

V12 VANQUISH

Workshop Manual
Volume 1

ASTON MARTIN LAGONDA LIMITED

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General Information

Workshop Manual Sections

The AMV03 Workshop Manual is divided into 8 sections as follows

1. Engine
2. Fuel, Emission Control and Exhaust
3. Transmission
4. Suspension and Steering
5. Brakes, Wheels and Tyres
6. Electrics
7. Chassis and Body
8. Air Conditioning

Procedure Numbering

The workshop manual procedures are numbered using the parts list numbers as a key. The first two digits of a workshop manual procedure number are also the parts list number (e.g. 1.5.01 Sump Removal relates to PL 1.5 Oil Pump and Sump). Thus when carrying out a procedure, you can quickly locate the relevant parts illustration and spare parts list.

To avoid excessive repetition, each procedure will be fully detailed once in its appropriate place in the manual. In any other location where this procedure is required, it will be referenced only by its title and its procedure number.

Special Tools

Where special service tools are required to perform an operation, the tool number is recorded at the point of use within the procedure. Consult the Special Service Tools catalogue for details of available tools.

Location References

References to the left, right, front or rear of the vehicle or of a component are always made as if sitting in the drivers seat facing forward. Any such references to assemblies removed from the vehicle are to the normal orientation of the assembly when fitted in the vehicle.

Repairs and Replacements

Where replacement parts are required, it is essential that only genuine Aston Martin parts are used. Your attention is drawn to the following points concerning repairs and the fitting of genuine Aston Martin parts and accessories:

- Safety features embodied in the vehicle may be impaired if other than genuine Aston Martin parts are fitted. In certain territories, legislation prohibits the fitting of parts which are not produced to the manufacturers specification.
- Adhere to torque wrench settings given in this manual.
- Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal, it must be renewed.
- The vehicle warranty may be invalidated by the fitting of other than genuine Aston Martin parts.

Safety Precautions

All service workshops are a source of potential danger and repair work should only be performed by technically trained staff following the procedures in this manual. A safety conscious approach to the performance of all service procedures must be observed at all times. Statutory requirements governing all aspects of health and safety at work including directives for the proper use of materials and equipment must be implemented.

The following contains a list of particular safety precautions which should be observed; it is not intended to be exhaustive.

Air Conditioning System

Do not break into the air conditioning refrigeration system until the refrigerant has been evacuated using the procedure in this manual. Do not disconnect any air conditioning refrigerant system pipes unless trained and instructed to do so. The refrigerant used can cause blindness if allowed to contact your eyes.

Chemical Handling and Storage

Chemicals used in the servicing of motor vehicles include acids, adhesives, antifreeze, brake fluids, coolants, grease, oil, paint, resin and solvents. Exposure to certain chemicals through direct contact or inhalation can be fatal.

Potential hazards may also be present through the incorrect use, storage and handling of chemicals causing a fire risk. The following precautions should be observed.

1. Strictly adhere to handling and safety information found on containers and labels.
2. Do not store chemicals in unlabelled or incorrectly labelled containers.
3. Containers used for storing chemicals should not be left open; there is a risk of spilling, or evaporation of fumes which may be inflammable or toxic.
4. Do not mix chemicals unless instructed to do so following manufacturers guidelines.
5. Do not inhale chemical materials to determine identity, they may be toxic.
6. Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for washing skin.
7. Containers whose capacity is over 25 litres (5 gallons) require a bund wall in order to contain spillages.
8. Chemicals based on solvents such as paint should not be sprayed in a confined space; work areas used for such operations should be well ventilated and fume extraction equipment should be utilised.
9. Ensure that adequate ventilation is provided when volatile de-greasing agents are being used.

   WARNING: Fume extraction equipment must be in operation when solvents are used e.g. trichloroethane, white spirit, SBP3, methylene chloride, perchlorethylene.

   WARNING: Do not smoke in the vicinity of volatile de-greasing agents.
10. Avoid splashing the skin, eyes and clothing.
11. Clean chemicals from the skin and clothing as soon as possible after soiling.
12. Wear protective clothing such as goggles, non porous gloves and apron when handling battery acid and other corrosive and toxic substances.

Safety Precautions (continued)

Electrical Equipment

1. Ensure that electrical equipment is in safe working order before use.
2. Inspect power leads of all mains electrical equipment for damage and security, and check that it is properly earthed.
3. Ensure that electrical equipment is protected by a fuse of the correct current rating.
4. Disconnect the battery before commencing repair operations to the electrical system, fuel system and engine or when working beneath the vehicle.

Exhaust Fumes

Engines should not be run in confined spaces, exhaust fumes contain harmful and toxic substances including carbon monoxide which can prove fatal if inhaled. Engines must only be run where there is fume extraction equipment in operation or where there is adequate ventilation.

Fire Precautions

1. Ensure that a suitable form of fire extinguisher is conveniently located near the work area.
2. Keep oils, solvents and combustible materials away from naked flames and other sources of ignition.
3. Ensure that NO SMOKING signs are posted around areas where combustible materials and vapour may be present and ensure that the warnings are strictly observed.
4. Ensure that dry sand is available to soak up any spillage of fuel or other flammable solutions.
5. Fume extraction equipment must be available and in full working order to remove combustible and toxic vapours.
6. All personnel should be aware of the fire drill procedures and precautions.

Jacking and Lifting

1. The recommended procedures for lifting, jacking and towing are included later in this section and must be strictly observed to ensure personal safety.
2. Always use a vehicle hoist, ramp or pit for working beneath the car in preference to jacking.
3. Never rely on a jack to support a car independently, use axle stands or blocks carefully placed at the jacking points to provide rigid support.
4. When working beneath a vehicle, chock the wheels as well as applying the handbrake.
5. Ensure that the vehicle is standing on firm level ground before jacking or lifting.
6. Check any lifting equipment used has adequate capacity for the load being lifted and is in full working order.

Safety Precautions (continued)

Tools and Equipment

1. Do not leave tools, equipment, spilt oil, etc. around or on the work area.
2. Ensure that tools and equipment used are in good condition; do not use damaged or defective tools or equipment.
3. Do not apply heat in an attempt to free stiff nuts or fittings; as well as causing damage to protective coatings, the stray heat may damage electronic equipment, harnesses and brake lines.
4. Use the recommended service tool where instructed to do so.

Used Engine Oil

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 should be provided.

Health protection precautions:

1. Avoid prolonged and repeated contact with oils, particularly used engine oil.
2. Wear protective clothing, including impervious gloves where practicable.
3. Do not put oily rags in pockets.
4. Avoid contaminating clothes with oil.
5. Overalls must be cleaned regularly. Discard unwashable clothes and oil impregnated footwear.
6. First aid treatment should be obtained immediately for open cuts or wounds.
7. Use barrier creams, apply before each work period to help the removal of oil from the skin.
8. Wash with soap and water to ensure all oil is removed. Preparations containing lanolin replace the natural skin oils which have been removed.
9. Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for washing skin.
10. If skin disorders develop, obtain medical advice.
11. Where practicable, degrease components prior to handling.
12. Where there is a risk of eye contact, eye protection should be worn. In addition, an eye wash facility should be provided.

Environmental Protection

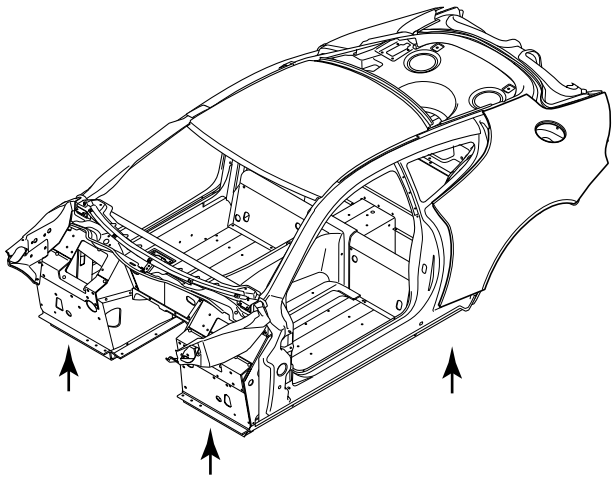
It is illegal to pour used oil on the ground, down sewers or drains, or into water courses. The burning of used engine oil in small space heaters or boilers is not recommended unless emission control equipment is fitted; in case of doubt, contact the Local Authority for advice on disposal facilities.

Lifting and Jacking

Safety Precautions

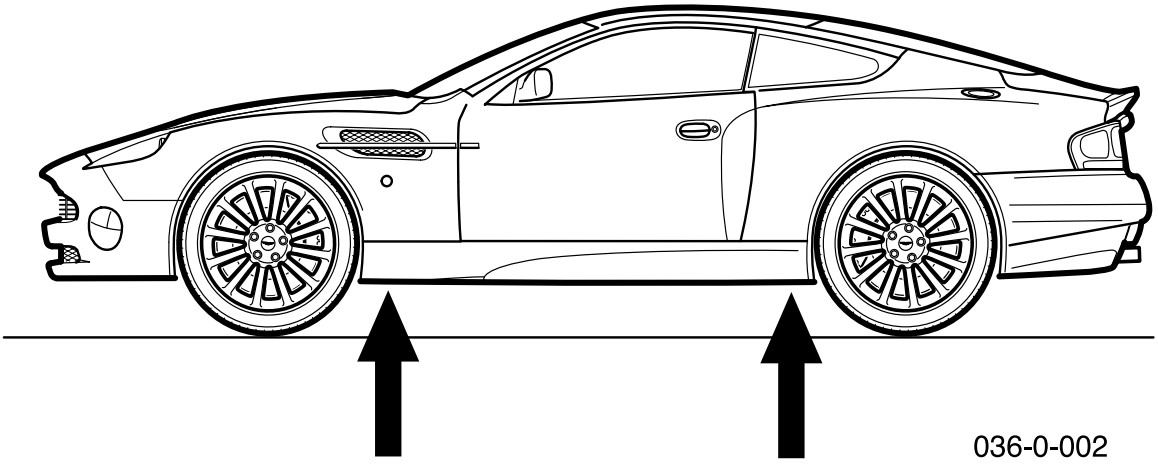
1. The recommended procedures for lifting, jacking and towing must be strictly observed to ensure personal safety.
2. Always use a vehicle hoist, ramp or pit for working beneath the car in preference to jacking.
3. Never rely on a jack to support a car independently, use axle stands or blocks carefully placed at the jacking points to provide rigid support.
4. When working beneath a vehicle, chock the wheels as well as applying the handbrake.
5. Ensure that the vehicle is standing on firm level ground before jacking or lifting.
6. Check that lifting equipment has adequate capacity for the load being lifted and is in full working order.

Jacking Points



The V12 Vanquish jacking points are at the positions shown, where the vertical bulkheads join the horizontal floor pan. Always use a jack with a rubber contact pad. Avoid the use of jacks with sharp contact pads which would damage the floor pan Always chock the opposite wheels as well as applying the handbrake when using the jack.

To prevent body distortion, avoid single point or one side jacking with the tunnel shear panel removed



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Lifting

The use of a workshop hoist is recommended for all operations where the vehicle must be raised. Follow the manufacturers instructions. If using an adjustable arm type, ensure that the lifting pads are correctly positioned at the four jacking points before lifting.

Workshop jack

To avoid any danger of bodywork damage when using a hydraulic jack, the vehicle must only be lifted at the jacking points.

Stands

When carrying out work (other than a wheel change) which requires a wheel to be raised, a stand must be used, located at the jacking point, to provide a secure support for the vehicle.

Front - one wheel

Jack under the outer end of the lower arm using a suitable wooden block or rubber pad on the jack head.

Rear - one wheel

Locate the jack with a wooden block or rubber pad on its head, under the outer end of the lower wishbone at the wheel to be raised.

Vehicle Recovery

General

The preferred method of vehicle recovery is by flat bed transporter.

The front towing eye is primarily for emergency use when towing for short distances, e.g. removing the vehicle if it is causing an obstruction or winching the vehicle onto a flatbed transporter.

If moving a V12 Vanquish in such a situation, fit the front towing eye to the bracket in the lower grille aperture.

Caution: Take care to protect the paintwork when fitting the towing eye. Make sure the towing eye is tight.

Transporting

If the vehicle is to be transported on a trailer or flat bed transporter, the handbrake must be applied and the wheels must be chocked.

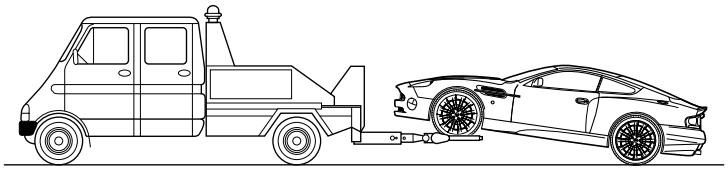
Suspended Towing

Do NOT tow with sling-type equipment since damage to the bodywork will result.

Take care when using 'spectacle frame' type towing equipment that the towing device is well clear of the front or rear apron. Body damage may occur if the vehicles pass over uneven road surfaces.

Ensure that the recovery team follow these instructions:

Front Suspended Tow



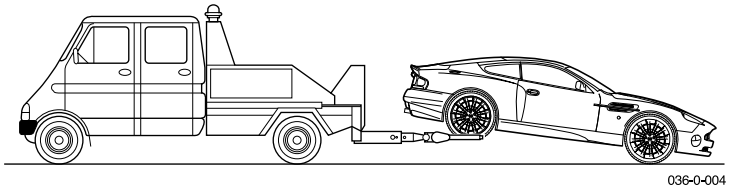
1.Switch on the ignition.

2.Pull both paddles simultaneousley twice to force the gearbox into Neutral. Switch of the ignition within three seconds.

3.Remove the ignition key from the ignition.

4. Raise the vehicle using a 'spectacle frame' type lifting device with a cradle positioned under each front wheel as shown below.

Rear Suspended Tow



1.Set the steering in the ‘straight ahead’ position. Remove the ignition key from the ignition/steering lock.

2.Raise the vehicle using a 'spectacle frame' style lifting device where a cradle is positioned under each rear wheel as indicated below.

Adhere to Towing Regulations

In certain countries the registration number of the towing vehicle and an ON TOW sign or warning triangle must be displayed in a prominent position at the rear of the vehicle being towed.

WARNING: When the engine is not running, the steering will no longer be power-assisted and the brake servo will become ineffective after a few applications of the brakes. Therefore be prepared for relatively heavy steering and the need for greatly increased brake pedal pressure.

The vehicle may be towed short distances by another provided that a speed of 48 km/h (30 mph) is not exceeded. When being towed, the vehicles gear lever, or gear selector lever (automatic transmission), must be in Neutral or position N with the ignition key turned to position II to release the steering lock and to render the horn, indicators and brake lights operational.

Fluid Capacities

	Europe	UK	USA
Engine sump (incl. filter)	9.5 litres	(16.7 pints)	(10.0 Qts)
Engine sump (excl. filter)	8.5 litres	(15.0 pints)	(9.0 Qts)
Engine cooling system	15 litres	(26.4 pints)	(16.5 Qts)
Screen washer reservoir	2.0 litres	(3.5 pints)	(2.2 Qts)
Gearbox & Cooler	4.17 litres	(7.3 pints)	(4.6 Qts)
Final drive	2.0 litres	(3.52 pints)	(2.2 Qts)
Fuel tank	80 litres	(17.6 galls)	(22.0 galls)

Recommended Fluids

Engine oil (Initial fill)	Mobil 1 0w30
Engine coolant	60% water, 40% Havoline OAT

Note: Do not mix OAT coolant with any glycol based anti-freeze.

Gearbox oil	Dexron III
ASM Fluid	FL CS Speed
Final drive oil	Mobil 1 80W-140
Brake fluid	Castrol DOT4
Power steering fluid	Esso Powersteering Fluid
A/C refrigerant	R134A (HFC134A)

Engine Oil

Do not mix Mobil 1 oil with any mineral oils.

Aston Martin Vanquish Maintenance Schedules

1,000 miles	7,500 miles	15,000 miles	Fluids, Filters and Leaks Check
1,500 km	12,000km	24,000km	
3 months	6 moths	12 months	
x	x	x	Pre-Maintenance road test evaluation
1,000 miles	**7,500 miles**	**15,000 miles**	**Fluids, Filters and Leaks Check**
1,500 km	12,000km	24,000km	
3 months	6 moths	12 months	
x	x	x	Renew the engine oil
x	x	x	Renew the engine oil filter
x	x	x	Check for engine oil leaks
-	-	x	Renew the air cleaner element
x	x	x	Check gearbox for leaks, top-up if necessary
Every 2 years or 30,000 miles			Renew gearbox oil
-	-	x	Renew rear axle oil
x	-	-	Check / top-up rear axle oil
-	x	-	Check rear axle for leaks, top up if necessary
150000 (or 5 years)			Renew engine coolant - check S.Gravity
x	x	x	Check/top-up engine coolant
x	x	x	Check cooling and heating systems for leaks
-	every 60000		Renew fuel filters
x	x	x	Check for fuel leaks
Every 2 years 30,000 miles			Renew brake fluid
x	x	x	Check / top-up brake fluid reservoir
x	x	x	Check / top-up ASM fluid reservoir
x	x	x	Check / top-up power steering reservoir
x	x	x	Check power steering system for leaks
x	x	x	Check ASM system for leaks
x	x	x	Check brake hoses, pipes and unions for leaks
x	x	x	Check suspension dampers for leaks
x	x	x	Top-up windscreen washer reservoir
x	x	x	Check exhaust system for leaks
x	-	-	Check air conditioning system for leaks
x	x	x	Check exhaust bypass valve operation

AMV03 Vehicle Maintenance Schedules (continued)

1,000 miles	7,500 miles	15,000 miles	Mechanical Function Check
1,500 km	12,000km	24,000km	
3 months	6 moths	12 months	
-	x	x	Lubricate all door locks and hinges
x	x	x	Check polyvee drive belt condition, renew if necessary
x	x	x	Lubricate handbrake links and cables
x	x	x	Check handbrake security
-	-	30,000	Check condition of handbrake pads
-	x	x	Inspect brake pad wear and condition of discs/calipers
-	x	x	Check and renew wiper blade inserts if necessary
-	-	30000	Renew wiper blades
-	-	30000	Clean out engine and A/C radiators
x	x	x	Check condition and operation of all seat belts
x	x	x	Check security of exhaust system mountings
x	x	x	Check brake hoses, pipes and unions for corrosion/mechanical defects
x	x	x	Check power steering pipes and unions for corrosion/mechanical defects
-	-	x	Check security and condition of fuel hoses
x	x	x	Check cooling system hoses security and condition
x	-	-	Check air conditioning hoses security and condition
x	x	x	Check condition and security of steering unit joints and gaiters
x	x	x	Check security and condition of suspension fixings
x	x	x	Check interior rear view mirrors, security and function
-	-	x	Check the condition of underbody protection
Electrical Function Check			
-	-	45,000 ml	Renew spark plugs
x	x	x	Clean and grease the battery connections
x	-	x	Check and if necessary adjust headlight alignment
x	x	x	Check operation of all lights
x	x	x	Check operation of ABS warning lamp
x	x	x	Check operation of all warning indicators
x	x	x	Check audible warnings including security system
x	x	x	Check operation of the horns
x	x	x	Check operation of the windscreen wipers
x	x	x	Check operation of the windscreen washers
x	x	x	Check exterior rear view mirrors (and foldback if fitted)
x	x	x	Interrogate DTC P codes
x	x	x	Check manual transmission cooling pump operation using PDU
x	x	x	Check electric window operation
x	x	x	Check transmission cooling pump
x	x	x	Check the rain sensor operaation
x	x	x	Check the operation of the battery disconnect / reconnect switches

AMV03 Vehicle Maintenance Schedules (continued)

1,000 miles 1,500 km 3 months	7,500 miles 12,000km 6 moths	15,000 miles 24,000km 12 months	Wheels and Tyres Check
x	x	x	Check that tyres are the correct size, type and rotation
x	x	x	Check and report tyre tread depth
x	x	x	Check tyres for uneven / excessive wear or damage
x	x	x	Check / adjust the tyre pressures if necessary
x	x	x	Check operation of the tyre pressure sensors
x	x	x	Check torque of road wheel nuts
x	x	x	Check road wheel rims for inner and outer damage

Final Checks

-	x	x	Degrease windscreen
x	x	x	Carry out road test
x	x	x	Check ABS and Traction Control operation
x	x	x	Check operation of all seat belts and buckles
x	x	x	Check that fuel filler bowl rain drain is clear

The Service Check List may be revised periodically. Franchaise holders will be notified of revisions by Service Bulletins.

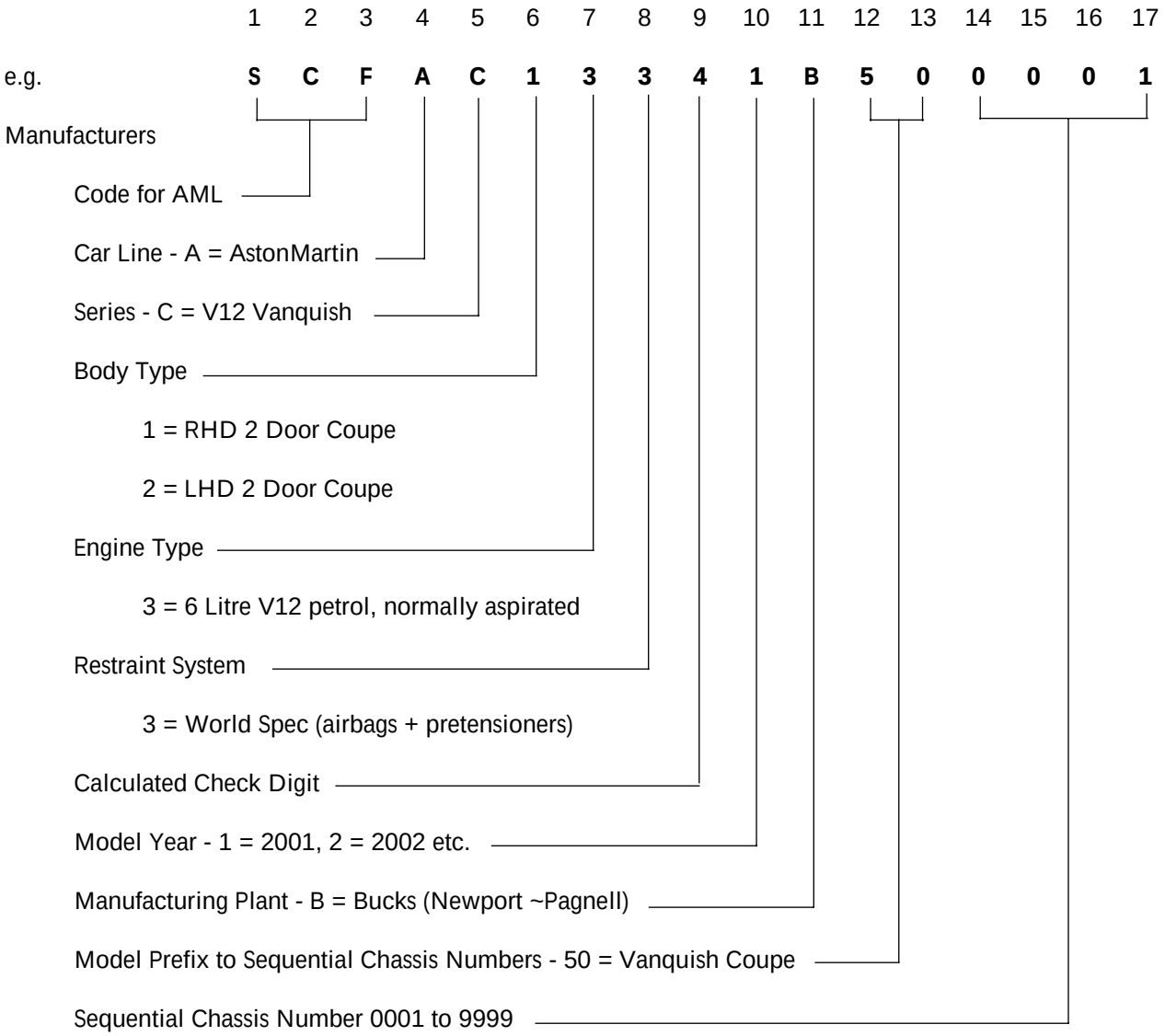
Service Tools

For full details of service tools please consult the Aston Martin Service Tools Catalogue.

Vehicle Identification Number

The Vehicle Identification Number (VIN) is a 17 character number which uniquely identifies the vehicle and gives fundamental data on the build site, date and initial configuration of the vehicle.

Character Position



VIN Number Location

The VIN number is shown on two labels in the car. The first is situated under the lower edge of the windscreen. The second is situated in the front of the engine bay.

The VIN number is also engraved on the floorpan in the right front footwell. Release the two press studs and lift the footwell carpet. Lift the flap in the sound deadening foam to access the engraved VIN number.

Torque Conversion Tables - Newton Metres to Pounds Feet

Newton Metres	Pounds Feet 0	1	2	3	4	5	6	7	8	9
0	-	0.74	1.47	2.21	2.95	3.69	4.42	5.16	5.90	6.64
10	7.38	8.11	8.85	9.59	10.33	11.06	11.80	12.54	13.28	14.01
20	14.75	15.49	16.23	16.96	17.71	18.44	19.18	19.91	20.65	21.39
30	22.13	22.86	23.60	24.34	25.08	25.81	20.55	27.29	28.03	28.76
40	29.50	30.24	30.98	31.71	32.45	33.19	33.93	34.68	35.40	36.14
50	36.88	37.62	38.35	39.09	39.83	40.57	41.30	42.04	42.78	43.52
60	44.25	44.99	45.73	46.47	47.20	47.94	48.68	49.42	50.15	50.89
70	51.63	52.37	53.10	53.84	54.58	55.32	56.06	56.79	57.53	58.27
80	59.00	59.74	60.48	61.22	61.95	62.69	63.43	64.17	64.91	65.64
90	66.38	67.12	67.86	68.59	68.33	70.07	70.81	71.54	72.28	73.02
100	73.76	74.49	75.23	75.97	76.71	77.44	78.18	78.92	79.66	80.39
110	81.13	81.87	82.61	83.34	84.08	84.82	85.56	86.29	87.03	87.77
120	88.51	89.24	89.98	90.72	91.46	92.19	92.93	93.67	94.41	95.15
130	95.88	96.62	97.36	98.09	98.83	98.58	100.3	101.00	101.78	102.52
140	103.26	104.00	104.73	105.47	108.21	106.95	107.68	108.42	109.16	109.90
150	110.63	111.37	112.11	112.85	113.59	114.33	115.06	115.80	116.54	117.27
160	118.01	118.75	119.49	120.22	120.98	121.70	122.44	123.17	123.91	124.65
170	125.39	126.12	126.86	127.60	128.34	129.07	129.81	130.55	131.29	132.02
180	132.76	133.50	134.24	134.87	135.71	136.45	137.19	137.92	138.68	139.40
190	140.14	140.87	141.61	142.35	143.09	143.83	144.56	145.30	146.04	140.78
200	147.51	148.25	148.99	149.73	150.46	151.20	151.94	152.68	153.41	154.15
210	154.89	155.63	156.36	157.10	157.83	158.58	159.31	160.05	160.79	161.53
220	162.26	163.00	163.74	164.48	165.21	165.95	166.69	167.43	168.16	168.90
230	169.64	170.38	171.11	171.85	172.59	173.33	174.07	174.80	175.54	176.28
240	177.02	177.75	178.49	179.23	179.97	180.70	181.44	182.18	182.92	133.65
250	184.39	185.13	185.87	186.60	187.34	158.08	188.82	189.55	190.29	191.03
260	191.77	192.50	193.24	193.98	194.72	195.45	196.19	198.93	197.67	198.40
270	198.14	198.58	200.62	201.35	202.09	202.83	203.57	204.31	205.10	205.78
280	206.52	207.26	207.99	208.73	209.47	210.21	210.94	211.68	212.42	213.16
298	213.89	214.63	215.37	216.11	216.84	217.58	218.32	219.06	219.79	220.53
300	221.27	222.01	222.74	223.48	224.22	224.98	225.68	226.43	227.17	227.91
310	228.64	229.38	230.12	230.86	231.68	232.33	233.07	233.81	234.55	235.28
320	236.02	238.76	237.50	238.23	238.97	239.71	240.45	241.18	241.92	242.68
330	243.40	244.13	244.87	245.61	246.35	247.08	247.82	248.56	249.20	250.03
340	250.77	251.51	252.25	252.98	253.72	254.46	255.20	255.93	256.67	257.41
350	258.15	258.68	259.62	260.36	261.10	261.84	262.57	263.31	264.05	264.79
360	265.52	268.26	267.00	267.74	268.47	267.21	269.95	270.68	271.42	272.16
370	272.90	273.64	274.37	275.11	275.85	276.59	277.32	278.06	278.80	279.54
380	280.27	281.01	281.75	282.49	283.22	283.98	284.70	285.44	286.17	286.91
390	287.65	298.38	289.12	289.86	298.68	291.34	292.08	292.81	293.55	294.29
400	295.03	295.76	298.50	297.24	297.98	298.71	299.45	300.19	300.93	301.68
410	302.40	303.14	303.88	304.61	305.35	306.09	306.83	307.56	308.30	309.04
426	309.78	310.51	311.25	311.99	312.73	313.46	314.20	314.94	315.68	316.41
430	317.15	317.89	318.63	319.36	320.10	320.84	321.58	322.32	323.05	323.79
440	324.53	325.27	326.00	326.74	327.48	328.22	328.95	329.68	330.43	331.17
450	331.90	332.64	333.38	334.12	334.35	335.59	336.33	337.07	337.80	338.54
460	339.28	340.02	340.75	341.49	342.23	342.97	343.70	344.44	345.18	345.92
470	346.65	347.39	348.13	348.87	349.60	350.34	351.08	351.82	352.56	353.29
480	354.03	354.77	355.51	356.24	356.98	357.72	358.46	359.19	359.93	350.67
490	361.41	362.14	362.88	363.62	364.36	365.08	365.83	366.57	367.31	368.04

Torque Conversion Tables - Newton Metres to Pounds Feet

Newton Metres	Pounds Feet 0	1	2	3	4	5	6	7	8	9
500	368.78	369.52	370.26	370.99	371.73	372.47	373.21	373.94	374.68	375.42
510	376.16	376.89	377.63	378.37	379.11	379.85	380.58	381.32	382.06	382.80
520	383.53	384.27	385.01	385.75	386.48	387.22	387.96	388.70	389.43	390.17
530	390.91	391.65	392.38	393.12	393.86	394.60	395.33	396.07	396.81	397.55
540	398.28	399.02	399.76	400.50	401.23	401.97	402.71	403.45	404.18	404.92
550	405.68	406.40	407.13	407.87	408.61	409.35	410.09	410.82	411.56	412.30
560	413.04	413.77	414.51	415.25	415.99	416.72	417.40	418.20	418.94	419.67
570	420.41	421.15	421.87	422.62	423.36	424.10	424.84	425.57	426.31	427.05
580	427.79	428.52	429.26	430.00	430.74	431.47	432.21	432.95	433.68	434.42
590	435.16	435.90	436.64	437.37	438.11	438.85	439.59	440.33	441.06	441.80
600	442.54	443.28	444.01	444.75	445.49	448.23	446.96	447.70	448.44	449.18
610	449.91	456.65	451.39	452.13	452.86	453.60	454.34	455.08	455.81	456.55
620	457.29	456.03	458.76	459.50	460.24	460.98	401.71	462.45	463.19	463.93
630	464.66	465.40	468.14	466.88	467.61	468.35	469.09	468.83	470.57	471.30
640	472.04	472.78	473.52	474.25	474.99	475.73	476.47	477.20	477.94	478.68
650	479.42	480.15	480.89	481.63	482.37	483.10	483.84	484.58	485.32	486.05
660	486.79	487.53	488.27	489.00	489.74	490.48	491.22	491.95	492.68	493.43
670	494.17	484.90	489.64	496.38	497.12	497.85	498.59	499.33	500.07	500.81
680	501.54	502.28	503.02	503.76	504.49	505.23	505.97	506.71	507.44	508.18
690	508.92	509.68	510.39	511.13	511.87	512.61	513.34	514.08	514.82	515.56
700	516.29	517.03	517.77	518.51	519.25	519.98	520.72	521.46	522.19	522.93
710	523.67	524.41	525.14	525.88	526.62	527.36	528.10	528.83	529.57	530.31
720	531.05	531.78	532.52	533.26	534.00	534.73	535.47	536.21	536.95	537.68
730	538.42	539.16	539.90	540.63	541.37	542.11	542.85	543.56	544.32	545.06
740	545.80	546.53	547.27	548.01	548.75	549.48	550.22	550.96	551.70	552.43
750	553.17	553.91	554.65	555.38	556.12	556.86	557.60	558.34	559.07	559.80
750	560.55	561.29	562.02	562.76	568.50	564.24	564.97	565.71	568.45	567.19
770	567.92	568.68	569.40	570.14	570.87	571.61	572.35	573.09	573.82	574.56
780	575.30	576.04	576.77	577.51	578.25	578.99	579.72	580.40	581.20	581.94
790	582.67	583.41	584.15	584.89	585.62	586.36	587.10	587.84	588.58	589.31
800	590.79	591.53	592.26	593.00	593.74	594.48	595.21	595.95	596.58	596.68
810	597.43	598.16	598.90	599.64	600.38	601.11	601.85	602.59	603.33	604.06
820	604.80	605.54	606.28	607.01	607.75	608.49	609.23	609.96	610.70	611.44
830	612.18	612.91	613.65	614.39	615.13	615.86	616.60	617.34	618.08	618.81
840	619.55	620.29	621.03	621.77	622.50	623.24	623.98	624.72	625.45	626.19
850	626.93	627.67	628.40	629.14	629.68	630.62	631.35	632.09	632.83	633.57
860	634.30	635.04	635.78	636.52	637.25	637.99	638.73	639.47	640.20	640.94
870	641.68	642.42	643.15	643.89	644.63	645.37	646.10	646.84	647.58	648.32
880	649.06	649.79	650.53	651.27	652.01	652.74	653.48	654.22	654.96	655.69
890	656.43	657.17	657.91	658.64	659.38	660.12	660.86	661.59	662.33	663.07
900	663.81	664.54	665.28	666.02	666.76	667.49	668.23	668.97	669.71	670.44
910	671.18	671.92	672.66	673.39	674.13	674.87	675.61	676.35	677.08	677.82
920	678.56	679.30	680.03	680.77	681.51	682.25	682.98	683.72	683.46	685.20
930	685.93	686.67	687.41	688.15	688.88	689.62	690.36	691.10	691.83	692.57
940	693.31	694.05	684.78	695.52	696.26	697.00	697.73	698.47	699.21	699.95
950	700.68	701.42	702.16	702.90	703.63	704.37	705.11	705.85	706.59	707.32
960	708.06	708.80	708.54	710.27	711.01	711.75	712.49	713.22	713.96	714.70
970	715.44	716.17	716.91	717.65	718.39	719.12	719.86	720.60	721.34	722.07
980	722.81	723.55	724.29	725.02	725.76	726.50	727.24	727.97	728.71	729.45
990	730.19	730.92	731.66	732.40	733.14	733.87	734.61	735.35	736.09	736.83

Torque Conversion Tables - Pounds Feet to Newton Metres

Pounds Feet	Newton Metres									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	-	1.36	2.71	4.07	5.42	6.78	8.13	9.49	10.85	12.20
10	13.56	14.91	16.27	17.63	18.98	20.34	21.69	23.05	24.40	25.76
20	27.12	28.47	29.83	31.18	32.54	33.89	35.25	36.61	37.96	39.32
30	40.67	42.03	43.39	44.74	46.10	47.45	48.81	50.16	51.52	52.88
40	54.23	55.59	56.94	58.30	59.66	61.01	62.37	63.72	65.08	66.43
50	67.79	69.15	70.50	71.86	73.21	74.57	75.93	77.28	78.64	79.99
60	81.35	82.70	84.06	85.42	86.77	88.13	89.49	90.84	92.20	93.55
70	94.91	96.26	97.62	98.97	100.33	101.68	103.04	104.40	105.75	107.11
80	108.47	109.82	111.12	112.53	113.89	115.25	116.60	117.96	199.31	120.67
90	122.02	123.38	124.74	126.09	127.45	128.80	130.16	131.51	132.87	134.23
100	135.58	136.94	138.29	139.65	141.01	142.36	143.72	145.07	146.43	147.78
110	149.14	150.50	151.85	153.21	154.56	155.92	157.28	158.63	159.99	161.34
120	162.70	164.05	165.41	166.77	163.12	169.48	170.83	172.19	173.55	174.90
130	176.26	177.61	178.97	180.32	181.68	183.04	184.39	185.75	187.10	188.46
140	189.82	191.17	192.53	193.88	195.24	196.59	197.95	199.31	200.66	202.02
150	203.37	204.73	206.08	207.44	208.80	210.15	211.51	212.86	214.22	215.58
160	216.93	218.29	219.64	221.00	222.35	223.71	225.07	226.42	227.78	229.13
170	230.49	231.85	233.20	234.56	235.91	237.27	238.64	239.98	241.34	242.69
180	244.05	245.40	246.76	248.12	249.47	250.83	252.18	253.54	254.89	250.25
190	257.61	258.96	260.32	261.67	263.03	264.38	265.74	267.10	263.45	269.81
200	271.16	272.52	273.88	275.23	276.59	277.94	279.30	280.65	282.01	283.37
210	284.72	286.08	287.43	288.79	290.15	291.50	292.86	294.21	295.57	296.92
220	298.28	299.64	300.99	302.35	303.70	305.06	306.42	307.77	309.13	310.48
230	311.84	313.19	314.55	315.91	317.26	318.62	319.97	321.33	322.68	324.04
240	325.40	326.75	328.11	329.46	330.82	332.18	333.53	334.89	336.24	337.60
250	338.95	340.31	341.67	343.02	344.38	345.73	347.09	348.45	349.80	351.16
260	352.51	353.87	355.22	356.58	357.94	359.29	360.65	362.00	363.36	364.72
270	366.07	367.43	368.78	370.14	371.49	372.85	374.21	375.56	376.92	378.27
280	379.63	380.98	382.34	363.70	385.05	386.41	387.76	389.12	390.48	391.63
290	393.19	394.54	395.90	397.26	398.61	398.97	401.32	402.63	464.03	405.39
300	406.75	408.10	409.46	410.81	412.17	413.52	414.98	416.24	417.59	418.95
310	420.30	421.68	423.02	424.37	425.73	427.08	428.44	429.79	431.15	492.51
320	433.86	435.22	436.57	437.93	439.29	440.64	442.00	443.35	444.71	448.06
330	447.42	448.78	450.13	451.49	452.84	454.20	455.56	456.91	458.27	459.62
340	460.98	462.33	463.69	465.05	466.40	467.76	489.11	470.47	471.63	473.18
350	474.54	475.89	477.25	478.60	479.98	481.32	482.67	464.03	485.38	486.74
360	488.09	489.45	498.81	492.16	493.52	494.87	496.23	497.59	498.94	500.30
370	501.65	503.01	504.36	505.72	507.08	598.43	509.79	511.14	512.50	513.86
380	515.21	516.57	517.92	519.28	520.63	521.98	523.34	524.70	526.06	527.41
390	528.77	530.13	531.48	532.84	534.19	535.55	536.90	538.26	539.62	540.97
400	542.33	543.68	545.04	546.40	547.75	549.11	550.46	551.82	553.17	554.53
410	555.89	557.24	558.60	559.95	561.31	562.66	564.02	565.38	566.73	568.09
420	569.45	570.80	572.16	573.51	574.87	576.22	577.59	578.93	580.29	581.65
430	583.00	584.38	585.71	587.07	598.41	589.78	591.14	592.49	593.85	595.20
440	596.56	597.92	599.27	600.63	601.98	603.34	604.70	606.05	607.41	608.76
450	610.12	611.47	612.83	614.19	615.54	616.90	618.25	619.61	620.97	622.32
460	623.68	625.03	626.39	627.74	629.10	630.46	631.81	633.17	634.52	635.98
470	637.23	638.59	639.95	641.30	642.68	644.01	645.37	640.73	648.08	649.44
480	650.79	652.15	653.50	654.86	656.22	657.57	658.93	660.28	661.64	663.00
490	664.35	665.71	667.06	668.42	669.77	671.13	672.49	673.84	675.20	676.55

Torque Conversion Tables - Pounds Feet to Newton Metres

Pounds Feet	Newton Metres									
	0	1	2	3	4	5	6	7	8	9
500	677.91	679.27	680.62	680.98	683.33	684.69	686.04	687.04	688.76	690.11
510	691.47	692.82	694.18	697.54	696.89	698.25	699.60	700.96	702.31	703.67
520	705.03	706.38	707.74	709.09	710.45	711.80	713.16	714.52	715.87	717.23
530	718.58	719.94	721.30	722.65	724.01	725.36	726.72	728.07	729.43	730.79
540	732.14	733.50	734.85	736.21	737.57	738.92	740.28	741.63	742.99	744.35
550	745.70	747.06	748.41	749.77	751.12	752.48	753.84	755.19	756.55	757.90
560	759.26	760.61	761.97	763.33	764.68	766.04	767.39	768.75	770.11	771.48
570	772.82	774.17	775.53	776.88	778.24	779.69	780.95	782.31	783.66	785.02
580	786.37	787.73	789.09	790.44	791.80	793.15	794.51	795.87	797.22	798.58
590	799.93	801.28	802.64	804.00	805.36	806.71	808.07	809.42	810.78	812.14
600	813.49	814.85	816.20	817.56	818.91	820.27	821.63	822.98	824.34	825.69
610	827.05	828.41	829.76	831.12	832.47	833.83	835.18	836.54	837.90	839.25
620	840.61	841.96	844.32	844.68	848.03	847.39	848.74	850.10	851.45	852.81
630	854.17	855.52	856.88	858.23	859.59	860.94	862.30	863.68	865.01	868.37
640	867.72	868.08	870.44	871.79	873.15	874.50	875.86	877.21	878.57	879.93
650	881.28	882.64	883.99	885.35	886.71	888.06	689.42	890.77	892.13	893.48
660	894.84	896.20	897.55	898.91	900.26	901.62	902.98	904.33	905.68	907.04
670	908.40	909.75	911.11	912.47	913.82	915.17	916.55	917.89	919.25	920.60
680	921.96	923.31	924.67	926.02	927.38	928.74	930.09	931.45	932.80	934.16
690	935.51	936.87	938.23	939.58	940.94	942.29	943.65	945.01	946.36	947.72
700	949.07	956.43	951.78	953.14	954.50	955.85	957.21	958.56	959.92	961.28
710	962.63	963.99	965.34	966.70	968.05	969.41	970.77	972.12	973.47	974.83
720	976.19	977.55	978.90	980.26	981.61	982.97	984.32	985.68	987.04	988.39
730	989.75	991.10	992.46	993.82	995.17	996.53	997.68	999.24	1000.6	1002.0
740	1003.3	1004.7	1006.0	1007.4	1008.7	1010.1	1011.4	1012.8	1014.2	1015.5
750	1016.9	1018.2	1019.6	1020.9	1022.3	1023.6	1025.0	1026.4	1027.7	1029.1
760	1030.4	1031.8	1033.1	1034.5	1035.8	1037.2	1038.6	1039.9	1041.3	1042.6
770	1044.0	1045.3	1048.7	1048.1	1049.4	1050.8	1052.1	1053.5	1054.8	1056.2
780	1057.5	1058.9	1060.3	1061.6	1063.0	1064.3	1065.7	1067.0	1068.4	1069.7
790	1071.1	1072.5	1073.8	1075.2	1076.5	1077.9	1079.2	1080.6	1081.9	1083.3
800	1084.7	1086.0	1087.4	1088.7	1090.1	1091.4	1092.8	1094.2	1095.5	1096.9
810	1098.2	1099.6	1100.9	1102.3	1103.6	1105.0	1106.4	1107.8	1109.1	1110.4
820	1111.8	1113.1	1114.5	1115.8	1117.2	1118.6	1119.9	1121.3	1122.6	1124.0
830	1125.3	1126.7	1128.0	1129.4	1130.8	1132.1	1133.5	1134.8	1136.2	1137.5
840	1138.9	1140.2	1141.6	1143.0	1144.3	1145.7	1147.0	1148.4	1149.7	1151.1
850	1152.5	1153.8	1155.2	1156.5	1157.9	1159.2	1160.6	1161.9	1163.3	1164.7
860	1168.0	1167.4	1168.7	1170.1	1171.4	1172.8	1174.1	1175.5	1176.9	1178.2
870	1179.6	1180.9	1182.3	1183.6	1185.0	1186.3	1187.7	1189.1	1190.4	1191.8
880	1193.1	1194.5	1195.8	1197.2	1198.5	1199.9	1201.3	1202.6	1204.0	1205.3
890	1206.7	1208.0	1209.4	1210.8	1212.1	1213.5	1214.8	1216.2	1217.5	1218.9
900	1220.2	1221.6	1223.0	1224.3	1225.7	1227.0	1228.4	1229.7	1231.1	1232.4
910	1233.8	1235.2	1236.5	1237.9	1239.2	1240.6	1241.9	1243.3	1244.6	1246.0
920	1247.4	1248.7	1250.1	1251.4	1252.8	1254.1	1255.5	1256.8	1258.2	1259.6
930	1260.9	1262.3	1263.6	1265.0	1266.3	1267.7	1269.1	1270.4	1271.8	1273.1
940	1274.5	1275.8	1277.2	1278.5	1279.9	1281.3	1282.6	1284.0	1285.3	1286.7
950	1288.0	1289.4	1290.7	1292.1	1293.5	1294.8	1296.2	1297.5	1298.9	1300.2
960	1301.6	1302.9	1304.3	1305.7	1307.0	1308.4	1309.7	1311.1	1312.4	1313.8
970	1315.1	1316.5	1317.9	1319.2	1320.6	1321.9	1323.3	1324.6	1326.0	1327.4
980	1328.7	1330.1	1331.4	1332.8	1334.1	1335.5	1336.8	1338.2	1339.6	1340.9
990	1342.3	1343.6	1345.0	1346.3	1347.7	1349.0	1350.4	1351.8	1353.1	1354.5

Torque Lists

General Fixings - Use these torque specifications for all general fixings not specified elsewhere in these lists:

Use	Description	Torque Nm
Nuts and bolts	M5 x 0.8	5-7
Nuts and bolts	M6 x 1	8-12
Nuts and bolts	M8 x 1.25	20-30
Nuts and bolts	M10 x 1.5	40-55
Nuts and bolts	M12 x 1.75	70-95
Nuts and bolts	M14 x 2	110-155
Pipe Unions	1/4” x 18 tpi	14 Nm + 180°
Pipe Unions	3/8” x 18 tpi	20 Nm + 180°
Pipe Unions	1/2” x 14 tpi	40 Nm + 180°
Pipe Unions	3/4” x 14 tpi	60-75 Nm
Pipe Unions	1” x 11.5 tpi	90 Nm + 180°

Engine

Cylinder Block

Use	Description	Torque Nm
Pipe plugs	3/4 x 14	63-72
Pipe plugs	1/4 x 18	14 Nm +180°
Oil squirters	Drilled oil jet	Hand tight
Main bearing caps (outer)	Flange head bolt M8	22-28 + 90°
Main bearing caps (side)	Flange head bolt M9	22-28 + 45°
Main bearing caps (inner)	Flange head bolt M10	37-43 + 90°
Big end bolts	Flange head bolt MJ9	40-45 +90-120°
Rear oil seal retainer	Flange head bolt M6	8-12
Oil pump bolt	Flange head bolt M6	8-12
OIl pump bolt	Flange head bolt M8	23-27
Windage tray	Flange head nut M6	5-7 + 45°
Oil pick-up pipe	Flange head bolt M6	8-12
Oil separators	Flange head bolt M6	8-12

Cylinder head

Pipe plugs	1/4 x 18	14 Nm + 180°
Pipe plug	3/8 x 18	20 Nm + 180°
Pipe plug	3/4 x 14	63-72
Pipe plug	1 x 11.5	90 Nm + 180°
Oil pressure adaptor sender	12-14 Nm + up to 240° until opening is within 60° of vertical	
Cylinder head bolt	Flange head bolt M10	See procedure
Cylinder head bolt	Flange head bolt M8	See procedure
Camshaft cap bolts	Flange head bolts M6	8-12
Exhaust manifold studs	Hex head Stud M8	10-13
Spark plugs	-	16-20

Timing Chains, Guides,Tensioners and Cover

Use	Description	Torque Nm
Chain guide and chain tensioner bolts	Flange head bolt M8	20-30
Timing cover bolts	Flange head bolt M8	23-27
Crank position sensor	Flange head bolt M6	8-12

Crankshaft Damper

Crankshaft damper bolt	Flange head bolt M12	See Procedure

Oil Pan

Drain plugs	Hex head 15 mm	23-27
OIl pan baffle bolts	Flange head bolt M6	8-12
Oil pan bolt	Flange head bolt M8	15 Nm + 90°

Camshaft Cover

Cylinder identification sensor	Flange head bolt M6	8-12
Camshaft cover bolt	Grommet bolt 10mm Hex	8-12
Ignition coil cover	Torx screw M4	2.5-3.5

Water Cross Over and Thermostat Housing

Housing mounting bolts	Flange head bolt M6	8-12
Housing bracket bolt (upper)	Flange head bolt M6	8-12
Housing bracket bolt (lower)	Flange head bolt M8	23-27

Drive Pulleys

Drive belt tensioner	Securing bolt hex head	23-27
Fixed idler pulleys (3)	Flange head bolt M8	23-27

Engine Auxiliaries

Pump securing bolts	Flange head bolt M8	23-27
Alternator bracket bolts	Flange head bolt M10	43-52
Alternator bolts	Flange head bolt M10	43-52
A/C compressor bolts	Flange head bolt M8	23-27
OIl cooler mounting	Special adaptor	55-60
OIl filter	-	17-21
Water pump mounting bolts	Flange head bolt M8	23-27
Starter motor mounting bolt	Flange head bolt M10	40-55

Inlet Manifolds

Manifold mounting bolts	Flange head bolt M6	8-12
Fuel rail bolts	Flange head bolt M6	8-12
Fuel rail cover	Flange head bolt M6	8-12

Exhaust Manifolds

Manifold mounting nuts	Flange nut M8	18-22
Heat shield Joining bolts	Flange head bolt M6	8-12
Heat shield Mounting bolts	Flange head bolt M6	8-12
Heat shield Mounting bolts	Flange head bolt M5	5-7

Engine Cradle Assembly

Strut tower upper support to strut tower	Flange head nut and bolt M12	86
Strut tower lower support to strut tower	Flange head bolt M10	55
Engine cradle to strut tower front	Flange head bolt M10	55
Strut tower to engine cradle rear	Flange head bolt M12	86
Belly plate to engine cradle	Fkange head screw M8	25
Strut tower support to tub top outer	Flange head bolt M12	86
Strut tower support to tub top inner	Flange head bolt M10	55
Engine cradle to tub	Flange head screw M12	86

Front Suspension

Use	Description	Torque Nm
Upper arm to strut tower	Flange bolt M10	65-70
Upper arm to knuckle	Flange nut M12	90
Lower arm to engine cradle	Flange nut M14	175
Lower arm to engine cradle	Cam and bolt assembly	175
Lower arm to engine cradle	Cam washer	175
Lower arm to knuckle	Flange nut M14	150
Lower arm to knuckle	Nut M16	175
Hub bearing to knuckle	Flange bolt M12	90
Stabiliser bar to engine cradle	Flange bolt M10	55
Stabiliser bar link	Flange nut M10	55
Damper top mount to strut tower	Flange nut M8	27.5
Damper to lower arm	Flange bolt M14	175
Damper to lower arm	Flange nut M14	175
Damper to top mount	Flange nut M12	45-55

Front Brakes

Brake caliper to adaptor	Cap head bolt M12	105-125
Brake caliper adaptor to knuckle	Flange bolt M12	105-125

Steering

Steering rack to engine cradle	Bolt and washer M12	86 + Loctite 242
Steering tie rod to knuckle	Flange nut M12	100
Intermediate shaft to steering column	Flange bolt M8	30
Intermediate shaft to steering rack	Flange bolt M8	30
Intermediate shaft adjust	Bolt	35 ± 3
Steering column to bulkhead bracket	Flange nut M8	24
Bulkhead bracket to main frame	Flange screw M8	24
Steering column to lower bracket and main frame	Flange screw M8	30
Steering wheel to column	Bolt and washer M10	40

Road Wheels

Wheels	Flange nut M12	70-80

Rear Suspension

Use	Description	Torque Nm
Rear subframe to main frame	Flange bolt M12	90
Rear lower arm to subframe	Flange bolt M14x77	150
Rear lower arm to subframe	Flange bolt M14x94	180
Rear knuckle to lower arm	Flange bolt M14	150
Upper arm to subframe	Flange bolt M12	90
Toe link to subframe	Nyloc nut and washer M12	120
Toe link heatshield to subframe	Screw M6	12
Rear knuckle to toe link	Flange bolt M10	55
Rear wheel hub	Nut and washer	410
Rear damper to top mount	Flange nut M12	50 ±5
Rear damper top mount to strut tower	Flange nut M8	36
Rear damper to lower arm	Bolt M14	140
ABS sensor to knuckle	Flange screw M6	11.5
Propshaft to differential	Flange bolt M12	71-84
Differential to subframe (front)	Flange head bolt M12	90
Differential to subframe (rear)	Flange head bolt M14	180
Stabiliser bar to rear subframe	Flange head bolt M10	55
Stabiliser bar link	Flange nut M10	48

Rear Brakes

Handbrake caliper to knuckle	Cap head bolt M8	20-30
Handbrake caliper to knuckle	Flange head bolt M10	40-46
Brake caliper to knuckle	Cap head bolt M12	105-120

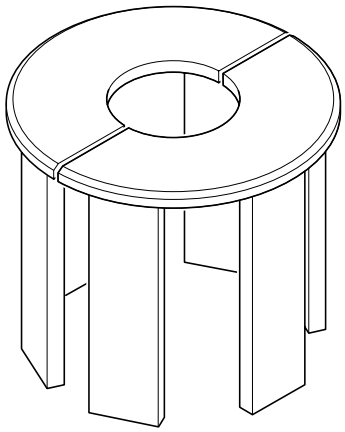
Miscellaneous

Checkstrap bracket to engine mounting leg	Flange head screw M8	23
Checkstrap bracket to engine mounting leg	Flange head screw M8	23
Checkstrap to gearbox crossmember	Flange head screw M8	23
Engine mounting leg to engine	Flange head screw M10	49
Engine mounting to cradle	Flange head screw M10	49
Gearbox crossmember to tunnel shear panel	Pan head screw M8	23
Gearbox crosmember to tunnel	Flange nut M8	23
Checkstrap to ASM bracket	Flange nut M8	23
Engine mounting to leg	Flange nut M10	49
Checkstrap to bracket	Flange head screw M8	23
Handbrake relay lever to bracket	bolt M8	25+Loctite 242
Flywheel to engine	bolt M10	55-60
Clutch to flywheel	bolt M8	25-30

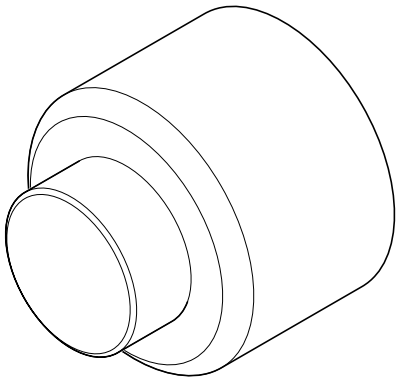
Special Tools - Pictorial Index

ITEM NO	PART NO.	DESCRIPTION	QTY
1	204-249	REAR HUB SUPPORT TOOL	1
2	204-250	REAR HUB BRG REM	1
3	204-252	BRG SUPPORT	1
4	204-269	CTR SCREW (USED WITH 205-491)	1
5	204-273	STEERING RACK BUSH REM/REP CUP	1
6	204-274	STEERING RACK BUSH REM/REP NUT	1
7	204-275	STEERING RACK BUSH REM/REP BOLT	1
8	204-321	F/R DAMPER SPRING COMPRESSOR	1
9	205-053	FLANGE HOLDING TOOL	1
10	205-491	HUB PULLER	1
11	205-519	FRONT DIFF MTG BUSH INSTALLER	1
12	205-520	FRONT DIFF MTG BUSH REP REC'R CUP	1
13	205-521	M12 CTR SCREW KIT	1
14	205-522	DIFF PINION SEAL REP	1
15	205-523	DIFF O/P 1/4 SHAFT SEAL REP	1
16	206-081	HANDBRAKE PISTON RETRACTOR	1
17	303-709	OXY SENSOR WRENCH	1
18	303-712	OIL FILTER DRAIN PAN	1
19	303-713	"SETTING GAUGE, CAMSHAFTS"	1
20	303-714	ENGINE LIFTING BRKT SET	1
21	303-F715	MULTI-PURPOSE TROLLEY	1
22	303-F715-01	SUBFRAME TO TROLLEY ADAPTORS	1
23	303-F715-02	ENGINE TO TROLLEY ADAPTORS	1
24	303-F715-03	RIDE HEIGHT SETTING ADAPTORS	1
25	307-447	OIL COOLER DISCONNECT TOOL	1
26	307-448	TRANSMISSION REAR SEAL INST	1
27	307-449	TX ASM DATUM TOOL	1
28	307-450	BRIDGE PIPE RESERVOIR COUPLING	1
29	310-096	FUEL RAIL DEPRESSURIZATION TOOL	1
30	310-097	FILLER CAP EVAPORATIVE LOSS	1
31	501-061	REAR SUB FRAME MOUNT REM SUPPORT BASE	1

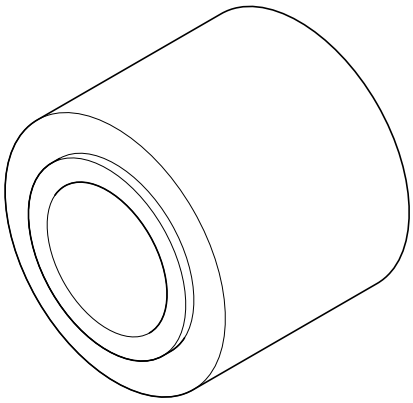
ITEM NO	PART NO.	DESCRIPTION	QTY
32	501-063	REAR MOUNT DIFF BUSH REM/REP RECEIVER CUP	1
33	501-082	M16 CTR SCREW KIT	1
34	501-083	REAR SUB FRAME MOUNT REM	1
35	501-084	REAR SUB FRAME MOUNT REP	1
36	501-085	REAR SUB FRAME MOUNT REP RECEIVER CUPS	1
37	501-086	REAR SUB FRAME MOUNT REM RECEIVER CUPS	1
38	501-087	REAR SUBFRAME ALIGNMENT TOOL	1
39	501-088	RIDE HEIGHT DROPPER SET	1
40	501-089	REAR MOUNT DIFF BUSH REM/REP	1



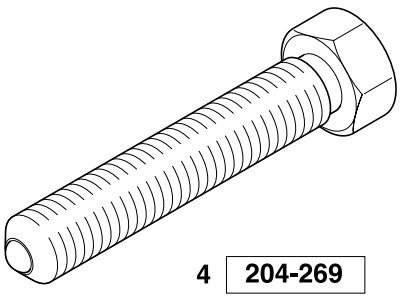
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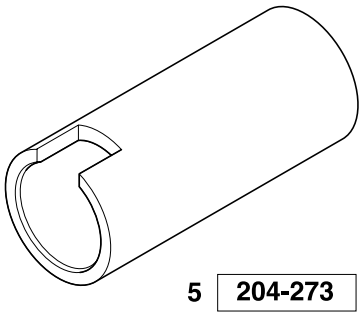
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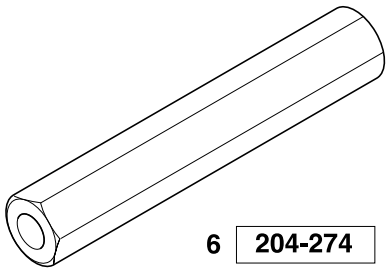
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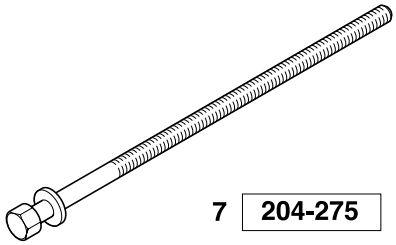
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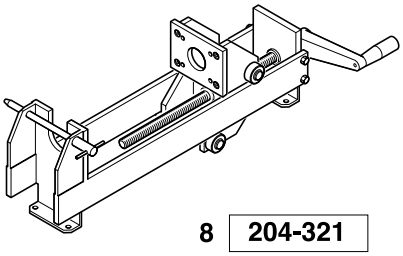
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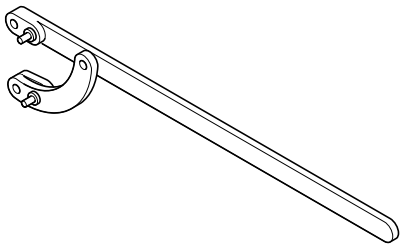
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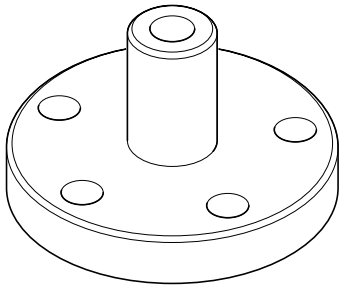
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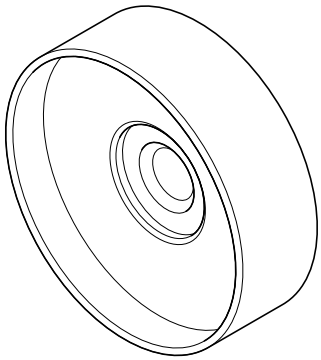
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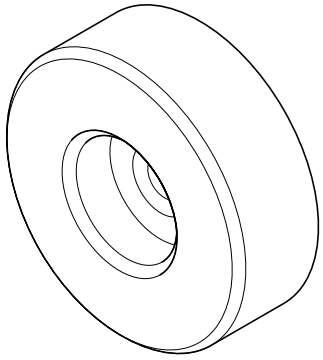
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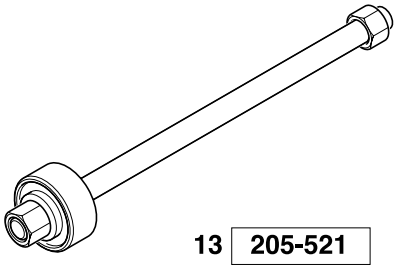


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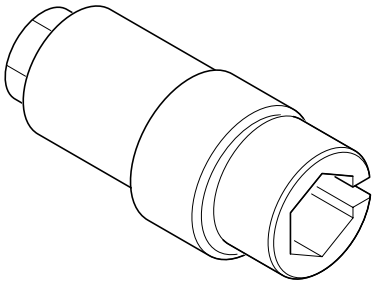


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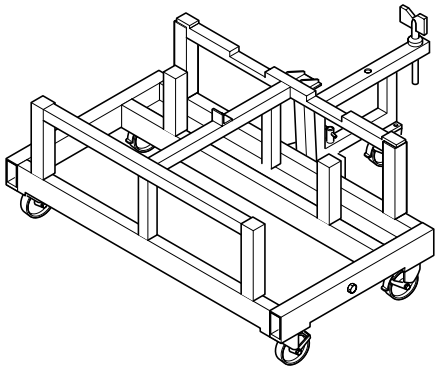
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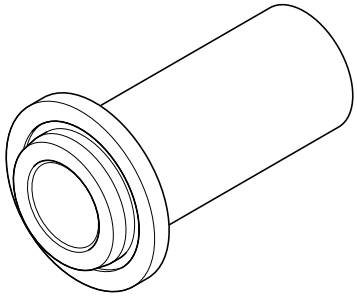
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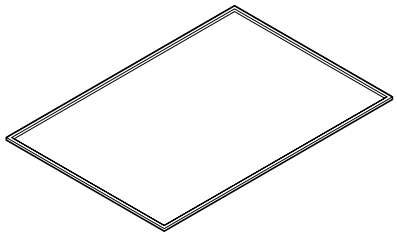
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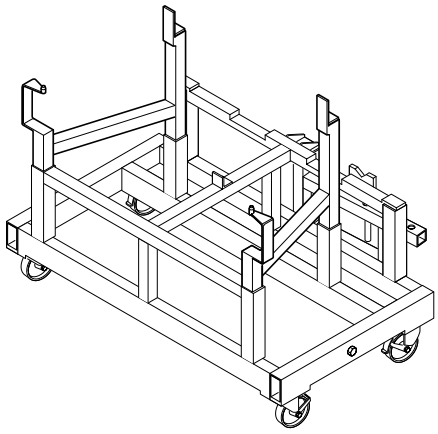
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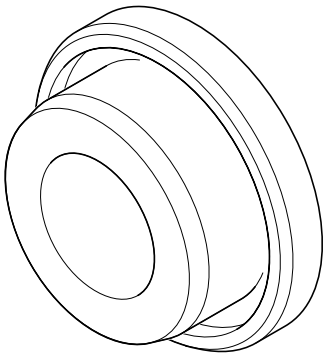
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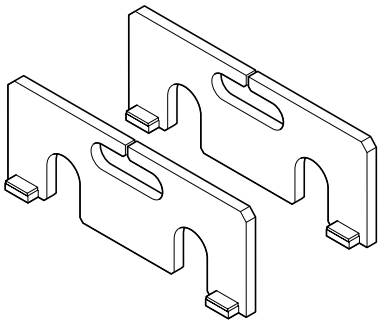
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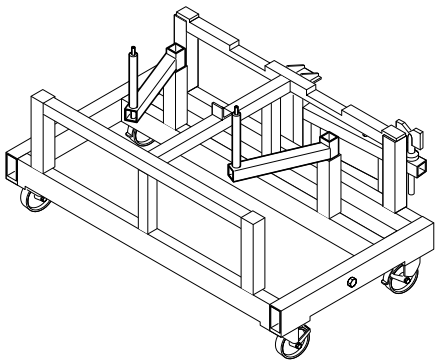
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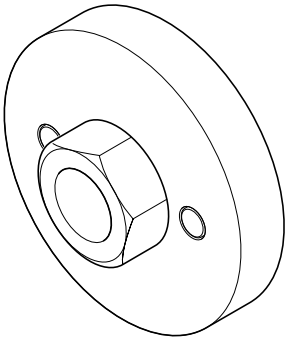
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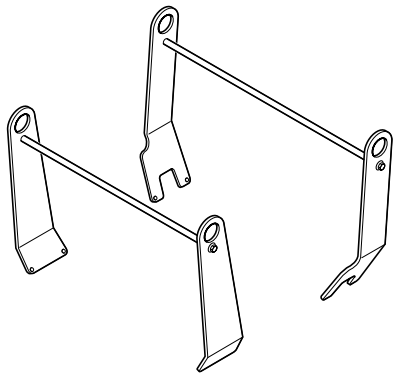
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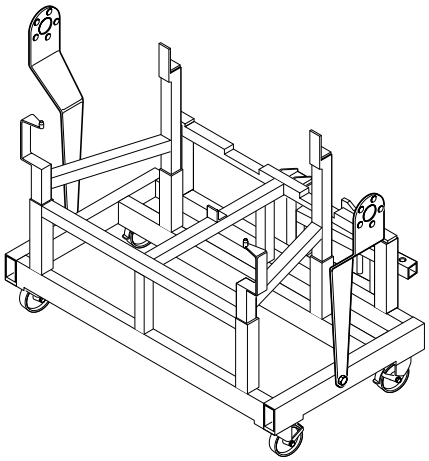


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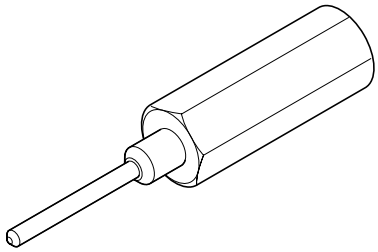


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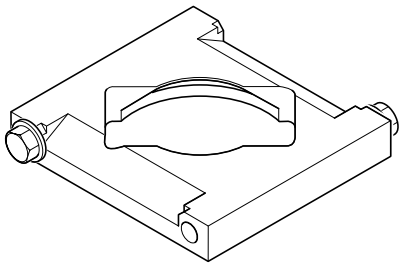
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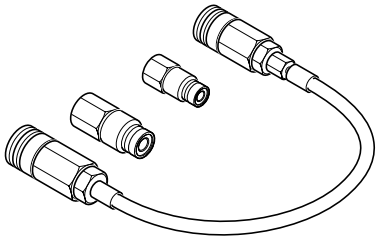
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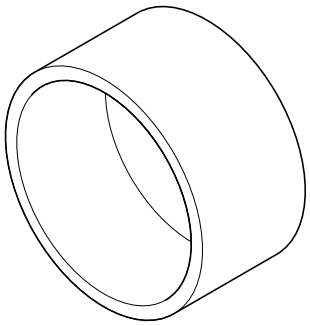
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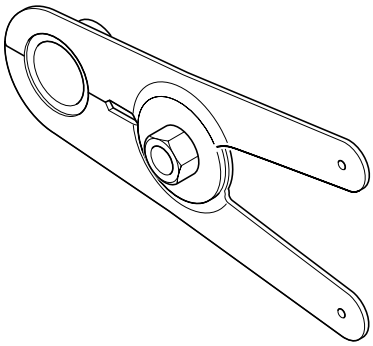
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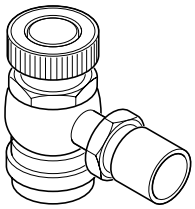
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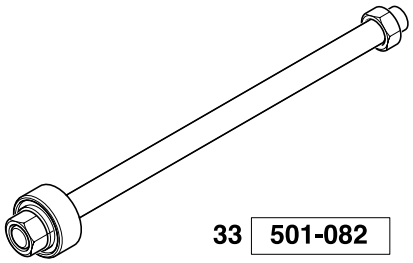
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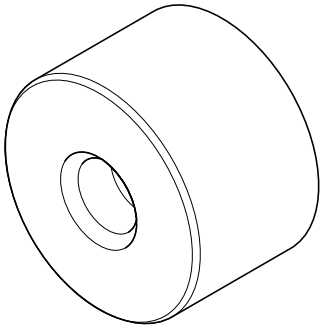
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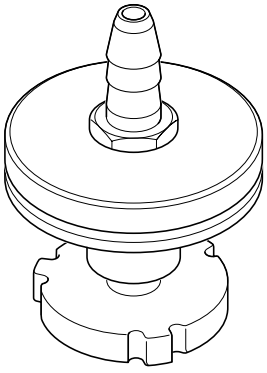
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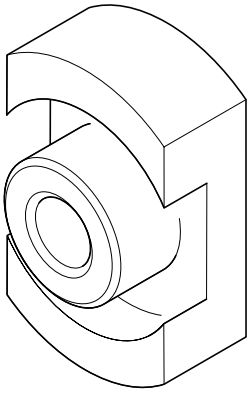
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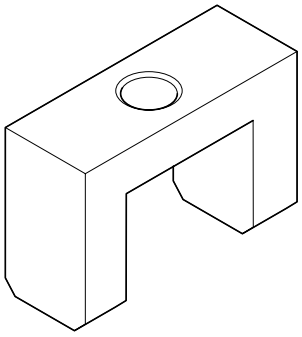


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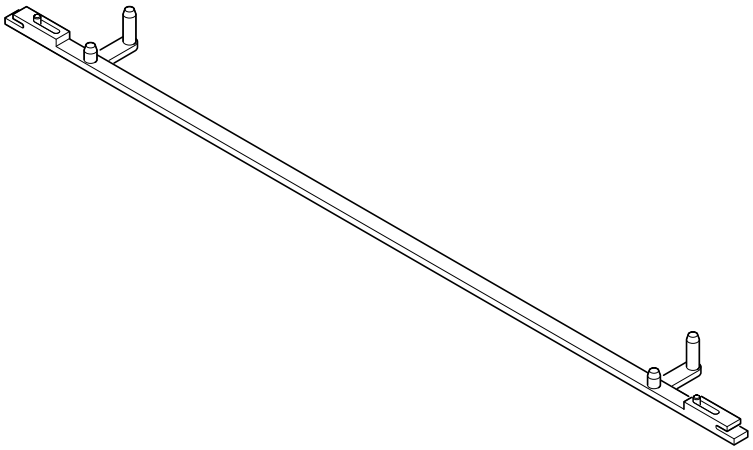


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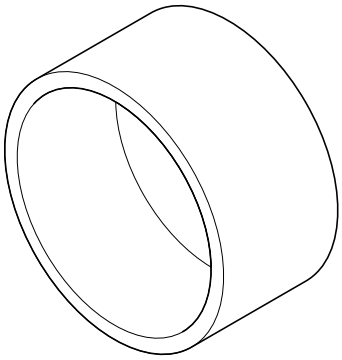
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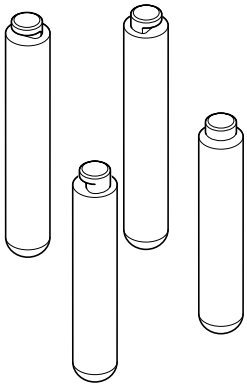
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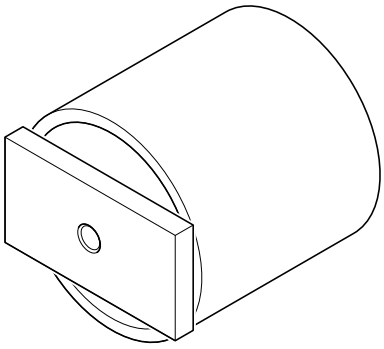
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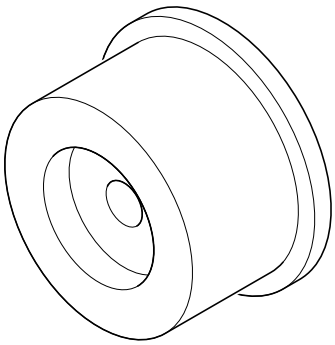
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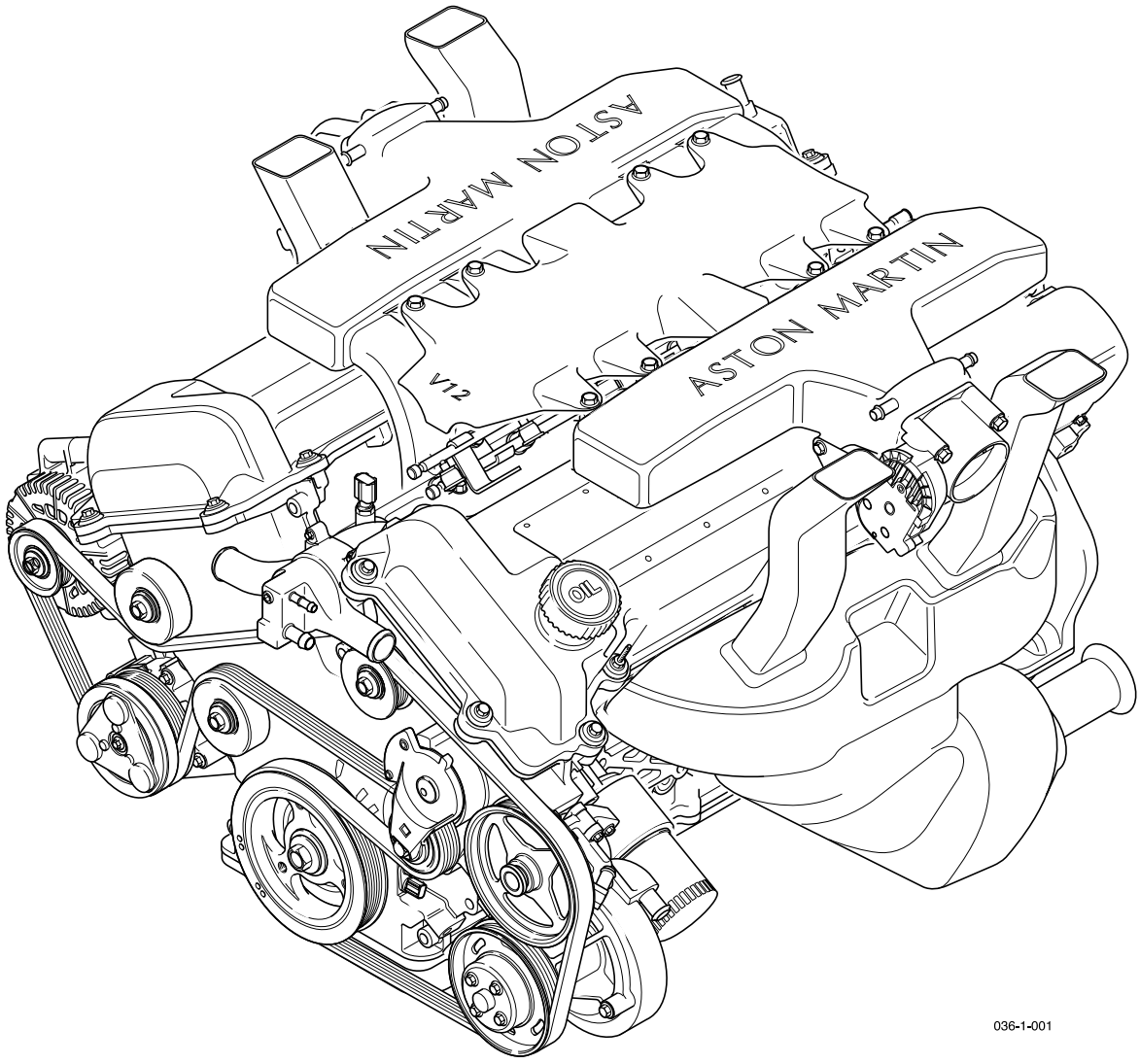
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Engine Description

General



The engine is an all aluminium 6.0 litre 60° V12 configuration. The cylinder heads have dual overhead camshafts and four valves per cylinder. An electronic engine management system controls the sequential multiport fuel injection and distributorless ignition systems.

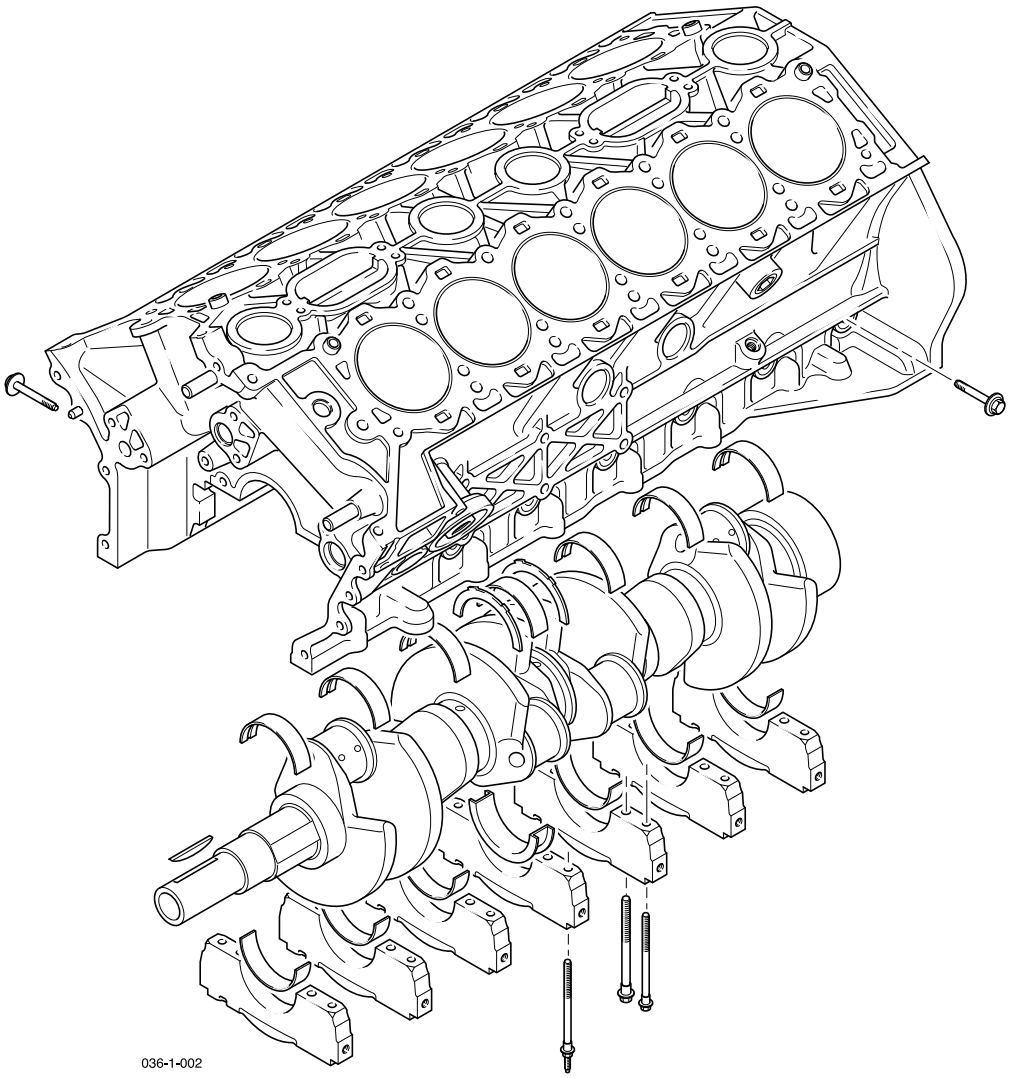
The engine uses the latest 'fast-burn' combustion technology. Heated oxygen sensors monitor the oxygen content of exhaust gasses. The engine management system uses the oxygen sensor signals together with other engine information to 'fine tune' fuelling levels and ignition timing. This helps to achieve the best possible fuel burn with minimum exhaust emissions. The exhaust system incorporates six catalytic convertors to minimise the levels of harmful gasses passing into the atmosphere. Additional oxygen sensors are placed after the catalysts so that long term catalyst efficiency can be monitored. The engine runs on unleaded fuel only.

Engine Block

The 60° V12 aluminium engine block incorporates paths for water cooling, oil distribution and positive crankcase ventilation.

The seven main bearing caps supporting the crankshaft are bolted laterally as well as vertically to provide additional crankcase stiffening whilst keeping engine weight to a minimum. Each bearing cap is numbered to identify its position in the engine block

The 12 cast iron cylinder liners are inserted and machined during block production and require specialist equipment for replacement.



Dowels are fitted to the principal mating faces of the block to ensure accurate alignment of cylinder heads, front timing cover, auxiliaries, etc.

Crankshaft

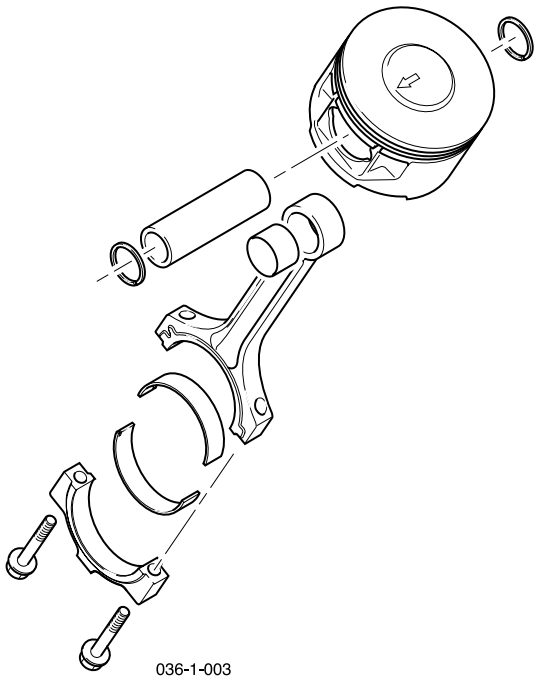
The crankshaft is mounted in 7 main bearings with end loads absorbed by thrust washers at number 4 main bearing. Main bearing bolts are of the 'torque to yield' type and must be renewed if removed.

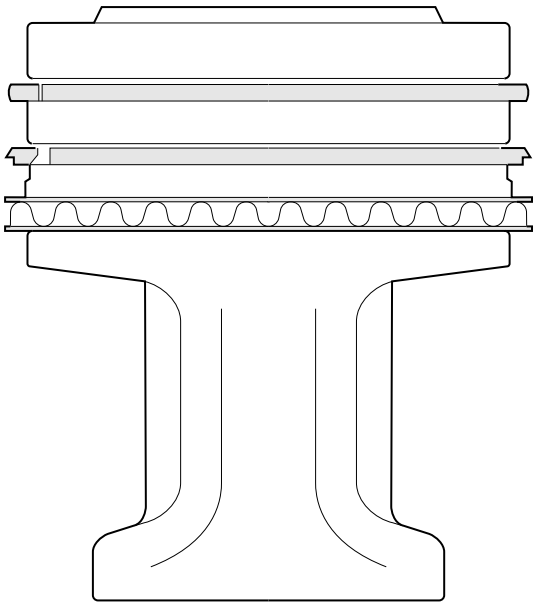
A twin sprocket fitted to the front end of the crankshaft drives the camshaft chains. A damper pulley fitted on the crankshaft nose drives the engine auxiliaries via a polyvee drive belt.

Also at the front of the engine a timing disc is fitted together with two crankshaft sensors. The sensors provide engine position signals to the two powertrain controllers.

Pistons and Connecting Rods

The six crankshaft big end journals each carry a pair of connecting rods. The rods are secured to the crankshaft by individual connecting rod caps enclosing the connecting rod bearing shells. Connecting rod bolts are of the 'torque to yield' type and must be renewed if removed.


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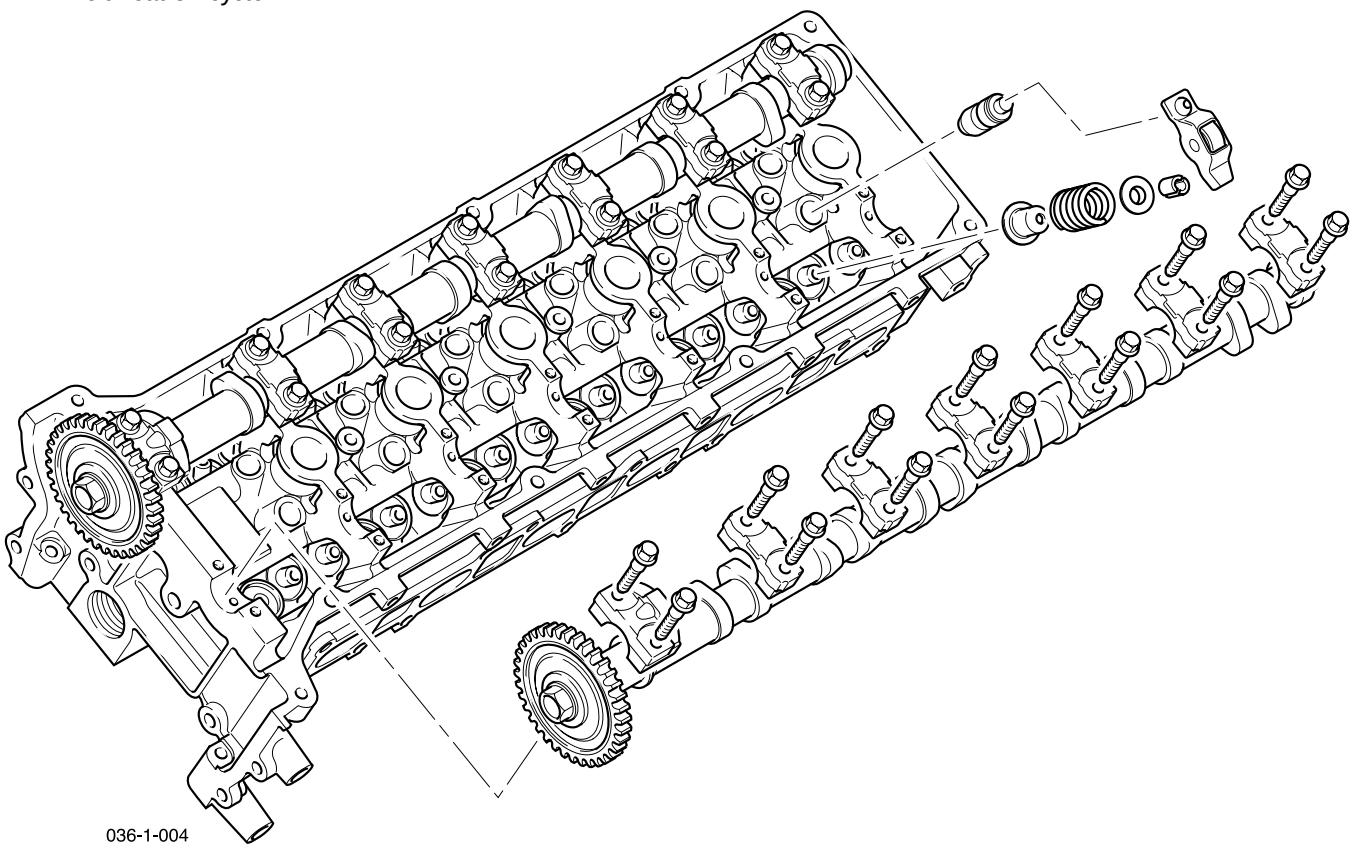


Each piston carries two compression rings and one oil control ring. The arrow on each piston crown must point to the front of the engine during installation.

Connecting rods are manufactured as a single piece with fracture lines at the connecting rod bearing. Each connecting rod cap is cracked from the rod after machining and drilling. Thus each cap will only fit to its matching rod and will only fit to that rod in one orientation.

Cylinder Heads

Each cylinder is provided with two inlet and two exhaust valves. The valves are operated by rocker arms beneath each cam. Valve clearances are maintained at zero by a hydraulic tappet system pressurised from the main engine lubrication system.



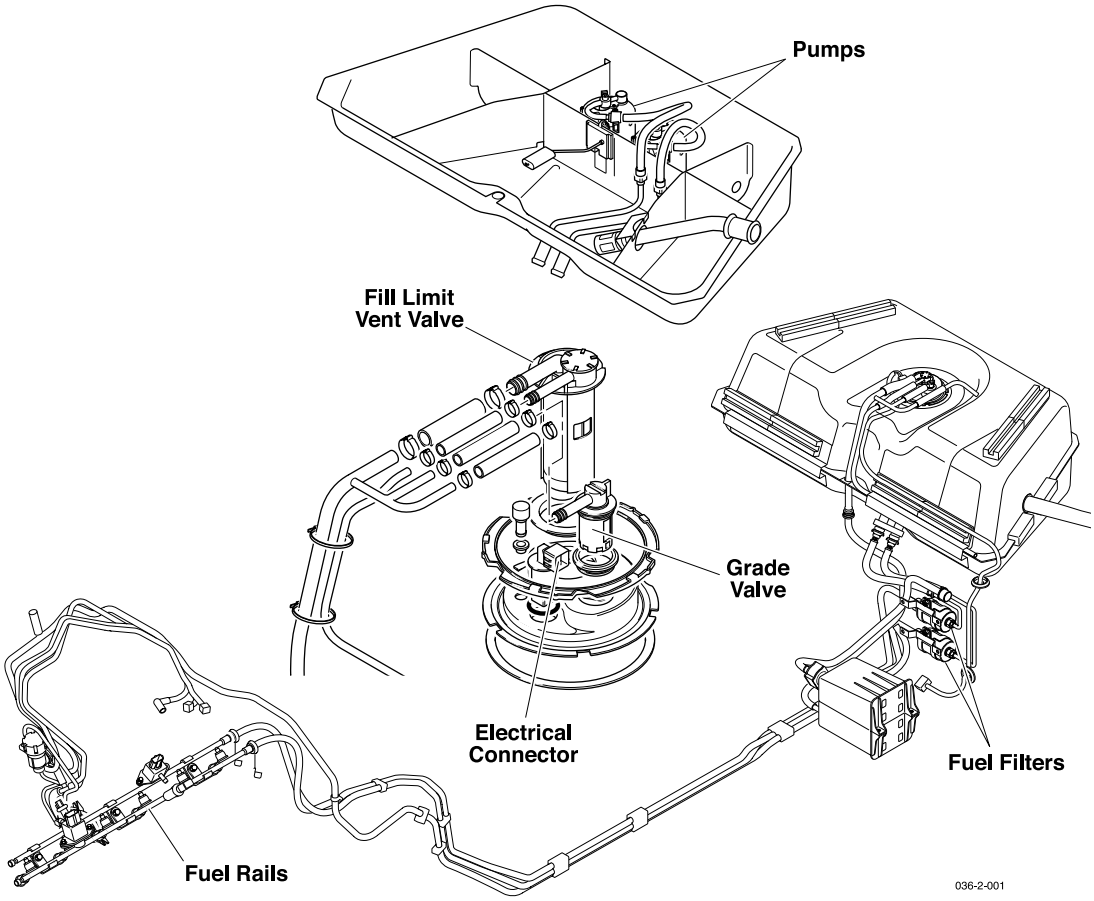
Camshafts

The inlet and exhaust camshafts in each head are chain driven directly from the crankshaft.

The twin crankshaft sprocket has 18 teeth and each camshaft sprocket has 36 teeth. The timing chains have 61 links. Three chain links are marked and are aligned with timing marks on the crank and cam sprockets during valve timing. Because of the odd number of links in the timing chains, the timing marks and marked links will only align once every 122 engine revolutions.

Fuel Injection System

The fuel tank is fitted with two in-tank fuel pumps. Two identical fuel injection systems are fitted, one for each engine bank. The fuel system operation is described in section 2 of this manual.



Evaporative Loss System

This system prevents the escape of fuel vapours into the atmosphere. The systems are summarised here but are fully described in section 2 of this workshop manual.

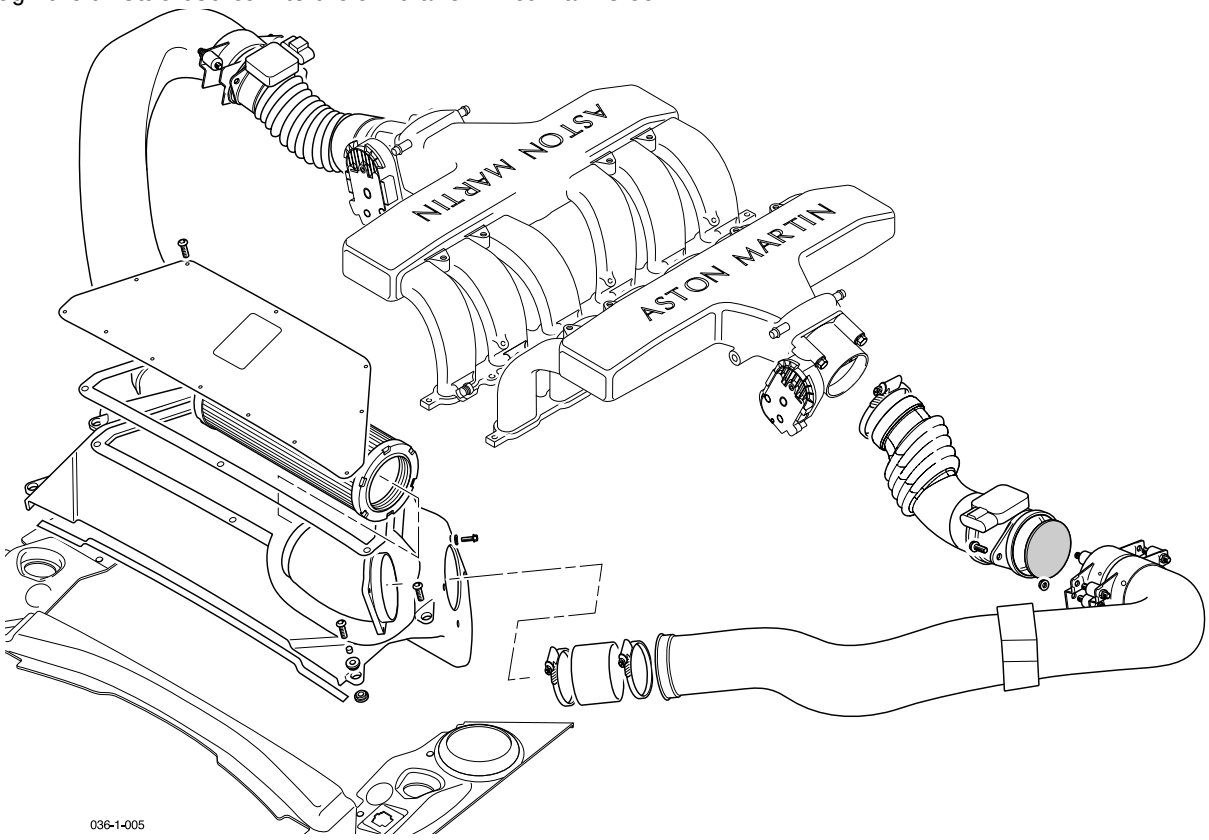
Any fuel vapour displaced from the fuel tank during fuel filling or by evaporation, will pass into the carbon canisters. The hydrocarbons will be absorbed and retained in the filter carbon. Clean, hydrocarbon-free air passes to atmosphere.

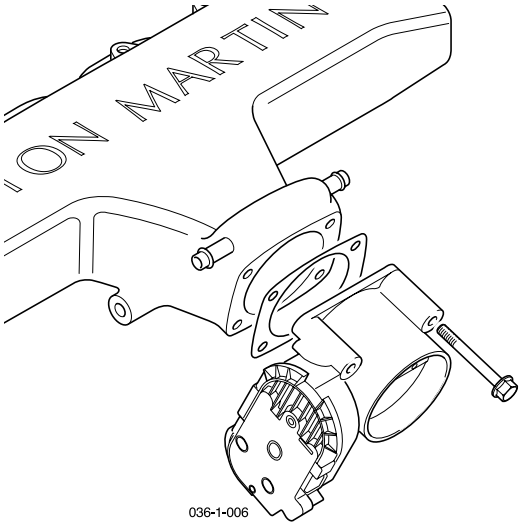
During normal running of the engine, the vapour management valves will be opened and air will be drawn through the filter carbon and into the inlet manifold. This airflow will purge any hydrocarbons from the carbon filters.

The engine management system will compensate for the additional hydrocarbons (fuel) in the incoming air and will make small reductions in the normal fuelling level to maintain the optimum fuel burn and to minimise emissions.

Air Induction System

Intake air is filtered and then passes through the mass air flow meters (MAF). The signals from the MAF meters are fed to the power train electronic control (PTEC) modules and are used together with other signals in calculating the required amount of fuel (Air fuel ratio approx. 14.3 parts air to 1.0 part fuel by weight). The air then passes through the throttle bodies into the six branch inlet manifolds.





Motorised Throttles

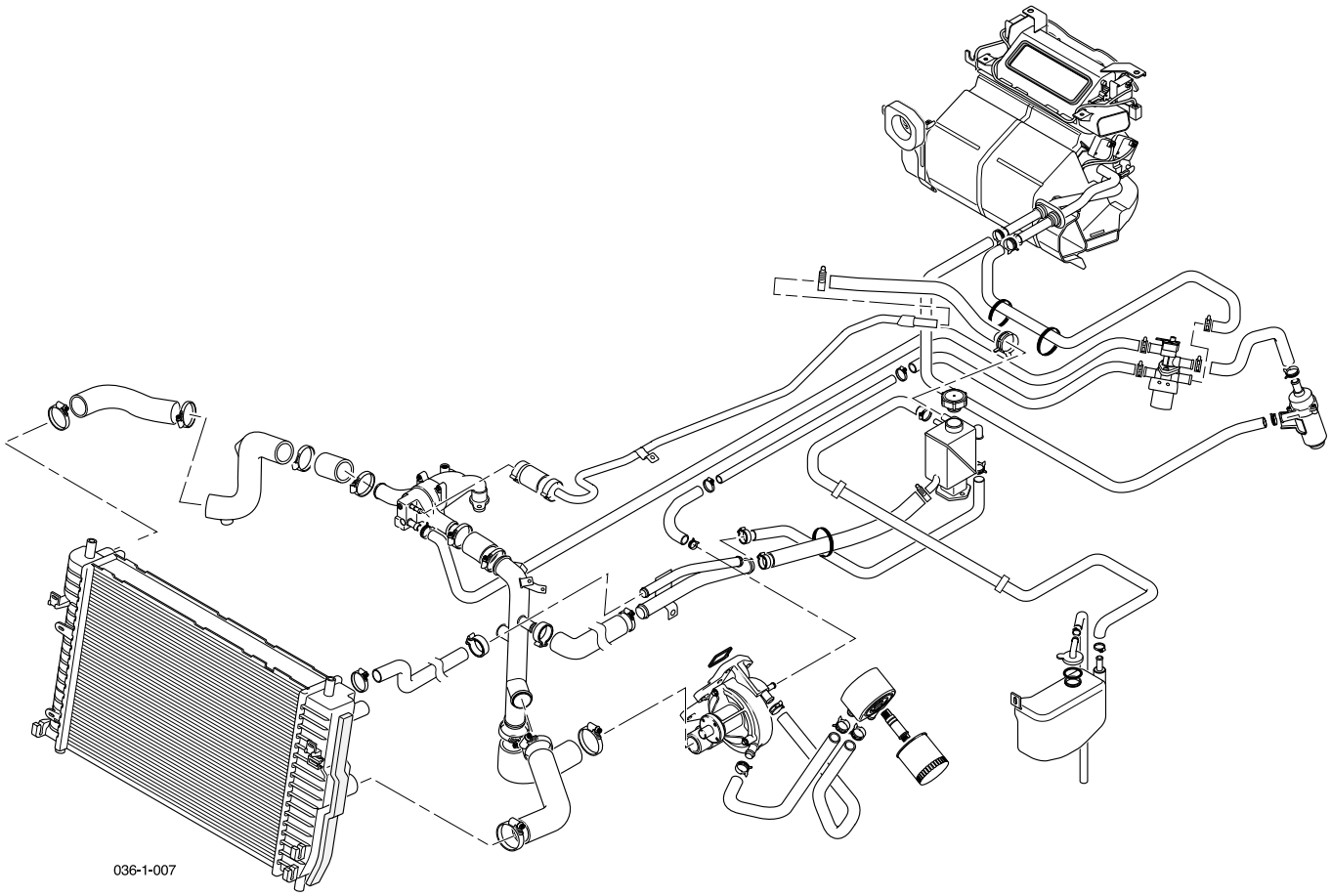
Two motorised throttles are fitted, one to each inlet manifold. These devices allow accurate control of inlet air and hence more precise engine fuelling can be achieved. No setup procedure is required and the inaccuracies of cable operated throttle systems are eliminated.

At idle, the throttle butterflies are almost closed and idle speed is controlled by small throttle movements.

A throttle position sensor (TPS) is incorporated into each motorised throttle assembly. The throttle position signals are fed to the power train electronic control (PTEC) modules. During normal engine run, the TPS signals are used by the PTECs to indicate the power demand from the engine. If not already at the desired position, the PTECs will drive the throttle motors to open or close the throttles by the required amount.

Cooling System

The engine cooling system uses a 50% OAT Coolant / 50% Water antifreeze mixture. The antifreeze is unique and cannot be mixed with other anti-freeze solutions. The OAT coolant/water mixture has a life of 100,000 miles.



Cold Engine - Coolant circulation is achieved by an engine driven water pump. With the engine cold and the thermostat closed, coolant flows through the bypass circuit. Coolant passes from the pump into the block and rises to the thermostat housing. When the engine is cold and the thermostat is closed, coolant is directed to the bypass outlet of the thermostat housing and back through the bypass pipe to the water pump. This path bypasses the radiator to achieve a fast engine warm-up.

Warm Engine - As coolant temperature increases, the thermostat opens (approximately 95°C) and directs coolant into the radiator top hose. Coolant will then flow downwards through the radiator and exit at a lower temperature via the radiator bottom hose to return to the engine via the water pump.

In-Car Heating - A pipe from the front of the thermostat housing directs coolant to the heater water valve which remains closed below XX°C. Above this temperature, the water valve will open and warm water will be available to the heater water pump. This pump will run when (?) and supply warm water to the air conditioning heater matrix. The matrix outlet is connected through the return side of the water valve, back to the rear of the engine water pump.

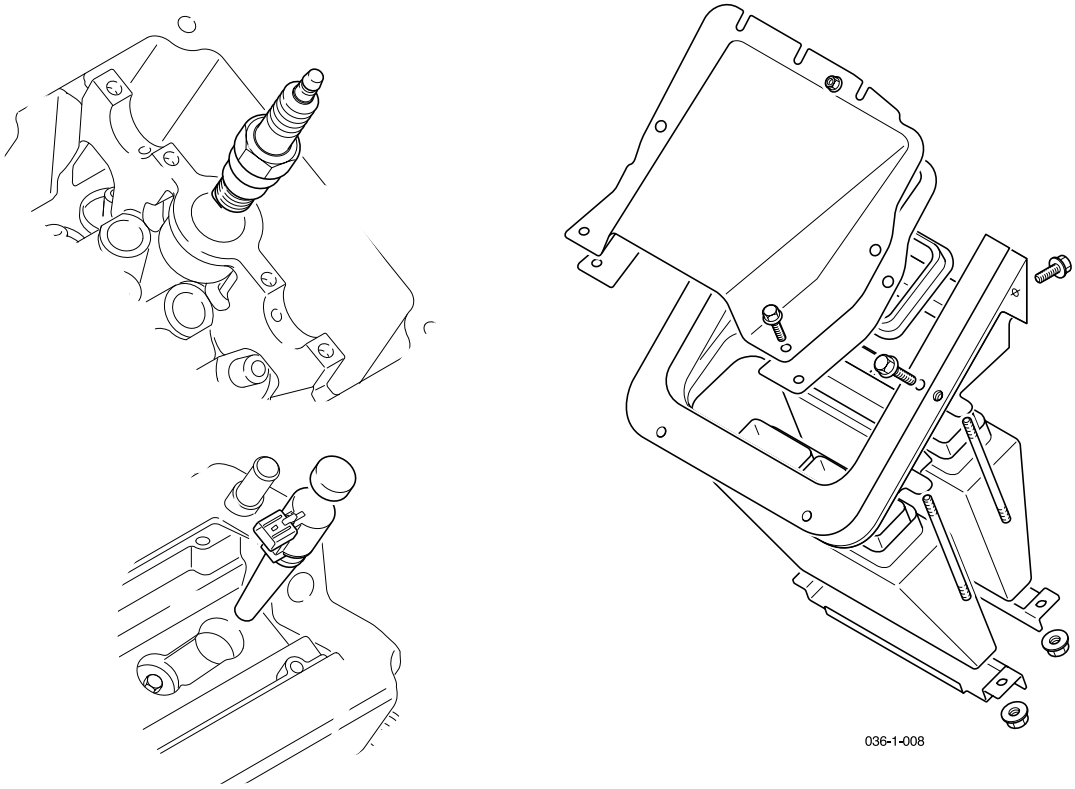
Coolant Expansion - The coolant expansion tank provides the fill position and acts as a degas reservoir. Any coolant displaced by thermal expansion flows into the overflow tank. When the coolant temperature decreases, the coolant contracts and a vacuum will be created to draw the displaced coolant back into the expansion tank.

Engine Oil Cooling - Coolant for the engine oil cooler is fed from the water pump outlet and returns to the water pump inlet. This heat exchanger enables engine oil temperature to be maintained close to coolant temperature during normal running of the vehicle.

Antifreeze - Only the specified extended life coolant coolant can be used. It must not be mixed with other anti freeze solutions.

Ignition System

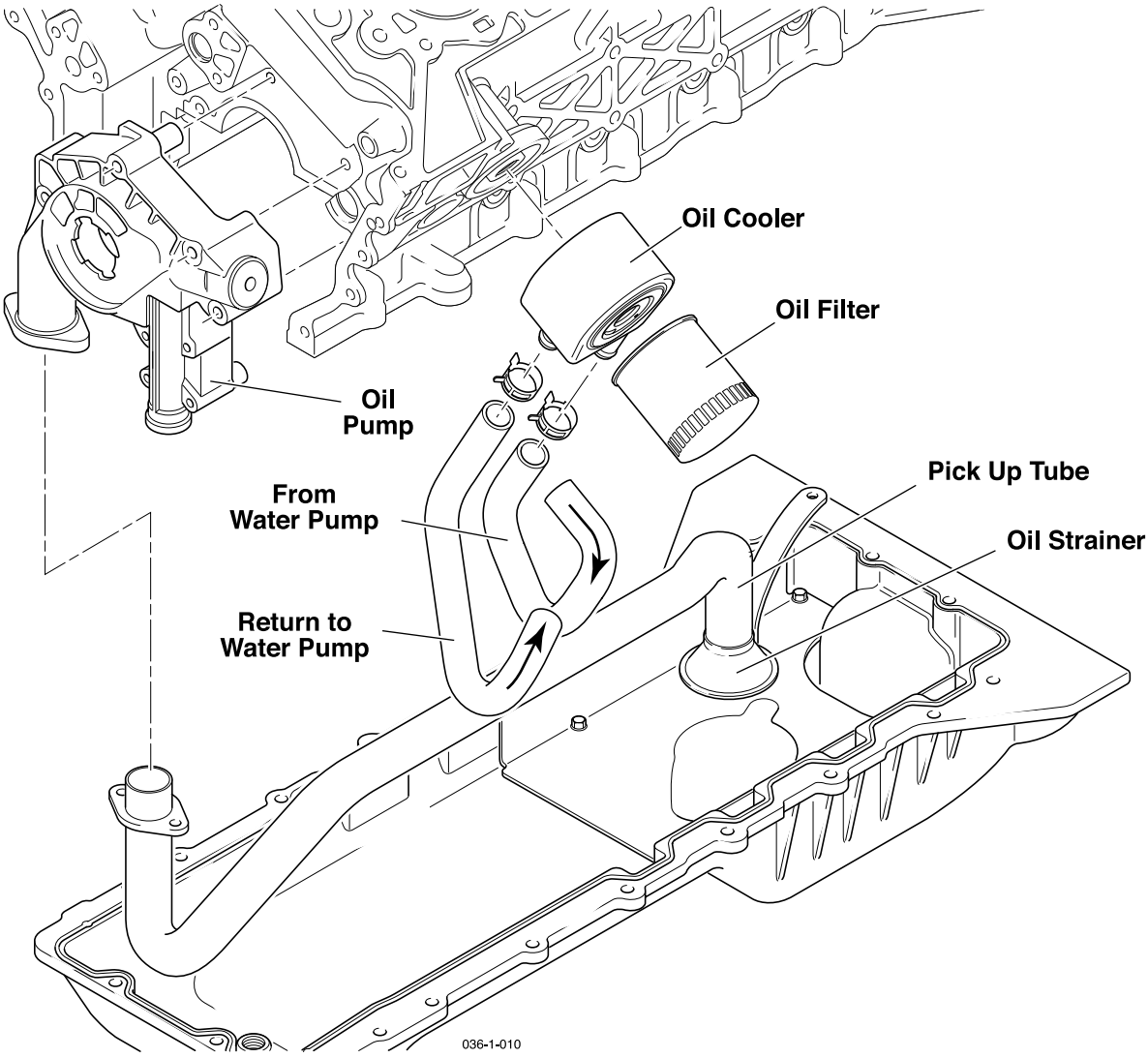
The twelve spark plugs are fired in sequence by the two power train electronic control modules (PTECs). Ignition timing can vary from 55° before TDC to 5° after TDC. The firing order is 1 - 7 - 5 - 11 - 3 - 9 - 6 - 12 - 2 - 8 - 4 - 10



Each spark plug is fitted with an individual ignition coil. All coils are connected to the PTECs. Low voltage signals are fed from the PTECs to the ignition coils to fire the plugs in sequence. The High Tension (HT) voltage required to fire the plugs is generated directly at the plug tops with no external HT wiring. Thus HT interference, HT breakdown and other problems of distributed ignition systems are minimised.

Engine Lubrication

The AMV03 engine uses a wet sump lubrication system. Initial oil fill is 11 US quarts (17.5 Imp pints) (10.4 litres).



Oil is drawn from the sump via an oil strainer and pick-up tube to the crankshaft driven oil pump. Pressure from the pump is limited by the in built oil pressure relief valve. Pressurised oil then flows from the left side of the engine through a filter and cooler then back into the engine main oil gallery.

Oil pressure at the re-entry point is approximately 60 psi with the engine hot and should reach at least 100 psi when cold.

Oil flow may be summarised as follows:

From the sump via an oil strainer to the oil pump

Oil pump to oil filter and cooler

OIl cooler to main oil gallery

Main oil gallery to crankshaft main and connecting rod big-end bearings

Oil squirters from the main gallery to lubricate the con-rod small ends and to cool the pistons

Feed from the main oil gallery to the timing chain tensioners

Vertical oil feed galleries from the main gallery to both cylinder heads

Twin galleries in each cylinder head feeding all camshaft bearings

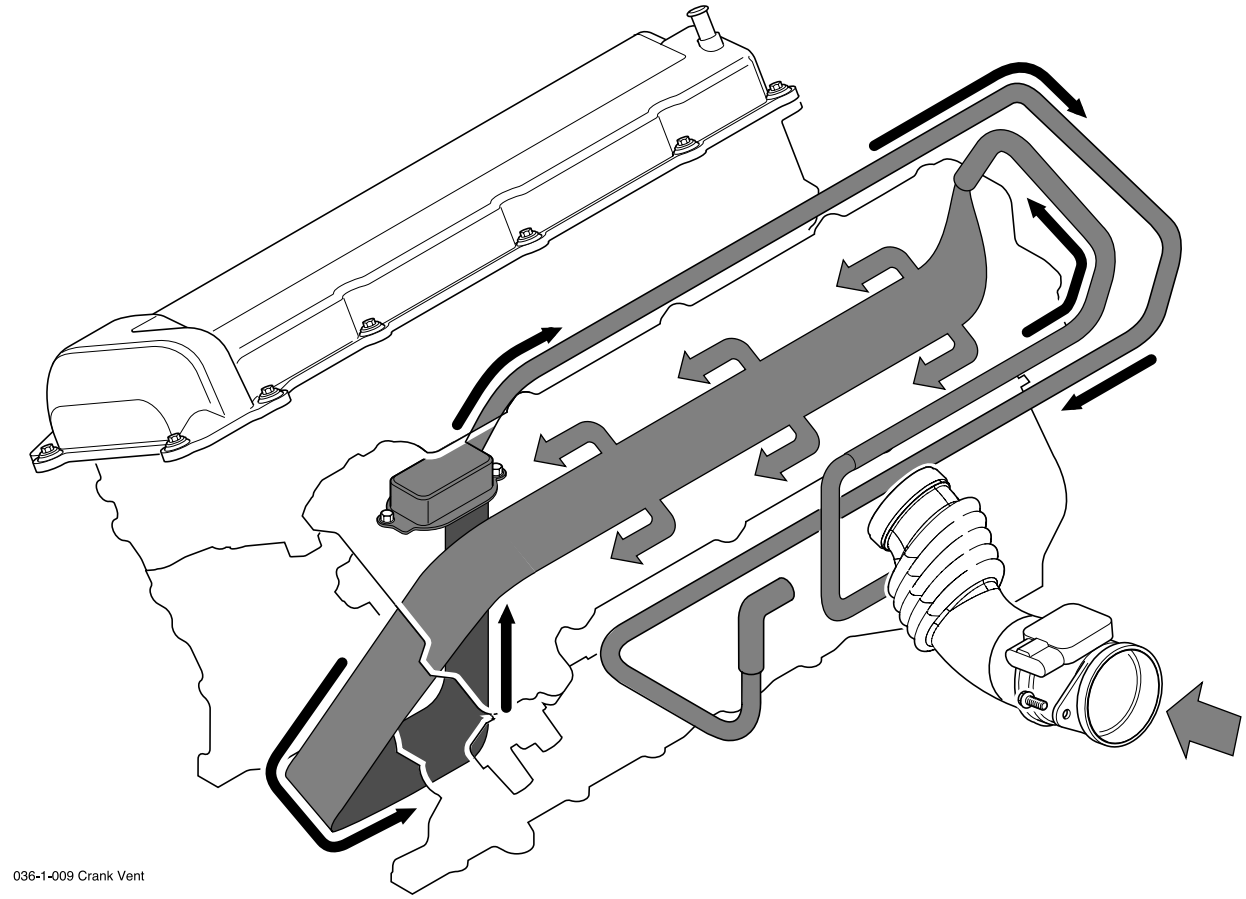
Splash feed from the sump to lubricate the timing chains and sprockets

Oil drains from the cylinder heads via drain channels in the block to return to the oil sump.

Positive Crankcase Ventilation

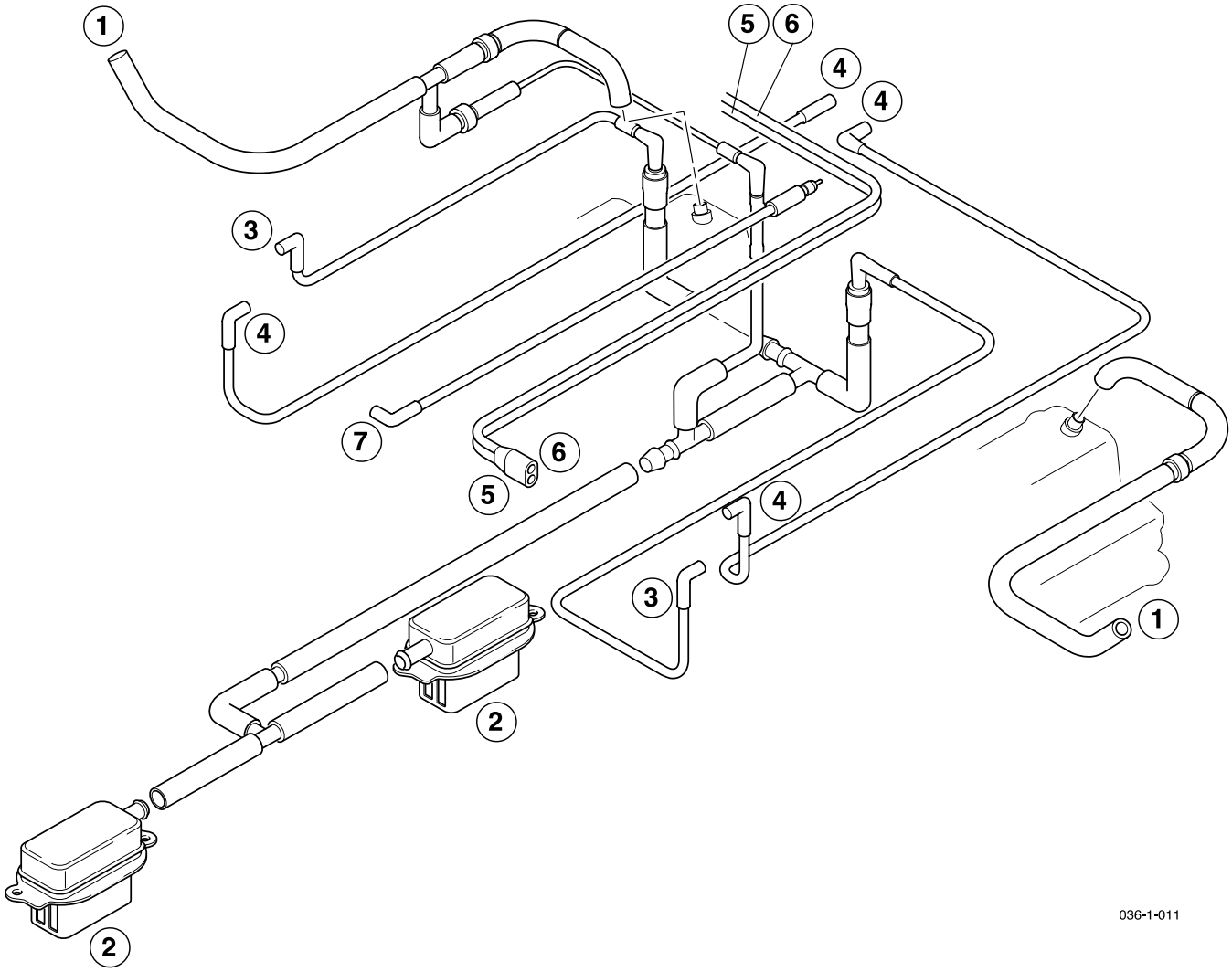
To avoid environmental pollution from crankcase gases, the crankcase is ventilated into the inlet manifold. Any noxious fumes in the crankcase gases will then be burned in the normal combustion process.

Fresh air from the intake system is fed into the camshaft cover on each engine bank. This air flows through the oil drain channels and down into the crankcase. Here any fumes in the crankcase will be displaced upwards through the oil separators and into the throttle body adaptor and inlet manifold.



036-1-009 Crank Vent

Vacuum Pipework Layout



Key

1 Clean air - Inlet duct to camshaft covers
2 Oil separators - Crankcase ventilation
3 Crankcase gasses to inlet manifold
4 Fuel vapour - Vapour management valves to inlet manifold
5 Vacuum supply - Vapour management valve control
6 Vacuum supply - Exhaust bypass system
7 Vacuum supply - Brake booster system

Vacuum System Operation

1. Vacuum for the positive crankcase ventilation system is supplied from the inlet manifold to two metered flow valves upstream of the oil separators.

2. The fresh air inlet for the PCV system is branched from the MAF ducting and flows as follows:

   - From the MAF ducting through one way valves into both cam covers.
   - Forward along the cam covers, down through the front timing cover and into the sump.
   - Up through the crankcase and into the two oil separators.
   - From the separators through the metered flow valves and into the inlet manifold stub pipes on either side of the engine.
   - The crankcase ventilation air rejoins the normal inlet air at this point and any crankcase vapours will be burned in the normal combustion process.

3. Any imbalance between the two engine banks will be removed by airflow in the balance pipe below the metered flow valves.

4. Any deficiency in air supply can be met by drawing additional air from the 'T' piece between the metered flow valves.

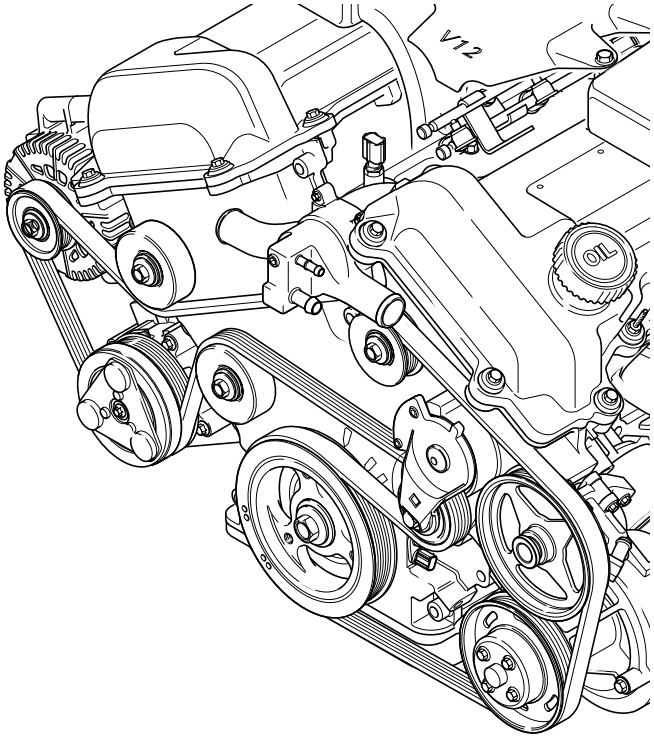
5. Metered flow valves must be mounted vertically. They allow sufficient flow of air for positive crankcase ventilation but will progressively inhibit excessive flow through the positive crankcase ventilation system. This will prevent oil contamination of the inlet manifold.

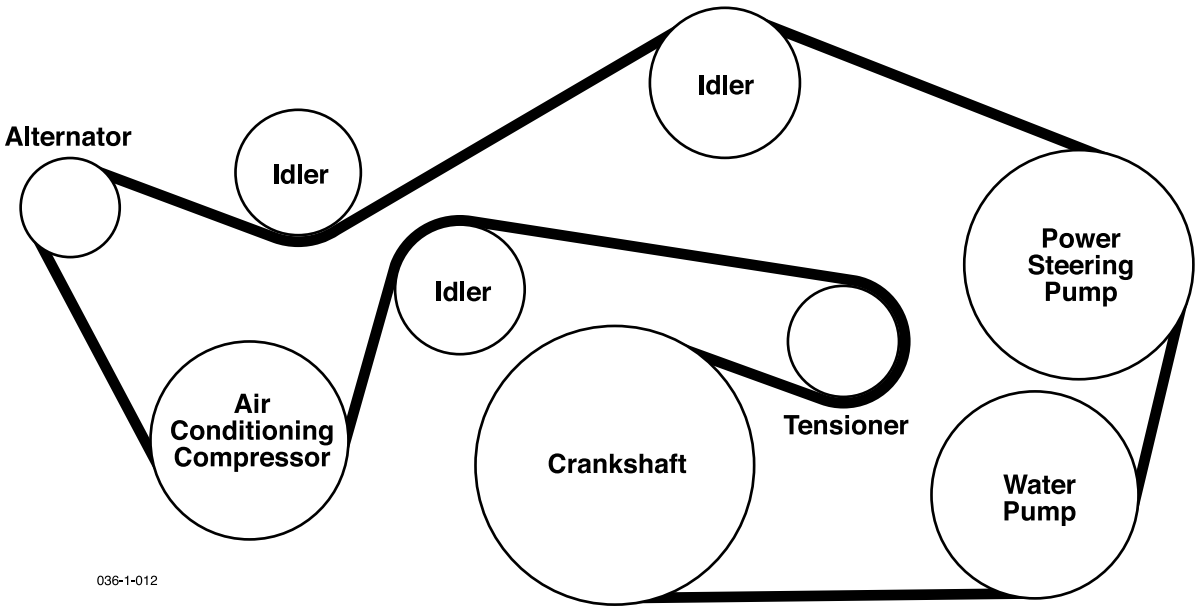
Auxiliary Drives

A pulley fitted to the front of the crankshaft drives a polyvee drive belt to power all of the engine auxiliaries. The following auxiliaries are fitted at the sides of the engine:

Air Conditioning Compressor
Alternator
Power Steering Pump
Water Pump

The following diagram illustrates the position of the auxiliaries and the polyvee drive belt routing:





Engine Specification

The following specifications relate to new build engines and are relevant to engines being completely refurbished to 'as new' standard. All dimensions in mm unless otherwise stated.

Component	Dimension mm
Block	
Cylinder Bore Grade 2	89.010 - 89.020
Main Bearing Bore (without shells)	72.400 - 72.424
Crankshaft	
Main Bearing Diameter	67.480 - 67.504
Main Bearing Clearance	0.025 - 0.050
(see Main Bearing Grade Chart for bearing shell selection)	
Connecting Rod Bearing Diameter	49.97 - 49.99
Connecting Rod Bearing Clearance	0.028 - 0.066
Crankshaft End Float	0.130 - 0.301
Pistons (See Piston Grades overleaf)	
Piston Diameter Grade 2	88.998 - 89.022
Piston Clearance	-0.007 - +0.024
Piston Ring Gaps (at 89.000 bore diameter)	
Ring Gap - Upper Compression Ring	0.100 - 0.250
Vertical Ring Clearance - Upper Compression Ring	0.04 - 0.075
Ring Gap - Lower Compression Ring	0.270 - 0.420
Vertical Ring Clearance - Lower Compression Ring	0.04 - 0.085
Ring Gap - Oil Control Ring Segments	0.150 - 0.650
Connecting Rods	
Connecting Rod Bearing Diameter (with shells)	
Piston Pin to Con Rod Clearance	0.004 - 0.020
Piston Pin to Piston Interference	-0.005 - 0.001
Big End Side Clearance (2 rods)	0.225 - 0.575
Cylinder Heads	
Head Volume	46.70 - 49.70 ml
Head Face-Roof Button	14.75 - 15.25
Valve Seat Width - Inlet	1.100 - 1.400
Valve Seat Width - Exhaust	1.400 - 1.700
Camshaft Bore	26.987 - 27.012
Camshaft Journals	26.936 - 26.962

Component	Dimension mm
Valves, Guides & Springs	
Spring Force at 40mm Spring Height	290 Newtons
Valve Guide Internal Diameter	6.015 - 6.044
Valve Guide Maximum Runout	0.030
Valve Stem Diameter - Inlet	5.975 - 5.995
Valve Stem Diameter - Exhaust	5.950 - 5.970
Valve Stem Clearance - Inlet	0.020 - 0.069
Valve Stem Clearance - Exhaust	0.046 - 0.095
Valve Face Maximum Runout	0.050
Valve Lash Adjusters	
Bore	16.018 - 16.057
Outside Diameter	15.988 - 16.000
Clearance	0.018 - 0.069
Turning Torque	
Guideline figures only. Use to assess quality during engine rebuilds	
A - Crankshaft and rear seal only	6 Nm
B - Crank, rear seal + pistons & rods	16-20 Nm
C - Crank, rear seal, pistons & rods + camshafts & tensioned chains	36-44 Nm
Crank Sensors	
Air Gap	1±0.5
Cam Sensors	
Air Gap	1±0.5
Spark Plugs	
Type	Dual Platinum Fine Wire
Gap	1.2 - 1.3
Torque	16-20 Nm

Piston Skirt Grading Chart

Grade	Piston Diameter 'A1' Prior to Skirt Coating	Cylinder Bore Diameter	Part Number
1	88.970 / 88.980	89.000 / 89.010	XW4E - 6110 - AD
2	88.978 / 88.992	89.008 / 89.022	XW4E - 6110 - BD
3	88.990 / 89.000	89.020 / 89.030	XW4E - 6110 - CD

Skirt Coating adds 0.020 - 0.030 to the diameter as follows:

Grade	Piston Diameter (Coated)	Clearance with Coating
1	88.990 / 89.010	New Build -0.014 (interference)
2	88.998 / 89.022	New Build + 0.024 (clearance)
3	89.010 / 89.030	Service Limit + 0.050 (clearance)

Main Bearing Grade Chart

The finished diameter of the crankshaft main bearing bores is indicated by numbers stamped on the block face. The first number, e.g. '04', refers to No.1 journal, the second number element refers to No.2 journal and so on.

The finished diameter of the seven crankshaft main bearing journals are indicated by seven letters stamped in bearing number sequence on No.1 counterweight. The first letter in the sequence refers to No.1 journal, the second letter refers to No.2 journal and so on.

Procedure

6. Read the first number on the cylinder block face and note it.
7. Read the first letter on No. 1 crankshaft counterweight and note it.
8. Using the letter and number, select the correct bearing grade for No. 1 journal.
9. Repeat steps 1-3 to obtain the correct bearing grades for journals 2-7.

Minimum Block Diameter

			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		72.400	.401	.402	.403	.404	.405	.406	.407	.408	.409	.410	.411	.412	.413	.414	.415	.416	.417	.418	.419	.420	.421	.422	.423	.424
M	X	67.488	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
a	W	67.487	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
x	V	67.486	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
	U	67.485	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
C	T	67.484	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
r	S	67.483	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
a	R	67.482	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
n	Q	67.481	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3
k	P	67.480	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3
s	O	67.479	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
h	N	67.478	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
a	M	67.477	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3
f	L	67.476	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
t	K	67.475	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3
	J	67.474	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
D	I	67.473	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3
i	H	67.472	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
a	G	67.471	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
m	F	67.470	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3
e	E	67.469	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
t	D	67.468	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
e	C	67.467	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
r	B	67.466	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	A	67.465	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Bearing Grade 1 = Orange
Bearing Grade 2 = Blue
Bearing Grade 3 = Green

Note: The bearing grade is stamped on the inside of the bearing

General Specifications

Torque Specifications

The following torque figures are to be used for all general fixings where a specific torque is not quoted.

Thread Size	Torque
M5	5-7 Nm
M6	8-12 Nm
M8	20-30 Nm
M10	40-55 Nm
M12	70-95 Nm
M14	110-155 Nm
1/4 - 18 pipe	12-16 Nm
3/8 - 18 pipe	16-24 Nm
1/2 - 14 pipe	35-45 Nm
3/4 - 14 pipe	60-75 Nm
1 - 11.5 pipe	80-100 Nm

Lubricants and Coolant

Engine oil (Initial fill)	Mobil 1 0w40 Europe (0w30 USA)
Engine oil	API SG/CD or API SH
Engine coolant	50% water, 50% Anti-Freeze use only Havoline XLC (Extended Life Coolant)
	Coolant listed above must not be mixed with other anti-freeze solutions.

Engine Sump Capacity

Initial Fill	11 Litres (20 Imp pints) (11.5 US Qts
Refill without filter change	10 Litres (18 Imp pints) (10.3 US Qts)
Refill with filter change	11 Litres (20 Imp pints) (11.5 US Qts

Fuel

95 RON Unleaded or 98 RON Super Unleaded (USA - Premium Unleaded).

1.0.01.1 Engine Removal

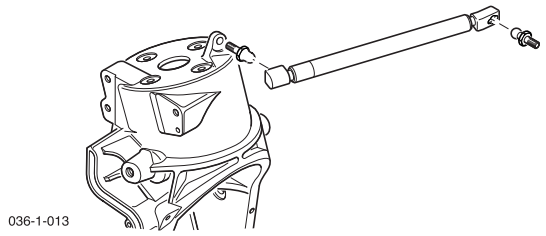
1. With the ignition on, motor the drivers seat to the maximum rearward position.

2. With the ignition on, pull both gearshift paddles simultaneously twice. This will force the gearbox to remain in neutral. Switch off the ignition within 3 seconds.

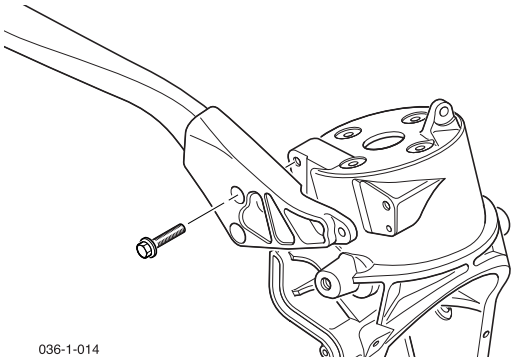
3. Switch off the battery disconnect switch. Disconnect the battery.

4. Remove the bonnet (2 man operation).

   - Open and support the bonnet
   - Disconnect the two gas struts
   - Remove 2 bolts from each of the two hinges
   - Remove the bonnet

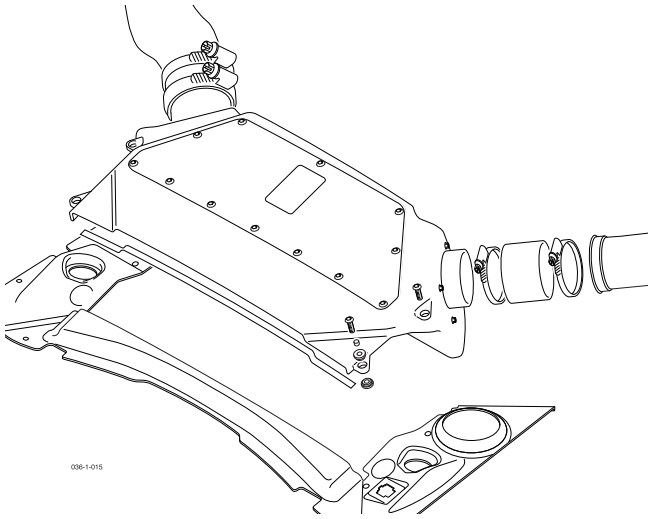


5. Remove three bolts from either end of the cross brace. Remove the cross brace from across the top of the front suspension towers.

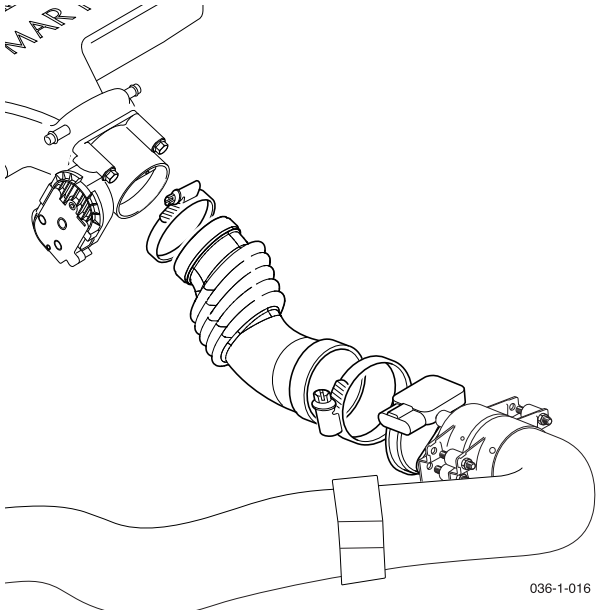


6. Remove the airbox.

   - Disconnect the air hoses at the airbox
   - Remove four bolts securing the airbox
   - Remove the airbox
   - Remove the small sections of hose from the front end of the two air ductings

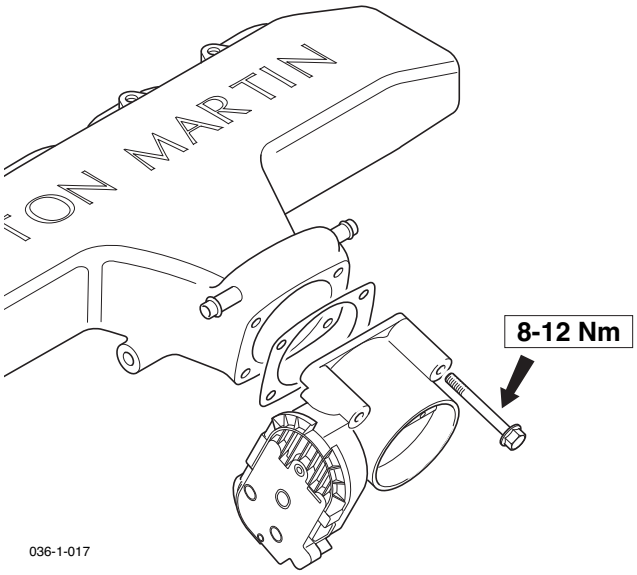


7. Remove the flexible hoses between the MAF sensors and the throttle bodies.

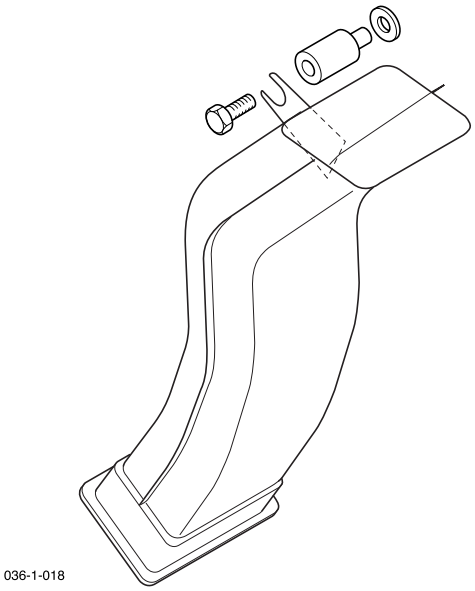


8. For protection, remove the two throttle bodies.

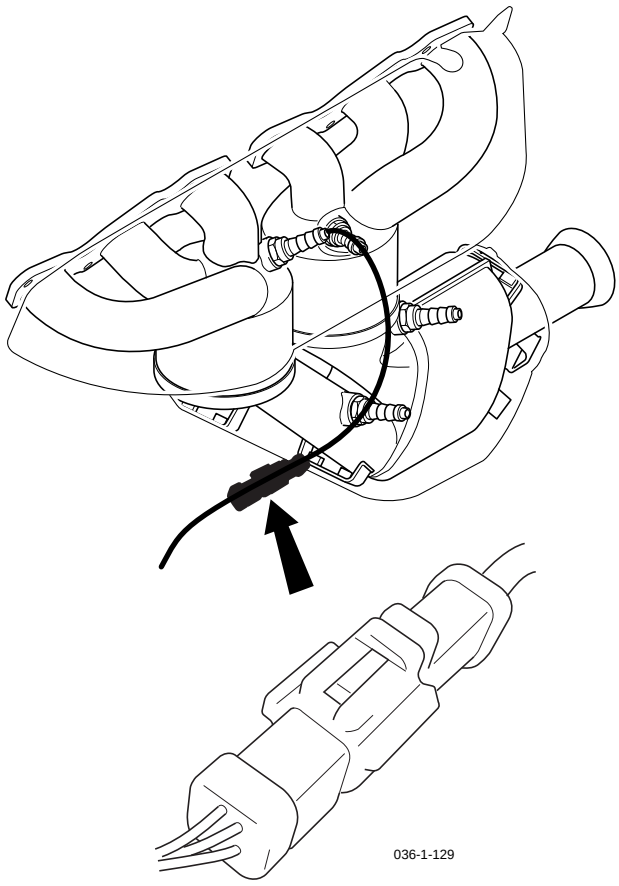
   - Disconnect the motorised throttles
   - Remove four screws and remove each of the throttle bodies



9. Remove one screw on each chimney and remove the four exhaust ventilation chimneys.

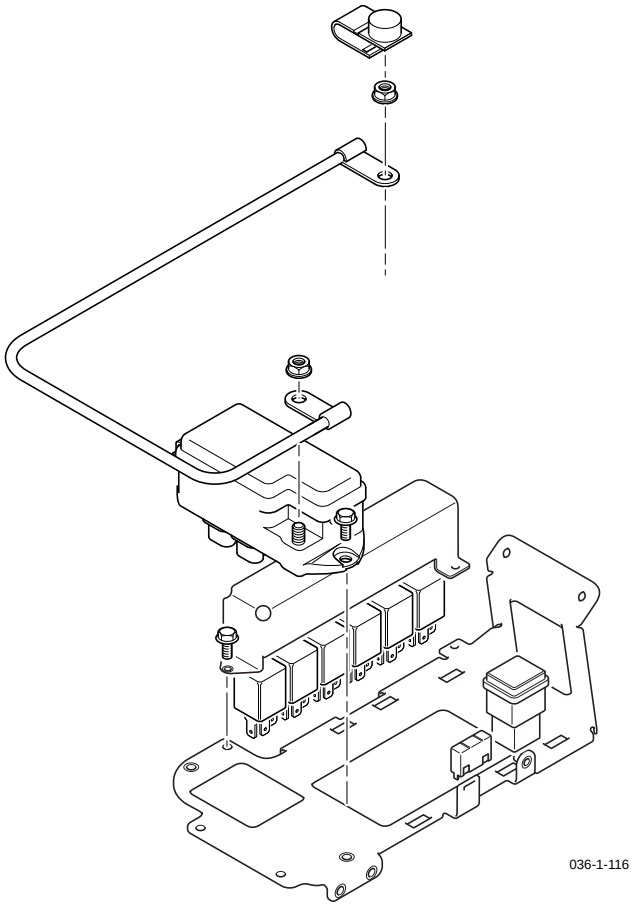


10. Disconnect the connectors on the four engine management oxygen sensors. Remove the sensor plugs from the mounting bracket. Remove the mounting bracket



11. Release the electrical accessories from the passenger side fusebox.

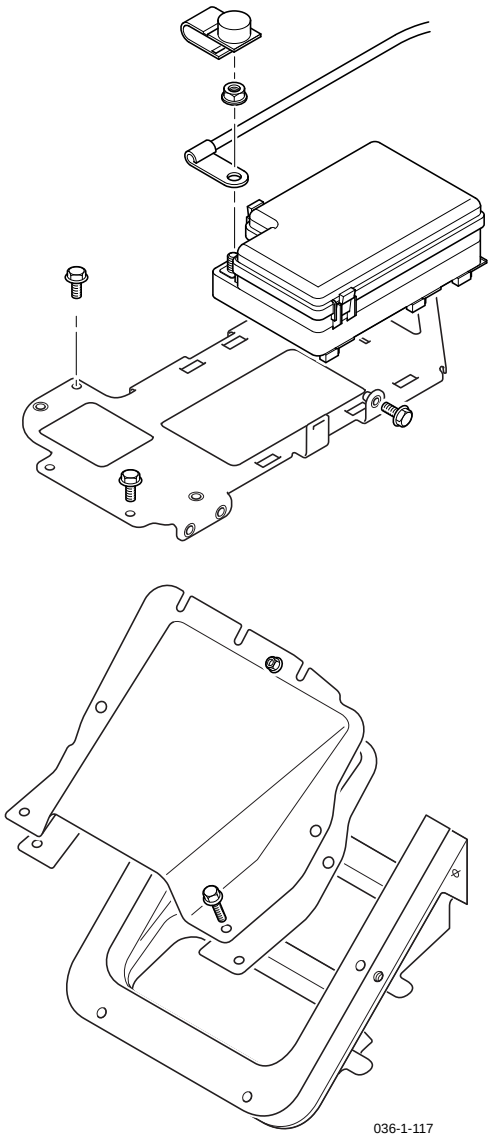
    - Remove two M6 screws and the relay cover
    - Unclip 7 relays from the fusebox bracket
    - Release the maxi fuse from the bracket
    - Release the 4 way fusebox from the bracket
    - Remove two M6 screws and release the small fusebox from the bracket and detach 2 plugs
    - Detach the 12V supply cables from both fuseboxes and remove the small fusebox



036-1-116

12. Release the passenger side fusebox and bracket to access the PTEC modules.

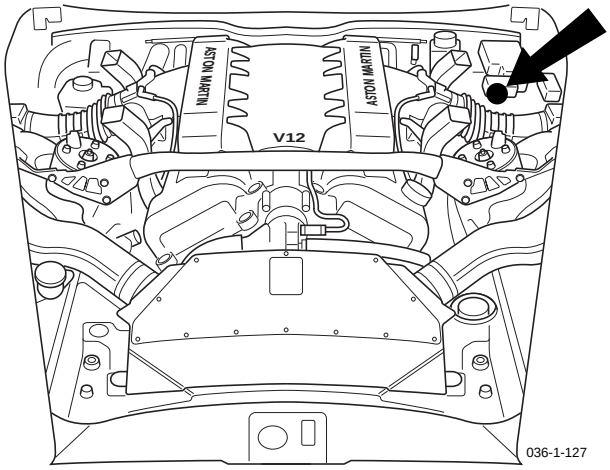
    - Release two M6 screws and detach the large fusebox from the bracket. Detach 4 plugs
    - Remove 2 nuts and two bolts and remove the fusebox bracket
    - Remove the PTEC connector cover.



036-1-117

13. Release the left section of the engine harness from the chassis.

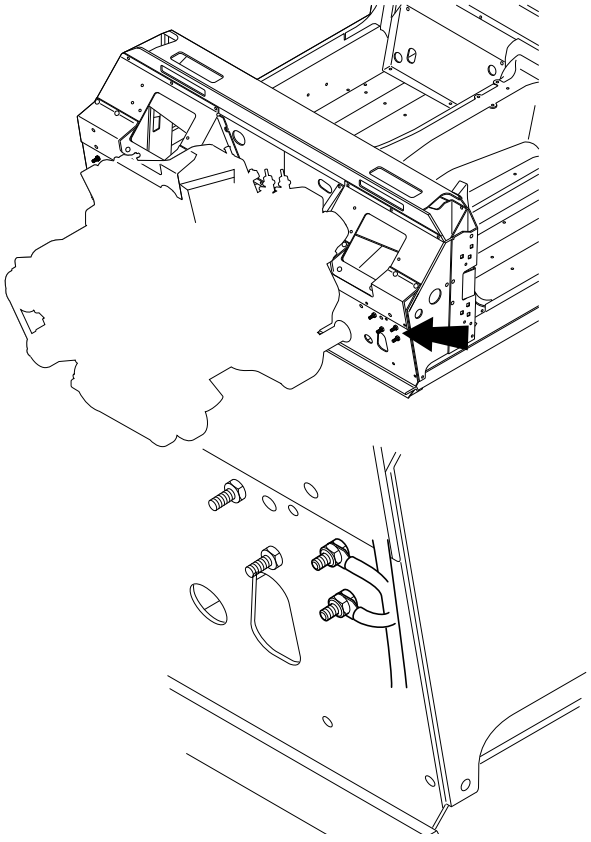
    - Cut the cable ties securing the engine harness to the forward harness
    - Disconnect the 13 way engine harness to forward harness connector



14. Disconnect the engine harness from the left side of the vehicle.

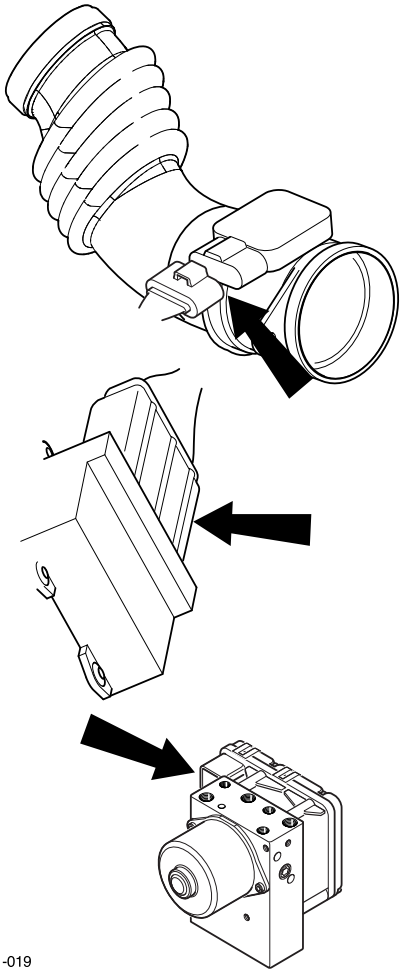
    - Disconnect 6 plugs from the PTEC modules
    - Mark the leads at the clean earth studs. Disconnect the leads.

    Note: These are 'Clean Earths' labelled 'Bank A' and 'Bank B'. Reconnect to the correct stud.



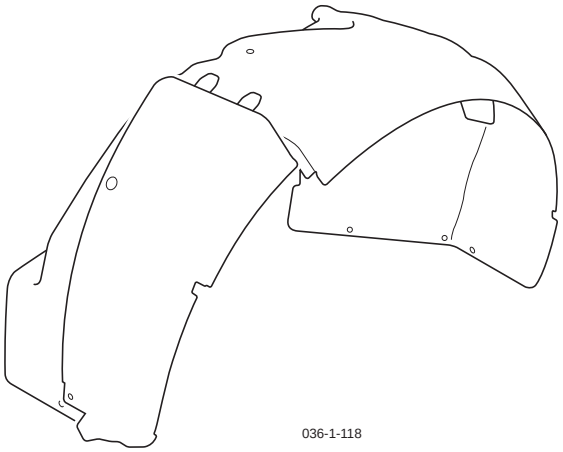
15. Disconnect the following components.

    - Disconnect the left hand MAF sensor
    - Disconnect the misfire detection module
    - Disconnect the ABS modulator connector
    - Lay the harness on top of the engine



16. Raise the vehicle and remove the front road wheels and wheel arch liners.

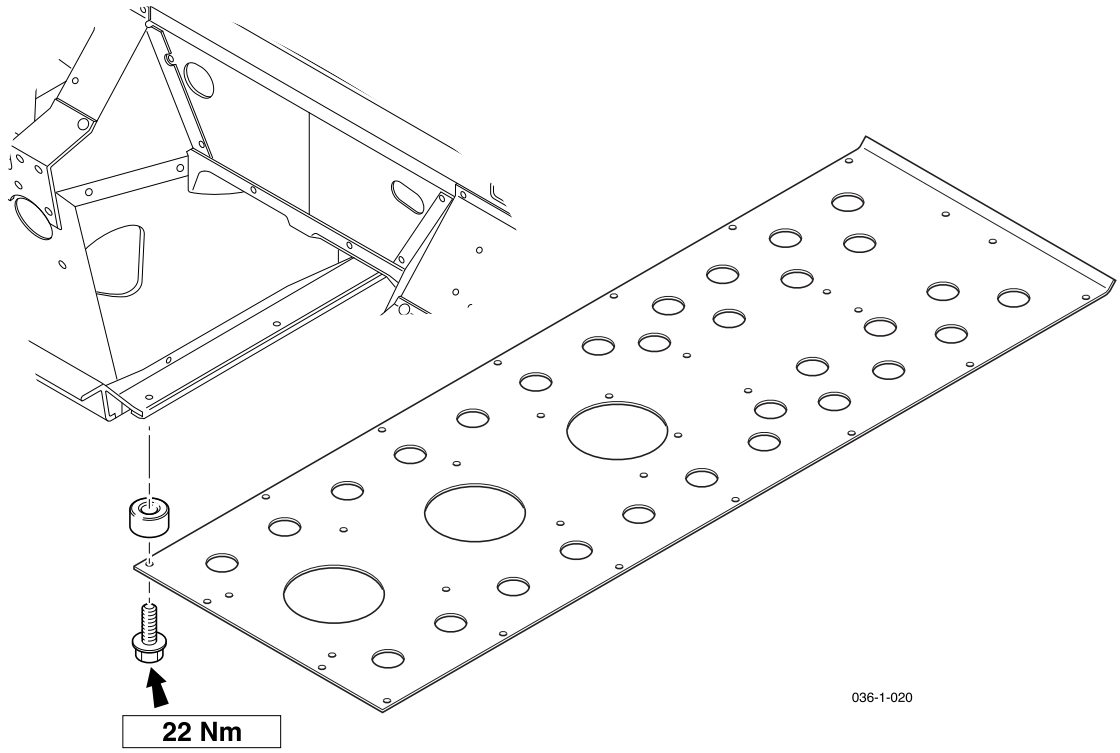
    - Remove the road wheel
    - Remove four bolts + three screws from liners
    - Remove the wheel arch liners



036-1-118

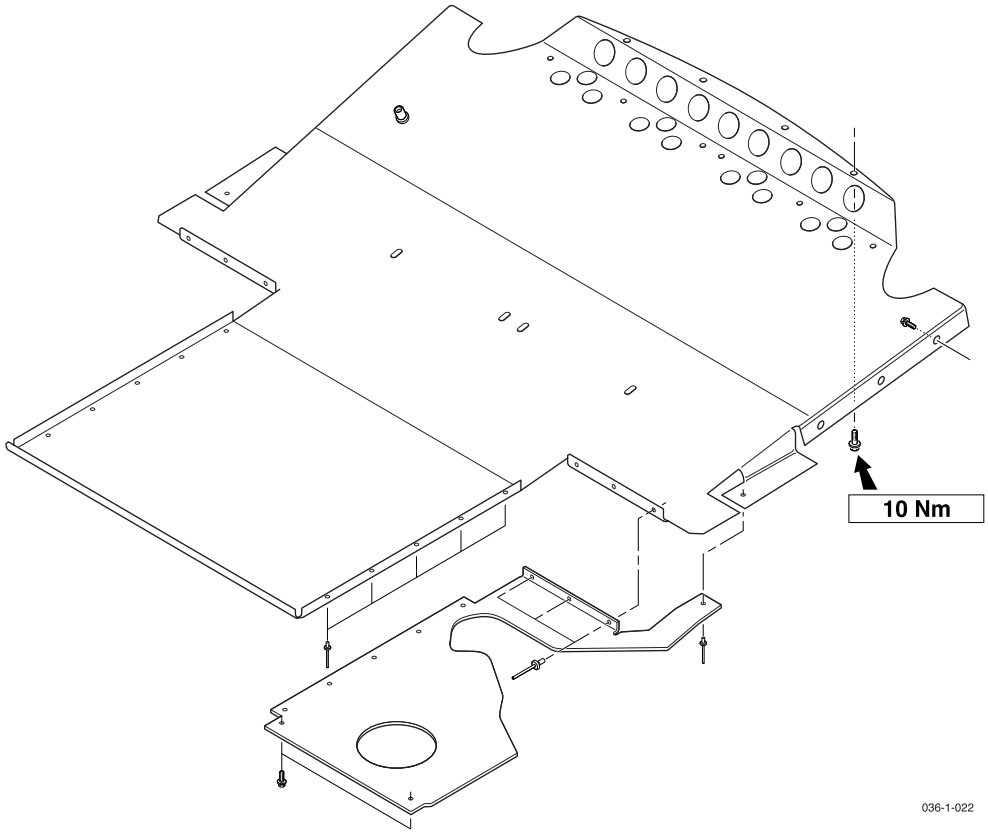
17. Remove the tunnel shear panel from under the vehicle.

    - Support the panel on a suitable stand.
    - Remove thirty M8 bolts and four screws
    - Lower the plate and recover 14 spacers

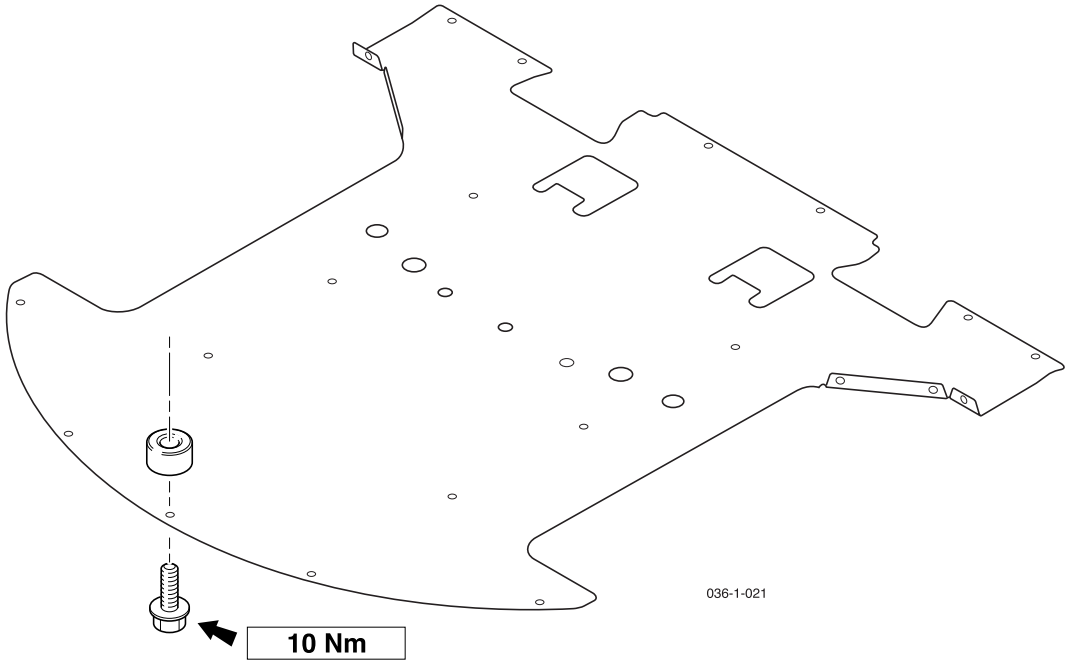


036-1-020

18. Remove the rear diffuser panel
    - Remove 16 bolts
    - Remove 8 screws
    - Lower the diffuser panel

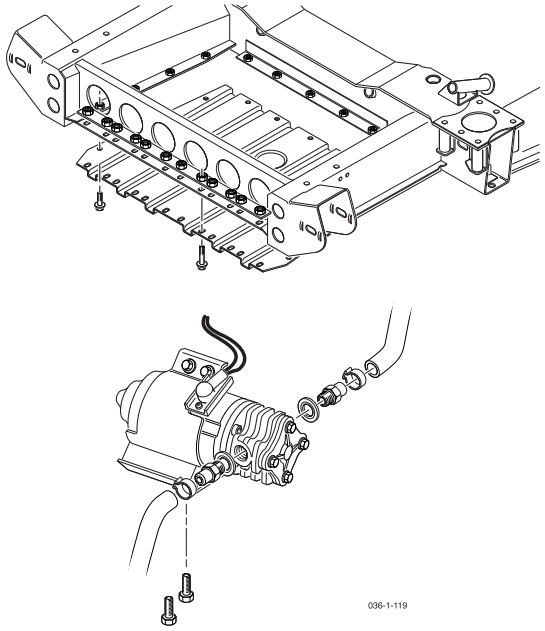


19. Remove the front undertray
    - Support the front undertray
    - Remove 15 bolts
    - Remove four screws from the wheel arch liner if not already removed
    - Remove the undertray



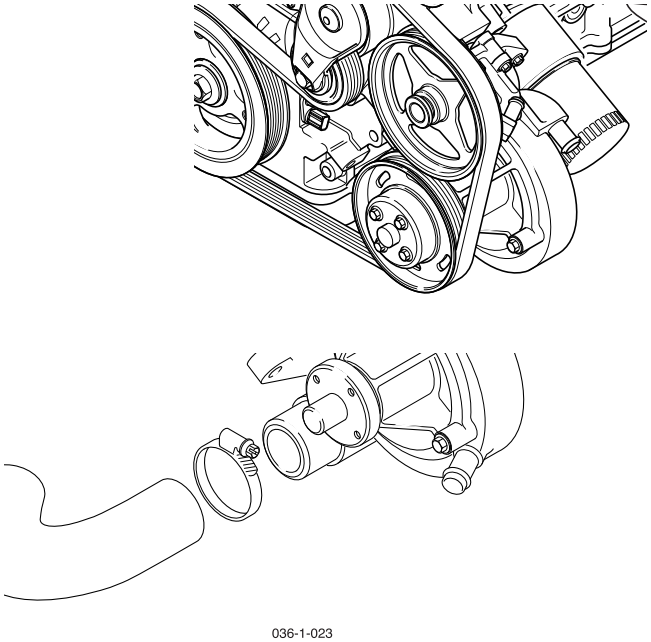
20. Remove the engine belly plate.

    - Remove 25 bolts (Note the long bolts at the front.)
    - Release the gearbox cooling pump from the belly plate
    - Remove the belly plate



21. Drain the engine coolant.

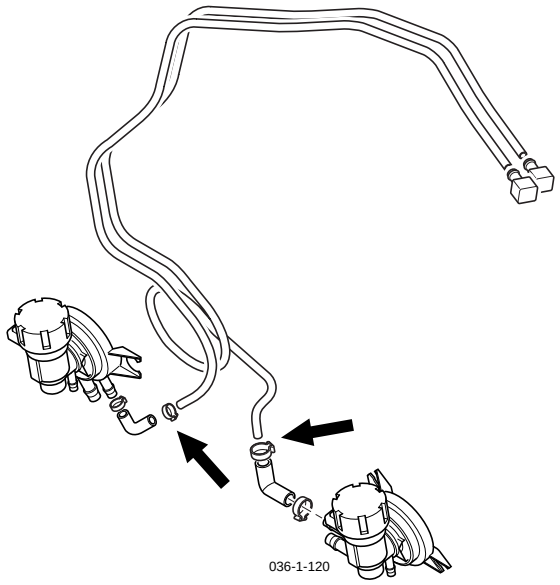
    - Release the bottom hose from the water pump and drain the coolant into a suitable drain tray.



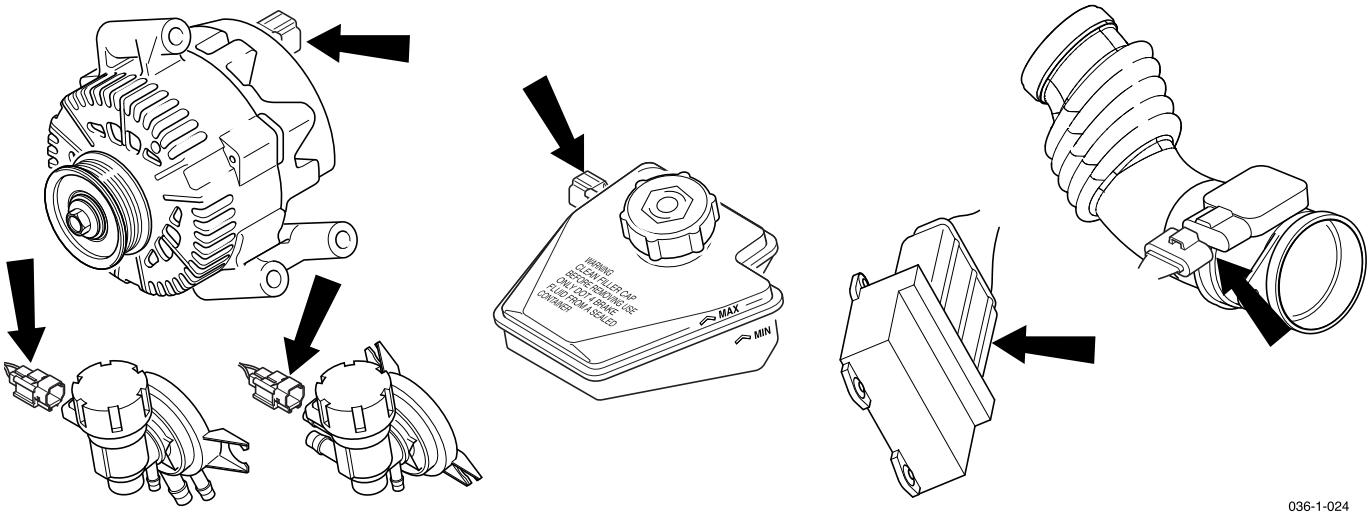
22. Remove the bolt from the upper dipstick mount. Fixing is required to mount the rear engine lifting eye.

23. Disconnect the following vacuum and vapour tubes:

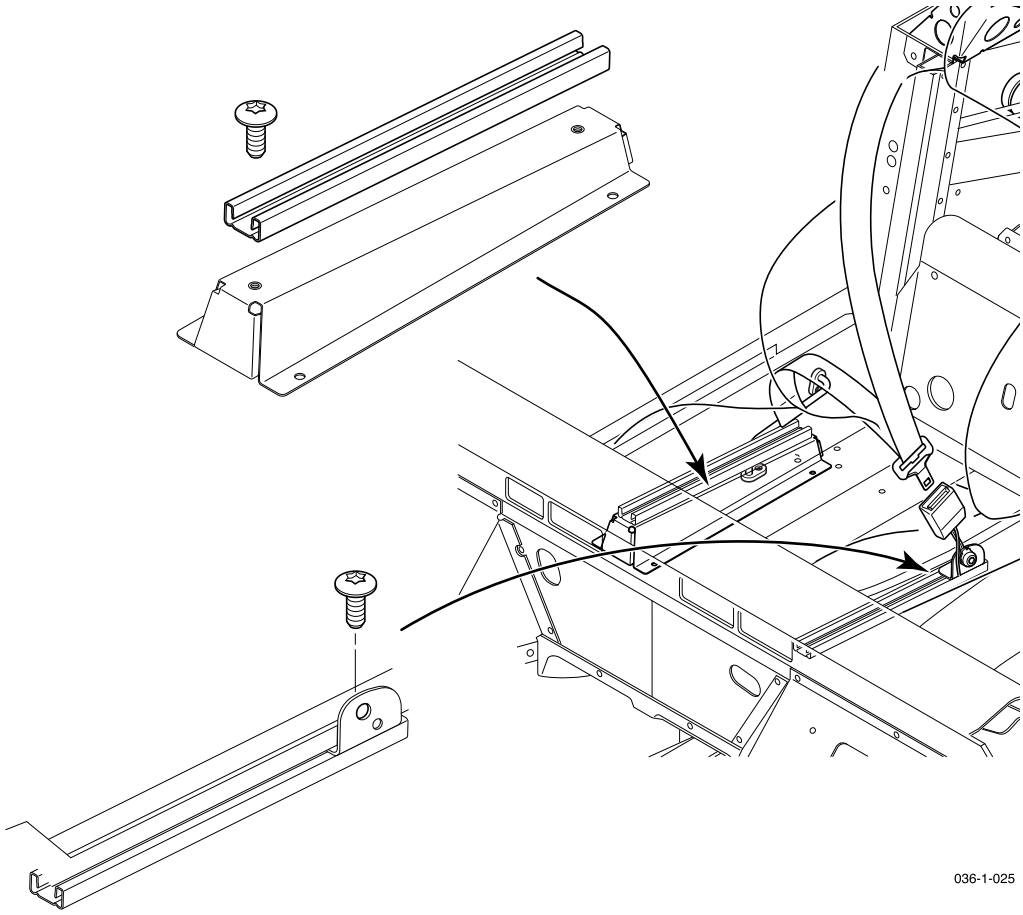
    - Disconnect the quickfit connectors on 3 vapour tubes from the vapour management valves.
    - Disconnect the brake servo vacuum line.



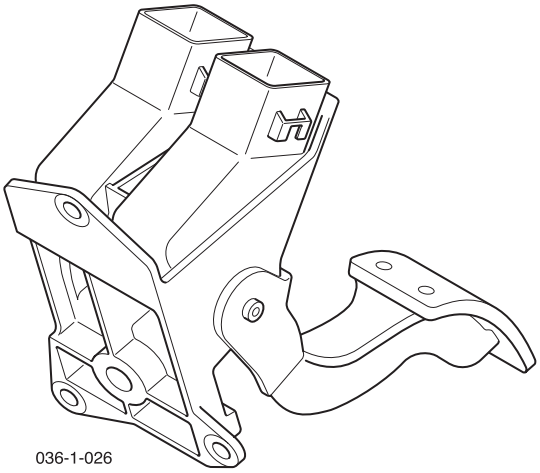
24. On the left side of the engine, disconnect the following electrical connectors.
    - Alternator
    - Vapour management valve connectors (2)
    - Brake fluid level sensor
    - MAF sensor
    - Misfire detection module



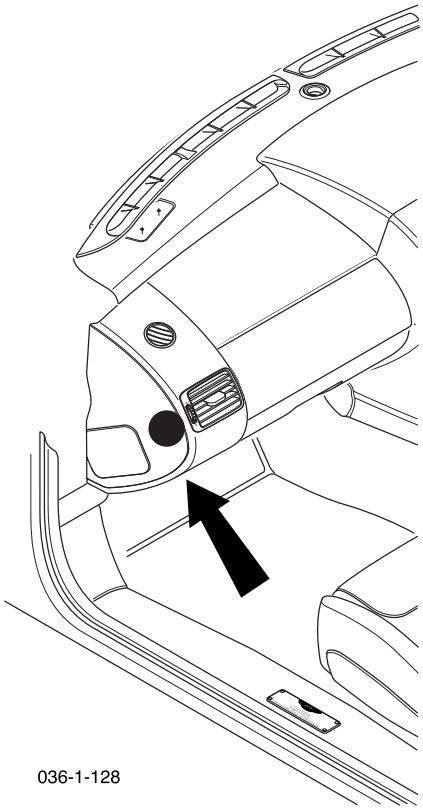
25. If necessary to gain access to the footwell area, remove the drivers seat.



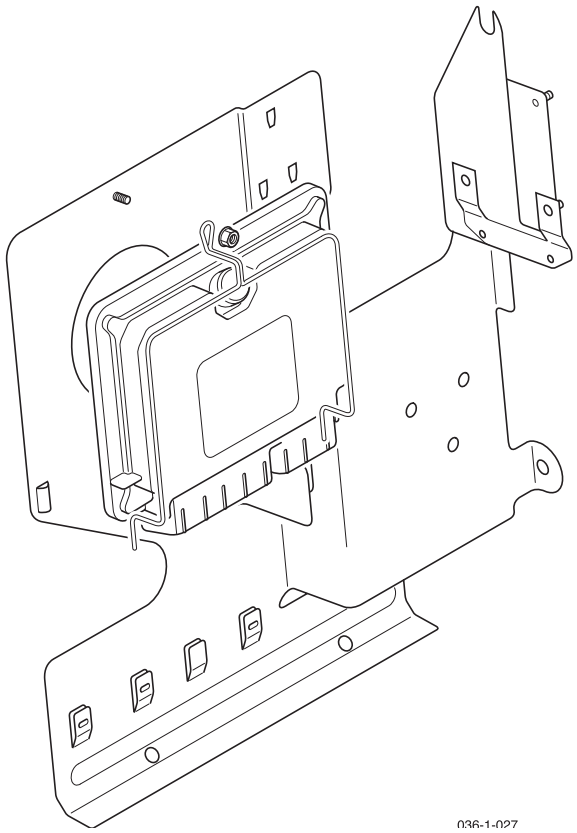
26. In the drivers footwell, note the positions of throttle pedal potentiometers A and B. Disconnect the two throttle pedal potentiometers.



27. Disconnect the two engine harness to cabin harness connectors.



28. In the passengers side footwell, disconnect the transmission control unit and two engine harness connectors..

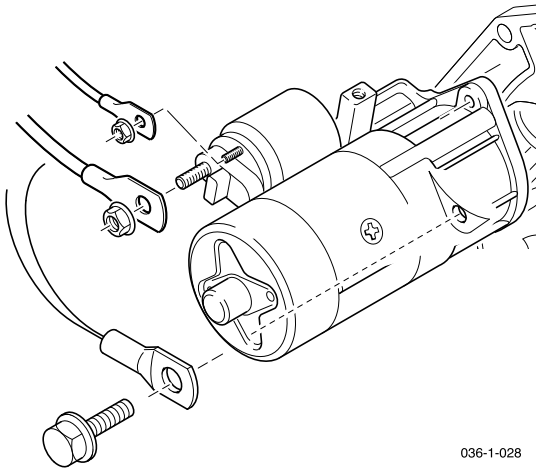


29. Push the engine harness grommet and the connectors back into the engine bay.

30. Lay the right engine harness onto the top of the engine banks.

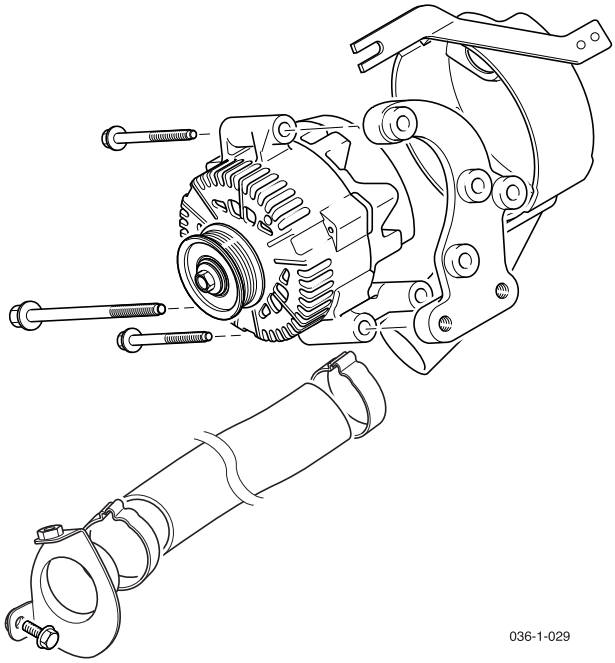
31. Disconnect the starter motor.

- Disconnect the starter solenoid connector
- Disconnect the 12V starter motor feed from the bulkhead stud
- Disconnect the main engine earth from the earth stud by the vapour management valves



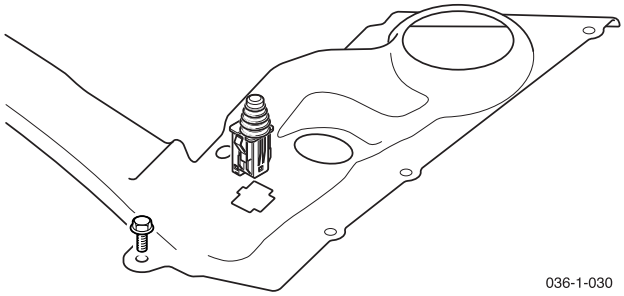
32. Remove the alternator.

- Disconnect the alternator air hose
- Release the tension on the polyvee drive belt
- Remove the three alternator securing bolts
- Remove the alternator and rear cover.

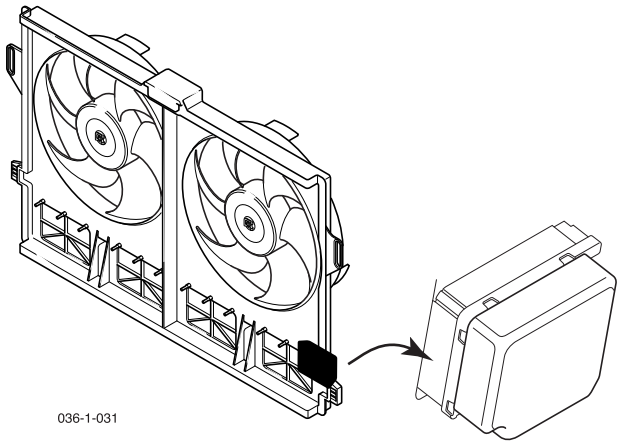


33. Remove the airbox mounting plate.

- Remove four bolts and release the airbox mounting plate
- Lift the mounting plate and disconnect the bonnet switch

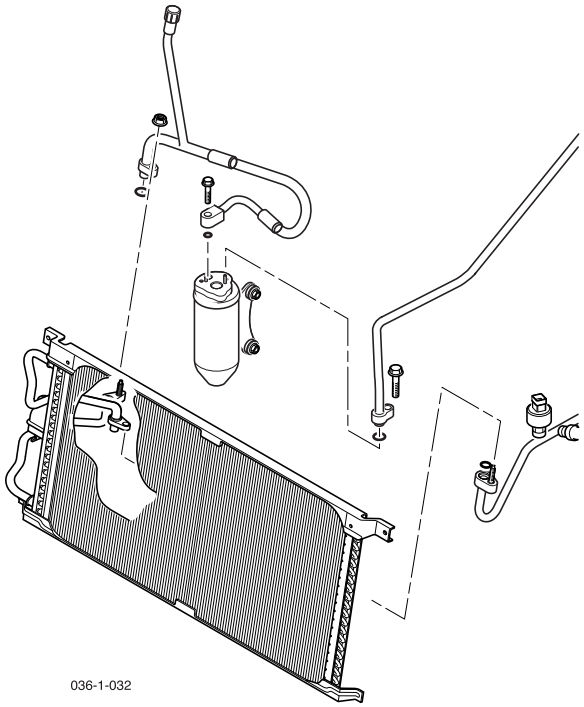


34. Disconnect the three forward harness connectors off the fan pack.



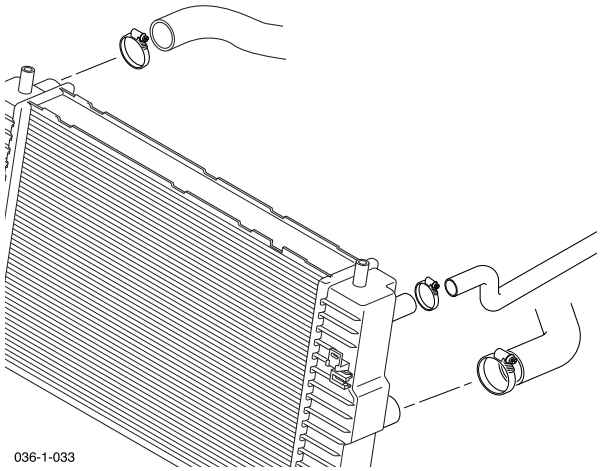
35. Evacuate the air-conditioning system.

36. Disconnect the air conditioning pipes from the receiver drier and condenser.



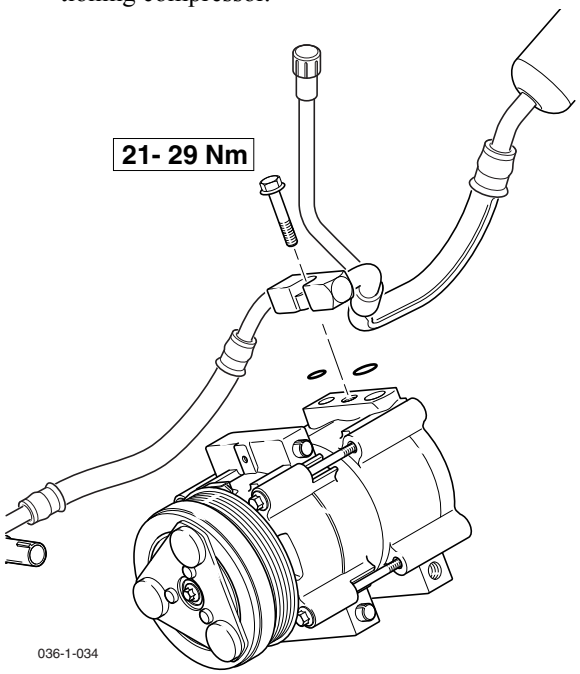
37. Remove the following hoses from the radiator

- Radiator top hose
- Radiator bottom hose
- Radiator bleed hose

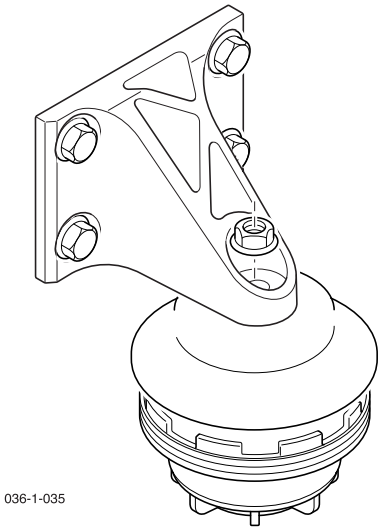


38. Remove the cooling pack.

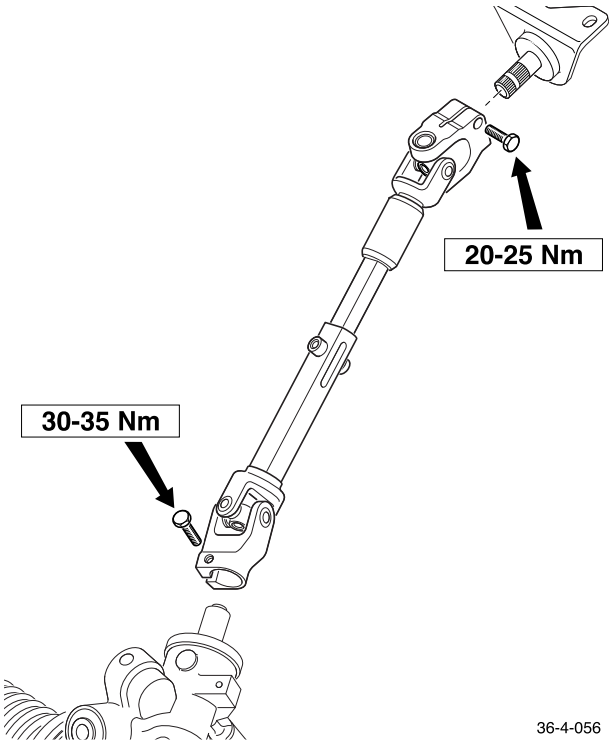
39. Disconnect the refrigerant pipes from the air-conditioning compressor.



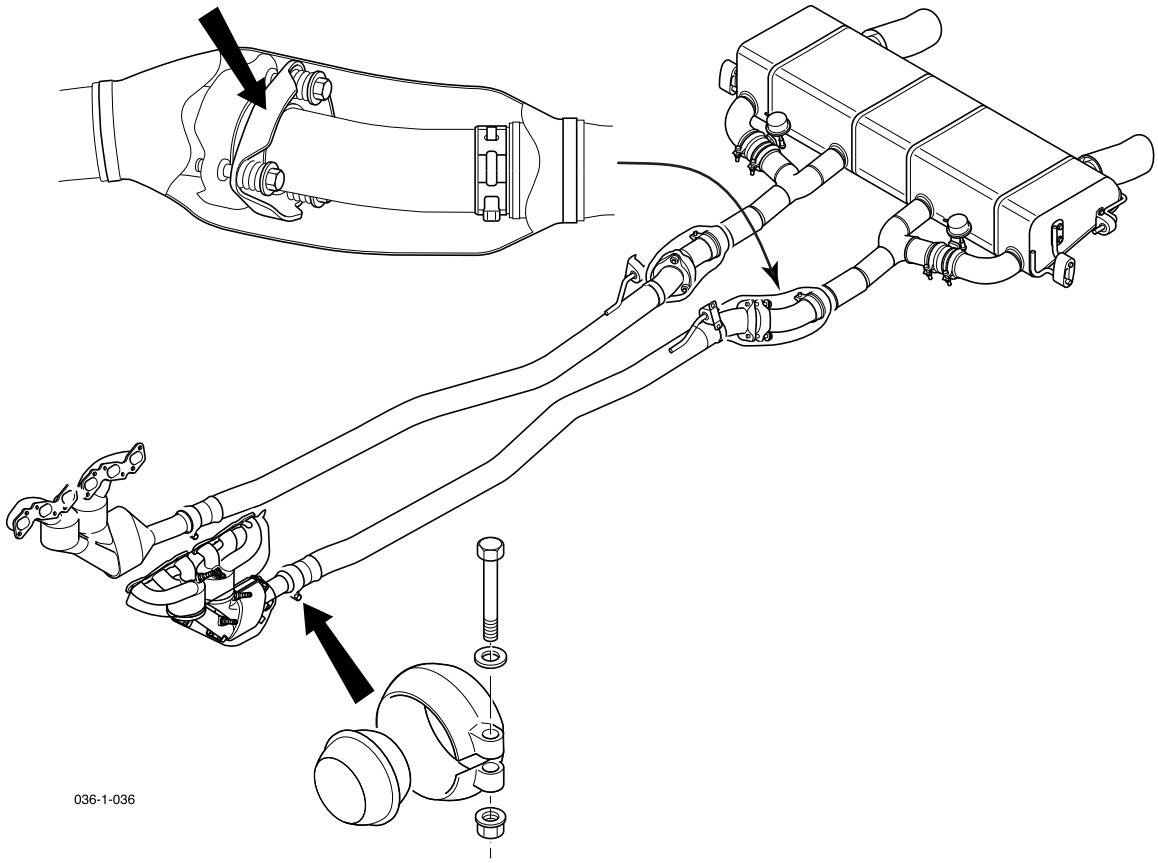
40. Remove the engine mounting nuts from beneath the car.



41. Remove the steering column lower section.



42. Release four clamps and remove the two exhaust intermediate pipes.



43. Remove the intermediate pipe heat shields.

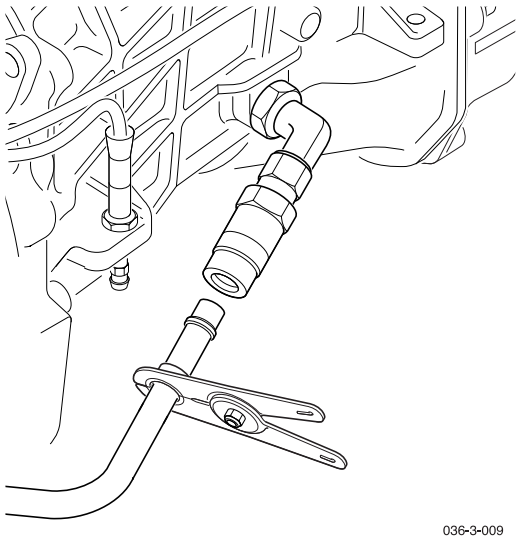
44. Remove the propeller shaft

- Remove three bolts from the rear propshaft coupling
- Slide the propshaft forward and remove it from the vehicle



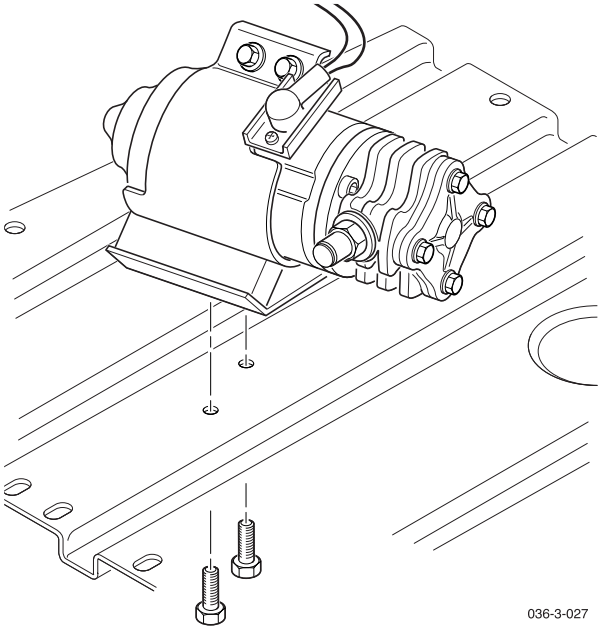
45. Drain the transmission cooling pipes.

- Disconnect the lower connector in the gearbox cooling circuit
- Drain the gearbox oil from the cooling pipesinto a suitable container
- Disconnect the second cooling pipe from the gearbox and drain the oil from the pipe.
- Cap the pipes to prevent further leakage.



46. Remove the gearbox cooling pump

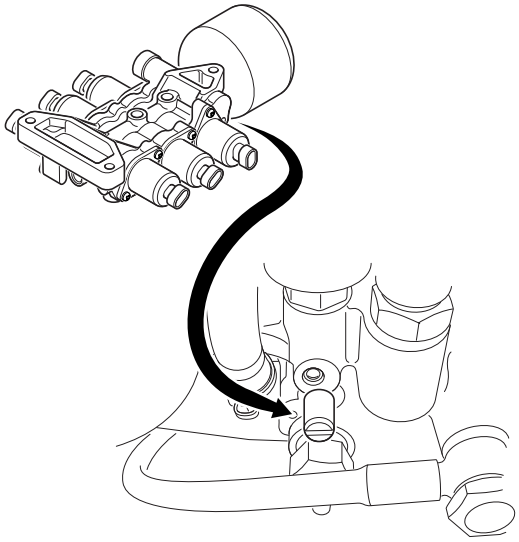
- Disconnect the cooling pipes from the gearbox cooling pump
- Disconnect the pump electrical connector
- Remove the pump



47. Remove the cooling pipe clamp from the right side of the gearbox. Remove the gearbox cooling pipes from the vehicle.

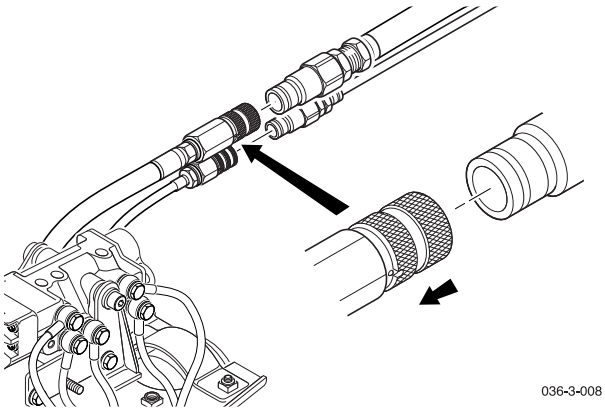
48. Open the pressure relief screw under the rear of the ASM assembly to relieve system pressure back to the reservoir. When the rush of fluid stops, close the pressure relief screw.

Caution: If pressure is not relieved, replacement of the gearbox will be made difficult because the clutch cylinder will be extended and the gearbox will not close to the bellhousing.



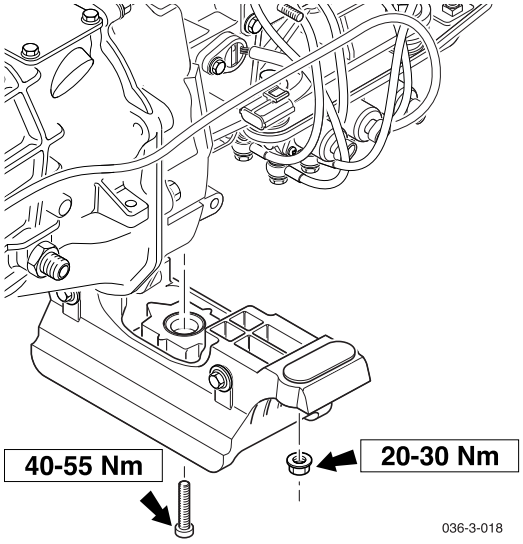
49. At the ASM assembly, release only the two snap connectors in the feed and return pipes to the ASM reservoir.

Caution: Do not disturb any other ASM or clutch pipework. The ASM system warranty will be void if the ASM pipework is disturbed.



50. Support the gearbox on a transmission stand.

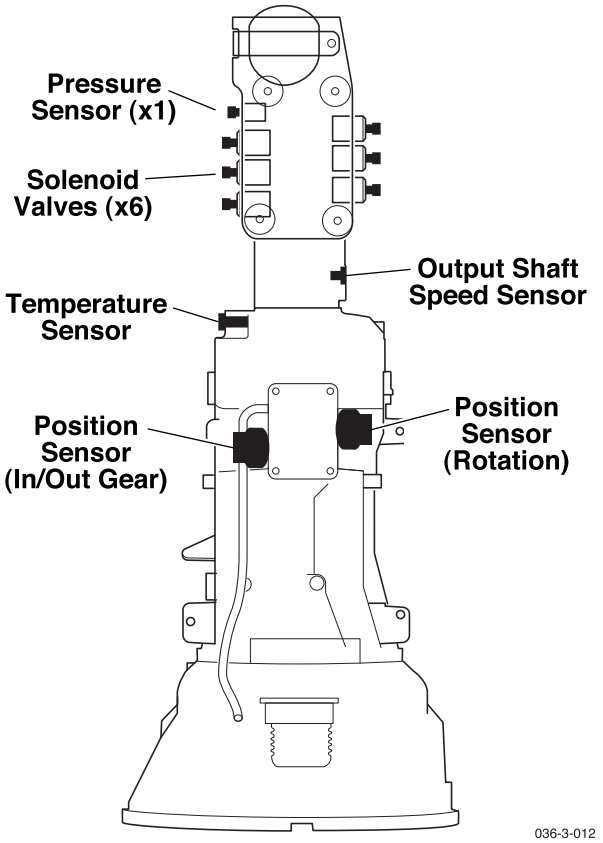
51. Remove the gearbox mount.



52. Lower the gearbox slightly to gain easier access to the bell housing bolts and electrical connectors.

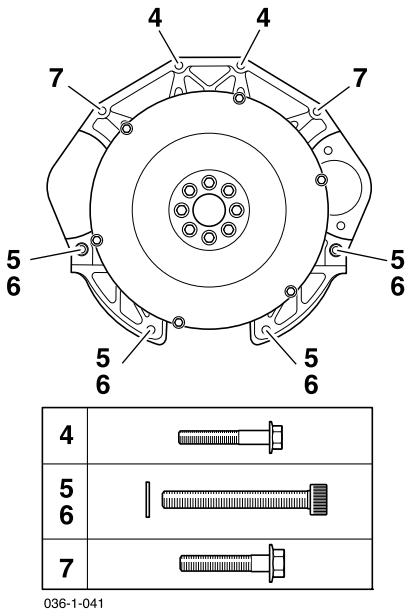
53. Disconnect the following electrical connectors

- 7 connectors at the rear (6 shift solenoids and the ASM pressure sensor)
- 2 position sensor connectors on the hydraulic shift mechanism
- 1 output speed sensor connector
- 1 input speed sensor connector
- 1 temperature sensor
- 1 clutch position sensor



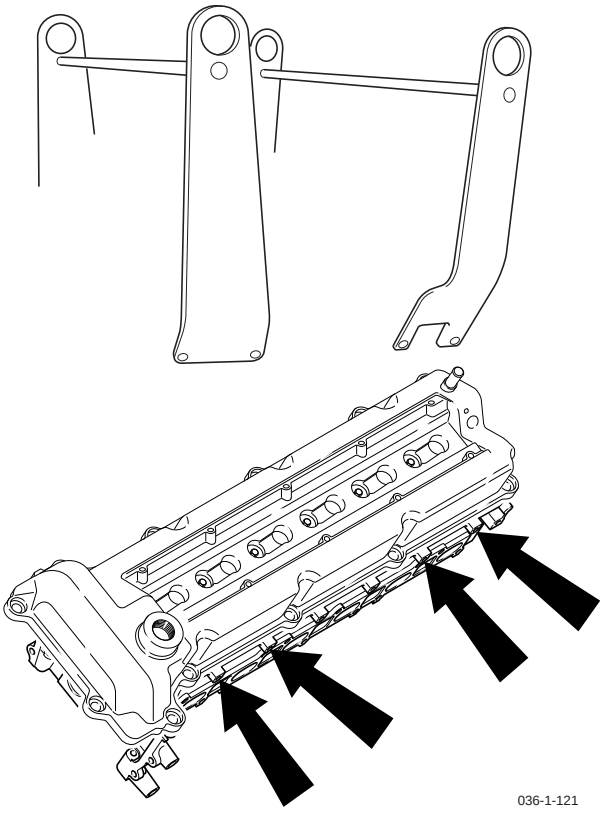
Lay the gearbox harness to the side.

54. Remove eight gearbox to bell housing bolts. Detach the gearbox from the bell housing and remove the gearbox.



55. Cut the tywraps securing the gearbox harness to the engine harness.

56. Attach four lifting eyes to the cylinder heads.



57. Place a security strap through both doors and around the ramp to prevent the body tipping backwards.

    Warning: When the engine is removed, the vehicle may become unstable on the ramp, particularly if the fuel tank is full and any weighty objects are in the boot.

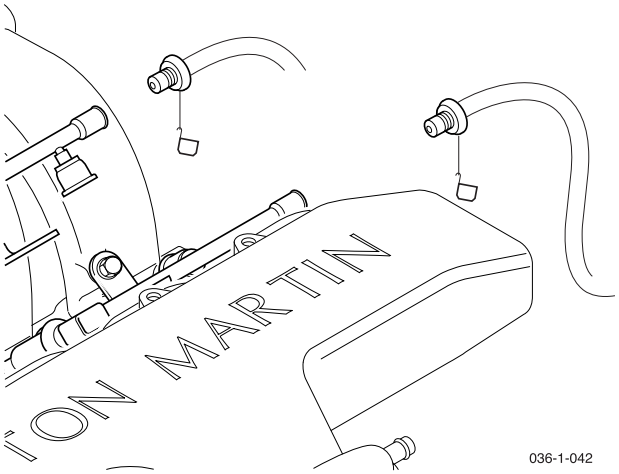
58. Fit the engine lifting gear to a suitable hoist.

    Caution: The fuel lines are still connected. Take care to avoid damaging the lines during the following step.

59. Lift the engine and move it forward and up with the engine inclined at approximately a 20-25° angle.

    As the engine is moved forward, disconnect the two fuel lines at the rear of the engine valley.

    Complete the engine removal.

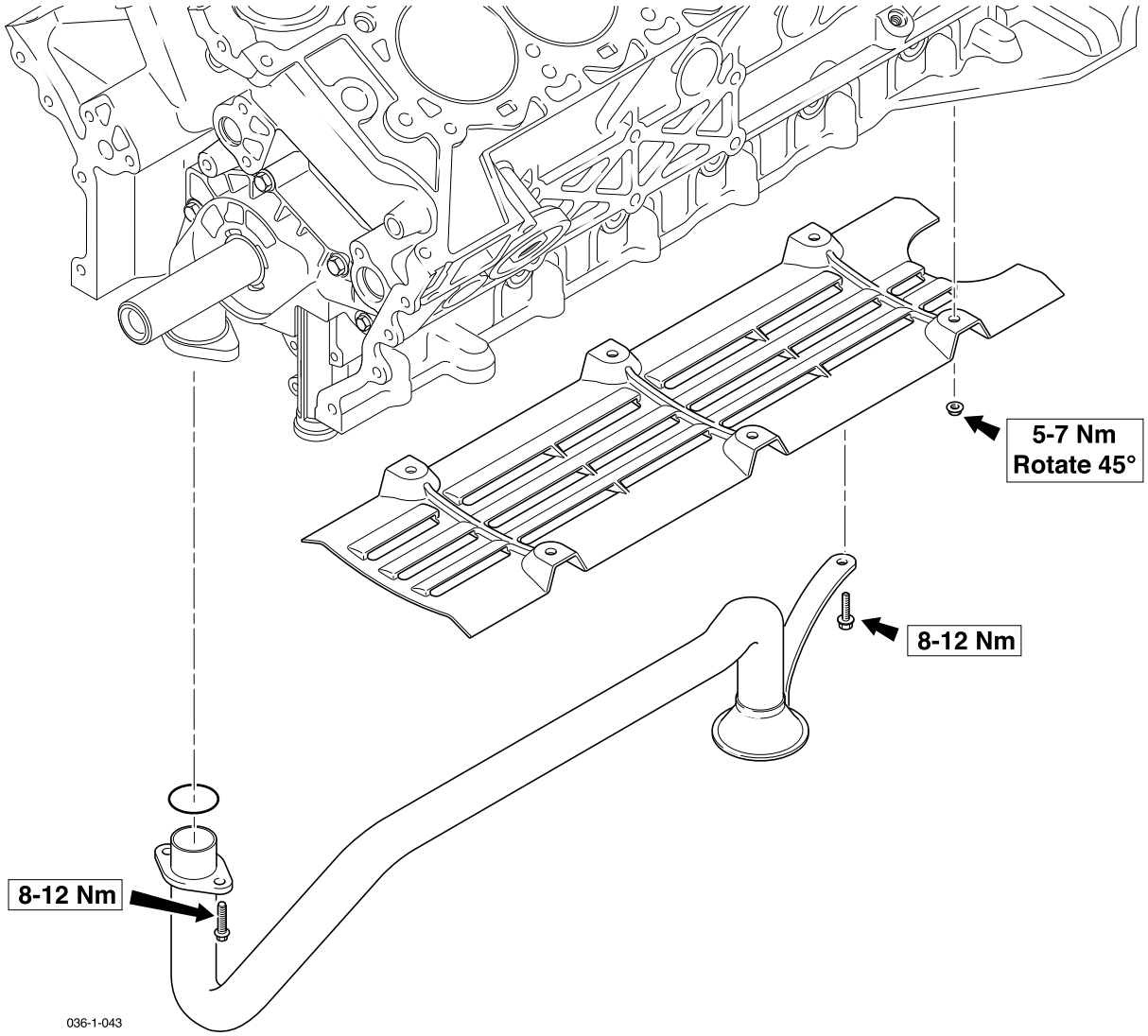


60. Secure the engine to an appropriate stand and detach the lifting gear.

1.2.04.1 Crankshaft

Removal

1. Remove the engine from the vehicle and secure to a suitable engine stand (1.0.01).
2. Remove the cylinder heads (1.3.03).
3. Remove the oil pan (1.5.02).
4. Remove the oil pick-up pipe and the windage tray.
   - Remove three M6 bolts
   - Remove the pick up pipe
   - Remove the 'O' ring
   - Remove six M6 nuts
   - Remove the windage tray

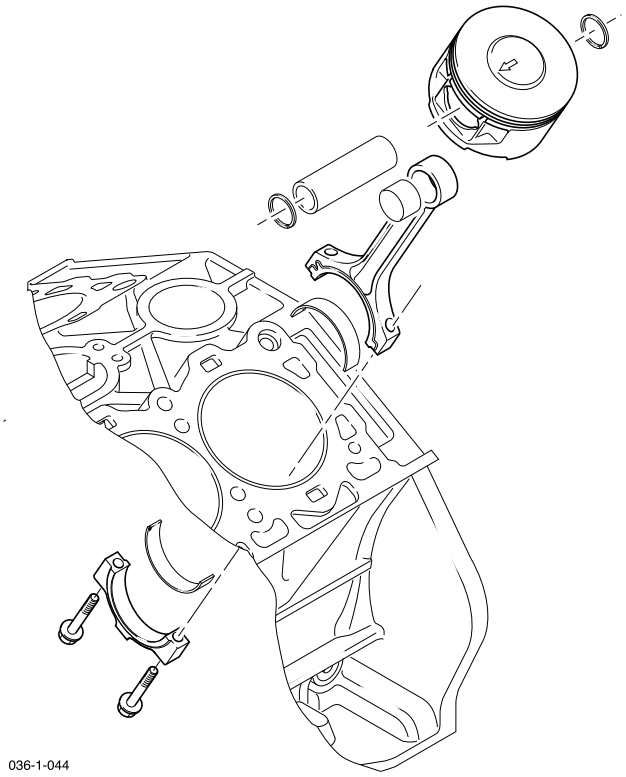


5. Remove the piston/connecting rod assemblies.

- Remove the connecting rod bolts
- Remove the connecting rod caps and bearings
- Withdraw the piston from the top of the bore.
- Retain each piston/connecting rod/connecting rod cap set together in the correct order for refitting to their original locations. The connecting rod and cap have identification marks which must match and align upon re-assembly.

Note: The arrow stamped on the piston upper face must point towards the front of the engine when re-assembled.

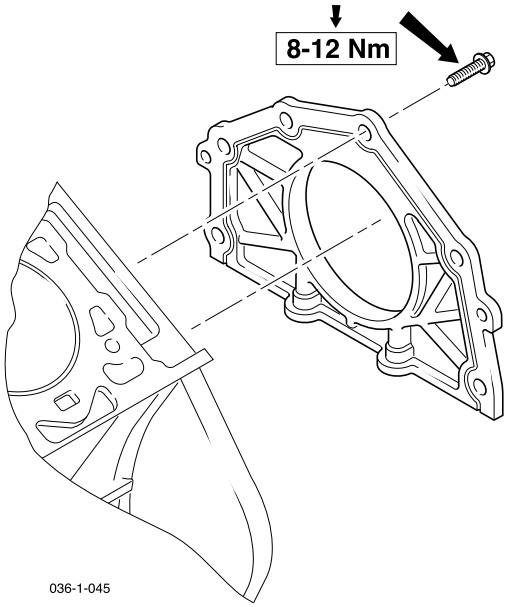
Note: The connecting rod is symmetrical and does not require front to rear orientation.



Note: Connecting rod bolts have ferrules pressed into the caps for new build bolt retention/ease of assembly. Replacement bolts do not have the captive ferrule. Original bolts can be removed by tapping the bolt out of the cap with a rubber mallet.

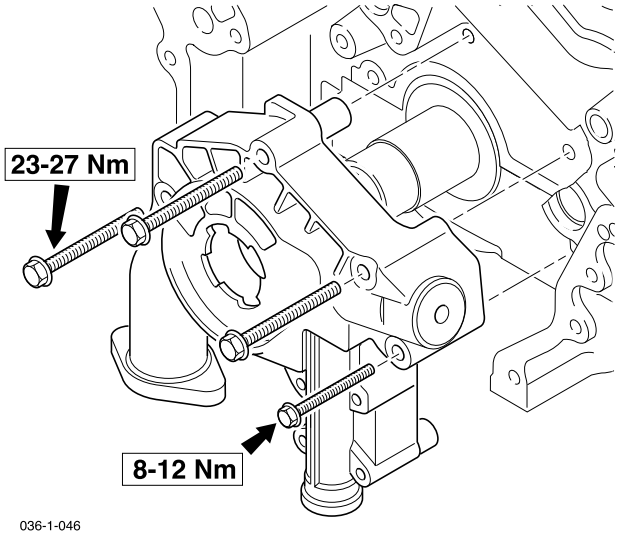
6. Remove the rear oil seal assembly.

- Remove six bolts
- Remove the seal retainer and oil seal

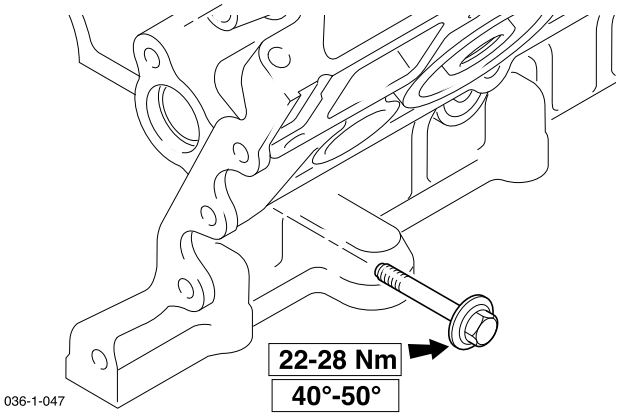


7. Remove the oil pump.

- Remove one M6 and three M8 bolts
- Remove the oil pump



8. Remove the fourteen M9 main bearing cap side bolts.

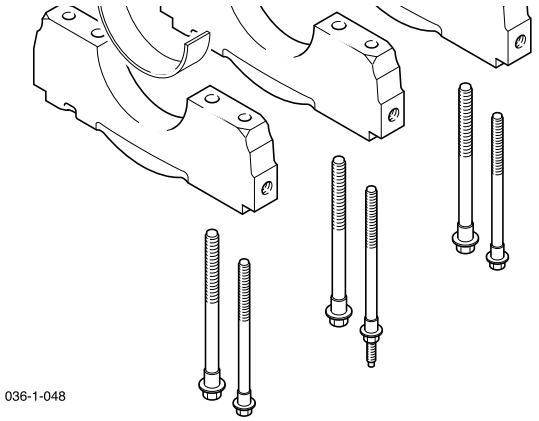


9. Remove the main bearing cap bolts.

   - Support the crankshaft and remove fourteen outer M8 bolts from the bearing caps.

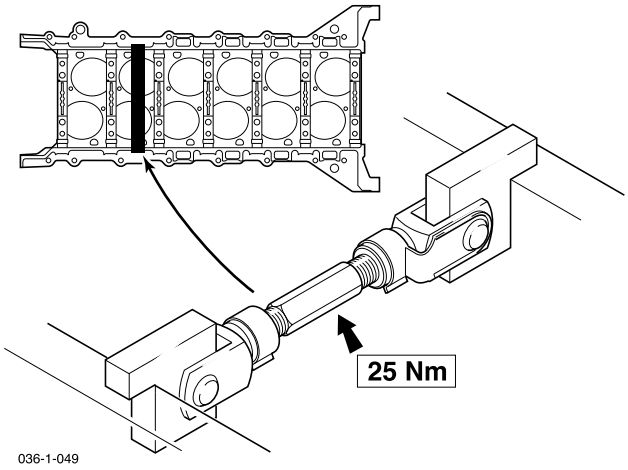
   (Note the positions of the M8 stud bolts at No. 2, 4 and 6 main bearing caps)

   - Remove fourteen inner M10 bolts from the bearing caps

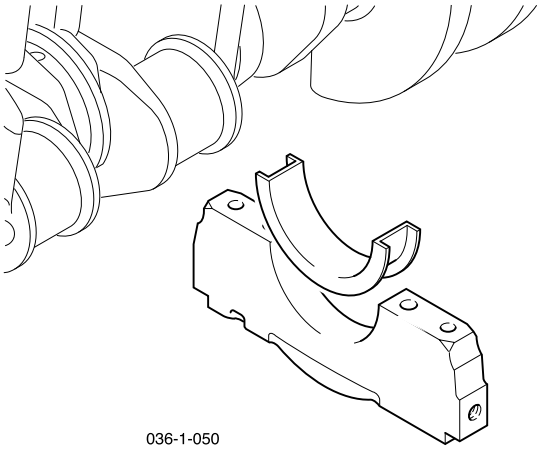


10. Spread the engine block side walls using the block spreading tool tensioned to 25 Nm.

    Caution: To avoid overstraining the block walls, do not exceed 25 Nm torque on the block spreader bolt.



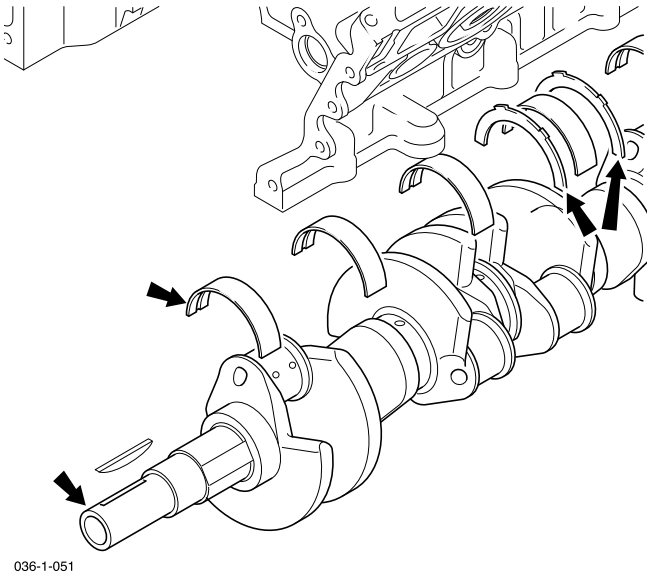
11. Remove the main bearing caps and bearing shells. Retain all components in order for refitting to their original locations if serviceable.



12. Remove the block spreaders.

13. Remove the crankshaft

    - Remove the crankshaft from the engine.
    - Remove the thrust washers from No. 4 main bearing.
    - Remove the upper bearing shells from all main bearings.
    - If serviceable, retain all bearings in order for refitting to their original locations.



Component Checks

1. Examine the crankshaft journals for wear, scuffing or other defects. Replace the crankshaft if unserviceable.

2. Examine all bearing shells and thrust washers for wear, scuffing or other defects. Replace if unserviceable.

3. If necessary, measure the diameter of the crankshaft main and big end bearings. Compare the results with the data in engine specifications.

   The finished diameter of the crankshaft main bearing bores is indicated by numbers stamped on the block face.

   The finished diameter of the seven crankshaft main bearing journals are indicated by seven letters stamped in bearing number sequence on No.1 counter weight.

4. Refer to the Main Bearing Grade Chart in Engine Specifications if main bearings are to be replaced.

Reassembly

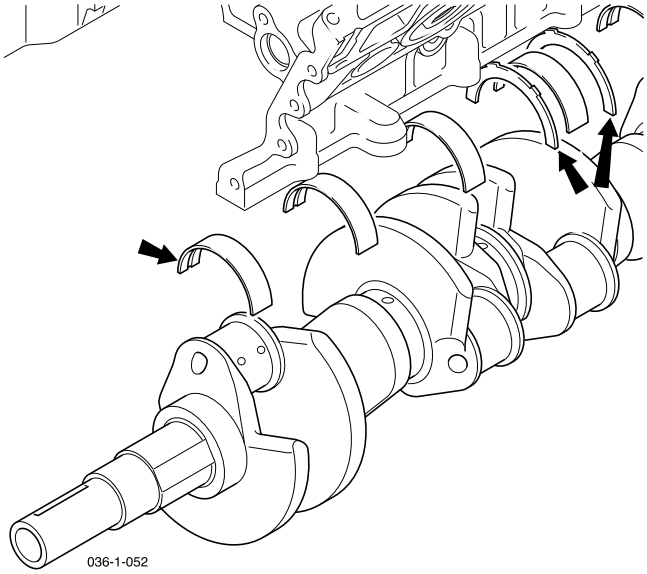
1. Clean all components ready for reassembly.

2. Fit the upper main bearings

   - Fit the upper bearing shells
   - Fit the thrust washers at No 4 bearing
   - Check the oil feed hole alignment
   - Lubricate the bearing surfaces with SAE 50 Assembly Oil.

3. Oil all crankshaft journals with engine oil.

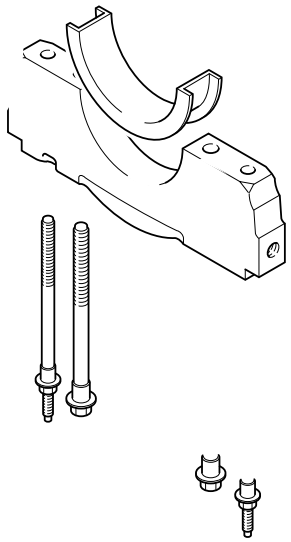
4. Fit the crankshaft into the upper main bearings.



5. Fit three block spreaders tightened to 25 Nm.

   Caution: To avoid overstraining the block walls, do not exceed 25 Nm torque on the block spreader bolt.

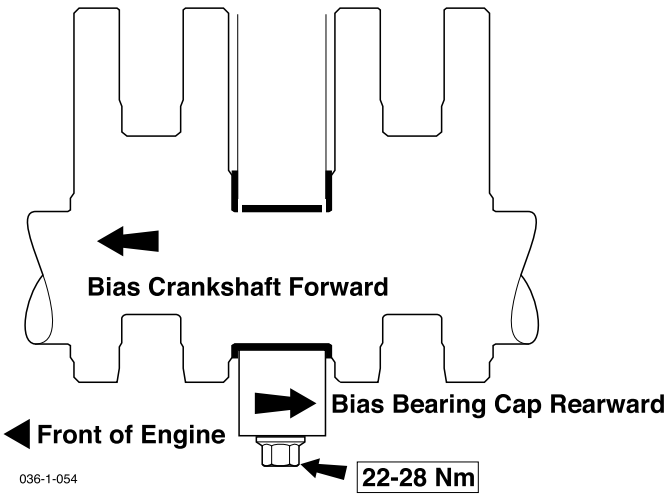
6. Oil the lower main bearing surfaces with engine oil. Loosely fit the No. 4 main bearing shell and bearing cap. Oil beneath the head of four bolts and fit to No. 4 bearing cap.



036-1-053

7. Set the No. 4 bearing so that end loads are taken on both the upper and lower bearing thrust faces:

   - Bias the crankshaft maximum forward against the upper thrust bearing.
   - With the crankshaft biased forward, bias the No. 4 bearing cap maximum rearward against the crankshaft thrust face.
   - In 'half turn' increments of the inner bolts, ease the cap down until it is fully seated.
   - Nip down No. 4 bearing cap bolts to 22-28 Nm.



036-1-054

8. Fit the remaining main bearing caps.

   Check and if necessary adjust No. 1 cap so that the front face does not protrude forward of the oil pump mounting face.

9. Oil beneath the head of all M10 bolts (Do not oil the threads). Hand start them into their holes.

10. Ease the caps down using the two inner bolts in half turn increments.

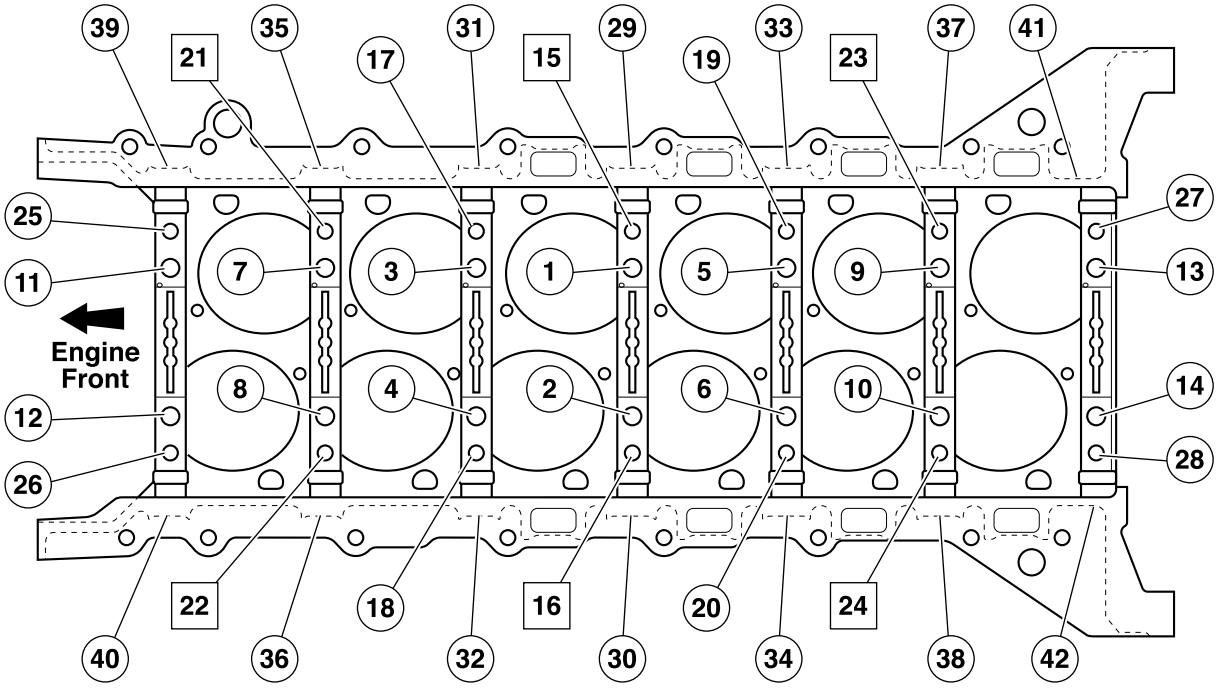
11. Oil beneath heads of the remaining bolts. Fit remaining main bolts and side bolts to all caps.

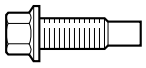
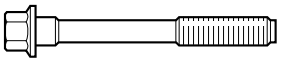
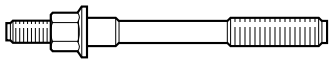
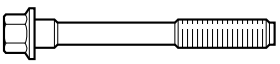
12. Remove the crankshaft support and block spreaders.

13. Initially, torque the M10 bolts to 22-28 Nm to hold the crankshaft position.

14. Torque tighten the main bearing cap bolts using the sequence and torque specifications from the diagram below.

Caution: The main bearing bolts are torqued to yield. They must be tightened precisely as specified.



Hole No.	Fastener	Description
29 to 42	○ 	M9 x 1.25 x 34 Bolt
17, 18, 19, 20 25, 26, 27, 28	○ 	M8 x 1.25 x 84 Bolt
15, 16, 21 22, 23, 24	□ 	M8 x 1.25 M6 x 1 x 120 Stud & Hex Washer
1 to 14	○ 	M10 x 1.5 x 93.5 Bolt
Note	Torque Fasteners 1 to 14 at 37-43 Nm Torque Fasteners 15 to 28 at 22-28 Nm Torque Fasteners 1 to 28 an Additional 85°-95° Torque Fasteners 29 to 42 at 22-28 Nm Plus 40°-50°	

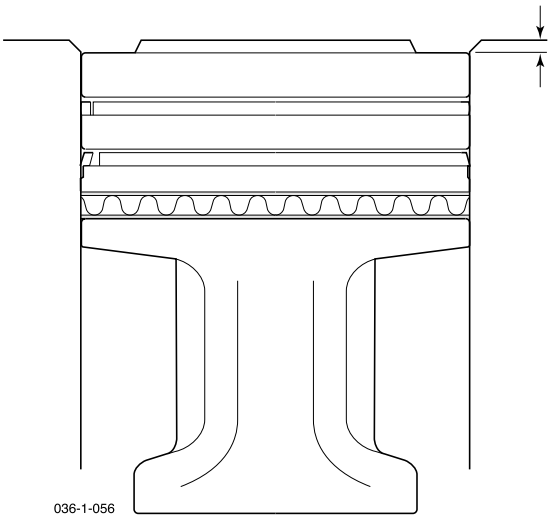
036-1-055

15. Refit the pistons and connecting rods in their numbered positions.

    Check the piston height (see 1.2.05) if new pistons or connecting rods are being fitted.

    Note: The arrows stamped on the piston upper surface must point towards the front of the engine during re-assembly.

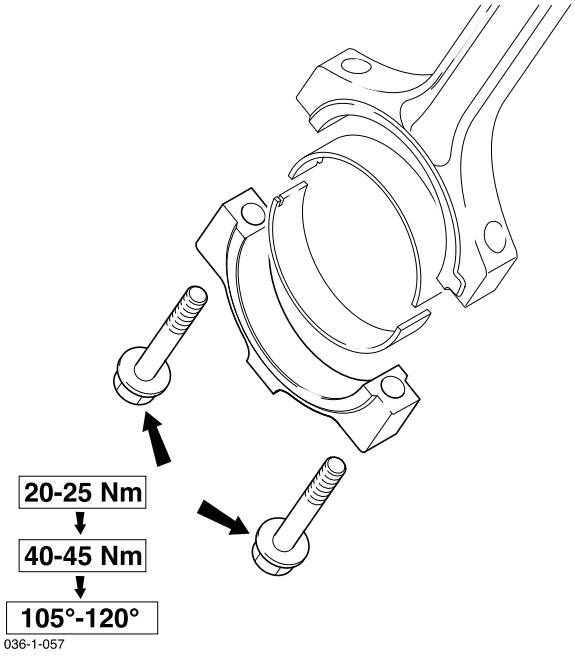
    Note: For full piston and connecting rod overhaul and assembly procedures, see 1.2.05.6.



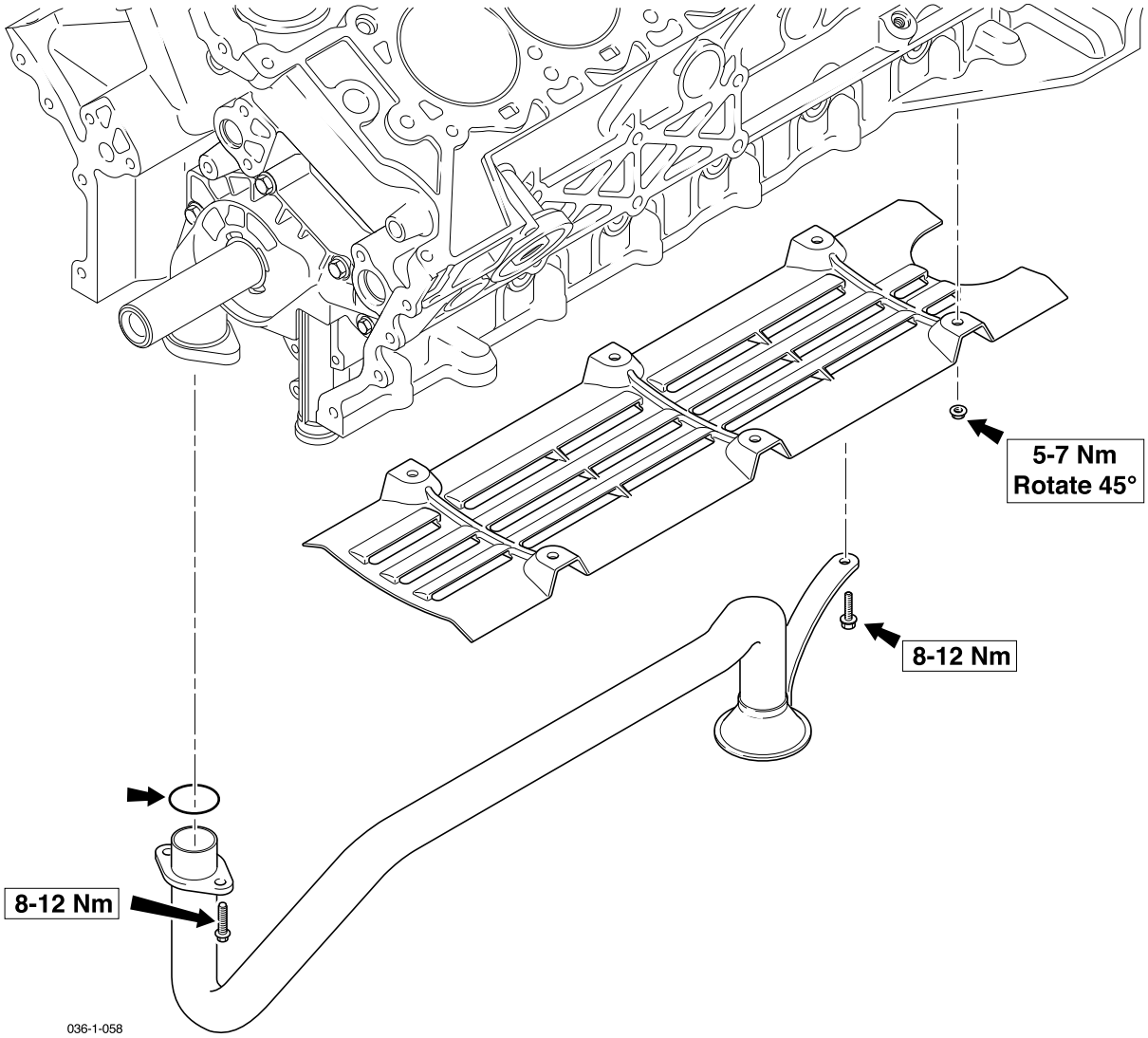
16. Fit the connecting rod bearings and caps.

    - Fit the connecting rod bearing shells and caps noting the correct orientation of each cap. Check that the connecting rod and cap identification marks match and align.
    - Secure the caps using two new bolts to each cap.

17. Torque all connecting rod bolts to 20-25 Nm. Then torque all bolts to 40-45 Nm. Then rotate all bolts a further 105°-120°.



18. Refit the windage tray and the oil pick-up pipe.
    - Fit the windage tray
    - Secure with six M6 nuts
    - Fit a new 'O' ring to the pick up pipe
    - Fit the pick up pipe using three M6 bolts.



19. Refit the oil pan (1.5.02).

20. Refit the cylinder heads (1.3.03) and complete the valve timing setup (1.3.04).

21. Refit the front timing cover (1.4.02) and the camshaft cover (1.3.01).

22. Refit the throttle body assemblies (2.1.03).

23. Refit the engine auxiliaries.

24. Fit and tension the polyvee drive belt (1.4.10).

25. Complete the engine reassembly and prepare to refit to the vehicle.

1.2.05.1 Pistons and Connecting Rods

Overhaul

Caution: Keep all components in sets for refitting in their original locations if serviceable.

1. Remove the piston pin circlips. Discard the circlips.

WARNING: During the following step, wear protective gloves to avoid burns.

2. Warm the pistons to approximately 70°C and push out the piston pins. Allow the components to cool.
3. Using a ring spreader, remove the piston rings from all pistons.
4. Wash all components and replace any with obvious wear or other signs of deterioration. Check that components meet the following dimensional specifications:

Piston ring gaps at 89.000 cylinder bore diameter

Upper compression ring	0.10 - 0.25 mm
Lower compression ring	0.27 - 0.42 mm
Oil control rings	0.15 - 0.65 mm

Compression ring vertical clearance

Upper compression ring	0.04 - 0.075 mm
Lower compression ring	0.04 - 0.085 mm

Piston pin fit

Piston pin fit	0.007 - 0.24 interference cold 0.001 mm clearance at 20°C
Piston pin to rod clearance	0.004 - 0.020 mm

Connecting Rods

Vertical clearance	0.028 - 0.066 mm
Side clearance	0.10 - 0.30 mm

Piston height

Piston height above the block face at TDC	0.415 mm below to 0.115 mm above

(measured along the centreline of each bank)

Cylinder bore diameter	89.00 - 89.03 mm

measured 50 ±0.05 mm below block face)

Piston diameterr	88.97 - 89.00 mm

Note: See Piston Skirt Grading Chart on page 1-4.

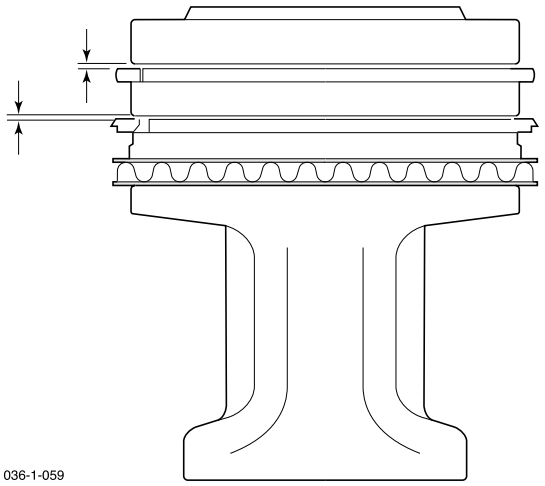
Reassembly

Note: Pistons are graded for each cylinder bore. If pistons and/or connecting rods are to be refitted, They must be refitted in their original sets and in their original positions.

The grade of a cylinder bore (1, 2 or 3) is marked on the outside of the engine block, adjacent to the bore. Pistons are similarly graded (1,2 or 3) on their upper surface. Make sure the correct piston grade is chosen when fitting a new piston.

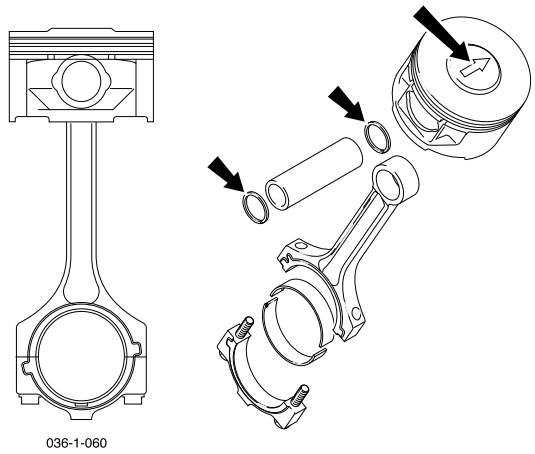
1. Check the ring gaps of any new piston rings.
2. Fit the piston rings and check the vertical clearance of the upper compression ring (1) and the lower compression ring (2) against the specification (see previous column).

WARNING: During the following step, wear protective gloves to avoid burns.



3. Fit the pistons to the connecting rods

   - Warm the pistons to approximately 70°C and fit the connecting rods and piston pins. Fit each piston with the arrow pointing forward. Secure the piston pins with new circlips.

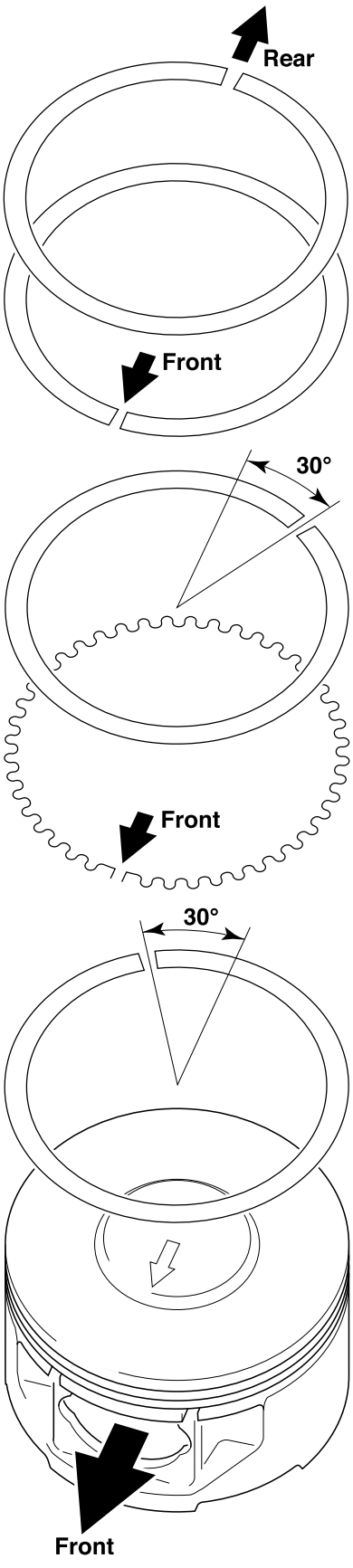


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4. Caution: Make sure that the connecting rods and caps are a matched set.

   - Fit new bearing shells to the connecting rods and caps. Prepare new connecting rod bolts by oiling beneath the bolt head with engine oil.

5. Before fitting to the engine, rotate the piston rings as necessary to the positions shown on the following diagram.

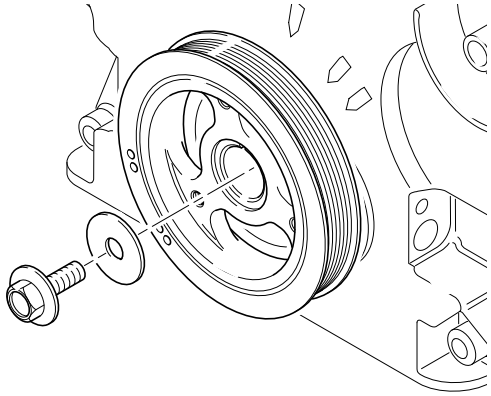


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1.2.06.1 Crankshaft Damper

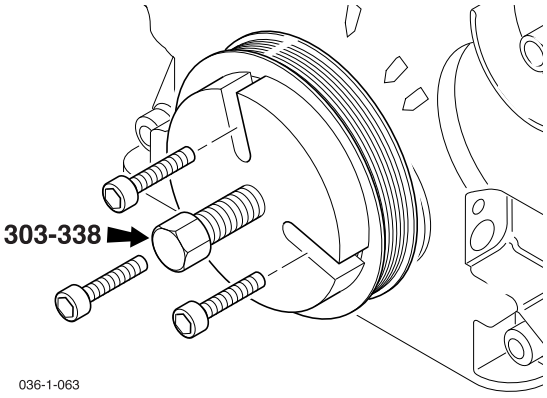
Removal

1. Release the polyvee drive belt (1.4.10.1).
2. Remove one M12 bolt and washer.



036-1-062

3. Using the special tool remove the crankshaft damper.

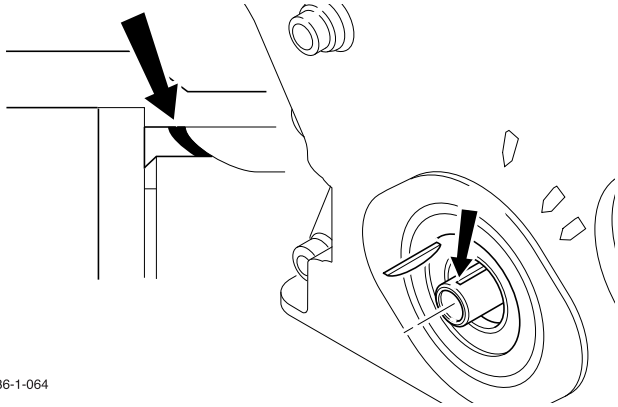


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4. Clean all sealant from the crankshaft keyway

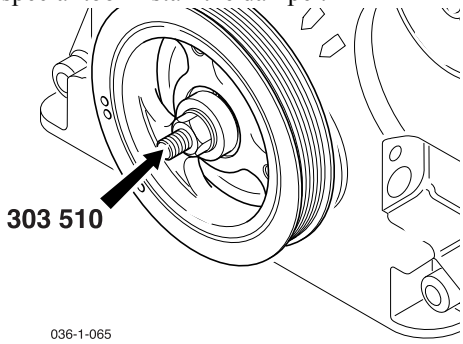
Refitting

1. Clean and oil the seal surface.
2. Apply silicone sealant to seal the keyway end.



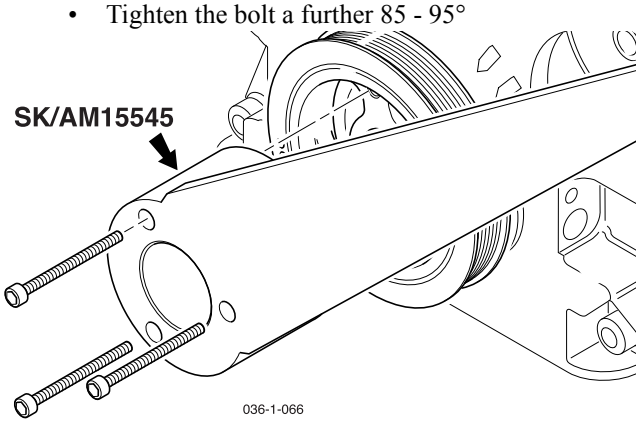
036-1-064

3. Using the special tool install the damper.



036-1-065

4. Using the special tool prevent the crankshaft from turning and torque the damper bolt
   - Pre-torque the bolt to 120 Nm
   - Back out a minimum of 360°
   - Torque the bolt to 47-53 Nm
   - Tighten the bolt a further 85 - 95°

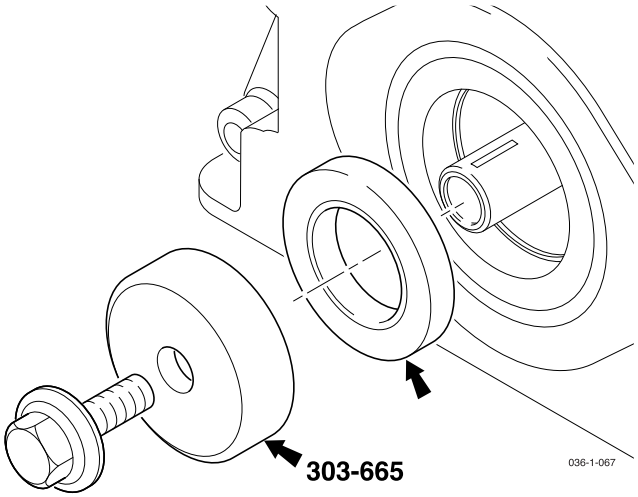


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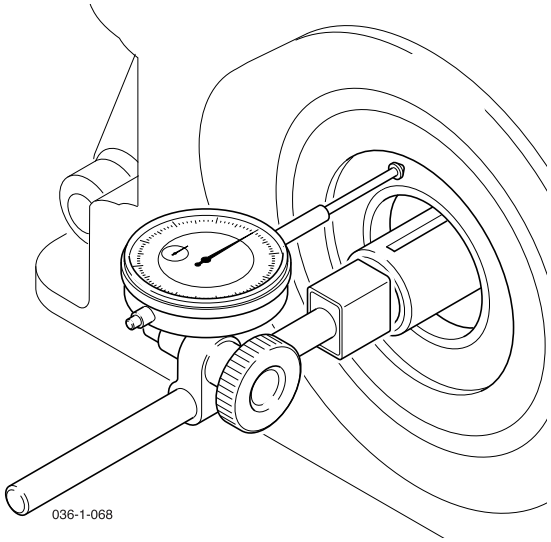
5. Remove the special tool and replace the polyvee drive belt.

1.2.07.1 Crankshaft Front Oil Seal

1. Remove the timing cover (1.4.02).
2. Remove the front oil seal from the front timing cover. Clean the seal recess in the cover.
3. Lubricate the outside of the new seal and the seal recess with engine oil.
4. Insert the new seal.
   - Oil the seal recess and position the seal on the cover
   - Using the special tool (303-665), press in the seal to 1mm below the seal recess edge



5. Check that the seal outer surface is parallel to the timing cover face.

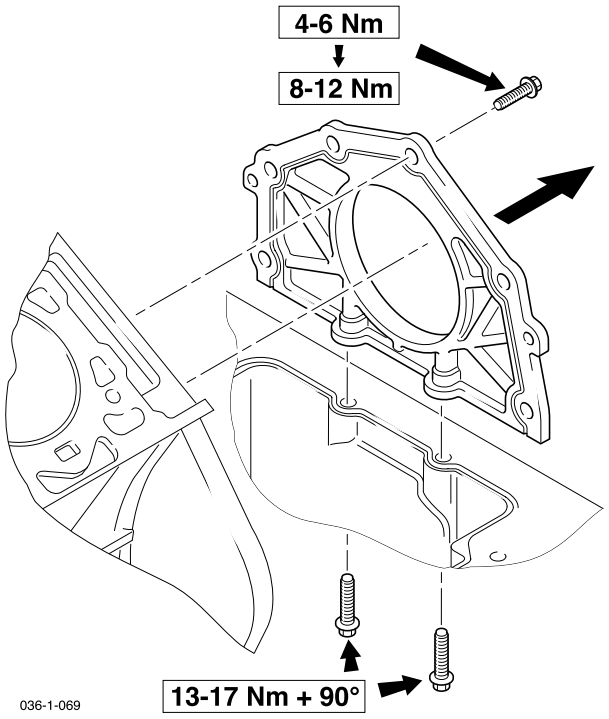


6. Lubricate the seal surface with engine oil before fitting the crankshaft damper (1.2.06).

1.2.08.1 Crankshaft Rear Oil Seal

Removal

1. Remove the transmission (3.0.01 auto) or (3.8.01 manual).
2. Remove the flywheel (3.6.04) or transmission drive plate (3.0.01).
3. Remove the rear oil seal retainer.
   - Remove six M6 bolts from the retainer.
   - Remove two M8 bolts securing the oil pan rear edge to the rear oil seal retainer.
   - Remove the retainer

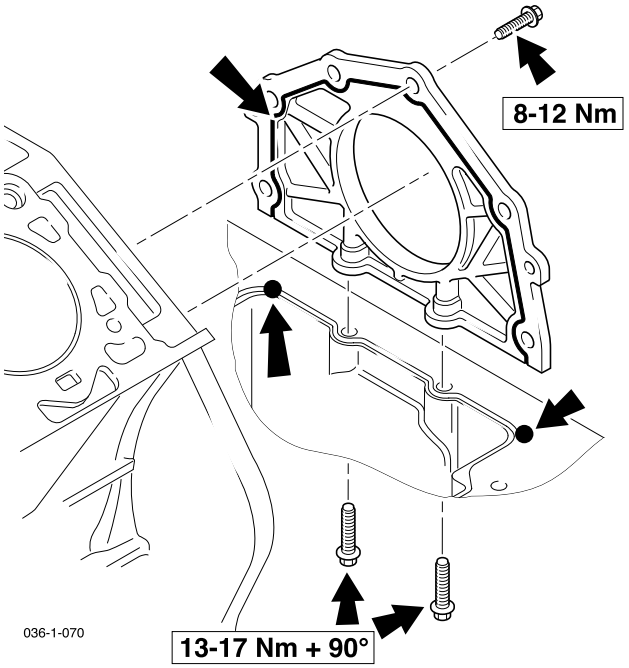


4. Extract the rear oil seal from the retainer.
5. Clean the oil seal recess and the mating face of the retainer. Clean the mating faces on the block and oil pan. Ensure that all mating faces are oil free.

Reassembly

1. Fit the rear oil seal retainer.

   - Apply a bead of sealant as indicated around the retainer mating face on the block.
   - Apply a bead of sealant where indicated at the oil pan interface.
   - Also apply a bead of sealant at the front of the engine, at the timing cover / oil pan interface. For full oil pan removal and installation see 1.5.02.1

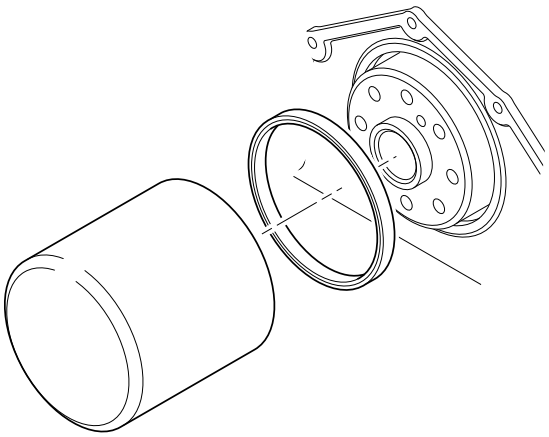


   - Within 5 minutes, fit the rear oil seal retainer over the locating dowels, Fit six M6 bolts and torque to 8-12 Nm.
   - Fit the two M8 bolts to the rear edge of the oil pan and torque to 13-17 Nm + 90°.

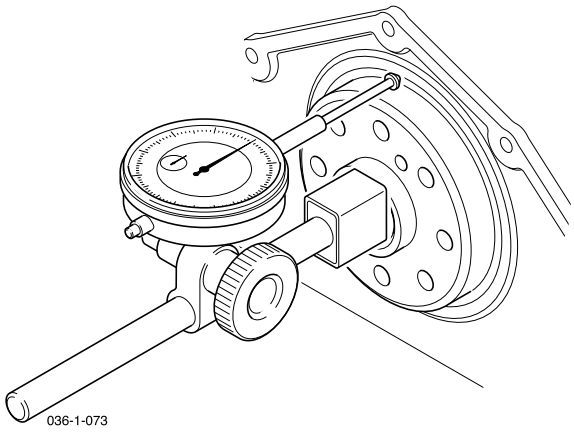
2. Lubricate the seal recess and the seal surface with engine oil.

3. Using the rear seal installation tool kit (303-664) insert the rear crankshaft seal.

   - Offer the seal to the recess in the seal retainer (spring side towards the engine).
   - Insert the seal ensuring that it sits squarely into the retainer recess



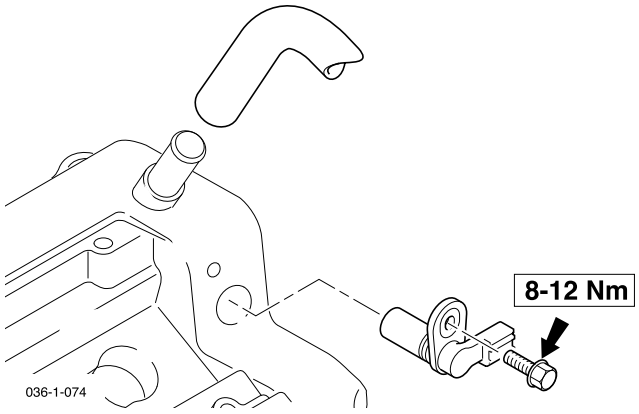
4. Check that the seal surface is parallel to the seal retainer face.



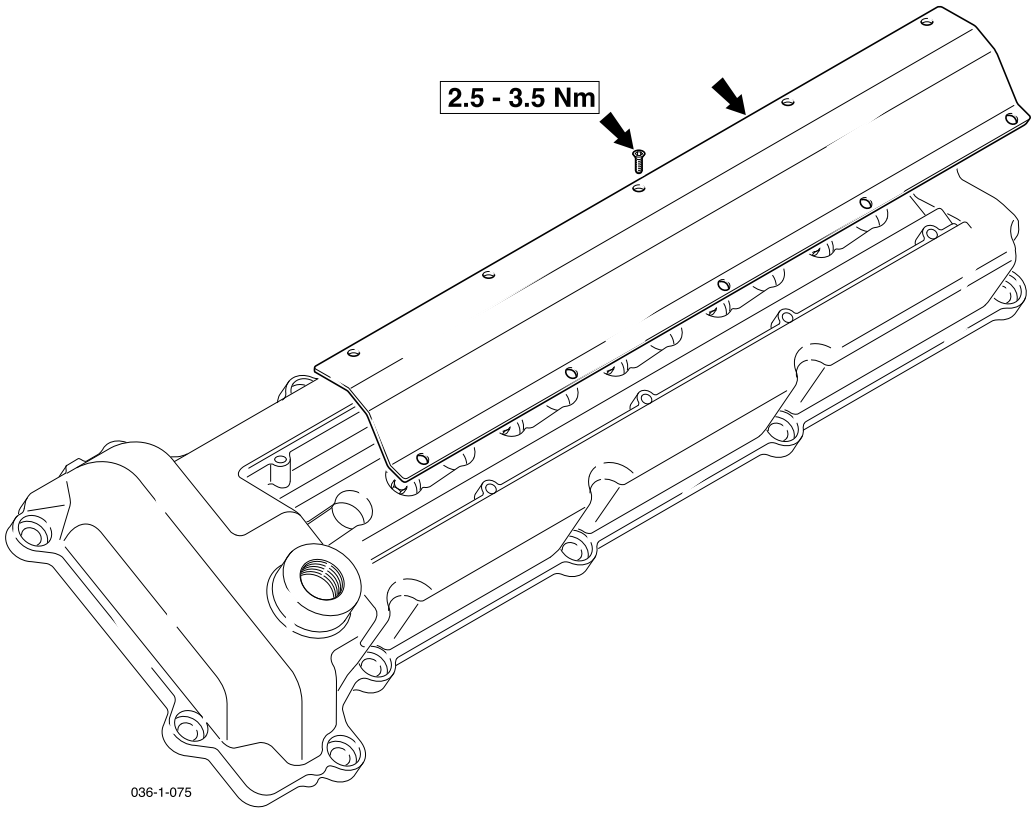
1.3.01.1 Camshaft Cover

Removal

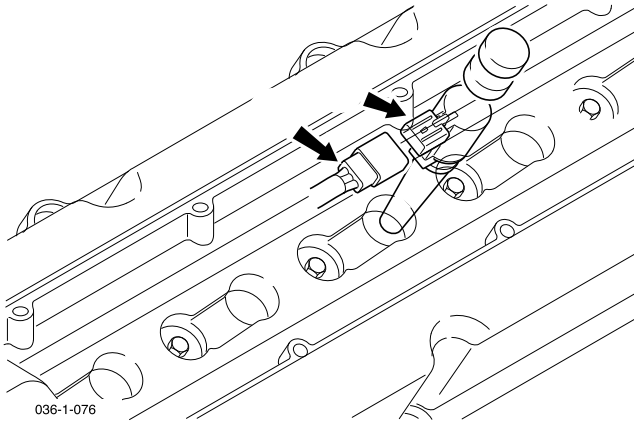
1. Remove the inlet manifold (2.2.01).
2. Disconnect the cam cover ventilation pipe and the camshaft sensor.



3. Remove the spark plug cover.

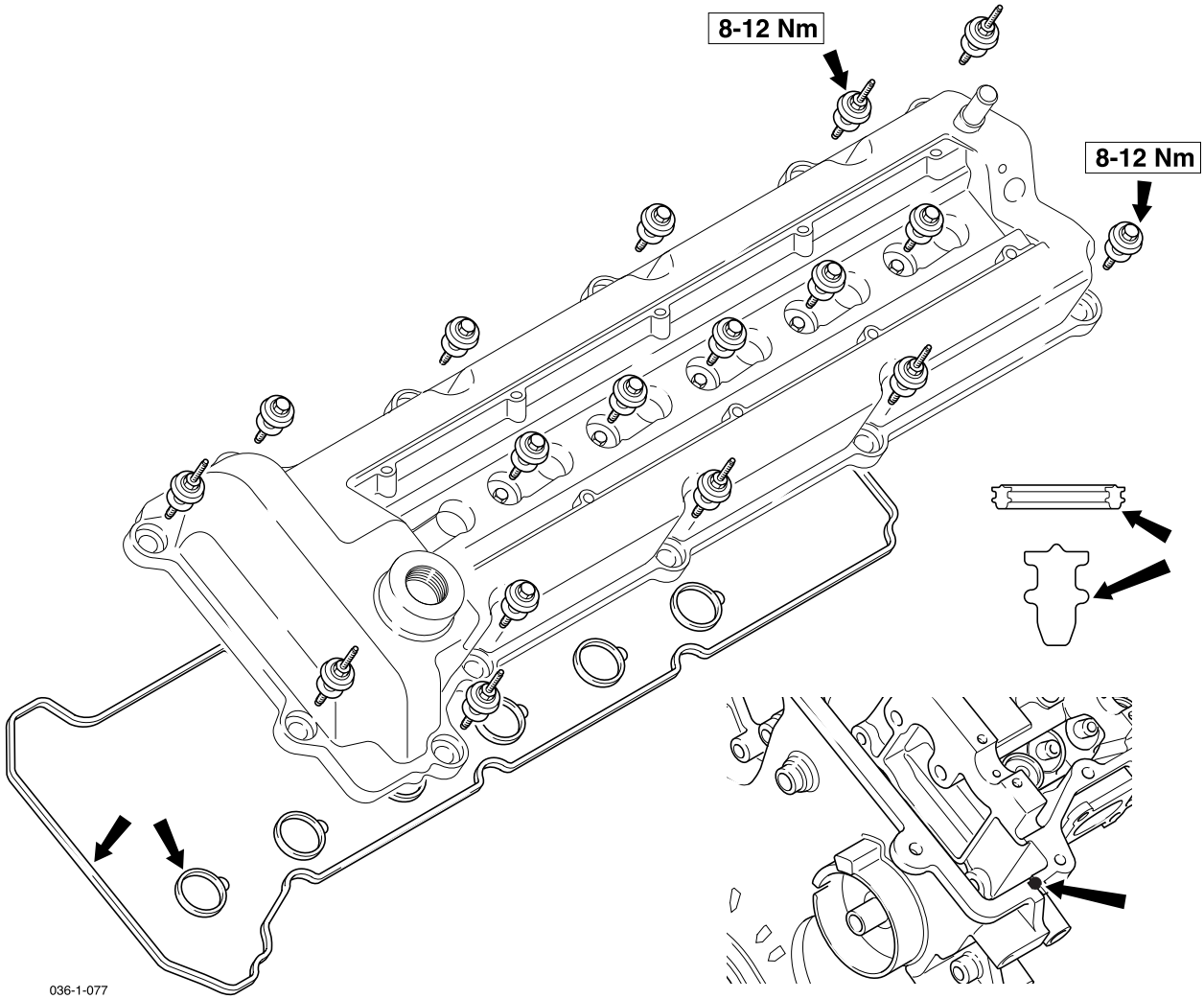


4. Disconnect the ignition coil connectors, remove the coils.



5. Remove 17 M6 bolts (16 M6 bolts for the RH bank) and remove the camshaft cover.

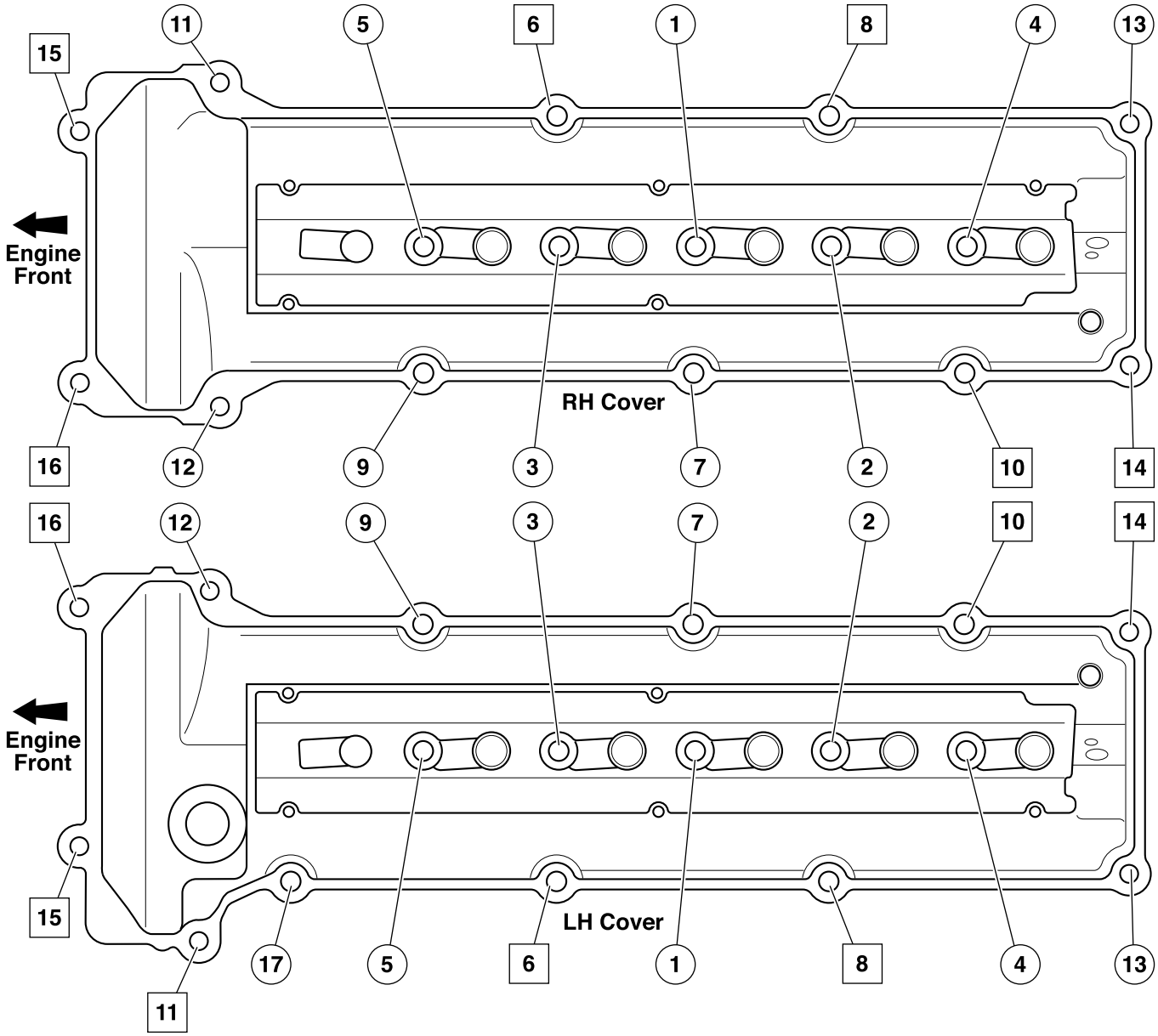
   Discard all seals from the camshaft cover.

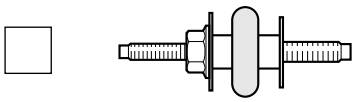
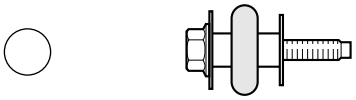


Installation

1. To install, reverse the removal procedure.
2. Apply a bead of sealant where indicated at the front cylinder head / timing cover interface.
3. Orientate the new cover seal and plug seals as shown.

4. Tighten the bolts to 8-12 Nm in the sequence shown below.



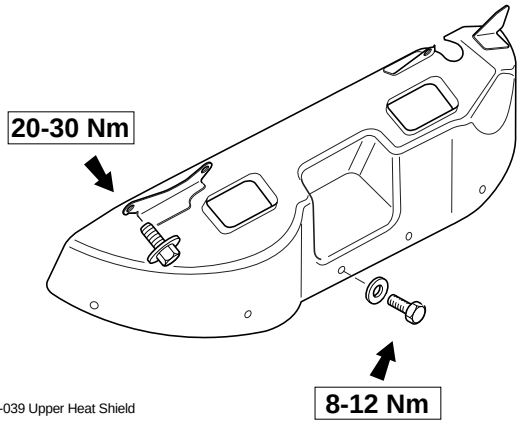
Hole No.	Fastener	Description
6, 8, 10, 11, 14, 15, 16		Grommet, Stud 10 mm Hex
1, 2, 3, 4, 5, 7, 9 12, 13, 17		Bolt 10 mm Hex
Note	Torque Sequence 1 to 17	

036-1-078

1.3.03.3 Cylinder Head

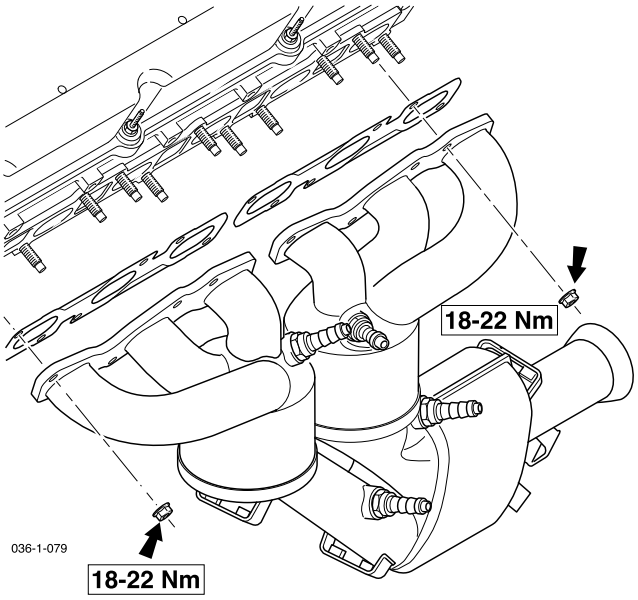
Removal

1. Remove the engine (1.0.01)
2. Remove the throttle body (2.1.03).
3. Remove the inlet manifold (2.2.01).
4. Remove the upper exhaust heat shields.
   - Remove six bolts from the lower edge of each upper heat shield
   - Remove three bolts from the upper mounts of each heat shield
   - Remove the heat shield?



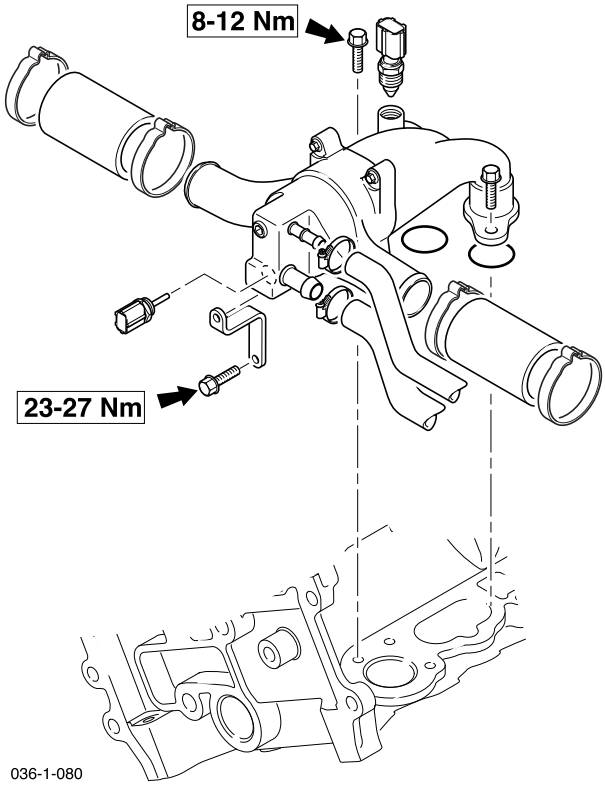
036-2-039 Upper Heat Shield

5. Remove the exhaust manifold.
   - Remove ten nuts?
   - Remove the exhaust manifold?
   - Remove the exhaust manifold gasket?



036-1-079

6. Drain the engine coolant (1.7.03).
7. Remove the thermostat housing
   - Disconnect the coolant hoses
   - Disconnect the coolant temperature sensors
   - Remove three M6 bolts from the rear of the housing
   - Remove the lower M6 bolt from the front of the housing
   - Remove the thermostat housing
   - Remove and discard the 'O' rings



036-1-080

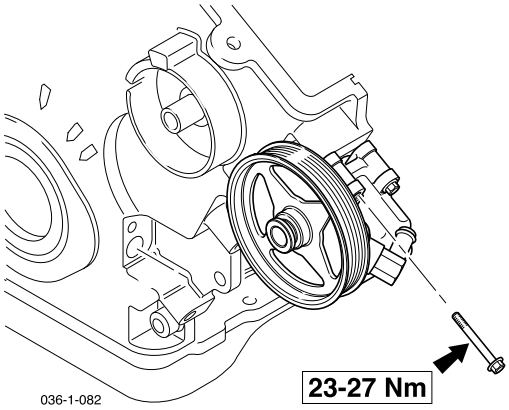
8. Remove the cam cover (1.3.01).

9. Remove the polyvee drive belt (1.4.10)

10. Remove the crankshaft damper pulley. (1.2.06)

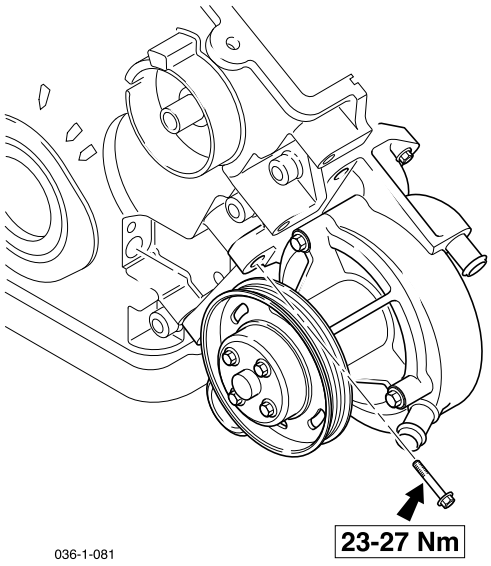
11. Release the power steering pump from the front timing cover.

    - Remove four M8 bolts
    - Release the power steering pump from the block
    - Remove two M8 bolts securing the water pump to the timing cover



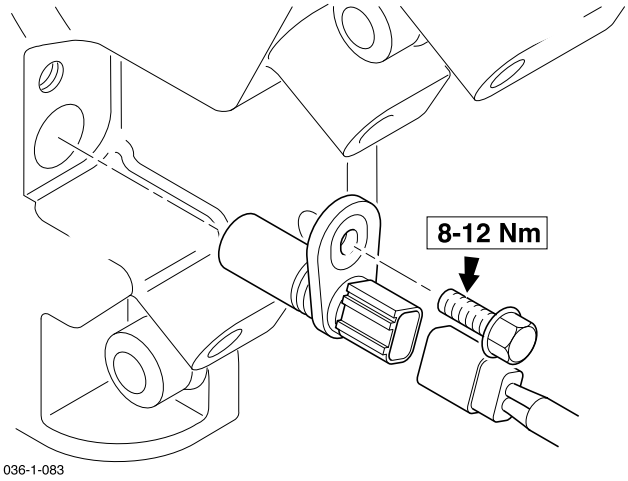
12. Release the water pump from the front timing cover

    - Remove two M8 bolts securing the water pump to the timing cover



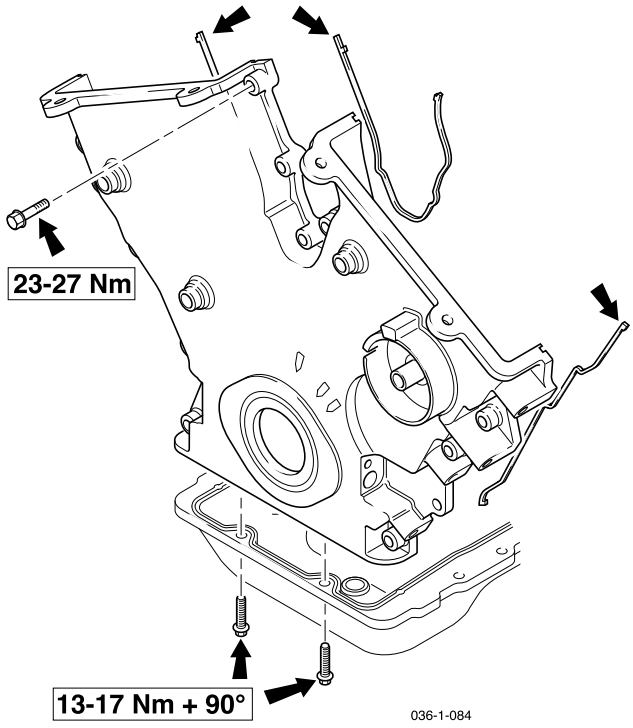
13. Remove two crank position sensors

    - Disconnect the two crank sensor connectors
    - Remove two M6 bolts
    - Remove the two crank sensors



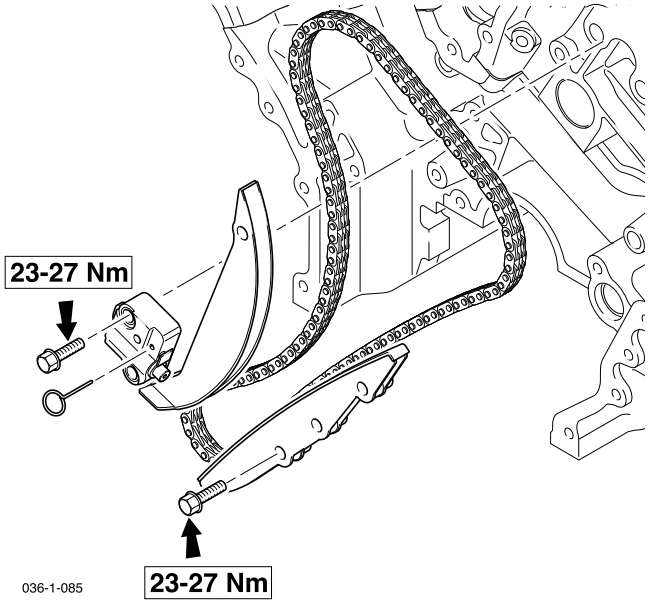
14. Remove the front timing cover.

    - Remove two M6 bolts from the oil pan front edge
    - Remove fourteen M8 bolts from the cover
    - Remove the timing cover
    - Remove and discard the front cover seals



15. Remove the timing chain tensioners

- Compress the chain tensioners
- Fit locking pins
- Remove four M8 bolts and the two chain tensioners



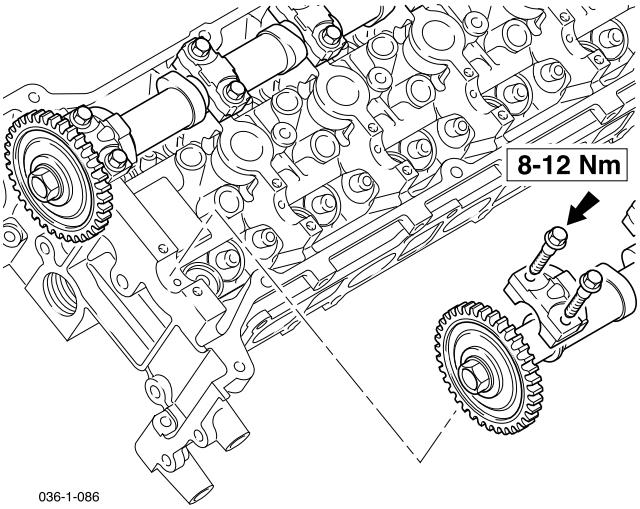
16. Remove the timing chains.

- Remove the chain tensioner arms
- Remove four M8 bolts
- Remove the fixed chain guides
- Remove the timing chains

17. Remove the camshafts.

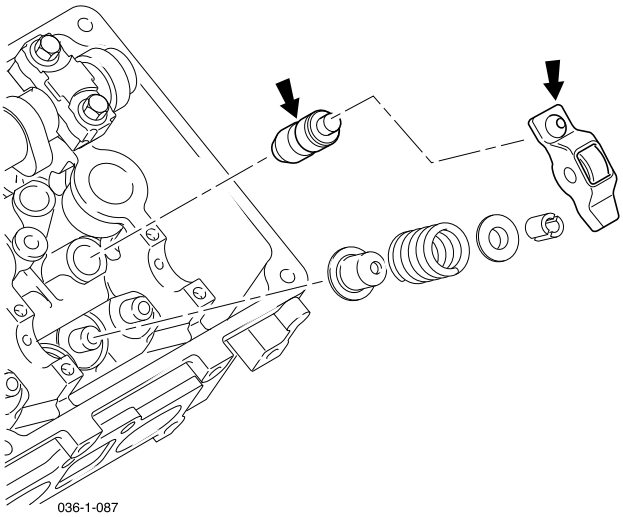
- Remove two M6 bolts from each bearing cap. See note below.
- Remove the bearing caps and retain in sequence
- Remove the camshafts

Note: The thrust cam bearing cap, shown exploded below, must be the first to be removed and the last to be installed.



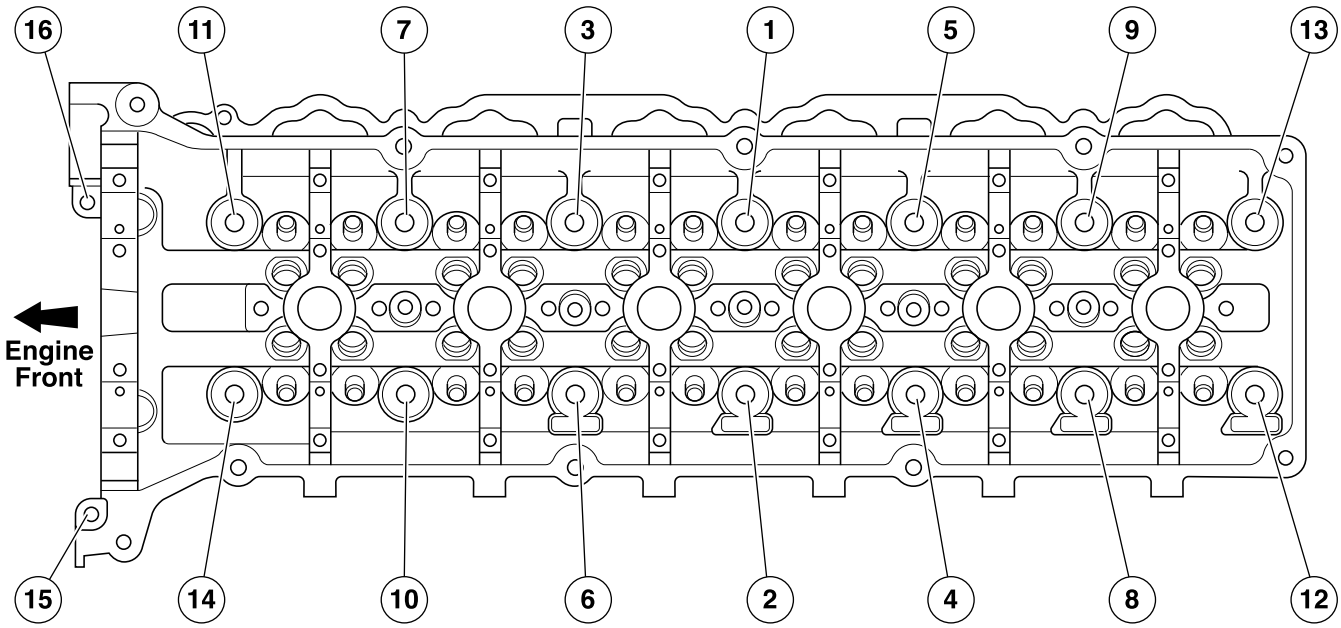
18. Remove the cam followers and lash adjusters. Keep in order for replacement to original positions.

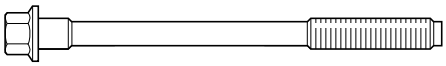
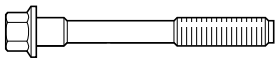
- Lift off the cam followers
- Withdraw the lash adjusters



19. Remove two M8 and fourteen M10 bolts from each cylinder head in the order shown in the diagram below.

Left Side Shown



Hole No.	Fastener	Description
1 to 14		M10 x 1.5 x 156 Bolt
15 to 16		M8 x 1.25 x 60 Bolt
Note		

036-1-088

20. Lift off the cylinder heads. Remove and discard the cylinder head gaskets.

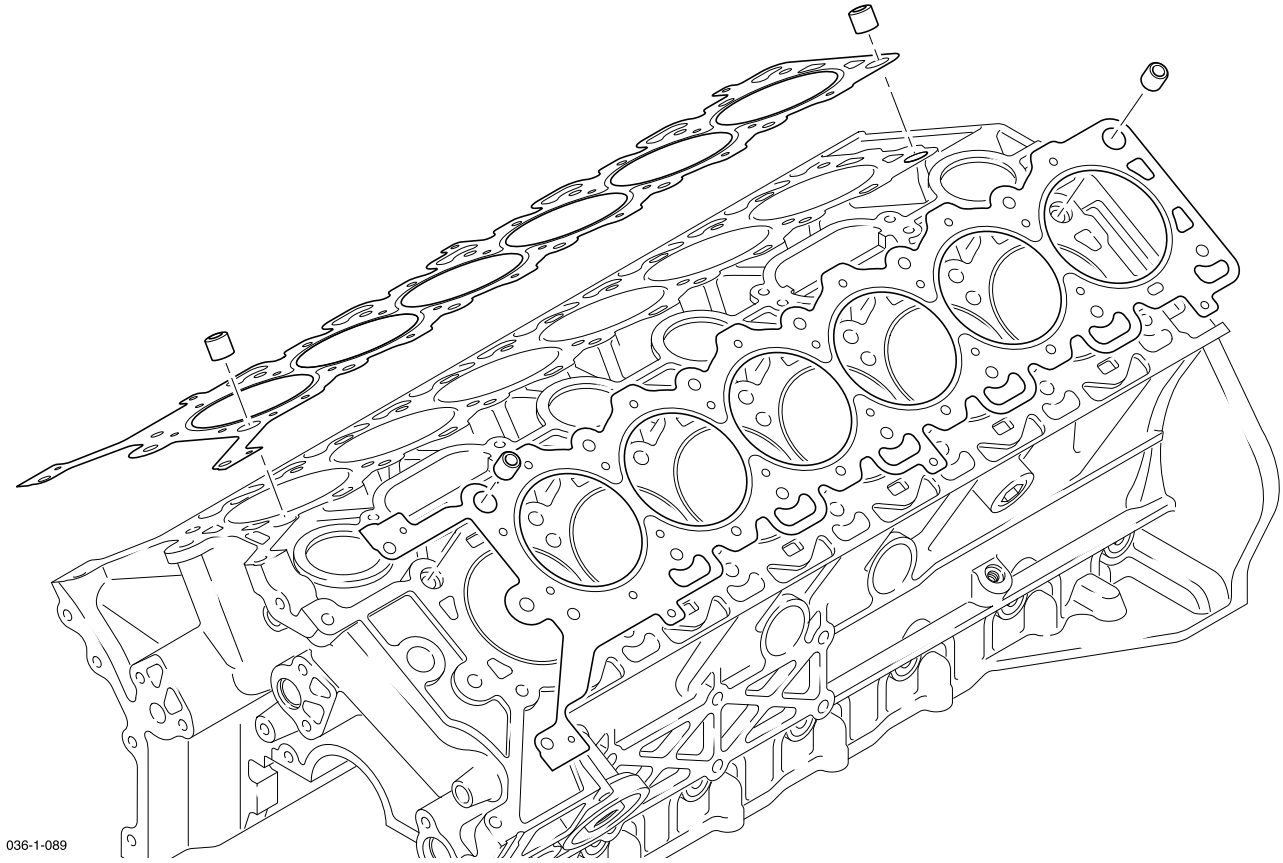
21. Cover the engine block to prevent ingress of foreign material.

22. Overhaul the cylinder heads as necessary (1.3.06.1).

Installation

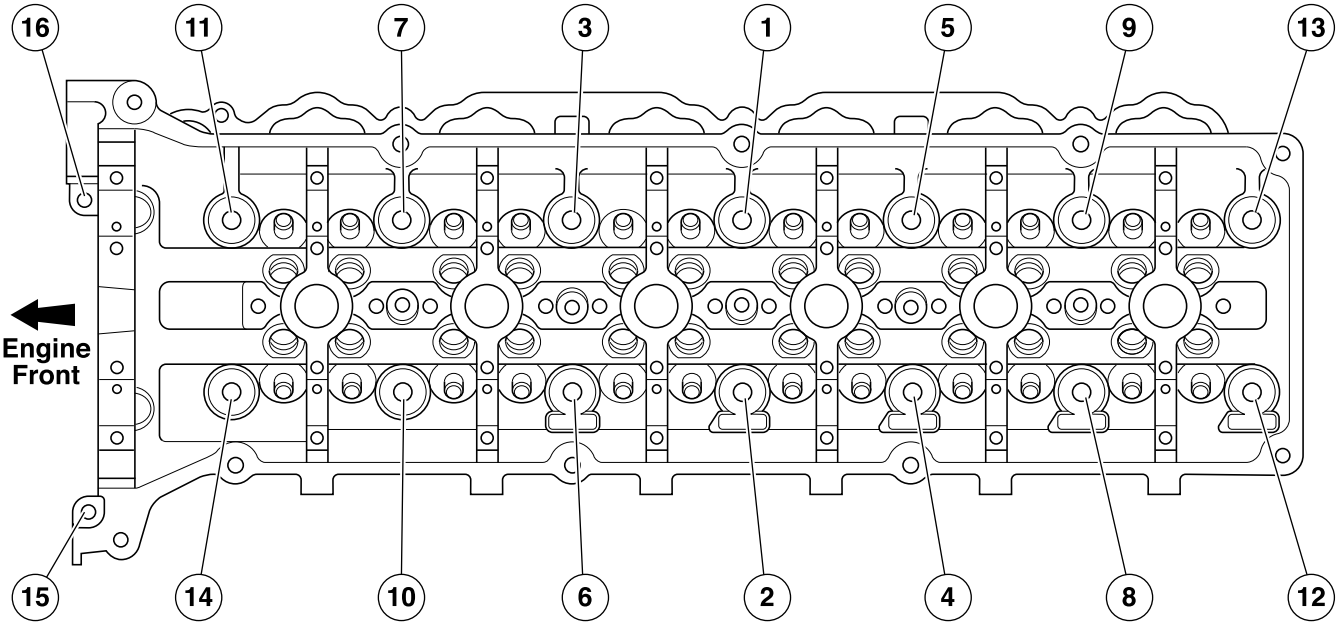
1. Clean all mating faces. Acquire new seals, ‘O’ rings and gaskets.

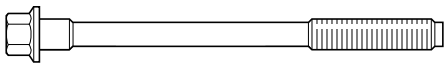
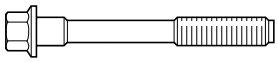
2. Fit new head gaskets over the locating dowels. Fit the cylinder heads



3. Lubricate beneath the head of all cylinder head bolts with engine oil. DO NOT LUBRICATE THE THREADS. Fit fourteen M10 (1-14) and two M8 bolts (15-16) to each head

Left Side Shown



Hole No.	Fastener	Description
1 to 14		M10 x 1.5 x 156 Bolt
15 to 16		M8 x 1.25 x 60 Bolt
Note		

036-1-088

4. *Caution: The following Pull-Down - Release - Final Pull-Down sequence must be performed exactly as specified to ensure correct cylinder head to block sealing.*

   After the initial pull-down and release of the cylinder head bolts, the final pull down is accomplished by tightening the M10 bolts in sequence to 37-43 Nm and then tightening a further 180° in two 90° steps.

5. Pull down the cylinder head in stages using the following procedure:

Cylinder Head Pull Down Sequence

Initial Pull-Down

- Tighten the M10 bolts (1-14) to 37-43 Nm in the sequence shown.
- Tighten the M8 bolts (15-16) to 15-20 Nm.
- Tighten the M10 bolts (1-14) a further 85-95 degrees in the sequence shown.

Release

- Loosen all M10 bolts (1-14) a minimum of one full turn (360°).

Final Pull Down

- Tighten all M10 bolts (1-14) to 37-43 Nm in the sequence shown.
- Tighten the M8 bolts (15-16) to 23-27 Nm.
- Tighten the M10 bolts (1-14) a further 85-95 degrees in the sequence shown.
- Tighten the M10 bolts (1-14) an additional 85-95 degrees in the sequence shown.

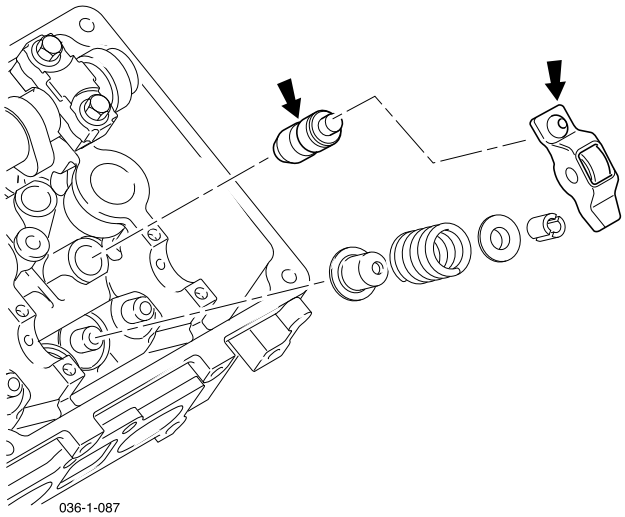
Installation (continued)

6. Fit the lash adjusters to the cylinder heads. Soak the roller finger followers in engine oil

   Insert each lash adjuster into its correct recess in the cylinder head

   Fit the cam followers to their valves with the dimpled end of the follower fitted to the lash adjuster and the plain end to the valve stem

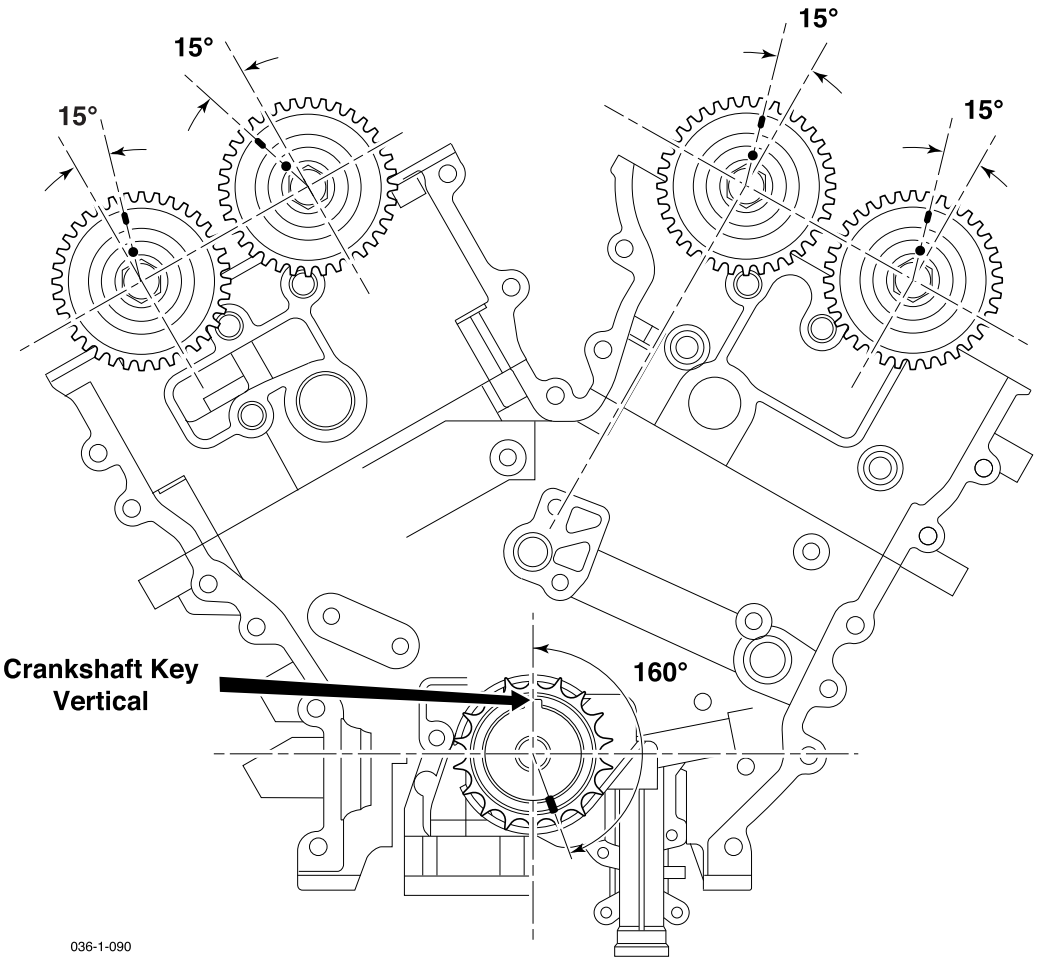
   Caution: Ensure that the dimpled end of the cam followers is fitted to the lash adjusters.



7. Set the crankshaft key to the vertical position.

8. Lubricate the camshaft journals and camshaft bearing caps with engine oil. Lubricate the roller finger followers with engine oil.

Fit the camshafts with the timing marks in the positions shown.



9. Fit the camcaps to both camshafts.

Fit all bearing caps except the two thrust cam bearing caps (No.1 cap) at the front of each camshaft.

Note: Bearing caps are numbered and correspond with numbers stamped on the head adjacent to the journal.

Loosely secure each camcap with two M6 bolts

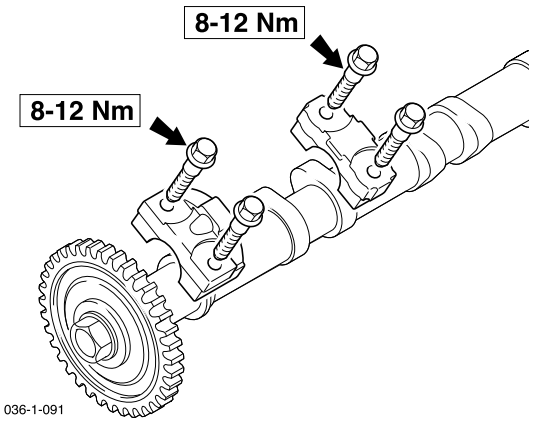
Test fit the No. 1 bearing caps over the thrust flange on each camshaft. If the bolt holes do not perfectly align, move the camshaft forward or rearward as required until No. 1 cap fits correctly.

Loosely secure the No.1 caps with two M6 bolts

10. Progressively nip down all bolts in stages, diagonally from the centre out, to pull the camshaft bearing caps down evenly into contact with the cylinder head.

11. Tighten the camshaft bearing caps in the sequence shown below.

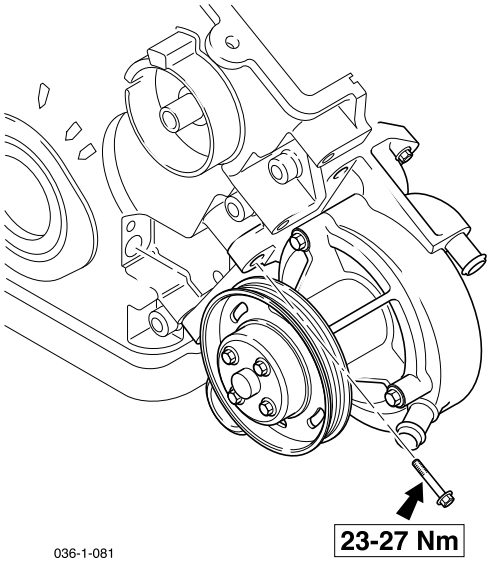
12. Perform the camshaft timing adjustment (1.3.06.11).



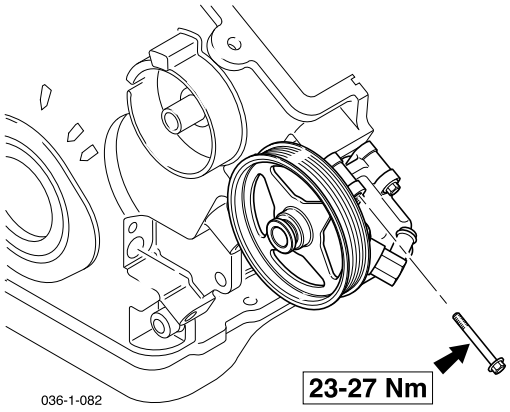
13. Refit the front timing cover (1.4.02).

14. Refit the cam cover (1.3.01).

15. Refit and tighten the bolts securing the water pump.



16. Refit and tighten the bolts securing the power steering pump.



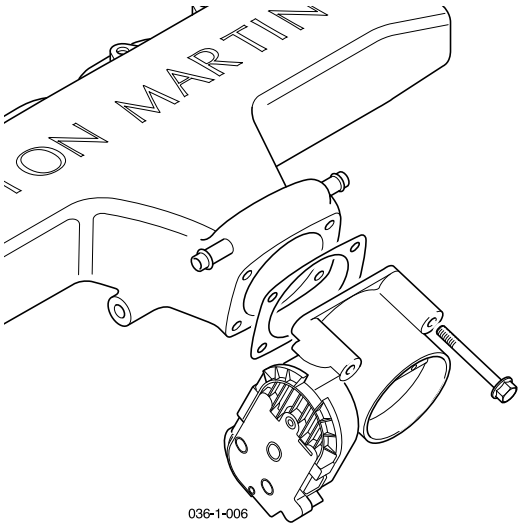
17. Refit the crankshaft damper/pulley assembly (1.2.06).

18. Refit the polyvee drive belt (1.4.10).

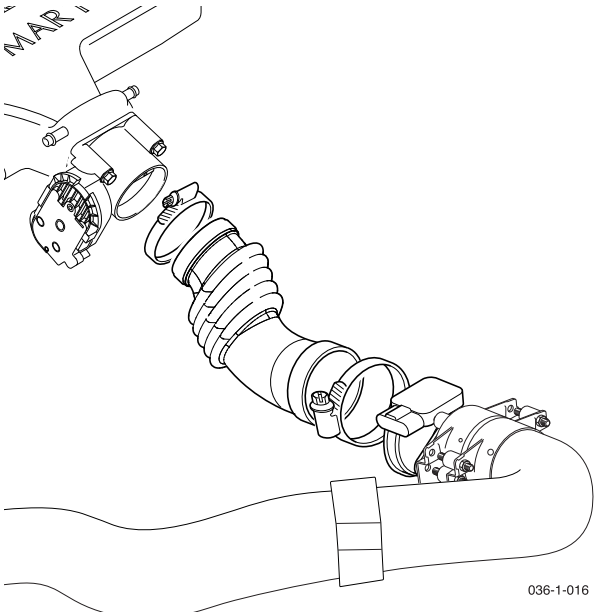
19. Refit the exhaust manifold using` new gaskets (2.7.02).

20. Refit the inlet manifold using a new gasket. (2.2.01)

21. Refit the throttle assembly to the inlet manifold with four bolts.

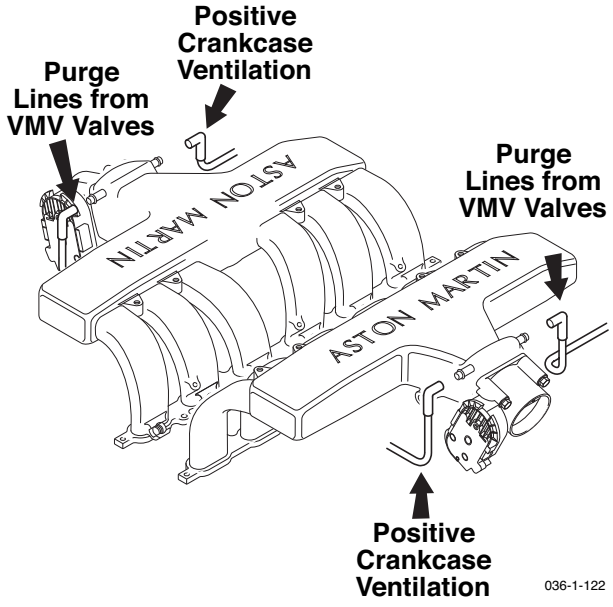


22. Refit the MAF sensors and trunking to the throttle bodies and secure the hose clips.



23. Reconnect the throttle body electrical connector.

24. Reconnect the vacuum pipes.

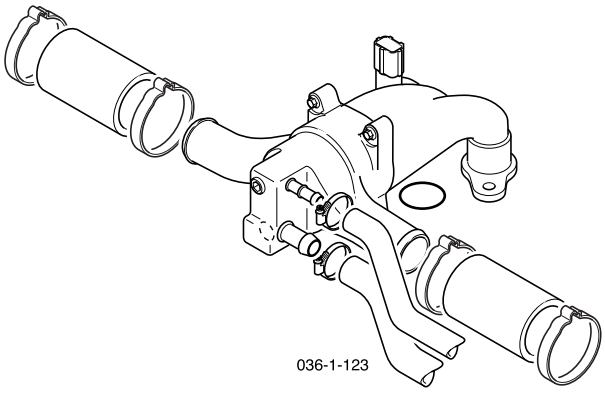


25. Refit the injectors and fuel rail (2.5.05).

26. Refit the thermostat housing using new 'O' ring seals (1.7.08).

27. Reconnect and secure the cooling system pipework at the thermostat housing.

- Fit the radiator top hose to the right hand stub pipe
- Fit the bypass hose to the left hand stub pipe
- Fit the header tank degas hose to the upper front stub pipe
- Fit the heater hose to the lower front stub pipe



28. Reconnect the engine harness to the injectors and temperature sensors.

29. Refit the fuel rail cover.

30. Refill the cooling system (1.7.03).

1.3.06.3 Cylinder Head Overhaul

Caution: All cylinder head components must be retained in sets and correctly identified for reassembly into their original positions if serviceable.

Caution: Place the cylinder head on wooden blocks or similar protective supports to prevent damage to the mating faces.

Stripdown

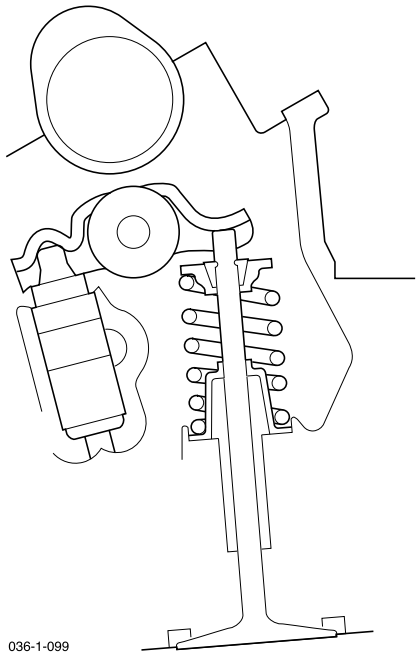
1. Remove the cylinder head (1.3.03.1). Examine the faces of the cylinder head, block and piston crowns for any evidence of problems (e.g. water/oil leaks, piston damage, or signs of poor combustion).
2. Remove the valves.
3. Lift out and discard the valve stem seals.
4. Invert the head and examine the lower end of each valve guide for evidence of oil leakage past the valve guides. Note the location of any affected guides.
5. Wash and decarbonise the cylinder head. Clean all mating faces.
6. Clean/decarbonise all valve set components as necessary

Component Check

1. Check each valve guide for wear (0.020 - 0.069 mm clearance valve stem to guide) and for oil leakage. If wear or oil leakage is present, the valve, the valve guide, valve seat and the valve stem seal must be replaced.
2. Examine all valve seats in the head for burning, irregular valve contact or other problems. Service the valve seats as necessary.
3. Examine the seat faces of all valves for burned or irregular valve contact. Replace any defective valves.
4. If irregular contact at the valve seat is evident, check each affected valve for straightness and diameter of the valve stem. Replace the valve if any defect of the valve stem is detected.
5. Check each suspect valve for valve face runout and wear. Replace the valve if any defect of the valve head is detected.
6. Check all hydraulic lash adjusters and roller finger followers for wear. Replace any components which are unserviceable.
7. Check the condition of all valve springs (Spring Force at 40mm Spring Height = 290 N). Replace any springs which are unserviceable or which are outside the free length specification.
8. Check the camshaft bearings and bearing caps. If significant scuffing or other damage is present, the head must be replaced.

Rebuild

1. Fit new valve stem seals. Lubricate all valve stems and valve guides with engine oil.
2. Refit the valves, springs and collets. Ensure that the collets lock correctly onto each valve stem.



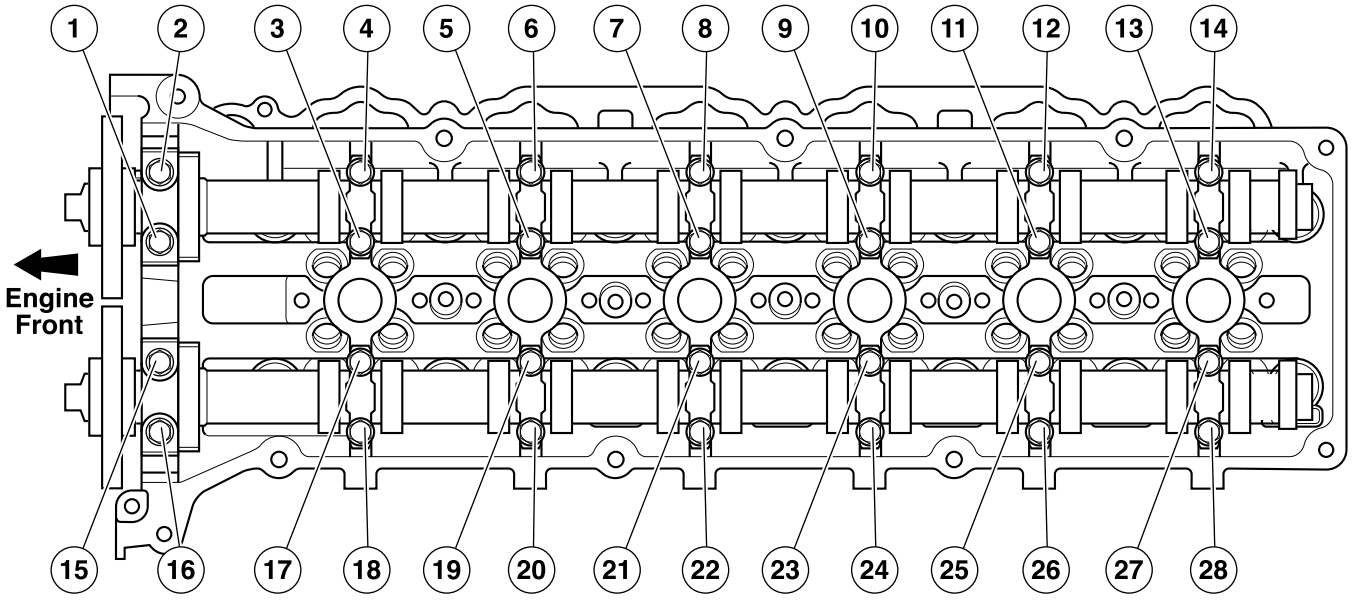
3. Soak the lash adjusters and cam followers in engine oil for at least five minutes. Fit the lash adjusters and cam followers.

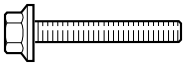
Caution: Ensure that each lash adjuster is sitting squarely in the cylinder head before fitting and pulling down the camshafts.

4. Lubricate the camshaft bearings and caps with engine oil. Fit the camshafts. Fit all bearing caps except the two thrust cam bearing caps (No.1 cap) at the front of each camshaft..

5. Fit bearing cap No. 1 over the thrust collar on the camshaft. Adjust the camshaft position if necessary until the bolt holes in No. 1 cap align with the holes in the cylinder head. Loosely secure No. 1 cap with two M6 bolts.

6. Progressively nip down all bolts pulling the shaft down squarely until the bearings are closed up. Then torque all M6 bolts to specification in the sequence shown below.



Hole No.	Fastener	Description
1 to 28		M6 x 1 x 43.25 Bolt
Note	Torque Sequence 1 to 28 Torque all Fasteners 8-12 Nm	

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1.3.06.11 Valve Timing Adjustment

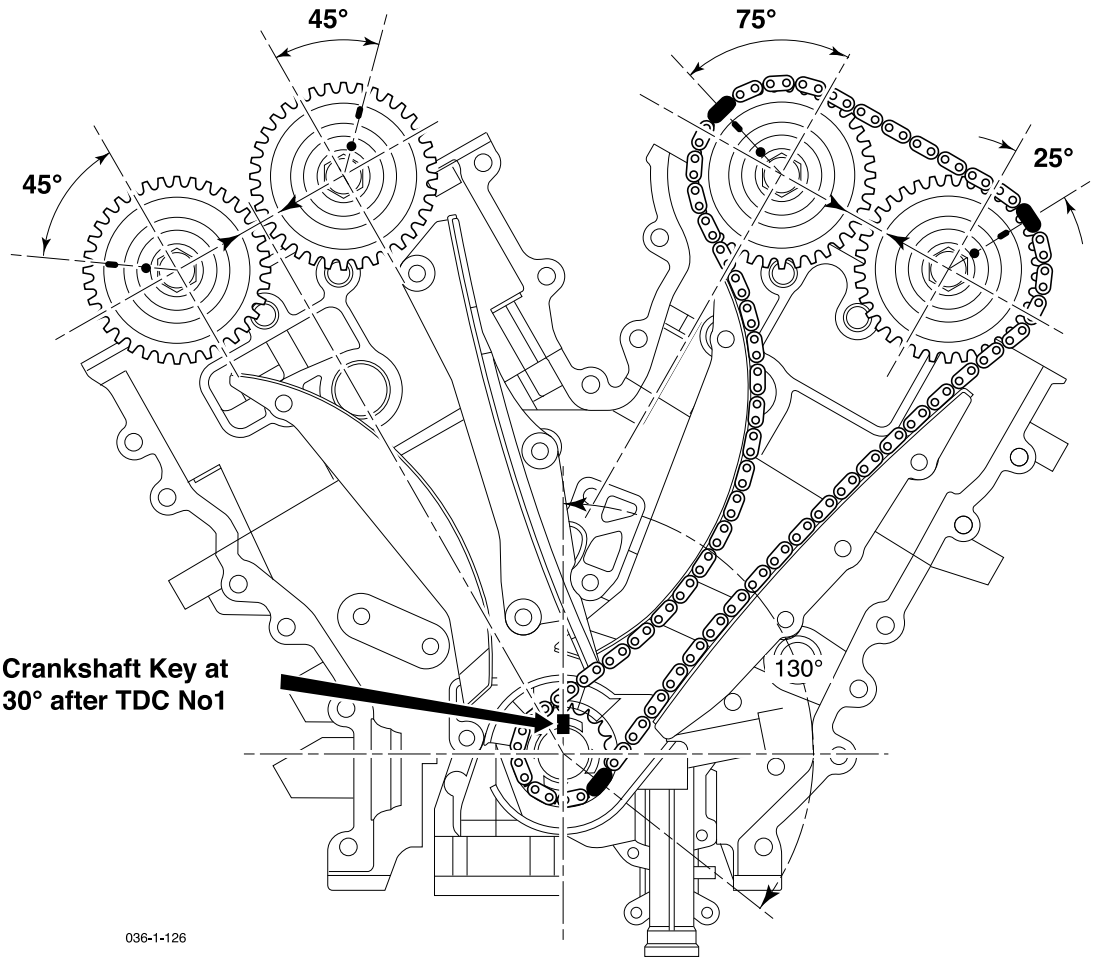
Caution: The crankshaft key must remain in the vertical position until the camshaft chains are correctly fitted and tensioned. Movement of the crankshaft before completion of the valve timing may cause contact between a piston and valve, resulting in valve and/or piston damage.

Left Hand Head (Cylinders 7-12)

1. Check that the crankshaft key is vertical and that all camshafts are in the initial positions shown.

   Note: The crank key is exactly in line with No.1 crank throw. With the key vertical, No.1 piston is 30° ATDC and all pistons are below the block face..

2. Engage the camshaft timing tool to the flats on the left hand (Cylinders 7-12) camshafts.



3. Fit the LH (Cylinders 7-12) fixed chain guide.

   - Fit the guide to its locating pin
   - Secure the guide with two M8 bolts
   - Fit the LH chain with the three marked links matching the marks on the crankshaft and camshaft sprockets.

4. The timing marks on the LH camshafts will then be positioned at approximately 75° and 25° as shown below.

5. Fit and tension the left hand timing chain arm and tensioner

   - Fit the left hand chain tensioner arm.
   - Fit and secure the left hand chain tensioner
   - Withdraw the tensioner lock pin

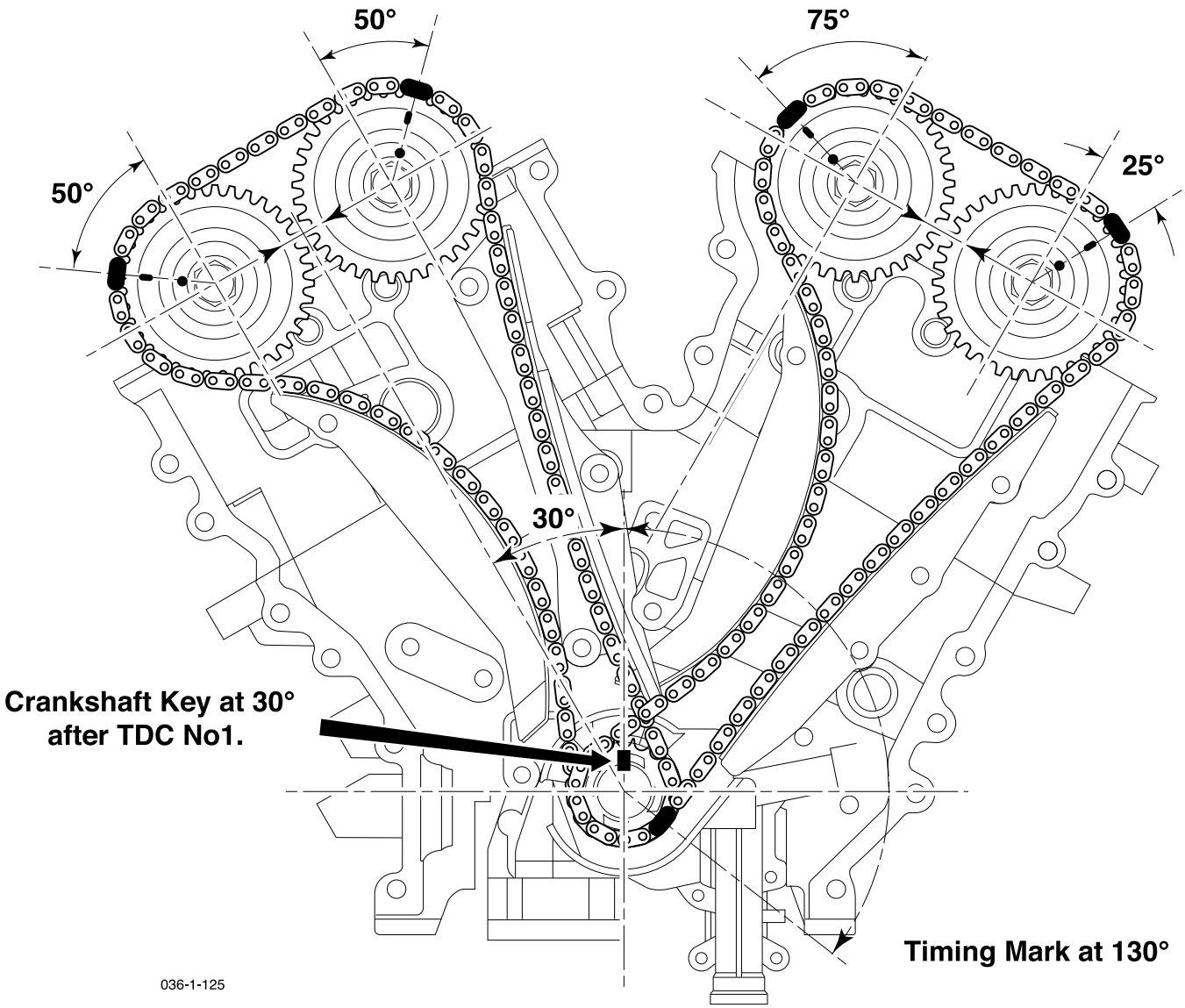
6. Recheck that all three marked chain links on the left hand chain align with the timing marks on the left hand camshaft and crankshaft sprockets.

7. Remove the timing tool.

Right Hand Head (Cylinders 1-6)

1. With the crankshaft key still at the vertical position, (No.1 cylinder at 30°ATDC), recheck that the RH camshafts are in the initial 45° positions shown.
2. Engage the camshaft timing tool to the flats on the right hand (Cylinders 1- 6) camshafts
3. Fit the RH fixed chain guide and secure with two M8 bolts. Torque to 20-30 Nm.
4. Fit the RH timing chain with the three marked links matching the timing marks on the sprockets.

   The RH camshafts will then be positioned at approximately 50° and 50° as shown.

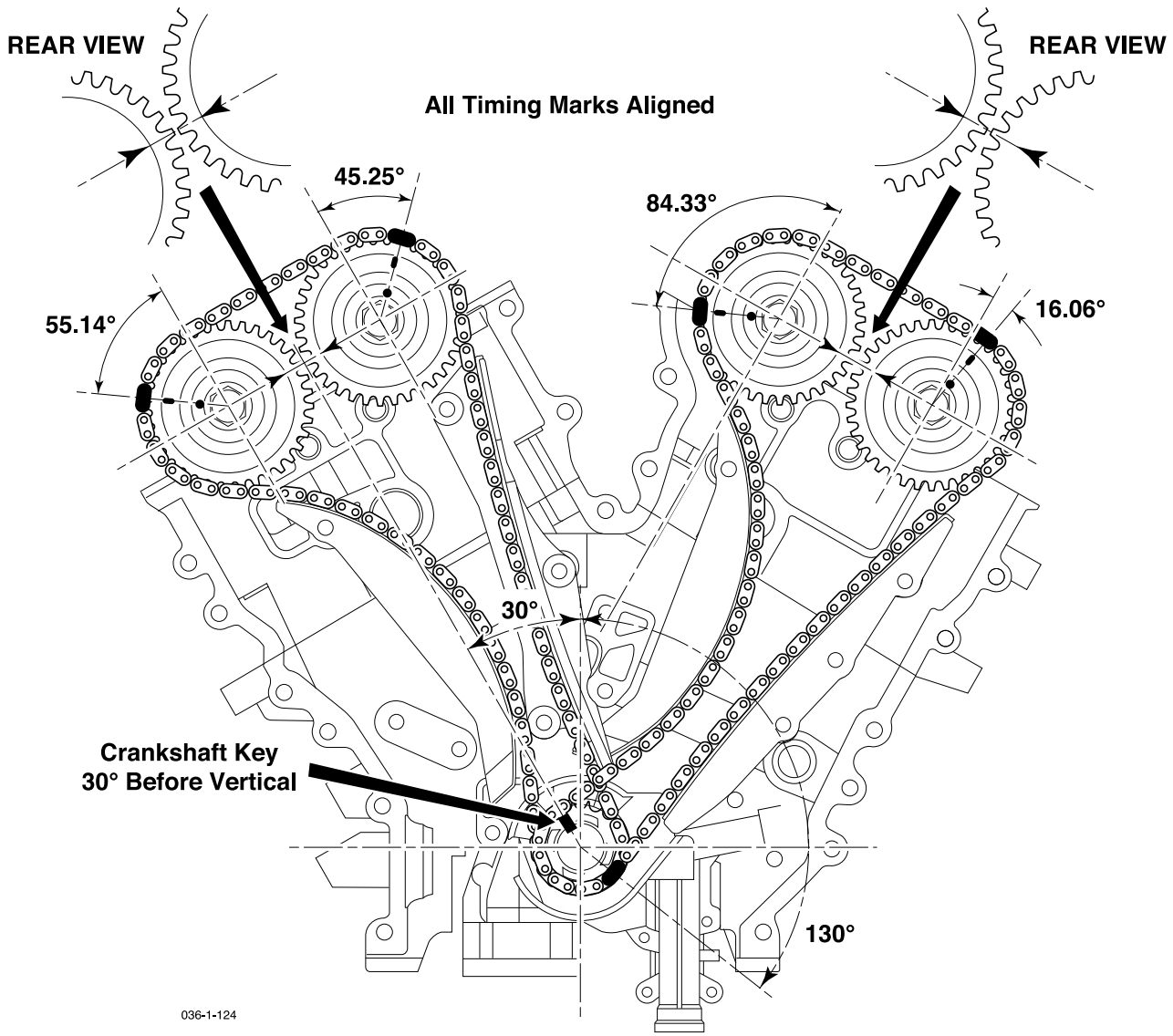


5. Fit the RH chain tensioner arm to the pivot pin.
6. Fit the RH chain tensioner and secure with two M8 bolts. Torque to 23-27 Nm.
7. Remove the RH chain tensioner lock pin.
8. Recheck that all three marked links on the RH chain align with the timing marks on the camshaft and crankshaft sprockets.
9. Remove the timing tool.

Final Valve Timing Check

1. Rotate the crank counter clockwise at least 60° and then rotate clockwise to TDC No 1 (crankshaft key 30° before vertical).

2. At TDC NO.1 (crankshaft key 30° before vertical), the timing marks on the REAR of the camshaft sprockets should be precisely aligned as shown in the diagram below.



Notes:

When No. 1 cylinder is at TDC compression, the timing marks on the rear of the cam sprockets will always align on a correctly timed engine.

When No. 1 cylinder is at TDC compression, the timing marks on the chains and on the front of the sprockets will only be aligned once every 122 crankshaft revolutions on a correctly timed engine.

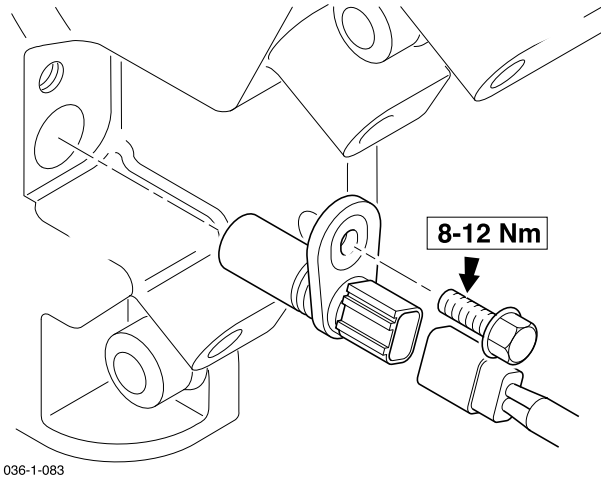
3. Before refitting the cylinder heads or oil pan, apply an 8mm bead of sealant at these points. Note that the mating components must be fitted and tightened within six minutes of applying the sealant.

4. Refit the remaining components and refill the engine coolant.

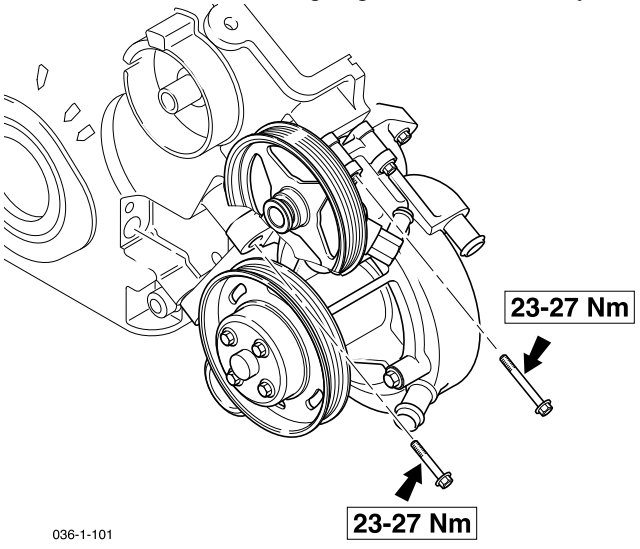
1.4.02.1 Front Timing Cover

Removal

1. Remove the polyvee drive belt (1.4.10).
2. Drain the engine coolant (1.7.03)
3. Remove the crankshaft damper (1.2.06).
4. Remove the camshaft cover (1.3.01).
5. Remove the crank sensors
   - Disconnect the connector
   - Remove one M6 bolt from each sensor
   - Remove the sensors

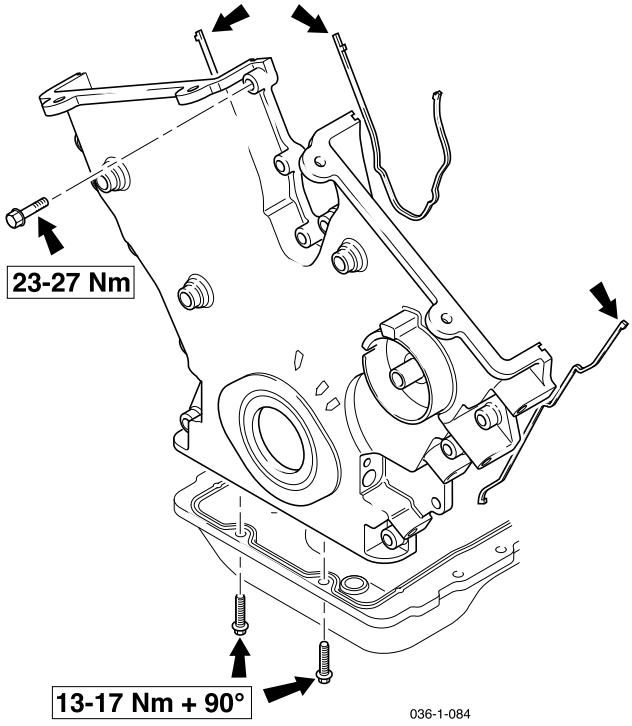


6. Release the power steering pump and water pump from the timing cover.
   - Remove four M8 bolts
   - Release the power steering pump.
   - Remove the two front M8 bolts
   - Release the water pump from the cover only



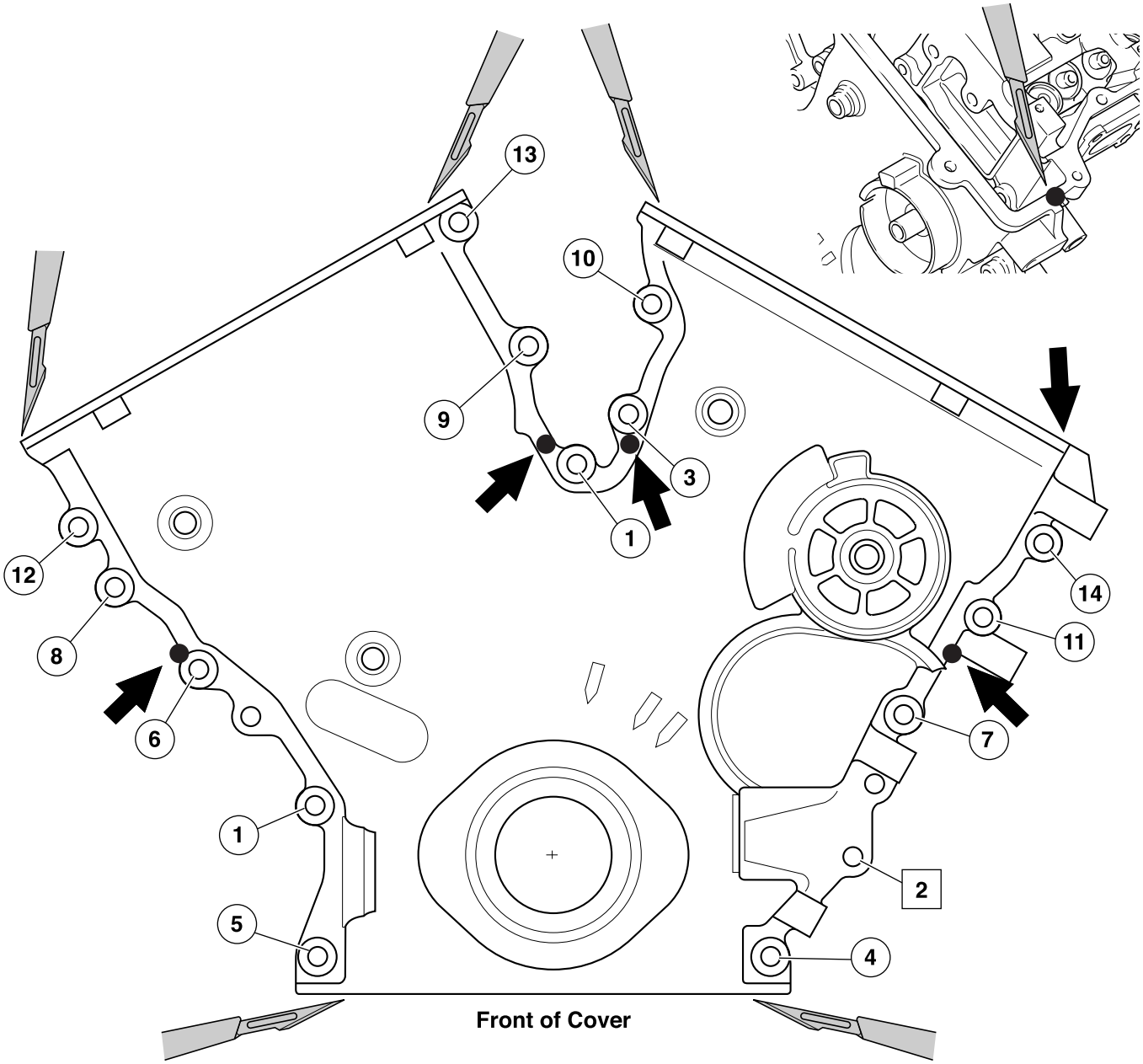
7. Remove the timing cover.
   - Remove two front oil pan bolts
   - Remove fifteen M8 bolts

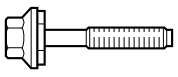
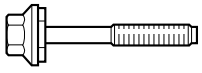
   Note the shorter bolt fitted at position 2
   - Remove the timing cover
   - Discard the cover seals



Installation

1. Clean mating faces and fit new front cover seals.
2. Apply RTV sealant at the cylinder head joints as shown.
3. Fit the front cover and secure with fifteen bolts.
4. Secure the water crossover stay at position 1.
5. Follow the torque sequence shown below.
6. When the front cover bolts are tightened, the ends of the cover seals may protrude from the joints (see illustration below). Trim flush with a sharp knife.



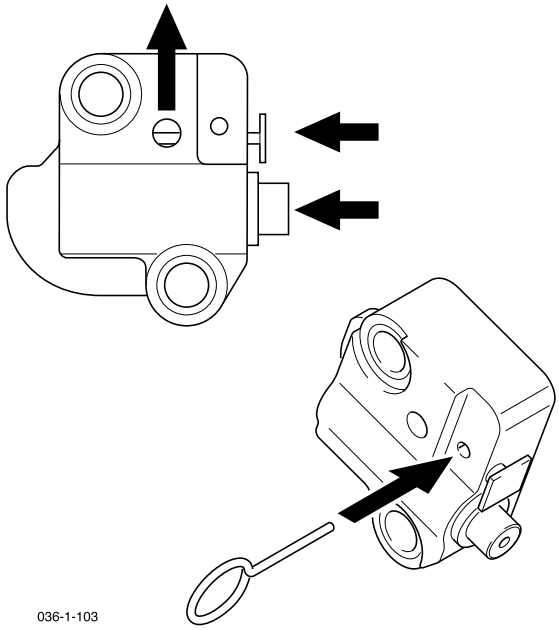
Hole No.	Fastener	Description
2	□ 	M8 x 1.25 x 36.3 Bolt & Hex Washer
1, 3 - 14	○ 	M8 x 1.25 x 51.8 Bolt & Hex Washer
Note	Torque Sequence 1 to 14 Torque all Fasteners 23-27 Nm	
Note	Apply RTV sealant at joints indicated by ● on the diagram above	

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1.4.03.5 Timing Chain Tensioners

Note: The timing chain tensioners must be compressed and locked before installation into the engine.

1. Hold the tensioner in a soft jaw vice.
2. Compress and lock the tensioner
   - Using a small pointed tool, hold back the ratchet stem from the plunger.
   - Slowly compress the tensioner plunger whilst continuing to hold back the ratchet stem (Take precautions - engine oil will bleed from the tensioner).
   - When the tensioner is fully compressed, insert a 0.040” - 0.065” locking pin. Release the ratchet stem and remove the tensioner from the vice.

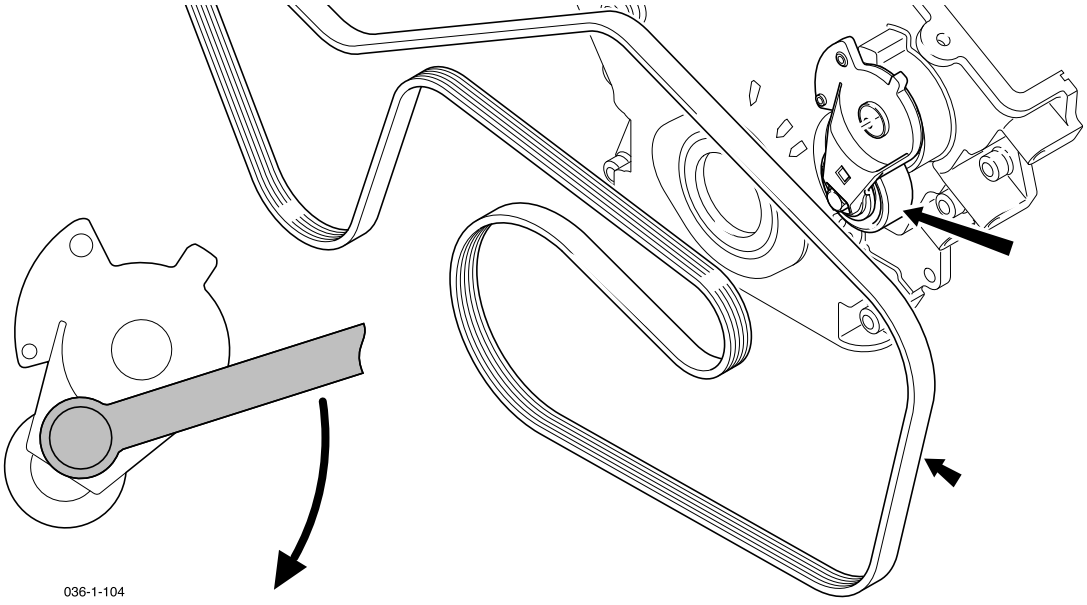


3. When fitting the tensioners to the engine, fit and secure all camshaft drive components before withdrawing the pins to tension the timing chains.

1.4.10.1 Polyvee Drive Belt

Removal

1. Using a $^{3}/_{8}$ inch ratchet handle or 'T' bar, rotate the tensioner clockwise to release the drive belt tension.
2. Slip the belt from behind the tensioner pulley and gently release the tensioner. Slip the belt off the remaining pulleys.
3. Check that the belt is in serviceable condition, replace if necessary.



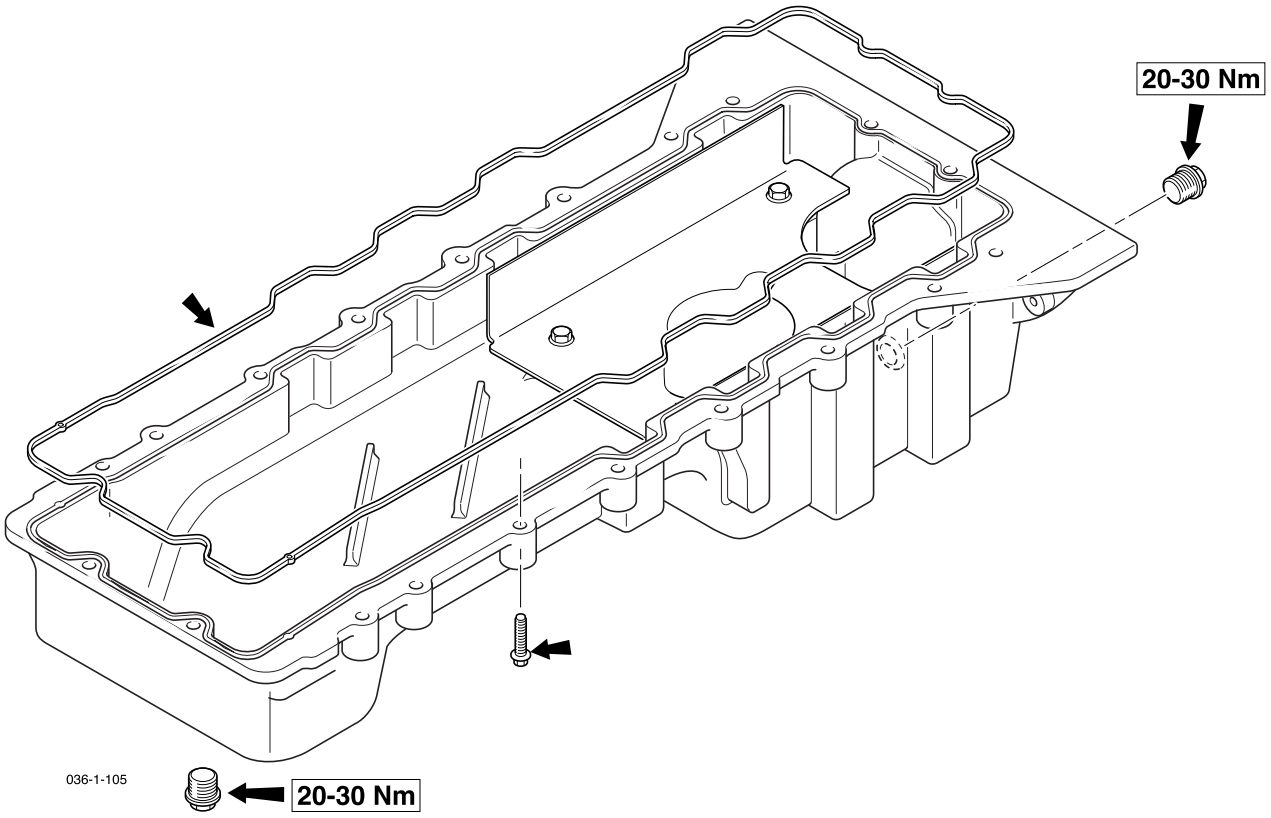
Installation

1. Fit the drive belt to the tensioner pulley and then around all but the alternator pulley.
2. Rotate the tensioner assembly clockwise. Fit the belt to the alternator pulley and gently release the tensioner.
3. Check that the belt is routed as shown above. Also check all pulleys to ensure correct lateral belt location.

1.5.01.1 Oil Pan

Removal

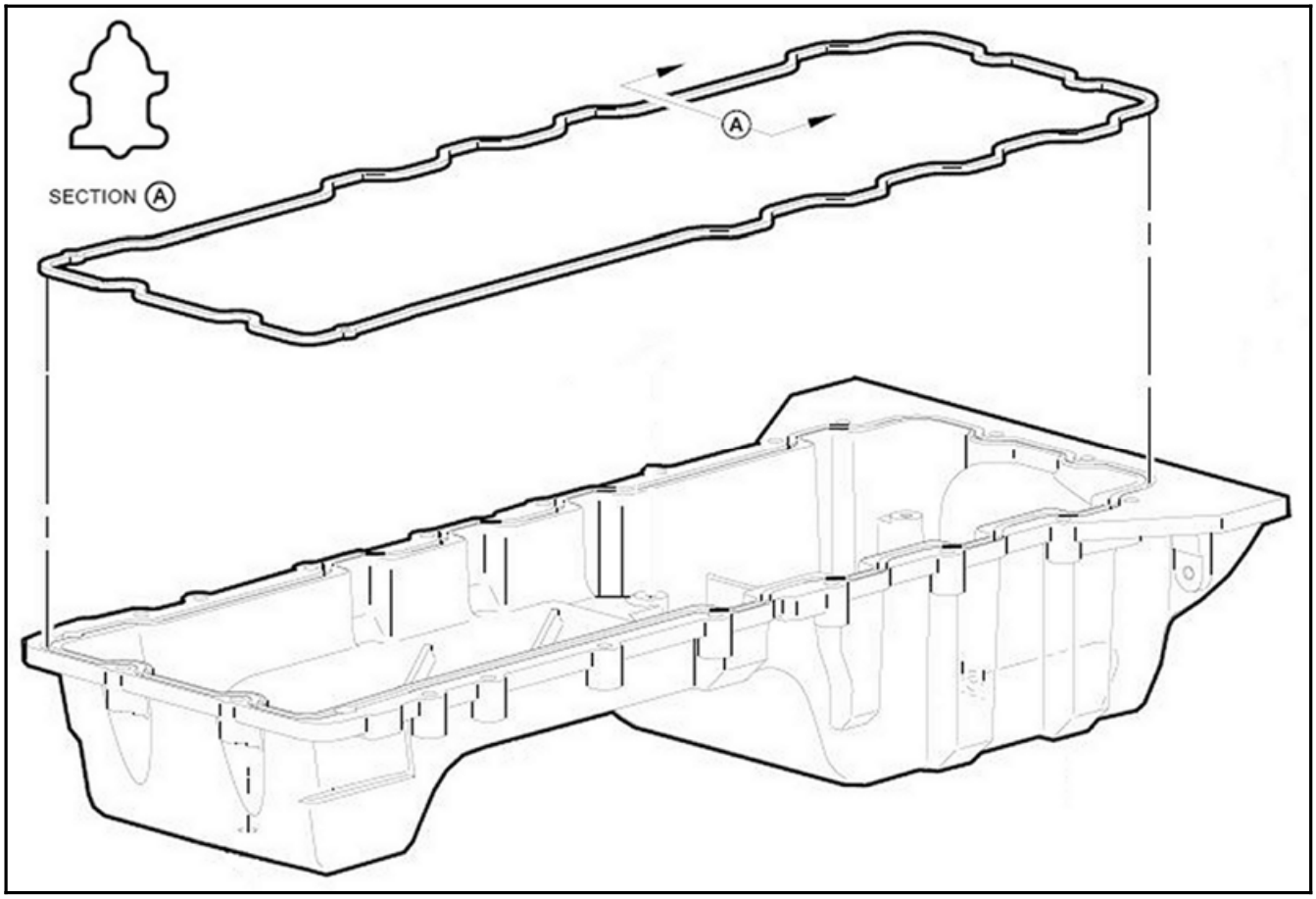
1. Drain the engine oil.
2. Remove the engine.
3. Secure the engine on an engine stand.
4. Remove the oil pan
   - Remove twenty M8 bolts and remove the oil pan
   - Remove and discard the oil pan gasket
   - Clean the sump and engine block mating faces.



Installation

1. Clean the mating faces of the oil pan and the engine block. Make sure that all remaining gasket material and sealant are removed, especially from the groove.

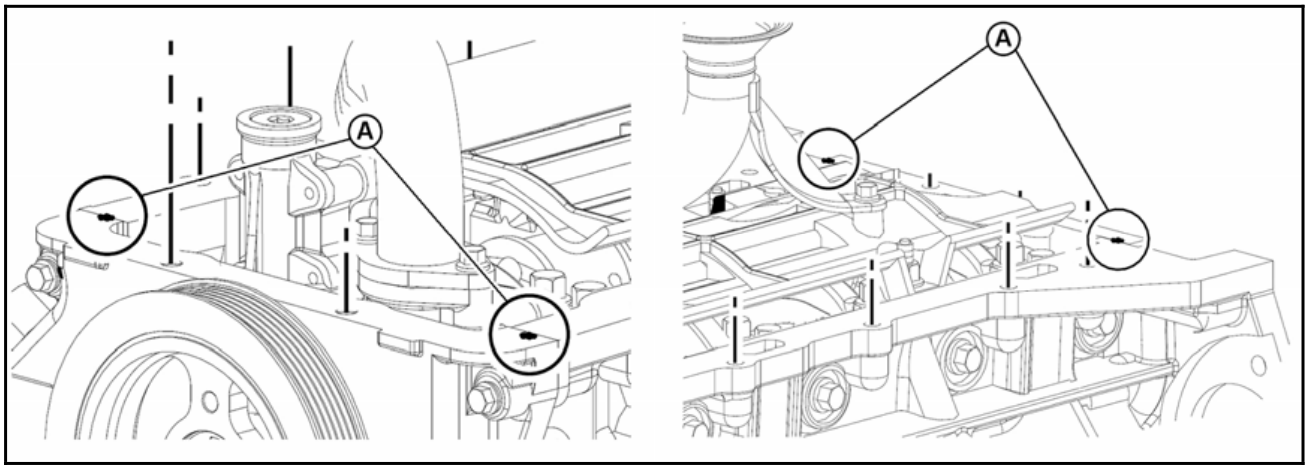
2. Install a new gasket into the groove in the oil pan (see Figure 1). The rounded face of the gasket goes against the engine block. Make sure that the top edge of the gasket is the same height above the oil pan all the way around.



Caution: THE OIL PAN MUST BE INSTALLED AND THE BOLTS TIGHTENED IN LESS THAN SIX MINUTES WHEN THE SEALANT HAS BEEN APPLIED.

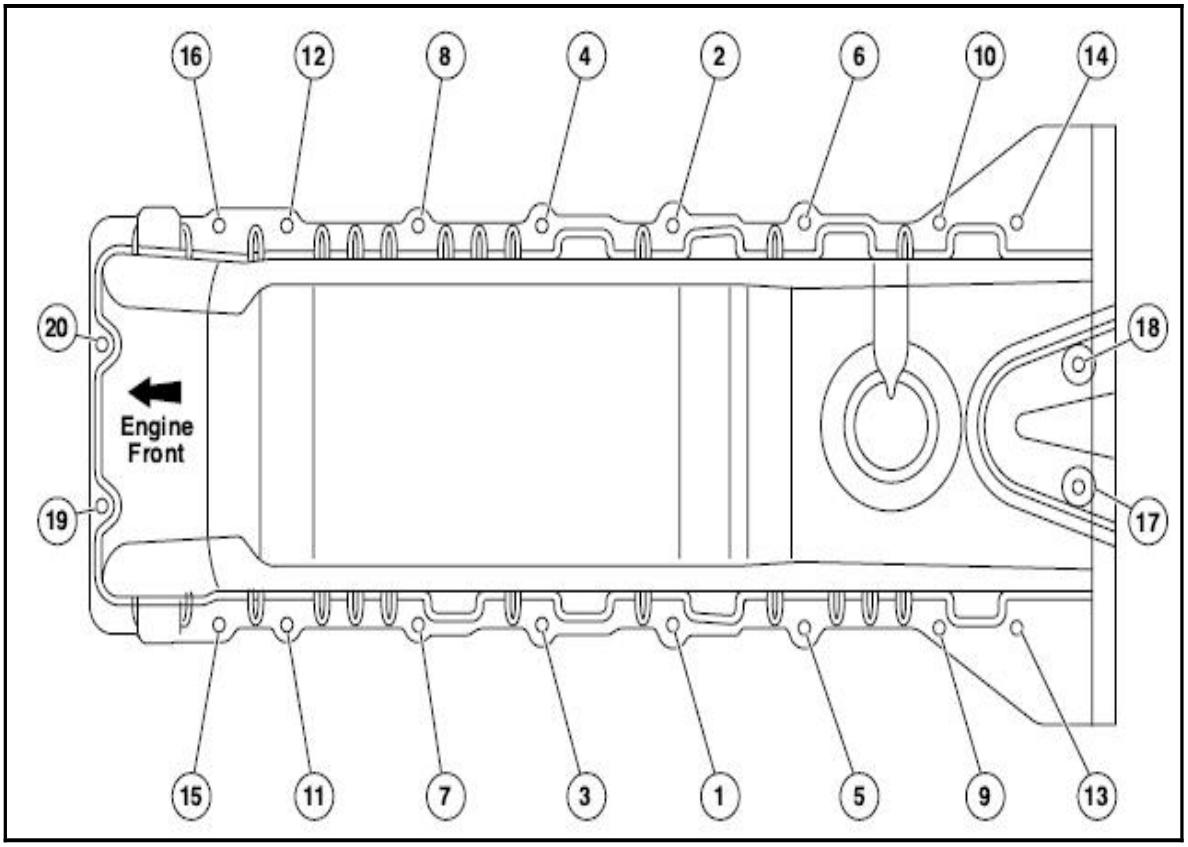
3. Apply a bead of sealant (see Table 1) to the mating face of the oil pan around the outside of the groove for the gasket. The sealant must be applied as one continuous bead, all gaps must be repaired. Do not get sealant on the top face of the gasket.

4. Apply 4, 10 mm circles of sealant to the mating face of the engine block in the positions shown in Figure 2.



5. Put the oil pan on to the engine block. The rear face of the oil pan must be 1.5 mm forward of the rear face of the engine block (1.5 mm less than flush).

6. Install the 20 M8 bolts. Tighten the bolts to 15 Nm in the sequence shown in Figure 3.



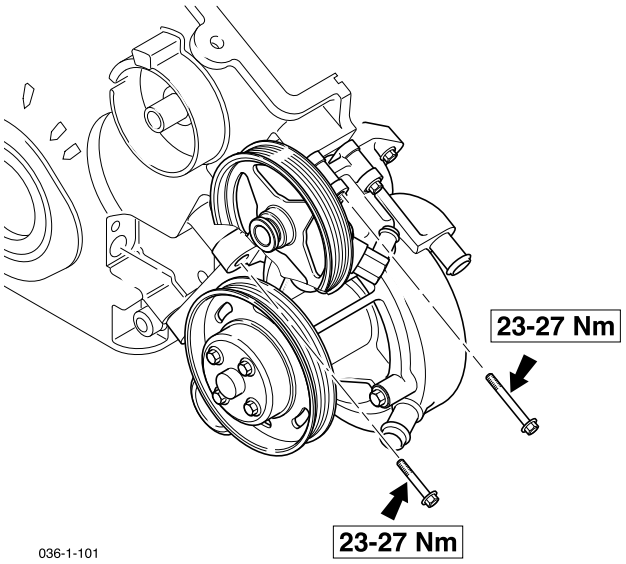
7. Use the same sequence and tighten the 20 M8 bolts 90 degrees more.

8. Remove all unwanted sealant from the oil pan and the engine block with a wooden or a plastic scraper.

1.5.07.2 Oil Pump

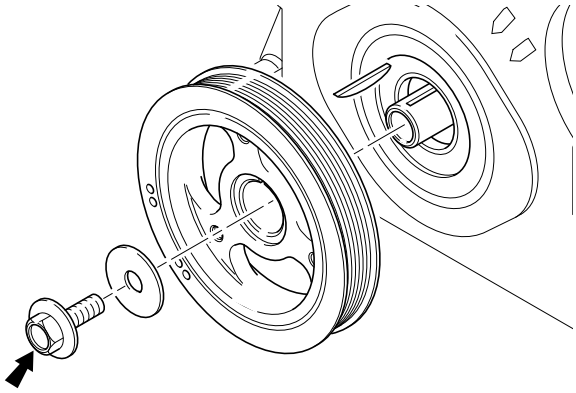
Removal

1. Drain the engine oil.
2. Remove the engine.
3. Remove the oil pan. Remove and discard the oil pan gasket.
4. Release the tension on the polyvee drive belt and remove the belt.
5. Release the power steering pump and the water pump from the front timing cover.
   - Remove four M8 bolts
   - Release the power steering pump from the block
   - Remove two M8 bolts
   - Release the water pump from the timing cover

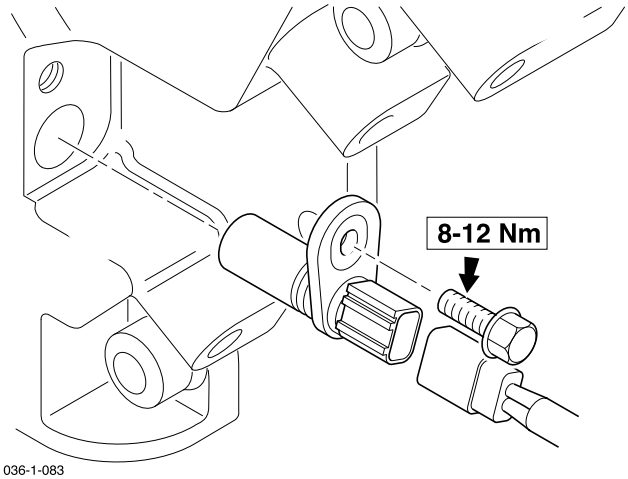


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6. Lock the crankshaft and remove the crankshaft damper pulley.
   - Remove one M12 bolt
   - Remove the M12 flat washer
   - Remove the pulley from the crankshaft


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7. Remove two crankshaft position sensors
   - Disconnect the two sensors
   - Remove one M6 bolt from each sensor
   - Remove the two sensors



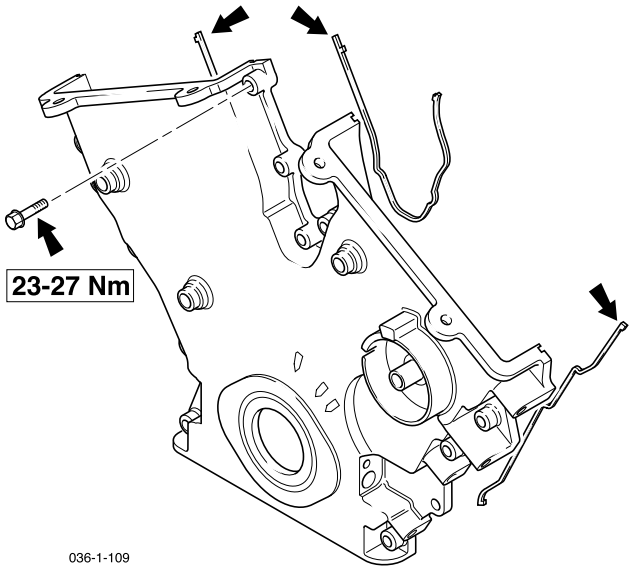
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8. Remove the front timing cover. Remove and discard the timing cover seals.

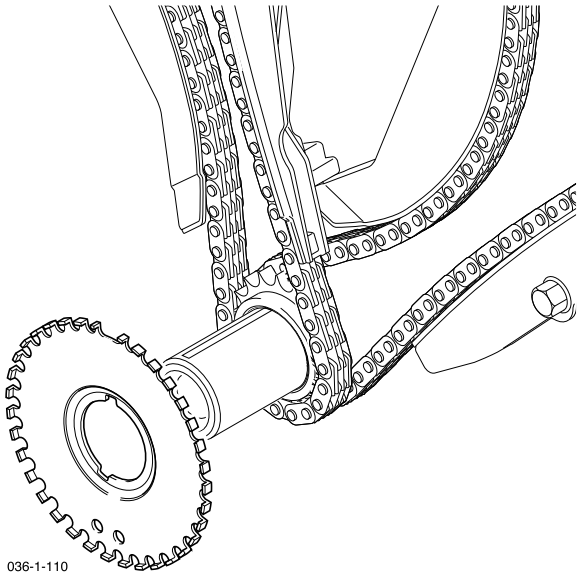
   - Remove fourteen M8 bolts

   Note the shorter bolt at position 2.

   - Remove the timing cover
   - Discard the cover seals

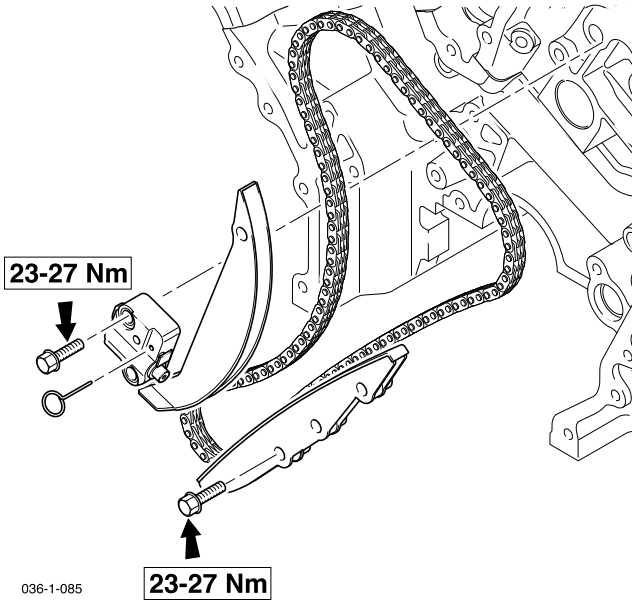


9. Remove the crankshaft timing disc.



10. Remove the timing chain tensioners and the chain guides.

    - Compress the chain tensioner
    - Insert a locking pin
    - Remove two bolts and the chain tensioner
    - Remove the tensioner arm
    - Remove two bolts
    - Remove the fixed chain guide
    - DO NOT remove the chain

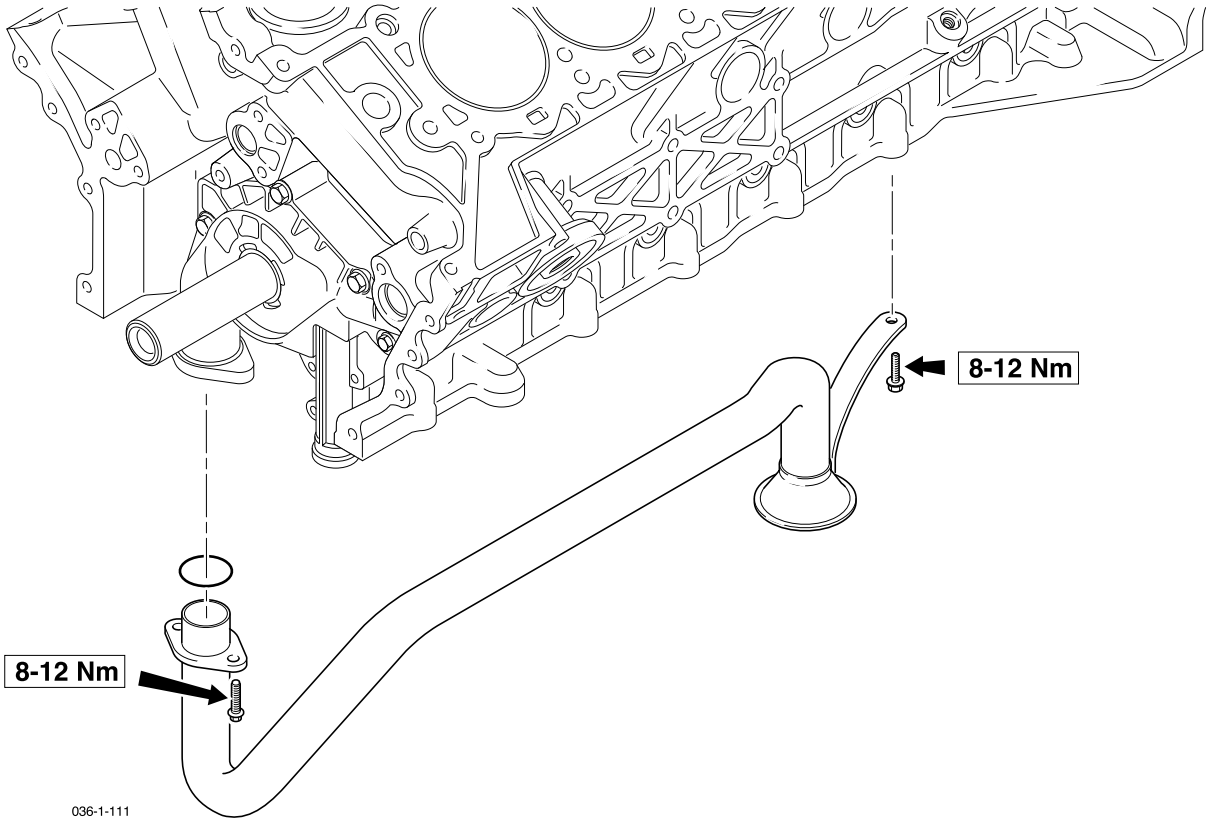


11. Caution: If the timing chain to crankshaft sprocket relationship is lost in the following step, it will be necessary to perform the full camshaft timing procedure (1.3.04).

12. Taking care to preserve the timing chain to crankshaft sprocket engagement, slide the both timing chains and the twin crankshaft sprocket from the crankshaft. Move the chains and twin sprocket to one side and secure safely.

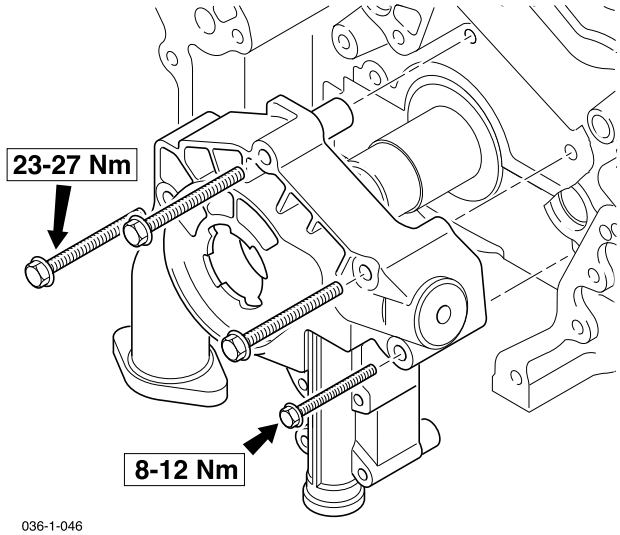
13. Remove the oil pick-up pipe.

- Remove three M6 bolts
- Remove the pick up pipe
- Remove the oil seal



14. Remove the oil pump.

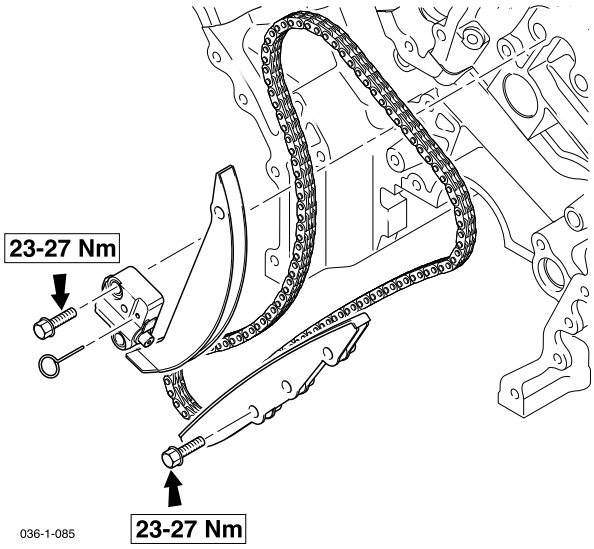
- Remove one M6 bolt
- Remove three M8 bolts
- Remove the oil pump



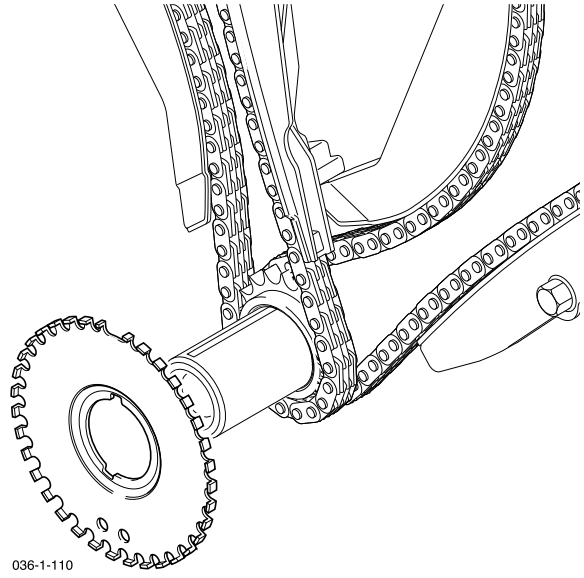
Installation

1. Clean all mating faces and fit new oil pan and timing cover gaskets.
2. Fit the oil pump.
3. Fit the oil pick-up pipe.
4. Carefully refit the twin crankshaft sprocket and timing chains with the drive run of the chains in tension. Refit the fixed chain guides and tension arms to the chains. Fit and secure the chain tensioners and withdraw the lock pins.

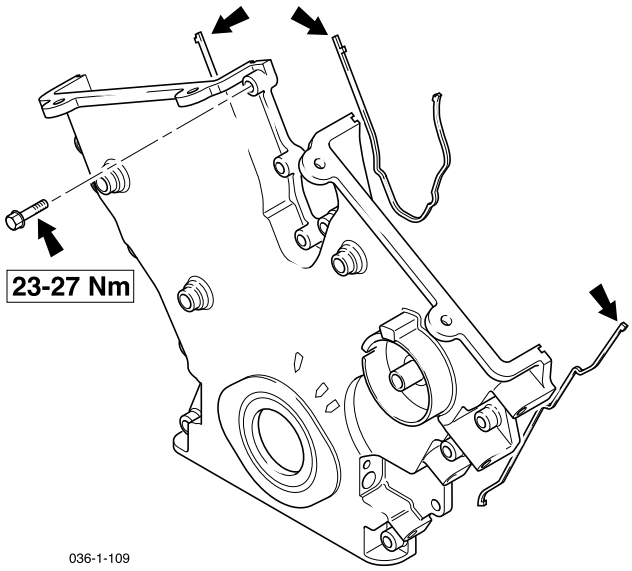
   Caution: If the timing chain to crankshaft sprocket relationship is lost during this step, perform the camshaft timing procedure (1.3.04.3).



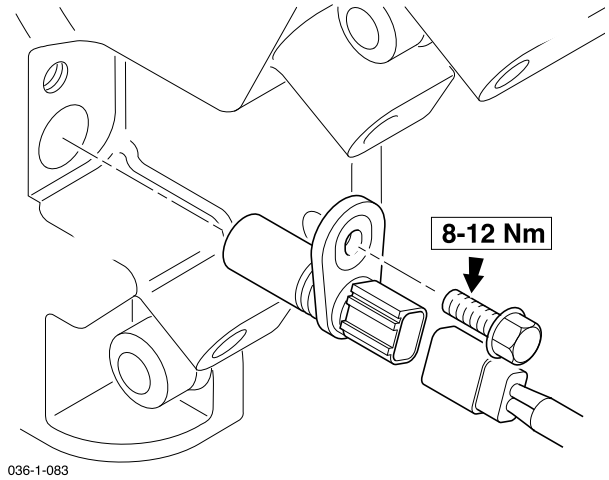
5. Fit the crankshaft timing disc.



6. Fit the front timing cover using new gaskets.

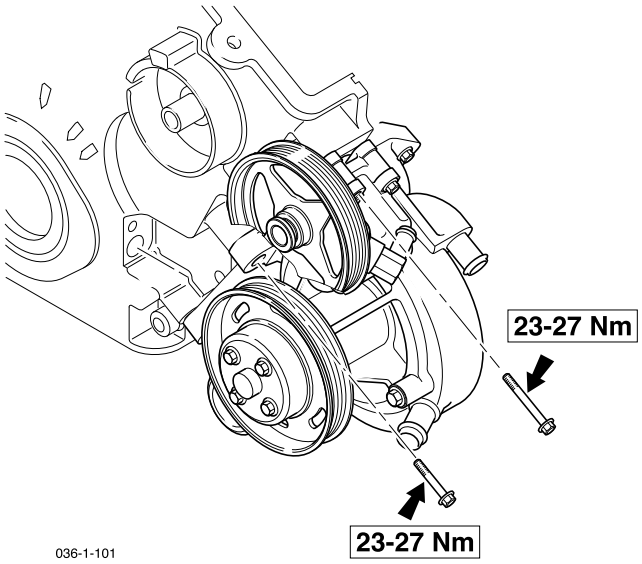


7. Fit and secure the two crankshaft sensors.



8. Fit and secure the crankshaft damper pulley (1.2.06.1).

9. Refit and secure the power steering pump. Refit the bolts securing the water pump to the timing cover.



10. Fit and tension the polyvee drive belt (1.4.10.1).

11. Refit the oil pan (1.5.02.1).

12. Refill the oil pan with 9.5 litres of the recommended engine oil (quantities include filter).

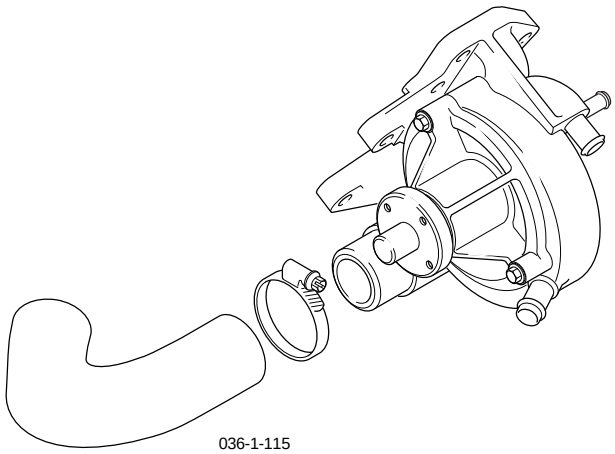
1.7.01.1 Engine Coolant - Drain and Refill

Drain

1. Remove the coolant filler cap from the header tank

2. Remove the front undertray.

3. Disconnect the water pump inlet hose and drain the coolant into a suitable tray.



Refill

1. Refit the coolant pipe to the water pump.

2. Fill with the specified coolant to the maximum level in the header tank and fit the pressure tank cap.

WARNING: In the following step take particular care to avoid burns from the cooling system. Do not remove the pressure cap when the coolant is hot.

3. Run the engine until fully warm. Stop the engine and allow it to cool down. Any coolant displaced due to expansion will be drawn back into the header tank as the system cools.

4. Recheck the level at the header tank. Top-up as necessary to the maximum level. Ensure that the pressure cap is fully tightened on completion of this procedure.

5. Refit the front undertray.

1.7.04.1 Cooling System Pressure Tests

Header tank pressure cap - 140kpa

Thermostat starts opening - 90°C

Thermostat fully open100 - 105°C

Cooling System

1. Ensure that the engine is at correct working temperature.
2. Carefully remove the pressure cap from the remote header tank. Check that the cap is the correct type and grade for the vehicle.
3. Select the correct adaptors for the neck of the header tank and fit the pressure tester to the header tank.
4. Pump up the pressure until it is equal to the pressure cap poundage.
5. Watch the gauge for ten seconds and, if the pressure drops, check the water pump and external connections for leaks.
6. If the pressure remains constant for ten seconds, maintain the pressure and visually check for pin point leaks. Tighten all connections and replace worn or leaky hoses.
7. If a head gasket leak is suspected, renew the cylinder head gaskets (1.3.03.1), inspecting the heads and block for surface finish (scratches etc.) and flatness.

Pressure Cap

8. Determine the correct adaptors for the cap to be checked. Attach the adaptors to the pressure tester.
9. Rinse the cap in water to remove any sediment and apply the cap to the tester.
10. Pump up the tester until the gauge pointer stops rising. The pressure should read between 125 and 150 kPa.
11. Reject the cap if it does not blow off within the 125 - 150 kPa range. Reject the cap if it does not hold the specified pressure for at least 10 seconds without additional pumping.

If replacing a cap, always fit one of identical pressure specification to the original equipment.

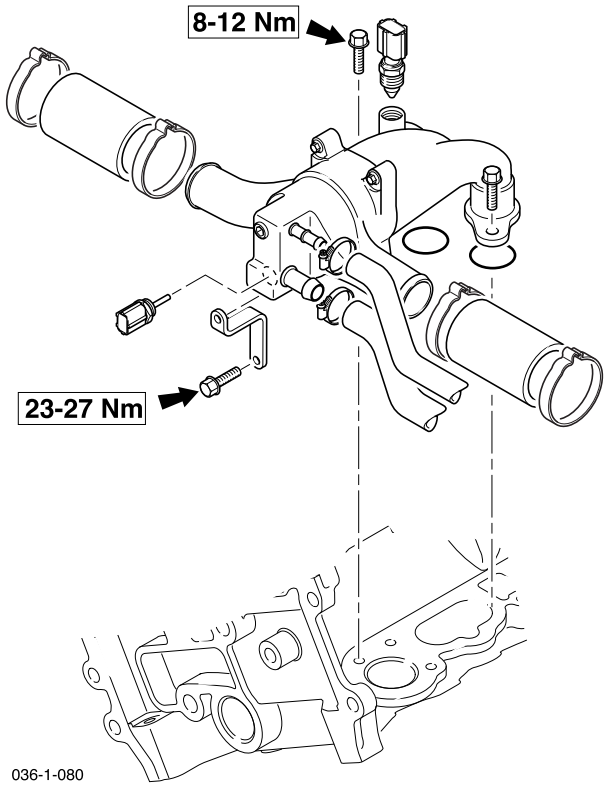
1.7.08.1 Thermostat Housing

Removal

1. Drain the engine coolant (1.7.03.1).
2. Remove the thermostat housing.
   - Disconnect the four hoses from the housing
   - Disconnect the two temperature sensors.
   - Remove three M6 bolts from the rear of the housing
   - Remove one M6 bolt from the support bracket
   - Release the thermostat housing
   - If necessary, remove four bolts and extract the cooling system thermostat.

Installation

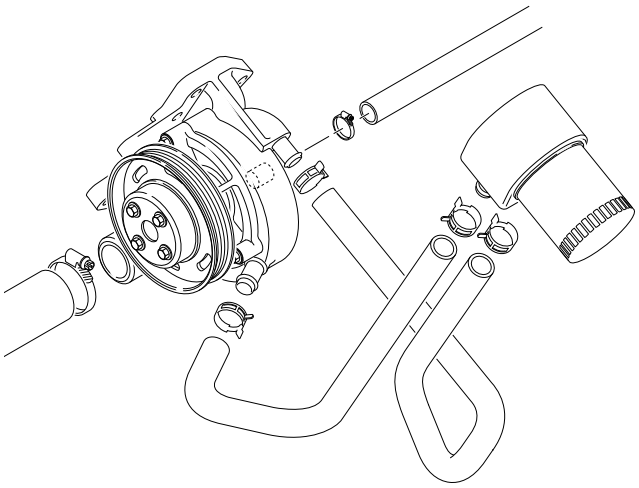
1. Clean all mating faces and fit new 'O' ring seals.
2. Refit the thermostat housing and secure all fixings
3. Refill the engine coolant (1.7.03.1)



1.7.12.1 Water Pump

Removal

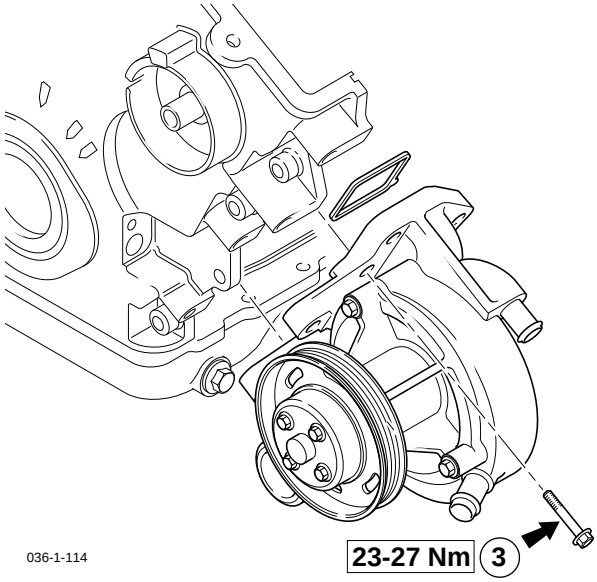
1. Drain the engine coolant (1.7.03).
2. Disconnect the water hoses from the water pump.
   - Heater Return Hose
   - Oil Cooler Return Hose
   - Oil Cooler Supply Hose
   - Radiator Bottom Hose



3. Release the tension on the polyvee drive belt and detach the belt from the water pump pulley.
4. Remove six bolts and remove the water pump.
5. Remove and discard the water pump gasket.

Installation

1. Clean the mating face of the water pump and fit a new 'O' ring seal to the block feed waterway on the pump.



2. Refit the water pump
   - Fit a new gasket to the water pump.
   - Secure with six M8 bolts
3. Reconnect and secure the water hoses.
4. Refit the polyvee drive belt (1.4.10)
5. Refill and bleed the cooling system (1.7.03).

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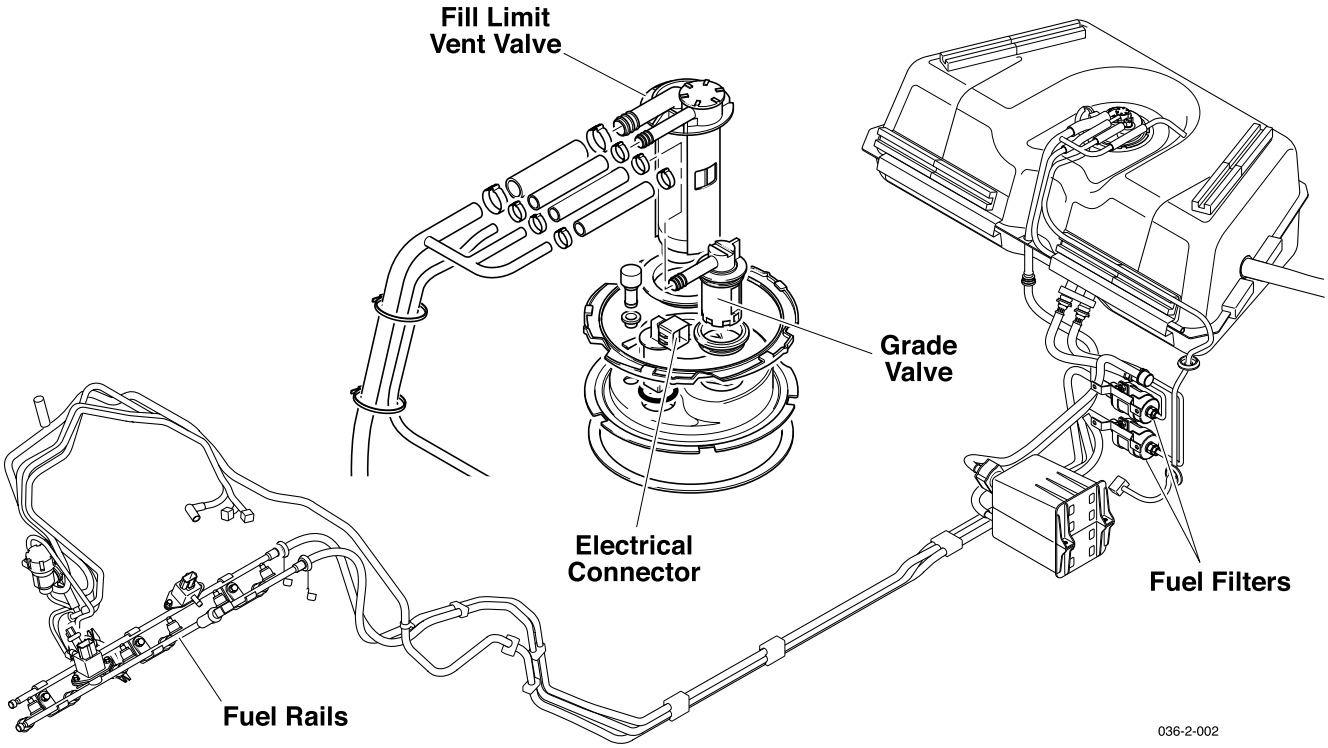
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Fuel System Description

General

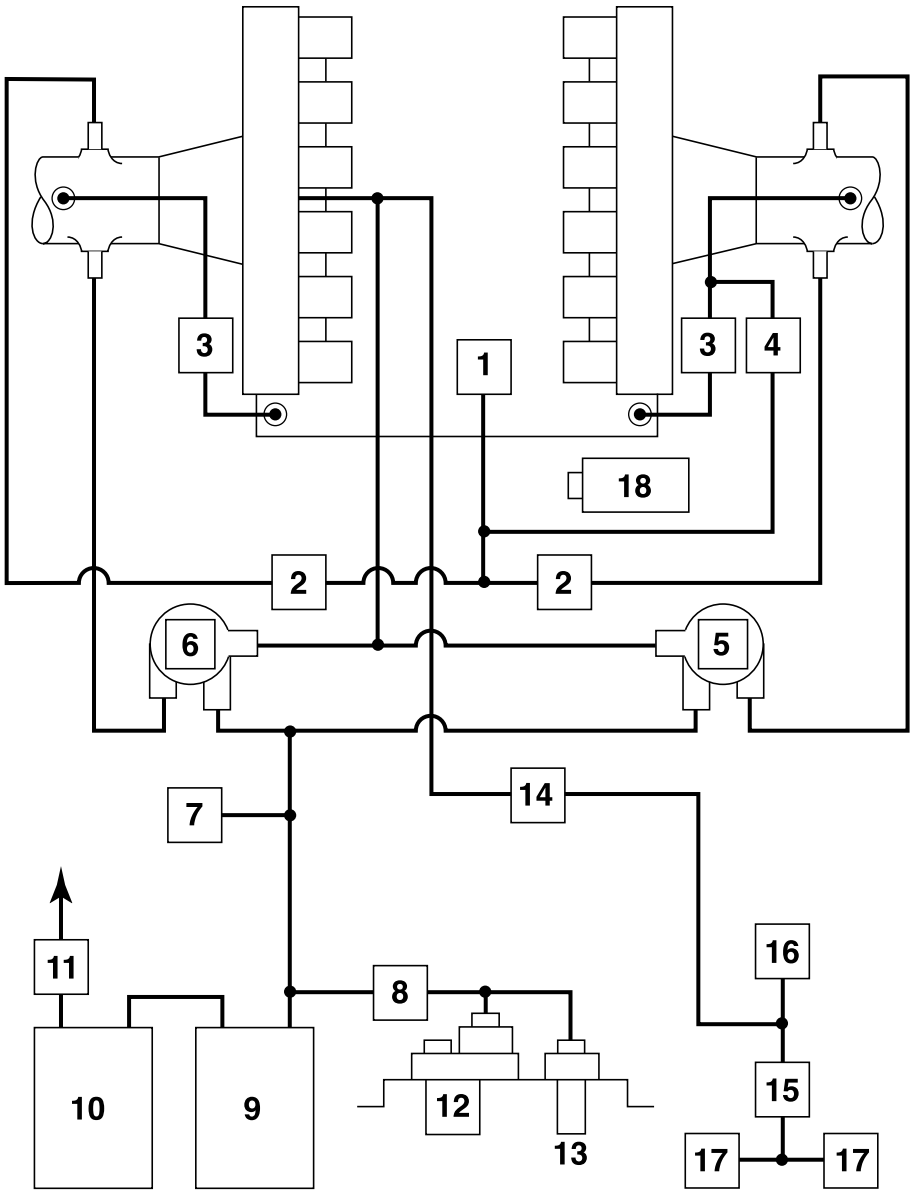
The AM Vanquish uses a mechanical returnless fuel system in which two fuel pumps are run to supply fuel through two filters to the two fuel rails. Each fuel rail is fitted with six fuel injectors, a pressure sensor and a temperature sensor. The fuel pump speeds are varied as required to regulate the fuel pressure in the fuel rails.



Fuel System Schematic Diagram

The schematic diagram on the following page shows the fuel system components. It includes the positive crankcase ventilation and vapour recovery systems.

Fuel System

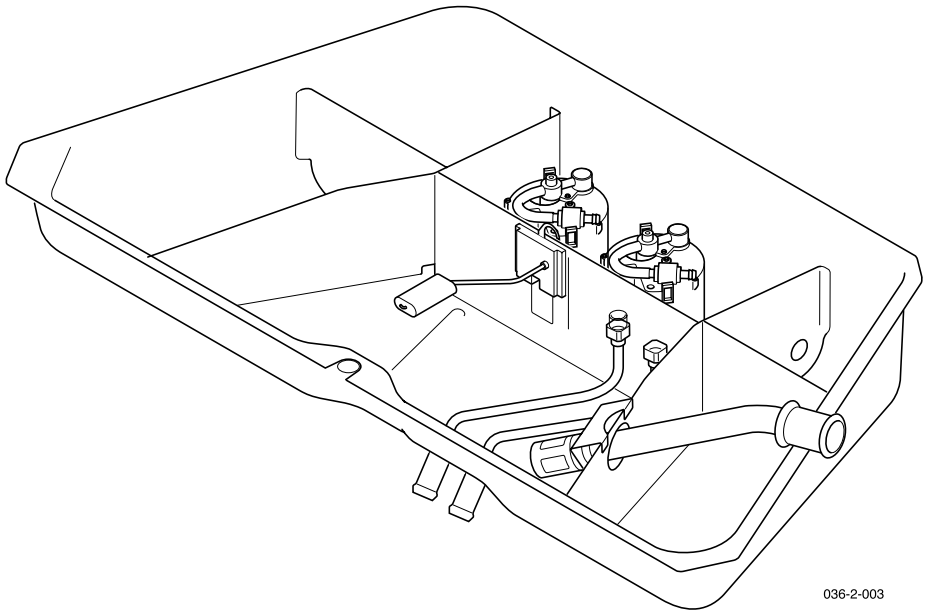


1. Oil Separator
2. PCV Valve
3. Check Valve
4. Relief Valve
5. Vapour Management Valve-RH
6. Vapour Management-LH
7. Service Port
8. Fuel Tank Pressure Transducer
9. Primary Carbon Canister
10. Secondary Carbon Canister
11. Canister Vent Valve
12. Fill Limit Vent Valve
13. Grade Vent Valve
14. Check Valve
15. Exhaust Bypass Solenoid
16. Vacuum Reservoir
17. Exhaust Bypass Valve
18. Brake Booster

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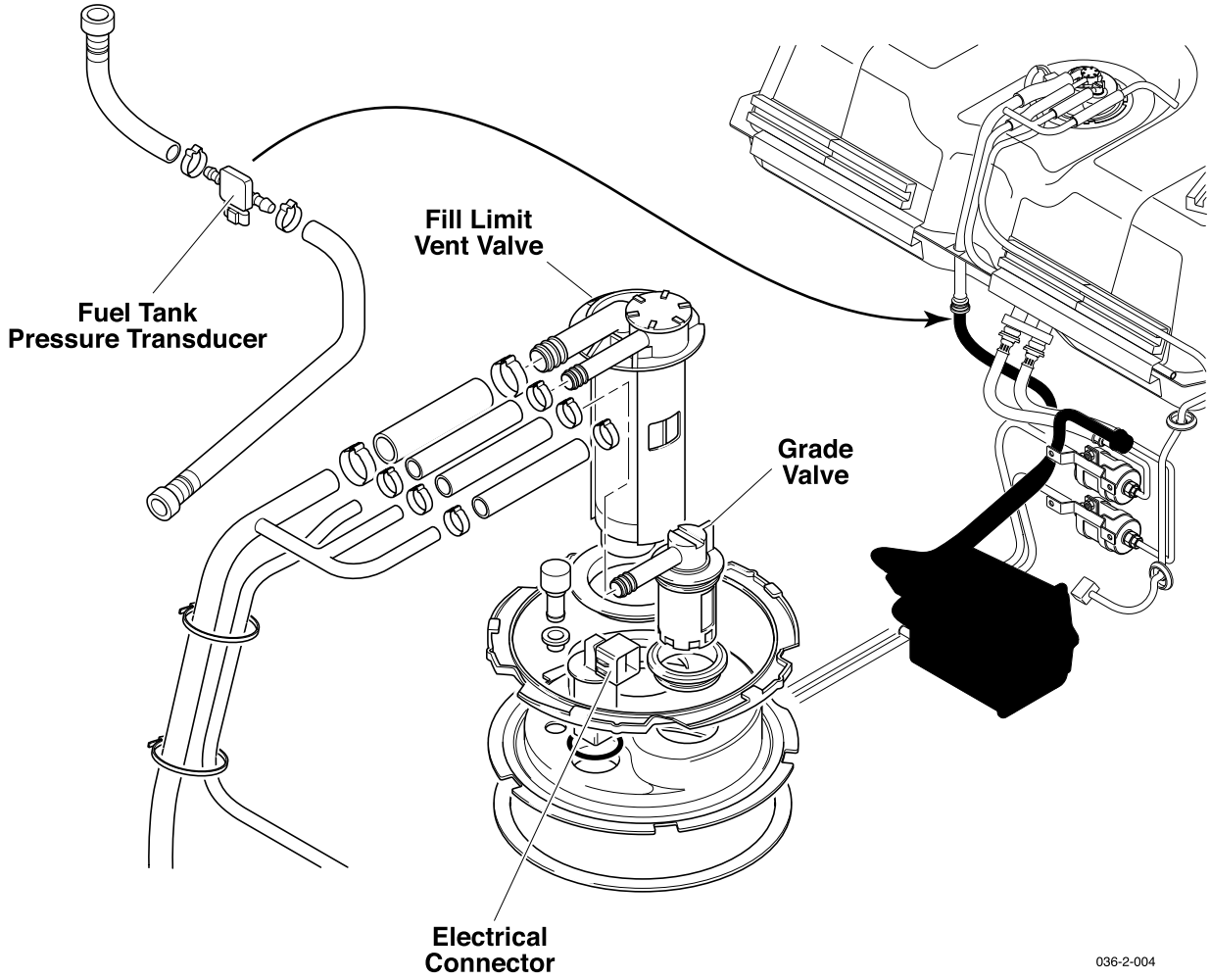
Fuel Tank

The fuel tank is fitted with a single filler neck and check valve. A roll over valve, fill level vent valve and a fuel tank pressure transducer are fitted in the evaporative loss flange on the top surface of the tank. An overfill vent valve is fitted inside the tank in the upper rear corner.



Filler Neck and Check Valve - Incoming fuel passes through a check valve at the base of the filler neck. This valve is normally held closed by a light spring. The valve will open under the pressure of incoming fuel and will close again when fuel flow ceases. The check valve prevents surging of fuel in the filler neck.

The filler neck also incorporates the on-board vapour recovery system. Incoming fuel forms a liquid seal in the filler neck. Thus any air displaced during fuel tank filling cannot escape via the filler neck and is forced out through the fill level vent valve. It passes to the carbon cannisters where any displaced fuel vapour is absorbed.



Fill Limit Vent Valve (FLVV) - This valve contains a float which rises to cut off the path for displaced air when the fuel level rises towards maximum during fuel filling. This causes a small pressure build up in the tank which triggers the cut-off valve in the fuel delivery nozzle. This discourages overfilling of the fuel tank.

The FLVV also includes an over pressure relief valve set at about 2 psi to vent the tank if all other vents fail.

The Grade Valve - This valve allows a pressure bleed from the fuel tank after the fill level vent valve closes. This bleed will prevent excessive pressure build up in the tank in an overfill situation.

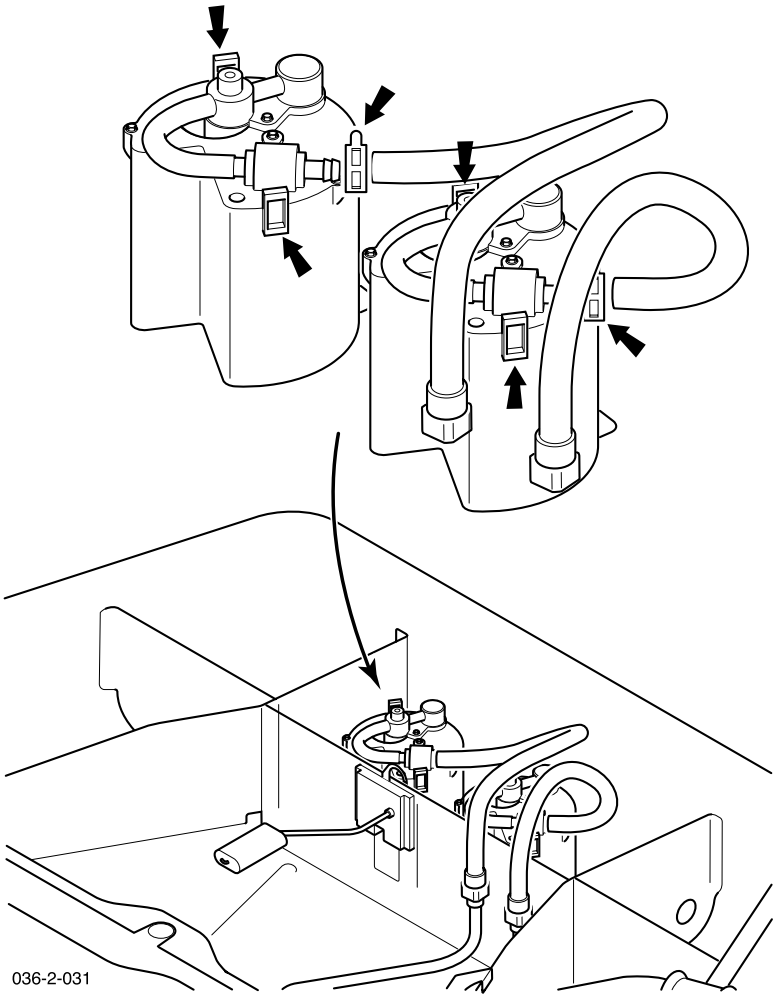
The Grade Valve is roll-over protected. In a roll-over condition, the grade valve closes and prevents escape of liquid fuel from the tank.

Overfill Vent Valve (not shown) - This valve is fitted in the right rear corner of the fuel tank. Its purpose is to vent the highest point of the tank. If the tank is grossly overfilled (e.g. many clicks over the normal filler nozzle cut-off), the FLVV and the Grade Valve will suffer a hydraulic lock. The Overfill Vent valve allows venting of the tank at the highest possible level in this situation.

If the vehicle is inverted in an accident, this valve also closes to prevent leakage of liquid fuel.

Fuel Tank Pressure Transducer - This sensor is fitted in the vapour line to the carbon canisters and measures fuel tank pressure. The fuel tank pressure signal is fed back to the Power Train Electronic Control Module (PTEC).

Fuel Pumps



The two modular fuel pumps are immersed in the base of the fuel tank. The in-tank fuel lines connect to the external lines using two snap connectors in the base of the fuel tank.

During normal running, pressurised fuel from each fuel pump passes from the tank, through a fuel filter to one of the two fuel rails on the engine.

Fuel temperature and pressure are measured by sensors on each fuel rail. The fuel pressure to each rail is regulated as required by continuously changing the run speed of the associated fuel pump.

A constant head of fuel is maintained in the fuel pump modules to ensure that the pumps cannot run dry in a 'low fuel' situation. Special procedures are required to prime new pumps before they are run continuously.

Evaporative Loss System

Fuel vapour is displaced from the fuel tank during filling. Vapour is also displaced due to fuel evaporation in higher temperatures. Displaced fuel vapour is absorbed in two carbon canister filters located under the rear floor.

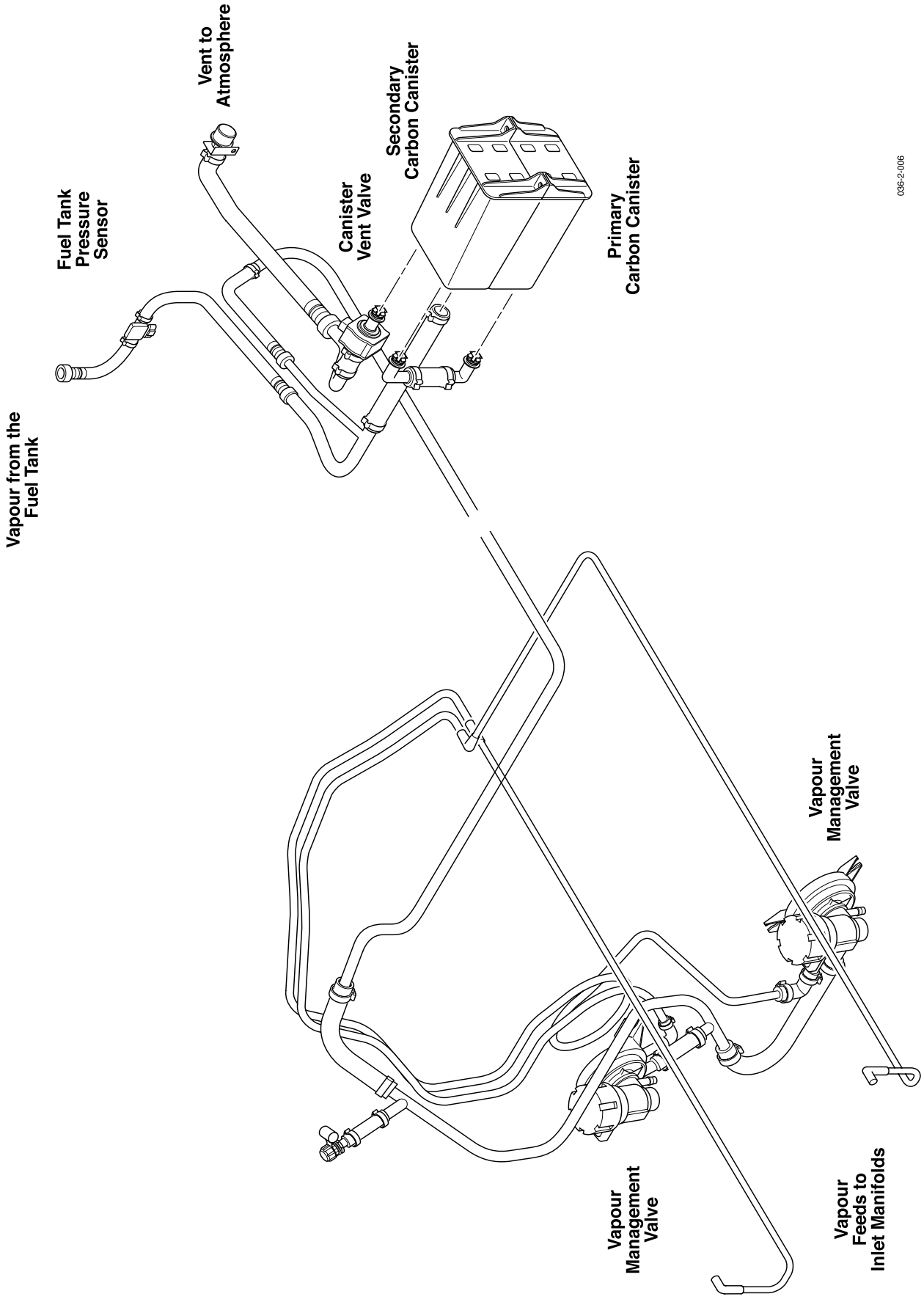
During normal engine running, absorbed fuel vapour is purged from the carbon canisters and mixed with the normal fuel/air charge in the inlet manifold.

System Operation

Displaced fuel vapour leaves the fuel tank via the normally open fill level vent valve. It passes through the primary and then the secondary carbon canisters where fuel hydrocarbons are absorbed. Clean air leaves the system via the normally open canister vent valve. This valve is only closed during diagnostic pressure testing of the fuel system.

During normal engine running, the vapour management valves in the engine bay are periodically opened allowing fresh air flow into the open canister vent valve, through the carbon canisters, through the vapour management valves and into the two inlet manifolds. This fresh air flow progressively purges any absorbed fuel vapour from the carbon canisters.

Evaporative Loss System - Fuel Tank Vents and Control Valves

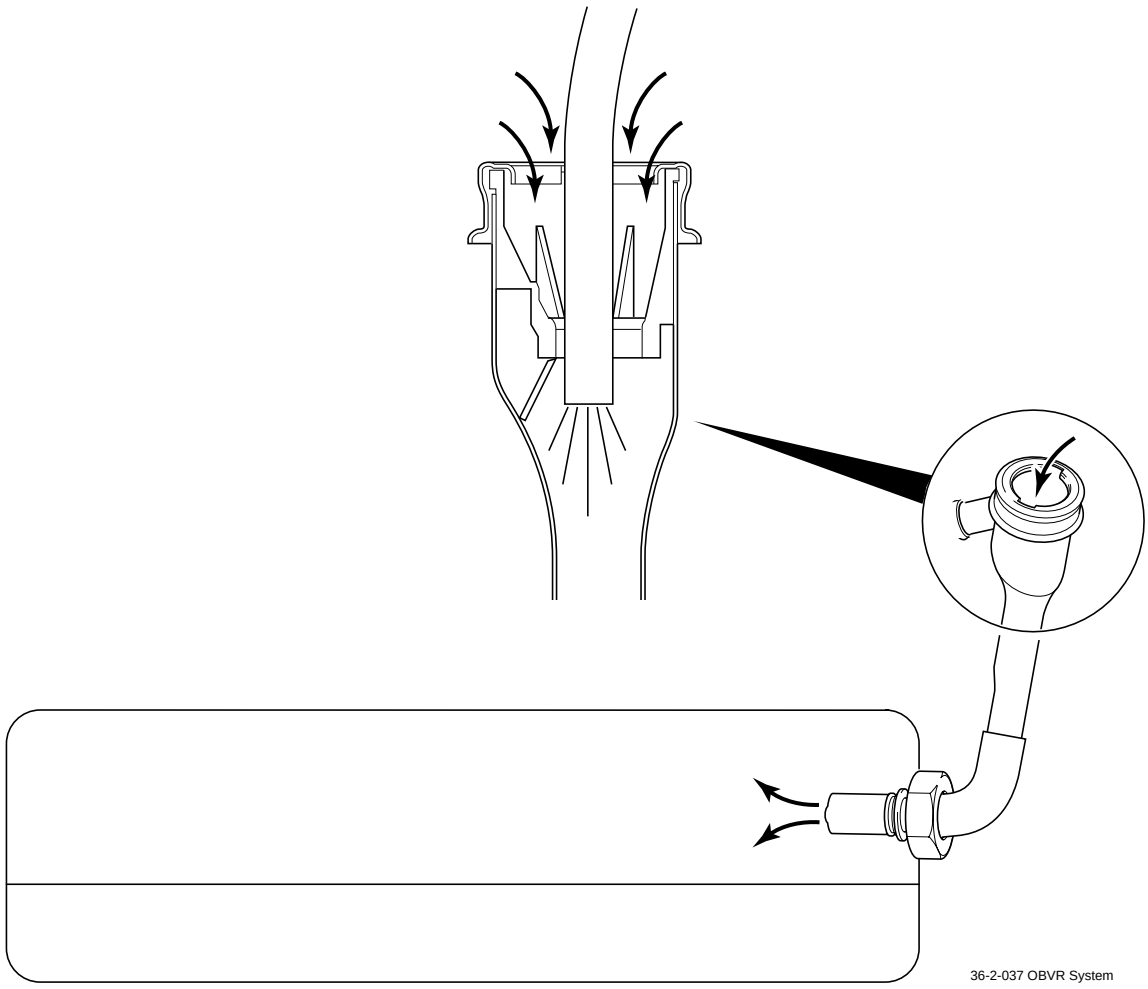


On-Board Vapour Recovery

The On Board Vapour Recovery system is fitted to capture any fuel vapour in the large quantity of air displaced from the fuel tank during filling. The system is designed so that incoming fuel forms a 'liquid seal' around the filler nozzle to prevent fuel vapour escape.

Normal Fuel Fill

Air displaced from the fuel tank during filling can only exit via the fill level vent valve and be forced through the carbon canisters. Any fuel vapour in the displaced air will be absorbed in the carbon filter material. No fuel vapour can escape to the atmosphere. Fuel vapour in the carbon canisters will be purged back into the inlet manifold during engine running and will be burned in the normal combustion process.



36-2-037 OBVR System

Excessive Fuel Fill

In the event of overfilling of the fuel tank, the Fill Level Vent Valve will close at normal maximum fuel level. Then the Grade Valve will close. Finally the Overfill Vent Valve will close, completely sealing the tank. Any excess pressure in the fuel tank can blow off via the Overpressure Vent Valve in the fill level vent valve assembly

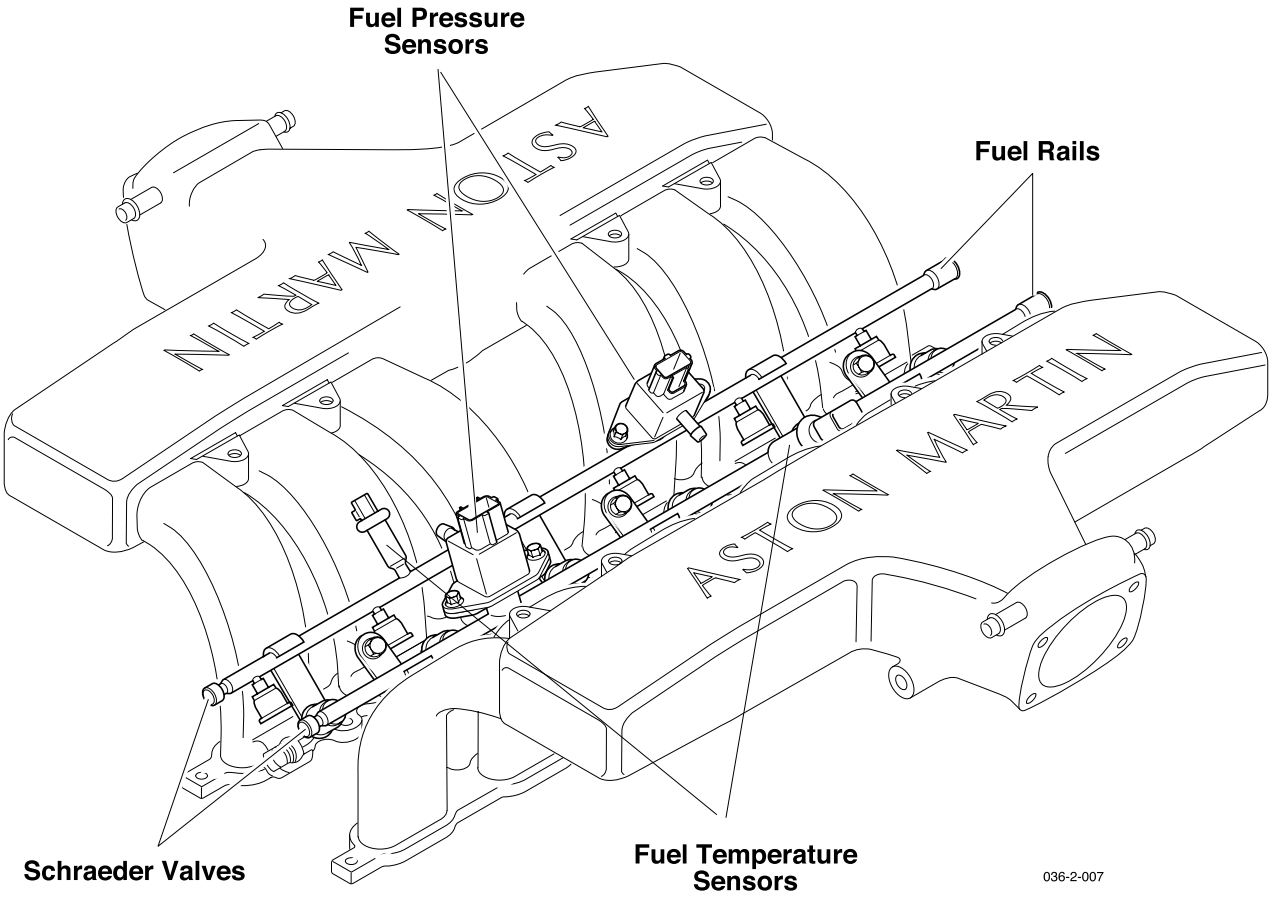
Fuel Tank Sealing (Vehicle Inverted)

If the vehicle is inverted, all vent valves will seal to prevent escape of liquid fuel from the tank.

Fuel Rails and Injectors

Fuel passes from the fuel filters, through the fuel lines and into the fuel rails. Each fuel rail is fitted with a fuel pressure sensor and a temperature sensor. Each fuel rail also has six fuel injectors connecting directly into the inlet manifold.

A 'Schraeder' valve is fitted at the front of each fuel rail. The Schraeder valve may be used to completely depressurise the fuel system.

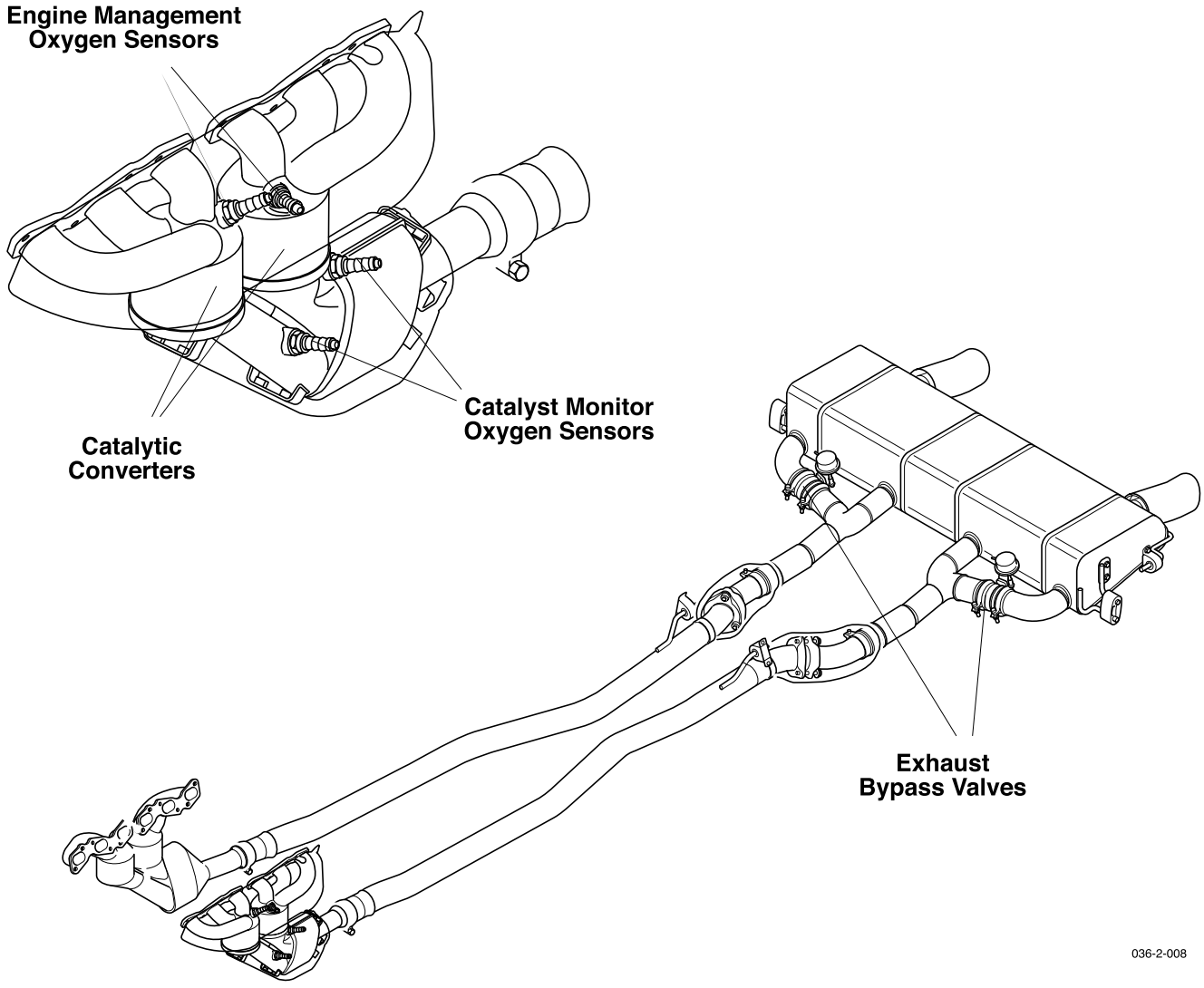


Exhaust System

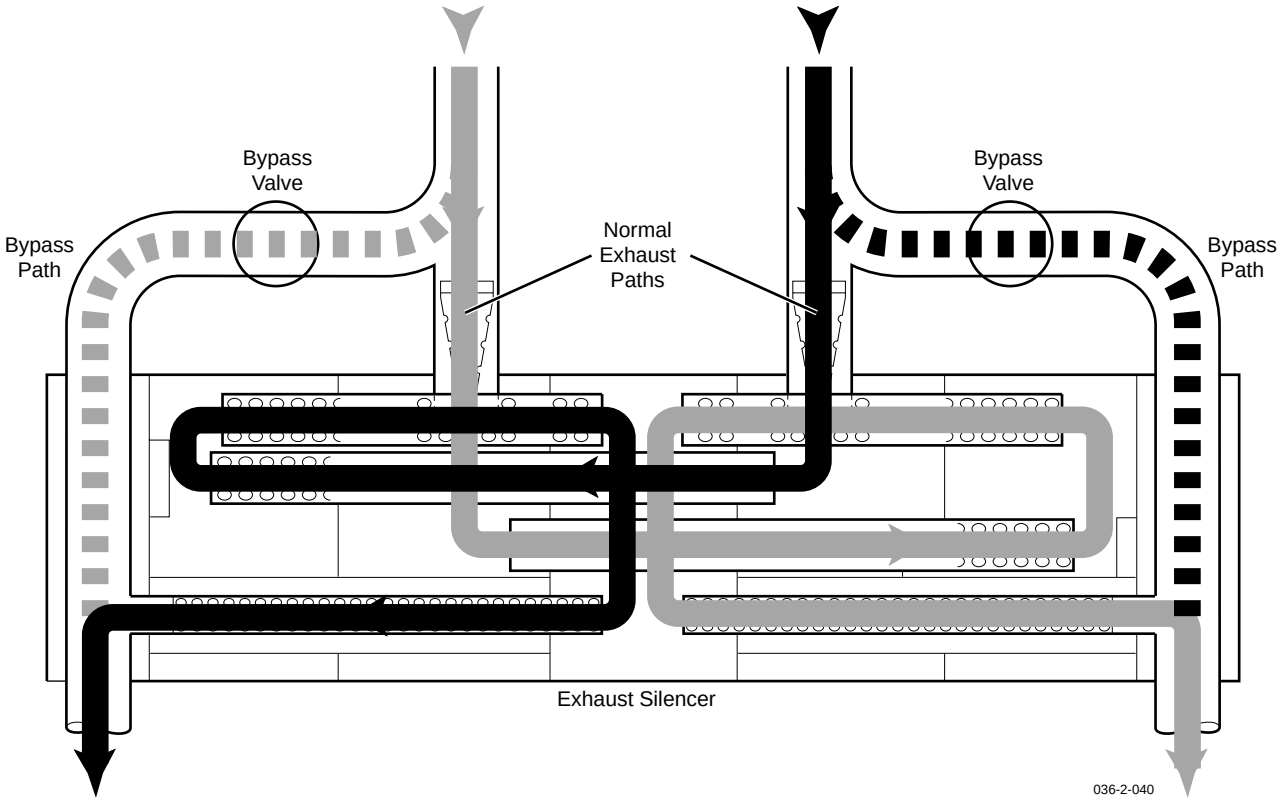
The exhaust system consists of two six-branch manifolds, four primary catalytic converters, eight oxygen sensors, two secondary catalytic converters and a single variable flow silencer assembly mounted across the rear of the vehicle.

Exhaust gasses flow from the manifolds, through the primary catalysts, through the secondary catalysts and on to the rear silencer assembly.

Eight oxygen sensors are fitted in the exhaust system. The four engine management oxygen sensors are mounted before the primary catalysts. The four catalyst monitor oxygen sensors are mounted between the primary and secondary catalysts.



Variable Flow Silencer Assembly

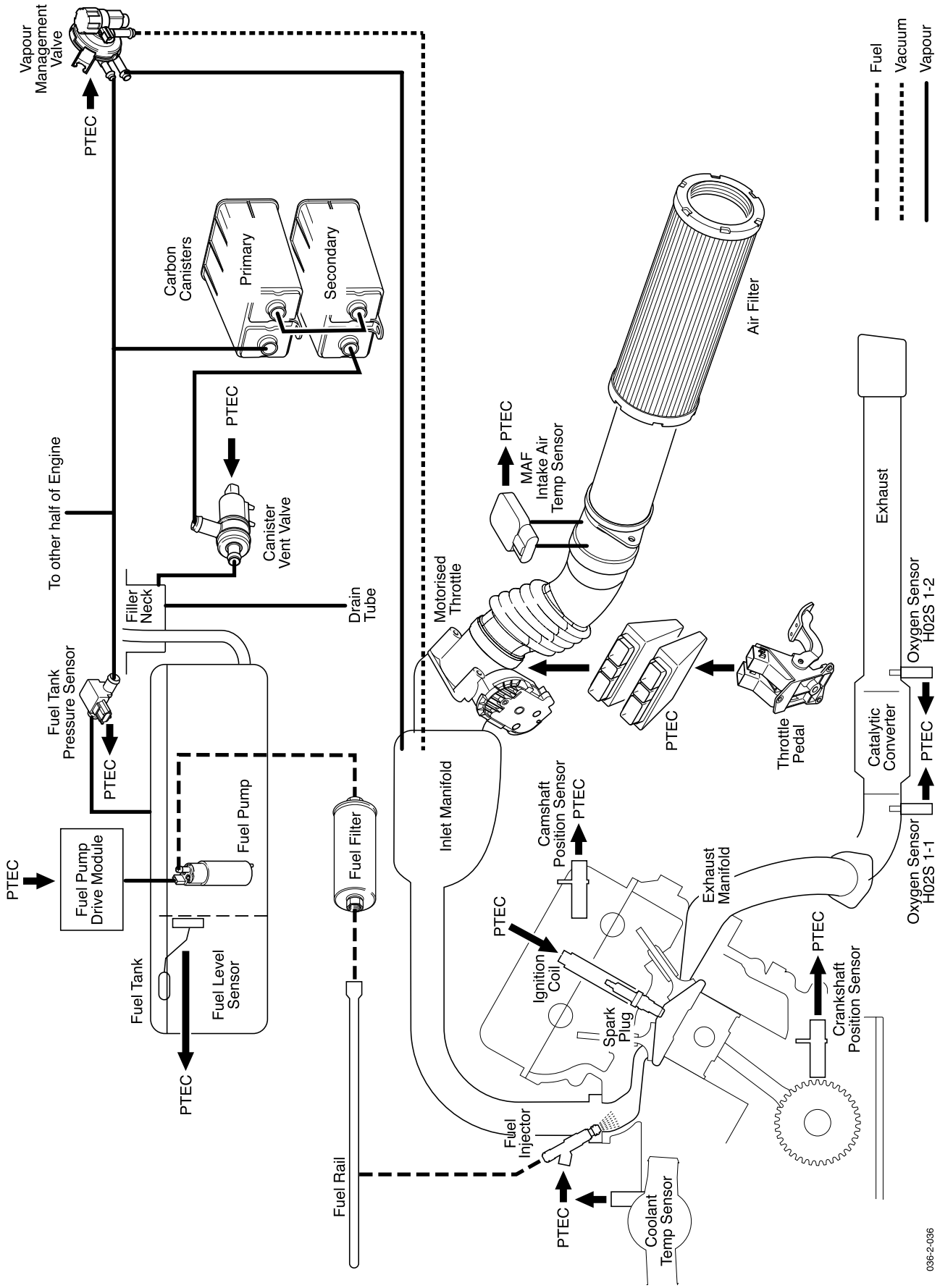


The rear silencer assembly has a variable flow path controlled by two bypass valves.

The sytem is intended to enhance top end performance in motor sport applications and will not operate in most normal driving conditions.

By directing exhaust gasses through a modified path at high vehicle speeds, exhaust backpressure is reduced and top end performance is enhanced.

The Engine Management System - Schematic Diagram



The Engine Management System - Description of Components

Power Train Electronic Control Module (PTEC) - Primary and Secondary

The engine management system is controlled by two Power Train Electronic Control Modules (PTECs) mounted above the passenger side footwell. The PTECs receive signals from the various engine management sensors, compare the signals to the required standards and then modify the fuel and ignition settings to maintain an optimum, fuel and air mixture under all conditions.

The Motorised Throttle Units

Two motorised throttle unit are fitted. One on each inlet manifold. The PTEC modules calculate the optimum throttle positions for each bank and output drive signals to motor the throttles to the new position.

The motorised throttle units are also used to control idle speed. By adjusting the minimum throttle opening, idle speed can be kept to the nominal 960 rpm.

Throttle Position Sensor (TP)

Throttle position is detected by the Throttle Position Sensors (TP) mounted in each throttle unit. These sensor signals are input to the PTECs.

The Throttle Pedal Position Sensors

The current position of the throttle pedal is detected by two twin potentiometers in the throttle pedal assembly. Pedal position signals are fed into the two PTEC modules.

The Mass Air Flow Sensor (MAF)

The Mass Air Flow Sensors (MAF), measure the quantity of air drawn into the engine and input mass air flow signals to the PTECs.

The Air Temperature Sensor (IAT)

An Inlet Air Temperature Sensors (IATs), are located one inside each of the two mass airflow meters and measure the temperature of the air entering the engine. Intake air temperature signals are input to the PTECs.

The Engine Coolant Temperature Sensor (ECT)

The Engine Coolant Temperature Sensor is mounted on the water crossover and inputs coolant temperature signals to PTEC-A. Engine coolant temperature data is fed to PTEC-B over the CAN bus.

Heated Oxygen Sensors (H02S)

The oxygen content of the exhaust gas entering the four primary catalysts is constantly checked by the four Upstream Heated Oxygen Sensors (H02S 1-1 and HO2S 2-1 on either bank). These 'Engine Management' sensors are situated at the entrance of the catalysts. The catalyst efficiency is checked using four downstream ‘Catalyst Monitor’ Sensors (H02S 1-2 and HO2S 2-2 on either bank). The sensor signals are input to the PTEC modules.

By monitoring the pre catalyst heated oxygen sensor signals the PTEC can make fuelling corrections as necessary. By comparing the pre and post catalyst oxygen sensors, the PTEC can monitor catalyst efficiency. All four sensors on each bank contain integral heaters which accelerate the warm-up of the sensors to their operating temperature.

The Fuel Pumps

Each power train electronic control module receives fuel pressure signals from the fuel rail pressure sensors. The PTEC modules control the speed and 'On' time of each fuel pump to maintain the required fuel pressure in the fuel rails. The required fuel pressure will vary dependant on current power requirement and engine load.

Fuel Injectors

The twelve fuel injectors are driven by the PTECs in sequence to inject fuel onto each inlet valve. The volume of fuel injected is determined by the length of time each injector is open and the fuel pressure at each injector.

Ignition Coils

Ignition is by spark plugs supplied with HT voltage from the ignition coil mounted on top of each plug. The ignition coils are triggered by signals from the PTECs.

Catalytic Convertors

Four primary catalytic convertors are fitted, two on each engine bank. The processed exhaust gasses from each two primary catalysts join in a 'Y' junction and pass into a single secondary catalyst on each side of the engine.

Crankshaft Position Sensor (CPS)

Crankshaft speed is measured from the pulse timing of the two Crankshaft Position Sensors (CPS). CPS signals are input to the primary and secondary Power Train Electronic Control modules (PTECs).

Camshaft Position Sensor - Cylinder Identification Sensor (CID)

Engine position is further determined by using the two Cylinder Identification Sensor (CID) signals. The signal is used in conjunction with the CPS to determine when each cylinder is on the intake or exhaust stroke. CID signals are input to the primary and secondary PTECs

Using both the CPS and CID signals, the PTECs can accurately control the start time for ignition and fuel injection events.

The Vapour Management Valves

The Vapour Management Valves are mounted on the engine bulkhead. They are controlled by the PTECs and open the canister vent lines to inlet manifold vacuum. When the vapour management valves open, air can flow through the carbon canisters, carrying recovered fuel vapour into the inlet manifolds to be burned in the engine.

To compensate for any overall increase in fuelling, the fuel injector on time is decreased slightly when the vapour management valves are open. The PTECs make the necessary fuelling corrections by responding to changes in the air/fuel ratio data received from the engine management heated oxygen sensors.

Fuel System Maintenance

Safety Precautions

WARNINGS: Operations on the fuel system result in fuel liquid and vapour being present in the working environment. This presents a very serious risk and the following precautions must be strictly observed.

1. ***Operations on refuelling and on the fuel system must only be performed by personnel who have completed training on fuel handling.***
2. ***Smoking must not be allowed near the working area.***
3. ***"NO SMOKING" signs must be posted around the area.***
4. ***Any operation which could involve sparks or naked lights (e.g. battery testing, welding, metal grinding, etc.) must not be allowed near the working area.***
5. ***A CO2 fire extinguisher must be available close at hand.***
6. ***Dry sand must be available close at hand to soak up any accidental spillage.***
7. ***If necessary, empty the fuel into an explosion proof container using suitable fireproof fuel handling equipment.***
8. ***The working area must be well ventilated.***
9. ***Disconnect the battery before commencing work on the fuel system.***
10. ***Depressurise the fuel system before disconnecting pipework.***

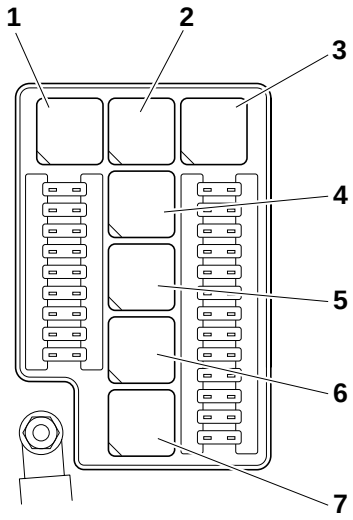
2.0.01.1 Depressurising and Repriming the Fuel System

WARNING: The fuel system is pressurised when the engine is running. Some residual pressure may remain in the fuel system as the ignition is switched off. Opening a pressurised fuel line will cause a fuel leak and a fire risk. Never break into the fuel system of a hot engine. The catalysts and exhaust systems run at high temperature and present a serious fire risk if fuel is spilled onto them when hot.

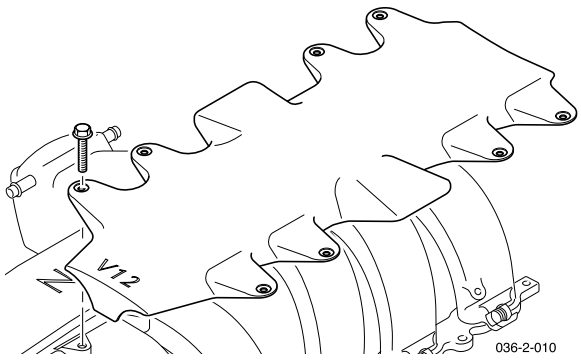
The fuel system must only be serviced by staff trained in fuel handling.

Fuel System - Depressurising

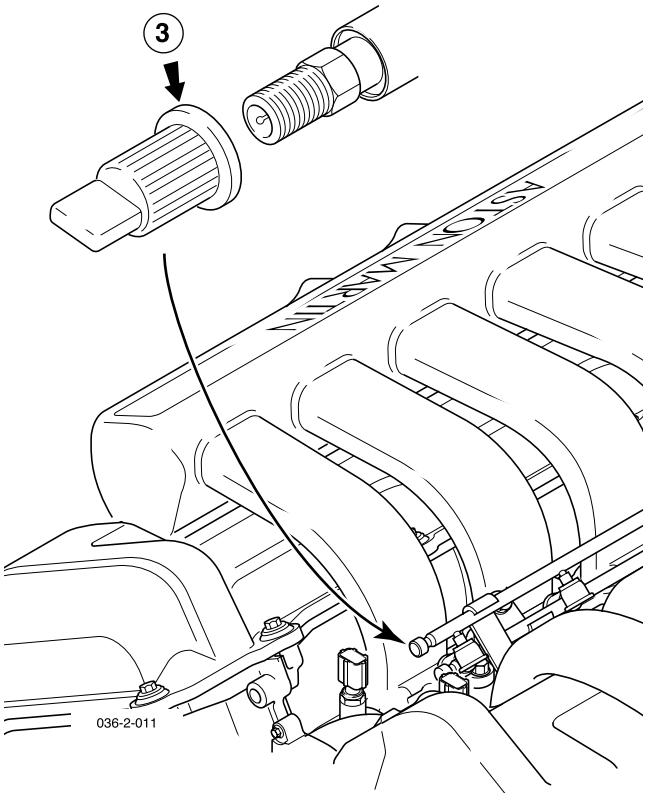
1. Read and observe the fuel system safety precautions at the start of this section.
2. Switch off the ignition and wait several minutes for residual fuel pressure to dissipate. Remove the fuel pump module relays. (Boot Fusebox - Relays 4 and 7)



3. Remove the fuel rail cover.

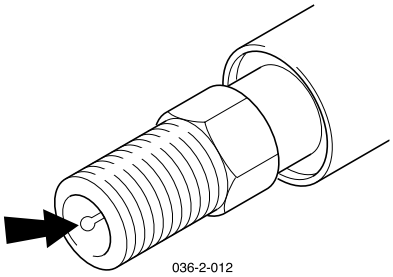


4. Remove the caps from the Schraeder valves at the front end of both fuel rails.



5. Place some absorbent cloth under the front end of both fuel rails.

6. Press the centre pin on each Schraeder valve in turn to check that any residual fuel pressure is dissipated.



7. Remove and dispose of any contaminated material safely.

8. Replace and secure the caps on both Schraeder valves.

9. Carry out any necessary work on the fuel system. Return to the repriming procedure only when all work on the fuel system is completed and any fuel fumes are dispersed.

Fuel System - Repriming

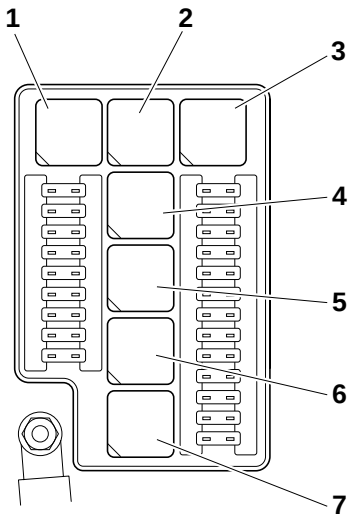
WARNING: Fire Risk - Do not switch on the ignition until all work on the fuel system is completed and the area is cleared of fuel and fuel vapour contamination.

Caution: New fuel pump modules require priming before attempting a continuous run. New fuel pumps may be destroyed if run continuously without correct priming.

Vehicles with unprimed fuel pump modules

1. Check the integrity of the fuel system and remove any exposed fuel or contaminated material from the work area.

2. Replace the fuel pump relays. (Boot Fusebox - Relays 4 and 7).



3. Switch the ignition On for 5 seconds,and then switch Off. Wait for 10 seconds.

   Repeat this On/Off/Wait cycle at least 10 times.

   Caution: The 10 second pause between Off/On ignition cycles is essential to allow fuel to flow through the fuel pump inlet valve. The fuel pumps may be damaged if the 10 second waiting period is not observed.

4. With the ignition off, check the fuel system for leaks. If any leak is present, depressurise the system and service as necessary. After repairing any leaks, again decontaminate the work area of any fuel, contaminated material and fuel fumes.

   WARNING: Fire Risk - Do not start the engine until the fuel system integrity has been assured.

5. Start the engine and check for correct fuel delivery.

Vehicles with primed fuel pump modules

1. Start the engine and run for a few moments until engine running (fuel flow) is stabilised.

2. Switch off the ignition.

2.0.01.2 Fuel System - Pressure Test

Data

Nominal pump pressure

40 psi (2.7 bar) above inlet manifold pressure

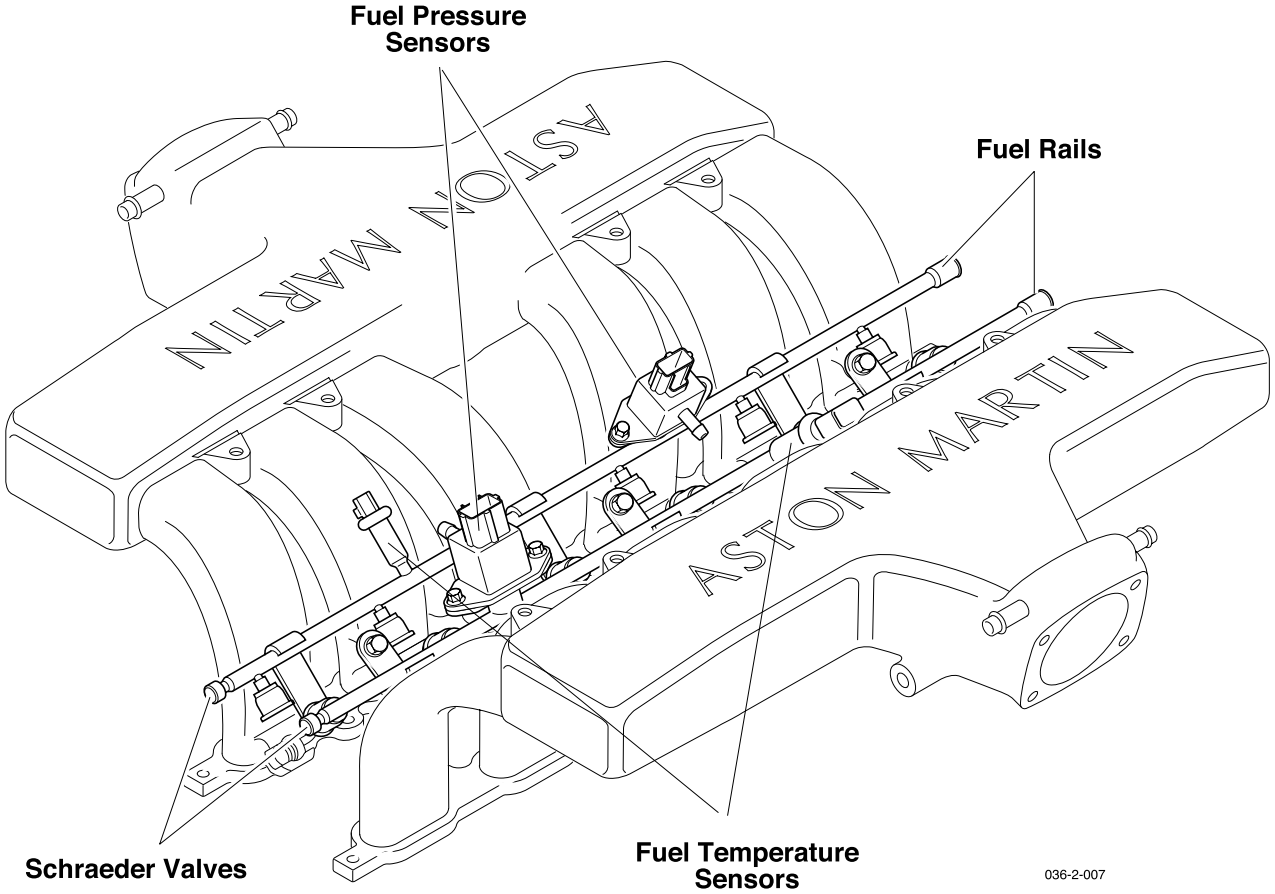
Procedure - Fuel Pressure Test

WARNING: Fire Risk - Depressurise the fuel system before disconnecting pipework. Use a pan or absorbent cloth to catch fuel spills which may occur due to residual pressure. Clean up spillages immediately and dispose of fuel contaminated materials safely.

1. Set up the WDS sytem to monitor fuel rail pressure (ΔFPRESS) in both fuel rails.
2. Start the engine and monitor the fuel pressure readings.

   Note: The WDS reading is actually ΔFPRESS (delta fuel pressure). i.e. the difference between actual fuel rail pressure and inlet manifold pressure.

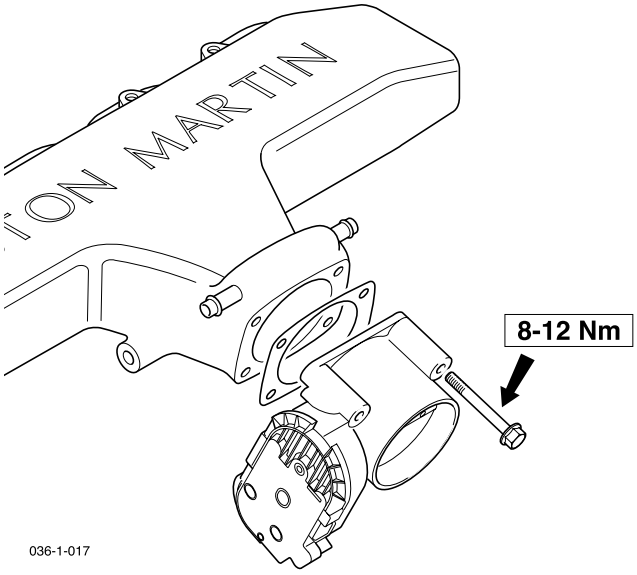
   Both fuel rails must show a *ΔFPRESS* pressure of more than 40psi for the engine to function satisfactorily.
3. If either fuel rail ΔFPRESS is lower than 40 psi, check for blocked or restricted fuel filter or fuel lines on the side showing low pressure.
4. If the filter and fuel lines are serviceable, suspect a defective fuel pump.



2.1.04.1 Throttle Body Assembly

Removal

1. Disconnect the air trunking at the throttle body.
   - Release the jubilee clip
   - Detach the trunking from the throttle body
2. Disconnect the electrical connector from the throttle body.
3. Remove the throttle assembly.
   - Remove four M6 bolts
   - Remove the throttle body and adaptor
   - Remove and discard the gasket



Installation

1. Fit the throttle assembly to the inlet manifold using a new gasket. Secure with four M6 bolts.
2. Reconnect the electrical connector
3. Refit and secure the inlet air trunking.

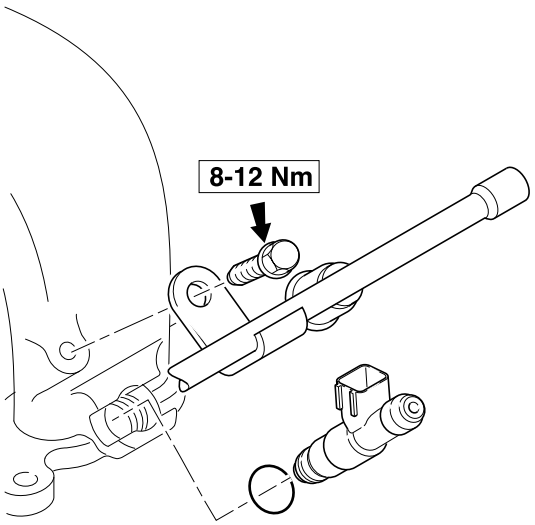
2.1.01.1 Inlet Manifold Removal

Removal

1. Release the throttle body from the inlet manifold (2.1.03).
2. Depressurise the fuel system (2.0.01).
3. Disconnect the engine harness from the fuel injectors.

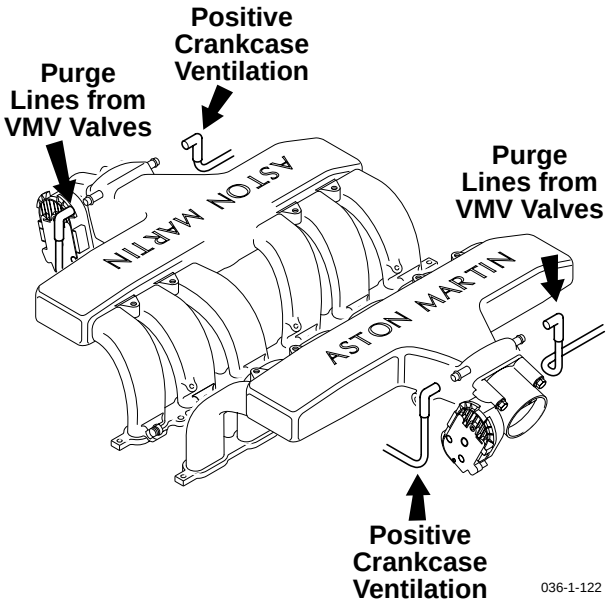
WARNING: Read and follow all fuel handling instructions at the start of this section.

4. Remove the fuel rail and injectors from the inlet manifold.
   - Remove three M6 bolts from each fuel rail.
   - Lift off the fuel rail
   - Lift out the fuel injectors
   - Remove and discard the two 'O' rings from each injector



036-2-013

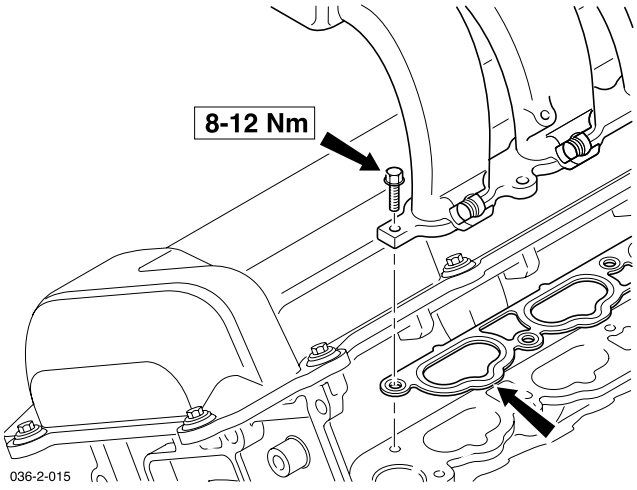
5. Disconnect the vacuum lines from the inlet manifold stub pipes.
   - Crankcase ventilation line
   - VMV vapour lines
   - VMV vacuum line (LH manifold)
   - Brake servo vacuum line (RH manifold)



036-1-122

6. Remove the inlet manifold.
   - Remove seven bolts from each manifold
   - Lift off the manifolds
   - Remove and discard the manifold gasket.
   - Fit the inlet manifold cover

Caution: Immediately fit the inlet manifold cover (special tool 303-671) to prevent the ingress of foreign material into the cylinder head.



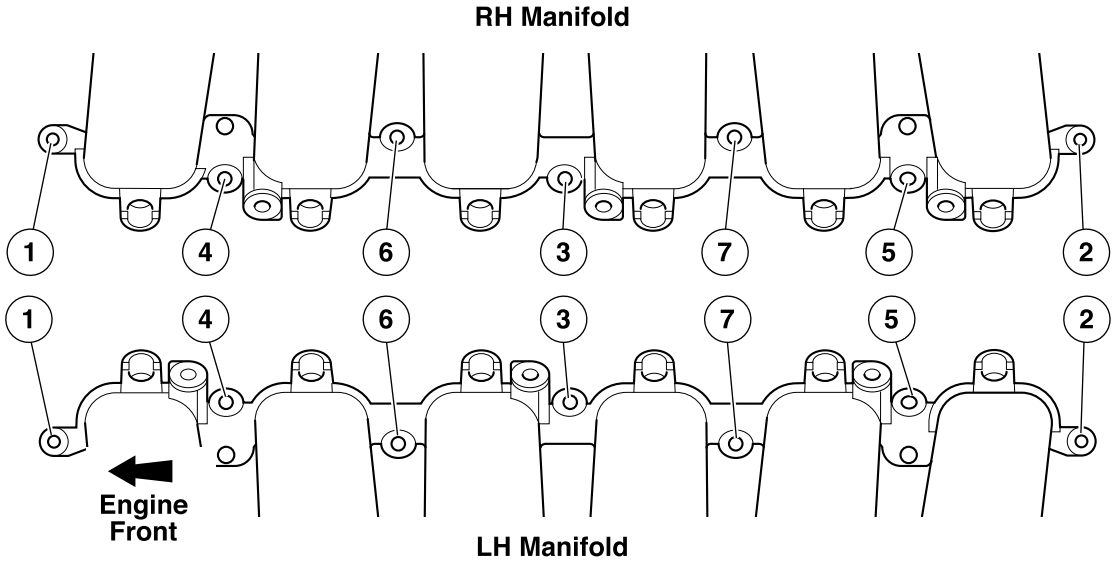
036-2-015

Installation

1. To install, reverse the removal procedure.

Use new gaskets at all joints and fit new 'O' ring seals to all injectors.

2. Tighten the manifold bolts in the sequence shown.



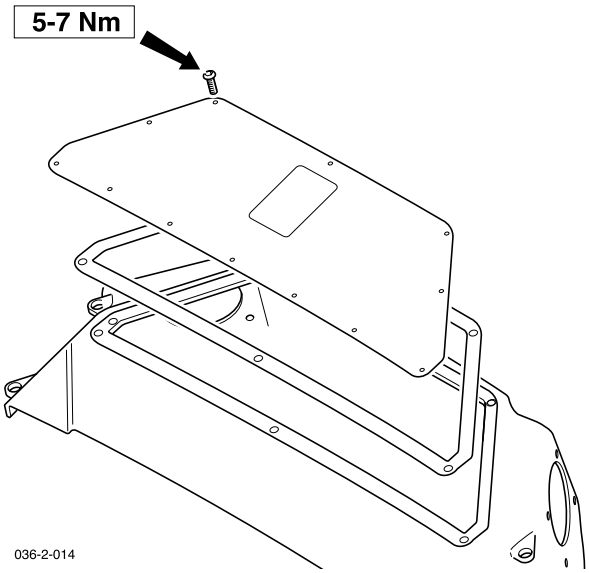
Hole No.	Fastener	Description
1 to 7		M6 x 1 x 35 Bolt & Hex Washer
Note	Torque Sequence 1 to 7 Torque all Fasteners 8-12 Nm	

036-2-016

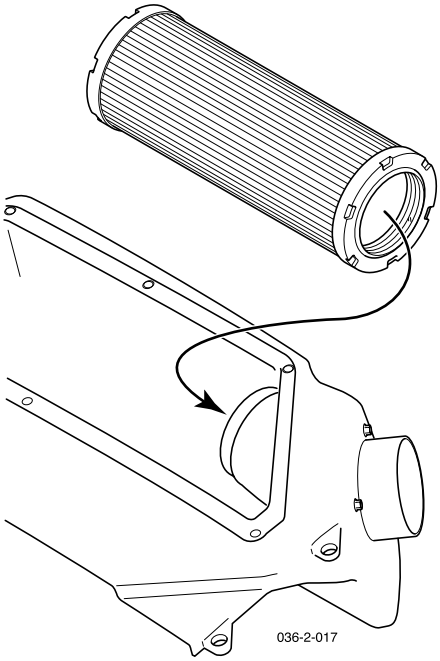
3. Lightly lubricate the new injector seals with engine oil prior to fitting.

2.1.06.1 Air Filters

1. Raise the bonnet.
2. Remove six bolts and remove the filter box cover.



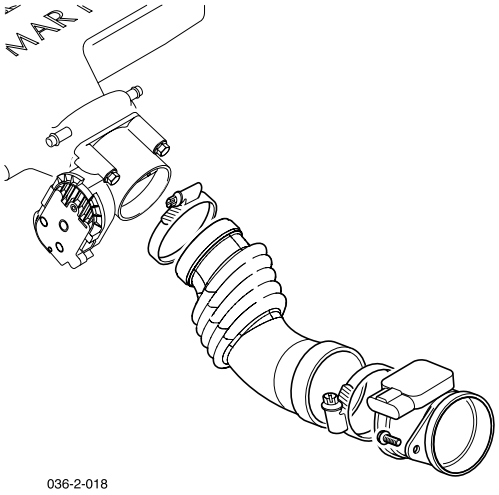
3. Remove the air filter.



4. Insert the new filter ensuring full engagement of the filter onto both air ducts in the filter housing.
5. Refit the filter box cover.

2.1.08.1 Mass Airflow Meter

1. Raise the bonnet.
2. Release the jubilee clip on the air trunking.

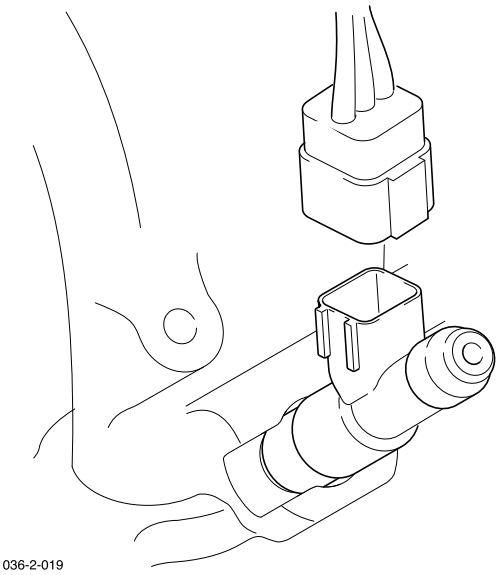


3. Remove the mass airflow meter.
   - Release the flexible air hose from the MAF meter.
   - Disconnect the harness connector to the MAF meter.
   - Release the jubilee clip securing the MAF meter to the outer air trunking.
   - Remove two screws and the mass airflow meter

2.2.01.1 Fuel Rails and Injectors

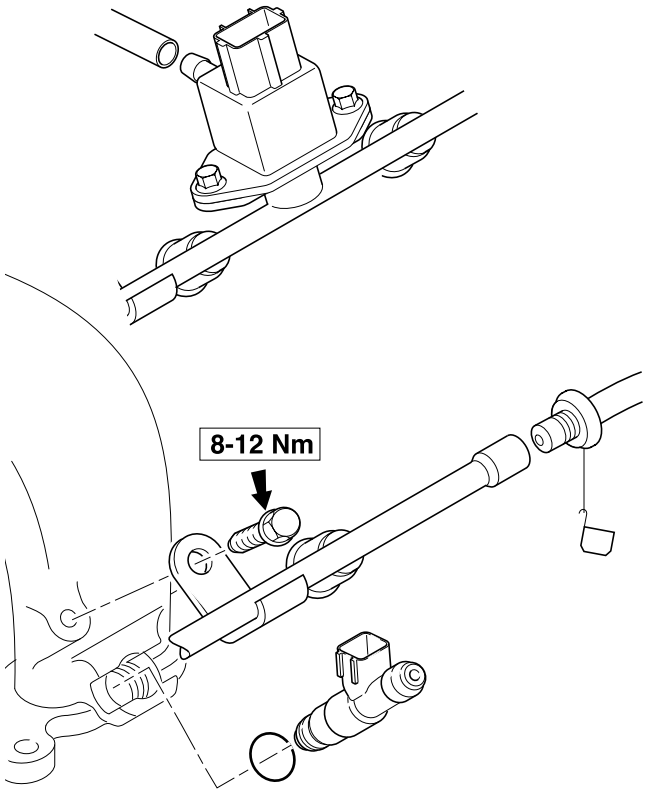
WARNING: Read and follow the fuel handling instructions at the start of this section.

1. Remove the fuel rail cover.
2. Depressurise the fuel system (2.0.01).
3. Disconnect the fuel injectors.



036-2-019

4. Remove the fuel rail and injectors from the inlet manifold.
   - Disconnect the fuel temperature and fuel pressure sensor connectors.
   - Release the fuel pressure sensor vacuum pipes
   - Remove three M6 bolts from each fuel rail
   - Lift off the fuel rail
   - Disconnect the rail from the fuel hoses
   - Lift out the fuel injectors
   - Remove and discard the two 'O' rings from each injector



036-2-020

2.5.04.1 Fuel Tank Draining

WARNING: Read and follow all fuel handling instructions given at the start of this section and in the bowser manufacturers fuel handling documentation before commencing work on the fuel system

Procedure

Warning: This procedure must only be performed by staff who are fully trained in fuel handling.

1. Depressurise the fuel system (2.0.01).
2. Prepare a approved fuel bowser.

   Connect the bowser ground leads to the vehicle chassis and to a known good ground (e.g. a ground point on the vehicle ramp)
3. Fit the fuel drain adaptor (310-096) to one fuel rail and fit the drain tube to the bowser inlet.
4. If using a bowser without on-board vapour recovery, connect the vent line from the fuel bowser to the filler cap of the tank being emptied (Dummy filler cap - Tool No. 310-097). Fuel vapour from the bowser will then be captured in the vehicle fuel tank.
5. Connect the WDS and select the component control function. Select the fuel pumps.
6. Switch on the fuel pump at the WDS and constantly observe the fuel flow into the bowser delivery hose. Switch off the fuel pump immediately when fuel flow ceases.

   Caution: The fuel pump will be irreparably damaged if allowed to run dry for any significant time.
7. Disconnect the WDS.
8. Remove the drain tube from the fuel rail and the bowser. Seal the bowser inlet.
9. Disconnect the fuel bowser ground leads.
10. Disconnect the bowser vent line from the dummy fuel cap. Refit the normal fuel cap.

    WARNING: Several litres of fuel remain in the tank sump after draining.

2.5.05.1 Fuel Tank Removal

Procedure

WARNINGS:

Read and follow the fuel handling instructions given in the warnings and precautions at the start of this section.

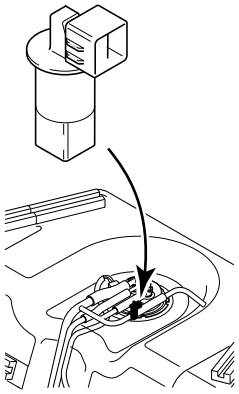
Fuel vapour is explosive. During the following procedure, the fuel tank and fuel lines will be open. Ensure good ventilation and take all necessary precautions to eliminate fire risks.

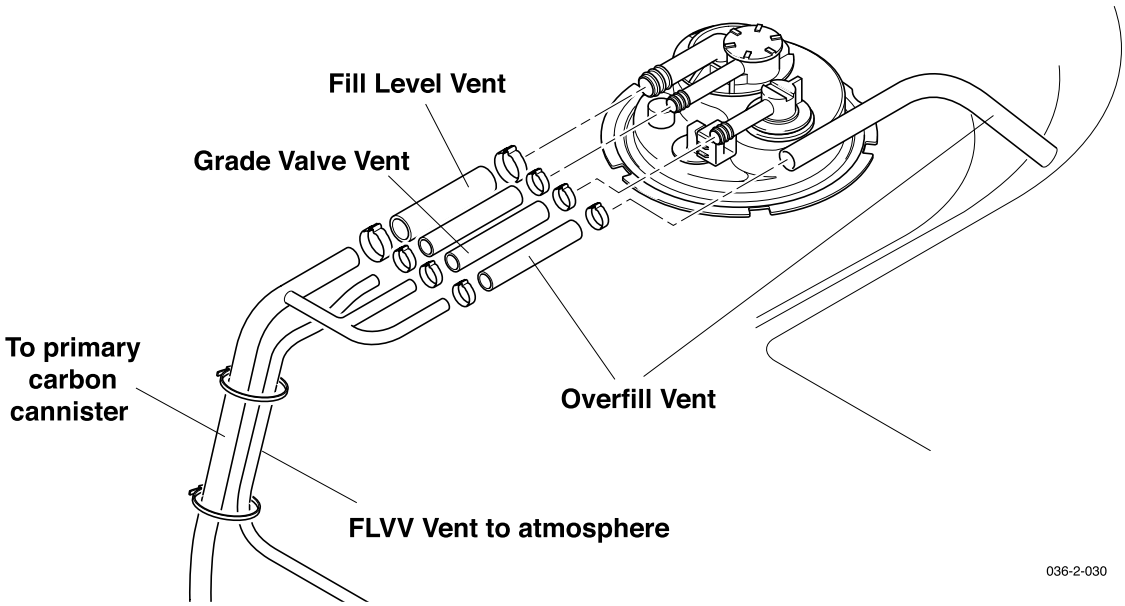
Take all necessary precautions to prevent sparks from electrical / electrostatic discharge or from friction.

1. Depressurise the fuel system (2.0.01).
2. Drain the fuel tank (2.6.01).

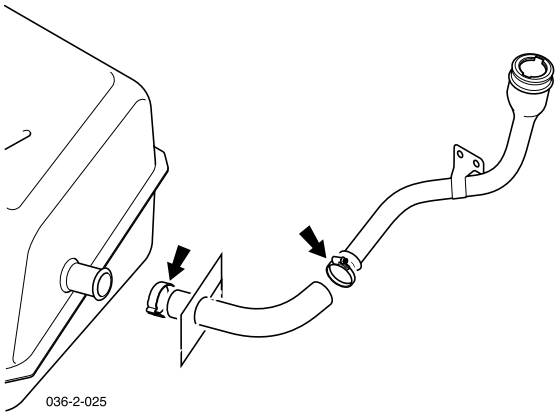
   WARNING: Several litres of fuel remain in the tank sump after draining.

3. Disconnect the battery.
4. Remove the tunnel shear panel and the rear undertray.
5. Remove the exhaust silencer, intermediate pipes and silencer heat shield box. (2.4.01)
6. Remove the rear suspension.
7. Disconnect the fuel tank electrical connector.
   - Access the top of the fuel tank through the rear parcel shelf.
   - Disconnect the electrical connector at the evaporative loss flange

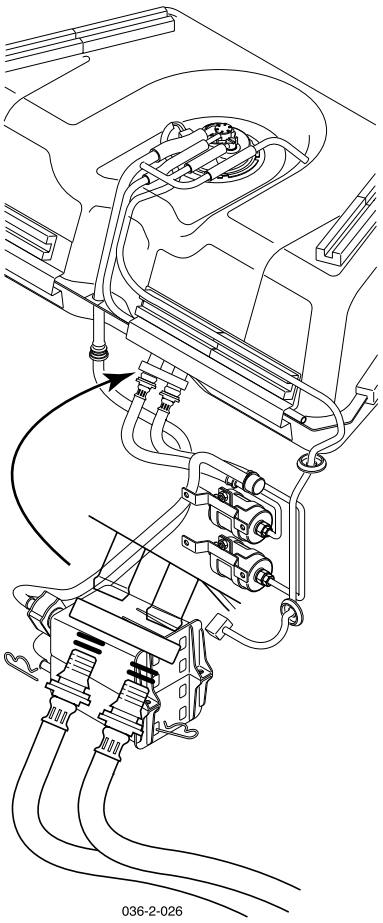




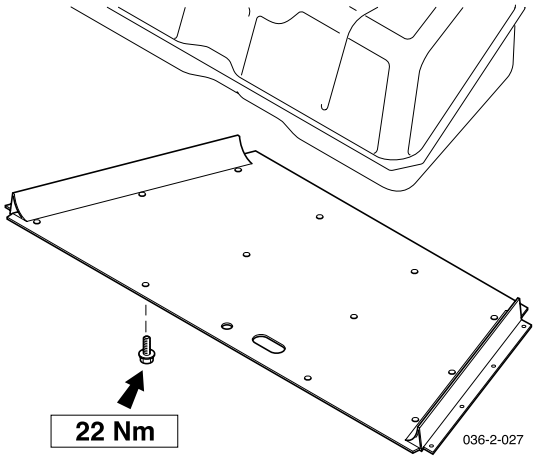
9. Release and remove the filler neck from the fuel tank. Cap the filler neck connector on the tank.



10. Disconnect the fuel lines from the fuel tank. Cap the fuel line connections on the tank and on the fuel lines.



11. Place a suitable support under the fuel tank. Remove 20 M8 bolts and the fuel tank retaining plate and lower the fuel tank from the vehicle.



Installation

1. To install, reverse the removal procedure.

   WARNING: Fire Risk - Do not connect the battery and switch on the ignition until all work on the fuel system is completed and the area is cleared of fuel contamination. Remove contaminated material, open fuel containers, waste fuel. Fully ventilate the vehicle and work area to remove all fuel fumes.

2. When reconnecting the fuel lines at the tank, check for complete engagement of the locking clips. Test the fuel system integrity before refitting the tunnel shear panel and the rear undertray.

3. Check and ensure the integrity of the fuel system. Refit and reconnect the battery.

4. Switch on the ignition. Reprime the fuel system (2.0.01). Confirm that there are no fuel leaks.

   WARNING: Fire Risk - Do not start the engine until the fuel system integrity is confirmed.

5. Start the engine and check for correct fuel system operation (i.e. correct engine running).

   Note: The clock will have stopped and the radio will have lost its preset programs whilst the battery has been disconnected.

2.6.01.2 Fuel Filters Renewal

Removal

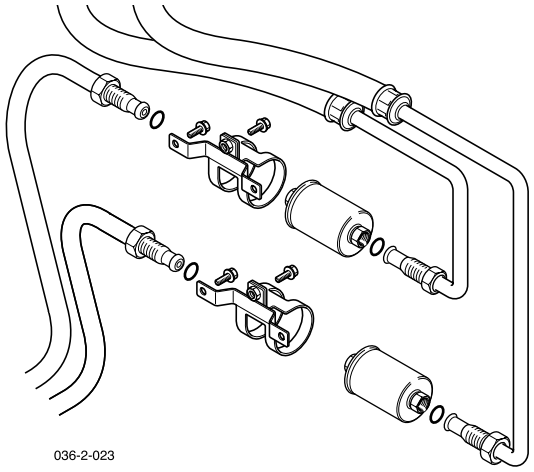
1. Raise the rear right wheel from the ground and remove the road wheel.

2. Depressurise the fuel system (2.0.01).

   WARNING: Fire Risk - Read and follow all fuel handling warnings and precautions given on page 17, to avoid fire risk from spilt fuel.

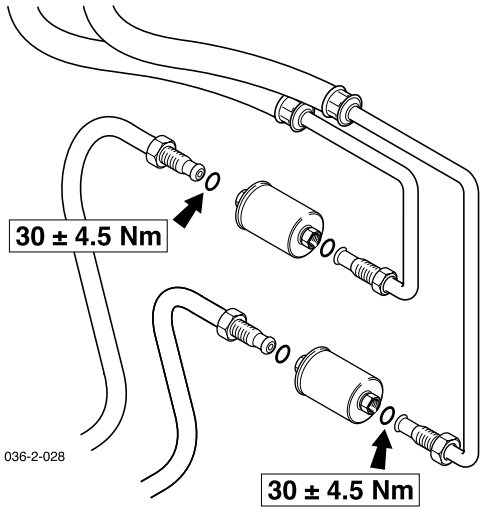
3. Remove the fuel filters.

   - Place a drip tray beneath the fuel filter area
   - Release the four filter unions
   - Remove and discard the four 'O' rings
   - Release the fuel filter clamps
   - Remove the fuel filters



4. Assemble new filters.

   - Fit new 'O' rings to the inlet and outlet unions
   - Fit the union nuts and torque to specification

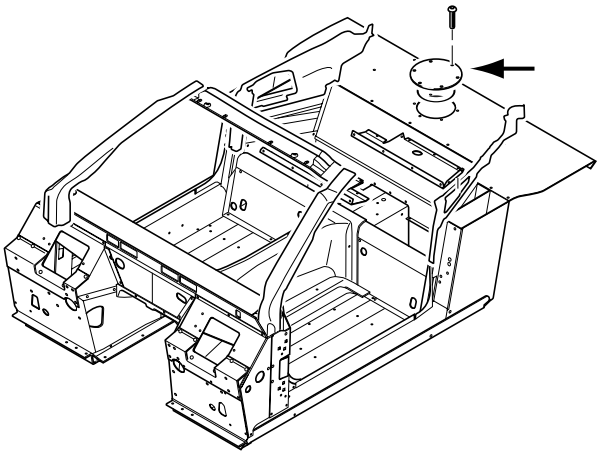


5. Remove the drip tray and safely dispose of any spilt fuel or contaminated material.

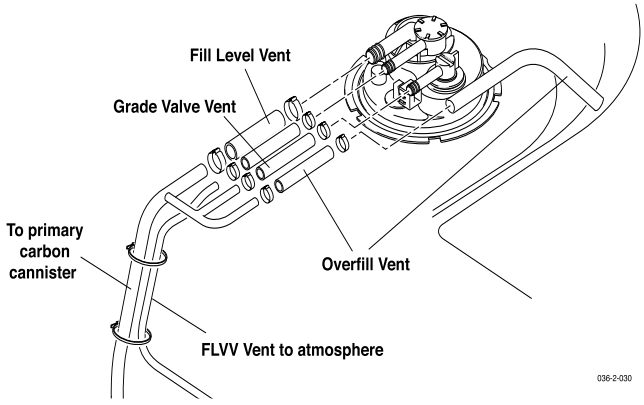
2.5.06.1 Fuel Pump Removal

Removal

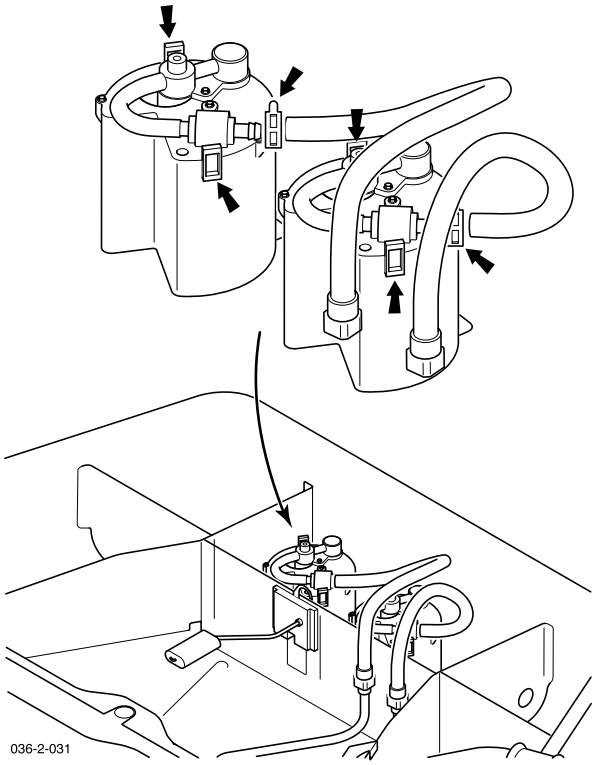
1. Drain the fuel tank (2.5.04.1)
2. Remove the parcel shelf pod.
3. Remove the access cover over the fuel tank flange.



4. Arrange adequate ventilation inside the vehicle (i.e. vehicle in a well ventilated area, windows open)
5. Disconnect the fuel tank electrical connector.
6. Disconnect four hoses from the fuel tank emission control valves.



7. Release and remove the evaporative loss flange.
8. Release and remove the fuel pumps

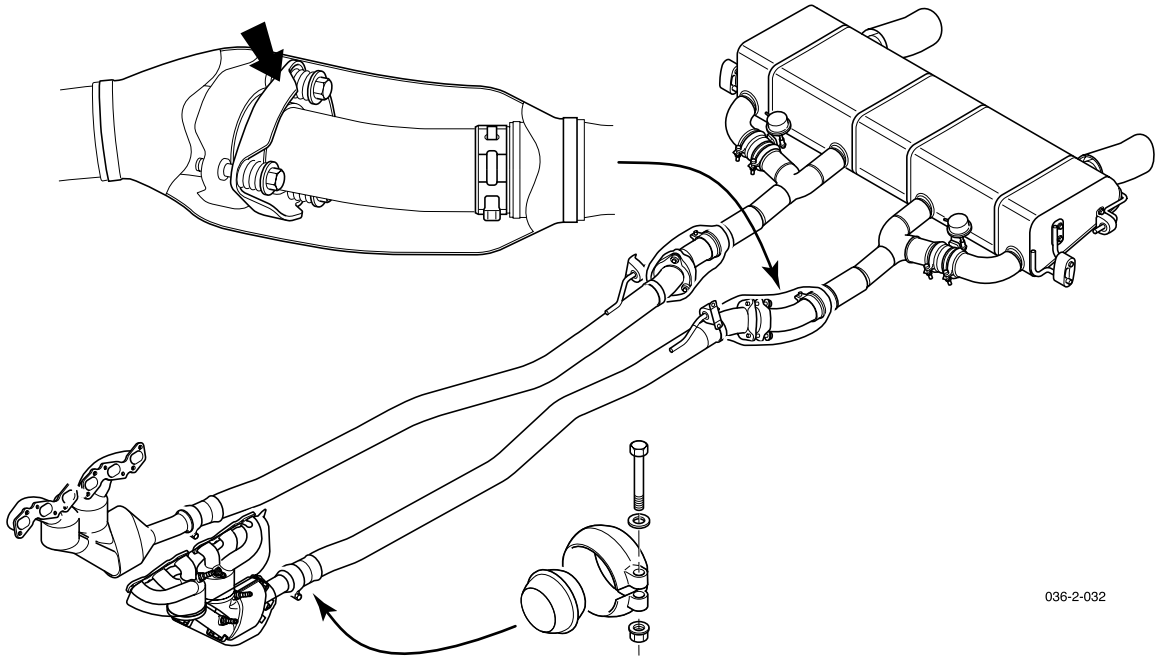


Installation

1. Installation is the reverse of the removal procedure.
2. On completion of the installation, the fuel pumps must be primed using procedure (2.0.01)

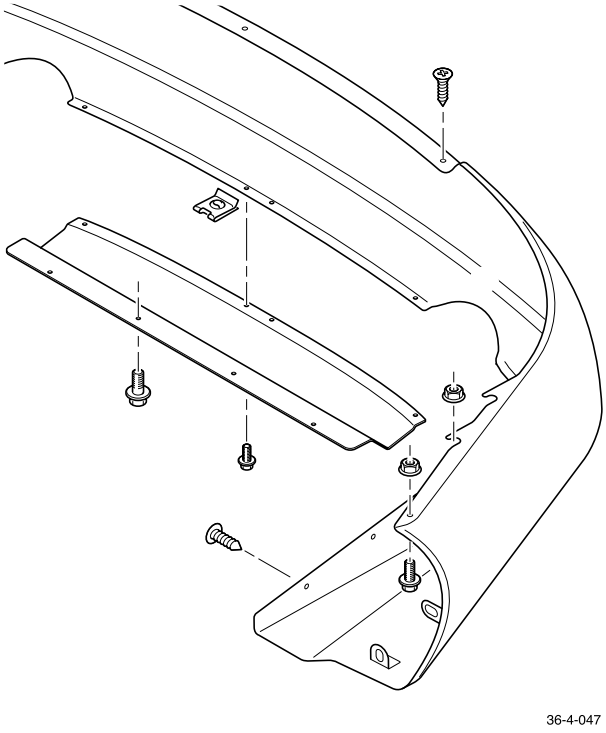
2.7.01.1 Exhaust System

1. Raise the vehicle and remove the tunnel shear panel and rear undertray.
2. Release two clamps at the front and two 3-bolt flanges at the rear. Remove the intermediate exhaust pipes.



3. Remove the rear bumper cover.

   - Release two pinch nuts and one screw in each wheel arch
   - Remove four screws from the rear lower edge
   - Remove five screws from the upper edge
   - Remove the bumper cover

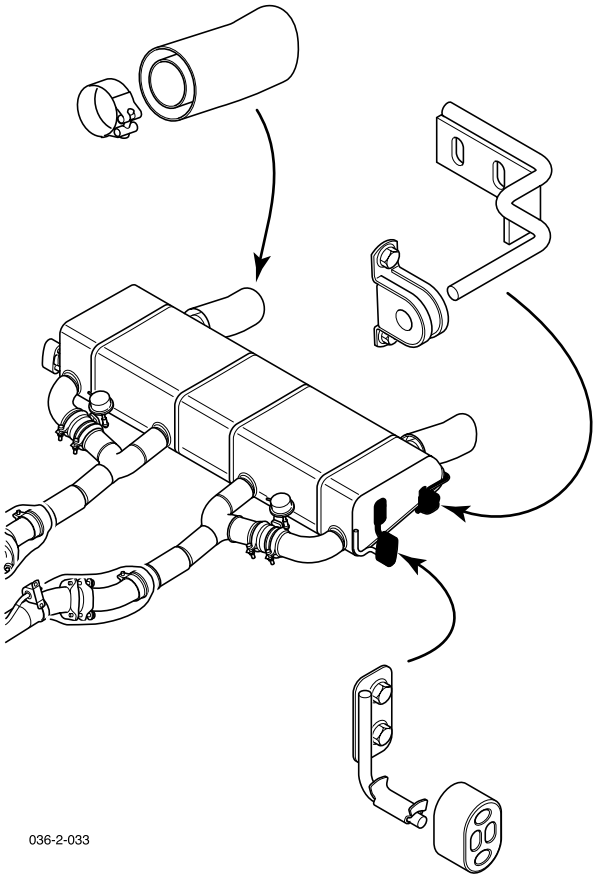


4. Disconnect the vacuum lines from the bypass valves.

5. Remove the silencer assembly.

   Warning: Danger of personal injury. This is a two person operation. Obtain assistance in handling the silencer assembly.

   - Remove the tail pipe finishers
   - Release the front hangers
   - Release the rear hangers
   - Remove the silencer assembly



Installation

Seal all clamp joints with a proprietary exhaust sealant prior to securing loosely. Fit new manifold flange gaskets.

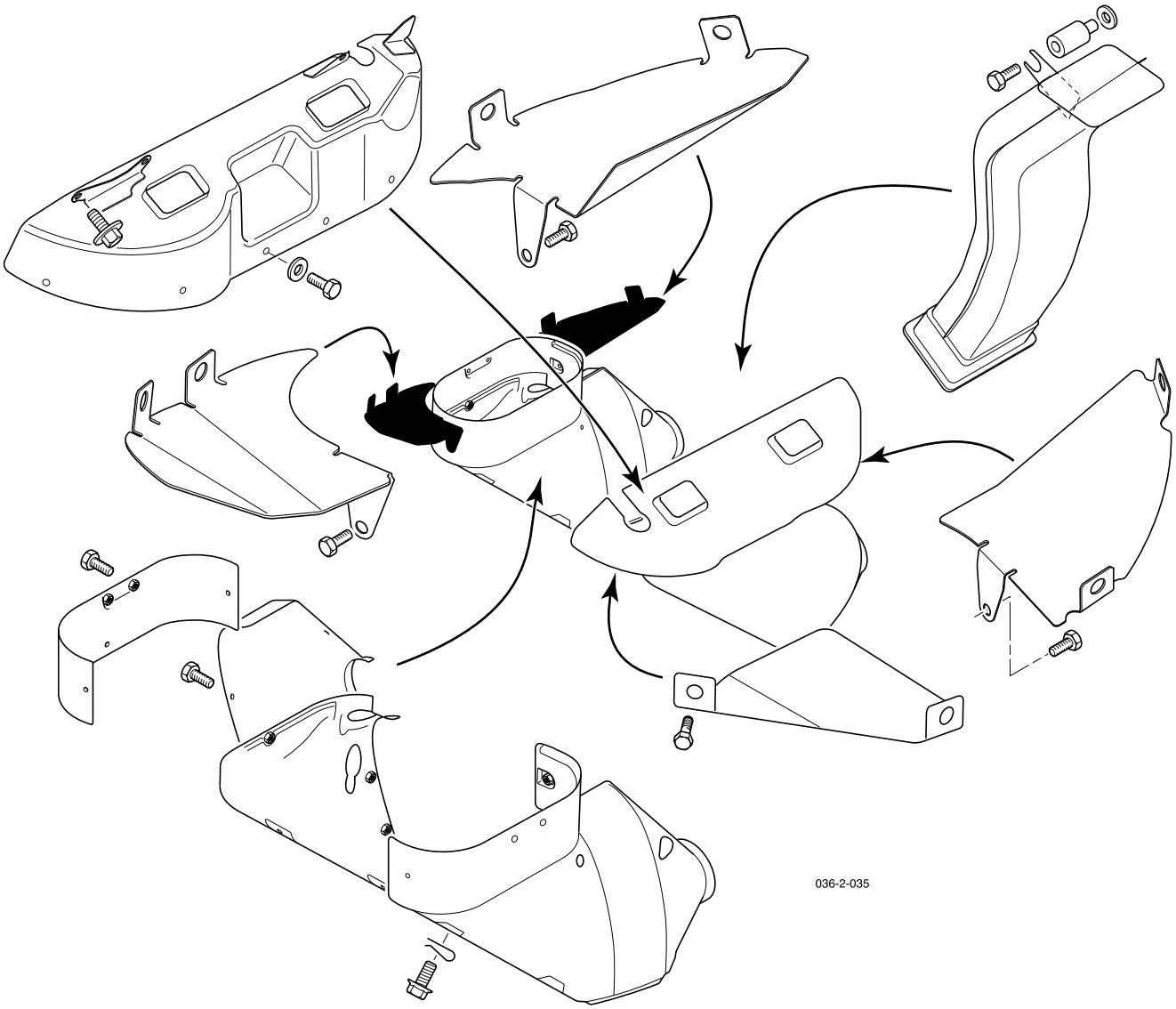
Work from the front and set all bodywork clearances prior to final tightening of all exhaust fixings.

2.7.02.2 Exhaust Manifolds

Removal

1. Remove the engine (1.0.01.1)

2. Remove the exhaust heatshields.
   - Remove the lower heat shield nuts
   - Remove the lower heat shields

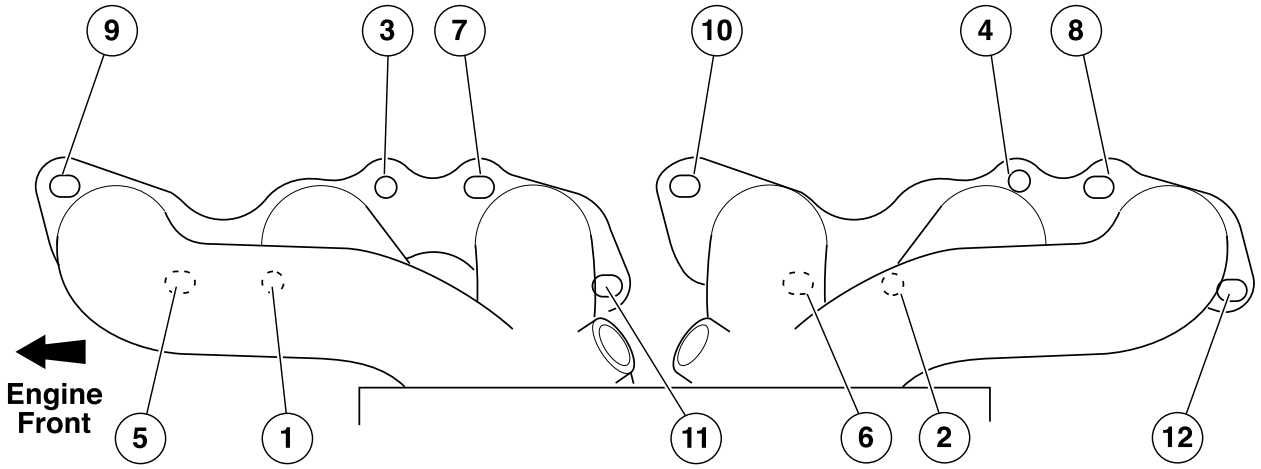


3. Remove the exhaust manifold

- Remove twelve manifold nuts
- Remove the manifold
- Remove and discard the manifold gasket

Installation

1. When replacing the manifold, use new gaskets and tighten the nuts in the sequence shown in the diagram below.



Hole No.	Fastener	Description
1 to 12		M8 x 1.25 Nut
Note	Torque Sequence 1 to 12 Torque all Fasteners 18-22 Nm	

036-2-034

2.0.01.3 Engine Fuelling Quick Check

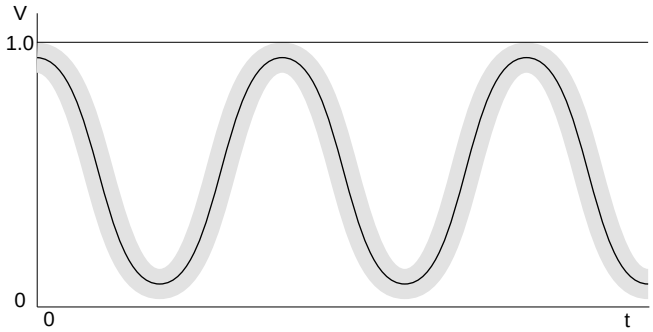
This procedure is intended as a quick check for correct engine running after major work on the fuel system. It uses the WDS datalogger to monitor the engine management oxygen sensor output signals.

A regular fluctuating signal from all EGO sensors indicates normal fuelling and ignition performance on both sides of the engine. If this is accompanied by a clear DTC log, then there are no current engine management problems.

1. Connect the WDS and note all logged DTCs.
2. Set the datalogger to monitor VEGO11 and VEGO21 for both PETEC modules.

   VEGO = Voltage - Exhaust Gas Oxygen sensors

   Also monitor ΔFPRESS (fuel rail pressure) for both fuel rails
3. Start the engine and run at idle until the temperature gauge rises above minimum.
4. Start the datalogger to monitor the upstream engine management VEGO signals. Observe the signal trace and compare with the illustration below



Approximate Engine Management Oxygen Sensor Output
(Engine at idle or at steady state running)

5. Note also the fuel rail pressure for both fuel rails.
6. Raise the engine speed to a steady level of approximately 2000 rpm. Again monitor the upstream VEGO signals and ΔFPRESS readings.
7. If there are no engine management DTCs logged and if the signal patterns observed in steps 3 and 4 meet the following guidelines, then engine running is acceptable.

   Look for:

   - a regular rise and fall in the EGO signal voltage
   - Increased frequency of EGO signals with increasing rpm.
   - similar signal patterns from all four EGO sensors
   - no major iregularities over time

   - ΔFPRESS above 40 psi for both engine banks
8. If the VEGO signal patterns are irregular or not closely matched, check for newly logged DTCs and investigate them using the procedures in the OBDII Diagnostic Manual.
9. Stop the datalogger and switch off the engine.

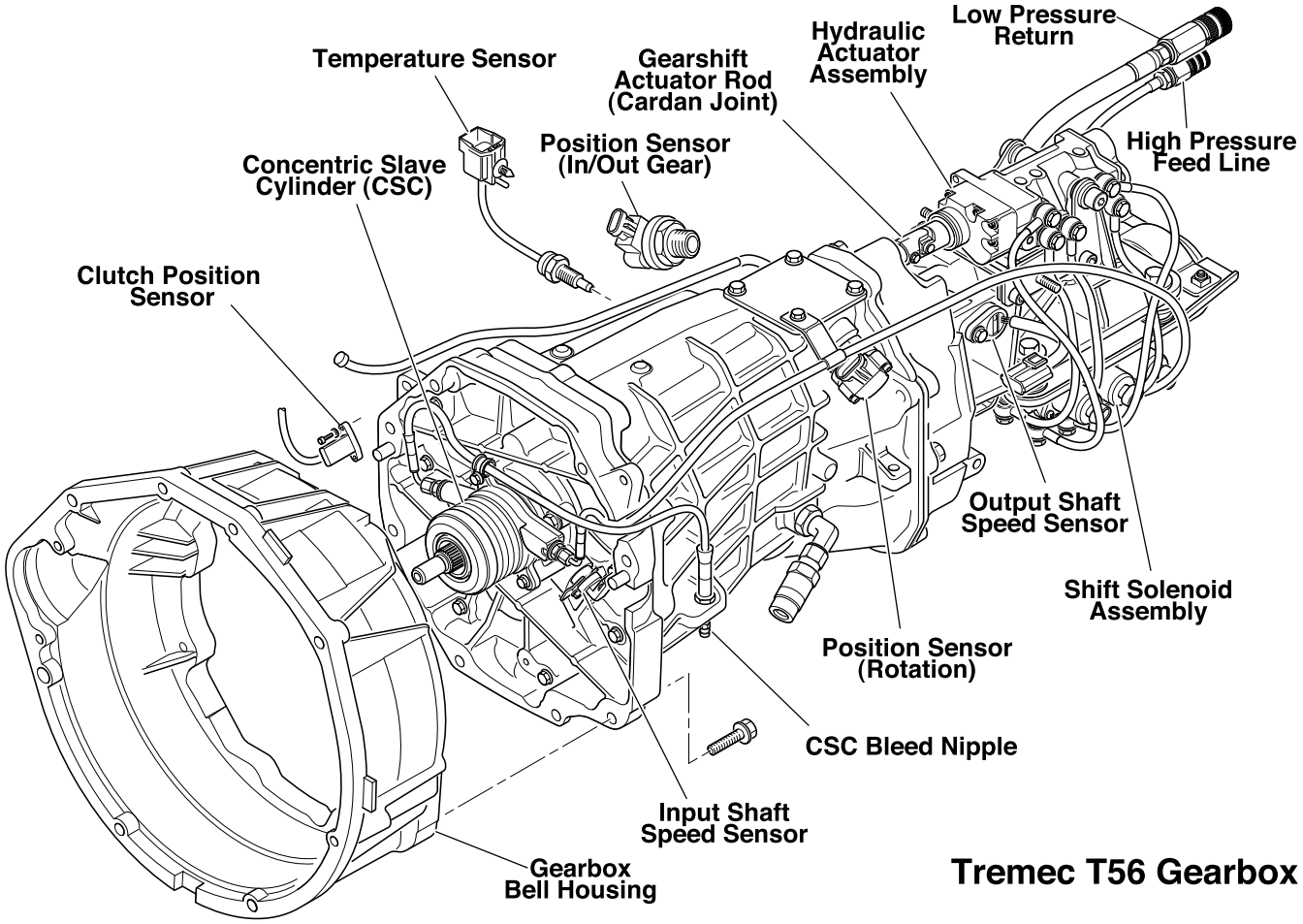
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Transmission - General Description

Transmission Type

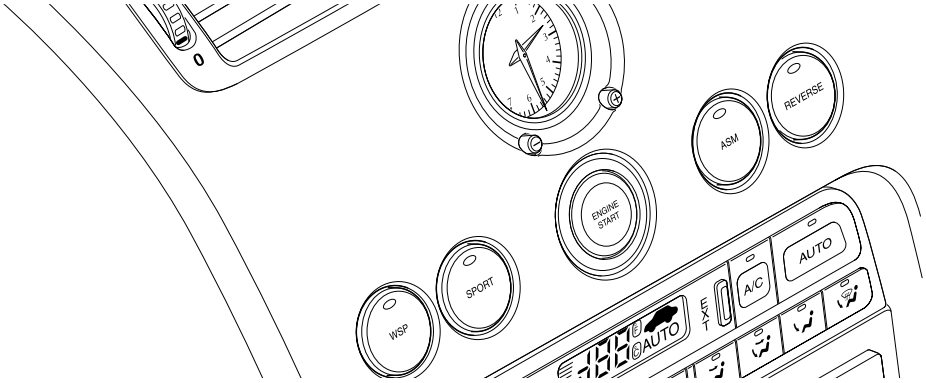
The V12 Vanquish is supplied with a Tremec T56 manual transmission fitted with a Magneti Marelli 'Paddle Operated' gear shift system. The clutch is a single plate, diaphragm spring type and is operated automatically by a concentric slave cylinder mounted around the first motion input shaft in the gearbox bell housing. Both gear shift and clutch operations are performed by the Transmission Control Unit (TCU) via a series of hydraulic solenoid valves and actuators. Gears are changed in either Select Shift or Auto Shift mode.



036-3-001

Shift Modes

Shift modes are selected using the four buttons on the clock surround of the centre console. These switches 'flip' for left and right hand drive vehicles. Reverse is always closest to the driver.



036-3-002

When the ignition is switched on, the transmission always reverts to Select Shift Mode. All alternative modes (except Wheel Slip Protection) are cancelled on switching off the ignition.

The Reverse button (R) will only cause selection of reverse gear when the vehicle is stationary.

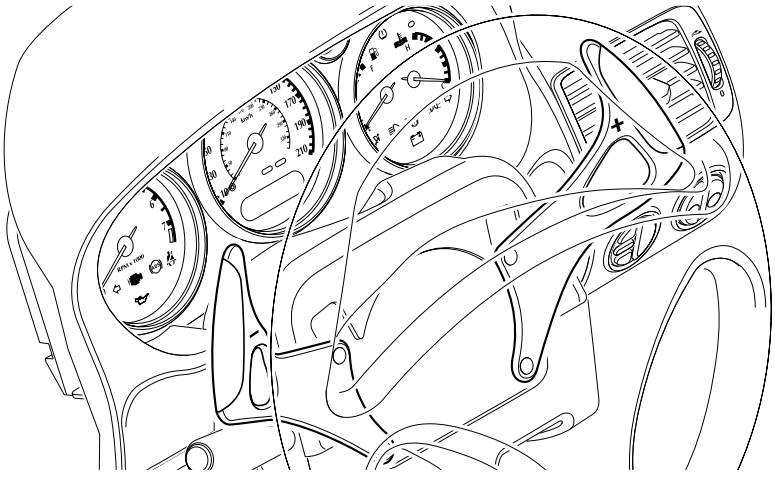
The ASM button selects/deselects Auto Shift Mode.

The Sport button selects/deselects Sport Mode.

The (WSP) button selects/deselects Wheel Slip Protection Mode.

Select Shift Mode (SSM)

When the ignition is switched on, the transmission always reverts to Select Shift mode. In Select Shift Mode (SSM) the gears are shifted up by the driver pulling the right (+) shift paddle. The gears are shifted down by the driver pulling the left (-) shift paddle.

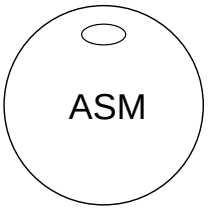


036-3-003

Neutral is selected by pulling both paddles at the same time.

The Transmission Control Unit (TCU) monitors the vehicle speed and current gear and will inhibit inappropriate gear changes, or selection of reverse at high speeds.

Auto Shift Mode (ASM)



036-3-043

In Auto Shift Mode (ASM) the gears are shifted up or down automatically by the transmission control unit after 1st gear has been manually selected. The operation is similar to an automatic gearbox with the following exceptions:

a) Clutch engagement is controlled by the throttle. 'Blipping' of the throttle with the brakes applied must be avoided since it would cause intermittent clutch engagement and excessive wear on the clutch mechanism.

b) The clutch is automatically disengaged when the vehicle comes to a halt with the engine idling. The brakes MUST be used to safely hold the vehicle during any temporary stop, particularly when stopped on an incline. Use of the throttle (clutch) for hill holding will cause excessive clutch wear.

c) There is no park lock mechanism to prevent the vehicle rolling when parked. Therefore the handbrake must always be used to secure the vehicle when parking.

d) The gearshift control system will always select first gear and engage the clutch when the ignition is switched off unless the driver deliberately selects neutral.

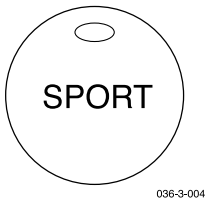
1st Gear Selection

The transmission will automatically shift to 1st gear as the vehicle is brought to a halt. If neutral is selected and then the ignition is switched off, the transmission controller will hold electrical power, switch the gearbox into first gear and then drop all electrical power. This system uses first gear when parked to reduce the risk of the vehicle rolling when left on an incline.

Note: The TCU will select Neutral if both the brake and Throttle are not depressed at a low vehicle speed for 10 seconds.

Additional Transmission Functions

Sport Mode - This mode may be selected at any time when either ASM or SSM is in operation. This mode is designed for the driver who wishes to extract maximum performance from the vehicle. In this mode, upshifts and downshifts occur more aggresively than in normal mode, permitting maximum acceleration and more effective engine braking. The upper limit on engine speed is also increased to permit engine use up to the rev limit in SSM and just below the rev limit in ASM.



036-3-004

Wheel Slip Protection Mode - This mode limits engine speed and reduces the possibility of wheel slip on ice or snow by upshifting at about 3,000 rpm.

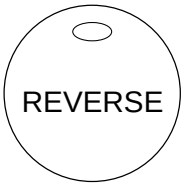


036-3-005

Neutral selection - Neutral may be selected at any time by pulling both paddles simultaneously. This will select neutral but will not inhibit the automatic selection of first gear at ignition off. Neutral must be selected to allow engine cranking.

Neutral should be selected whenever the vehicle is parked for extended periods and the battery conditioner should be used to maintain battery charge. If left in gear with a discharged battery, the vehicle cannot be moved.

If you require to place the transmission into neutral permanently, pull both paddles twice in quick succession and switch off the ignition within three seconds. This will permanently select neutral for such purposes as towing or manually moving the vehicle in a workshop



.**Reverse Selection** - Reverse may be selected from Neutral with:

- The brake applied.
- The vehicle at rest

by pressing the reverse button once.

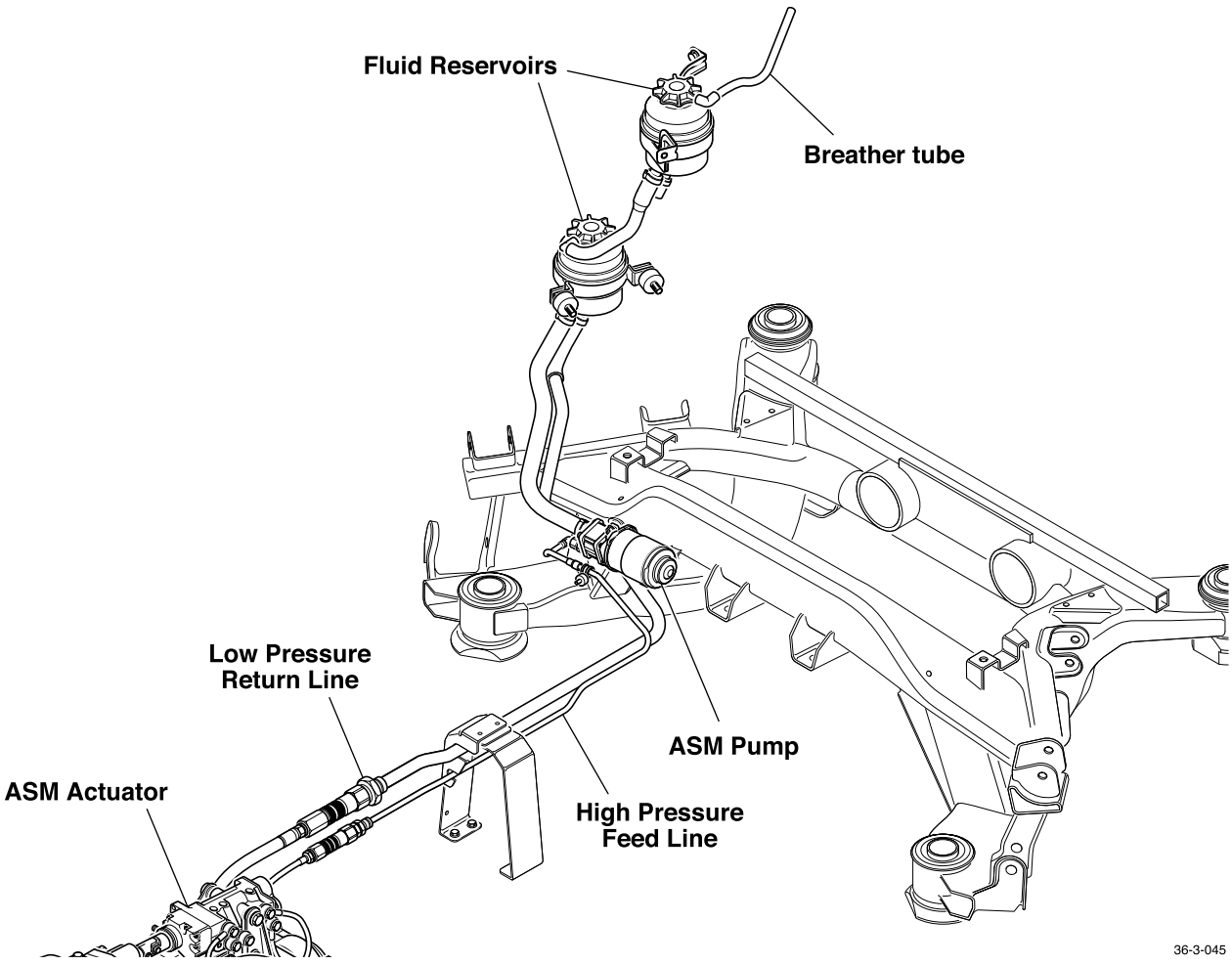
If the Reverse button is pressed whilst:

- In 1st gear
- Brake applied
- At low vehicle speed

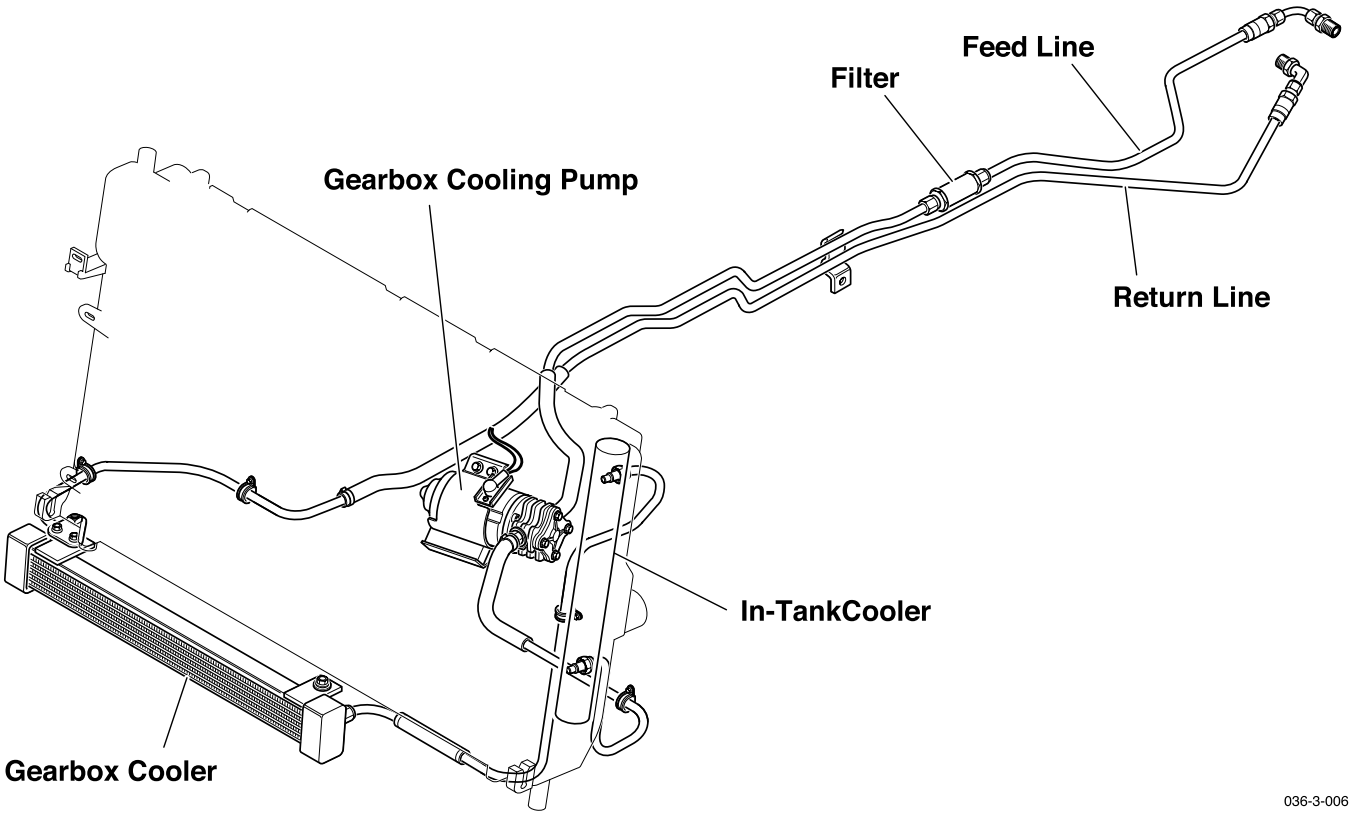
Neutral will be selected

ASM System - Fluid Pressure

The fluid pressure necessary to actuate the ASM system valves is generated by the ASM pump in the rear axle well. Pressurised fluid is fed to the ASM valve block, used in actuating the gearshift valves and then returned to the twin ASM reservoirs. Two reservoirs are necessary to allow adequate degassing of the ASM fluid before it is pumped into the pressurised system. Any gasses included in the circulating fluid would cause serious inefficiencies in gear-shifting. The ASM reservoir and fluid lines must be filled and bled using the WDS procedure before being coupled to the transmission.



Transmission Cooling



A pump mounted on the belly plate cuts in at the pre-determined temperature and pumps transmission oil through the cooling system and back to the transmission.

Transmission Specifications

Type

Six speed Tremec T 56 gearbox

Gear Ratios

1st	2nd	3rd	4th	5th	6th	Reverse
2.66:1	1.78:1	1.30:1	1.00:1	0.80:1	0.63:1	2.90:1

Transmission Fluid

Texaco Dexron III

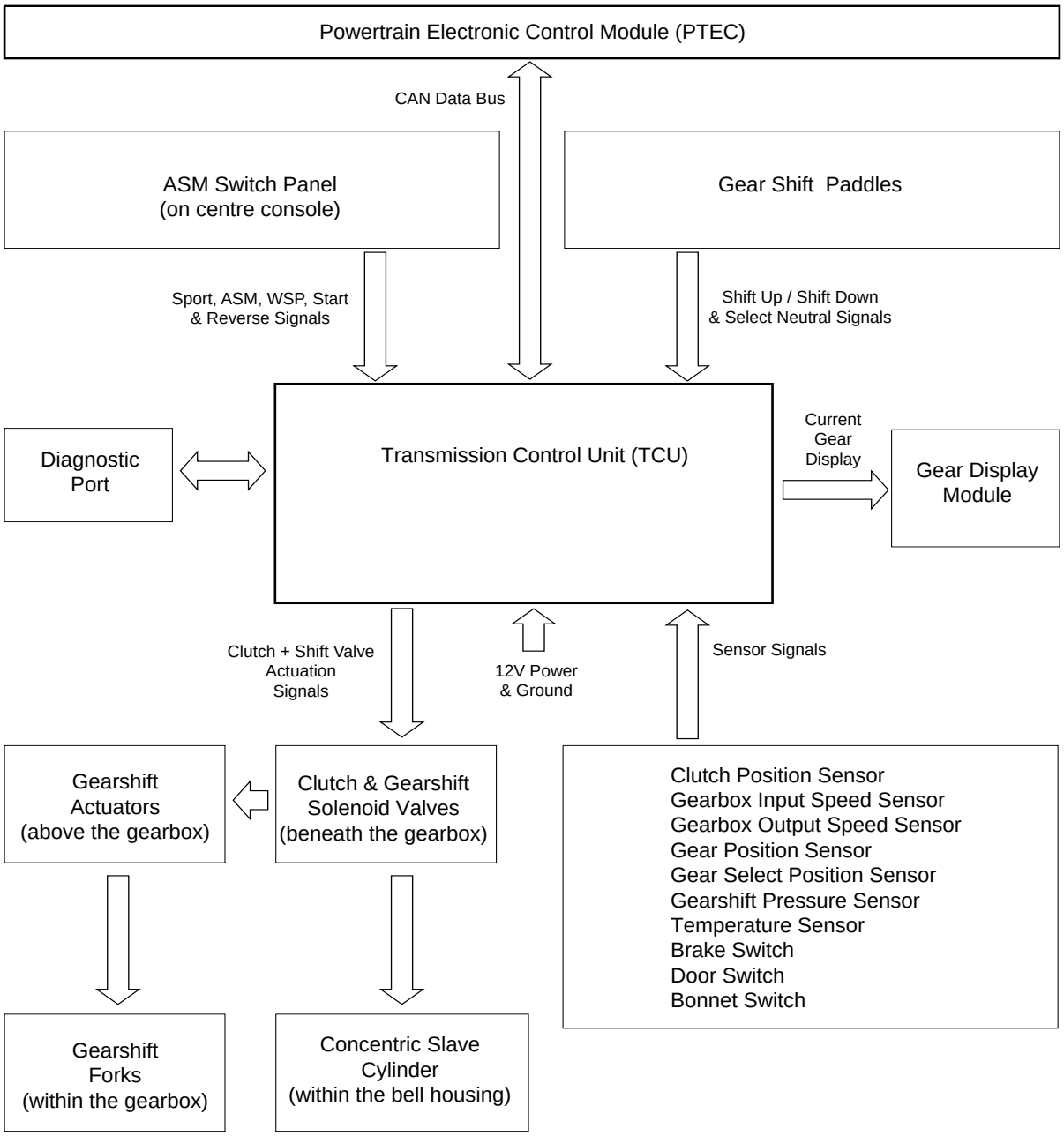
Fluid Change Interval

Recommended at 30,000 miles. Due to having no fill hole, if the transmission cooling system is opened, the whole system must be drained and refilled with 4.17 litres of Texaco Dexron III.

Transmission Weight:

62 kg

Transmission Control System



The TCU processes the incoming signals and outputs commands to the clutch and gearshift solenoid valves to change gear as necessary. Such gearchanges may be at the command of the driver in Select Shift Mode or may be performed automatically in Auto Shift Mode.

The two Power Train Electronic Controller (PTECs) are in constant communication with the TCU. The TCU constantly monitors vehicle status and will only permit gear changes when safe and appropriate. Gear changes are inhibitted when driver safety may be compromised or when the vehicle might be damaged by excessively high or low engine speeds.

Solenoid Valve Operation

The shift solenoid assembly contains six solenoid valves. Five valves control gear shifting and the sixth valve controls clutch operation. The following table shows solenoid logic.

Table 1: Solenoid Valve Actuation

Gear	EV1	EV2	EV3	EV4	EV5
1	1	0	1	0	1
2	0	1	1	0	1
3	1	0	1	1	1
4	0	1	1	1	1
5	1	0	1	1	1
6	0	1	1	1	1
Reverse	1	0	0	1	0
Neutral	1	1	1	0	1

0 = Off

1 = On

Valves EV1 and EV2 control the gear engagement.

Valves EV3, EV4 and EV5 control the gear selection.

Valve EVF controls the concentric slave cylinder (Off for clutch engagement)

Transmission Diagnostics

The following applications are included in the transmission diagnostics software suite:

Communications driver for the Selespeed Module

Transmission Datalogger

Transmission Setup

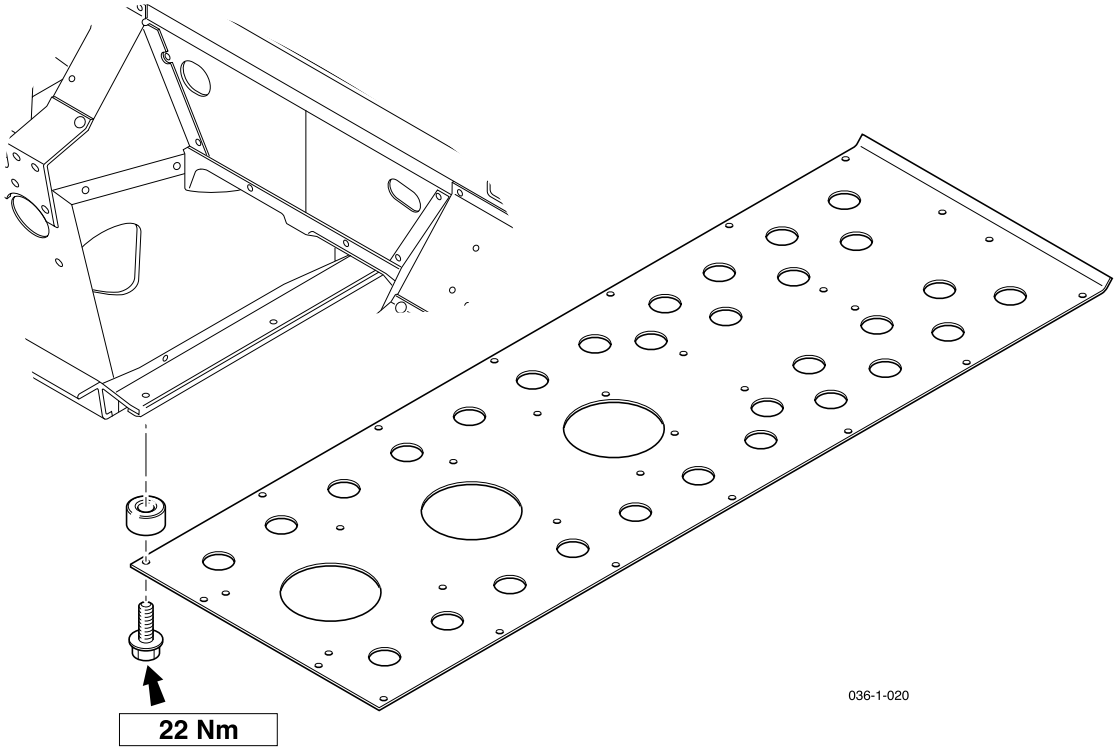
- Potentiometer Check
- Pump Reservoir Bleed
- Actuator Lock Test
- 3rd / 4th Gear Burn Test

Transmission Fluid Bleed

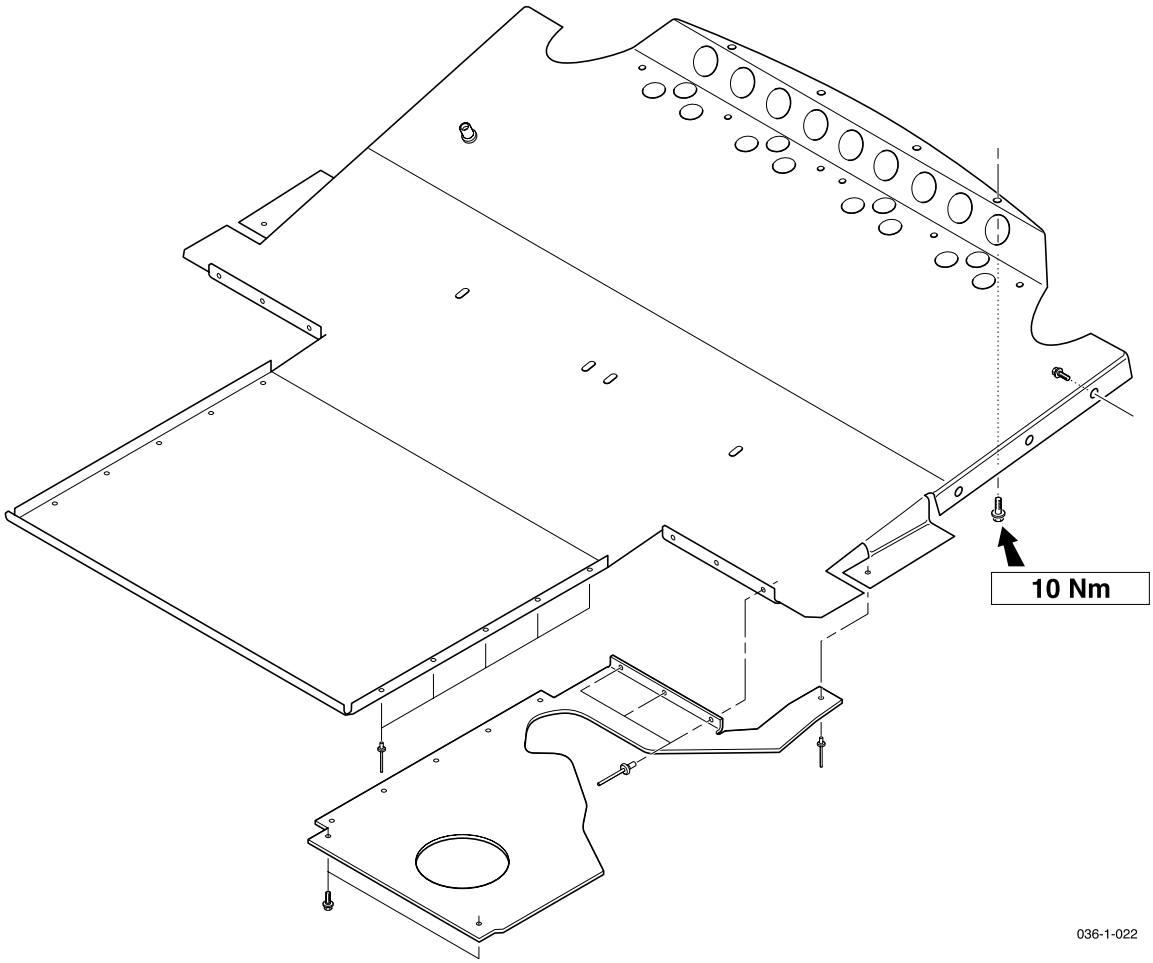
3.1.01.2 Transmission - Removal

Procedure

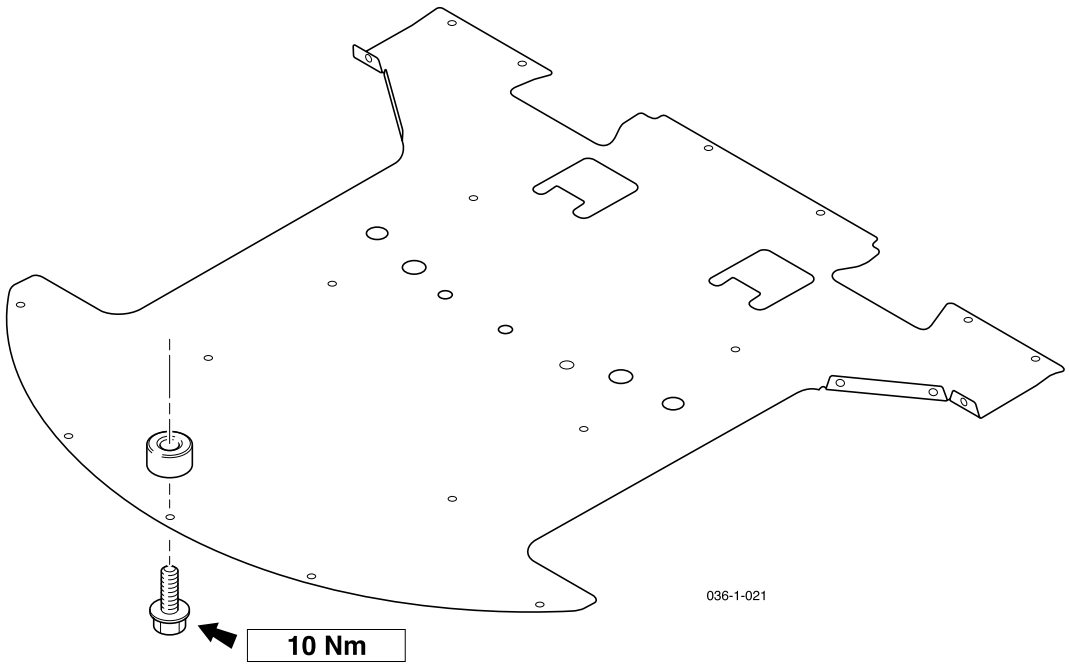
1. Switch off the battery disconnect switch.
2. Raise the vehicle on a four point hoist.
3. Remove the tunnel shear panel.



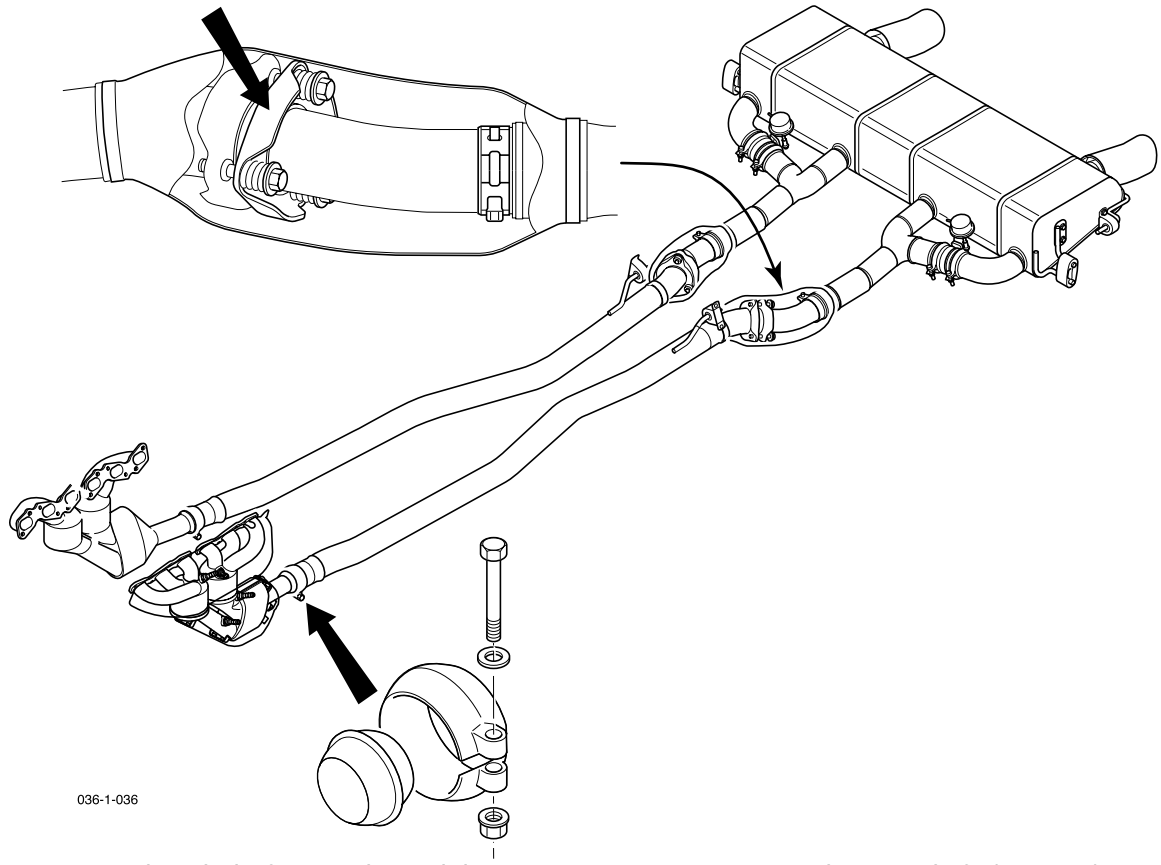
4. Remove the rear undertray. (16 bolts, 8 screws and 12 spacers)



5. Remove the front undertray. (15 bolts and 4 screws from the wheel arch liners)



6. Remove the exhaust intermediate pipes.



- Remove three bolts from each rear joint.
- Release two front clamps
- Flex the silencer rearwards and remove the intermediate pipes.
- Remove the intermediate pipe heat shields.

7. Remove the prop shaft. (3.4.02.3)

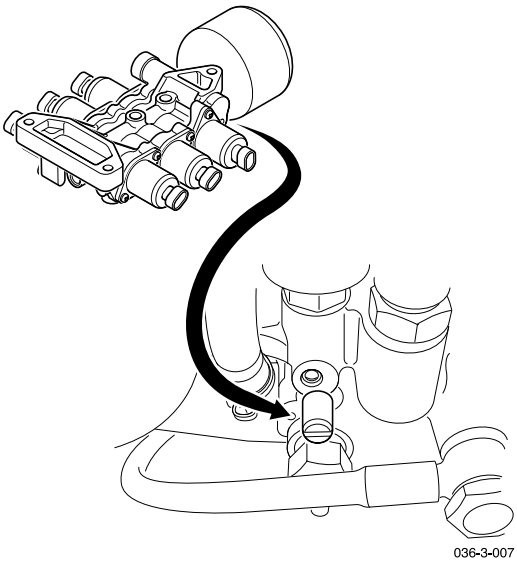
- Remove three bolts securing the propshaft to the hypoid unit drive flange.
- Remove the prop shaft.

8. Secure a transmission jack to the gearbox.

9. Release the pressure in the ASM system by opening the high to low pressure bypass screw. Close the bypass screw as soon as the rush of fluid ceases and before opening the quickfit connectors.

   Caution: This step is essential to release the pressure in the ASM hydraulic system.

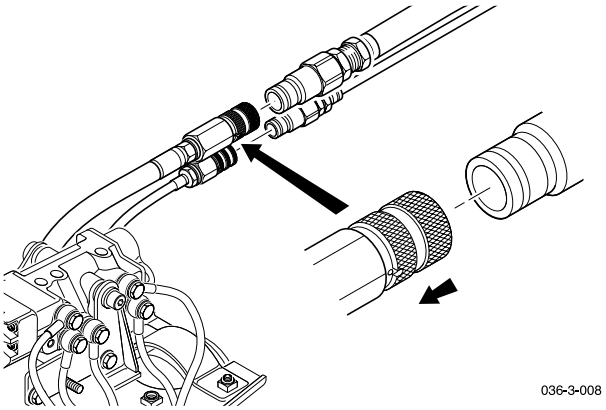
   If not completed, difficulty will be experienced in reconnecting the ASM pump lines because of residual pressure. Fitting of the transmission to the engine will also be difficult because residual pressure in the clutch cylinder will inhibit mating of the gearbox to the bell housing.



036-3-007

10. Disconnect the ASM pump supply and return line quickfit connectors at the rear of the gearbox.

    - Rotate the collar to line up the notch with the locator ball.
    - Push back the collar and disconnect the hose.

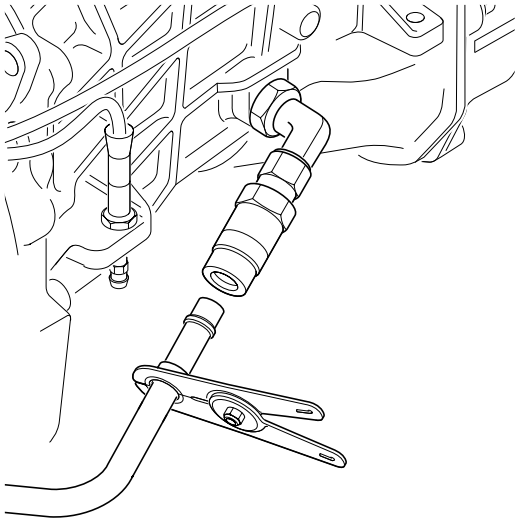


036-3-008

Caution: Do not open any other ASM hydraulic system lines. It is not possible to bleed the system and the warranty will be void if any other hydraulic lines are opened.

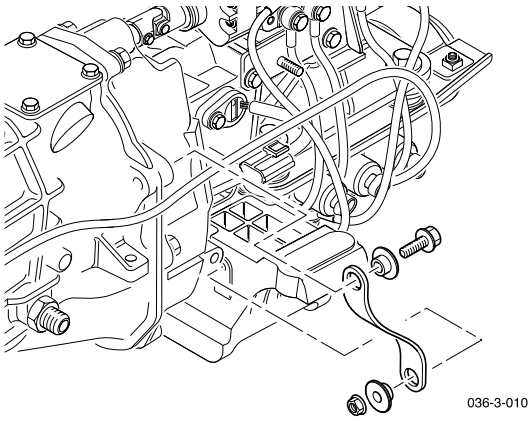
11. Disconnect the gearbox cooling pipes.

    - Clamp the extractor tool (307-447) onto the pipe union.
    - Push the lock inboard and disconnect the pipe
    - Drain any escaping oil into a suitable container.



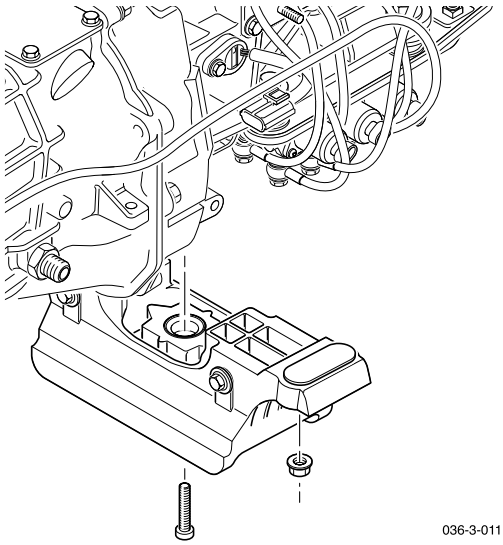
036-3-009

12. Release two bolts and the transmission retainer straps from the transmission support bracket.



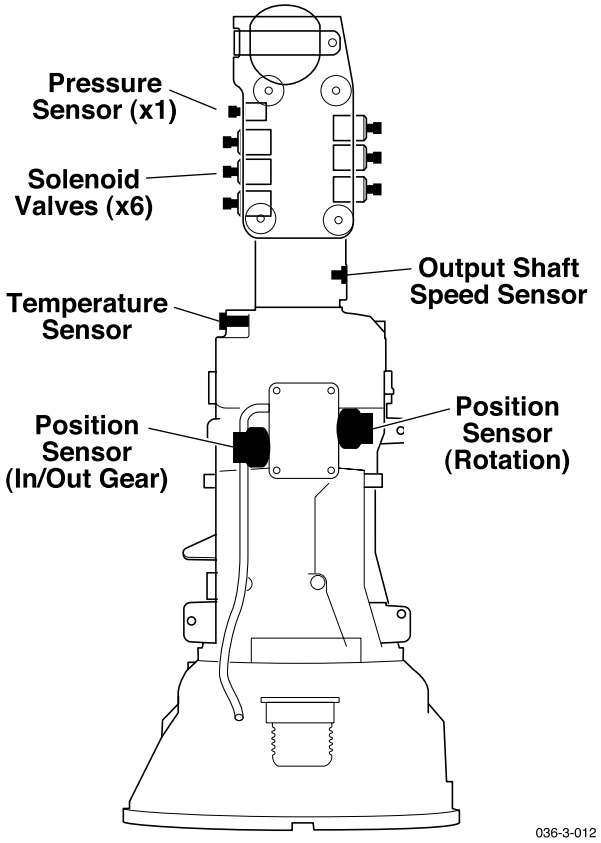
13. Remove the transmission support bracket.

- Remove one torx 50 screw
- Remove four nuts and the gearbox support

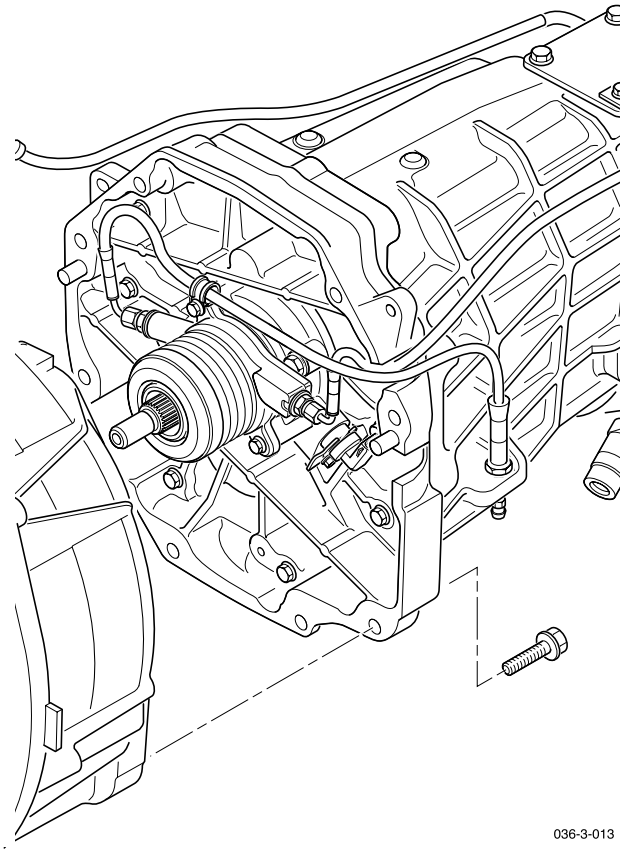


14. Lower the rear of the gearbox to access the electrical connectors. Disconnect the following connections:

- 7 connectors at the rear (6 solenoid valves and the pressure sensor)
- 1 temperature sensor connector
- 2 position sensor connectors on the gear shift mechanism
- 1 output speed sensor connector

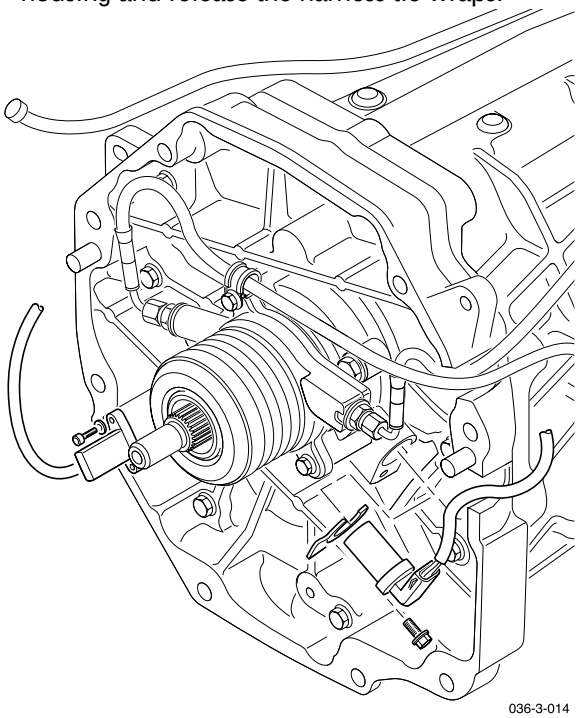


15. Remove eight bolts securing the transmission to the bell housing.



16. Move the transmission rearwards approximately 75mm (3 inches).

17. Disconnect the input speed sensor and clutch position sensor connectors inside the clutch housing and release the harness tie wraps.



18. Move the transmission clear of the bell housing and remove the transmission/ASM system as a complete assembly

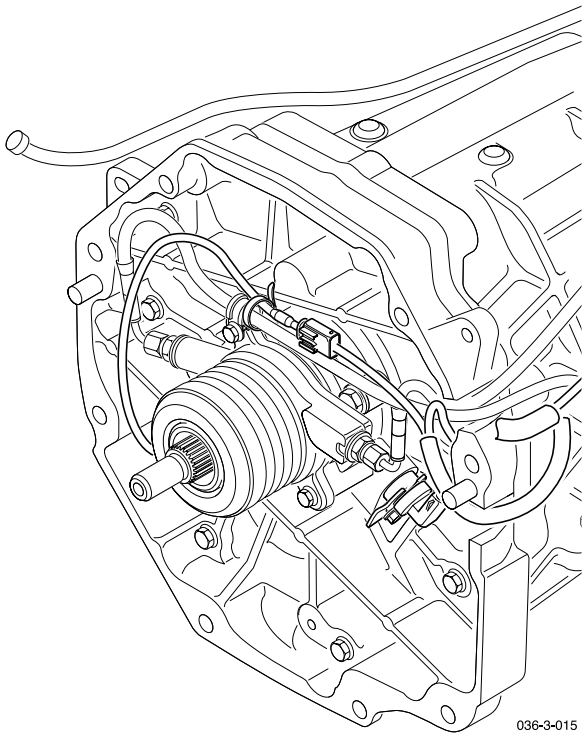
Caution: Do not open the ASM hydraulic system. Bleeding of the system is not possible without special equipment. Opening of the system will also invalidate the ASM system Warranty

Installation

1. Using special tool 303-667, check that the clutch plate is accurately centred to the flywheel pilot bearing.

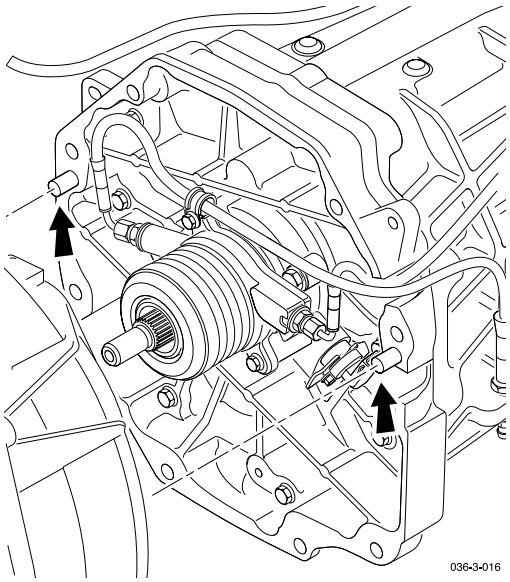
2. Lift the transmission on a hoist and offer it to the bell housing.

3. Reconnect the input speed sensor and clutch position sensor. Secure the harness clear of moving parts.



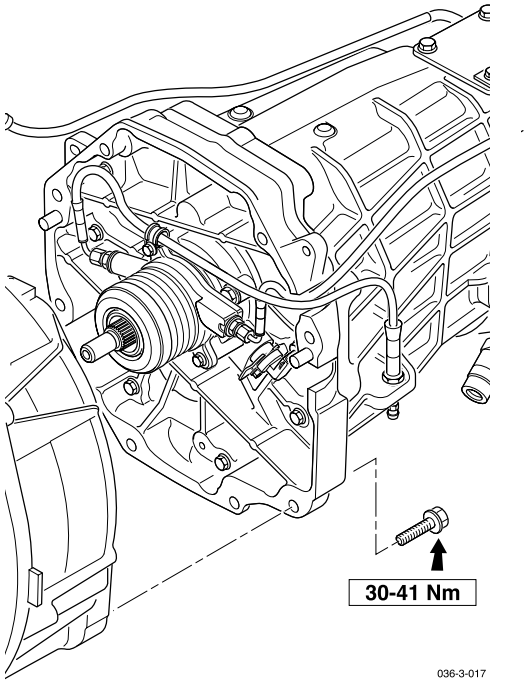
4. Close up the transmisison to align the input shaft with the clutch plate and pilot bearing.

5. Align the transmission unit as necessary until the two gearbox dowels are aligned with the dowel pin holes on the bell housing.



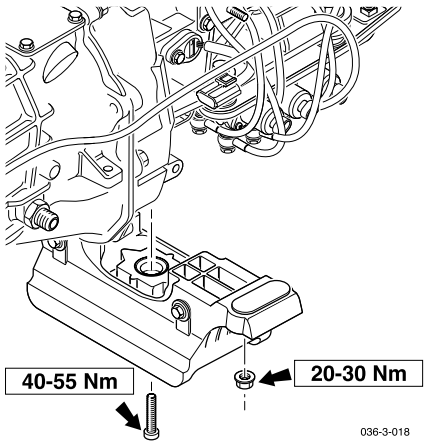
6. Insert the eight bolts and nip up to safely secure the transmission.

7. Cross torque all eight bolts to 30-41 Nm.



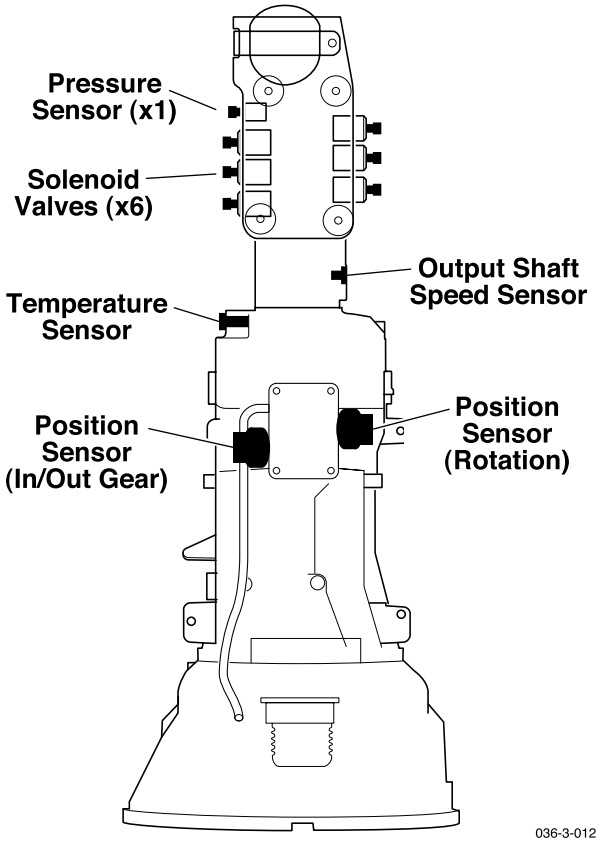
8. Raise the transmission to its final position. Refit and secure the transmission rear mount

- Tighten the four nuts to 20-30 Nm.
- Tighten the torx 50 screw to 45-55 Nm.

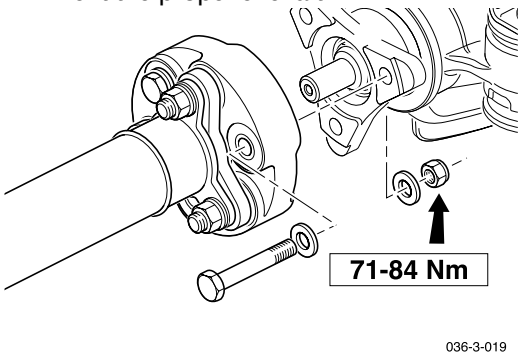


9. Refill the transmission (3.1.01.2).

10. Refit the 11 gearbox electrical connectors



11. Refit the propeller shaft



12. Reconnect the quickfit connections to the ASM reservoir.

13. Reconnect the exhaust system.

14. Refit the undertrays and tunnel shear panel.

15. Test drive the vehicle to ensure correct operation.

3.1.05.1 Flywheel Removal

1. Remove the clutch assembly 3.1.06.1

   Warning: Personal danger, the flywheel is heavy. Take care to provide adequate support when removing or replacing it.

2. Remove eight M10 bolts and retain for refitting.

   Caution: The flywheel assembly, including the mounting bolts, are a balanced assembly. Use the same bolts when reassembling to retain balance.

3. Place a support surface under the flywheel. Insert two of the flywheel bolts into the threaded puller holes in the flywheel.

   Warning: Personal danger. Prevent the flywheel from falling as it is released from the crankshaft.

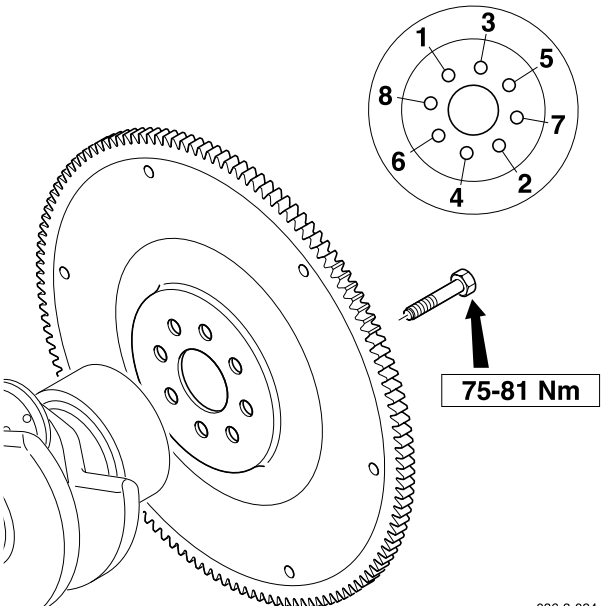
4. Tighten the bolts in stages to ease the flywheel from its location on the crankshaft.

Refitting

1. Using a suitable support surface under the flywheel, offer the flywheel to the crankshaft and align the attachment holes.

2. Loosely fit the eight flywheel mounting bolts and finger tighten.

3. Tighten the bolts in half turn stages in the pattern illustrated below. Continue until the flywheel face is in full contact with the crankshaft flange.

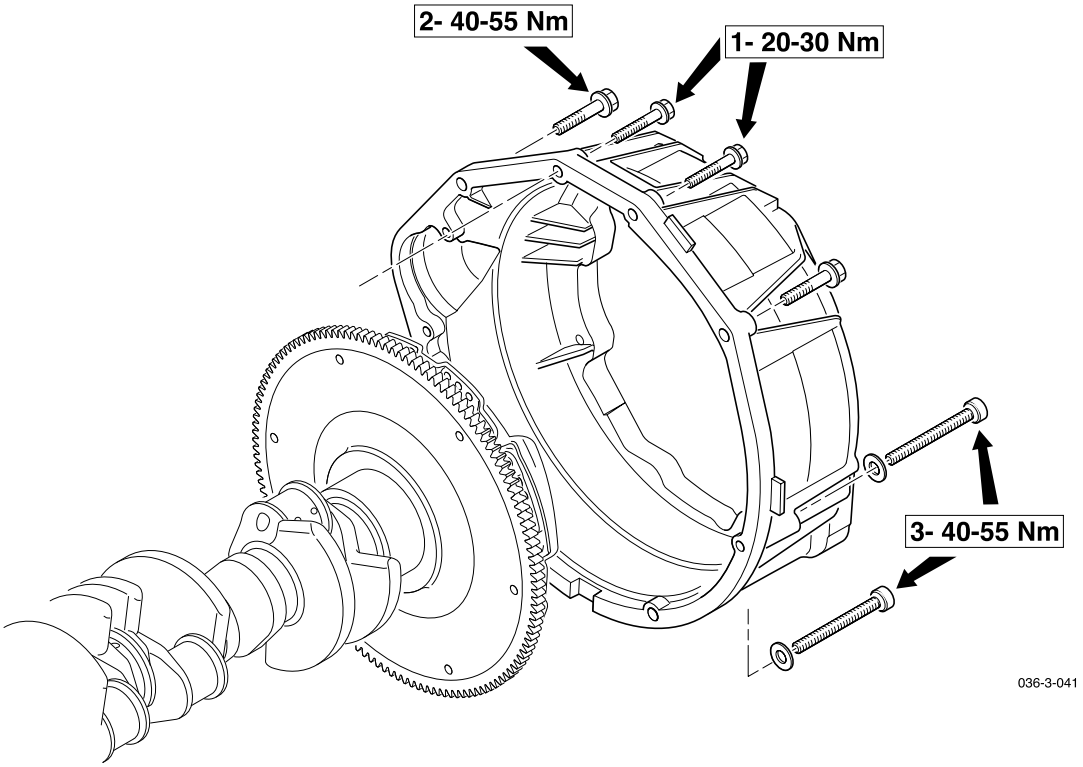


Loosen the bolts and then torque tighten in even stages to 75-81 Nm in a star sequence.

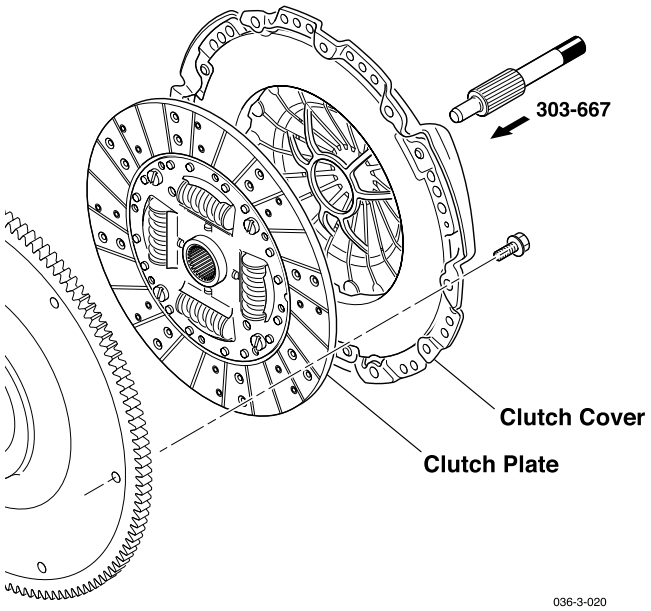
3.1.06.1 Clutch Assembly Renew

Warning: The clutch is replaced as a complete assembly (Flywheel, Plate and Cover). Replacing only the clutch plate will result in clutch non-release.

1. Remove the transmission (3.1.01.2)
2. Release the two starter motor mounting bolts
3. Remove the clutch bell housing.
   - Remove 8 bolts and the bell housing.



4. Remove the clutch assembly.
   - Insert the clutch plate alignment tool and remove six M8 bolts and lock washers. Retain these bolts for reassembly.



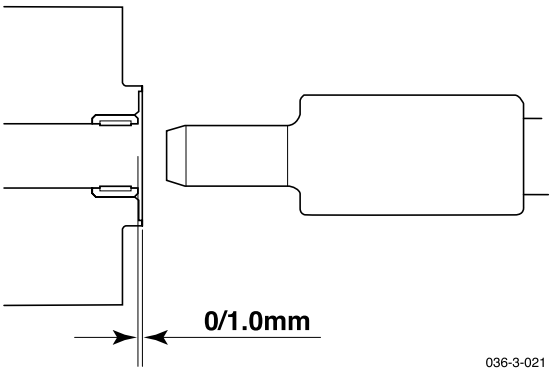
Note the alignment marks on the clutch cover.

- Remove the clutch cover
- Remove the clutch plate and alignment tool.

WARNING: The flywheel assembly is heavy. If removing the flywheel, ensure that it is adequately supported.

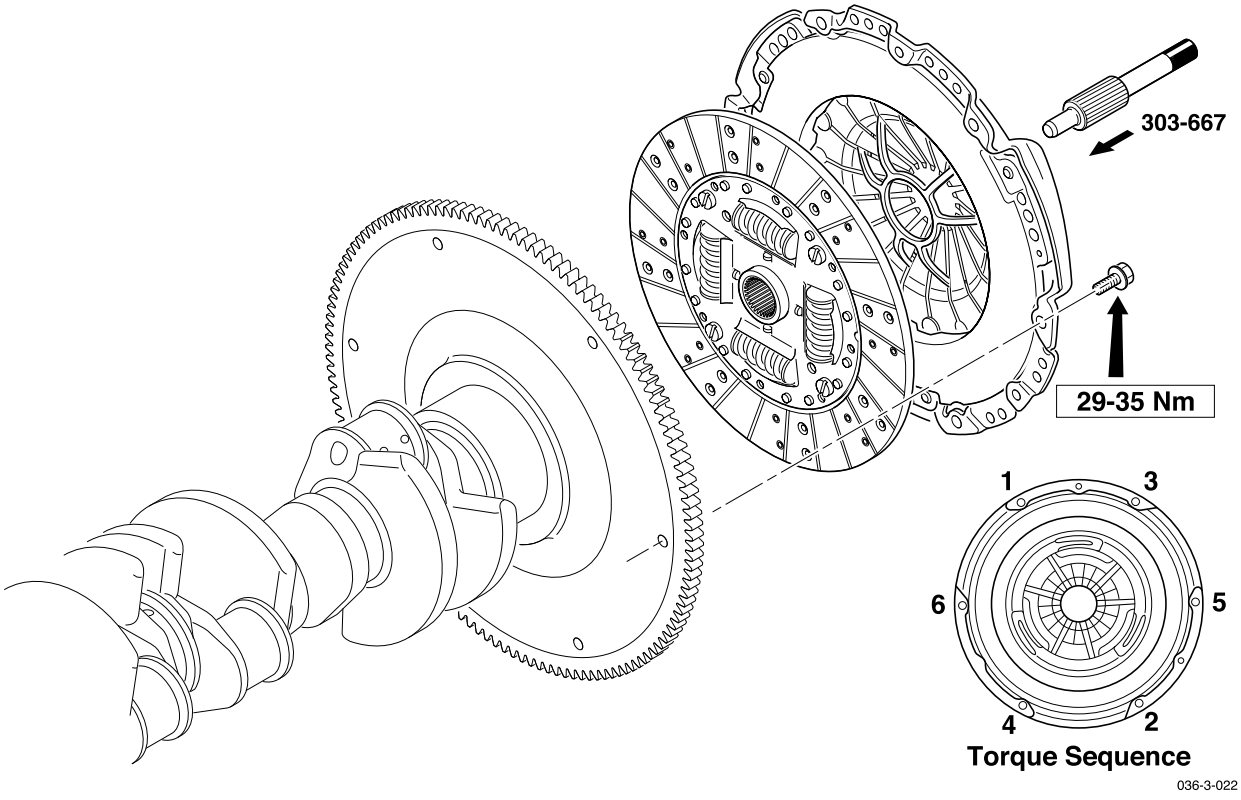
Installation

1. Check that the pilot bearing in the rear end of the crankshaft is 0.0-1.0mm below the crankshaft end face.



2. Insert the alignment tool through the new clutch plate. Make sure the tool and clutch plate are oriented correctly, as shown in the illustration. Offer the clutch plate to the flywheel and insert the alignment tool into the crankshaft pilot bearing. Seat the clutch plate to the flywheel face.

Note: The clutch plate is stamped "Flywheel Side" near the hub to aid in correct orientation to the flywheel.

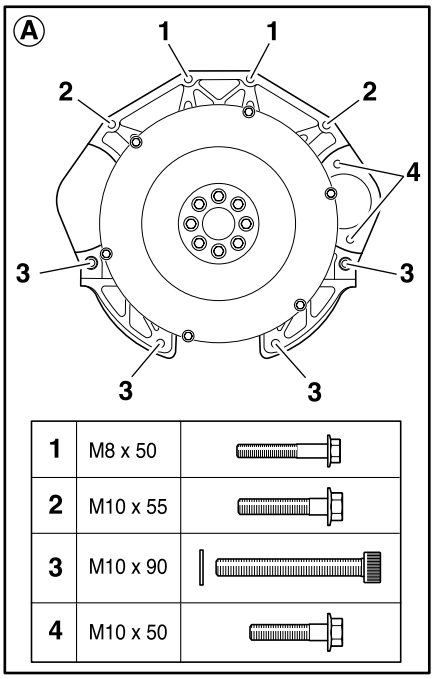


3. *Caution: The flywheel and pressure plate are a balanced assembly. Make sure the balance marks are aligned.*

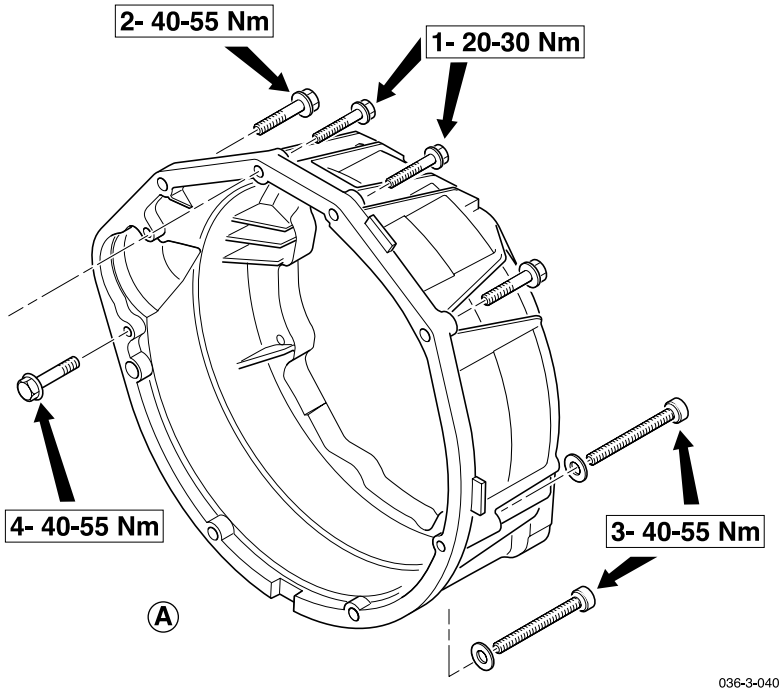
   Offer the clutch pressure plate to the flywheel, aligning the mark on the pressure plate/cover to the painted mark on the flywheel.

4. Insert six M8 bolts and torque to specification (29-35 Nm). Remove the alignment tool.

5. Refit the bell housing and torque the M8 bolts to 20-30Nm and the M10 bolts to 40-55Nm.

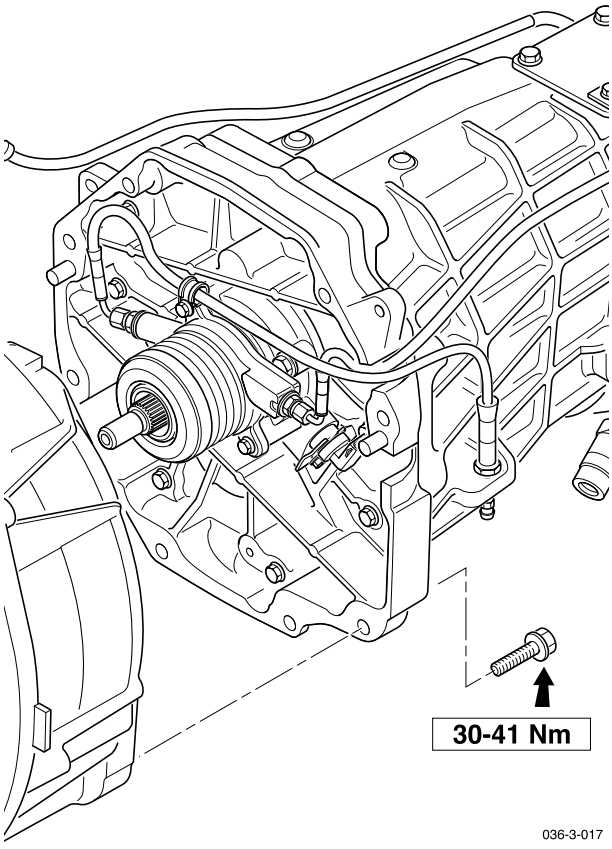


1	M8 x 50	
2	M10 x 55	
3	M10 x 90	
4	M10 x 50	



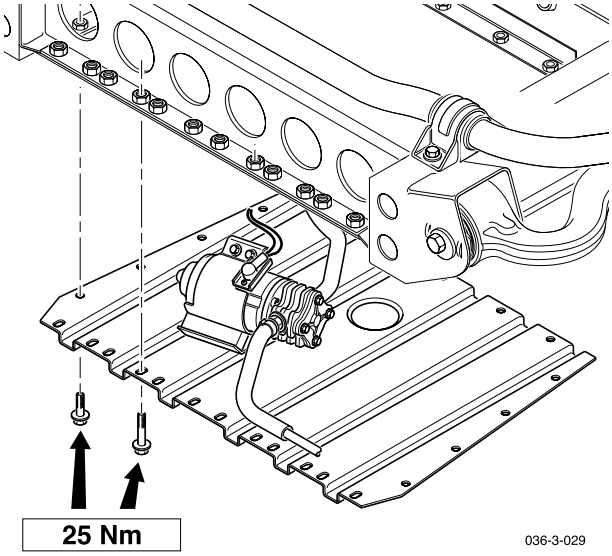
6. Refit the starter motor bolts and torque to 30-35Nm.

7. Refit the transmission (3.1.01.2)..

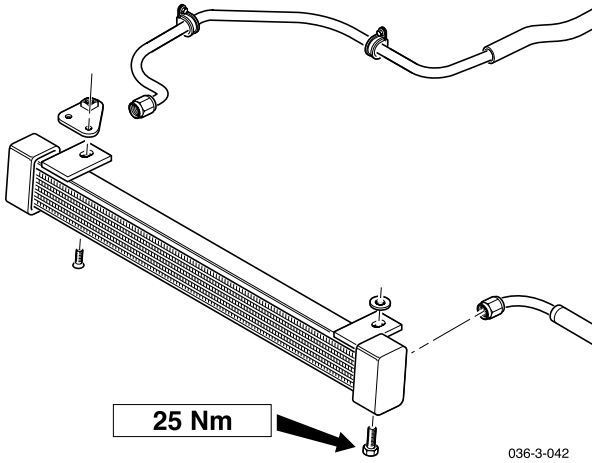


3.2.01.1 Gearbox Oil Cooler Renew

1. Remove the front undertray
2. Remove the front base plate.
   - Remove 25 screws and lower the base plate.



3. Disconnect the gearbox cooling feed and return pipes at the cooler. Plug the pipes immediately to prevent oil leakage and the ingress of foreign material.



4. Remove two bolts and remove the gearbox cooler.

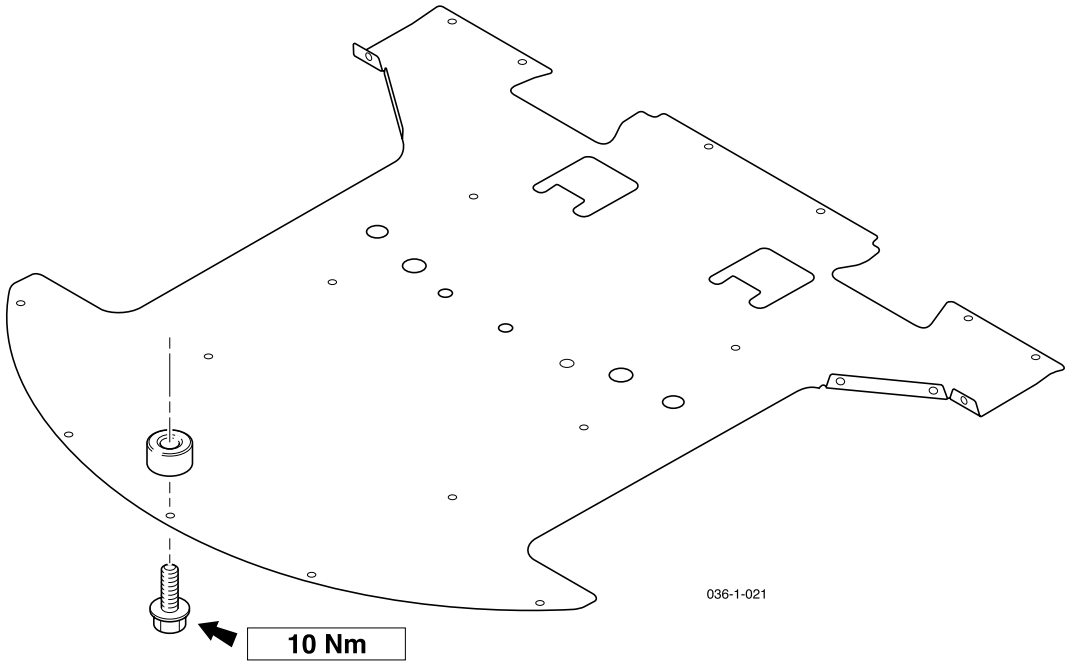
Installation

1. To install, reverse the removal procedure.
2. Use new 'Oetiker' hose clips when reconnecting the pump hoses.

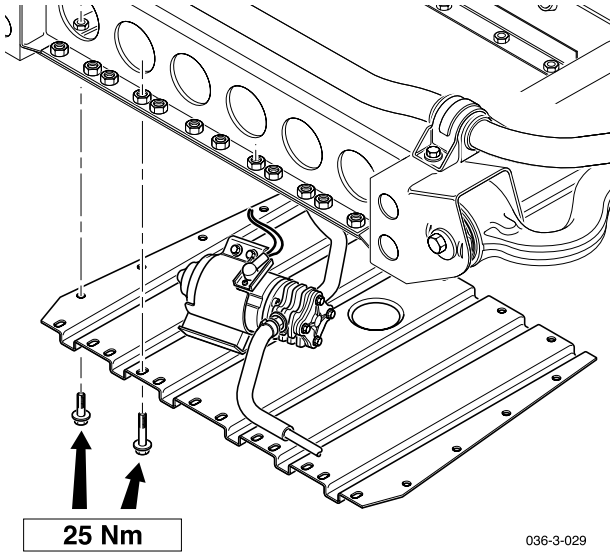
Perform the gearbox fill/top-up procedure (3.2.05.1) to make up any oil loss.

3.2.03.1 Gearbox Cooling Pump Removal

1. Remove the front undertray.

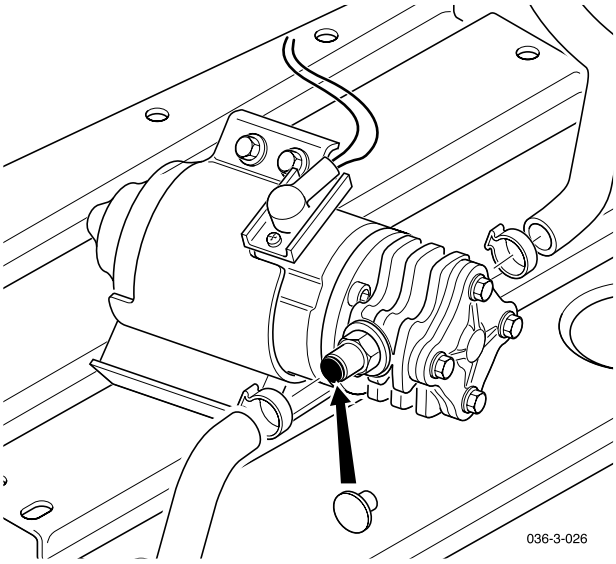


2. Remove the front base plate.



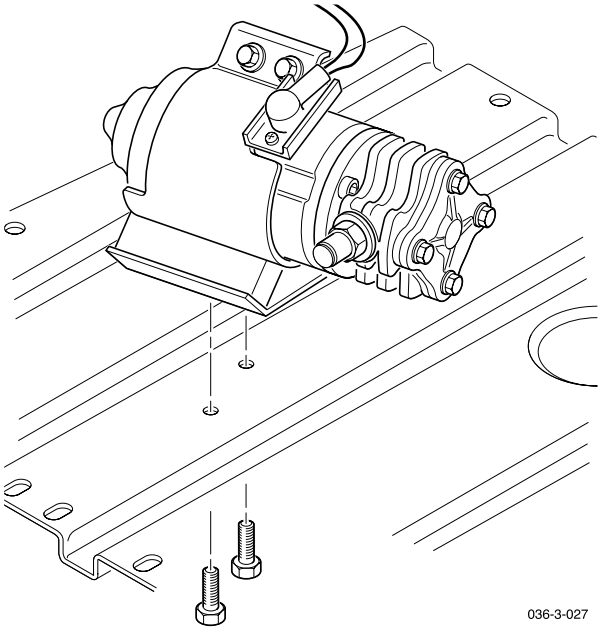
- Remove 25 screws and lower the base plate.

3. Disconnect the gearbox cooling pump feed and return pipes. Plug the pipes immediately to prevent the ingress of foreign material.



4. Disconnect the electrical connector.

5. Loosen two nuts and bolts, release the gearbox cooling pump.

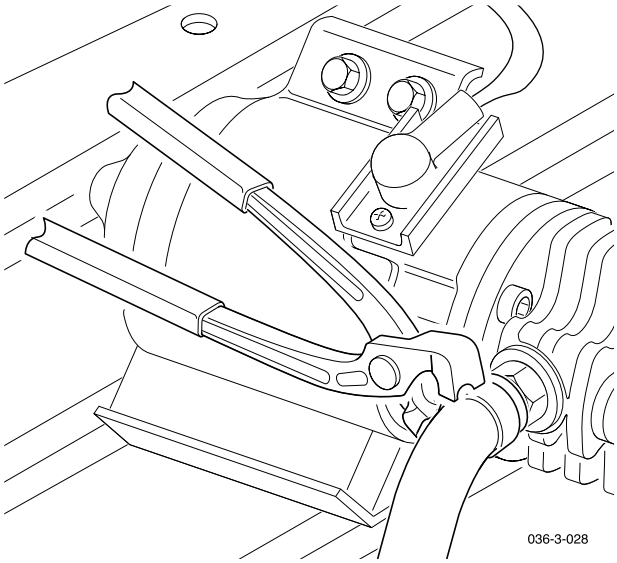


6. Remove the pump.

Installation

1. To install, reverse the removal procedure.

2. Use new 'Oetiker' hose clips when reconnecting the feed and return pipes.



3. Check the transmission oil level (3.2.05.1) and top up if necessary.

3.2.05.1 Transmission Oil Check and Top-up

Data

The transmission is filled for life and would only require checking and topping-up in the event of a fluid leak or strip down of the gearbox cooling system.

Recommended Gearbox Oil

Texaco Dexron III

Quantity Total Fill:

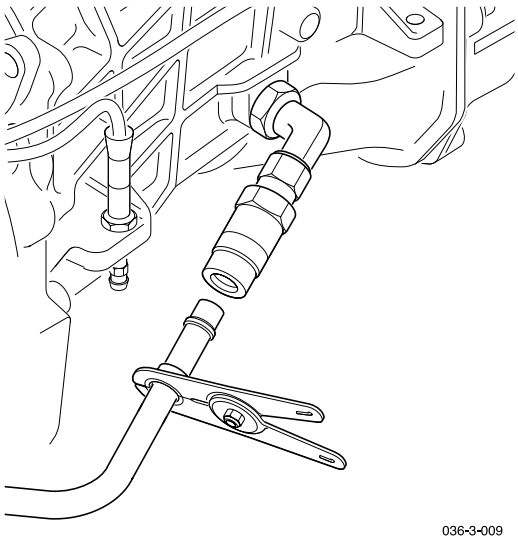
4.17 Litres - 7.3 Imp Pints. - 4.6 US quarts

WARNING: Observe all transmission fluid manufacturer's safety instructions when draining and refilling the transmission.

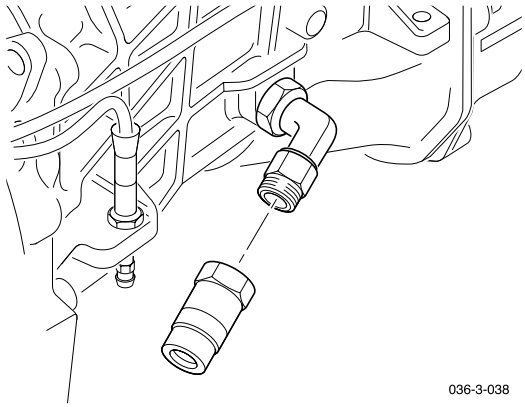
Drain Procedure

Use this drain procedure only if it is necessary to completely drain the gearbox and cooling circuit.

1. Remove the tunnel shear panel.
2. Place a drip tray beneath the transmission. Using tool 307-447, release the quickfit connectors in the feed and return lines from the gearbox adaptors. Allow all oil to drain from the cooling circuit.

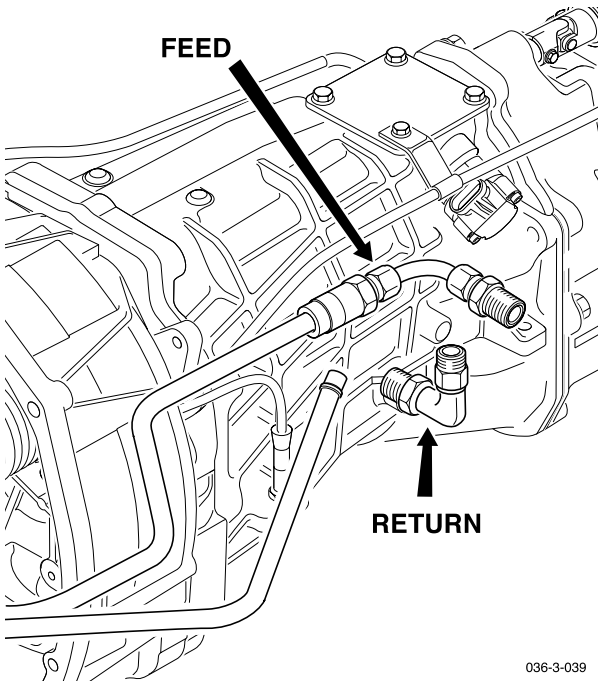

036-3-009

3. Use the WDS component control function, run the gearbox cooling pump to clear as much oil as possible from the cooling circuit.
4. Remove the quickfit connectors from the inlet and outlet connections on the gearbox. Allow any remaining oil to drain from the gearbox into the drip tray


036-3-038

Fill/Top-Up Procedure

1. Replace the quickfit connector in the feed (right hand) side of the gearbox. reconnect the oil feed hose at the quick release connector on the right side of the gearbox.



036-3-039

2. Raise the return hose above the return coupling to avoid oil leakage.
3. Rotate the return hose adaptor to a vertical position

4. Accurately measure out 4.17 Litres - 7.3 Imp Pints. - 4.6 US quarts of transmission oil.

5. From the measured oil, refill the transmission through the return adaptor until the oil is about to overflow.

6. Refit the cooling hose to the return port. Push fit the pipe into the swivel port adaptor until it seats with an audible click.

7. Cycle the transmission cooling pump for 2 minutes using the WDS.

8. Switch the pump off.

9. Disconnect the return pipe from the swivel connector. Top-up the gearbox to overflow level. Refit the cooling return pipe

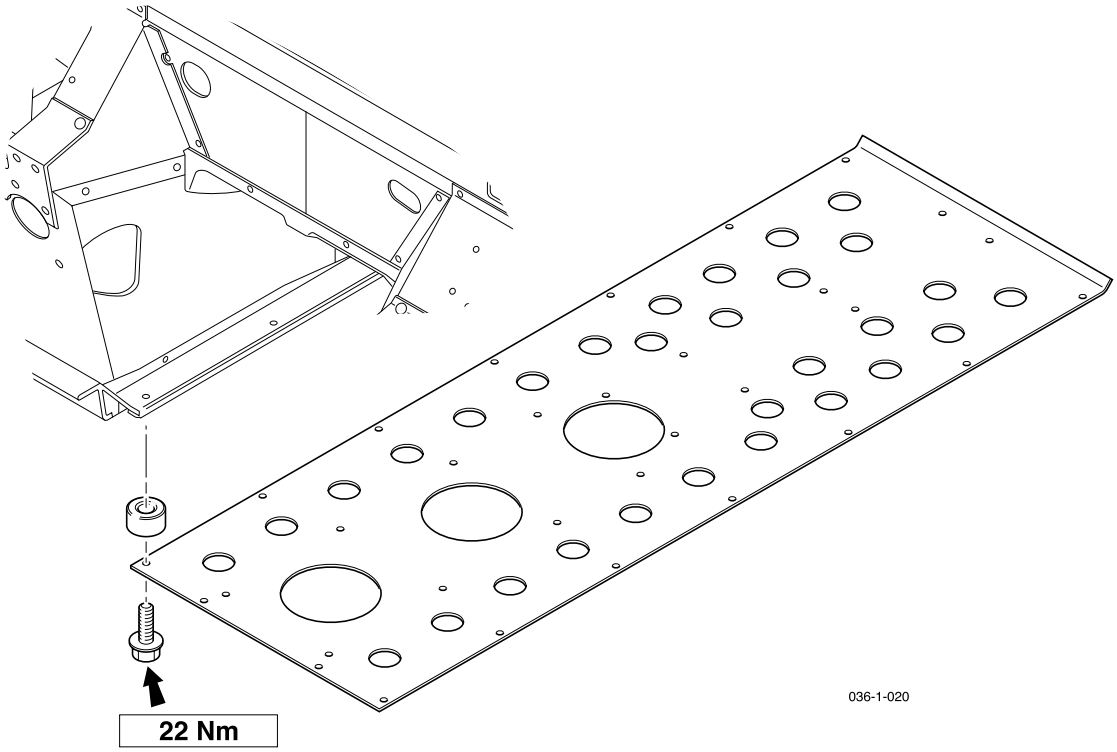
10. If the total fill quantity has not been used, repeat the run and top-up sequence to completely bleed all air from the cooling system .

11. Cycle the cooling pump again for two minutes and check for leaks.

12. Road test the vehicle make a final leak check.

3.3.01.1 ASM System/Clutch Cylinder Renew

1. Raise the vehicle.

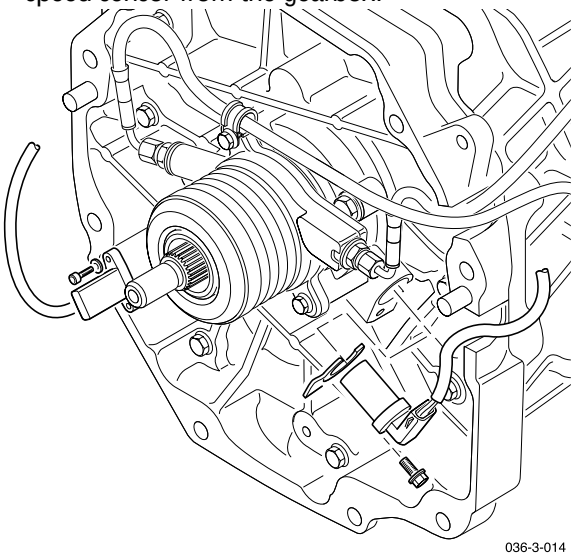


2. Remove the tunnel shear panel.

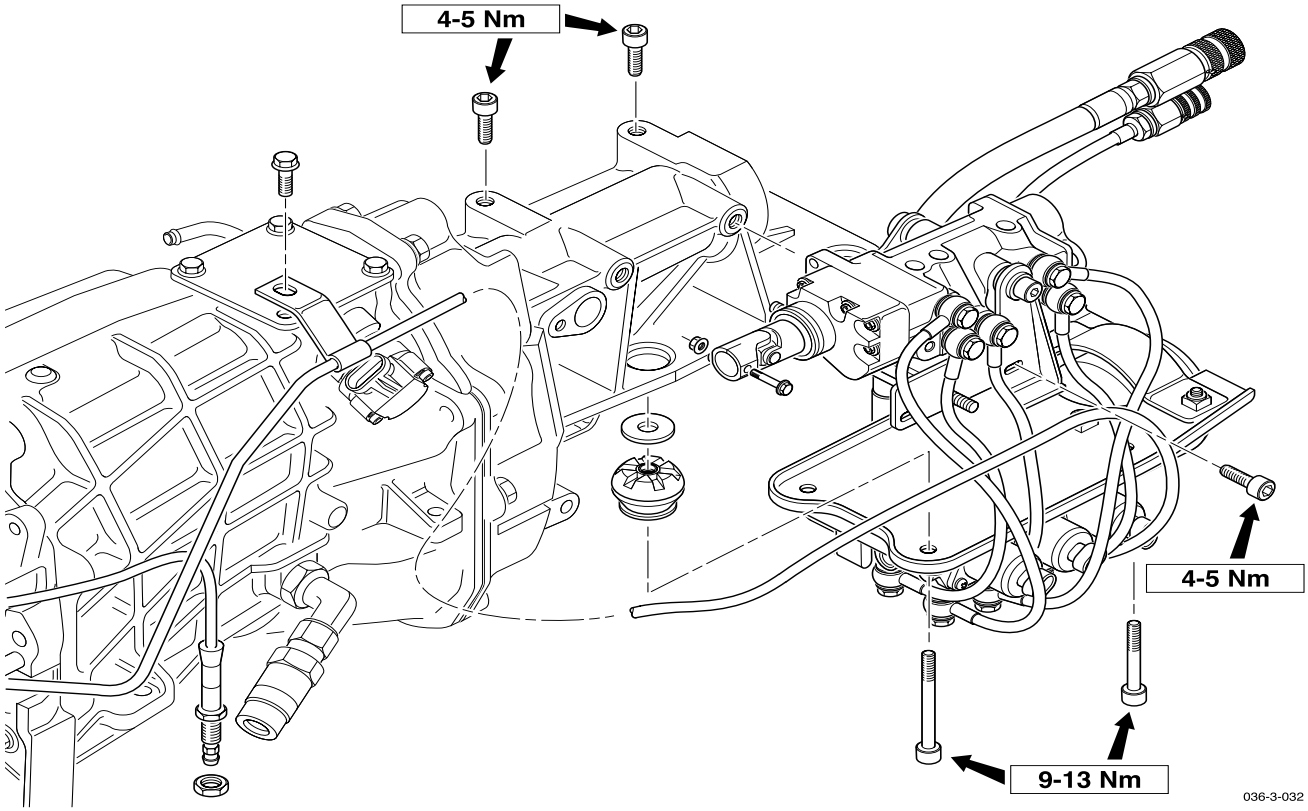
3. Remove the gearbox (3.1.01.2)

CAUTION: In the following steps, do not open any hydraulic connections. The Clutch Cylinder/ ASM Valve Block/ASM Actuator assembly must be removed as a complete unit. DO NOT break any hydraulic connection. The system warranty will be invalidated if any hydraulic connection is opened.

4. Release the clutch position sensor and the input speed sensor from the gearbox.

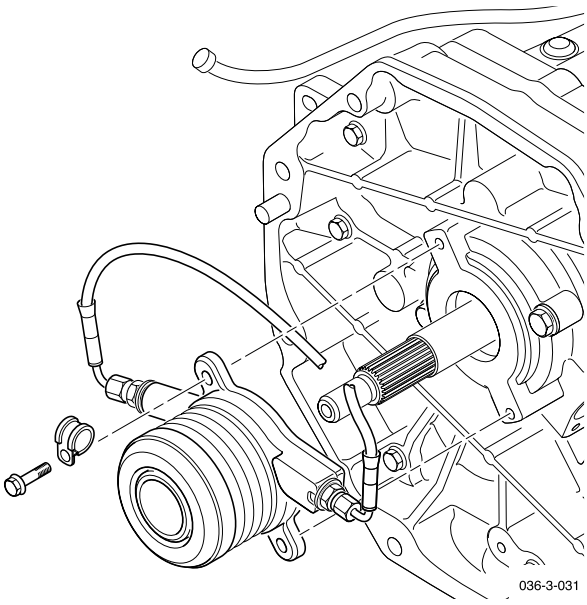


5. Release the ASM valve body from beneath the gearbox.



6. Release the ASM actuator assembly from the top of the gearbox.

7. Release the clutch cylinder from the gearbox.



8. Remove the complete ASM assembly.

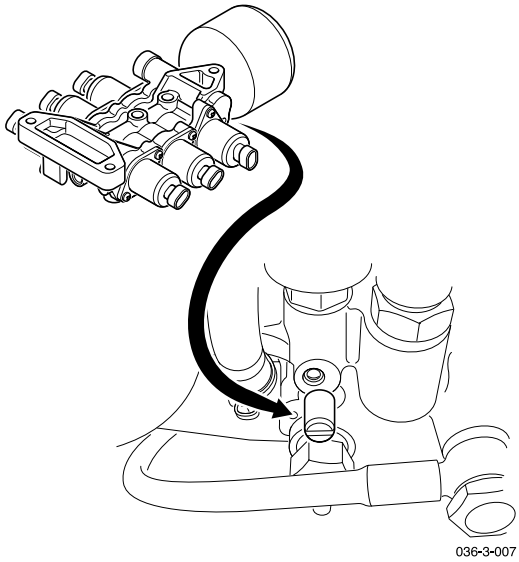
Replacement

1. Fit and secure the new ASM assembly in the following order:
   - Fit and secure the concentric clutch cylinder
   - Fit and secure the ASM actuator to the top of the gearbox
   - Fit and secure the ASM valve body assembly to the bottom of the gearbox.
   - Ensure that the
2. Perform the ASM Setup Procedure.

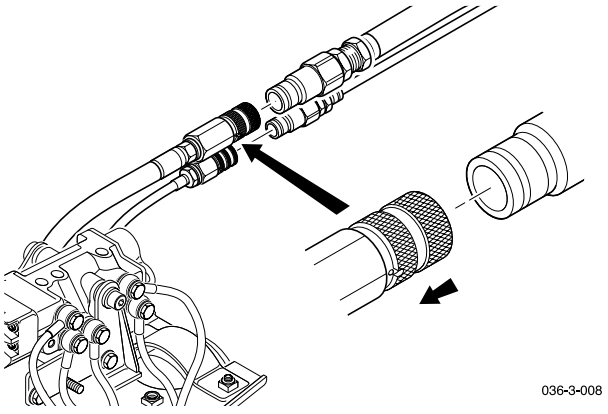
3.3.03.1 Transmission Setup Procedure

Initial Preparation

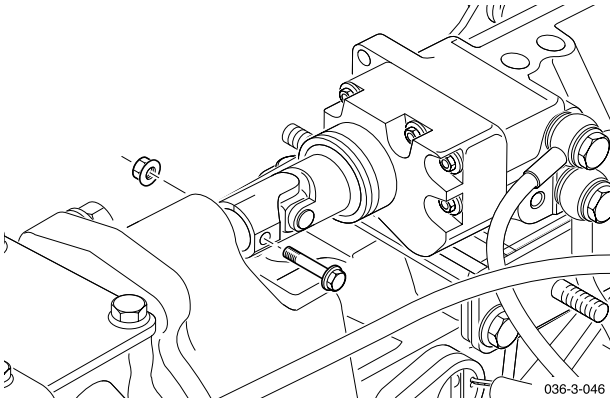
1. Remove the tunnel shear panel and the rear undertray.
2. Open the ASM bleed screw.



3. Remove the transmission and secure on a suitable stand (3.1.01.2)
4. Remove the access plate over the selector forks.
5. Reconnect all electrical connectors.
6. Disconnect the hydraulic feed and return hoses at the quickfit connectors



7. Follow the screen instructions to couple the feed and return hoses from the pump together using loop hose 307-450.
8. Remove and discard the pinch bolt securing the actuator rod to the selector fork rod.



9. Loosen the bolts securing the hydraulic actuator assembly to the gearbox.
10. Power up the WDS and enter the VIN number and confirm the correct entry.
11. Select:

    - Configure tab
    - Transmission
    - System Test

Pump Bleed Procedure

Follow the screen instructions to complete the bleed and setup procedures.

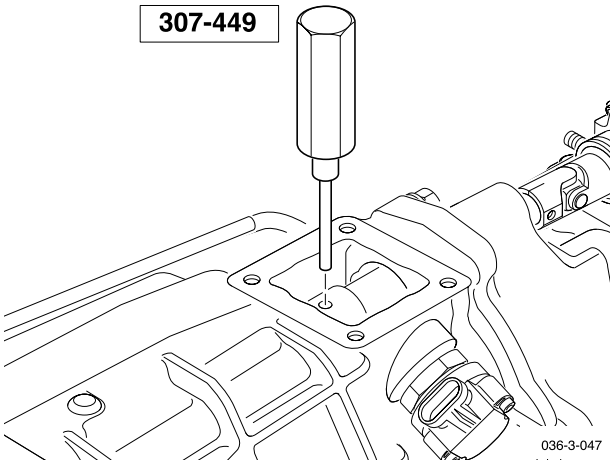
12. Disconnect the ASM pump electrical connector, connect the WDS to the drivers side diagnostic socket, switch on the ignition and establish communications.
13. Reconnect the pump and confirm. The pump bleeding cycle commences. The pump will repeat a 5 seconds On, 8 seconds Off cycle several times.

    When prompted on the screen, repeat the bleed cycle if necessary. When bleeding is complete, select NO to the “repeat bleed cycle? prompt. Confirm the response to exit the bleed cycle.

14. Disconnect the loop hose (307-450) and couple the feed and return hoses to the gearbox.

Gearbox Setup

15. Lock the transmission in the 3-4 Neutral position using tool 307-449.



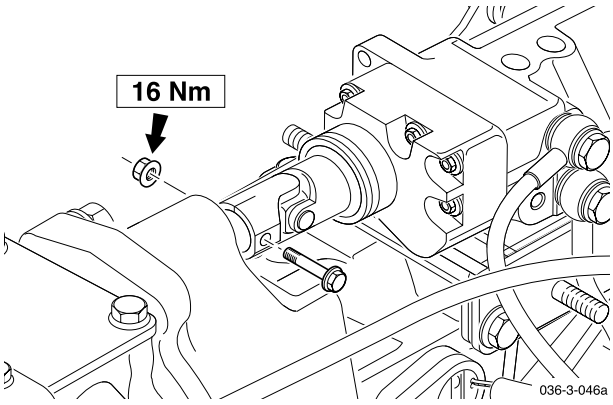
16. When the tool is correctly fitted, confirm the fitting. The system will enter Potentiometer Setup.

17. If necessary, adjust sensor potentiometers PS or PI until the bargraph display is centred in the tolerance window.

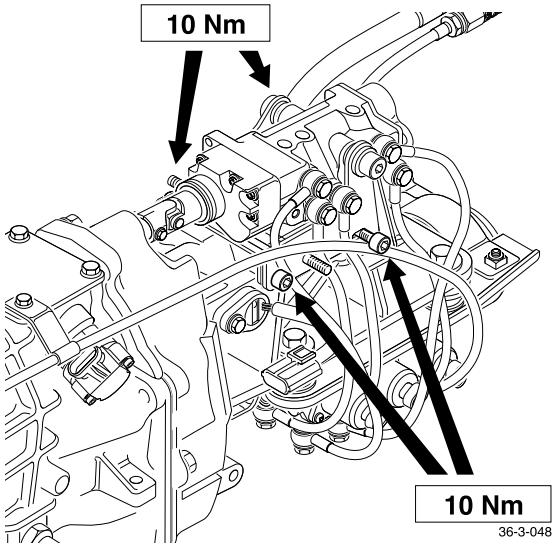
18. Set the actuator to the 3-4 Neutral position.

19. Secure the actuator to the gearbox selector rod using a new bolt and torque to 16 Nm

    Caution: The pinch bolt is 'torqued to yield' and must NOT be re-used.



20. Torque the actuator bracket bolts



21. Remove the 3-4 Neutral locking pin.

22. Switch the iginition Off and then On.

23. Press confirm to start the 'Octopus Manoeuvre' The system will select each gear several times and learn the optimum position for each gear selected.

24. Switch Off the ignition to record the gear position settings into TCU memory. These settings will be held in memory and will be used for all gearshifts during normal driving.

25. Caution: If the ignition is not switched off at the prompt, the gear position settings will be lost.

Wrap Up

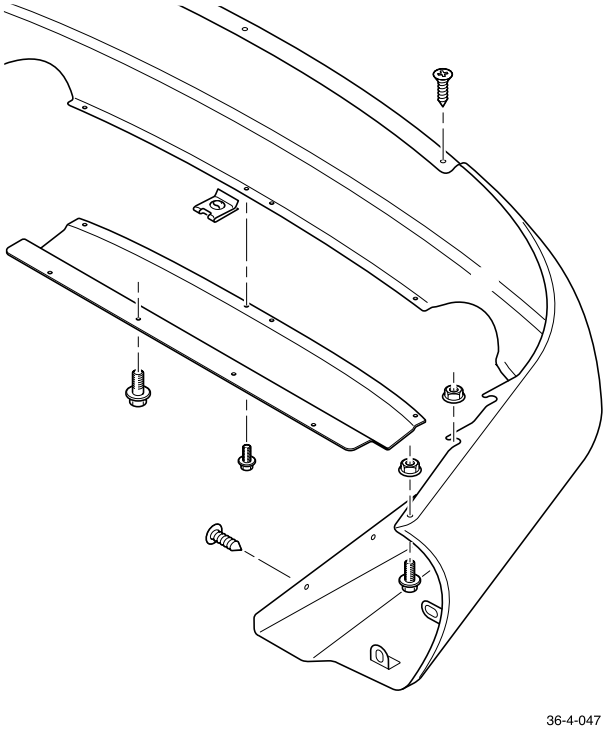
26. On completion of the setup, refit the gearbox.

27. Refit the tunnel shear panel and rear undertray.

28. Test drive the vehicle to ensure satisfactory performance of the ASM system.

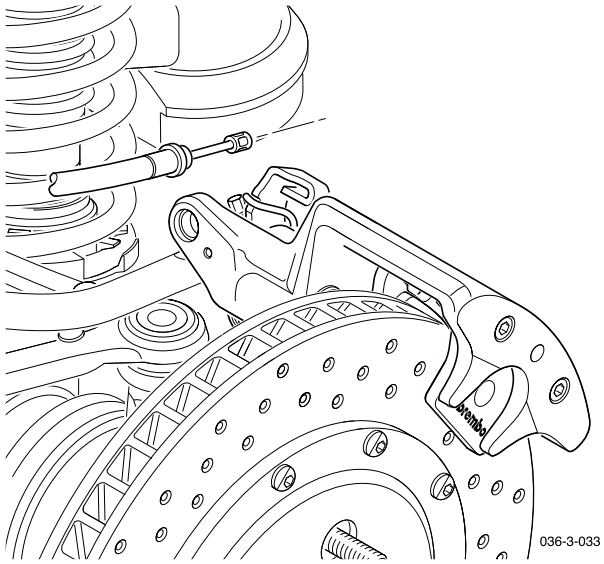
3.4.01.1 Hypoid Unit Remove

1. Raise the vehicle on an appropriate hoist.
2. Remove the rear road wheels.
3. Remove the rear undertray.
4. Remove the rear bumper cover.
   - Remove four screws and the wheel arch liner.
   - Remove three screws on the cover top edge
   - Remove three screws from the undertray extension
   - Remove three nuts at either end and remove the bumper cover



36-4-047

5. Remove the exhaust system. (2.7.10.1)
6. Release the handbrake cables.
   - Release the handbrake cable tension at the equaliser
   - Disconnect the cable s from the calipers

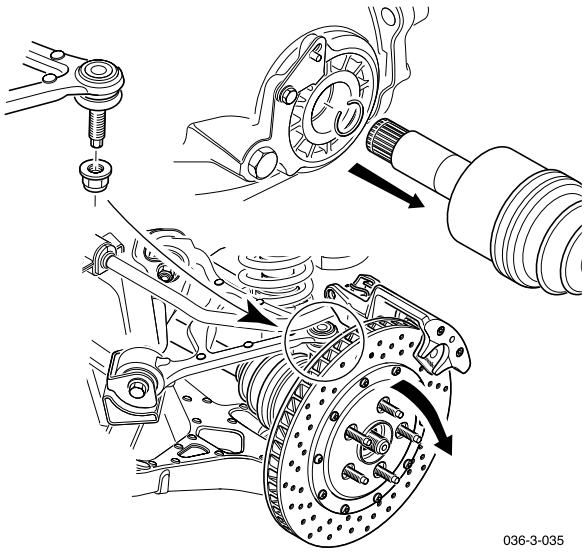


036-3-033

7. Release the rear hub assembly
   - Release the inner end of both trackrods

Note: To retain rear wheel alignment, do not disturb the tie rod adjuster nuts when releasing the track rods.

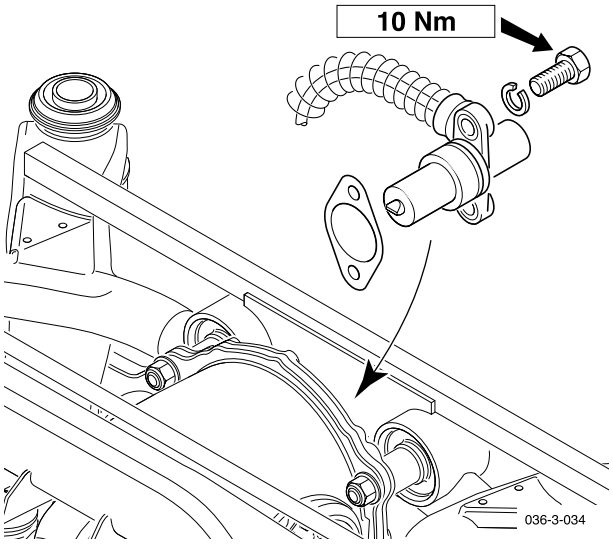
   - Release the brake calipers from the hub and secure to the body.
   - Release the upper ball joints
   - Swing each hub outwards whilst using a suitable lever to separate the inner CV joint and drive shaft from the hypoid unit. Repeat for the other drive shaft.



036-3-035

8. Remove the vehicle speed sensor

   - Release the VSS sensor from the hypoid unit
   - Release the P clip from the frame
   - Disconnect the sensor and remove

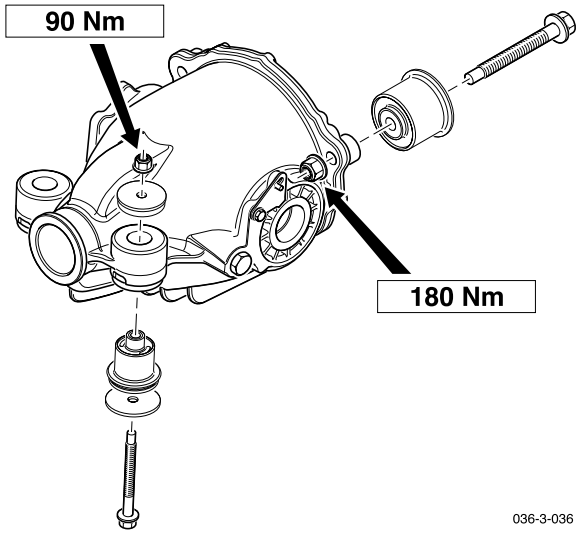


9. Release the hypoid breather tube from the frame.

10. Support the hypoid unit.

11. Remove the hypoid unit mounting bolts

    Note the positions of the large and small washers. Replace in the same locations..



12. Lower the hypoid unit from the vehicle.

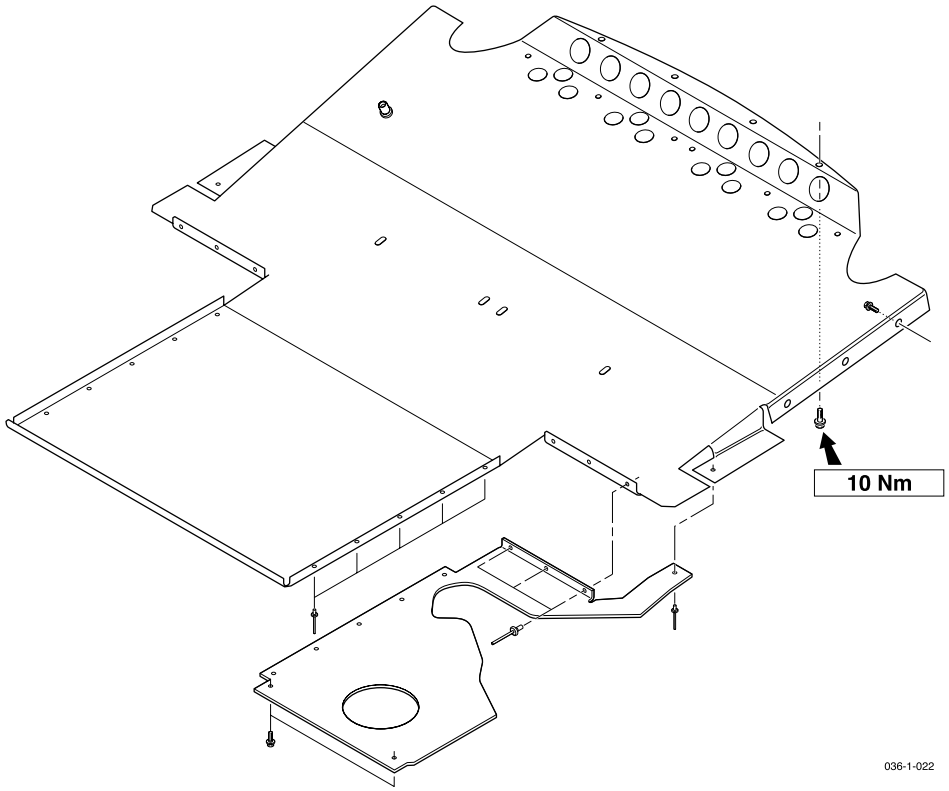
13. Cap the drive shaft holes

Installation

Complete the reassembly and check the rear wheel alignment.

3.4.02.3 Propeller Shaft Remove

1. Raise the vehicle on an appropriate hoist.

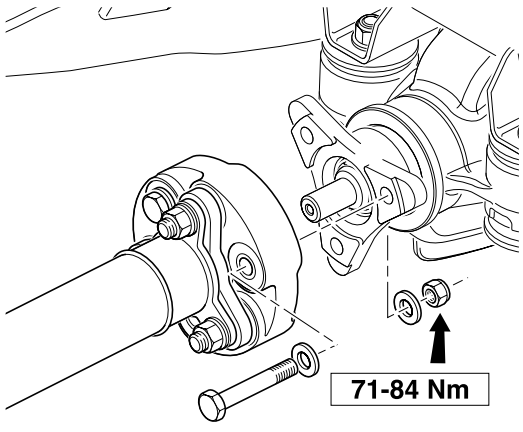


2. Remove the rear undertray.

3. Mark the propshaft flange relative to the differential flange before removing the propshaft.

WARNING: The propeller shaft is connected to the transmission output by means of a splined slip joint. Make sure the propeller shaft is securely supported before disconnecting the shaft at the hypoid flange.

- Remove three bolts and remove the prop shaft



Replacement

When reconnecting the rear propshaft flange to the differential flange, align the balance marks to retain the original balance of the assembly

3.4.04.2 Speedometer Sensor Adjust

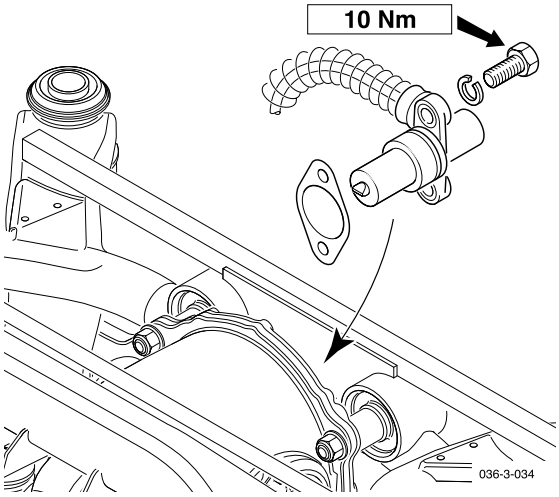
Data

Torque Figures

Speedo sensor to cover plate 7 ± 1Nm

Procedure

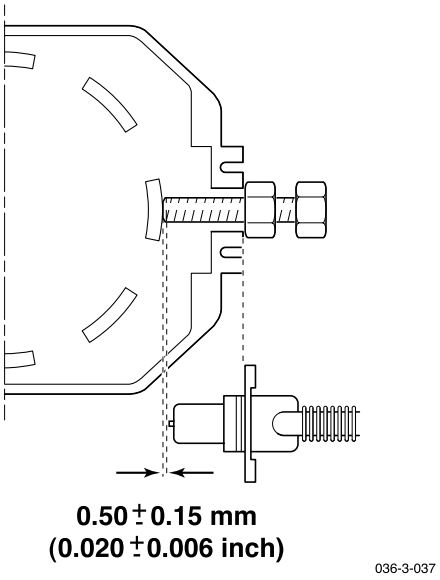
1. Raise the vehicle.
2. Remove two bolts and remove the speedometer sensor.



3. Ensure that a tab on the planet wheel carrier is opposite the sensor mounting hole.

   Rotate a roadwheel if necessary to align a tab with the sensor mounting hole.

4. Use a 75mm long bolt and nut as a depth gauge. Fit the bolt squarely through the sensor mounting hole until the bolt end just touches the planet wheel carrier tab. Adjust the nut until it just touches the sensor mounting face.



5. Withdraw the bolt and measure from the bolt end to the nut lower face.
6. Measure from the mounting face on the sensor to the sensor tip.
7. Subtract the two dimensions. The difference is the sensor air gap. This must be 0.020 ± 0.006 inch (0.5 ± 0.15mm).

   Note: A wrongly adjusted air gap may cause fluctuation in the speedometer reading.

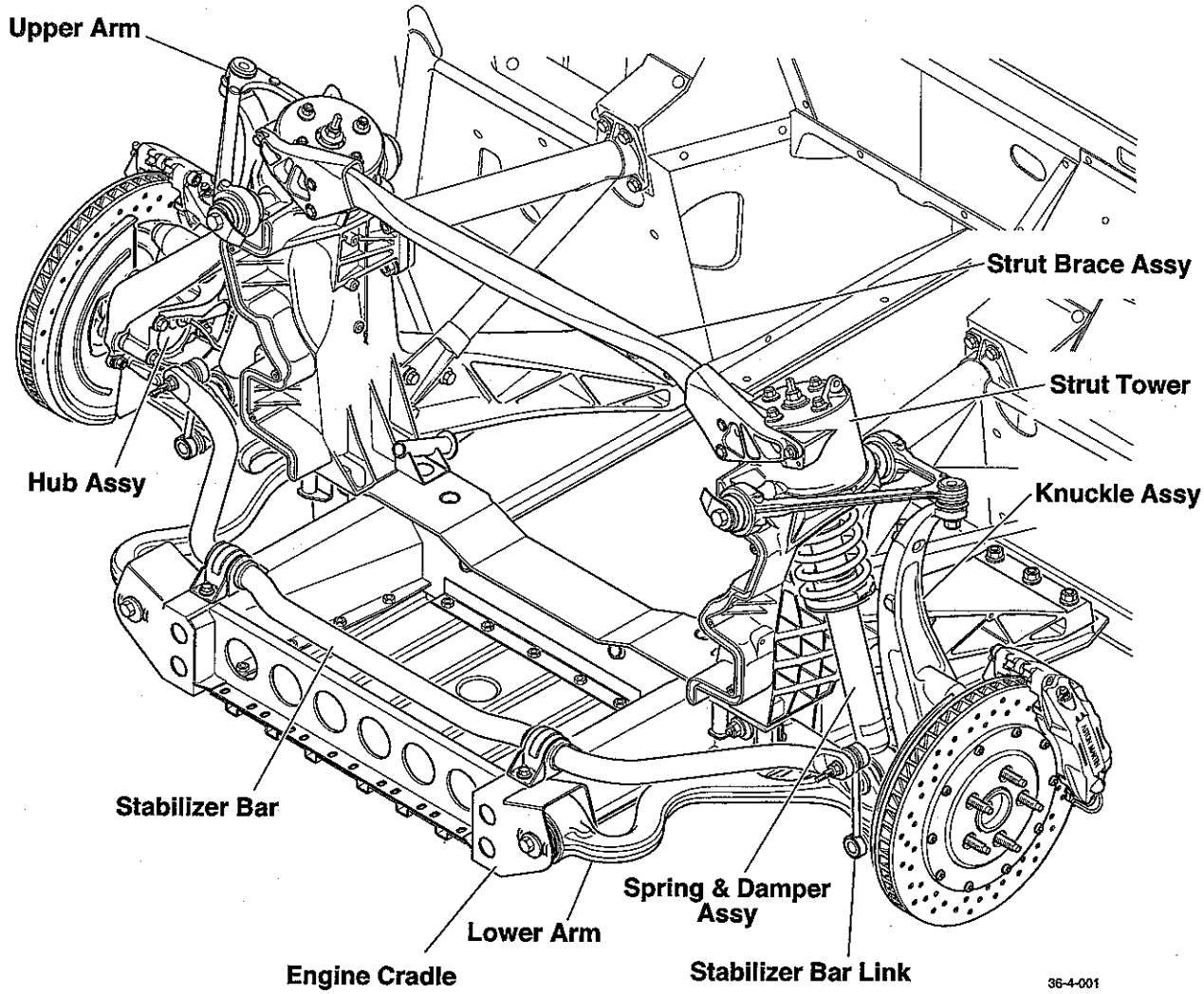
8. Add or subtract shims from the sensor mounting face as required to correct the dimension. Refit and secure the sensor.

   Note: Each shim is 0.010" (≈0.025 mm) and 1-2 shims are normally fitted.

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Front Suspension Description



Description

The independent front suspension is of the double wishbone type and is mounted on a steel fabricated engine cradle. The cradle is secured to the body tub and to the lower ends of the front suspension strut towers.

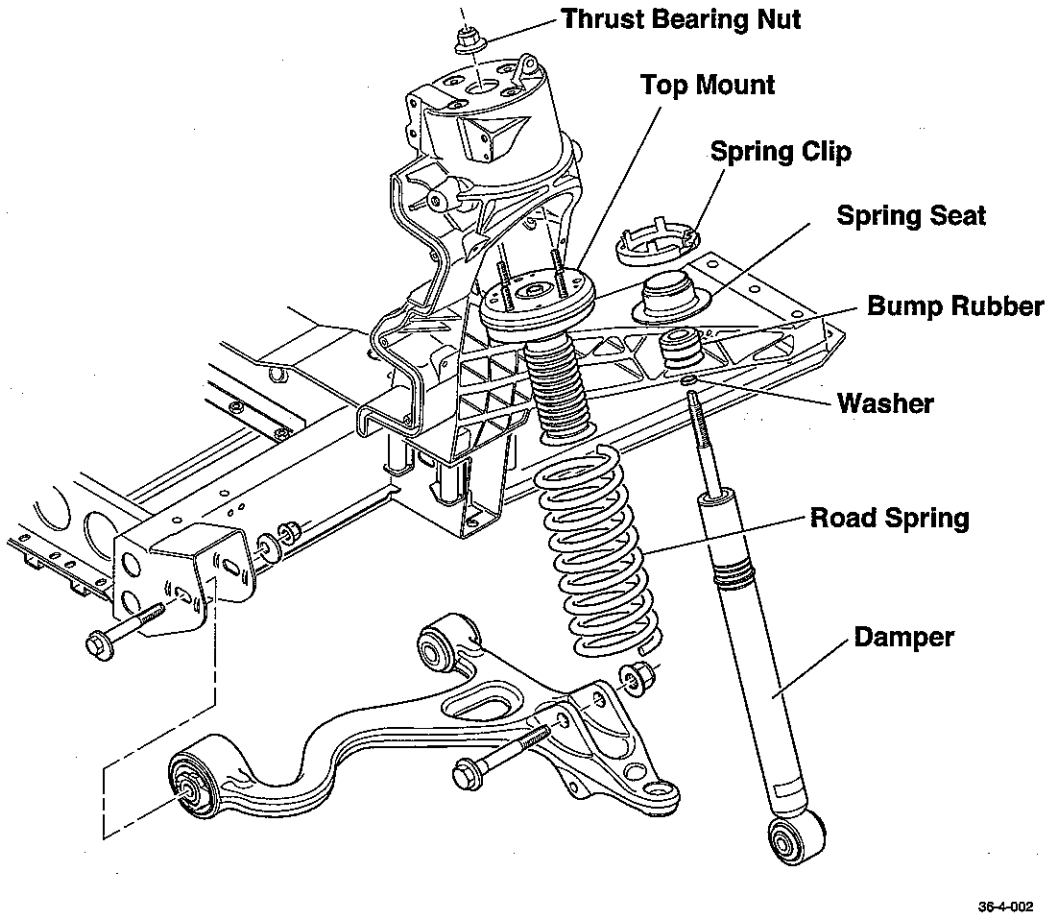
The engine cradle provides the mounting points for the power assisted steering gear, the lower suspension arm bushings, the engine mounts and the stabilizer bar.

The strut towers provide the mounting points for the upper suspension arms and also provide the upper mountings for the spring and damper assemblies.

A vertical link (the knuckle assembly) is installed between the lower and upper suspension arms. This link carries the front hub, ABS rotor and bearing assembly. The ABS sensor and the brake assembly are also mounted on the vertical link.

A stabilizer bar is mounted via bushes to the engine cradle / front cross member and via links to each of the lower arms.

Strut and Spring Assembly



A co-axial spring and damper assembly is installed between each lower arm and the top of each strut tower.

Torque Specifications

Front Suspension

Description	Nm	Lb/Ft
Stabilizer bar to connecting link nuts	55	41
Stabilizer bar clamp bolts	55	41
Lower arm to wheel knuckle nut	150-200	111-147
Lower arm to subframe nuts	175	129
Upper arm to wheel knuckle nut	90	66
Upper arm to strut tower	65-70	48-52
Disc brake caliper to adaptor	105	77
Brake caliper adaptor to knuckle	105	77
Damper assembly to strut tower	50	37
Damper assembly to lower arm bolt	175	129
Tie-rod end to wheel knuckle	100	74
Shock absorber top mounting nut	50	37
Wheel hub nuts	130	96

Rear Suspension

Subframe to tub	90	66
Tie Rod Outer Bolt	55	41
Lower Arm, Front Inner Bolt	150	111
Lower Arm Rear Inner Bolt	180	133
Upper Arm Outer Bolt	90	66
Upper Arm Inner Bolt	90	66
Damper Bottom Bolt	140	103
Damper Isolator to strut tower	36	21
Rear brake Caliper Carrier Bolt	103	76
Stabilizer Bar	55	41
ABS Sensor	10	7

Front Suspension Inspection and Verification

Visually inspect for obvious signs of mechanical damage.

If necessary, verify the customer's concern by carrying out a road test on a smooth road.

Visual Inspection Chart

Mechanical

Damaged tyres
Wheel bearing(s)
Loose or damaged front or rear suspension components
Loose, damaged or missing suspension fastener(s)
Incorrect spring usage
Damaged or sagging spring(s)
Damaged or leaking shock absorber(s)
Worn or damaged suspension bushing(s)
Loose, worn or damaged steering system components

If an obvious cause for an observed or reported condition is found, correct the cause before proceeding to the next step. If the fault is not visually evident, verify the symptom and refer to the following Symptom Chart.

Symptom / Cause / Action Chart

Crabbing

Possible Cause:	Front or rear suspension components/Wheel Alignment.
Action:	INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary/Set wheel alignment.
Possible Cause:	Drive axle damaged.
Action:	INSTALL a new drive axle.

Front Bottoming or Riding Low

Possible Cause:	Spring(s).
Action:	CHECK/ADJUST the ride height. INSTALL new springs if necessary.

Drift/Pull

Possible Cause:	Unequal tyre pressure.
Action:	CHECK and ADJUST the tyre pressures. INSPECT the tyre for excessive wear.
Possible Cause:	Incorrect wheel alignment.
Action:	CHECK and ADJUST the wheel alignment.
Possible Cause:	Tyres.
Action:	CHECK and ADJUST the tyre pressures. INSPECT the tyre for excessive wear.
Possible Cause:	Unevenly loaded or overloaded vehicle.
Action:	NOTIFY the customer of incorrect vehicle loading.
Possible Cause:	Damaged steering components.
Action:	CHECK the steering system.
Possible Cause:	Brake drag.
Action:	CHECK the brakes.

Rough Ride

Possible Cause:	Spring(s).
Action:	CHECK and INSTALL new springs as necessary.
Possible Cause:	Shock absorber(s).
Action:	CHECK and INSTALL new shock absorbers as necessary.

Incorrect Tyre Wear

Possible Cause:	Incorrect tyre pressure (rapid center rib or inner and outer edge wear).
Action:	CHECK and ADJUST the tyre pressure. INSPECT the tyre for excessive wear.
Possible Cause:	Excessive front or rear toe (rapid inner or outer edge wear).
Action:	CHECK and ADJUST the wheel alignment. For additional information, refer to the steering geometry set-up in this section.
Possible Cause:	Excessive negative or positive camber (rapid or outer edge wear).
Action:	CHECK and ADJUST the wheel alignment.
Possible Cause:	Tyres out of balance (tyres cupped or dished).
Action:	BALANCE the tyres.

Shimmy or Wheel Tramp

Possible Cause:	Loose wheel nut(s).
Action:	CHECK and TIGHTEN the wheel nuts to specification.
Possible Cause:	Loose front suspension fasteners.
Action:	CHECK and TIGHTEN the suspension fasteners to specification.
Possible Cause:	Front wheel bearing(s).
Action:	CHECK the wheel bearings.Possible Cause:Wheel/tyres.
Action:	CHECK the wheels/tyres. BALANCE or INSTALL new wheel/tyres as necessary.
Possible Cause:	Shock absorber(s).
Action:	CHECK and INSTALL new shock absorbers as necessary.
Possible Cause:	Spring(s).
Action:	CHECK and INSTALL new springs as necessary.
Possible Cause:	Loose, worn or damaged ball joint(s).
Action:	CHECK the Ball Joint(s). For additional information, refer to Ball Joint inspection in this section.
Possible Cause:	Loose, worn or damaged steering components.
Action:	CHECK and INSTALL new components as necessary.
Possible Cause:	Front wheel alignment.
Action:	CHECK and ADJUST the wheel alignment. For additional information, refer to Toe Adjustment - Front in this section.

Poor Returnability of the steering

Possible Cause:	Ball joints.
Action:	CHECK the Ball Joint(s).
Possible Cause:	Steering components.
Action:	CHECK and INSTALL new components as necessary.

Steering wheel off-center

Possible Cause:	Unequal front or rear toe settings.
Action:	CHECK and ADJUST the wheel alignment.
Possible Cause:	Steering components.
Action:	CHECK and INSTALL new components as necessary.

Sway or roll

Possible Cause:	Overloaded, unevenly or incorrectly loaded vehicle.
Action:	NOTIFY the customer of incorrect vehicle loading.
Possible Cause:	Loose wheel nut(s).
Action:	CHECK and TIGHTEN the wheel nut(s) to specification.
Possible Cause:	Spring(s).
Action:	CHECK and INSTALL new springs as necessary.
Possible Cause:	Shock absorber(s).
Action:	CHECK and INSTALL new shock absorbers as necessary.
Possible Cause:	Loose front stabilizer bar or rear stabilizer bar .
Action:	CHECK and TIGHTEN the stabiliser bar to specification.

Vibration/Noise

Possible Causes:	Tyres/wheel. Wheel bearings. Wheel hubs. Brake components. Suspension components. Steering components.
Action:	CHECK and INSTALL new components as necessary.

Vehicle Leans to One Side

Possible Cause:	Unevenly loaded or overloaded vehicle.
Action:	NOTIFY the customer of incorrect vehicle loading.
Possible Cause:	Front or rear suspension components.
Action:	INSPECT the front and rear suspension systems. REPAIR or INSTALL new suspension components as necessary.
Possible Cause:	Shock absorber(s).
Action:	CHECK and INSTALL new shock absorbers as necessary.
Possible Cause:	Spring(s).
Action:	CHECK and INSTALL new springs as necessary.
Possible Cause:	Incorrect ride height. Lateral tilt out of specification.
Action:	CHECK the ride height. INSTALL new springs as necessary.

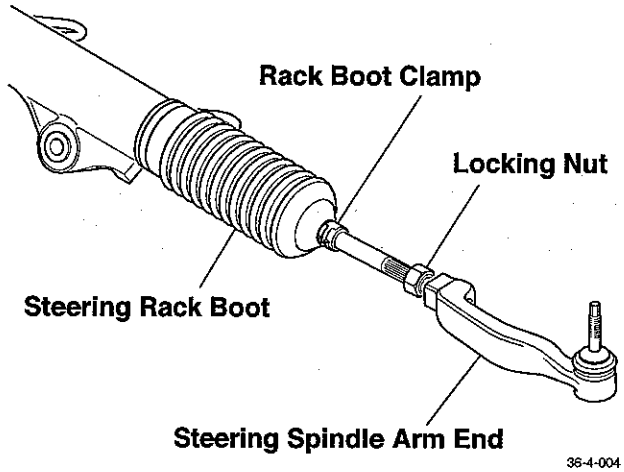
Wander

Possible Cause:	Unevenly loaded or overloaded vehicle.
Action:	NOTIFY the customer of incorrect vehicle loading.
Possible Cause:	Ball joint(s).
Action:	CHECK the Ball Joint(s). For additional information, refer to Ball Joint inspection in this section.
Possible Cause:	Front wheel bearing(s).
Action:	CHECK the wheel bearings.
Possible Cause:	Loose, worn or damaged suspension components.
Action:	CHECK and INSTALL new suspension components as necessary.
Possible Cause:	Loose suspension fasteners.
Action:	CHECK and TIGHTEN the suspension fasteners to specification.
Possible Cause:	Steering components.
Action:	CHECK and INSTALL new steering components.
Possible Cause:	Wheel alignment (excessive total front toe-out).
Action:	CHECK and ADJUST the wheel alignment. For additional information, refer to Toe Adjustment - Front in this section.

Vehicles Requiring Toe and Camber Adjustment

NOTE: Adjustments to the camber impact the toe settings. Therefore, the camber and toe may need to be adjusted at the same time to achieve the correct values. Both the LH and RH toe need to be adjusted when adjusting the camber.

1. Slacken the tie-rod end lock nut and remove the steering gear boot clamp.

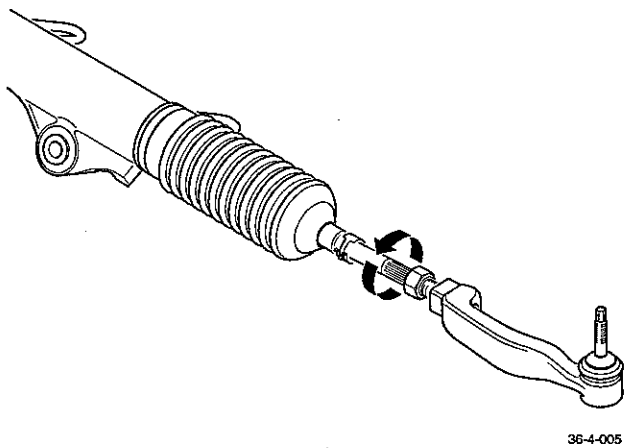


2. Clean and lubricate the lock nut and tie-rod threads.

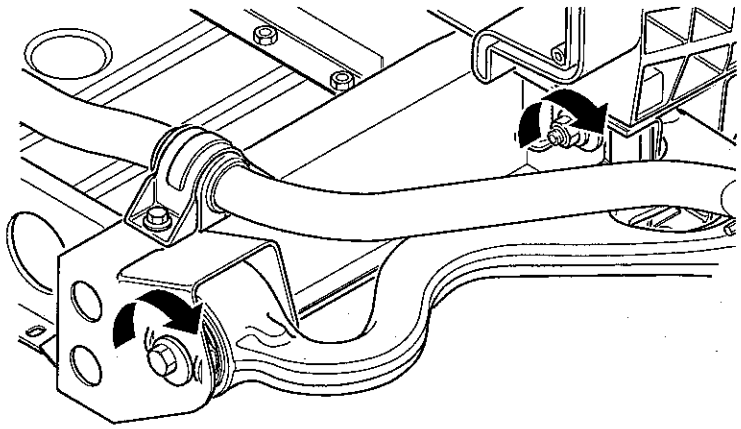
   NOTE: Do not allow the steering gear boot to twist when the tie-rod is rotated.

3. Rotate the tie-rod to adjust the toe.

   NOTE: To aid in accurate camber and toe measurements, support the front suspension lower arm by hand while rotating the camber adjustment cam bolt.



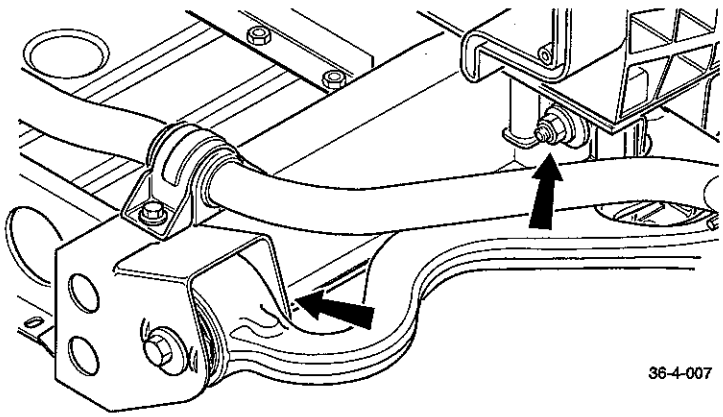
4. Rotate both the lower arm camber adjustment cam bolts equally to adjust the camber.



5. Repeat the above camber adjustment steps until the correct camber and toe measurements are achieved.

All vehicles

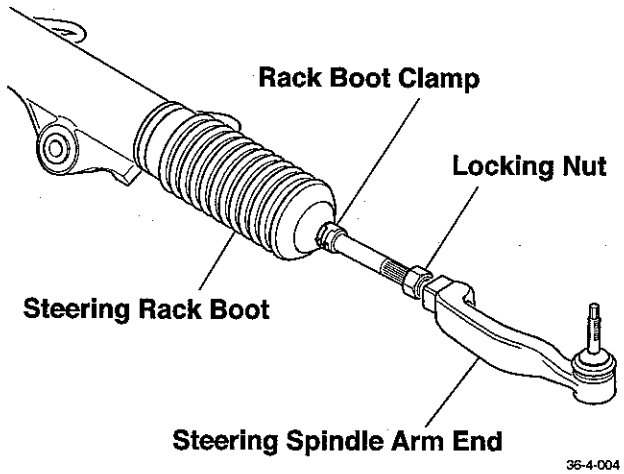
1. Tighten the cam bolt lock nuts.



2. Tighten the tie-rod end lock nuts. Secure the steering gear boot clamps.
3. Recheck the alignment settings. Follow the equipment manufacturer's instructions. Readjust if necessary.

Toe Adjustment Front

1. Start the engine and center the steering rack.
2. Turn the engine off, and lock the steering position.
3. Check the toe settings. Follow the equipment manufacturer's instructions.

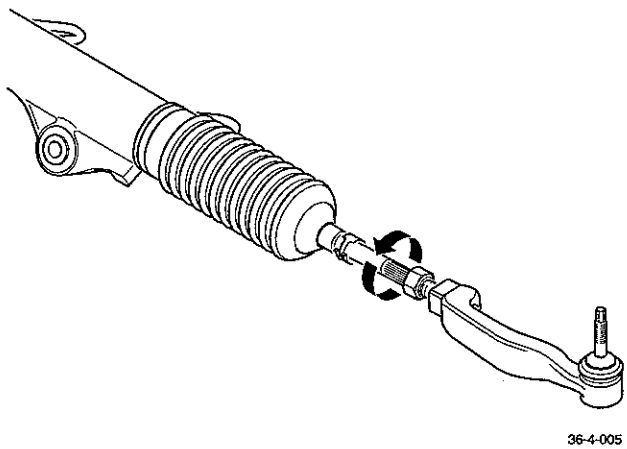


Loosen the lock nuts. Release the steering gear boot clamps.

Clean and lubricate the lock nuts and front tie-rod threads.

NOTE: Do not allow the steering gear boot to twist when the front tie-rod is rotated.

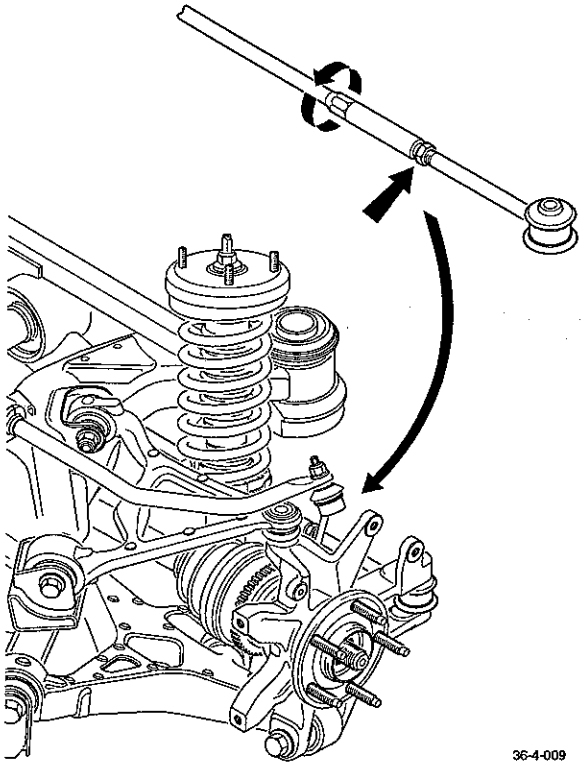
Rotate the front tie-rods to adjust the toe setting.



4. Tighten the lock nuts, and recheck the toe setting. Readjust if necessary. When correct, secure the steering gear boot clamps.

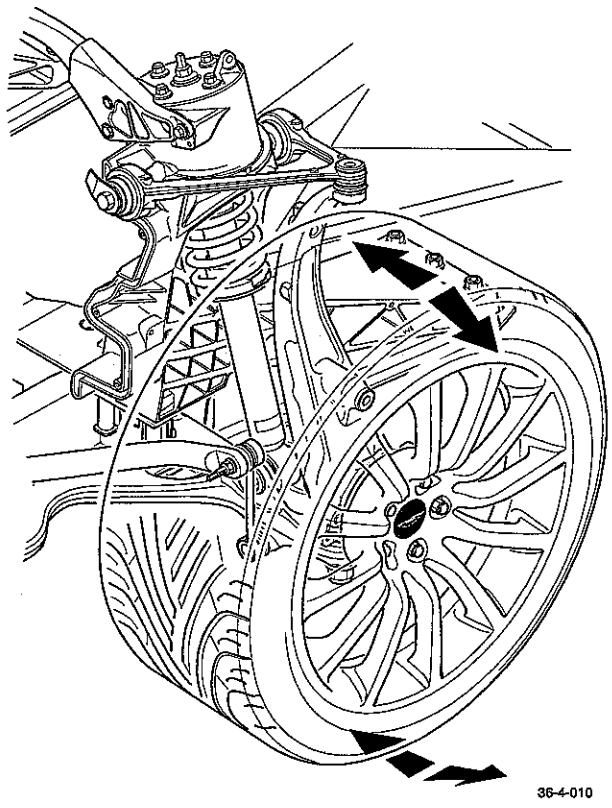
Toe Adjustment Rear

1. Loosen the toe link locknuts



2. Clean and lubricate the locknuts and toe link threads.
3. Rotate the link to adjust the toe settings
4. Tighten the lock nut.
5. Recheck the toe settings. Readjust if necessary.

Wheel Bearing Inspection - Front and Rear



1. Raise and support the vehicle.
2. Make sure that the wheel rotates freely and that the brake pads are sufficiently retracted to allow free movement of the tyre and wheel assembly.

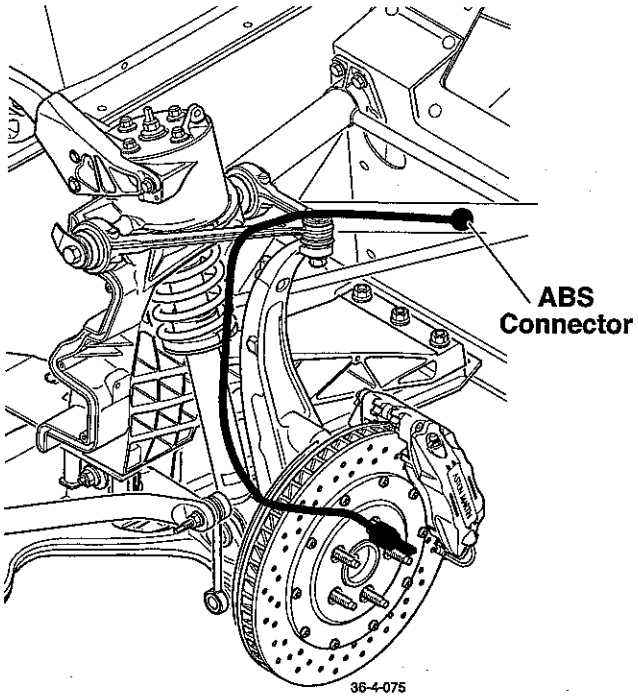
   Caution: Have a collegue observe the upper and lower ball joints for movement during the following check. This will ensure that the cause of any free play is correctly identified.

3. Firmly grasp the tyre at the top and bottom. Attempt to move the wheel inward and outward while lifting the weight of the assembly off the wheel bearings.
4. If there is any excess movement in the wheel bearing, replace the hub and bearing assembly.

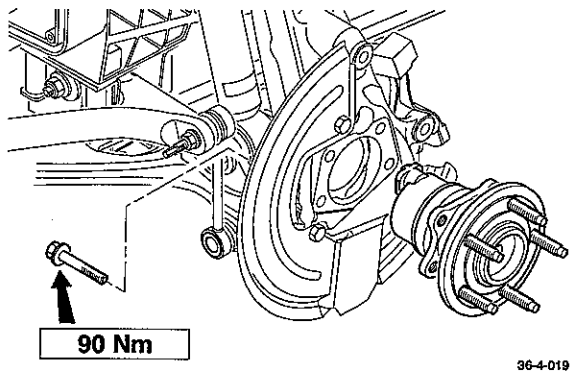
4.1.04.1 Front Wheel Hub and Bearing

Removal

1. Remove the front brake disc.
2. Disconnect the front ABS sensor.



3. Remove the four wheel hub bolts. Remove the wheel hub.



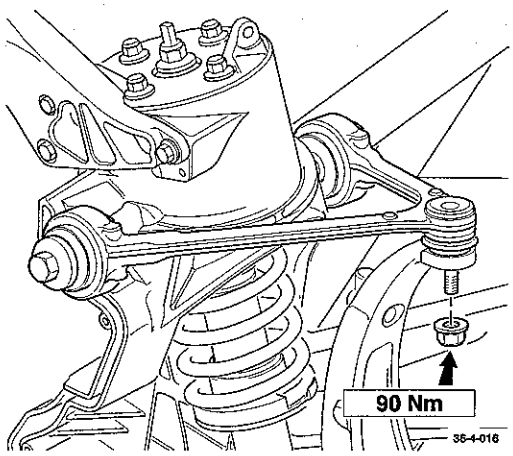
Installation

1. To install, reverse the removal procedure. Use threadlock on the four wheel hub bolts during reassembly.

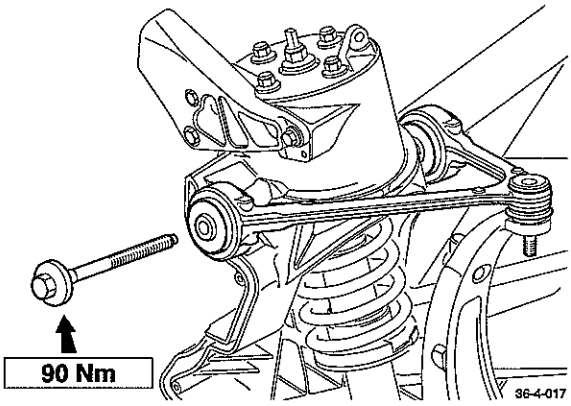
4.1.10.1 Front Suspension Upper Arm

Removal

1. Loosen the wheel nuts.
2. Raise and support the vehicle.
3. Remove the wheel.
4. Detach the upper arm from the vertical link.



5. Support the vertical link
6. Remove the upper arm.



- Remove the upper arm bolts.
- Remove the upper arm.

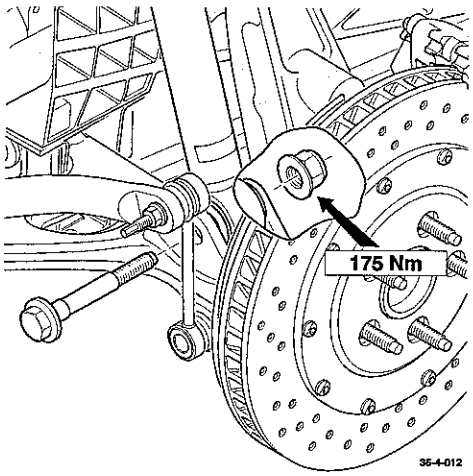
Installation

1. To install, reverse the removal procedure.
2. Torque all suspension fixings with the vehicle at normal ride height.

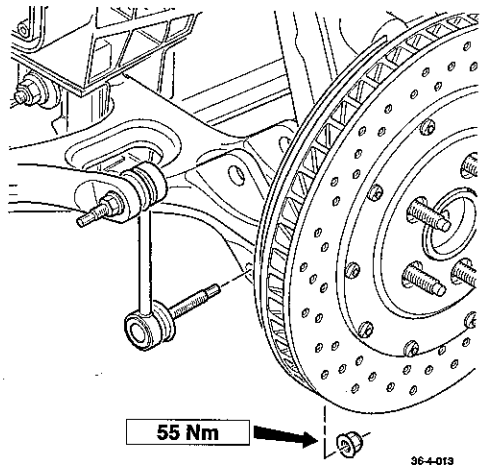
4.1.11.1 Front Suspension Lower Arm

Removal

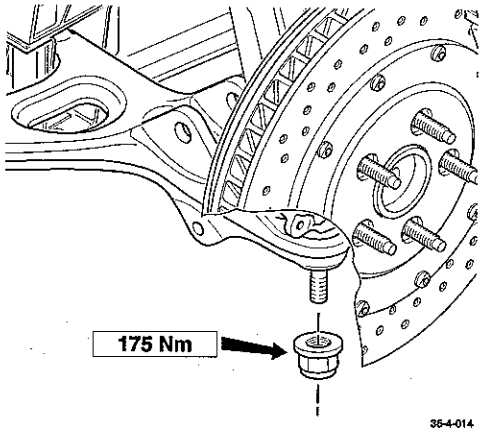
1. Remove the damper lower mounting bolt.
   - Raise the vehicle until the damper is fully extended.
   - Remove the damper lower mounting bolt.



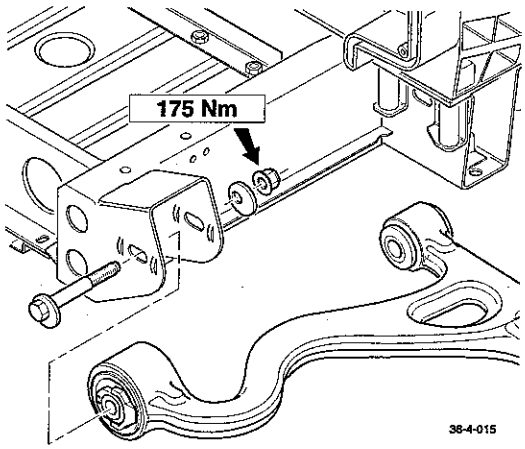
2. Detach the stabiliser bar from the lower arm.



3. Support the vertical link and detach the lower ball joint.



4. Detach and remove the lower arm.



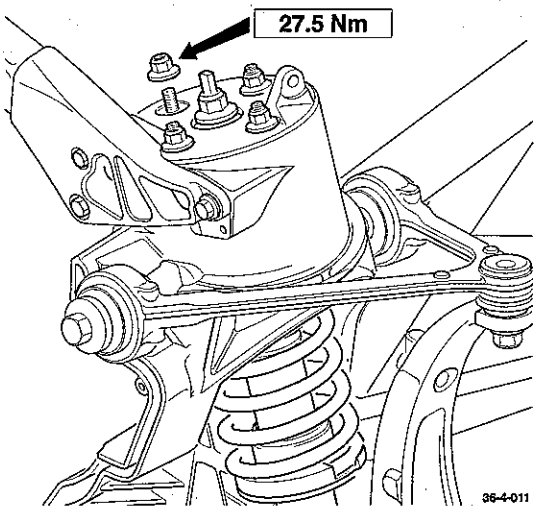
Installation

1. Installation is the reverse of the removal procedure.
2. Torque all suspension fixings with the vehicle at normal ride height.
3. Check/Adjust the camber and toe settings.

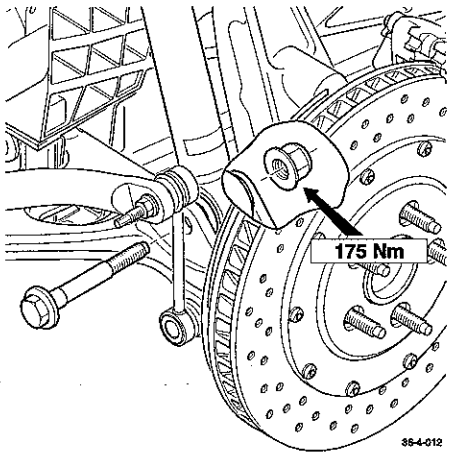
4.1.14.1 Front Damper and Spring Assembly

Removal

1. Slightly loosen the wheel nuts.
2. Raise and support the vehicle so that the damper and spring assembly is fully extended.
3. Remove the front wheel.
4. Remove the suspension turret nuts.



5. Remove the damper and spring assembly.



- Ensure that the damper is fully extended.
- Remove the damper lower mounting bolt.
- Remove the damper and spring assembly.

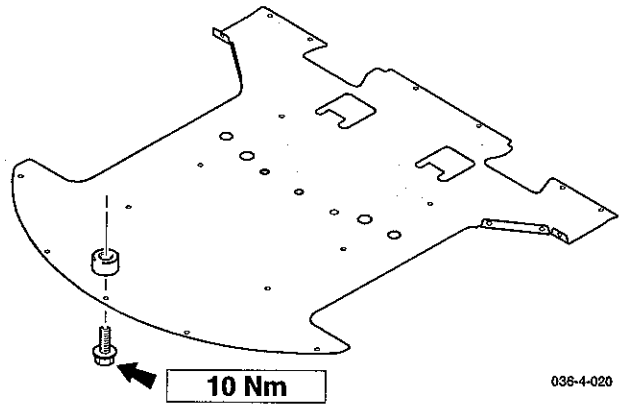
Installation

1. To install, reverse the removal procedure.

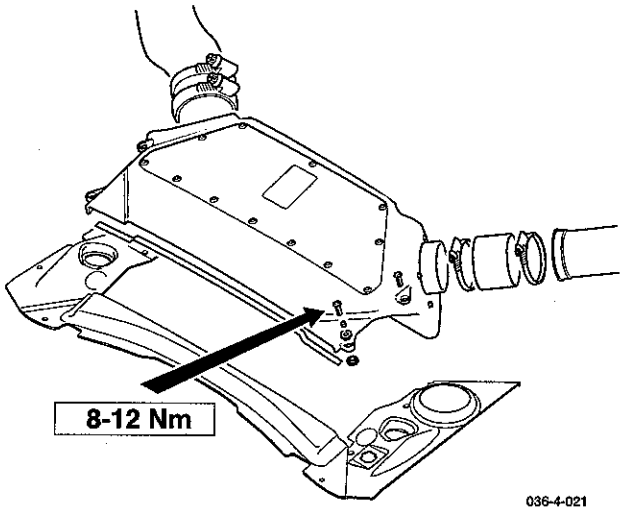
4.1.16.1 Front Stabiliser Bar

Removal

1. Remove the front wheels and wheel arch liners.
2. Detach the front undertray.

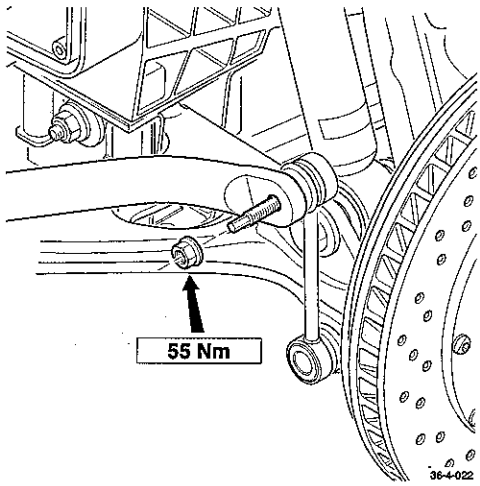


3. Detach the airbox.

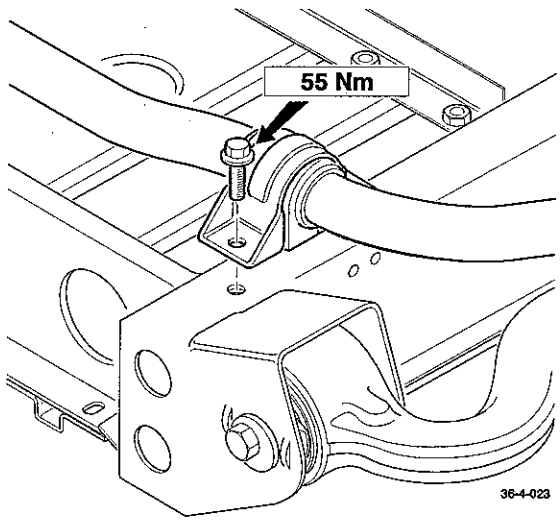


- Detach two hoses.
- Remove four screws and the airbox.

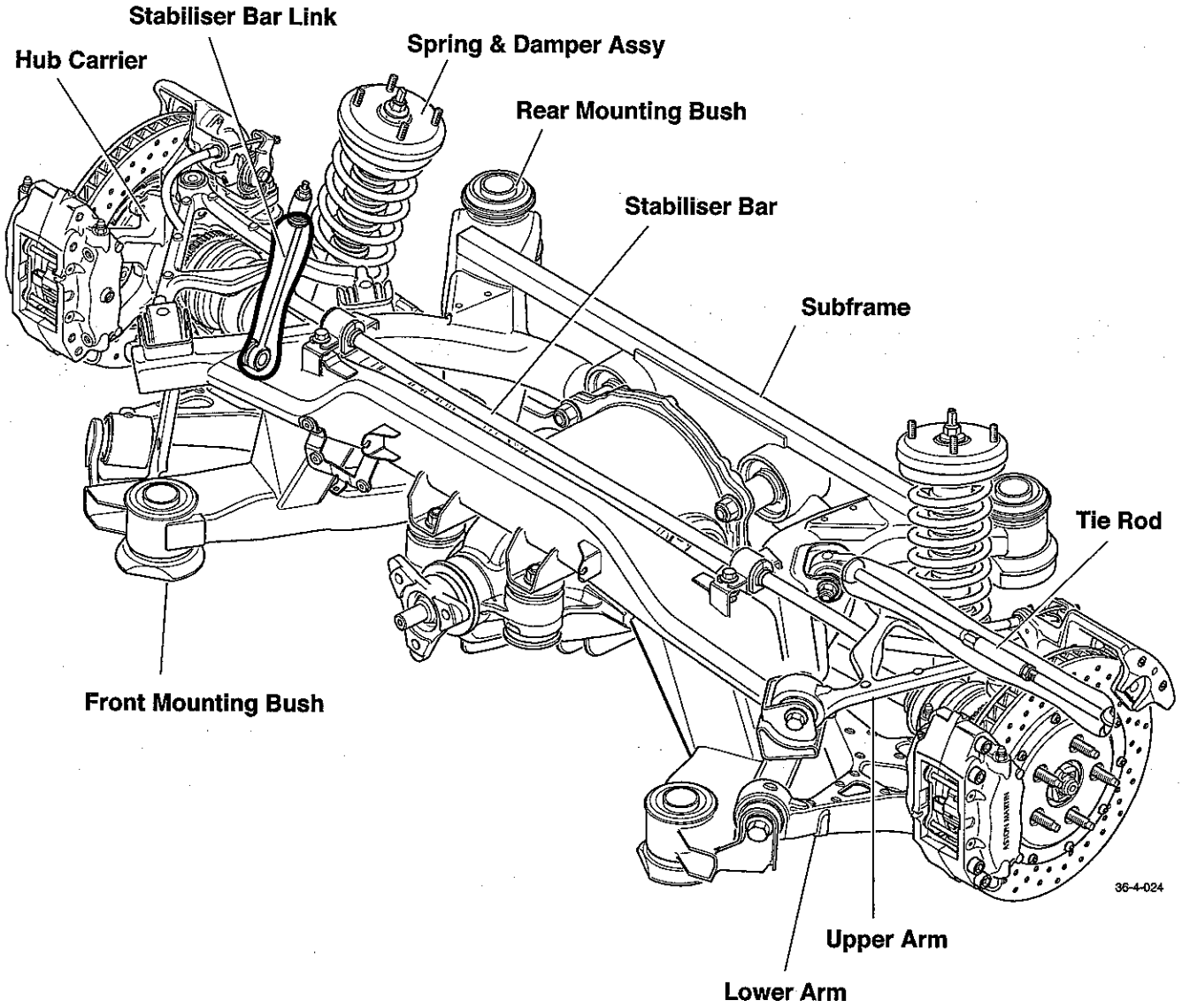
4. Detach the stabiliser bar from the links.



5. Detach the stabiliser bar mountings from the engine cradle and remove the stabiliser bar.



Rear Suspension Description



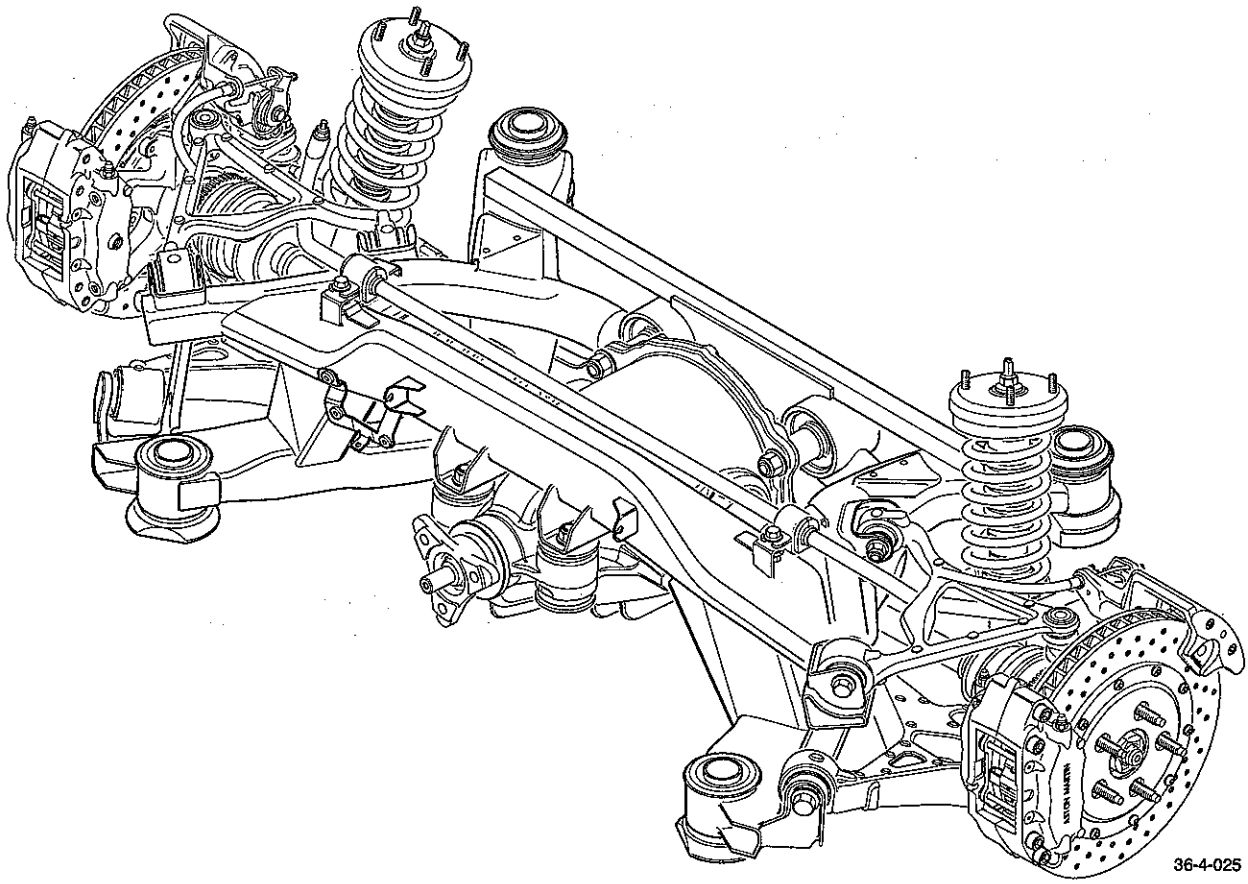
The Rear Suspension

The independent rear suspension assembly features a steel subframe with aluminium upper and lower control arms which carry the rear hub assemblies, road springs and dampers.

Components

The Subframe

- Is of steel construction and isolated from the vehicle body using four mounting bushes
- Carries the differential unit with two rear mounting bushes built integral with the subframe and two front bushes attached to the differential unit
- Carries the upper arm, lower arm and hub assembly
- The subframe also carries the rear stabiliser bar and the ASM pump

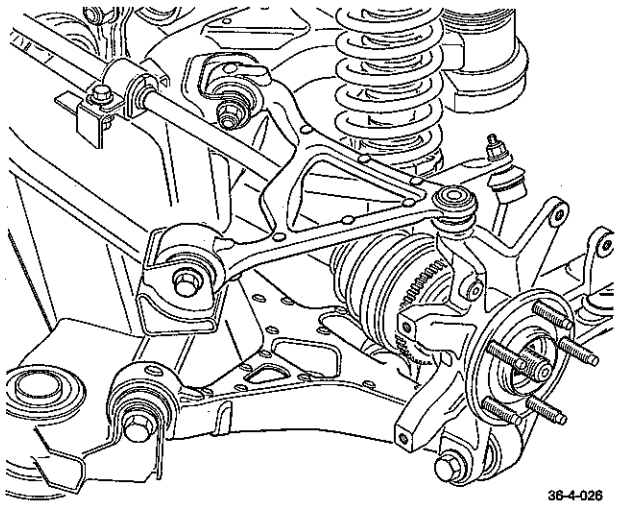


Mounting Bushes

- Four mounting bushes are incorporated within the crossmember to isolate noise and vibration.
- The bushes are a moulded construction with aluminium inserts which locate precisely onto fixed pegs aligned on the vehicle chassis
- Mounting bolts pass through the bushes and fix to the pegs on the vehicle chassis to secure the rear suspension assembly to the vehicle body.

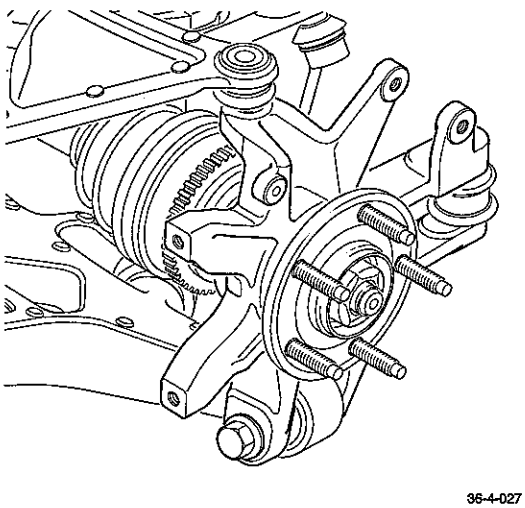
The Upper Arm

- Is a one piece aluminium casting and incorporates a built in ball joint
- Is the upper support for the hub carrier
- Is attached to the crossmember at the two mounting points



The Lower Arm

- Is a one piece aluminium casting with integral mounting points for the road spring and damper assembly, and the stabiliser bar drop links
- Is the lower support for the hub carrier
- Is attached to the crossmember at the two mounting points

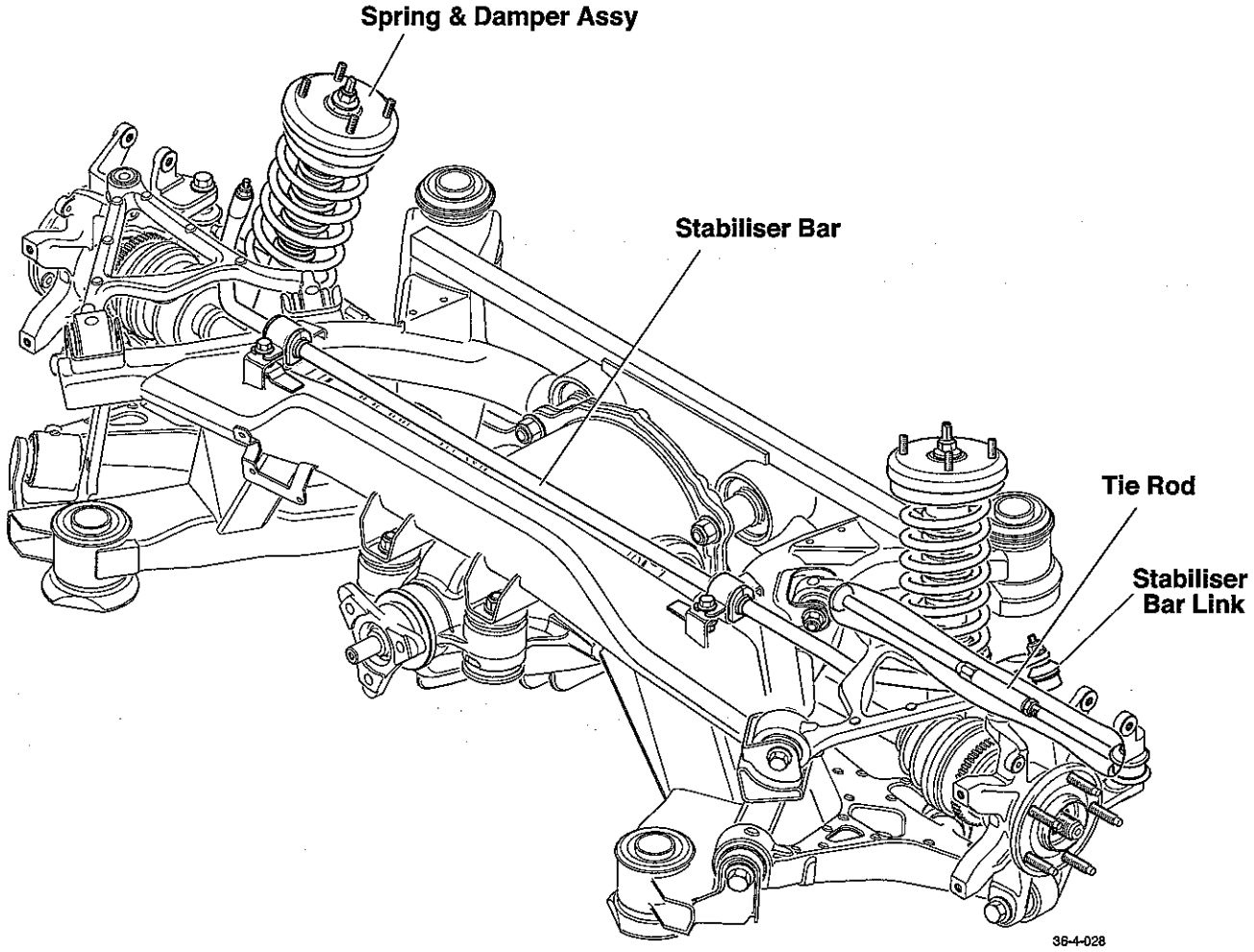


The Hub Carrier

- Carries the rear hub
- Carries the brake calliper assemblies
- Carries the ABS sensor
- Carries the hub bearing and seals

The Spring and Damper Assembly

- Support the weight of the vehicle and its occupants
- Provide occupant comfort by absorbing the shocks as the vehicle rolls over road surface imperfections
- Damps the oscillations of the road springs after spring deflection
- Maintains driveability by maximising tyre contact with the road surface



The Stabiliser Bar Link

- Is of steel construction with a ball joint at either end
- Transmits vertical movement of the rear suspension to the stabiliser bar to minimise body roll

The Stabiliser Bar

- Is mounted on the crossmember assembly
- Is connected to the left and right hand lower wishbones by the drop links

The Tie Rods

- Are of two piece steel construction with a ball joint at either end
- They secure the rear of the hub carrier to the crossmember
- The length of the tie rods may be adjusted to alter the rear wheel toe alignment

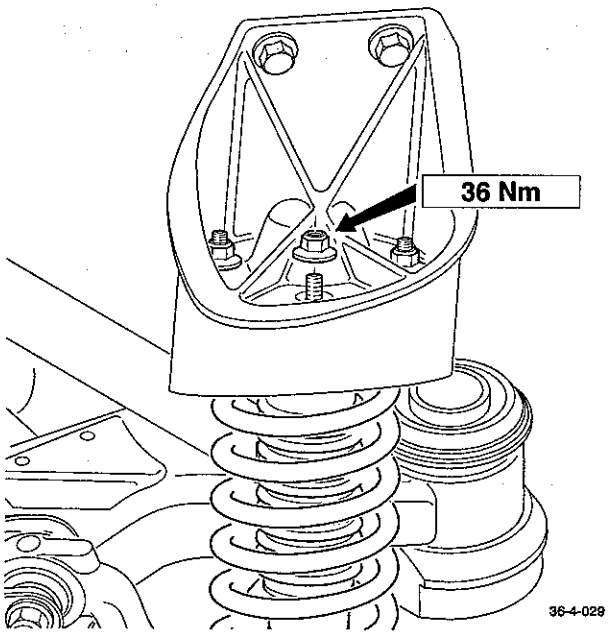
Rear Suspension - Torque Specifications

Description	Nm	Lb/Ft
Crossmember to Main Frame Bolts	90	66
Toe Link to Rear Knuckle Bolt and Nut	55	41
Lower Arm to Subframe Rear Bolt	180	133
Lower Arm to Subframe Front Bolt	150	111
Upper Arm Front and Rear Bolts	90	66
Damper to Lower Arm Bolt	140	103
Damper top mounting nut M12	50	37
Rear Brake Caliper to Knuckle	105-120	77-88
Stabiliser Bar	55	41
ABS Sensor	11.5	8.5
Rear Hub Nut	410	302
Wheel Nuts	130	96

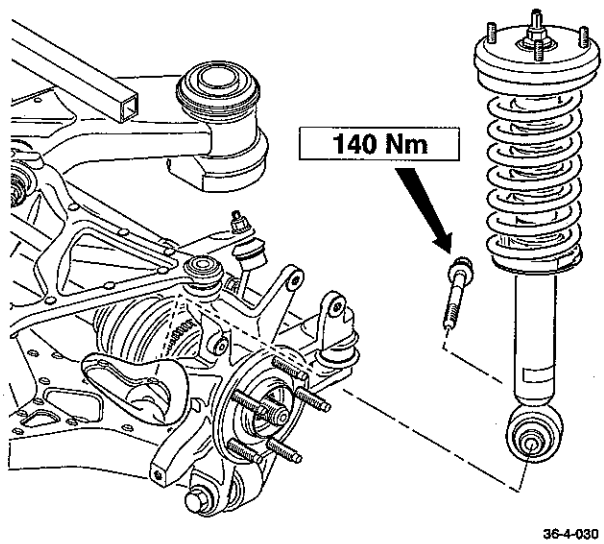
4.2.03.2 Rear Damper and Spring Assembly

Removal

1. Raise the vehicle on a four point hoist so that the damper and spring are fully extended.
2. Remove the road wheels.
3. Remove the retaining nuts from the damper assembly upper mounting.



4. Remove the bolt from the lower damper mounting.



5. Remove the spring and damper assembly.

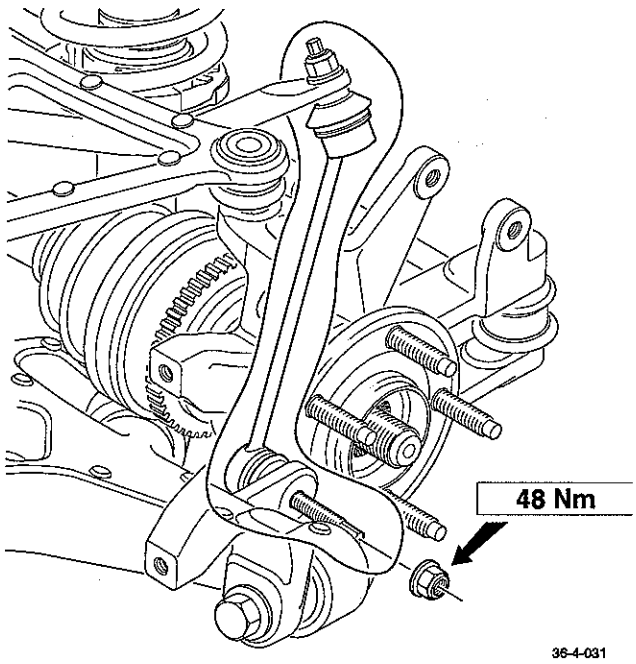
Installation

1. To install, reverse the removal procedure.

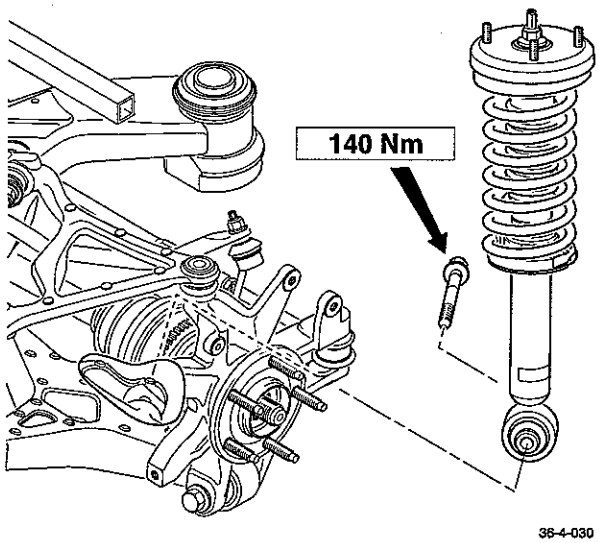
4.2.06.1 Rear Lower Arm Assembly

Removal

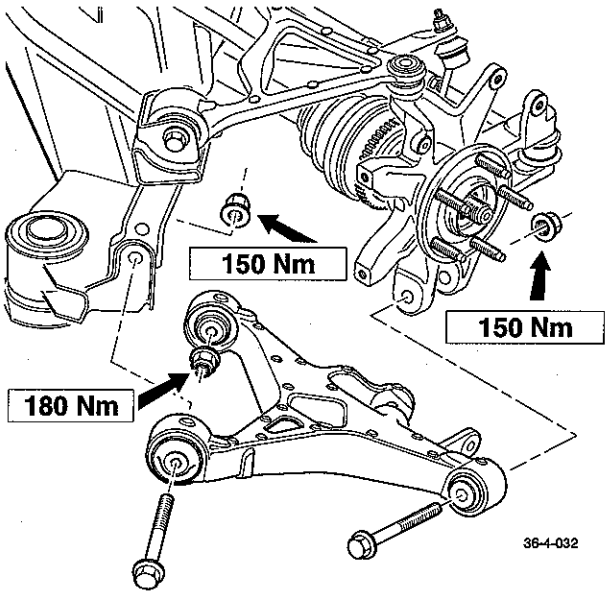
1. Raise the vehicle on a four post hoist.
2. Remove the relevant rear wheel.
3. Detach the stabiliser bar link.



4. Detach the damper from the lower arm.



5. Detach the lower arm from the subframe.
6. Detach the lower arm from the hub.



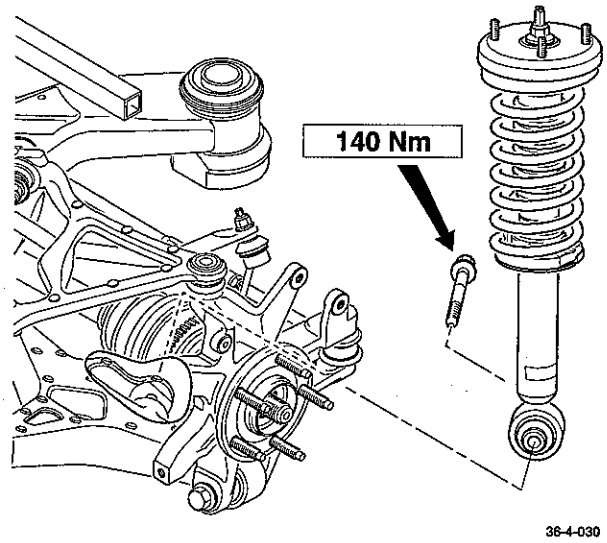
7. Remove the lower arm.

Installation

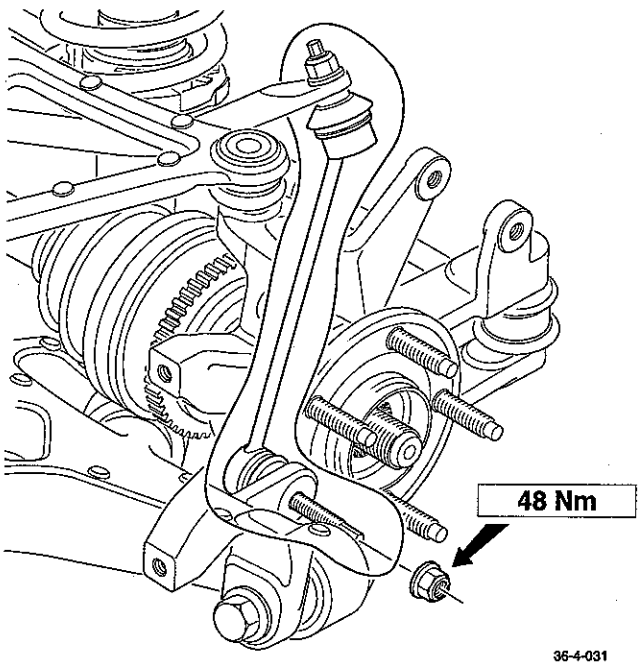
Caution: The final tightening of the rear suspension components must be carried out with the full weight of the vehicle on its road wheels. Failure to secure the bushes in the normally laden position will overstress the bushes when the suspension is deflected to maximum upward or downward travel.

1. Initially, only install bolts finger tight.
2. Install the lower arm to the subframe and to the hub assembly.

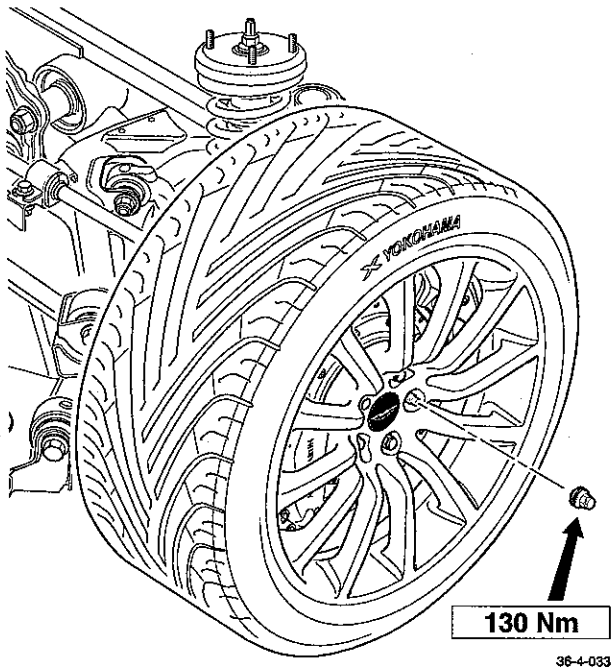
3. Install the damper assembly to the lower arm.



4. Install the stabiliser bar link.



5. Install the wheel.



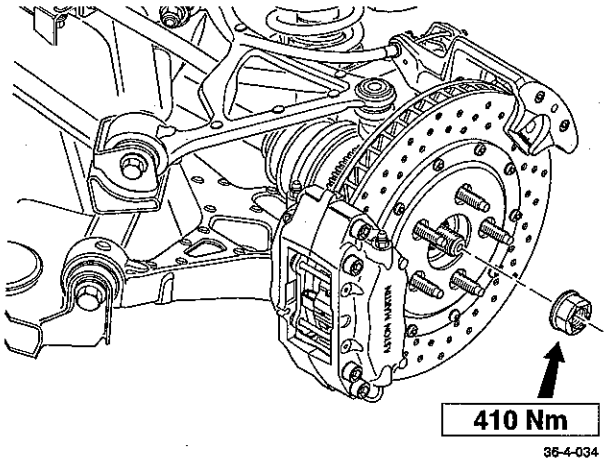
6. Lower the vehicle so that the full vehicle weight is taken on the suspension. Tighten all fixings to the specified torque figues.

7. Check the rear wheel alignment and adjust if necessary.

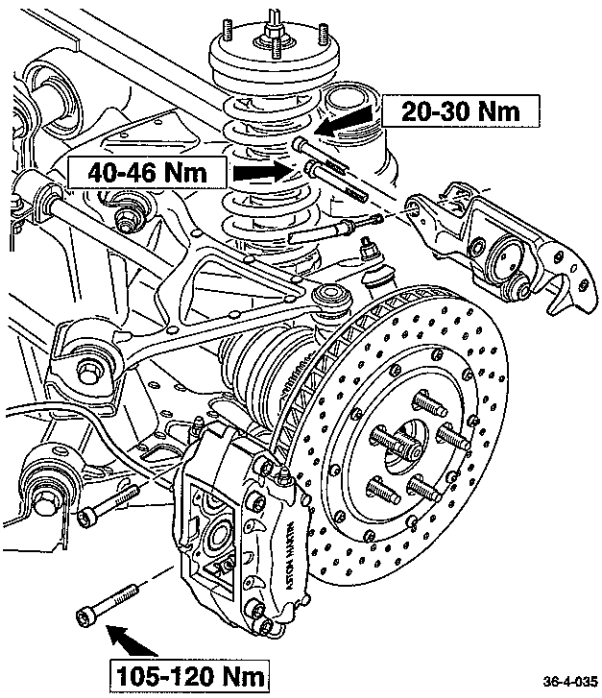
4.2.06.5 Rear Upper Arm Assembly

Removal

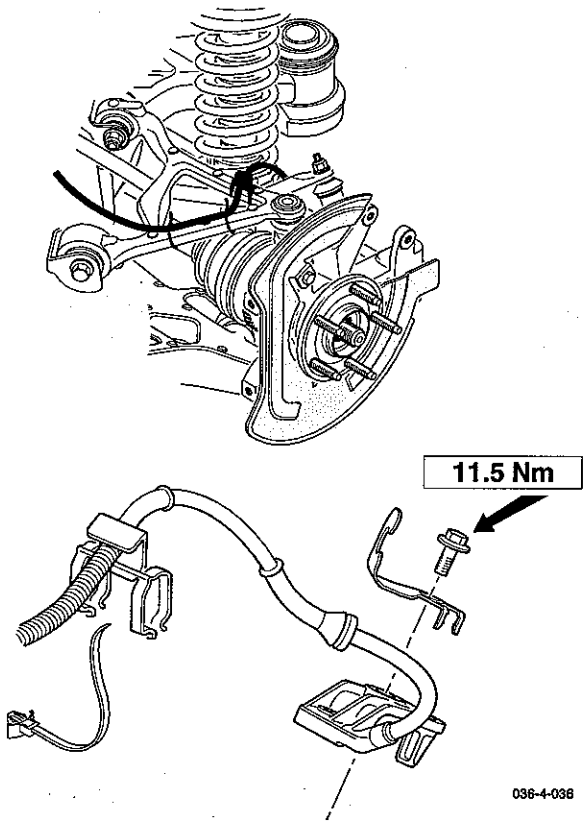
1. Raise the vehicle on a four point hoist.
2. Remove the relevant rear wheel.
3. Remove the axle shaft hub nut.



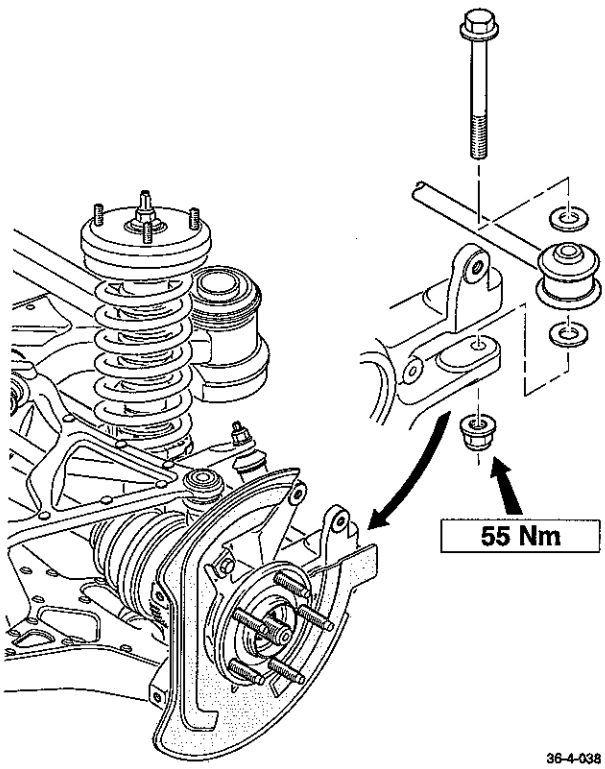
4. Remove the pads from the rear brake caliper and the handbrake caliper.
5. Detach the brake and handbrake callipers



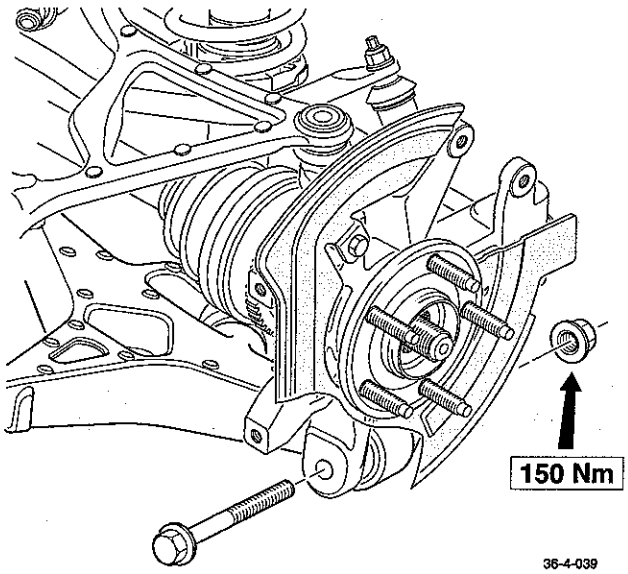
6. Unclip the ABS sensor wiring harness. Detach the ABS sensor. Detach the handbrake cable from the upper arm



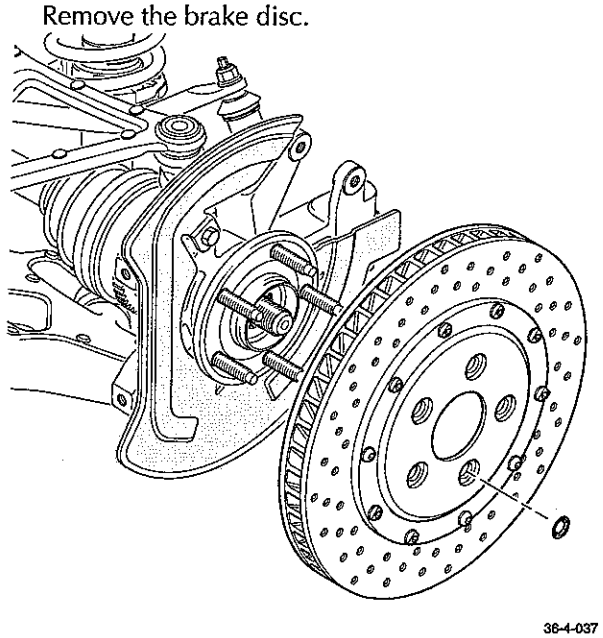
7. Detach the outer end of the tie rod.



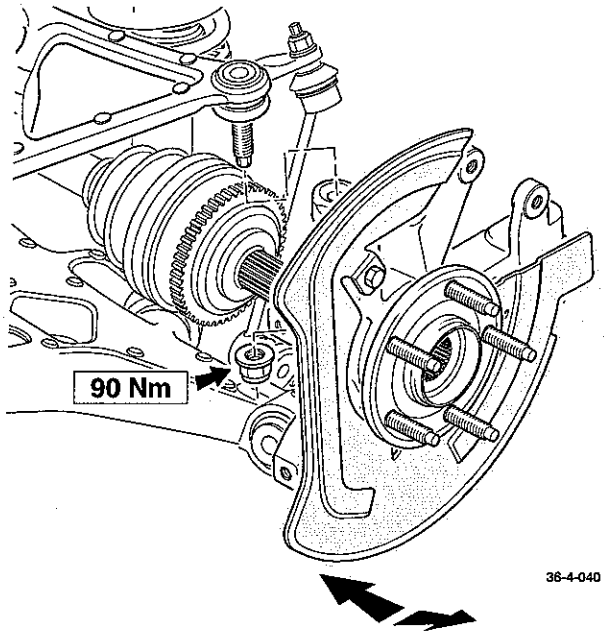
8. Detach the lower arm from the hub assembly.



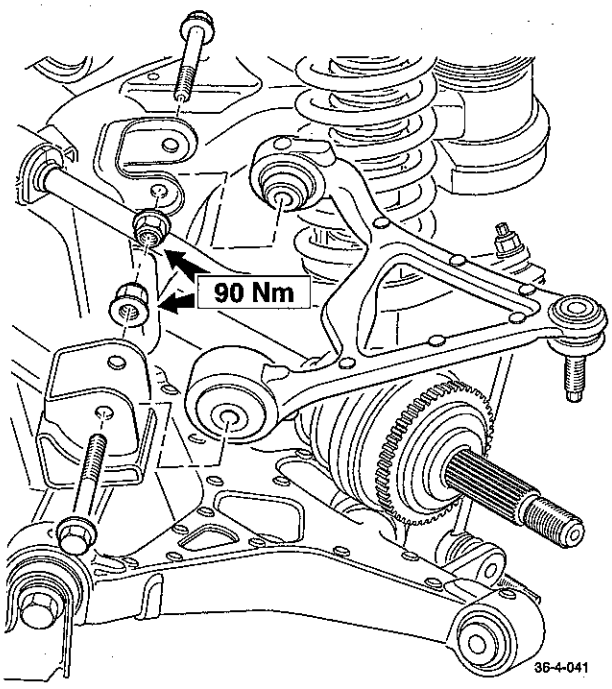
9. Remove the brake disc.



10. Detach the hub assembly from the driveshaft. Detach the upper ball joint and remove the hub assembly.



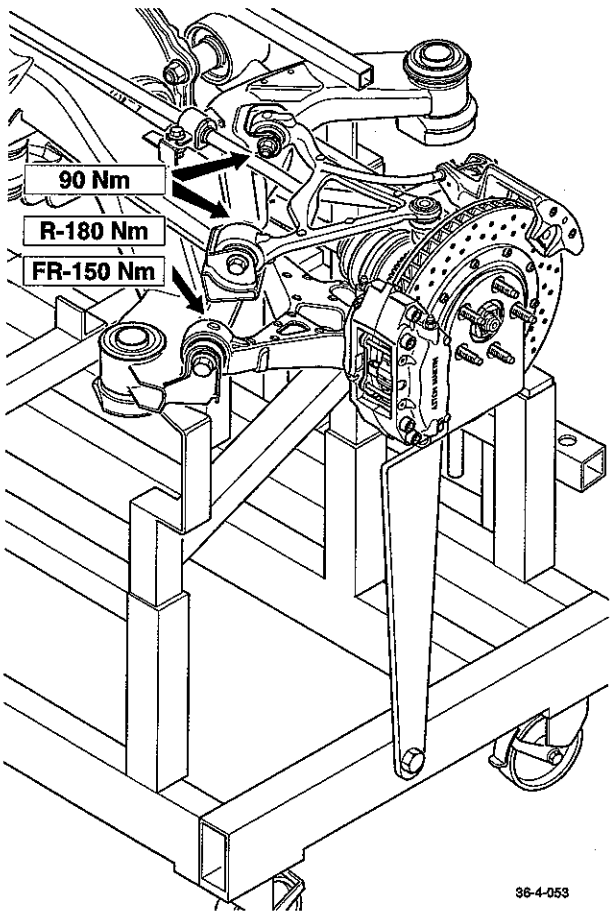
11. Remove the upper arm.



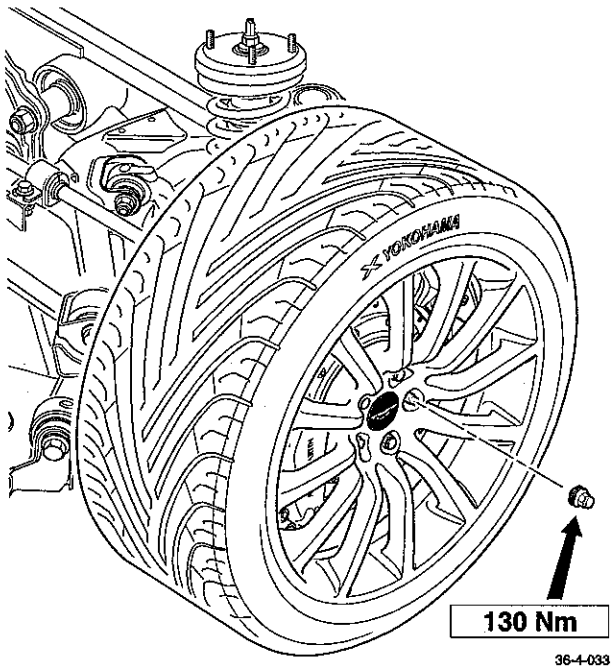
Installation

Caution: The final tightening of the rear suspension components must be carried out with the suspension arms at the normal ride height position. Failure to follow this requirement will overstress the suspension bushes when the suspension is deflected to maximum upward travel.

1. Install all components using the reverse of the removal sequence. Leave the bolts through the upper and lower arms loose.
2. Lower the vehicle onto the multipurpose trolley (303-F715) so that the rear suspension frame rests fully on the mounting points.
3. Raise each rear hub in turn, fit and secure the hub support brackets to hold the hubs at normal ride height.
4. Tighten all fixings to the specified torque figures.

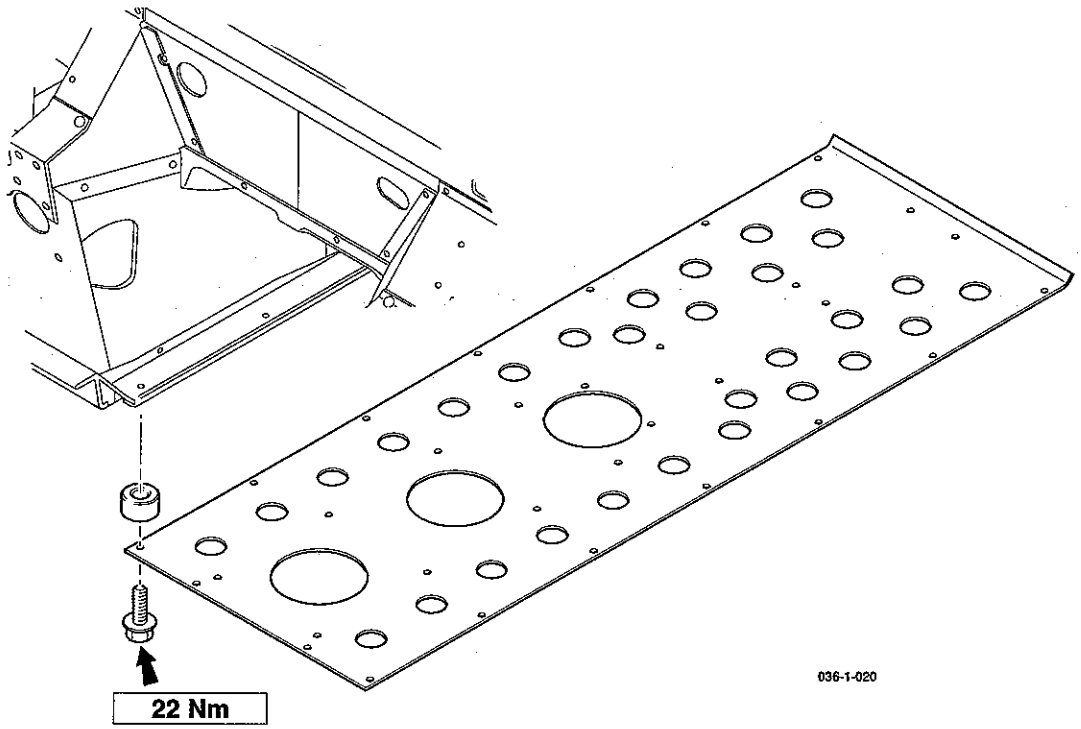


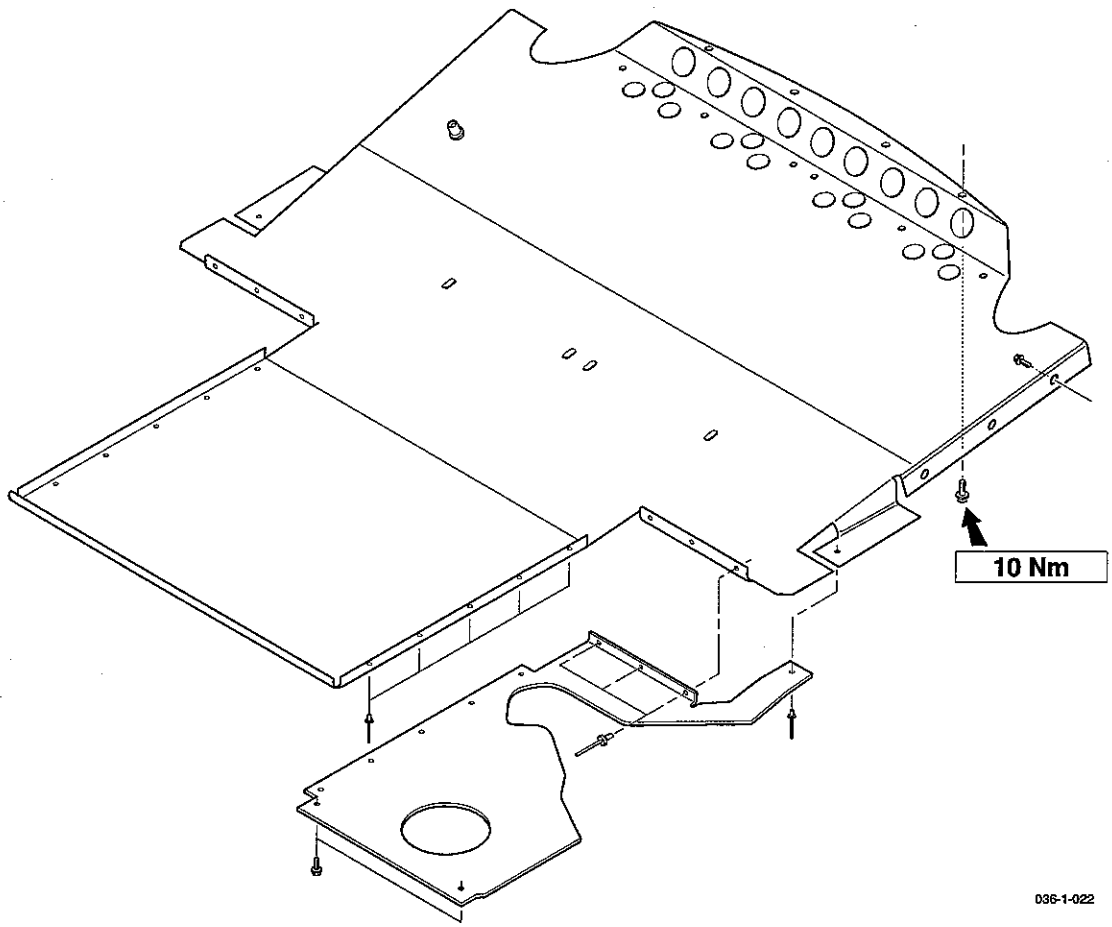
5. Fit the road wheels. Torque tighten the wheel nuts.



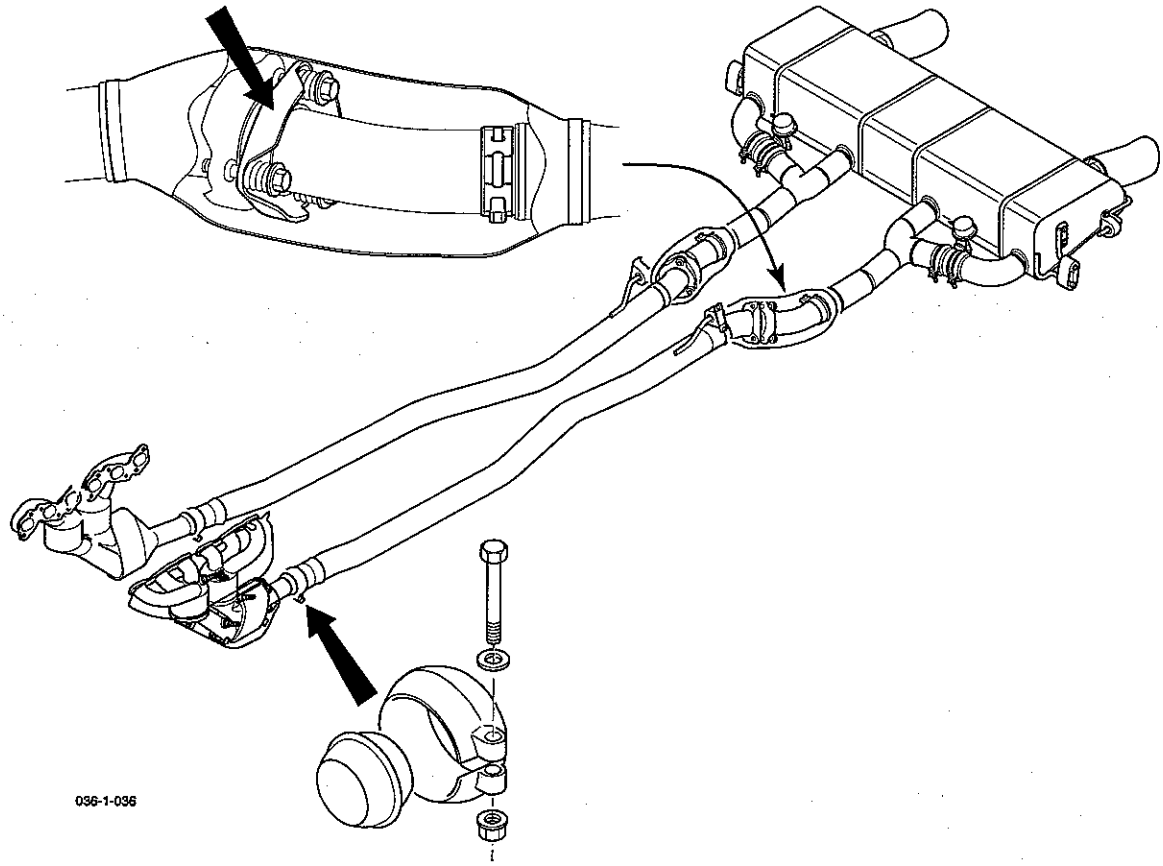
4.2.07.2 Rear Suspension Removal

1. Switch off the battery disconnect switch.
2. Raise the vehicle on a hoist and remove the tunnel shear panel and rear undertray.

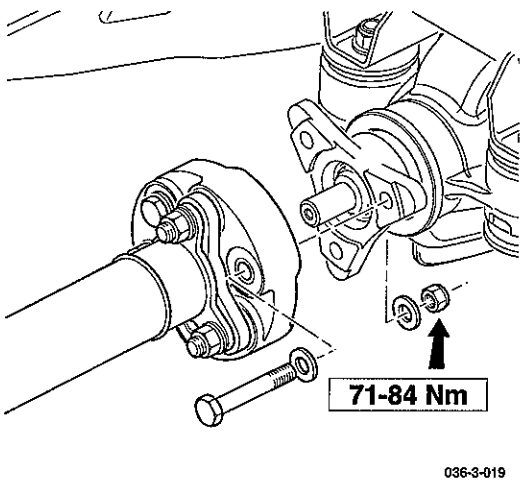




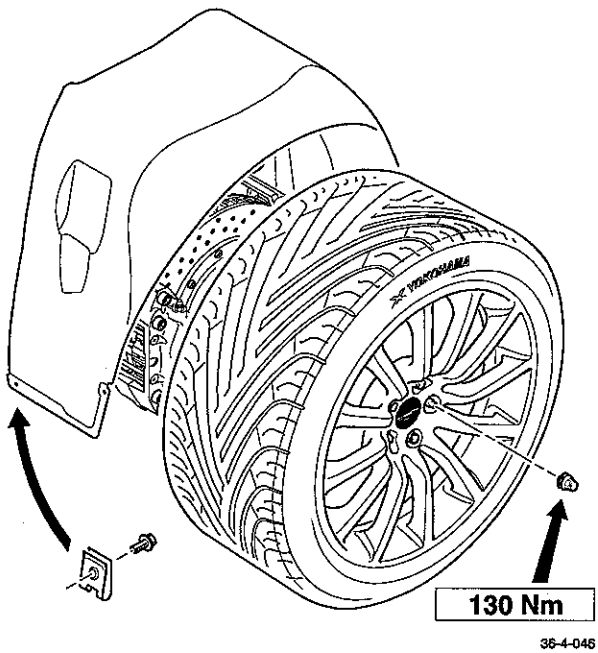
3. Remove the intermediate exhaust pipes. Release two clamps at the front and two flanges at the rear.



4. Release three bolts and remove the propshaft.

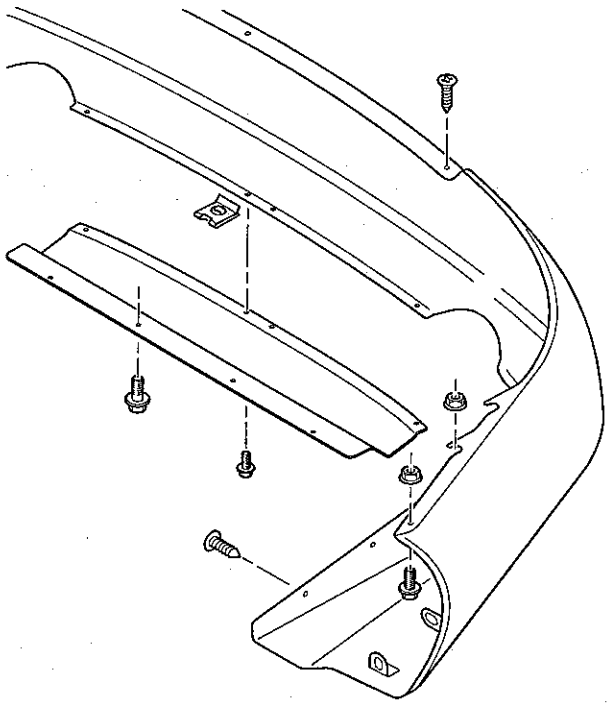


5. Remove the rear wheels and wheel arch liners



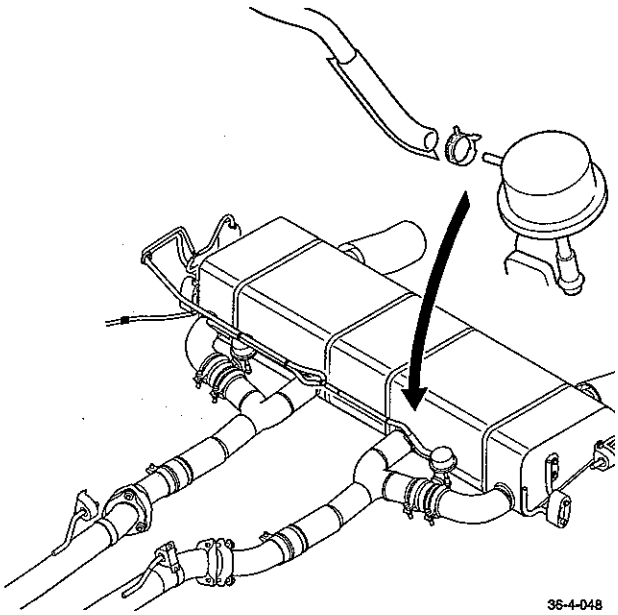
6. Remove the rear bumper cover.

   - Release two pinch nuts and one screw in each wheel arch
   - Remove four screws from the rear lower edge
   - Remove five screws from the upper edge
   - Remove the bumper cover



36-4-047

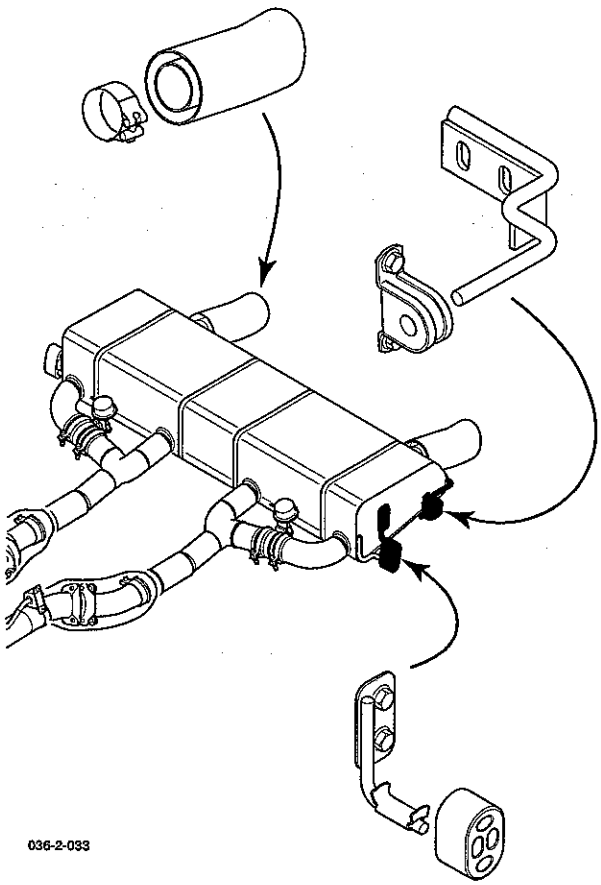
7. Disconnect the vacuum pipes from the two exhaust bypass valves.



36-4-048

8. With the assistance of a second person, detach the silencer assembly from its mounts and remove the silencer assembly.

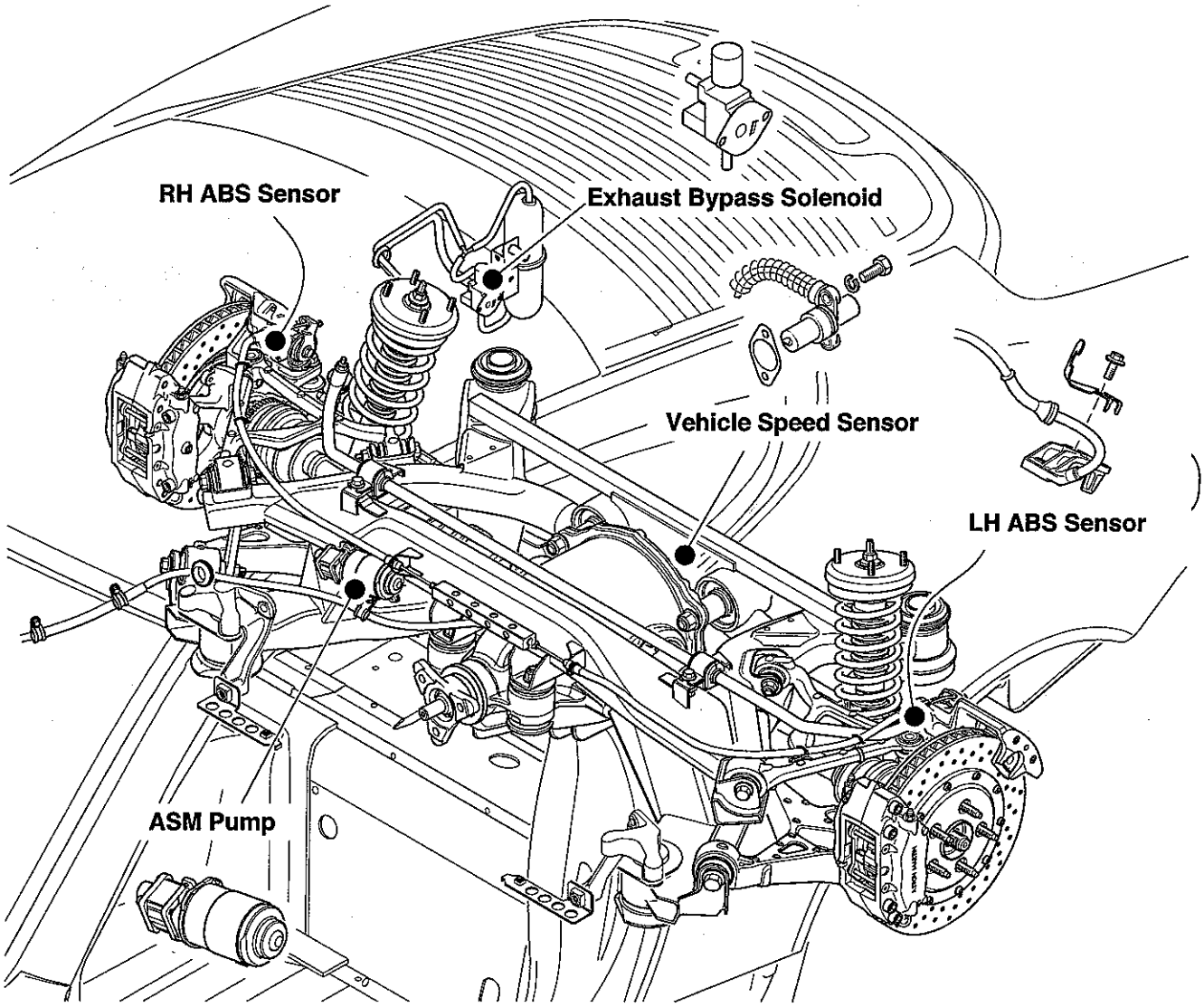
Warning: Danger of personal injury. Because of the size and weight of the silencer assembly, obtain the assistance of a second person when removing the silencer.



036-2-033

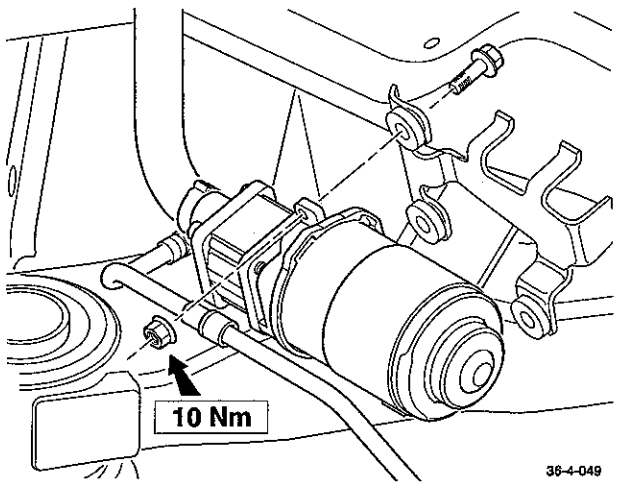
9. Disconnect the following connectors:

- ASM Pump
- RH ABS Sensor
- LH ABS Sensor
- Exhaust Bypass Solenoid
- Vehicle Speed Sensor



10. Remove two M6 bolts and release the ASM pump assembly from the axle.

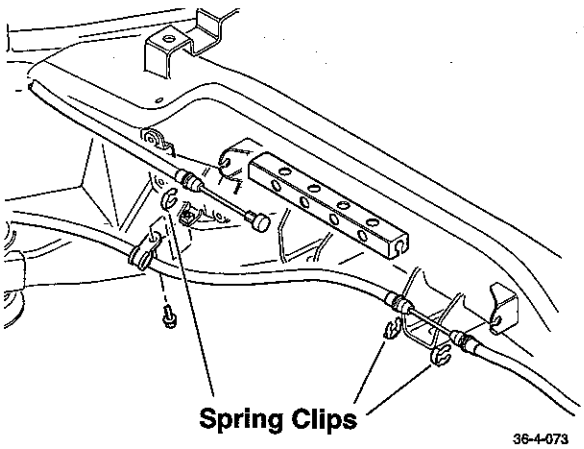
Caution: DO NOT release any hydraulic connections in the ASM system. Cleanliness of the system is extremely critical.



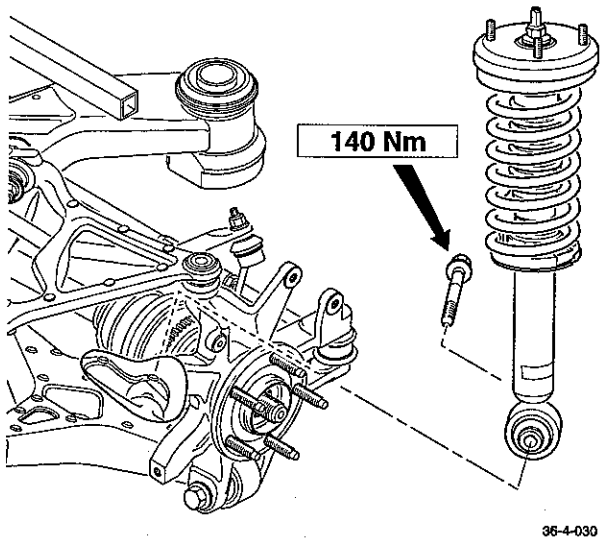
11. Release the pinch bolts and release the ASM reservoirs.

12. Release the handbrake cables.

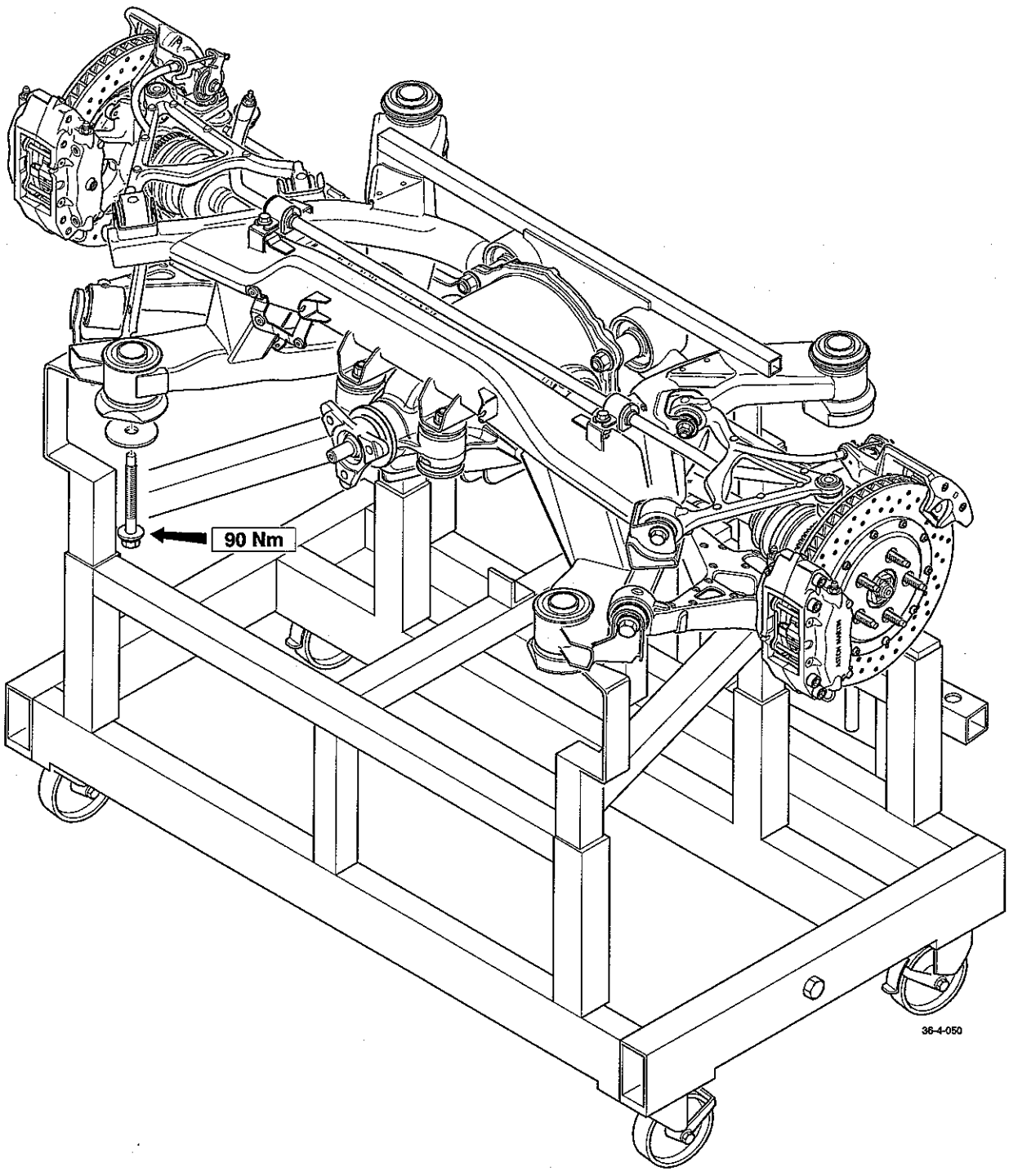
    - Release the cables from the handbrake calipers.
    - Release two tie-wraps at the outer end of each cable
    - Release three spring clips, two at the abutment brackets and one at the stirrup. Release the handbrake cables from the brackets.



13. Remove the bolt from the lower mount of each damper.



14. Place the multipurpose support trolley (303-F715)under the rear suspension assembly. Lower the vehicle until the rear suspension is correctly located on the trolley. Remove the four bolts securing the rear suspension assembly.



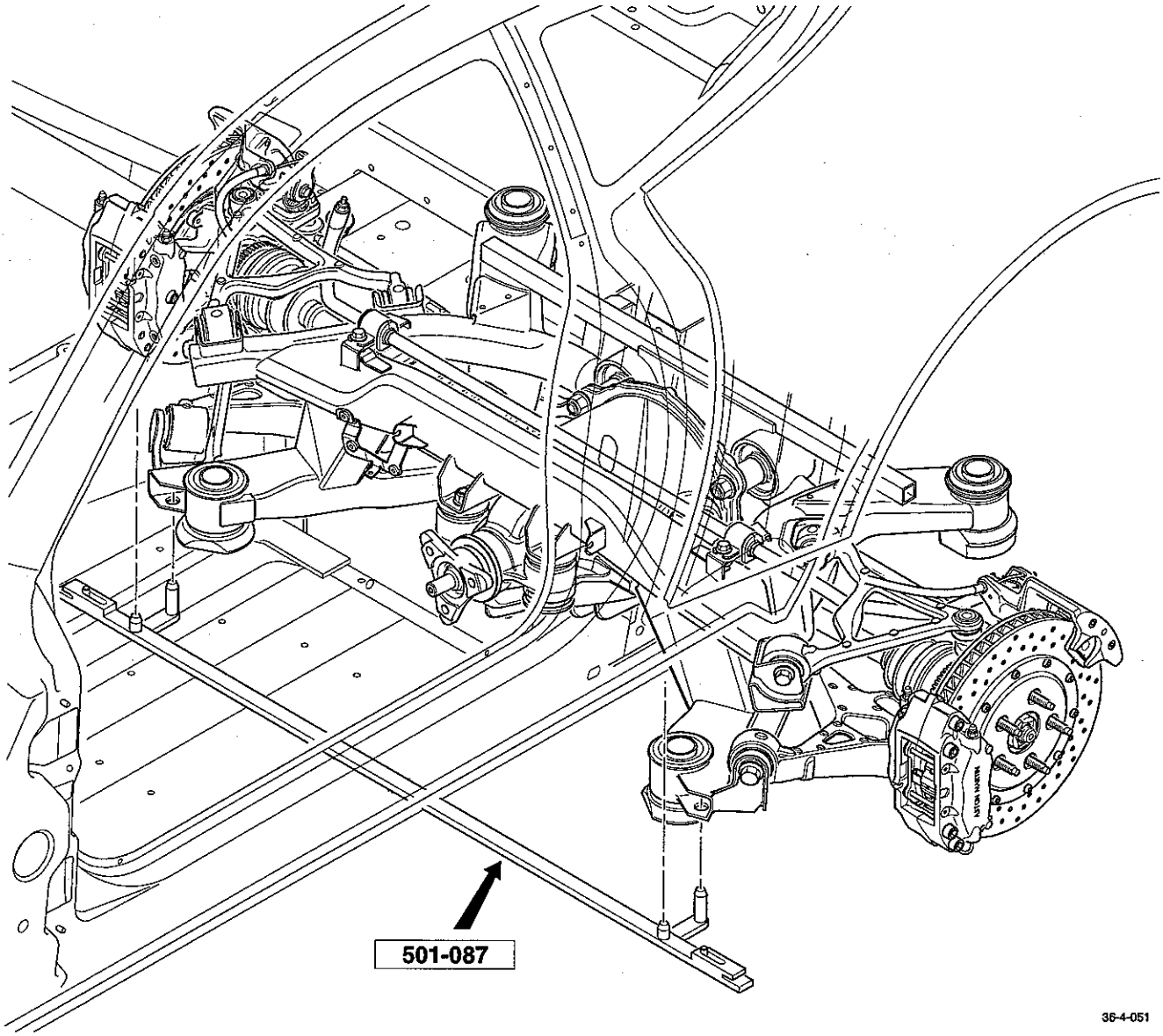
15. Progressively raise the vehicle from the rear suspension, clearing all pipes and cables as the vehicle lifts.

16. Temporarily secure the ASM pump and reservoir to avoid strain and spillage.

17. Retain the spacers from each suspension frame mounting pad. These should be refitted in the same positions when the suspension assembly is refitted.

Replacement

1. Replacement is the reverse of the removal predure. Use tool 501-087 to align the axle assembly to the tub. Secure the axle assembly before removing the alignment tool.

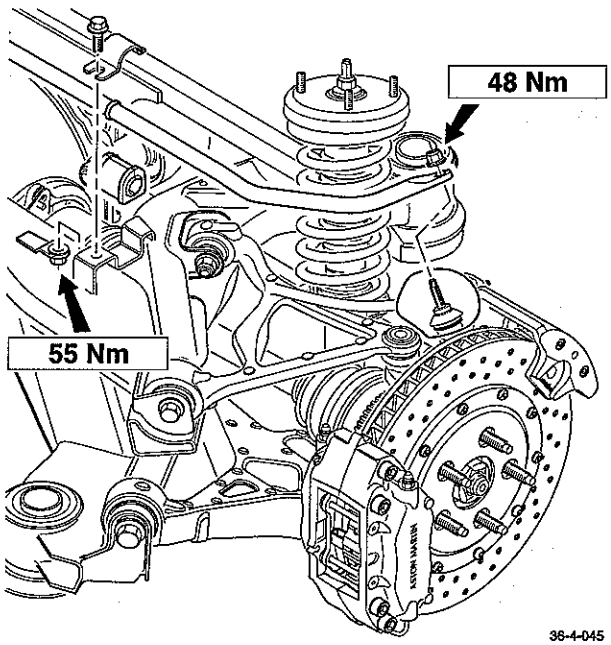


2. After completing the replacement, perform the following checks and adjustments.
   - Rear wheel toe adjustment

4.2.09.1 Rear Stabiliser Bar

Removal

1. Remove the rear suspension.
2. Disconnect the stabiliser link bar.
3. Remove the stabiliser bar.



Installation

Caution: The final tightening of the rear suspension components must be carried out with the full weight of the vehicle on its road wheels. Failure to follow this requirement will overstress the suspension bushes when the suspension is deflected to maximum upward travel.

1. Install the stabiliser bar.
2. Install the rear suspension (4.2.07.2).
3. Check the rear suspension alignment and adjust as necessary.
4. Check the wheel alignment and adjust as necessary.

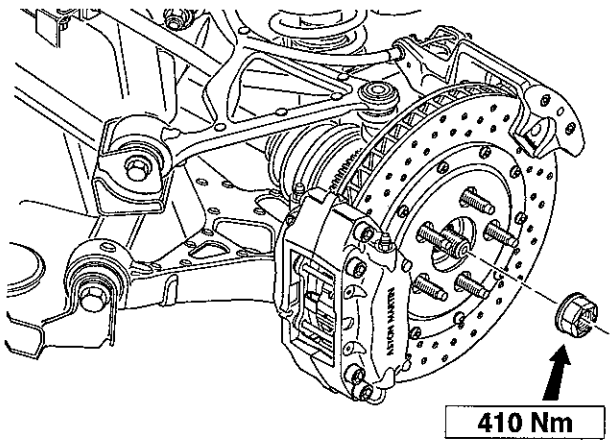
4.2.12.1 Rear Hub Assembly

Special Service tools

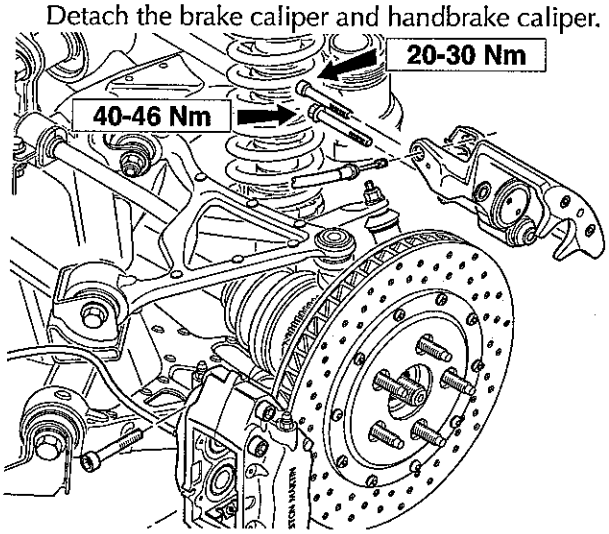
Hand Press 100-019
Hand Press Adapter Base Plate 100-019-01
Hub Support 204-249
Remover Rear Bearing Outer 204-250
Bearing Replacer 205-470
Inner Hub Removal/Installer Tool 204-193
Support-Rear Hub 204-252

Removal

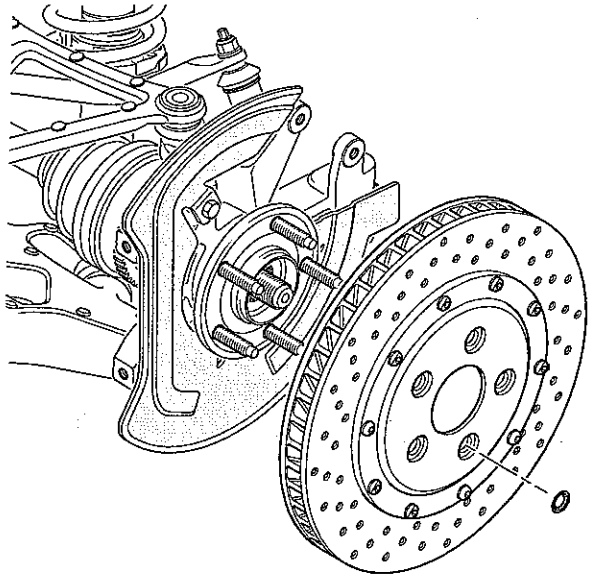
1. Loosen the wheel nuts.
2. Raise and support the vehicle. Remove the wheel.
3. Remove the axle shaft hub nut.



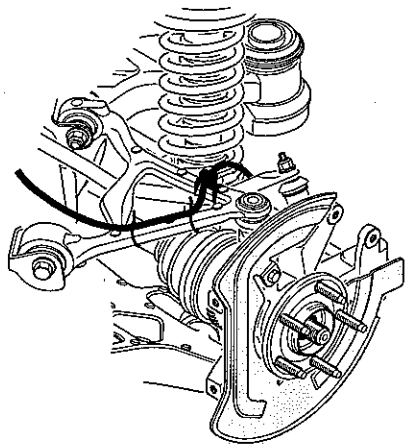
4. Remove the brake and handbrake pads.
5. Detach the brake caliper and handbrake caliper.

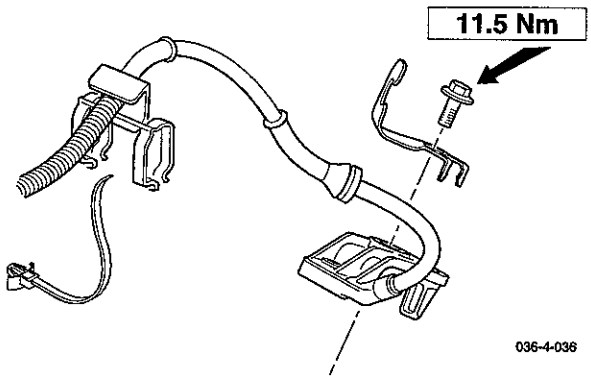


6. Remove the brake disc.

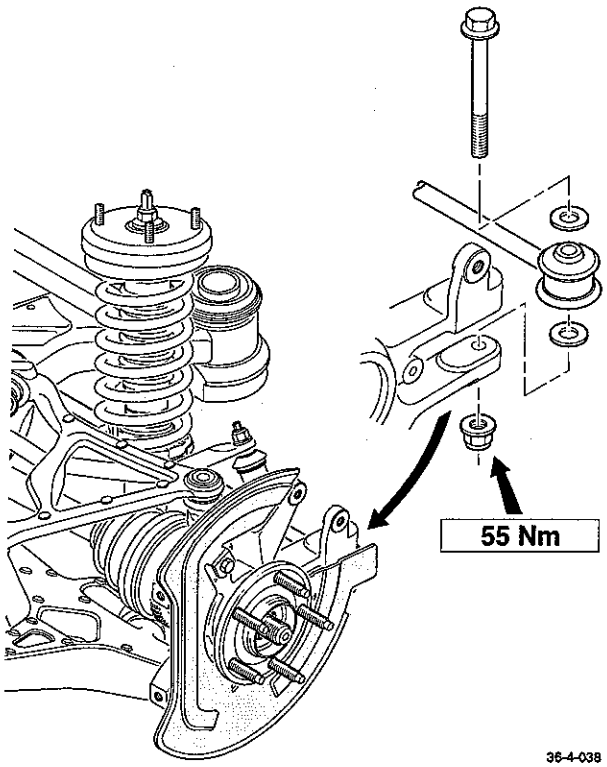


7. Unclip the ABS sensor wiring harness. Detach the ABS sensor.

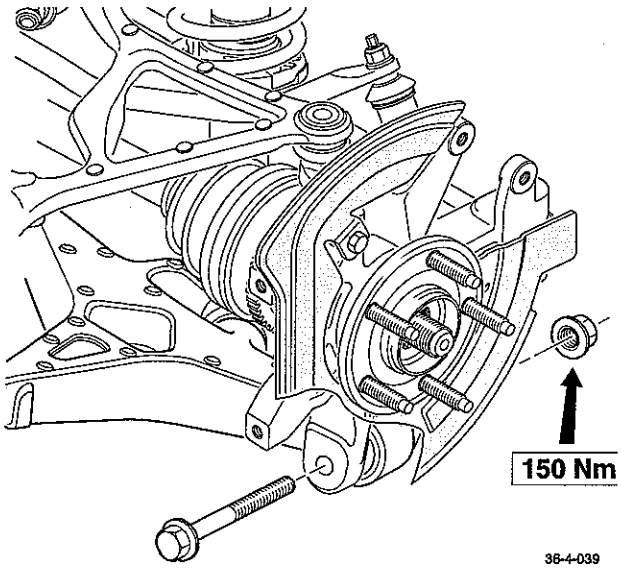




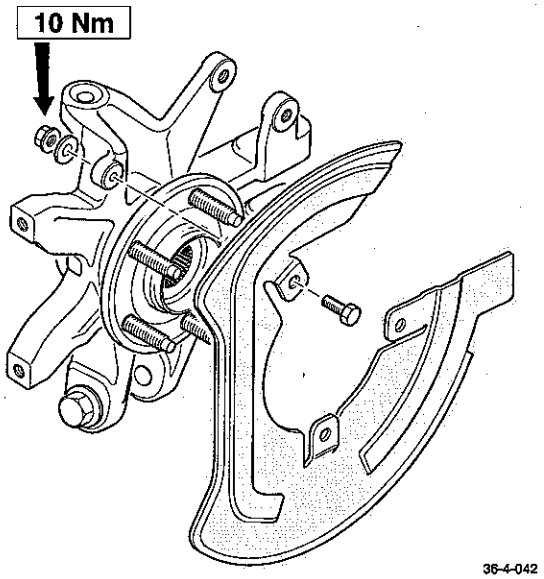
8. Detach the outer tie rod.



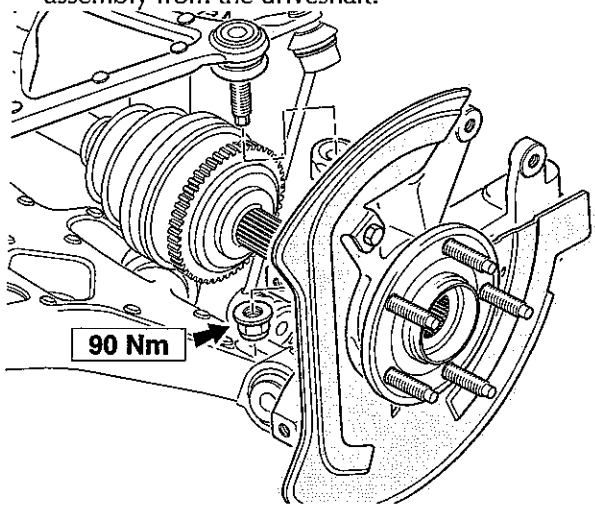
9. Detach the lower arm from the hub assembly.



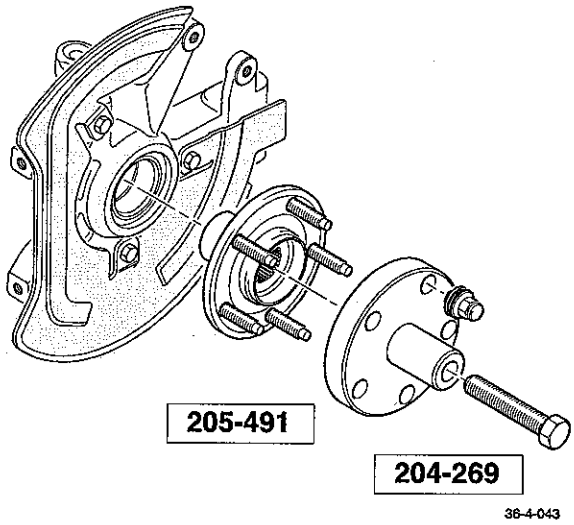
10. Remove the brake dust shield.



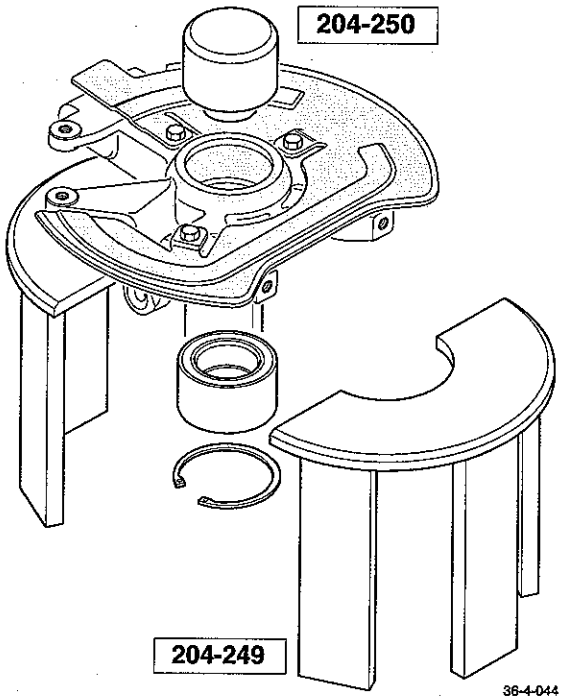
11. Detach the upper ball joint and remove the hub assembly from the driveshaft.



12. Using the special tools, remove the hub from the bearing.



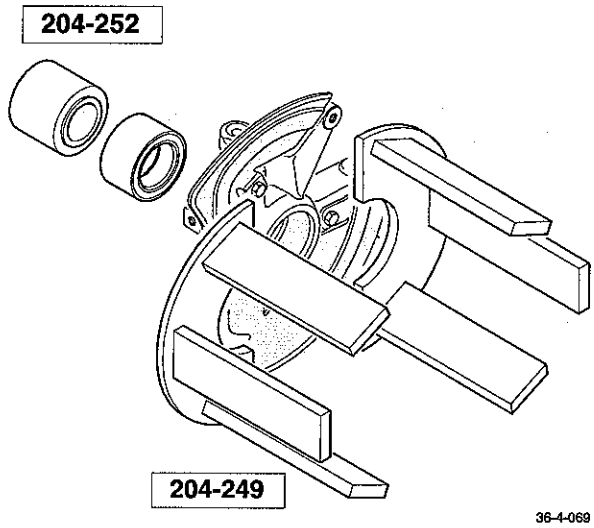
13. Remove the circlip and press the bearing from the hub carrier.



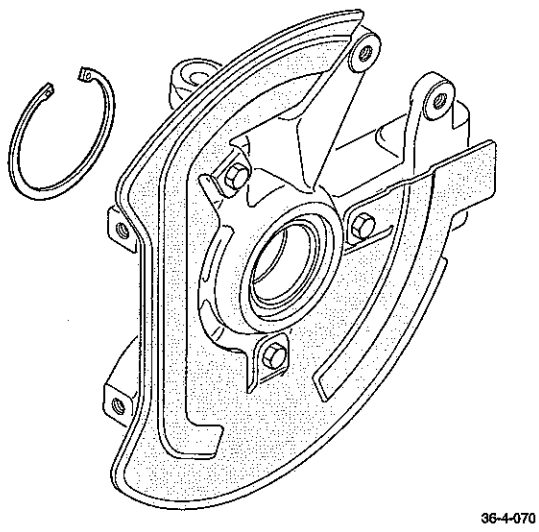
Installation

Caution: The final tightening of the rear suspension components must be carried out with the full weight of the vehicle on its wheels.

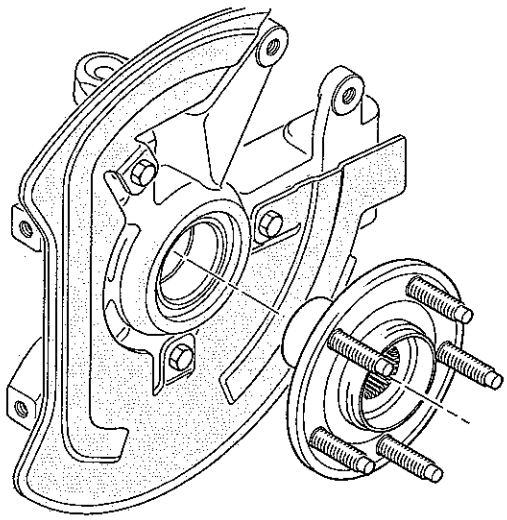
1. Using the special tools, install the hub bearing to the hub carrier.



2. Install the circlip.

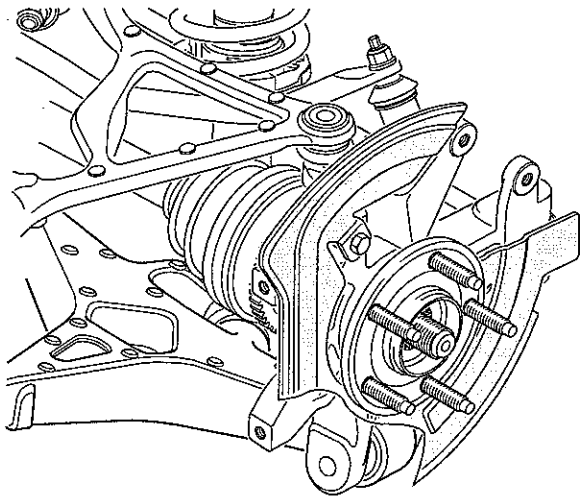


3. Using the special tools, install the hub to the bearing.

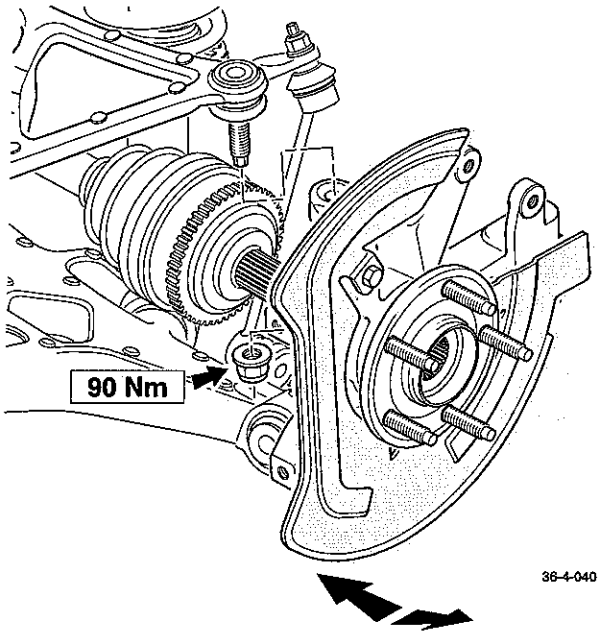


36-4-071

4. Install the hub assembly.

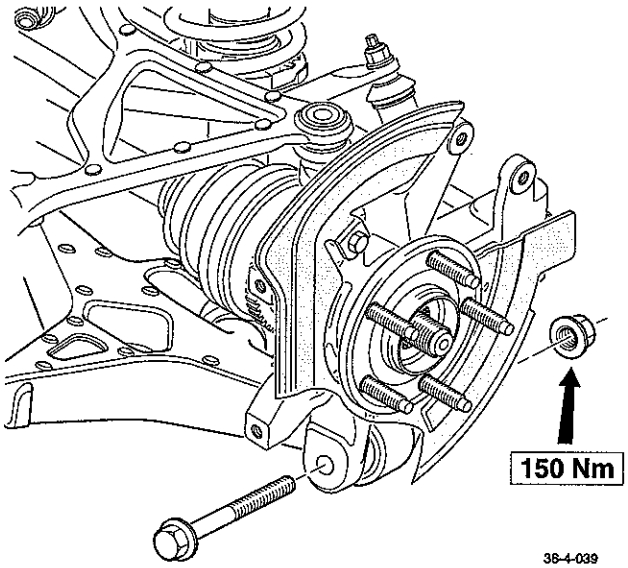


5. Attach the hub assembly to the upper arm.



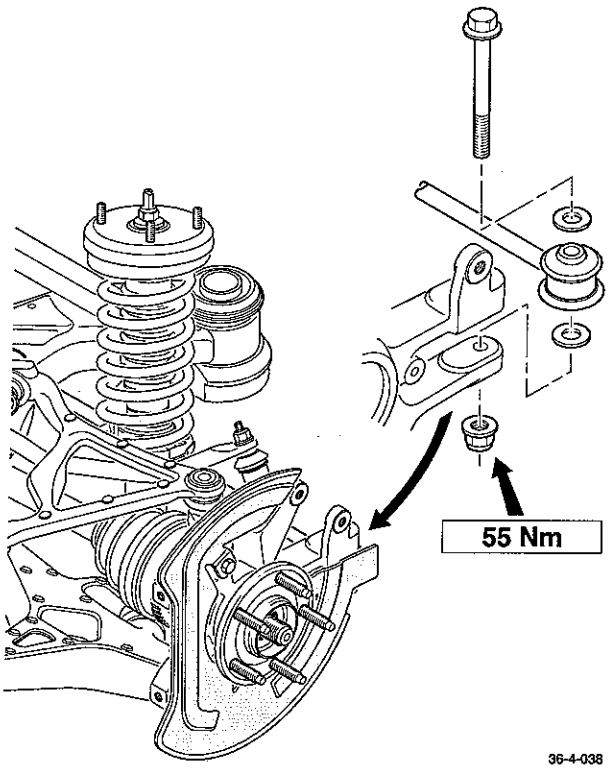
36-4-040

6. Install the lower arm to the hub assembly.

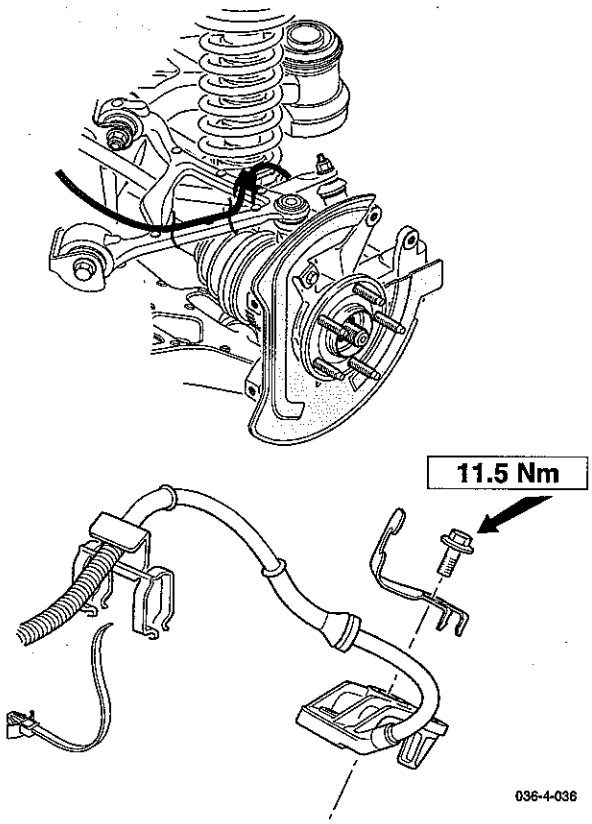


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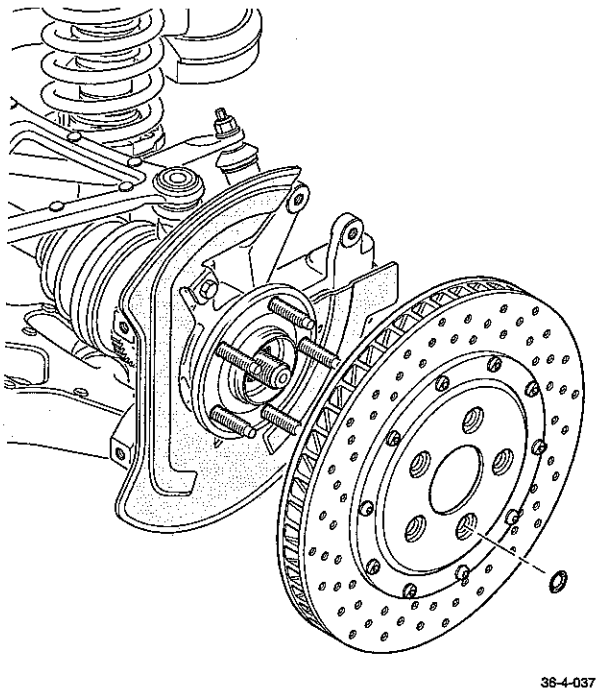
7. Install the outer tie rod.



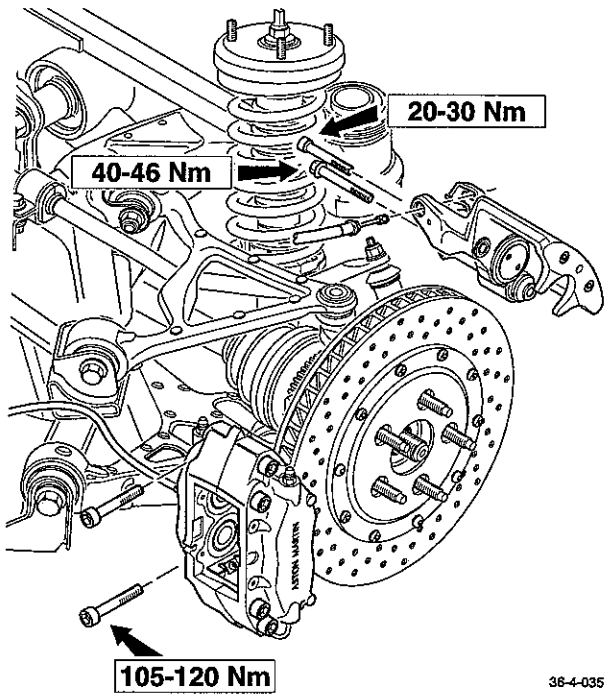
8. Install the ABS sensor.



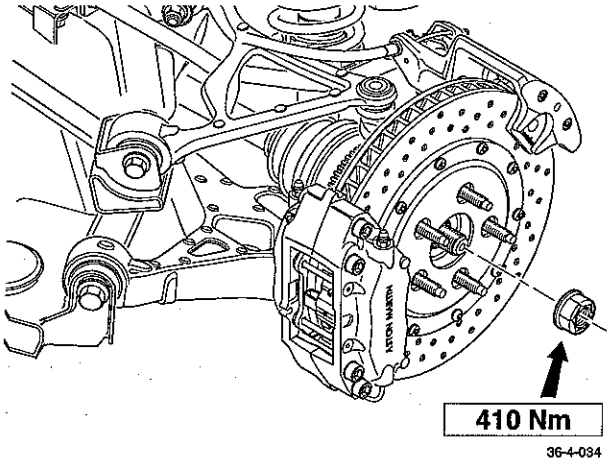
9. Install the brake disc and retaining clip.



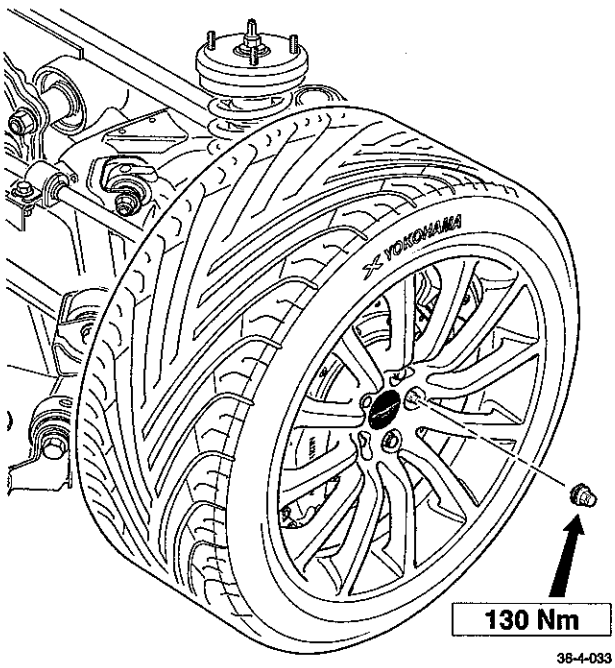
10. Install the brake calipers.



11. Install the axle shaft hub nut.



12. Install the wheels.

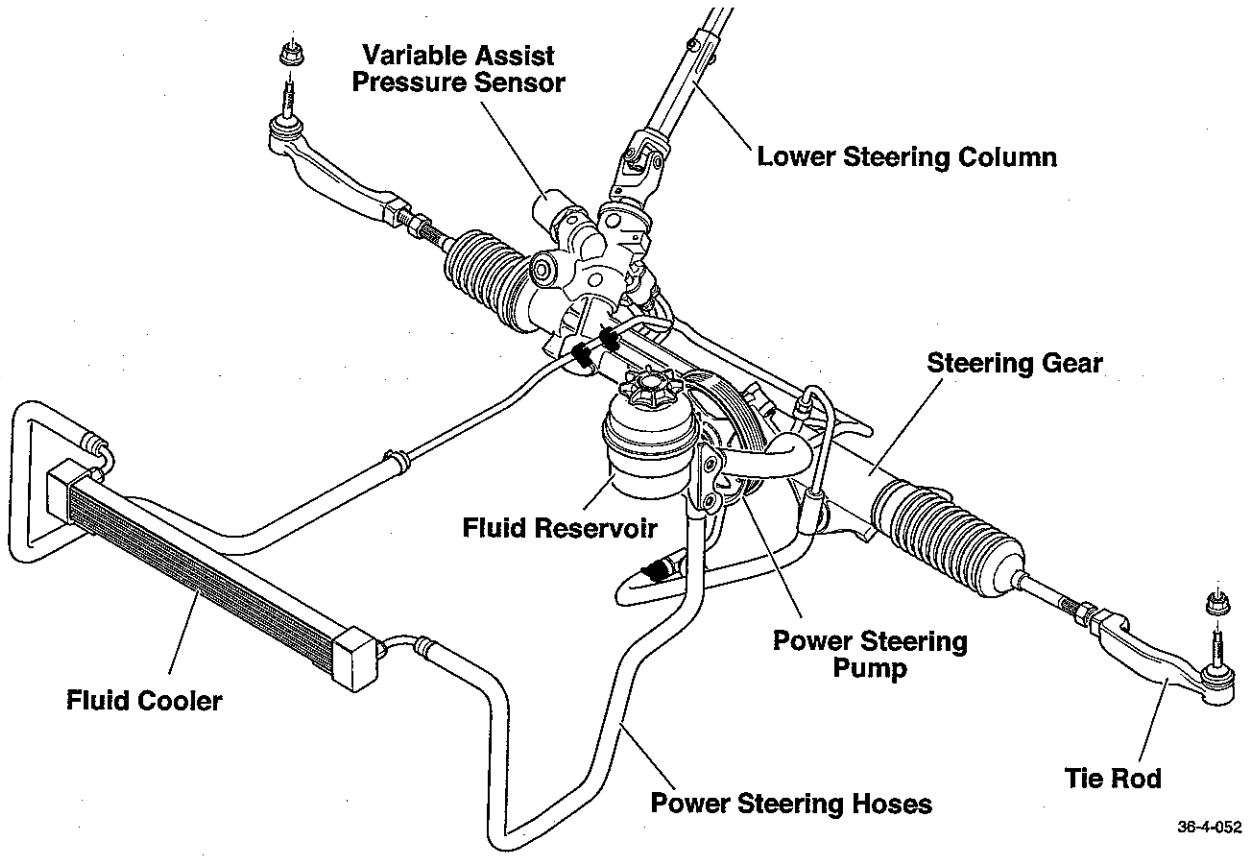


13. Lower the vehicle.

14. Perform the following procedures

- Handbrake cable adjustment
- Brake bleeding procedure

Power Steering System



Item	Description
1	Lower steering column
2	Fluid reservoir
3	Power steering pump
4	Power steering hoses
5	Fluid cooler
6	Steering gear
7	Tie-rod end

The power steering system is a rack and pinion design, with an engine-driven pump providing the steering assistance. The system features speed dependant steering assistance.

Absolute cleanliness must be observed when replenishing the fluid or dismantling any part of the system. When topping up the system, new fluid from a sealed container must be used.

Steering Specifications

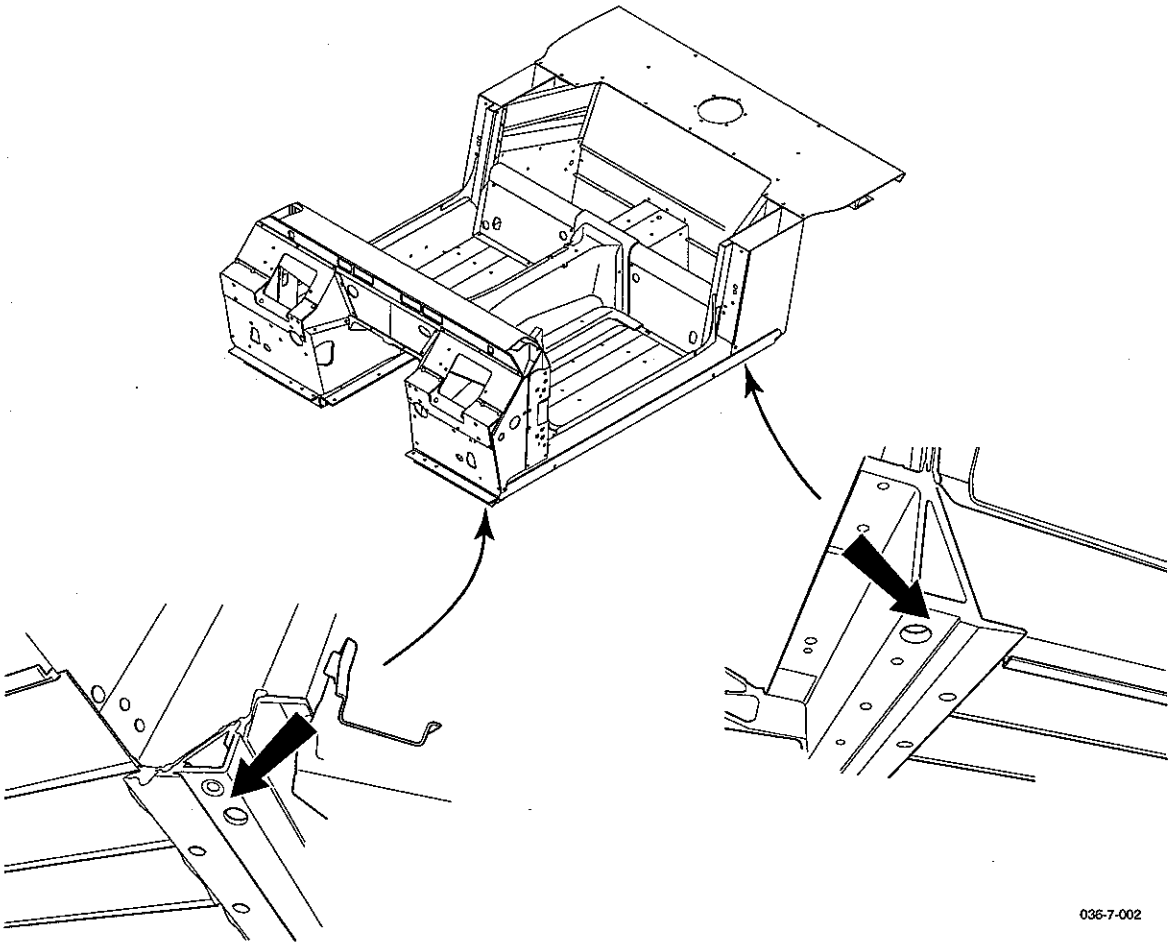
Steering Linkage free play	0.6 mm (0.024 in) at the steering wheel rim
Steering Pump Pressure	1400 - 1530 psi
Power Steering Fluid	699 999

Steering Geometry

Geometry is to be checked and set at the design load of; Curb weight + full fluids + 75kg on each front seat.

Ride Height Measurement

Ride height to be measured from level ground to the underbody adjacent to the front and rear jigging holes at the outer corners of the floor.



Geometry Adjustment

Adjust front toe on the front track rods.

Adjust rear toe on the rear tie rods.

Adjust front camber on the lower control arm mounting bolts. Rear is not adjustable.

Caster angle and king pin inclination are not adjustable. Specifications are included here to aid in assessing accident damage.

Ride Height	Front	151 mm
	Rear	172 mm
Total toe	Front	0.0 (+1.0 / -0.0) mm
	Rear	3.0 (+0.0 / -1.0) mm
Camber	Front	-0.25° (+0.25° / -0.0°)
	Rear	-1.0°
Caster (reference only)	Front	8.5°
	Rear	8.5°
King Pin Inclination (reference only)	Front	8.0°
	Rear	8.0°
Bumpstop free travel	Front	11.0 mm
	Rear	17.0 mm

Steering System - Inspection and Verification

Verify the customer concern by driving the vehicle.

Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection Chart

Mechanical

- Incorrect tyre pressure, loose wheel nuts, incorrect wheel alignment
- Loose tie-rods
- Loose damper and spring assemblies or ball joint
- Loose steering column shaft universal joints
- Loose pinch bolts on steering column shaft
- Loose steering gear assembly
- Damaged accessory drive belt
- Binding or misaligned steering column, pump or steering gear
- Incorrect fluid level
- Hose leaks or line restrictions

If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

If the concern is not visually evident, verify the symptom and refer to the Symptom Charts.

Symptom Charts

The vehicle wanders from side to side on the road when driven straight ahead with the steering wheel held firmly.

Possible Cause:	Incorrect tyre size or pressure.
Action:	CHECK for the correct tyre size and adjust tyre pressures.
Possible Cause:	Vehicle is unevenly loaded or overloaded.
Action:	Adjust the load.
Possible Cause:	Loose or worn tie-rods or tie-rod ends.
Action:	INSTALL a new tie-rod end or steering gear.
Possible Cause:	Steering gear bolts loose or damaged.
Action:	TIGHTEN or INSTALL new bolts.
Possible Cause:	Loose or worn suspension ball joint(s).
Action:	INSTALL a new suspension ball joint assembly.
Possible Cause:	Steering column universal joint pinch bolt loose.
Action:	TIGHTEN the pinch bolt.
Possible Cause:	Incorrect toe adjustment.
Action:	ADJUST as necessary. For additional information, refer to <<204-00>>
Possible Cause:	Loose or worn rear suspension.
Action:	TIGHTEN loose, or INSTALL new rear suspension components.
Possible Cause:	Steering gear bushes worn/damaged.
Action:	Install new steering gear.

Vehicle tends to pull to one side when driven on a level surface.

Possible Cause:	Incorrect tyre pressure.
Action:	ADJUST the tyre pressure.
Possible Cause:	Incorrect tyre size or different tyre/tread type.
Action:	INSTALL a new tyre as necessary.
Possible Cause:	Vehicle is unevenly or excessively loaded.
Action:	ADJUST the load evenly.
Possible Cause:	Incorrect toe adjustment.
Action:	ADJUST as necessary.
Possible Cause:	Damaged front or rear suspension components.
Action:	INSTALL new suspension components as necessary.
Possible Cause:	Steering gear valve effort out of balance.
Action:	SHIFT the transmission into NEUTRAL while driving at no more than 30 miles/hour (50 km/h) and turn the ignition to position I (engine OFF-coasting). If the vehicle does not pull with the engine off, INSTALL a new steering gear. If the vehicle does drift with the engine off, CROSS SWITCH front wheel assemblies. Test at low speed due to directional tyres If the vehicle pulls to the opposite side, SWITCH wheels that were on the rear to the same side on the front. If the vehicle pull direction is not changed, CHECK the front suspension components and toe adjustments.
Possible Cause:	Check the front and rear brakes for correct operation.
Action:	ADJUST as necessary.
Possible Cause:	Check for bent rear suspension components and for damaged coil springs in the front suspension.
Action:	INSTALL new rear suspension components as necessary. INSTALL new front suspension components as necessary.
Possible Cause:	Check the rear suspension for loose or worn suspension components.
Action:	TIGHTEN or INSTALL new components as necessary.
Possible Cause:	Incorrect underbody alignment.
Action:	CHECK underbody alignment.

Feedback (whining or knocking noises in the steering gear)

Condition where roughness is felt in the steering wheel by the driver when the vehicle is driven over rough surfaces.

Possible Cause:	Loose/worn tie-rods.
Action:	INSTALL a new steering gear as necessary.
Possible Cause:	Steering gear bolts loose or damaged.
Action:	TIGHTEN or INSTALL new bolts as necessary.
Possible Cause:	Loose suspension bushing, bolts or ball joints.
Action:	TIGHTEN or INSTALL new components as necessary.
Possible Cause:	Damaged steering column.
Action:	INSTALL a new steering column as necessary.

Power steering pump or reservoir leaks

Possible Cause:	Overfilled system.
Action:	CORRECT the fluid level as necessary.
Possible Cause:	Damaged fluid cap.
Action:	INSTALL a new cap.
Possible Cause:	Loose or damaged hose fittings.
Action:	TIGHTEN or INSTALL a new hose as necessary.
Possible Cause:	Leakage at power steering pump.
Action:	INSTALL a new power steering pump.

Poor returnability of the steering.

Possible Cause:	Incorrect tyre pressure.
Action:	CHECK and ADJUST the tyre pressure.
Possible Cause:	Incorrect tyre size or type.
Action:	INSTALL a new tyre as necessary.
Possible Cause:	Steering column universal joints binding.
Action:	INSTALL a new steering column.

Possible Cause:	Steering column shaft floor seal may be torn.
Action:	INSTALL a new floor seal as necessary.
Possible Cause:	Binding or damaged tie-rods.
Action:	INSTALL a new steering gear.
Possible Cause:	Damaged or worn front suspension components.
Action:	INSTALL new front suspension components as necessary.
Possible Cause:	Incorrect toe adjustment.
Action:	ADJUST as necessary.

Excessive steering efforts required to turn corners and during parking maneuvers.

Possible Cause:	Low power steering pump fluid.
Action:	FILL as necessary and check for system leaks.
Possible Cause:	Damaged accessory drive belt tensioner.
Action:	INSTALL a new accessory drive belt tensioner.
Possible Cause:	Hose or oil cooler external leak.
Action:	INSTALL a new hose or oil cooler as necessary.
Possible Cause:	Hose or cooler line restriction.
Action:	INSTALL a new hose as necessary.
Possible Cause:	Fluid aeration.
Action:	BLEED the system.

Fluid leakage

Possible Cause:	Overfilled system.
Action:	CORRECT the fluid level as necessary.
Possible Cause:	Component leak.
Action:	LOCATE the suspect component and repair as necessary.

Accessory drive belt squeal

Possible Cause:	Check accessory drive belt for correct tension or glazing.
Action:	INSTALL a new accessory drive belt.

Chirp noise in the steering pump

Possible Cause:	Loose or worn accessory drive belt.
Action:	INSTALL a new accessory drive belt.

Power steering pump noisy

Possible Cause:	Low fluid level.
Action:	FILL as necessary and check for system leaks.
Possible Cause:	Power steering pump.
Action:	CHECK for leaks. REPAIR as necessary.
	INSTALL a new power steering pump as necessary.

Swish type noise

Possible Cause:	Fluid flow into the bypass valve of the pump valve housing with fluid temperature below 54°C (130°F).
Action:	Normal noise.

Whine type noise

Possible Cause:	Aerated fluid.
Action:	BLEED the system.

Steering Linkage

CAUTION: Boots must be handled carefully to avoid damage. Use new steering gear boot clamps when installing boots.

Inspect the boots for cuts, deterioration, twisting or distortion. Check the steering gear boots to make sure they are tight. Install new boots or clamps as necessary.

With the wheels in the straight ahead position, gently turn the steering wheel to the left and the right to check for free play.

Free play should be between 0 and 6 mm (0 and 0.24 in) at the steering wheel rim. If the free play exceeds this limit, either the ball joints are worn or the backlash of the steering gear is excessive.

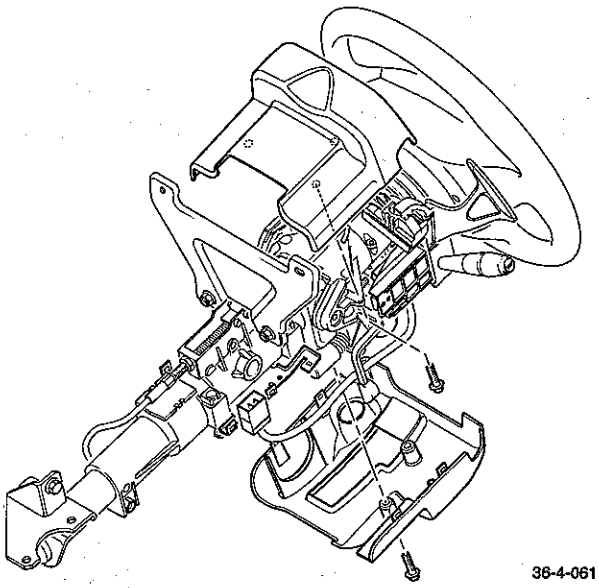
The backlash of the steering gear cannot be adjusted, install a new steering gear.

Grasp the steering wheel firmly and move it up and down and to the left and right without turning the wheel to check for column bearing wear.

4.3.06.1 Upper Steering Column

Removal

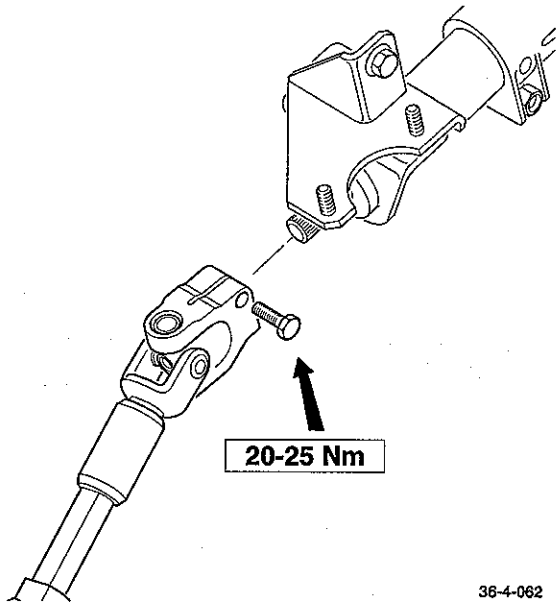
1. Power the driver's seat to the lowest and most rearward position.
2. Remove the drivers side underscuttle panel.
3. Remove the steering column cowls.



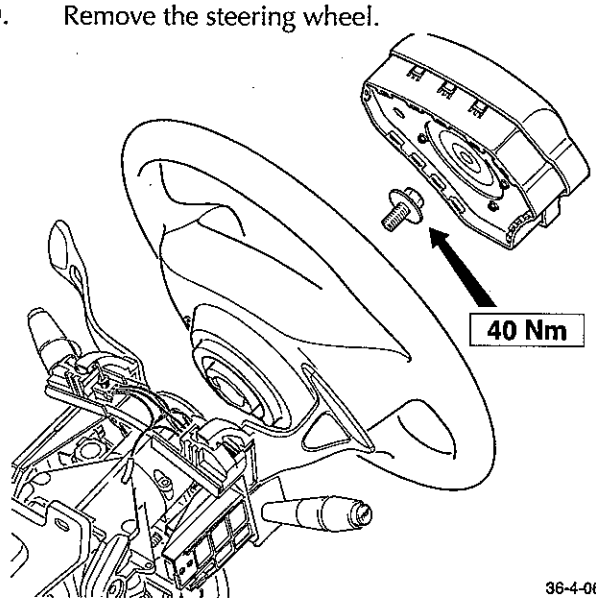
4. Switch off the battery disconnect switch.

   WARNING: The airbag is equipped with a back-up power supply and may be inadvertently deployed. To avoid accidental airbag deployment, wait at least one minute before starting work so that any residual power is dissipated.

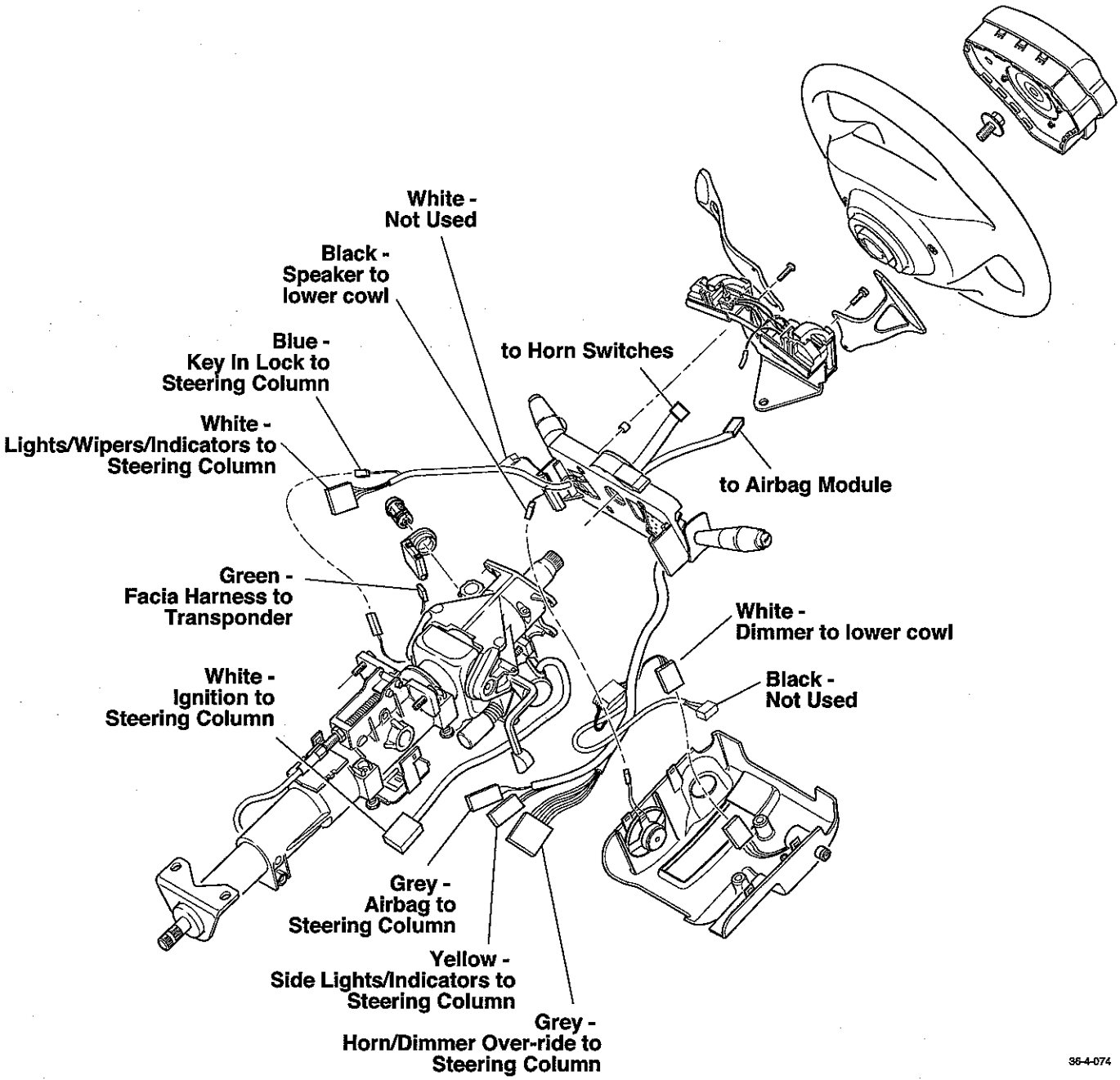
5. Center the steering.
6. Engage the steering column lock.
7. Unscrew and remove the upper steering column to universal joint nuts.



8. Disarm and remove the air bag module; refer to Section 6.
9. Remove the steering wheel.

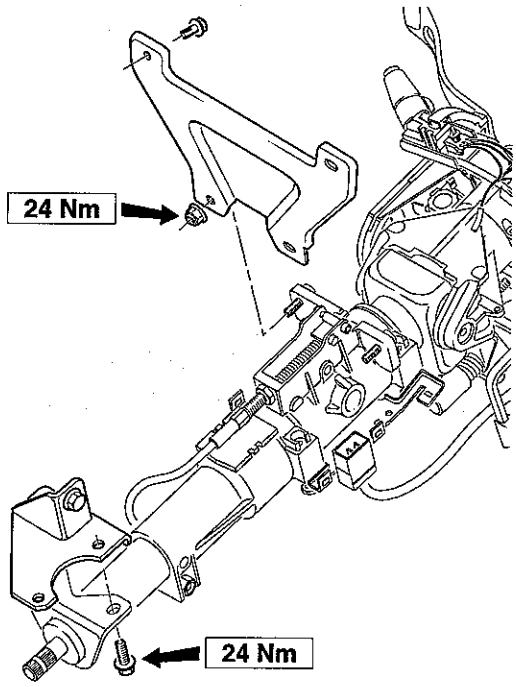


10. Disconnect the following harness multiplugs.



- ignition switch to fascia harness.
- air bag harness to cabin harness.
- indicator switchgear to fascia harness.
- washer switchgear to fascia harness.
- Cut and remove the harness securing tie straps.
- Disconnect the key lock solenoid and key barrel transponder harness multiplugs.

11. Unscrew and remove the column lower mounting bracket securing bolts.

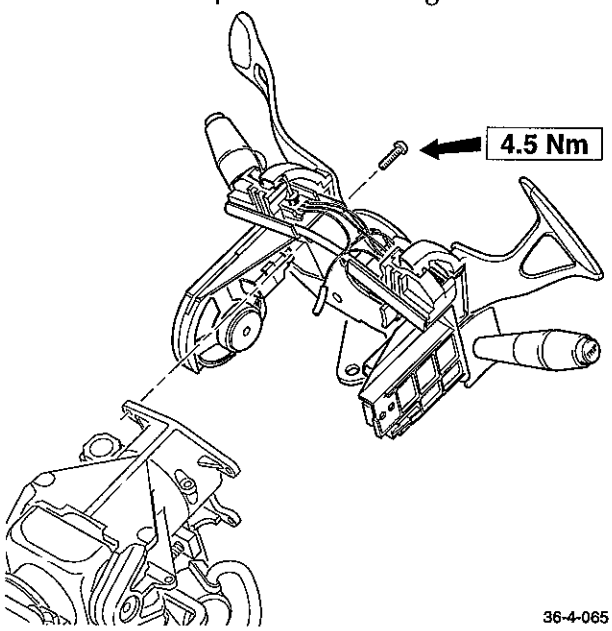


12. Unscrew and remove the column to upper mounting bracket securing nuts.

13. Remove the steering column.

- Release the column from the universal joint.
- Remove the steering column.

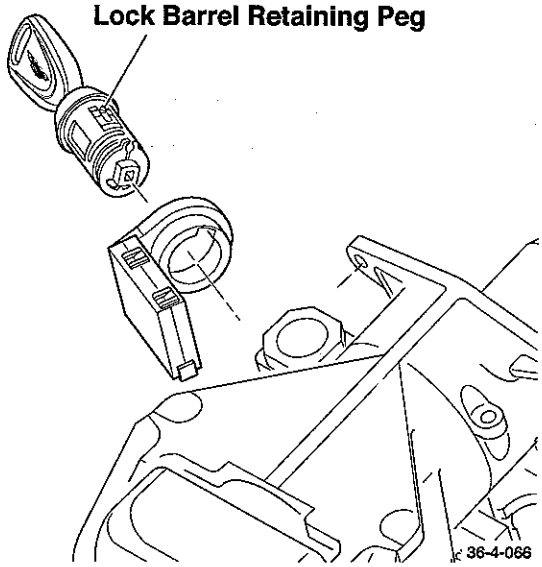
14. Remove the paddle and switchgear assemblies.



- Unscrew and remove the bolts securing the switchgear mounting bracket assembly.
- Remove the switchgear mounting bracket .

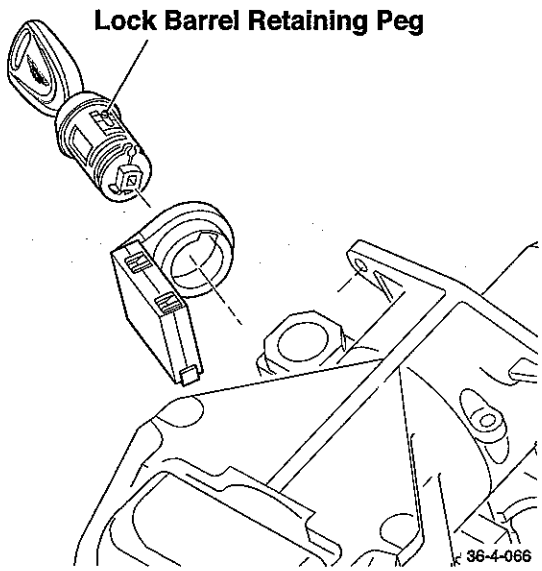
15. Remove the key transponder and lock from the steering column.

- Insert the ignition key in the steering lock barrel and turn it to the auxiliary position.
- Press the retaining peg, remove the lock.
- Withdraw the lock barrel assembly from the PATS transceiver.

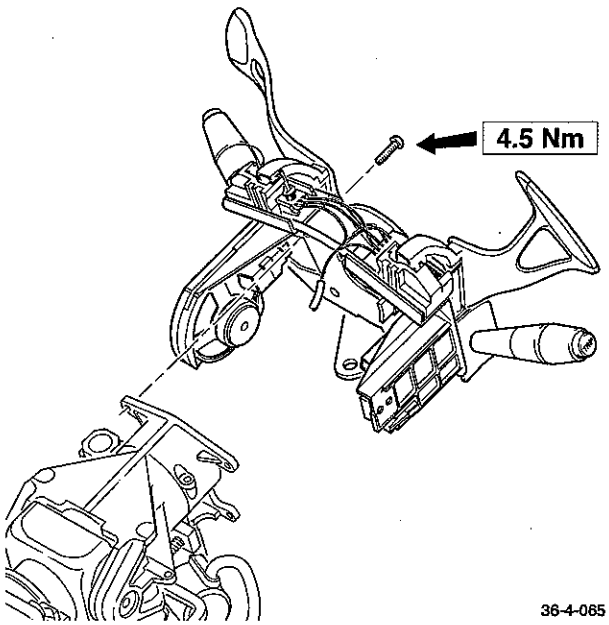


Installation

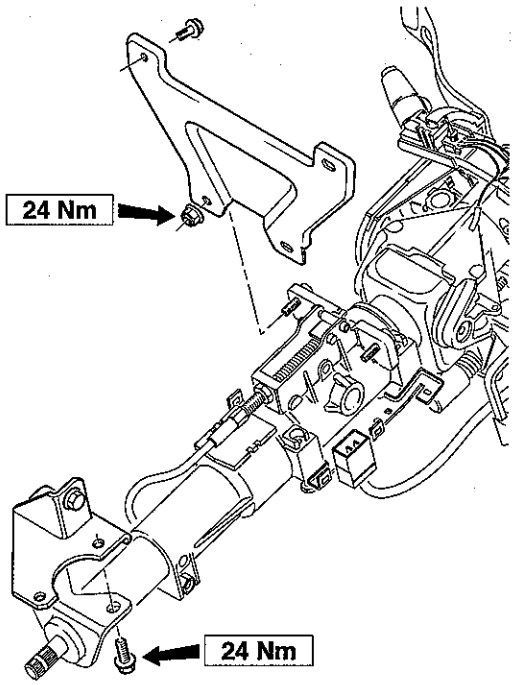
1. Turn the ignition lock to the AUX position and remove it from the lock barrel.
2. Install the lock barrel and PATS transponder.



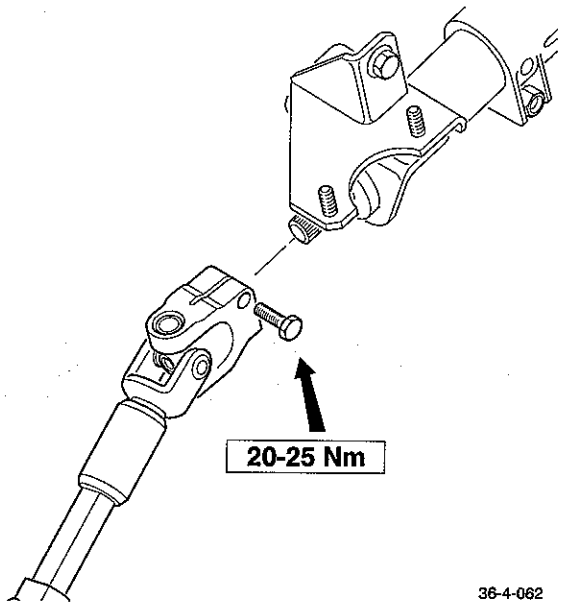
3. Install the column mounting bracket on the steering column.
   - Align the switchgear mounting bracket.
   - Install and tighten the switchgear mounting bracket bolts.



4. Place the steering column in the vehicle.
5. Engage the lower steering column universal joint with the upper column.
6. Install the upper column nuts, but do not tighten them.
7. Install and tighten the column lower securing nuts and bolts.
   - Install and tighten the column lower securing nuts.
   - Tighten the previously installed column upper securing nuts.



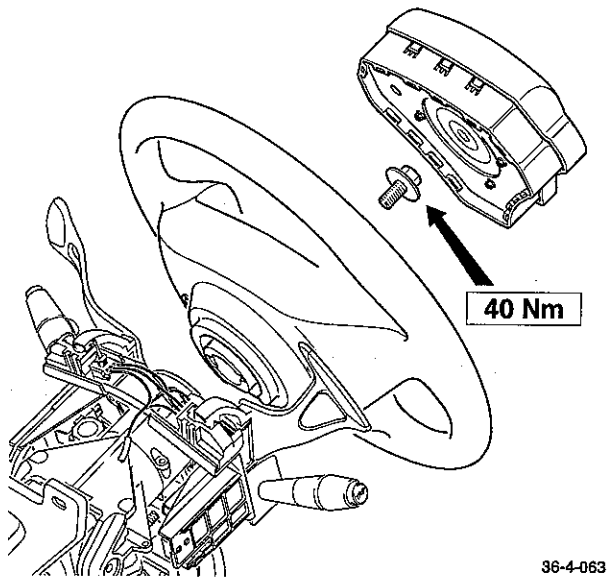
8. Install the universal joint securing bolt and tighten to specification.



9. Connect the following harness multiplugs.
   - ignition switch to fascia harness.
   - air bag harness to cabin harness.
   - indicator switchgear to fascia harness.
   - washer switchgear to fascia harness.
   - Connect the key lock solenoid and key barrel transponder harness multiplugs.

10. Install and tighten the harness securing tie straps.

11. Install the steering wheel.



12. Install the air bag module.
13. Reconnect the battery ground cable.
14. Install the battery cover.
15. Install the steering column cowls.
16. Install the underscuttle.

4.3.06.2 Steering Wheel

WARNING: DO NOT remove the airbag without first reading and fully understanding the warnings related to airbag removal. Follow the step by step procedure for removing the airbag.

Removal

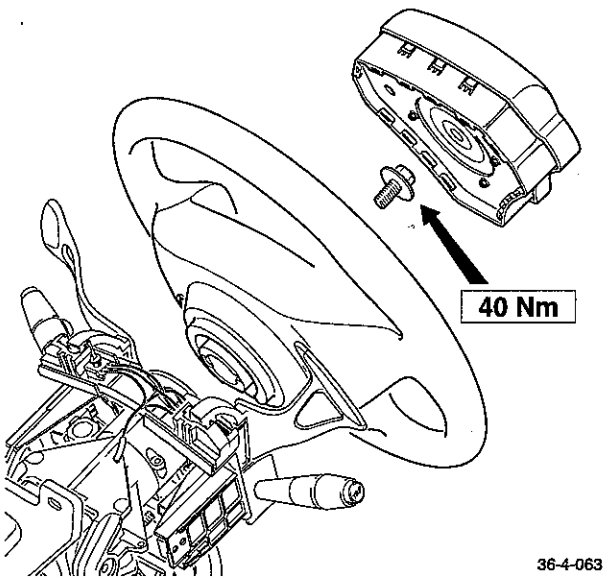
1. Disarm and remove the airbag (Section 6).
2. Place the steering in the 'straight ahead' position.

   Caution: Do not use the steering lock to hold the wheel whilst releasing the securing nut. The steering lock may be irreparably damaged.

3. Undo and remove the steering wheel securing nut.
4. Place marks on the steering wheel and column to indicate the correct spline alignment. Pull the steering wheel from the steering column splines.

Replacement

1. Ensure that the roadwheels are still in the 'straight ahead' position. Align the steering wheel spokes in the straight ahead position. Align the steering wheel and column marks correctly and refit the wheel on to the steering column splines. Check that the steering wheel rotation is accurately centred when the roadwheels are in the 'straight ahead' position.
2. Fit and tighten the securing bolt

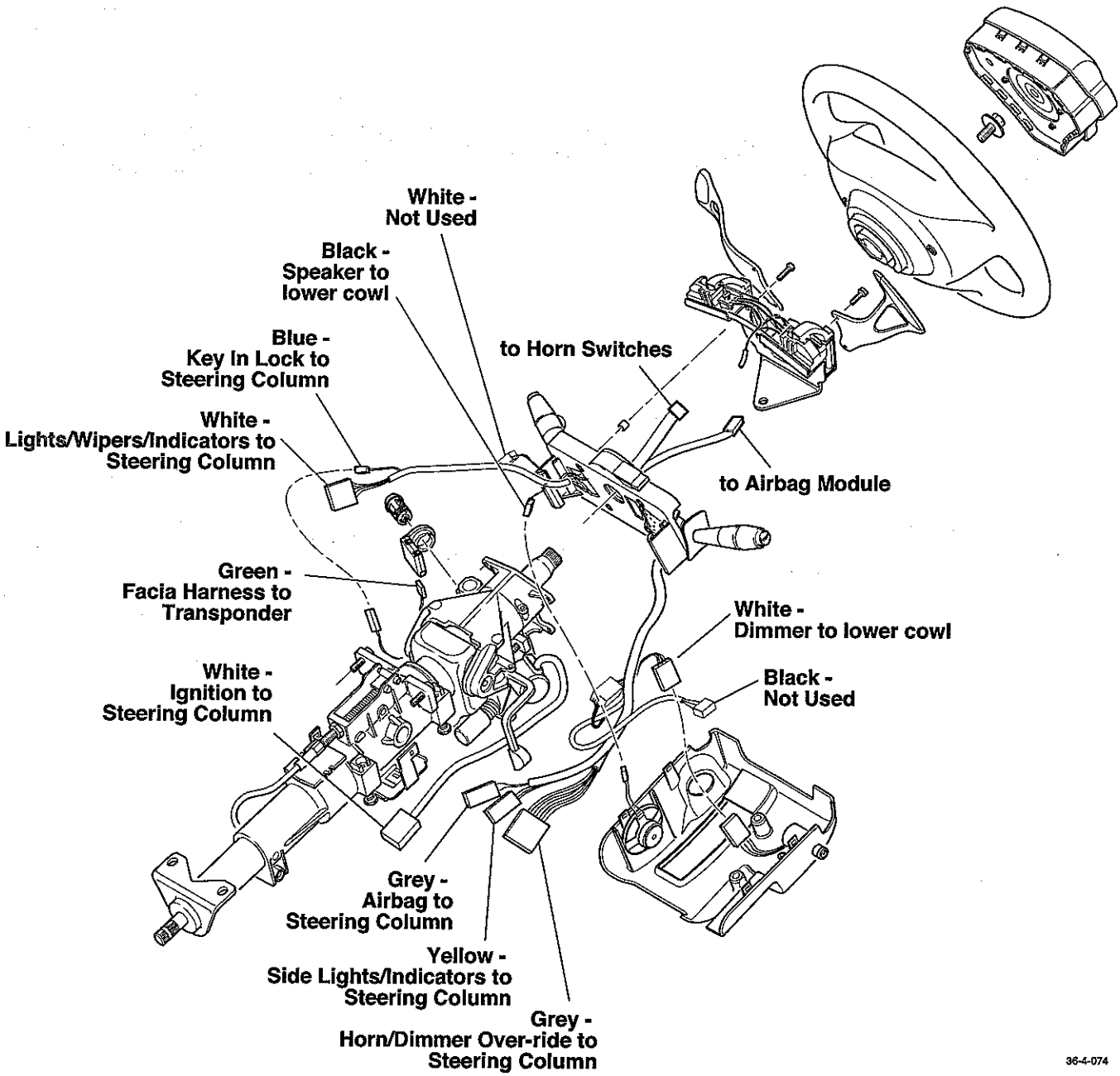


3. Refit the drivers airbag.

4.3.07.3 Steering Column Switchgear

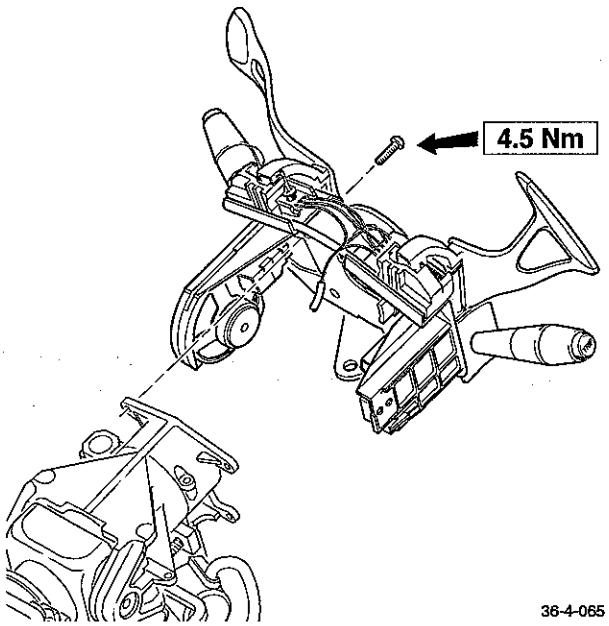
Removal

1. Remove the steering column cowls.
2. Disconnect the battery ground cable.
3. Disarm and remove the driver's air bag module.
4. Ensure that the steering is centered.
5. Remove the steering wheel.
6. Disconnect the following multiplugs.



- ignition switch to fascia harness.
- air bag harness to cabin harness.
- indicator switchgear to fascia harness.
- washer switchgear to fascia harness.
- Cut and remove the harness securing tie straps.
- Disconnect the key lock solenoid and key barrel transponder harness multiplugs.

7. Remove the switch assemblies.



- Unscrew the switchgear securing screws.
- Remove the switchgear assembly from the mounting bracket.
- Remove the switch assemblies from the cancellation module and mounting bracket.
- Remove the cancellation module from the mounting bracket.

Installation

1. Install and align the cancellation module to the column mounting bracket.
2. Install the flasher switch and washer switch assemblies to the module mounting bracket.
   - Install and align the flasher switch assembly.
   - Install and align the washer switch assembly.
3. Install and align the switchgear assembly to the steering column.
4. Install and tighten the switchgear and cancellation module securing bolts.
5. Reconnect the following multiplugs.
   - cancellation module
   - wiper/washer switch.
   - flasher/headlamp switch
   - Install the steering wheel to the column in the correct orientation.cancellation module
   - wiper/washer switch.
   - flasher/headlamp switch
6. Install the driver's air bag; refer to Section 6.
7. Reconnect the battery ground cable.
8. Install the steering column upper and lower cowls.
9. Install the underscuttle

4.4.02.1 Power Steering System Bleeding

When filling the reservoir, make sure that the fluid is clean and not agitated prior to use. Pour the fluid slowly to minimize aeration.

Procedure

1. Check that the reservoir level is well above the minimum mark. Add fluid if necessary and fit the reservoir cap loosely to avoid fluid splashes during system bleeding.
2. Start the engine and run for several minutes. Check the returning fluid in the reservoir. When air bubbles cease to flow, top up the reservoir and go to step 3.
3. Turn the steering hard over on one lock. Run the engine for several minutes. Check the returning fluid in the reservoir. When air bubbles cease to flow, top up the reservoir and go to step 4.
4. Turn the steering hard over on the opposite lock. Run the engine for several minutes. Check the returning fluid in the reservoir. When air bubbles cease to flow, top up the reservoir and go to step 5.
5. Allow the engine to idle for 5 minutes with the wheels in the straight ahead position.
6. Briefly turn the steering to one lock and then to the opposite lock. If no air sounds are heard, the bleeding was succesful.

   If air noises are present, repeat the bleeding procedure.
7. Top-up the reservoir to the maximum level and secure the reservoir cap.

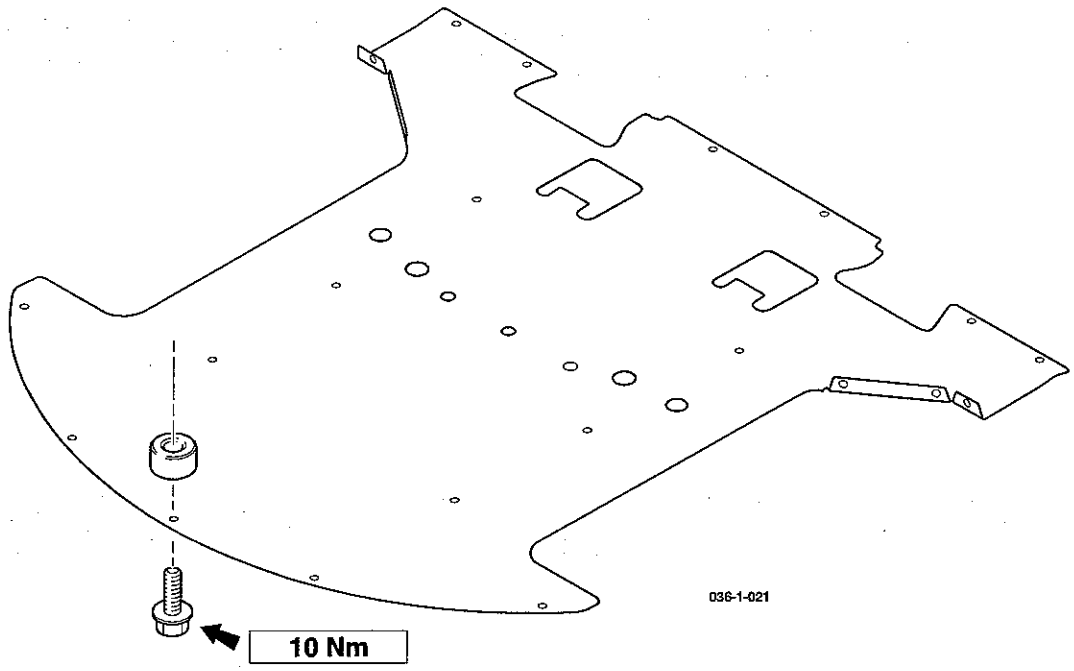
4.4.03.2 Steering Rack Renew

Removal

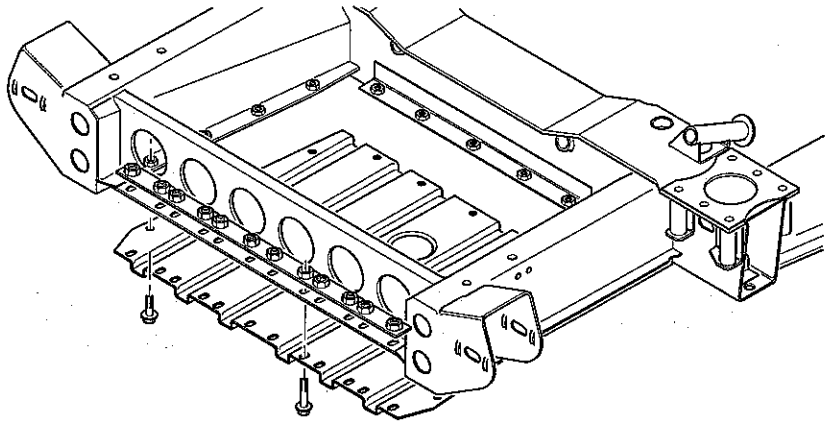
1. Switch off the battery disconnect switch.
2. Secure the steering wheel in the centred position.
   - Centre the steering wheel. Remove the ignition key and engage the steering lock with the wheel as accurately centred as possible.

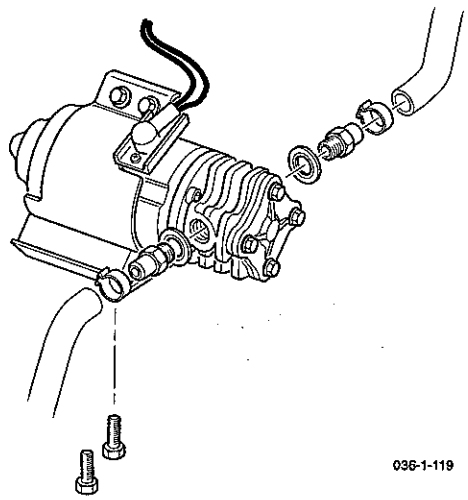
NOTE: Failure to centre the steering wheel and rack during reassembly may cause damage to the airbag clock-spring and also may cause difficulties in attaining correct alignment of the steering wheel in the straight ahead position

3. Raise and support the vehicle.
4. Remove the front undertray.



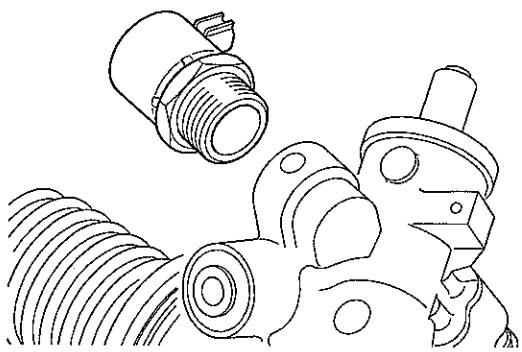
5. Remove the the belly plate.
   - Remove 25 bolts (Note the long bolts at the front).
   - Release the cooling pump from the belly plate.
   - Remove the belly plate





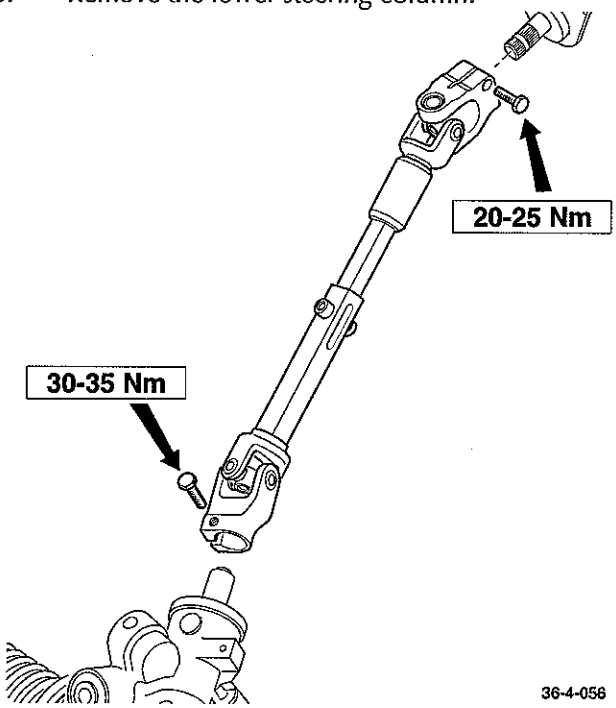
036-1-119

- Remove the power steering pressure sensor.



36-4-055

6. Remove the lower steering column.



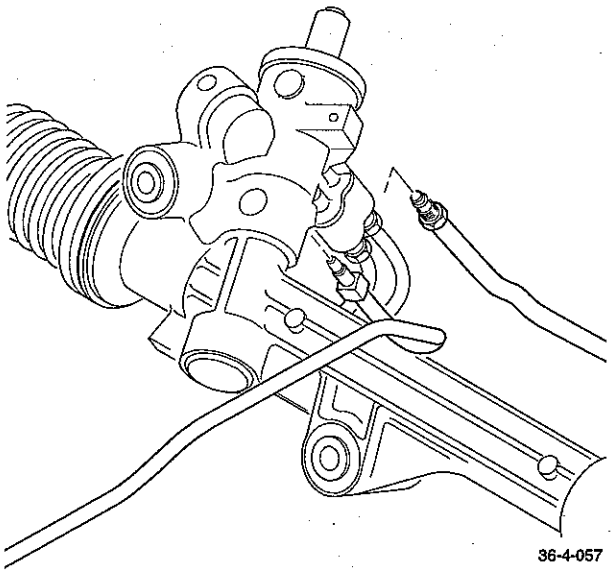
36-4-056

7. Disconnect the power steering supply and return pipes from the rack.

   CAUTION: Whenever the steering gear unions are disconnected the steering gear valve body ports should be plugged to prevent dirt ingress.

   - Drain the fluid into a suitable container.
   - Remove and discard the washer seals.

8. Remove all the power steering tubes from the steering rack

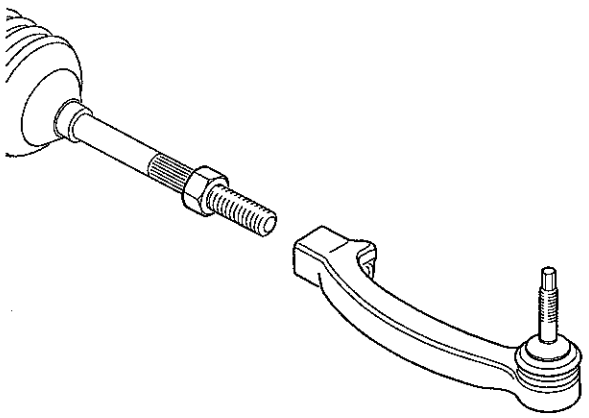


36-4-057

9. Disconnect both tie rod ends.

   - Loosen the tie rod lock nut.
   - Unscrew the tie rod.

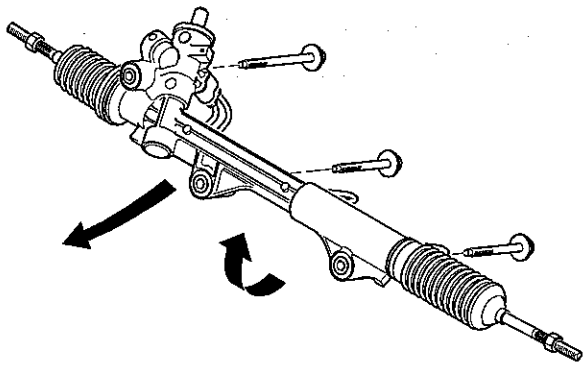
10. Disconnect and remove the outer section of each tie rod.



36-4-058

11. Remove the steering rack

    - Remove three bolts
    - rotate the rack approximately 90° to the rear of the car.
    - Move the rack to one side until the tie rod clears inside the chassis frame.
    - Lower one end of the rack and remove it from the vehicle ..



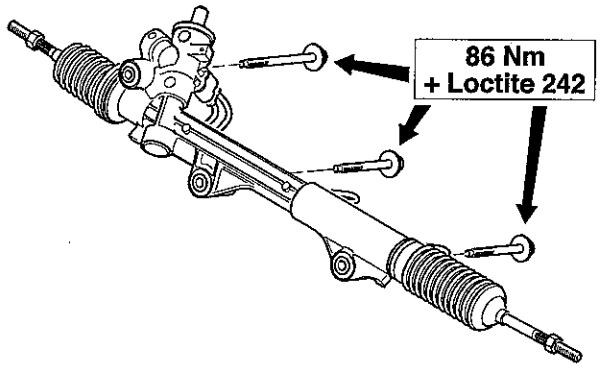
36-4-059

Installation

1. Install the steering rack.

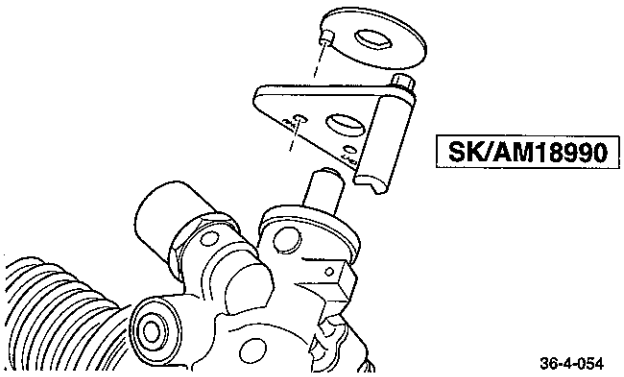
   - Insert the replacement rack and rotate it to the normal orientation.
   - Install and tighten the three retaining bolts using Loctite 542 on the threads.

   NOTE: Do not fully tighten the tie rod lock nut until the steering geometry is set.



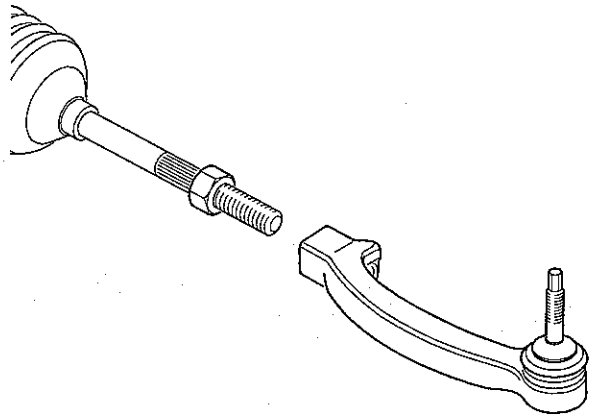
36-4-060

2. Centre the new rack .



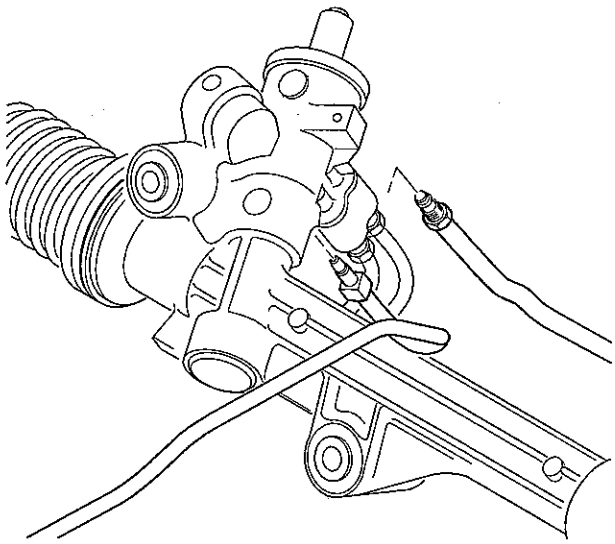
36-4-054

3. Loosely connect the tie rod outer links and the tie rod ball joints.

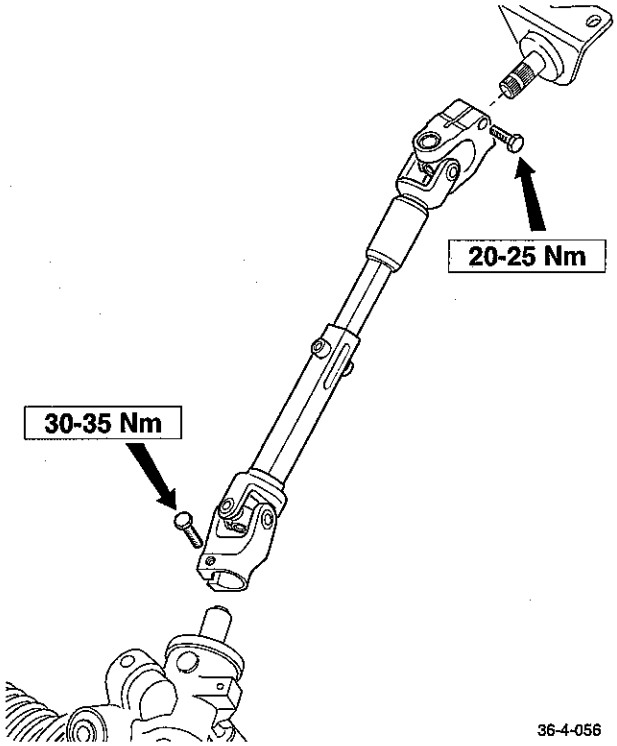


36-4-058

4. Reconnect the power steering system pipework.



5. Recheck that both the steering wheel and rack are accurately centred. Remove the rack centering tool and install the steering column lower section.



6. Install the power steering pressure switch.
7. Lower the vehicle.
8. Connect the battery ground cable.
9. Bleed the power steering system.

   WARNING: Do not drive the vehicle until the steering geometry has been set and all fixings have been secured.

10. Check and adjust the front wheel alignment.

Contents

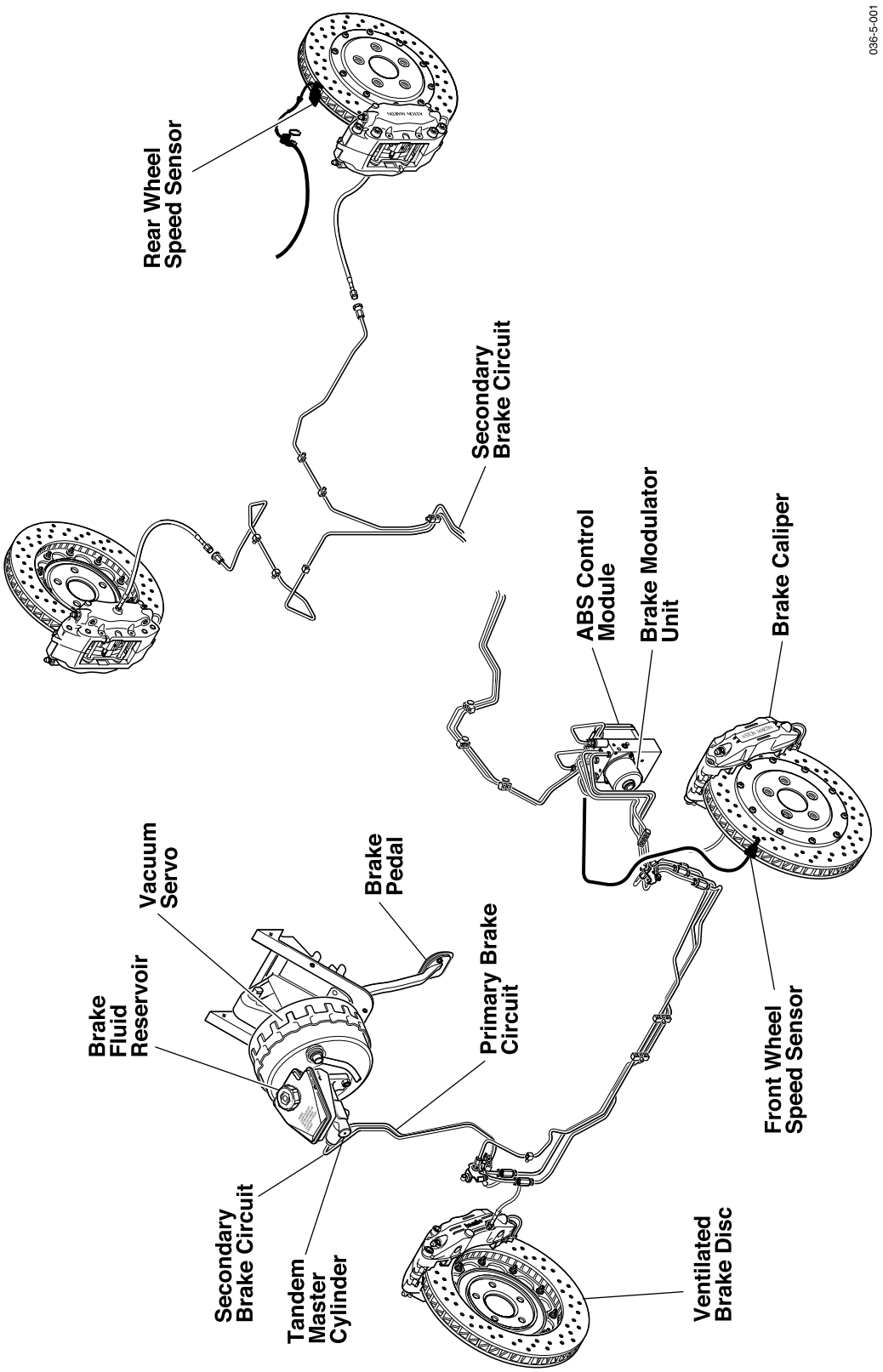
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Brakes - General Description

The V12 Vanquish is equipped with outboard disc brakes on all wheels. Anti-lock braking (ABS) and traction control systems (TCS) are also fitted. Separate braking circuits are used for the front and rear brakes. The primary circuit operates the front brakes and the secondary circuit operates the rear brakes. Both circuits operate from the vacuum assisted tandem master cylinder via the ABS modulator.



The Anti-lock Braking System (ABS)

The anti-lock braking system will prevent total lock-up of any wheel when the brakes are applied. When a wheel shows a tendency to lock-up, the ABS system operates and reduces the brake fluid pressure to the brake on that wheel. This prevents the wheel from locking up.

Wheel rotation is detected by a toothed rotor and an ABS sensor at each wheel hub. Signals from all four ABS sensors are fed to the ABS Control Module. Provided that all wheels rotate at the same speed, the sensor signals will all be at the same frequency and no action is taken by the ABS system.

If a wheel tends to lock-up during heavy braking, the ABS signal frequency from that wheel will become lower than the signal frequencies from the other three wheels. This difference is immediately detected by the ABS control logic which then reduces the brake pressure at the affected wheel using the solenoid valves in the modulator valve block.

The valve block in the ABS modulator unit contains four pairs of solenoid operated valves, one pair for each wheel. By actuating the modulator valves in sequence, the brake fluid pressure at the affected wheel will be reduced. The ABS signal frequency from the affected wheel will return to normal indicating normal wheel rotation. The pressure will then be returned to normal. If the wheel tends to lock again, this cycle will be repeated provided that the driver continues to press the brake pedal.

This cycling of the hydraulic valves may cause a pulsating effect at the brake pedal. It is vital that owners are warned of this possible effect. They should be advised to maintain brake pedal pressure, allowing the braking/ABS systems to reduce the vehicle speed safely without completely locking any wheel.

The Traction Control System

The Traction Control System (TCS) is designed to detect wheelspin where the rotational speed of any driven wheel exceeds the average speed of the other wheels.

Wheel spin is controlled primarily by engine intervention (spark retard, fuel injector cut-off). Brake intervention is invoked only during occurrences of split friction between the driven wheels, i.e. one driven wheel spinning.

The system uses the vehicles ABS sensors to monitor the wheel speed of all four road wheels. During brake intervention, the system automatically applies braking to the affected wheel.

ABS and TCS hydraulics are described in detail in Hydraulic Circuit Operation.

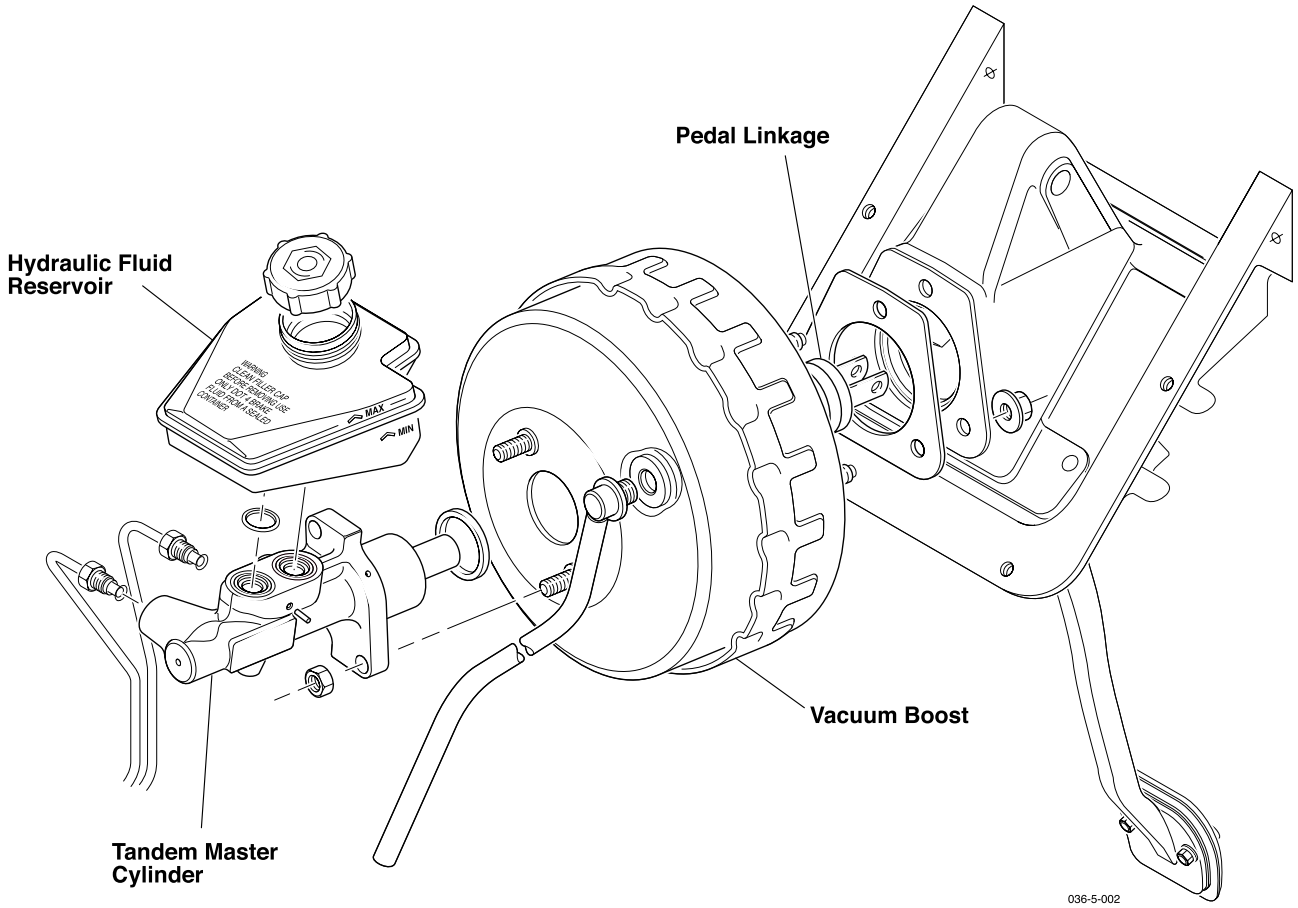
During traction control operation, engine power is reduced by automatic adjustment of the ignition timing and the fuelling level. Temporary misfiring of the engine may occur as these temporary adjustments are in effect. This is a normal characteristic of traction control operation and will be corrected as the wheelspin is eliminated and the engine returns to normal control.

Caution: Do not drive in such a manner that traction control is frequently in operation. The consequent misfiring may cause damage to the catalytic convertors in the exhaust system.

Braking System Components

The Vacuum Booster / Master Cylinder Assembly

The brake actuation assembly contains the vacuum booster, the tandem master cylinder and the brake fluid reservoir. The assembly is mounted in the engine compartment on the drivers side of the vehicle.

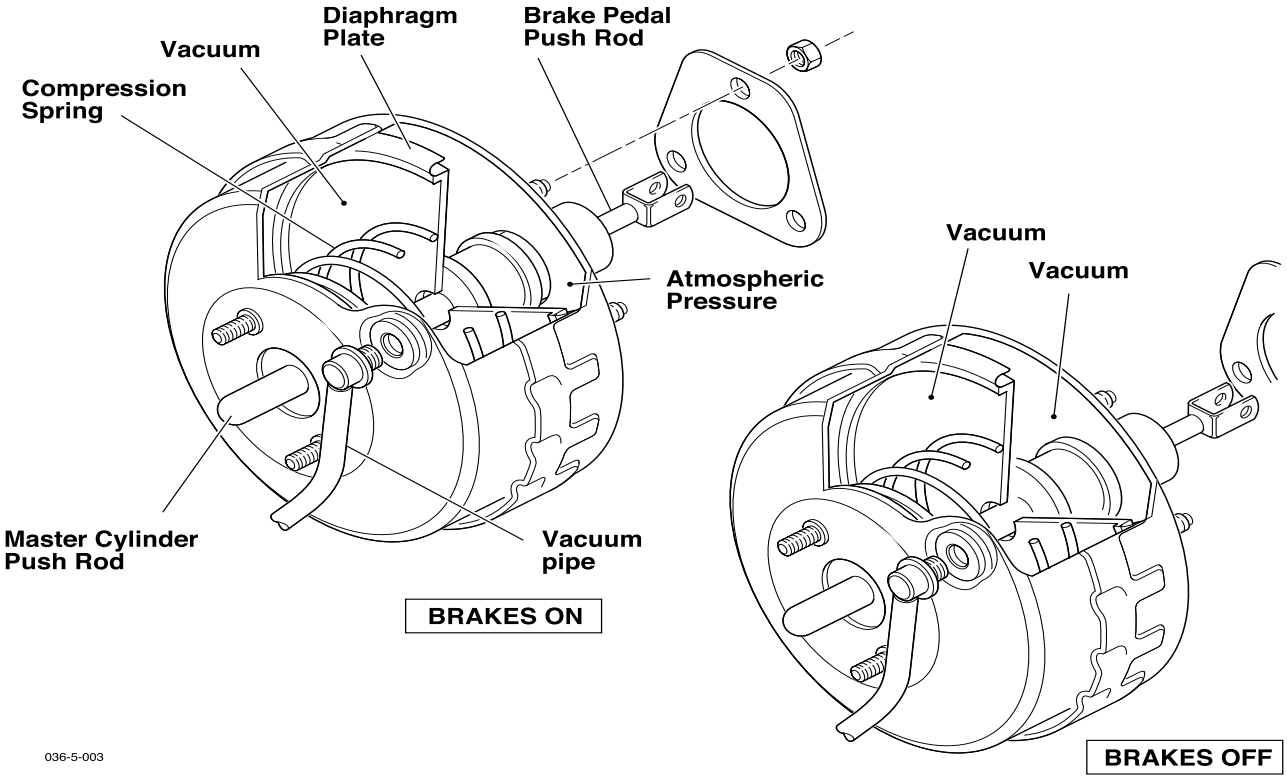


Brake Vacuum Booster

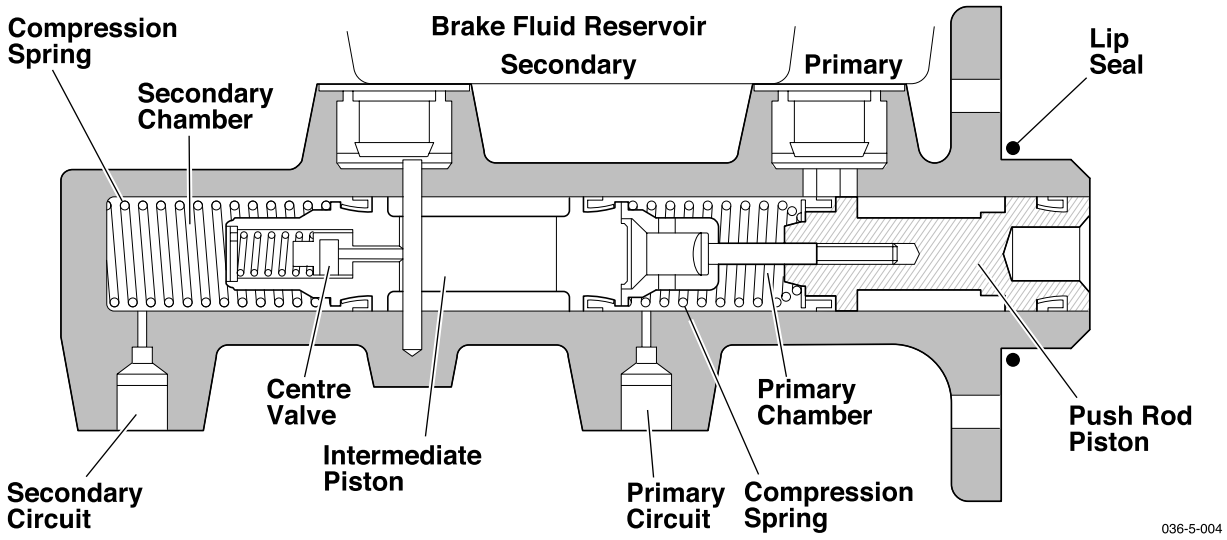
The brake vacuum booster is located in the engine compartment and secured to the pedal housing. The vacuum booster unit comprises a chamber divided by a diaphragm plate.

As the brake pedal is pressed, a poppet valve opens allowing atmospheric pressure into the drivers side of the diaphragm. Atmospheric pressure builds up on the drivers side of the diaphragm and pushes against the partial vacuum on the other side. This additional force boosts the applied brake pedal force up to 6.5 times.

When the brake pedal is released, the poppet valve closes. The pressure on the diaphragm reduces and the compression spring returns the diaphragm to the release position.



The Tandem Master Cylinder



The tandem master cylinder is secured to the vacuum booster casing. The master cylinder, contains two pistons which drive the primary and secondary circuits of the braking system. Pressure on the pistons is transmitted to the front and rear wheel calipers via the ABS valve block. The ABS valve block has no effect during normal braking.

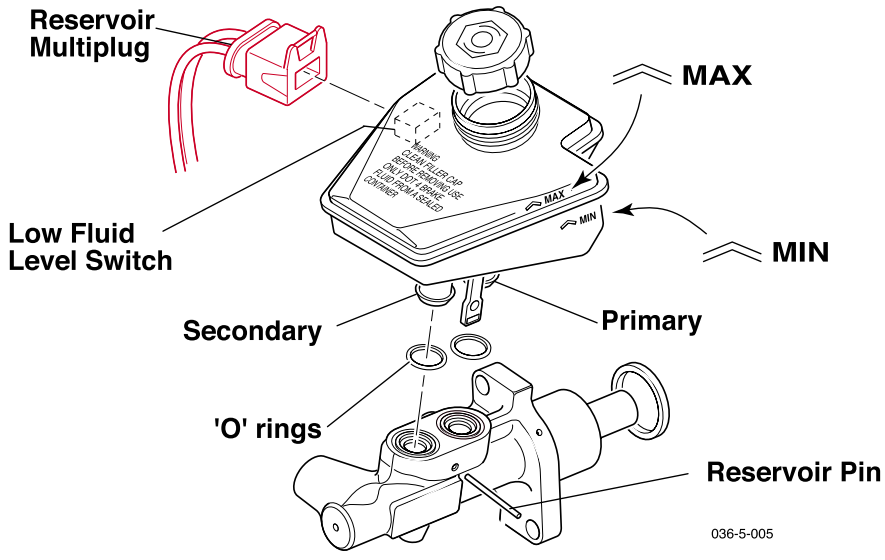
The two brake circuits work independently of each other. In the event of a failure of one of the circuits, the other circuit will continue to operate and transmit hydraulic pressure to its respective wheel cylinders.

Valves in the master cylinder pistons allow rapid release of system pressure when the brake pedal is released. These valves also permit additional brake fluid into the system to compensate for brake pad wear.

Brake Fluid Reservoir

The brake fluid reservoir is mounted directly on the tandem master cylinder and secured with a pin. Two stub pipes, on the base of the reservoir locate into the primary and secondary chambers of the master cylinder.

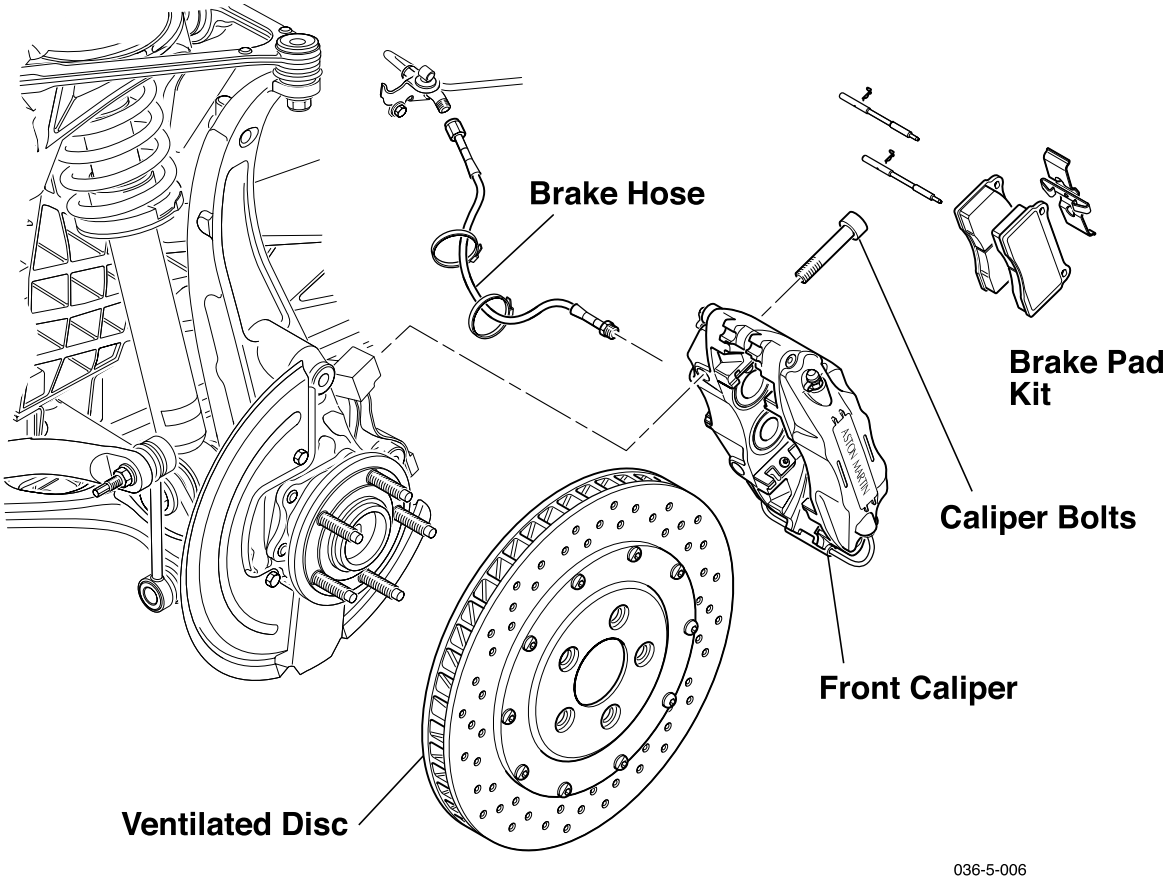
The brake fluid reservoir is fitted with a low fluid level switch which opens when fluid level is low to illuminates the fluid level indicator lamp on the instrument panel.



Brake Calipers

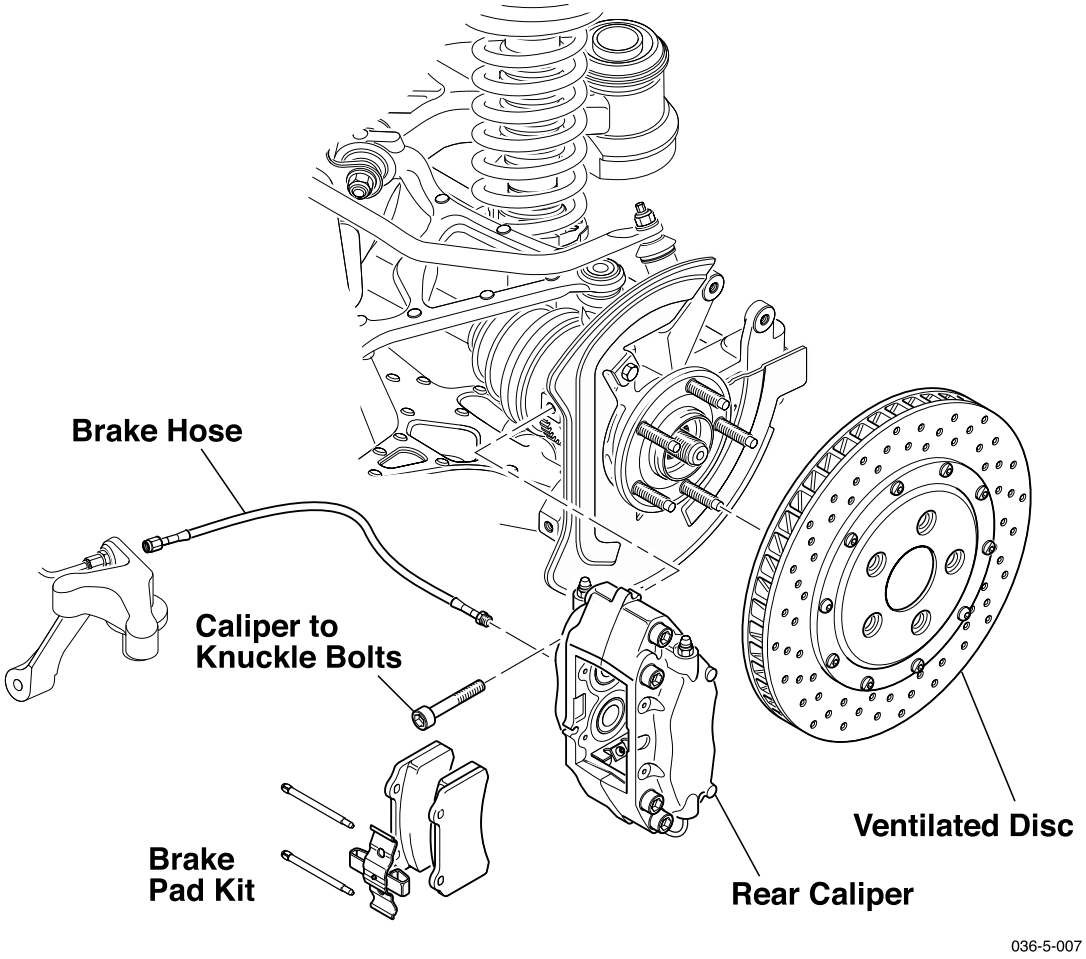
Front Brake Calipers

The front brakes are fitted with four piston calipers acting upon 355 mm diameter, 32 mm thick ventilated and cross drilled brake discs. The caliper is bolted to a mounting bracket on the suspension vertical link.



Rear Brake Calipers

The four piston rear calipers act upon 330mm diameter, 28 mm thick ventilated and cross drilled brake discs.



Handbrake Caliper

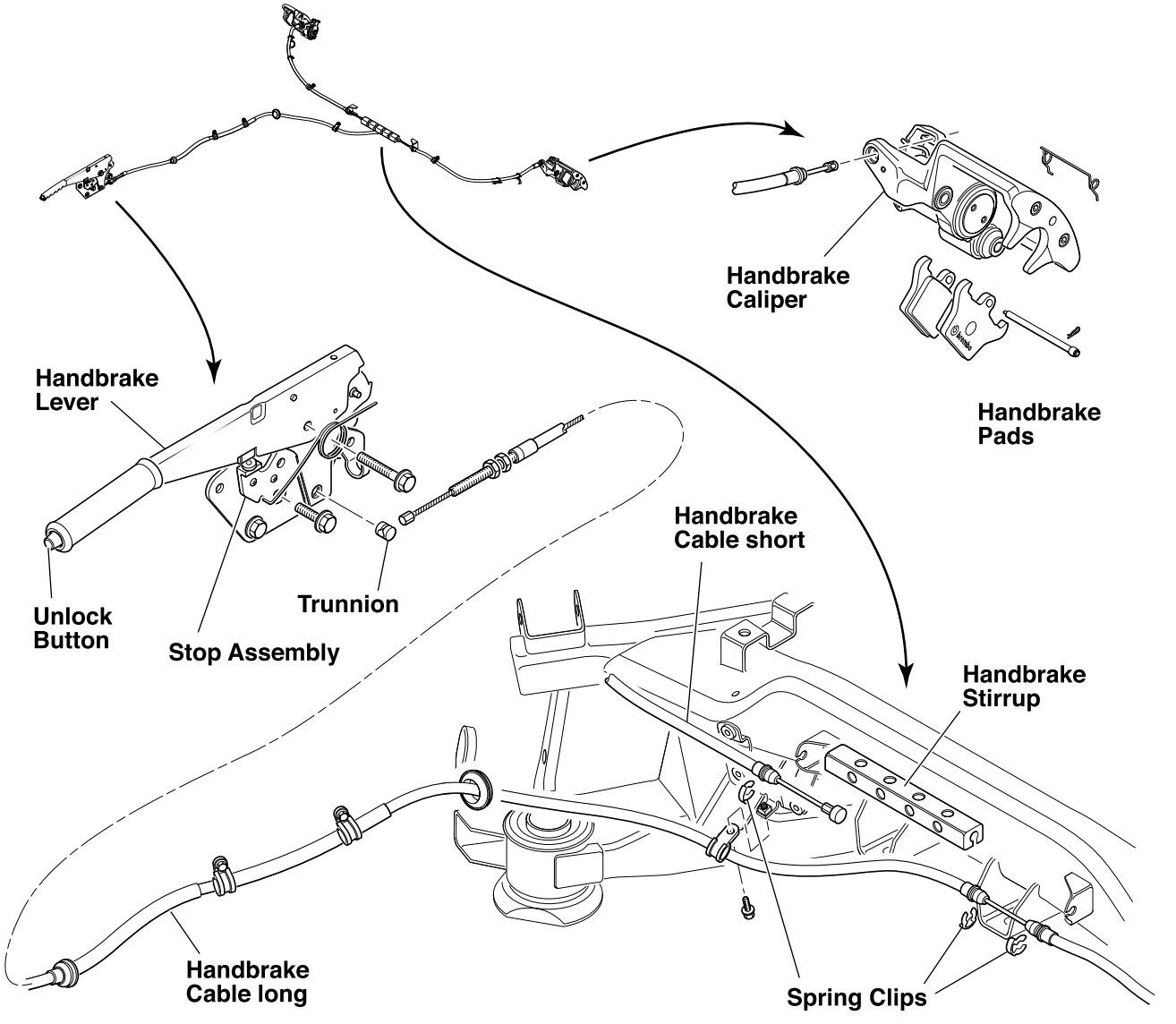
The handbrake pads are operated by an additional mechanical caliper on each rear wheel brake disc.

When the handbrake is applied, the handbrake cable applies force, via a stirrup to both left and right parking brake cables. The brake cables operate the expander unit and press the handbrake pads against the brake disk, locking the rear wheels.

Return springs on each caliper retract the pads when the handbrake is released.

Wear in the handbrake pads can be taken up using the cable adjuster mechanism.

- The handbrake switch is wired normally closed. The switch is held open whilst the handbrake is off and closes when the handbrake is applied. The handbrake warning lamp on the instrument panel is illuminated when the handbrake is applied.



The Anti Lock Braking System

The anti-lock braking system (ABS) comprises:

- The ABS Control Module.
- The modulator valve block.
- Four inductive wheel speed sensors mounted one on each wheel hub.
- The ABS warning lamp mounted on the instrument panel.

The valve block houses nine solenoid operated valves which are activated by the ABS control module. The signals are generated when necessary by the control programme using wheel speed information received from the wheel speed sensors.

The valves regulate the supply of pressure individually to the front and rear wheels as necessary to prevent a wheel locking up during braking.

When the ignition is switched on, an ABS self-test is performed. During this test, the ABS warning light on the instrument panel will be lit for several seconds and will then extinguish. After satisfactory completion of this self test, the controller is ready to monitor and if necessary intervene in the operation of the braking system.

The controller uses software defined algorithms to decide when intervention is necessary.

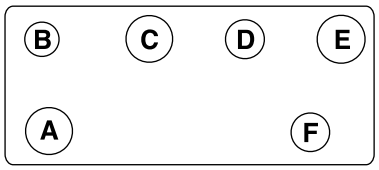
During the ABS system self check and during normal operation system performance is monitored and any faults will be logged in the system memory. When a fault is detected, the ABS warning lamp will be lit. If an ABS system fault is detected and logged, the ABS system is inhibited and the system reverts to normal servo assisted brakes (as on a non-ABS vehicle)

Fault conditions detected by the ABS controller disable the ABS circuits until the fault is rectified. The system will be disabled when any of the following conditions occur:

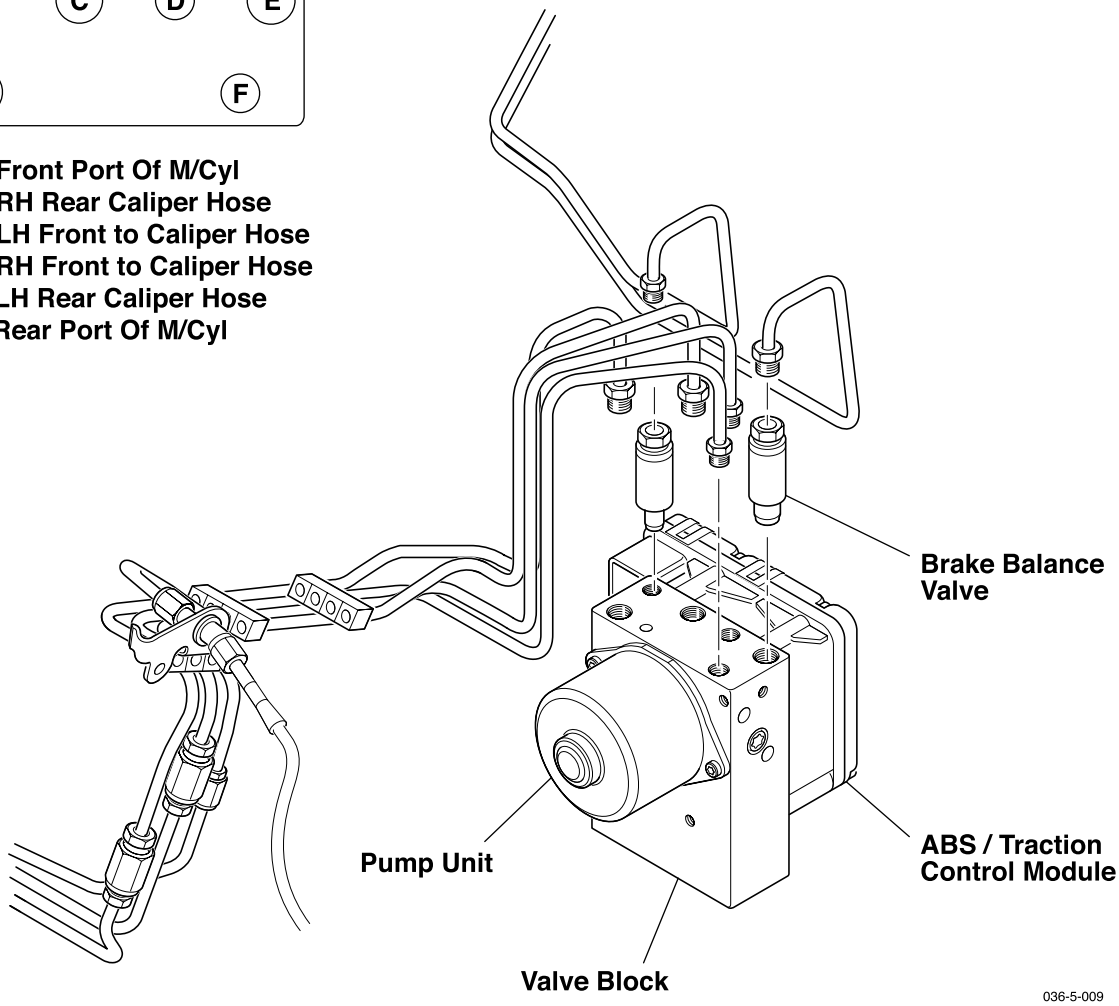
- Valve Failure.
- Sensor Failure.
- Main driver failure (internal control module problem).
- Redundancy error (internal control module problem).
- Over voltage / Under Voltage.
- Pump Motor Failure.

ABS Modulator Unit

The brake modulator unit, comprising: the pump motor, the modulator valve block and the control unit is located on the engine bulkhead. The motor driven hydraulic pump is of the reciprocating two-circuit type. The pump provides adequate pressure and volume supply to the brake circuits under anti-lock braking conditions. The pump housing incorporates an accumulator and damping chamber for each brake circuit. Non-return valves are fitted on the outlets of the accumulators, pumps and damping chamber.



A- Front Port Of M/Cyl
B- RH Rear Caliper Hose
C- LH Front to Caliper Hose
D- RH Front to Caliper Hose
E- LH Rear Caliper Hose
F- Rear Port Of M/Cyl



The modulator valve block houses nine solenoid valves. Four normally open inlet valves, four normally closed outlet valves and a transfer valve used in the traction control function. These valves provide the means of increasing, holding or decreasing the brake fluid pressure at any individual caliper.

All electronic and power connections are made through one connector to the ABS/TCS control module mounted on the valve block.

The pump, motor and valve block are non-serviceable. If a fault occurs in any of the components, the whole hydraulic control module must be replaced.

The ABS/TCS control module can be replaced separately.

ABS Control Module

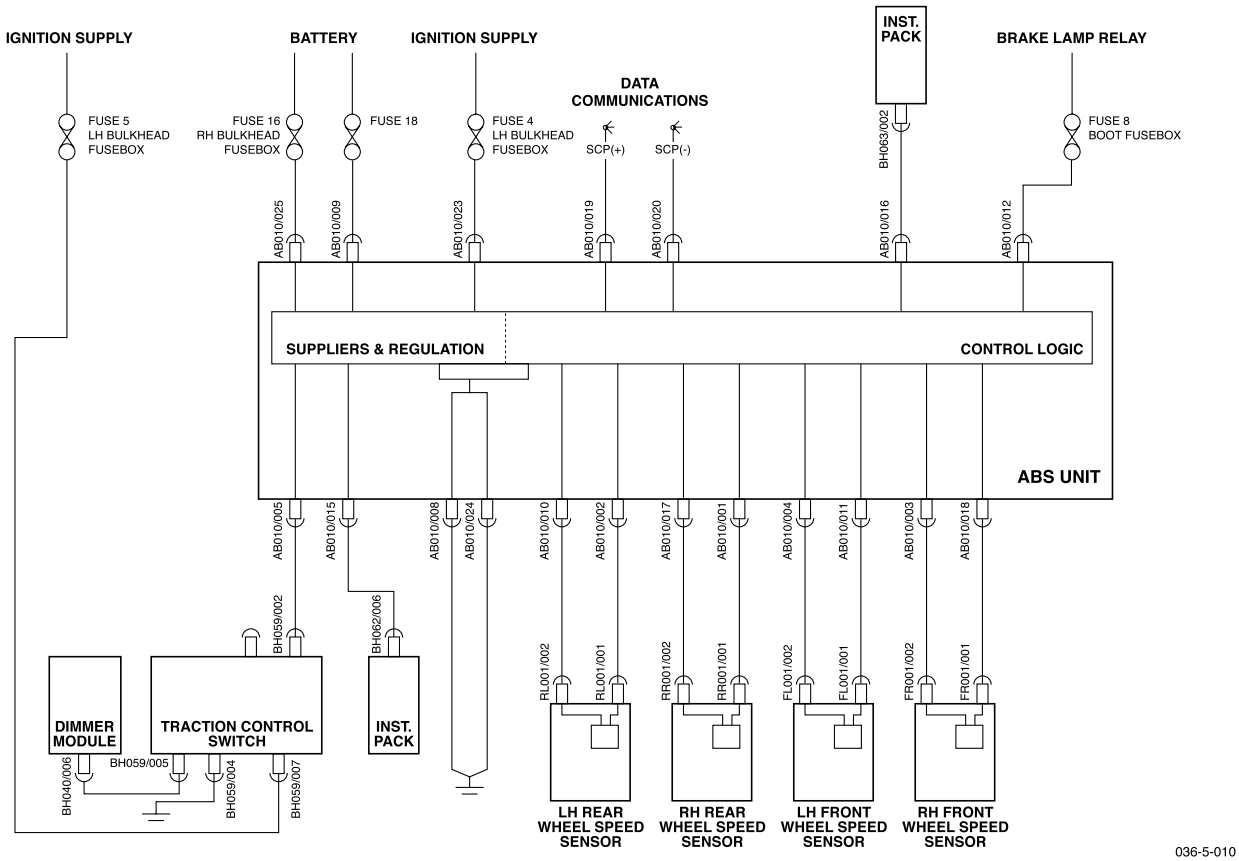
The ABS control module processes all the information supplied from the external wheel speed sensors. The signals from the four sensors are independently processed and compared by the control module during driving. If the wheel speed signal frequency from one wheel drops significantly below that of the other wheels, this indicates that the wheel is tending to lock. The controller will then modulate the hydraulic pressure at the affected wheel to eliminate the tendency to lock. This is achieved by closing and opening the appropriate solenoid valves in the valve block. When the wheel slip condition is corrected, the solenoid valves will be returned to their normal states.

The control module continuously monitors the ABS operation, lighting the ABS warning lamp and inhibiting or disabling the system when a system fault is detected.

When the ABS system is inhibited or disabled, the normal vacuum boosted brakes remain fully operational (as with a vehicle not fitted with ABS).

The control module houses all control circuits, including the solenoids which operate the hydraulic valves in the valve block. The module cannot be serviced and must be replaced if an internal fault is diagnosed.

ABS Control Module Connections



ABS Control Module Connector - Pin / Function List

1/17	Speed Sensor - Rear Right-Hand	16	ABS Warning Lamp
2/10	Speed Sensor - Rear Left-Hand	19/20	Diagnostic Communication
3/18	Speed Sensor - Front Right-Hand	23	Ignition Power
4/11	Speed Sensor - Front Left-Hand	24/8	Main ECU Ground
5	Traction Control Switch Input	25	Pump Driver Battery Supply
9	Solenoid Valves Driver Power	26	Pump Motor Power (Motor Connector)
12	Brake Lamp Signal Output	27	Pump Motor Ground (Motor Connector)
15	Traction Control Warning Lamp		

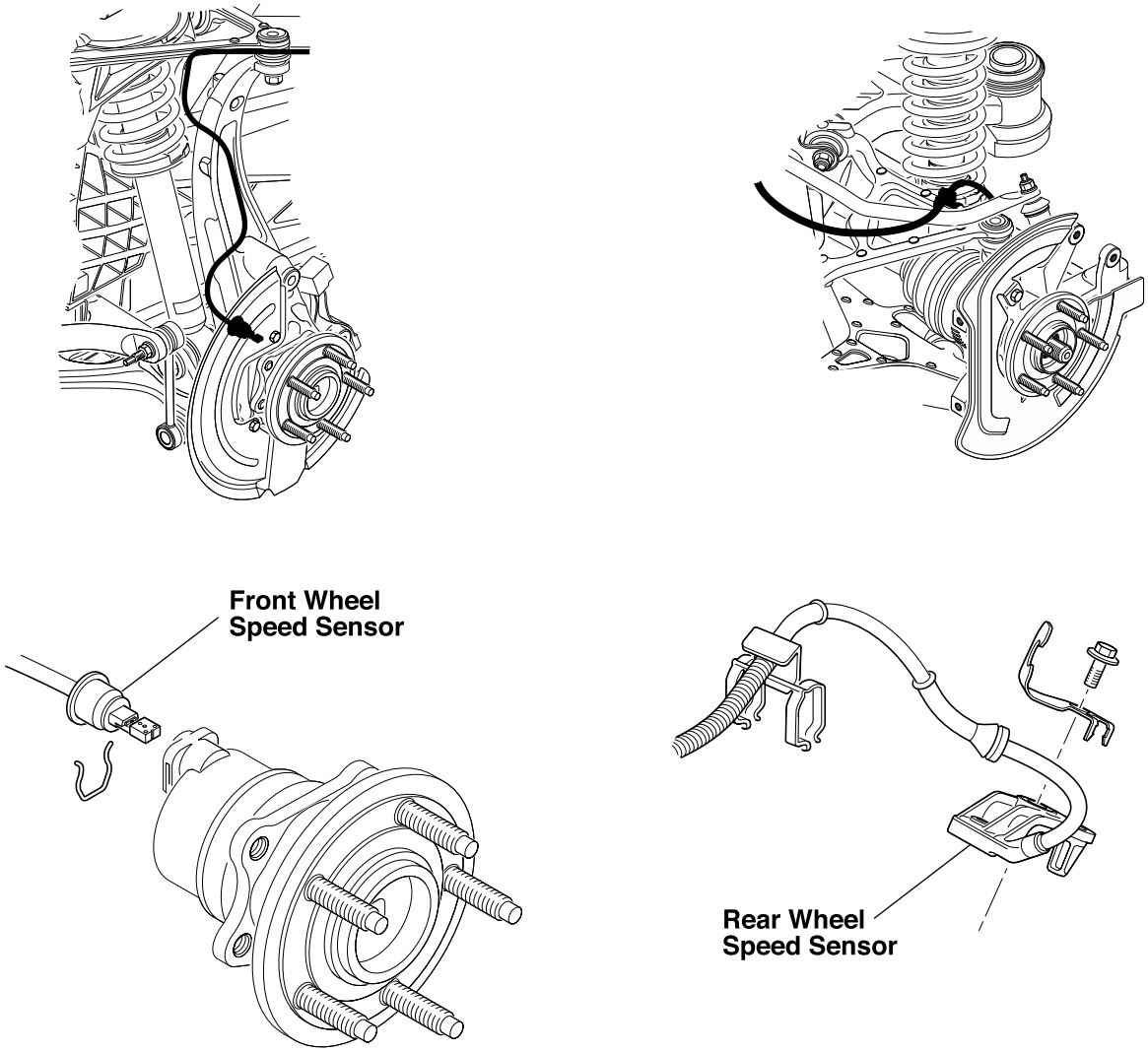
Wheel Speed Sensors

Speed sensors are fitted in the vertical link for each road wheel. Each sensor is secured with either a spring clip or a single securing bolt.

A toothed wheel fitted to each hub, turns with the road wheel and induces an oscillating voltage signal in each speed sensor. The frequency of the oscillating signals varies directly with wheel speed, providing the ABS control module with information about the speed of individual wheels. If there is no significant difference between wheel speed signals, the ABS control will not be activated and braking will be under the control of the normal hydraulic devices.

Each wheel speed sensor is monitored for open or short circuits. The control logic will also look for abnormalities in signal levels when the brakes are not applied. Any serious errors will cause the ABS circuits to be disabled and the ABS warning lamp to be illuminated.

The wheel speed sensor coils each have a resistance of 1100Ω and have an applied voltage of 2.5 volts on each connecting pin when the vehicle is stationary with the ignition on.



036-5-011

Brakes - Hydraulic Operation

Normal braking

On pressing the brake pedal, the tandem master cylinder pushrod operates both the primary and secondary pistons to pressurise the brake circuits. The primary circuit D applies brake pressure to the front brakes via the normally open valves 13 & 14. The rear brakes are applied by the secondary circuit E in the tandem master cylinder via the normally open valves 11 & 12. Brake pressure in both circuits is controlled by pedal pressure plus vacuum booster assistance under normal braking conditions.

ABS Operation

Should the ABS ECU detect a significant difference in the frequencies of the wheel speed sensor signals, ABS operation will be initiated.

The pump 8 will start and the normally open inlet valves 11,12, 13, and 14 will be close simultaneously. This prevents any further increase in brake pressure by the driver. The ABS controller will then open the appropriate normally closed outlet valve 15, 16, 17 or 18 to reduce the hydraulic pressure in the'slipping wheel' circuit. Excess fluid from the affected circuit will flow to a low pressure accumulator 5. This operation will continue until the affected wheel accelerates again to normal road speed.

Fluid from the low pressure accumulator is pumped back into the master cylinder. The driver may notice that the brake pedal is forced back at this time.

Brake pressure is then increased at the affected wheel by opening the inlet valve and closing the outlet valve. The driver will notice a slight drop in the brake pedal during this operation.

This cycle of reducing and then increasing the brake pedal pressure will be repeated very rapidly and the driver may notice a high frequency pulsing in the brake pedal.

When the sensors indicate that the skid condition no longer exists, the pump stops and the inlet and outlet valves return to their normal states. Normal braking is resumed.

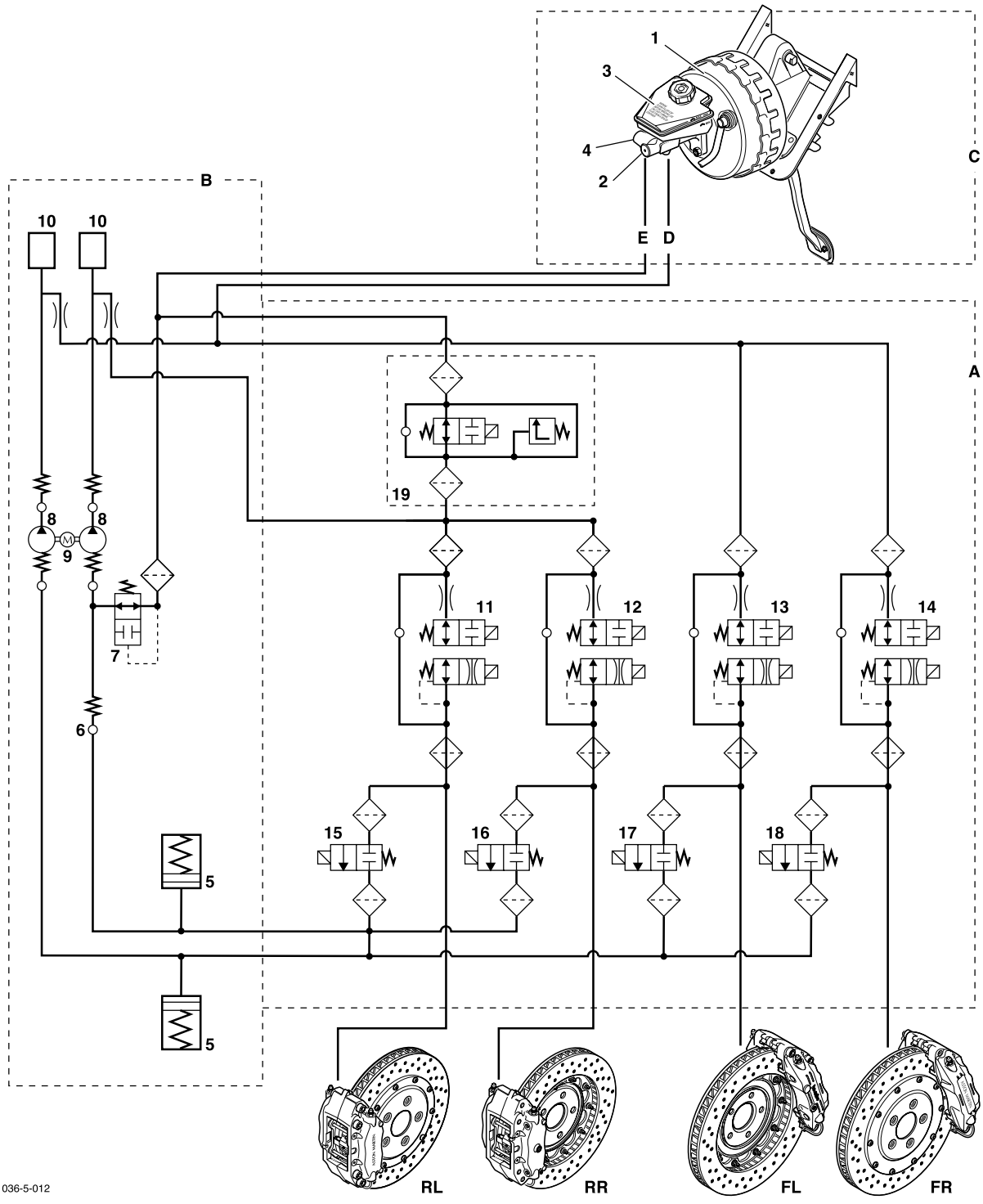
The Traction Control System

The Traction Control System (TCS) is designed to detect wheelspin where the rotational speed of any driven wheel exceeds the average speed of the other wheels. The system uses the vehicles ABS sensors to monitor the wheel speed of all four road wheels and is controlled by the ABS ECU. Traction control is invoked as soon as a driven rear wheel starts to spin due to the application of too much engine power for the available grip.

Wheel spin is controlled primarily by engine intervention (ignition retard, fuel injector cut-off). Brake intervention is invoked only during occurrences of split friction between the driven wheels, i.e. one driven wheel spinning, and to correct initial wheel spinning.

Should the ABS ECU detect a wheel spin situation, normally open traction control valve 7, and the isolation valve 19 are closed and the pump 8 runs. The inlet valve of the non-spinning driven wheel (11 or 12) is closed to prevent pressurisation of the caliper. Closing valves 7 and 19 allows the hydraulic fluid level in the master cylinder and reservoir to be maintained, in readiness for brake application. The pump draws hydraulic fluid from the low pressure accumulators 5 and pressurises the calipers of the spinning wheel, checking its tendency to spin. Normally closed outlet valve 17 and 18 are opened during traction control to prevent the front calipers from pressurising.

If the brakes are applied during traction control, the ABS ECU detects brake light illumination and switches off traction control, returning all valve to their normal states.



Key

A	Valve block	1	Vacuum Booster	10	Noise Dampeners
B	Pump/ Motor Unit	2	Tandem Master Cylinder	11	Inlet Valve (NO) RL
C	Actuation Unit	3	Fluid Reservoir	12	Inlet Valve (NO) RR
D	Primary Circuit	4	Proportioning Valve	13	Inlet Valve (NO) FL
E	Secondary Circuit	5	Low Pressure Accumulator	14	Inlet Valve (NO) FR
RL	Rear Brake Circuit (Left)	6	Check Valve	15	Outlet Valve (NC) RL
RR	Rear Brake Circuit (Right)	7	Traction Control Valve	16	Outlet Valve (NC) RR
FL	Front Brake Circuit (Left)	8	Hydraulic Pump	17	Outlet Valve (NC) FL
FR	Front Brake Circuit (Right)	9	DC Motor	18	Outlet Valve (NC) FR
				19	Isolation Valve (NO)

Brakes - Non-ABS Diagnostics

1. Symptom - Vibration during braking

Possible Causes

a) Worn/damaged brake pads

Renew brake pads

b) Loose caliper mounting bolts

Tighten caliper mounting bolts

c) Foreign material or scratches on brake disc contact surfaces

Clean brake disc contact surface

d) Damaged brake disc contact surface

Renew brake disc

Excessive runout of discs - Hub bearings loose

e) Caliper mis-aligned to disc (some calipers are shimmed to the vertical link)

2. Symptom - Poor brake performance

Possible Causes

a) Leak in hydraulic system - Long Pedal Travel

Repair leak. Check all pipework connections. Refill and bleed the system

b) Air in hydraulic system

Check for leaks and bleed the system

c) Worn/damaged brake pads

Renew brake pads

d) Foreign material on brake pads

Examine brake pads and clean or renew as necessary

e) Brake caliper piston malfunction

Renew faulty brake caliper

f) Tandem master cylinder malfunction

Service or renew tandem master cylinder

g) Vacuum booster fault

Renew vacuum booster

h) Disconnected or damaged vacuum hose

Renew vacuum hose

i) Low brake fluid level

Check for leaks, refill and bleed the system

3. Symptom - Brakes pull to one side

Possible Causes

a) Worn/damaged brake pads

Renew brake pads

b) Foreign material on brake pads

Examine pads and clean or renew as necessary

c) Failing valves in ABS valve block

Renew hydraulic control module

d) Abnormal wear or distortion on front brake disc

Examine front brake disc and service or renew as necessary

e) Incorrect wheel alignment / badly seated wheels

Realign wheels

f) Incorrect tyre pressures

Inflate tyres to correct pressure

4. Symptom - Brakes do not release

Possible Causes

a) No brake pedal free play

Adjust brake pedal free play

b) Vacuum booster binding

Renew vacuum booster

c) Tandem master cylinder return port faulty

Clean master cylinder return port

d) Faulty valve in ABS valve block

Renew hydraulic control module

5. Symptom - Brakes grab

Possible Causes

a) Brake pads contaminated with grease or brake fluid

Check pipework and seals for leaks. Renew brake pads.

b) Brake pads distorted, cracked or loose

Renew brake pads

c) Loose caliper mounting bolts

Check calipers. Repair/Renew as necessary

6. Symptom - Excessive pedal travel

Possible Causes

a) Leak in hydraulic system

Repair leak. Check all pipework connections. Refill and bleed the system

b) Air in hydraulic system

Check for leaks and bleed the system

c) Worn master cylinder piston seals or scored cylinder bore

Renew master cylinder

d) 'Knock Back'. Excessive brake disc run-out or loose wheel bearings

Check brake disc run-out and renew as necessary. Adjust or replace wheel bearings

e) Brake caliper piston(s) sticking.

Service or renew caliper or caliper guide pins.

f) Worn/damaged brake pads.

Renew brake pads

7. Symptom - Brakes drag

Possible Causes

a) Seized or incorrectly adjusted handbrake or cable

Check handbrake, repair/renew as necessary

b) Broken or weak handbrake return springs

Renew handbrake return springs

c) Caliper piston(s) seized

Check calipers. Repair/renew as necessary

d) Brake pedal binding at pivot points

Examine brake pedal bushings and repair renew as necessary

e) Vacuum booster binding

Renew vacuum booster

f) Tandem master cylinder faulty

Examine master cylinder, repair/renew as necessary

8. Symptom - Excessive pedal force required

Possible Causes

a) Lack of vacuum at the vacuum booster

Check vacuum hose. Repair or renew as necessary

b) Check operation of one-way valve for rapid or slow vacuum decay)

Renew brake booster

c) Tandem master cylinder push rod binding

Renew master cylinder

d) Seized tandem master cylinder piston

Renew master cylinder

e) Brake caliper piston seized

Examine caliper, repair/renew as necessary

9. Symptom - Excessive brake noise

Possible Causes

a) Worn brake pads

Renew brake pads

b) Bent or cracked handbrake pads

Renew handbrake pads

c) Foreign objects in brake pads or handbrake pads

Examine brake pads and handbrake pads. Clean or renew as necessary.

d) Broken/loose handbrake return springs

Examine handbrake assembly, Repair or renew as necessary

e) Loose caliper mounting bolts

Torque-tighten caliper mounting bolts

ABS Control Module - Pin Connections

1.
2. Brake Pedal Depressed
3. RH Front Wheel Speed Sensor In
4. RH Front Wheel Speed Sensor Out
5. Not Used
6. RH Rear Wheel Speed Sensor Out
7. RH Rear Wheel Speed Sensor In
8. Ground
9. +12V Pump and Motor
10. SCP -
11. SCP +
12. Not Used
13. Not Used
14. Traction Control On/Off
15. Traction Control Status Lamp On/Off
16.
17. LH Front Wheel Speed Sensor In
18. LH Front Wheel Speed Sensor Out
19. Road Speed Out
20. +12V Ignition
21. LH Rear Wheel Speed Sensor In
22. LH Rear Wheel Speed Sensor Out
23. OBD 11 Diagnostics
24. Ground
25. +12V Valves

ABS Module Quick Checks

Test	Ignition On/Off	Test Procedure	Specification
ABS Module Voltage Supplies			
Pump/Motor Power	Ign Off	Underbonnet Fusebox F18 - Chassis Ground	+12V
Valve Power	Ign Off	Underbonnet Fusebox F16 - Chassis Ground	+12V
Ignition Feed	Ign On	Underbonnet Fusebox F4 - Chassis Ground	+12V
Wheel Speed Sensor Resistance			
Disconnect the ABS module connector			
Left Front	Ign Off	Pin 17 - Pin 18	0.8 - 1.4 kΩ
Right Front	Ign Off	Pin 3 - Pin 4	0.8 - 1.4 kΩ
Left Rear	Ign Off	Pin 21 - Pin 22	0.8 - 1.4 kΩ
Right Rear	Ign Off	Pin 6 - Pin 7	0.8 - 1.4 kΩ
Wheel Speed Sensor Insulation from Ground			
Sensor Ground	Ign Off	Pins 8/24 - Chassis Ground	∞
Left Front	Ign Off	Pin 17/18 - Pin 8/24	∞
Right Front	Ign Off	Pin 3/4 - Pin 8/24	∞
Left Rear	Ign Off	Pin 21/22 - Pin 8/24	∞
Right Rear	Ign Off	Pin 6/7 - Pin 8/24	∞
Sensor output			
Reconnect the ABS module connector			
Connect the PDU Datalogger and monitor the following wheel speed signals:			
LF_WSPD	Ign On	Spin the wheel at approx. 1rev/second	≈ 5mph
RF_WSPD	Ign On	Spin the wheel at approx. 1rev/second	≈ 5mph
LR_WSPD	Ign On	Spin the wheel at approx. 1rev/second	≈ 5mph
RR_WSPD	Ign On	Spin the wheel at approx. 1rev/second	≈ 5mph
ABS Warning Lamp			
Switch the ignition Off and then On			
ABS Self-Check	Off-On	Observe ABS warning lamp	Lamp on for 5 seconds then off

Table 1: ABS Diagnostic Codes

DTC	DTC Description	When SET		Fault Condition	Comment
B1342	ECU is defective	C	O	"ABS/TCS/IVD module internal failure, processor, RAM, ROM, timer, valves, etc.	"ECU Failure - Replace Module.
C1095	ABS hydraulic pump motor circuit failure	C	O	"Short circuit to ignition or ground, pump motor cable disconnected, non-rotating pump, defective internal power transistor, etc.	"Monitored with and without pump motor activation
C1145	Wheel speed RF input circuit failure	C	O	"Open, short to ground or battery, defective trigger circuit, etc.	""Below 5 kph, system is inhibited. Above 5 kph, module is disabled."
C1155	Wheel speed LF input circuit failure	C	O	"Open, short to ground or battery, defective trigger circuit, etc.	""Below 5 kph, system is inhibited. Above 5 kph, module is disabled."
C1165	Wheel speed RR input circuit failure	C	O	"Open, short to ground or battery, defective trigger circuit, etc.	""Below 5 kph, system is inhibited. Above 5 kph, module is disabled."
C1175	Wheel speed LR input circuit failure	C	O	"Open, short to ground or battery, defective trigger circuit, etc.	""Below 5 kph, system is inhibited. Above 5 kph, module is disabled."
C1233	LF wheel speed input signal missing	C	O	"Signal faulted: sensor air gap too large, missing tooth wheel, etc.	"Detectable if vehicle speed exceeds 20 kph
C1234	RF wheel speed input signal missing	C	O	"Signal faulted: sensor air gap too large, missing tooth wheel, etc.	"Detectable if vehicle speed exceeds 20 kph
C1235	RR wheel speed input signal missing	C	O	"Signal faulted: sensor air gap too large, missing tooth wheel, etc.	"Detectable if vehicle speed exceeds 20 kph
C1236	LR wheel speed input signal missing	C	O	"Signal faulted: sensor air gap too large, missing tooth wheel, etc.	"Detectable if vehicle speed exceeds 20 kph
B1676	Battery voltage out of range	C	O	Battery voltage to ABS module out of range	Battry voltage less than 9 volts for more than 200ms.t
B2477	Module configuration failure	C		Module data incorrect or not configured	If not configured, the ABS lamp will flash.
C1805	Mismatched PTEC and/ or ABS/TC module	C		Module not configured or PTEC SCP message data not correct..	PTEC data at power up compared with expected data. If U1263 is present, fix this first.

Table 1: ABS Diagnostic Codes

DTC	DTC Description	When SET		Fault Condition	Comment
U1262	Actual axle torque compared to Min & Max	C	O	Vehicle SCP network message not received.	
C1267	Engine rpm compared with rate of change compared with throttle position.	C	O	SCP data not received.	
U1272	Engine configuration status. (1.8 second aging. on power up only)	C	O	SCP message not received	
U1273	Transmission Configuration Status. (1.8 second aging. on power up only)	C	O	SCP network message not received.	

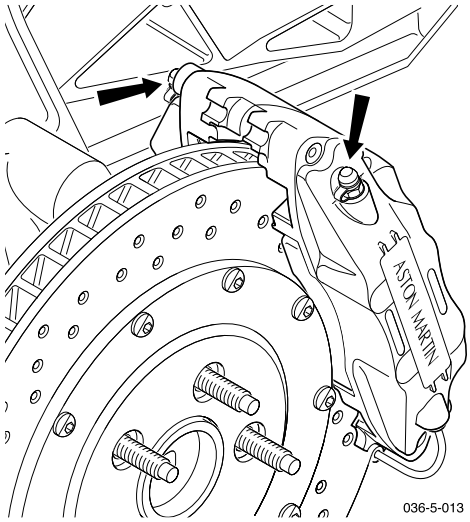
O = On-Demand Self-Test

C = Continuous Self-Test

5.0.03 Brake Bleeding Procedure

Preparation

1. Access the bleed nipples on all calipers. Clean each caliper as necessary in the area of the bleed nipples and remove the dust caps.



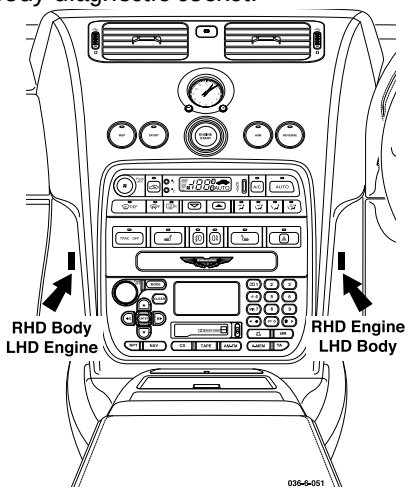
2. Prepare a bleed tube and bottle containing a small quantity of clean brake fluid.

3. If necessary, top up the brake fluid reservoir with fluid from a freshly opened container.

   Warning: Brake fluid is hygroscopic. If kept in opened containers, it will absorb water vapour. Use only fluid from freshly opened containers when topping up the brake fluid reservoir.

4. At the WDS base station, switch on the WDS and load the anti-lock braking diagnostics software.

5. Select Brake Bleed and then connect the WDS to the body diagnostic socket.



Procedure

1. Select “Operate ABS/TCS vales/pump”. Enter the selection for left or right hand drive vehicles.

2. Ensure that the brake fluid in the reservoir is at maximum level.

3. Connect the bleed tube to the outer nipple of the caliper furthest from the master cylinder

4. Switch on the ignition. The WDS will direct you through the following sequence:

   Bleed the Modulator

   - WDS runs the ABS modulator pump
   - Operator presses the brake pedal
   - WDS opens the modulator valves and brake pedal sinks to the floor
   - WDS closes the valves and operates the modulator pump. The brake pedal rises fully.
   - Release the brake pedal

   Bleed the Outer Brake Cylinder

   - Open the outer bleed nipple on the rear caliper furthest from the master cylinder
   - Fully depress and release the brake pedal five times
   - Close the outer bleed nipple

   Bleed the Inner Brake Cylinder

   - Open the inner bleed nipple on the rear caliper furthest from the master cylinder
   - Fully depress and release the brake pedal five times
   - Close the inner bleed nipple

   Bleed the Remaining Calipers

   - Check and top up the fluid reservoir
   - Transfer the bleed tube and bottle to the next caliper
   - Repeat the above sequence for the remaining three wheels in the order specified on the WDS

   Final Clear Up

   - Firmly press the brake pedal several times to seat the pads
   - Top up the brake fluid reservoir as necessary
   - Remove the bleed tube and bottle
   - Wipe away any traces of brake fluid from the calipers and refit the eight dust caps
   - Disconnect the WDS and refit the vehicle trim.

5.1.01 Front Brake Caliper Renew

Data

Specification

Wheel nuts	130 Nm
Brake hose union	16 Nm
Caliper bracket to vertical link	105-125 Nm

Oils / Greases

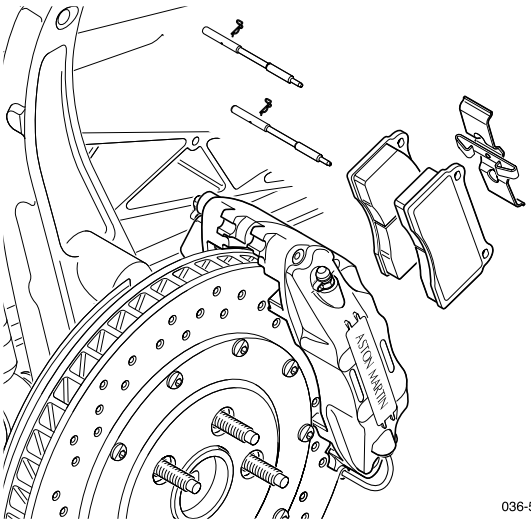
Brake & Clutch Fluid (Not silicon based fluid)	DOT 4 spec.

Removal

1. Slacken off the wheel nuts for the affected wheel(s) 1/4 turn each. Raise the vehicle on an appropriate hoist and remove the affected road wheel(s)

2. Remove the brake pads.

   - Remove the spring clips
   - Remove the pad locating pins
   - Remove the anti rattle spring
   - Remove the brake pads

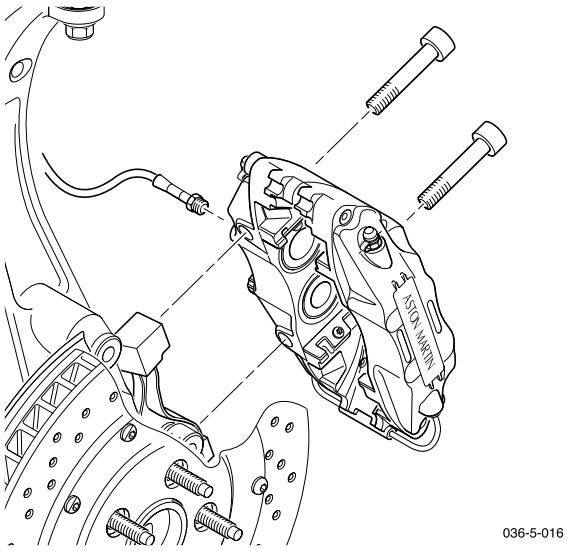


3. Consider renewing brake pads when less than 1/3 of the friction material remains, especially if the car is regularly used and some time remains before the next service.

   WARNING: Always use a vacuum brush or aqueous brake cleaner to remove brake lining dust. Never use an air line.

4. Remove the brake caliper.

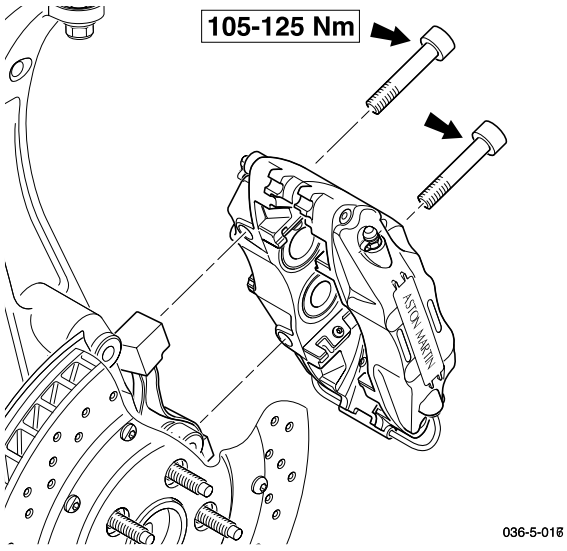
   - Disconnect the brake hose union and cap the union bolt.
   - Plug the hose aperture in the caliper.
   - Remove two bolts securing the caliper bracket to the vertical link
   - Remove the brake caliper and bracket assembly.



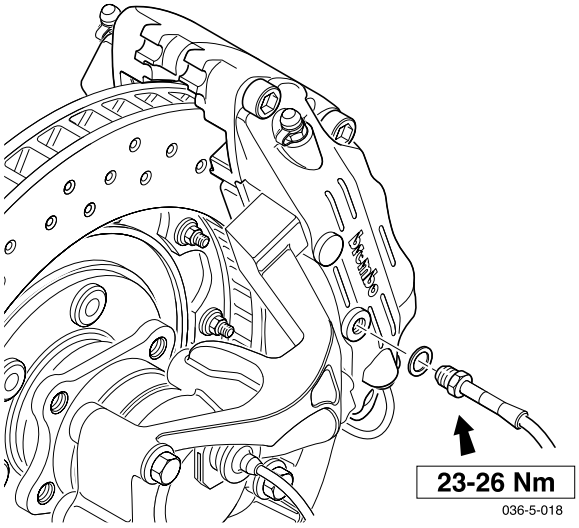
Note: Only remove the caliper bracket if required for wheel bearing/hub replacement.

Installation

1. Fit and tighten two bolts.



2. Remove the cap nut from the union bolt and the plug from the caliper. Secure the brake hose union ensuring that the flexible hose is not twisted.



3. Fit the brake pads.

   - Apply a trace of copper grease to the back of the brake pads and to the locating pins. Fit the brake pads to the caliper.
   - Fit the anti-rattle spring
   - Fit the pad locating pins.
   - Secure the pins with spring clips.

4. Refit the road wheel and tighten the wheel nuts to specification.

5. Carry out brake bleed procedure (5.0.03.1).

5.1.04 Front Brake Disc Renew

Data

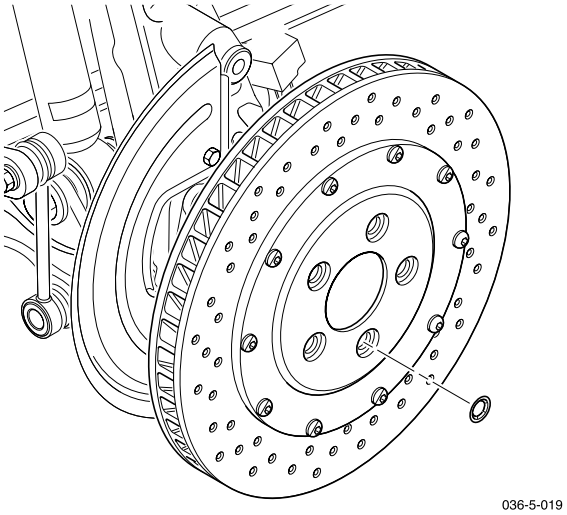
Specification

Brake disc initial thickness	31.9-32.1 mm
Brake disc minimum thickness	29.9-30.1 mm
Wheel nuts	130 Nm

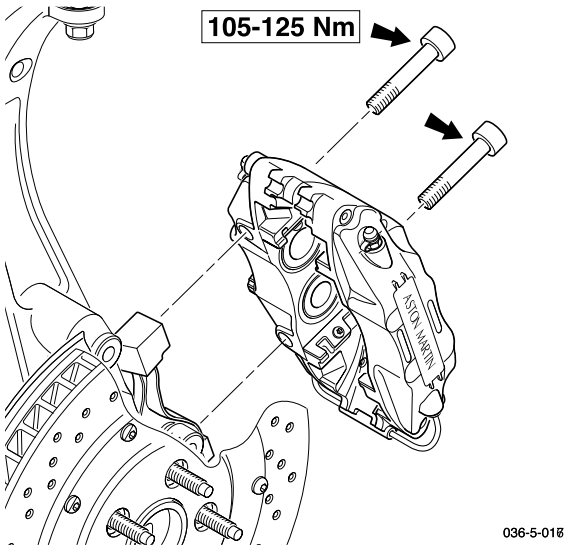
Procedure

1. Remove the front road wheel.
2. Remove the front brake caliper and adaptor from the vertical link (5.1.01). Support the caliper and adaptor to prevent excessive strain on the flexible hose.
3. Remove the brake disc retaining lockwasher.
4. Remove the front brake disc.

   Caution: The brake disc and mounting bell are balanced during manufacture and must not be separated. DO NOT remove the disc from the mounting bell.



5. Fit the replacement brake disc.
6. Fit a new retaining lockwasher.
7. Refit the brake caliper and adaptor to the vertical link (5.1.01).



8. Refit the road wheels and nip-up the wheel nuts.
9. Lower the vehicle to the ground and torque tighten the wheel nuts.

5.1.05 Fluid Reservoir Renew

Data

Oils / Greases / Sealants

Universal Brake and Clutch Fluid to, or exceeding, DOT 4 specification.

Removal

1. Open the bonnet. Remove the passenger side engine bay cover.

   WARNINGS:

   Avoid skin / eye contact or ingestion of brake fluid. If skin or eyes are splashed with brake fluid, rinse the affected area immediately with plenty of water and obtain medical attention.

   If brake fluid is ingested, obtain immediate medical attention.

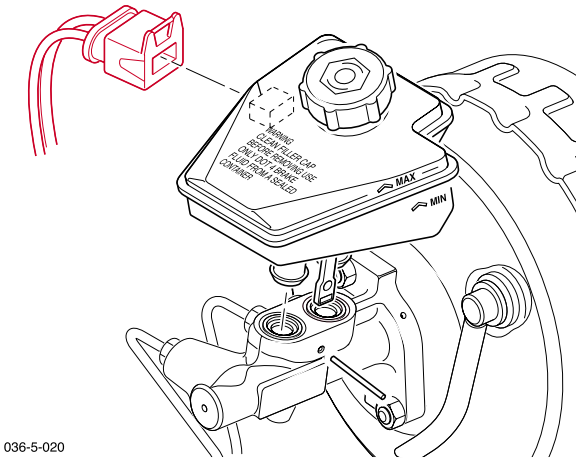
   Caution: Fluid must not be allowed to contact the vehicle paintwork. Remove spilt fluid from the paintwork by rinsing away with running water.

2. Place suitable absorbent material around the reservoir area to catch any spilt fluid.

3. Using a flexible tube and container, siphon as much fluid as possible from the reservoir.

4. Remove the brake fluid reservoir.

   - Disconnect the reservoir multiplug.
   - Remove the reservoir securing pin.
   - Remove the reservoir taking care to minimise fluid spill. Clear any spilt fluid immediately.



036-5-020

Installation

1. Fit new ‘O’ rings to the replacement reservoir. Lightly lubricate the ’O' rings with brake fluid.

2. Refit the reservoir to the master cylinder, ensuring correct location of the ‘O’ rings.

   - Fit the reservoir securing pin.
   - Connect the reservoir multiplug.
   - Refill the reservoir with the specified brake fluid from a new unopened container.

3. Bleed the brake system (5.0.03.1).

5.1.06 Master Cylinder Assembly Renew

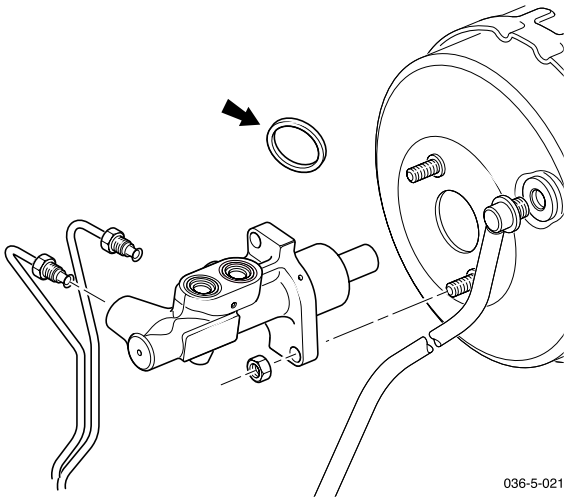
Data

Oils / Greases

Universal Brake and Clutch Fluid to, or exceeding, DOT 4 specification.

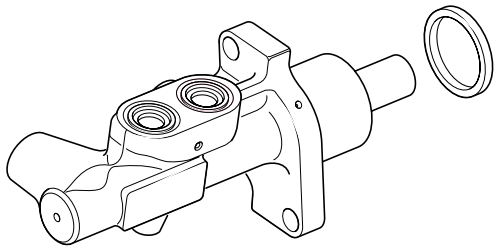
Removal

1. Remove the fluid reservoir (5.1.05).
2. Place suitable absorbent material below the master cylinder to catch any spilt fluid.
3. Remove the master cylinder.
   - Disconnect the two outlet pipes from the master cylinder. Fit blanking plugs to all ports and pipe ends to prevent fluid leakage.
   - Remove the two nuts securing the master cylinder to the brake servo then remove the master cylinder.
   - Discard the lapels gasket.

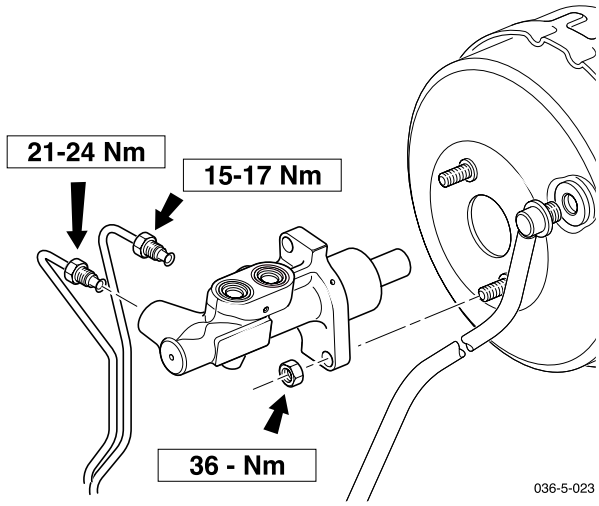


Installation

1. Fit a new gasket to the master cylinder.



2. Fit the master cylinder to the brake servo.
   - Secure the master cylinder with the two nuts and washers.
   - Fit the two outlet pipe unions to their original positions on the master cylinder. Tighten the unions to specification.



3. Fit the original fluid reservoir to the new master cylinder (5.1.05).

5.1.08 ABS Modulator / Control Module

Data

Oils / Greases

Universal Brake and Clutch Fluid to / or exceeding DOT 4 specification.

WARNINGS:

Avoid skin / eye contact or ingestion of brake fluid. If skin or eyes are splashed with brake fluid, rinse the affected area immediately with plenty of water and obtain medical attention.

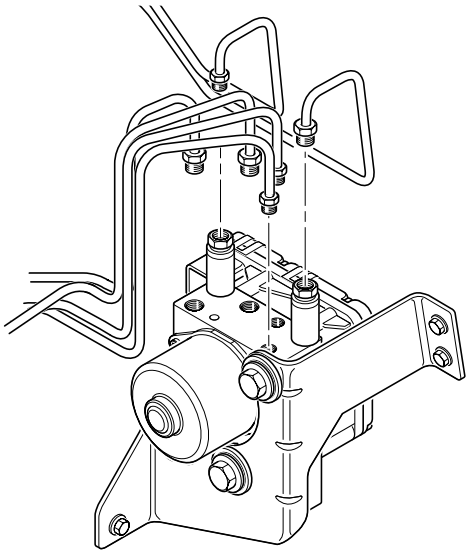
If brake fluid is ingested, obtain immediate medical attention.

Specification

Wheel nuts	130 Nm

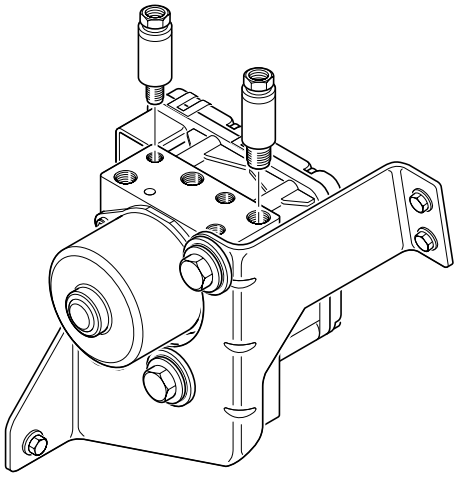
Removal

1. Switch off the battery master switch.
2. Remove the left front wheel and wheel arch liner.
3. Release the six unions from the modulator valve block. Cap each pipe and plug each valve block outlet to prevent further leakage.



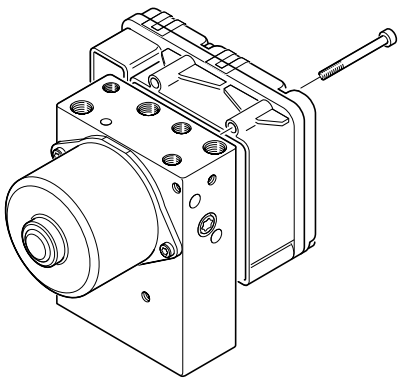
036-5-024

4. Remove the balance valves from the modulator valve block.



036-5-025

5. Release three bolts and lower the modulator mounting bracket.
6. Disconnect the modulator electrical connector.
7. Remove three bolts securing the modulator to its bracket.
8. Remove the modulator/control module assembly.
9. Remove four torx head screws and separate the control module and modulator.



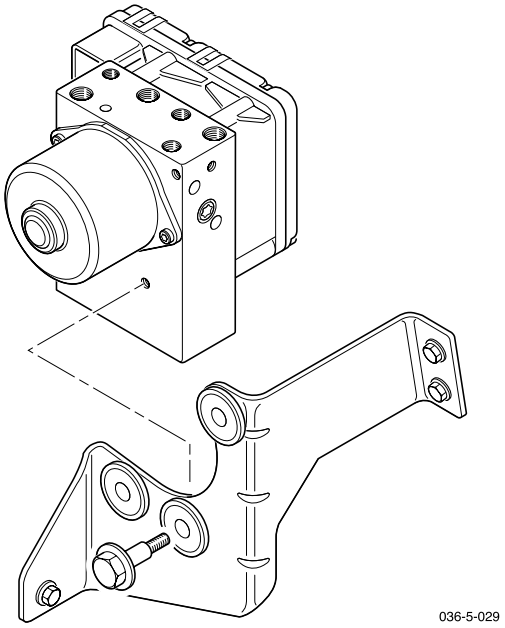
036-5-027

Note: The control module can be renewed separately from the modulator assembly and can be removed from the vehicle without disturbing the hydraulic circuit.

Installation

1. Fit the control module to the modulator and secure with four torx head screws.

2. Fit the modulator to its mounting bracket and secure with three screws.

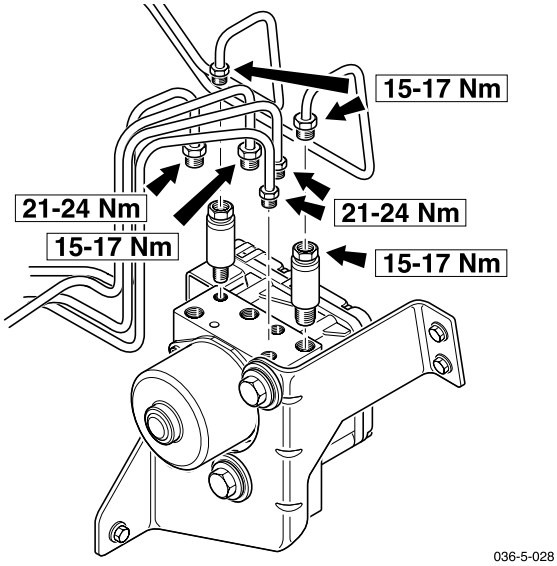


3. Reconnect the ABS control module electrical connector.

4. Fit the modulator and bracket to the vehicle using three screws.

5. Remove sealing caps from the brake pipes. Fit the balance valves and six brake pipe unions to their matching outlets on the valve block. Tighten the unions to specification.

Note: The left and right hand outlets are different sizes. The front and rear master cylinder unions are also different sizes.



6. Remove any remaining traces of brake fluid from the modulator and surrounding area.

7. Refit the wheel arch liner and wheel.

8. Bleed the brake system (5.0.03.1).

9. Lower the vehicle to the ground and tighten the wheel nuts to specification.

5.2.02 Rear Brake Disc Renew

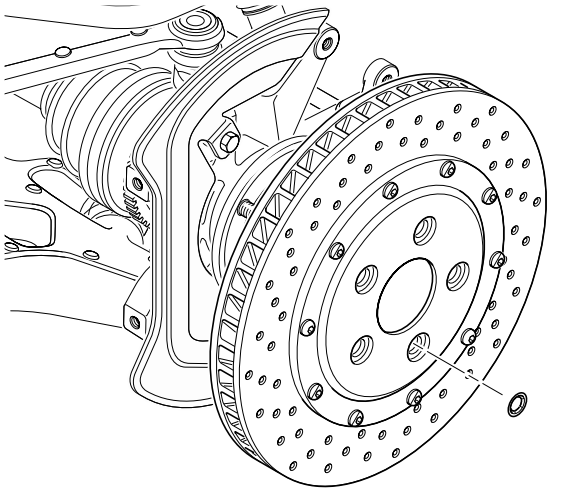
Data

Specification

Brake disc initial thickness	27.9-28.1 mm
Brake disc minimum thickness	25.9-26.1 mm
Wheel nuts	130 Nm

Removal

1. Remove the rear road wheels.
2. Remove the rear brake caliper (5.2.04).
3. Remove the handbrake caliper (5.3.03).
4. Remove the disc retaining lockwasher.
5. Remove the rear brake disc

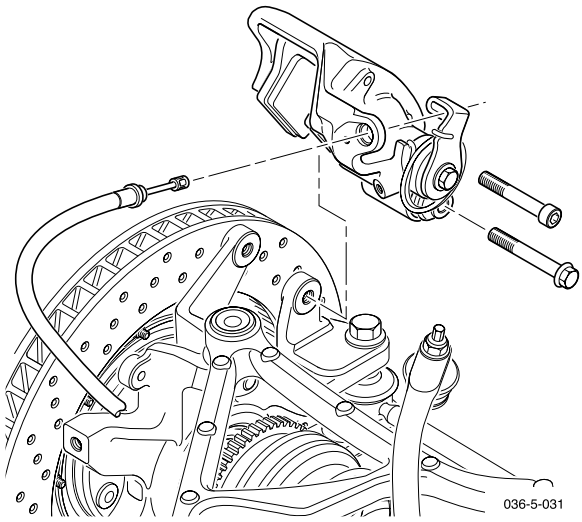


6. Clean all brake dust from the calipers.

WARNING: Always use a vacuum brush to remove brake pad dust. Never use an air line.

Installation

1. Fit a new rear brake disc.
2. Fit a new disc retaining lockwasher.
3. Refit the brake caliper (5.2.04).
4. Refit the handbrake caliper.



5. Operate the handbrake lever to centralize the handbrake pads.
6. Adjust the handbrake if necessary (5.3.02).
7. Refit the road wheel and tighten the wheel nuts.
8. Apply and release the brakes several times to settle the pads to the new brake disc.

   WARNING: Application of the brake pedal must be carried out, as the brakes will not operate efficiently until the pads are correctly positioned.
9. Check the brake fluid and top up as necessary.

5.2.03 Rear Brake Pad Renew

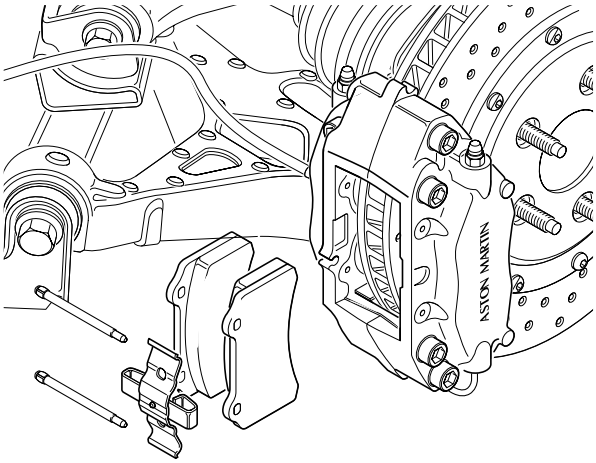
Specification

New pad thickness	14.75mm
Minimum lining thickness	7.5 mm
Wheel nuts	130 Nm

Consider renewing brake pads when 1/3 of the friction material remains, especially if the car is regularly used and some time remains before the next service.

Removal

1. Slacken off the road wheel nuts for the affected wheel(s) 1/4 turn each. Raise the vehicle on an appropriate hoist and remove the affected road wheel(s)
2. Remove the brake pads.
   - Drift out the pad locating pins
   - Remove the anti rattle springs
   - Remove and discard the brake pads
   - Clean all brake dust from the caliper area using approved brake cleaning equipment.



036-5-032

WARNING: Always use a vacuum brush or aqueous brake cleaner to remove brake lining dust. Never use an air line.

Installation

1. Fit the rear brake pads.
   - Apply copper grease to the back of the brake pads and to the locating pins. Fit the brake pads to the caliper.
   - Fit the anti rattle springs
   - Fit the pad locating pins
2. Refit the road wheel and tighten the wheel nuts to specification.

5.2.04 Rear Brake Caliper Renew

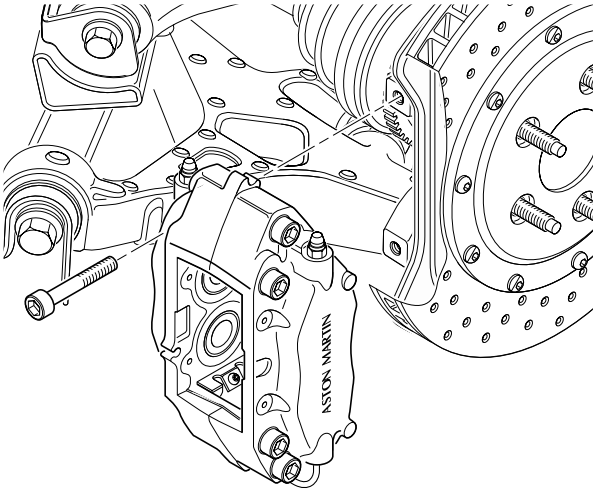
Data

Oils / Greases / Sealants

Brake fluid to a minimum DOT 4 specification.

Removal

1. Place a cloth around the brake reservoir filler cap / neck to absorb any possible spillage.
2. Raise the rear of the vehicle and place on stands. Remove the road wheel and tyre assembly.
3. Remove the rear caliper assemblies.
   - Disconnect the flexible hose union from the caliper. Cap the union nut. Plug the hose aperture in the caliper.
   - Remove the carrier to hub securing bolts and remove the caliper.



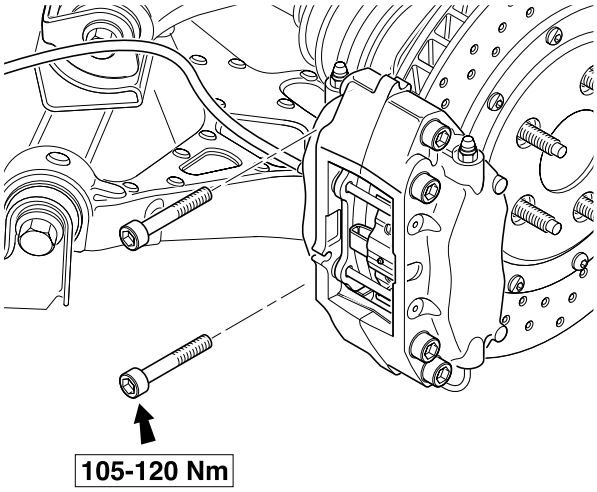
036-5-033

4. Remove the brake pads from the caliper.
5. Clean all brake dust from the components using approved brake cleaning equipment.

   WARNING: Always use a vacuum brush to remove brake pad dust. Never use an air line.

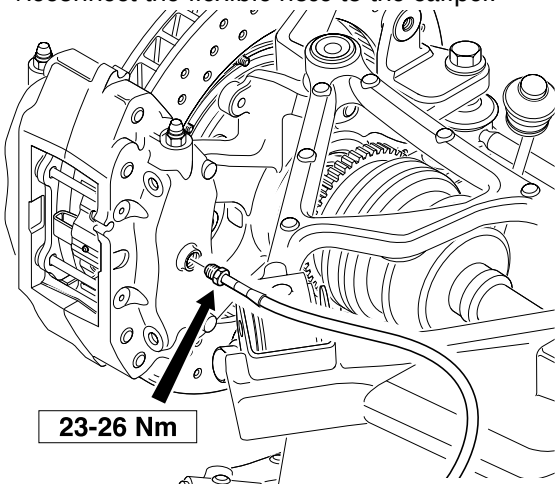
Installation

1. Fit the caliper to the hub assembly and tighten the securing bolts.



036-5-034

2. Ensure the caliper pistons on the new caliper are fully retracted.
3. Refit the brake pads if serviceable. Consider renewing the brake pads when 1/3 of the friction material remains, especially if the car is regularly used and some time remains before the next service (5.2.03).
4. Refit the anti rattle spring and the pad locating pins.
5. Reconnect the flexible hose to the caliper.

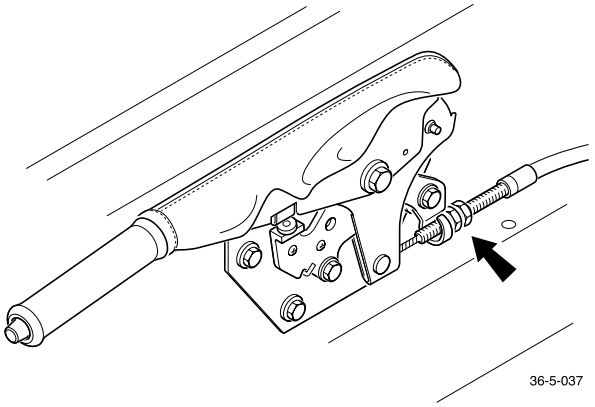


6. Refit the road wheel and tyre assembly and tighten the wheel nuts.
7. Lower the vehicle from the axle stands and torque the wheel nuts to 130 Nm.
8. Bleed the brakes (5.0.03.1.

5.3.02 Handbrake Cable Setting Procedure

Adjustment

1. Firmly apply and release the handbrake several times to equalise the handbrake calipers.
2. Access the handbrake cable adjuster locknuts.
   - Loosen the hand bake cable adjuster locknuts.



3. Adjust the handbrake lever cable.
   - From inside the vehicle, adjust the cable until upon application of the handbrake, only three to four notches of the ratchet are felt / heard.
   - Tighten the locknuts.
4. Refit the interior trim.

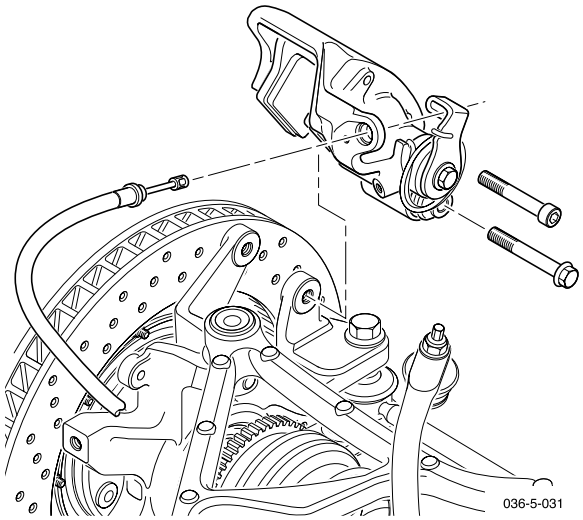
5.3.03 Handbrake Pads - Renew

Removal

1. Raise the vehicle on a four point hoist and remove the rear road wheels.

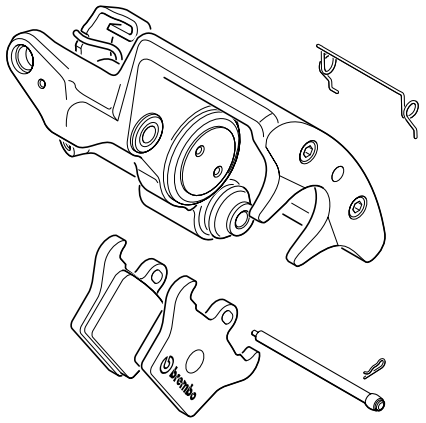
2. Release the handbrake calipers.

   - Remove two bolts
   - Remove the caliper



3. Release the handbrake pads.

   - Remove the pin retaining clip
   - Withdraw the retaining pin and recover the anti-rattle springs
   - Remove the handbrake pads.



036-5-036

Warning:

Always use a vacuum brush or aqueous brake cleaner to remove brake pad dust. Never use an air line.

4. Carefully remove brake dust / dirt from the brake system components.

5. Check that the handbrake caliper is free on its mounting pins, service as necessary.

Installation

1. To install reverse the removal procedure.

2. Carry out the handbrake cable setting procedure (5.3.02).

Wheels and Tyres

Specifications

Normal Use

Unique Aston Martin lightweight aluminium alloy wheels. 9J x 19 Front, 10J x 19 Rear

Vanquish tyres are made exclusively for Aston Martin. They are Yokohama AVS Sport V102 AML tyres of the following sizes:

Front - 255 x 40 ZR 19, Rear - 285 x 40 ZR 19

Note: AVS Sport V102 tyres are also made without the AML marking. These tyres are a different specification for lower performance cars and must not be fitted to the Aston Martin V12 Vanquish

Tyre Pressures:

All Wheels: 2.62 bar 262 kPa 38 psi

Caution: In order to protect tyres against flat spots during storage and transportation, tyre pressures should be increased to 65 - 70 psi (450 - 500 kPa) for transportation only.

Warning: Pressures must be reduced to the normal level (38psi) during PDI. The vehicle must never be run on the road with the elevated tyre pressures, driveability may be seriously compromised.

Wheel Nuts

Torque - 130 Nm

Tighten the wheel nuts in a ‘star’ pattern. Firstly, tighten all nuts to 80 Nm. Then tighten each nut from 80 to 130 Nm in one movement.

General

Tyres of the correct type, dimensions and at the correct cold inflation pressures are an integral part of the vehicle's design. Regular maintenance of tyres is an essential contribution to road safety and correctly inflated tyres in good condition will assist in retaining optimum roadholding, steering and braking qualities.

Tyres of the same type and size have widely varying characteristics depending upon manufacturer. It is strongly recommended that only tyres of the same make and type are fitted to all wheels.

The radial ply uni-directional tyres specified are designed to meet the high speed performance of which this car is capable.

Warning: The tyres are unidirectional and must be fitted with the direction arrows pointing in the direction of forward rotation. Correct fitting is critical to personal and vehicle safety

Pressure

The tyre inflation pressures specified provide optimum ride and handling characteristics for all normal conditions.

Tyre pressures should be checked and, if necessary, adjusted weekly with the tyres cold i.e. not immediately following use as pressure increases with temperature due to road friction. 'Bleeding' a warm tyre to the recommended pressure will result in under-inflation which can be both dangerous and reduce tyre life. Pressure loss with time is normal, but a thorough investigation should be performed if a pressure loss in excess of 0.14 bar (2 psi; 14kPa; 0.14 kgf/cm2) is encountered during a period of one week or less.

It is an offence in the UK to use a vehicle on public roads with tyres improperly inflated. Furthermore, incorrect inflation accelerates wear and causes excessive heating which can result in tyre failure due to blow out.

Wear

All tyres fitted as standard have a tread wear indicator moulded into their tread pattern to provide indication when the tread depth remaining is 1,6 mm (0.063 in). Each indicator appears on the tread surface as bars which connect the tread pattern across the full width of the tyre. It is illegal in the UK and certain other countries to continue using tyres after the tread has worn to less than 1,6 mm (0.063 in) over the central three quarters of the width and the entire circumference of the tyre.

Tyre Tread Wear Indicators

The properties of many tyres alter progressively with wear. In particular, 'wet grip' and aquaplaning resistance properties are gradually, but substantially, reduced. Extra care and speed restriction should therefore be exercised on wet roads as the effective tread depth diminishes.

When replacement of tyres is necessary it is preferable to fit a complete vehicle set. Should either front or rear tyres only show excessive wear, new tyres must be fitted to replace worn ones. Under no circumstances interchange tyres from side to side, front to rear or vice versa as individual tyre wear produces unique characteristics depending upon their position. If the position is changed after wear has occurred, the performance of the tyre will be adversely affected.

Damage

Excessive localized distortion, sometimes caused by severe contact with kerbs or stones. can cause the tyre casing to fracture and may lead to premature tyre failure. Tyres should, therefore, be periodically examined and any tyre having distortion, cracks and / or cuts should be replaced. In addition, all tread embedded objects, such as stones and glass, should be withdrawn and all contamination, i.e. oil and grease removed using a suitable solvent.

CAUTION: Paraffin (kerosene) must not be used as a cleansing agent on tyres.

Heat

Tyres should not be subjected to excessive heat such as that encountered in paint drying ovens. If the vehicle is to be subjected to such temperatures, remove the road wheels.

Repairs

In view of the high performance capability of the vehicle, damaged tyres should be renewed and not repaired.

Valves

When a new tubeless tyre is fitted, the valve should be renewed.

Tyre Use After Vehicle Storage

After a long period of vehicle standing, tyres may become locally distorted with a flat area. This may cause an uneven ride for a few miles until the tyres have warmed up and the 'flats' round off.

Winter (Snow) Tyres

The tyres fitted as original equipment are designed with a rubber mixture, tread pattern and width specially suited for high speeds in normal road conditions, but they are less suitable for winter conditions. The use of winter tyres will considerably improve the vehicle's handling in winter conditions.

Winter tyres must be used in vehicle sets, i.e. fitted on all four wheels. When fitted with winter tread tyres, the vehicle should not be driven at speeds in excess of the tyre speed category symbol as moulded on the tyre.

Snow Chains

WARNING: Only fit snow chains recommended by Aston Martin.

Snow chains may be fitted to rear wheels only. Remove the snow chains immediately upon the road being clear of snow. Snow chains should only be used with the recommended winter tyres. Maximum speed with snow chains fitted - 48km / h (30 mile / h). Tyres may be fitted with studs provided maximum speed does not exceed 145 km/h (90 mile/h). Studs must be of the parallel type, 10mm long, 8mm diameter single flange; the use of studs is not permitted in certain countries. Check local legislation.

USA Gradings

The following information relates to the tyre grading system developed by the National Highway Traffic Safety Administration which grades tyres by tread wear, traction and temperature performance.

Tread Wear

The tread wear grade is a comparative rating based on the wear rate of the tyre when tested under controlled conditions on a specified government test course. For example, a tyre graded 150 would wear one and a half times less on the government course than a tyre graded 100. The relative performance of the tyres depends upon the actual conditions of their use and may depart significantly from normal due to variations in driving habits, service practices and differences in road characteristics and climate.

Traction - A, B, C

The traction grades, from highest to lowest, are A, B and C and they represent the tyre's ability to stop in wet conditions measured on specified government test surfaces of asphalt and concrete.

WARNING: THE TRACTION GRADE IS BASED ON BRAKING (STRAIGHT AHEAD) TRACTION TESTS AND DOES NOT INCLUDE CORNERING (TURNING) TRACTION.

Temperature - A, B, C

The temperature grades are A (the highest), B and C, and they represent the tyre's resistance to the generation of wear and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel. Sustained high temperature can cause the material of the tyre to degenerate and reduce tyre life, and excessive temperature can lead to sudden tyre failure. Grade C corresponds to a level of performance which all passenger car tyres must meet under Federal Motor Vehicle Safety Standard No. 109. Grades B and A represent higher levels of performance on the laboratory test wheel than the minimum required by law.

WARNING:

The temperature grade is established for a tyre that is properly inflated and not overloaded. Excessive speed, under inflation or excessive loading, whether separately or in combination, can cause heat build-up and possible tyre failure.

Care of Alloy Road Wheels

Cast alloy road wheels are covered with a protective coating, and to prevent corrosion it is essential that this coating is not damaged. When removing or fitting tyres only equipment utilizing spigot or stud hole clamping must be used. The equipment must not have any moving parts which contact the wheel, and tyre levers must not be used.

To clean the wheels use warm soapy water; stubborn stains can be removed using a soft brush or by using a proprietary alloy wheel cleaner.

Misalignment and Road Camber Effects

It is important that correct wheel alignment be maintained. Misalignment causes tyre tread to be scrubbed off laterally because the natural direction of the wheel differs from that of the car.

A sharp 'fin' protrusion on the edge of each pattern rib is a sure sign of misalignment and it is possible to determine from the position of the 'fins' whether the wheels are toeing-in or toeing-out.

'Fins' on the inside edges of the pattern ribs, particularly on the nearside tyre, indicate toe-in. 'Fins' on the outside edges, particularly on the offside tyre, indicate toe-out.

With minor misalignment, the evidence is less noticeable and sharp pattern edges may be caused by road camber even when the wheel alignment is correct. In such cases it is better to make sure by checking with an alignment gauge. Road camber affects the direction of the car by imposing a side thrust and, if left to follow its natural course, the car will drift towards its nearside. This is instinctively corrected by steering towards the road centre and, as a result, the car runs crabwise . The diagram shows why nearside tyres are very sensitive to too much toe-in and offside tyres to toe-out.

It also shows why sharp 'fins' appear on one tyre but not on the other, and why the direction of misalignment can be determined by noting the position of the 'fins'. Severe misalignment produces clear evidence on both tyres.

The front wheels on a moving car should be parallel, Tyre wear can be affected noticeably by quite small variations from this condition. It will be noted from the diagram that even with parallel wheels, the car is still out of line with its direction of movement, but there is less tendency for the wear to be concentrated on one tyre.

The near front tyre sometimes persists in wearing faster and more unevenly than the other tyres, even when the mechanical condition of the car and tyre maintenance are satisfactory. The more severe the average road camber, the more marked this tendency will be.

Misalignment Effects

1. The wheels are correctly aligned but crabbing due to road camber. All tyres will wear equally.
2. Shows the wheels 'toed-out' in motion. The RH front tyre will wear faster.
3. Shows the wheels 'toed-in' in motion. The LH front tyre will wear faster.

Alignment Precautions

Wheels and tyres vary laterally within their manufacturing tolerances, or as a result of service, and alignment figures obtained without moving the car are unreliable. The following precautions should, therefore, be observed:

1. The car should have come to rest from a forward movement. This ensures, as far as possible, that the wheels are in natural running positions.

2. It is preferable for alignment to be checked with the car laden.

3. With a conventional base bar tyre alignment gauge, measurements should be taken in front of and behind the wheel centres at the same position on the tyre and rim flanges. This is achieved by marking the tyres where the first reading is taken and moving the car forwards approximately half a road wheel revolution before taking the second reading at the same points. With an optical gauge, two or three readings should be taken with the car moved forwards to different positions - 180° road wheel turn for two readings and 120° for three readings. An average figure should then be calculated.

Tyre and Wheel Balance

Static Balance

For smooth riding, precise steering and the avoidance of high speed 'tramp' or 'wheel hop', all tyres are balance checked to predetermined limits. To ensure the best degree of tyre balance, the covers are marked with white spots on one bead and these indicate the highest part of the cover.

The original degree of balance is not necessarily maintained and it may be affected by uneven tread wear, tyre removal or refitting, or by wheel damage or eccentricity. The car may also become sensitive to unbalance due to normal wear of moving parts. If roughness or high speed steering troubles develop and mechanical investigation fails to disclose a possible cause, wheel and tyre balance should be suspected.

WARNING: If balancing equipment is used to dynamically balance the road wheels, always jack both rear wheels off the ground when rear wheel balancing, otherwise damage may be caused to the differential. This is doubly important in the case of cars fitted with a limited slip differential, as in addition to possible damage to the differential, the car may drive itself off the jack or stand.

Dynamic Balance

Static unbalance can be measured when the tyre and wheel assembly is stationary. There is another form known as dynamic unbalance which can be detected only when the assembly is revolving.

There may be no heavy spot, i.e. there is no natural tendency for the assembly to rotate about its centre due to gravity, but the weight may be unevenly distributed each side of the tyre centre line. Laterally, the eccentric wheels give the same effect. During rotation, the offset weight distribution sets up a situation which tends to steer the wheel to the right and left alternately.

Dynamic unbalance of the tyre and wheel assemblies can be measured on suitable tyre balancing equipment, and corrections implemented. Where it is clear that a damaged wheel is the primary cause of severe unbalance, it is advisable for the wheel to be renewed.

Irregular Wear and Tyre Damage

Incorrect Tyre Pressure

Under-inflation is a frequent cause of severe tyre damage, resulting from the excessive flexing of the tyre. Under-inflation builds up internal heat which eventually weakens the casing. It also causes rapid and irregular tread wear.

Over-inflation leads to shortened tyre life with tread wear concentrated on the centre section in contact with the road. The cushioning effect of the tyre is impaired, resulting in a hard and uncomfortable ride. The tyre is also susceptible to impact fracture and casing damage.

Misalignment Wear

Rasped and feathered tread condition is caused by wheel misalignment and results in very rapid tread wear. 'Fins' on the inside edges of the pattern ribs, particularly on the nearside tyre, indicate toe-in. 'Fins' on the outside edges, particularly on the offside tyre, indicate toe-out.

Camber Wear

One shoulder more severely worn than the other. This type of wear is accentuated by mechanical irregularities of steering or suspension, or by high speed cornering.

Irregular Wear

Caused by mechanical irregularity of the vehicle as, for example, worn bearings, steering joints or badly adjusted brakes.

Age Deterioration

Cracking and crazing of the tread and sidewall rubber, sometimes accompanied by carcass deformation. An indication that the tyres have been in service for a very long time.

Deflation Damage

Breakdown of the tyre casing structure which can arise from under-inflation, overloading or running on a flat tyre.

Neglected Cut

Damage through accidental cuts or penetrations will extend in use due to continued flexing and/or ingress of moisture and road matter.

Impact Fracture

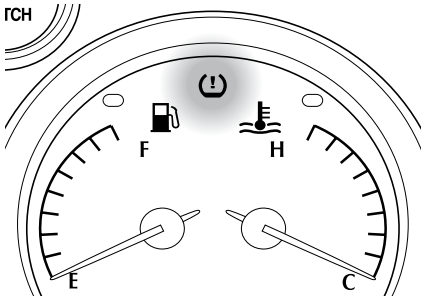
Resultant damage from impact fractures is not always visible externally and, therefore, as a safety precaution the tyre should be removed and examined.

(a) Casing fracture caused by severe localized impact through driving over kerbs, hitting potholes and / or objects in the road.

(b) A double fracture caused by crushing the side wall of the tyre between an object and the rim flange.

Note: In both instances, such damage can lead to sudden and dangerous tyre deflation some time after the impact occurred.

Tyre Pressure Sensing





The tyre pressure sensing system operates to remotely monitor tyre pressures and feed back information on tyre pressures to the driver.

Warning: This system is not intended to replace normal driver awareness of tyre performance or the need for the recommended weekly checks on tyre condition and pressure.

Each wheel is fitted with a tyre pressure sensing device which sends tyre pressure information to a control box mounted on the right hand side of the boot.

The control box will give the driver a visual warning by illuminating the tyre pressure warning lamp in the instrument panel if any tyre pressure falls below specification.

The warning lamp has two levels of illumination.

Lamp on Permanently - Tyre pressure below specification. Reduce speed immediately to 30 mph and re-inflate the tyre at the first possible opportunity.

Lamp Flashing - Tyre pressure dangerously low. Stop immediately in a safe location. Check for a puncture and repair if possible using the procedure in ‘Owner Maintenance’. If not, call for assistance.

One of the coloured lamps on the right side of the control box will also illuminate red to indicate which tyre requires inflating. The lamp colour corresponds to the colour of the band below each tyre valve cap. Take care to replace caps on the correct wheel after re-inflating tyres.

If the left hand control unit lamp illuminates amber, there is a control unit fault. Consult your Aston Martin dealer.

Summary of Tyre Pressure Warning Indications

Instrument Pack Warning Lamp	Tyre Pressure Module	Fault	Recommended Action
Flashing Warning	Tyre LED flashing Red	Tyre below lower pressure threshold	Stop in safe place ASAP Seek assistance or refer to tyre inflation section of Owners Guide
Constant Warning	Tyre LED constant Red	Tyre below upper pressure threshold	Max Speed 30 mph Inflate to specified pressure at earliest opportunity
Constant Warning	Tyre LED constant Amber	Tyre Transmitter Fault	Stop in safe place ASAP Inspect affected tyre for flat. Reinflate if necessary. If OK, continue at 30 mph maximum and have transmitter replaced at earliest opportunity.
Constant Warning	Module LED Constant Amber	Receiver Module Fault	Check all tyre for flats. If OK, continue at 30 mph maximum. Have receiver replaced at earliest opportunity

Pressure Sensing with Winter Wheels and Tyres

Tyre pressure sensing does not function when winter wheels and tyres are fitted. The indicator lamps in the pressure sensing unit will all remain illuminated. The instrument panel warning lamp will remain extinguished. Tyre pressure sensing will be reinstated when the normal wheels with pressure sensors are refitted.

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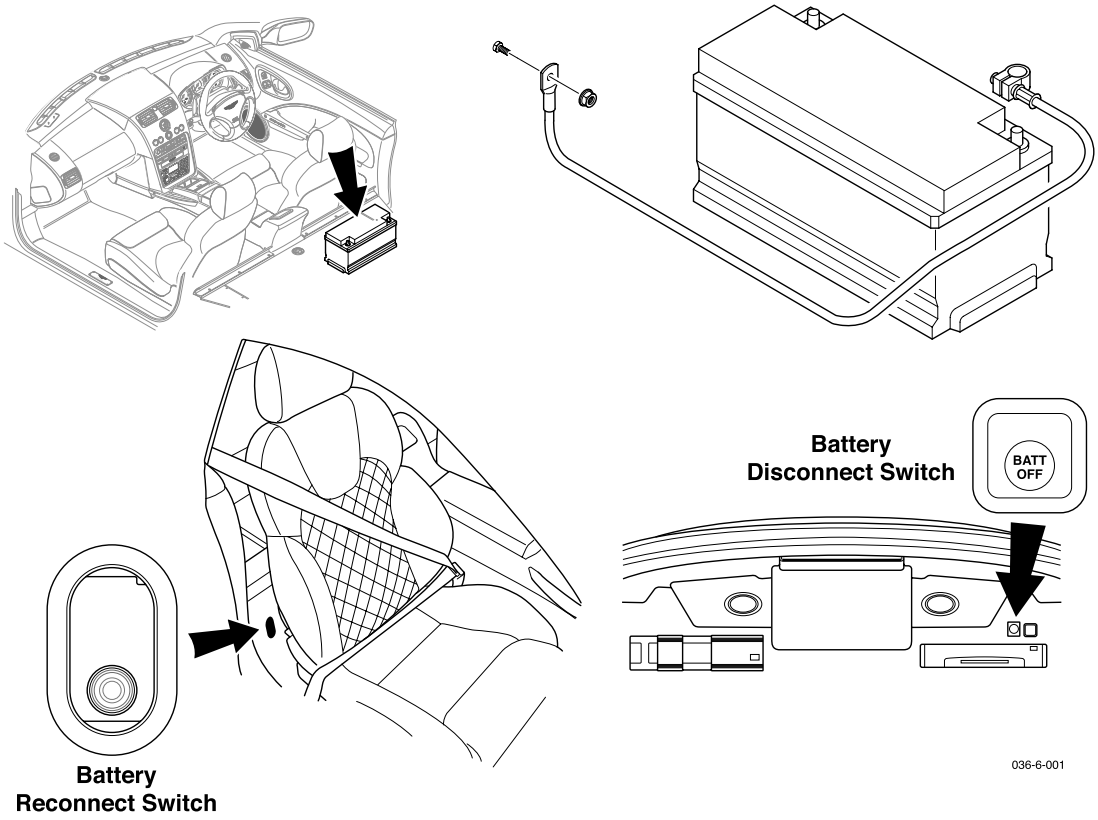
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Electrical Systems General Description

Power Supply and Distribution

The 12 volt negative earth battery is located under the rear seat. The negative battery terminal is grounded to the right side of the vehicle body.

The battery positive terminal is connected to a battery reconnect switch on the front wall of the battery box. The reconnect switch may be opened by pressing the battery disconnect switch on the front wall of the boot



Battery Reconnect Switch

When opened by pressing the battery disconnect switch, the battery reconnect switch will remove electrical power from all systems except the 'keep alive memory' functions in the PTECs, TCU, radio, navigation system and door modules. This function should be used to remove electrical power from the vehicle circuits under all normal service conditions with the following exceptions.

The battery positive lead should only require disconnection under the following circumstances:

- Before any welding or other work which may induce high voltages into the electronic control modules.
- Before disconnecting any of the control modules with 'keep alive memory'.
- Before any major service task (e.g. engine removal)
- Before fitting any accessory which involves modification of vehicle wiring.

If the battery positive terminal is disconnected, the data held in keep alive memories will be lost. After reconnecting the battery, the radio preset stationss and door window controllers will require to be reset. The adaptive learning data in the PTECs and Transmission Control Unit will require to be re-learned by driving the vehicle for some miles in a range of driving conditions. Driveability may be slightly compromised until the vehicle systems have completed their adaptive learning routines again.

Battery Disconnection and Alarm Activation

The vehicle is fitted with an alarm which will be activated if the battery is disconnected. This alarm is driven by a back up battery within the alarm sounder unit.

To prevent the alarm from sounding when the battery is disconnected for workshop procedures, disconnect the battery within 10 seconds of switching off the ignition. Always carry out the following procedures upon reconnection of the battery.

- Reset the clock
- Reset the radio preset programmes.
- Reset the window maximum up and maximum down settings.

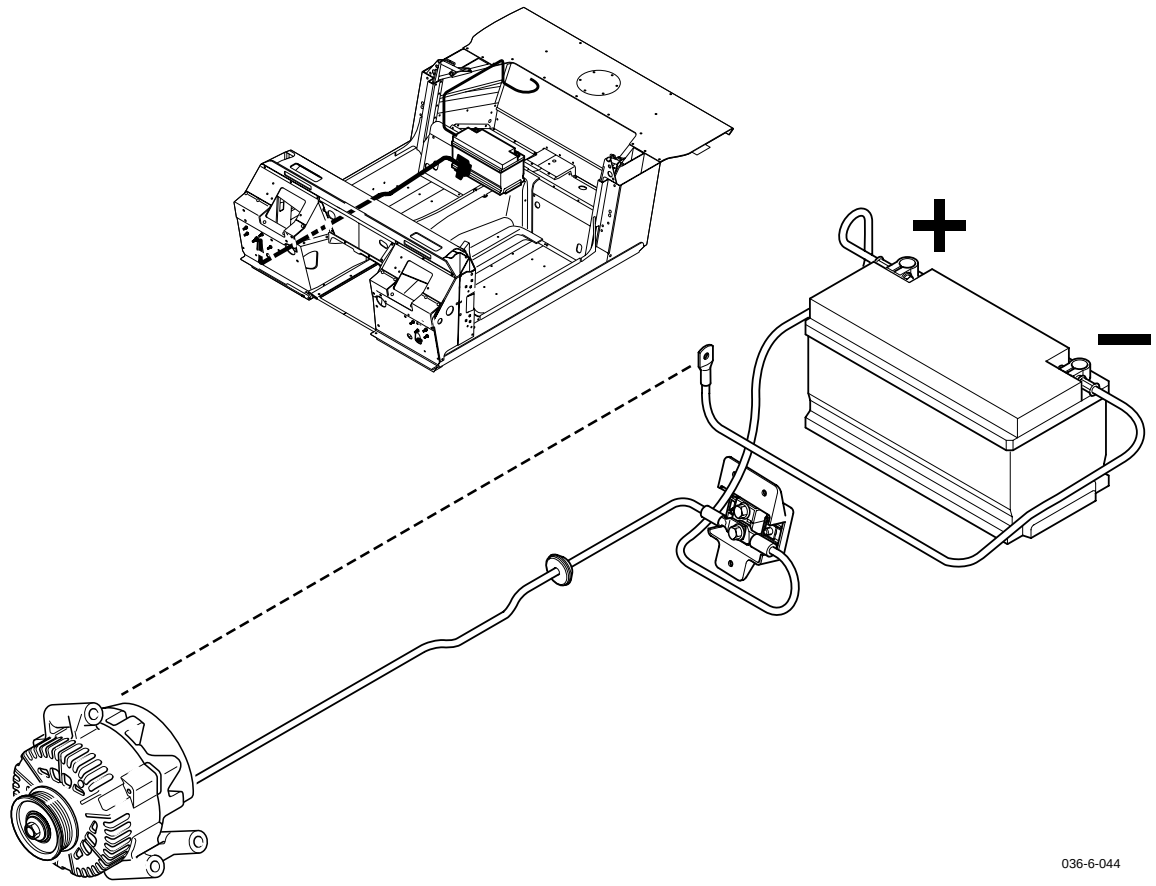
Window Reset Procedure

- Sit in the driver's seat.
- Ensure that both doors are closed and turn on the ignition key.
- Press and hold each window down button in turn until the window motor stalls in the maximum down position. Continue to hold the switch for 5 seconds then release the switch.
- Press and hold each window up button in turn until the window motors stall against the door seal in the maximum up position. Continue to hold the switch actuated for a further 5 seconds, then release the switch.

Each window should open fully when the down switch is momentarily pressed and close in one movement if the up button is held pressed.

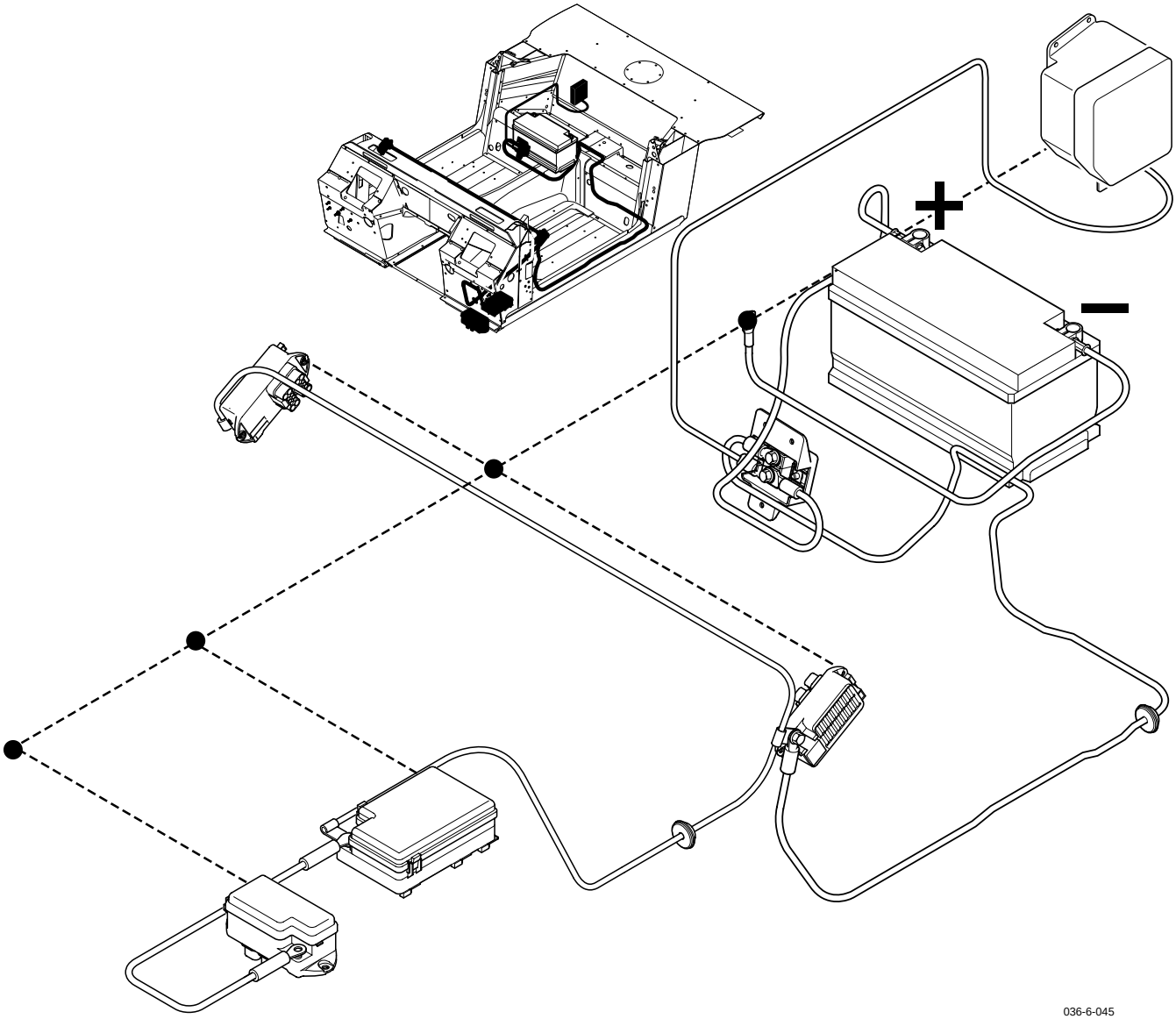
Battery Charging

The charging circuit is isolated from the normal +12V distribution circuits to minimise the effects of electrical noise on the electronic control modules. The following diagram shows the isolated +12V charging circuit.



+12 Volt Distribution

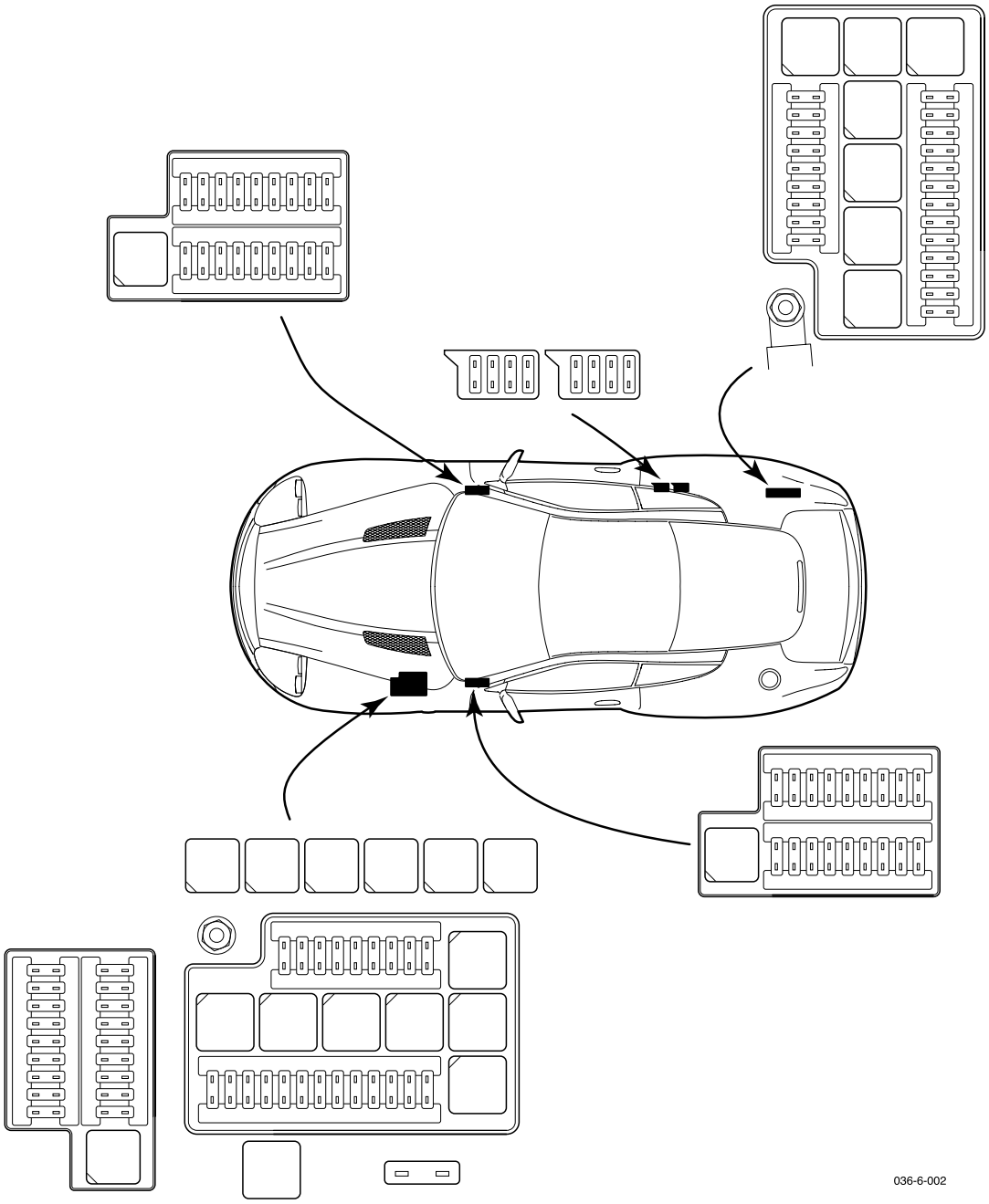
This diagram shows the +12 volt distribution circuits from the battery +ve terminal via the battery reconnect switch to the main fuseboxes of the vehicle. Note that the ground path for the battery is the same as on the charging circuit and that all fuseboxes are grounded through their mountings to the vehicle body.



Fuseboxes

From the clean 12V output terminal of the battery disconnect switch, electrical power is distributed to five main fuseboxes:

- Boot Fusebox
- Driver's Side Fusebox
- Passenger Side Fusebox
- Underbonnet Fusebox
- Engine Management Fusebox



Further supplementary fuses are mounted in the battery compartment

The principal fuseboxes also contain many of the switching relays. Further relays are mounted on brackets close to the fuseboxes and on an additional bracket in the passenger footwell.

Relay Locations - Stand-alone Relays

Under Bonnet

Wiper On/Off	Passenger side-rear	Black Change-over	On forward harness
Wiper Slow/Fast	Passenger side-rear	Black Change-over	On forward harness
Starter Relay	Passenger side-rear	Brown Normally open	On forward harness
Secondary PTEC power	Passenger side-rear	Brown Normally open	On EMS harness
Ignition Coils 'B' bank	Passenger side-rear	Brown Normally open	On EMS harness
Ignition Coils 'A' bank	Passenger side-rear	Brown Normally open	On EMS harness
Gearbox Oil Cooler	Passenger side-rear	Brown Normally open	On forward harness

In-Car Relays

Aircon Isolate	Passenger Footwell	Micro	Shares base with Door Lock
Door Lock	Passenger Footwell	Micro	Shares base with Aircon Isolate
LH Blower	Passenger Footwell	Micro	Shares base with RH Blower
RH Blower	Passenger Footwell	Micro	Shares base with LH Blower
Mirror Heater	Passenger Footwell	Micro	Shares base with Fan Run-On
Fan Run-On	Passenger Footwell	Micro	Shares base with Mirror Heater
Not in Park	Passenger Footwell	Micro	Shares base with Traction Logic
Traction Logic	Passenger Footwell	Micro	Shares base with Not in Park

Boot Relays

ASM Hydraulic Pump	Right Rear of Boot	Grey - Special 9 Pin

Relay Locations - Fusebox Mounted Relays

Under-Bonnet 22-way Fusebox

Relay 1	Aircon Water Pump
Relay 2	Front Fog Lamps
Relay 3	Main Beam Headlamps
Relay 4	Aircon Clutch
Relay 5	RH & LH Dipped Beam Headlamps
Relay 6	RH & LH Horns
Relay 7	Ignition Positive

Boot 22-way Fusebox

Relay 1	Rear Fog Lights
Relay 2	Heated Rear Window
Relay 3	Tail Lights, No. Plate Lights and Side Markers
Relay 4	Fuel Pump (Cylinders 1-6)
Relay 5	Stop Lamps and 'Brake' signal to PTECs, TCU & ABS
Relay 6	Accessory Sockets, Aux supply to telephone
Relay 7	Ignition Positive

Fuse Listings

Underbonnet Fusebox - 22 way

Number	Rating	Purpose
F1	10A	Transmission Control (Ignition Supply - see also fuse 1B - TCU battery supply)
F2	5A	Alternator Regulator
F3	5A	Security Sounder, Relays 1 & 2
F4	5A	ABS Control Unit & Relay Logic (+12V Ignition)
F5	10A	Gearbox OIl Pump Relay, Starter Relay, Cooling Fan Controller
F6	10A	RH Dipped Beam
F7	10A	Aircon Clutch
F8	10A	LH Dipped Beam
F9	10A	Security Sounder
F10	10A	Gearbox Oil Pump Relay
F11	10A	RH Horn
F12	-	Not Used
F13	10A	LH Horn
F14	30A	Wiper Motor Relays
F15	10A	Aircon Water Pump
F16	30A	ABS Control Valves
F17	15A	Front Fog Lamps
F18	30A	ABS Pump
F19	10A	RH Main Beam
F20	25A	Starter Solenoid
F21	10A	LH Main Beam
F22	-	Not Used

Underbonnet Fusebox - 4 way

Note: The supply to these fuses comes via F1 of the engine management fusebox and is switched by the PTEC B Power Relay. The PTEC B power Relay coil is suplied via F6 of the engine management fusebox when the ignition is switched on.

Number	Rating	Purpose
F1	15A	Secondary PTEC Engine Management & Catalyst Monitor Oxygen Sensor Heaters
F2	10A	Secondary EGR Vac Valve, Vapour Management Valve and Misfire Detection Module
F3	20A	Injectors, MAF, Ignition Coil Relay Primary
F4	-	Not Used

Driver's Side Fusebox - 18 way

Number	Rating	Purpose
F1	20A	Driver's Seat Module (+12V Battery)
F2	10A	Door Mirror Heaters
F3	-	Not Used
F4	-	Not Used
F5	15A	Body Processor Module (Lamp Supply 12V)
F6	5A	Centre Console Switch Pack, Rain Sensor, Glass Break Sensor§
F7	15A	Body Processor Module (Motor Supply 12V)
F8	5A	Driver's Switchpack, Driver's Seat Belt Buckle
F9	5A	Brake Pedal
F10	5A	Ign Switched - OBDII
F11	10A	Aircon Control Unit, Aircon Relay
F12	10A	Ign Switched - Aircon ECU, Interior Mirror, VAP, Mirror Heater Relay, Blower Relays
F13	-	Not Used
F14	10A	Ign Switched - Instrument Pack, Gear Display Module
F15	30A	LH Heated Front Screen
F16	5A	Ign Switched - Heated Fr Screen Relays, PATS, ASM Switchpack
F17	30A	RH Heated Front Screen
F18	5A	Instrument Pack

Passenger's Side Fusebox - 18 way

Number	Rating	Purpose
F1	20A	Passenger's Seat Module (+12V Battery)
F2	10A	Door lock Relay
F3	5A	OBDII, Clock, ASM Switch Panel
F4	5A	Key Barrel Switches, Window Switches, Mirror Joystick, Ext Door Handle Switches
F5	5A	Radio Telephone
F6	20A	RH Blower Motor
F7	20A	Accessory Sockets (Fascia and Boot)
F8	5A	Passengers Seat Switchpack, Passenger's Seat Belt Buckle
F9	-	Not Used
F10	5A	Ign Switched - Radio Telephone
F11	20A	LH Blower Motor
F12	20A	Ign Switched - Accessory Socket (Fascia)
F13	5A	PATS
F14	20A	Ign Switched - Cigar Lighter
F15	-	Not Used
F16	5A	Ign Switched - In-Car Entertainment Interface, Navigation System
F17	15A	Body Processor Module (+12V to Lighting High Power Semiconductor Switches)
F18	10A	Dimmer Module

Engine Management Fusebox - 18 way

Number	Rating	Purpose
F1	30A	Secondary PTEC VPWR
F2	-	Not Used
F3	-	Not Used
F4	-	Not Used
F5	-	Not Used
F6	5A	Secondary PTEC VPWR Relay (Closes to switch VPWR from F1 to secondary PTEC)
F7	10A	Ignition Coil Supply Secondary PTEC
F8	-	Not Used
F9	-	Not Used
F10	30A	Primary PTEC VPWR
F11	-	Not Used
F12	20A	Injectors, MAF, Ignition Coil Relay Primary, Cooling Fan Run-On Relay
F13	-	Not Used
F14	10A	Canister Vent Valve, Vapour Management Valve, Misfire Detection Module
F15	-	Not Used
F16	15A	Primary PTEC Engine Management & Catalyst Monitor Oxygen Sensor Heater Supply
F17	-	Not Used
F18	10A	Ignition Coil Supply Primary

Boot Fusebox - 22 way

Number	Rating	Purpose
F1	5A	Security and Locking Module - Reverse Lamp Feed
F2	10A	Exhaust Bypass Vac Valve Solenoid
F3	5A	Boot Fusebox Relays 1, 2 & 4 Coils - Ignition switched supply
F4	20A	Cylinders 7-12 Fuel Pump - Ignition switched supply
F5	5A	Airbag Control Module - Ignition switched supply
F6	5A	LH & RH Stop Lamps
F7	20A	Cylinders 1-6 Fuel Pump - Ignition switched supply
F8	5A	High Mounted Stop Lamp & Brake signal to PTECs, TCU & ABS
F9	-	Not Used
F10	10A	Security & Locking Module - Battery supply
F11	10A	Accessory Sockets - Fascia and boot
F12	-	Not Used
F13	-	Not Used
F14	-	Not Used
F15	10A	Rear Fog Lamps
F16	-	Not Used
F17	25A	Heated Rear Window
F18	30A	In-Car Entertainment - Power Amplifier
F19	5A	RH Tail Lamps, LH & RH Number Plate Lamps
F20	20A	Gearbox Hydraulic Pump
F21	5A	LH Tail Lamps, LH & RH Rear Side Markers
F22	10A	Exhaust Bypass Relay

Electrical Subsystems

Supplementary Restraint Systems (SRS)

The driver and passenger airbags and seat belt pretensioners (fitted to both front seats) are controlled by a single module, the occupant restraint module mounted on the rear end of the transmission tunnel

This module initiates the deployment of both airbags and simultaneously fires the seat belt pretensioners, when a frontal impact above a pre-set threshold is detected. The single point crash sensor is an integral part of the module and cannot be serviced separately.

The SRS is designed so that both airbags and both pretensioners are fired by a single signal provided by the occupant restrain module (single point sensing). The system is not designed to individually deploy any restraint device.

The system is only active when the ignition is on and for one minute after the ignition is switched off.

Security Systems

Vehicle protection is provided by the security module mounted at the right side of the boot. The system provides the following security features:

- Remote Arming/Disarming from the Key Fob.
- Perimeter Sensing via switches on the doors, boot lid and bonnet.
- Glass Breakage Detection.
- Boot Release on the Key Fob.
- Panic Alarm triggered using the Alarm Key Fob.
- 120dB Siren with battery back-up (in markets where audible sirens are permitted).
- Random Code Encryption to prevent electronic scanning or grabbing of the key fob identity code.

The system is controlled by a four button key fob. The upper left (lock symbol) button controls the normal locking of the car and arms the alarm system. The upper right (unlock symbol) button controls the unlocking of the car and disarming of the alarm. The lower left (headlamp symbol) button switches on the headlamps for 25 seconds to provide exit illumination. The lower right (boot lid symbol) button unlocks the boot even when the security system is armed. The Panic Alarm feature is operated by pressing the headlamp button three times within three seconds.

The security system aerial is located near the rear window. The normal operating range of the key fob is approximately 10 metres (30 feet).

Passive Anti-Theft Device (PATS)

The Passive Anti-Theft System (PATS) Uses radio frequency identification technology to deter a driveaway theft by engine immobilisation.

PATS uses a specially encoded ignition key. Each key contains a permanently installed transponder. Each transponder contains a unique electronic identification code.

Each encoded ignition key must be programmed into the vehicle's powertrain control module before it can be used to start the engine.

During each vehicle start sequence, the transceiver module reads the code from the ignition key and sends the data to the PATS module. The PATS module in turn communicates with the PCM. If the key has an incorrect code, is unprogrammed, or is in some way damaged, fuel injection will be inhibited, thereby immobilising the engine.

The PATS status lamp on the centre console beneath the clock provides system status information when the ignition is OFF, ON or when the engine is RUNNING.

Central Locking System

The central locking system consists of motor operated lock actuators in both doors, the boot and the fuel flap mechanism. The central locking control module is located on the right end of the boot.

Each motor driven lock actuator incorporates a microswitch which will signal a change of state when any motor runs to drive the actuator. The microswitches are of the changeover type and provide an earth for the lock or unlock signals to the control unit.

The two door lock inputs to the control unit are connected together so that operation of either door lock with the ignition key will simultaneously operate the other door lock. Similarly, the unlock inputs to the control unit are also connected together for sumultaneous operation.

The boot will remain locked or will be unlocked simultaneously with the doors dependant on the boot lock position. With the boot key turned clockwise, the boot lock operates in unison with the doors. With the boot key turned anticlockwise, the boot lock cannot be unlocked using the central locking system.

The boot can be opened at any time using the ignition key irrespective of the central locking status.

Electric Windows

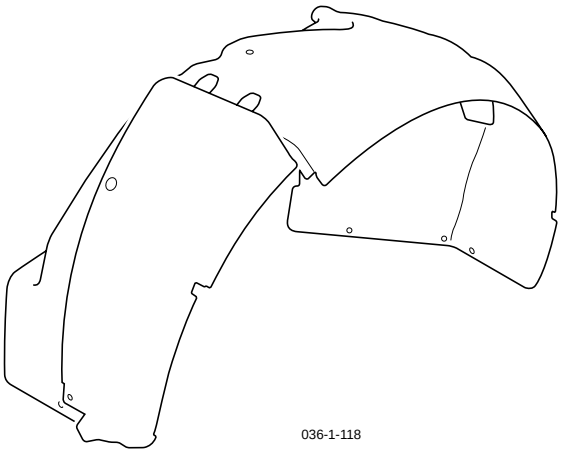
Power to the window wind circuits is available when the ignition switch is on and is supplied through a thermal cut-out to the left and right window switches. The switches are double pole earth so that the current through a window motor may be switched in either direction to raise or lower the window.

V12 Vanquish uses frameless door windows which seal against rubber strips around the body shell door opening. To avoid damaging these seals during door opening, the door glass must be lowered before the door can be opened. This function is controlled by the window control units. The units are mounted on the inside of each door frame and will sense if a door handle is pulled to open the door. Before releasing the door lock, the control unit will drive the window wind motor briefly to lower the door window glass down until it clears the window seals. Similarly, after closing a door, the window motor will be run to raise the door glass to seat the glass against the body seals.

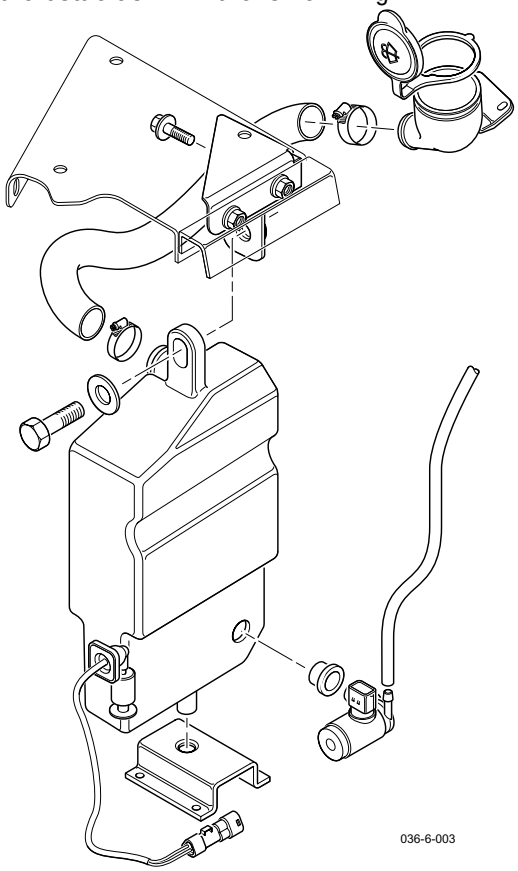
6.1.01.1 Headlamp Unit

Removal

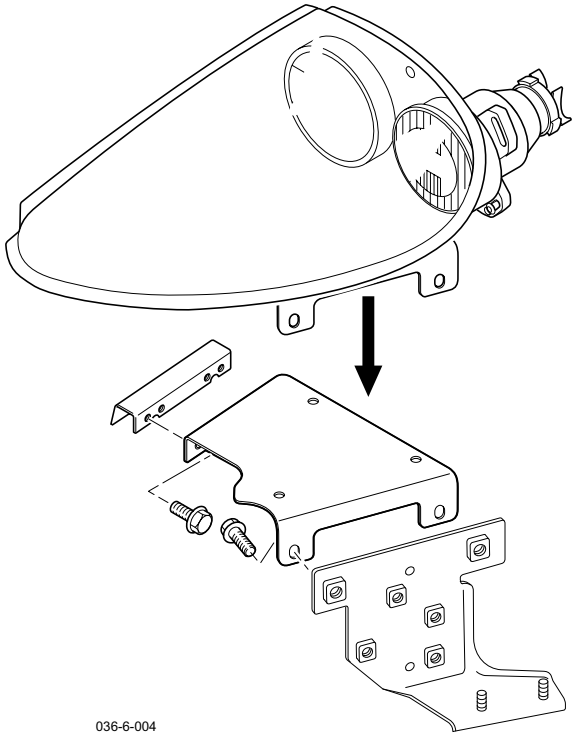
1. Remove the relevant front wheel.
2. Remove the wheel arch liner.



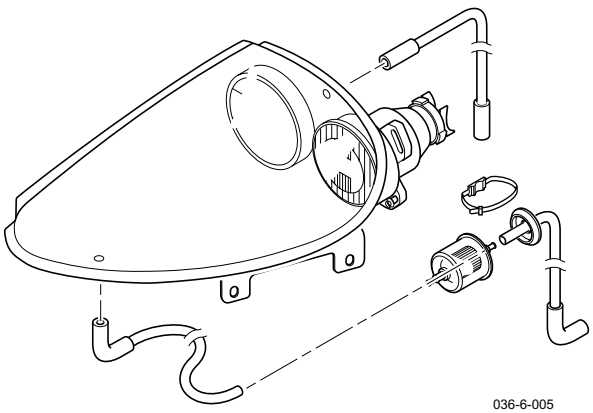
3. Release the washer bottle pipe from the washer filler neck.
4. Remove the washer bottle steady bracket and lay the bottle down in the lower wing.



5. Disconnect the headlamp assembly connectors.
6. Remove two bolts securing the headlamp bracket.



7. Remove the headlamp assembly from under the wing.
8. Disconnect the headlamp ventilation tubes.



9. On refitting the headlamp assembly, carry out the headlamp alignment procedure.

6.1.02.1Headlamp Alignment

Data

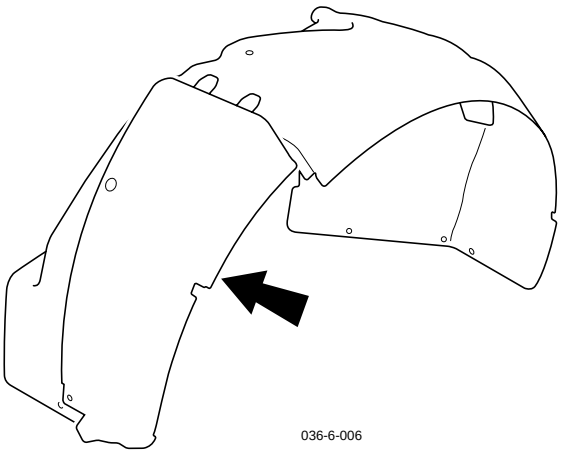
Alignment Specification
Main Beam Alignment1.5° Down
Dipped Beam Alignment1.5° Down

Procedure

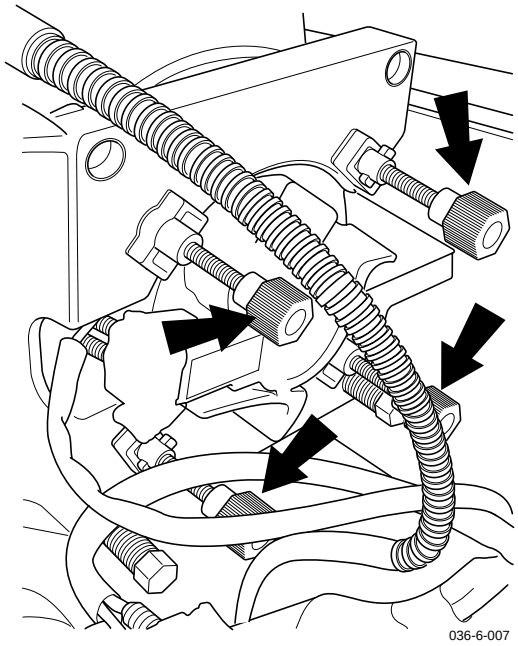
1. Headlamp alignment should be carried out with the vehicle at design weight:

   - Vehicle at kerb weight, plus
   - All fluids at normal full level, plus
   - A 75 kg weight in each front seat.

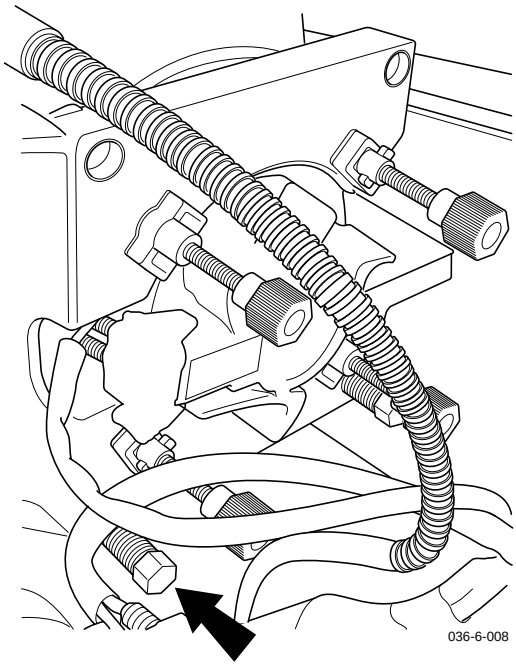
2. Remove the headlamp access panels from the wheel arch liners to acces the rear of the headlamp units.



3. Using the large hex adjusters, align the outer dipped beams to the correct pattern in the alignment gauge.



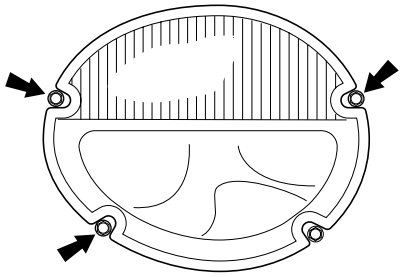
4. Using the small hex adjuster, set the inner main beam alignments so that the bright spot is centralised and 1.5° down in the alignment gauge. If necessary, fine tune the adjustment to suit average vehicle loading and driver requirements.

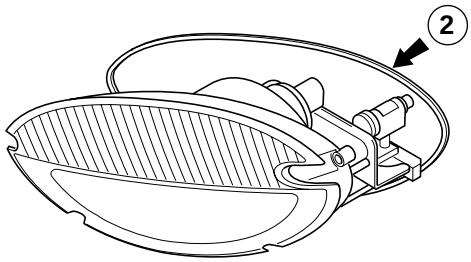


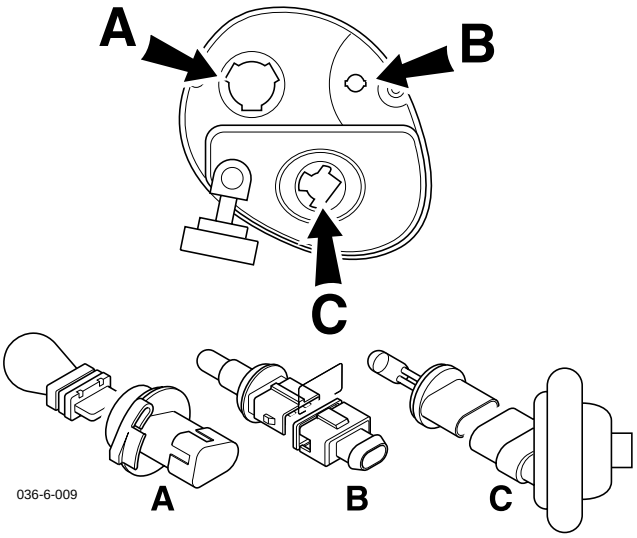
6.1.03.3 Front Indicator/Park/Fog Lamp Unit

Removal

1. Remove three screws and displace the lamp unit.



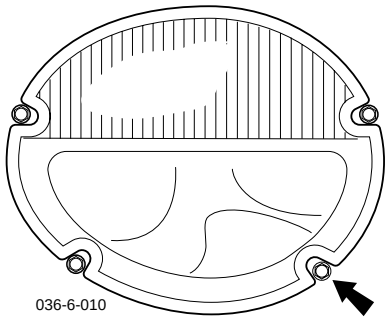




2. Discard the 'O' ring.
3. Disconnect three electrical connectors at the rear of the assembly and remove the lamp unit from the front apron.
4. Renew bulbs if necessary as shown below

Adjustment

1. Using a Torx socket driver on the adjusting screw indicated below, rotate the screw to adjust the fog lamp.

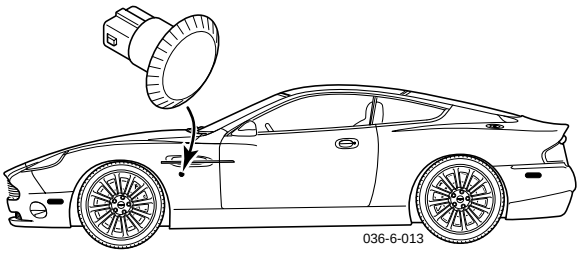


2. Rotate the screw clockwise to raise the foglamp, or anti-clockwise to lower the lamp.

6.1.05.2 Side Repeater Lamps

Removal

1. Protect the surrounding paintwork and use a screwdriver to lever the assembly from the front wing.

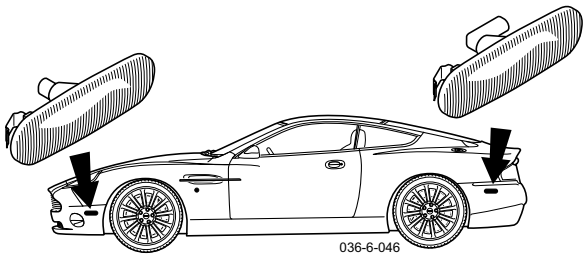


2. Disconnect the electrical connector at the rear of the lamp and remove the assembly

6.1.06.1 Sidemarker lamps - Federal and GCC Markets Only

Removal

1. Remove two screws and displace the lamp unit.

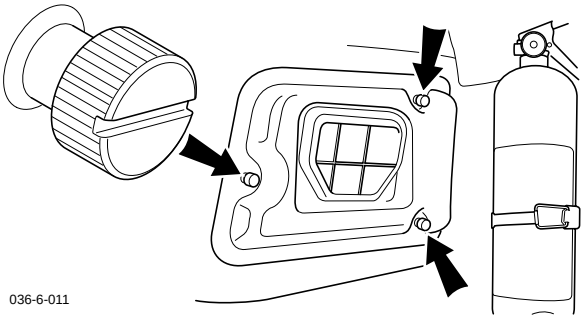


2. Disconnect the electrical connector at the rear of the lamp and remove the assembly.

6.1.10.1-4 Rear Lamp Bulbs Renew

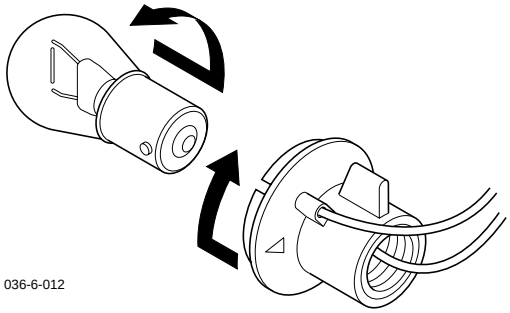
Removal

1. Remove the rear lamp cluster cover.



Bulb Renewal

1. Rotate the light holder a quarter turn anticlockwise and remove it.



2. Rotate the bulb anticlockwise in the holder and remove the bulb.

3. Fit a new bulb and turn it clockwise to lock it.

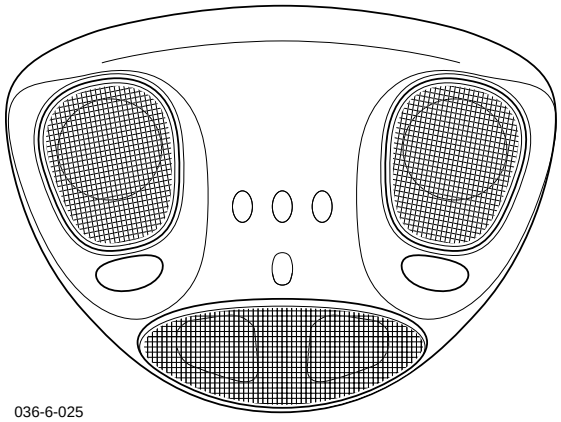
   NOTE: All cars except North America - The stop/rear light bulb has two filaments and offset bayonet pins. Ensure correct orientation when fitting.

4. Refit the bulb holder to the light cluster and refit the rear lamp access panel.

6.1.12.1 Front Interior Lamps

Removal

1. Release four screws and lower the header rail trim panel from above the windscreen.
2. Disconnect the interior lamp assembly connectors.
3. To renew an interior light festoon bulb, pull the defective bulb from its clips and insert a new one.
4. To renew the assembly, remove three screws and detach the lamp assembly from the header rail trim panel.
5. Refit the light assembly to the header rail trim panel with three screws.
6. Refit the trim panel to the header rail

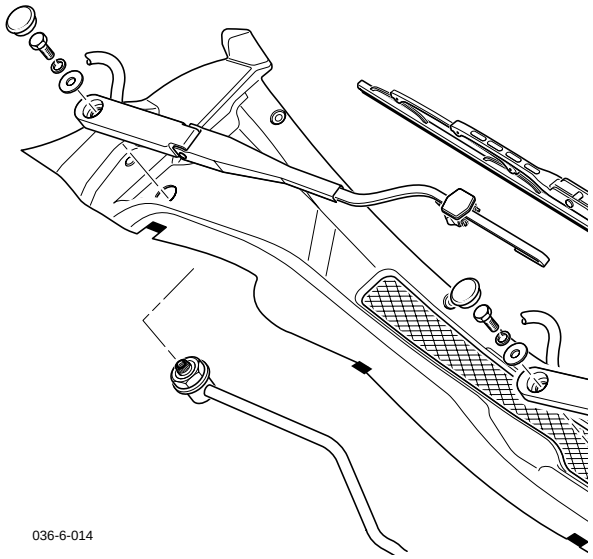


036-6-025

6.3.02.1 Windscreen Wiper Motor

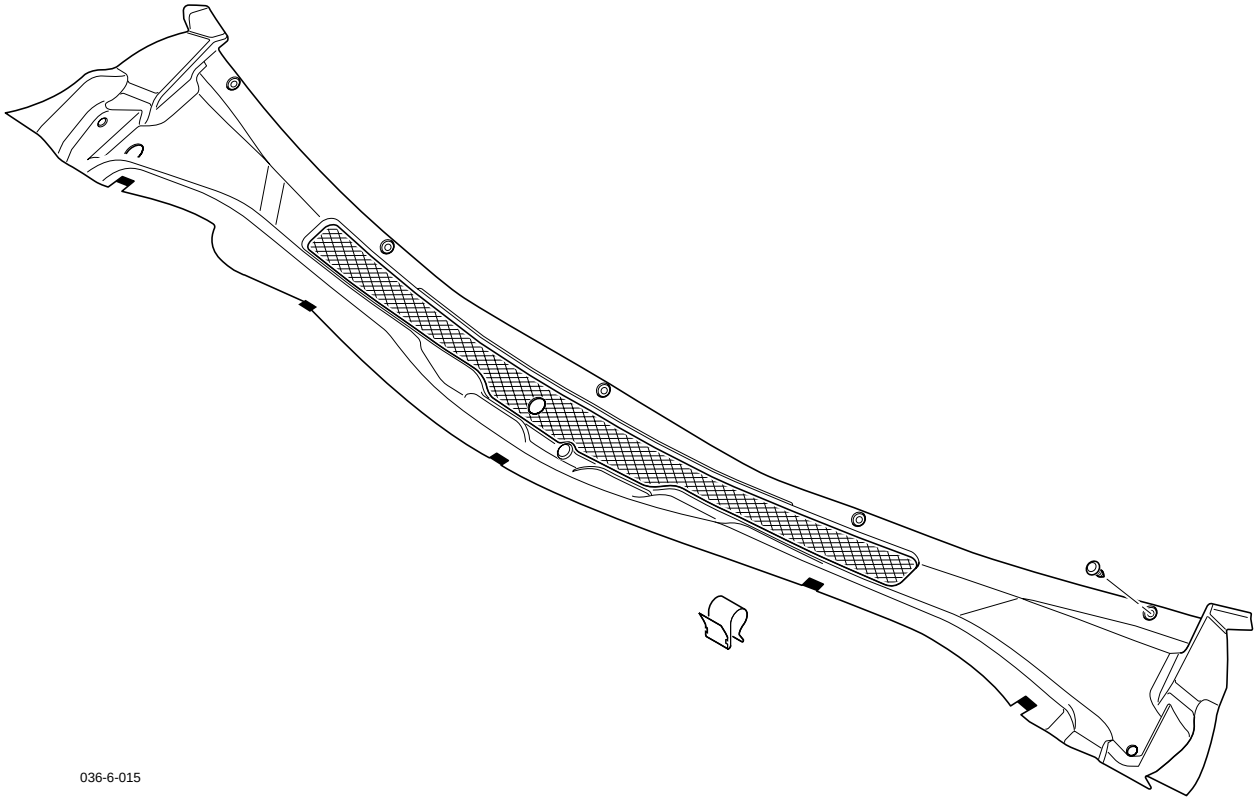
Removal

1. Switch off the battery disconnect switch.
2. Remove the wiper arms
   - Remove the cap and bolt from each wiper arm
   - Remove the arms from the spindles
   - Disconnect the arms from the washer tubes



036-6-014

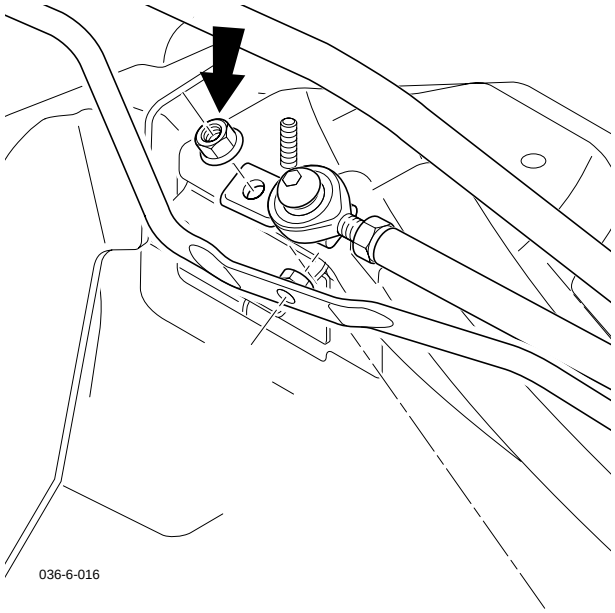
3. Remove the plenum top
   - Remove five screws and five clips
   - Lift up the plenum top



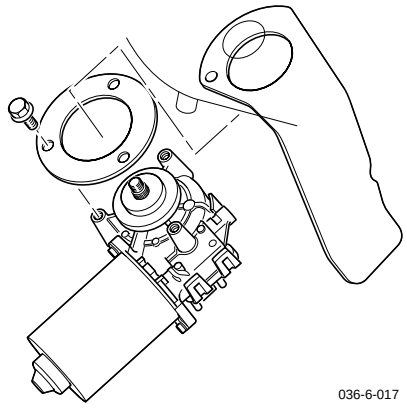
036-6-015

4. Release the wiper mechanism from the wiper motor

   - Remove one Durlock nut
   - Release the wiper actuator arm from the motor shaft.



5. Remove three bolts and separate the wiper motor from the mounting bracket.



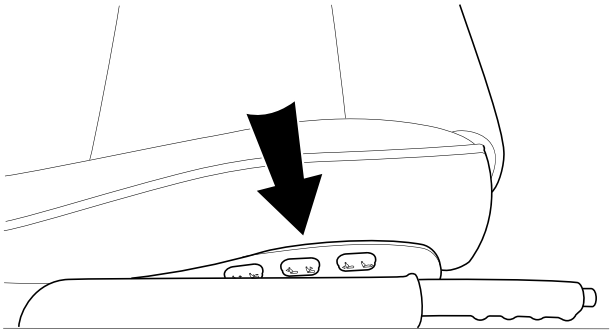
6. Disconnect the wiper motor multi-plug and remove the motor.

6.5.08.1 Seat Control Switch Panels

Removal

1. Drive the seat forward to access the switch panel.
2. Carefully lever the switch panel away from the seat, taking care not to damage the seat material.
3. Caution: Make sure that the finisher panel is protected before levering out the switch.

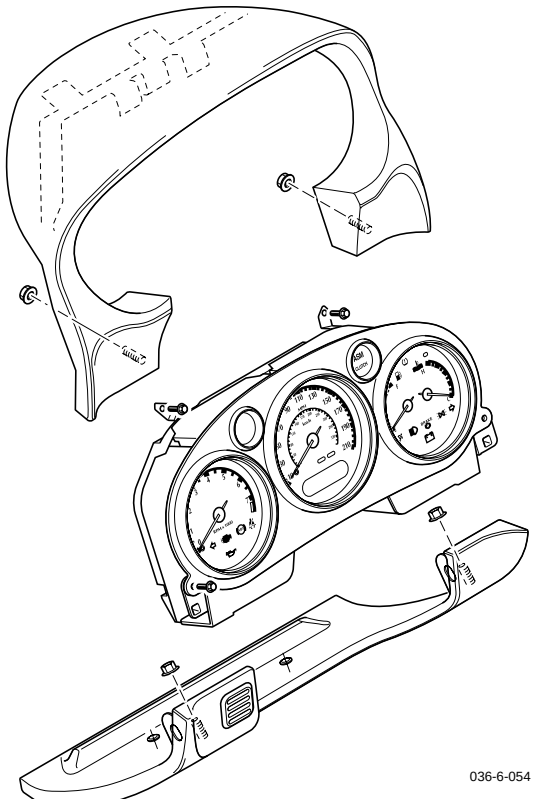
   Using a suitable lever, raise each end of the switch to release the spring clips.
4. Pull the switch clear of the finisher and disconnect the electrical connector.



6.6.01.1 Instrument Panel

Removal

1. Switch off the battery disconnect switch.
2. Remove the facia underpanel.
   - Remove the steering column lower cowl
   - Remove the two upper screws on the facia underpanel.
   - Loosen the four lower screws and allow the underpanel to drop downwards.
3. Remove two nuts on the instrument panel cowl. Unclip the instrument panel cowl from the facia.



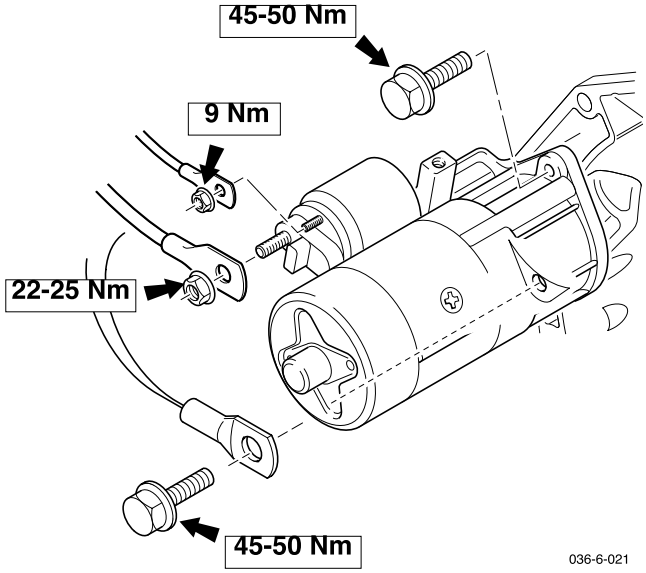
4. Remove four bolts and displace the instrument panel.
5. Detach three electrical connectors and remove the instrument panel.
6. Panel warning lamps are 1.2W bayonet fit. The larger panel illumination lamps are also 1.2W bayonet fit.

6.7.04.1 Starter Motor

Removal

.

1. Disconnect the starter motor solenoid connector and the starter motor power lead.

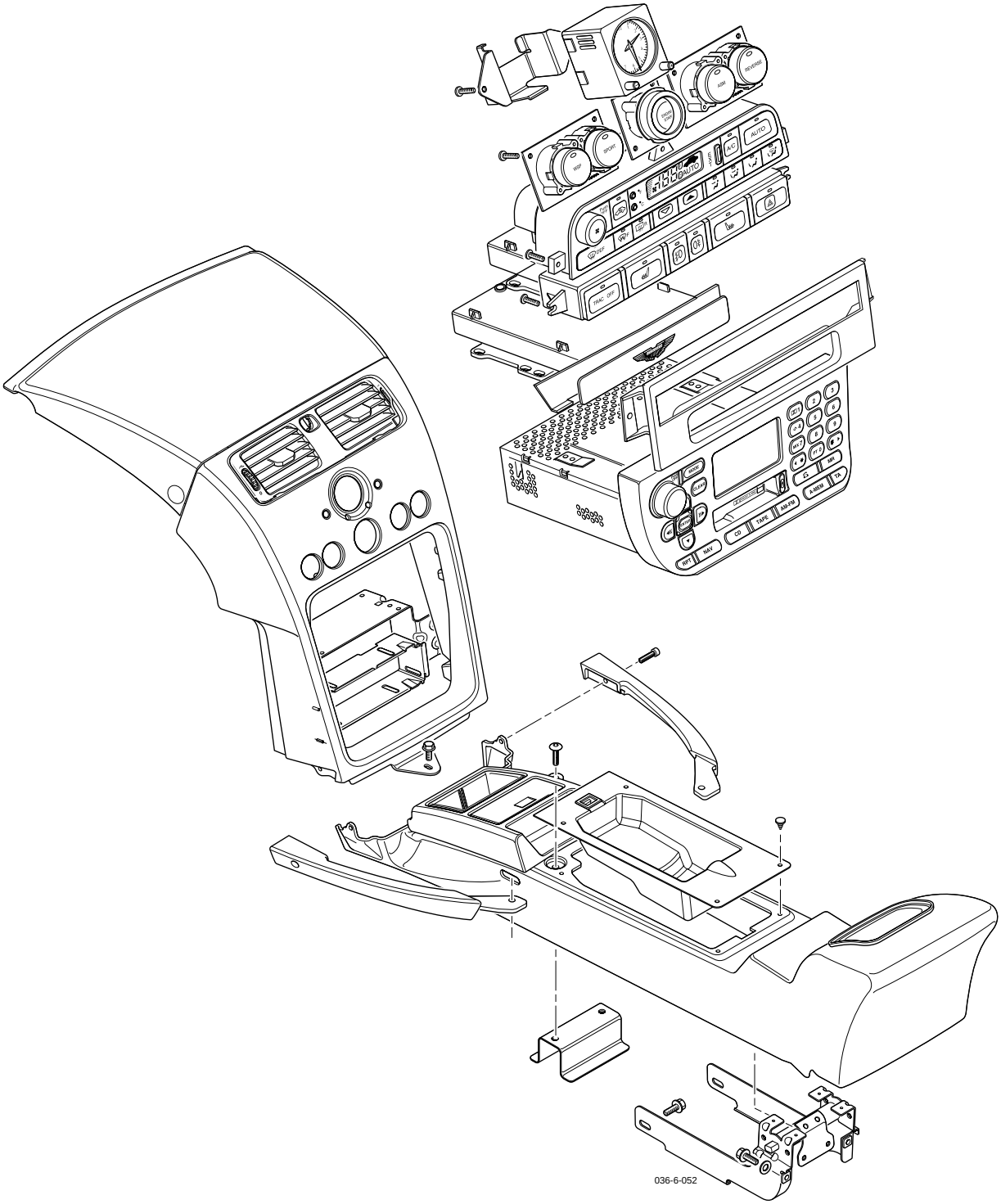


2. Remove two bolts and remove the starter motor.

6.6.01.3 Centre Console Controls/Switches

Removal

1. Remove the centre console.
   - Remove four screws and the stowage box insert.
   - Remove four screws and remove the two grab handles.
   - Remove two centre securing screws.
   - Remove two rear securing screws
   - Remove the centre console

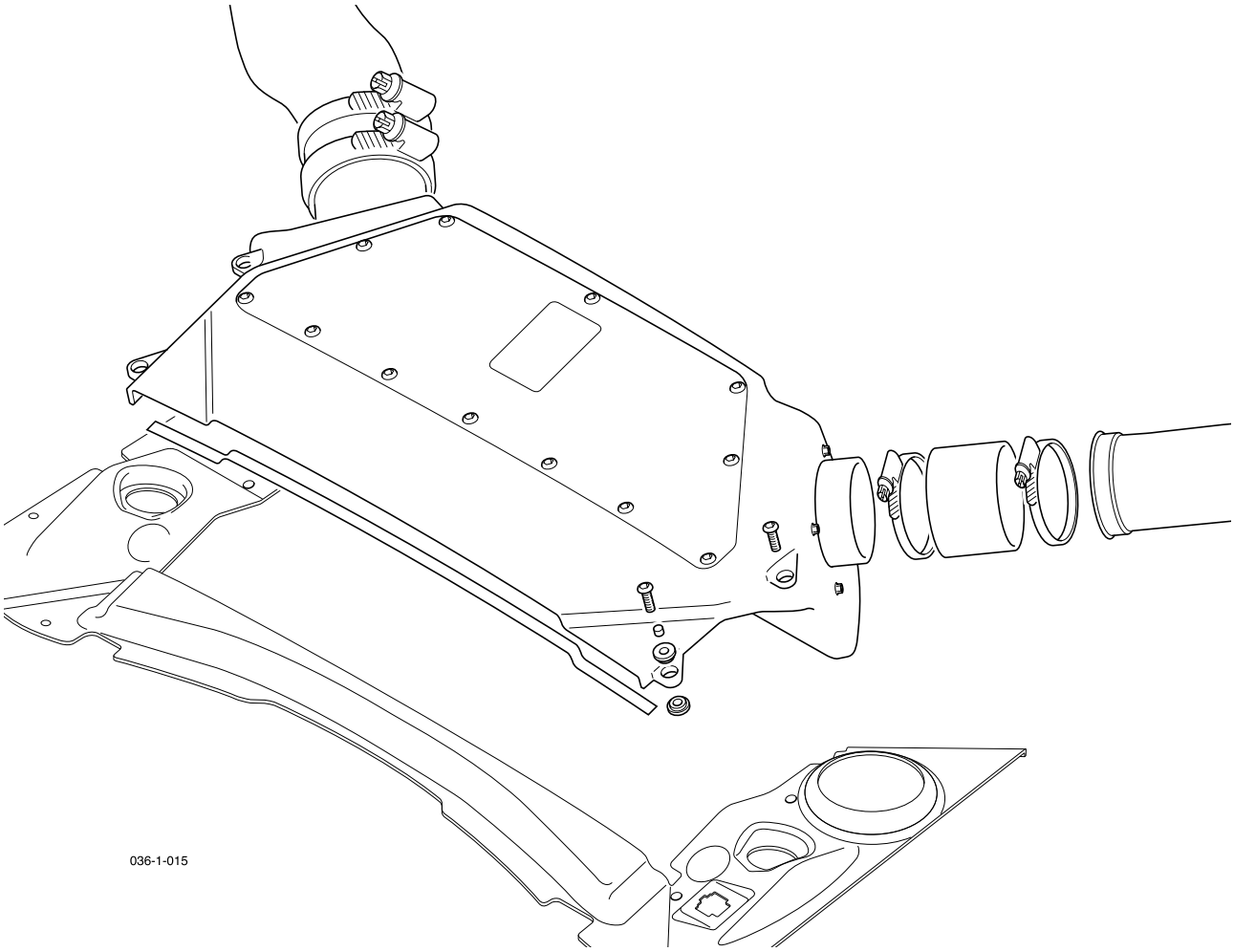


2. Remove one bolt from the control panel lower edge.
3. Unclip the console from the facia.
4. Disconnect all electrical connectors from the console.
5. Remove the console.

6.7.05.1 Alternator

Removal

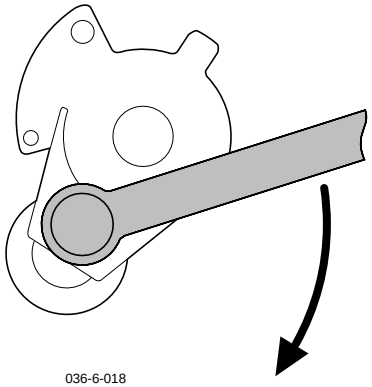
1. Switch off the battery disconnect switch.



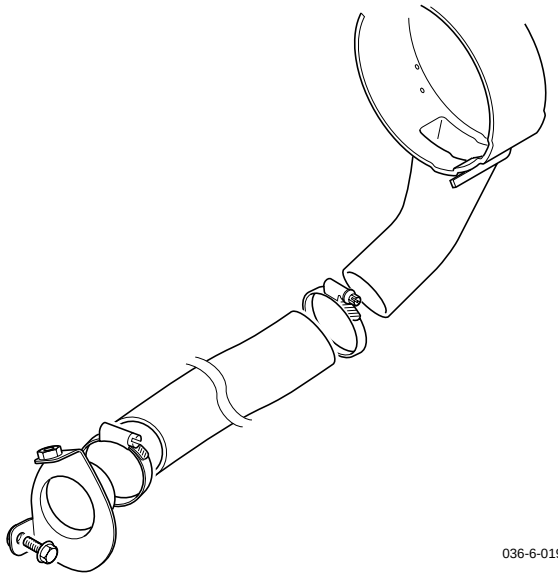
2. Remove the airbox

3. Remove the polyvee drive belt from the alternator drive pulley

   - Using a 1/2 inch ratchet handle 'T' bar, rotate the drive belt tensioner clockwise and slip the belt from behind the tensioner pulley.
   - Slip the belt off the alternator drive pulley



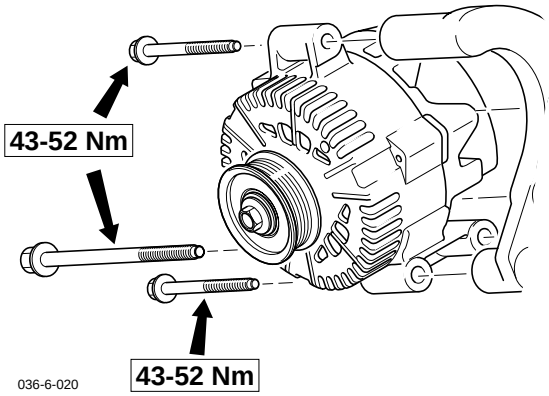
4. Disconnect the alternator cooling hose.



5. Remove the alternator output lead cover, remove the nut and washers and disconnect the alternator output lead.

6. Disconnect the electrical plug on the rear of the alternator.

7. Remove two M10 x 100 bolts and washers and one M10 x 150 bolt and washer from the alternator bracket. Remove the alternator and cooling shield.



Installation

To install, reverse the removal procedure. Refit the polyvee drive belt as follows:

1. Fit the drive belt around all pulleys except the alternator pulley.

2. Rotate the tensioner assembly clockwise. Fit the belt to the alternator pulley and release the tensioner.

3. Check all pulleys to ensure correct belt location.

Component Location

Find the component in the Component Location Index and note the references to physical location and circuit location.

Physical location references (e.g. 5-17) relate to the Component Location Diagrams and give the diagram number and item number for each component. (Figure 5, Item 17 in this example)

Note: Fuse, relay and harness location illustrations and lists, are provided in the preceding pages. Where appropriate, references are made to these page numbers in the Component Location Index.

Circuit location references (e.g. 11-B6) relate to Circuit Diagrams and give the sheet number (11 in this example) and alpha/numeric coordinates (B6 in this example) to find the component on the appropriate circuit diagram.

A complete set of circuit diagrams for the vehicle is inserted at the back of this section.

Circuit Diagrams

Current flow on all circuits is from top to bottom. Most component circuits are completely covered on one diagram. Occasionally, circuits will interconnect between circuit sheets. Note the cross reference information at splices or module interconnections to trace circuit continuations.

Key to Wire Colours

B = Black	P = Purple	G = Green
K = Pink	S = Slate	LG = Light Green
N = Brown	W = White	O = Orange
R = Red	U = Blue	Y = Yellow

Wire Splices

Many wire runs are spliced within the loom wrapping and additional information is required to aid in fault analysis. All splices are noted on the circuit diagrams (e.g. EMS8 = Engine Management Harness - Splice 8). A note beside any splice lists circuits connections to other circuit sheets.

If you wish to investigate a component which is not on the current circuit, locate the component name in the index and follow the circuit or physical location entries to find the component and its wiring.

Component Location Index and Diagrams

The following pages contain the Component Location Index, component location diagrams and electrical circuit diagrams.

Component	Circuit Locations	Physical Location Fig/Item
A		
ABS Control Module	03,08,25	4-2
Accessory Socket-Boot/Facia and Console	07	9-9
Air Conditioning-4-way Pressure Switch	17	
Air Conditioning-Air Bypass Servo Motor	17	
Air Conditioning-Air Intake Servo Motor RH/LH	17	
Air Conditioning-Ambient Temp Sensor	17	
Air Conditioning-Compressor Clutch	17	
Air Conditioning-Control Module	07,17,19,25	3-14
Air Conditioning-Control Panel	04,06,17,18	9-6
Air Conditioning-Defrost Servo Motor	17	
Air Conditioning-Evaporator Sensor	17	
Air Conditioning-Foot Vent Servo Motor	17	
Air Conditioning-In-Car Aspirated Temp Sensor	17	
Air Conditioning-Output Air Temp Sensor	17	
Air Conditioning-Panel Illumination	06	
Air Conditioning-Pressure Sensor	21	
Air Conditioning-Solar Sensor	17	
Air Conditioning-Vent Servo Motor	17	
Air Conditioning-Water Pump	17	7-3
Airbag Crash Sensor RH/LH	19	
Airbag Ignitor Drivers/Passengers	19	3-17
Airbag Module	18,19,25	5-2
Alarm LED	03,13	
Alternator Regulator	14	
Alternator	18	7-7
Ambient Air Temp Sensor	17	
ASM Switch Panel Illumination	06	
ASM Switch Panel	03,06,07,11,14,22,23,25	
Aspirator Motor	17	
Audible Warning Speaker	05,18	

Component	Circuit Locations	Physical Location Fig/Item
B		
Barometric Pressure Sensor	22	5-14
Battery Condition Unit	12,16	5-1
Battery Off Switch	14	
Battery	14	7-1
Blower Motor RH/LH	17	
Battery Disconnect Switch	03,07,14,21	
Body Processor Module	02,03,04,05,06,07,10,12,13,14,18,19,23,25	3-7
Bonnet Switch	03,13	5-6
Boot Ajar Switch	05,12	3-19
Boot and Fuel Flap Release Switches	06,12	
Boot lamp Diode 4	05	
Boot Lamps	051-16	
Boot Release Solenoid	12	3-20
Brake Fluid Low Switch	21	4-4
Brake Switch	03,07	4-1
Bypass Valve	22	
C		
Canister Vent Valve	21	
Catalyst Monitor Sensor and Heater 1-6	21	
Catalyst Monitor Sensor and Heater 7-12	22	
Center Console Switch Pack Illumination	06	
Cigar Lighter Illumination	06	
Cigar Lighter	07	9-8
Clutch Position Sensor	23	8-11
Column Switchgear	02,03,04,06,11,13,18	
Compact Disc Auto Changer	15	6-2
Console Switch Pack	02,03,05,06,07,08,12,13,18	
Coolant Level Sensor	18	
Coolant Temp Sensor	21	8-8/10/12
Crank Position Sensor 1-6	21	8-7
Crank Position Sensor 7-12	22	8-6
Crank Switch	07,14,23	
Cylinder Identification Sensor 1-6	21	8-2
Cylinder Identification Sensor 7-12	22	8-3

Component	Circuit Locations	Physical Location Fig/Item
D		
Diagnostic Socket "A" & "B	07,19,25	
Dimmer Module	02,03,04,06,07,15,18	3-8
Diode 1	13	
Diode 2	14	
Diode 3	22	
Diode 4	05	
Diode 5	17	
Diode 6	13,23	
Diode 7	07,14	
Dip Beam Lamps	02	
Direction Indicator Lamps	02,03	1-3
Door Ajar Switches	05,12,13	4-5
Door Lock Switches	12	
Door Mirror Heaters	17	
Drivers Door Key Barrel Switch	13	
Drivers Door Lock Actuator Motors	12	
Drivers Door Lock Switches	12	
Drivers Door Mirror Heaters	17	
Drivers Door Mirror Motors	11	
Drivers Door Module	05,11,12,13,25,26	3-16
Drivers Door Superlocking Actuator	12	
Drivers Door Switchpack Illumination	06	
Drivers External Door Handle Switch	12	
Drivers Seat Belt Buckle Switch	09	3-4
Drivers Seat Module	07,09,14,25	
Drivers Seat Motors	09	
Drivers Seat Switchpack	09	
Drivers Window Lift Motor	26	7-11
Drivers Window Lift Movement Sensor	26	
Drivers Window Lift Switches	26	5-4
E		
Engine Block Heater		7-5
Engine Cooling Fans Control Module	14,21	3-12
Engine Cooling Fans	21	
Engine PTEC A	03,07,13,14,17,21,22,23,25	
Engine PTEC B	03,14,17,19,21,22,23,25	
External Boot Open Switch	12	

Component	Circuit Locations	Physical Location Fig/Item
F		
Fusebox Boot	03,07,08,12,14,15,16,17,21,22,23,25	
Fusebox Drivers side	03,04,05,06,07,09,11,12,13,14,17,18,19,23	
Fusebox Engine Management	07,14,21,22	
Fusebox Passengers Side	03,06,07,09,11,12,13,14,15,17,26	
Fog Lamps Front	02	1-3
Fog Lamps Rear	03	
Foot Brake Switch	03,07	
Footwell Lamps	05	1-11
Front Screen Heater RH/LH	17	
Front Screen Wiper Stalk	04	
Fuel Filler Flap Release Switch	12	
Fuel Filler Flap Solenoid	12	2-2
Fuel Injectors 1-6	21	8-9
Fuel Injectors 7-12	22	8-9
Fuel Pump A 1-6	21	2-4
Fuel Pump B 7-12	22	2-4
Fuel Pump Control Module 1-6	21	5-3
Fuel Pump Control Module 7-12	22	5-3
Fuel Rail Pressure Sensor 1-6	21	8-5
Fuel Rail Pressure Sensor 7-12	22	8-5
Fuel Rail Temp Sensor 1-6	21	
Fuel Rail Temp Sensor 7-12	22	
Fuel Tank Level Sensor	18	2-5
Fuel Tank Pressure Sensor	21	2-2
Fuse Engine Cooling Fans	21	
Fusebox Rear Seat	12,13,14,15,1621,22,23,25,26	
Fusebox Underbonnet	02,04,07,08,13,14,17,21,22,23	
G		
Gear Display Module	05,06,18,19,23,25	
Gear Position Sensor	23	
Gear Selection lever	23	
Gear Selection Position Sensor	23	
Gearbox Cooling Pump	22	8-1
Gearbox ECU	03,07,13,21,25	
Gearbox Hydraulic Pump	23	
Gearbox Input Speed Sensor	23	
Gearbox Oil Temp Sensor	23	
Gearbox Output Speed Sensor	23	8-13
Gearbox Pressure Sensor	23	
Gearbox Pump Relay	23	

Component	Circuit Locations	Physical Location Fig/Item
Gearbox Solenoid Valves	23	
Glass Break Sensor	05	
Glovebox Lamp and Switch	05	1--6
H		
Handbrake Switch	13	
Hazard Switch	02,03	
Header Console	02,03,05,06,13	
HEGO Sensor 1-6	21	2-3
HEGO Sensor 7-12	22	2-3
High Mounted Stop Lamp	03	1-4
Horns	13	5-8
I		
ICE CD Player	15,16	
ICE Head Unit	06,15,18,20	
ICE Power Amplifier	15,16	
ICE Speakers	15,16	
Ignition AUX Switch	07,14	
Ignition Coils 1-6	21	
Ignition Coils 7-12	22	
Ignition Position Switch	03,04,07,14	
Immobiliser status LED	13,23	
Inertia Switch	07,14,21	
Instrument Pack	04,06,14,15,17,18,19,23,25	3-15
Interior Electrochromatic Mirror	11	
Interior Rear lamps	05	1-15
Interior Roof Lamp Assembly	05	1-5
K		
Key Barrel Switch	07,12,13,14,26	
Key Lock Solenoid	12	
Key Transponder Module	02,03,05,06,07,13,14,19,25	3-3
L		
Lighting and Dimmer Override Switches	06	
Lighting Stalk	02	
Low Brake Fluid Sensor	21	

Component	Circuit Locations	Physical Location Fig/Item
M		
Main Beam Lamps	02	1-1
Mass Air Flow Module 1-6	21	7-2
Mass Air Flow Module 7-12	22	7-2
Mirror Electrochromatic Rear View	02,03,04,11	
Mirror Electrochromatic RH/LH	11	
Mirror Joystick	11	
Mirror Park Motors RH/LH	11	
Missfire Detection Module 1-6	21	5-10
Missfire Detection Module 7-12	22	5-10
N		
Navigation Unit	03,11,15,16	6-10
O		
Oil Pressure Switch	18	
P		
Passenger Door Ajar Switch	05,12,13	
Passenger Door lock Actuator Motor	12	
Passenger Door lock Switches	12	
Passenger Door Mirror Heaters	17	
Passenger Door Mirror Motors	11	
Passenger Door Module	05,11,12,13,25,26	3-16
Passenger Door Switchpack Illumination	06	
Passenger Door Switchpack	12	
Passenger External Door Handle Switch	12	
Passenger Footwell Lamp	05	
Passenger Seat Heaters	09	
Passenger Seat Motors	09	
Passenger Seat Switchpack	09	
Passenger Superlocking Actuator	12	
Passenger Window lift Motor	26	
Passenger Window lift Switches	26	5-4
Passenger Window Movement Sensor	26	
PATS Module	13,14,25	3-5
PATS Transponder Unit	13	5-12
Power Steering Control Module	04,18	3-9
Power Steering Switch	21	
Primary Crash Sensor RH/LH	19	
PTEC "A”	03,07,13,14,17,21,22,23,25	3-10
PTEC "B	"03,14,17,21,22,23,25	3-10

Component	Circuit Locations	Physical Location Fig/Item
R		
Radiator Cooling Fans	21	
Radiator Fan Control Module	21	
Radio Cassette Head Unit	06,15,16,18,20	6-5
Rain Sensor Module	04,07,11	3--2
Rear Screen Heater	17	
Regulator	14	
Relay-#1 Wiper Motor Run /Stop	04	
Relay-#2 Wiper Motor Fast/Slow	04	
Relay-#3 Starter	14	
Relay-#4 PTEC "B" Power	22	
Relay-#5 Ignition Coils 7-1	22	
Relay-#6 Ignition Coils 1-6	21	
Relay-#7 Gearbox Oil Pump	14,22	
Relay-Aircon Isolate	16,17	
Relay-Blower Motors RH/LH	17	
Relay-BT#1 Rear Fog Lamps	03,07	
Relay-BT#2 Heated Rear Window	07,17	
Relay-BT#3 Tail/No Plate Lamps	03	
Relay-BT#4 Fuel Pump 1-6	07,22,21	
Relay-BT#5 Stop Lamps	03,07,08	
Relay-BT#6 Accessory Socket	07	
Relay-BT#7 Ignition Positive	03,07,21,22	
Relay-Door Locking	12	
Relay-Door Mirror Heaters	17	
Relay-DS#1 Ignition Positive	07	
Relay-EM#1 PTEC "A" Power	07,21	
Relay-H/Brake Switch	13	
Relay-Heated Front Screen RH/LH	05,14,17	
Relay-Ignition Control Of Passengers Seat	09	
Relay-PS#1 AUX Positive	07,15,16	
Relay-Radiator Fan Run On	05,21	
Relay-Traction Status	08	
Relay-UB#1 Water Pump	07,17	
Relay-UB#2 Front Fog Lamps	02,07,08	
Relay-UB#3 Main Beam	02,07	
Relay-UB#4 Aircon Compressor Clutch	17	
Relay-UB#5 Dip Beam	02	
Relay-UB#6 Horns	13	
Relay-UB#7 IGN Positive	07,08,14,21,23	
Reverse Lamps	03,11	1-14
Road Speed Sensor	21	

Component	Circuit Locations	Physical Location Fig/Item
S		
Screen Heater Front	17	
Screen Heater Relay Front	17	
Screenwash Level Sensor	04	
Screenwash Pump	04	
Seat Belt Pretensioners	19	
Seat Heater Switch RH/LH	10	
Seat Heaters	10	
Seat Module RH/LH (Heated Seat Option)	10	5-5
Security Locking Module	03,05,11,12,25	5-17
Security Sounder Active/Passive	07,08,13,25	5-9
Side Lamps	02	1-2
Side Marker Lamps Front	02	1-10
Side Marker Lamps Rear	03	1-8
Side Repeater Lamps	02	1-9
Solar Sensor	17	
Speakers	15,16	6-1/4/6/7
Sport Switch and Indicator	22	
Starter Motor Relay	14	
Starter Motor	14	7-9
Stop Lamps	03	1-14
T		
Tail Lamps	03	1-14
Telephone Aerial	20	6-9
Telephone Microphone	20	
Telephone Portable	20	
Telephone PSE	20	6-8
Throttle Actuator 1-6	21	8-4
Throttle Actuator 7-12	22	
Throttle Position Sensor 1-6	21	
Throttle Position Sensor 7-12	22	
Traction Control Switch and LED	08	
Transmission Control Unit	03,07,21	3-6
Transmission Output Speed Sensor	23	
Transmission Pressure Sensor	23	
Trip Keyboard Illumination	06	
Trip Keyboard Switches	18	
Tyre Pressure Monitor	03,07,14,18	5-16

Component	Circuit Locations	Physical Location Fig/Item
V		
VAP Solenoid Resistor	04	
VAP Solenoid	04	
Vapor Management Valve 1-6	21	2-6
Vapor Management Valve 7-12	22	2-7
Vehicle Speed Sensor	21	8-14
W		
Wash Fluid Level Sensor	04	3-13
Wash Motor	04	
Water Pump	17	
Water Valve	17	7-4
Wheel Speed Sensors	08	
Wiper Motor Relay	04	
Wiper Motor	04	7-8
Wiper Stalk Switch	04,07	

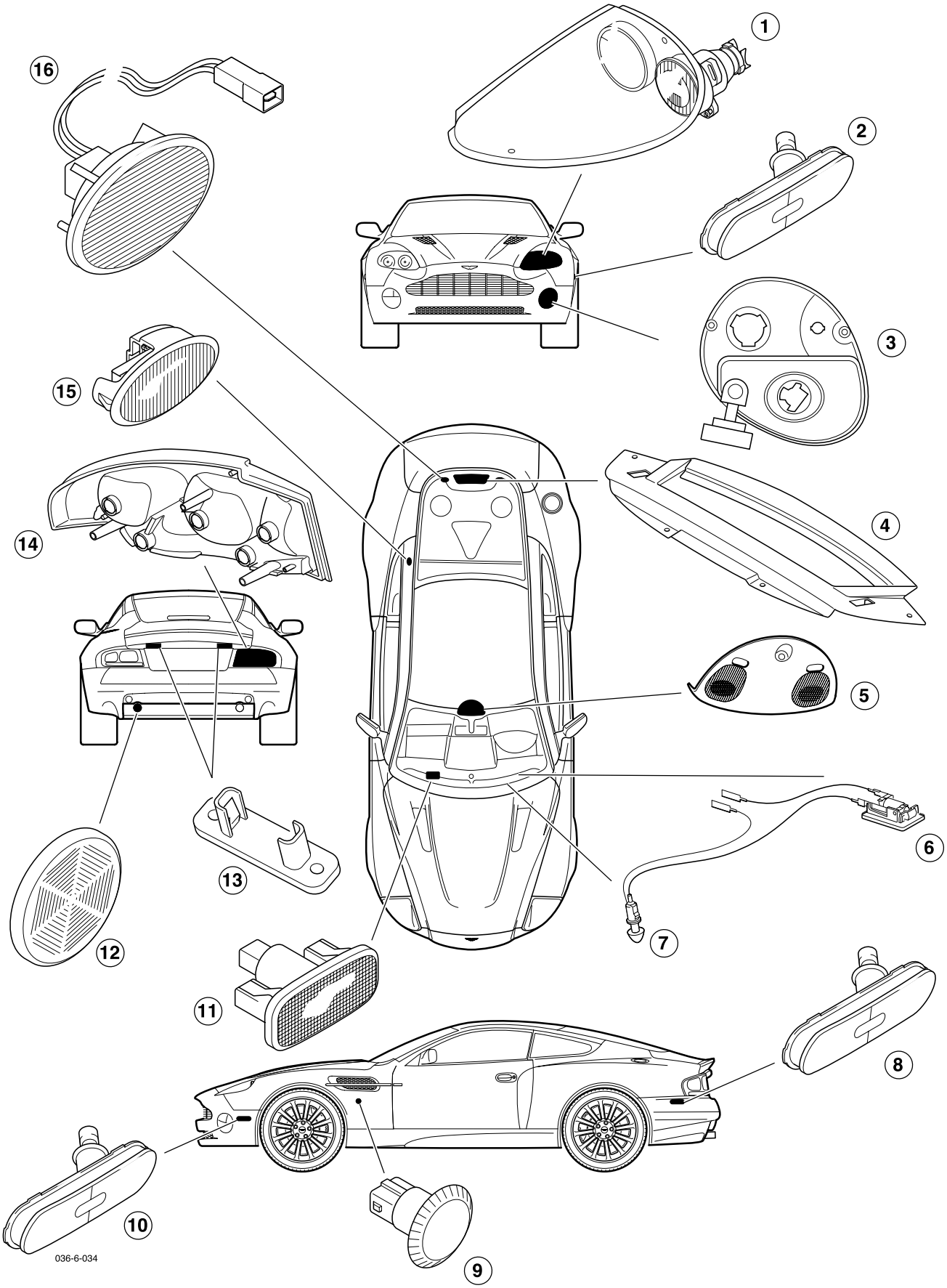


Figure 1

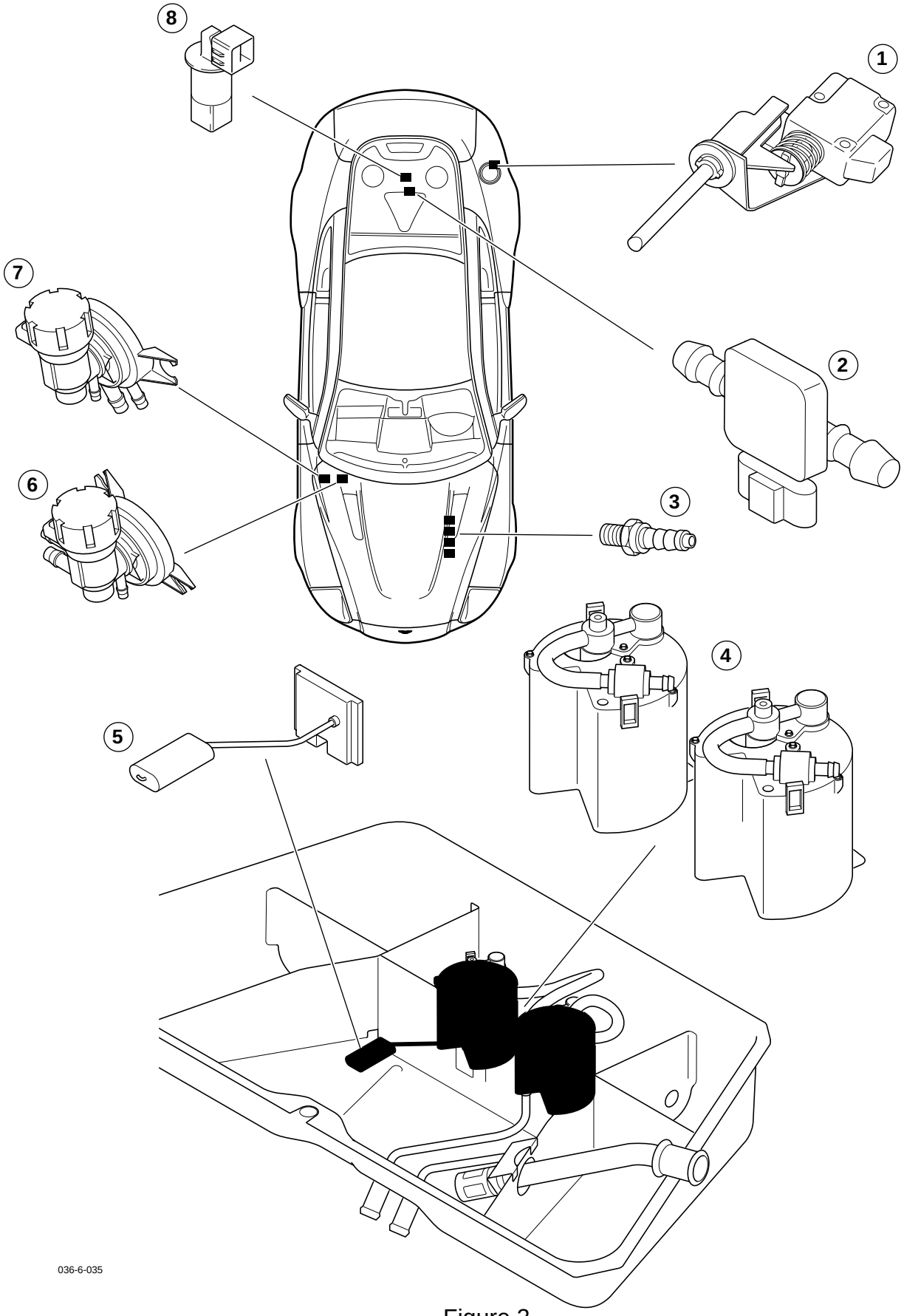


Figure 2

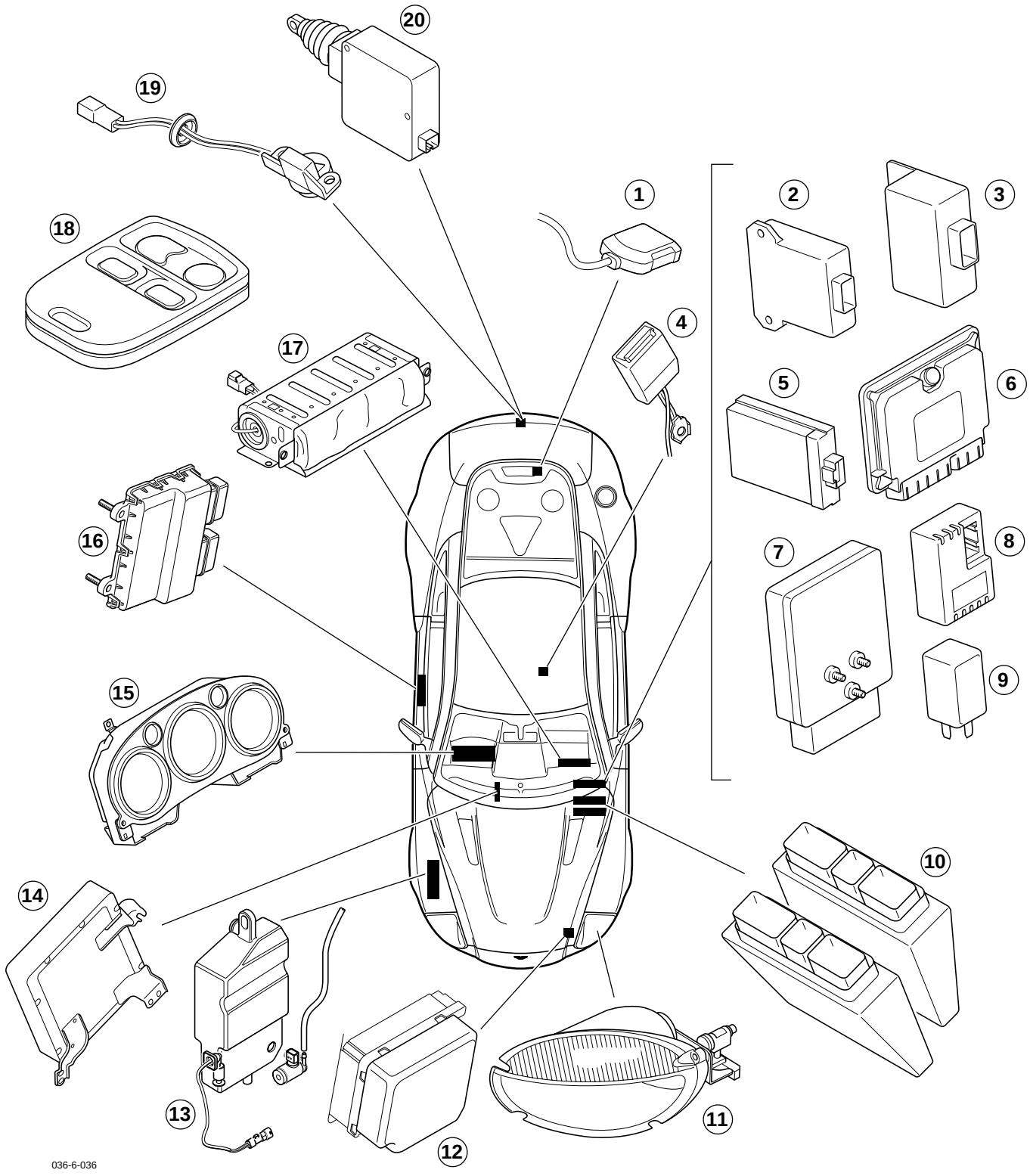


Figure 3

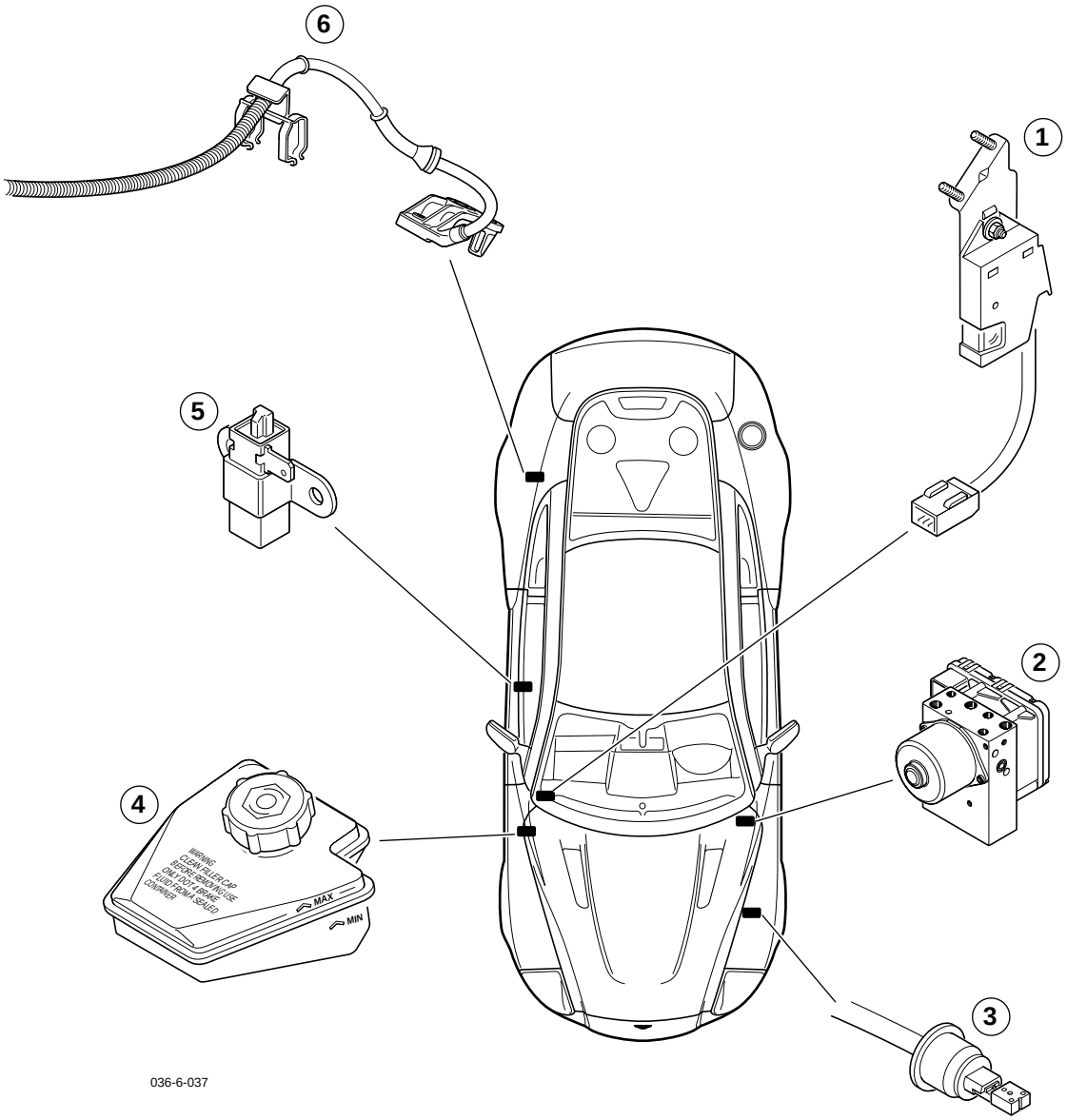


Figure 4

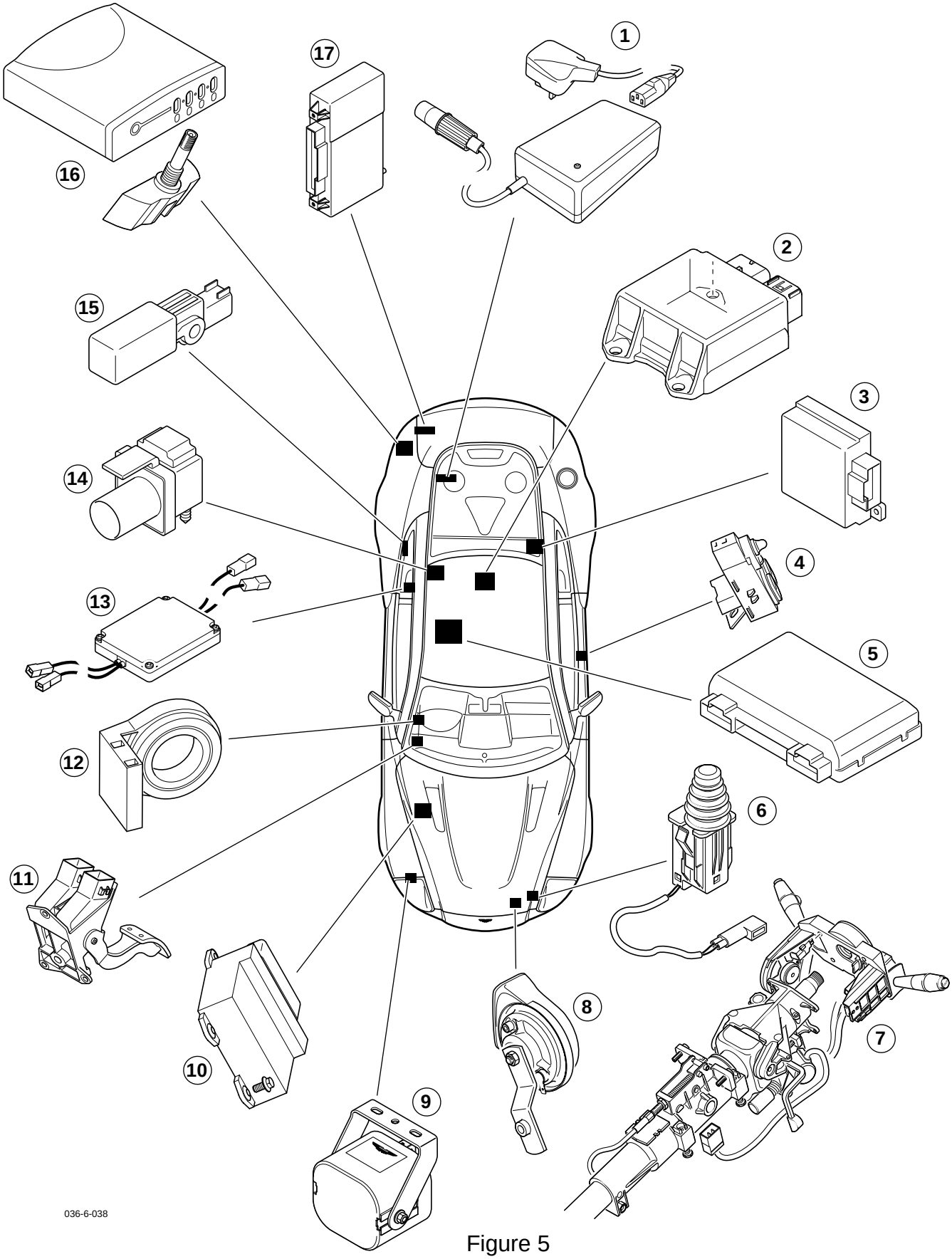
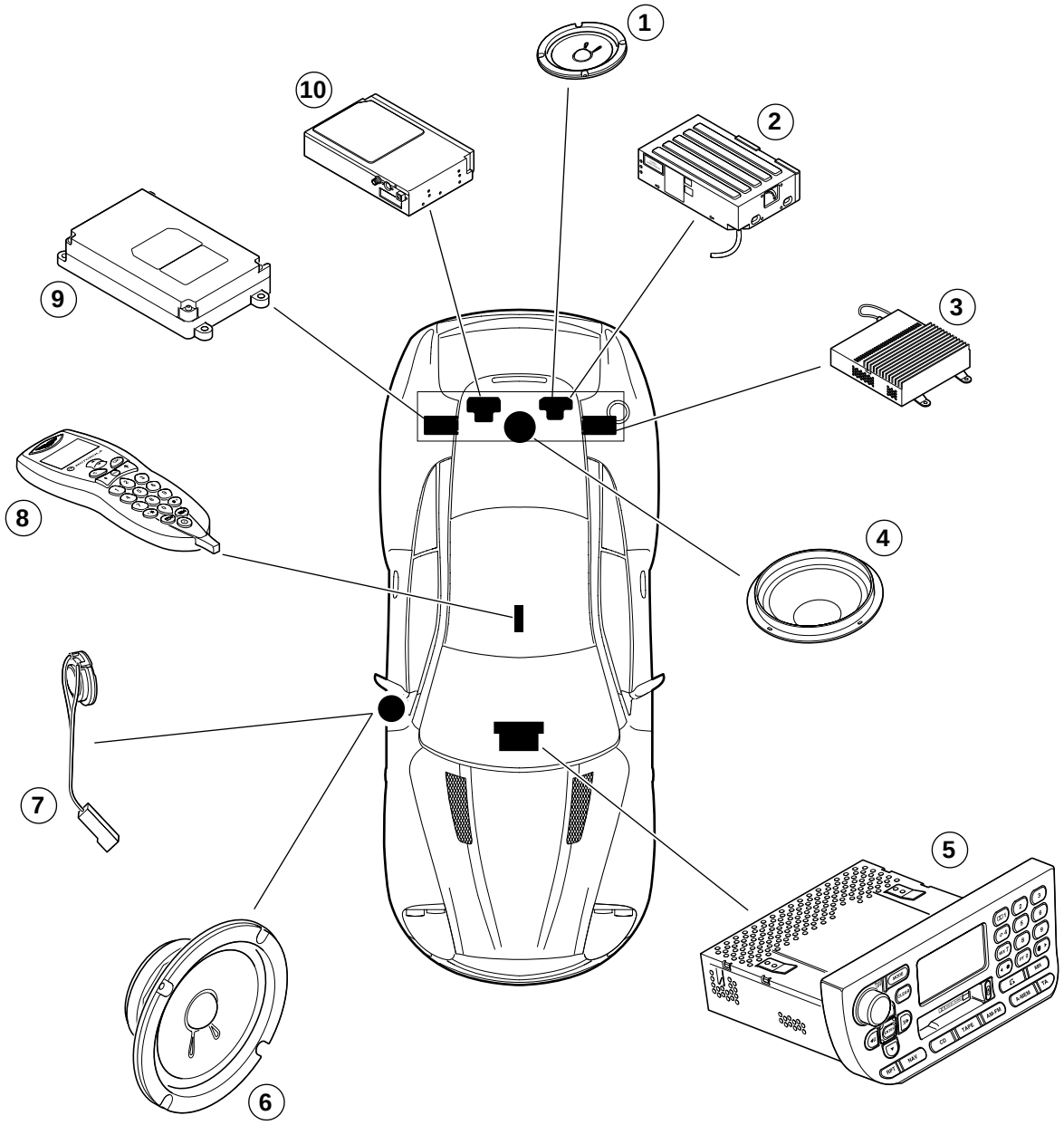


Figure 5



036-6-039

Figure 6

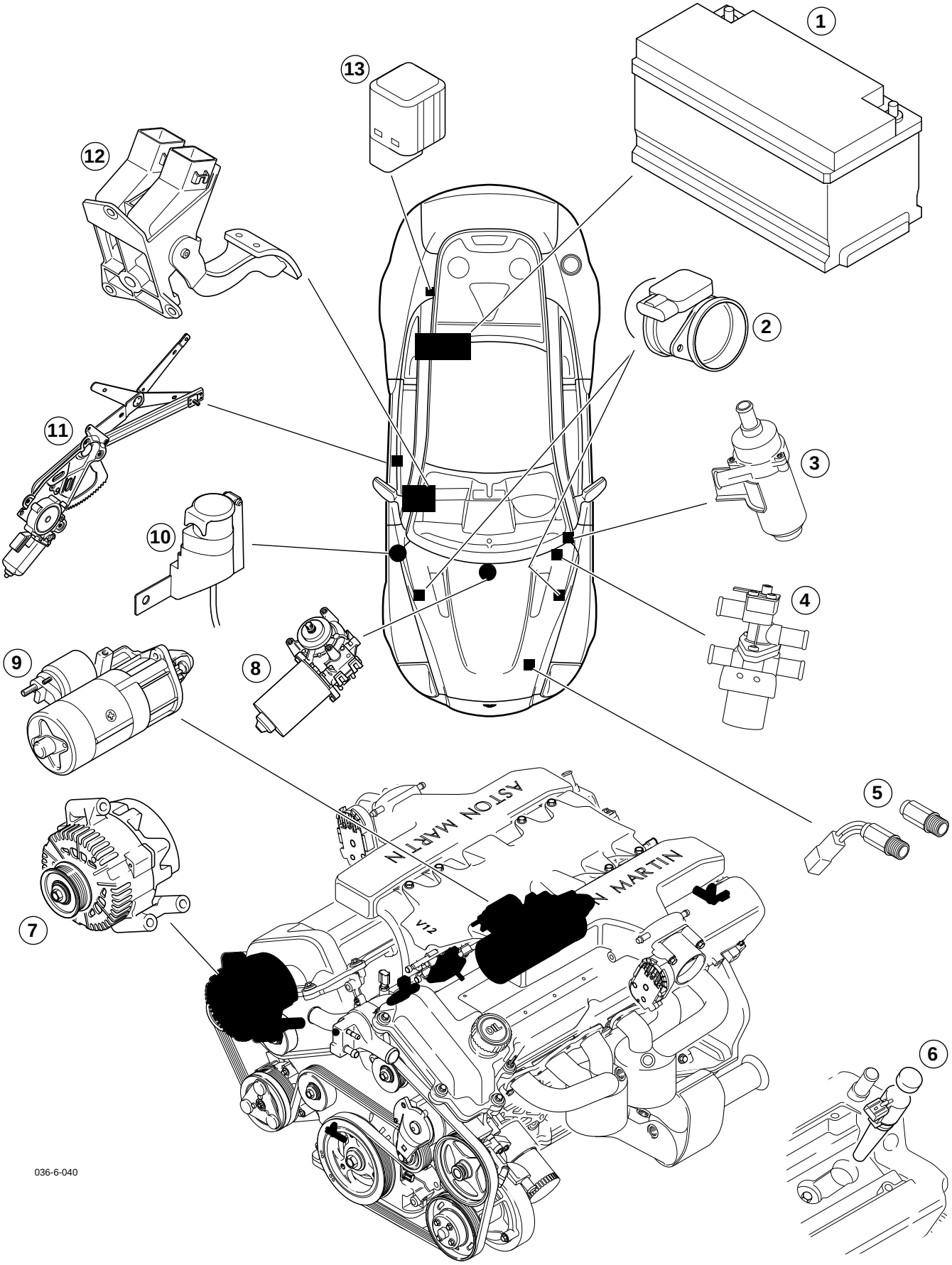


Figure 7

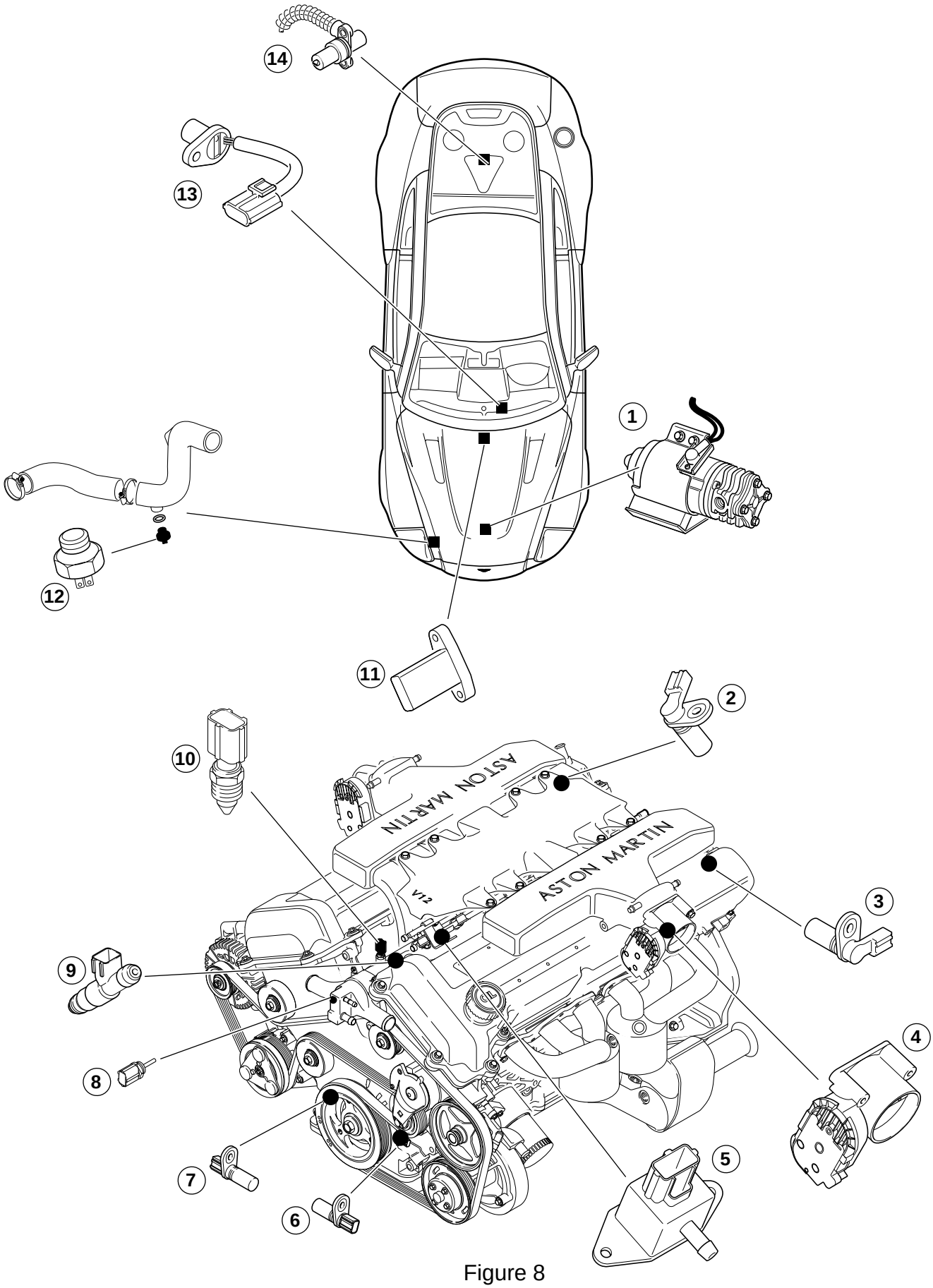


Figure 8

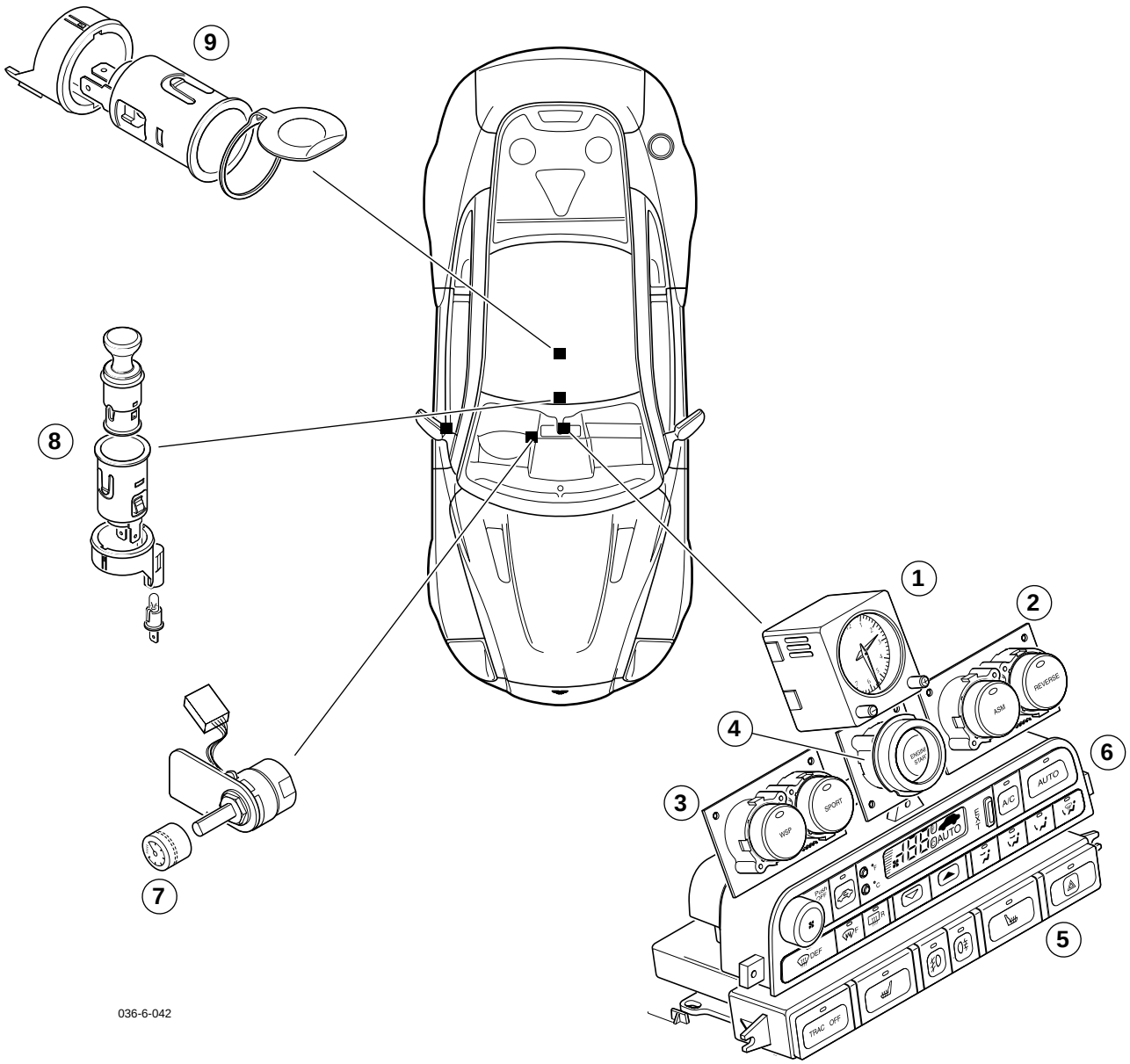


Figure 9

Circuit Diagrams

The following circuit diagrams relate to the initial build V12 Vanquish from chassis number 0001. Further revisions may be published. Please check that you are using the correct diagram.

Circuit Number	Title
1	Matrix Sheet
2	Exterior Lighting Front
3	Exterior Lighting Rear
4	Wash/Wipe and Power Steering Control
5	Interior Lighting
6	Dimmer
7	Ignition Control
8	ABS
9	Front Seat (Unheated)
10	Front Seat Option
11	Column/Mirror Movement
12	Door Locking/Unlocking
13	Security
14	Battery And Starter Circuits
15	Premium ICE System
16	Standard ICE System
17	Air Conditioning
18	Instrument Panel
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The Passive Anti-Theft System (PATS)

Description and Operation

The Passive Anti-Theft System (PATS) uses radio frequency identification technology to deter a driveaway theft by engine immobilisation. Passive means that it does not require any intervention from the user.

Each specially encoded PATS ignition key contains a permanently installed transponder. Each transponder contains a unique electronic identification code.

Each encoded ignition key must be recognised by the vehicle's powertrain electronic control module (PTEC) before it can be used to start the engine. Instructions for encoding keys are included later in this section.

A transceiver module is located around the steering lock. The transceiver module communicates with the encoded ignition key. During each vehicle start sequence, the transceiver module reads the ignition key identification code and sends the data to the PATS module. The PATS module in turn communicates with the PTEC. If the key has an incorrect code, is unprogrammed, or is in some way damaged, fuel injection will be inhibited, thereby immobilising the engine.

The PATS status lamp on the centre console provides system status information when the ignition is OFF, ON or when the engine is RUNNING.

System States

Ignition OFF

The PATS status lamp blinks every 2 seconds

Ignition turned to ON and engine running

The PATS status lamp comes ON for three seconds, then OFF. Normal vehicle start with correct key code received.

If the status lamp remains ON when the ignition is swithed on, the system is in fail-safe mode, i.e. PATS has a fault.

Ignition turned to ON, engine not started

The PATS status lamp comes ON for three seconds, then OFF for one second, then ON for one minute. Key code received/vehicle disabled (more than 2 keys learned).

Ignition turned to ON, engine not started

The PATS status lamp comes ON briefly, flashes for one minute, then flashes a fault code 10 times.

System Malfunction

The PATS status lamp flashes for 60 seconds after IGN ON then flashes a fault code.

Encoded Ignition Keys

The encoded ignition keys are powered by low power radio frequency induction provided by the transceiver module and therefore do not require batteries.

Each encoded key has a unique key identification code that is transmitted to the transceiver module as a radio frequency data signal.

The transceiver module sends the key identification code to the PATS control module which determines if the ignition key used is a valid, programmed key.

A minimum of two encoded ignition keys must be programmed to a vehicle in order for the keys to start the engine. A maximum of eight keys can be programmed to a vehicle.

The PATS Control Module

The PATS control module is mounted on the passenger footwell bracket and performs the following functions:

- Operates the transceiver module, stores and compares key identification codes
- Initiates the key interrogation sequence when the vehicle ignition switch is turned to position II
- Enters anti-scan mode when an unprogrammed encoded ignition key (with the correct mechanical cut) is used in an attempt to start the vehicle. Anti-scan mode is a 20 second time-out period during which no ignition keys are allowed to start the vehicle
- Stores the vehicle's key identification codes in non-volatile random access memory (NVRAM). The identification codes are remembered even if the vehicle battery has been disconnected.

Vehicle Start Disabling

The PATS system will disable the vehicle from starting under any of the following conditions:

- Damaged encoded ignition key
- Unprogrammed encoded ignition key
- Non-encoded ignition key (key with no electronics)
- Transceiver module malfunction
- PTEC malfunction
- Wiring harness malfunction.

PATS Functional Description

Normal Activation and De-activation

- PATS is de-activated when the correct key is turned to the ignition position II
- The PATS LED shows a three second prove out and the vehicle is enabled. If an error condition exists the fuel injectors are disabled and the LED shows an error code.
- Five seconds after the ignition has been switched off, PATS is activated automatically. The vehicle is disabled and the PATS LED flashes once every two seconds.

Error Condition

In an error condition, the PATS LED blinks rapidly at a frequency of 4 Hz for one minute after the key is turned to the ignition position.

After one minute a two digit error code is blinked out. Each digit is blinked at a rate of one second. There is a break of 1 second between the digits. After a pause of 3 seconds, the error code is repeated.

Spare Key Learning Procedure

CHECK THESE PROCEDURES AGAINST WDS SCREENS !!!!

The following procedure can be used to 'teach' extra keys without the use of a PDU.

Both, or any two valid keys are required to perform the following procedure.

1. Insert the first key and turn it to ignition position II.
2. Take the key out within five seconds.
3. Within five seconds insert a second valid key and turn it to ignition position II.
4. Take the key out within five seconds.

   The key learning mode is now initiated
5. Within ten seconds insert the new key and turn it to ignition position II.
6. The new key is now programmed and valid.

Spare Key Erasing Procedure

This procedure may be required if a key is lost or the number of valid keys is unknown. This procedure clears all keys from the PATS memory except the keys used to perform the clearing function.

Any two of all valid keys are required to perform the following procedure.

1. Insert the first key and turn it to ignition position II.
2. Take the key out within five seconds.
3. Within five seconds insert a second valid key and turn it to ignition position II.
4. Take the key out within five seconds.

   The key learning mode is now initiated
5. Within five seconds use the second valid key and turn it again to ignition position II.
6. Take the key out within five seconds.
7. Within five seconds insert the first valid key and turn it to ignition position II.
8. The PATS LED starts to flash rapidly for a period of five seconds.
9. Leave the key in for the five second period of rapid flashing. This will clear all keys from the PATS memory, except the two keys used to perform the procedure.

   Note: If at step 6 the key is remove during the five second period of rapid flashing, the key clearing function is aborted.``

Fault Codes

CHECK THESE CODES AGAINST WDS SCREENS !!!!

Fault Code Flashing

If a fault condition occurs, the LED will flash a two digit fault code indicating the system problem. The fault code format is 2 digits. Each digit is flashed at a rate of 1 Hz (e.g. digit 2 = 2 flashes). There is a one second wait between the flashing of the first and the second digit and a three second wait after the completion of the second digit before starting the first digit again.

If more than one PATS fault exists, only the lowest number code will flash.

Fault codes only when the ignition is in postition II.

LED Code	BUS-DTC (PDU)	Visible DTC	Description
11	9681	B1681	Transceiver not connected - No transmit verify Transceiver does not respond to key read request. Possible wiring fault to the PATS module. Check transceiver wiring and connector.
12	9232	B1232	Transceiver fault, Coil fault
	A103	B2103	Transceiver module does not operate properly. The device is not mounted correctly, the coil is broken or the devices is not tuned correctly. This fault is indicated by a non OK control byte that is sent by the transceiver module. Check mounting of the transceiver. Replace part.
13	9600	B1600	No key code received PATS attempted to read the ignition key at least 10 times, and no transponder signal was returned. This code appears with a disabled vehicle, and with a fail-safe vehicle to show why fail safe occured. No key or non-PATS key was used. Transceiver and module are OK.
14	9602	B1602	Partial key code received PATS attempts to read the ignition key at least 10 times and an incomplete response from the transponder was received. Check the transceiver mounting and battery voltage. Is there metal close to key?

LED Code	BUS-DTC (PDU)	Visible DTC	Description
15	9601	B1601	Non valid key code received The transponder code received is not programmed as valid. The key is not known to the system. Key learning is required. Transceiver and module operating correctly.
16			SCP communication error
	D262		Check wiring of SCP link and PTEC configuration/type
	D147	U1147	Invalid PTEC data
21	9213	B1213	Less than the minimum number of keys stored in memory The system expects to have three key codes stored before delivery to customer. If not this code will be displayed. This code only appears with an enabled vehicle. Programme missing keys to the system.
22	A141	B1213	Initialisation after part replacement or end-of-line missing If a module is connected for the first time to a vehicle it will store automatically the PTEC ID after the key has been turned for the first time to ignition position II. If no PTEC ID is stored or the PTEC ID has been cleared, this code will be displayed.
23	A139	B2139	SCP not configured, PTEC ID does not match This based on a system error. The PTEC verify message indicate disable due to a responce error. Codes of SCP PATS module and PTEC do not match

Fault Code 13 - No Key Code Received

Fault Analysis

1. Access the ignition switch and check the security of the transceiver connector.

   If secure, go to step 2.

   If displaced, reconnect the transceiver. Connect the PDU and clear the fault code. Retest to ensure that the problem is resolved.

2. Disconnect the transceiver, switch on the ignition and check for 8 volts from pin 1 (+) to pin 2 (-) of the harness connector.

   If 8 volts is present from pin 1 to pin 2, go to step 3

   If 8 volts is not present from pin 1 to pin 2, access the PATS module and repeat the voltage check at PATS module pin 7 (+) to pin 6 (-).

   If 8 volts is present at the PATS module, repair the wiring and retest to ensure that the problem is resolved.

   If 8 volts is not present at the PATS module, check the following:

   12 volts battery input to pin 8.

   12 volts ignition input to pin 15.

   Ground input to pin 14.

   If these inputs are good, replace the PATS module and carry out the (New PATS Module) procedure to reprogramme all vehicle keys.

3. Reconnect the transceiver. Connect the PDU and clear the fault code 13.

   Using all encoded keys in turn, attempt to start the engine.

   If a single key creates a fault code 13 condition, replace the faulty key and reprogramme the new key.

   If all keys create a fault code 13, go to step 4.

4. Check continuity of the data lines from transceiver pin 3 to PATS module pin 1 and from transceiver pin 4 to PATS module pin 9.

   If a continuity problem is identified, service the wiring as necessary and retest to ensure that the problem is resolved.

   If continuity is good, replace the transceiver and retest. If the problem is not resolved, replace the PATS module.

Fault Code 14 - Incomplete Key Code

Fault Analysis

1. Access the ignition switch and check the security of the transceiver connector.

   If secure, go to step 2.

   If displaced, reconnect the transceiver. Connect the PDU and clear the fault code. Retest to ensure that the problem is resolved.

2. Using all encoded keys in turn, attempt to start the engine.

   If a single key creates a fault code 14 condition, replace the faulty key and reprogramme the new key.

   If all keys create a fault code 14, go to step 3.

3. Check the continuity of the data lines from transceiver pin 3 to PATS module pin 1 and from transceiver pin 4 to PATS module pin 9.

   If a continuity problem is identified, service the wiring as necessary and retest to ensure that the problem is resolved.

   If continuity is good, replace the transceiver and retest. If the problem is not resolved, replace the PATS module.

Fault Code 15 - Incorrect Key Code

Fault Analysis

1. Connect the PDU and clear the fault code 15.

   Using all encoded keys in turn, attempt to start the engine.

   If a single key creates a fault code 15 condition, replace the faulty key, clear the code 15 and reprogramme the new key.

   If all keys create a fault code 15, go to step 2.

2. Using the (New PATS Module) procedure, clear the PATS module memory and attempt to reprogramme all keys for the vehicle.

   If the key programming fails, check continuity of the data lines from transceiver pin 3 to PATS module pin 1 and from transceiver pin 4 to PATS module pin 9.

   If a continuity problem is identified, service the wiring as necessary and retest to ensure that the problem is resolved.

   If continuity is good, replace the transceiver and retest. If the problem is not resolved, replace the PATS module.

Fault Code 16 - Error in SCP Communications

Fault Analysis

1. Connect the PDU to the lower diagnostic socket and attempt to clear the fault code 16.

   If any communications problem is detected, switch the PDU to Engine Diagnostics and check that the PDU will 'talk to' the Powertrain Control Module (the PTEC and PATS modules share the SCP communications lines to the lower diagnostic socket).

   If communications to the PTEC are good but communications to the PATS module are faulty, check continuity of the PATS SCP data lines from PATS module pins 4 and 5 to lower diagnostic socket pins 2 and 10. Service the wiring as necessary, clear the fault code 16 and exercise the PATS communications to ensure that the problem is resolved.

Fault Code 21 - Less Than Two Key Codes Stored

Fault Analysis

1. Connect the PDU and clear the fault code 21. Check the current key count using the 'Count Keys' function.

   If the current count is less than 2, reprogramme the slave keys to ensure a keycount of 2.

   If there is any problem in reprogramming, use the 'Master Key Lost (New PATS Module)' procedure to completely reprogramme the PATS module.

WDS Procedures

The PDU PATS menu offers the following options:

Datalogger

Diagnostic Trouble Codes

Datalogger

The following signals may be monitored using the PATS datalogger function:

Signal	Range	Description
CONTDTC	0-10	A count of the DTCs since the last 'Clear DTCs' command. Only the most recent 10 codes are saved for retrieval.
FAILST	ON-OFF	Identifies the functionality of engine immobilisation following the detection of a PATS system failure. When the module is in Failsafe ON mode, the engine will always start with the correct physical key and ignore the key code.
KEYCODE	0-8	This parameter maintains a count of the number of keys stored in the PATS memory. Up to 8 unique keys can be programmed into the PATS module memory.
KEYST	0/I/II	This parameter identifies the position of the ignition key in the lock barrel (Off, Accesories, Run).
SOFTVER	0-15	This parameter identifies the version number of the software programmed into the PATS module.
STATE	Disable/Enable	This parameter identifies the current state of the engine immobilizer.
STRTEN	On/Fault	This parameter is only valid when the ignition is in the start (crank) position. The PATS module provides a ground for the starter relay primary circuit. On switching the ignition to 'Start', the PATS module measures the current passing through this circuit, from the 12 volt supply provided by the ignition switch.

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Bodywork Repairs

V12 Vanquish incorporates both new technologies and materials as well as specialised construction methods utilising adhesives for the bonding of aluminium and composite panels, as well as structural subcomponents to a central monocoque tub.

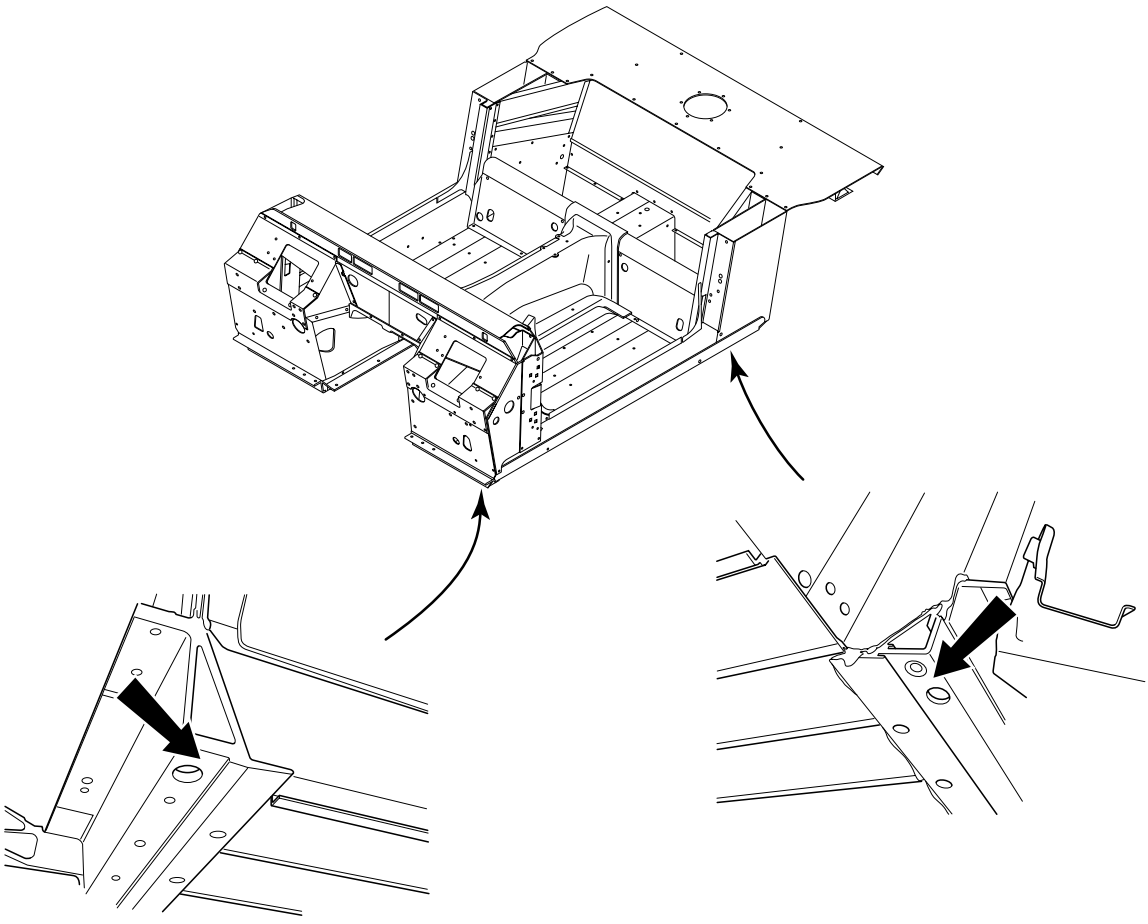
Because of this, a separate V12 Vanquish Body Repair Methods Manual has been written and is issued only to approved Vanquish repair centres. Consult this publication for instructions on the repair or replacement of V12 Vanquish body components.

This section of the V12 Vanquish Workshop Manual contains only those body and trim procedures which do not involve removal/replacement of bonded components.

Vehicle Jacking

When raising the vehicle on a four point hoist or using a workshop jack, support the vehicle only at the points shown on the diagram below.

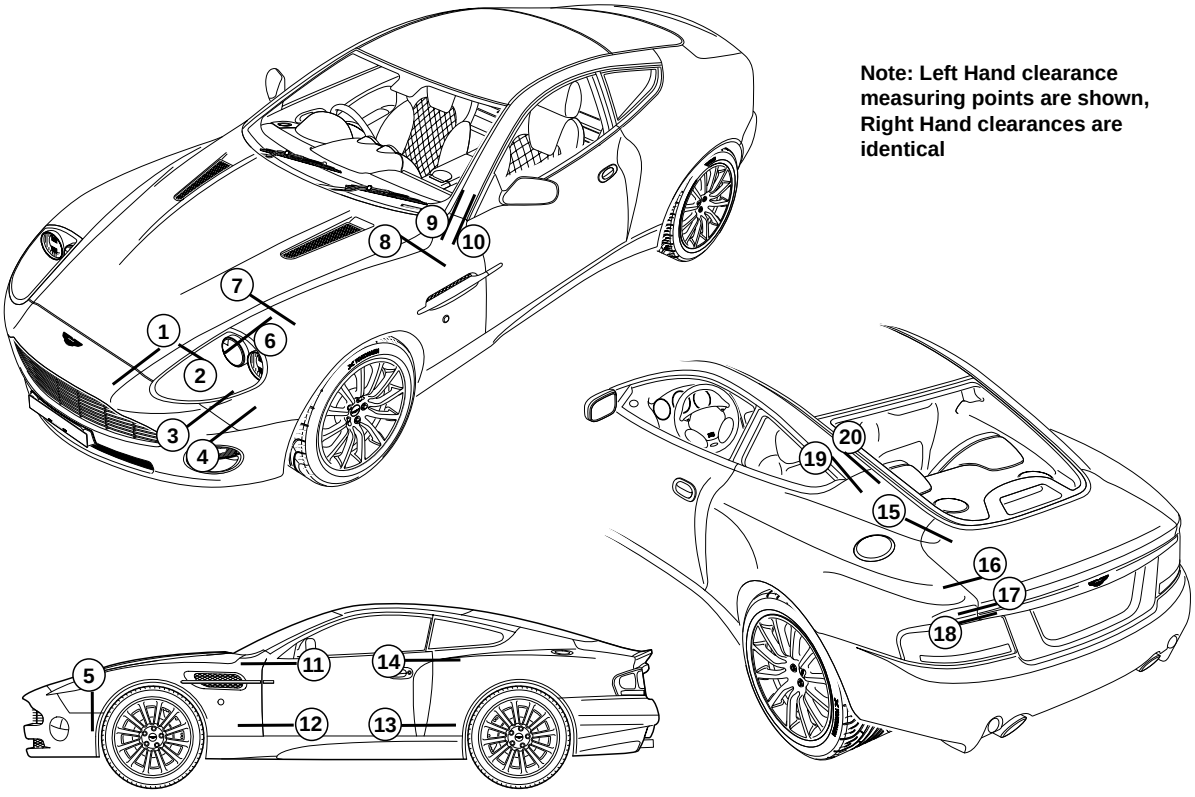
Use only lifting devices fitted with large rubber contact pads. Do not use lifting devices fitted with sharp contact points which may damage the Vanquish floor pan.



036-7-002

External Panel Fit - Specifications

Item No.	Gap Max mm	Gap Min mm	Flush Max mm	Flush Min mm
1	4.6	2.6	0.0	-1.0
2	5.0	3.0	0.0	-1.0
3	1.5	0.5	0.0	-1.0
4	1.5	0.5	0.0	-1.0
5	1.5	0.5	0.0	-1.0
6	3.7	2.7	0.0	-1.0
7	5.0	3.0	0.0	-1.0
8	5.0	3.0	0.0	-1.0
9	4.2	2.2	0.0	-1.0
10	4.2	2.2	0.0	-1.0
11	5.0	3.0	0.0	-1.0
12	5.0	3.0	0.0	-1.0
13	5.0	3.0	0.0	-1.0
14	5.0	3.0	0.0	-1.0
15	4.3	2.7	0.0	-1.0
16	4.3	2.7	0.0	-1.0
17	4.3	2.7	0.0	-1.0
18	4.3	2.7	0.0	-1.0
19	4.0	2.0	0.0	-1.0
20	4.0	2.0	0.0	-1.0

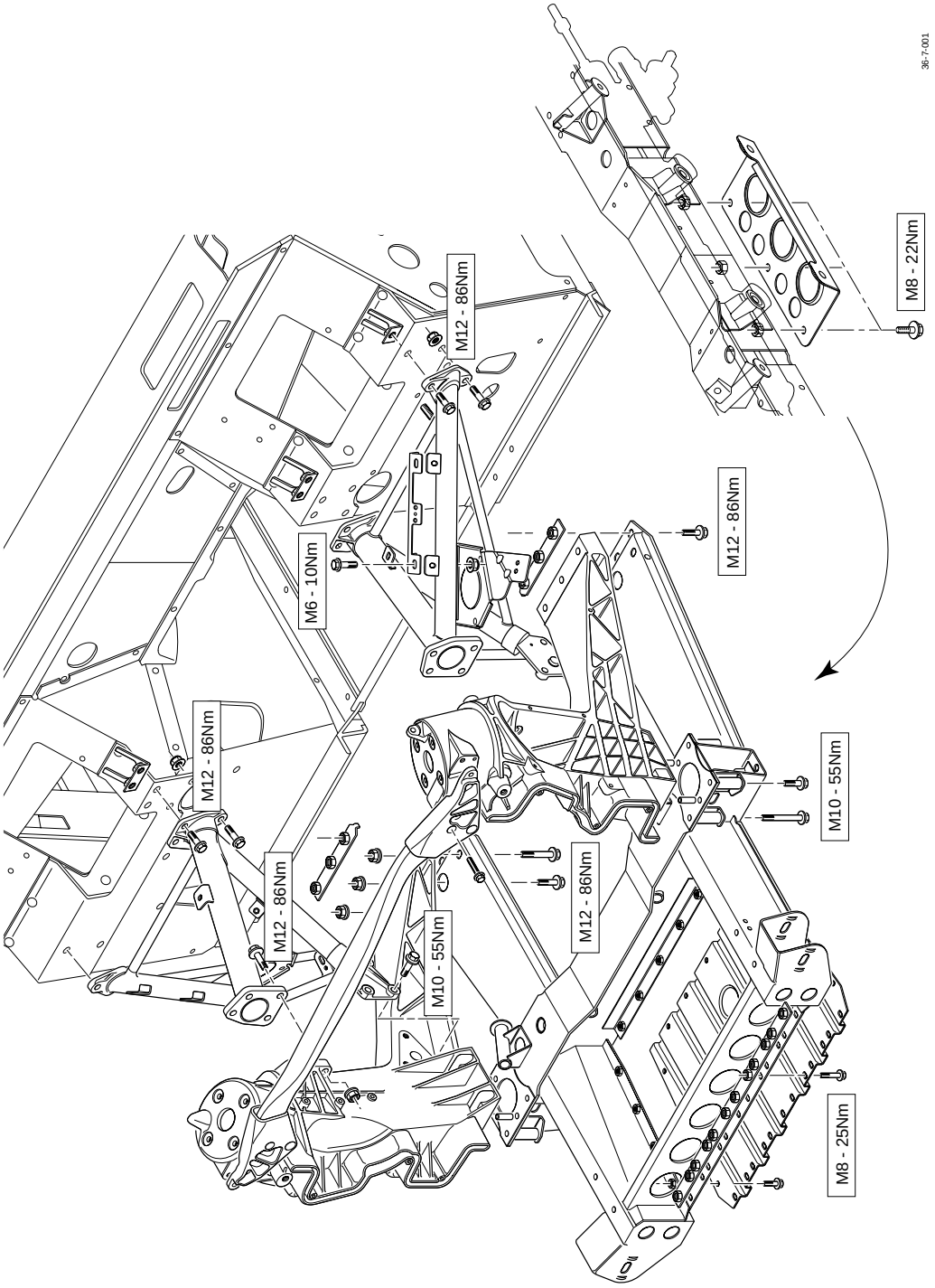


Note: Left Hand clearance measuring points are shown, Right Hand clearances are identical

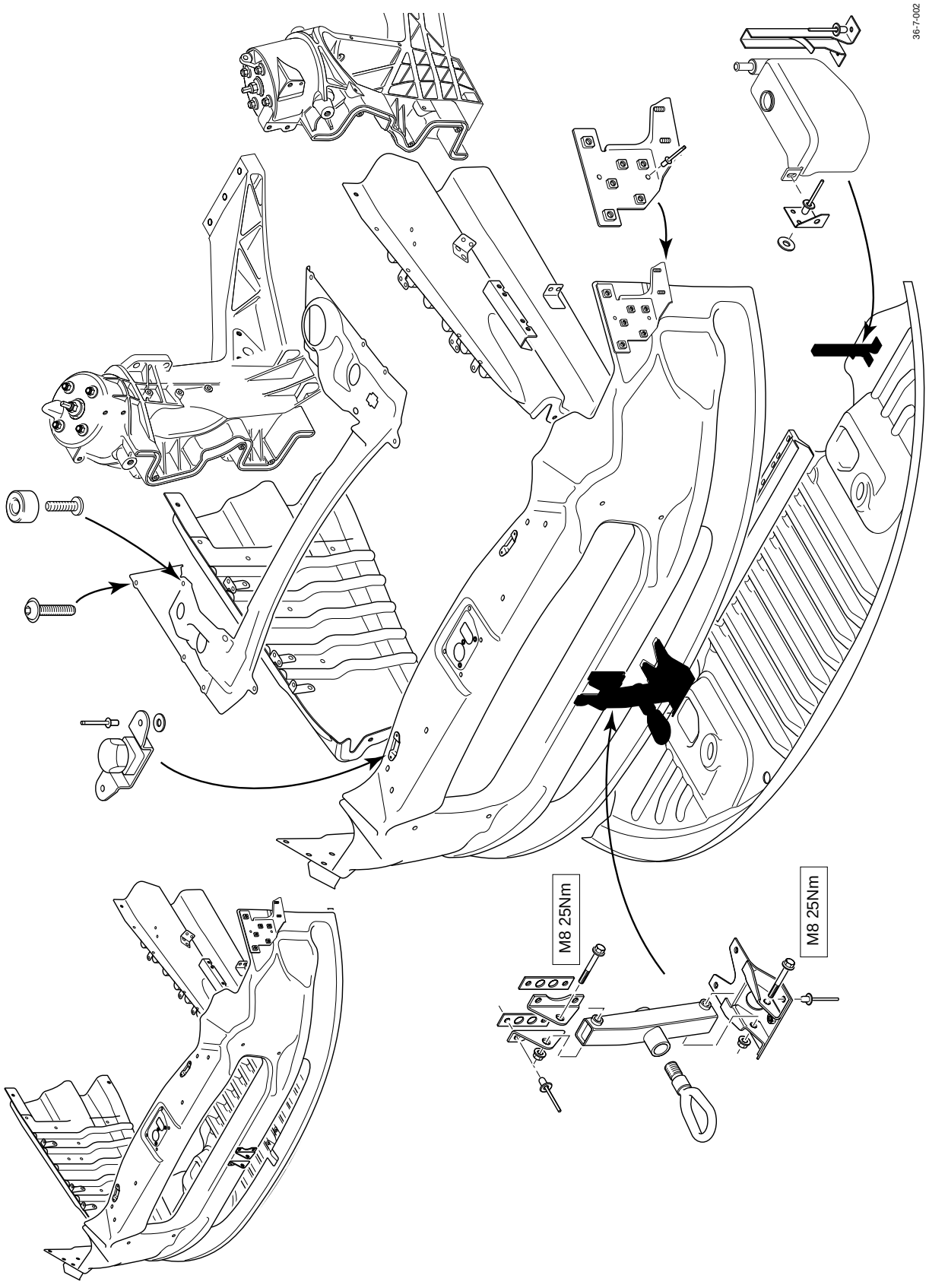
Body and Trim - Component Removal

The following illustrations show the principal fixings for removable body components and the trim panels which may require removal during normal vehicle servicing.

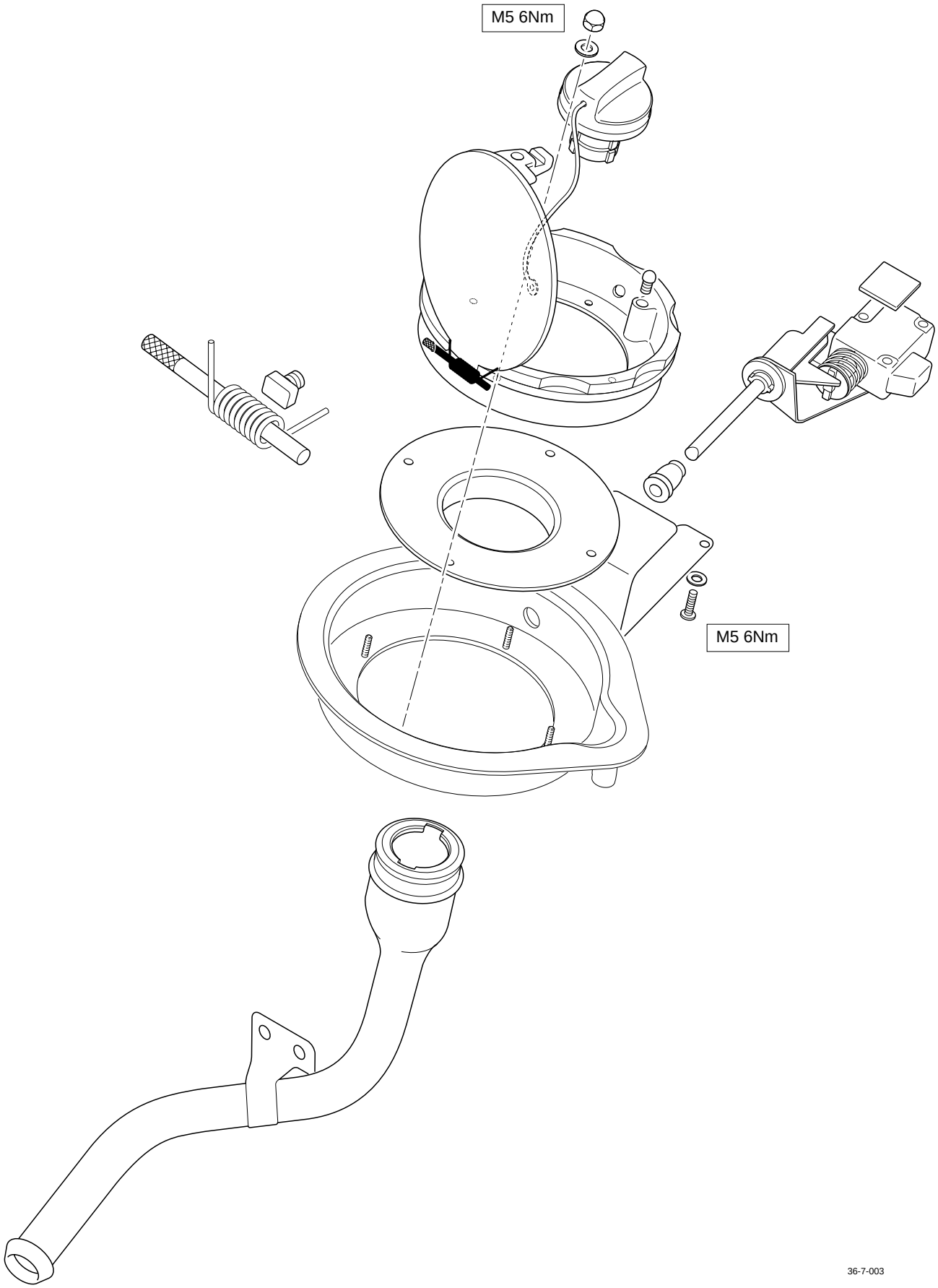
Front Supports



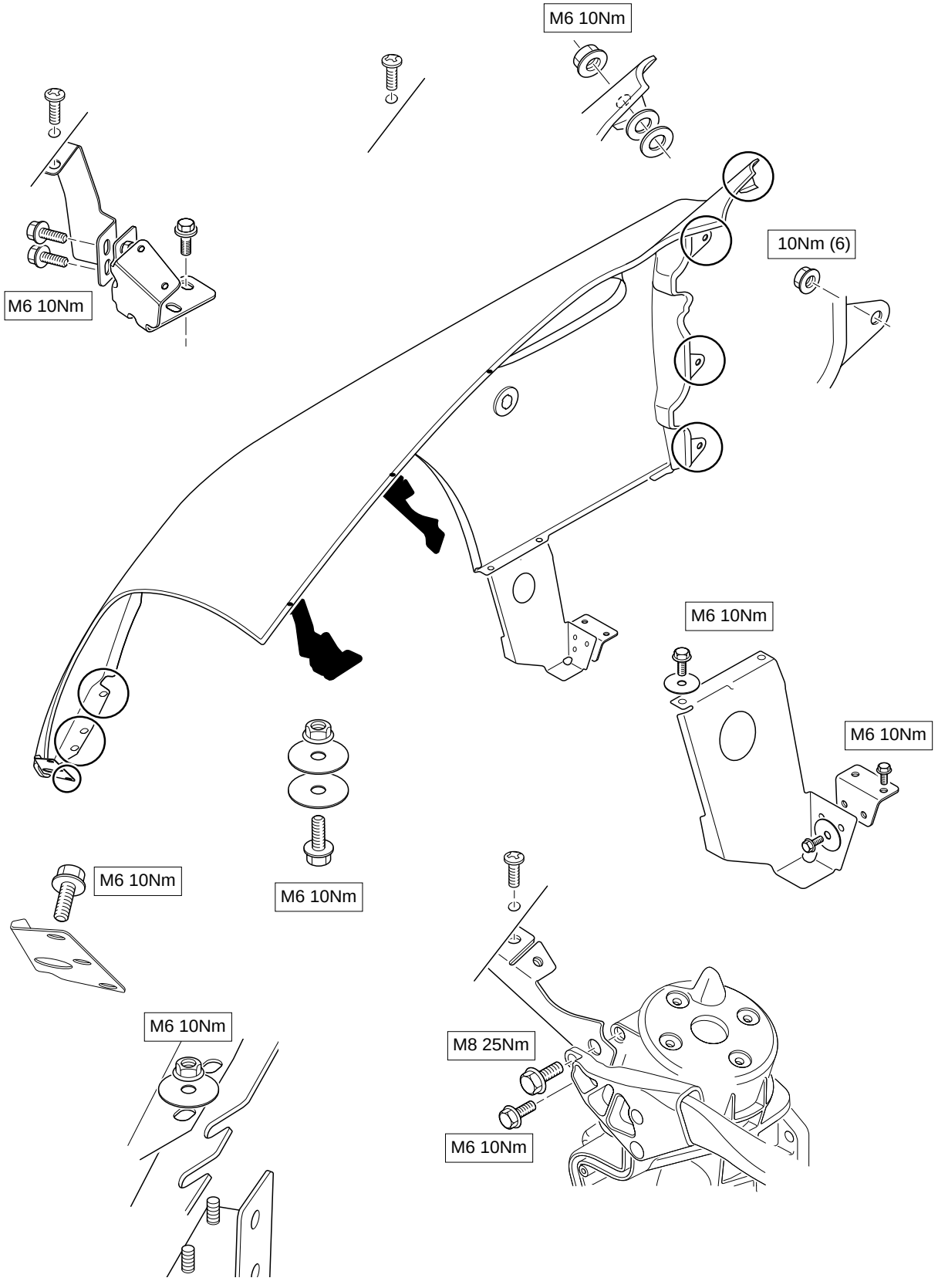
Front Impact Structure



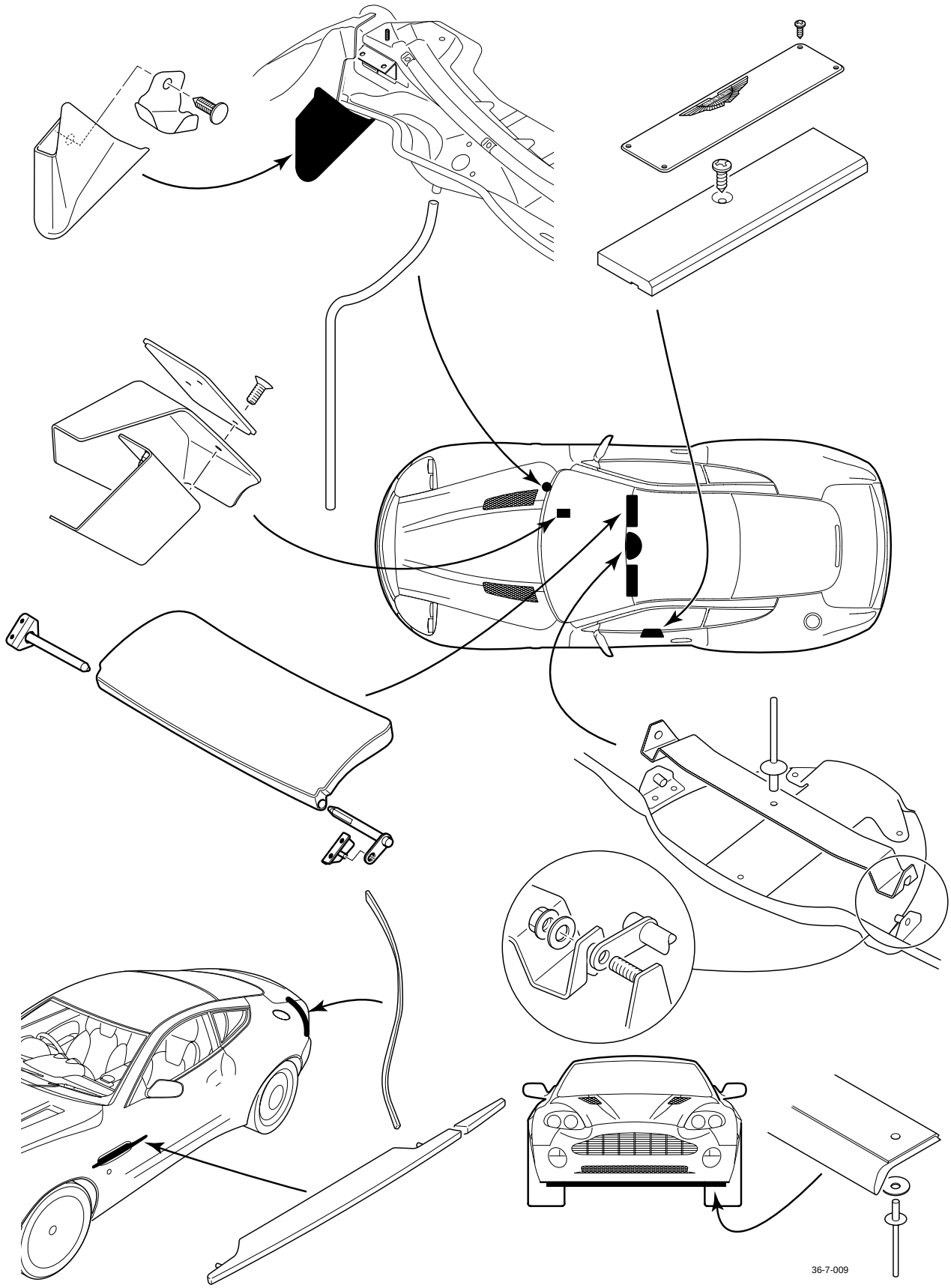
Fuel Filler Assembly



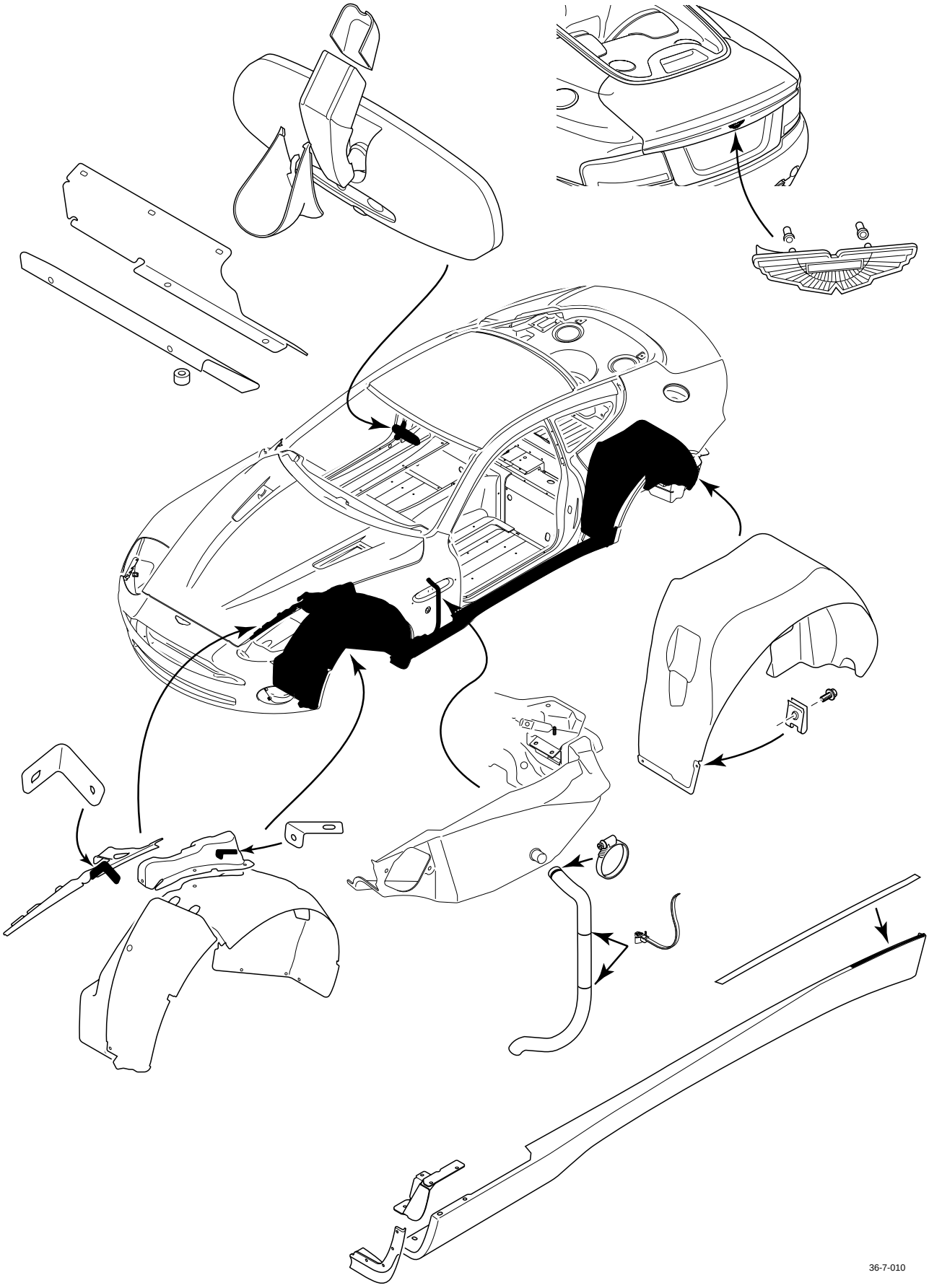
Front Wings


M6 10Nm
M6 10Nm
10Nm (6)
M6 10Nm
M6 10Nm
M6 10Nm
M6 10Nm
M6 10Nm
M8 25Nm
M6 10Nm
36-7-007

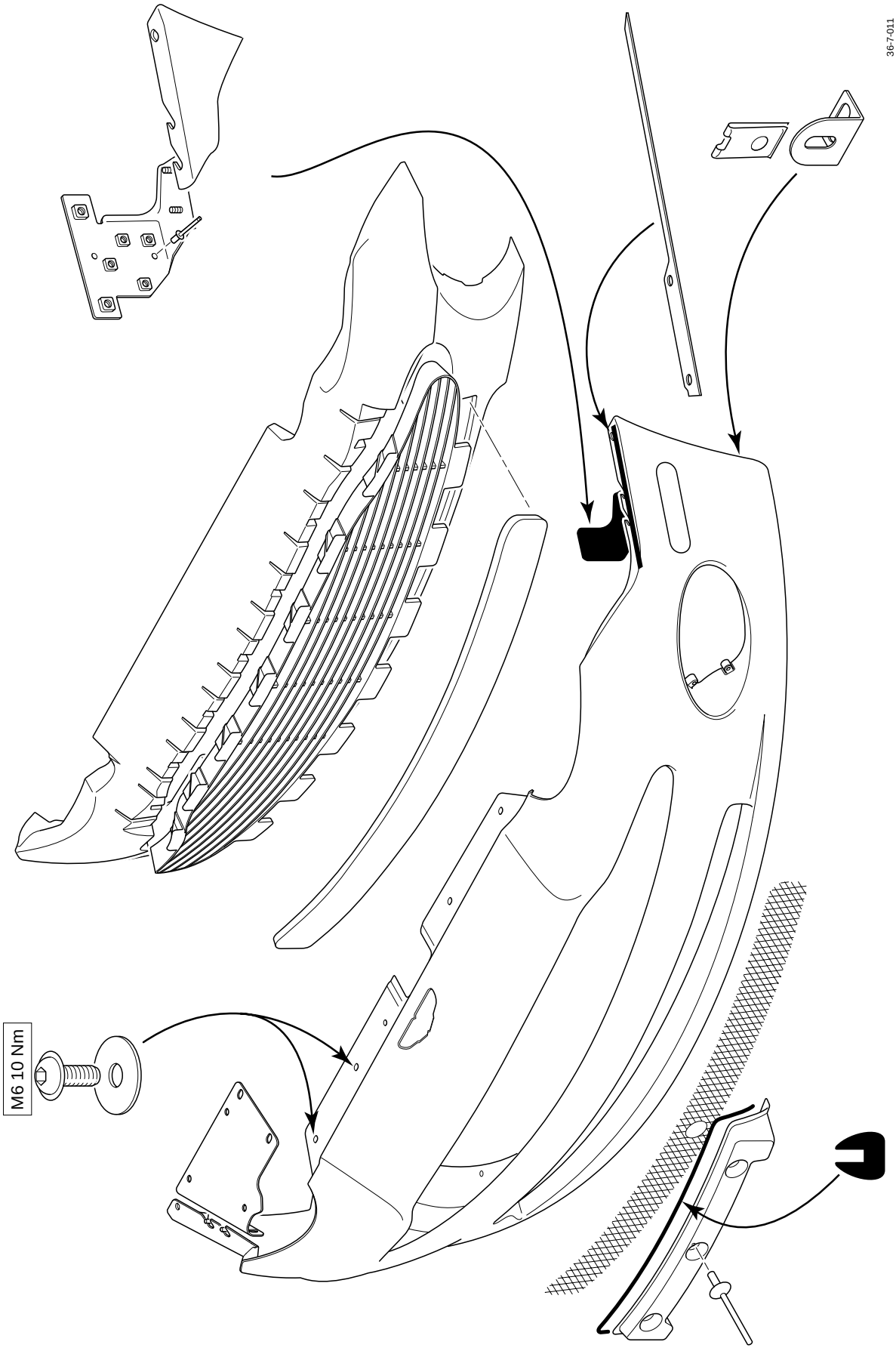
Body Fittings 1



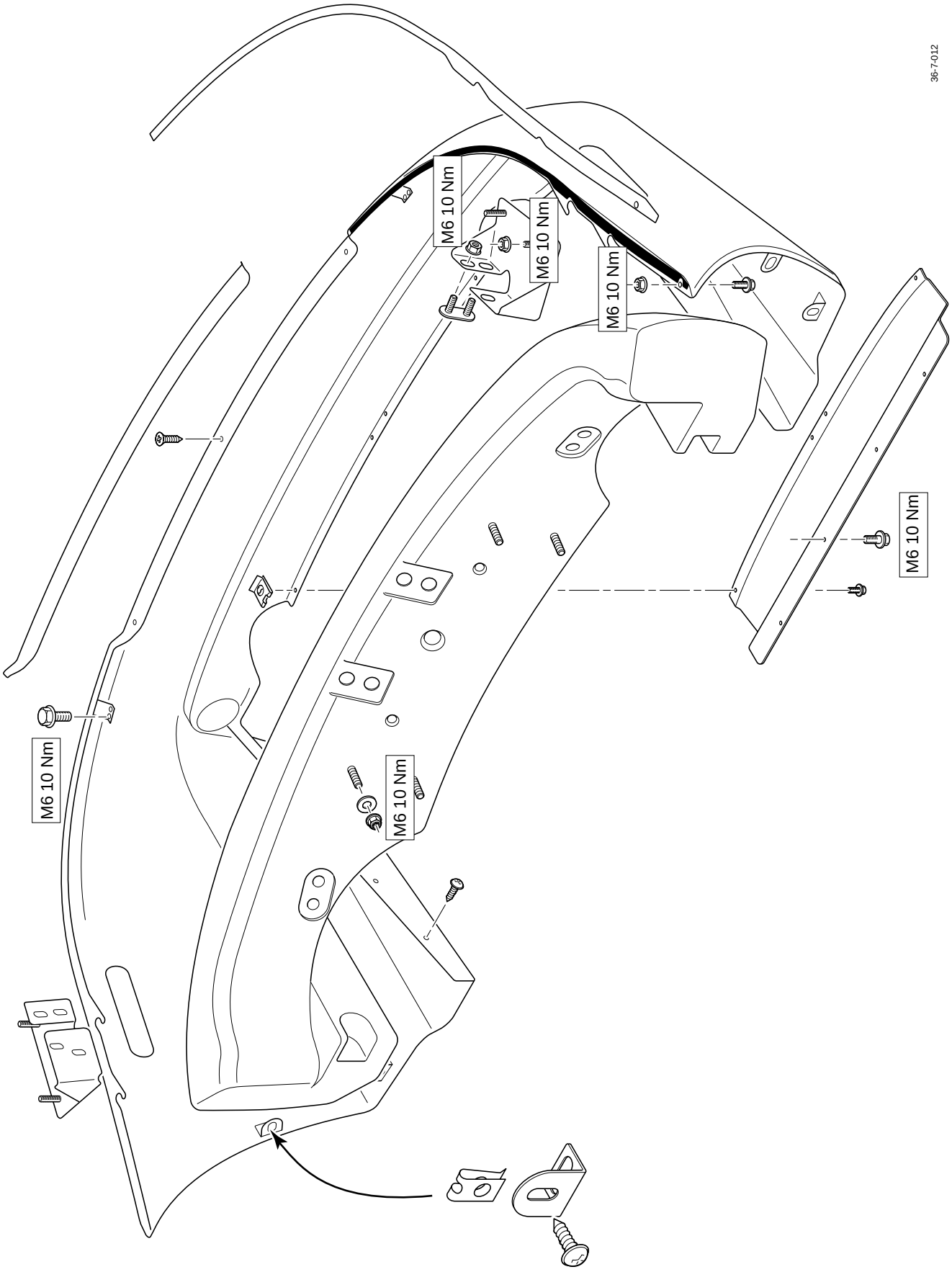
Body Fittings 2



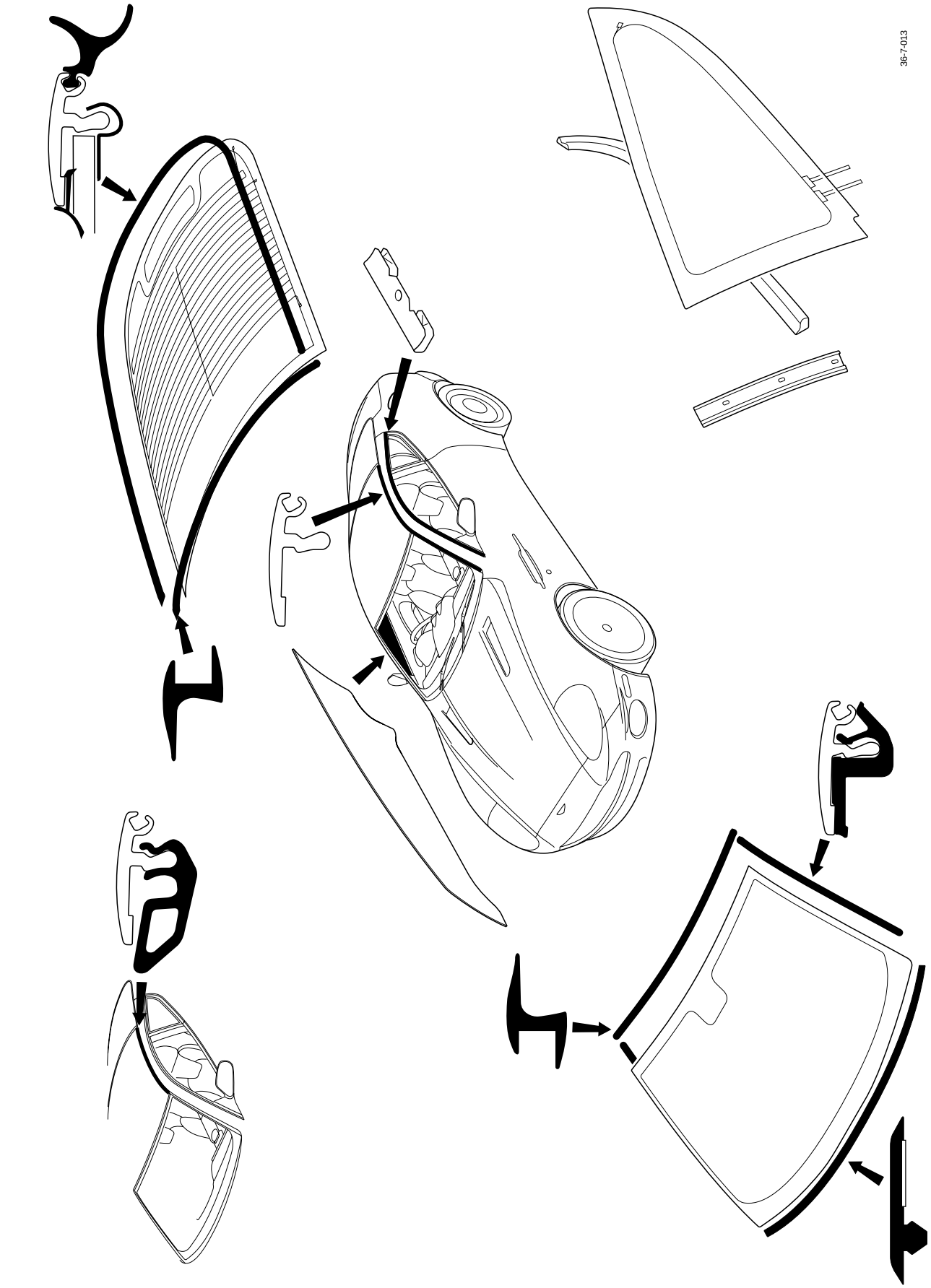
Front Bumper



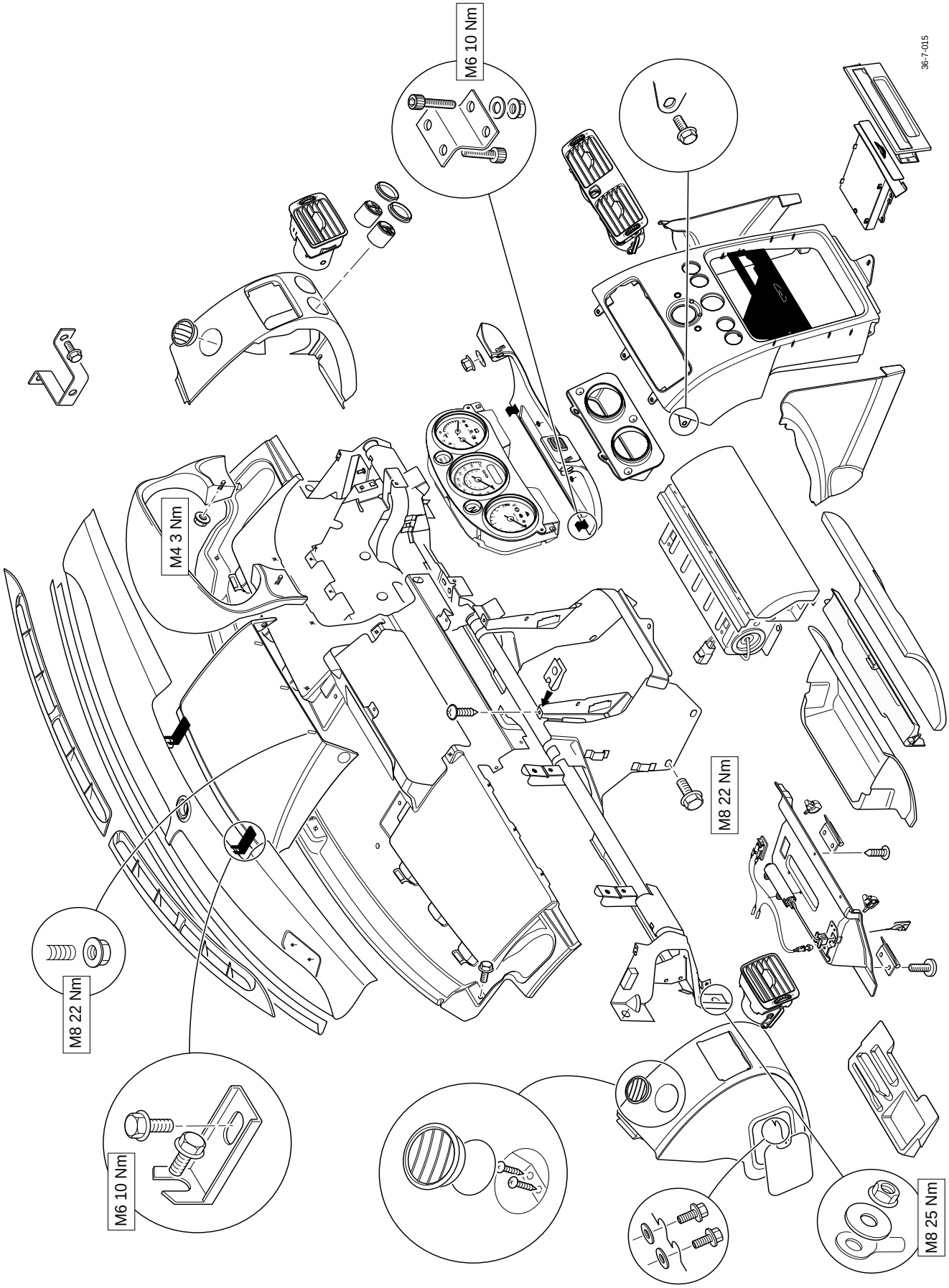
Rear Bumper



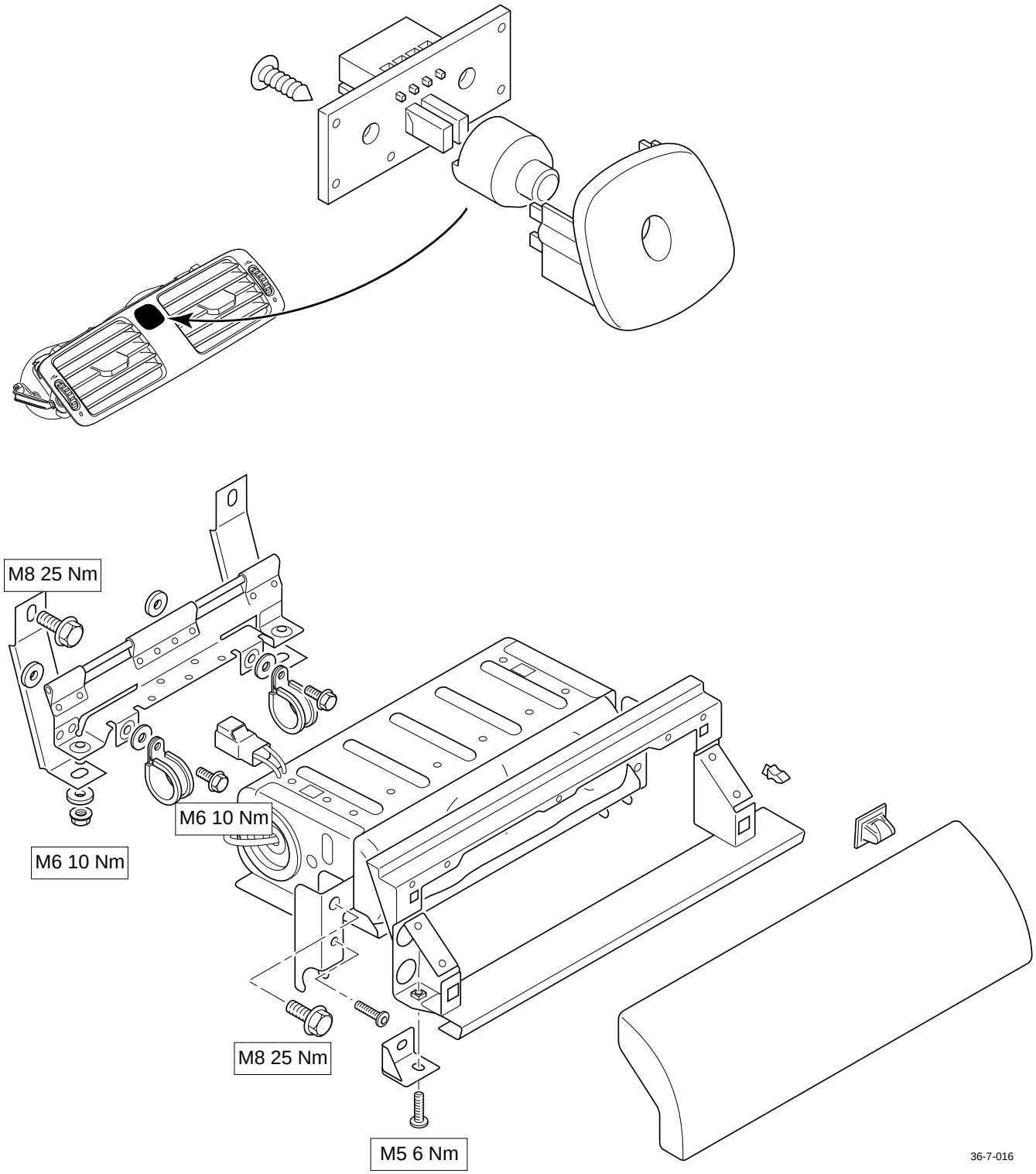
Glass and Finishers



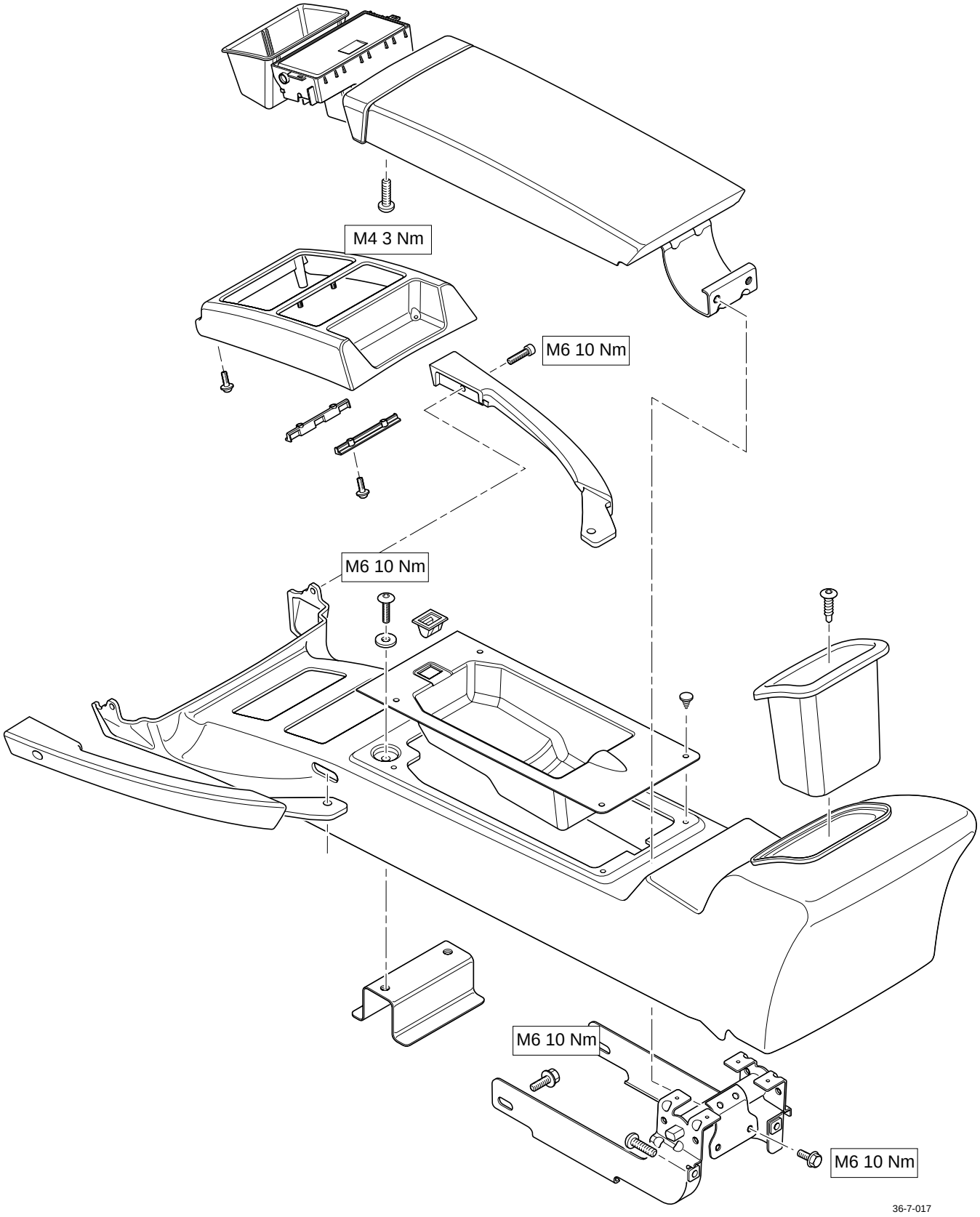
Facia and Trim 1



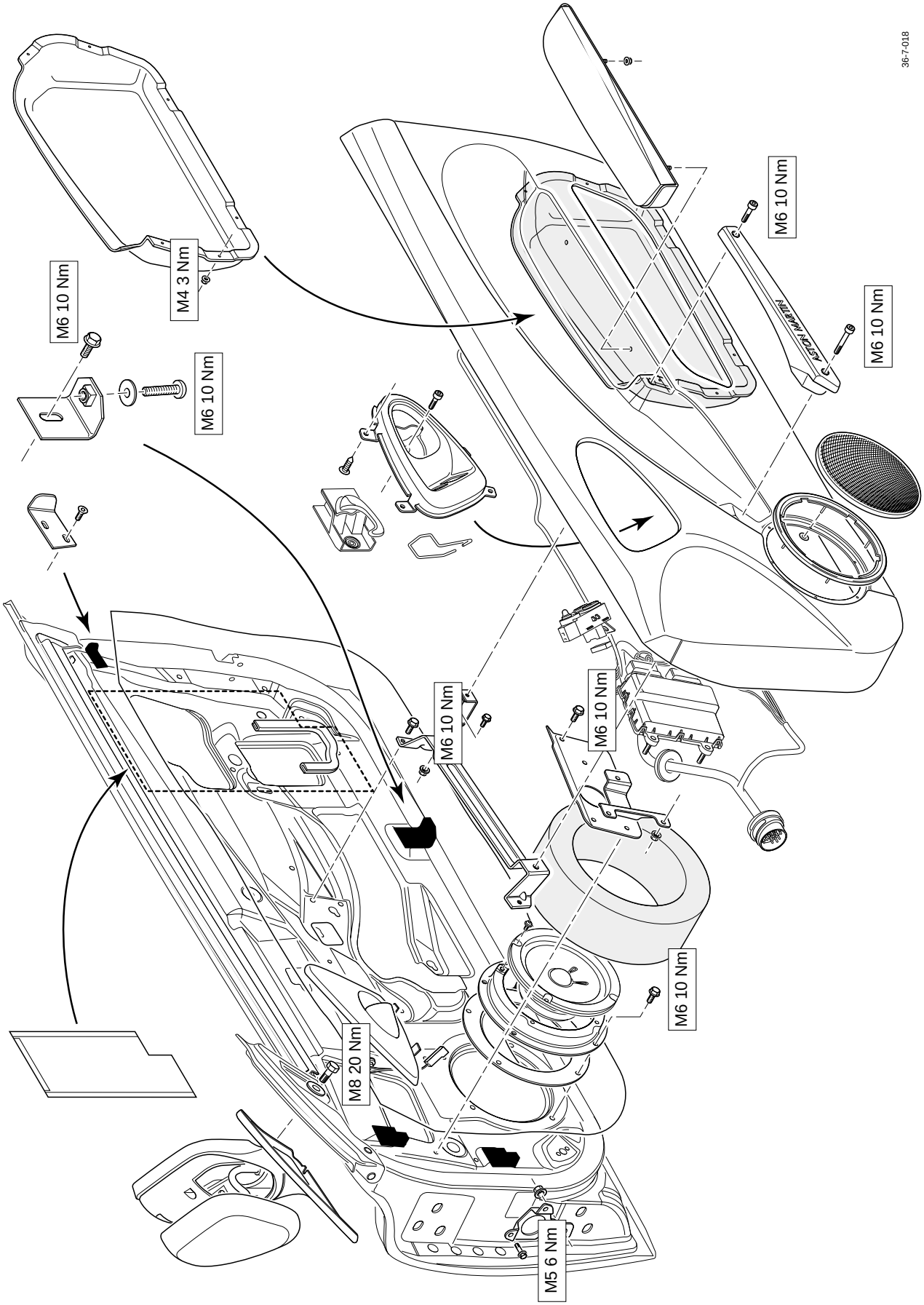
Facia and Trim 2



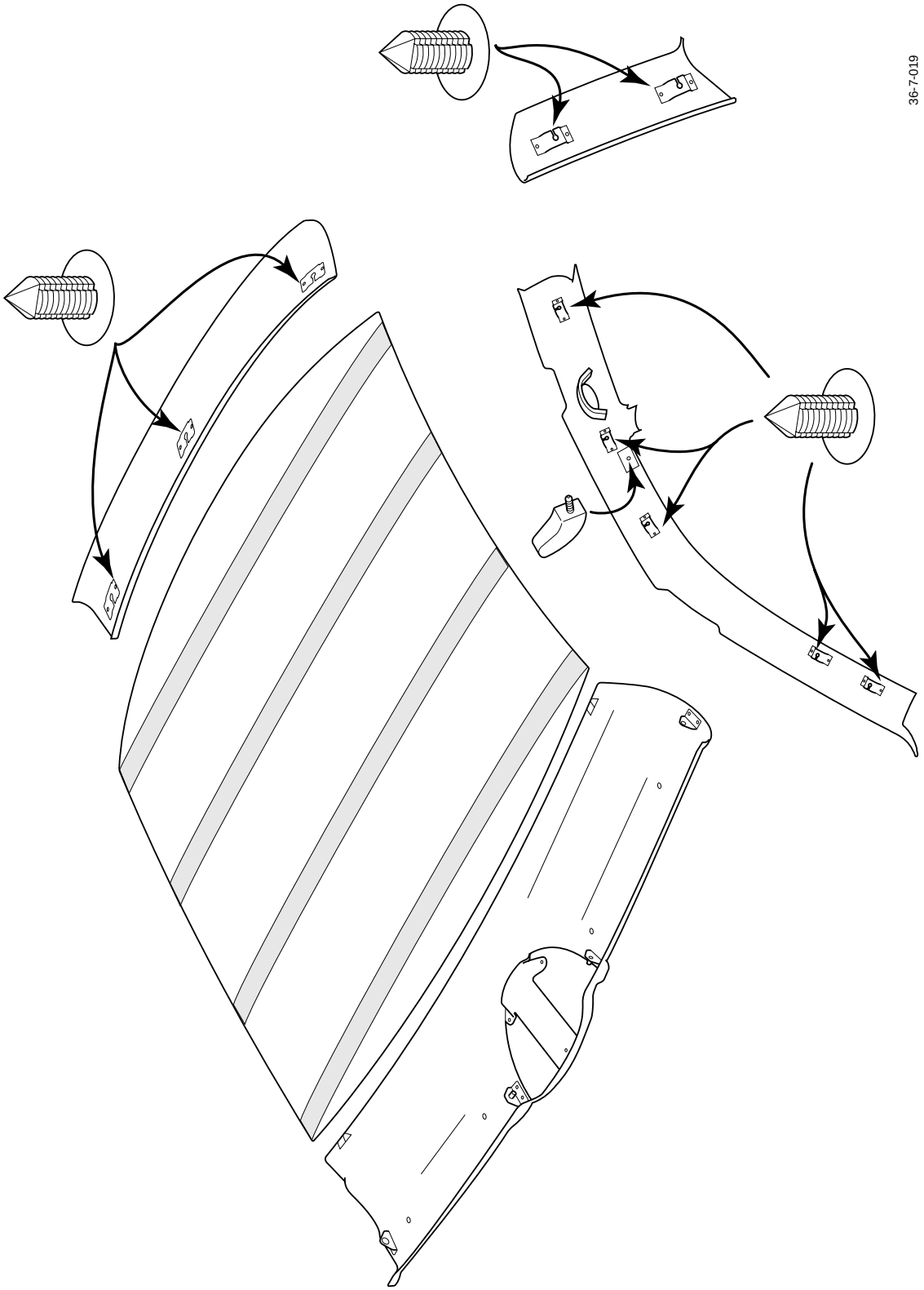
Centre Console



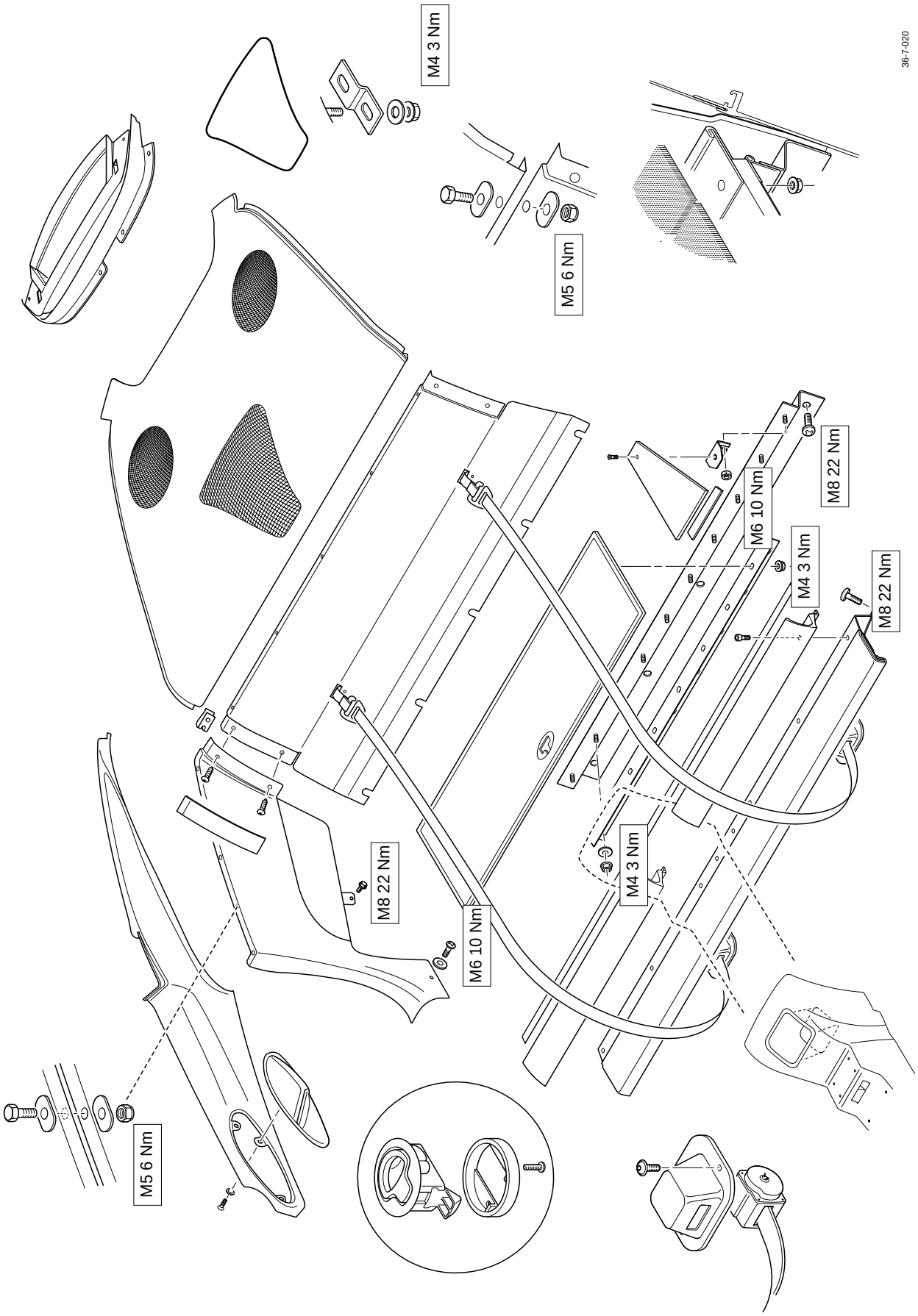
Door Casings



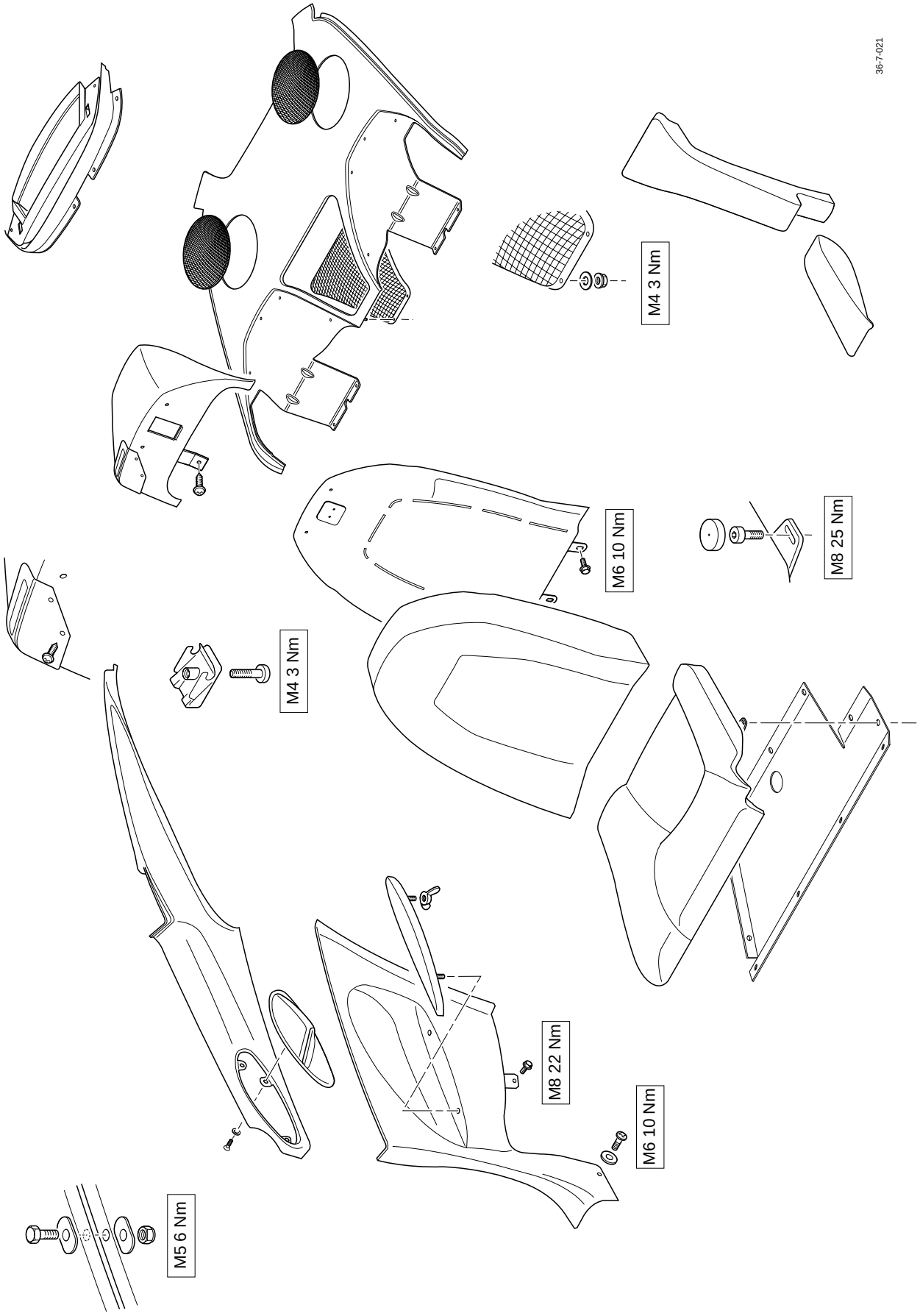
Upper Trim



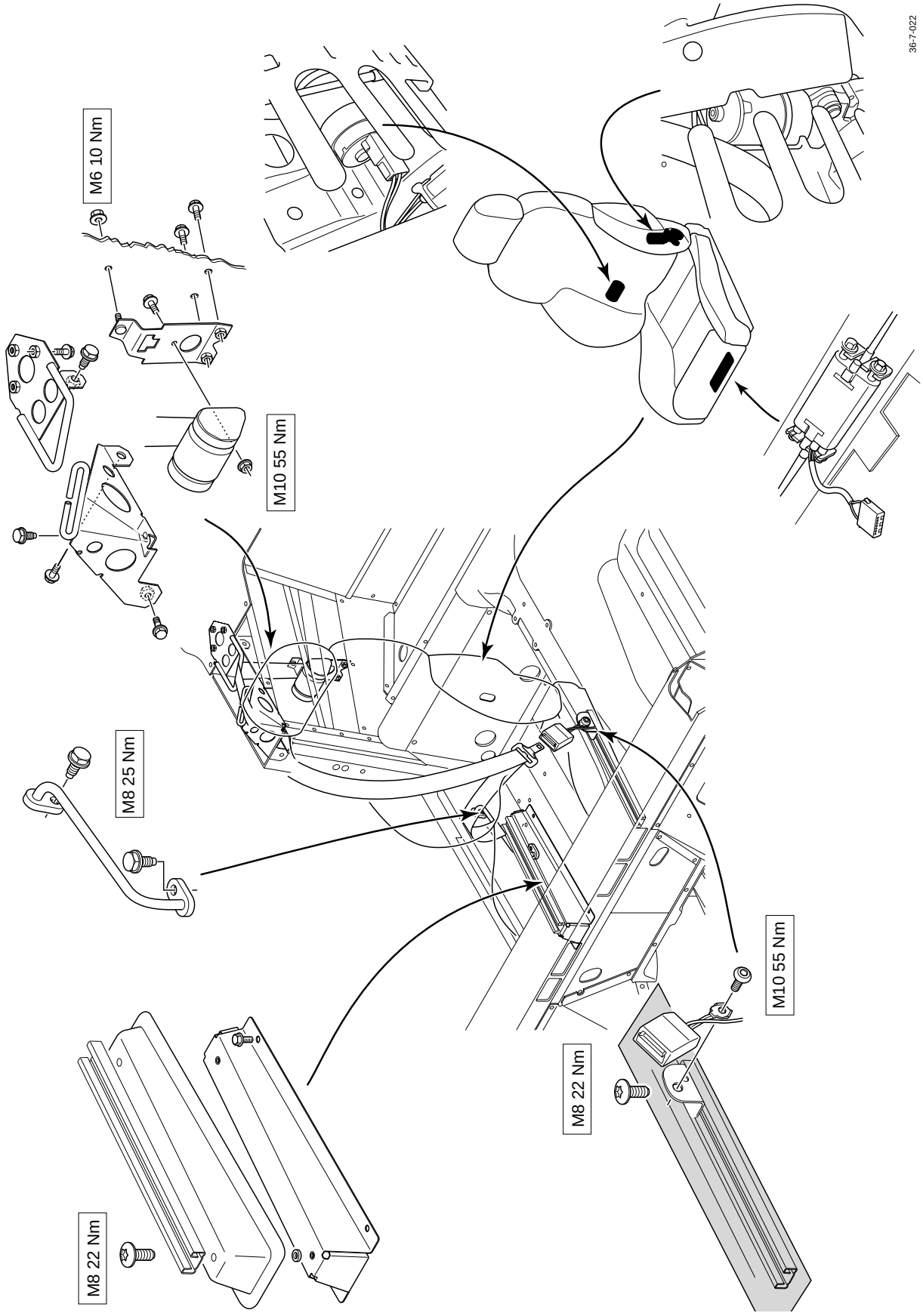
Rear Trim 2 + 0


36-7-020
M4 3 Nm
M5 6 Nm
M8 22 Nm
M6 10 Nm
M4 3 Nm
M8 22 Nm
M4 3 Nm
M8 22 Nm
M6 10 Nm
M5 6 Nm

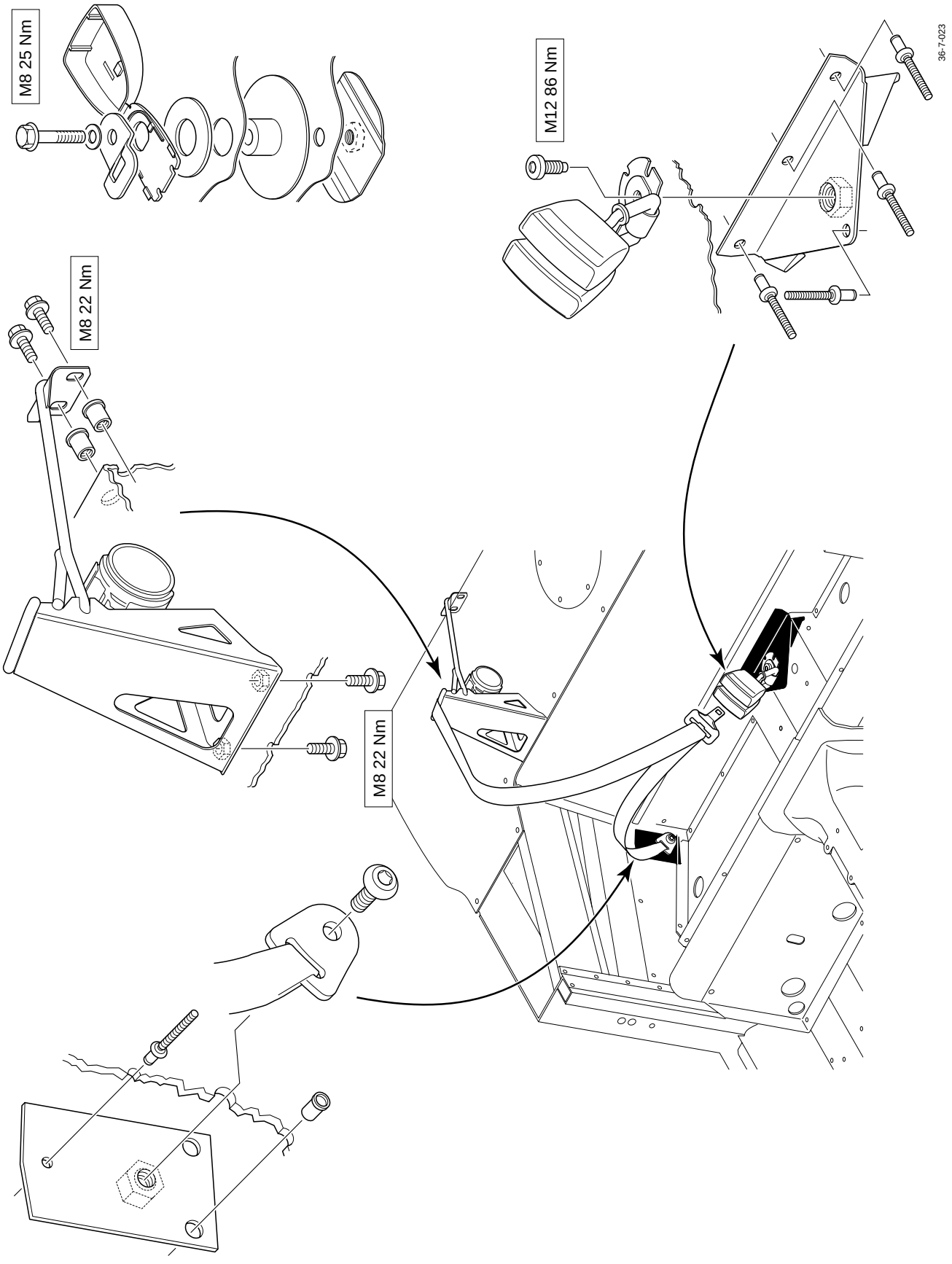
Rear Trim 2 + 2



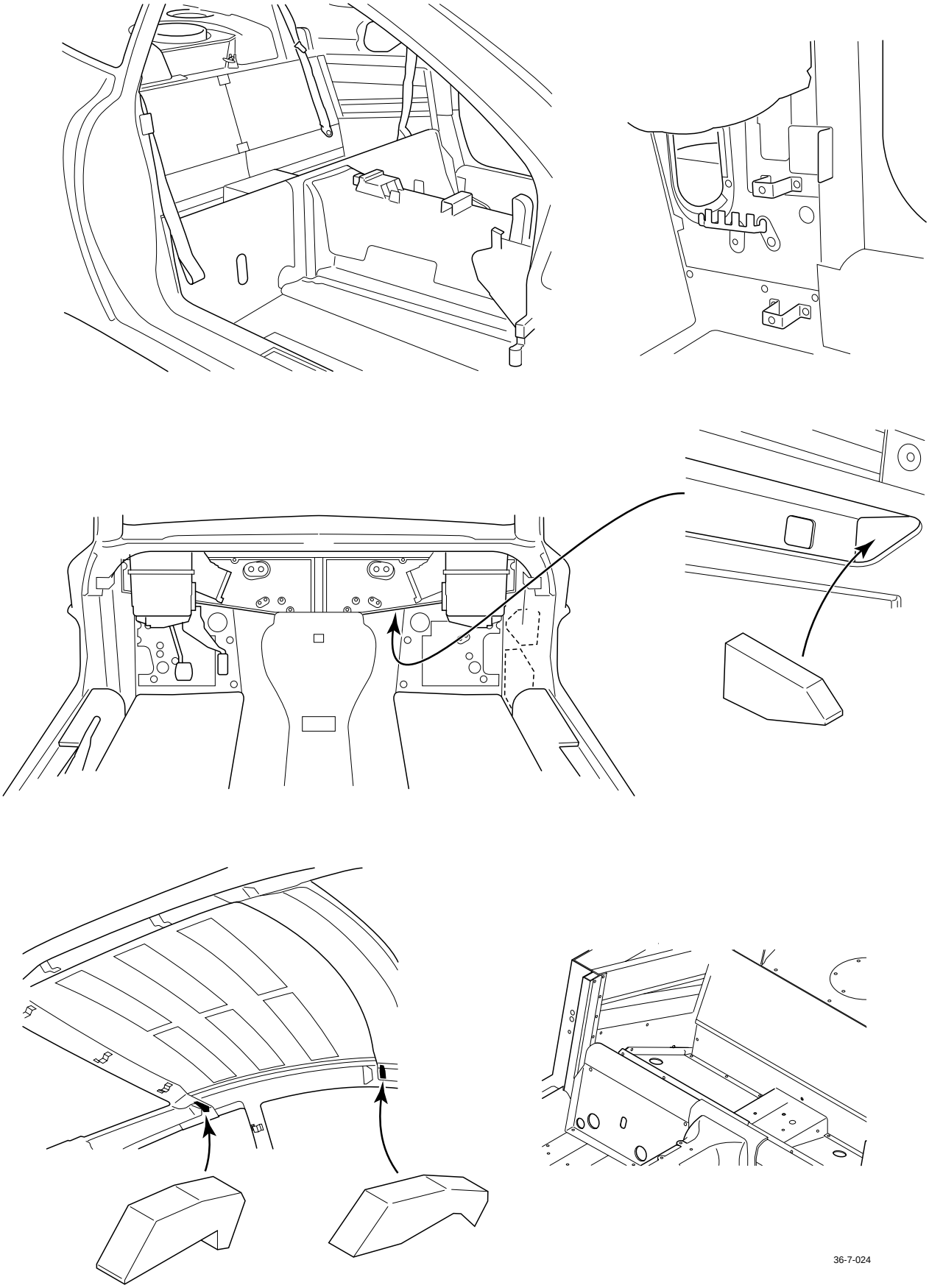
Front Seats and Belts



Rear Seatbelts

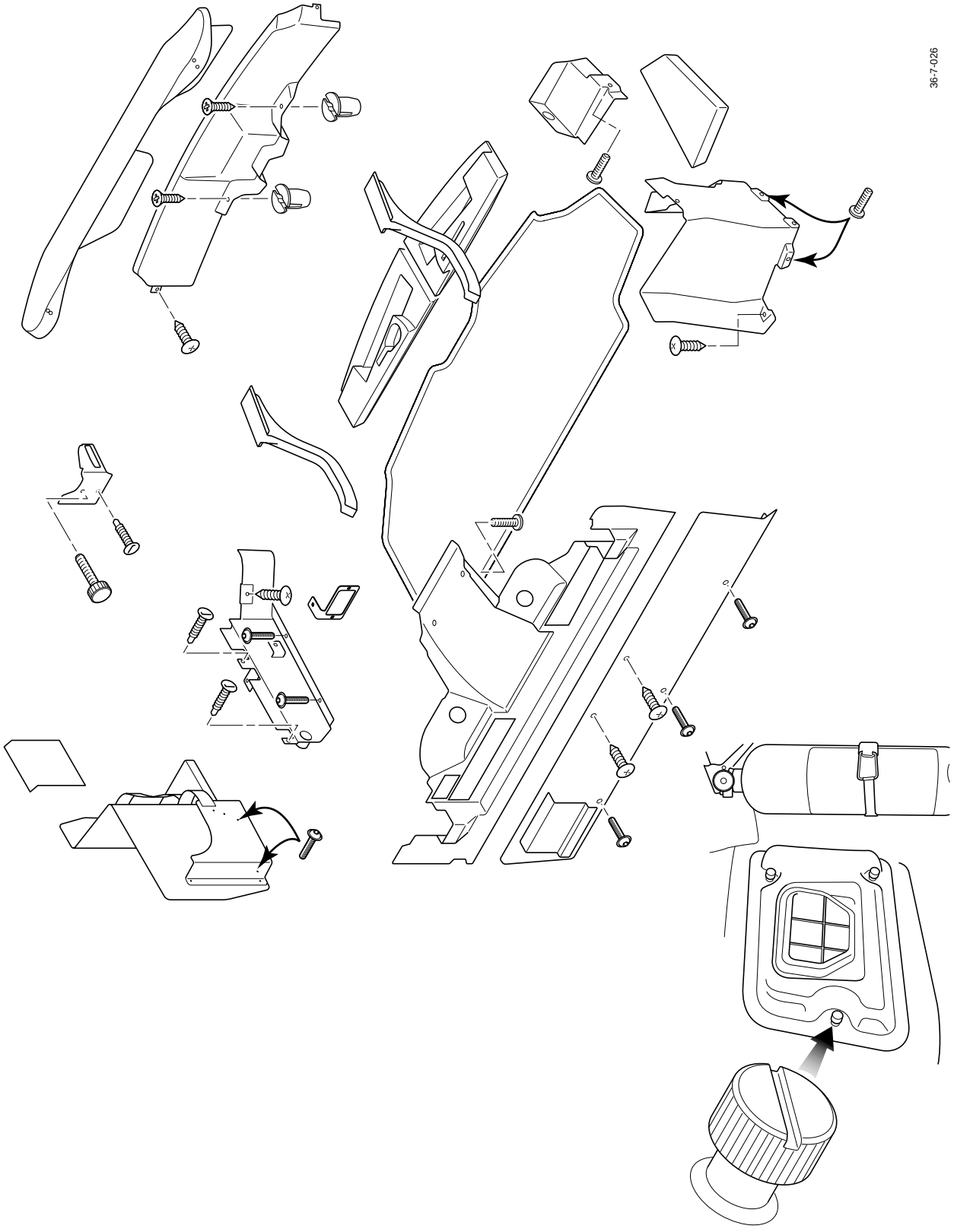


Sound Deadening

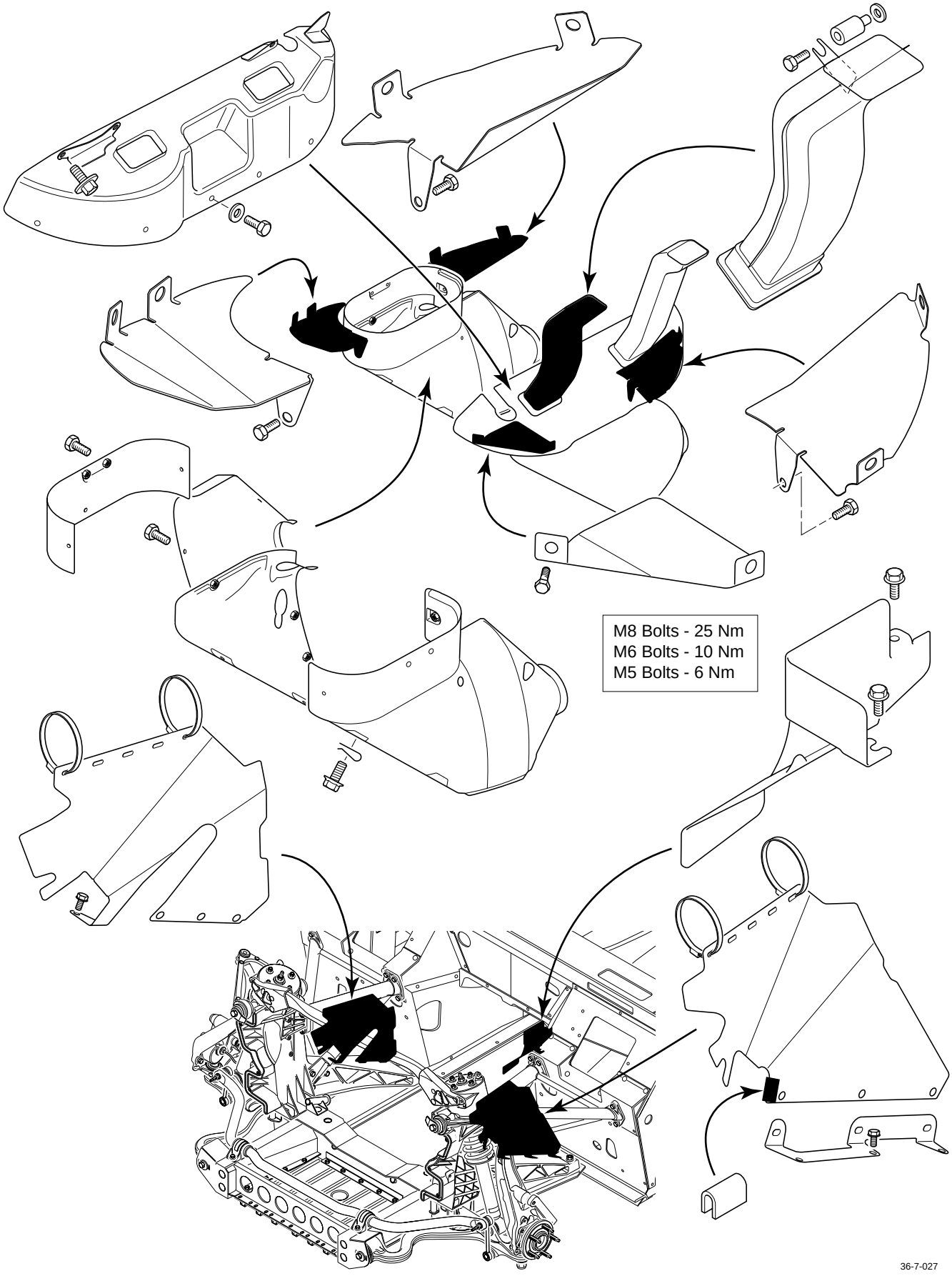


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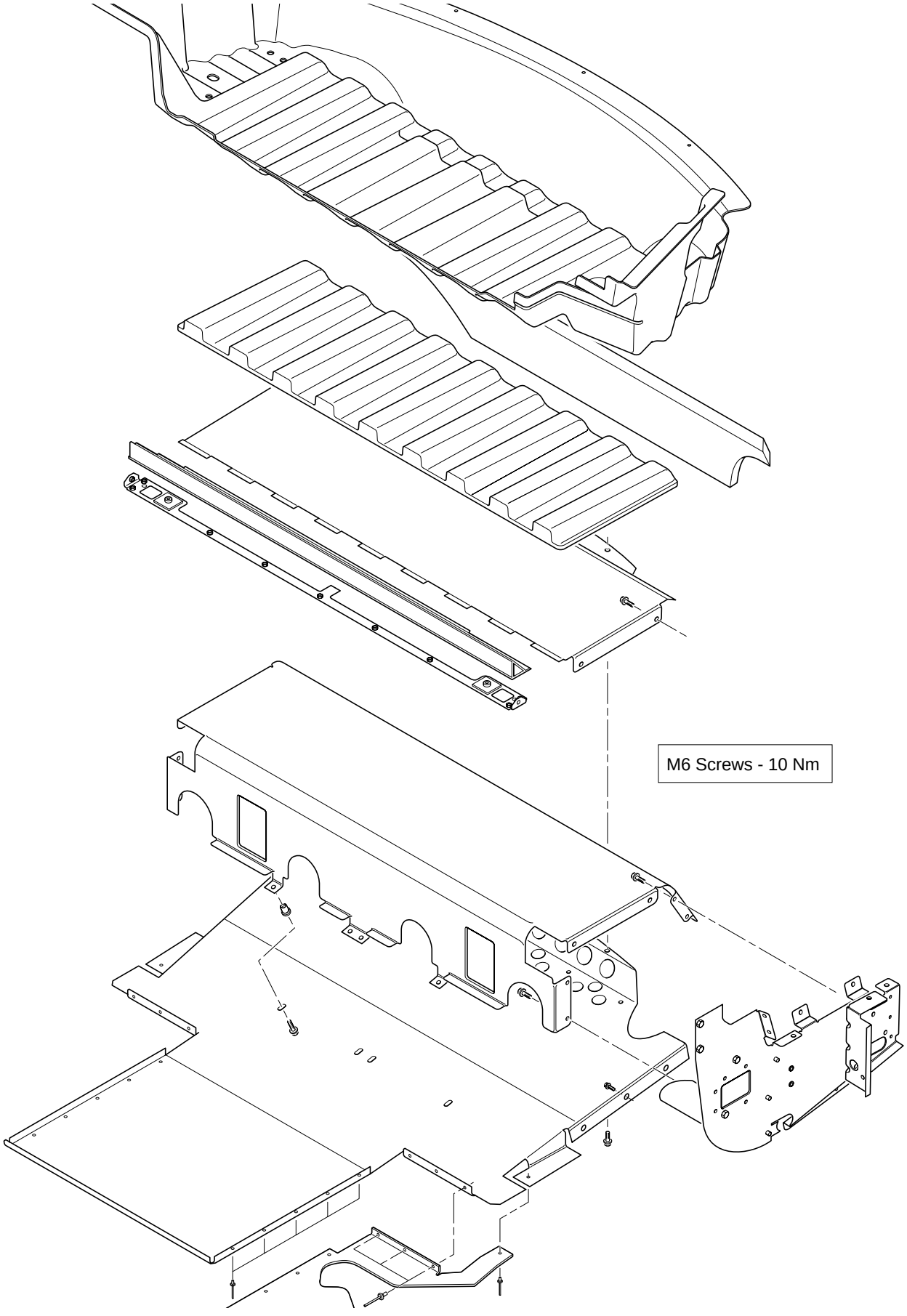
Trunk Casing



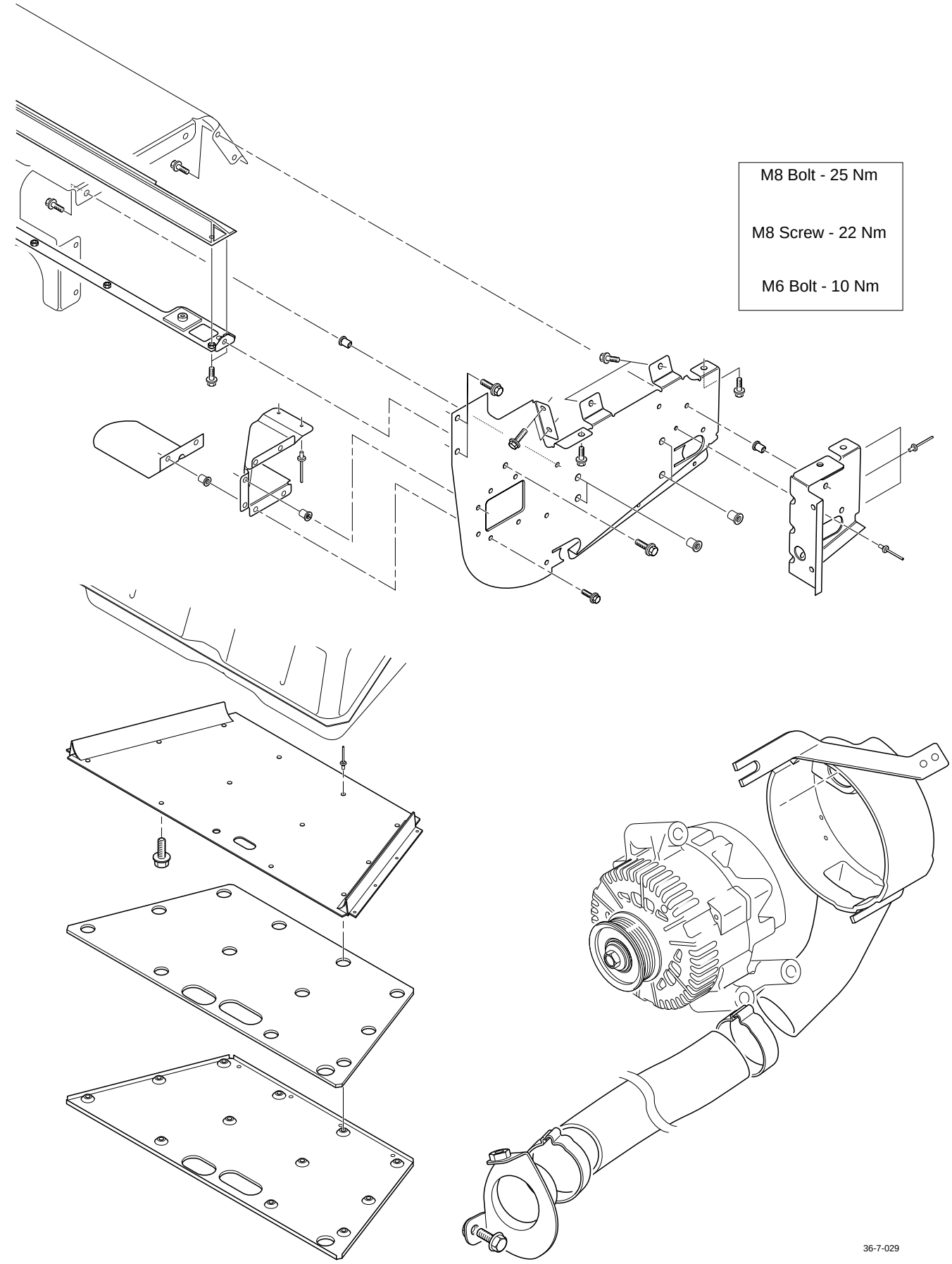
Heat Shields 1



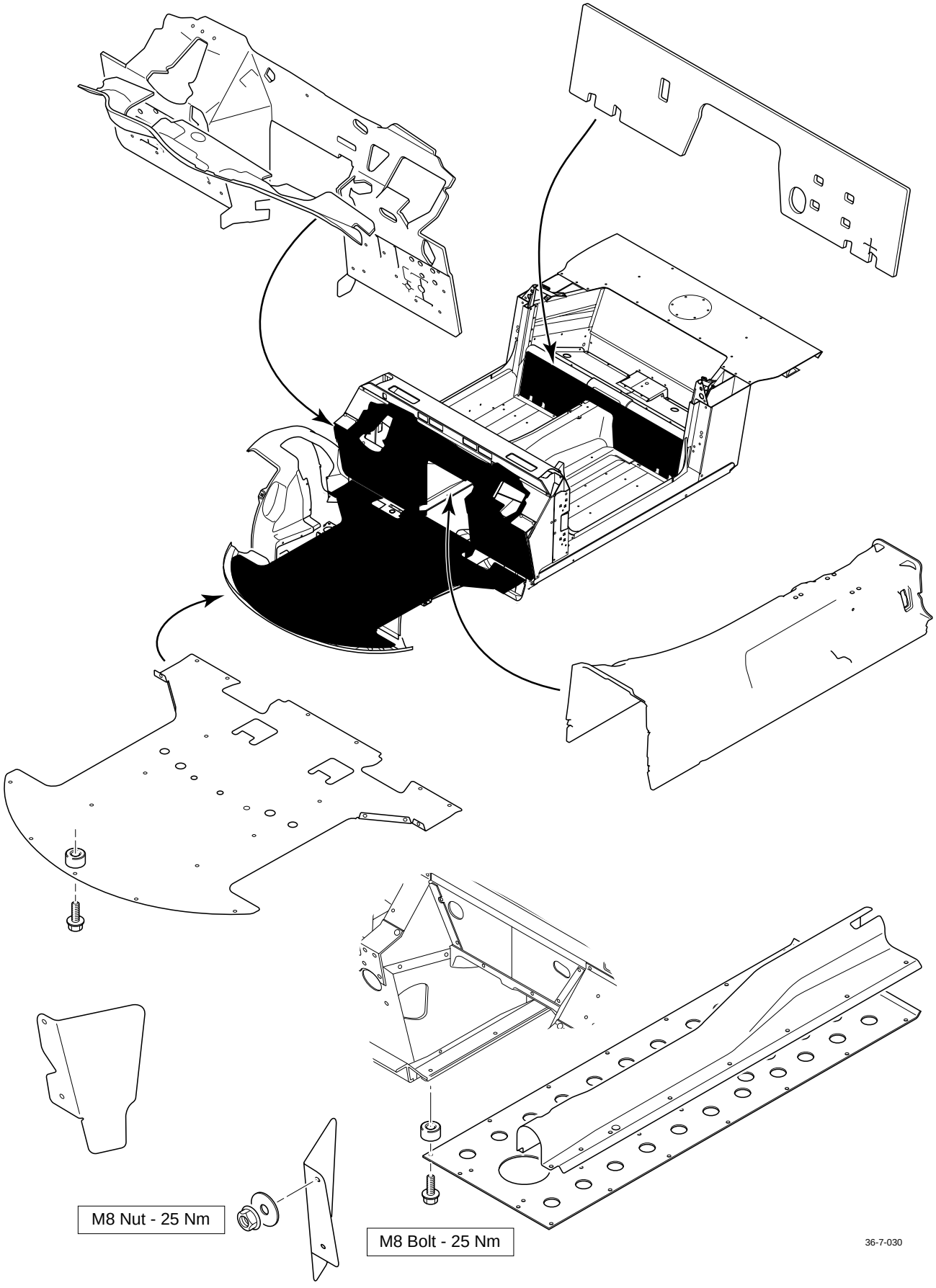
Heat Shields 2



Heat Shields 3



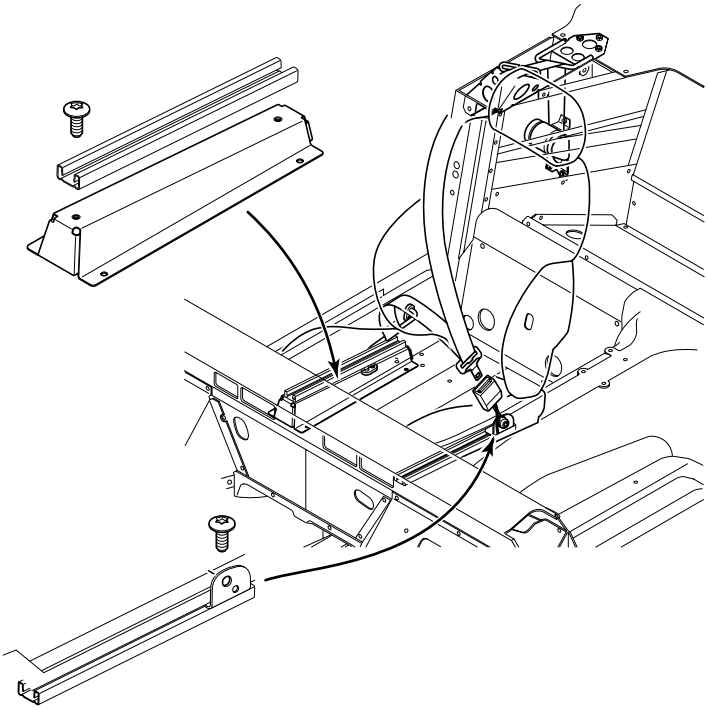
Heat Shields 4

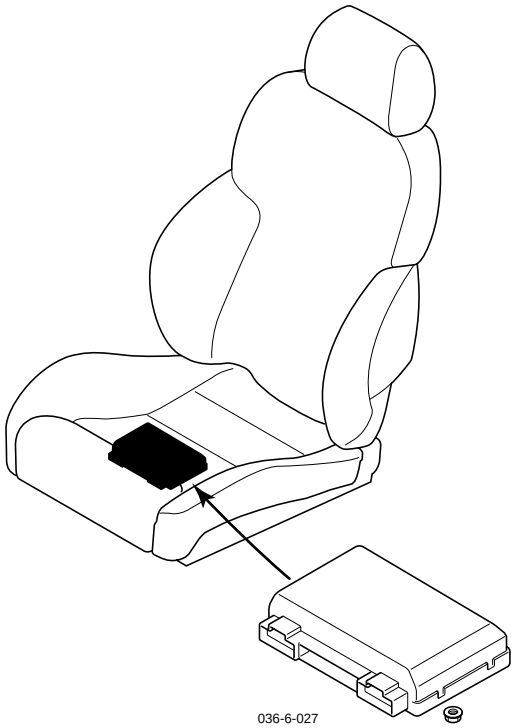


7.7.07.1 Front Seat

Removal

1. Motor the front seat forward and remove the rear securing bolts for the seat rails.
2. Motor the seat to the rear and remove the front seat rail securing bolts.
3. Tip the seat rearwards and disconnect the seat control unit.
4. Remove the seat assembly.



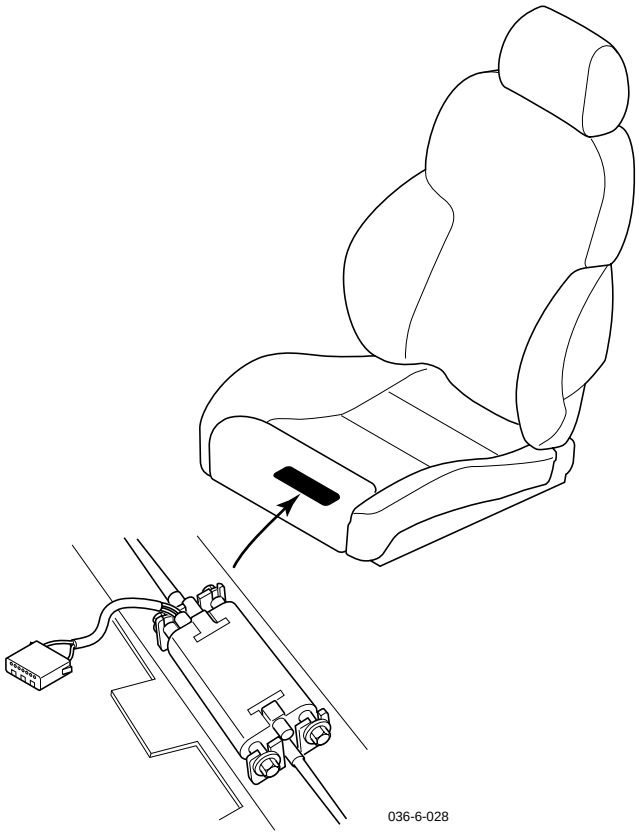


036-6-027

7.7.01.8 Front Seat Rail Motor

Removal

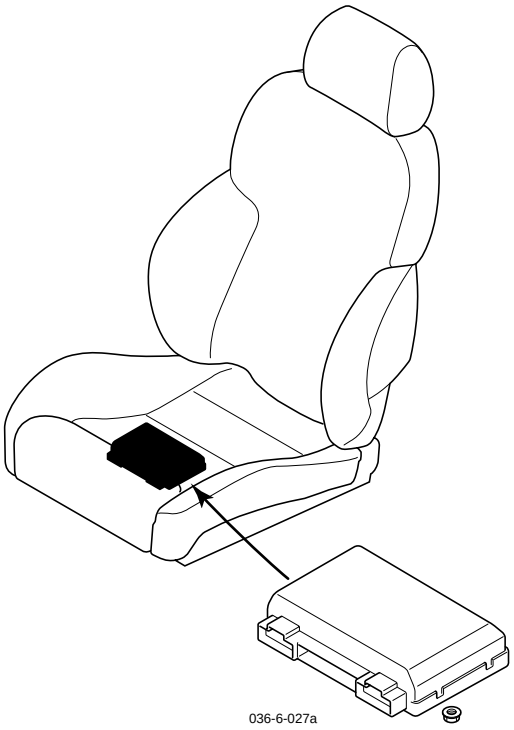
1. Remove the seat from the vehicle (6.6.03).
2. Remove the front seat runner assembly from the seat (6.6.04).
3. Remove the seat harness clamp.
4. Disconnect the seat rail motor plug.
5. Loosen the motor securing screws and remove the motor/drive assembly.



6.5.01.19 Seat Control Module

Removal

1. Remove the seat (7.x.xx).
2. Release the module securing screws and remove the module.



7.1.07.1 Bonnet (Hood)

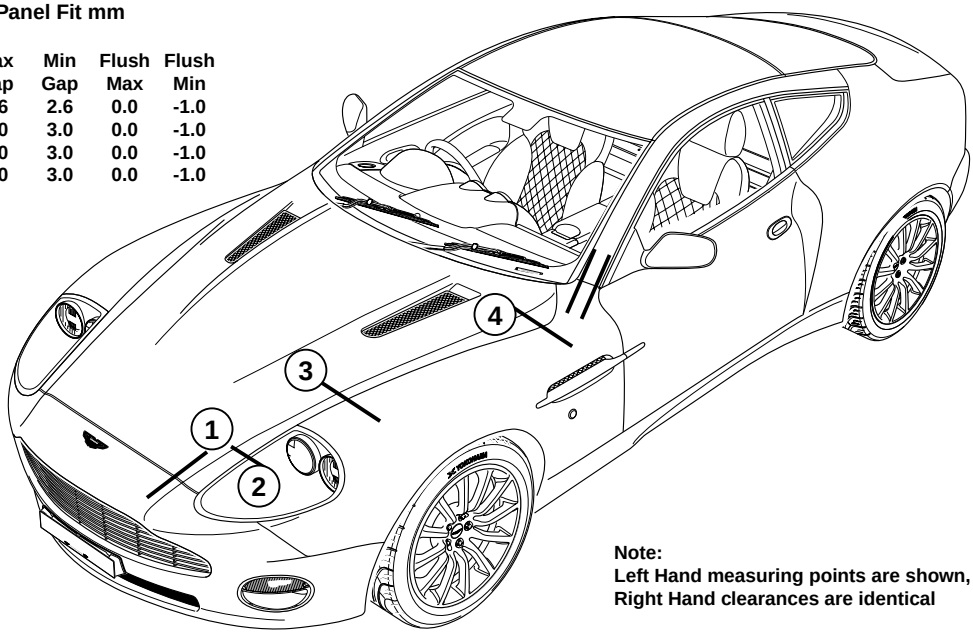
Removal

Warning: The bonnet (hood) is heavy. Removal / Replacement is a two person operation.

1. Open the bonnet (hood).
2. Slightly loosen four M8 bolts securing the hinge to the bonnet.
3. With two persons supporting the bonnet, disconnect the gas struts and remove the four hinge bolts.
4. Remove the bonnet.

Panel Fit mm

Item	Max Gap	Min Gap	Flush Max	Flush Min
1	4.6	2.6	0.0	-1.0
2	5.0	3.0	0.0	-1.0
3	5.0	3.0	0.0	-1.0
4	5.0	3.0	0.0	-1.0



Note:
Left Hand measuring points are shown, Right Hand clearances are identical

Replacement / Realignment

Note: If many exterior panels have been removed, realignment should be completed in the following sequence.

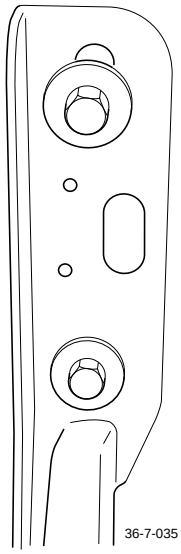
a) doors

b) wings

c) front apron

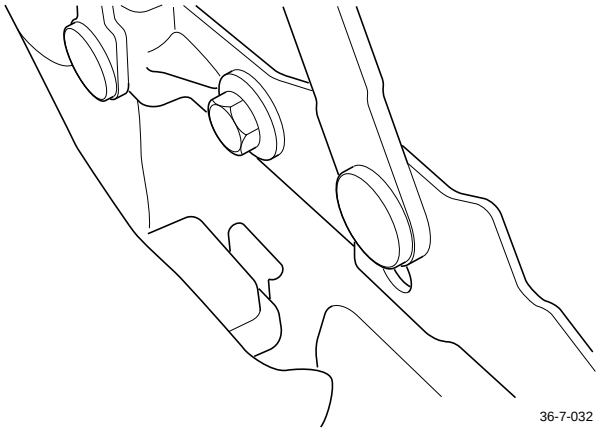
d) Bonnet

1. With two persons carrying the bonnet, align the bonnet to the hinges and loosely fit four M8 bolts. Gently lower the bonnet and adjust the alignment so that the corners do not touch the wings at front and rear.



2. Align the bonnet front edge centrally in the aperture and move it front to rear as necessary to achieve the correct gaps.
3. Partially raise the bonnet and nip up one hinge bolt either side.

4. Lower the bonnet again to check for correct alignment and readjust if necessary. Adjust the hinge mountings to the body to acquire the correct flush fit of the rear edge.

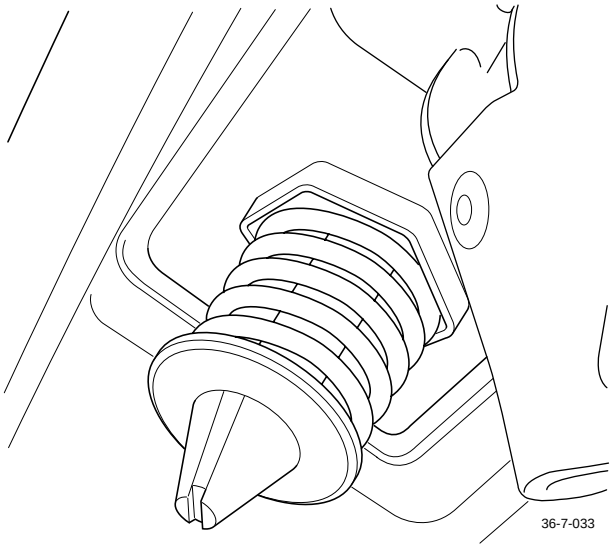


5. Fully raise the bonnet and torque all hinge bolts.

6. Fit the bonnet gas struts to the hinges.

7. Gently close the bonnet and check for correct engagement of the bonnet latch. Adjust the latch if necessary.

8. Fully close the bonnet again and check for correct flush fit of the bonnet front edge to the wings. If necessary, adjust the bonnet catch to achieve the 0 to -1 mm flush specification. Loosen the large nut above the spring and rotate the conical bonnet catch until the bonnet is flush with the wings. Lock the catch by tightening the large nut.



9. Fully close the bonnet. Check for correct operation of the bonnet release lever, the bonnet release switch and the key fob bonnet release.

7.1.09.1 Boot (Trunk)

Removal

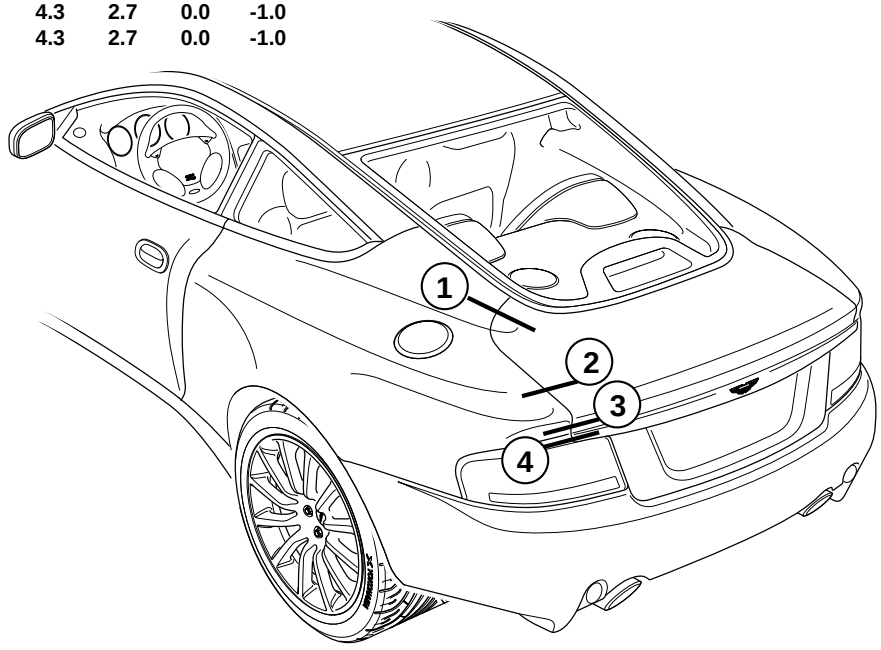
Warning: The boot (trunk) lid is heavy. Removal / Replacement is a two person operation.

1. Open the boot (trunk).
2. Disconnect the boot lid harness at the fusebox and release the harness.
3. Slightly loosen four M6 bolts securing the hinges to the boot lid.
4. With two persons supporting the boot lid, disconnect the gas struts and remove the hinge bolts.
5. Remove the boot lid.

Boot Lid Panel Fit mm

Item	Max Gap	Min Gap	Flush Max	Flush Min
1	4.3	2.7	0.0	-1.0
2	4.3	2.7	0.0	-1.0
3	4.3	2.7	0.0	-1.0
4	4.3	2.7	0.0	-1.0

Note:
Left Hand measuring points are shown, Right Hand clearances are identical

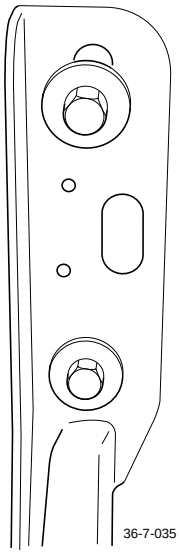


Replacement / Realignment

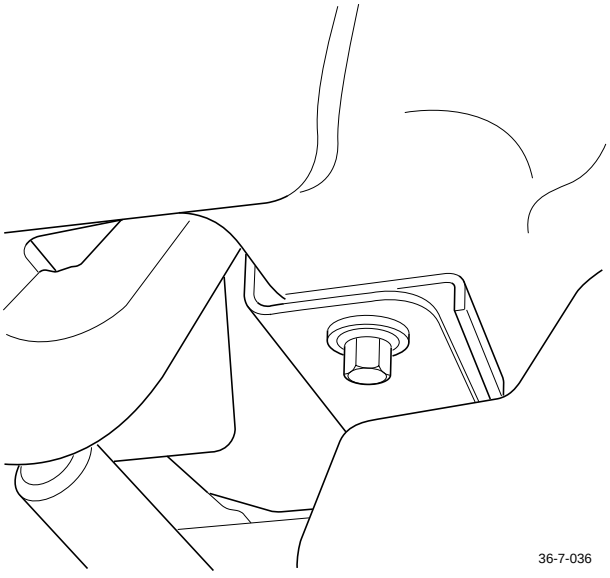
1. With two persons carrying the boot lid, align the lid to the hinges and loosely fit four M6 bolts. Gently lower the rear edge, checking that the front corners do not touch the rear wings.

2. Align the front edge centrally in the aperture and move it front to rear as necessary to achieve the correct gaps.

3. Partially raise the boot and nip up the hinge bolts.



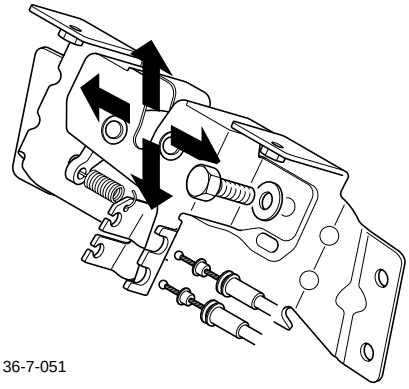
4. Lower the boot lid again to check for correct alignment and readjust if necessary.



5. Fully raise the lid and torque the hinge bolts.

6. Fit the gas struts to the hinges.

7. Gently close the boot lid and check for correct engagement of the latch. Adjust the latch if necessary by loosening the latch bolts and moving the latch assembly on its bracket. Tighten the latch bolts on completion of the adjustment.



8. Fully close the boot. Check for correct operation of the boot release lever, the boot release switch and the key fob boot release.

9. Refit the boot trim.

7.1.05.3 Finished Doors

Removal / Replacement of Finished Door

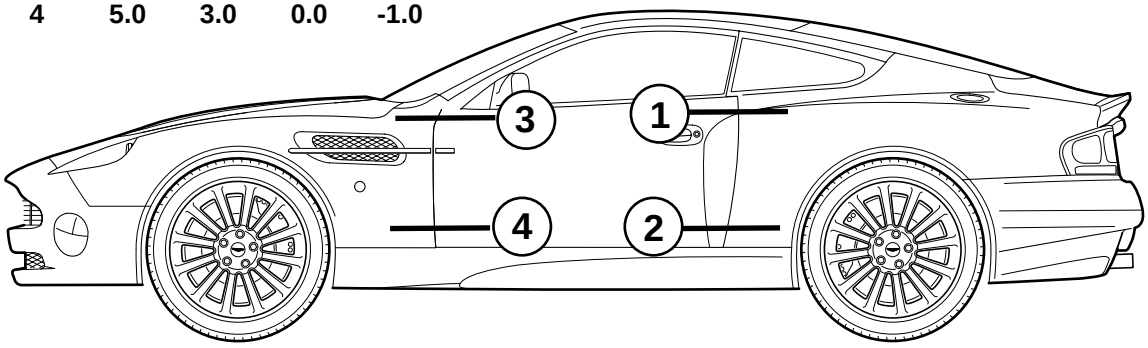
Warning: The doors are heavy. Removal / Replacement is a two person operation.

1. Switch off the battery disconnect switch and open the door.
2. Disconnect the door harness at the front edge of the door. Disconnect the door check strap.
3. Slightly loosen two door hinge locking screws. Have a colleague support the outer end of the door. Remove the locking screws and remove the door.

Door Panel Fit mm

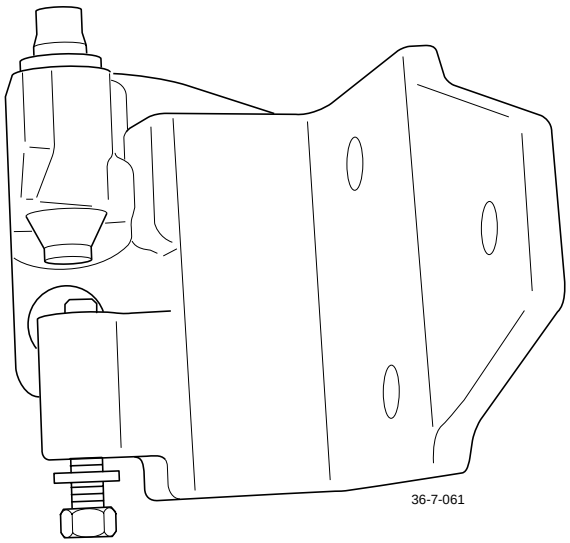
Item	Max Gap	Min Gap	Flush Max	Flush Min
1	5.0	3.0	0.0	-1.0
2	5.0	3.0	0.0	-1.0
3	5.0	3.0	0.0	-1.0
4	5.0	3.0	0.0	-1.0

Note:
Left Hand measuring points are shown, Right Hand clearances are identical



Replacement / Realignment

1. With two persons carrying the door, align the door to the upper hinge and fit the locking screw.



2. Align the lower hinge and fit the locking screw.
3. Reconnect the door harness connector and the door check strap.
4. Check the front edge alignment and adjust as necessary. Add/remove shims to achieve the specified flush fit. Move the door left/right on the A post to achieve the correct gaps. Secure the door hinges.
5. Gently close the door and check for correct alignment and closure of the door latch. Adjust the latch if necessary.
6. Check for correct operation of all door lock functions.

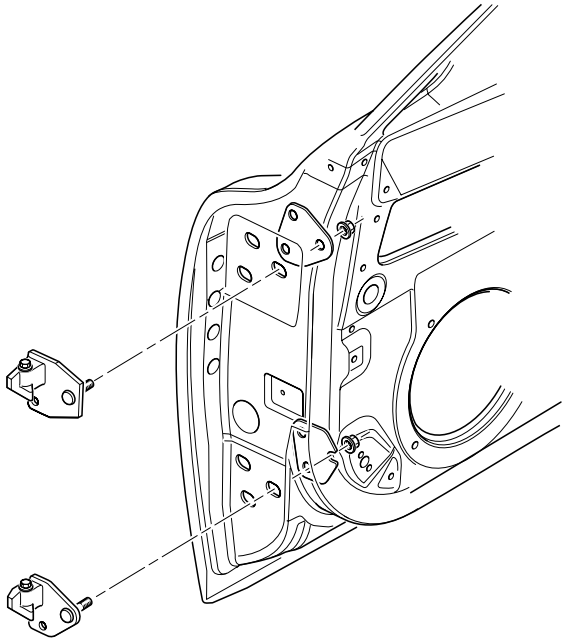
   Warning: Never touch the door lock linkage with electrical power available to the door. The window mechanism can move and trap your hands in the door frame.
7. Check for correct operation and sealing of the door window.

7.1.05.1 New Door Assembly

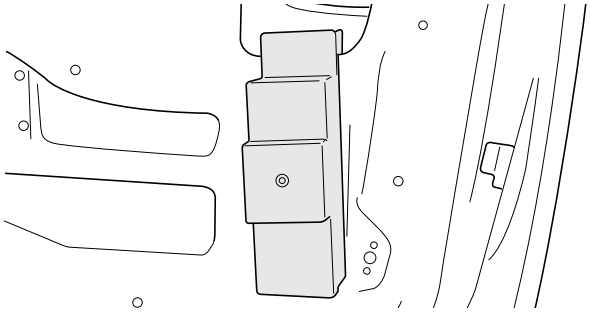
Preliminary Hinge Setup

Caution: A bare new door will settle approximately 4 mm when fully fitted and trimmed

1. Fit the door halves of the hinges to the new door carcase and offer the door to the A post. Align the door mounted hinge sections to the A post sections using the locking screws as a guide. Secure the hinges to the door.



2. Place a weight of 8.2 kg (to compensate for the weight of door windows, locks etc.) hanging from the inner door skin as shown.



Note: The weight and its position are critical to accurately simulate the weight and distribution of the door fittings. Adjustment is difficult on a fully fitted door.

3. If removed, refit and secure the front wing. Ensure that any shims under the rear fixing bolts are refitted in their original positions.

4. Gently close the door and check for an acceptable initial fit

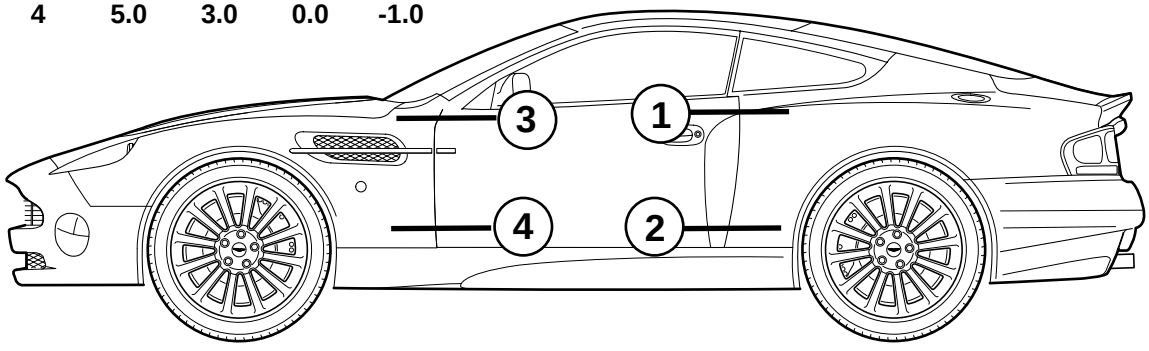
5. Adjust the door fit in the following order

   - Rear upper corner to rear wing panel (move the hinges on the A post to achieve flush and gap specs)
   - Rear lower corner (fine tune hinge position on the door to achieve flush and gap specs)
   - Front upper corner (shim the rear wing upper mounts to achieve flush and gap specs)
   - Front lower corner (shim the rear wing lower mounts to achieve flush and gap specs)

Door Panel Fit mm

Item	Max Gap	Min Gap	Flush Max	Flush Min
1	5.0	3.0	0.0	-1.0
2	5.0	3.0	0.0	-1.0
3	5.0	3.0	0.0	-1.0
4	5.0	3.0	0.0	-1.0

Note:
Left Hand measuring points are shown,
Right Hand clearances are identical

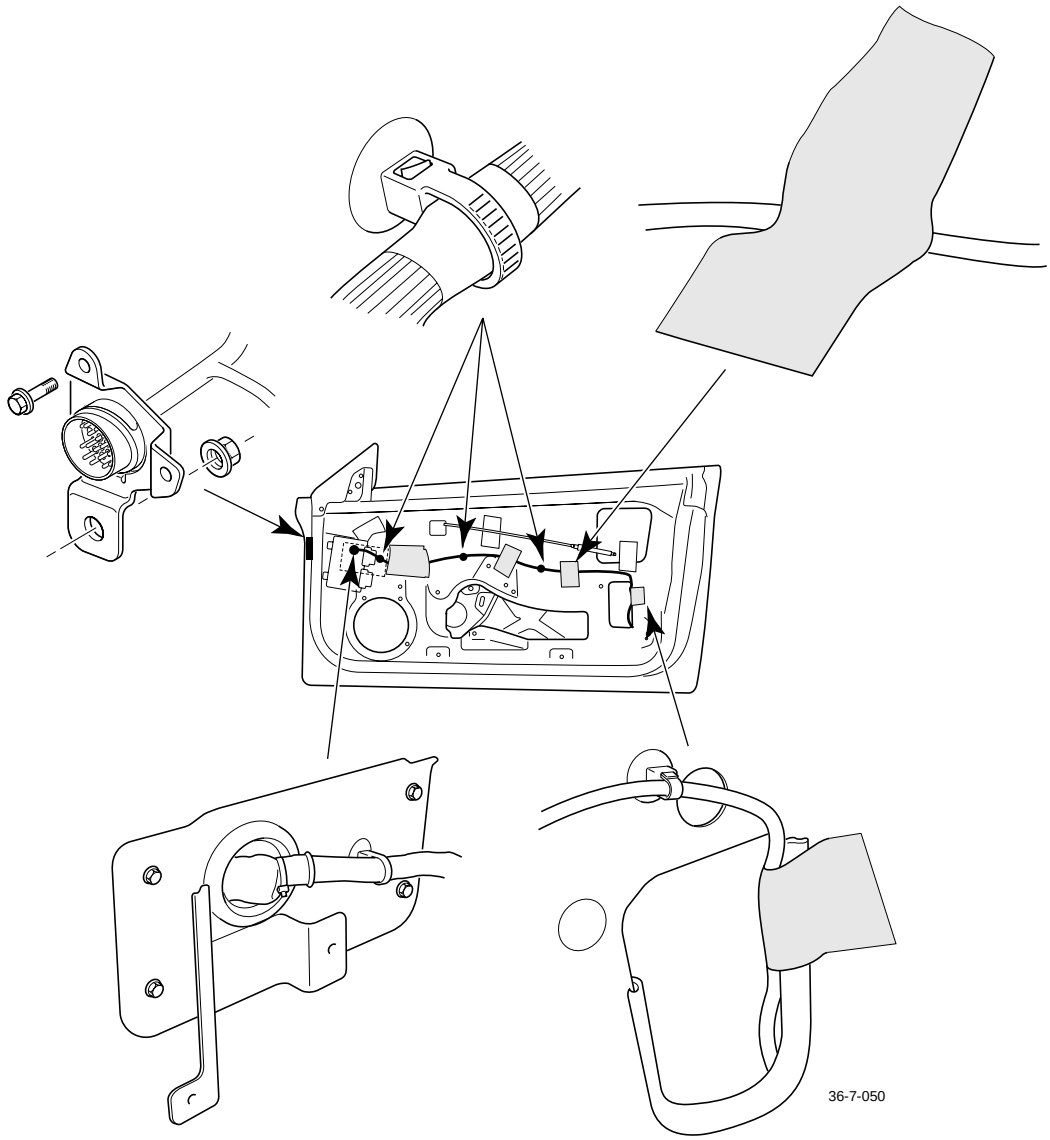


6. Open the door and secure all hinge bolts. Remove the door weight.

7. Release the hinge locking screws and remove the door for fitting of the window, locks etc.

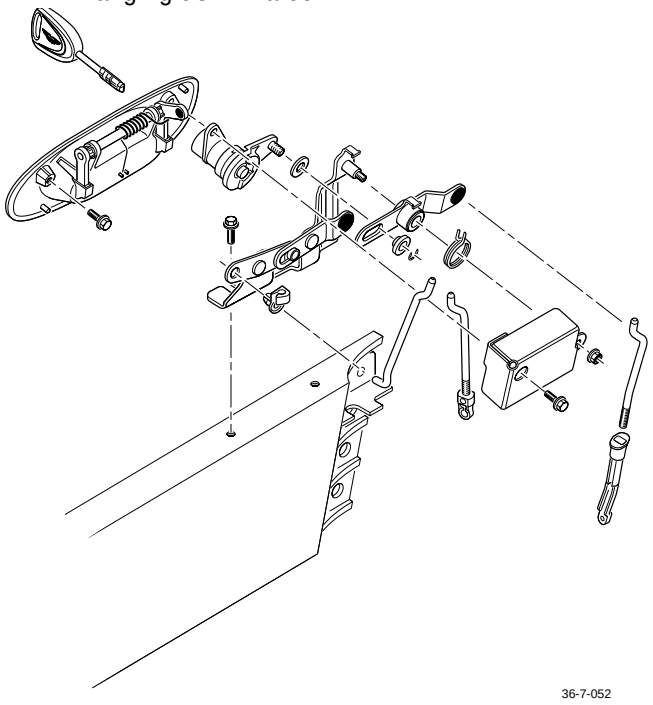
Door Interior Fit

8. Fit the mounting plate to the door harness connector. Fit the connector assembly to the inside of the door and secure. Feed the harness through the grommet hole and secure the grommet. Fit the harness clips and secure the door harness. Tape the harness to the door in the positions shown.



9. Fit the exterior door handle and secure with one M5 screw at the front.

10. Fit the door lock and linkage. Secure the linkage and door handle with one M5 screw through the door lock shield and one M5 nut at the rear of the shield. Ensure that the two links are fitted and hanging downwards.

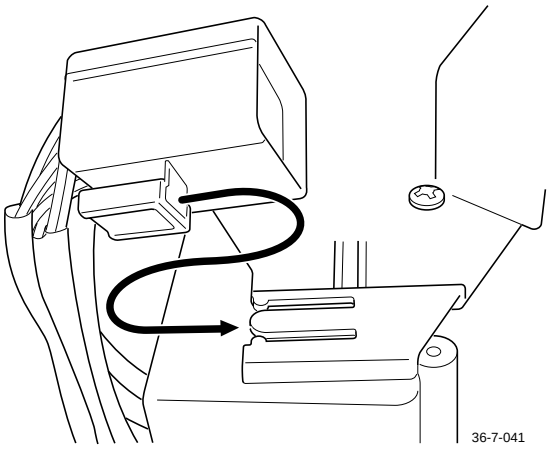


11. Ensure that the door harness connector is disconnected from the car

    Ensure that the white plastic transit pin is fitted to the latch assembly.

    Warning: Ensure that electrical power to the door is disconnected. Never touch the door lock linkage with electrical power available to the door. The window mechanism can move and trap your hands in the door frame.

    Connect the harness connector to the latch assembly and engage the connector onto the tab on the latch body.



    Fit the door latch assembly with the latch link pointing upward. Secure the assembly with three M6 torx screws.

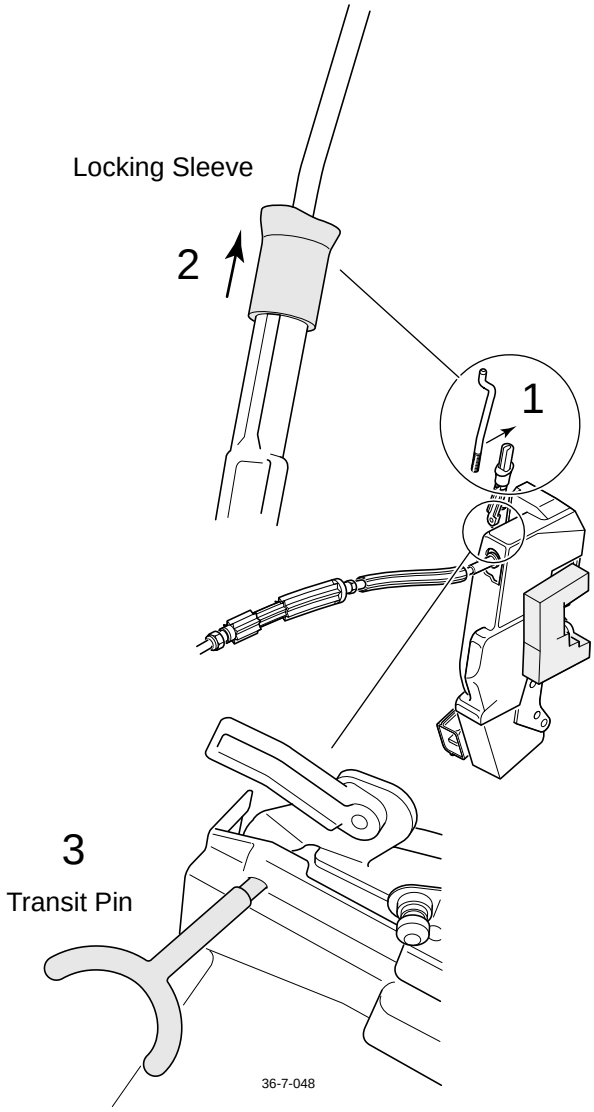
12. Latch Link Setting

    Warning: Danger of trapped fingers. Double check that all electrical power is removed from the door

    Ensure that the key is removed from the door lock and that the lock is free and in its central position.

    Slide down the locking sleeve on the latch link rod.

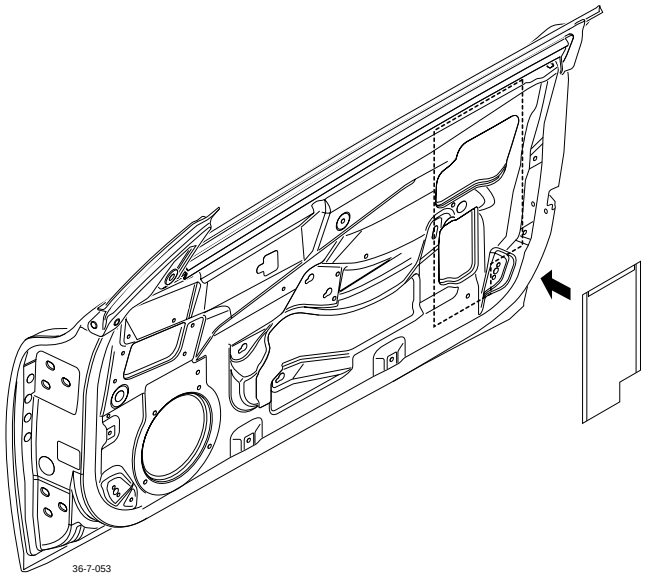
    Ensure that the door link and latch link are in their relaxed position. Nip the door lock link into the latch link and raise the locking sleeve.



    Remove the white plastic transit pin from the latch assembly.

13. Route the interior handle cable towards the front of the door.

14. Fit the small water shedder inside the rear upper door aperture. Seal the water shedder around the latch cable.



Door Cheater Panel

15. Fit the friction bush to the mirror mounting hole.

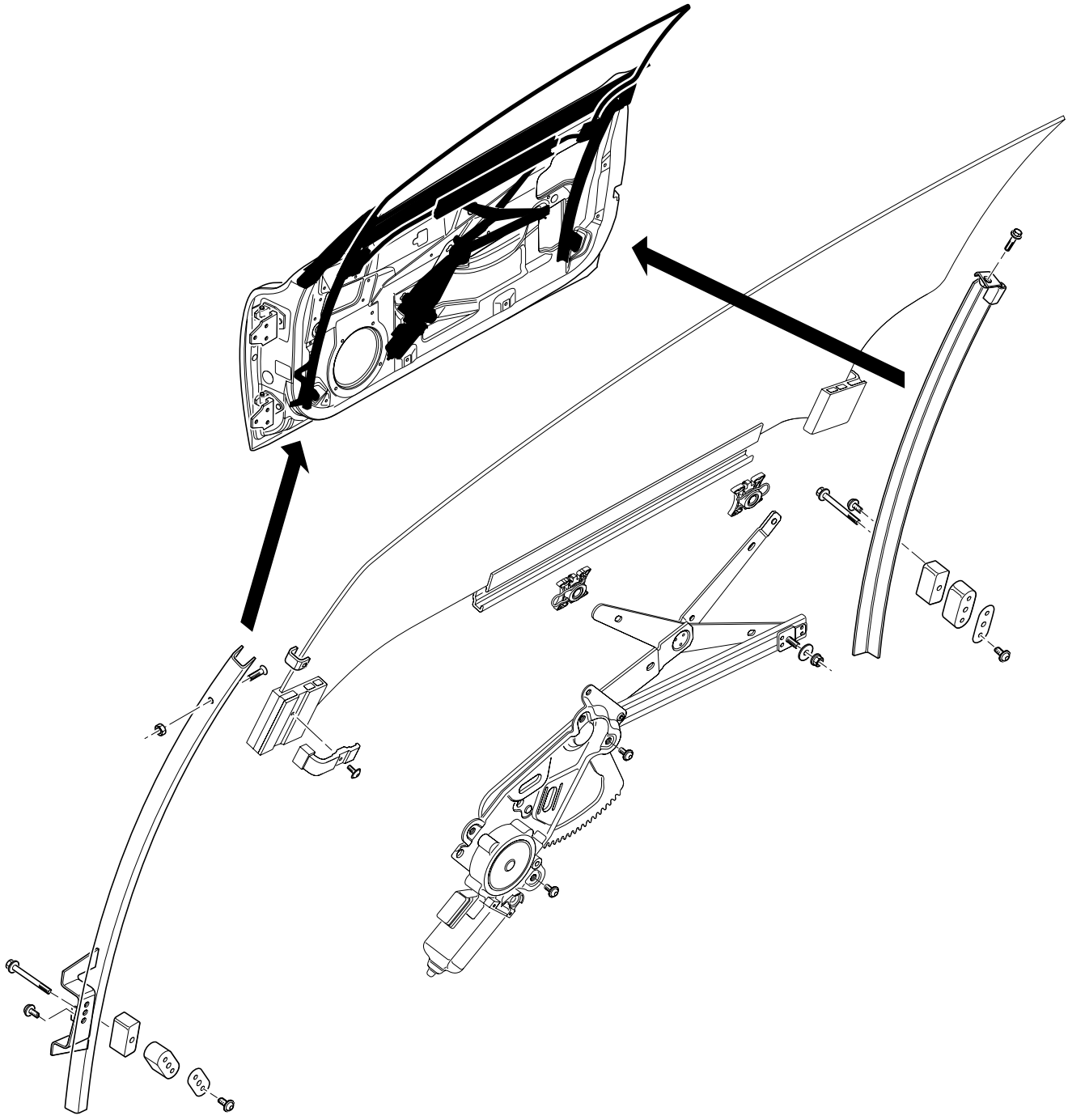
16. Fit the door cheater seal assembly and secure with the firtree fasteners.

Window Regulator and Door Glass

17. Fit the front window channel and secure with one M6 nut and bolt at the top and two M6 torx screws at the bottom.

18. Fit the regulator assembly and secure with four M6 screws and two M6 nuts and washers.

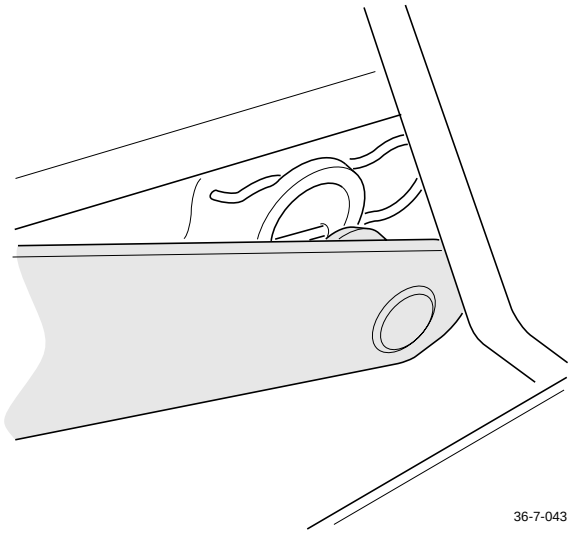
19. Fit the rear window runner and secure to the door frame. with one M6 nut and bolt at the top and two M6 torx screws at the bottom.



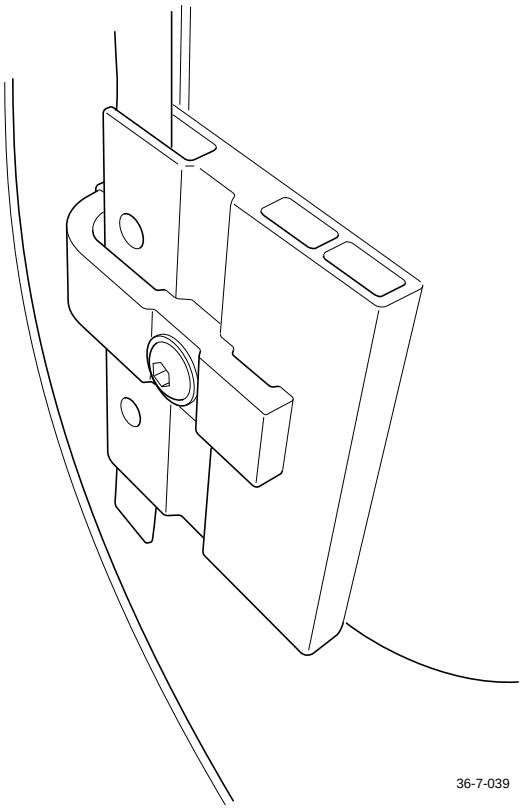
20. Lightly grease the slide rail and both window runners with a good quality high melting point grease.

21. Fit the slide bars to the window bottom slide rail.

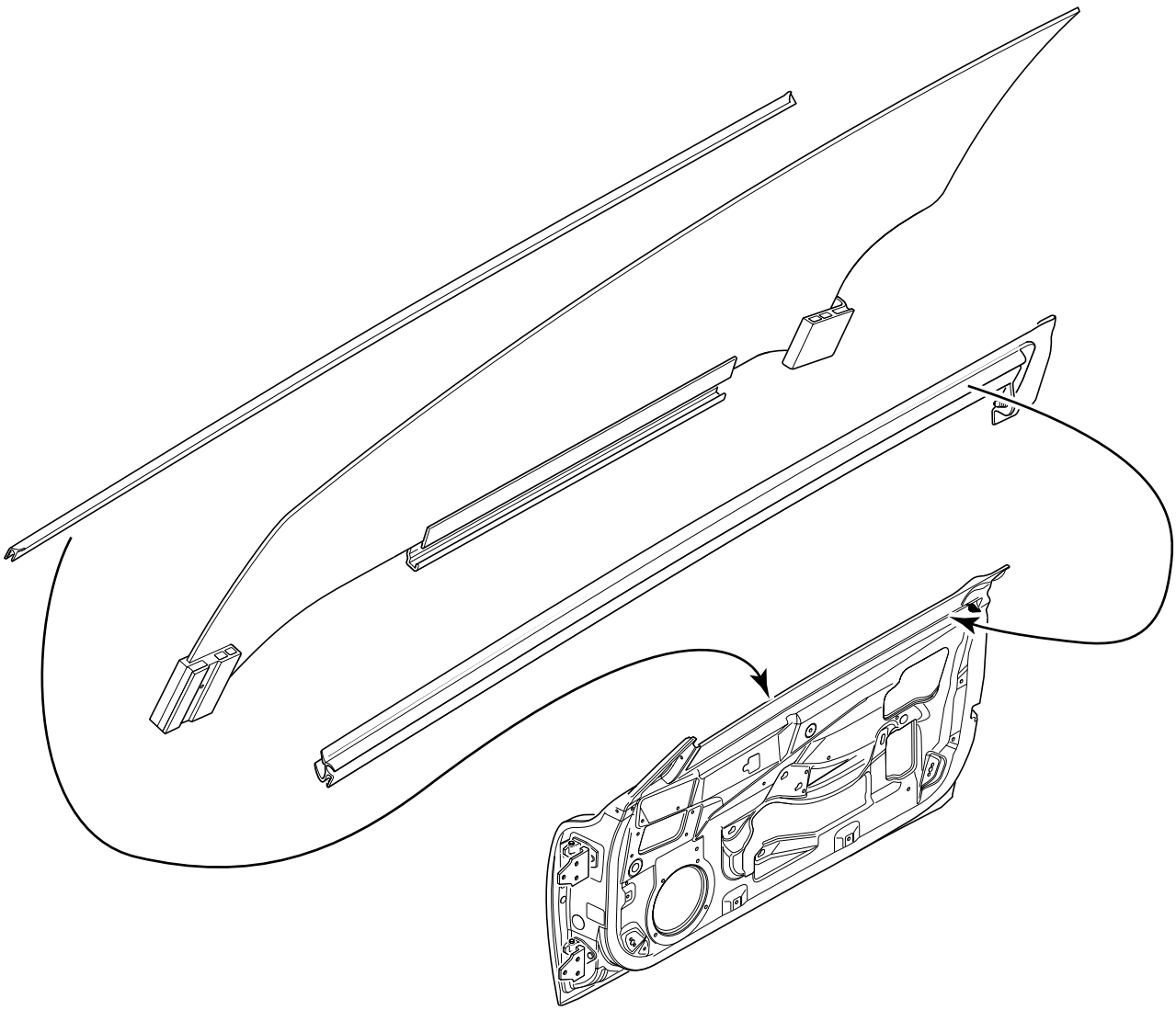
22. With the aid of a colleague, fit the window glass to the door. Engage the ball ended pins on the regulator arms into the recesses in the slide bars. Ensure that the spring locking clips are fully engaged.



23. Fit the slider clamps to the front and rear of the window glass.



24. Fit the outer and inner weather strips to the door casing.



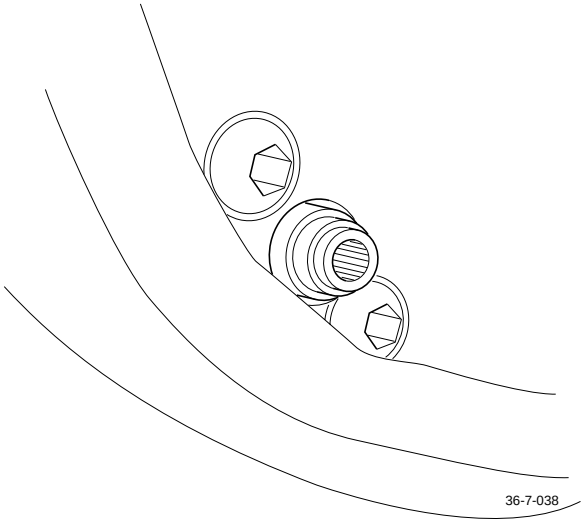
Warning: In the next steps, do not put your hands in the door with the harness connected. Danger of hands being trapped in the window regulator mechanism.

25. If possible, connect the door harness to the car and test the window movement.

    If satisfactory, disconnect the harness, fit the door to its hinges and secure the hinge locking screws. reconnect the door harness.

26. Close the door. Temporarily fit the door window switch to the door harness.

    Switch on the ignition and raise the door glass in stages. Check for correct alignment of the glass to the door seals at each stage as the glass approaches the fully closed position.



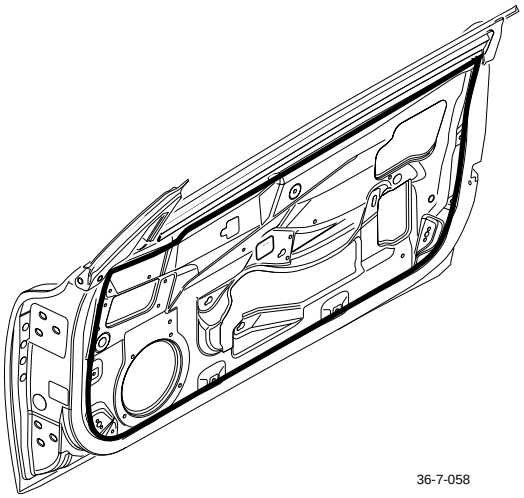
If necessary, disconnect power to the door and realign the glass guide rails using the adjusters at the bottom of the guide rails to achieve effective water sealing all around the door glass.

Once satisfactory alignment is achieved, fully tighten all the rail fixings.

Water Shedder and Door Module

27. Clean the inner face of the door in preparation for fitting the inner water shedder. Slit the shedder as necessary to fit around the door harness, door module bracket etc.

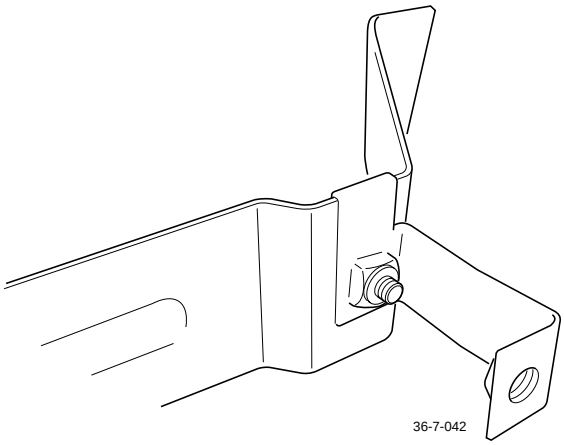
28. Using double sided tape, attach the large water shedder to the inside of the door casing. Seal around the harness slit etc. with waterproof tape to ensure a complete seal.



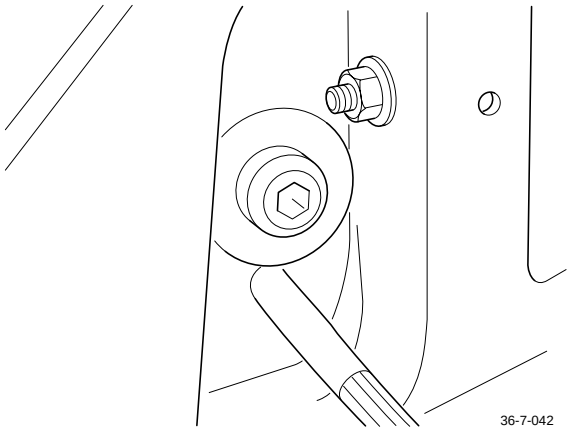
29. Fit the door module bracket and door module. Connect the module harness connector.

Door Trim

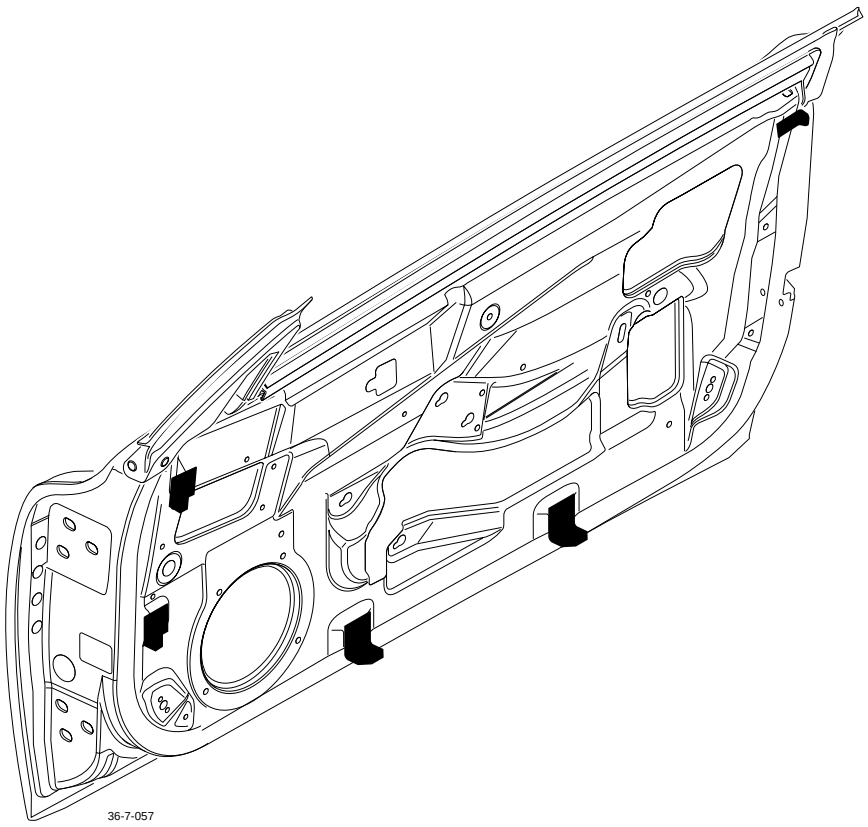
30. Fit the handle mounting bracket and secure with two M6 screws. Fit the handle fixing spacer to the rear of the bracket as shown and secure with one M6 screw.



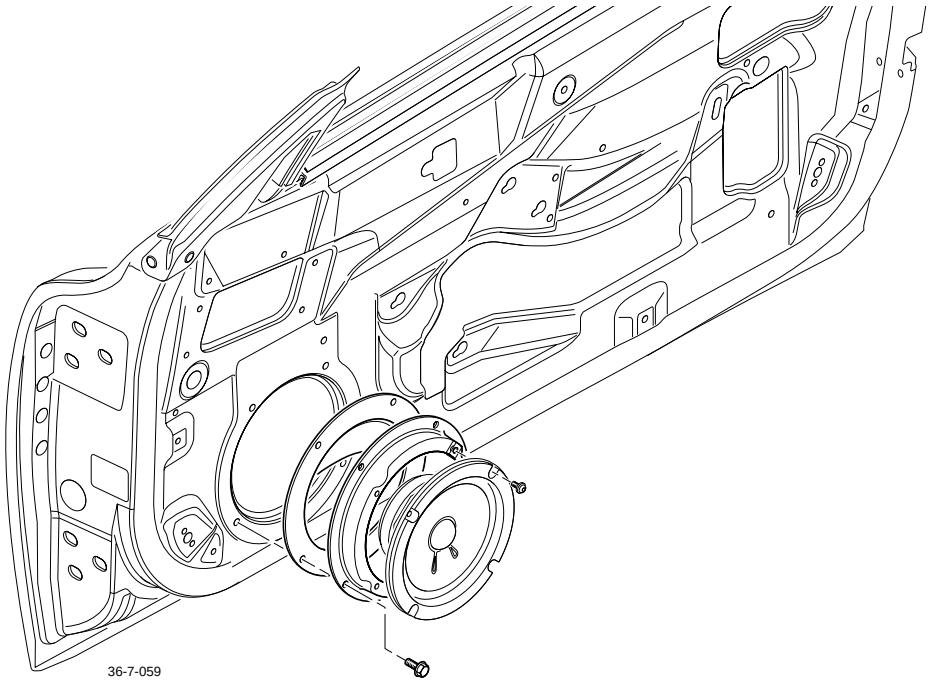
31. Fit and connect the door mirror. Secure with one M8 screw. Fit the cheater interior trim.



32. Fit four trim mounting brackets and secure each with one M6 screw. Fit one upper mounting bracket and secure with two M6 screws.



33. Fit the door speaker water shedder and speaker mounting bracket.



34. Connect the door speaker harness connector. Fit the door speaker and secure with four screws.

35. Fit the speaker foam seal.

36. Engage the door inner handle to the end of the latch cable and lock the cable in position. Fit the door inner handle and secure to the door with one M5 screw.

37. Offer the door trim panel to the door and connect the window and mirror switches. Fit the door trim panel and secure with five screws around the outer edges. Fit the door pull and secure with two M6 screws.

38. Connect and fit the door mirror and secure with one M8 screw. Fit the cheater trim cover.

39. Close the door and switch on the ignition. Carry out a full functional check on the window, mirror and locking functions.

Module Replacement

If it is necessary to order a replacement door module, your order MUST include the full VIN for the car plus the market and customer requirements for any programmable options in the Door Module software. A correctly programmed module cannot be supplied without this information.

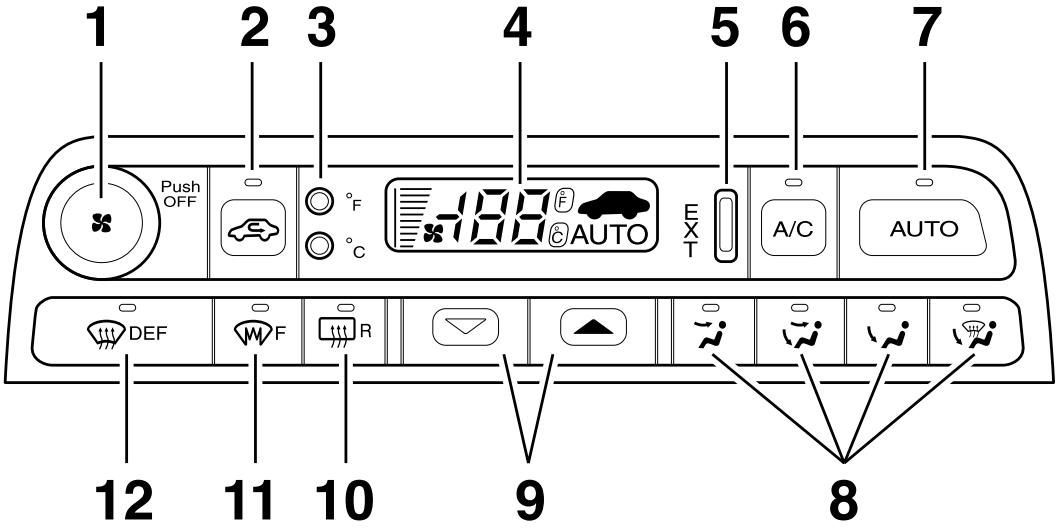
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Air Conditioning Control Panel



036-8-020

Key

No.	Component
1.	Push to switch On or Off. Rotate for manual fan speed selection
2.	Manual recirculation/outside air
3.	Centigrade/Fahrenheit selection buttons
4.	Display panel
5.	External temperature
6.	Air conditioning
7.	Automatic operation
8.	Manual distribution Face only Bi-level (face and feet) Feet only Demist (Screen and feet)
9.	Temperature selection Blue - Decrease Red - Increase
10.	Heated rear screen
11.	Heated front screen (optional)
12.	Defrost

Switching the Climate Control System ON

The climate control system can be switched ON by pressing one of the following :

On / Off	(Item 1)	(restarts the system at the previous system settings).
A / C	(Item 10)	(restarts the system at the previous system settings).
AUTO	(Item 11)	(restarts the system at the previous temperature setting).
DEF	(Item 12)	(restarts the system at the previous temperature setting).

Switch Logic

All push switches with an integral LED state lamp conform to the following operating logic.

When the state lamp is lit the relevant function is operational. From this condition, pressing the button will de-activate the function and the LED will extinguish. A single audible 'beep' will be heard to confirm actuation of any function switch.

Communication between the control panel and the A/CCM is via a serial data communications link.

Control Switches

1. ON / OFF & manual fan speed.

Pressing this knob switches the system ON at the last setting. Press again to switch the system OFF.

Rotate the knob clockwise to increase and anti-clockwise to decrease the fan speed and thus the airflow.

With the system OFF, only ram air is available. This air will be distributed according to the selected air distribution mode. Air flow will NOT occur unless a manual air distribution mode is selected. Any ram air which enters the passenger compartment will be unconditioned (no heating, cooling or dehumidifying) and airflow will be dependent upon vehicle speed.

NOTE: The blowers are inhibited until the engine coolant temperature is above 35°C, unless DEFROST is selected.

2. Manual Air Recirculation

Closes the outside air intakes of the blower assemblies and recirculates air within the vehicle.

Two options of control are available :

- Timed Recirculation. Pressing the button for less than 1.5 seconds lights up the LED (confirmed by a single bleep). The recirculation flaps will actuate and the fans will run at the set speed. Interior air will circulate for a period of approximately 5 minutes. Pressing the button within five minutes returns the system to fresh air intake mode.
- Continuous Recirculation. Pressing and holding the button for more than 1.5 seconds lights up the LED (confirmed by two beeps). This provides continuous recirculation of interior air. Pressing the button returns the system to fresh air intake mode.

NOTE: Avoid using manual air recirculation for prolonged periods. Such use may result in interior misting on cold glass surfaces and in diminished oxygen supply for the vehicle occupants

3. Temperature Scale Selection

Press the appropriate button to display temperatures in degrees Celsius or in degrees Fahrenheit.

Liquid Crystal Display (LCD) (Items 4-8)

4. Manual Fan Speed

Rotating the fan speed control knob (to vary fan speed) will display a proportional number of horizontal bars on the LCD. There are total of eleven manual fan speeds available.

5. Temperature Display

Indicator of internal demand temperature or external ambient temperature. The external ambient is updated every 4 seconds when the road speed is greater than 25 km/h.

6. Scale

Selected temperature scale, Celsius or Fahrenheit.

7. External temperature

Symbol indicates when this option is selected

8. Automatic

Symbol indicates when the control of, temperature, fan speed and air distribution are all in Auto mode.

9. External

There are two modes of external ambient temperature selection;

- Quick Display. Pressing the button for less than 1.5 seconds (confirmed by a single bleep) will display the external temperature for 4 seconds.
- Continuous Display. Pressing and holding the button for greater than 1.5 seconds (confirmed by two beeps) displays the external ambient temperature continuously. The temperature display will be updated every 4 seconds given that vehicle road speed is greater than 25 km/h. Pressing the button again for more than 1.5 seconds resets to the previous display.

NOTE: Continuous external temperature display will be cancelled when the ignition is switched OFF but not during engine cranking.

10. A/C

This push-on / push-off button will either select or deselect the refrigeration function.

NOTE: Interior misting of screens may be reduced by continuous operation of the refrigeration system.

11. Auto

When selected and the Auto state lamp is lit, A/C mode will be operational and control of vent outlet temperature, fans speed and air distribution will be automatic.

AUTO mode will disengage should manual air distribution or defrost buttons be operated or the manual fan speed knob be rotated.

NOTE: Automatic temperature control is constantly maintained irrespective of selected manual overrides.

12. Defrost

Push-on push-off button, which when engaged will direct all air to the front and side glass at maximum fan speed. The heated windshield will also be energised for 6.5 minutes, but may be cancelled by pressing the HEATED WINDSHIELD (F) button. Pressing 'DEF' again will return to the last setting with automatic temperature control being maintained.

Directing warm and humid air onto a cold screen can produce interior misting of screens. Running the climate control system with the refrigeration system deselected will increase this problem.

NOTE: Directing cold air onto the screen in warm humid conditions can produce external condensation.

13. Heated Windshield (F)

Pressing the heated windshield button will energize the electrically heated windshield elements for 6.5 minutes; pressing the button again will cancel the request. Should the engine stall or the ignition be turned OFF, the timer will be cleared and the function cancelled.

NOTE: The heated windshield may be activated with the climate control system OFF but the engine must be running.

In very cold ambient temperatures, icing of the interior of the glass is possible when the climate control system is operating in AUTO mode; to reduce this possibility the A/CCM provides automatic operation of the heated windshield. At low ambient temperatures and with the following conditions met, the heated windshield will automatically energize but the state lamp will NOT be lit.

- External temperature below 0 °C
- Vehicle speed more than 48 km/h
- The first two conditions exist for over 2 minutes.
- Engine speed above 50 revs / min

14. Heated Rear Window (R)

Pressing the heated rear window button will simultaneously energize the heater elements for timed cycles of;

- 21 minutes rear window
- 11 minutes exterior mirrors

Pressing the button again within the 21 minute timer period will cancel the request.

If the engine is stalled, or the ignition switched OFF, the rear window and door mirror timers will be cleared, resulting in both functions being switched off.

NOTE: The backlight and door mirrors may be activated with the A/C system OFF, but the engine must be running.

15. Temperature Decrease

Pressing this button (BLUE symbol) decreases the interior temperature setting in 1° steps. The display will indicate 'LO' if a temperature below 17°C (61-62F) is selected.

16. Temperature Increase

Pressing this button (RED symbol) will raise the temperature setting in 1° increments. The display will indicate 'HI' if a temperature above 31C (89-90F) is selcted.

Automatic Temperature Control Range

The system operates within the temperature range 17 - 31°C (61 - 90°F). Outside this range, either LO (below 17°C) or HI (above 31°C) will be displayed.

Table 1: Temperature Range

°C	LO	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	HI
°F	LO	62	64	66	67	69	71	73	75	76	78	80	82	84	86	88	HI

LO demands the maximum COOLING performance from the system with the blowers operating automatically at maximum speed.

HI demands the maximum HEATING performance from the system with the blowers operating automatically at maximum speed.

Pressing and holding either temperature selection button continuously changes the setting temperature by steps of 1°, every 0.4 seconds.

NOTE: The interior temperature does not change when the temperature scale is changed between Celsius and Fahrenheit, however the temperature display will change to the nearest equivalent number.

17. Face

Pressing this button will direct all airflow to the center and side face vents only; pressing again will return the system to automatic control mode.

NOTE: When in AUTO mode and in a hot climate, a bleed of cold air is delivered to foot level. This bleed automatically shuts off when the interior temperature has cooled sufficiently.

18. Bi-Level

This push-on / push-off button will direct air to the center and side face vents and the front footwells.

Pressing the button (off) will return the system to automatic control mode.

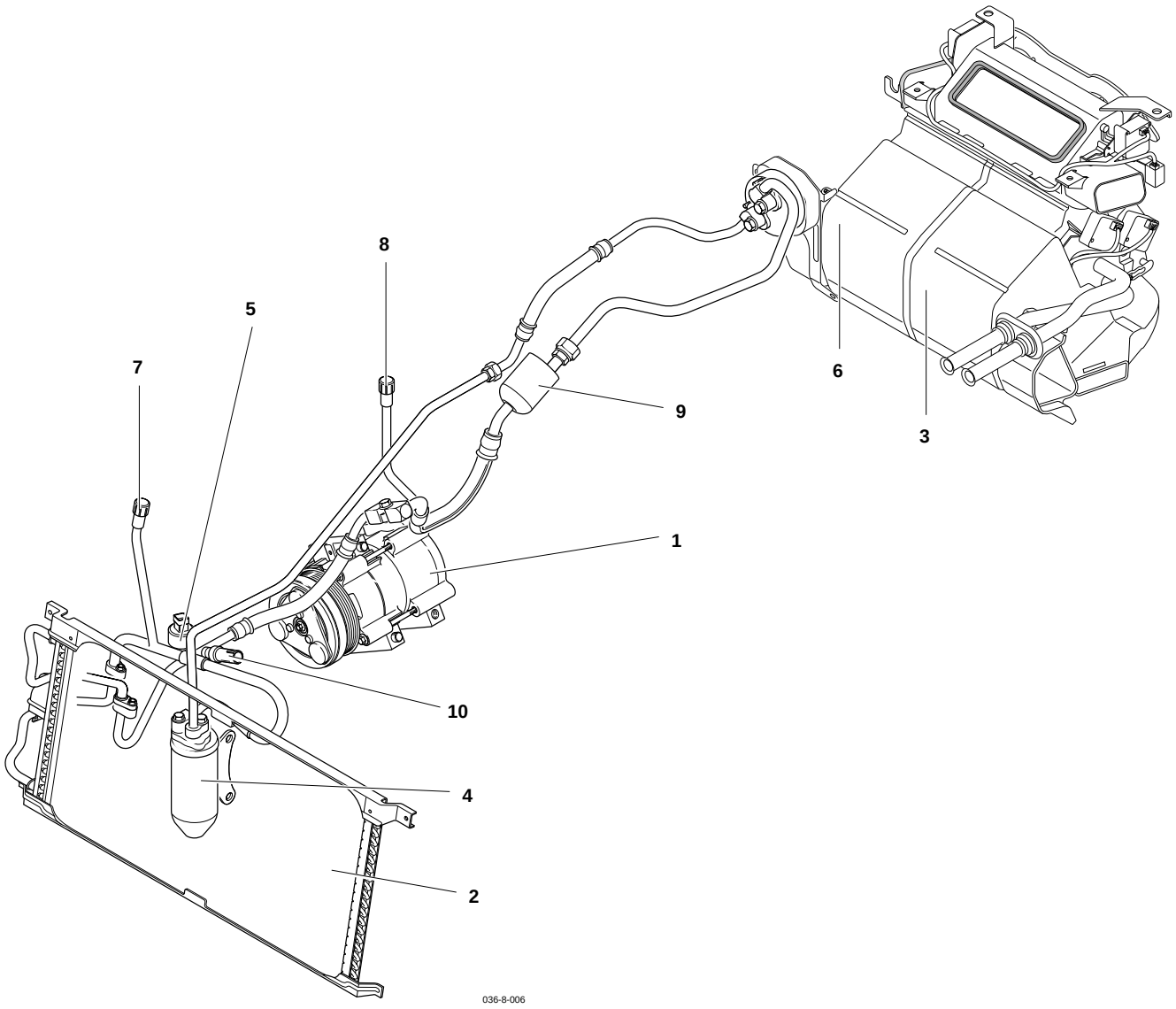
19. Foot

This push-on / push-off button will direct the majority of airflow to the front footwells with a small bleed of air to the front and side screens. Pressing the button (off) will return the system to automatic control mode.

20. Demist

Pressing this button will direct air to the front and side screens and the front footwells. Pressing the button (off) will return the system to automatic control mode.

A/C System Major Components



Item	Description	Item	Description
1	Compressor assembly	6	Expansion valve (internal)
2	Condenser	7	High-side charge port
3	Evaporator & heater matrix (internal)	8	Low-side charge port
4	Receiver drier	9	Suction muffler
5	Trinary switch	10	Switch, A/C Cut-Off

Compressor

Features

- Engine mounted, driven by the accessory drive belt.
- Fixed displacement type.
- High-pressure relief valve, to avoid system over-pressure.
- ECM controlled clutch energised via a relay.

Receiver drier

Features

- Vertically mounted on the right-hand side of the engine compartment next to the engine coolant radiator.
- The high-side charge port is fitted in the high side entry pipe to the receiver drier..

Condenser

Features

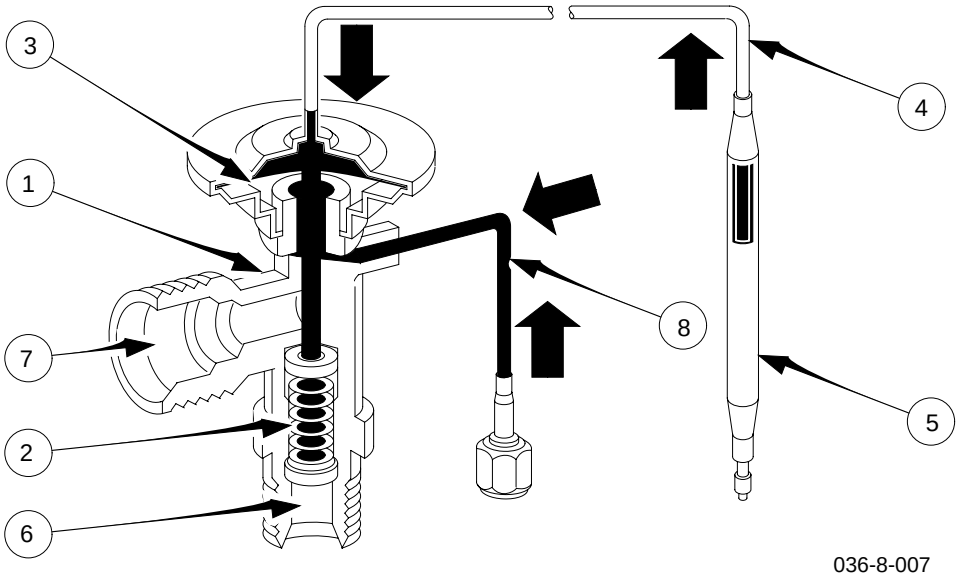
- Multi-pass fin-over-tube type, mounted in front of the engine cooling pack and directly to the radiator.

Trinary switch

Features

- Located in the compressor discharge pipe.
- Provides a signal, via the A/CCM, to the ECM, to disengage the compressor clutch should the refrigerant pressure be less than 2 bar or greater than 30 bar.
- Provides a hard-wired signal to the ECM, to switch the cooling fans to HIGH speed at 22 bar rising pressure and to LOW speed at 17,5 bar falling pressure.
- Provides a hard-wired signal to the ECM, to switch the radiator cooling fans to LOW speed at 12 bar rising pressure and to switch the fans OFF at 8 bar falling pressure.

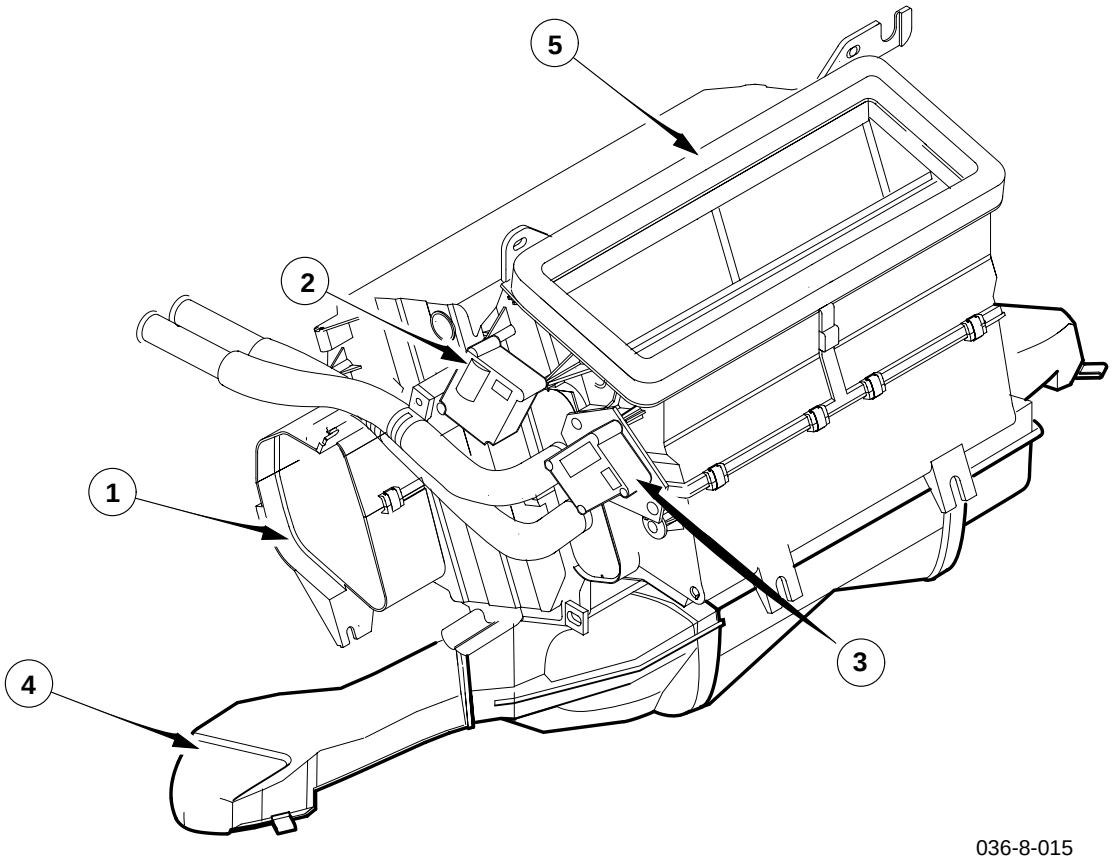
Expansion Valve



Item	Description	Item	Description
1	Valve body	5	Temperature sensing bulb
2	Pressure spring	6	Valve inlet
3	Diaphragm	7	Valve outlet
4	Capillary tube	8	Equaliser pipe

The expansion valve is located inside the heater / air conditioning unit and comprises of a diaphragm, connected by a capillary tube to a temperature sensing bulb, which regulates the valve according to temperature variations at the evaporator outlet pipe. This component is NOT serviceable. See ‘Refrigeration Cycle’

Air Conditioning (Heater / Cooler) Unit



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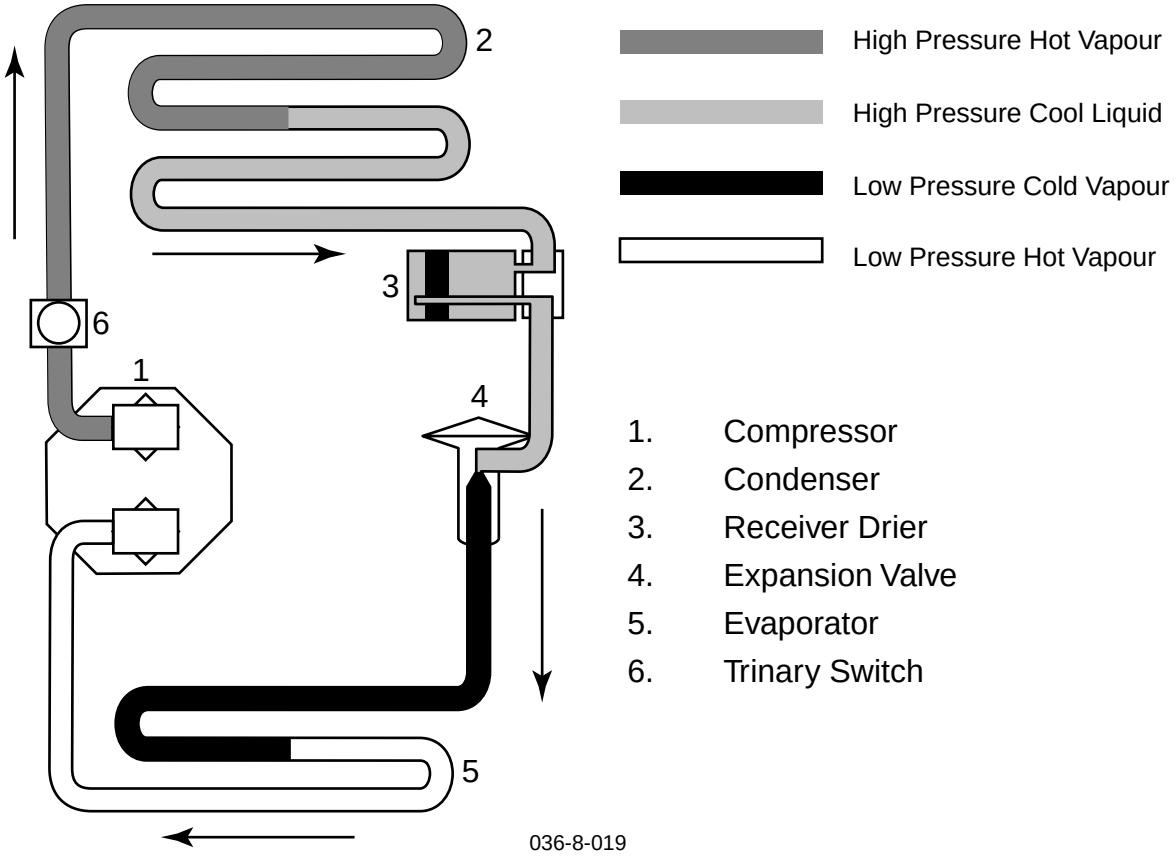
Item	Description
1	Air inlet - LH (RH opposite, not shown)
2	Servomotor - cool air bypass
3	Servomotor - footwell outlet
4	Air outlet - footwell
5	Air outlet - Air Distribution Box (with foam seal)

The air conditioning unit houses the evaporator, heater matrix and their temperature sensors. The unit also incorporates two servo motor operated air distribution flaps. The first regulates airflow to the front footwells. The second regulates the quantity of airflow through the cool air bypass (air which by-passes the heater matrix) up to the upper air distribution box.

When the front footwell flap is open, air is ducted to the footwell area via the lower air distribution duct and front footwell duct. The lower duct is clipped to the bottom of the air conditioning unit case and the front foot ducts clipped onto the outlets of the lower duct.

Condensate (water) which forms on the evaporator fins is drained out of the unit case through two drains, located either side of the unit underneath the evaporator. The liquid is routed to the vehicle exterior via flexible tubes which are located at either side of the transmission tunnel.

The Refrigeration System



Refrigeration System Operation

The Compressor (1) draws low pressure, low temperature, refrigerant vapour from the evaporator (5) and compresses it. This raises the refrigerant pressure and temperature.

This high pressure, hot, refrigerant vapour enters the condenser (2), where it is cooled by the flow of ambient air and changes state into a cooler, high pressure liquid.

From the condenser, the liquid passes into the receiver drier (3) which has three functions:

- Removes moisture from the refrigerant using a dessicant.
- Filters the refrigerant to remove system contaminants.
- Stores the refrigerant to cope with varying system refrigerant demands.

The filtered liquid refrigerant, still at high pressure, then enters the expansion valve (4). Here it passes through a controlled orifice and emerges as an atomised liquid spray. This has the effect of reducing the refrigerant pressure and temperature. The cold refrigerant spray now flows into the evaporator (5).

As refrigerant passes through the evaporator core, it cools the incoming airflow. Heat is absorbed by the refrigerant, during this process and it once again changes state, from an atomised cool liquid into a vapor. The refrigerant vapour then returns to the compressor for the cycle to be repeated.

An automatic safety valve is incorporated in the compressor, which will open if the system pressure rises above 41 bar. The valve will reseat when the pressure drops below 27,6 bar. When the safety valve is open, the compressor will 'free wheel' and the excess pressure will be dissipated through the expansion valve. When the pressure drops below 27.6 bar, the safety valve will close again and the compressor will be operative.

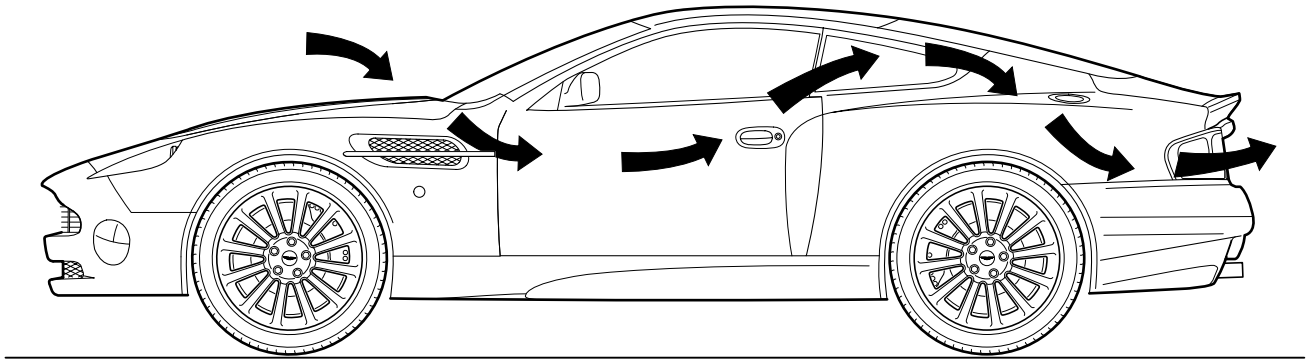
The terms ‘high’ and ‘low’ pressure (or side) refer to the pressure differential between the compressor and expansion valve ports. This differential is critical to system fault diagnosis and efficiency checks.

The HI side starts at the compressor and includes the trinary switch, condenser, receiver drier and expansion valve.

The LO side starts at the expansion valve outlet and includes the evaporator and all connections back to the compressor.

The trinary switch (6) monitors system pressure between the compressor and condenser. If the pressure rises above 30 bar or falls below 2 bar the compressor clutch is deenergised to prevent damage to system components.

The Air Intake & Distribution System



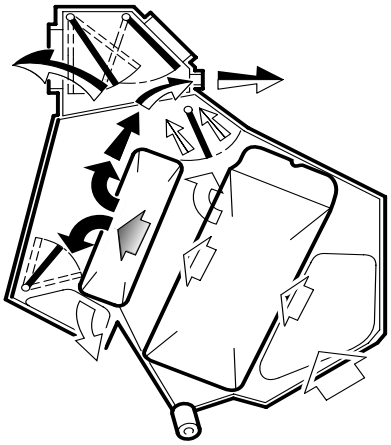
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Outside air enters the plenum via inlets at the base of the windscreen. If the air conditioning system is operating in FRESH mode (not recirculation mode), then air is drawn in through the plenum and into the blower motors. Air enters the air conditioning unit via ducting from the LH and RH blower assemblies. Air is cooled and dehumidified as it passes through the evaporator and is then ‘reheated’ to the required temperature as it passes through the heater matrix.

In RECIRCULATION mode, the air in the passenger compartment is drawn into the air conditioning unit via the recirculation air inlets on the blower assemblies.

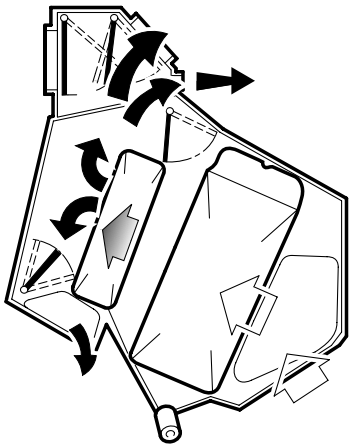
In FRESH mode, air flows from the cabin into the boot via the speaker grilles and through apertures in the rear parcel shelf. The air is exhausted from the vehicle through extraction vent assemblies (incorporating one way flaps) in the rear lamp covers.

Air Flow Paths



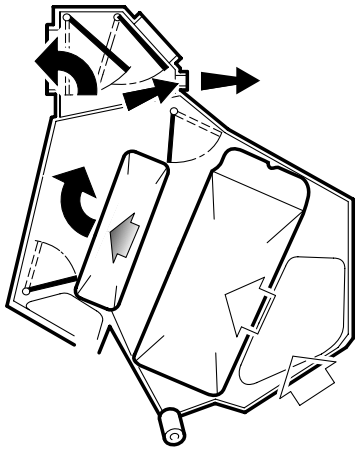
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Air Flow - Bi-level mode



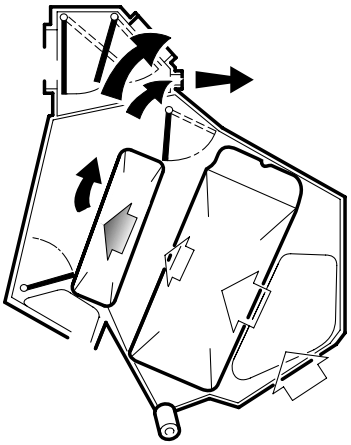
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Foot / defrost mode



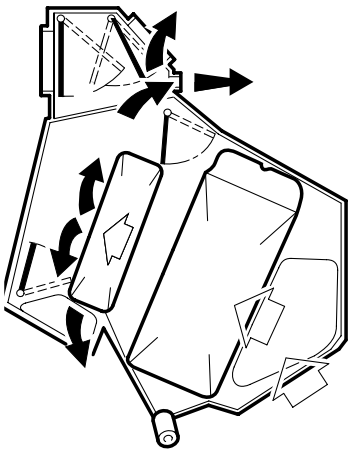
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Air Flow - Face mode.



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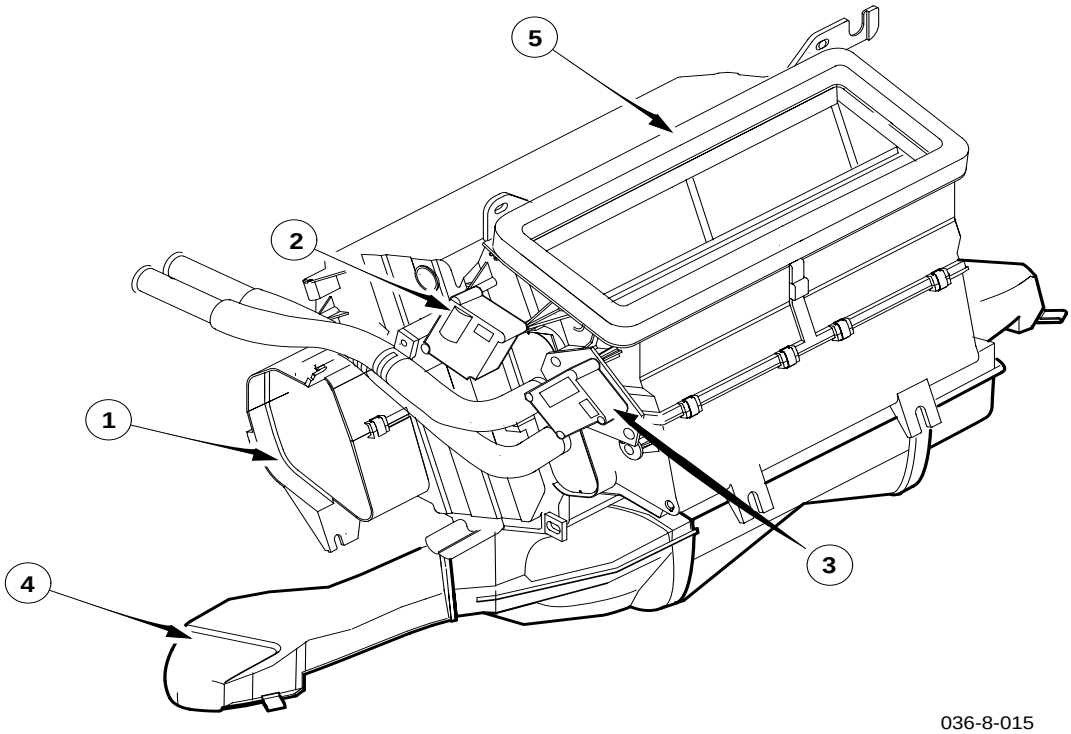
Defrost mode.



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Air Flow - Foot mode (with automatic air bleed to the windshield)

Lower Air Distribution Box and Footwell Ducts

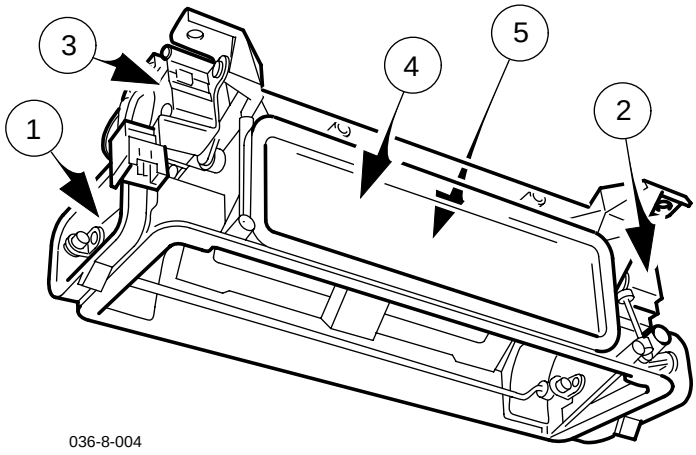


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Item	Description		
1	Air Inlet from blower motor	4	Air outlet - footwell
2	Servomotor - center facia vent	5	To Upper Air Distribution Box
3	Servomotor - windshield		

The lower air distribution box is fixed to the defrost duct and facia assembly, and seals by contact pressure to the outlet (top) of the air conditioning unit. The upper box incorporates two servo motor operated flaps which regulate airflow to:

Upper Air Distribution Box



036-8-004

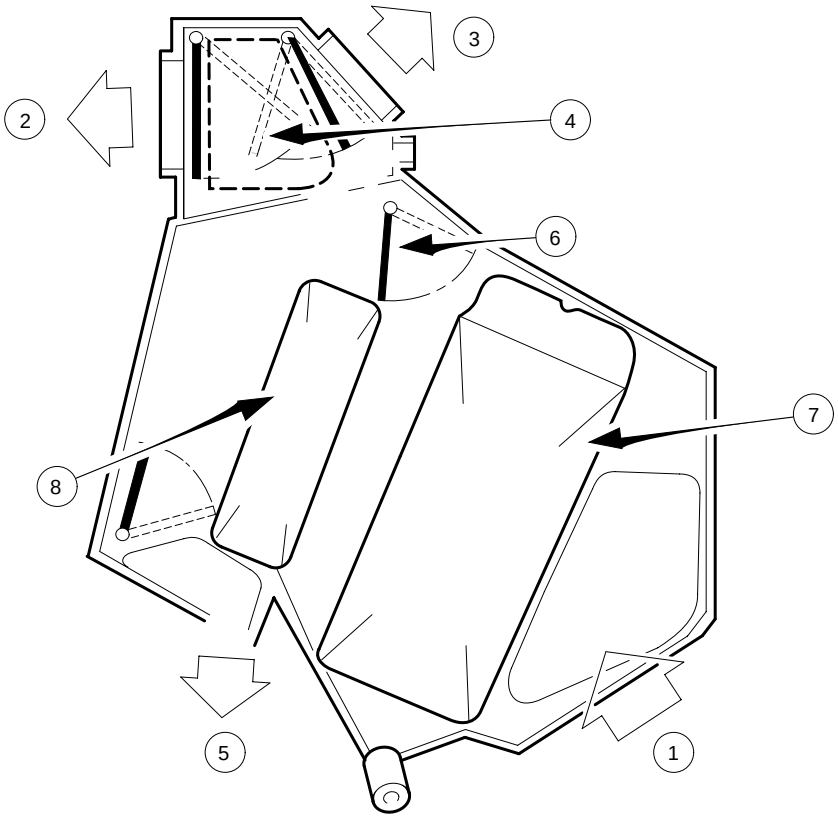
Item	Description		
1	Air outlet - End of dash vent	4	Air outlet - facia center
2	Servomotor - center facia vent	5	Air outlet - windshield
3	Servomotor - windshield		

The upper air distribution box is fixed to the defrost duct and facia assembly, and seals by contact pressure to the outlet (top) of the air conditioning unit. The upper box incorporates two servo motor operated flaps which regulate airflow to:

- Windshield and door drop glass
- Fascia center and end of dash vents

Air is ducted from the upper box to the fascia air outlet vents. The center vent duct incorporates a baffle plate which balances the volume of airflow between the center and end of dash vents.

Air Conditioning Unit - Internal Components & Air Flow



J.412.088

Item	Description
1	Air inlets - from blowers
2	Air outlet - fascia centre vent
3	Air outlet - defrost
4	Air outlets - end of dash
5	Air outlet - footwell
6	Flap - cool air bypass
7	Evaporator
8	Matrix - heater

Fault Diagnosis

Introduction

It is very important to positively identify the area of concern before starting a rectification procedure.

Functional Check

This simple procedure checks whether the A/C system is operating within its design parameters.

With the engine at normal running temperature:

1. Presss AUTO to display selected temperature and illuminate AUTO and A/C state lamps.
2. Rotate FAN to increase or decrease blower speed, verify bar graph representation.
3. Select A/C to toggle on or off. (The compressor may be inhibited by the ECM should the ambient be less than 2° C).
4. Select RECIRC, state lamp should be lit and the recirculation flaps open.
5. Select distribution buttons in turn, verify correct air distribution and relevant state lamp.
6. Select DEFROST, check max fans and air to the windshield.
7. Cycle TEMPERATURE to ‘HI’ and ‘LO’ to verify demanded variations and display operation. Note that extremes will provide max heat or cold independent of in-car temperature.
8. Select EXT to toggle between ambient and control temperatures.
9. Select screenheaters F and R - noting exterior mirror; verify timer and operation (glass may be warm to the touch)
10. Initiate ‘Actuator Self Check’ to test the system actuators and to display stored fault codes should any of the above not perform as stated.

Actuator Self Check Procedure

The system self test procedure drives all the actuator motors, to check their operation. If an actuator is operating incorrectly or operating outside of its limits then a fault code will be present. Before commencing with the actuator check procedure, ensure the car is operating under normal conditions.

1. Switch ignition OFF.
2. Press and hold the RECIRC & AUTO buttons simultaneously whilst switching the ignition ON & starting the engine.
3. All the control panel LEDs and all LCD segments will flash on and off. Any LED indicator which does not flash on / off suggests a fault condition within that area of the panel or, with the LED. Any LCD element which fails to flash on / off indicates a fault within the display element or panel.
4. Press AUTO
5. Press RECIRC button to initiate actuator check mode.
6. Press FACE to cycle through the actuator mode conditions 20 to 27. Using the information in the following table, check all actuators for correct status as each code is displayed.

Actuator Fault Codes and Component States

NOTE: The water valve operates on a 6 second pulse, ie 3 seconds ON, 3 seconds OFF.

		Outlet States					Component States		
Code	**Blower Level**	**Centre Vent**	**Foot**	**Defrost**	**Cool air By-Pass**	**Fresh / Recirc**	**Compres-sor**	**Water Valve**	**Water Pump**
20	0	open	closed	closed	closed	fresh	OFF	closed	OFF
21	1	open	closed	closed	closed	fresh	OFF	closed	ON
22	10	open	closed	closed	open	half open	A/C ON	closed	ON
23	17	bleed	half open	closed	half open	half open	A/C ON	6s pulse	ON
24	17	bleed	half open	closed	closed	recirc.	A/C ON	6s pulse	ON
25	23	closed	open	bleed	closed	recirc.	A/C ON	open	ON
26	23	closed	half open	half open	closed	recirc.	A/C ON	open	ON
27	31	closed	closed	open	closed	open	A/C ON	open	ON

7. Press the FAN button to restore normal operation with default panel settings, ie AUTO @ 24°C.

Associated Faults

Other conditions which may exist but will NOT log fault codes:

No heat

Possible Cause(s):	Action(s):
Airlock in system.	Refer to fill / bleed procedure
Heater water pump inoperative	Check operation & circuit
Coolant flow valve stuck closed	Check operation & circuit
Faulty engine coolant thermostat	Renew as required

One vent failing to open / close

Possible Cause(s):	Action(s):
Broken linkage.	Renew as required

Poor airflow

Possible Cause(s):	Action(s):
Blower motors - incorrect operation	Check operation & circuit

Panel Communication Check

The panel communication check verifies the inputs and outputs from the control panel to the A/CCM.

1. Simultaneously hold FACE & FAN, Switch ignition to ON.

   Panel communication with FACE, BI-LEVEL, FOOT, DEMIST, DEFROST & RECIRC lines checked.

   State lamps will illuminate if all is OK. Unlit state lamp indicates a continuity fault for that specific link.

2. Press ON to exit check mode.

Panel Inputs and Outputs

Item	Check LED	Condition	Circuit Ref
Ignition	Defrost	IGN input at 12V, check LED is illuminated	Sheet 17
Auxiliary	Face	AUX input at 12V, check LED is illuminated	Sheet 17
Clock	Feet / face	Clock input normal, check LED is illuminated	Sheet 17
Start input	Foot	Start input normal, check LED is illuminated	Sheet 17
Data out	Screen / foot	Data out input normal, check LED is illuminated	Sheet 17
Dimmer override	Recirc.	Dimmer override input ON, check LED is illuminated	Sheet 6

A/C System Self-test

Control Panel Interrogation Procedure

The control panel has a self-diagnosis feature, and is capable of displaying and clearing stored fault codes.

Climate control is an integrated system, therefore it is recommended that the WDS is used for fault diagnosis. The fault codes displayed with the control panel self-diagnosis feature are not as comprehensive as those of the WDS. The WDS will display the relevant fault code, fault code description and information of the system peripherals at the time the fault occurred.

Fault Code Extraction and Deletion Procedure

Error information is stored in the A/CCM up to a maximum of 5 faults. Should a sensor fault occur there will be an audible beep and the message **Er** will be displayed on the control panel display for 5 seconds after ignition on. Please note that this will happen only once in any ignition switch cycle. The error source may be accessed by the following procedure. This procedure must be completed through one complete cycle, 1 through 6

Step	Procedure	Result	Notes
1	Simultaneously hold AUTO & RECIRC, Switch Ignition to ON	Display element check	
2	Press AUTO	Display of stored fault (NUMERIC) code.	If ZERO appears, there are no stored codes
3	Press FACE	Scroll through stored faults	Maximum of 5
4	Simultaneously press FACE & R	Clear stored fault codes	(may need to be repeated for each fault)
5	Press RECIRC (Press FAN to skip actuator check)	Initiate actuator check (Actuator codes 20 through 27*)	
6	Press FAN	Exit error check mode	

NOTE: Actuator codes do NOT equate to system fault codes.

NOTE: Only codes 11, 15 & 21 (see Fault Code Listing) will cause audible beep and 'Er' display.

NOTE: If '0' is displayed, there are no stored fault codes, wait 30 seconds to allow system self-test.

- The control panel display will flash repeatedly indicating a list of two digit numbers (see table for code analysis).
- Should a code be displayed accompanied by an audible beep, the fault is current and therefore still present within the system. A code displayed without an accompanying 'beep' indicates a fault had previously occurred but is not present within the system.

NOTE: It is advisable to check all areas indicated with cleared fault codes. Such faults may re-occur if intermittent problems are present in the system.

- To delete stored and cleared fault codes press 'R' and 'FACE' buttons simultaneously.
- After investigating and correcting all stored faults, press the 'Push Off' button to restore normal operation with default panel settings, ie AUTO at 24°C.

System Symptoms

There are five basic symptoms associated with air conditioning fault diagnosis.

The following conditions are not in order of priority.

Symptom #1 - No Cooling

Possible Cause(s):	Action(s):
Compressor seized	Renew compressor
Compressor seal failure	Renew compressor
Compressor valve or piston damage	Renew compressor
Compressor clutch / circuit faulty	Refer to WDS
Drive belt slack / broken	Adjust or renew
Blower motor / circuit faulty	Refer to WDS
Pressure switch / circuit fault	Refer to WDS
Total loss of refrigerant / broken pipe or joint	Repair / renew. Check code 23
Partial loss of refrigerant / leaking joint or pipe	Repair / renew, check fault code #23

Symptom #2 - Insufficient Cooling

NOTE: Should a leak or low refrigerant be established as the cause of INSUFFICIENT COOLING, follow the procedures Recovery / Recycle / Recharge in this section, and observe all refrigerant and oil handling instructions.

Possible Cause(s):	Action(s):
Compressor clutch slipping	Renew clutch assembly
Flaps or vents closed / seized	Check fault codes #41 to 46
Blower circuit fault	Refer to WDS
Blocked condenser matrix / fins	Check high / low side pressures. Check / clean fins
Blocked evaporator matrix	Check high / low side pressures / renew
Blocked pollen filter (if fitted)	Clean or renew
Evaporator temperature sensor faulty	Refer to WDS
Partial loss of refrigerant / leaking joint or pipe	Repair / renew
Blocked expansion valve	Check high / low side pressures / renew
Expansion valve fault	Check system pressure differential
Collapsed air conditioning hose hose	Check high / low side pressures / renew
Moisture or air in the system	Check system pressures
Low refrigerant charge	Initiate recovery procedure, check fault code #23
Coolant flow valve open	Check operation

Symptom #3 - Intermittent Cooling

Possible Cause(s):	Action(s):
Compressor clutch slipping	Renew clutch assembly
Compressor clutch circuit faulty	Refer to WDS
Blower(s) circuit faulty	Refer to WDS
Motorized in-car aspirator faulty	Refer to WDS, check fault code #11
Evaporator temperature sensor faulty	Refer to WDS, check fault code #13
Blocked condenser matrix / fins	Check high / low side pressures. Check / clean fins
Blocked evaporator matrix	Check high / low side pressures / renew

Symptom #4 - Noisy System

Possible Cause(s):	Action(s):
Loose or damaged compressor drive belt	Adjust or renew
Loose compressor mountings	Check for damage, tighten to specification if OK
Compressor oil level low	Look for evidence of leakage and rectify as required
Compressor internal damage	Check for debris, renew compressor and drier
Blower motor noise	Renew motor (assuming no fan interference)
Excessive refrigerant charge	Check for vibration or 'thumping' in high pressure line; may be witnessed by high pressure on both HIGH and LOW sides. Recover / recharge
Low refrigerant charge	Check for 'hissing' at expansion valve; may be witnessed by low HI side pressure. Recover / recharge
Moisture or air in the system	Check system pressures
Heater circuit air-lock	Refer to section 1 for coolant fill / bleed procedure

Symptom #5 - Insufficient Heating

Possible Cause(s):	Action(s):
Coolant flow valve stuck 'closed'	Renew valve
Coolant flow valve stuck 'open' allowing recirculation of coolant at engine idle	Renew valve
Motorised in-car aspirator seized	Renew aspirator
Cool air bypass damper stuck open	Renew, check fault code #43
Blocked air inlet / pollen filter	Check / clean / renew
Blower speed low	Check performance range
Low coolant level	Adjust as required (verify and correct reason for loss)
Engine thermostat faulty	Check engine running temperature
Heater water pump seized	Check operation
Heater matrix blocked	Renew matrix
Heater circuit air-lock	Refer to engine section for coolant fill procedure

A/C Control Panel Fault Code Listing

Fault Code 0 - Normal operation no fault codes present

Possible Cause(s):	Action(s):
None	Wait 30 seconds for system self-check.

Fault Code 11 - Motorized in-car aspirator malfunction

Possible Cause(s):	Action(s):
Harness / connector fault	Panel fault codes are not stored for motorized in-car aspirator motor failure.
Sensor open / short circuit	Panel fault codes are not stored for motorized in-car aspirator motor failure.

Fault Code 12 - Ambient temperature sensor malfunction

Possible Cause(s):	Action(s):
Harness / connector fault	After rectification, disconnect the vehicle battery for 10 seconds to reset the system.
Sensor open / short circuit	After rectification, disconnect the vehicle battery for 10 seconds to reset the system.

Fault Code 13 - Evaporator temperature sensor malfunction

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Sensor open / short circuit	Refer to WDS

Fault Code 14 - Water temperature input malfunction

Possible Cause(s):	Action(s):
Instrument cluster output	Refer to WDS

Fault Code 15 - Heater matrix temperature sensor malfunction

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Sensor open / short circuit	Refer to WDS

Fault Code 21 - Solar sensor

Possible Cause(s):	Action(s):
Sensor open /short circuit	Refer to WDS

Fault Code 22 - Compressor lock signal fault

Possible Cause(s):	Action(s):
Low refrigerant charge, low compressor oil level, loose drive belt	Adjust items as required
Harness / connector fault	Adjust items as required

Fault Code 23 - Refrigerant pressure switch malfunction

NOTE: Reference fault code 23: In ambient temperatures below 0°C, this code may be logged because the low ambient causes a temporary low gas pressure.

NOTE: Where the ambient temperature rises above 40° C, with the engine close to overheating, electrical feed to the compressor clutch may be cut and code 23 registered.

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Switch open / short circuit	Refer to WDS

Fault Code 23 - Refrigerant pressure low refrigerant charge

Possible Cause(s):	Action(s):
Leak from damaged pipe or joint	Rectify as required & recharge system

Fault Code 24 - Face vent demand potentiometer fault

Possible Cause(s):	Action(s):
Potentiometer open / short circuit	Refer to WDS
Harness / connector fault	Refer to WDS

Fault Code 31 - LH fresh / recirc. potentiometer fault

Possible Cause(s):	Action(s):
Harness / connector fault	• Refer to WDS
In certain circumstances the servo motor may over-travel & cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	• Refer to WDS

Fault Code 32 - RH fresh / recirc. potentiometer fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
In certain circumstances the servo motor may over-travel & cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	Refer to WDS

Fault Code 33 - Cool air by-pass potentiometer fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
In certain circumstances the servo motor may over-travel & cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	Refer to WDS

Fault Code 34 - Defrost vent potentiometer fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
In certain circumstances the servo motor may over-travel & cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	Refer to WDS

Fault Code 35 - Centre vent potentiometer fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
In certain circumstances the servo motor may over-travel & cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	Refer to WDS

Fault Code 36 - Foot vent potentiometer fault

Possible Cause(s):	Action(s):
Harness / connector fault	• Refer to WDS
In certain circumstances the servo motor may over-travel & cause further logged faults. This may be cured, following fault rectification, by cycling the ignition ON-OFF-ON 3 times	• Refer to WDS

Fault Code 41 - LH fresh / recirc. motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

Fault Code 42 - RH fresh / recirc. motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

Fault Code 43 - Cool air by-pass motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

Fault Code 43 - Cool Air by-pass motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

Fault Code 44 - Defrost vent motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

Fault Code 45 - Centre vent motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

Fault Code 46 - Foot vent motor fault

Possible Cause(s):	Action(s):
Harness / connector fault	Refer to WDS
Servo motor seized or sticking	Refer to WDS
Flap seized or sticking	Refer to WDS

A/C System Electrical Connectors

The following lists detail the function of each pin on the A/C controller connector. Note that the electrical loom is fitted with four connections, 26 way FC35, 16 way FC36, 12 way FC37 and 22 way FC38 which mate with the single 76 way connector on the A/CCM.

A/CCM Connections via 22 Way Connector FC38

FC38 Pin	A/CCM Pin #	Specification
1	1	Ignition positive supply. With ign ON
2	2	Battery isolate supply. Activated when IGN ON and for 30 seconds after IGN OFF
3	3	Auxiliary ground. Auxiliary switch closed to ground
4	4	Auxiliary ground. Direct line to pin #3
5	5	B+
6	6	Engine speed input. Open collector, 3 pulses per rev.
7	7	Electrical load drive inhibit. Active low signal from EMS
8	8	Sensor +5V
9	9	Clutch request. Open collector R = 1KW, connected to IGN, activated high
10	10	Diagnostic L line
11	11	Not used
12	12	Ignition (+VE) to control panel
13	13	System ground
14	14	Ground to control panel
15	15	Isolation relay. Activated when IGN ON and for 30 seconds after IGN OFF
16	16	Vehicle speed input
17	17	Pressure switch. Ground for normal pressure. IGN+ for abnormal pressure
18	18	Aspirator motor. 0.05A at 12V, activated high during ON mode only
19	19	Sensor ground
20	20	Logic ground for diagnostic lines
21	21	Diagnostic K line
22	22	Water pump ground. Sensing cct current signal

A/CCM Connections via 12 Way Connector FC37

FC37 Pin	A/CCM Pin #	Specification
1	23	Screen request to ECMOpen collector R = 57W, connected to IGN, active low
2	24	CLOCK to control panel. Open collector R = 1KW, connected to IGN, active high
3	25	DATA OUT to control panel. Open collector R = 1KW, connected to IGN, active high
4	26	Compressor lock signal
5	27	Ambient air temperature sensor. Voltage / temperature values
6	28	Heater matrix temperature sensor. Voltage / temperature values
7	29	DATA IN signal from control panel
8	30	START signal to control panel. Open collector R = 1KW, connected to IGN, active high
9	31	Not used
10	32	Compressor lock select. Ign. voltage
11	33	In-car temperature sensor. Voltage / temperature values
12	34	Evaporator temperature sensor. Voltage / temperature values

A/CCM Connections via 16 Way Connector FC36

FC37 Pin	A/CCM Pin #	Specification
1	35	Solar sensorVoltage / temperature values
2	36	Centre vent servo motor. Resistance 6KW. ±10%. Closed - 1V, open - 4V
3	37	RH air intake servo feedback pot. Resistance 6KW ±10%. Closed - 1V, open - 4V
4	38	Not used
5	39	Cool air bypass servo feedback pot. Resistance 6KW. ±10%. Closed - 1V, open - 4V
6	40	Coolant temperature signal. PWM signal
7	41	RH blower motor voltage feedback
8	42	RH blower motor drive signal0V to 3V max.
9	43	Differential potentiometerResistance 10KW. ±10%. Min. 1V, Max. 4V
10	44	Defrost servo motor feedback pot. Resistance 6KW. ±10%. Closed - 1V, open - 4V
11	45	LH air intake servo motorfeedback pot. Resistance 6KW. ±10%. Closed - 1V, open - 4V
12	46	Not used
13	47	Foot servo motor feedback pot. Resistance 6KW. ±10% Closed - 1V, open - 4V
14	48	Not used
15	49	LH blower motor voltage feedback
16	50	LH blower motor drive signal0V to 3V max.

A/CCM Connections via 26 Way Connector FC35

FC35 Pin	A/CCM Pin #	Specification
1	51	Compressor ON signal. B+ @ compressor ON
2	52	Water valve. 1 amp at 12 volts
3	53	RH Blower motor relay. Load 105W at 12V IGN, activated low
4	54	Heated front windshield relays. Load 36W at 12V IGN, activated low
5	55	Heated door mirror relay. Load 105W at 12V IGN, activated low
6	56	Defrost servo motor (+VE). B+ when operated
7	57	Centre vent servo motor (+VE). B+ when operated
8	58	LH air intake servo motor (+VE). B+ when operated
9	59	RH air intake servo motor (+VE). B+ when operated
10	60	Not used
11	61	Not used
12	62	Foot servo motor (+VE). B+ when operated
13	63	Cool air bypass servo motor (+VE). B+ when operated
14	64	RH High speed relay. Load 105W at 12V IGN, activated low
15	65	LH High speed relay. Load 105W at 12V IGN, activated low
16	66	LH Blower motor relay. Load 105W at 12V IGN, activated low
17	67	Water pump motor relay. Load 105W at 12V IGN, activated low
18	68	Rear Screen Heater Relay. Load 72W at 12V IGN, activated low
19	69	Defrost servo motor (-VE). B+ when operated
20	70	Centre vent servo motor (-VE). B+ when operated
21	71	LH air intake servo motor (-VE). B+ when operated
22	72	RH air intake servo motor (-VE). B+ when operated
23	73	Not used
24	74	Not used
25	75	Foot servo motor (-VE). B+ when operated
26	76	Cool air bypass servo motor (-VE). B+ when operated

Connector Pin Identity Chart for FC043 - A/C Control Panel Connector

Control Panel Inputs / Outputs

Pin #	Description	Cable color
1	Output clock	Slate
2	Output start	Slate / Red
3	Input data in	Slate / Yellow
4	Output data out	Slate / Green
5	Output ignition positive	White / Red
6	Output auxiliary positive	White / Blue
7	Output ground	Black
8	Dimmer	Red/Pink
9	Dimmer override	Red /Light Green
10	Not used	n/a
11	Not used	n/a
12	Not used	n/a

Specifications

Standard for Recovery, Recharge and Recycle Eqiupment

Recovery Rate	0.014 - 0.062 m3/min (1,36 kg in 20 minutes)
Cleaning Capability	15 ppm moisture, 4000 ppm oil, 330 ppm non-condensable gasses in air
Oil Separator	With hermatic compressor and automatic oil return
Moisture Indicator	Sight-glass type, sensitive to 15 ppm
Vacuum Pump	Two-stage 0.07 - 0.127 m3/min
Filter	Replaceable with moisture indicator
Charge	Selectable charge weight and automatic delivery
Hoses	Dedicated HFC 134A port connections
Charge Pressure	Heating element to increase pressure

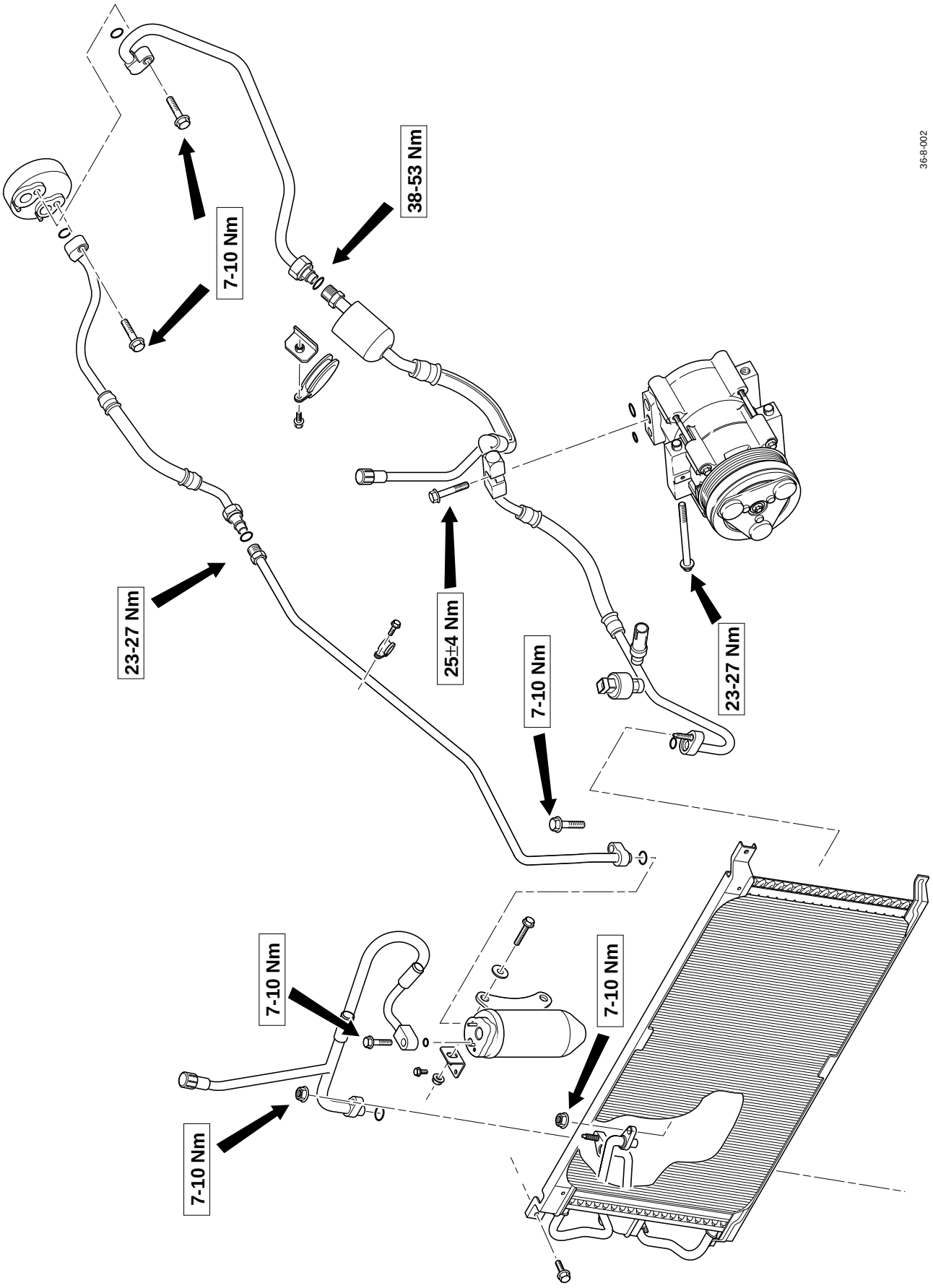
Refrigerant and Lubricant

Refrigerant	HFC 134A
Compressor Lubricant	Polyalkyleneglycol (PAG)

Capacities

Refrigerant charge Weight	650 ± 50 g
Compressor Lubricant	125 - 150 ml

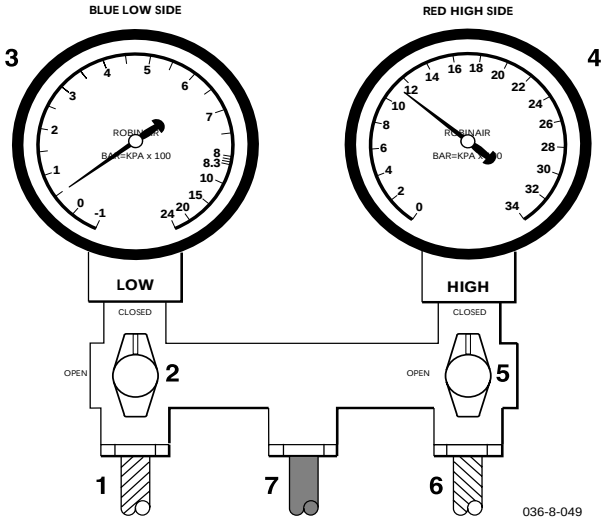
Torque Levels for A/C System Connections



Manifold Gauge Set

The 'manifold gauge set' is a most important tool for tracing faults and system efficiency assessment. The relationship between HIGH and LOW pressures and their correlation to AMBIENT and EVAPORATOR temperatures must be compared to determine system status (see Pressure / Temperature graphs).

Because of the heavy reliance upon this piece of equipment for service diagnosis, ensure that the gauges are calibrated regularly and the equipment is treated with care.



Parts List

Item	Description
1	LOW side service hose - BLUE
2	LOW side hand valve - BLUE
3	LOW pressure compound gauge _ BLUE
4	HIGH pressure gauge _ RED
5	HIGH side hand valve - RED
6	HIGH side service hose - RED
7	System service hose - Neutral color, commonly YELLOW

Manifold.

The manifold is designed to control refrigerant flow. When connected into the system, pressure is registered on both gauges at all times. During system tests both the high and low side hand valves should be closed (rotate clockwise to seat the valves). The hand valves isolate the low and the high sides from the center (service) hose.

Low Side Pressure Gauge.

This compound gauge, is designed to register positive and negative pressure and may be typically calibrated - Full Scale Deflection, 0 to 10 bar (0 to 150 lbf / in2) pressure in a clockwise direction; 0 to 1000 mbar (0 to 30 in Hg) FSD negative pressure in a counter clockwise direction.

High Side Pressure Gauge.

This pressure gauge may be typically calibrated from 0 to 30 bar (0 to 500 lbf / in2) FSD in a clockwise direction. Depending on the manufacturer, this gauge may also be of the compound type.

System Checking with the Manifold Gauge Set

Evacuating the Manifold Gauge Set

Attach the center (service) hose to a vacuum pump and start the pump. Open fully both high and low valves and allow the vacuum to remove air and moisture from the manifold set for at least five minutes.

CAUTION: It is imperative that the vacuum pump is not subjected to a positive pressure of any degree. Therefore the pump must be fitted with an isolation valve at the center (service hose) connection and this valve must be closed before the pump is switched off. This operation replaces the 'purge' procedure used on previous systems. Observe the manufacturer's recommendation with regard to vacuum pump oil changes.

Turn the vacuum pump off and isolate it from the center service hose but do not open the hose to atmosphere.

Connecting the Manifold Gauge Set

CAUTION: Only use hoses with connectors which are dedicated to HFC 134A charge ports.

Attachment of the hose quick release connectors to the high and low side system ports is straightforward, provided that the high and low valves are closed and the system is NOT operational.

WARNING: UNDER NO CIRCUMSTANCES SHOULD THE CONNECTIONS BE MADE WITH THE SYSTEM IN OPERATION OR THE VALVES OPEN. SHOULD THE VALVES BE OPEN AND A VACUUM PUMP OR REFRIGERANT CONTAINER ATTACHED, AN EXPLOSION COULD OCCUR AS A RESULT OF HIGH PRESSURE REFRIGERANT BEING FORCED BACK INTO THE VACUUM PUMP OR CONTAINER.

Assessment of system operating efficiency and fault classification may be achieved by using the facilities on your Recovery / Recharging / Recycling station, follow the manufacturer's instructions implicitly and observe all safety considerations.

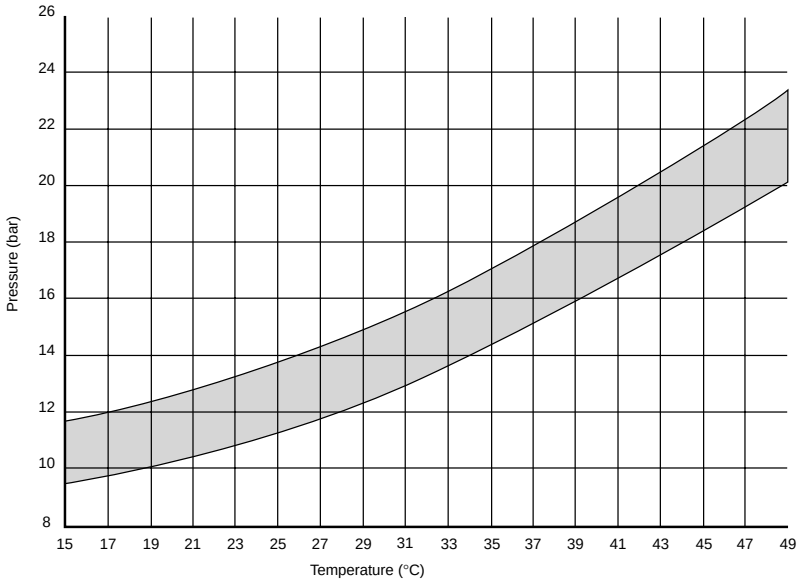
Stabilising the System

Accurate test gauge data will only be attained if the system temperatures and pressures are stabilized.

- Ensure that equipment and hoses canot come into contact with engine moving parts or sources of heat.
- It is recommended that a free standing air mover is placed in front of the condeser/cooling system.
- Start the engine, allow it to attain normal working temperature and set at fast idle (typically 1200 - 1500 rpm). Use a suitable tool to partially depress the throttle pedal.
- Select full air conditioning performance.
- With all temperatures and pressures stable, or displaying symptoms of faults, begin the relevant test procedures.

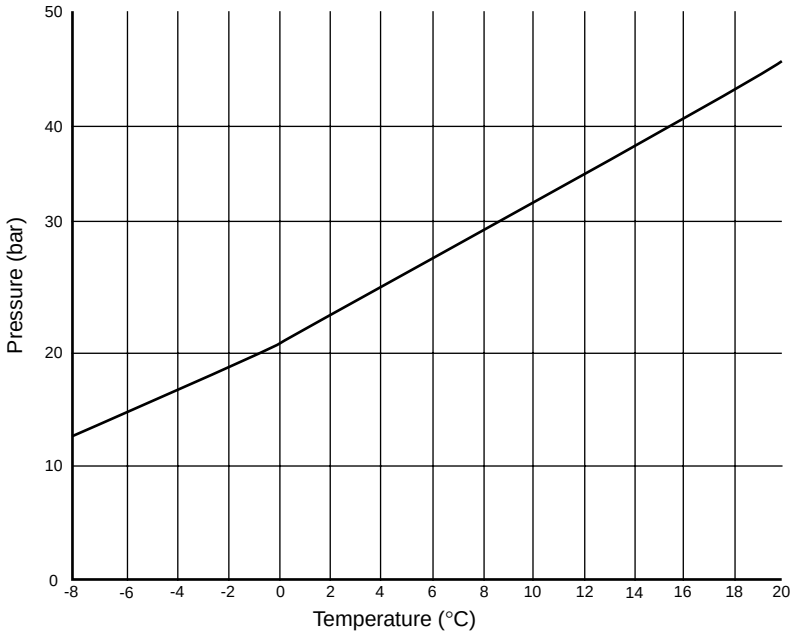
Graph - High Side Pressure against Ambient Temperature

The 'Normal' condition is that which is relevant to the prevailing ambient temperature.



Graph - Low Side Pressure against Evaporator Temperature

(To obtain lbf / in2 from bar, multiply the figure by 14.5)



Probable causes of faults may be found by comparing actual system pressures, registered on your manifold gauge set or recovery / recharge / recycle station, and the relevant pressure to temperature relationship graph. The following chart shows the interpretation that may be made by this difference.

NOTE: The A/CCM will disengage the compressor clutch should the evaporator temperature fall to 0°C.

NOTE: Graphs are typical for HFC 134A

The 'Normal' condition is that which is relevant to the prevailing evaporator temperature.

System Pressure Fault Classification

NOTE: If erratic or unusual gauge movements occur, check the equipment against a known (calibrated) manifold gauge set.

This table should be used in conjunction with the graphical representations of 'High side' pressure / ambient temperature and 'Low side' pressure / evaporator temperature.

Low side gauge reading	High side gauge reading	Fault	Cause
Normal	Normal	Discharge air initially cool then warms up	Moisture in system
Normal to low	Normal	As above	As above
Low	Low	Discharge air slightly cool	Refrigerant charge low
Low	Low	Discharge air warm	Refrigerant charge very low
Low	Low	Discharge air slightly cool or frost build up at expansion valve	Expansion valve stuck closed
Low	Low	Discharge air slightly cool, sweating or frost after point of restriction	Restriction in High side of system
High	Low	Compressor noisy	Defective compressor reed valve
High	High	Discharge air warm and high side pipes hot	Refrigerant charge high or inefficient condenser cooling due to air flow blockage or engine cooling fans not working
High	High	Discharge air warm Sweating or frost at evaporator	Expansion valve stuck open

Leak Test

Faults associated with low refrigerant charge weight and low pressure may be caused by leakage. Leaks traced to mechanical connections may be caused by torque relaxation or joint face contamination. Evidence of oil around such areas is an indicator of leakage.

Models that have fluorescent tracer dye incorporated into the refrigeration system can be checked for non-apparent leaks by scanning with a high intensity ultraviolet lamp. The location of leaks can be pinpointed by the bright yellow glow of the tracer dye.

CAUTION: Observe ALL safety precautions associated with ultraviolet equipment.

Should a leak be traced to a joint, check that the fixing is secured to the correct tightening torque before taking any other action.

When examining the system for leaks, check the compressor shaft seal and evaporator.

Charge Recovery (system depressurization)

The process of charge recovery will depend on the basic characteristics of your chosen recovery / recycle / recharge equipment, therefore, follow the manufacturer's instructions carefully.

Remember that compressor oil may be drawn out during this process, take note of the quantity recovered so that it may be replaced.

Evacuating the System

1.This process, the removal of unwanted air and moisture, is critical to the correct operation of the air conditioning system.

Moisture in the system can be highly destructive and may cause internal blockages due to freezing; water suspended in the lubricating oil will damage the compressor. Once the system has been dismantled, or the refrigerant charge recovered, all traces of moisture must be removed before recharging.

Specific procedures will vary depending on the individual characteristics of the recovery / recycle / recharge equipment, and must be carried out exactly in accordance with the manufacturer's instructions. However, it is recommended that initially only the high-side valve be opened at the start of the procedure. After a short time a small depression should be seen on the low-side, at which point the low-side valve may be opened and the evacuation process completed. If a vacuum is not registered on the low-side, it may indicate that the expansion valve is permanently closed or that the system is blocked. This simple check may save time and effort when the system is recharged.

8.0.01.1 Recover, Recycle and Recharge the Refrigerant

Recovering Refrigerant

Caution: The Recovery-Recycle-Recharging equipment has special fittings to avoid cross contamination with R-12 systems. Do not attempt to adapt this unit for R-12 as system failure will result.

WARNING: Follow the safety procedures as defined at the beginning of the section.

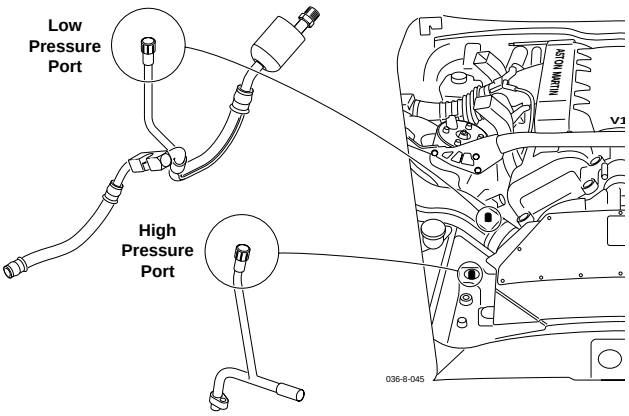
Caution: The unit's overfill limitation mechanism has been calibrated specifically for use with the 50 lb. (23 Kg) refillable refrigerant tank.

As the refrigerant is recovered it is passed through an oil separator and a filter drier before it is allowed to enter the refrigerant tank. When it is dry the moisture indicator turns green.

Recovery Procedure

Note: Run the air-conditioning system for a few minutes before starting the recovery procedure as this will enable more refrigerant to be recovered. Turn the system off before starting the procedure.

1. Attach the red (high side) hose of the unit to the high side fitting of the system on the vehicle then fit the blue (low side) fitting to the low side on the vehicle.



Note: Make sure that the air conditioning system has pressure in it before beginning the recovery process; if there is no system pressure there is no refrigerant to recover. Ensure that the oil drain valve is closed.

2. Open both the high and low side valves on the control panel.

3. Open the red GAS (vapour) valve and the blue LIQUID valve on the tank.

4. Turn on the MAIN POWER switch.

5. Press the RECOVERY key on the key-pad. The display shows that the unit in the RECOVER mode and AUTOMATIC cycle. After the compressor starts the display shows the weight of refrigerant being recovered. The compressor shuts off automatically when the recovery is complete and the display shows the message 'CPL' and the final weight of the recovered refrigerant.

6. Wait for five minutes and watch the manifold gauges for a rise above 0. If a rise occurs press the HOLD/CONT key. Repeat as needed until the system pressure holds for two minutes.

Note:Drain the oil separator after each job.

7. Slowly open the oil drain valve and drain the oil into the oil catch bottle. When all the recovered oil has completely drained close the valve.

8. Replace oil lost during the recovery procedure by measuring the amount of oil in the catch bottle and adding the same amount of new oil to the system.

Note: Dispose of the recovered oil in an approved way.

9. When the recovery tank is full the compressor is shut off and the display shows the message FULL.

Evacuating and Recycling the Refrigerant

1. Open the red (high side) and the blue (low side) valves on the unit and open the red GAS (vapour) valve and the blue LIQUID valve on the tank.

2. Enter the required time using the key-pad, press enter, the display shows the entered time in minutes.

3. Start the vacuum pump by pressing the VACUUM key again. The recycling process begins approximately five seconds after the vacuum pump starts and the message RECYCLE is displayed.

   Note: If the vacuum pump has run for ten hours or over without an oil change the message OIL flashes on the display. Change the pump oil and then press the SHIFT/RESET key and the zero key to reset the oil change timer to zero.

   The digital display counts down the evacuation time.

4. Check for non-condensibles after five minutes recycling. If the gauge needles are more than 10 psi apart purge the non-condensibles from the tank by opening the purge valve on the back of the unit and continue to bleed until both needles show the same reading.

   The vacuum sequence continues until the programmed time has elapsed at which point the message CPL is displayed.

5. If the moisture indicator turns green recharge with refrigerant.

   or

   If the moisture indicator has not turned green replace the unit's filter-drier, which is probably saturated.

   Note: Pressing any key at this point allows the next function to be accessed.

   To recycle the refrigerant only without pulling a vacuum for an indefinite period of time press the SHIFT/RESET key and the RECYCLE key on the key-pad. Press the SHIFT/RESET key to cancel.

   For vacuum only press the SHIFT/RESET key and the ENTER key and then press "1". Run the vacuum pump as long as required and then press "1" or press SHIFT/RESET to cancel.

Recharging the System

1. Open the high side valve on the unit control panel. If the messages PROGRAM and CHARGE are not displayed press the CHG key to enter PROGRAM mode.

2. Key in the amount of refrigerant needed to recharge the system and press ENTER.

3. Press the CHG key; the message AUTOMATIC and the required charge of refrigerant will be displayed. The display counts down to zero as the charging process proceeds. When the charging is complete the message CPL is displayed.

   If the refrigerant transfer is too slow the charging unit emits a signal. If the message CHECK REFRIGERANT is not displayed, close the high side valve, open the low side valve and start the air conditioning system to pull the remainder of the charge into the system.

   If the refrigerant transfer will not complete and the message CHECK REFRIGERANT is displayed, press the HOLD/CONT key to interrupt the cycle then reset the unit by pressing the RESET key. Recover the refrigerant already charged into the system by following the procedure for recovering the refrigerant, add new refrigerant to the tank and return to Step 1 to recharge the system.

4. If the air conditioning system is not running start it and let it run until the gauge pressure readings stabilize (compare the gauge readings with the system manufacturer's specifications).

   Note: Ensure that the readings are accurate by closing both the high and low side valves on the unit's control panel.

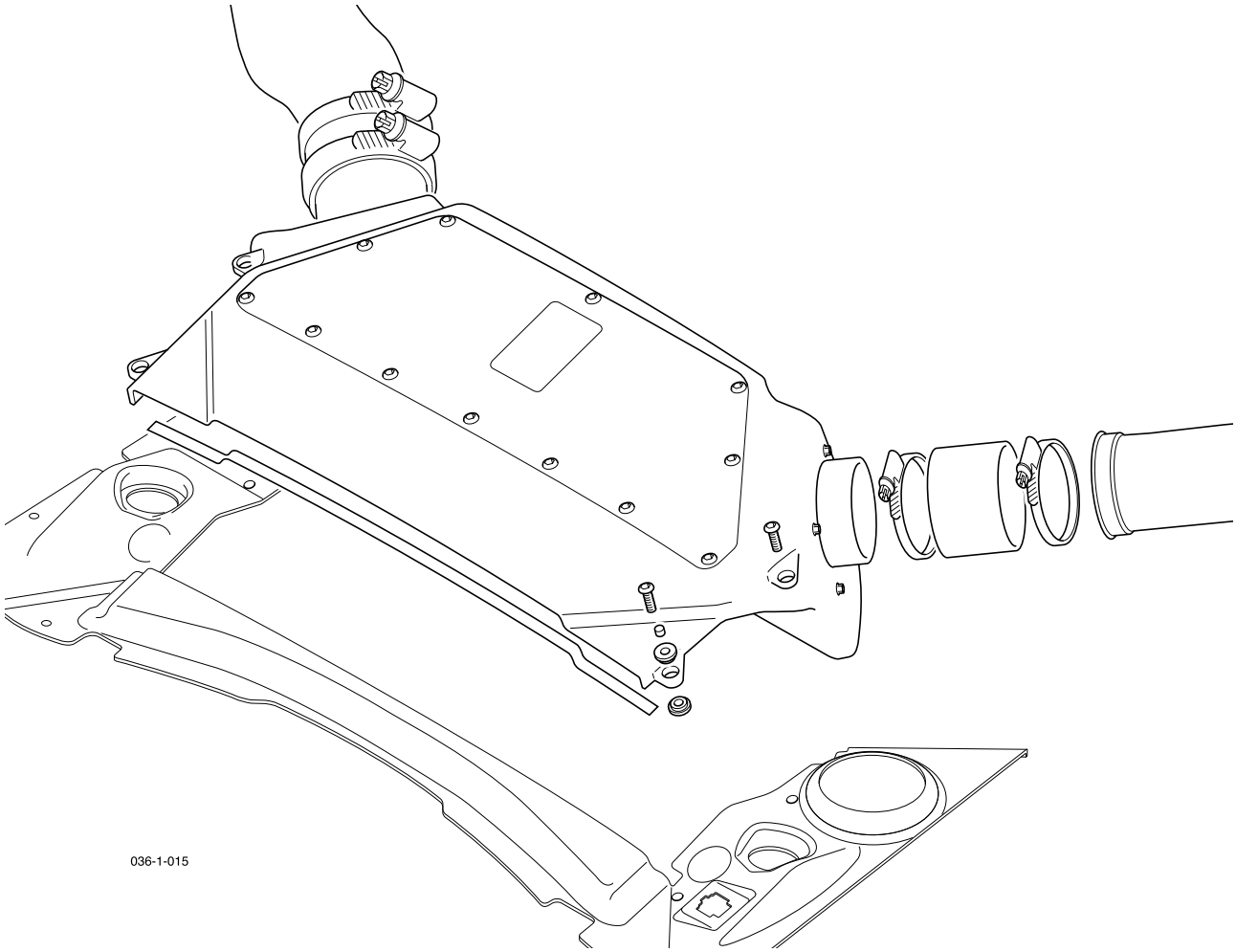
5. Check the evaporator outlet temperature to make sure that the air conditioning system is operating properly (refer to the system manufacturer's specifications for the proper temperature).

   Note: During production, 7.4 ml of tracer dye is included in the system charge to aid in leak detection (Robinair Tracker 16276. AML Part No. 1R12-895293-AA). Dealers with TracerLine or similar leak detection equipment may wish to include this dye during any recharging of the A/C system.

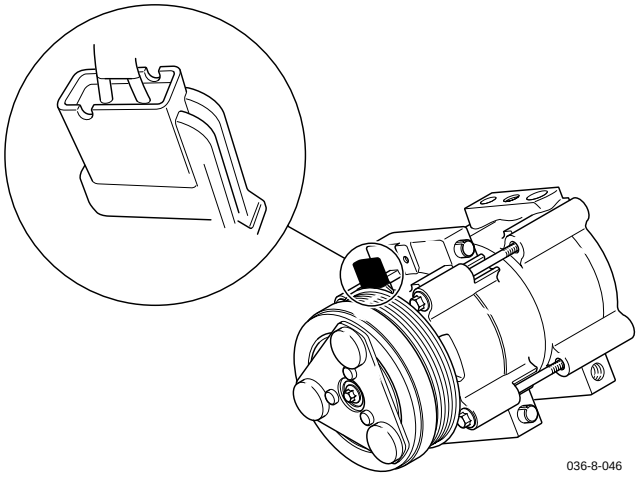
8.1.01.1 Air Conditioning Compressor

Removal

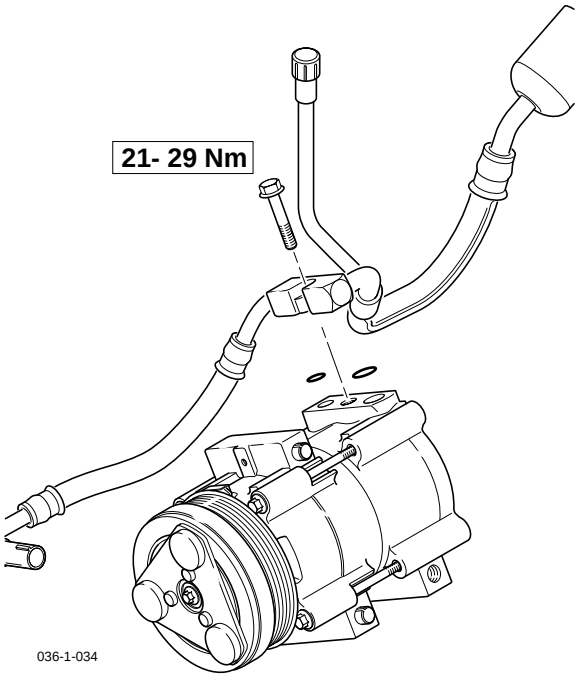
1. Switch off the battery disconnect switch.
2. Recover the refrigerant from the air conditioning system.
3. Remove the air filter box.



4. Remove the accessory drive belt.
5. Disconnect the harness connector from the compressor clutch.

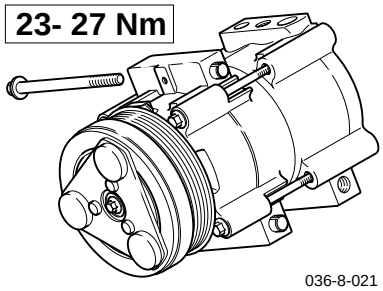


6. Remove the suction and discharge pipes from the compressor.



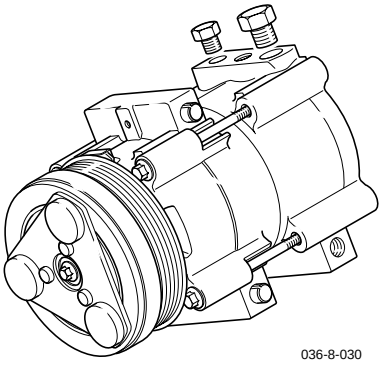
- Discard O-rings.
- Fit suitable blanking plugs.

7. Remove the compressor.



- Remove three bolts.

8. Measure the amount of oil held in compressor.



NOTE: This step is not necessary in the case of refrigerant loss.

- Pour the oil from the old compressor into a suitable measuring container. Note the amount and discard the oil.
- Fit blanking plugs to the old compressor.

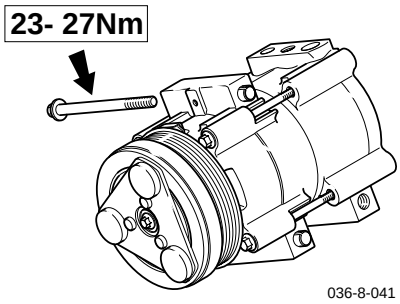
- Note the additional volume of oil recovered with the refrigerant.

Installation

1. Fill new compressor with correct amount of oil.

- Remove blanking plugs from compressor.
- Fill the compressor with the same amount of oil that was removed from the original compressor, plus the amount recovered from the recovery equipment.
- Fit blanking plugs to the compressor.

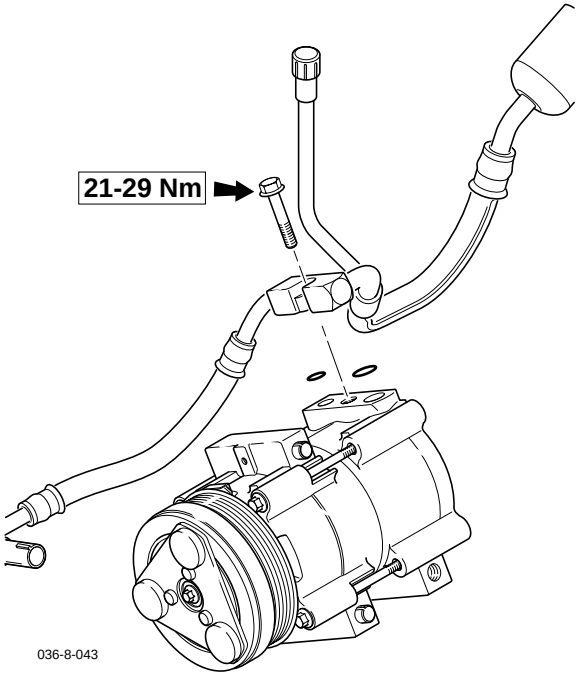
2. Install the compressor.



- Tighten fixings.

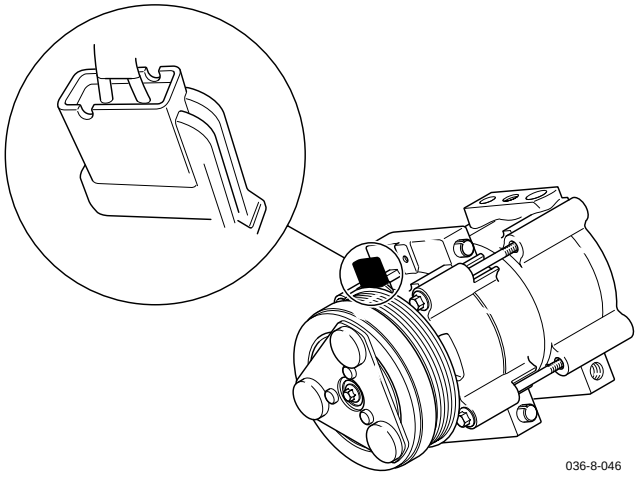
If replacing a faulty compressor with internal mechanical damage, also replace the receiver drier which could also be contaminated with mechanical debris.

3. Fit suction and discharge pipes to the compressor.

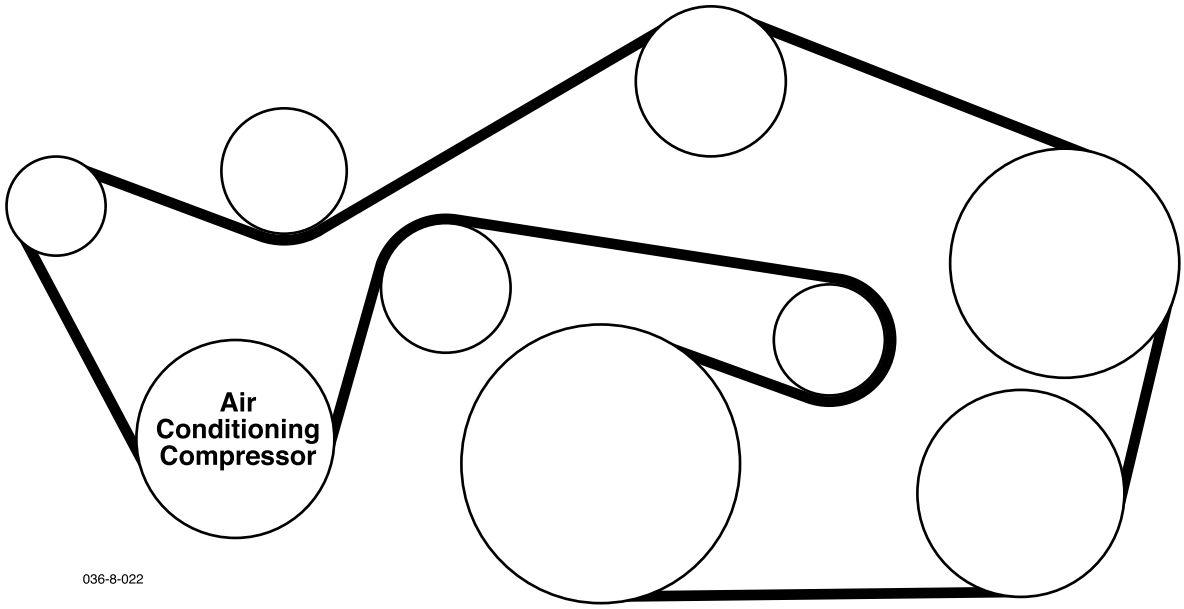


- Fit new O-rings.
- Tighten fixings.

4. Connect harness connector to compressor.



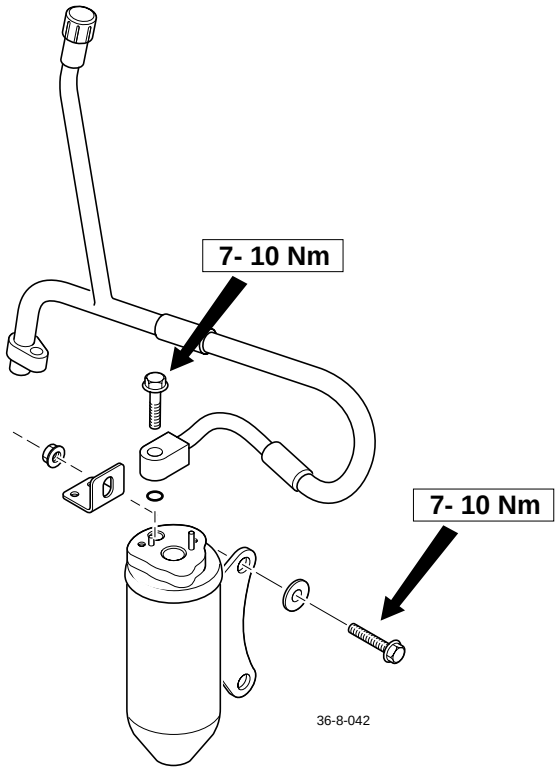
5. Install accessory drive belt.



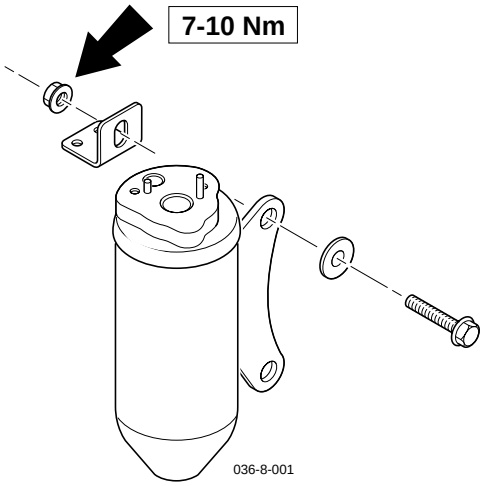
6. Switch on the battery disconnect switch.
7. Recharge air conditioning system.
8. Start the engine and allow ther cooling system to come to normal running temperature. Carry out the system actuator check and the system functional check to ensure correct operation.

8.1.03.1 Receiver Drier Assembly

1. Switch off the battery disconnect switch.
2. Recover the refrigerant (8.0.01.1).
3. Disconnect the refrigerant lines from the receiver/ drier.
   - Remove one bolt from each refrigerant connector.
   - Disconnect the refrigerant lines
   - Remove and discard the ‘O’ ring seals
   - Fit suitable blanking plugs



4. Remove the reciever/drier.
   - Remove two M6 bolts
   - Remove the receiver/drier
   - Recover the spacers and ferrules for reuse.



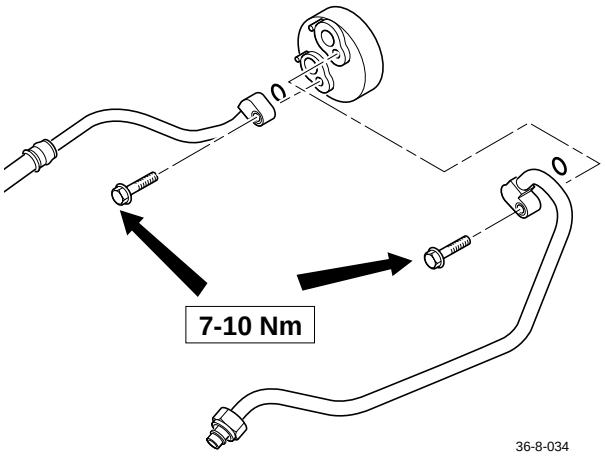
Reassembly

1. Reassembly is the reverse of the removal procedure.
2. Fit new ‘O’ rings to the refrigerant connectors before securing.

8.2.02.1 Air Conditioning Unit

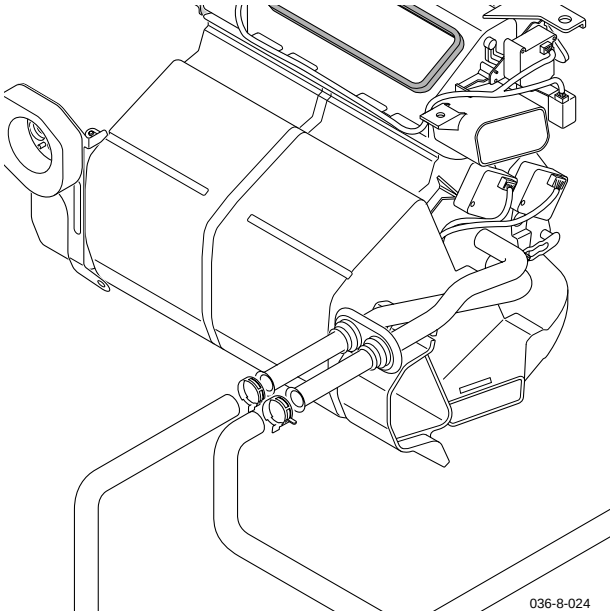
Removal

1. Connect the WDS and record any logged fault codes in the A/C system.
2. Switch off the battery disconnect switch.
3. Recover the refrigerant from the air conditioning system (8.0.01.1).
4. Drain the engine coolant (1.7.01.1).
5. Remove the centre console and facia (See section 7).
6. From under the hood: Disconnect the air conditioning refrigerant pipes at the evaporator.



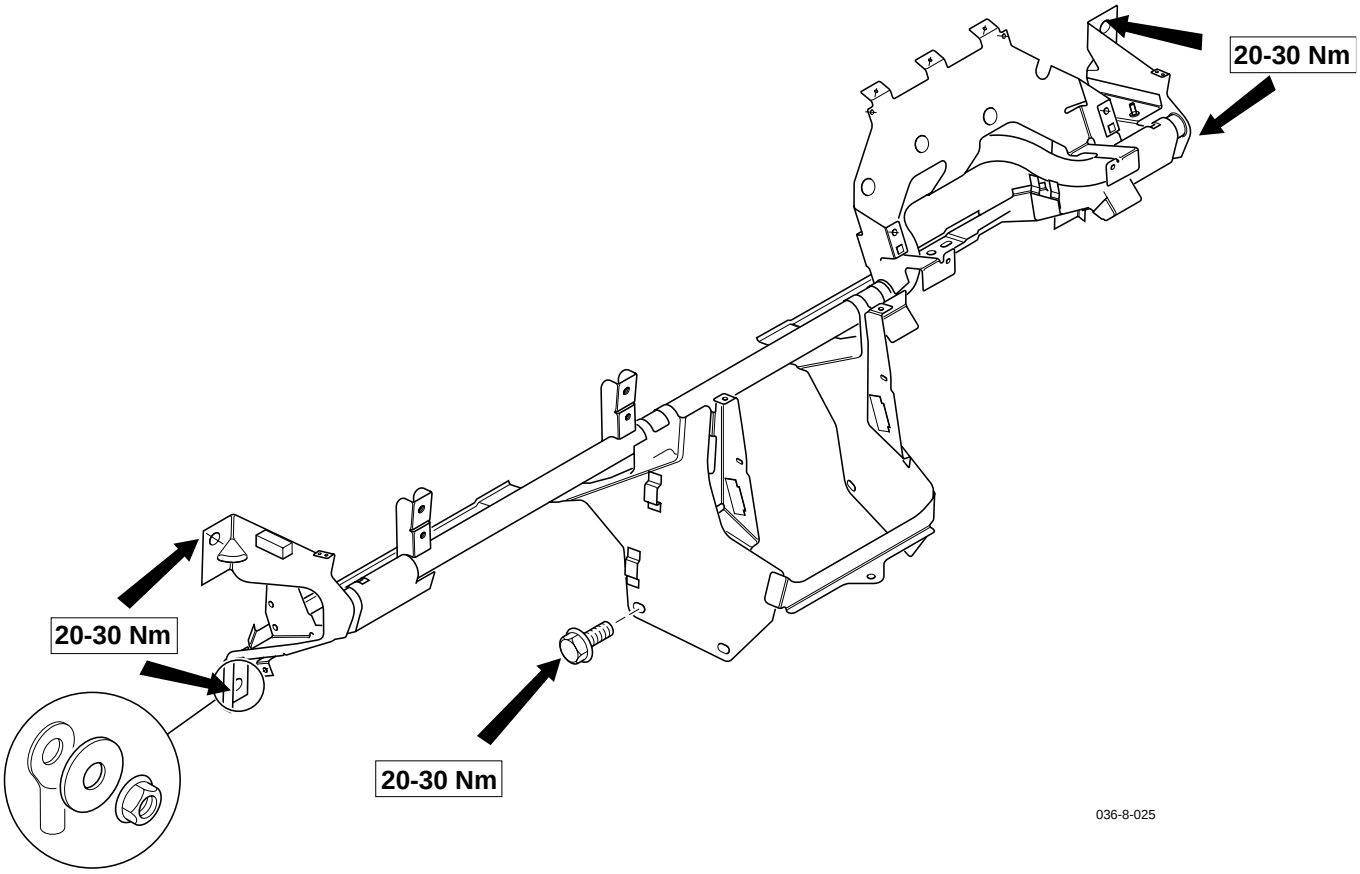
- Remove bolts.
- Discard O-rings.
- Install suitable blanking plugs.

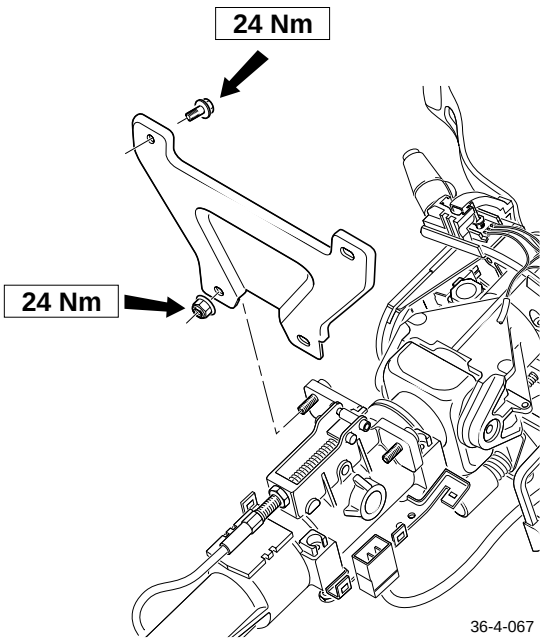
7. From under the hood: Disconnect the heater hoses from the heater matrix pipes.



- Release spring band clips and disconnect heater hoses.
- Install suitable blanking plugs.

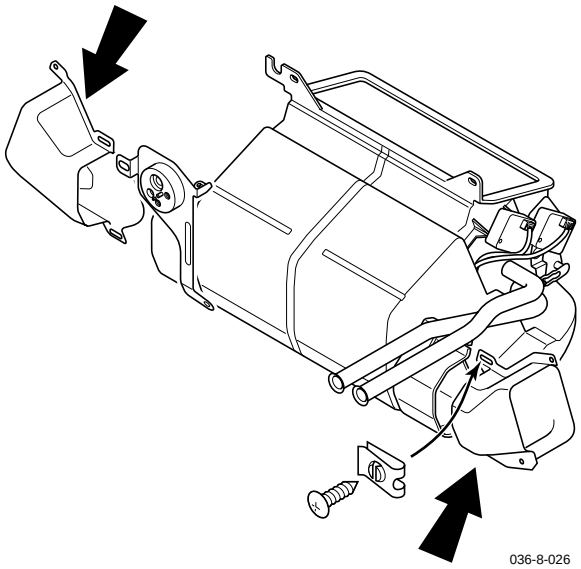
8. From inside the vehicle: remove the cross-car brace tube.





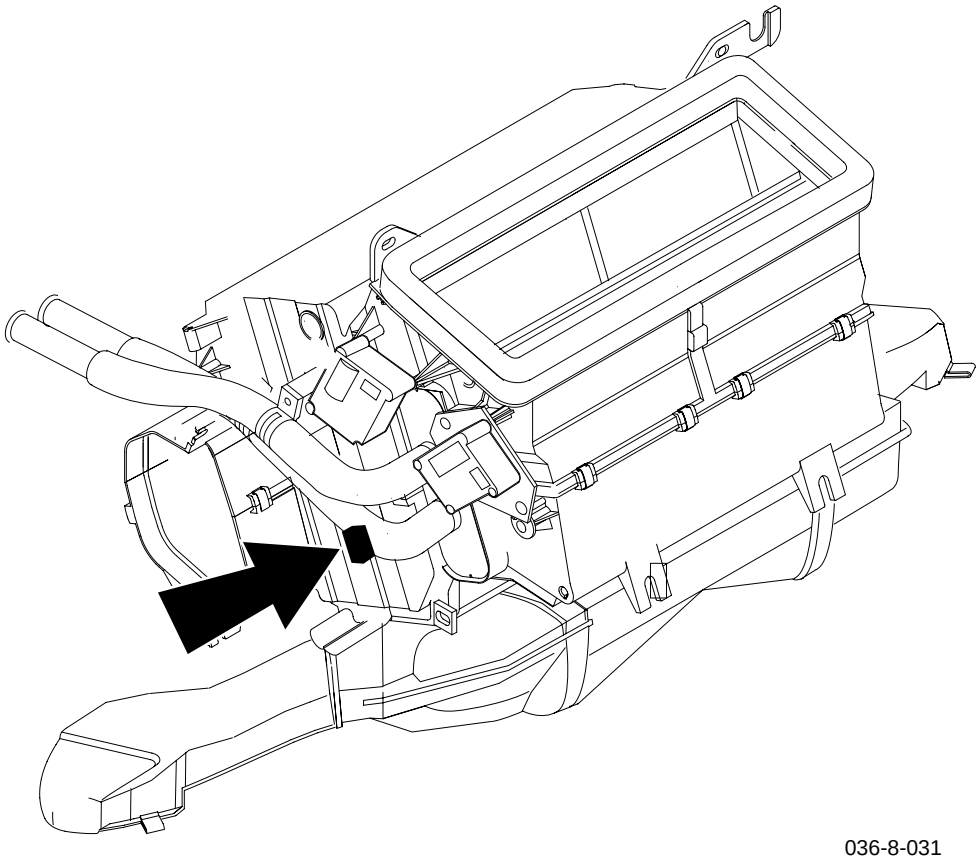
- Remove steering column upper mounting bracket / brace to bulkhead securing bolt.
- Remove the brace tube to vehicle body securing bolts.
- Remove the brace tube.

9. Remove LH and RH fan motor ducts.
   - Remove screws.
   - Remove duct.s



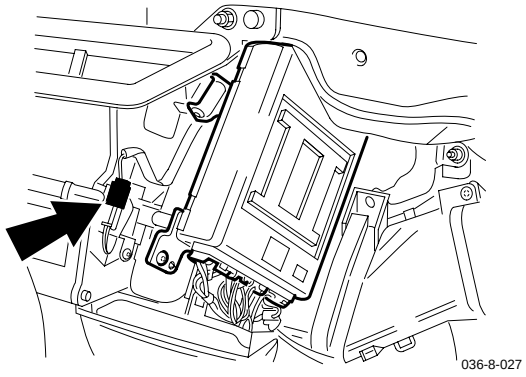
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10. Disconnect the heater / cooler unit electrical connector.

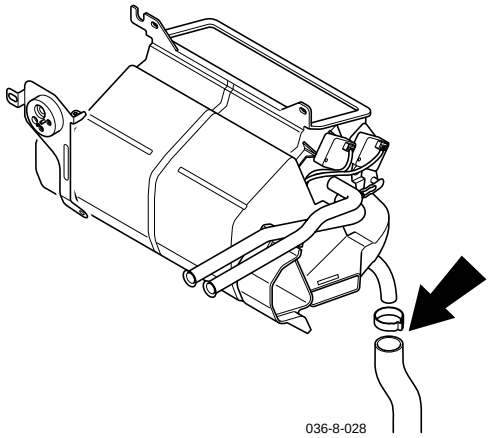


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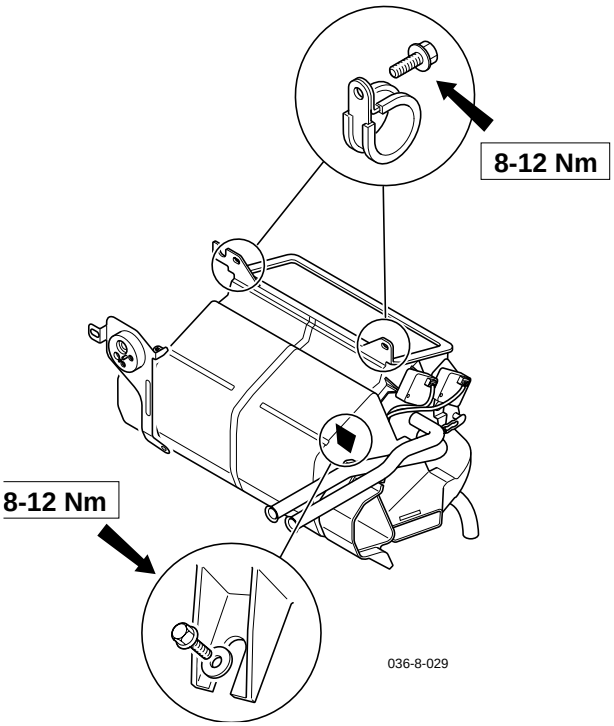
11. Disconnect air conditioning control module electrical connectors.



12. Disconnect condensate drain tubes from heater / cooler assembly.

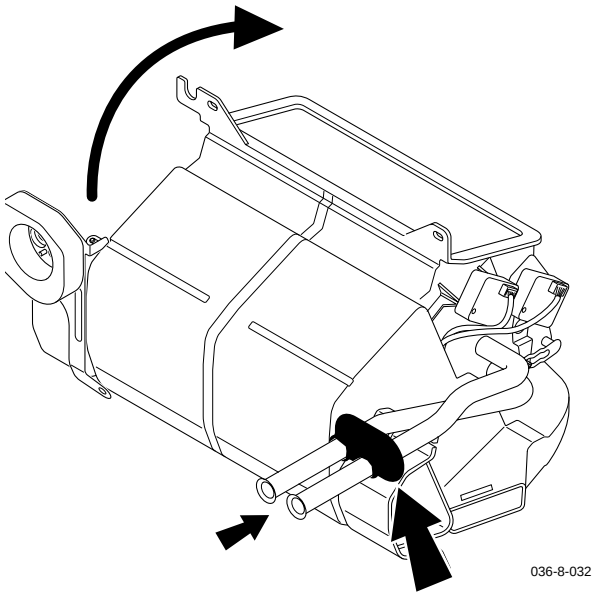


13. Remove heater / cooler assembly fixings.



- Remove lower fixing bolts.
- Remove upper fixing bolts.

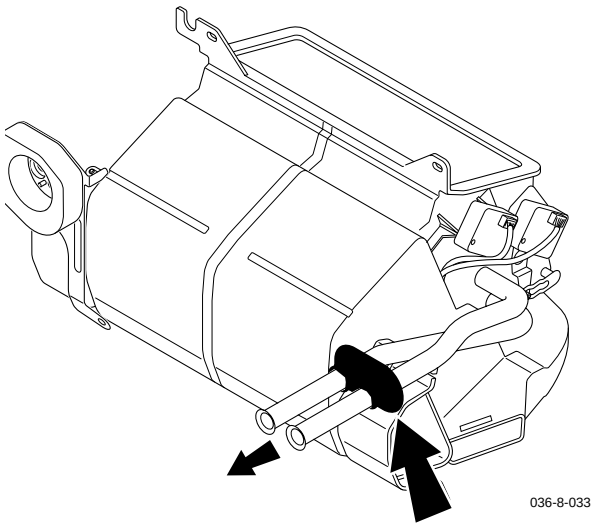
14. Remove heater / cooler unit from vehicle.



- Remove the heater/cooler unit, right end first
- Manoeuvre matrix heater pipe stubs through bulkhead grommet into vehicle.
- Remove unit.

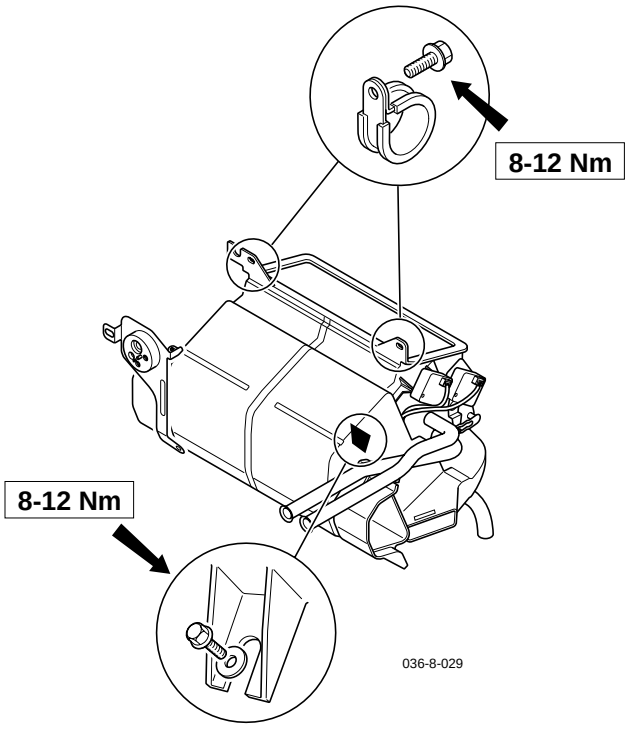
Installation

1. Install heater / cooler unit into vehicle.



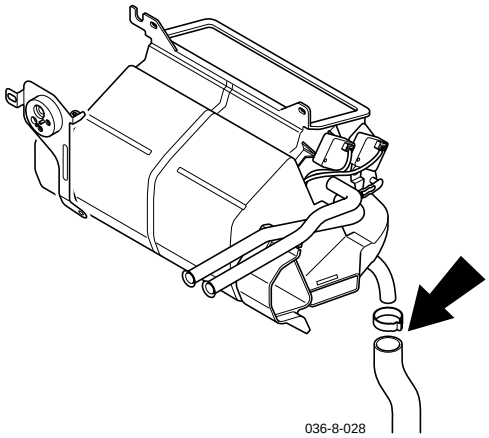
- Guide matrix heater pipe stubs through bulkhead grommet.
- Position heater / cooler unit against bulkhead.

2. Install heater / cooler assembly fixings.

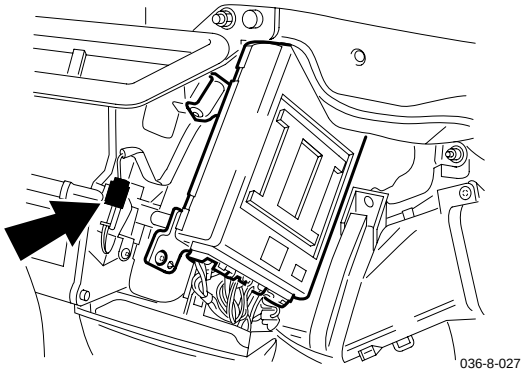


- Install upper fixing bolts.
- Install lower fixing bolts.

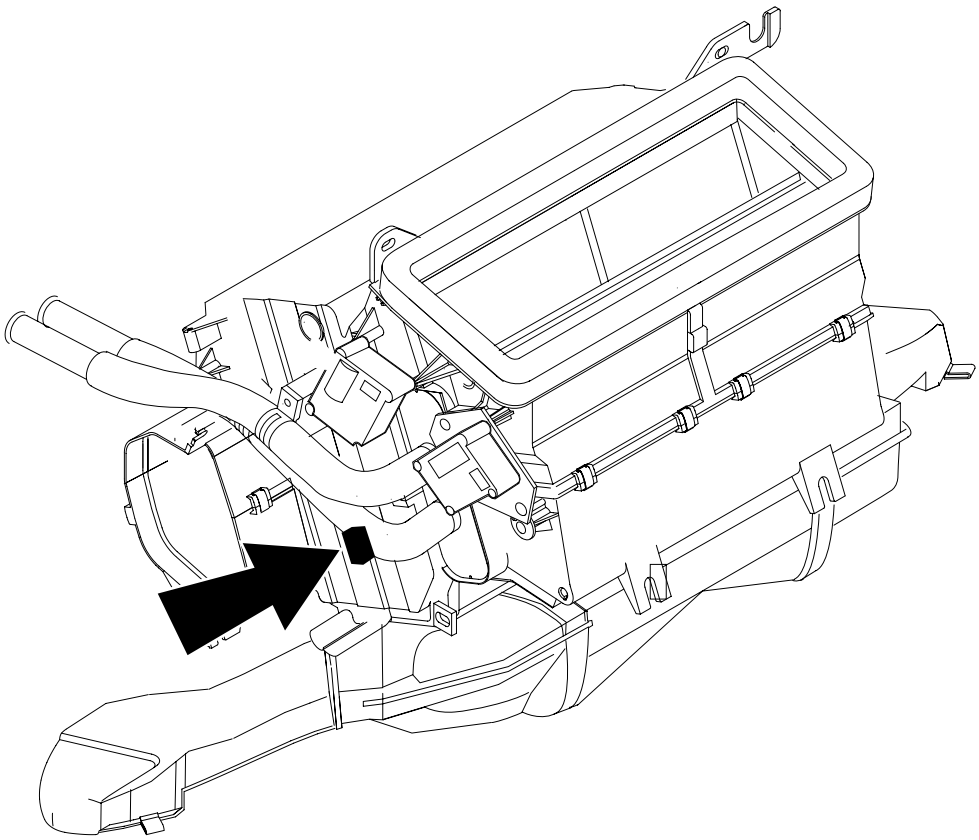
3. Connect condensate drain tubes to cooler unit.



4. Reconnect air conditioning control module electrical connectors.

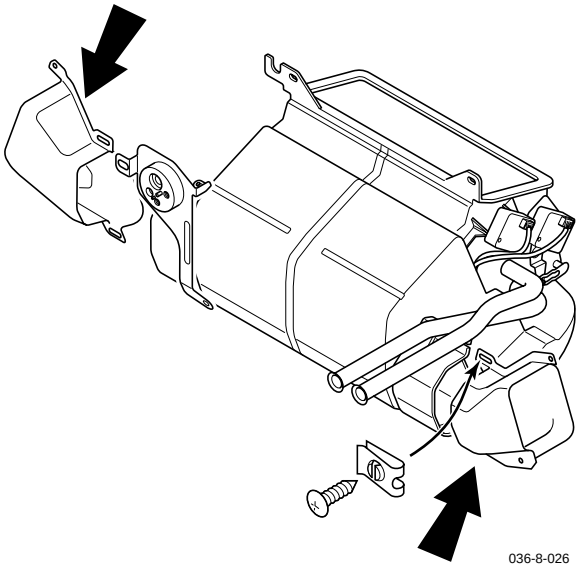


5. Connect heater / cooler unit electrical connector.



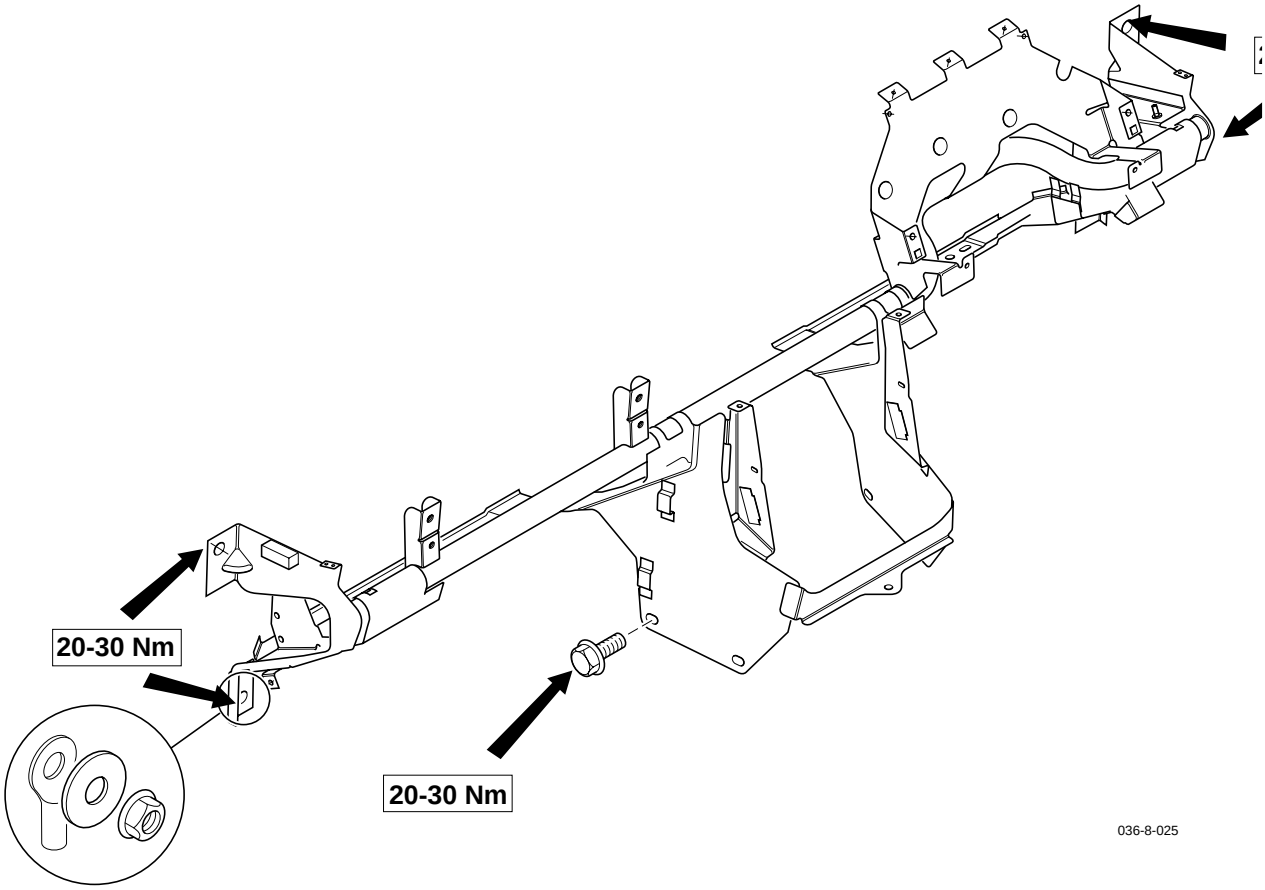
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6. Install LH and RH fan motor ducts.



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7. Install the cross-car brace tube.



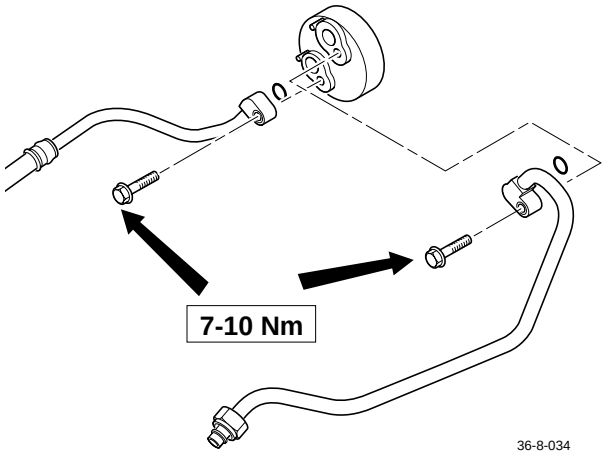
- Position and align the brace tube to the vehicle body and the heater / cooler unit.
- Installthe brace to body securing bolts.
- Install brace to bulkhead securing bolt (where fitted).
- Install steering column upper mounting bracket / brace to bulkhead securing bolt.

8. Under hood:

Reconnect heater hoses to heater matrix pipes.

- Remove blanking plugs.
- Reconnect heater hoses and reposition spring band clips.

9. Reconnect the air conditioning pipes at the evaporator.



- Remove blanking plugs.
- Install, fully seat and lubricate new O-rings.
- Install bolts.

10. Install the centre console and fascia.

11. Recharge air conditioning system.

12. Re-fill cooling system.

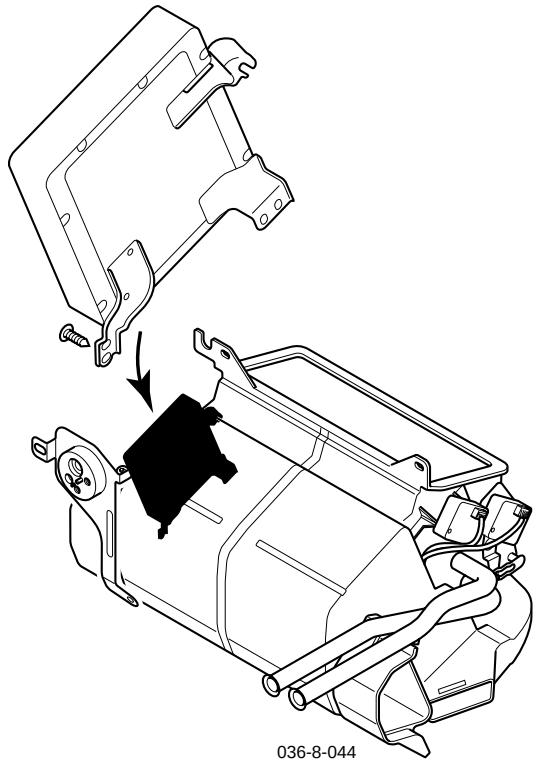
13. Switch on the battery disconnect switch. Start the engine and allow the cooling system to come to normal running temperature. Carry out the system actuator check and the system functional check to ensure correct operation.

8.2.05.1 Evaporator

Removal

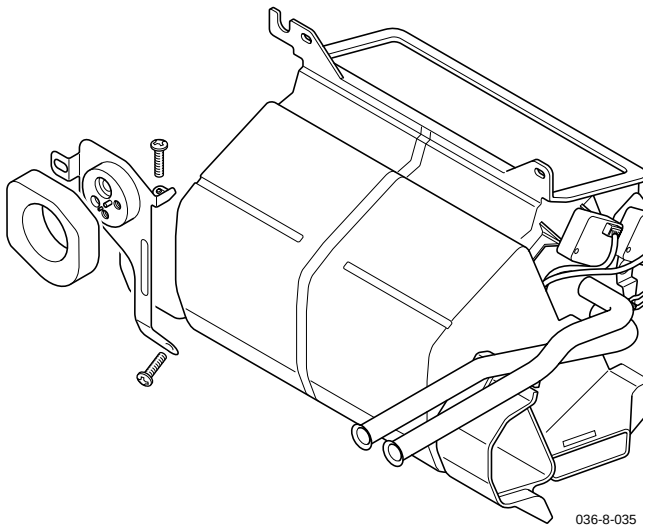
1. Remove the air conditioning unit (8.2.02.1).

2. Remove air conditioning control module from the unit.



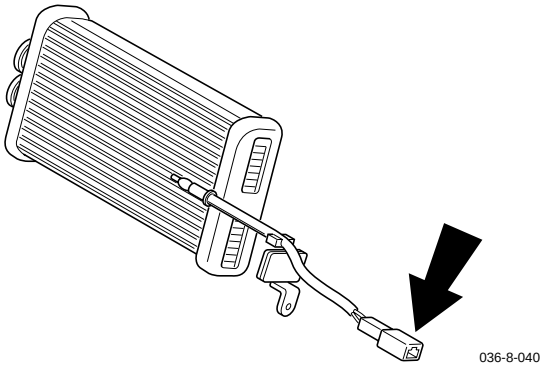
- Slacken upper fixing.
- Remove lower fixings.

3. Remove evaporator pipe bulkhead seal plate.



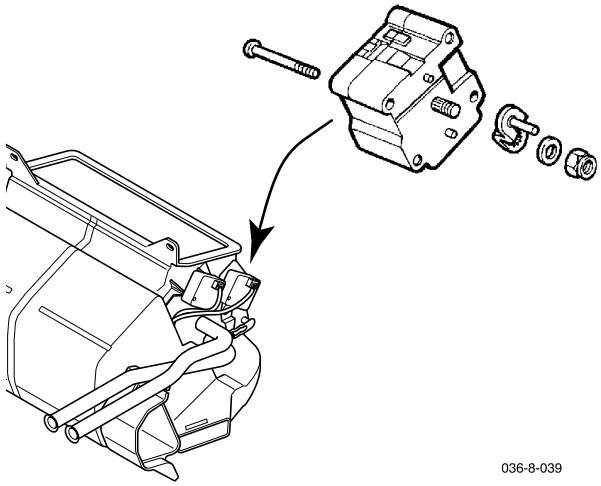
- Remove screws.
- Remove plate.

4. Disconnect heater matrix temperature sensor.



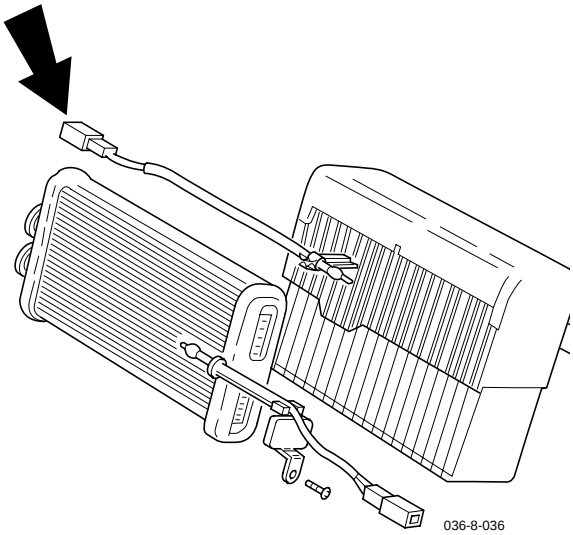
- Detach heater matrix temperature sensor connector from unit.
- Disconnect connector.

5. Remove footwell servo motor from heater / cooler unit.



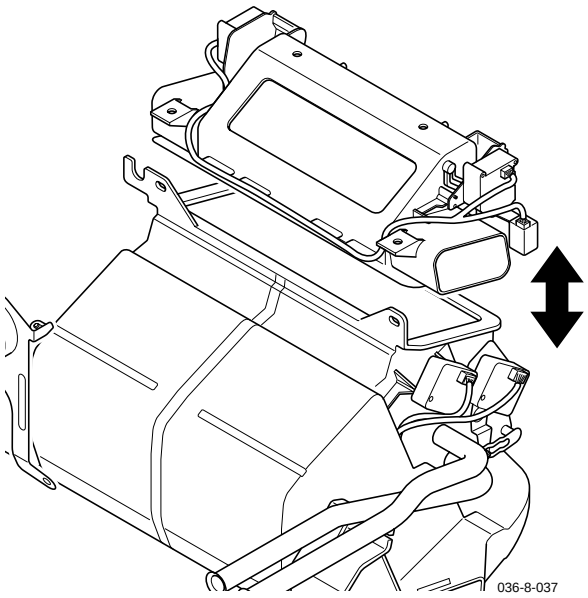
- Disconnect connector.
- Remove screws.
- Remove motor complete with bracket.

6. Disconnect evaporator sensor connector.



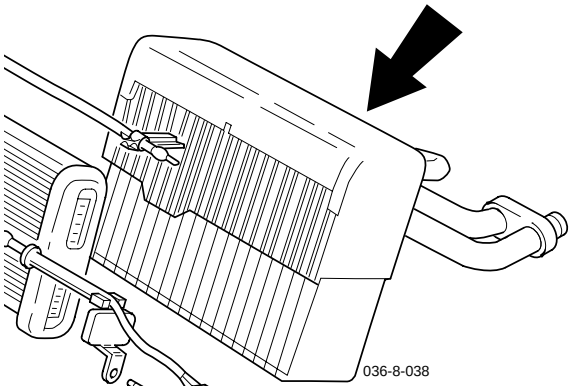
- Detach heater / cooler unit connector.
- Detach evaporator sensor connector.
- Disconnect connector.

7. Remove heater / cooler unit upper case from lower case.



- Remove screw.
- Remove 15 clips.
- Remove upper case from lower case.

8. Remove evaporator from case.



- Remove sensor and clip.
- Remove evaporator.

Installation

9. Installation is the reverse of removal.

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Harness Identification

CA - Cabin
DD - Driver Door
DP - Passenger Door
EM - Engine Management
FC - Facia
FS - Front Seat Heated
FW - Forward
HC - Header Console
IC - In/Car Entertainment
RT - Radio Telephone
SD - Seat Driver
SP - Seat Passenger

Circuit Description	Sheet Number
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Exterior Lighting - Rear	03
Wash Wipe & Power Steering	04
Interior Lighting	05
Dimmer	06
Ignition Switched Circuits	07
A.B.S	08
Seat Front Unheated	09
Seat Front Heated/Foldback Mirrors	10
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Security System	13
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In Car Entertainment Standard	16
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Instrument Pack	18
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PTEC "B"	22
Gearbox Controller	23
Earth Points	24
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Diode	Circuit Sheet	Harness	Function	Description
1	13	FC	Blocking	Prevents BPM pin 67 (Not in Park) Having Sneek Ground Via Internal Circuit Of BPM pin 58 (Key In Switch)
2	14	FW	Blocking	Prevents Grounding Of BPM Crank Input (FC014/041) and BDS Crank Input When Ignition Is Off. Path Is Via Starter Relay Coil And Ignition Fuses Supply Via Relay #7 In The Underbonnet Fusebox
3	22	EM	Reverse Voltage	Ensures That Secondary PTEC VPWR Supply Has Reverse Voltage Protection By Blocking Polarity To VPWR Coil
4	5	BT	Blocking	Prevents Grounding Of Security Boot Ajar Input (BT041/005) Via Interior Boot/Glovebox Lamps. Allows Common Switch For Security Plus Boot Lamps
5	17	FW	Suppresion	Flywheel Diode Across Air-Con Clutch Solenoid
6	23	FC	Blocking	Prevents Bonnet Open Input On BPM pin 56 Being Enabled Due To 5v Pull Up On TCU Input pin 70. BPM Logic Threshold Is <9v Active Low
7	14	CA	Blocking	Prevents BDS Cut Off With Ignition Off

V12 Vanquish

CIRCUIT TITLE	MATRIX SHEET
MODEL	COUPE
APPLICABILITY	FROM CHASSIS 0001

CIRCUIT SHEET 01

SOURCE 1R12-370795-AD

1 2 3 4 5 6 7 8

A B C D E F

Underbonnet Fusebox

BATT

RELAY#5 DIP BEAM LAMPS

RELAY#2 FRONT FOG LAMPS

RELAY#3 MAIN BEAM LAMPS

F8 10A

F6 10A

F17 15A

F21 10A

F19 10A

FW6/8 UY

FW6/4 UK

FW6/9 US

FW8/3 OB

FW8/10 OW

FW5/8 OG

FW5/4 UB

FW7/10 UW

FW5/7 UG

FW1/7

FW1/6 UG

FW1/5 US

FW1/3 GO

FW1/9 RB

FW1/2 GY

FW1/10 RK

FW4/1

FW58/1

FW41/4 WR

FW41/1 WU

FW41/3 UW

FW42/2 NW

FW42/1 NY

FW43/2 NW

FW43/1 NY

FW44/3 UW

FW44/1 WU

FW44/4 WR

FW59/1

FW65/1

FW4/2

FW58/2

FW41/2 B

FW42/3 N

FW43/3 N

FW44/2 B

FW59/2

FW65/2

B

FWS9

FWS8

FW1AR

FW3AR

LH DI SIDE REPEATER 5W

LH SIDE MARKER 5W FED ONLY

LH DI LAMP 21W

LH SIDE LAMP 5W

LH FOG LAMP 55W

LH DIP BEAM 55W

LH MAIN BEAM 65W

RH MAIN BEAM 65W

RH DIP BEAM 55W

RH FOG LAMP 55W

RH SIDE LAMP 5W

RH DI LAMP 21W

RH SIDE MARKER 5W FED ONLY

RH DI SIDE REPEATER 5W

FC1BL LHD

FC4BL RHD

FCS49

FC55/16 +12 V

Center Console Switchpack

FC55/18 OG

FC55/17 OG

FC55/4

Dimmer SHT06

FC55/1 OR

FC55/3 PY

FC55/9 PW

FCS37

FC14/20

FC14/38

FC14/59

FC14/96

FC14/80

Homelink

Glass Break Sensor

HC3/1 R

HC4/4 R

Header Console SHT 05

CA27/3 NR

Key Transponder Module SHT 13

FC22/4 NR

Drivers Side Fusebox

BATT

F6 5A

F5 15A

FC5/10 NR

FC5/9 NB

CA3/19 NR

NR

FCS19

FW1/7

FW1/6 UG FC14/45 Main Beam Lights

FW1/5 US FC14/68 Dip Beam Lights

GO FC14/27 DI Side repeater Left

RB FC14/54 Side Marker Left

GY FC14/2 DI Light Front Left

RK FC14/53 Side Light Front Left

Front Fog Lamps

Front Fog Lamp switch

Hazard Switch

Hazard Warning lamp

Lamp Supply 12V

Body Processor Module

NOTE:-
B.P.M. Case Must Be Grounded By The Mountings

Ssde Light Front Right FC14/1 RY

DI Lamp Front Right FC14/3 GK

Side Light Marker Right FC14/28 RW

DI Side Repeater Right FC14/81 GR

Dip Beam Switch FC14/42 RY

Sidelight Switch FC14/16 RY

Headlamp Flash FC14/30 U

Main Beam Switch FC14/14 UB

LH DI Switch FC14/88 YG

RH DI Switch FC14/61 KG

Dimmer Module SHT 06

FC23/4 RY

FCS9

UY RY

SC2/4

SC2/3

SC2/2

SC2/6

SC2/7

SC2/8

Rear View interior Mirror SHT 11 Auto Headlamps

CA60/5 YU

CA4/10 YU

SCS2

SC1/2

SC1/3

SC1/10

SC1/9

SC1/6

SC1/7

DIP

SIDE

H/L FLASH

MAIN BEAM

LH

D.I.

RH

TRIP CYCLE

SC1/5

BK

SCS1

Column Switchgear

SC2/1

SC2/9

FCS48

BK BK

FC2AL LHD

FC5AL RHD

V12 Vanquish

TITLE	Exterior Lighting Front
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 02

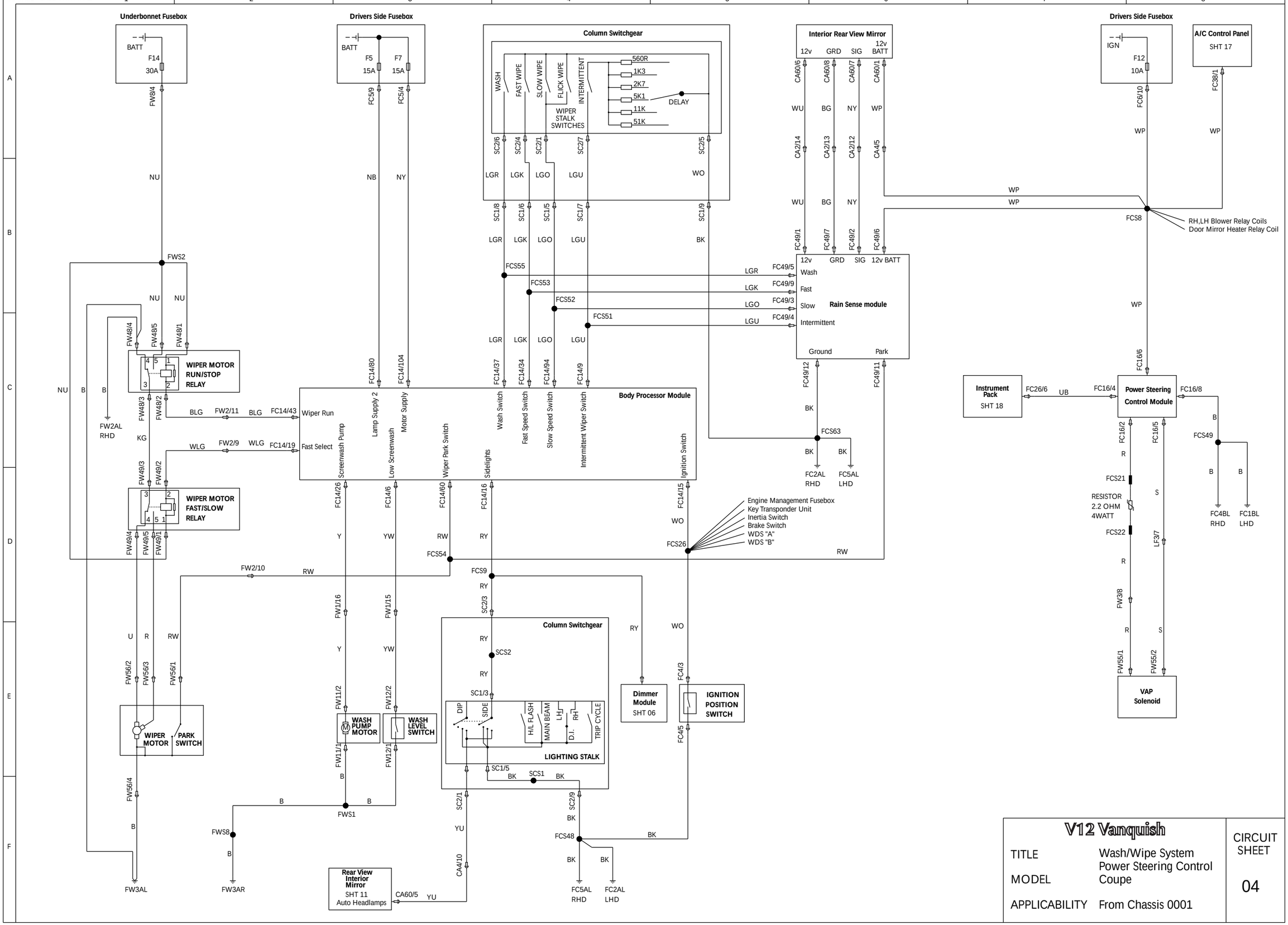
SOURCE 1R12-370795-AD

V12 Vanquish

TITLE	Exterior lighting Rear
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 03

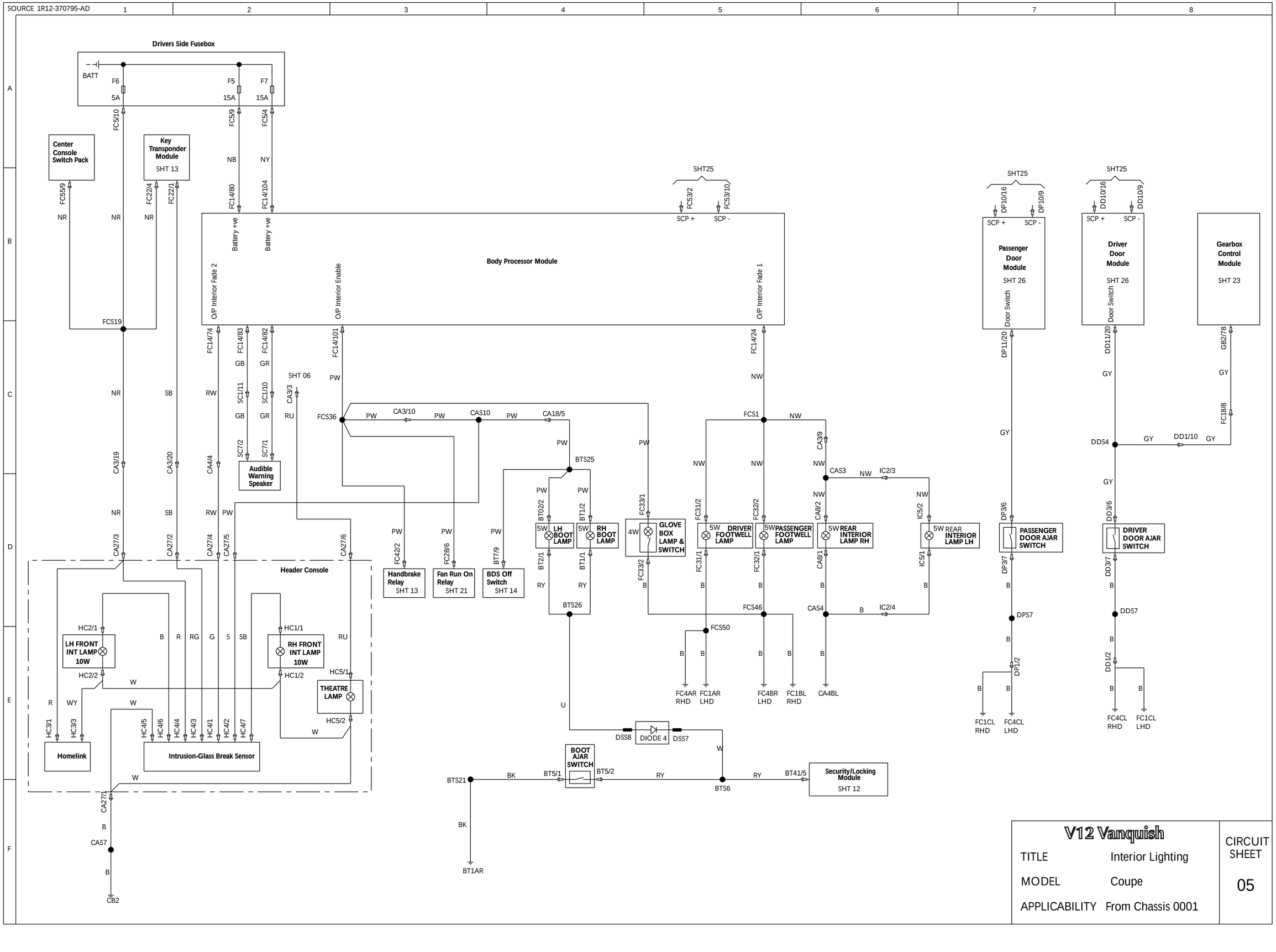
SOURCE 1R12-370795-AD



	V12 Vanquish
TITLE	Wash/Wipe System Power Steering Control
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 04

SOURCE 1R12-370795-AD



V12 Vanquish

TITLE	Interior Lighting
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 05

SOURCE 1R12-370795-AD

1 2 3 4 5 6 7 8

A B C D E F

Homelink

Glass Break Sensor

HC3/1 R — HC4/4 R

Header Console SHT 05

CA27/3 NR

CA3/19 NR

Drivers Side Fusebox

BATT F6 5A

FC5/10 NR FCS19

Passengers Side Fusebox

BATT F18 10A

FC20/6 NP

Key Transponder Unit SHT 13

FC22/4 NR FC22/13 WN

BPM

FC14/96 PW FC14/32 WN FC14/16 RY

COLUMN SWITCHGEAR

SC1/5 BK

LIGHTING SWITCH — DIP SIDE OFF

OVERRIDE SWITCH (Opens in the Override position)

SC1/3 RY — SC11/3 RY — SC11/4 UO — SC11/5 Y — SC11/6 G — SC11/2 RLG

SCS2 RY — SCS1 BK

SC2/3 RY — SC3/9 UO — SC3/10 Y — SC3/11 G — SC3/8 RLG — SC2/9 BK

FCS48

FC2AL LHD — FC5AL RHD

Passenger Side Fusebox
Gearbox Control Module
ASM Switch Panel
A/C Control Panel
WDS PLUG "A"
WDS PLUG "B"

FCS17 NP NP — FCS20 WN — FCS9 RY

FC23/10 Battery Supply — FC23/11 Battery Supply — FC23/3 Auxiliary Ground — FC23/4 RY — FC23/12 UO — FC23/5 Y — FC23/6 G

Dimmer Module

FC23/8 Output 2 RK — FC23/9 Ground — FC23/7 Output 2 RU — FC23/1 Output 1 RO — FC23/2 Output 2 RO

FCS3 — FCS31 — FCS72 — FCS4

DP1/9 RK — DP17/4 RK — DP17/3 B — DPS1 B — DP1/1 B B — FC1CR RHD FC4CR LHD

PASS DOOR SWITCHPACK ILLUMINATION

DD1/9 RK — DD17/5 RK — DD17/4 B — DDS1 B — DD1/1 B B — FC4CR RHD FC1CR LHD

DRIVER DOOR SWITCHPACK ILLUMINATION

FC43/8 RK — FC43/7 B — FC38/14 — **Aircon Module**

AIRCON PANEL ILLUM

FC55/9 NR — FC55/3 — FC55/4 RK — FC55/16 B — FCS49 B B — FC1BL LHD FC4BL RHD

Center Console Switchpack Illumination

HAZ-ARD — LH SEAT HTR — RH SEAT HTR — FOG LAMP F — FOG LAMP R — TRACTION CONTROL

FC56/3 RK — FC56/24 B

ASM Switch Panel

AUTO ILLUM — REV ILLUM — SPORT ILLUM — WINTER ILLUM

FC10/1 RK — FC63/2 B

CIGAR LIGHTER ILLUM

FC41/4 RK — FC41/2 B — FCS50 B B — FC4AR RHD FC1AR LHD

BOOT/FUEL RELEASE SW ILLUM

FC27/3 RK — FC27/4 B

TRIP KEYBOARD ILLUM

FCS46 B B — FC4BR LHD FC1BL RHD

CA3/3 RU — CA27/6 — **HEADER CONSOLE** SHT 06

IC1/6 RU RLG — IC11/20 — IC11/21 — **Radio Head Unit**

IC1/5 RO RLG — FC25/6 — FC26/21 — **Instrument Pack**

RLG — F055/10 — **Center Console Switch Pack** Status LEDs

RLG — FC43/9 — **Aircon Panel**

RLG — FC8/4 — **Gear Display Module**

RLG — FC56/6 — **ASM Switch Panel**

V12 Vanquish

CIRCUIT TITLE	Dimmer
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 06

SOURCE 1R12-370795-AD

V12 Vanquish

CIRCUIT TITLE	Ignition Control
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 07

Underbonnet Fusebox
Engine Management Fusebox
Drivers Side Fusebox
Passengers Side Fusebox
Boot Fusebox
RELAY #1 AIRCON WATER PUMP
RELAY #3 MAIN BEAM
RELAY #2 FRONT FOG LAMPS
RELAY #7 IGNITION POSITIVE
RELAY #1 PTEC A POSITIVE
RELAY #1 EMS CONTROL
RELAY #1 AUXILLARY POSITIVE
RELAY #7 IGNITION POSITIVE
RELAY #1 REAR FOG LAMP
RELAY #2 HEATED REAR WINDOW
RELAY #4 FUEL PUMP 1
RELAY #5 STOP LAMP
RELAY #6 ACCESS-ORY SOCKET
Aircon Water Pump
Aircon ECU
LH Main beam Lamp
RH Main Beam Lamp
BPM
LH Front Fog Lamp
RH Front Fog Lamp
BPM & Center Console Switch Pack
Alternator Regulator
Transmission Control Keypower
Engine Fan Module Gearbox Oil Pump Relay
ABS ECU
PTEC "A" VPWR
Cooling fan Run On Relay Injectors,Mass Air Flow
MFDM,VMV & Canister Vent
HEGO/CMS Heaters PTEC "A"
PTEC "B" VPWR Relay Coils
PTEC "B" VPWR
Air Bag ECU
Air Con ECU,Interior Mirror VAPS,Mirror Heater Relay & Blower Motor Relays
Inst Pack & Gear Display Module
Spare
Ice Head Unit & Navigation
Fuel Pump Driver Module 2
OBD 2
By-Pass Motor
Rear Fog Lamps
Security Locking Module
Spare
Heated Rear Window
Aircon ECU
Gearbox Hydraulic Pump
Fuel Pump Driver Module 1
High Stop Lamp
ABS,TCU,PTEC "A" & "B"
LH Stop Lamp
RH Stop Lamp
Telephone
Active Security Sounder SHT 13
Center Console Switch Pack
Traction Status Relay
Inertia Switch
Crank Input
Key In Ignition
Ignition On
Body Processor Module
Passengers Seat SHT 09
Drivers Seat SHT 09
JDS OBD2 Connector A SHT 25
JDS OBD2 Connector B SHT 25
Key Transponder Module SHT 13
INERTIA SWITCH
FOOTBRAKE SWITCH
Patts Module Heated Front Screen Relays
Starter Relay
WDS OBD2 Connector A
Key Transponder Module
Auxiliary On Body Processor Module
Aircon Module
Dimmer Module
WDS OBD2 Connector B
TCU
IGNITION POSITION
KEY IN IGNITION
AUXILLARY POSITION
Ignition Switch
ASM Switch Panel
Ignition
Start Button Illumination
Start Button
Start i/p
Start o/p
Aux i/p
Aux o/p
Tyre Pressure Monitor SHT 18
Battery Disconnect Switch SHT 14
Accessory Socket (Console)
Cigar Lighter
DIODE 7
PTEC A SHT 21
Accessory Socket (Facia)
Accessory Socket (Boot)
FC1AL LHD
FC1AR RHD
FC4BL RHD
FC1AS LHD
FC2AL LHD
FC5AL RHD
FC4AR RHD
BT2AL

SOURCE 1R12-370795-AD

1 2 3 4 5 6 7 8

A B C D E F

Active Security Sounder SHT 13

FW13/1

Underbonnet Fusebox

BATT

RELAY #2 FRONT FOG LAMPS

RELAY #7 IGNITION POSITIVE

F17 15A | F3 5A | F4 5A | F18 30A | F16 30A

FW8/10 FW5/8 FW5/9 FW8/8 FW8/9 FW7/9 FW5/1 FW7/4

WR WR WU NR NY

Boot Fusebox

BATT

RELAY#5 STOP LAMP RELAY

F8 5A

BT11/9 BT11/5

UO

G/Box ECU SHT 23

GB2/69 UO

FC18/7 UO

PTEC "A" SHT 21

EM-A/40 UO

PTEC "B" SHT 22

EM-A/40 UO

CA18/15 UO CA1/4 UO FCS35 UO FC47/9 UO EMS12

UO FW2/5 UO FW19/2

WR WR FWS5

SHT 25

FW19/20 FW19/9 FW19/25 FW19/23 FW19/10 FW19/11

ABS Module

+12V Ignition | +12V Pump & Motor | +12V Valves | OBD 2 DIA | SCP - | SCP + | Brake Pedel Dperessed

Traction/Stability Switch | Traction/Stability Status LED | Ground | Ground | Sensor (In) | Sensor (Out) | Sensor (In) | Sensor (Out) | Sensor (In) | Sensor (Out) | Sensor (In) | Sensor (Out) | Road Speed Out

LF19/14 LF19/15 FW19/8 FW19/24 FW19/7 FW19/6 FW19/17 FW19/18 FW19/21 FW19/22 FW19/3 FW19/4 FW19/19

YO R B B O Y W R P U S G

FW2/7 WR LF2/3 YO LF2/1 R FW2AR

FW3/10 FW3/9 FW3/17 FW3/18

CA13/2 CA13/1 CA13/4 CA13/3 FW35/2 FW35/1 FW36/2 FW36/1

CA29/10 CA29/11 CA29/12 CA29/13

BT73/2 BT73/1 BT72/2 BT72/1 FL1/2 FL1/1 FR1/2 FR1/1

RR1/2 RR1/1 RL1/2 RL1/1

RH REAR WHEELSPEED SENSOR

LH REAR WHEELSPEED SENSOR

LH FRONT WHEELSPEED SENSOR

RH FRONT WHEELSPEED SENSOR

Option LHD

FCS24 WR FC42/8 FC42/10 WR FC42/6 FC42/7

TRACTION STATUS RELAY B

RY

FC55/4 SHT06 FC55/12 FC55/11

ILLUM TRACTION CONTROL SWITCH FC55/5 WR

+12V 560 TRACTION STATUS LED

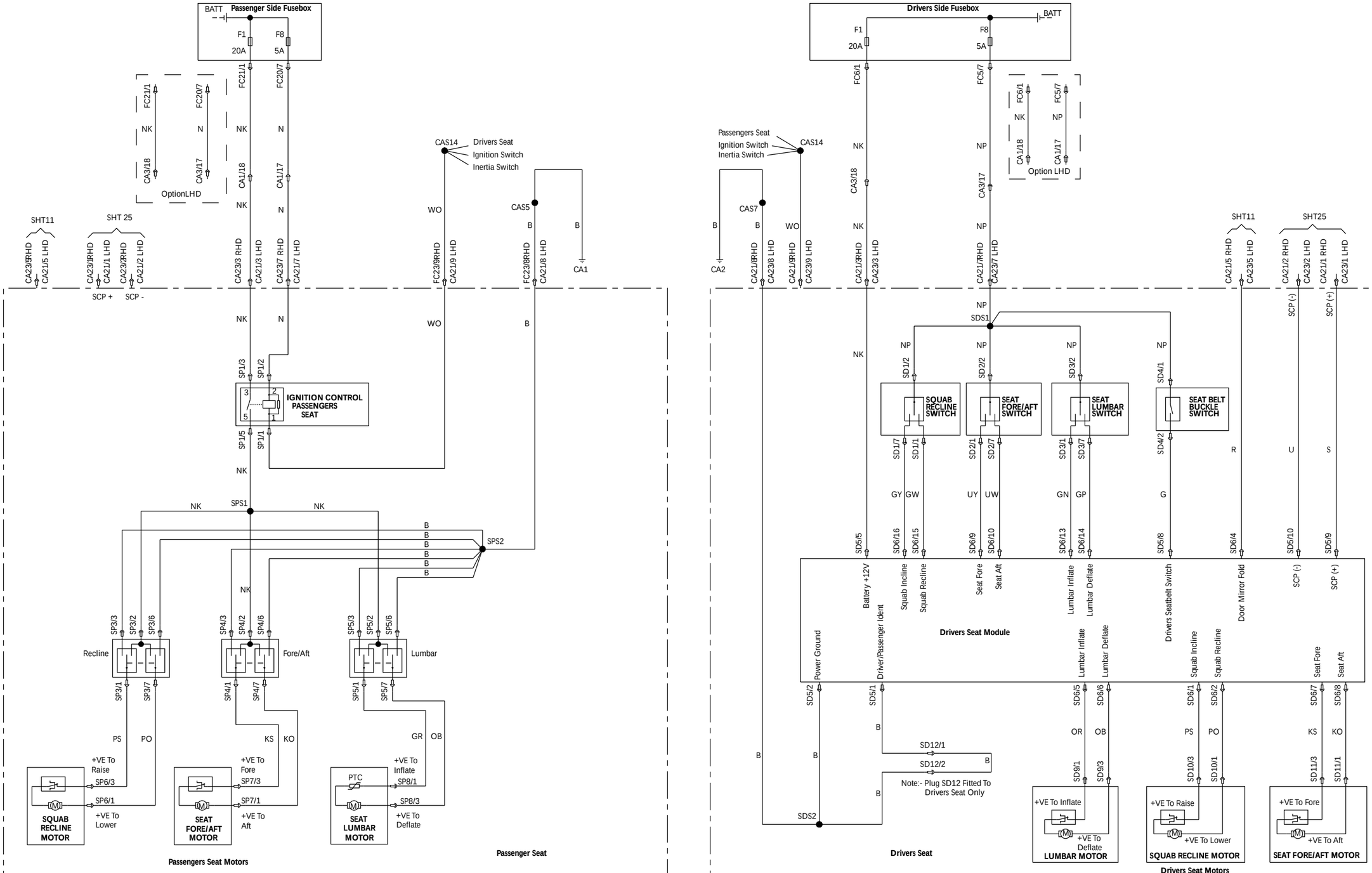
Center Console Switch Pack

FC55/16 B FCS49 B B

FC1BL LHD FC4BL RHD

V12 Vanquish		CIRCUIT SHEET
CIRCUIT TITLE	A.B.S	08
MODEL	Coupe	
APPLICABILITY	From Chassis 0001	

SOURCE 1R12-370795-AD

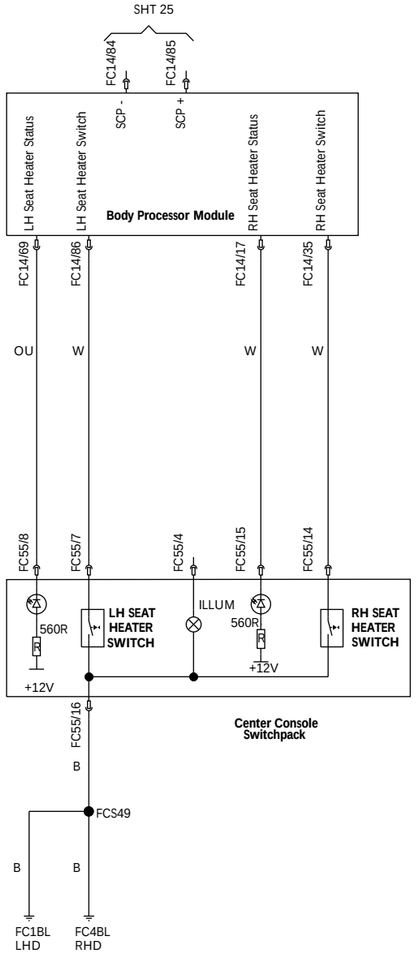


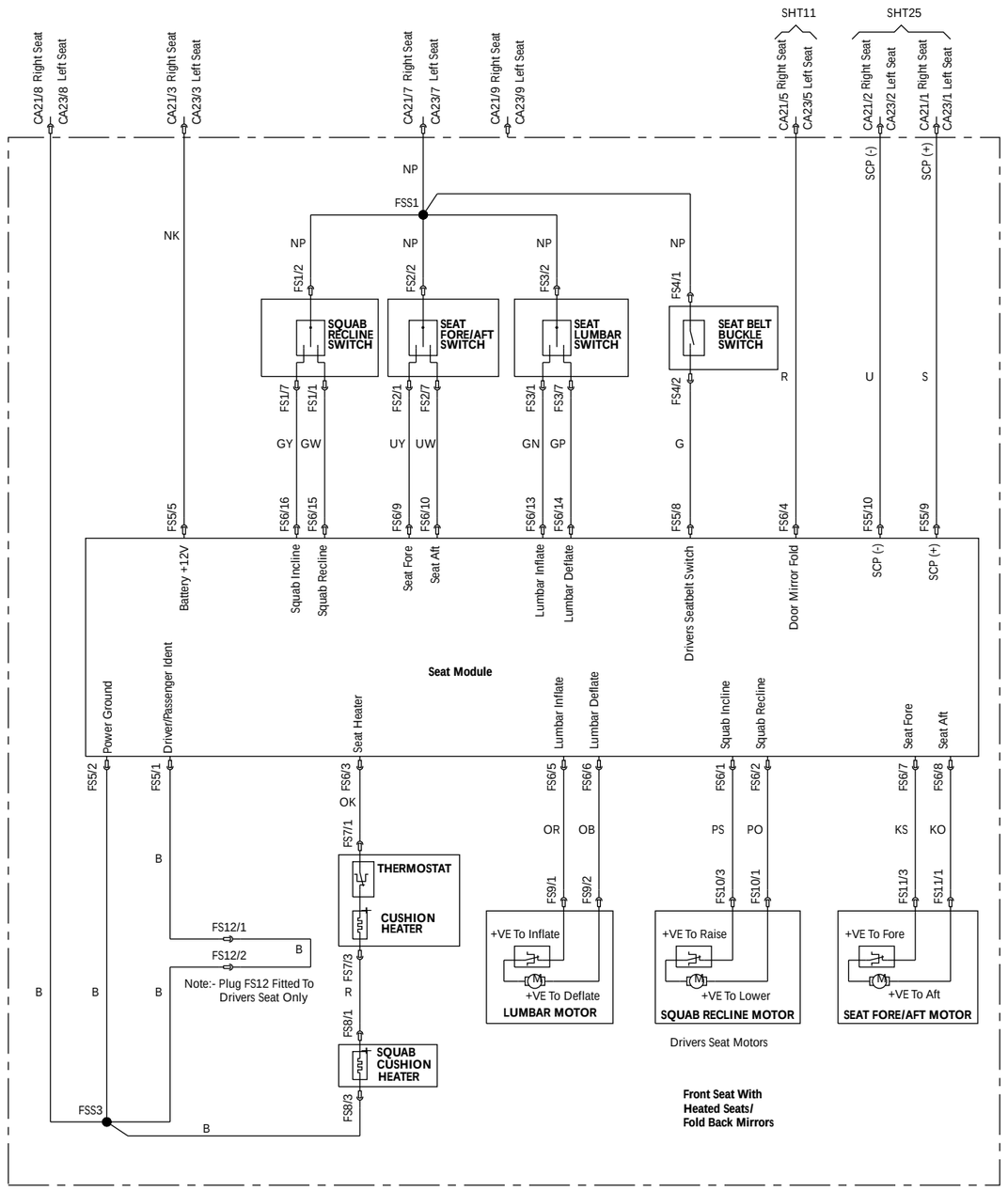
V12 Vanquish

CIRCUIT TITLE	Front Seat Unheated
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 09

SOURCE 1R12-370795-AD

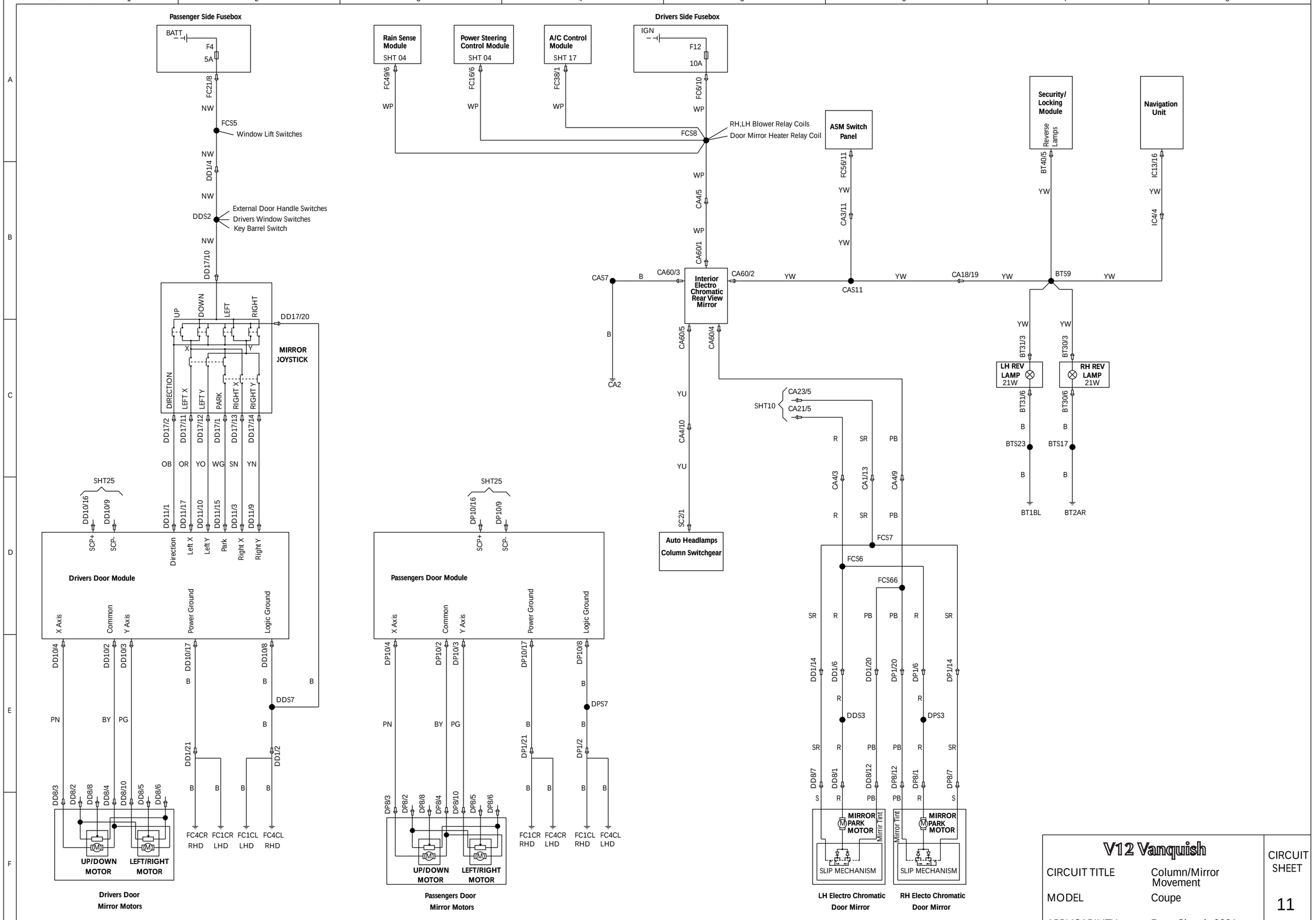




V12 Vanquish	
CIRCUIT TITLE	Front Seat Option
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 10

SOURCE 1R12-370795-AD



V12 Vanquish

CIRCUIT TITLE	Column/Mirror Movement
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 11

SOURCE 1R12-370795-AD

1 2 3 4 5 6 7 8

A B C D E F

Passenger Side Fusebox

BATT F4 5A F2 10A

Battery Conditioner Unit (Option)

Drivers Side Fusebox

BATT F5 15A

Boot Fusebox

BATT F10 10A

CAS8 Rear Seat Fusebox 3A,4A Battery Disconnect Switch

CA37/1 1A 25A CA37/2

CA37/3 2A 25A CA37/4

CA36/2 1C 5A CA36/1

FC21/8 NW FC21/5 NR

BT16/1 BT16/2 B BT1BR

FC5/9 NB

BT13/2 NY

CA18/12 NY NY NY

NY NO NW DD1/4 NW NW DP1/4 FCS5

Window Lift Switches

FCS18 NR NR

NW

Mirror Joystick Drivers Window Switch DDS2

Passengers Window Switch DPS2

CA4/16 CA4/17

NW NW NW

DD3/12 DD3/13 DP3/13

NO NY

KEY BARREL SWITCH **EXTERIOR DOOR HANDLE SWITCH** **Driver Doorlock Switches**

Passenger Doorlock Switch **EXTERIOR DOOR HANDLE SWITCH**

FCS46 B B

FC24/9 FC24/10 FC24/6

DOOR LOCKING RELAY #H 4 5 1 3 STD 2

FC4BR LHD FC1BL RHD

FC24/8 FC24/7 SG SR

DP3/5 LGU

DD1/22 DP1/22 NY NY

SHT25

NO OY OU LGU

DD10/1 DD11/12 DD11/4 DD11/5 DD10/16 DD10/9

DP10/1 DP10/16 DP10/9 DP11/5

FC14/71 FC14/85 FC14/86 FC14/80

BT40/15 BT40/8 BT40/16

Drivers Door Module: +12V Battery, Actuator Unlock, Drivers Door Key Lock, Actuator Superlock, Drivers Door Key Unlock, Drivers Door External Handle, Door Ajar Switch, SCP+, SCP-

Passenger Door Module: +12V Battery, Actuator Unlock, Actuator Superlock, Passenger Door External Handle, Door Ajar Switch, SCP+, SCP-

Body Processor Module: Door Locking Relay, Keylock Solenoid, Boot Release Switch, Fuel Flap Release Switch, +12V Battery, SCP+, SCP-

Security & Locking Module: Passenger Doorlock Status, Driver Doorlock Statue, +12V Battery, Ground, Ground, Ground, Boot Open Switch, SCP+, SCP-, Fuel Flap Solenoid, Boot Release Solenoid

DD10/5 DD10/6 DD11/20 DP10/5 DP10/6 DP11/20 FC14/51 FC14/5 FC14/31

BT41/7 BT41/19 BT41/10 BT40/13 BT40/14 BT41/5 BT41/6 BT40/2 BT40/1

SG FCS65 SG

RW SC1/1 RW SC5/1 SC5/2 B SC1/2 B FCS49

KEYLOCK SOLENOID **Column Switchgear**

FC4BL RHD FC1BL LHD

Center Consol Switch Pack Logic Ground FC55/2

SO SW FC41/10 FC41/6 FC41/4 SHT06

BOOT RELEASE SWITCH **FUEL FLAP RELEASE SWITCH** **ILLUM**

FC41/3 BK FCS47 FC41/2 B FCS50

BK BK B B

FC5AR RHD FC2AR LHD FC4AR RHD FC1AR LHD

RY OU L/R Boot Lamps BTS6

BL1/3

BT5/2 BL2/2 BT8/2 BT100/2

SWITCH AJAR BOOT **OPEN EXT BOOT SWITCH** **FUEL FILLER FLAP SOLENOID** **BOOT RELEASE SOLENOID**

BT5/1 BL2/1 BT8/1 BT100/1

BK B B B

BLS1

BTS21 BTS20

BK B

BT1AR BT1AL

Y SY SU SG GY GY

DD3/9 DD3/3 DD3/1 DD3/2 DD3/6 DD3/7 DD3/8

DOOR LOCK MOTOR **DOOR LOCKED STATUS** **DRIVER DOOR AJAR SWITCH**

Drivers Door Superlocking Actuator

DDS4 DDS7 B B B

DD1/19 DD1/10 GY GY GY FC18/8 GB2/78

Gearbox Control Module SHT 23

DD1/2 B B FC4CL RHD FC1CL LHD

Y SY SU SG GY

DP3/9 DP3/3 DP3/1 DP3/2 DP3/6 DP3/7 DP3/8

DOOR LOCK MOTOR **DOOR LOCKED STATUS** **PASSENGER DOOR AJAR SWITCH**

Passenger Door Superlocking Actuator

DP1/19 DPS7 B B B

DP1/2 B B FC1CL RHD FC4CL LHD

DP1/16 YP CA2/8 YP CA29/16

YR YR

DD1/16 YR CA2/9 YR CA29/7

BK BK BK

V12 Vanquish

CIRCUIT TITLE	Doorlocking/Unlocking
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 12

SOURCE 1R12-370795-AD

1 2 3 4 5 6 7 8

A B C D E F

Passenger Side Fusebox

BATT F4 5A F13 5A

FC21/8 FC21/4

NW

FCS5 Window Lift Switch

NW

DD1/4

NW

DDS2 Mirror Joyswitch, Ext Door Handle Switch, Drivers Window Switch

NW

DD3/12

DRIVER DOOR KEY BARREL SWITCH

DD3/10 DD3/11

OY OU

DD11/12 DD11/4

Drivers Door Module

Drivers Door Key Lock, Drivers Door Key Unlock, +12V Battery, Drivers Door Ajar Switch

DD11/20

GY

DDS4

GY GY

DD3/6 DD1/10

GY

DRIVERS DOOR AJAR SWITCH

DD3/7

B

DDS7

B

DD1/2

B B

FC1CL LHD FC4CL RHD

Rear Seat Fusebox 3A,4A

Battery Disconnect Switch CAS8

N N

CA37/1 CA37/3

1A 25A 2A 25A

CA37/2 CA37/4

NO NY

CA4/16 CA4/17

NO NY

DD1/22 DP1/22

NO NY

DD10/1 DP10/1

Gearbox Control Module SHT 23

GB2/78 GB2/70

FC18/8 FC18/5

GY UW

Passengers Door Module

Passenger Door Ajar Switch, +12V Battery

DP11/20

GY

DP3/6

PASSENGER DOOR AJAR SWITCH

DP3/7

B

DPS7

B

DP1/2

B B

FC1CL RHD FC4CL LHD

Driver Side Fusebox

IGN F16 5A

FC5/5

WP

FCS67 Heated Front Screen Relays, ASM Switch Panel

W W W W W

FC15/8 FC15/7 FC15/6 FC15/1 FC15/9 FC15/15

Pats Transceiver

FC50/1 FC50/2 FC50/3 FC50/4

Pats Module

SCP - SCP +

FC15/14 FC15/4 FC15/5 FC15/2

SHT 25

BK W

FCS63

BK BK

FC2AL RHD FC5AL LHD

FC56/13

LED STATUS IMMOBILISER

FC56/1

PW

BATT F5 15A F7 15A F6 5A

FC5/9 FC5/4 FC5/10

NR

FCS19

NR NR

CA27/3

Homelink HC3/1 R

Glass Break Sensor HC4/4 R

Header Console SHT 05

NR

FC22/4

Key Transponder Module

FC22/9 FC22/17 FC22/12

BK

FCS47

BK BK

FC5AR RHD FC2AR LHD

NB NY SU Y

FC14/80 FC14/104 FC14/92 FC14/39

Body Processor Module

O/P Enable, +12V Battery, +12V Battery, Ok To Fuel, Security Acknowledge, Security Bonnet Switch, Horn Switches, Security Active Indicator, Security Sounder 1, Horn Relay, Security Sounder 2, Securitu Sounder Control

FC14/101 FC14/58 FC14/67 FC14/56 FC14/4 FC14/29 FC14/22 FC14/23 FC14/13 FC14/70

PW PW SB UR UW GU S WB WO GO

Body Processor Module
Fan Run On Relay
Glovebox Lamp
Interior Mirror

OG FC42/1 FC42/2 PW FCS36

FC42/4 FC42/3

H/BRAKE SWITCH RELAY

GY

UR

FCS28 U DSS2 DIODE 1 DSS1 W FCS27

UW U DSS12 DIODE 6 DSS11 W

FCS30 CA1/3

FCS62 OG OG CAS9

OG OG UR

CA9/1 CA10/1 FC4/4 FW46/2

H/BRAKE SWITCH LHD **H/BRAKE SWITCH RHD** **KEY IN IGNITION** **UNDERBONNET SECURITY SWITCH**

CA22/1 CA24/1 FC4/5 FW46/1

B B BK B

CAS5 CAS7 FCS48 FWS7

B B BK BK

CA1 CA2 FC5AL RHD FC2AL LHD FW1AL

FCS2

UW

FW1/18

UW

Traction Status Relay FCS24

WR

FW2/7

WR

FWS5

Underbonnet Fusebox

BATT IGN

F13 F11 F9 F3

10A 10A 10A 5A

FW7/5 FW7/1 FW6/6 FW6/3 FW8/8

GU PB GS WR

Center Console Switch Pack

FC55/9 FC55/5

NR WR

FW1/17

GS

FW16 FW14

LH HORN **RH HORN**

FW17 FW15

B B

FWS9 FWS8

B B

FW1AR FW3AR

Column Switchgear

SC3/12 SC2/9

GU BK

SPS1

BK

GU

SW1/1 SW1/5

CASSETTE SPRING

SW2/1 SW2/5

GU GU B

HP1 HP2 HP3

LH HORN SWITCH **RH HORN SWITCH** Steering Wheel

FCS48 BK

BK BK

FC5AL RHD FC2AL LHD

ALARM ACTIVE LED 160R

FC56/4 FC56/23

PASSIVE SECURITY SOUNDER **ACTIVE SECURITY SOUNDER**

FW2/13 FW2/12 FW1/12 FW13/4 FW13/1

WB WO GO NW WR

FW13/2 FW13/3 FW13/6

FW13/5

B

FWS4

B B

FW2AL LHD FW1BS RHD

V12 Vanquish

CIRCUIT TITLE	Security
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 13

SOURCE 1R12-370795-AD

1	2	3	4	5	6	7	8

A B C D E F

LH Heated Front Screen Relay SHT17 — FC68/2 WP

RH Heated Front Screen Relay SHT17 — FC69/2 WP

PATS Module SHT13 — FC15/15 WP

Drivers Side Fusebox — IGN F16 5A — FC5/5 WP

FCS67

WP

Underbonnet Fusebox

BATT — RELAY #7 IGNITION POSITIVE

F2 5A — FW8/1 W

F5 10A — FW6/2 GO — FW7/9 GO

F20 25A — FW5/3 GO

FW47/3

FW39/2 W

FWS3 — U — DSS4 DIODE 2 DSS3 — W — FWS1

W — NW KW

EM5/2 EM5/3

Alternator Regulator

EM5/4 UW — EM5/1 NU

FW39/3 UW — FW39/1 NU

FW2/18 UW — FW3/11 NU

FC26/22 — CA4/18

Instrument Pack SHT 18

FW20/3 FW20/1

STARTER RELAY

FW20/5 WR — FW20/2 GO

FW60/1 WR — FW3/5 GO

SL3

STARTER MOTOR

NU

Engine Fan Module SHT 21 — RD1/6 GO

Gearbox Oil Pump Relay SHT 22 — FW69/2 GO

Tyre Pressure Monitor SHT 18 — BT14/1 WG

Boot Fusebox

IGN — F3 5A — BT10/9 WG — BT13/8 WG

BTS1

WG

CA29/4

WG

Body Processor Module

Key Transponder Module SHT 13 — FC22/17 Y

Security Acknowledge — FC14/39 WN

Auxiliary Ignition Switch — FC14/32 GO

Crank Input — FC14/41 UR

Key In Ignition Switch — FC14/67 WO

Ignition Position Switch — FC14/15 RG

Inertia Switch — FC14/33

FCS20

WDS Plug "A"
WDS Plug "B"
Dimmer Module
A/C Control Module
Gearbox Control Module
Passenger Side Fusebox
Key Transponder Module

FCS25

By-Pass Pump Relay Coil
Underbonnet Fusebox
Drivers Side Fusebox
Boot Fusebox

RG

CA1/2

FCS68 — GO — CA3/12 — GO — CAS2

ST11 Alternator — ST26 Jump Start Stud — ST24 Starter Motor

B B B

ST10 — ST27 — ST23

ST28 Bulkhead Stud RH Side

Engine Management Fusebox — ST15 B — Underbonnet Fusebox ST14

ST9 B

ST7 — ST6 B — ST8 Drivers Side Fusebox

Passenger Side Fusebox ST5

B B B — ST4 Boot Fusebox

ST29 — ST3 — ST2

N N

ST20 Battery Disconnect Switch

CA28/6 — CA28/3 — CA28/2 — CA28/5 — CA29/1

U — B — R — B

CAS17

U

DSS14

DIODE 7

DSS13

W

CAS4

B

CA4BL

CA29/5

Battery

CAS8

N N N N

CA37/1 CA37/3 CA37/5 CA37/7

1A 25A — 2A 25A — 3A 10A — 4A 10A

CA37/2 CA37/4 CA37/6 CA37/8

PDM SHT12 — NAV SHT15

DDM SHT12 — RADIO SHT15

CA36/2

1C 5A

CA36/1

BATTERY CONDITIONER SHT13

CAS6

N N N N

CA32/1 CA32/3 CA32/5 CA32/7

1B 20A — 2B 10A — 3B 10A — 4B 5A

CA32/2 CA32/4 CA32/6 CA32/8

TCU SHT22 — PTEC A SHT20 — PTEC B SHT21

ASM Switch Panel

Start Button Illumination

Start Button

Ignition — FC56/2

Start i/p — FC56/20 — GB

Start o/p — FC56/18 — GO

Aux i/p — FC56/9 — WN

Aux o/p — FC56/8 — WN

Diode 1 — UR — FCS27

FCS26 — WO

Engine Management Fusebox
Key Transponder Module
Brake Switch
WDS Plug "A"
WDS Plug "B"

FC4/2 FC4/4 FC4/3

AUXILIARY POSITION — KEY IN IGNITION — IGNITION POSITION

Ignition Switch

FC4/5 BK

FCS48

BK BK

FC5AL RHD — FC2AL LHD

WO — CA1/1 — WO — CAS14

WO WO

FC23/9RHD CA21/9 LHD — Passengers Seat SHT 09

FC21/9RHD CA23/9 LHD — Drivers Seat SHT 09

FC48/13 — GB — EM-A/19 — Engine Crank PTEC "A" Inertia Switch SHT 21

RG — CA19/1 CA19/2 — INERTIA SWITCH

Y — CA1/5 — Y — FC48/8 — Y — EMS31 — Y — EM-A/47

Y — EM-A/47 — PTEC "B" Inertia Switch SHT 22

CA19/3

WO

BTS21 — BK — BT7/5 — BT7/4 — R — BT7/9 — BDS Off Switch

BK — BT1AR

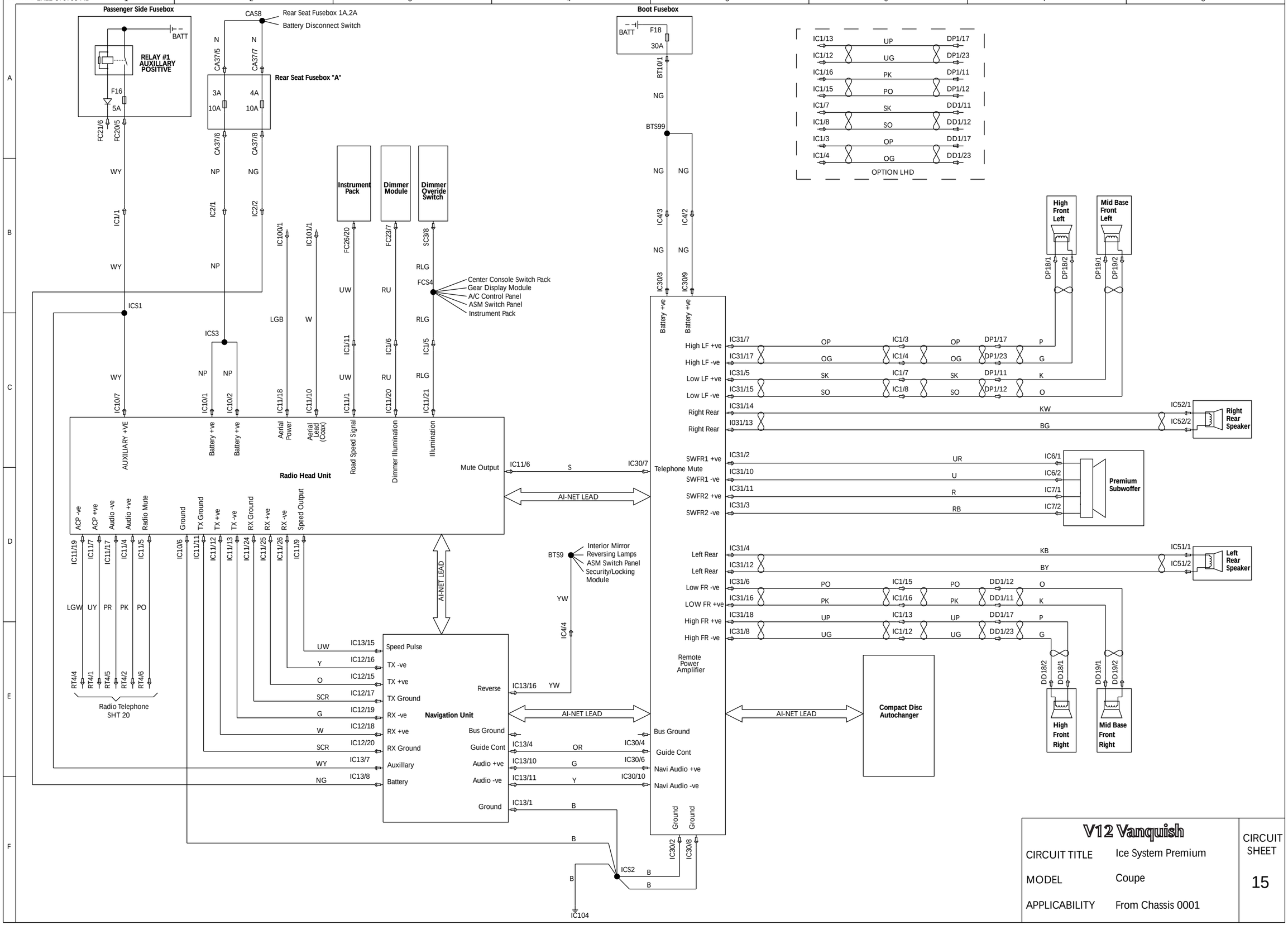
L/R Boot Lamps — PW — BTS25

V12 Vanquish

CIRCUIT TITLE	Battery/Starter etc
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 14

SOURCE 1R12-370795-AD



V12 Vanquish

CIRCUIT TITLE	Ice System Premium
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 15

SOURCE 1R12-370795-AD

Passenger Side Fusebox
BATT
RELAY #1 AUXILLARY POSITIVE
5A
PS_F16
FC21/6
FC20/5
WY
IC1/1
WY
ICS1
WY
IC10/7
Auxillary

CAS8
N
CA37/7
CA37/5
Rear Seat Fusebox "A"
RS_3A
10A
RS_4A
10A
CA37/8
CA37/6
NG
NP
IC2/2
IC2/1
NP
ICS3
NP
NP
IC10/1
IC10/2
Battery
Battery

Instrument Pack
FC26/20
UW
IC1/11
UW
IC11/1
Road Speed Signal

Dimmer Module
FC23/7
RU
IC1/6
RU
IC11/20
Dimmer Illumination

Dimmer Overide Switch
SC3/8
RLG
FCS4
Center Console Switch Pack
Gear Display Module
A/C Control Panel
ASM Switch Panel
Instrument Pack
RLG
IC1/5
RLG
IC11/21
Illumination

IC1/13 UP DP1/17
IC1/12 UG DP1/23
IC1/16 PK DP1/11
IC1/15 PO DP1/12
IC1/7 SK DD1/11
IC1/8 SO DD1/12
IC1/3 OP DD1/17
IC1/4 OG DD1/23
Option LHD

OP IC1/3 OP DP1/17 P DP18/1
OG IC1/4 OG DP1/23 G DP18/2
High Left Front

SPL1A
Left Front +ve
Left Front -ve
FC10/3 SK SPL1 SK IC1/7 SK DP1/11 K DP19/1
FC10/8 SO SO IC1/8 SO DP1/12 O DP19/2
SPL2
Mid Base Left Front

Left Rear +ve
Left Rear -ve
FC10/4 KB IC51/1
FC10/11 BY IC51/2
Left Rear Speaker

Right Rear +ve
Right Rear -ve
FC10/5 KW IC52/1
FC10/12 BG IC52/2
Right Rear Speaker

Right Front -ve
Right Front +ve
FC10/10 PK SPL4 PK IC1/16 PK DD1/11 K IC19/2
FC10/9 PO SPL3 PO IC1/15 PO DD1/12 O IC19/1
Mid Base Right Front

SPL3A
UP IC1/13 UP DD1/17 P DD18/1
UG IC1/12 UG DD1/23 G DD18/2
High Right Front

Radio Head Unit
ACP +VE IC11/19 LGY RT4/4
ACP -VE IC11/7 UY RT4/1
Audio +ve IC11/17 PR RT4/5
Audio -ve IC11/4 PK RT4/2
Radio Mute IC11/5 PO RT4/6
Radio Telephone SHT 20
TX Ground IC11/11
TX +ve IC11/12
TX -ve IC11/13
RX Ground IC11/24
RX +ve IC11/25
RX -ve IC11/26
Speed O/P IC11/9
AI- NET LEAD
Guide Cont IC11/22 OR IC12/13
Ground IC10/6 B
ICS2
B
IC104
BTS9
YW
IC4/4
Interior Mirror
Reversing Lamps
ASM Switch Panel
Security/Locking Module

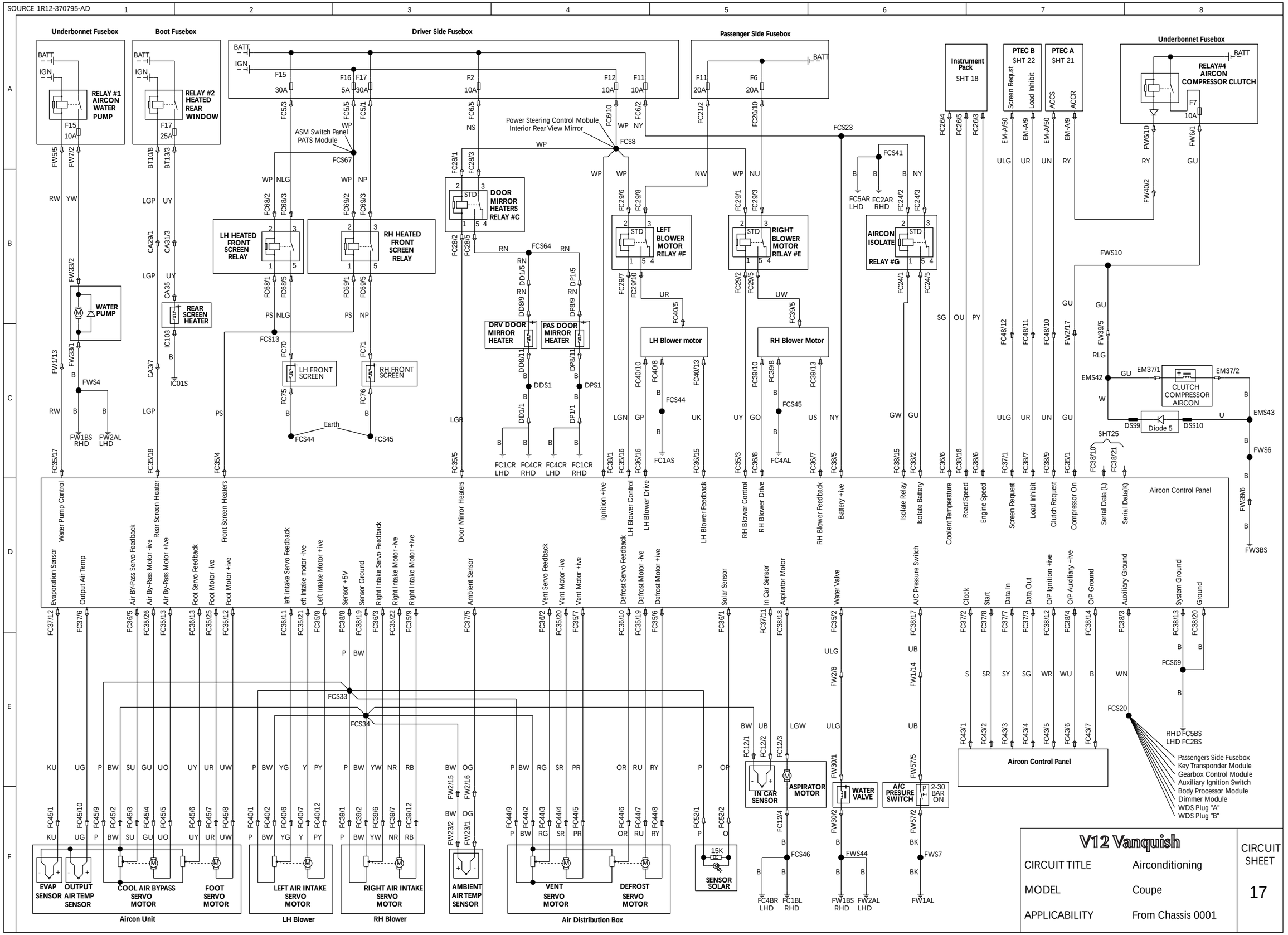
UW IC13/15 Speed O/P
Y IC12/16 TX -ve
O IC12/15 TX +ve
SCR IC12/17 TX Ground
G IC12/19 RX -ve
W IC12/18 RX +ve
SCR IC12/20 RX Ground
WY IC13/7 Auxillary
NG IC13/8 Battery
Guide Cont
Ground IC13/1 B
Reverse IC13/16 YW
Navigation Unit
AI- NET LEAD
Compact Disc Autochanger

V12 Vanquish

CIRCUIT TITLE	ICE SYSTEM
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 16

SOURCE 1R12-370795-AD

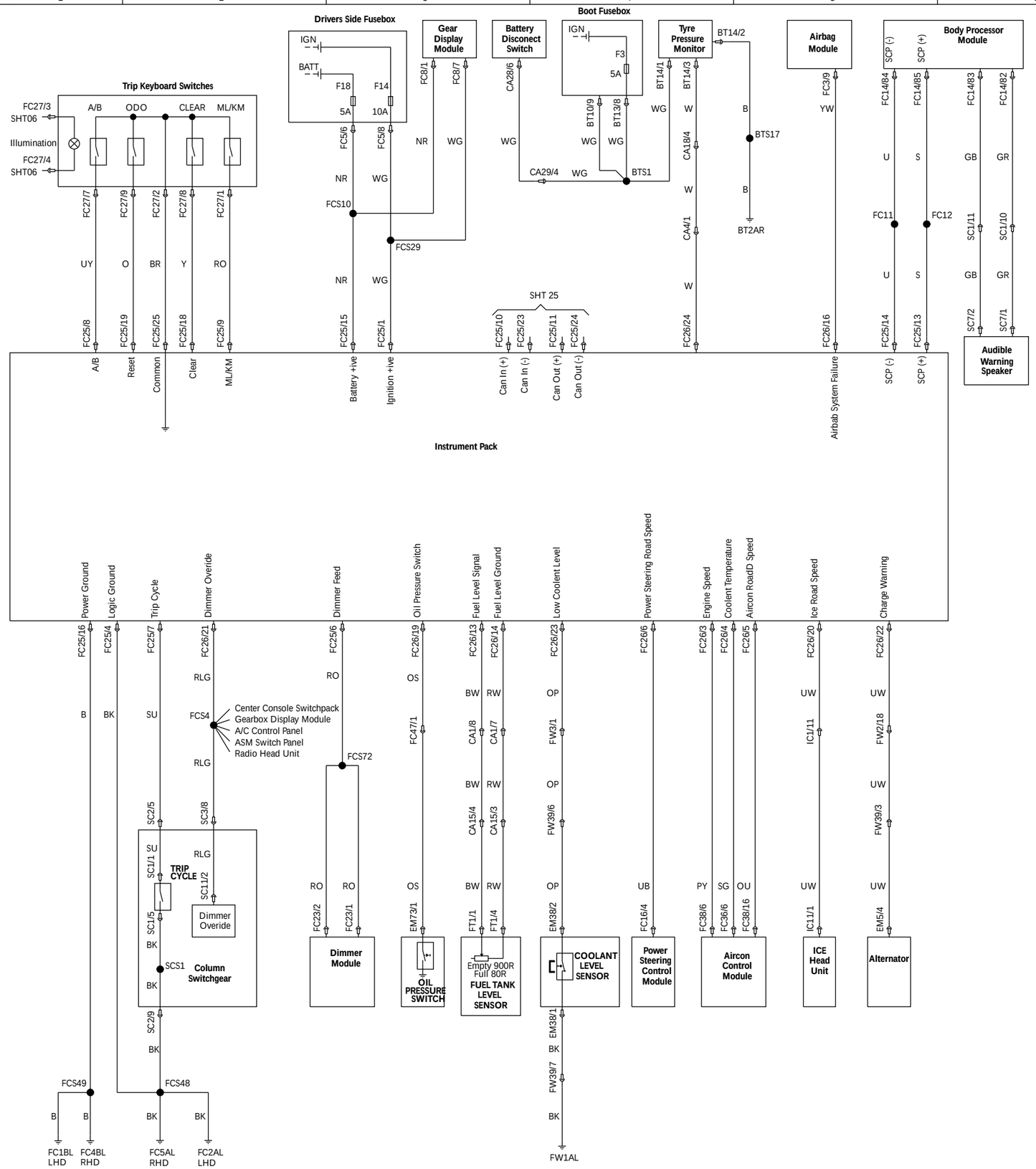


V12 Vanquish

CIRCUIT TITLE	Airconditioning
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 17

SOURCE 1R12-370795-AD



FC025 Black 26 Way Connector		
PLUG	PIN	CIRCUIT
FC025	1	Ignition
FC025	2	Battery Out (Minor Cluster)
FC025	3	Reserved
FC025	4	Logic Ground
FC025	5	Reserved
FC025	6	General Illumination (IN)
FC025	7	Trip Cycle
FC025	8	Trip A/B
FC025	9	Trip (Metric/English)
FC025	10	Can + (J1962)
FC025	11	Can +
FC025	12	Can Screen Out
FC025	13	SCP B +
FC025	14	SCP A -
FC025	15	Battery
FC025	16	Chassis Ground
FC025	17	General Illumination (out)
FC025	18	Trip Message Clear
FC025	19	Trip Reset
FC025	20	Reserved
FC025	21	Reserved
FC025	22	Reserved
FC025	23	Can - (J1962)
FC025	24	Can -
FC025	25	Trip Computer Ground
FC025	26	Reserved

FC026 Yellow 26 Way Connector		
PLUG	PIN	CIRCUIT
FC026	1	Charge Warning Out
FC026	2	Oil Pressure Low Out
FC026	3	Engine Speed Out (Aircon)
FC026	4	Coolent Temp Out (Aircon)
FC026	5	Vehicle Speed Out 2 (Aircon)
FC026	6	Vehicle Speed Out 1 (Steering)
FC026	7	Vehicle Speed Out 4 (Damping)
FC026	8	Battery Gauge Pin 3
FC026	9	Battery Gauge Pin 4
FC026	10	Oil Gauge Pin 1
FC026	11	Battery Gauge Pin 1
FC026	12	Battery Gauge Pin 2
FC026	13	Fuel Level In
FC026	14	Fuel Sender Ground
FC026	15	Oil Gauge Pin 2
FC026	16	Airbag Warning
FC026	17	Oil Gauge Pin 4
FC026	18	Oil Gauge Pin 3
FC026	19	Oil Pressure In
FC026	20	Vehicle Speed Out 3 (ice)
FC026	21	LCD Daylight Override In
FC026	22	Charge Cooling
FC026	23	Coolant Low
FC026	24	Tyre Pressure Low
FC026	25	Reserved
FC026	26	Reserved

V12 Vanquish

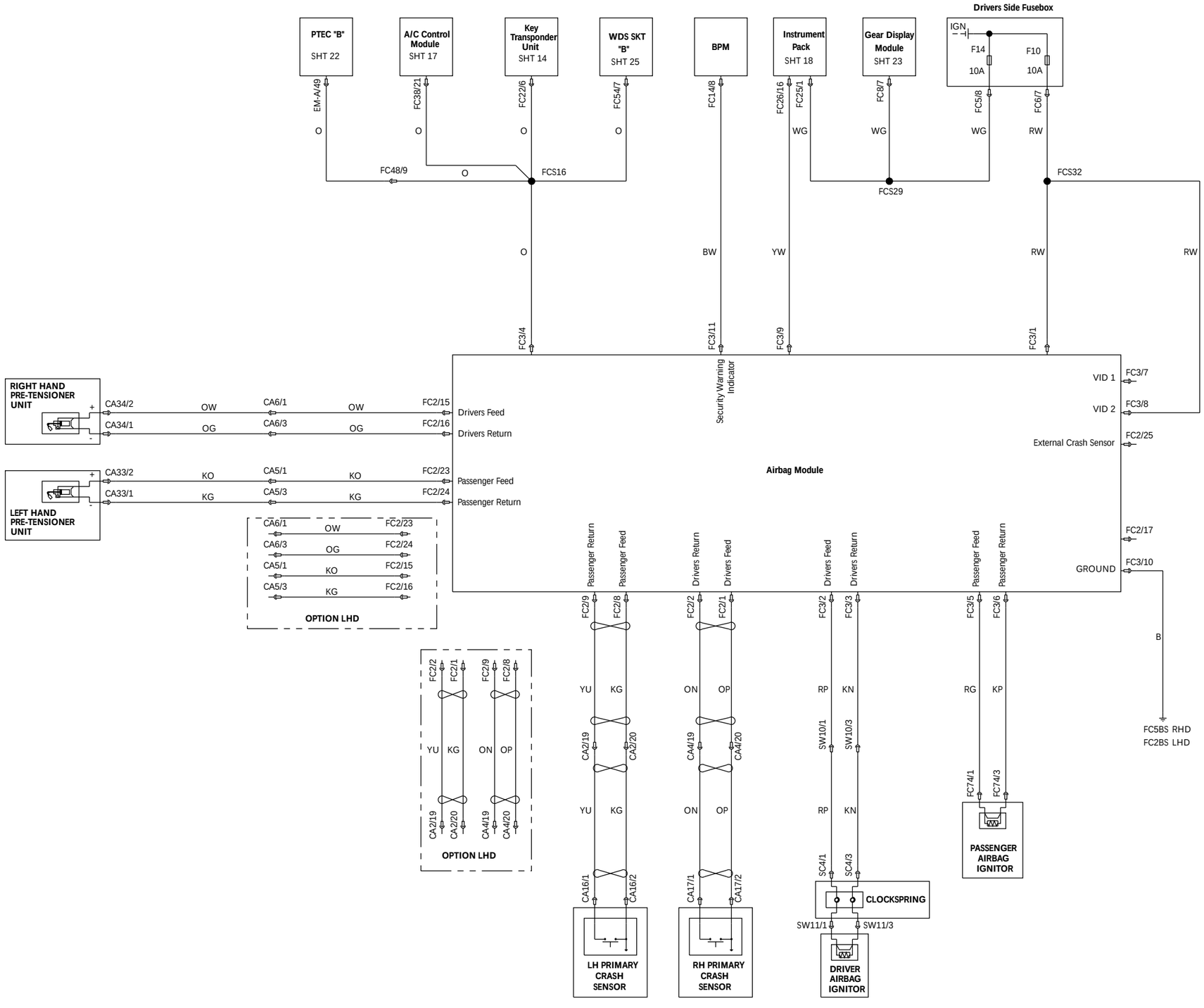
CIRCUIT TITLE Instrument Panel

MODEL Coupe

APPLICABILITY From Chassis 0001

CIRCUIT SHEET 18

SOURCE 1R12-370795-AD

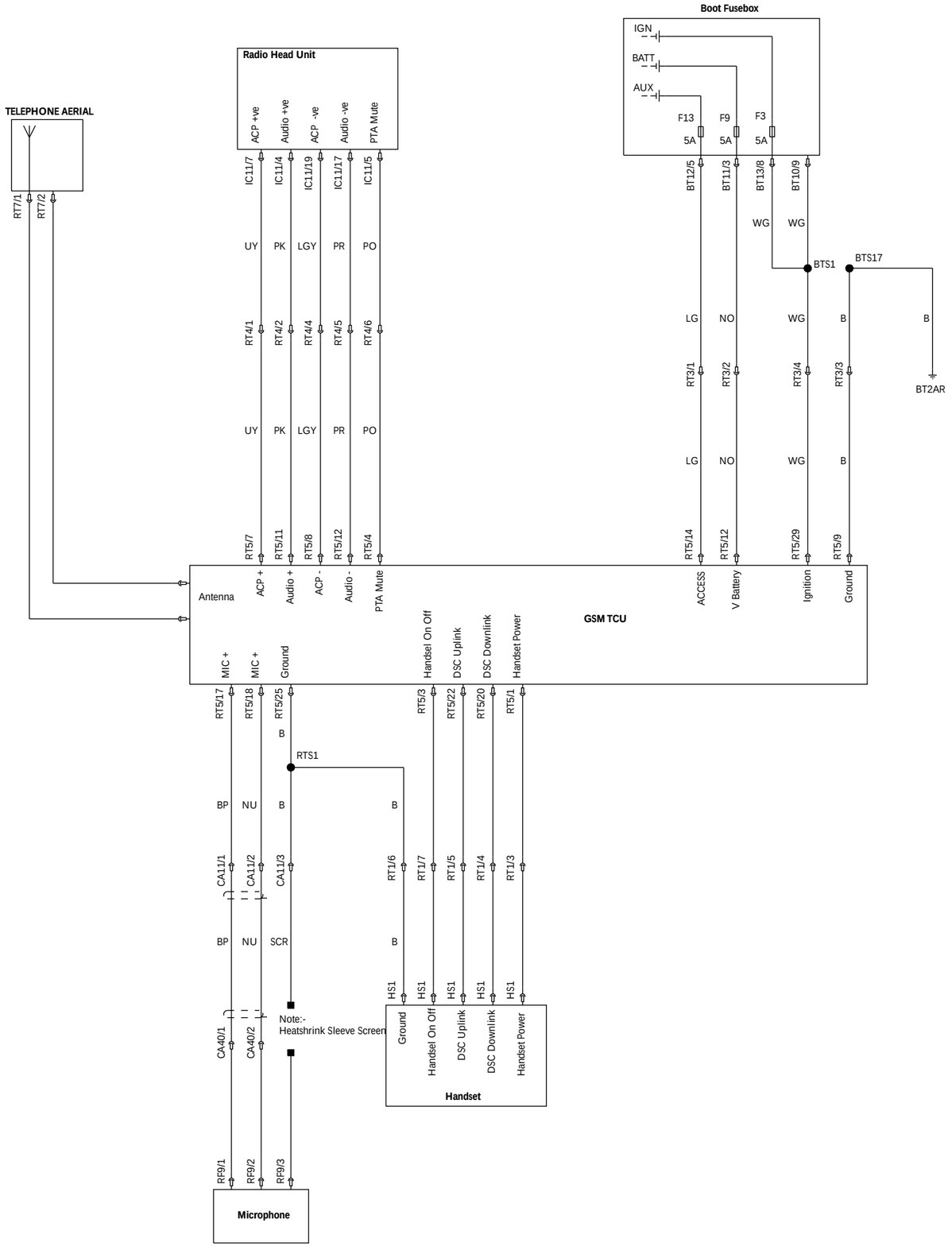


V12 Vanquish

CIRCUIT TITLE	Airbag System
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 19

SOURCE 1R12-370795-AD



V12 Vanquish	CIRCUIT SHEET 20
CIRCUIT TITLE: Telephone System	
MODEL: Coupe	
APPLICABILITY: From Chassis 0001	

SOURCE 1R12-370795-AD

Engine Management Fusebox

Underbonnet Fusebox

Boot Fusebox

RELAY#1 EMS CONTROL POSITIVE

RELAY#7 IGNITION POSITIVE

RELAY#7 IGNITION POSITIVE

RELAY#4 FUEL PUMP 1

Battery Disconnect Switch

IGNITION COILS

RUN ON TEMP S/W

FAN RUN ON RELAY #D

FAN MODULE FUSE (Underbonnet Fusebox)

Rear Seat Fusebox 1B,3B,4B

Battery Disconnect Switch

Interior Mirror

Glovebox Lamp

Handbrake Relay

Body Processor Module

Starter Relay

Gearbox Oil Pump Relay

Body Processor Module

Inerita Switch

Inertia Switch

Diode 3

Coil Suppressor

Plug In Tank Top

Fuel Pump Control Module 1

FUEL PUMP

Gearbox Oil Temp Switch

Canister Vent Valve

Missfire Detection Module

Mass Air Flow/ Intake Air Temp

VMV

Injectors 1-6

2-2 CMS Rear

1-2 CMS Front

2-1 Hego Rear

1-1 Hego Front

Electro Drive Fan Module

COIL 1

COIL 2

COIL 3

COIL 4

COIL 5

COIL 6

CRANK POS SENSOR

Fuel Tank Pressure Sensor

Pedal Position Sensor

Throttle unit

A Bank Cid Sensor

COOLANT TEMP SENSOR

Engine Fuel Temp

Injector Pressure Sensor

A/C Pressure Sensor

POWER STEERING SWITCH

LOW BRAKE FLUID LEVEL

TCU rpm

Inertia Switch

Brake Switch

Stop Lamp Relay F8

Speed Sensor

PTEC A

PTEC B

PTEC "B"

SHT25

SHT13

SHT14

SHT17

V12 Vanquish	
CIRCUIT TITLE	PTEC "A" Primary
MODEL	Coupe
APPLICABILITY	From Chassis 0001
CIRCUIT SHEET	21

SOURCE NO 1R12-370795-AD.sht 27

Underbonnet Fusebox

Boot Fusebox

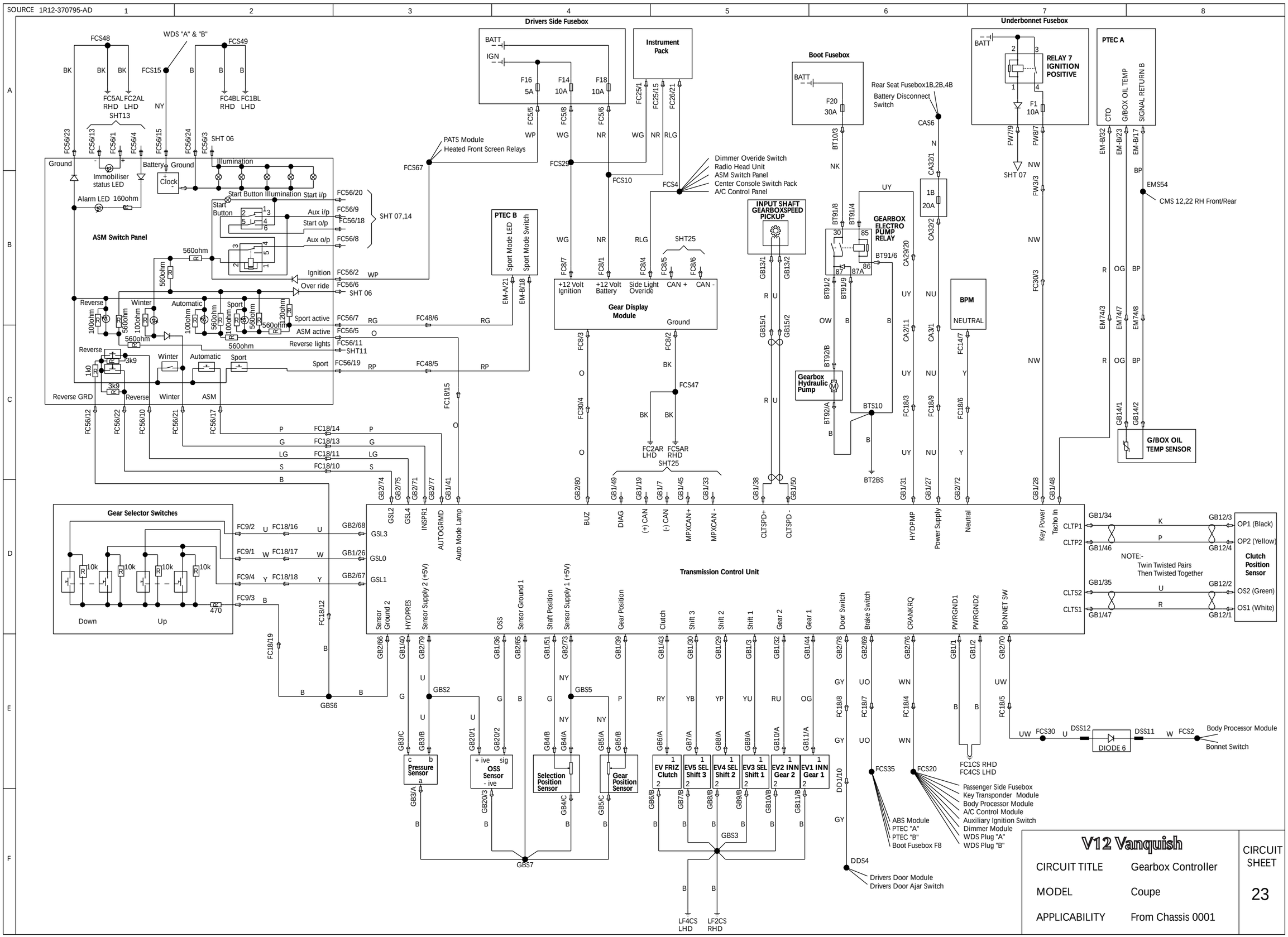
Engine Management Fusebox

PTEC B

PTEC A

V12 Vanquish	CIRCUIT SHEET 22
CIRCUIT TITLE	PTEC "B" Secondary
MODEL	Coupe
APPLICABILITY	From Chassis 0001

SOURCE 1R12-370795-AD

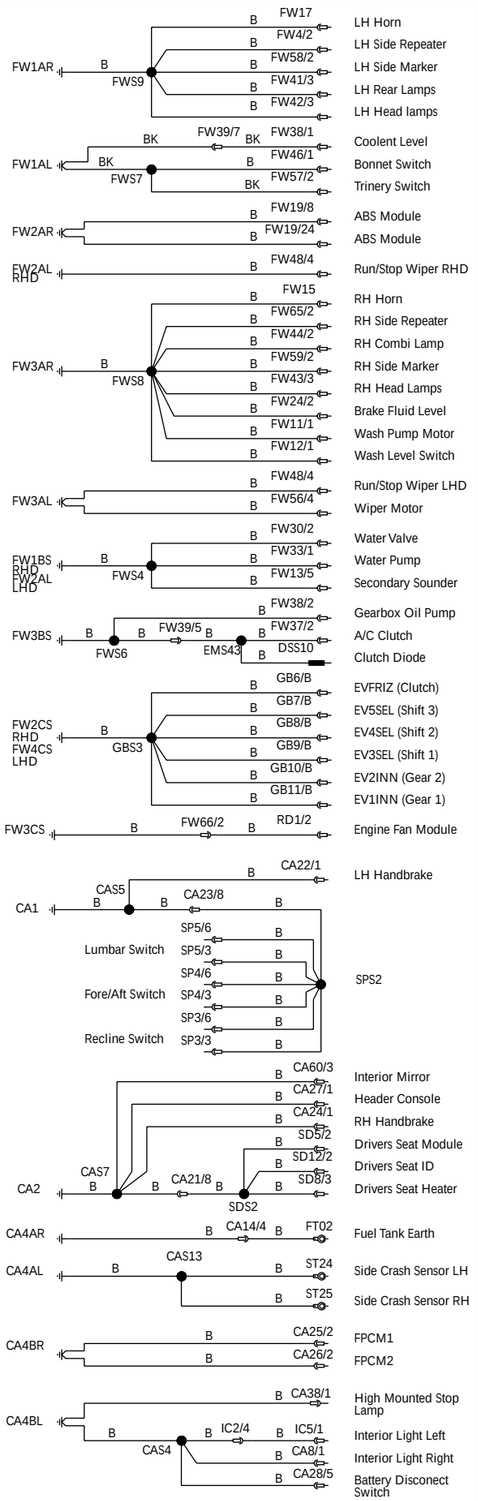


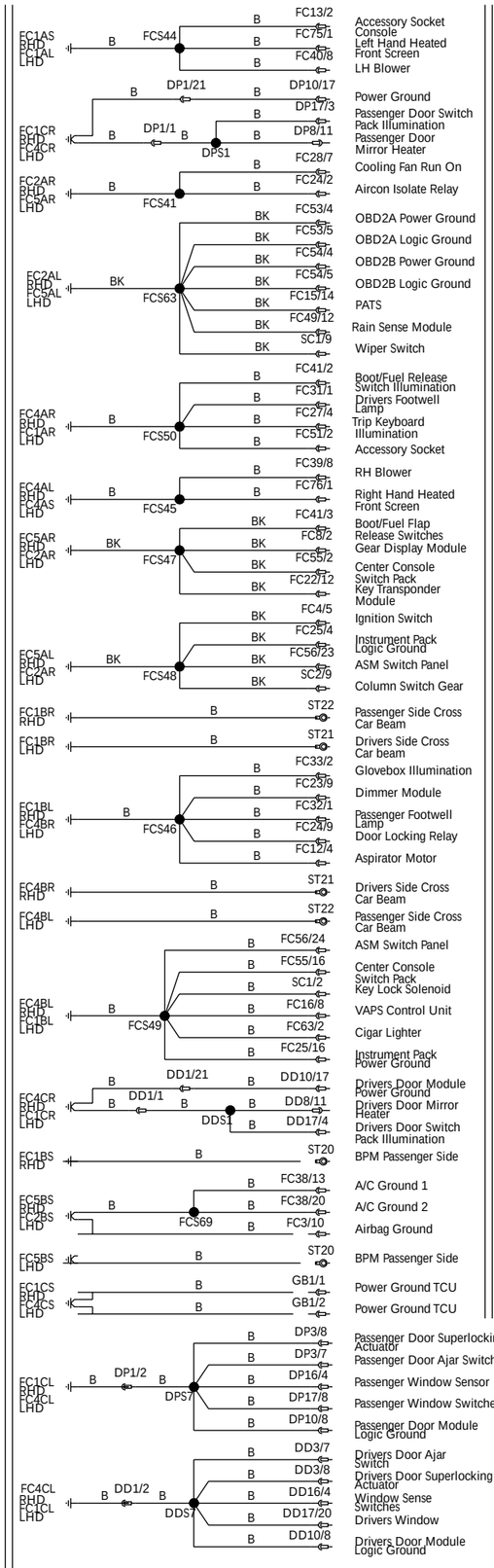
V12 Vanquish

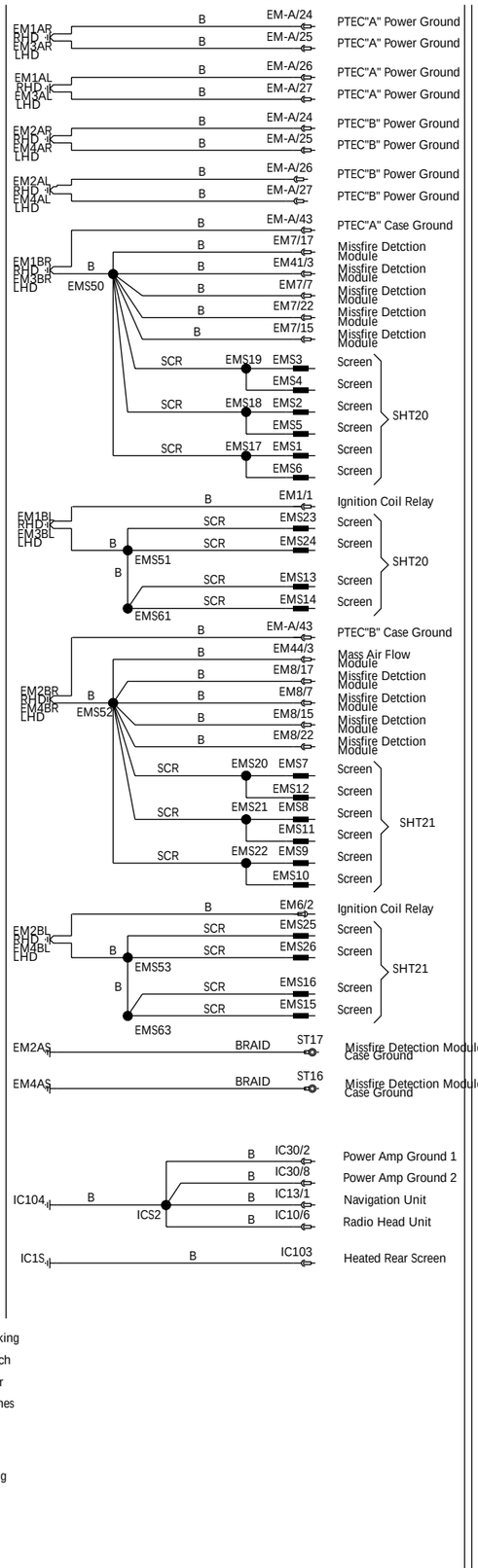
CIRCUIT TITLE	Gearbox Controller
MODEL	Coupe
APPLICABILITY	From Chassis 0001

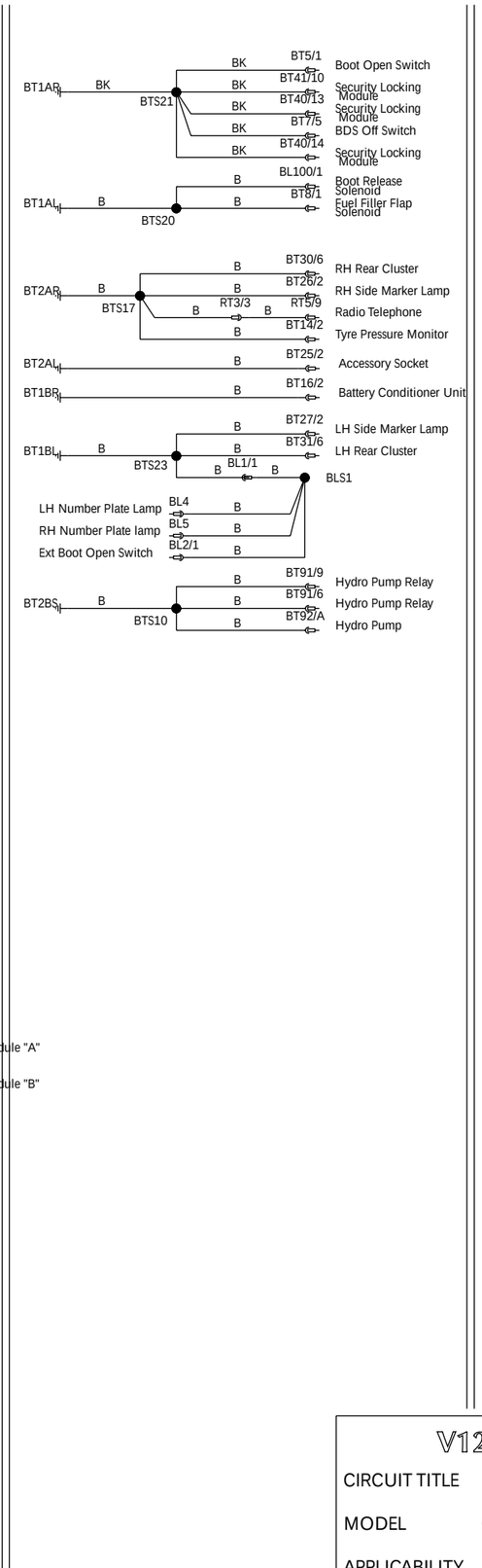
CIRCUIT SHEET 23

SOURCE1R12-370795-AD

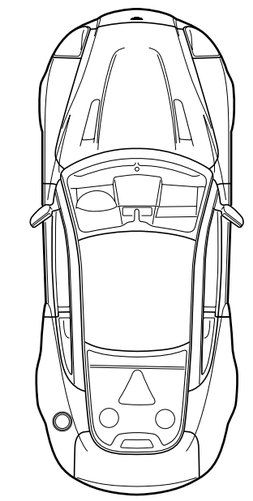


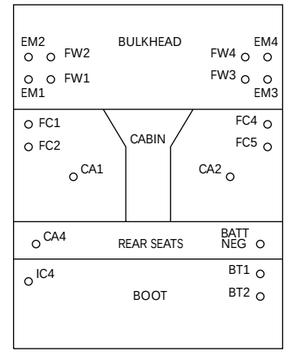






Earth Points





V12 Vanquish

CIRCUIT TITLE	Earth Points
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 24

SOURCE 1R12-370795-AD

Boot Fusebox
IGN
F5
5A
BT11/2
WU

Passenger Side Fusebox
BATT
F3
5A
FC21/3
NY

ASM Switch Panel
Clock
FC56/15
NY

CA18/17 WU CA2/17 WU FCS14
FCS15

Body Processor Module
SCP-
SCP+
FC14/84 U
FC14/85 S
FCS11

Security & Locking Module
SCP-
SCP+
BT40/16 U CA18/10 U CA1/9 U
BT40/8 S CA18/11 S CA1/10 S
FCS12

Passenger Door Module
SCP+
SCP-
DP010/016 S DP1/8 S
DP010/009 U DP1/3 U

Driver Door Module
SCP+
SCP-
DD10/16 S DD1/3 S
DD10/9 U DD1/8 U

ABS
SCP+
SCP-
FW19/11 S FW40/6 S
FW19/10 U FW40/5 U
FW/23 OP FW2/2 OP

PATS
SCP-
SCP+
FC15/4 U
FC15/5 S

CA3/16 U CA21/2 U SD5/10
CA3/15 S CA21/1 S SD5/9
RHD SM
SCP BUS
CA1/15 S CA23/1 S SP5/9
CA1/16 U CA23/2 U SP5/10
LHD SM

Instrument Pack
SCP -ve
SCP +ve
Can -ve
Can Out
Can +ve
Can In
Can +ve
Can -ve
FC25/14
FC25/13
FC25/24
FC25/11
FC25/10
FC25/23

Can +ve
Gear Display Module
Can -ve
FC8/5 Y
FC8/6 G
FCS58
FCS59

FCS56
FCS57
FC54/6 Y Can Link +ve
FC54/14 G Can Link -ve

FC18/1
FC18/2
GB1/19
GB1/7
FC47/10
FC47/11
EM-A/45
EM-A/46

Ignition +ve
Battery +ve
SCP +
SCP -
ISO
FC53/9 WU
FC53/16 NY
FC53/2 S
FC53/10 U
FC53/7 OP
FCS60
FCS61
FCS38
FC47/15 S
FC47/16 U
FC47/7 OP
EMS14 S
EMS15 OP
EM-A/3 S
EM-A/4 U
EM-A/49 OP
EM-A/13 OY
SCP +
SCP -
ISO
FEPS A
CAN +
CAN -
PTEC A
EM-A/45 Y
EM-A/46 G
EM74/1
EM74/2
GB1/45
GB1/33
CAN +
CAN -
TCU
GB1/49
PTEC B
FEPS B
EM-A/3
EM-A/4
EM-A/13
EM-A/49
ISO
FC48/9
O

Engine "A"
KW 2000
FEPS
CAN +
CAN -
FC53/6 Y
FC53/14 G
FC53/3 OG
FC53/13 OY
FC18/20
FC48/17
EMS28

Ignition Ground
Auxiliary Ground
FC53/1 WO
FC53/8 WN
FCS26
FCS20
FC54/1 Ignition Ground
FC54/8 Auxiliary Ground

Passenger Side Fusebox
Key Transponder Module
Body Processor Module
Gearbox Control Module
Auxiliary Ignition Switch
A/C Control Module
Dimmer Module

Engine Management Fusebox
Key Transponder Module
Body Processor Module
Drivers Side Fusebox
Ignition Switch
Inertia Switch
Brake Switch

Body Processor Module
FC14/92 Serial Out SU
FC14/13 GO FW1/12 GO FC13/6
ISO Databus
Serial Databus
Key Transponder Module
FC22/9
FC22/6 O
Active Security Sounder
FCS16
FC54/7 Serial Out "K"
FC54/15 Serial In "L"

Airbag Module
FC3/4 O

Aircon Control Module
Out
In
FC38/21 O
FC38/10 K

Power Ground
Locic Ground
FC53/4 BK
FC53/5 BK
FCS63
BK BK
FC5AL LHD
FC2AL RHD

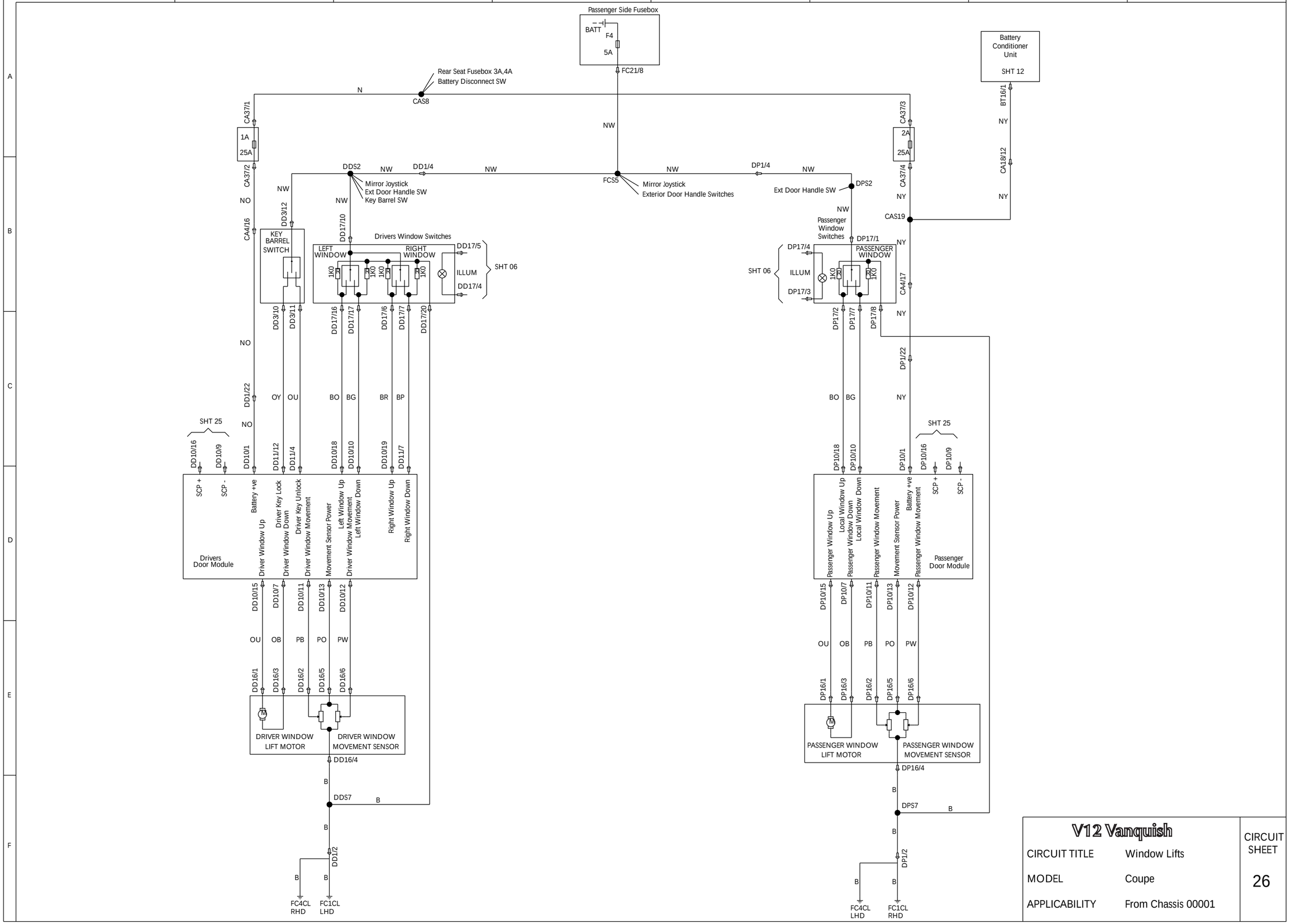
Body"B"
SCP +ive
SCP -ive
Ignition +ive
Battery +ive
FC54/2
FC54/10
FC54/9
FC54/16
FC54/3
FC54/4
FC54/5
Power Ground
logic Ground
BK BK

V12 Vanquish

CIRCUIT TITLE	WDS/Data Buses
MODEL	Coupe
APPLICABILITY	From Chassis 0001

CIRCUIT SHEET 25

SOURCE 1R12-370795-AD



V12 Vanquish

CIRCUIT TITLE	Window Lifts
MODEL	Coupe
APPLICABILITY	From Chassis 00001

CIRCUIT SHEET 26