6 to 10 on the inlet side. Bearing caps 1 and 6 are to be found at the front toothed belt pulley end. The bearing cap numbers face towards the inside.

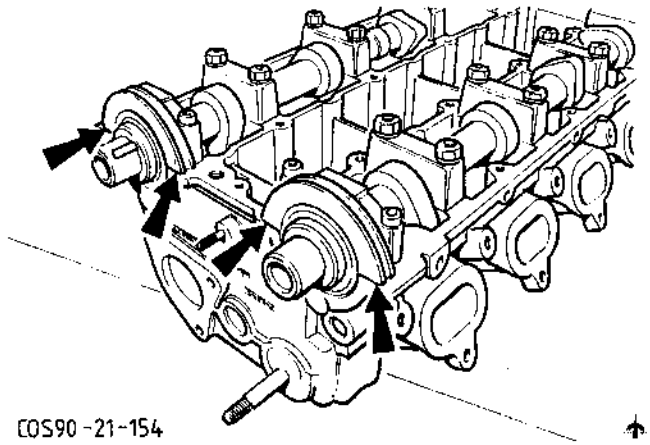


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Fig.11. Camshafts

Fig.11. Camashafts.
A - Bearing caps with nuts
B - Hexagon
C - Front bearing caps with cylinder head bolts
D - Toothed belt pulley

19. Fit the camshaft toothed belt pulleys. Hold the camshaft by the hexagon while tightening the bolt, Fig.11 (B, D).



COS90-21-154

Fig.12. Mating faces of front bearing caps

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20. Fit the coolant hose connecting flange with the engine coolant temperature sensor, Fig.13 (C).

Fig.13. Parts attached to cylinder head.
A - Connector of turbocharger oil feed pipe
B - Temperature gauge sender unit
C - Coolant hose connecting flange with engine colant temperature sensor

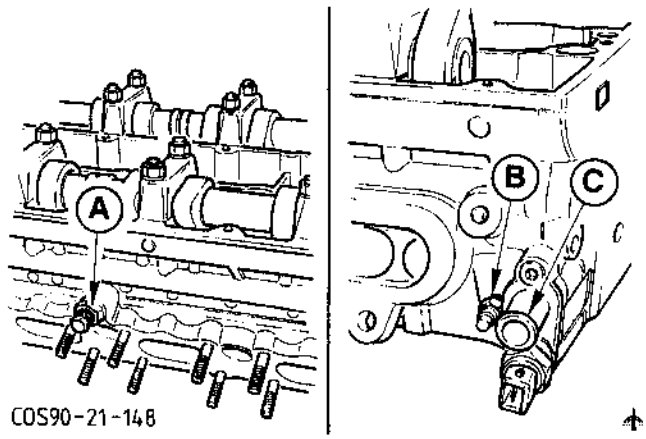


Fig.13. Parts attached to cylinder head.

21. Apply sealer (see Technical Data) and screw in the temperature gauge sender unit, Fig.13 (B).

22. Screw in the connector of the turbocharger oil feed pipe, Fig.13 (A).

23. Fit the toothed belt tensioning pulley, Fig.14. (B).

24. Fit the toothed belt cover spacer stud, Fig.14. (A).

25. Fit the engine lifting eyes.

26. Fit the inlet manifold, Fig.15:

- Fit a new gasket
- Locate the inlet manifold in position.
- Screw in the upper retaining bolts and screw on the lower retaining nuts.
- Connect the multiplug of the engine coolant temperature sensor and the plug of the temperature gauge sender unit.

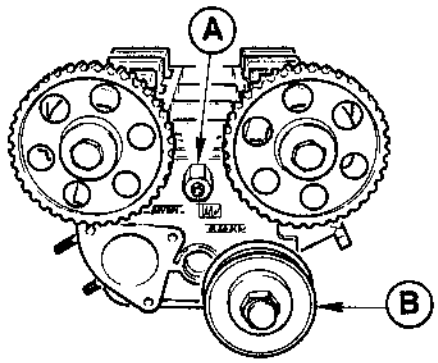


Fig.14. A - Toothed belt cover spacer stud
B - Tensioning pulley

Fig.15. Inlet manifold (shown from below).
A - Retaining bolts
B - Multiplug of engine coolant temperature sensor
C - Plug of temperature gauge sender unit
D - Retaining nuts

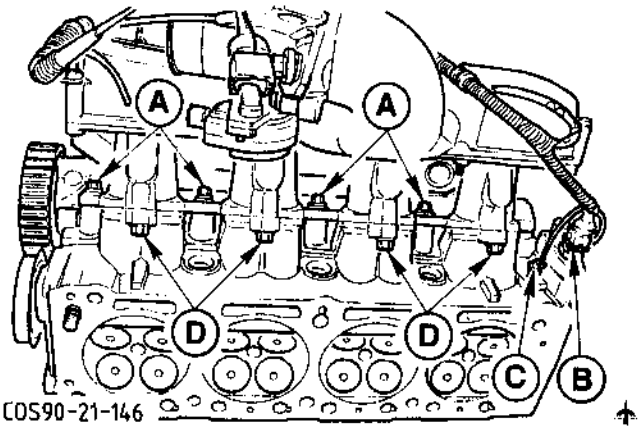


Fig.15. Inlet manifold (shown from below).

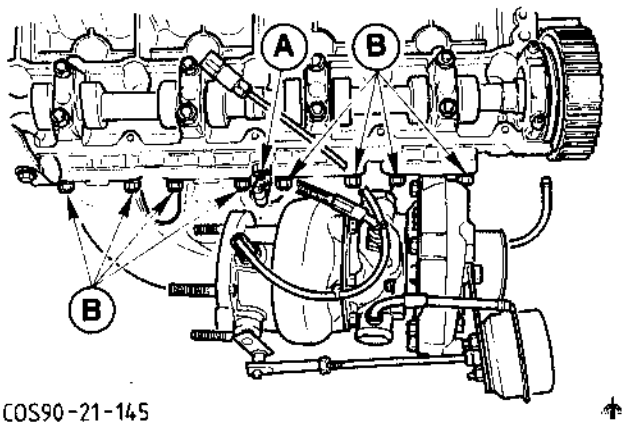
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27. Fit the exhaust manifold, Fig.16:

- Fit the 4 gaskets.

NOTE: The metal-coated side must face the exhaust manifold.

- Locate the exhaust manifold and turbocharger in position.
- Screw on new retaining nuts.
- Connect the turbocharger oil feed pipe.



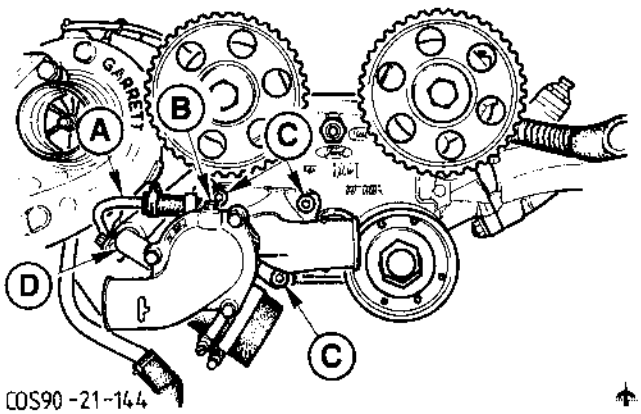
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Fig.16. A - Turbocharger oil feed pipe
B - Upper retaining nuts of exhaust manifold

28. Fit the thermostat housing, Fig.17:

- Locate the thermostat housing and coolant pipe in position and secure them.
- Screw in the vent screw.
- Connect the turbocharger coolant return hose.

Fig.17. Thermostat housing.
A - Turbocharger coolant return hose
B - Vent screw
C - Retaining bolts
D - Coolant pipe



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Fig.17. Thermostat housing.

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21 183 0 INLET MANIFOLD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Fuel pipe disconnector .. .. 23-027 A

To Remove

1. Disconnect the battery earth cable.

2. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.1, and place it to one side.

3. Unclip the throttle cable from the throttle linkage (1 clip). Compress the 2 sprung lugs of the retaining clip using pliers and detach the throttle cable from the bracket, Fig.2.

Fig.2. Detach throttle cable
A - Throttle cable
B - Clip on throttle linkage
C - Retaining clip

4. Detach the bracket of the engine breather valve hose, disconnect the hose from the engine breather valve connection and place it to one side. Unscrew the retaining nut of the engine breather valve bracket on the inlet manifod, Fig.3, and pull the engine breather valve down out of the bracket.

Fig.3. Hose between engine breather valve and oil separator.
A - Bracket
B - Connector on engine breather valve
C - Retaining nut on engine breather valve bracket (shown with cylinder head removed)

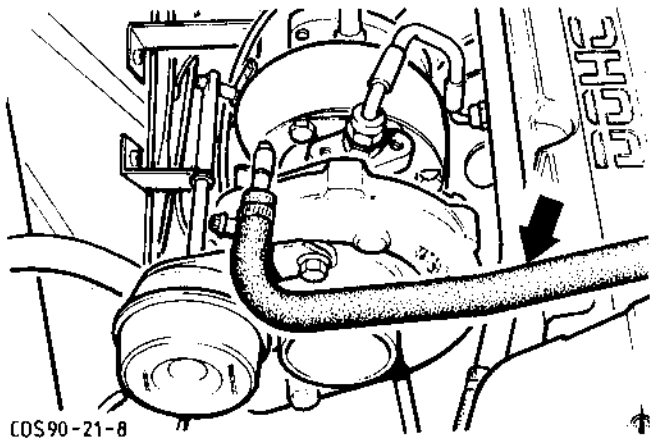


Fig.1. Coolant hose to degas tank.

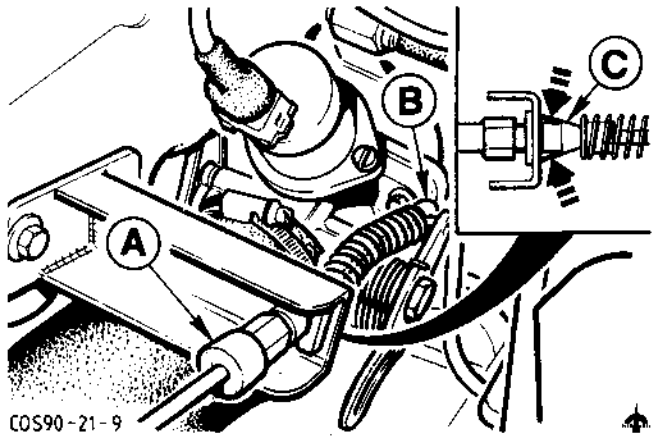


Fig.2. Detach throttle cable.

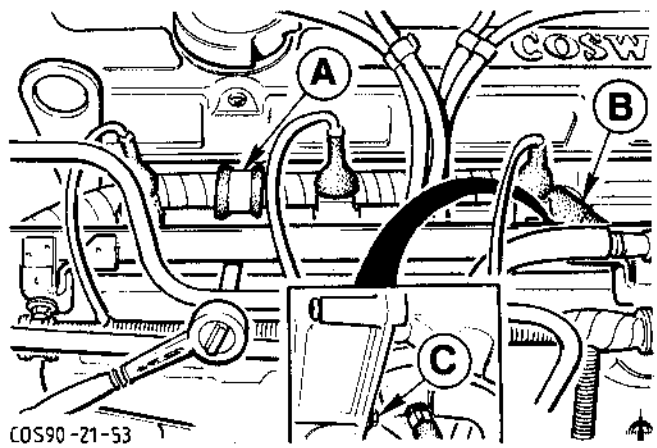


Fig.3. Hose between engine breather valve and oil separator (shown with cylinder head removed)

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5. Disconnect the HT leads from the spark plugs. Disconnect the ignition coil lead from the distributor cap. Pull the HT leads with the rubber guide down out of the HT lead bracket and remove the distributor cap and rotor arm, Fig.4.

Fig.4. Distributor and leads.
A - Bracket for HT leads with rubber guide
B - Ignition coil lead
C - Distributor cap

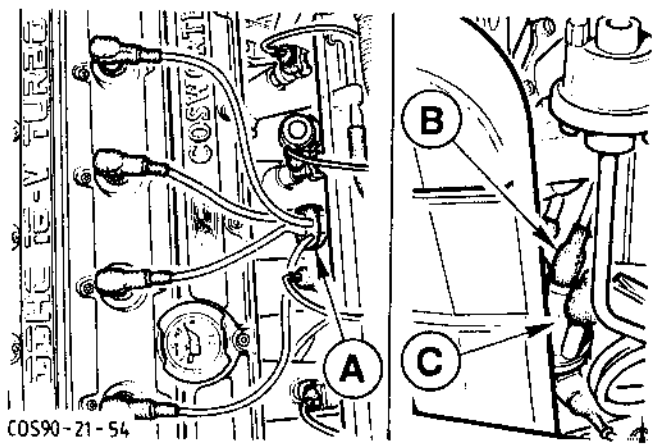


Fig.4. Distributor and leads.

6. Disconnect the vacuum pipes/hose to the by-pass valve, to the MAP sensor and to the carbon canister from the plenum chamber, Fig.5.

Fig.5. Vacuum pipes/hose.
A - To-by-pass valve
B - To MAP sensor
C - To carbon canister/engine breather valve

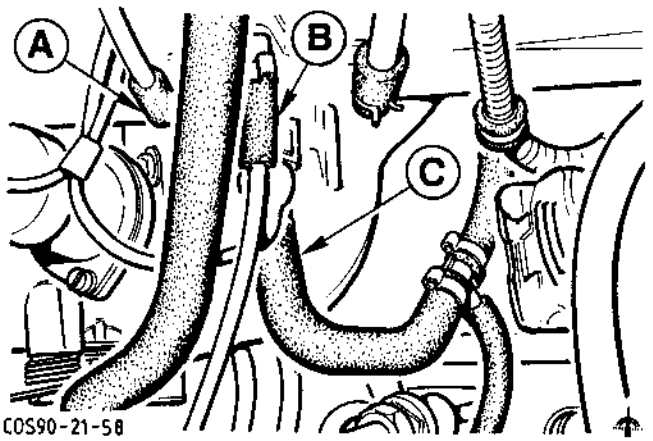


Fig.5. Vacuum pipes/hose

7. Remove the oil dipstick and detach the bracket of the oil dipstick tube from the cylinder head (1 bolt), Fig.6.

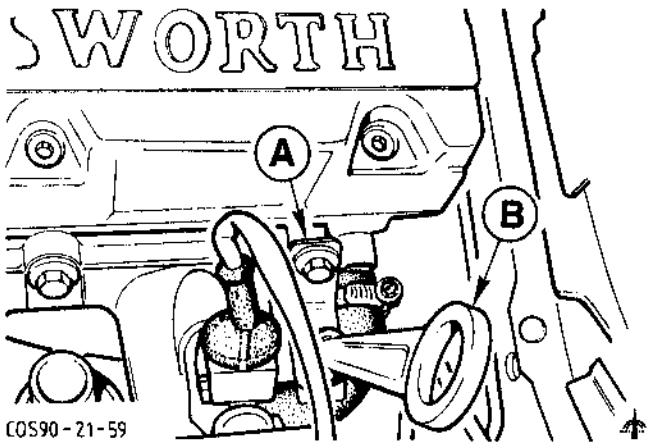


Fig.6. A - Bracket of oil dipstick tube
B - Oil dipstick

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8. Disconnect the air hose from the intercooler to the throttle housing, Fig.7.

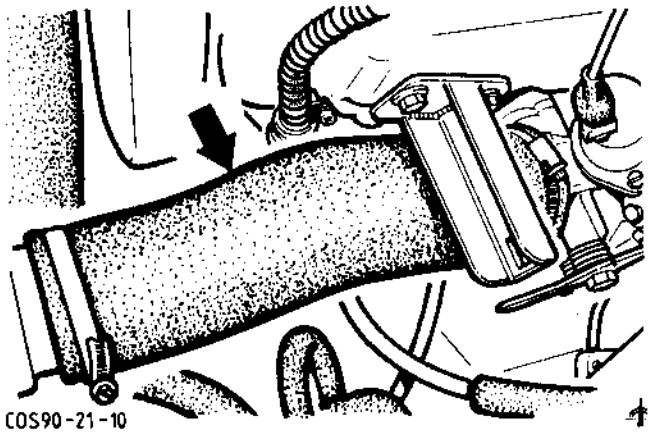


Fig.7. Air hose from intercooler to throttle housing.

9. Disconnect the fuel pipes:

- Insert the steel wire ends of Special Tool 23-027 A in the openings in the pipe coupling and press in while pulling on the other part of the fuel feed pipe, Fig.8, and disconnect the coupling.

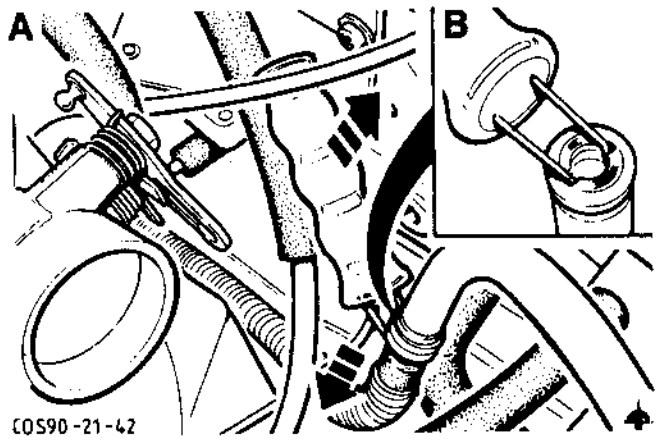


Fig.8. Fuel feed pipe.
A - Disconnect using Special Tool 23-027 A
B - Special Tool inserted (fuel pipes shown disconnected)

Fig.8. Fuel feed pipe.

- Disconnect the fuel return pipe, Fig.9, as described for the feed pipe.

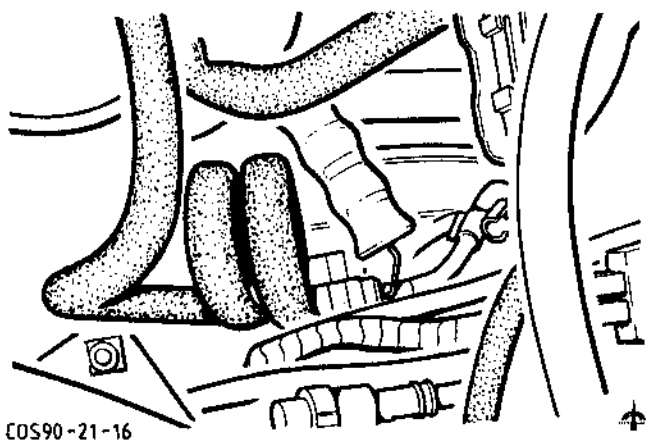


Fig.9. Disconnnect fuel return pipe using Special Tool 23-027 A.

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10. Disconnect the 3 engine wiring loom multiplugs, Fig.10.

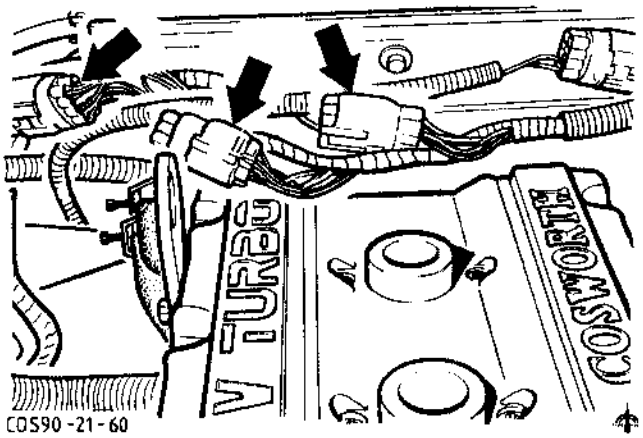


Fig.10. Engine wiring loom multiplug on bulkhead.

11. Disconnect the distributor multiplug, the knock sensor multiplug and the engine speed/TDC sensor multiplug from the distributor, Fig.11.

Fig.11. Multiplugs on distributor.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

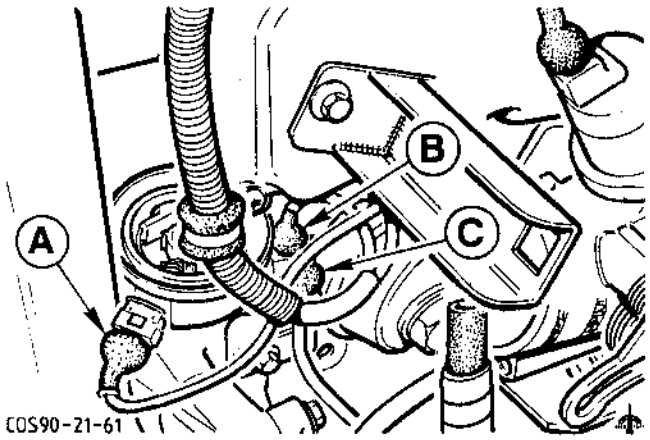


Fig.11. Multiplug on distributor.

12. Disconnect the plug/multiplug from the temperature gauge sender unit, engine coolant temperature sensor and oil pressure switch, Fig.12.

Fig.12. Plugs/multiplugs.
A - Temperature gauge sender unit
B - Engine coolant temperature sensor
C - Oil pressure switch
(shown with engine removed)

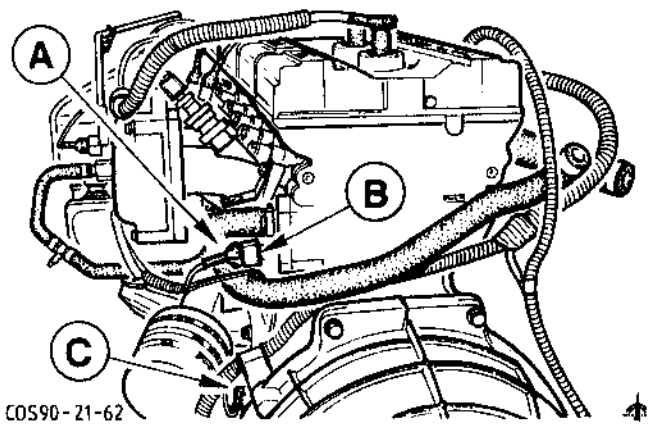


Fig.12. Plugs/multiplugs (shown with engine removed).

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13. Release the nut on the (left-hand side), engine mounting and unscrew it. Release the self-locking nut on the throttle housing vibration damper, Fig.13.

Fig.13. Throttle housing vibration damper.
A - Nut on engine mounting
B - Self-locking nut with spring washers

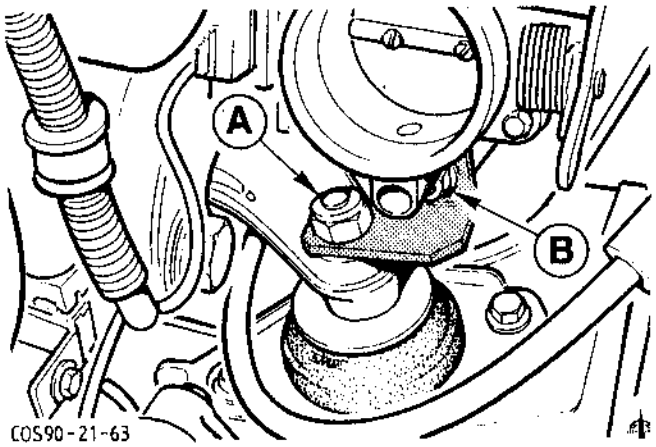


Fig.13. Throttle housing vibration damper.

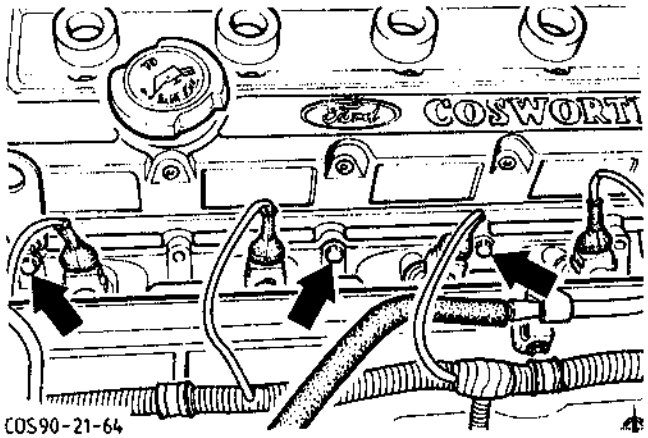


Fig.14. Retaining bolts of inlet manifold.

14. Remove the inlet manifold:

- Remove the remaining 3 inlet manifold retaining bolts, Fig.14.

- Remove the 4 inlet manifold retaining nuts from below, Fig.15.
Remove the inlet manifold complete with the wiring from the cylinder head.

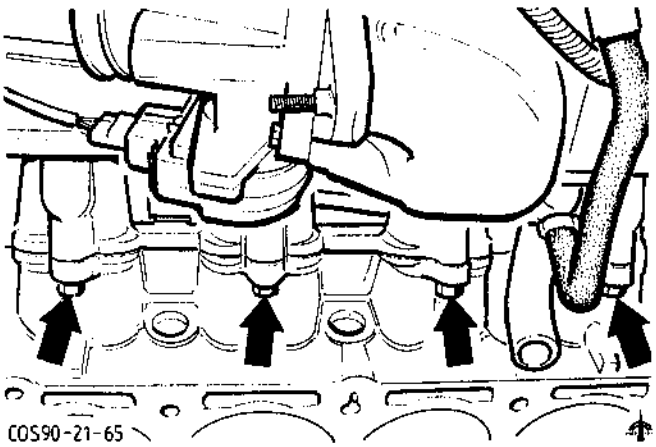
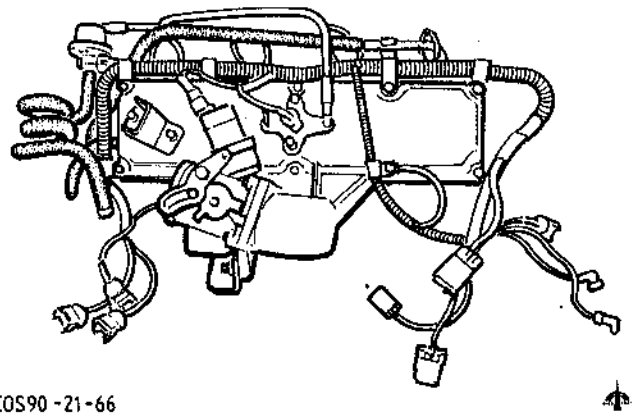


Fig.15. Retaining nuts of inlet manifold, (shown with cylinder head removed).

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To Install

NOTE: When installing tighten the nuts, bolts and pipe unions as specified in Technical Data.



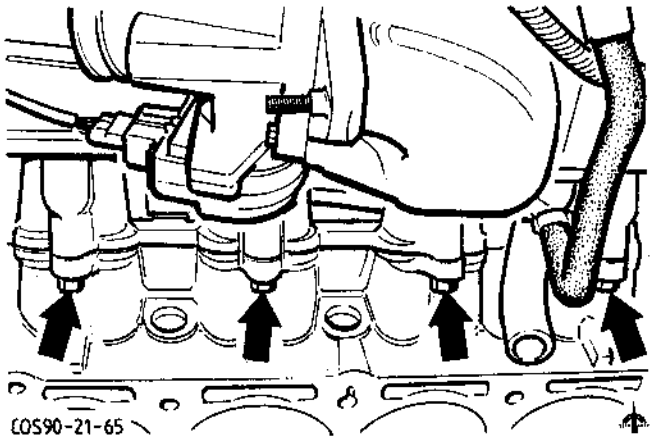
COS90-21-66

Fig.16. Inlet manifold removed.

15. Fit a new inlet manifold gasket to the cylinder head.

    Locate the inlet manifold in position and connect the plug of the oil pressure switch. Fit the engine breather valve in the bracket.

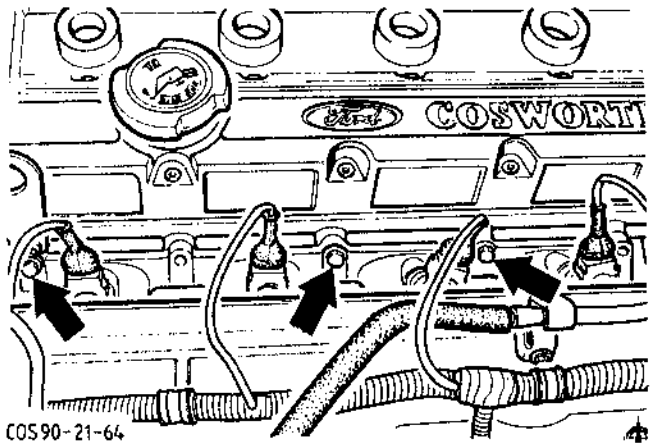
NOTE: Guide the throttle housing support bracket onto the engine mounting stud.



COS90-21-65

Fig.17. Retaining nuts of inlet manifold, (shown with cylinder head removed).

16. Secure the inlet manifold to the cylinder head at the bottom (4 nuts), Fig.17.



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Fig.18. Retaining bolts of inlet manifold.

17. Secure the inlet manifold to the cylinder head at the top (3 bolts), Fig.18.

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18. Screw a new self-locking nut to the throttle housing vibration damper but do not tighten it. Tighten the nut on the engine mounting, Fig.19 (A, B).
Tighten the self-locking nut to a torque of 8 to 10 Nm and then release it half a turn.

NOTE: Note the arrangement of the spring washers, Fig.19 (C).

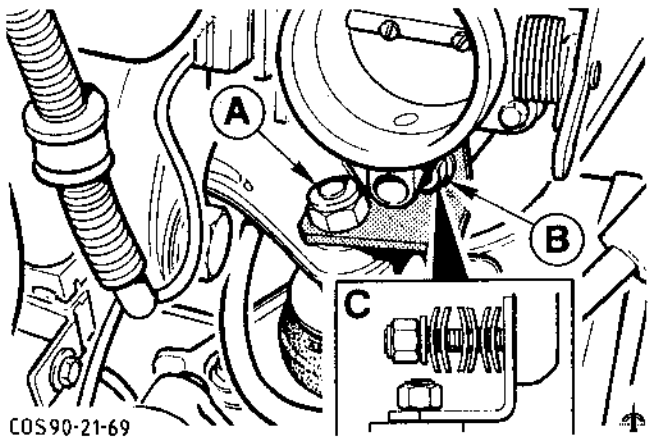


Fig.19. Throttle housing vibration damper.
A - Nut on engine mounting
B - Self-locking nut
C - Arrangement of spring washers

19. Connect the distributor multiplug, the knock sensor multiplug and the engine speed/TDC sensor multiplug to the connections on the distributor following the numbers marked, Fig.20.

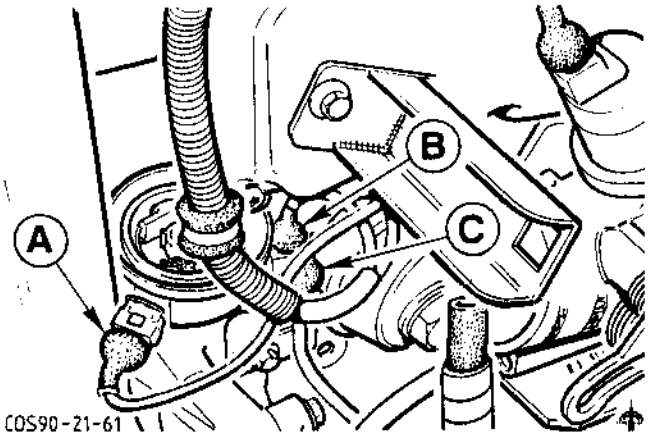


Fig.20. Multiplug on distributor.
A - Distributor
B - Knock sensor
C - Engine speed/TDC sensor

20. Connect the multiplugs of the temperature gauge sender unit and engine coolant temperature sensor.

21. Connect the 3 engine wiring loom multiplugs, Fig.21.

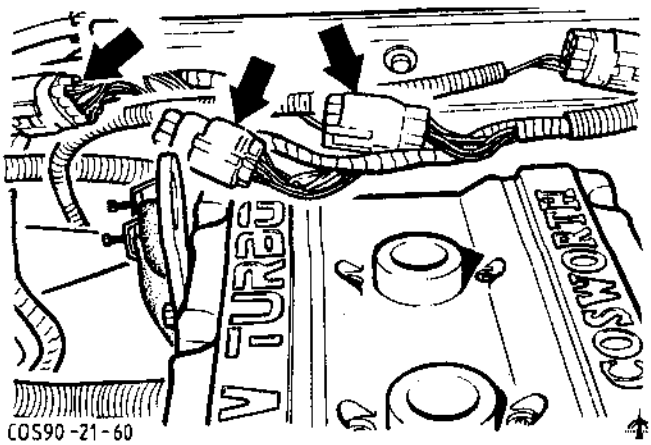


Fig.21. Engine wiring loom multiplugs on bulkhead.

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22. Connect the fuel feed pipe and the fuel return pipe, Fig.22.

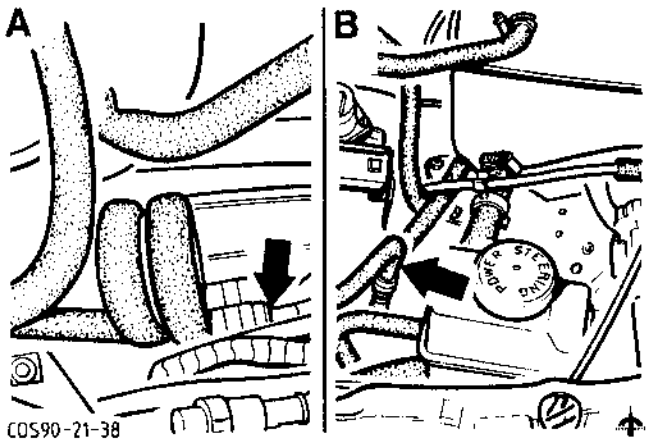


Fig.22. Fuel pipes connected.
A - Feed pipe
B - Return pipe

23. Connect the air hose from the intercooler to the throttle housing, Fig.23.

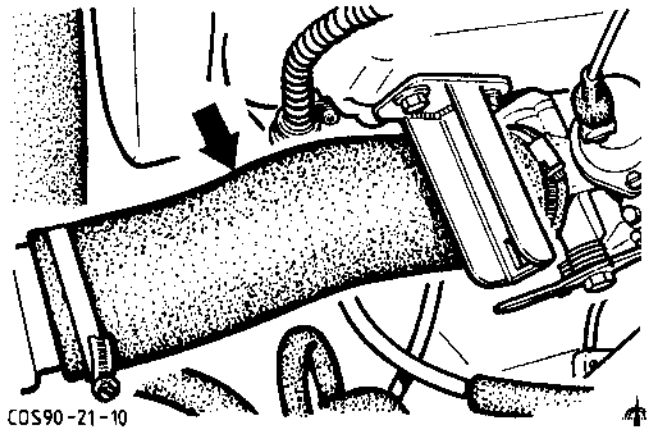


Fig.23. Air hose from intercooler to throttle housing.

24. Fit the bracket of the oil dipstick tube to the cylinder head and insert the oil dipstick.

25. Connect the vacuum pipes/hose running to the by-pass valve, MAP sensor and carbon canister to the plenum chamber connections, Fig.24.

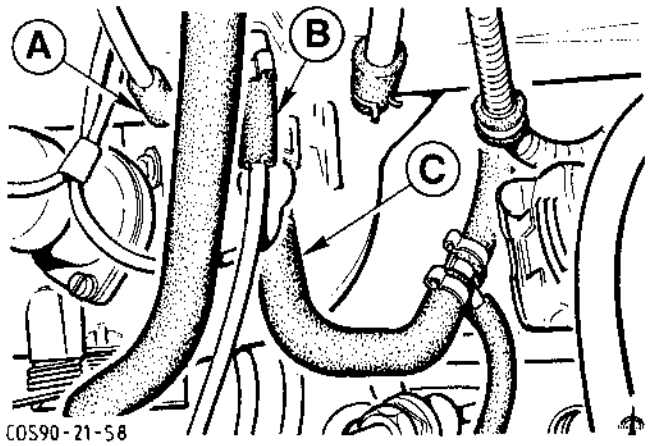


Fig.24. Vacuum pipes/hose.
A - To by-pass valve
b - To MAP sensor
C - To carbon canister/engine breather valve

Fig.24. Vacuum pipes/hose.

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26. Fit the rotor arm in the distributor, fit the distributor cap with the HT leads and connect the ignition coil lead to the connection on the distributor cap. Run the HT leads up between the inlet manifold and the cylinder head, fit the rubber guide in the bracket and connect the spark plug connectors to the spark plugs, Fig.25.

Fig.25. Distributor and leads.
A - Brake for HT leads with rubber guide
B - Ignition coil lead
C - Distributor cap

27. Tighten the retaining nut securing the engine breather valve bracket to the inlet manifold. Connect the air pipe to the engine breather valve connector and attach it to the cylinder head with the bracket, Fig.26.

Fig.26. Hose between engine breather valve and oil separator.
A - Bracket
B - Connector on engine breather valve
C - Retaining nut securing engine breather valve bracket (shown with cylinder head removed)

28. Guide the throttle cable and retaining clip into the opening in the throttle cable bracket and clip it in place. Clip the throttle cable to the throttle linkage.

NOTE: Position the sprung lugs vertically to facilitate removal.

29. Connect the coolant hose running to the degas tank to the turbocharger connector.

30. Fill the cooling system with coolant up to the MAX mark on the degas tank (see Technical Data for quantity and specification) unscrewing the vent screw in the thermostat housing to allow air to escape from the cooling system.
Apply sealer (see Technical Data for specification) and tighten the vent screw.

NOTE: Fill up with coolant slowly to allow air bubbles to escape.

31. Connect the battery earth cable.

32. Start the engine and run it up to normal operating temperature. Check the coolant hose connections for leaks and tighten as necessary.

33. Check the engine tuning settings as specified at normal operating temperature and rectify as necessary.

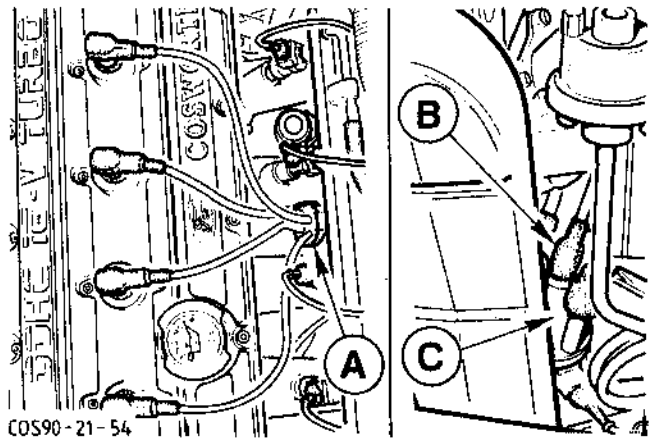


Fig.25. Distributor and leads.

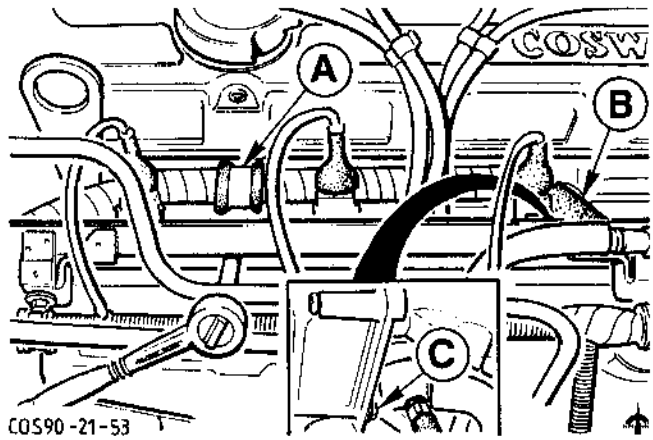


Fig.26. Hose between engine breather valve and oil separator (shown with cylinder head removed).

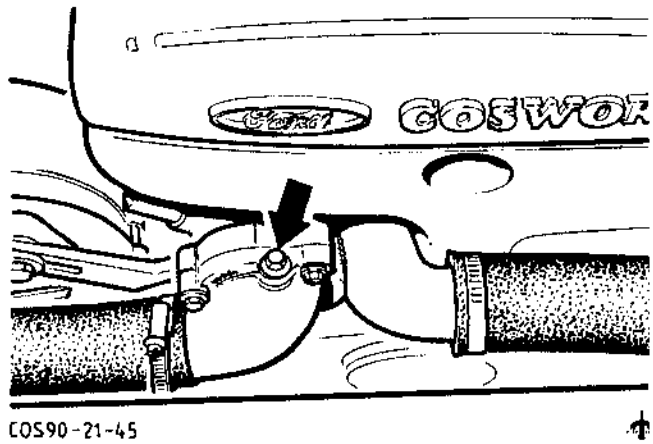


Fig.27. Cooling system vent screw in thermostat housing.

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21 187 0 EXHAUST MANIFOLD - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.

2. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.1 (B).

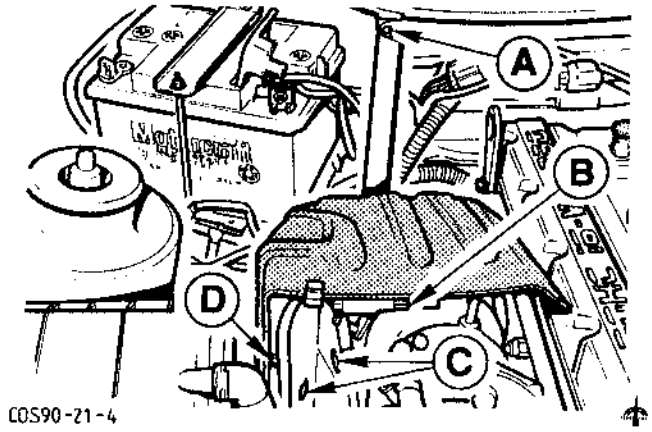


Fig.1. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

Fig.1. Turbocharger heat shield.

3. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.1 (A, C, D).

4. Disconnect the intake air hose from the turbocharger, air cleaner and by-pass valve, Fig.2.

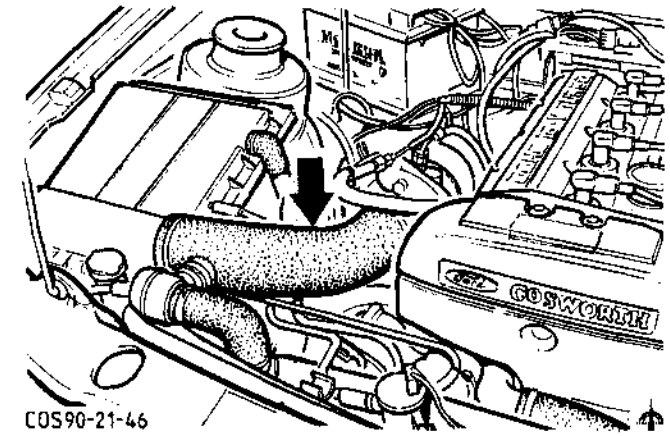


Fig.2. Turbocharger intake air hose to air cleaner/by-pass valve.

5. Disconnect the solenoid control valve vacuum pipe from the turbocharger diaphragm unit and from the turbocharger compressor housing, Fig.3. (A, B).

Fig.3. Solenoid control valve and turbocharger lower air hose.
A - Vacuum pipe to diaphragm unit
B - Vacuun pipe to compressor housing
C - Turbocharger lower air hose

6. Disconnect the turbocharger lower air hose to the intercooler from the turbocharger, Fig.3 (C).

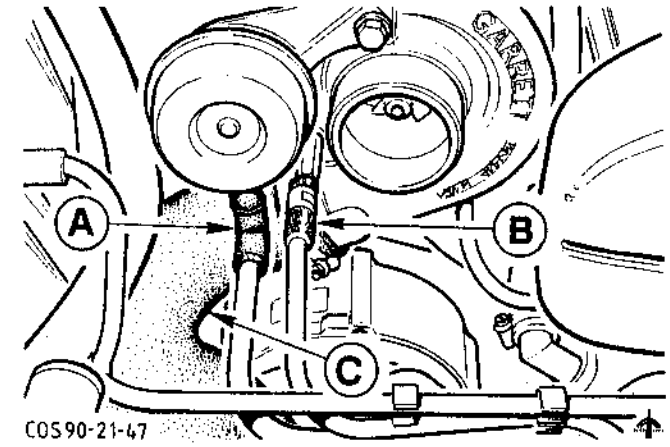


Fig.3. Solenoid control valve and turbocharger lower air hose.

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7. Raise the vehicle.

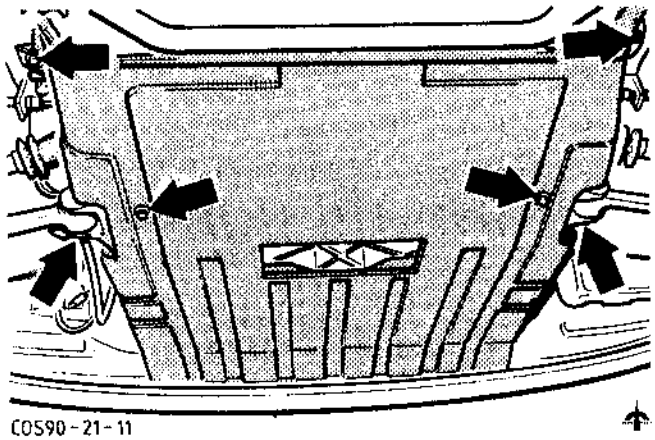

COS90-21-11

Fig.4. Retaining bolts of lower engine cover.

8. Detach the lower engine cover from the side members and the front axle/engine crossember on the left and right-hand sides, Fig.4 and remove cover.

9. Place a clean collecting tray under the radiator. Disconenct the lower right-hand side coolant hose from the radiator, Fig.5, and drain off the coolant.

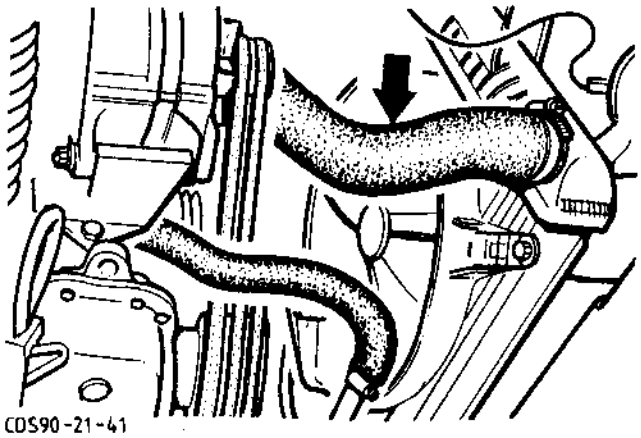

COS90-21-41

Fig.5. Lower right-hand side coolant hose to radiator.

10. Lower the vehicle to the ground.

11. Disconnect the coolant hose running to the lower right-hand side of the radiator from the thermostat housing and remove it, Fig.6.

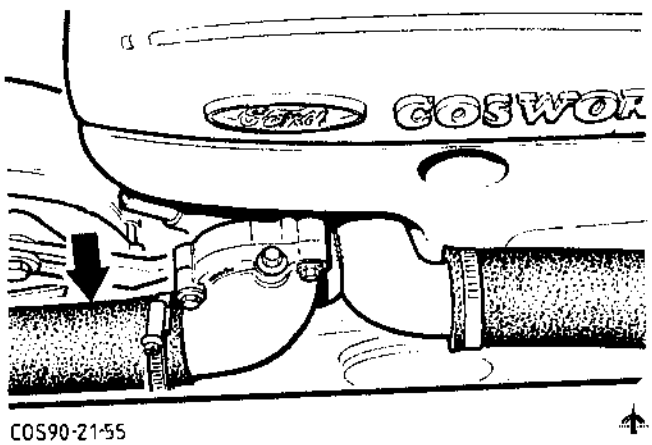

COS90-21-55

Fig.6. Coolant hose from thermotat housing to lower right-hand side of radiator.

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12. Disconnect the coolant hose to the degas tank from the turbocharger connector, Fig.7 (A).

13. Unscrew the oil feed pipe from the turbocharger and the cylinder head (2 union nuts) and remove it, Fig.7 (B).

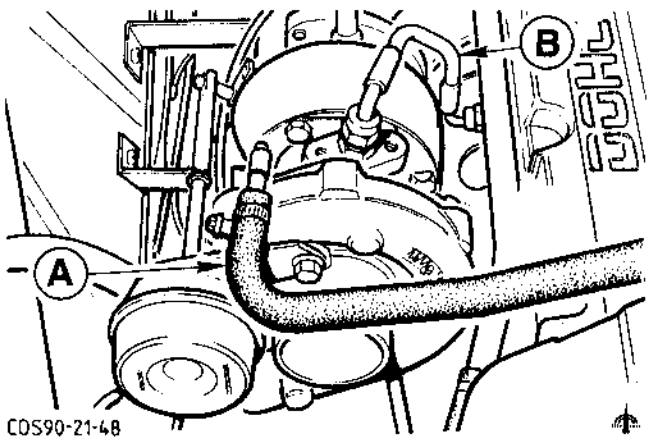


Fig.7. A - Coolant hose
B - Oil feed pipe

14. Disconnect the coolant pipe to the turbocharger from the hose connector on the thermostat housing, Fig.8 (B).

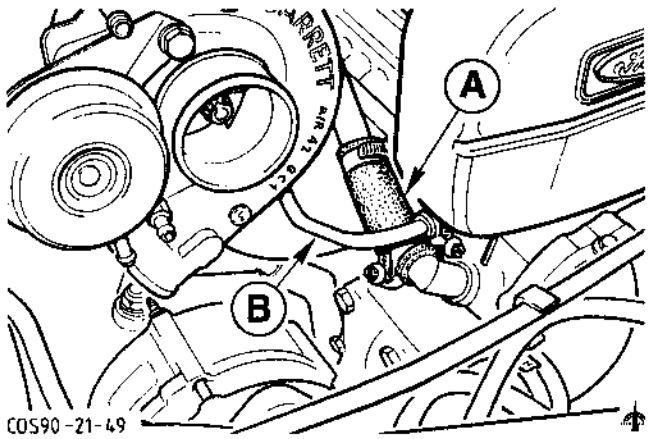


Fig.8. Coolant hose/pipe to thermostat housing.
A - To heater radiator
B - To turbocharger

Fig.8. Coolant hose/pipe to thermostat housing.

15. Disconnect the coolant hose/pipe from the heater radiator at the thermostat housing, Fig.8 (A).

16. Disconnect the front exhaust pipe from the turbocharger (3 nuts), Fig.9.

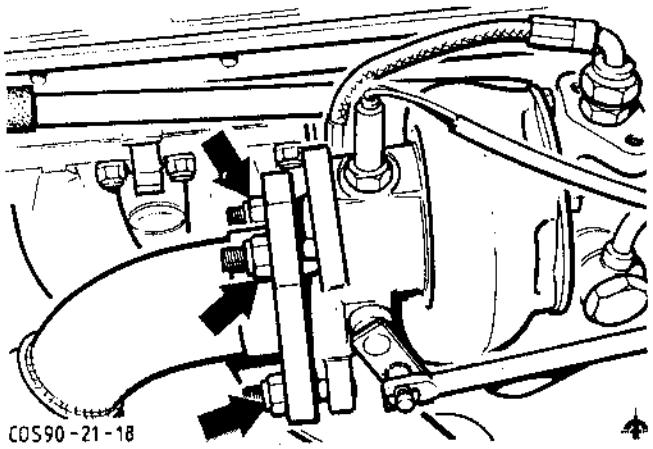


Fig.9. Front exhaust pipe to turbocharger retaining nuts.

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17. Loosen the clamp bolt of the alternator adjusting strap, remove the V-belt and press the alternator downwards, Fig.10.

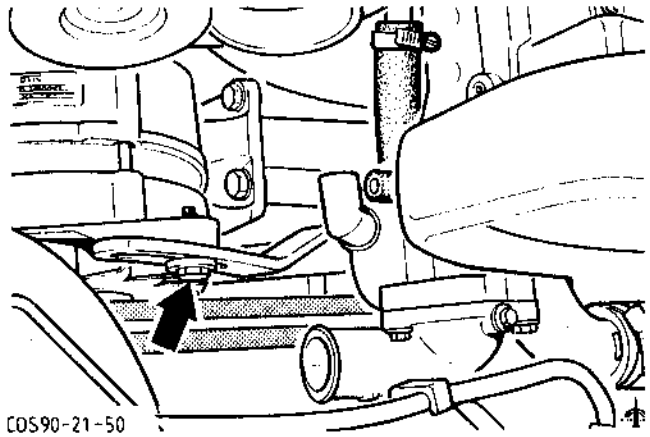


Fig.10. Clamp bolt of alternator adjusting strap.

18. Move the hose clip of the turbocharger oil return hose down on the hose, Fig.11.

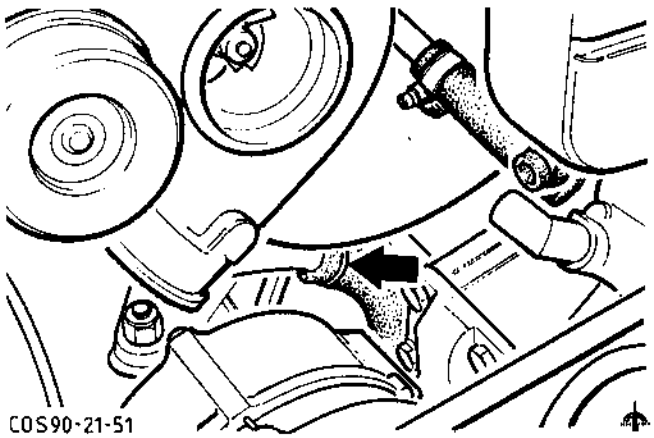


Fig.11. Hose clip of turbocharger oil return hose.

19. Detach the exhaust manifold from the cylinder head (16 nuts with washers) and lift it out with the turbocahrger, Fig.12, withdraw the oil pipe from the turbocharger oil return hose.

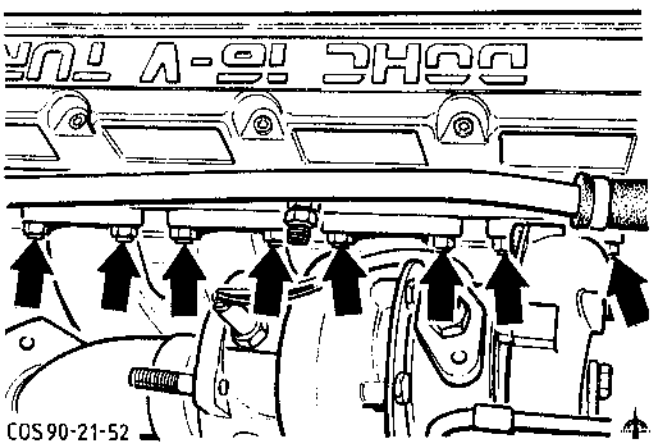
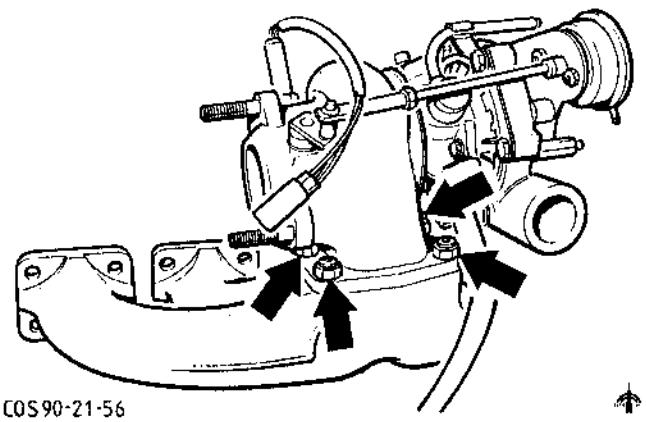


Fig.12. Retaining nuts of exhaust manifold. (8 upper retaining nuts shown)

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20. Remove the turbocharger complete from the exhaust manifold (4 nuts), Fig.13.



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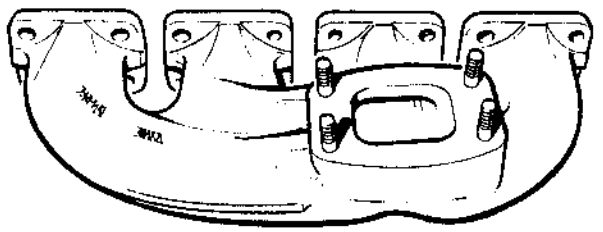
Fig.13. Retaining nuts of turbocharger. (exhaust manifold and turbocharger removed)

To Install

NOTE: When installing, tighten the nuts, bolts and pipe unions as specified in Technical Data.

21. Fit the turbocharger complete to the exhaust manifold, Fig.13.

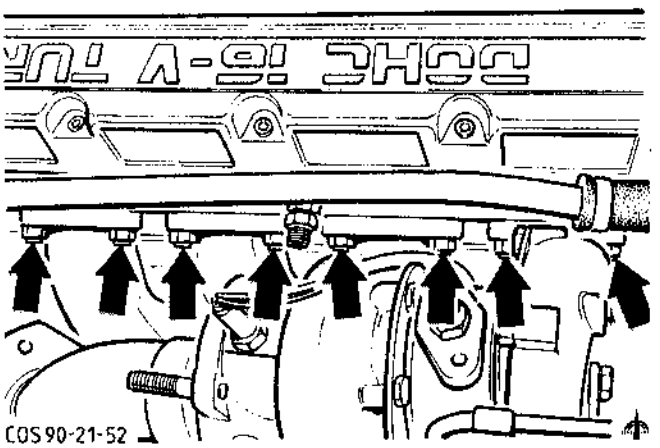
22. Fit new exhaust manifold gaskets to the cylinder head. Locate the exhaust manifold and turbocharger in position, connect the oil return hose to the oil pipe and secure it with the hose clip. Secure the exhaust manifold to the cylinder head, Fig.15.



COS90-21-57

Fig.14. Exhaust manifold removed.

23. Fit the alternator V-belt and tension it (see Technical Data for V-belt tension).



COS90-21-52

Fig.15. Retaining nuts of exhaust manifold. (8 upper retaining nuts shown)

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24. Connect the front exhaust pipe to the turbocharger, Fig.16.

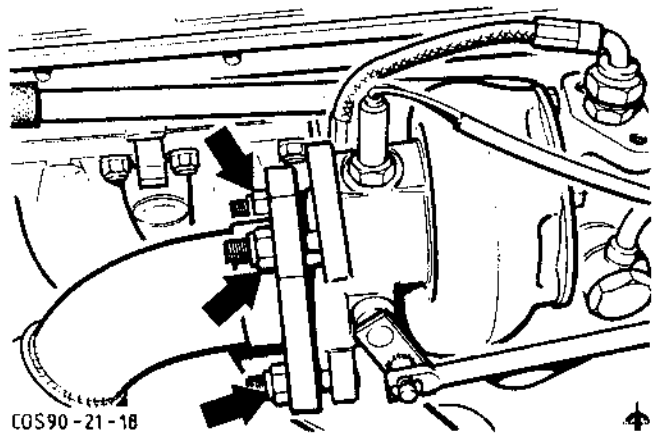


Fig.16. Front exhaust pipe to turbocharger retaining nuts.

25. Connect the coolant hose/pipe from the heater radiator to the thermostat housing, Fig.17 (A).

Fig.17. Coolant hose/pipe to thermostat housing.
A - To heater radiator
B - To turbocharger

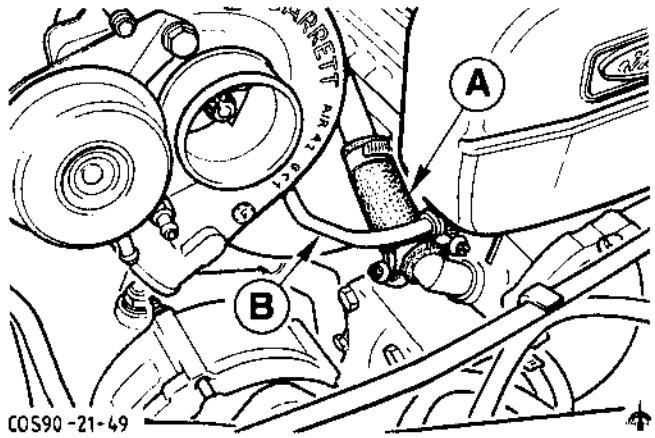


Fig.17. Coolant hose/pipe to thermostat housing.

26. Connect the coolant pipe running to the turbocharger to the hose connector on the thermostat housing, Fig.17 (B).

27. Connect the oil feed pipe to the turbocharger and the cylinder head, Fig.18 (B).

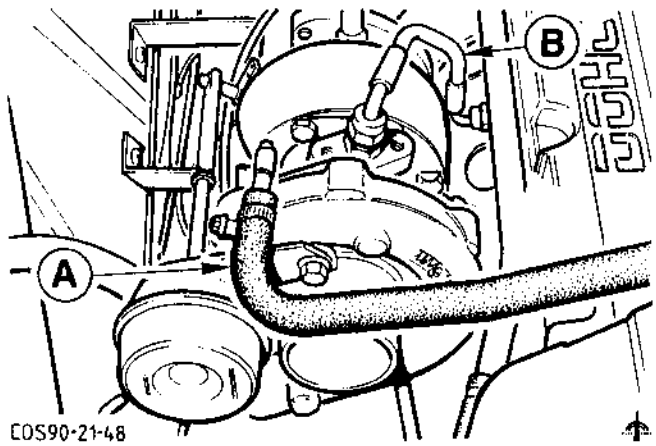
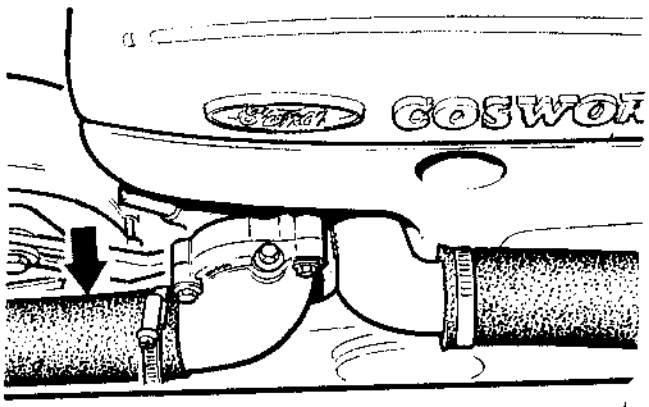


Fig.18. A - Coolant hose
B - Oil feed pipe

28. Connect the coolant hose running to the degas tank to the connector on the turbocharger, Fig.18 (A).

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29. Fit the coolant hose leading to the lower right-hand side of the radiator and connect it to the thermostat, Fig.19.

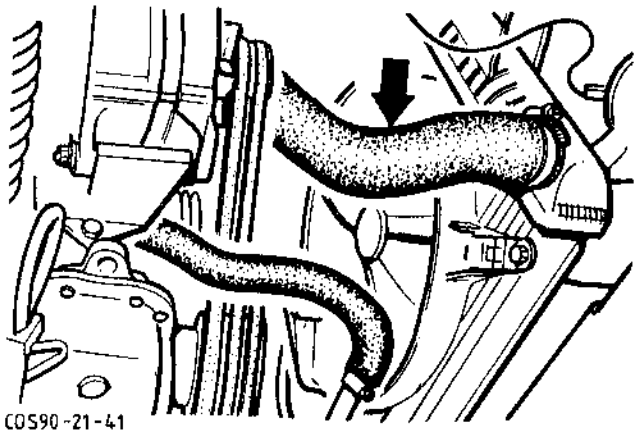


COS90-21-55

Fig.19. Coolant hose from the thermostat housing to lower right-hand side of radiator.

30. Raise the vehicle.

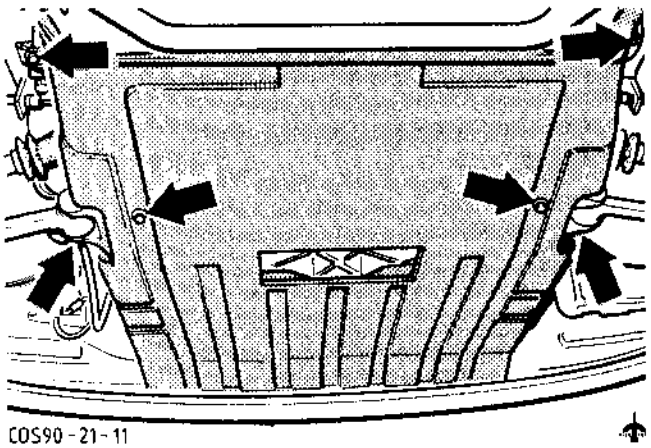
31. Connect the lower right-hand side coolant hose to the radiator, Fig.20.



COS90-21-41

Fig.20. Lower right-hand side coolant hose to radiator.

32. Secure the lower engine cover to the side members and the front axle/engine crossmember, Fig.21.



COS90-21-11

Fig.21. Retaining bolts of lower engine cover.

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33. Connect the turbocharger lower air hose running to the intercooler at the turbocharger, Fig.22 (C).

34. Connect the solenoid control valve vacuum pipe to the turbocharger diaphragm unit and to the turbocharger compressor housing, Fig.22 (A, B).

Fig.22. Solenoid control valve and turbocharger lower air hose.
A - Vacuun pipe to diaphragm unit
B - Vacuum pipe to compressor housing
C - Turbocharger lower air hose

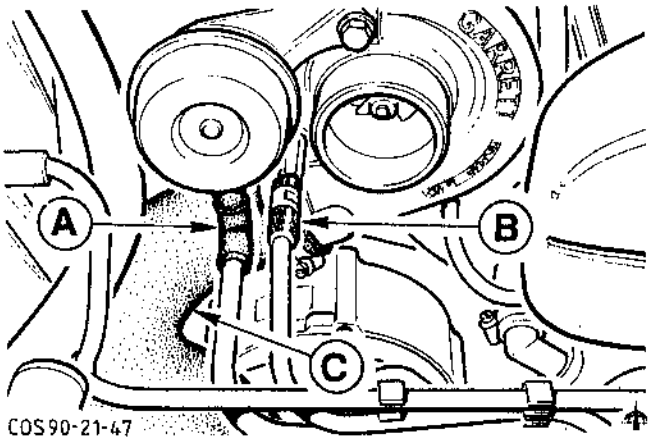


Fig.22. Solenoid control valve and turbocharger lower air hose.

35. Connect the intake air hose to the turbocharger, air cleaner and by-pass valve.

36. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.23 (A, C, D).

Fig.23. Turbocharger heat shield.
A - Retaining bolts
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

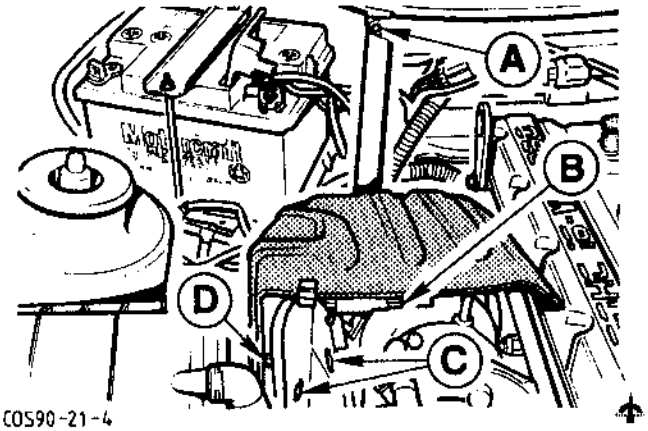


Fig.23. Turbocharger heat shield.

37. Connect the multiplug of the HEGO sensor, Fig.23 (B), and clip it to the heat shield.

38. Fill the cooling system with coolant up to the MAX mark on the degas tank (see Technical Data for quantity and specifiction). Unscrew the vent screw in the thermostat housing to allow air to escape from the cooling system, Fig.24.
Apply sealer (see Techncial Data for specification) and screw in the vent screw securely.

NOTE: Fill up with coolant slowly to allow air bubbles to escape.

39. Connect the battery earth cable.

40. Start the engine and run it up to normal operating temperature. Check the coolant hose connections for leaks and tighten as necessary.

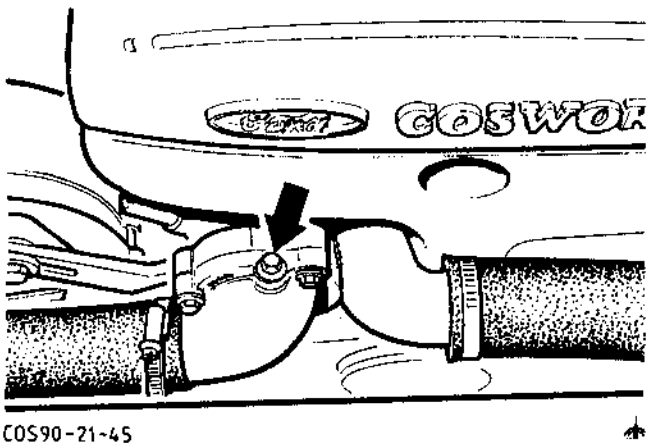


Fig.24. Cooling system vent screw in thermostat housing.

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21 238 0 SEALS - VALVE STEM - REPLACE (All)

SPECIAL SERVICE TOOLS REQUIRED:

Slide hammer	15-053
Valve spring compressor	21-024
Adaptor for valve spring compressor	21-024-06
Toothed belt tension test gauge ..	21-113
Valve stem oil seal installer (exhaust valve)	21-129 A
Valve stem oil seal installer (inlet valve)	21-130 A
Valve stem oil seal extractor ..	21-142

PROPRIETARY TOOLS:

Compressed air adaptor with spark plug thread ("Hazet 3428")
Rubber sucker ("Hazet 795-2")

WORKSHOP FABRICATED TOOLS:

Mounting plate for valve spring compressor (see Fig.8 in Technical data).

To Remove

1. Disconnect the battery earth cable.

2. Unclip the multiplug of the HEGO sensor from the turbocharger heat shield and disconnect it, Fig.1 (B).

3. Detach the turbocharger heat shield with the bracket from the bulkhead (1 bolt) and from the bracket on the fender (1 nut). Pull the heat shield out of the lower clips and remove it, Fig.1 (A, C, D).

Fig.1. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

4. Remove the toothed belt cover from the cylinder head/block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.2.

5. Disconnect the spark plug connectors from the spark plugs and place them to one side.

6. Disconnect the coolant hose to the degas tank from the connector on the turbocharger, Fig.3, pull it out of the engine lifting eye and place it to one side.

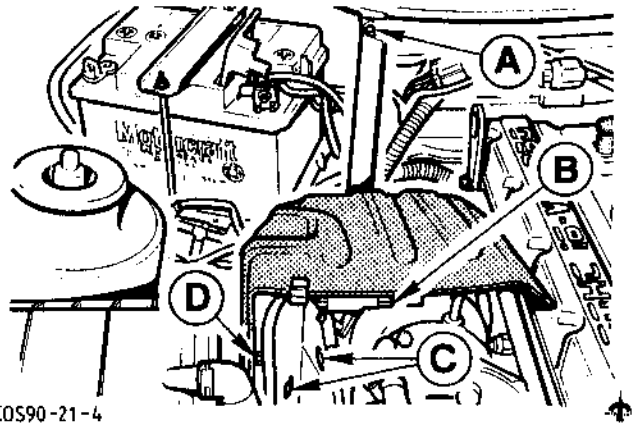


Fig.1. Turbocharger heat shield.

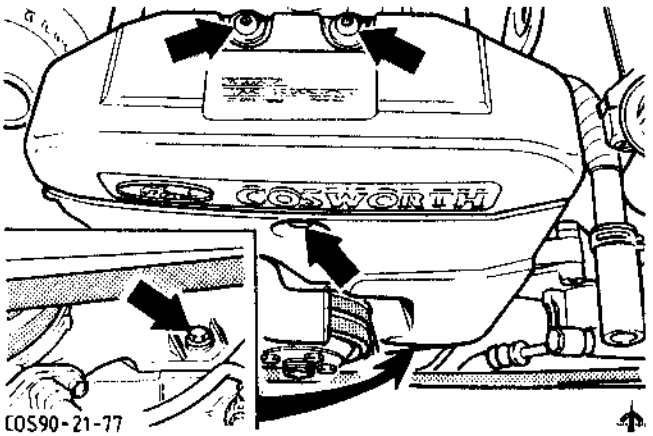


Fig.2. Retaining bolts of toothed belt cover (inset shows detail from below).

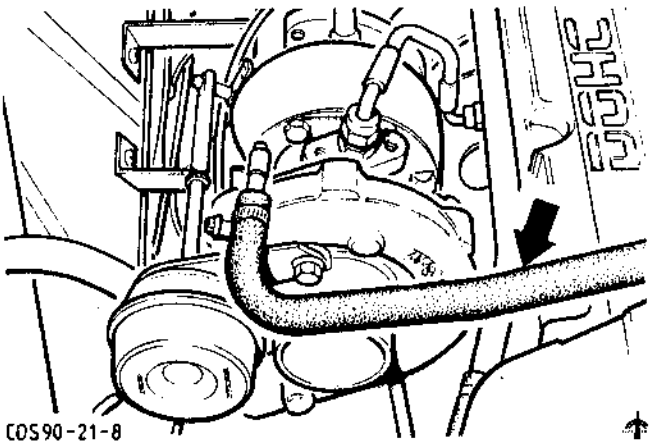


Fig.3. Coolant hose to degas tank.

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7. Remove the distributor cap from the distributor and place it to one side.

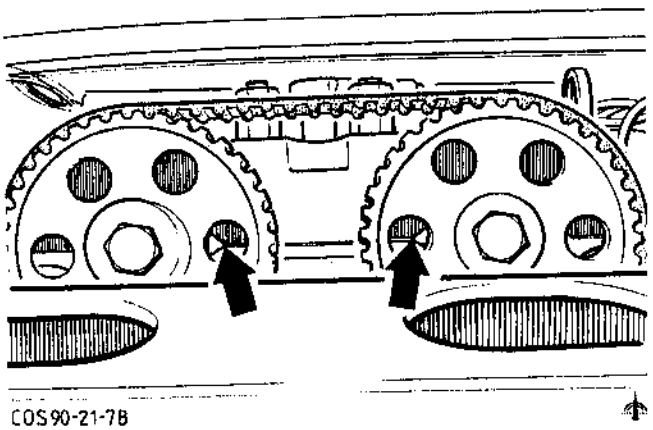
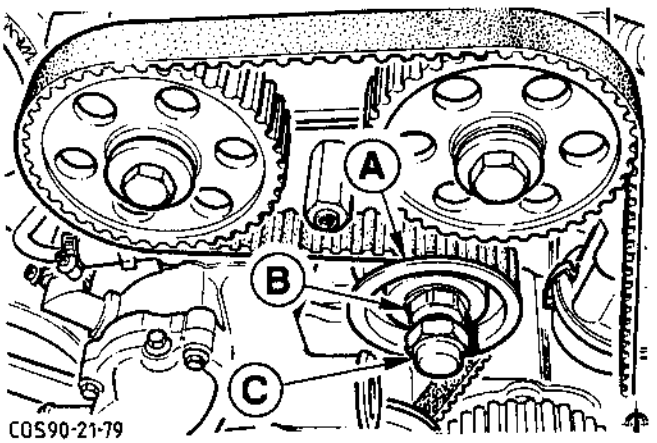

COS90-21-78

Fig.4. Camshaft toothed belt pulleys lined up on TDC marks.

8. Turn the crankshaft in the normal direction of rotation using a proprietary socket wrench until the 2 camshaft toothed belt pulleys line up on the TDC marks, Fig.4.

9. Hold the eccentric and release the lock nut. Turn the eccentric and slacken the toothed belt, Fig.5. Remove the toothed belt.

NOTE: Mark the direction in which the toothed belt runs.



COS90-21-79

Fig.5. Toothed belt tensioning pulley.

Fig.5. Toothed belt tensioning pulley.
A - Tensioning pulley
B - Eccentric
C - Lock nut

10. Remove the cylinder head cover (20 hexagon socket head bolts), Fig.6.

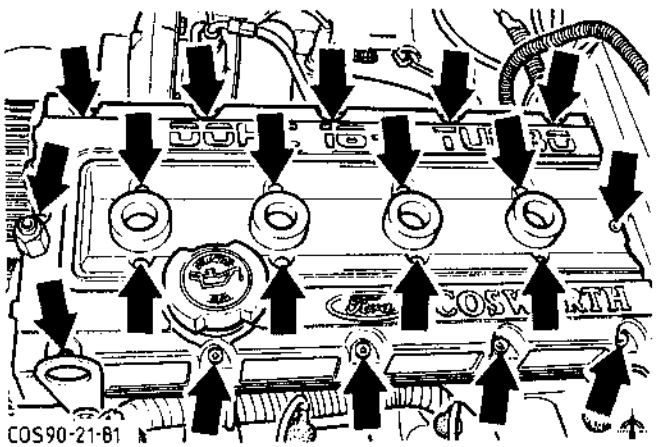

COS90-21-81

Fig.6. Retaining bolts of cylinder head cover.

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11. Release the 8 nuts of the 4 rear bearing caps and the 2 hexagon socket head bolts of the front bearing cap of each camshaft uniformly, unscrew the nuts and remove the washers and bearing caps. Remove the bolts and lift off the front bearing caps vertically, Fig.7.
Lift off the camshafts with the toothed belt pulleys vertically.

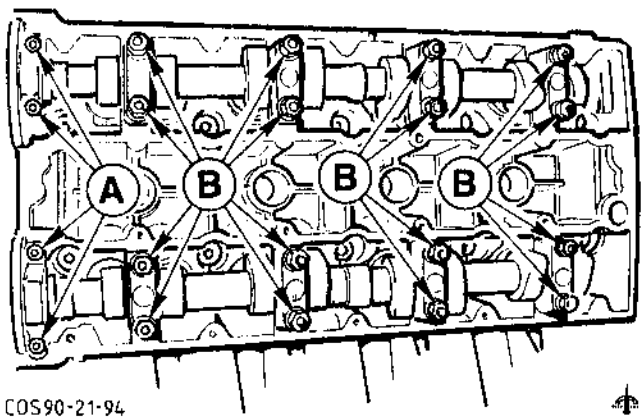


Fig.7. Fixture of camshafts.
A - Hexagon socket head bolts
B - Nuts

12. Remove the hydraulic bucket tappets from the cylinder head using a proprietary rubber sucker, Fig.8.
Stand the bucket tappets on their upper end in the order in which they are removed to ensure that the tappets are refitted in their original positions.

NOTE: Do not use a magnet.

13. Unscrew the spark plugs and block the bores with clean rags to prevent the ingress of dirt, Fig.8.

14. Turn the crankshaft by hand until all the pistons are at mid-stroke. Immobilise the engine (by engaging 1st gear) and apply the handbrake.

NOTE: No valves can drop into the cylinders with the pistons in this position.

The engine speed/TDC sensor must be in the middle of 2 cams on the V-belt pulley.

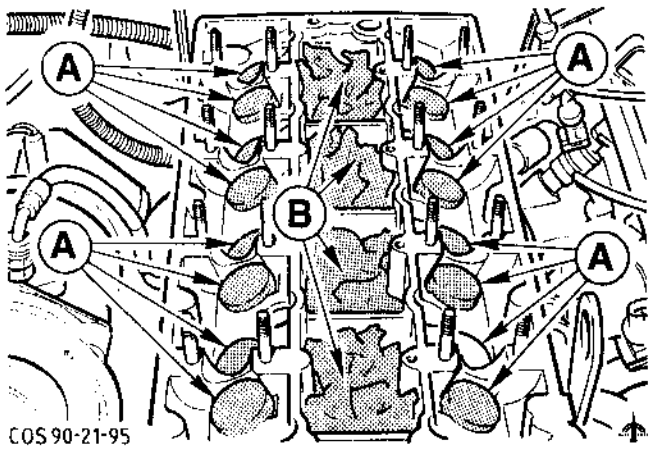


Fig.8. A - Hydraulic tappets
B - Clean rags

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15. Screw a proprietary compressed air adaptor into the spark plug tapped hole and connect it to the compressed air supply (7 to 10 bars), Fig.9 (D).

16. Release the valve spring collets by tapping the spring retainers using a plastic drift.

17. Secure the mounting plate, Fig.9 (C), (see WORKSHOP FABRICATED TOOLS) to Special Tool 21-024.

18. Screw 2 flat nuts (M8, DIN 936) onto 2 camshaft bearing studs as far as the end of the thread by hand or fit 2 suitable spacer sleeves. Fit Special Tool 21-024 with the mounting plate and secure it with 2 more flat nuts.

NOTE: For the exhaust valves secure Special Tool 21-024 with the mounting plate on the exhaust side and vice versa (except for cylinder No.4).

19. Compress the valve springs of the cylinder being supplied with compressed air using Special Tools 21-024 and 21-024-06 and remove the valve spring collets, Fig.9 (A, B). Remove the valve spring retainers and valve springs.

20. Remove the valve stem oil seal using Special Tools 21-142 and 15-053, Fig.10:

- Fit the clamping jaws of Special Tool 21-142 under the valve stem oil seal.
- Slide the sleeve over the clamping jaws until the clamping jaws are closed and the clamping nut can be screwed on.
- Tighten the clamping nut by hand.
- Screw the slide hammer, Special Tool 15-053, into the clamping jaws and draw out the valve stem oil seal.
- Adjust the clamping nut after each blow.

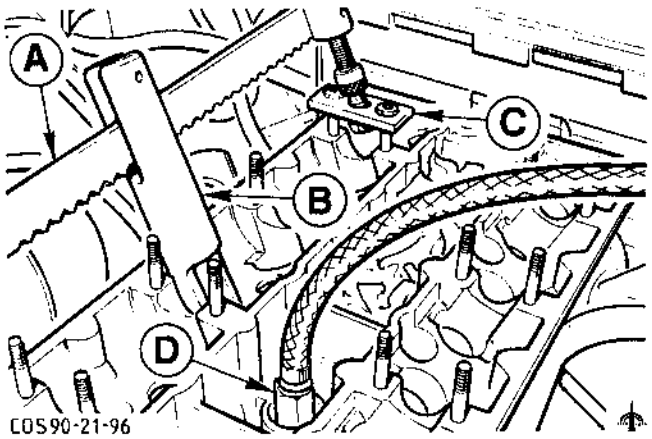


Fig.9. Remove valve spring collets.
A - Special Tool 21-024
B - Special Tool 21-024-06
C - Workshop fabricated mounting plate
D - Compressed air adaptor

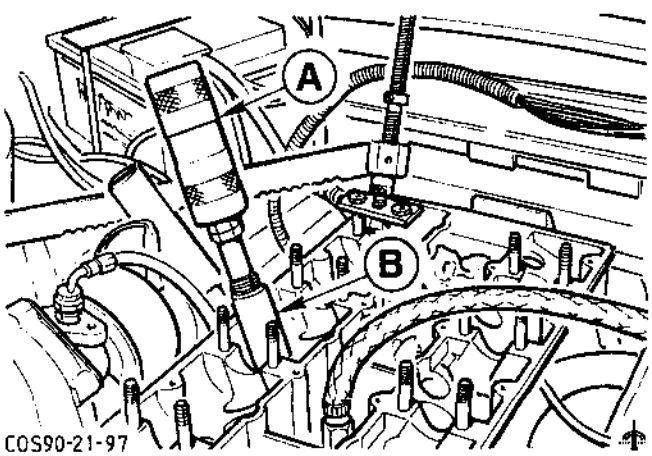


Fig.10. Remove valve stem oil seals.
A - Special Tool 15-053
B - Special Tool 21-142

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21. Mask the valve collet grooves with adhesive platic tape.
Lubricate the valve stems and valve stem oil seals with clean engine oil. Fit the valve stem oil seals using Special Tool 21-129 A (for the exhaust valves) and 21-130 A (for the inlet valves), Fig.11.

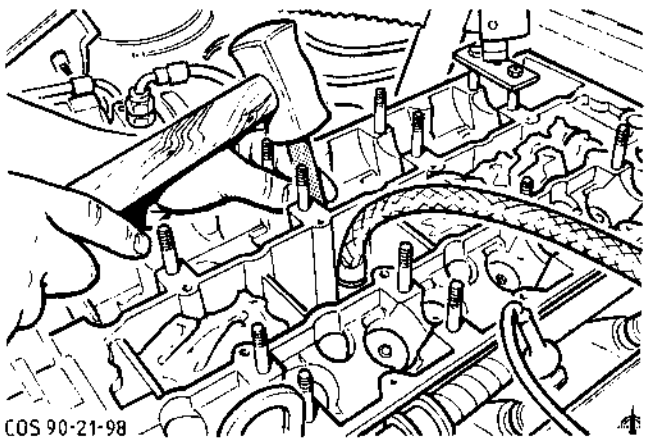


Fig.11. Fit valve stem oil seals using Special Tool 21-0129 A or 21-130 A.

22. Fit the valve springs and valve spring retainers. Compress the valve springs using Special Tools 21-024 and 21-024-06. Fit the valve spring collets.

NOTE: Make sure the valve spring collets are seated correctly by tapping the valve spring retainers using a plastic drift.

23. Repeat sub-operations 15 to 22 for the other 3 cylinders, moving Special Tools 21-024 and 21-024-06 and the mounting plate each time for improved leverage.

NOTE: For the valves of cylinder No.4 apply the lever of Special Tool 21-024 to Special Tool 21-024-06.
Secure the mounting plate and Special Tool 21-024 on the exhaust side to compress the valve springs on the inlet side and vice versa, Fig.12.

Fig.12. Remove valve spring collets of cylinder No.4.
A - Special Tool 21-024 attached on exhaust side and 21-024-06 inserted on inlet side
B - Special Tool 21-024 applied to 21-024-06

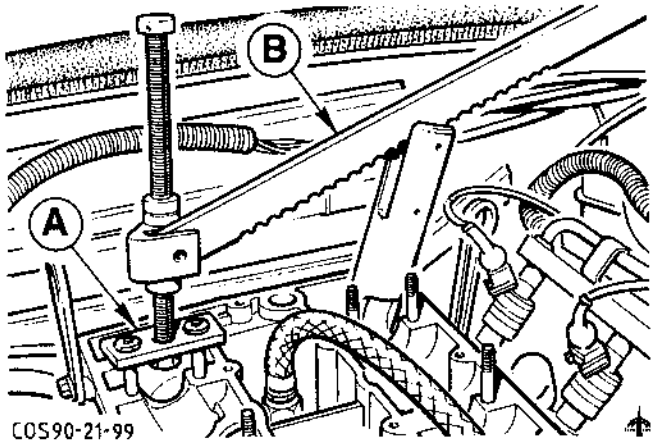


Fig.12. Remove valve spring collets of cylinder No.4.

24. Remove the 2 Special Tools with the mounting plate and the compressed air adaptor.

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25. Lubricate the bucket tappets with oil and refit them in their original positions.

NOTE: Make sure that no air is trapped under the bucket tappets.

26. Release the handbrake, move the gear lever to the neutral position and turn the crankshaft V-belt pulley to the TDC position, Fig.13.

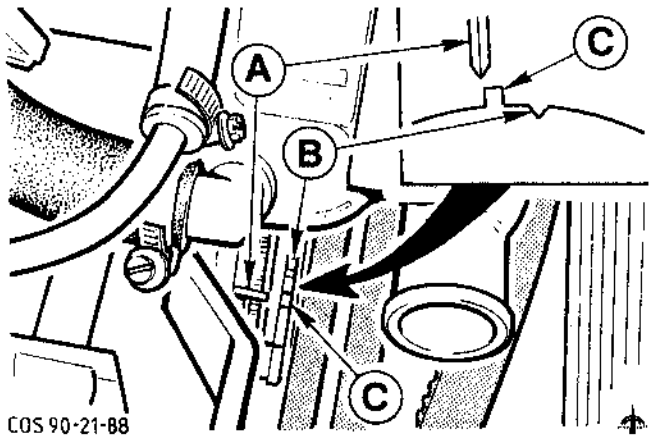


Fig.13. Crankshaft V-belt in TDC position.

Fig.13. Crankshaft V-belt pulley in TDC position.
A - Tooth on cylinder block
B - Notch in V-belt pulley
C - Tooth on V-belt pulley

27. Fit the 2 camshafts in the cylinder head so that the TDC marks of the toothed belt pulleys face one another.
The gap in the camshaft retaining ring must be at the top, Fig.14.

NOTE: The camshaft for the inlet valves can be identified by the oil grooves in the camshaft bearings.

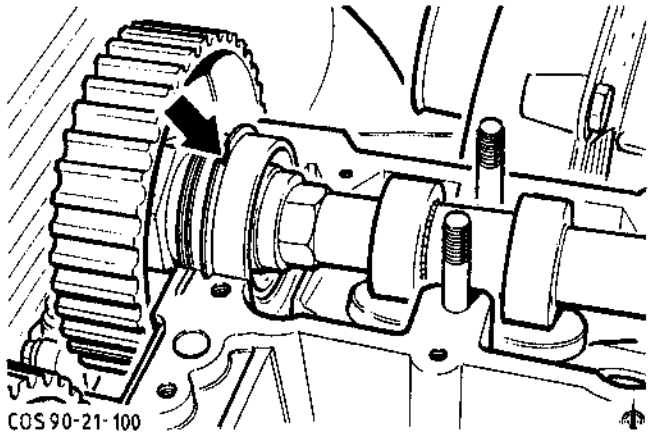


Fig.14. Gap in camshaft retaining ring.

28. Oil the camshaft bearing caps and fit them in the correct sequence, starting with the front bearing caps (1 and 6), and tighten them down to the specified torque (see Technical Data). Remove the rags, Fig.15.

Coat the mating faces of the front bearing caps with sealer (see Techncial Data).

NOTE: Bearing caps 1 to 5 are located on the exhaust side and bearing caps 6 to 10 on the inlet side. Bearing caps 1 and 6 are located at the front toothed belt pulley end. The bearing cap numbers face inwards.

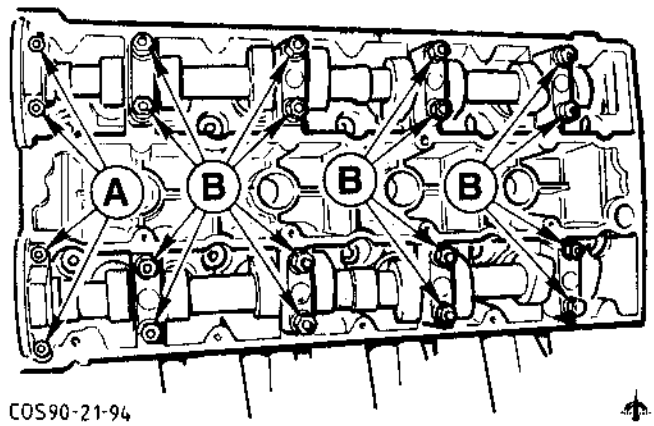


Fig.15. Fixture of camshafts.
A - Hexagon socket head bolts
B - Nuts

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29. Fit the spark plugs and tighten them to the specified torque.

30. Fit the toothed belt in an anti-clockwise direction, starting at the distributor shaft.

NOTE: Note the direction in which it runs.

31. Adjust the toothed belt tension as follows:

- Turn the tensioning pulley towards the toothed belt in a clockwise direction by hand and tighten the lock nut of the toothed belt tensioning pulley.
- Turn the engine several revolutions in the normal direction of rotation and then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

Check the toothed belt tension applying Special Tool 21-113 to the longest span of the toothed belt, Fig.16.
If necessary, adjust the toothed belt tensioning pulley until the specified tension is obtained (see Technical Data).

Check the toothed belt tension and the TDC positions again and repeat the tensioning process if necessary.

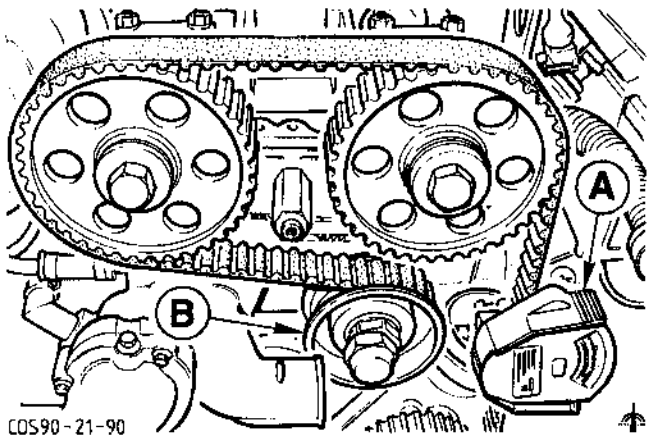


Fig.16. Tension toothed belt.
A - Special Tool 21-113
B - Toothed belt tensioning pulley

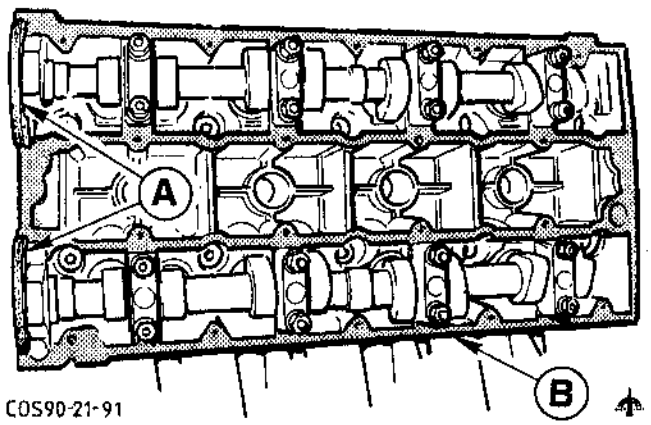


Fig.17. A - Cylinder head cover gasket
B - Rubber seals

32. Place the cylinder head cover gasket on the cylinder head and place the 2 rubber seals on the camshaft front bearing caps, Fig.17.

NOTE: Smear the ends of the rubber seals with sealer (see Technical Data).

33. Fit the cylinder head cover, insert the 20 hexagon socket head bolts and tighten them to the specified torque (see Technical Data), Fig.18.

34. Fit the distributor cap to the distributor and connnect the spark plug connectors to the spark plugs.

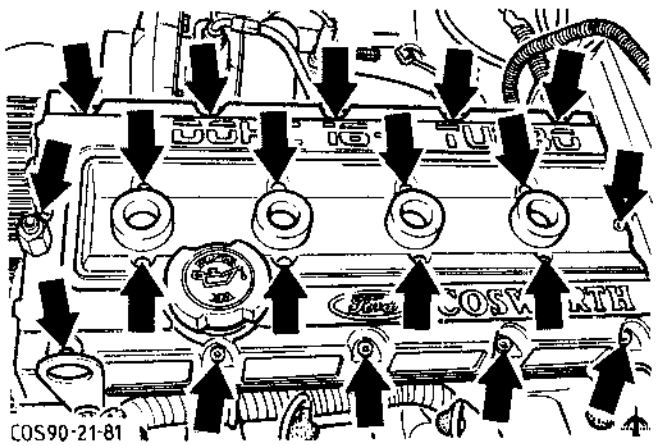


Fig.18. Retaining bolts of cylinder head cover.

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35. Pass the coolant hose to the degas tank through the engine lifting eye and connnect it to the connector on the turbocharger, Fig.19.

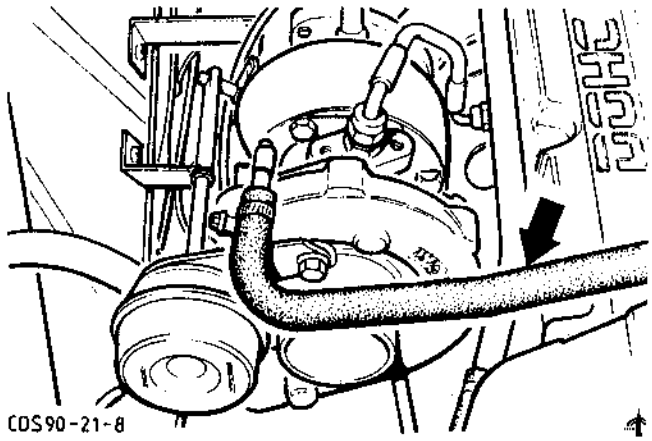


Fig.19. Coolant hose to degas tank.

36. Fit the toothed belt cover, Fig.20.

37. Locate the turbocharger heat shield in position and press it into the 2 lower clips. Secure the turbocharger heat shield with the bracket to the bulkhead and to the bracket on the fender, Fig.21 (A, C, D).

Fig.21. Turbocharger heat shield.
A - Retaining bolt
B - Multiplug of HEGO sensor
C - Heat shield clips
D - Retaining nut

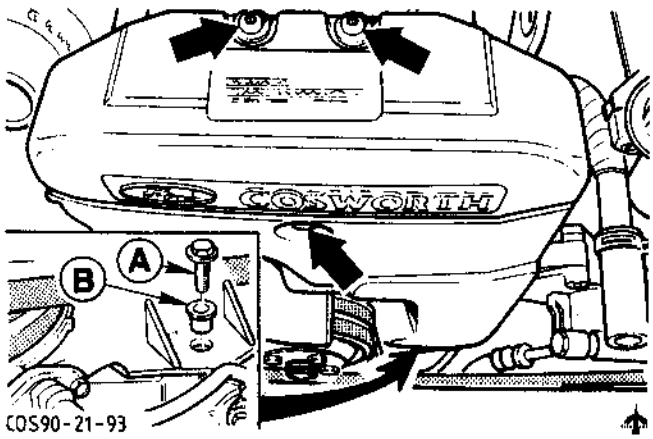


Fig.20. Retaining bolts of toothed belt cover (detail shown from below).
A - Bolt
B - Bush

38. Connect the multiplug of the HEGO sensor and clip it to the heat shield, Fig.21. (B).

39. Connect the battery earth cable.

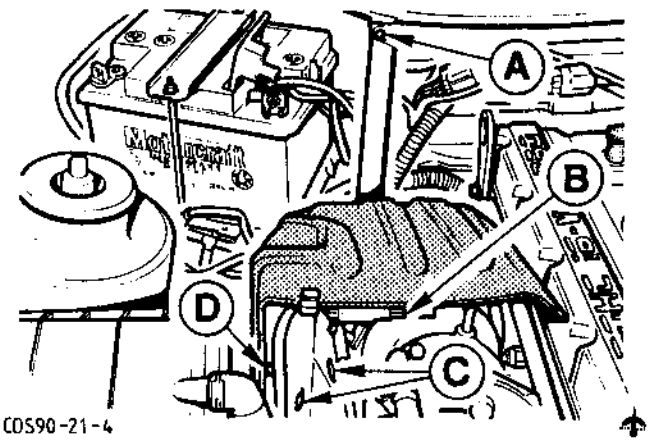


Fig.21. Turbocharger heat shield.

40. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.

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ENGINE
(Escort RS Cosworth only) 21C

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21 134 8	Engine Assembly - Dismantle and Reassemble (Engine Removed) (Refer to Section 21B)	..	-	-
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21 185 5	Cylinder Head - Replace (Cylinder Head Removed) (Refer to Section 21B)	.. .. ..	-	-
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TECHNICAL DATA

Engine - 83 US

Engine - General

Emission standard			83 US
Identification code			N5F
Firing order			1-3-4-2
Bore	mm		90,82
Stroke	mm		76,95
Cubic capacity	effective	cc	1993
Compression ratio			8,0 : 1
Compression pressure	at starter motor speed	bars	8,5
Boost pressure		bars	0,9
Idle speed		rpm	900
Max. engine speed	continuous	rpm	6500
Power output (DIN)		kW	165
	at	rpm	6250
Torque (DIN)		Nm	290
	at	rpm	3500
Spark plugs	Production		Nippon Denso PK20PR-PII
	Service		AGPR 902 P
Ignition timing			16° before TDC at idle speed

Engine Lubrication

Viscosity			5W/50
Specification			Mobil 1 or API SG/CD (synthetic oil) only
Initial fill capacity	incl. filter	litres	4,75
Oil change	interval	km	10000
	excl. filter	litres	3,0
	incl. filter	litres	3,6
Minimum oil pressure *	at 900/950 rpm	bars	1,8
	at 2000 rpm	bars	2,4

* with SAE 5W-50 oil at 80°C

Cooling System

Fill capacity incl. heater and expansion tank		litres	7,5
Antifreeze - type			Motorcraft Super Plus antifreeze
- specification			ESD-M97B49-A
- use a 50/50 (% by volume) mixture when filling and topping up			

NOTE: Refer to Section 218 in this Service Microfiche for Technical Data concerning the basic engine and not included here.

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TECHNICAL DATA (cont'd)

Engine - 83 US

Tightening Torques

Nm

Installing Engine and Transmission Assembly (21 132 0) - In Installation Order

Front axle/engine crossmember to side members	70 to 90
Transmission crossmember to floor assembly	21 to 28
Torx studs in transmission output flange	70 to 90
Driveshaft to transmission output flange	67 to 83
Driveshaft to rear axle	57 to 75
Driveshaft centre bearing to floor assembly	18 to 23
Exhaust mounting bracket to transfer case	39 to 53
Left-hand exhaust mounting bracket to rear axle crossmember	21 to 28
Starter motor wiring to starter motor - M6	4,5 to 6,0
Starter motor wiring to starter motor - M8	5 to 7
Speedometer drive cable union nut	6 to 9
Engine/transmission flange bolts	29 to 41
Front axle housing cover	9 to 11
Front axle oil filler plug	8 to 10
Steering intermediate shaft to steering shaft	20 to 28
Stabiliser bar brackets to side members	70 to 90
Lower suspension arms to spindle carriers	48 to 60
Castellated nut - track rod to steering arm	20 to 32
Power steering oil pipe to side member	35 to 45
Oil pipes to power steering pump	32 to 40
Oil hose to power steering pump	3
Lower engine cover to side members	-
Lower engine cover to body	-
Wheel nuts	70 to 100
Retaining bolts of engine lifting eyes	19 to 21
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10
Nuts - engine mounting bracket to engine mounting	70 to 90
Front exhaust pipe to turbocharger	31 to 44
Oil hose to power steering reservoir	3
Wiring loom to air plenum chamber	-
Alternator wiring	4 to 5
Turbocharger heat shield to bracket	9 to 11
Turbocharger heat shield to threaded stud	20 to 26
Turbocharger heat shield to air cleaner housing	5 to 6
Centre console	2,5
Retaining frame of inner gear lever gaiter	1
Bleed screw in thermostat housing	7 to 10

Connecting Engine to Transmission (21 134 4)

Engine/transmission flange bolts	41 - 58
Bolt securing adaptor plate to transmission	9 - 12
Starter motor	29 - 41
Front driveshaft to drive flange	34 - 46

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TECHNICAL DATA (cont'd) Engine - 83 US

Tightening Torques (cont'd)	Nm	Remarks
Installing Cylinder Head (21 163 0)		
Engine lifting eyes to cylinder head	19 to 21	
Cylinder head to cylinder block Stage 1	45 to 50	Oil thread and underside of bolt head
Stage 2		Turn 180° ± 10° more
Stage 3		Check for 110 Nm
Toothed belt tensioning pulley to cylinder head	40 to 48	
Cylinder head cover	10 to 15	
Spark plugs	28 to 33	
Toothed belt cover (all bolts)	8 to 10	
Front exhaust pipe to turbocharger	31 to 44	
Engine mounting bracket nuts	70 to 90	
Self-locking nut on throttle housing vibration damper (then slacken half a turn)	8 to 10	
Bracket of oil dipstick tube to cylinder block	8 to 10	
Wiring loom clips to air plenum chamber	-	
Coolant hoses	3	
Air hoses	4	
Lower engine cover to side members	-	
Lower engine cover to body	-	
Turbocharger heat shield to bracket	9 to 11	
Turbocharger heat shield to threaded stud	20 to 26	
Turbocharger heat shield to air cleaner housing	5 to 6	
Vent screw in thermostat housing	7 to 10	
Installing Crankshaft Oil Seal (21 467 0)		
Toothed belt tensioning pulley to cylinder head	40 to 48	
Retaining bolt of crankshaft vibration damper/belt pulley	190 to 200	Oil thread and underside of bolt head
Radiator to side members	-	
Radiator to hood lock panel	-	
Cooling fan shroud to radiator	-	
Coolant pipe bracket to radiator	5	
Toothed belt cover (all bolts)	8 to 10	
Lower engine cover to side members	-	
Lower engine cover to body	-	

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GENERAL DESCRIPTION

Engine - 83 US

The Escort RS Cosworth increases the choice of sporting variants within the Escort model range.

The body is a modified derivative of the Escort 3-door body. The floor assembly is a derivative of the Sierra Cosworth 4x4 floor assembly, again with modifications. The engine, the complete 4x4 drive train and the running gear were taken from the Sierra Cosworth 4x4 with few modifications.

Like the Sierra Cosworth, the Escort RS Cosworth was developed as a high-performance road vehicle and approved for use in motor sport in FISA groups A and N. It is available in a road sport version with reduced kerb weight and reduced interior trim suitable for motor sport, and a high series road version. The mechanical assemblies and bodywork of the two versions are identical. The Motorsport version of the 4-cylinder Sierra Cosworth engine also meets the 83 US emission standard.

Detailed information is to be found in product introduction brochure CG7458 D 2/92 entitled "Escort RS Cosworth" in the "Technical Service Training" series. However, this training document must not be used for repair purposes because only the Service Microfiche is updated when required.

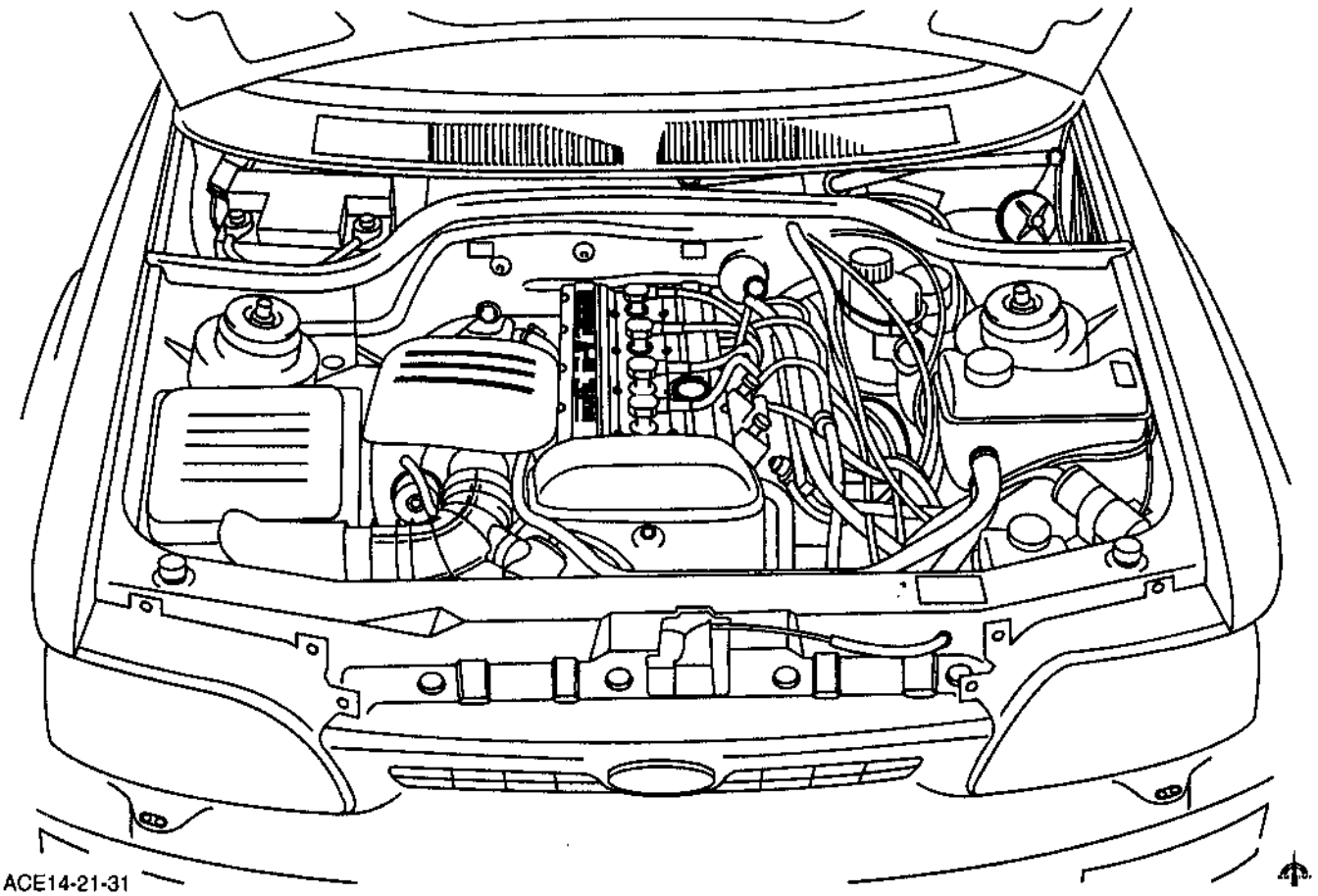
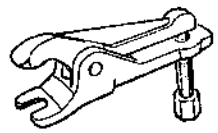
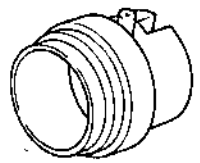
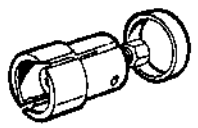
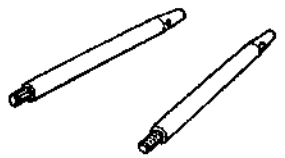
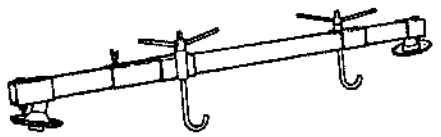
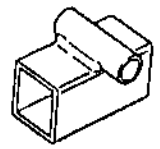
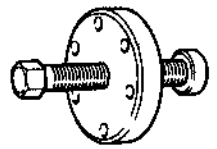


Fig.A. Engine compartment of Escort RS Cosworth.

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SPECIAL SERVICE TOOL RECOGNITION

	13-006	Ball joint separator
	21-002	Socket wrench for cylinder head bolts
	21-009 B	Radial oil seal installer
	21-028 A	Toothed belt pulley remover
	21-113	Toothed belt tension test gauge
	21-128	Cylinder head locating studs
	21-140	Engine support bar
	21-140-02	Adaptor for 21-140
	21-143	Radial oil seal remover
	21-153	Belt pulley remover

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21 132 0 ENGINE AND TRANSMISSION ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED:

Ball joint separator	13-006
Engine support bar	21-140
Adaptor for 21-140	21-140-02

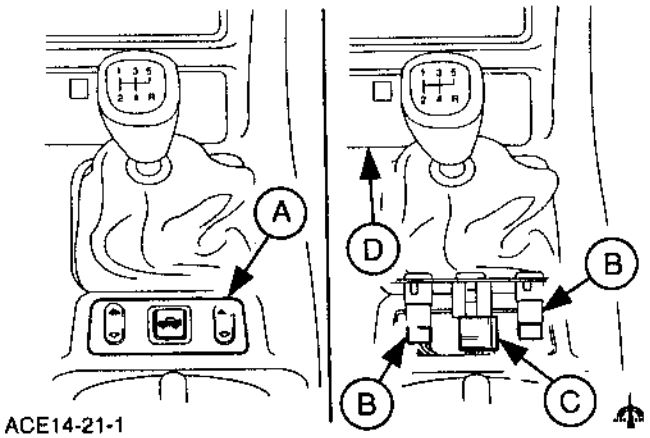
To Remove

NOTE: Remove the engine and transmission assembly from below. Cut the cable ties securing wiring and vacuum pipes/hoses as necessary during removal.

1. Disconnect the battery earth cable.

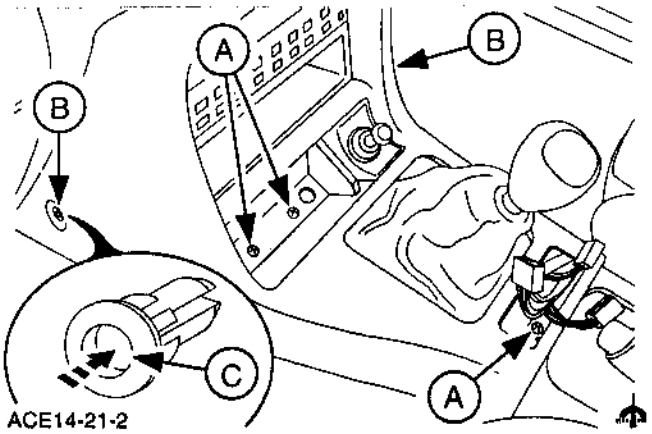
2. Prise off the switch cover. Disconnect the multiplugs from the switches of the electrically operated windows (2) and the luggage compartment lock switch. Remove the ashtray. Fig.1.

Fig.1. Switch cover.
A - Switch cover
B - Multiplugs of switches of electrically operated windows
C - Multiplug of luggage compartment lock switch
D - Ashtray



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Fig.1. Switch cover.



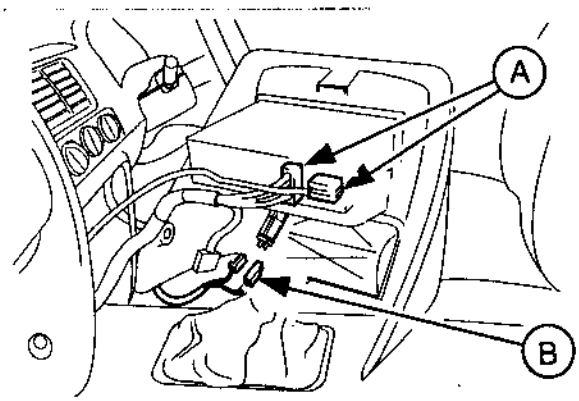
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Fig.2. Fixture of centre console.
A - Screws
B - Clips
C - Centre pin of clip

3. Detach the centre console (3 screws, 2 clips).

NOTE: To release the clip, press in the centre pin, Fig.2.

4. Lift the centre console. Disconnect the multiplugs from the radio (2) and the cigarette lighter, Fig.3. Put the centre console to one side.



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Fig.3. Multiplugs.
A - Radio
B - Cigarette lighter

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5. Pull up the leather gaiter inside out, cut the cable tie and remove the gaiter, Fig.4.(A,B).

Fig.4. Gaiters and retaining frame.
A - Leather gaiter
B - Cable tie
C - Retaining frame with inner gaiter
D - Retaining screws

6. Detach the retaining frame (4 screws) and remove it with the inner gaiter, Fig.4.(C,D). Support the clutch pedal.

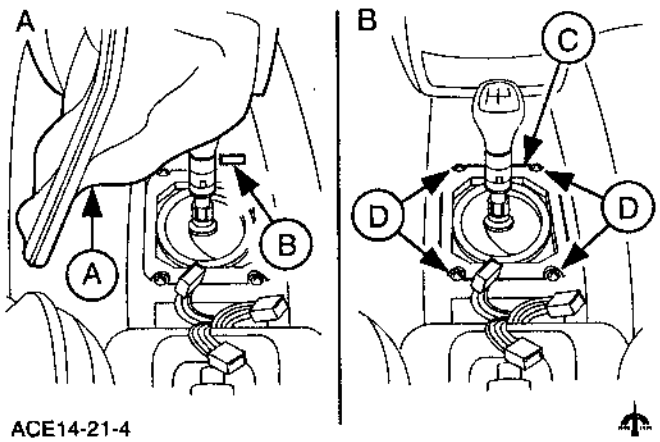


Fig.4. Gaiters and retaining frame.

7. Loosen the front wheel nuts.

8. Disconnect the multiplug from the HEGO sensor and unclip the wiring, Fig.5.

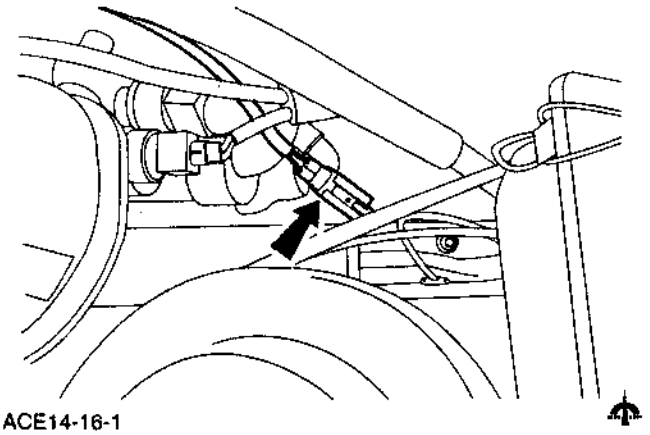


Fig.5. Multiplug of HEGO sensor.

9. Detach the turbocharger heat shield from the bracket, air cleaner housing and fender (2 bolts, 1 nut in the wheelhouse), Fig.6.

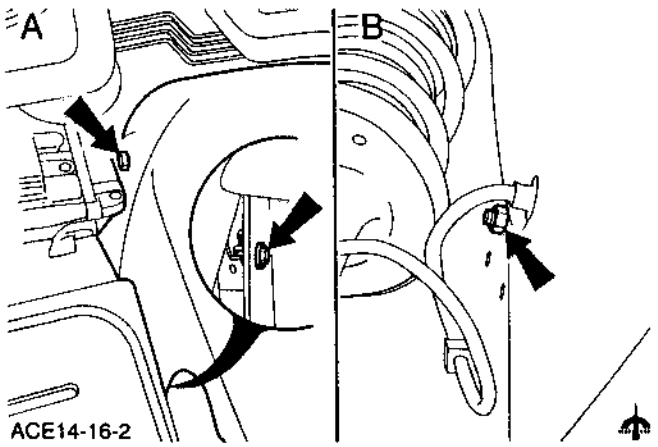


Fig.6. Fixture of turbocharger heat shield.
A - Bolts
B - Nut in wheelhouse

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10. Release the air cleaner cover (4 clips). Disconnect the air hoses (2 clips) from the turbocharger and the by-pass valve. Disconnect the vacuum pipe from the tee on the air plenum chamber, Fig.7. Remove the cover and take out the filter element.

Fig.7. Air cleaner cover with air hoses/ vacuum pipe.
A - To turbocharger
B - To air plenum chamber
C - To by-pass valve

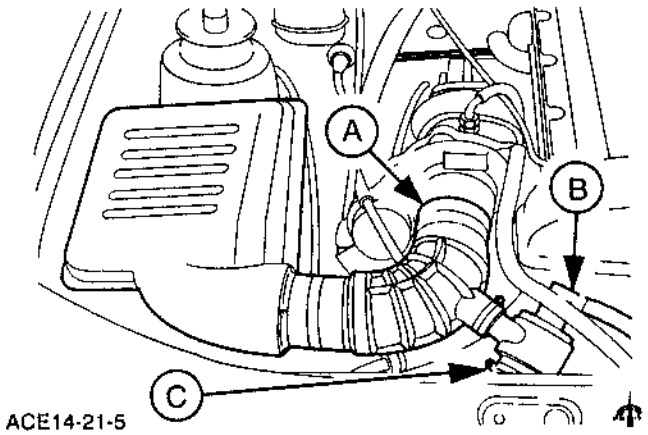


Fig.7. Air cleaner cover with air hoses/vacuum pipe.

11. Disconnect the engine breather pipe from the air cleaner housing and from the connecting hose, Fig.8. Remove the pipe.

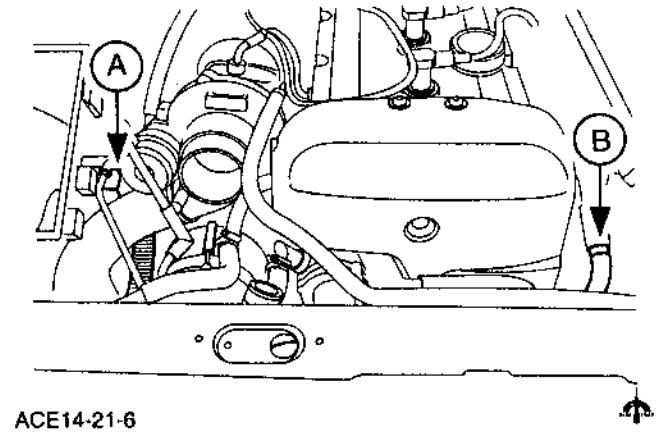


Fig.8. Engine breather pipe.
A - To air cleaner housing
B - To connecting hose

12. Disconnect the air pipes from the air cleaner housing and from the turbocharger tee (1 clip), Fig.9.(A,C).

Fig.9. Pipes/hoses.
A - To air cleaner housing
B - To turbocharger connecting pipe
C - To turbocharger tee
D - Lower air hose to turbocharger

13. Disconnect the lower air hose from the turbocharger, Fig.9.(D).

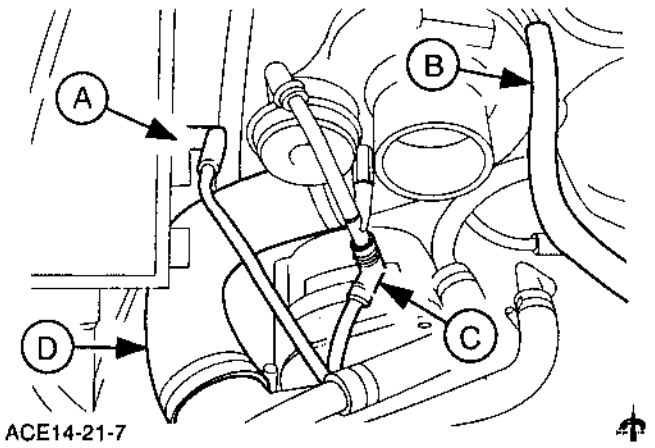


Fig.9. Pipes/hoses.

14. Disconnect the coolant hose from the turbocharger connecting pipe, Fig.9.(B).

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15. Detach the throttle cable from the throttle linkage (1 clip).
Remove the clip from the bracket.
Compress the 2 lugs of the retainer and withdraw the throttle cable from the bracket, Fig.10.

Fig.10. Throttle cable.
A - Attached
B - Detached
C - Clip pulled out
D - Lug of retainer
E - Clip on throttle linkage

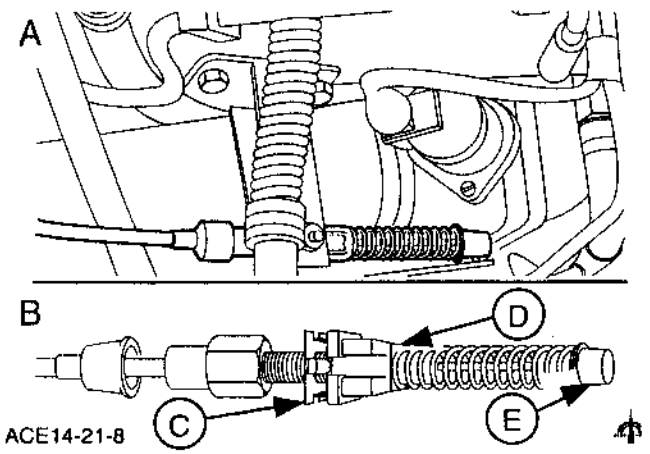


Fig.10. Throttle cable.

16. Disconnect the air hose from the intercooler and from the throttle housing (2 clips) and remove it, Fig.11.

17. Raise the vehicle.

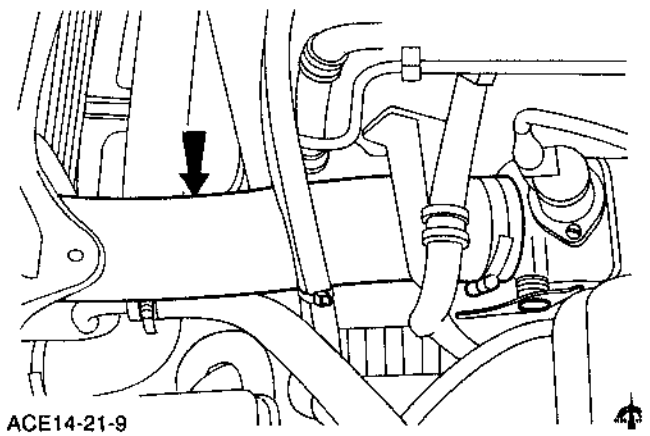


Fig.11. Air hose from intercooler to throttle housing.

18. Detach the lower engine cover from the side members (4 bolts) and the body (5 bolts), Fig.12.

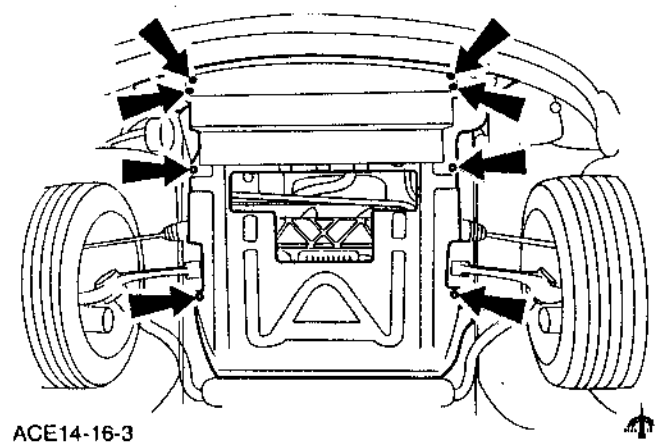


Fig.12. Retaining bolts of lower engine cover.

19. Place a clean collecting tray under the radiator. Disconnect the lower coolant hose from the radiator, Fig.13.(A), and drain off the coolant.

20. Lower the vehicle to the ground. Disconnect the lower radiator hose from the thermostat and remove it, Fig.13.(B).

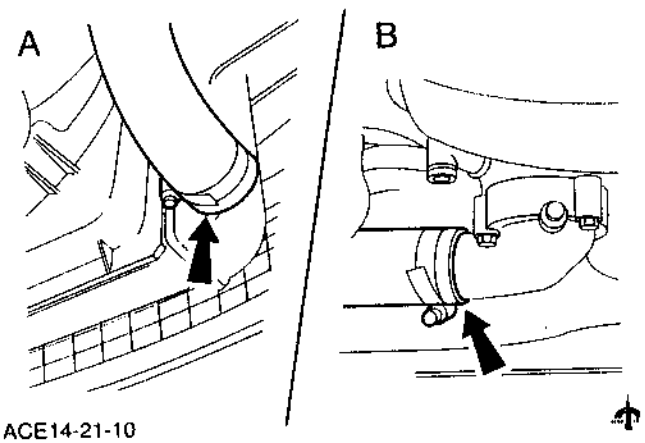


Fig.13. Coolant hose.
A - To radiator
B - To thermostat housing

21. Disconnect the coolant hoses from the heater pipe and thermostat housing, Fig.14.

Fig.14. Coolant hoses.
A - From intercooler to heater pipe
B - From intercooler to thermostat housing
C - From top of radiator to thermostat housing

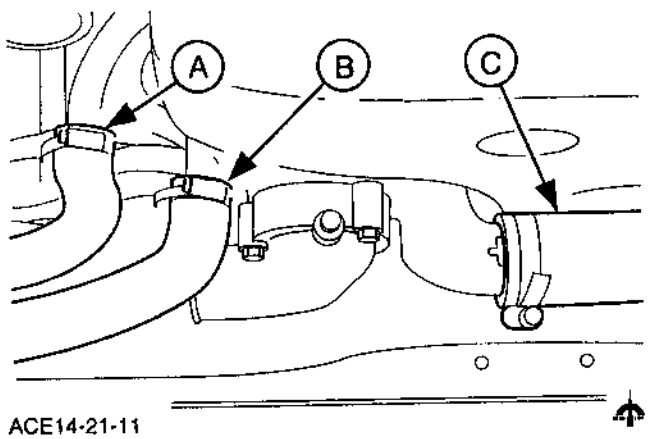


Fig.14. Coolant hoses.

22. Disconnect the upper coolant hose from the heater radiator, Fig.15.

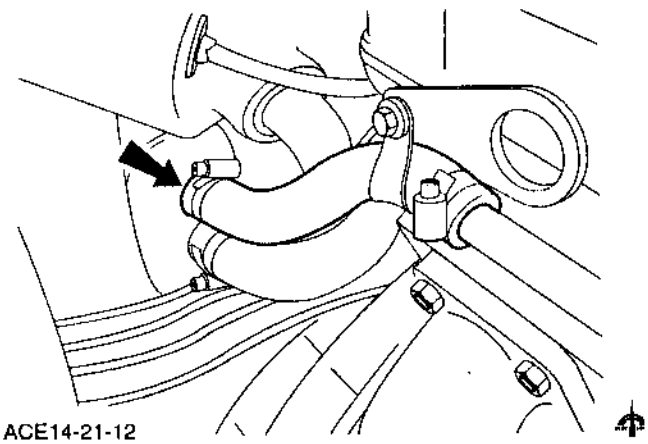


Fig.15. Upper coolant hose to heater radiator.

23. Disconnect the plug and wiring from the alternator, Fig.16.(B).

24. Disconnect the ignition coil high tension lead from the distributor, Fig.16.(A).

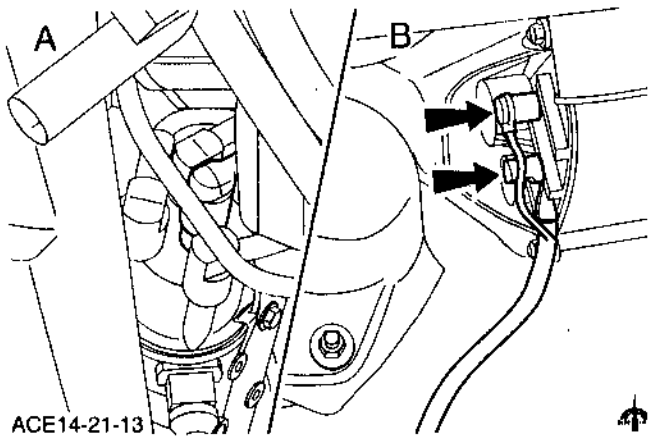


Fig.16. A - Lead between distributor and ignition coil
B - Alternator wiring connections

25. Unclip the two engine wiring loom multiplugs and disconnect them, Fig.17.

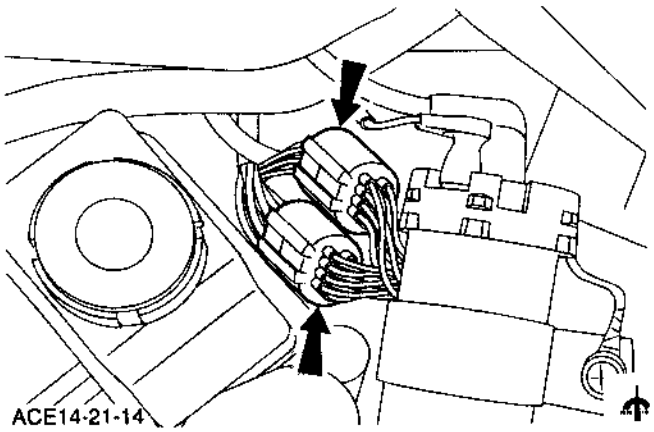


Fig.17. Engine wiring loom multiplugs.

26. Detach the wiring loom from the air plenum chamber (1 bolt), Fig.18.

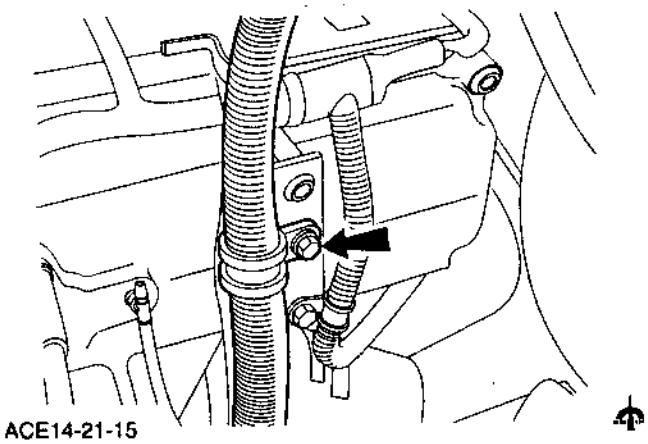
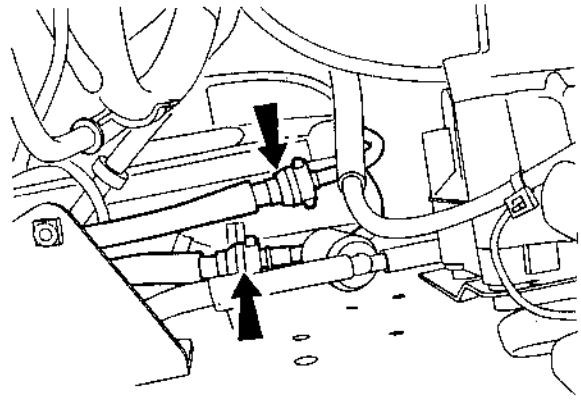


Fig.18. Retaining bolt of wiring loom.

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27. Compress the lugs of the quick-release couplings on the fuel feed and return hoses and disconnect the hoses from the fuel pipes, Fig.19.

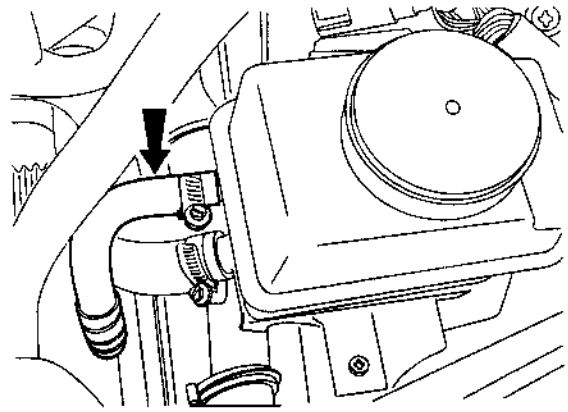


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Fig.19. Quick-release couplings connecting fuel hoses to fuel pipes. (RHD variant shown)

28. Disconnect the small hose from the power steering reservoir, Fig.20.

NOTE: Collect the power steering fluid in a clean container.

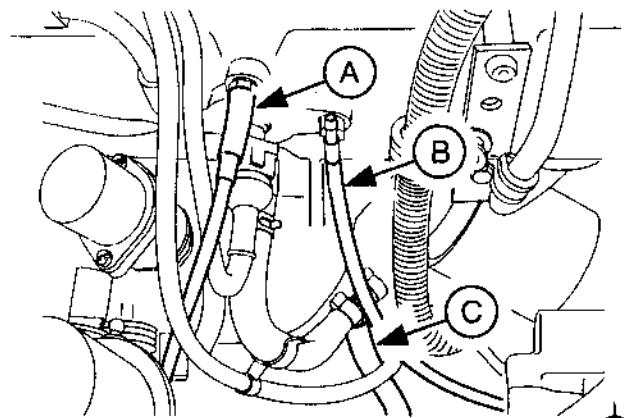


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Fig.20. Hose to power steering reservoir.

29. Disconnect the vacuum pipes/hose from the air plenum chamber, Fig.21.

Fig.21. Vacuum pipes/hose.
A - To MAP sensor
B - To interior
C - To carbon canister



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Fig.21. Vacuum pipes/hose.

30. Detach the heat shield of the right-hand engine mounting bracket (2 nuts), Fig.22.

31. Disconnect the front exhaust pipe from the turbocharger (3 nuts).

32. Release the nut of the right-hand engine mounting bracket and remove it. Release the self-locking nut on the throttle housing vibration damper. Release the nut of the left-hand engine mounting bracket and remove it, Fig.23.

Fig.23. Nuts of engine mounting brackets.
A - Right
B - Left
C - Self-locking nut on throttle housing vibration damper

33. Remove the dust caps from the shock absorber top mountings and fit engine support bar 21-140 in conjunction with adaptor 21-140-02. Slacken the bolts of the engine lifting eyes, angle the engine lifting eyes towards the engine support bar and tighten the bolts again. Hook the 2 chains to the spindles of the engine support bar and attach them to the engine lifting eyes, Fig.24. Screw up the spindles on the engine support bar to take up the slack.

NOTE: The left-hand spindle on the engine support bar must be at the front and the right-hand spindle at the back.

Fig.24. Engine support bar 21-140 attached.
A - Right-hand spindle at the back
B - Left-hand spindle at the front
C - Engine lifting eyes at an angle

34. Raise the vehicle.

35. Remove the front wheels.

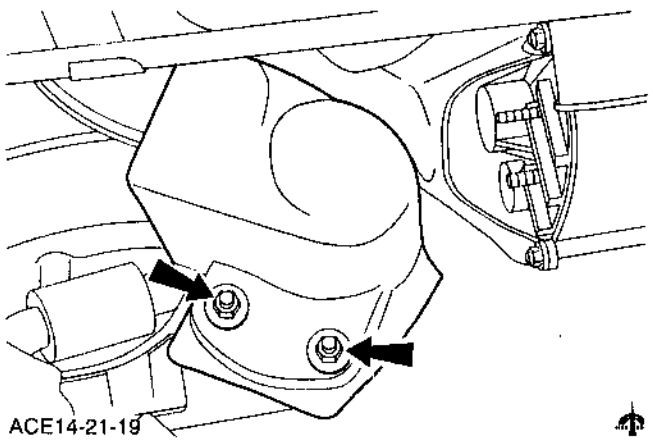


Fig.22. Retaining nuts of engine mounting bracket heat shield.

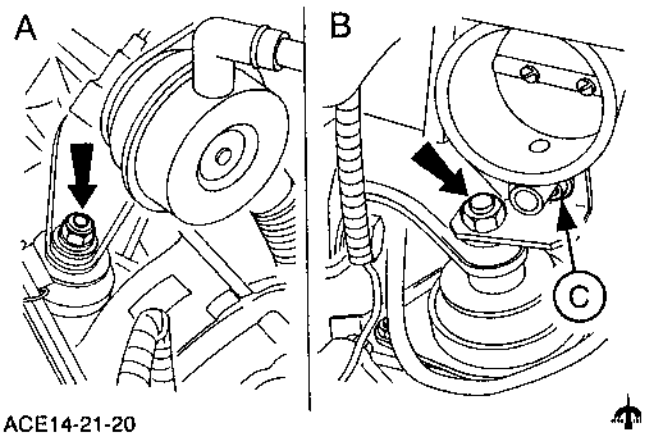


Fig.23. Nuts of engine mounting brackets.

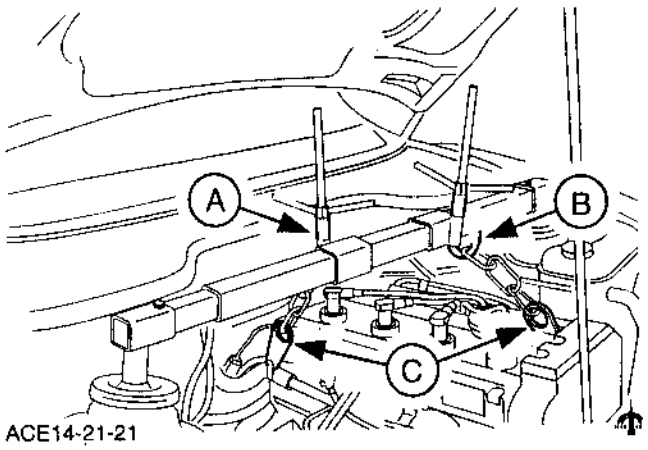


Fig.24. Engine support bar 21-140 attached.

36. Disconnect the oil hose from the power steering pump (1 clip) and disconnect the high-pressure oil pipe (1 inlet union screw), Fig.25.(A,B). Detach the oil pipe from the left-hand side member (1 bolt) and tie it securely to the side.

37. Disconnect the coolant hose running from the water pump at the pipe (1 clip), Fig.25.(C).

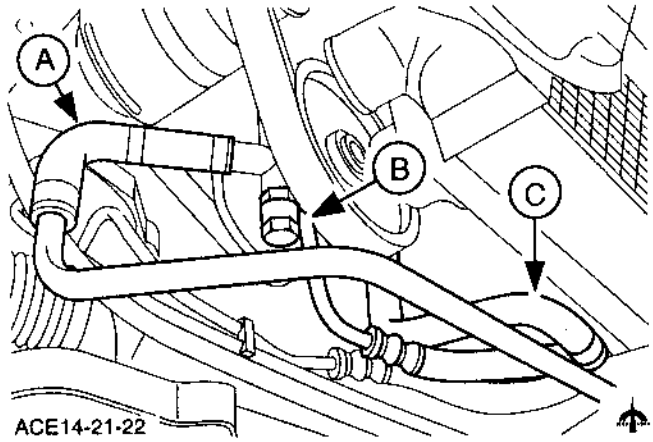


Fig.25. A - Oil hose
B - High-pressure oil pipe
C - Coolant hose

38. Detach the track rod from the steering arm on both sides. Withdraw the split pin and slacken the castellated nut on the track rod end. Press the track rod end out of the spindle carrier using Special Tool 13-006, Fig.26.(A,B,C). Unscrew the castellated nut and detach the track rod end from the spindle carrier.

Fig.26. Front suspension.
(left-hand side shown)
A - Track rod
B - Special Tool 13-006
C - Spindle carrier
D - Lower suspension arm retaining bolt
E - Lower suspension arm

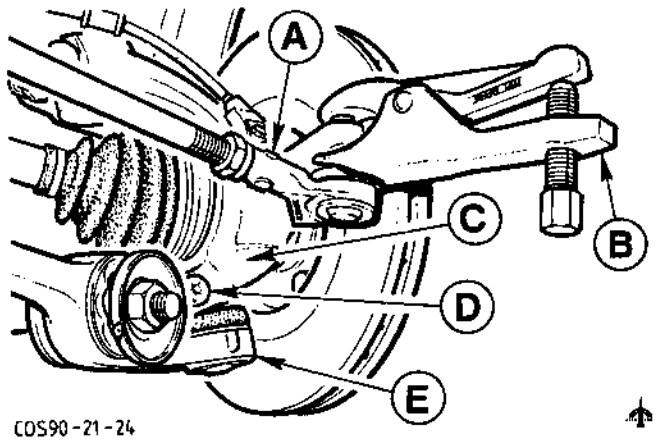


Fig.26. Front suspension.
(left-hand side shown)

39. Detach the Torx bolt and nut on both sides and lever the lower suspension arm downwards away from the spindle carrier, Fig.26.(C,D,E).

40. Detach the stabiliser bar bracket from the side member on the left and right-hand sides (4 bolts), Fig.27.

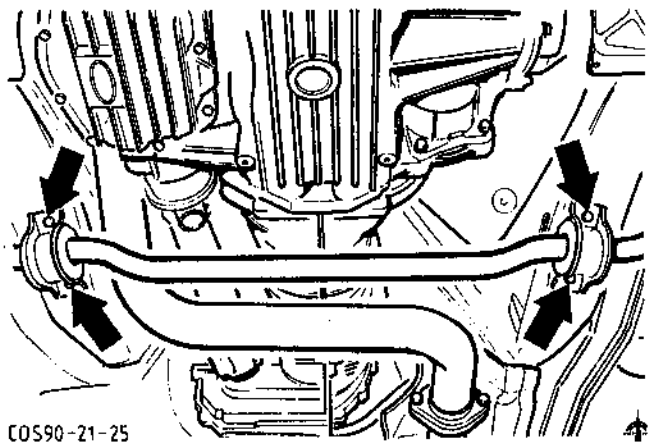


Fig.27. Retaining bolts of stabiliser bar brackets.

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41. Disconnect the intermediate steering shaft from the steering shaft (1 clamp), Fig.28.

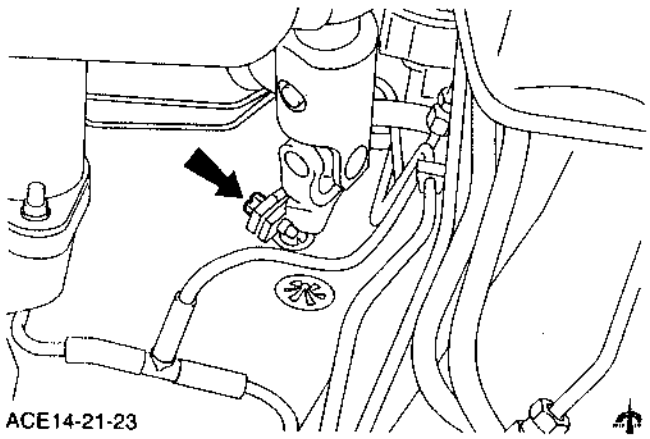


Fig.28. Bolt securing intermediate steering shaft.

42. Place a collecting tray under the front axle assembly, remove the housing cover (8 bolts), Fig.29, and drain the oil.

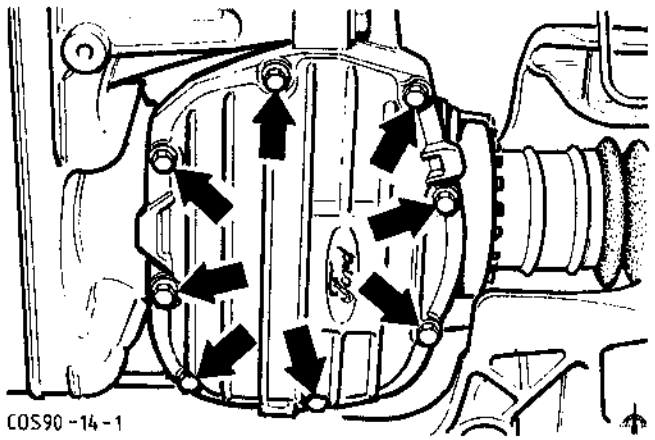


Fig.29. Retaining bolts of front axle housing cover.

43. Remove the circlip securing the driveshaft in the front axle assembly, Fig.30.

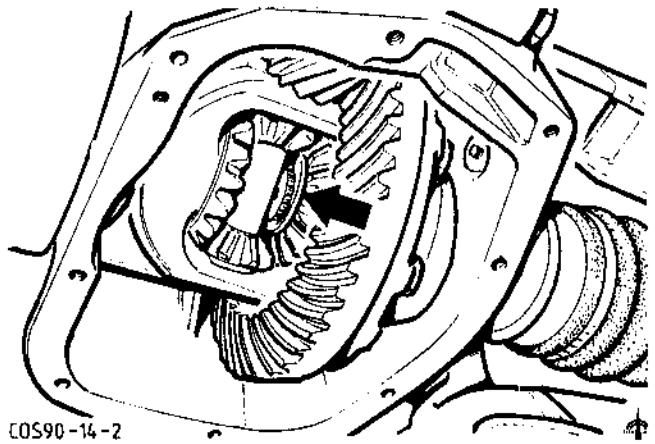


Fig.30. Circlip securing driveshaft in front axle assembly.

0392

44. Detach the brake pipes from the brackets on the left and right-hand sides (2 U-shaped retainers), Fig.31.(A,D).

Fig.31. U-shaped retainers of brake pipes and driveshafts.
A - Right-hand U-shaped retainer
B - Right-hand driveshaft
C - Left-hand driveshaft
D - Left-hand U-shaped retainer

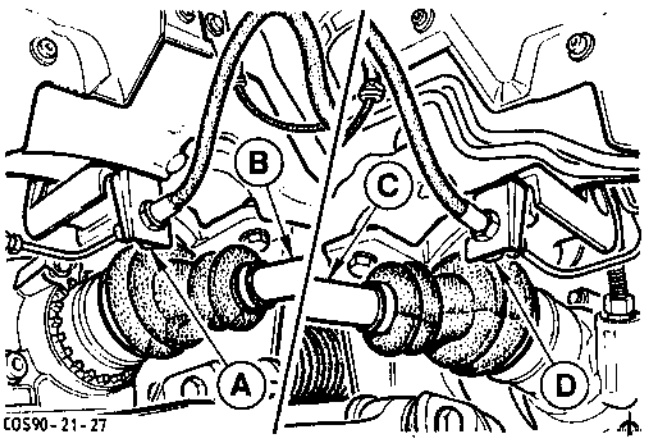


Fig.31. U-shaped retainers of brake pipes and driveshafts.

45. Pull the drive driveshaft joint out of the front axle assembly (on the right-hand side) and out of the intermediate shaft (on the left-hand side), Fig.31.(B,C).

46. Suspend the left and right-hand driveshafts using lengths of wire, Fig.32.

NOTE: The inner drive joints must not be bent at more than 20°, the outer drive joints must not be bent at more than 45°.

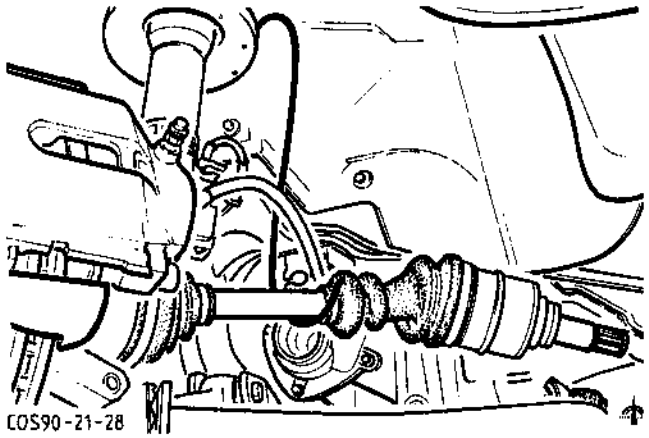


Fig.32. Driveshaft suspended. (left-hand side shown)

47. Pull off the cap, unscrew the 2 nuts and disconnect the starter motor wiring, Fig.33.(A).

48. Unscrew the union nut of the speedometer drive cable from the intermediate shaft housing cover and withdraw the speedometer drive cable, Fig.33.(B).

49. Disconnect the earth cable (1 flange bolt), Fig.33.(C).

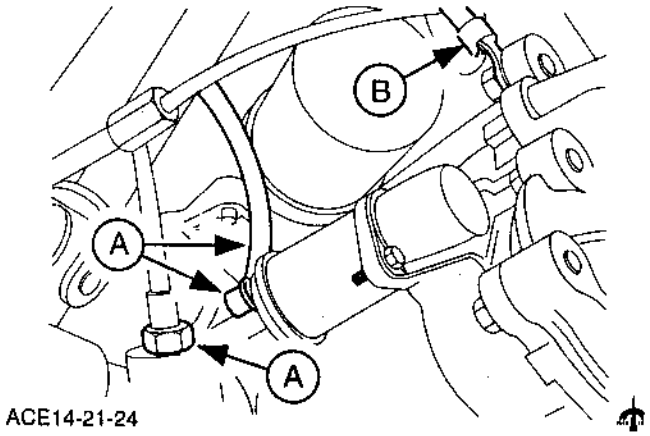
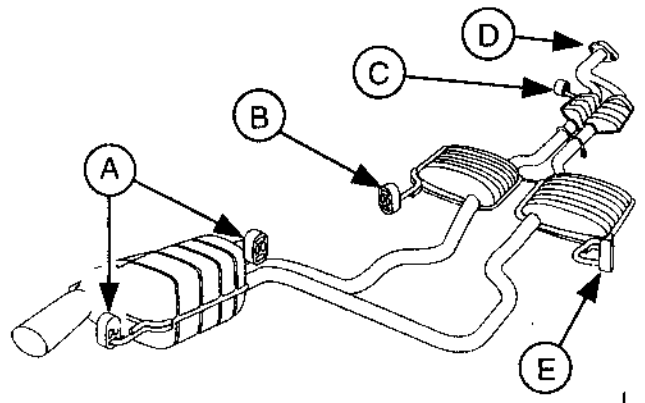


Fig.33. A - Starter motor wiring
B - Earth cable
C - Union nut of speedometer drive cable

0392

50. Detach the exhaust system complete, Fig.34:

- Detach the front exhaust flange (2 bolts).
- Detach the left-hand middle exhaust mounting bracket from the rear axle crossmember (2 bolts).
- Unhook the exhaust system from the front, right-hand middle and the 2 rear mountings and remove it.
- Remove the front exhaust pipe

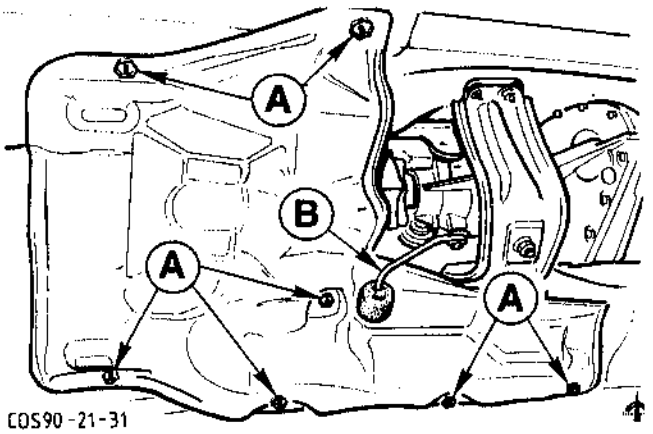


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Fig.34. Exhaust mounting points.
(exhaust system removed for clarity)
A - Rear
B - Left-hand middle, bolted
C - Front
D - Flange
E - Right-hand middle

51. Detach the exhaust mounting bracket from the transfer case (1 bolt), Fig.35.(B).

52. Detach the exhaust system heat shield from the floor assembly (7 clips), Fig.35.(A).



COS90-21-31

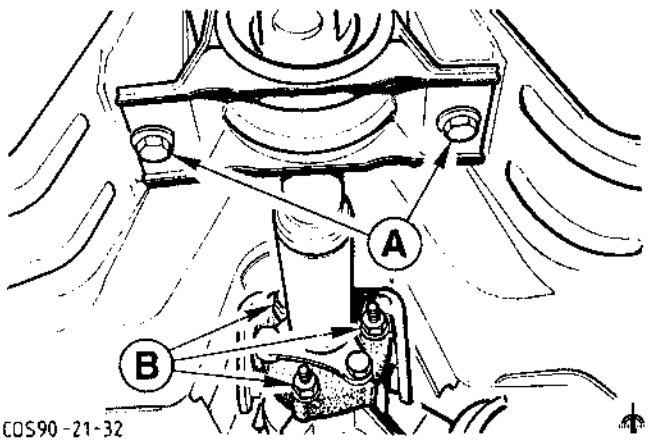
Fig.35. A - Heat shield clips
B - Exhaust mounting bracket

53. Unscrew the 3 nuts securing the driveshaft on the Torx studs on the transmission output flange, Fig.36.(B), holding the Torx studs with a Torx wrench (refer to PROPRIETARY TOOLS).

Unscrew the 2 centre bearing retaining bolts and remove them with the U-shaped washers, Fig.36.(A).

Unscrew the 4 retaining bolts on the rear axle drive pinion flange.

Remove the driveshaft complete.



COS90-21-32

Fig.36. Fixture of driveshaft.
A - Centre bearing bolts
B - Transmission output flange nuts

54. Disconnect the multiplug of the reversing lights, Fig.37.(B).

55. Detach the clutch cable gaiter and unhook the clutch cable from the clutch release lever, Fig.37.(A).

56. Support the front axle/engine crossmember using a jack and detach it from the side member together with the brake pipe brackets (4 bolts). Remove the front axle/engine crossmember complete with the steering gear, lower suspension arms and stabiliser bar, Fig.38.

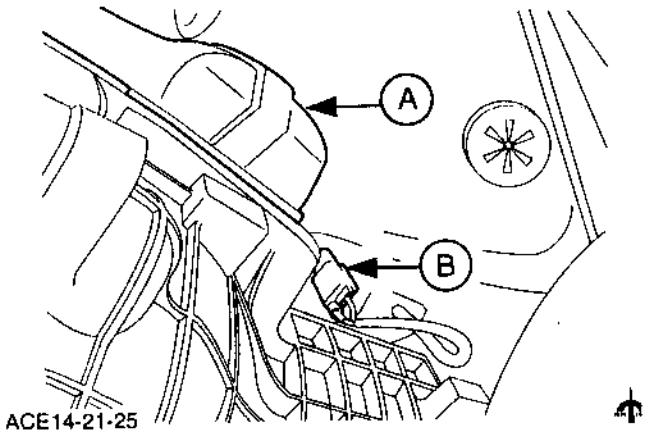


Fig.37. A - Clutch cable gaiter
B - Multiplug of reversing lights

57. Support the transmission using a jack. Unscrew and remove the transmission mounting retaining nut and 2 diagonally opposed retaining nuts securing the transmission crossmember to the floor assembly. Unscrew the remaining 2 retaining nuts of the transmission crossmember but only to the point at which the nuts are still fully engaged on the thread on the stud, Fig.39.

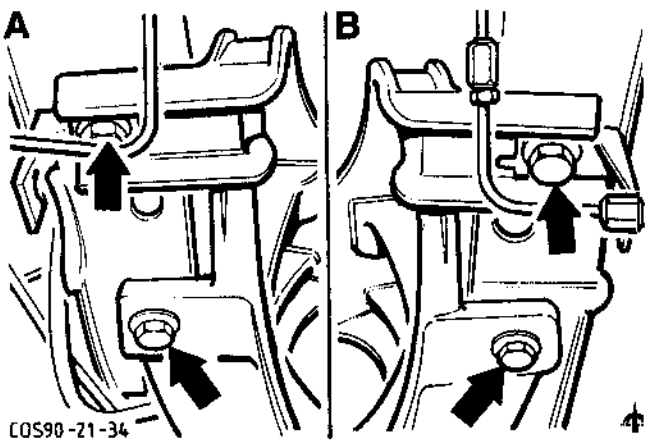


Fig.38. Retaining bolts of front axle/engine crossmember.
A - Left-hand side
B - Right-hand side

58. Position a trolley under the engine and transmission assembly. Lower the vehicle until the engine and transmission assembly is resting on the trolley. Support the engine and transmission assembly on the trolley with blocks.

59. Unscrew the 2 retaining nuts of the transmission crossmember and detach the transmission crossmember from the floor assembly, Fig.39.

60. Unhook the engine support bar from the engine lifting eyes and carefully lift the vehicle. Slide the engine and transmission assembly out from under the vehicle.

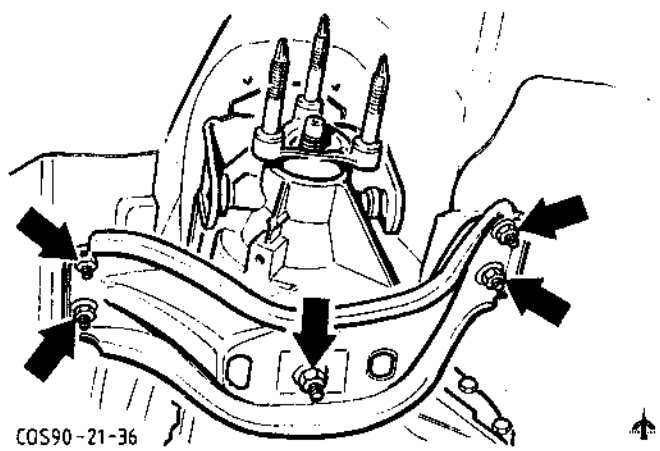


Fig.39. Retaining nuts of transmission crossmember.

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To Install

NOTE: When installing, tighten the nuts, bolts and hose/pipes as specified in Technical Data. Once routed correctly, secure wiring and vacuum pipes/hoses with cable ties.

61. Position the engine and transmission assembly under the vehicle on the trolley. Carefully lower the vehicle and attach the engine support bar to the engine lifting eyes.

62. Attach the transmission crossmember to the floor assembly. Fit the retaining nuts of the transmission crossmember and tighten finger tight.

63. Raise the vehicle.

64. Locate the front axle/engine crossmember in position using a jack. Guide the engine mounting bracket studs into the engine mountings on the left and right-hand sides. Fit the engine mounting bracket nuts and tighten finger tight. Attach the front axle/engine crossmember to the side members, Fig.41.
Remove the jack.

NOTE: Fit the throttle housing support bracket over the engine mounting bracket stud.

65. Tighten the retaining nuts of the transmission crossmember and the transmission mounting.

66. Attach the clutch cable to the clutch release lever and fit the clutch cable gaiter, Fig.42.(A).

67. Connect the multiplug of the reversing lights, Fig.42.(B).

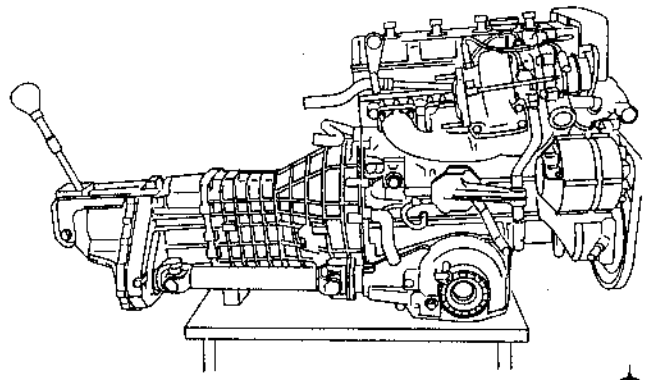


Fig.40. Engine and transmission assembly removed on trolley.

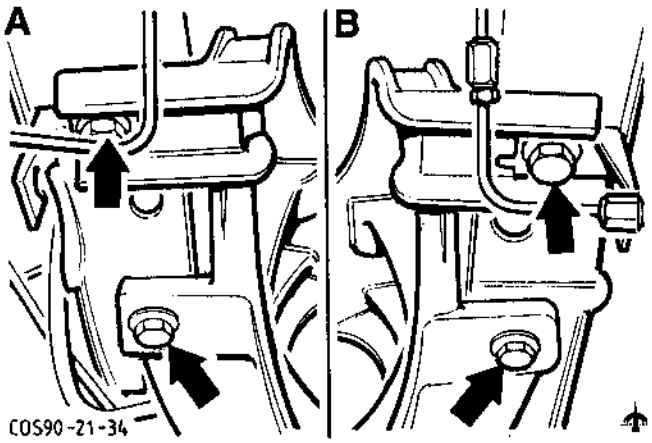


Fig.41. Retaining bolts of front axle/engine crossmember.
A - Left-hand side
B - Right-hand side

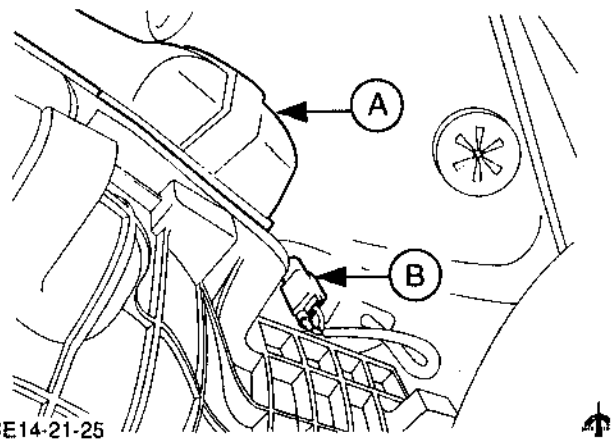


Fig.42. A - Clutch cable gaiter
B - Multiplug of reversing lights

68. Assemble the driveshaft to the rear axle if disconnected.

NOTE: When assembling, guide the master spline into the double groove, Fig.43.

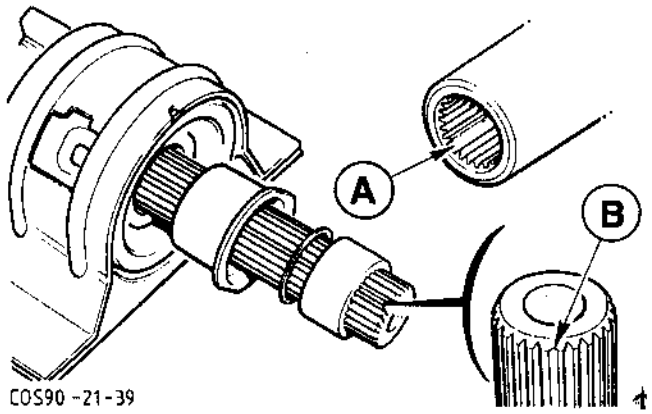


Fig.43. Rear axle driveshaft disconnected.
A - Double groove
B - Master spline

69. Before the driveshaft rubber coupling is attached to the transmission output flange, check the Torx studs are secure in the transmission output flange. To do this, put a torque wrench with a Torx socket (refer to PROPRIETARY TOOLS) on the Torx head and apply the specified torque in the tightening direction. Any studs which turn must be removed and refitted as follows.

- Clean the threaded holes in the transmission output flange, Fig.44.(C), and the threads of the studs, Fig.44.(A), removing all traces of grease and dirt.

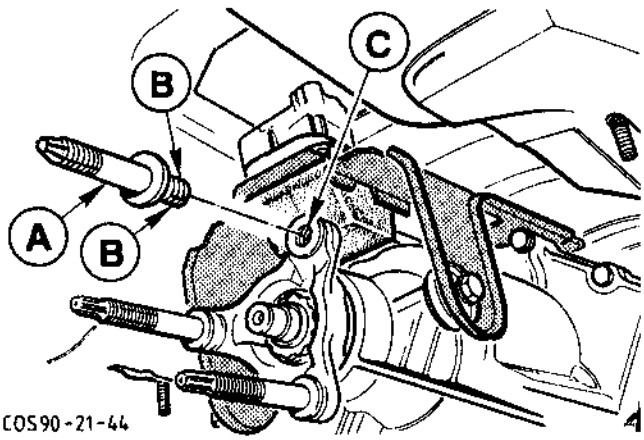


Fig.44. Transmission output flange with Torx studs.
A - Torx studs
B - Thread-locking compound
C - Threaded hole

Fig.44. Transmission output flange with studs.

- Apply 2 drops of thread-locking compound (refer to Technical Data) staggered at 180° on the thread at the flange-end of the stud, Fig.44.(B).
- Insert the stud and tighten it to the specified torque.

NOTE: The stud must be tightened completely within a maximum of 5 minutes of applying the thread-locking compound.

- Let the thread-locking compound harden for 30 minutes.

70. Locate the driveshaft in position.

Attach the driveshaft to the transmission output flange using new nuts. Attach the driveshaft to the rear axle and secure the driveshaft centre bearing to the floor assembly, Fig.45.

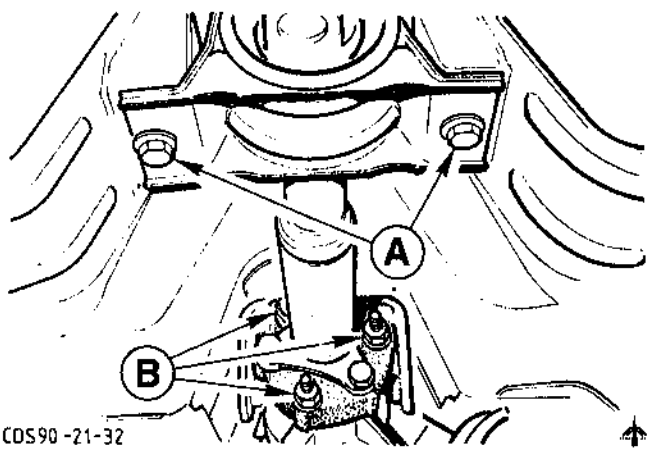


Fig.45. Fixture of driveshaft.
A - Centre bearing bolts
B - Transmission output flange nuts

0392

71. Fit the exhaust system heat shield to the floor assembly, Fig.46.(A).

72. Fit the exhaust mounting bracket to the transfer box, Fig.46.(B).

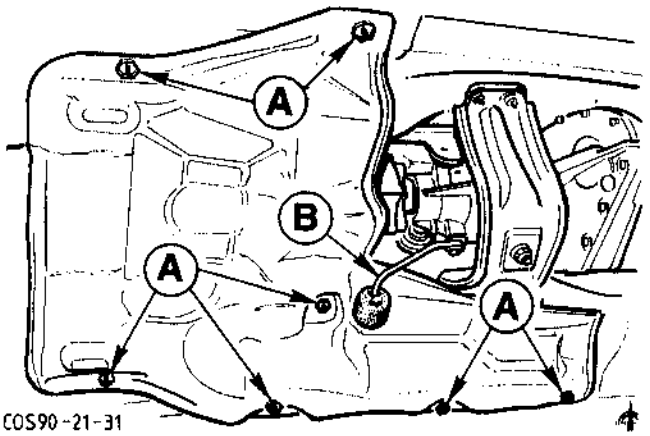


Fig.46. A - Heat shield clips
B - Exhaust mounting bracket

73. Fit the exhaust system complete, Fig.47:

- Locate the front exhaust pipe in position and attach it loosely to the exhaust manifold.
- Locate the exhaust system in position.
- Attach the exhaust system to the 2 rear, right-hand middle and front mountings.
- Secure the left-hand middle exhaust mounting bracket to the rear axle crossmember and attach the exhaust system to this mounting.
- Connect the front exhaust flange.

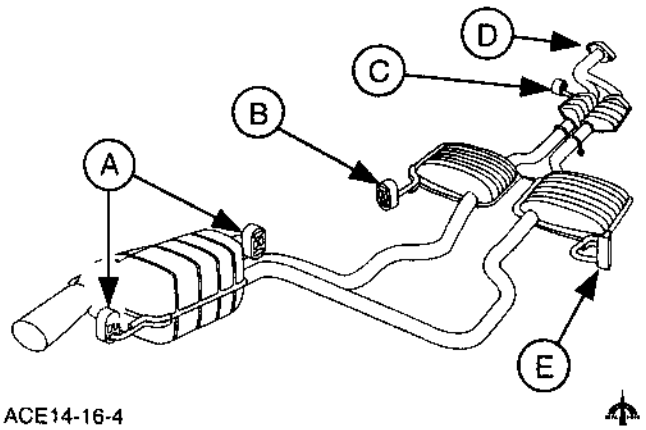


Fig.47. Exhaust mountings.
(exhaust system removed for clarity)

Fig.47. Exhaust mounting points.
(exhaust system removed for clarity)
A - Rear
B - Left-hand middle
C - Front
D - Flange
E - Right-hand middle

74. Connect the starter motor wiring and refit the cap, Fig.48.(A).

75. Insert the speedometer drive cable in the intermediate shaft housing cover, fit the union nut and tighten it, Fig.48.(B).

76. Connect the earth cable with the flange bolt, Fig.48.(C).

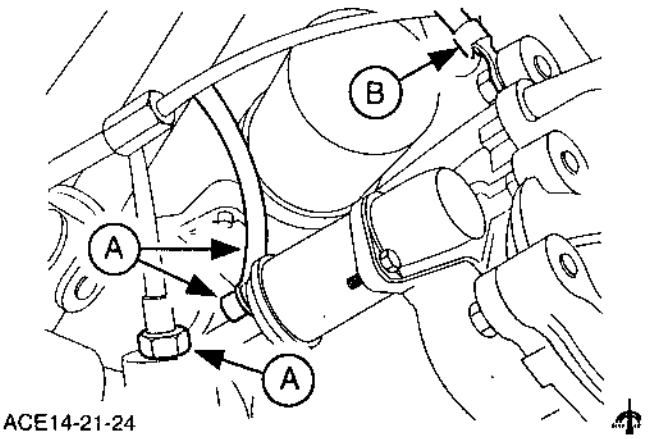


Fig.48. A - Starter motor wiring
B - Speedometer drive cable union nut
C - Earth cable

0392

77. Fit the driveshaft drive joint in the intermediate shaft (on the left-hand side) using a circlip, Fig.49.(C).

Fig.49. U-shaped retainers of brake pipes and driveshafts.
A - Right-hand U-shaped retainer
B - Right-hand driveshaft
C - Left-hand driveshaft
D - Left-hand U-shaped retainer

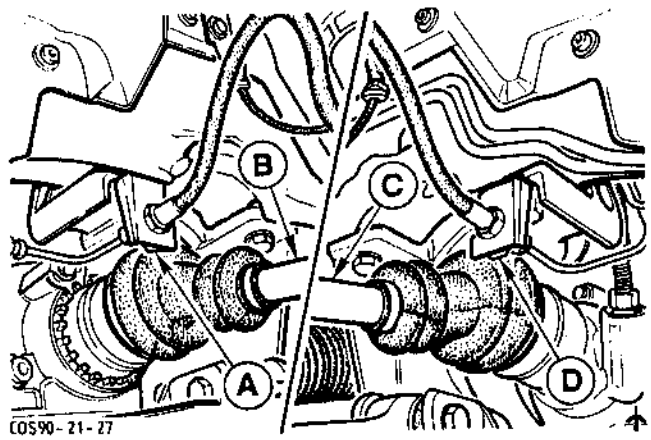


Fig.49. U-shaped retainers of brake pipes and driveshafts.

78. Fit the driveshaft in the front axle assembly (on the right-hand side), Fig.49.(B), and secure it using a new circlip, Fig.50.

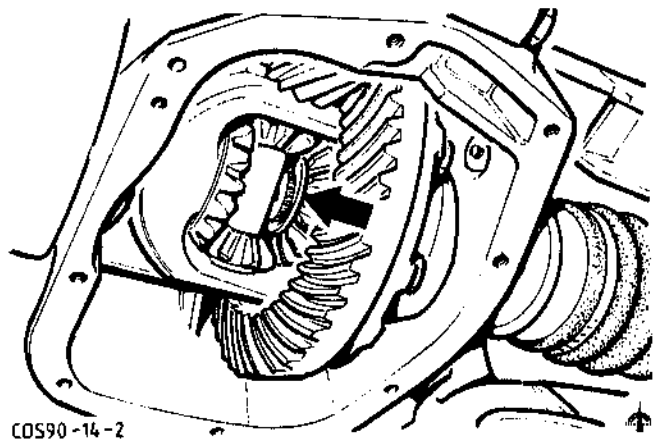


Fig.50. Circlip securing driveshaft in front axle assembly.

79. Apply sealer (refer to Technical Data for specification) and fit the front axle housing cover, Fig.51.
Fill the front axle assembly with oil (refer to Technical Data for quantity and specification) and screw in the oil filler plug.

80. Attach the brake pipes to the brackets on the left and right-hand sides and secure them with the U-shaped retainers, Fig.49.(A,D).

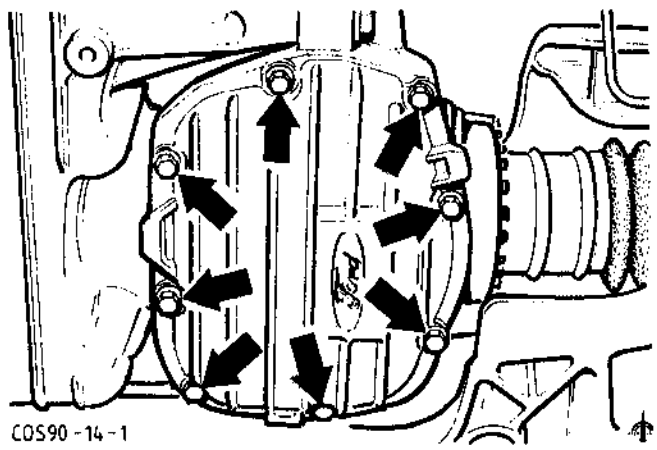


Fig.51. Retaining bolts of front axle housing cover.

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81. Centralise the steering wheel and steering gear. Connect the intermediate steering shaft to the steering shaft, Fig.52.

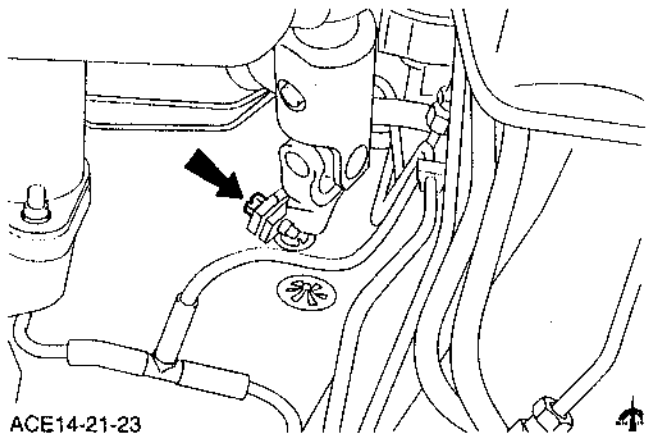


Fig.52. Clamp bolt of intermediate steering shaft.

82. Fit the stabiliser bar brackets to the side members on the left and right-hand sides, Fig.53.

NOTE: Make sure the rubber bushes are seated correctly.

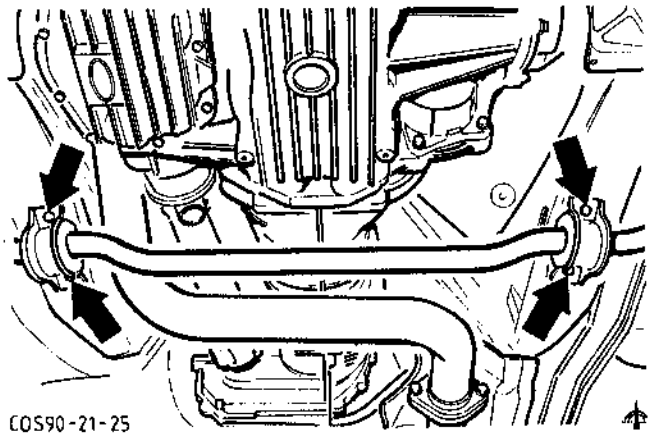


Fig.53. Retaining bolts of stabiliser bar brackets.

83. Attach the lower suspension arm to the spindle carrier (on both sides), Fig.54.(A,B).

84. Connect the track rod to the steering arm, Fig.54.(C,D). Fit the castellated nut on the track rod end, tighten it and secure it using a new split pin (on both sides).

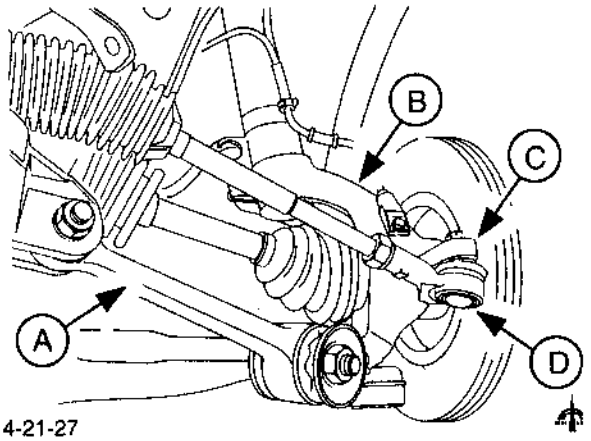


Fig.54. A - Lower suspension arm
B - Spindle carrier
C - Steering arm
D - Track rod

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85. Attach the coolant hose running from the water pump to the pipe, Fig.55.(C).

Fig.55. Oil hose/oil pipe and coolant hoses.
A - Oil hose
B - Oil pipe
C - Coolant hose to pipe
D - Coolant hose to radiator

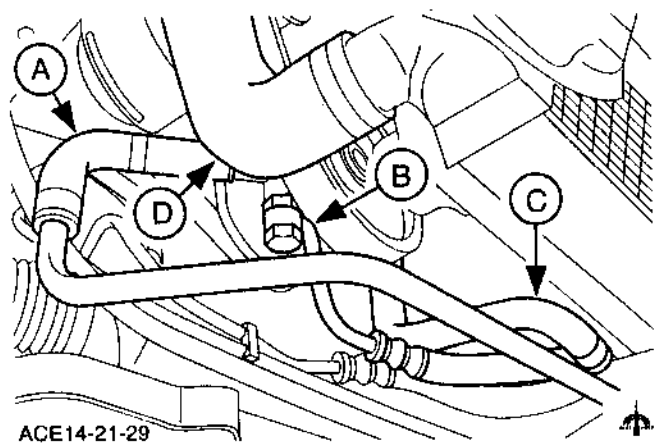


Fig.55. Oil hose/oil pipe and coolant hoses.

86. Attach the power steering oil pipe to the left-hand side member.
Connect the oil hose and the high-pressure oil pipe to the power steering pump, Fig.55.(A,B).
Locate the lower coolant hose in position and connect it to the radiator, Fig.55.(D).

87. Fit the front wheels.

88. Fit the lower engine cover to the side members and the body, Fig.56.

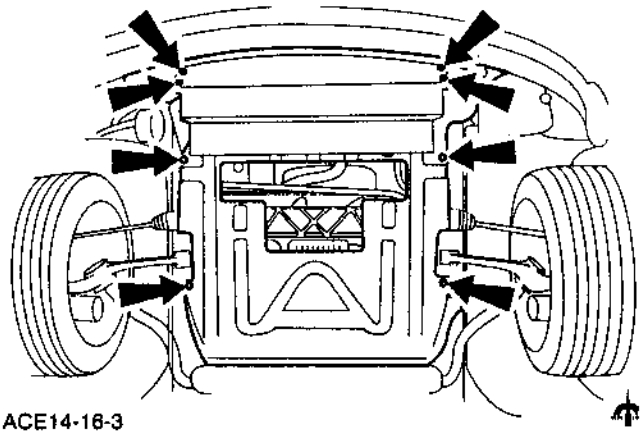


Fig.56. Retaining bolts of lower engine cover.

89. Lower the vehicle to the ground and tighten the front wheel nuts.

90. Unscrew the spindles on the engine support bar and unhook the chains. Remove the engine support bar. Unscrew the bolts securing the engine lifting eyes, position the engine lifting eyes upright and tighten the bolts. Fit the dust caps over the shock absorber top mountings, Fig.57.

Fig.57. Engine support bar 21-140 attached.
A - Right-hand spindle at the rear
B - Left-hand spindle at the front
C - Engine lifting eyes angled

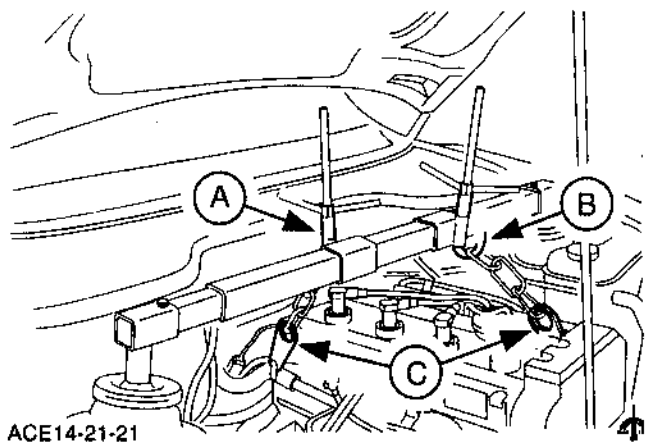


Fig.57. Engine support bar 21-140 attached.

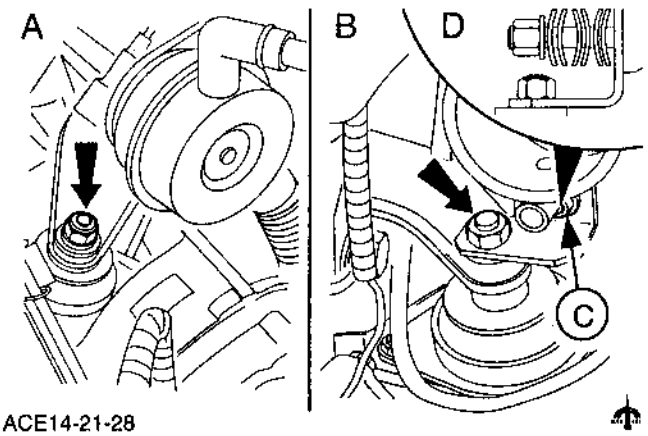
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91. Fit a new self-locking nut on the throttle housing vibration damper but do not tighten it.

    Tighten the 2 engine mounting bracket nuts, Fig.58.(A,B,C).
    Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken it half a turn.

NOTE: Make sure the spring washers are fitted correctly, Fig.58.(D).

Fig.58. Nuts of engine mounting brackets and vibration damper.
A - Right
B - Left
C - Self-locking nut on throttle housing vibration damper
D - Arrangement of spring washers



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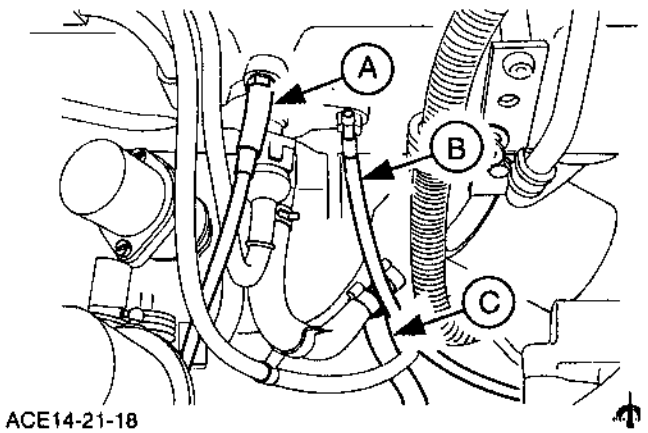
Fig.58. Nuts of engine mounting brackets and vibration damper.

92. Fit the heat shield to the right-hand engine mounting bracket.

93. Connect the front exhaust pipe to the exhaust manifold.

94. Connect the vacuum pipes/hose to the air plenum chamber, Fig.59.

Fig.59. Vacuum pipes/hose.
A - To MAP sensor
B - To interior
C - To carbon canister



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Fig.59. Vacuum pipes/hose.

95. Connect the oil hose to the power steering reservoir.

96. Connect the quick-release couplings of the fuel hoses/pipes, Fig.60.

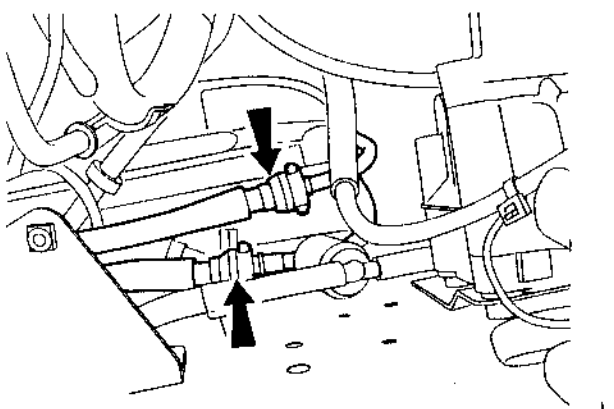

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Fig.60. Quick-release couplings of fuel hoses/pipes.

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97. Secure the wiring loom to the air plenum chamber, Fig.61.

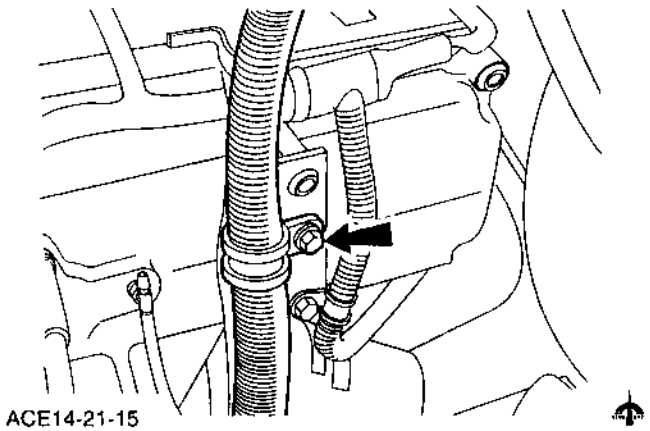


Fig.61. Retaining bolt of wiring loom.

98. Connect the 2 multiplugs of the engine wiring loom and clip them to the wheelarch, Fig.62.

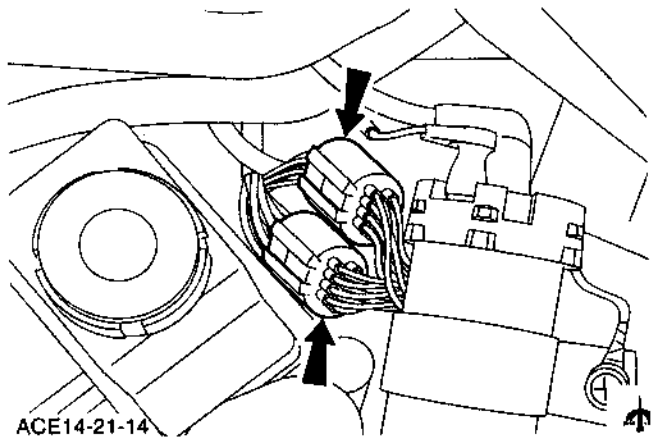


Fig.62. Multiplugs of engine wiring loom.

99. Connect the ignition coil high-tension lead to the distributor, Fig.63.(A).

100. Connect the plug and wiring to the alternator, Fig.63.(B).

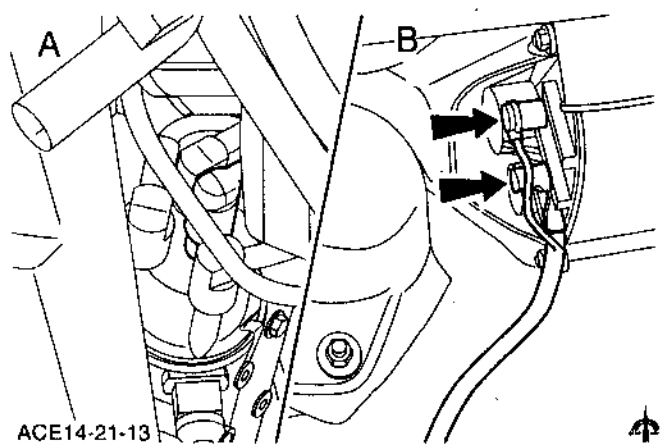


Fig.63. A - Lead between distributor and ignition coil
B - Electrical connections of alternator

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101. Connect the upper coolant hose to the heater radiator.

102. Connect the coolant hoses to the heater pipe and the thermostat housing, Fig.64.

Fig.64. Coolant hoses.
A - From intercooler to heater pipe
B - From intercooler to thermostat housing
C - Upper radiator hose the thermostat housing

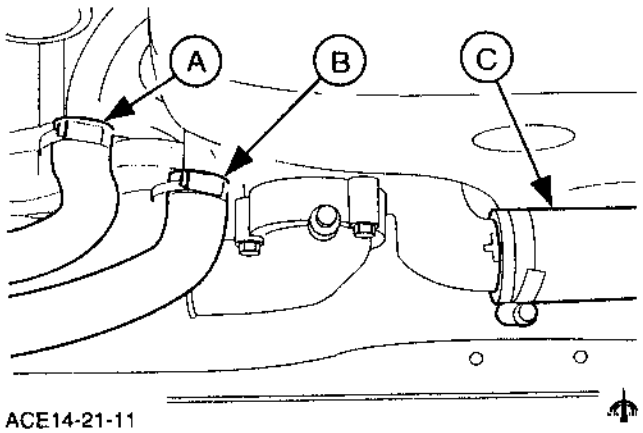


Fig.64. Coolant hoses.

103. Attach the coolant hose running from the bottom of the radiator to the thermostat housing.

104. Locate the air hose running from the intercooler to the throttle housing in position and connect it, Fig.65.

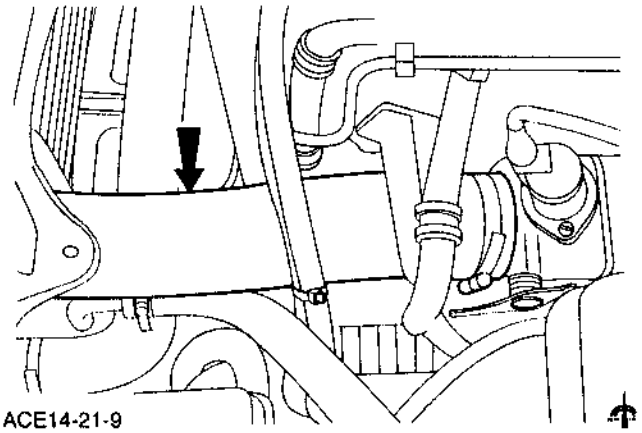


Fig.65. Air hose from intercooler to throttle housing.

105. Fit the throttle cable into the bracket, engage the lugs, hook the cable to the throttle linkage and secure it with 2 clips, Fig.66.

Fig.66. Throttle cable.
A - Attached
B - Detached
C - Clip pulled out
D - Lugs of retainer
E - Clip on throttle linkage

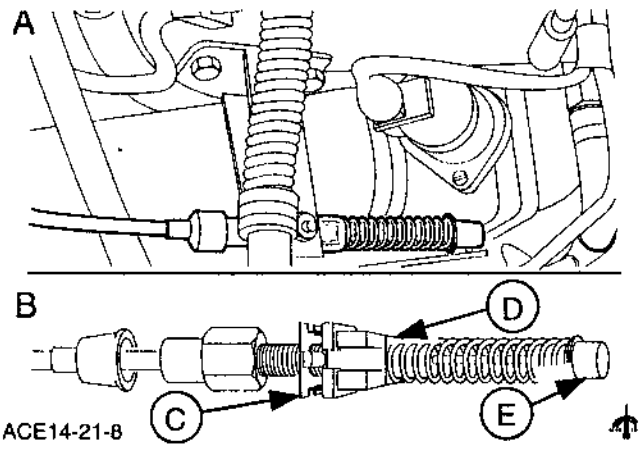


Fig.66. Throttle cable.

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106. Connect the air pipes to the air cleaner housing and to the turbocharger tee, Fig.67.(A,C).

Fig.67. Pipes/hoses.
A - To air cleaner housing
B - To turbocharger connecting pipe
C - To turbocharger tee
D - To turbocharger

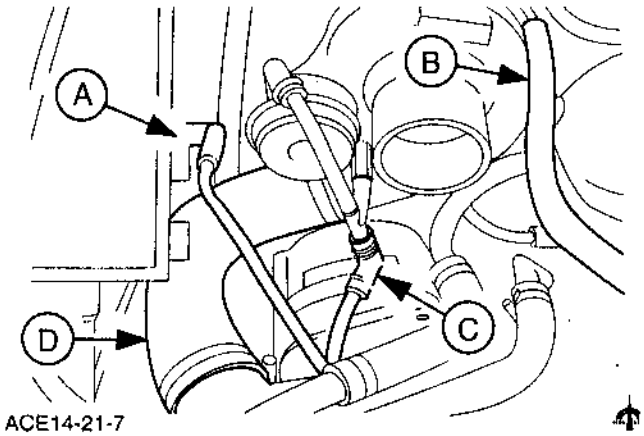


Fig.67. Pipes/hoses.

107. Connect the coolant hose to the turbocharger connecting pipe, Fig.67.(B).

108. Connect the lower air hose to the turbocharger, Fig.67.(D).

109. Locate the engine breather pipe in position. Connect the pipe to the air cleaner housing and to the connecting hose, Fig.68.

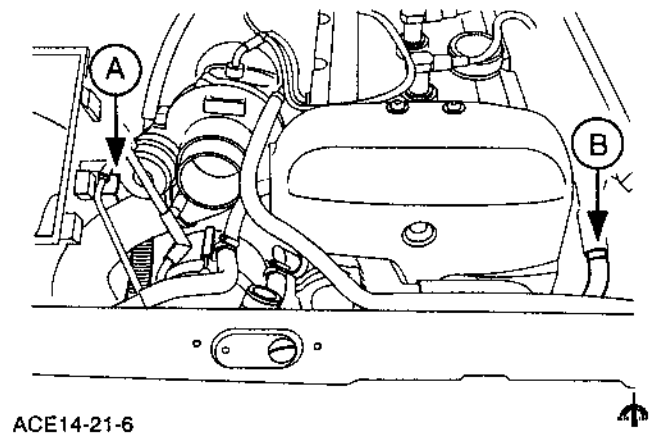


Fig.68. Engine breather pipe.
A - To air cleaner housing
B - To connecting hose

110. Insert the air cleaner element.
Fit the air cleaner cover and secure it.
Connect the air hoses to the turbocharger and the by-pass valve.
Run the vacuum pipe to the air plenum chamber and connect it to the tee, Fig.69.

Fig.69. Air cleaner cover with air hoses/vacuum pipe.
A - To turbocharger
B - To air plenum chamber
C - To by-pass valve

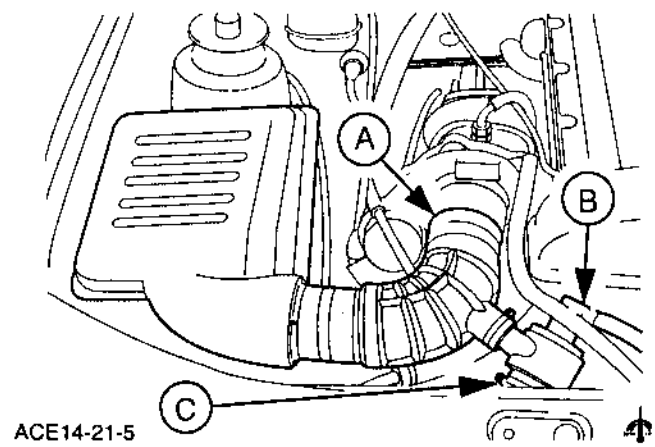


Fig.69. Air cleaner cover with air hoses/vacuum pipe.

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111. Fit the turbocharger heat shield, Fig.70.

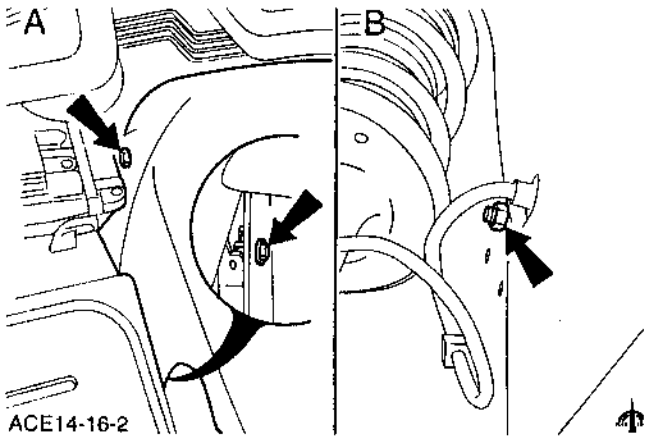


Fig.70. Fixture of turbocharger heat shield.
A - Bolts
B - Nut in wheelhouse

112. Connect the multiplug of the HEGO sensor, Fig.71.

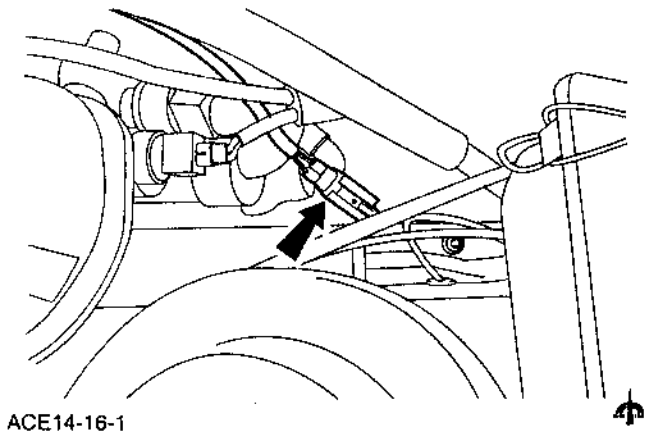


Fig.71. Multiplug of HEGO sensor.

113. Fit the retaining frame with the inner gear lever gaiter.

114. Fit the leather gaiter over the gear lever, pull it up inside out, secure it with a cable tie and refit it.
Remove the support from the clutch pedal.

115. Locate the centre console roughly in position.
Connect the multiplugs of the radio (2) and the cigarette lighter.
Fit the centre console.

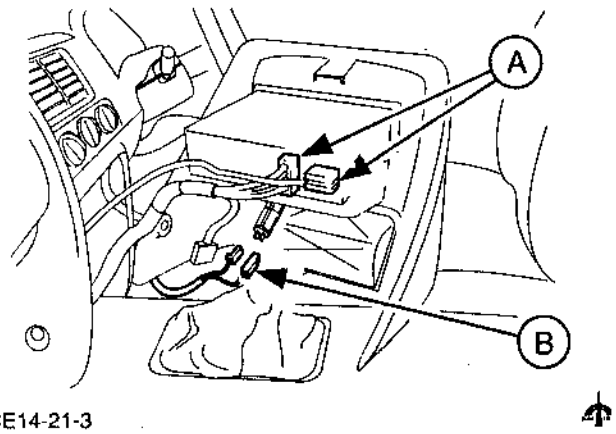


Fig.72. Multiplugs.
A - Radio
B - Cigarette lighter

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116. Secure the centre console (3 screws, 2 clips), Fig.73.

NOTE: Set the clip before fitment: Spread the sprung legs slightly and push back the centre pin until it protrudes the front face of the clip.

117. Fit the ashtray. Connect the multiplugs to the switches for the electrically operated windows (2) and to the switch for the luggage compartment lock. Fit the switch cover, Fig.74.

Fig.74. Switch cover.
A - Switch cover
B - Multiplugs for electrically operated windows
C - Multiplug for luggage compartment lock
D - Ashtray

118. Connect the battery earth cable.

119. Fill the cooling system expansion tank up to the MAX mark (refer to Technical Data for coolant quantity and specification), opening the bleed screw on the thermostat housing to allow air to escape from the cooling system. Apply sealer (refer to Technical Data for specification) and screw in and tighten the bleed screw, Fig.75.

NOTE: Pour the coolant in slowly so that air bubbles can escape.

120. Check the engine oil level and top up as necessary (refer to Technical Data for specification).

121. Fill the power steering reservoir and bleed the system as indicated in Operation 13 416 1 (refer to Technical Data for quantity and specification).

122. Start the engine and run it up to normal operating temperature. Check all the coolant and oil hose connections for leaks and top up with coolant or oil as necessary.

123. Check the engine tuning settings as specified at normal operating temperature and adjust as necessary.

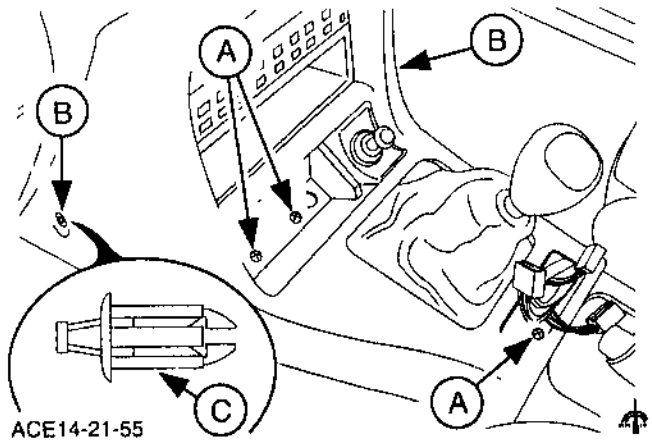


Fig.73. Fixture of centre console.
A - Screws
B - Clip
C - Clip set in position

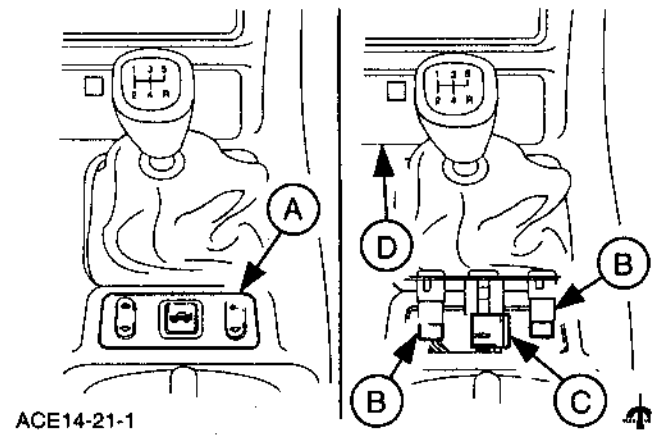


Fig.74. Switch cover.

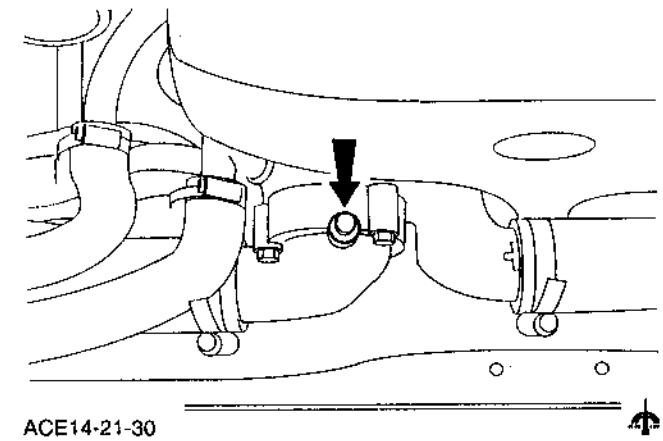


Fig.75. Cooling system bleed screw on thermostat housing.

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21 163 0 CYLINDER HEAD - REMOVE AND INSTALL

SPECIAL SERVICE TOOL RECOGNITION:

Socket wrench for cylinder head bolts .. 21-002
Toothed belt tension test gauge 21-113
Cylinder head locating studs 21-128

NOTE: The engine must always be allowed to cool down completely before removing the cylinder head with the turbocharger and inlet manifold.

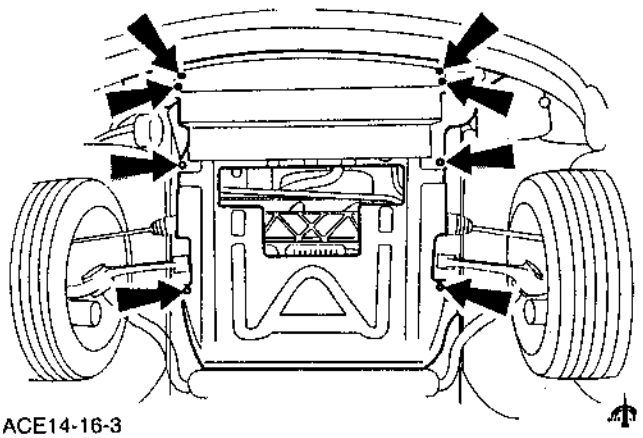


Fig.1. Retaining bolts of lower engine cover.

To Remove

1. Disconnect the battery earth cable.

2. Raise the vehicle.

3. Detach the lower engine cover from the side members (4 bolts) and the bodywork (5 bolts), Fig.1.

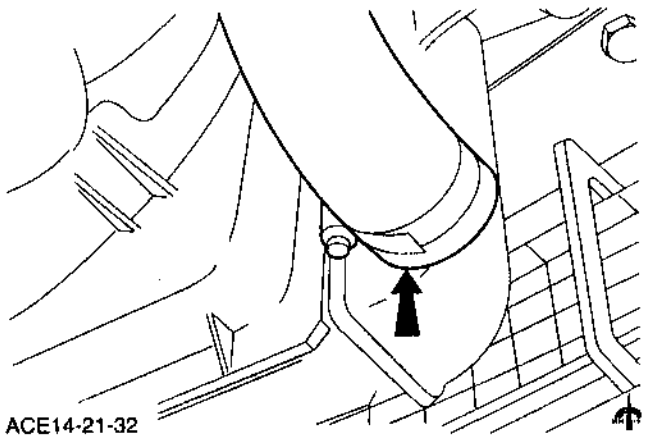


Fig.2. Lower coolant hose on radiator.

4. Position a clean collecting tray under the radiator. Disconnect the lower coolant hose from the radiator, Fig.2, and drain off the coolant.

5. Lower the vehicle to the ground.

6. Disconnect the multiplug of the HEGO sensor and unclip the wiring, Fig.3.

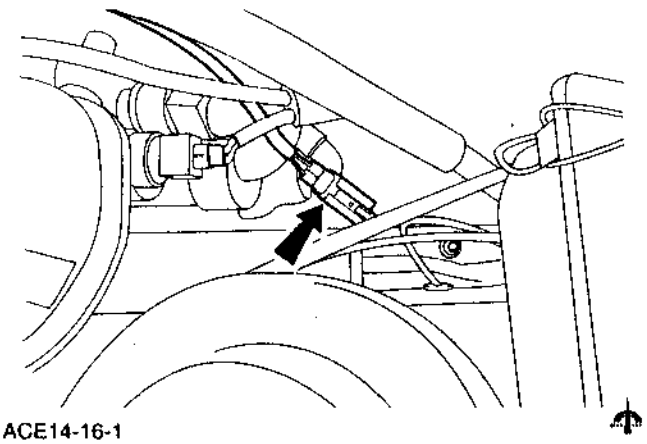


Fig.3. Multiplug of HEGO sensor.

7. Detach the turbocharger heat shield from the bracket, air cleaner housing and fender (2 bolts, 1 nut in the wheelhouse), Fig.4.

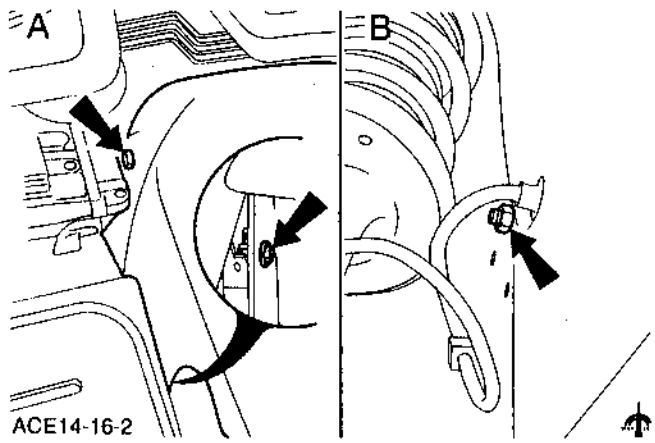


Fig.4. Fixture of turbocharger heat shield.
A - Bolts
B - Nut in wheelhouse

8. Release the air cleaner cover (4 clips). Disconnect the air hoses (2 clips) from the turbocharger and from the by-pass valve. Disconnect the vacuum pipe from the tee on the air plenum chamber, Fig.5. Remove the cover and take out the filter element.

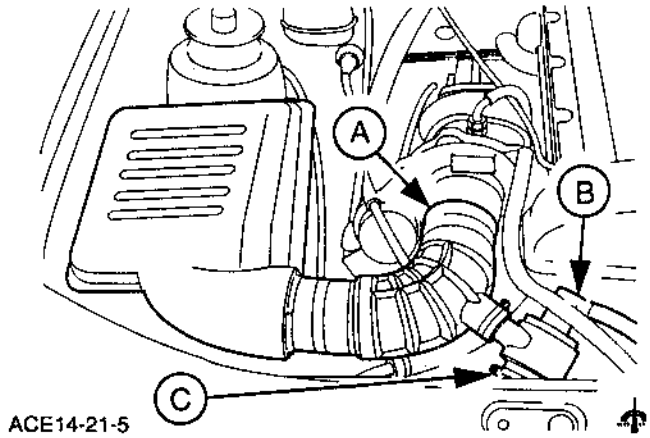


Fig.5. Air cleaner cover with air hoses/vacuum pipe.
A - To turbocharger
B - To air plenum chamber
C - To by-pass valve

9. Disconnect the engine breather pipe from the air cleaner housing and from the connecting hose, Fig.6. Remove the pipe.

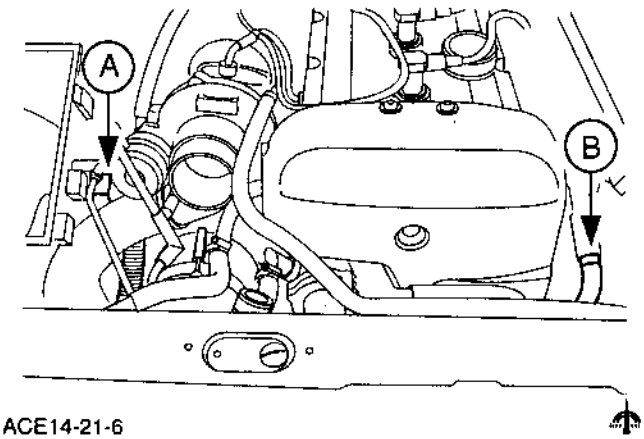


Fig.6. Engine breather pipe.
A - To air cleaner housing
B - To connecting hose

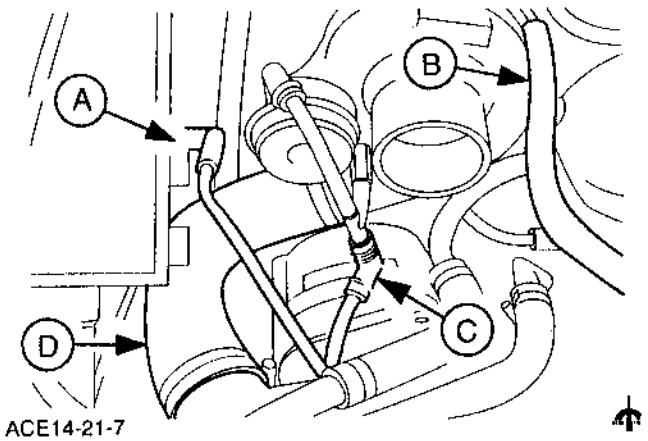
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10. Disconnect the air pipes from the air cleaner housing and from the turbocharger tee (1 clip), Fig.7.(A,C).

Fig.7. Pipes/hoses.
A - To air cleaner housing
B - To turbocharger
C - To turbocharger tee
D - Lower turbocharger air hose

11. Disconnect the lower air hose from the turbocharger, Fig.7.(D).

12. Disconnect the coolant hose from the connecting pipe/turbocharger, Fig.7.(B).



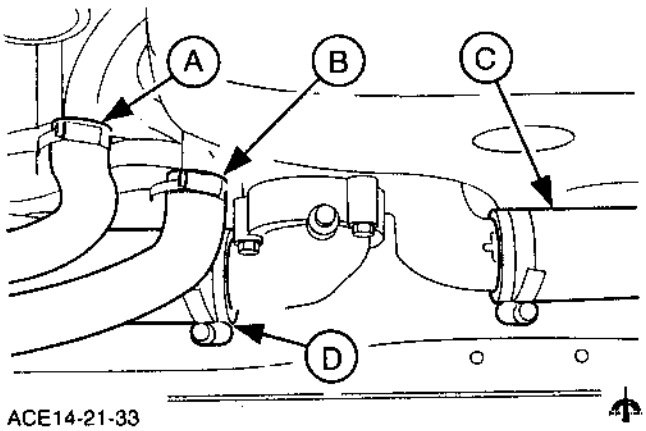
ACE14-21-7

Fig.7. Pipes/hoses.

13. Disconnect the coolant hose running to the bottom of the radiator from the thermostat housing and remove it.

Disconnect the coolant hoses from the heater pipe and the thermostat housing, Fig.8.

Fig.8. Coolant hoses.
A - From intercooler to heater pipe
B - From intercooler to thermostat housing
C - From top of radiator to thermostat housing
D - From bottom of radiator to thermostat housing



ACE14-21-33

Fig.8. Coolant hoses.

14. Disconnect the upper coolant hose from the heater radiator, Fig.9.

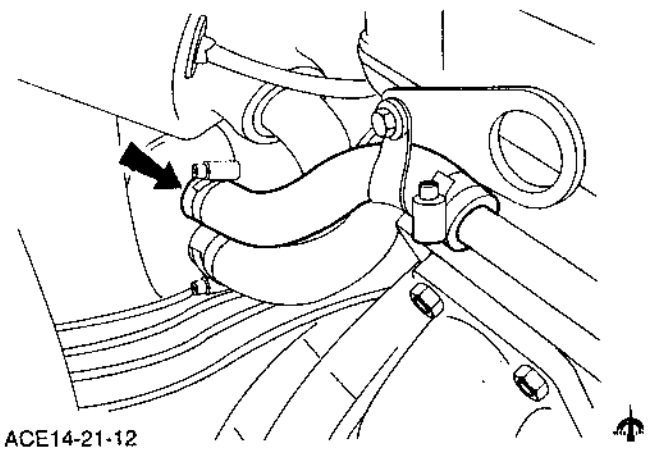

ACE14-21-12

Fig.9. Upper coolant hose to heater radiator.

15. Release the upper hose clip on the coolant hose between the thermostat housing and the water pump, Fig.10.(A).

Fig.10. Hose clips on coolant hose and oil return hose.
A - Upper clip on coolant hose between thermostat housing and water pump
B - Clip on turbocharger oil return hose

16. Slide the clip on the turbocharger oil return hose Fig.10.(B), down the hose.

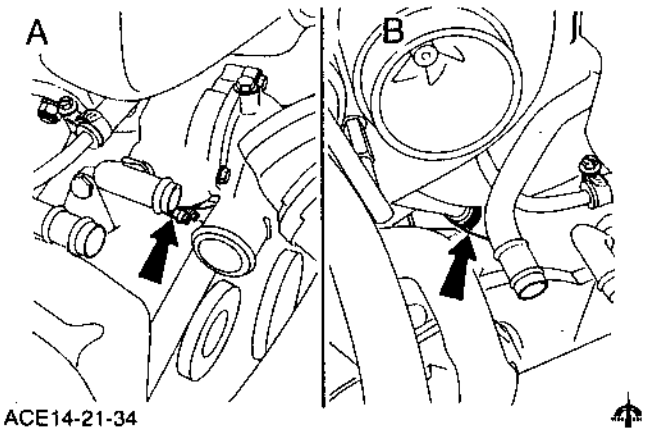


Fig.10. Hose clips on coolant hose and oil return hose.

17. Detach the throttle cable from the throttle linkage (1 clip).
Remove the clip on the bracket.
Compress the 2 lugs of the retainer and withdraw the throttle cable from the bracket, Fig.11.

Fig.11. Throttle cable.
A - Attached
B - Detached
C - Clip pulled out
D - Lug of retainer
E - Clip on throttle linkage

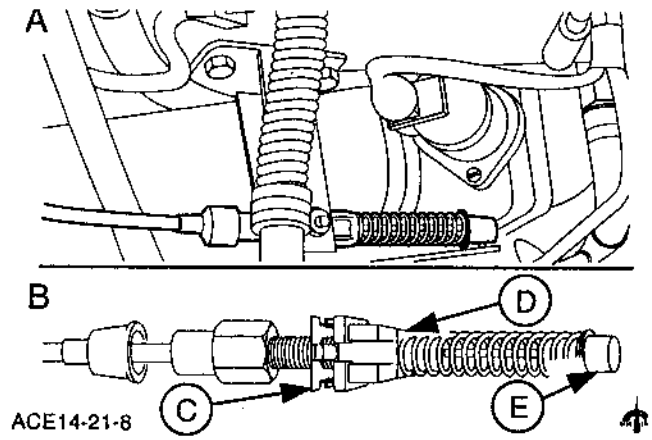


Fig.11. Throttle cable.

18. Disconnect the air hose from the intercooler and from the throttle housing (2 clips) and remove it, Fig.12.

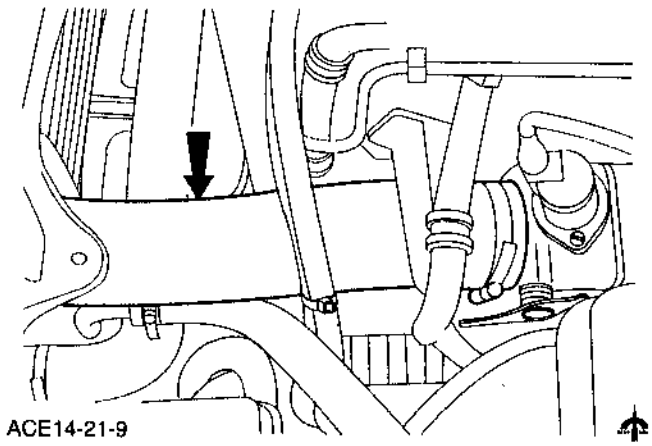


Fig.12. Air hose from intercooler to throttle housing.

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19. Detach the wiring loom from the air plenum chamber (1 bolt), Fig.13.

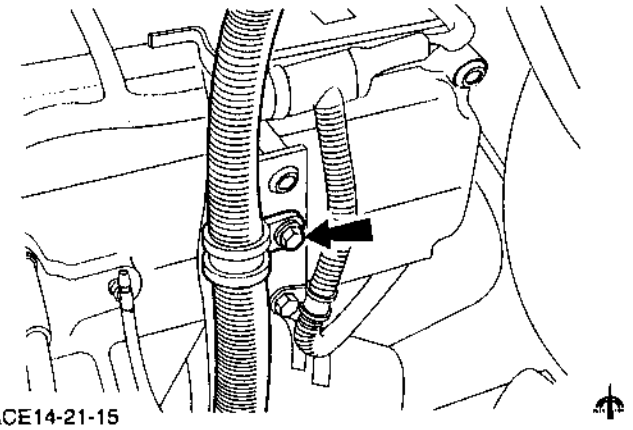


Fig.13. Retaining bolt of wiring loom.

20. Disconnect the multiplug of the distributor (DTR). Disconnect the multiplugs of the knock sensor (KS) and the engine speed/TDC sensor (EST), Fig.14.

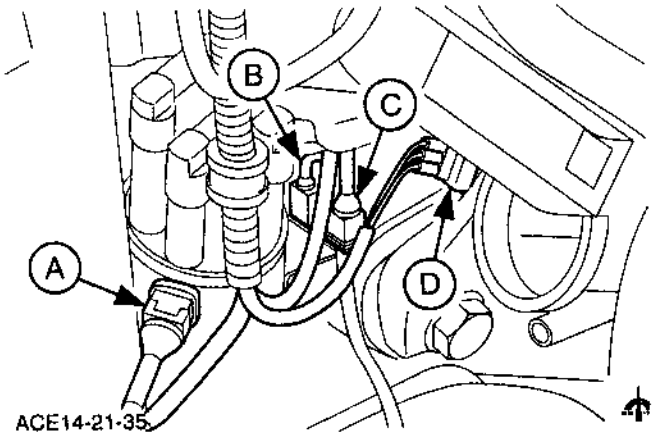


Fig.14. Multiplugs.
A - DTR C - EST
B - KS D - TPS

21. Disconnect the multiplug of the engine coolant temperature sensor (ECT), Fig.15.

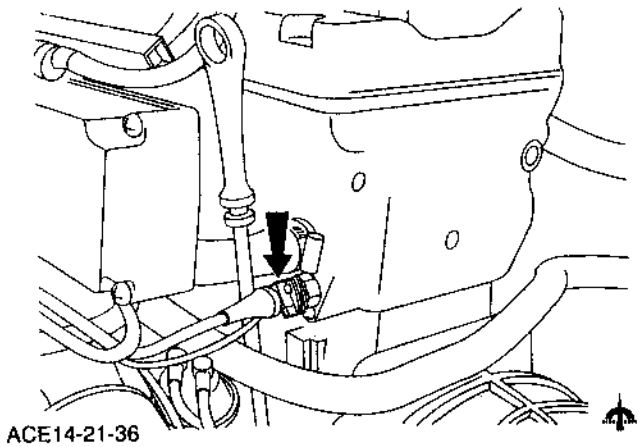


Fig.15. Multiplug of ECT.
(shown with engine removed)

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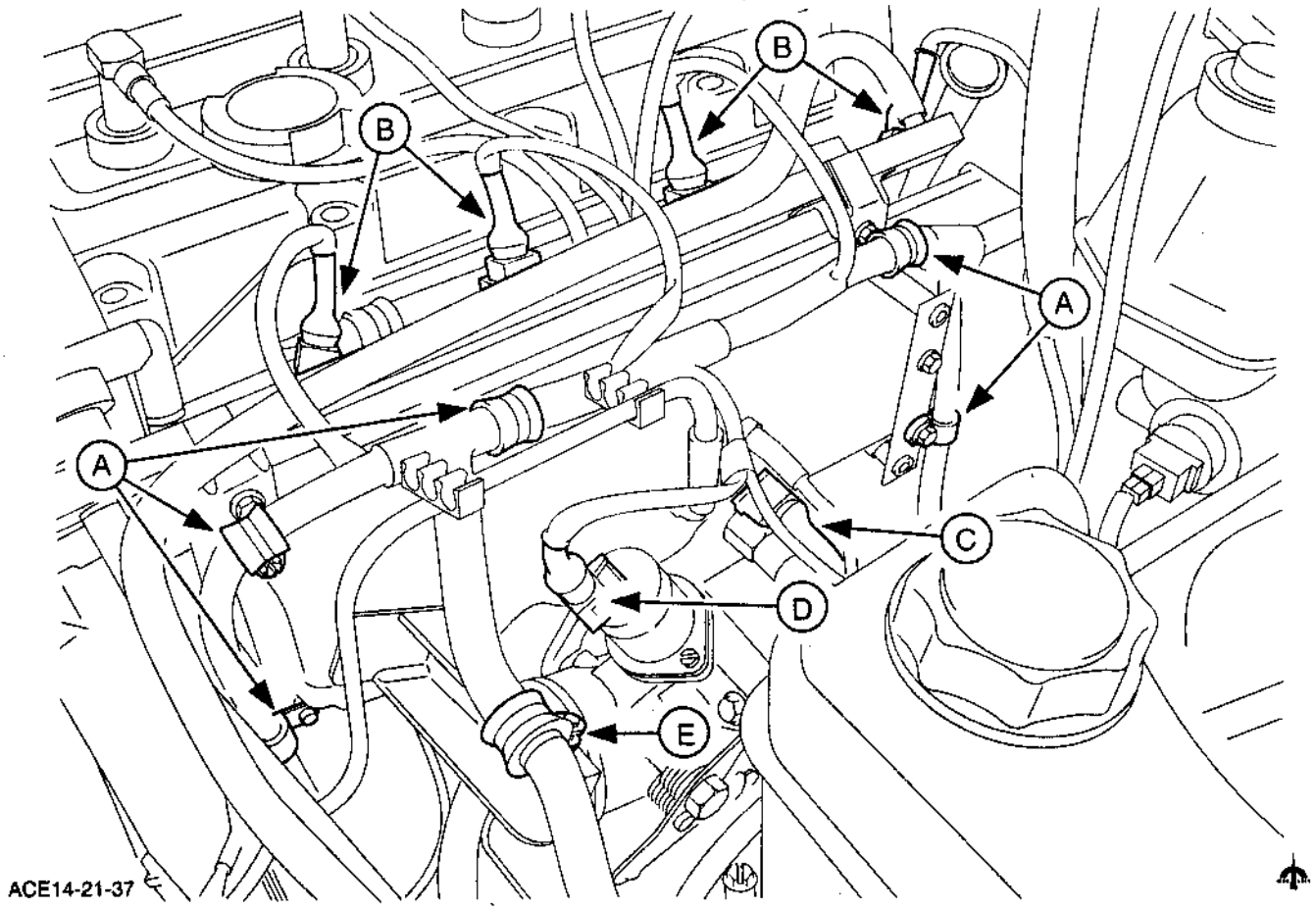


Fig.16. Multiplugs/wiring loom fixture.
A - Clips with screws
B - Multiplug - INJ
C - Multiplug - ACT
D - Multiplug - ISC
E - Clip with nut

22. Detach the wiring loom (5 clips with screws, 1 clip with a nut), Fig.16.(A,E).

23. Disconnect the multiplugs of the injectors (INJ), the air charge temperature sensor (ACT) and the idle speed control valve (ISC), Fig.16.(B,C,D).

24. Compress the lugs of the quick-release couplings on the fuel feed and return hoses and disconnect the hoses from the fuel pipes, Fig.17.

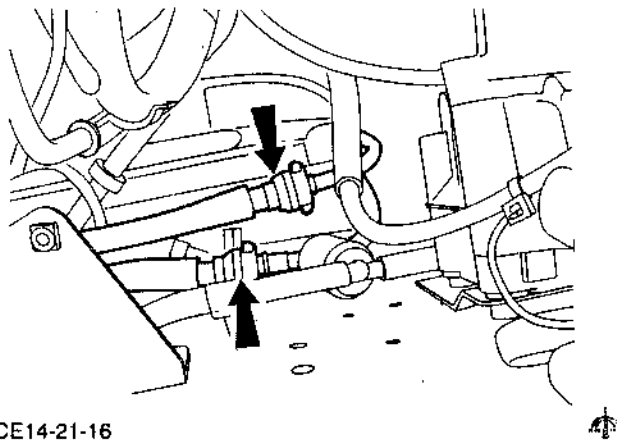


Fig.17. Quick-release couplings connecting fuel hoses to fuel pipes.
(RHD variant shown)

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25. Remove the oil dipstick and detach the bracket of the oil dipstick tube from the cylinder head (1 bolt), Fig.18.(A,C).

26. Disconnect the coolant hose to the oil cooler from the cylinder head, Fig.18.(B).

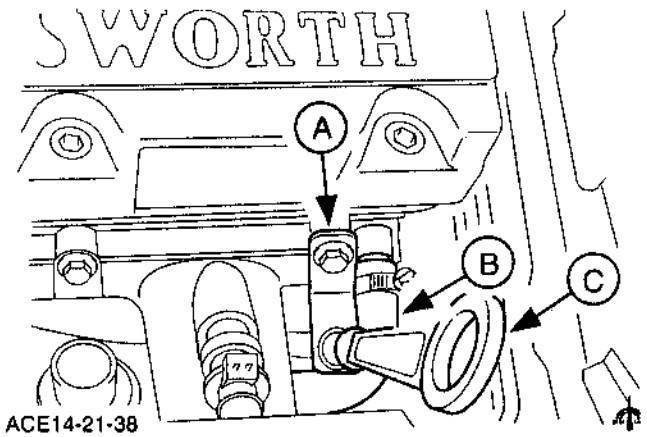


Fig.18. A - Bracket of oil dipstick tube
B - Coolant hose to oil cooler
C - Oil dipstick

27. Loosen the self-locking nut on the throttle housing vibration damper, Fig.19. Unscrew and remove the nut on the engine mounting bracket (on the left-hand side).

Fig.19. Throttle housing vibration damper.
A - Nut on engine mounting bracket
B - Self-locking nut with spring washers

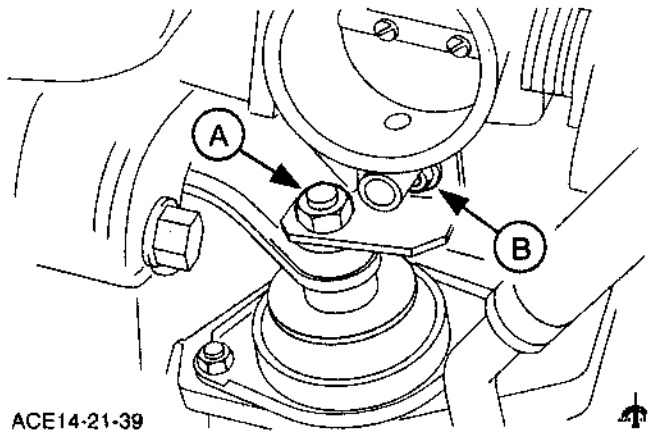


Fig.19. Throttle housing vibration damper.

28. Disconnect the vacuum pipes/hose from the air plenum chamber, Fig.20.

Fig.20. Vacuum pipes/hose.
A - To MAP sensor
B - To interior
C - To carbon canister

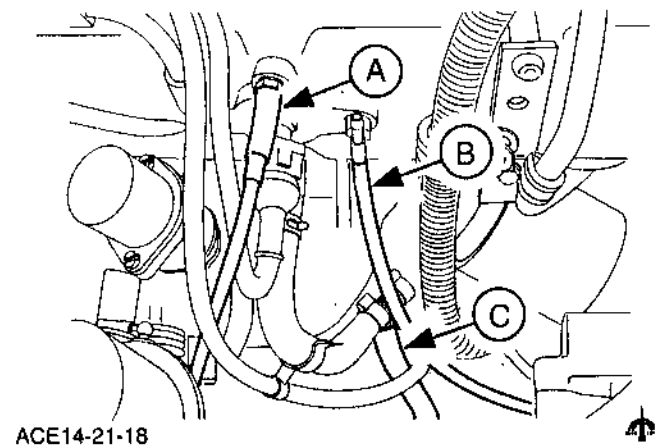


Fig.20. Vacuum pipes/hose.

29. Disconnect the front exhaust pipe from the turbocharger (3 nuts), Fig.21.

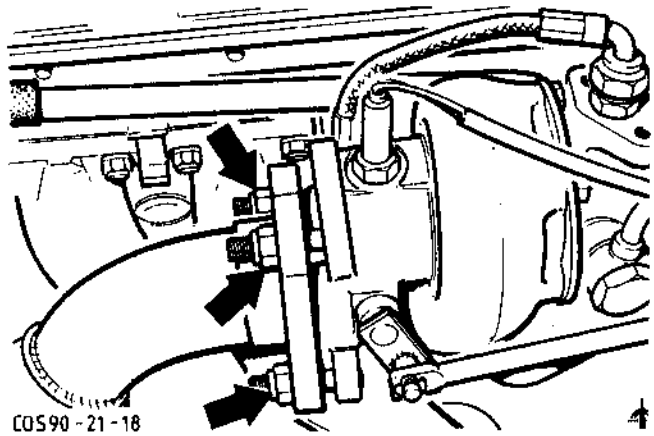


Fig.21. Retaining nuts of front exhaust pipe to turbocharger.

30. Detach the toothed belt cover from the cylinder head/cylinder block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.22.

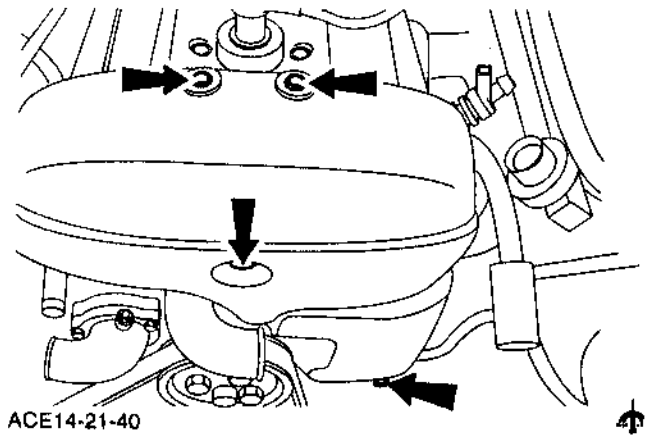


Fig.22. Retaining bolts of toothed belt cover.

31. Disconnect the high-tension leads from the spark plugs and remove the spark plugs. Disconnect the ignition coil lead from the distributor cap. Pull the high-tension leads and the rubber guide out of the high-tension lead bracket from below and remove the distributor cap with the rotor arm, Fig.23.

Fig.23. Distributor/leads.
A - Bracket for HT leads with rubber guide
B - Ignition coil lead
C - Distributor cap

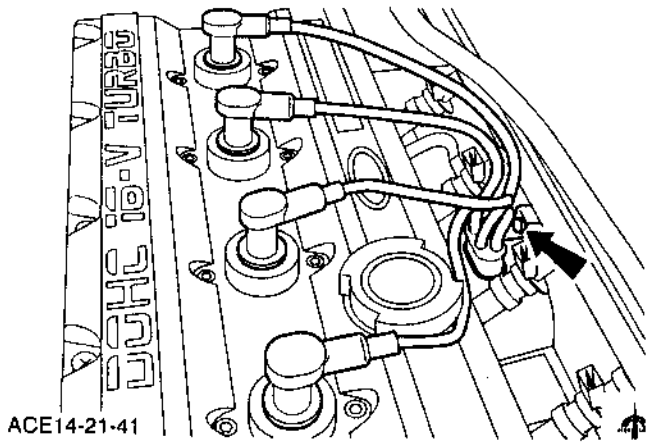


Fig.23. Distributor/leads.

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32. Using a proprietary socket wrench, turn the crankshaft in the normal direction of rotation until the 2 camshaft toothed belt pulleys are lined up on the TDC mark, Fig.24.

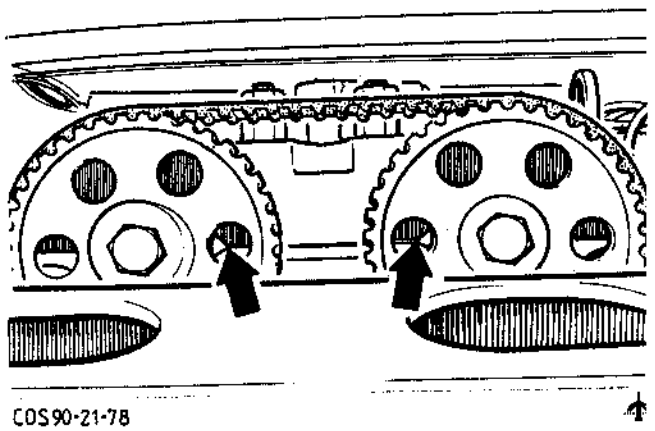


Fig.24. Camshaft toothed belt pulleys lined up on TDC mark.

33. Hold the eccentric and loosen the lock nut. Turn the eccentric and release the toothed belt, Fig.25.
Remove the toothed belt.

NOTE: Mark the direction in which the toothed belt goes round.

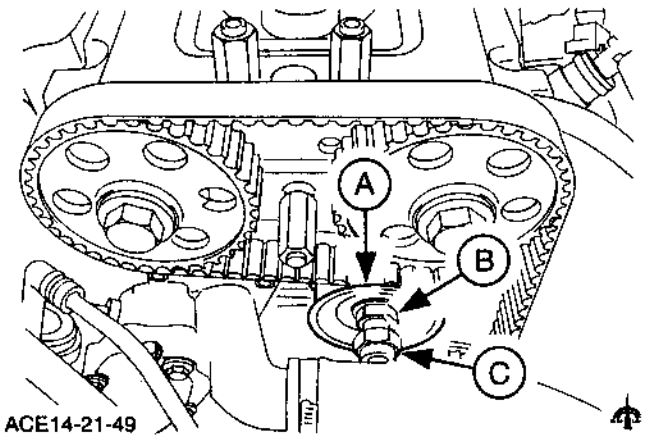


Fig.25. Toothed belt tensioning pulley.
A - Tensioning pulley C - Lock nut
B - Eccentric

34. Remove the cylinder head cover from the cylinder head (20 hexagon socket head bolts), Fig.26.

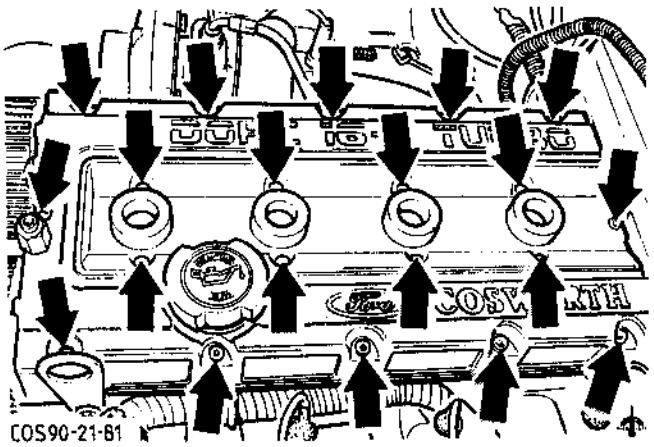


Fig.26. Retaining bolts of cylinder head cover.

35. Loosen the bolts of the engine lifting eyes, angle the engine lifting eyes towards the centre of the cylinder head and tighten the bolts again, Fig.28.(A).

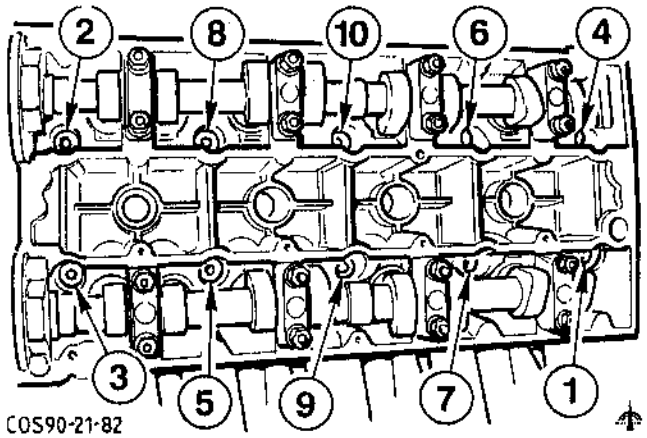


Fig.27. Cylinder head bolt loosening sequence.

36. Unscrew the 10 cylinder head bolts in the sequence indicated in the diagram using Special Tool 21-002 and remove them, Fig.27.

NOTE: The engine must have cooled down to below 45°C before the cylinder head bolts are undone.

37. Attach the hooks of the chain to the engine lifting eyes. Lift the cylinder head complete with the turbocharger and inlet manifold off the cylinder block using a hoist, Fig.28, disconnect the oil pipe from the turbocharger oil return hose, the thermostat housing connector from the coolant hose and the hose from the oil separator.

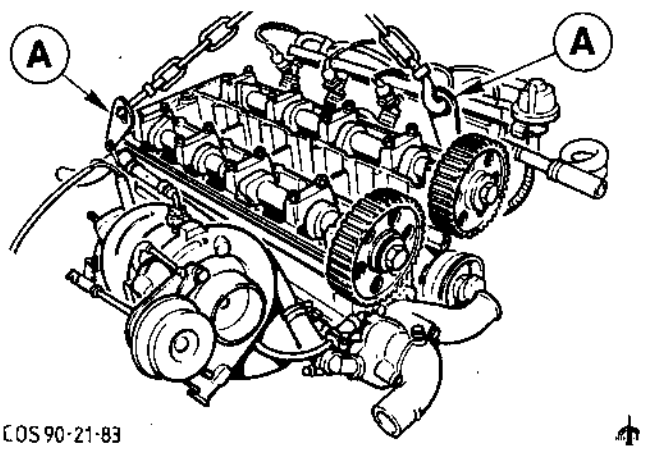


Fig.28. Cylinder head suspended and lifted clear. (Sierra shown)
A - Lifting eyes angled

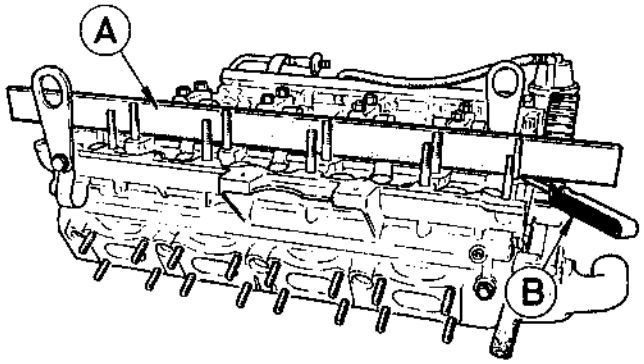
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Check the cylinder head is flat and free of distortion

Whenever a cylinder head is removed, the faces mating with the cylinder block and cylinder head cover must always be checked as follows to ensure they are flat:

38. Carefully clean the face mating with the cylinder head cover. Lay a steel straight edge lengthwise along the centre line and check for flatness or convex distortion with a feeler gauge, Fig.29.

NOTE: If the distortion is more than 0,1 mm, the cylinder head has been overheated and cannot be used again. If the distortion is 0,1 mm or less, check the face mating with the cylinder block.

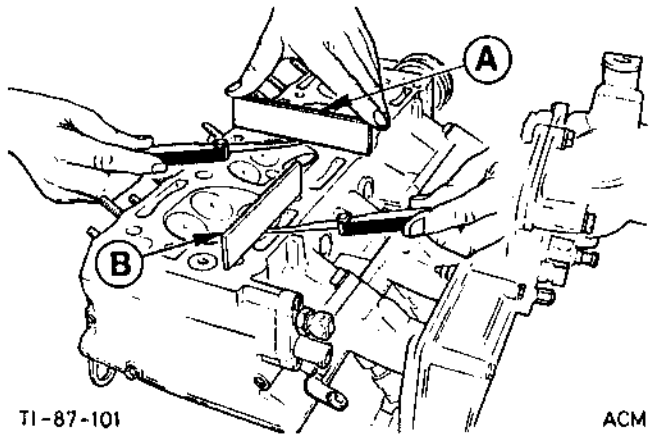


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Fig.29. Check face mating with cylinder head cover for flatness.
A - Steel straight edge
B - Feeler gauge

39. Carefully clean the mating face. Check for flatness in the transverse direction between the bolt holes (5 measurement points) using a 100 mm long steel straight edge, Fig.30.(A). Repeat the check in the longitudinal direction between the bolt holes (8 measuring points), Fig.30.(B).

NOTE: The maximum permissible tolerance is 0,02 mm.



TI-87-101 ACM

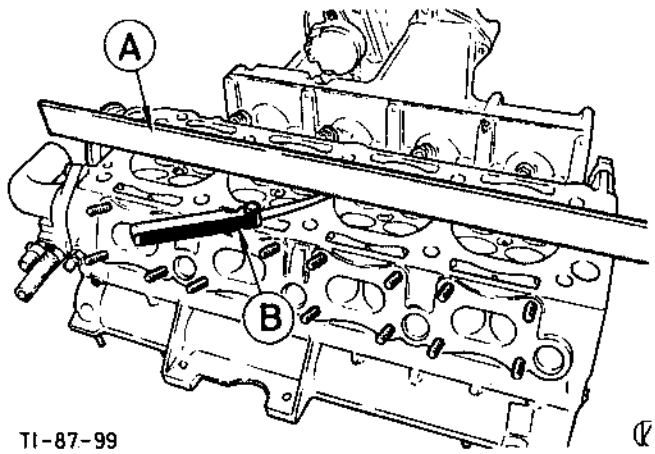
Fig.30. Check face mating with cylinder block for flatness.
A - Transversely
B - Longitudinally

40. Check for flatness or concave distortion along the centre line in the longitudinal direction, Fig.31.

NOTE: The maximum permissible tolerance is 0,08 mm.

If the maximum figures of 0,02 and 0,08 mm are exceeded, the mating face must be skimmed removing a maximum of 0,13 mm of material.

The minimum cylinder head height (distance between the 2 mating faces) must not be less than 138,68 mm.



TI-87-99

Fig.31. Measure distortion longitudinally.

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To Install

NOTE: When installing, tighten the nuts and bolts as specified in Technical Data. Make sure that the mating faces of the cylinder head/block and the new gasket are clean.

41. Screw the locating studs, Special Tools 21-128 into the threaded holes for the cylinder head bolts and fit the cylinder head gasket, Fig.32.(A,B).

42. Lift the cylinder head using a hoist and guide the corresponding holes in the cylinder head over the locating studs and lower the cylinder head onto the cylinder block.

NOTE: Guide the support bracket for the throttle housing vibration damper over the engine mounting bracket stud. Connect the turbocharger oil return hose to the oil pipe and secure it with a hose clip. Connect the thermostat housing to the coolant hose to the water pump and secure it with a hose clip. Connect the engine breather hose to the oil separator, Fig.32.(C,D,E,F).

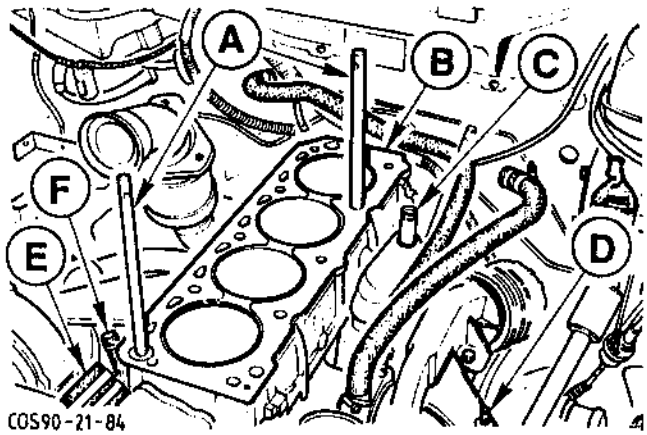


Fig.32. Cylinder head removed. (Sierra shown)
A - Special Tool 21-128
B - Cylinder head gasket
C - Oil separator connector
D - Engine mounting bracket stud
E - Coolant hose to water pump
F - Turbocharger oil return hose

43. Detach the hooks of the chain from the cylinder head lifting eyes and remove the hoist. Straighten the lifting eyes and tighten the bolts.

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44. Fit new cylinder head bolts and tighten finger tight. Remove the locating studs and replace them with the last 2 cylinder head bolts.

NOTE: Before inserting the cylinder head bolts, lubricate the U-shaped washers and the threads and undersides of the heads of the bolts with engine oil.

45. Tighten the cylinder head bolts in the specified sequence using Special Tool 21-002 (refer to Technical Data), Fig.33.

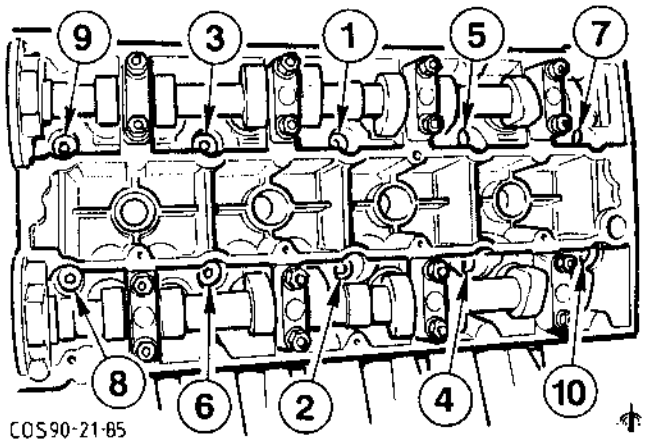


Fig.33. Cylinder head bolt tightening sequence.

46. Then tighten the cylinder head bolts a further 180° ± 10° in the same sequence using Special Tool 21-002 and a proprietary angle gauge and note the tightening torque obtained, Fig.34.

NOTE: A tightening torque of less than 115 Nm is not acceptable. Bolts with such a torque must be replaced. When all the bolts have been tightened, make sure than none of the bolts will turn any more applying a torque of 110 Nm.

Fig.34. Re-torque cylinder head bolts.
A - Torque wrench
B - Proprietary angle gauge
C - Special Tool 21-002

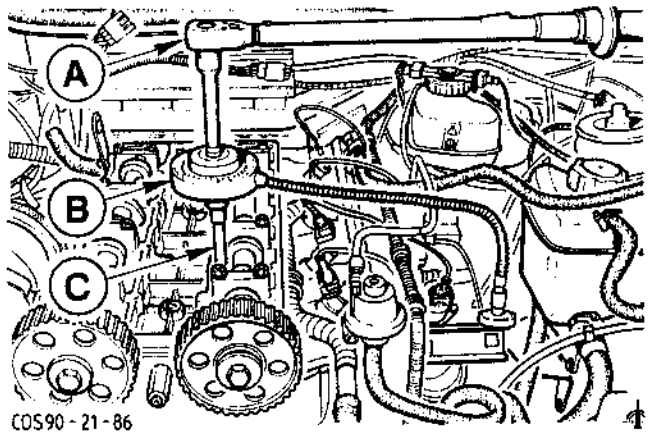


Fig.34. Re-torque cylinder head bolts.
(Sierra shown)

47. Check that the crankshaft vibration damper/belt pulley is in the TDC position, Fig.35.

Fig.35. Crankshaft vibration damper/belt pulley in TDC position.
A - Mark on cylinder block
B - Cam on belt pulley
C - Notch in belt pulley

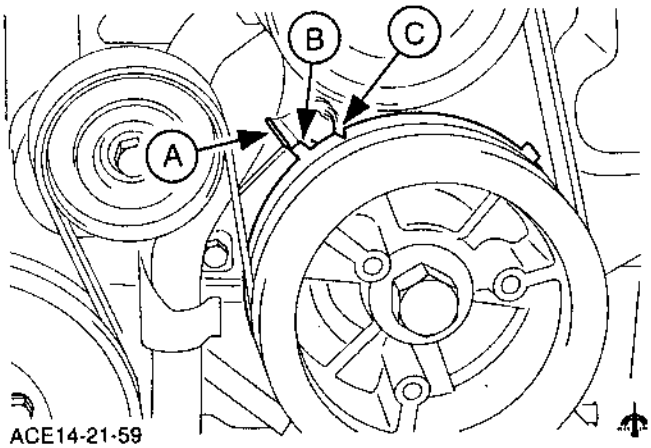


Fig.35. Crankshaft vibration damper/belt pulley in TDC position.
(shown with engine removed)

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48. Turn the 2 camshaft toothed belt pulleys to the TDC position, Fig.36.

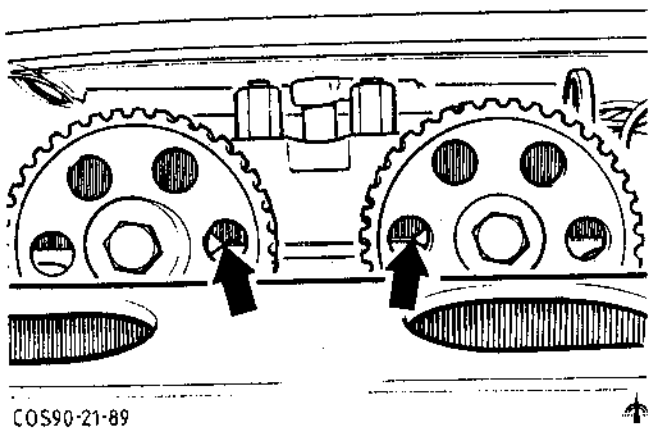

COS90-21-89

Fig.36. Camshaft toothed belt pulleys in TDC position.

49. Align the distributor on the TDC mark. The distributor rotor arm must line up with the mark, Fig.37.

50. Fit the toothed belt in an anti-clockwise direction, starting at the distributor shaft.

NOTE: Make sure the toothed belt goes round in the right direction.

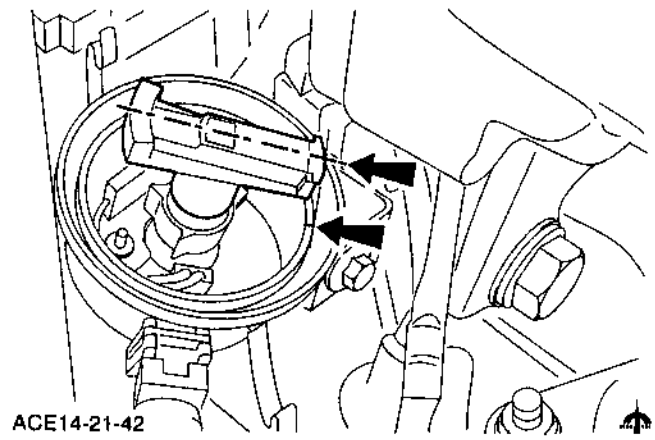

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Fig.37. Distributor in TDC position.

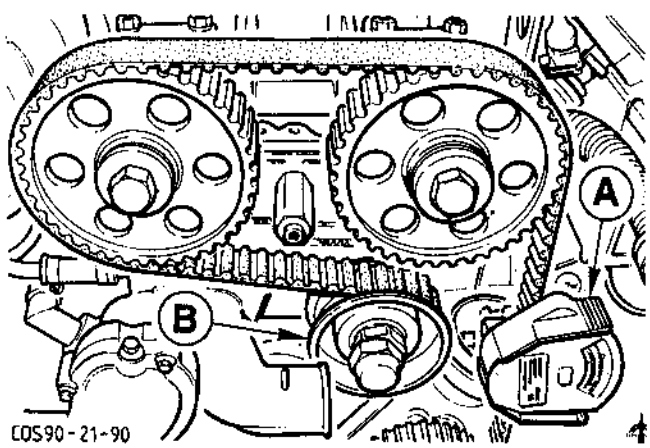
51. Adjust the toothed belt tension as follows:

- Turn the toothed belt tensioning pulley clockwise towards the toothed belt by hand and tighten the lock nut of the toothed belt tensioning pulley.
- Turn the engine several revolutions in the normal direction of rotation and then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

Check the toothed belt tension at the longest span of the toothed belt using Special Tool 21-113, Fig.38.
If necessary, adjust the toothed belt tensioning pulley until the specified tension (refer to Technical Data) is obtained.

Re-check the toothed belt tension and the TDC positions and if necessary repeat the tensioning procedure.



COS90-21-90

Fig.38. Tension toothed belt.
A - Special Tool 21-113
B - Toothed belt tensioning pulley

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52. Place the cylinder head cover gasket on the cylinder head and the 2 rubber gaskets on the front camshaft bearing caps.

53. Fit the cylinder head cover, insert the 20 hexagon socket head bolts and tighten them.

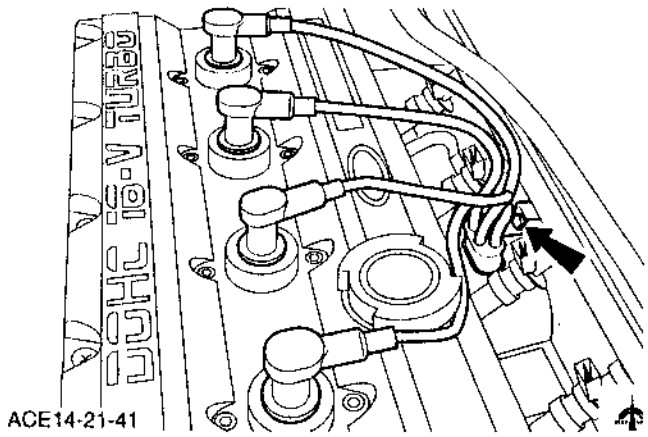


Fig.39. Distributor and leads.

54. Fit the high-tension leads and the rubber guide in the high-tension lead bracket.
Fit the distributor cap with the rotor arm.
Connect the ignition coil lead to the distributor cap, Fig.39.
Fit the spark plugs.
Connect the high-tension leads to the spark plugs.

Fig.39. Distributor/leads
A - Bracket for HT leads with and rubber guide
B - Ignition coil lead
C - Distributor cap

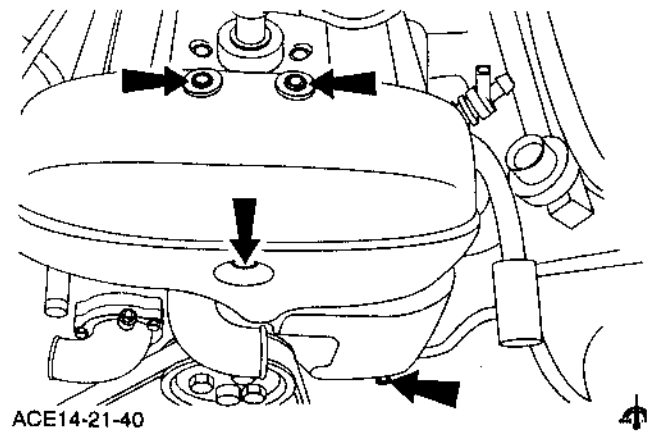


Fig.40. Retaining bolts of toothed belt cover.

55. Fit the toothed belt cover to the cylinder head and block, Fig.40.

56. Connect the front exhaust pipe to the turbocharger, Fig.41.

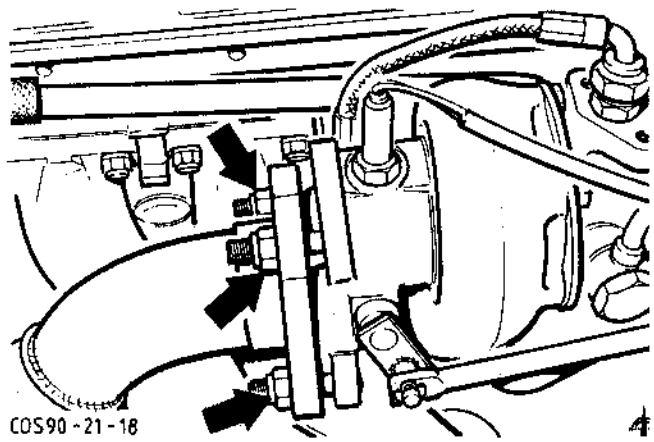


Fig.41. Retaining nuts of front exhaust pipe to turbocharger.

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57. Connect the vacuum pipes/hose to the air plenum chamber, Fig.42.

Fig.42. Vacuum pipes/hose.
A - To MAP sensor
B - To interior
C - To carbon canister

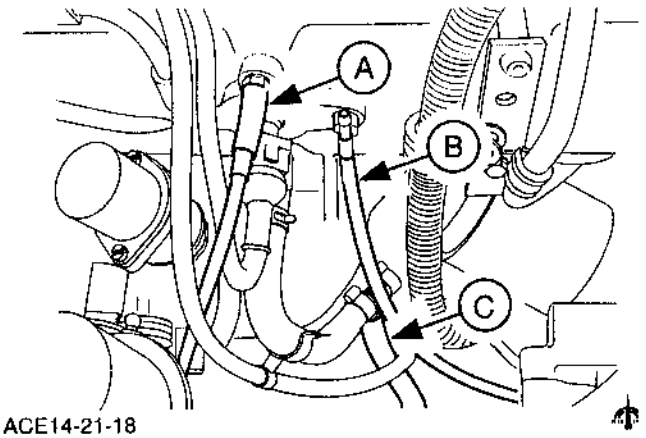


Fig.42. Vacuum pipes/hose.

58. Fit a new self-locking nut on the throttle housing vibration damper but do not tighten it.
Tighten the nut on the engine mounting bracket.
Tighten the self-locking nut to a torque of 8 to 10 Nm and then slacken it half a turn, Fig.43.(A,B).

NOTE: Make sure the spring washers are fitted correctly, Fig.43.(C).

Fig.43. Throttle housing vibration damper.
A - Nut on engine mounting bracket
B - Self-locking nut
C - Arrangement of spring washers

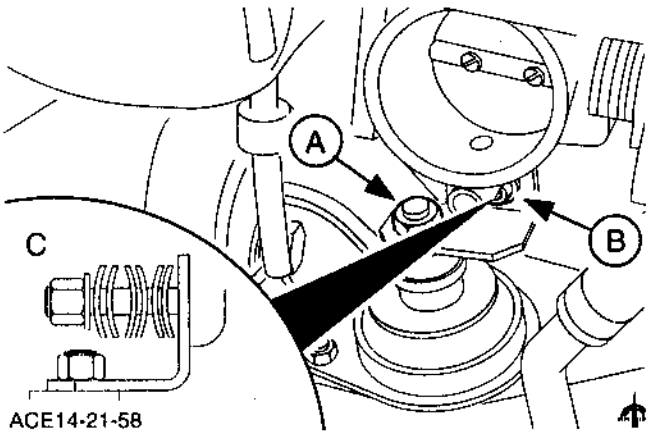


Fig.43. Throttle housing vibration damper.

59. Connect the coolant hose from the oil cooler to the cylinder head, Fig.44.(B).

60. Fit the bracket of the oil dipstick tube to the cylinder head and insert the oil dipstick, Fig.44.(A,C).

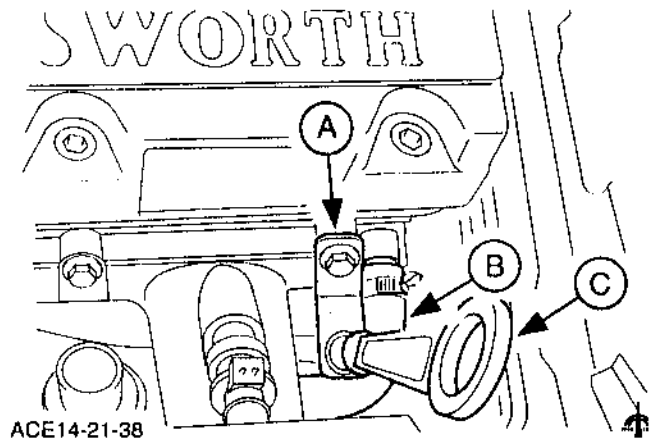


Fig.44. A - Bracket of oil dipstick tube
B - Coolant hose to oil cooler
C - Oil dipstick

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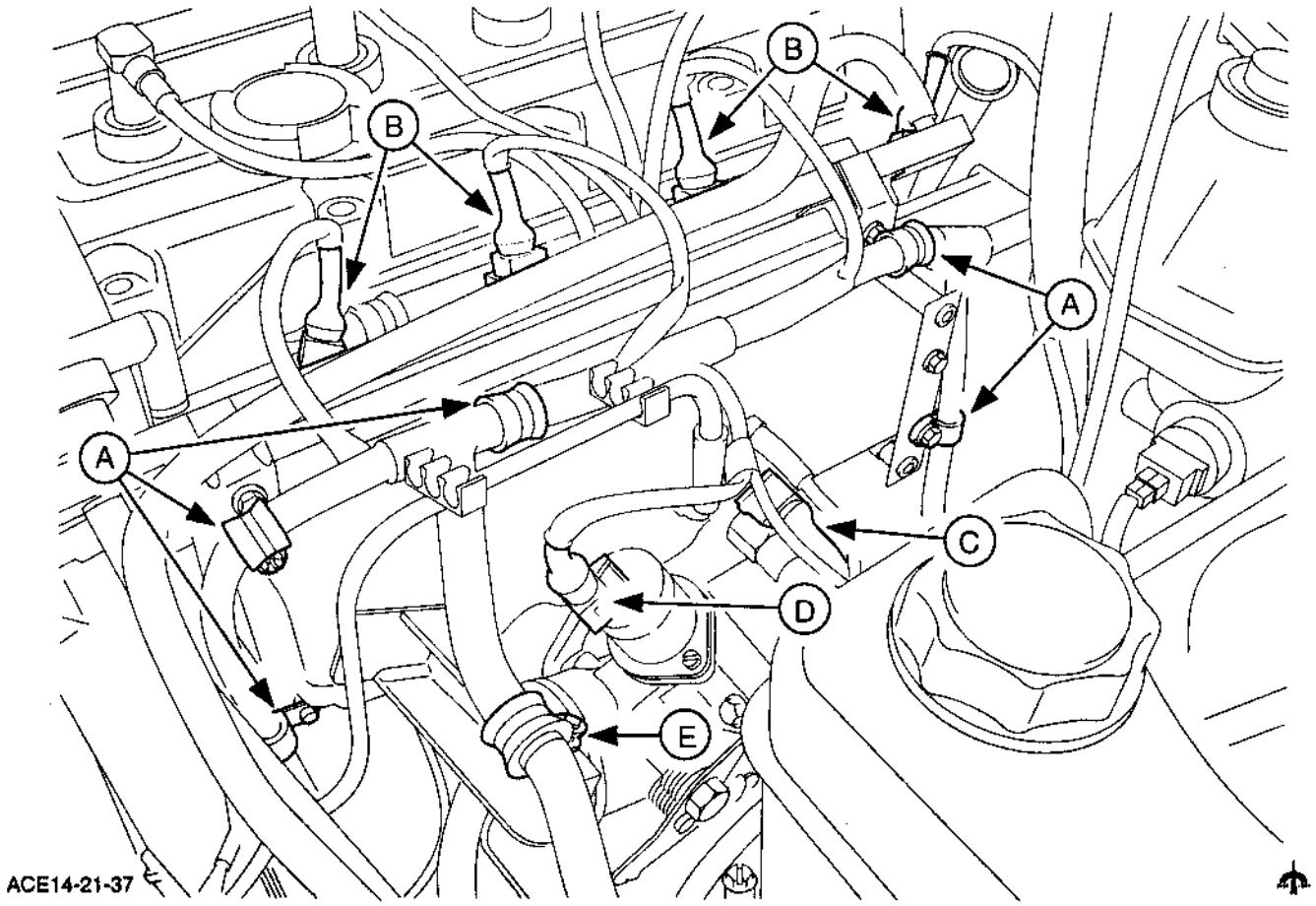


Fig.45. Multiplugs/wiring loom fixture.
A - Clips with screws
B - Multiplug - INJ
C - Multiplug - ACT
D - Multiplug - ISC
E - Clip with nut

61. Connect the multiplugs of the injectors (INJ), air charge temperature sensor (ACT) and idle speed control valve (ISC), Fig.45.(B,C,D).

62. Secure the wiring loom (5 clips with bolts, 1 clip with a nut), Fig.45.(A,E).

63. Connect the quick-release couplings of the fuel hoses/pipes, Fig.46.

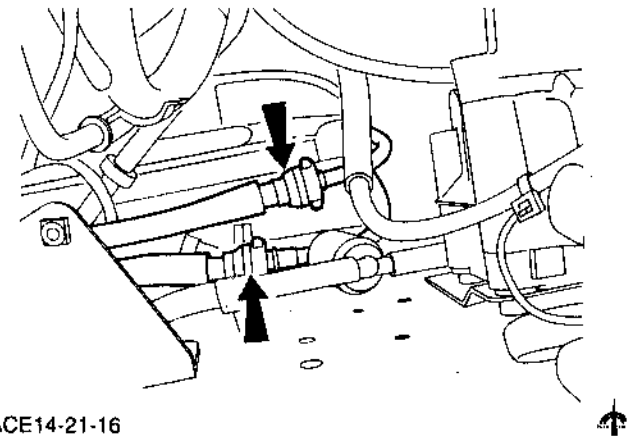


Fig.46. Quick-release couplings of fuel hoses/pipes.
(RHD variant shown)

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64. Connect the multiplug of the engine coolant temperature sensor (ECT), Fig.47.

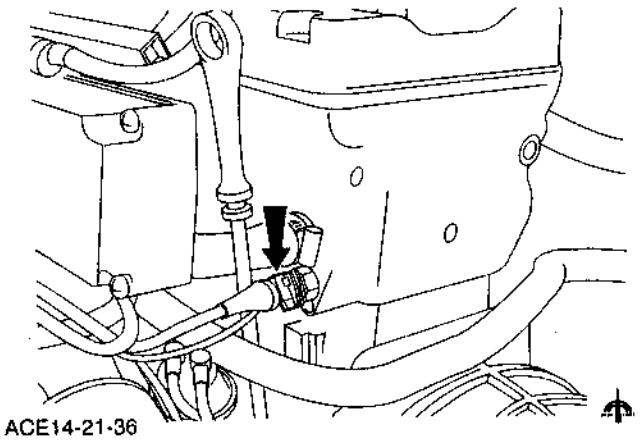


Fig.47. Multiplug of ECT.
(shown with engine removed)

65. Connect the distributor multiplug (DTR). Connect the multiplug of the knock sensor (KS) and the engine speed/TDC sensor (EST), Fig.48.

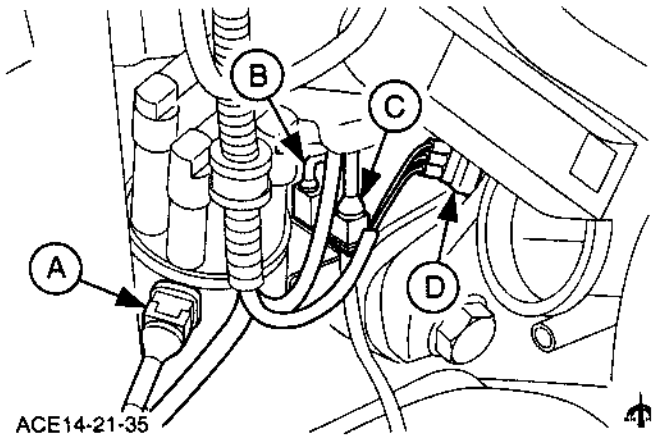


Fig.48. Multiplugs.
A - DTR
B - KS
C - EST
D - TPS

66. Secure the wiring loom to the air plenum chamber (1 bolt), Fig.49.

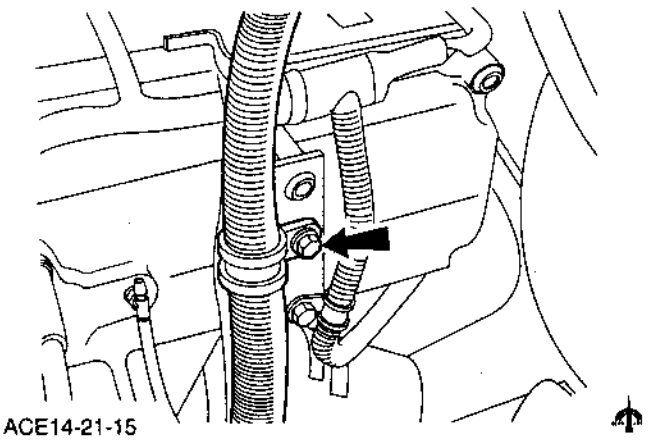


Fig.49. Wiring loom retaining bolt.

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67. Connect the air hose to the intercooler and to the throttle housing (2 clips), Fig.50.

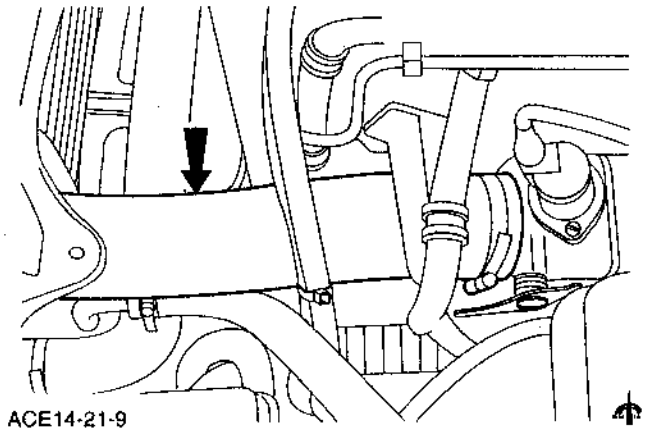


Fig.50. Air hose from intercooler to throttle housing.

68. Guide the throttle cable into the bracket, engage the lugs of the retainer, attach the cable to the throttle linkage and secure it with 2 clips, Fig.51.

Fig.51. Throttle cable.
A - Attached
B - Detached
C - Clip pulled out
D - Lug of retainer
E - Clip on throttle linkage

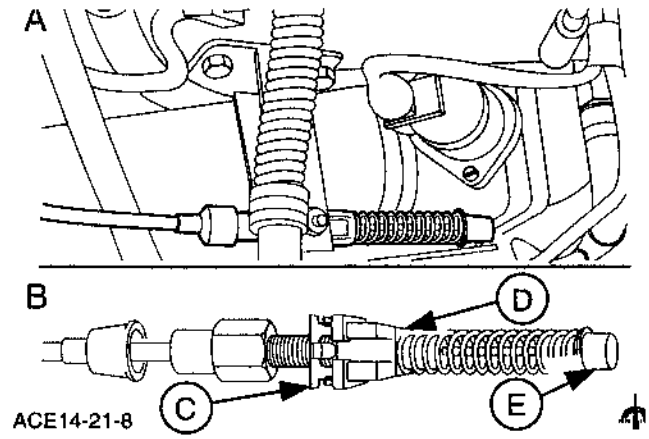


Fig.51. Throttle cable.

69. Connect the upper coolant hose to the heater radiator, Fig.52.

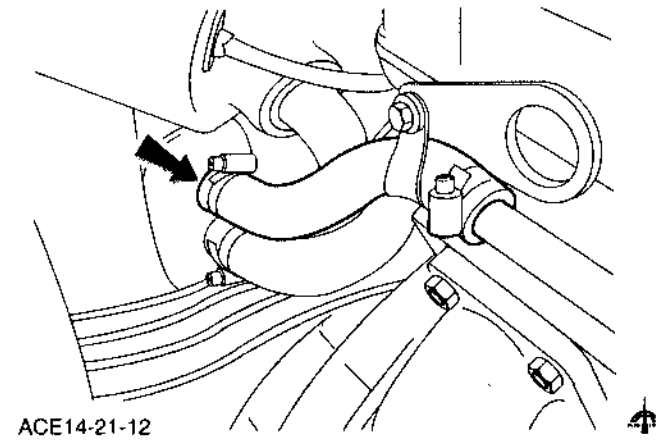
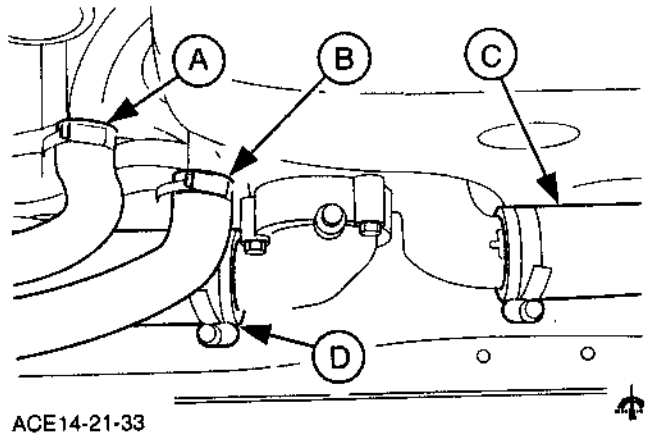


Fig.52. Upper coolant hose to heater radiator.

70. Connect the coolant hose running from the bottom of the radiator to the thermostat housing.

    Connect the coolant hoses to the heater pipe and to the thermostat housing, Fig.53.

    Fig.53. Coolant hoses.
    A - From intercooler to heater pipe
    B - From intercooler to thermostat housing
    C - From top of radiator to thermostat housing
    D - From bottom of radiator to thermostat housing



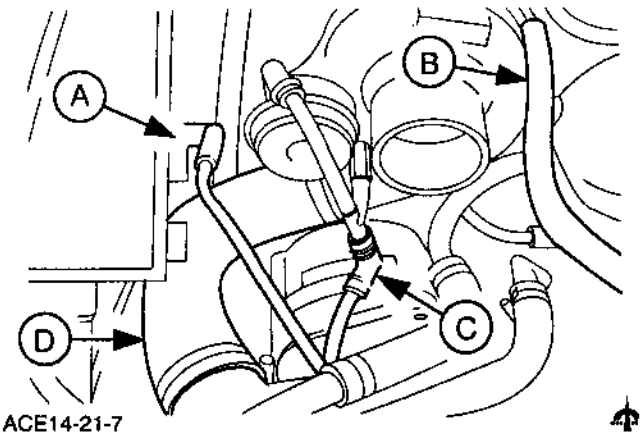
ACE14-21-33

Fig.53. Coolant hoses.

71. Connect the coolant hose to the connecting pipe/turbocharger, Fig.54.(B).

    Fig.54. Pipes/hoses.
    A - To air cleaner housing
    B - To turbocharger
    C - To turbocharger tee
    D - Turbocharger lower air hose

72. Connect the lower air hose to the turbocharger, Fig.54.(D).

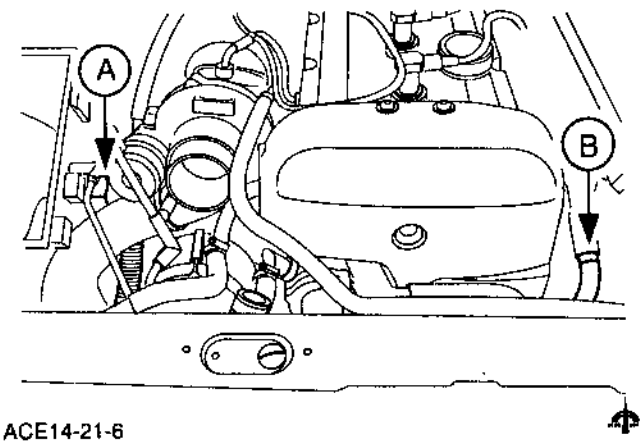


ACE14-21-7

Fig.54. Pipes/hoses.

73. Connect the air pipes to the air cleaner housing and to the turbocharger tee, Fig.54.(A,C).

74. Locate the engine breather pipe in position. Connect the pipe to the air cleaner housing and the connecting hose, Fig.55.



ACE14-21-6

Fig.55. Engine breather pipe.
A - To air cleaner housing
B - To connecting hose

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75. Fit the air cleaner element.
Fit the air cleaner cover and secure it.
Connect the air hoses to the turbocharger and to the by-pass valve.
Route the vacuum pipes and connect them to the tee on the air plenum chamber, Fig.56.

Fig.56. Air cleaner cover with air pipes/vacuum pipes.
A - To turbocharger
B - To air plenum chamber
C - To by-pass valve

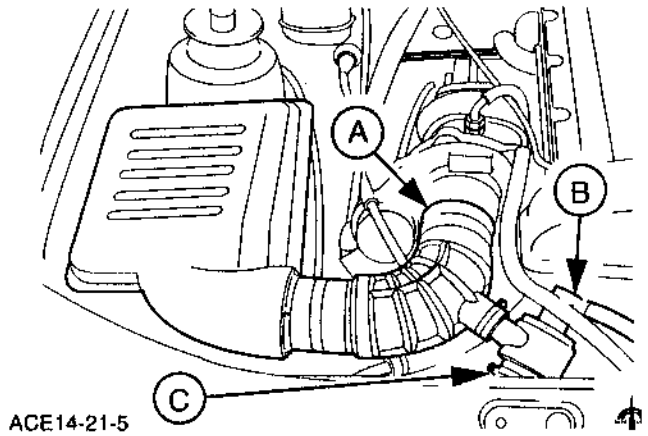


Fig.56. Air cleaner cover with air hoses/vacuum pipes.

76. Attach the turbocharger heat shield to the bracket on the air cleaner housing and the fender, Fig.57.

77. Connect the multiplug of the HEGO sensor and clip the wiring in place, Fig.58.

78. Connect the lower coolant hose to the radiator.

79. Connect the battery earth cable.

80. Fill the cooling system expansion tank up to the MAX mark (refer to Technical Data for coolant quantity and specification). Unscrew the bleed screw on the thermostat housing so that air can escape from the cooling system. Insert the bleed screw and tighten it.

NOTE: Pour in the coolant slowly so that air bubbles can escape.

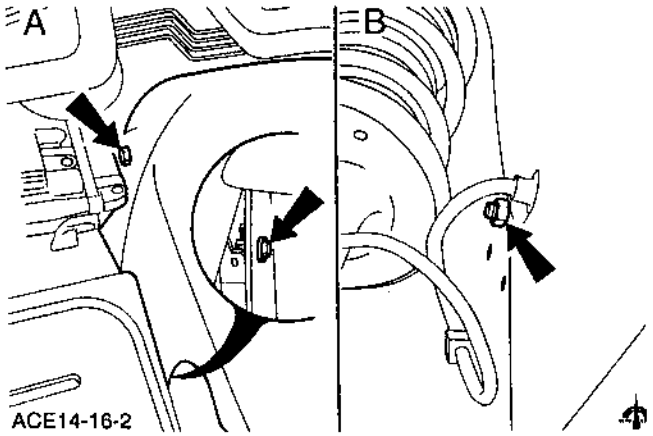


Fig.57. Fixture of turbocharger heat shield.
A - Bolts
B - Nut in wheelhouse

81. Check the engine oil level and top up as necessary (refer to Technical Data for quantity and specification).

82. Start the engine and run it up to normal operating temperature. Check all the coolant/oil hose connections for leaks and tighten as necessary. Top up with coolant or oil as necessary.

83. Check the engine tuning adjustments as specified at normal operating temperature and rectify as necessary.

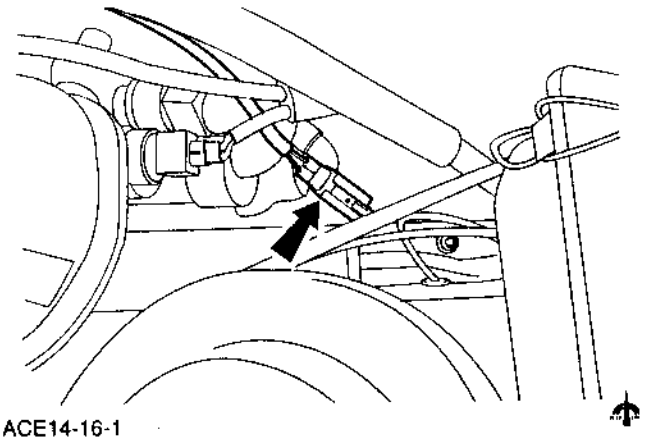


Fig.58. Multiplug of HEGO sensor.

84. Raise the vehicle. Fit the lower engine cover. Lower the vehicle to the ground.

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21 467 0 SEAL - CRANKSHAFT FRONT - REPLACE

SPECIAL SERVICE TOOLS REQUIRED:

Radial oil seal installer	21-009 B
Toothed belt pulley remover	21-028 A
Toothed belt tension test gauge ..	21-113
Radial oil seal remover	21-143
Belt pulley remover	21-153

To Remove

1. Disconnect the battery earth cable.

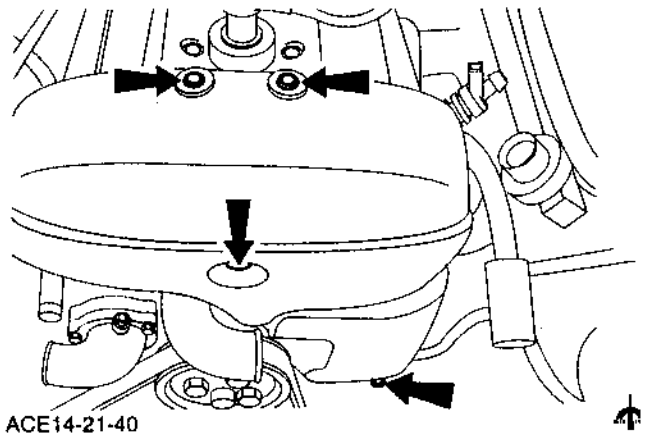


Fig.1. Retaining bolts of toothed belt cover.

2. Detach the toothed belt cover from the cylinder head/block (3 Torx socket head bolts with washers, 1 hexagon bolt with a spacer sleeve), Fig.1.

3. Raise the vehicle.
   Detach the lower engine cover.

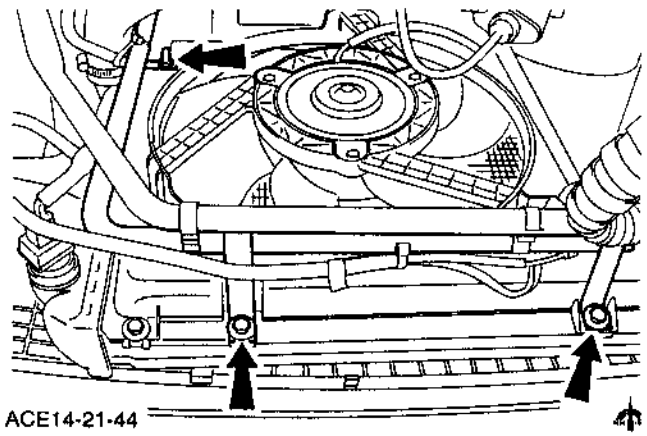


Fig.2. Fixture of coolant pipe brackets.

4. Detach the 3 coolant pipe brackets from the radiator (2 bolts, 1 nut), Fig.2.

5. Disconnect the 2 engine cooling fan multiplugs, Fig.3.

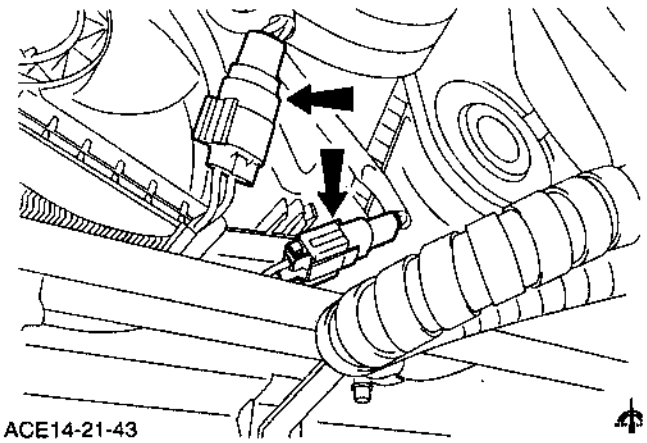


Fig.3. Multiplugs of engine cooling fan.

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6. Detach the radiator shroud with the fan motors from the radiator (4 bolts), Fig.4.

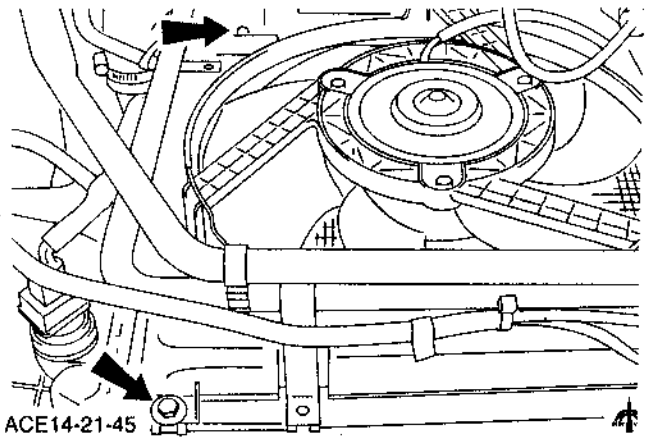


Fig.4. Fixture of radiator shroud.

7. Detach the radiator (2 bolts, 2 nuts), pull it forwards and tie it securely, Fig.5.

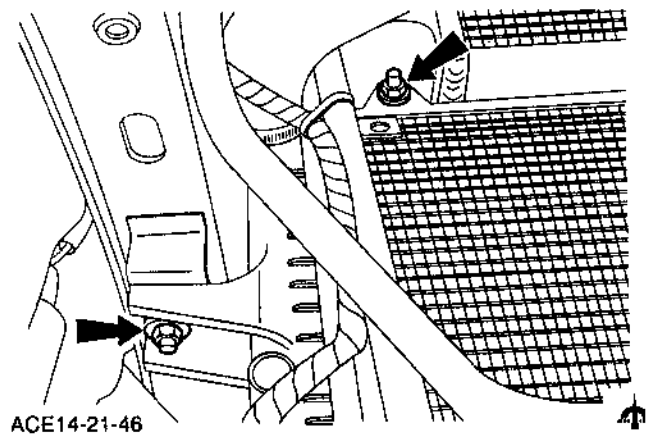


Fig.5. Fixture of radiator.

8. Release the retaining bolt of the crankshaft vibration damper/belt pulley.

NOTE: Screw in two M8 bolts and hold the pulley using a lever, Fig.6.

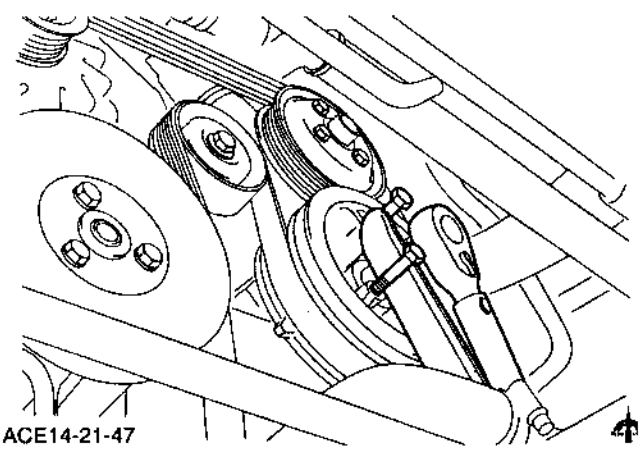


Fig.6. Release retaining bolt of crankshaft vibration damper/belt pulley.

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9. Back off the tensioner of the poly-V belt and remove the poly-V belt, Fig.7.

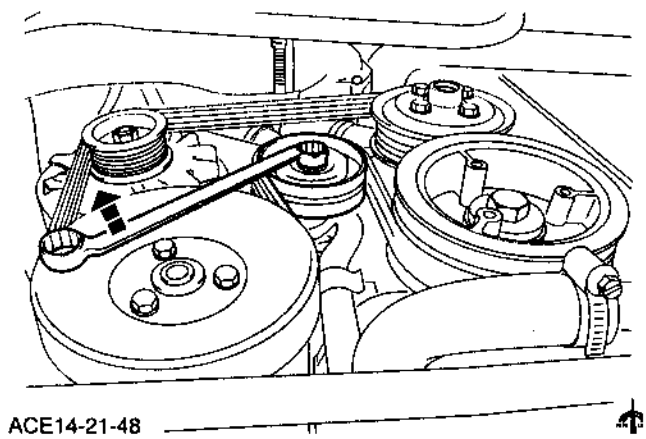


Fig.7. Back off tensioner of poly-V belt.

10. Lower the vehicle to the ground.

11. Using a proprietary socket wrench, turn the crankshaft in the normal direction of rotation until the 2 camshaft toothed belt pulleys line up on the TDC mark, Fig.8.

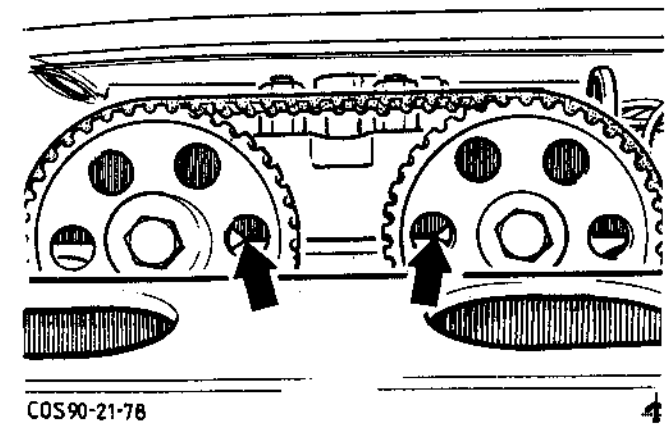


Fig.8. Camshaft toothed belt pulleys at TDC.

12. Hold the eccentric and release the lock-nut. Turn the eccentric and slacken the toothed belt, Fig.24. Remove the toothed belt.

NOTE: Mark the direction in which the toothed belt goes round.

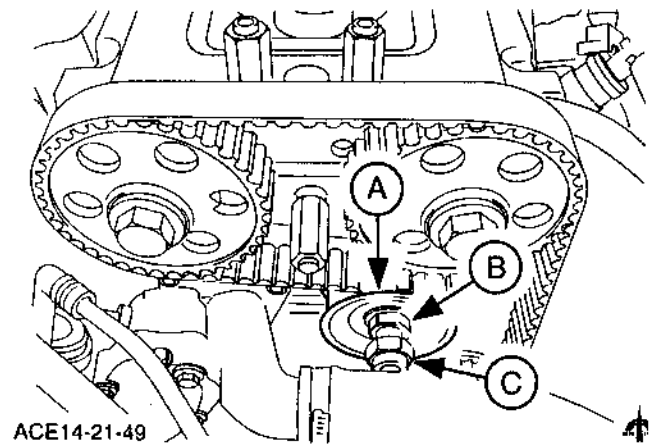


Fig.9. Toothed belt tensioning pulley.
A - Tensioning pulley
B - Eccentric
C - Lock nut

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13. Raise the vehicle.

14. Attach Special Tool 21-153 using three M8 bolts and pull off the crankshaft vibration damper/belt pulley, Fig.10.

NOTE: Towards the end of the removal operation, change the reversible ratchet handle for a ring spanner as otherwise the reversible ratchet handle will be impossible to remove.

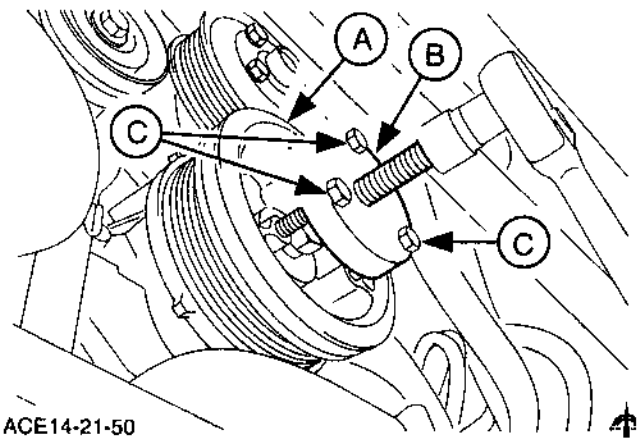


Fig.10. Pull off crankshaft vibration damper/belt pulley.

Fig.10. Crankshaft vibration damper/belt pulley.
A - Crankshaft vibration damper/belt pulley
B - Special Tool 21-153
C - M8 bolts

15. Remove the thrust washer and the toothed belt, Fig.11.

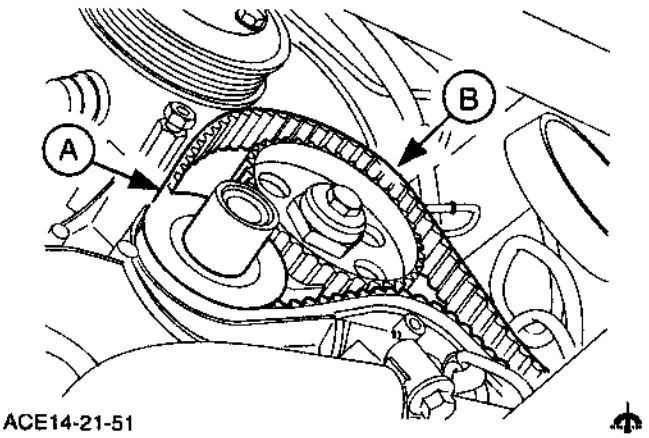


Fig.11. A - Thrust washer
B - Toothed belt

16. Pull off the crankshaft toothed belt pulley using Special Tool 21-028 A, Fig.12.

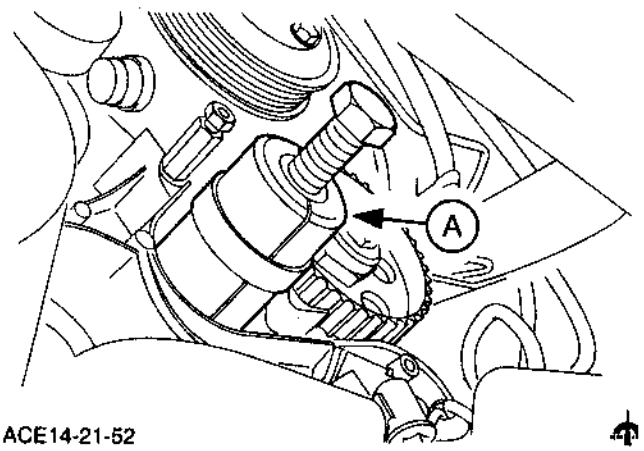


Fig.12. Pull off crankshaft toothed belt pulley.
A - Special Tool 21-028 A

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17. Extract the crankshaft radial oil seal using Special Tool 21-143, Fig.13.

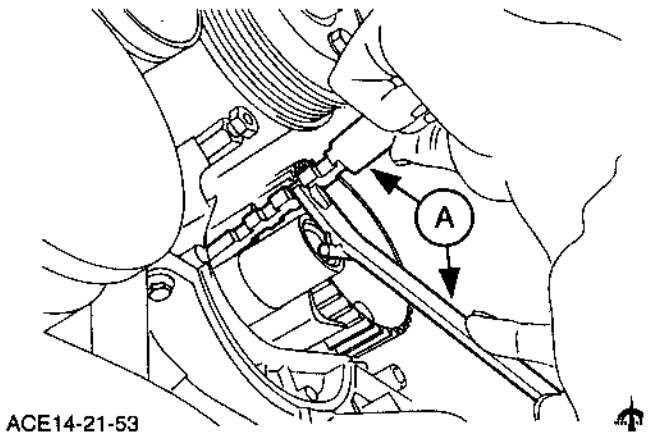


Fig.13. Remove crankshaft radial oil seal.
A - Special Tool 21-143

To Install

18. Fit the crankshaft radial oil seal, Fig.14.

Fig.14. Fit crankshaft radial oil seal.
A - Special Tool 21-009 B
B - Crankshaft toothed belt pulley
C - Bolt and washer of crankshaft toothed belt pulley

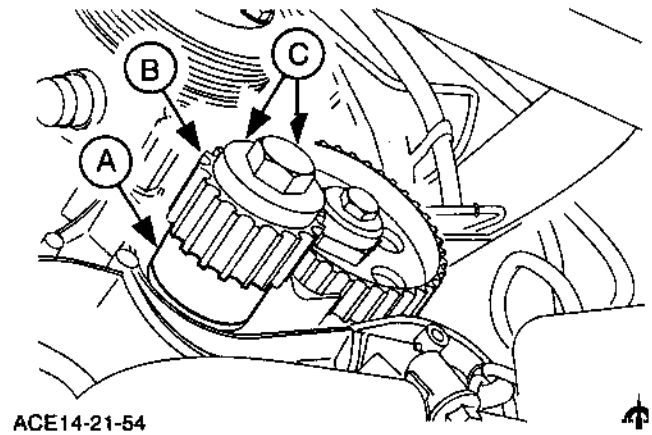


Fig.14. Fit crankshaft radial oil seal.

19. Fit the crankshaft toothed belt pulley with the chamfered side facing the engine.

20. Lay the toothed belt over the crankshaft toothed belt pulley and fit the thrust washer with the curved side facing the engine.

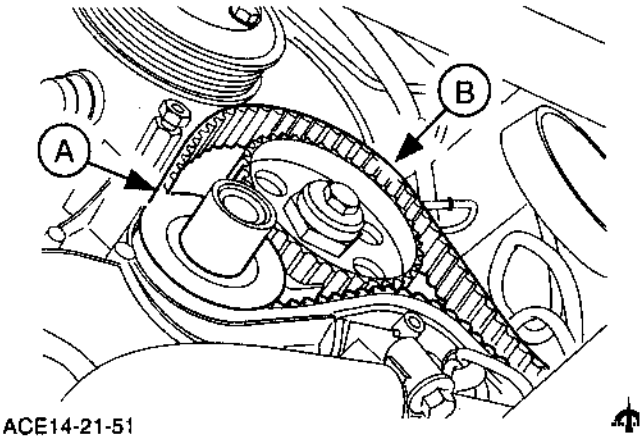


Fig.15. A - Thrust washer
B - Toothed belt

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21. Fit the crankshaft vibration damper/belt pulley loosely and check the crankshaft TDC mark, Fig.16. Rectify if necessary.

Fig.16. Crankshaft vibration damper/belt pulley in TDC position.
(shown with engine removed)
A - Mark on cylinder block
B - Cam on belt pulley
C - Notch in belt pulley

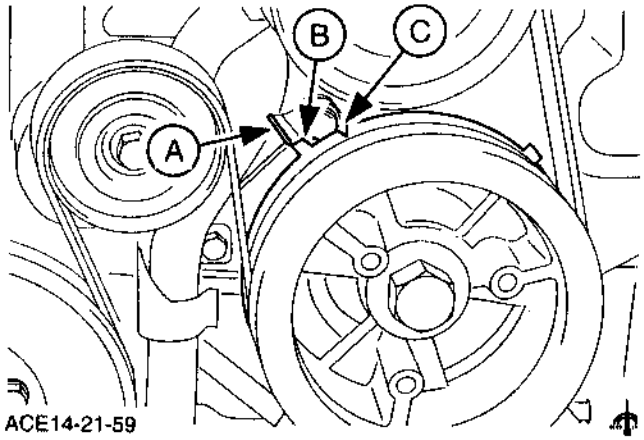


Fig.16. Crankshaft vibration damper/belt pulley in TDC position.
(shown with engine removed)

22. Lower the vehicle to the ground. Check the TDC positions of the camshaft toothed belt pulleys and rectify as necessary, Fig.17.

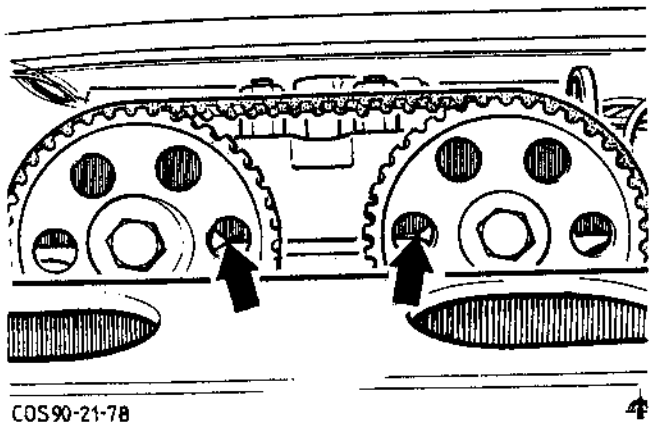


Fig.17. Camshaft toothed belt pulleys in TDC position.

23. Align the distributor on the TDC mark. The distributor rotor arm must line up on the mark, Fig.18.

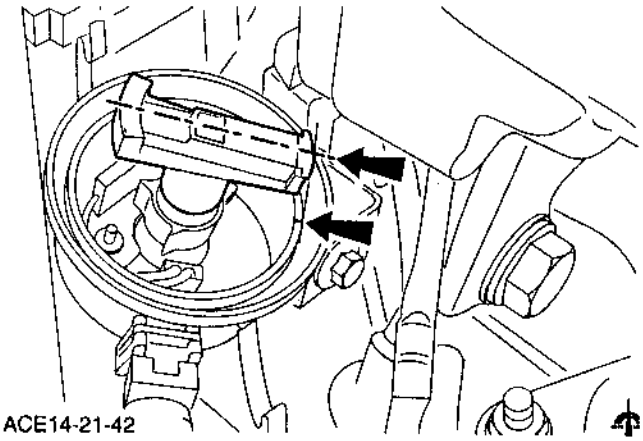


Fig.18. TDC position of distributor.

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24. Fit the toothed belt and tension it:
Fit the toothed belt and turn the tensioning pulley clockwise towards the toothed belt by hand and tighten the tensioning pulley retaining nut, Fig.19.

NOTE: If the original toothed belt is still being used, note the direction in which it goes round.

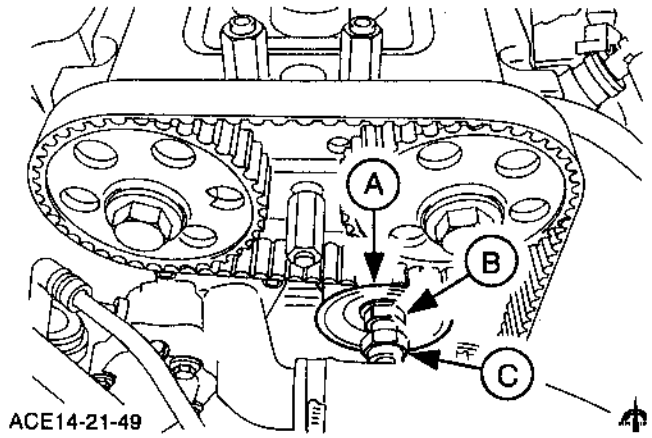


Fig.19. Toothed belt tensioning pulley.
A - Tensioning pulley
B - Eccentric
C - Lock nut

- Raise the vehicle.

- Turn the engine 2 revolutions in the normal direction of rotation and then turn it back 1 complete revolution to the TDC position.

NOTE: Do not turn it beyond the TDC position.

- Check the toothed belt tension at the longest span using Special Tool 21-113, Fig.20. Adjust to specification (refer to Technical Data) by turning the tensioning pulley. Tighten the tensioning pulley retaining nut.

- Re-check the toothed belt tension and the TDC positions and if necessary repeat the tensioning procedure.

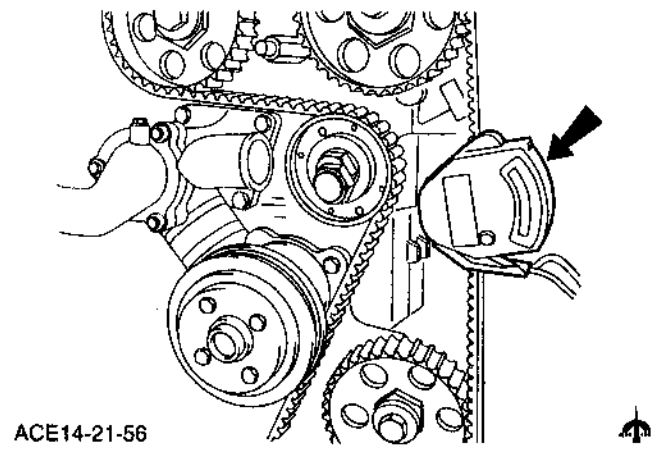


Fig.20. Check toothed belt tension using Special Tool 21-113.

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25. Back off the belt tensioner and fit the poly-V belt.
The poly-V belt is tensioned automatically when the belt tensioner is released, Fig.21.

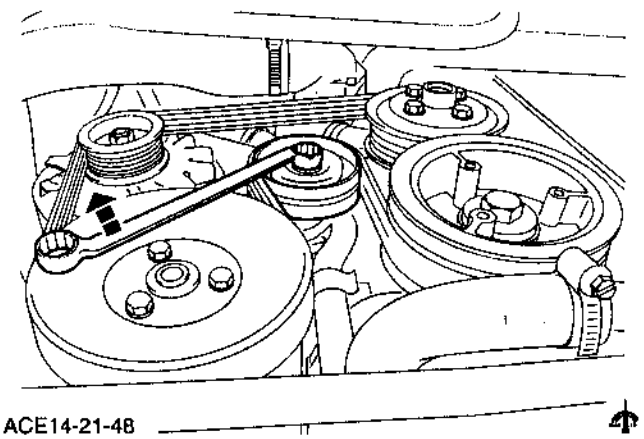


Fig.21. Back off tensioner of poly-V belt.

26. Tighten the retaining bolt of the crankshaft vibration damper/belt pulley.

NOTE: Screw in two M8 bolts and hold the pulley using a lever, Fig.22.

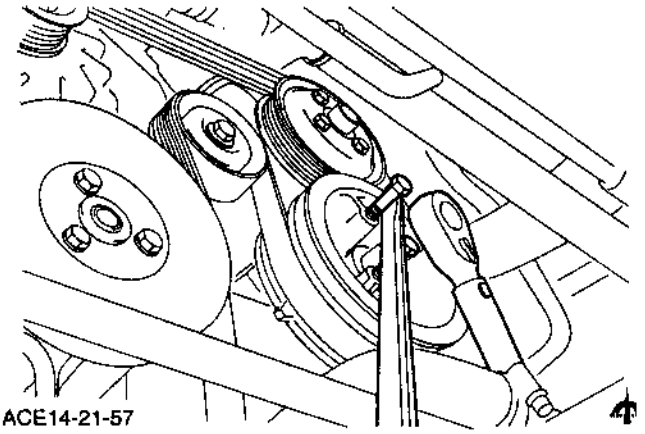


Fig.22. Tighten retaining bolt of crankshaft vibration damper/belt pulley.

27. Secure the radiator, Fig.23.

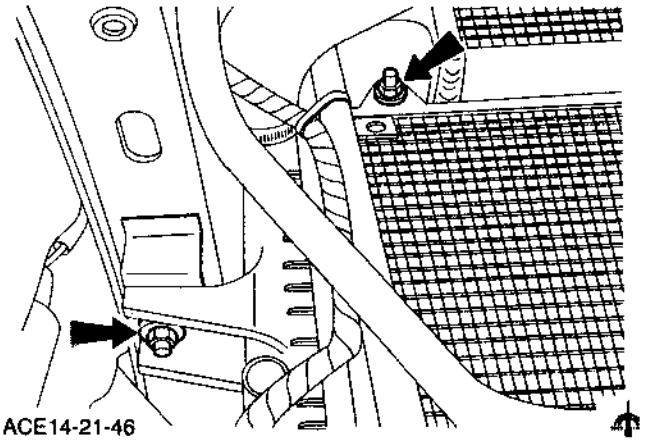


Fig.23. Fixture of radiator.

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28. Fit the radiator shroud with the fan motors, Fig.24.

29. Connect the 2 engine cooling fan multiplugs, Fig.25.

30. Secure the 3 coolant pipe brackets to the radiator, Fig.26.

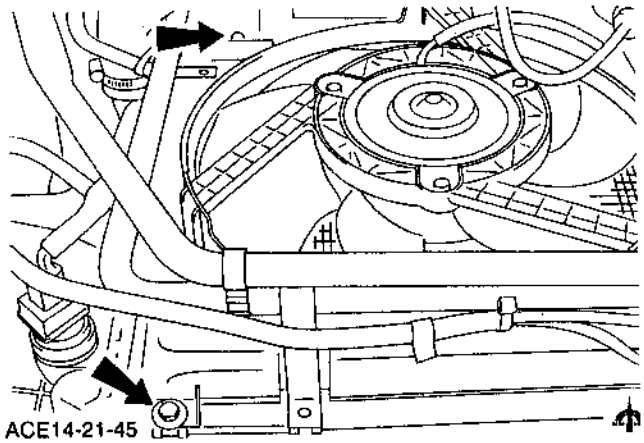


Fig.24. Fixture of radiator shroud.

31. Lower the vehicle to the ground.

32. Fit the toothed belt cover.

33. Connect the battery earth cable.

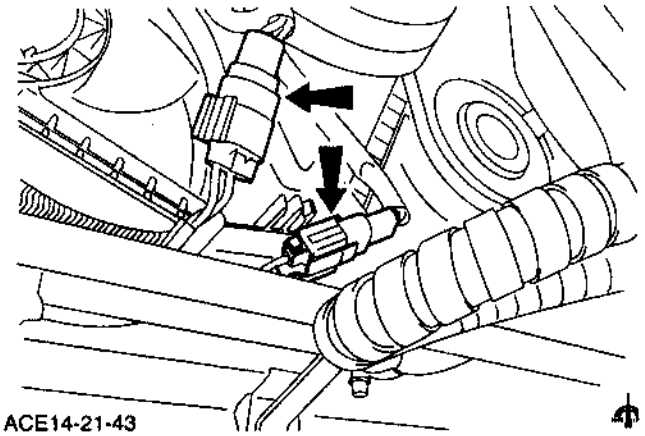


Fig.25. Multiplugs of engine cooling fan.

34. Check the engine oil level and top up as necessary (refer to Technical Data for quantity and specification).

35. Check the engine tuning settings as specified at normal operating temperature and rectify as necessary.

36. Raise the vehicle. Fit the lower engine cover. Lower the vehicle to the ground.

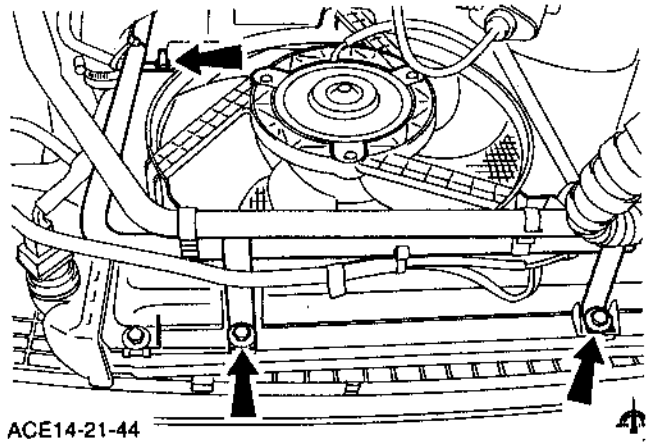


Fig.26. Fixture of coolant pipe brackets.

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Ignition System 22

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22 292 0	Ignition Amplifier Module - Remove and Install	-		5
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22 619 0	Speed Sensor - Engine - Remove and Install	-		6
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TECHNICAL DATA

Coil

Manufacturer	Motorcraft
Type	High output breakerless ignition coil
Output	25,0 kilovolts (minimum) - open circuit condition
Primary resistance	0,72 to 0,88 ohms
Secondary resistance	4500 to 7000 ohms

Spark Plugs

Type	AGPR901C
Electrode gap - all territories	0,75 mm (0,030 in)
Firing order	1-3-4-2

Distributor

Manufacturer	Marelli
Type	Breakerless
Automatic Advance	Totally controlled by Engine Management Module
Drive	Skew gear from auxiliary shaft
Dwell angle	It is totally controlled by the electronic module and cannot be adjusted
Idle advance initial	16° BTDC

HT Leads

Resistance	30,000 ohms maximum per lead
Heat sink compound	81SF-12103-AA

Tightening Torques

	Nm	
TDC sensor bracket to sump	8 to 10	
TDC sensor to bracket	4 to 6	Loctite 270
Distributor clamp to cylinder block	18,5 to 21,5	

Clearance Settings

TDC sensor to pulley teeth	0,6 to 1,0 mm
Distributor cam to phase sensor	0,2 to 0,3 mm

22 214 0 DISTRIBUTOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable. Remove air hose from intercooler to throttle body.
2. Unclip distributor cap and position clear of distributor. Remove rotor arm and dust cover. Refit rotor arm.
3. Using a spanner on the crankshaft pulley bolt, rotate the engine clockwise until No.1 cylinder is at T.D.C. No.1. cylinder is at T.D.C. when the lug nearest the groove on the pully is inline with pointer and the rotor is pointing to the distributor body scribe mark.

   NOTE: If rotor is 180° degrees out, continue rotating engine until both marks align.

4. Disconnect distributor multiplug. Remove distributor retaining bolt and plate, and remove distributor from engine.

To Install

   Note: If refitting the old distributor, go to Sub-Operation No.6.

5. Remove cap, rotor and dust cover from new distributor and refit rotor. Transfer HT leads from old distributor cap to the new.
6. Check that 'O' ring on distributor body is in good condition, fit a new 'O' ring if necessary.
7. Turn distributor shaft until the rotor is aligned with the cap retaining clip, as shown in Fig.2.
8. Insert distributor into engine. Rotate distributor body until rotor aligns with scribe mark. Fit retaining plate and bolt, and tighten bolt.
9. Remove rotor and refit dust cover, rotor and distributor cap.
10. Reconnect distributor multiplug and refit air hose.
11. Reconnect battery and remove fender covers.

    Note: Ignition timing is totally controlled by the module and does NOT require checking with a timing light.

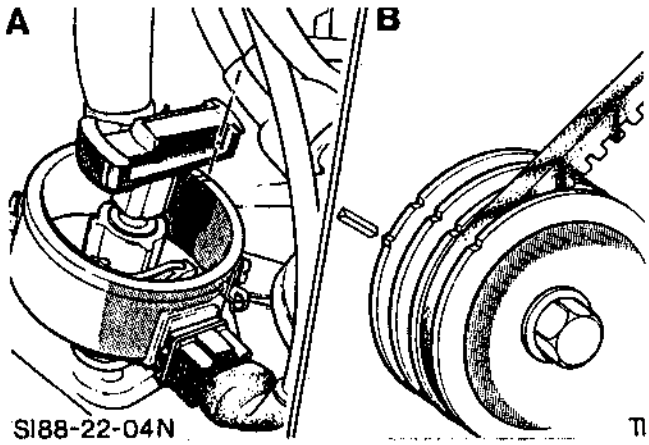


Fig.1. No.1. cylinder at T.D.C.
A - Distributor mark
B - Crank pulley lug inline with pointer

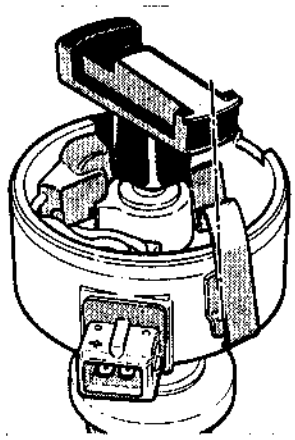
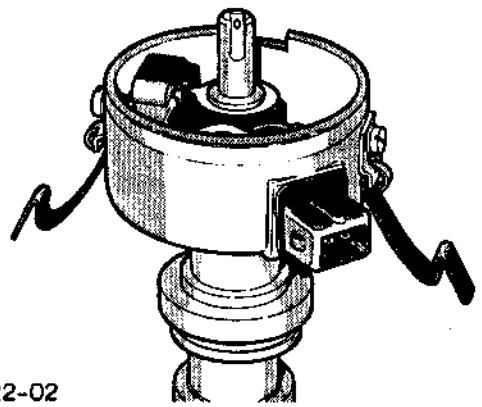


Fig.2. Before installing distributor, align rotor with distributor cap retaining clip.

22 215 4 PHASE SENSOR - DISTRIBUTOR - REMOVE AND INSTALL (Distributor removed)

SPECIAL TOOLS REQUIRED: NONE



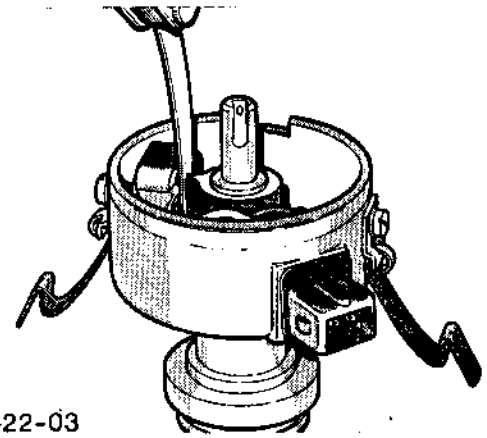
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Fig.3. Distributor removed.

To Dismantle

1. Remove rotor arm, disconnect phase sensor plug and remove from base plate.

2. Remove base plate and phase sensor from distributor housing (2 bolts).



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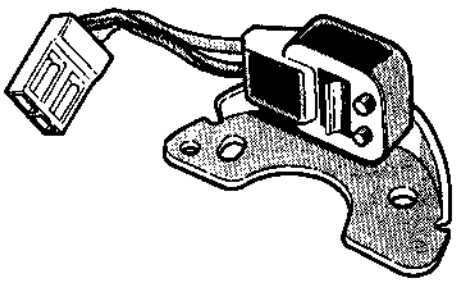
Fig.4. Adjust distributor phase sensor to obtain the correct clearance.

To Reassemble

3. Fit base plate and phase sensor to distributor housing (2 bolts).

4. Fit phase sensor plug to base plate.

5. Adjust phase sensor (distributor)
Slacken the base plate, Fig.4. and adjust phase sensor to a distance of 0,2 to 0,3 mm from the distributor shaft cams. Tighten base plate. Refit rotor arm.



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Fig.5. Phase sensor removed.

22 292 0 IGNITION AMPLIFIER MODULE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.
2. Depress locking clip on multiplug and disconnect multiplug.
3. Remove two screws, lock washers and plain washers.

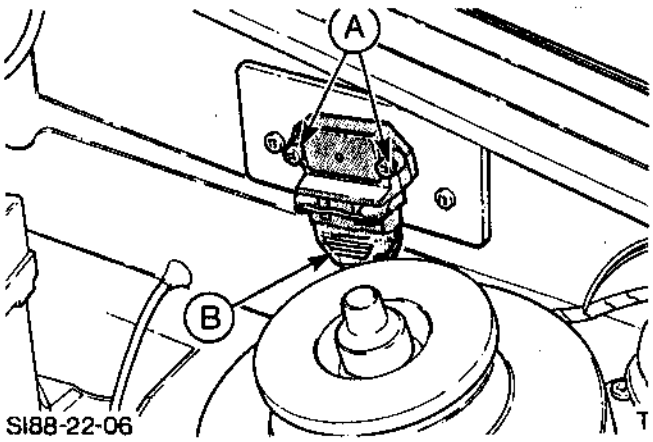


Fig.6. Ignition amplifier module.
A - Multiplug connection
B - Two securing screws

To Install

4. Coat rear face of ignition amplifier module with heat sink compound, refer Technical Data.
5. Position and secure module with two screws, lock washers and plain washers.
6. Reconnect module multiplug.
7. Reconnect battery and remove fender covers.

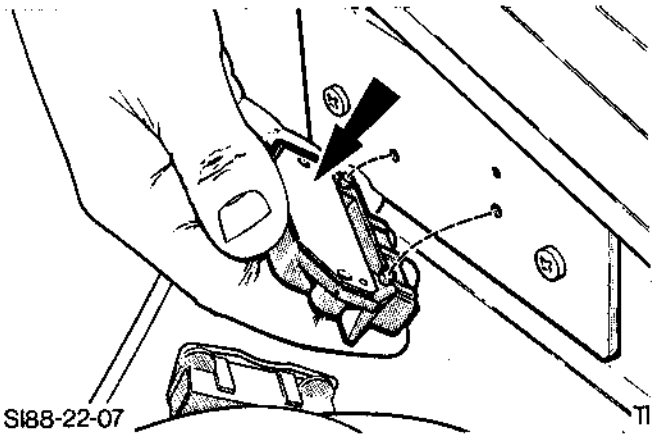


Fig.7. Coat rear face of module with heat sink compound.

22 414 0 IGNITION COIL - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.
2. Disconnect HT and LT connections at coil. Remove two screws and detach coil with strap assembly and suppression capacitor.

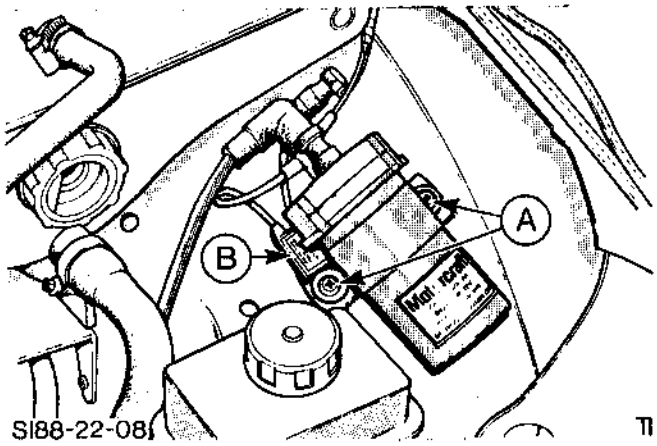


Fig.8. Ignition coil.
A - Mounting screws
B - Suppression capacitor

To Install

3. Position coil, strap assembly and suppression capacitor, secure with two screws. Reconnect HT and LT connections.
4. Reconnect battery earth cable. Start engine check coil operation. Remove fender covers.

22 619 0 SPEED SENSOR - ENGINE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Raise vehicle.

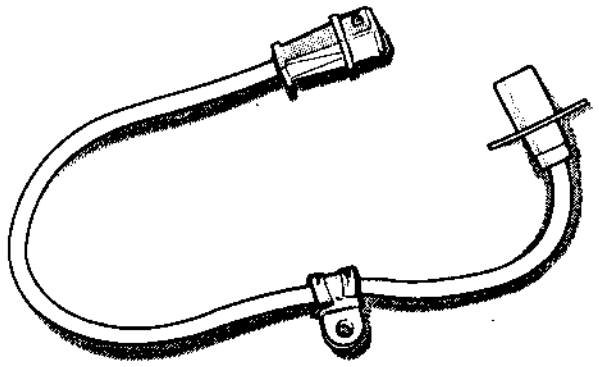


Fig.9. Engine speed/TDC sensor removed.

3. Remove engine speed/TDC sensor from sump (2 bolts).

4. Disconnect multiplug plug, from wiring harness and remove cable from retainer. Remove cable clip from sump (1 bolt) and remove engine speed/TDC sensor.

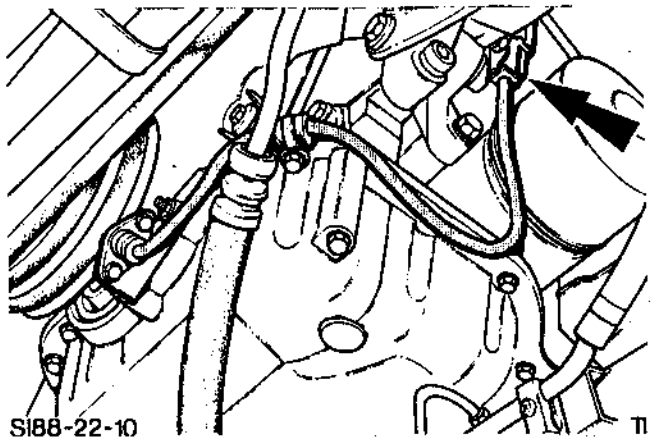


Fig.10. Engine speed/TDC sensor cable plug.

To Install

5. Clip engine speed/TDC sensor cable into retainer and connect multiplug.

6. Fit engine speed/TDC sensor to mounting. Align crankshaft pulley teeth with sensor and set sensor clearance, 0,6 to 1,0 mm.

7. Lower vehicle.

8. Re-connect battery earth cable.

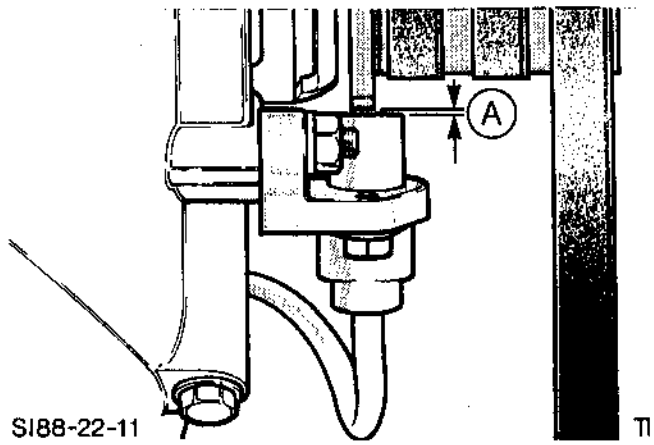


Fig.11. Engine speed/TDC sensor.
A - 0,6 to 1,0 mm

29 200 0 CONTROL MODULE - ENGINE MANAGEMENT REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

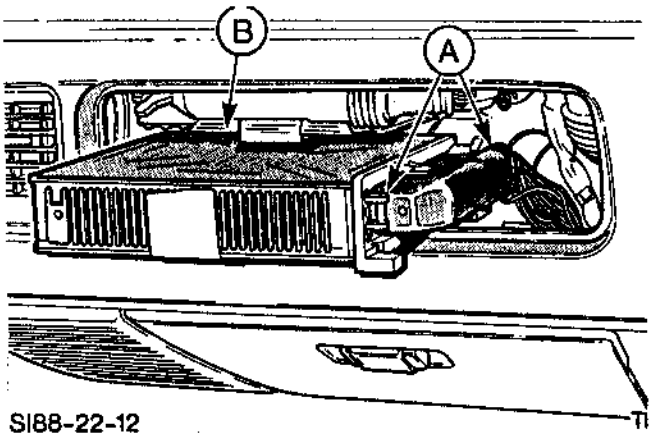
To Remove

1. Disconnect battery earth cable.

2. Unclip trim above glove compartment.

3. Remove module and remove multiplug from module.

   - Push back plug retainer,
   - Lift up multiplug and remove from retainer.



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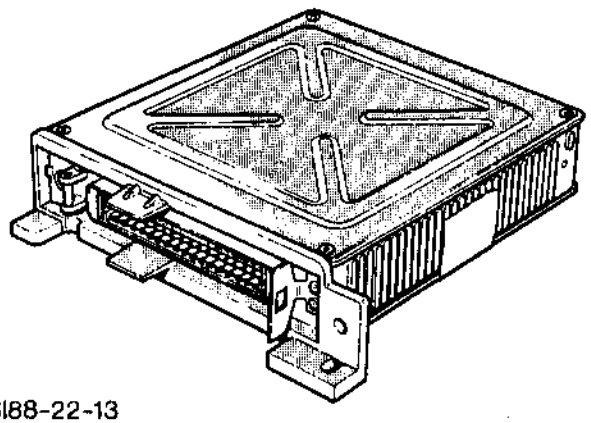
Fig.12. Engine management module.
A - Multiplug retainer
B - Retainer

To Install

4. Connect multiplug to module:

   - Refit retainer and
   - Push in multiplug so that clip engages.

5. Insert module into holder, connect battery earth cable.



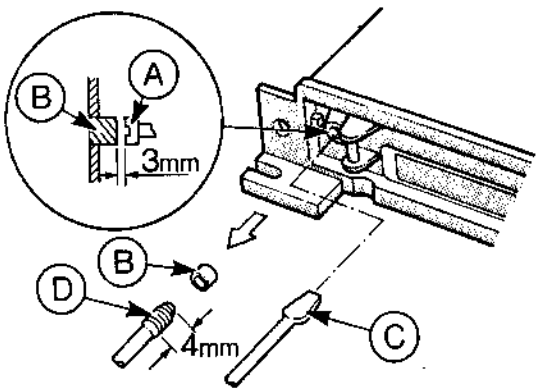
SI88-22-13 TI

Fig.13. Engine management module.

6. Check CO content and adjust if necessary:

   - Connect CO meter and check CO content at normal operating temperature.
   - If required, remove CO adjustment tamperproof plug, on module and turn adjusting screw to correct CO content. Fit new tamperproof plug to adjusting screw.

IMPORTANT NOTE: When performing this operation, note that the depth of the tamperproof plug remover should not exceed 4 mm as this will result in damage to the CO - adjustment potentiometer.



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Fig.14. A - CO - adjustment screw
B - Tamperproof plug
C - Screwdriver
D - Extractor tamperproof plug

7. Fit trim above glove compartment.

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Fuel System 23

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TECHNICAL DATA

Injectors

Manufacturer	Weber
Type	Electronically operated
Grease for injector seals, specification No.	ESEM 1C171A

Fuel Pump

Manufacturer	Bosch
Type	Roller cell
Output pressure	Greater than 5 bar at 12 volts

Pressure Regulator

Manufacturer	Weber
System pressure	3,5 bar (when ignition is switched on)
System pressure	3,0 bar (at idle speed)

Idle Speed

850 rpm

Idle CO%

1,0 to 2,0

Turbocharger

Maximal boost pressure (ECU controlled) .. 0,7 bar (max. 0,9 bar)

Solenoid control valve:

Control begins at	1,000 rpm (approximately)
Boost reduces at	6,000 rpm (approximately)
Charge air control temperature	70°C

Tightening Torques

	Nm	
Locknut actuator rod	5,6 to 7,9	
Actuator to retainer	5,6 to 7,9	
Intermediate housing to turbine housing	18,5 to 21,9	
Intermediate housing to compressor housing	16,4 to 19,8	
Turbo damper to cylinder head	18,5 to 21,5	
Turbo damper friction assembly	Finger tight + 1½ turns	
Lock nut turbo damper	6 to 8	
Turbocharger to secondary exhaust manifold	40 to 48	
Exhaust down pipe to turbocharger	19 to 23 (M8)	35 - 47 (M10)
Main exhaust manifold to secondary exhaust manifold	32 to 36	
Oil feed adaptor to turbocharger	25 to 35	
Oil feed to adaptor	25	
Turbo drain pipe to turbo	18,5 to 21,5	
Water pipe banjo bolts to turbo	19 to 23	
Throttle cable bracket to plenum cover	18,5 to 21,5	+ Loctite 518
Fuel regulator to bracket	8 to 10	
Fuel regulator bracket to inlet manifold	8 to 10	
Fuel regulator banjo bolt	1,5 to 2	
Fuel rail to plenum cover	8 to 10	
Camshaft breather valve to inlet manifold	8 to 10	
Breather valve intake to plenum cover	15 to 20	+ Loctite 242
Air temperature sensor to plenum cover	23 to 25	+ Loctite 518

FUEL (PETROLEUM SPIRIT) HANDLING SAFETY PRECAUTIONS

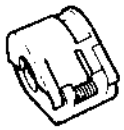
When carrying out repairs to vehicle fuel systems it is easy to become complacent about handling fuel, particularly in relation to draining fuel tanks. The risks involved should not be under-estimated. The information contained in Section 05 on the SIERRA Service Microfiche provides the basic precautions which must be taken if fuel is to be handled safety and also points out some other areas of risk that must not be overlooked.

WARNING:

- The fuel system remains pressurised when the engine has stopped. Adequate safety precautions must be taken when removing fuel lines to prevent fuel spillage.

- Loosen fuel pipes slowly to relieve system pressure.

SPECIAL SERVICE TOOLS

Tool	Tool Name
 23-021	Pressure Gauge
 23-023A	Fuel Hose Remover

GENERAL EQUIPMENT

- CO Meter
- Tamperproof Plug Remover, 150 mm long
- Cooling System Pressure Tester

SERVICE AND REPAIR OPERATIONS

23 174 0 AIR CLEANER ASSEMBLY - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cables and fit fender covers.
2. Remove air hose engine ventilation, air hose solenoid control valve and air hose turbo-charger from air cleaner cover.
3. Release air cleaner cover, detach and remove air cleaner element.
4. Remove right hand inner fender protector. Remove air cleaner box retaining nuts and washers from beneath inner fender.
5. Withdraw air cleaner box from engine compartment.

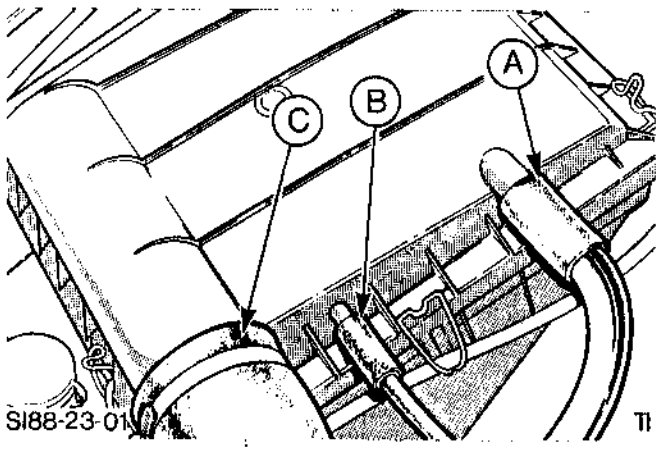


Fig.1. Air cleaner hose connections.
A - Engine ventilation hose
B - Solenoid control valve hose
C - Turbocharger hose

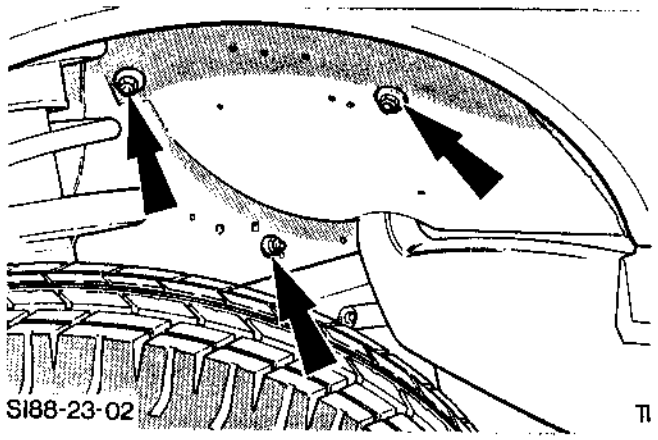


Fig.2. Air cleaner retaining nuts to inner wheel arch.

To Install

6. Transfer metal reinforcements to new air cleaner box.
7. Locate air cleaner box and refit retaining nuts and washers from beneath inner fender.
8. Fit new air cleaner element and cover, secure with five clips.
9. Reconnect air hoses to cover. Refit inner fender protective shield.
10. Reconnect battery and remove fender covers.

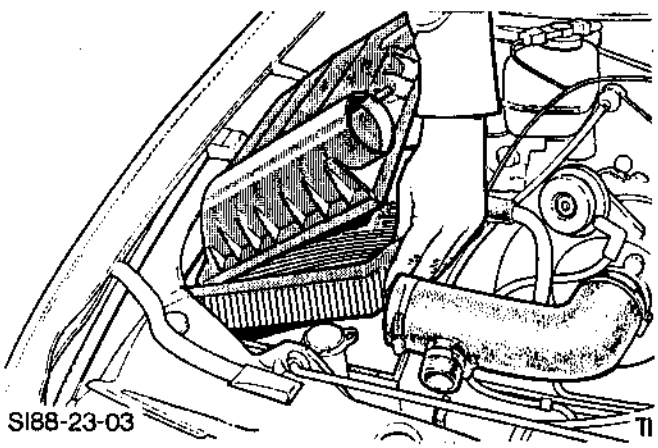


Fig.3. Air cleaner removal.

23 215 0 FUEL MIXTURE/CO - ADJUST

SPECIAL EQUIPMENT REQUIRED:

CO Meter
Tamperproof Plug Remover, 150 mm long

IMPORTANT NOTE: If CO reading is exceptionally high (above 2,5%) or below 0,3%, carry out checks contained in the Vehicle System Test Manual for high fuel consumption.

To Adjust

1. Remove module cover from above glove box.

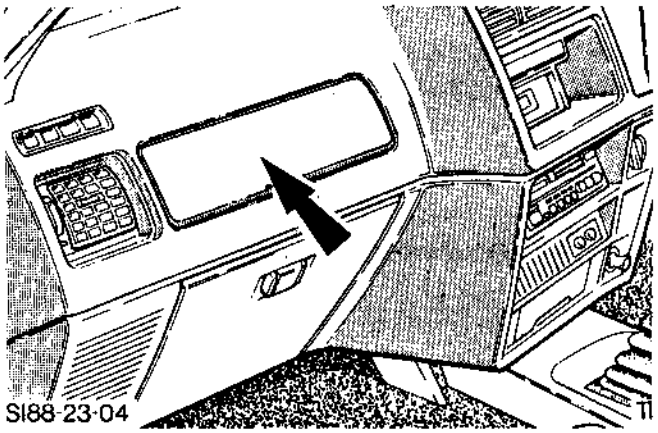


Fig.4. Module cover.

2. Remove tamperproof plug with a suitable tool.

IMPORTANT NOTE: When performing this operation, note that the depth of the tamperproof plug remover should not exceed 4 mm as this will result in damage to the CO adjustment potentiometer.

3. Warm engine to normal operating temperature.

4. Connect a CO meter to engine as per manufacturer's instructions.

5. Stabilise engine by running at 3000 rpm for approximately 15 seconds and allow engine to idle.

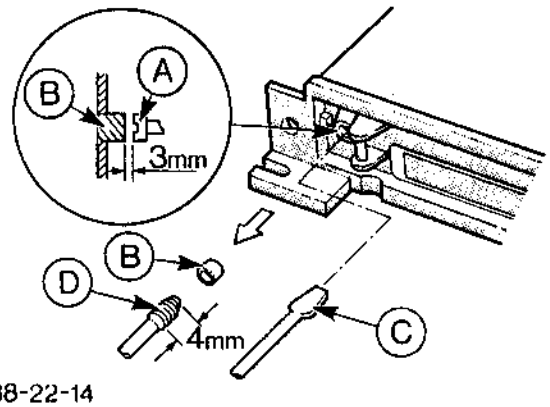


Fig.5. A - CO adjustment screw
B - Tamperproof plug
C - Screwdriver
D - Tamperproof plug remover

6. Wait for meter to stabilise and record %CO and idle speed.

7. Adjust CO screw with screwdriver to achieve correct %CO, Fig.5.

8. Remove idle speed control valve multiplug. Engine should idle at 850 rpm. If idle is incorrect, refer to the Vehicle System Test manual and carryout checks for incorrect idle speed.

9. Switch off engine and remove equipment. Fit new tamperproof plug.

10. Fit module cover.

IMPORTANT NOTE: Adjustment must be carried out within 10 to 30 seconds from time meters stabilise. If time taken is longer than 30 seconds, run engine again at 3000 rpm for 15 seconds and re-check.

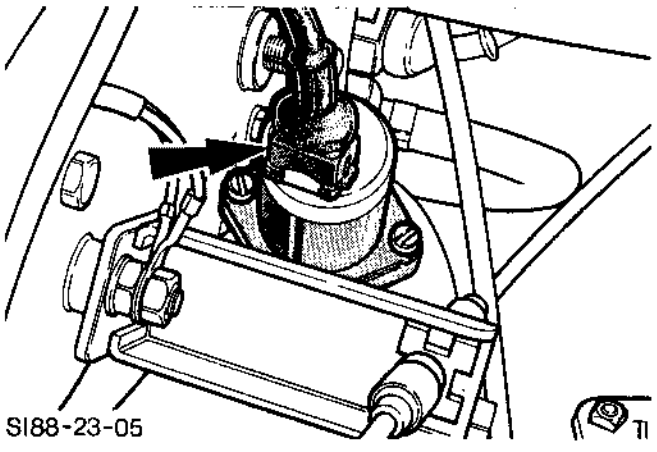


Fig.6. Idle speed control valve multiplug.

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23 266 0 FUEL PRESSURE REGULATOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

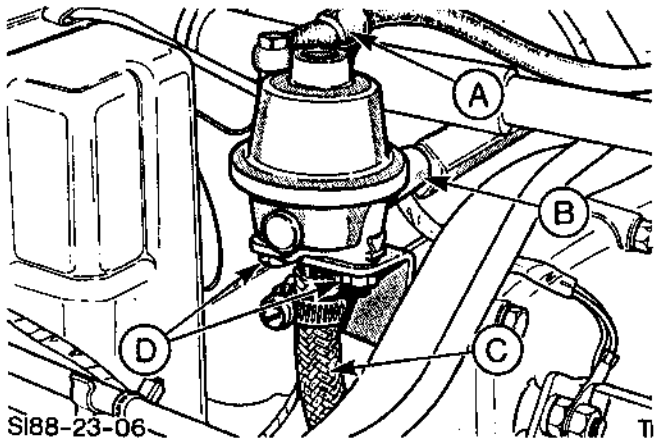


Fig.7. Fuel pressure regulator.
A - Vacuum/air hose C - Fuel return
B - Fuel feed D - Retaining bolts

To Remove

1. Disconnect battery and fit fender covers. Disconnect vacuum/air hose.

2. Disconnect fuel return pipe and slacken fuel feed pipe.

NOTE: If a crimped type hose clamp is fitted, it must be cut free using side cutters.

3. Remove regulator from its mounting bracket (2 bolts). Remove mounting bracket retaining nut and remove bracket.

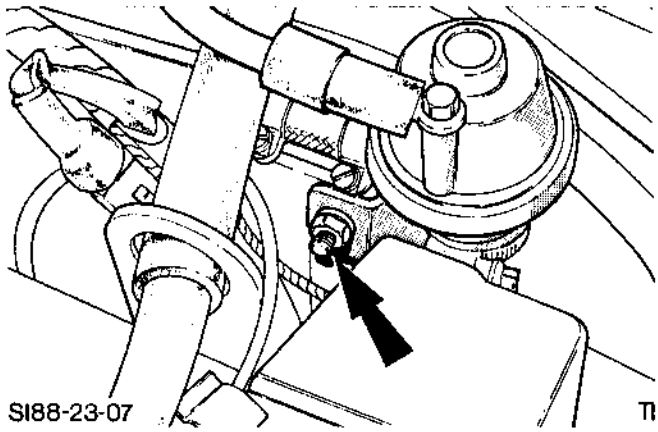


Fig.8. Fuel pressure regulator mounting bracket retaining nut.

To Install

4. Position and secure regulator to its bracket. Secure bracket to air intake.

5. Tighten fuel feed pipe and refit fuel return pipe.

NOTE: Ensure regulator inlet pipe is aligned with fuel rail, adjust bracket if necessary.

6. Reconnect vacuum/air hose. Reconnect battery and remove fender covers.

23 323 0 IDLE SPEED CONTROL VALVE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable and fit fender covers.

2. Remove multiplug from idle speed control valve.

3. Remove two retaining bolts and withdraw idle speed control valve.

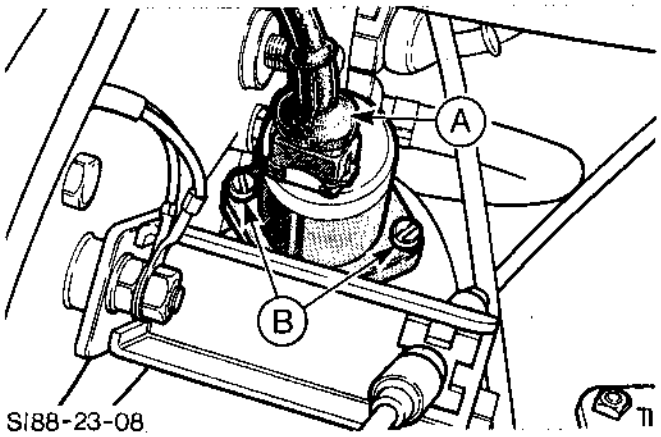


Fig.9. Idle speed control valve.
A - Multiplug
B - Retaining bolts

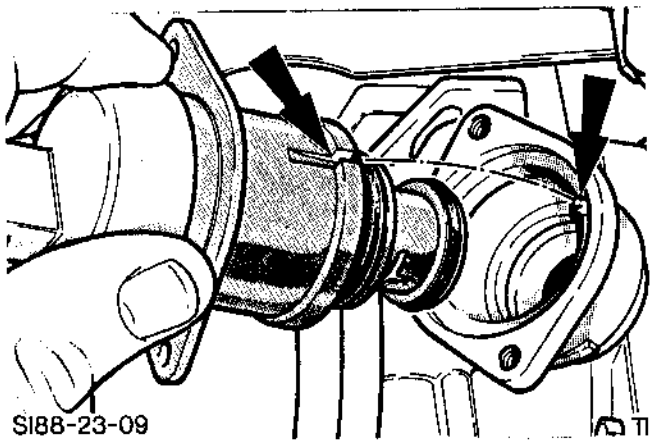


Fig.10. Locate valve on detent pin.

To Install

4. Fit new O-rings. Position idle speed control valve to detent pin and secure valve.

5. Refit multiplug.

6. Reconnect battery and remove fender covers.

23 325 0 THROTTLE POSITION SENSOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable and fender covers.
2. Remove throttle cable from throttle butterfly (1 clip).

NOTE: Do not remove throttle cable bracket from air chamber as Loctite used at initial build may fall inside air chamber.

3. Remove air hose from throttle body intake connection.
4. Disconnect throttle position sensor plug and idle speed control plug.
5. Remove throttle butterfly housing from air chamber connection (4 bolts).
6. Remove sensor from throttle butterfly housing (2 bolts).

To Install

7. Locate sensor on throttle butterfly shaft and turn anti-clockwise until spring pressure is felt. Tighten retaining bolts ensuring spring pressure is not being applied.
8. Clean gasket faces and using a new gasket, fit throttle butterfly housing to air chamber connection.
9. Connect plugs to throttle position sensor and idle speed control valve.
10. Fit air hose to throttle plate intake connection.
11. Fit throttle cable to throttle butterfly. Adjust throttle cable.
12. Re-connect battery earth cable and remove fender covers.

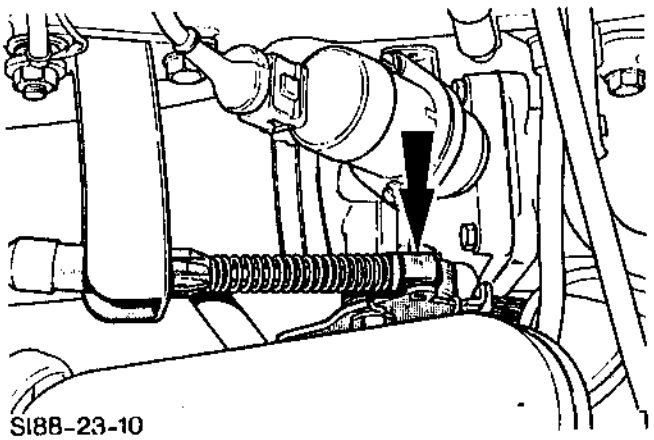


Fig.11. Remove throttle cable from throttle butterfly.

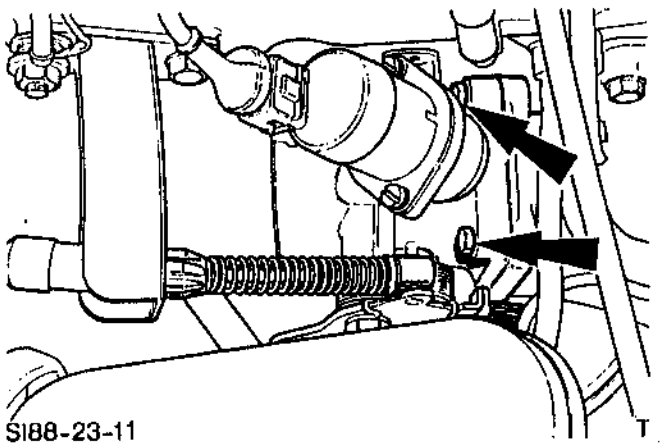


Fig.12. Remove throttle housing retaining bolts (4) - 2 bolts arrowed.

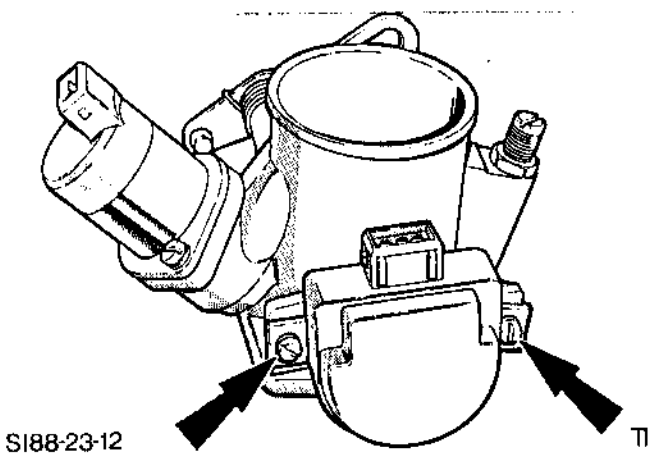


Fig.13. Throttle position sensor securing screws.

23 455 0 FUEL INJECTORS - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED:

Fuel Hose Remover 23-023A

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

To Remove

1. Disconnect battery earth cable and fit fender covers.

2. Remove vacuum line from fuel pressure regulator. Remove degas hose and crankcase vent pipe.

3. Disconnect multiplugs from injectors, idle speed control valve and air charge temperature sensor.

4. Remove fuel line from fuel pressure regulator, remove regulator mounting bolts and remove regulator.

NOTE: If a crimped type hose clamp is fitted, it must be cut free using side cutters.

5. Disconnect earth cables from air intake, cut cable ties and position cables clear of fuel rail.

6. Remove safety clip from fuel feed hose. Using Special Tool 23-023A, disconnect fuel feed pipe.

7. Remove fuel rail retaining bolts from air chamber (2 bolts). Remove fuel rail complete with injectors, from intake manifold.

8. Remove injectors from fuel rail (4 clips).

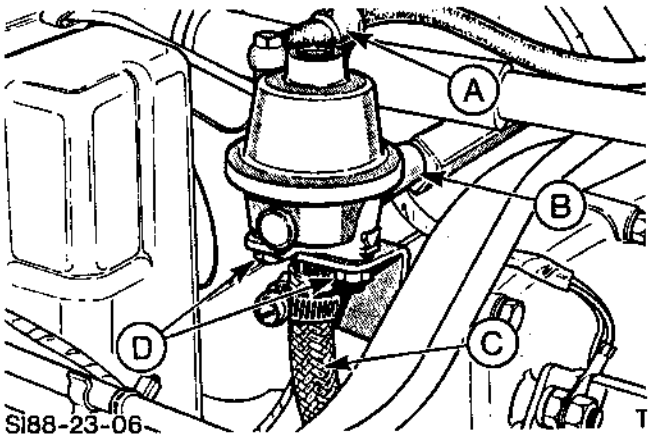


Fig.14. Fuel pressure regulator.
A - Air hose C - Fuel return
B - Fuel feed D - Retaining bolts

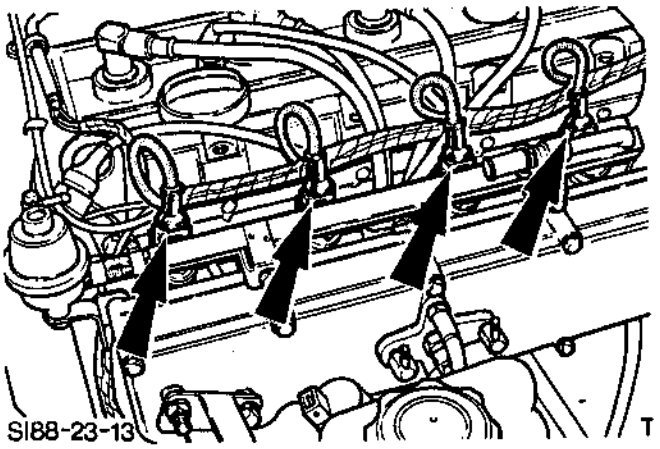


Fig.15. Injector plugs.

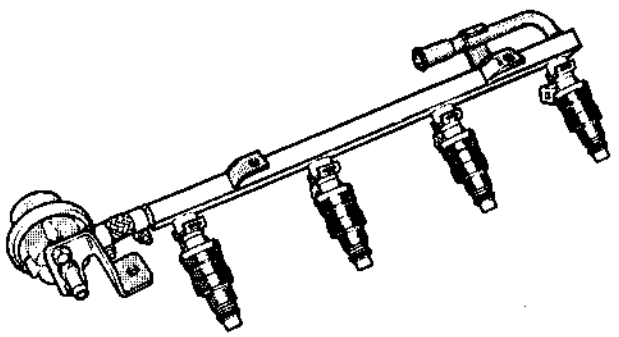


Fig.16. Fuel rail with injectors.

23 455 0

To Install

9. Fit injectors to fuel rail and secure with clips.

NOTE: Always use new 'O' rings and clips when refitting injectors.

10. Locate injectors complete with fuel rail into intake manifold and fit to air chamber (2 bolts).

NOTE: When installing the injectors, ensure there is a gap between intake manifold and injector body.

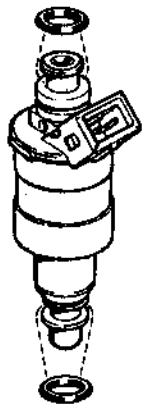

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Fig.17. Use new 'O' rings when refitting injectors.

11. Fit fuel pressure regulator retaining bolts to air chamber.

12. Fit fuel line and vacuum line to fuel pressure regulator.

NOTE: If crimped clamps were removed they must be replaced with screw and nut type clamps.

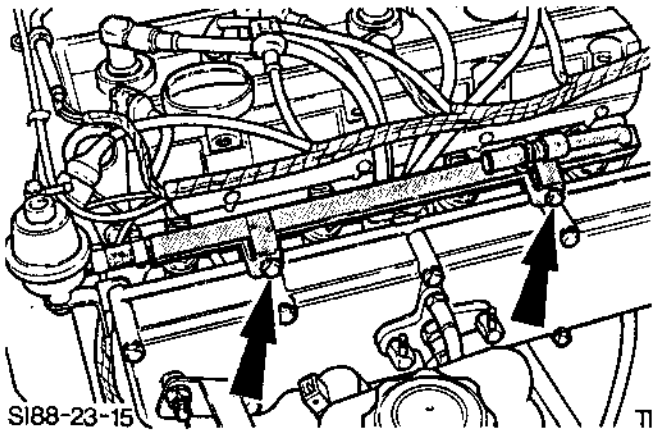

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Fig.18. Refit fuel rail retaining bolts.

13. Connect multiplugs to injectors, idle speed control valve and charge temperature sensor. Route cables and secure with new ties.

14. Refit degas tank hose and crankcase vent pipe. Reconnect battery earth cable.

15. Start engine and check for any fuel leaks.

16. Remove fender covers.

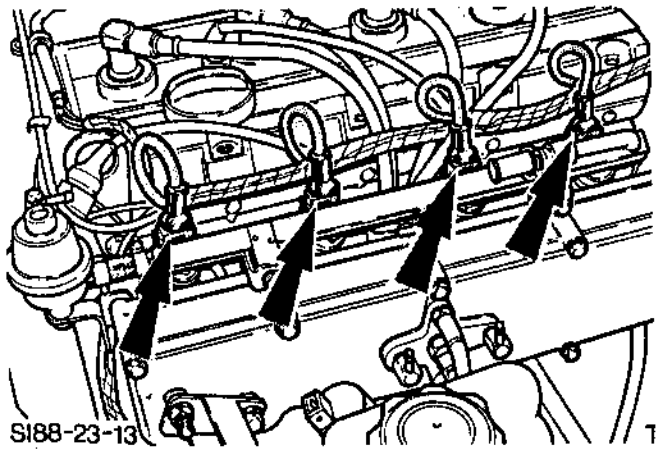

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Fig.19. Connect plugs to injectors.

1287

23 534 0 FUEL PUMP - REMOVE AND INSTALL

SPECIAL SERVICE EQUIPMENT REQUIRED: NONE

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE

To Remove

1. Disconnect battery.

2. Raise vehicle on a ramp. Clamp fuel pump inlet hose with a suitable clamp to prevent fuel draining from tank when hose is disconnected. Take care not to damage hose.

3. Hold a suitable container beneath fuel pump inlet connection, loosen clamp and remove hose. Plug end of hose to prevent fuel seepage.

4. Loosen fuel outlet hose gently as fuel system will still be pressurised. Remove hose and collect any fuel in a suitable container.

5. Disconnect wiring loom connectors. Loosen pump securing bolt and slide pump from bracket. Remove damper from outlet port.

To Install

6. Clean fuel and wiring connections.

7. Slide pump into bracket and secure.

8. Reconnect fuel lines and wiring. Remove clamp from hose.

9. Reconnect battery, start engine and check for leaks.

10. Lower vehicle to the ground.

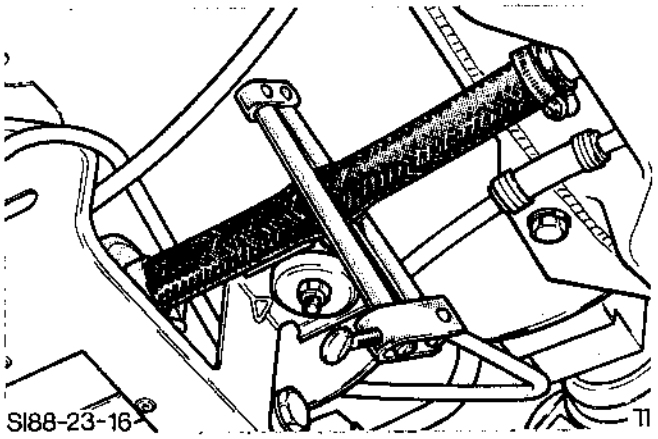


Fig.20. Pump inlet hose suitably clamped.

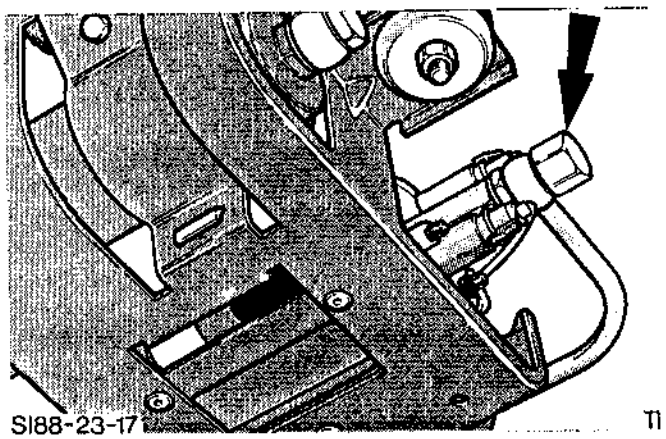


Fig.21. Slacken outlet hose, taking appropriate precautions to collect spilt fuel.

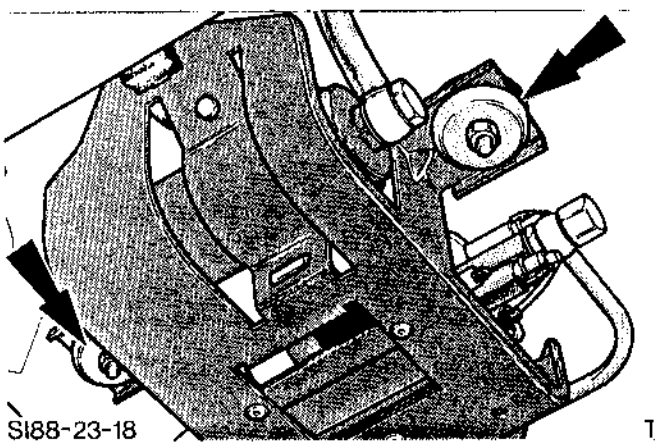


Fig.22. Fuel pump retaining nuts.

23 545 0 FUEL FILTER - REMOVE AND INSTALL

SPECIAL SERVICE EQUIPMENT REQUIRED: NONE

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

To Remove

1. Disconnect battery, raise vehicle on a ramp, clamp fuel feed hose at tank.

2. Position a suitable container beneath fuel filter. Slacken fuel inlet pipe, allow pressure in fuel line to reduce. Remove fuel inlet and outlet pipe.

3. Loosen filter retaining bolts and withdraw filter assembly.

NOTE: Take care when removing filter, as it contains fuel.

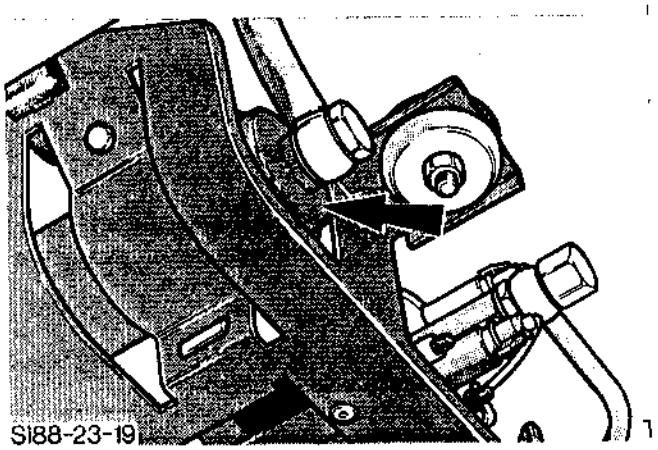


Fig.23. Fuel filter location.

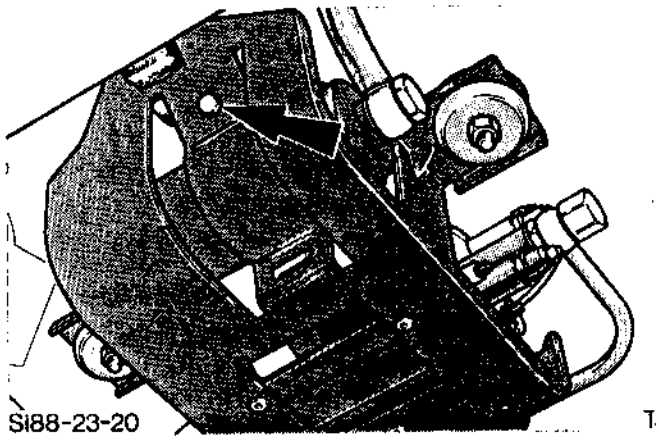


Fig.24. Fuel filter assembly.

To Install

4. Fit new filter assembly and secure, ensuring that filter is round the correct way (note direction of flow arrows).

5. Refit fuel filter inlet and outlet pipes. Remove clamp.

6. Reconnect battery. Switch ignition 'on' and 'off' five times and check filter and fuel pipes for leakage.

7. Lower vehicle.

23 601 0 BOOST PRESSURE - ADJUST

SPECIAL TOOLS REQUIRED:

Pressure Gauge and Hose 23-021
Cooling System Pressure Tester

NOTE: After fitment or replacement parts to the Turbocharger, the boost pressure will require resetting.

This operation is divided into two sections: initial 'static' adjustment and final adjustment during/after road test.

IMPORTANT NOTE: Roller testing is not recommended as the temperatures generated by the engine and brakes and the inadequate cooling available on a roller test.

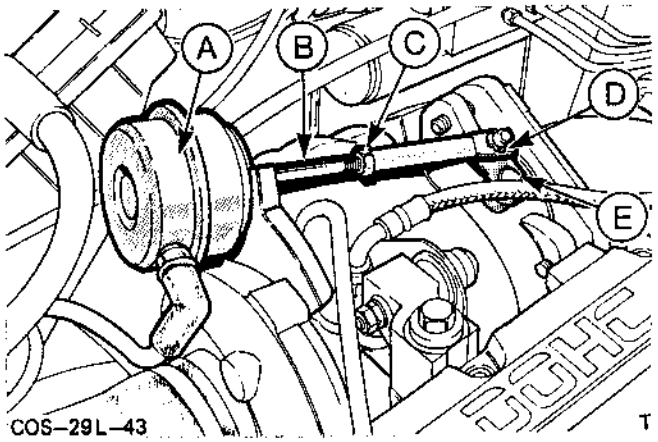


Fig.25. Actuator rod and waste gate.
A - Waste gate actuator D - Circlip
B - Actuator rod E - Operating lever
C - Locknut

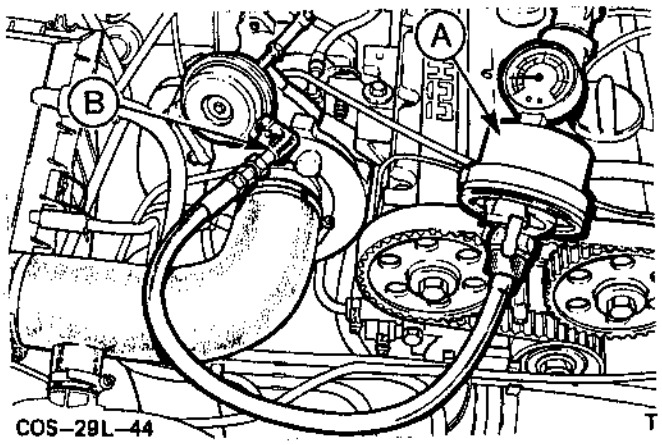


Fig.26. A - Cooling system pressure tester
B - Waste gate actuator hose

Initial Static Adjustment

1. With the actuator rod disconnected from the waste gate operating lever, connect the cooling system pressure tester to the waste gate actuator and apply a pressure of 0,45 bar (max. 0,48 bar).

2. Move the operating lever to fully close the waste gaste valve.

3. With 0,45 bar (max. 0,48 bar) pressure still applied to the actuator, adjust the rod length so that it just slips onto the waste gate lever.

4. Fit a new circlip to retain the rod and tighten the locknut ensuring that the rod eye is not twisted and allows the waste gate to move freely when the pressure is released.

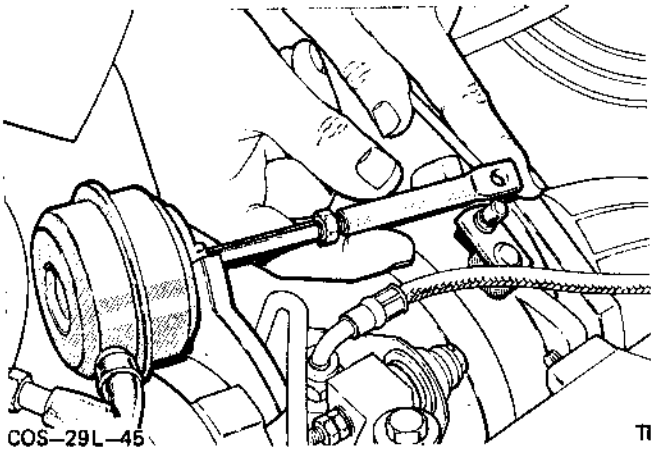


Fig.27. Adjust the rod length so that it just slips onto the waste gate lever.

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Road Testing

NOTE: When performing this operation, the duration of the actual boost test itself should be no more than 3 - 5 seconds.

The boost pressure is measured via a gauge and connecting pipe work as detailed below:

5. Pull off the hose of the turbocharger boost pressure gauge. Connect the pressure gauge, using a 2,0 metre length of 6 mm diameter neoprene tubing.

NOTE: It is essential for correct readings that the pressure gauge is securely fixed to the driver's side vent nozzle in an upright position.

6. Drive the vehicle until normal operating temperature is reached.

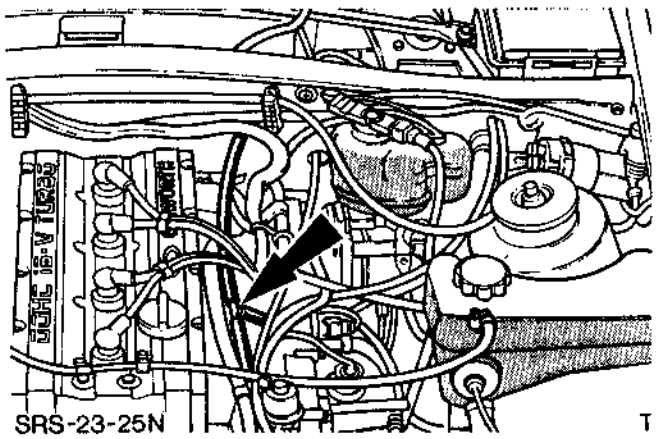


Fig.28. 'T' piece location (only on vehicles fitted with a boost gauge).

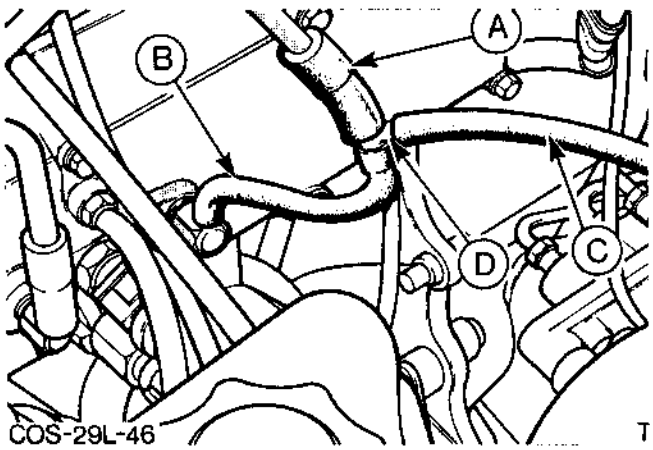


Fig.29. 'T' piece and hose installation.
A - Hose to bypass valve C - Hose to gauge
B - Hose to air chamber D - 'T' piece

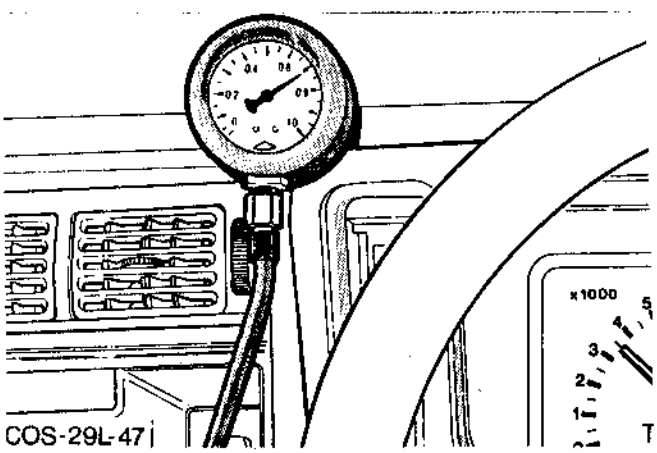


Fig.30. Gauge installation hose routing.

7. With a clear, straight road ahead and behind (preferably without junctions). Select 4th gear and drive along at an engine speed of approximately 1500 rpm.

8. Fully depress the throttle pedal.

9. Keeping the throttle pedal fully depressed, fully apply the brakes when the engine reaches 3500 rpm - DO NOT EXCEED THE TEST DURATION (MAX 5 SECS).
With both throttle and brake fully depressed read the boost pressure from the gauge.

   Specification: 0,7 bar (max. 0,9)

NOTE: After taking reading, drive the car for at least 1 mile to allow the brakes to cool.

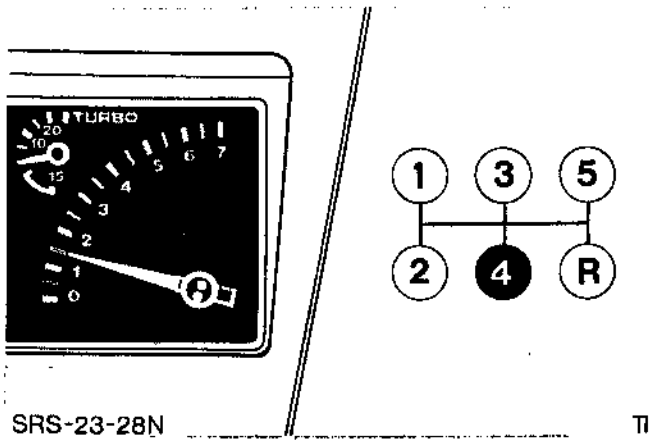


Fig.31. 4th gear engaged and engine speed at 1500 rpm.

10. If the reading obtained is within specification, apply a small amount of paint to the actuator rod threads and locknut to lock into position.

11. If the reading obtained was outside the specification, the actuator rod should be adjusted as follows:

12. Loosen locknut nut at rod eye, remove the circlip and detach the rod from the waste gate operating lever.

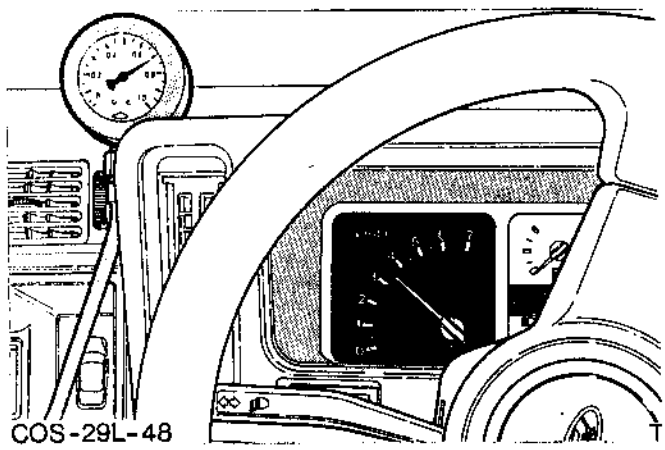


Fig.32. Readings with full load induced.

- Boost Pressure Low

  Shorten rod one half turn for every 0,02 bar of pressure below that specified.

- Boost Pressure High

  Lengthen rod one half turn for every 0,02 bar of pressure above that specified.

13. After adjustment, refit rod and circlip and tighten locknut ensuring the rod eye does not bind on the waste gate lever.

14. Repeat test.

15. If boost pressure is now within specification, apply paint to the actuator rod threads and locknut to lock in position.

16. Remove the test equipment and reconnect turbocharger boost pressure gauge hose to the 'T' piece.

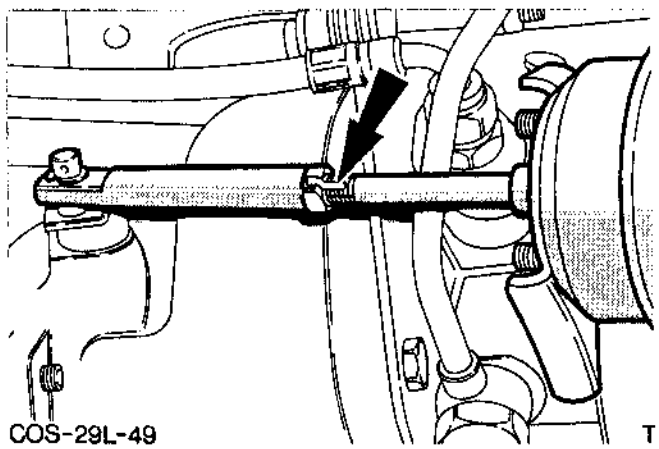


Fig.33. Paint mark over threads and locknut of waste gate actuator rod.

23 612 0 TURBOCHARGER - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.

2. Remove air hoses from air cleaner, bypass valve and turbocharger (3 hose clamps).

3. Remove heat shield.

4. Remove both solenoid control valve hoses from turbocharger and actuator.

5. Remove bottom air hose from turbocharger.

6. Remove oil pressure hose from turbocharger.

7. Remove turbocharger coolant return pipe from turbocharger. Detach retainer from cylinder head cover.

8. Remove turbocharger cooling feed pipe from thermostat housing.

9. Remove exhaust pipe from turbocharger.

10. Remove secondary exhaust manifold from main exhaust manifold (two bolts top and two bolts bottom).

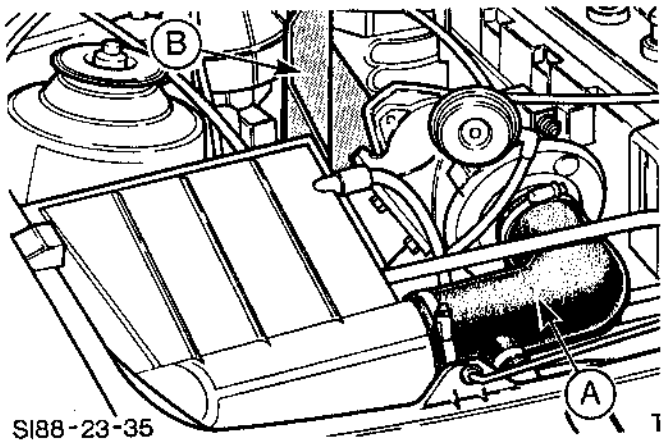


Fig.34. A - Top air hose
B - Heat shield

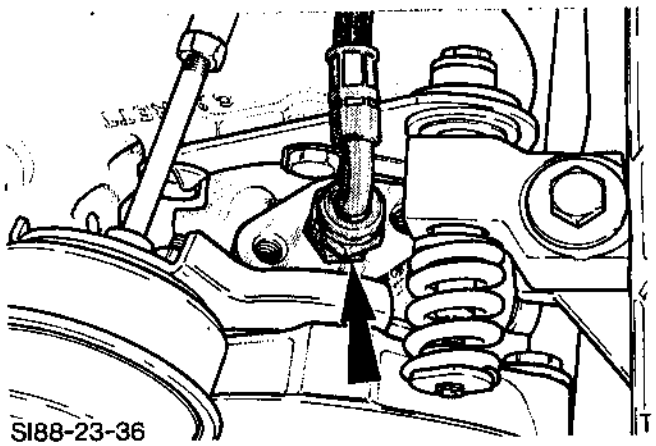


Fig.35. Oil pressure hose connection.

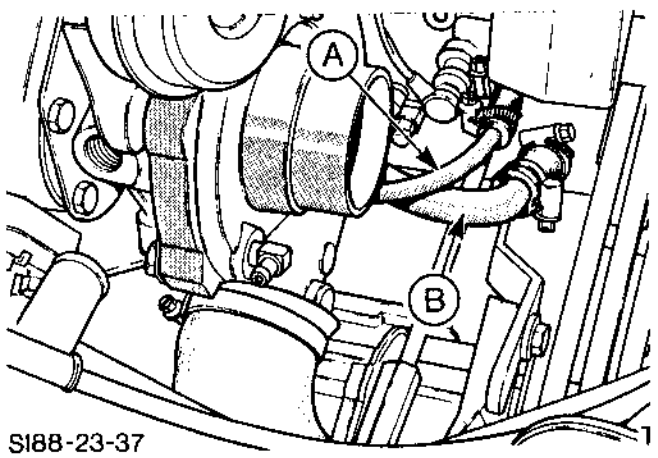


Fig.36. Turbocharger coolant.
A - Coolant feed pipe
B - Coolant return pipe

11. Remove turbocharger vibration damper assembly (1 bolt) and withdraw turbocharger.

12. Replace Turbocharger (turbocharger removed)

- Remove secondary exhaust manifold from turbocharger (4 bolts, locked).
- Remove oil return pipe (2 bolts).
- Remove coolant pipe from turbocharger.
- Remove waste gate actuator with rod and retainer (2 bolts, 1 clip).
- Transfer oil pressure/boost pressure connection fittings.
- Refit all parts in reverse order.
- Use new friction washers if necessary.

13. Position turbocharger assembly and locate oil return pipe.

14. Fit secondary exhaust manifold to main exhaust manifold, tighten bolts finger tight only.

NOTE: Use new bolts.

Install Turbocharger Vibration Damper (Damper without spring, for damper incorporating spring go to sub-operation 23).

NOTE: Special care should be taken during the assembly and adjustment of the turbocharger vibration damper.

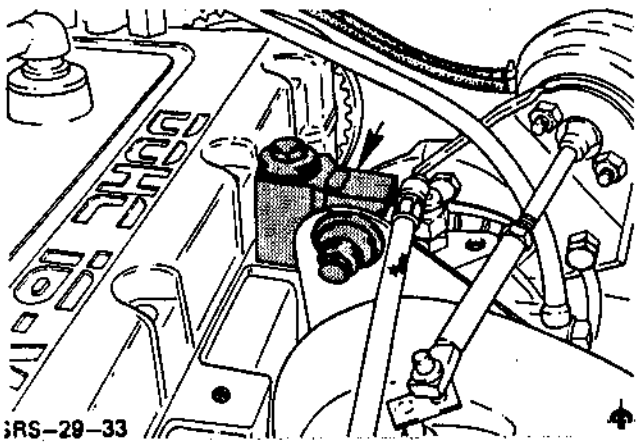


Fig.37. Turbocharger vibration damper.

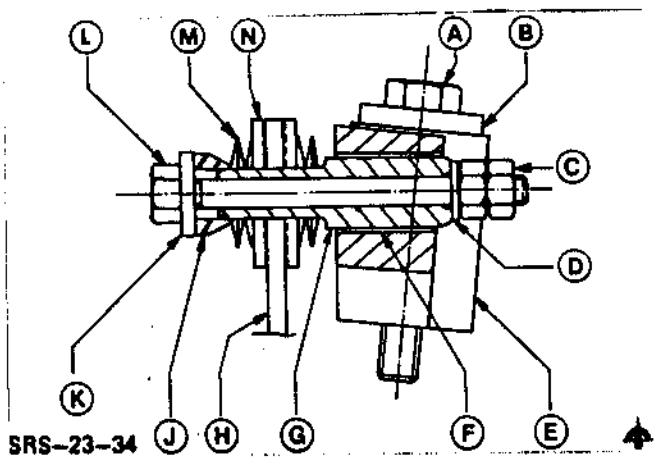


Fig.38. Turbocharger vibration damper cross section.

Fig.38. Turbocharger vibration damper cross section.
A - Bolt
B - Washer
C - Locknut
D - Washer
E - Damper support
F - Bearing bush
G - Guide pin
H - Turbocharger support
J - Taper sleeve
K - Washer
L - Bolt
M - Disc spring
N - Friction washer

15. Assemble the turbocharger vibration damper parts finger tight as shown in Fig.38.

16. Adjust the guide pin so that its shoulder protrudes 4 mm from the damper support. Check distance with a rule, Fig.39.

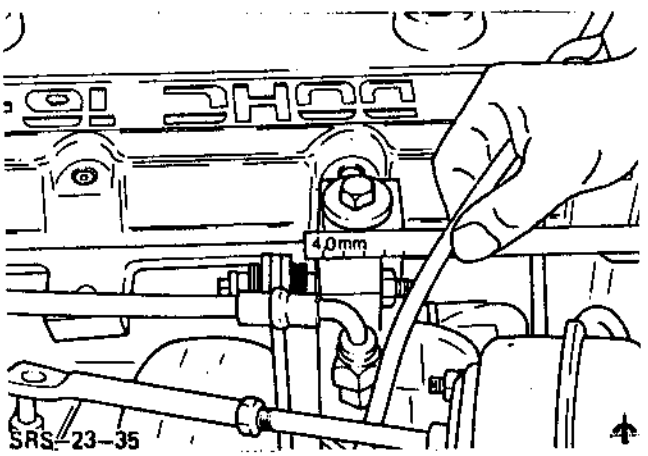


Fig.39. Setting - guide pin shoulder to damper support - 4 mm.

23 612 0

17. Adjust the vibration damper so that the friction washers are flush with the turbocharger holder at the top and also are 5,4 mm from the side.

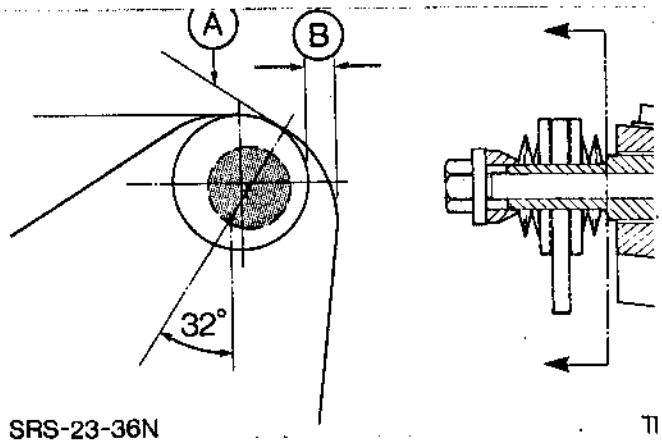


Fig.40. Turbocharger vibration damper assembly.
A - Holder and friction washers flush
B - Holder to friction washers 5,4 mm

18. Measure the distance between the friction washers and the turbocharger holder with vernier calipers.

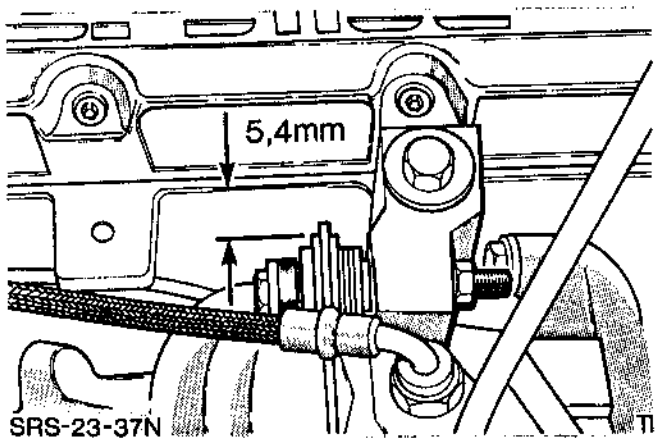


Fig.41. Holder to friction washer setting 5,4 mm.

19. Insert a 0,04 mm feeler gauge between two disc springs and tighten the nut until the feeler can just be withdrawn.

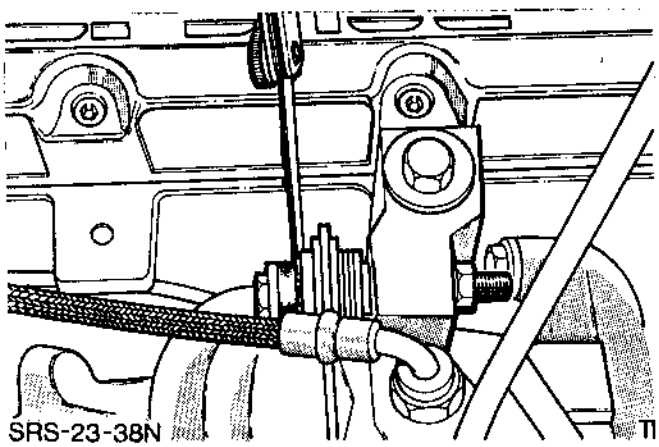


Fig.42. Feeler gauge (0,04 mm) between two disc springs.

20. Hold the bolt, then tighten the nut 1½ to 2 turns. Use a marking pen on the nut to assure correct adjustment.

NOTE: Do not exceed 2 turns.

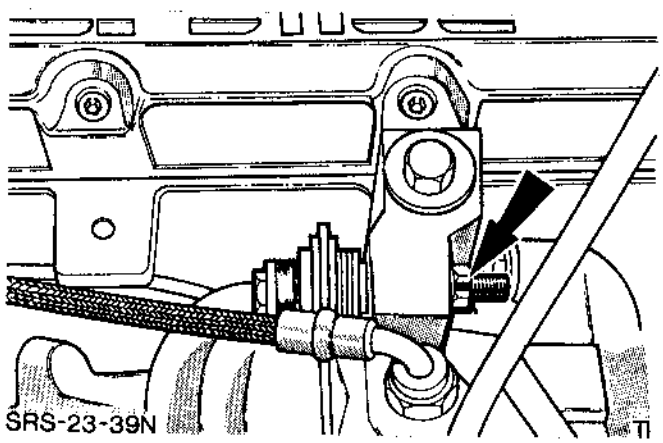


Fig.43. Mark nut.

21. Fit locknut and tighten to specified torque (see Technical Data).

NOTE: After tightening the locknut to the specified torque, recheck the 4,0 mm gap.

22. Tighten retaining screw, vibration damper to cylinder head, to the specified torque (see Technical Data).

Tighten the turbocharger manifold to exhaust manifold bolts (4) to the specified torque (See Technical Data), go to sub-operation 29.

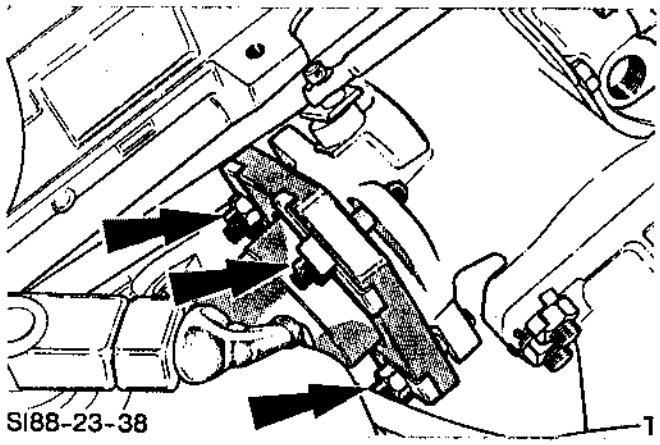


Fig.44. Exhaust pipe to turbocharger.

Install turbocharger damper assembly (spring type)

23. Mount damper block to cylinder head, do not fully tigthen bolt.

24. Assemble damper components as shown in Fig.45.

Fig.45. Spring type damper assembly components.
A - Bolt
B - Washer
C - Taper sleeve
D - Friction washers
E - Guide sleeve
F - Collar
G - Spring
H - Threaded collar
J - Lock nut

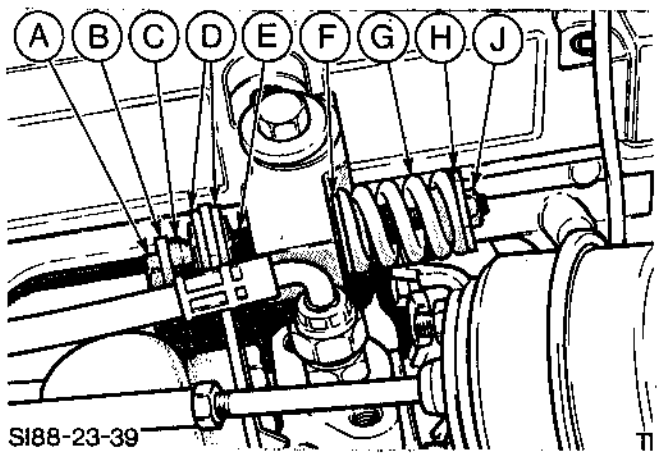


Fig.45. Spring type damper assembly components.

25. Tighten the threaded collar until the friction washers abutt the bracket and can still be rotated by hand. Adjust the damper so that the friction washers are flush with the turbocharger holder at the top and are also 5,4 mm from the side.

26. Position 4,0 mm gauge between turbocharger holder and mounting block. Adjust the mounting block to obtain the 4,0 mm setting and tighten the retaining bolt to the specified torque (refer to Technical Data)

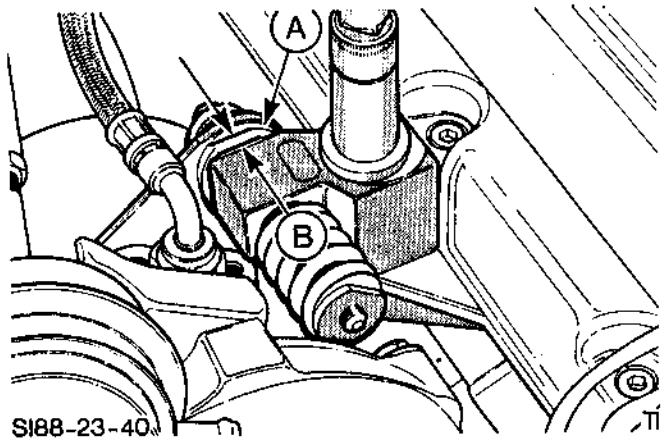


Fig.46. Turbocharger vibration damper assembly.
A - Insert 4 mm gauge
B - Ensure 4 mm clearance is obtained between damper and mounting block

27. Hold through bolt and tighten threaded collar until spring is compressed to a length of 25 mm. Fit locknut, hold threaded collar and tighten locknut to 8 to 10 Nm.

28. Tighten the turbocharger manifold to exhaust manifold bolts (4) to the specified torque (See Technical Data).

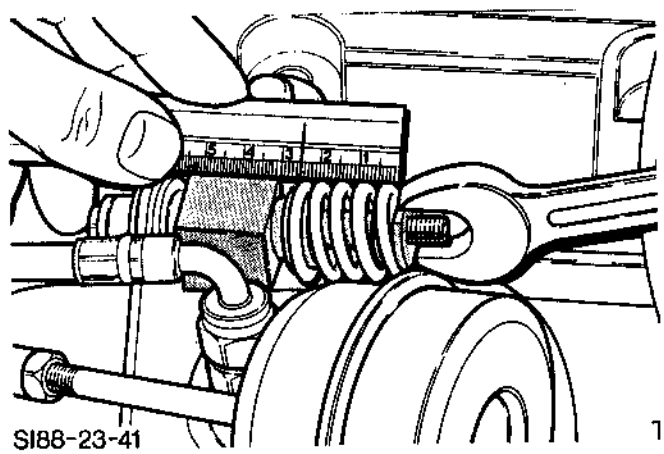


Fig.47. Tighten spring to compress to 25 mm.

29. Fit exhaust pipe to turbocharger, tighten to specified torque (refer to Technical Data).

30. Fit turbocharger coolant feed to thermostat housing.

31. Fit turbocharger coolant system return to turbocharger and mount retainer on cylinder head cover.

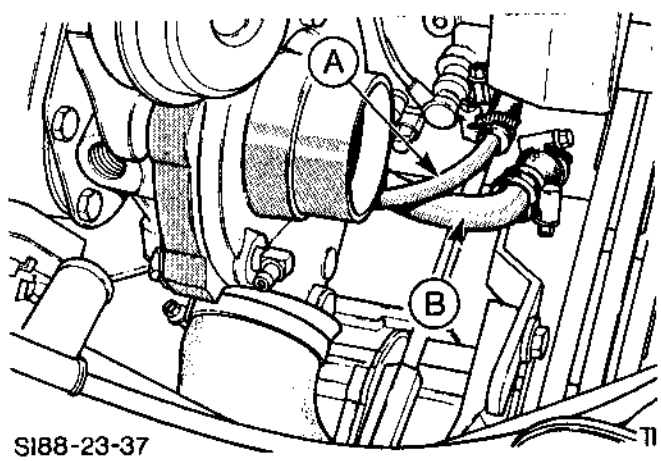


Fig.48. Turbocharger coolant.
A - Feed pipe
B - Return pipe

32. Fit oil feed hose to turbocharger.

33. Fit bottom air hose to turbocharger.

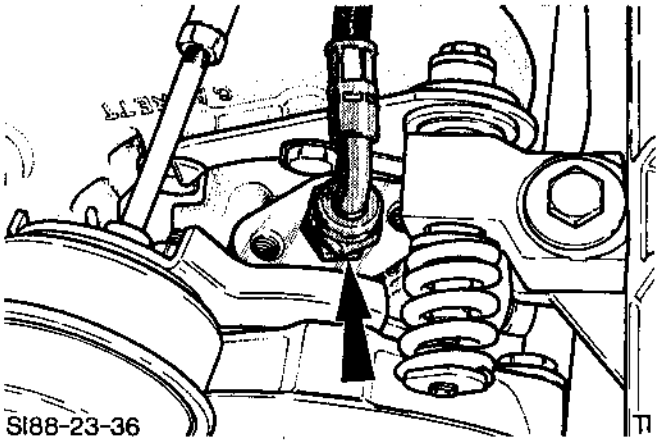
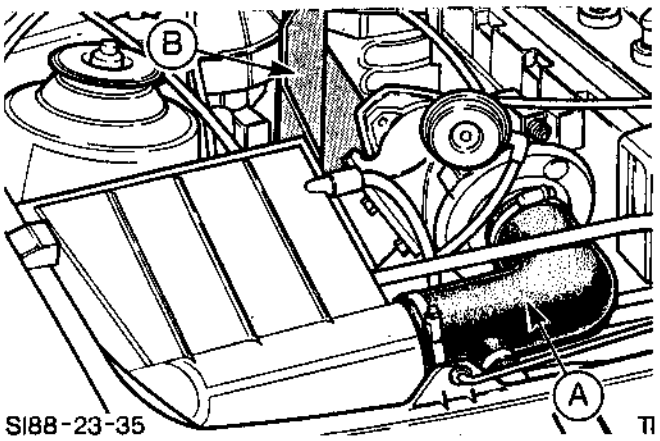


Fig.49. Oil pressure hose connection.

34. Fit both hoses connecting solenoid control valve to turbocharger and actuator.

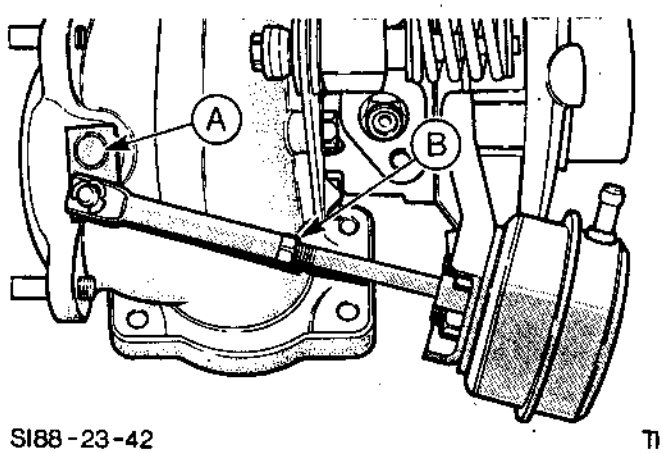
35. Fit heat shield assembly.



36. Fit top air hose to air cleaner, bypass valve and turbocharger.

Fig.50. A - Top air hose
B - Heat shield

37. Reconnect battery earth cable and remove fender covers.



38. Check waste gate valve setting and adjust rod if necessary (see Repair Operation 23 601 0).

Fig.51. A - Waste gate valve
B - Adjust rod

23 616 0 SOLENOID CONTROL VALVE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

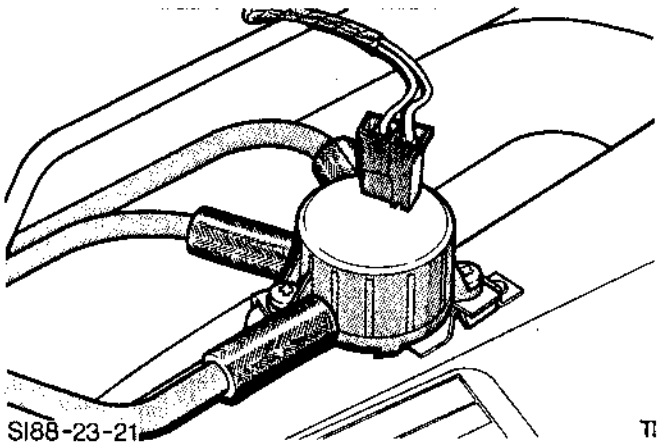


Fig.52. Solenoid control valve.

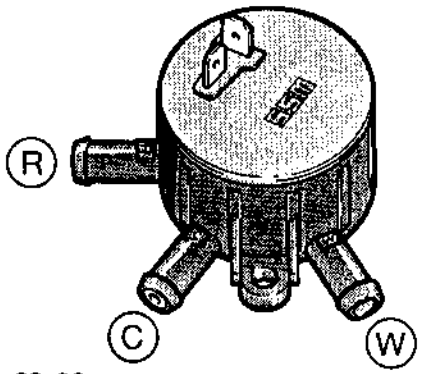


Fig.53. Solenoid control valve removed.

To Remove

1. Fit fender covers and disconnect battery earth cable.
2. Remove multiplug.
3. Remove the three hoses from the solenoid control valve.
4. Remove securing screws and detach the solenoid control valve.

To Install

5. Refit solenoid control valve and fully tighten the securing screws.
6. Reconnect the three air hoses:
   - air hose of turbocharger waste gate actuator to connection W (W - waste gate)
   - air hose of turbocharger compressor housing to connection C (C - compressor)
   - air hose of air cleaner to connection R (R - return)
7. Reconnect multiplug.
8. Reconnect battery and remove fender covers.

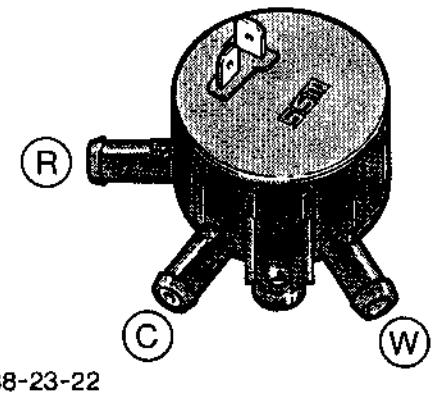
23 620 0 INTERCOOLER - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.

2. Remove solenoid control valve from intercooler (2 bolts). Disconnect multiplug.

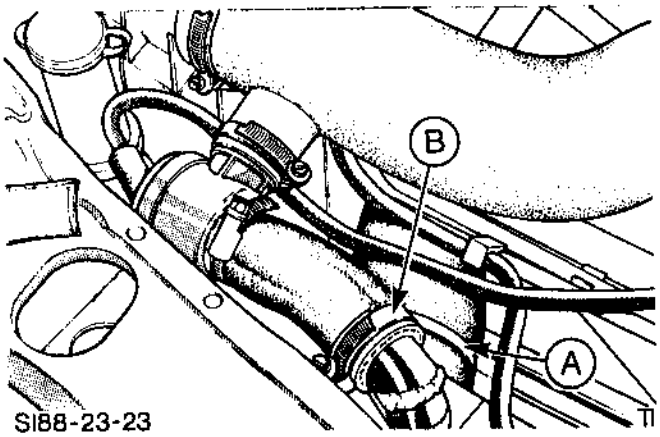


SI88-23-22 TI

Fig.54. Solenoid control valve.

3. Remove bypass hose from intercooler and rotate to give adequate clearance when removing intercooler.

4. Remove air hoses (left and right) from intercooler.



SI88-23-23 TI

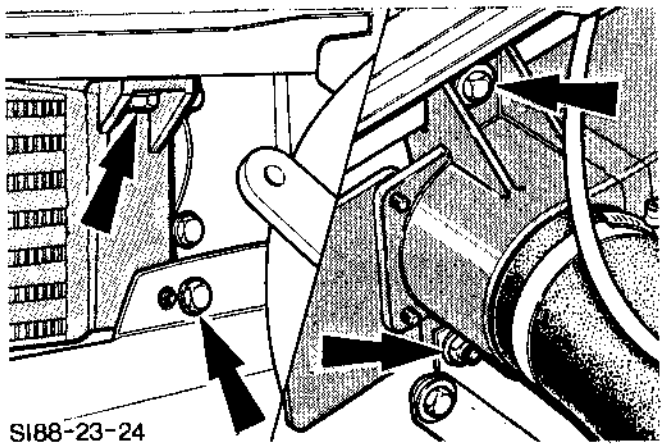
Fig.55. A - Air cleaner intake
B - Bypass hose

5. Remove air cleaner intake,(1 plastic expansion rivet) from intercooler. Remove air cleaner cover.

6. Pre '88 Model Year only. Remove radiator grille.

7. Remove air duct plate from intercooler (2 bolts).

8. Remove intercooler from upper front body crossmember (2 bolts).



SI88-23-24

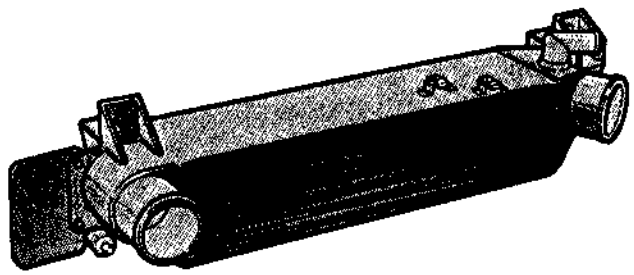
Fig.56. Intercooler retaining bolts (1 side shown).

23 620 0

9. Remove intercooler from above radiator (2 nuts).

10. Raise vehicle on a ramp.

11. Loosen six clips retaining air shroud and two bottom radiator mounting bolts to release radiator and remove intercooler.



SI88-23-25

Fig.57. Intercooler assembly.

To Install

12. Position intercooler, tighten bottom radiator bolts and fasten air shroud with 6 clips.

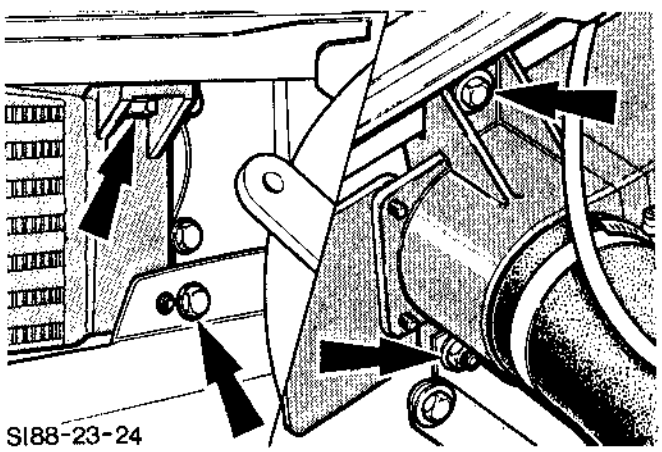
13. Lower vehicle to the ground.

14. Fit top of intercooler to radiator (2 nuts).

15. Fit intercooler to upper front body cross-member (4 bolts).

16. Fit air shroud to intercooler (2 bolts).

17. If removed, fit radiator grille (4 bolts).



SI88-23-24

Fig.58. Intercooler mounting bolts (1 side shown).

18. Fit air cleaner intake to intercooler (1 plastic expansion rivet).

NOTE: Use new plastic expansion rivet to fit air cleaner intake connection.

19. Fit left and right-hand air hoses to intercooler.

20. Fit air cleaner cover complete with hoses.

21. Refit bypass valve hose to intercooler.

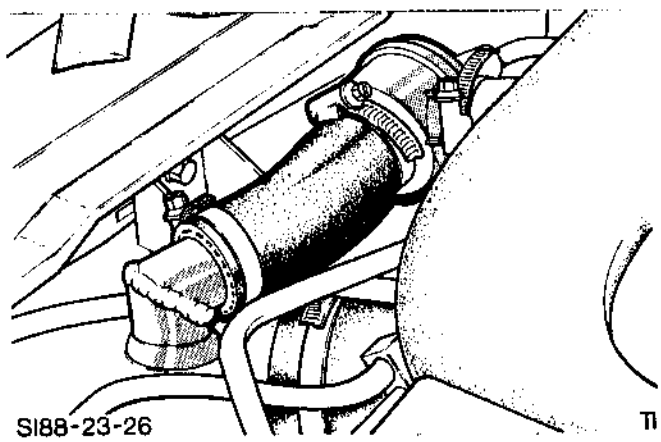


Fig.59. Top air hose and bypass valve hose.

22. Fit solenoid control valve to intercooler and connect plug.

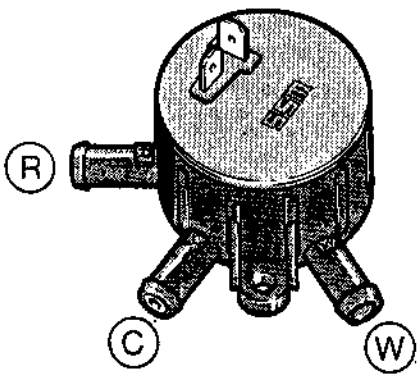


Fig.60. Solenoid control valve.

23. Reconnect battery earth cable and remove fender covers.

29 622 0 AIR CHARGE TEMPERATURE SENSOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

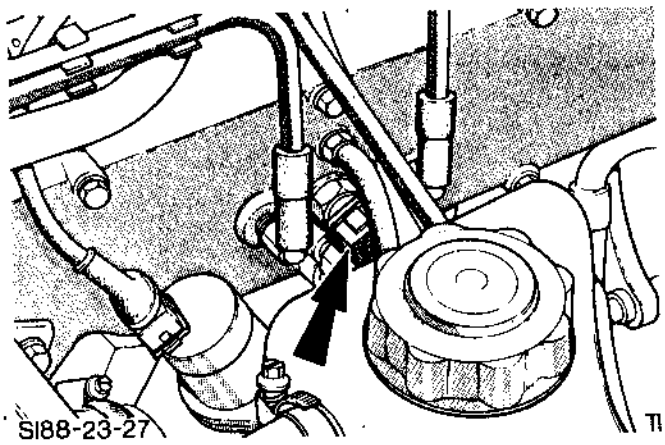


Fig.61. Air charge temperature sensor.

To Remove

1. Fit fender covers and disconnect battery earth cable.

2. Remove multiplug.

3. Using a suitable spanner, remove the sensor from air chamber.

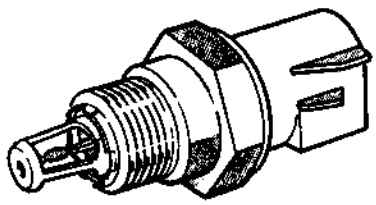


Fig.62. Air charge temperature sensor removed.

To Install

4. Apply sealant to sensor (see Technical Data) and refit sensor to air chamber.

5. Tighten sensor to specified torque (refer to Technical Data).

6. Reconnect multiplug and battery and remove fender covers.

Cooling System 24

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24 222 0 Fan Motor - Remove and Install	-	3
24 254 0 Radiator - Remove and Install	-	5
24 404 0 Water Pump Assembly - Remove and Install	-	9

TECHNICAL DATA

Coolant Capacity

Including heater circuit and degas tank	7,5 litres

Engine Coolant (All Climates)

Type	Motorcraft Antifreeze Super Plus
Specification No.	SSM-97B-9103-A

Pressure Cap

Releasing pressure	0,85 to 1,10 bar

Thermostat

Nominal temperature rating	88°C
Opening temperature	76°C to 88°C

Drive Belt Tensions

Alternator - new	400 to 500 N
- used	300 to 400 N
Power assisted steering - new	450 to 550 N
- used	350 to 450 N

Tightening Torques

	Nm	lbf,ft
Radiator to front body panel	8,0 to 12,0	6.0 to 9,0
Water pump retaining bolts	9,0 to 13,0	7,0 to 9,5
Water pump pulley retaining bolts	20,5 to 25,5	15,0 to 19,0
Alternator adjusting strap to to water pump	18,0 to 25,0	13,0 to 19,0
Alternator adjusting strap to alternator	18,0 to 25,0	13,0 to 19,0
Alternator to bracket	18,0 to 25,0	13,0 to 19,0
Fan motor to shroud	8,0 to 10,0	6,0 to 7,5
Fan motor shroud to radiator	6,8 to 9,5	5,0 to 7,0

SERVICE AND REPAIR OPERATIONS

24 222 0 FAN MOTOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery earth cable.

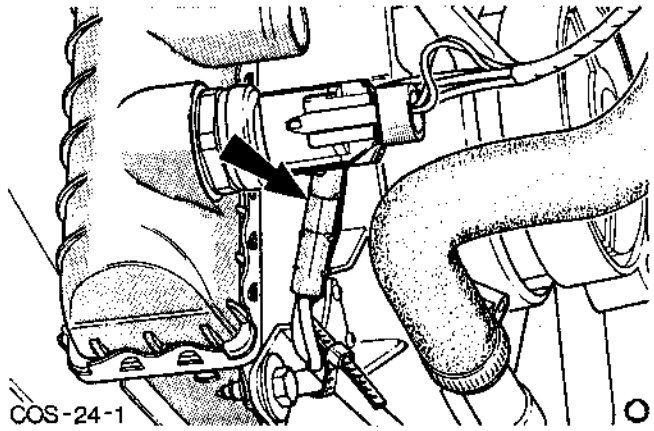


Fig.1. Disconnect fan motor electrical connection.

2. Raise vehicle on ramp.

3. Disconnect fan motor electrical cable. Remove screws securing transfer tube to radiator.

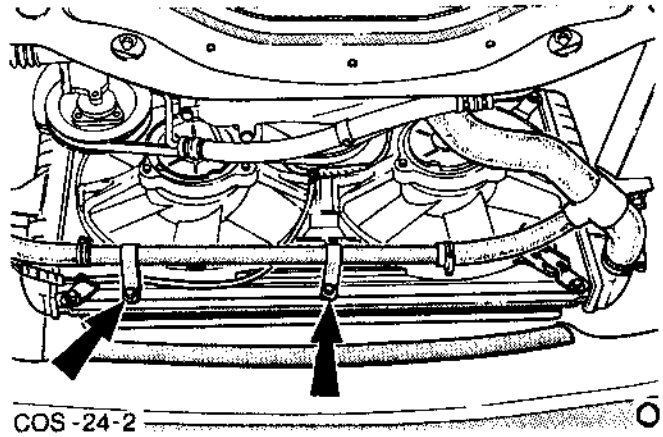


Fig.2. Transfer tube support bracket retaining bolts.

4. Remove fan shroud retaining screws from radiator and remove assembly from below vehicle.

5. Remove fan motor/s from shroud (3 bolts).

6. Disconnect electrical connection between motor assemblies.

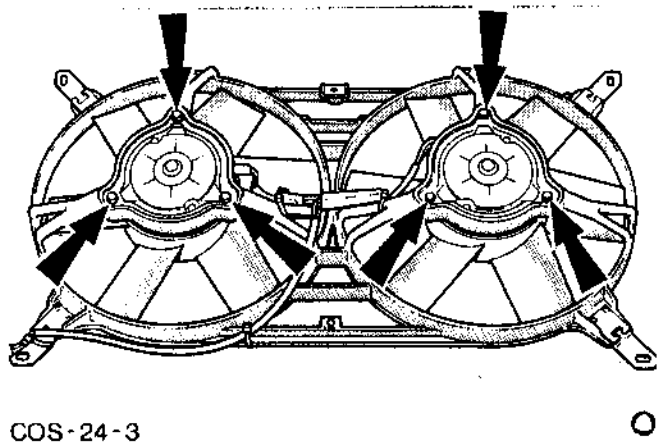


Fig.3. Remove fan motor from shroud.

7. Remove fan from motor (1 snap ring).

To Install

8. Fit fan to motor and fasten with snap ring.

NOTE: Slide the retaining lug on motor driveshaft into groove in fan.

9. Fit fan motor/s to shroud (3 bolts).

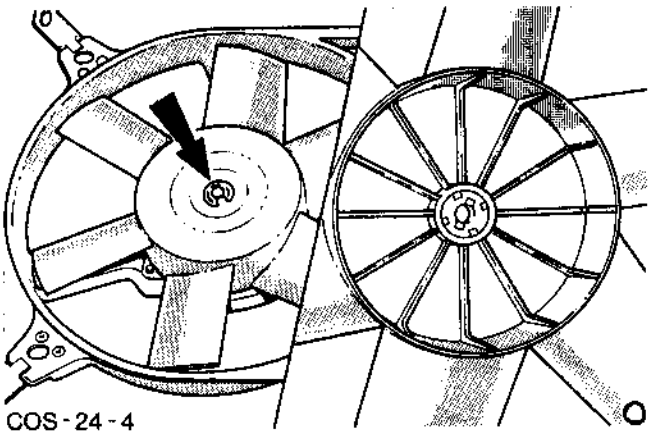


Fig.4. Fan groove and retaining clip.

10. Connect electrical cable connection between fan motor assemblies.

11. Position fan shroud assembly on radiator from below vehicle and secure shroud to radiator.

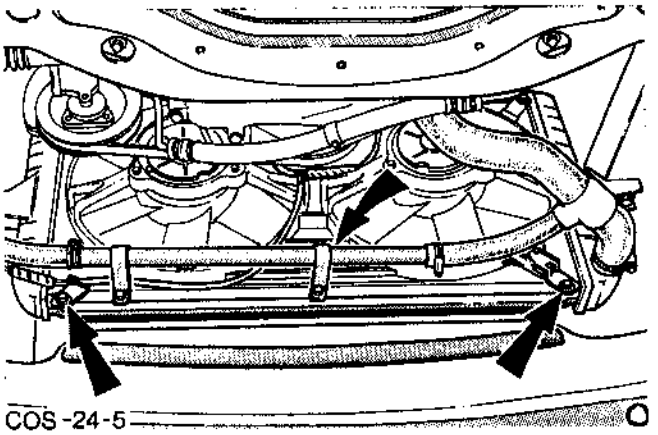


Fig.5. Fit fan motor shroud to radiator. (viewed from below)

12. Reconnect fan motor cable to main loom.

13. Locate transfer tube to radiator and secure.

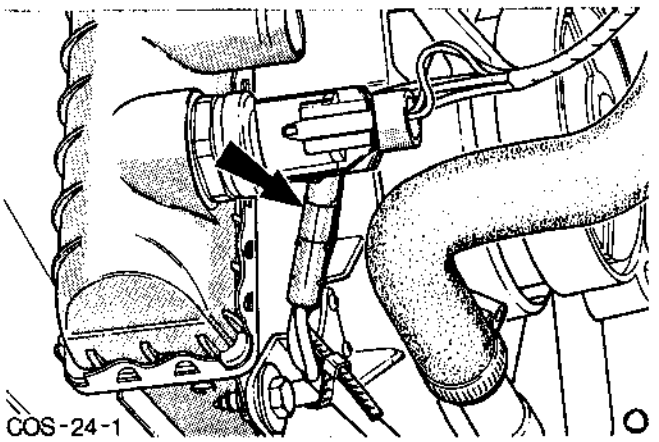


Fig.6. Connect fan motor cable.

14. Lower vehicle to ground.

15. Reconnect battery, remove fender covers and close hood.

24 254 0 RADIATOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

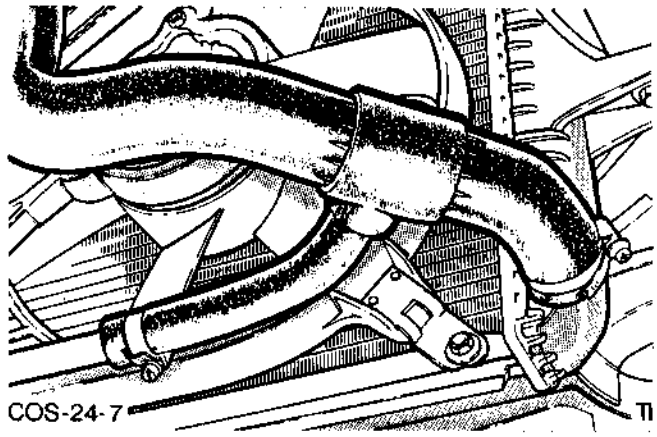


Fig.7. Remove lower radiator coolant hose.

2. Position drain tray below radiator and relieve system pressure by slowly unscrewing degas tank cap.

NOTE: When releasing system pressure, cover cap with thick cloth to prevent coolant scalding.

3. Remove lower coolant hose from radiator and drain coolant into tray.

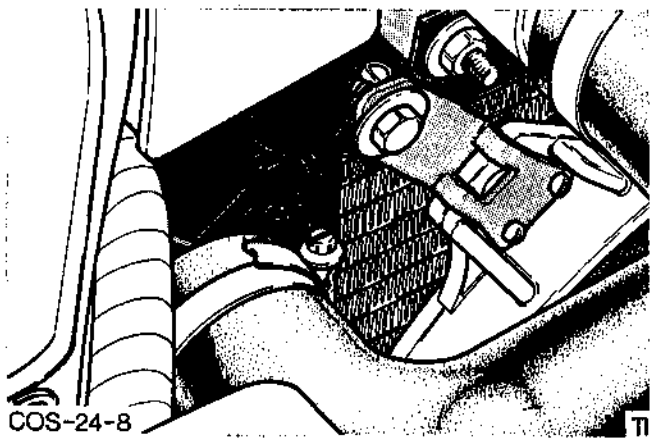


Fig.8. Remove radiator top hose.

4. Remove radiator top hose from hose connection.

5. Remove nuts securing intercooler to radiator.

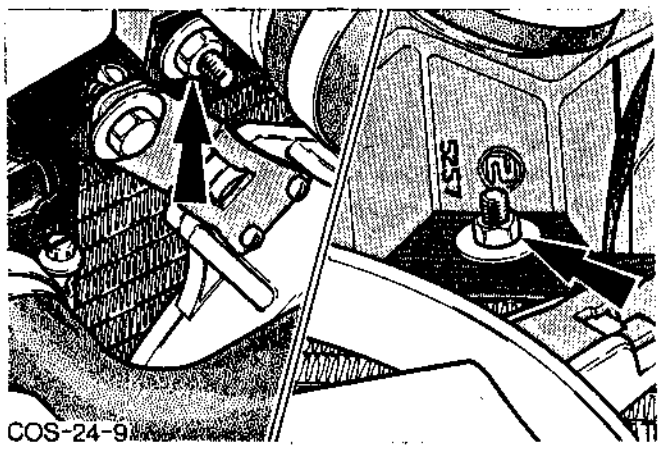


Fig.9. Detach radiator from intercooler (2 nuts).

6. Raise vehicle.

7. Disconnect cable from thermo-sensor and fan motors.

8. Remove coolant transfer tube from bottom of radiator.

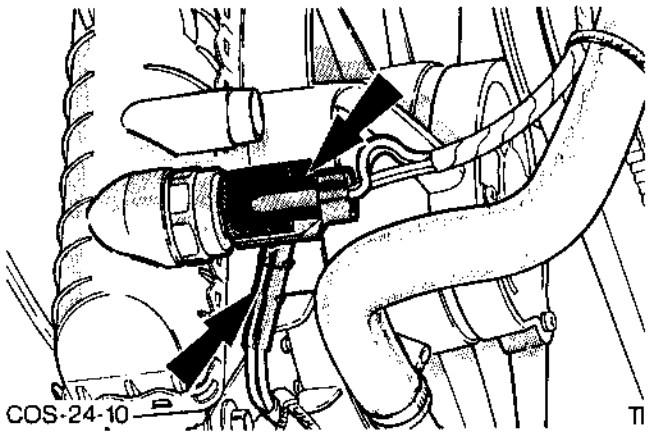


Fig.10. Disconnect electrical connection from radiator.

9. Remove radiator mounting bolts and lower radiator, complete with shroud assembly, from below vehicle.

10. Check radiator hoses for damage and renew if required.

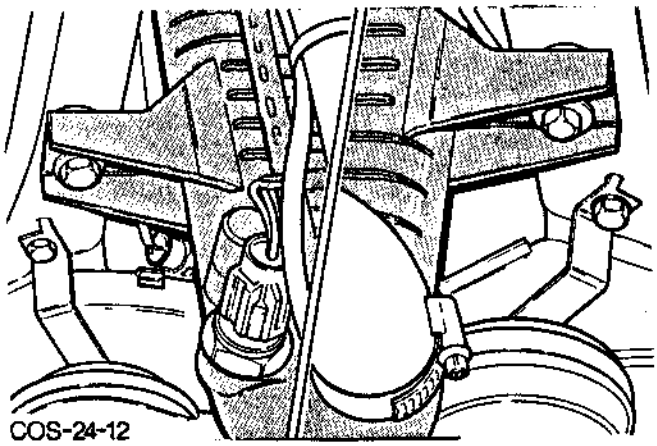


Fig.11. Radiator mounting bolts.

11. Unscrew thermo-sensor from radiator and fit to radiator.

NOTE: Use new gasket when fitting thermo-sensor.

12. Unscrew fan motors and shroud assembly from radiator and remove securing clips from radiator body.

13. Remove radiator mounting bushes and sleeve.

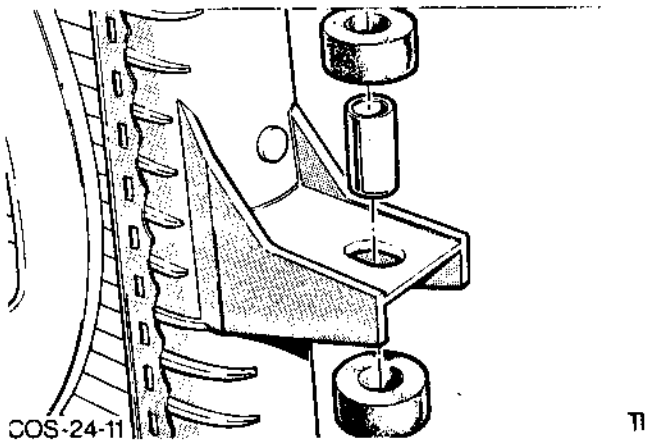


Fig.12. Remove radiator mounting bushes.

To Install

14. Refit radiator mounting bushes and fan shroud securing clips. Refit thermo-sensor switch and new gasket.

15. Refit fan motor and shroud assembly.

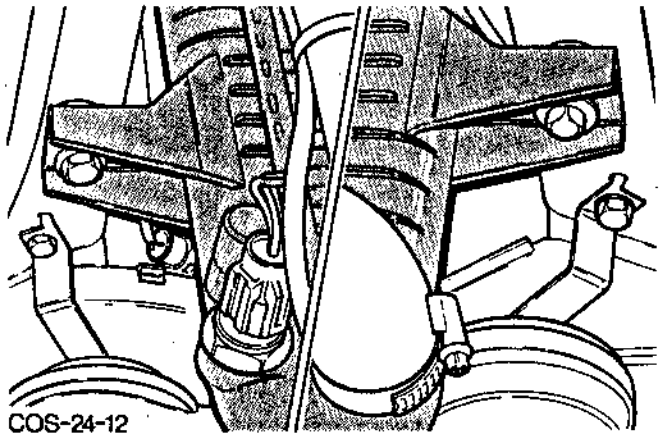


Fig.13. Radiator retaining bolts.

16. Position radiator from below vehicle onto radiator support brackets and fit retaining bolts. Torque bolts to specification.

17. Connect transfer tube to bottom of radiator.

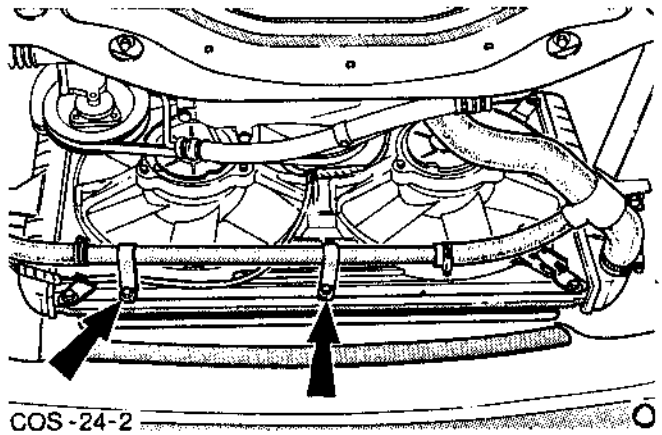


Fig.14. Transfer tube securing screws.

18. Reconnect lower coolant hose to radiator.

19. Reconnect fan motor electrical connection and thermo-sensor connection.

20. Lower vehicle.

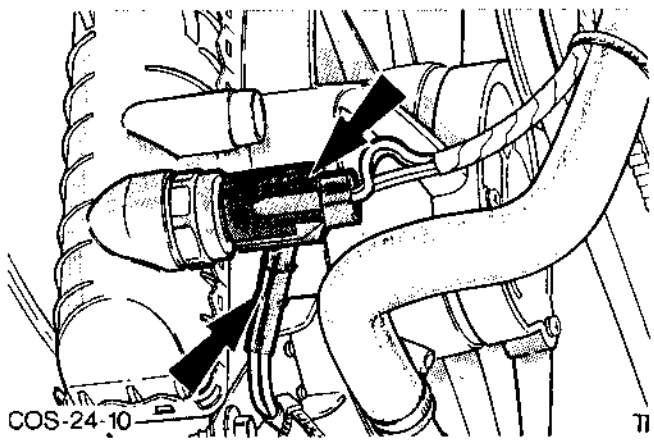


Fig.15. Connect cables to thermo-sensor and fan motors.

24 254 0

21. Resecure intercooler to top of radiator.

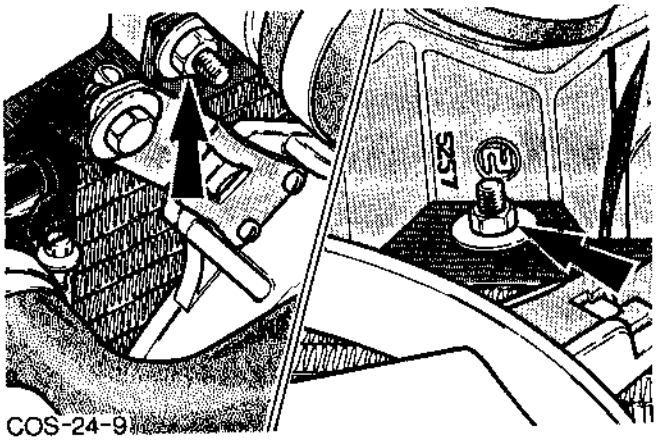


Fig.16. Radiator to intercooler securing nuts.

22. Reconnect radiator top hose.

23. Top-up cooling system.

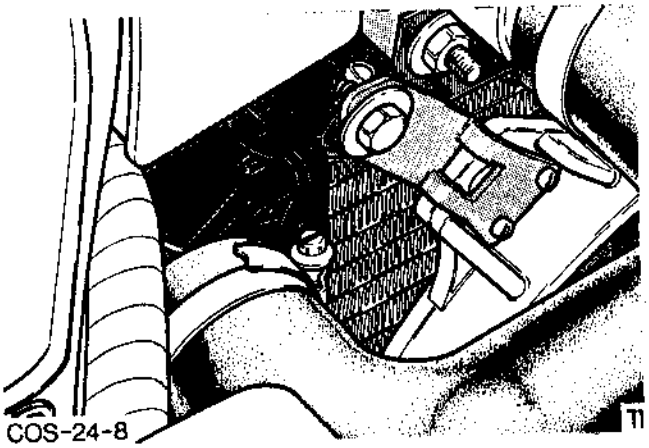


Fig.17. Radiator top hose connection.

24. Connect battery cable.

25. Start engine and allow to warm up to operating temperature.

    Check coolant level and top up if required.
    Check hose connections for leaks.

26. Remove fender covers and close hood.

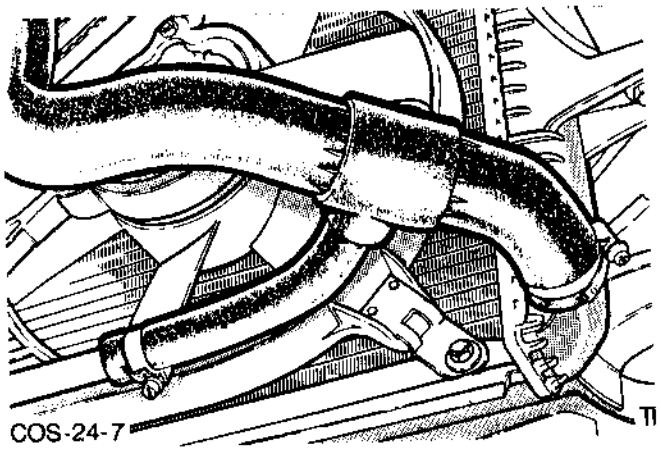


Fig.18. Lower coolant hose connection.

24 404 0 WATER PUMP ASSEMBLY - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery earth cable. Relieve system pressure by slowly unscrewing degas tank cap.

NOTE: When releasing system pressure, cover cap with thick cloth to prevent coolant scalding.

2. Remove toothed drive belt cover retaining screws.

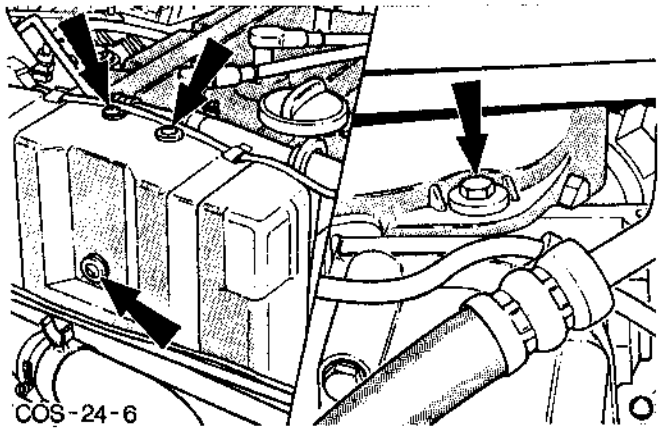


Fig.19. Toothed drive belt cover retaining screws.

3. Position clean drain tray below engine, detach bottom hose from radiator and drain coolant.

4. Remove bottom coolant hose from water pump.

5. Remove heater hose from water pump.

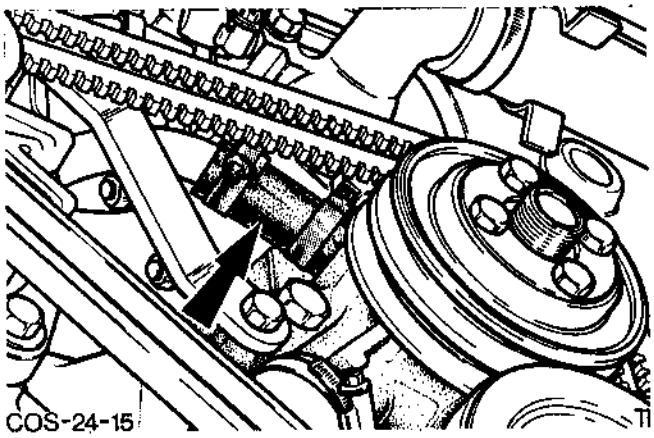


Fig.20. Heater hose - water pump.

6. Remove bolts securing water pump pulley to drive flange.

7. Remove water pump drive belt by loosening alternator adjusting strap.

8. Remove water pump pulley.

9. Remove bolts securing water pump to cylinder block. Remove single bolt securing alternator adjuster strap to water pump body.

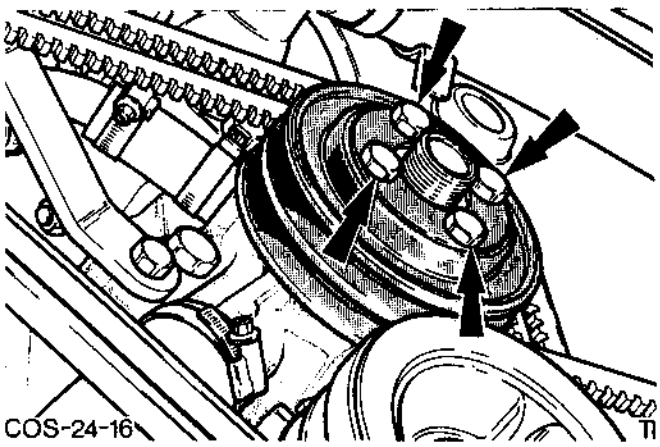


Fig.21. Remove water pump pulley retaining bolts.

24 404 0

To Install

10. Using new gasket, position and secure water pump assembly to cylinder block. Reconnect alternator adjusting strap to water pump body.

11. Fit drive belt pulley to water pump.

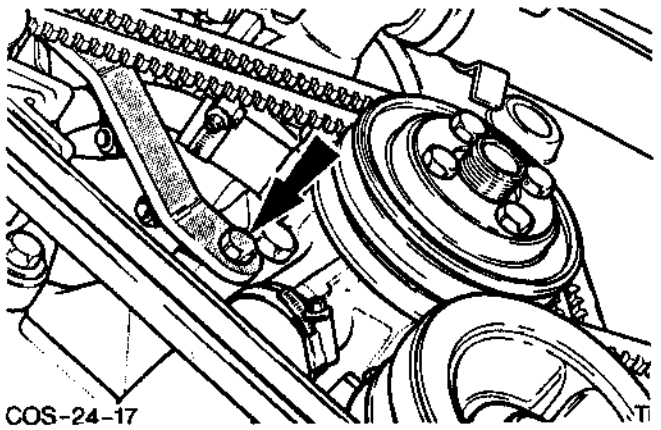


Fig.22. Alternator adjusting strap pivot bolt.

12. Refit and tension water pump drive belts.

    Swing alternator downwards to apply the necessary tension to the drive belt (see Technical Data) and tighten alternator mounting bolts.

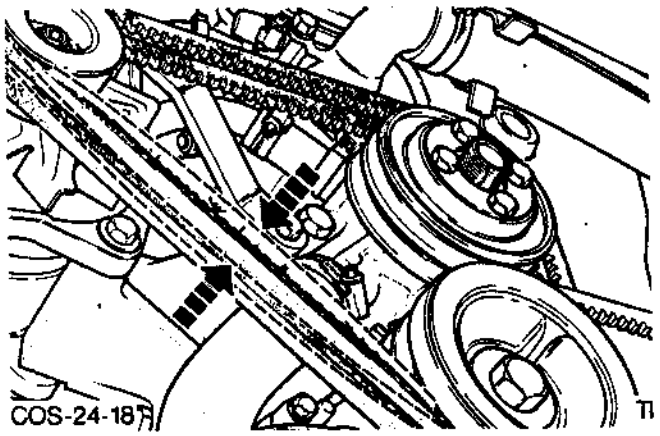


Fig.23. Adjust drive belt tension.

13. Tighten drive belt pulley bolts.

14. Refit heater hose to water pump.

15. Refit lower coolant hose to water pump and radiator.

16. Refit toothed belt cover.

17. Fill cooling system. Start engine and allow to warm up to normal operating temperature. Check coolant level and check hose connections for leaks.

18. Reconnect battery, remove fender covers and close hood.

COOLING SYSTEM
(COSWORTH 4x4 Variants only) 24B

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24 454 0	Thermostat - Remove and Install	-	15

Coolant Capacity

Including heater circuit and degas tank .. .. 7,5 litres

Antifreeze

Type .. .. Ford Super Plus 4 Antifreeze

Specification No. ESD-M97B49-A

Concentration

Specific Gravity (providing no other additive is in coolant)	Approximate Precentage of antifreeze (by volume)	Remains fluid to		Solidifies at	
		°C	°F	°C	°F
1,069 at +15°C	45	-30	-22	-38	-36

A 45% concentration of Motorcraft Super Plus 4 antifreeze, which contains a powerful corrosion inhibitor, should remain in the cooling system for a maximum period of 4 years (regardless of climate) before being renewed. If only water is used as a coolant, severe corrosion could result.

Coolant top ups in service should be 50/50 mix for convenience.

Pressure Cap

Releasing pressure .. .. 0,85 to 1,10 bar

Thermostat

Nominal temperature rating .. .. 88°C

Opening temperature .. .. 76°C to 88°C

Drive Belt Tensions

Alternator - new .. .. 400 to 500 N

- used .. .. 300 to 400 N

Power assisted steering - new .. .. 450 to 550 N

- used .. .. 350 to 450 N

Tightening Torques	Nm	lbf,ft
Radiator to front body panel	8,0 to 12,0	6.0 to 9,0
Water pump retaining bolts	9,0 to 13,0	7,0 to 9,5
Water pump pulley retaining bolts	20,5 to 25,5	15,0 to 19,0
Alternator adjusting strap to to water pump	18,0 to 25,0	13,0 to 19,0
Alternator adjusting strap to alternator	18,0 to 25,0	13,0 to 19,0
Alternator to bracket	18,0 to 25,0	13,0 to 19,0
Fan motor to shroud	8,0 to 10,0	6,0 to 7,5
Fan motor shroud to radiator	6,8 to 9,5	5,0 to 7,0

The major cooling system components comprise an aluminium radiator core with plastic end tanks, water circulation pump, thermostat and electrically driven cooling fan. In addition, a plastic degas tank is used to ensure that the system is maintained at the correct volume of coolant.

The wax type thermostat ensures rapid engine warm up by restricting coolant flow at lower operating temperatures, it also assists in maintaining engine operating temperatures between pre-determined limits.

The radiator is of an aluminium construction with plastic end tanks.

The twin electric cooling fans are mounted within a shroud behind the radiator and are operated by a thermal switch. This actuates the fans when coolant temperatures reach a specific level.

ANTIFREEZE

Antifreeze content should be checked through the degas tank filler neck with a hydrometer. The specific gravity (sg) of correctly balanced coolant is 1,069 (sg) at 15°C, which indicates an antifreeze concentration of 45%. If the concentration falls below 45% there is insufficient low temperature protection and the corrosion resistance will be inadequate. In such cases, the concentration must be brought back to specification.

Changing coolant:

New Motorcraft Antifreeze Super Plus 4, in the correct proportions, will protect the cooling system against frost damage for an indefinite period, but its corrosion inhibitors lose their effectiveness after prolonged use. Therefore the cooling system should be drained, by removing the drain plug, and back-flushed every four years. The system should then be refilled using new Motorcraft Antifreeze Super Plus 4, Ford Specification No. ESD-M97B49-A, to the correct proportions (45% antifreeze).

NOTE: For normal top-up purposes, it is recommended that a mixture of 50% antifreeze/50% water is used.

Antifreeze contains monoethylene glycol and other constituents which are toxic if taken internally and can be absorbed into the skin with prolonged contact.

The following precautions must be taken to promote the safe handling of antifreeze

1. Antifreeze must never be taken internally. If antifreeze is swallowed accidentally, medical advice must be sought immediately.

2. Precautions should be taken to avoid skin contact. In the event of accidental spillage onto the skin, antifreeze should be washed off as soon as practicable. If clothing is splashed with antifreeze, it should be removed and washed before being worn again, to avoid prolonged skin contact.

3. For regular and frequent handling of antifreeze, protective clothing (plastic or rubber gloves, boots and impervious overalls or aprons) must be used to minimise skin contact.

SPECIAL SERVICE TOOL RECOGNITION

TOOL	TOOL NAME
	NO SPECIAL SERVICE TOOLS REQUIRED

GENERAL EQUIPMENT

- Cooling system pressure tester

24 222 0 FAN MOTOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

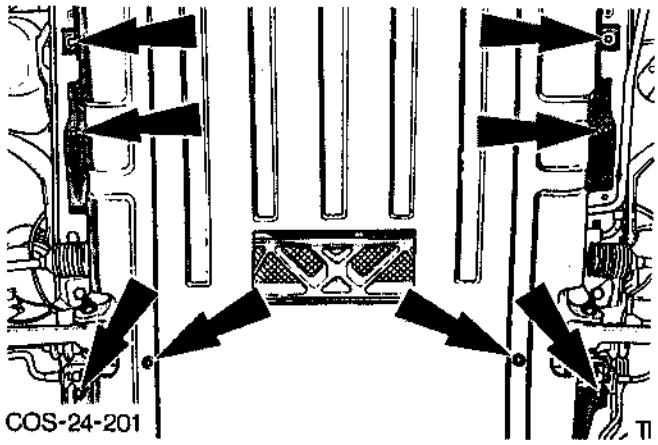


Fig.1. Sump guard securing bolts.

2. Raise vehicle on a ramp.

3. Remove sump guard (eight securing bolts) and position clear of vehicle, refer to Fig.1.

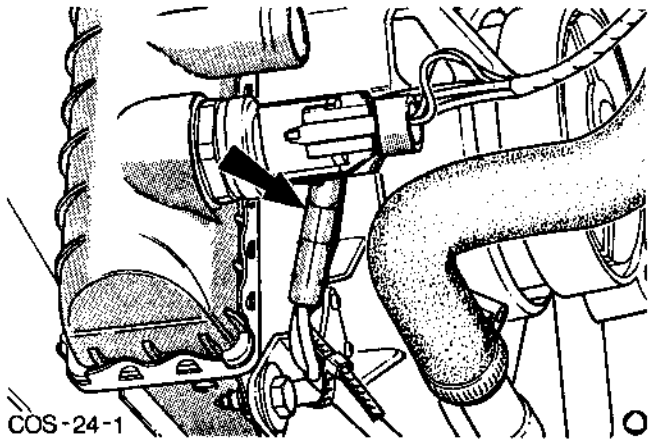


Fig.2. Fan motor electrical connection.

4. Disconnect fan motor electrical connections, refer to Fig.2. Remove screws securing transfer tube to radiator, refer to Fig.3.

5. Remove fan shroud retaining screws from radiator and remove assembly from below vehicle.

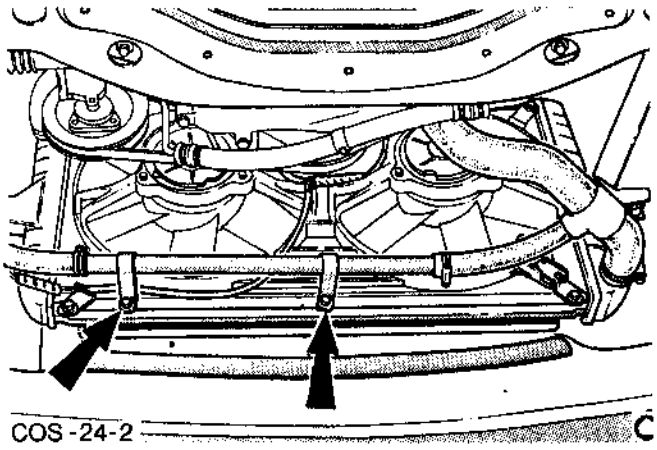


Fig.3. Transfer tube support bracket retaining screws.

6. Remove fan motor/s from shroud (3 bolts each).

7. Disconnect electrical connection between motor assemblies.

To Install

8. Fit fan motor/s to shroud (3 bolts each).

9. Connect electrical cable connection between fan motor assemblies.

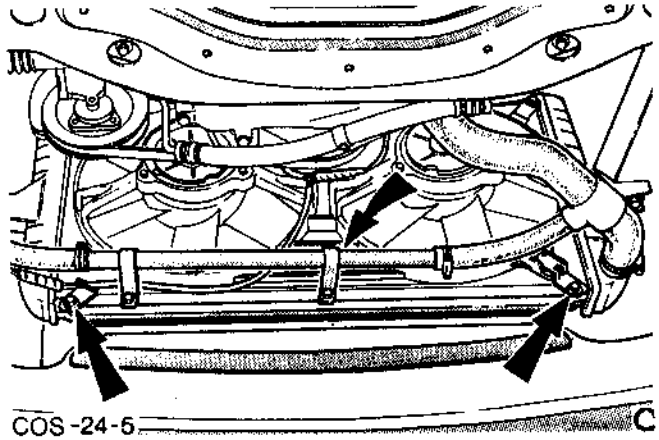


Fig.4. Fit fan motor shroud to radiator. (Viewed from below vehicle)

10. Position fan shroud assembly on radiator from below vehicle and secure shroud to radiator (four securing screws).

11. Reconnect fan motor cable to main loom.

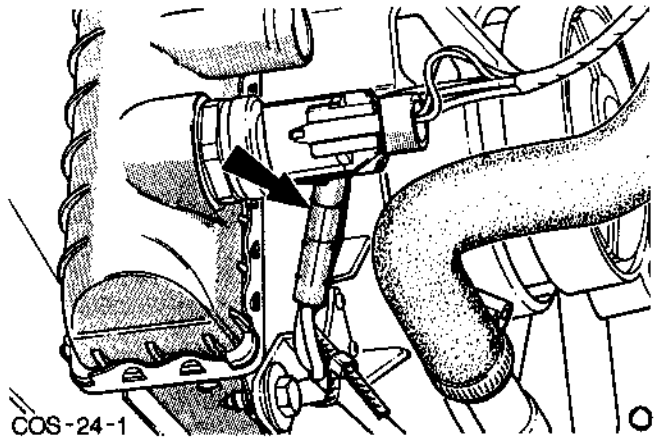


Fig.5. Connect fan motor cable.

12. Locate transfer tube to radiator and secure.

13. Refit sump guard and secure, refer to Fig.6.

14. Lower vehicle to the ground.

15. Reconnect battery earth cable.

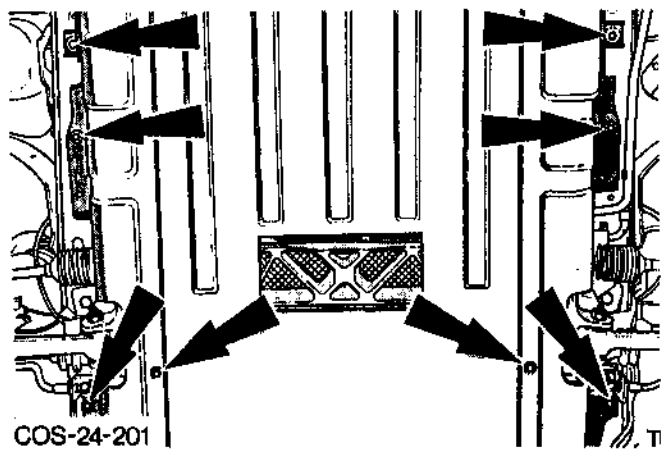


Fig.6. Sump guard securing bolts.

24 254 0 RADIATOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

WARNING: When releasing system pressure, cover cap with thick cloth to prevent coolant scalding.

2. Raise vehicle on a ramp.

3. Remove sump guard securing bolts and position clear of vehicle, refer to Fig.1.

4. Position drain tray below radiator bottom hose and relieve system pressure by slowly unscrewing degas tank cap.

5. Remove lower coolant hose from radiator and drain coolant into tray.

6. Disconnect top hose from radiator and water pump and remove.

7. Disconnect coolant and power steering pipes from radiator and chassis rail, Fig.2. (4 bolts).

8. Remove both nuts securing intercooler to radiator.

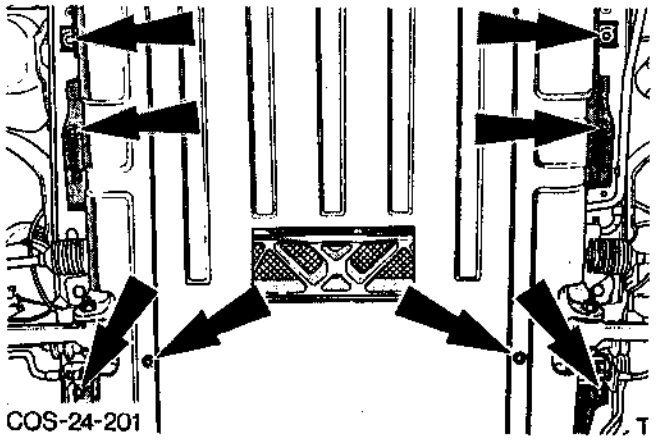


Fig.1. Sump guard securing bolts.

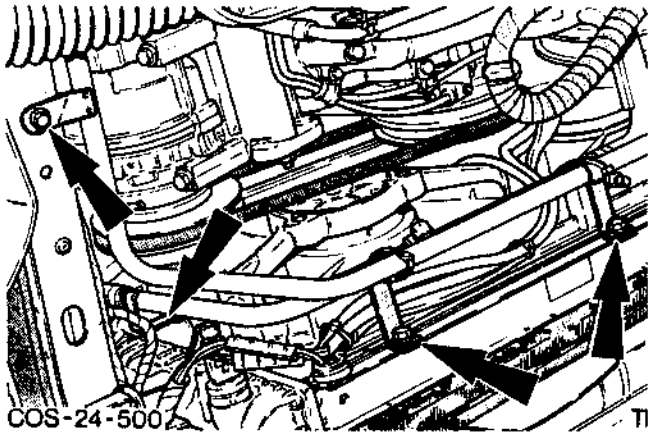


Fig.2. Remove coolant and power steering securing bolts.

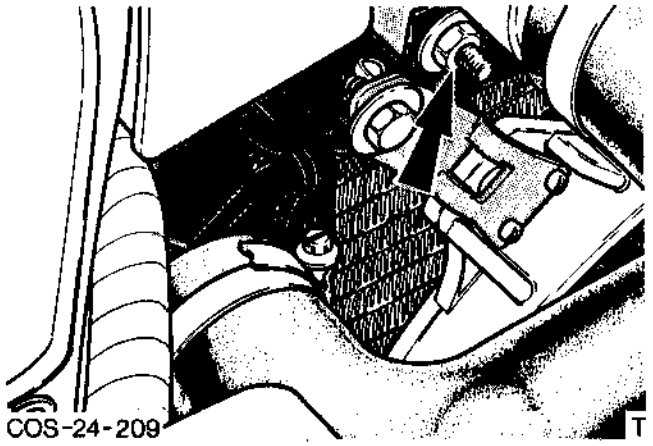


Fig.3. Detach radiator from intercooler (2 nuts). (One shown)

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9. Disconnect both thermal sensor and fan motor multiplugs, refer to Fig.4.

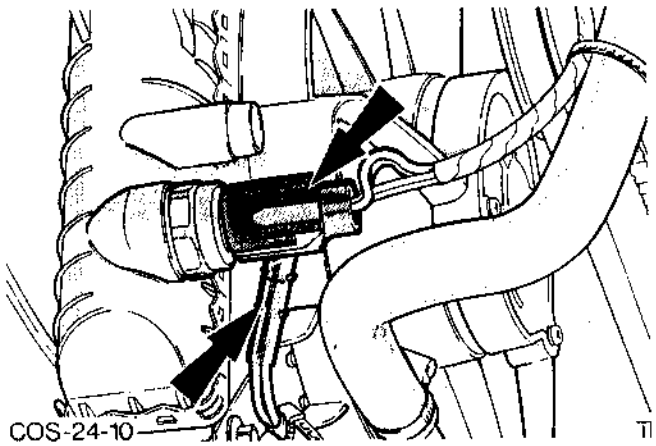


Fig.4. Disconnect electrical connections from radiator.

10. Remove radiator mounting bolts, refer to Fig.5 and lower radiator, complete with shroud assembly, from underneath vehicle.

11. Check radiator hoses for damage and renew if necessary.

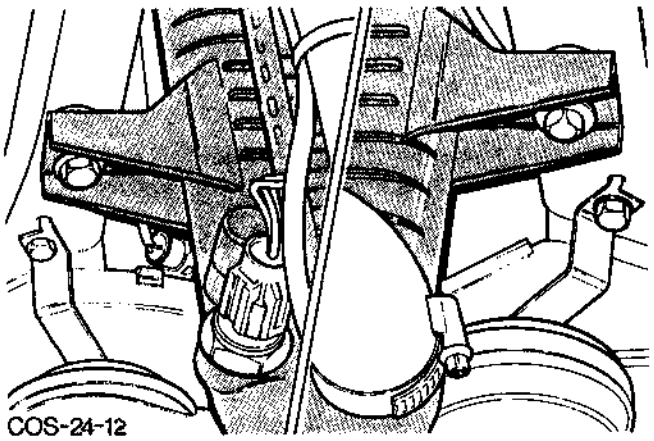


Fig.5. Radiator mounting bolts.

12. Unscrew thermal sensor from radiator.

13. Unscrew shroud assembly complete with fan motors from radiator and remove securing clips from radiator body.

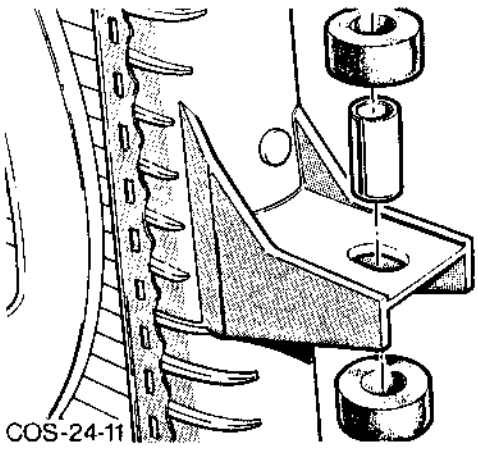


Fig.6. Remove radiator mounting bushes.

14. Remove radiator mounting bushes and sleeve, refer to Fig.6.

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To Install

15. Refit radiator mounting bushes and fan shroud securing clips. Refit thermo-sensor and new gasket.

NOTE: Use new gasket when refitting thermo-sensor.

16. Refit shroud assembly complete with fan motors to radiator, refer to Fig.7.

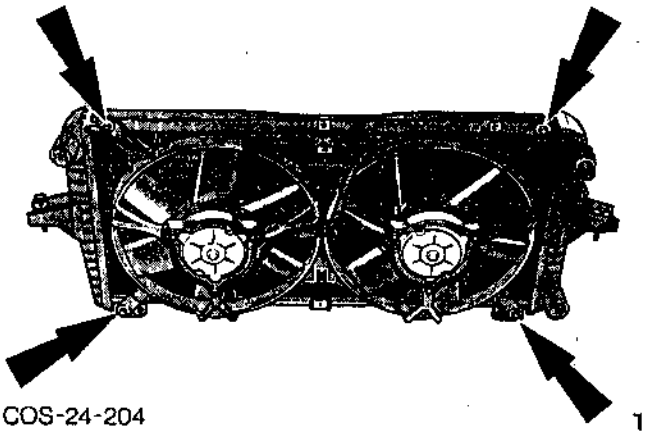


Fig.7. Shroud assembly securing screws.

17. Position radiator from below vehicle onto radiator support brackets and fit retaining bolts, refer to Fig.8. Torque bolts to specification, (see Technical Data).

18. Secure coolant and power steering tubes to bottom of radiator and chassis rail (4 bolts).

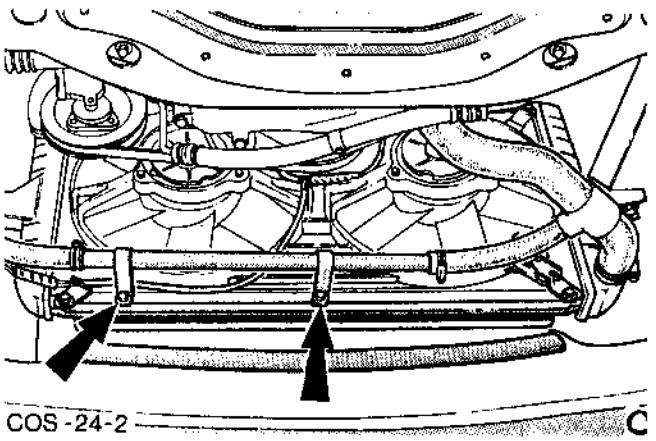


Fig.8. Radiator retaining bolts.

19. Reconnect lower coolant hose to radiator, Fig.9.

20. Reconnect both fan motor and thermo-sensor multiplugs.

21. Refit sump guard and secure.

22. Lower vehicle to the ground.

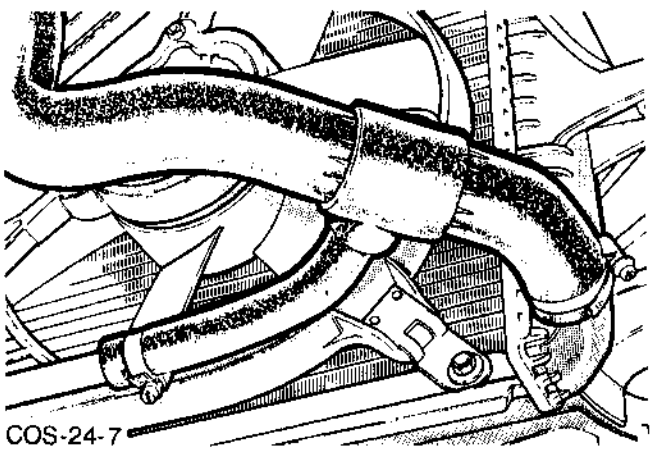


Fig.9. Lower coolant hose connection.

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23. Secure intercooler to top of radiator.

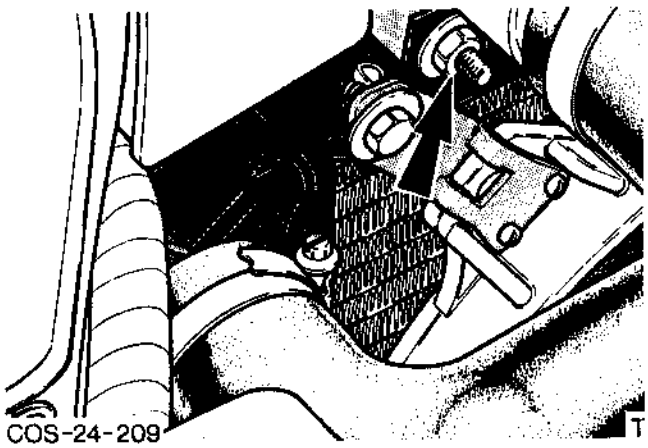


Fig.10. Radiator to intercooler securing nuts. (One shown)

24. Refit radiator top hose.

25. Top-up cooling system.

26. Connect battery earth cable.

27. Start engine and allow to warm up to operating temperature.

    Check coolant level and top up if required.
    Check hose connections for leaks.

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24 404 0 WATER PUMP ASSEMBLY - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

WARNING: When releasing system pressure, cover cap with thick cloth to prevent coolant scalding.

1. Disconnect battery earth cable. Relieve system pressure by slowly unscrewing degas tank cap.

2. Remove toothed drive belt cover retaining screws.

3. Position clean drain tray below radiator, detach bottom hose from radiator and drain coolant.

4. Remove bottom coolant hose from water pump.

5. Remove heater hose from water pump.

6. Remove bolts securing water pump pulley to drive flange.

7. Remove water pump drive belt by loosening alternator adjusting strap.

8. Remove water pump pulley.

9. Remove bolts securing water pump to cylinder block. Remove single bolt securing alternator adjuster strap to water pump body.

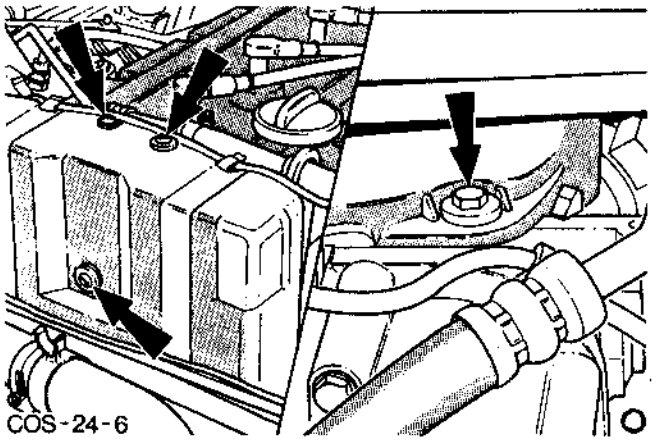


Fig.1. Toothed drive belt cover retaining screws.

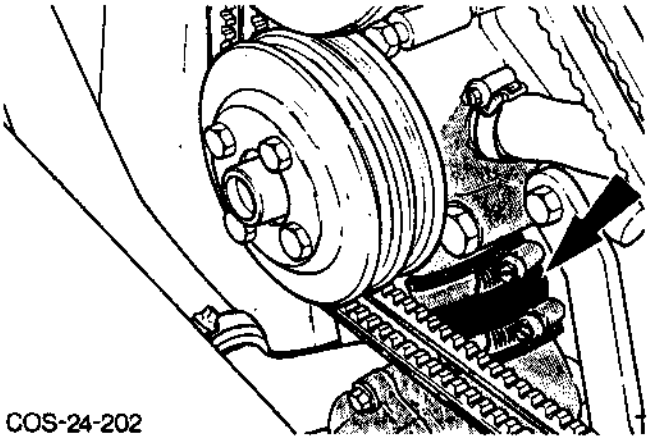


Fig.2. Heater hose - water pump.

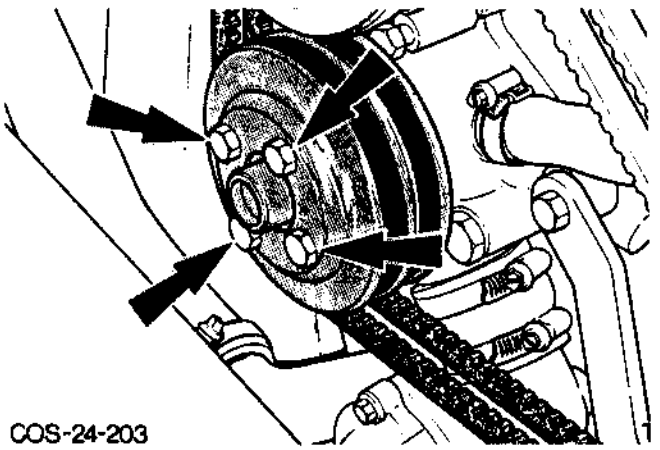


Fig.3. Remove water pump pulley retaining bolts.

To Install

10. Using new gasket, position and secure water pump assembly to cylinder block. Reconnect alternator adjusting strap to water pump body.

11. Fit drive belt pulley to water pump.

12. Refit and tension water pump drive belts.

    Swing alternator downwards to apply the necessary tension to the drive belt (see Technical Data) and tighten alternator mounting bolts.

13. Tighten drive belt pulley bolts.

14. Refit heater hose to water pump.

15. Refit lower coolant hose to water pump and radiator.

16. Refit toothed belt cover.

17. Reconnect battery.

18. Fill cooling system. Start engine and allow to warm up to normal operating temperature. Check coolant level and check hose connections for leaks.

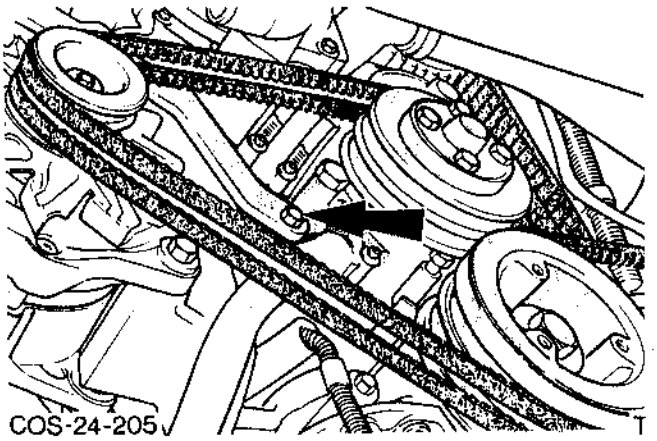


Fig.4. Alternator adjusting strap pivot bolt.

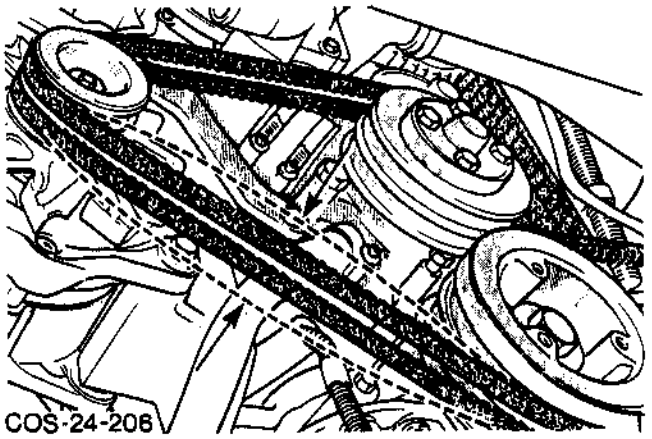


Fig.5. Adjust drive belt tension.

24 451 0 THERMOSTAT - TEST (THERMOSTAT REMOVED)

SPECIAL SERVICE TOOLS REQUIRED: NONE

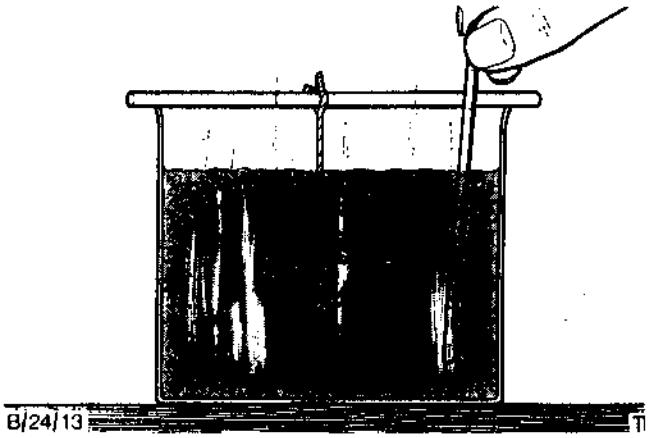


Fig.1. Testing thermostat.

To Test

1. Suspend thermostat in water in a suitable container. Ensure thermostat does not touch sides of container, refer to Fig.1.

2. Gradually heat water, frequently checking temperature with an accurate thermometer.

3. Observe thermostat opening temperature and check with specification on thermostat upper face.

NOTE: It is only possible to check the opening temperature and not the fully open condition, this is because the temperature required to fully open the thermostat is above the boiling point of water at normal atmospheric conditions.

4. If thermostat function is not to specification, a new thermostat should be fitted.

24 454 0 THERMOSTAT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Position drain tray underneath radiator bottom hose.

WARNING: When releasing system pressure, cover degas tank cap with thick cloth to prevent coolant scalding.

3. Release cooling system pressure by slowly unscrewing degas tank cap.

4. Remove radiator bottom hose and drain cooling system. To assist draining remove degas tank cap.

5. Remove coolant hose from thermostat cover.

6. Remove thermostat housing cover (3 bolts), refer to Fig.1.

7. Remove gasket and pull out retaining collar.

8. Remove thermostat and sealing ring.

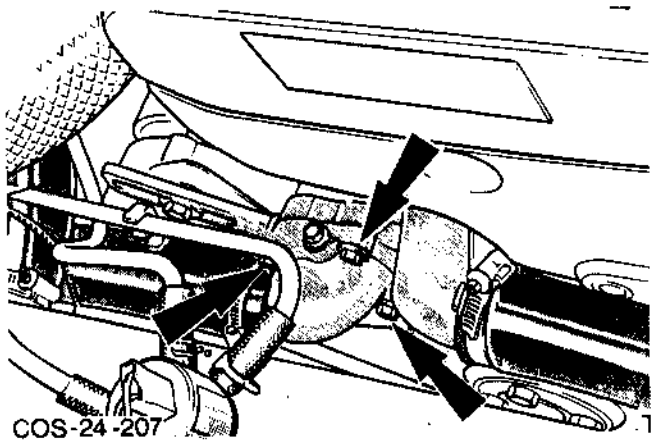


Fig.1. Thermostat housing securing bolts.

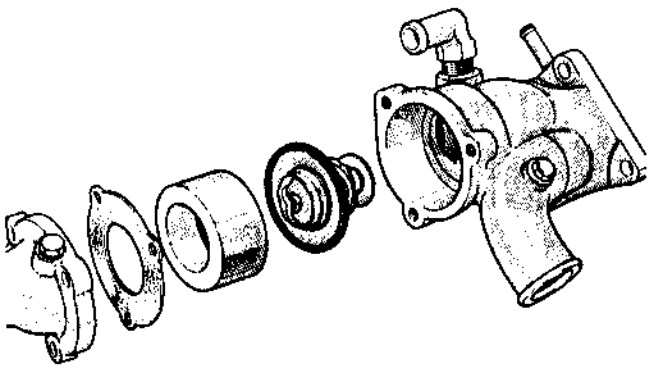


Fig.2. Exploded view of thermostat. (Removed from vehicle for illustration clarity)

To Install

9. Clean thermostat housing mating faces.

10. Fit new thermostat sealing ring and refit thermostat assembly into the thermostat housing.

11. Refit retaining collar.

12. Position a new gasket and secure thermostat housing cover.

13. Refit coolant hose to thermostat cover.

14. Refit radiator bottom hose and refill cooling system.

15. Reconnect battery earth cable. Start engine and allow to warm to normal operating temperature. Check coolant level and check for leaks.

Exhaust System 25

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Service Exhaust System	3

Service and Repair Operations	Contained in Operation	Page
25 204 0 Exhaust System - Replace		4
25 223 0 Muffler Front - Replace		5
25 233 0 Mufflers - Centre Replace	25 223 0	
25 243 0 Muffler Rear - Replace		6
25 263 0 Exhaust Pipe Front - Replace		7

TECHNICAL DATA

Tightening Torques

	Nm	kgf.m	lbf.ft
Front exhaust pipe at turbocharger (M8 hardware)	19 to 23	1,9 to 2,3	14 to 17
(M10 hardware)	35 to 47	3,5 to 4,7	26 to 35
Flange connection front exhaust pipe/front muffler	35 to 40	3,5 to 4,0	26 to 30
Clamps	38 to 45	3,8 to 4,5	28 to 33

Sealants

Exhaust jointing compound	SPM 4G 9100-A

TECHNICAL DATA (cont'd)

Service Exhaust System

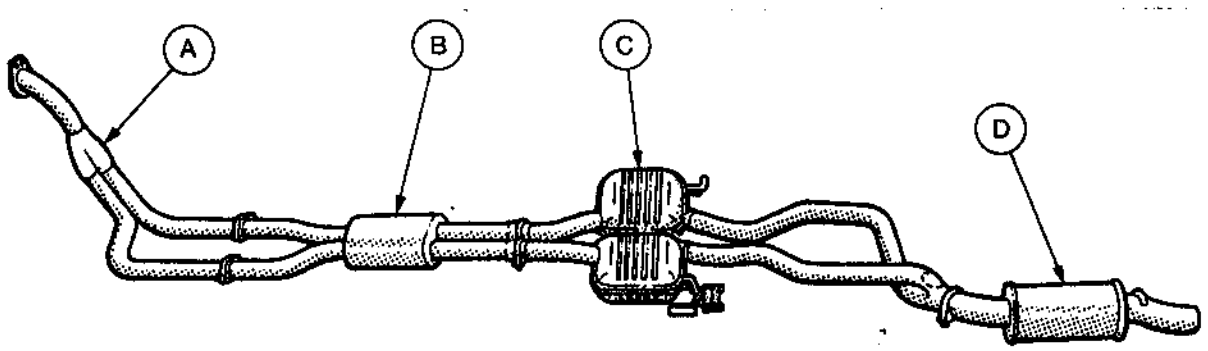
As the production and service exhaust systems differ, the front service muffler cannot be replaced with the production rear muffler system. If the front muffler needs replacement before the rear muffler assembly, the centre muffler assembly must also be replaced.

NOTE: When reversing onto some ramps, it may be necessary to raise the front of the vehicle to prevent damage to the front spoiler and/or exhaust flange connection.

The service exhaust system consists of four parts (see Fig.1.):

Front downpipe, front muffler, two intermediate centre mufflers and rear muffler

The parts required for service are fitted with connector tubes and clamps.



COS-25-1

Fig.1. Service exhaust system components.
A - Front downpipe
B - Front muffler
C - Centre muffler assembly
D - Intermediate rear muffler

SERVICE AND REPAIR OPERATIONS

25 204 0 EXHAUST SYSTEM - REPLACE

SPECIAL TOOLS REQUIRED: NONE

NOTE: This operation does not include the front down pipe from turbo to flange joint.

To Remove

1. Open hood, fit fender covers and disconnect battery. Disconnect front pipe to exhaust system flange joints (Fig.2).
2. Support exhaust system, unhook rubber insulators from front and rear muffler assembly and carefully remove exhaust system.

NOTE: Production exhaust assembly is of one piece construction.

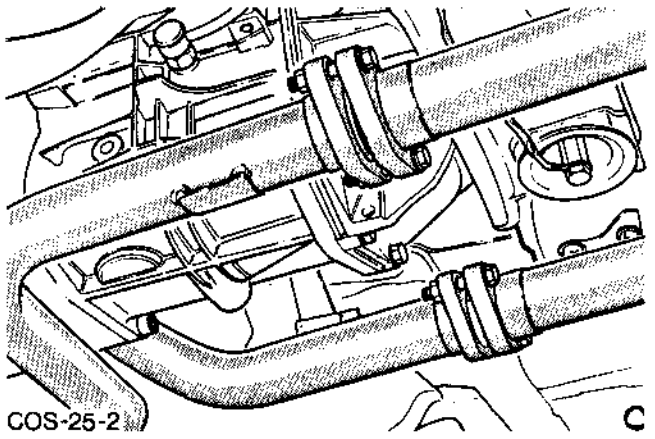


Fig.2. Front pipe flange connection.

To Install

3. Inspect rubber insulators for cracks, splits or damage, replace as necessary.
4. Clean front exhaust pipe flanges.
5. Fit rubber insulators to exhaust system brackets, lift exhaust system into position, secure rubber insulators to body brackets.
6. Reconnect exhaust system to front pipe flanges, torque joints to specification.
7. Reconnect battery. Start engine and check exhaust system for leaks. Remove fender covers and close hood.

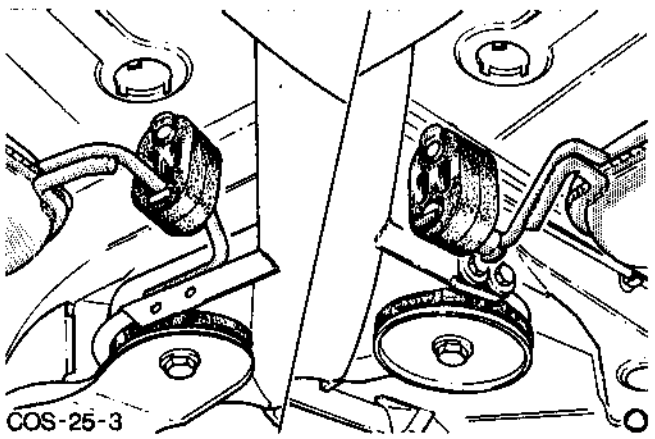


Fig.3. Centre muffler assembly rubber insulators.

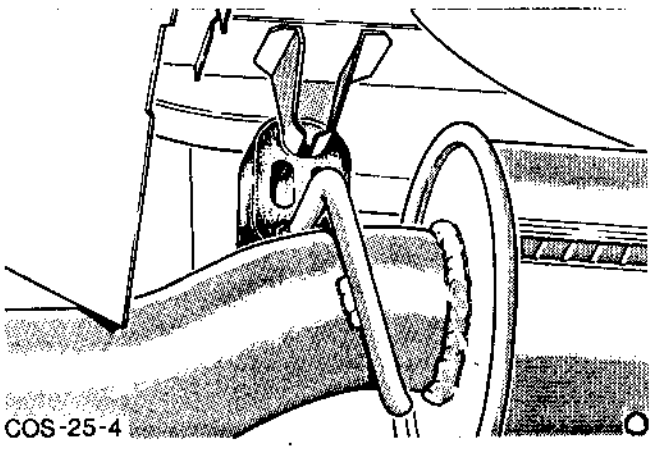


Fig.4. Rear muffler insulator assembly.

25 223 0 MUFFLER FRONT - REPLACE

SPECIAL TOOLS REQIURED: NONE

Service jointing sleeves are not available for the SIERRA RS COSWORTH. The front muffler of the production mounted exhaust system can only be replaced together with the two centre mufflers. This operation assumes that the centre exhaust section has already been replaced.

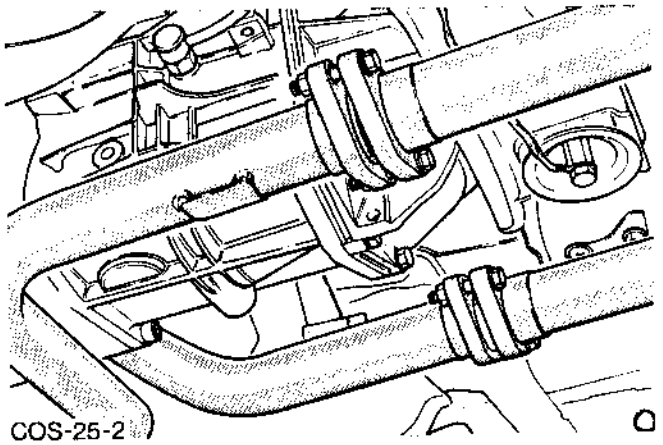


Fig.5. Front flange connections.

To Remove

1. Open hood, fit fender covers and disconnect battery. Raise vehicle on ramp. Support front exhaust pipe.

2. Disconnect flanges between front exhaust pipe and front muffler, Fig.5, and the clamps between front and centre mufflers, Fig.6. Remove muffler assembly.

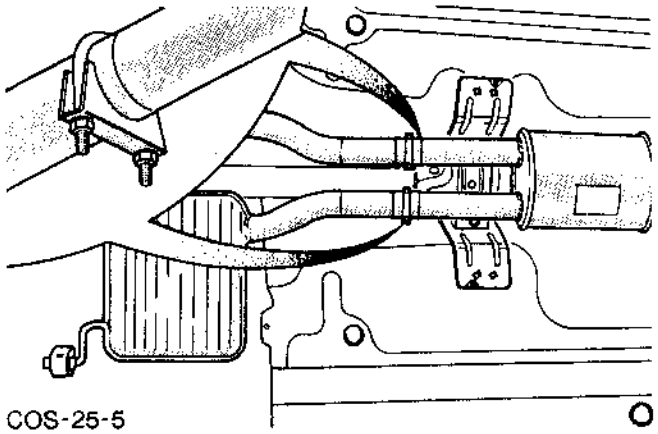


Fig.6. Clamps between front muffler and centre mufflers.

To Install

3. Clean connector and apply sealant (see Technical Data) to front muffler joint.

4. Fit front muffler. Loosely secure the front pipe flange clamp connections to muffler assembly.

5. Check that the exhaust system is in the correct installation position and tighten flange clamp and front pipe connections to the specified torque.

6. Reconnect battery, start engine and check exhaust system for leaks. Lower vehicle.

7. Remove fender covers and close hood.

25 243 0 MUFFLER REAR - REPLACE

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery.

2. Raise vehicle on ramp. Remove rear muffler clamp.

3. Unhook rubber insulator and remove rear muffler assembly.

NOTE: Inspect rubber insulators for cracks and splits before unhooking rear muffler, this can achieved by applying light downward pressure on the rear muffler and observing rubber insulator.

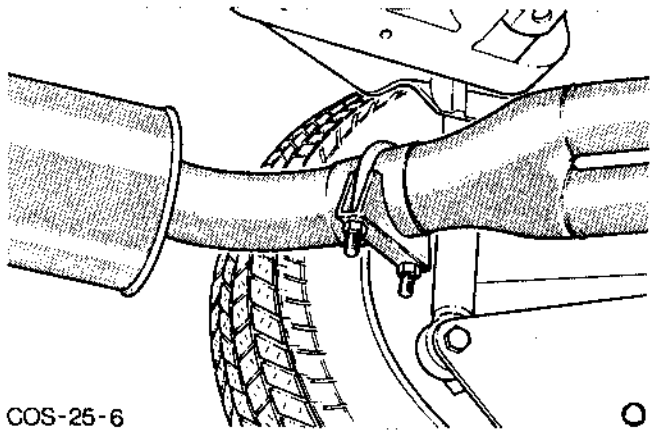


Fig.7. Rear muffler clamp.

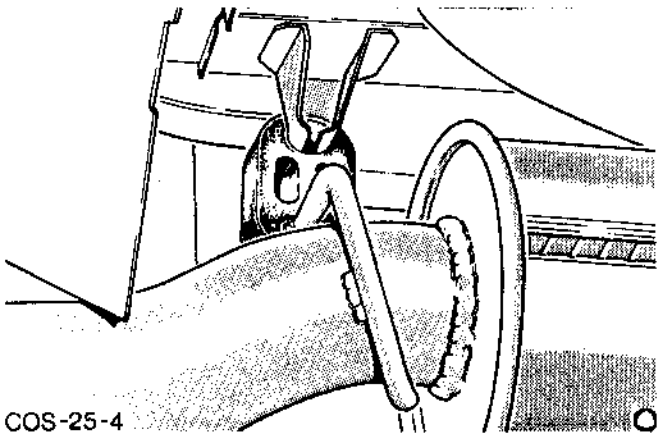


Fig.8. Rubber insulator, rear muffler.

To Install

4. Clean joint and apply sealant (see Technical Data).

5. Position exhaust system onto centre pipe assembly. Fit insulator to rear muffler and hook insulator onto body bracket.

6. Align rear muffler assembly and tighten clamp to correct torque, (see Technical Data).

7. Reconnect battery.

8. Start engine and check exhaust system for leaks. Lower vehicle, remove fender covers and close hood.

25 263 0 EXHAUST PIPE - FRONT - RIGHT - REPLACE

SPECIAL TOOLS REQUIRED: NONE

NOTE: When M10 studs are fitted, the tab washers are deleted and self-locking nuts are used which should be replaced after removal.

To Remove

1. Open hood, fit fender covers and disconnect battery.
2. Raise vehicle and disconnect front pipe to exhaust system flanges.
3. Bend back lock tabs and remove the three nuts securing front pipes to turbocharger. Remove front pipe from vehicle.

NOTE: Care should be taken when removing these nuts as high temperatures may cause the nuts to seize to the studs.

4. Clean turbocharger flange with wire brush, ensure dirt does not enter turbocharger during this cleaning operation.

To Install

5. Locate front pipe in position, loosely securing turbocharger flange and front pipe exhaust system flanges.
6. Ensure front pipe is free from strain, secure front pipe flange to turbocharger using new nuts and lock tabs. Tighten nuts to correct torque and bend over lock tabs.
7. Secure front pipe to exhaust system flanges, fully tighten joints.
8. Reconnect battery, start engine and check system for exhaust leaks.
9. Remove fender covers and close hood.

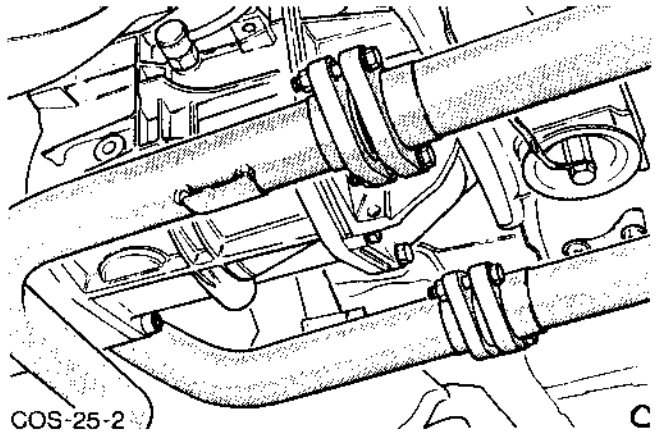


Fig.9. Disconnect front pipe to exhaust system flanges.

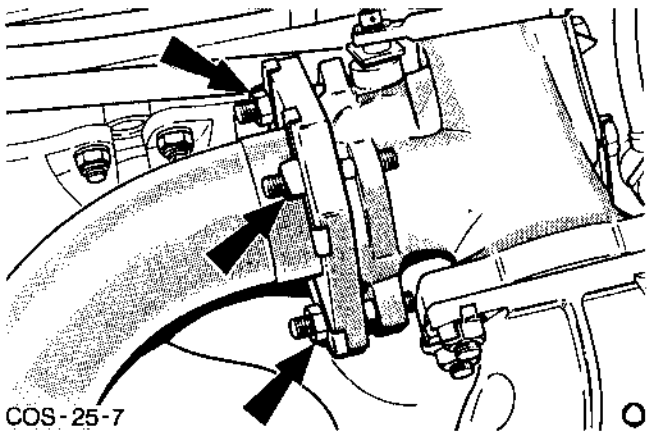


Fig.10. Turbo charger to front pipe securing nuts and lock tabs.

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Tightening Torques	Nm	lbf.ft
Front exhaust pipe at turbocharger (M10 hardware)	35 to 47	26 to 35
All flange joints	35 to 40	26 to 30
All clamps	38 to 45	28 to 33

Sealants	
Exhaust jointing compound	SPM 4G 9100-A

GENERAL DESCRIPTION

The exhaust system fitted to the Sierra RS Cosworth 4x4 is designed to safely, quietly and efficiently conduct exhaust gases away from the engine at all engine speeds without adversely affecting fuel consumption.

The exhaust system comprises a manifold, downpipe/pre-catalytic converter (83US variants only), front mufflers (15.04 variants only) or front catalytic converters (83US variants only), centre mufflers and a rear muffler assembly. The rear muffler assembly is made from an aluminised material which helps to increase the service life of the system. In addition, the internals and end plates of the rear muffler assembly are of stainless steel to provide increased protection against the corrosive products of combustion held in the exhaust gas condensate.

Vehicles meeting the 15.04 emission level are fitted with two-piece exhaust systems for production and three-piece for service.

Vehicles meeting the 83US emission level are fitted with three-piece exhaust systems for production and four piece for service.

Each system is secured at the front by the manifold flange and supported in the middle and at the rear by rubber insulators.

Service Exhaust Systems

These comprise a downpipe, front muffler, centre muffler assemblies and rear muffler assembly. Refer to frame five for service/product exhaust system installation.

NOTE: The front/centre mufflers of the production system cannot be replaced without fitting a new rear muffler too.

Downpipe/Pre-catalytic converter

The downpipe assembly fitted to 83US variants incorporates a catalytic converter which starts off the conversion process before being completed by the two catalytic converters positioned in the exhaust system prior to the centre muffler assemblies.

Front Muffler Assemblies (15.04 variants only)

The front muffler assemblies smooth the exhaust gas pulses which reduces the exhaust pressure/noise at an early stage.

Centre Muffler Assemblies

The centre mufflers reduce exhaust gas noise by the use of sound absorbing materials.

Rear Muffler Assembly

The rear muffler further reduces exhaust gas noise by the use of sound absorbing materials.

The Catalytic Converter (83US variants only)

The catalysts fitted to the Sierra RS Cosworth 4x4, where a stricter emission level has to be met, resemble a small muffler assembly. The vehicle underbody around the catalyst has been protected by heat shields, because of the high temperatures at which the catalyst operates.

The catalyst is designed to convert exhaust gases to levels which comply with territorial legislation.

The Three-Way Catalyst (TWC) converts three emissions: HC, CO and NO_x.

HC	=	Hydrocarbons (unburnt fuel)		CO_2	= Carbon Dioxide
			CONVERT		
CO	=	Carbon Monoxide		N_2	= Nitrogen
			TO		
NO_x	=	Oxides of Nitrogen (TWCs only)		H_2O	= Water

Internally there are two components, these being the Support Mat and the Coated Substrate (catalyst), both are explained below:

The Support Mat

This is used to mount the catalyst in the converter assembly. The support mat is made of a high temperature ceramic fibre (alumina silicate) containing vermiculite.

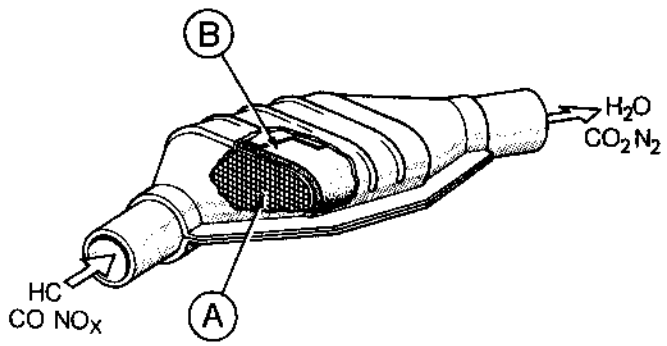
Vermiculite causes the support mat to expand as the temperature of the catalyst increases, thus maintaining adequate holding force on the catalyst under all operating conditions.

The Coated Substrate

The coated substrate consists of a substrate which is covered by a washcoat impregnated with precious metals; these are explained below:

- The substrate: This is the components on which the catalytic materials are supported. Its honeycomb structure provides a high geometric surface area for the exhaust gases to pass over. Ceramic substrates are of a porous material which gives good washcoat adhesion.

- Washcoat: This is an alumina-based material which is applied to the substrate to provide a high surface area for optimum precious metal dispersion. The complex structure of the washcoat effectively increases the surface area of the substrate, this feature being necessary to achieve a high degree of catalytic activity. Precious metals are the active catalytic components and are dispersed onto the washcoat as precious metals used in automotive catalysts are platinum, palladium and rhodium.



BE13-25A-10

Fig.1. Catalytic converter assembly.
A - Catalyst B - Support Mat

Catalyst Operation

The catalyst, in order to function, requires to reach a minimum operating temperature. Once this temperature has been attained the catalyst starts to react and rapidly approaches peak conversion efficiency, generating its own heat. Below 320°C conversion of exhaust gases is negligible.

In order for catalysts to convert efficiently it is essential that the air/fuel ratio is correctly controlled. This is particularly true for the TWCs which will only work within a narrow band. To operate within this band, closed-loop fuelling is employed to achieve the more stringent emission standards.

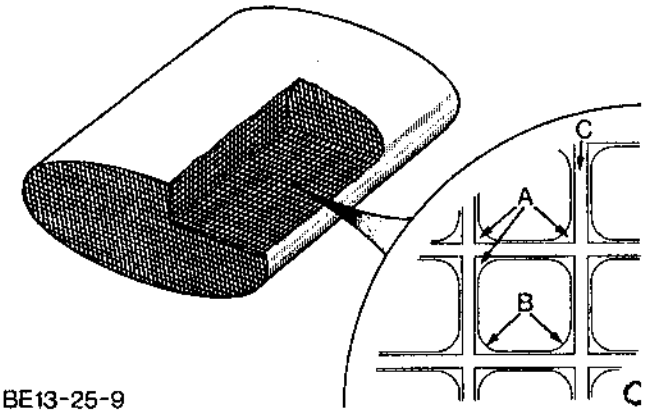


Fig.2. Catalyst substrate.
A - Washcoat
B - Precious metal deposits
C - Substrate

Catalyst Deactivation due to poisoning

Lead (Pb) in fuel can cause severe deactivation at levels above 5mg per litre of fuel. It is therefore essential that catalyst-equipped vehicles always operate on unleaded fuel.

Zinc (Zn) and Phosphorous (P) present in some engine oils, can cause deactivation when oil consumption levels are high.

Sulphur (S) in fuel can also cause deactivation but the effect of sulphur is felt most if it is released from the catalyst as Hydrogen Sulphide (H_2S).

Hydrogen Sulphide Emissions (H_2S). Some catalyst-equipped vehicles may give off hydrogen sulphide. This has an unpleasant odour similar to rotten eggs. Under normal operating conditions, sulphur released from the fuel during combustion becomes stored on the washcoat. During rich operation this stored sulphur combines with hydrogen in the exhaust and is released as hydrogen sulphide. It is this storage/release phenomenon that causes the hydrogen sulphide to be emitted at levels detectable by smell. Normally this situation will improve as the catalyst 'ages'; renewing the catalytic converter will only serve to promote the phenomenon. To minimise hydrogen sulphide emissions it is essential that the idle CO is within specification (preferably at the lower end of the emission range). It is therefore important that the engine management system is functioning correctly.

NOTE: Changing the fuel source or manufacturer may also help in reducing this phenomenon.

The Catalytic Converter (cont'd)

Thermal Deactivation and Catalyst Melt

Thermal deactivation of the catalyst occurs throughout the life of the exhaust, but is most severe over the first 6,500 km (4000 miles). Catalysts are intended to operate at temperatures up to 850°C, under these conditions normal deactivation takes place.

Advanced thermal ageing occurs when temperatures exceed 850°C, the ageing process accelerates rapidly at temperatures above 1000°C.

If temperatures exceeding 1400°C are achieved, the catalyst substrate will melt down. Catalyst melts are normally accompanied by loss of power due to excessive exhaust gas back pressure.

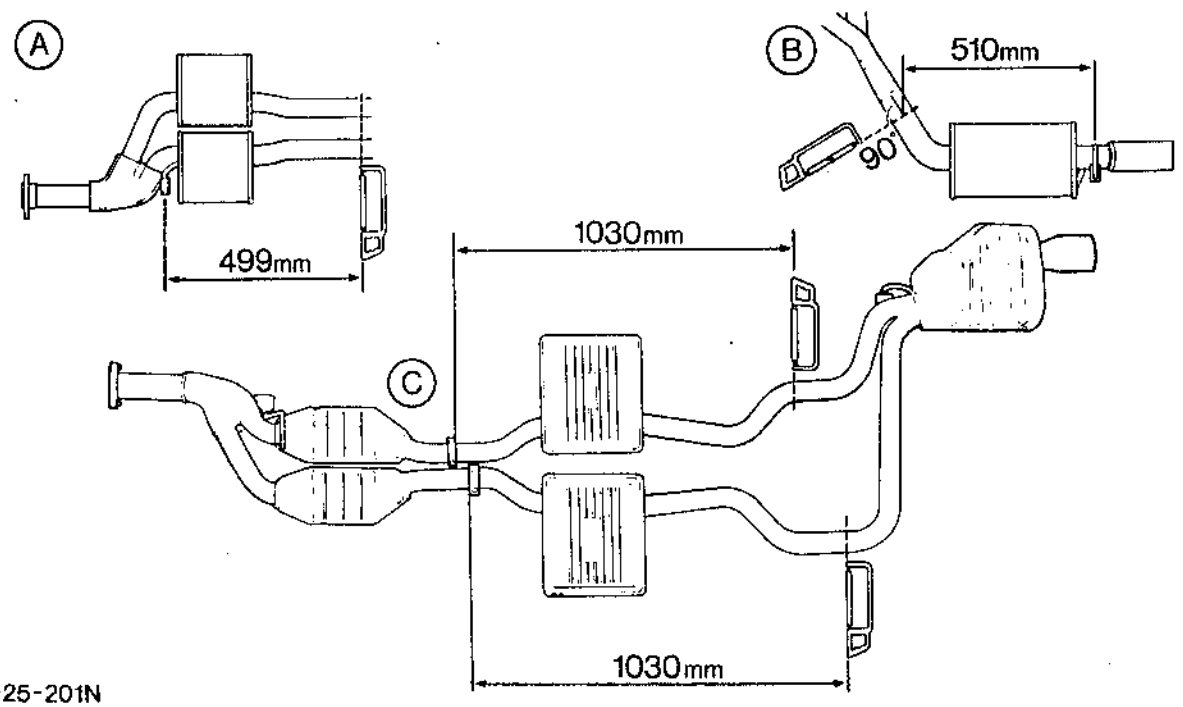
High substrate temperatures are caused by malfunction of the ignition or fuel systems, or by driver abuse (such as switching 'off' ignition when the vehicle is still in motion). These causal factors allow unburnt fuel to enter the catalyst, which ignites, producing localised high temperatures within the catalyst.

Catalysts are fairly tolerant of low engine speed misfire. Misfire at high engine speed may result in an almost instantaneous melt. IT IS IMPORTANT THAT THE CAUSE OF THE MISFIRE IS IDENTIFIED AND RECTIFIED IF SUBSEQUENT MELTS ARE TO BE PREVENTED.

Service-Fit Exhaust System

It is not possible to replace a centre section of the production exhaust system on its own. Should it be necessary to replace this section, a new centre and rear muffler assembly must be fitted.

To replace a rear tail pipe and muffler assembly, cut the production exhaust pipe at the point shown in Fig.3.

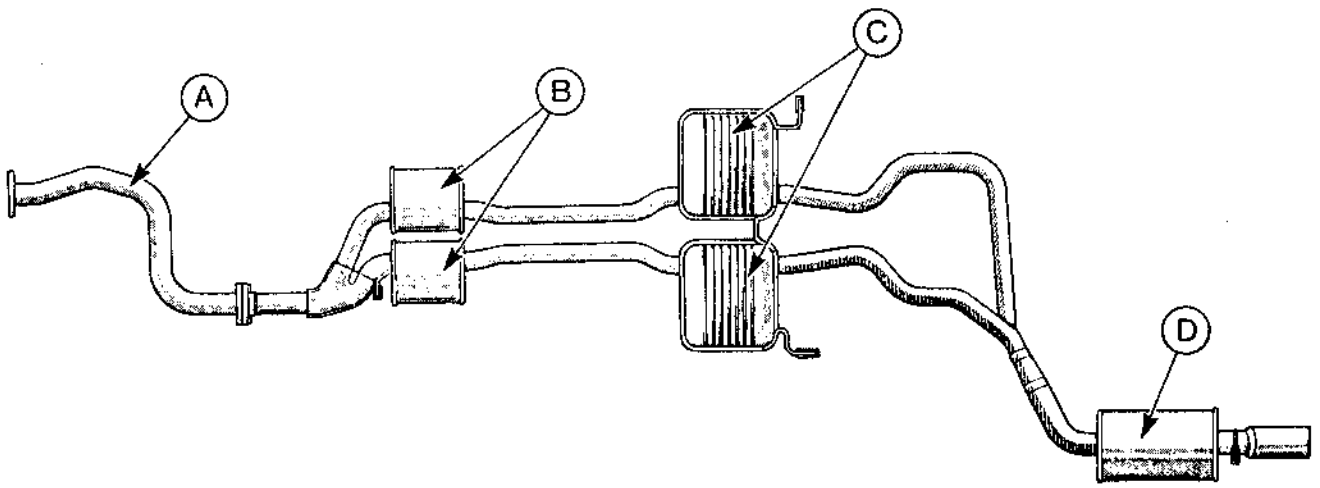


COS-25-201N

Fig.3. Cut line of production exhaust system.
A - Cut dimension for Sierra front muffler assemblies
B - Cut dimension for Sierra rear muffler assembly
C - Cut dimension for Escort rear muffler assembly

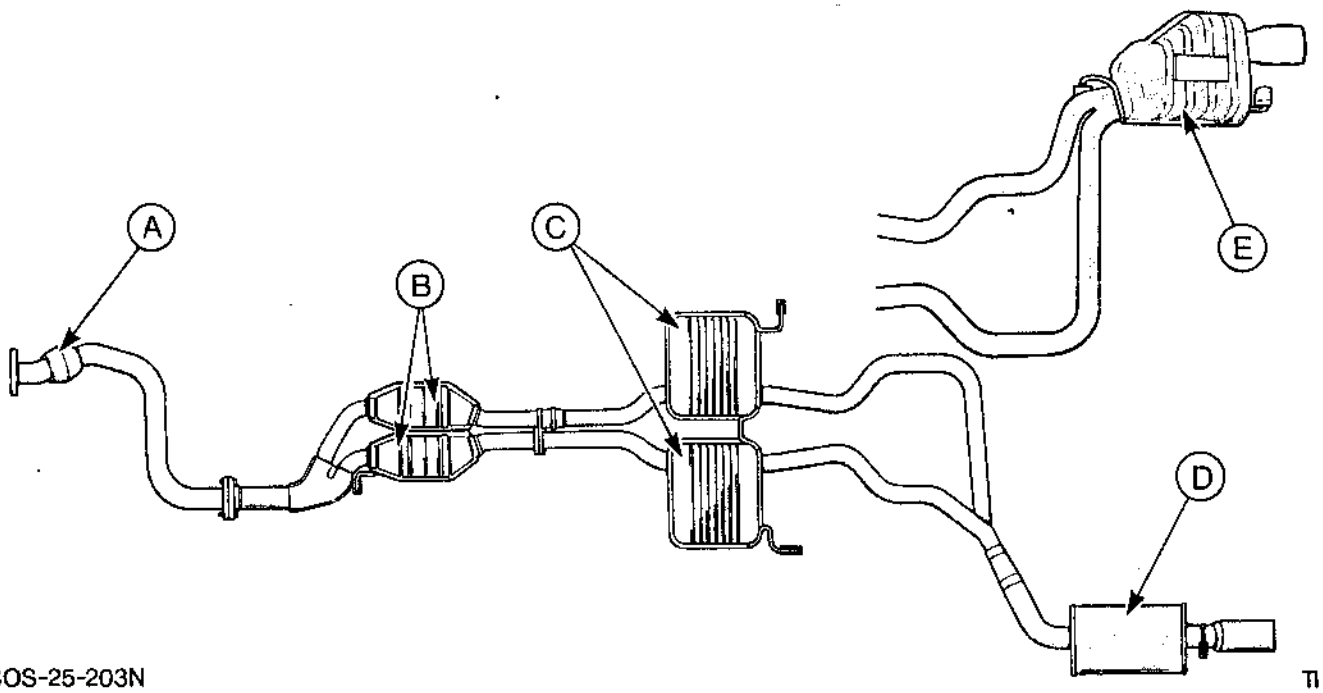
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Exhaust Systems Removed from Vehicle



COS-25-202 TI

Fig.4. Exhaust system removed (15.04 emission level).
A - Downpipe
B - Front muffler assemblies
C - Centre muffler assemblies
D - Rear muffler assembly



COS-25-203N TI

Fig.5. Exhaust system removed (83US emission level).
A - Downpipe/Pre-catalytic converter
B - Catalytic converter assemblies
C - Centre muffler assemblies
D - Sierra Rear muffler assembly
E - Escort rear muffler assembly

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25 204 0 EXHAUST SYSTEM - REPLACE

SPECIAL TOOLS REQUIRED: NONE

NOTE: This operation does not include the front down pipe from turbo to flange joint.

To Remove

1. Disconnect battery earth cable. Raise vehicle on a ramp.

2. Remove plastic sump guard, refer to Fig.1.

3. Disconnect front pipe to exhaust system flange joints, refer to Fig.2.

4. Support exhaust system, unhook rubber insulators from front and rear muffler assembly and carefully remove exhaust system.

CAUTION: Care should be taken not to damage catalyst assembly. Excessive force may damage the internal ceramic substrates.

To Install

5. Inspect rubber insulators for cracks, splits or damage, replace as necessary.

NOTE: Variants fitted with a catalytic converter use special exhaust insulators made from high temperature resistant natural rubber. Use only correct insulators as detailed in the vehicle parts microfiche.

6. Clean front exhaust pipe flanges.

7. Fit rubber insulators to exhaust system brackets, lift exhaust system into position, secure rubber insulators to body brackets.

8. Reconnect exhaust system to front pipe flanges, torque joints to specification.

9. Reconnect battery. Start engine and check exhaust system for leaks. Lower vehicle to ground.

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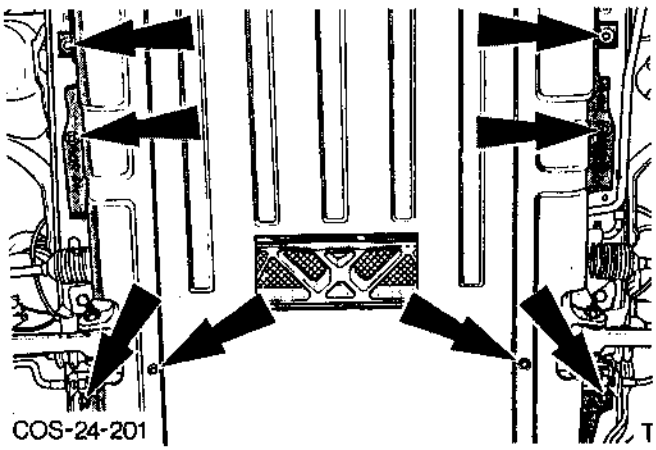


Fig.1. Sump guard securing bolts (Sierra shown).

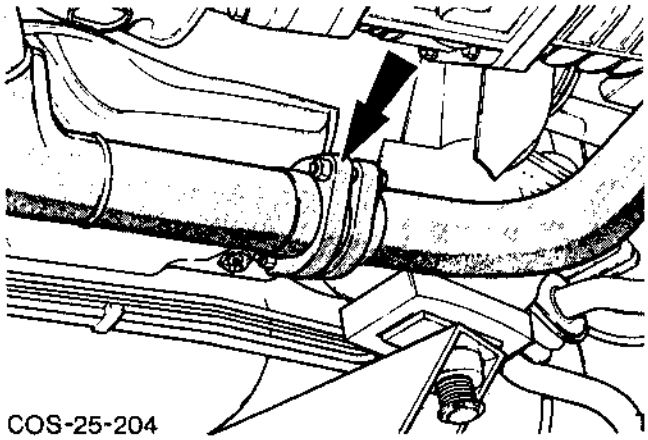


Fig.2. Front pipe flange connection.

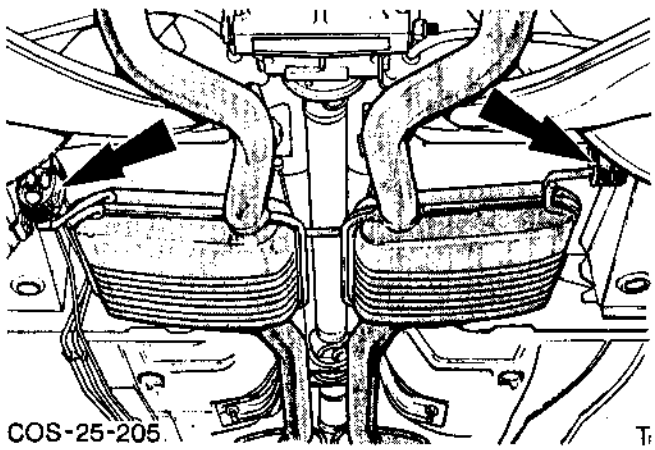


Fig.3. Centre muffler assembly rubber insulators.

25 223 0 MUFFLER FRONT - REPLACE

SPECIAL TOOLS REQUIRED: NONE

Service jointing sleeves are not available for the SIERRA RS COSWORTH. The front muffler of the production mounted exhaust system can only be replaced together with the two centre mufflers. This operation assumes that the centre exhaust section has already been replaced.

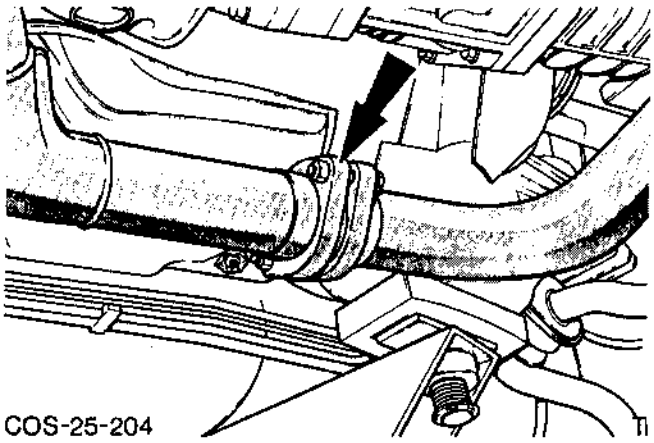


Fig.1. Front flange connections.

To Remove

1. Disconnect battery earth cable. Raise vehicle on a ramp. Support front exhaust pipe.

2. Disconnect flanges between front exhaust pipe and front muffler, refer to Fig.1, and the clamps between front and centre mufflers, refer to Fig.2. Remove muffler assembly.

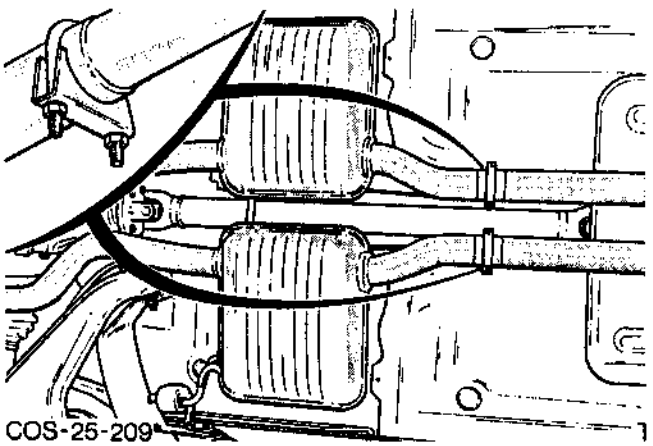


Fig.2. Clamps between front muffler and centre mufflers.

To Install

3. Clean connector and apply sealant (refer to Technical Data) to front muffler joint.

4. Fit front muffler. Loosely secure the front pipe flange clamp connections to muffler assembly.

5. Check that the exhaust system is in the correct installation position and tighten flange clamp and front pipe connections to the specified torque.

6. Reconnect battery, start engine and check exhaust system for leaks. Lower vehicle to the ground.

25 243 0 MUFFLER REAR - REPLACE

SPECIAL TOOLS REQUIRED: NONE

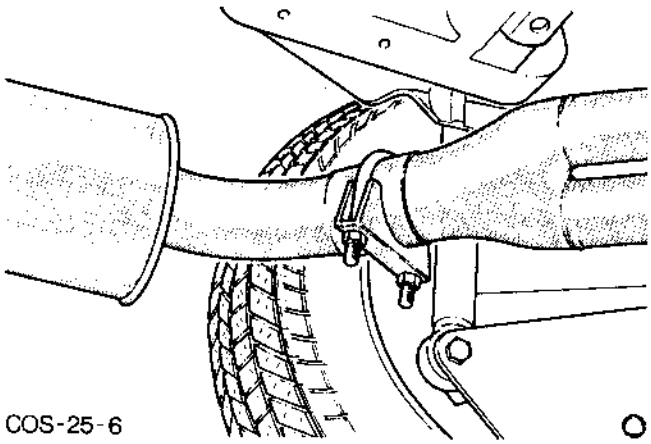


Fig.1. Rear muffler clamp (Sierra shown).

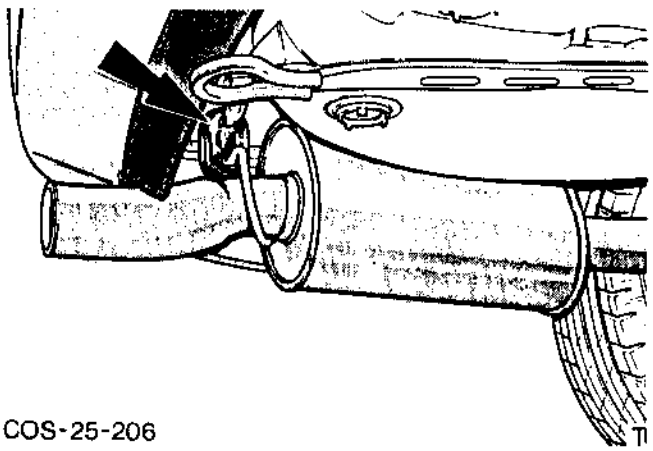


Fig.2. Rubber insulator, rear muffler (Sierra shown).

To Remove

1. Disconnect battery earth cable.

2. Raise vehicle on a ramp. Remove rear muffler clamp, refer to Fig.1.

3. Unhook rubber insulator and remove rear muffler assembly.

NOTE: Inspect rubber insulators for cracks and splits before unhooking rear muffler, this can achieved by applying light downward pressure on the rear muffler and observing rubber insulator.

To Install

4. Clean joint and apply sealant (refer to Technical Data).

5. Position exhaust system onto centre pipe assembly. Fit insulator to rear muffler and hook insulator onto body bracket.

6. Align rear muffler assembly and tighten clamp to correct torque, (refer to Technical Data).

7. Reconnect battery earth cable.

8. Start engine and check exhaust system for leaks. Lower vehicle to the ground.

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25 250 0 CATALYST - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

CAUTION: NEVER USE JOINTING COMPOUND FORWARD OF THE CATALYTIC CONVERTER.

To Remove

1. Disconnect battery earth cable.

2. Raise vehicle on a ramp.

3. Remove front flange bolts securing catalyst to exhaust downpipe, Fig.1, and separate joint.

4. Remove rear flange bolts securing catalyst to exhaust pipe, refer to Fig.2.

5. Unhook exhaust system from rear insulators.

6. Unhook catalyst from front exhaust rubber insulator.

NOTE: Inspect insulators for cracks and splits before unhooking system. This can be achieved by applying light downward movement on exhaust system whilst observing insulator condition.

7. Separate catalyst from exhaust system. Care should be taken not to damage catalyst assembly. Excessive force may damage the internal ceramic substrates.

To Install

8. Clean all mating joints.

NOTE: Catalyst systems use special exhaust insulators, made from high temperature-resistant, natural rubber. Use only correct insulators as detailed in vehicle parts microfiche.

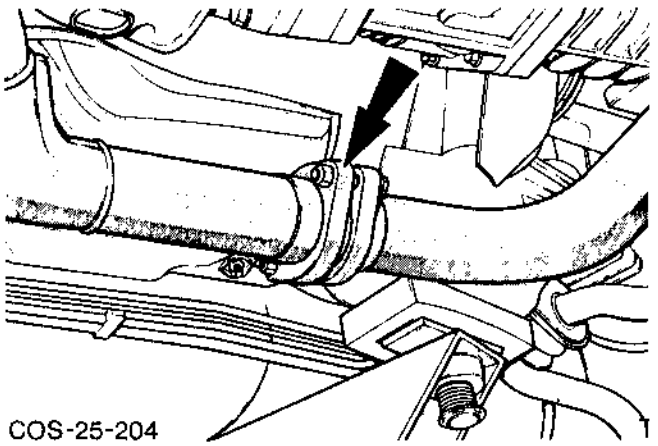


Fig.1. Remove front flange securing bolts.

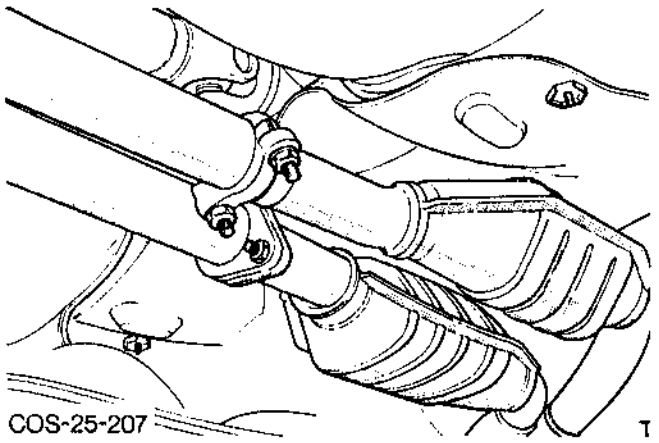


Fig.2. Remove rear flange securing bolts.

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9. Locate catalyst to rear exhaust pipe, apply exhaust jointing compound to pipe connections. Tighten 'U' clamp nuts to specification, (see Technical Data).

10. Refit exhaust system to rubber insulators.

11. Align and secure catalyst to exhaust downpipe, fitting new sealing ring. Tighten bolts to specification, (see Technical Data).

12. Lower vehicle and reconnect battery earth cable.

13. Start engine and check system for leaks. Ensure spring-loaded flexible joint has some free movement by applying light downward pressure to exhaust system.

25 263 0 EXHAUST PIPE - FRONT - RIGHT - REPLACE

SPECIAL TOOLS REQUIRED: NONE

NOTE: When M10 studs are fitted, the tab washers are deleted and self-locking nuts are used which should be replaced after removal.

To Remove

1. Disconnect battery earth cable.

2. Raise vehicle and disconnect front pipe to exhaust system flanges.

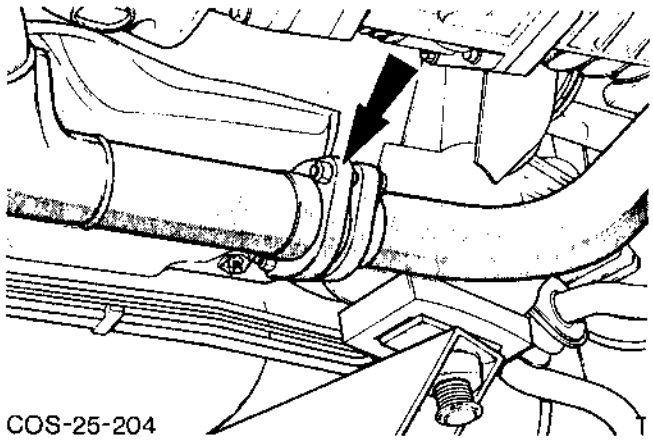


Fig.1. Disconnect front pipe to exhaust system flanges.

3. Bend back lock tabs and remove the three nuts securing front pipes to turbocharger. Remove front pipe from vehicle.

NOTE: Care should be taken when removing these nuts as high temperatures may cause the nuts to seize to the studs.

4. Clean turbocharger flange with wire brush, ensure dirt does not enter turbocharger during this cleaning operation.

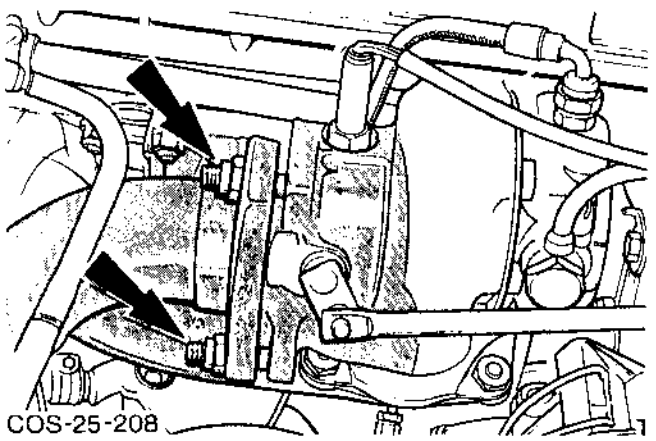


Fig.2. Turbo charger to front pipe securing nuts. (Two of three illustrated)

To Install

5. Locate front pipe in position, loosely securing turbocharger flange and front pipe exhaust system flanges.

6. Ensure front pipe is free from strain, secure front pipe flange to turbocharger using new nuts and lock tabs. Tighten nuts to correct torque, (see Technical Data) and bend over lock tabs.

7. Secure front pipe to exhaust system flanges, fully tighten joints to specified torque, (see Technical Data).

8. Reconnect battery, start engine and check system for exhaust leaks. Lower vehicle to ground.

9. Remove fender covers and close hood.

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Starting System 26

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Exploded View

Bosch DW (Gear Reduced) Starter Motor . .. . -		8

TECHNICAL DATA

Manufacturer/Type	Bosch DW
Output	1,4 Kw
Number of brushes	4
Brush material	Carbon
Min. brush length mm (in)	8,0(0,32)
Brush spring pressure gm (oz)	1600 (56)
Min. diameter of commutator mm(in)	32,8(1,29)
Armature end float mm (in.)	0,3(0,01)

26 111 0 STARTER MOTOR AND STARTING SYSTEM - TEST

Check that the battery is in an acceptable condition for the purpose of the tests (fully charged with a voltmeter reading of 12,6 volts or above). If not satisfactory, replace with a battery known to be fully charged and in good condition.

Test 1. Starter Solenoid Unit - Check

A. Disconnect battery earth cable. Remove both cables from solenoid. Check continuity of solenoid windings by connecting a test lamp circuit comprising a 12 volt battery and low wattage (1-3 watts) bulb between starter feed terminal and solenoid body. The lamp should light, Fig.1.

B. With both solenoid cables still disconnected, connect a new test circuit, (Fig.2.) this time with a high wattage (18 to 21 watts) bulb switched by solenoid main terminals. Energise solenoid by applying 12 volts between spade terminal and starter feed terminal. The solenoid should be heard to operate and test bulb should light fully, indicating closure of solenoid contacts.

Test 2. Voltage Check at Battery Terminals (On Load)

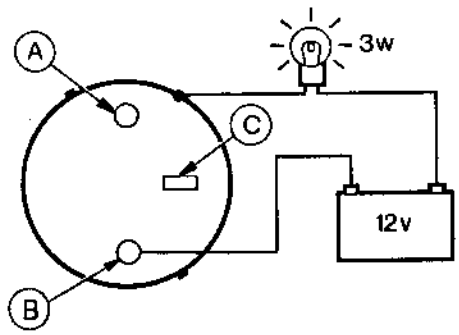
Connect a voltmeter/multimeter directly between battery terminals.

Operate starter with ignition off, i.e. disconnect positive terminal on ignition coil. Voltmeter reading should not be less than 10,5 volts.

Test 3. Voltage Check at Starter Main Terminal (On Load)

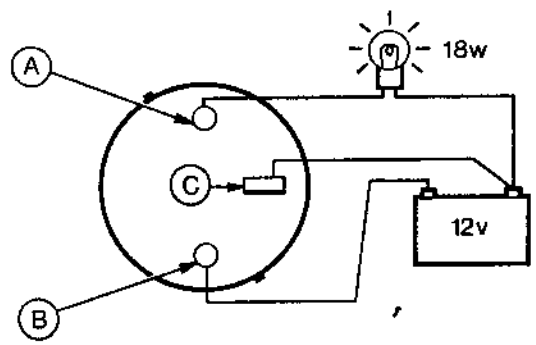
Connect a voltmeter/multimeter between the starter main terminal and the body of the starter, Fig.3.

Operate starter with ignition off. A reading within 1,0 volt of the readings obtained at the battery should be registered. If a greater voltage drop is measured, the circuit between the battery and starter terminal should be examined.



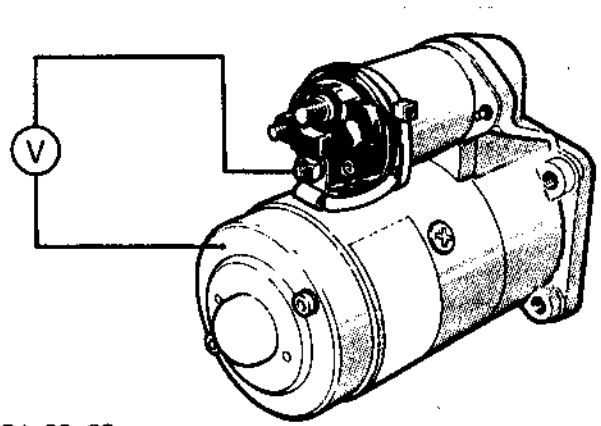
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Fig.1. Solenoid winding check.
A - Battery terminal C - Spade terminal
B - Feed terminal



F/26/90

Fig.2. Solenoid continuity check.
A - Battery terminal C - Spade terminal
B - Feed terminal



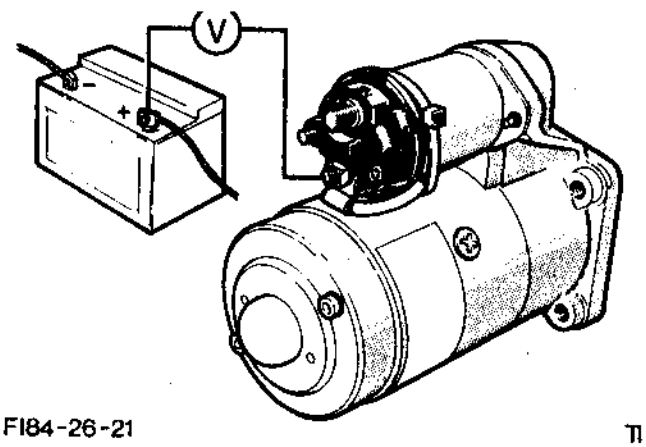
FI84-26-20

Fig.3. Main terminal voltage check.

Test 4. Voltage Drop in Main Insulated Line (On Load)

Connect a voltmeter/multimeter between the battery positive terminal and the starter motor main feed terminal, Fig.4.

Operate starter with ignition off for two or three seconds, checking meter readings. Battery voltage should be indicated first and then drop by less than 1,0 volt. Voltage drops above this level indicate a high resistance in the circuit, proceed to Test 5. If the drop is less than 1,0 volt, proceed to Test 6.



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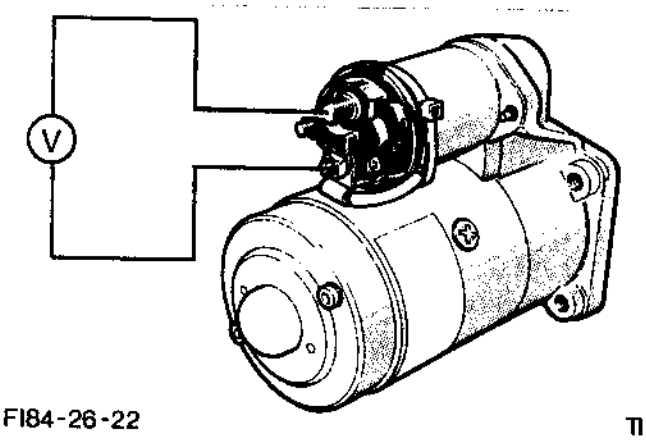
Fig.4. Testing voltage drop in main wiring.

Test 5. Voltage Drop Across Starter (Solenoid) Switch.

Connect a voltmeter/multimeter between the two main terminal stud connections, Fig.5.

Operate the starter for two or three seconds with the ignition off and note the meter readings.

Battery voltage should be indicated first and then a volt drop of less than 0,5 volts. If not, check for faulty switch or connections. If the reading is acceptable, then any high resistance can be due to either a loose or corroded terminal.



FI84-26-22 TI

Fig.5. Testing voltage drop across starter solenoid switch.

Test 6. Voltage Drop Check on Earth Line (On Load)

Connect a voltmeter/multimeter between the battery negative (earth) terminal and the starter motor main casing.

With the ignition off, operate starter for two or three seconds. If the earth line is satisfactory, the reading should be less than 0,5 volts. A reading of 0,6 volts or more indicates a high resistance somewhere in the earth return side of the circuit.

Test 7. Battery Earth Connection - Check

A high reading in Test 6 can be due to a dirty or loose connection in the battery earth cable either at the battery or at the location of the earth cable to the engine block.

Check to ensure that all connections are clean and tight.

Clean and re-tighten where necessary and repeat Test 6.

26 204 0 STARTER MOTOR ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

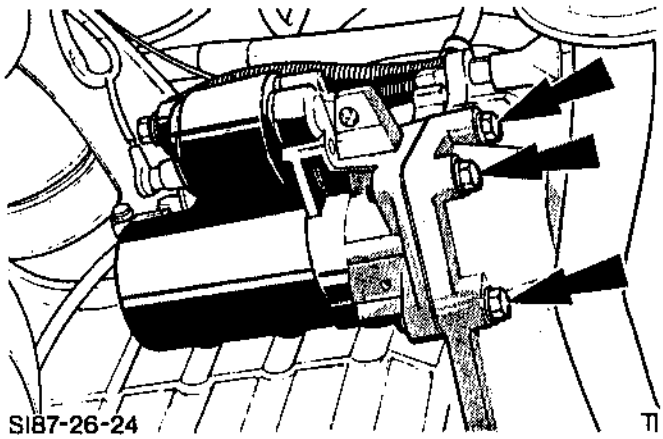


Fig.6. Starter motor in situ.

To Remove

1. Open hood and fit fender covers.
2. Disconnect battery. From underneath vehicle disconnect the main starter motor cable.
3. Disconnect the loom connector from starter motor solenoid.
4. Remove the starter motor securing bolts and support bracket, (where fitted) and guide starter motor clear of the vehicle.

To Install

5. Align starter motor in position and secure, refitting engine earth strap to top fixing bolt. Refit support bracket bolt, where fitted.
6. Connect main starter feed cable and loom connector.
7. Connect battery and test starter for correct function.
8. Remove fender covers and close hood.

Within the operation 26 204 8 - Starter Motor - Overhaul, various aspects of the Starter Motor mechanical and electrical function should be assessed before the motor is reassembled.

STARTER MOTOR EXAMINATION AND TESTING

A. Brushgear.

Check for sticking brushes. If necessary, clean brushes and brush channels with a petrol-moistened cloth.

Check brushes for wear. If brushes are worn to less than minimum dimension shown in the Technical Data, the complete brushplate assembly must be replaced.

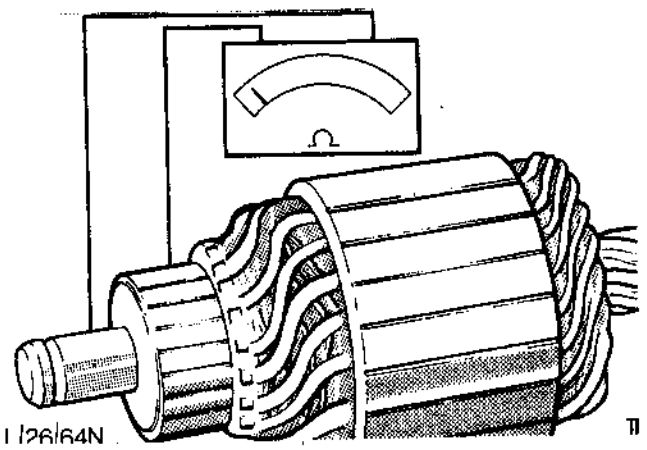


Fig.7. Armature insulation test.

B. Armature

Face of commutator should be clean and free from burnt spots. If necessary, remove any burnt spots using fine glass paper, (do not use emery cloth), and then clean commutator with a petrol-moistened cloth.

If it is necessary to skim commutator, the minimum permissible diameter to which the armature commutator can be skimmed is specified in Technical Data. The skimming operation should be followed by polishing the commutator surface with fine glasspaper, then wiping clean with a petrol-moistened cloth.

NOTE: DO NOT CUT INTO THE COMMUTATOR METAL WHEN RECUTTING INSULATION SLOTS.

Armature insulation can be checked by connecting an ohmmeter/multimeter between a commutator segment and shaft. There should be no reading, Fig.7.

Short-circuited armature windings can only be detected by the use of specialised armature testing equipment. If this equipment is not available, check the armature by substitution.

If there is evidence that armature laminations have been in contact with the yoke or field windings, then the armature bearings are probably excessively worn. First check that the field windings are secure and that the armature runs true in a lathe. If necessary, renew armature bearings.

STARTER MOTOR EXAMINATION AND TESTING (Cont'd)

C. Yoke and Field Winding Assembly

A visual check should be made to determine that field magnets are seated correctly and are not damaged.

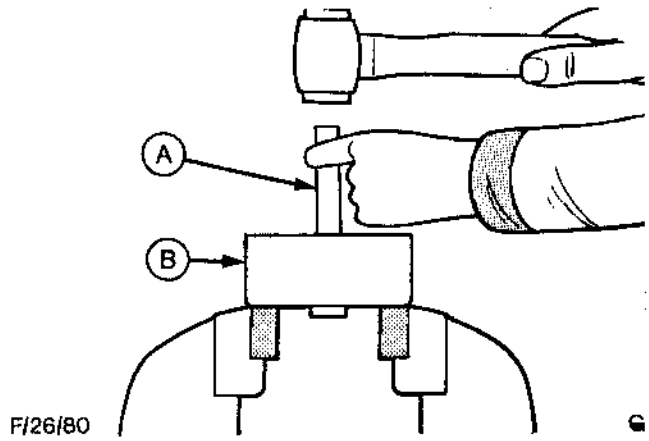


Fig.8. Removing commutator housing bush.
A - Suitably sized mandrel
B - Housing

D. Bearing Bushes

Bearing bushes in both end housings are self lubricating porous bronze.

Renew bushes when excessive armature shaft side-play is evident. Fouling of pole-pieces by armature, or inefficient operation of starter, is likely to occur if armature bushes are excessively worn.

NOTE: If the output shaft intermediate bush requires renewal, the complete output shaft/planet gear assembly must be changed.

The commutator end housing bush should be removed by carefully tapping out using a mandrel. Ensure that the end plate is well supported, Fig.8.

The drive end housing bush can be tapped out with a suitably-sized mandrel, Fig.9. after supporting the plate.

New bushes should be pressed into position using a mandrel.

Bushes must not be reamed after fitting, as the self-lubricating qualities will be impaired.

NOTE: New bushes must be completely immersed in clean engine oil (SAE 30/40 grade) for at least 20 minutes before being fitted.

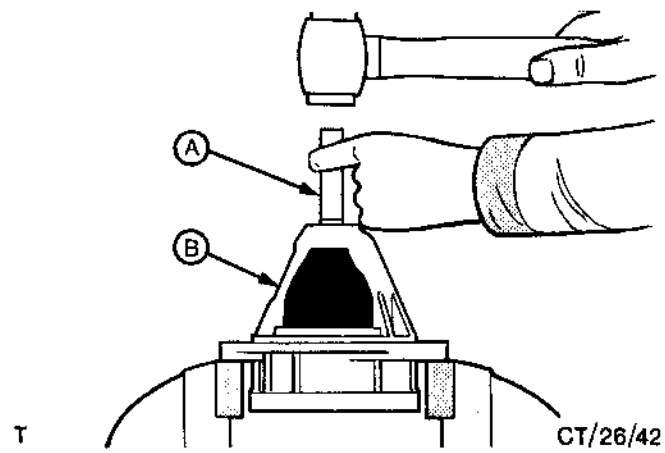


Fig.9. Removing drive end housing bush.
A - Suitably sized mandrel
B - Housing

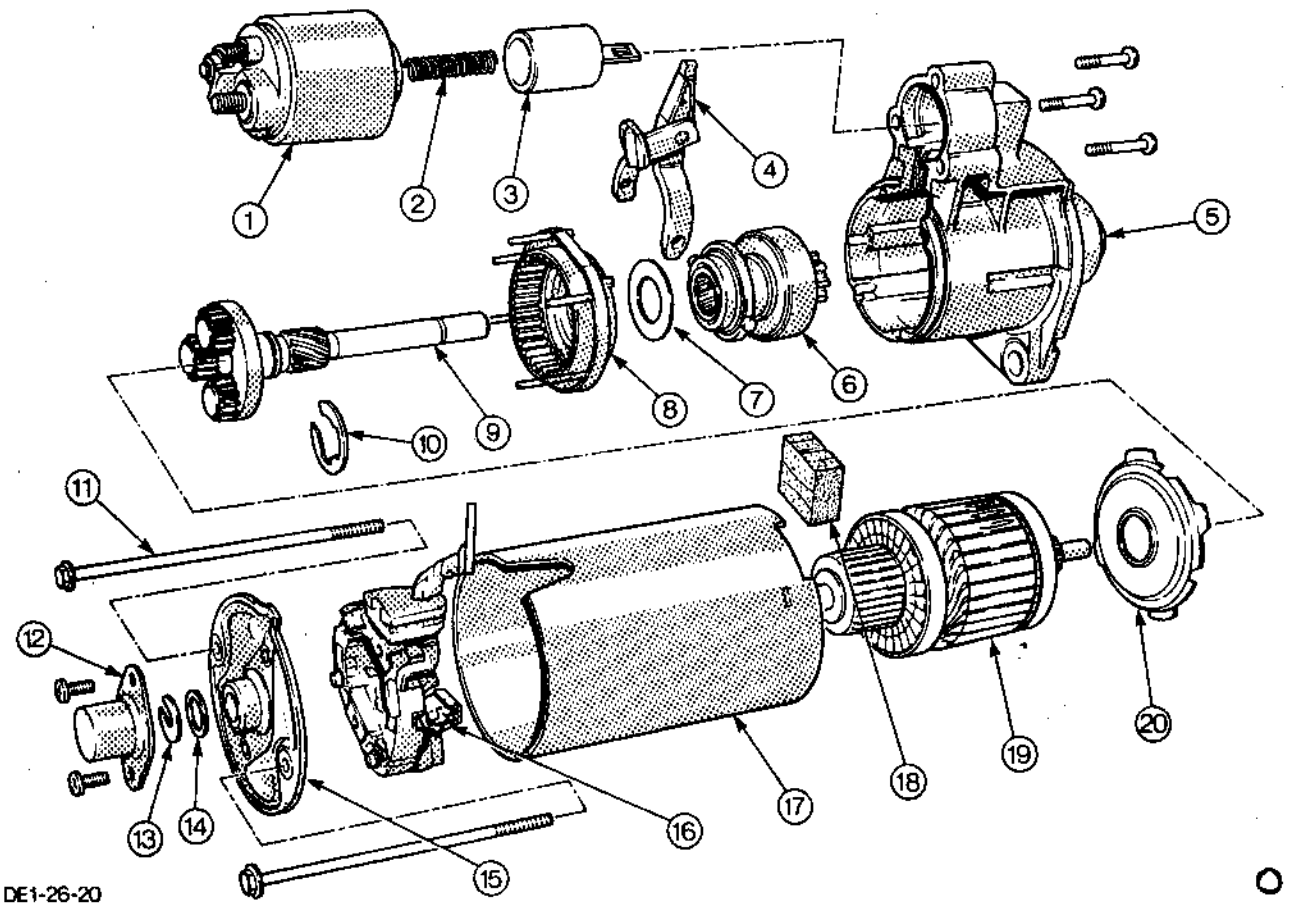


Fig.10. Bosch DW gear reduced starter motor - exploded view.

1 - Solenoid
2 - Solenoid return spring
3 - Solenoid armature
4 - Actuating fork
5 - Drive end housing
6 - Pinion and roller clutch
7 - Spacer
8 - Ring gear
9 - Output shaft and planet gear assembly
10 - Circlip
11 - Through bolt
12 - End cap
13 - 'C' clip
14 - Spacer
15 - Commutator end plate
16 - Brush plate
17 - Main housing (yoke)
18 - Rubber block
19 - Armature
20 - Retaining plate

26 204 8 STARTER MOTOR - OVERHAUL (STARTER MOTOR REMOVED)

TYPE: BOSCH DW

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Dismantle

1. Undo two screws and remove armature shaft cover. Fig.11.

2. Remove 'C'-clip and spacer from armature shaft.

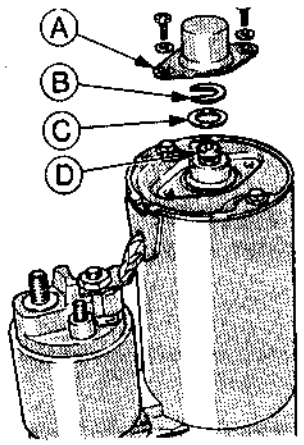


Fig.11. Armature shaft cover.
A - Shaft cover C - Spacer
B - 'C'-clip D - Shaft

3. Undo two through bolts and lift off commutator end plate. Fig.12.

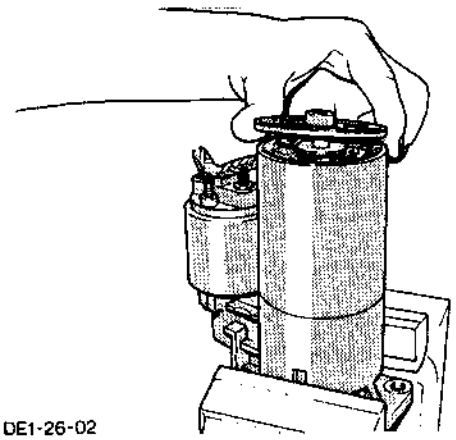


Fig.12. Lift off commutator end plate.

4. Undo nut and remove brush wiring from solenoid terminal.

5. Remove complete yoke and armature assembly from drive end housing. Fig.13.

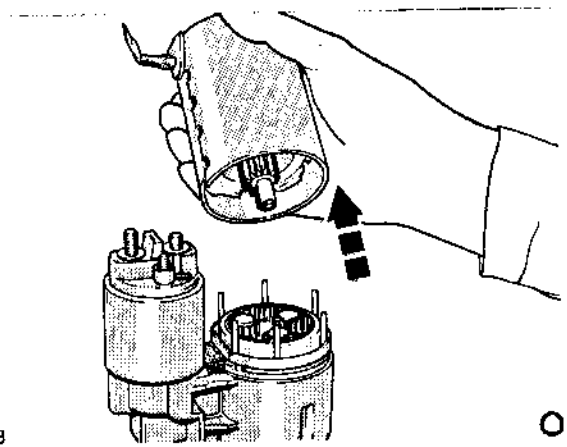


Fig.13. Separate yoke from drive end housing.

6. Release brushes from brushboxes and remove brushplate from armature shaft. Remove armature retaining plate and withdraw armature from yoke housing, overcoming magnetic attraction.

NOTE: Brushes should be released before attempting to remove brush plate, this will prevent accidental damage to brushes.

7. Undo three screws and remove solenoid body from drive end housing. Fig.14.

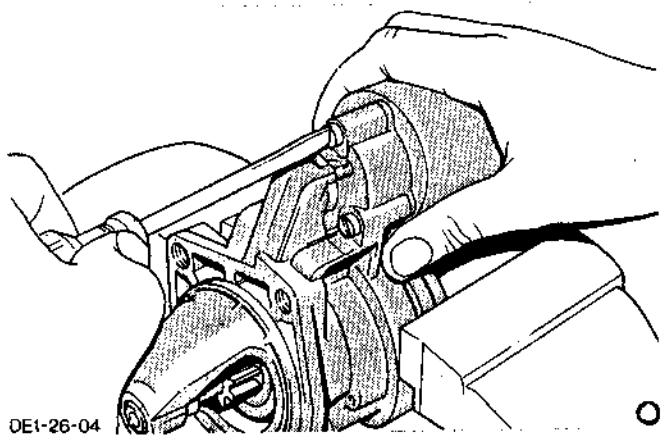


Fig.14. Remove solenoid body.

8. Remove complete pinion/roller clutch assembly from drive end housing. Fig.15.

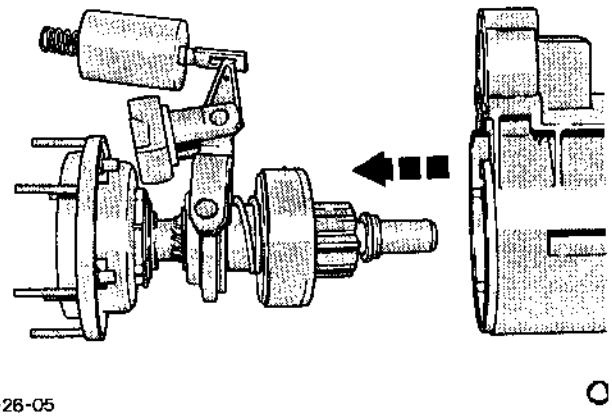


Fig.15. Separate pinion assembly from drive end housing.

9. Disconnect solenoid armature 'hook' from actuating arm.

10. To remove drive pinion from output shaft, support assembly as shown in Fig.16. and using a suitable sized tube, separate the thrust collar from the 'C'-clip.

NOTE: Do not grip one-way clutch in a vice whilst carrying out this operation as it will be damaged.

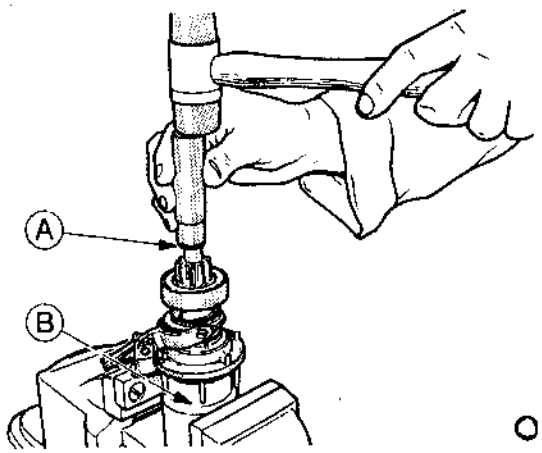


Fig.16. Separate thrust collar from 'C-clip.
A - Thrust collar
B - Suitably sized socket

11. Remove the 'C'-clip and slide the drive pinion off the output shaft.

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To Assemble

12. Slide drive pinion assembly onto output shaft. Fit 'C'-clip and pull thrust collar over 'C'-clip.

13. Refit pinion/clutch assembly into drive end housing ensuring correct location of ring gear carrier. Fig.17. Refit rubber block.

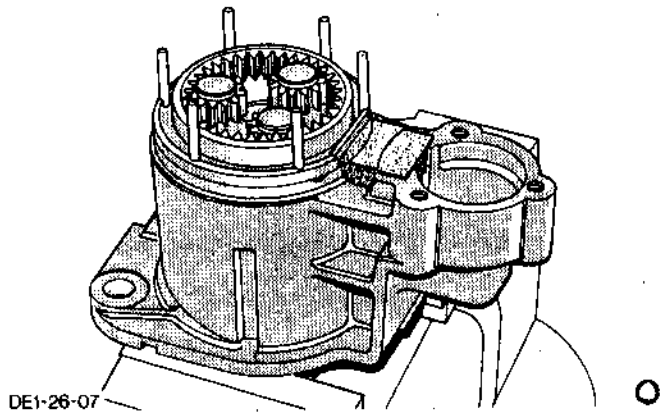


Fig.17. Correct positioning of ring gear carrier.

14. Smear lithium based grease over solenoid armature 'hook' and refit to actuating arm.

15. Refit solenoid spring and body. Secure to drive end housing with three screws. Fig.18.

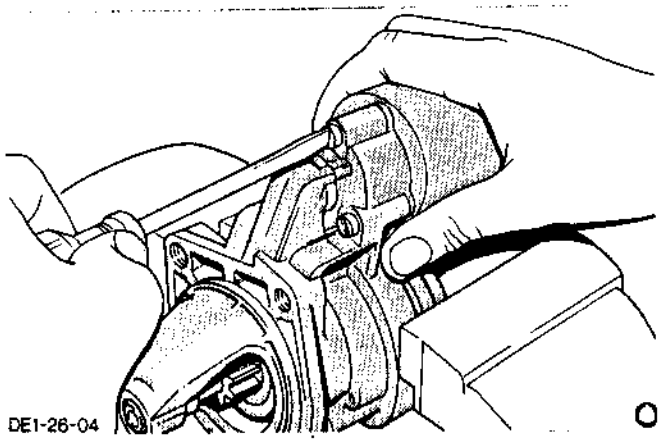


Fig.18. Refit solenoid body.

16. Position brushplate over commutator and assemble brush-boxes, springs and brushes onto brushplate, ensuring that securing lugs on brush-boxes are positively located, Fig.19.

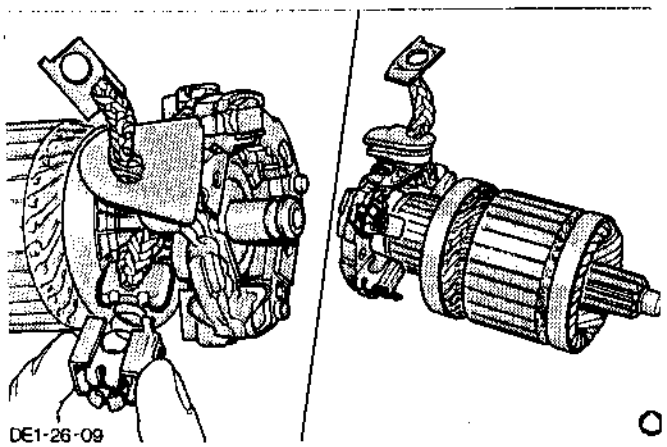


Fig.19. Assembly of brushplate to commutator.

17. Insert armature into yoke housing, ensuring brushplate stays in place, and engage rubber insulator with cut-out in yoke.

18. Refit armature with retaining plate, ensuring correct positioning, Fig.20.

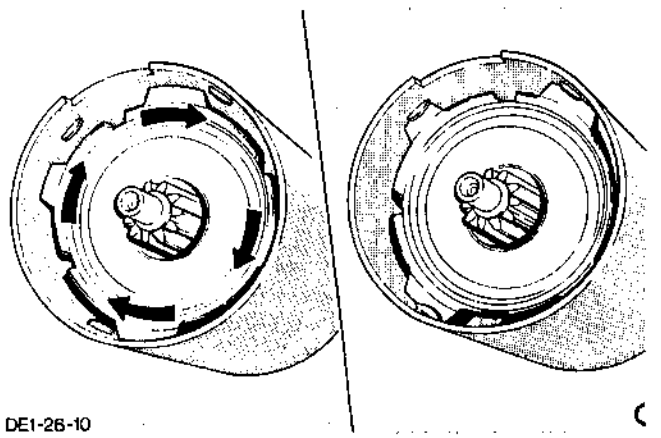


Fig.20. Correct armature retaining plate position.

19. Refit yoke and armature to drive end housing, aligning sun gear with planet gears. Refit end cap and retain with two through bolts.

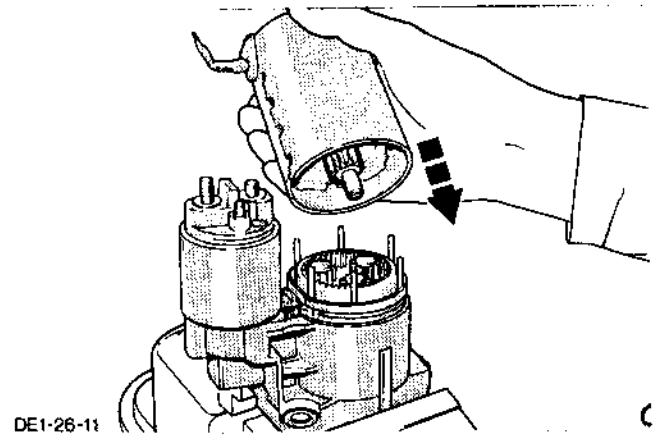


Fig.21. Refit yoke to drive end housing.

20. Refit spacer and 'C'-clip over armature shaft, smear with lithium based grease and fit bearing cap, securing with two screws.

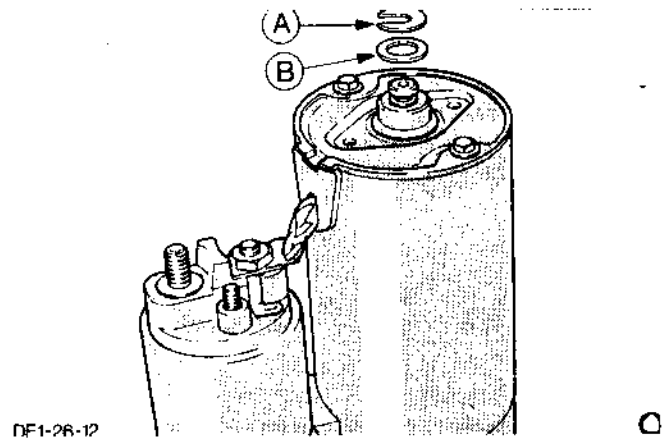
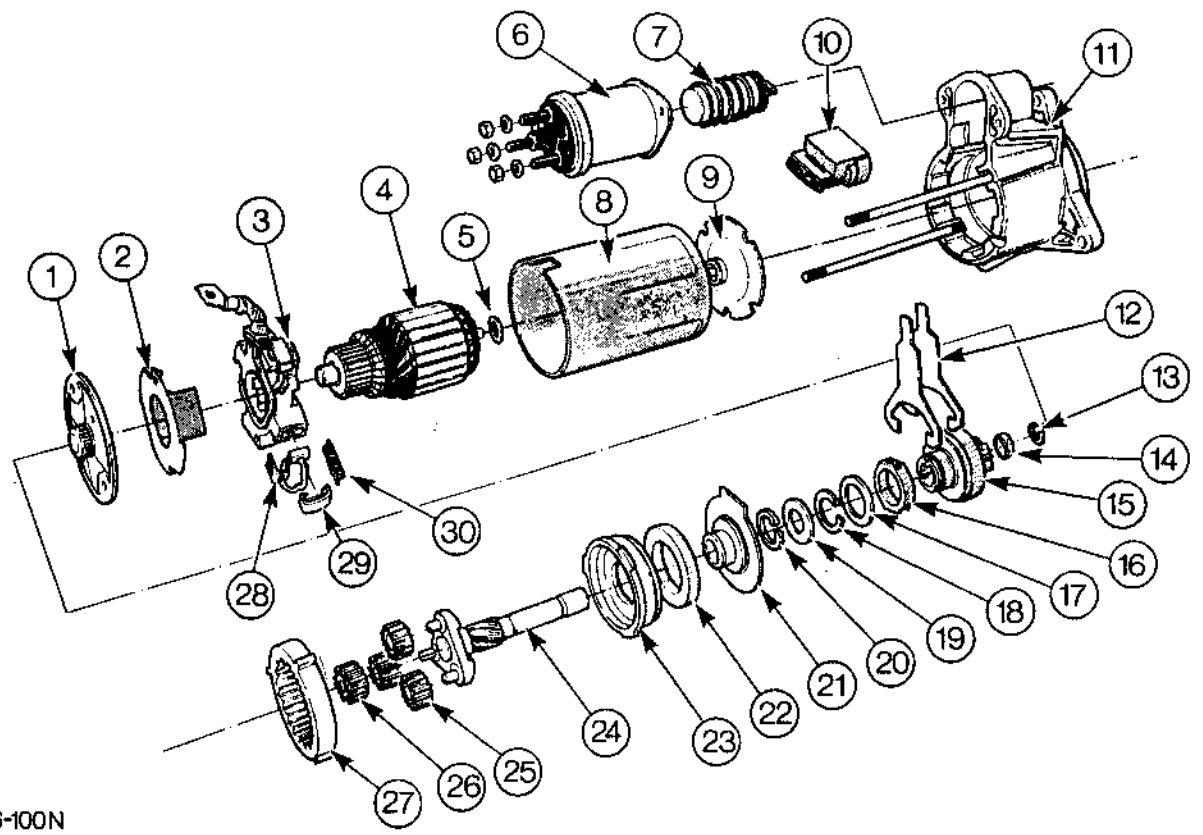


Fig.22. Refit spacer and 'C'-clip.
A - 'C'-clip
B - Spacer



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Fig.23. Magneti Marelli M78R starter motor - exploded view.

1. Commutator end plate
2. Brush box insulator
3. Brush box
4. Armature
5. Spacer
6. Solenoid
7. Solenoid armature
8. Main housing
9. Bearing plate
10. Rubber block
11. Drive end housing
12. Actuating levers
13. 'C' clip
14. Thrust collar
15. Pinion and roller clutch
16. Carrier
17. Washer
18. Circlip
19. Washer
20. Circlip
21. Bearing support plate
22. Seal
23. Support cup
24. Output shaft
25. Planet gears
26. Sun gear
27. Annulus
28. Brush
29. Brush clip
30. Brush spring

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26 204 8 STARTER MOTOR - OVERHAUL (Starter Motor removed)

TYPE: MAGNETI MARELLI M78R

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Dismantle

1. Clamp starter motor in a vice fitted with protective soft jaws. Disconnect and remove connector link from solenoid.

2. Undo two screws and remove solenoid yoke, Fig.24. Unhook solenoid armature from actuating lever and remove.

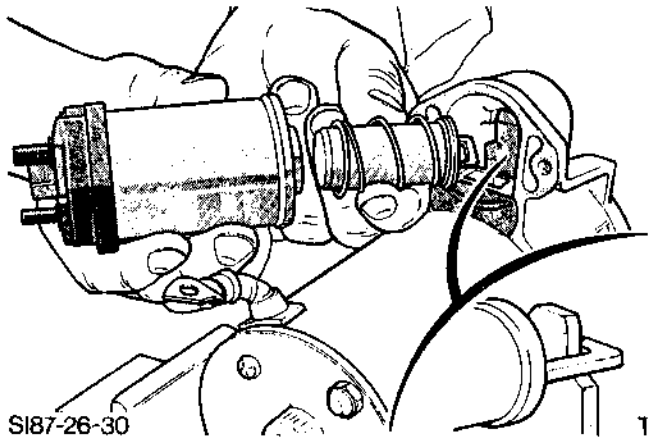


Fig.24. Remove solenoid.

3. Remove two through bolt nuts and withdraw main casing, complete with armature, from drive end housing, Fig.25.

4. Undo two screws and remove commutator end plate.

5. Remove bearing support plate, and withdraw armature from the commutator end of the yoke housing, overcoming magnetic attraction.

6. Release brushes from brush boxes and remove brush box and insulator from commutator.

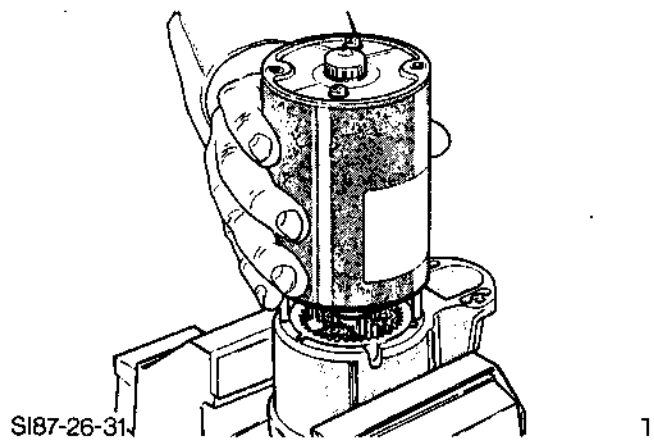


Fig.25. Withdraw main casing from drive end housing.

NOTE: Brushes should be released before attempting to remove brush moulding, this will prevent accidental damage to brushes.

7. Remove complete pinion/roller clutch/reduction gear assembly from drive end housing together with the actuating lever and rubber block, Fig.26.

8. Dismantle the gear train and remove the rubber block.

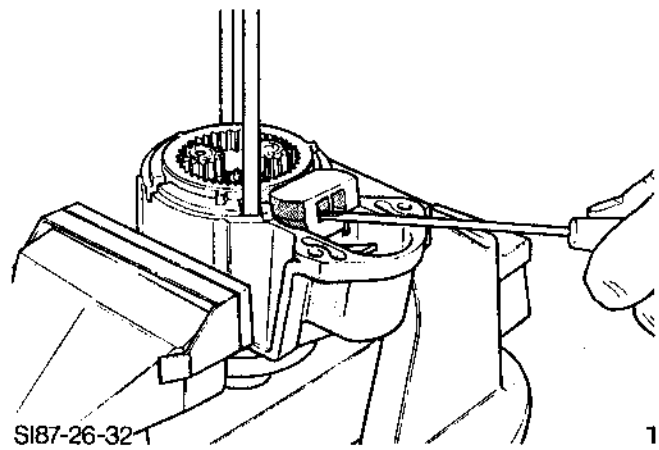


Fig.26. Remove pinion assembly from drive end housing.

9. To remove the pinion from the output shaft, support assembly as shown in Fig.27, using a suitably dimensioned tube e.g. deep socket, to separate the thrust collar from the 'C' clip.

NOTE: Do not grip the one-way clutch in a vice whilst carrying out this operation as it will be damaged.

10. Remove the 'C' clip and slide the drive pinion assembly off the output shaft.

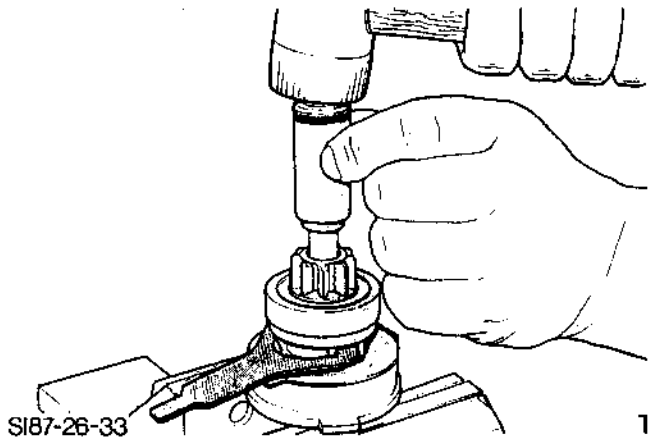


Fig.27. Separate thrust collar from 'C' clip.

11. Remove the circlip, Fig.28, and washer from the drive pinion assembly and slide off the actuating levers and carrier. Remove the actuating levers from the carrier.

12. Remove the circlip and washer from the output shaft and slide off the bearing support plate, seal and plastic support cup.

13. After dismantling, examine all components for wear or damage and replace as necessary.

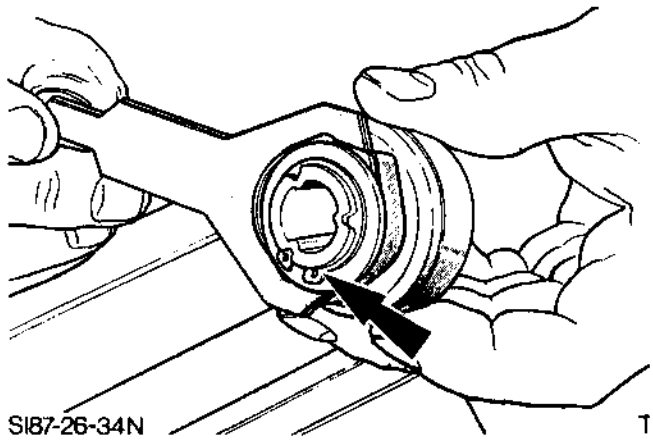


Fig.28. Remove circlip from drive pinion assembly.

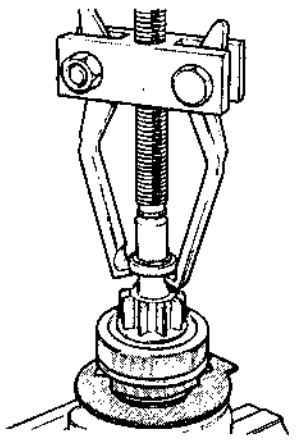
To Assemble

14. Refit the plastic support cup, seal and bearing support plate to the output shaft and secure with the washer and circlip.

NOTE: Make sure that the seal is correctly located in the support cup.

15. Refit the actuating levers to the carrier. Slide carrier onto the drive pinion assembly. Refit the washer and circlip.

16. Slide the drive pinion assembly onto the output shaft. Fit thrust collar and 'C' clip, using a suitable puller to locate collar on 'C' clip, Fig.29.

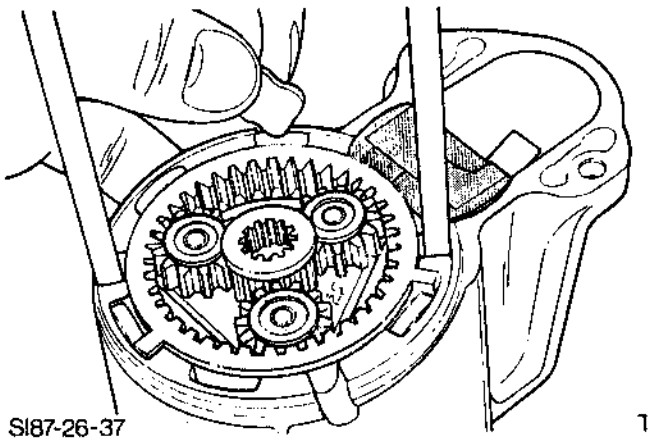


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Fig.29. Use a suitable puller to locate thrust collar.

17. Refit the rubber block to the actuating lever and refit pinion/clutch assembly into the drive end housing ensuring correct location of the rubber block.

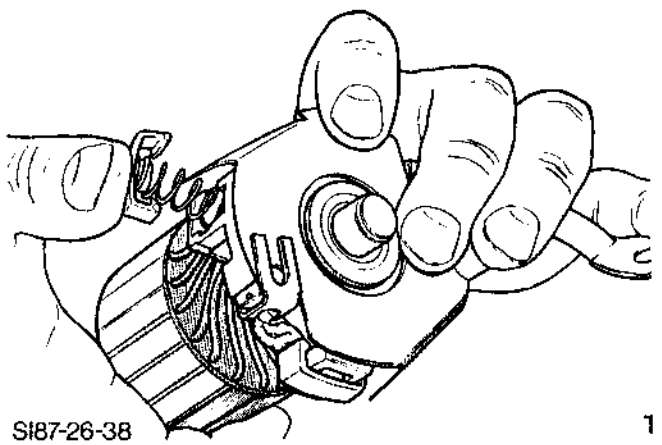
18. Reassemble the epicyclic gear train with lithium based grease ensuring correct location of the plastic thrust blocks, Fig.30.



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Fig.30. Correct location of thrust blocks.

19. Assemble the brush boxes on the commutator and refit the insulator, Fig.31.



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Fig.31. Assemble brush boxes on commutator.

20. Insert the armature into the yoke housing, ensuring correct location of the through bolts and solenoid cable, Fig.32. Refit spacer and bearing plate.

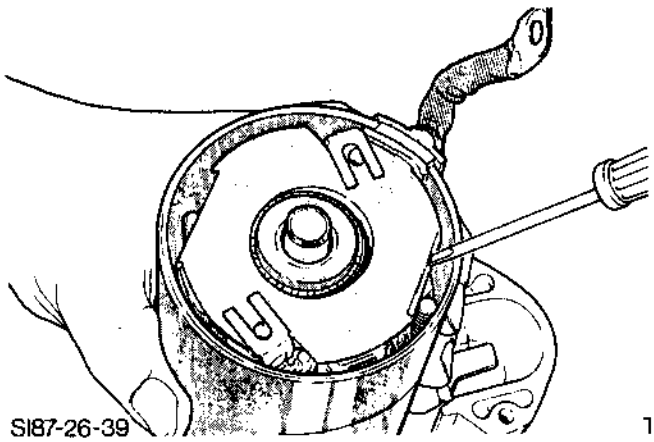


Fig.32. Insert armature into yoke housing.

21. Fit the main casing to the drive end housing and align correctly, Fig.33.

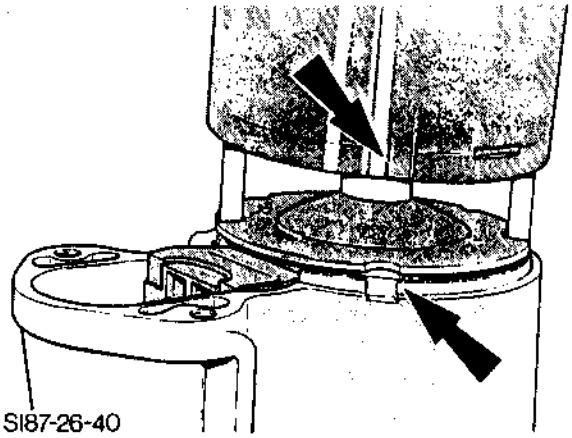


Fig.33. Align main casing with drive end housing.

22. Refit commutator end plate and brush assembly retaining screws, secure with through bolt nuts.

23. Smear lithium based grease over solenoid armature 'hook' and refit to actuating arm. Refit solenoid spring and yoke and secure with two screws.

24. Reconnect cable to solenoid stud.

Engine Management and Emission System 29L

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22 214 0	Distributor - Remove and Install	-		5
22 215 5	Phase Sensor - Distributor - Remove and Install (Districutor removed)	-		6
22 292 0	Ignition Amplifier Module - Remove and Install	-		7
22 414 0	Ignition Coil - Remove and Install	-		7
22 619 0	Speed Sensor - Engine - Remove and Install	-		8
23 174 0	Air Cleaner Assembly - Remove and Install	-		9
23 215 0	Fuel Mixture/CO - Adjust	-		10
23 266 0	Fuel Pressure Regulator - Remove and Install	-		11
23 323 0	Idle Speed Control Valve - Remove and Install	-		12
23 325 0	Throttle Position Sensor - Remove and Install	-		13
23 455 0	Fuel Injectors - Remove and Install	-		14
23 534 0	Fuel Pump - Remove and Install	-		16
23 545 0	Fuel Filter - Remove and Install	-		17
23 601 0	Boost Pressure - Adjust	-		18
23 612 0	Turbocharger - Remove and Install	-		21
23 616 0	Solenoid Control Valve - Remove and Install	-		27
23 620 0	Intercooler - Remove and Install	-		28
29 622 0	Air Charge Temperature Sensor - Remove and Install	-		31
29 200 0	Control Module - Engine Management - Remove and Install . ..	-		32
29 224 0	Sensor - Manifold Absolute Pressure - Remove and Install ..	-		33

TECHNICAL DATA

Fuel System

Injectors

Manufacturer	Weber
Type	Electronically operated
Grease for injector seals, specification No.	ESEM 1C171A

Fuel Pump

Manufacturer	Bosch
Type	Roller cell
Output pressure	Greater than 5 bar at 12 volts

Pressure Regulator

Manufacturer	Weber
System pressure	3,5 bar (when ignition is switched on)
System pressure	3,0 bar (at idle speed)

Idle Speed .. 850 rpm

Idle CO% .. 1,0 to 2,0

Turbocharger

Maximal boost pressure (ECU controlled) .. 0,7 bar (max. 0,9 bar)

Solenoid control valve:

Control begins at	1,000 rpm (approximately)
Boost reduces at	6,000 rpm (approximately)
Charge air control temperature	70°C

Tightening Torques

	Nm		
Locknut actuator rod	5,6 to 7,9		
Actuator to retainer	5,6 to 7,9		
Intermediate housing to turbine housing	18,5 to 21,9		
Intermediate housing to compressor housing	16,4 to 19,8		
Turbo damper to cylinder head	18,5 to 21,5		
Turbo damper friction assembly	Finger tight + 1½ turns		
Lock nut turbo damper	6 to 8		
Turbocharger to secondary exhaust manifold	40 to 48		
Exhaust down pipe to turbocharger	19 to 23 (M8)	35 - 47 (M10)	
Main exhaust manifold to secondary exhaust manifold	32 to 36		
Oil feed adaptor to turbocharger	25 to 35		
Oil feed to adaptor	25		
Turbo drain pipe to turbo	18,5 to 21,5		
Water pipe banjo bolts to turbo	19 to 23		
Throttle cable bracket to plenum cover	18,5 to 21,5	+	Loctite 518
Fuel regulator to bracket	8 to 10		
Fuel regulator bracket to inlet manifold	8 to 10		
Fuel regulator banjo bolt	1,5 to 2		
Fuel rail to plenum cover	8 to 10		
Camshaft breather valve to inlet manifold	8 to 10		
Breather valve intake to plenum cover	15 to 20	+	Loctite 242
Air temperature sensor to plenum cover	23 to 25	+	Loctite 518

TECHNICAL DATA (cont'd)

Ignition System

Coil

Primary resistance	0,72 to 0,88 ohms
Secondary resistance	4500 to 7000 ohms

Spark Plugs

Type	AGPR901C
Electrode gap - all territories	0,75 mm (0,030 in)
Firing order	1 - 3 - 4 - 2

Distributor

Dwell angle	It is totally controlled by the electronic module and cannot be adjusted
Idle advance initial	16° BTDC

HT Leads

Resistance	30,000 ohms maximum per lead
Heat sink compound	81SF-12103-AA

Tightening Torques	Nm	
TDC sensor bracket to sump	8 to 10	
TDC sensor to bracket	4 to 6	Loctite 270
Distributor clamp to cylinder block	18,5 to 21,5	

Clearance Settings

TDC sensor to pulley teeth	0,6 to 1,0 mm
Distributor cam to phase sensor	0,2 to 0,3 mm

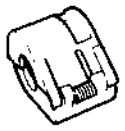
FUEL (PETROLEUM SPIRIT) HANDLING SAFETY PRECAUTIONS

When carrying out repairs to vehicle fuel systems it is easy to become complacent about handling fuel, particularly in relation to draining fuel tanks. The risks involved should not be under-estimated. The information contained in Section 05 on the SIERRA Service Microfiche provides the basic precautions which must be taken if fuel is to be handled safety and also points out some other areas of risk that must not be overlooked.

WARNING:

- The fuel system remains pressurised when the engine has stopped. Adequate safety precautions must be taken when removing fuel lines to prevent fuel spillage.
- Loosen fuel pipes slowly to relieve system pressure.

SPECIAL SERVICE TOOLS

Tool	Tool Name
 23-021	Pressure Gauge
 23-023A	Fuel Hose Remover

GENERAL EQUIPMENT

- CO Meter
- Tamperproof Plug Remover, 150 mm long
- Cooling System Pressure Tester

SERVICE AND REPAIR OPERATIONS

22 214 0 DISTRIBUTOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable. Remove air hose from intercooler to throttle body.
2. Unclip distributor cap and position clear of distributor. Remove rotor arm and dust cover. Refit rotor arm.
3. Using a spanner on the crankshaft pulley bolt, rotate the engine clockwise until No.1 cylinder is at T.D.C. No.1. cylinder is at T.D.C. when the lug nearest the groove on the pully is inline with pointer and the rotor is pointing to the distributor body scribe mark.

   NOTE: If rotor is 180° degrees out, continue rotating engine until both marks align.

4. Disconnect distributor multiplug. Remove distributor retaining bolt and plate, and remove distributor from engine.

To Install

   Note: If refitting the old distributor, go to Sub-Operation No.6.

5. Remove cap, rotor and dust cover from new distributor and refit rotor. Transfer HT leads from old distributor cap to the new.
6. Check that 'O' ring on distributor body is in good condition, fit a new 'O' ring if necessary.
7. Turn distributor shaft until the rotor is aligned with the cap retaining clip, as shown in Fig.2.
8. Insert distributor into engine. Rotate distributor body until rotor aligns with scribe mark. Fit retaining plate and bolt, and tighten bolt.
9. Remove rotor and refit dust cover, rotor and distributor cap.
10. Reconnect distributor multiplug and refit air hose.
11. Reconnect battery and remove fender covers.

    Note: Ignition timing is totally controlled by the module and does NOT require checking with a timing light.

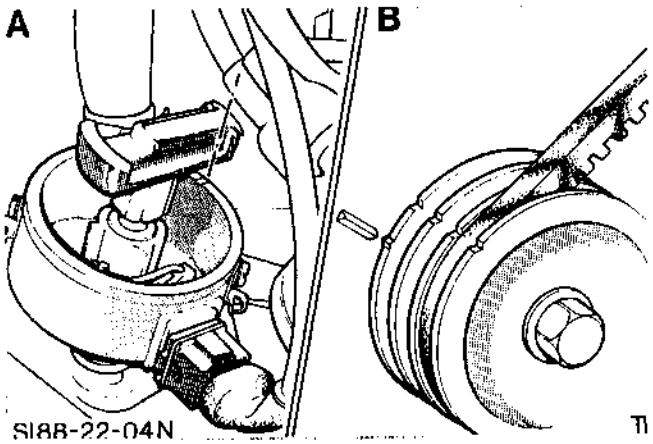


Fig.1. No.1. cylinder at T.D.C.
A - Distributor mark
B - Crank pulley lug inline with pointer

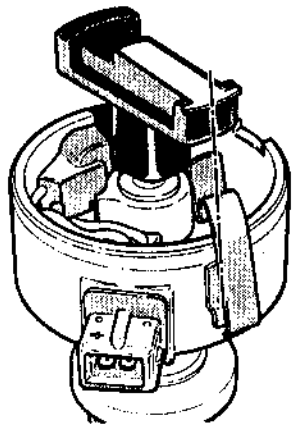
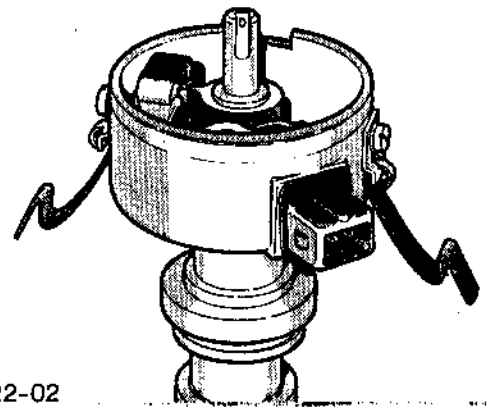


Fig.2. Before installing distributor, align rotor with distributor cap retaining clip.

22 215 5 PHASE SENSOR - DISTRIBUTOR - REMOVE AND INSTALL (Distributor removed)

SPECIAL TOOLS REQUIRED: NONE



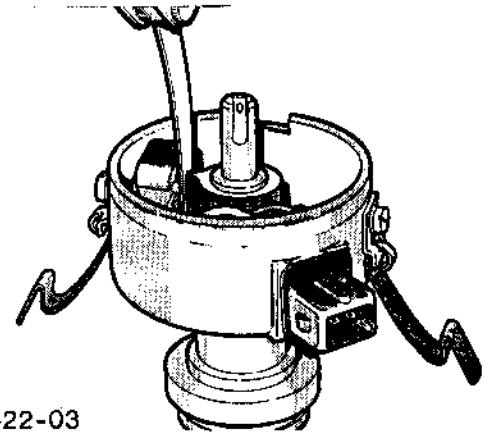
SI88-22-02 TI

Fig.3. Distributor removed.

To Dismantle

1. Remove rotor arm, disconnect phase sensor plug and remove from base plate.

2. Remove base plate and phase sensor from distributor housing (2 bolts).



SI88-22-03 TI

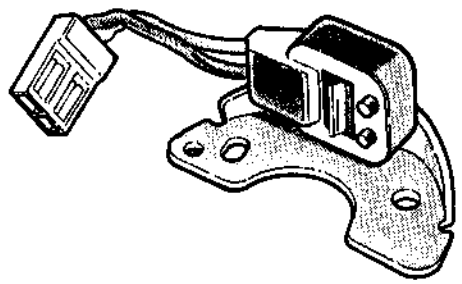
Fig.4. Adjust distributor phase sensor to obtain the correct clearance.

To Reassemble

3. Fit base plate and phase sensor to distributor housing (2 bolts).

4. Fit phase sensor plug to base plate.

5. Adjust phase sensor (distributor)
Slacken the base plate, Fig.4. and adjust phase sensor to a distance of 0,2 to 0,3 mm from the distributor shaft cams. Tighten base plate. Refit rotor arm.



SI88-22-05 TI

Fig.5. Phase sensor removed.

22 292 0 IGNITION AMPLIFIER MODULE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.
2. Depress locking clip on multiplug and disconnect multiplug.
3. Remove two screws, lock washers and plain washers.

To Install

4. Coat rear face of ignition amplifier module with heat sink compound, refer Technical Data.
5. Position and secure module with two screws, lock washers and plain washers.
6. Reconnect module multiplug.
7. Reconnect battery and remove fender covers.

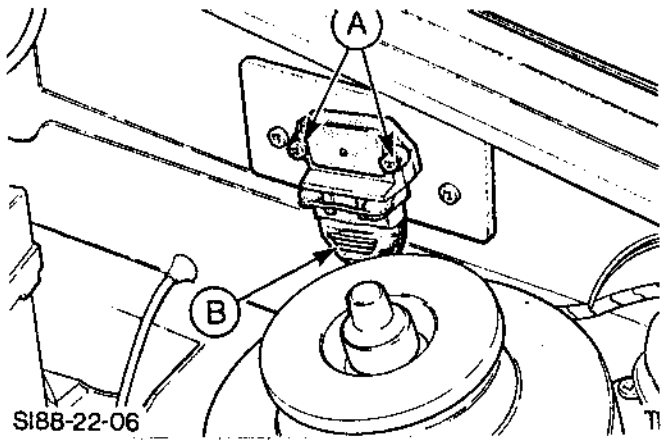


Fig.6. Ignition amplifier module.
A - Multiplug connection
B - Two securing screws

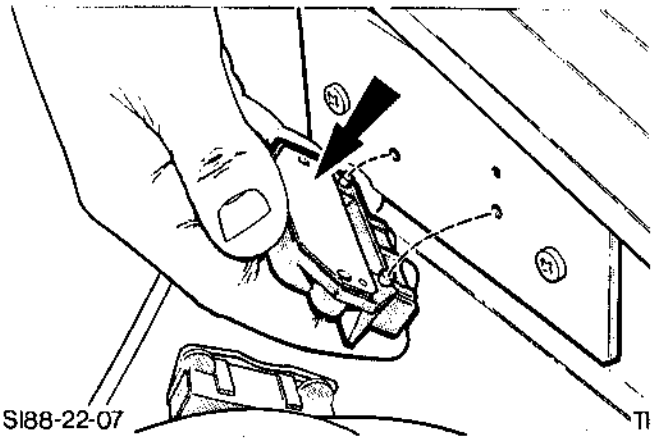


Fig.7. Coat rear face of module with heat sink compound.

22 414 0 IGNITION COIL - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.
2. Disconnect HT and LT connections at coil. Remove two screws and detach coil with strap assembly and suppression capacitor.

To Install

3. Position coil, strap assembly and suppression capacitor, secure with two screws. Reconnect HT and LT connections.
4. Reconnect battery earth cable. Start engine check coil operation. Remove fender covers.

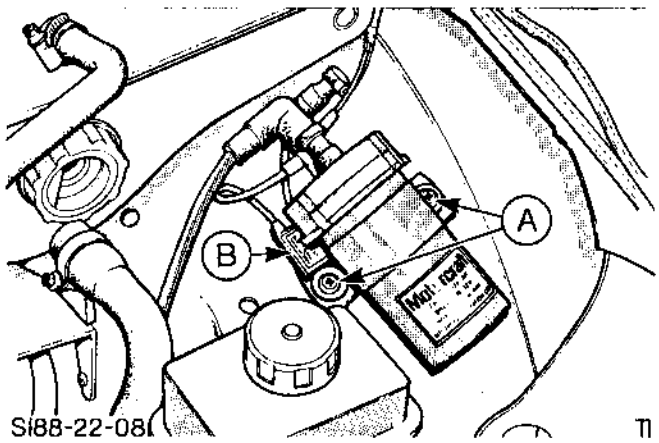


Fig.8. Ignition coil.
A - Mounting screws
B - Suppression capacitor

22 619 0 SPEED SENSOR - ENGINE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Raise vehicle.

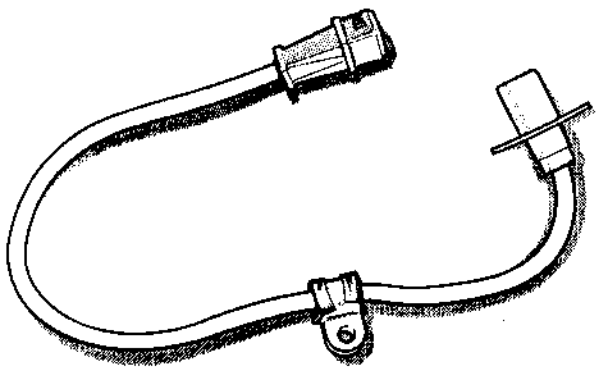


Fig.9. Engine speed/TDC sensor removed.

3. Remove engine speed/TDC sensor from sump (2 bolts).

4. Disconnect multiplug plug, from wiring harness and remove cable from retainer. Remove cable clip from sump (1 bolt) and remove engine speed/TDC sensor.

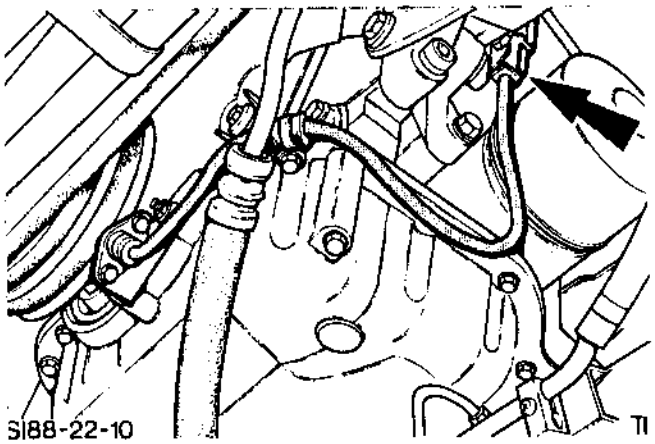


Fig.10. Engine speed/TDC sensor cable plug.

To Install

5. Clip engine speed/TDC sensor cable into retainer and connect multiplug.

6. Fit engine speed/TDC sensor to mounting. Align crankshaft pulley teeth with sensor and set sensor clearance, 0,6 to 1,0 mm.

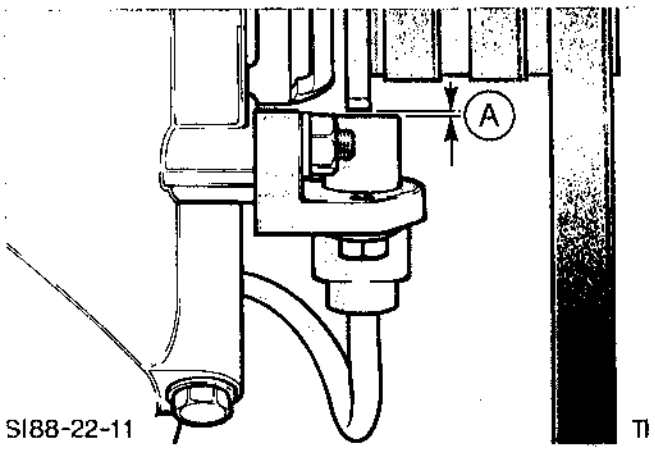


Fig.11. Engine speed/TDC sensor.
A - 0,6 to 1,0 mm

7. Lower vehicle.

8. Re-connect battery earth cable.

23 174 0 AIR CLEANER ASSEMBLY - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cables and fit fender covers.

2. Remove air hose engine ventilation, air hose solenoid control valve and air hose turbo-charger from air cleaner cover.

3. Release air cleaner cover, detach and remove air cleaner element.

4. Remove right hand inner fender protector. Remove air cleaner box retaining nuts and washers from beneath inner fender.

5. Withdraw air cleaner box from engine compartment.

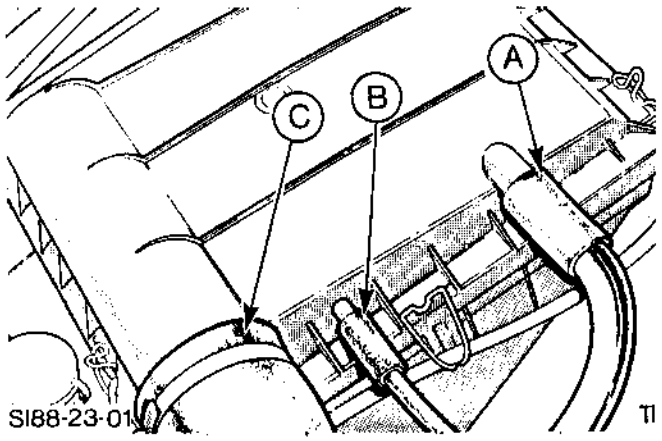


Fig.12. Air cleaner hose connections.
A - Engine ventilation hose
B - Solenoid control valve hose
C - Turbocharger hose

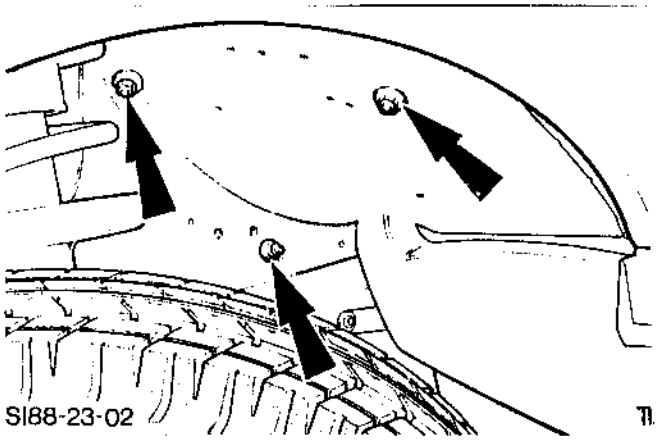


Fig.13. Air cleaner retaining nuts to inner wheel arch.

To Install

6. Transfer metal reinforcements to new air cleaner box.

7. Locate air cleaner box and refit retaining nuts and washers from beneath inner fender.

8. Fit new air cleaner element and cover, secure with five clips.

9. Reconnect air hoses to cover. Refit inner fender protective shield.

10. Reconnect battery and remove fender covers.

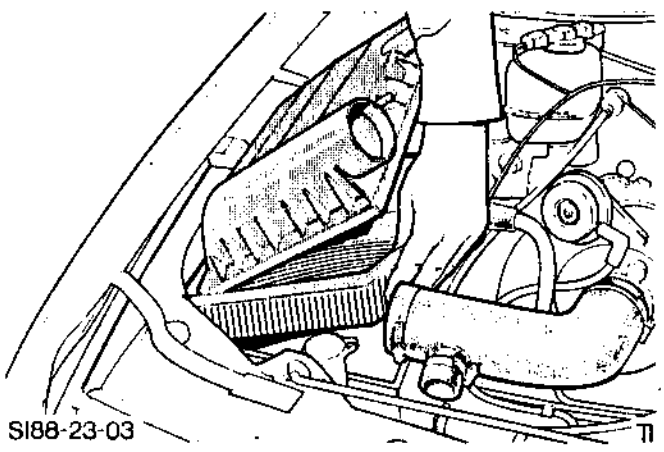


Fig.14. Air cleaner removal.

23 215 0 FUEL MIXTURE/CO - ADJUST

SPECIAL EQUIPMENT REQUIRED:

CO Meter
Tamperproof Plug Remover, 150 mm long

IMPORTANT NOTE: If CO reading is exceptionally high (above 2,5%) or below 0,3%, carry out checks contained in the Vehicle System Test Manual for high fuel consumption.

To Adjust

1. Remove module cover from above glove box.

2. Remove tamperproof plug with a suitable tool.

IMPORTANT NOTE: When performing this operation, note that the depth of the tamperproof plug remover should not exceed 4 mm as this will result in damage to the CO adjustment potentiometer.

3. Warm engine to normal operating temperature.

4. Connect a CO meter to engine as per manufacturer's instructions.

5. Stabilise engine by running at 3000 rpm for approximately 15 seconds and allow engine to idle.

6. Wait for meter to stabilise and record %CO and idle speed.

7. Adjust CO screw with screwdriver to achieve correct %CO, Fig.16.

8. Remove idle speed control valve multiplug. Engine should idle at 850 rpm. If idle is incorrect, refer to the Vehicle System Test manual and carryout checks for incorrect idle speed.

9. Switch off engine and remove equipment. Fit new tamperproof plug.

10. Fit module cover.

IMPORTANT NOTE: Adjustment must be carried out within 10 to 30 seconds from time meters stabilise. If time taken is longer than 30 seconds, run engine again at 3000 rpm for 15 seconds and re-check.

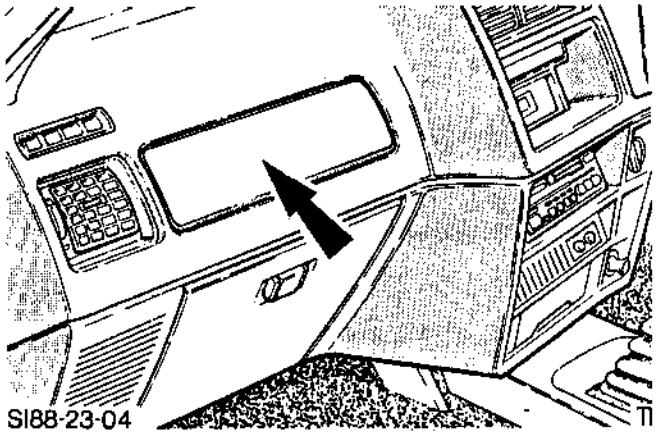


Fig.15. Module cover.

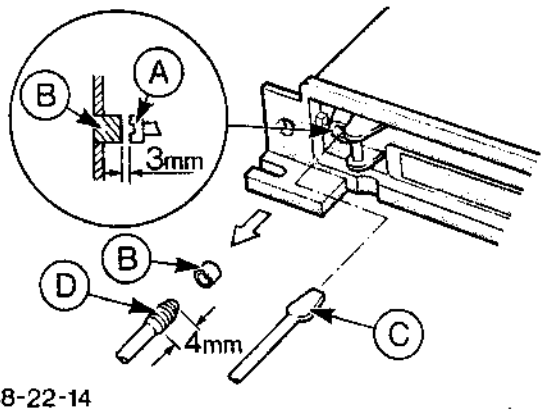


Fig.16. A - CO adjustment ssrew
B - Tamperproof plug
C - Screwdriver
D - Tamperproof plug remover

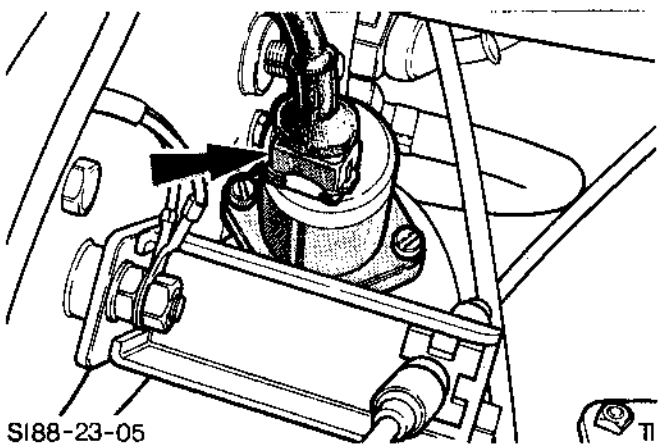


Fig.17. Idle speed control valve multiplug.

23 266 0 FUEL PRESSURE REGULATOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

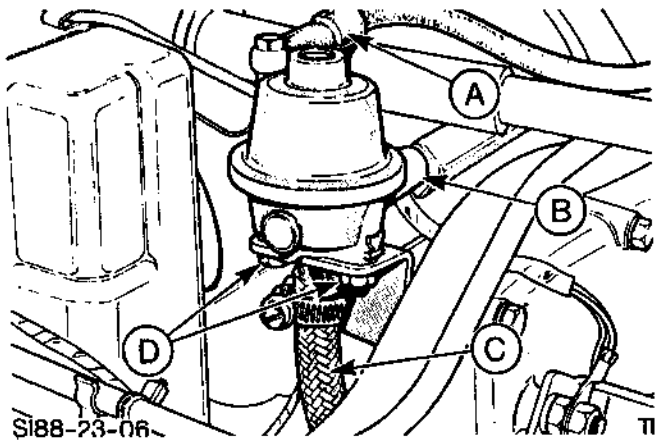


Fig.18. Fuel pressure regulator.
A - Vacuum/air hose C - Fuel return
B - Fuel feed D - Retaining bolts

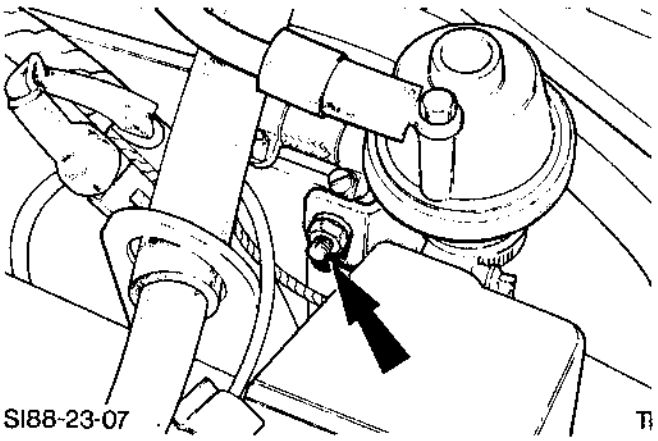


Fig.19. Fuel pressure regulator mounting bracket retaining nut.

To Remove

1. Disconnect battery and fit fender covers. Disconnect vacuum/air hose.

2. Disconnect fuel return pipe and slacken fuel feed pipe.

NOTE: If a crimped type hose clamp is fitted, it must be cut free using side cutters.

3. Remove regulator from its mounting bracket (2 bolts). Remove mounting bracket retaining nut and remove bracket.

To Install

4. Position and secure regulator to its bracket. Secure bracket to air intake.

5. Tighten fuel feed pipe and refit fuel return pipe.

NOTE: Ensure regulator inlet pipe is aligned with fuel rail, adjust bracket if necessary.

6. Reconnect vacuum/air hose. Reconnect battery and remove fender covers.

23 323 0 IDLE SPEED CONTROL VALVE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

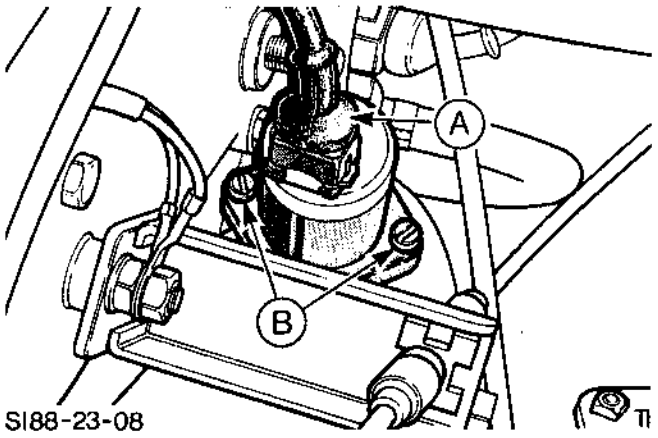


Fig.20. Idle speed control valve.
A - Multiplug
B - Retaining bolts

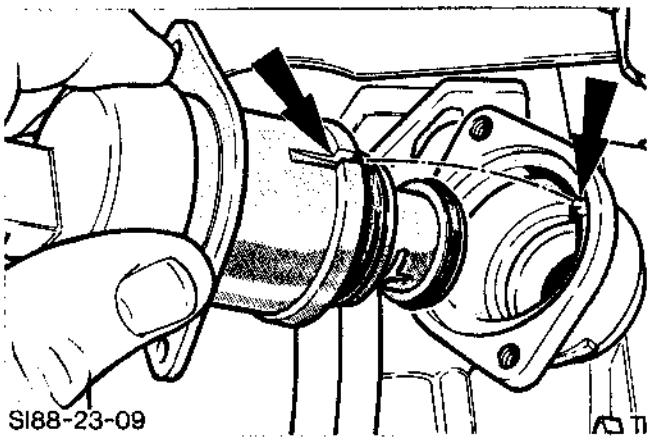


Fig.21. Locate valve on detent pin.

To Remove

1. Disconnect battery earth cable and fit fender covers.
2. Remove multiplug from idle speed control valve.
3. Remove two retaining bolts and withdraw idle speed control valve.

To Install

4. Fit new O-rings. Position idle speed control valve to detent pin and secure valve.
5. Refit multiplug.
6. Reconnect battery and remove fender covers.

23 325 0 THROTTLE POSITION SENSOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable and fender covers.
2. Remove throttle cable from throttle butterfly (1 clip).

NOTE: Do not remove throttle cable bracket from air chamber as Loctite used at initial build may fall inside air chamber.

3. Remove air hose from throttle body intake connection.
4. Disconnect throttle position sensor plug and idle speed control plug.
5. Remove throttle butterfly housing from air chamber connection (4 bolts).
6. Remove sensor from throttle butterfly housing (2 bolts).

To Install

7. Locate sensor on throttle butterfly shaft and turn anti-clockwise until spring pressure is felt. Tighten retaining bolts ensuring spring pressure is not being applied.
8. Clean gasket faces and using a new gasket, fit throttle butterfly housing to air chamber connection.
9. Connect plugs to throttle position sensor and idle speed control valve.
10. Fit air hose to throttle plate intake connection.
11. Fit throttle cable to throttle butterfly. Adjust throttle cable.
12. Re-connect battery earth cable and remove fender covers.

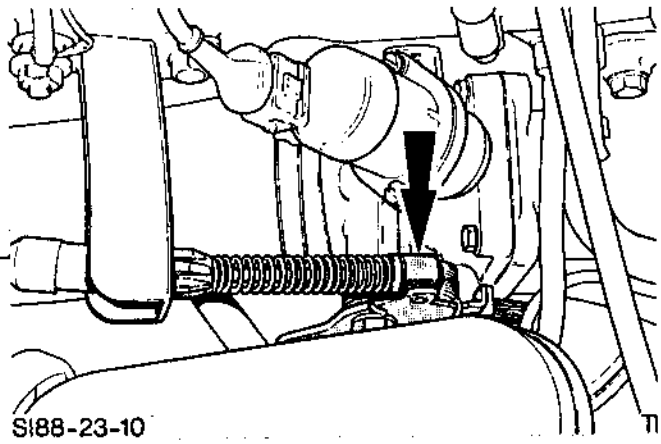


Fig.22. Remove throttle cable from throttle butterfly.

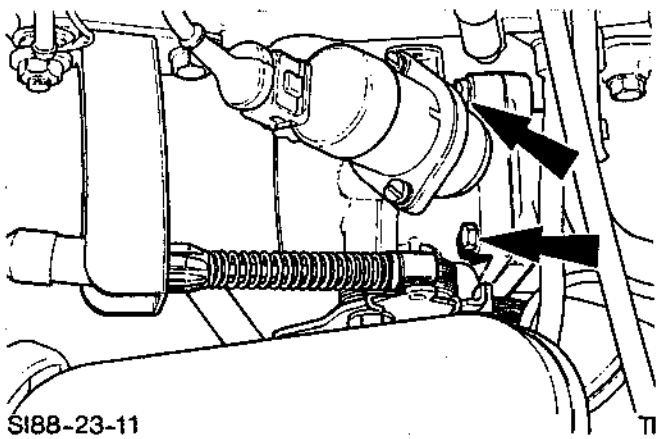


Fig.23. Remove throttle housing retaining bolts (4) - 2 bolts arrowed.

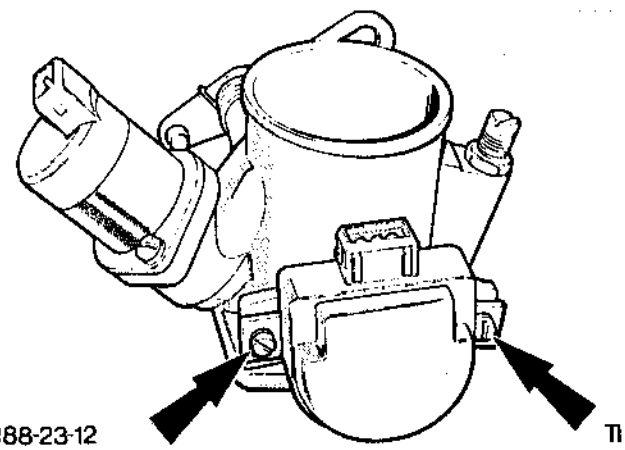


Fig.24. Throttle position sensor securing screws.

23 455 0 FUEL INJECTORS - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED:

Fuel Hose Remover 23-023A

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

To Remove

1. Disconnect battery earth cable and fit fender covers.

2. Remove vacuum line from fuel pressure regulator. Remove degas hose and crankcase vent pipe.

3. Disconnect multiplugs from injectors, idle speed control valve and air charge temperature sensor.

4. Remove fuel line from fuel pressure regulator, remove regulator mounting bolts and remove regulator.

NOTE: If a crimped type hose clamp is fitted, it must be cut free using side cutters.

5. Disconnect earth cables from air intake, cut cable ties and position cables clear of fuel rail.

6. Remove safety clip from fuel feed hose. Using Special Tool 23-023A, disconnect fuel feed pipe.

7. Remove fuel rail retaining bolts from air chamber (2 bolts). Remove fuel rail complete with injectors, from intake manifold.

8. Remove injectors from fuel rail (4 clips).

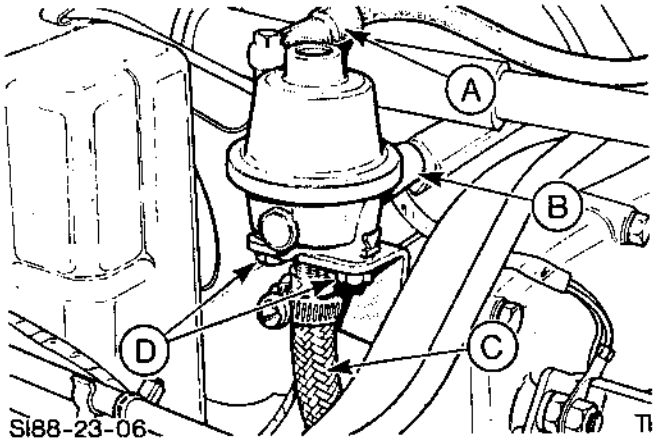


Fig.25. Fuel pressure regulator.
A - Air hose C - Fuel return
B - Fuel feed D - Retaining bolts

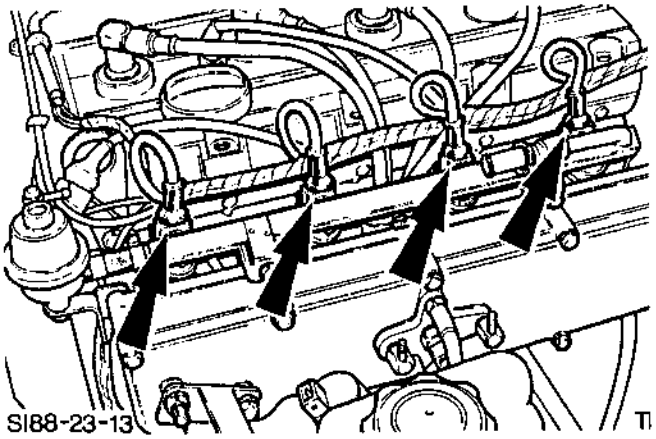


Fig.26. Injector plugs.

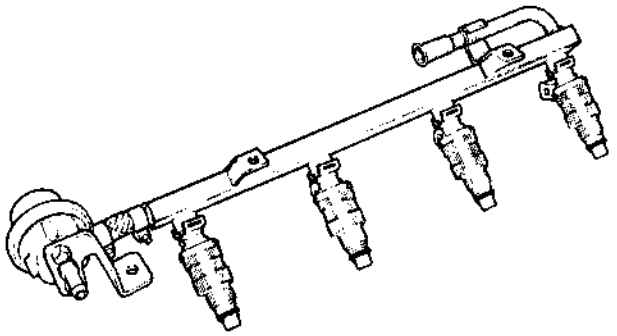


Fig.27. Fuel rail with injectors.

23 455 0

To Install

9. Fit injectors to fuel rail and secure with clips.

NOTE: Always use new 'O' rings and clips when refitting injectors.

10. Locate injectors complete with fuel rail into intake manifold and fit to air chamber (2 bolts).

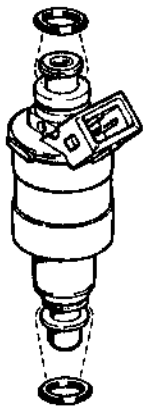

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Fig.28. Use new 'O' rings when refitting injectors.

NOTE: When installing the injectors, ensure there is a gap between intake manifold and injector body.

11. Fit fuel pressure regulator retaining bolts to air chamber.

12. Fit fuel line and vacuum line to fuel pressure regulator.

NOTE: If crimped clamps were removed they must be replaced with screw and nut type clamps.

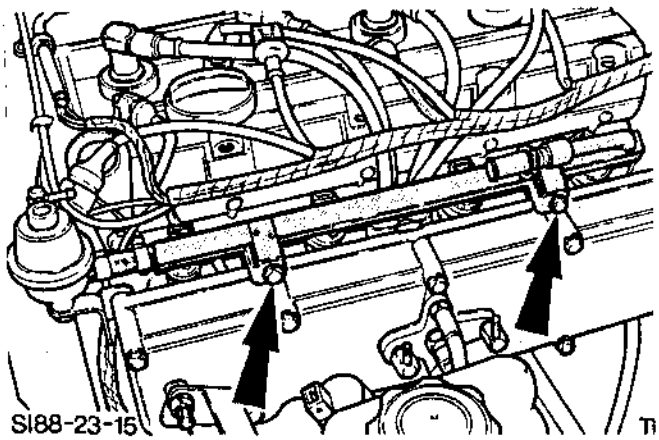

SI88-23-15

Fig.29. Refit fuel rail retaining bolts.

13. Connect multiplugs to injectors, idle speed control valve and charge temperature sensor. Route cables and secure with new ties.

14. Refit degas tank hose and crankcase vent pipe. Reconnect battery earth cable.

15. Start engine and check for any fuel leaks.

16. Remove fender covers.

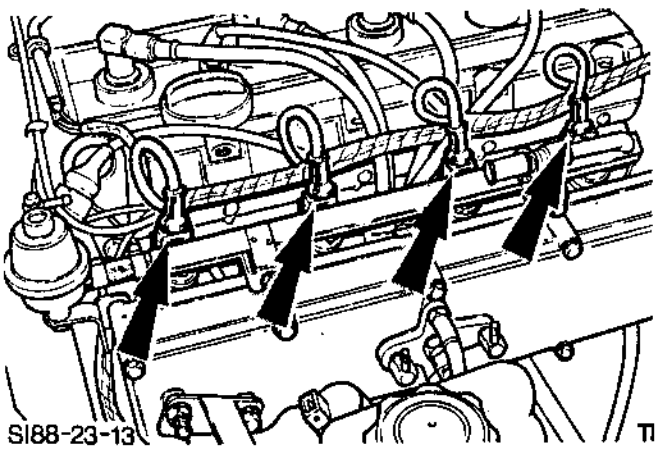

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Fig.30. Connect plugs to injectors.

1287

23 534 0 FUEL PUMP - REMOVE AND INSTALL

SPECIAL SERVICE EQUIPMENT REQUIRED: NONE

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE

To Remove

1. Disconnect battery.
2. Raise vehicle on a ramp. Clamp fuel pump inlet hose with a suitable clamp to prevent fuel draining from tank when hose is disconnected. Take care not to damage hose.
3. Hold a suitable container beneath fuel pump inlet connection, loosen clamp and remove hose. Plug end of hose to prevent fuel seepage.
4. Loosen fuel outlet hose gently as fuel system will still be pressurised. Remove hose and collect any fuel in a suitable container.
5. Disconnect wiring loom connectors. Loosen pump securing bolt and slide pump from bracket. Remove damper from outlet port.

To Install

6. Clean fuel and wiring connections.
7. Slide pump into bracket and secure.
8. Reconnect fuel lines and wiring. Remove clamp from hose.
9. Reconnect battery, start engine and check for leaks.
10. Lower vehicle to the ground.

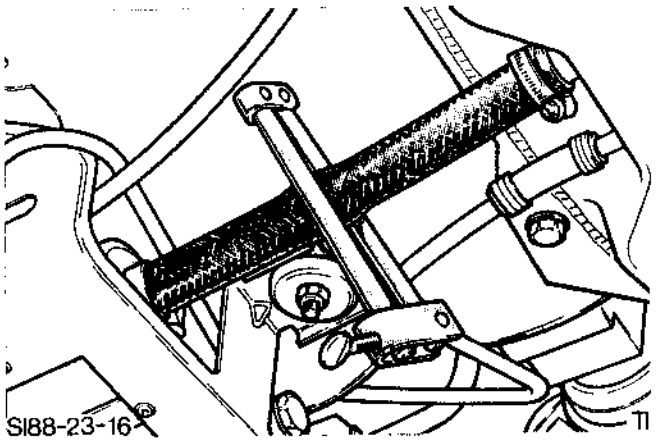


Fig.31. Pump inlet hose suitably clamped.

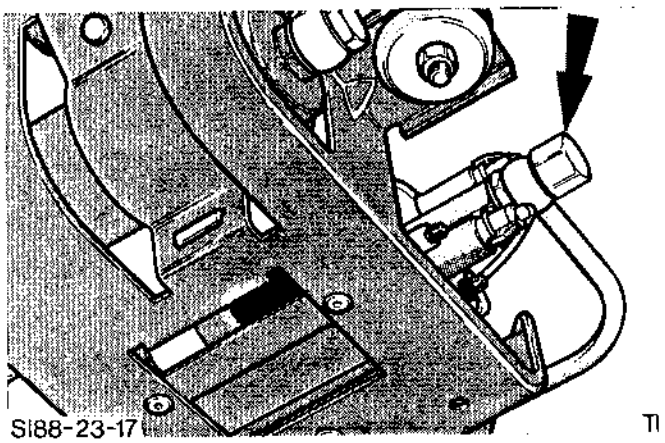


Fig.32. Slacken outlet hose, taking appropriate precautions to collect spilt fuel.

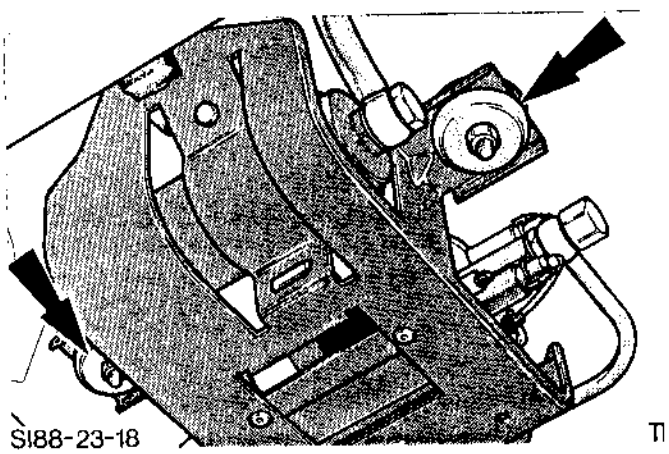


Fig.33. Fuel pump retaining nuts.

23 545 0 FUEL FILTER - REMOVE AND INSTALL

SPECIAL SERVICE EQUIPMENT REQUIRED: NONE

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

To Remove

1. Disconnect battery, raise vehicle on a ramp, clamp fuel feed hose at tank.

2. Position a suitable container beneath fuel filter. Slacken fuel inlet pipe, allow pressure in fuel line to reduce. Remove fuel inlet and outlet pipe.

3. Loosen filter retaining bolts and withdraw filter assembly.

NOTE: Take care when removing filter, as it contains fuel.

To Install

4. Fit new filter assembly and secure, ensuring that filter is round the correct way (note direction of flow arrows).

5. Refit fuel filter inlet and outlet pipes. Remove clamp.

6. Reconnect battery. Switch ignition 'on' and 'off' five times and check filter and fuel pipes for leakage.

7. Lower vehicle.

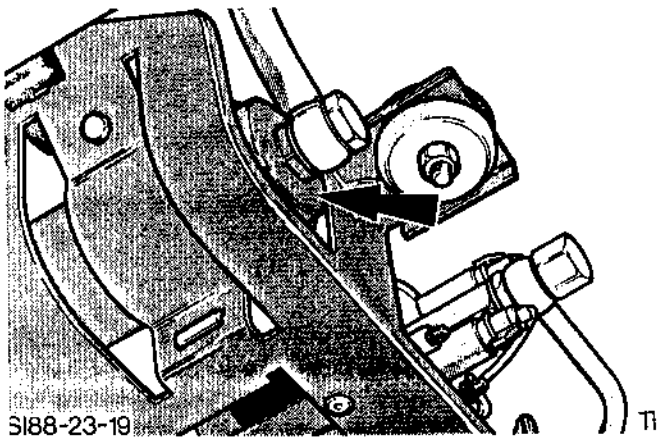


Fig.34. Fuel filter location.

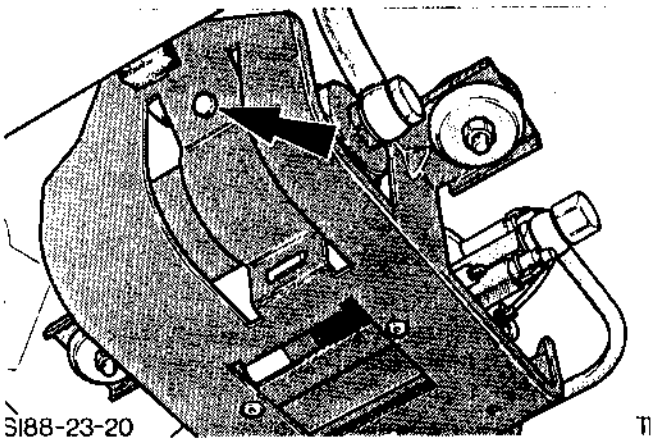


Fig.35. Fuel filter assembly.

23 601 0 BOOST PRESSURE - ADJUST

SPECIAL TOOLS REQUIRED:

Pressure Gauge and Hose 23-021
Cooling System Pressure Tester

NOTE: After fitment or replacement parts to the Turbocharger, the boost pressure will require resetting.

This operation is divided into two sections: initial 'static' adjustment and final adjustment during/after road test.

IMPORTANT NOTE: Roller testing is not recommended as the temperatures generated by the engine and brakes and the inadequate cooling available on a roller test.

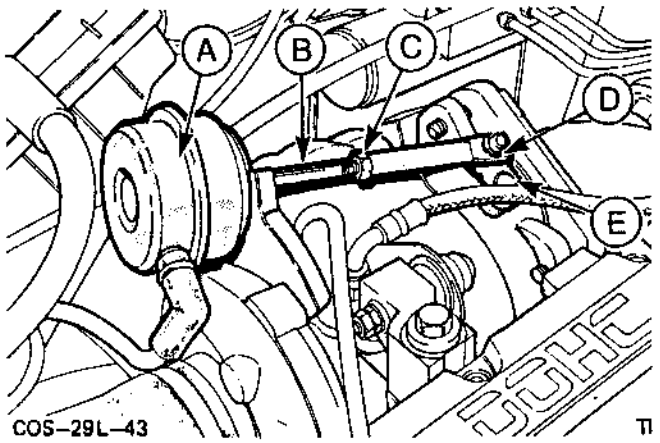


Fig.36. Actuator rod and waste gate.
A - Waste gate actuator D - Circlip
B - Actuator rod E - Operating lever
C - Locknut

Initial Static Adjustment

1. With the actuator rod disconnected from the waste gate operating lever, connect the cooling system pressure tester to the waste gate actuator and apply a pressure of 0,45 bar (max. 0,48 bar).

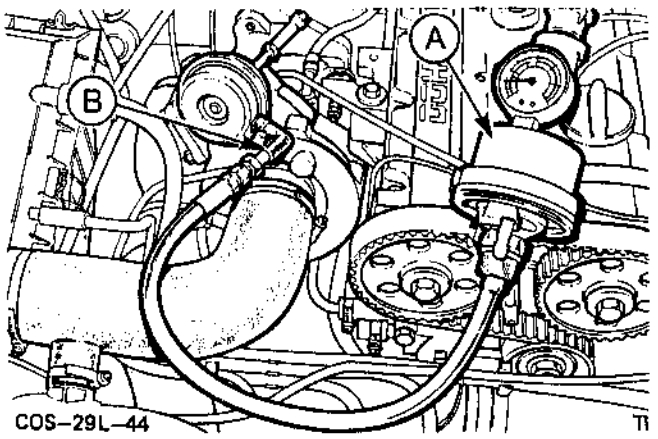


Fig.37. A - Cooling system pressure tester
B - Waste gate actuator hose

2. Move the operating lever to fully close the waste gaste valve.

3. With 0,45 bar (max. 0,48 bar) pressure still applied to the actuator, adjust the rod length so that it just slips onto the waste gate lever.

4. Fit a new circlip to retain the rod and tighten the locknut ensuring that the rod eye is not twisted and allows the waste gate to move freely when the pressure is released.

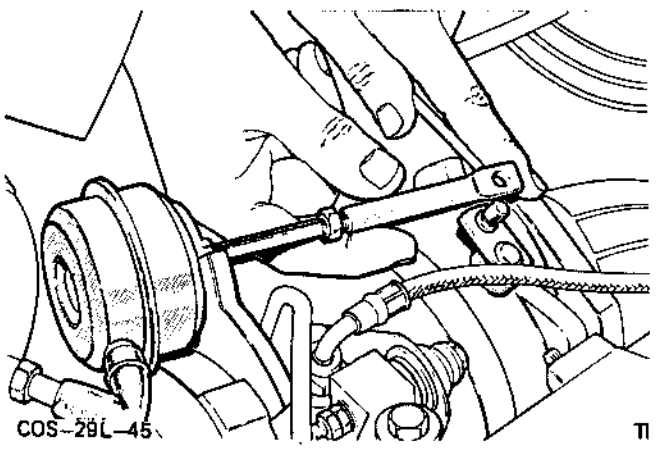


Fig.38. Adjust the rod length so that it just slips onto the waste gate lever.

23 601 0

Road Testing

NOTE: When performing this operation, the duration of the actual boost test itself should be no more than 3 - 5 seconds.

The boost pressure is measured via a gauge and connecting pipe work as detailed below:

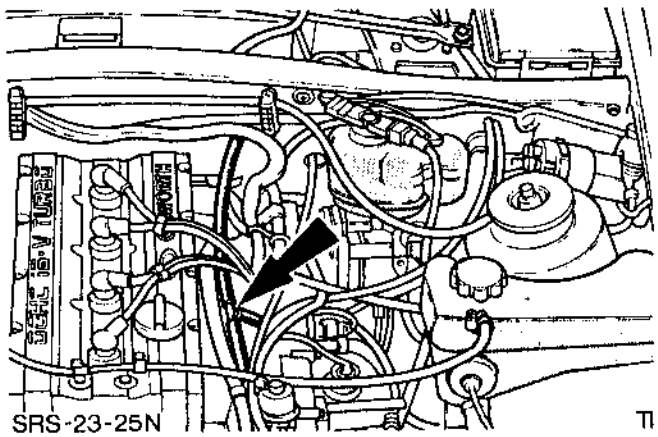


Fig.39. 'T' piece location (only on vehicles fitted with a boost gauge).

5. Pull off the hose of the turbocharger boost pressure gauge. Connect the pressure gauge, using a 2,0 metre length of 6 mm diameter neoprene tubing.

NOTE: It is essential for correct readings that the pressure gauge is securely fixed to the driver's side vent nozzle in an upright position.

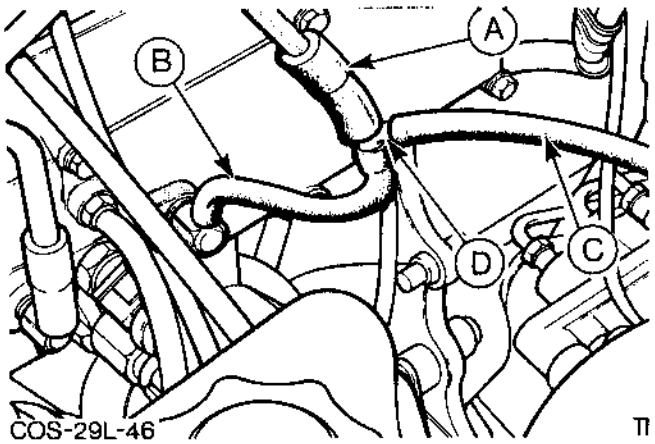


Fig.40. 'T' piece and hose installation.
A - Hose to bypass valve C - Hose to gauge
B - Hose to air chamber D - 'T' piece

6. Drive the vehicle until normal operating temperature is reached.

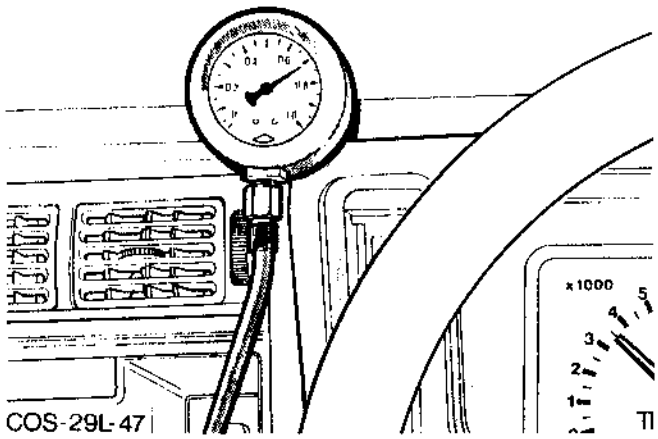


Fig.41. Gauge installation hose routing.

7. With a clear, straight road ahead and behind (preferably without junctions). Select 4th gear and drive along at an engine speed of approximately 1500 rpm.

8. Fully depress the throttle pedal.

9. Keeping the throttle pedal fully depressed, fully apply the brakes when the engine reaches 3500 rpm - DO NOT EXCEED THE TEST DURATION (MAX 5 SECS).
With both throttle and brake fully depressed read the boost pressure from the gauge.

   Specification: 0,7 bar (max. 0,9)

NOTE: After taking reading, drive the car for at least 1 mile to allow the brakes to cool.

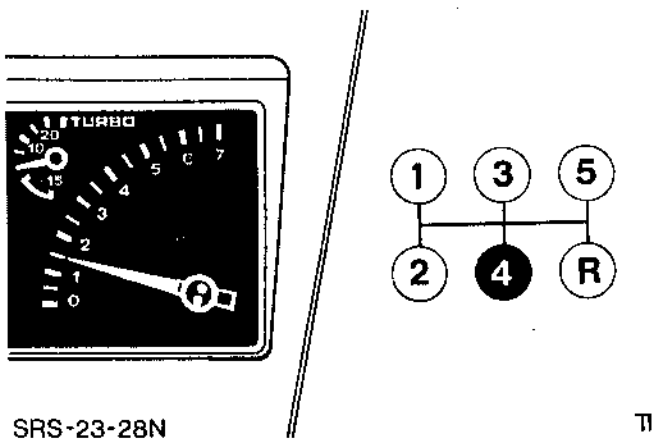


Fig.42. 4th gear engaged and engine speed at 1500 rpm.

10. If the reading obtained is within specification, apply a small amount of paint to the actuator rod threads and locknut to lock into position.

11. If the reading obtained was outside the specification, the actuator rod should be adjusted as follows:

12. Loosen locknut nut at rod eye, remove the circlip and detach the rod from the waste gate operating lever.

- Boost Pressure Low

  Shorten rod one half turn for every 0,02 bar of pressure below that specified.

- Boost Pressure High

  Lengthen rod one half turn for every 0,02 bar of pressure above that specified.

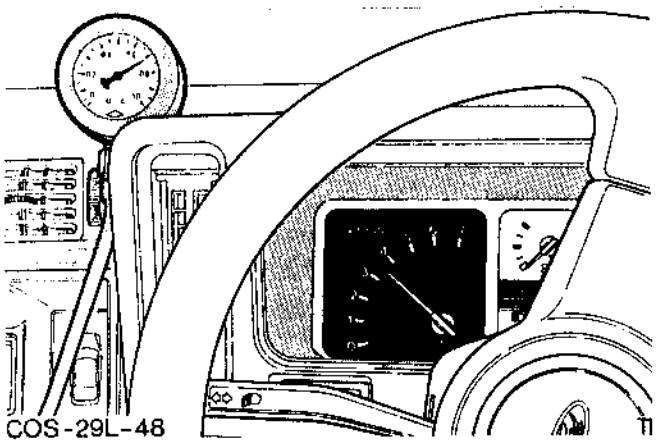


Fig.43. Readings with full load induced.

13. After adjustment, refit rod and circlip and tighten locknut ensuring the rod eye does not bind on the waste gate lever.

14. Repeat test.

15. If boost pressure is now within specification, apply paint to the actuator rod threads and locknut to lock in position.

16. Remove the test equipment and reconnect turbocharger boost pressure gauge hose to the 'T' piece.

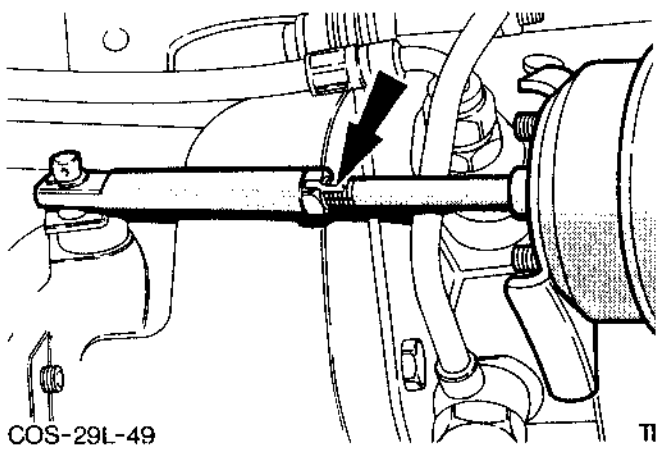


Fig.44. Paint mark over threads and locknut of waste gate actuator rod.

23 612 0 TURBOCHARGER - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.

2. Remove air hoses from air cleaner, bypass valve and turbocharger (3 hose clamps).

3. Remove heat shield.

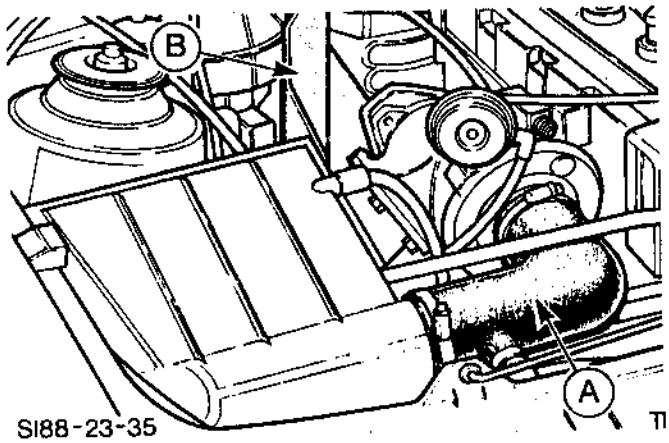


Fig.45. A - Top air hose
B - Heat shield

4. Remove both solenoid control valve hoses from turbocharger and actuator.

5. Remove bottom air hose from turbocharger.

6. Remove oil pressure hose from turbocharger.

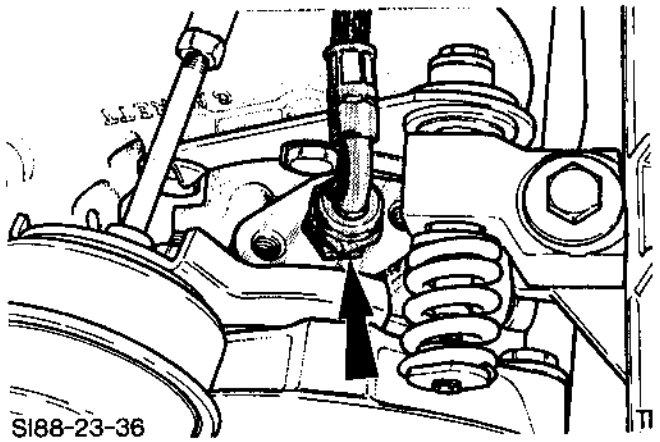


Fig.46. Oil pressure hose connection.

7. Remove turbocharger coolant return pipe from turbocharger. Detach retainer from cylinder head cover.

8. Remove turbocharger cooling feed pipe from thermostat housing.

9. Remove exhaust pipe from turbocharger (3 bolts).

10. Remove secondary exhaust manifold from main exhaust manifold (two bolts top and two bolts bottom).

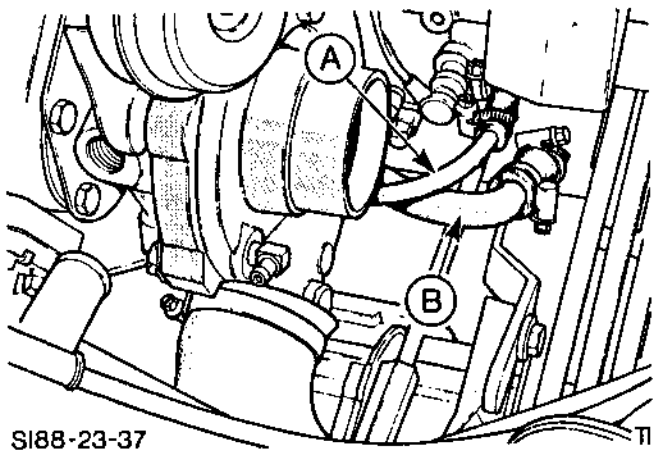


Fig.47. Turbocharger coolant.
A - Coolant feed pipe
B - Coolant return pipe

11. Remove turbocharger vibration damper assembly (1 bolt) and withdraw turbocharger.

12. Replace Turbocharger (turbocharger removed)

- Remove secondary exhaust manifold from turbocharger (4 bolts, locked).
- Remove oil return pipe (2 bolts).
- Remove coolant pipe from turbocharger.
- Remove waste gate actuator with rod and retainer (2 bolts, 1 clip).
- Transfer oil pressure/boost pressure connection fittings.
- Refit all parts in reverse order.
- Use new friction washers if necessary.

13. Position turbocharger assembly and locate oil return pipe.

14. Fit secondary exhaust manifold to main exhaust manifold, tighten bolts finger tight only.

NOTE: Use new bolts.

Install Turbocharger Vibration Damper (Damper without spring, for damper incorporating spring go to sub-operation 23).

NOTE: Special care should be taken during the assembly and adjustment of the turbocharger vibration damper.

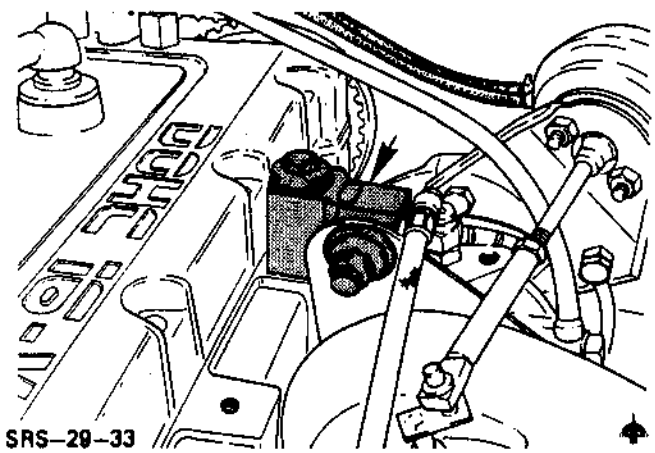


Fig.48. Turbocharger vibration damper.

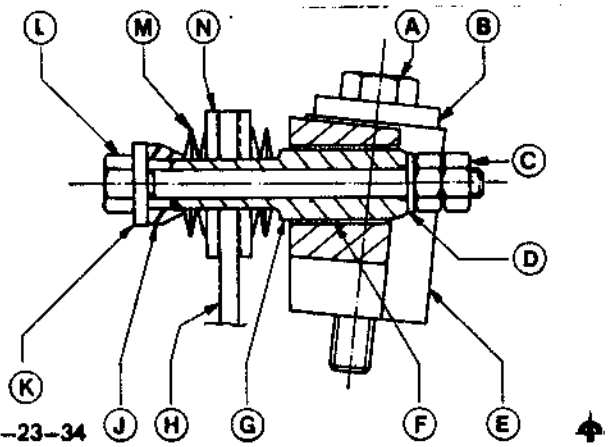


Fig.49. Turbocharger vibration damper cross section.

Fig.49. Turbocharger vibration damper cross section.
A - Bolt
B - Washer
C - Locknut
D - Washer
E - Damper support
F - Bearing bush
G - Guide pin
H - Turbocharger support
J - Taper sleeve
K - Washer
L - Bolt
M - Disc spring
N - Friction washer

15. Assemble the turbocharger vibration damper parts finger tight as shown in Fig.49.

16. Adjust the guide pin so that its shoulder protrudes 4 mm from the damper support. Check distance with a rule, Fig.50.

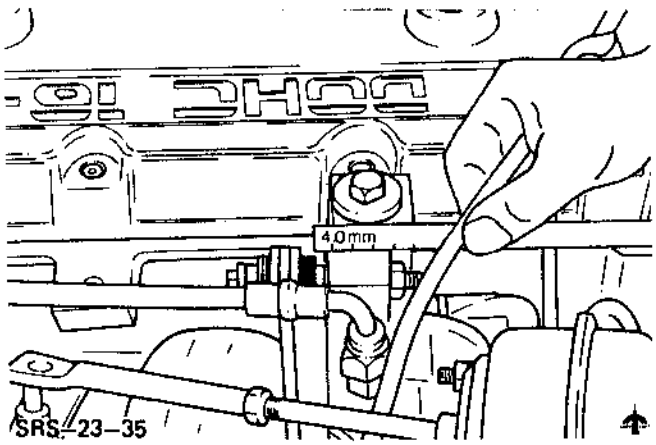


Fig.50. Setting - guide pin shoulder to damper support - 4 mm.

17. Adjust the vibration damper so that the friction washers are flush with the turbocharger holder at the top and also are 5,4 mm from the side.

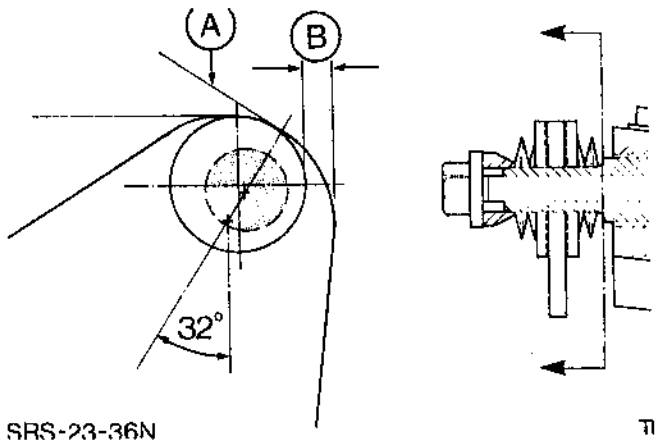


Fig.51. Turbocharger vibration damper assembly.
A - Holder and friction washers flush
B - Holder to friction washers 5,4 mm

18. Measure the distance between the friction washers and the turbocharger holder with vernier calipers.

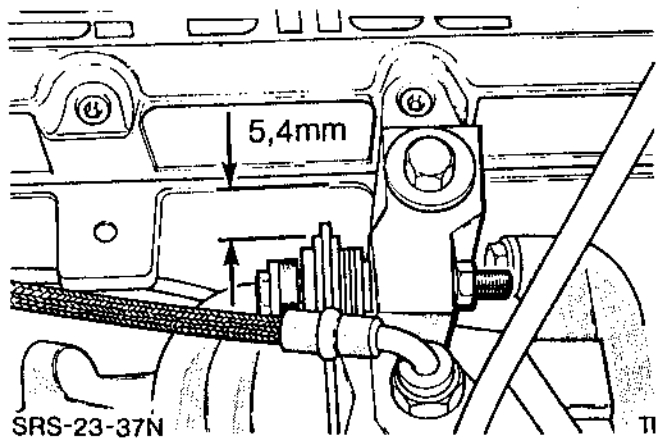


Fig.52. Holder to friction washer setting 5,4 mm.

19. Insert a 0,04 mm feeler gauge between two disc springs and tighten the nut until the feeler can just be withdrawn.

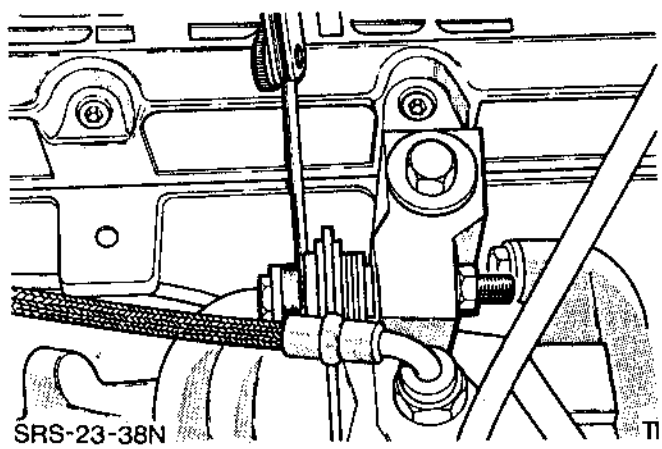


Fig.53. Feeler gauge (0,04 mm) between two disc springs.

20. Hold the bolt, then tighten the nut 1½ to 2 turns. Use a marking pen on the nut to assure correct adjustment.

NOTE: Do not exceed 2 turns.

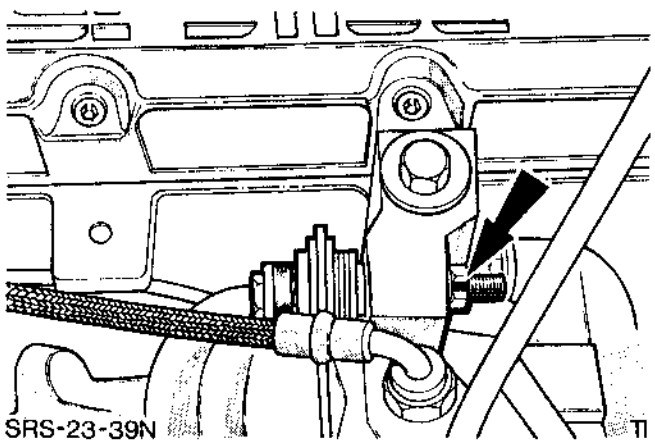


Fig.54. Mark nut.

21. Fit locknut and tighten to specified torque (see Technical Data).

NOTE: After tightening the locknut to the specified torque, recheck the 4,0 mm gap.

22. Tighten retaining screw, vibration damper to cylinder head, to the specified torque (see Technical Data).

Tighten the turbocharger manifold to exhaust manifold bolts (4) to the specified torque (See Technical Data), go to sub-operation 29.

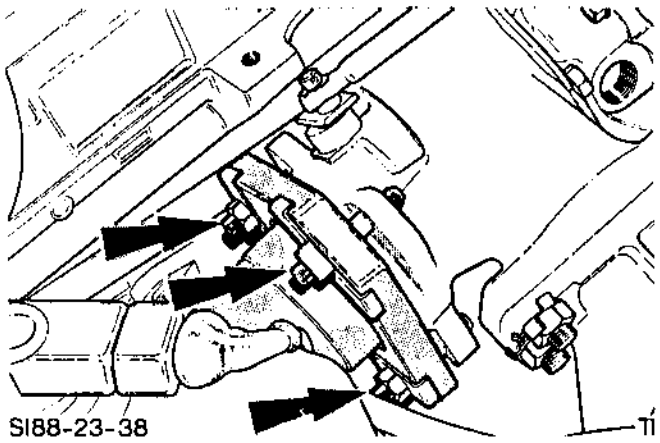


Fig.55. Exhaust pipe to turbocharger.

Install turbocharger damper assembly (spring type)

23. Mount damper block to cylinder head, do not fully tigthen bolt.

24. Assemble damper components as shown in Fig.56.

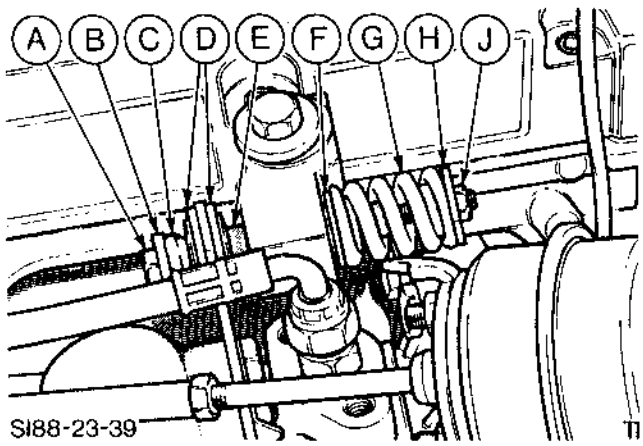


Fig.56. Spring type damper assembly components.

Fig.56. Spring type damper assembly components.
- A - Bolt
- B - Washer
- C - Taper sleeve
- D - Friction washers
- E - Guide sleeve
- F - Collar
- G - Spring
- H - Threaded collar
- J - Lock nut

25. Tighten the threaded collar until the friction washers abutt the bracket and can still be rotated by hand. Adjust the damper so that the friction washers are flush with the turbocharger holder at the top and are also 5,4 mm from the side.

26. Position 4,0 mm gauge between turbocharger holder and mounting block. Adjust the mounting block to obtain the 4,0 mm setting and tighten the retaining bolt to the specified torque (refer to Technical Data)

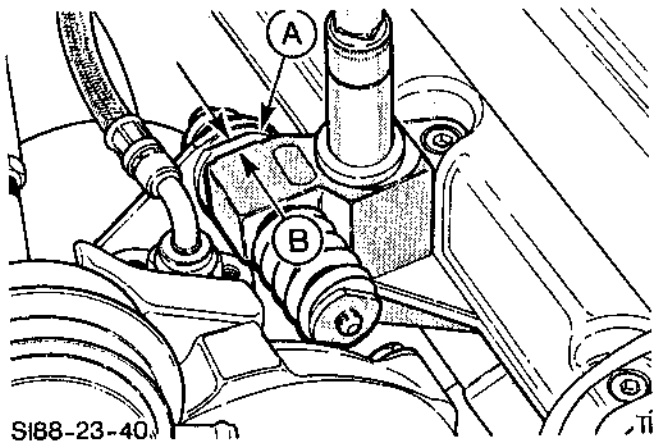


Fig.57. Turbocharger vibration damper assembly.
A - Insert 4 mm gauge.
B - Ensure 4 mm clearance is obtained between damper and mounting block

27. Hold through bolt and tighten threaded collar until spring is compressed to a length of 25 mm. Fit locknut, hold threaded collar and tighten locknut to 8 to 10 Nm.

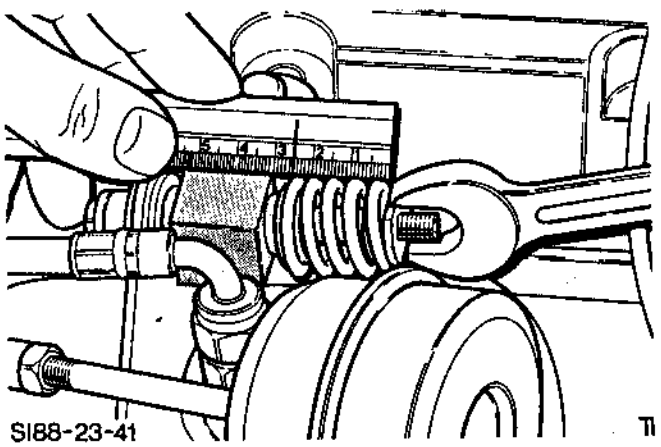


Fig.58. Tighten spring to compress to 25 mm.

28. Tighten the turbocharger manifold to exhaust manifold bolts (4) to the specified torque (See Technical Data).

29. Fit exhaust pipe to turbocharger, tighten to specified torque (refer to Technical Data).

30. Fit turbocharger coolant feed to thermostat housing.

31. Fit turbocharger coolant system return to turbocharger and mount retainer on cylinder head cover.

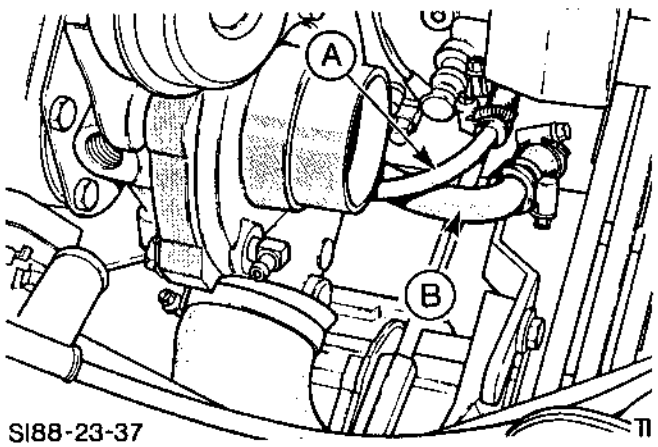


Fig.59. Turbocharger coolant.
A - Feed pipe
B - Return pipe

32. Fit oil feed hose to turbocharger.

33. Fit bottom air hose to turbocharger.

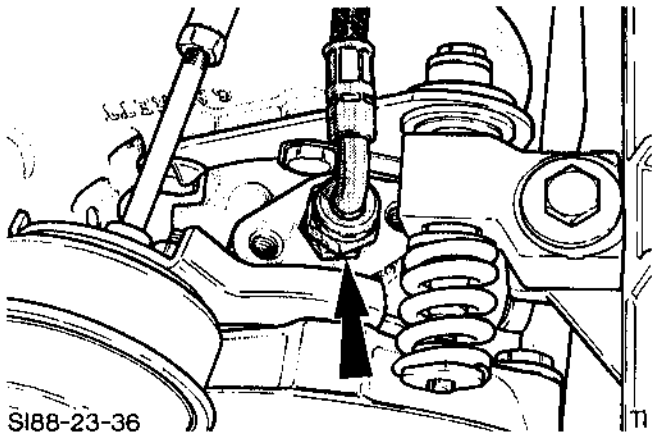


Fig.60. Oil pressure hose connection.

34. Fit both hoses connecting solenoid control valve to turbocharger and actuator.

35. Fit heat shield assembly.

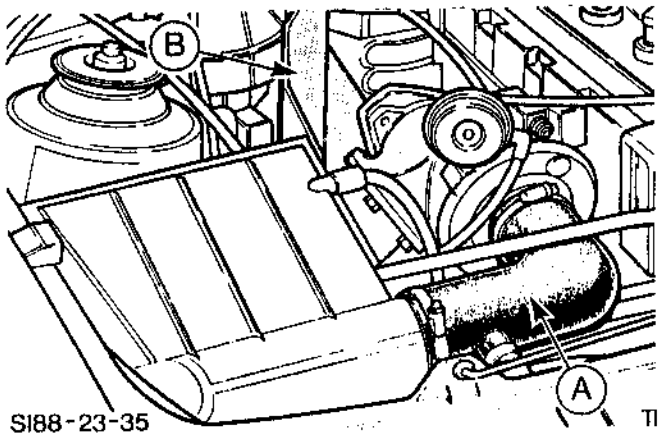


Fig.61. A - Top air hose
B - Heat shield

36. Fit top air hose to air cleaner, bypass valve and turbocharger.

37. Reconnect battery earth cable and remove fender covers.

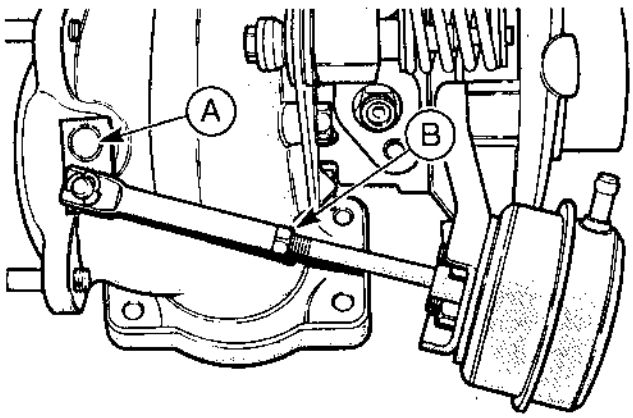


Fig.62. A - Waste gate valve
B - Adjust rod

38. Check waste gate valve setting and adjust rod if necessary (see Repair Operation 23 601 0).

23 616 0 SOLENOID CONTROL VALVE - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

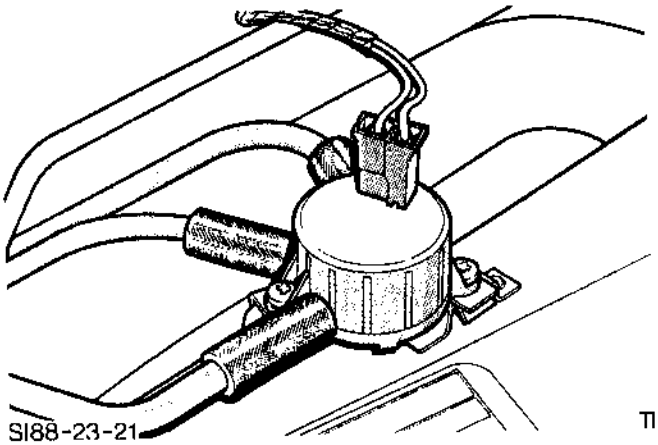


Fig.63. Solenoid control valve.

To Remove

1. Fit fender covers and disconnect battery earth cable.
2. Remove multiplug.
3. Remove the three hoses from the solenoid control valve.
4. Remove securing screws and detach the solenoid control valve.

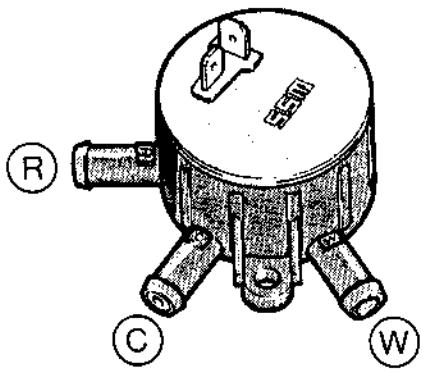


Fig.64. Solenoid control valve removed.

To Install

5. Refit solenoid control valve and fully tighten the securing screws.
6. Reconnect the three air hoses:
   - air hose of turbocharger waste gate actuator to connection W (W - waste gate)
   - air hose of turbocharger compressor housing to connection C (C - compressor)
   - air hose of air cleaner to connection R (R - return)
7. Reconnect multiplug.
8. Reconnect battery and remove fender covers.

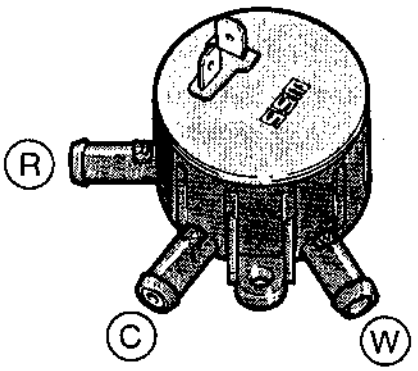
23 620 0 INTERCOOLER - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Fit fender covers and disconnect battery earth cable.

2. Remove solenoid control valve from intercooler (2 bolts). Disconnect multiplug.

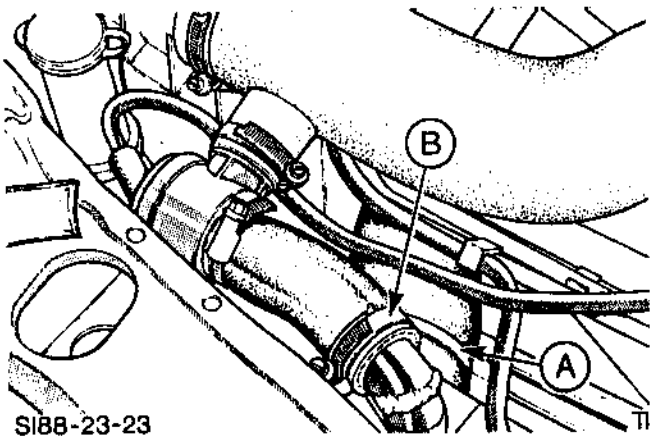


SI88-23-22

Fig.65. Solenoid control valve.

3. Remove bypass hose from intercooler and rotate to give adequate clearance when removing intercooler.

4. Remove air hoses (left and right) from intercooler.



SI88-23-23

Fig.66. A - Air cleaner intake
B - Bypass hose

5. Remove air cleaner intake,(1 plastic expansion rivet) from intercooler. Remove air cleaner cover.

6. Pre '88 Model Year only. Remove radiator grille.

7. Remove air duct plate from intercooler (2 bolts).

8. Remove intercooler from upper front body crossmember (2 bolts).

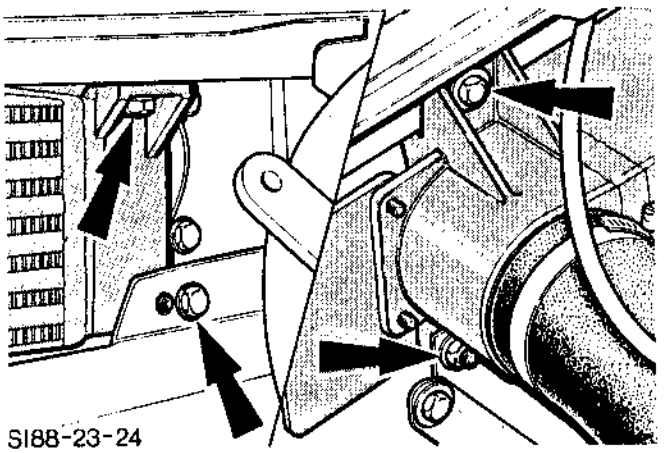
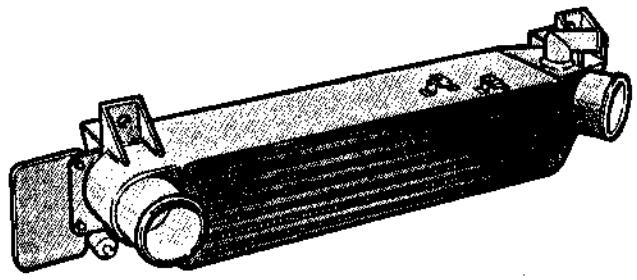

SI88-23-24

Fig.67. Intercooler retaining bolts (1 side shown).

9. Remove intercooler from above radiator (2 nuts).

10. Raise vehicle on a ramp.

11. Loosen six clips retaining air shroud and two bottom radiator mounting bolts to release radiator and remove intercooler.



SI88-23-25 TI

Fig.68. Intercooler assembly.

To Install

12. Position intercooler, tighten bottom radiator bolts and fasten air shroud with 6 clips.

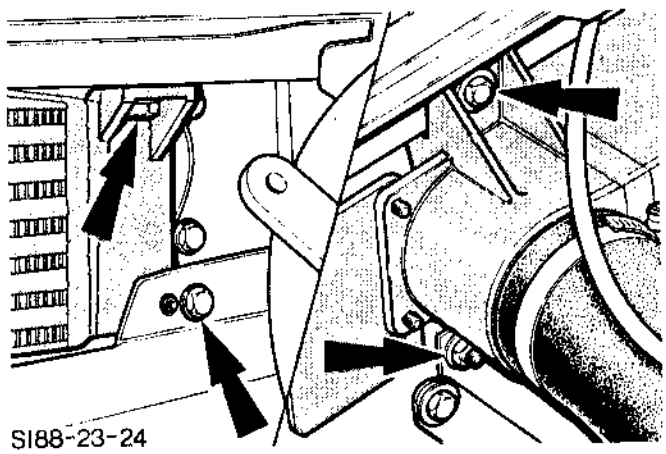
13. Lower vehicle to the ground.

14. Fit top of intercooler to radiator (2 nuts).

15. Fit intercooler to upper front body cross-member (4 bolts).

16. Fit air shroud to intercooler (2 bolts).

17. If removed, fit radiator grille (4 bolts).



SI88-23-24

Fig.69. Intercooler mounting bolts (1 side shown).

23 620 0

18. Fit air cleaner intake to intercooler (1 plastic expansion rivet).

NOTE: Use new plastic expansion rivet to fit air cleaner intake connection.

19. Fit left and right-hand air hoses to intercooler.

20. Fit air cleaner cover complete with hoses.

21. Refit bypass valve hose to intercooler.

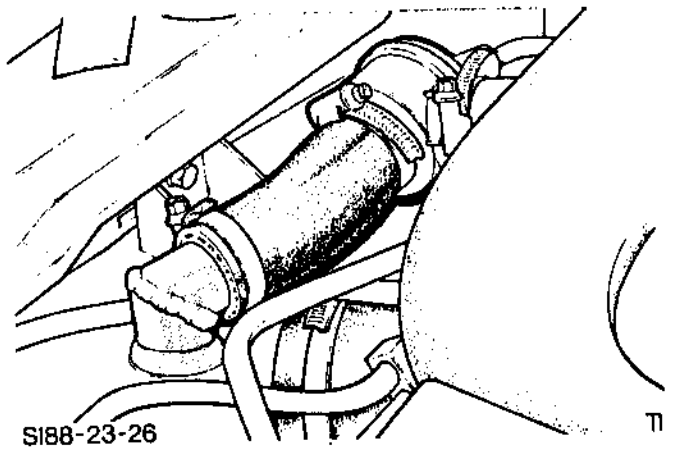


Fig.70. Top air hose and bypass valve hose.

22. Fit solenoid control valve to intercooler and connect plug.

23. Reconnect battery earth cable and remove fender covers.

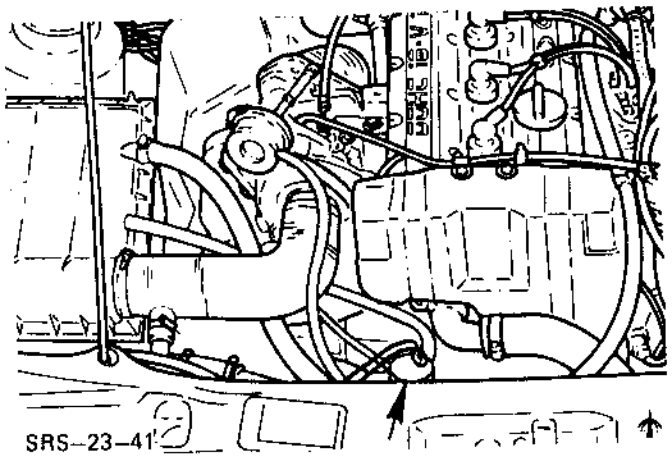


Fig.71. Solenoid control valve.

29 622 0 AIR CHARGE TEMPERATURE SENSOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

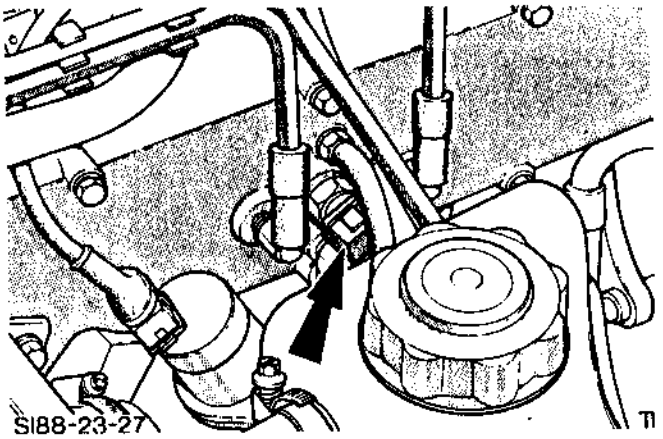


Fig.72. Air charge temperature sensor.

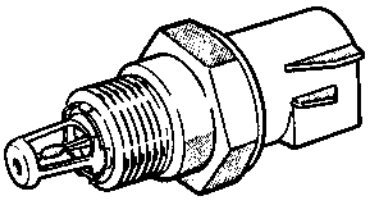


Fig.73. Air charge temperature sensor removed.

To Remove

1. Fit fender covers and disconnect battery earth cable.

2. Remove multiplug.

3. Using a suitable spanner, remove the sensor from air chamber.

To Install

4. Apply sealant to sensor (see Technical Data) and refit sensor to air chamber.

5. Tighten sensor to specified torque (refer to Technical Data).

6. Reconnect multiplug and battery and remove fender covers.

29 200 0 CONTROL MODULE - ENGINE MANAGEMENT REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

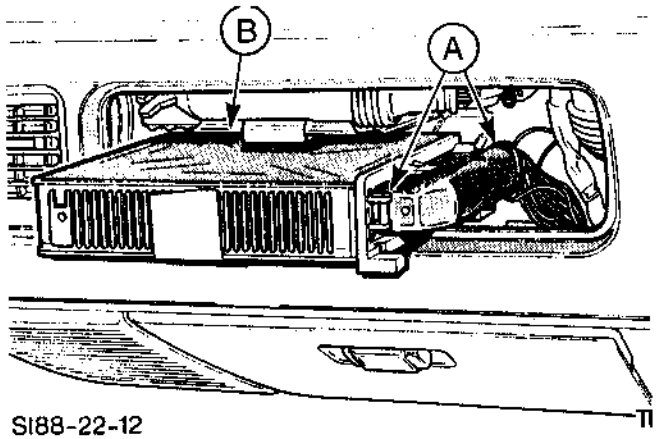
To Remove

1. Disconnect battery earth cable.

2. Unclip trim above glove compartment.

3. Remove module and remove multiplug from module.

   - Push back plug retainer,
   - Lift up multiplug and remove from retainer.



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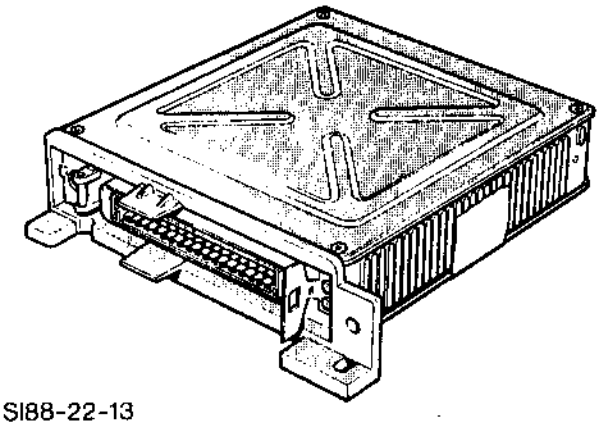
Fig.74. Engine management module.
A - Multiplug retainer
B - Retainer

To Install

4. Connect multiplug to module:

   - Refit retainer and
   - Push in multiplug so that clip engages.

5. Insert module into holder, connect battery earth cable.



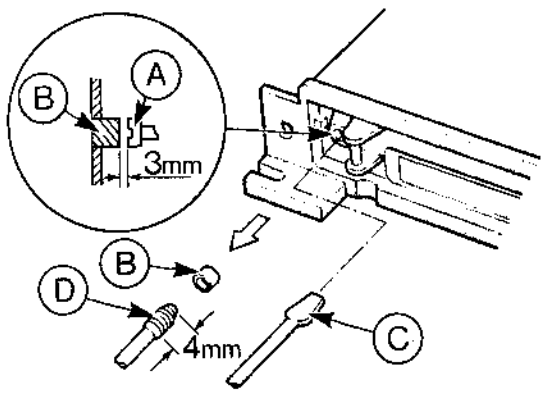
SI88-22-13 TI

Fig.75. Engine management module.

6. Check CO content and adjust if necessary:

   - Connect CO meter and check CO content at normal operating temperature.
   - If required, remove CO adjustment tamperproof plug, on module and turn adjusting screw to correct CO content. Fit new tamperproof plug to adjusting screw.

IMPORTANT NOTE: When performing this operation, note that the depth of the tamperproof plug remover should not exceed 4 mm as this will result in damage to the CO - adjustment potentiometer.



SI88-22-14 TI

Fig.76. A - CO adjustment screw
B - Tamperproof plug
C - Screwdriver
D - Extractor tamperproof plug

7. Fit trim above glove compartment.

29 224 0 SENSOR - MANIFOLD ABSOLUTE PRESSURE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth cable and fit fender covers.

2. Remove three retaining bolts securing sensor to bracket, from underside of bracket.

3. Disconnect multiplug. Cut hose clip and remove vacuum pipe from sensor.

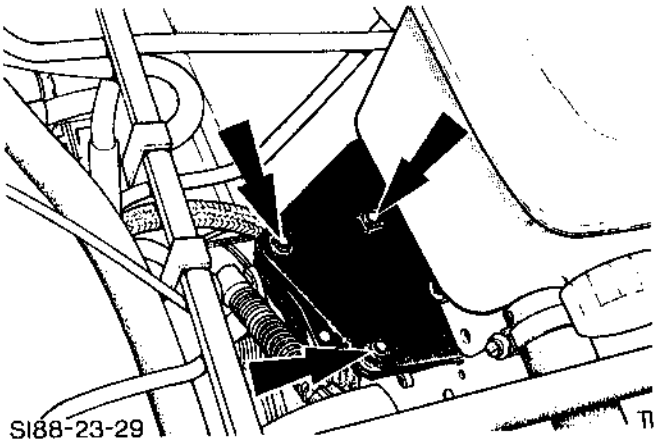


Fig.77. Sensor secuirng bolts. (Remove from underside of bracket).

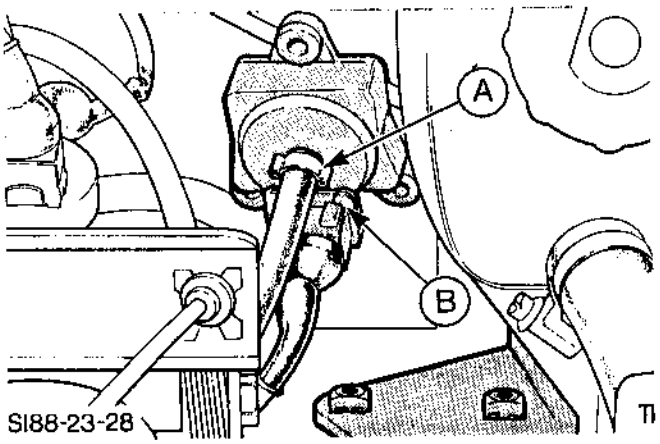


Fig.78. A - Vacuum pipe connection
B - Sensor multiplug

To Install

4. Refit vacuum pipe, using a new hose clip. Reconnect multiplug.

5. Locate sensor on bracket and secure with three bolts.

6. Reconnect battery and remove fender covers.

ENGINE MANAGEMENT AND EMISSION SYSTEM 29T
(RS Cosworth 4x4
15:04 and 83 US Emission Levels)

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0990

TECHNICAL DATA — RS COSWORTH 4x4

Fuel System

Injectors

Manufacturer	Weber
Type	Electronically operated
Lubrication for injector seals	Clean engine oil

Fuel Pump

Manufacturer	Bosch
Type	Electric roller cell
Output pressure	Greater than 5 bar at 12 volts

Pressure Regulator

Manufacturer	Weber
System pressure	3,2 to 3,8 bar (with ignition 'on' - engine not running)
System pressure	2,7 to 3,3 bar (at idle with engine running).
Lubricant for Regulator seals	clean engine oil

Idle Speed

15:04 vehicles	850 ± 50 rpm
83 US vehicles	900 ∓ 50 rpm
Idle CO% (15:04 variants only)	1,0 to 2,0

Turbocharger

Boost pressure (ECU controlled)	0,8 bar (maximum 0,9 bar)
Solenoid control valve:	
Control begins at	1,000 rpm (approximately)
Boost reduces at	6,000 rpm (approximately)
Charge air control temperature	70°C

Tightening Torques

	Nm	lbf ft
Wastegate actuator rod locknut	5,6 to 7,9	4,0 to 6,0
Actuator to retainer	5,6 to 7,9	4,0 to 6,0
Intermediate housing to turbine housing	18,5 to 21,9	14,0 to 16,0
Intermediate housing to compressor housing	16,4 to 19,8	12,0 to 14,0
Exhaust downpipe to turbocharger	19,0 to 23,0 (M8) 35 - 47 (M10)	14,0 to 17,0
Exhaust manifold to Turbocharger assembly	32,0 to 36,0	24,0 to 27,0
Oil feed adaptor to turbocharger	25,0 to 35,0	18,0 to 26,0
Oil feed to adaptor	25,0 to 27,0	18,0 to 20,0
Turbo drain pipe to turbocharger	18,5 to 21,5	14,0 to 16,0
Water pipe banjo bolts to turbocharger	19,0 to 23,0	14,0 to 17,0
Throttle cable bracket to plenum chamber	18,5 to 21,5 + Loctite 518	14,0 to 16,0
Fuel regulator to fuel rail	8,0 to 10,0	6,0 to 8,0
Fuel rail to plenum chamber	8,0 to 10,0	6,0 to 8,0
Breather valve intake to plenum chamber	15,0 to 20,0 + Loctite 242	11,0 to 15,0
Air charge temperature sensor to plenum chamber	23,0 to 25,0 + Loctite 518	17,0 to 18,0
HEGO sensor to turbocharger	28,0 to 30,0	20,0 to 22,0
TDC sensor bracket to sump	8,0 to 10,0	6,0 to 8,0
TDC sensor to bracket	4,0 to 6,0 + Loctite 270	3,0 to 5,0
Distributor clamp to cylinder block	8,5 to 21,5	13,0 to 16,0

TECHNICAL DATA (cont'd) RS COSWORTH 4x4

Ignition System

Coil

Primary resistance	0,72 to 0,88 ohms
Secondary resistance	4500 to 8600 ohms

Spark Plugs

Type	AGPR 902P
Electrode gap - all territories	1,00 mm (0,040 in)
Firing order	1 - 3 - 4 - 2

Distributor

Dwell angle	Totally controlled by ECU module and cannot be adjusted
Initial advance	16° BTDC

HT Leads

Resistance	30,000 ohms maximum per lead

Ignition Amplifier Module

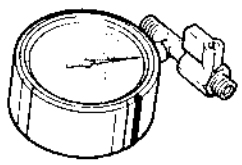
Ignition Amplifier Module heat sink compound (specification number)	81SF-12103-AA

Clearance Settings

TDC sensor to pulley teeth	0,6 to 1,0 mm
Distributor cam to phase sensor	0,2 to 0,3 mm

0392

SPECIAL SERVICE TOOLS

Tool	Tool Name
 23-021	Pressure gauge
 23-027	Fuel line separator
 21-152	Distributor installation alignment tool

GENERAL EQUIPMENT

- RPM Meter
- CO Meter
- Tamperproof Plug Remover (150 mm long)
- Cooling System Pressure Tester
- L.E.D. tester (V. Lowener No. 0132060, V.L. Churchill No. 0472060)

1189

22 214 0 DISTRIBUTOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED:

Distributor installation alignment tool 21-152

To Remove

1. Disconnect battery earth cable.
2. Remove induction hose from intercooler to throttle body.
3. Remove timing belt cover to enable access to distributor assembly.
4. Unclip distributor cap and position clear of distributor. Remove rotor arm and dust cover (refit rotor arm).
5. Using a spanner on the crankshaft pulley bolt, rotate engine clockwise until No.1 cylinder is at T.D.C.
6. Disconnect distributor multiplug.
7. Remove distributor retaining bolt and plate, then "lift out" distributor assembly from engine.

To Install

8. Check that 'O' ring on distributor body is in good condition, if not, fit a new 'O' ring.
9. Insert alignment tool 21-152, into distributor (rotor arm must be removed), thereby locking distributor shaft into the correct position relative to the phase sensor, refer to Fig.3. Insert distributor into engine.

   Should distributor not engage into engine, it may be helpful to slightly rock the crankshaft drive pulley (see Part 'B' of Fig.1) backwards and forwards with the use of a suitable spanner or socket with bar. This will enable the distributor drive to engage and allow the distributor to slide fully into the engine. Recheck to ensure timing marks are correctly positioned before securing distributor into position.
10. Refit dust cover, rotor and distributor cap.
11. Reconnect distributor multiplug and induction hose from intercooler to throttle body.
12. Refit timing belt cover to engine and secure.
13. Reconnect battery earth cable.

NOTE: Ignition timing is totally controlled by the Engine Management control module and does NOT require checking with a timing light.

14. Start engine to ensure correct operation.

1189

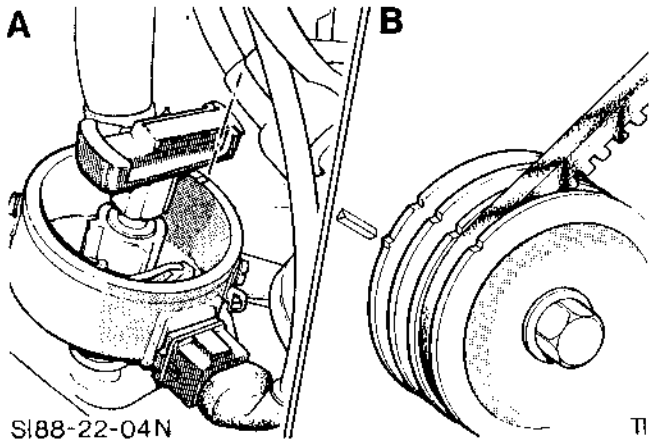


Fig.1. No.1. cylinder at T.D.C.
A - Distributor mark
B - Crank pulley lug inline with pointer

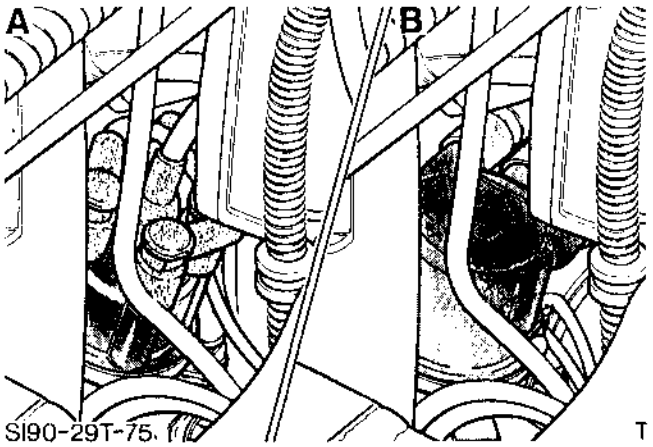


Fig.2. A - 83 US distributor cap
B - 15:04 distributor cap

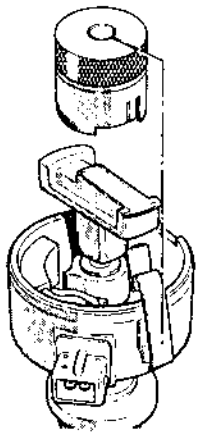


Fig.3. Align rotor arm with Special Tool. (Distributor rotor arm to be removed)

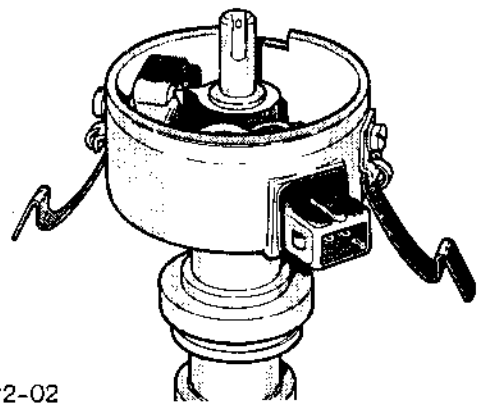
22 215 5 PHASE SENSOR - DISTRIBUTOR - REMOVE AND INSTALL (Distributor removed from vehicle)

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Dismantle

1. Disconnect "phase" sensor plug and remove from base plate of distributor.

2. Remove base plate and "phase" sensor from distributor housing (2 bolts), refer to Fig.2.



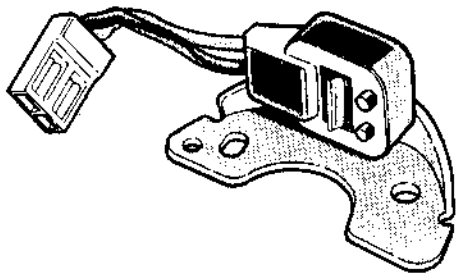
SI88-22-02 T

Fig.1. Distributor assembly removed from vehicle.

To Reassemble

3. Refit base plate and "phase" sensor to distributor housing (2 bolts).

4. Refit "phase" sensor plug to base plate.

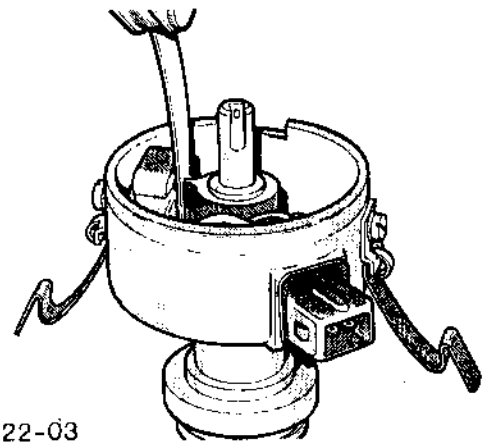


SI88-22-05 T

Fig.2. "Phase" sensor removed from distributor.

5. Adjust phase sensor

Slacken base plate and adjust "phase" sensor to a clearance of 0,2 to 0,3 mm from distributor shaft cam lobes, refer to Fig.3. Tighten base plate, ensuring correct clearance is maintained.



SI88-22-03 T

Fig.3. Adjust "phase" sensor to specification.

22 292 0 IGNITION AMPLIFIER MODULE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect multiplug from ignition amplifier module, refer to Fig.1.

3. Remove both screws along with their washers and "lift out" module from vehicle.

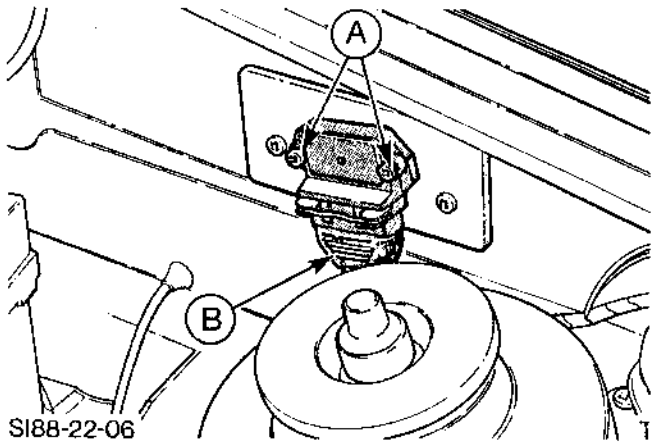


Fig.1. Ignition amplifier module.
A - Securing screws
B - Multiplug

To Install

4. Coat rear face of ignition amplifier module with heat sink compound, refer Technical Data on page 3.

5. Reposition ignition amplifier module and secure with both screws and washers.

6. Reconnect ignition amplifier module multiplug.

7. Reconnect battery earth cable.

8. Start engine to ensure correct operation.

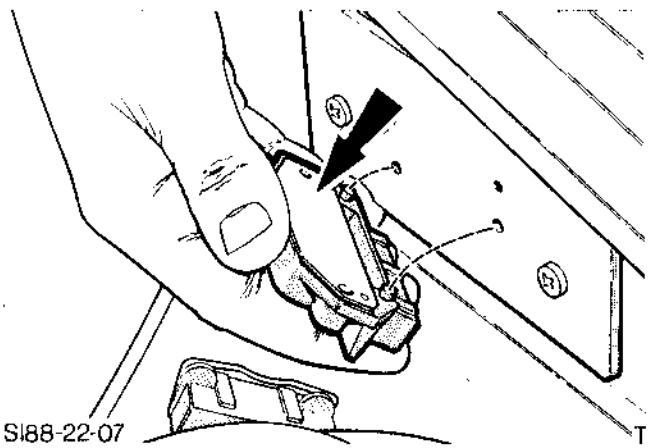


Fig.2. Apply heat sink compound to module.

22 414 0 IGNITION COIL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect HT and LT connections at coil.

3. Remove both screws, "lift out" coil with strap assembly and suppression capacitor.

To Install

4. Reposition coil with strap assembly and suppression capacitor in place. Secure with both retaining screws.

5. Reconnect HT and LT connections.

6. Reconnect battery earth cable.

7. Start engine to ensure correct operation.

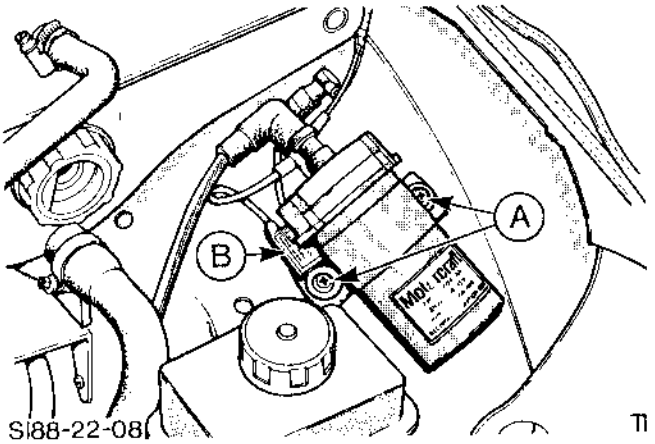


Fig.1. Ignition coil location.
A - Mounting screws
B - Suppression capacitor

22 619 0 SPEED SENSOR - ENGINE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

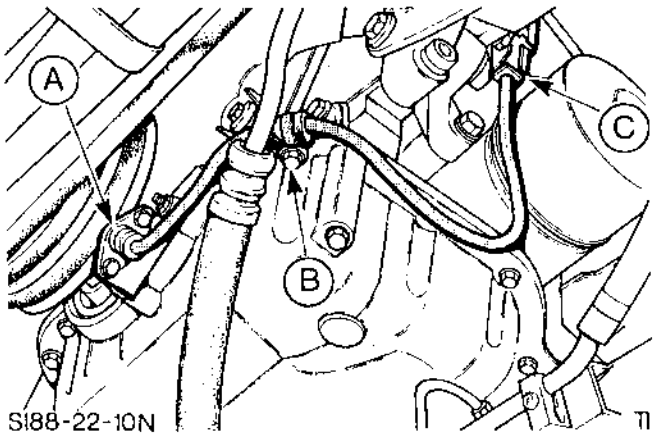


Fig.1. A - Engine speed/TDC sensor
B - Engine speed/TDC sensor cable bracket
C - Engine speed/TDC sensor cable multiplug

To Remove

1. Disconnect battery earth cable.
2. Raise vehicle on ramp.
3. Remove both bolts securing engine speed/TDC sensor to sump bracket.
4. Disconnect speed sensor multiplug from wiring harness. Remove cable and securing clip from sump (1 bolt).

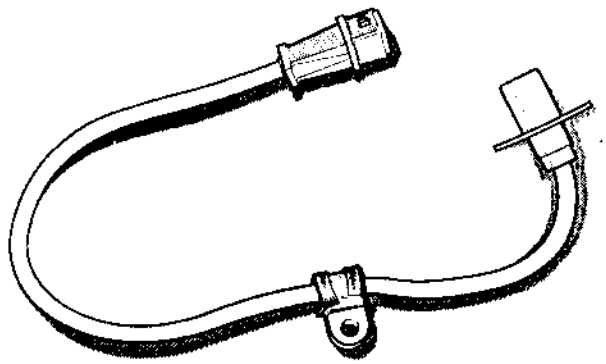


Fig.2. Engine speed/TDC sensor assembly.

To Install

5. Reposition and secure engine speed/TDC sensor cable bracket (1 bolt) and reconnect multiplug.
6. Reposition engine speed/TDC sensor to mounting bracket. Align crankshaft pulley teeth with sensor and adjust sensor to a clearance of 0,6 to 1,0 mm, refer to Fig.3.
7. Lower vehicle to ground.
8. Reconnect battery earth cable.
9. Start engine to ensure correct operation.

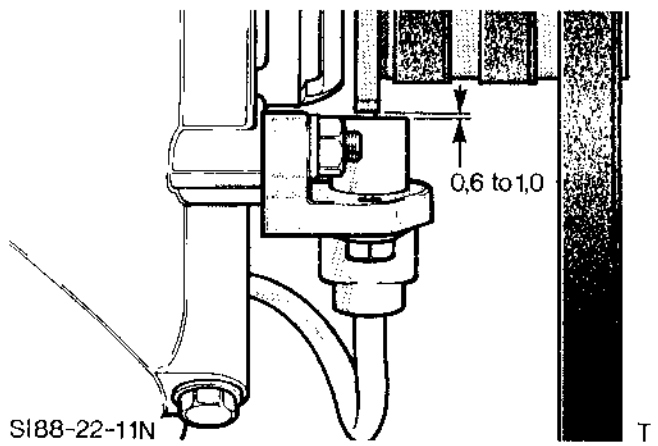


Fig.3. Engine speed/TDC sensor clearance.

23 174 0 AIR CLEANER ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Remove engine breather hose, solenoid control valve hose and air cleaner to turbocharger intake hose, refer to Fig.1.

3. Release air cleaner cover, detach and remove air cleaner element, refer to Fig.2.

4. Remove right hand inner fender wheelarch protector. Remove air cleaner box retaining nuts and washers from beneath inner fender, refer to Fig.3.

5. "Lift out" air cleaner box assembly from engine compartment.

To Install

6. Transfer metal reinforcements to new air cleaner box assembly, should new air cleaner box be required to be fitted.

7. Reposition air cleaner box assembly, refit retaining nuts, along with washers from beneath inner fender.

8. Refit air cleaner element and cover, then secure with all five retaining clips.

9. Reconnect hoses to air cleaner box cover.

10. Refit inner fender protective shield.

11. Reconnect battery earth cable.

12. Start engine to ensure correct operation.

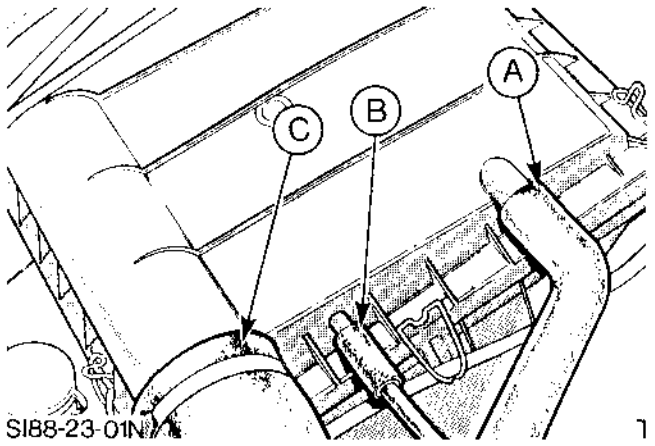


Fig.1. A - Engine breather hose
B - Solenoid control valve hose
C - Turbocharger intake hose

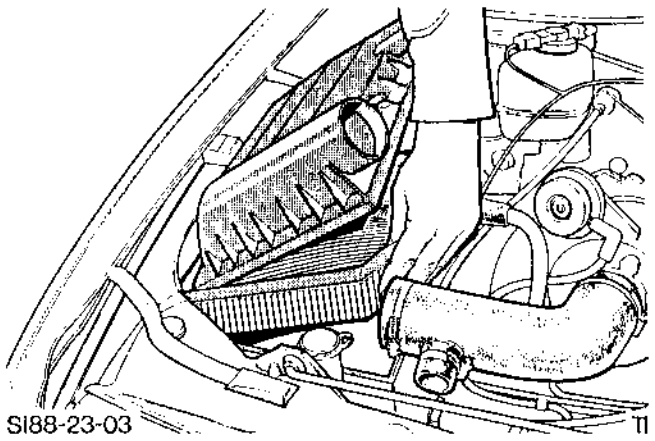


Fig.2. Air cleaner element removal.

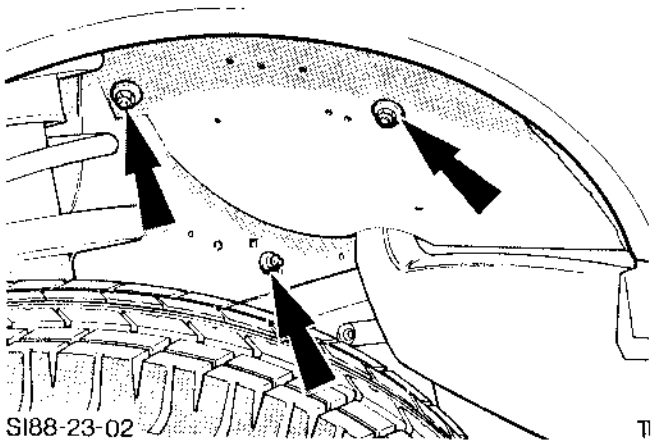


Fig.3. Air cleaner nuts to inner wheelarch.

23 215 0 FUEL MIXTURE/CO% - ADJUST

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED:

CO Meter
RPM Meter
Tamperproof Plug Remover (150 mm long)

NOTE: The procedure below is for 15:04 emission level vehicles only. For '83 US emission level vehicles, refer to control module remove and install (29 200 0), commencing page 28.

IMPORTANT NOTE: If CO% reading is exceptionally high (above 2,5%) or below 0,3%, carryout checks in the Vehicle System Test Manual.

To Adjust

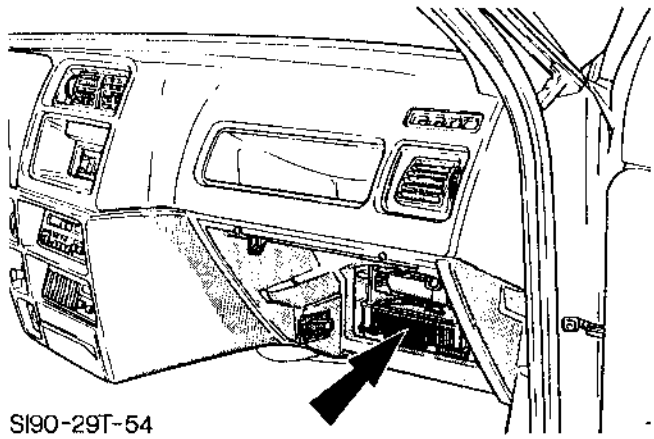
1. Warm engine to normal operating temperature.
2. Open glove box on passenger's side of vehicle.
3. Remove glove box assembly, enabling access to ECU module, refer to Fig.1.
4. Unclip ECU module from retaining bracket, refer to Fig.2.
5. Connect a CO meter to engine as per manufacturer's instructions.
6. Stabilise engine by running at 3000 rpm for approximately 15 seconds and allow to idle.
7. Wait for meter to stabilise and record CO% and idle speed.
8. Adjust CO% screw to achieve correct specification, refer to Fig.3.

IMPORTANT NOTE: When performing this operation, note that the depth of the tamperproof plug remover should not exceed 4 mm, otherwise damage to the CO% adjustment potentiometer can occur.

IMPORTANT NOTE: Adjustment must be completed within 10 to 30 seconds from time meters stabilise. If time taken is longer than 30 seconds, run engine again at 3000 rpm for a further 15 seconds and re-check.

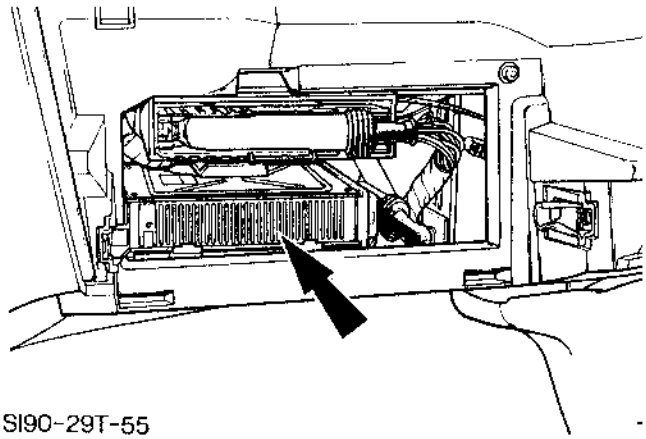
9. Remove idle speed control valve multiplug. Engine idle should stablise at approximately 850 rpm. If idle is incorrect, refer to the Vehicle System Test manual and carryout checks for incorrect idle speed.
10. Switch 'off' engine and remove test equipment.
11. Fit new tamperproof plug to ECU module.
12. Position module into retaining bracket, ensuring bracket clips module into position.
13. Refit glove box assembly.

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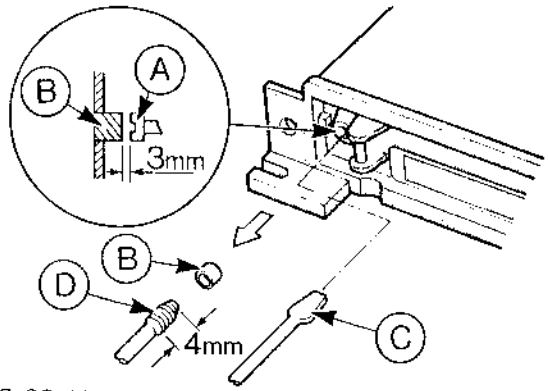
SI90-29T-54

Fig.1. ECU module location.



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Fig.2. Module positioned in retaining bracket.



SI88-22-14

Fig.3. A - CO% adjustment screw
B - Tamperproof plug
C - Screwdriver
D - Tamperproof plug remover

23 266 0 FUEL PRESSURE REGULATOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED:

Fuel Line Separator 23-027

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE FUEL SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

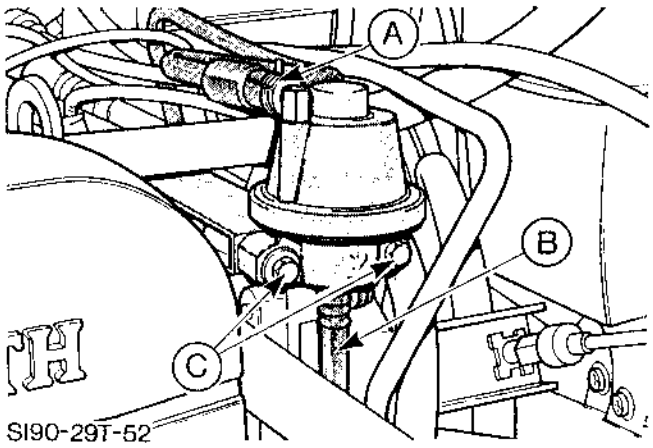


Fig.1. Fuel pressure regulator.
A - Vacuum hose
B - Fuel return pipe
C - Retaining bolts

To Remove

1. Disconnect battery earth cable.
2. Disconnect vacuum hose.
3. Disconnect fuel return pipe at chassis fuel line with Special Service Tool 23-027, refer to Fig.2.
4. Remove both securing bolts and lift off regulator assembly, refer to Fig.1.

To Install

5. Reposition regulator after having lubricated seal with clean engine oil and secure to fuel rail with both bolts.
6. Reconnect fuel return line connection.
7. Reconnect vacuum hose.
8. Reconnect battery earth cable.
9. Start engine to ensure correct operation.

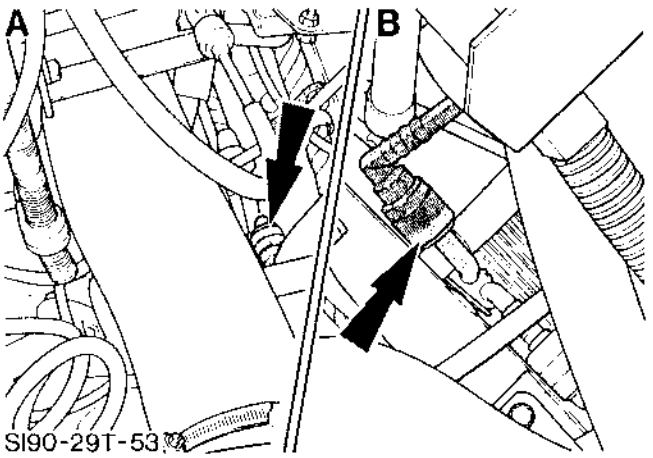


Fig.2. Fuel return pipe connector.

23 323 0 IDLE SPEED CONTROL VALVE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

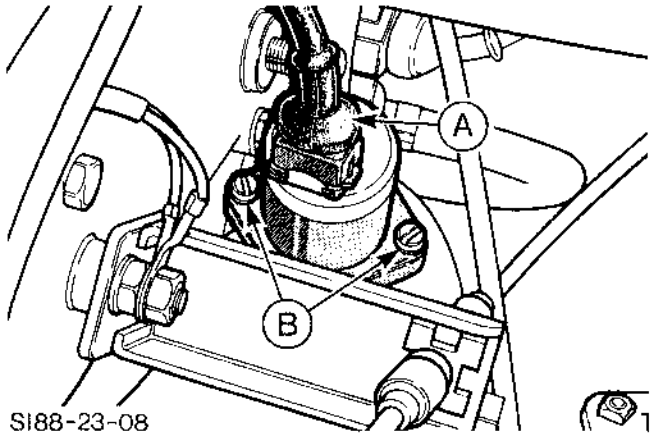


Fig.1. Idle speed control valve location.
A - Multiplug
B - Retaining bolts

To Remove

1. Disconnect battery earth cable.

2. Disconnect multiplug from idle speed control valve.

3. Remove both retaining bolts and 'lift-out' idle speed control valve.

To Install

4. Fit new "O" rings to idle speed control valve.

5. Position idle speed control valve into detent pin and secure with both bolts.

6. Refit multiplug connector to valve.

7. Reconnect battery earth cable.

8. Start engine to ensure correct operation.

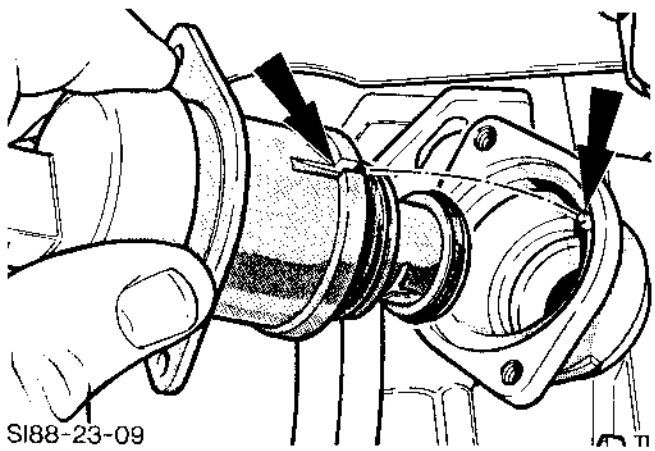


Fig.2. Locate valve on detent pin.

23 325 0 THROTTLE POSITION SENSOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.
2. Remove throttle cable to throttle butterfly clip.

NOTE: Do not remove throttle cable bracket from air chamber as Loctite used at initial build may fall inside air chamber.

3. Remove induction hose from throttle body intake connection.
4. Disconnect throttle position sensor multiplug and idle speed control valve multiplug.
5. Remove throttle butterfly housing from induction chamber connection (4 bolts), refer to Fig.2.
6. Remove both bolts securing sensor to throttle butterfly housing, refer to Fig.3.

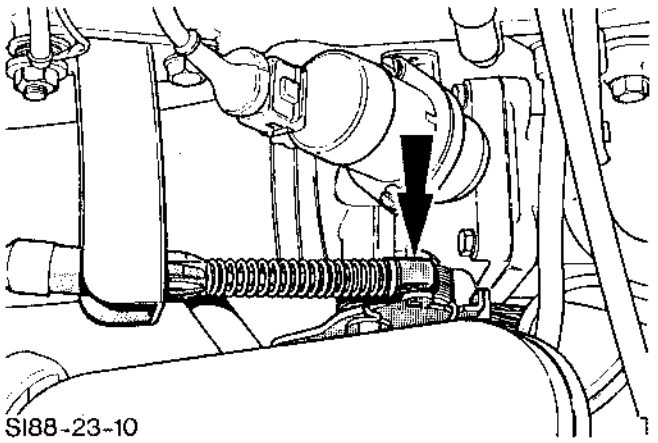


Fig.1. Throttle cable to throttle butterfly.

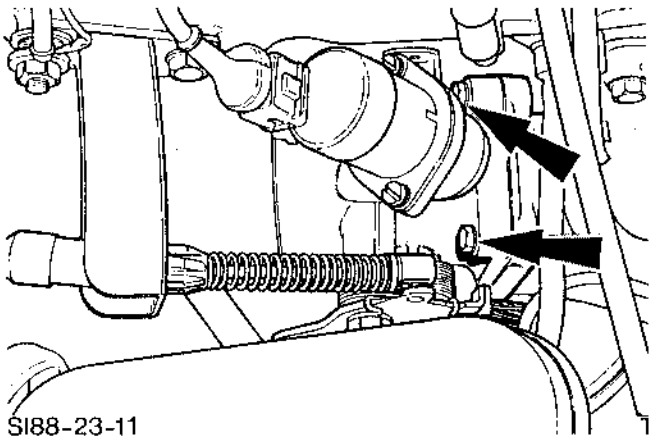


Fig.2. Throttle housing bolts (2 shown).

To Install

7. Position sensor on throttle butterfly shaft and turn anti-clockwise until spring pressure is felt. Tighten retaining bolts, ensuring spring pressure is not being applied.
8. Clean gasket faces and using a new gasket, fit throttle butterfly housing to air chamber connection.
9. Reconnect throttle position sensor and idle speed control valve multiplugs.
10. Fit induction hose to throttle plate intake connection.
11. Fit throttle cable to throttle butterfly and adjust throttle cable as necessary.
12. Reconnect battery earth cable.
13. Start engine to ensure correct operation.

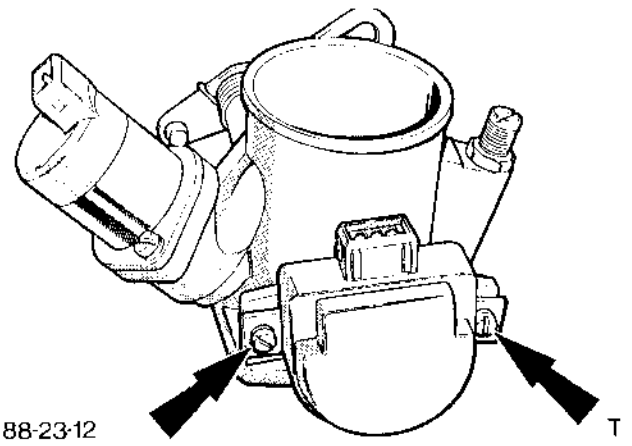


Fig.3. Throttle position sensor securing screws.

23 455 0 FUEL INJECTORS - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED:

Fuel line separator 23-027

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE FUEL SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

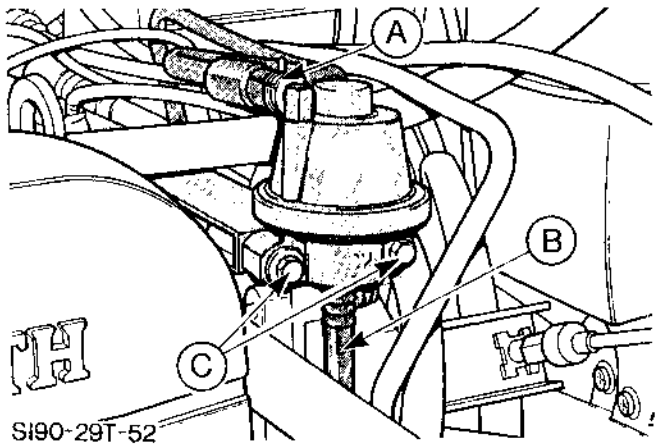


Fig.1. A - Vacuum hose
B - Fuel return pipe
C - Retaining bolts

To Remove

1. Disconnect battery earth cable.
2. Disconnect and remove vacuum hose from fuel pressure regulator.
3. Disconnect and remove degas hose and crankcase vent pipe.
4. Disconnect multiplugs from injectors, idle speed control valve and air charge temperature sensor.
5. Disconnect fuel supply and return pipe connections with Special Service Tool 23-027 refer to Fig.2.
6. Remove fuel rail retaining bolts and "lift out" fuel rail complete with injectors from intake manifold, refer to Fig.3.
7. Remove individual injector securing clips, allowing injectors to become detached from fuel rail.

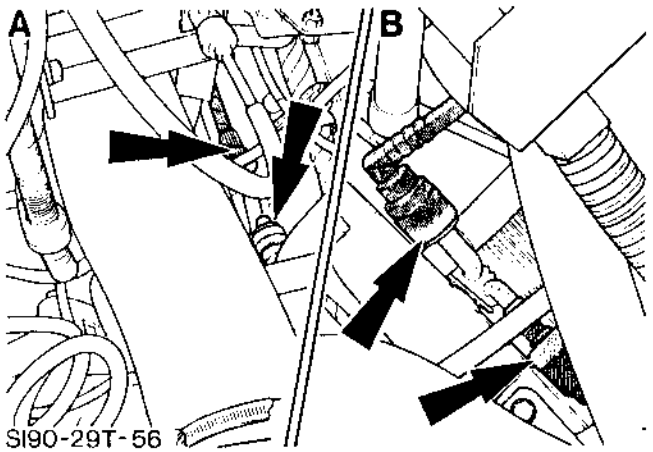


Fig.2. Both A and B show fuel pipe connectors viewed from different angles.

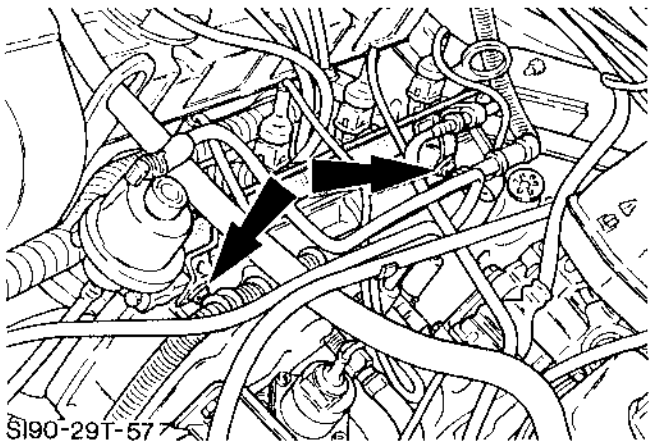
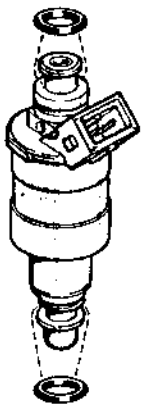


Fig.3. Fuel rail retaining bolts.

To Install

8. Fit injectors to fuel rail assembly and secure with clips (one per injector).

NOTE: Always use new 'O' rings and clips on all injectors when refitting, refer to Fig.4.



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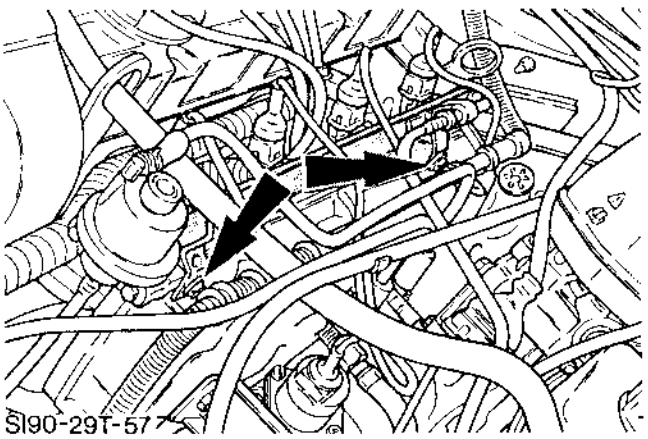
Fig.4. New injector 'O' rings fitted.

9. Lubricate injector 'O' rings with clean engine oil and reposition complete with fuel rail assembly into intake manifold. Secure with both bolts, refer to Fig.5.

10. Reconnect fuel supply and return pipe connectors.

11. Reconnect vacuum line to fuel pressure regulator.

12. Reconnect multiplugs to injectors, idle speed control valve and air charge temperature sensor (route cables and secure as appropriate).



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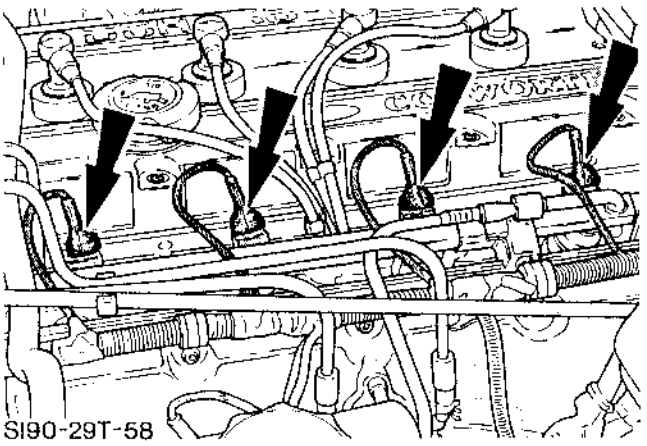
Fig.5. Refit fuel rail retaining bolts.

13. Refit degas tank hose and crankcase vent pipe.

14. Reconnect battery earth cable.

15. Switch ignition 'on' and check for fuel leaks.

16. Start engine to ensure correct operation.



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Fig.6. Reconnect plugs to injectors.

23 534 0 FUEL PUMP - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE FUEL SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE

To Remove

1. Disconnect battery earth cable.
2. Raise vehicle on a ramp.
3. Clamp fuel pump inlet hose with a suitable clamp to prevent fuel draining from tank when hose is disconnected (take care not to damage hose), refer to Fig.1.
4. Hold a suitable container beneath fuel pump inlet connection, loosen clamp and remove hose. Plug end of hose to prevent fuel seepage.
5. Loosen fuel outlet hose gently as fuel system will still be pressurised, refer to Fig.2. Remove hose and collect any fuel in a suitable container.
6. Disconnect electrical wiring loom connectors. Loosen pump securing bolt and slide pump out from bracket. Remove damper from outlet port.

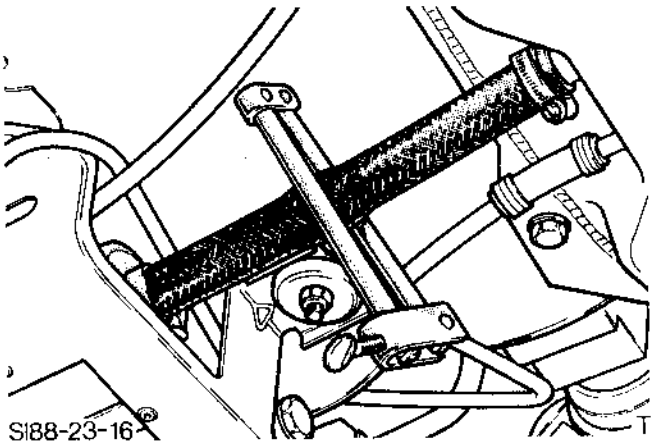


Fig.1. Pump inlet hose suitably clamped.

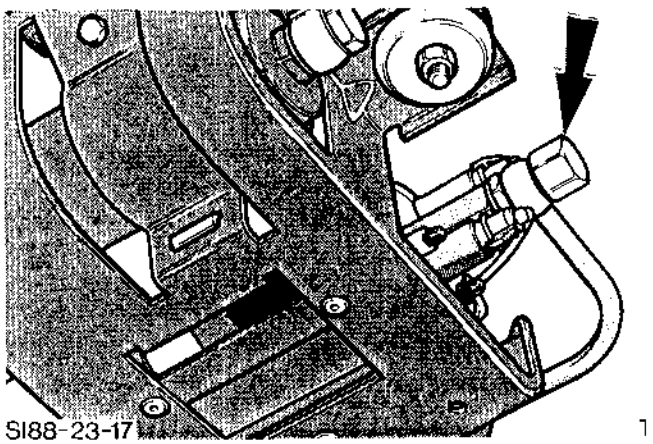


Fig.2. Slacken outlet hose, taking appropriate precautions to collect fuel residue.

To Install

7. Clean fuel pipe and wiring connectors.
8. Slide fuel pump into bracket and secure.
9. Reconnect fuel lines and wiring connectors.
10. Remove clamp from hose.
11. Reconnect battery earth cable.
12. Lower vehicle to the ground.
13. Switch ignition 'on' and 'off' five times and check for fuel leakage.

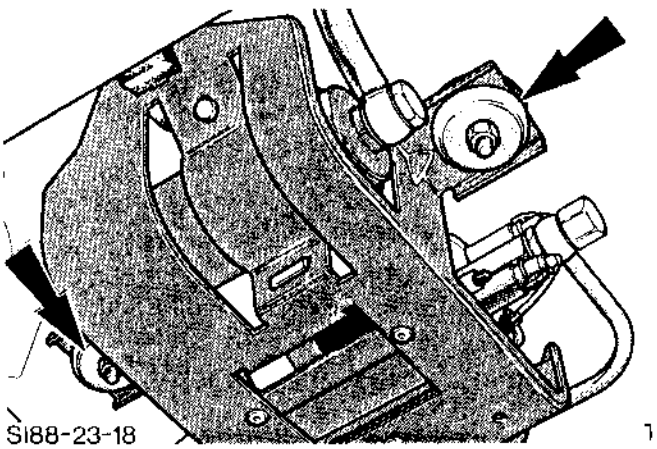


Fig.3. Fuel pump retaining nuts.

23 545 0 FUEL FILTER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

IMPORTANT NOTE: WHEN REMOVING FUEL LINES, IT MUST BE REMEMBERED THAT THE FUEL SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

To Remove

1. Disconnect battery earth cable.
2. Raise vehicle on a ramp.
3. Clamp fuel feed hose at tank.
4. Position a suitable container beneath fuel filter. Slacken fuel inlet pipe, allow pressure to reduce. Remove fuel inlet and outlet pipe, refer to Fig.1.
5. Loosen filter retaining bolts and slide out filter assembly, refer to Fig.2.

NOTE: Take care when removing filter, as it will still contain fuel.

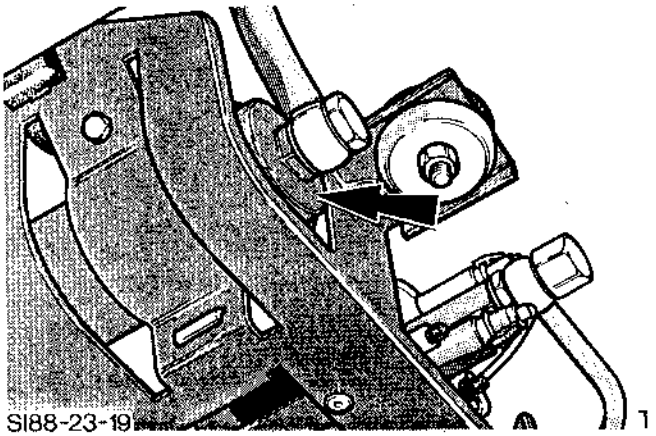


Fig.1. Fuel filter location.

To Install

6. Fit new filter assembly and secure, ensuring that filter is round the correct way (note direction of flow arrows).
7. Refit fuel filter inlet and outlet pipes.
8. Remove clamp from fuel feed hose.
9. Reconnect battery earth cable.
10. Lower vehicle to ground.
11. Switch ignition 'on' and 'off' five times and check for fuel leakage.

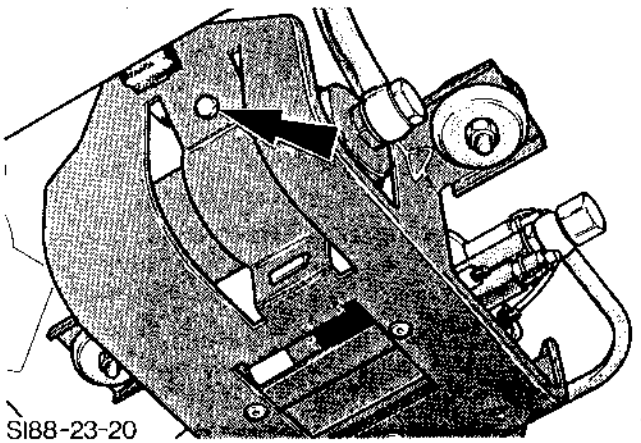


Fig.2. Fuel filter assembly retaining bolt.

23 601 0 BOOST PRESSURE - ADJUST

SPECIAL TOOLS AND EQUIPMENT REQUIRED:

Pressure Gauge and Hose 23-021

Cooling System Pressure Tester

NOTE: Following fitment of a new turbocharger or refitting of the original unit to the engine, boost pressure must be checked and adjusted as necessary.

This operation is divided into three sections:

- Initial 'static' adjustment.
- Preparing the vehicle for road testing.
- Carrying out the road test - final operating adjustment.

IMPORTANT NOTE: Roller testing is not recommended as the temperatures generated by the engine, brakes and road tyres become extremely high and maximum cooling of these components will only be satisfactorily achieved by actually driving the vehicle on the road.

NOTE: Once the tamperproof lead seal positioned on the turbo charger waste gate actuator rod has been removed, enabling the following procedure to be carried out, there is no "in Service" requirement for a new lead seal or for the original broken and removed lead seal to be repaired and refitted, following completion of this procedure.

Initial Static Adjustment

1. With actuator rod disconnected from waste gate operating lever, connect cooling system pressure tester to waste gate actuator and apply a pressure of 0,6 bar (max. 0,63 bar), refer to Fig.2.

2. With 0,6 bar (max. 0,63 bar) pressure applied to the actuator, adjust actuator rod length so that it just slips onto the waste gate lever, refer to Fig.3.

3. Fit a new circlip to retain actuator rod to waste gate lever. Tighten actuator rod locknut, ensuring that the rod eye does not twist on tightening.

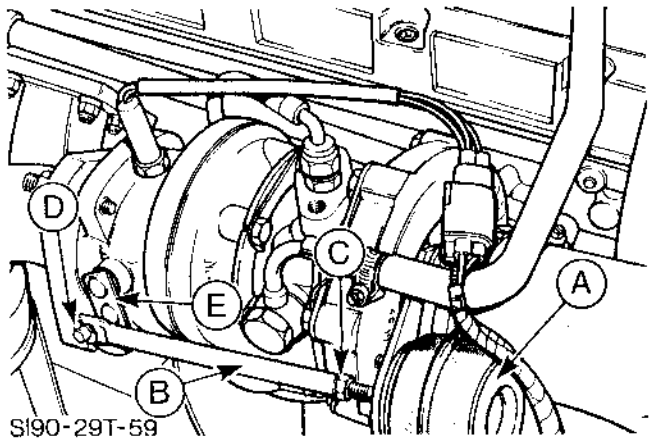


Fig.1. A - Waste gate actuator
B - Actuator rod
C - Actuator rod locknut
D - Circlip
E - Waste gate lever

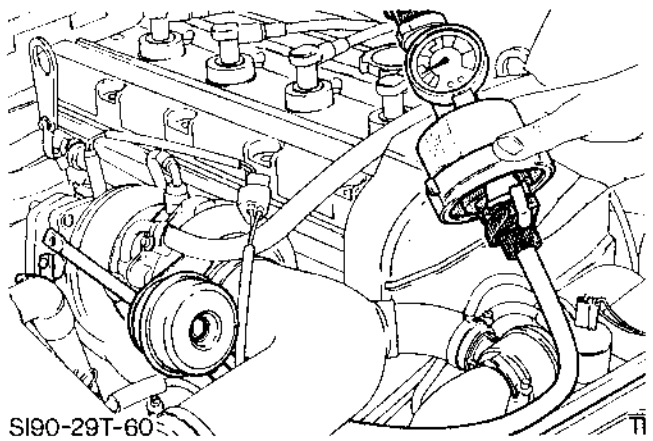


Fig.2. Waste gate actuator rod disconnected and cooling system pressure tester fitted.

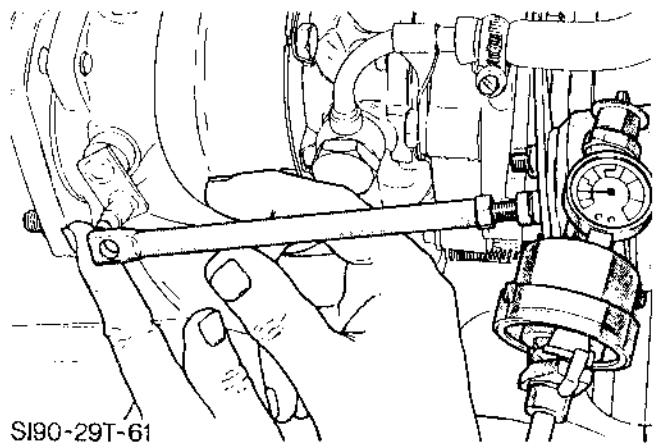


Fig.3. Adjust rod length so that it just slips onto waste gate lever.

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Preparing the Vehicle for Road Testing

Boost pressure is measured with a pressure gauge which reads "bar". Connect gauge to vehicle as detailed below:

4. Connect the pressure gauge into a 'T' piece as indicated in Fig.4. Use approximately a 2 metre length of 6 mm diameter neoprene tubing, enabling gauge to be routed into vehicle for the purpose of viewing.

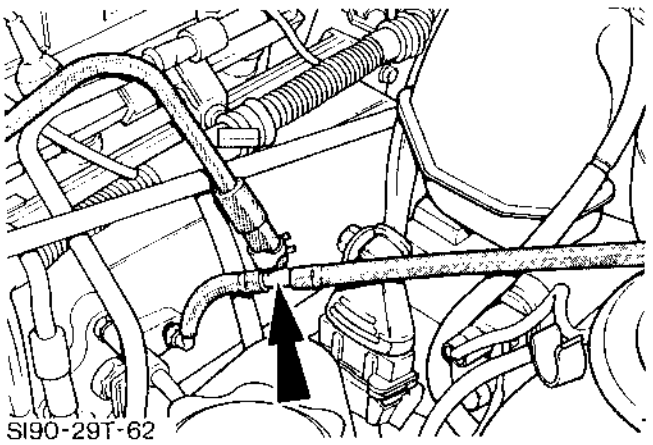


Fig.4. Connect pressure gauge to engine.

5. If only one person will be carrying out the test, it is essential that the pressure gauge is secured to the driver's side vent nozzle and in an upright position, refer to Fig.5.

6. Warm engine to normal operating temperature and conduct road testing as described below and on the following page.

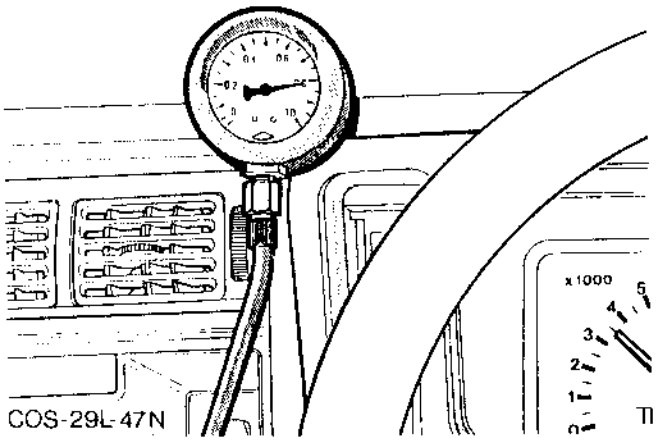


Fig.5. Gauge installation hose routing.

Carrying out the Road Test - final operating adjustment

IMPORTANT NOTE:
We strongly recommend that the test is carried out by two individuals, one to drive the car to the requirements mentioned on the following page and to ensure that the road conditions are acceptable for this to occur. The other person to read the gauge accurately to ensure that the correct reading is taken and logged.

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Test Commences

a) With a clear, straight road ahead and behind (without junctions), select 3rd gear and drive along at an engine speed of approximately 1500 rpm.

b) Fully depress the throttle pedal.

c) Keeping the throttle pedal fully depressed, allow engine speed to rise to 3500 rpm, at which time fully apply the footbrake (still ensuring that full throttle is maintained). With both throttle and footbrake fully applied, read boost pressure seen on gauge and log. DO NOT EXCEED 5 SECONDS FOR TOTAL TEST DURATION WITH FULL THROTTLE AND FULL BRAKES APPLIED.

Specification: 0,8 bar (maximum 0,9)

NOTE: After taking reading, drive the car for at least 1 mile to allow the brakes to cool.

7. If reading obtained is within specification, (see figure identified above), apply a small amount of paint to turbocharger actuator rod threads and locknut, refer to Fig.8.

8. If reading obtained was outside specification, actuator rod should be adjusted as follows:

NOTE: Once the tamperproof lead seal positioned on the turbo charger waste gate actuator rod has been removed, enabling adjustment to be carried out, there is no "in Service" requirement for a new lead seal or for the old original broken and removed lead seal to be repaired and refitted, following completion of this procedure.

- Loosen locknut on waste gate actuator rod, remove circlip and detach rod from the waste gate operating lever.
- If Boost Pressure Low

  Shorten rod one half turn for every 0,02 bar of pressure below that specified.
- If Boost Pressure High

  Lengthen rod one half turn for every 0,02 bar of pressure above that specified.

9. After adjustment, refit rod and circlip and tighten locknut, ensuring that rod eye does not bind on waste gate lever.

10. Repeat road test procedure mentioned above to ensure correct specification is now met.

11. If boost pressure is now within specification, apply paint mark to actuator rod threads and locknut, refer to Fig.8.

12. Remove test equipment from vehicle.

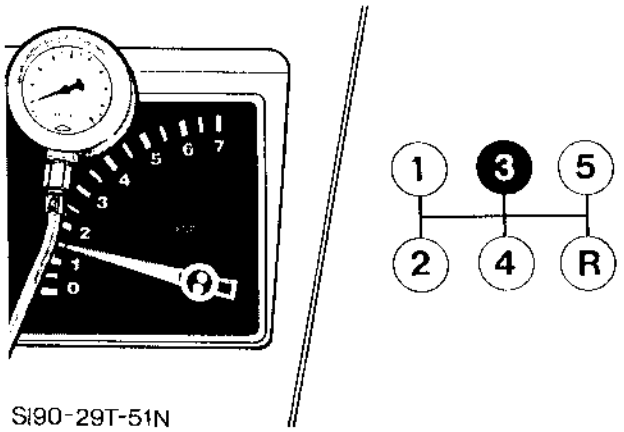


Fig.6. 3rd gear engaged (engine speed at 1500 rpm).

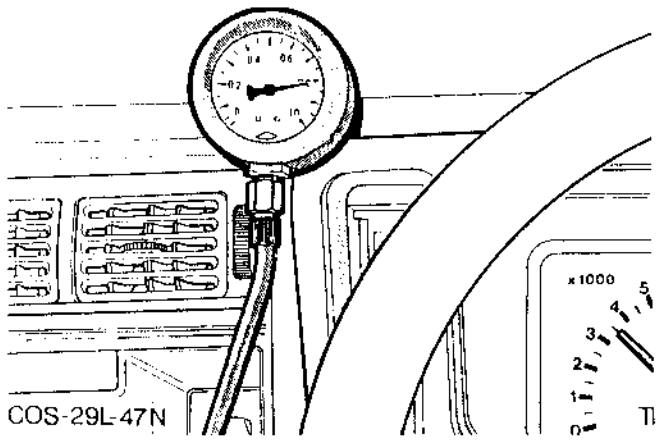


Fig.7. Readings taken with throttle and brakes fully depressed.

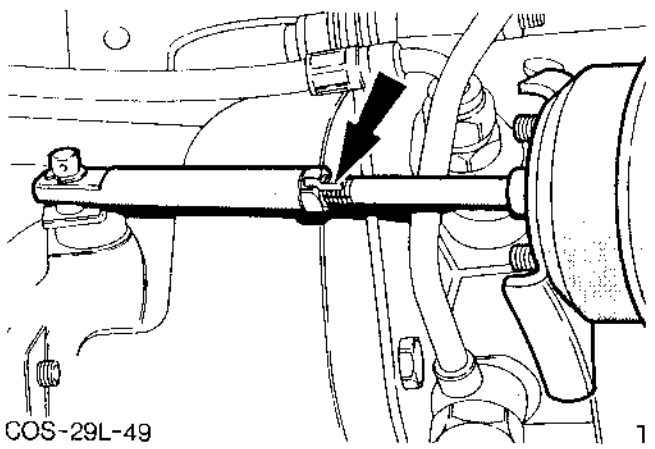


Fig.8. Paint mark introduced over thread and locknut of waste gate actuator rod.

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23 612 0 TURBOCHARGER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.
2. Remove induction hose from air cleaner, bypass valve and turbocharger assembly.
3. Remove turbocharger heat shield.
4. Remove both solenoid control valve hoses from turbocharger and actuator.
5. Disconnect bottom induction hose from turbocharger to intercooler.
6. Disconnect HEGO sensor ('83 US vehicles only).
7. Remove oil pressure hose from turbocharger, refer to Fig.1.
8. Drain engine coolant. Remove coolant feed and return pipes from turbocharger.
9. Remove 3 exhaust securing nuts to turbocharger, refer to Fig.2.
10. Disconnect top heater hose enabling access to top row of exhaust manifold nuts. Remove top row of exhaust manifold nuts.
11. Disconnect turbocharger oil return pipe at sump connection, refer to Fig.2.
12. Disconnect bolts securing exhaust downpipe to catalytic portion of exhaust system.
13. Remove alternator and bracket, enabling access to bottom exhaust manifold nuts.
14. Remove bottom exhaust manifold nuts and lift turbocharger along with exhaust manifold out of vehicle.
15. Remove turbocharger from exhaust manifold.
16. With Turbocharger removed, strip down to required level.

    Strip turbocharger assembly down to required level and transfer items such as oil pressure connection, boost pressure connection onto new unit (should one be required to be fitted), prior to installation.

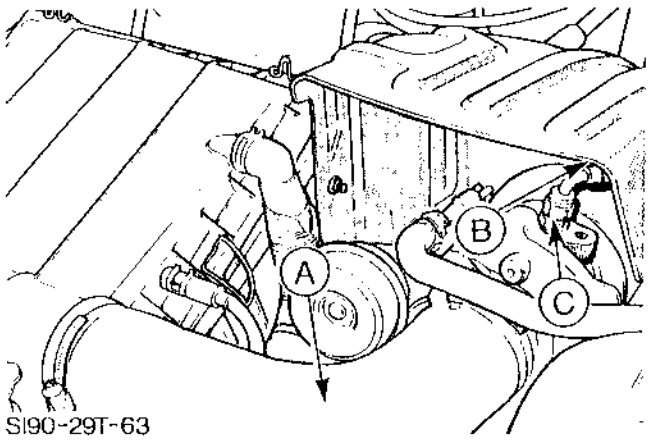


Fig.1. A - Induction hose
B - Heat shield
C - Oil pressure hose connection

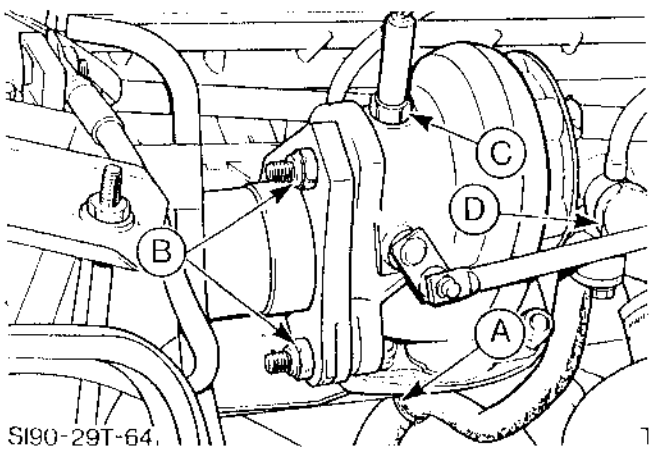


Fig.2. A - Turbocharger sump connection
B - Turbocharger to exhaust system nuts
C - HEGO sensor ('83 US vehicle only)
D - Coolant outlet pipe

To Install

17. Reposition turbocharger assembly onto exhaust manifold and tighten nuts to specification.

18. Reposition exhaust manifold with Turbocharger connected into vehicle, ensuring new manifold gaskets are used and oil return pipe at sump connection is made (refer to Fig.3).

19. Reconnect turbocharger engine coolant feed pipe from thermostat housing.

20. Reconnect engine coolant return pipe from turbocharger.

21. Reconnect HEGO sensor ('83 US vehicles only).

22. Reconnect and torque oil pressure hose to turbocharger to specification (see page 2), refer to Fig.4.

23. Reconnect bottom induction hose from intercooler to turbocharger.

24. Reconnect both solenoid control valve hoses from turbocharger and actuator.

25. Reconnect top heater hose from thermostat housing to heater assembly.

26. Reconnect induction hose from air cleaner, bypass valve and turbocharger assembly.

27. Refit alternator and bracket assembly to engine. Reconnect electrical connections and both alternator drive belts.

28. Reposition exhaust down pipe loosely into exhaust system.

29. Reconnect exhaust system to turbocharger assembly (3 nuts) and torque to specification, refer to Fig.2.

30. Realign exhaust system and tighten into position.

31. Fill cooling system to 'max' mark.

32. Reconnect battery earth cable.

33. Check waste gate valve setting and adjust rod as necessary (see Repair Operation 23 601 0 on page 19).

34. Following completion of Repair Operation No. 23 601 1, refit turbocharger heat shield.

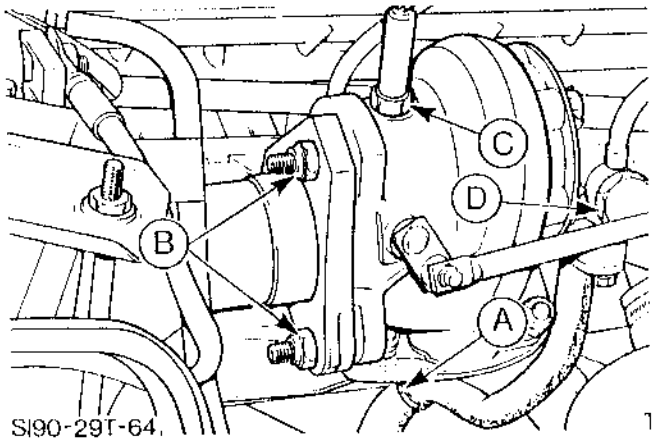


Fig.3. A - Turbocharger sump connection
B - Turbocharger to exhaust system nuts
C - HEGO sensor ('83 US vehicle only)
D - Coolant outlet pipe

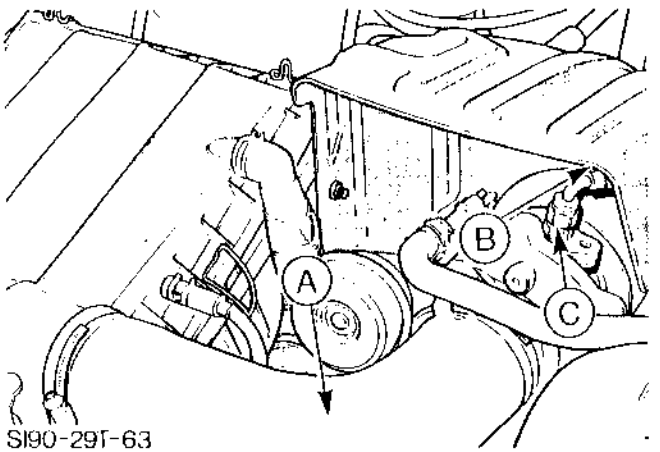


Fig.4. A - Induction hose
B - Heatshield
C - Oil pressure hose connection

23 616 0 SOLENOID CONTROL VALVE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

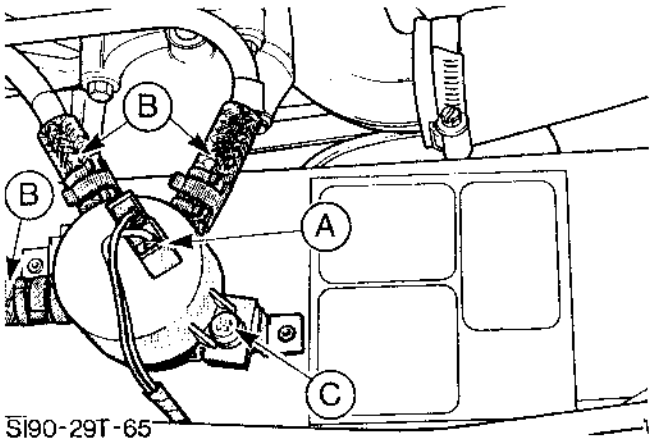


Fig.1. Solenoid control valve assembly.
A - Multiplug connection
B - 3 hose connections
C - Solenoid securing screw

To Remove

1. Disconnect battery earth cable.

2. Disconnect solenoid control valve multiplug, refer to Fig.1.

3. Disconnect three hoses from solenoid control valve assembly, refer to Fig.1.

   For your assistance, below are listed the hose connections associated with the solenoid control valve assembly, refer to Fig.2.

   W (W - waste gate) Air hose to turbocharger waste gate actuator from solenoid.

   C (C - compressor) Air hose from turbocharger compressor housing to solenoid.

   R (R - return) Air hose to air cleaner from solenoid.

4. Remove securing screws and lift off solenoid control valve from vehicle.

To Install

5. Reposition solenoid control valve and secure with both screws, refer to Fig.1.

6. Reconnect all three air hoses to solenoid control valve assembly.

7. Reconnect solenoid control valve multiplug.

8. Reconnect battery earth cable.

9. Start engine to ensure correct operation.

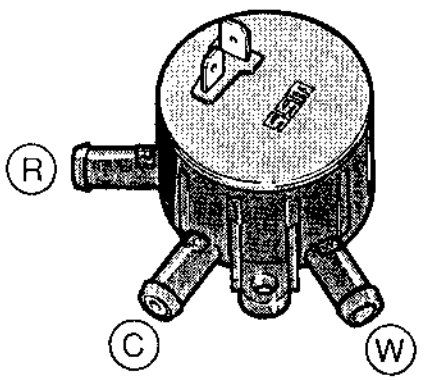


Fig.2. Solenoid control valve removed.

23 620 0 INTERCOOLER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

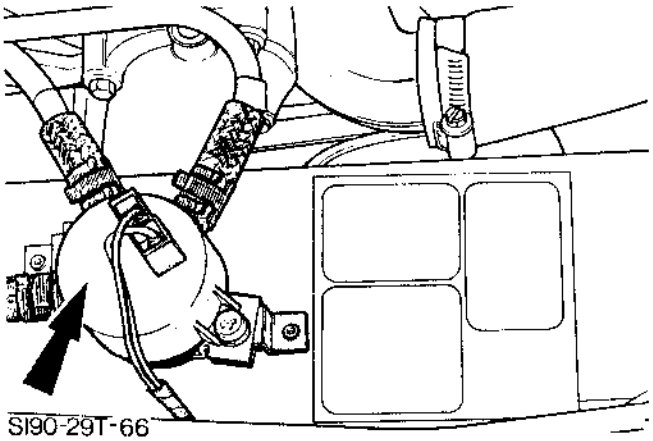


Fig.1. Solenoid control valve assembly.

2. Disconnect solenoid control valve multiplug, 3 air hose connections and both assembly securing screws, refer to Fig.1.

3. Disconnect "by-pass" hose from top of intercooler and position to one side, refer to Fig.2.

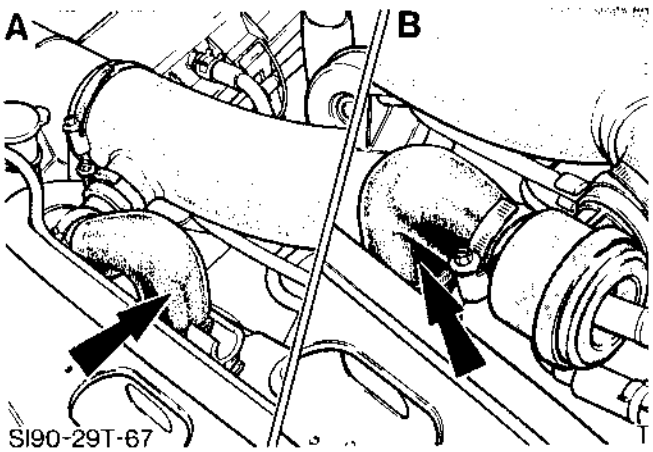


Fig.2. A - 15:04 vehicle variant
B - 83 US vehicle variant

4. Disconnect air hoses from left and right hand sides of intercooler.

5. Remove air cleaner intake from intercooler body (1 plastic expansion rivet).

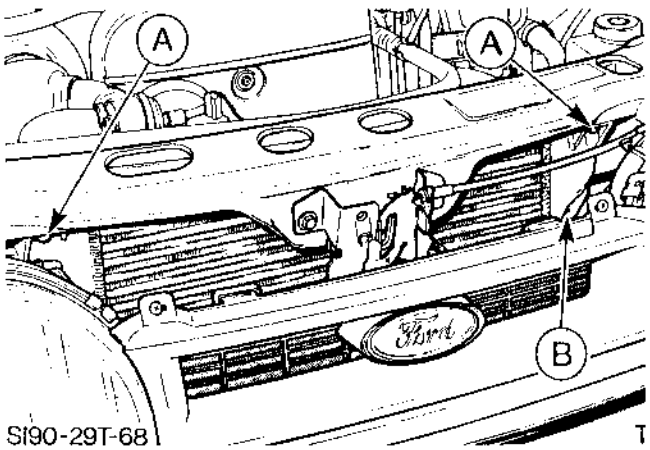


Fig.3. Intercooler retaining nuts and bolts.
A - Outside top retaining bolts
B - Inside bottom nuts (one shown)

6. Remove 4 intercooler securing bolts and 2 nuts, refer to Fig.3 and Fig.4. This will allow intercooler assembly to be removed from vehicle.

To Install

7. Position intercooler into vehicle and fasten with 4 bolts and 2 nuts, refer to Fig.4.

8. Reconnect air cleaner intake pipe to intercooler body (1 new plastic expansion rivet).

9. Reconnect air hoses to left and right hand side of intercooler.

10. Reconnect "by-pass" hose into top of intercooler, refer to Fig.2.

11. Refit solenoid control valve with both securing screws.

12. Reconnect all 3 air hoses and multiplug connections.

12. Reconnect battery earth cable.

14. Start engine to ensure correct operation.

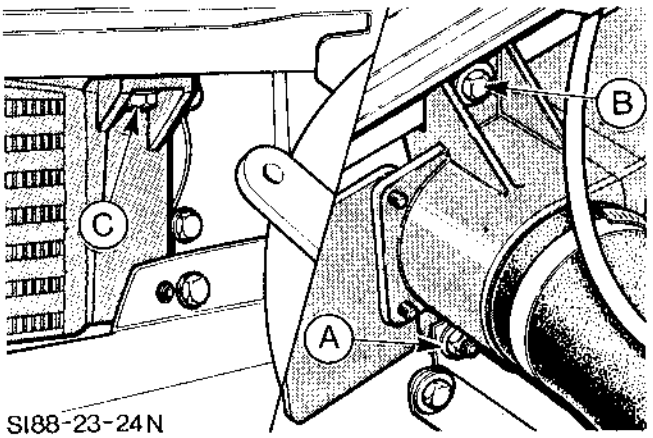
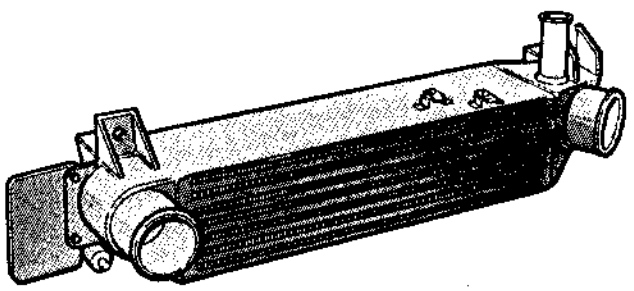


Fig.4. A - Bottom intercooler securing nuts
B - Top inside intercooler securing bolts
C - Top outside intercooler securing bolts



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Fig.5. Intercooler assembly.

25 250 0 CATALYST - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

NOTE: 83 US emission level vehicles only.

To Remove

1. Disconnect battery earth cable.
2. Raise vehicle on hoist.
3. Remove both nuts securing front flange of catalyst to exhaust system "downpipe", refer to Fig.2.
4. Remove both sets of nuts securing rear catalyst flanges to remainder of exhaust system.
5. Separate catalysts from exhaust system.

To Install

6. Clean all mating joints.
7. Loosely reposition catalysts back into exhaust system.
8. Align complete exhaust system and secure.
9. Lower hoist to ground.
10. Reconnect battery earth cable.
11. Start engine and check exhaust joints for leakage.

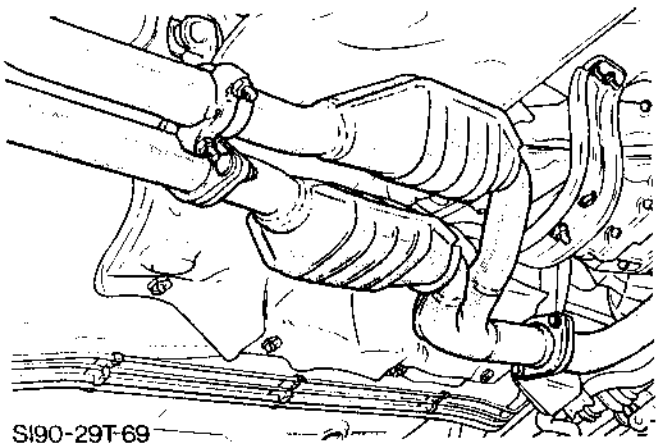


Fig.1. Catalyst section of exhaust system.

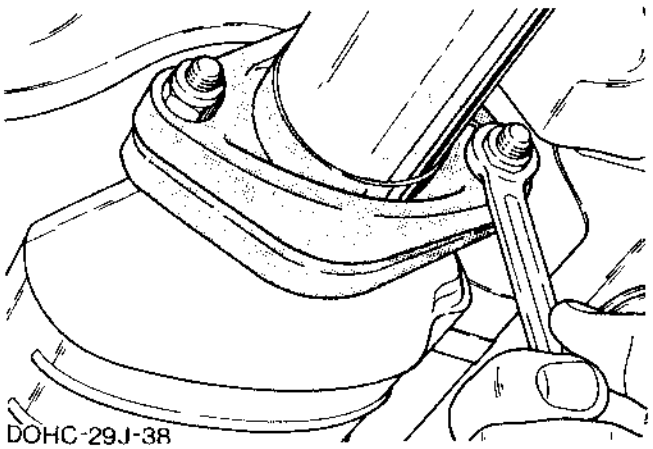


Fig.2. Remove bolts securing front and rear flanges of catalyst to exhaust system.

PRELIMINARY CATALYTIC CONVERTER

To Remove

1. Disconnect battery earth cable.
2. Remove 3 nuts from the Preliminary catalyst flange to turbocharger, refer to Fig.3.
3. Raise vehicle on hoist.
4. Remove both nuts securing catalysts to Preliminary catalyst, and lift away from vehicle, refer to Fig.3.

To Install

5. Refit Preliminary catalyst loosely to exhaust system.
6. Align exhaust system and tighten bolts to torques on page 2.
7. Lower vehicle to ground and reconnect battery.
8. Start engine and check joints for leakage.

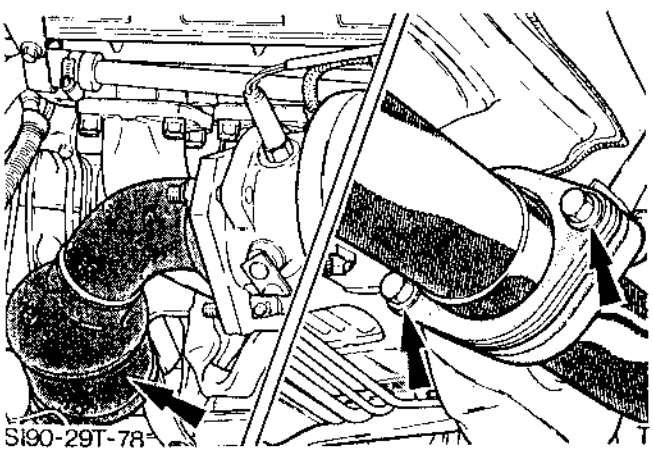


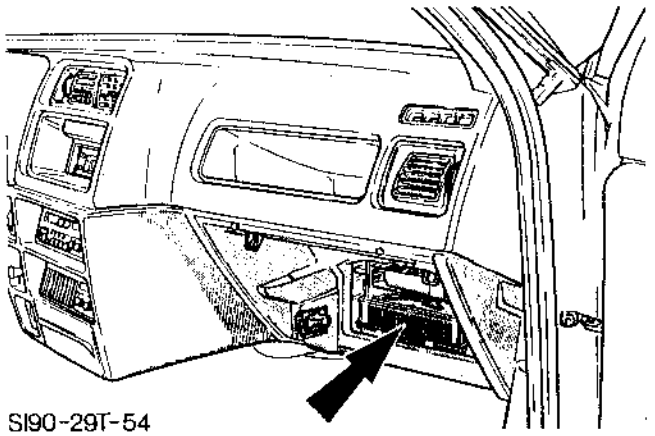
Fig.3. Preliminary catalytic converter.

29 200 0 CONTROL MODULE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED:

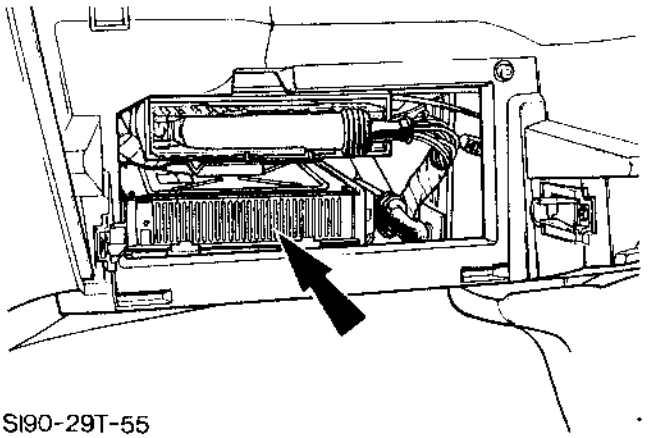
- CO meter .. .. .. (15:04 vehicles)
- RPM meter .. .. .. (15:04 vehicles)
- L.E.D. tester .. .. (83 US vehicles)

NOTE: On Removal and Installation of Control Module, CO% must be checked on both 15:04 and '83 US vehicles. The procedures for '83 US emission level vehicles follows the control module removal and installation instruction below. For 15:04 emission level vehicles, CO% check and adjust is featured in 23 215 0 (page 11).



SI90-29T-54

Fig.1. ECU module location.



SI90-29T-55

Fig.2. Module positioned in retaining bracket.

To Remove

1. Disconnect battery earth cable.
2. Open glove box on passenger side of vehicle.
3. Remove glove box assembly to allow access to the ECU module, refer to Fig.1.
4. Unclip ECU module from retaining bracket, refer to Fig.2.
5. Disconnect ECU multiplug by unclipping.

To Install

6. Refit multiplug to ECU module.
7. Position module into retaining bracket, ensuring bracket clips into position.
8. Refit glove box assembly.
9. Reconnect battery earth cable.

15:04 Emission Level Vehicles Only

The current CO% mixture check and adjust procedure featured in 23 215 0 (page 11), should be followed.

83 US Emission Level Vehicles Only

(applies to Sierra only, because there is no adjustment on Escort)

An L.E.D. tester (V. Lowener No. 0132060 or V.L. Churchill No. 0472060) must be used to achieve correct CO% check and adjustment. The procedure of which, is featured on page 29.

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CO% Check and Adjust Procedure (83 US only)

RS COSWORTH 4x4

1. Warm engine to normal operating temperature then switch 'off' engine.

2. Join L.E.D. tester to vehicle self-test connector (located next to ECU module, refer to Fig.1) with red lead of tester to battery positive terminal. Ensure on/off switch is in '0' position.

NOTE: The L.E.D. tester provides three functions:
- Fault diagnosis
- CO% check
- HEGO sensor operation

3. Start engine and allow to idle.

NOTE: Ensure that electric cooling fans are not running whilst watching and waiting for information to be forthcoming from L.E.D. tester, nor whilst moving CO% adjustment screw in or out of ECU module, during the course of this procedure. If they do activate, switch 'off' engine, wait for approximately 30 seconds (until fans have stopped running), then restart engine and commence procedure from the beginning again.

4. The indicator light on the L.E.D. tester should flash rapidly, which indicates that all is O.K. If the L.E.D. remains illuminated then a vehicle fault condition is evident, refer to page 32 of the Cosworth 4x4 Vehicle System test manual.

5. Move the switch on the L.E.D. tester to position '1' and observe the light (should be 'off' indicating that all is O.K. If not, refer to page 32 of the Cosworth 4x4 Vehicle System Test manual).

6. Return switch to position '0' on L.E.D. tester.

7. Return switch to position '1' on L.E.D. tester, then wait for approximately 10 seconds so that CO% can be checked and displayed by L.E.D.

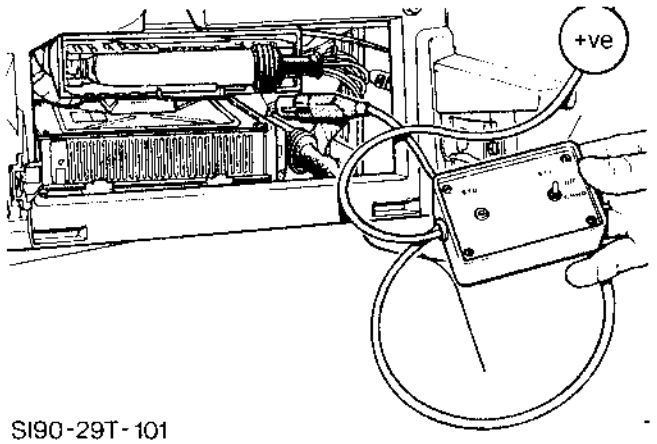
   - If the light on the L.E.D. tester flashes rapidly, CO% is correct and no adjustment is required.

   - If the light on the L.E.D. tester remains 'on', the CO% is rich and must be adjusted by turning the control module adjustment screw anti-clockwise (refer to Fig.2.), then 'blip' throttle and await L.E.D. response.

   - If the light on the L.E.D. is not illuminated the CO% is lean and must be adjusted by turning the control module adjustment screw clockwise, (refer to Fig.2), then 'blip' throttle and await L.E.D. response.

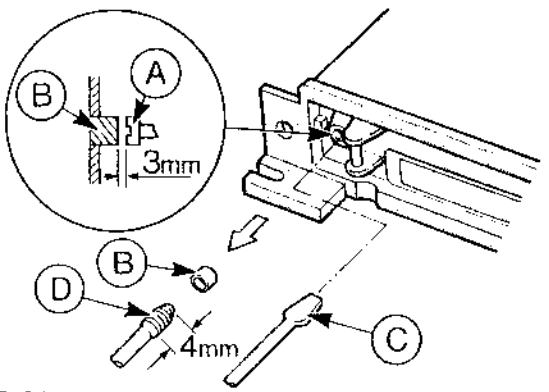
NOTE: If the light flashes slowly at a constant rate this indicates that certain vehicle conditions are not correct, i.e. coolant not to normal operating temperature or engine idle speed not to specification.
If CO% setting is completely lost and you are unable to adjust in line with correct specification, please refer to next page.

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SI90-29T-101

Fig.1. L.E.D. tester connected to vehicle.



SI88-22-14

Fig.2. A - CO% adjustment screw
B - Tamperproof plug
C - Screwdriver
D - Tamperproof plug remover

If a 3-1 error code (HEGO sensor) is given by the L.E.D. tester, this does not necessarily mean that the HEGO sensor is faulty, but possibly "out of range" of adjustment. Should this occur or the CO% setting appears to be completely lost, carry out the action specified below:-

- With LED tester in position '0' and connected to engine (engine switched 'off'), turn ECU CO% adjustment screw 6 full turns Lean (anti-clockwise) then 2 turns Rich (clockwise) to mid point of range.
- Start engine. L.E.D. tester will now 'flash' rapidly, whilst in position '0'.
- Then switch 0-1 (to error code position), no codes should show (no flashing of L.E.D. should occur).
- Return switch to position '0' on L.E.D. tester.
- Return switch to position '1' on L.E.D. tester, then wait for approximately 10 seconds for an L.E.D. response. This will determine the engine operating CO% specification at the time, from which you can establish whether an adjustment is necessary.

NOTE: Ensure that electric cooling fans are <u>not</u> running whilst watching and waiting for information to be forthcoming from L.E.D. tester, nor whilst moving CO% adjustment screw in or out of ECU module, during the course of this procedure. If they do activate, switch 'off' engine, wait for approximately 30 seconds (until fans have stopped running), then restart engine and commence procedure from the beginning again.

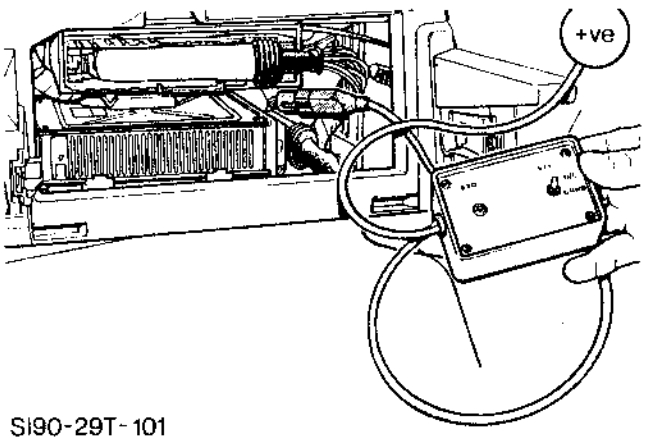
- Move CO% screw in ½ a turn at a time to find either full Rich (light 'on'), full Lean (light 'off') or rapid flashing, confirming CO% is to correct specification.

  Correct CO% specification is normally found to be about ½ turn from mid point of range. 1 full turn away from mid point of tolerance band either way, will cause an "out of range" situation to occur (light flashing slowly).

- If the L.E.D. is then switched 0-1 for a further 10 seconds, HEGO operation will then be seen (light flashes 'on' and 'off' as HEGO operates - normally a slowish rate).

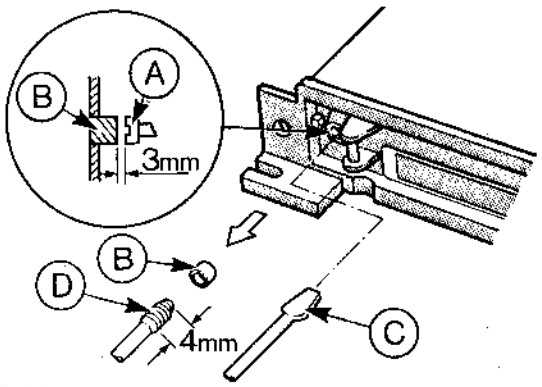
  If L.E.D. is permanently 'on' or 'off', HEGO sensor or ECU module is not working properly.

NOTE: Following each "in Service" adjustment of the ECU module adjustment screw, the throttle must be depressed, allowing the engine speed to rise to 3,000 rpm momentarily. When returning to idle the true CO% can be registered and displayed by the LED tester.



SI90-29T-101

Fig.3. LED tester connected to vehicle.



SI88-22-14

Fig.4. A - CO% adjustment screw
B - Tamperproof plug
C - Screwdriver
D - Tamperproof plug remover

29 220 0 HEGO SENSOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

NOTE: 83 US emission level vehicles only

To Remove

1. Disconnect battery earth cable.

2. Remove both turbocharger heat shield securing bolts, refer to Fig.1.

3. Disconnect HEGO sensor multiplug, do not pull on wiring, refer to Fig.2.

4. Unscrew HEGO sensor from turbocharger assembly and remove, ensuring sealing ring is attached, refer to Fig.2.

To Install

5. Do not touch tip of HEGO sensor. Ensure HEGO sensor and turbocharger threads are clean.

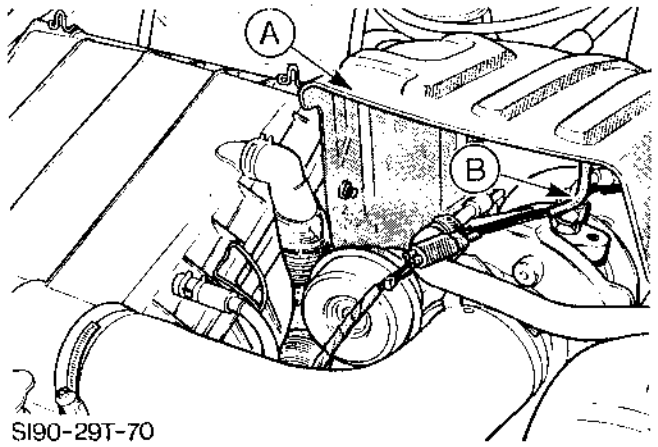
6. Refit HEGO with new sealing ring. Tighten to specified torque, refer to Technical Data on page 2.

7. Refit multiplug, ensuring lock tabs "snap" into position.

8. Reconnect battery earth cable.

9. Start engine and check HEGO sensor joint for leaks.

10. Refit turbocharger heat shield and secure with both bolts.



SI90-29T-70

Fig.1. A - Turbocharger heat shield
B - HEGO sensor location

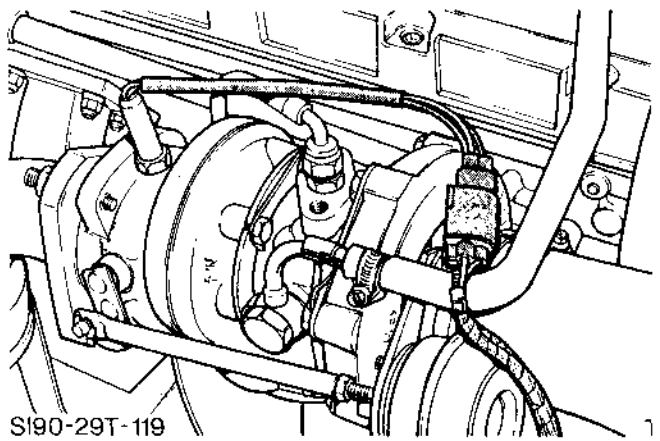

SI90-29T-119

Fig.2. HEGO sensor location in turbocharger.

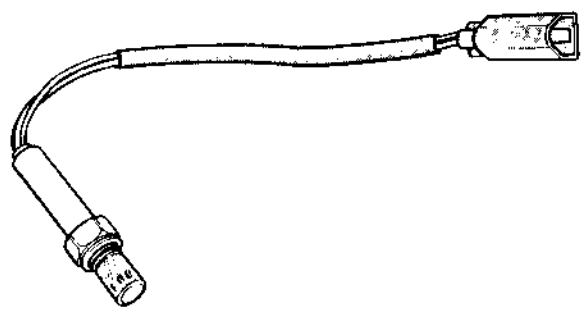

SI90-29T-120

Fig.3. HEGO sensor assembly.

0990

29 222 0 KNOCK SENSOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect knock sensor multiplug, which is located next to distributor (transmission side of distributor), refer to Fig.1.

3. Carefully guide wiring loom from its routing as it runs to opposite side of engine to knock sensor location.

4. Unscrew knock sensor from engine.

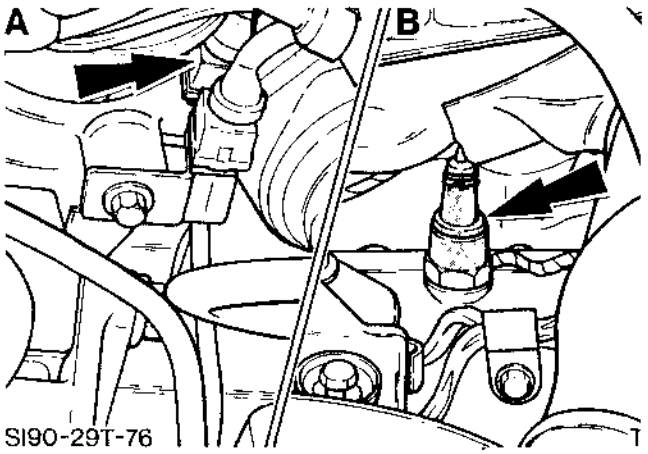


Fig.1. A - Knock sensor multiplug (distributor side of engine)
B - Knock sensor (turbocharger side of engine)

To Install

5. Reposition, screw and tighten knock sensor into engine block, ensuring that wiring loom does not become twisted and sustain internal damage.

6. Route wiring loom from knock sensor around the engine to its multiplug connection point with the main engine loom by the distributor and reconnect, refer to Fig.1.

7. Reconnect battery earth cable.

8. Start engine to ensure correct operation.

29 224 0 SENSOR - MANIFOLD ABSOLUTE PRESSURE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

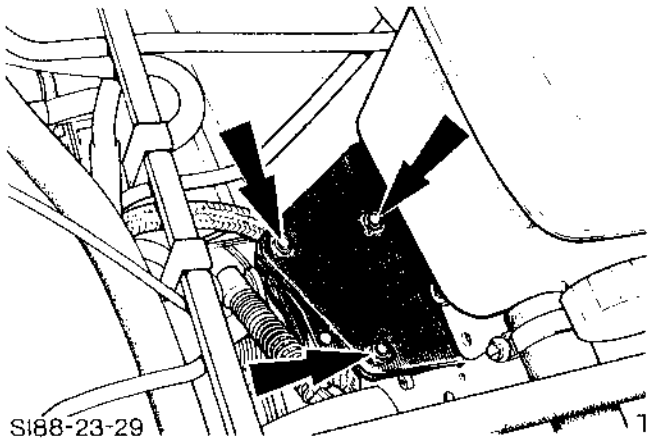


Fig.1. Sensor securing bolts.
(Remove from underside of bracket).

To Remove

1. Disconnect battery earth cable.

2. Remove three retaining bolts securing sensor to bracket (sensor positioned on underside of bracket), refer to Fig.1.

3. Disconnect manifold absolute pressure sensor multiplug.

4. Cut "off" existing hose clip and remove vacuum pipe from sensor, refer to Fig.2.

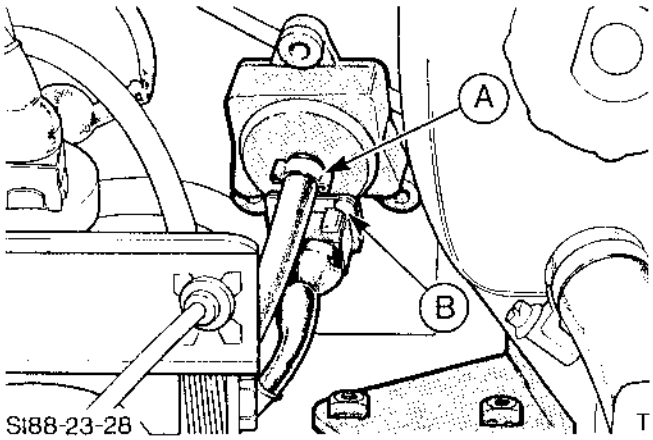


Fig.2. A - Vacuum pipe connection
B - Sensor multiplug

To Install

5. Refit vacuum pipe, using a new hose clip.

6. Reconnect manifold absolute pressure sensor multiplug.

7. Reposition sensor to underside of bracket and secure with three bolts.

8. Reconnect battery earth cable.

9. Start engine to ensure correct operation.

0990

29 250 0 CARBON CANISTER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

NOTE: 83 US emission level vehicles only.

To Remove

1. Disconnect battery earth cable.

2. Remove both turbocharger heat shield bolts to allow access to the Carbon Canister assembly.

3. Detach canister plastic pipe connector (push fit into canister assembly), refer to Fig.2.

4. Remove retaining bolt and "lift out" canister assembly, refer to Fig.2.

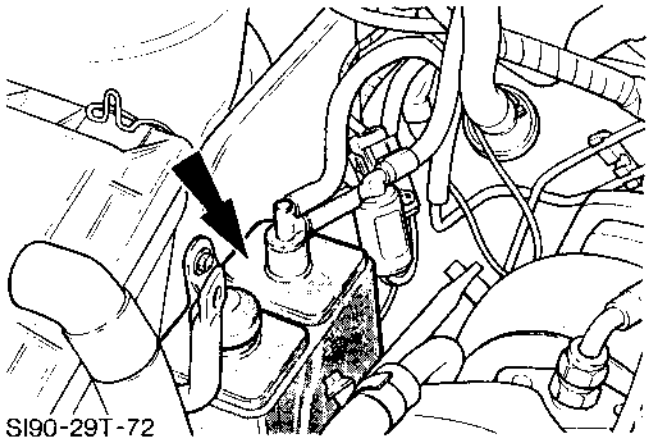


Fig.1. Carbon canister assembly and location.

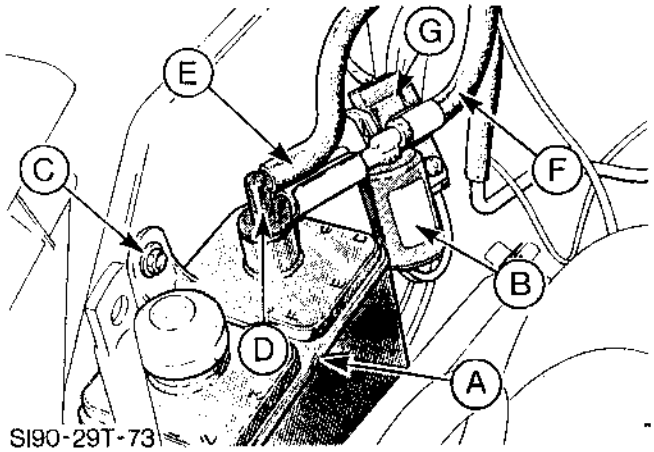


Fig.2. A - Carbon canister
B - Solenoid assembly
C - Canister retaining bolt
D - Canister pipe connector
E - Canister purge line from tank
F - Canister purge line to engine
G - Solenoid multiplug connector

To Install

5. Refit canister assembly into its location and secure with retaining bolt.

6. Refit canister plastic pipe connector (push in), refer to Fig.2.

7. Refit turbocharger heat shield and secure with both bolts.

8. Reconnect battery earth cable.

0990

29 622 0 AIR CHARGE TEMPERATURE SENSOR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect multiplug from air charge temperature sensor, refer to Fig.1.

3. Remove sensor from plenum chamber of engine, refer to Fig.1.

To Install

4. Refit sensor into plenum chamber of engine, refer to Fig.1.

5. Tighten sensor to specified torque, see Technical Data on page 2.

6. Reconnect sensor multiplug.

7. Reconnect battery earth cable.

8. Start engine to ensure correct operation.

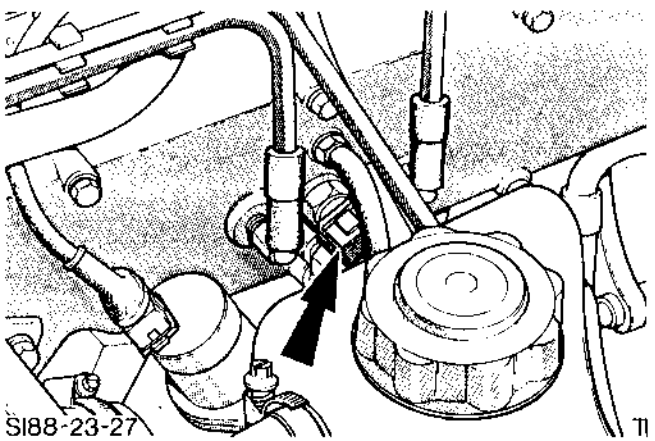


Fig.1. Air charge temperature sensor multiplug.

0990

33 577 0 SWITCH - FUEL SHUT OFF - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Remove spare wheel and cover from vehicle.

3. Locate inertia switch mounted in spare wheel well, refer to Fig.1.

4. Remove both screws securing inertia switch to bracket located in spare wheel body recess, refer to Fig.2.

5. Disconnect multiplug from switch, do not pull on wiring.

To Install

6. Reconnect multiplug to switch, ensuring that locking tabs "snap" into position.

7. Refit switch into its location and secure with both screws.

8. Ensure inertia switch is reset by pushing button down on top of switch assembly, refer to Fig.2.

9. Reposition spare wheel and cover into vehicle.

10. Reconnect battery earth cable.

11. Start engine to ensure switch is operating correctly.

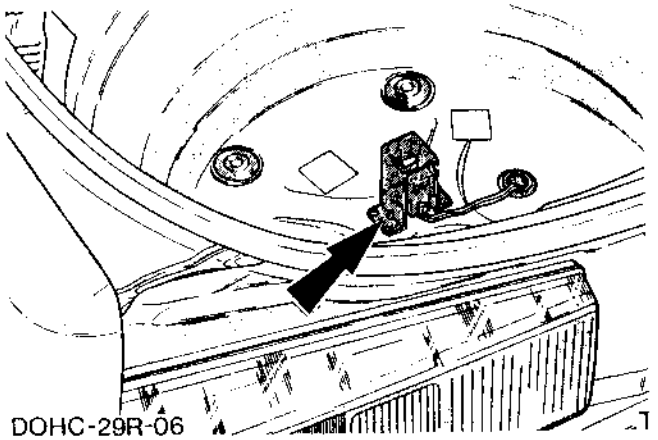


Fig.1. Inertia switch location.

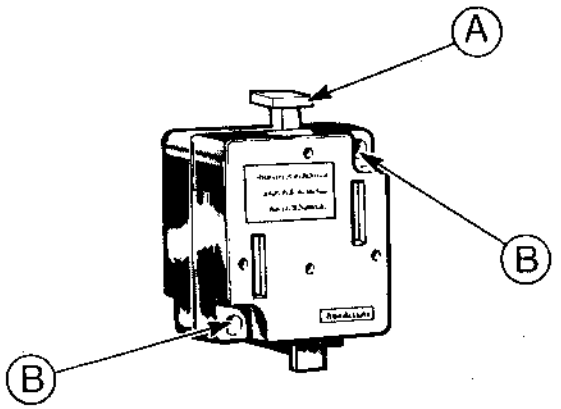


Fig.2. A - Inertia switch reset button
B - inertia switch securing points

0990

33 772 0 SOLENOID CANISTER PURGE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

NOTE: 83 US emission level vehicles only.

To Remove

1. Disconnect battery earth cable.

2. Disconnect solenoid multiplug, do not pull on wiring, refer to Fig.1.

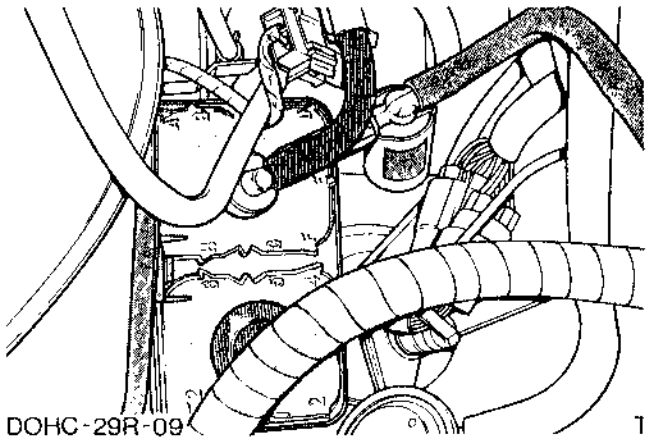


Fig.1. Canister purge solenoid and location.

3. Disconnect both pipes from canister purge solenoid. Remove solenoid assembly from its location, refer to Fig.2.

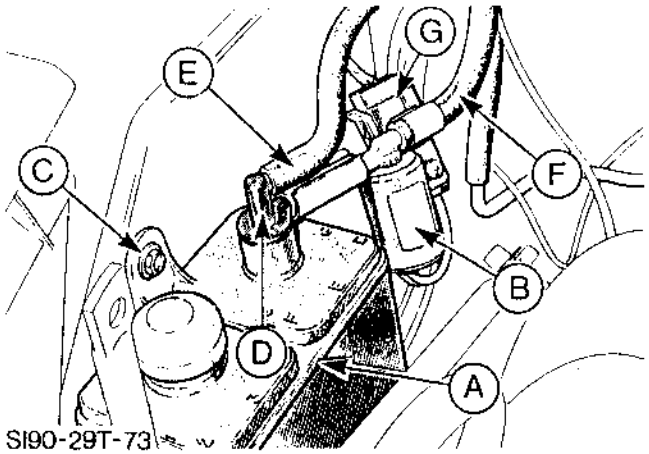


Fig.2. A - Carbon canister
B - Solenoid assembly
C - Canister retaining bolt
D - Canister pipe connector
E - Canister purge line from tank
F - Canister purge line to engine
G - Solenoid multiplug connector

To Install

4. Refit both pipes to canister purge solenoid.

5. Reconnect multiplug, ensuring locking tab "snaps" into position.

6. Reconnect battery earth cable.

7. Start engine to ensure correct operation.

0990

ENGINE MANAGEMENT AND EMISSION SYSTEM 29W
(Escort RS Cosworth 4x4
83 US Emission Levels)

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ANY SERVICE AND/OR REPAIR OPERATION FOR THE ESCORT RS COSWORTH WHICH IS NOT FEATURED IN THIS SECTION, REFER TO SIERRA RS COSWORTH SECTION (29T) ABOVE.

0492

Fuel System

Injectors

Manufacturer	Weber
Type	Electronically operated
Lubrication for injector seals	Clean engine oil

Fuel Pump

Manufacturer	A/C Delco
Type	Intank - Electric roller cell
Output pressure	Greater than 3 bar at 12 volts

Pressure Regulator

Manufacturer	Weber
System pressure	3,2 to 3,8 bar (with ignition on - engine not running)
System pressure	2,7 to 3,3 bar (engine running at idle)
Lubricant for Regulator seals	clean engine oil

Idle Speed

83 US vehicles	900 ± 50 rpm

Turbocharger

Manufacturer	Garret
Type	T034
Boost pressure (ECU controlled)	0,8 bar (maximum 0,9 bar)

Tightening Torques

	Nm		lbf ft
Wastegate actuator rod locknut	5,6 to 7,9		4,0 to 6,0
Actuator to retainer	5,6 to 7,9		4,0 to 6,0
Intermediate housing to turbine housing	18,5 to 21,9		14,0 to 16,0
Intermediate housing to compressor housing	16,4 to 19,8		12,0 to 14,0
Exhaust downpipe to turbocharger	19,0 to 23,0 (M8)	35 - 47 (M10)	14,0 to 17,0
Exhaust manifold to Turbocharger assembly	32,0 to 36,0		24,0 to 27,0
Oil feed adaptor to turbocharger	25,0 to 35,0		18,0 to 26,0
Oil feed to adaptor	25,0 to 27,0		18,0 to 20,0
Turbo drain pipe to turbocharger	18,5 to 21,5		14,0 to 16,0
Water pipe banjo bolts to turbocharger	19,0 to 23,0		14,0 to 17,0
Throttle cable bracket to plenum chamber	18,5 to 21,5	+ Loctite 518	14,0 to 16,0
Fuel regulator to fuel rail	8,0 to 10,0		6,0 to 8,0
Fuel rail to plenum chamber	8,0 to 10,0		6,0 to 8,0
Breather valve intake to plenum chamber.	15,0 to 20,0	+ Loctite 242	11,0 to 15,0
Air charge temperature sensor to plenum chamber	23,0 to 25,0	+ Loctite 518	17,0 to 18,0
HEGO sensor to turbocharger	28,0 to 30,0		20,0 to 22,0
TDC sensor bracket to sump	8,0 to 10,0		6,0 to 8,0
TDC sensor to bracket	4,0 to 6,0	+ Loctite 270	3,0 to 5,0
Distributor clamp to cylinder block	8,5 to 21,5		13,0 to 16,0

0492

Ignition System

Coil

Manufacturer	Motorcraft
Primary resistance	0,72 to 0,88 ohms
Secondary resistance	4500 to 8600 ohms

Spark Plugs

Manufacturer	Nippondenso
Type	PK 20 PR P11
Electrode material	Platinum
Electrode gap - all territories	1,10 mm (0,060 in)
Firing order	1 - 3 - 4 - 2

Distributor

Dwell angle	Totally controlled by ECU module and cannot be adjusted
Initial advance	16° BTDC

HT Leads

Resistance	10,000 ohms maximum per 300 mm

ECU Module

Manufacturer	Weber Marelli

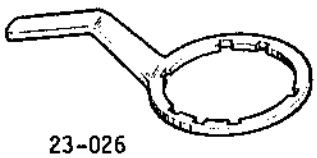
Ignition Amplifier Module

Manufacturer	Motorcraft
Ignition Amplifier Module heat sink compound (specification number)	81SF-12103-AA
(Finis code)	6092983

Clearance Settings

TDC sensor to pulley teeth	0,6 to 1,0 mm
Distributor cam to phase sensor	0,2 to 0,3 mm

SPECIAL SERVICE TOOLS

Tool	Tool Name
 23-026	Fuel tank sender unit wrench

GENERAL EQUIPMENT

0492

22 292 0 IGNITION AMPLIFIER MODULE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect multiplug from ignition amplifier module, refer to Fig.1.

3. Remove both screws along with their washers and lift out module from vehicle.

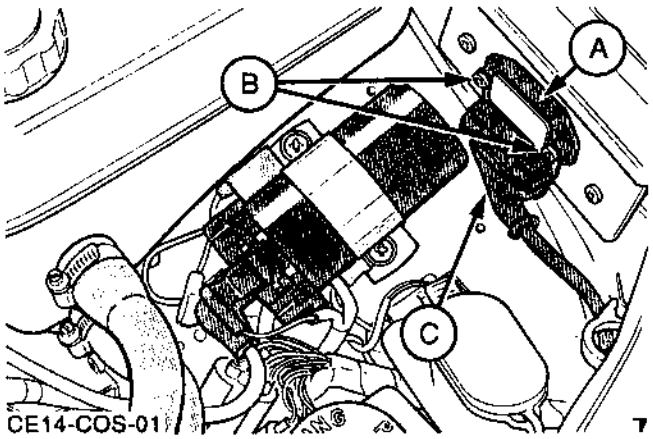


Fig.1. A - Ignition amplifier module.
B - Securing screws
C - Multiplug

To Install

4. Coat rear face of ignition amplifier module with heat sink compound, refer to Fig.2 (see Technical Data on page 3 for compound finis code number).

5. Reposition ignition amplifier module and secure with both screws and washers.

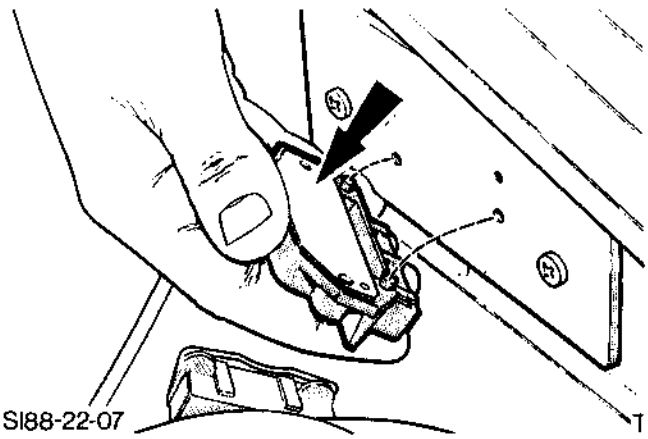


Fig.2. Apply heat sink compound to module.

6. Reconnect ignition amplifier module multiplug, refer to Fig.1.

7. Reconnect battery earth cable.

8. Start engine to ensure correct operation.

0492

22 414 0 IGNITION COIL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect HT and LT connections at coil.

3. Remove both ignition coil securing screws, and lift out coil with suppression capacitor.

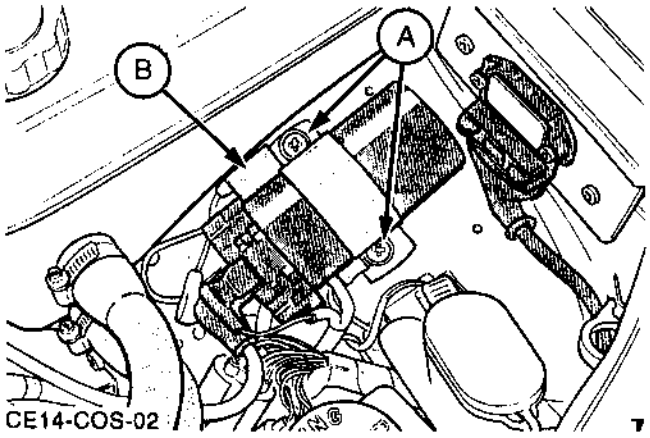


Fig.1. Ignition coil location.
A - Mounting screws
B - Suppression capacitor

To Install

4. Reposition coil with suppression capacitor and secure with both retaining screws.

5. Reconnect HT and LT connections.

6. Reconnect battery earth cable.

7. Start engine to ensure correct operation.

0492

23 534 0 FUEL PUMP (INTANK) - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED:

Fuel tank sender unit wrench .. 23-026

WARNING: ENSURE FUEL HANDLING SAFETY PRECAUTIONS ARE STRICTLY ADHERED TO.

CAUTION: Ensure that any fuel drained from the vehicle is stored in an appropriately marked storage container with either an identification of 'LEADED FUEL ONLY' or 'UNLEADED FUEL ONLY'. Should this not occur and a common storage container be used, a deterioration to the catalytic converters and HEGO sensors (where fitted) will occur.

To Remove

1. Disconnect battery earth cable.

WARNING: ENSURE FUEL HANDLING SAFETY PRECAUTIONS ARE STRICTLY ADHERED TO. REFER TO SECTION 05 OF THE MICROFICHE.

2. Pump fuel from vehicle fuel tank into a closed container (see 'Caution Note' above).

3. Raise vehicle on hoist.

4. Disconnect fuel tank filler hose neck, breather hose and valve hose at body filler neck.

5. Support fuel tank whilst it is in position and remove both tank securing straps.

6. Carefully lower fuel tank and disconnect fuel pump/sender unit multiplug, do not pull on wiring, refer to Fig.1.

7. Disconnect fuel supply hose connector (white) and return hose connector (red) both at fuel tank, refer to Fig.1.

8. Remove fuel tank assembly from vehicle and drain any residue into a suitable container.

9. Using Special Service Tool 23-026, remove fuel pump/sender unit, refer to Fig.3. Disconnect and remove fuel tank filler hose, breather hose and valve hose from tank.

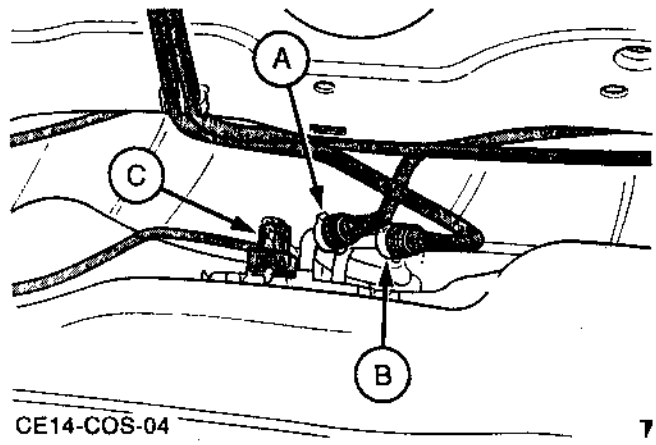


Fig.1. A - Fuel line connector (red)
B - Fuel line connector (white)
C - Fuel pump/sender unit multiplug

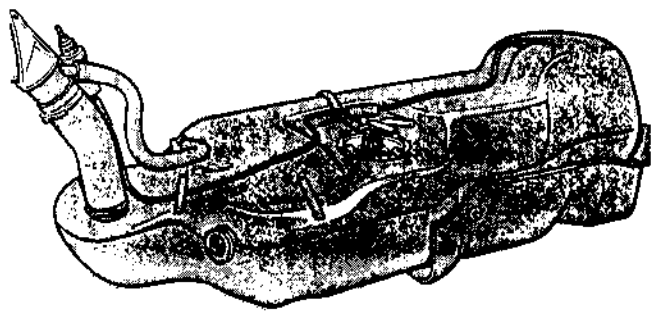


Fig.2. Fuel tank with all components fitted.

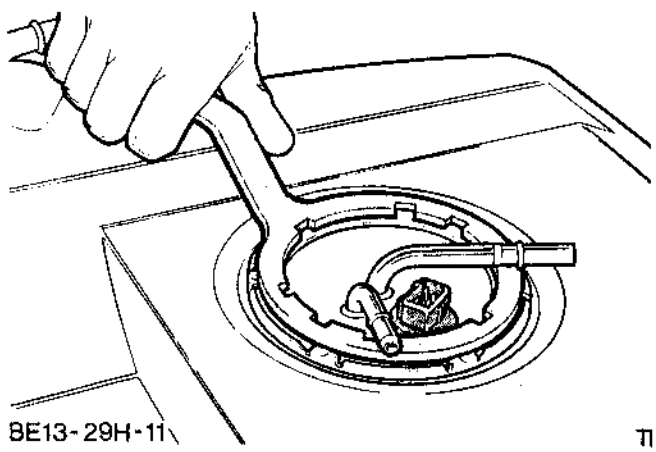


Fig.3. Intank fuel pump/sender unit removal.

0492

To Install

NOTE: A used sender unit seal usually distorts and is difficult to install correctly. It is therefore, appropriate to fit a new seal each time the fuel pump/sender is removed from the tank and installed.

10. With a new seal refit fuel pump/sender unit into fuel tank. Tighten with Special Service Tool 23-026, refer to Fig.4.

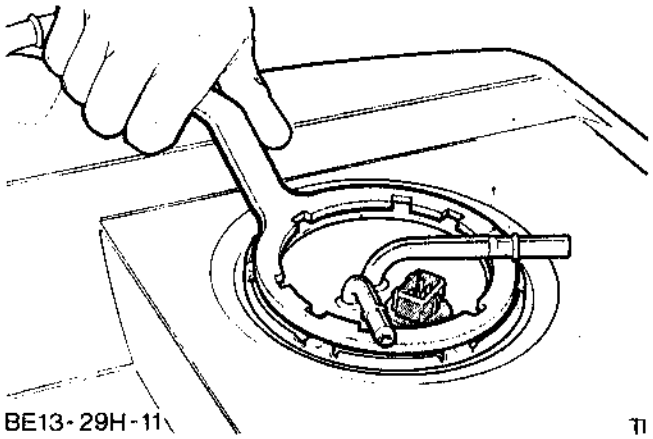


Fig.4. Intank fuel pump/sender unit.

11. Fit fuel tank filler neck hose, breather hose and valve hose to tank. Apply a very thin coat of grease to the tank flanges to assist with fitment of hoses, prior to lifting fuel tank into position.

12. Support and reposition tank beneath vehicle, ensuring that tank vent hose is routed through hole located in chassis, refer to Fig.6.

13. Reconnect fuel supply hose connector (white) and return hose connector (red). Reconnect fuel tank sender unit multiplug.

14. Fully locate tank into position and secure with both tank straps. Reconnect fuel fill neck hose, breather hose and valve hose.

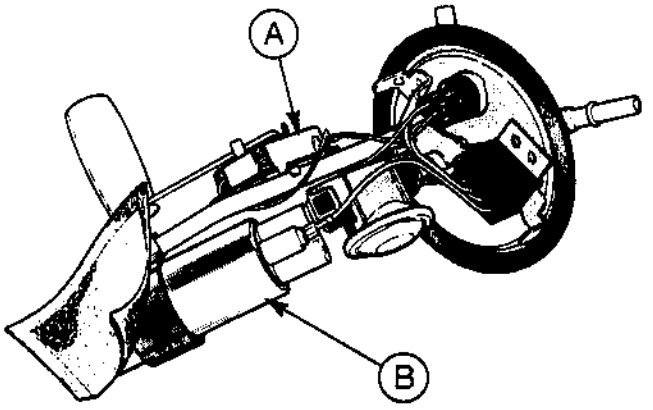


Fig.5. A - Sender unit
B - Fuel pump

15. Lower vehicle to ground and refill tank with fuel (see 'Caution Note' on previous page).

16. Reconnect battery earth cable.

17. Start engine to ensure correct fuel pump operation and that no fuel leaks exist.

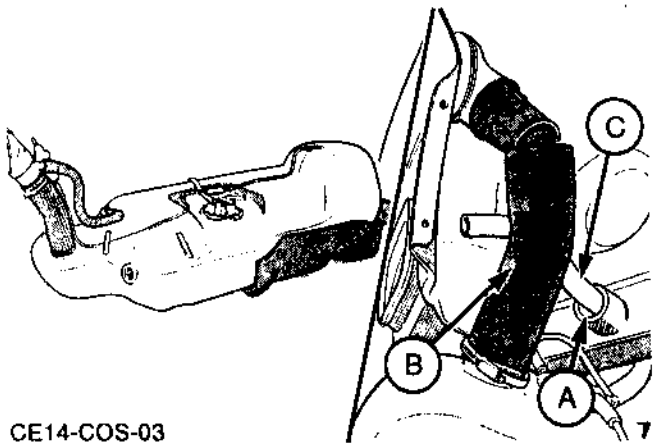


Fig.6. A - Fuel tank vent hose hole in chassis.
B - Fuel tank filler neck
C - Fuel tank vent hose

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23 545 0 FUEL FILTER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

WARNING: THE FUEL SYSTEM REMAINS PRESSURISED. TAKE ADEQUATE SAFETY PRECAUTIONS TO PREVENT FUEL SPILLAGE.

To Remove

1. Disconnect battery earth cable.

2. Raise vehicle on a hoist.

3. Position a suitable container beneath fuel filter. Carefully disconnect fuel outlet pipe from filter, allow pressure in fuel line to reduce. Remove fuel inlet pipe, refer to Fig.1.

4. Slacken fuel filter retaining bolt and withdraw filter assembly, refer to Fig.1.

NOTE: Take care when removing filter, as filter will still contain a certain amount of fuel after removal of supply and outlet pipes.

To Install

5. Fit new filter assembly and secure, ensuring filter assembly is correctly positioned (note direction of fuel flow arrows on side of filter canister), refer to Fig.2.

6. Reconnect fuel filter inlet and outlet pipes.

7. Reconnect battery earth cable.

8. Switch ignition on and off five times to generate fuel system pressure. Check filter and connecting fuel pipes, to ensure that no fuel leakage is evident.

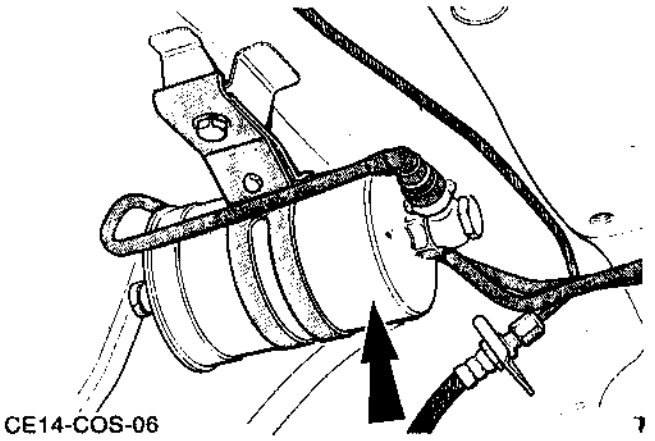
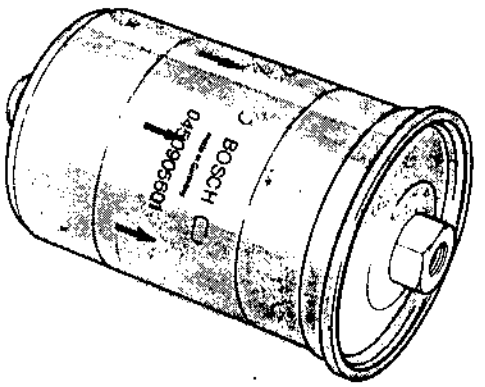


Fig.1. Fuel filter position beneath vehicle.



S-29C-32N

C

Fig.2. Fuel filter assembly.

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23 616 0 SOLENOID CONTROL VALVE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Establish position of solenoid control valve beneath bonnet slam panel and above intercooler. Then disconnect solenoid control valve multiplug, refer to Fig.1.

3. Disconnect both hoses at solenoid control valve assembly, refer to Fig.1.

4. Remove securing screws and lift off solenoid control valve from vehicle.

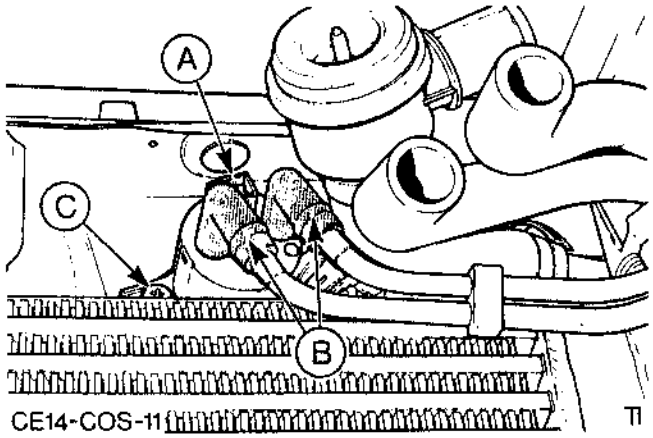


Fig.1. Solenoid control valve assembly.
A - Multiplug connection
B - 2 hose connections
C - Solenoid securing screws (one shown)

To Install

5. Reposition solenoid control valve and secure with both screws, refer to Fig.1.

6. Reconnect both air hoses to solenoid control valve assembly.

7. Reconnect solenoid control valve multiplug.

8. Reconnect battery earth cable.

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23 620 0 INTERCOOLER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect solenoid control valve multiplug, 2 air hose connections and both assembly securing screws, refer to Fig.1.

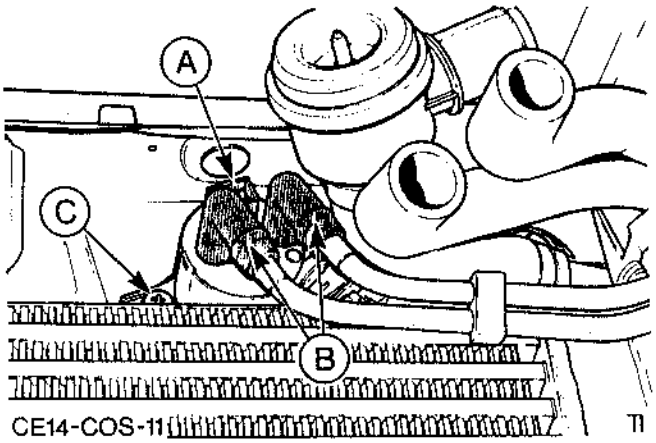


Fig.1. Solenoid control valve assembly.
A - Multiplug connection
B - 2 hose connections
C - Solenoid securing screws (one shown)

3. Remove air hose between air cleaner assembly and turbocharger.

4. Disconnect and remove bypass hose (with valve) from top of intercooler, refer to Fig.2.

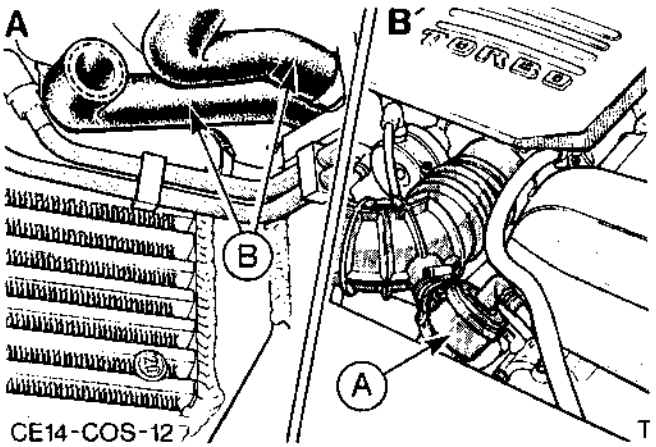


Fig.2. A - Bypass hose with valve
B - Coolant hoses

5. Disconnect coolant hoses to intercooler, once having placed a drain tray beneath engine, refer to Fig.2.

6. Disconnect air hoses from left and right hand sides of intercooler.

7. Remove 4 intercooler securing bolts and 2 nuts, refer to Fig.3. This will allow the intercooler assembly to be carefully removed from vehicle, once both bolts securing bottom of intercooler to top of radiator have been removed.

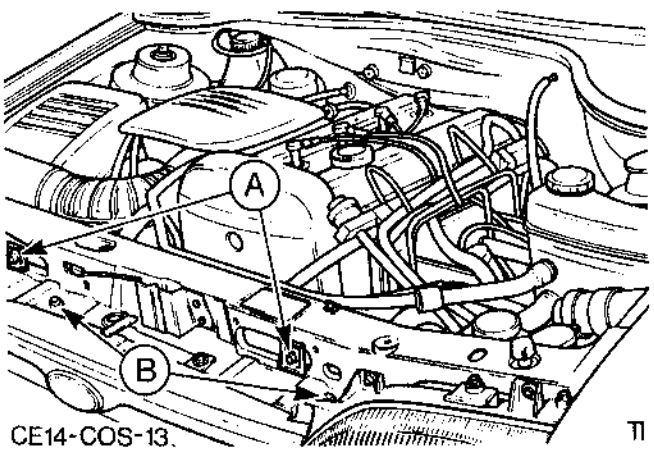


Fig.3. Intercooler retaining nuts and bolts.
A - Upper retaining bolts shown
B - Lower retaining bolts shown

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To Install

8. Position intercooler into vehicle and secure, refer to Fig.4.

9. Reconnect air hoses to left and right hand side of intercooler.

10. Reconnect coolant hoses to intercooler.

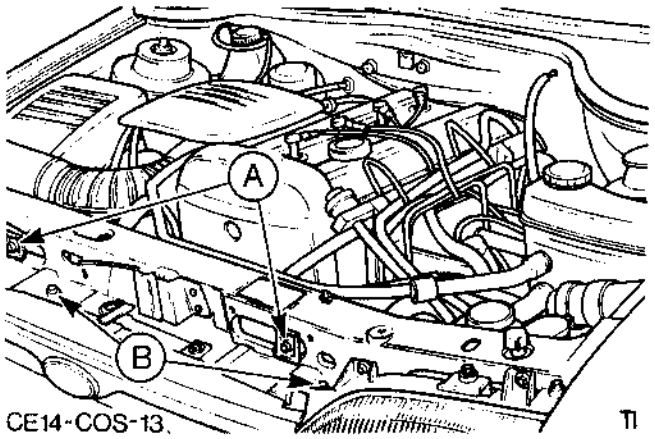


Fig.4. Intercooler retaining nuts and bolts.
A - Upper retaining bolts
B - Lower retaining bolts

11. Refit solenoid control valve with both securing screws, refer to Fig.6.

12. Reconnect both air hoses and multiplug connections to solenoid control valve.

NOTE: Check the condition of air hoses for signs of deterioration. Replace if necessary.

13. Reconnect air bypass hose with valve into top of intercooler, refer to Fig.5.

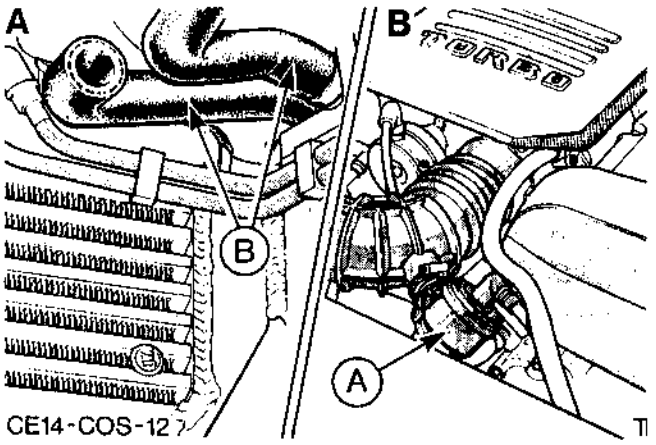


Fig.5. A - Bypass hose
B - Coolant hoses

14. Reconnect battery earth cable.

15. Start engine to ensure correct operation.

16. Top up engine coolant reservoir to "max" mark and remove drain tray from beneath vehicle.

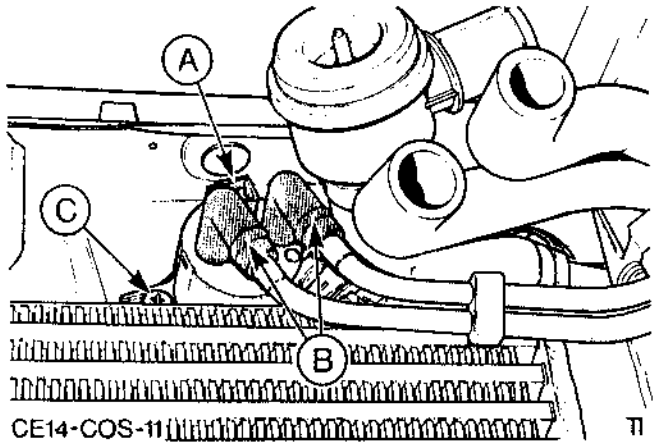


Fig.6. Solenoid control valve assembly.
A - Multiplug connection
B - 2 hose connections
C - Solenoid securing screws (one shown)

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29 200 0 CONTROL MODULE - ENGINE MANAGEMENT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

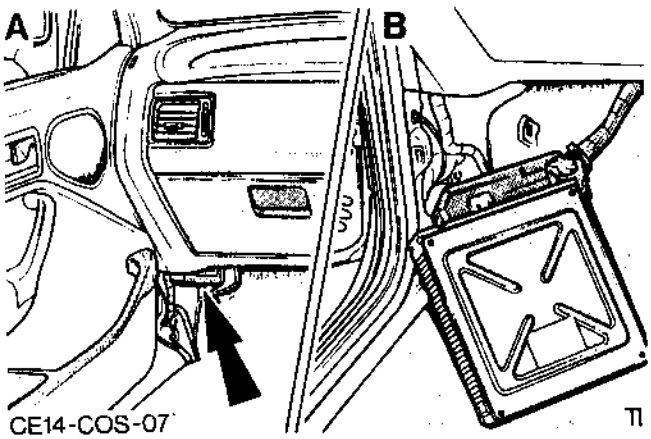


Fig.1. ECU Module positioned in vehicle.

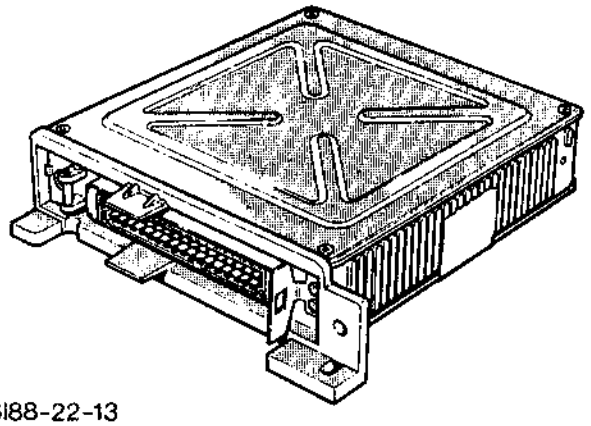


Fig.2. ECU module.

To Remove

1. Disconnect battery earth cable.
2. From inside vehicle, remove passenger side kick panel trim to enable access to ECU module, refer to Fig.1.
3. Unclip ECU module from its retaining bracket, refer to Fig.1. Disconnect wiring loom ECU multiplug connector.

To Install

4. Refit ECU module to wiring loom multiplug connector.
5. Position ECU module into retaining bracket, refer to Fig.1.
6. Refit passenger side foot well kick panel trim over ECU module and secure, refer to Fig.1.
7. Reconnect battery earth cable.
8. Start engine to ensure correct operation.

IMPORTANT

There is no requirement for CO% adjustment.

On disconnection of the ECU module ALL KAM values will be erased. This includes idle and drive values and any fault codes detected.

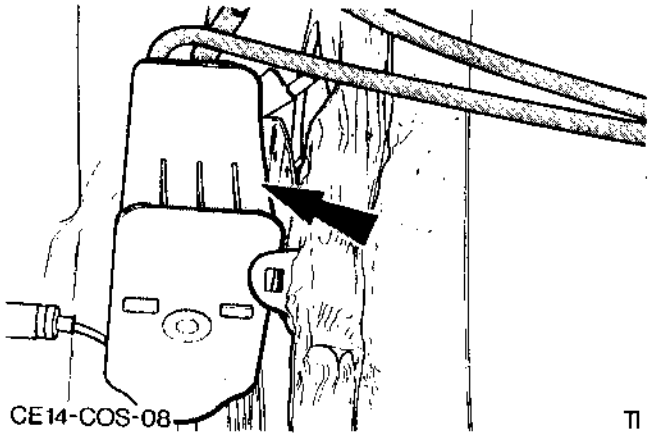
After reconnection of the ECU module the engine should be allowed to idle for 3 minutes. At normal operation temperature engine speed should then be increased to 1200 rpm and maintained for approximately 2 minutes. This will allow the ECU module to re-learn idle and drive values. Surge, hesitation, erratic idle or a deterioration of driveability may result if this procedure is not carried out.

The ECU module should complete its learning strategy after approximately 5 miles (8 kilometres) of varied driving.

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29 250 0 CARBON CANISTER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

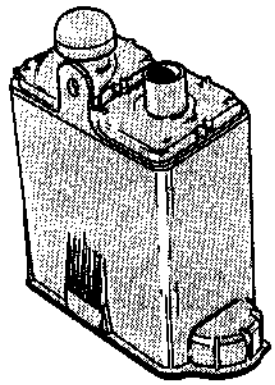


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Fig.1. Carbon canister assembly in vehicle (wheel arch liner removed for clarity).

To Remove

1. Disconnect battery earth cable.
2. Remove wheel arch plastic liner, refer to Fig.1.
3. Establish position of carbon canister beneath front wing, refer to Fig.1.
4. Disconnect carbon canister pipe connection to top of carbon canister.
5. Remove carbon canister retaining screw and lift assembly clear of vehicle, refer to Fig.2.



O

Fig.2. Carbon canister assembly.

To Install

6. Reposition carbon canister into position and secure with retaining screw.
7. Reconnect carbon canister pipe connector into top of carbon canister.
8. Refit wheel arch plastic liner.
9. Reconnect battery earth cable.

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33 577 0 INERTIA SWITCH - FUEL SHUT OFF - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

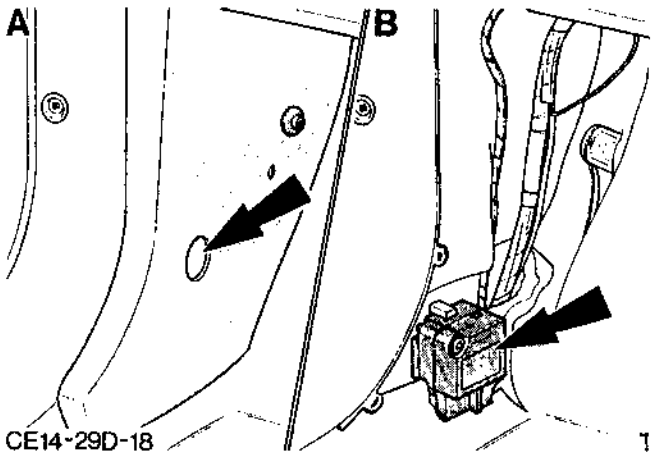


Fig.1. A - Access for switch reset
B - With kick panel removed

To Remove

1. Disconnect battery earth cable.
2. Remove driver's side footwell kick panel, allowing access to the fuel shut off switch, refer to Fig.1.
3. Remove screws securing fuel shut off switch to vehicle body, refer to Fig.2.
4. Disconnect fuel shut off switch multiplug, pull on multiplug not on wiring and lift switch out of vehicle.

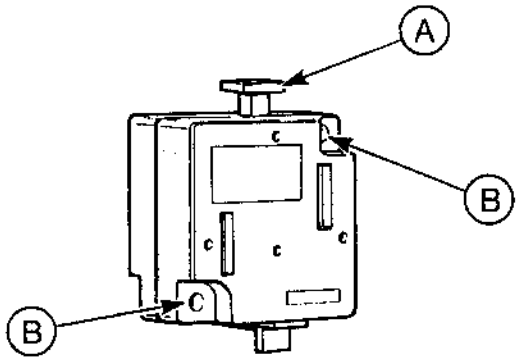


Fig.2. A - Switch reset button
B - Switch securing points

To Install

5. Reconnect fuel shut off switch multiplug, ensuring locking tab 'snaps' into position on switch.
6. Reposition fuel shut off switch and secure with both screws to vehicle body.
7. Ensure fuel shut off switch is reset by pushing down button on top of switch assembly, refer to Fig.2.
8. Refit kick panel and secure into position.
9. Start engine to ensure switch is operating.

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33 711 0 RELAY - POWER - REMOVE AND INSTALL
33 750 0 RELAY - FUEL PUMP - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Remove plastic panel positioned in front of fuse/relay pack located in facia assembly, refer to Fig.1.

3. Remove 3 screws securing plastic panel in front of fuse/relay pack. Release spring retaining clip, allowing fuse/relay pack to loaded lower from underside of facia, refer to Fig.2.

4. Remove power relay (coloured green) or fuel pump relay (coloured brown), refer to Fig.2.

To Install

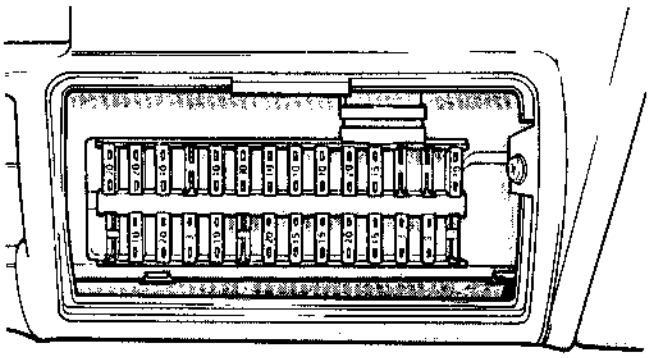
5. Refit relay into fuse/relay pack, refer to Fig.2.

6. Reposition and lock fuse/relay pack into underside of facia, refer to Fig.1.

7. Refit plastic panel over fuse/relay pack and secure.

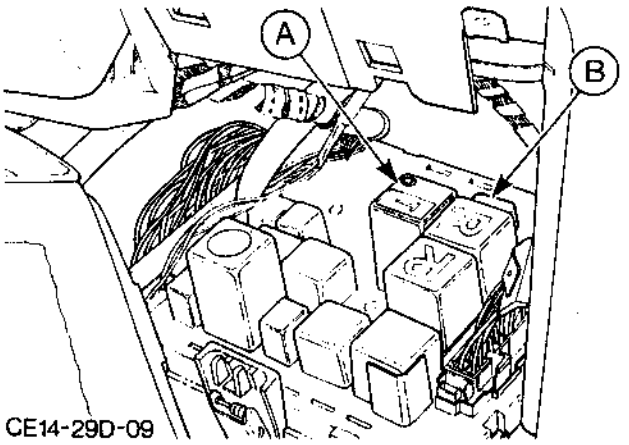
8. Reconnect battery earth cable.

9. Start engine to ensure correct operation.



CE14-29D-19

Fig.1. Fuse/relay pack positioned in dash.



CE14-29D-09

Fig.2. A - Power relay location
B - Fuel pump relay location

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33 772 0 SOLENOID - CANISTER PURGE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS AND EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery earth cable.

2. Disconnect canister purge solenoid multiplug, do not pull on wiring, refer to Fig.2.

3. Remove both hoses from canister purge solenoid and lift solenoid out from vehicle.

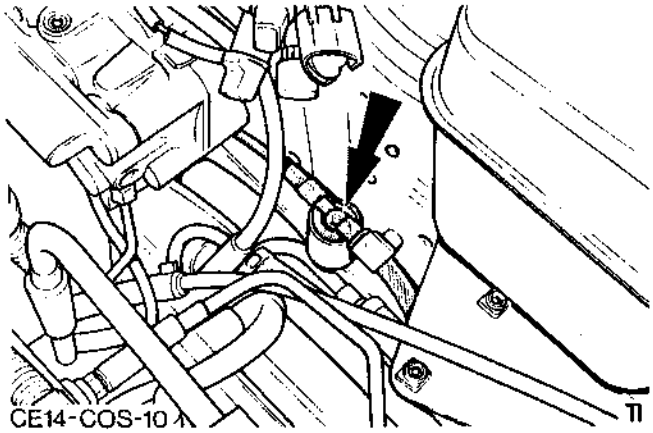


Fig.1. Canister purge solenoid position.

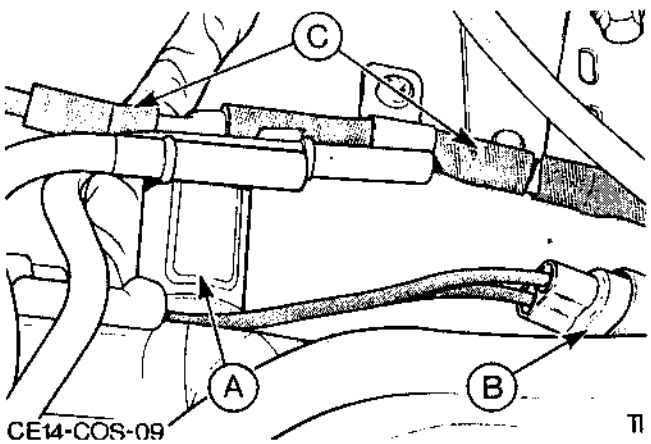


Fig.2. A - Canister purge solenoid
B - Canister purge solenoid multiplug
C - Canister purge hoses

To Install

4. Reconnect both hoses to solenoid.

5. Reconnect multiplug, ensuring locking tab 'snaps' into position, refer to Fig.2.

6. Reconnect battery earth cable.

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CHARGING SYSTEM 31

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Service and Repair Operations

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Exploded View

Bosch alternator 6

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TECHNICAL DATA

Alternator (BOSCH)

Type	N1-70A	N1-90A
Nominal rated output at 13,5 volts and engine speed of 6,000 rev/min	70 amp	90 amp
Max. continuous speed (rev/min)	15,000	15,000
Stator winding resistance, ohms/phase	0,05 + 0,005 - 0	0,09 + 0,009 - 0
Rotor winding resistance, ohms at 20°C	2,8 + 0,28 - 0,0	2,8 + 0,28 - 0,0
Min.length of slip ring end brushes	5mm (0,197in)	5mm (0,197in)
Regulating voltage at engine speed of 4,000 rev/min and 3 to 7 amp load	ALL MODELS:	13,7 to 14,6 volts

DRIVE BELT TENSION

Belt tension is as follows:

New belt - 400 to 500N

Used belt - 300 to 400N

Variants fitted with self-adjusting tensioning systems 270N (Constant)

All figures refer to cold belts, a used belt is one which has run for at least ten minutes.

BATTERY

Type .. .. Lead acid (Maintenance Free)

Voltage 12

Battery model Depending upon territory, the battery fitted will be one of the following:-

500A/70RC

590A/90RC

Battery size is given in terms of cold start performance (Amps) and reserve capability (Minutes).

The first set of figures (eg. 270) is the current that the battery will supply, at a temperature of -18°C, for a minimum period of 30 seconds with the terminal voltage not falling below 7,2 volts.

The second set of figures (eg. 50RC) is the time in minutes for the battery terminal voltage to drop to 10,5 volts when supplying a load of 25 amps, with the battery at a temperature of 22°C.

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SERVICE AND REPAIR OPERATIONS

31 211 0 BATTERY - TEST (Sealed for life type)

SPECIAL EQUIPMENT REQUIRED: DC Voltmeter 0-20V or multimeter (±1%)

The battery condition is tested by checking the voltage across the terminals. This technique of battery testing only using a voltmeter gives a cleaner quicker indication of battery condition.

NOTE: The battery should be in a 'stabilised' condition, that is when no charging of any type has occurred for 6 hours or more. Any battery that has been charged can be stabilised to remove any over-voltage caused by charging by discharging the battery through the headlights for 30 seconds. After waiting for 4 to 5 minutes, the battery can then be tested.

A - Batteries off charge for 6 hours or more ON or OFF vehicle

1. Clean battery and read the voltage across battery terminals.

B - Batteries ON the vehicle that have been recently charged
i.e. on engines running prior to testing.

1. Switch on headlamps for 30 seconds.
2. Switch off headlamps and all electrical accessories and wait 4 to 5 minutes.
3. Clean battery and read the voltage across battery terminals.

Typical Battery Conditions (Voltage)

12,4 volts	POOR
12,6 volts	NORMAL
12,7 volts or more	GOOD

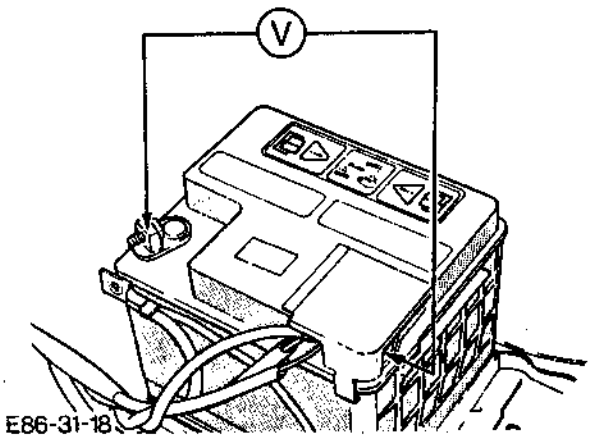


Fig.1. Reading the battery voltage across the terminals.

31 214 0 BATTERY - REMOVE AND INSTALL

SPECIAL EQUIPMENT REQUIRED: NONE

To Remove

1. Open hood, fit fender covers and disconnect battery leads, earth first.
2. Remove battery clamp bolts, Fig.2, clamps and battery.

To Install

3. Position battery in vehicle and secure.
4. Reconnect battery leads, positive lead first.
5. Cover terminals with industrial petroleum jelly, remove fender covers and close hood.

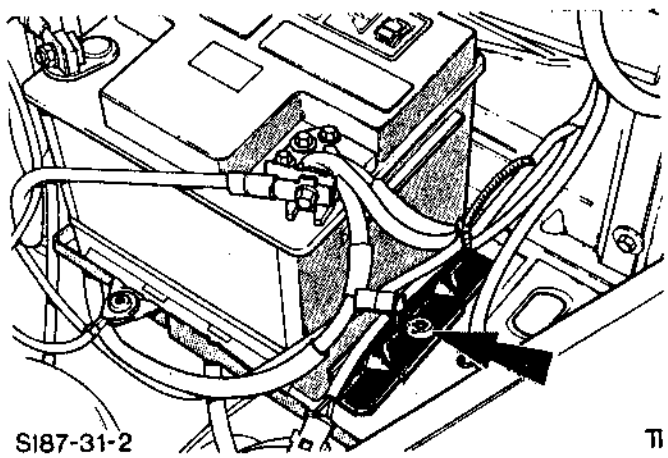


Fig.2. Battery clamp bolt.

31 414 0 ALTERNATOR ASSEMBLY - REMOVE AND INSTALL ((Manual belt tension adjust)

SPECIAL EQUIPMENT REQUIRED: NONE

To Remove

1. Disconnect battery.

   Remove heatshield from rear of alternator and disconnect wiring. Slacken alternator mounting bolts and tilt alternator towards engine.

   Remove drive belts.

   Remove alternator mounting bolts and remove alternator from vehicle, Fig.3.

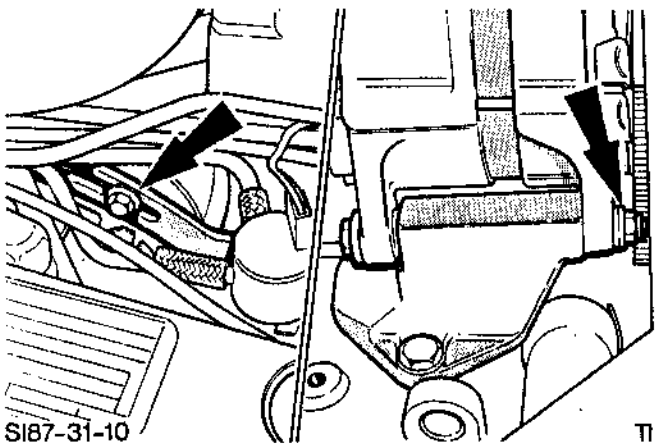


Fig.3. Alternator mounting bolts.

To Install

2. Position alternator and retain with mounting bolts.

3. Check drive belt tension using a belt tension gauge if available, for tensions see Technical Data. Alternatively, total free movement measured on the longest span should be 4mm (0,16 in) applying normal fingertip pressure.

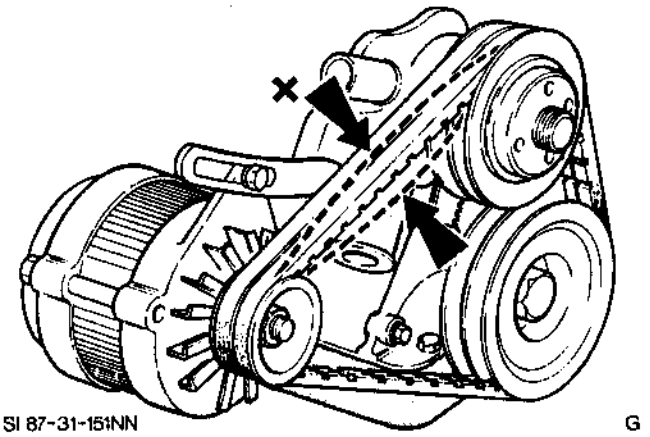


Fig.4. Adjusting the drive belt tension.
X = 4 mm

4. Tighten alternator adjusting and mounting bolts in the following order:

   a. Adjusting strap bolt
   b. Through bolt and nut

5. Reconnect wiring and refit heatshield.

6. Reconnect battery.

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31 414 0 ALTERNATOR ASSEMBLY - REMOVE AND INSTALL (Automatic belt tension adjust)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect battery earth lead, raise vehicle and remove sump guard; Operation No. 24 254 0 refers.

2. Remove turbo heatshield (2 nuts, 1 bolt), Fig.1.

3. Remove heatshield from rear of alternator and disconnect wiring.

4. Use a suitable ring spanner to rotate the belt tensioner in a clockwise direction to release tension on the belt, Fig.2. Remove belt after noting its position around the pulleys.

5. Remove upper and lower retaining bolts, Fig.3, then remove alternator from underneath vehicle.

To Install

6. Locate the alternator in its bracket and secure with the upper and lower retaining bolts.

7. Release the tensioner and refit the drive belt ensuring that it is correctly arranged around the pulleys, Fig.2.

8. Reconnect alternator wiring and refit heatshield.

9. Refit turbo heatshield and secure with 2 nuts and 1 bolt, Fig.1.

10. Refit sump guard, lower vehicle and reconnect battery earth lead.

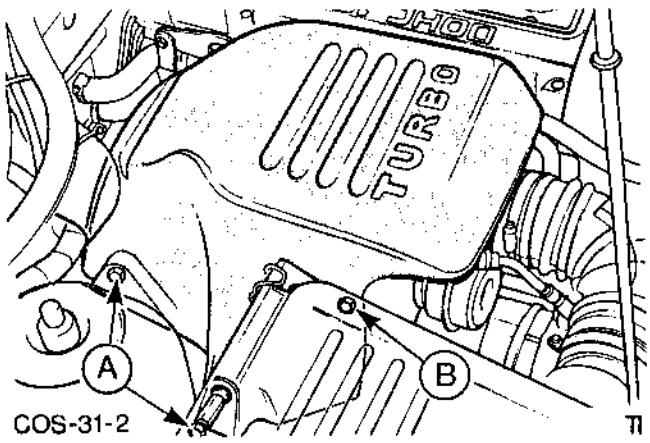


Fig.1. Turbo heatshield fixings.
A - Nuts
B - Bolt

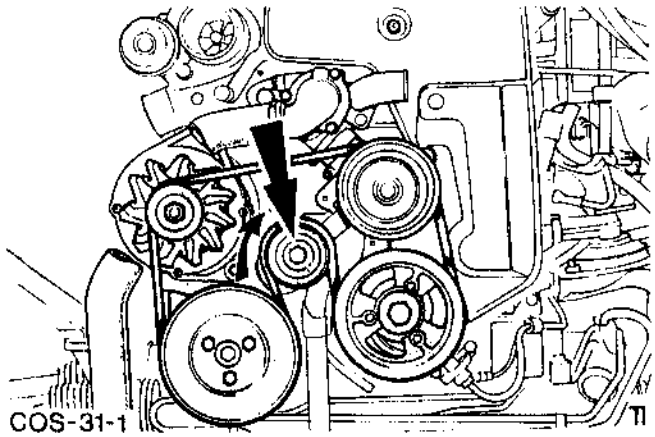


Fig.2. Rotate tensioner to release drive belt.

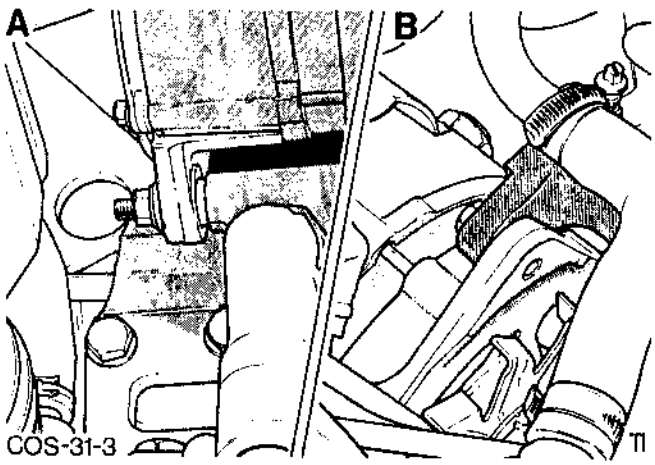


Fig.3. Alternator upper and lower retaining bolts.

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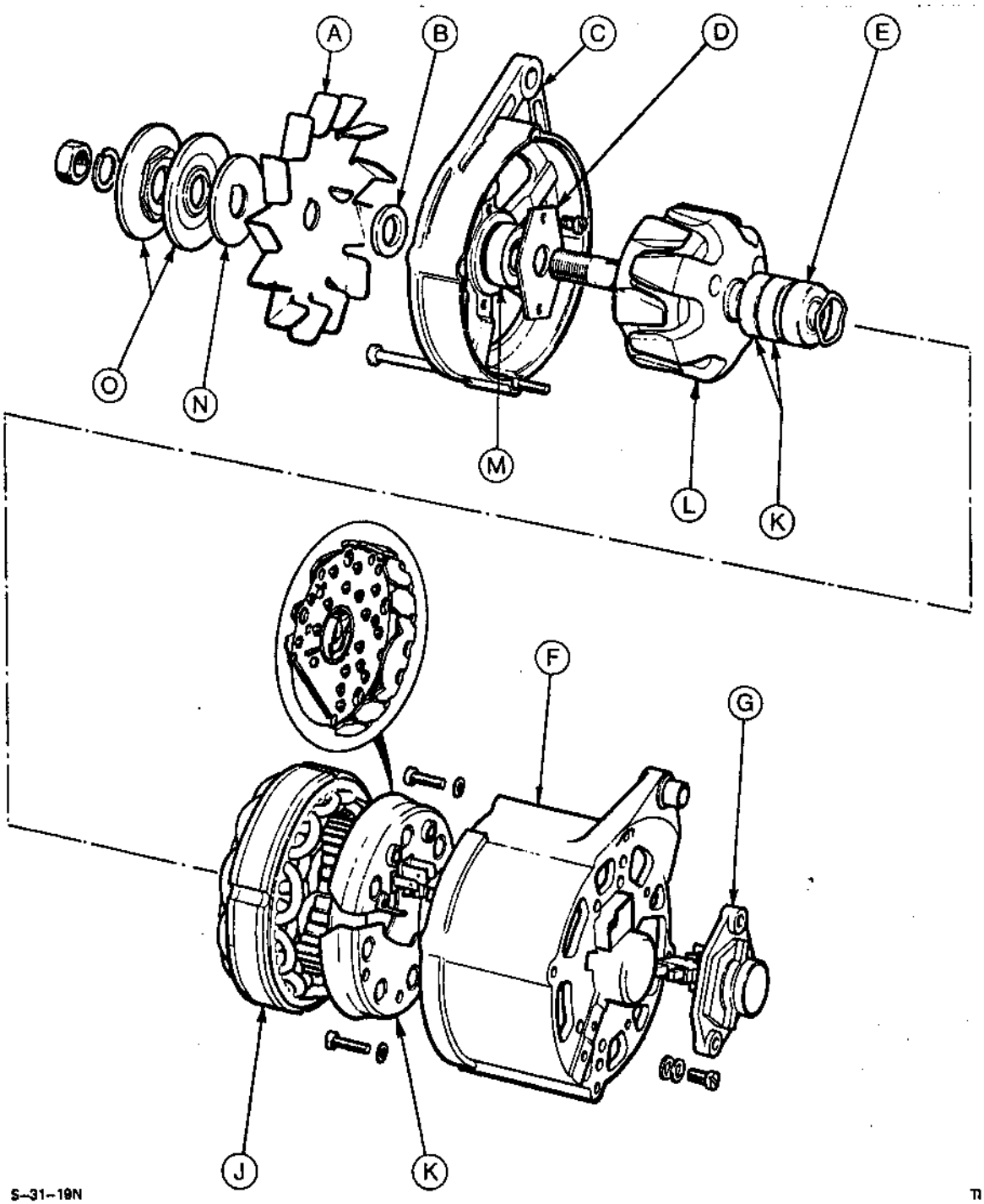


Fig.5. Exploded view of Bosch N1-90 alternator.

A - Fan
B - Spacer
C - Drive end housing
D - Drive end bearing retaining plate
E - Slip ring end bearing
F - Slip ring end housing
G - Brush box and regulator
H - Rectifier (diode) pack
J - Stator
K - Slip rings
L - Rotor
M - Drive end bearing
N - Spacer
O - Pulley

31 414 8 ALTERNATOR ASSEMBLY - OVERHAUL (ALTERNATOR REMOVED)

Manufacturer - BOSCH

SPECIAL EQUIPMENT REQUIRED: Press, Test Lamp, Ohmmeter/Multimeter

To Dismantle

1. Remove pulley retaining nut, washer, pulley, fan, spacer and woodruff key (where fitted).
2. Remove brush box and regulator.
3. Remove through bolts and separate drive end housing and rotor from slip ring end housing.
4. Press out rotor from drive end housing.
5. Remove drive end bearing and retainer.
6. Support slip ring end bearing with a large washer, incorporating a cut out to accommodate the rotor shaft, and press bearing from shaft. Fig.6.
7. Remove rectifier (diode) pack retaining screws and lift out stator and rectifier pack.
8. Unsolder stator to diode pack connections using a pair of pliers as a heat sink to reduce heat spread to diodes. Overheating may cause diode failure.
9. Clean and examine all components.

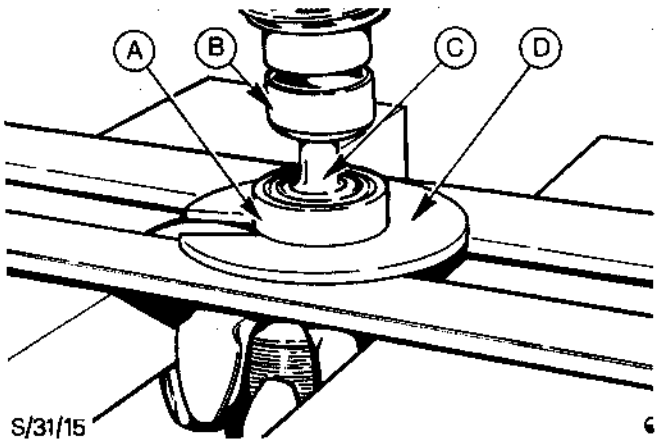


Fig.6. Removing the slip ring end bearing.
A - Bearing C - Mandrel
B - Press D - Washer

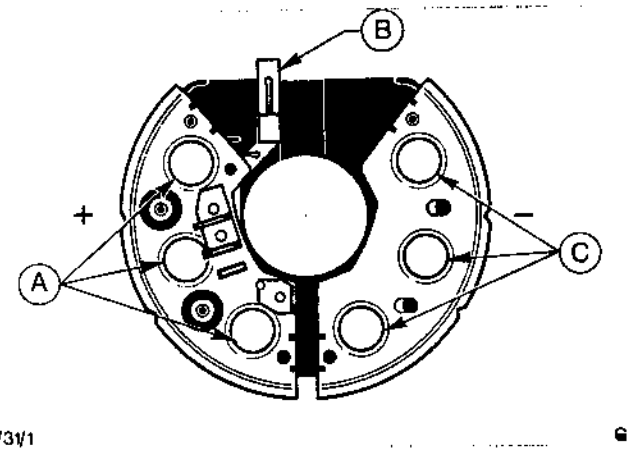


Fig.7. Diode pack.
A - Positive diodes C - Negative diodes
B - Brushbox terminal

Checking Diodes

10. To check positive diodes, connect a 12 volt supply via test lamp of approximately 5 watts, wired to form a circuit when connected through one of the diodes.
    (a) Connect test equipment to positive section of diode pack, Fig.8. with negative terminal attached to topside of one of diodes. Connect positive terminal to underside of diode, Fig.8. If diode is functioning correctly, bulb will light.
    (b) Carry out same procedure for remaining two positive diodes.

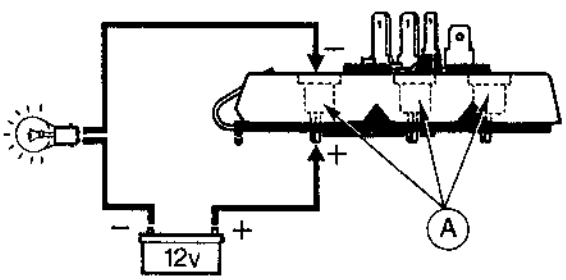
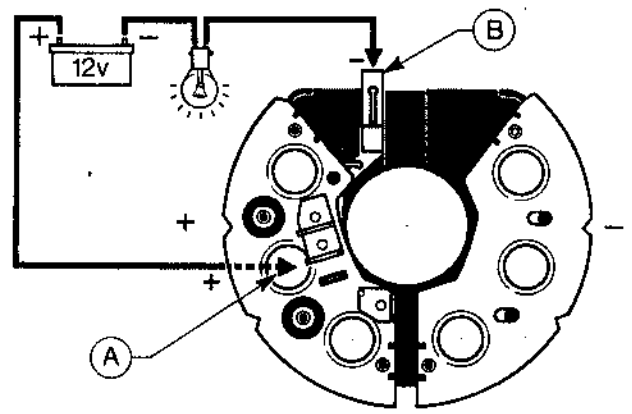


Fig.8. A - Positive diodes.

(c) Reverse the terminals, i.e. positive terminal to topside and negative terminal to underside. If bulb illuminates diode is defective.

(d) Carry out same procedure for remaining two positive diodes.



B/31/3

Fig.9. Diode pack.
A - Positive diodes
B - Brushbox terminal

11. To check field diodes, connect test equipment as shown in Fig.9. With negative connection coupled to brush-box terminal and positive connection to diode pin, bulb will light if diode is operating correctly.

(a) Connect positive terminal to two remaining diodes in turn to test.

(b) Reverse terminals. If bulb illuminates, diode is defective.

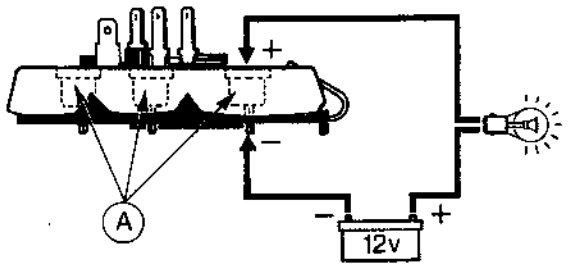
<u>To check negative diodes.</u>

(a) Connect test equipment to negative section of diode pack, Fig.10, with positive terminal attached to topside of one of diodes. Connect negative terminal to underside of diode, Fig.10. If diode is functioning correctly, bulb will light.

(b) Carry out procedure for remaining two diodes.

(c) Reverse terminals. If bulb illuminates diode is defective.

Repeat process on remaining two diodes.



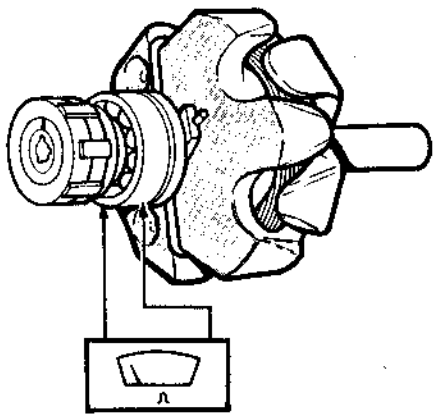
B/31/4

Fig.10. A - Negative diodes

12. Carry out electrical check of rotor condition

(a) Rotor winding continuity, Fig.11.

Connect an ohmmeter/multimeter between the two slip ring contacts. For correct resistance values, refer to Technical Data.

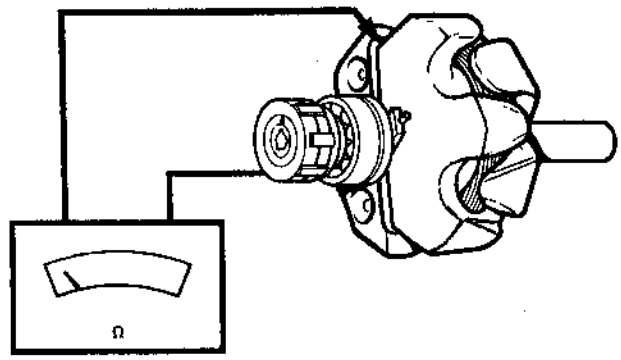


S/31/13

Fig.11. Rotor winding continuity check.

(b) Rotor winding insulation, Fig.12.

Connect an ohmmeter between one slip ring contact and one of the rotor poles. There should be no reading.



S/31/14

Fig.12. Rotor winding insulation check.

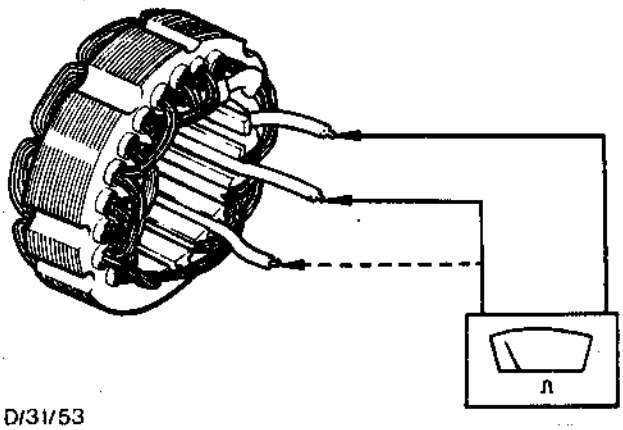
13. Carry out electrical check of stator condition.

(a) Stator winding continuity, Fig.13.

Connect an ohmmeter between two of the three stator winding connections. The resistance should be within limits shown below. Repeat test using third stator winding connection and one of the two connections used in first test. The resistance should again be within the limits shown below:

N1-70 Amp 0,10 to 0,11 ohms

N1-90 Amp 0,09 to 0,10 ohms

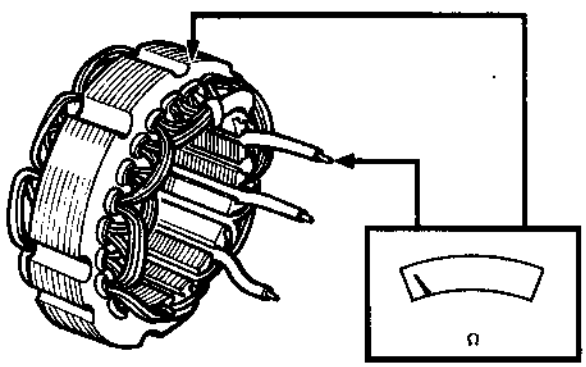


D/31/53

Fig.13. Stator winding continuity check.

(b) Stator winding installation, Fig.14.

Connect an ohmmeter between one stator wire contact and the lamination pack. There should be no reading.



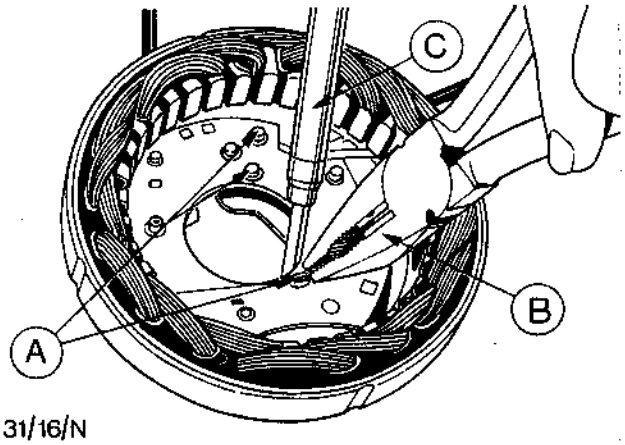
D/31/8/N

Fig.14. Stator winding insulation check.

To Assemble

14. Re-solder stator to diode pack connections, Fig.15. using only a 60/40 electricians solder.

    Use a pair of pliers as a heat sink to reduce heat spread to diodes.

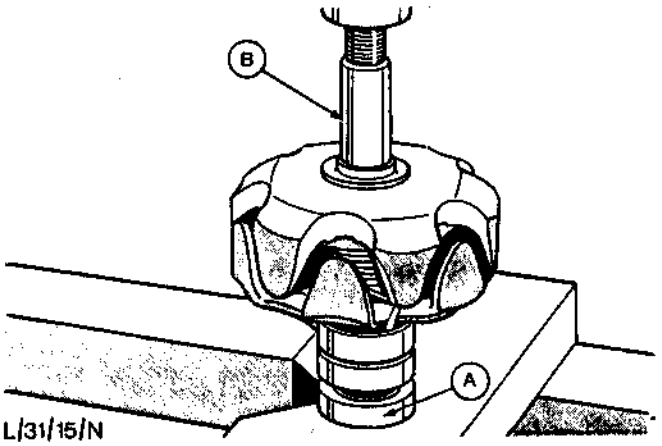


L/31/16/N

Fig.15. Resoldering stator to diode pack.
A - Stator connections C - Soldering iron
B - Pliers

15. Position stator and diode pack in slip ring end housing and secure.

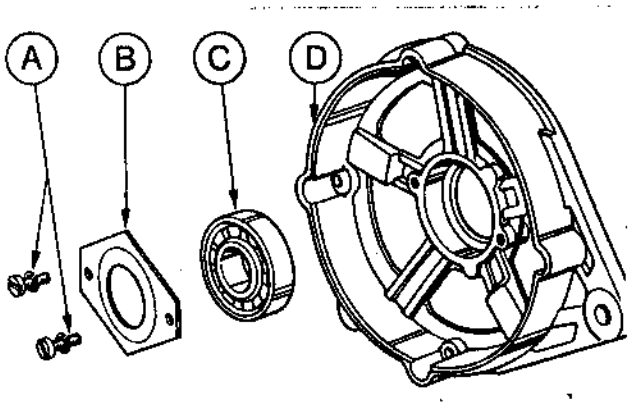
16. Press slip ring end bearing onto rotor shaft Fig.16.



L/31/15/N

Fig.16. Fitting the slip ring end bearing.
A - Bearing
B - Rotor shaft

17. Refit drive end bearing into housing and secure with retainer plate. Assemble the bearing and retainer as shown in Fig.17.



L/31/14

Fig.17. Fitting the drive end bearing.
A - Screws C - Drive end bearing
B - Retainer plate D - Drive end housing

18. Refit rotor to drive end housing.

19. Assemble rotor and drive end housing to slip ring end housing.

20. Refit regulator box.

21. Refit thrust washer, fan, spacer, pulley, lock washer and retaining nut, assembling the components as shown in Fig.18.

A - Retaining nut
B - Lock washer
C - Pulley
D - Spacer
E - Fan
F - Washer
G - Key (where fitted)

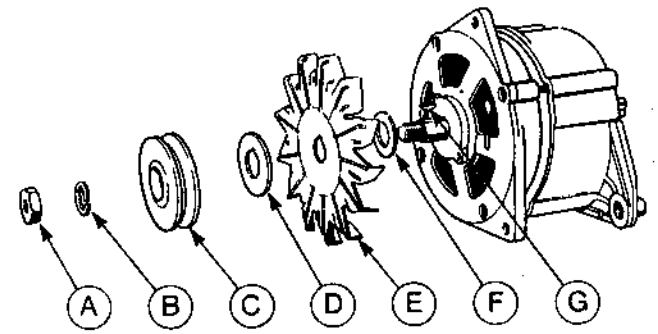


Fig.18. Fan, pulley and associated components.

NOTE: Spacer 'D' in Fig.18. must be fitted correctly, with the outer circumference pressing against the fan. In this way, it acts as a vibration damper and prevents fatigue failures.

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS (Sierra) 32

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EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

Service and Repair Operations			Contained in Operation	Page
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TECHNICAL DATA

Exterior Lights

Headlamp type .. .. Rectangular, aligned by adjusting the reflector

NOTE: On vehicles fitted with the electrical headlamp levelling system the basic headlamp alignment must only be carried out in switch position '0'.

Setting X for headlamps .. .. 12 cm/10 m = 0 degrees 41 minutes = 1,2%
(see Operation No. 32 113 0)
Setting X for foglamps .. .. 22 cm/10 m = 1 degree 16 minutes = 2,2%
(see Operation No. 32 113 0)

Bulb Chart - 12V

Lamp	Fitting/Type	Wattage
Halogen headlamp	H4	60/55
Halogen auxiliary lamp	H3	55
Halogen fog lamp	H3	55
Side lamps	Glass base	5
Parking lamp side lamps	Glass base	5
Front direction indicators	Bayonet	21
Rear direction indicators	Bayonet	21
Brake lamps	Bayonet	21
Reversing lamps	Bayonet	21
Rear fog/tail lamps	Bayonet	21/4
Licence plate lamps	Glass base	5

Wipers

Windscreen wiper motor type — Electric, three-speed, self-parking with intermittent wipe facility

Headlamp wiper motor type — Electric, single-speed, self-parking - functions only when headlamp washers are operated with dipped beam switched 'on'.

Washers

Windscreen — Electric pump
Headlamps — Electric pump

NOTE: The electric washer pumps are mounted on the front of the common reservoir.

Tightening Torques

	Nm
Screws - Windscreen wiper motor to bracket (M6 x 18)* ..	8,0 to 10,0
* Initial fixture when a new motor is fitted	10,0 to 12,0
Screws - Wiper motor bracket to bulkhead	6,0 to 7,0
Nut - Link to motor shaft (M6)	14,0 to 16,0
(M8)	23,0 to 24,0
Nut Wiper arm to output shaft	17,0 to 18,0 **
Screws - reservoir (5 litres) to vehicle	1,8 to 2,8
Nut - Headlamp wiper arm	2,5 to 3,5
Screws - Wiper motor to headlamp housing	4,7 to 6,3

** NOTE: Tighten the nut to the indicated torque, wet the screen, operate the wipers at speeds 1 and 2 and tighten the nut to the indicated torque again.

Lubricant

Bushes - windscreen wiper linkage grease, Ford Specification SAM-1C-9111-A
Bush - pivot shaft .. .. grease, Ford Specification SAM-1C-9111-A

1189

GENERAL DESCRIPTION

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

Differences between the SIERRA COSWORTH '86 and other Sierra variants up to Model Year 1987 are not covered by the following description, nor are any Service and Repair Operations applicable to the SIERRA COSWORTH '86.

Figs.A - D in this part show features of the SIERRA COSWORTH '89 which differ from SIERRA '87 variants. This section only contains service operations for the SIERRA COSWORTH from model year '88 onwards.

Different features:

- New design of screen washer reservoir with a detachable filler (up to April '88) - the filler is no longer detachable from April '88.

- Side indicator lamps
- Fog light moulding
- Twin horns

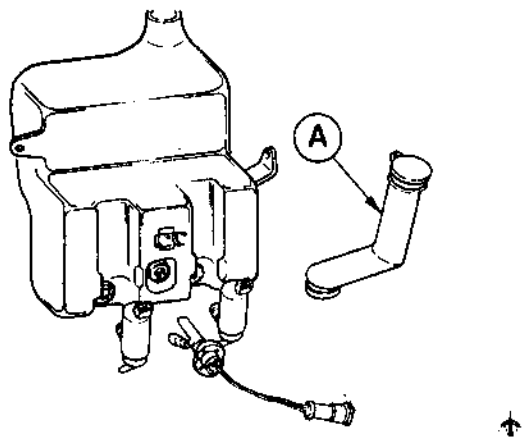


Fig.A. Windscreen/headlamp washer reservoir.
A - Removable filler tube

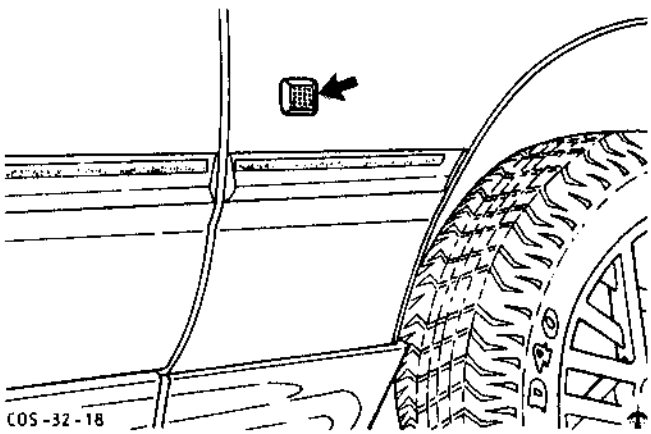


Fig.B. Side indicator lamp.

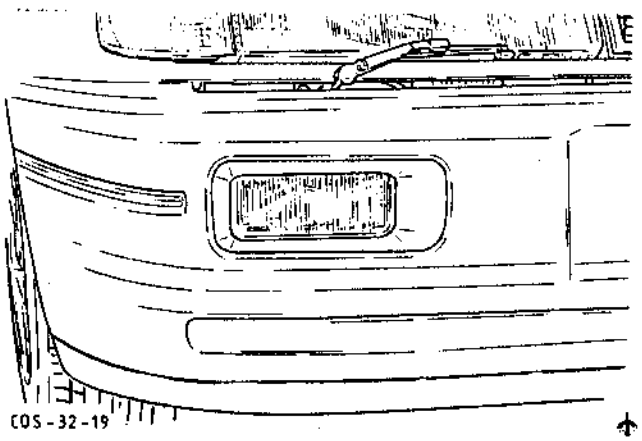


Fig.C. Foglight.

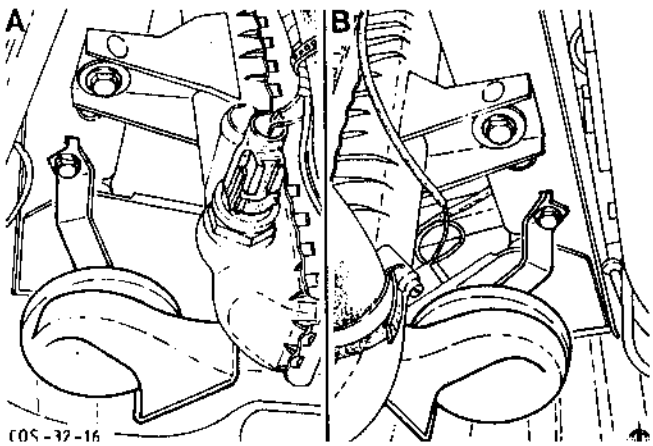


Fig.D. Twin horns.
A - Left hand horn
B - Right hand horn

GENERAL DESCRIPTION (cont'd)

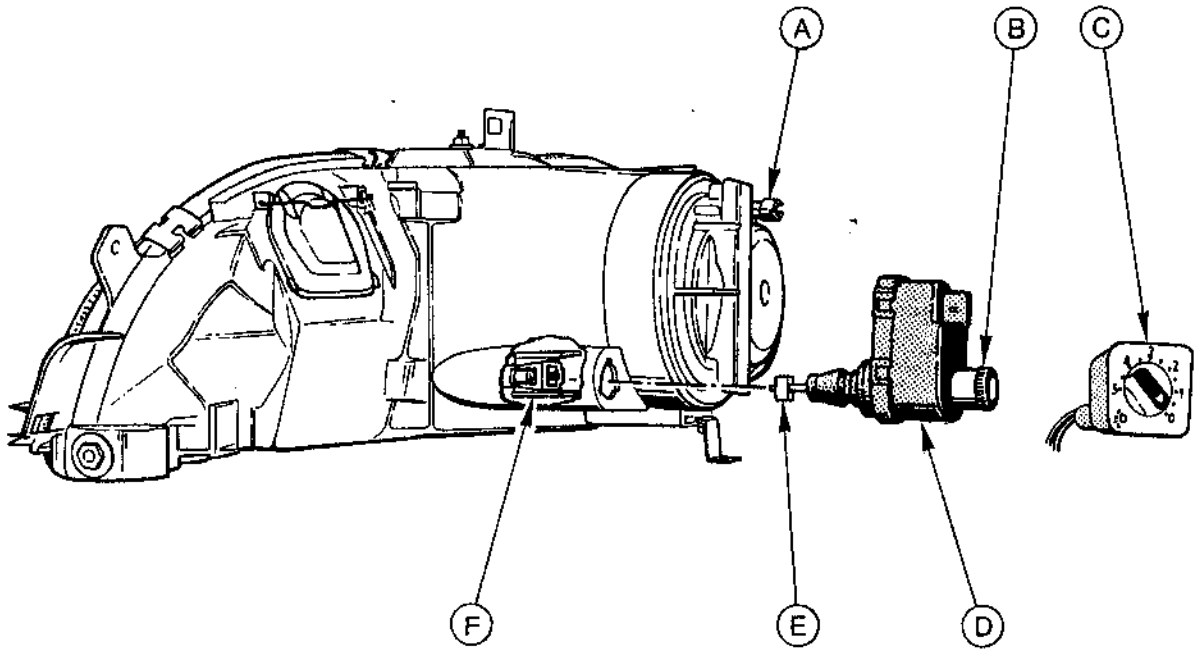
With effect from model year '90 in some territories some Sierra Cosworth variants are fitted with an electrical headlamp levelling system to comply with statutory requirements. To avoid dazzling oncoming traffic, the required range of the headlamp beams can be adjusted infinitely according to the load in the vehicle while switched to dipped beams by means of a switch in the facia. Each lamp unit has a motor which is activated electrically when the switch is turned and moves the pivotably mounted headlamp to the desired setting by means of an adjusting spindle.

The headlamp levelling switch has two stops. The switch engages in switch position '0', the basic setting. The headlamps tilt to their maximum angle in switch position '5'.

The headlamp levelling system operates by means of DC motors controlled by frequency. A certain frequency (required setting) is set in the headlamp levelling switch by the movement of an iron core in a coil. Working on the same principle, the control element in the motor produces a frequency contingent on the position of the adjusting spindle (actual setting). The integral electronics compare the required setting (switch position) with the actual setting (position of the adjusting spindle). The headlamps are swivelled up or down according to the difference in frequency until the two values are the same.

The basic alignment of the headlamps must always be carried out in switch position '0'. The adjusting screw for the basic vertical alignment is located on the back of the adjusting motor.

The correct range of adjustment of the adjusting spindle between switch positions '0' and '5' is 5,0 $\pm$ 0,5 mm.



COS-32-20

E

Fig.E. Electrical headlamp levelling system (right hand headlamp shown).
A - Adjusting screw for horizontal alignment
B - Adjusting screw for basic vertical alignment
C - Headlamp levelling switch
D - Headlamp levelling motor
E - Adjusting spindle
F - Socket for adjusting spindle

1189

The following changes have also been made to the SIERRA COSWORTH for the model year '90:

- The front direction indicators now have white lenses.

- The rear lamps are black.

  The procedure for removing and fitting the direction indicators and rear lamps remains the same.

- The windscreen washer nozzles are heated electrically. The heating works continuously while the engine is running.

  The temperature at the nozzle is regulated according to the ambient temperature by a semi-conductor resistor (PTC) incorporated in the nozzle.

SERVICE CHECKS AND ADJUSTMENTS

At prescribed service intervals or after repairs the following points must be checked and the corresponding adjustments carried out as necessary.

1. Align the headlamps as indicated in Operation 32 113 0.

2. Check the operation of the screen washer system and the headlamp washers.

3. If necessary, top up the screen washer reservoir.

4. Check the operation of all the exterior lights, horn and wipers. Also check the wiper blades for wear and damage.

5. Checking the operation of the headlamps with the electrical levelling system:

   The headlamp levelling system only operates when the headlamps are dipped.

   Check the basic headlamp alignment in switch position '0' and rectify it as necessary (headlamp alignment setting X = 12 cm / 10 m - 0 degrees 41 minutes).

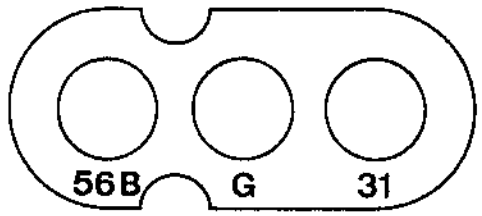
   Once the basic alignment of the headlamps has been carried out to specification, the headlamp levelling system is operating correctly if the beam-setting equipment indicates a headlamp inclination of at least 50 cm / 10 m or 2 degrees 52 minutes when the screen of the beam-setting equipment is set to the light/dark boundary in switch position '5'.

   If this value is not obtained, the voltage and resistance must be checked at the plug of the headlamp levelling motor, Fig.1.

Min. voltage between terminal 56b and 31	12V
Resistance between terminal G and 31	100 - 120 ohms

   Both measurements are independent of the switch position.

   If there is no break in the circuit and the specified resistance is not obtained, the headlamp levelling switch is faulty.



TI-89-48 ACM

Fig.1. Plug of headlamp levelling motor.

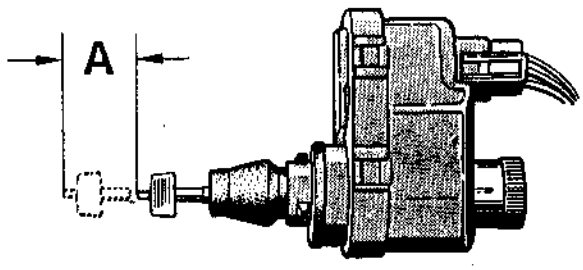
SERVICE CHECKS AND ADJUSTMENTS cont'd

If there is no break in the circuit but the specified resistance is obtained, the headlamp levelling motor must be removed and the range of adjustment of the adjusting spindle between switch positions '0' and '5' must be measured, Fig.2.

Range of adjustment of adjusting spindle $5 \pm 0,5$ mm

If the specified range of adjustment of the adjusting spindle is not obtained, replace the headlamp levelling motor.

Align the headlamps and check that they operate correctly.



S187-32-45 E

Fig.2. Headlamp levelling motor.
A - Range of adjustment of adjusting spindle ($5 \pm 0,5$ mm)

32 113 0 HEADLAMPS - ALIGN

Align the headlamps with optical beam-setting equipment, following the operating instructions supplied by the equipment manufacturer. The vehicle must be parked on level ground. The vehicle and the beam-setting equipment must be lined up as specified by the equipment manufacturer.

NOTE: Before aligning the headlamps, check them for faulty lenses and reflectors and blackened bulbs and fit replacements as necessary.

Headlamp alignment requirements:

Check the tyre pressures and rectify them if necessary.

Bounce the front and rear suspension several times or roll the vehicle a few metres to settle the suspension.

The vehicle must be unladen and have a full fuel tank. If the tank is only half full or less, place a 25 kg weight in the luggage compartment. In addition, have a person or alternatively a 75 kg weight in the driver's seat.

NOTE: On vehicles fitted with the electrical headlamp levelling system the basic headlamp alignment must only be carried out in switch position '0'.

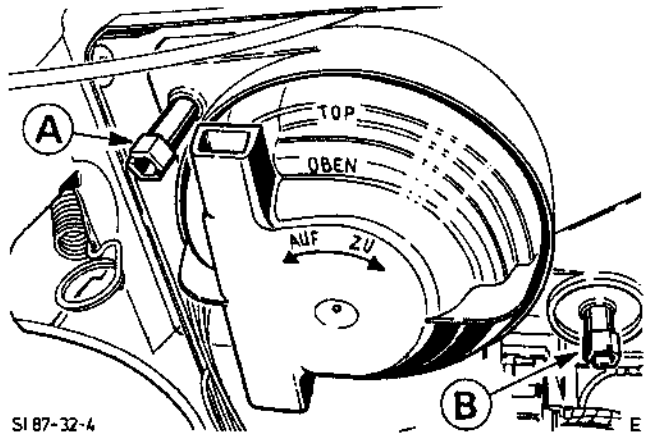


Fig.1. Headlamp without electrical levelling system.
A - Horizontal adjusting screw
B - Vertical adjusting screw

Headlamp dipped beam alignment:

Set up the screen of the beam-setting equipment to adjust the dipped beams to the following headlamp alignment setting (X):

X = 12 cm / 10 m = 0 degrees 41 minutes = 1,2%

Switch on the dipped beams and align the headlamps by turning the adjusting screws, Figs.1 and 2.

NOTE: On vehicles fitted with the electrical headlamp levelling system the air cleaner cover and the protective cap over the headlamp bulbs must be removed to carry out the basic alignment of the right hand headlamp.

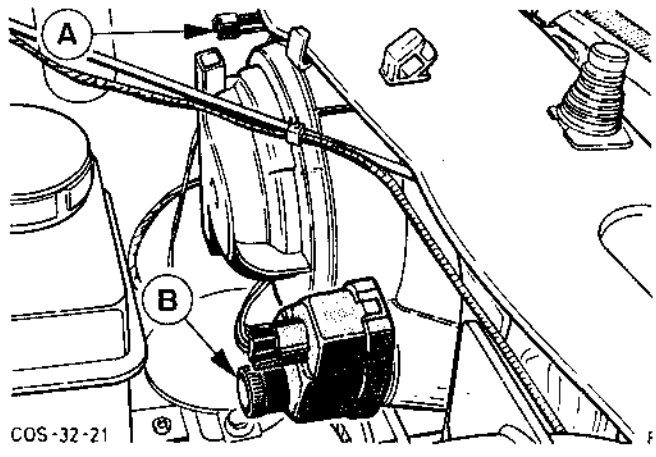


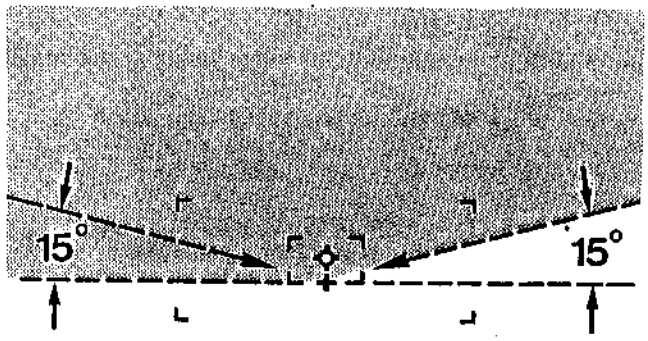
Fig.2. Headlamp with electrical levelling system.
A - Horizontal adjusting screw
B - Vertical adjusting screw

Adjust the dipped beams so that the light/dark boundary touches the horizontal - and the 15 degrees - boundary line at the common point of intersection (lower alignment cross), Fig.3. For RHD variants use the 15 degrees boundary line to the left of the alignment cross in Fig.3.

Some equipment manufacturers use screens without the 15 degrees boundary line. In this case a perpendicular line through the alignment cross gives the reference point.

Align the headlamps so that the beams do not go above the horizontal boundary line at any point.

Aligning the dipped beams also aligns the main beam.



EO86-32-6

Fig.3. Screen of beam-setting equipment (light/dark boundary for dipped beams of LHD variants).

Fog lamp alignment:

The same requirements apply as indicated previously for the basic headlamp alignment. However, set up the screen of the beam-setting equipment to the fog lamp alignment setting (X):

X = 22 cm / 10 m = 1 degree 16 minutes = 2,2%

Remove the fog lamp trim (1 crosshead screw).

Switch on the fog lamps and align the fog lamps by turning the adjusting screw, Fig.4(A).

Align the beams of the fog lamps so that the light/dark boundary touches the horizontal boundary line, Fig.5.

Refit the fog lamp trim (1 crosshead screw).

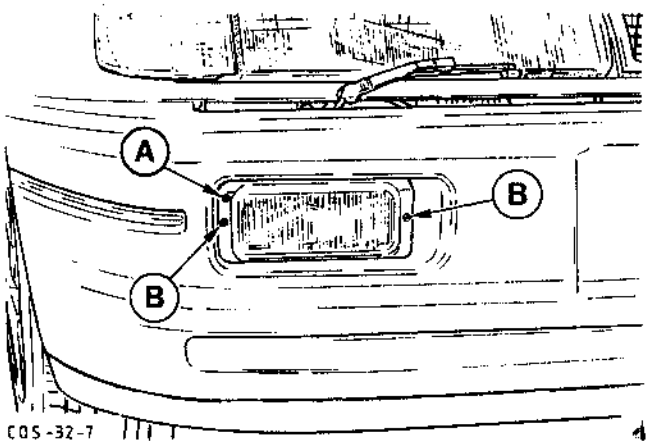
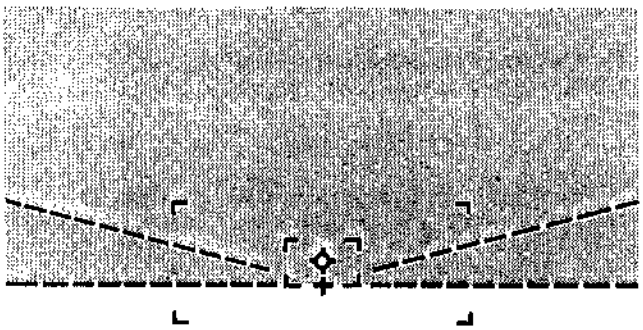


Fig.4. Fog lamp.
A - Adjusting screw
B - Retaining screws



BE13-32-45

Fig.5. Screen of beam-setting equipment (light/dark boundary for fog lamps).

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 115 0 HEADLAMP ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: Do not touch the glass of H3 or H4 bulbs with bare fingers.

To Remove

1. Remove the headlamp wiper arm as described in Operation No. 32 654 0 (sub-operation 1).

2. Unscrew the radiator grille (2 cross head screws).
   Pull the radiator grille out of the guide at the side (in the fender) and remove the upper and lower parts of the radiator grille together, Fig.1.

   Remove the filler of the screen washer fluid reservoir (only on vehicles up to build month April '89).

3. Unscrew the wiper motor bracket from the headlamp housing (2 hex. head screws) and slide the motor rearwards out of the guide, Fig.2.

4. Pull off the headlamp wiring multiplug next to the protective cap on the back of the headlamp. Undo the headlamp retaining screws (2 hex. head screws) and undo the nut on the side mounting, Fig.3. Pull the headlamp assembly forwards and swivel it out sideways.

5. Remove the headlamp bulb as described in Operation No. 32 147 0.

6. Remove the side lamp bulb as described in Operation No. 32 207 0.

7. Remove the auxiliary lamp bulb as described in Operation No. 32 277 0.

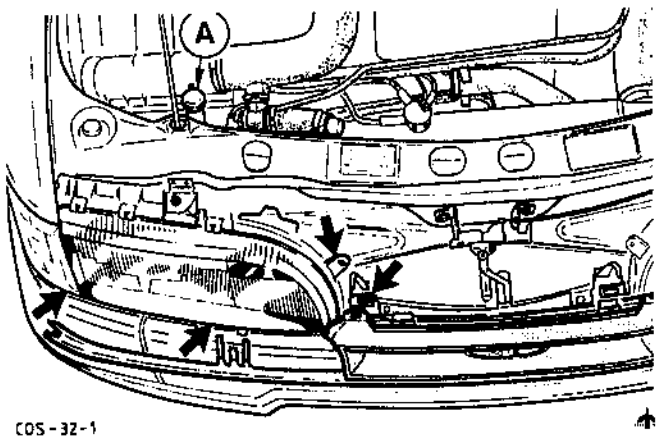


Fig.1. Radiator grille attachment points.
A - Washer reservoir filler tube

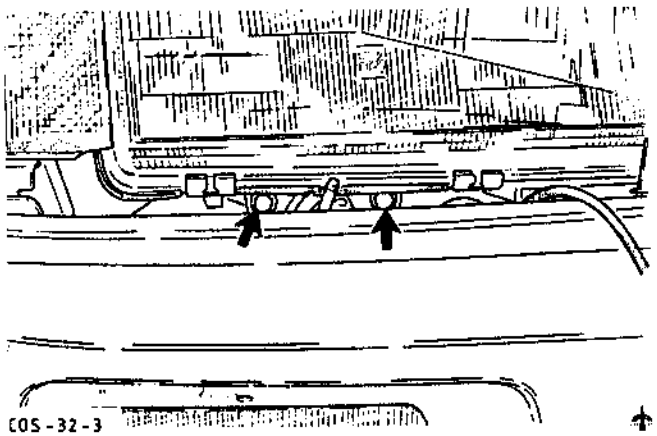


Fig.2. Headlamp wiper motor fixture.

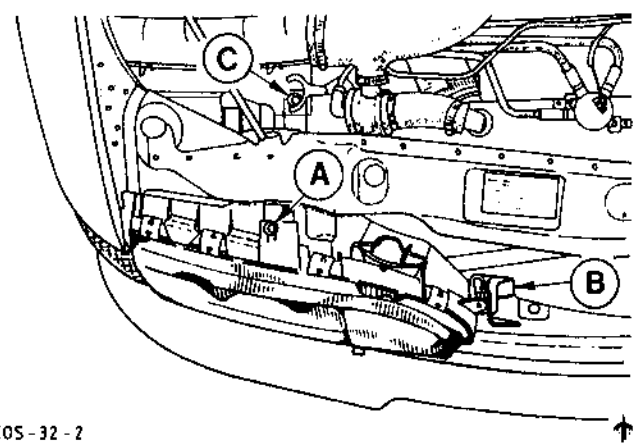


Fig.3. Headlamp fixture.
A - Upper mounting
B - Side mounting
C - Rear mounting

32 115 0

To Install

8. Refit the bulbs as described in the Operations detailed in sub-operations 5 to 7.

9. Locate the headlamp assembly in position. Guide the locating pin on the outside of the headlamp housing sideways into the headlamp mounting panel, swivel the headlamp assembly inwards into the mounting, Fig.4, and align it (clearance), closing the hood to do so. Tighten the nut on the side mounting. Open the hood, insert and tighten the upper and lower retaining screws.

10. Connect the multiplug to the headlamp.

11. Fit the wiper motor as described in Operation No. 32 654 0 (sub-operation 7).

12. Locate both upper and lower parts of the radiator grille together in its mounting (in the fender). Hook the radiator grille retaining lugs into the slots to the side and at the bottom of the headlamp housing and fit the screws at the top (2 cross head screws). Insert the filler of the screen washer fluid reservoir and clip it in place (only on vehicles up to build month April '88).

13. Fit the wiper arm as described in Operation 32 654 0 (sub-operation 9).

14. Check the operation of the headlamp washers and check the free hose length.

15. Check the operation of the headlamp while switched to dipped beams and align as indicated in Operation 32 113 0.

NOTE: If the fender is damaged in an accident, the headlamp mounting panel must be realigned.

1) Install the direction indicator, ensuring that it is seated correctly in relation to the fender.

2) Locate the headlamp mounting panel over the direction indicator guides and secure it.

3) Screw the white spacer bolt against the housing of the direction indicator; the direction indicator must remain in its position.

4) Install the headlamp assembly as described in Operation No. 32 115 0.

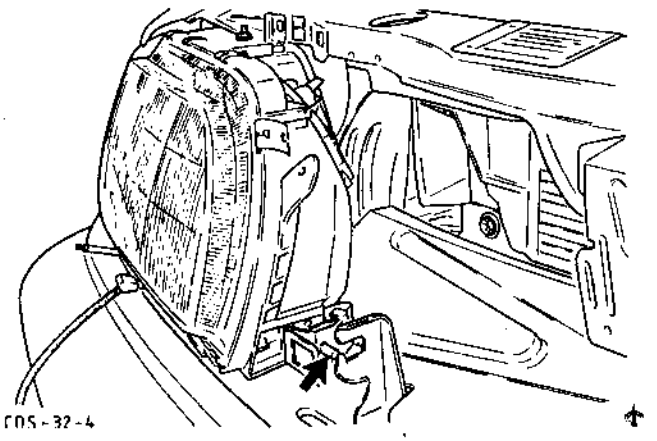


Fig.4. Install headlamp assembly.

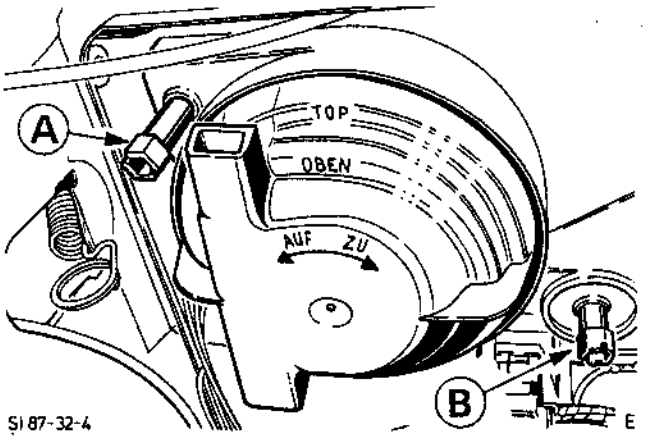


Fig.5. Headlamp alignment screws.
A - Horizontal alignment screw
B - Vertical alignment screw

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 145 0 LENS - HEADLAMP - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the headlamp assembly as described in Operation No. 32 115 0 (sub-operations 1 to 4).

2. Insert a suitable screwdriver in the opening in the spring clips on the side of the housing and lever the clips off (8 off), Fig.2(A).

3. Remove the damaged headlamp lens and remove the gasket.

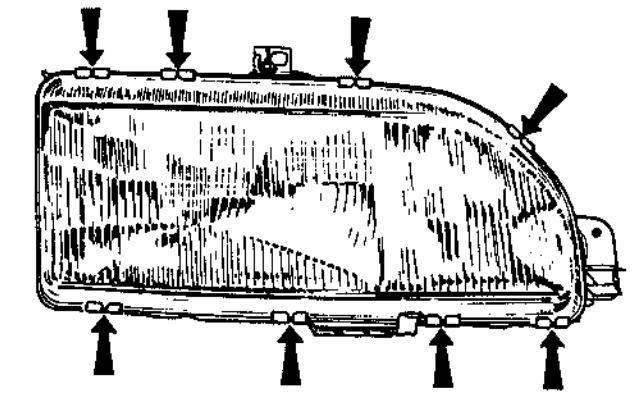
To Install

4. Fit the gasket and new headlamp lens. Make sure that the gasket is seated correctly.

5. Locate the spring clips (8 off) in the correct positions around the edge of the lens and press them over the edge of the housing (without using a tool), Fig.2(B).

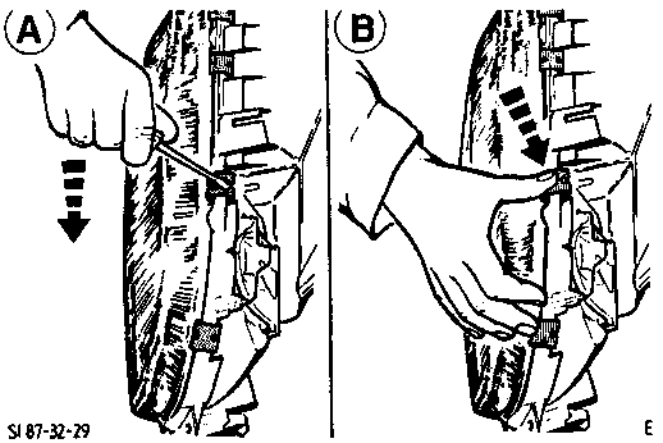
6. Install the headlamp assembly as described in Operation 32 115 0 (sub-operations 9 to 15).

7. Check operation.



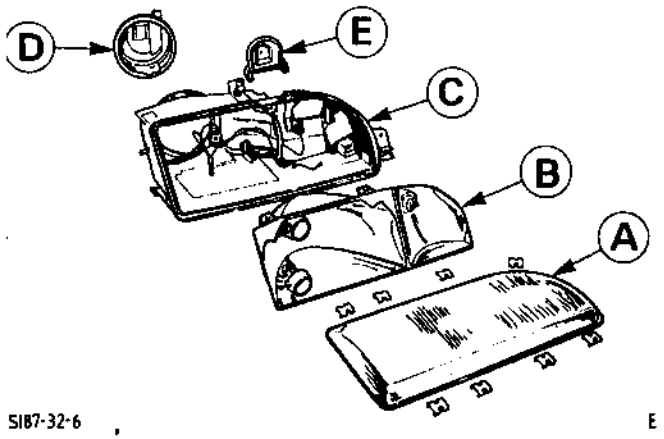
SI87-32-5 E

Fig.1. Location of spring clips around headlamp lens.



SI87-32-29 E

Fig.2. Headlamp lens spring clips.
A - Spring clip removal
B - Spring clip fitting



SI87-32-6 E

Fig.3. Headlamp assembly - exploded view.
A - Headlamp lens with spring clips
B - Reflector
C - Headlamp housing
D - Protective cap for headlamp bulbs
E - Protective cap for auxiliary lamps (when fitted).

Fig.3. Headlamp assembly - exploded view.

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 147 0 BULB - HEADLAMP - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: Do not touch the bulb glass with bare fingers.

To Remove

1. Twist the protective cap over the headlamp bulbs anti-clockwise and remove it. Pull the multiplug from the base of the bulb.

NOTE: On vehicles from model year '90 the air cleaner cover must be removed (5 retaining clips) to remove the protective cap of the right hand headlamp.

2. Compress the spring retainer and swing it back. Grasp the bulb by its contacts and carefully withdraw it.

To Install

3. Insert the new bulb correctly in the holder and secure it with the spring retainer. Connect the multiplug to the bulb.

4. Fit the protective cap over the headlamp bulbs and turn it clockwise until it engages. The words 'OBEN' or 'TOP' on the cap must be exactly at the top.

NOTE: On vehicles from model year '90 refit the air cleaner cover (5 retaining clips).

5. Check operation.

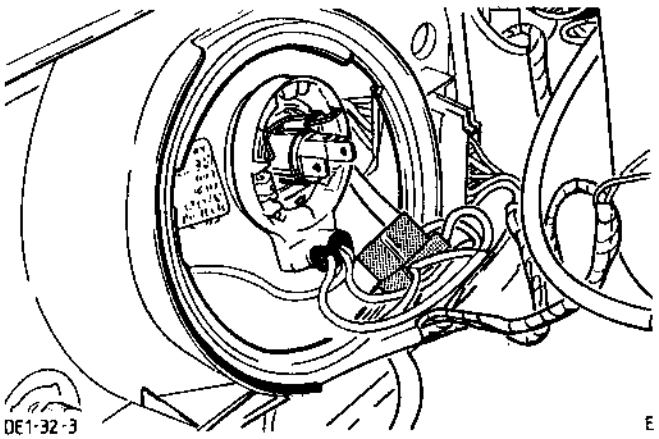


Fig.1. Bulb multiplug disconnected.

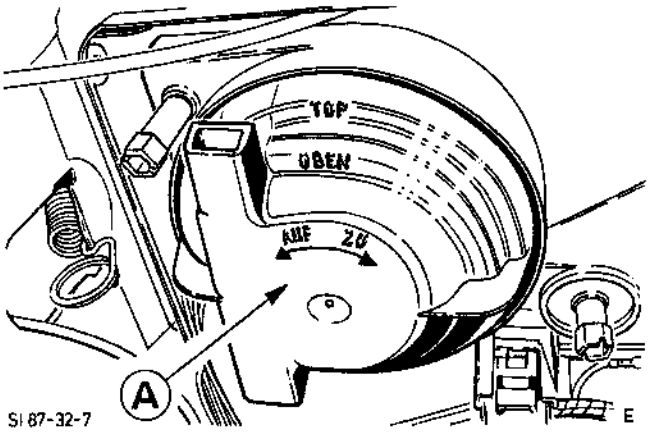


Fig.2. Protective cap fitted over headlamp bulbs.
A - Protective cap

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 207 0 BULB - SIDE LAMP - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Turn the protective cap over the headlamp bulbs anti-clockwise and remove it.

NOTE: On vehicles from model year '90 the air cleaner cover must be removed (5 retaining clips) to remove the protective cap of the right hand headlamp.

2. Withdraw the holder with the sidelamp bulb and pull the bulb out of the holder (push fit).

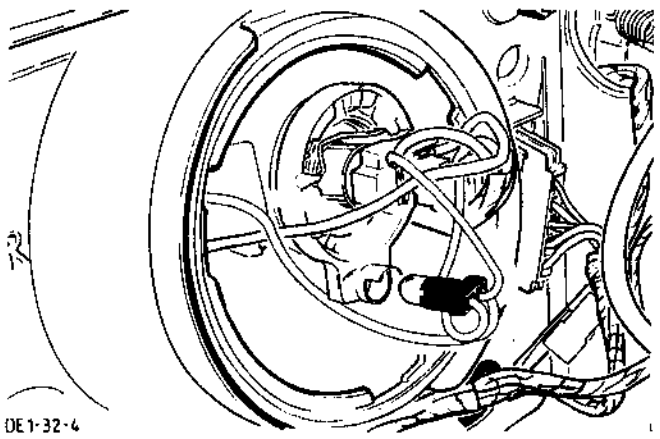


Fig.1. Side lamp bulb and holder.

To Install

3. Place the new bulb in the holder and press the holder and bulb into position in the opening in the reflector.

4. Fit the protective cap over the headlamp bulbs and turn it clockwise until it engages properly.

NOTE: On vehicles from model year '90 refit the air cleaner cover (5 retaining clips).

5. Check operation.

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 225 0 INDICATOR ASSEMBLY - FRONT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Unhook the retaining spring on the back of the indicator assembly from the apron panel, Fig.1, and remove the indicator assembly from the side.

2. Twist the bulb holder anti-clockwise and remove it from the indicator assembly.

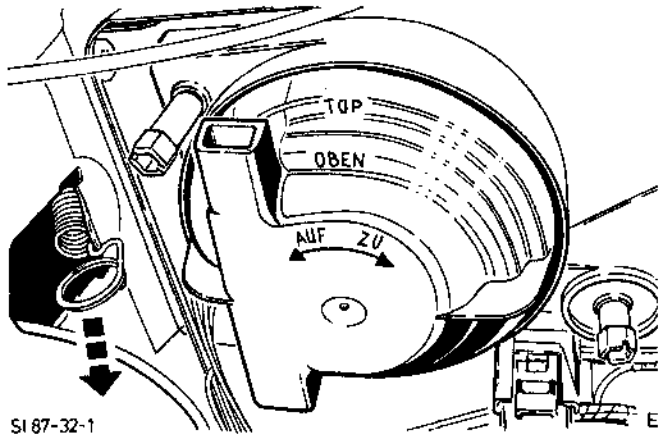


Fig.1. Indicator retaining spring.

To Install

3. Insert the bulb holder in the indicator assembly and secure by turning it clockwise.

4. Insert the indicator assembly in the fender, guiding the plain indicator locating pins into the associated locating holes in the headlamp mounting panel. Secure the indicator assembly by attaching the retaining spring to the apron panel.

5. Check operation of indicator.

32 228 0 INDICATOR LAMP - SIDE - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Twist the indicator lamp a quarter of a turn clockwise and pull it out, Fig.2.

2. Twist the bulb holder a quarter of a turn anti-clockwise and remove it from the indicator lamp.

To Install

3. Insert the bulb holder into the indicator lamp and secure by turning it a quarter of a turn clockwise.

4. Correctly insert the indicator lamp in the cut-outs and secure by turning a quarter of a turn anti-clockwise.

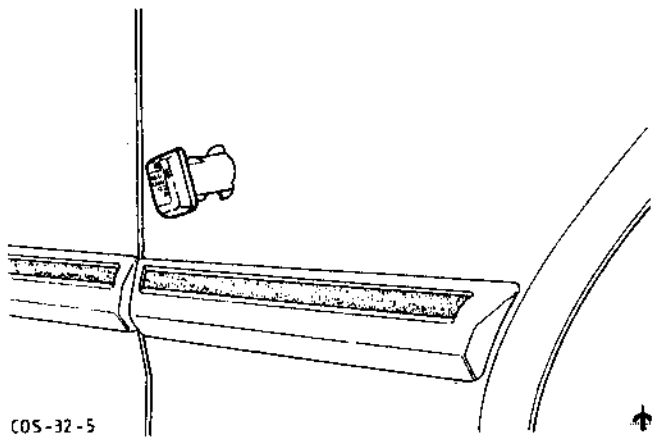


Fig.2. Side indicator lamp (pulled out).

32 237 0 BULB - FRONT INDICATOR - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the indicator assembly as described in Operation No. 32 225 0.
2. Release the bulb holder by pressing it in and turning it clockwise and then remove the bulb from the holder.

To Install

3. Insert the bulb in the holder. Secure the bulb holder by turning it clockwise.
4. Install the indicator assembly as described in Operation No. 32 225 0.
5. Check operation.

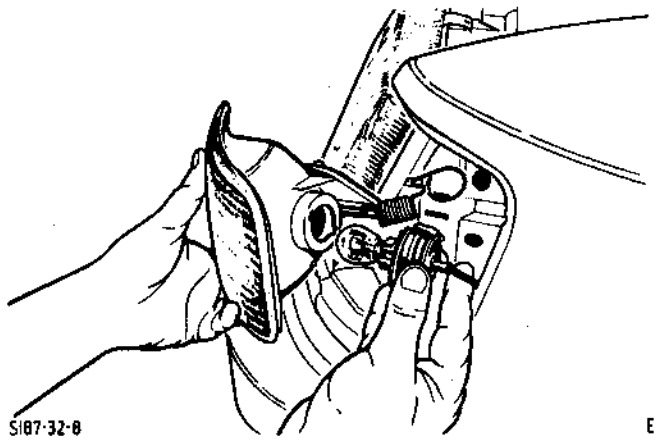


Fig.1. Insert indicator bulb and holder.

32 277 0 BULB - AUXILIARY LAMP - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Release the retainer securing the protective cap, lift and detach the cap. Disconnect the wiring to the bulb.
2. Press the spring retainer down, release it and swing it upwards. Remove the bulb.

To Install

3. Insert the bulb in the holder and secure it by engaging the spring retainer. Connect the wiring.
4. Fit the protective cap and secure it with the retainer.
5. Check operation of auxiliary lamp.

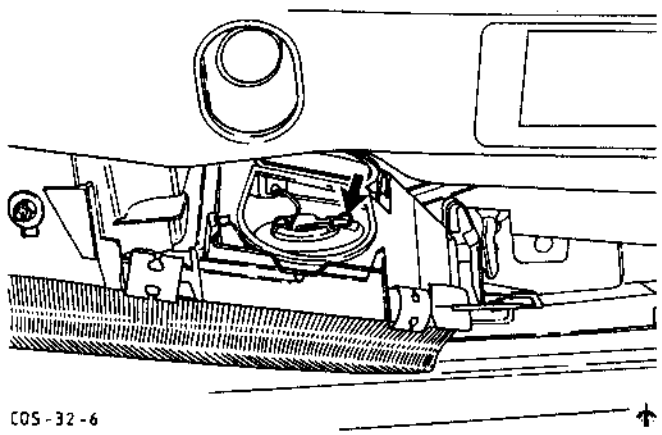


Fig.2. Spring retainer securing auxiliary lamp bulb.

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 281 0 LAMP ASSEMBLY - FOG - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the moulding (1 cross head screw).

2. Undo the retaining screws (slotted/Torx - 2 off) and withdraw the fog lamp assembly from the mounting, Fig.1, with the aid of the screws inserted halfway into the screw holes. Disconnect the two leads, Fig.2.

3. Release the spring retainer and pull the bulb out of the holder.

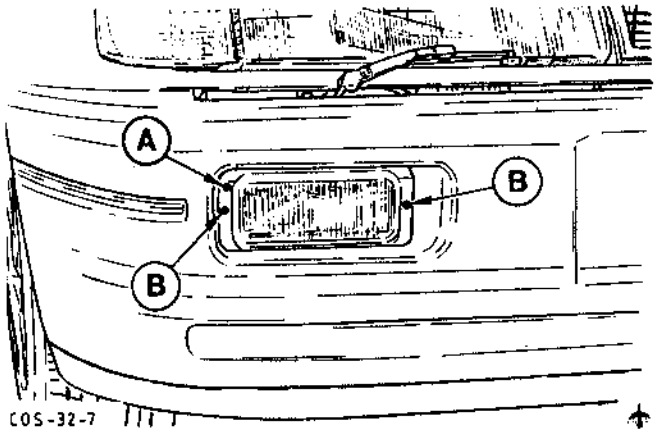


Fig.1. Fog lamp.
A - Alignment screw
B - Retaining screws

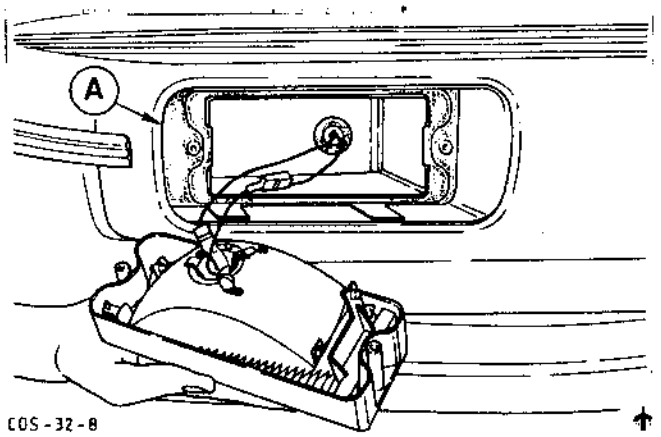


Fig.2. Fog lamp with wiring connections.

To Install

4. Insert the bulb correctly in the bulb holder (cut-outs) and secure with the spring retainer.

5. Connect the two wiring connectors, insert the fog lamp in its mounting and secure it with the 2 screws.

   Align the fog lamp as described in Operation 32 113 0.

   Fog lamp alignment setting X = 22 cm/10 m = 1 degree 16 minutes.

NOTE: Replace the gasket if replacing the fog lamp assembly complete.

6. Fit the moulding.

7. Check operation of fog lamp.

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 305 0 LAMP ASSEMBLY - REAR - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open the luggage compartment lid. Release the bulb holder and remove the bulb holder. Pull off the multiplug.

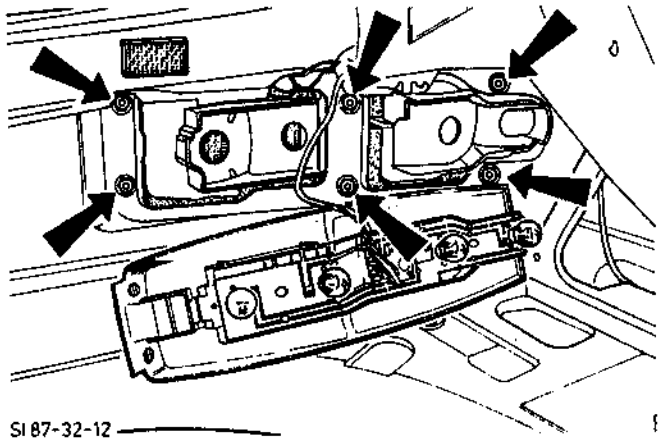
2. Detach the rear lamp assembly (6 nuts) and remove the gasket, Fig.1.

To Install

3. Place the gasket over the rear lamp assembly and fit the rear lamp assembly (6 nuts).

4. Connect the multiplug to the bulb holder and insert the bulb holder.

5. Check operation of rear lamps.



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Fig.1. Locations of rear lamp retaining nuts.

32 317 0 BULB - REAR LAMP - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the bulb holder as described in Operation No. 32 305 0. The bulbs have bayonet fittings.

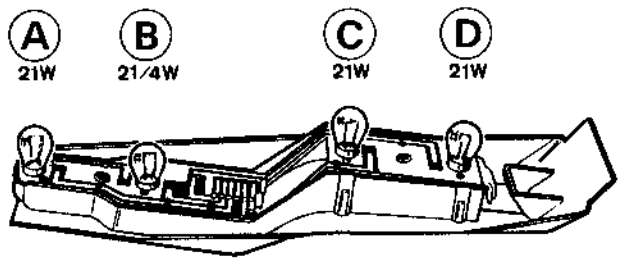
2. Twist the bulb(s) anti-clockwise and remove.

To Install

3. Insert the bulb(s) in the bulb holder.

4. Fit the bulb holder and check the operation of the bulb(s).

NOTE: One bulb doubles as rear fog lamp and tail lamp.



SI 87-32-13

Fig.2. Rear lamp bulbs
A - Direction indicator
B - Rear fog/tail lamp
C - Reversing lamp
D - Brake lamp

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 365 0 LICENCE PLATE LAMP - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. The licence plate lamp is held in the bumper by two spring clips. Insert a suitable screwdriver in the groove, press it in, lever the licence plate lamp upwards out of the bumper and withdraw it. Pull the plug off the bulb holder, Fig.1.

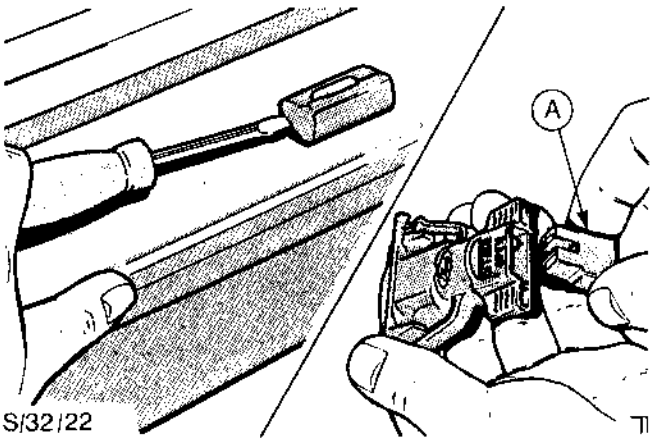


Fig.1. Remove licence plate lamp.
A - Plug

To Install

2. Connect the plug to the bulb holder and press the lamp assembly into the bumper.

32 377 0 BULB - LICENCE PLATE LAMP - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the licence plate lamp from the bumper as described in Operation 32 365 0.

2. Twist the bulb holder anti-clockwise and pull it out. The bulb is a push-fit.

To Install

3. Insert the new bulb and insert the bulb holder in the lamp housing. Install the lamp assembly in the bumper and check operation.

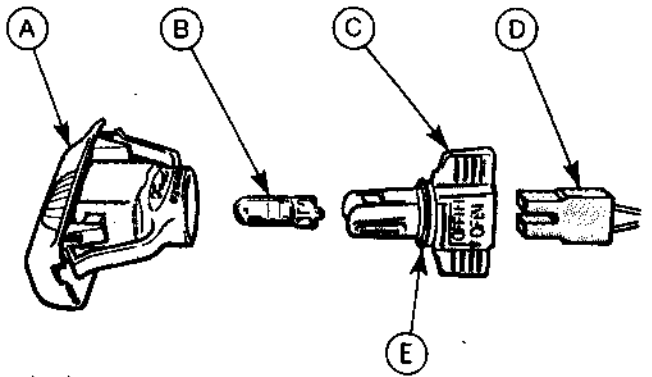


Fig.2. Licence plate lamp - exploded view.
A - Housing with lens
B - Bulb
C - Bulb holder
D - Plug
E - O-ring

Fig.2. Licence plate lamp.

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

35 524 0 MOTOR - WINDSCREEN WIPER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Switch on the wiper motor and switch off with the linkage in a position in which all the retaining screws are accessible. Disconnect the battery earth cable.

2. Unscrew the link from the motor shaft (1 nut), Fig.1(B).

3. Unscrew the motor from the bracket on the vehicle (3 screws), remove the motor and disconnect the multiplug.

4. Remove the cover from the wiper motor (push fit).

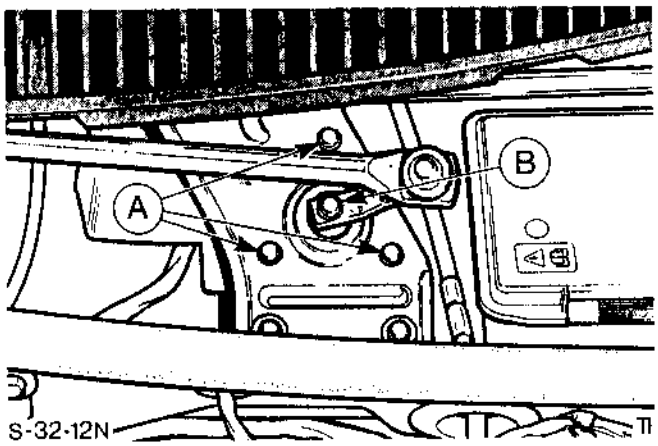


Fig.1. Wiper motor.
A - Wiper motor retaining bolts
B - Shaft retaining nut

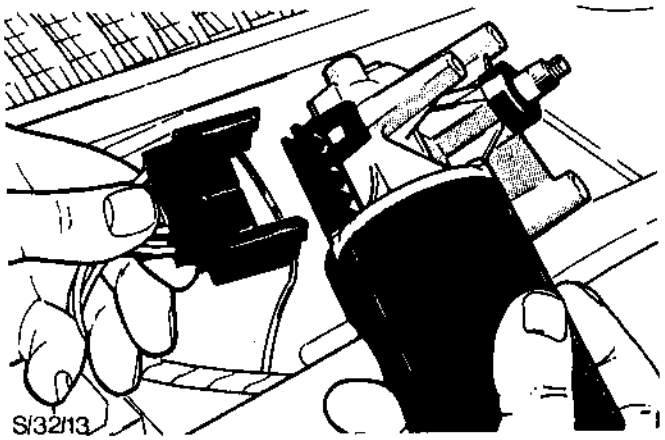


Fig.2. Remove wiper motor.

To Install

During installation, tighten nuts and bolts to the torque specified in Technical Data.

5. Fit the cover to the wiper motor. Connect the multiplug.

6. Insert the wiper motor and attach it to the bracket with the three screws.

7. Attach the link to the motor shaft (1 nut), making sure that the locating lug on the link is seated correctly in relation to the groove on the motor shaft.

8. Connect the battery. Check wiper operation.

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 554 0 LINKAGE - WINDSCREEN WIPER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open the hood. Using a suitable open-ended spanner, carefully lever the windscreen wiper linkage off at the pivots and remove it, Fig.1(A).

To Install

2. Pack the windscreen wiper linkage bushes with grease (see Technical Data), locate the linkage on the spherical pivots and clip it into place with an appropriate socket, Fig.1(B).

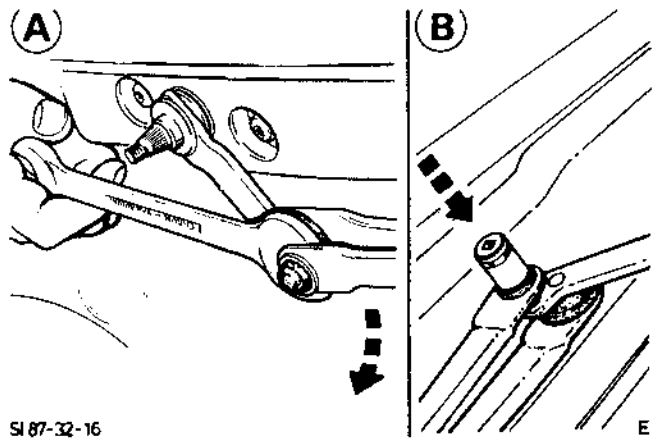


Fig.1. Windscreen wiper linkage.
A - Removal
B - Installation

32 563 0 PIVOT SHAFT - WIPER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Lift the plastic cap over the wiper arm pivot. Detach the wiper arms (1 nut and 1 washer in each case).

2. Detach the cowl grille (3 plastic screws with clips and 2 cross head screws). Pull the nozzles forwards so that they disengage, and pull off the hoses.

3. Remove the wiper motor with the bracket and linkage (7 hexagon head screws), Fig.2. Disconnect the multiplug.

4. Detach the link (1 nut) and the bracket (3 screws) from the wiper motor.

5. Using a suitable open-ended spanner, carefully lever the wiper linkage off at the pivots and remove it.

6. Remove the circlip from the pivot shaft and withdraw the pivot shaft from the housing, Fig.3.

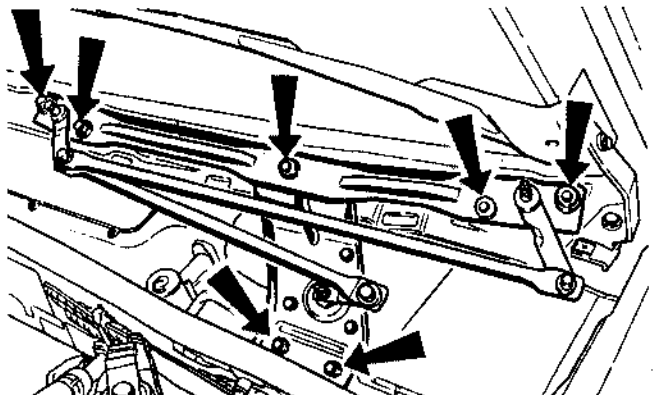


Fig.2. Screws securing wiper motor bracket.

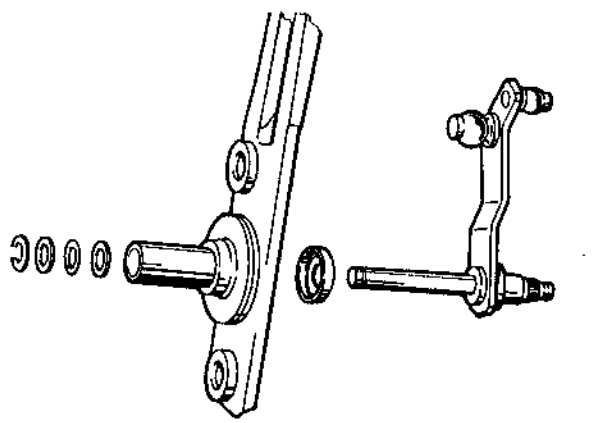


Fig.3. Wiper pivot shaft - exploded view.

7. Drill out the three rivets securing the pivot shaft housing.

To Install

8. Insert the pivot shaft housing in the bracket and rivet it in place (3 rivets), Fig.4.

9. Pack the pivot shaft bush with grease (see Technical Data). Fit the corrugated washer and the plain washer to the shaft in the correct order, secure them with the circlip and slide the rubber insulator onto the housing.

10. Pack the windscreen wiper bushes with grease, (see Technical Data). Position the wiper linkage on the pivots and clip it into place.

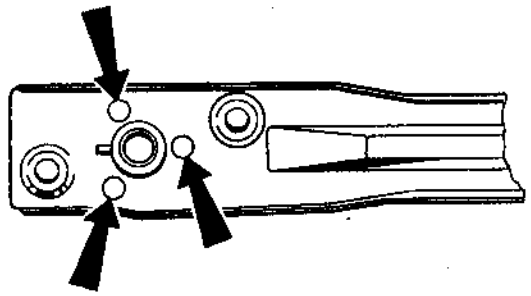
11. Attach the windscreen wiper motor to the bracket (3 screws) and connect the link to the motor shaft (1 nut) ensuring that the locating lug on the link is positioned correctly in relation to the groove on the motor shaft.

12. Connect the multiplug to the wiper motor.

13. Insert the wiper motor complete with the bracket and linkage and secure it (7 hex. head screws).

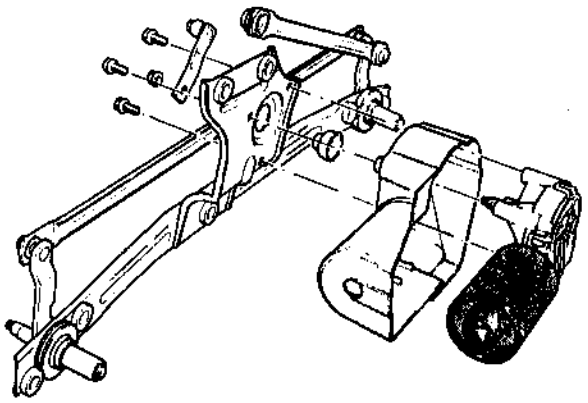
14. Fit the cowl grille (3 plastic screws with clips and 2 cross head screws). Attach the hoses to the nozzles and insert the nozzles in the cowl grille.

15. Fit the wiper arms (1 washer and 1 nut in each case).



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Fig.4. Locations of rivets securing pivot shaft housing.



S-32-38N

Fig.5. View of wiper motor with linkage.

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 584 0 BLADE - WIPER - REPLACE

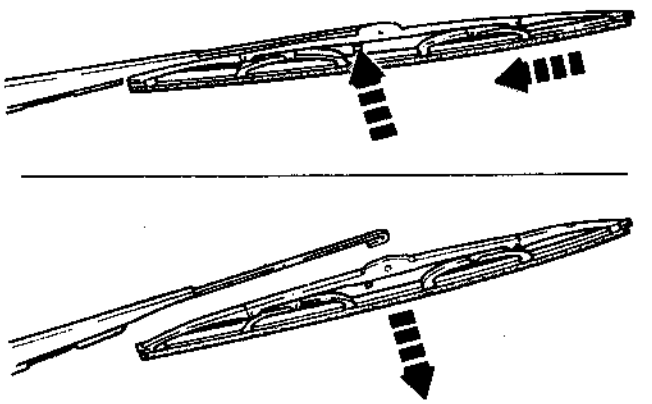
SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Lift the wiper arm clear of the windscreen, press in the spring at the wiper blade mounting, simultaneously draw the wiper blade rearwards out of the hook on the wiper arm and remove it, Fig.1.

To Install

2. Guide the new wiper blade over the hook on the wiper arm, slide it up and engage it.



DE1-32-23 ACM

Fig.1. Detach wiper blade.

32 586 0 RUBBERS - WIPER BLADE - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

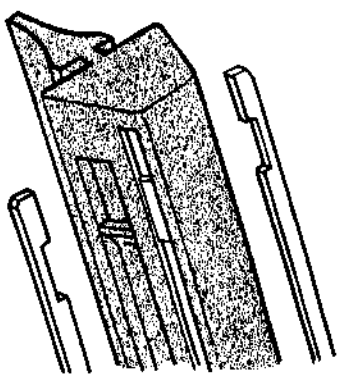
1. Remove the wiper blade as described in Operation No. 32 584 0.

2. Lubricate the rubber and the two spring strips with soap, disengage them from the claw-shaped retainer on the wiper blade and pull them out of the frame of the blade.

To Install

3. Fit the spring strips in the new wiper rubber. The cut-outs in the spring strips must be aligned with one another, Fig.2. Slide the rubber into the frame of the blade and engage it in the claw-shaped retainer.

4. Fit the wiper blade as described in Operation No 32 584 0.



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Fig.2. Cut-outs in strips must be aligned with one another.

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 622 0 RESERVOIR - WASHER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: The windscreen washer and headlamp washer are supplied from a common reservoir.

To Remove

1. Syphon the water from the reservoir. Remove the reservoir filler (only up to build month April '88). Disconnect the hoses from the pumps.

2. Unclip and disconnect the warning system sender unit multiplug. Press in the pump multiplug retaining springs and disconnect the multiplugs from both pumps.

3. Undo the three screws securing the reservoir and remove the reservoir, Fig.2.

4. Lever the pumps out of the reservoir using a screwdriver.

5. Press the rubber grommets from the pumps and warning system sender unit out of the reservoir.

To Install

6. Fit the rubber grommets, pumps and warning system sender unit in the reservoir.

7. Locate the reservoir in place and secure with the three screws. Connect the multiplugs to both pumps and to the warning system sender unit. Ensure safety clips are seated correctly. Clip the warning system multiplug in place.

NOTE: White multiplug connects to headlamp washer pump.

8. Connect the hoses to the pumps. Insert the reservoir filler (only up to build month April '88).

9. Fill the reservoir with water and check the operation of the washer system.

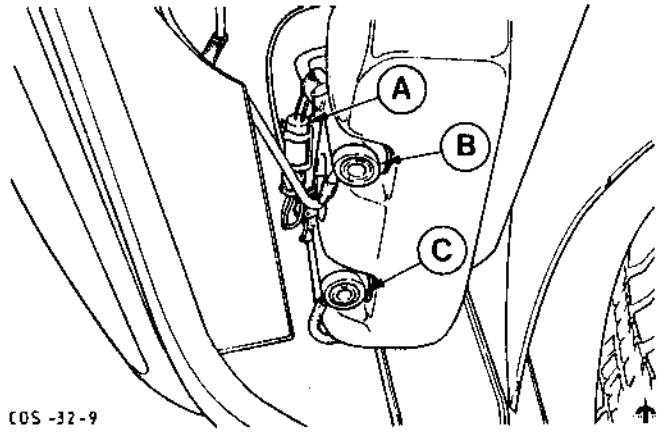


Fig.1. A - Warning system sender unit multiplug
B - Headlamp washer pump multiplug
C - Windscreen washer pump multiplug

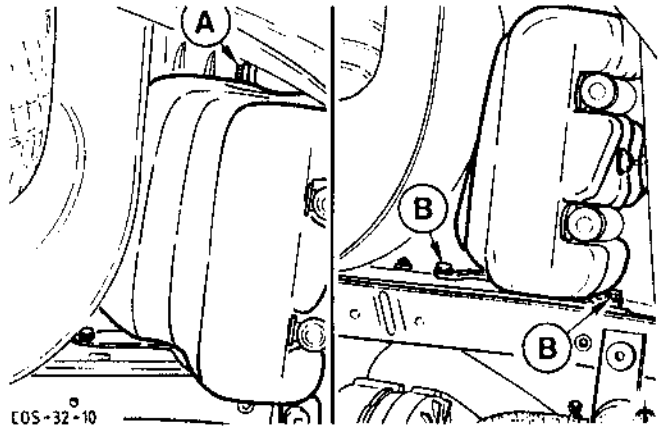


Fig.2. Washer reservoir attachment bolts.
A - Right
B - Left

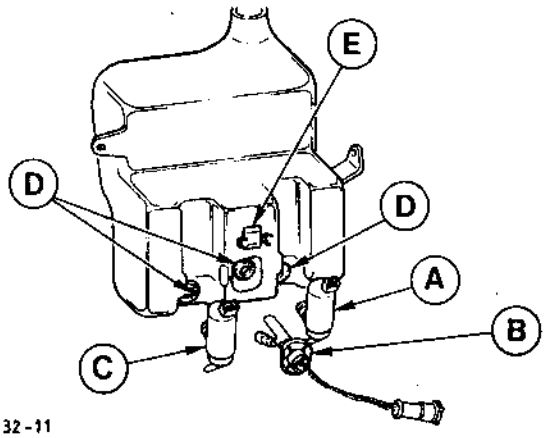


Fig.3. Washer reservoir.

Fig.3. Washer reservoir.
A - Windscreen washer pump
B - Warning system sender unit
C - Headlamp washer pump
D - Rubber grommets
E - Clip - warning system multiplug

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 624 0 PUMP - WINDSCREEN WASHER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Syphon the water from the reservoir.
2. Disconnect the multiplug and pull off the hose.
3. Lever the pump out of the reservoir with a screwdriver.
4. Remove the rubber grommet from the reservoir.

To Install

5. Fit the rubber grommet and pump in the reservoir.
6. Connect the multiplug and hose.
7. Fill the reservoir with water and check the operation of the pump.

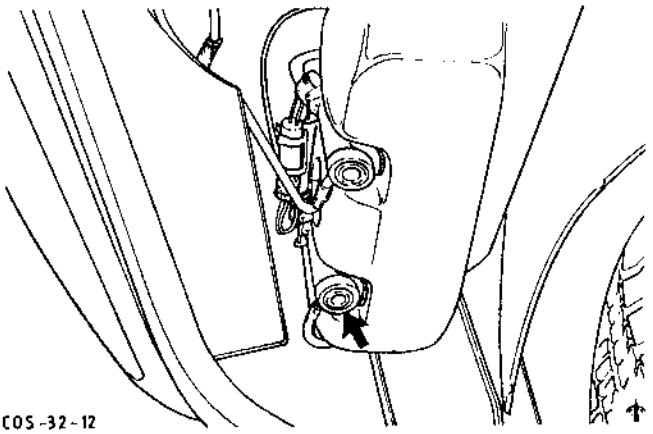


Fig.1. Windscreen washer pump.

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 634 0 NOZZLE - WINDSCREEN WASHER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the multiplug of the heated nozzle (from model year '90), Fig.1.

2. Pull the nozzle forwards, Fig.2, or lift the nozzle with the aid of a screwdriver in the lower slot at the front so that it disengages.

3. Pull off the hose and remove the nozzle.

To Install

4. Connect the hose and press the nozzle into the cowl panel grille until it engages.

5. Connect the multiplug of the heated nozzle (from model year '90).

6. Check the operation and adjust the nozzle as necessary, Fig.3.

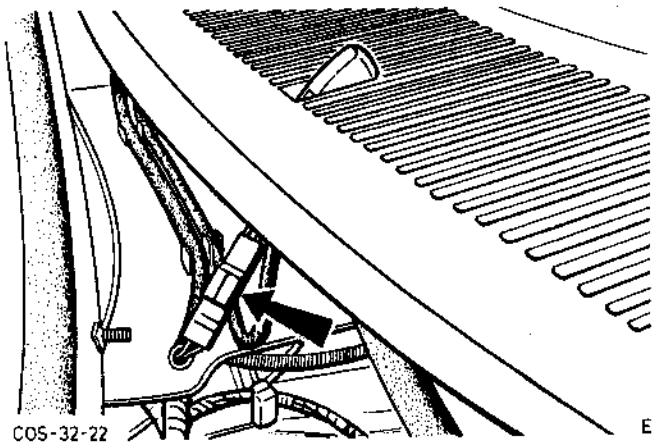


Fig.1. Multiplug of heated nozzle.

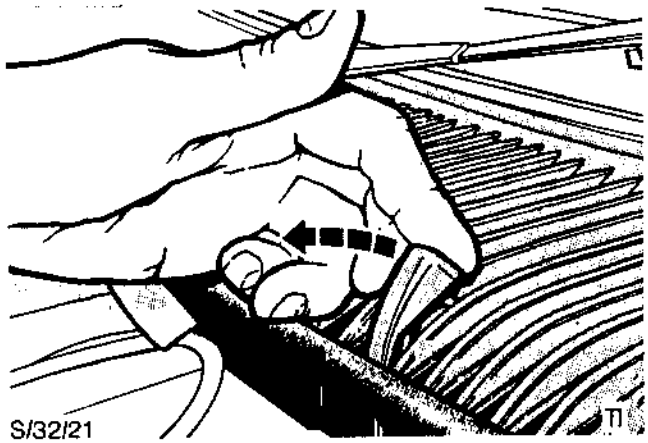


Fig.2. Remove nozzle.

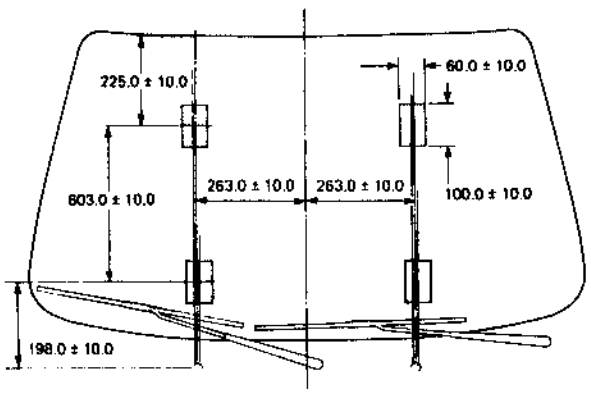


Fig.3. Windscreen nozzle alignment diagram (dimensions in mm).

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS

32 650 0 MOTOR - HEADLAMP LEVELLING - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.
2. Remove the headlamp assembly as indicated in Operation 32 115 0 (sub-operations 1 to 4).
3. Remove the protective cap from the headlamp.
4. Press the headlamp levelling motor in and turn it away from the headlamp until the bayonet fitting disengages, Fig.1.

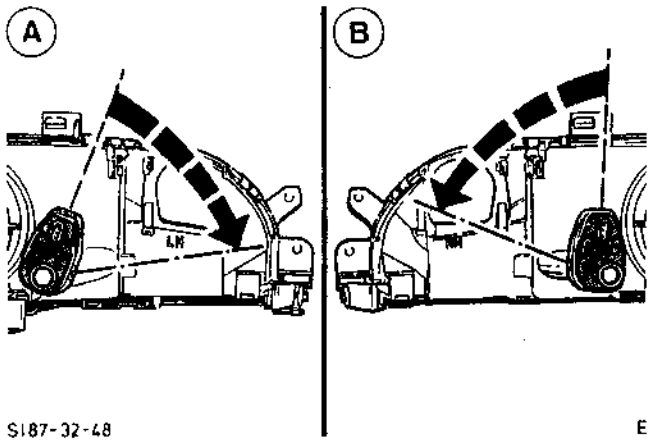


Fig.1. Turn headlamp levelling motor until bayonet fitting disengages.
A - Left hand headlamp
B - Right hand headlamp

5. Insert a suitable screwdriver through the opening in the headlamp housing, release the adjusting spindle and withdraw the headlamp levelling motor, Fig.2.

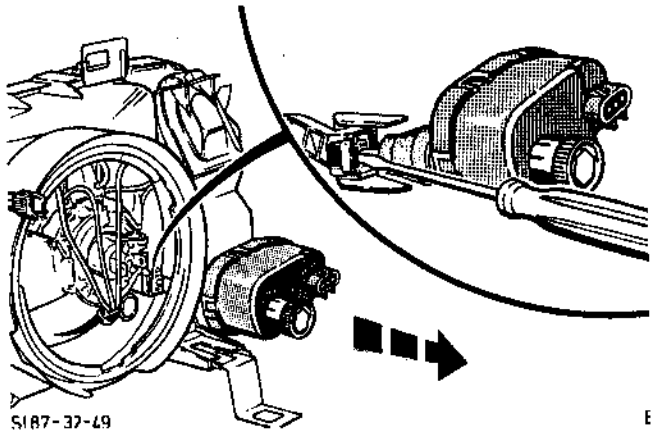


Fig.2. Release adjusting spindle and withdraw headlamp levelling motor.

To Install

6. Fit the headlamp levelling motor in the headlamp housing with the adjusting spindle aligned with the socket. Press the headlamp levelling motor in and turn it towards the headlamp housing until the bayonet fitting engages.
7. Pull the headlamp reflector back until the adjusting spindle engages fully in the socket.
8. Refit the protective cap to the headlamp.
9. Install the headlamp assembly as indicated in Operation 32 115 0 (sub-operations 9 to 14).
10. Reconnect the battery earth cable and check the operation of the headlamp levelling system while switched to dipped beams. Align the headlamp as indicated in Operation 32 113 0.

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 515 0 SWITCH - HEADLAMP LEVELLING - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.
2. Pull the knob off the headlamp levelling switch, Fig.1.
3. Pull the switch light housing out of the facia.
4. Compress the retaining lugs of the headlamp levelling switch and pull the switch out of the facia, Fig.2.
5. Disconnect the multiplug from the headlamp levelling switch.

To Install

6. Connect the multiplug to the headlamp levelling switch.
7. Fit the headlamp levelling switch in the facia (the retaining lugs must engage).
8. Fit the switch light housing in the facia.
9. Refit the knob to the headlamp levelling switch.
10. Reconnect the earth cable.
11. Check the operation of the headlamp levelling system while switched to dipped beam.

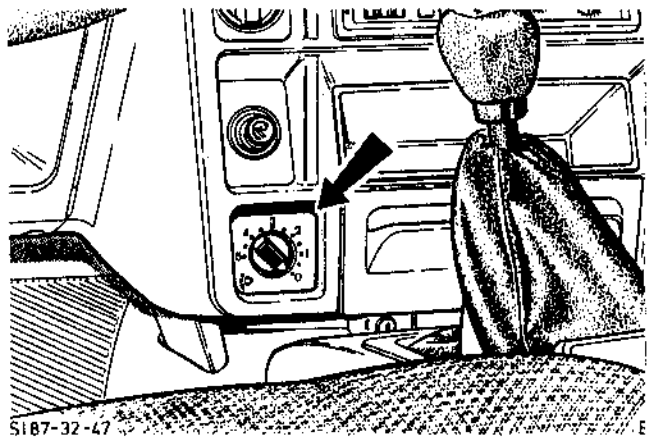


Fig.1. Location of headlamp levelling switch.

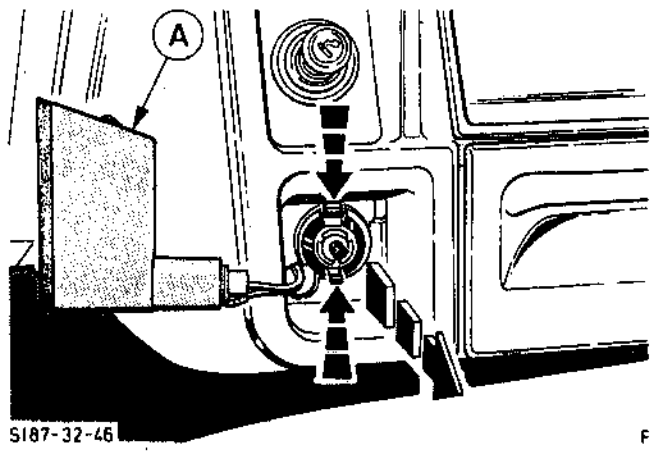


Fig.2. Remove headlamp levelling switch.
A - Switch light housing

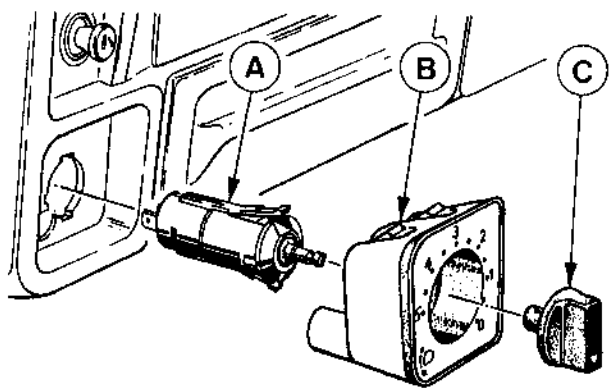


Fig.3. Individual parts of headlamp levelling switch.
A - Switch
B - Switch light housing
C - Switch knob

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 654 0 MOTOR - HEADLAMP WIPER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Lift the plastic cap over the wiper arm pivot. Pull the hose off the nozzle and out of the retaining loop. Unscrew the wiper arm retaining nut, remove the washer and wiper arm, Fig.1.

2. Pull the water hose and retaining hose off the motor shaft.

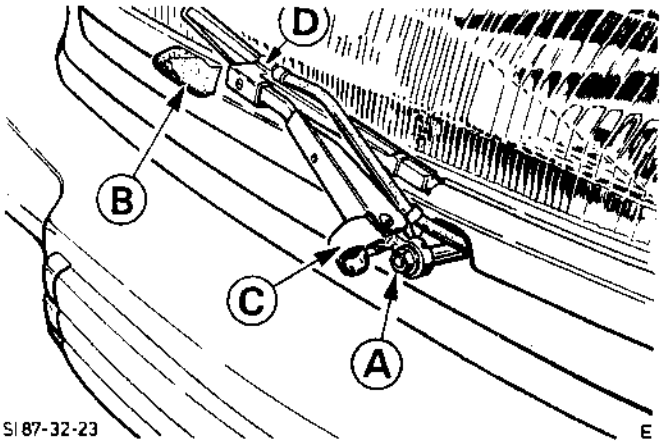


Fig.1. Headlamp wash/wipe system.
A - Wiper arm retaining nut
B - Wiper blade stop
C - Plastic cap on wiper arm
D - Nozzle

3. Using a 1/4" drive socket and extension inserted through the gap between headlamp and bumper, unscrew the wiper motor bracket from the headlamp housing (2 hexagon head screws), Fig.2. Remove the wiper motor from the mounting on the headlamp housing (accessible from the wheelarch).

4. Disconnect the wiper motor multiplug.

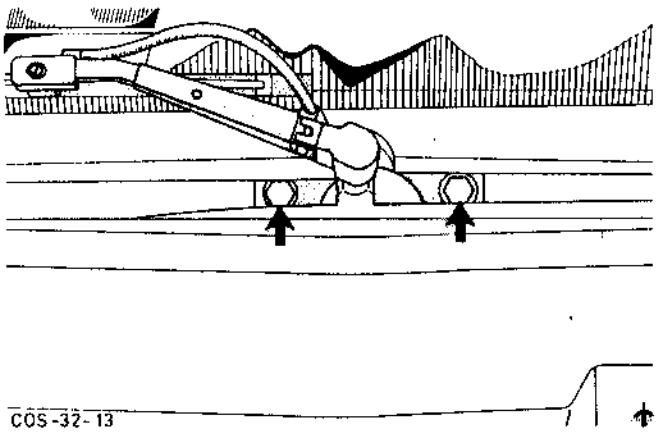


Fig.2. Wiper motor bracket screws.

To Install

5. Connect the multiplug.

6. Insert the wiper motor bracket in the mounting on the headlamp housing and secure it (2 screws) through the gap between headlight and bumper. Slide the water hose and retaining hose over the motor shaft.

7. Screw the wiper arm in place in the parked position and press the cap down. Push the hose through the retaining loop and attach the hose to the nozzle on the wiper arm.

8. Adjust the free length of hose between the retaining hose and the nozzle in line with the wiping movement.

9. Check the headlamp washers operate correctly.

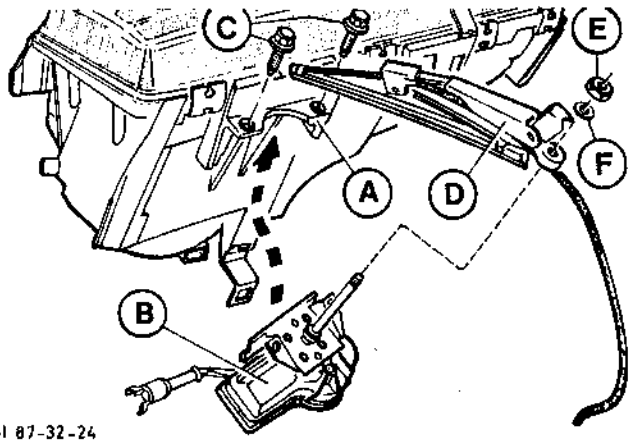


Fig.3. Headlamp washer system - exploded view.
A - Mounting on headlamp housing
B - Wiper motor
C - Retaining screws
D - Wiper arm
E - Nut
F - Spring washer

EXTERIOR LIGHTS, DIRECTION INDICATORS,
HORN AND WINDSCREEN WIPERS

32 672 0 BLADE - HEADLAMP WIPER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Swing the wiper arm clear of the headlamp lens.
2. Hold the wiper arm and lever the wiper blade, Fig.1, out of the mounting (on the wiper arm).

To Install

3. Press the wiper blade into the mounting and engage it. Place the wiper arm against the headlamp lens in the parked position.
4. Check operation.

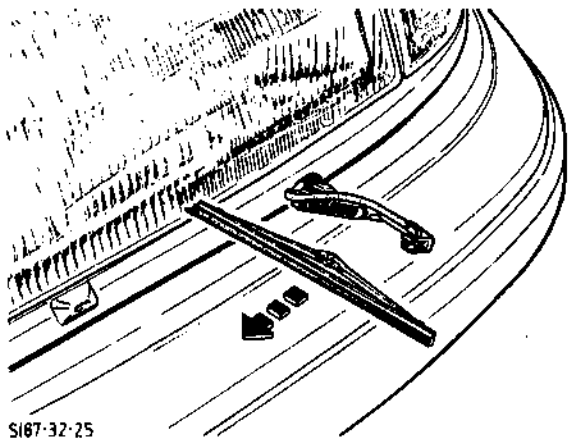


Fig.1. Headlamp wiper blade.

32 676 0 PUMP - HEADLAMP WASHER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Siphon the water from the reservoir.
2. Disconnect the multiplug and pull off the hose.
3. Remove the pump, levering the pump out of the reservoir with the aid of a screwdriver.
4. Remove the rubber grommet from the reservoir

To Install

5. Fit the rubber grommet and pump in the reservoir.
6. Connect the multiplug and hose.
7. Fill the reservoir with water and check the operation of the pump.

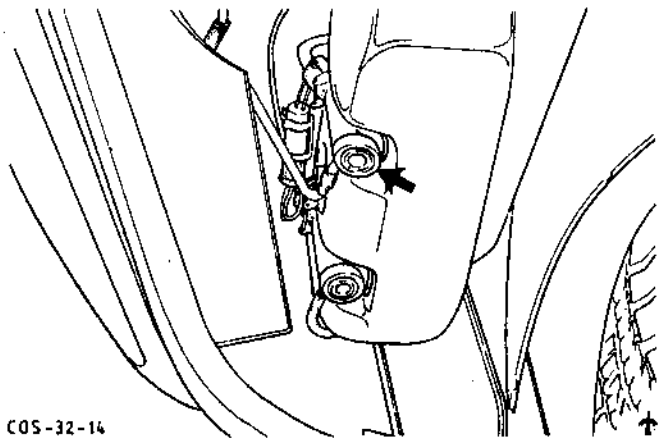


Fig.2. Headlamp washer pump.

32 678 0 NOZZLE - HEADLAMP WASHER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

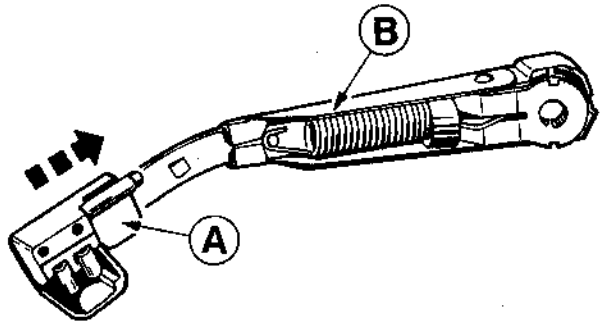
To Remove

1. Detach the wiper blade as described in Operation 32 672 0.
2. Remove the hose from the nozzle.
3. Pull the combined wiper blade mounting and nozzle off the wiper arm with a suitable tool (screwdriver, pliers).

To Install

4. Fit the nozzle/wiper blade mounting on the wiper arm (until it engages audibly), Fig.1.
5. Fit the wiper blade as described in Operation 32 672 0.
6. Check that the headlamp wash/wipe system operates correctly.

NOTE: The nozzle is not adjustable.



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Fig.1. Fit headlamp washer nozzle.
A - Nozzle and wiper blade mounting
B - Wiper arm

32 816 0 HORN - REMOVE AND INSTALL (BOTH)

SPECIAL SERVICE TOOLS REQUIRED: NONE

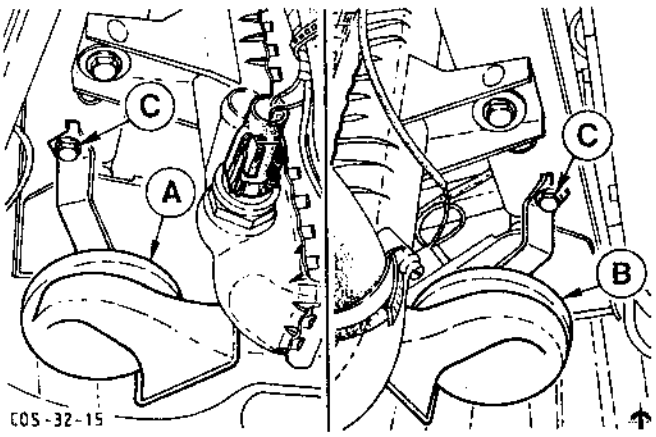
NOTE: Only replace the horn complete with the bracket.

To Remove

1. Pull off the cable plug and unscrew the horn bracket retaining bolt. Remove the horn and bracket.
2. Repeat sub-operation 1 for the other horn.

To Install

3. Secure the horn to the bracket. Fit the horn complete with bracket, align and secure. Connect the cable plug.
4. Repeat sub-operation 3 for the other horn.
5. Check the operation of the horns.



COS-32-15

Fig.2. Remove horn.
A - Left hand horn
B - Right hand horn
C - Retaining bolt

EXTERIOR LIGHTS, DIRECTION INDICATORS, HORN AND WINDSCREEN WIPERS (Escort)

32A

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32 281 0 Lamp Assembly - Fog - Remove and Install	-	7
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For Service and Repair Operations not listed here, please refer to the Escort/Orion '91 Service Microfiche.

0392

TECHNICAL DATA — Exterior Lights, Direction Indictors, Horn and Windscreen Wipers

Headlamp alignment dimension "X"	16 cm/10 m = 0° 55' = 1,6 %
Front fog lamp alignment dimension "X"	26 cm/10 m = 1° 29' = 2,6 %

NOTE: On vehicles fitted with the headlamp levelling system the basic headlamp alignment must only be carried out in switch position "0".

Bulb Chart - Exterior Lights (12 V)

	Wattage	Type/Fitting
Headlamp - H4 (Halogen)	60/55	Retaining clip
Front fog lamp - H3 (Halogen)	55	Retaining clip
Auxiliary driving lamp - H3 (Halogen)	55	Retaining clip
Side lamp	4	Wedge base
Front indicator lamp	21	Bayonet fitting
Side indicator lamp	5	Wedge base
Rear light	5	Bayonet fitting
Brake light	21	Bayonet fitting
Reversing light	21	Bayonet fitting
Rear fog light	21	Bayonet fitting
Rear indicator lamp	21	Bayonet fitting
Licence plate lamp	10	Bayonet fitting

Tightening Torques

Bolts securing wiper motor to bracket *	8 to 10
* Initial tightening when fitting a new wiper motor	10 to 12
Bolts securing wiper motor bracket to bulkhead/tailgate	6 to 8
Nuts securing pivot arm to driving spindle	22 to 24
Wiper arm retaining nut (front and rear)	16 to 20 **
Windscreen washer reservoir retaining bolts	3
Headlamp retaining bolts	5 to 6
Rear lamp retaining nuts	2 to 3
Bolt securing horn to side member	24 to 33
Wheelhouse cover retaining bolt	0,7 to 0,9

** NOTE: Tighten the nut to the specified torque, wet the glass and operate the wipers at speeds 1 and 2 and then re-torque to the specified figure.

32 113 0 HEADLAMPS - ALIGN (All)

Align the headlamps with optical beam-setting equipment, following the operating instructions provided by the equipment manufacturer. The vehicle must be standing on level ground. The vehicle and the beam-setting equipment must be lined up as specified by the equipment manufacturer.

NOTE: Before aligning the headlamps, check them for faulty lenses, reflectors and blackened bulbs and renew as necessary.

Headlamp alignment requirements:

Check the tyre pressures and rectify as necessary.

Bounce the front and rear of the vehicle several times or roll it a few metres to settle the suspension.

The vehicle must be unladen and have a full fuel tank. In addition, a person or alternatively a 75 kg weight must be in the driver's seat.

NOTE: On vehicles fitted with the headlamp levelling system, the basic headlamp alignment must only be carried out in switch position "0".

Headlamp dipped beam alignment:

Refer to Service Operation 32 113 0 in the Escort/Orion '91 Service Microfiche.

Front fog lamp alignment:

The same requirements apply as for aligning the headlamps. However, set the screen of the headlamp beam-setting equipment to the alignment setting "X" for fog lamps:

X = 26 cm/10 m - 1° 29' = 2,6 %

Switch on the fog lamps and align the beams as necessary by turning the adjusting screw, Fig.1.

Align the fog lamp beams so that the light/dark boundary touches the horizontal boundary line.

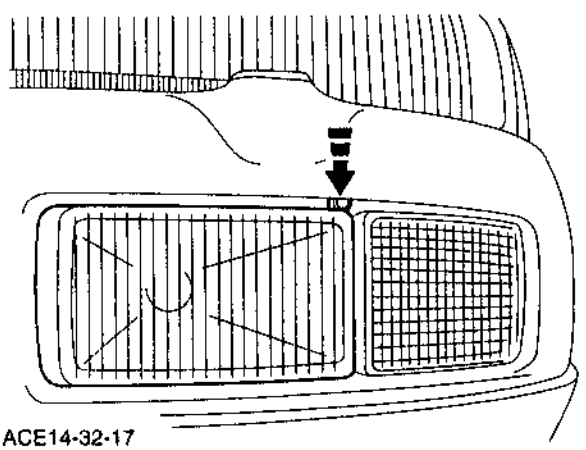


Fig.1. Fog lamp beam adjusting screw.

0392

32 115 0 HEADLAMP ASSEMBLY - REMOVE AND INSTALL (One Side)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the indicator lamp as indicated in Operation 32 225 0.

2. Remove the front fog lamp as indicated in Operation 32 281 0.

3. Working from the engine compartment, pull back and unhook the retaining spring of the side lamp (former direction indicator), pull it out towards the front and disconnect the multiplug.

4. Disconnect the multiplugs from the headlamp, auxiliary driving lamp and headlamp levelling motor, Fig.1.

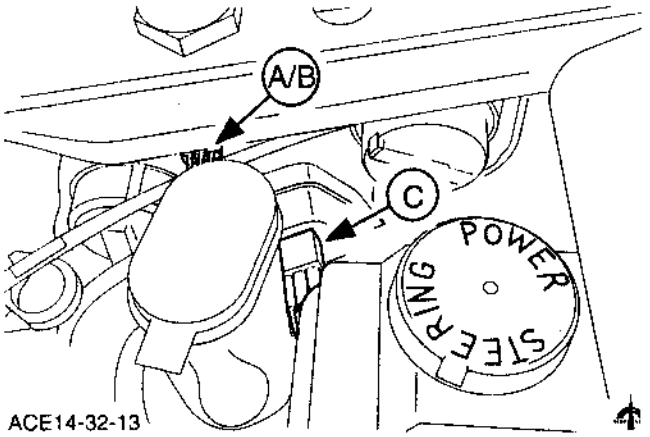
Fig.1. Multiplugs.
A - Headlamp
B - Auxiliary driving lamp
C - Headlamp levelling motor

5. Unscrew the radiator grille retaining bolt, Fig.3.(B).

6. Unscrew the lower headlamp retaining bolt through the opening for the fog lamp, Fig.2, then unscrew the 2 upper retaining bolts, Fig.3.(A). Remove the headlamp assembly.

7. Pull the protective rubber cap off the headlamp and auxiliary driving lamp bulbs. Unhook the bulb retaining clip and remove the bulbs from the reflector.
Turn the side lamp bulb holder anti-clockwise and pull it out.

NOTE: Do not touch the bulb glass with bare fingers.



ACE14-32-13

Fig.1. Multiplugs.

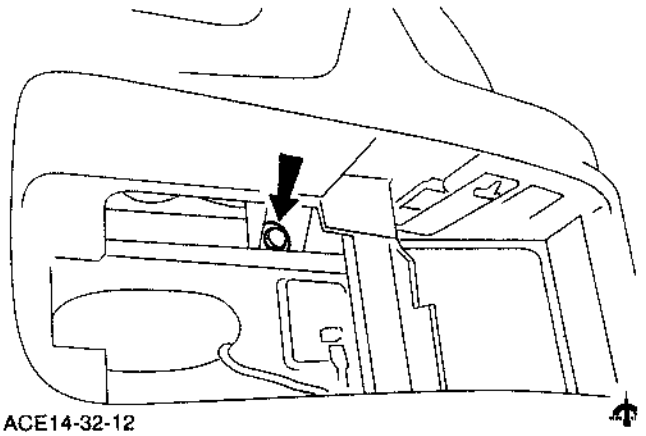
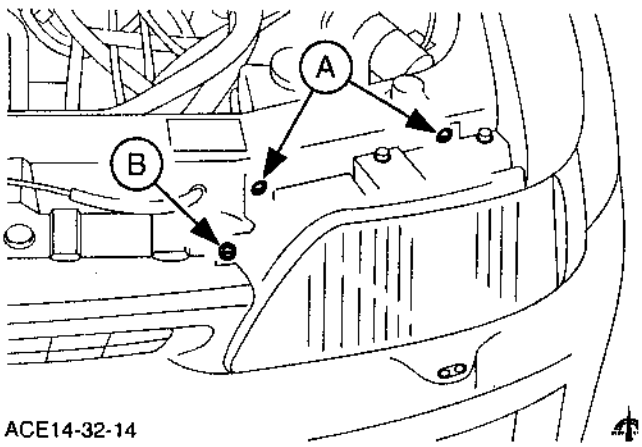

ACE14-32-12

Fig.2. Lower headlamp retaining bolt.



ACE14-32-14

Fig.3. Retaining bolts.
A - Headlamp
B - Radiator grille

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To Install

NOTE: Tighten to the torques specified in Technical Data.

8. Insert the bulbs in the new headlamp, secure them with the retaining clip and refit the protective rubber caps. Make sure the rubber caps are seated correctly.

9. Insert the headlamp assembly. The locating pin of the headlamp must be seated in the recess. Screw in the 2 upper headlamp retaining bolts and the single lower retaining bolt loosely, Fig.4.

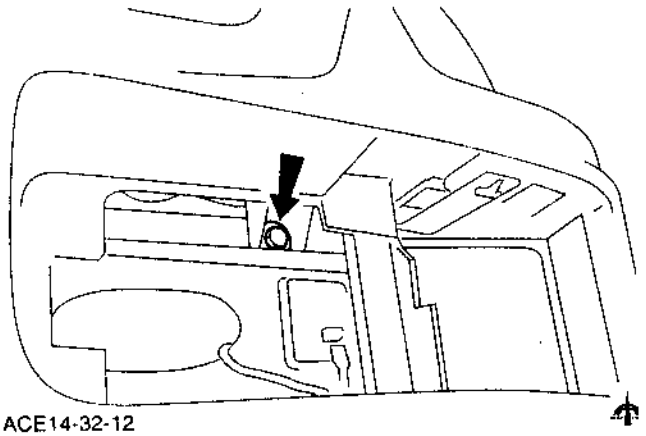


Fig.4. Lower headlamp retaining bolt.

10. Connect the multiplug. Insert the 2 retaining lugs of the side lamp in the slots in the headlamp housing. Align the side lamp with the fender and attach the side lamp retaining spring.

11. Align the headlamp with the side lamp so that the upper and lower spacing ribs touch the side lamp. The gap between the headlamp and side lamp must be even. Tighten the 2 upper headlamp retaining bolts. Tighten the lower headlamp retaining bolt.

12. Screw in the radiator grille retaining bolt.

13. Connect the multiplugs of the headlamps, auxiliary driving lamp and headlamp levelling motor.

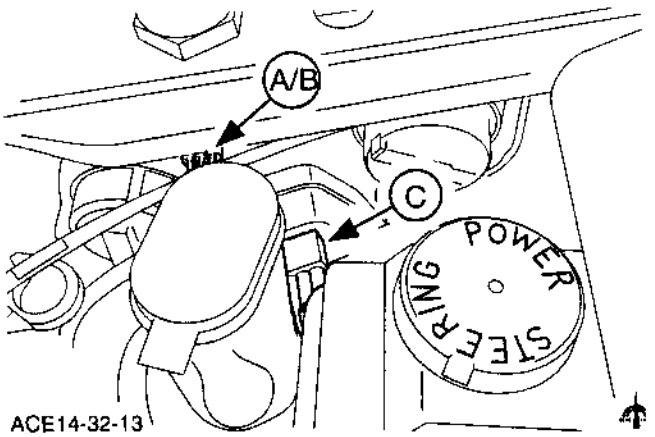


Fig.5. Multiplugs.
A - Headlamp
B - Auxiliary driving lamp
C - Headlamp levelling motor

14. Install the fog lamp as indicated in Operation 32 281 0.

15. Install the indicator lamp as indicated in Operation 32 225 0.

16. Check the operation of the headlamp, auxiliary driving lamp and fog lamp and align the beams as indicated in Operation 32 113 0 in the Escort/Orion '91 Service Microfiche or this Section.

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32 225 0 INDICATOR ASSEMBLY - FRONT - REMOVE AND INSTALL (One)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Insert a small insulated screwdriver at the top between the indicator and the retaining clip, Fig.1.
   Press the retaining clip up, Fig.2.(A), and pull out the indicator lamp.

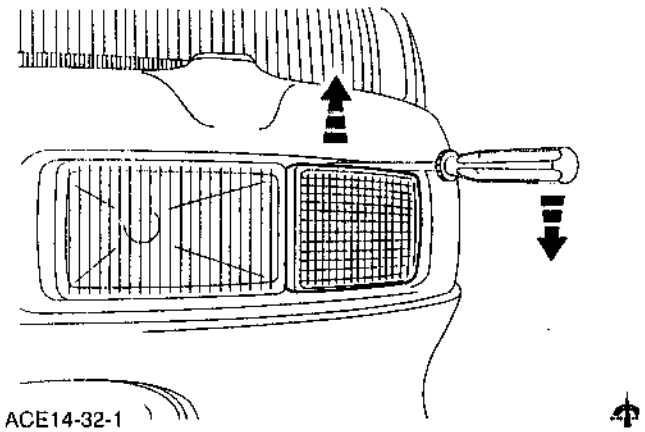


Fig.1. Remove indicator lamp.

2. Turn the bulb holder anti-clockwise and remove it from the housing, Fig.2.(B).

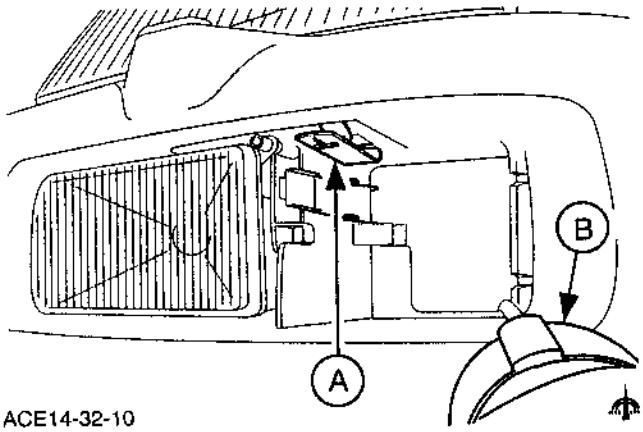


Fig.2. Indicator lamp removed.
A - Retaining clip
B - Bulb holder

To Install

3. Insert the indicator bulb holder and secure it by turning it clockwise.

4. Guide the indicator lamp into the bumper until the retaining clip engages.

5. Check the operation of the indicator lamp.

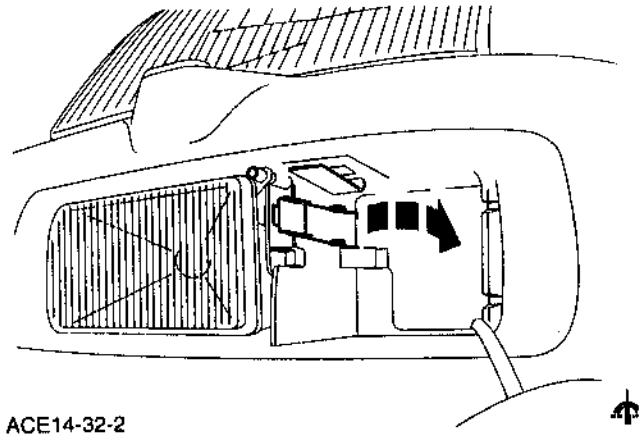
0392

32 281 0 LAMP ASSEMBLY - FOG - REMOVE AND INSTALL (One)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Remove the indicator lamp as indicated in Operation 32 225 0.
2. Swing the spring clip to the rear, Fig.1.
3. Swivel the fog lamp out on the spring clip side and pull it forwards.
4. Detach the bulb holder and remove the fog lamp.

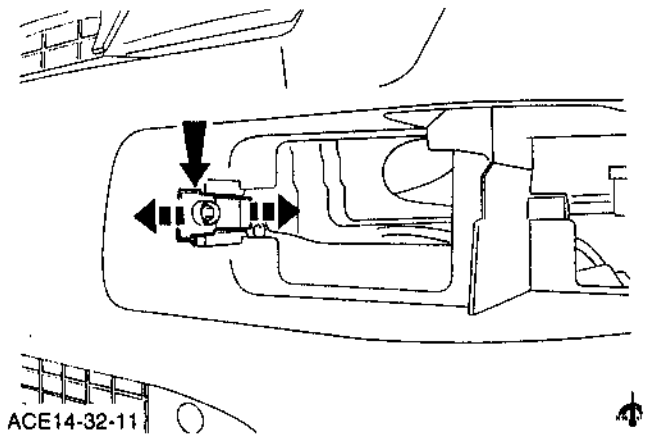


ACE14-32-2

Fig.1. Swing spring clip to the rear.

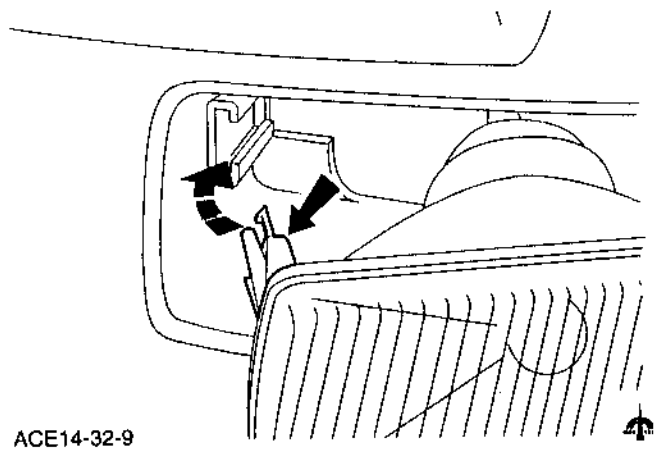
To Install

5. Remove the locating clip, Fig.2, and fit it on the fog lamp locating pin, Fig.3.
6. Fit the bulb holder.
7. Insert the fog lamp with the locating clip first.
8. Attach the spring clip to the body. Attach the fog lamp and swing it back into place.
9. Fit the indicator lamp as indicated in Operation 32 225 0.
10. Check the operation of the fog lamp and align the beams as indicated in Operation 32 113 0.



ACE14-32-11

Fig.2. Remove locating clip.



ACE14-32-9

Fig.3. Locating clip fitted to fog lamp.

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32 622 0 RESERVOIR - WINDSCREEN WASHER - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Drain the windscreen washer reservoir.

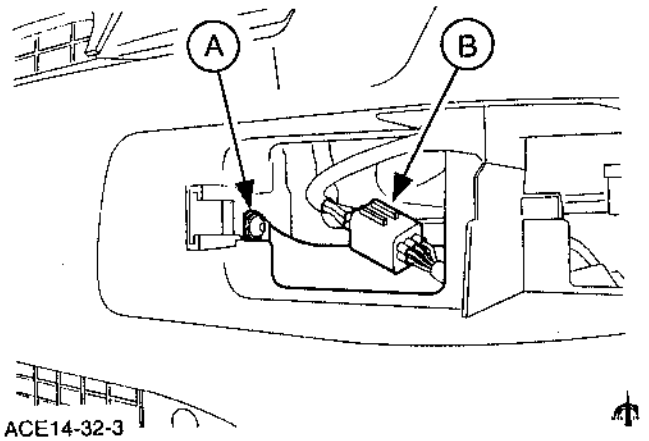


Fig.1. A - Reservoir retaining bolt
B - Multiplug of windscreen washer and headlamp washer pumps

2. Remove the left-hand indicator lamp as indicated in Operation 32 225 0.

3. Remove the left-hand fog lamp as indicated in Operation 32 281 0.

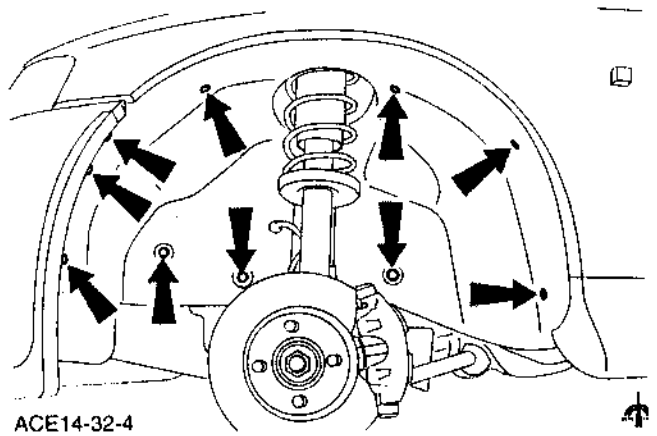


Fig.2. Wheelhouse cover retaining bolts.

4. Working through the opening for the fog lamp, Unscrew 1 reservoir retaining bolt and disconnect the multiplug from the windscreen washer and headlamp washer pumps, Fig.1.

5. Remove the left-hand wheelhouse cover: Unscrew the 10 Torx bolts and remove the wheelhouse cover, Fig.2.

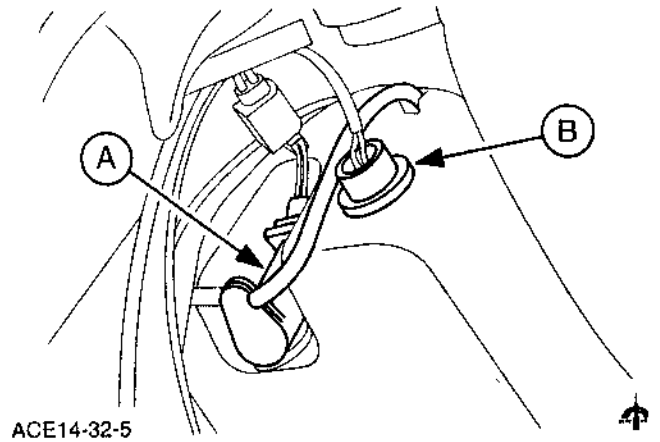


Fig.3. A - Windscreen washer pump
B - Switch for low fluid level

6. Withdraw the windscreen washer pump and the switch for low fluid level from the reservoir.

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7. Prise the headlamp wash pump out from above, Fig.4.

8. Unclip and release the hoses and wiring from the guides on the reservoir. Working from the wheelhouse, unscrew the 2 reservoir retaining bolts, Fig.5, and remove the reservoir.

9. Prise out the 3 rubber grommets.

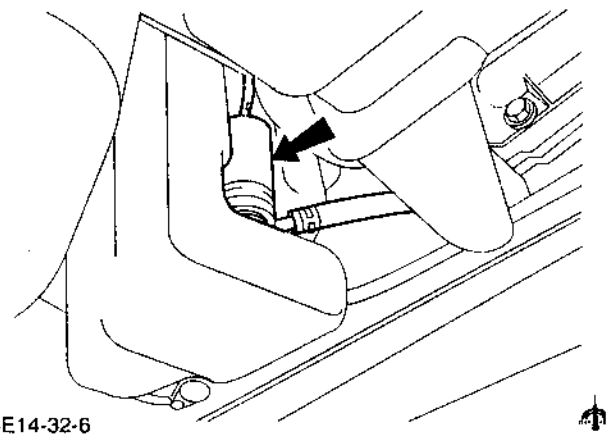


Fig.4. Headlamp wash pump.

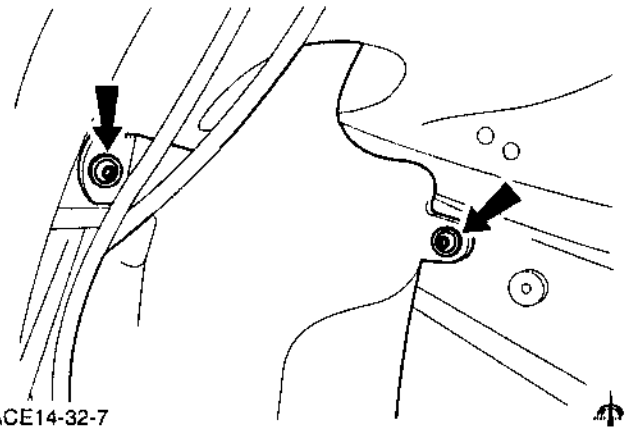


Fig.5. Reservoir retaining bolts in wheelhouse.

To Install

NOTE: Tighten to the torques specified in Technical Data.

10. Insert the 3 rubber grommets.

11. Locate the reservoir in position, working from the wheelhouse, screw in and tighten the 2 retaining bolts, Fig.5.
Run the wiring and hoses in the guides on the reservoir and clip them in place securely or secure them with adhesive tape.

12. Insert the headlamp wash pump, Fig.4.

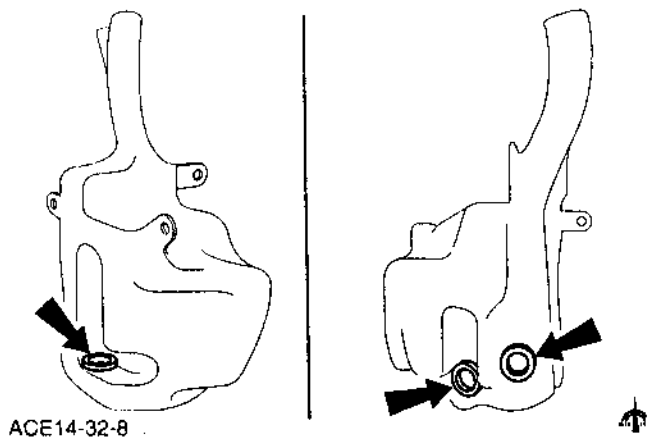


Fig.6. Rubber grommets. (reservoir removed)

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13. Insert the windscreen washer pump and the switch for low fluid level, Fig.7.

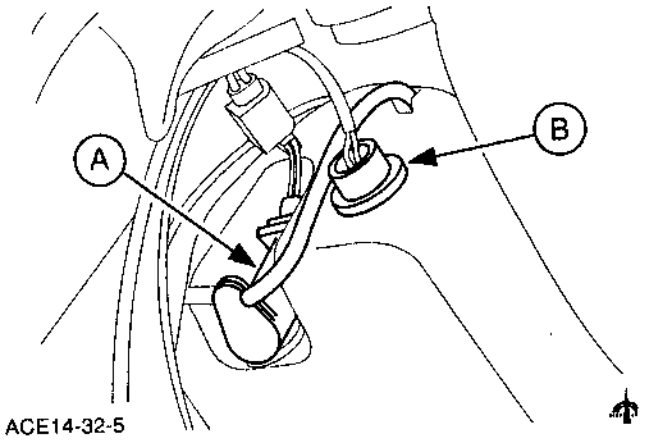


Fig.7. A - Windscreen washer pump
B - Switch for low fluid level

14. Fit the wheelhouse cover, Fig.8.

15. Screw in the third reservoir retaining bolt and connect the multiplug, Fig.9.

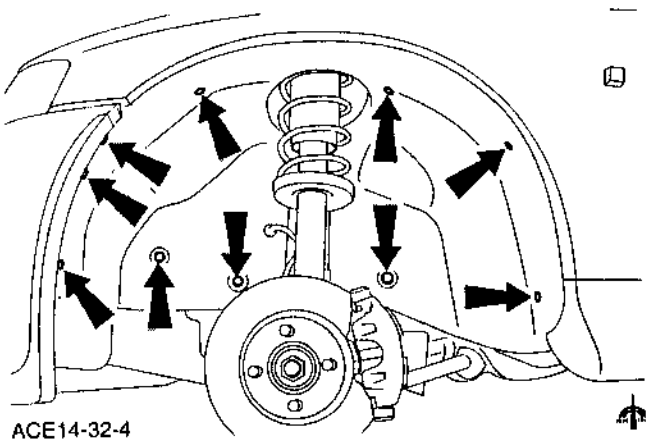


Fig.8. Wheelhouse cover retaining bolts.

16. Fit the fog lamp as indicated in Operation 32 281 0.

17. Fit the indicator lamp as indicated in Operation 32 225 0.

18. Fill the reservoir and check the operation of the windscreen and headlamp washers.

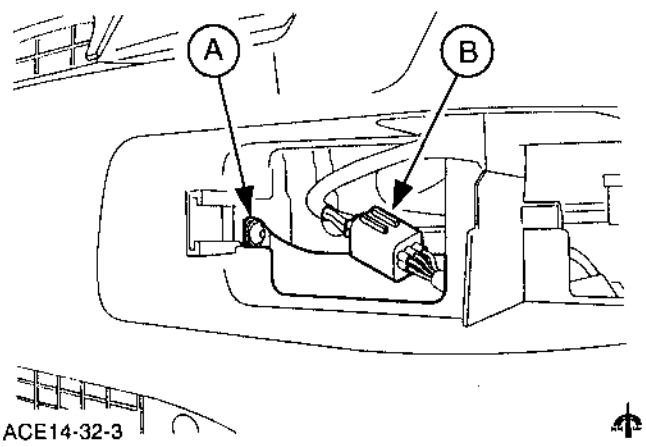


Fig.9. A - Reservoir retaining bolt
B - Multiplug of windscreen and headlamp washer pumps

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32 624 0 PUMP - WINDSCREEN WASHER - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Drain the windscreen washer reservoir.
2. Disconnect the multiplug from the windscreen washer pump, Fig.1.(A).
3. Disconnect the hoses from the windscreen washer pump, Fig.1.(B).
4. Withdraw the pump from the reservoir.
5. Prise the rubber grommets out of the reservoir.

To Install

6. Fit the rubber grommet in the reservoir.
7. Insert the pump.
8. Connect the hoses to the pump.
9. Connect the multiplug to the pump.
10. Fill the windscreen washer reservoir and check the operation of the windscreen washers.

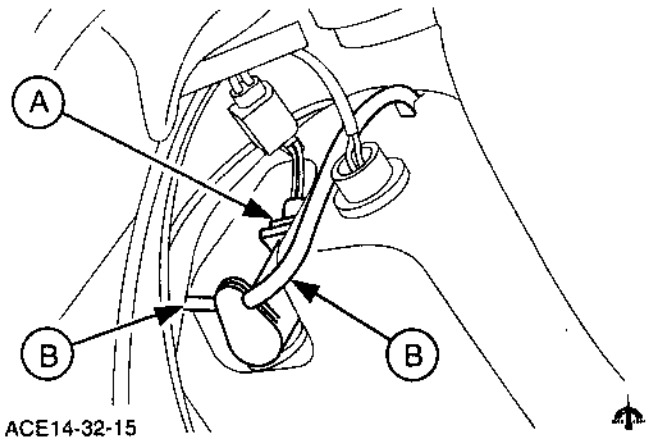


Fig.1. Windscreen washer pump.
A - Multiplug
B - Hoses

32 676 0 PUMP - HEADLAMP WASH - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Drain the windscreen washer reservoir.
2. Disconnect the multiplug from the headlamp wash pump, Fig.1.(A).
3. Disconnect the hose from the headlamp wash pump, Fig.1.(B).
4. Withdraw the pump from the reservoir.
5. Prise the rubber grommets out of the reservoir.

To Install

6. Fit the rubber grommet in the reservoir.
7. Fit the pump.
8. Connect the hose to the pump.
9. Connect the multiplug to the pump.
10. Fill the windscreen washer reservoir and check the operation of the headlamp washers.

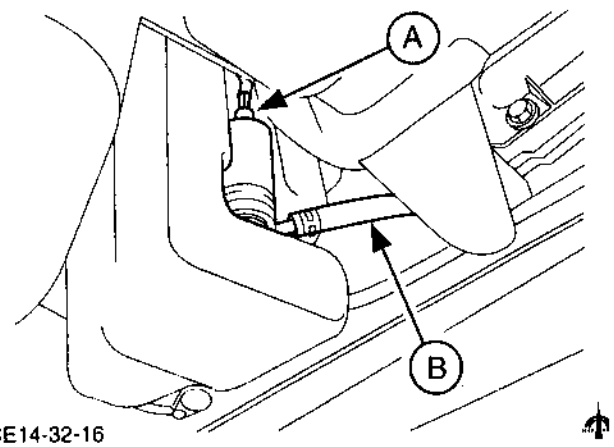


Fig.2. Headlamp wash pump.
A - Multiplug

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(ESCORT RS COSWORTH)

Service and Repair Operations	Contained in Operation	Page
33 314 0 Gauge - Oil Pressure - Remove and Install	33 340 0	
33 340 0 Gauge - Turbo Boost - Remove and Install	-	2
33 364 0 Indicator - Battery Condition - Remove and Install	33 340 0	

33 340 0 GAUGE - TURBO BOOST - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Insert a short screwdriver into slot located below the Cosworth logo and carefully pull trim cover away and remove, Fig.1.

   Remove retaining screw cover from upper crash pad, inset in Fig.1.

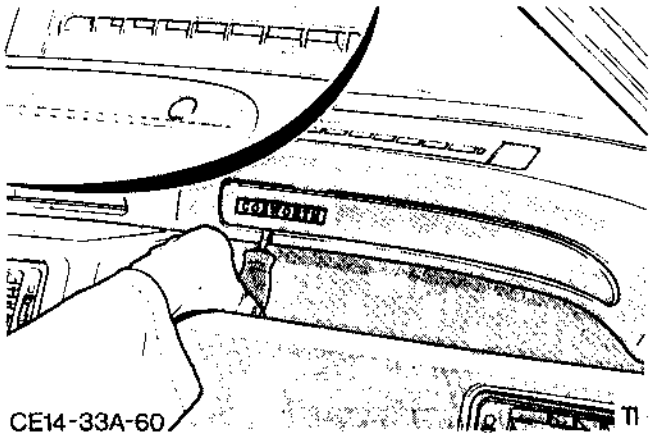


Fig.1. Trim cover removal.

2. Remove 4 retaining screws and carefully withdraw upper crash pad, Fig.2.

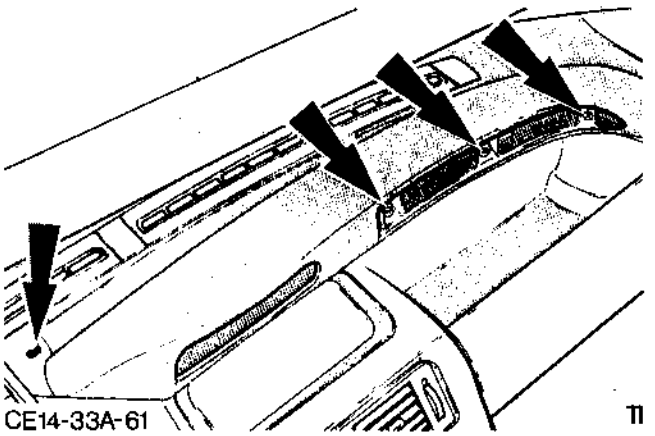


Fig.2. Upper crash pad retaining screws.

3. Remove vacuum pipe and pull multiplugs to disconnect gauges, Fig.3.

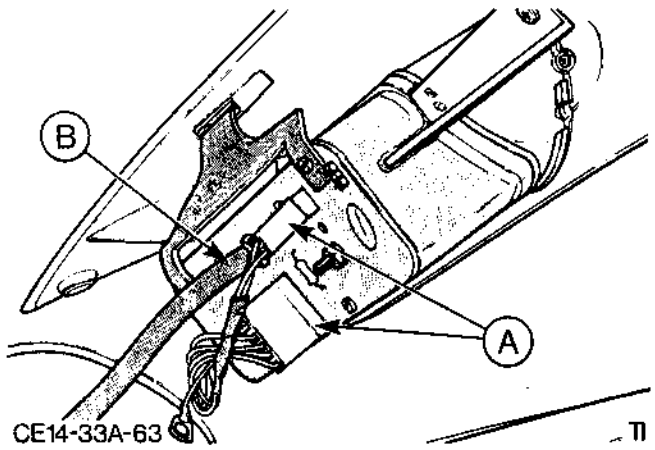


Fig.3. Gauge multiplugs (A) and vacuum tube (B).

4. Undo and remove 2 screws, detach and remove gauge assembly from upper crash pad, Fig.4.

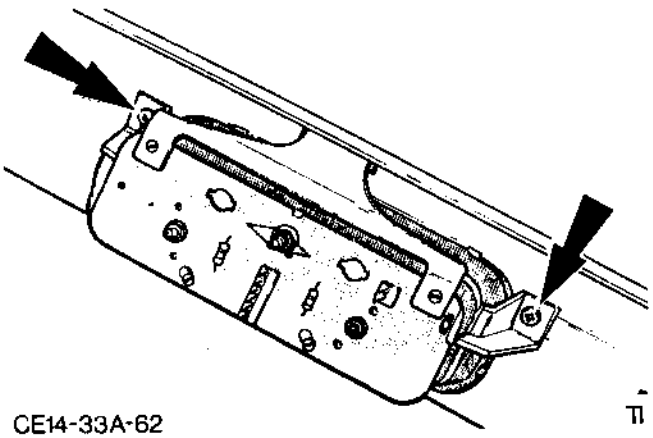


Fig.4. Gauge retaining screws.

To Install

5. Refit gauge assembly to upper crash pad and secure with 2 screws.

6. Reconnect gauges and vacuum tube.

7. Refit upper cash pad and secure with 4 retaining screws. Refit retaining screw cover.

8. Refit trim panel and push home to secure.

HEATING AND VENTILATION (Sierra) 34A

Index Page

SPECIAL SERVICE TOOLS REQUIRED: NONE

Service and Repair Operations		Contained in Operation	Page
*34 314 0	Heater Controls - Remove and Install	-	4
*34 354 0	Heater Assembly - Remove and Install	-	6
34 354 8	Heater Assembly - Dismantle and Reassemble (heater assembly removed)	-	7
34 374 0	Motor - Heater Fan - Remove and Install	-	9
*34 473 0	Hose - Demister - Remove and Install (Right)	34 354 0	
*34 487 0	Vent - Face Level - Remove and Install (Right)	-	10
*34 488 0	Vent - Face Level - Remove and Install (Left).	-	11
*34 489 0	Vent - Face Level - Remove and Install (Centre)	-	12
34 491 0	Hose - Vent - Rear Compartment - Remove and Install	-	13
34 491 0	Hose - Vent - Rear Compartment - Remove and Install (Heater removed)	34 491 0	

NOTE: The procedures listed above marked with an asterisk refer to Left Hand Drive vehicles. When carrying out repairs on Right Hand Drive vehicles any references to Left and Right within the text should be reversed. For example, Operation 34 314 0 sub operation 5 should read "Remove the side trim panel from the left hand footwell (2 screws)" when applied to a Right Hand Drive vehicle. In addition some illustrations within this section refer to Left Hand Drive vehicles.

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SERVICE AND REPAIR OPERATIONS

34 314 0 HEATER CONTROLS - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure applies to a LHD vehicle. Refer to the note on Page 1 before carrying out repairs on a RHD vehicle.

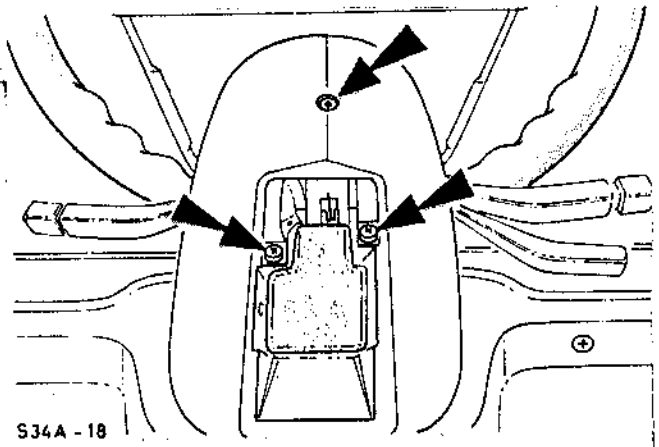


Fig.1. Detach the steering column lower shroud.

To Remove

1. Disconnect the battery earth cable.

2. Detach the steering column upper shroud (1 screw) and lower shroud (3 screws).

3. Carefully lever out the wiper delay control and instrument cluster light switches from the instrument cluster bezel, disconnect the plugs and remove the switches.

4. Remove the instrument cluster bezel (4 screws).

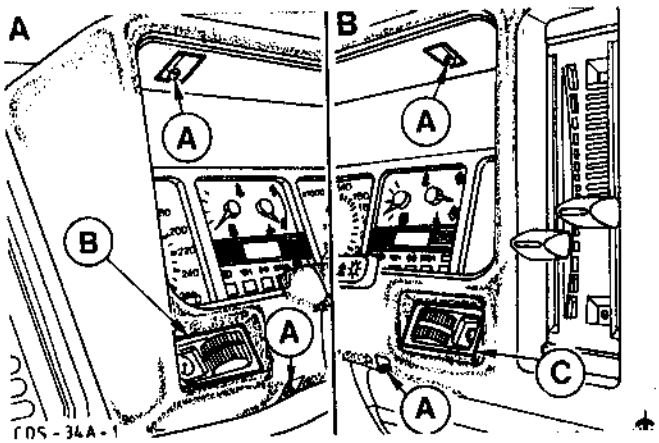


Fig.2. Instrument cluster bezel.

Fig.2. Instrument cluster bezel.
A - Retaining screws - instrument cluster bezel
B - Switch - instrument cluster light
C - Switch - wiper delay control

5. Remove the cowl side trim panel from the right hand footwell (2 screws). Detach under dash cover panel above the left hand footwell (2 clips).

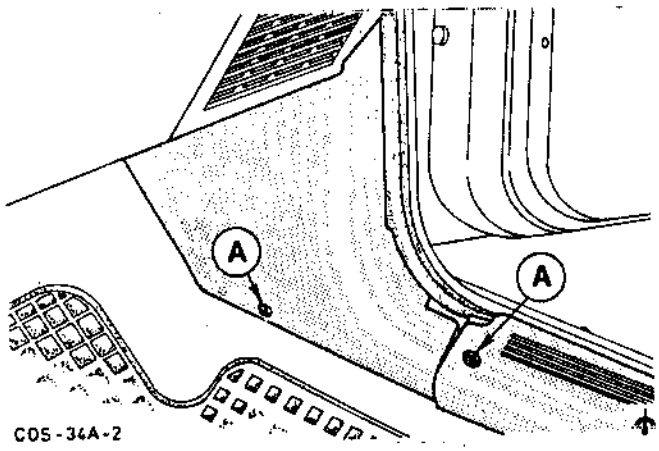


Fig.3. Cowl side trim panel - right hand footwell.
A - retaining screws

6. Release the right hand lower crash padding (8 cross head screws, 2 hex. head screws, washers and plate), draw it forwards and disconnect the heater fan switch, cigarette lighter, radio and glove compartment light. Remove the crash padding.

7. Pull off the two vent hoses on the left hand side of the heater.

8. Detach the lower ends of the two Bowden cables from the heater.

9. Unscrew the heater control unit (3 screws), slide it through and withdraw it downwards. Remove the bulb with its holder.

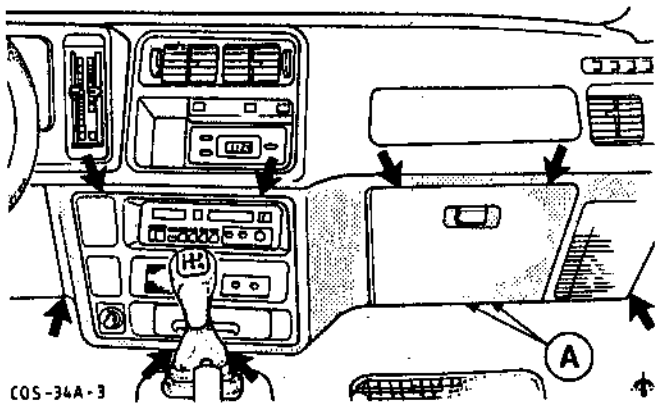


Fig.4. Right hand lower crash padding attachment.
A - Hex. head screws

To Install

10. Insert the bulb and holder in the heater control unit and fasten the heater control unit with the three screws.

11. Move the two control levers on the heater control unit to the 'up' position, attach the Bowden cables to the heater (the Bowden cable must project 0 - 4 mm out of the clip) and secure the cover.

NOTE: The Bowden cables are adjusted automatically at the heater control unit. To do this, move the levers on the heater control unit downwards from the upper stops. When this is done, an appreciable resistance may be encountered. This must be overcome.

12. Locate the right hand lower crash padding padding in position. Connect the heater fan switch, cigarette lighter, radio and glove compartment light. Secure the crash padding with ten screws.

13. Fit the cowl side trim panel in the right hand footwell.

14. Fit the under dash cover panel above the left hand footwell (2 clips).

15. Connect the plugs to the instrument cluster light and wiper delay control switches and install the switches.

16. Fit the instrument cluster bezel.

17. Install the steering column upper and lower shrouds.

18. Connect the battery earth cable.

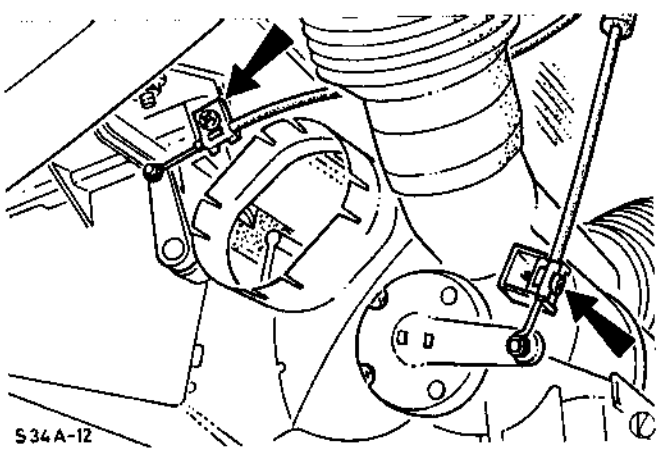


Fig.5. Detach Bowden cables from heater casing.

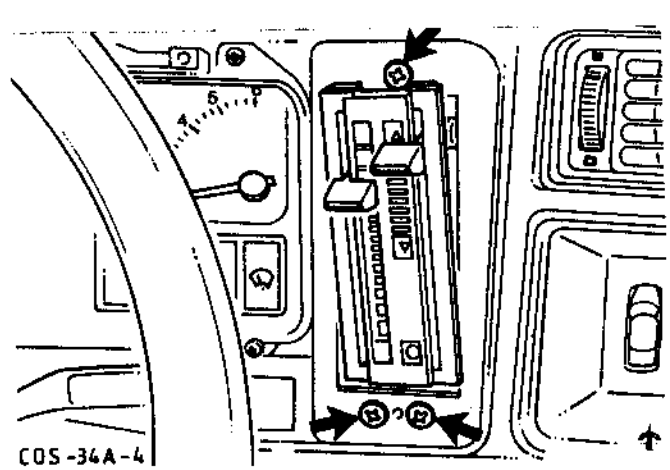


Fig.6. Screws securing heater control unit.

34 354 0 HEATER ASSEMBLY - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure applies to a LHD vehicle. Refer to the note on Page 1 before carrying out repairs on a RHD vehicle.

To Remove

1. Disconnect the battery earth cable.

2. In the engine compartment, detach the heater coolant hoses from the connectors on the heater radiator.

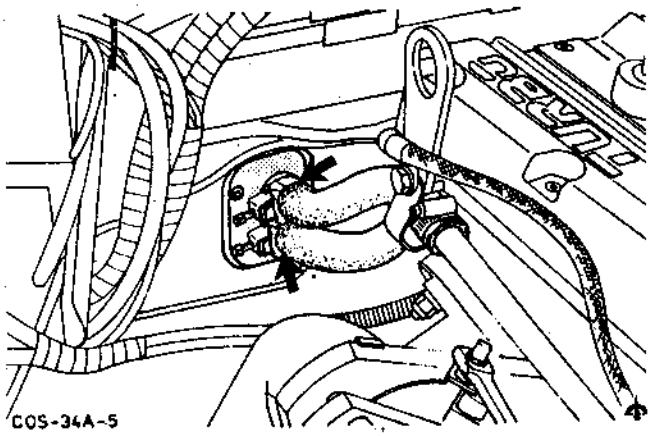


Fig.7. Heater radiator hoses.

NOTE: Collect the coolant in a tray. Secure the hoses in the engine compartment with the open ends raised.

3. Carefully blow compressed air through the heater radiator to remove the remaining coolant from the heater radiator.

4. Detach the cover plate and gasket from the bulkhead (2 screws).

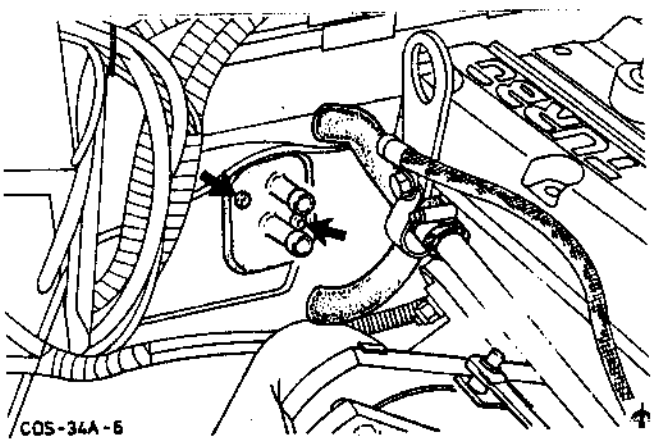


Fig.8. Bulkhead cover plate.

5. Unscrew the cowl side trim panel from the right hand footwell (2 screws). Detach the trim panel above the left hand footwell (2 clips).

6. Release the right hand lower crash padding (8 cross head screws, 2 hex. head screws, washers and plate), draw it forwards and disconnect the heater fan switch, cigarette lighter, radio and glove compartment light. Remove the crash padding.

7. Pull all five vent hoses off the heater and fan.

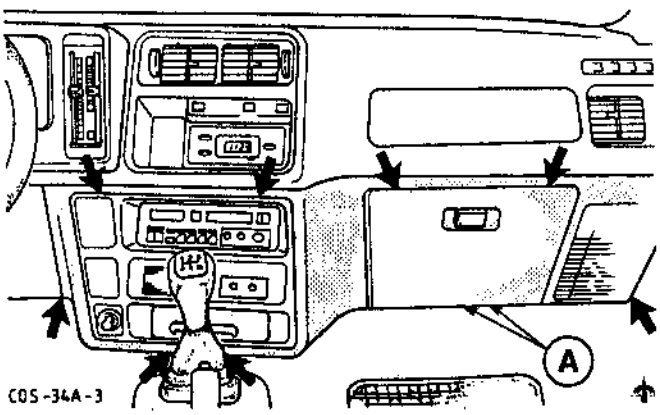


Fig.9. Right hand lower crash padding attachment.
A - Hex. head screws

8. Detach the two Bowden cables from the heater casing.

9. Unscrew the heater from the bulkhead (2 screws) and draw it back towards the interior until the water connectors on the heater radiator are clear. Then remove the heater assembly towards the right.

To Install

10. Fit the heater assembly on the bulkhead from the right and secure it with two screws.

NOTE: Before securing the heater assembly, make sure that the foam gasket and the heater assembly are located correctly on the bulkhead.

11. Attach the two Bowden cables to the heater casing. Move the control levers to the 'up' position, connect the cables and secure the covers.

NOTE: The Bowden cables are adjusted automatically at the heater control unit. To do this, move the two levers on the control unit downwards from the upper stops. When this is done an appreciable resistance may be encountered. This must be overcome.

12. Attach all five hoses to the casing.

13. Locate the right hand lower crash padding in position. Connect the fan switch, cigarette lighter, radio and glove compartment light. Secure the crash padding with the ten screws.

14. Secure the cowl side trim panel in the right hand footwell with the 2 screws.

15. Fit the under dash cover panel above the left hand footwell (2 clips).

16. Slide the cover plate and gasket over the water connectors on the heater radiator and screw it to the bulkhead. Attach the coolant hoses.

17. Fill the cooling system and connect the battery. Run the engine, vent the system and check the coolant connections for leaks.

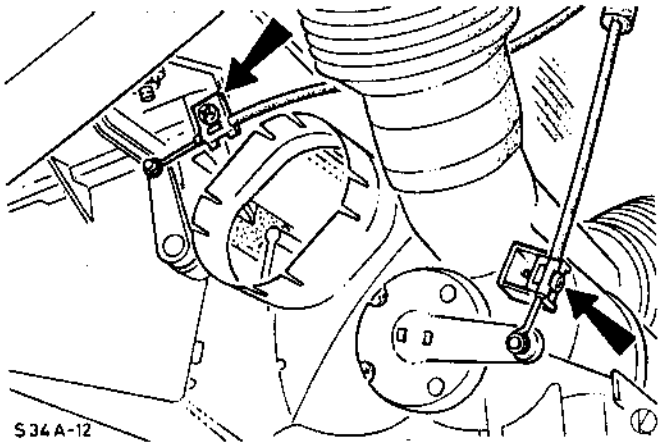


Fig.10. Detach Bowden cables from heater casing.

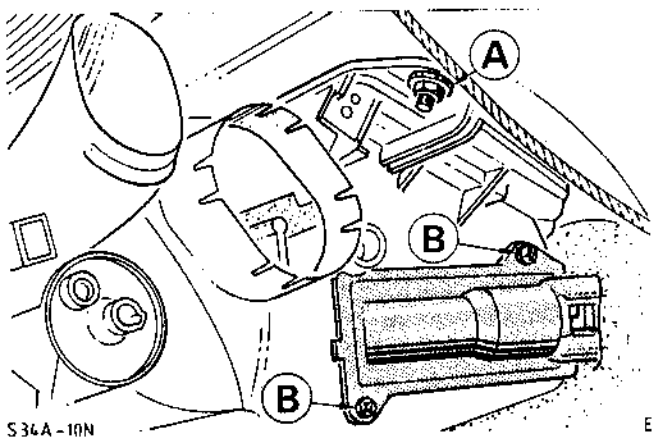


Fig.11. Detach heater assembly from bulkhead (screws A).
Remove heater radiator (screws B).

34 354 8 HEATER ASSEMBLY - DISMANTLE AND REASSEMBLE (heater assembly removed)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Dismantle

1. Remove the heater radiator from the heater casing (2 screws).

2. Cut the casing gasket with a knife. Prise off the retaining clips with a suitable screwdriver and separate the casing halves using a second screwdriver. Withdraw the lower part of the casing to the side.

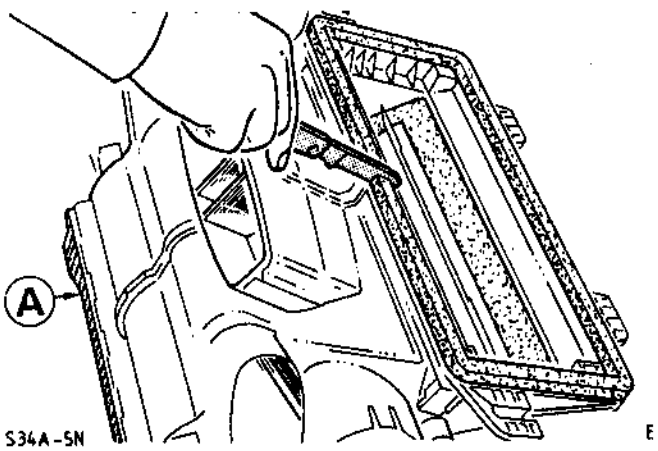


Fig.12. Cut gasket.
A - Lower part of casing

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34 354 8

3. Remove the air flap valves and remove the control levers from the casing half.

NOTE: The control lever for the UP/DOWN adjustment can only be removed when the marks line up.

NOTE: The cross marks are for right hand drive vehicles.

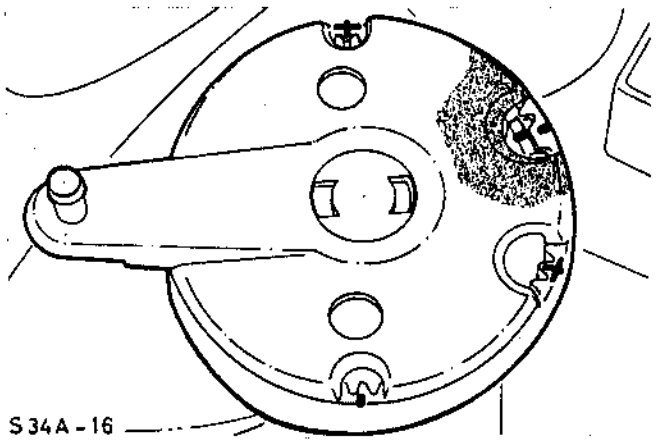


Fig.13. Position of control lever on removal.

To Reassemble

4. Install the control lever for the UP/DOWN adjustment. Note the mark on the toothed segments.

5. Fit the other control lever and the air flap valves in the casing.

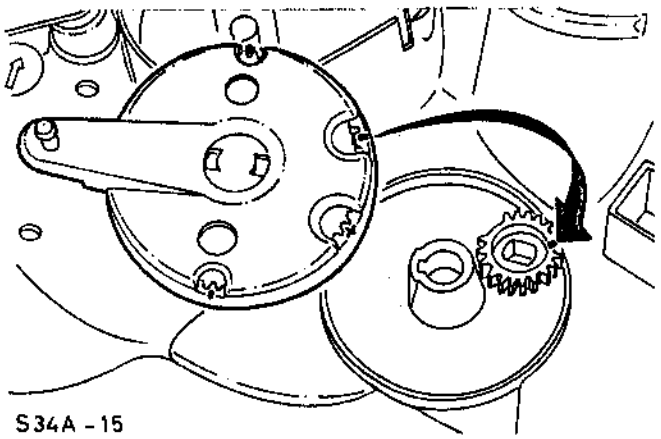


Fig.14. Fit control lever.

6. Slide the lower part of the casing sideways into the casing guides.

7. Assemble the two casing halves and secure them with additional clips.

NOTE: The lower part must be slid in correctly in the two casing halves.

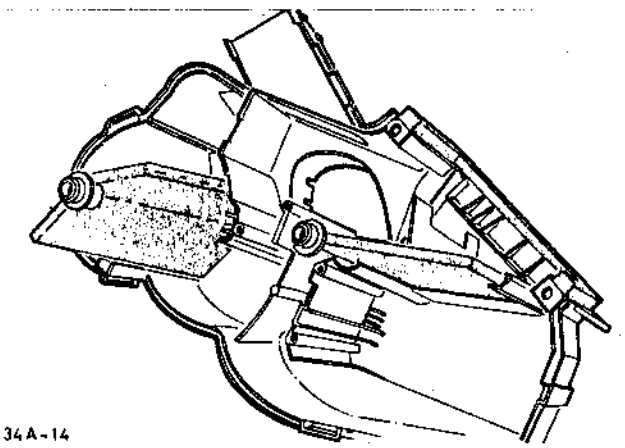


Fig.15. Position of air flap valves on installation.

8. Install the heater radiator (2 screws).

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34 374 0 MOTOR - HEATER FAN - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.
2. Pull the rubber gasket of the plenum chamber off the bulkhead (not fixed).
3. Remove the windscreen washer hoses and wiring from the heater fan cover and secure them to the bodywork. Detach the heater fan cover (2 screws).
4. Disconnect the plug from the resistor assembly and unscrew the earth cable.
5. Unscrew the fan and remove it.
6. Unclip the casing halves.
7. Open the motor retaining strap with a drift. Detach the wiring from the resistor assembly and remove the motor and fan wheels from the casing.

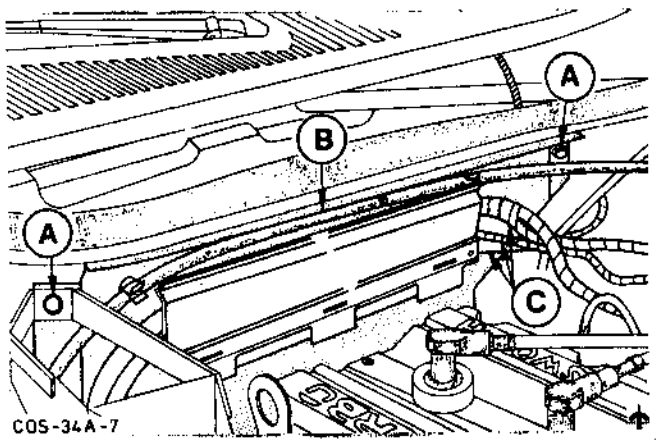


Fig.16. A - Fan motor cover
B - Windscreen washer hose
C - Wiring

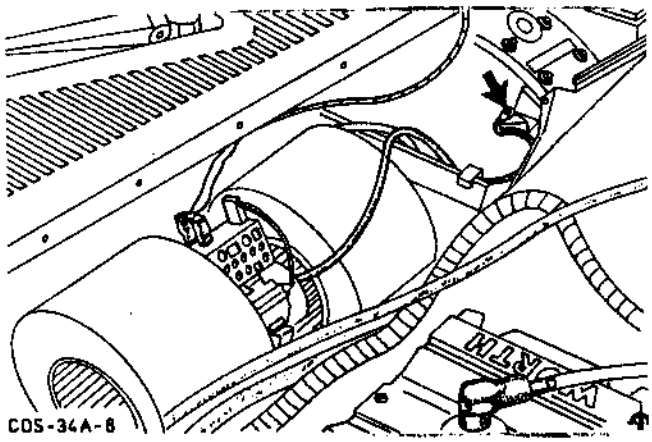


Fig.17. Fan motor earth cable attachment.

To Install

8. Insert the motor and fan wheels in the casing and secure the resistor assembly with the strap. Connect the wiring to the motor.
9. Fit the two casing halves and secure them with additional clips.
10. Install the fan assembly and secure it.
11. Connect the plug to the resistor assembly and attach the earth cable.
12. Screw the cover in place, attach the wiring and hoses and fit the rubber gasket.
13. Connect the battery earth cable.

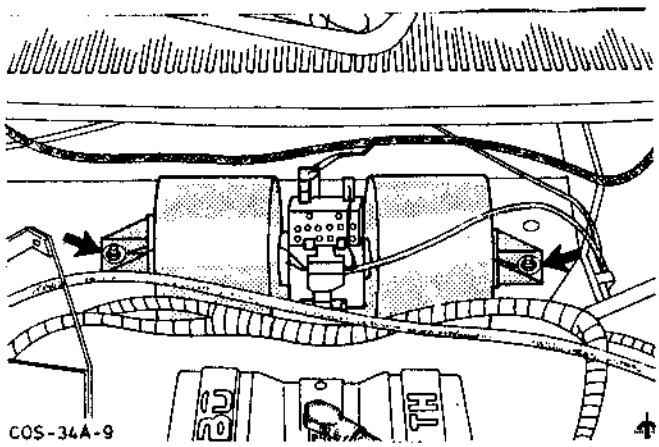


Fig.18. Fan assembly attachment.

34 487 0 VENT - FACE LEVEL - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure applies to a LHD vehicle. Refer to the note on Page 1 before carrying out repairs on a RHD vehicle.

To Remove

1. Disconnect the battery earth cable.

2. Unscrew the cowl side trim panel in the right hand footwell (2 screws).

3. Release the right hand lower crash padding (8 cross head screws, 2 hex. head screws, washers and plate), draw it forwards and disconnect the heater fan switch, cigarette lighter, radio and glove compartment light. Remove the crash padding.

4. Pull the hose off the vent nozzle. From the back, press the lower retaining clip out of the retaining slot with a screwdriver or by hand and remove the vent nozzle from the front.

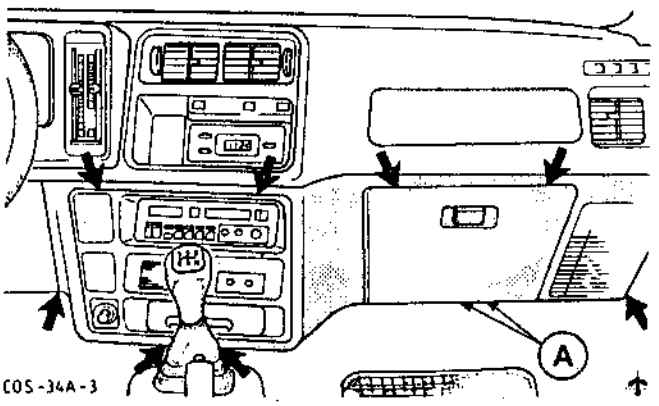


Fig.19. Right hand lower crash padding attachment.
A - Hex. head screws

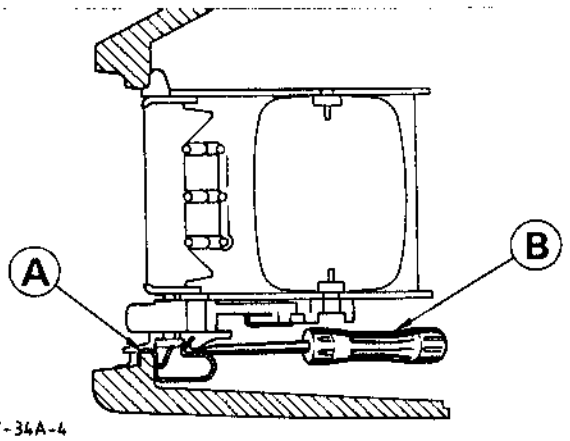


Fig.20. Vent nozzle (sectional drawing).
A - Retaining clip
B - Screwdriver

To Install

5. Insert the lower retaining clip in the vent nozzle slot, insert the nozzle, engage the retaining spring from the back with a screwdriver and simultaneously press the nozzle into place from the front. Attach the vent hose.

6. Locate the crash padding in position. Connect the fan switch, cigarette lighter, radio and glove compartment light. Secure the crash padding with ten screws.

7. Secure the cowl side trim panel in the right hand footwell with two screws.

8. Connect the battery earth cable.

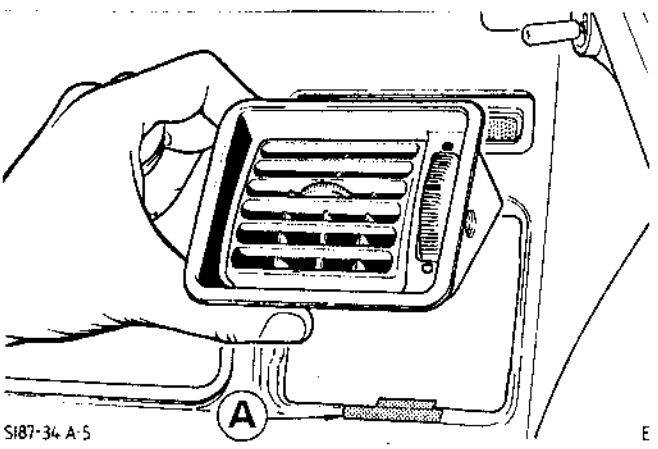


Fig.21. Insert vent nozzle.
A - Retaining clip

34 488 0 VENT - FACE LEVEL - REMOVE AND INSTALL (Left) with switch mounting

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure applies to a LHD vehicle. Refer to the note on Page 1 before carrying out repairs on a RHD vehicle.

To Remove

1. Disconnect the battery earth cable.
2. Unscrew the lower steering column shroud.
3. Unscrew the left hand lower cowl side trim panel.
4. Detach the under dash cover panel from above the left hand footwell (2 clips). Unscrew the lower left hand crash padding (4 screws).
5. Pull the hose off the vent nozzle.
6. Pull the push button switch out towards the front and disconnect the multiplug. Note the colour of the plug and the associated push button switch symbol.
7. Unscrew the vent nozzle with mounting (2 screws).

NOTE: The left hand vent nozzle is secured at the top with two screws. The screws are located on the back of the nozzle.

To Install

8. Insert the nozzle, engaging the lower retaining lugs, press the nozzle in and secure it with the two screws at the top.
9. Connect the multiplug to the push-button switch and press in the switch.
10. Attach the vent hose, simultaneously pressing against the vent nozzle from the front.
11. Fit the lower left hand crash padding. Fit the under dash cover panel above the footwell.
12. Secure the cowl side trim panel in the left hand footwell with two screws.
13. Fit the lower steering column shroud.
14. Connect the battery earth cable.

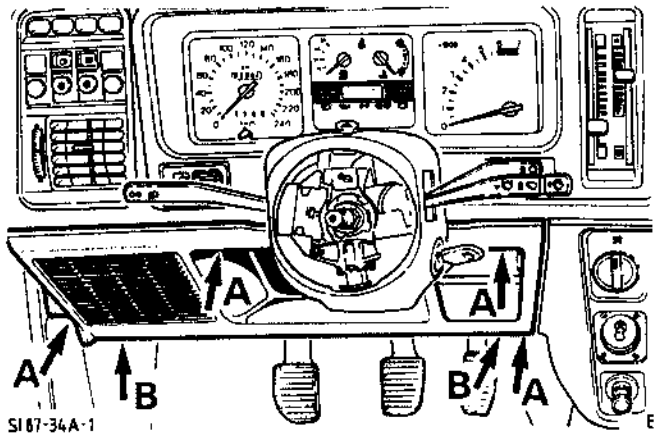


Fig.22. Left hand lower crash padding (with steering wheel removed for clarity).
A - 4 screws B - 2 clips

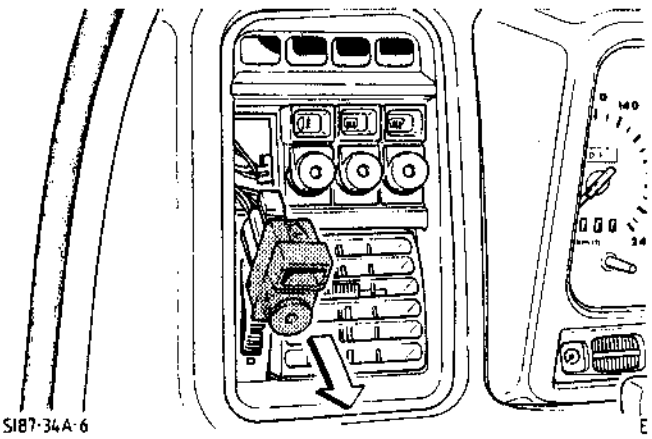


Fig.23. Pull the push button switch forwards and disconnect it.

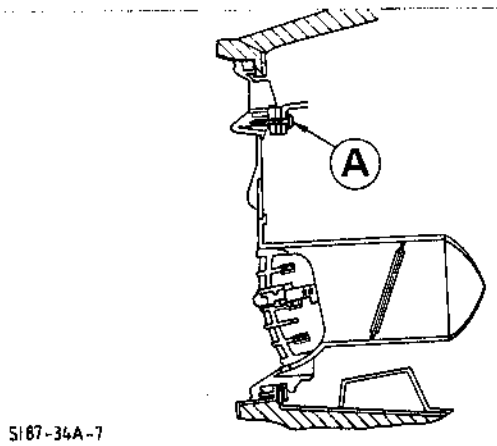


Fig.24. Vent nozzle (sectional diagram).
A - Retaining screw

34 489 0 VENT - FACE LEVEL - REMOVE AND INSTALL (Centre)

SPECIAL SERVICE TOOLS REQUIRED: NONE

NOTE: This procedure applies to a LHD vehicle. Refer to the note on Page 1 before carrying out repairs on a RHD vehicle.

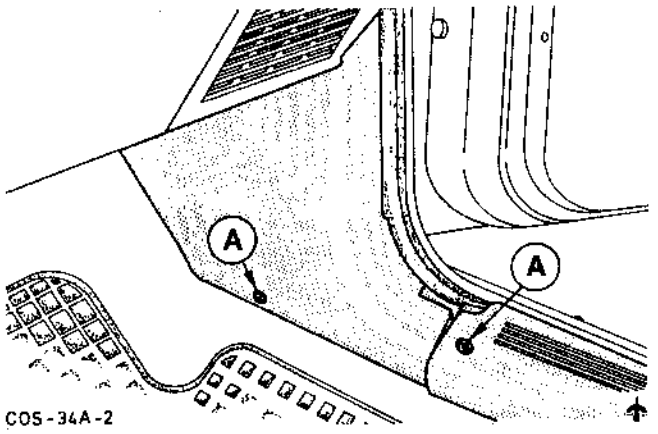


Fig.25. Cowl side trim panel - right hand footwell.
A - Retaining screws

To Remove

1. Disconnect the battery earth cable.
2. Unscrew the cowl side trim panel in the right hand footwell (2 screws).
3. Release the right hand lower crash padding (8 cross head screws, 2 hex. head screws, washers and plate) draw it forward and disconnect the heater fan switch, cigarette lighter, radio and glove compartment light. Remove the crash padding.
4. Pull the vent hose off the nozzle. With a screwdriver lever the left and right hand side retaining clips out of the retaining slot and withdraw the nozzle.

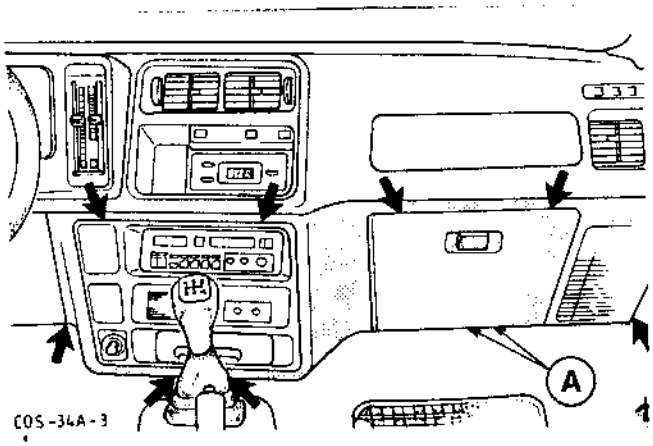


Fig.26. Right hand lower crash padding attachment.
A - Hex. head screws

To Install

5. Insert the retaining clips in the vent nozzle cut-out, insert the vent nozzle, from the rear press the retaining clips into the retaining slot with a screwdriver. Connect the vent hose.
6. Locate the crash padding in position. Connect the fan switch, cigarette lighter, radio and glove compartment light. Secure the crash padding with ten screws.
7. Secure the cowl side trim panel in the right hand footwell with two screws.
9. Connect the battery earth cable.

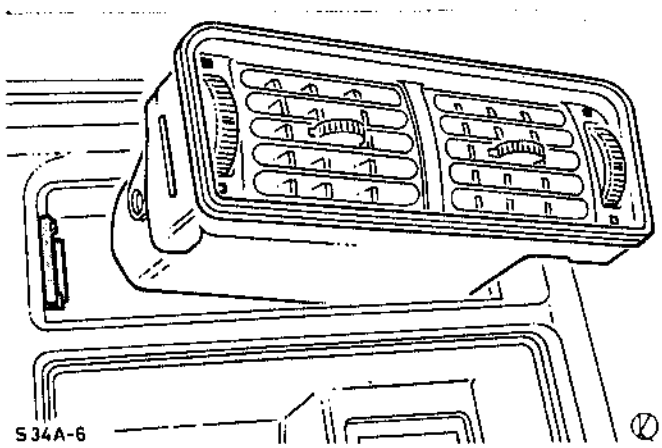


Fig.27. Remove centre vent nozzle.

34 491 0 HOSE - VENT - REAR COMPARTMENT - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.

2. Release the centre console tray at the front (3 screws). Disconnect the switches from the electrically operated windows and remove the tray.

   Remove the cassette compartment (2 screws), unscrew the arm rest (4 screws) and then remove the centre console (6 screws).

3. Unscrew the five bolts securing the front seat and remove the seat.

4. Unscrew the front scuff plate (2 screws), remove the cowl side trim panel in the footwell (1 screw) and remove the trim panel above the footwell (2 clips).

5. Fold the carpet back. Undo the screw securing the rear compartment vent hose to the rear footwell (1 screw), remove the clip securing the hose to the heater assembly and withdraw the hose.

To Install

6. Fit the rear compartment vent hose to the rear footwell and secure it with the clip and the screw. Relay the carpet.

7. Fit the footwell trim panel, the cowl side trim panel in the footwell and the scuff plate.

8. Install the front seat (5 bolts).

9. Install the centre console (6 screws), fit the arm rest (2 screws), fit the cassette compartment (2 screws). Fit the tray with the three screws, connecting the switches of the electrically operated windows.

10. Connect the battery earth cable.

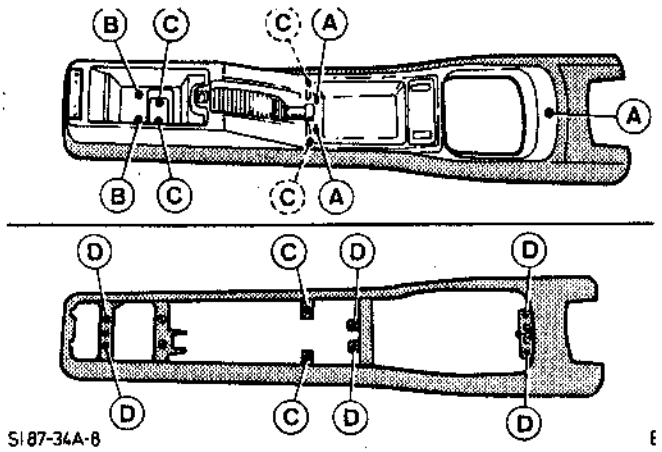


Fig.28. Screws securing centre console.
A - Tray (3) B - Cassette compartment (2)
C - Arm rest (4) D - Centre console (6)

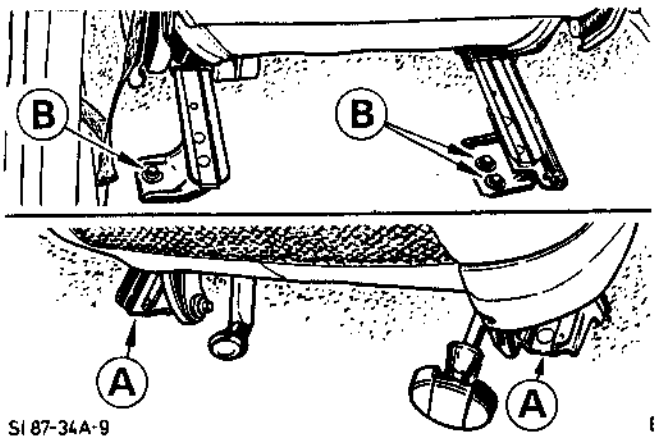


Fig.29. Remove front seat.
A - 2 bolts in footwell at front (hidden)
B - 3 bolts in footwell at rear

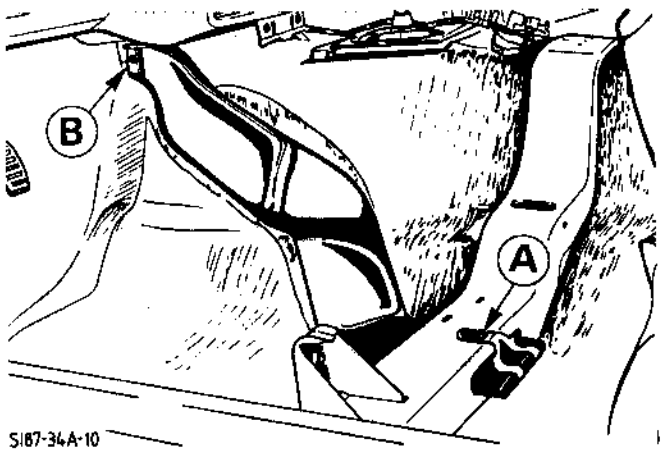


Fig.30. Remove vent hose to rear footwell.
A - Retaining screw
B - Retaining clip

HEATING AND VENTILATION (Escort) 34B

Index Page

SPECIAL SERVICE TOOLS REQUIRED: NONE

Service and Repair Operations	Contained in Operation	Page
34 374 0 Motor - Heater Fan - Remove and Install	-	3
34 382 0 Resistor - Heater Fan Motor - Replace	-	6

For Service and Repair Operations not listed here, please refer to the Escort/Orion '91 Service Microfiche.

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TECHNICAL DATA — Heating and Ventilation

Tightening Torques	Nm
Hose clips of heater hoses	3 to 4
Coolant drain plug	1,2 to 1,5
Fan motor to shroud	8 to 10
Fan motor earth cable to shroud	3
Shroud to radiator	3,0 to 5,0
Radiator to front crossmember	19,5 to 26,5
Heater housing to body	7,0 to 11,0
Heater radiator to heater housing	1,0 to 1,4

Fill Capacities	
Coolant	7,5 litres

0392

34 374 0 MOTOR - HEATER FAN - REMOVE AND INSTALL

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.

2. Remove the air plenum chamber seal, Fig.1.(A).

Fig.1. Bulkhead cover.
A - Seal
B - Cable ties
C - Rubber grommet
D - Hexagon bolts
E - Torx bolts

3. Cut the cable ties, Fig.1.(B), and detach the wiring loom from the bulkhead cover.

4. Pull the rubber grommet and wiring loom out of the bulkhead cover, Fig.1.(C).

NOTE: Do not detach the speedometer drive cable.

5. Detach the cover from the bulkhead (8 bolts), Fig.1.(D,E), pull it forwards and place it on the engine.

6. Withdraw the heater fan cover from the guides and remove it, Fig.2.

7. Disconnect the multiplug from the fan motor resistor and unscrew the earth cable from the body. Detach the heater fan from the cowl panel (2 nuts) and remove it from the air plenum chamber, Fig.3.

Fig.3. Heater fan.
A - Multiplug of fan motor resistor
B - Retaining nuts
C - Earth cable

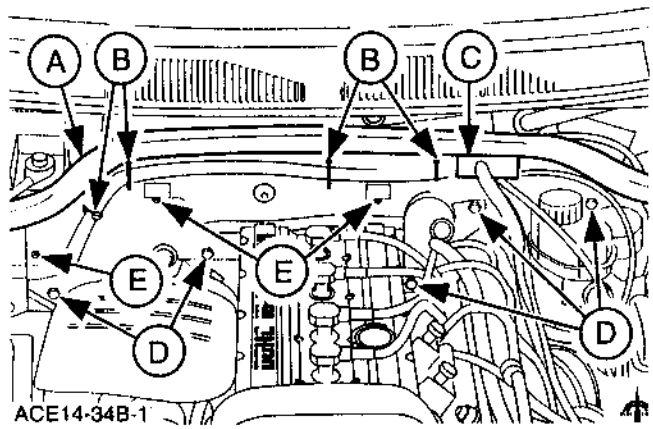


Fig.1. Bulkhead cover.

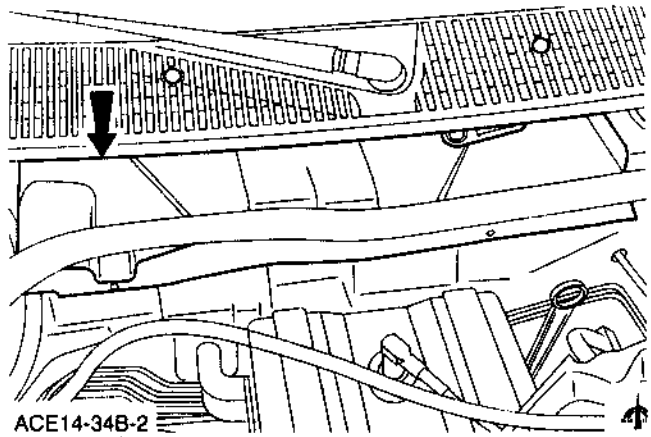


Fig.2. Heater fan cover.

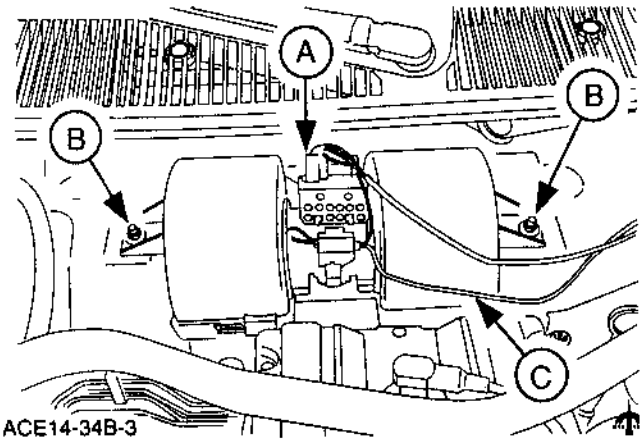


Fig.3. Heater fan.

0392

8. Detach the 2 heater fan housing covers. If necessary, remove the retaining clips (4) and release the retaining lugs using a punch, Fig.4.(A,B).

Fig.4. Heater fan removed
A - Retaining clips
B - Retaining lugs
C - Plug of fan motor resistor

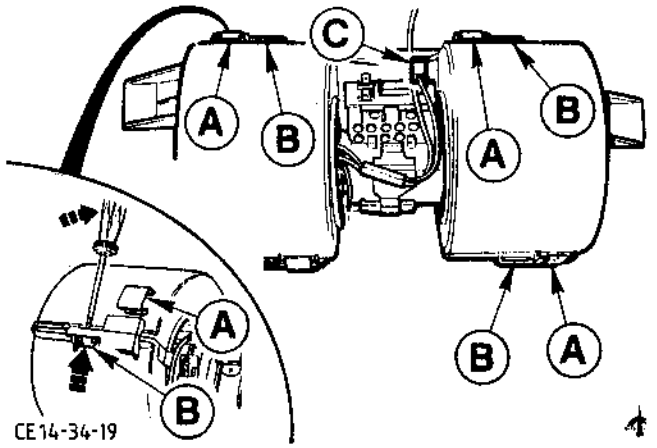


Fig.4. Heater fan removed.

9. Disconnect the plug from the fan motor resistor, Fig.4.(C). Bend up the retaining strap using a screwdriver and pull it off the fan motor with the resistor, Fig.5.(B,C).

10. Remove the fan motor from the housing, Fig.5.(A).

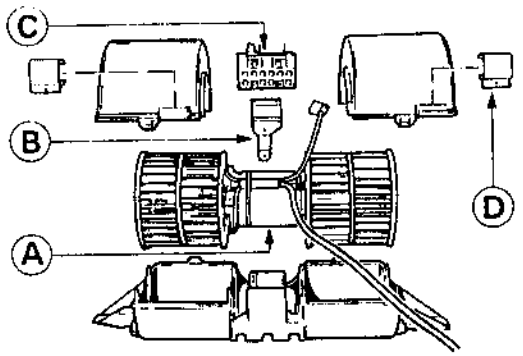


Fig.5. Heater fan - exploded view.
A - Fan motor
B - Retaining strap
C - Resistor
D - Retaining clips

To Install

11. Fit the fan motor in the housing, Fig.5.(A).

12. Fit the resistor and the retaining strap over the fan motor and secure it, Fig.5.(B,C). Connect the plug to the fan motor resistor, Fig.4.(C).

13. Fit the 2 heater fan housing covers and secure them with retaining clips, Fig.4.(A).

NOTE: The retaining lugs must engage, Fig.4.(B).

14. Fit the heater fan in the air plenum chamber and secure it to the cowl panel. Connect the multiplug to the fan motor resistor and screw the earth cable to the body, Fig.6.

Fig.6. Heater fan.
A - Multiplug of fan motor resistor
B - Retaining nuts
C - Earth cable

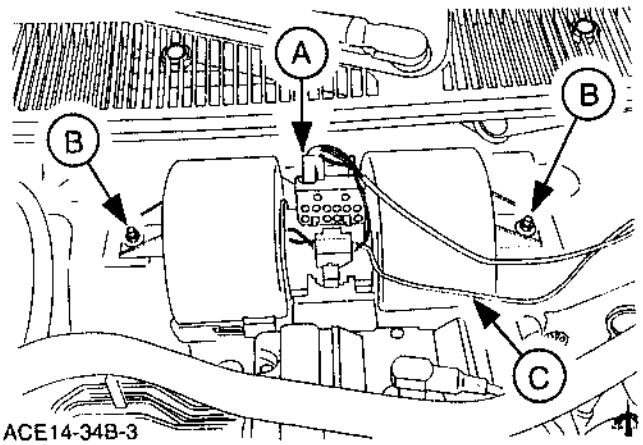


Fig.6. Heater fan.

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15. Fit the heater fan cover in the guides, Fig.7.

16. Fit the cover to the bulkhead, Fig.8.(D,E).

17. Fit the rubber grommet with the wiring loom, Fig.8.(C).

18. Tie the wiring loom to the bulkhead cover, Fig.8.(B).

19. Fit the air plenum chamber seal, Fig.8.(A).

20. Connect the battery earth cable.

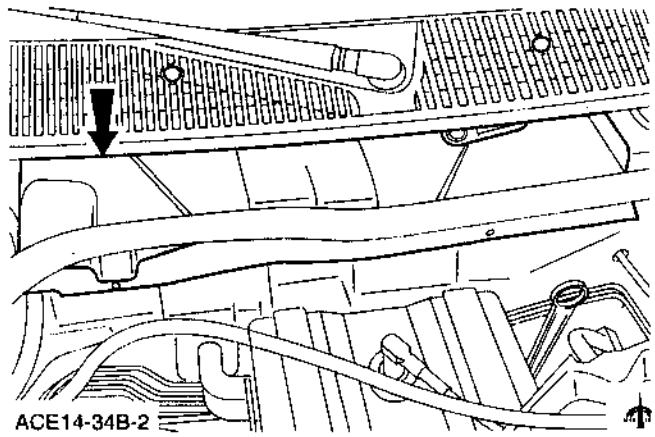


Fig.7. Heater fan cover.

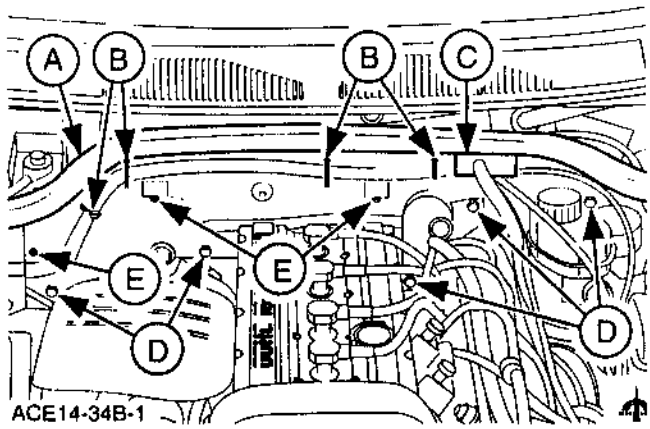


Fig.8. Bulkhead cover.
A - Seal
B - Cable ties
C - Rubber grommet
D - Hexagon bolts
E - Torx bolts

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34 382 0 RESISTOR - HEATER FAN MOTOR - REPLACE

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Disconnect the battery earth cable.
2. Remove the air plenum chamber seal, Fig.1.(A).

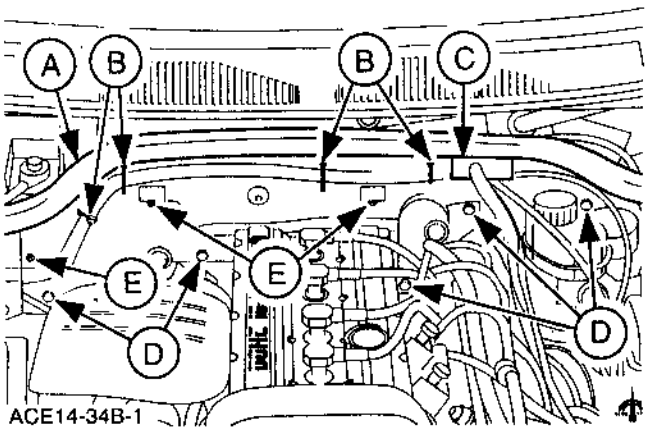


Fig.1. Bulkhead cover.
A - Seal
B - Cable ties
C - Rubber grommet
D - Hexagon bolts
E - Torx bolts

3. Cut the cable ties, Fig.1.(B), and detach the wiring loom from the bulkhead cover.
4. Withdraw the rubber grommet and the wiring loom from the bulkhead cover, Fig.1.(C).

NOTE: Do not detach the speedometer drive cable.

5. Detach the cover from the bulkhead (8 bolts), Fig.1.(D,E), pull it forwards and place it on the engine.
6. Withdraw the heater fan cover from the guides and remove it, Fig.2.
7. Disconnect the plug and the multiplug from the fan motor resistor. Lift the retaining tabs of the retaining strap slightly with a screwdriver and detach the resistor, Fig.3.

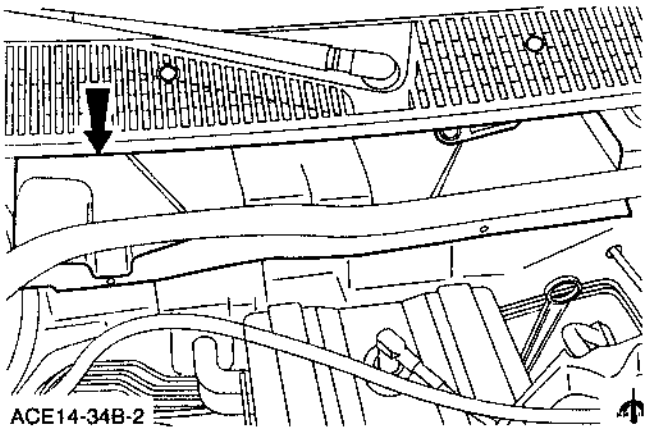


Fig.2. Heater fan cover.

To Install

8. Fit the resistor to the fan motor and fit it to the retaining strap. Connect the plug and the multiplug to the fan motor resistor, Fig.3.

NOTE: The resistor must engage in the retaining strap retaining tabs.

9. Fit the heater fan cover in the guides, Fig.2.
10. Fit the cover to the bulkhead, Fig.1.(D,E).
11. Fit the rubber grommet with the wiring loom, Fig.1.(C).
12. Tie the wiring loom to the bulkhead cover, Fig.1.(B).
13. Fit the air plenum chamber seal, Fig.1.(A).
14. Connect the battery earth cable.

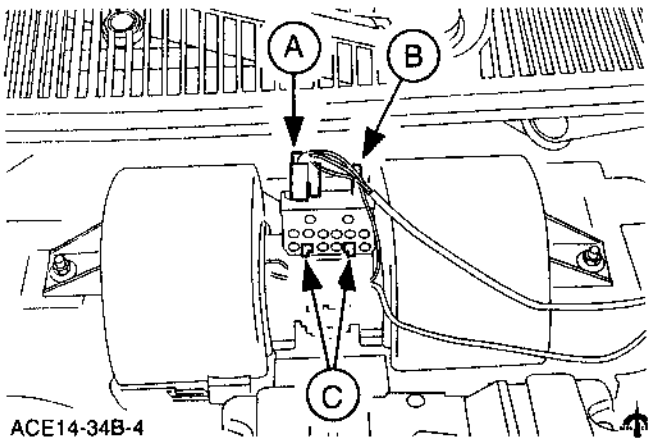


Fig.3. Fan motor resistor.
A - Multiplug
B - Plug
C - Retaining strap retaining tabs

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INTERIOR AND EXTERIOR TRIM 43

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TECHNICAL DATA

Tightening Torques:	Nm	lbf.ft
Rear bumper to body bolts	21	15,5
Rear bumper bracket to bumper	21	15,5
Front bumper bracket to bumper	21	15,5
Front bumper lock screw	21	15,5

Adhesives & Primers:	Part Number
Double sided adhesive tape - Bumper moulding (12 mm wide) ..	ESK-M3G-134A
Primer - Double sided tape - Bumper moulding	ESK-M2G-264A
Double sided adhesive tape - Headlining	A73SX-369503-AA

Rear bumper bracket - initial setting dimension	111 mm - measured from top of bumper to upper face of bumper bracket.

SPECIAL SERVICE TOOL RECOGNITION

No Special Service Tools Required

0990

43 180 0 HOOD LOUVRE GRILLE - REMOVE AND INSTALL (Sierra Hatchback and 4x4 only)

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. With hood supported, remove four retaining screws from louvre, Fig.1.

2. Lift out louvre grille upwards.

3. Remove gasket

To Install

4. Refit gasket.

5. Insert louvre grille.

6. Secure with four screws.

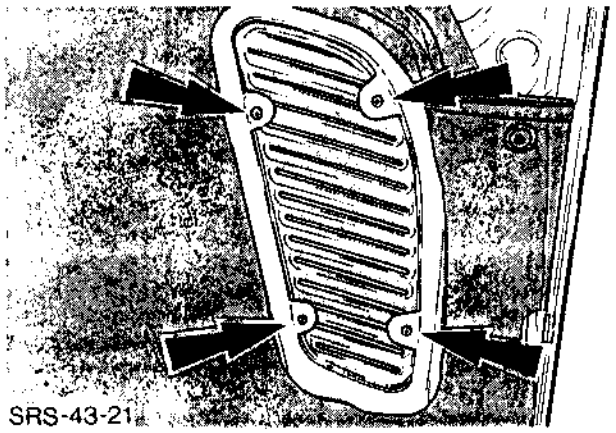


Fig.1. Sierra hood louvre grille retaining screws, (4 x 4 shown).

43 180 0 HOOD LOUVRE GRILLE - REMOVE AND INSTALL (Escort only)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. With hood supported, detach louvre from six retaining clips, Fig.1.

2. Lift out louvre grille upwards.

To Install

3. Insert louvre grille.

4. Locate louvre into retaining clips.

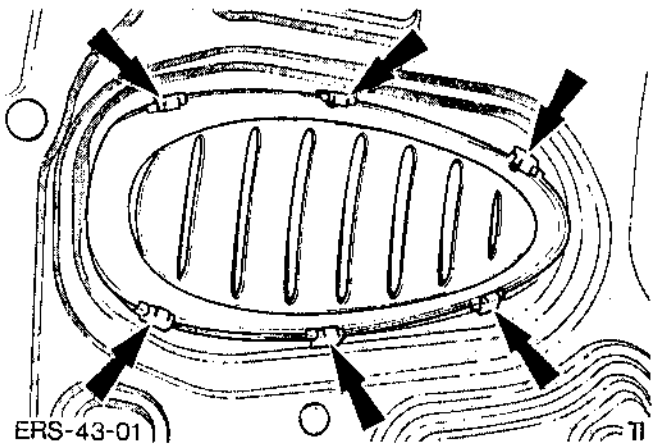


Fig.1. Escort louvre grille retaining clips.

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43 216 0 MOTIF - HOOD - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

NOTE: This procedure can be used to remove and install any of the mouldings, motifs or badges secured to the vehicle body by adhesive tape, Figs.1 and 2 refer. The moulding or motif is supplied with the tape, which is protected by a plastic foil covering, already applied.

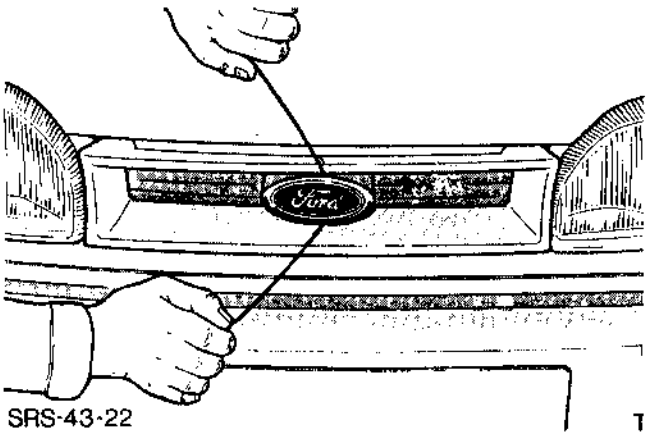


Fig.1. Remove the motif from the hood.

To Remove

1. Using a length of fine nylon cord, break the adhesive bond between the motif and body panel by drawing the cord behind the motif, Figs.1 and 2.

2. Using methylated spirits, thoroughly clean the motif's location, where necessary rolling any remaining adhesive away with the thumb. After cleaning do not touch the motif's location.

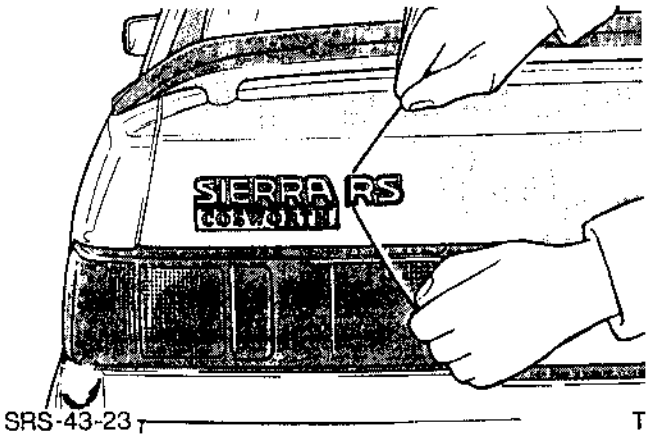


Fig.2. Method of removing a luggage compartment lid badge.

To Install

3. Warm the motif under a paint repair lamp or similar dry heat source until the motif is warm to the touch.

4. Holding the motif between finger and thumb, carefully remove the backing foil. Apply and press the motif onto the body panel, maintaining the pressure for at least thirty seconds to ensure a good bond is achieved.

0990

43 232 0 GRILLE - RADIATOR - REMOVE AND INSTALL

SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Open hood, and remove four retaining screws. Fig.1. and Fig.2.

2. Sierra Hatchback only

   Lift grille panel to disengage four mounting lugs.

3. Remove grille.

To Install

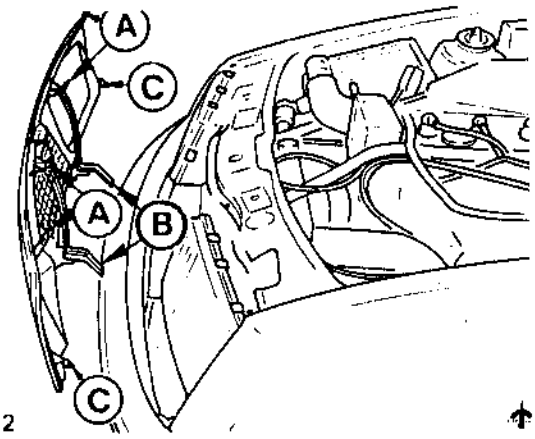
3. Sierra Hatchback only

   Check that small mounting lugs are protected by rubber caps.

   Locate grille panel on body ensuring correct engagement of the four lugs.

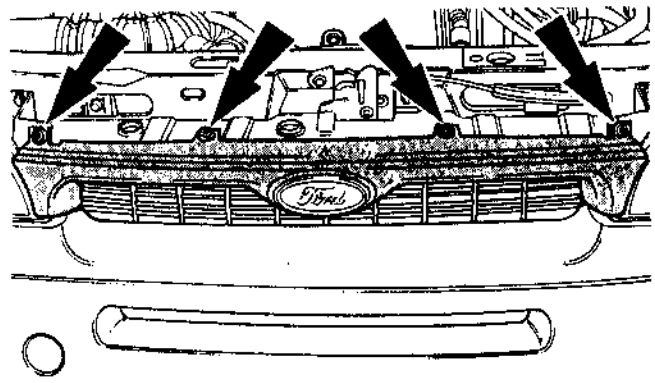
NOTE: Install rubber strip between the contact area of grille to fender, Fig.3.

4. Secure grille panel with four screws. Close hood.



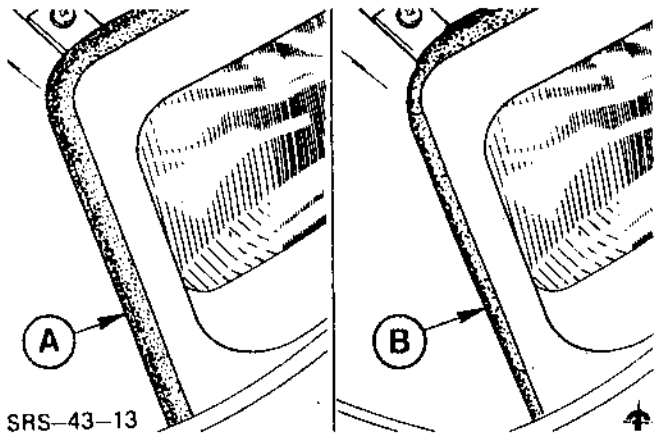
SRS-43-12

Fig.1. Grille panel mounting - Sierra Hatchback.
A - Locations fixing screw
B - Mounting lugs
C - Rubber caps



ERS-43-05

Fig.2. Grille panel mounting - except Sierra Hatchback.



SRS-43-13

Fig.3. Rubber strip.
A - Wrong mounting
B - Correct mounting

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43 354 0 MOULDING - ROCKER PANEL - REMOVE AND INSTALL (Sierra Hatchback only)

SPECIAL SERVICE TOOLS REQUIRED: NONE

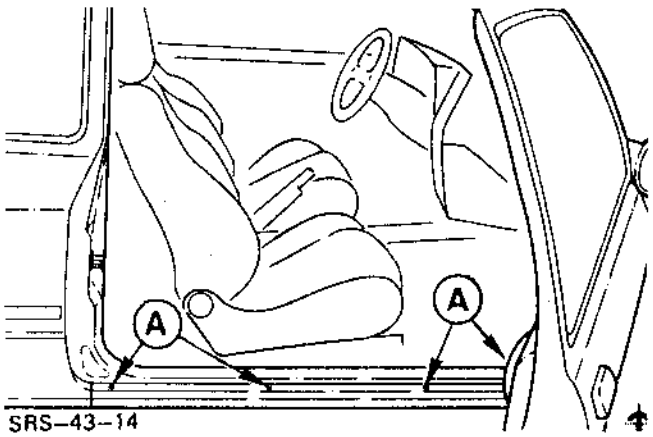


Fig.1. Sierra moulding - rocker panel fastening points.
A - Four rivets with trim covers

To Remove

1. Open door.
2. Remove four rivet trim covers and drill out the rivets, Fig.1.
3. Lift upper edge of rocker panel moulding and press moulding assembly downwards.

To Install

4. Align moulding with existing holes.
5. Secure moulding with four rivets and press the trim covers onto the rivets or moulding.
6. Shut the door.

43 354 0 MOULDING - ROCKER PANEL - REMOVE AND INSTALL (Escort)

SPECIAL SERVICE TOOLS REQUIRED: NONE

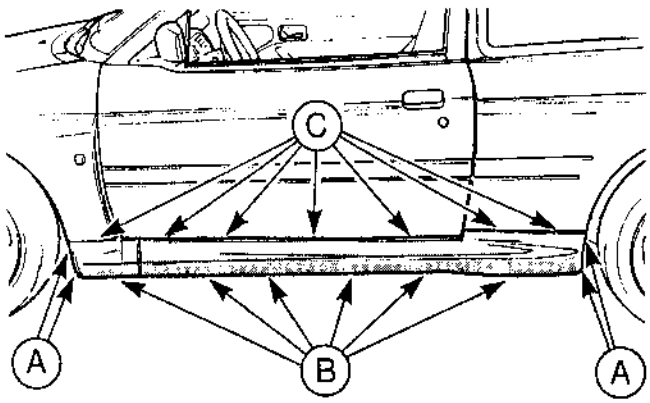


Fig.1. Escort moulding fastening prints.
A - Rivets
B - Torx screws
C - Clips

To Remove

1. Drill out four rivets, Fig.1.
2. Remove six torx screws, Fig.1.
3. Detach mouldings from securing clips and remove.

To Install

4. Locate mouldings into securing clips.
5. Secure mouldings with four rivets and six torx screws.

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43 354 0 MOULDING - ROCKER PANEL - REMOVE AND INSTALL (Sierra Notchback back)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open both doors and drill out upper rivets (8), Fig.1 refers.

2. Drill out front wheelarch rivets (2) and remove front section, Fig.1 refers.

3. Drill out rocker panel front rivets and remove panel by unclipping lower edge.

To Install

4. Clean rocker body flange.

5. Position and secure main section with rivets and clips.

6. Refit front fender section.

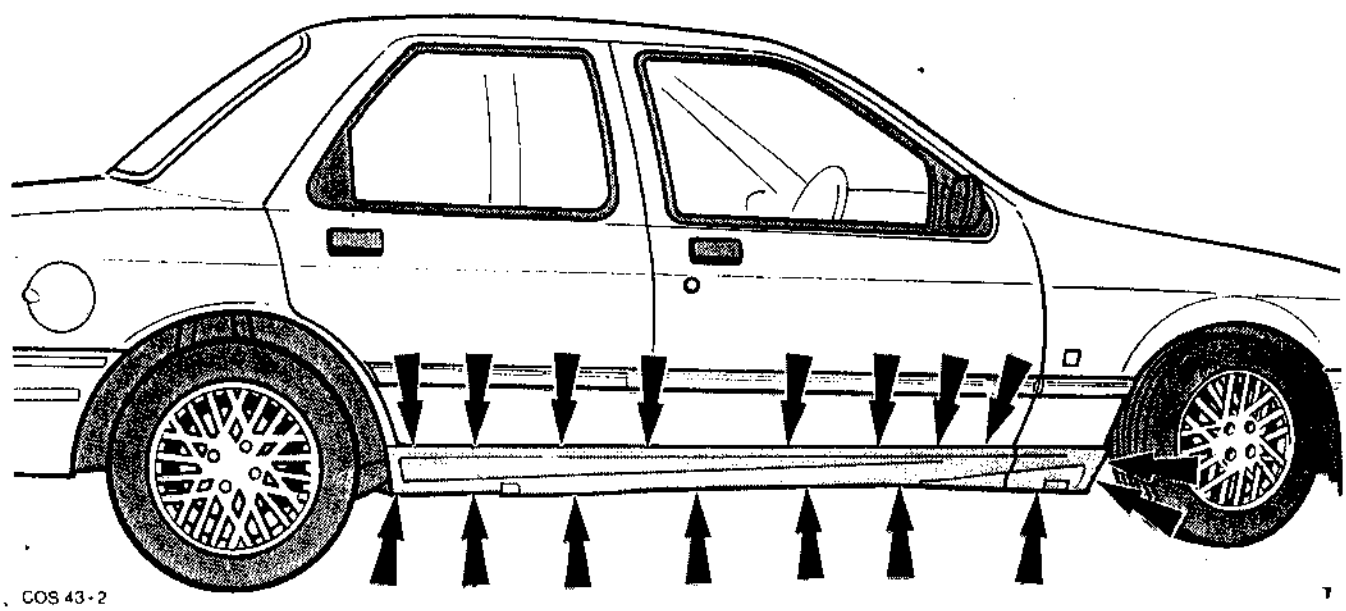


Fig.1. Sierra rocker panel moulding securing rivet locations.

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43 423 0 BUMPER ASSEMBLY - FRONT - REMOVE AND INSTALL (Sierra Hatchback only)

SPECIAL TOOLS REQUIRED: NONE

To Remove

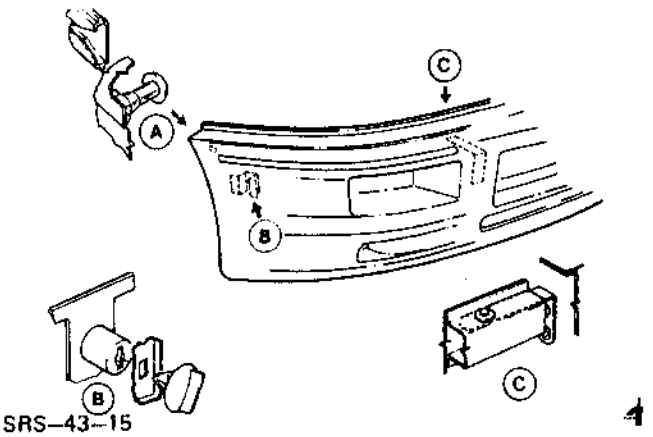
1. Open hood.

2. Remove radiator grille panel as described in Operation No. 43 232 0. Disconnect front fog and indicator lamps.

3. From inside the wheel arch release one bayonet catch on each side, Fig.1.

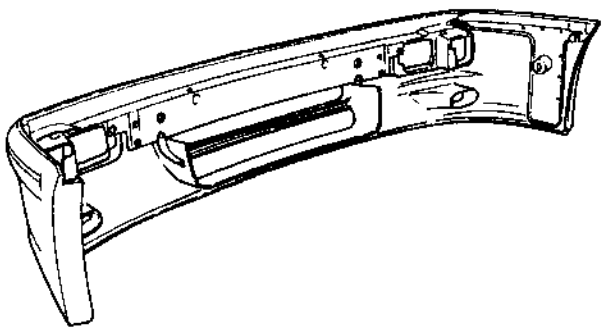
4. Unscrew bumper retaining brackets (1 bolt per side) from body.

5. Pull bumper horizontally from vehicle, taking care to disengage bumper side pins from clips.



SRS-43-15

Fig.1. Front bumper mounting.
A - Side pins
B - Bayonet catch
C - Retaining bracket



SRS-43-16

Fig.2. Front bumper removed.

To Install

6. Fit bumper horizontally and align fastening points.

7. Bolt bumper retaining brackets to body (1 bolt per side).

8. From inside the wheel arch, fit one bayonet catch on each side.

9. Replace grille panel as described for Operation No. 43 232 0. Reconnect the front fog and indicator lamps.

10. Close the hood.

0392

43 423 0 BUMPER ASSEMBLY - FRONT - REMOVE AND INSTALL (Escort)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

Disconnect battery earth lead. Remove, disconnect or detach components in numerical order referring to Fig.1.

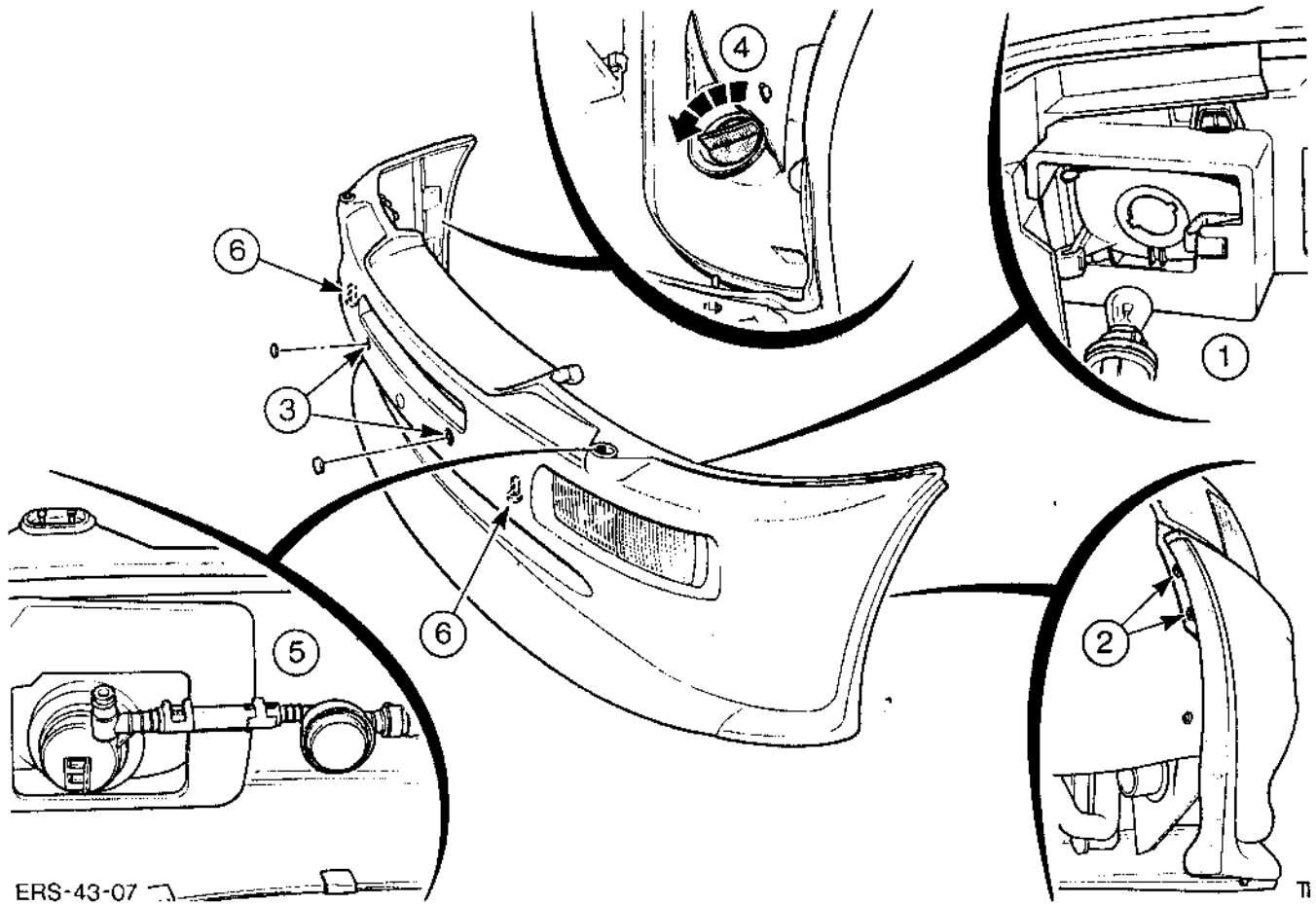


Fig.1. Escort front bumper.

To Install

Refit, reconnect or reattach components in reverse numerical order. Reconnect battery earth lead.

0392

43 492 0 SPOILER - TAILGATE - REMOVE AND INSTALL (Sierra Hatchback only)

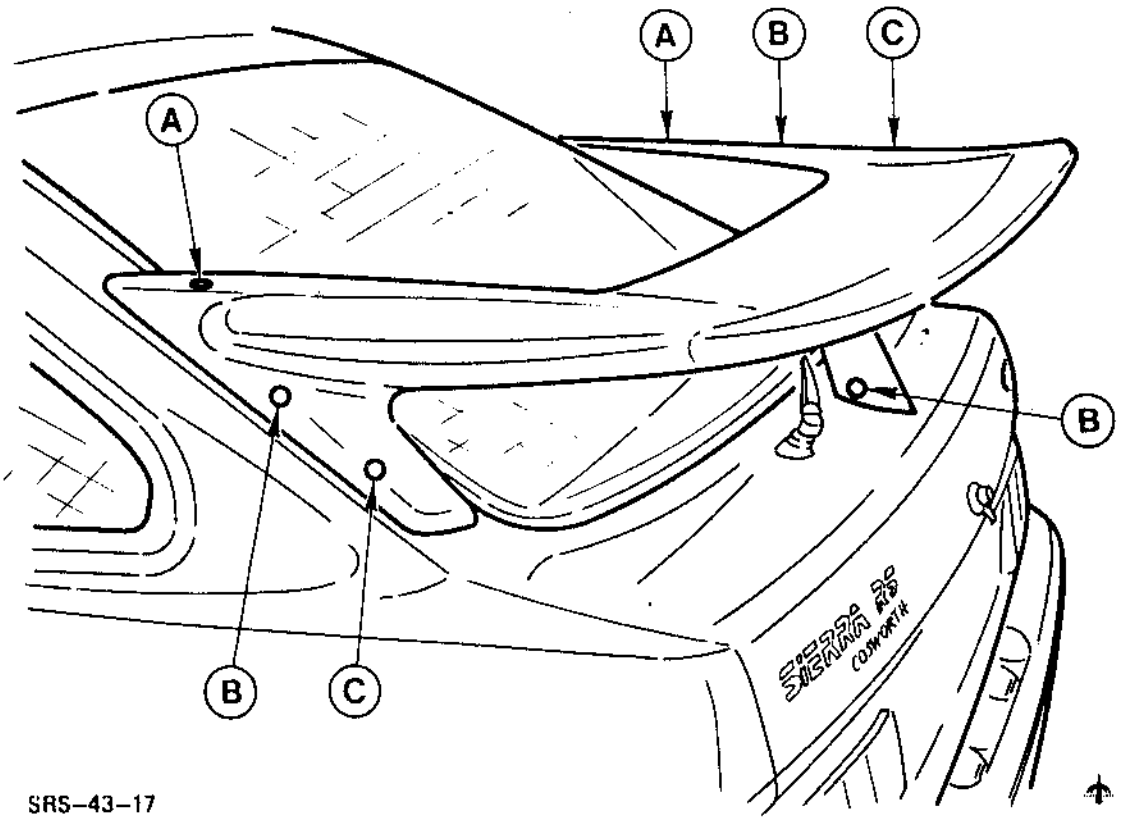
SPECIAL TOOLS REQUIRED: NONE

To Remove

1. Carefully remove seven trim covers.
2. Unscrew five retaining screws and drill out two rivets.
3. Remove spoiler.

To Install

4. Position spoiler and align with fastening holes.
5. Insert five bolts and two rivets and tighten.
6. Refit seven trim covers.



SRS-43-17

Fig.1. Sierra rear spoiler, fastening points.
A - Retaining screws, M5x14
B - Retaining screws, M5x10
C - Rivets

0392

43 492 0 SPOILER - LUGGAGE COMPARTMENT LID - REMOVE AND INSTALL (Sierra Notchback only)

SPECIAL SERVICE TOOLS REQUIRED: NONE

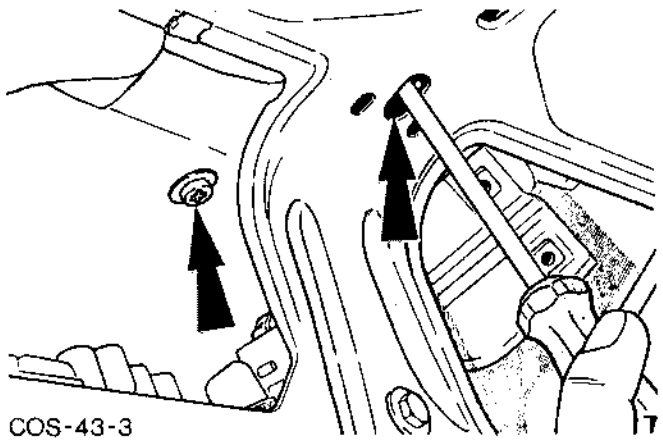


Fig.1. Spoiler retaining screws.

To Remove

1. Open luggage compartment lid remove two screws from lock assembly bracket and position bracket away from working area, Fig.1. refers.

2. Remove spoiler centre securing screws, Fig.1.

3. Close luggage compartment lid, prise out spoiler caps and remove both outer fixing screws, remove spoiler.

To Install

4. Align spoiler and refit outer screws and caps, Fig.2.

5. Open luggage compartment lid refit centre fixing screws.

6. Reposition luggage compartment lid lock bracket and secure, close tailgate.

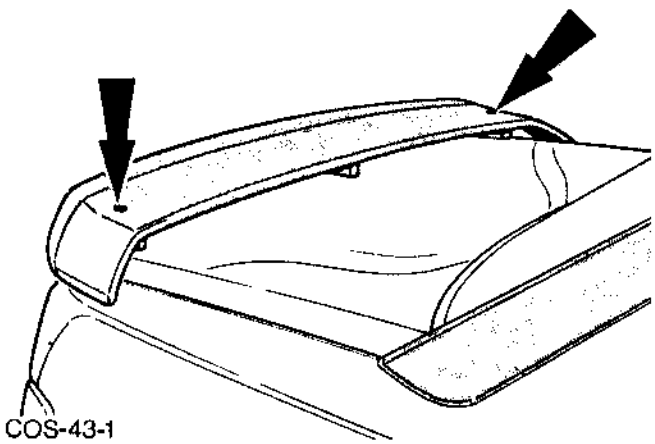


Fig.2. Spoiler retaining screws.

0392

43 492 0 SPOILER - TAILGATE - REMOVE AND INSTALL (Escort)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

1. Open tailgate, refer to Operation No. 43 744 0 and remove tailgate trim.

2. Remove securing bolts, Fig.1, and lift spoiler away from tailgate.

To Install

3. Position spoiler and align with securing bolt holes.

4. Insert securing bolts and tighten.

5. Refit tailgate trim and close tailgate.

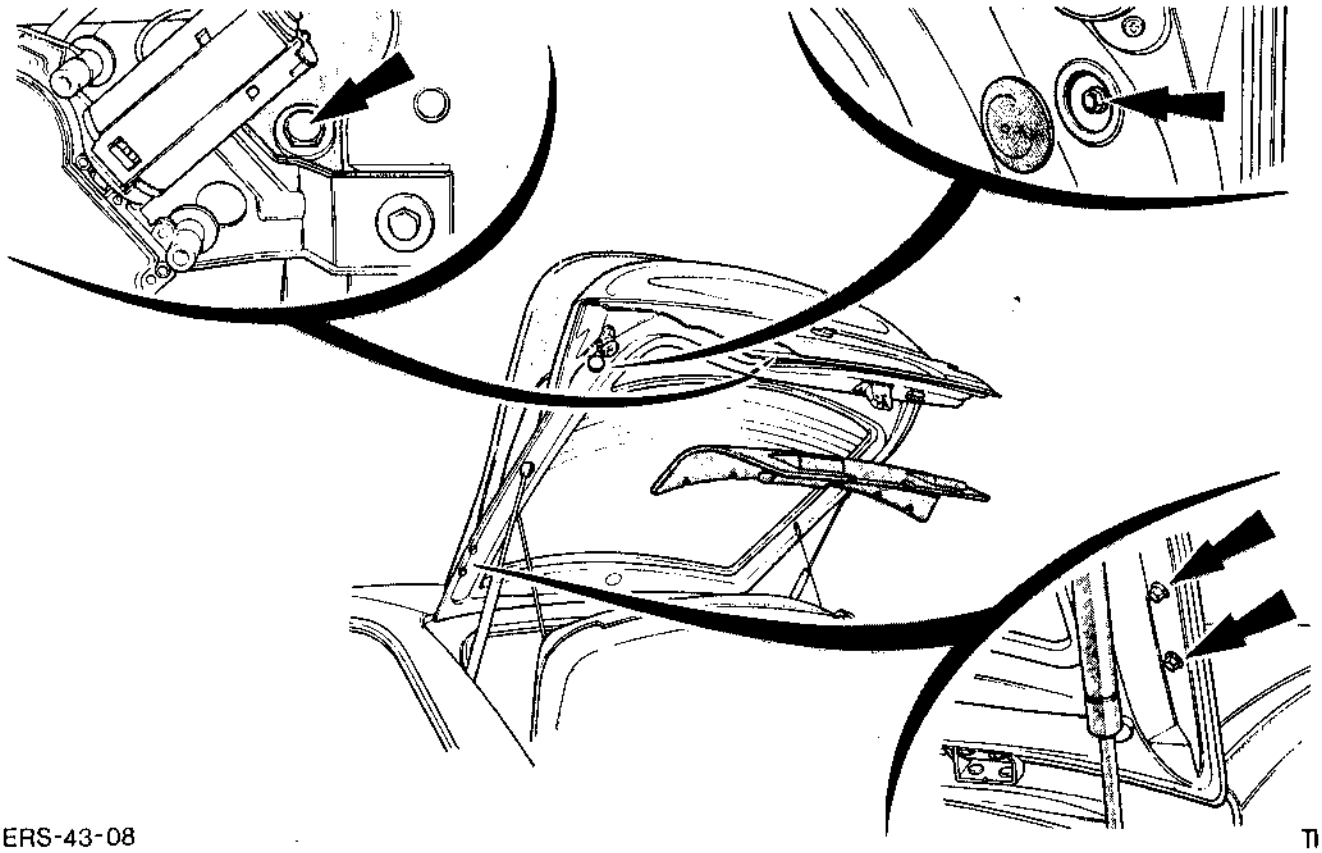
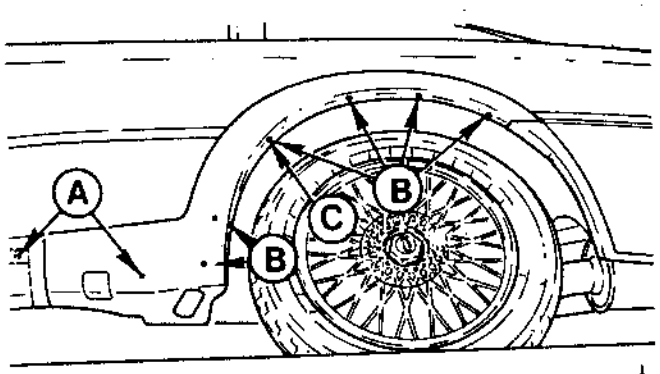


Fig.1. Escort rear spoiler, securing bolts.

0392

43 494 0 SPOILER - WHEEL ARCH - REAR - REMOVE AND INSTALL (one side) (Hatchback only)

SPECIAL TOOLS REQUIRED: NONE



SRS-43-18

Fig.1. Rear wheel arch spoiler.
A - Self-tapping screws
B - Screw M5x14
C - Screw cover

To Remove

1. Remove rocker panel moulding as described in Operation No. 43 354 0.

2. Remove two screws M5x14, Fig.1.

3. Remove one screw cover and six self-tapping screws.

4. Remove spoiler.

To Install

5. Align spoiler fixing holes.

6. Insert six self-tapping screws and refit single screw cover.

7. Refit the two M5x14 screws.

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43 497 0 SPOILER - WHEEL ARCH - FRONT - REMOVE AND INSTALL (one side) (Hatchback only)

SPECIAL TOOLS REQUIRED: NONE

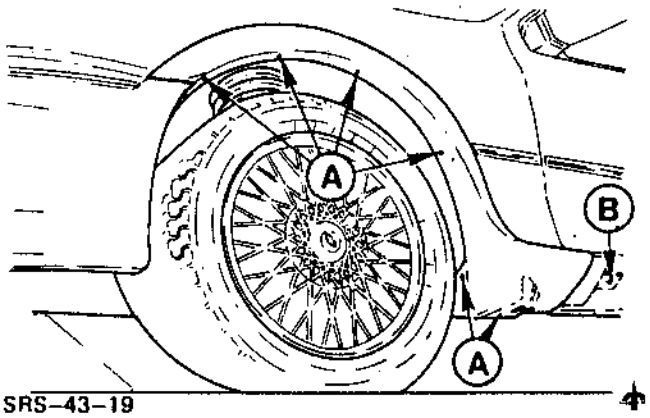


Fig.1. Front wheel arch spoiler.
A - Self-tapping screws
B - Screw M5x14

To Remove

1. Remove rocker panel moulding as described in Operation No. 43 354 0.
2. Remove one screw M5x14, 'B' in Fig.1.
3. Remove six self-tapping flat headed screws.
4. Remove spoiler.

To Install

5. Align spoiler fixing holes.
6. Refit six self-tapping screws.
7. Refit screw M5x14.
8. Install rocker panel moulding as described in Operation No. 43 354 0.

0990

43 644 0 CRASH PAD - FACIA - REMOVE AND INSTALL (Escort)

SPECIAL SERVICE TOOLS REQUIRED: NONE

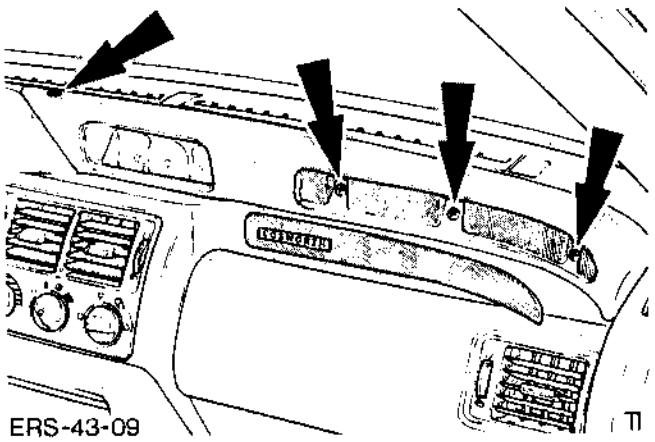


Fig.1. Instrument pod securing screws.

To Remove

1. Disconnect battery earth lead.
2. Detach badge facia from instrument pod.
3. Remove four screws, Fig.1, disconnect multiplugs and remove pod.
4. Refer to Operation No. 43 644 0 in Escort/Orion '91 onwards Service Microfiche to complete crash pad removal.

To Install

5. Refer to Escort/Orion '91 onwards Service Microfiche.
6. Refit pod, connect multiplugs and secure with four screws.
7. Refit badge facia. Reconnect battery earth lead.

43 744 0 PANEL - TAILGATE TRIM - REMOVE AND INSTALL (Escort)

SPECIAL SERVICE TOOLS REQUIRED: NONE

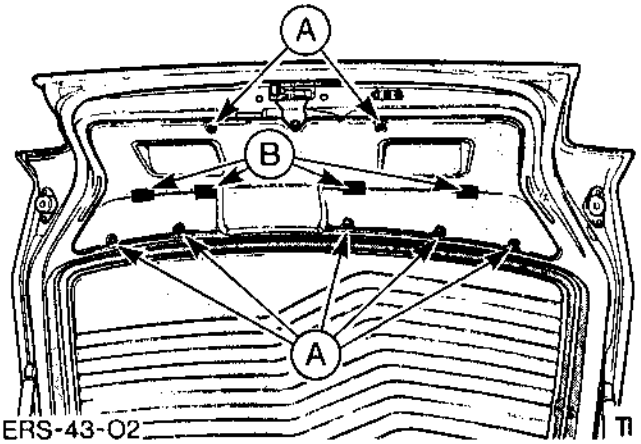


Fig.1. Tailgate fixtures.
A - Screws
B - Clips

To Remove

1. Open tailgate, remove securing screws, Fig.1.
2. Detach from four clips, lower front edge of trim and push towards front of vehicle to remove.

To Install

3. Locate trim in position and engage four clips.
4. Refit securing screws. Close tailgate.

0392

43 814 0 CENTRE CONSOLE - REMOVE AND INSTALL (Escort)

SPECIAL SERVICE TOOLS REQUIRED: NONE

To Remove

Disconnect battery, earth lead. Remove, disconnect or detach components in numerical order referring to Fig.1.

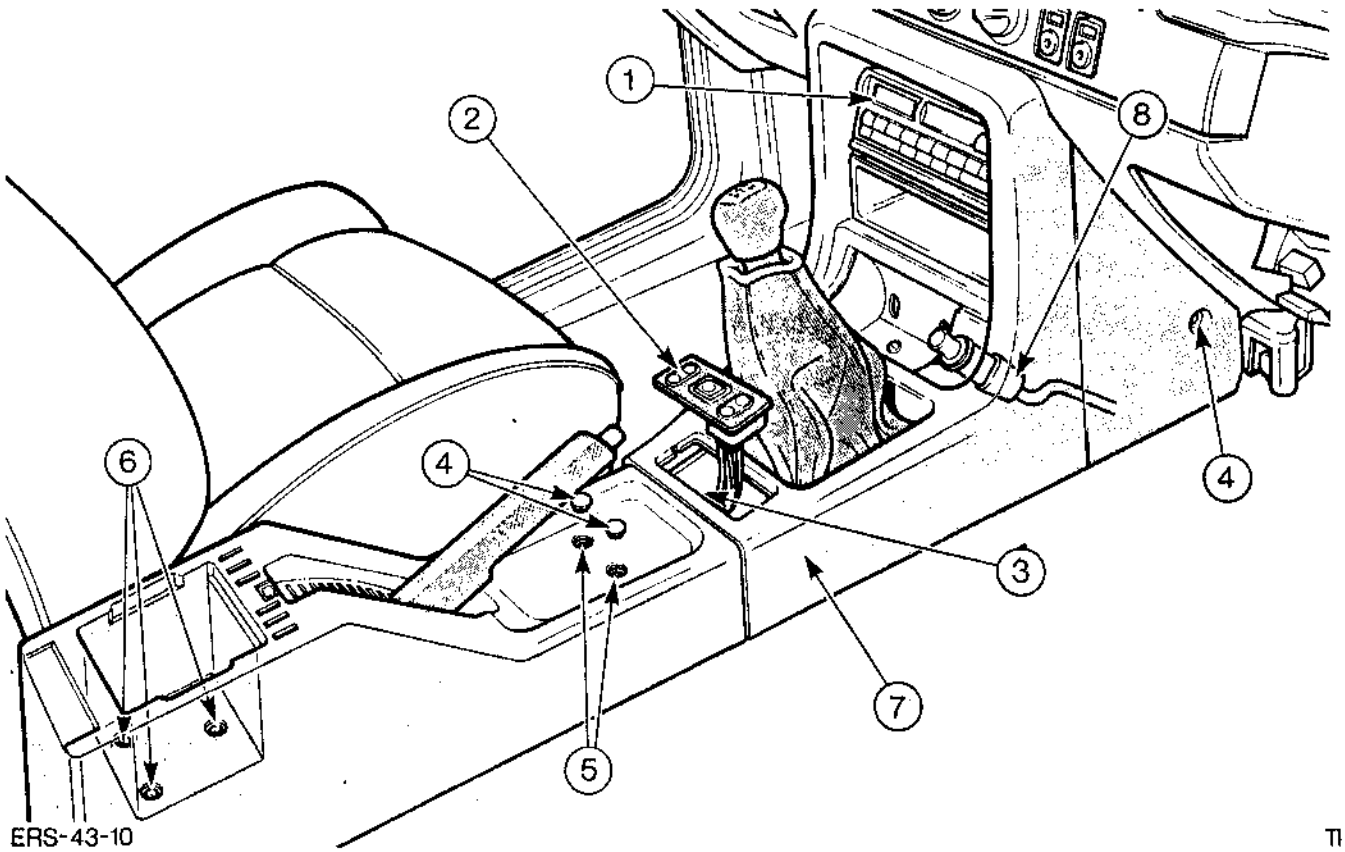


Fig.1. Escort centre console.

To Install

Refit, reconnect or reattach components in reverse numerical order. Reconnect battery earth lead.