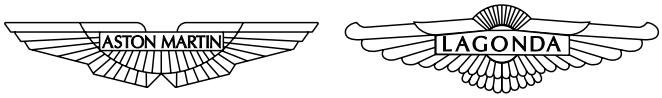
DB7 VANTAGE

Workshop Manual

Volume 3



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ASTON MARTIN LAGONDA LIMITED

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General Information

Workshop Manual Sections

The DB7 Vantage Workshop Manual is divided into 9 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

9. Aston Martin Diagnostic System

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.

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 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.

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, there is a risk of damage to electronic equipment and brake lines from stray heat.
4. Use the recommended service tool where instructed to do so.

Safety Precautions (continued)

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.

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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
Block	
Cylinder Bore Grade 2	89.008 - 89.022
Main Bearing Bore (without shells)	72.400 - 72.424
Crankshaft	
Main Bearing Diameter	67.480 - 67.504
Main Bearing Clearance	0.025 - 0.045
(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
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
Ring Gap - Lower Compression Ring	0.270 - 0.420
Ring Gap - Oil Control Ring Segments	0.150 - 0.650
Connecting Rods	
Connecting Rod Bearing Diameter (with shells)	
Piston Pin Clearance	0.004 - 0.020
Side Clearance	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
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	0.045 - 0.094
Valve Face Maximum Runout	0.050

Component	Dimension
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 .020 - .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 element, 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

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

Minimum Block Diameter

Maximum Crankshaft 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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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	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
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
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
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 in the manual.

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 (see note below)
Engine coolant	50% water, 50% Anti-Freeze (use only BASF D542 or Havoline DEX-COOL)

Note: The coolants 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).

1.0.00.1 Engine Removal - Auto

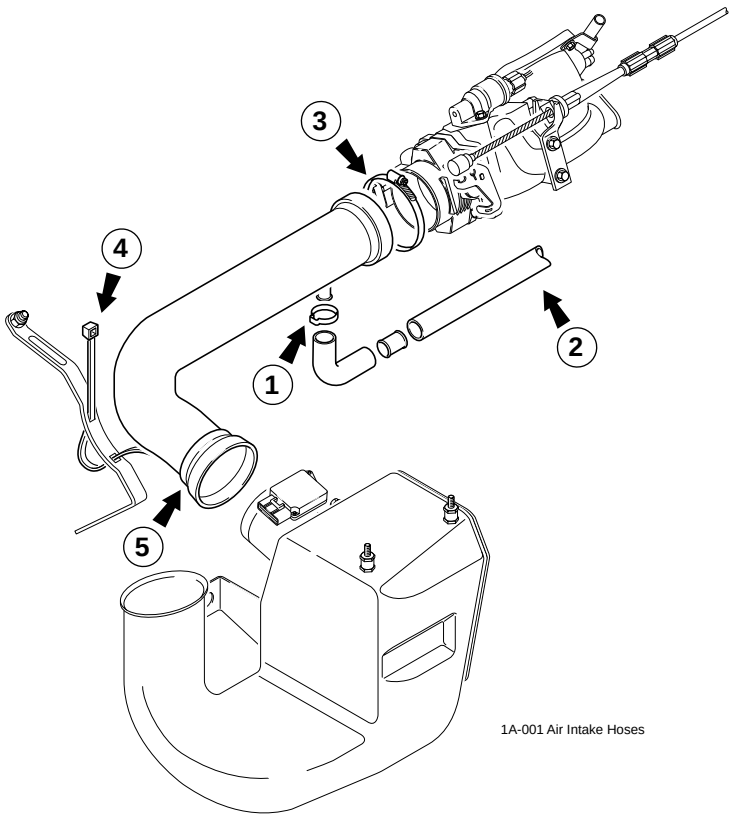
Preparation

WARNING: The fuel system is pressurised to 4 bar and must be safely depressurised before any work is done. 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.

1. Depressurise the fuel system 2.0.01.
2. Disconnect the battery.
3. Remove the bonnet (7.1.01).
4. Remove the front wheels and wheel arch liners.
5. Remove the front apron and undertray (7.1.01.1)
6. Remove the engine compartment and fuel rail covers.
7. Drain the engine oil.
8. Drain the engine coolant (1.7.03.1).
9. Evacuate the air conditioning system (see section 8).

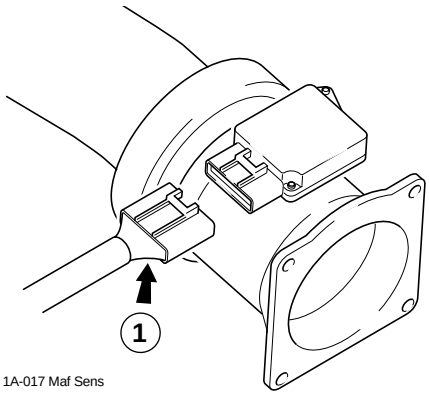
Removal

1. Remove the air intake hoses from both banks
    1. Release the clips and disconnect the crankcase ventilation hose.
    2. Disconnect the hose from the adaptor on the cam cover and remove from the vehicle.
    3. Disconnect the intake hose at the air filter and throttle body adaptor.
    4. Unclip the intake hose from the bracket.
    5. Remove the intake hose from the vehicle.



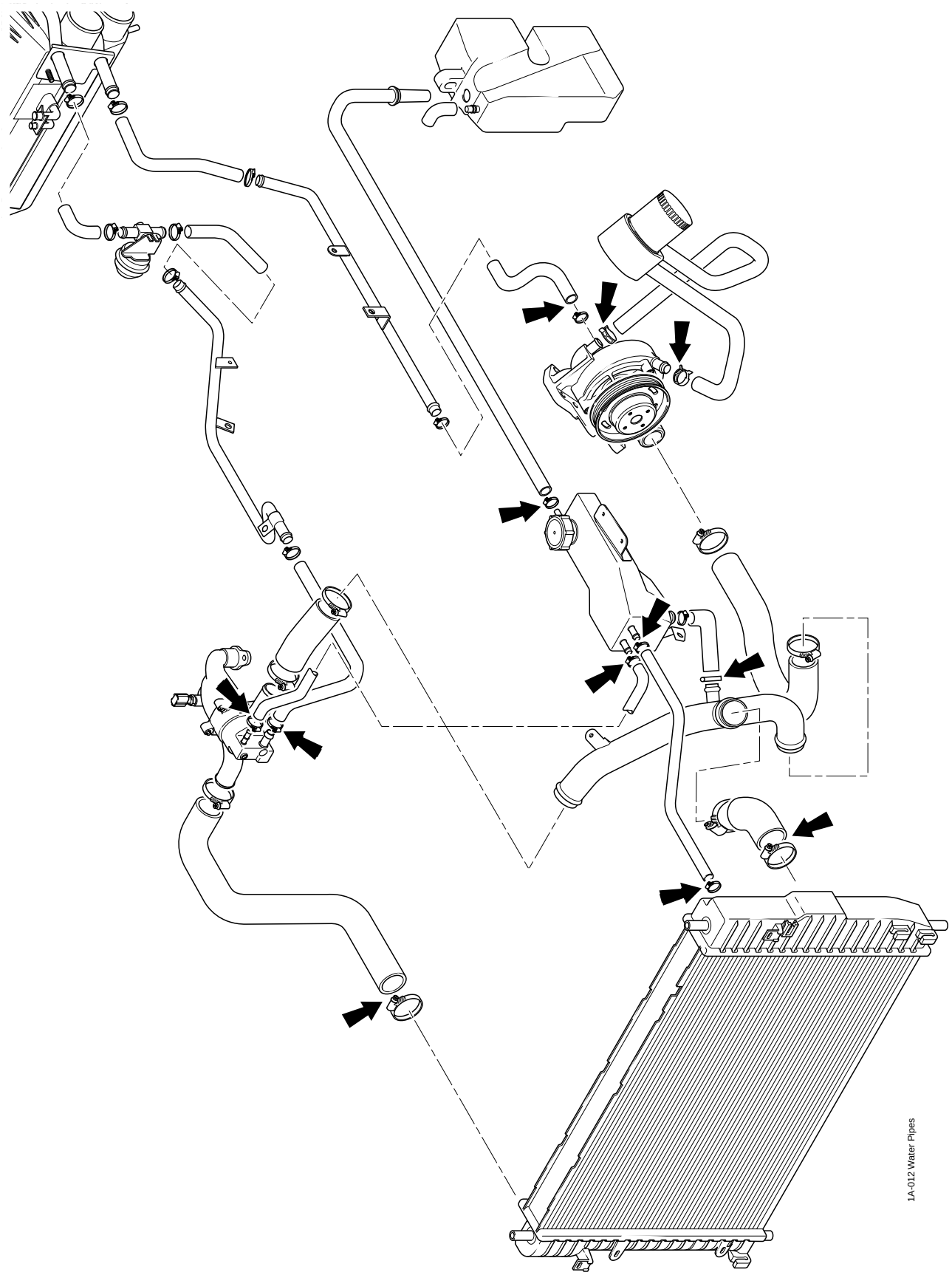
1A-001 Air Intake Hoses

2. Disconnect two mass air flow sensor connectors.

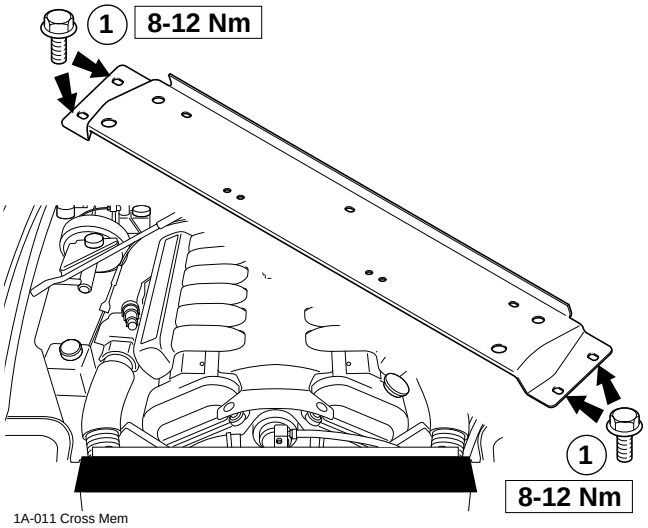


1A-017 Maf Sens

3. Disconnect the cooling system hoses at the positions indicated by arrows on the Illustration.

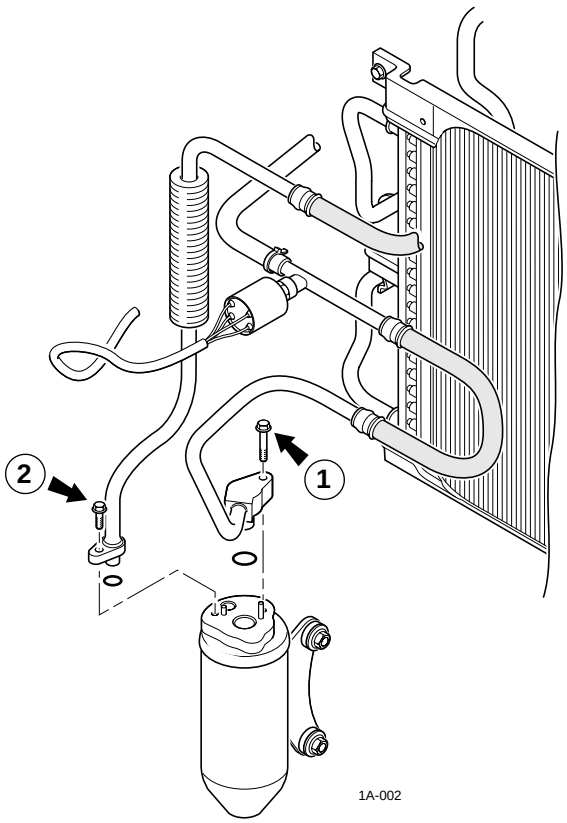


4. Remove four M6 bolts and remove the cross member.



1A-011 Cross Mem

5. Disconnect the receiver drier hoses and displace.

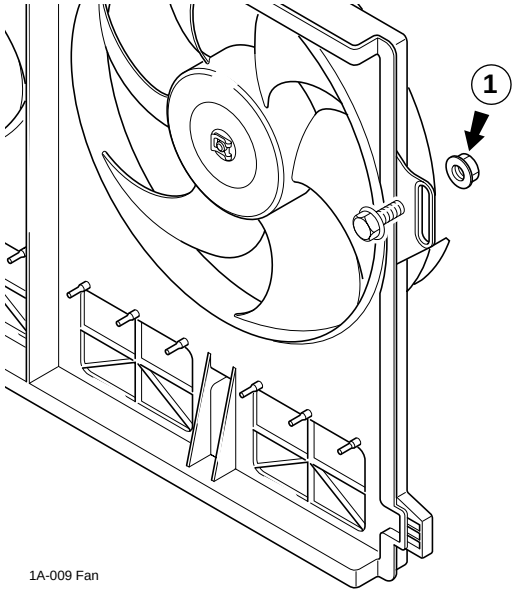


1A-002

6. Disconnect the fan pack electrical connections. Remove tie wraps from the harness and displace the harness.

7. Remove two nuts and washers.

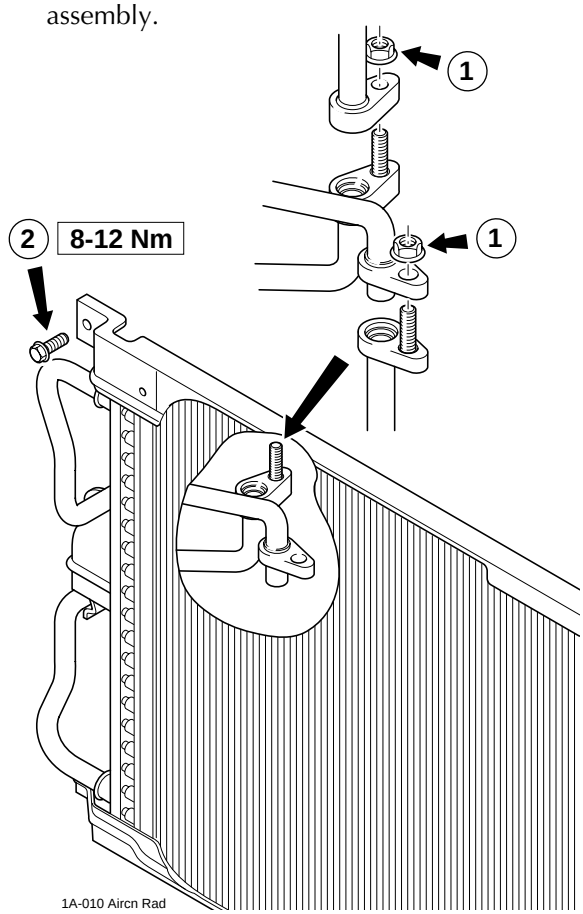
8. Remove the fan pack.



1A-009 Fan

9. Disconnect the air conditioning condenser hoses.

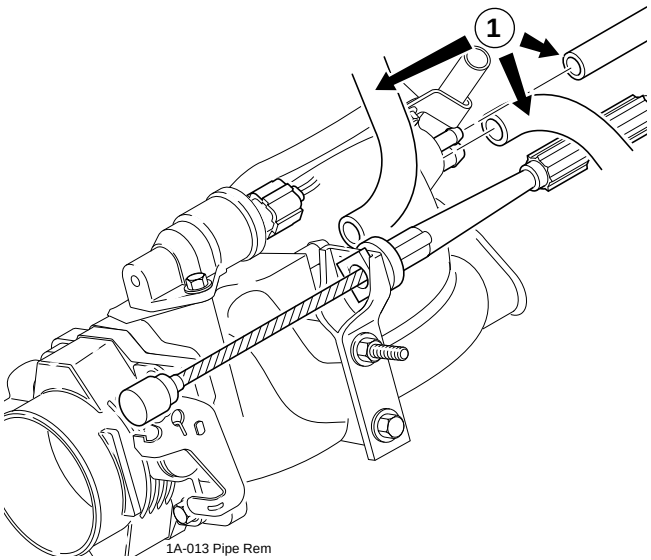
10. Remove the radiator/air conditioning condenser assembly.



1A-010 Aircn Rad

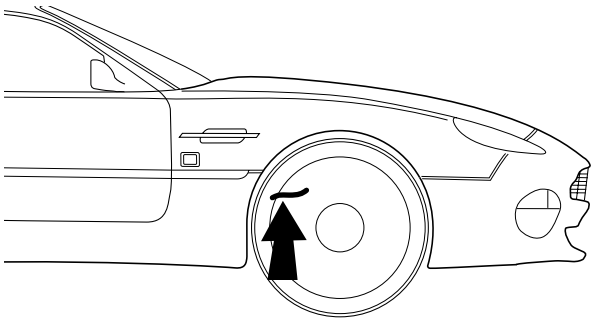
11. On the throttle body adaptor assembly remove the fuel pressure regulator and brake servo/HVAC vacuum lines and crankcase ventilation line.

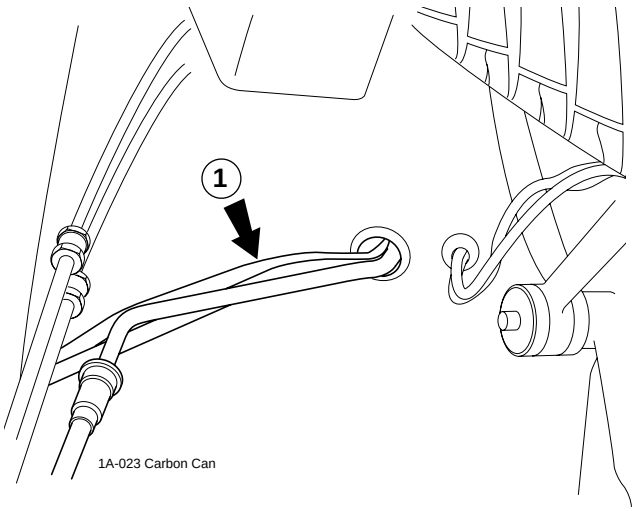
    Repeat for the other bank.



1A-013 Pipe Rem

12. Disconnect three hoses from the vapour management valves at the front right hand wheel arch. Feed the hoses through the wheel arch aperture to the engine bay.





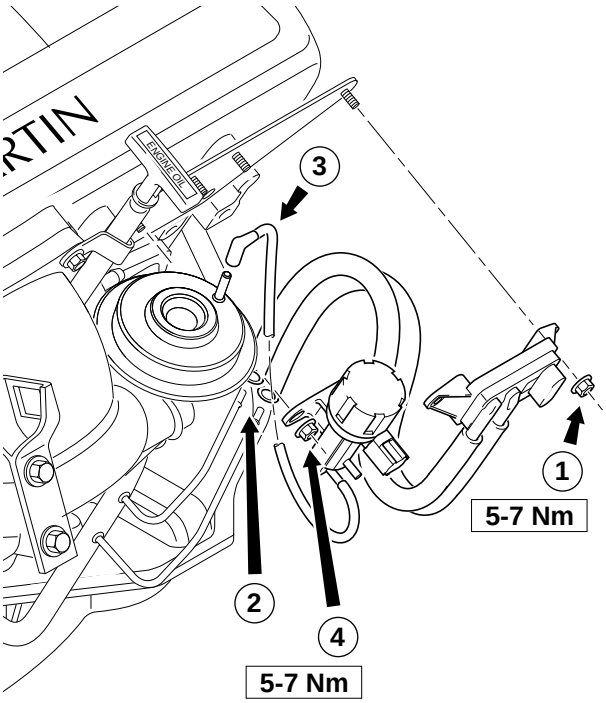
1A-023 Carbon Can

13. Remove two M5 nuts. Disconnect the DPFE hoses and remove the sensor and hoses.

    Repeat for the other bank.

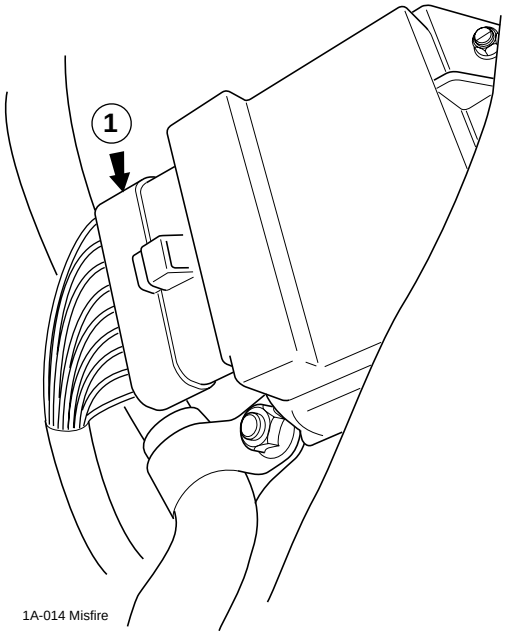
14. Remove two M5 nuts. Disconnect the EVR tube and remove the EVR solenoid and tube.

    Repeat for the other bank



1A-004

15. Disconnect two misfire detection module harnesses. Displace the harnesses. The illustration shows the module to the front left of engine bay. The second module is mounted opposite.

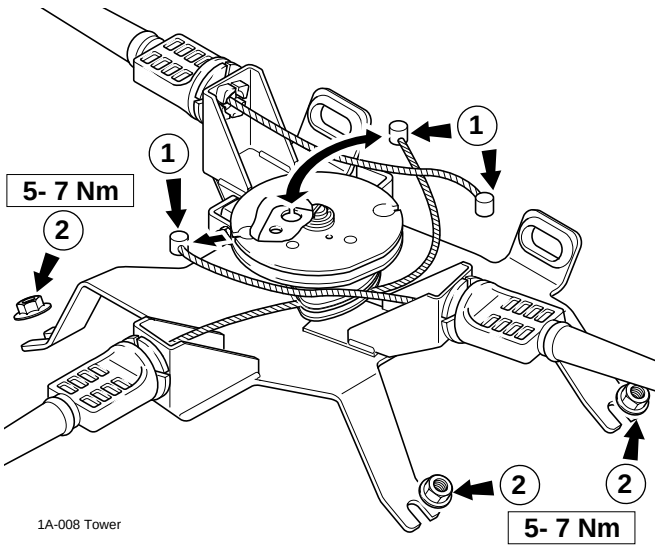


1A-014 Misfire

16. Disconnect the throttle pedal cable from the cable tower.

17. Disconnect both throttle cables from the throttle bodies and the support bracket.

18. Remove four M8 nuts and remove the throttle cable tower.

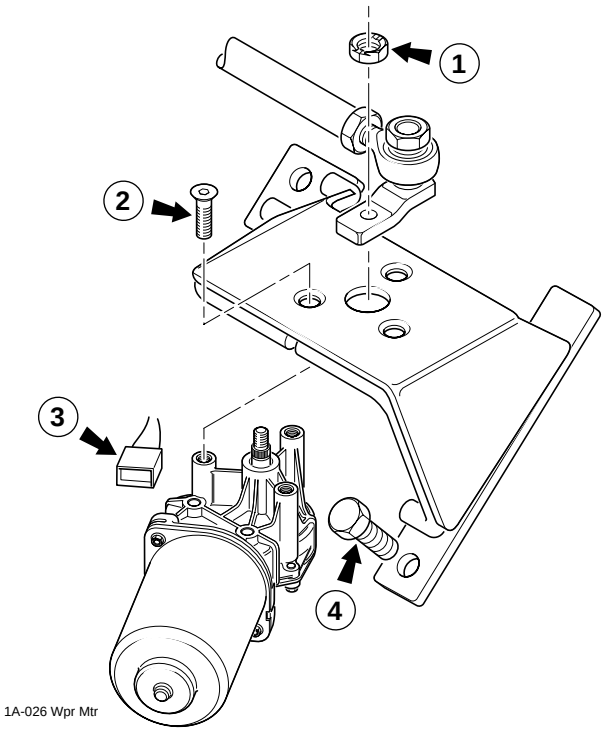


1A-008 Tower

19. Remove the wiper motor and bracket

    1. Remove the special nut and disconnect the drive bracket from the motor shaft.

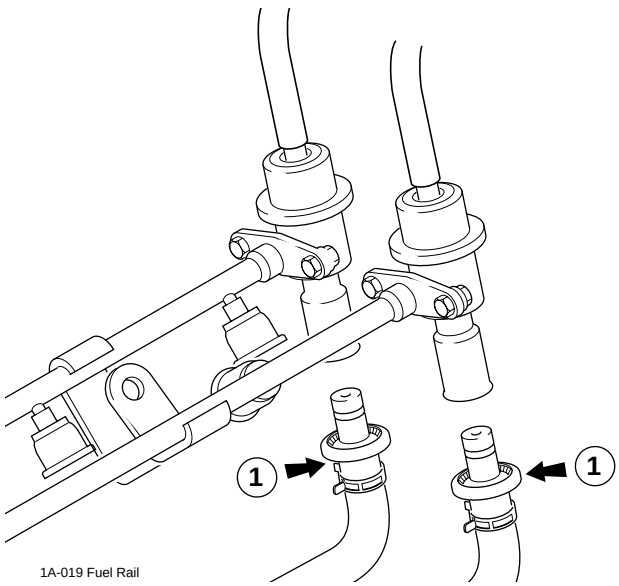
       Displace the rod and drive bracket.
    2. Remove three M6 screws and separate the wiper motor from mounting bracket.
    3. Disconnect the wiper motor multi-plug and remove the motor.
    4. Remove three bolts and remove the bracket.



1A-026 Wpr Mtr

20. Disconnect the fuel hoses from the fuel pressure regulators. Discard the 'O' rings.

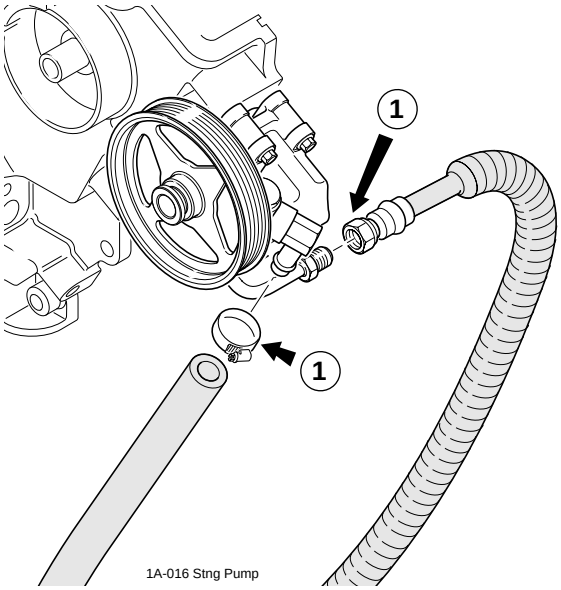
    Note: To help identification, the fuel hose for the right hand bank is colour coded green at each end.



1A-019 Fuel Rail

21. Disconnect the air conditioning vacuum supply hose at the rear of the engine.

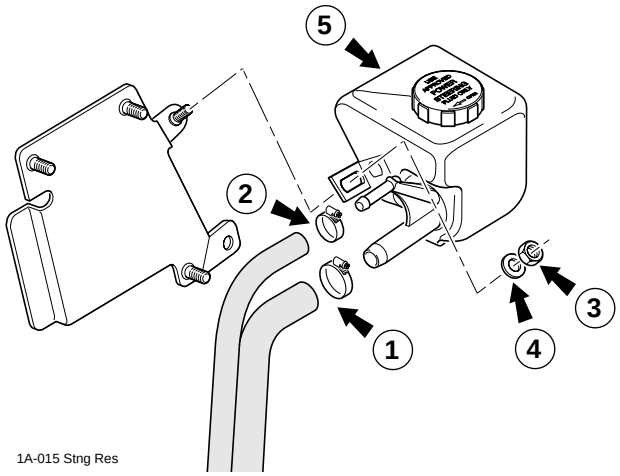
22. Disconnect the power steering pump hoses. Remove the power steering reservoir cap and drain the system.



1A-016 Stng Pump

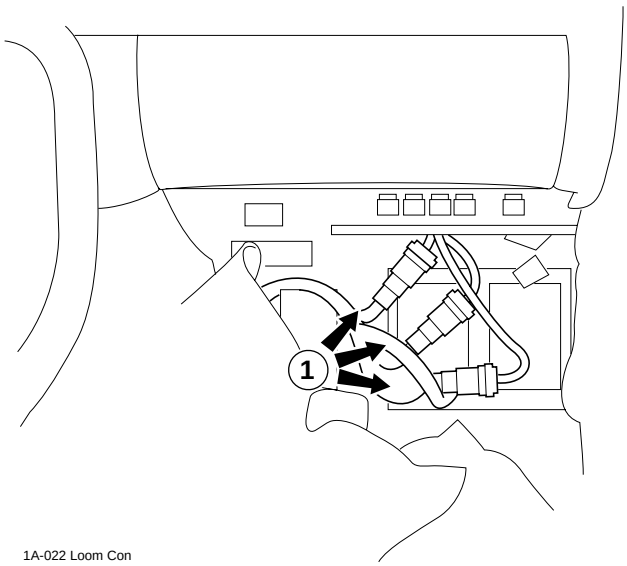
23. Remove two M6 nuts and washers.

24. Disconnect two low pressure hoses and remove the power steering reservoir.



1A-015 Stng Res

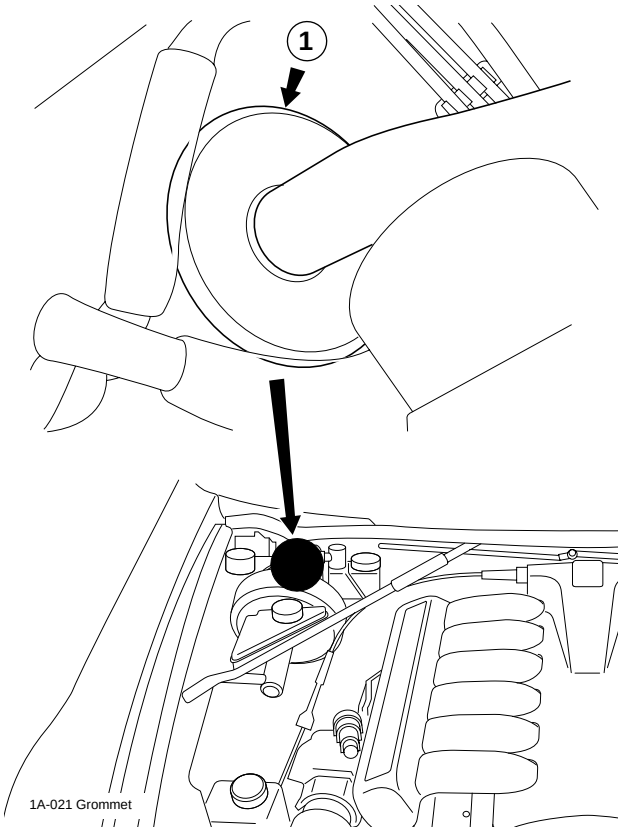
25. Disconnect the engine loom connectors in the passenger footwell.



1A-022 Loom Con

26. Disconnect the engine loom earth at the bulkhead.

27. Dislodge the engine loom grommet from the bulkhead and pass the loom connectors into the engine bay.



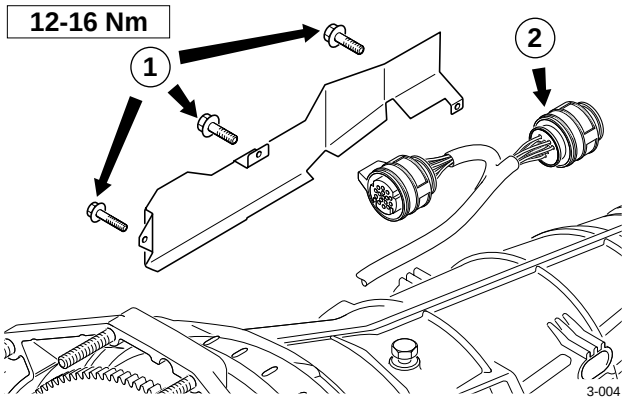
28. Raise the vehicle.

Beneath the Vehicle

29. Remove the steering rack heat shield.

30. Remove the catalytic converters, cruciform section and intermediate silencers from the exhaust system (2.7.01).

31. Remove the heat shield and disconnect the transmission electrical connectors.

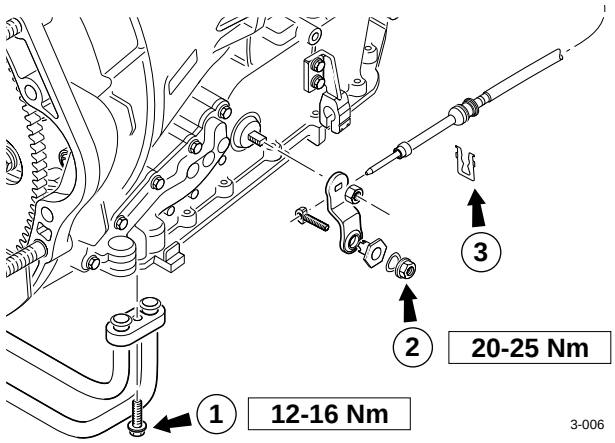


32. Remove the transmission oil pipes and gear selector lever.

    1 Remove one M6 bolt, disconnect and displace the oil pipes

    2 Loosen the clamp bolt on the gear selector lever.

    3 Remove the spring clip and displace the selector cable from the transmission.



33. Remove the propshaft

1 Remove six M8 bolts and remove the belly plate.

2 Support the transmission on a jack.

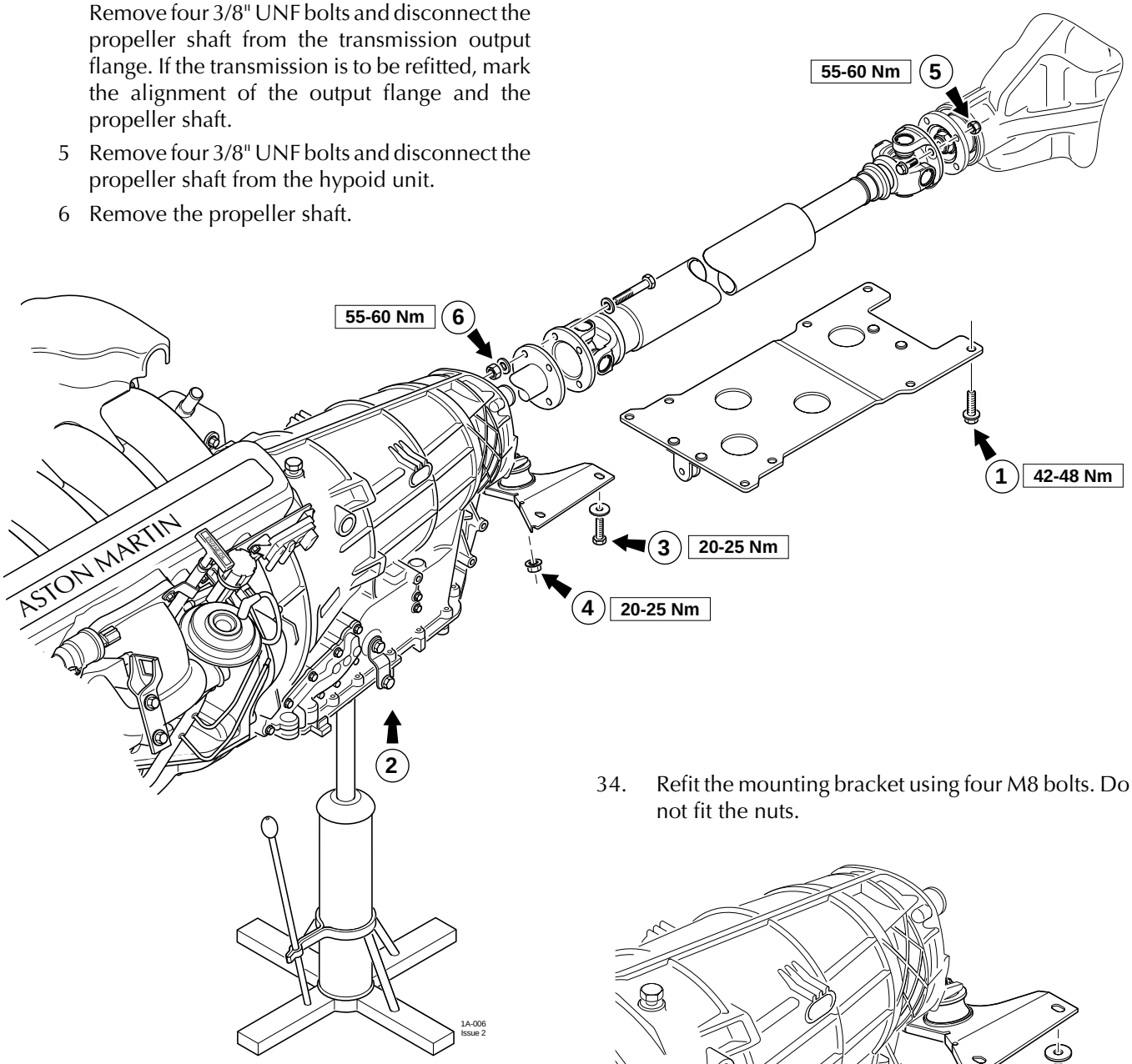
3 Remove four M8 bolts and washers and two M8 nyloc nuts and remove the mounting bracket. Leave the rubber mounts in place.

4 ***WARNING: Make sure the propeller shaft is adequately supported before removing the last bolts.***

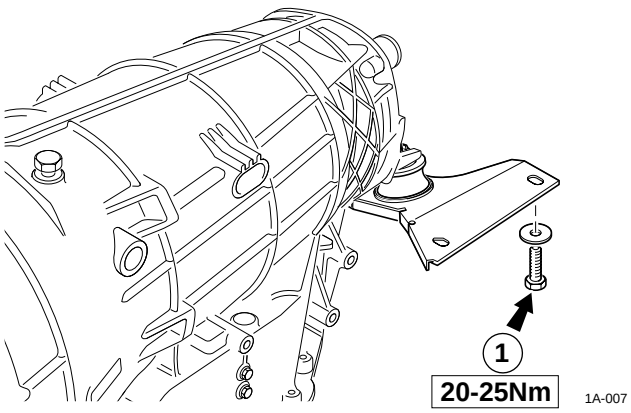
Remove four 3/8" UNF bolts and disconnect the propeller shaft from the transmission output flange. If the transmission is to be refitted, mark the alignment of the output flange and the propeller shaft.

5 Remove four 3/8" UNF bolts and disconnect the propeller shaft from the hypoid unit.

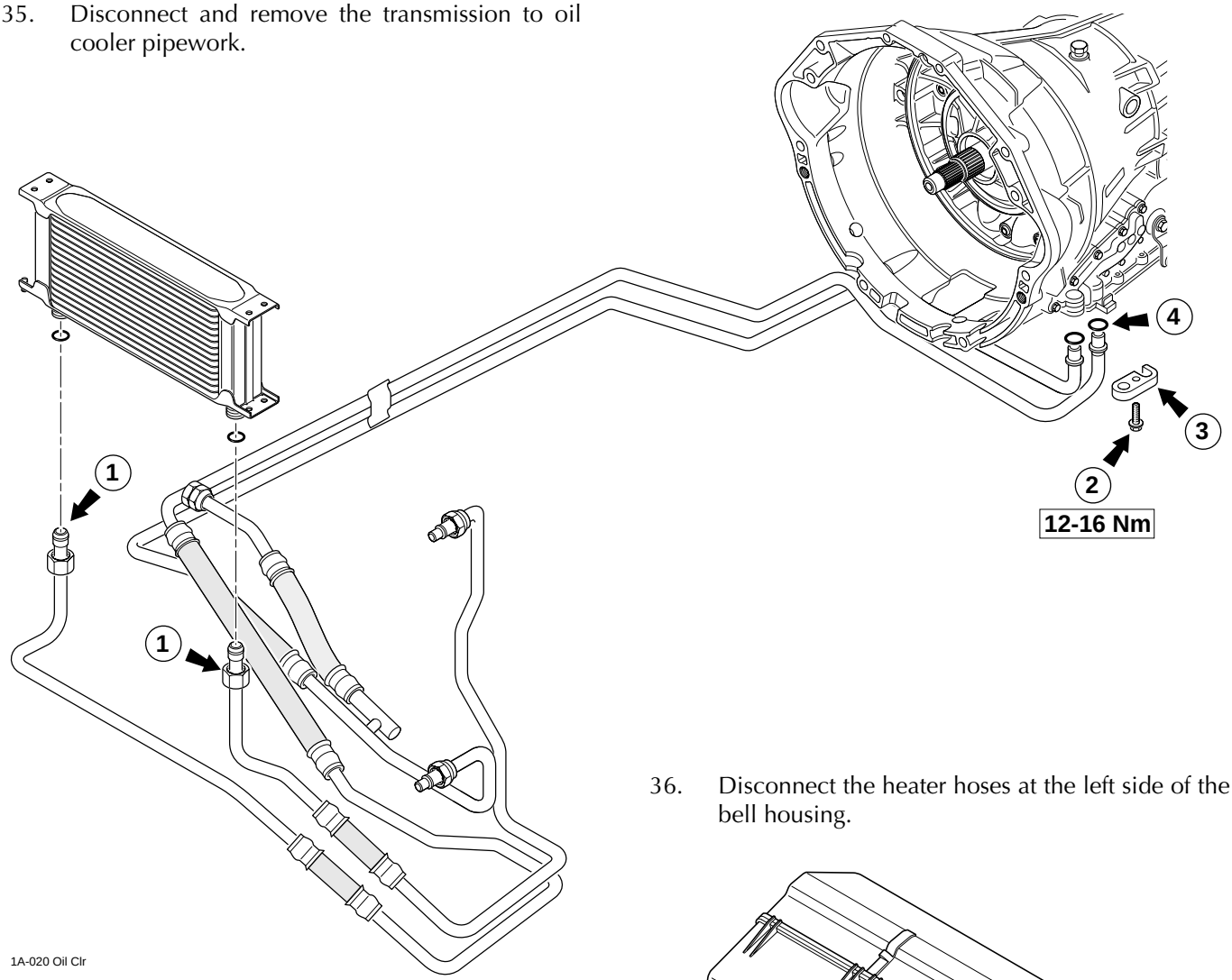
6 Remove the propeller shaft.



34. Refit the mounting bracket using four M8 bolts. Do not fit the nuts.

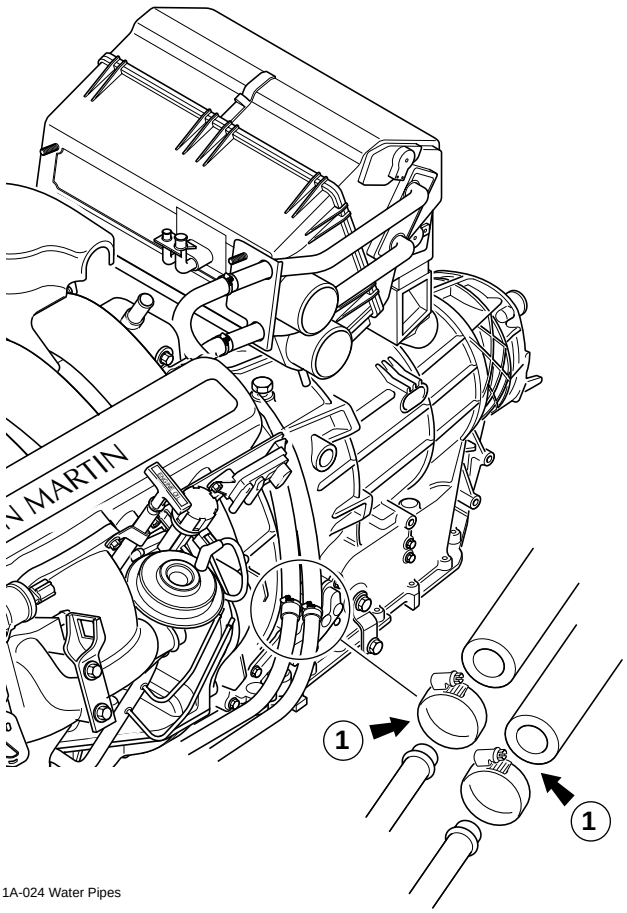


35. Disconnect and remove the transmission to oil cooler pipework.



1A-020 Oil Clr

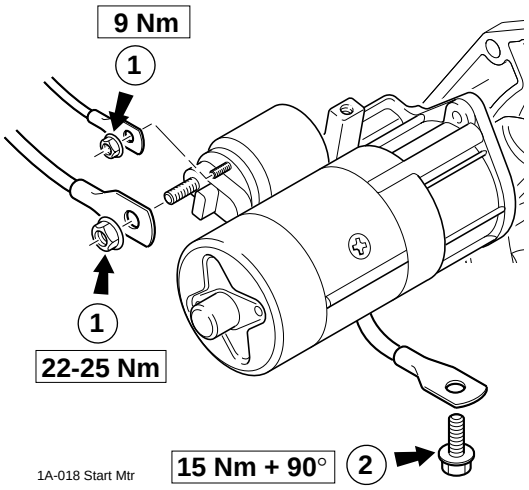
36. Disconnect the heater hoses at the left side of the bell housing.



1A-024 Water Pipes

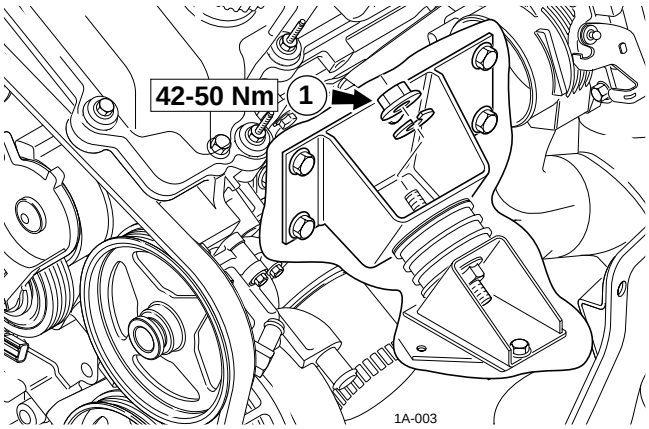
37. Disconnect the starter motor electrical connections.

38. Disconnect the earth strap from sump bolt.



39. Remove the transmission jack.

40. Remove the engine mount top nuts.

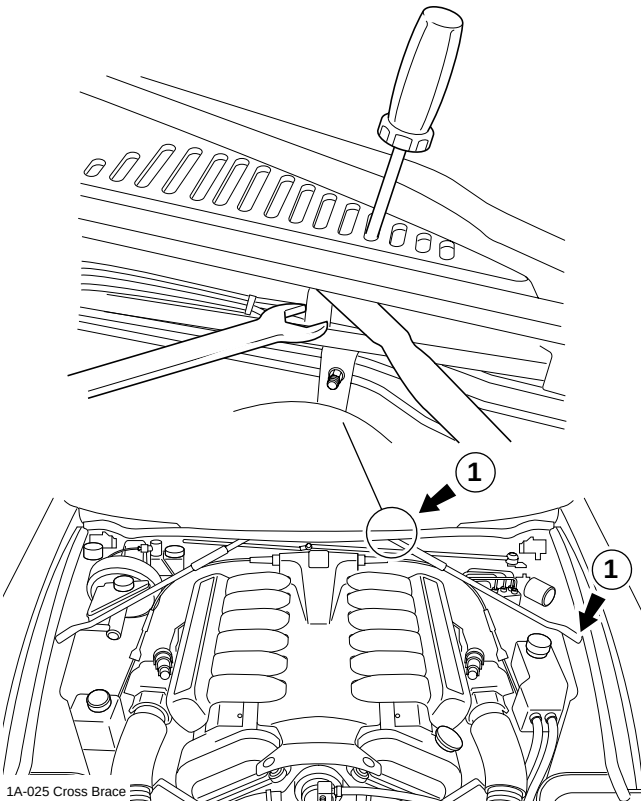


41. Lower the vehicle.

Engine Top

42. ***Caution: Take care not to damage the scuttle plate when removing the rear cross brace bolts.***

Remove four bolts and remove the cross braces.



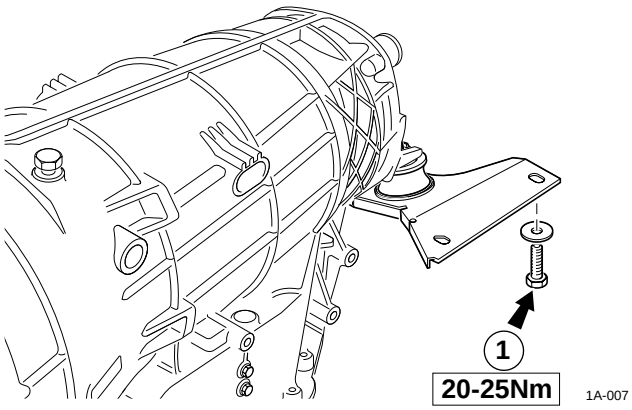
Engine Removal

43. Raise the vehicle

44. Remove the sump plugs and drain the engine oil.

45. Support the transmission on a jack.

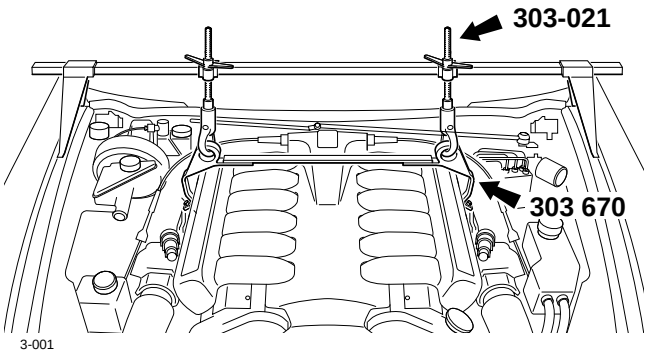
46. Remove four M8 bolts and remove the transmission mounting bracket.



47. Lower the transmission jack slowly so that the transmission drops slightly. Tilting the engine/ transmission in this manner will aid removal from the vehicle

48. Lower the vehicle slowly.

49. Position an engine hoist over the engine and using the special tool attach hooks to the lifting eyes.



51. Check that all electrical connectors and hoses etc., which need to be disconnected for engine/ transmission removal, have been disconnected.

52. Slowly raise the engine/transmission, while gradually moving the hoist away from the vehicle, until clear of the engine bay.

Installation

To install, reverse the removal procedure.

Note the following procedures and set ups which need to be done.

1. Set up the throttle cables (2.1.01).

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 contamination. Remove any fuel contaminated material, open fuel containers, waste fuel. Fully ventilate the vehicle and work area to remove all traces of fuel fumes.

Caution: Make sure the fuel hoses are reconnected correctly. The hose for the right hand bank is colour coded green at each end.

2. Prime the fuel system (2.0.01).

3. Fill and bleed the power steering system (4.4.02).

4. Check/Top up the transmission fluid (3.1.01.4).

5. Recharge the air conditioning system (see section 8).

Some electrical systems will need to be reset upon reconnection of the battery, refer to the electrics section for instructions.

Engine Removal - Manual Transmissions

There are some variations to this procedure for engines with manual transmissions. Refer to the transmission section for instructions on removing manual transmissions (3.8.01.1).

1.0.02.1 Compression Pressure Check

Data

Compression Pressure

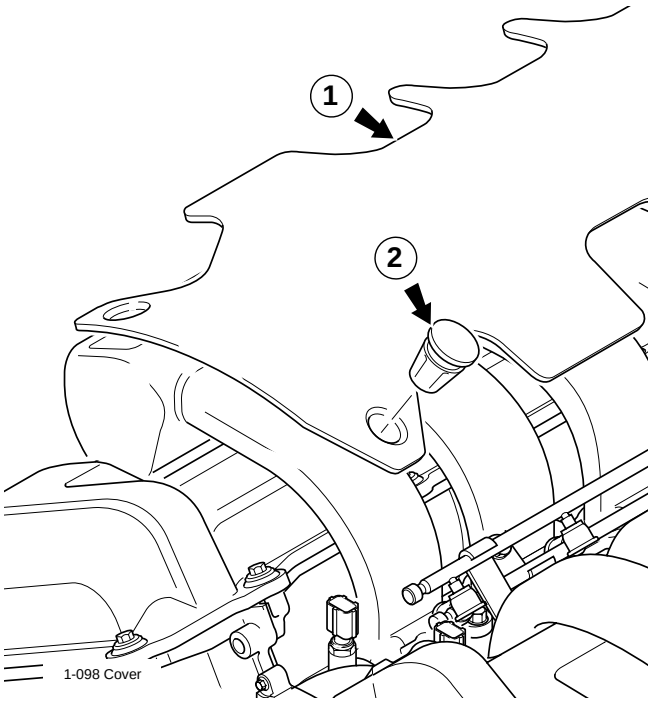
Compression Pressure	210-220 lb/in^2
Differential between cylinders	10%
Minimum limit	185 lb/in^2
Firing order	1- 7 - 5 -11- 3 - 9 - 6 - 12 - 2 - 8 - 4 -10
Sparking plug gap	1.2 - 1.3mm

Torque Figures

Spark plug to cylinder head 16 - 20 Nm

Procedure

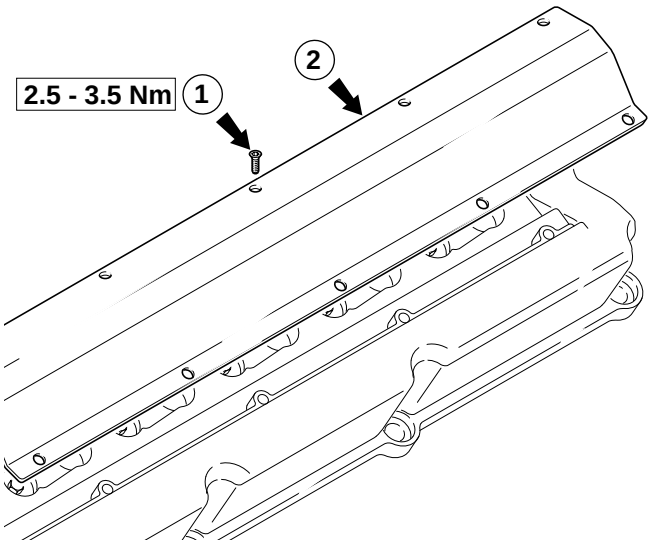
1. Run the engine until it reaches its normal operating temperature.
2. Stop the engine.
3. Remove the throttle body and adaptor (2.1.03)
4. Remove the fuel rail cover. Retain the front supports on the cam cover stud bolts.



5. Depressurise the fuel system (2.0.01).

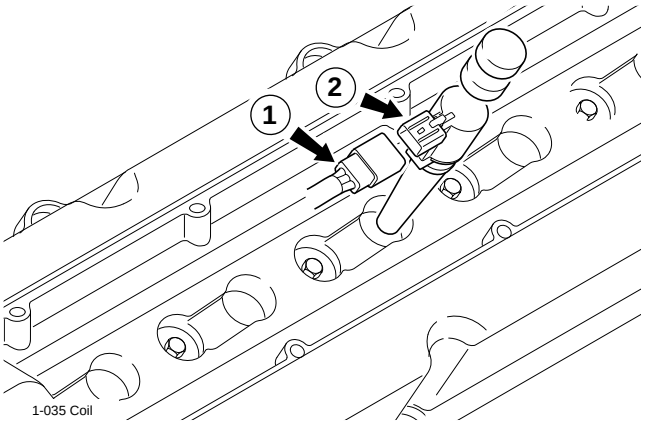
WARNING: Fire Risk - Make sure that you comply with the fuel system safety precautions given in section 2 of this manual.

6. Remove both fuel rails and injectors (2.5.05).
7. Remove the intake manifold (2.2.01)
8. Remove both LH and RH spark plug covers.



9. Disconnect the ignition coil connectors from the wiring harness, remove the ignition coils.

10. Remove all sparking plugs.



1-035 Coil

11. Fit a compression test gauge to plug hole No.1.

12. Crank the engine, using the starter motor, for ten seconds..

Note: The crank speed must not drop below 300 rpm and the throttle must be wide open.

13. Make a note of the test gauge reading and release the pressure from the gauge.

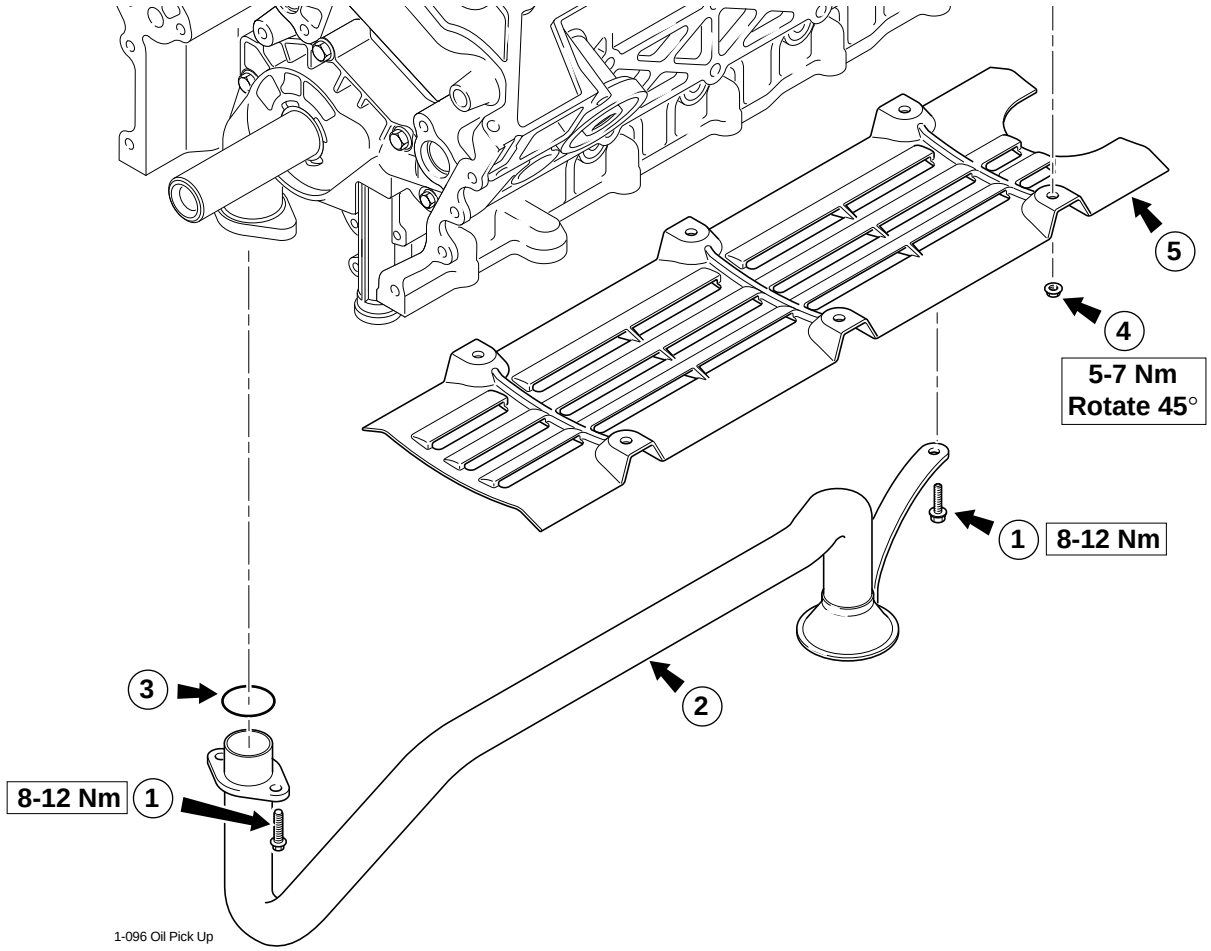
14. Repeat the procedure for the remaining cylinders.

15. Compare readings for all cylinders which should be be within ±10% of the specified compression pressure. Any cylinder with a reading outside this limit must be investigated further.

1.2.04.1 Crankshaft

Removal

1. Remove the cylinder heads (1.3.03.1).
2. Remove the oil pan (1.5.02.1).
3. Remove the oil pick-up pipe and the windage tray.
   1 Remove three M6 bolts
   2 Remove the pick up pipe
   3 Remove the 'O' ring
   4 Remove six M6 nuts
   5 Remove the windage tray



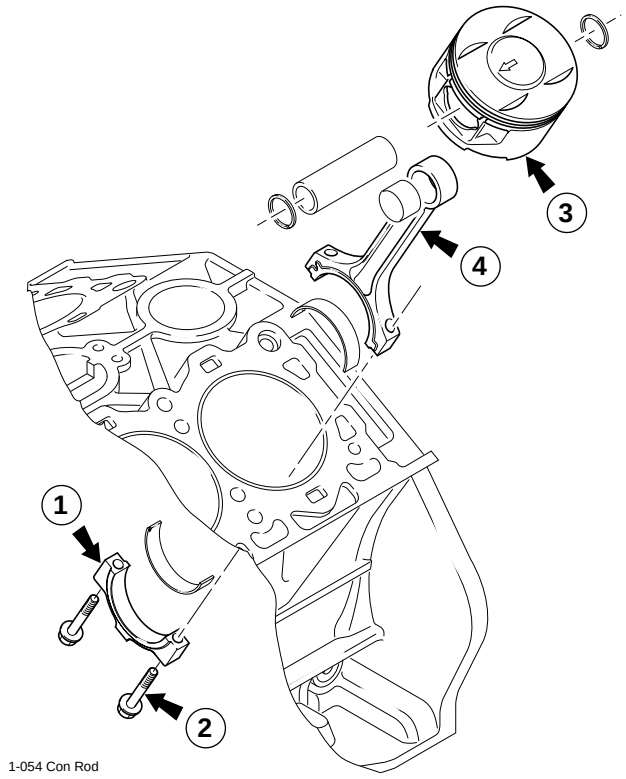
1-096 Oil Pick Up

4. Remove the piston/connecting rod assemblies.

   1 Remove the connecting rod bolts
   2 Remove the connecting rod caps and bearings
   3 Withdraw the piston from the top of the bore.
   4 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.

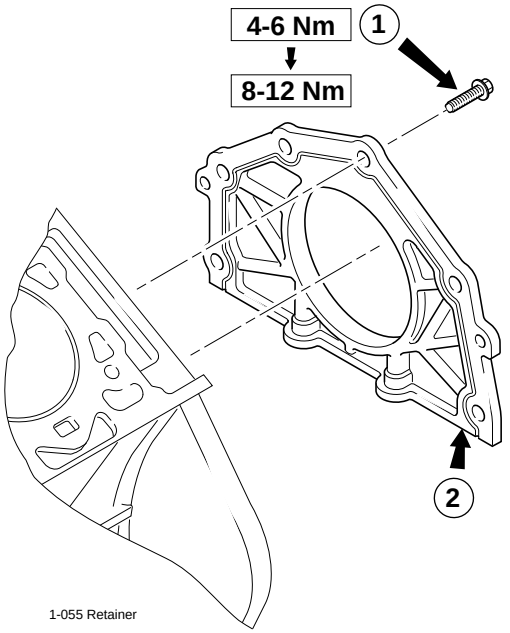


1-054 Con Rod

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.

5. Remove the rear oil seal assembly.

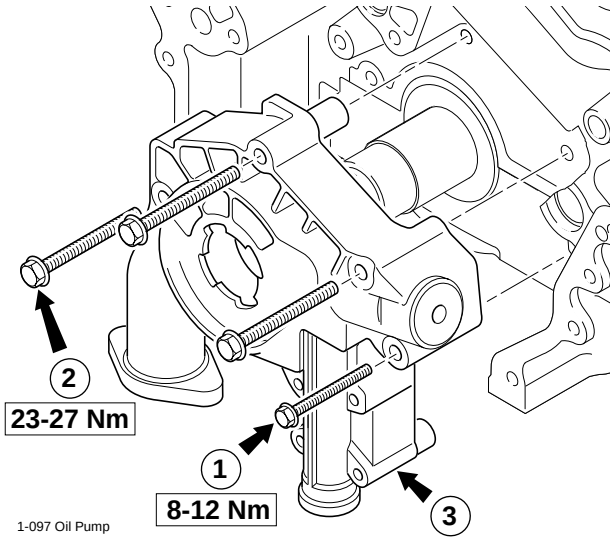
   1 Remove six bolts
   2 Remove the seal retainer and oil seal



1-055 Retainer

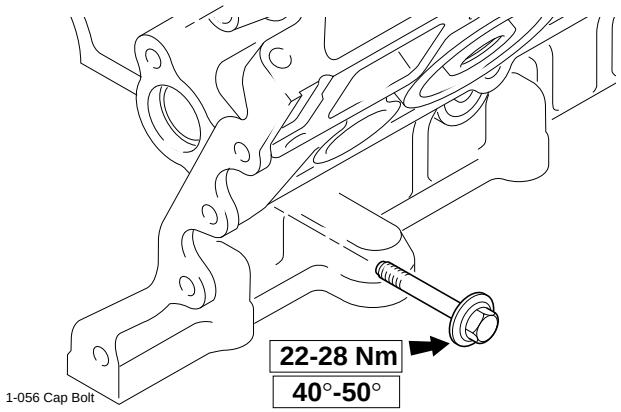
6. Remove the oil pump.

   1 Remove one M6 and three M8 bolts
   2 Remove the oil pump



1-097 Oil Pump

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



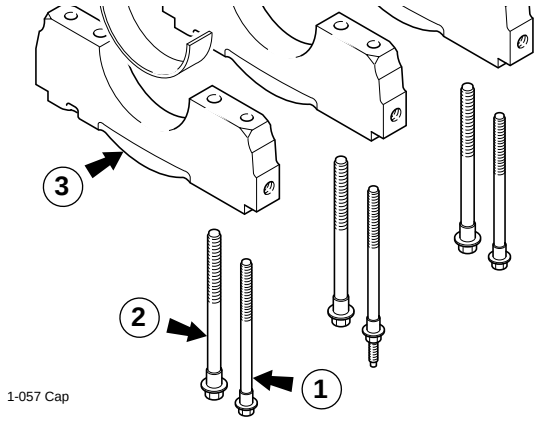
1-056 Cap Bolt

8. Remove the main bearing cap bolts.

   1 Remove fourteen outer M8 bolts from the bearing caps.

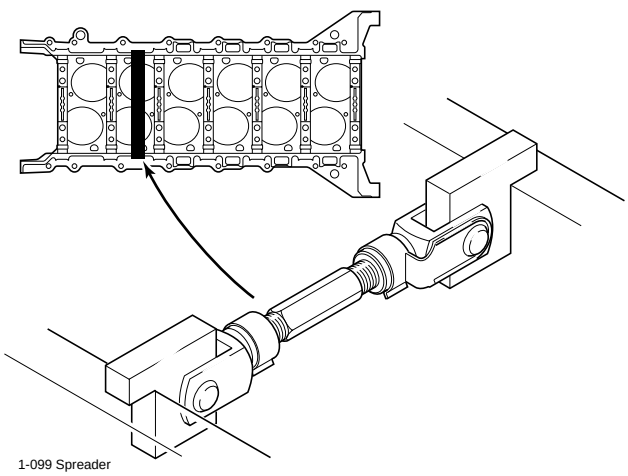
   (Note the positions of the M8 stud bolts at No. 2, 4 and 6 main bearing caps)

   2 Remove fourteen inner M10 bolts from the bearing caps

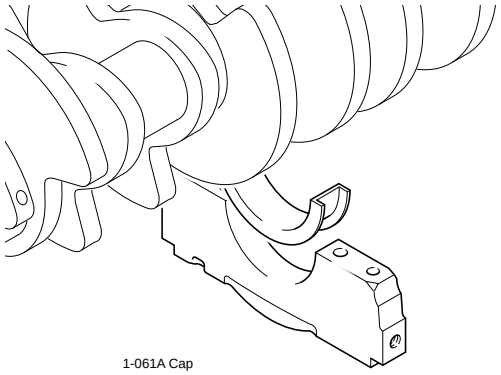


1-057 Cap

9. Spread the engine block side walls.


1-099 Spreader

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


1-061A Cap

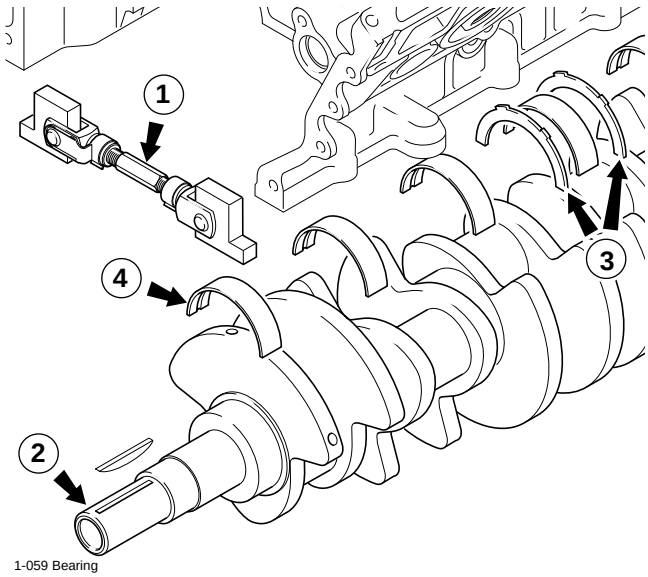
11. Remove the crankshaft

   1 Remove the frame spreaders.

   2 Lift out the crankshaft.

   3 Remove the thrust washers from No. 4 main bearing.

   4 Remove the upper bearing shells from all main bearings.



1-059 Bearing

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. 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..

   Refer to the Main Bearing Grade Chart in Engine Specifications, page 1-3.

Reassembly

1. Clean all components ready for reassembly.

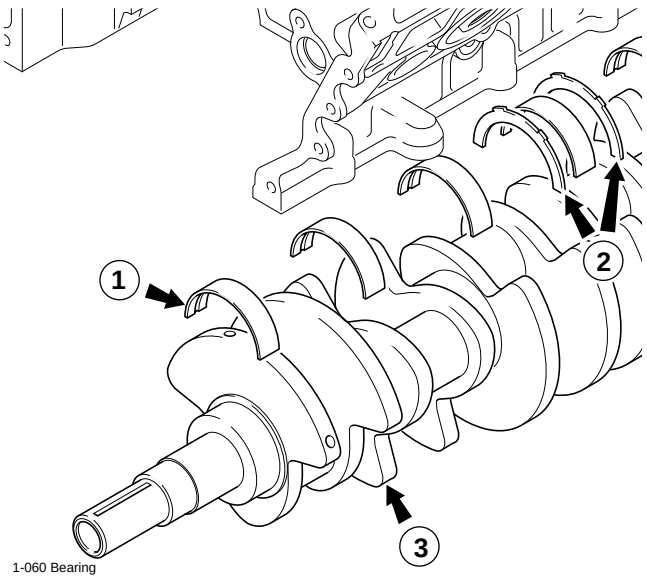
2. Fit the upper main bearings

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

3. Oil all crankshaft journals with engine oil. Fit the crankshaft.

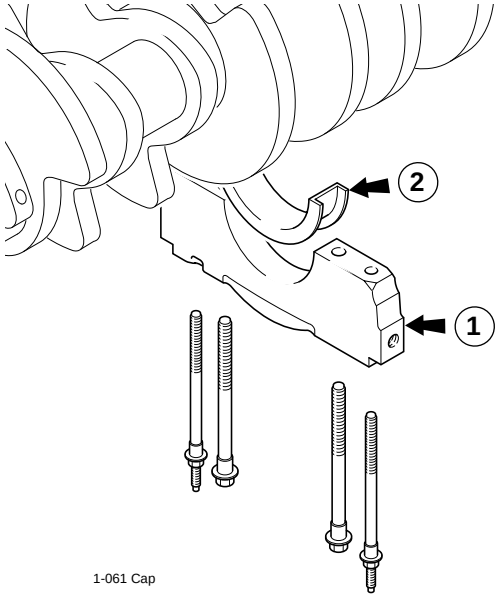
4. Fit three frame spreaders tightened to 25-30 Nm.

Caution: Do not overtension the frame spreaders.



1-060 Bearing

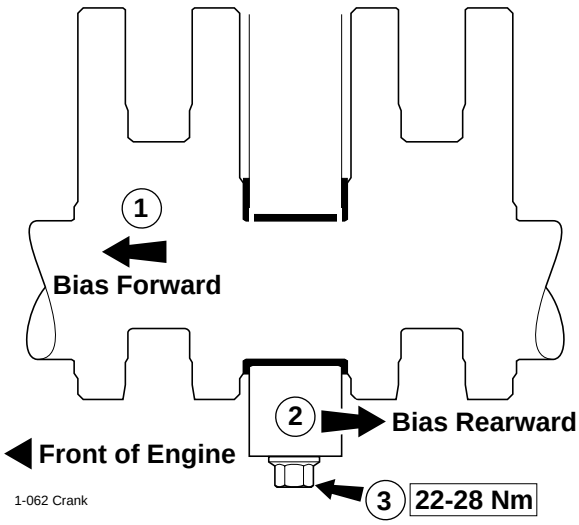
5. Oil the lower main bearing surfaces with engine oil. Loosely fit the No. 4 main bearing cap and bearing shell. Oil beneath the head of four bolts and fit to No. 4 bearing cap.



1-061 Cap

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

   1 Bias the crankshaft maximum forward.
   2 Bias the No. 4 bearing cap maximum rearwards.
   3 In 'half turn' increments of the inner bolts, ease the cap down until it is fully seated.
   4 Nip down the No. 4 bearing cap bolts to 22-28 Nm.



1-062 Crank

7. Fit the remaining main bearing caps.

   Note: The front face of No. 1 cap must not protrude forward of the oil pump mounting face.

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

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

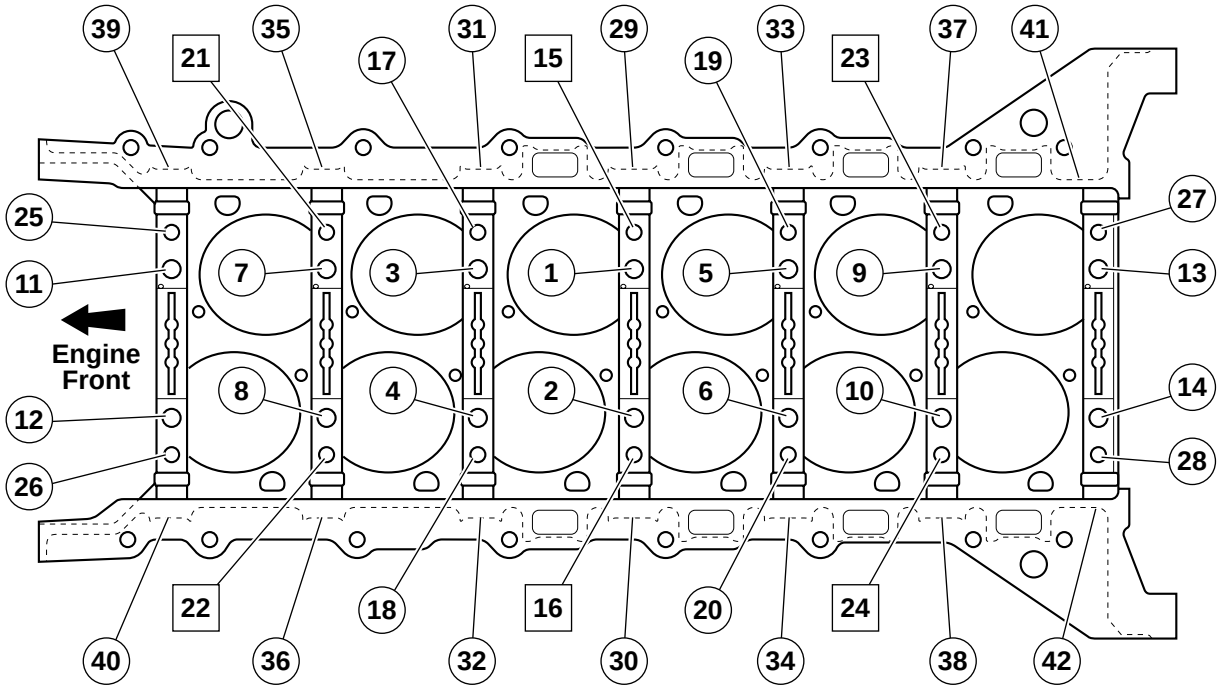
10. Oil beneath heads of the remaining bolts. Fit remaining main bolts and side bolts to all caps.

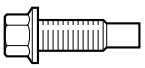
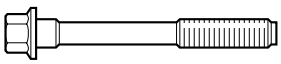
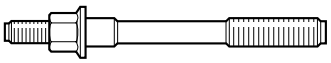
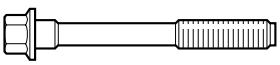
11. Remove the block spreaders.

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

13. 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 below.



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°	

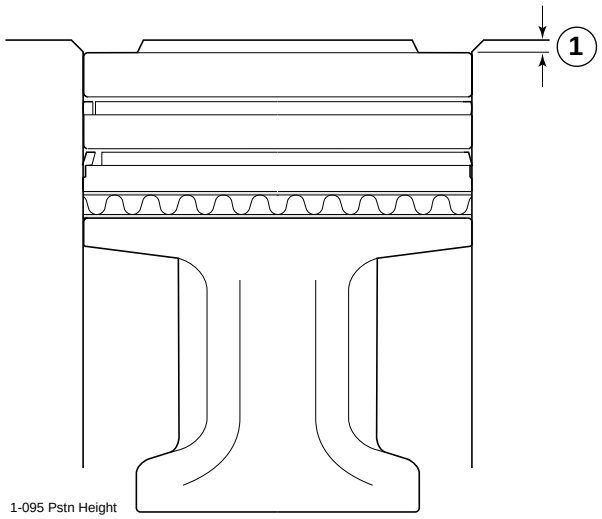
1-064 Main Bearing

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

    1 Check the piston height (see 1.2.05.6) 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.

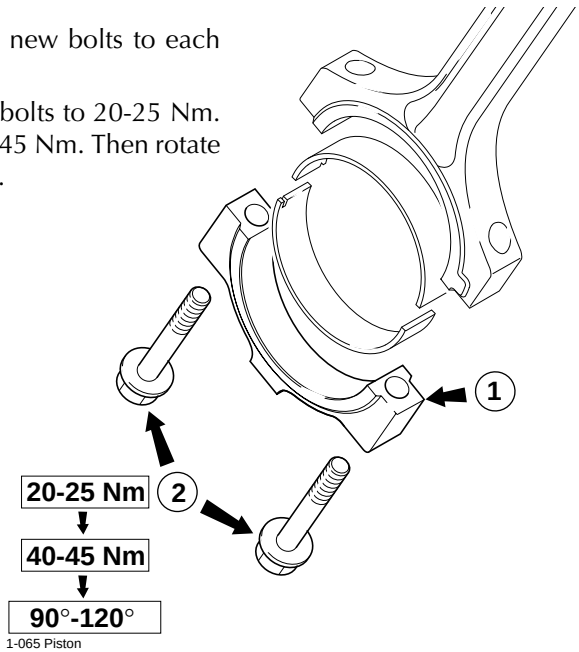
    Note: For full piston and connecting rod overhaul and assembly procedures, see 1.2.05.6.



1-095 Pstn Height

15. Fit the connecting rod bearings and caps.

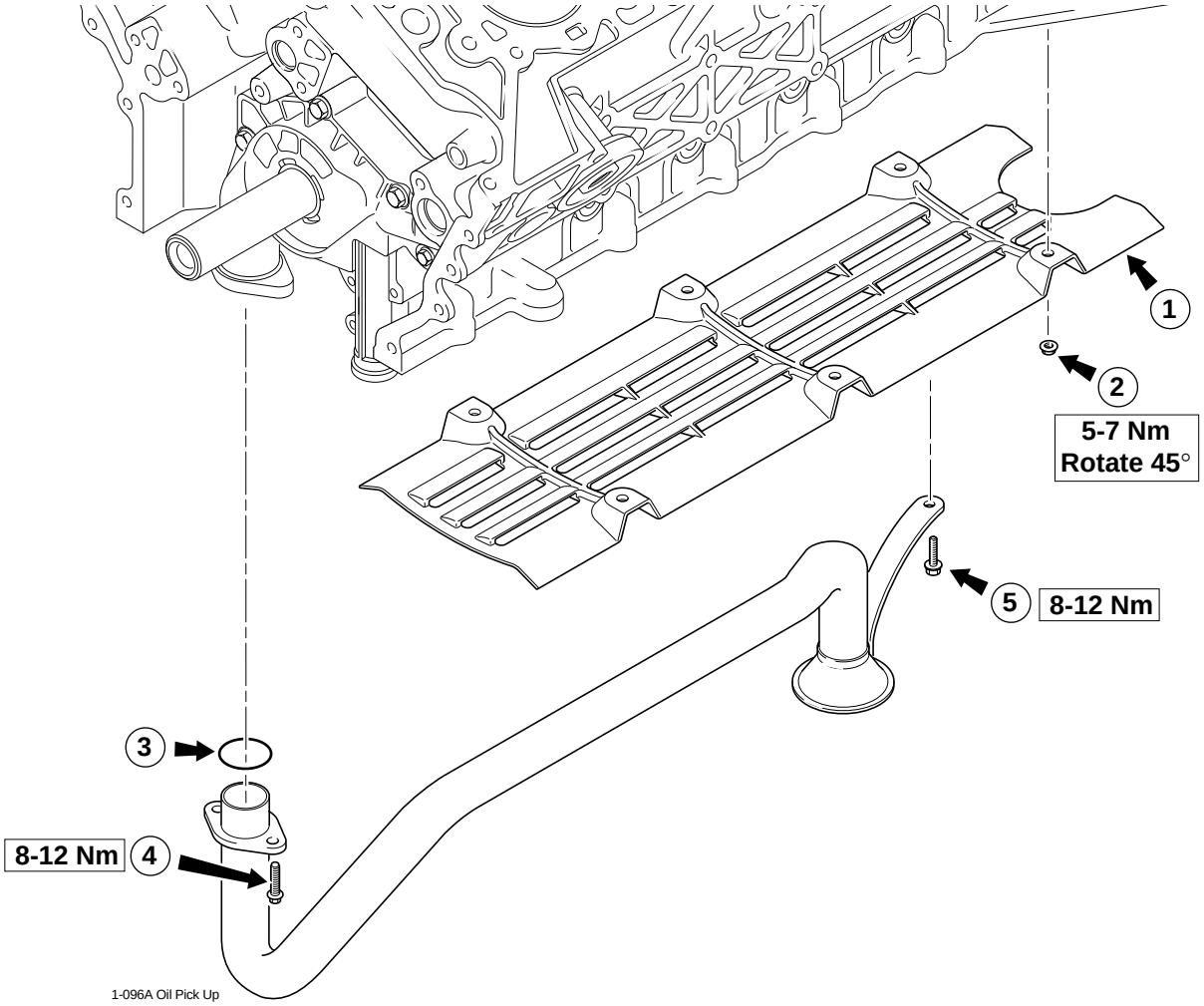
    1 Fit the connecting rod bearing shells and caps noting the correct orientation of each cap. Check that the connecting rod and cap identification marks match and align.
    2 Secure the caps using two new bolts to each cap.
    3 Torque all connecting rod bolts to 20-25 Nm. Then torque all bolts to 40-45 Nm. Then rotate all bolts a further 90°-120°.



1-065 Piston

16. Refit the windage tray and the oil pick-up pipe.

    1 Fit the windage tray
    2 Secure with six M6 nuts
    3 Fit a new 'O' ring to the pick up pipe
    4. Fit the pick up pipe using three M6 bolts.



17. Refit the oil pan (1.5.02.1).

18. Refit the cylinder heads (1.3.03.1) and complete the valve timing setup (1.3.04.3).

19. Refit the front timing cover (1.4.02.1) and the camshaft cover (1.3.01.1).

20. Refit the throttle body assemblies (2.1.03).

21. Refit the EGR system.

22. Refit the engine auxiliaries.

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

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

1.2.05.6 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 (measured along the centreline of each bank)	0.415 mm below to 0.115 mm above

Cylinder bore diameter 89.000 - 89.030 mm
(measured 50 ±0.05 mm below block face)

Piston diameter 88.970 - 89.000 mm

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

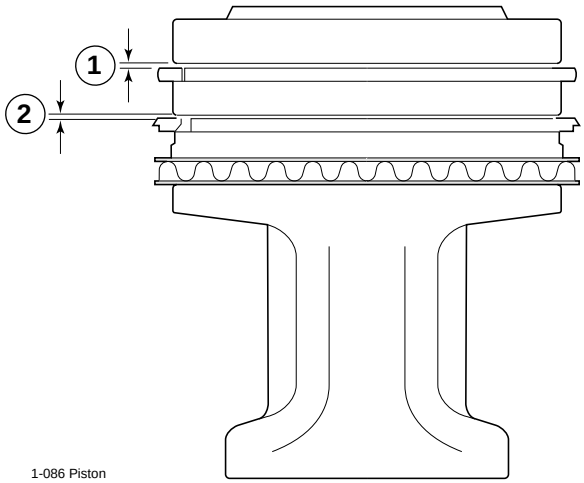
Reassembly

Note: Pistons are graded for each cylinder bore. If pistons and/or connecting rods are to be reffited, 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).

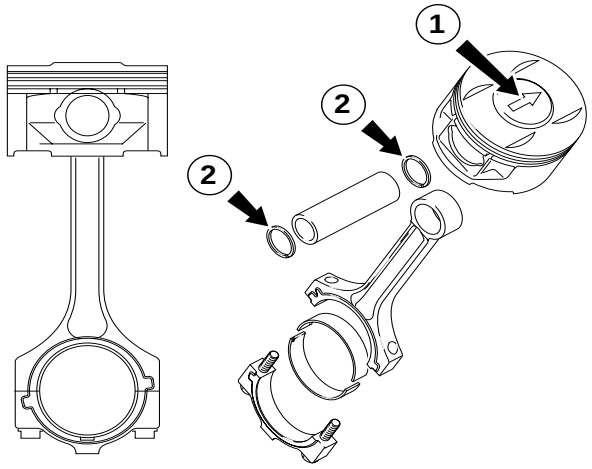
WARNING: During the following step, wear protective gloves to avoid burns.



1-086 Piston

3. Fit the pistons to the connecting rods

   1 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.

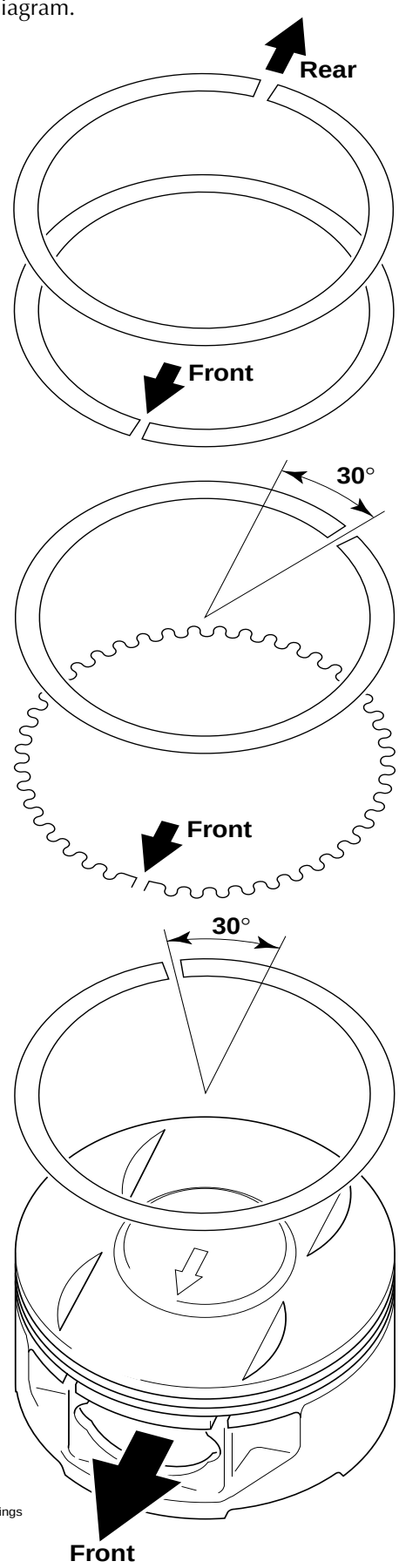


1-087 Piston

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.

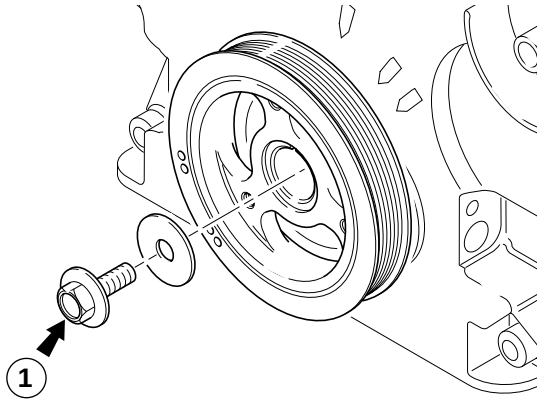


1-091 Pstn Rings

1.2.06.1 Crankshaft Damper

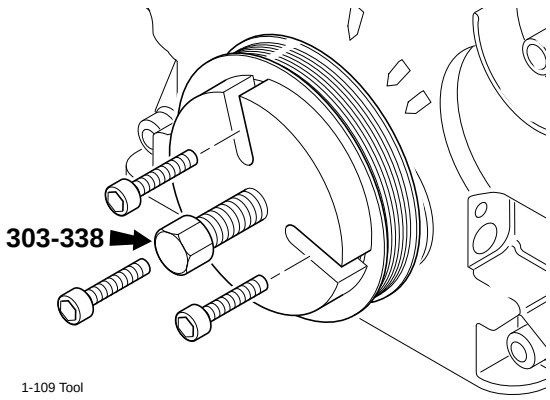
Removal

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



1-069a Damper

3. Using the special tool remove the crankshaft damper.

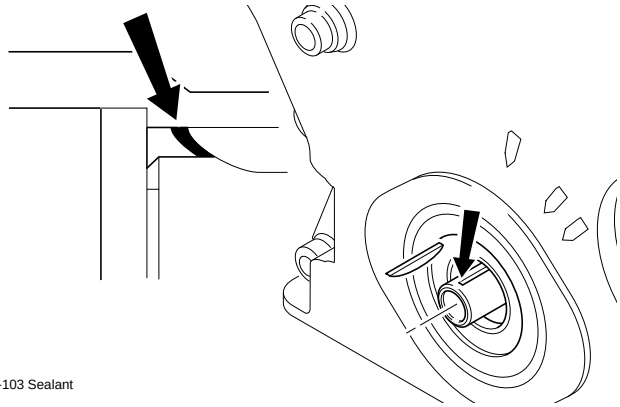


1-109 Tool

4. Clean all sealant from the crankshaft keyway

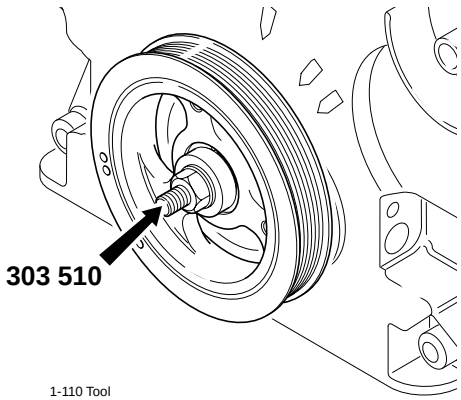
Refitting

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



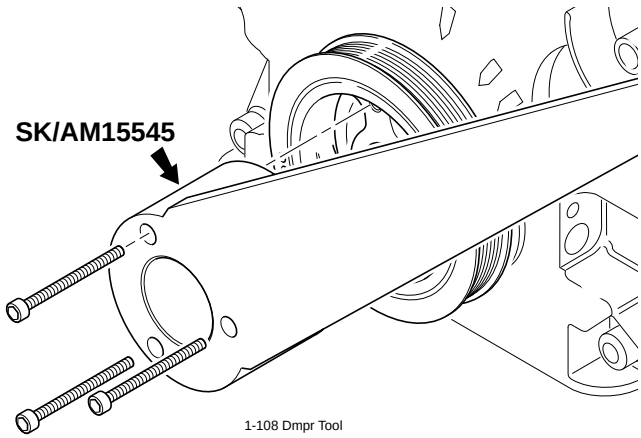
1-103 Sealant

3. Using the special tool install the damper.



1-110 Tool

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 a further 85 - 95°

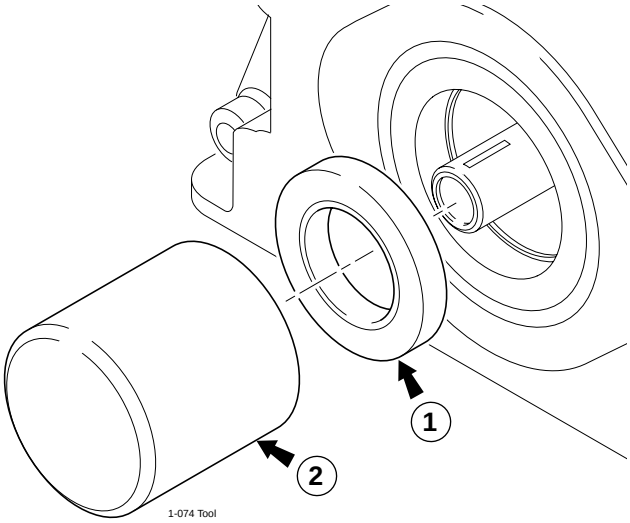


1-108 Dmpr Tool

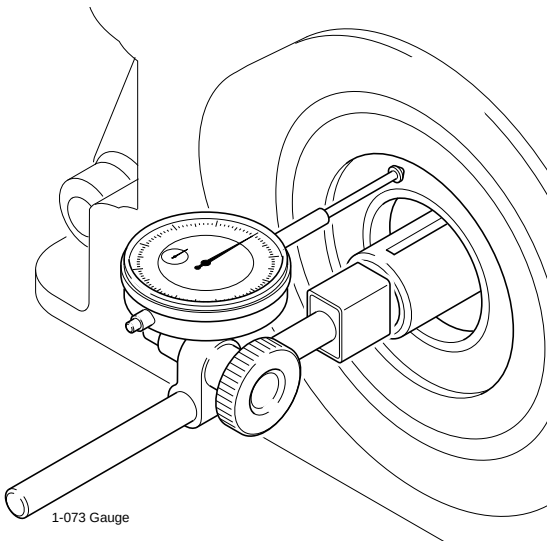
5. Remove the special tool and replace the polyvee drive belt.

1.2.07.1 Crankshaft Front Oil Seal

1. Remove the timing cover (1.4.02.1).
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.
   1 Oil the seal recess and position the seal on the cover
   2 Using the special tool, 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.

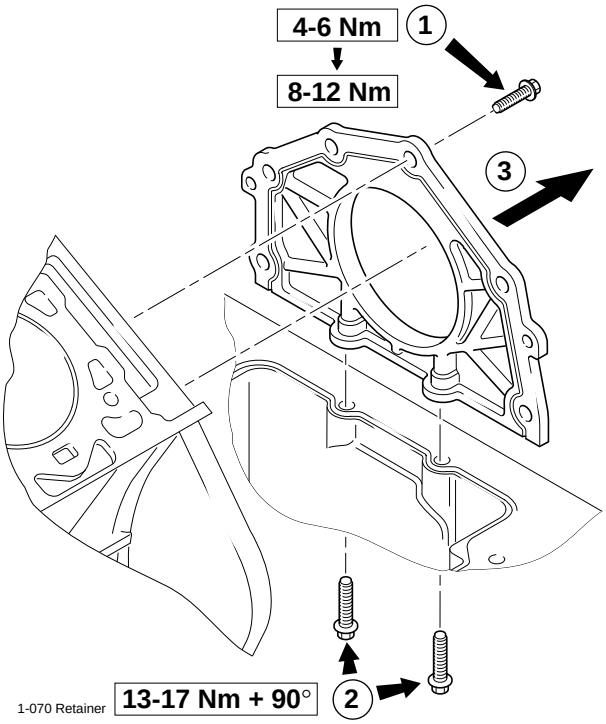


6. Lubricate the seal surface with engine oil before fitting the crankshaft damper (1.2.06.1).

1.2.08.1 Crankshaft Rear Oil Seal

Removal

1. Remove the transmission (3.0.01.1 auto) and (3.8.01.1 manual).
2. Remove the flywheel (3.6.04.1) or transmission drive plate (3.0.01.1).
3. Remove the rear oil seal retainer.
   1 Remove six M6 bolts from the retainer.
   2 Remove two M8 bolts securing the oil pan rear edge to the rear oil seal retainer.
   3 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.

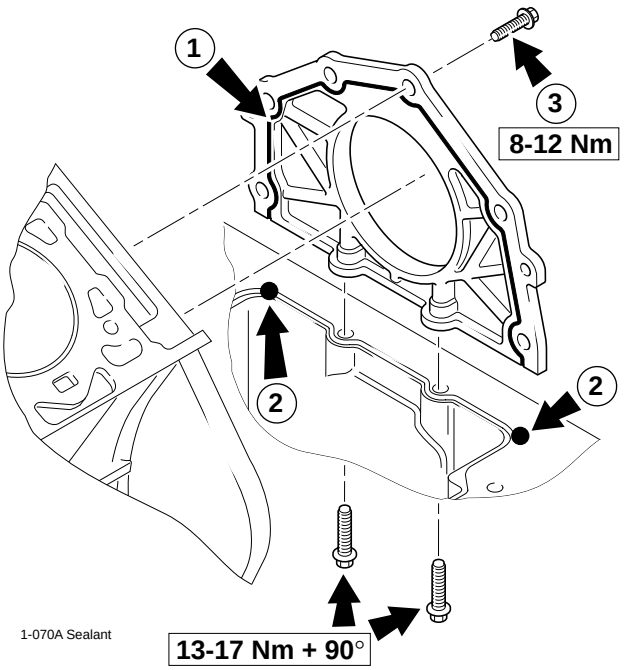
   1 Apply a bead of sealant as indicated around the retainer mating face on the block.

   2 Apply a bead of sealant where indicated at the oil pan interface.

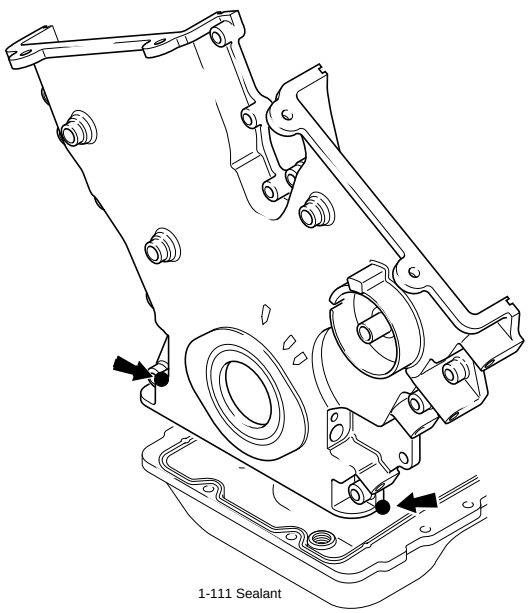
   Note: Also apply a bead of sealant at the front of the engine, at the timing cover / oil pan interface. For full oil pan removal and installation see 1.5.02.1

   3 Within 5 minutes, fit the rear oil seal retainer over the locating dowels, Fit six M6 bolts and torque to 8-12 Nm.

   4. Fit the two M8 bolts to the rear edge of the oil pan and torque to 13-17 Nm + 90°.



1-070A Sealant

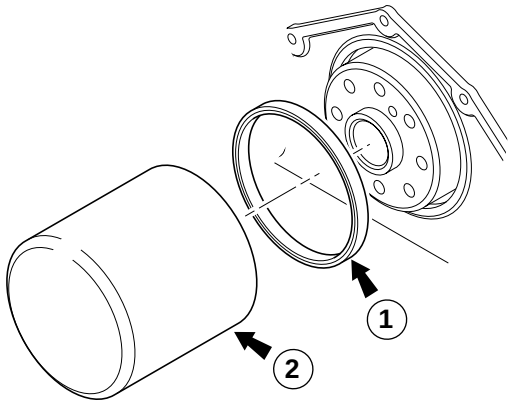

1-111 Sealant

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

3. Using the rear seal installation tool kit (T95P-1000-FH/FLMH) insert the rear crankshaft seal.

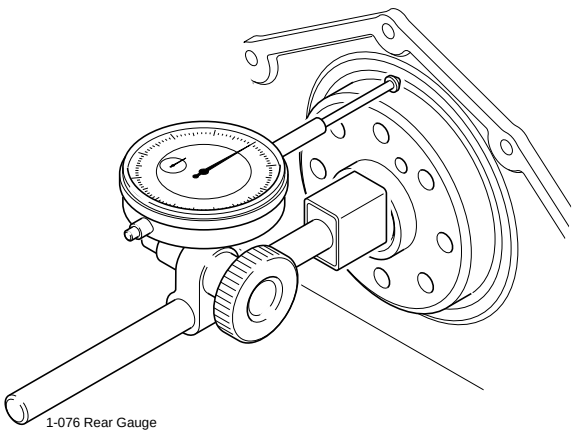
   1 Offer the seal to the recess in the seal retainer (spring side towards the engine).

   2 Insert the seal ensuring that it sits squarely into the retainer recess



1-075 Rear Tool

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

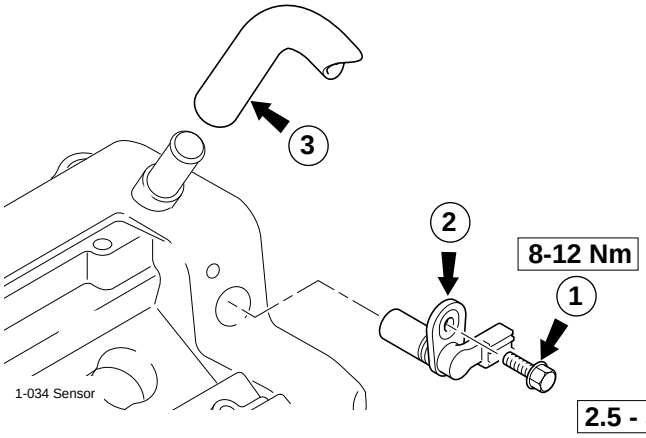

1-076 Rear Gauge

1.3.01.1 Camshaft Cover

Removal

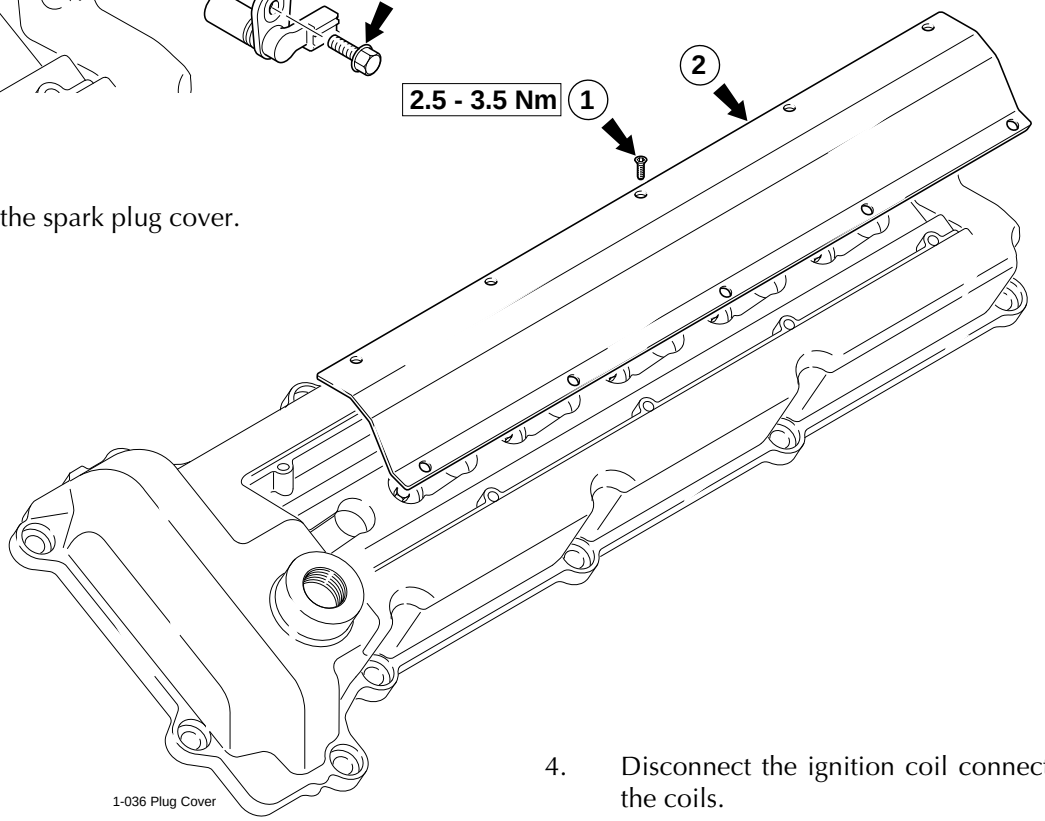
1. Remove the inlet manifold (2.2.01).

2. Disconnect the cam cover ventilation pipe and the camshaft sensor.



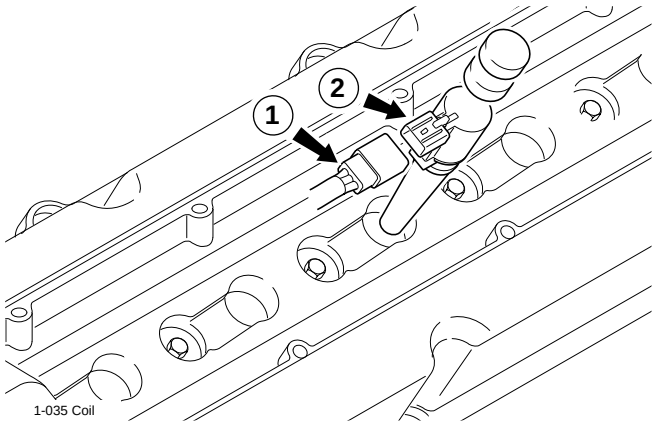
1-034 Sensor

3. Remove the spark plug cover.



1-036 Plug Cover

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



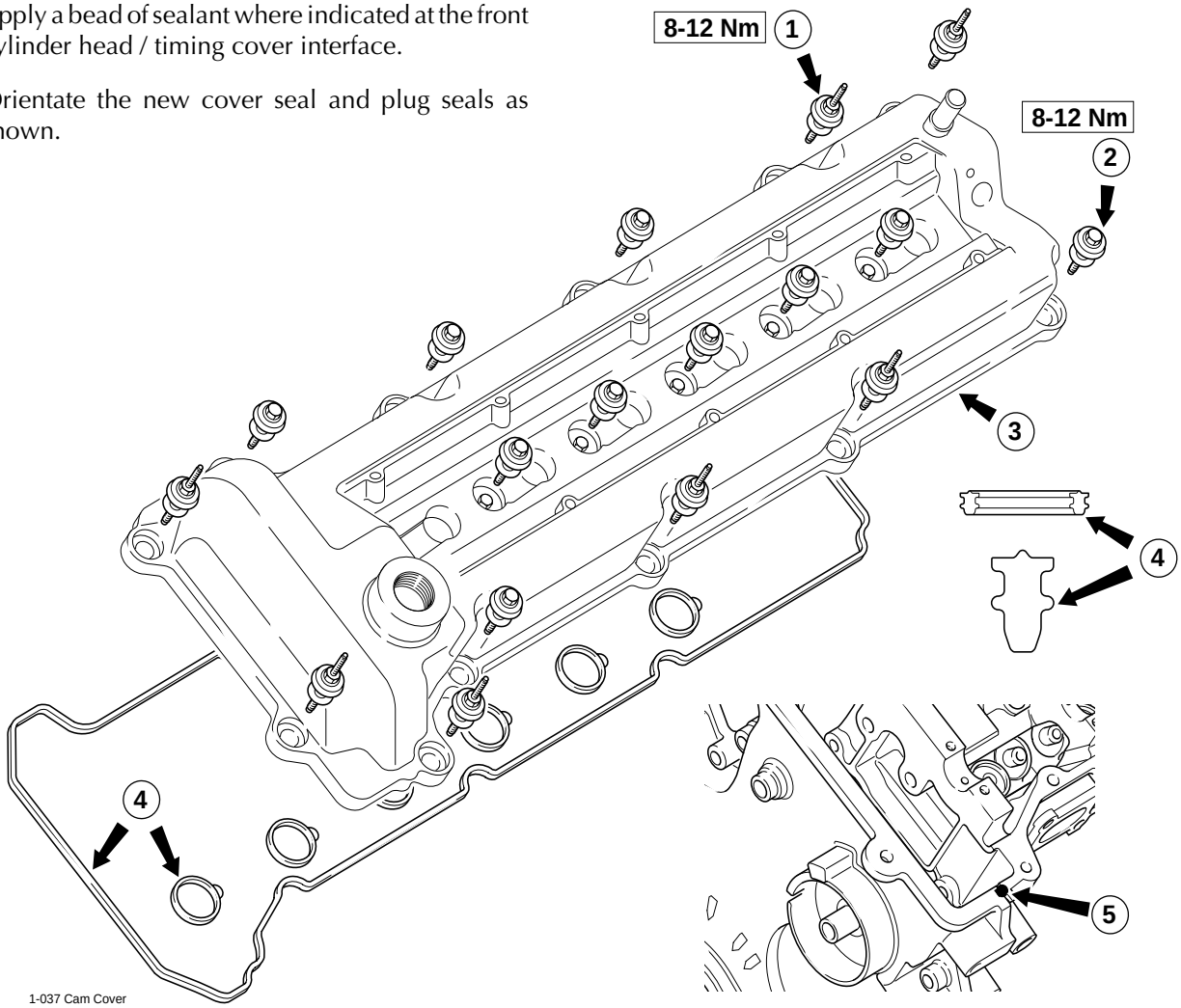
1-035 Coil

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

   Discard all seals from the camshaft cover.

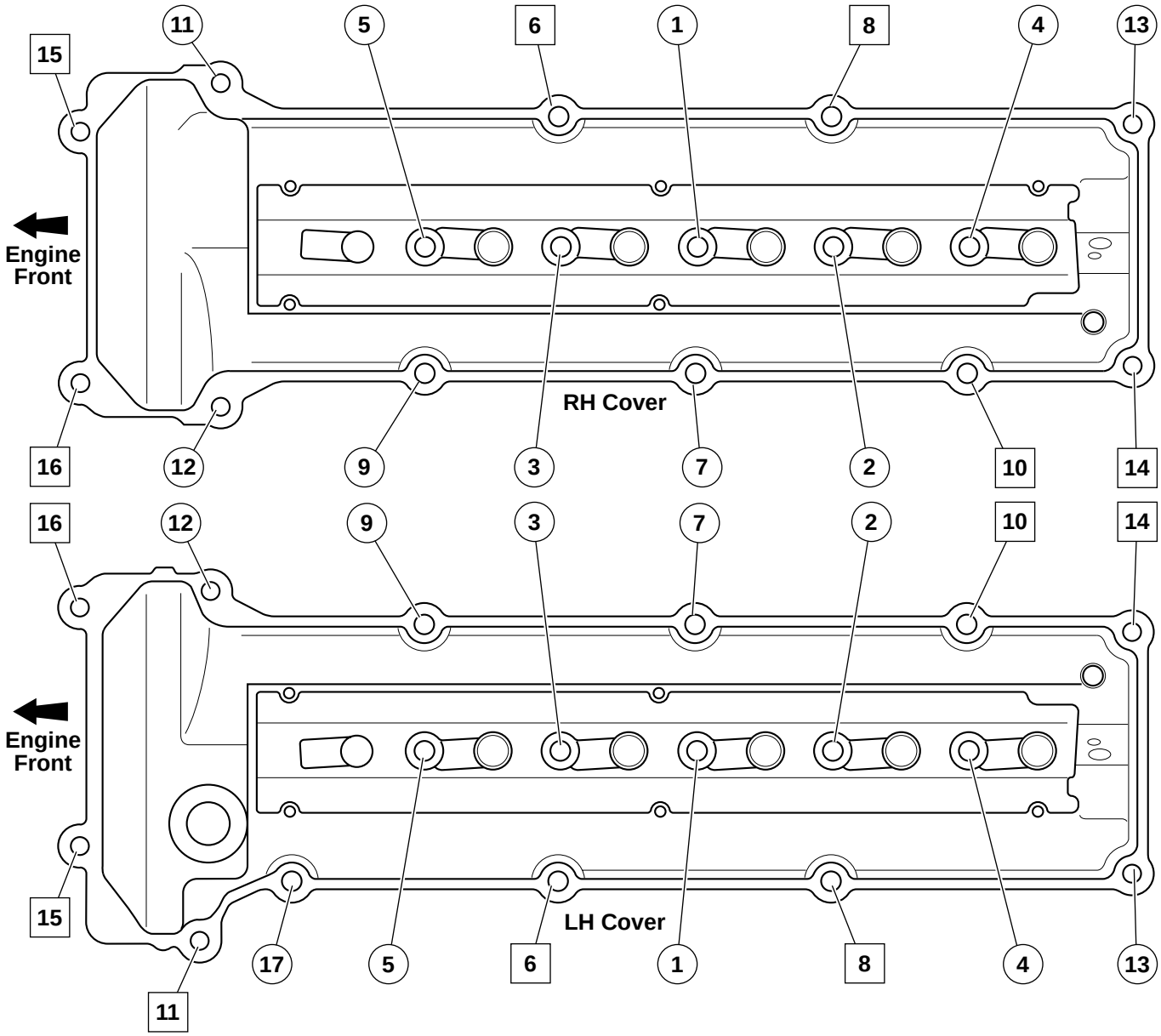
Installation

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.



1-037 Cam Cover

3. Tighten the bolts in the sequence shown below.



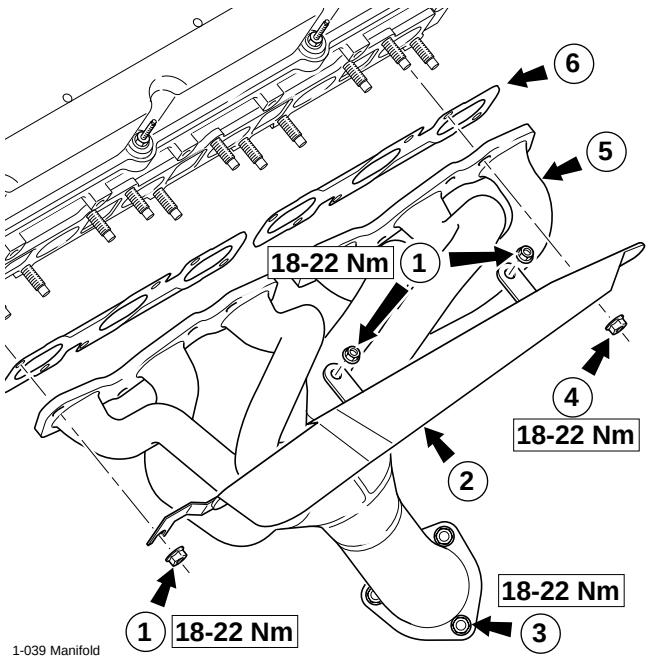
Hole No.	Fastener	Description
6, 8, 10, 11, 14, 15, 16	□	Grommet, Stud 10 mm Hex
1, 2, 3, 4, 5, 7, 9 12, 13, 17	○	Bolt 10 mm Hex
Note	Torque Sequence 1 to 17	

1-038 Torque

1.3.03.1 Cylinder Head

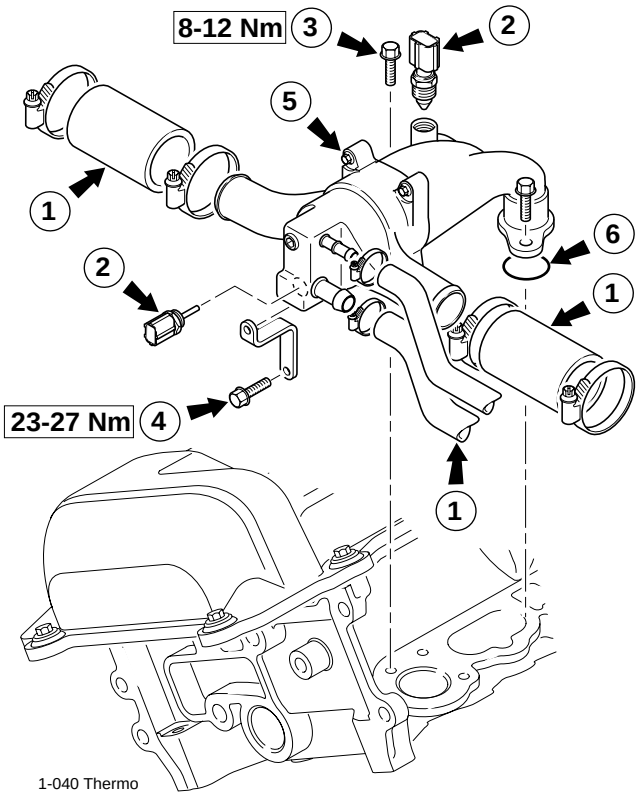
Removal

1. Remove the throttle body throttle body adaptor and the EGR system (2.1.03).
2. Remove the inlet manifold (2.2.01).
3. Remove the exhaust heat shield and exhaust manifold.
   1 Remove four nuts
   2 Remove the heat shield
   3 Remove three bolts
   4 Remove ten nuts
   5 Remove the exhaust manifold
   6 Remove the exhaust manifold gasket



1-039 Manifold

4. Drain the engine coolant (1.7.03.1).
5. Remove the thermostat housing
   1 Disconnect the coolant hoses
   2 Disconnect the three coolant temperature sensors
   3 Remove three M6 bolts from the rear of the housing
   4 Remove the lower M6 bolt from the front of the housing
   5 Remove the thermostat housing
   6 Remove and discard the 'O' rings

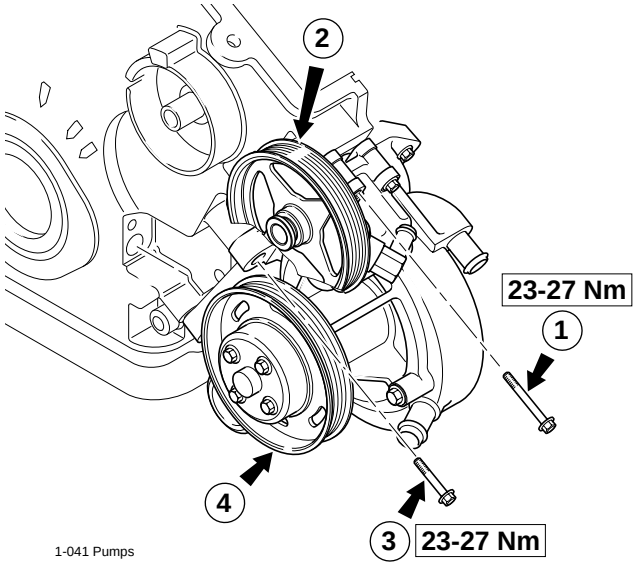


1-040 Thermo

6. Remove the cam cover (1.3.01.1).
7. Remove the polyvee drive belt (1.4.10.1)
8. Remove the crankshaft damper pulley. (1.2.06.1)

9. Release the power steering and water pumps from the front timing cover.

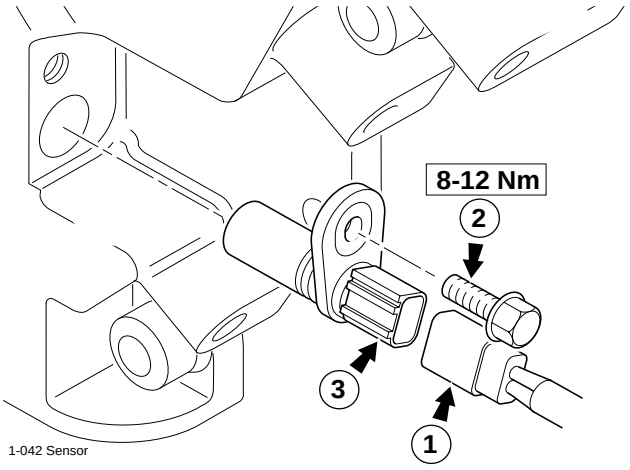
   1 Remove four M8 bolts
   2 Release the power steering pump from the block
   3 Remove two M8 bolts securing the water pump to the timing cover



1-041 Pumps

10. Remove two crank position sensors

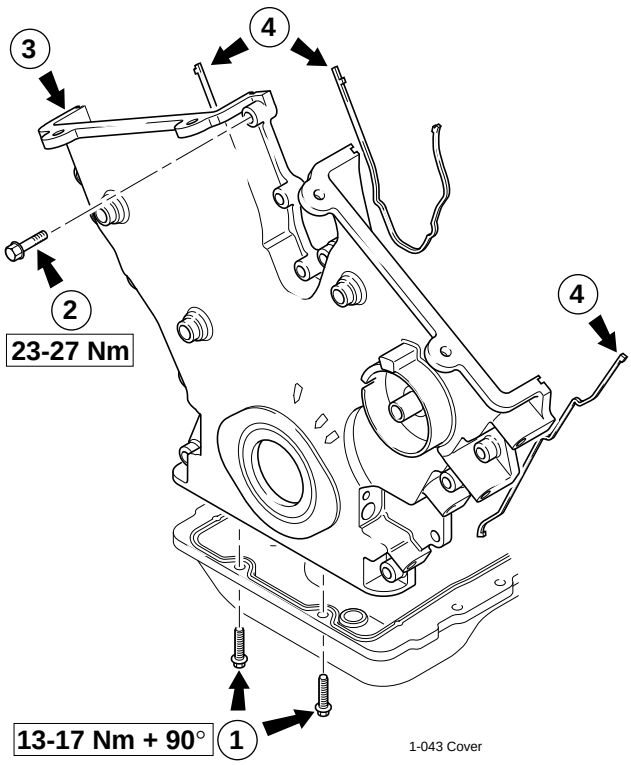
   1 Disconnect the two crank sensor connectors
   2 Remove two M6 bolts
   3 Remove the two crank sensors



1-042 Sensor

11. Remove the front timing cover.

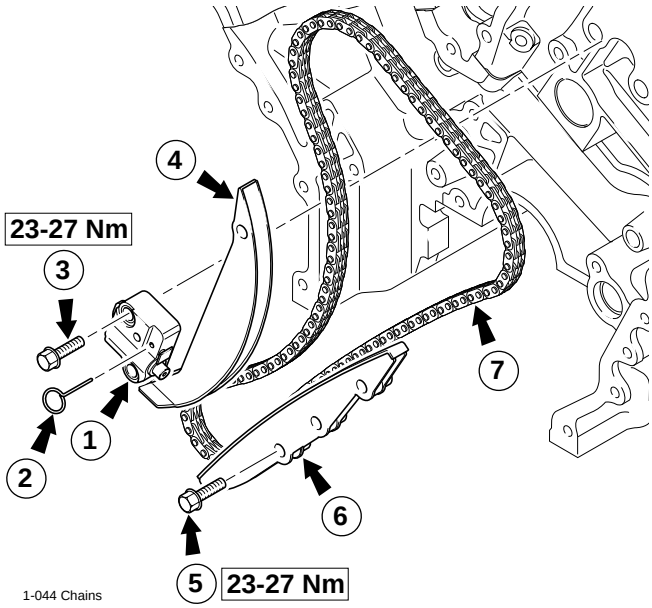
   1 Remove two M6 bolts from the oil pan front edge
   2 Remove fourteen M8 bolts from the cover
   3 Remove the timing cover
   4 Remove and discard the front cover seals



1-043 Cover

12. Remove the timing chains

    1 Compress the chain tensioners
    2 Fit locking pins
    3 Remove four M8 bolts and the chain tensioners
    4 Remove the chain tensioner arms
    5 Remove four M8 bolts
    6 Remove the fixed chain guides
    7 Remove the timing chains

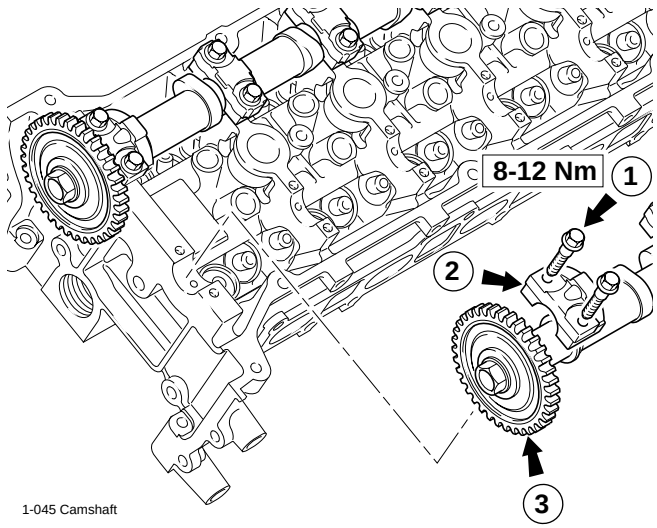


1-044 Chains

13. Remove the camshafts.

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

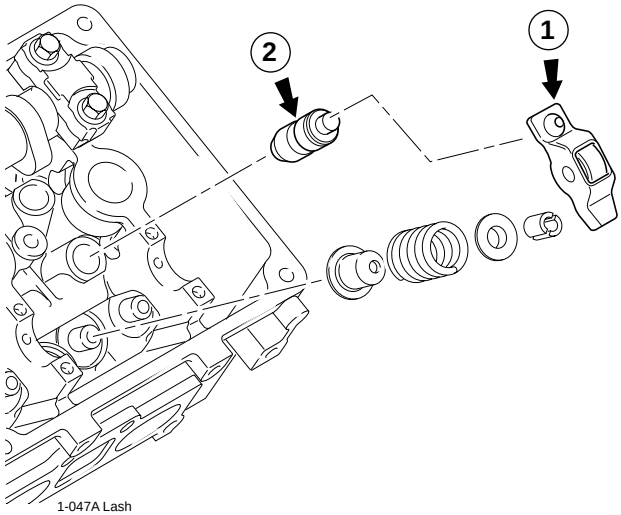
    Note: The thrust cam bearing cap, shown exploded below, must be the first to be removed and the last to be installed.



1-045 Camshaft

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

    1 Lift off the cam followers
    2 Withdraw the lash adjusters



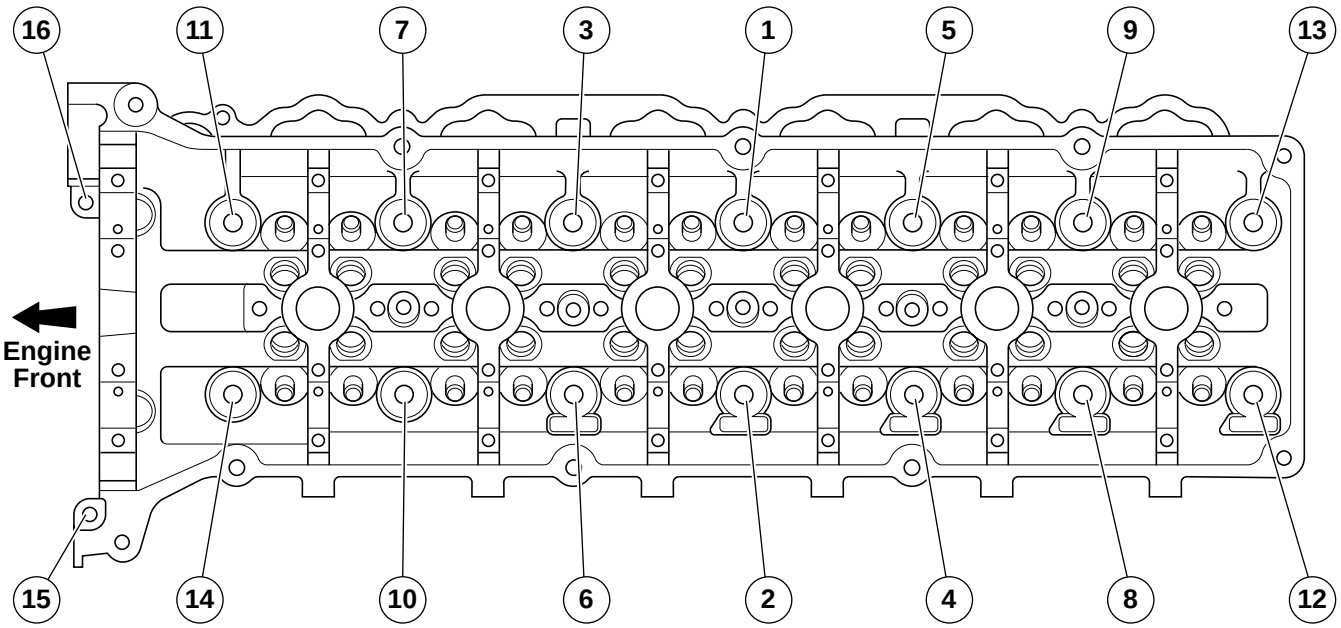
1-047A Lash

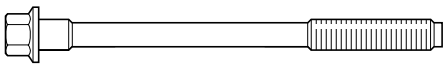
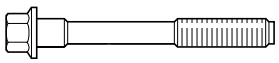
15. Remove two M8 and fourteen M10 bolts from each cylinder head in the order shown in the diagram below.

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

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

Left Side Shown



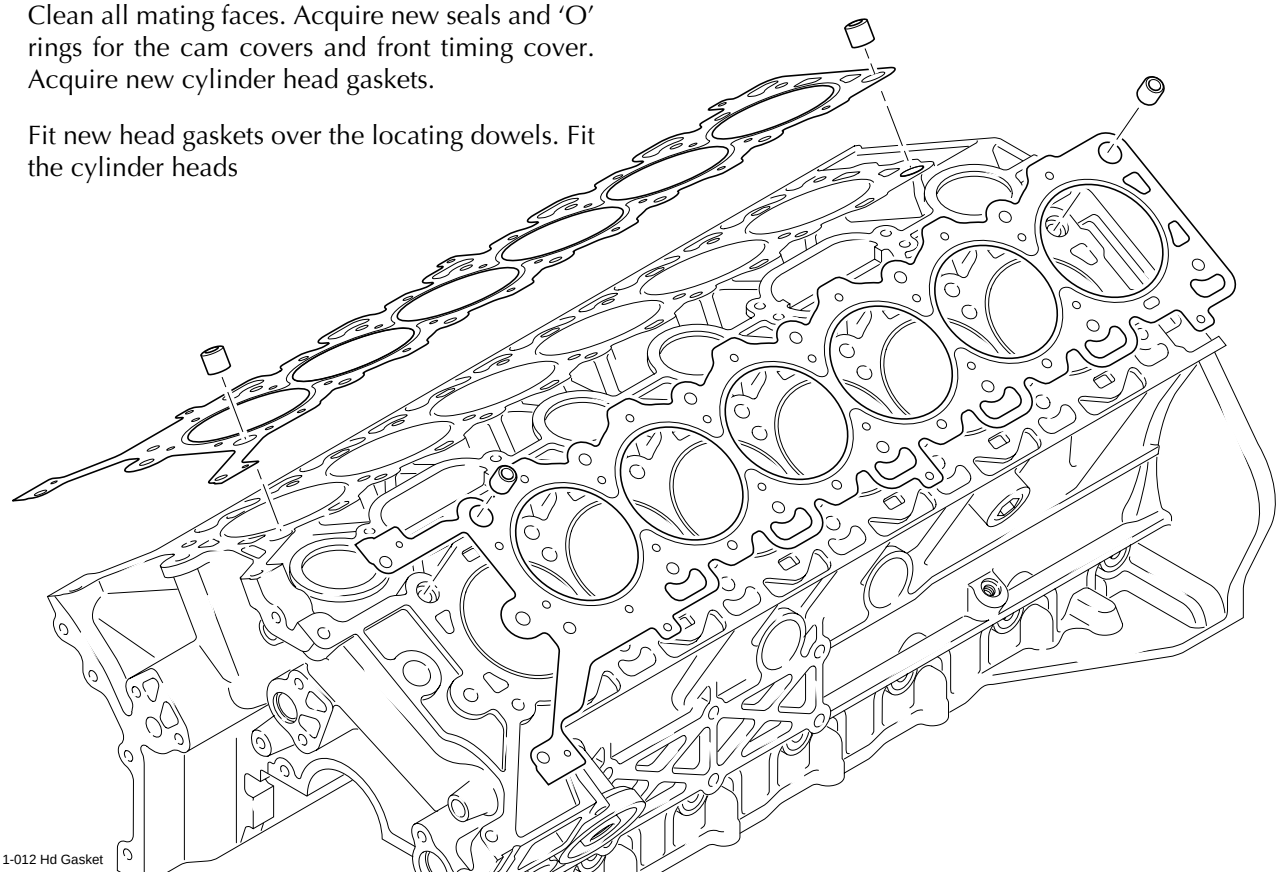
Hole No.	Fastener	Description
1 to 14		M10 x 1.5 x 156 Bolt
15 to 16		M8 x 1.25 x 60 Bolt
Note		

1-046 Head

Installation

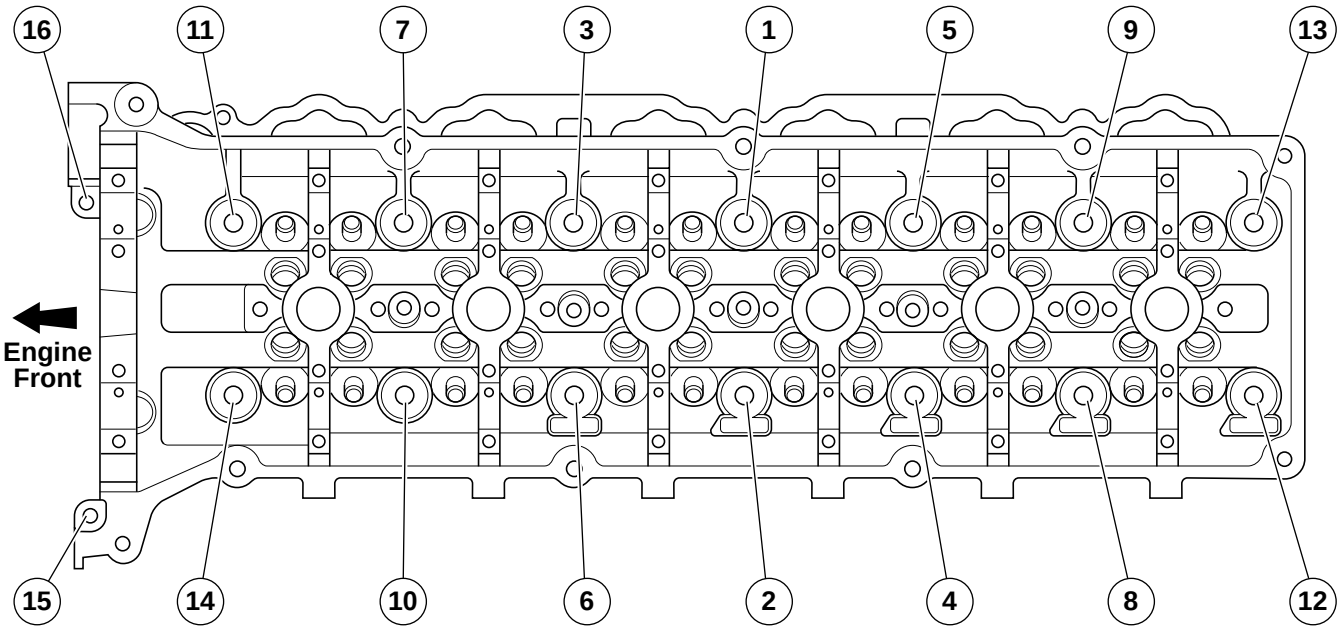
1. Clean all mating faces. Acquire new seals and 'O' rings for the cam covers and front timing cover. Acquire new cylinder head gaskets.

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

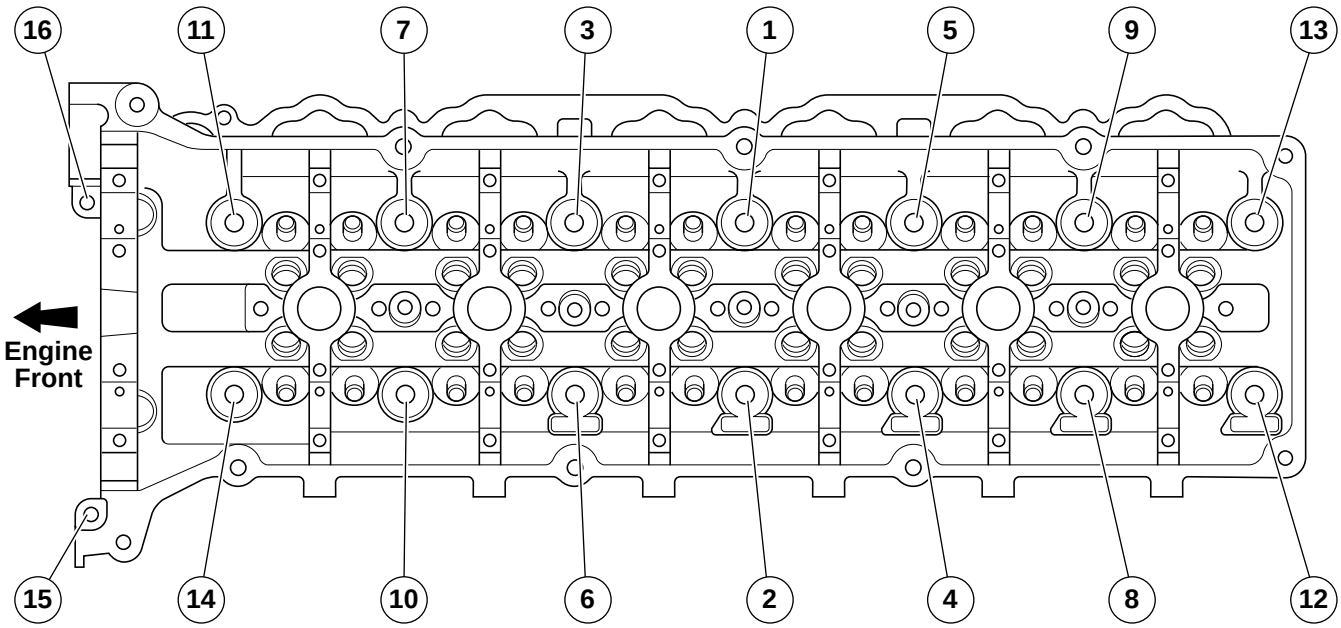


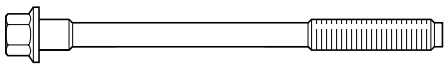
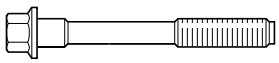
4. ***Caution: The following Pull-Down - Release - Final Pull-Down sequence must be performed exactly as specified to ensure correct cylinder head to block sealing.***

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.

Pull down the cylinder head in stages using the sequence and torque settings 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		

1-046 Head

Cylinder Head Pull Down Sequence

Initial Pull-Down

a) Tighten the M10 bolts (1-14) to 37-43 Nm in the sequence shown.

b) Tighten the M8 bolts (15-16) to 15-20 Nm.

c) Tighten the M10 bolts (1-14) a further 85-95 degrees in the sequence shown.

Release

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

Final Pull Down

e) Tighten all M10 bolts (1-14) to 37-43 Nm in the sequence shown.

f) Tighten the M8 bolts (15-16) to 23-27 Nm.

g) Tighten the M10 bolts (1-14) a further 85-95 degrees in the sequence shown.

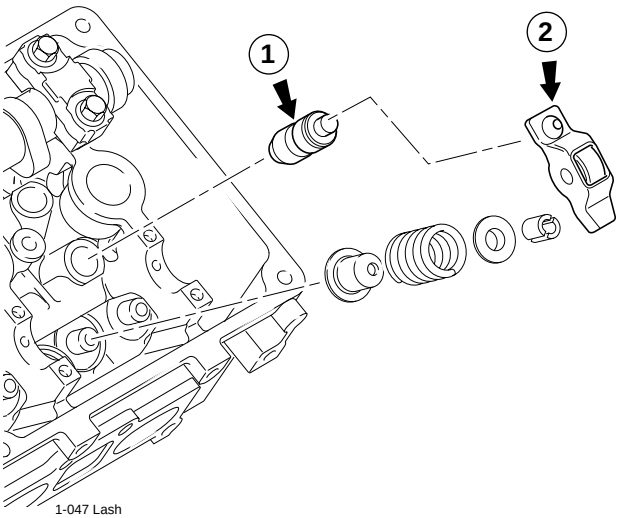
h) Tighten the M10 bolts (1-14) an additional 85-95 degrees in the sequence shown.

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

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

   2 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.

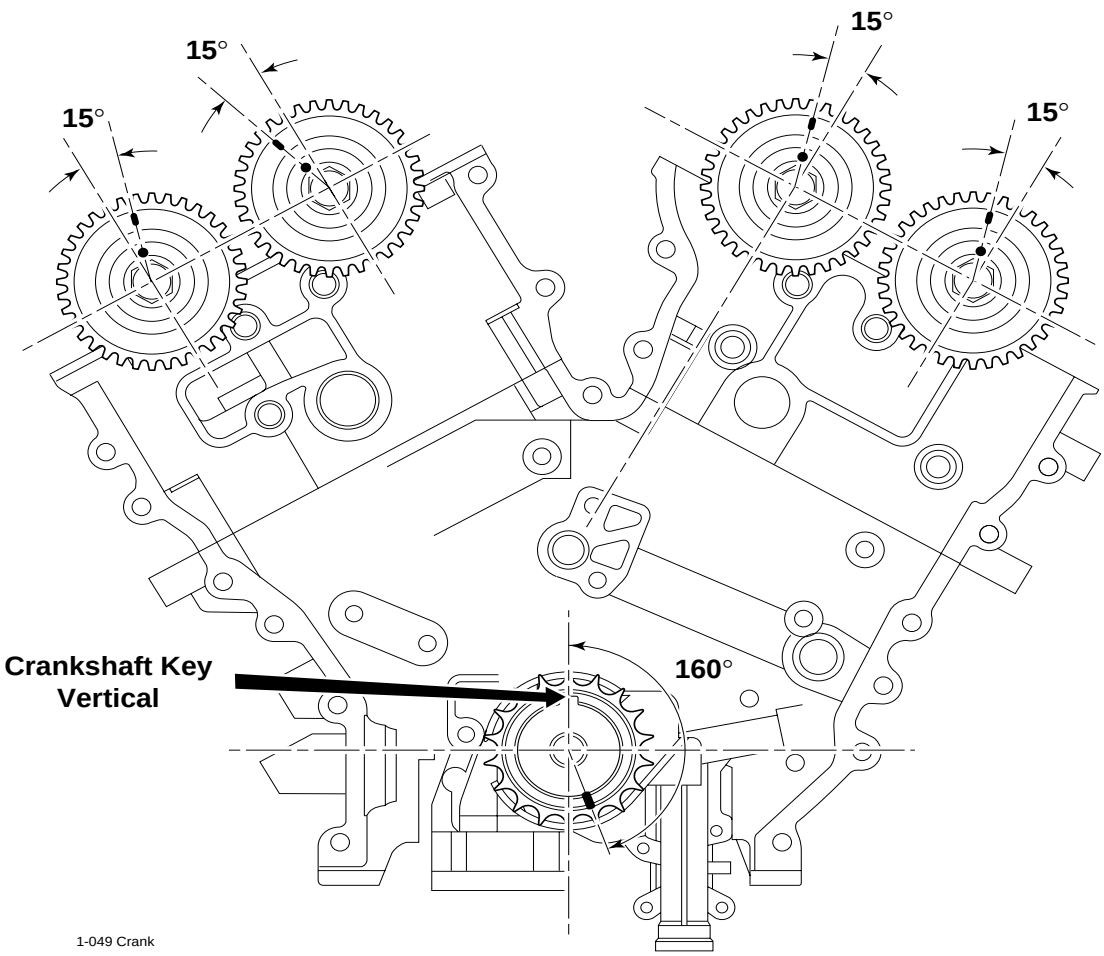


1-047 Lash

6. Set the crankshaft key to the vertical position.

7. 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 below.



1-049 Crank

8. Fit the camcaps to both camshafts.

   1 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 crankcase adjacent to the jounal.

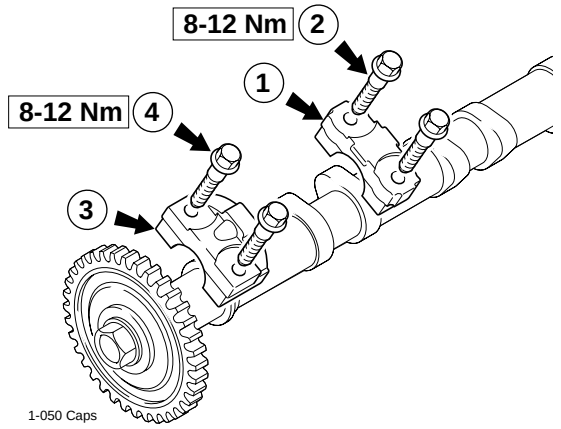
   2 Loosely secure each camcap with two M6 bolts

   3 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.

   4 Secure the No.1 caps with two M6 bolts

9 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.

   Tighten the camshaft bearing caps in the sequence shown below.

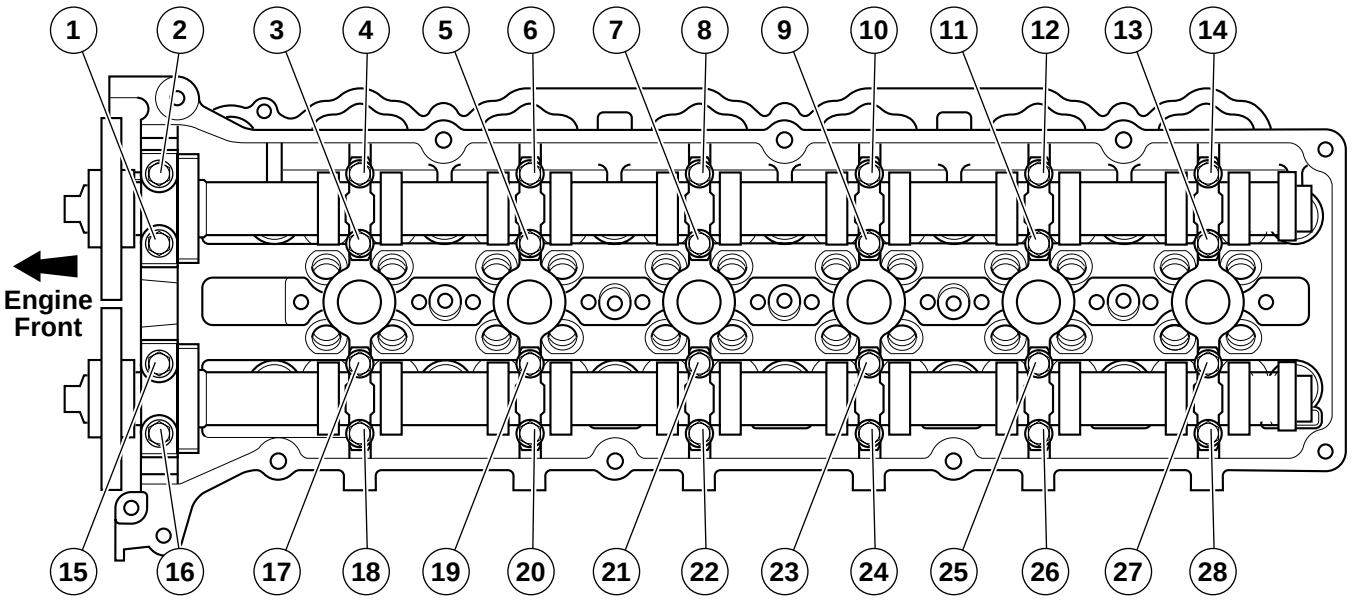


1-050 Caps

10. Perform the camshaft timing adjustment (1.3.04.3).

11. Refit the front timing cover (1.4.02.1).

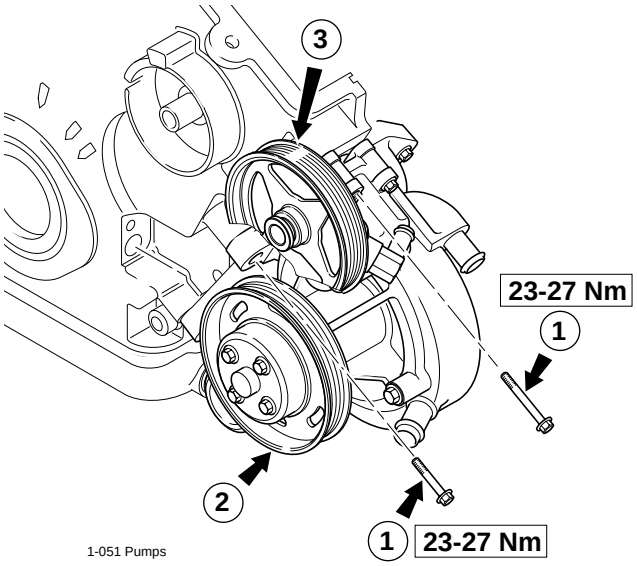
12. Refit the cam cover (1.3.01.1).



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	

1-027 Camshaft

13. Refit and tighten the bolts securing the water pump and power steering pump.



1-051 Pumps

14. Refit the crankshaft damper/pulley assembly (1.2.06.1).

15. Refit the polyvee drive belt (1.4.10.1).

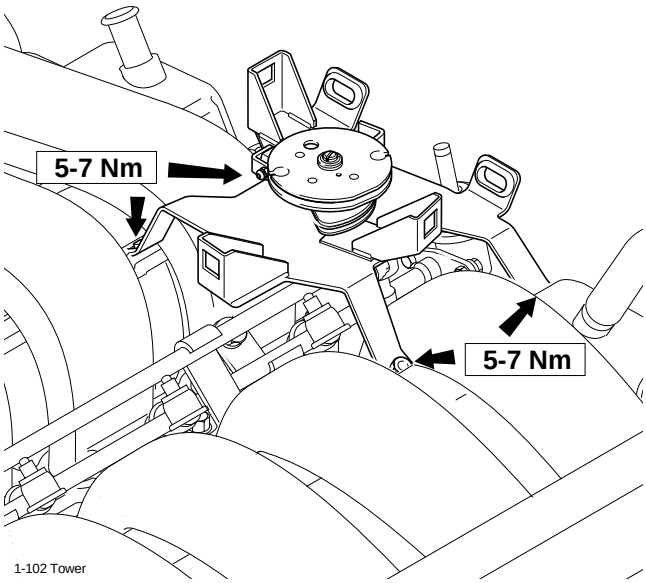
16. Refit the exhaust manifold using` new gaskets (2.7.02).

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

18. Refit the inlet tract to the inlet manifold using a new gasket.

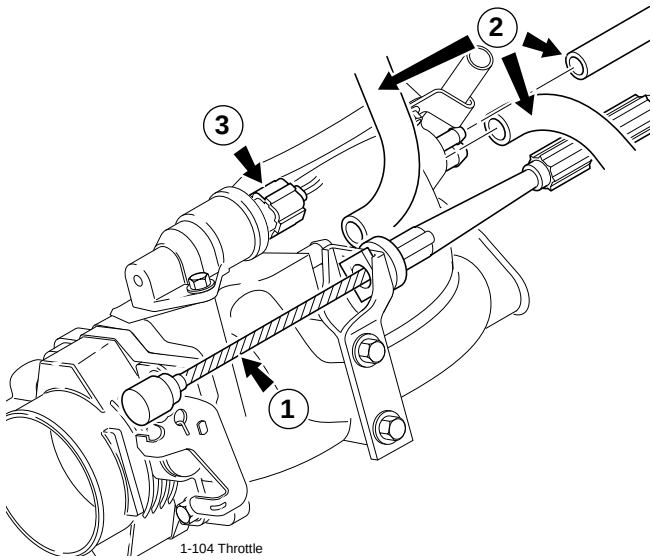
19. Refit the EGR system to the cylinder head and inlet manifold (2.1.03).

20. Refit the throttle cable tower to the rear stud bolts of both camshaft covers.



1-102 Tower

21. Reconnect the throttle cables, vacuum pipes and idle speed control valve connector at the throttle bodies and adaptors.



1-104 Throttle

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

23. Refit the thermostat housing using new 'O' ring seals (1.7.08.1).

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

    1 Fit the radiator top hose to the right hand stub pipe
    2 Fit the bypass hose to the left hand stub pipe
    3 Fit the header tank degas hose to the upper front stub pipe
    4 Fit the Heater hose to the lower front stub pipe

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

25. Refit the fuel rail cover.

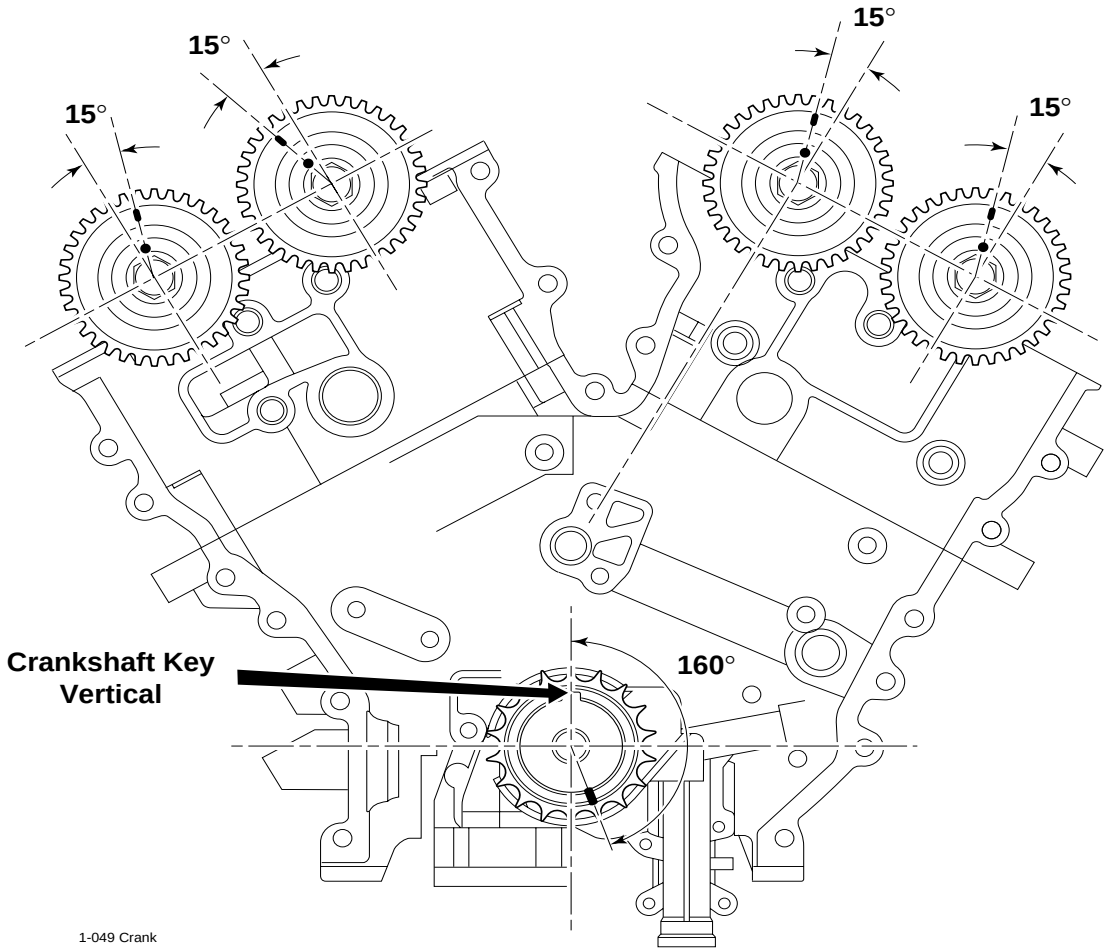
26. Refill the cooling system (1.7.03.1).

1.3.04.3 Valve Timing Adjustment

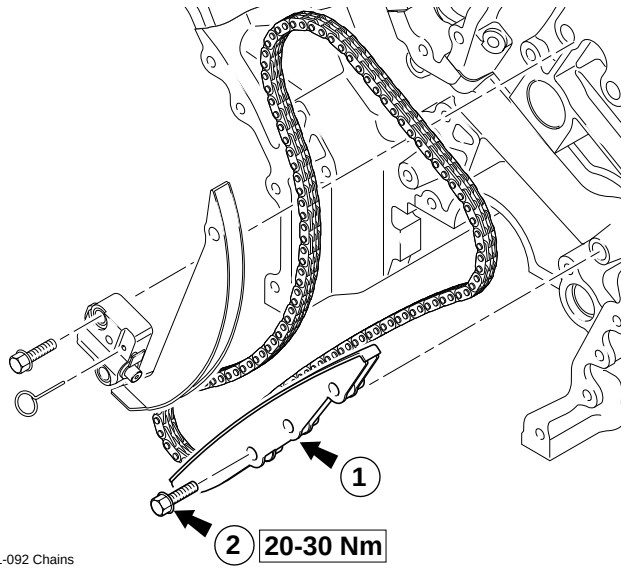
Left Hand Head (Cylinders 7-12)

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.



1-049 Crank



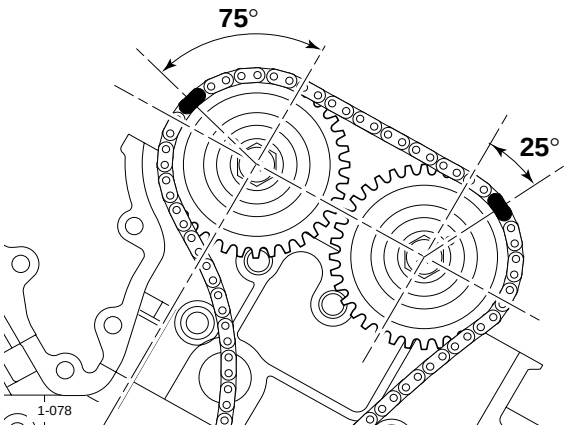
1-092 Chains

2. Fit the LH (Cyl's 7-12) fixed chain guide.
   1 Fit the guide to its locating pin
   2 Secure the guide with two M8 bolts

3. Fit the LH timing chain with the three marked links matching the timing marks on the crankshaft and camshaft sprockets.

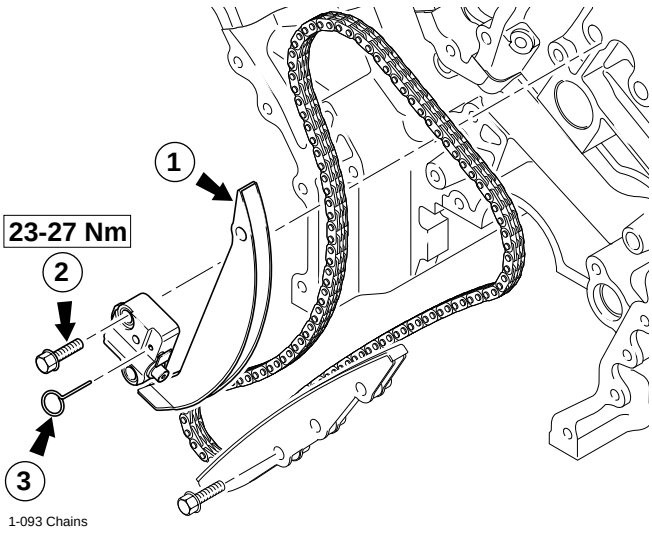
   Rotate the camshafts as necessary to achieve correct alignment and to remove the slack from the drive run of the chain. **Do not move the crankshaft.**

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



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

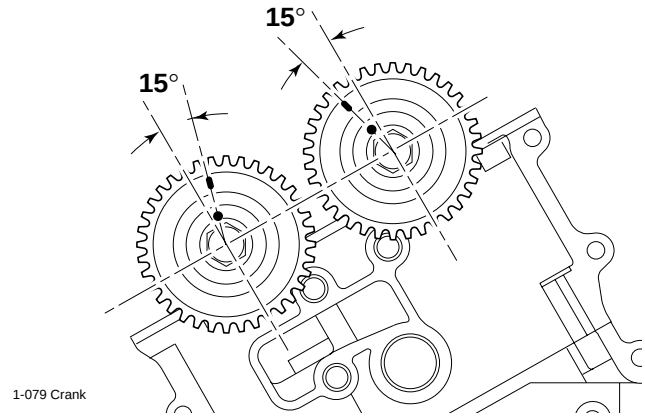
   1. Fit the left hand chain tensioner arm.
   2 Fit and secure the left hand chain tensioner
   3 Withdraw the tensioner lock pin



5. 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.

Right Hand Head (Cylinders 1-6)

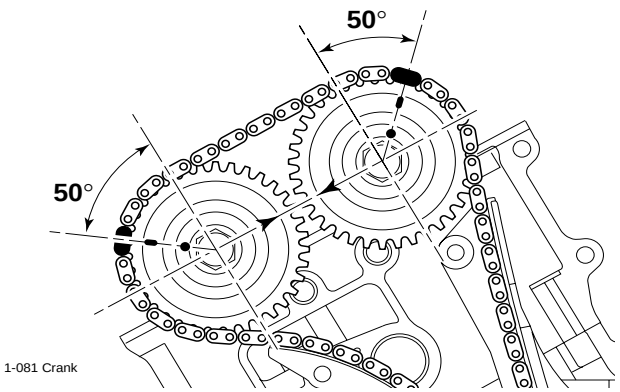
1. With the crankshaft key still at the vertical position, (No.1 cylinder at 30°ATDC), recheck that the RH camshafts are in the initial positions shown.



2. Fit the RH fixed chain guide and secure with two M8 bolts. Torque to 20-30 Nm.

3. Fit the RH timing chain with the three marked links matching the timing marks on the sprockets. Rotate the camshafts as necessary to achieve correct alignment and to remove the slack from the drive run of the chain.

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



4. Fit the RH chain tensioner arm to the pivot pin.

5. Fit the RH chain tensioner and secure with two M8 bolts. Torque to 23-27 Nm.

6. Remove the RH chain tensioner lock pin.

7. Recheck that all three marked links on the RH chain align with the timing marks on the camshaft and crankshaft sprockets.

Final Valve Timing Check

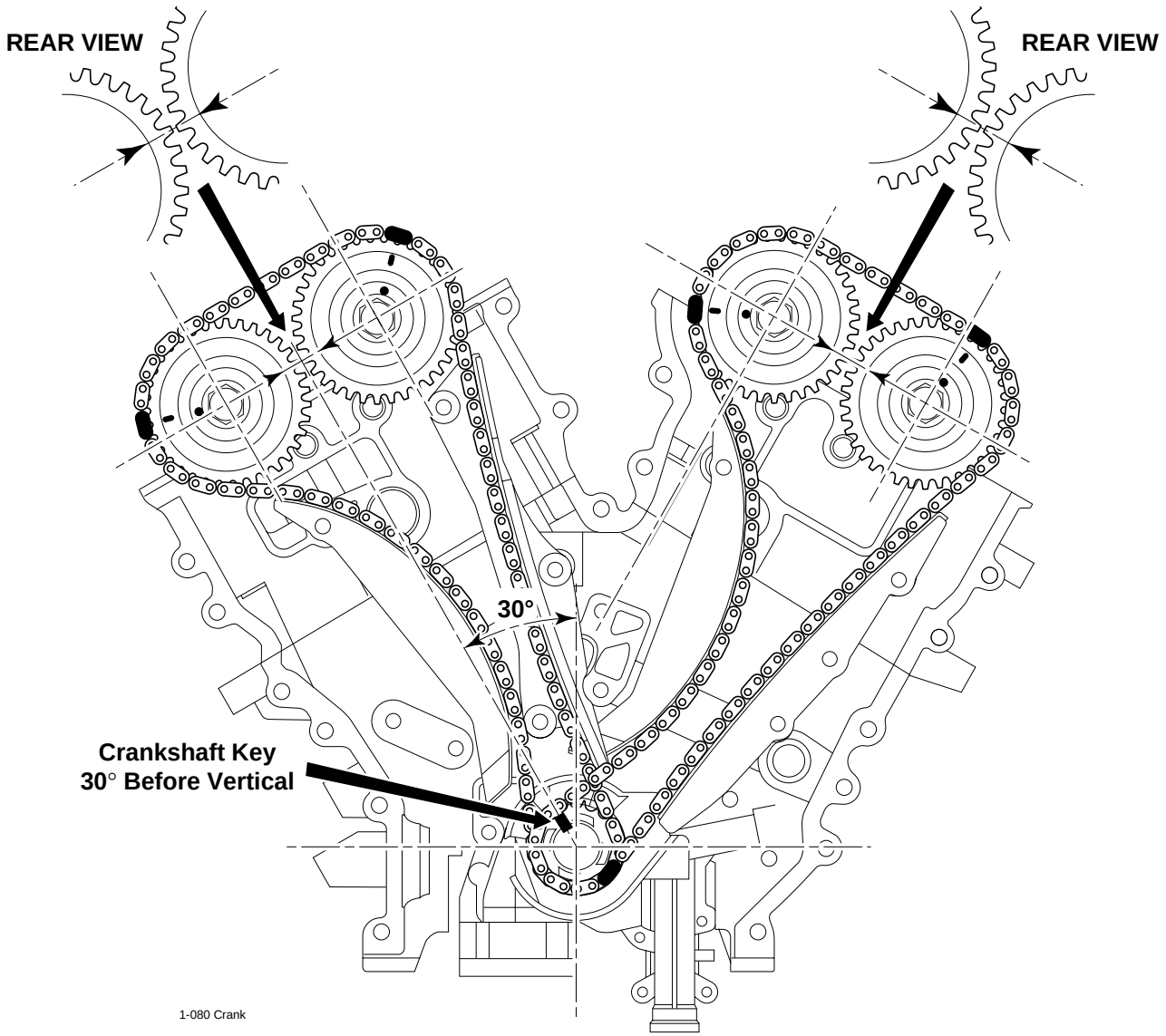
1. Rotate the crank counter clockwise at least 60° and then rotate clockwise to TDC No 1 (crankshaft key 30° before vertical).

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.



1.3.06.1 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

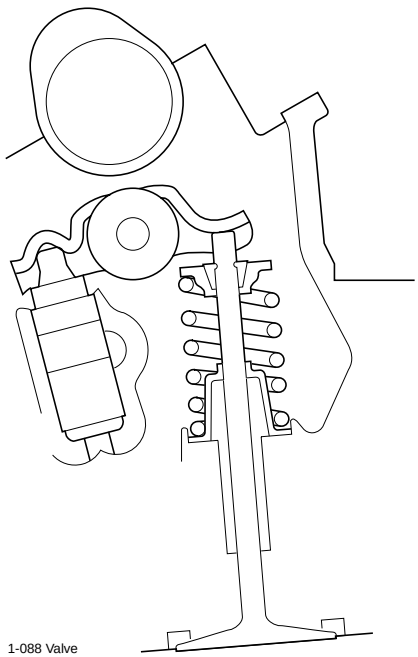
1. Remove the cylinder head (1.3.03.1). Examine the faces of the cylinder head, block and piston crowns for any evidence of problems (e.g. water/oil leaks, piston damage, or signs of poor combustion).
2. Remove the valves .
3. Lift out and discard the valve stem seals.
4. Invert the head and examine 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.



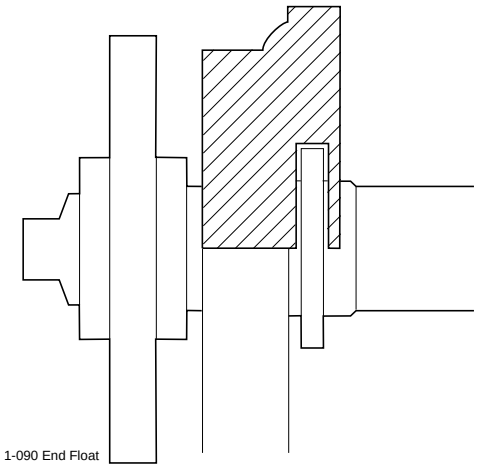
1-088 Valve

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

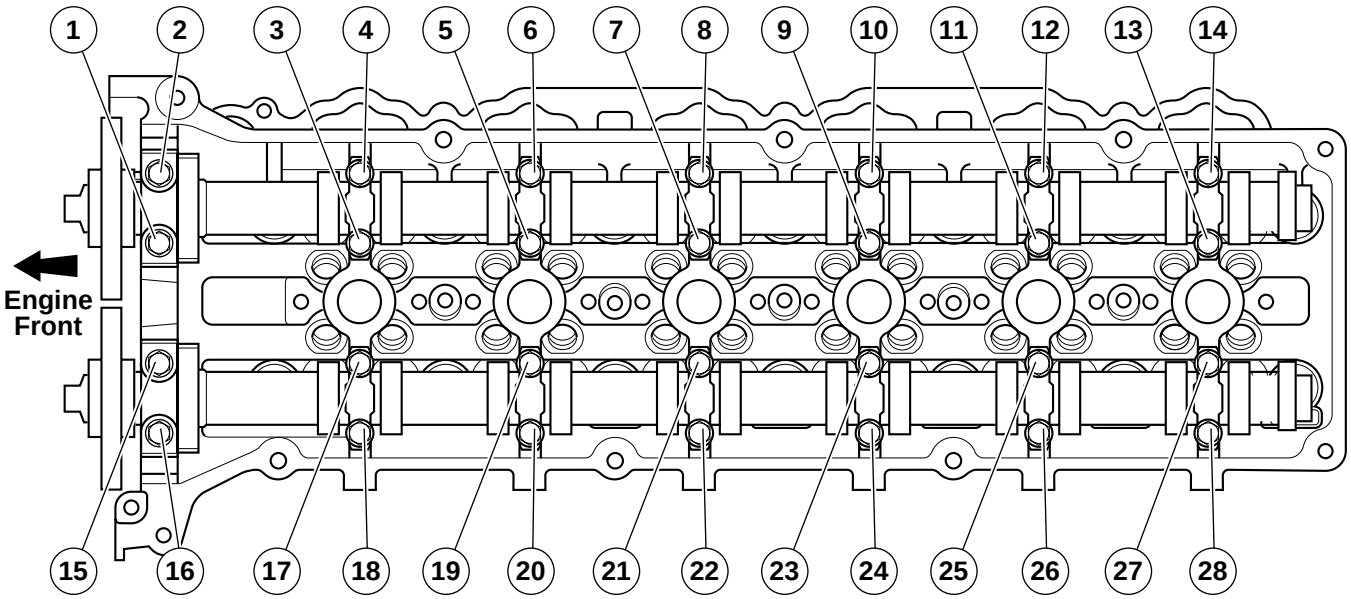
4. Lubricate the camshaft bearings and caps with engine oil. Fit the camshafts. Fit all bearing caps except the two thrust cam bearing caps (No.1 cap) at the front of each camshaft..

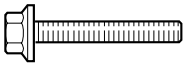
5. Fit bearing cap No. 1 over the thrust collar on the camshaft. Adjust the camshaft position if necessary until the bolt holes in No. 1 cap align with the holes in the cylinder head. Loosely secure No. 1 cap with two M6 bolts.

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.



1-090 End Float



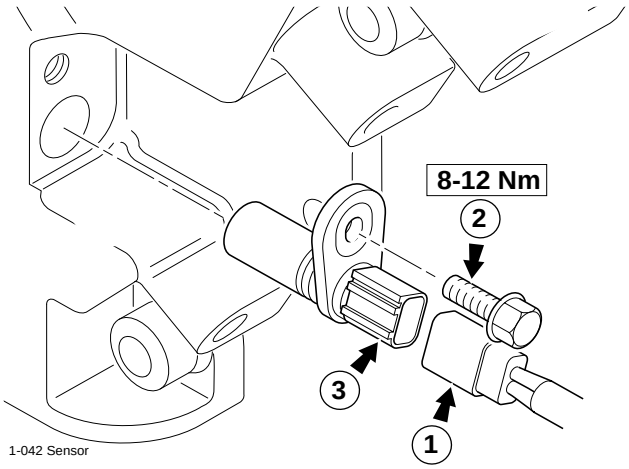
Hole No.	Fastener	Description
1 to 28		M6 x 1 x 43.25 Bolt
Note	Torque Sequence 1 to 28 Torque all Fasteners 8-12 Nm	

1-027 Camshaft

1.4.02.1 Front Timing Cover

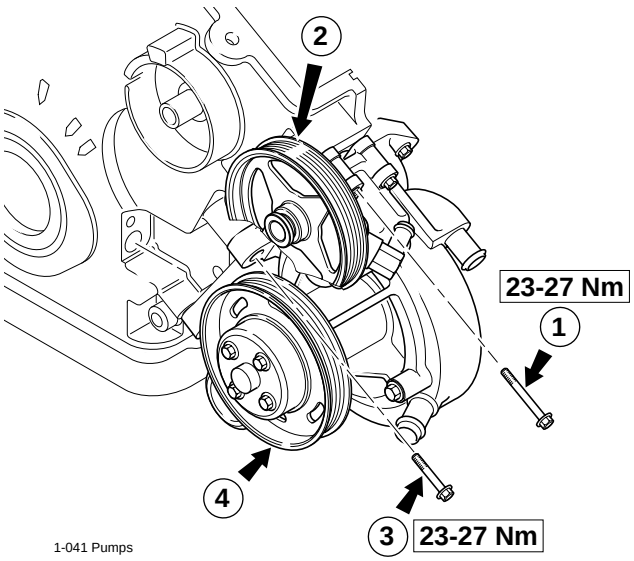
Removal

1. Remove the polyvee drive belt (1.4.10.1).
2. Drain the engine coolant (1.7.03.1)
3. Remove the crankshaft damper (1.2.06.1).
4. Remove the camshaft cover (1.3.01.1).
5. Remove the crank sensors
   1 Disconnect the connector
   2 Remove one M6 bolt from each sensor
   3 Remove the sensors



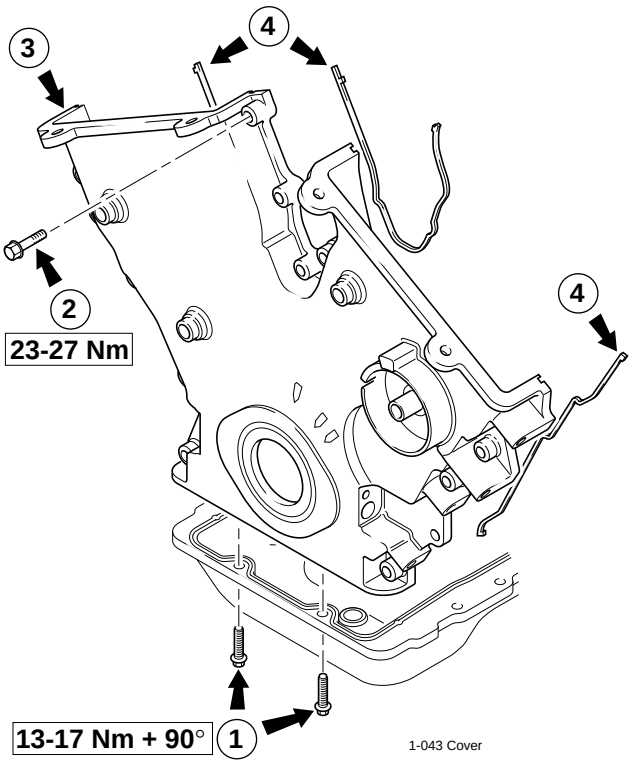
1-042 Sensor

6. Remove the power steering pump and water pump from the timing cover.
   1 Remove four M8 bolts
   2 Release the power steering pump from the block.
   3 Remove two M8 bolts
   4 Release the water pump from the block



1-041 Pumps

7. Remove the timing cover.
   1 Remove two oil pan bolts
   2 Remove fifteen M8 bolts
   3 Remove the timing cover
   4 Discard the cover seals

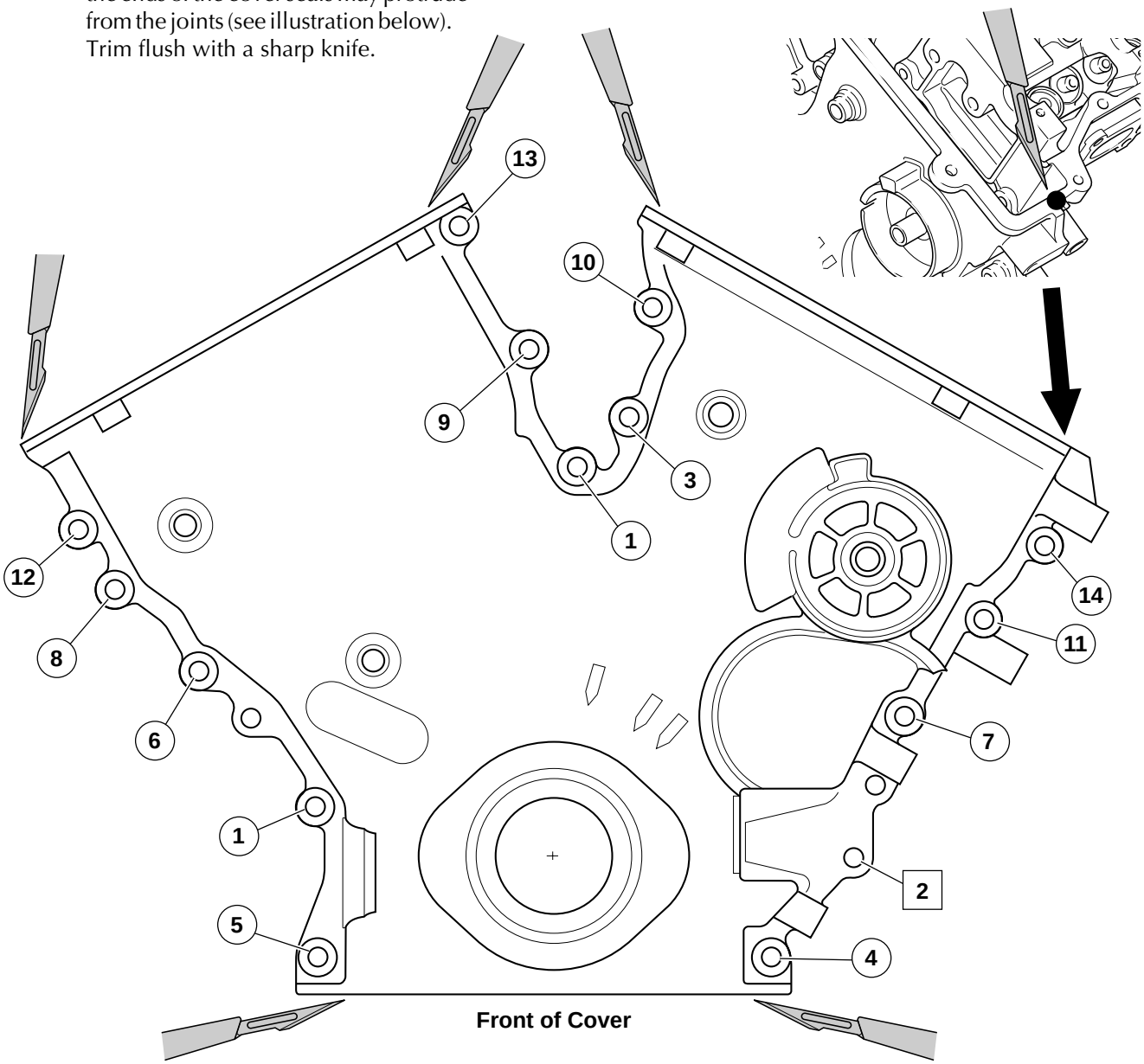


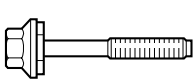
1-043 Cover

Installation

1. Clean all mating faces and fit new front cover seals.
2. Fit the front cover and secure with fifteen bolts. Secure the water crossover stay at position 1.
3. Follow the torque sequence shown below.
4. 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.

   Before refitting the cylinder heads or oil pan, apply an 8MM bead of sealant at these points. Note that the heads or oil pan must be fitted and tightened within six minutes of applying the sealant.
5. Refit the remaining components removed in steps 1-6 and refill the engine coolant.



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	

1-107 Front Cover

1.4.03.6 Timing Chain Tensioners

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

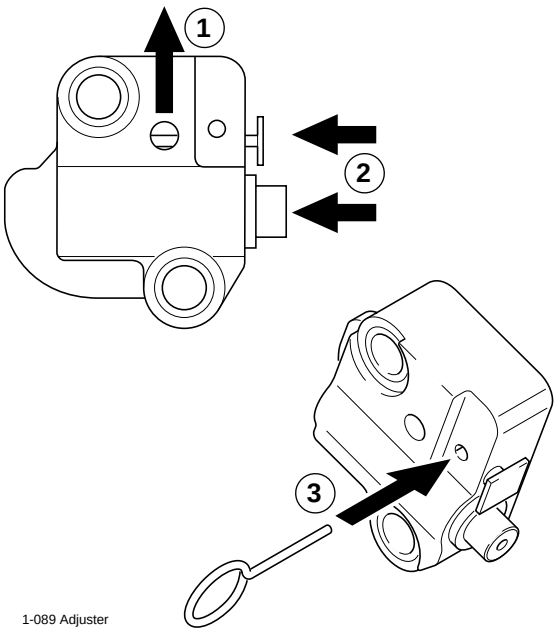
1. Hold the tensioner in a soft jawed vice.

2. Compress and lock the tensioner

   1 Using a small pointed tool, hold back the ratchet stem from the plunger.

   2 Slowly compress the tensioner plunger whilst continuing to hold back the ratchet stem (Take precautions - engine oil will bleed from the tensioner).

   3 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.



1-089 Adjuster

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

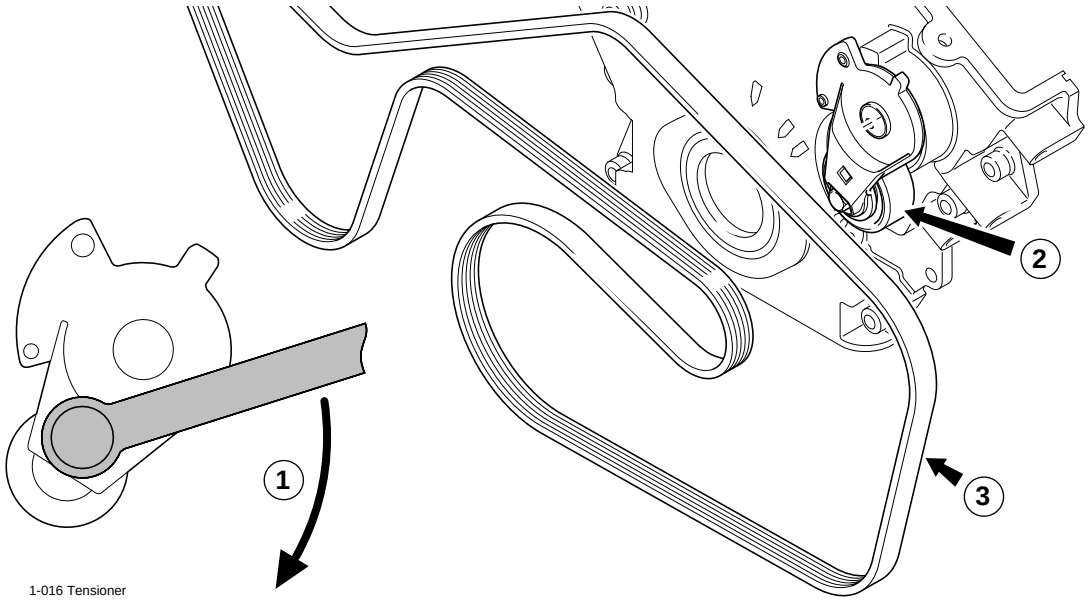
1.4.10.1 Polyvee Drive Belt

Removal

1. Using a 1/2 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 release the tensioner.
3. Check all pulleys to ensure correct belt location.

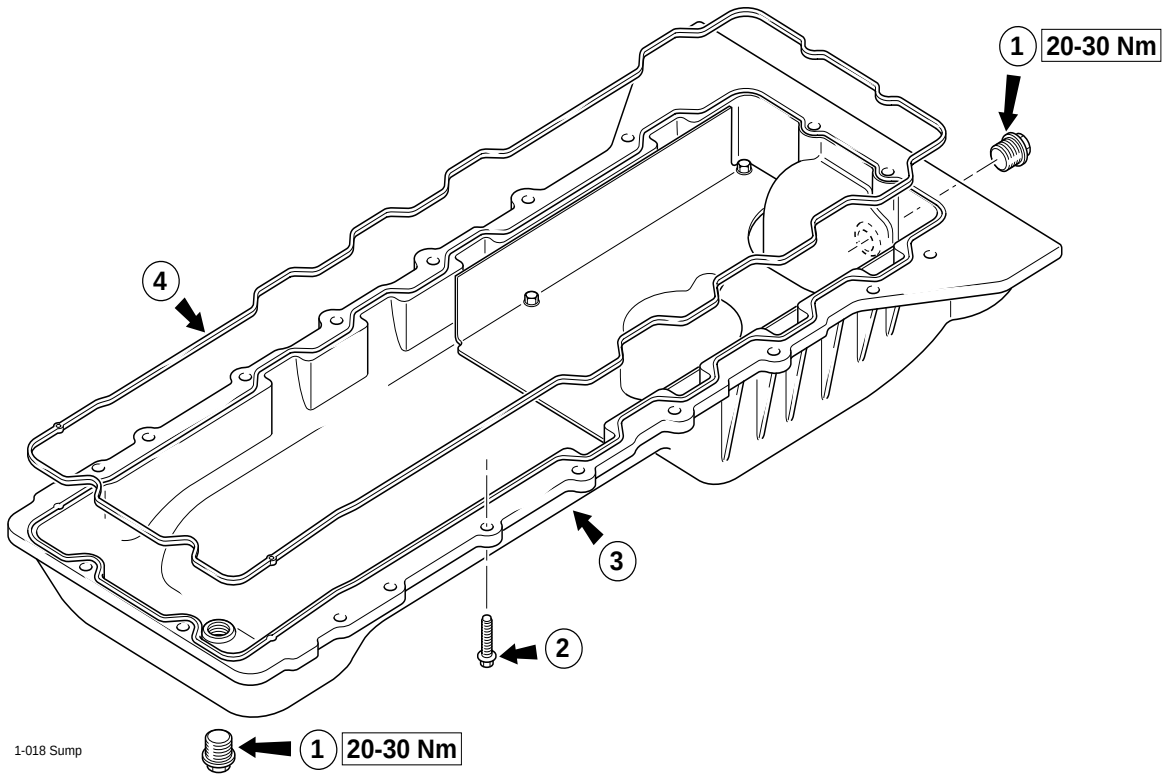


1-016 Tensioner

1.5.02.1 Oil Pan

Removal

1. Drop the front suspension (4.1.13).
2. Drain and remove the oil pan.
   1 Drain the engine oil. Refit the oil pan drain plugs.
   2 Remove twenty M8 bolts
   3 Remove the oil pan.
   4 Remove and discard the oil pan gasket.



Installation

1. Clean the oil pan.

2 Fit the oil pan.

1 Fit a new oil pan gasket orientated as shown in the diagram below.

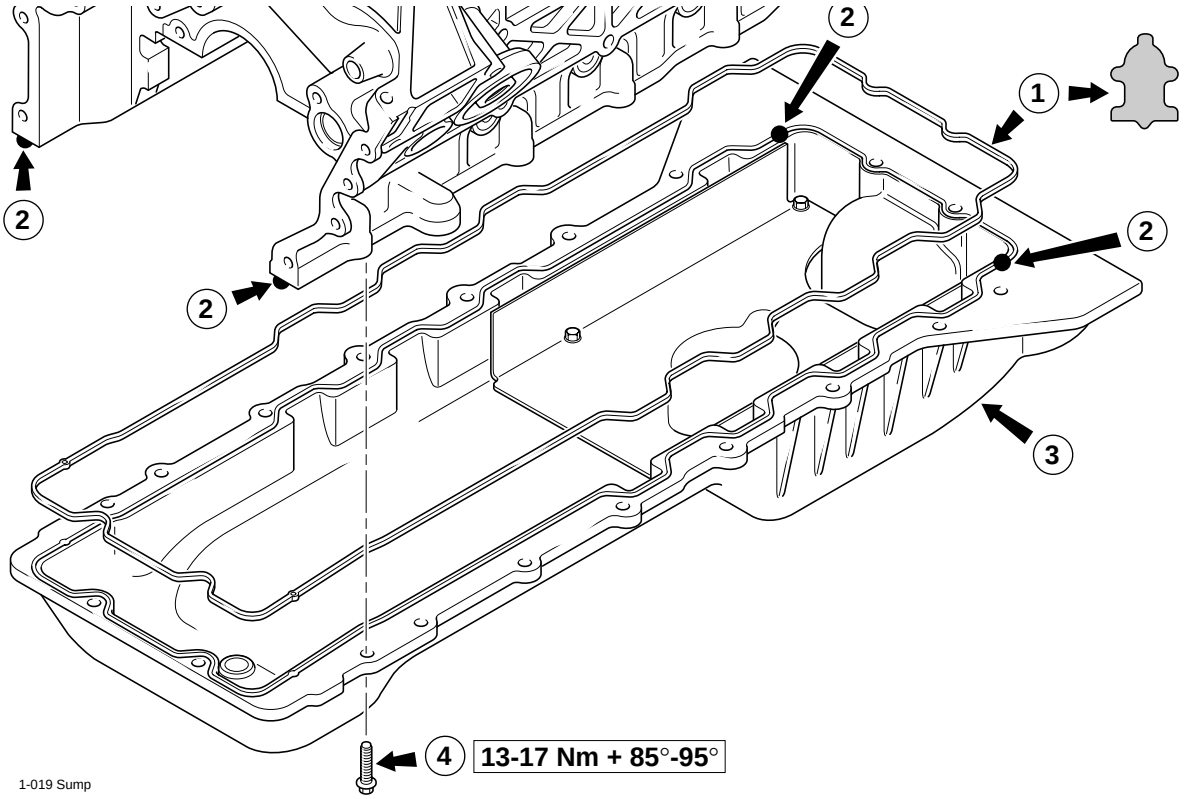
2. Apply beads of sealant to the oil pan sealing face in the positions indicated on the diagram below.

Caution: The oil pan must be refitted and torqued within 6 minutes of applying the beads of sealant

3. Fit the oil pan with its transmission mounting face 1.51mm forward of the rear face of the engine block, i.e. 1.51mm underflush.

4 Fit twenty M8 bolts

Note: The tightening sequence is shown on the following page



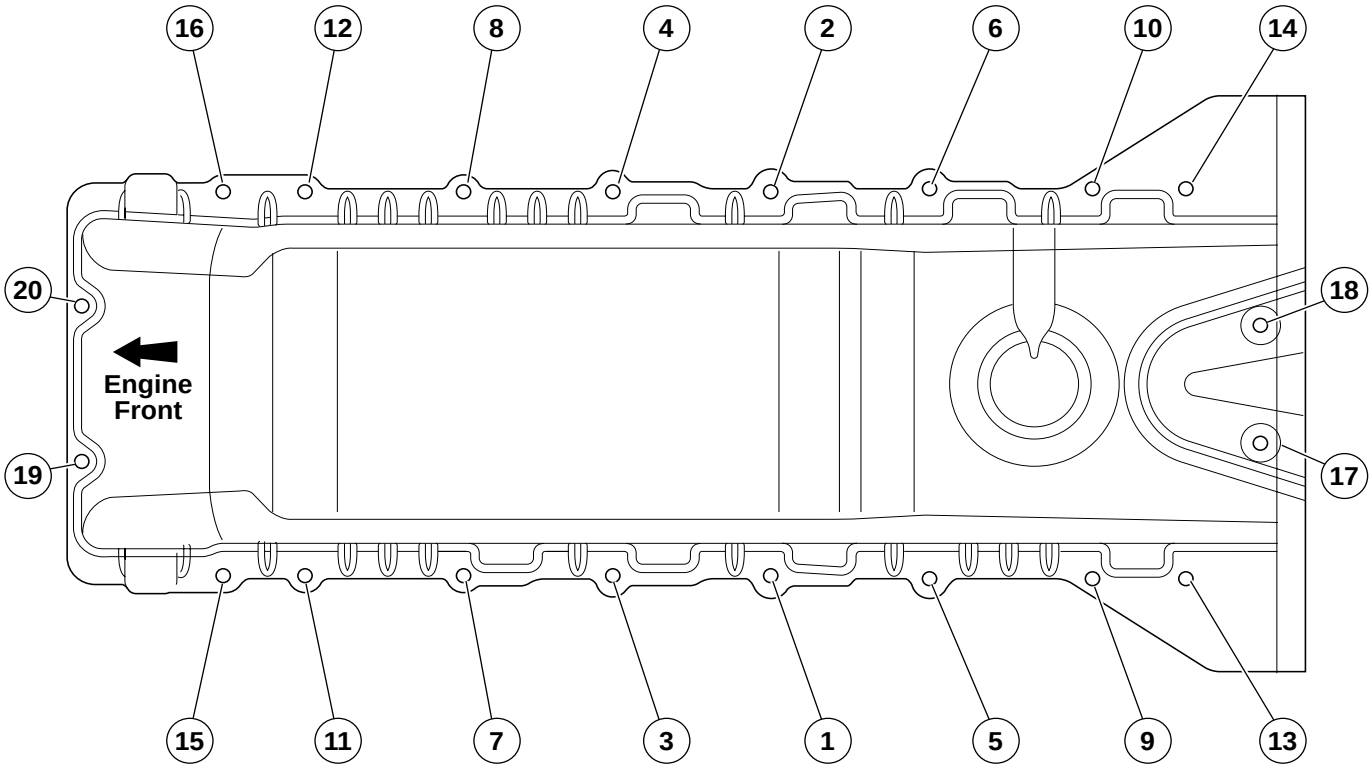
1-019 Sump

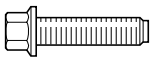
4. Torque tighten twenty M8 bolts to 13 -17 Nm in the sequence shown in the diagram above.

5. Rotate each bolt an extra 90° following the same sequence.

6. Raise and secure the front suspension (4.1.13).

7. Refill the oil pan with 11 litres (20 Imp pints) (11.5 US quarts) recommended quantity and grade of engine oil (quantities include filter).



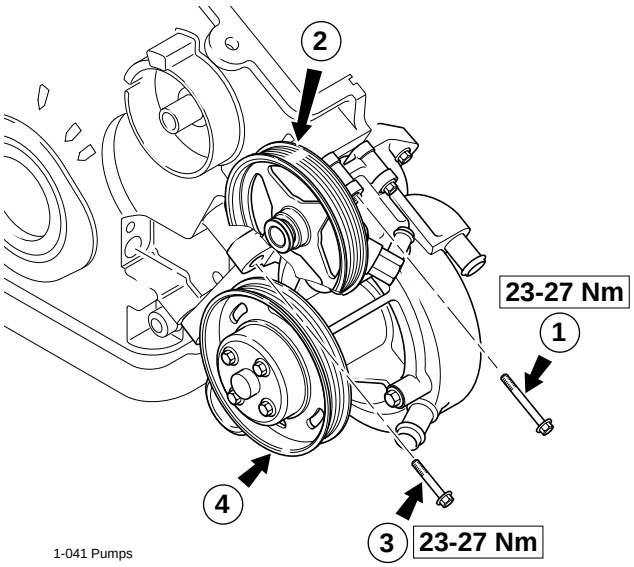
Hole No.	Fastener	Description
1 to 20		M8 x 1.25 x 30 Bolt
Note	Torque Sequence 1 to 20 Torque all Fasteners 13-17 Nm Then Rotate each Fastener in Sequence an Additional 85°-95°	

1-021 Oil Pan

1.5.07.2 Oil Pump

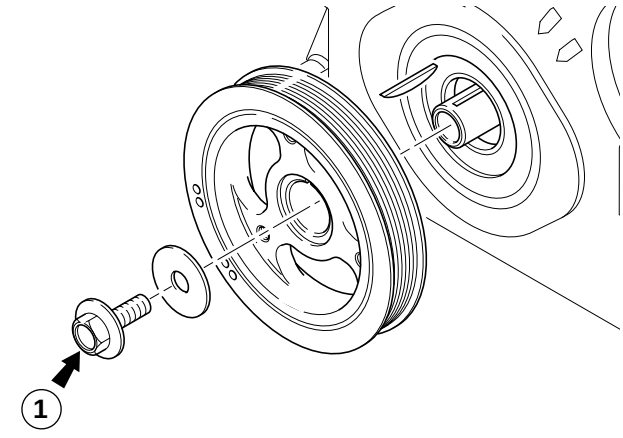
Removal

1. Drain the engine oil.
2. Drop the front suspension. (4.1.13)
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.
   1 Remove four M8 bolts
   2 Release the power steering pump from the block
   3 Remove two M8 bolts
   4 Release the water pump from the timing cover



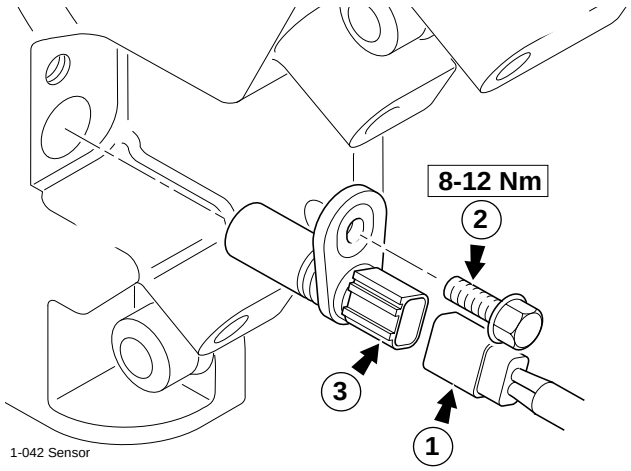
1-041 Pumps

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



1-069 Damper

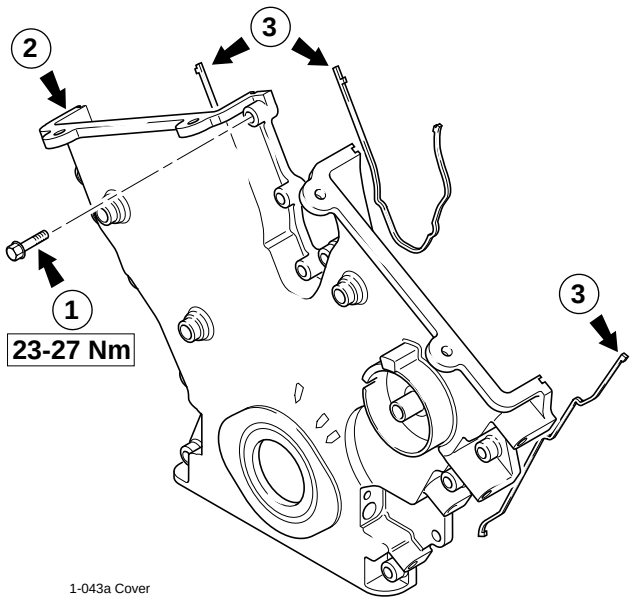
7. Remove two crankshaft position connectors
   1 Disconnect the two sensors
   2 Remove one M6 bolt from each sensor
   3 Remove the two sensors



1-042 Sensor

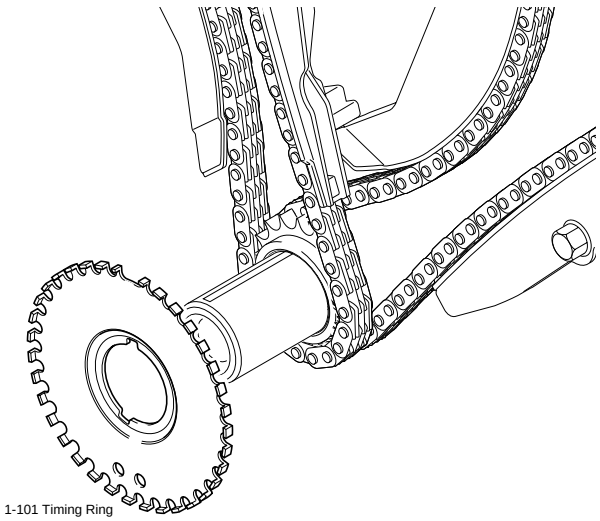
8. Remove the front timing cover. Remove and discard the timing cover seals.

   1 Remove fifteen M8 bolts
   2 Remove the timing cover
   3 Discard the cover seals



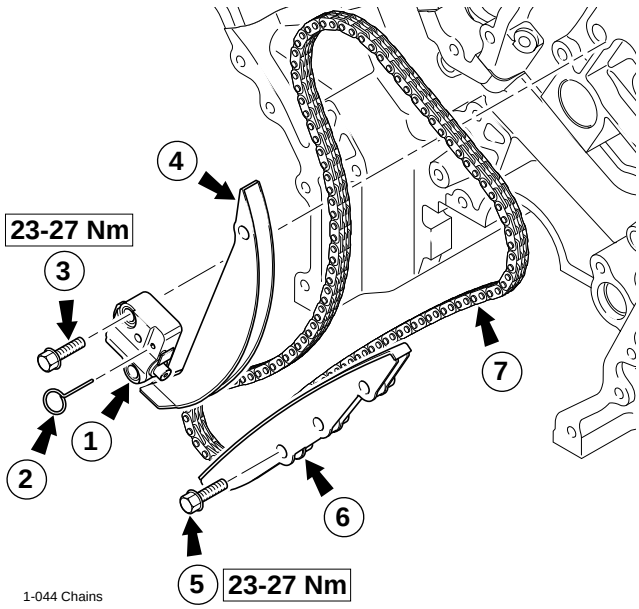
1-043a Cover

9. Remove the crankshaft timing disc.


1-101 Timing Ring

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

   1 Compress the chain tensioner
   2 Insert a locking pin
   3 Remove two bolts and the chain tensioner
   4 Remove the tensioner arm
   5 Remove two bolts
   6 Remove the fixed chain guide
   7 DO NOT remove the chain



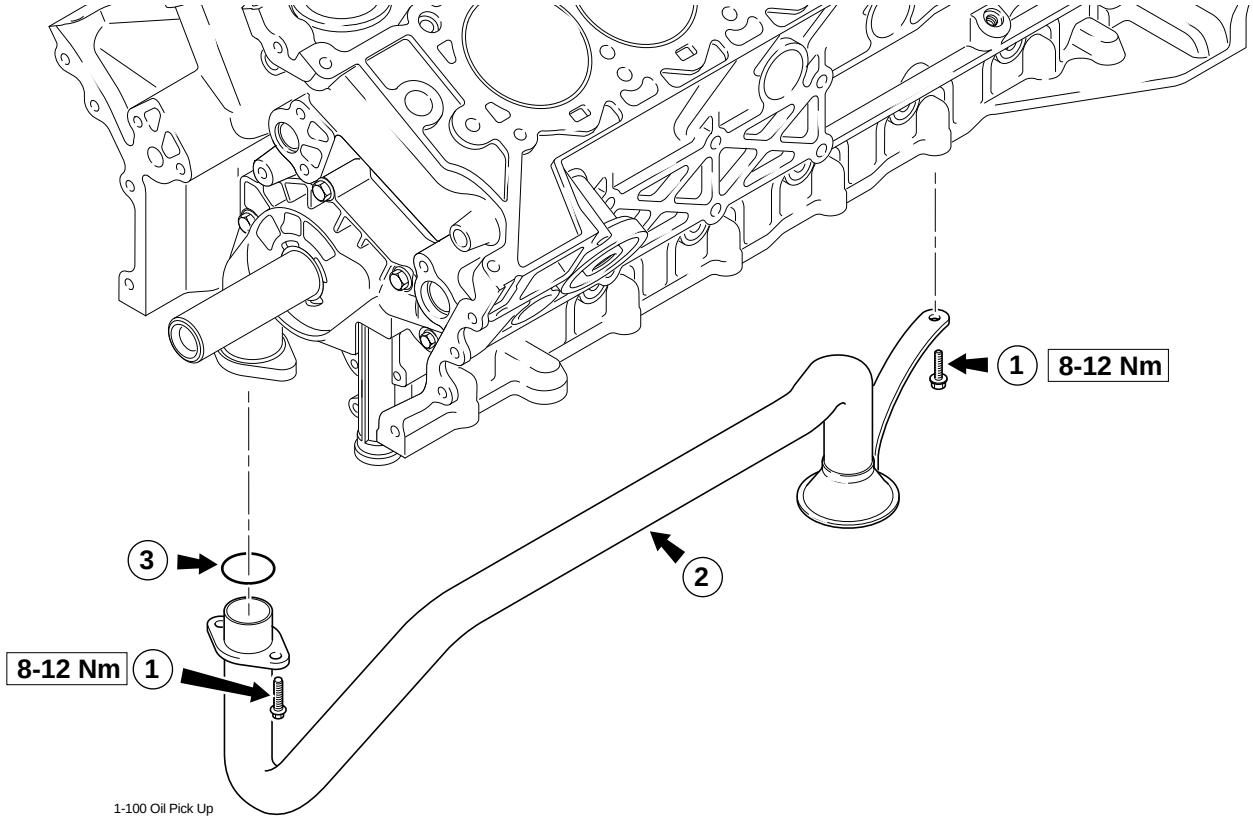
1-044 Chains

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 (1.3.04.3).***

   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.

12. Remove the oil pick-up pipe.

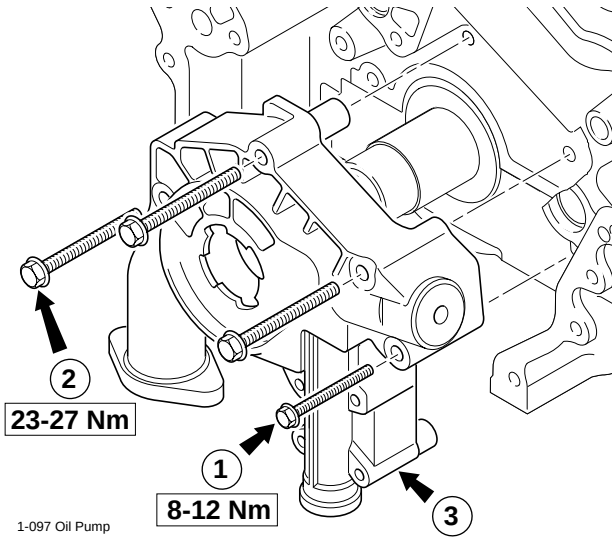
    1 Remove three M6 bolts
    2 Remove the pick up pipe
    3 Remove the oil seal



1-100 Oil Pick Up

13. Remove the oil pump.

    1 Remove one M6 bolt
    2 Remove three M8 bolts
    3 Remove the oil pump

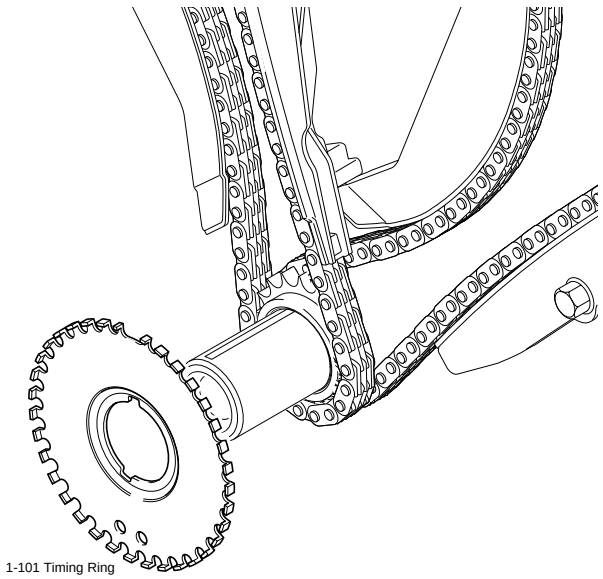


1-097 Oil Pump

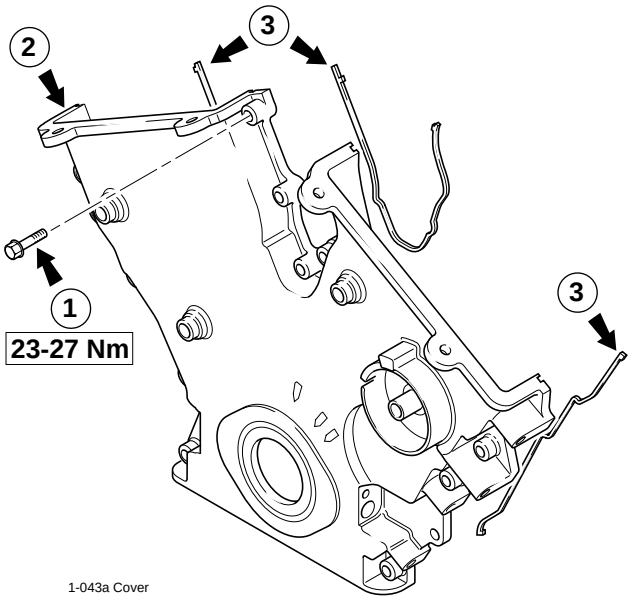
Installation

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, remove the inlet manifolds and cam covers, then perform the full camshaft timing procedure (1.3.04.3).

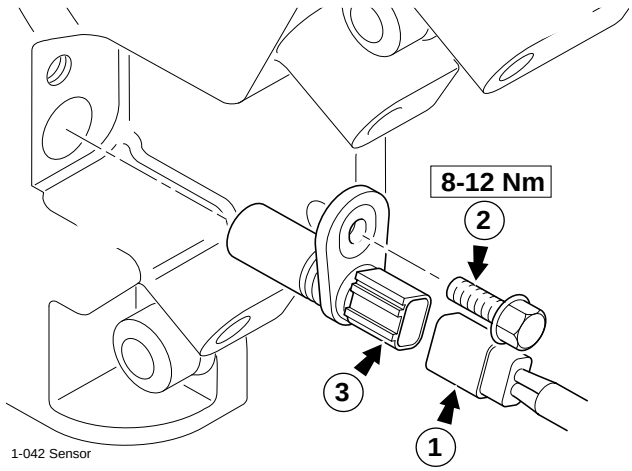

1-101 Timing Ring

5. Fit the crankshaft timing disc.
6. Fit the front timing cover using new gaskets.



1-043a Cover

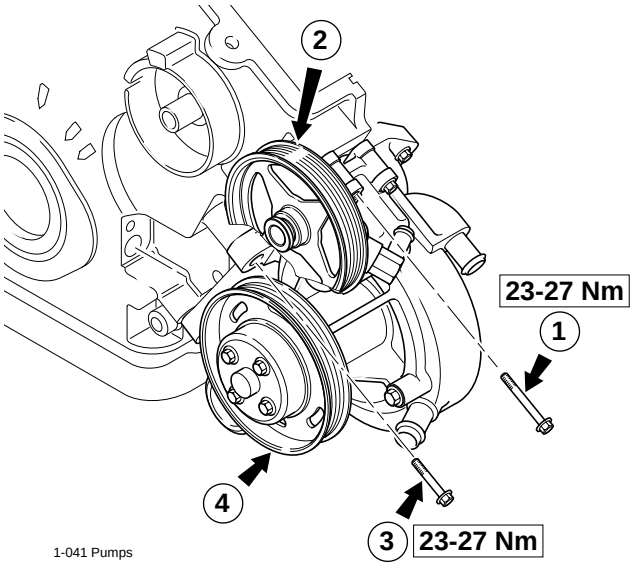
7. Fit and secure the two crankshaft sensors.



1-042 Sensor

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.



1-041 Pumps

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

11. Refit the oil pan (1.5.02.1).

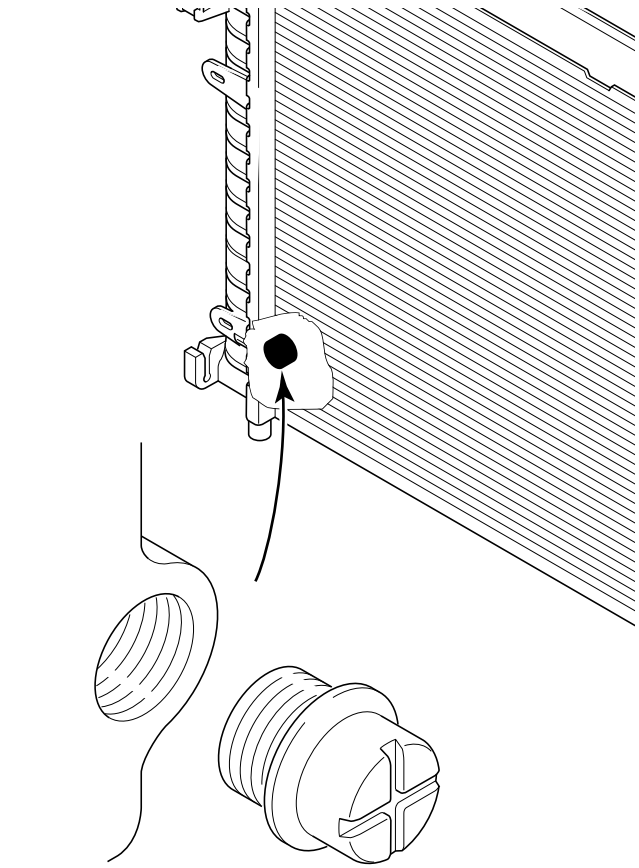
12. Refill the oil pan with 11 litres of the recommended engine oil (quantities include filter).

1.7.03.1 Engine Coolant - Drain and Refill

Drain

1. Remove the coolant filler cap from the header tank

2. Remove the drain plug and drain the coolant.



1-105 Rad Drain

Refill

1. Refit the drain plug.

2. Fill 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.

1.7.04 Cooling System Pressure Tests

Header tank pressure cap	140kpa
Thermostat Starts opening	90°C
Thermostat fully open	100 - 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, check and examine the rubbers for cracks and wear.
9. Rinse the cap in water to remove any sediment and apply the cap to the tester. Pump up the tester until the gauge pointer stops rising. The pressure should read between 125 and 150 kPa. Reject the cap if it does not blow off within the minimum/maximum pressure range. Reject any cap that does not hold the rated pressure for 10 seconds without additional pumping.

Caution: When renewing a defective pressure cap, never fit a cap of a higher or lower pressure rating than that of the original fitment.

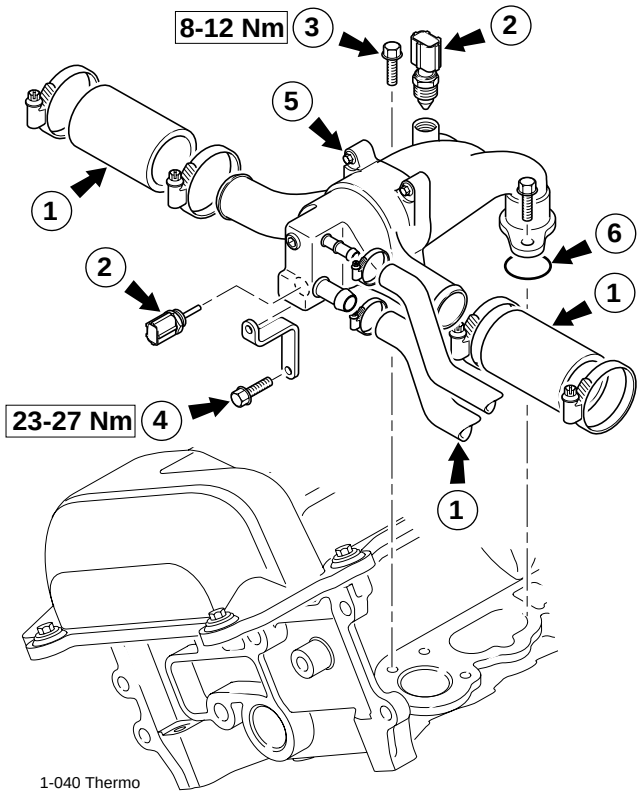
1.7.08.1 Thermostat Housing

Removal

1. Drain the engine coolant (1.7.03.1).
2. Remove the thermostat housing.
   1 Disconnect the four hoses from the housing
   2 Disconnect the two temperature sensors.
   3. Remove three M6 bolts from the rear of the housing
   4 Remove one M6 bolt
   5 Release the thermostat housing
   6 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)

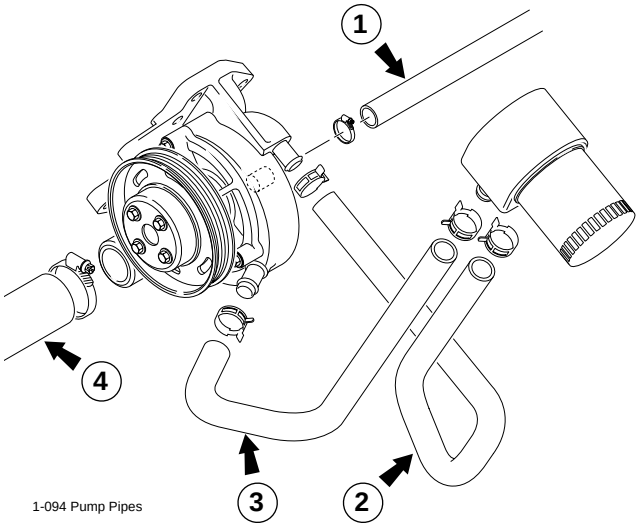


1-040 Thermo

1.7.12.1 Water Pump

Removal

1. Drain the engine coolant (1.7.03.1).
2. Disconnect the water hoses from the water pump.
   1 Heater Return Hose
   2 Oil Cooler Return Hose
   3 Oil Cooler Supply Hose
   4 Radiator Bottom Hose

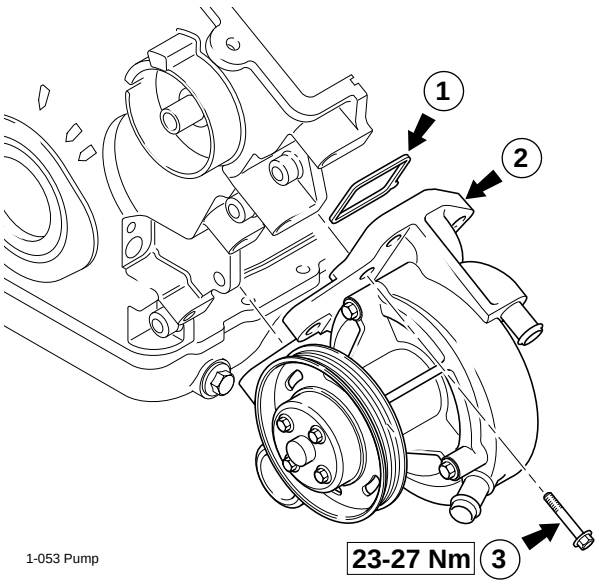


1-094 Pump Pipes

3. Release the tension on the 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
   1 Fit a new gasket to the water pump.
   2 Secure with six M8 bolts



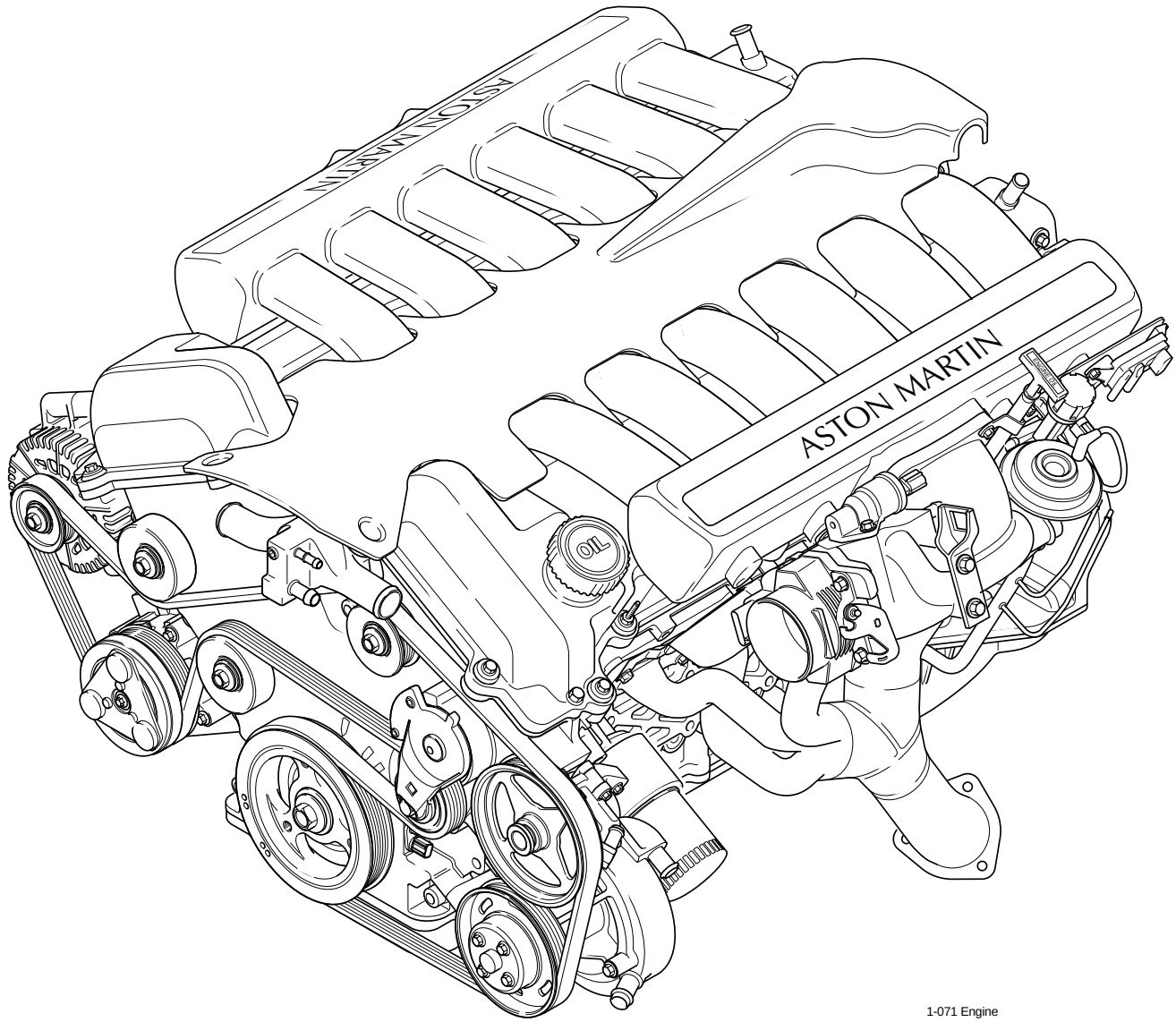
1-053 Pump

3. Reconnect and secure the water hoses.
4. Refit the polyvee drive belt (1.4.10.1)
5. Refill and bleed the cooling system (1.7.03.1).

Engine Description

General

The DB7 Vantage 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.



1-071 Engine

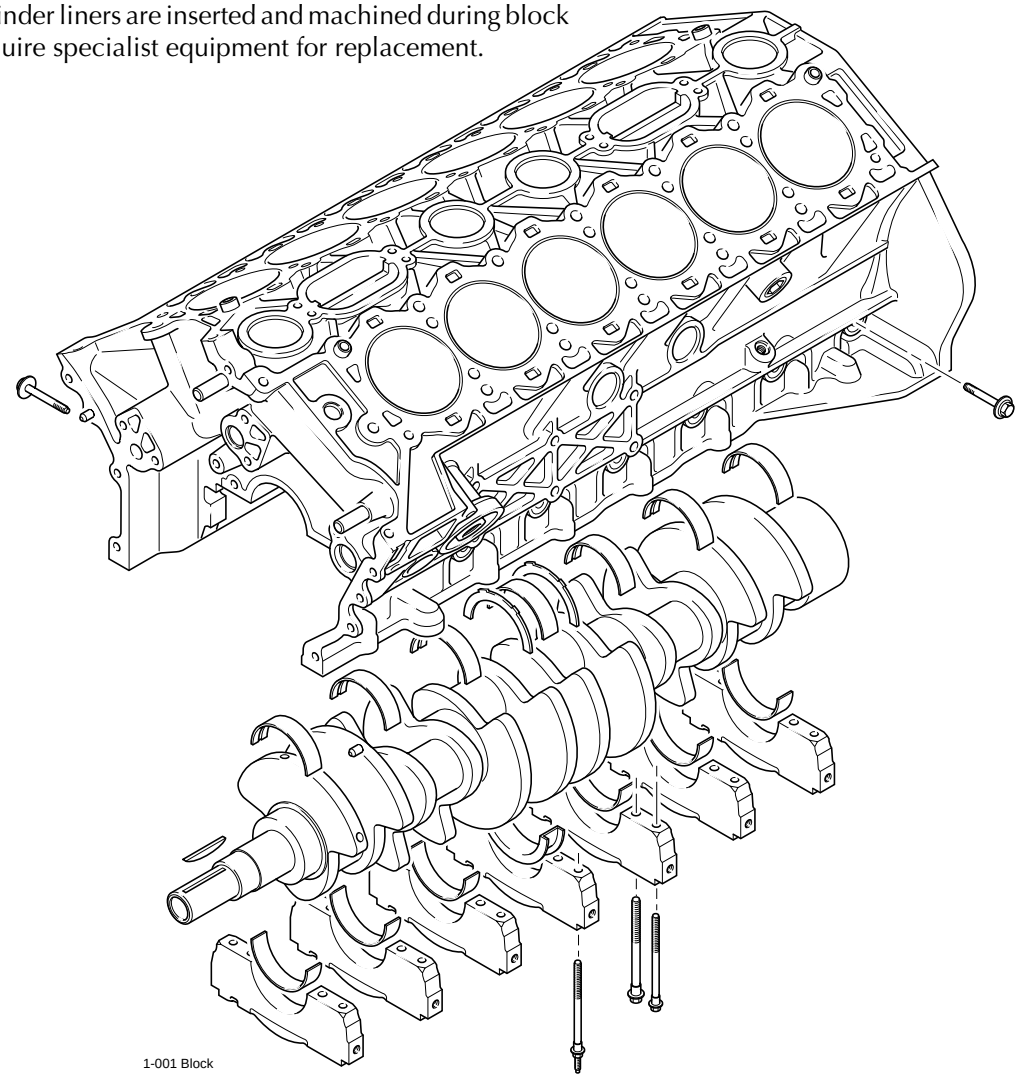
The engine uses the latest 'fast-burn' combustion technology and an exhaust gas recirculation system. Heated oxygen sensors monitor the oxygen content of exhaust gasses. The engine management system uses the oxygen sensor signals together with other engine information to 'fine tune' fuelling levels and ignition timing. This helps to achieve the best possible fuel burn with minimum exhaust emissions. The exhaust system incorporates 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 non-leaded 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.



1-001 Block

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.

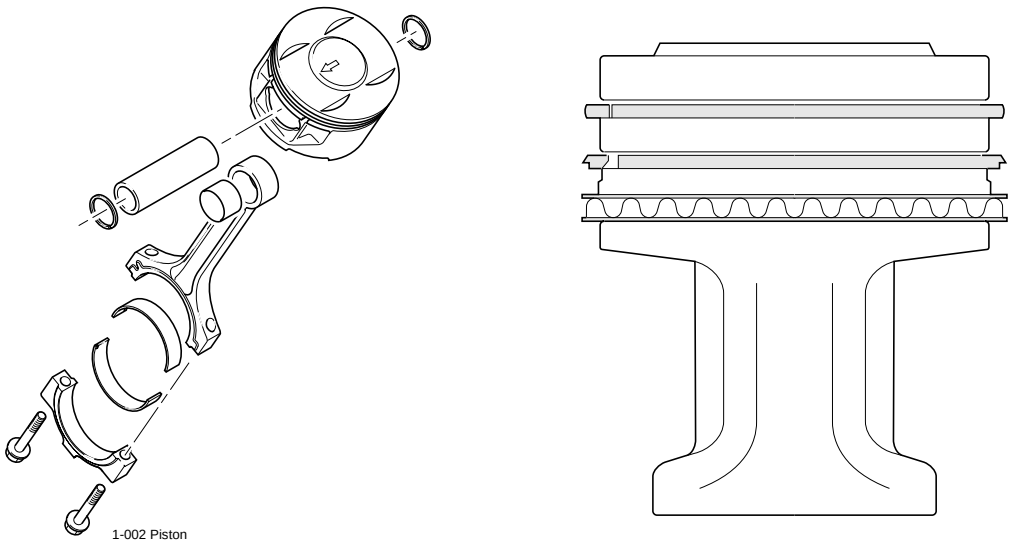
A twin sprocket fitted to the front end of the crankshaft drives the camshaft chains. A damper pulley fitted on the crankshaft nose drives the engine auxiliaries with a polyvee drive belt.

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 engine management controllers.

At the rear end of the crankshaft, provision is made for fitting a flywheel and clutch or a drive plate depending on the type of transmission to be used.

Pistons and Connecting Rods

The six crankshaft pin 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.



1-002 Piston

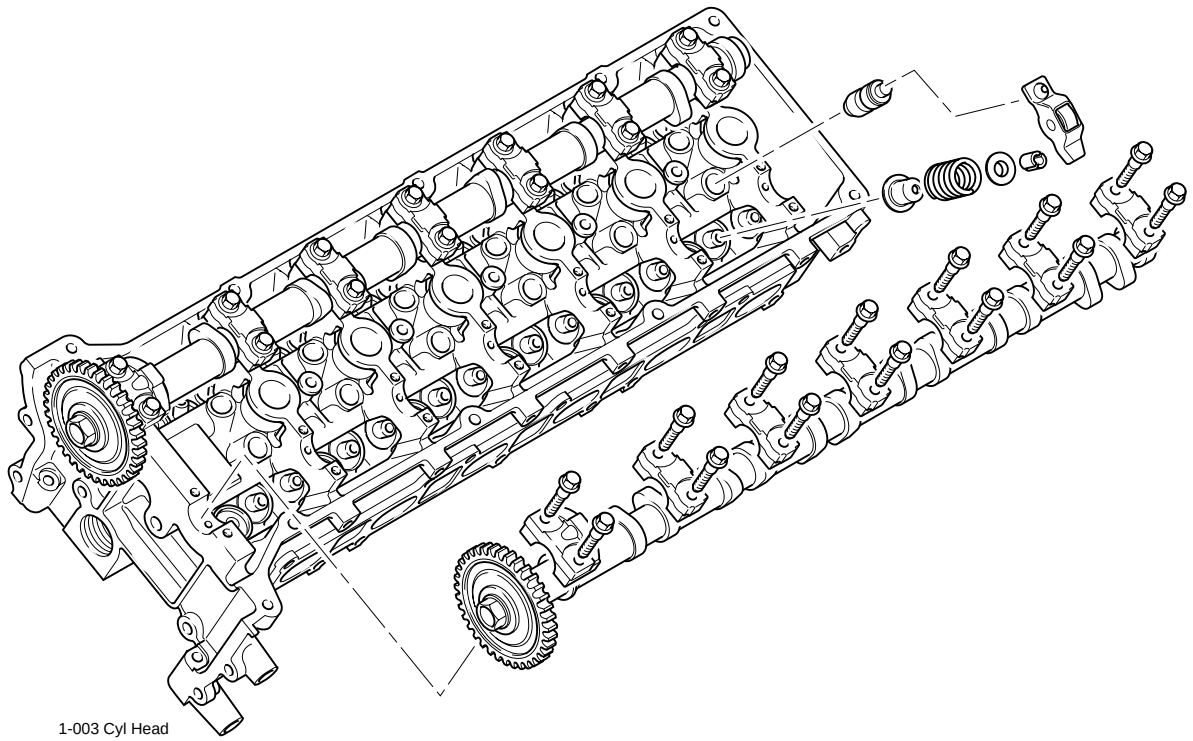
Each piston carries two compression rings and one oil control ring sandwiched between two oil control segment rings. The arrow on each piston crown must point to the front of the engine during installation.

The lower compression ring is of the 'Napier" style and also acts as an oil scraper ring to aid in the control of oil consumption.

Connecting rods are manufactured as a single piece with fracture lines at the connecting rod bearing. The 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.



1-003 Cyl Head

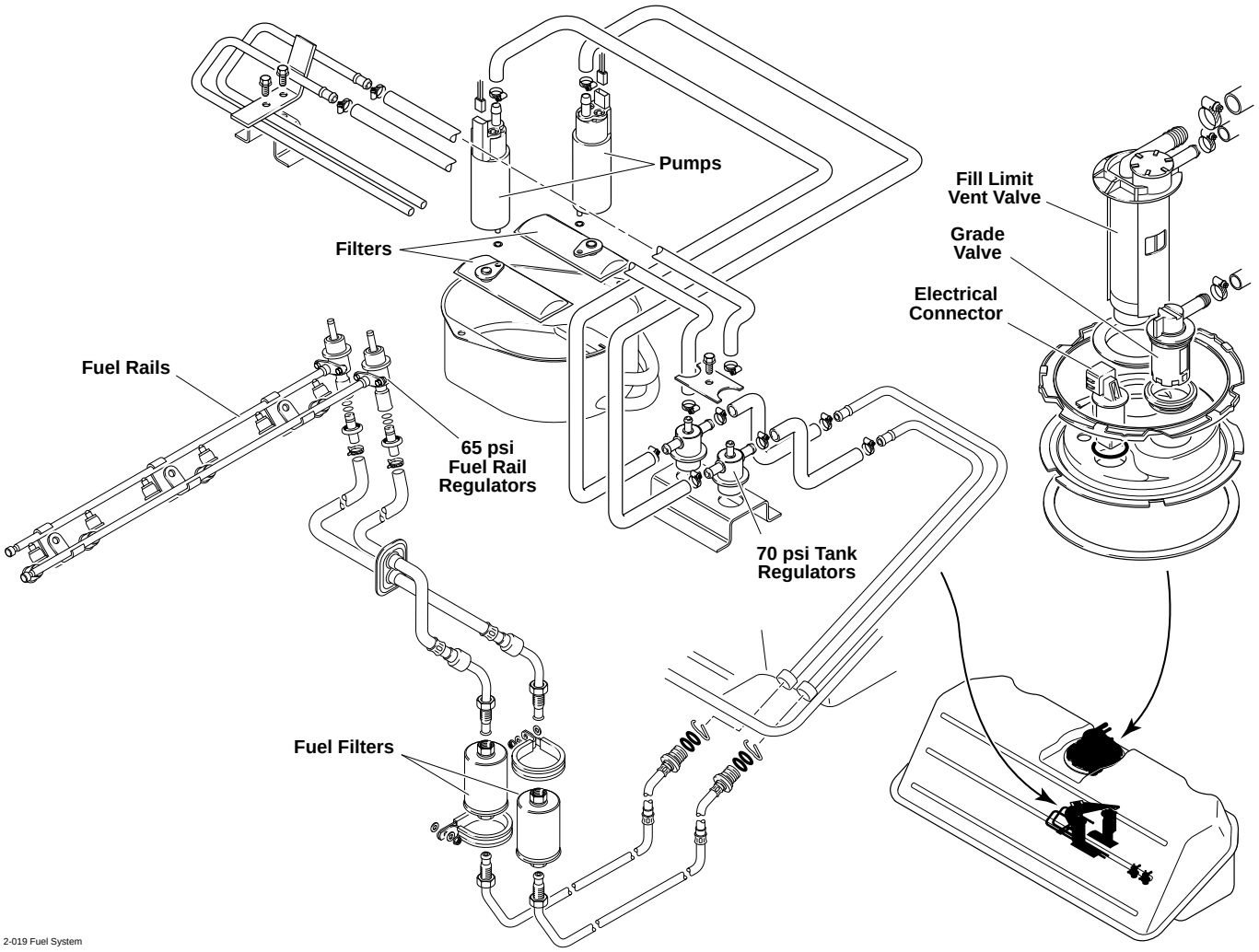
Camshafts

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 (Coupe 89 litre, Volante 82 litre) is fitted with two in-tank fuel pumps and pressure regulators. Two identical fuel systems are fitted, one for each engine bank.



2-019 Fuel System

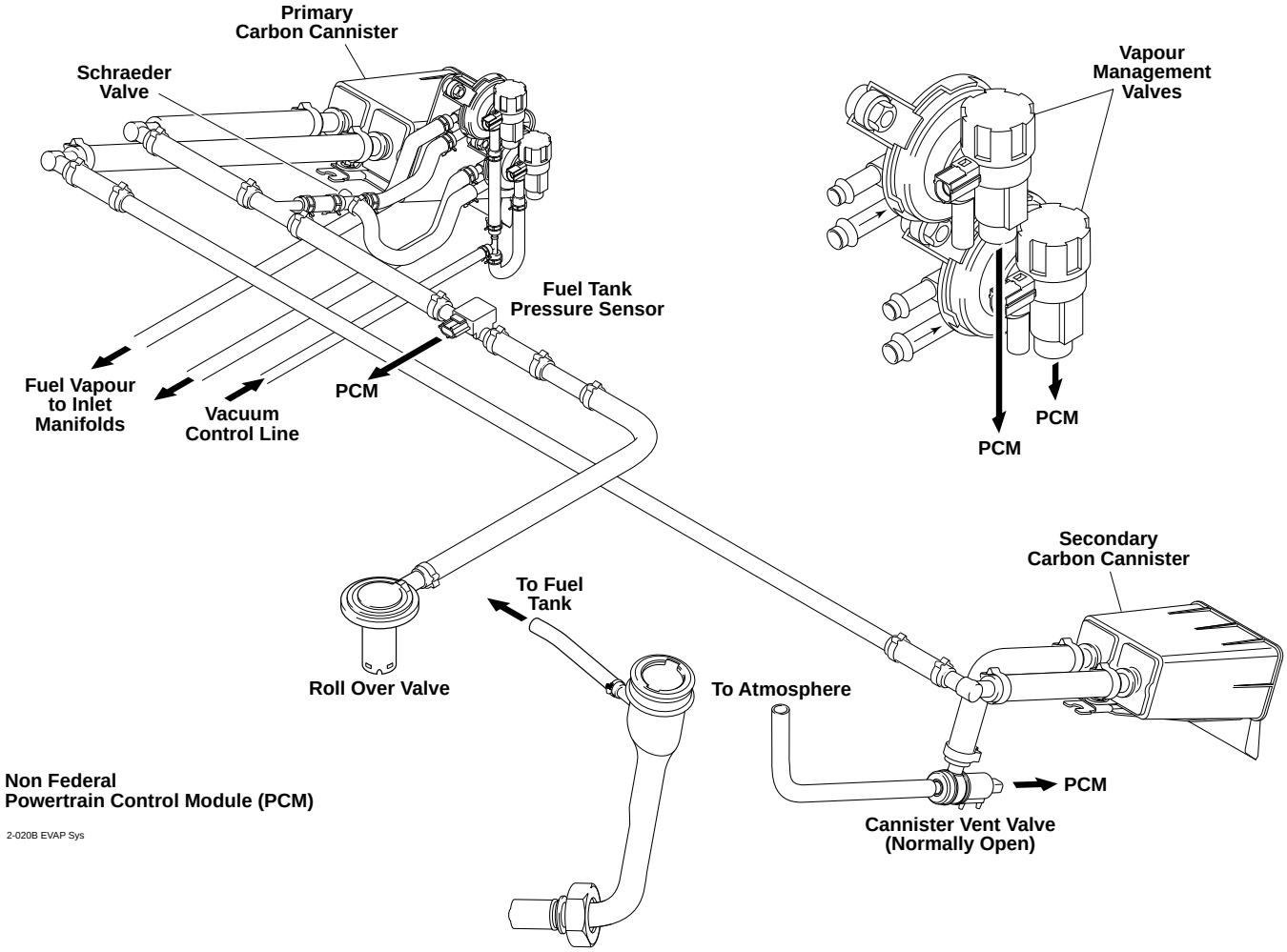
Fuel is drawn through each electric fuel pump and passes immediately to the in-tank fuel pressure regulators. These limit the initial fuel pressure to 70 psi and return any excess fuel to the tank. Excess fuel from the in-tank pressure regulators is returned to the swirl pot via two venturis which draw in additional fuel. Thus, when the fuel level is low, the level in the swirl pot is kept above that in the tank, maintaining pump suction.

After passing forward through the fuel lines and filters, fuel enters the two fuel rails via further fuel pressure regulators. These regulators maintains a fuel pressure of 65 psi above manifold pressure. This constant pressure ensures that fuel quantity delivered to the engine can be metered by varying the injector 'on-time' only, and will not be seriously affected by fuel pressure variations.

The twelve fuel injectors are connected to the two fuel rails. As each fuel injector is energised in firing order sequence by the EEC, fuel is sprayed directly into the inlet port of each cylinder.

Evaporative Loss System

This system prevents the escape of fuel vapours into the atmosphere. Two configurations are fitted to meet the different legislative requirements of North America and the Rest of the World. The systems are fully described in section 2 of this workshop manual. The North American version is shown below.



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.

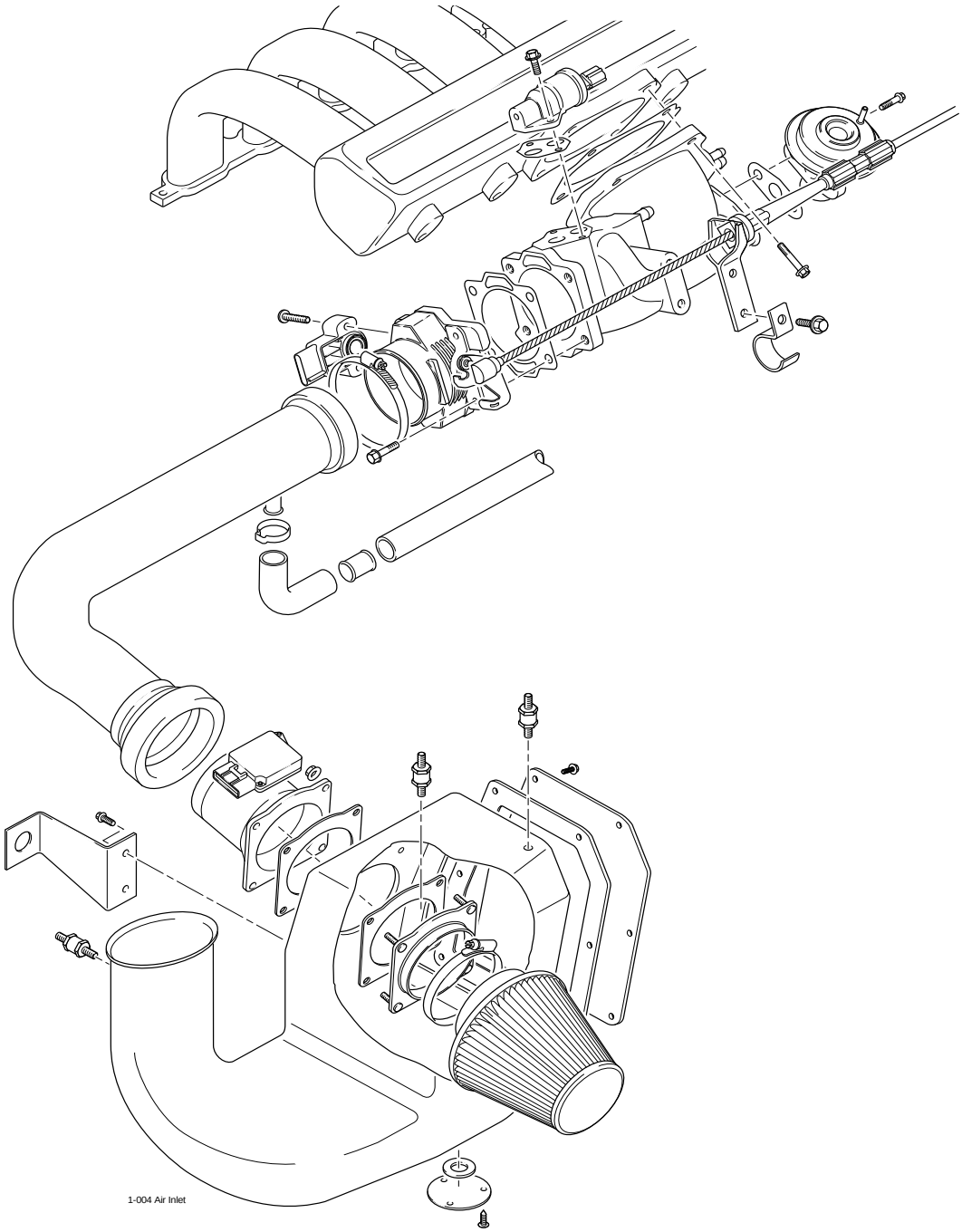
The engine management system will compensate for the additional hydrocarbons (fuel) in the purge gasses and will make small reductions in the normal fuelling level to maintain the optimum fuel burn and to minimise emissions.

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 engine management EEC and are used together with other signals in calculating the required amount of fuel.

The air then passes through the throttle bodies and throttle body adaptors into the six branch inlet manifolds.

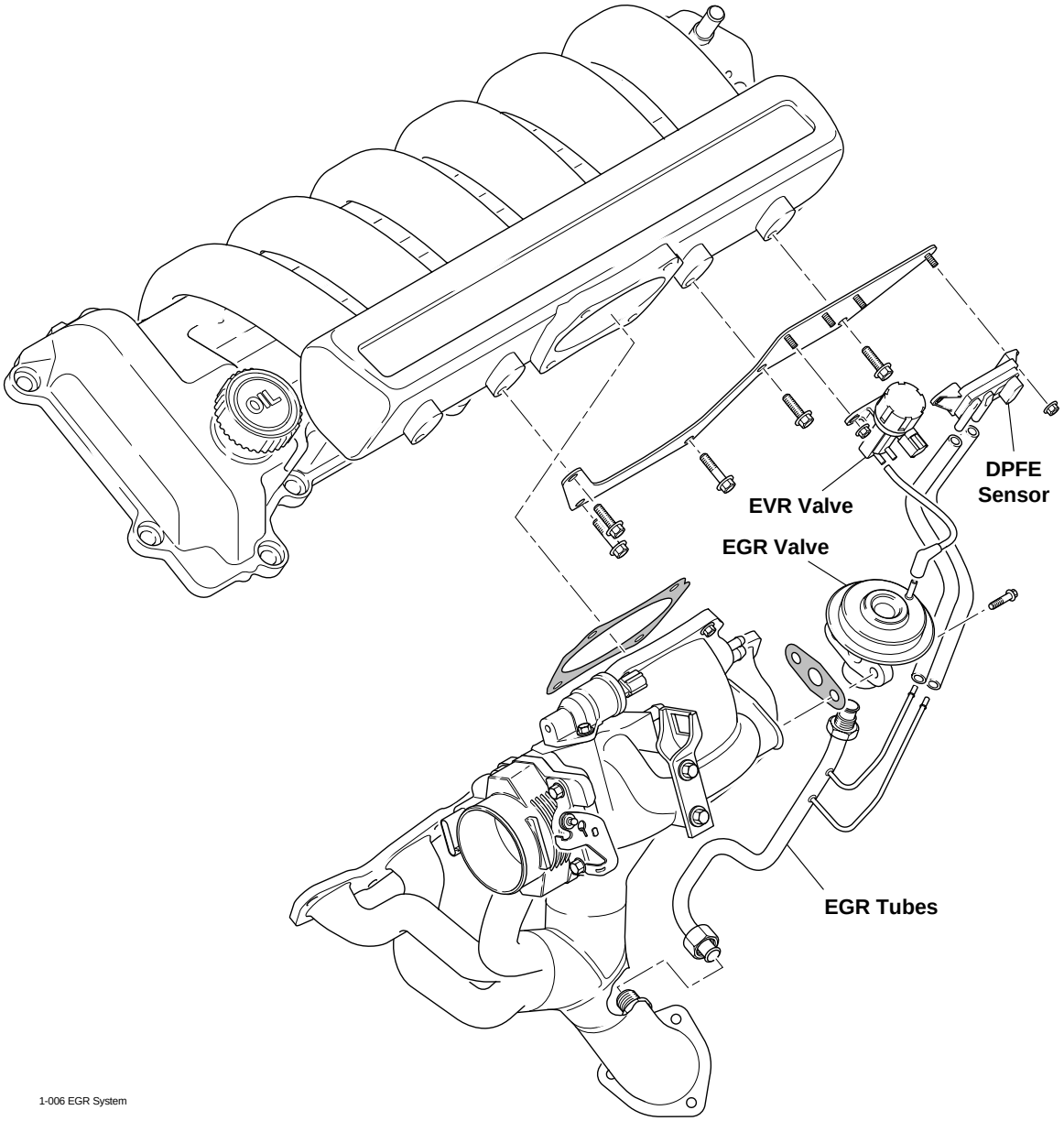
At idle, the throttle butterflies are closed and the air necessary to run the engine is controlled by the idle air control valves mounted on each throttle body adaptor.



A throttle position sensor (TPS) is mounted on each throttle body. The throttle position signals are fed to the engine management EECs. During normal engine run, the TPS signals are used by the engine management EECs to indicate the power demand from the engine.

Exhaust Gas Recirculation (EGR)

At higher combustion temperatures, nitrous and nitric oxide (NOx) would normally be generated in the exhaust gases. An exhaust gas recirculation system is fitted to reduce combustion temperature and hence reduce NOx emissions.



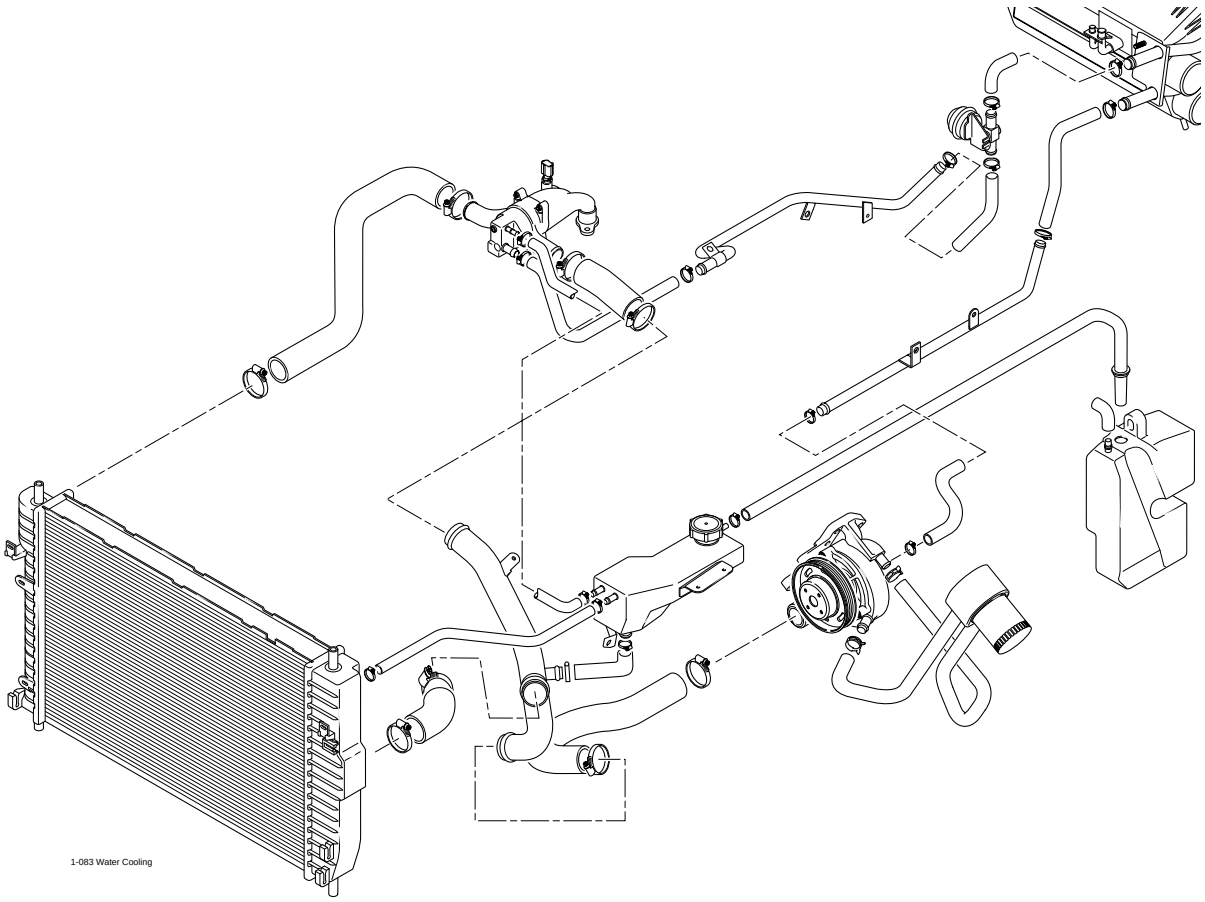
1-006 EGR System

The EGR system uses the EGR (Exhaust Gas Recirculation) Valve as its primary control. When the vehicle is running at normal road speeds, the EECs energise the Exhaust Vacuum Regulator(EVR) Valves to control vacuum from the inlet tract to control the EGR Valve and permit a controlled quantity of exhaust gasses to recirculate back into the inlet system.

The Differential Pressure Feedback (DPFE) Sensor on each bank measures the pressure difference across a restrictor in the exhaust gas recirculation tubes. The DPFE signals are used by the EECs as a measure of the quantity of EGR gas entering the inlet system. Thus accurate control of EGR can be achieved.

Cooling System

The engine cooling system uses a low silicate, glycol based, coolant to a ratio of 50% coolant, 50% water mixture. The coolant has a 30,000 mile (48,000 km, 2 year) service life.



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, coolant is directed to the bypass outlet and back through the bypass pipe and radiator bottom hose to the water pump. This flow path bypasses the radiator to achieve a fast engine warm-up.

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.

A pipe from the front of the thermostat housing directs coolant to the air conditioning heater matrix. This outlet is permanently open. Thus hot water will be available as early as possible for demisting the screen and warming the vehicle interior. Coolant from the heater matrix returns to the cooling system via a stub pipe on the rear of the water pump.

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.

The coolant header tank on the left inner wing provides the fill position and a degas reservoir. Any coolant displaced by thermal expansion flows into the expansion tank. When the system cools down and contracts, a vacuum will be created to draw the displaced coolant back into the header tank.

Antifreeze

Only the coolants listed below can be used. They must not be mixed with other anti freeze solutions

BASF D542 (clear liquid) or Havoline DEX-COOL (orange liquid)

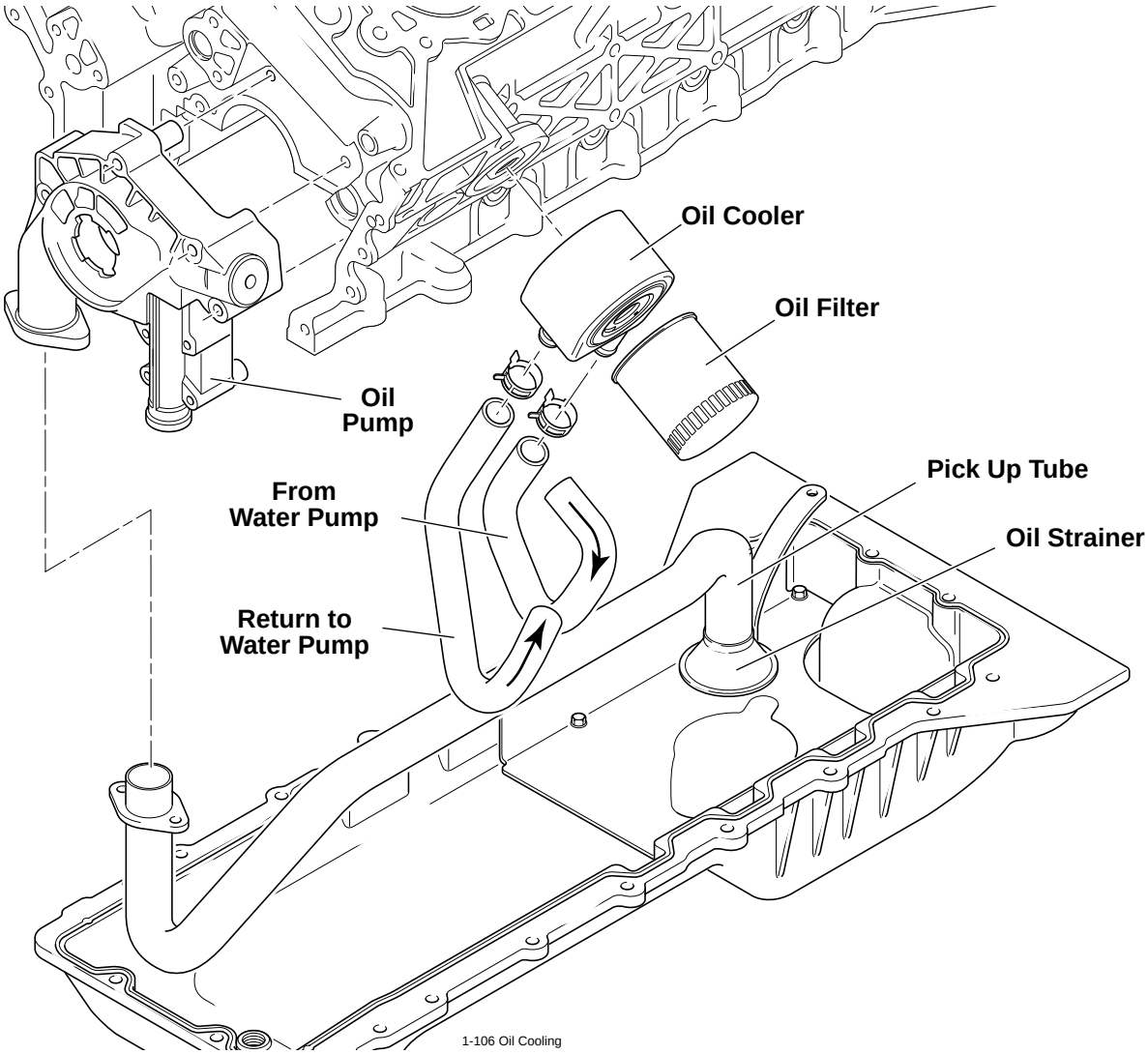
Ignition System

The twelve spark plugs are fired in sequence by the two engine management EECs (Electronic Engine Controllers). 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 engine management EECs. Low voltage signals are fed from the EECs 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 avoided.

Engine Lubrication

The AM 702 engine uses a wet sump lubrication system. Initial oil fill is approximately 11 litres (20 Imp pints) (11.5 US quarts).



1-106 Oil Cooling

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 again.

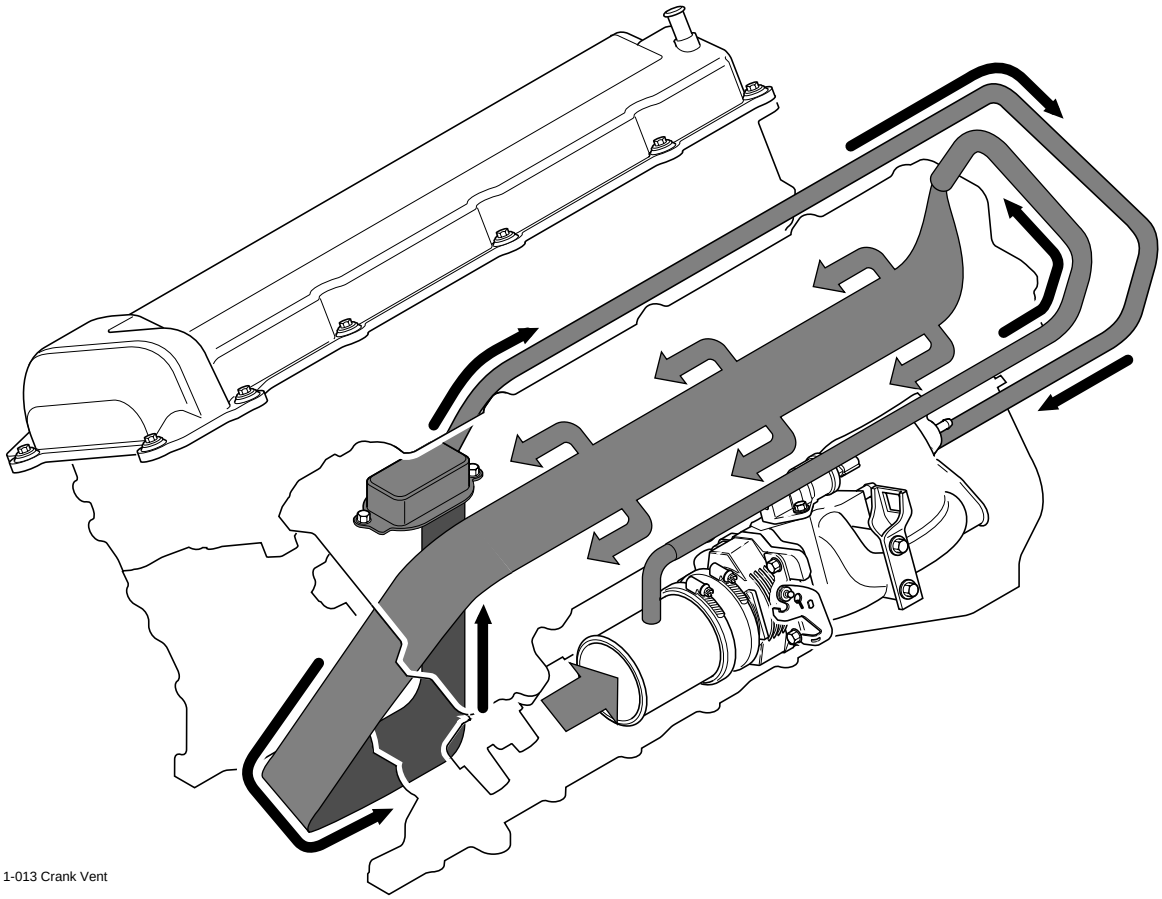
Oil pressure at the re-entry point is approximately 60 psi with the engine hot and should reach at least 100psi when cold. Oil distribution is as follows:

Main oil gallery to crankshaft main and connecting rod bearings and to the piston oil squirters
Main oil gallery to the timing chain tensioners
Oil feed galleries 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

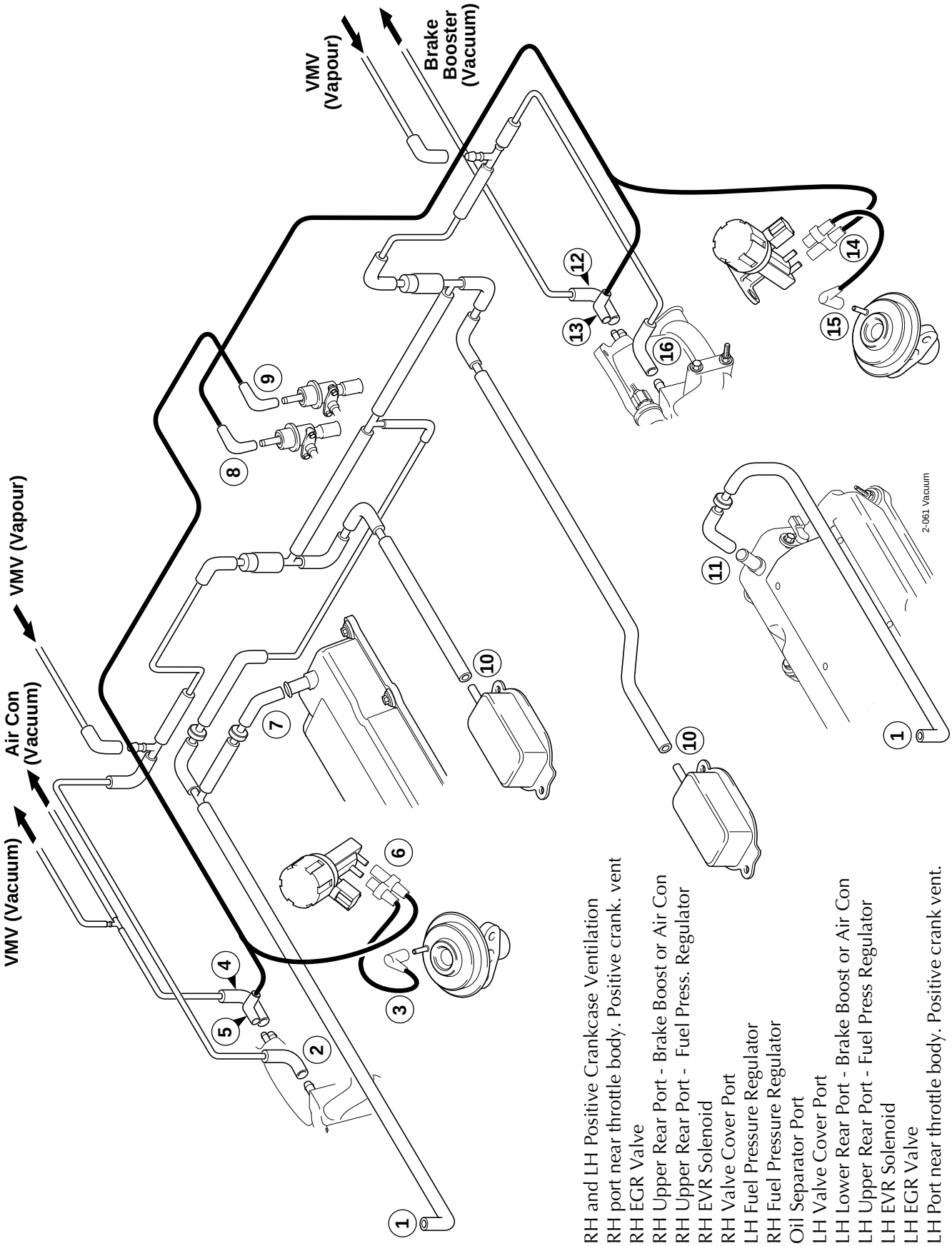
To avoid environmental pollution from crankcase gases, the crankcase is ventilated into the inlet manifold. Any noxious fumes in the crankcase gases will then be burned in the normal combustion process.



1-013 Crank Vent

Fresh air from the intake system is fed into the camshaft cover on each engine bank. This air flows through the oil drain channels 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.

Vacuum Pipework System



Key

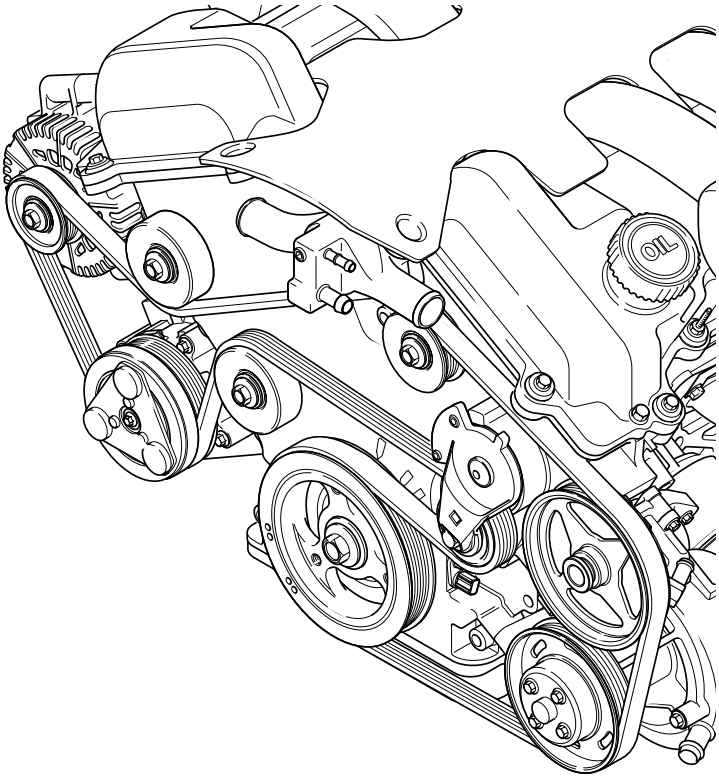
1. RH and LH Positive Crankcase Ventilation
2. RH port near throttle body. Positive crank. vent
3. RH EGR Valve
4. RH Upper Rear Port - Brake Boost or Air Con
5. RH Upper Rear Port - Fuel Press. Regulator
6. RH EVR Solenoid
7. RH Valve Cover Port
8. LH Fuel Pressure Regulator
9. RH Fuel Pressure Regulator
10. Oil Separator Port
11. LH Valve Cover Port
12. LH Lower Rear Port - Brake Boost or Air Con
13. LH Upper Rear Port - Fuel Press Regulator
14. LH EVR Solenoid
15. LH EGR Valve
16. LH Port near throttle body. Positive crank vent.

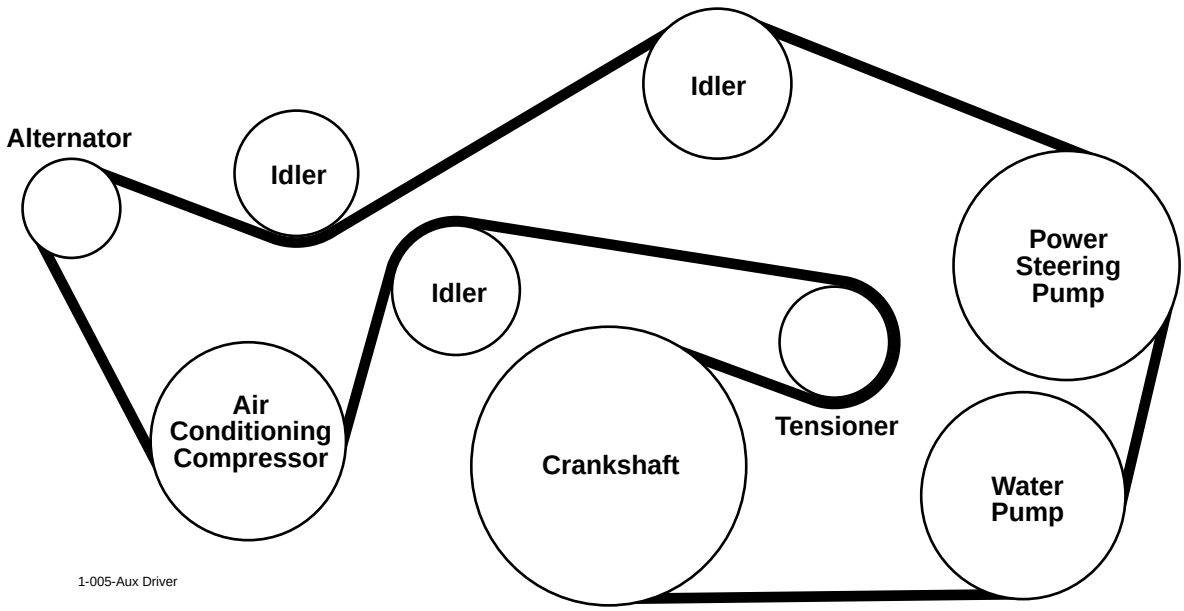
Auxiliary Drives

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 diagrams illustrate the position of the auxiliaries and the polyvee drive belt routing:





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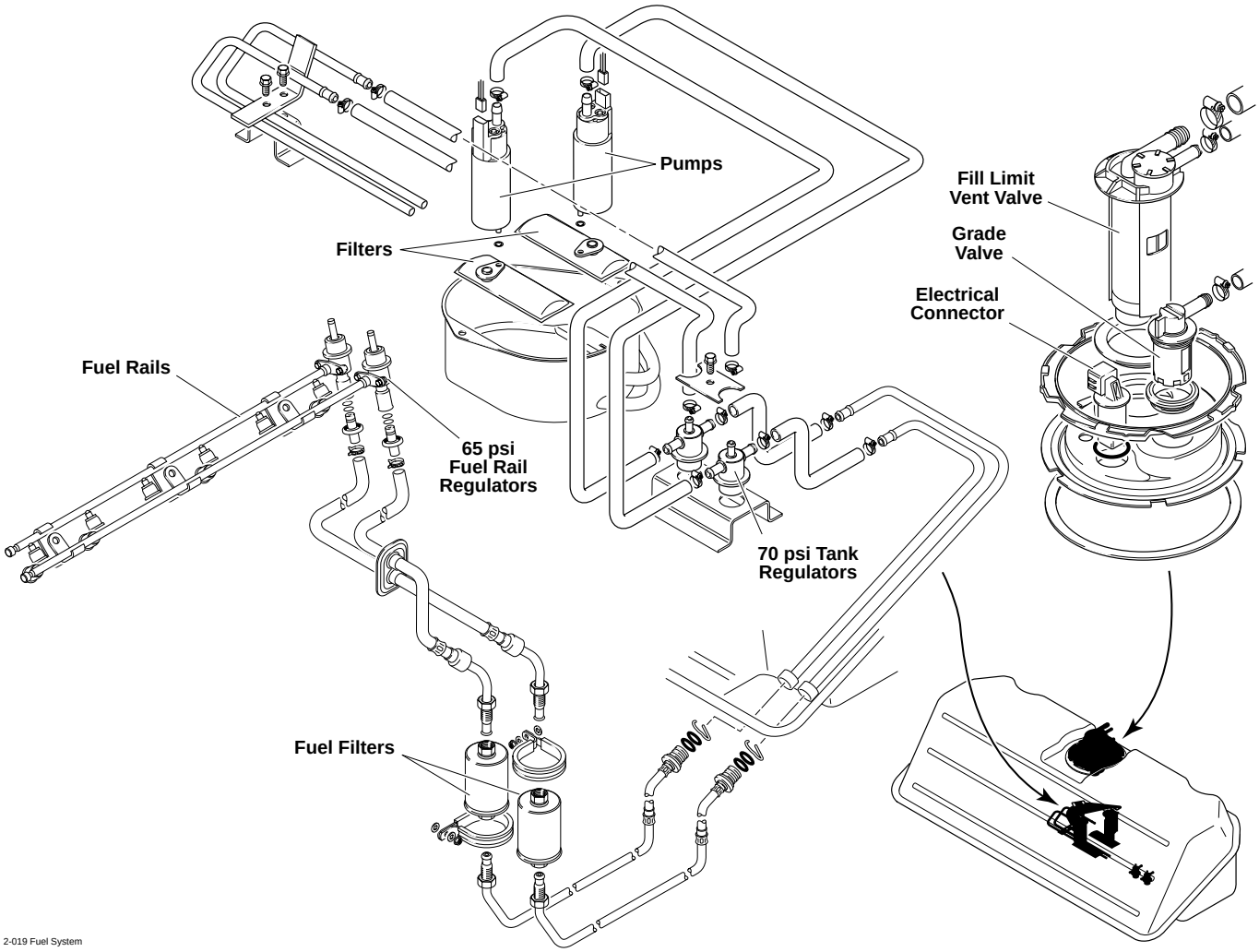
Fuel System Description

General

The DB7 Vantage uses a mechanical returnless fuel system in which two fuel pumps supply fuel through pressure regulators and filters to the two fuel rails. Each fuel rail is fitted with six fuel injectors. There are no fuel return lines.

The two fuel pumps are immersed in a swirl pot at the base of the fuel tank. Both draw in and pump fuel to two fuel regulators within the fuel tank which limit the maximum fuel pressure to 70 psi. The fuel then passes via fuel filters mounted in the front wheel arches to further regulators on the rear end of each fuel rail. The fuel rail regulators limit fuel pressure at the injectors to 65 psi above inlet manifold pressure.

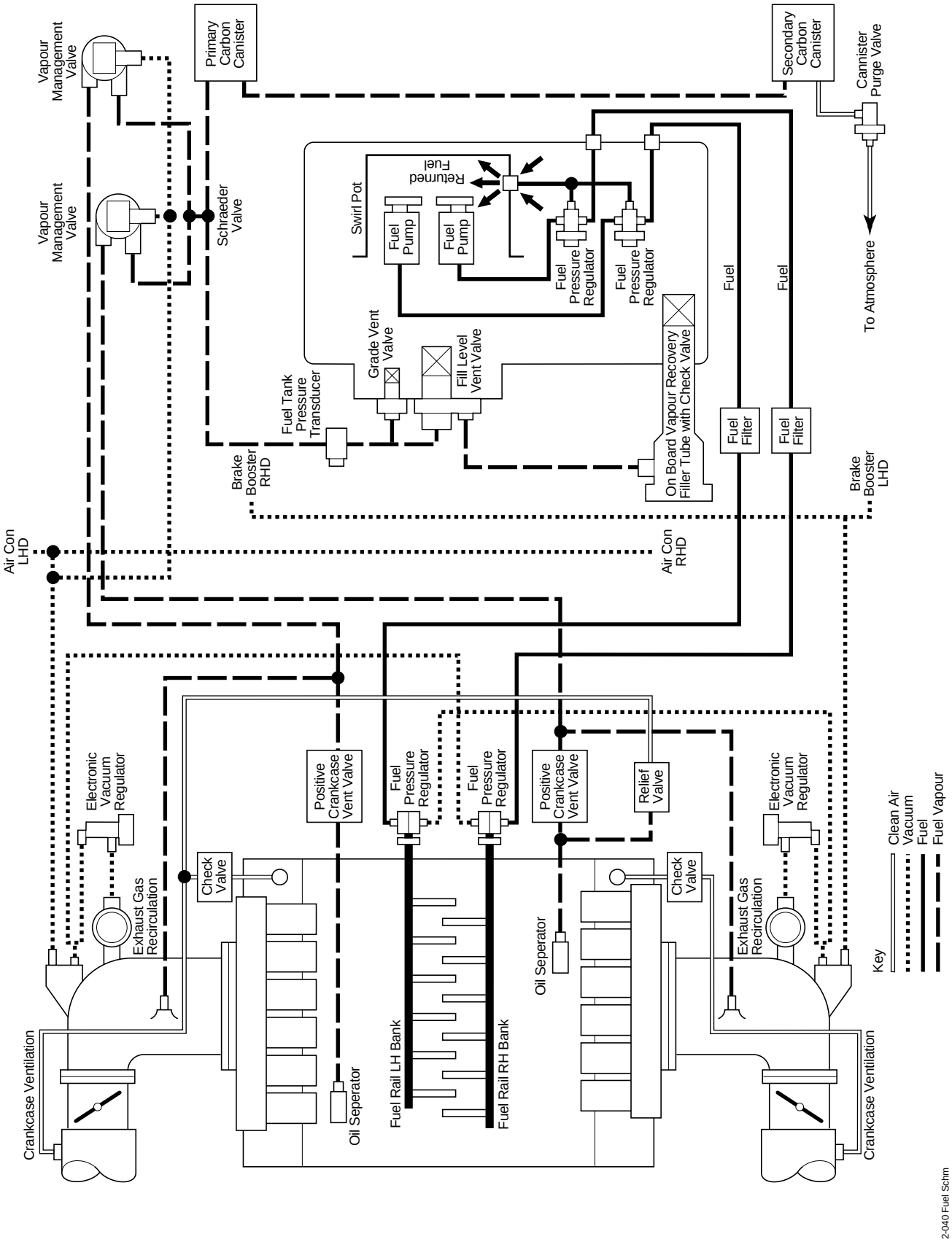


2-019 Fuel System

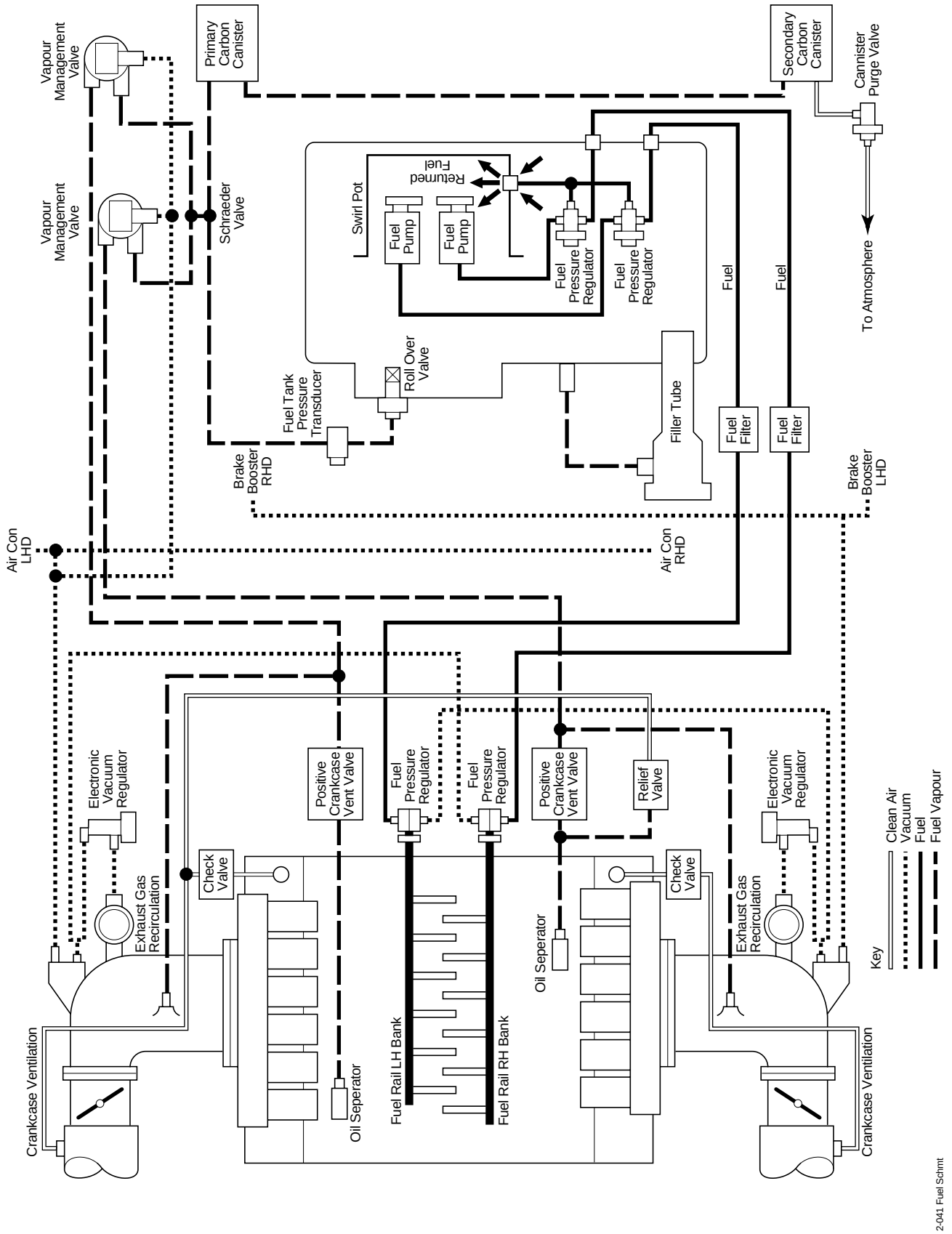
Fuel System Schematic Diagrams

The diagrams on the following two pages show the fuel system components for the North American and for the Rest of the World variants. They include the positive crankcase ventilation and vapour recovery systems for all cars. The On-Board Vapour Recovery System is also included in the North American specification.

North American Fuel System



Rest of the World Fuel System



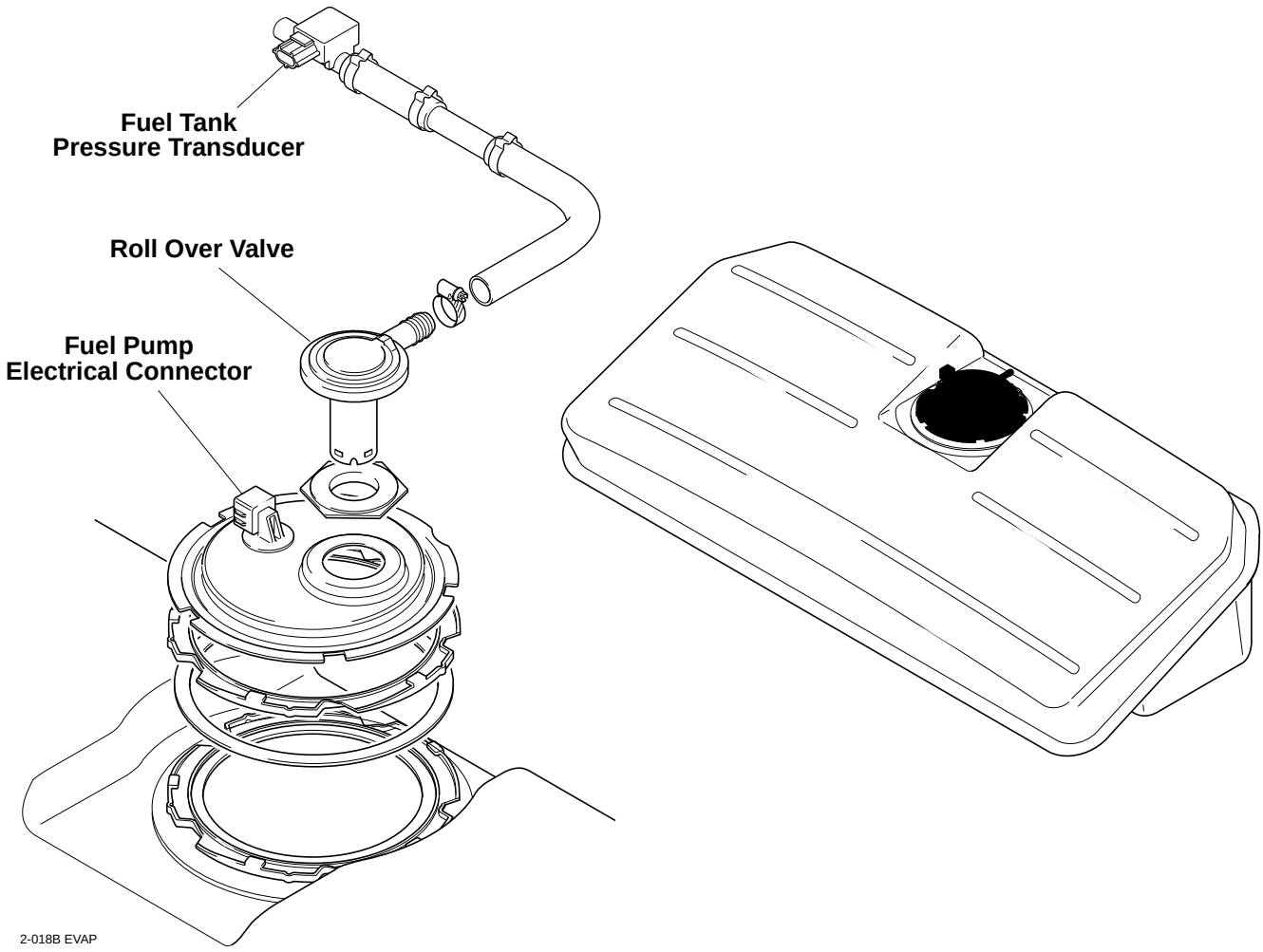
Fuel Tank

The fuel tank is fitted with a single filler neck and either a roll over valve (ROW Spec) or two vent valves (US Spec). A fuel tank pressure transducer is fitted in the fuel tank vent lines.

Fuel Tank Fittings - ROW Specification

Pressure Transducer - This sensor measures fuel tank pressure and feeds a signal back to the engine management Powertrain Control Module (PCM).

Roll Over Valve (ROW Spec) - This valve is connected to the evaporative loss carbon canisters and permits a free flow of vapour through the canisters to atmosphere under normal run or park conditions. If the vehicle is inverted in an accident, the roll over valve closes to prevent fuel leakage.



Fuel Tank Fittings - US Specification

Pressure Transducer - This sensor measures fuel tank pressure and feeds a signal back to the engine management PCM.

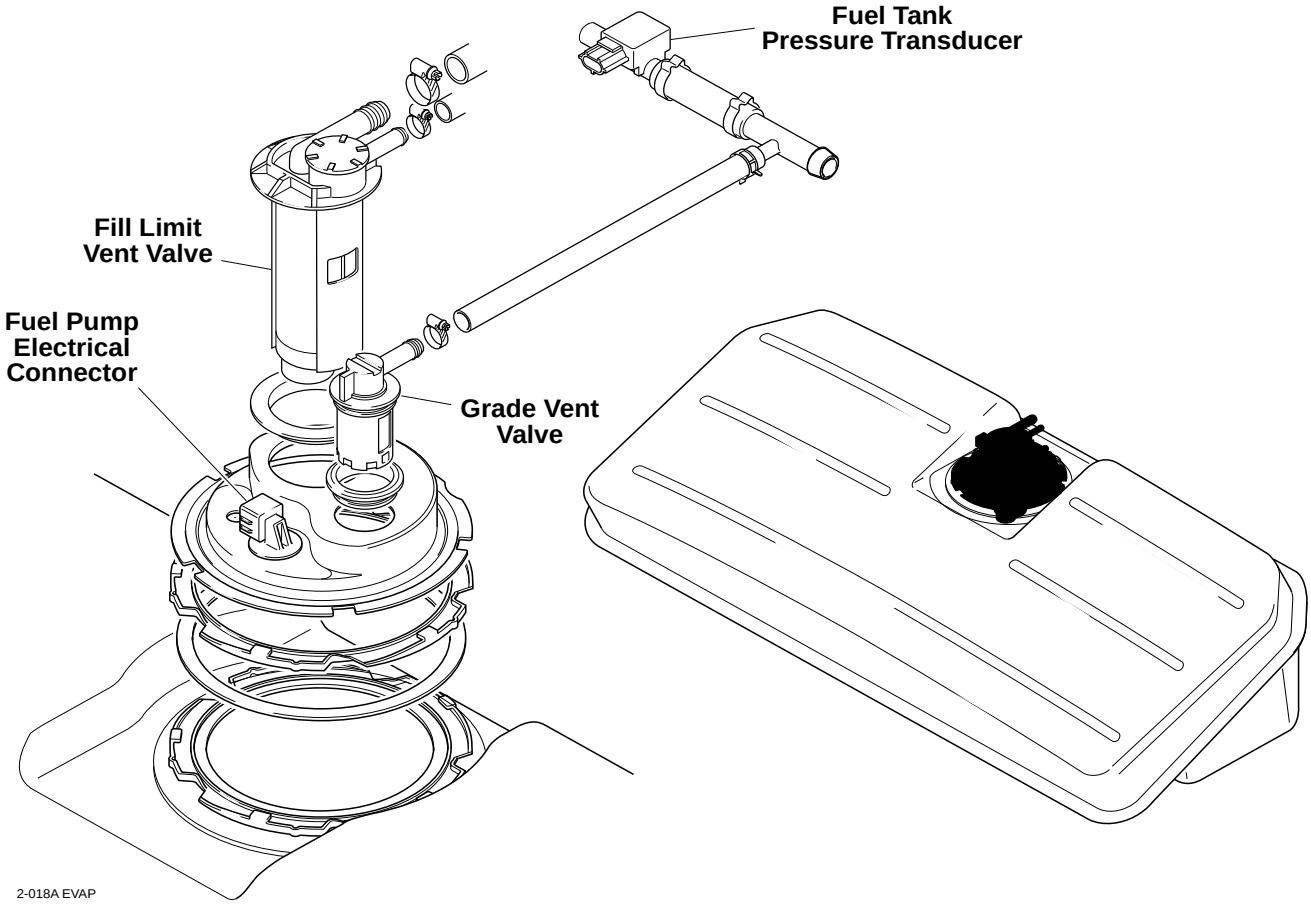
Fill Limit Vent Valve (FLVV) - This valve contains a float which rises to cut off the path for displaced air when the fuel level rises towards maximum during fuel filling. This causes a pressure build up in the tank which triggers the cutoff valve in the fuel delivery nozzle. This prevents overfilling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

The FLVV also includes an over pressure relief valve to vent any excess fuel tank pressure through the carbon canisters even when the FLVV is closed.

The FLVV is roll over protected. In a roll over condition, fuel vapour is allowed to pass to the evaporative loss system but will not allow liquid fuel to pass, preventing fuel leakage.

Grade Vent Valve

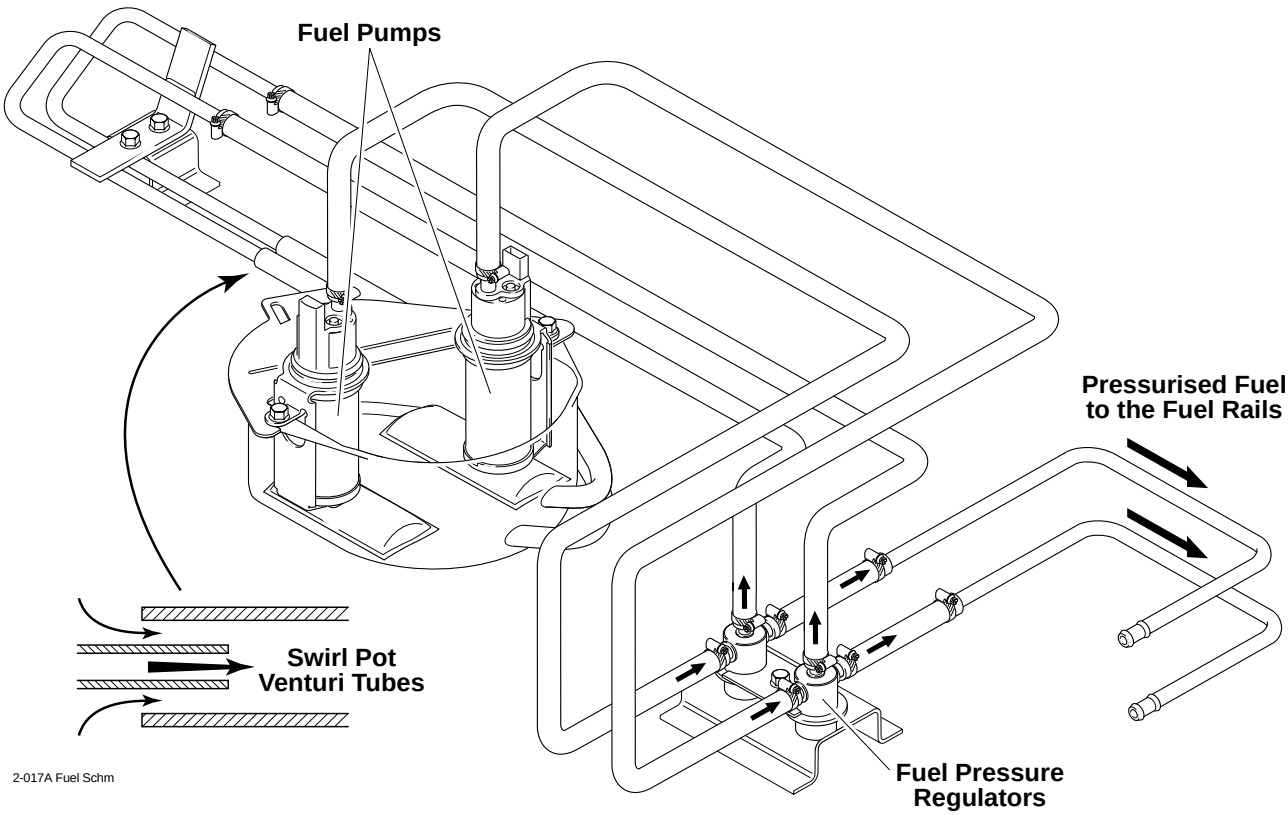
This valve is designed to vent the fuel tank under normal pressure conditions. The valve vents over the range of angles encountered during normal vehicle operation. The grade valve will close under 'roll-over' conditions, preventing fuel leakage if the vehicle is inverted in an accident.



Fuel Pumps

The two fuel pumps are immersed in a swirl pot in the base of the fuel tank. During normal running, pressurised fuel from the fuel pumps passes through two in-tank fuel pressure regulators. The pressure regulators deliver fuel at 70 psi via two fuel feed lines to the fuel filters in the front left wheel arch. Filtered fuel then passes via two additional pressure regulators to the fuel rails on the engine, delivering fuel at 65psi to the fuel rail.

Excess fuel exits from the in-tank regulators and is 'squirted' back into the swirl pot via two venturi tubes immersed in the base of the tank. This draws additional fuel into the swirl pot to keep the pump inlets submerged even when the tank fuel level approaches minimum, under severe dynamic conditions.



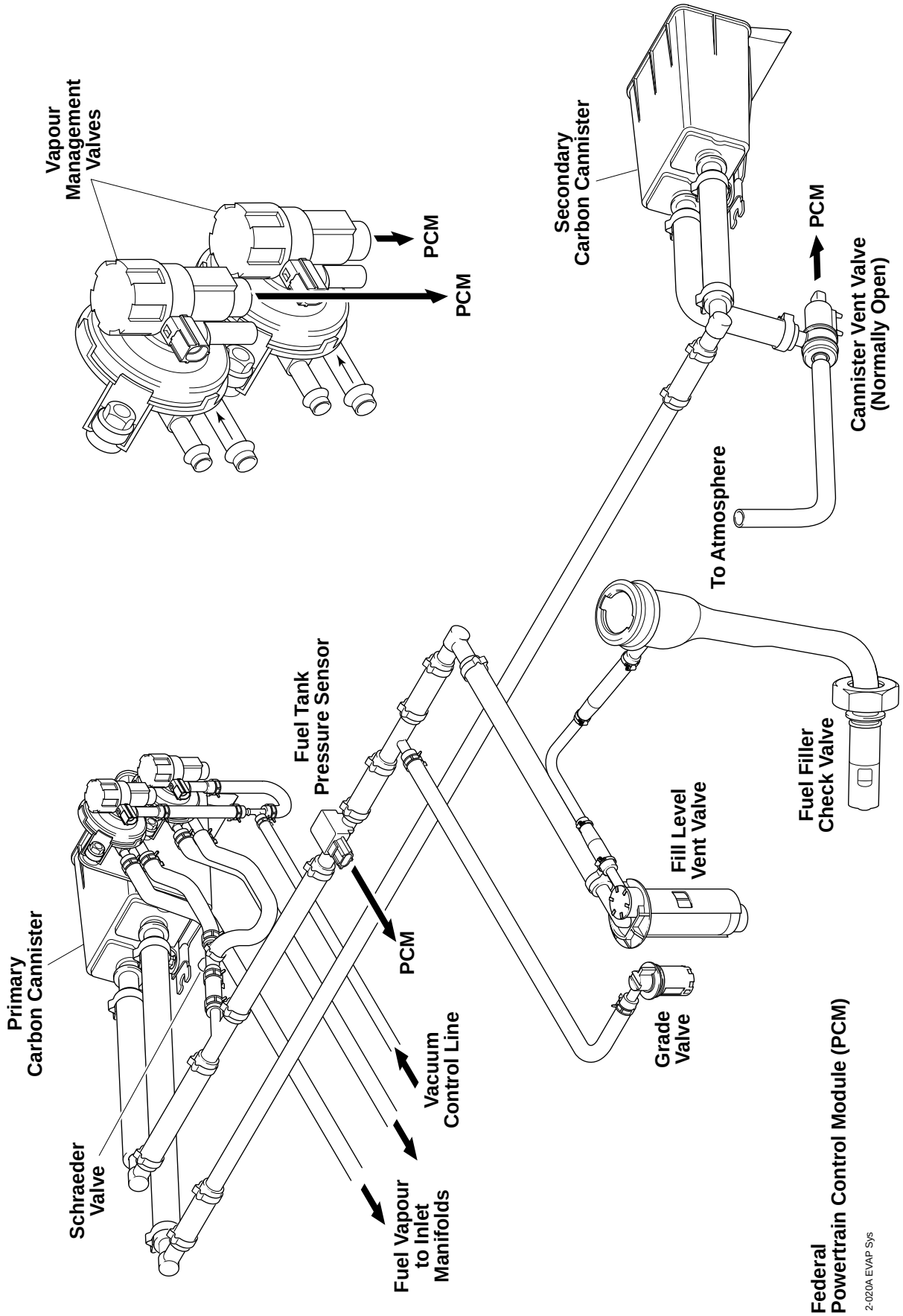
Evaporative Loss System

Hydrocarbons displaced from the fuel tank in fuel vapour, are absorbed in two carbon canister filters. Absorbed Hydrocarbons are drawn into the engine and burned during normal engine running when the system is purged.

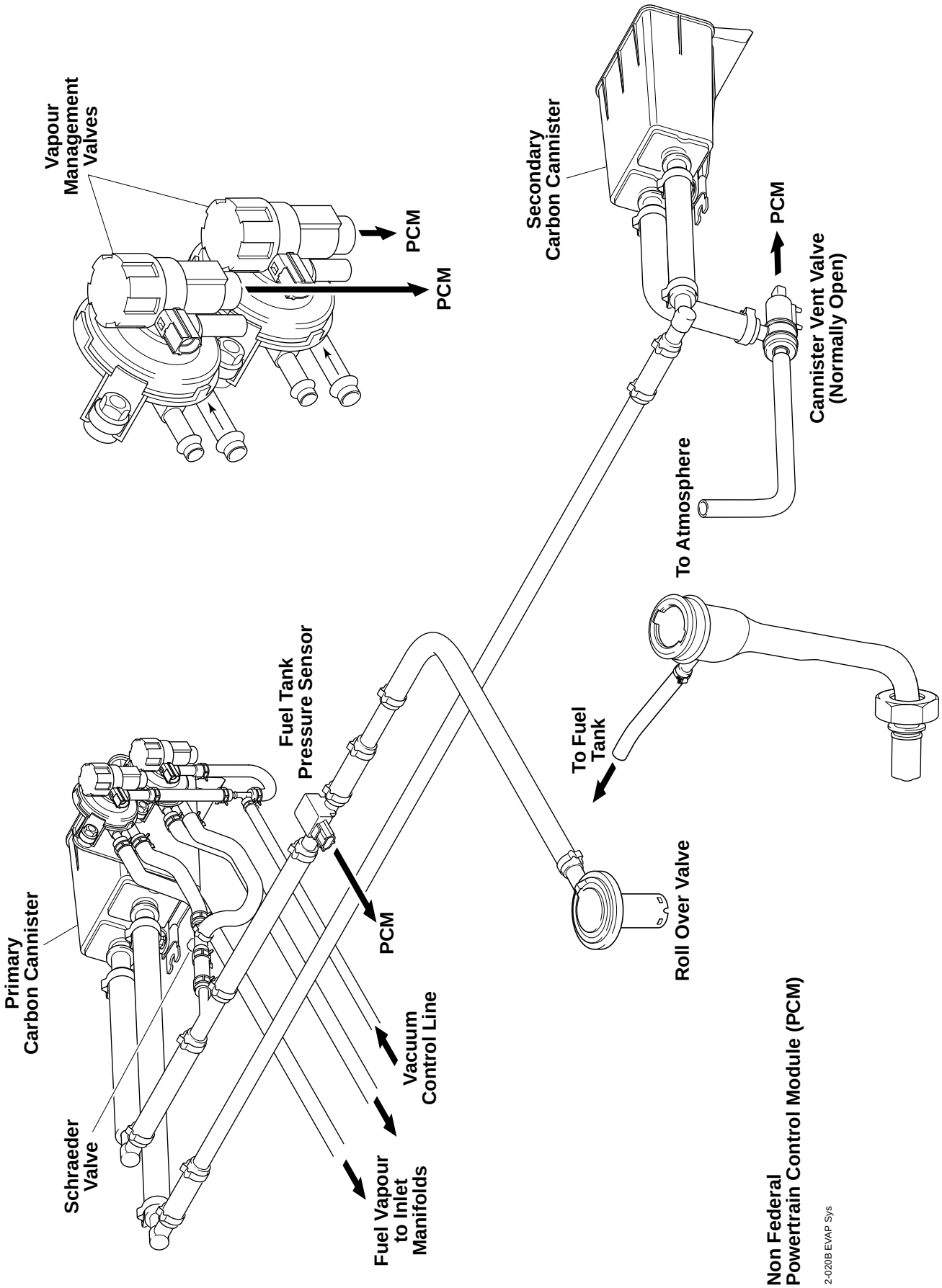
Displaced fuel vapour leaves the tank via the normally open fill level vent valve (US spec) (roll-over valve - ROW spec). It passes through the primary and then the secondary carbon canisters where Hydrocarbons are absorbed. Clean air leaves the system via the normally open canister vent valve. This valve is only closed during diagnostic pressure testing of the system.

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

Evaporative Loss System - Fuel Tank Vents and Control Valves - Federal Specification



Evaporative Loss System - Fuel Tank Vents and Control Valves - ROW Specification



On-Board Refuelling Vapour Recovery (US Specification)

This system is fitted to capture any fuel vapour in the large quantity of air displaced from the fuel tank during filling.

The fuel tank filler neck incorporates a spring loaded flap which acts as a check valve, not allowing fuel vapour to escape from the filler neck when the filler nozzle is withdrawn.

The internal contours of the filler neck are shaped so that fuel vapour which collects around the top of the filler neck during filling, is drawn down the filler neck and into the fuel tank.

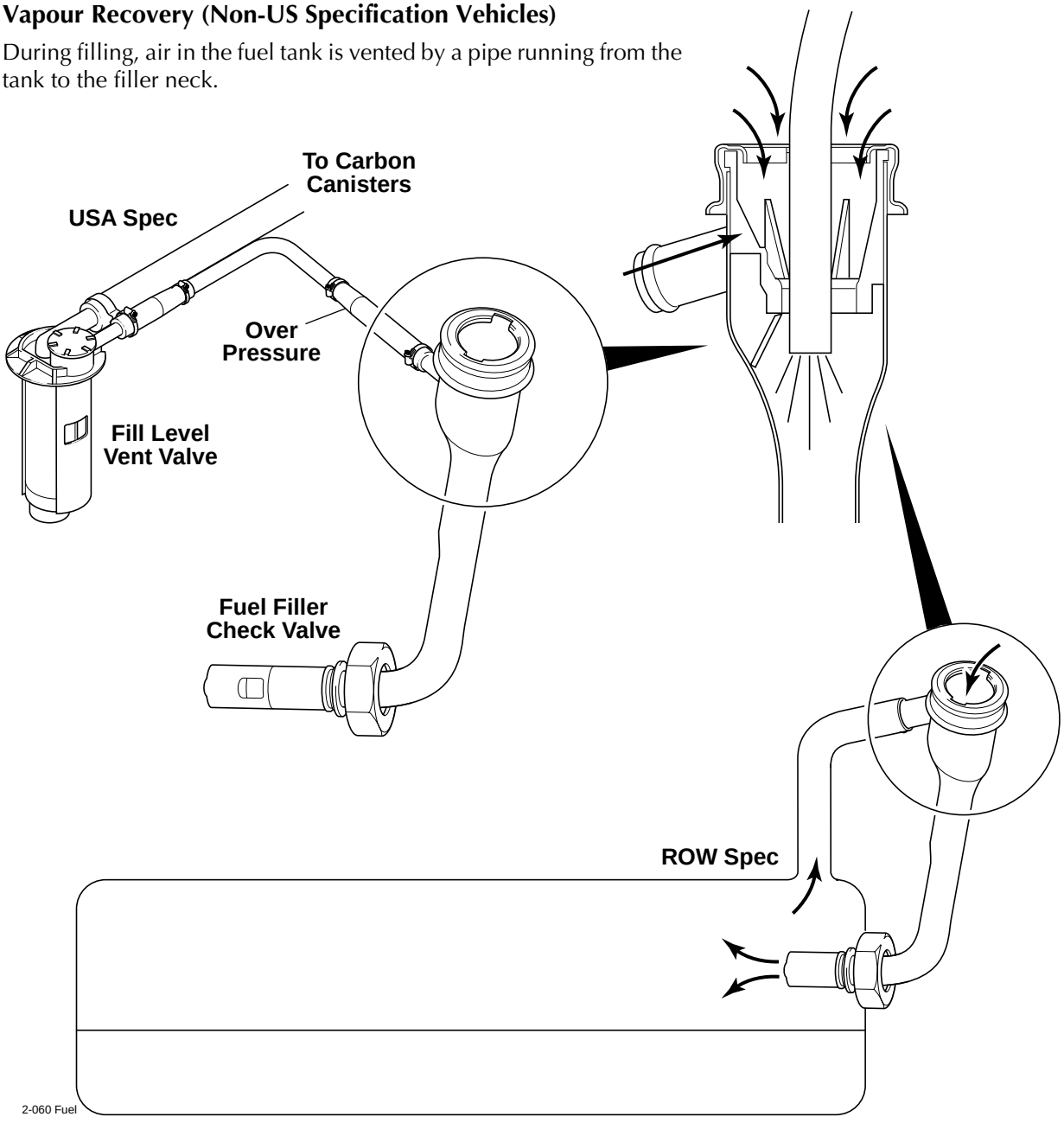
Vapour Recovery (US Specification Vehicles)

Air displaced from the fuel tank during filling will exit via the fill limit vent valve and be forced through the carbon canisters where any fuel vapour will be absorbed. No fuel vapour can escape to the atmosphere and environmental pollution is reduced. The carbon canisters will be purged during normal engine running.

When pressure in the tank exceeds a pre-set limit, i.e. when the tank is almost full, fuel vapour is vented by a pipe connected to the filler neck. Here fuel vapour where it is drawn back in to the tank by the contours of the filler neck.

Vapour Recovery (Non-US Specification Vehicles)

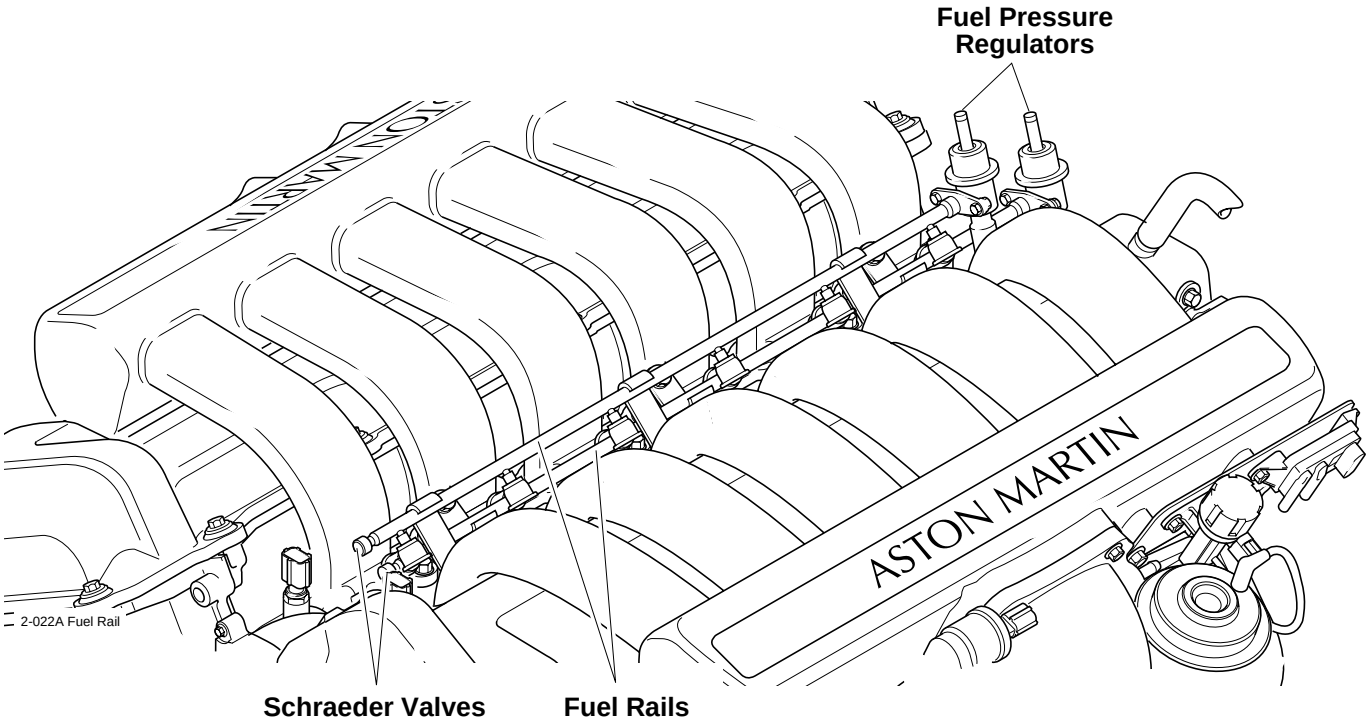
During filling, air in the fuel tank is vented by a pipe running from the tank to the filler neck.



Fuel Rails and Injectors

Fuel passes from the fuel filters, through the fuel pressure regulators and into the fuel rails. The fuel pressure regulators are designed to keep the fuel rail pressure at 65 psi above inlet manifold pressure. Each fuel rail 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 is used to connect to a pressure gauge adaptor when testing fuel pressure. This valve is also used to depressurise the fuel system.



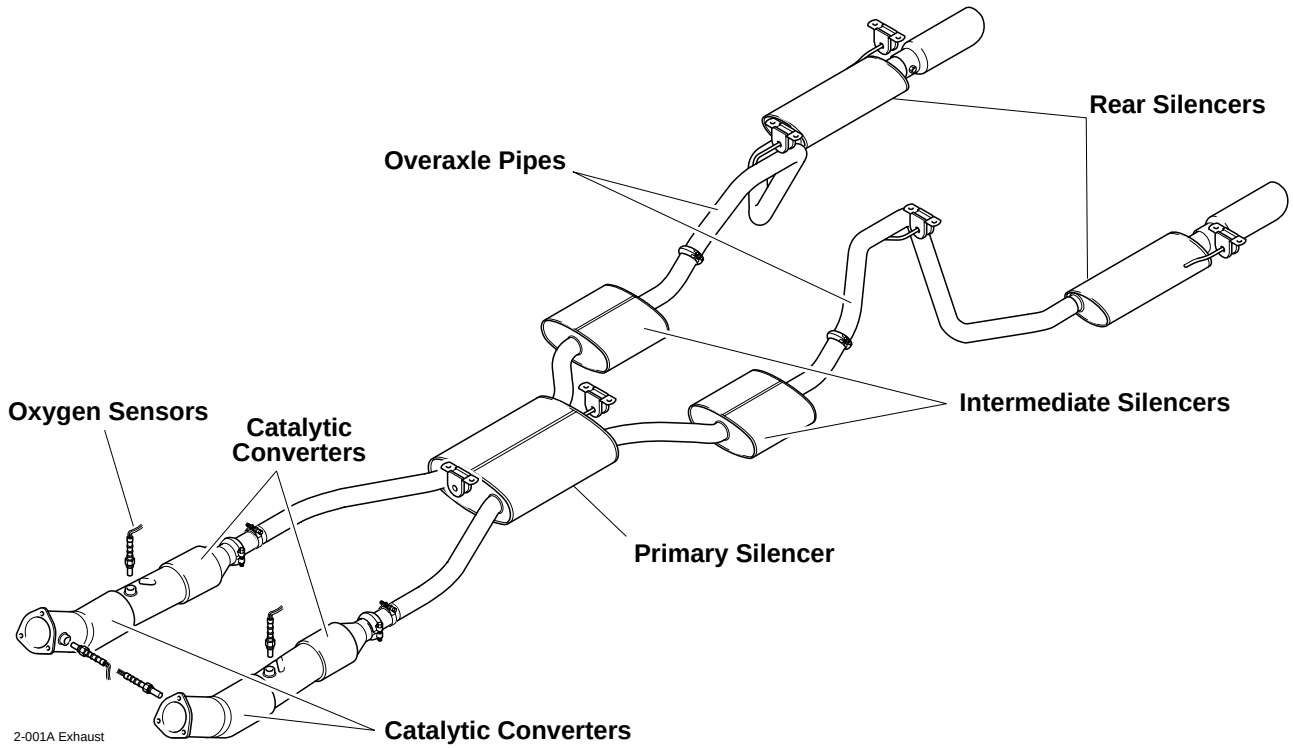
Exhaust System

Exhaust gases leave the exhaust ports and flow through two six branch manifolds, one at either side of the engine. They then pass the first pair of heated oxygen sensors. These are used in the control of fuelling levels during 'closed loop' operation of the engine management system.

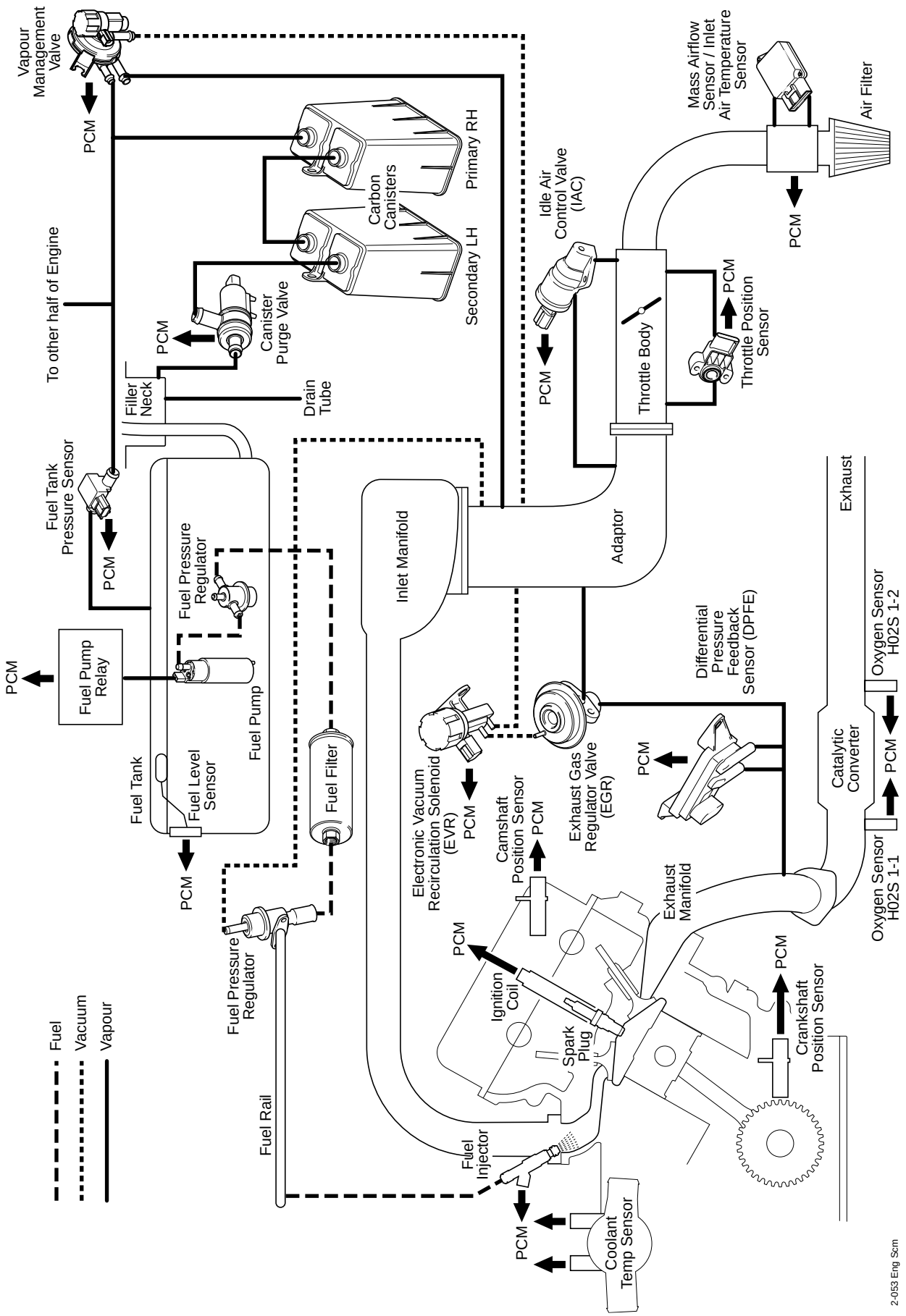
Gases then pass through the catalytic converters where hydrocarbon and carbon monoxide content is reduced to acceptable levels.

A second pair of oxygen sensors are fitted after the first part of the catalysts. This pair is used during catalyst efficiency measurements to ensure the continued elimination of harmful gasses in the exhaust.

Gases then pass through a series of three stages of silencer to the exhaust tail pipes.



The Engine Management System



The Engine Management System - Description of Components

Powertrain Control Module (PCM) - Primary and Secondary

The engine management system is controlled by the Powertrain Control Modules (PCM), which receives signals from the sensors, compares them to the required standards and then modifies the fuel and ignition settings to maintain an optimum, fuel and air mixture under all conditions. Sensor information is supplied to the Control Module Inputs, and control commands are issued through the Control Module Outputs. The PCMs are located in the right footwell, behind a carpeted cover.

The Mass Air Flow Sensor (MAF)

The Mass Air Flow Sensors (MAF), measure the quantity of air drawn into the engine and inputs to the PCM.

The Air Temperature Sensor (IAT)

The two Inlet Air Temperature Sensors (IATs), are located inside each mass airflow meter and measure the temperature of the air entering of the engine and input to the PCM.

The Idle Air Control Valve (IAC)

The Idle Air Control Valves (IACs), responding to PCM output signals, and in conjunction with ignition timing, control engine idle speed.

The Engine Coolant Temperature Sensors (ECT)

The Engine Coolant Temperature Sensor (ECT) is mounted on the water crossover and monitors the engine coolant temperature and inputs to the PCM.

The Fuel Pumps

The Fuel Pumps, situated in the fuel tank, supply fuel to the fuel injectors. The Fuel Pressure Regulators, in the Fuel Tank and on the rear of the Fuel Rails, control the fuel pressure at the Fuel Injectors.

Fuel Injectors

The twelve fuel injectors are driven by the PCMs 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 constant 65psi fuel pressure at each injector.

Ignition Coils

Ignition is by Spark Plugs supplied with HT voltage from the Ignition Coil mounted on each plug driven by the PCM. The timing of ignition is varied by the PCM.

Catalytic Convertor
Heated Oxygen Sensors (H02S)

The exhaust gases, after passing through the exhaust manifolds, enter the Catalytic Convertors, where the exhaust gas pollutants are reduced.

The air to fuel ratio is constantly checked by the two Upstream Heated Oxygen Sensors (H02S 1-1 on either bank), which are situated at the entrance of the catalysts. The catalyst efficiency is checked using two Downstream Heated Oxygen Sensors (H02S 1-2 on either bank). The sensors input to the PCM.

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

Throttle Position Sensor (TP)

Throttle position is detected by the Throttle Position Sensors (TP) mounted on each throttle body. These sensors input to the PCMs.

The Exhaust Gas Recirculation Valve (EGR)
The vacuum operated Exhaust Gas Recirculation Valves (EGR), when activated by the PCM and EGR Vacuum Regulator, allows exhaust gas to enter the intake air streams to dilute the oxygen content of the combustible fuel / air mixture, so lowering combustion temperatures and consequently NOx emissions.

Differential Pressure Feedback Sensor (DPFE)
The Differential Pressure Feedback Sensors (DPFE) measure pressure difference across restrictors in the EGR lines, measuring EGR flow. The setting of the EGR Valves can then be 'fine tuned' to give a more accurate control. The sensors input to the PCM.

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 Powertrain Control Modules.

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 PCMs

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

The Fuel Tank - Evaporative Emission Canisters
Vapour displaced during filling, expansion, agitation and heating, is vented to atmosphere through the Evaporative Emission Canisters. The carbon elements in the canisters absorb any. Hydrocarbons in the displaced fuel vapour. As fuel is withdrawn from the tank, air is drawn in through the canisters to avoid creating a vacuum in the fuel tank.

When the fuel laden air in the tank expands at higher temperatures, pressure is relieved by allowing the displaced air to vent through the canisters which retain the suspended fuel vapour.

The Vapour Management Valves

The Vapour Management Valves, are controlled by the PCMs and open the canister lines to inlet manifold vacuum. When the vapour management valves open, air can flow through the carbon canisters absorbing the Hydrocarbons, carrying fuel vapour into the inlet manifolds where it is burned in the engine.

To compensate for an overall increase in fuelling, the length of time the fuel injectors are open is decreased. The PCM makes the necessary fuelling corrections by responding to the air/fuel ratio data received from the pre catalyst heated oxygen sensor.

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 CO_2 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.***

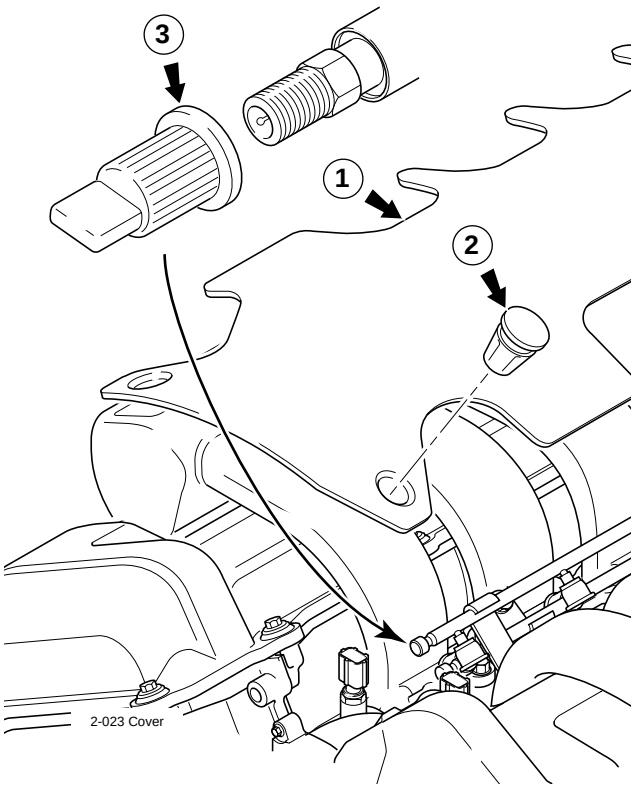
10. ***Depressurise the fuel system before disconnecting pipework.***

2.0.01 Depressurise the Fuel System

WARNING: The fuel system is pressurised to 4.5 bar and must be safely depressurised before any work is performed. 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.

Fuel System - Depressurising

1. Read and observe the fuel system safety precautions at the start of this section.
2. Disconnect the battery. See Instructions for Battery Disconnection in Section 6 - Electrics. Some vehicle systems require attention after battery disconnection.
3. Access the fuel rail Schraeder valves
   1 Remove the fuel rail cover.
   2 Retain the front supports on the cam cover stud bolts
   3 Remove the caps from the Schraeder valves at the front end of both fuel rails.



4. Place some absorbent cloth under the front end of both fuel rails.
5. Press the centre pin on each Schraeder valve in turn until to release the fuel pressure.
6. Remove and dispose of the contaminated cloth safely.
7. Replace and secure the caps on both Schraeder valves.
8. 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 dissipated.

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 contamination. Remove any fuel contaminated material, open fuel containers, waste fuel. Fully ventilate the vehicle and work area to remove all traces of fuel fumes.

1. Check the integrity of the fuel system and remove any fuel or contaminated material from the work area.
2. Replace the fuel pump relays. Reconnect the battery and replace the boot floor.
3. Switch on the ignition and immediately check for fuel leaks as the system repressurises.

   If necessary, depressurise the system and repair any leaks. 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.

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

2.7.02.5 Fuel System - Pressure Test

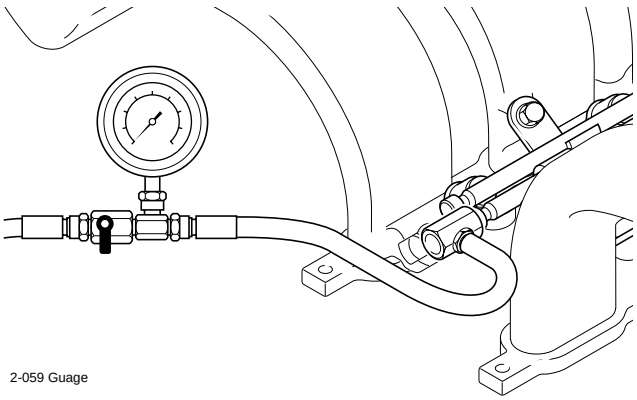
Data

Pump pressure - 70 psi (4.5 bar)
Fuel pressure - 65 psi (4 bar)

Procedure - Fuel Pressure Test

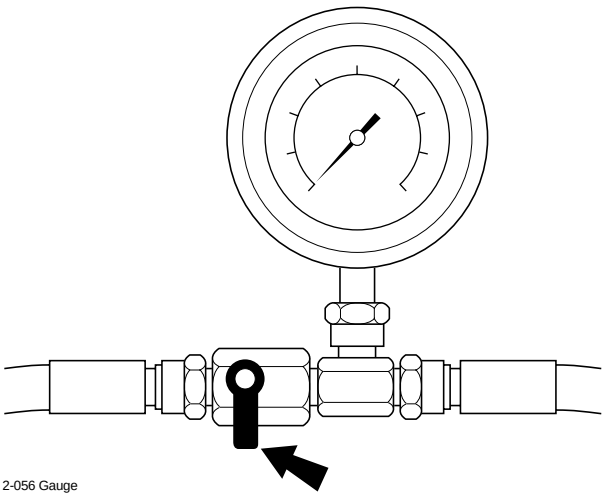
WARNING: Fire Risk - Depressurise the fuel system before disconnecting pipework. Use a pan or absorbent cloth to catch fuel spills which may occur due to residual pressure. Clean up spillages immediately.

1. Depressurise the fuel system 2.0.01.
2. Remove one Schraeder valve cap and connect the adaptor as shown below.



2-059 Guage

3. Make sure the tap of the pressure gauge is turned down (closed) before proceeding.



2-056 Gauge

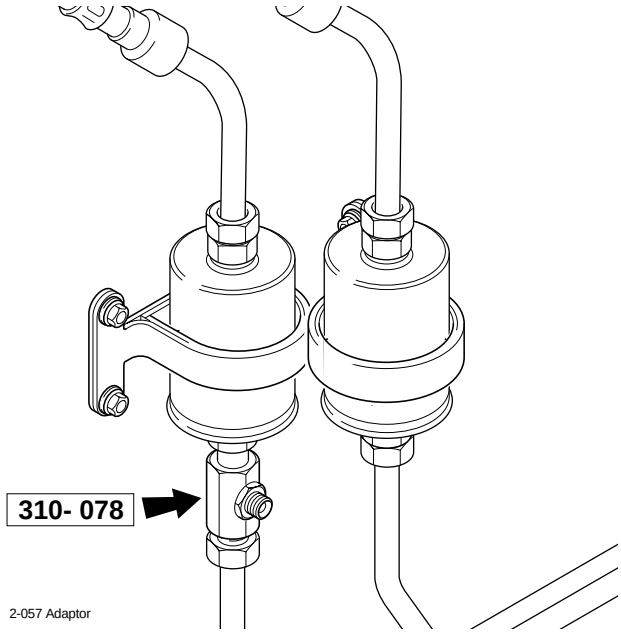
4. Connect the pressure gauge.
5. Reprime the fuel system (2.0.01).
6. With the gear selector in Park or Neutral and the handbrake applied, start the engine and note the fuel pressure. Switch off the engine.
7. ***WARNING: Depressurise the fuel system (2.0.01) before disconnecting the gauge from the adaptor.***

   Place an absorbent cloth beneath the fuel rail. Disconnect the gauge and remove the adaptor.
8. Refit the Schraeder valve cap.
9. Do not reprime the fuel system at this stage. Leave depressurised and test the other fuel rail.
10. Start the engine and check for fuel leaks.
11. Repeat the procedure for the other fuel rail.
12. If the fuel pressures recorded in this procedure vary from the specified fuel pressure, carry out the following fuel pump pressure test.

Procedure - Pump Pressure Test

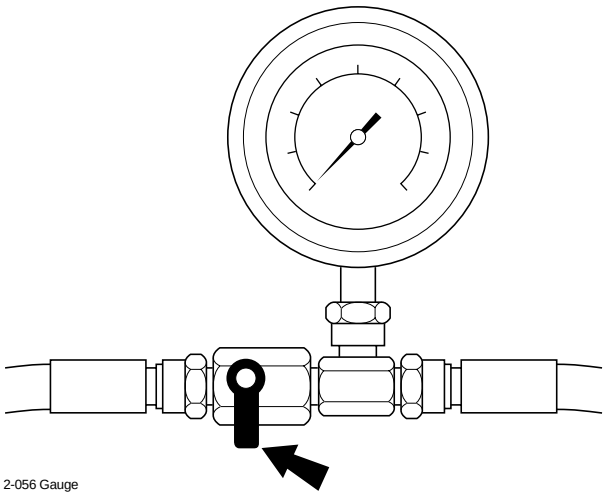
WARNING: Fire Risk - Depressurise the fuel system before disconnecting pipework. Use a pan or absorbent cloth to catch fuel spills which may occur due to residual pressure. Clean up spillages immediately.

1. Depressurise the fuel system 2.0.01.
2. Raise the vehicle and remove the front left wheel.
3. Remove the front left wheel arch liner (see section 7) to access the fuel filters.
4. Place a pan beneath the fuel filters and disconnect the underfloor pipe to one of the filters. Displace the underfloor pipe from the clips to allow the adaptor to be fitted.
5. Connect the adaptor 'in-line' between the fuel pipe and filter as shown below.



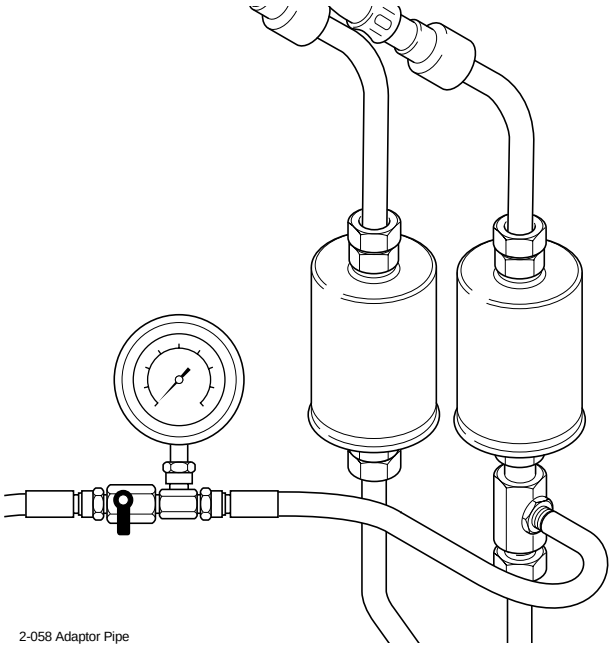
2-057 Adaptor

6. Make sure the pressure gauge tap is turned down (closed) before proceeding.



2-056 Gauge

7. Connect the pressure gauge.



2-058 Adaptor Pipe

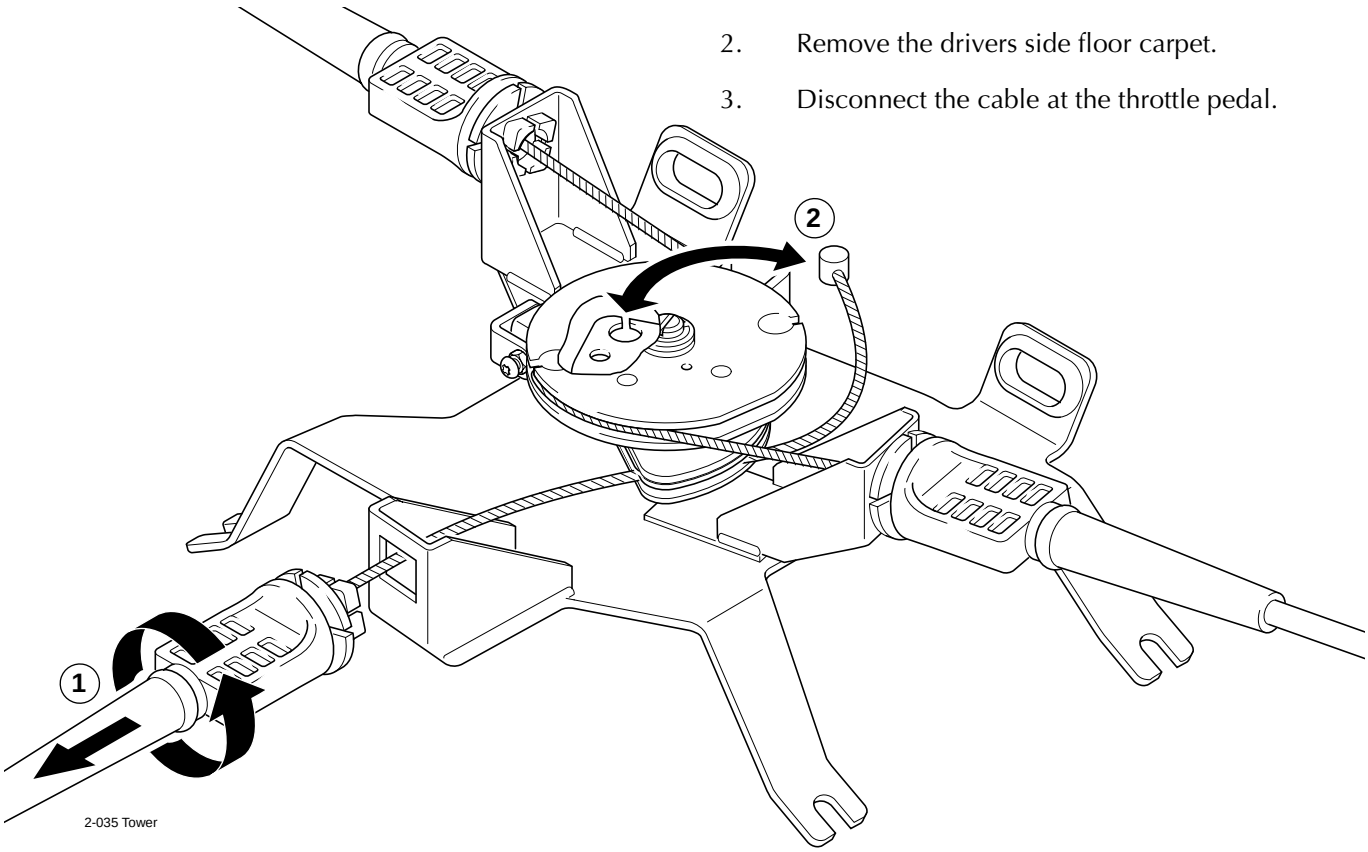
8. Reprime the fuel system (2.0.01).
9. With the gear selector in Park or Neutral and the handbrake applied, start the engine and note the pump pressure. Switch off the engine.
10. ***WARNING: Depressurise the fuel system (2.0.01) before disconnecting the gauge from the adaptor.***

    Place a pan beneath the fuel filter. Disconnect the gauge and remove the adaptor.
11. Reconnect the under floor pipe and the filter. Make sure the underfloor pipe is secured in the clips.
12. Do not reprime the fuel system at this stage. Leave the system depressurised so that the other fuel line can be tested.
13. Repeat the procedure for the other fuel filter.
14. Reprime the system. Start the engine and check for fuel leaks.
15. Refit the wheel arch liner and the roadwheel.

2.1.01 Throttle Cables Removal

Throttle Pedal Cable - pedal to tower

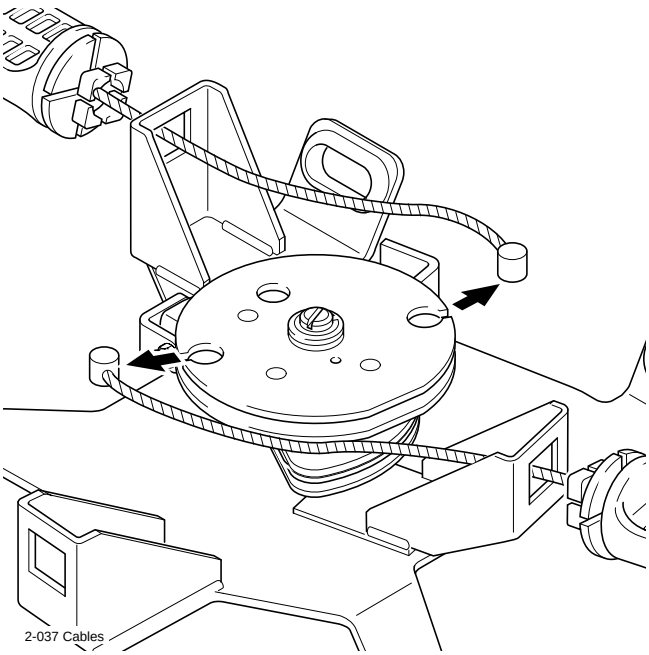
1. Disconnect the pedal cable (1) and (2) from the cable tower.
2. Remove the drivers side floor carpet.
3. Disconnect the cable at the throttle pedal.



2-035 Tower

Throttle Cables - tower to throttle bodies

1. Disconnect the cables from the throttle bodies.
2. Remove the cable from the throttle cable tower.


2-037 Cables

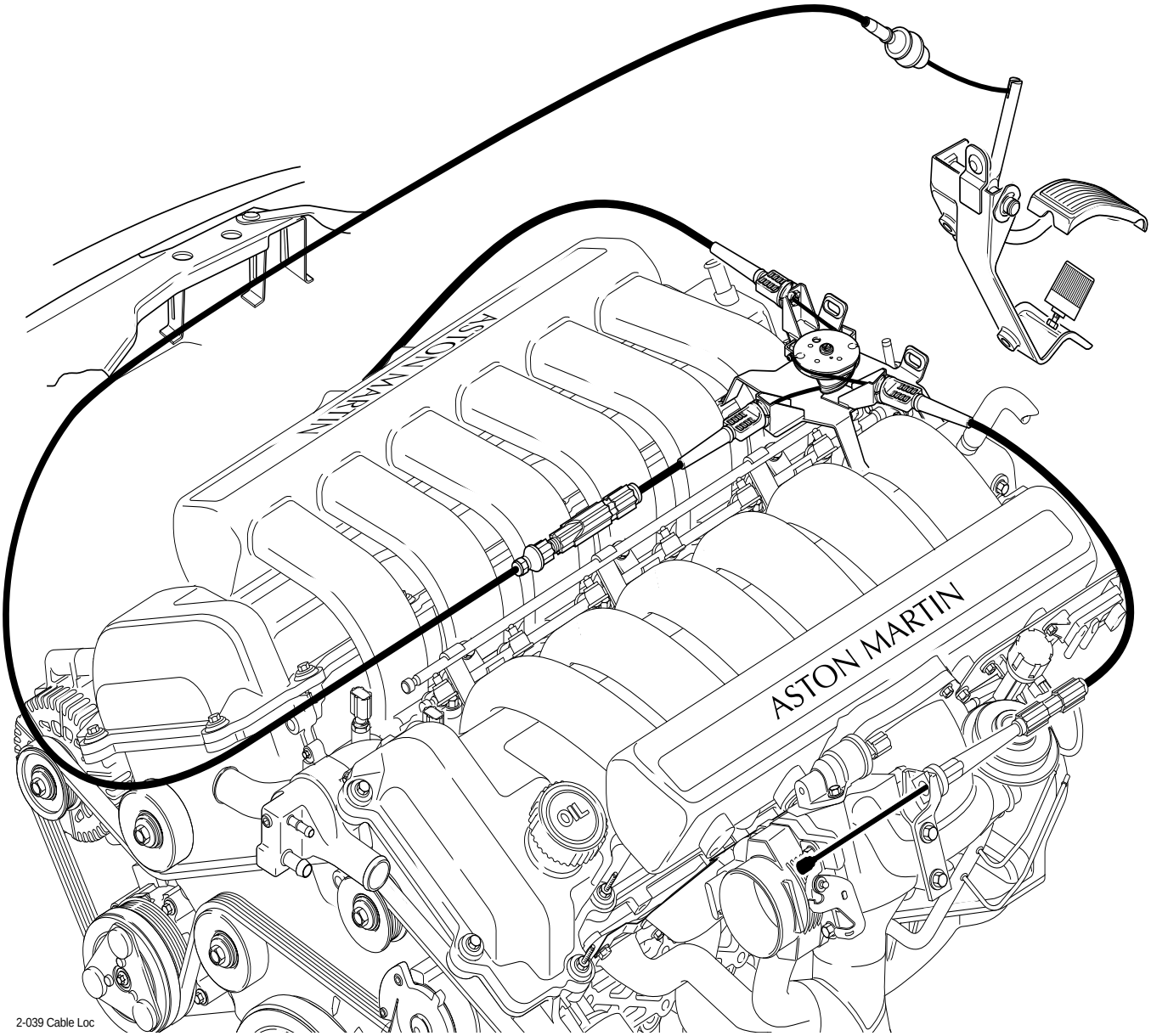
Throttle Potentiometer Data

Before connecting the throttle cables, connect the PDU to the lower diagnostic socket. Note the throttle potentiometer readings for closed and wide open throttle for both throttle bodies.

Installation

WARNING: Route the passenger side throttle cable as detailed below to ensure correct throttle operation.

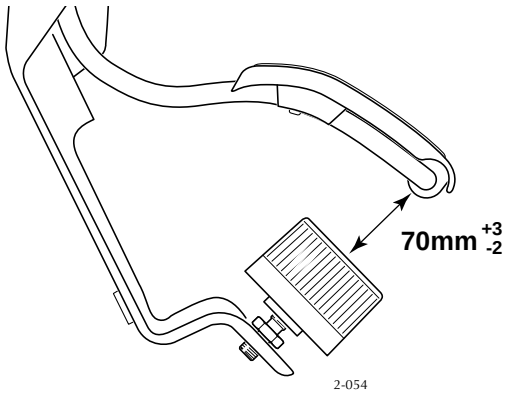
1. To install, reverse of the removal procedure. Route the cables as shown.



2-039 Cable Loc

Cable Setup

1. Before proceeding with the throttle setup procedure, check and adjust the accelerator pedal to achieve a nominal pedal travel of 70mm (68 to 73mm). Use a measured block or gauge between the contact area of the pedal and the wide open throttle (or kickdown switch (not depressed).



2-054

2. Before fitting the throttle cables, use the PDU and note the throttle readings, for both throttle bodies, with the throttle arms (**1**) fully against the throttle stops (idle) and at wide open position.

3. Fit and pre-tension all cables. Fit the pedal cable first. To pretension the cables:

   1 Slide back the adjuster locking sleeve (**2**)

   2 Rotate the adjuster (**3**) to remove all slack from the cable.

   3 Slide the locking sleeve forward.

4. Using the PDU, check that both throttles are fully closed, i.e. Throttle potentiometer at the minimum reading noted previously.

   Adjust the throttle cables until the PDU indicates that the throttles are just open. A gap of 0.1 - 0.2 mm between the idle stop and adjuster screw (**4**) should be achieved.

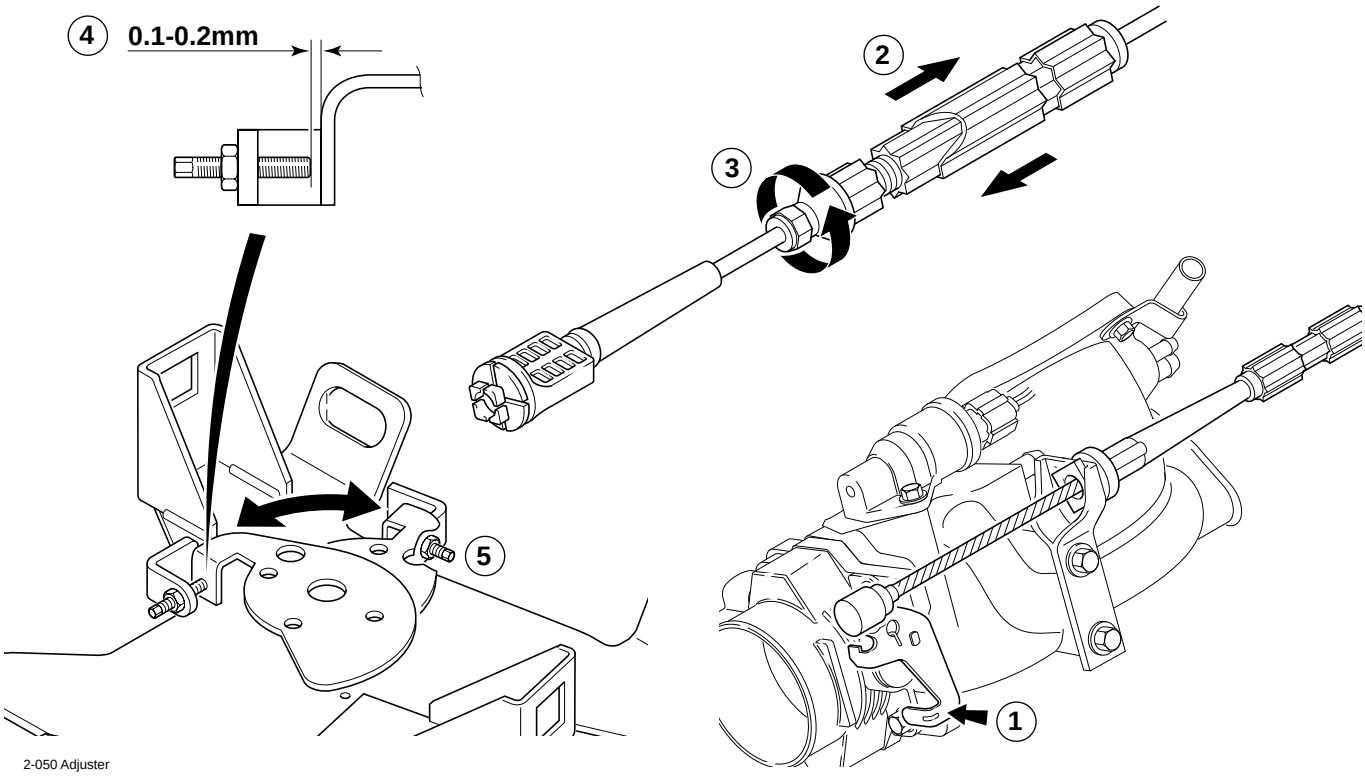
   Turn the adjusters back one notch (loosen the cable) and lock in position.

5. Recheck the pedal cable tension and the gap at **4**.

6. Using the PDU depress the throttle pedal until it just contacts the pedal stop / kickdown switch. Check that both throttle are at the wide open position, i.e. throttle potentiometers are at the maximum reading noted previously (within five throttle counts).

7. Adjust the tower wide open throttle stop screw (**5**) to give a gap of 0.1 to 0.2mm.

8. Repeat steps 5 to 7 four times and check that the idle and wide open throttle readings remain within the setup limits.

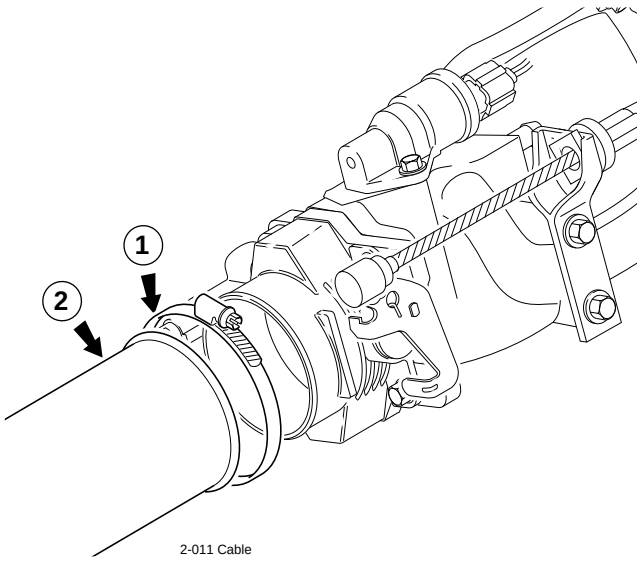


2-050 Adjuster

2.1.03 Throttle Body and Adaptor

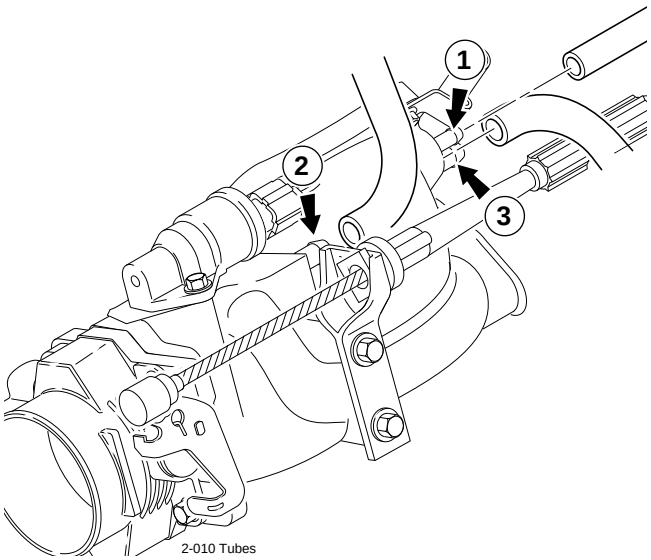
Removal

1. Disconnect the air trunking at the throttle body.
   1 Release the jubilee clip
   2 Detach the trunking from the throttle body



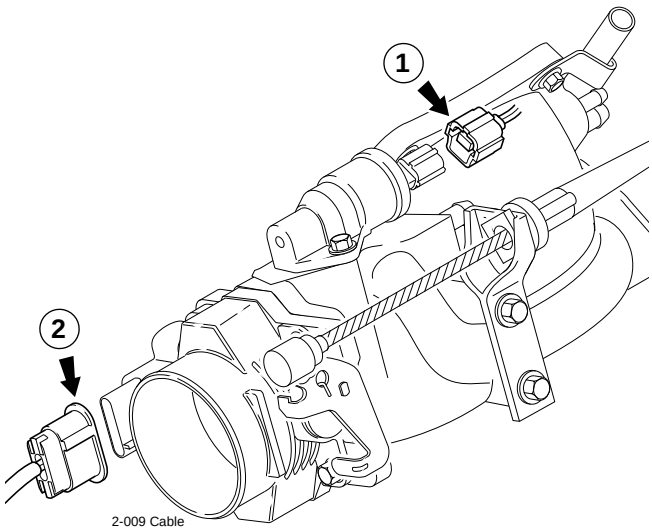
2-011 Cable

2. Release the vacuum hoses from the throttle body adaptor.
   1 Disconnect the fuel pressure regulator vacuum line
   2 Disconnect the crankcase ventilation line
   3 Disconnect the brake servo/AC vacuum line



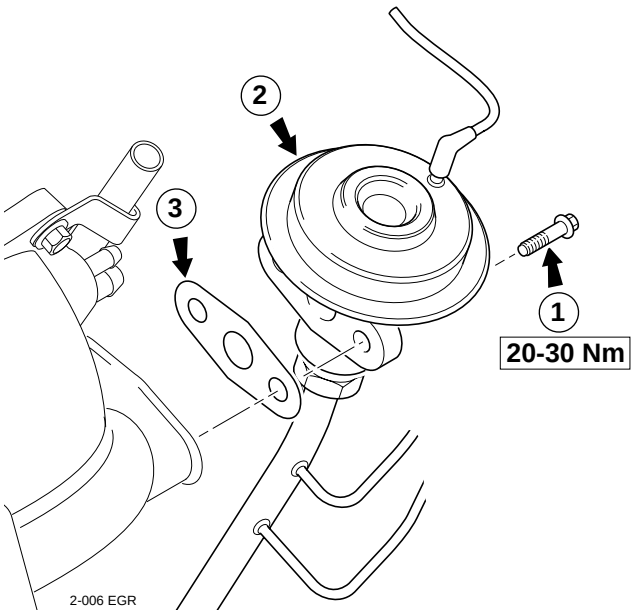
2-010 Tubes

3. Disconnect the electrical connectors from the throttle body.
   1 Disconnect the IAC valve connector
   2 Disconnect the throttle potentiometer connector



2-009 Cable

4. Release the EGR valve.
   1 Remove two M8 bolts
   2 Separate the EGR valve from the throttle body
   3 Remove and discard the gasket

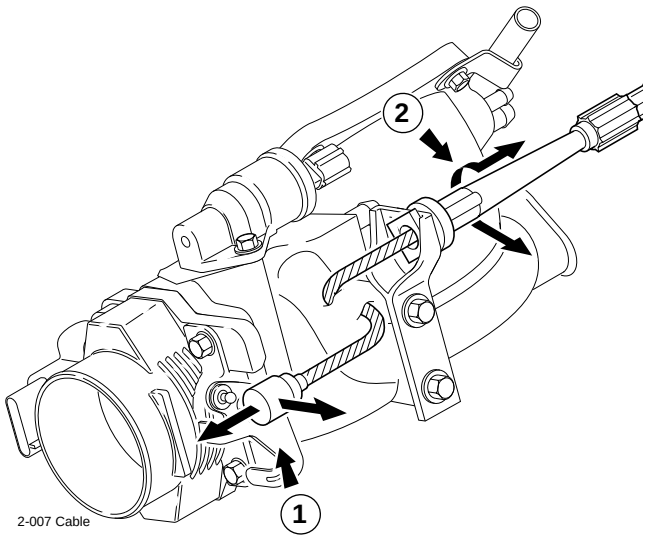


2-006 EGR

5. Release the throttle cable from the throttle body and bracket.

   1 Slide off the locking clip and remove the cable end from the throttle arm

   2 Twist the outer cable and dislodge it from the support bracket



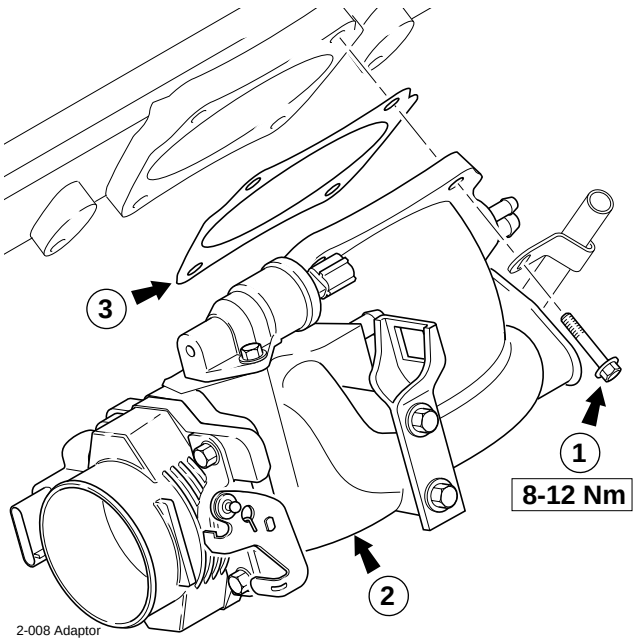
2-007 Cable

6. Remove four M6 bolts and remove the throttle assembly.

   1 Remove four M6 bolts

   2 Remove the throttle body and adaptor

   3 Remove and discard the gasket



2-008 Adaptor

Installation

1. Fit the assembly to the inlet manifold using a new gasket. Secure with four M6 bolts. The left upper rear bolt also secures the dipstick tube.

2. Refit the EGR valve using a new gasket. Secure with two M8 bolts.

3. Reconnect the idle air control valve.

4. Reconnect the vacuum hoses to the throttle body adaptor.

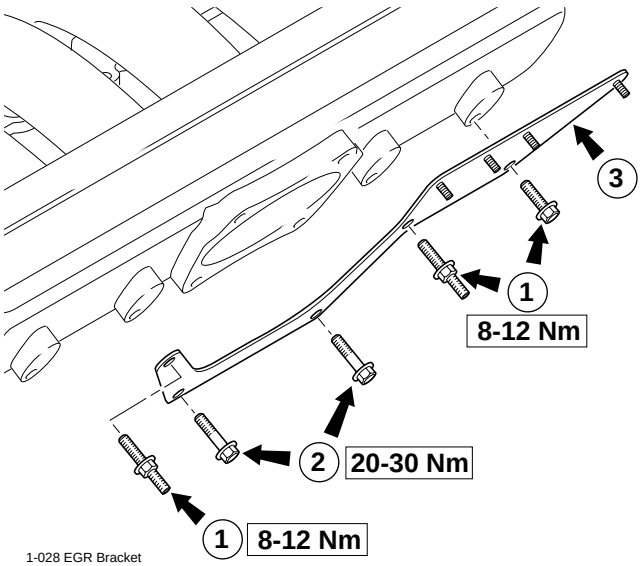
5. Refit and secure the inlet air trunking.

2.2.01 Inlet Manifold Removal

Removal

1. Release the EGR bracket

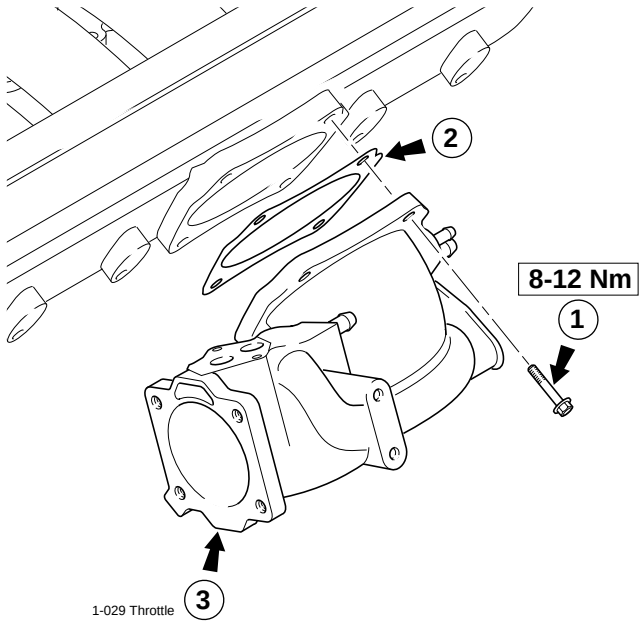
   1 Remove three bolts from the inlet manifold.
   2 Loosen two bolts from the cylinder head.
   3 Ease the EGR bracket away from the inlet manifold



1-028 EGR Bracket

2. Release the throttle body adaptor from the inlet manifold.

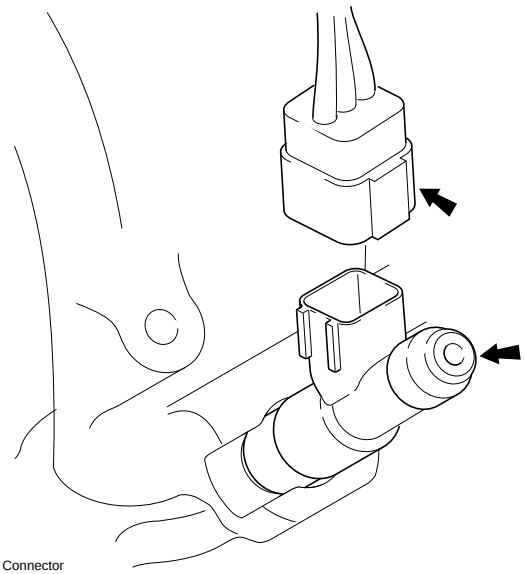
   1 Remove four M6 bolts from the throttle body adaptor
   2 Remove and discard the gasket
   3 Move the throttle body and adaptor clear of the inlet manifold



1-029 Throttle

3. Depressurise the fuel system (2.0.01).

4. Disconnect the engine harness from the fuel injectors.

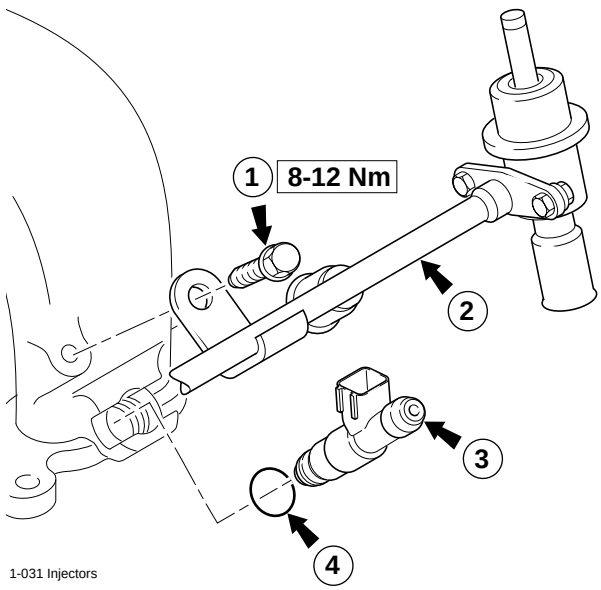


1-082 Connector

5. ***WARNING: Read and follow all fuel handling instructions given in the warnings on page 17.***

   Remove the fuel rail and injectors from the inlet manifold.

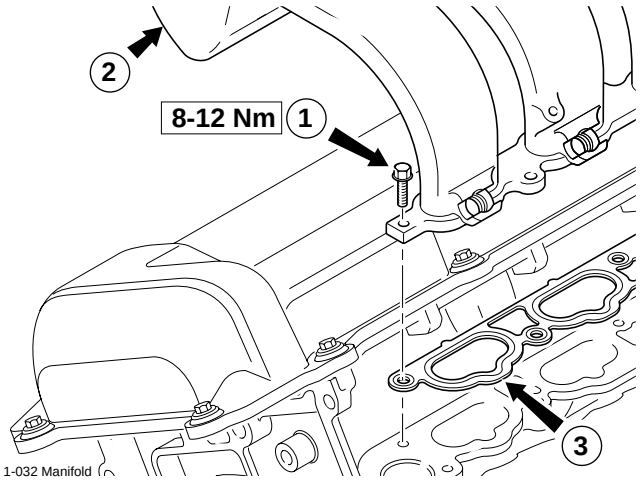
   1 Remove three M6 bolts from each fuel rail.
   2 Remove two bolts washers and nuts
   3 Lift off the fuel rail
   4 Lift out the fuel injectors
   5 Remove and discard the 'O' rings from each injector



1-031 Injectors

6. Remove the inlet manifold.

   1 Remove seven bolts from each manifold
   2 Lift off the manifolds
   3 Remove and discard the manifold gasket.



1-032 Manifold

7. ***Caution: Fit the inlet manifold cover (special tool 303-231) immediately to prevent the ingress of foreign material.***

Installation

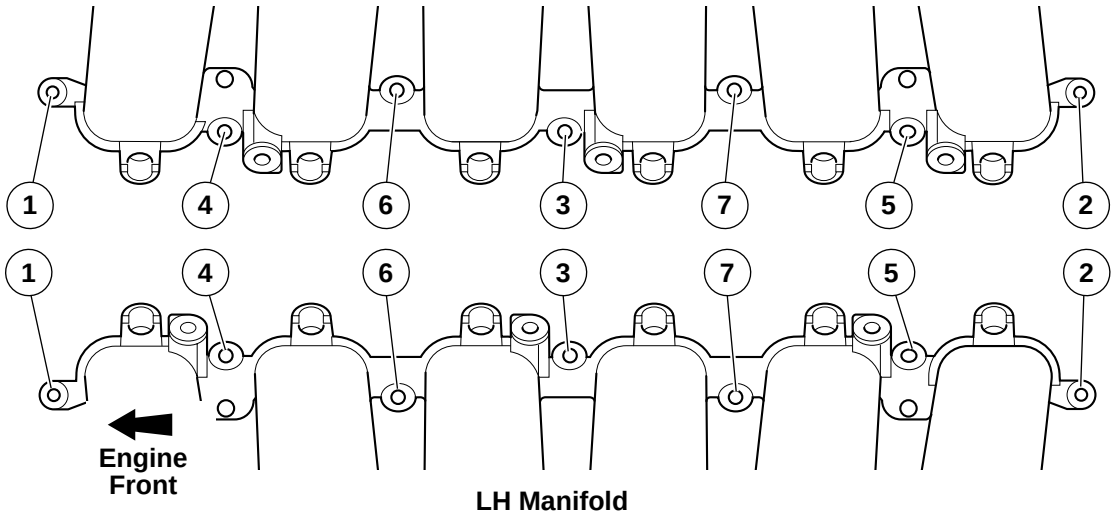
1. To install, reverse the removal procedure.

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

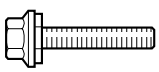
2. Tighten the manifold bolts in the sequence shown.

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

RH Manifold



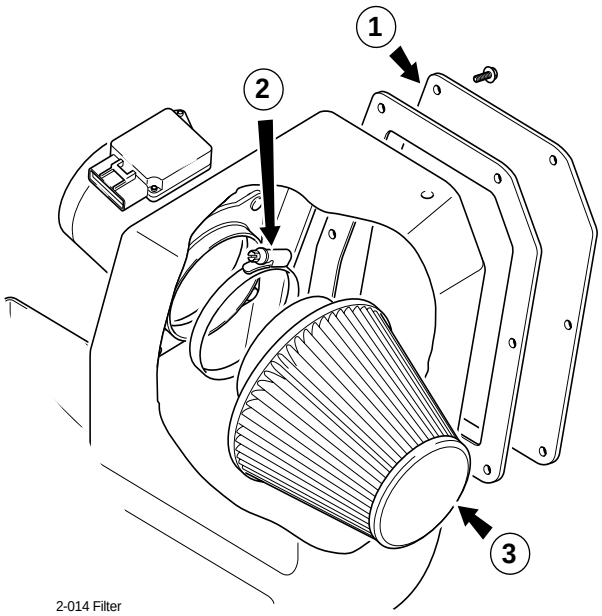
LH Manifold

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	

1-033 Manifold

2.2.04 Air Filters

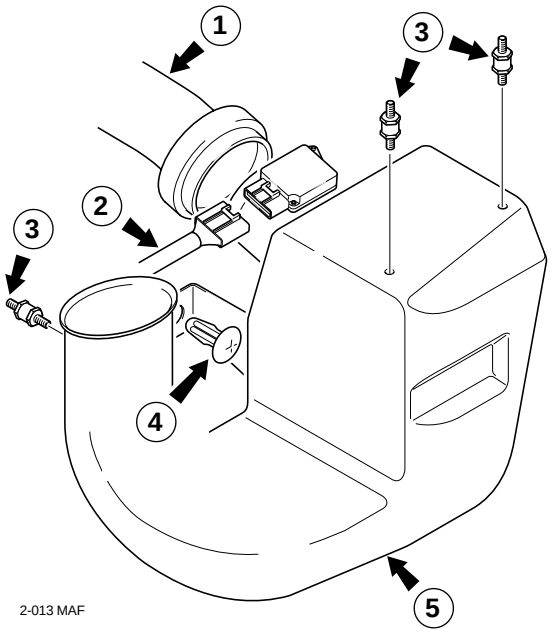
1. Remove the front wheels.
2. Remove the wheel arch liners (see Section 7).
3. Access and remove the air filters.
   1 Remove the filter box covers
   2 Release the filter clips
   3 Remove the filters



2-014 Filter

2.2.06 Mass Airflow Meter

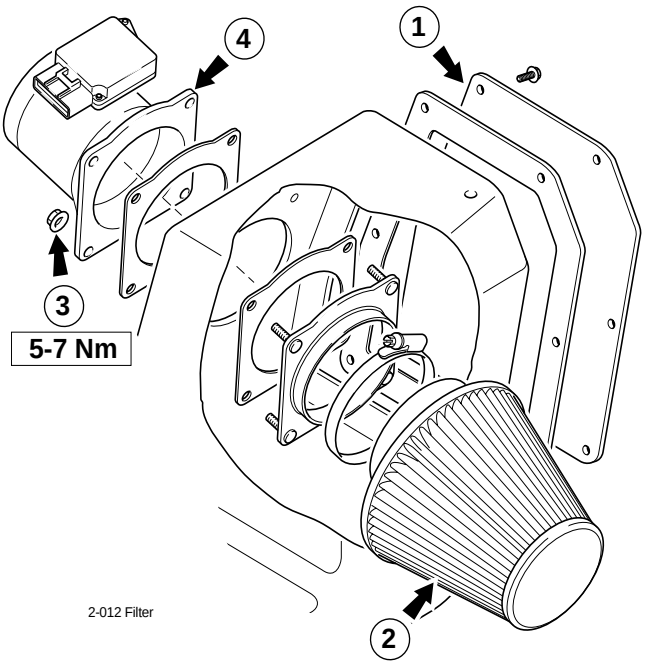
1. Remove the appropriate front wheel and wheel arch liner.
2. Remove the front undertray.
3. Remove the air filter box
   1 Release the air hose from the MAF sensor.
   2 Disconnect the harness connector to the MAF sensor.
   3 Release three flexible mounts
   4 Remove one bolt from the support bracket
   5 Remove the filter box.



2-013 MAF

4. Remove the filter and release the MAF sensor

   1 Remove the filter box cover
   2 Release the filter securing clip and withdraw the filter.
   3 Remove four nuts and remove the air filter mount
   4 Remove the MAF sensor from the filter box.



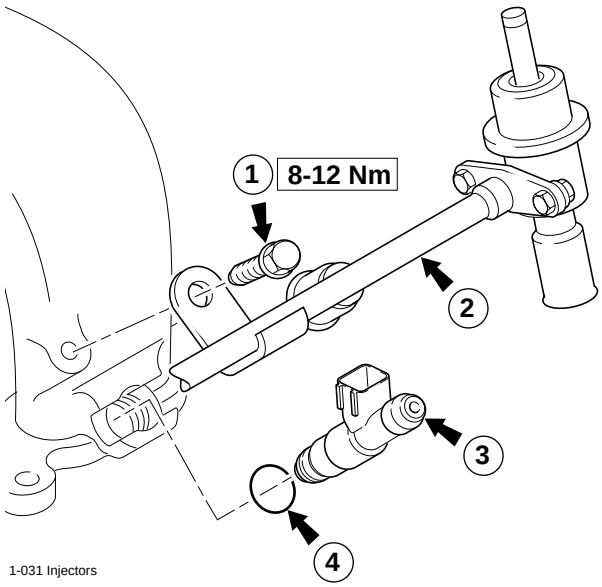
2-012 Filter

2.5.05 Fuel Rails and Injectors

WARNING: Read and follow the fuel handling instructions given in the warnings and precautions on page 17.

1. Remove the fuel rail cover.
2. Depressurise the fuel system (2.0.01).
3. Disconnect the fuel injectors.
4. Remove the fuel rail and injectors from the inlet manifold.

   1 Remove three M6 bolts from each fuel rail
   2 Remove two bolts washers and nuts
   3 Lift off the fuel rail
   4 Lift out the fuel injectors
   5 Remove and discard the 'O' rings from each injector



1-031 Injectors

2.6.01 Fuel Tank Draining

WARNING: Read and follow all fuel handling instructions given in the warnings on page 17 and in the bowser manufacturers fuel handling documentation before commencing work on the fuel system

Procedure

This procedure must only be performed by staff fully trained in fuel handling.

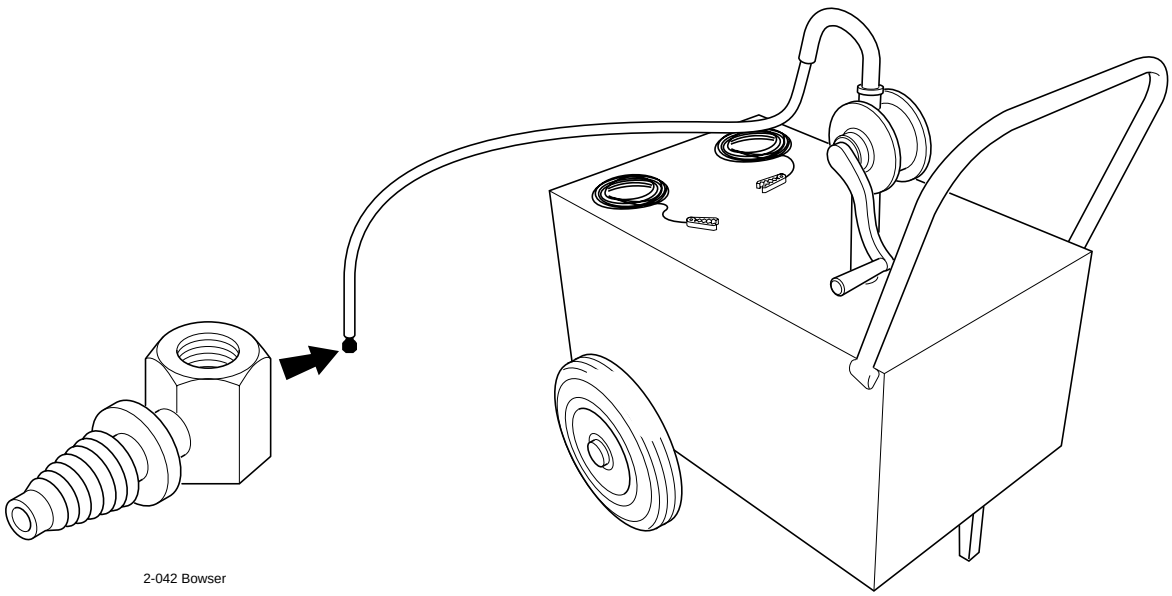
1. Depressurise the fuel system (2.0.01).
2. Disconnect the battery.
3. Remove the front left wheel.
4. Remove the wheel arch liner (7.0.0).
5. Prepare a fuel bowser by fitting the fuel pipe adaptor to the bowser inlet hose.

   Connect the bowser ground leads to the vehicle chassis and to a known good ground (e.g. a ground point on the vehicle ramp)
6. 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. Fuel vapour from the bowser will then be captured in the vehicle fuel tank.

WARNING: A small volume of fuel will escape as the filter is disconnected. Take precautions to capture the spilt fuel and to prevent fire.

7. Remove one fuel filter (2.6.04)
8. Connect the fuel pipe from the pump operated fuel bowser to the vehicle fuel supply line from the tank at the base of the removed filter.
9. Operate the bowser pump to extract fuel down to the outlet level.

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



2-042 Bowser

2.6.02 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.

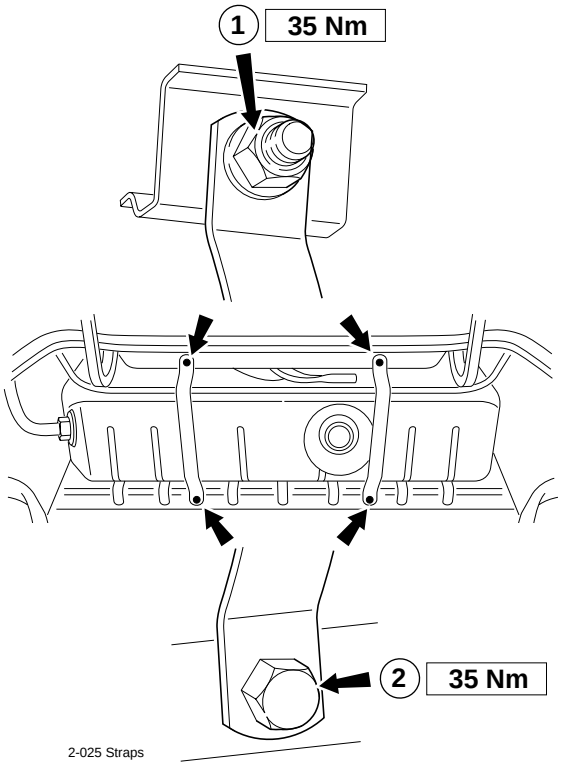
Take all necessary precautions to prevent sparks from electrical / electrostatic discharge or from friction.

1. Access the fuel tank.
2. Depressurise the fuel system (2.0.01).
3. Disconnect and remove the battery.
4. Remove the spare wheel and insert.
5. Drain the fuel tank (2.6.01).
6. Remove the fuel tank retainers.

Coupe

1 Remove one nut and washer from the top of each retainer strap

2 Remove one bolt from the bottom of each retainer strap. Remove the two straps



2-025 Straps

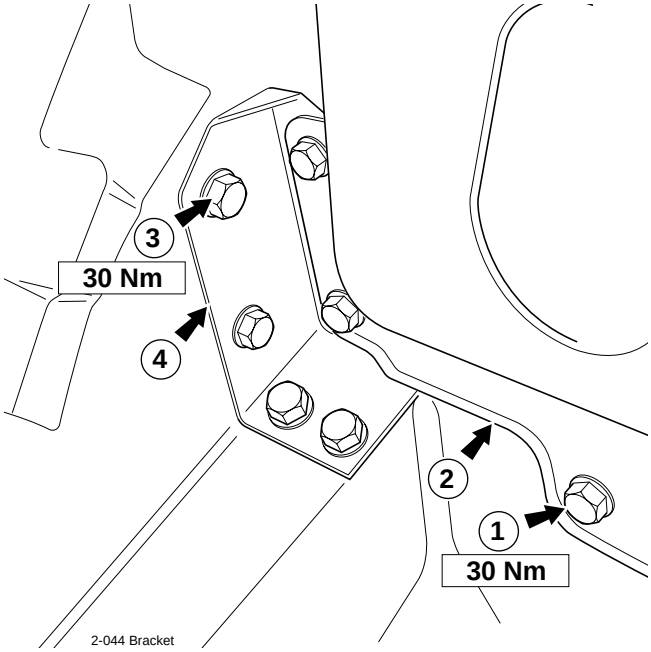
Volante

1 Remove the bolts from the fuel tank retainer

2 Remove the retainer

3 Remove four bolts from each corner bracket

4 Remove the corner brackets



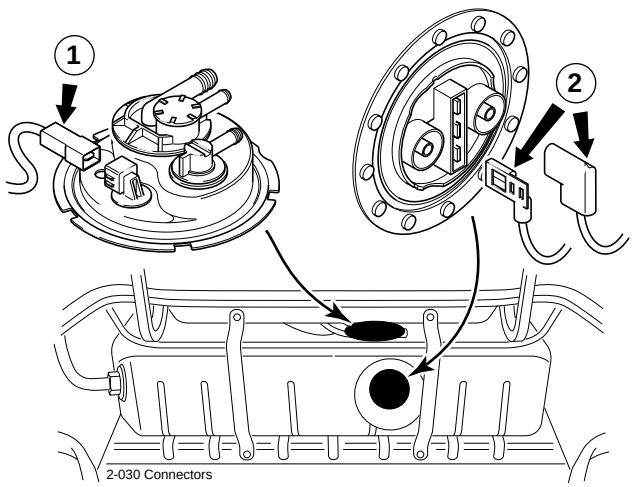
2-044 Bracket

7. Disconnect the fuel tank electrical connectors.

1 Disconnect the fuel pump electrical connector at the evaporative loss flange

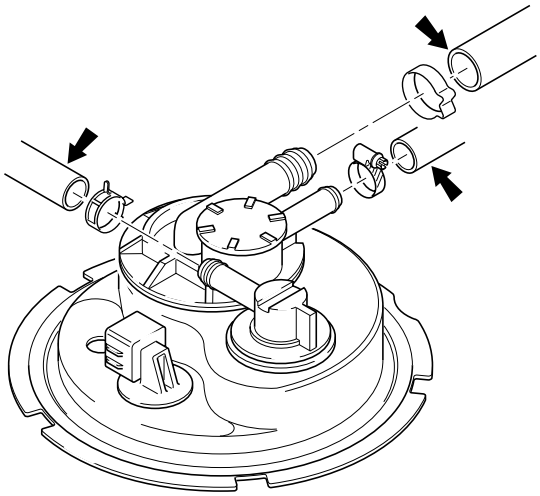
2 Disconnect the fuel level sender unit at the unit.

3 Release the harnesses from the clips and lay them safely to the right front corner of the boot.



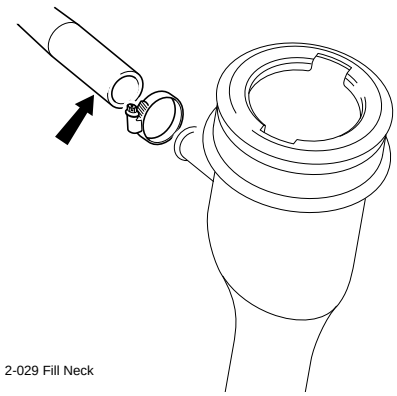
2-030 Connectors

8. Disconnect the vapour tubes at the evap loss flange. Seal the flange openings.



2-026 Lines

9. Remove the safety vent tube from the filler neck.



2-029 Fill Neck

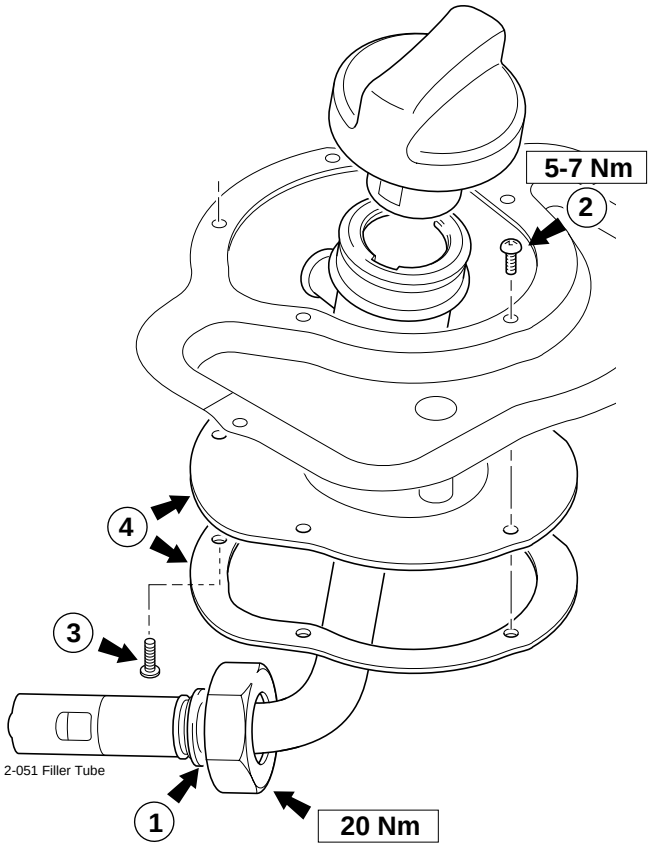
10. Remove the filler tube.

1 Release the flange nut at the lower end of the filler tube

2 Remove three screws from around the filler neck and two from inside the boot

3 Remove the fuel filler grommets

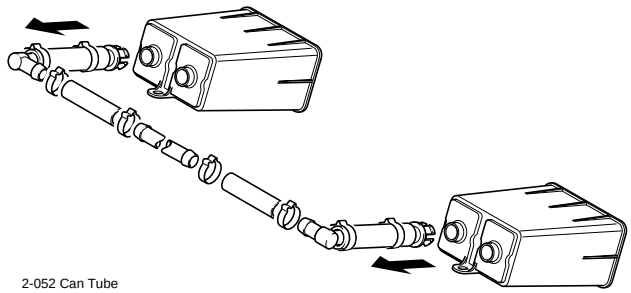
4 Remove the filler cap/filler tube assembly from the outside of the car



2-051 Filler Tube

11. Fit and secure a "redcap" or similar seal to the fuel tank filler pipe aperture to prevent fuel vapour escape and to prevent spillage of any remaining fuel during tank removal.

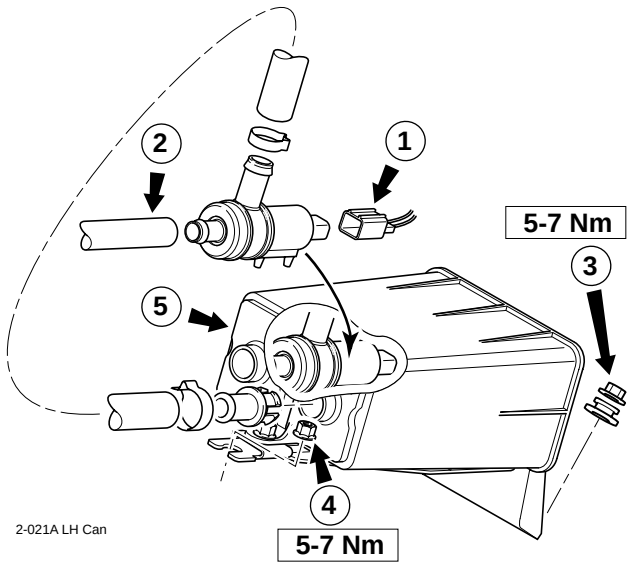
12. Remove the canister to canister pipework by disconnecting at the carbon canisters.



2-052 Can Tube

13. Remove the left hand carbon canister and bracket. This will give the clearance needed to remove the fuel tank.

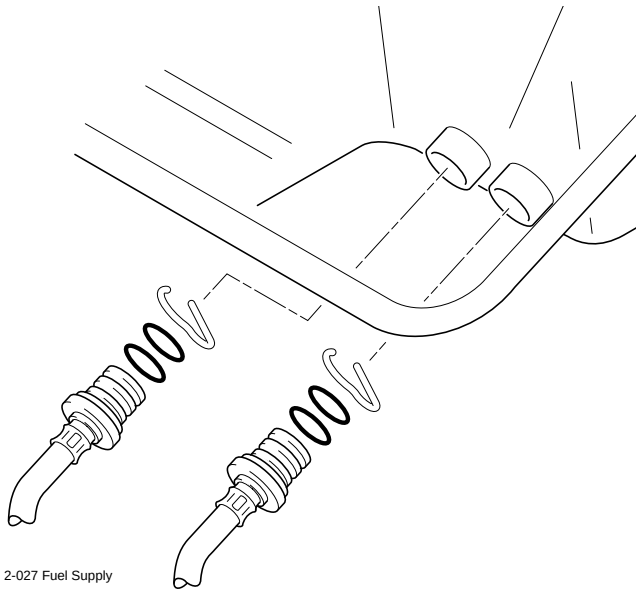
    1 Disconnect the electrical connector from the purge valve.
    2 Disconnect the pipe from the purge valve
    3 Remove two nuts and washers
    4 Remove one nut
    5 Remove the left hand carbon canister



2-021A LH Can

WARNING: During the following step, take precautions to capture any small amount of fuel which may leak from the supply hoses or from the fuel tank stub pipes when the hoses are disconnected.

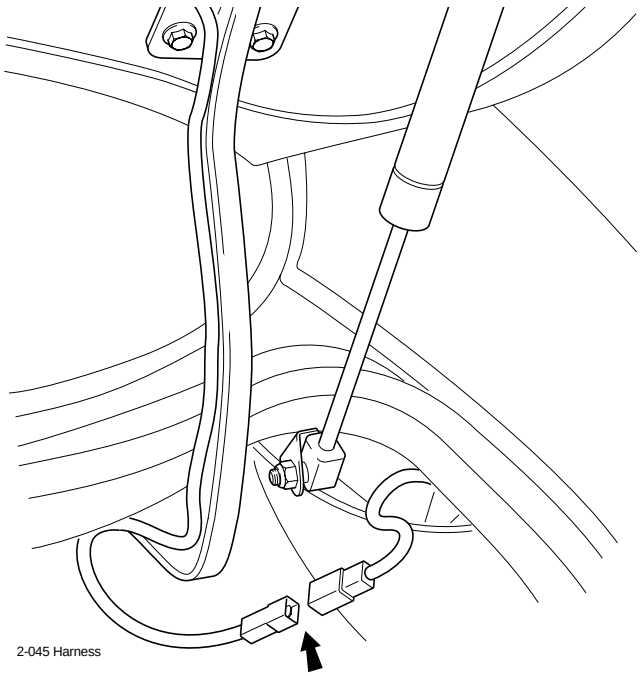
14 Slightly raise the left side of the vehicle if possible to reduce the risk of fuel spillage. Disconnect the fuel supply lines and seal the hoses and tank outlets.



2-027 Fuel Supply

15. Safely dispose of any captured or spilt fuel before proceeding.

16. Lower the vehicle to ground level. Release the boot lid harness and lay it in the right corner of the boot. Displace the boot harness at the right hand wheel arch to protect the harness during fuel tank movement.



2-045 Harness

17. Remove the fuel tank.

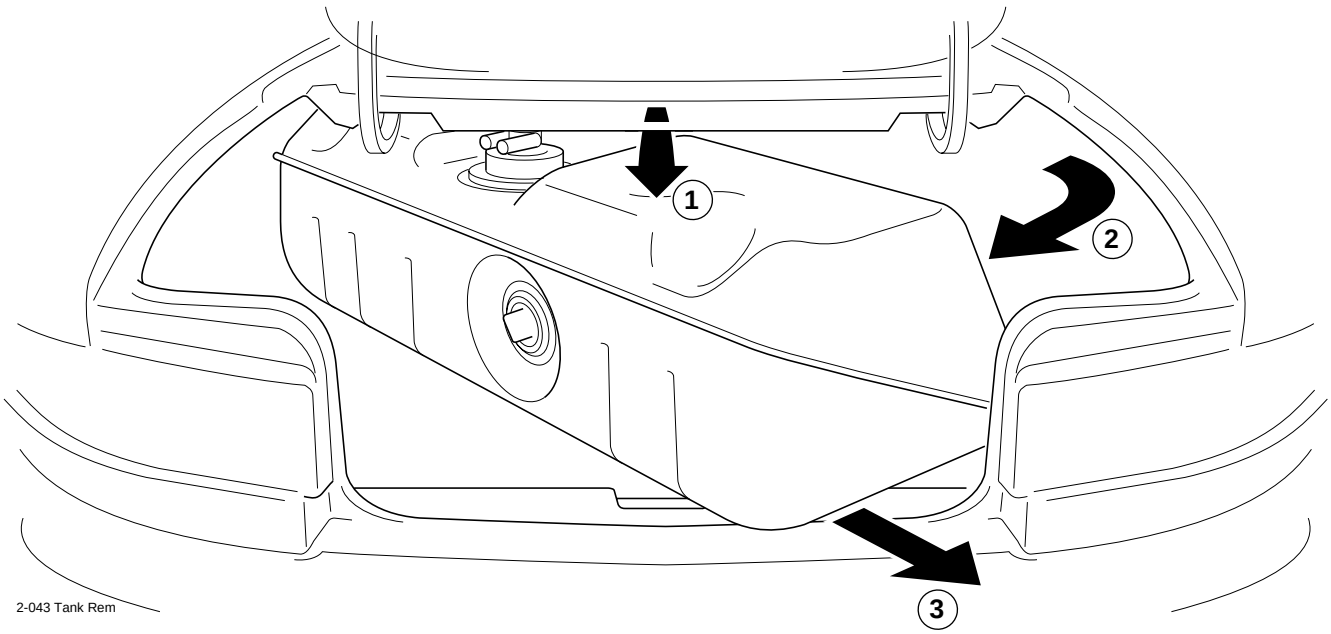
WARNING: Single-handed removal of the fuel tank is difficult and unsafe. Two people are required to safely move and rotate the tank during removal.

1 Move the tank rearwards

2 Rotate the tank 90° clockwise until the right end is resting on the rear wall of the boot.

3 Remove the tank rearwards

18. Leave any edge protection strip, fitted to seam of the tank, in place. If it must be removed, mark the areas along the seam where strip should be refitted.



Installation

1. To install, reverse the removal procedure.

   During replacement, note the correct assembly and connection of the purge pipework. (See the schematic diagrams in the Evaporative Loss description at the start of this section.)

2. Make sure all fixings are tightened to their correct torque value. Do not overtighten.

3. Remove all fuel and fuel contaminated material from the work area. Fully ventilate the area to remove all fuel vapour.

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

   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.

5. Switch on the ignition. Allow the fuel system to pressurise. Confirm that there are no fuel leaks.

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

6. Start the engine and check for correct fuel system operation.

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

7. Reset the clock and radio preset programs on completion of the reassembly.

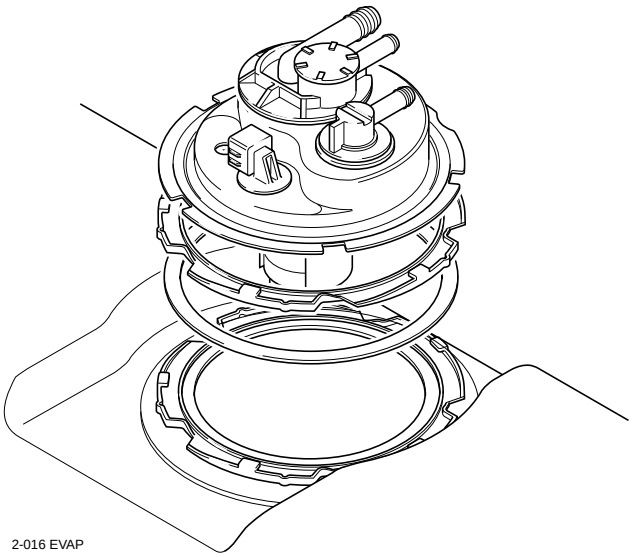
2.6.03 Fuel Pump Removal

WARNING: Read and follow the fuel handling instructions given in the warnings on page 17, before commencing.

Removal

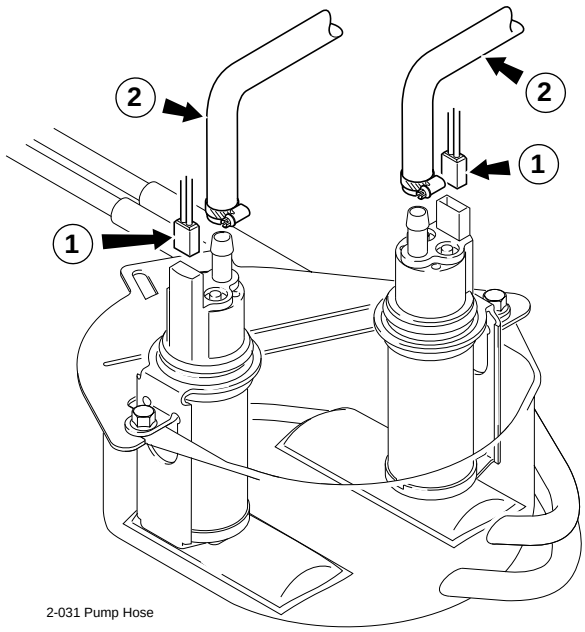
1. Drain the fuel tank (2.6.01).
2. Remove the fuel tank (2.6.02).

   Note: the tank need not be removed from the boot (trunk). Move it rearwards sufficiently to access and remove the evaporative loss flange.
3. Remove the evaporative loss flange.



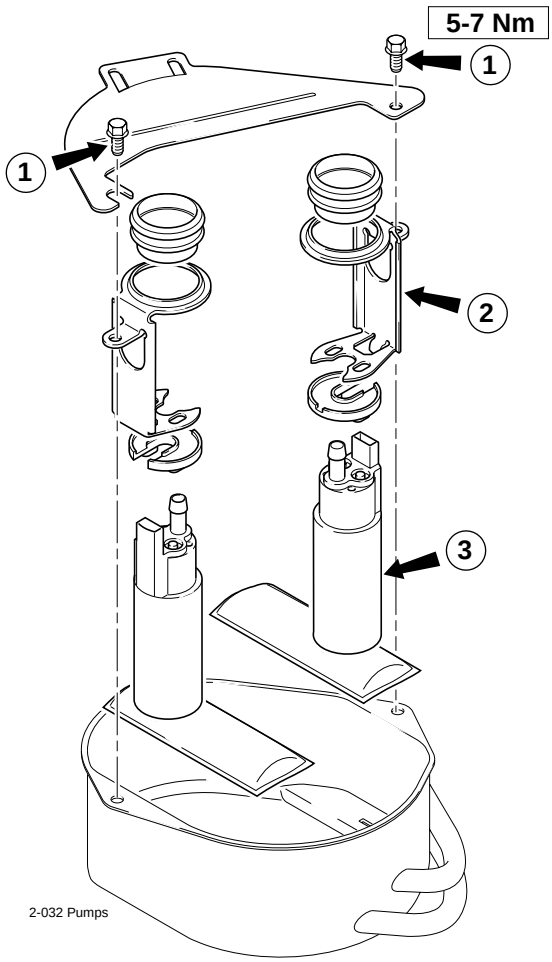
2-016 EVAP

4. Disconnect the fuel pumps.
   1 Disconnect the fuel pump multi-plugs
   2 Disconnect the fuel pump hoses at the pumps.



2-031 Pump Hose

5. Remove the fuel pumps.
   1 Remove one M5 bolt from each pump bracket.
   2 Remove the pump and bracket from the tank.
   3 Separate the fuel pump from its mounting bracket.



2-032 Pumps

6. Carefully invert the pump into the fuel tank and drain any residual fuel.
7. Seal the evaporative loss flange opening if immediate access is not required.

Installation

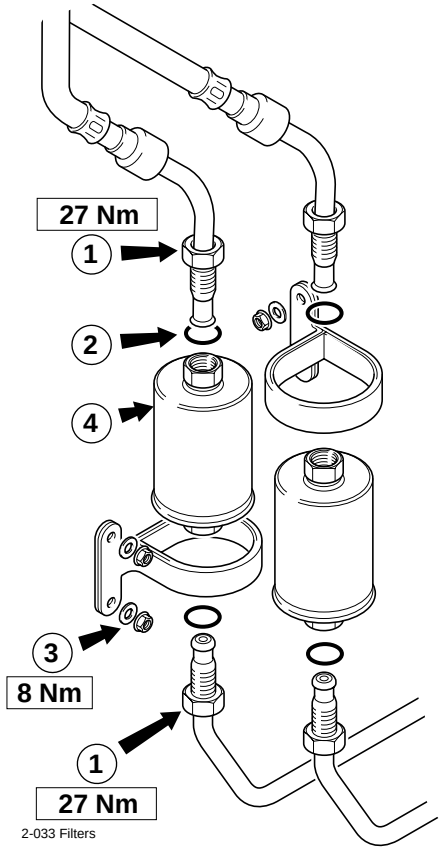
To install, reverse the removal procedure.

Fit new seals to the evaporative loss flange and the filler neck union during replacement.

2.6.04 Fuel Filter Renewal

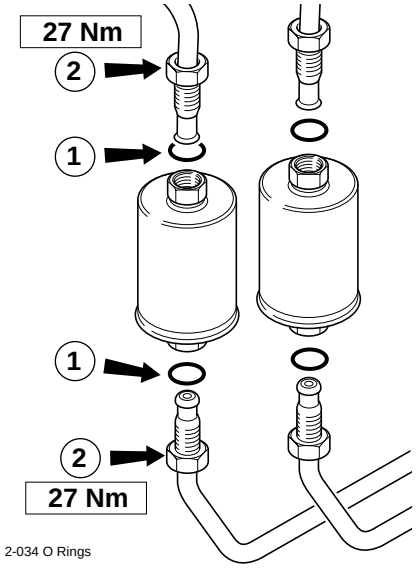
Removal

1. Raise the front left wheel from the ground and remove the road wheel.
2. Remove the wheel arch liner (7.0.0)
3. Depressurise the fuel system (2.0.01).
4. ***WARNING: Fire Risk - Read and follow all fuel handling warnings and precautions given on page 17, to avoid fire risk from spilt fuel.***
5. Remove the fuel filters.
   1 Release the filter unions
   2 Remove and discard the four 'O' rings
   3 Release the fuel filter clamps
   4 Remove the fuel filters



2-033 Filters

6. Assemble new filters.
   1 Fit new 'O' rings to the top and bottom unions
   2 Fit the union nuts and torque to specification

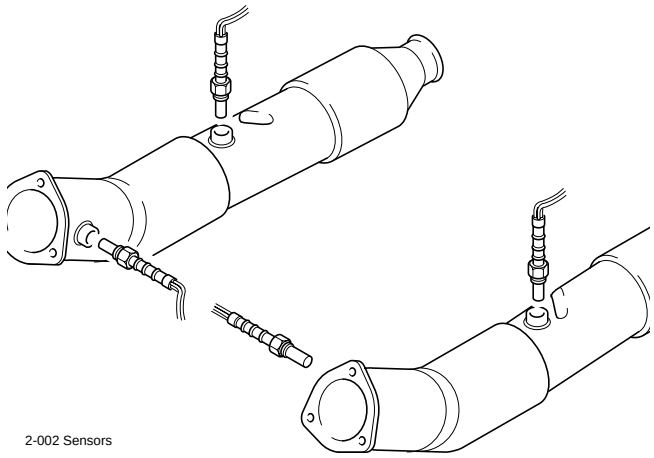


2-034 O Rings

7. Remove the drip tray and safely dispose of any spilt fuel.

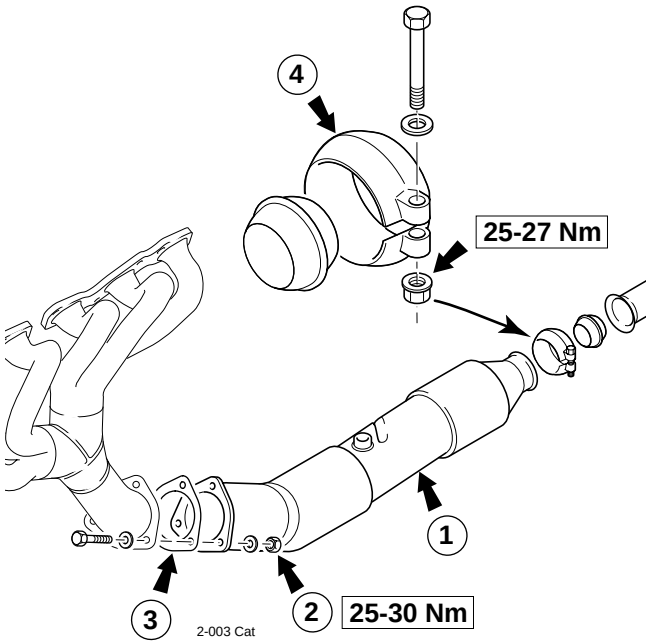
2.7.01.1 Exhaust System

1. Disconnect the four oxygen sensors.



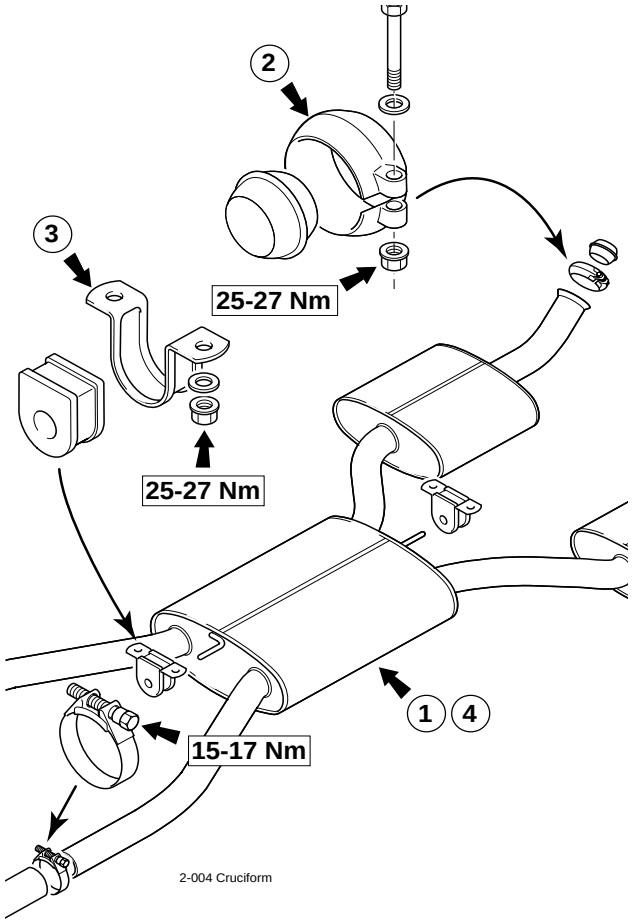
2. Remove the catalytic convertors.

   1 Support the catalysts
   2 Remove three bolts from each flange
   3 Discard the flange gaskets.
   4 Release the rear clamps and remove the catalysts



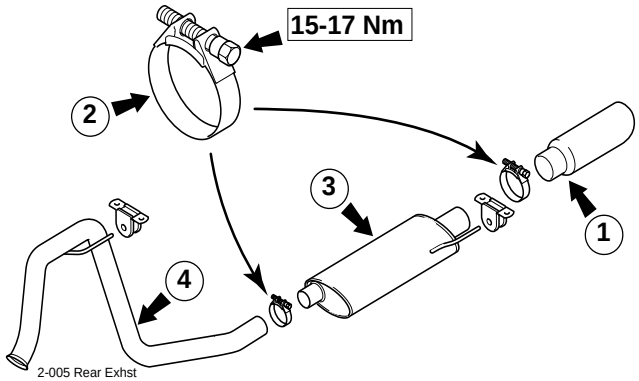
3. Remove the cruciform silencer and intermediate silencers.

   1 Support the cruciform silencer assembly
   2 Release the overaxle pipe clamps
   3 Release the forward support
   4 Remove the cruciform silencer/intermediate silencer assembly



4. Remove the rear silencers.

   1 Remove the tail pipe finishers
   2 Release the front clamps
   3 Remove the rear silencers
   4 Remove the overaxle pipes



Installation

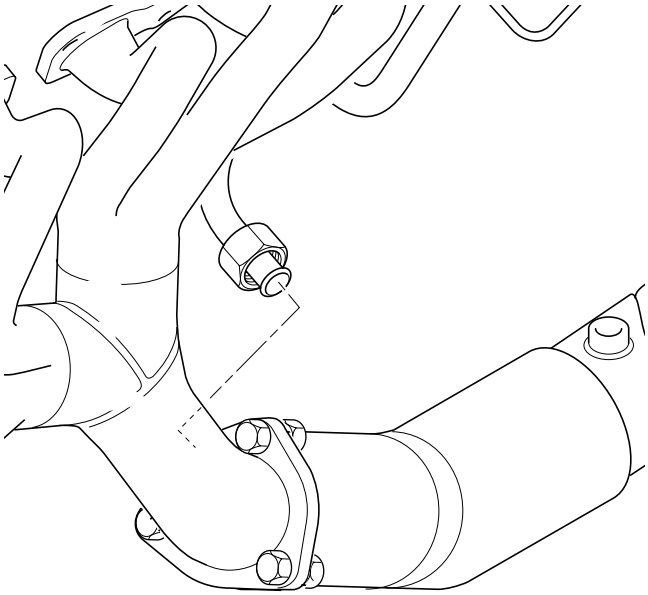
Seal all clamp joints with a proprietary exhaust sealant prior to securing loosely. Fit new manifold flange gaskets.

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

2.7.02 Exhaust Manifolds

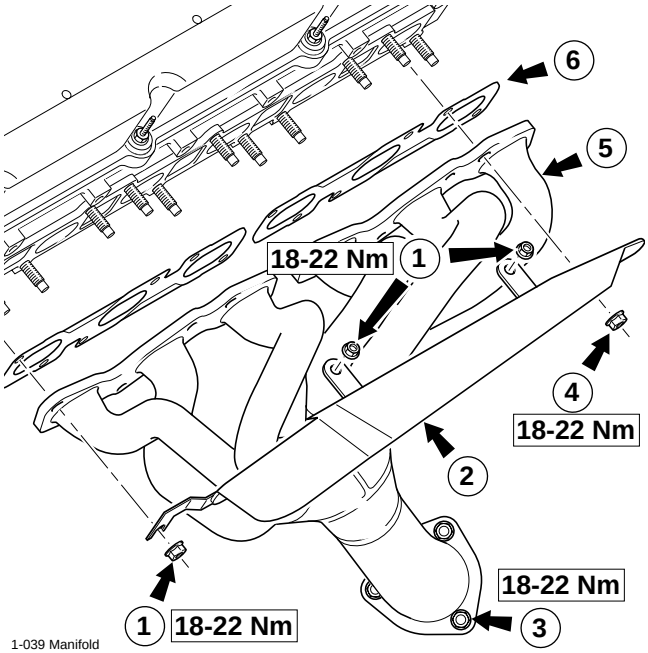
Removal

1. Remove the throttle body and adaptor (2.1.03)
2. Remove the oil dipstick and tube.
3. Disconnect the EGR pipe from the exhaust manifold.



2-055 EGR Pipe

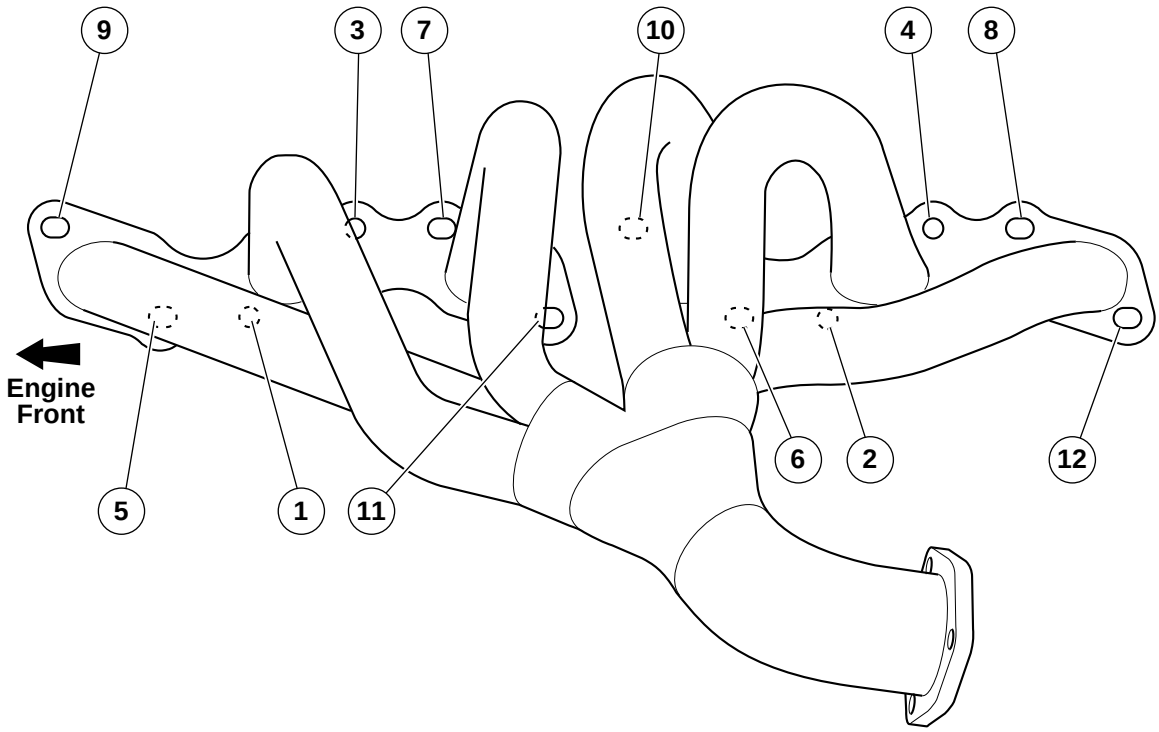
4. Remove the exhaust manifold.
   1 Remove the heatshield nuts
   2 Remove the heatshield
   3 Release the manifold lower flange
   4 Remove eleven manifold nuts
   5 Remove the manifold
   6 Remove and discard the manifold gasket



1-039 Manifold

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	

1-011 Manifold

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Transmissions - General Description

Transmission Types

The DB7 Vantage can be supplied with manual or automatic transmission. The manual vehicle has a single plate clutch and six speed Tremec T 56 gearbox. The automatic version has a torque convertor and ZF 5 HP-30 five speed automatic transmission.

Manual Transmission

Clutch and Flywheel

The clutch is a single plate, diaphragm spring type and is operated hydraulically by a concentric slave cylinder mounted around the first motion shaft in the gearbox bell housing.

The clutch master cylinder is mounted on the engine bulkhead and is operated directly by the clutch pedal.

A hydraulic connection from the master cylinder feeds pressurised fluid to the slave cylinder. The clutch slave cylinder has an extension tube and bleed nipple extending from the left side of the bell housing for bleeding the system after any major work.

The flywheel is mounted to the end of the crankshaft together with the separate starter ring gear and flex plate.

Gearbox

The Tremec T 56 six speed transmission fitted to this vehicle incorporates synchromesh on all gears. Gear selection is by a centrally mounted lever, connected to the transmission selector shaft via a pivoting joint.

A gear is engaged by moving one of four selector rods to which the selector forks are attached. The forks are engaged onto the synchro unit sleeves. A gear is engaged by locking the synchro unit sleeve over the desired gearwheel to lock the selected gearwheel to the gearbox output shaft.

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

Cooling

The manual transmission has an external cooling circuit which comes into operation at higher speeds (above 160 kmh (120 mph)) to prevent overheating of the transmis sion oil. A pump mounted in front of the radiator cuts in at a pre-determined speed and pumps transmission oil around the radiator and back to the transmission.

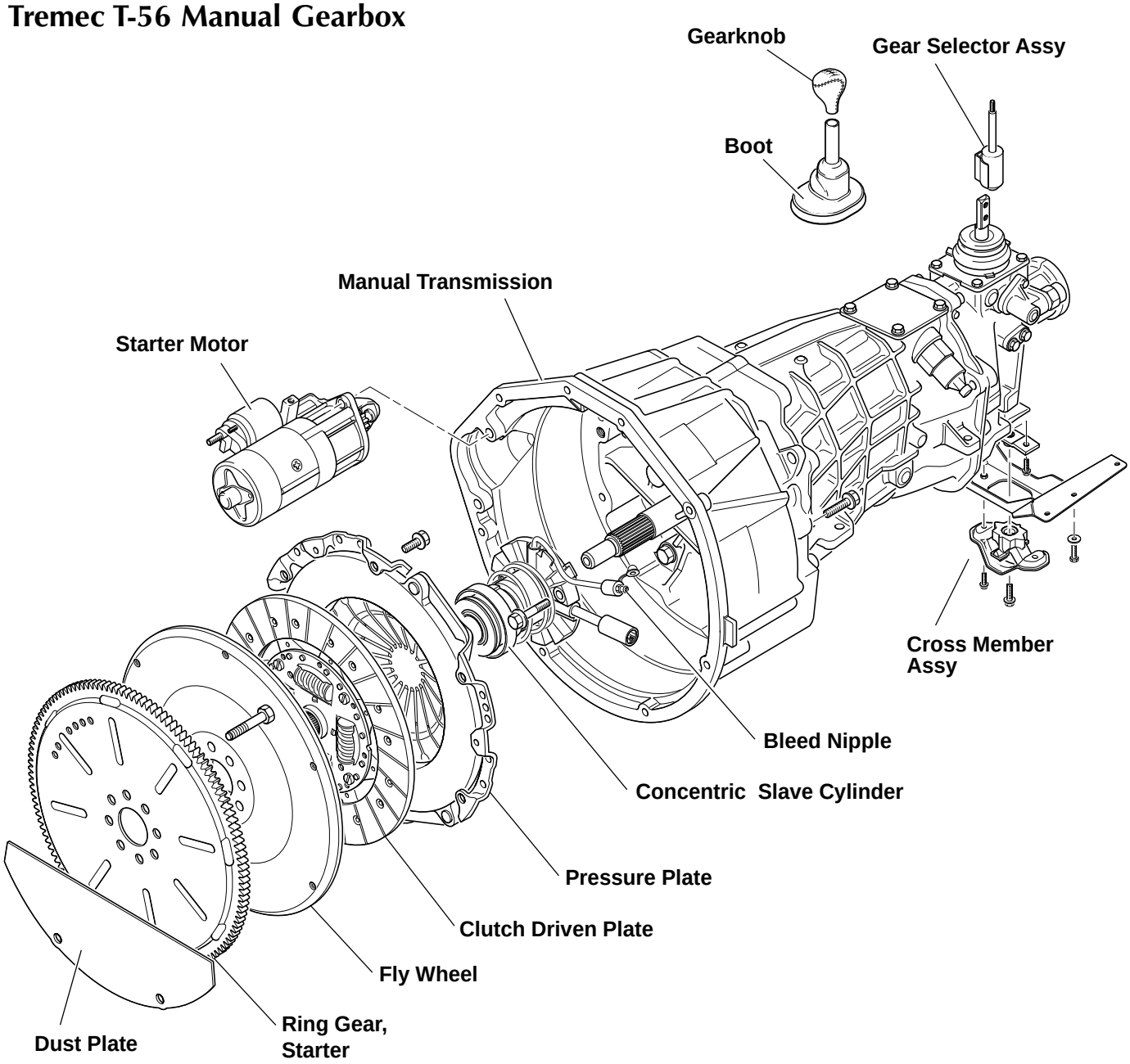
Automatic Transmission

The ZF 5 HP-30 is a five-speed, high torque capacity, electronically controlled automatic transmission. It consists of a torque converter and three planetary gear sets. There are multiple disc clutches and other elements to provide the control necessary for correct sequential gear engagement and operation.

Gear shift operations are controlled from the Transmission Control Module (TCM), which governs the electronically controlled valve body situated within the transmission. Gear changes are fully automatic in relation to load, vehicle speed and throttle opening.

The transmission control module (TCM) receives various vehicle sensor input signals, and transmits operating signals to the solenoids located in the control valve assembly. These solenoids govern the transmission operating pressures, up-shift and down-shift gear selection patterns, and also the torque converter clutch operation.

Tremec T-56 Manual Gearbox



Specifications

Type

Six speed Tremec T 56 gearbox, single plate clutch.

Gear Ratios:

1st	2.66
2nd	1.78
3rd	1.3
4th	1.0
5th	0.80
6th	0.63
Reverse	2.90

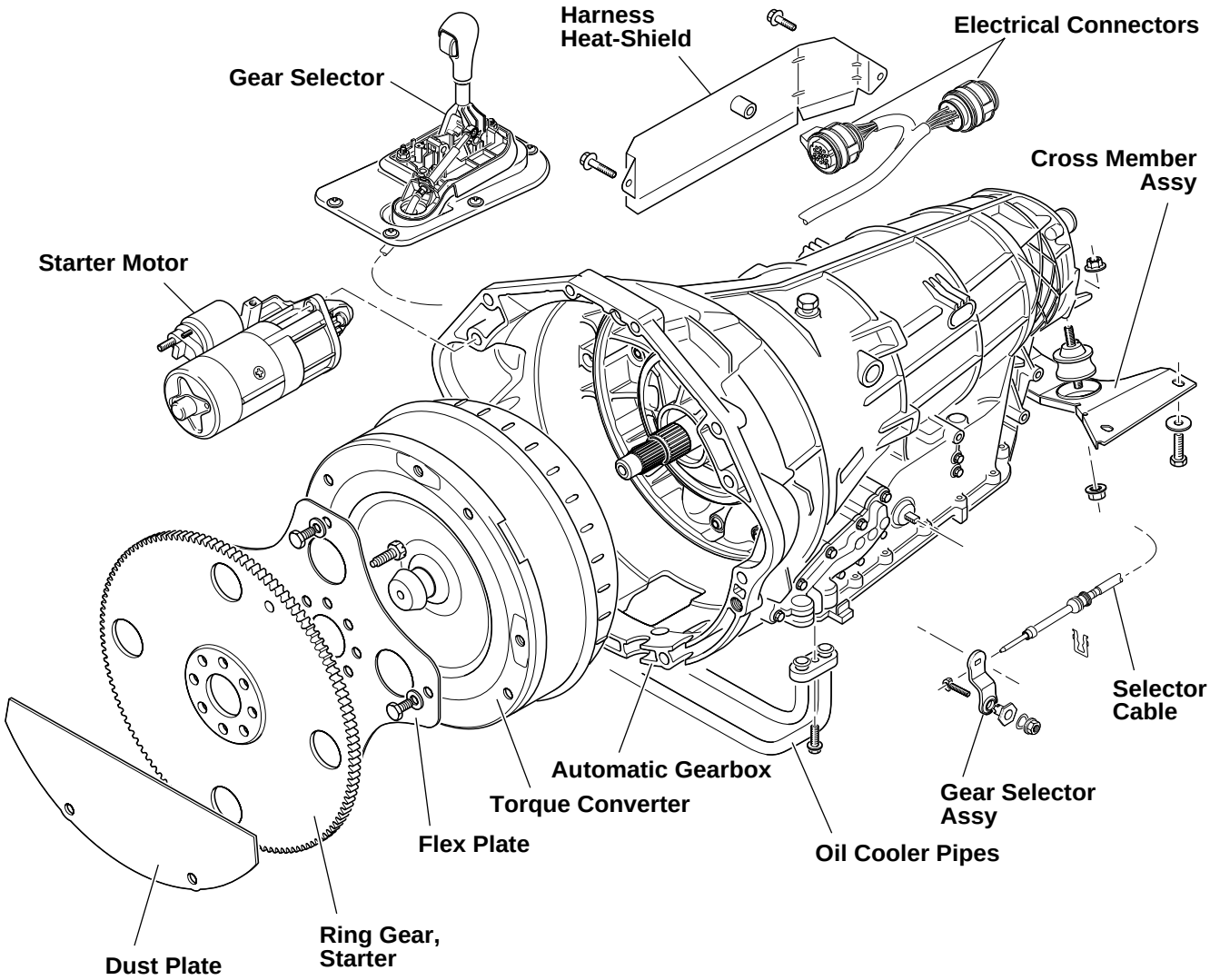
Transmission Fluid: Texaco 1863, Mobil ATF, Dexron III or Transam7045

Fluid Change Interval Lifetime fluid fill

Transmission Weight:

Complete with fluid 63.5 kg (140 lbs) with oil

ZF 5 HP-30 Automatic Gearbox



Gear Ranges

Selectable gear positions are: P - Park, R - Reverse, N - Neutral, D - Drive, 4, 3, 2.

P Selection of Park mechanically locks the transmission, and as such, must only be engaged when the vehicle is stationary. In addition, and for extra safety, the handbrake should also be applied. It is necessary to have the ignition on and the foot brake applied to move the selector lever from the Park position. For ignition key removal the selector lever must be in the Park position. The engine can be started in the Park position.

R Moves the vehicle in a rearwards direction. The engine cannot be started in Reverse position.

N Neutral position enables the engine to be started and run without driving the vehicle. It also allows the vehicle to be moved manually for access, e.g. for removal of the propeller shaft.

D Drive position allows the automatic selection of all five forward gear ratios during normal driving conditions for maximum efficiency and fuel economy. On acceleration, down-shifts are obtained by depressing the accelerator pedal or by manual selection. The engine cannot be started in this position.

4 Selection of the 4 position allows automatic operation of the four lower gear ratios but inhibits selection of the fifth ratio. This position is used when greater engine braking control is required or if you wish to remain in a lower gear when hill climbing. The engine cannot be started in this position.

3 Selection of the 3 position allows automatic operation of the three lower gear ratios but inhibits selection of the fourth and fifth ratios. This position is used for heavy traffic congestion or negotiating hilly terrain when even greater engine braking control is required than is provided by manual fourth. This ratio may be selected at any vehicle speed - even if the transmission is in fourth or fifth ratio, the transmission will immediately down-shift to third gear provided the vehicle speed is below 137 km / h (85 mile / h). The engine cannot be started in this position.

2 Selection of the 2 position allows automatic operation of the two lowest gear ratios but inhibits selection of the third, fourth and fifth ratios. This position is used for maximum engine braking control. It is advisable to reduce vehicle speed to below 50 mph (80kmh) before engaging the 2 position. The engine cannot be started in this position.

Mode Selection

The switch beside the gear lever enables selection of two modes of operation, Normal and Sport.

Normal - This is the normal gearbox mode in which gear changes will be made automatically dependant on the vehicle speed and engine load. 'Normal' mode is automatically engaged when the engine is started at the beginning of any journey.

In 'Normal' mode the gearshift pattern is designed to maximise fuel economy and minimise the risk of wheel spin whilst still offering sports car performance.

Sport - The Sport program is designed for the driver who wishes to extract maximum performance from the vehicle. When 'Sport' is selected, upshifts and downshifts will occur at higher engine speeds and different throttle openings than in 'Normal' mode. 'Sport' mode permits maximum acceleration and more effective engine braking.

Specifications

Type

5 speed ZF 5HP30 automatic transmission and torque converter

Gear Ratios:

1st	3.55
2nd	2.24
3rd	1.54
4th	1.00
5th	0.79
Reverse	3.68

Maximum rpm:	6400 rpm in gears 1 to 3 6800 rpm in gear 4 Limited to 165 mph in 5th gear
Transmission Fluid:	Esso LT 711-41
Fluid Change Interval	Lifetime fluid fill
Transmission Weight:	
Complete with fluid	119.5 kg (262.9 lbs) with oil
Maximum Towing Distance	150 km (93 miles) at a maximum speed of 70 km/h (43 mph) Disconnect the prop shaft if on suspended tow

Transmission Components

Torque Converter

The torque converter acts as a fluid coupling to transmit the engine power smoothly to the transmission gear train. The torque converter also magnifies torque to a maximum ratio of 1.95:1 at 'stall'.

In some speed/load conditions, the Torque Converter Clutch operates to eliminate all slip in the converter and ensure 100% torque conversion.

Planetary Gear Sets

Each of the three planetary gear sets in this transmission comprises a centre or sun gear, an annulus or internal ring gear, and a planetary carrier (spider) assembly containing the smaller planet gears.

The various ratios are obtained by introducing torque through various elements of the planetary gear sets whilst holding other elements using solenoid operated brake bands.

Power is transmitted to the output shaft via the spider shaft of the last planetary gear set.

Reverse gear is selected by holding ring gears 1, 3 and planet spider No. 2. The drive will then reverse as it passes from gear sets 2 to 3 and the output shaft will rotate in the opposite direction to the engine.

Hydraulic Shift Control Unit

The hydraulic shift control unit is located in the sump of the automatic transmission.

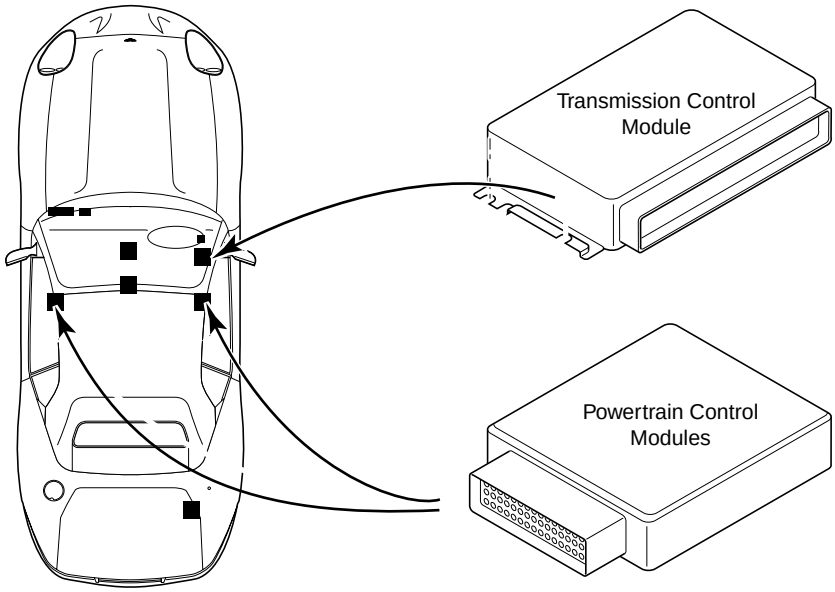
It contains electrical actuators and sensors as well as hydraulic valves which, acting in conjunction with the electronic control unit, perform the gear changes in the automatic transmission.

The electromechanical components are arranged in such a way that they may be replaced while the transmission is installed in the vehicle.

Transmission Control Module

Operation

The Transmission Control Unit (TCM) is mounted under the front right hand seat.



Caution: Disconnection of other control modules and / or the vehicle battery, may introduce fault codes (DTCs). Following rectification and reconnection, please ensure that no induced codes exist in the TCM memory.

Caution: Disconnection of other control modules and / or the vehicle battery, will cause shift adaptations to be lost; this may be apparent by slight shift quality degradation. Shift quality adaptations are made to compensate for changing transmission characteristics over time. Following reconnection, a period of adaptation will be required as the TCM re-learns the transmissions operating characteristics.

The TCM processes information received in both analogue and digital form, such as:

- Transmission input speed
- Transmission output speed
- Throttle position
- Accelerator pedal demand
- Gear selector position
- Engine torque
- Engine speed
- Transmission fluid temperature
- Mode switch.

This information is then used by the TCM to control shift energy management and decide which shift program to implement and which gear to select.

The TCM uses the various sensors and inputs to monitor the correct operation of the system and is programmed to take default action and inform the operator if a fault occurs.

A TCM failure, a failure of supply to the TCM or a Transmission mechanical failure, is always indicated by the transmission control indicator lamp (TCIL). A failure of the TCM invokes the 'limp-home' mode. See **Safety Functions**.

TCM fault codes are reported via the CAN bus (Controller Area Network) to the Powertrain Control Module (PCM).

Safety Functions

The safety functions are designed to safeguard against inappropriate actions by the operator as well as against system malfunctions. The system prevents reverse gear from being engaged at high forward speeds and prevents manual downshifting at excessive engine speeds. The functions are not operational in mechanical limp-home mode.

The TCM constantly monitors the transmission for faults. In the event of a problem the TCM will adopt a limp-home mode in which only P R N D - (4th) (selector in D but only fourth gear available). If a transmission fault is detected, the PCM illuminates the transmission control indicator lamp (TCIL).

The electrical and diagnostic system has been designed such that system integrity is protected at all times. The safety concept is based on the following.

1. The hydraulic system has 'fail-safe' characteristics regarding its electrical operation, such that should the power supply be lost to the electro-hydraulic actuators, the transmission will initiate a limp-home mode.

2. Recognition of critical shift operation by monitoring the last element in the signal path, i.e. the solenoid valve, and checking by means of redundant measured variables, i.e. engine speed, input speed and output speed.

3. Each time the vehicle is started there is a check on the entire safety hardware and the associated program parts and signal paths. A malfunction in this part of the system, or triggering of the safety circuit, is communicated to the operator through the illumination of the transmission control indicator lamp (TCIL).

System Functions

Range Selection

The selector lever is connected to the transmission via a bowden cable, which operates the transmission selector shaft between all positions except Drive to 4.

The TCM detects the gear selected by means of a rotary position switch (the transmission range sensor - TRS) fitted to the transmission selector shaft. A separate Drive to 4 switch is located within the PRNDL assembly.

Movement of the lever between Park, Reverse, Neutral and Drive, manually controls the flow of transmission fluid, the TCM having control of the forward gear selected in Drive.

Additional movement of the lever to 4, 3 and 2 positions does not manually modify the fluid flow, the TCM detects these positions using the range switches and controls the gear electronically.

Shift Point Selection

The gearshift points are selected, by the TCM, as a function of the output speed, engine load, selector position and shift program selected. The operator has control over the shift points via the selector lever, throttle pedal movement, kickdown function and mode switch.

Mode Switch

This switch allows the driver to select one of two shift patterns: Normal and Sport modes. The mode switch is non-latching, i.e. with Sport is selected, the mode defaults to Normal on the next ignition cycle. Sport mode is indicated by the 'Sport' warning indicator.

Torque Converter Operation

The TCM continually monitors the state of the torque converter.

There are three operating modes for the converter

1. Fully open - Torque converter 'disengaged'
2. Fully closed - Torque converter 'engaged'
3. Slip control - The TCM monitors slip and may apply sufficient pressure to allow a small degree of slip. This mode maximises economy by reducing slip to a minimum whilst providing isolation from drive-line shunt and vibration.

Torque Converter Clutch Hydraulic Pressure Regulation

The TCM supplies an internally switched +12V supply to the No.4 pressure regulator. The regulator is operated by switching the other side of the operating winding to ground. Hydraulic pressure is controlled by 'pulse width modulation' (PWM) of the ground switching signal i.e. the duty cycle: the time that the pressure regulator is switched on.

Transmission Control Module Supply Voltage

The TCM monitors battery and ignition switched supply voltages.

A permanent supply is used to maintain a battery backed 'memory'. Should this supply be cut, due to battery disconnection or power interruption, the shift quality adaptations (made due to the transmission's changing characteristics over time) will be lost. This will result in a small reduction in shift quality for a period until the shift adaptations are re-learned.

The TCM will adopt limp-home mode as a result of the supply voltage being greater than 16 V or below 7V with an engine speed of greater than 1600 rpm.

Should the ignition supply be between 7 and 9 volts, the TCM will hold the gear that it has currently selected. If after 2.5 seconds, with the engine speed more than 1600 rpm, the voltage remains at this level, 'limp-home' mode will be adopted. The 2.5 second delay is built in to prevent reaction to a momentary voltage fluctuation.

TCM Inputs

Transmission Input Speed Sensor (ISS)

The input speed sensor provides the TCM with transmission input shaft speed information. This signal is produced from an inductive pick-up, generating 36 pulses per revolution.

Transmission Output Speed Sensor (OSS)

The output speed sensor provides the TCM with transmission output shaft speed information. This signal is produced from an inductive pick-up, generating 36 pulses per revolution.

Transmission Fluid Temperature Sensor (TFT)

A thermistor which provides an electrical indication of the fluid temperature to the TCM. The signal is measured as a voltage with reference to analogue ground in the TCM.

Kickdown Switch

Kickdown is intended to provide maximum vehicle acceleration, via the appropriate downshift(s), when the operator uses full throttle. A kickdown switch provides an electrical signal to the TCM when the accelerator pedal is fully pressed down. The switch is normally open, connected to vehicle ground. Should the switch fail the TCM will detect kickdown using the accelerator pedal position.

Mode Selection Switch

The mode selection switch indicates to the TCM the current performance mode selected by the driver.

Transmission Range Switch (TRS)

The transmission range switch detects the position of the transmission selector shaft. The switch is supplied as part of a new transmission assembly, mounted on the transmission body. The switch is used to indicate to the TCM the positions of the shaft: Park, Reverse, Neutral, Drive, Fourth, Third and Second.

Serial Communication Interfaces

Controller Area Network (CAN)

The TCM is an integral part of the CAN system which facilitates the interchange of real-time data between control modules and sensors.

On Board Diagnostics (OBDII) Interface

Data concerning OBDII related transmission failures is stored in the PCM for access from the lower J1962 socket.

The following conditions are monitored by the TCM and if a malfunction or out of range condition occurs, the TCM will report the condition to the PCM.

22 Throttle signal out of range LOW
24 Output speed out of range LOW
28 Out of range (PRNDL) signal
33 Barometric pressure signal out of range HIGH
34 Barometric pressure signal out of range LOW
37 Brake switch stuck on
38 Brake switch stuck off
39 Torque convertor clutch stuck off
53 Ignition voltage high
58 Transmission temperature out of range HIGH
59 Transmission temperature out of range LOW
68 Invalid 4th gear ratio
69 Torque converter clutch stuck on
71 Engine speed loss
72 Output speed rate of change invalid
73 Force motor electrical fault
74 Input speed loss
75 Ignition voltage low
77 Invalid mode switch signal
79 Transmission temperature hot
81 Shift solenoid B electrical fault
82 Shift solenoid A electrical fault
83 Torque convertor clutch solenoid electrical fault
85 Invalid gear ratio or incorrect range (PRNDL) signal
86 Shift solewnoid B stuck on
87 Shift solenoid B stuck off
89 Length of shift high

These trouble codes are defined on the PDU screen. Definitions may be accessed using the Help (*) icon.

Solenoid/Clutch Application

The following figure shows the solenoid/clutch logic for each gear. The "*" symbol indicates that a solenoid is active or being regulated in the case of pressure regulating solenoids. The "-" symbol indicates that a solenoid is inactive, but does not differentiate between inactive On or inactive Off. A further explanation of this situation will be made using the application of the torque converter clutch for example.

The pressure regulating solenoid (EDS) number 4 is used to apply the torque converter clutch in 4th and 5th gears. The sequence of symbols in the gear logic chart shows "-*-". The sequence of symbols represents the actions taking place. The first "-" represents the torque converter clutch open, EDS 4 inactive. The "*" represents EDS 4 under regulation, or active, to engage the converter clutch. The last"-" represents EDS 4 inactive, torque converter clutch closed. There is a voltage difference between inactive, torque converter open (approximately 1 VDC) and inactive, torque converter clutch closed (approximately 5 VDC).

EDS 1 regulates transmission mainline pressure and delivers maximum pressure with minimum current and minimum pressure with maximum current. EDS 2, 3, 4, and 5 regulate clutch application and release pressures and deliver maximum pressure with maximum current and minimum pressure with minimum current.

Solenoid Valve and Clutch Logic Functions

	Solenoid Valve Logic								**Clutch Logic**								
	Sol. Valve			EDS					Clutches			Brakes				Sprag Units	
Gear	**1**	**2**	**3**	**1**	**2**	**3**	**4**	**5**	**A**	**B**	**C**	**D**	**E1**	**E2**	**F**	**FrF**	**FrE**
P = Park	*				-*	*		-*							*		
R = Reverse		*		*	*-	*		*-			*				*		
N = Neutral	*			*	-*	*		-*							*		
D, 1st Gear	*			*	*-	*-		*-	*							*	
D, 2nd Gear	*	*		*		*		*	*				*	*			*
D, 3rd Gear		*		*	*	*		*	*			*	*				
D, 4th Gear + WK		*		*	*-		-*-	*-	*	*			*				
D, 5th Gear + WK			-*	*	*		-*-	*-		*		*	*				
2, 1st Gear	*			*	*	*		*-	*						*		
Reverse Lockout	-*	-	*	*	*-	*-	-	*-			-				-		
Emergency Program									*	*			*				

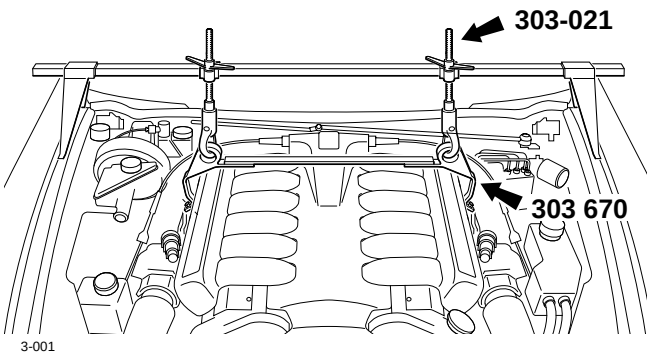
Key * = Solenoid actuated or valve being regulated

- = Component inactive

3.0.01.1 Automatic Transmission

Removal

1. Disconnect the battery.
2. Fit the engine support service tool across the wing channels, engage the hooks in the rear lifting eyes. Tension the hooks to support the engine.

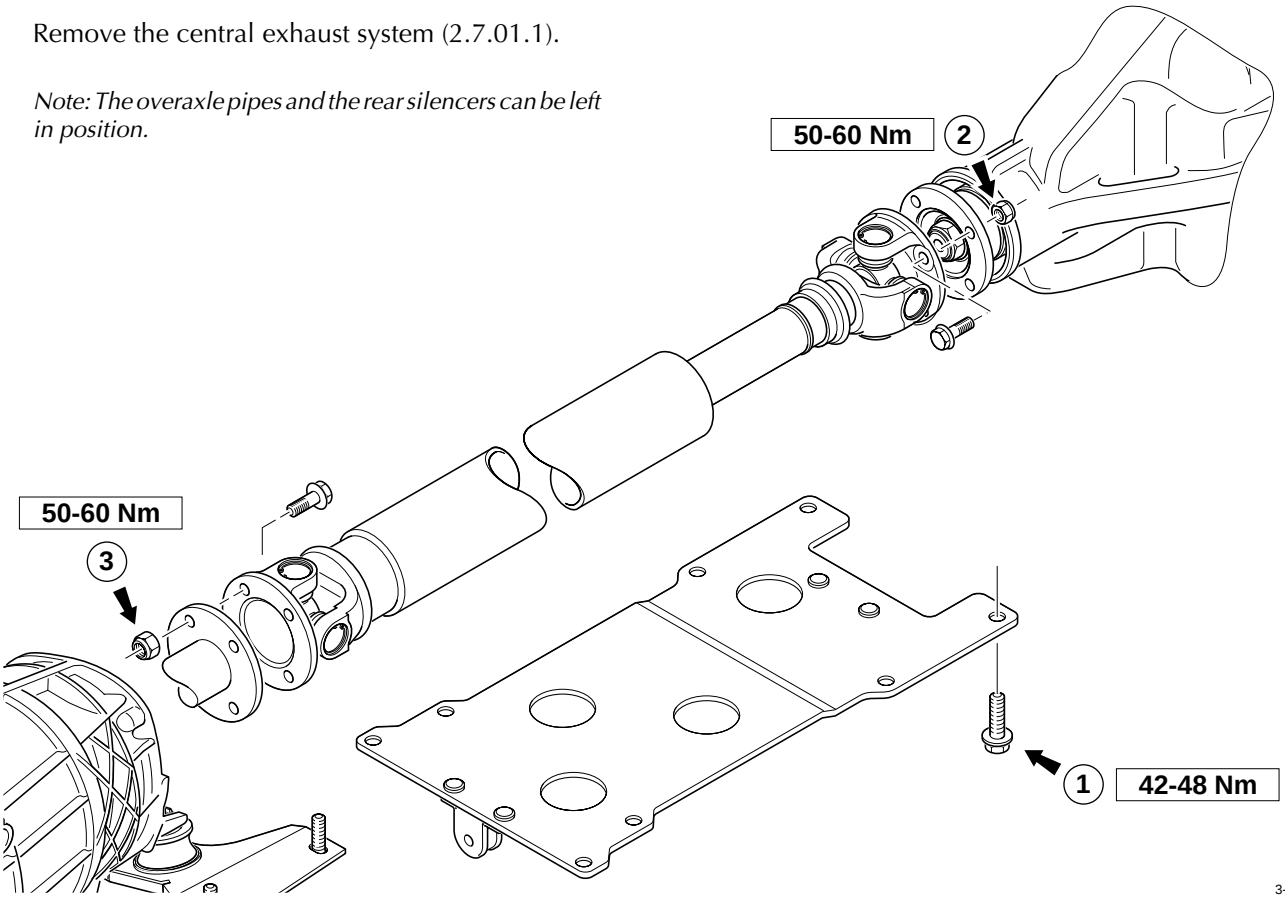


3. Raise the vehicle on a four point hoist.
4. Remove the central exhaust system (2.7.01.1).

   Note: The overaxle pipes and the rear silencers can be left in position.

5. Drain the transmission.
6. Secure the transmission to a transmission jack.
7. Remove the belly plate and propeller shaft.
   1 Remove six bolts and remove the belly plate.
   2 ***WARNING: make sure that the shaft is adequately supported while removing the last bolts.***

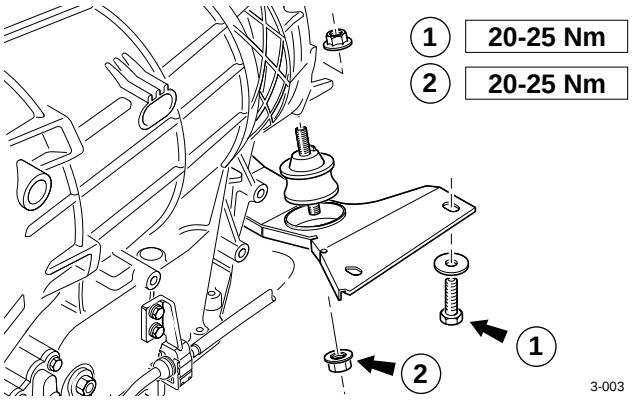
   Remove four 3/8 UNF bolts and disconnect the propeller shaft from the transmission output flange. If the transmission is to be refitted, mark the alignment of the output flange and the propeller shaft.
   3 Remove four 3/8 UNF bolts and disconnect the propeller shaft from the hypoid unit.
   4 Remove the propshaft.



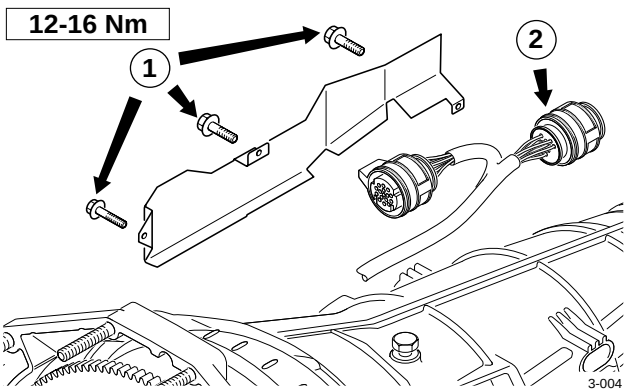
8. Remove the rear mounting assembly

   1 Remove two bolts and disconnect the rubber mounts.

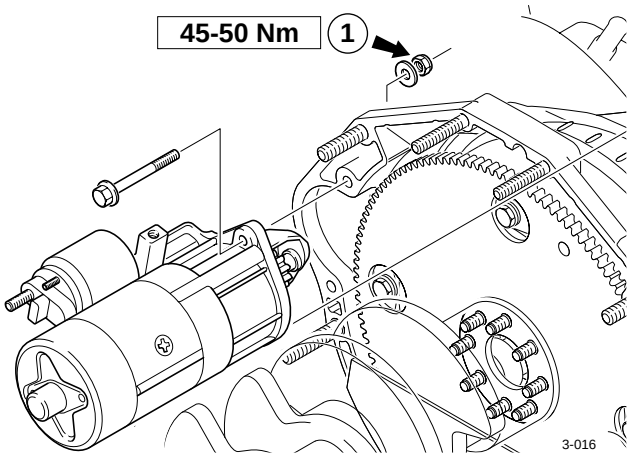
   2 Remove 4 M8 screws and remove the transmission mounting bracket.



9. Remove three bolts and the transmission harness heat shield. Disconnect the harness.



10. Disconnect and remove the starter motor. For the full procedure see (6.3.02.1).

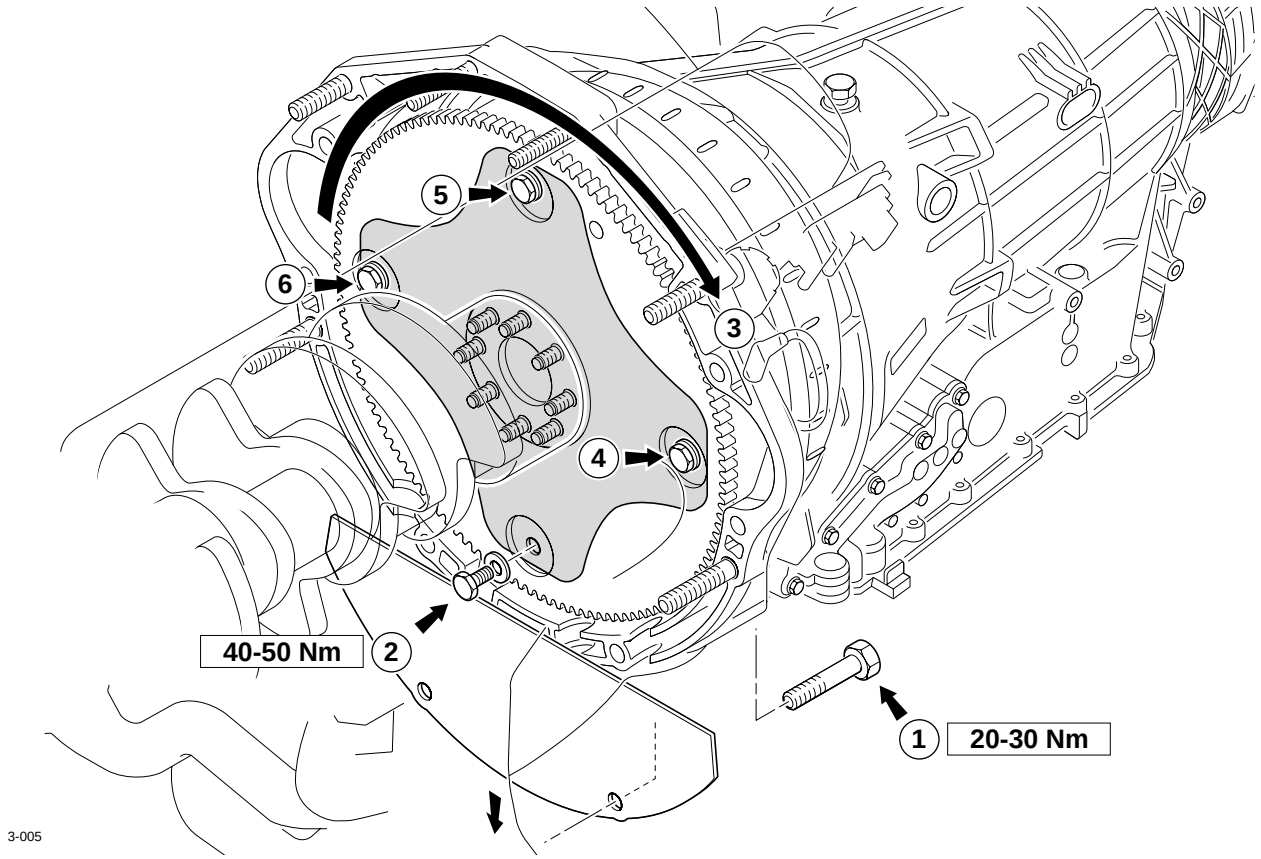


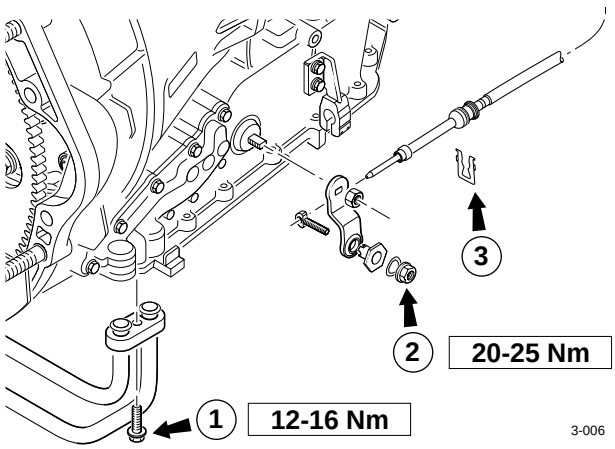
11. Disconnect the flex plate from the torque converter.

    1 Remove two M8 bolts.
    2 Remove the rear engine cover plate
    3 Remove four M10 bolts, turning the crankshaft for access
    4 Separate the torque converter from the crankshaft.

12. Remove the oil pipes and gear selector lever.

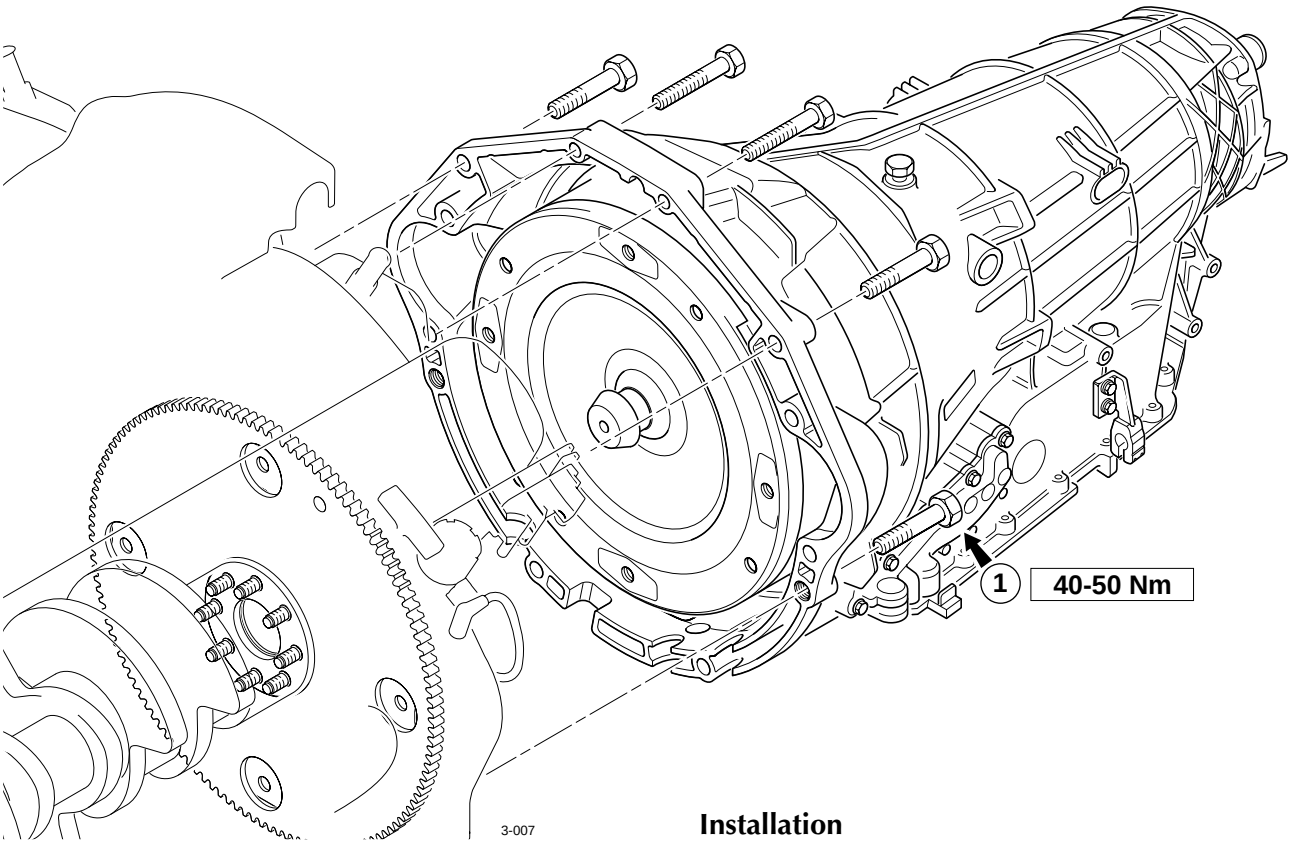
    1 Remove one M8 bolt and displace the oil cooler pipes to allow clearance for the transmission.
    2 Loosen the clamp bolt on the gear selector lever.
    3 Remove the spring clip and displace the selector cable from the transmission.





13. Remove the six remaining bolts from the bell housing.

14. Lower the transmission from the vehicle. Fit a torque converter retainer.



WARNING: The flywheel and flex plate/ring gear assembly is extremely heavy. If removing these parts, make sure that it is adequately supported.

16. If the flex plate and ring gear assembly is to be removed, remove eight M10 bolts and use the special tool to pull the assembly from the crankshaft.

Installation

1. To install, reverse the removal procedure. On completion of the replacement, set the gear selector cable and top-up the transmission fluid as follows:

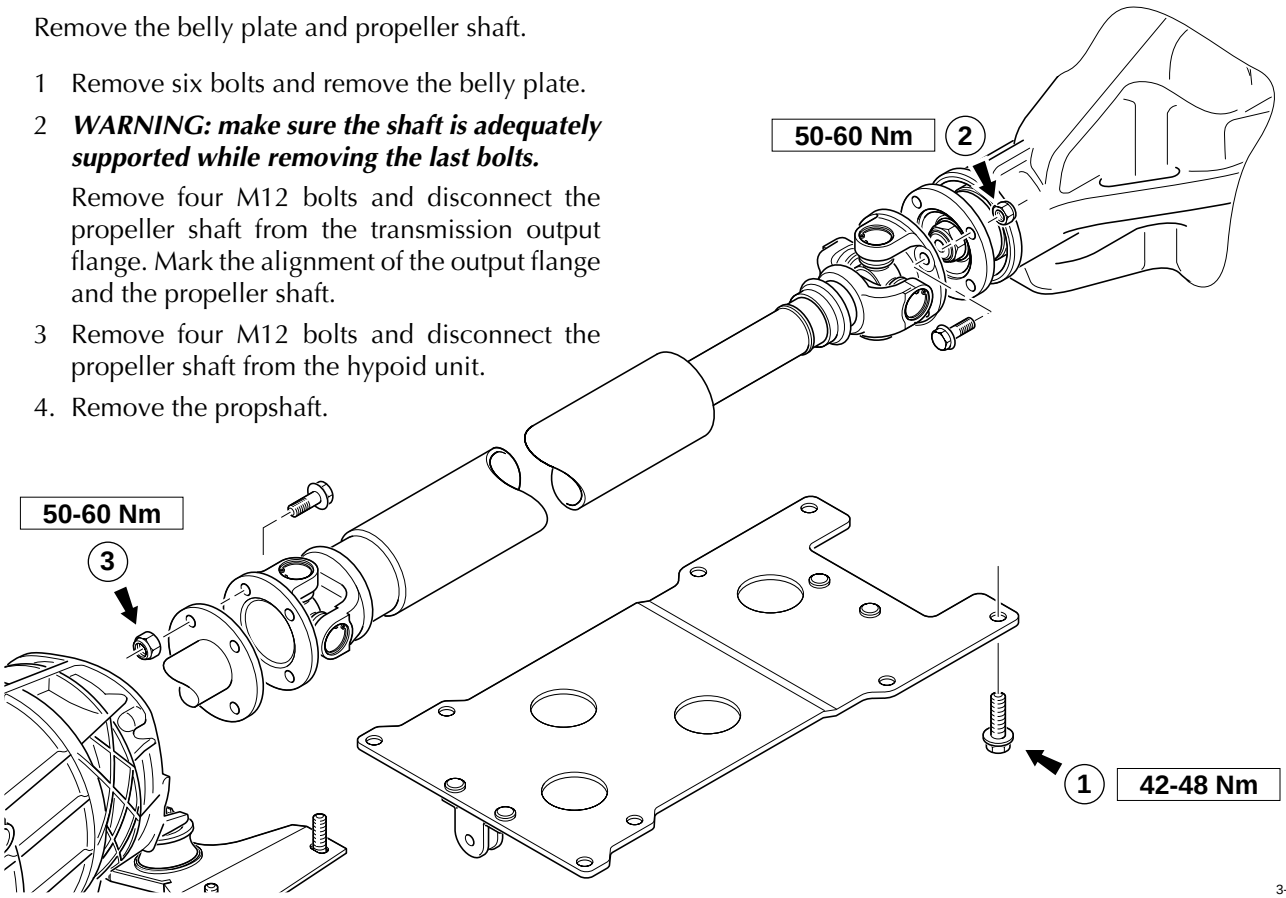
2. Push the gearbox selector lever fully forward to the 'P' position. Set the drivers gear selector lever to the 'P' position. Insert the selector cable through the support bracket and through the gearbox selector lever. Secure the selector lever cable clamp. Start the engine and ensure that the selector lever correctly locates in all positions.

3. Run the engine and place the gear selector lever in each position for at least 10 seconds. Stop the engine.

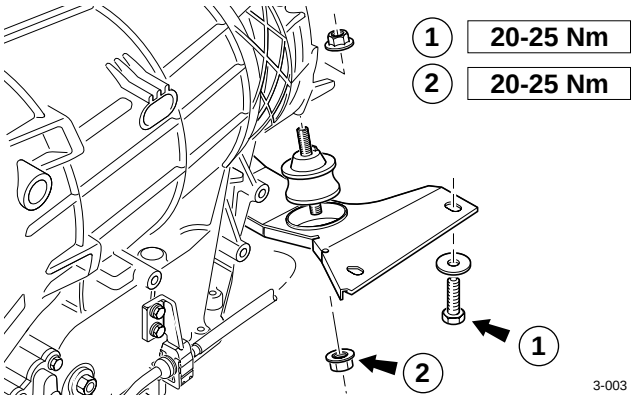
4. Check and, if necessary, top-up the transmission fluid (3.1.01.4).

3.0.01.2 Output Flange Oil Seal Renew

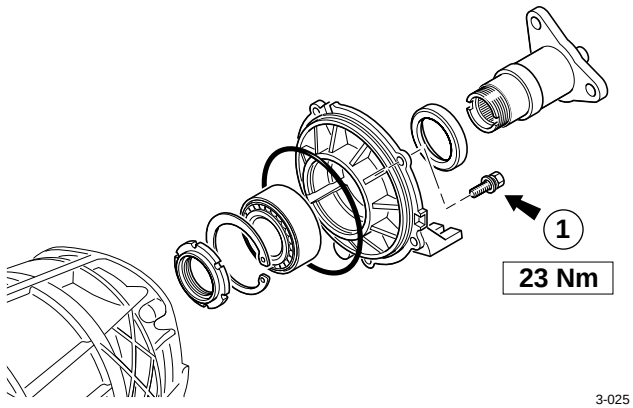
1. Disconnect the battery.
2. Fit the engine support service tool 303-021 across the wing channels, engage the hooks in the rear lifting eyes. Tension hooks to support the engine
3. Remove the central exhaust system (2.7.01), leaving the overaxle pipes and the rear silencers can be left in position.
4. Remove the belly plate and propeller shaft.
   1 Remove six bolts and remove the belly plate.
   2 ***WARNING: make sure the shaft is adequately supported while removing the last bolts.***
   Remove four M12 bolts and disconnect the propeller shaft from the transmission output flange. Mark the alignment of the output flange and the propeller shaft.
   3 Remove four M12 bolts and disconnect the propeller shaft from the hypoid unit.
   4. Remove the propshaft.



5. Support the transmission on a jack and remove the rear mounting assembly.



6. Remove five M10 bolts and remove the complete output assembly (shown here exploded).

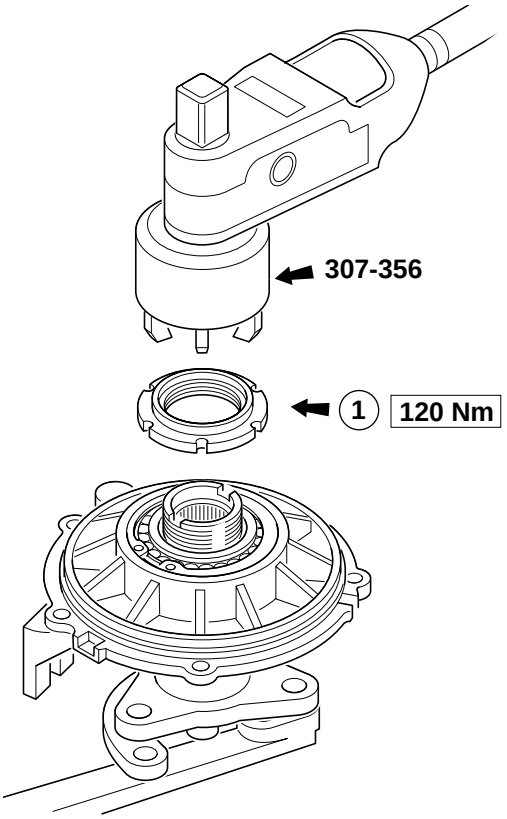


7. Use the special tool to secure the output flange.

8. Using a punch, knock back the two staked areas of the coupling nut.

9. Use the special tool to remove the coupling nut.

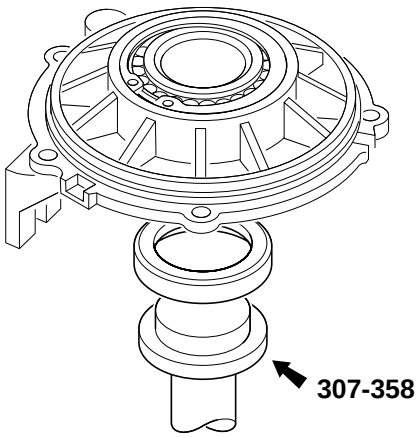
10. Remove the snap ring and separate the housing and output flange.



11. Remove the housing oil seal using a suitable seal puller. Clean the oil seal mating faces.

12. Use the special tool to fit a new housing oil seal.

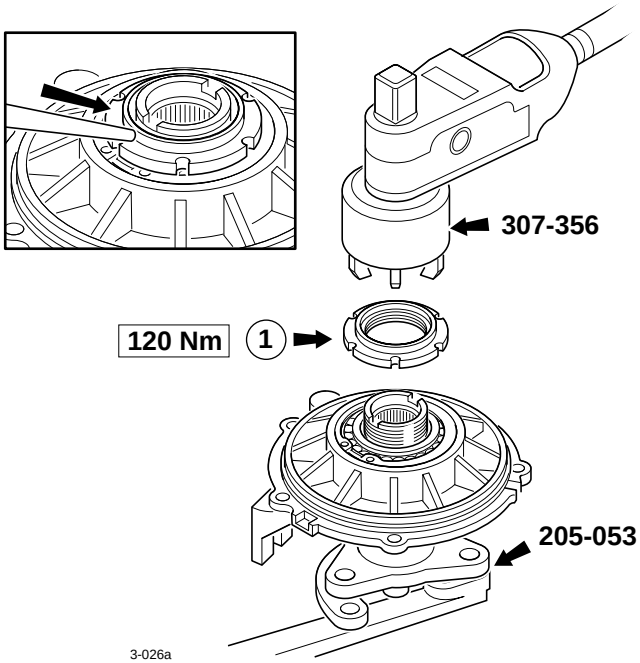
    Lubricate the oil seal before fitting.



13. Fit the output flange to the housing. Use the special tool to secure the flange.

14. Use the special tool to fit the coupling nut. Stake the nut at two positions.

15. Fit a new 'O' ring to the housing and refit the housing.

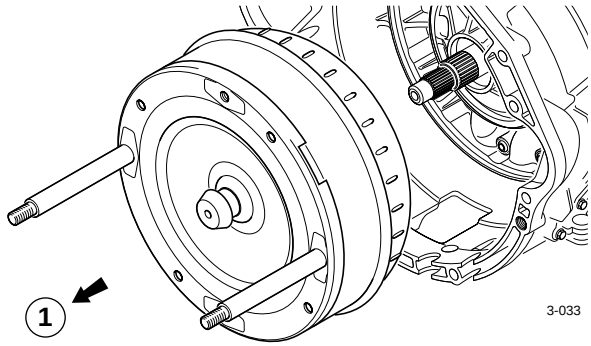


3.1.01.2 Torque Converter Removal

1. Remove the transmission from the vehicle (3.1.01.1).
2. Fit the lifting handles.
3. ***WARNING: Oil will escape as the converter is being removed.***

   Caution: Remove the converter carefully to avoid damaging the converter bearings and the shaft sealing ring on the pump.

   Remove the torque converter from the transmission.



4. Remove the lifting handles and clean the torque converter and mating faces.

Installation

CAUTION: Use extreme care not to damage the oil seal with the converter spigot.

Ensure that the converter is fully located.

1. Fit the lifting handles.
2. Lubricate the front pump seal.
3. To aid location, rotate the converter as it is being fitted and note the engagement of splines and oil pump drive.
4. Check that the converter fixing boss faces are approximately ***8.0 mm inboard of the transmission mounting face.***
5. Refit the retaining hoop.
6. Remove the lifting handles.

3.1.01.4 Automatic Transmission Fluid Check/Top-Up

Data

Oils, Seals and Lubricants

ATF Esso LT 71141 - AML No. 45-120299-AA

Quantity 14 Litres - 500 fl oz - 15.5 US quarts

The ZF 5 HP-30 automatic transmission is 'filled for life' at the manufacturers and will not normally require any servicing. In the event of a fluid leak from the transmission cooling system, the leak must be repaired and then the transmission fluid may be replenished as follows:

Procedure

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

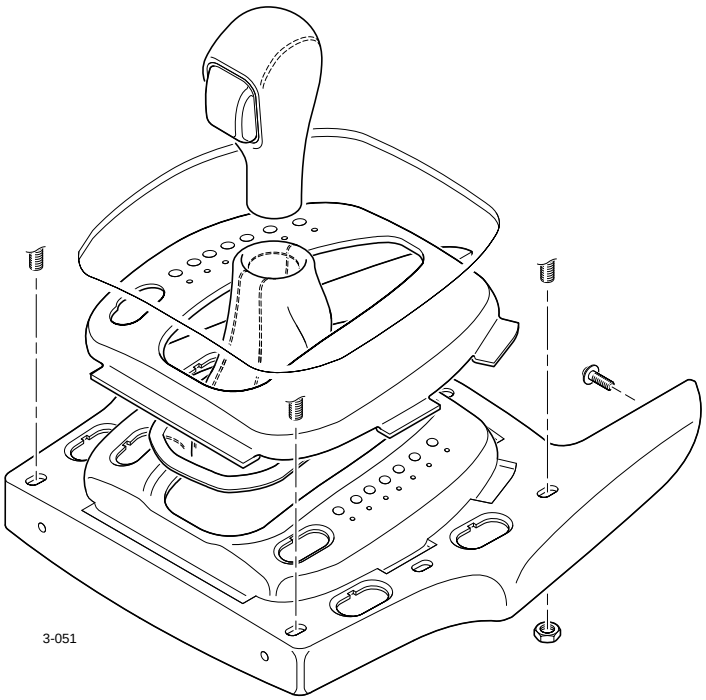
1. Raise the vehicle on a hoist. Wait until the vehicle has remained still for at least two minutes, i.e. the rear wheels have not turned.
2. Run the engine at idle speed, approximately 600 rpm.
3. Check that the transmission is not in 'Limp Home' mode.
4. Select Reverse and Drive for a minimum of 5 seconds to make sure that the clutches and brakes in the transmission are filled.
5. Select Park for the check. Leave the engine running.

WARNING: To avoid the risk of burns, make sure that the oil sump temperature remains in the range of 30°C to 50°C throughout the whole procedure.

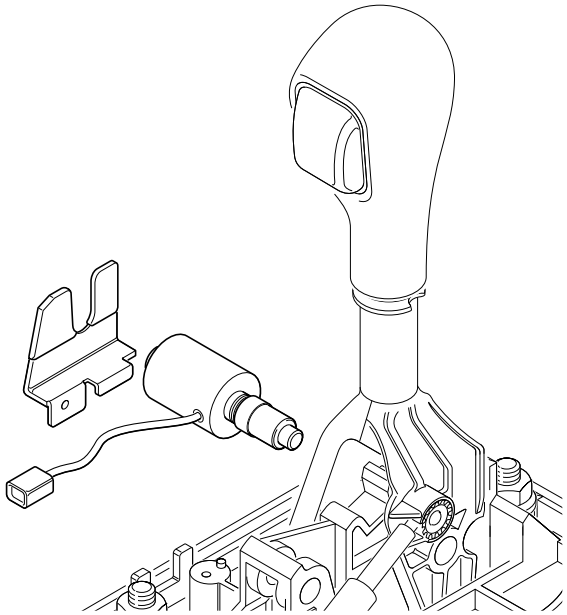
6. Place an drip tray beneath the transmission.
7. Remove the filler plug from the underside of the oil pan.
8. Using a swan neck filler tube and an ATF dispenser, fill the transmission to overflow with the ATF-oil Esso LT 71141. Allow any excess fluid to drain into the drip tray.
9. Fit a new seal to the filler plug. Refit the filler plug.

3.3.01.1 Gear Shift Interlock Solenoid Removal

1. Disconnect the battery.
2. Remove the PRNDL assembly
   1 The substrate, PRNDL, gaiter and veneer trim are an assembly, fitted as shown below.
   2 Before the assembly can be released, the air conditioning switch panel must be removed and the console 'horseshoe' surround displaced.
   See Section 7, Body and Trim for full details.
   3 From inside the cubby box remove two screws and displace the assembly.
   4 Disconnect the electrical connections and remove the assembly.



3. Disconnect the solenoid multiplug.
4. Unclip the solenoid bracket, release the solenoid from the bracket and remove.



Installation

To install, reverse the removal procedure.

Releasing the Interlock Manually

If the battery is disconnected or discharged, the gearshift interlock will not disengage when the ignition is turned on. The gear selector lever will be locked in Position. The vehicle cannot then be moved since the parking lock in the transmission will be engaged.

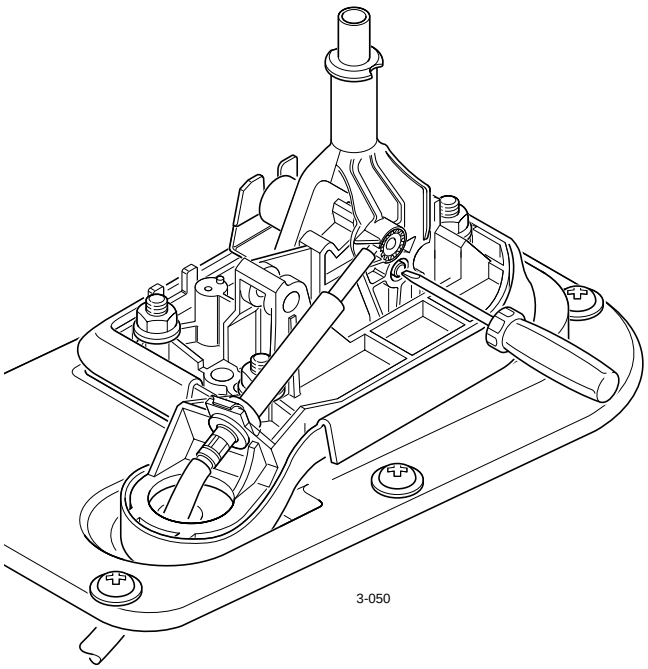
To disengage the actuator:

Access the mechanism by following the procedure for removing the gear shift interlock solenoid (3.3.01.1).

Using a suitable implement, push back the solenoid actuator until it disengages.

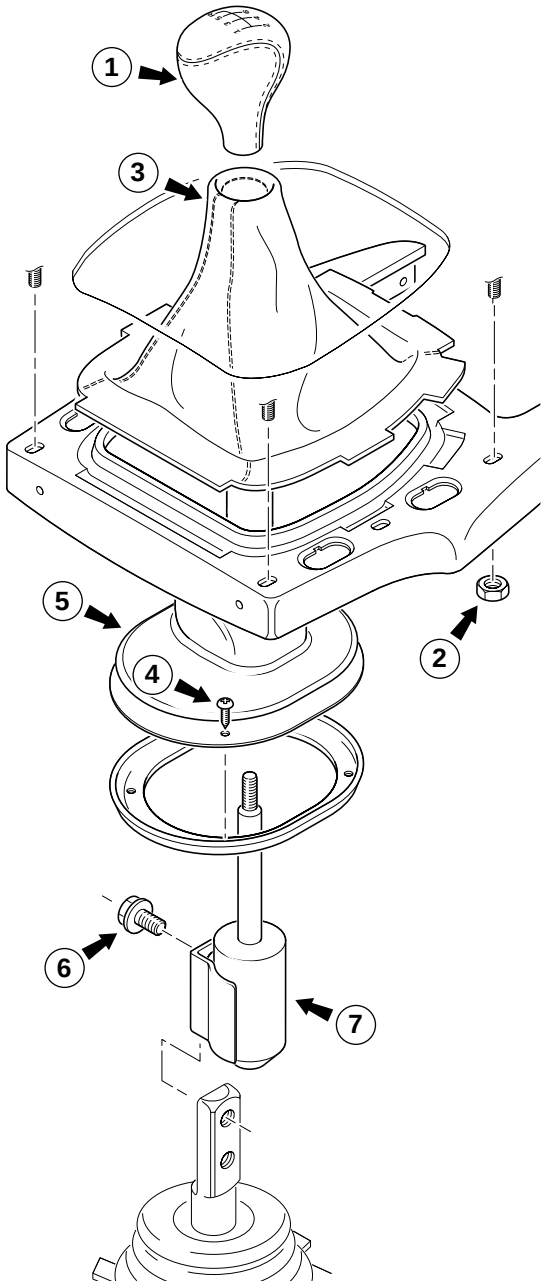
Move the gear selector lever to the Neutral position.

Refit the gaiter and surround.



3.3.04.1 Gear Shift Lever Renew

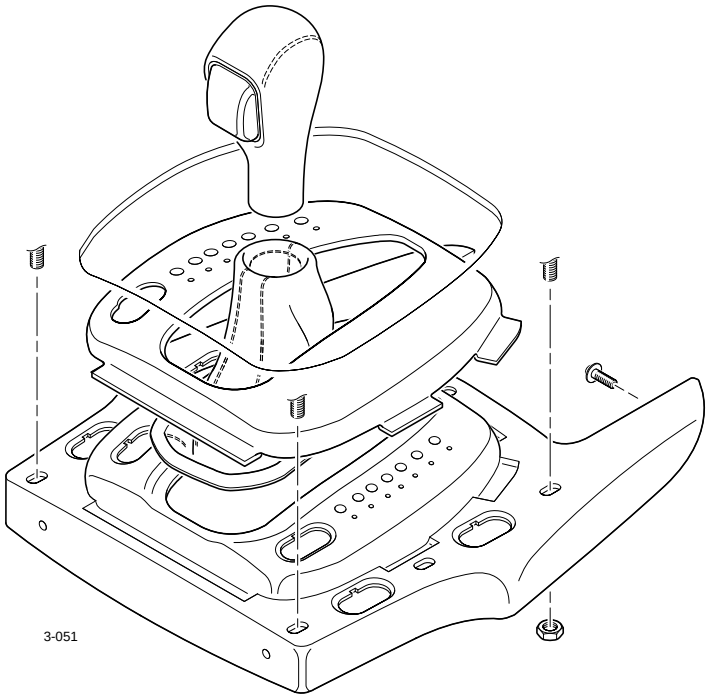
1. Remove the gear lever knob.
2. The substrate, gaiter and veneer trim are an assembly, fitted as shown below. Before the assembly can be released, the air conditioning switch panel must be removed and the console 'horseshoe' surround displaced. See Section 7, Body and Trim for details.
3. Remove the gaiter and substrate assembly.
   1 From inside the cubby box remove two screws and displace and remove the substrate assembly.
   2 Remove four screws and move the draught excluder and retaining ring
   3 Remove two M8 bolts
   4 Slide the gear shift lever off the stub shaft.



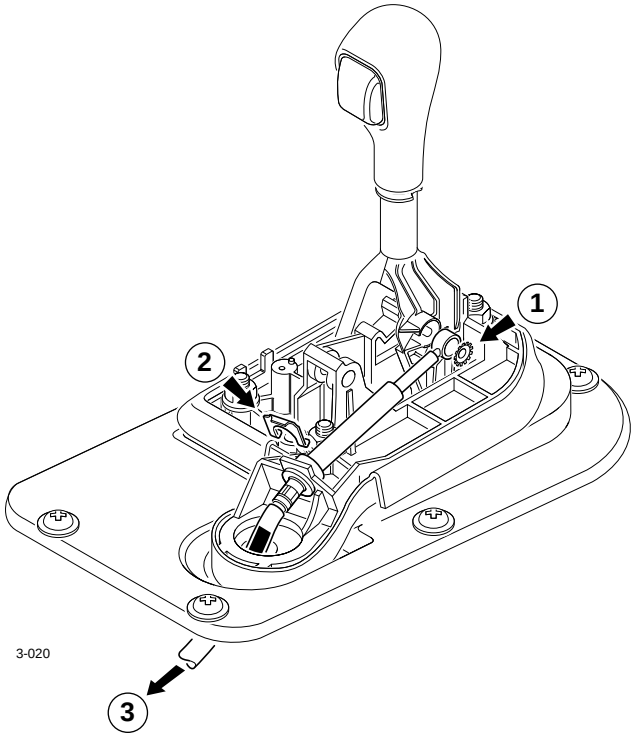
3.3.07.2 Gear Selector Cable Assembly

Removal

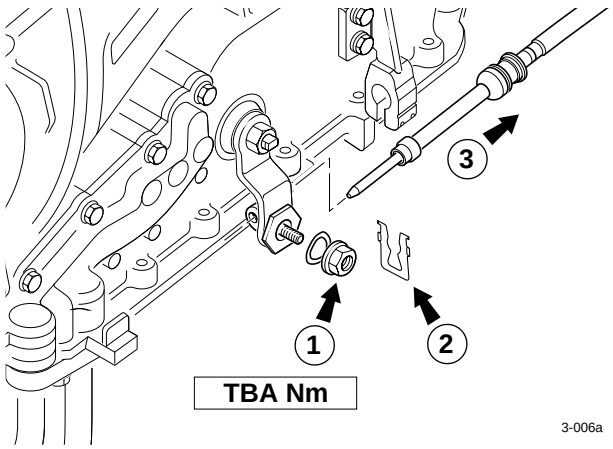
1. Place the gear lever in P.
2. Remove the gear selector knob.
3. Remove the PRNDL assembly
   1 The substrate, PRNDL, gaiter and veneer trim are an assembly, fitted as shown below.
   2 Before the assembly can be released, the air conditioning switch panel must be removed and the console 'horseshoe' surround displaced.
   See Section 7, Body and Trim for full details.
   3 From inside the cubby box remove two screws and displace the assembly.
   4 Disconnect the electrical connections and remove the assembly.



3. Disconnect the selector cable at the gear lever end.
   1 Prise out the spring washer and pull the cable end from the recess
   2 Slide out securing plate
   3 Push grommet through aperture



4. Raise the vehicle for access.
5. Detach the selector cable from the transmission.
   1 Remove one nut, washer and special nut
   2 Remove the cable retaining plate.
   3 Remove the Cable assembly from the vehicle.



Installation

To install, reverse the removal procedure.

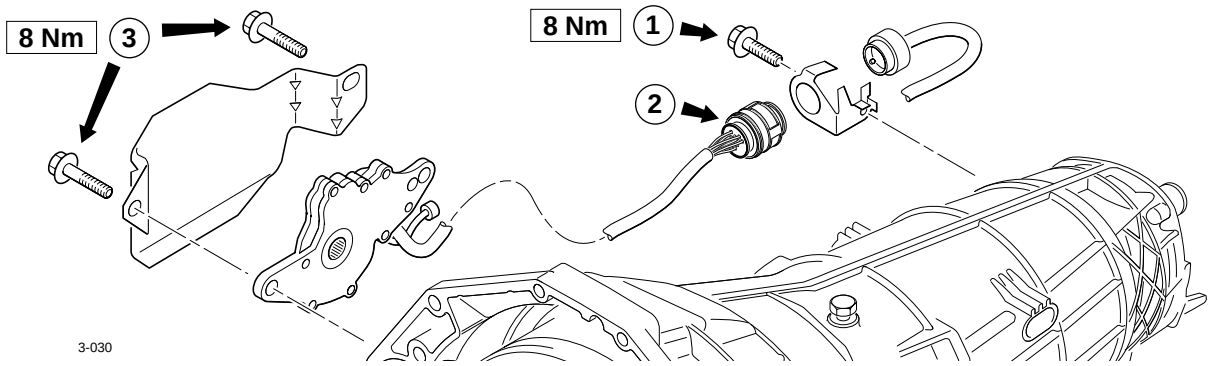
Before clamping the cable assembly to the selector lever, make sure the gear lever is in the 'P' position and the gear selector is in the corresponding vertical position.

3.3.09.1 Rotary Switch Removal

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove the central exhaust system (2.7.01.1).

   Note: The overaxle pipes and the rear silencers can be left in position.

4. Remove the rotary switch
   1 Remove one M6 bolt
   2 Lever out the cable from the cable clip.
   3 Remove two M6 bolts and remove the heatshield.
   4. Remove one M6 bolt and remove the selector switch.

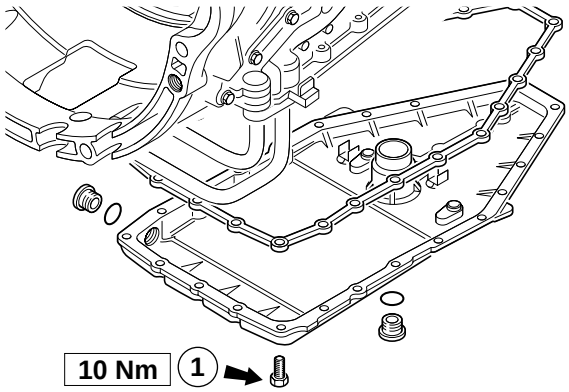


Installation

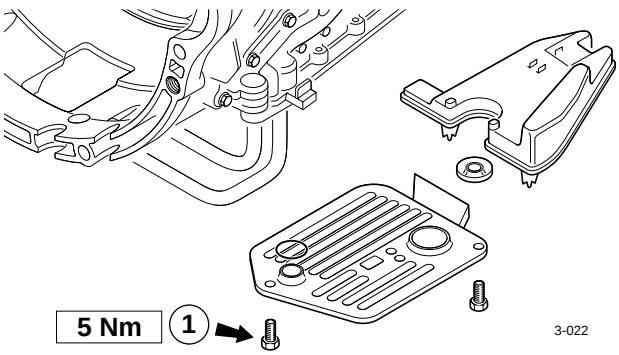
To install, reverse the removal procedure.

3.4.02.1 Speed Sensor Renew

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove the transmission drain plug and drain the transmission fluid.
4. Remove 23 M6 capscrews and remove the oil sump. Clean away all traces of gasket material.



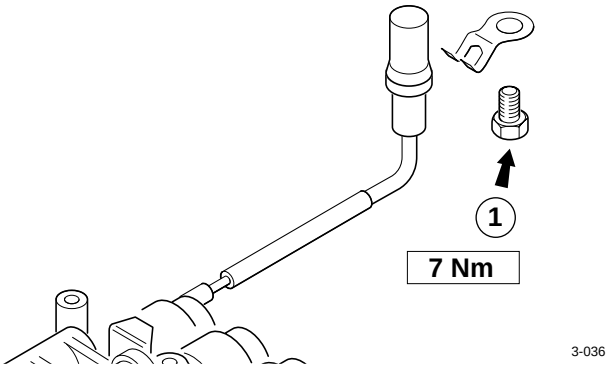
5. Unclip the oil container and remove the container and magnet.
6. Remove two screws, remove the filter and 'O' ring.



Note: The oil container and filter need not be removed if the output speed sensor only is to be renewed.

7. Remove one screw and remove the speed sensor bracket.

   Withdraw the speed sensor.



8. Disconnect the speed sensor from the multiplug and fit a new one.

Installation

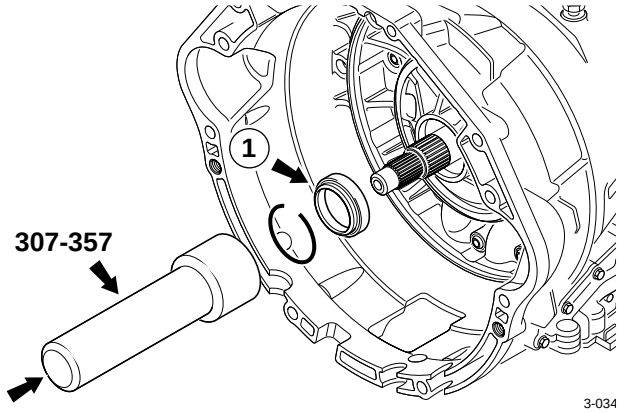
1. To install, reverse the removal procedure.
2. Fit a new 'O' ring to the filter if removed. Grease lightly with vasoline.
3. Fit the oil sump using a new gasket.

3.4.05.3 Oil Pump Shaft Seal Renew

1. Remove the transmission from the vehicle (3.0.01.1).
2. Remove the torque converter (3.1.01.2)
3. Remove the seal retaining snap ring.
4. Using a 'snap-on' seal puller, remove and discard the shaft seal.
5. Clean the seal housing.

Installation

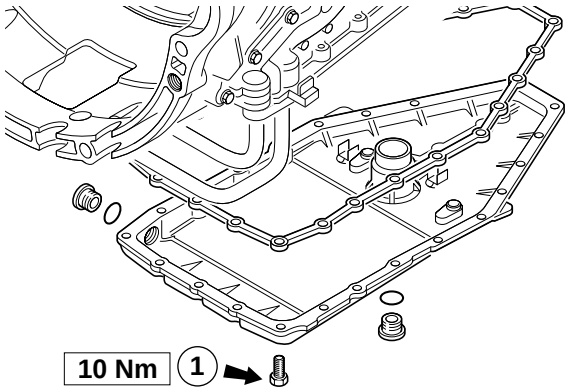
1. To install, reverse the removal procedure.
2. Lubricate the oil seal before fitting and install using the special tool.



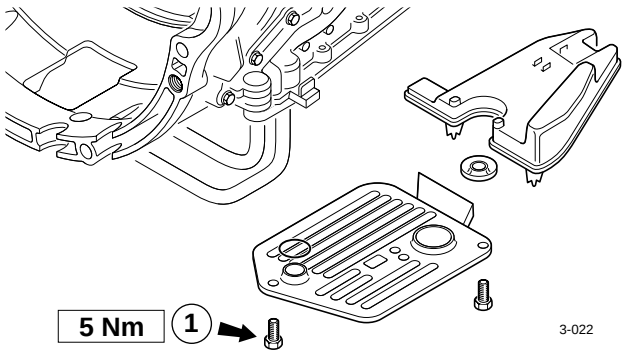
3.5.05.1 Shift Unit Removal

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove the transmission drain plug and drain the transmission fluid.
4. ***WARNING: Observe all transmission fluid manufacturer's safety instructions when draining and refilling the automatic transmission.***

   Remove 23 M6 capscrews and remove the oil sump. Clean away all traces of gasket material.



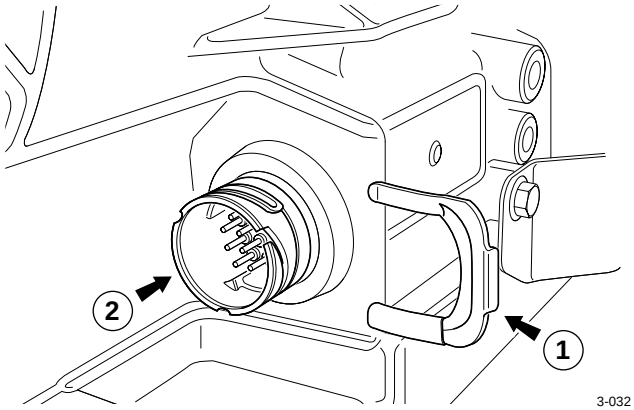
5. Unclip the oil container and remove the container and magnet.
6. Remove two screws and remove the filter and 'O' ring.



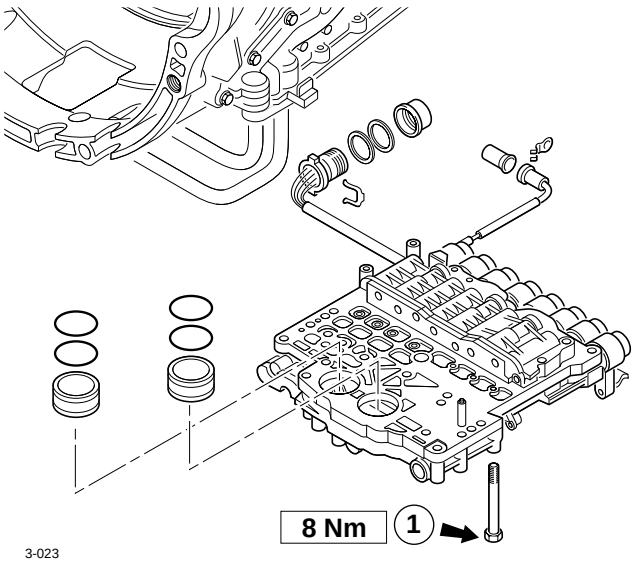
7. Remove the cable harness from the transmission housing

   1 Release the retaining bracket on the plug using a screwdriver.

   2 Push the plug through the housing. Discard two 'O' rings.



8. Disconnect the input and output speed sensors.
9. Remove 15 M5 cap screws and remove the shift unit complete with suction and pressure pipes and internal harness.

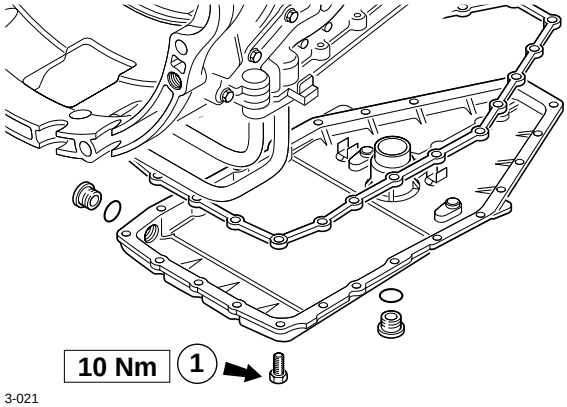


Installation

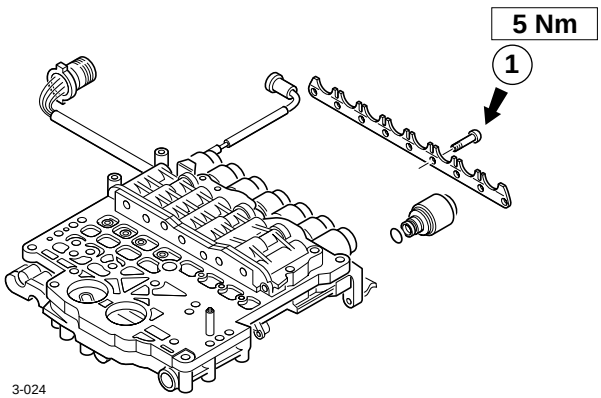
1. To Install, reverse the removal procedure.
2. Fit new 'O' rings to the suction and pressure pipes. The harness plug and the filter. Grease lightly with vasoline.
3. Fit the oil sump using a new gasket.

3.5.07.1 Regulator/Solenoid Valve Removal

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove the transmission drain plug and drain the transmission fluid.
4. Remove 23 M6 capscrews and remove the oil sump. Clean away all traces of gasket material.



5. Remove nine M5 cap screws.
6. Remove the fixing plate.
7. Remove the relevant regulator or solenoid valve.



Installation

1. To install, reverse the removal procedure.

   *Note: When a pressure regulator or solenoid is refitted a new 'O' ring **must** be used.*

2. Fit the oil sump using a new gasket.

3.5.10.2 / 3.8.10.1 Propeller Shaft Remove

1. Make sure the gearbox is in Neutral or Park.
2. Disconnect the battery.
3. Fit the engine support 303-021, 303-670 across the wing channels, engage the hooks in the rear lifting eyes. Tension the hooks to support the engine.
4. Raise the vehicle on a four point hoist.
5. Remove the exhaust cruciform and the catalytic converters (2.7.01).
6. Mark the propshaft flange relative to the differential flange before removing the propshaft.
7. Remove the tunnel cover plate and prop shaft.

Manual

1 Remove six M10 bolts and remove the tunnel cover plate

2 ***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 end.***

Disconnect the propeller shaft flange at the hypoid unit. Remove the prop shaft.

Automatic

1 Remove six bolts and remove the tunnel cover plate.

2 ***WARNING: make sure that the shaft is adequately supported while removing the last bolts.***

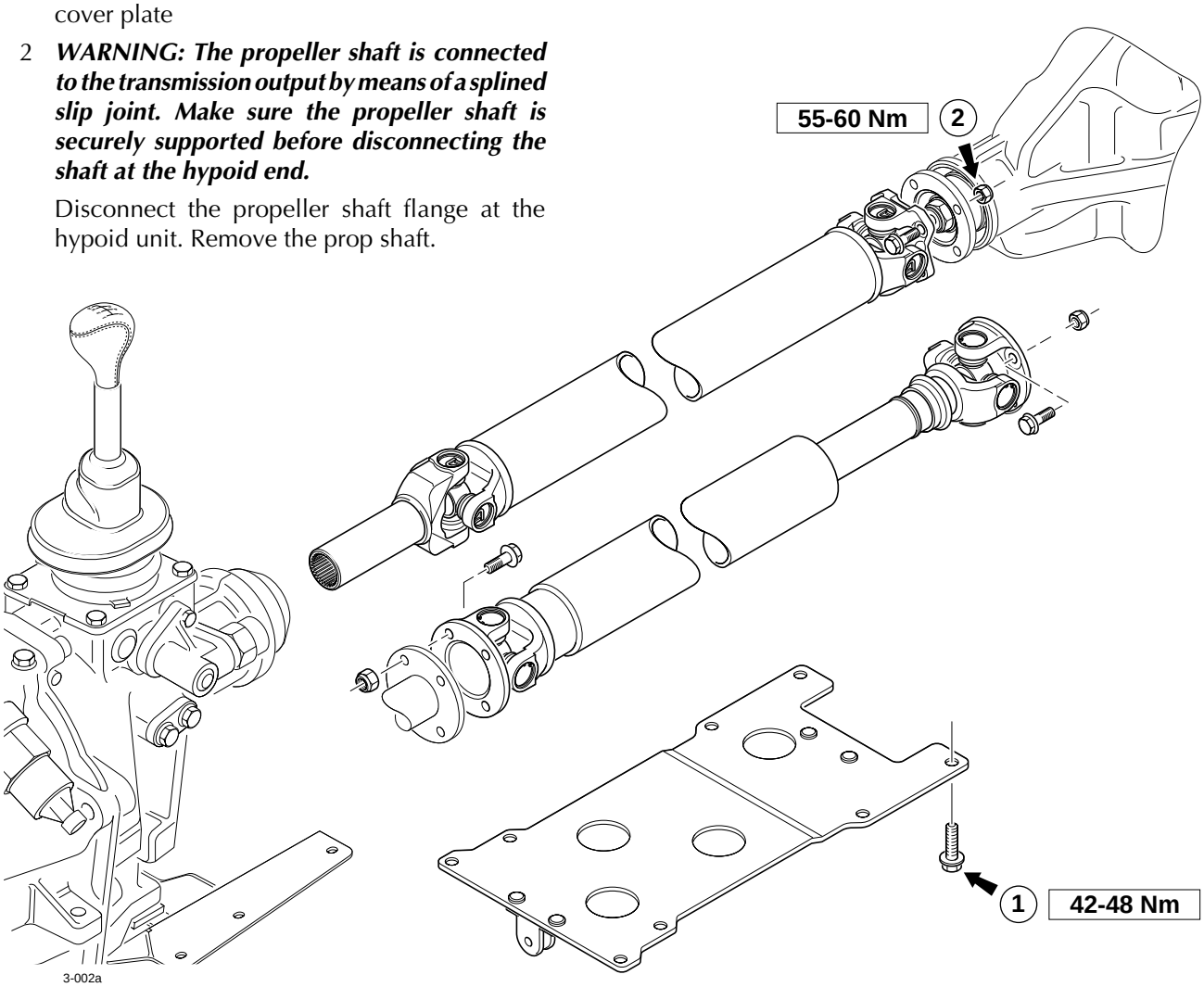
Remove four M12 bolts and disconnect the propeller shaft from the transmission output flange. Mark the alignment of the output flange and the propeller shaft.

3 Remove four M12 bolts and disconnect the propeller shaft from the hypoid unit.

4. Remove the propshaft.

Installation

1. To install, reverse the removal procedure.

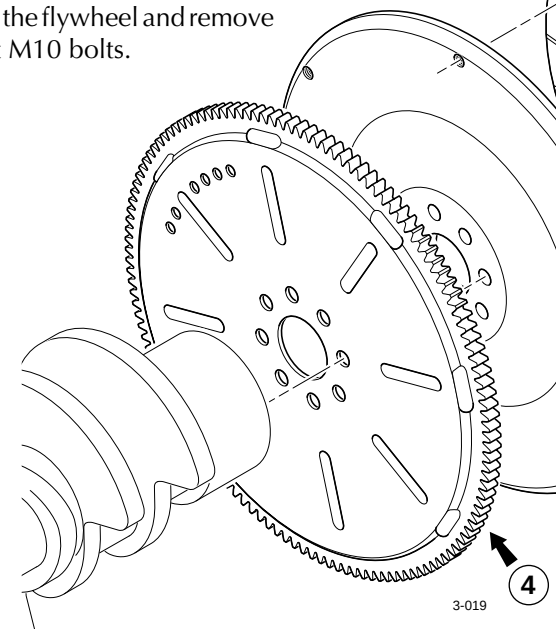


3.6.04.1 Clutch Assembly Renew

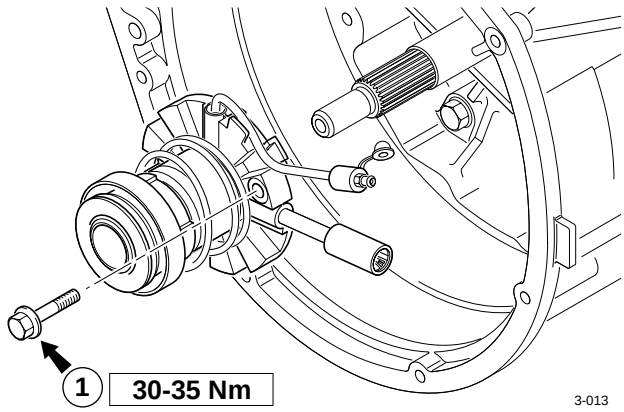
1. Remove the transmission (3.8.01.1)
2. Remove the clutch assembly
   1 Support the clutch assembly, insert the alignment tool and remove six M10 bolts and lock washers. Retain these bolts for reassembly.
   2 Remove the pressure plate
   3 Remove the driven plate and alignment tool.

WARNING: The flywheel and flex plate/ring gear assembly is extremely heavy. If removing these parts, make sure that it is adequately supported.

3 Lock the flywheel and remove eight M10 bolts.

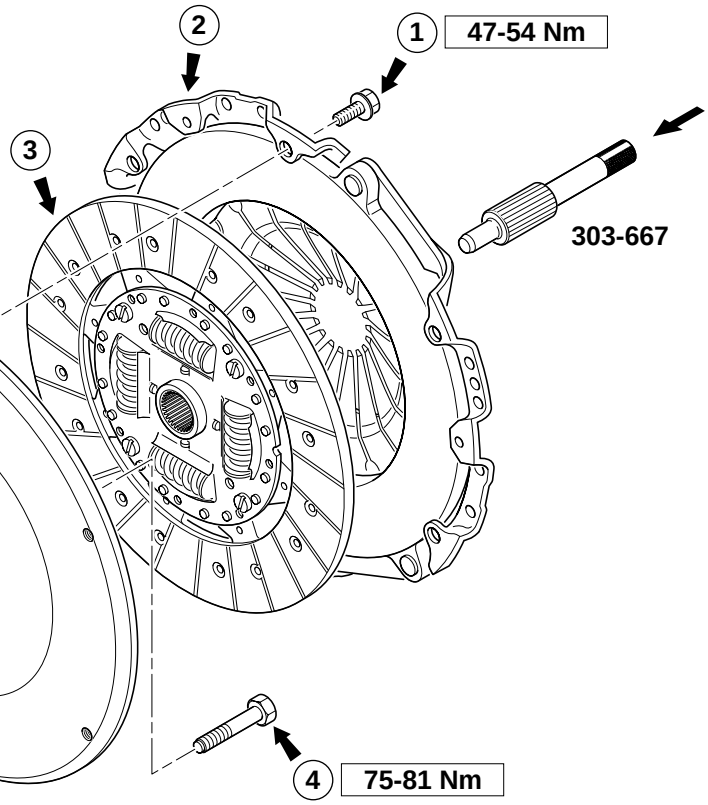


4. Using the special tool, remove the flywheel - flex plate/ring gear assembly from the crankshaft.
5. Remove two M8 bolts and remove the concentric slave cylinder and bearing assembly.



Installation

1. Insert the pilot bearing into the crankshaft bore with the puller slots facing the engine. Press in the bearing to 0.0-1.0mm below the crankshaft end face.



2. Fit the flex plate/ring gear assembly on to the crankshaft pilot and align the holes.
3. Seat the flywheel assembly to the lead-in edge of the crankshaft and align the holes.
4. Insert eight M10 bolts through the flywheel - flex plate, starting with the offset alignment hole first. Finger tighten all bolts.
5. Torque each bolt evenly in a star pattern at half turns until the assembly is seated. Loosen the bolts and retorque in a star pattern.

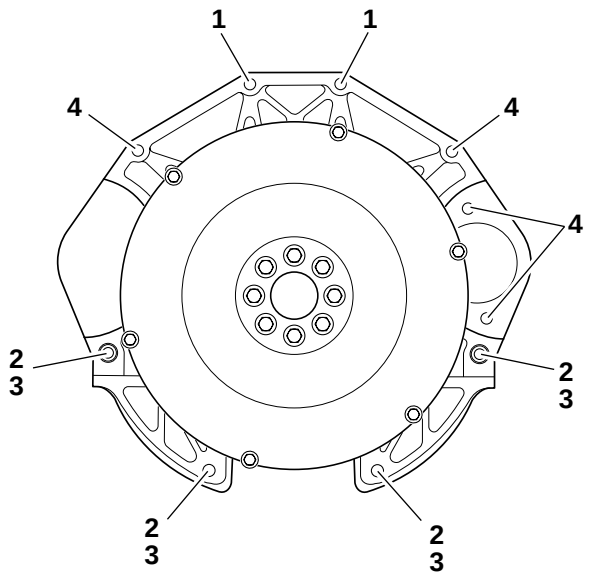
6. Insert the alignment tool into the driven plate spline. Make sure the tool is oriented correctly, as shown in the illustration. Insert the alignment tool into the crankshaft pilot. Seat the driven plate to the flywheel face.

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

   Align the white mark on the pressure plate/cover to the white painted dowel pin on the flywheel.

8. Insert six M10 bolts and torque to specification. Remove the alignment tool.

9. Refit the manual transmission (3.8.01.1). Note the sizes and lengths of the bolts indicated on the daigram below.



1		M8 x 50 Bolt
2 3		M10 x 80 Bolt Washer
4		M10 x 50 Bolt

3-054 Bolts

3.6.05.1 Transmission Fluid Check and Top-up

Data

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

Oils, Seals and Lubricants

Recommended Transmission Fluid:
Texaco 1863
Transamatic 7045

Quantity Total Fill:

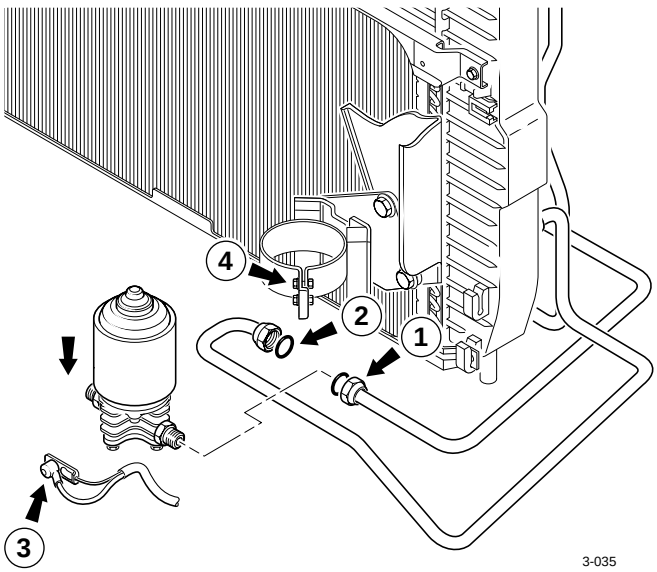
4.26 Litres - 150.3 fl oz - 4.5 US quarts

	Litres	fl oz
Transmission	3.52	124
End Tank Cooler	.20	7.3
Lines	0.54	19

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

Drain Procedure

1. Place a drip tray beneath the end tank cooler. Release the connectors in the feed and return lines by pulling back the plastic sleeves. This will allow the radiator end tank cooler and pump return lines to drain.

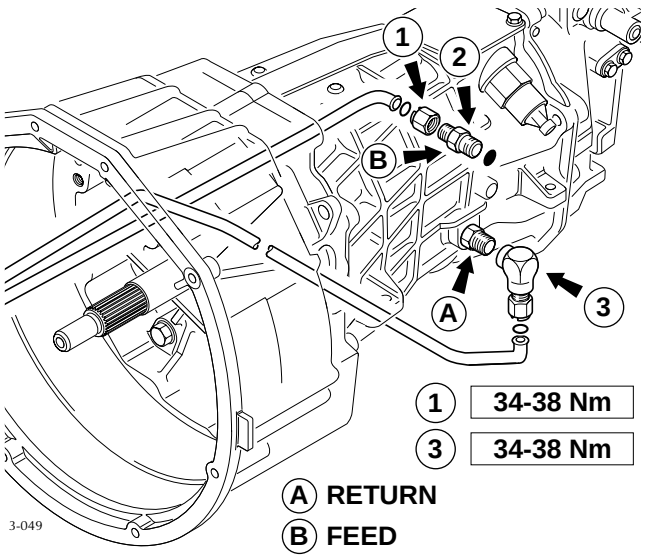


3-035

2. Reposition the drip tray beneath the transmission fill and drain ports. Loosen both feed and return cooling lines from the fixing brackets.

3. Release the cooling feed pipe from the adaptor fitted to the drain port by depressing the plastic tabs. Remove the pipe.

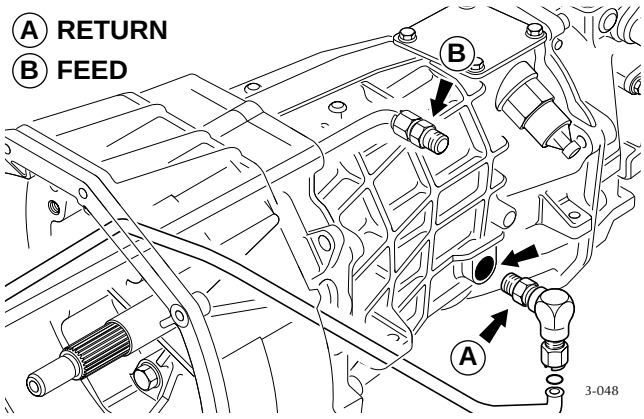
4. Release the cooling return pipe from the swivel connector fitted to the fill port by depressing the plastic tabs. Remove the pipe and unscrew the swivel connector from the fill port.



Fill Procedure

1. Reconnect the cooling feed pipe at the quick release connector and push fit the pipe into the drain port adaptor until it seats with an audible click.

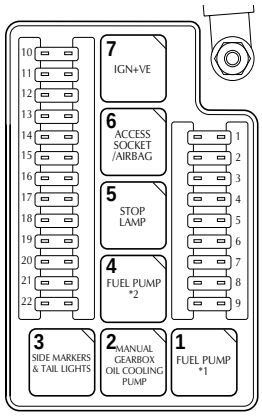
2. Refill the transmission with 3.8 Litres (134 fl oz) of the recommended transmission lubricant.



3. Refit the swivel connector to the fill port. Push fit the pipe into the swivel port adaptor until it seats with an audible click.

4. Cycle the transmission cooling pump for 2 minutes using the PDU if available, or by the following method.

   1 Switch the ignition off.
   2 Remove relay No.2 in the boot fuse box.
   3 Assemble a 150mm shorting link using 2mm gauge with crimped ends.
   4 Short out contacts 30 and 87 (relay contacts 3 and 5). This will run the pump.



5. Switch the pump off (with PDU or by removing the shorting link.

6. Disconnect the cooling feed pipe from the swivel connector and immediately seal the end of the pipe to prevent loss of lubricant. Remove the swivel connector and add 0.5 Litres (17.6 fl oz) of transmission lubricant. Refit the swivel connector and the cooling pipe.

7. Retighten all cooling pipe clamps and brackets.

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

9. After road testing the vehicle make a final leak check.

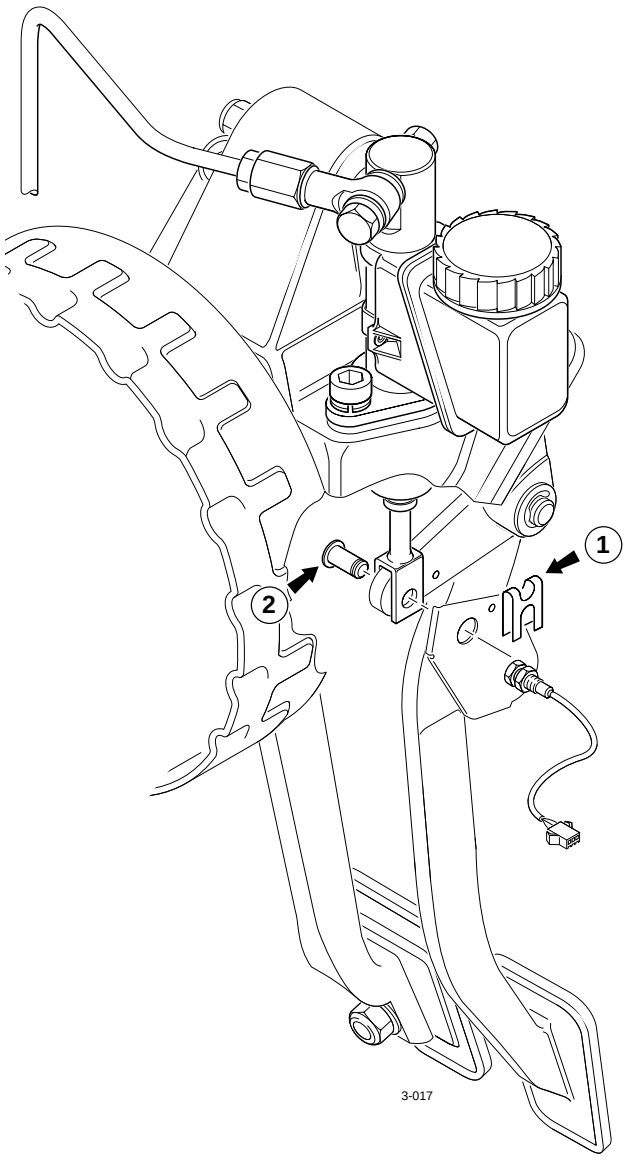
3.7.01.1 Master Cylinder Renew

Data

Oils, Greases and Fluids

Castrol/Girling Universal Brake and clutch fluid.

1. Remove the clip and withdraw the pin from the clutch pedal.

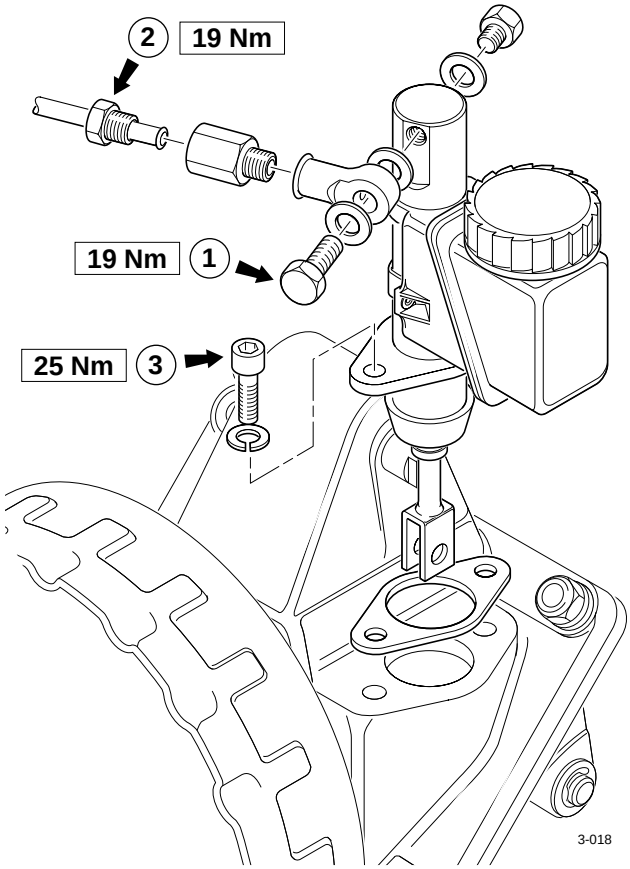


2. Drain the clutch hydraulic system. Make sure that the body is protected from spillage.

3. Disconnect the hydraulic pipe from the master cylinder.

4. Fit blanking plugs to the pipe and master cylinder.

5. Remove two cap screws and washers and remove the master cylinder assembly and gasket.



Installation

1. Secure the master cylinder in a bench vice and remove the top.

2. Fill the reservoir with the recommended fluid. Refit and tighten the top.

3. Prime the cylinder by 'working' the cylinder until fluid appears at the hydraulic pipe outlet.

The rest of the installation procedure is a reversal of the removal procedure.

3.7.05.1 Clutch Hydraulic System Bleed

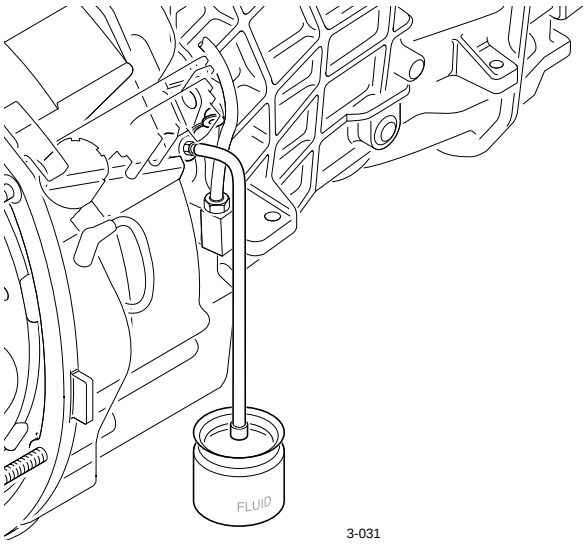
Data

Oils, Greases and Fluids

Castrol/Girling Universal Brake and Clutch fluid

Caution: Use only Castrol/Girling Universal Brake and Clutch fluid in the hydraulic system.

1. Remove the reservoir filler cap. Top up the reservoir to the correct level with hydraulic fluid.
2. Attach one end of a bleed tube to the slave cylinder bleed nipple where it exits the clutch housing.
3. Partially fill a clean container with hydraulic fluid. Immerse the other end of the bleed tube in the fluid.



3-031

4. Slacken the slave cylinder bleed nipple.
5. Pump the clutch pedal slowly up and down, pausing between each stroke.
6. Top up the reservoir with fresh hydraulic fluid after each three pedal strokes.

Caution: Do not use fluid bled from the system for topping up purposes as this will contain air. If the fluid has been in use for some time it should be discarded. Fresh fluid bled from the system may be used after it has stood for a few hours allowing all the air bubbles to disperse.

7. Pump the clutch pedal until the pedal becomes firm, tighten the bleed nipple.
8. Apply the working pressure to the clutch pedal for two to three minutes and examine the system for leaks.

3.8.01.1 Manual Transmission - Removal

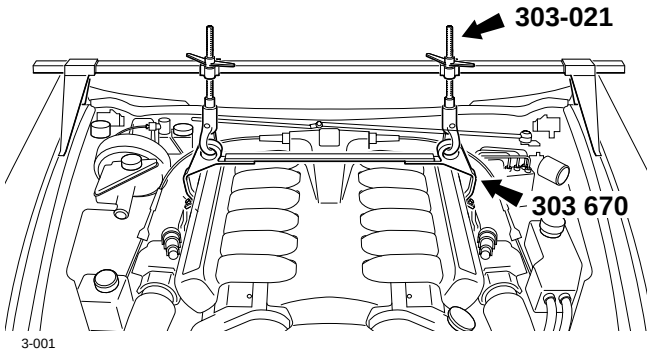
Data

Sealants

Betaseal HV3 Superflex PUR Adhesive/Sealant

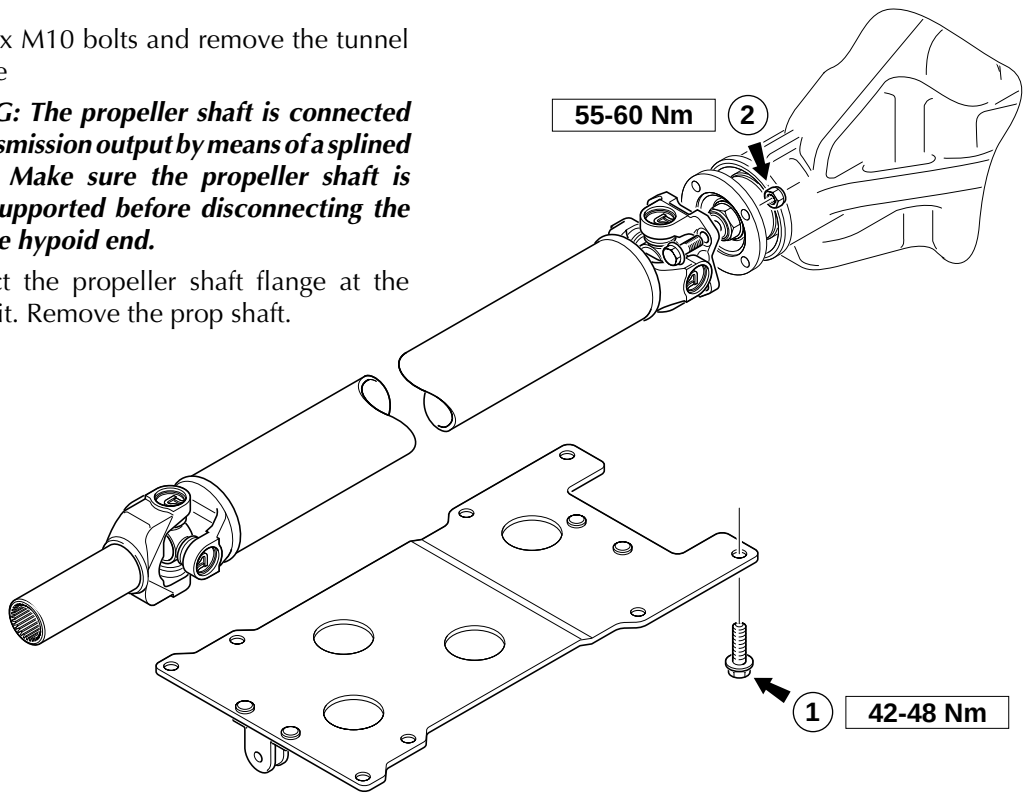
Procedure

1. Make sure the gearbox is in Neutral.
2. Disconnect the battery.
3. Fit the engine support service tool across the wing channels, engage the hooks in the rear lifting eyes. Tension the hooks to support the engine.

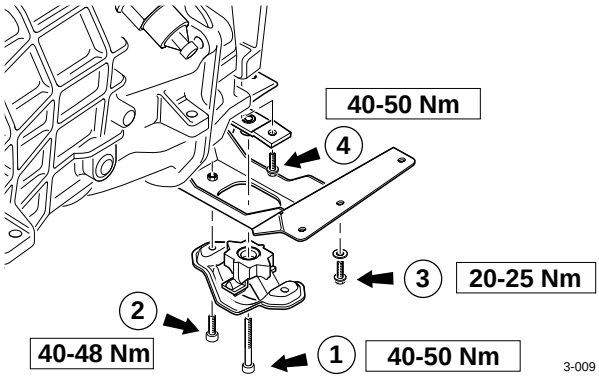


4. Raise the vehicle on a four point hoist.
5. Remove the exhaust cruciform and the catalytic converters (2.7.01).
6. Remove the cover plate and prop shaft.
   1 Remove six M10 bolts and remove the tunnel cover plate
   2 ***WARNING: The propeller shaft is connected to the transmission output by means of a splined slip joint. Make sure the propeller shaft is securely supported before disconnecting the shaft at the hypoid end.***

     Disconnect the propeller shaft flange at the hypoid unit. Remove the prop shaft.

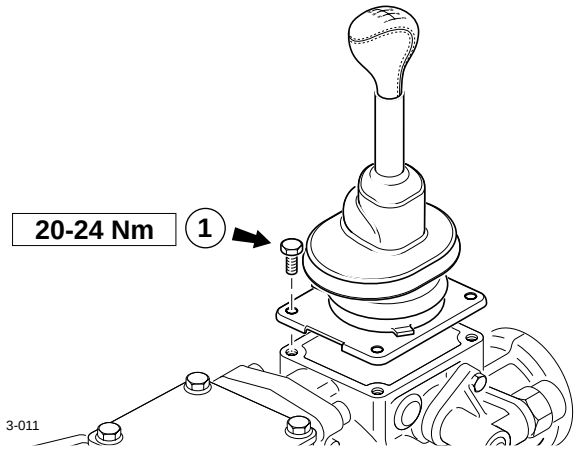


7. Secure a transmission jack to the gearbox.
8. Remove the transmission support bracket.

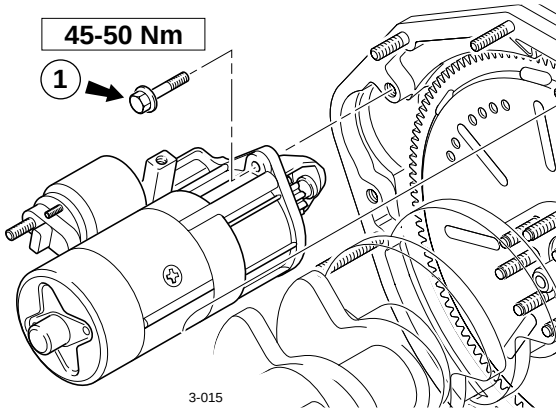


9. Lower the transmission jack to increase access to the bell housing and the stub shaft plate.

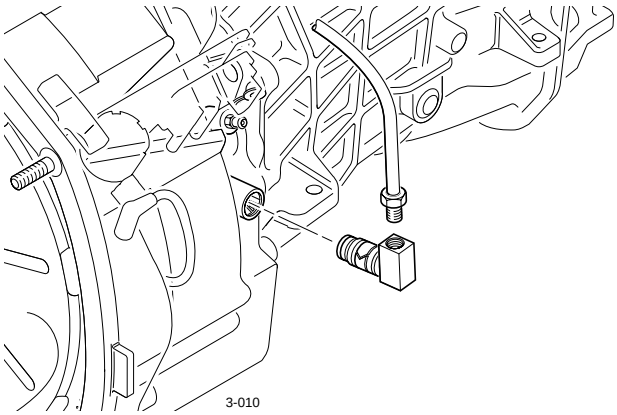
10. Remove four bolts from the stub shaft plate to allow the transmission to be removed, leaving the gear lever in position.



11. Remove two bolts and displace the starter motor. Do not disconnect the starter motor connections. For the full procedure see (6.3.02)

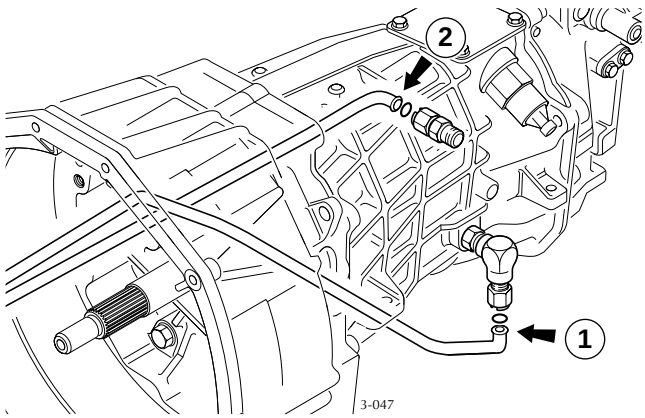


12. Using the special tool, disconnect the clutch slave cylinder hydraulic connector.



13. Disconnect the reverse gear switch.

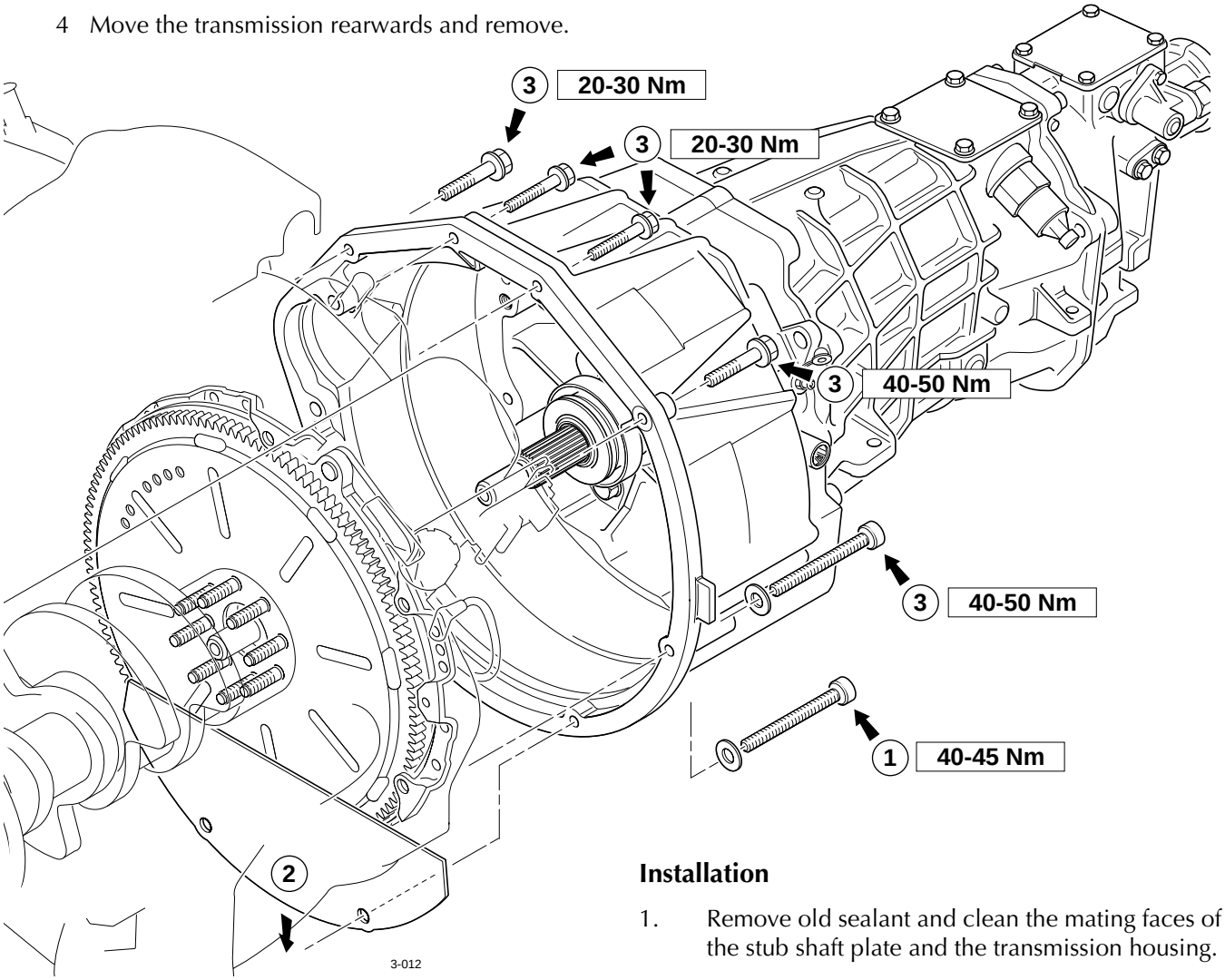
14. Disconnect the transmission cooling pipe work and displace the pipes.



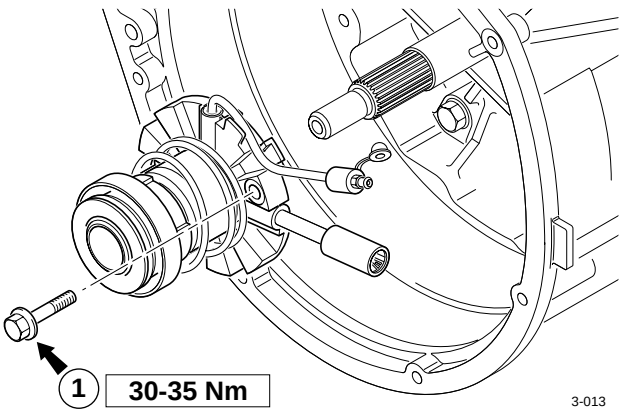
15. Disconnect the reverse inhibit solenoid electrical connector.

16. Remove the transmission from the vehicle

    1 Remove two lower M10 bolts.
    2 Remove the engine cover plate
    3 Remove four M10 and two M8 bolts
    4 Move the transmission rearwards and remove.



17. Remove the clutch slave cylinder from the gearbox.

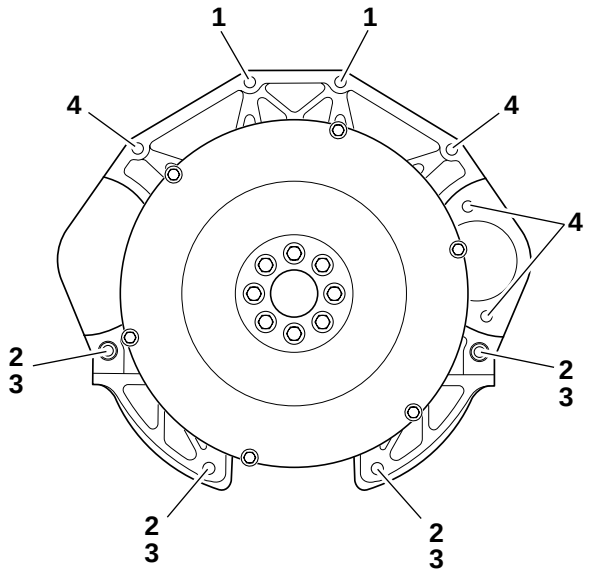


Installation

1. Remove old sealant and clean the mating faces of the stub shaft plate and the transmission housing.
2. Apply sealant to the mating faces prior to installation. See Data for sealant specification.
3. Lift the transmission with a hoist and align input shaft with the pilot bearing.
4. Rotate the transmission unit the two clutch housing dowel holes are aligned dowel pins on the block.
5. Move the transmission forward to insert the input shaft into the crankshaft pilot bearing and to seat the clutch housing correctly on to the engine block.

6. Insert the two M8 bolts and loosely tighten.

7. Insert the upper two M10 bolts and loosely tighten.



1		M8 x 50 Bolt
2 3		M10 x 80 Bolt Washer
4		M10 x 50 Bolt

3-054 Bolts

8. Fit the cover plate.

9. Position four washers and insert four M10 bolts.

10. Cross torque all eight bolts.

11. Refit and secure the transmission rear mount

12. Refill the transmission (3.6.05.1).

13. Refit the following

- Propeller Shaft
- Cover Plate
- Starter Motor
- Gear Lever
- Reversing switch connector
- Clutch hydraulic connection

14. Bleed the clutch hydraulic system.

15. Test drive the vehicle to ensure correct operation.

3.8.10.2 Oil Cooling Pump Removal

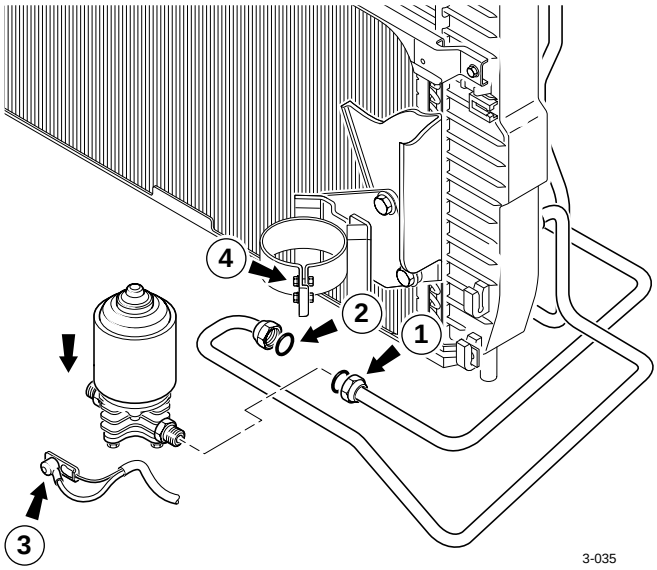
1. Remove the front apron and the under tray 7.1.01.1).

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

3. Remove and discard the 'O' rings.

4. Disconnect the electrical connector.

5. Loosen two nuts and bolts release the oil pump.



3-035

6. Remove the oil pump.

Installation

1. To install, reverse the removal procedure.

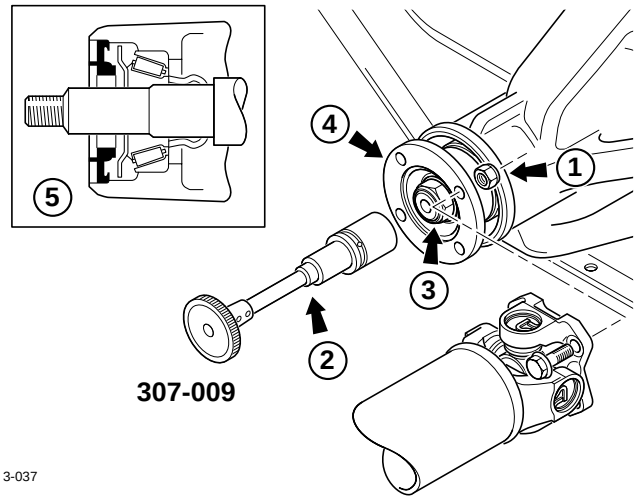
2. Use new 'O' rings when reconnecting the feed and return pipes.

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

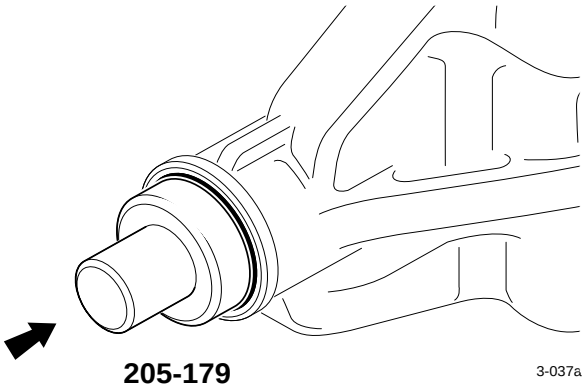
3.9.03.1 Pinion Shaft Oil Seal Renew

1. Remove the propeller shaft (3.5.10.1 / 3.8.10.1)
2. Using the special tool, measure the torque required to turn the flange through backlash, using the torque screwdriver (Service Tool 19G 681) fitted with a suitable adaptor and socket.

   Note: Set the screwdriver to 0.6 Nm (5 lbf/in) initially and increase the setting progressively until a torque figure , at which the flange begins to move, is reached.
3. The flange MUST be turned fully anticlockwise through backlash between each check.
4. Mark the nut and pinion shaft so that the nut can be returned to its original position on the shaft when it is refitted.
5. Remove the nut and washer.
6. Draw the flange from the pinion shaft using an extractor.
7. Prise the old oil seal out of the final drive casing.



8. Clean the splines on the pinion shaft thoroughly, clean the oil recess and coat it internally with Welseal liquid sealant.
9. Using the special tool 18G 1428A, tap the new oil seal squarely into position with the sealing lip facing to the rear.



10. Smear the sealing lip with grease.
11. Apply grease lightly to the outer two thirds of the pinion shaft splines.
12. Lightly tap the flange into position on the pinion shaft using a wooden mallet.
13. Refit the pinion nut and washer.
14. Tighten the nut until it reaches, exactly, the position previously marked.
15. Check the turning torque again.

    The Torque required to turn the pinion shaft through backlash should exceed the torque previously recorded (step 3) by 0.6-1.1 Nm (5 to 10 lbf/in). (If the torque required to turn the pinion shaft exceeds 5 Nm (45 lbf/in) then the final drive must be renewed.)
16. Refit the propeller shaft.
17. Check the oil level in the final drive unit and top up if necessary.

3.9.04.1 Output Shaft Assembly Renew

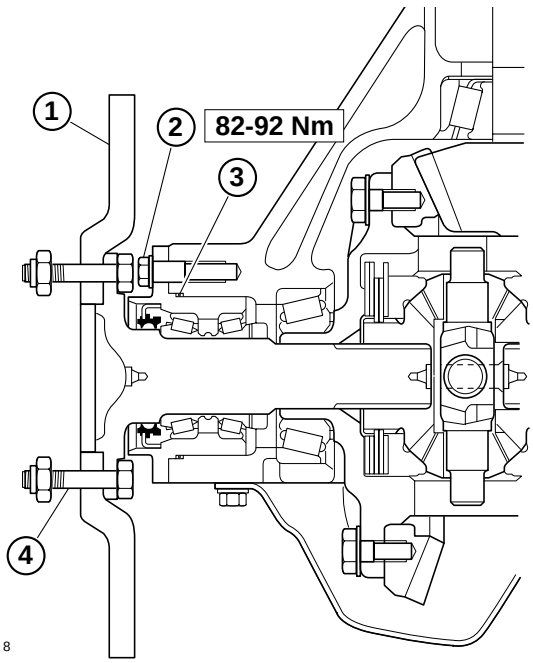
Data

Oils, Sealants and Lubricants

Differential oil Shell Spirax Super 90
Thermally Stable

Procedure

1. Remove the final drive unit (3.9.01.1).
2. Remove the four bolts (2) that secure the output shaft bearing housing flange to the final drive.
3. Withdraw the complete output shaft assembly and discard the 'O' ring (3).
4. Examine all components for wear and damage and renew where necessary.
5. Ensure that the four flange bolts (4) are in position and that a new 'O' ring is fitted.



6. Lightly oil the splines and the outside of the bearing with final drive oil and insert the output shaft assembly.
7. Fit and tighten the securing bolts to torque
8. Check the camber angle of the rear wheels and adjust if necessary (4.2.02).

3.9.05.1 Output Shaft Bearing Renew

Data

Torque Figures

Output shaft bearing housing to unit 81.5-93.5 Nm

Procedure

1. Remove the final drive unit (3.9.01.1).
2. Remove the output shaft assembly, discard the 'O' ring and clean the output/shaft bearing assembly.
3. Clamp the output shaft bearing housing in a vice. Ensure that the jaws of the vice are protected.
4. Push back the lock washer tabs (Fig 1-3).
5. Remove the bearing retaining nut (Fig 1-2) from the shaft using Service Tool SL 15 B (Fig 3).
6. Remove and discard the lock washer.
7. Withdraw the output shaft (Fig 1-6) from the output shaft bearing housing (Fig 1-8).
8. Collect the inner bearing (Fig 1-3) and cone.
9. Discard the collapsed spacer.

   Note: If the outer bearing (Fig. 1-5) remains on the shaft and pushes the oil seal (Fig. 1-7) out of the output shaft bearing housing on withdrawal, remove it from the shaft using Service Tool SL 47-3/1 in conjunction with the hand press 18G 47 (Fig. 3).

10. Prise the oil seal (Fig. 1-7) from the output shaft bearing housing. Collect the outer bearing (Fig. 1-5) and cone. Discard the oil seal.

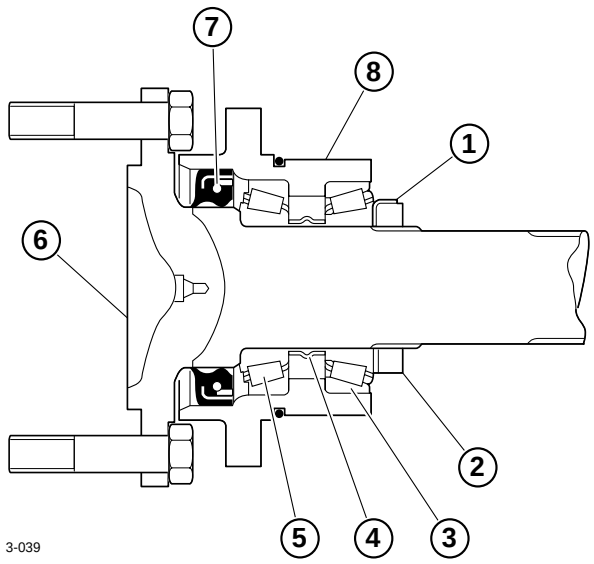


Figure 1

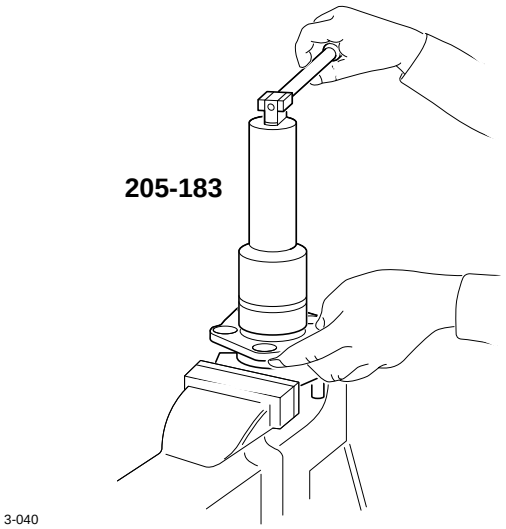


Figure 2

11. Tap the bearing cups out of the housing, gently, using a suitable drift.
12. Remove the output shaft bearing housing from the vice and carefully clean internally.

    Note: When the bearing are to be renewed always replace complete bearings. Never fit new cone and roller assemblies into used cups.

13. Grease new bearings lightly before fitting. To prevent premature seal or bearing wear, before oil begins to flow from the axle centre, add 4cc of hypoid oil to the cavity between the bearings during assembly and lubricate the oil seal by packing the annular space between its sealing edges with grease.
14. Press the cups of the replacement bearings into the housing using a press and adaptors to ensure that the cups are pressed home fully in the housing.

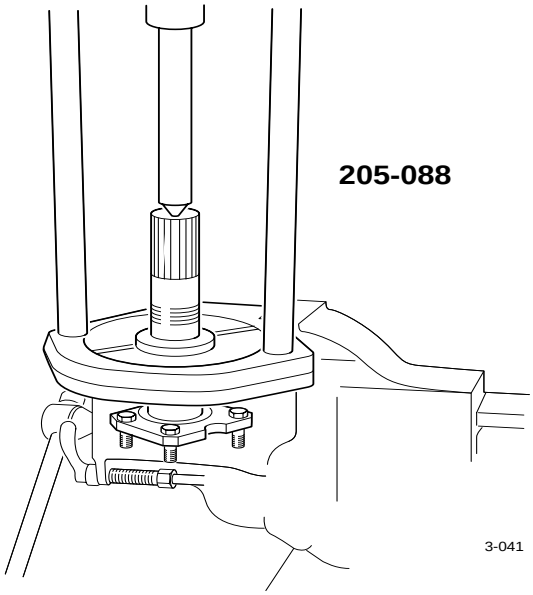


Figure 3

15. Place the roller and cone assembly of the outer bearing, which is already greased, into position.

16. Press the new oil seal into position (Fig. 4-1), making sure that the spring loaded sealing edge is in contact with the bearing.

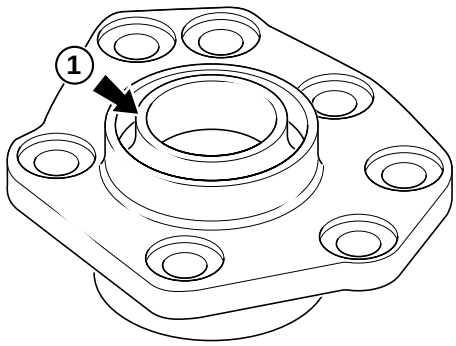


Figure 4

17. Load the seal with grease between the sealing edges.

18. Clamp the output shaft bearing housing between the protected jaws of a vice.

19. Insert the shaft into the seal and outer bearing.

20. Fit the bearing using special tools.

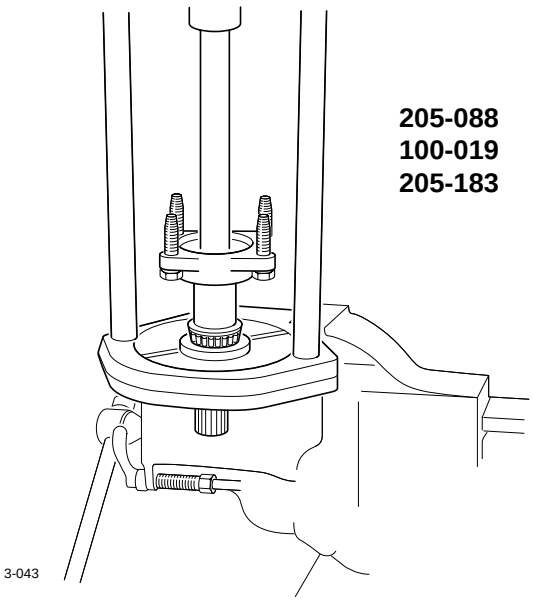


Figure 5

21. Fit a new collapsible spacer.

22. Fill the space between the bearings with Shell Spirax 90 thermally stable oil before refitting the rollers and the cone of the inner bearing.

23. Fit a new lock washer onto the shaft.

24. Place the nut onto the shaft, grease the face next to the washer and finger tighten only.

25. Using Service Tool SL 15 B and a tommy bar on the disc attachment bolts, to oppose the torque, tighten the nut on the shaft just enough to almost eliminate play from the bearings. Torque required to turn the shaft should be 1.1-2.3 Nm (10-20 lbf/in).

26. Tighten the nut again, but only slightly (not more than a thirty-second of a turn, or about 5 mm (3/16 in)) at the perimeter of the nut, and recheck the torque required to turn the shaft. Continue tightening in this way, turning the shaft to seat the bearing and measuring the torque after each turn until the correct figure is reached.

Caution: If the torque required to turn the shaft exceeds the torque recorded in the first check by more than 2.3 Nm (20 lbf/in), dismantle the assembly, discard the collapsible spacer and rebuild with a new collapsible spacer.

Do not slacken off the nut after collapsing the spacer because the bearing cones are not rigidly clamped.

27. Lock over the tab washers in two places to lock the shaft nut. Remove the assembly from the vice.

28. Ensure that the four disc flange bolts are in position and that a new 'O' ring is fitted before fitting the output shaft assembly.

39. Lightly oil the splines and the outside of the bearing with final drive oil and insert the output shaft assembly.

30. Fit and torque the securing bolts.

31. Check the camber angle of the rear wheels and adjust if necessary (4.2.02).

3.9.06.1 Hypoid Casing Rear Cover Seal Renew

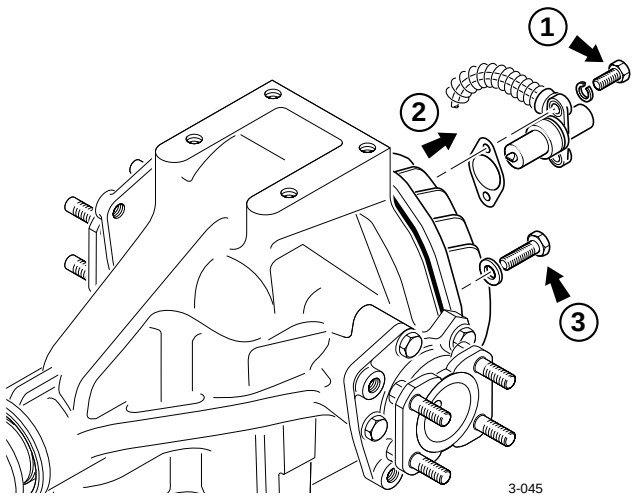
Data

Oil, Seals and Lubricants

Differential oil Shell Spirax Super 90
Thermally Stable
Differential cover Hylosil

Procedure

1. Remove the rear suspension unit (4.2.07).
2. Remove the hypoid unit (3.9.01.1)
3. Drain the oil from the final drive.
4. Remove two screws and spring washers that secure the speed transducer to the rear cover and remove the transducer. Discard the gasket.
5. Remove the ten setscrews and remove the rear cover noting the position of the identification tabs.



6. Clean of the sealant from the rear cover and the hypoid housing.
7. Apply silicon sealant to the cover and the housing mating faces.
8. Refit the rear cover.
9. Fit and torque the cover bolts in a diagonal sequence.
10. Refit the speed transducer and fit and tighten the two securing setscrews.
11. Refill the final drive unit with new oil.

Note: The vehicle must be level when checking the oil level.

3.9.07.1 Speedometer Sensor Adjust

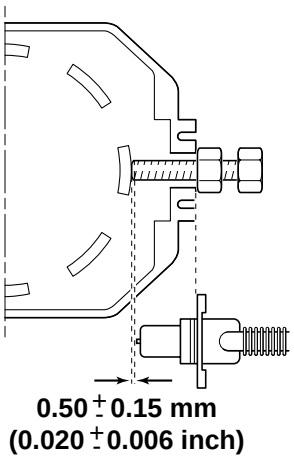
Data

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.
4. Use a 75mm bolt and nut as a depth gauge. Fit the bolt through the sensor mounting hole until the bolt end 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.

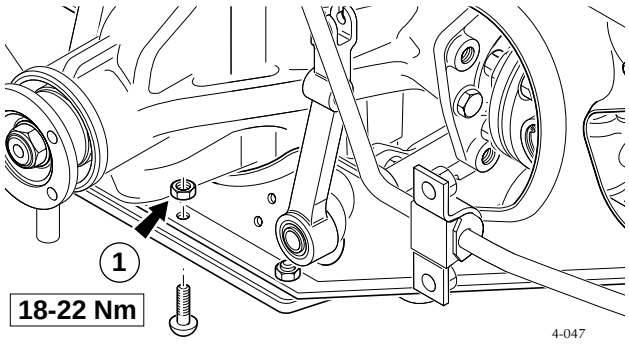
8. Add or subtract shims from the sensor mounting face as required to correct the dimension and refit and secure the sensor.

3.9.10.1 Hypoid Unit Remove

1. Remove the rear suspension unit (4.2.07).

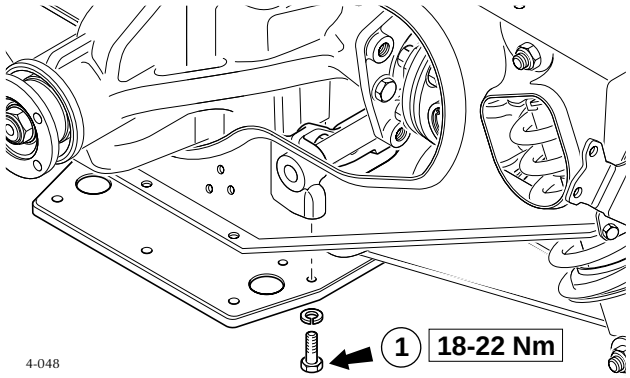
2. Drain the oil from the final drive, to prevent leakage from the breather, and invert the whole assembly.

3. Remove the four remaining bolts and nuts securing the tie-plate to the crossbeam.



*Note: Illustrations show assembly **not** inverted.*

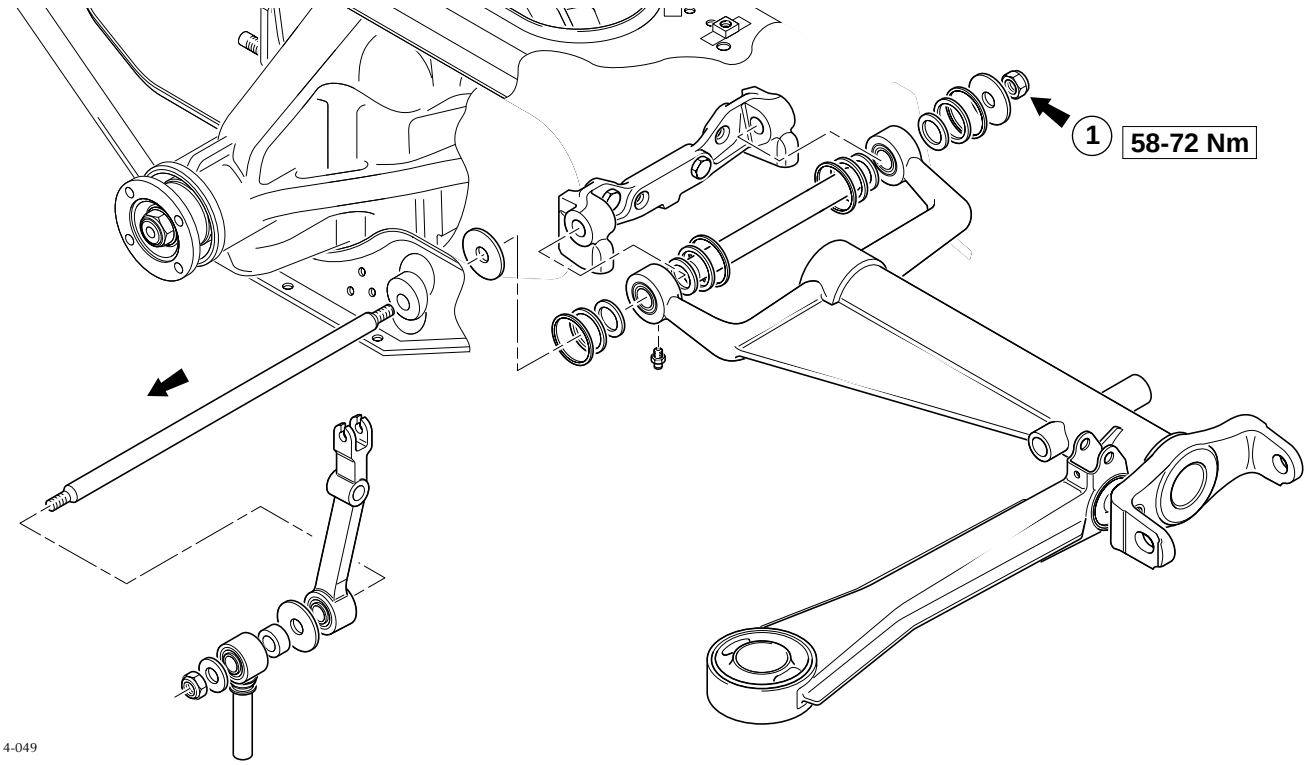
4. Remove eight setscrews securing the tie-plate to the inner fulcrum brackets. Remove the tie plate.



5. Remove the rear nut from the inner fulcrum shaft. Disconnect the parking brake cable from the ratio levers. Using a thin drift, drive the shaft clear of the inner fulcrum mounting bracket.

   Withdraw the drift. Recover thrust washers, sealing rings and sealing ring retainers from the wishbone inner mounts. Also remove the spacer tube.

   Repeat for the other wishbone.

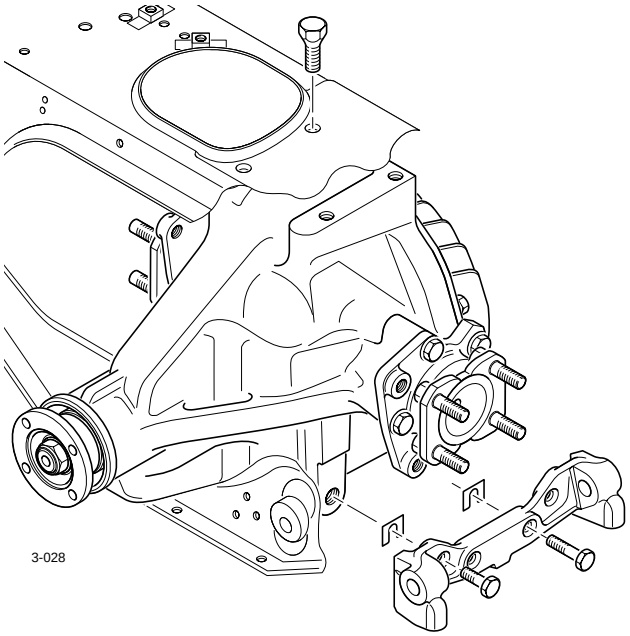


6. Remove two screws securing the fulcrum mounting to the final drive unit. Recover two shims.

   Repeat for the other mounting.

   Cation: Note the shims fitted at the fulcrum bracket mounts. Refit in the original positions to retain the rear wheel geometry settings.

7. Remove four bolts.



8. Sling the final drive unit securely and remove from the cross beam assembly.

Installation

1. To install, reverse the removal procedure.
2. During installation, observe the following points:
   - Position the original shims between the inner fulcrum bracket and the hypoid unit. Lock wire the bracket setscrews.
   - Fit new grease seals to the wishbone inner fulcrum arms.
   - Apply the recommended grease to the inner fulcrum bearings.
3. To refit the fulcrum shaft use special tool JD14 to assembly and fit the seals, seal retainers and thrust washers.

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Front Suspension

Description

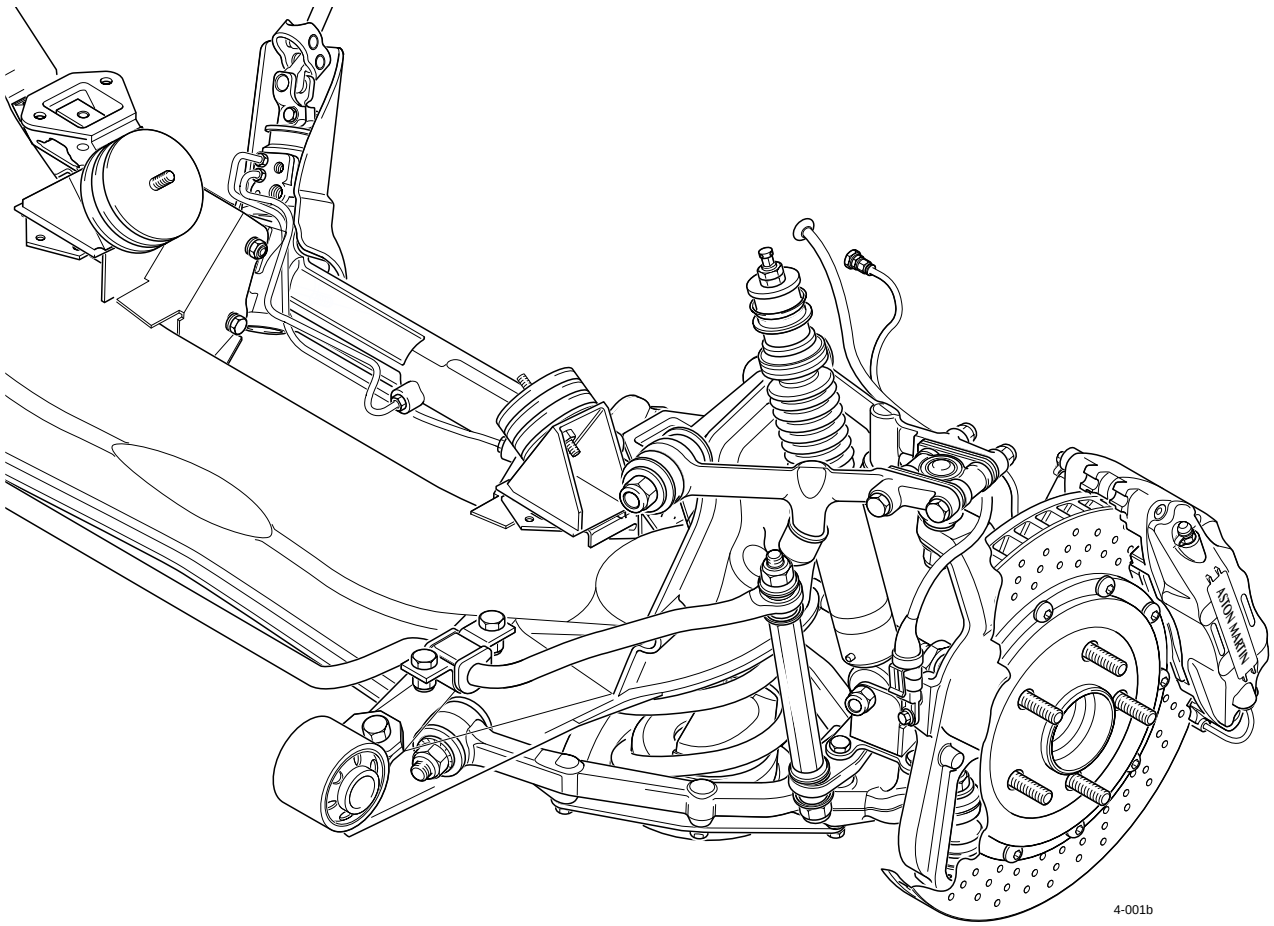
The front suspension is fitted to the vehicle as a complete unit. It comprises a fabricated steel frame, mounted to the body/chassis structure at four points. Two longitudinal extensions from the front of the frame are attached to the chassis side member with rubber/steel mountings. The rear of the front frame is attached to the chassis in two 'V' mounts.

The frame has a turret welded at each end housing the front suspension coil springs. The springs are retained at their lower end by spring seat pans, bolted to the lower wishbones. Lower wishbones are two-piece forgings bolted together at the lower balljoint. The inner end is attached to the suspension frame by rubber/steel-bonded bushes. The outer end is attached to the hub carrier by a lower ball joint assembly.

Upper wishbones are mounted at their inner ends to a fulcrum shaft on rubber/steel bonded bushes. The fulcrum shaft is bolted to the spring turret. The outer ends of the upper wishbones are attached to the hub carrier by an upper ball joint.

The anti-roll bar, is attached to the lower wishbones by vertical links. The anti roll bar is attached to the chassis in two rubber insulated brackets.

The wheel hub is supported on a sealed twin taper roller bearing, located in the hub carrier between two circlips. The wheel hub is fitted through the bearing and secured on the inside by a threaded locking ring. The locking ring is castellated on its outer face and also functions as the ABS sensor ring.



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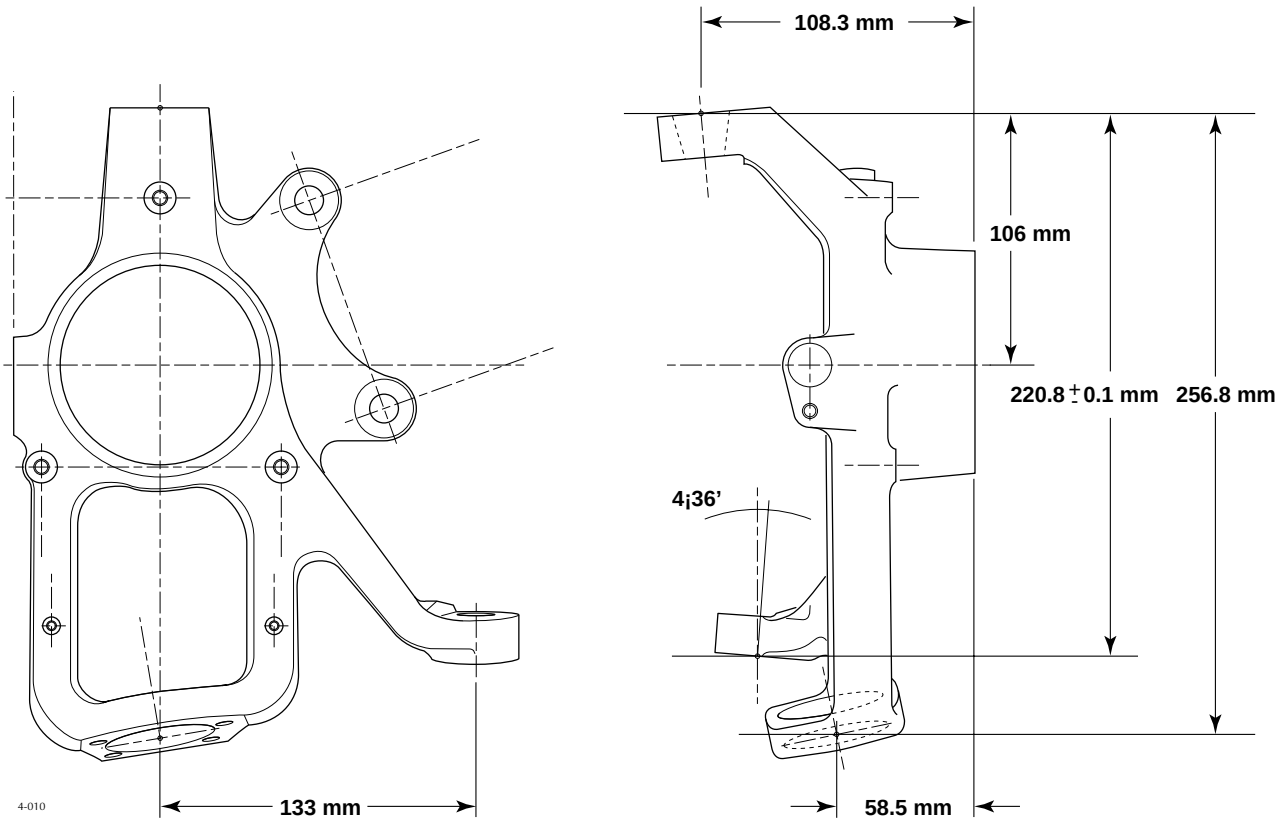
Data

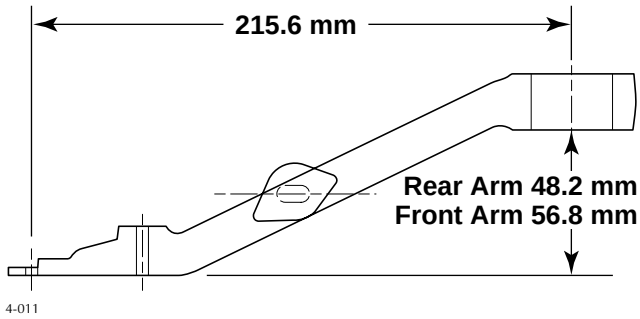
The following dimensional drawings are provided to assist in assessing accident damage to the suspension wishbones. Any component suspected of being damaged must be removed from the vehicle, cleaned thoroughly, and the critical dimensions checked against the specifications below.

WARNING: Components found to be dimensionally inaccurate or damaged in any way must be scrapped and no attempt must be made to straighten or re-use them.

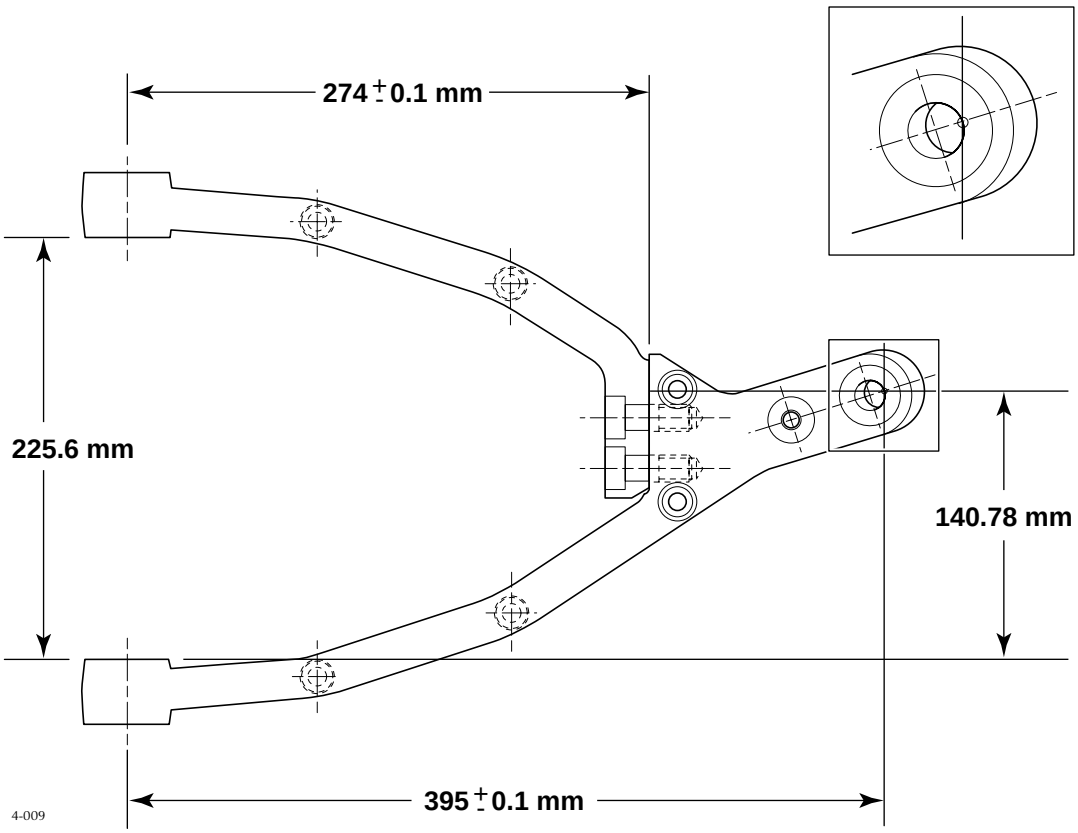
Dimensions - Vertical Link



Dimensions - Upper Wishbone Arms



Dimensions - Lower Wishbone



Suspension Settings

The following table shows ride heights and basic geometry at kerb, half laden and maximum vehicle weight.

Ride Heights

Coupe - Manual Transmission

Load Condition	Front Axle Weight	Front Cross Member Height	Rear Axle Weight	Rear Cross Member Height	% Split Front/Rear	Total Weight
Kerb Weight	988kg	137mm	812kg	169mm	54.9 45.1	1800kg
1/2 Laden	1040kg	131mm	910kg	148mm	53.3 46.7	1950kg
GVW	1056kg	130mm	1044kg	115mm	50.3 49.7	2100kg
Max Permissible	1200kg		1200kg			

Coupe - Automatic Transmission

Kerb Weight	1041kg	137mm	811kg	169mm	56.2 43.8	1852kg
1/2 Laden	1092kg	131mm	910kg	148mm	54.5 45.5	2002kg
GVW	1108kg	130mm	1044kg	115mm	51.5 48.5	2152kg
Max Permissible	1200kg		1200kg			

Volante - Manual Transmission

Kerb Weight	1000kg	137mm	868kg	169mm	53.5 46.5	1868kg
1/2 Laden	1052kg	131mm	966kg	148mm	52.1 47.9	2018kg
GVW	1068kg	130mm	1100kg	115mm	49.3 50.7	2168kg
Max Permissible	1200kg		1200kg			

Volante - Automatic Transmission

Kerb Weight	1052kg	137mm	868kg	169mm	54.8 45.2	1920kg
1/2 Laden	1104kg	131mm	966kg	148mm	53.3 46.7	2070kg
GVW	1120kg	130mm	1100kg	115mm	50.5 49.5	2220kg
Max Permissible	1200kg		1200kg			

Geometry at Half-Laden Weight

Assumes ride heights are at half laden settings for manual transmission, i.e. front - 131mm, rear - 148mm.

FRONT AXLE			REAR AXLE	
Camber	Total Toe In	Castor Angle	Camber	Total Toe In
-20min ±10 balance 10'	Parallel ± 5'	6° ± 30' balance 20'	-1° ± 10min	15' ± 5' balance 2' total

Suspension Set-Up

The following procedure should be used when it is necessary to check and adjust the complete ride height and steering geometry set-up of a vehicle.

The checks and adjustments are interrelated. They must be performed in the sequence listed in this procedure.

Initial Preparation

1. Check that the correct tyres are fitted and that they are in serviceable condition.

   Tyre Specifications for Normal Use

   Unique Aston Martin lightweight aluminium alloy wheels. 8J x 18 Front, 9J x 18 Rear

   Bridgestone SO2 unidirectional tyres. 245 x 40 FZ 18 Front, 265 x 35 CZ 18 Rear

2. Check that the tyre pressures are adjusted to the following specification:

   Tyre Pressures - Normal Use:

   Front: 2.4 bar 240 kPa 34psi Rear: 2.4 bar 240 kPa 34psi

3. Visually check the front and rear suspension systems for worn or damaged components. Repair or replace as necessary to correct any obvious defects.

4. Top up all fluids to the maximum level so that the vehicle is at accurate unladen weight.

5. Check for any heavy items of luggage etc. in the vehicle which would affect ride height. Remove any such objects.

Ride Height and Suspension Geometry Checks

Ride Height Check

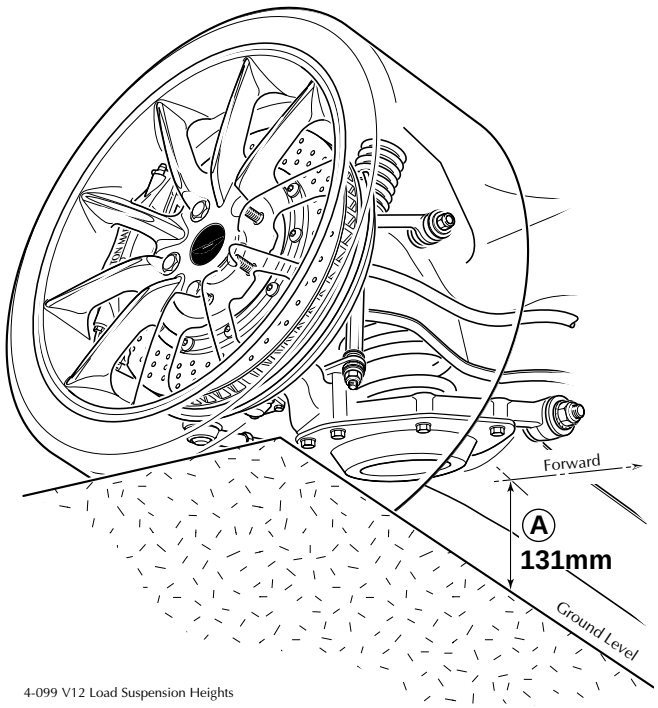
Ride height checks must be carried out with the vehicle at **Half Laden** condition, as follows:

1. Place the vehicle on a firm and level floor.

2. Top up all fluid levels including fuel.

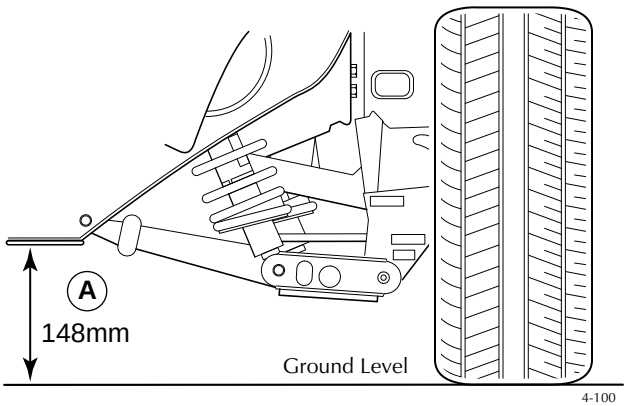
3. Place a 68 Kg (150 lb) weight in each front seat and a 7 Kg (15 lb) weight in the boot.

4. Measure the front suspension ride height from the underside of the front sub frame (minus acoustic undertray) on the centre line of the vehicle.



4-099 V12 Load Suspension Heights

5. Measure the rear suspension ride height from the lip of the axle plate.



4-100

6. If the measurements are in specification, go to the toe, castor and camber geometry checks in the Rear Suspension and Steering sections.

   ***Note**: If the measured ride height is below the specified limit, increasing the height can only be achieved by renewing the road springs.*

7. On completion of the ride height adjustment, check the suspension geometry.

Normal Workshop Ride Height Checks

The following workshop checks allow for the normal variation in ride height on a car which has been set to the correct half laden weight.

1. Do not perform the normal workshop checks on the suspension geometry if the ride height is out of tolerance. The angles of the suspension components change significantly as ride height changes.

2. If ride height is correct, check the front and rear wheel geometry using standard workshop equipment and compare the results with the specification below.

   Front Suspension - Geometry at nominal unladen ride height

Toe In	Parallel ± 5' total
Camber	20' ± 10' balance 10'
Castor	6° ± 30'

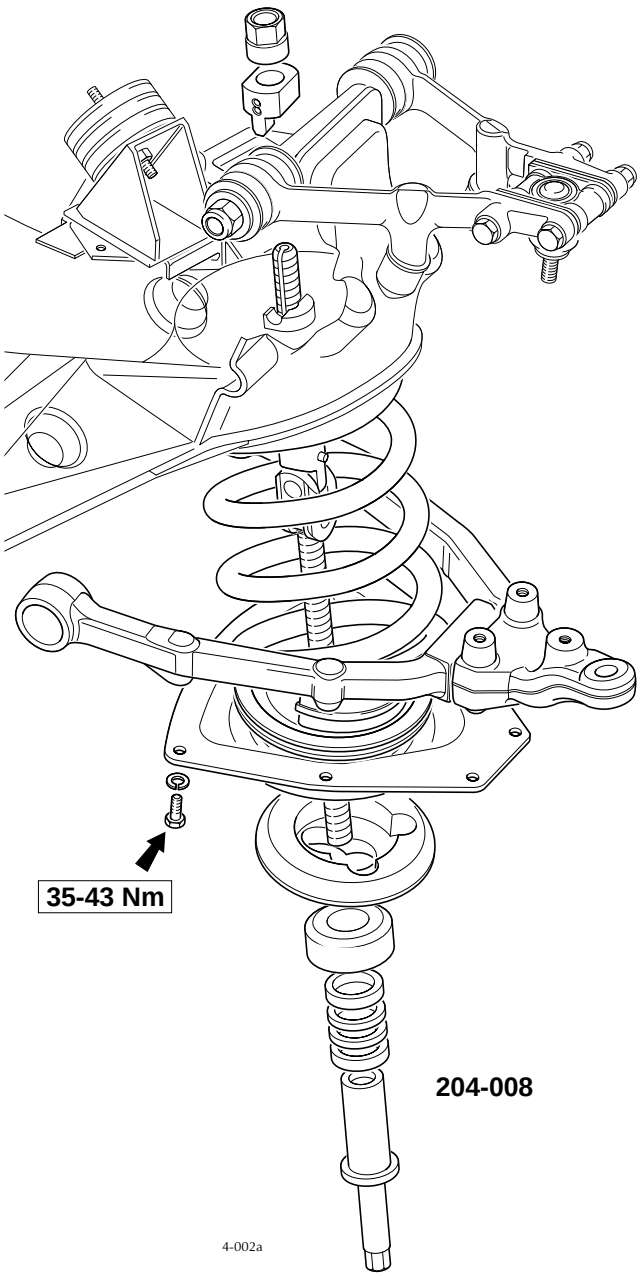
   Rear Suspension - Geometry at nominal unladen ride height

Toe In	15' ± 5' balance 2'
Camber	1° ± 10' balance 20'

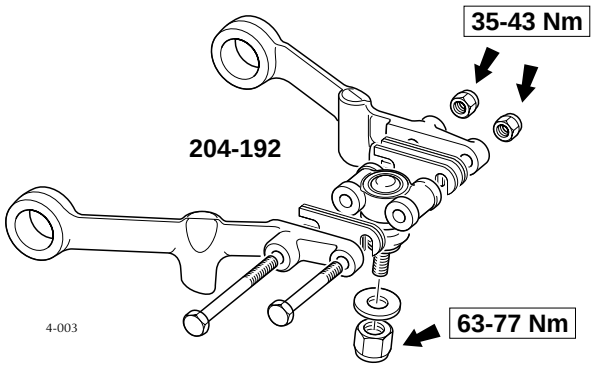
4.1.01 Upper Balljoint Renewal

Procedure

1. Remove the road wheel.
2. Fit and tighten the spring compressor.



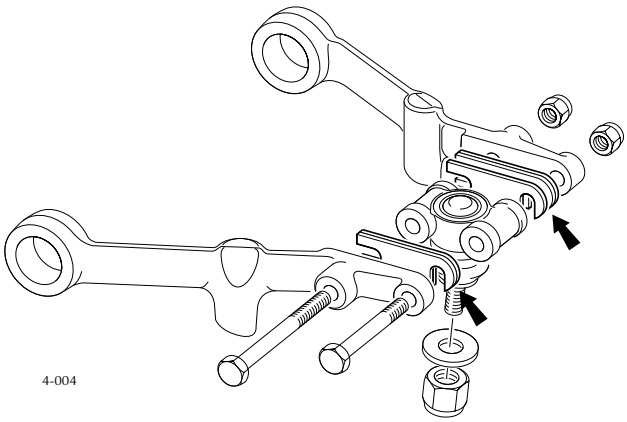
3. Support the vertical link.
4. Remove the upper ball joint.



Note: Record the number and position of the castor angle shims.

Note: It may be necessary to substitute a two inch long 1/2in UNF socket head grub screw, for the existing bolt of JD 24.

5. Fit and secure the new upper ball joint. Ensure that the castor angle shims are fitted in their original positions.



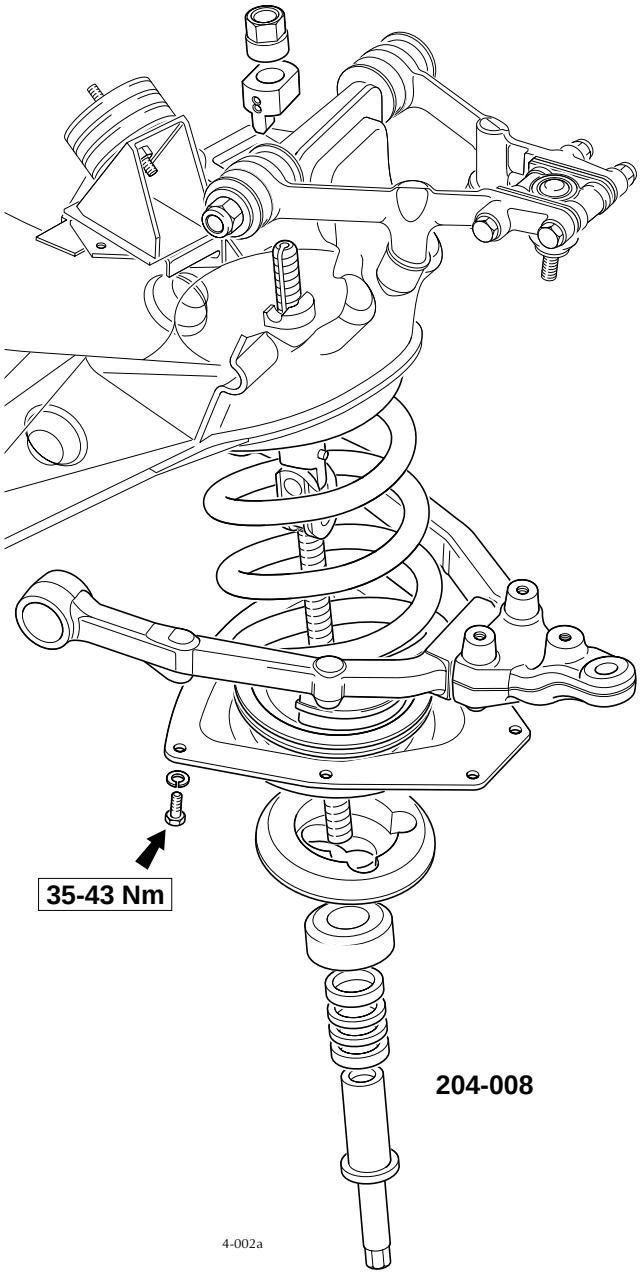
6. Remove the support from the vertical link. Remove the spring compressor.
7. Refit the road wheel, and the wheel nuts.
8. Lower the vehicle to the ground.
9. Torque the wheel nuts to 88 - 102 Nm.
10. Check/adjust the front wheel alignment (4.3.01).

4.1.02 Lower Balljoint Renewal

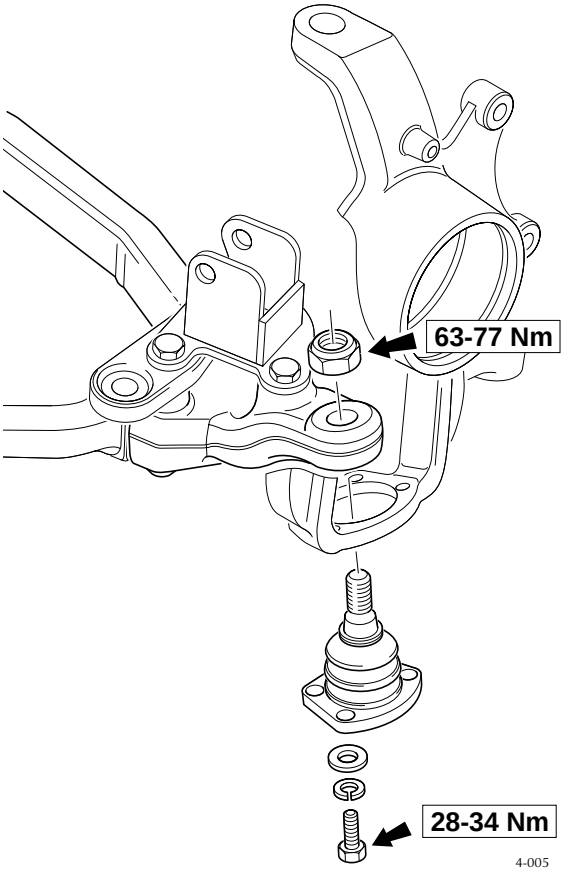
Procedure

1. Raise the vehicle on a four point hoist. Turn the steering so that the affected wheel is pointing outward and remove the road wheel.

2. Fit and tighten the spring compressor.



3. Disconnect the lower ball joint from the lower wishbone.



5. Remove the lower ball joint from the vertical link.

6. Fit the new ball joint to the vertical link using new bolts.

7. Fit and secure the lower ball joint to the lower wishbone.

8. Remove the spring compressor.

9. Refit the road wheel and the wheel nuts.

10. Lower the vehicle to the ground.

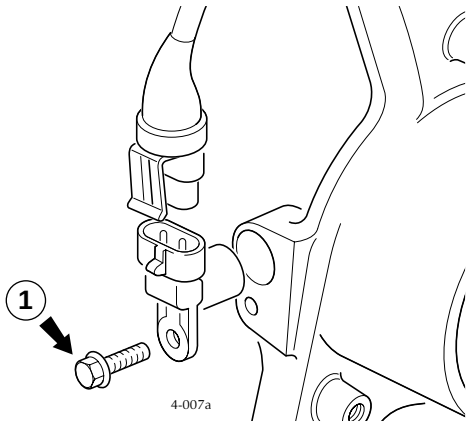
11. Torque the wheel nuts to 88 - 102 Nm.

10. Check/adjust the front wheel alignment (4.3.01).

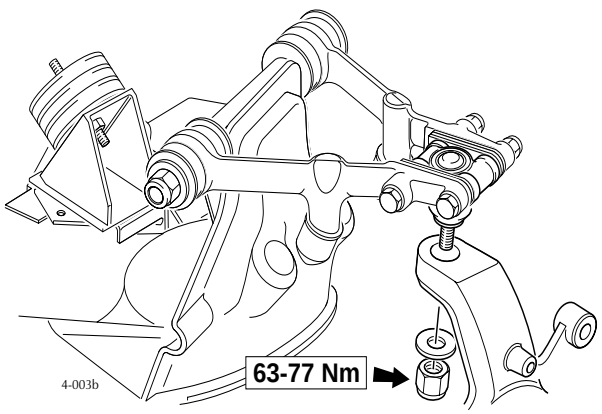
4.1.06 Front Hub Bearing Renewal

Removal

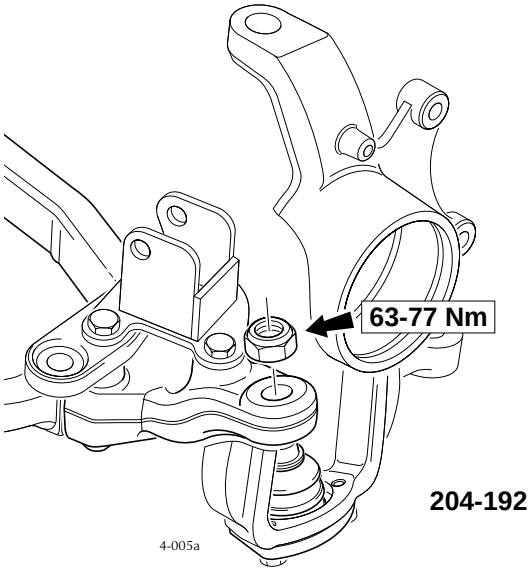
1. Raise the vehicle on a four point hoist and remove the front road wheels.
2. Disconnect the ABS sensor.



3. Remove the brake calipers and support them from the road spring (5.1.01).
4. Remove the brake discs and shield.
5. Release the track rod ball joints.
6. Release the upper ball joint from the vertical link



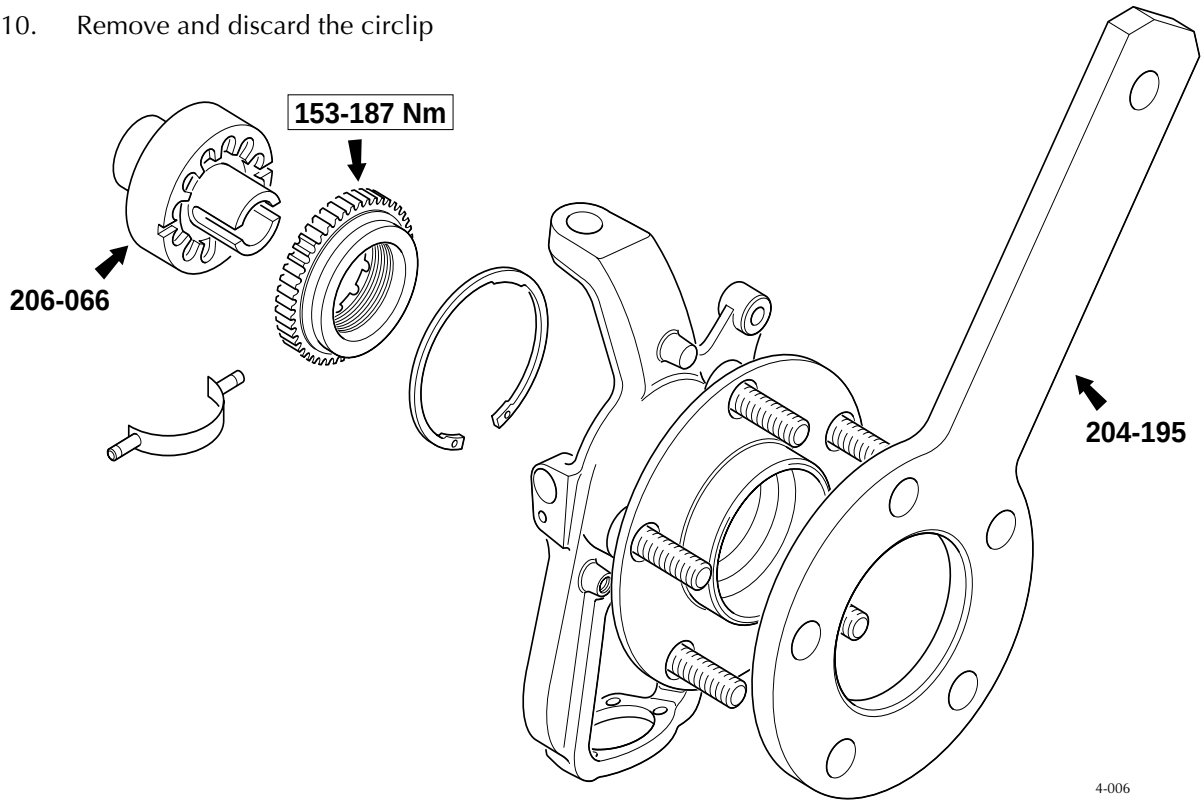
7. Release the lower ball joint from the lower wishbone.



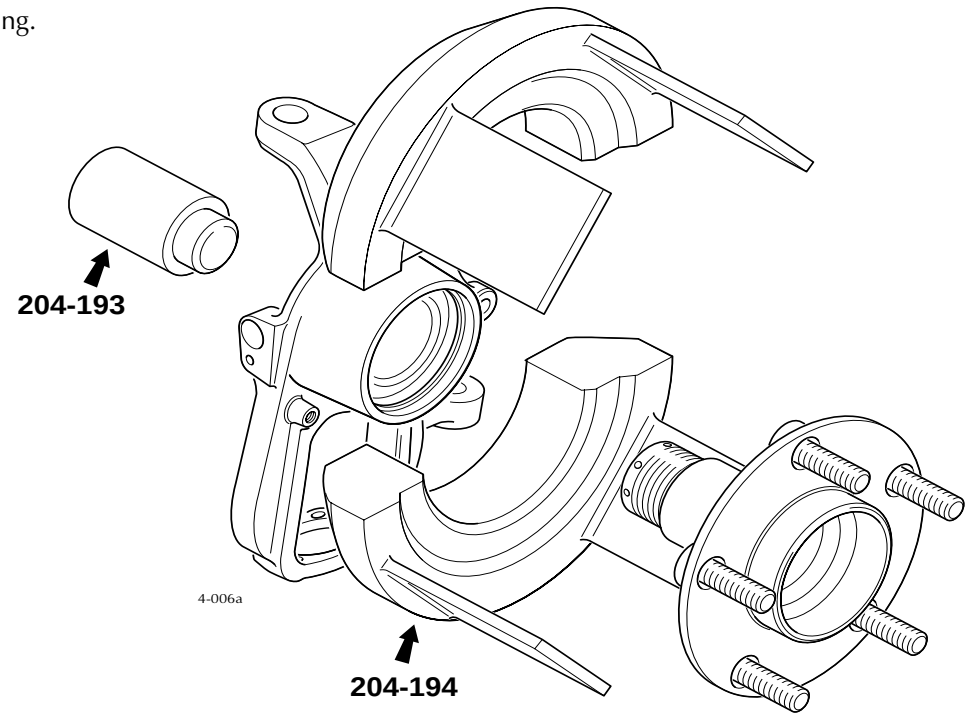
8. Remove the vertical link assembly.

9. Remove the spring clip and ABS rotor nut using the special tool.

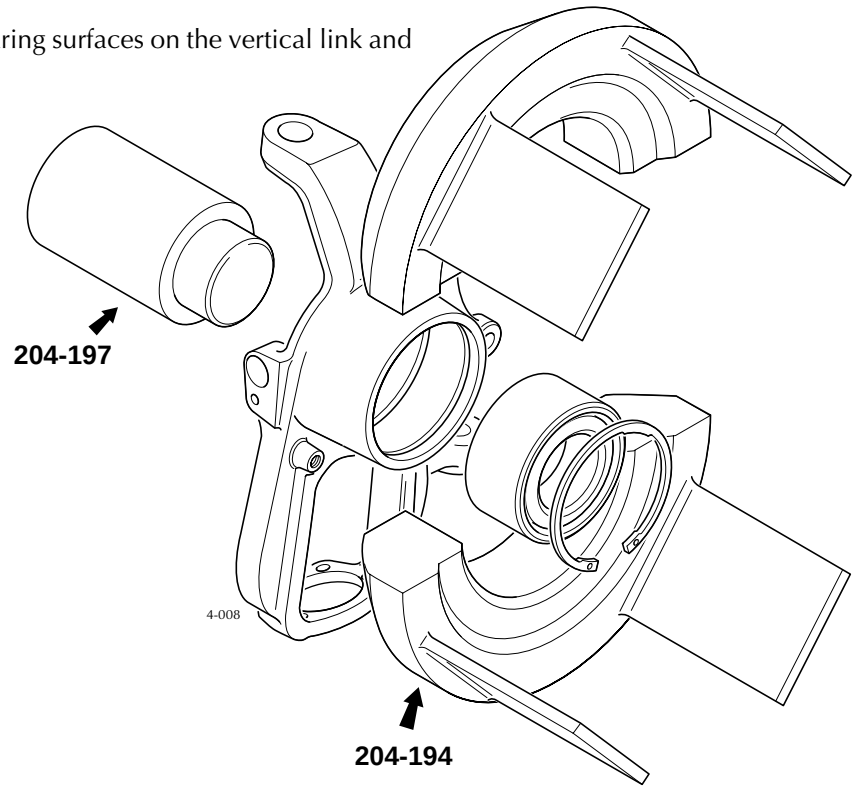
10. Remove and discard the circlip



10. Stand the assembly on the hub remover collets and press the hub from the bearing.



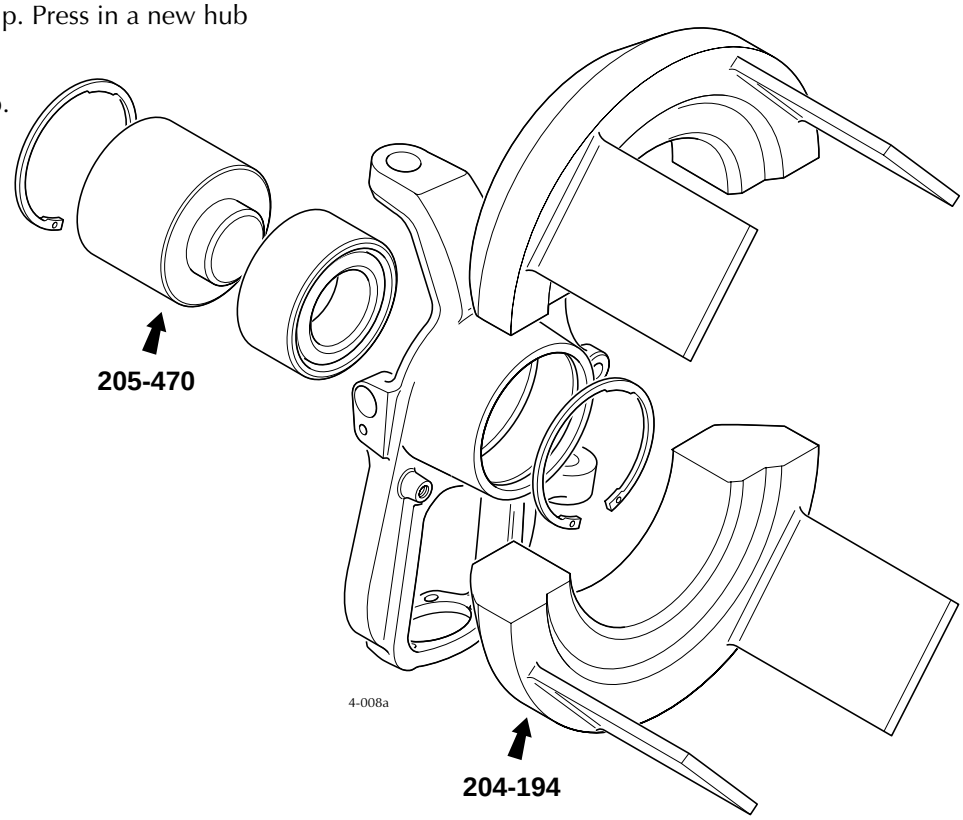
11. Remove and discard the outer circlip.
12. Press out the bearing and discard.
13. Clean the bearing surfaces on the vertical link and hub.



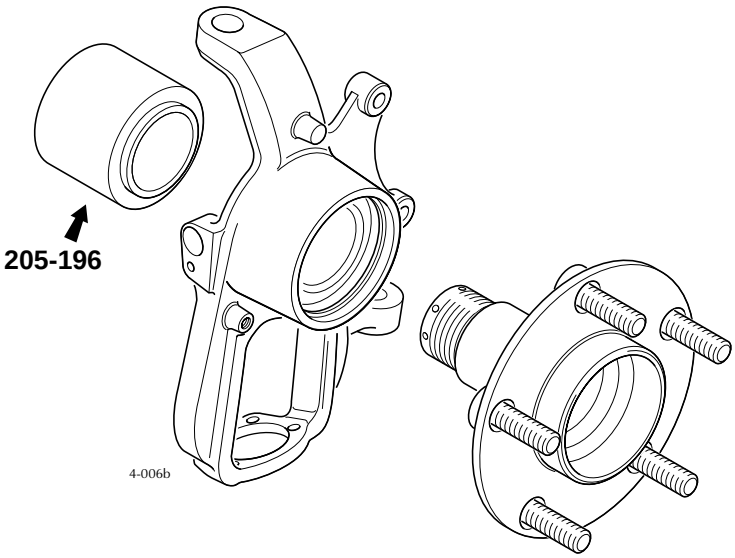
Installation

Caution: Install the retaining circlips with the ears in the lowest position to permit water drainage.

1. Install a new outboard circlip. Press in a new hub bearing.
2. Install a new inboard circlip.

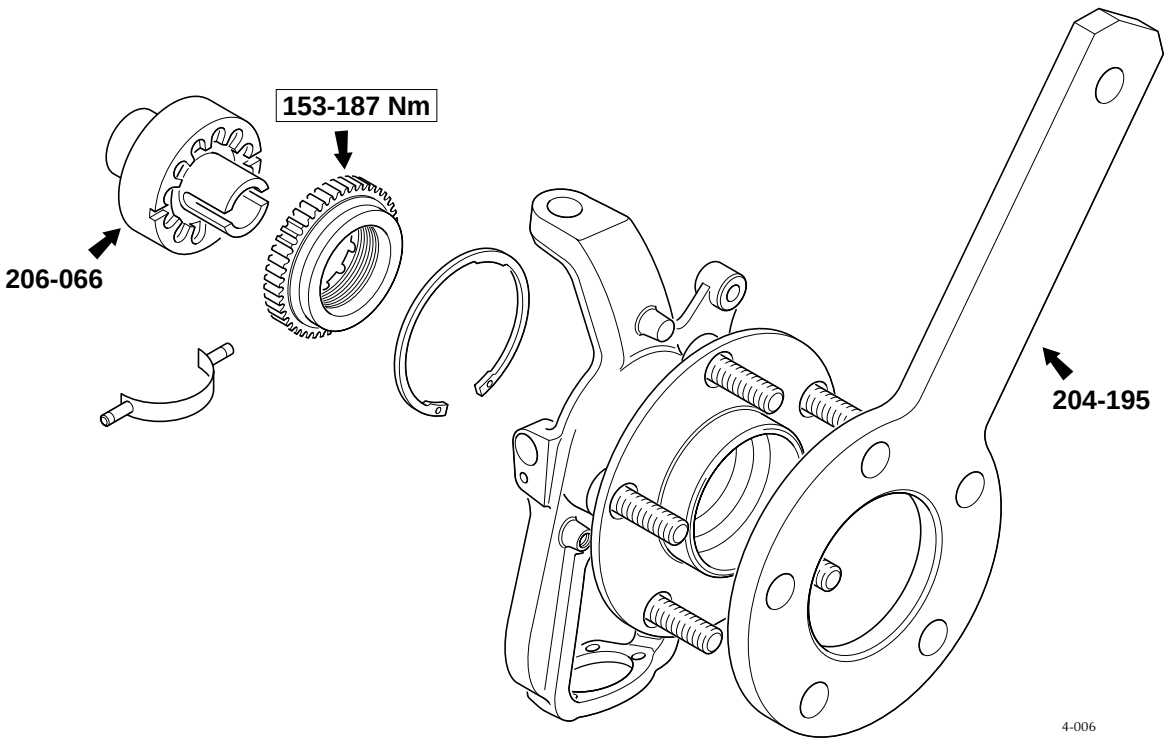


3. Install the hub into the bearing.

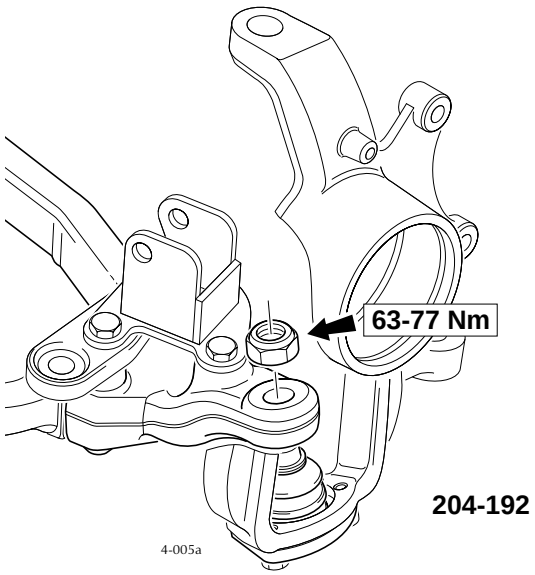


4. Install the ABS rotor/hub nut and tighten to specification.

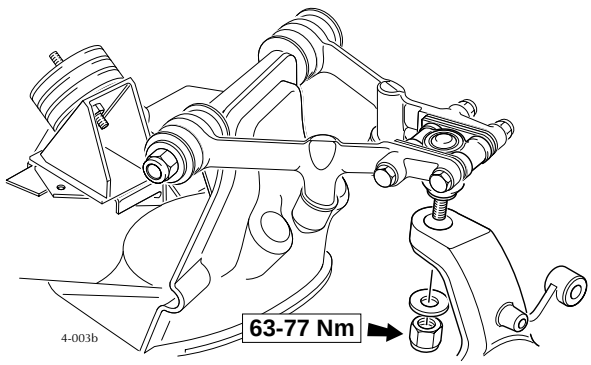
5. Fit the spring clip. Tighten the hub nut further if necessary until the clip fits.



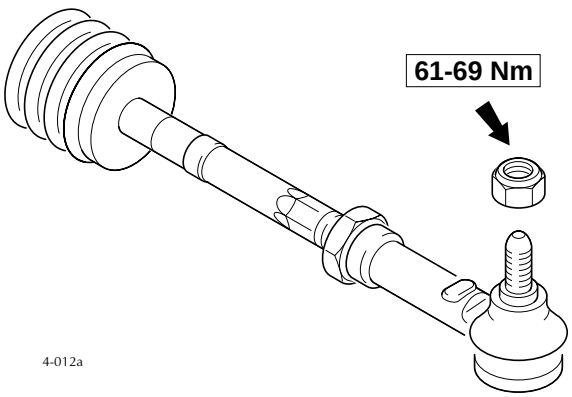
6. Install the lower wishbone to vertical link ball joint.



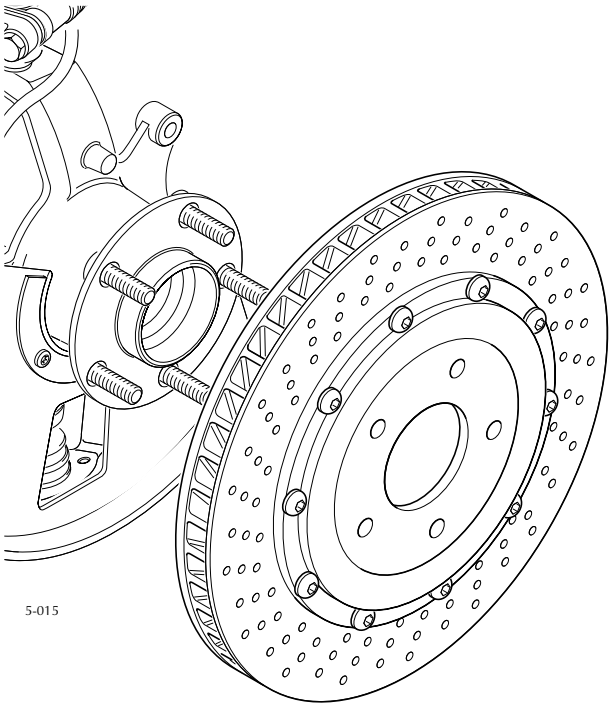
7. Install the upper ball joint to the vertical link.



8. Install the track rod ball joints.

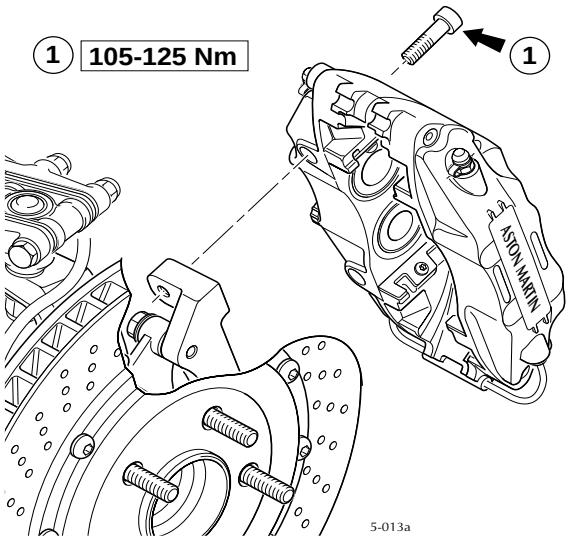


9. Install the brake disc.



10. Install the brake calipers.

Note: for full brake disc and caliper removal and installation procedure, see Section 5 - Brakes, Wheels and Tyres.



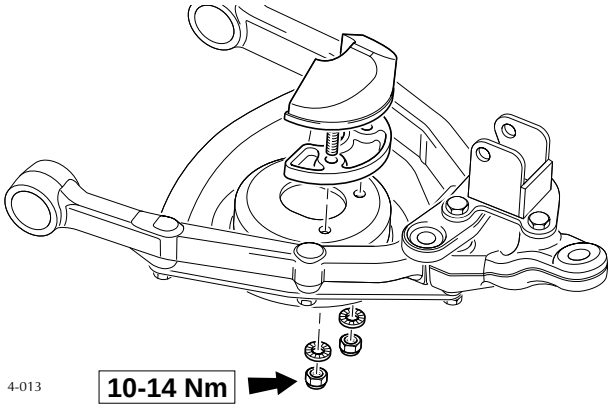
11. Reconnect the ABS sensor.

12. Refit the road wheels and torque to 88-102 Nm.

4.1.08 Bump Stops

Procedure

1. Raise the vehicle on a four point hoist. Remove the front road wheel.
2. Release the bump stop.



3. Manoeuvre the bump stop clear through the coils of the spring.

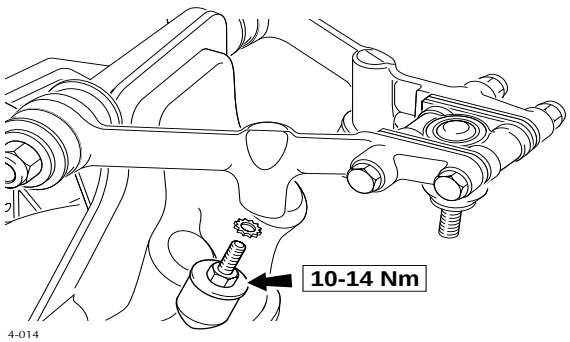
   Note: It may be necessary to prise apart the coils carefully to enable the bump stop to be removed.
4. Fit the new bump stop, through the spring, and locate into position.
5. Locate the bump stop bolts through the spring pan and secure with nuts and washers.
6. Refit the road wheel, fit and nip up the wheel nuts.
7. Lower the vehicle to the ground and immediately torque the wheel nuts to 88 - 102 Nm.

4.1.09 Rebound Stops

Procedure

Caution: Rebound stops must only be renewed in pairs. Single replacement may cause uneven loading on the upper wishbone arms.

1. Raise the vehicle on a four point hoist or a jack and stands and remove the front road wheels.
2. Remove the rebound stops.

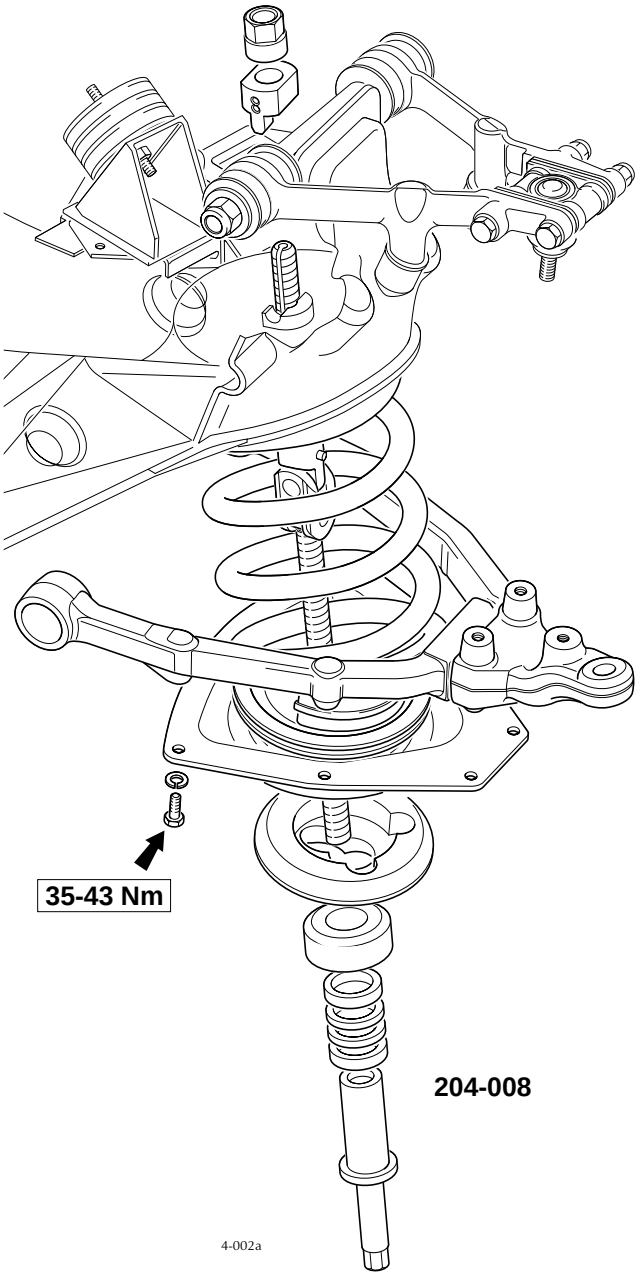


3. Fit the replacement rebound stops.
4. Refit the road wheel and torque the wheel nuts to 88 - 102 Nm.

4.1.10 Upper Wishbone Renewal

Removal

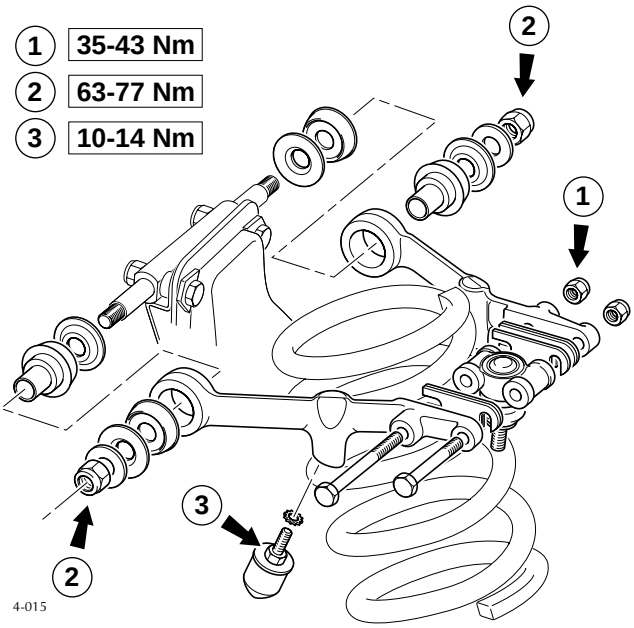
1. Remove the front road wheels.
2. Fit and tension the coil spring compressor.



3. Tie the vertical link to the crossmember spring turret.
4. Remove the upper wishbone arms.
   1 Remove two nuts and bolts securing the upper ball joint to the wishbones.

   Note: Record the number and position of the castor angle shims.

   2 Release the inner ends of the wishbones from the fulcrum shaft.
   3 Remove the rebound rubbers from the wishbones.



5. When renewing the upper wishbone renew the bushes at the same time.

Installation

1. Press a new Slipflex bushes into the new wishbone eye.

2. Refit the upper wishbone arms.

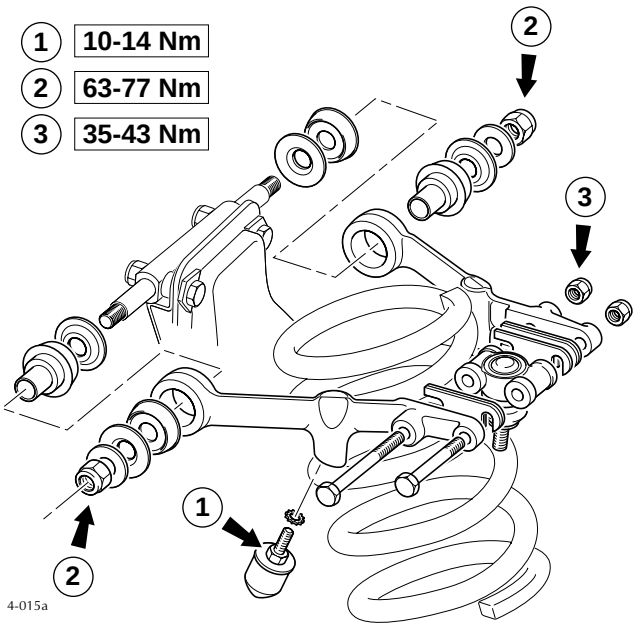
   Caution: To avoid pre-loading the slipflex bushes, do not tighten the nyloc nuts until the vehicle rests fully on the suspension and is at half-laden weight.

   1 Fit the rebound rubbers to the new wishbone.

   2 Fit the wishbone levers to the fulcrum shaft. Secure the wishbone levers using washers and new nyloc nuts.

   3 Secure the wishbone levers to the upper ball joint using new nyloc nuts.

   Note: Take care to reposition the castor angle shims in their original positions to establish correct castor angle adjustment.



3. Remove the support wire or cord used to tie the vertical link. Remove the spring compressor.

4. Refit the road wheels.

5. Lower the vehicle to the ground and torque the wheel nuts to 88 - 102 Nm immediately.

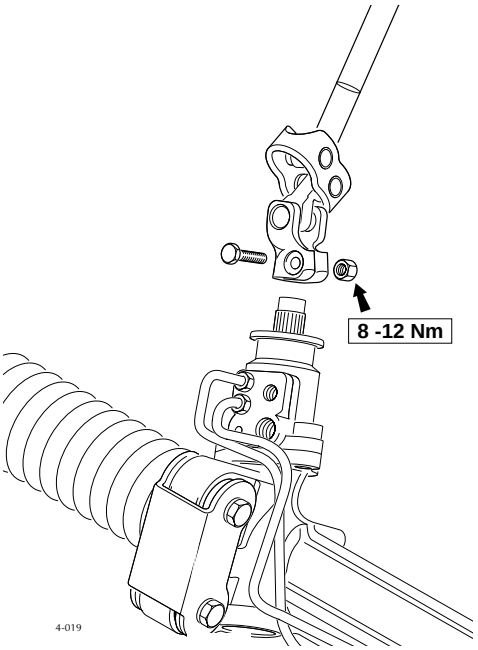
6. Check/adjust the front wheel alignment.

4.1.11 Lower Wishbone Renewal

Removal

1. Raise the vehicle on a four point hoist and remove the front road wheels.

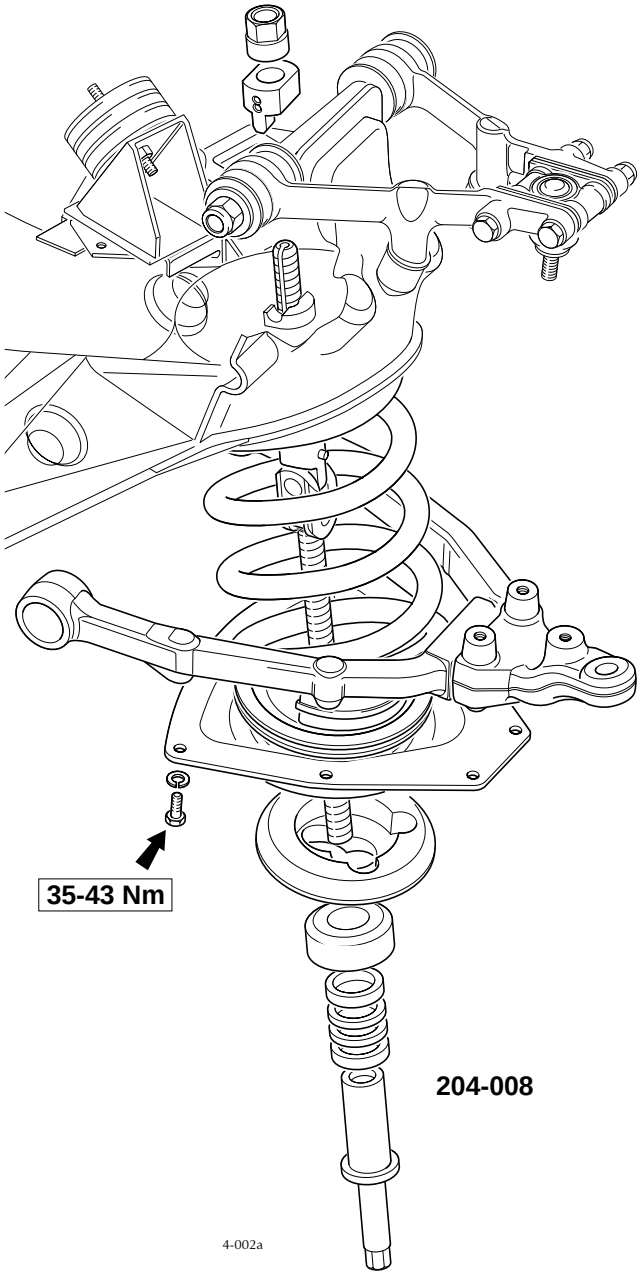
2. Remove the pinch bolt securing the lower steering column to the rack pinion.



3. Release the rack from the suspension frame.

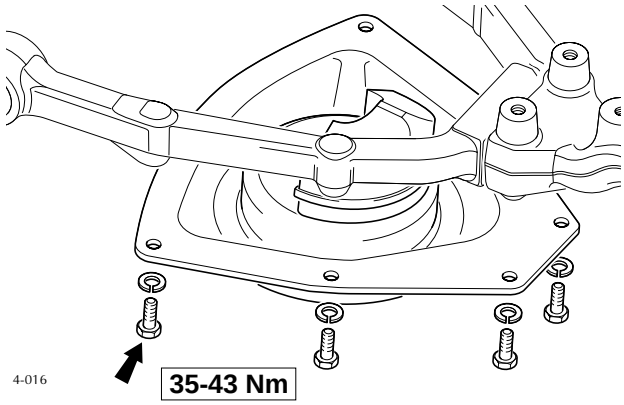
4. Remove the steering rack from the crossmember and tie it safely to avoid damage or strain on the flexible hoses. Retrieve the packing washers.

5. Compress the front suspension spring.



204-008

6. Release the spring seat pan.

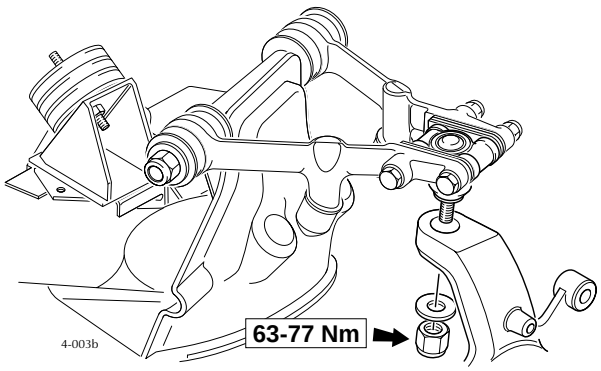


7. Slacken the spring compressor tool and remove the spring seat pan, spring and packers.

Note: Record the quantity and position of the packers for reassembly.

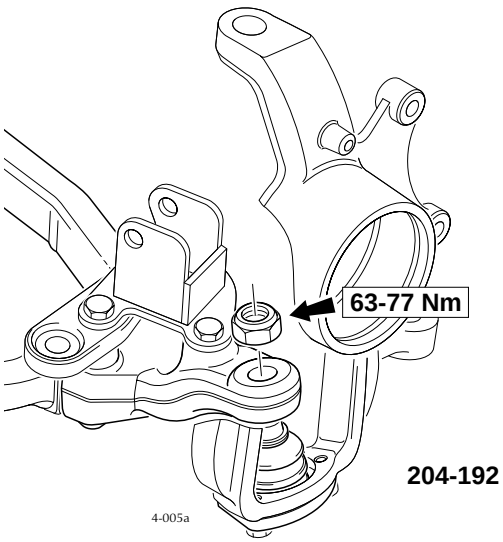
8. Release the upper ball joint from the vertical link.

Allow the vertical link to swing outward to access the lower balljoint. Secure the vertical link with a strong tie to avoid strain in the brake flexible hose.



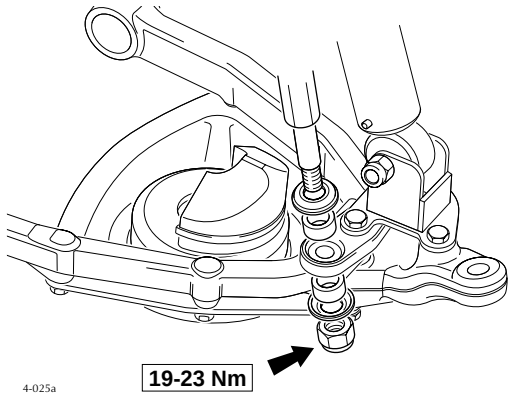
9. Disconnect the lower ball joint from the lower wishbone assembly.

Note: It may be necessary to substitute a two inch long 1/2in UNF socket head grub screw, for the existing bolt of the special tool.

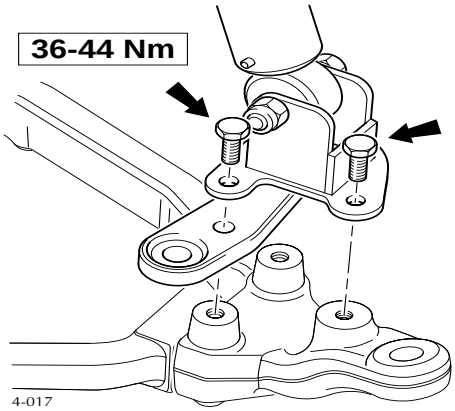


204-192

10. Release the anti-roll bar from the lower wishbone.



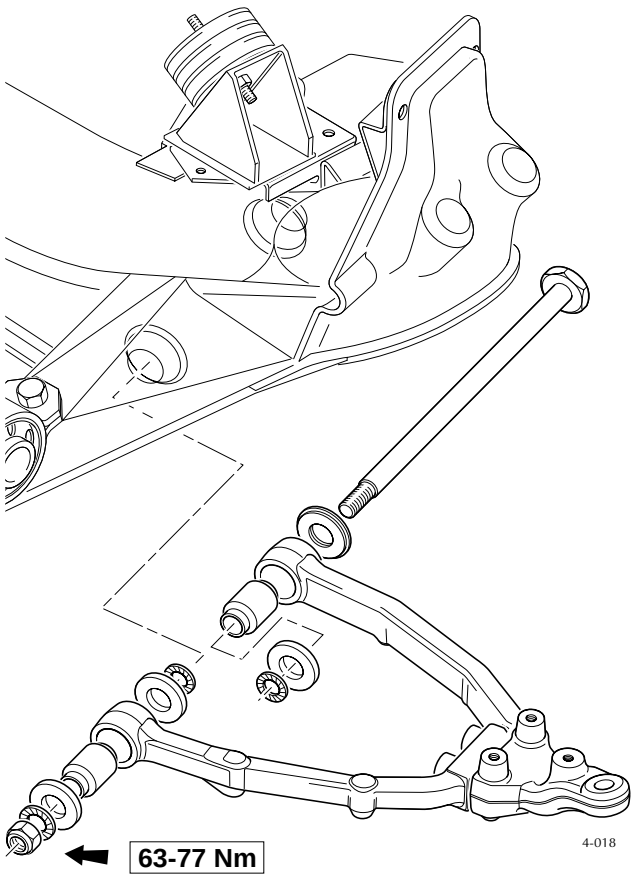
11. Release the shock absorber from the lower wishbone.



12. Telescope the shock absorber and move it clear.

13. Remove the lower wishbone fulcrum shaft.

14. Remove the lower wishbone and spacer washers.



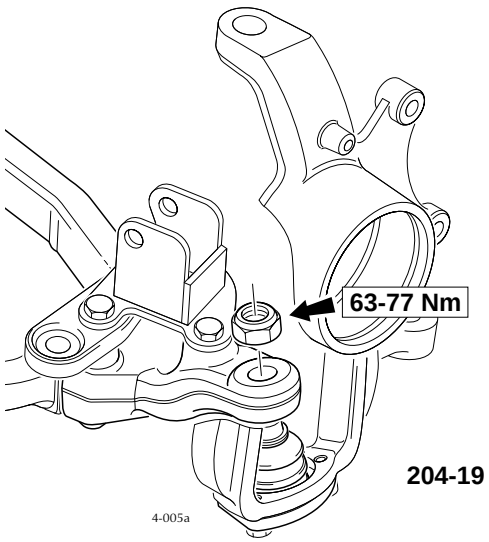
Installation

1. Press new bushes into the wishbone eyes.

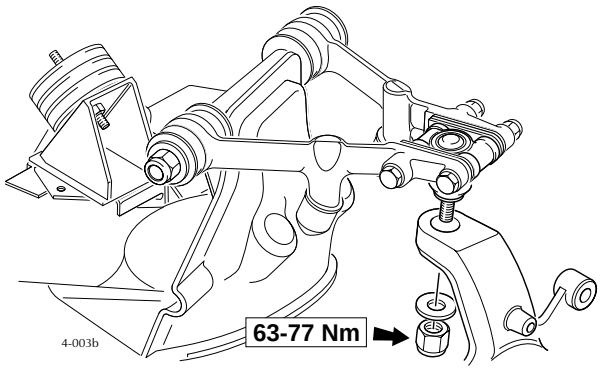
2. Fit the wishbone assembly and spacers to the suspension frame. DO NOT tighten the fulcrum bolt at this stage.

3. Fit the shock absorber lower mount.

4. Fit the lower ball joint and vertical link to the lower wishbone.



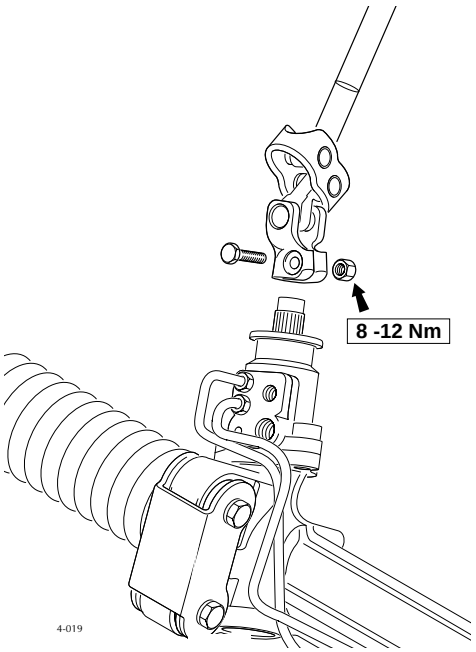
5. Fit the upper ball joint to the vertical link.



6. ***Caution: When fitting the spring seat pan, use loctite on the bolts or new patchbolts***.

   Fit the spring seat pan, spring and packers using Service Tool JD 6G.

7. Refit the steering rack.



8. Refit the road wheel, fit and nip up the wheel nuts.

9. Lower the vehicle to the ground.

10. Torque tighten the wheel nuts to 88-102 Nm.

11. ***Caution: To avoid pre-loading the fulcrum shaft bushes, do not tighten the nuts until the vehicle rests fully on the suspension and is at half-laden weight.***

    Tighten the lower fulcrum shaft nuts.

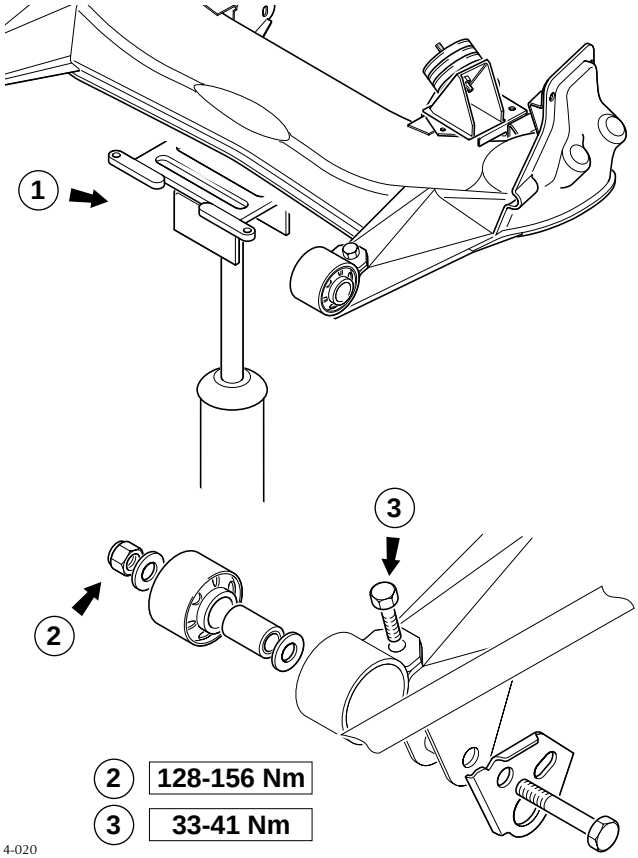
12. Check/adjust the front wheel alignment.

4.1.12 Front Suspension Mounting Bush

Removal

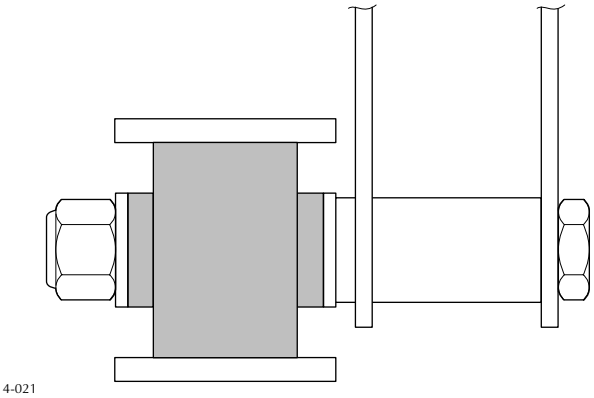
Note: A worn or damaged bush implies that undue strain has been placed upon the apparently satisfactory bush on the opposite side of the vehicle. Bushes must therefore be renewed as a pair.

1. Raise the vehicle on a four point hoist.
2. Remove the front undertray.
3. Support the weight of the front suspension crossmember.
4. Remove the front mounting bolts



Note: Record the position of the plain and special washers and, if fitted, the tie down bracket.

5. Slacken the clamping bolt and remove the bushes.
6. Fit the new bushes centrally in the mount.
7. Fit the inner tubes, mounting bolts and spacer washers. Tighten to specification.

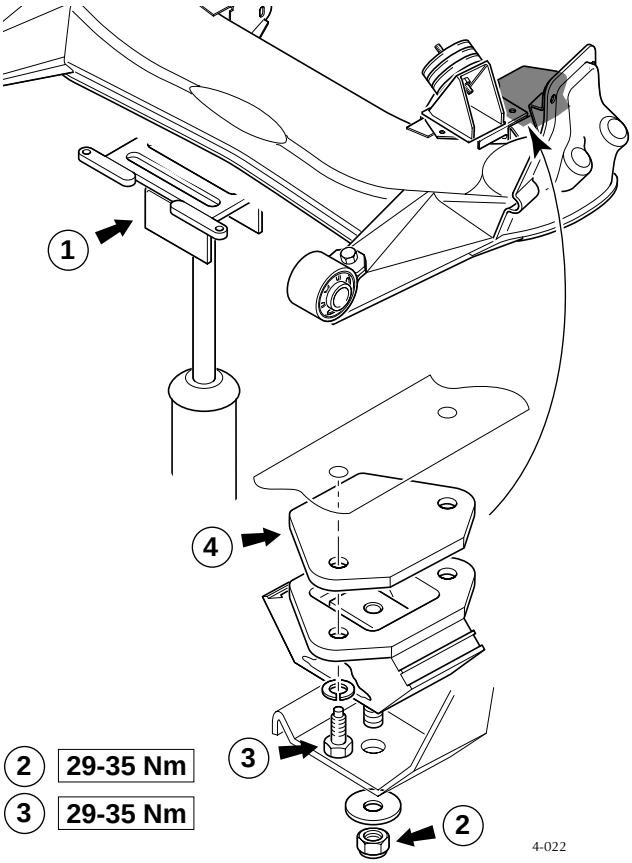


8. Remove the trolley jack and lower the vehicle.

4.1.13 Front Suspension Rear Mounting

Procedure

1. Raise the vehicle on a four point hoist. Position a trolley jack under the front suspension crossmember.
2. Slacken the front mounting bolts
3. Release the rear mounts.



4. Lower the rear of the suspension frame. Remove the rear mount fixings.
5. Remove the rear mountings

CAUTION: In the following steps, the rear mounts must be secured first. Undue stress will be placed in the front mounts if they are secured before the rear is raised. This could result in early front mount failure.

Installation

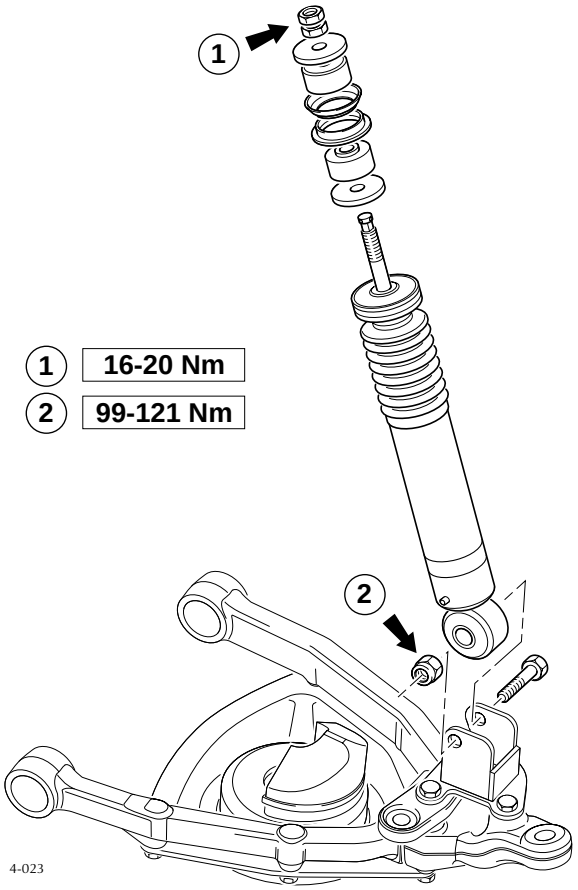
1. Fit the new mountings into position, using the jack to align the bolt holes. Refit the packing pieces, fit and tighten the screws/washers.
2. Jack up the crossmember, align the bolt hole, fit and tighten the locknut.
3. Tighten the front mounting bush nuts and bolts to 129-155 Nm.
4. Remove the trolley jack and lower the vehicle to the ground.

4.1.14 Front Shock Absorber

Removal

Note: Apart from the gaiter which can be renewed, the shock absorbers are not serviceable items.

1. Release the shock absorber top mounting.



2. Raise the vehicle on a four point hoist and remove the M14 bolt and the shock absorber.

Installation

1. Fit the new shock absorber to the vehicle.

   Note: Ensure that the lower washers and rubber buffer are in position on the damper stem, before inserting through the hole in the wheel arch.

2. Fit the lower mounting bolt from the rear of the vehicle.

3. Lower the vehicle to the ground.

   Caution: To avoid pre-loading the damper mountings, do not tighten the mounting bolts until the vehicle rests fully on the suspension and is at half-laden weight.

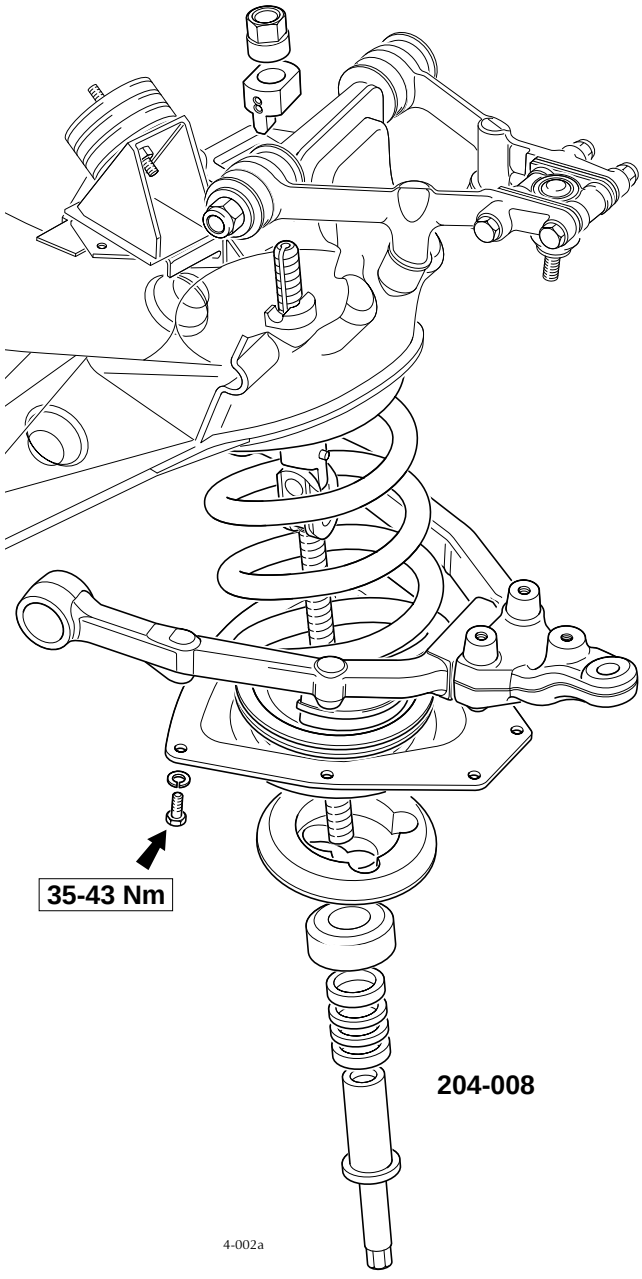
4. Fit and tighten the upper mounting. Torque the upper and lower fixing.

4.1.15 Front Road Springs

Removal

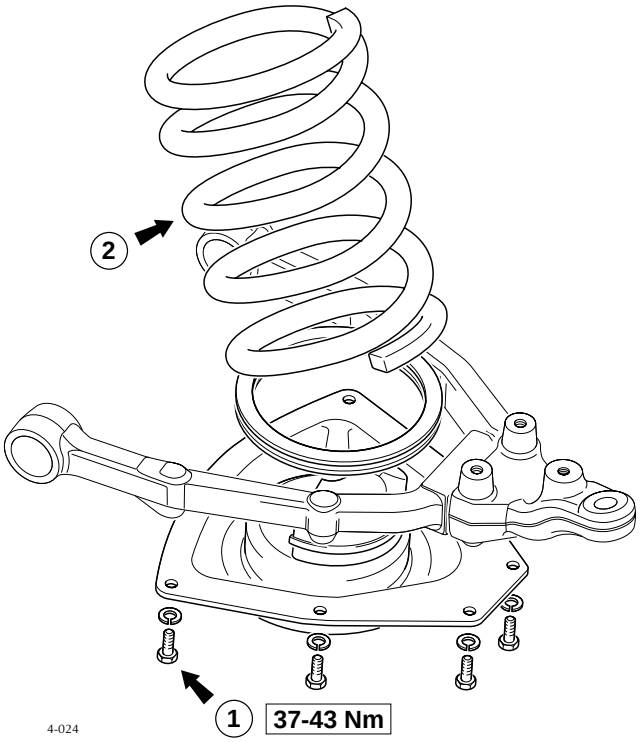
1. Raise the vehicle on a four point hoist. Remove the front road wheels.

2. Compress the front road spring.



204-008

3. Release the spring pan.



4. Slacken and detach the spring compressor. Remove the road spring.

Note: Record the position of any packers to assist during replacement.

Installation

To install, reverse the removal procedure.

Caution: When fitting the spring pan use loctite on the bolts or use new patchbolts.

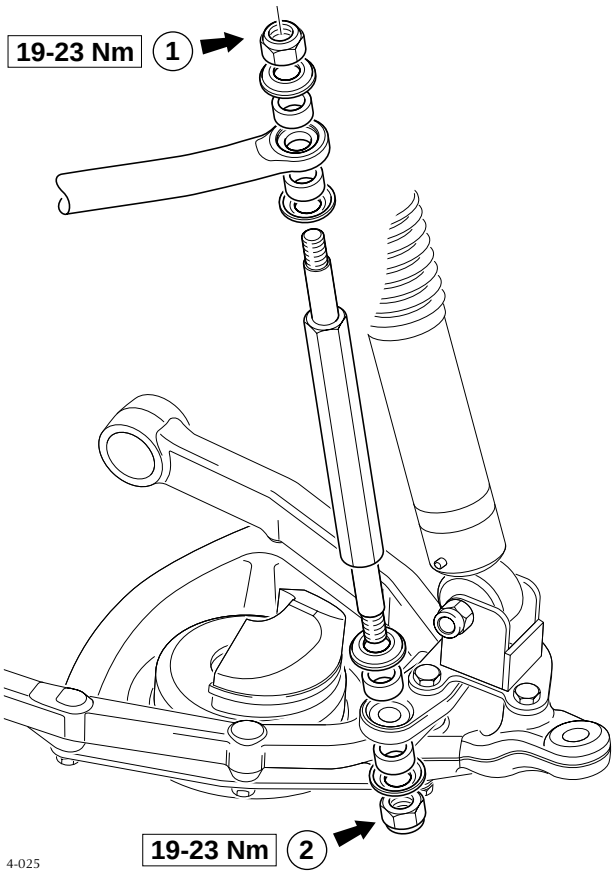
Take care to replace the correct number of packer shims between the spring and spring pan.

On completion of the replacement, check the ride height and adjust if necessary.

4.1.16 Front Anti-Roll Bar

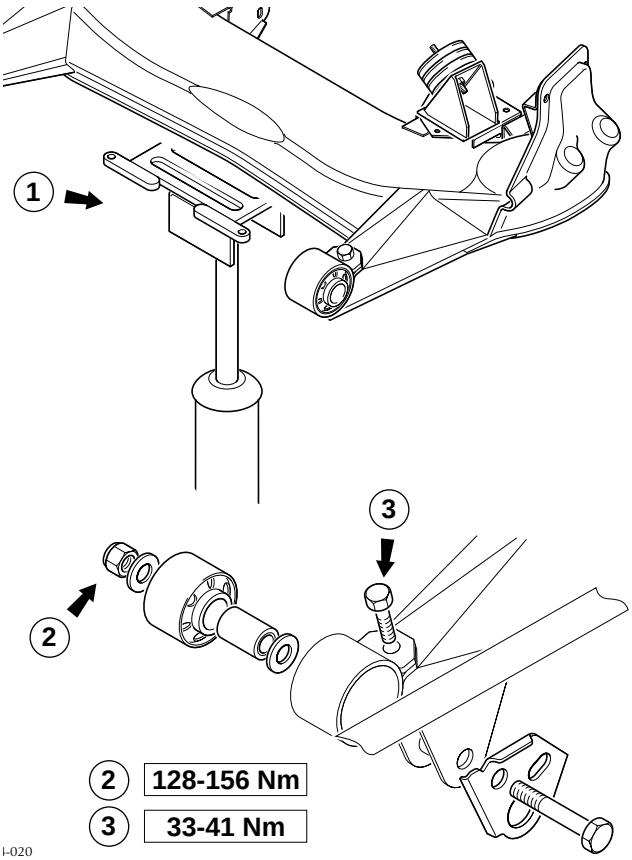
Removal

1. Raise the vehicle on a four point hoist. Remove the front road wheels.
2. Remove the front undertray.
3. Disconnect the anti-roll bar links.



4. Release the front suspension front mountings.

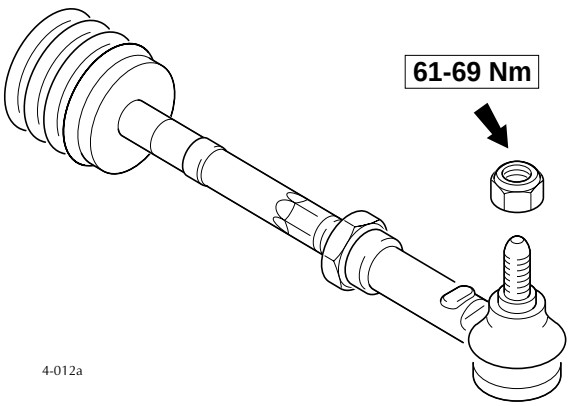
   1 Support the front suspension cross beam.
   2 Remove the front suspension mounting bolts.
   3 If the bushes are worn, release the pinch bolt and remove the bushes.



I-020

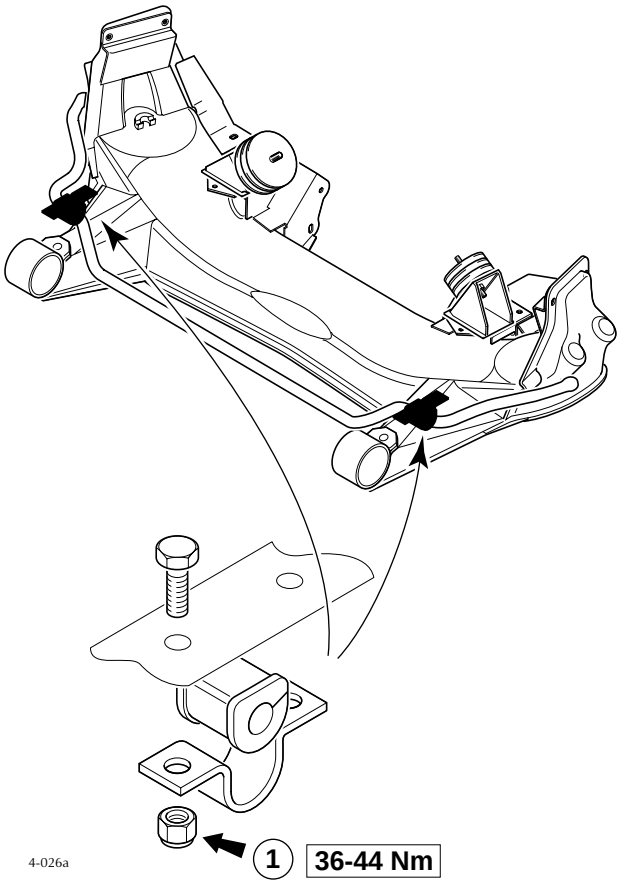
5. Release one steering rod ball joint from the steering arm. Swivel the hub to give access for anti-roll bar removal.

   Note: When using JD 24 Steering Joint Separator, substitute a 2in long UNF socket headed screw for the existing bolt.



4-012a

6. Release the anti-roll bar mounts.



4-026a

7. Slightly lower the suspension assembly and remove the anti-roll bar.

   Note: The fitting of the rubber bushes will be greatly assisted if a proprietary rubber lubricant or a liquid soap and water solution is used.

Installation

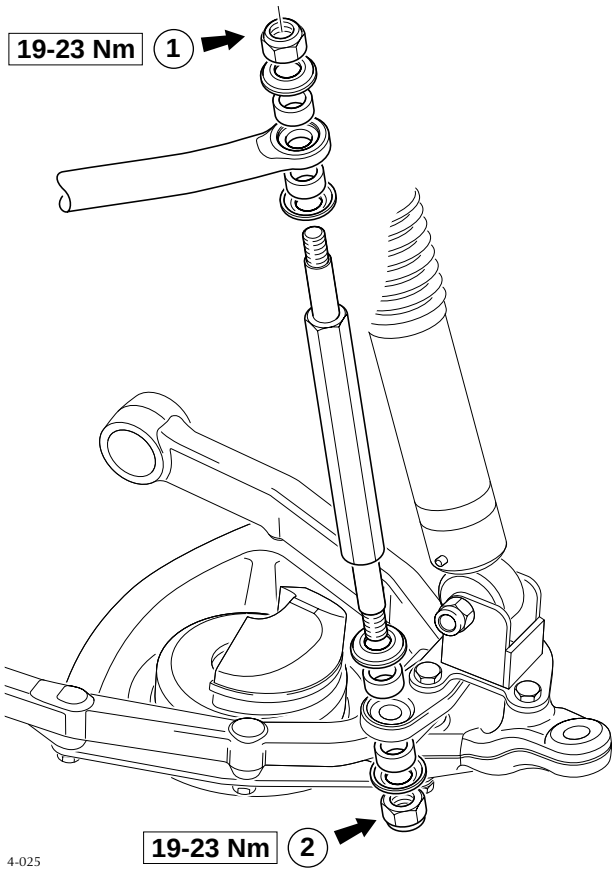
Caution: To avoid pre-loading the suspension mounting and anti-roll bushes, do not tighten the mounting bolts, pinch bolts or anti-roll mounting bolts, until the vehicle rests fully on the suspension and is at half-laden weight.

1. Replacement is the reverse of the removal procedure.
2. If the anti-roll bar bushes are worn, fit new bushes during reassembly. Orientate the anti-roll bar bushes as shown.
3. Check the front wheel alignment and adjust if necessary.

4.1.17 Anti-Roll Bar Link Arm

Removal

1. Raise the vehicle on a four post hoist. Raise and remove the front road wheels.
2. Remove the anti-roll bar links.



3. Recover two spacer tubes, rubber bushes and special washers from each link. Discard the rubber bushes.

Installation

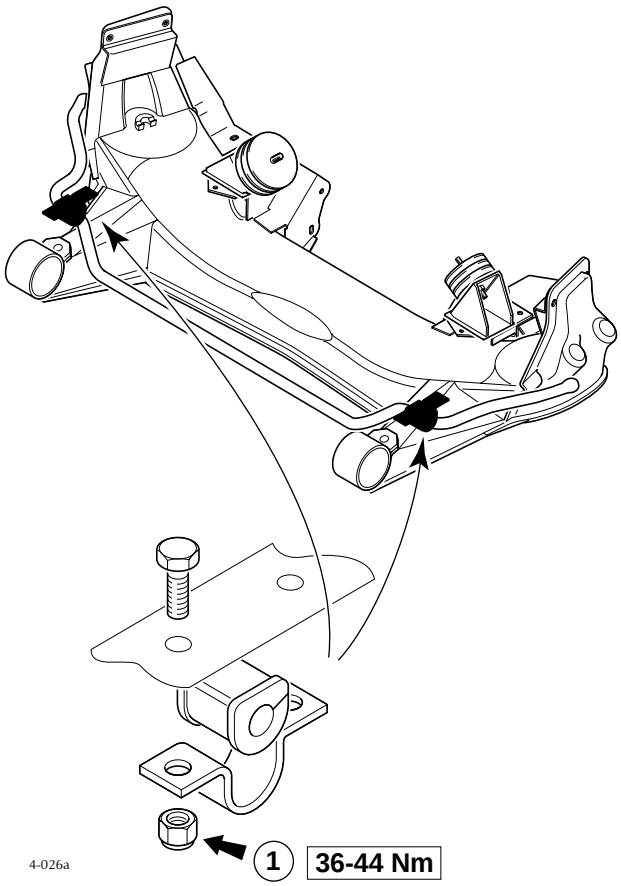
1. Fit the new bushes to the links.
2. Refit the link arms to the vehicle.
3. Refit the front wheels and nip up the wheel nuts. Lower the front wheels back onto the ramp. Tighten the wheel nuts to specification.
4. ***Caution: To avoid pre-loading the suspension mounting and anti-roll bushes, do not tighten the mounting bolts, pinch bolts or anti-roll mounting bolts, until the vehicle rests fully on the suspension and is at half-laden weight.***

   Torque tighten the anti-roll bar link upper and lower fixings.

4.1.18 Anti-Roll Bar Bushes

Removal

1. Raise the vehicle and remove the front undertray.
2. Release the anti-roll bar bush mountings. Remove the bushes.



Installation

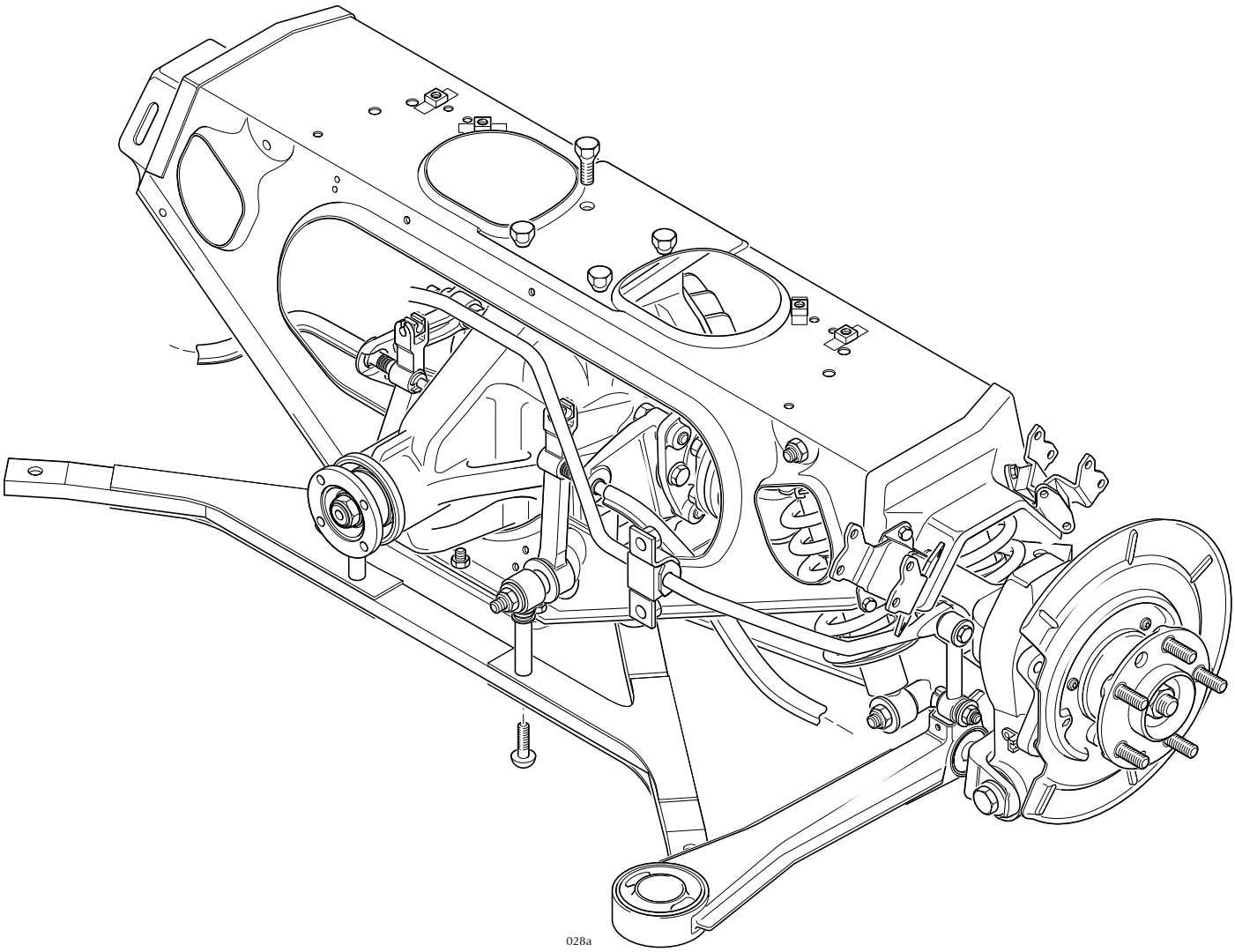
1. Fit new anti-roll bar bushes.
2. Fit and secure the bush retaining brackets, DO NOT tighten the bracket bolts with the vehicle raised from the ground
3. ***Caution: To avoid pre-loading the suspension mounting and anti-roll bushes, do not tighten the mounting bolts, pinch bolts or anti-roll mounting bolts, until the vehicle rests fully on the suspension and is at half-laden weight.***

   Lower the vehicle to the ground so that the full vehicle weight rests on the suspension. Torque tighten the mounting nuts.
4. Raise the vehicle again and refit the front undertray.

Rear Suspension

Description

The complete independent rear suspension system is mounted in a pressed steel crossbeam attached to the body by two 'Vee' rubber mountings at either end. Two radius rods extend from the outer ends of the lower wishbones to tie the hub assemblies to the vehicle floorpan. The front and rear of the hypoid unit are secured to a bracing frame secured to the floor pan. This additional stiffening is provided to eliminate the tendency for the hypoid nose to rise during heavy acceleration.



028a

Hypoid

Description

The hypoid unit is mounted centrally in the crossbeam. Drive shafts connect the hypoid unit to the rear wheel hubs. The drive shafts are equipped with universal joints at either end. The rear hub carriers are supported by swinging wishbones between the hypoid unit and the hub carriers. The system functions as a double wishbone configuration.

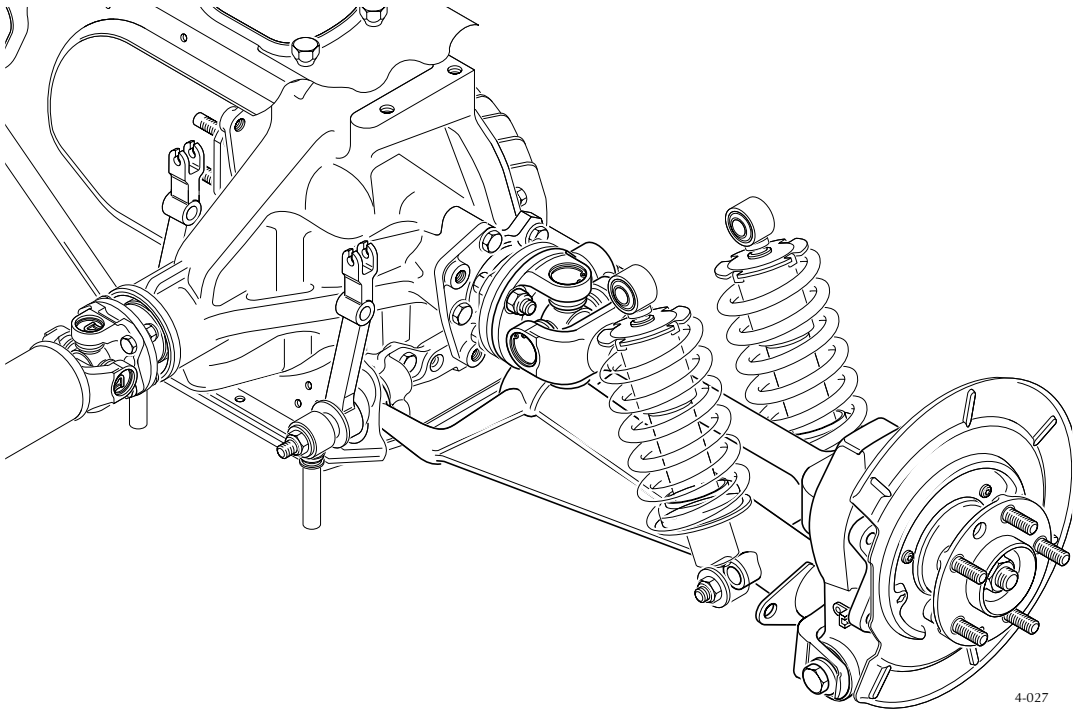
Two gas filled shock absorber and spring assemblies are mounted between each lower wishbone and the crossbeam to regulate bump and rebound forces.

The hub carrier houses a rear hub that is splined to the drive shaft and runs in taper roller bearings.

Rear wheel camber angle and 'toe in' are adjustable.

Warning:

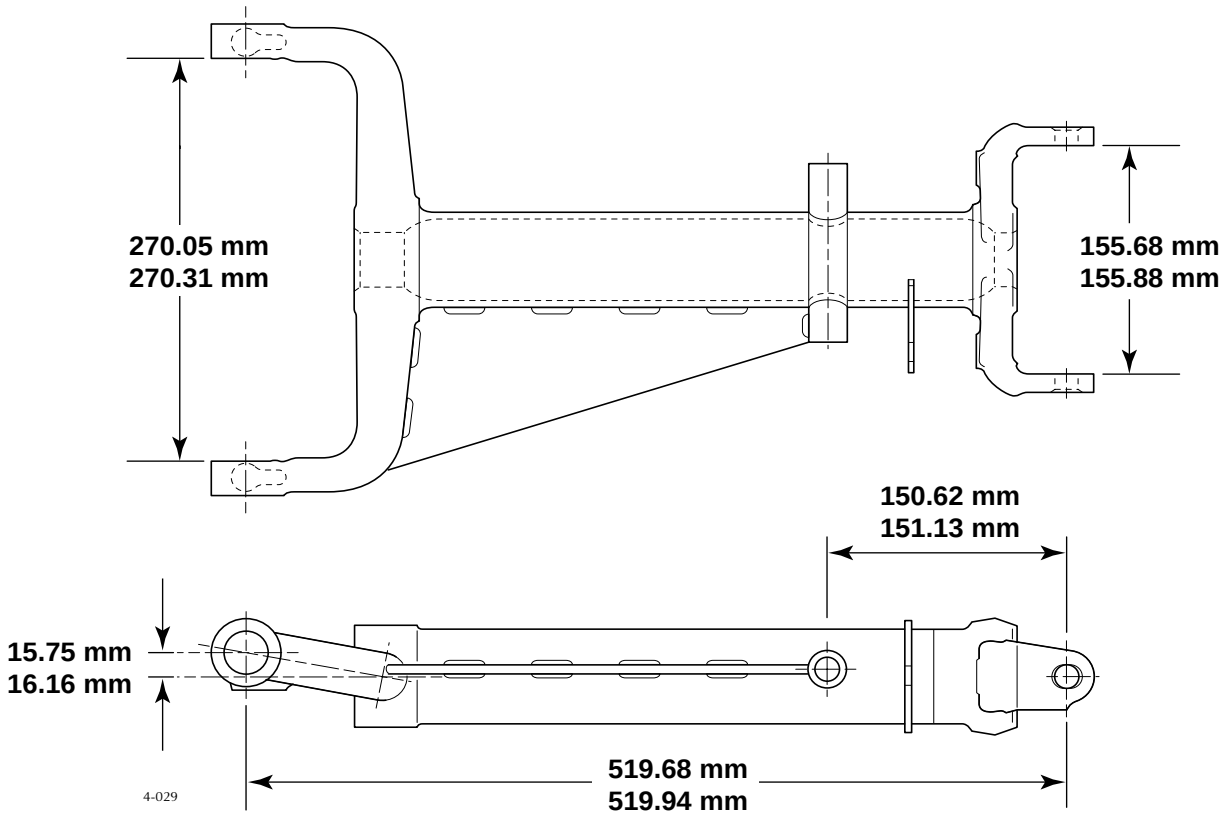
Under no circumstances must the engine be run with the vehicle in gear and only one wheel off the ground. The limited slip differential will transfer all drive to the wheel on the ground and drive the vehicle off the jack. If it is necessary to turn the drive train with the vehicle in gear then both rear wheels must be raised clear of the ground.



Data

The following illustration is provided to assist in assessing accidental damage. Any component suspected of being damaged must be removed, cleaned thoroughly and the dimensions compared with those specified in the diagram.

Dimensions - Rear Wishbone



4.2.01 Rear Suspension Height Check

Data

Service Tools

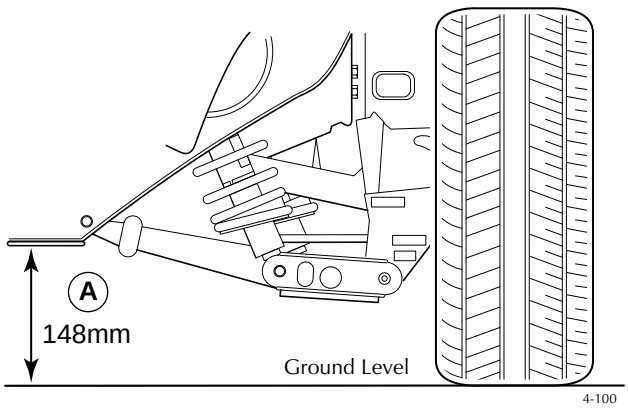
204-007 Setting links
Camber gauge

Procedure

Note: Make sure that the vehicle is in its half laden condition i.e. with all fluids topped up and a full tank of fuel.

68 Kg (150 lbs) weights must be placed in each front seat and a 7kg (15 lbs) weight placed in the rear.

1. Check that the tyres are at the correct pressure.
2. Roll the vehicle forward three lengths on a perfectly level surface and measure the distance between the lower surface of the rear crossbeam and the ground on both sides of the vehicle.



The distance A must be 148mm. If not, check all bushes and bearing points of the rear suspension including the position of the damper spring support ring.

If these are not the cause of the fault then change the rear road springs.

Note: Springs must be replaced as a set of four.

4.2.02 Check and Adjust the Camber Angle

Data

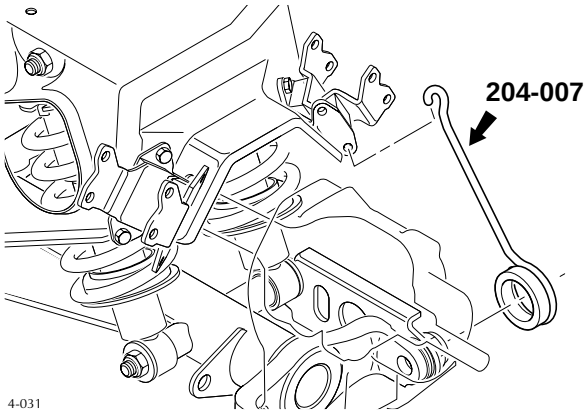
Camber Angle -1° ± 10'.

Check

Note: Camber angle is set at the half laden position

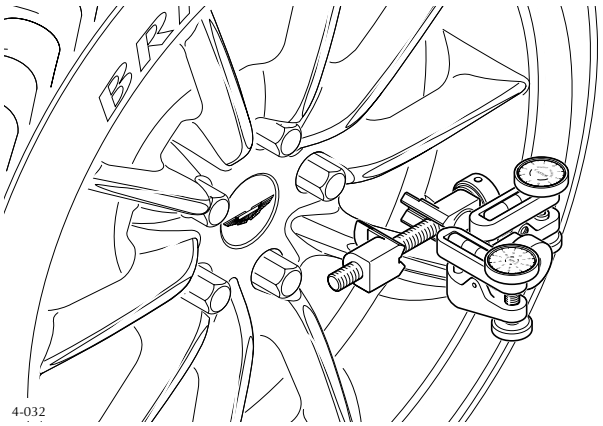
Note: Check that the tyre pressures are correct.

1. Position the vehicle on a level surface.
2. Fit the Setting Links.



3. Check the camber angle.

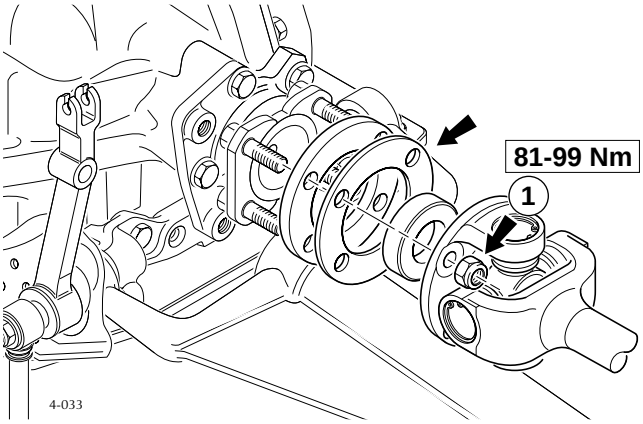
   The correct reading should be 1° ± 10 mins. negative, at the half laden position, if it is not adjust the camber angle.



Adjust

1. Remove the setting links. Raise the vehicle on a four point hoist.
2. Remove the appropriate road wheel.
3. Release the drive shaft from the hypoid unit.
   1 Remove four nyloc nuts from the drive shaft flange.
   2 Separate the drive shaft from the hypoid unit
   3 Check the size of the interchangeable shim (the outer shim arrowed on the illustration is interchangeable). Increase or reduce the size to adjust the camber angle.

   Note: Shims are available from 3.5mm to 7mm in increments of 0.5 mm (0.020 in). Each 0.5mm increment changes the camber angle by approximately 25' - 30'.



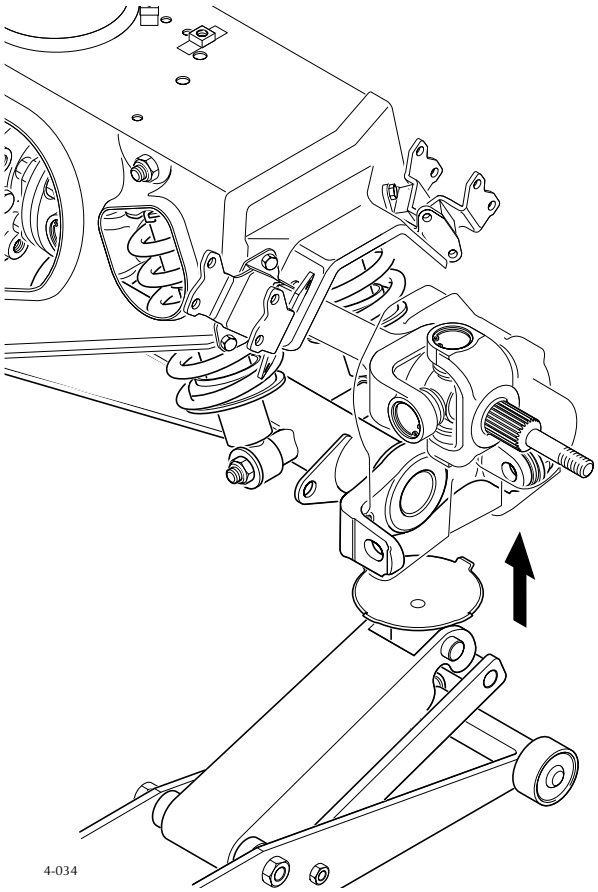
4. Refit and secure the drive shaft flange.
5. Refit the road wheel and wheel nuts.
6. Lower the vehicle the vehicle to the ground.
7. Tighten the wheel nuts to 88-102 Nm.
8. Re-check the camber angle.

4.2.03 Rear Spring/Shock Absorber

Removal

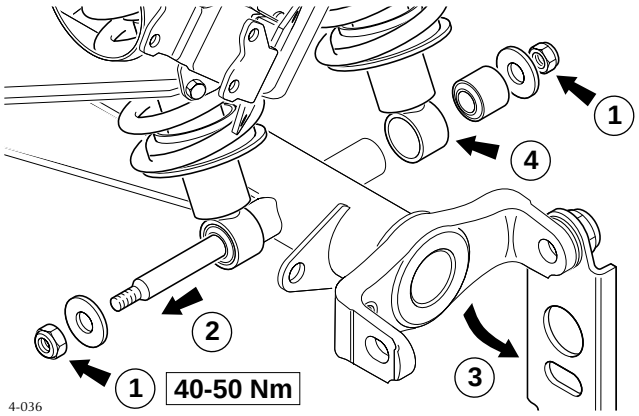
Note: The road spring and hydraulic shock absorber assemblies can be removed from the car with the rear suspension assembly in position.

1. Raise the vehicle on a four point hoist. Remove the road wheel.
2. Support the lower wishbone.

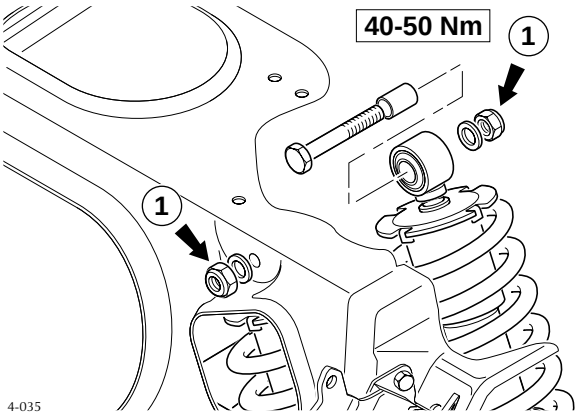


3. Release the bottom of the shock absorbers.

   1 Remove the nuts and washers securing the shock absorber to the mounting pin.
   2 Loosen the outer nut and swing down the rear tie-down bracket.
   3 Drift out the shock absorber mounting pin.

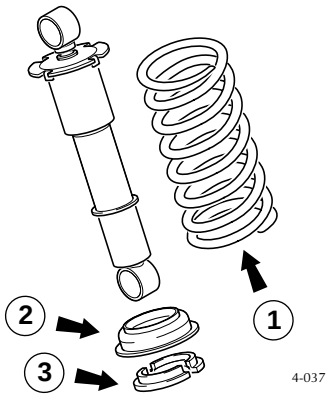


4. Release the top mountings and remove the shock absorbers.



5. Remove the road spring from the shock absorber.

   1 Using the special tool, compress the road spring.
   2 Raise the lower spring pan
   3 Remove the lower collets, spring pan and spring.



6. Renew all worn or damaged parts as required.

Installation

1. To install, reverse the removal procedure.

   Caution: To avoid pre-loading the shock absorber mountings, do not tighten the mounting bolts until the vehicle rests fully on the suspension and is at half laden weight.

   WARNING: Ensure that the spring seats and collets are fully locked before releasing the spring compressor.

4.2.04 Radius Arm Bushes Renew

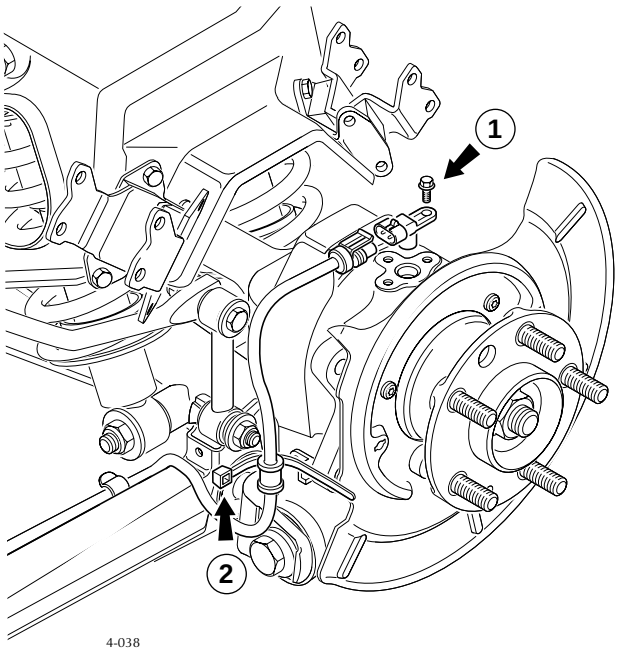
Data

Service Tools

204-007 Setting Links

Removal

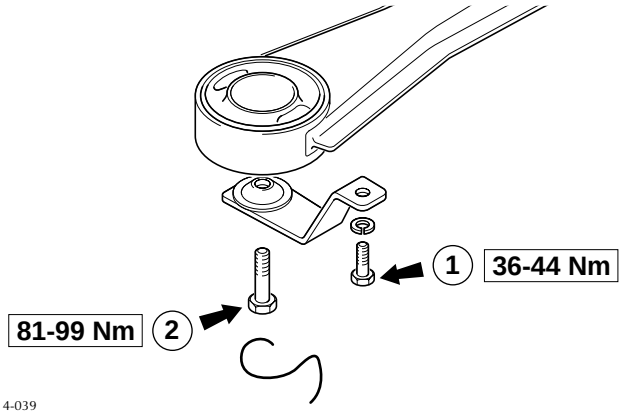
1. Raise the vehicle on a four point hoist. Remove the appropriate road wheel.
2. Disconnect the ABS sensor lead at the sensor. Release the lead from the radius arm clips.



4-038

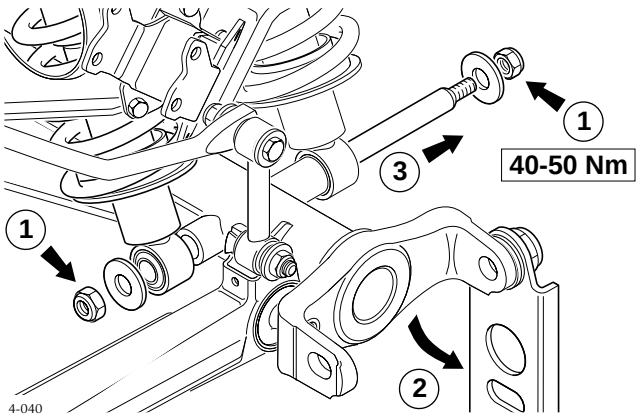
3. Remove the radius arm front mounting bolt.
   1 Remove the locking wire and safety strap.
   2 Remove the bolt securing the radius arm to the body.

   Note: When refitting the locking wire refer to the Installation section and observe the warning relating to this part.



4-039

4. Displace the radius arm front mounting bush from the body.
5. Remove the lower damper mounting pin.
   1 Remove the nyloc nuts from the damper lower mounting pin.
   2 Displace the tie-down bracket.
   3 Remove the lower damper mounting pin.

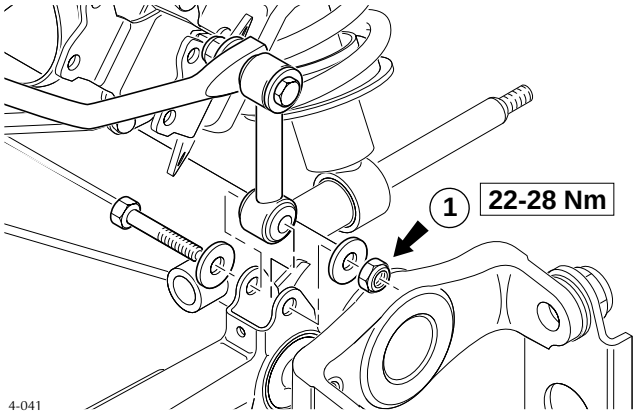


4-040

6. Disengage the anti-roll bar.

   1 Remove the nut and bolt securing the roll bar link.

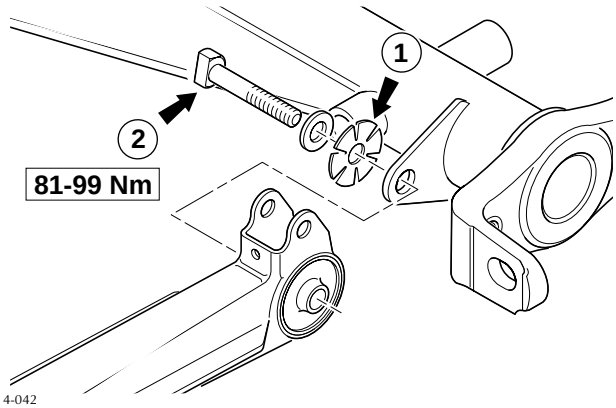
   2 Disengage the link and capture the spacer washers.



7. Remove the radius arm.

   1 Knock back the tabs of the lock-washer.

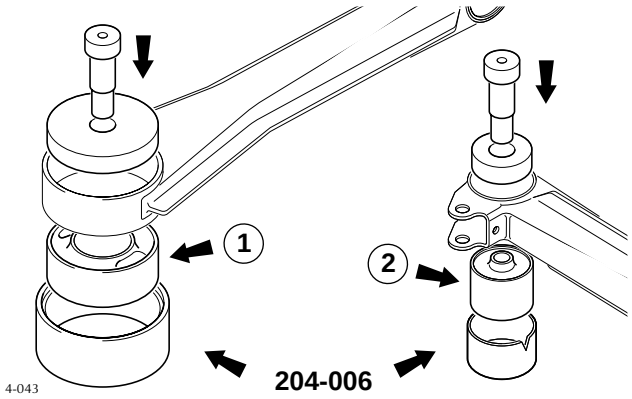
   2 Remove the bolt securing the radius arm to the wishbone.



8. Remove radius arm bushes using the special tool.

   1 Use the tools as shown and a suitable press, remove the front bushes from the radius arm.

   2 Use the tools as shown and a suitable press, remove the rear bushes from the radius arm.



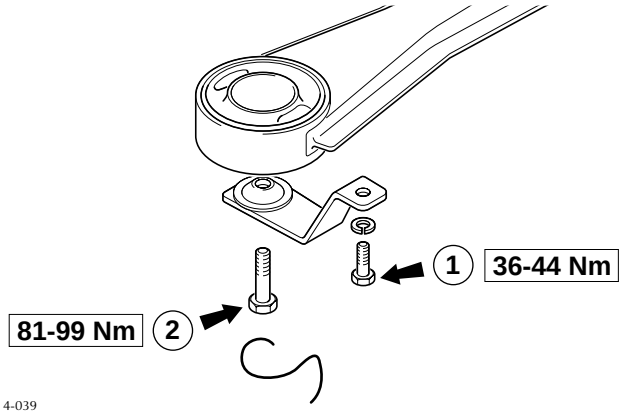
Installation

1. Using the special tool 204-006 press in new bushes ensuring that each bush is inserted squarely into its housing in the radius arm.

2. To install, reverse the removal procedure observing the following points:

   Caution: To avoid pre-loading the radius arm bushes, do not tighten the mounting bolts until the vehicle rests fully on the suspension and is at half laden weight.

   WARNING: When refitting the locking wire to the radius arm mounting bolt make sure the wire does not pass over the top of the bolt head. A locking wire exposed in this way could be damaged if the vehicle is jacked up at this point. Check the lockwire on both radius arms when working on the rear suspension.



4.2.06 Wishbone/Inner Fulcrum Mounting Bracket Renew

Data

Service Tools

204-007 Setting Links

Oils, Sealants and Lubricants

Fulcrum shaft LM Multipurpose Grease

Removal

1. Remove the rear suspension (4.2.07)

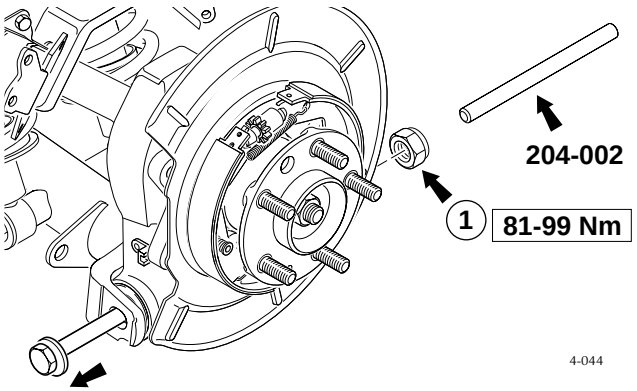
Warning: The wishbone can be removed/replaced with the suspension unit in the vehicle. Experience has shown it to be safer and more efficient to remove the suspension unit and invert it on the floor to carry out this procedure.

Note: The following illustrations show all components in their normal orientation. It is more convenient to invert the assembly to remove the lower wishbones.

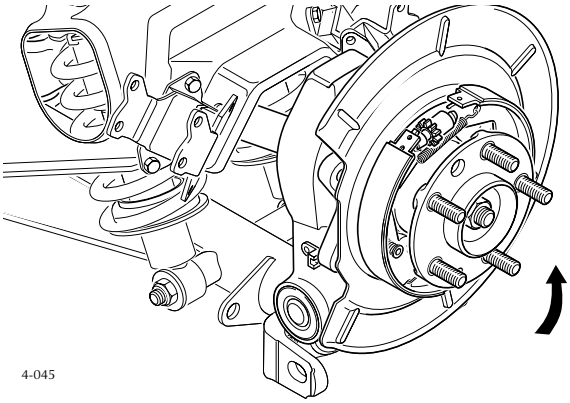
2. Release the wishbone outer fulcrum.

   1 Remove the self-locking nut from the rear of the outer fulcrum shaft and remove the shaft towards the front using the dummy shaft JD 14.

Note the shims between the wishbone and the hub carrier. Retain the shims and oil seal retaining washer at each side of the hub carrier with adhesive tape.



3. Raise the hub carrier and drive shaft clear of the wishbone, secure to the crossbeam using strong wire or cord.



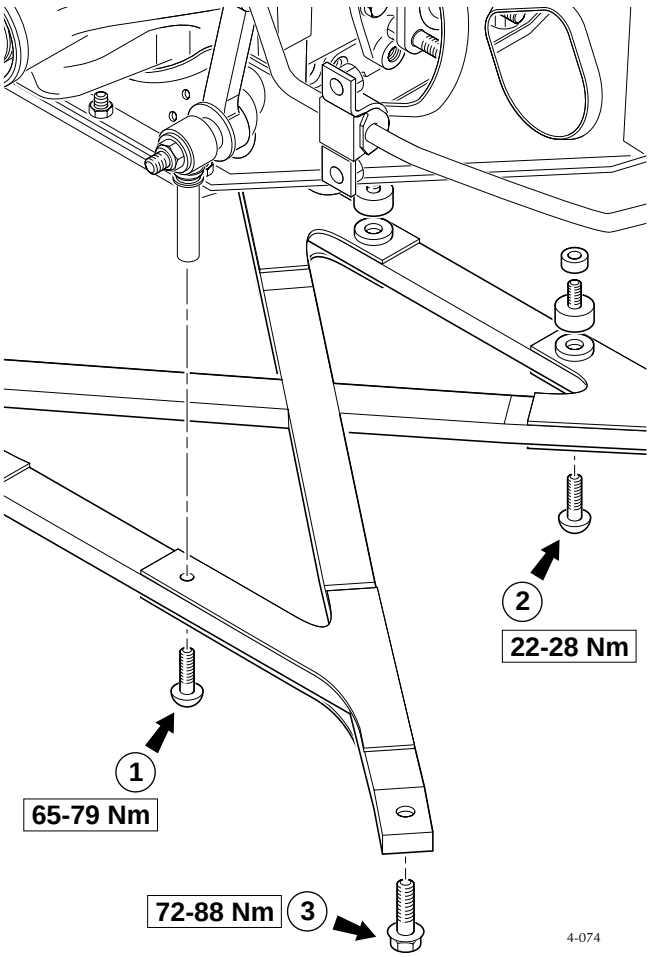
4. Remove the rear cross-brace / anti-tramp device.

   1 Remove two M12 bolts from the front of the cross-brace.

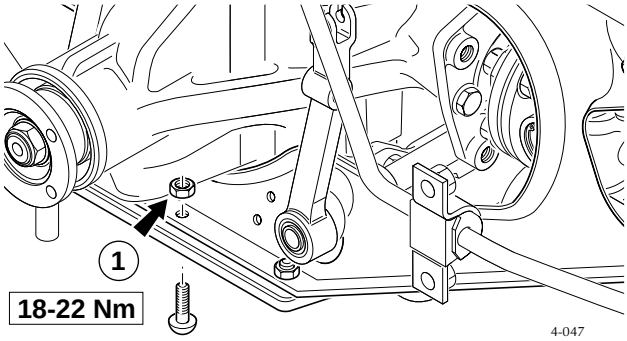
   2 Remove three M12 bolts and nuts from the rear of the cross-brace.

   3 ***Warning: You will require assistance to support the weight of the cross-brace while you remove the bolts.***

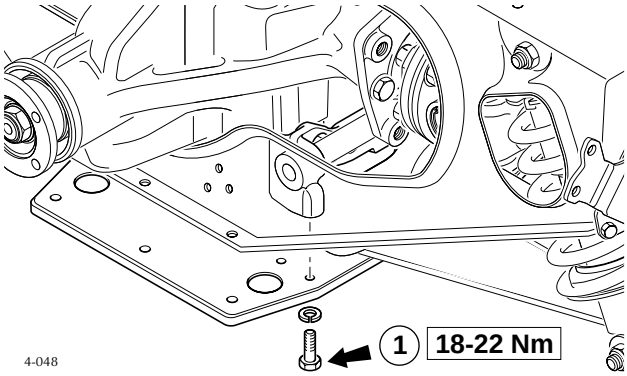
   Remove four bolts and remove the cross-brace, retrieve three rubber mounts and spacers.



5. Remove the six bolts and nuts securing the tie-plate to the crossbeam.

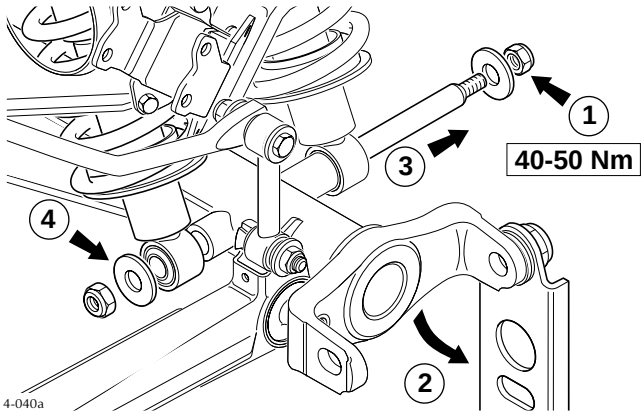


6. Remove eight setscrews securing the tie-plate to the inner fulcrum brackets. Remove the tie plate.



7. Release the dampers from the wishbone.

   1 Remove the nyloc nuts from the damper lower mounting pin.
   2 Displace the tie-down bracket.
   3 Remove the lower damper mounting pin.
   4 Recover the outer washers and the spacer from the front damper mounting.

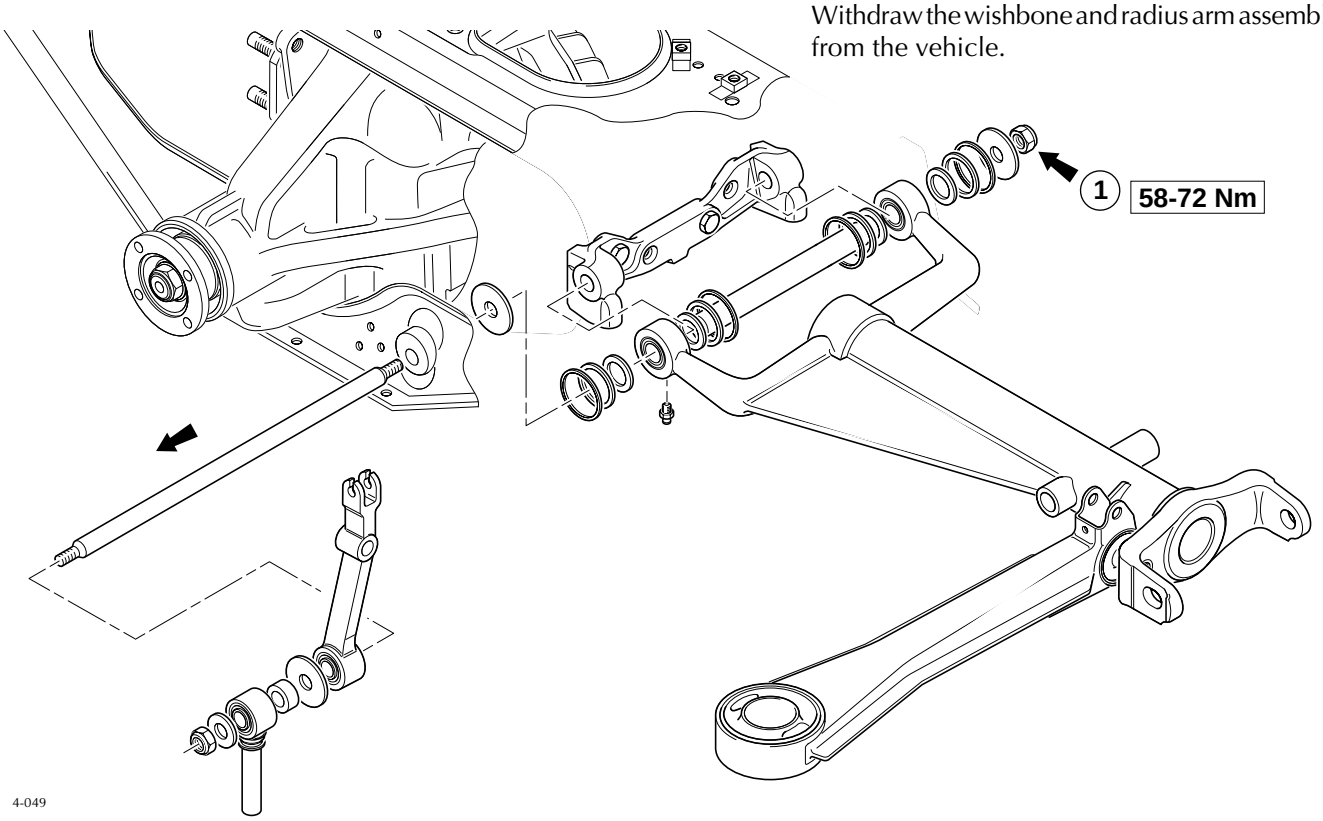


8. Remove the wishbone.

   1 Remove the rear nut from the inner fulcrum shaft. Disconnect the parking brake cable from the ratio levers. Using a thin drift, drive the shaft clear of the inner fulcrum mounting bracket.

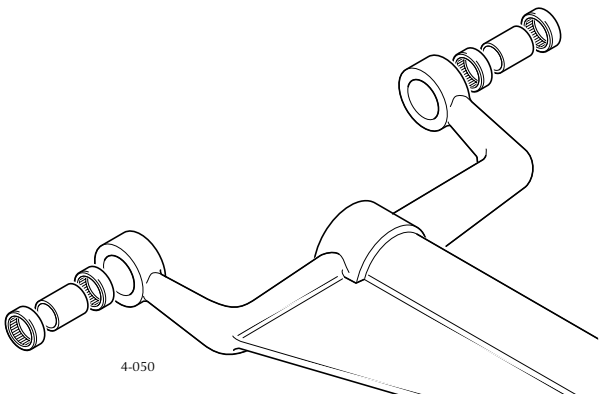
   Withdraw the drift. Recover thrust washers and sealing rings from the wishbone inner mounts.

   Withdraw the wishbone and radius arm assembly from the vehicle.



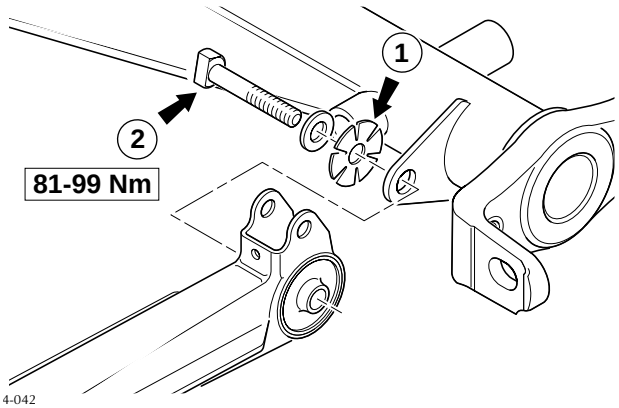
9. Remove the wishbone inner fulcrum bearings.

   Remove the two bearing tubes. Use a drift to tap the needle roller cages carefully from the wishbone.



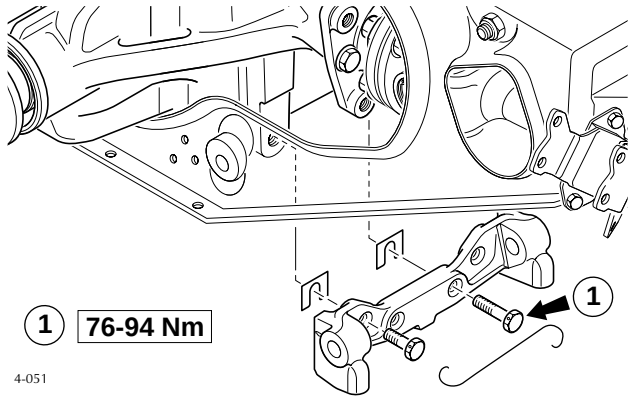
10. Release the radius arm from the wishbone.

    1 Bend back the tab washer
    2 Remove the bolt securing the radius arm.



11. If necessary, remove the inner fulcrum mounting bracket from the hypoid unit. Note the shims fitted at the fulcrum bracket mounts. Refit in the original positions to retain the rear wheel geometry settings.

    1 Remove the spacing tube from between the lugs of the mounting bracket. Remove the locking wire from the setscrews. Remove the setscrews and withdraw the fulcrum bracket.



Note: Make a record of the number and position of the shims at each attachment point.

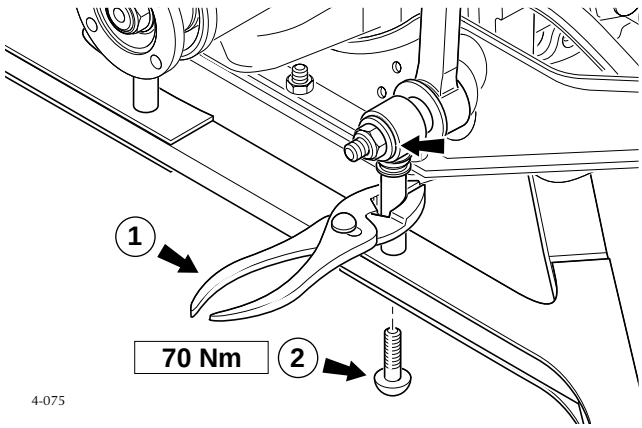
12. Examine all the components for wear and damage; renew as necessary.

Installation

1. To install, reverse the removal procedure and observe the following points:

   - The engraved edge of each bearing needle cage facing outwards.
   - Position the original shims between the inner fulcrum bracket and the hypoid unit. Lock wire the bracket setscrews.
   - ***Caution: When re-installing the cross-brace - drop link bolts, use a suitable gripping tool to prevent the link from twisting and pre-stressing the drop link bush.***

     Check for a parallel gap between the washer behind the fulcrum pin nut (arrowed).



   - Fit new grease seals to the wishbone inner fulcrum arms.
   - * ***Caution: To avoid pre-loading the radius arm bushes, and the damper lower mounting bushes, do not fully tighten the mounting bolts until the vehicle rests fully on the suspension and is at half laden weight.***

4.2.07 Rear Suspension Unit Renewal

Data

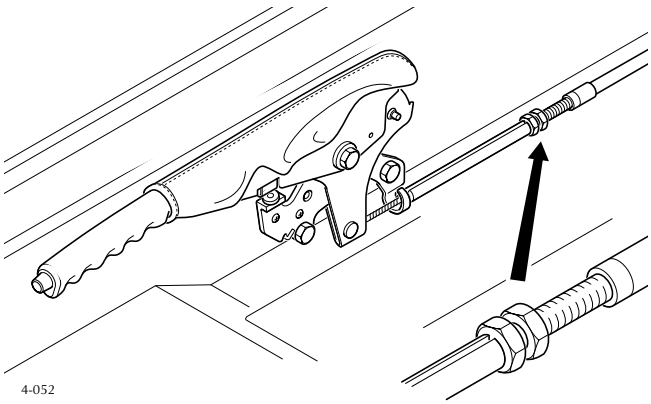
Service Tools

JD 14 Dummy shaft

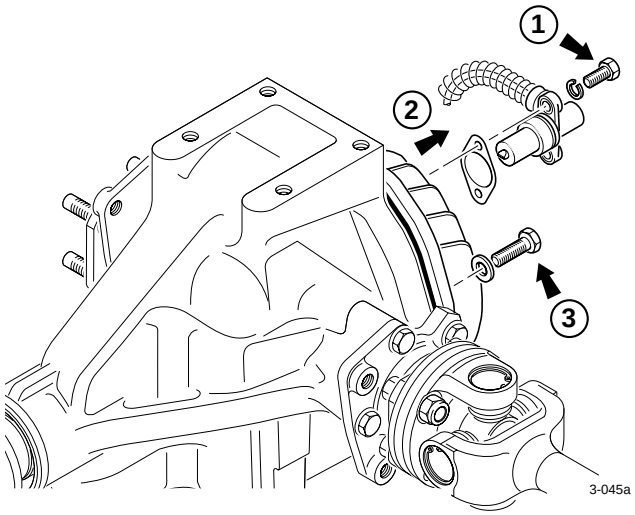
Removal

1. Slacken the handbrake cable.

   Ensure that the handbrake is released fully. Lift the carpet adjacent to the handbrake mounting for access to the cable adjusting nuts, slacken the cable lock and adjusting nuts.



2. Disconnect the vehicle speed sensor lead



3. Secure the vehicle speed sensor lead so that it does not become entangled with any part of the rear suspension unit when it is lowered. If necessary, displace the boot left hand trim panel and pull the lead up so that it rests against the underside of the boot floor.

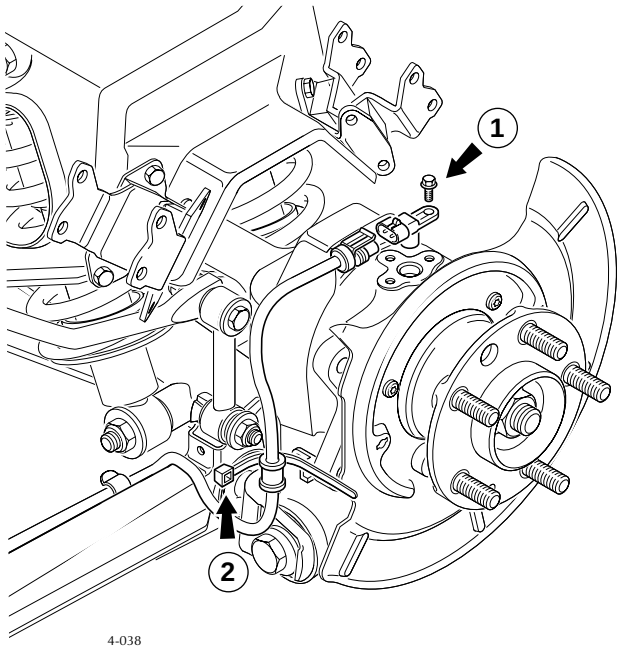
4. Raise the vehicle on a four point hoist and remove both rear road wheels.

5. Remove the exhaust system from the intermediate silencers rearwards (2.7.01.1).

6. Disconnect the ABS sensors. Disc assembly removed from the illustration for clarity

   1 Disconnect the sensor lead at the sensor

   2 Release the lead from its clips on the radius arm. Secure the lead away from the radius arm.

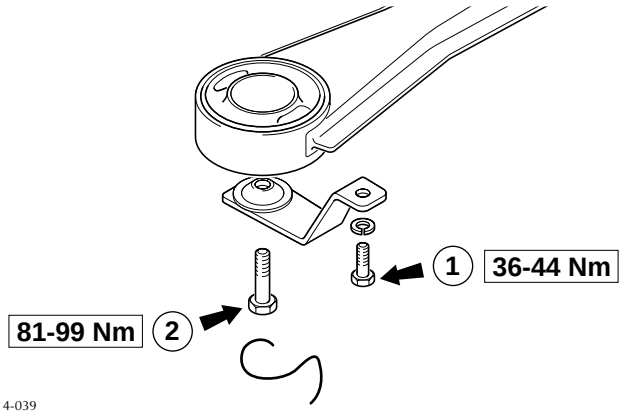


7. Release the radius arms.

   1 Remove the bolt and spring washer securing each radius arm safety strap to the body.

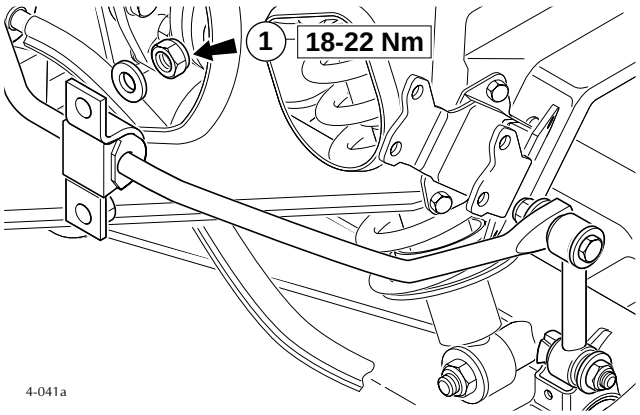
   2 Remove the locking wire and bolt securing each radius arm to the body.

   Note: When refitting the locking wire refer to the Installation section and observe the warning relating to this part.



8. Disconnect the anti-roll bar supports from the body.

9. Disconnect both brake pipe hoses at the body mounting bracket. Plug the ends to prevent the ingress of dirt.



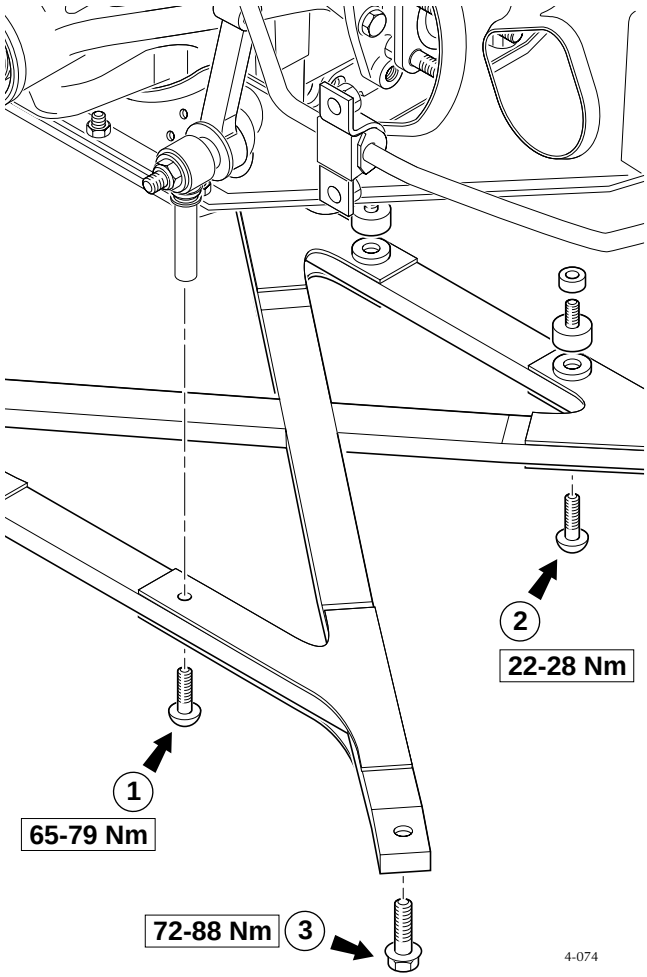
10. Remove the rear cross-brace / anti-tramp device.

   1 Remove two M12 bolts from the front of the cross-brace

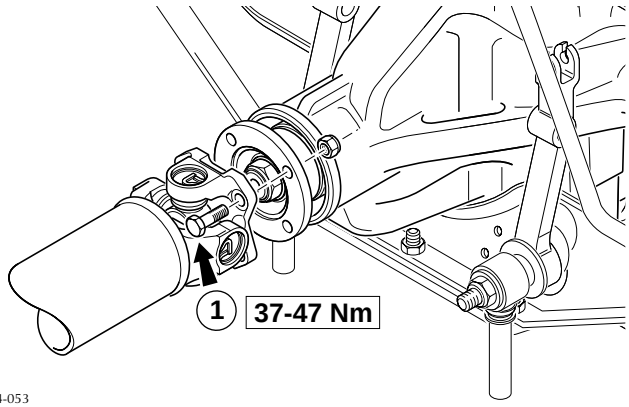
   2 Remove three M12 bolts and nuts from the rear of the cross-brace.

   3 ***Warning: You will require assistance to support the weight of the cross-brace while you remove the bolts.***

   Remove four bolts and remove the cross-brace, Retrieve three rubber mounts and spacers.

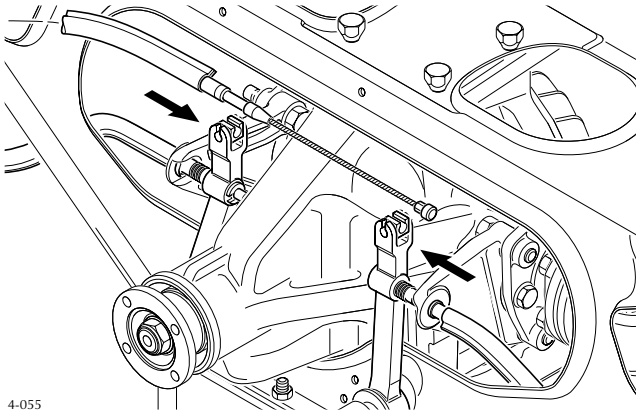


11. Disconnect the propeller shaft from the hypoid.



12. Detach the handbrake cable at the ratio arms.

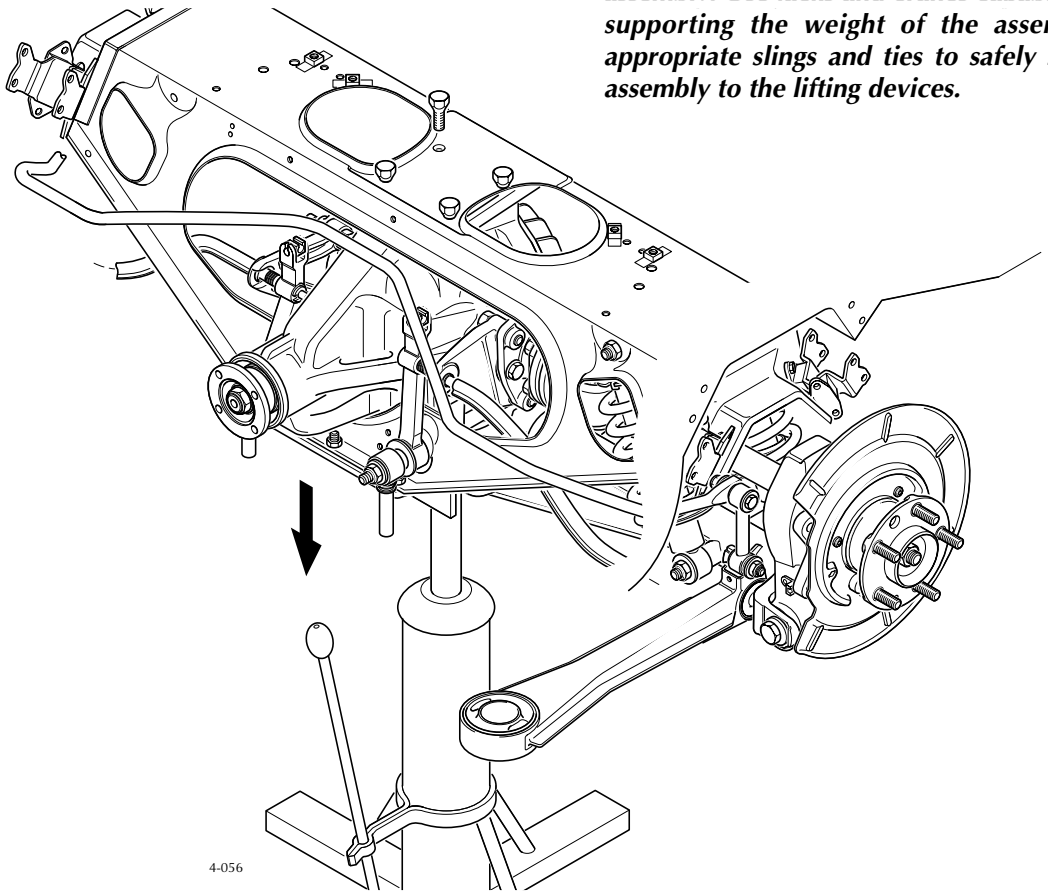
    Lever both ratio arms together towards the centre line of the vehicle, to enable the end of the handbrake operating cable to be detached from the arm.



4-055

13. Fit a lifting plate to a suitable jack and position the jack centrally underneath the tie-plate. Raise the jack sufficiently to take the weight of the rear suspension assembly. Secure the suspension assembly to the jack.

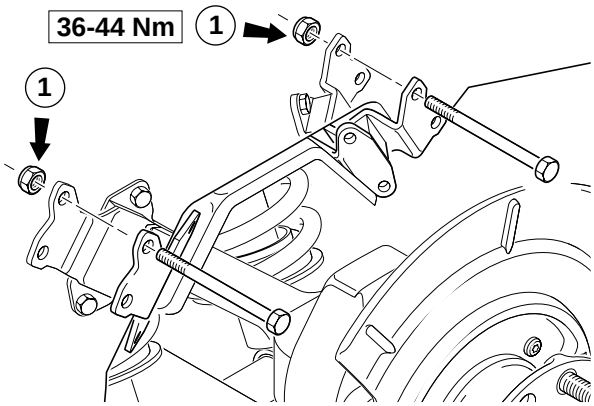
WARNING: The rear suspension unit weighs 167 Kg (368 lbs). Do not attempt to manually lift the assembly. Use jacks and cranes capable of safely supporting the weight of the assembly. Use appropriate slings and ties to safely secure the assembly to the lifting devices.



4-056

14. Release the rear suspension.

    1 Remove the eight self-locking nuts and the eight bolts securing the mounting brackets to the crossbeam.



15. Carefully lower the jack and suspension unit.

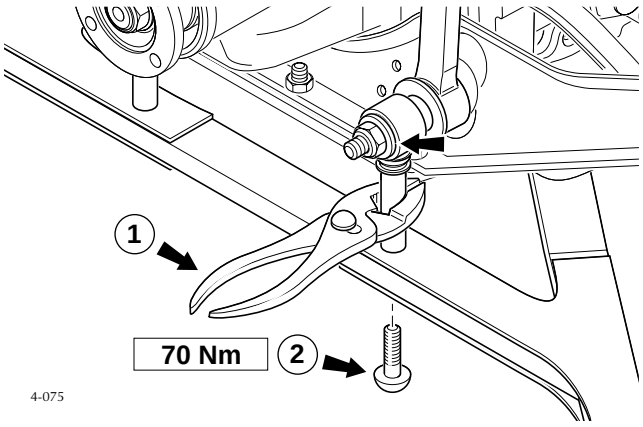
16. Using a suitable crane and slings, remove the suspension unit from the jack and lower it to the ground.

Installation

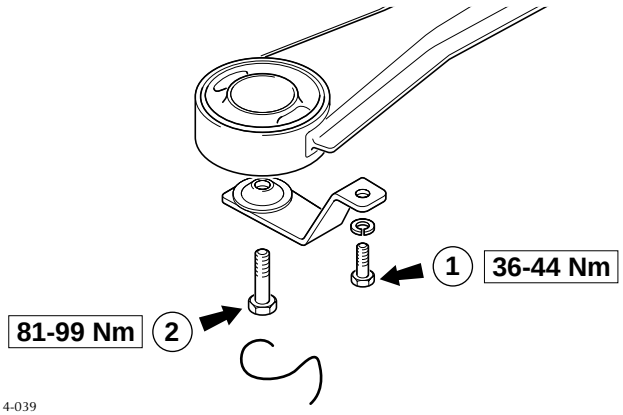
1. To install, reverse the removal procedure, observing the following points:

2. ***Caution: When re-installing the cross-brace - drop link bolts, use a suitable gripping tool to prevent the link from twisting and pre-stressing the drop link bush.***

   Check for a parallel gap between the washer behind the fulcrum pin nut (arrowed).



3. ***WARNING: When refitting the locking wire to the radius arm mounting bolt make sure the wire does not pass over the top of the bolt head. A locking wire exposed in this way could be damaged if the vehicle is jacked up at this point. Check the lockwire on both radius arms when working on the rear suspension.***

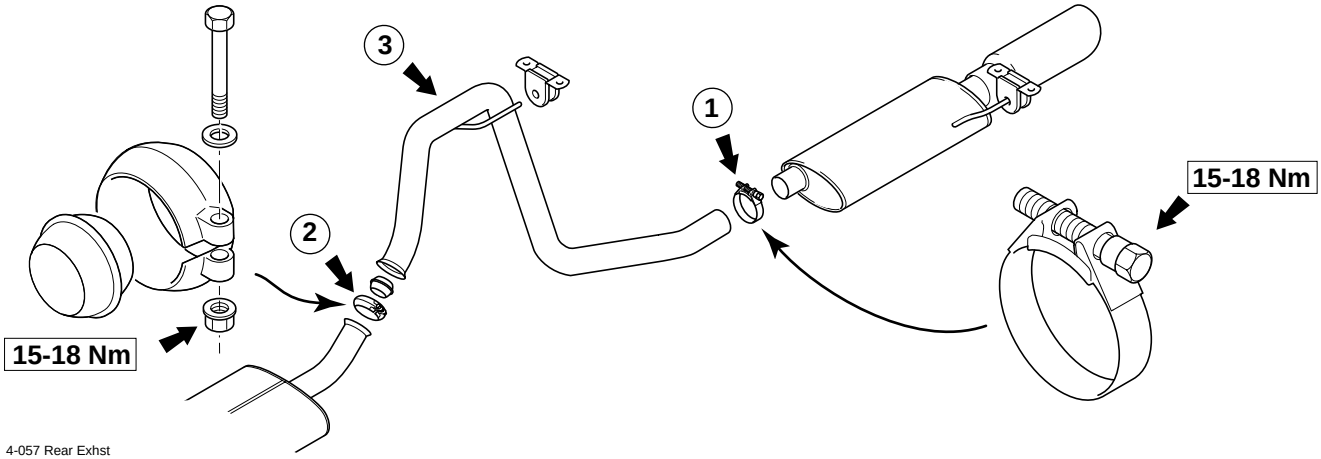


4. ***Caution: To avoid pre-loading the radius arm bushes, and the damper mounting bushes, do not fully tighten the mounting bolts until the vehicle rests fully on the suspension and is at half laden weight.***

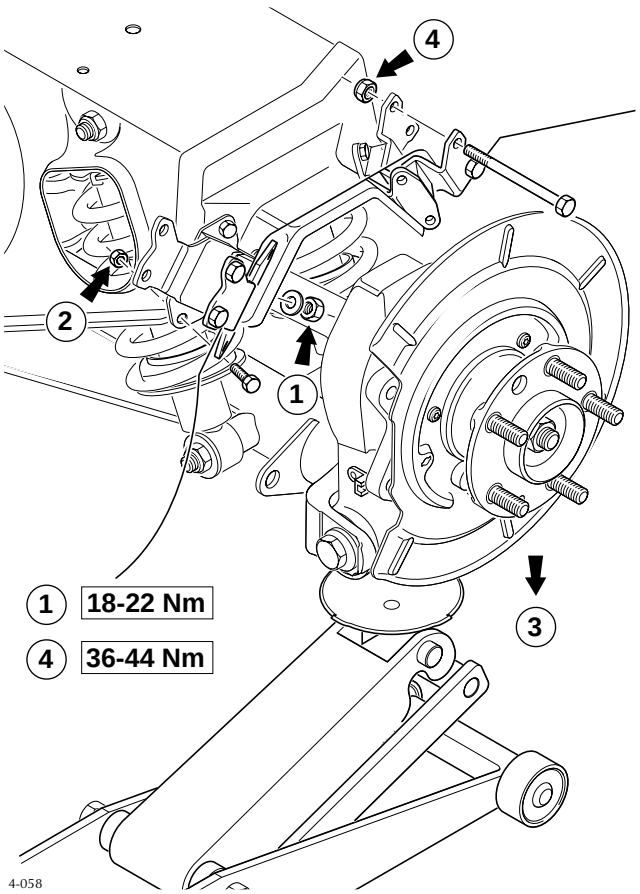
4.2.08 Rear Suspension Mountings Renew

Removal

1. Raise the vehicle on a four point hoist and remove the rear road wheels.



4-057 Rear Exhst



4-058

2. Support the weight of the rear suspension using a trolley jack under the tie plate.
3. Remove the rear exhaust system
   1 Release the clamps at the front of the rear silencers and separate the joints.
   2 Release the clamps at the rear of the intermediate silencers.
   3 Displace the overaxle pipes from their upper supports.
4. Remove the rear suspension mounts on one side of the vehicle.
   1 Remove the nut securing each mount to the axle beam.
   2 Remove two nuts securing each mount to the vehicle chassis.
   3 Slightly lower the axle beam assembly.
   4 Remove the bolts from each mounting and remove the mountings.

Installation

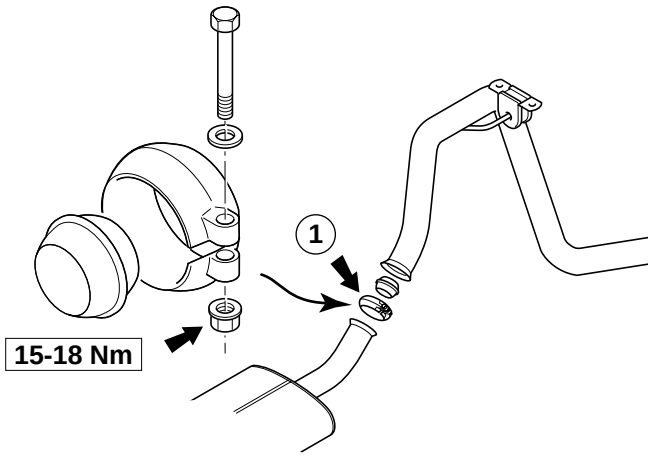
1. Fit the new mounts to the axle beam. Raise the axle to the body and secure each mounting with two bolts. Torque all fixings to specification.
2. Repeat steps 4-5 to replace the opposite side mounts.
3. Reconnect and tighten the exhaust pipes.
4. Fit the road wheels and nip up the wheel nuts.
5. Remove the trolley jack. Lower the vehicle to the ground.
6. Torque tighten the wheel nuts to 88-102 Nm.

4.2.09 Anti Roll Bar Renew (Coupe only)

Removal

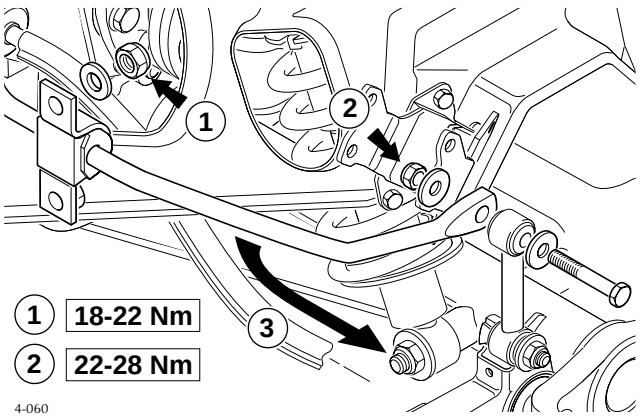
1. Raise the vehicle on a four point hoist. Remove the rear road wheels.

2. Separate the right hand exhaust pipe joint, forward of the rear suspension frame.



3. Detach the antı-roll bar

   1 Remove the four nuts securing the anti-roll bar supports to the body.
   2 Remove the bolts securing the anti-roll bar to the top of the links.
   3 Remove the anti-roll bar supports and bushes.



4. Remove the bar through the left hand wheel arch.

Installation

To install, reverse the removal procedure.

Caution: To avoid pre-loading the anti-roll bar bushes, do not fully tighten the mounting bolts until the vehicle rests fully on the suspension and is at half laden weight.

Rear Wheel Toe Adjustment

See: **Rear Wheel Toe Check and Adjust** - Steering (4.3.02).

Drive Shaft Description

Drive Shaft

The drive shafts transmit drive from the final drive unit to the hubs and also serve as upper wishbones to locate the rear wheels

The inner universal joints are attached to the final drive unit by bolts. Because the outer joints are integral with the hub driving shafts, the hubs must be separated from the drive shafts before they can be removed.

Universal Joints

When fitting a drive shaft ensure that the universal joints operate freely; any stiffness, even in a single joint, will initiate shaft vibration.

Universal joints must always be fitted as a set.

4.2.14 Drive Shaft Renew and Overhaul

Data

Torque Figures

Drive shaft to final drive unit 66.5-74.5 Nm
Drive shaft to hub carrier 135-163 Nm
Lower damper mounting 41-48 Nm
Outer pivot pin 131-144 Nm

Oils Sealants and Lubricants

Drive shaft splines — Loctite DRIVE SHAFT

Procedure

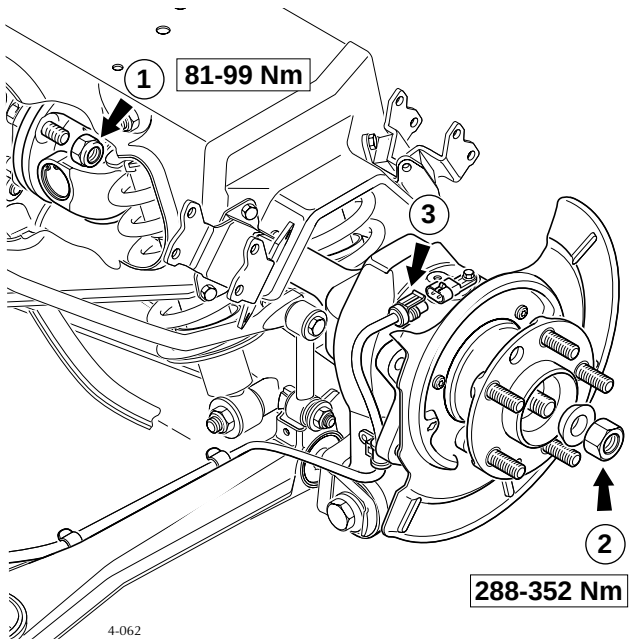
Note: This procedure is the same for left or right hand drive shaft.

Removal

1. Jack up the rear of vehicle and support with axle stands.
2. Remove the road wheel.
3. Remove the rear caliper. Retain any shims fitted between the caliper and its mounting to ensure that the caliper is centralized over the disc (5.2.0.4).
4. Remove the rear brake disc (5.2.0.2)
5. Disconnect the drive shaft.

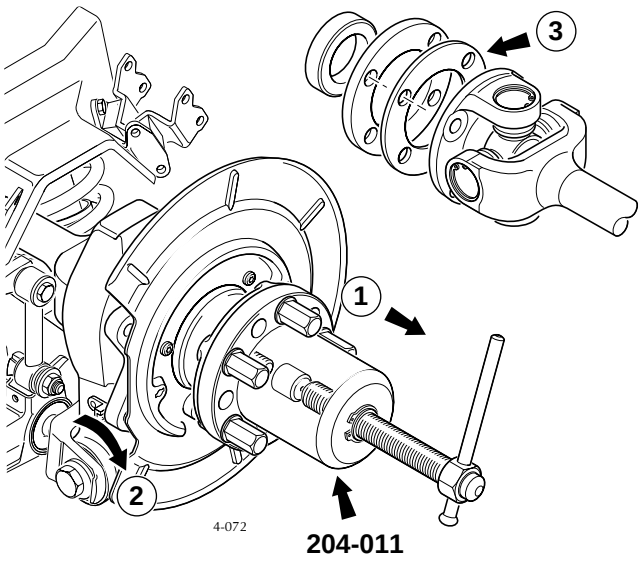
   1 Remove the four drive flange securing nuts at the hypoid output flange.
   2. Remove the hub nut.

   3 Release the ABS sensor cable from the clips on the radius arm and disconnect the sensor.



6. Remove the drive shaft.

   1 Fit the hub puller (JD-1D) and push the drive shaft from the hub/hub carrier assembly.
   2 Allow the hub carrier to pivot outwards on the fulcrum shaft.
   3 Remove the drive shaft and collect the camber shims and the spacer collet at the hypoid flange.

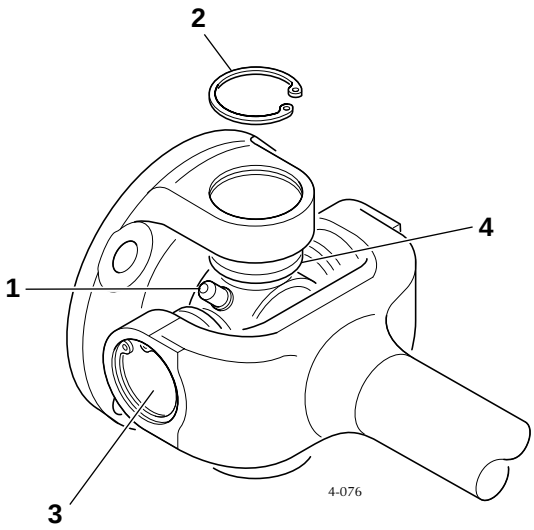


7. Remove the hub puller.

Overhaul

1. Remove grease nipples from universal joint yokes.
2. Remove four circlips from one of the universal joints.

   Note: Tap the bearings slightly inwards to assist removal of the circlips.



3. Displace the bearings.
4. Remove the grease seals from the yoke.
5. Repeat the removal procedure for the universal joint at the opposite end of the drive shaft.
6. Clean all components.
7. Check the splined yoke for wear of the splines. Replace the drive shaft if the spline wear is significant. If the components are serviceable, continue with the overhaul procedure.
8. Fit new bearings to each joint and secure with new circlips.
9. Fit the grease nipples to both spiders.
10. Grease the joints with a hand grease gun.

Installation

1. Clean and refit the flange spacer and the camber shims and fit new nuts without tightening.
2. Apply Loctite to the hub splines.
3. Raise the hub carrier and replace the splined shaft into the hub.

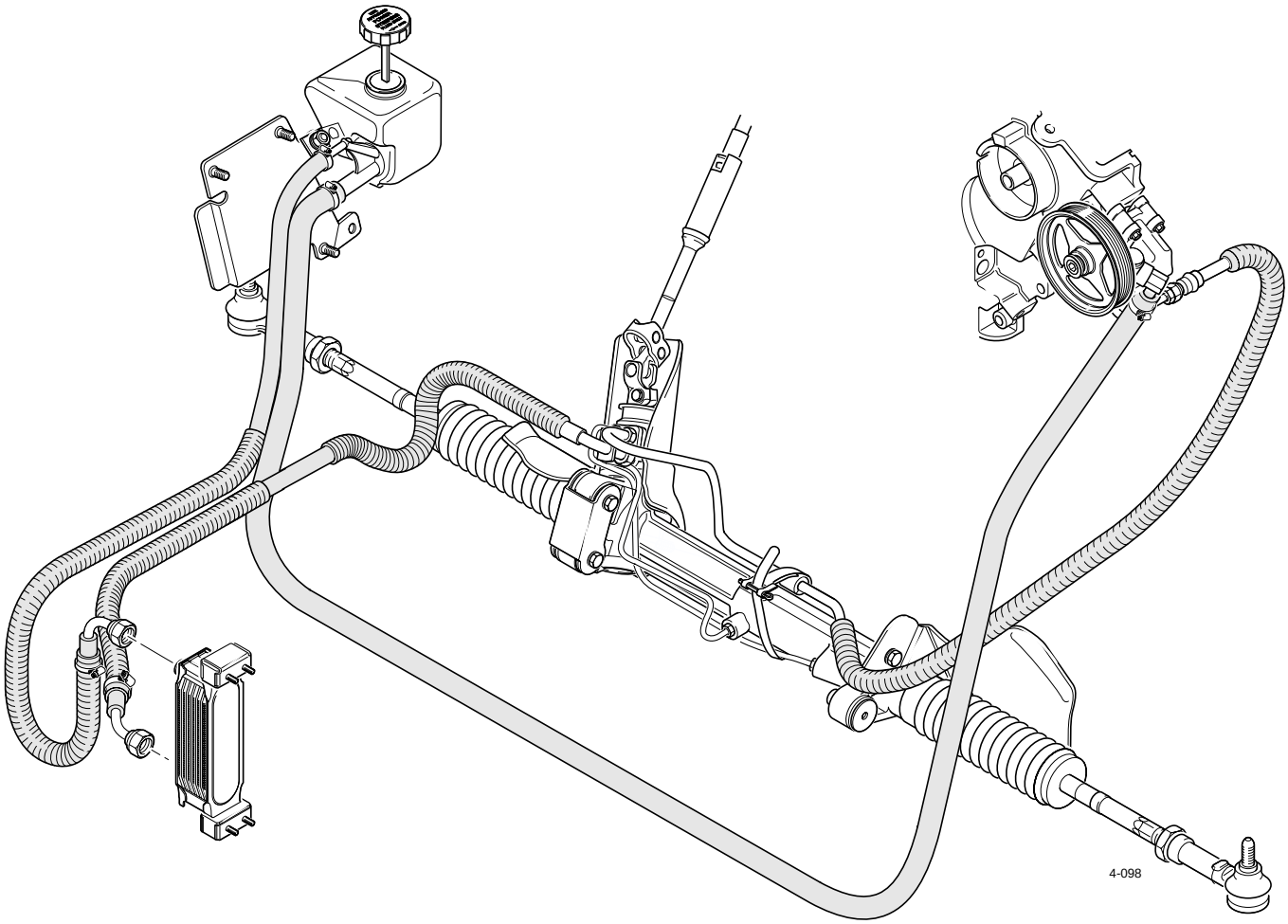
4. Tap hub home onto the splines. Refit the hub nut.
5. Fully tighten the drive flange nuts.
6. Refit the road wheel.
7. Remove the axle stands and lower the vehicle.
8. Fully tighten the hub nut.

Steering

Description

The power assisted steering rack is mounted to the front suspension frame with three rubber damping bushes.

A single piston, operating in an enclosed cylinder, is fitted to the steering rack. A control valve at the base of the steering column provides power assistance to the rack by directing hydraulic pressure to the appropriate side of the rack piston. Oil flow through the control valve is continuous. Low pressure is applied to each side of the piston as long as the steering load is low.



As the steering wheel is turned under low loads, the steering column pinion will move the rack with little or no power assistance.

Under heavy loads, a torsion bar, in the control valve assembly, will twist a few degrees before turning the rack pinion. This twisting in the torsion bar is used to open and close the ports in the control valve.

As the torsion bar twists and the control valve opens, the hydraulic pressure directed to one side of the piston is increased from 2.8 kgf/cm2 (40 lbf/in2) to a maximum of 84 kgf/cm2 (1200 lbf/in2). the high pressure on the rack piston assists the driver in rotating the steering.

As the steering manoeuvre is being completed, the steering load will reduce. The twist in the torsion bar will reduce and the pressure difference across the piston will return to zero. The degree of power assistance is thus directly proportional to the twist in the torsion bar.

The hydraulic pressure is provided by a vane-type pump that is driven directly from the engine auxiliary drive belt. To prevent the hydraulic pressure from exceeding 84 kgf/cm2 (1200 lbf/in2) a pressure relief valve is fitted to the outlet port of the pump.

Data

Front Castor angle	6° ± 30' positive (wheels to be within 10' of each other)
Front Camber angle	-20' ± 10' negative (wheels to be within 10' of each other)
Front Toe In	Parallel (wheels to be within 5' of each other)
Rear Camber angle	-1° ± 10'
Rear Toe In	15° ± 5' (wheels to be within 5' of each other)
Power steering fluid	SAE Automatic Transmission Fluid Type G

Fault Diagnosis Chart

Symptom	Possible Cause	Corrective Action
Oil leaks from steering rack	Damaged or worn seals	Replace seals
	Loose unions	Tighten unions
	Damaged union sealing washers	Replace sealing washers
Oil leak at pump shaft	Damaged shaft seal	Replace shaft seal
Oil leak at high pressure outlet union	Loose or damaged union	Tighten union
	Damaged pipe end	Replace pipe
Oil leak at low pressure inlet connection	Loose or damaged hose connection	Remove and refit or renew hose and clip
Oil from reservoir cap	Reservoir over-full	Reduce level in reservoir
	Sticking flow control valve (closed)	Remove valve, renew and refit
Noise from hydraulic system	Air in system	Bleed system
	Pipes touching	Check pipe security
Noise from pump	Worn drive coupling	Renew coupling
	Internal wear and damage	Overhaul pump
Noise from rack (rattling)	Worn rack and pinion gears	Adjust rack damper
	Worn inner ball joints	Replace inner ball joints
	Universal joint loose	Tighten clamping bolts
Steering veering to left or right	Unbalanced tyre pressures	Inflate to correct pressure
	Incorrect tyres fitted	Fit tyres of correct specification
	Incorrect geometry	Reset geometry to correct specification
	Steering unit out of trim	Replace valve and pinion assembly
Heavy steering when driving	Low tyre pressures	Inflate to correct specification
	Tightness in steering column	Grease or replace
	Tightness in steering joints	Grease or renew joints
	Low fluid	Top up fluid reservoir
Heavy steering when parking	Low tyre pressures	Inflate to correct specification
	Tightness in steering column	Grease or replace
	Tightness in steering joints	Grease or renew joints
	Restricted hose	Replace hose
	Internal leaks in steering unit	Replace seals
Steering effort too light	Valve torsion bar dowel pins worn	Replace valve assembly
	Valve torsion bar broken	Replace valve assembly
	Incorrect castor angle	Check steering geometry
Momentary increase in effort when steering wheel is turned quickly in either direction.	Low fluid level	Top up fluid reservoir
	High internal leakage	Overhaul steering pump
'Jerky' steering, especially when parking.	Low fluid level	Top up fluid reservoir
	Insufficient pump pressure	Check flow valve, overhaul pump

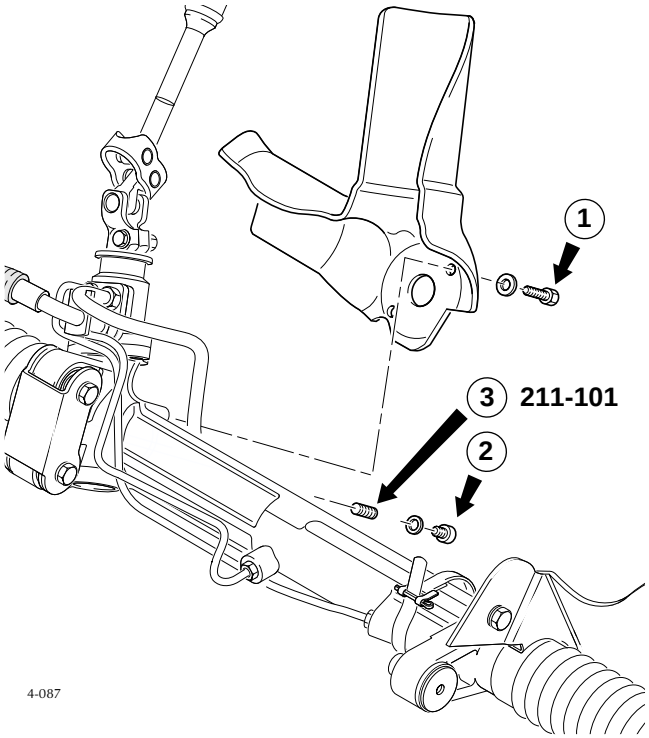
4.3.01 Front Wheel Toe Adjustment

Data

Toe adjustment: Parallel

Alignment Check

1. Check that the tyre pressures are correct.
2. Position the steering wheel in the straight ahead position and proceed as follows:
   1 Remove the rack heat shield
   2 Remove the access plug from beside the rack pinion housing
   3 Screw in the centering grub screw
   4 Adjust the steering as necessary until the centering screw fully bottoms into the recess in the rack shaft



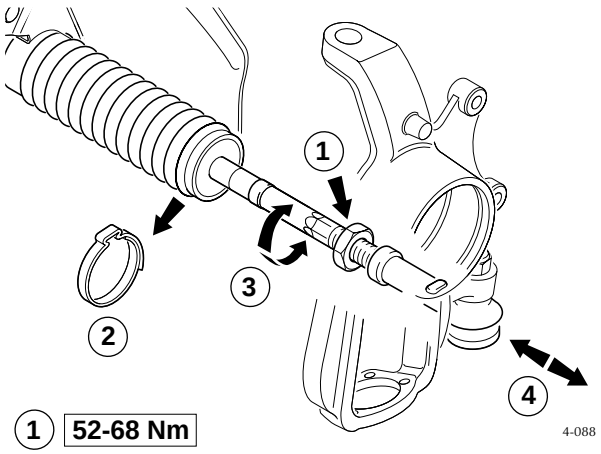
3. Check the alignment by using light beam equipment or an approved track setting gauge.
4. If an alignment discrepancy exceeds specified limits (see Steering - Data), damage to a suspension component may have occurred and a dimensional check must be carried out, on the vertical links and wishbones (see Front Suspension - Data).

   If the wheel alignment is in specification, remove the test equipment.

   If any error in wheel alignment is significant but not indicative of damaged components, proceed with the wheel alignment adjustment.

Adjust the Front Wheel Alignment

1. Release the track rod locknut.
2. Remove the gaiter circlips.
3. Turn the tie rods by an equal amount at both ends of the steering rack until the alignment of the wheels is correct. With the rack centred, the wheels must be within 0°5" of each other.



4. Tighten the locknuts while holding the track rod end spanner flats. Re-check the alignment.
5. Ensure that the gaiters are not twisted and re-tighten the clips.
6. Remove the centralising pin and refit the access plug. Check and top up the power steering fluid
7. Check the castor and camber angles (4.3.02).

4.3.02 Front Wheel Castor/Camber Angles

Data

Castor angle 6° ± 30' +ve, balance 10'.
Camber angle -20' ± 10' -ve
(both front wheels to be within 10' of each other).
Rear wheel toe 15' ± 5'

Torque Figures

Outer ball joint locknut 61-69 Nm
Track adjustment locknut 52-61 Nm
Upper ball joint to wishbone 35-43 Nm
Upper fulcrum shaft to crossmember 66-74 Nm

Procedure

All ride heights and geometry checks must be carried out at half laden condition.

Note: Before checking, examine all rubber and steel bushes for deterioration or distortion. Check upper and lower wishbone ball joints for excessive play. Check shock absorbers for leaks and mountings for security.

To prepare the vehicle for checking and adjustment, set it up in an unladen condition and at the correct ride height as follows:

1. Ensure that the vehicle is standing on level ground and check that the tyre pressures are correct.

2. Check that the ride heights are equal on both sides of the vehicle. If ride heights are not to specification, service the suspension as necessary.

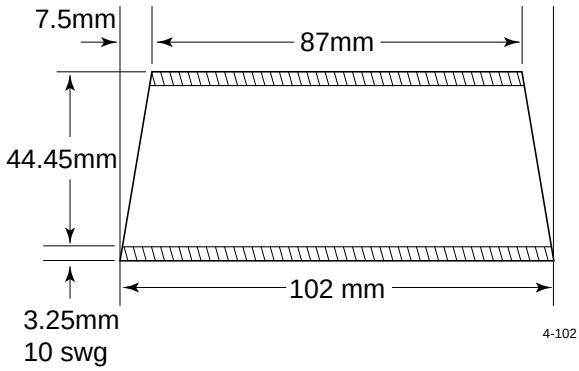
3. Check that all fluids are topped up to the maximum level.

   If the fuel tank is partially full, switch on the ignition and estimate the fuel quantity required to fill the tank. The weight deficiency may be corrected by adding the appropriate quantity of weights at 7.5lbs/gallon (0.75kg/l) on the floor behind the drivers and passengers seats divided equally on either side of the car.

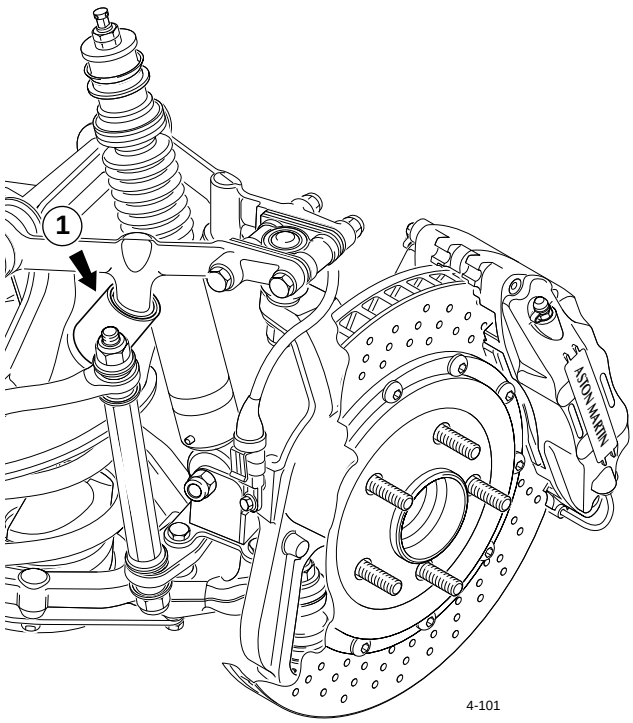
4. Add weights to achieve half laden condition, i.e. 68 Kgs (150 lbs) in each front seat and 7 Kgs (15 lbs) in the boot.

5. Remove all none standard items from the boot and from inside the car.

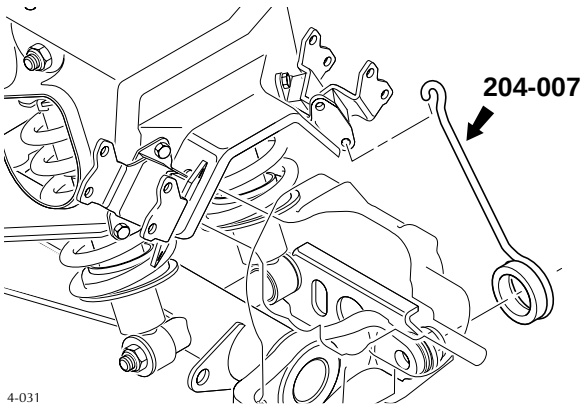
6. Make up two front suspension setting tubes to the dimensions shown below.



7. Compress the front suspension and insert the setting tubes under the upper wishbones, adjacent to the rebound stop rubbers, and over the brackets welded to the bottom of the 'turrets'. This locks the front suspension in the mid-laden condition.



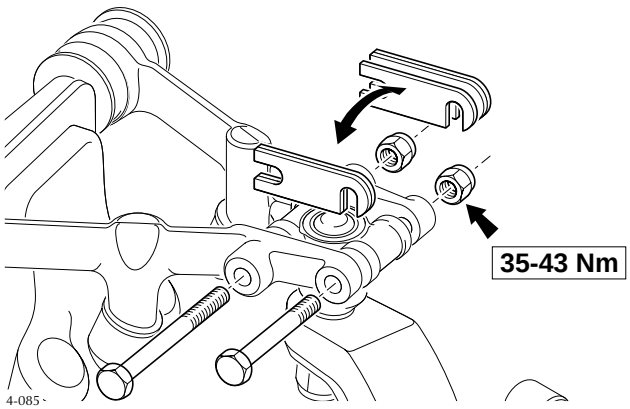
8. Fit the setting links as shown below



Check/Adjust the Front Castor Angle

1. Check the castor angle, using the castor angle checking gauge. Refer to Data for correct setting.
2. To adjust, slacken two bolts that secure the upper wishbone members to the upper ball joints.
3. Move shims between front and rear to alter the castor angle. Transposing one shim 1.6 mm thick alters the castor angle by approximately 1/4°.

Caution: Never introduce additional shims.



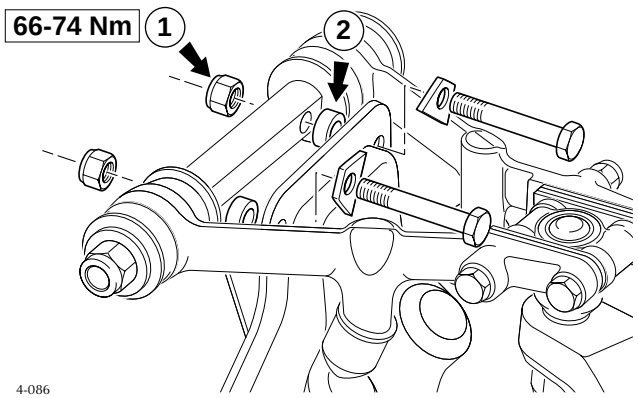
4. After adjusting the castor angle tighten the bolts.
5. Check front wheel alignment and adjust if required.

Check/Adjust the Front Camber Angle

1. Check the wheel runout and replace any wheel which shows excessive distortion.
2. Check camber angle. If necessary, adjust as follows.

WARNING Compress spring using special tool before loosening crossmember to inner wishbone pivot bolts. Never remove both bolts together.

1 Compress the spring using special tool ***204-008***
2 Slacken off the nuts and bolts that secure the upper wishbone inner pivots to the crossmember.
3 Remove one bolt. Add / remove shims to adjust the camber. Refit the bolt but do not tighten nut.
4 Repeat for the other bolt.



Caution: Make sure that an equal thickness of shims is fitted on front and rear bolts. If not the caster angle will be affected.

Shims are available in 0.8 mm (1/32 in), 1.6 mm (1/16 in) and 3.2 mm (1/8 in) thickness. A change of 1.6 mm (1/16 in) in shim thickness alters the camber angle by approximately 1/4°.

3. Tighten all the bolts and nuts to the correct torque, and re-check the camber angle.
4. Check front wheel alignment and adjust if required.

Rear Wheel Toe Check and Adjust

Check

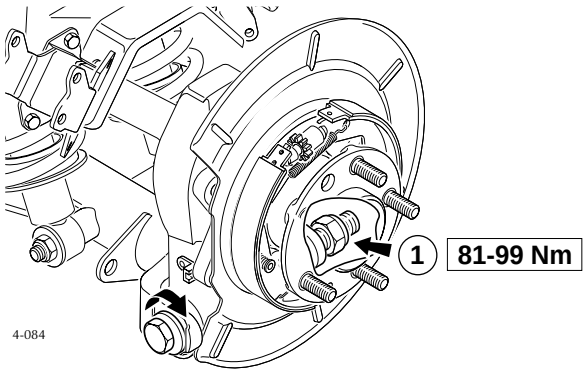
1. ***Caution: It is important that skid plates are used to avoid straining the wishbone.***

Set the rear wheels onto skid plates.

2. Check the rear wheel toe setting. If the setting is not to specification, continue with the adjustment procedure.

Adjust

3. Slacken off the M14 locknuts at the rear end of each rear wishbone fulcrum shaft.
4. Rotate the fulcrum eccentric bolt to adjust the toe setting to specification. Ensure equal toe settings at either side of the vehicle.
5. Lock the fulcrum setting using the M14 nuts.



6. Roll the vehicle at least one wheel rotation and then back again.
7. Check and confirm the rear wheel toe adjustment.

4.3.03 Track Rod Ball Joint Renewal

Data

Front wheel alignment: Parallel ± 5'.

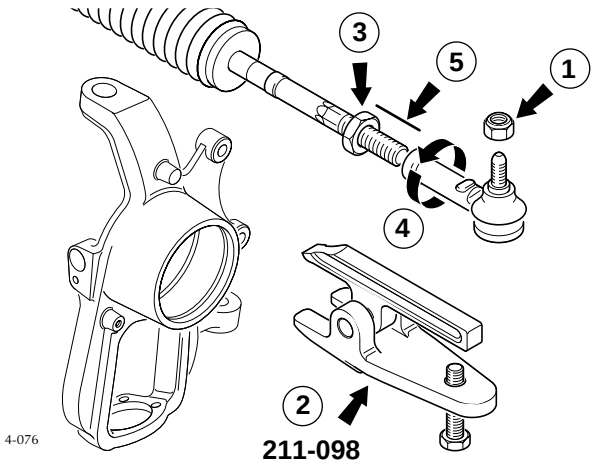
Torque Figures

Outer ball joint locknut 61-69 Nm
Track adjustment locknut 52-68 Nm
Wheel nut to wheel stud 88-102 Nm

Procedure

Note: To assist in the initial setting of the front wheel alignment, count and note the exposed threads on each tie bar inboard of the ball joint lock nut.

1. Raise the vehicle on a four point hoist.
2. Mark the position of the wheel on the hub. Remove the road wheel.
3. Remove the self locking nut that secures the outer ball joint to the steering arm. Detach the ball joint from the steering arm using the special tool.
4. Release the outer ball joint locknut. Do not run the locknut along the thread.

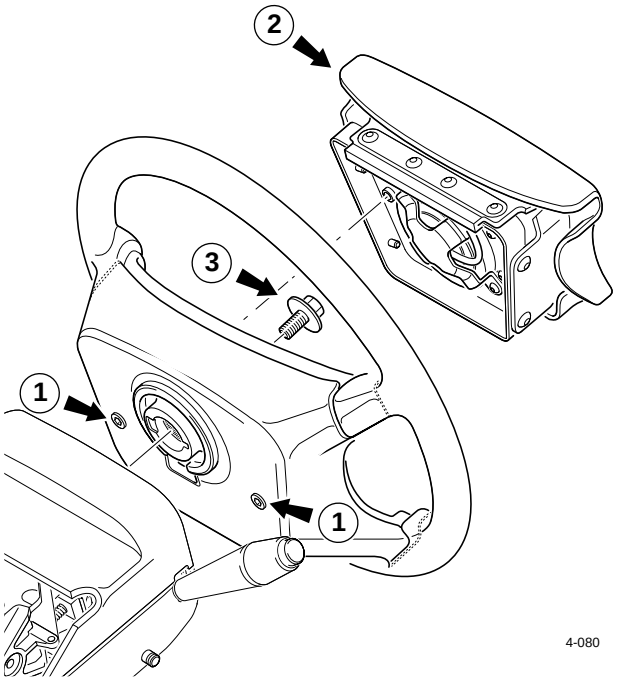


5. Remove the defective ball joint from the tie rod. Screw on the replacement ball joint up to the locknut. This gives an approximate toe-in setting prior to checking the front wheel alignment.
6. Fit the new ball joint to the steering arm and secure using a new self locking nut.
7. Refit the road wheel. Fit and tighten the wheel nuts.
8. Lock the steering rack at the mid point using the centering pin.
9. Check and adjust the front wheel alignment ensuring equal toe readings at either side of the vehicle.

4.3.05.1 Steering Wheel

Removal

1. ***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.***
2. Remove the airbag (4.5.01.3). See Electrics - Section 6.
3. Place the steering in the 'straight ahead' position.
4. Undo and remove the steering wheel securing nut.



5. Place marks on the steering wheel and column to indicate the correct spline alignment. Pull the steering wheel from the steering column splines.

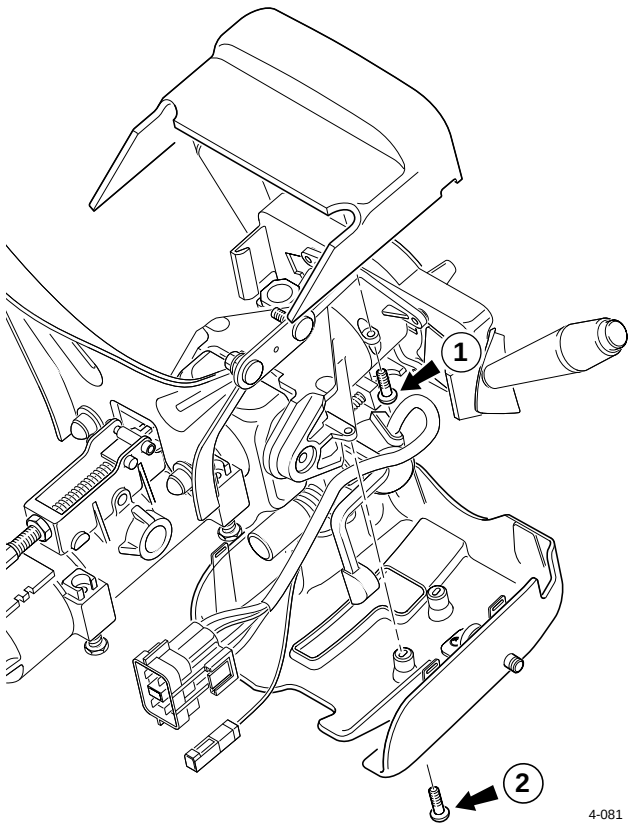
Installation

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.

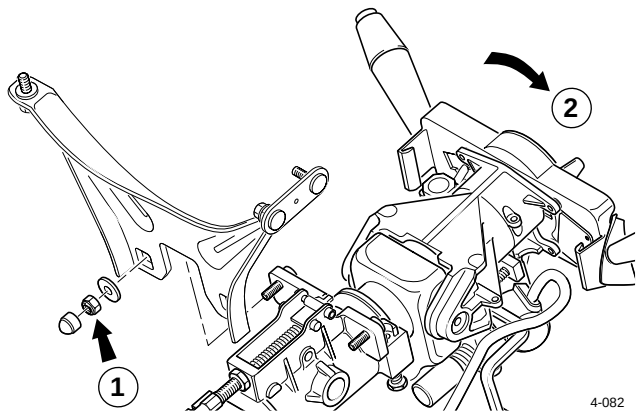
4.3.06.1 Upper Steering Column Renew

Removal

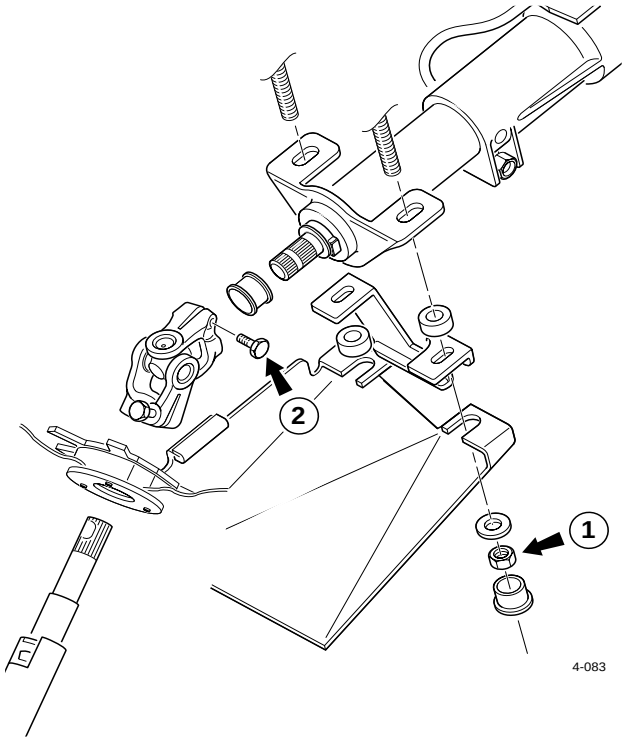
1. Remove the steering wheel (4.3.05.1).
2. Remove the underscuttle (7.8.01.1)
3. Remove five M4 screws and remove the upper and lower steering column cowls.



4. Remove two protection caps, M8 nuts and washers. Pull the steering column back to release it from the upper mounting bracket.



5. Remove the nut covers and remove two nuts and washers.
6. Remove the UJ cover and retain the spacers and reinforcing bracket.
7. Loosen the pinch bolt and remove the steering column from the vehicle.

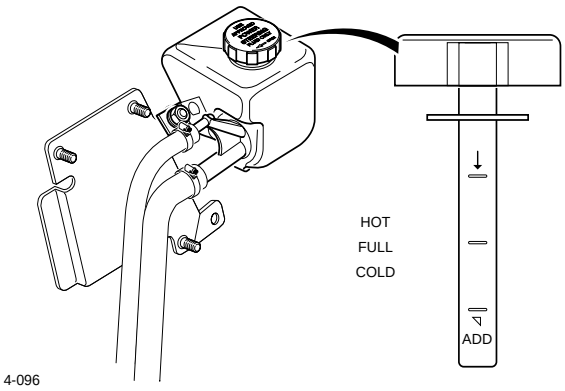


4.4.02 Power Assisted Steering System Bleed

The presence of air in the system causes the steering to be rough and erratic. Air is removed by the following method:

Procedure

1. Check the reservoir level.



2. Start the engine and allow it to run at idle speed. Turn the steering to one lock. Allow the fluid to circulate for a short time. Turn the steering to the opposite lock and allow the fluid to circulate.
3. Check and top up the fluid level if necessary.
4. Centre the steering. Allow the engine to idle for a few minutes.
5. Switch off the engine, allow the system to settle, re-check and top up the fluid level as necessary.
6. Use only fluid of the correct specification.
7. Refit the reservoir filler cap.

4.4.03 Power Steering Rack Renew

Data

Front wheel alignment: Parallel ± 5'.

Special Tools

JD 24 Ball joint separator
JD 36A Rack checking fixture

Torque Figures

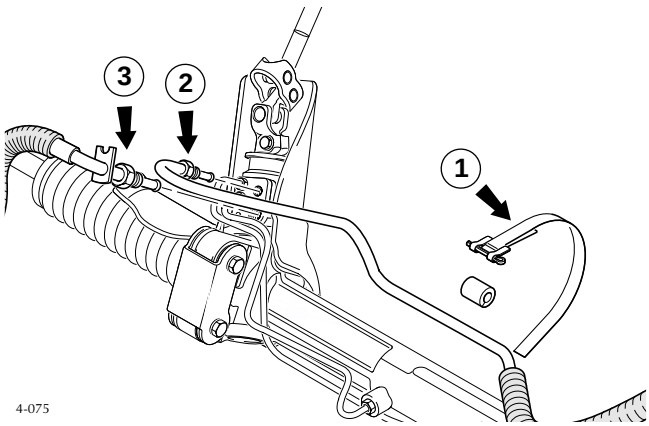
Outer ball joint locknut 61-69 Nm
1/2" UNF rack pipe connection 18-22 Nm
5/8" UNF rack pipe connection 23-27 Nm
Rack mounting bolts 18-24 Nm
Track adjustment locknut 52-68 Nm
Universal joint pinch bolts 24-30 Nm
Wheel nut to wheel stud 88-102 Nm

Oils, Greases and Lubricants

Power steering reservoir DEXRON 11D

Removal

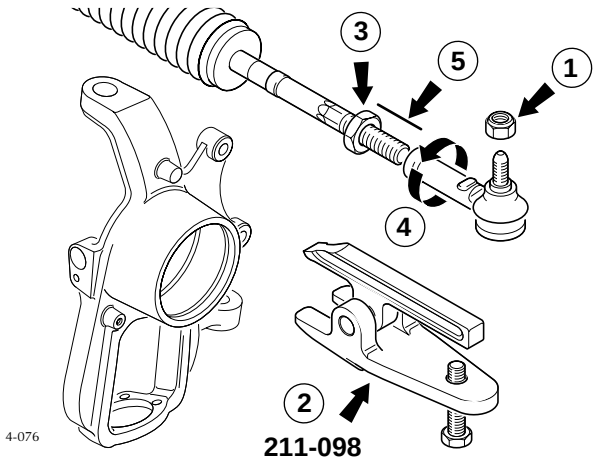
1. Slacken off the power steering fluid reservoir filler cap.
2. Raise the vehicle on a four point hoist (Fig. 1).
3. If the steering rack is to be re-fitted, engage the steering lock, remove the heat shield and fit the steering rack centering pin.
4. Remove the front road wheels.
5. Detach both the hoses from the steering rack pinion housing. Collect the escaping fluid in a suitable container.



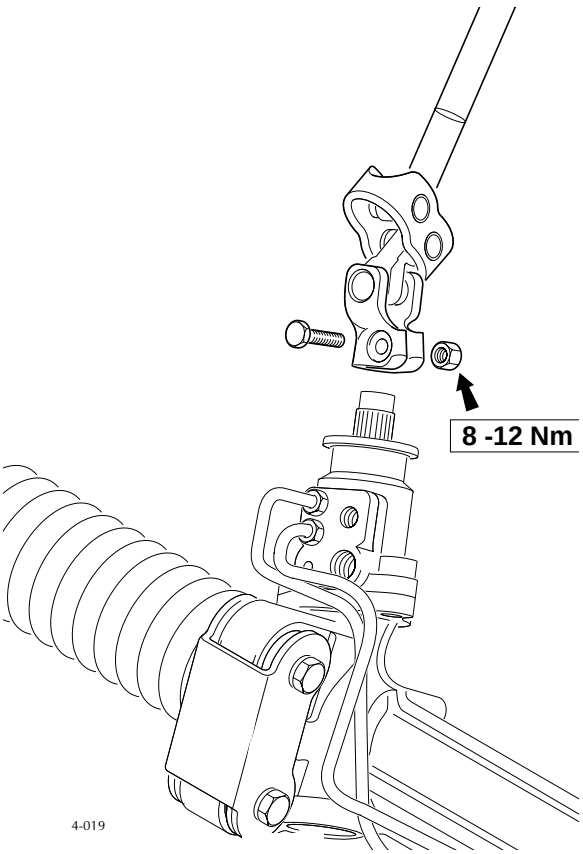
6. Fit blanking plugs to all ports and hoses.

7. Detach the ball joints from the steering arms

   1 Remove the self locking nut
   2 Using the special tool detach the ball joint
   3 Release the ball joint locknuts. Do not run the locknuts along the threads.
   4 Unscrew the ball joint from track rods
   5. Count and note the number of threads from the locknut to the end of the trackrod.

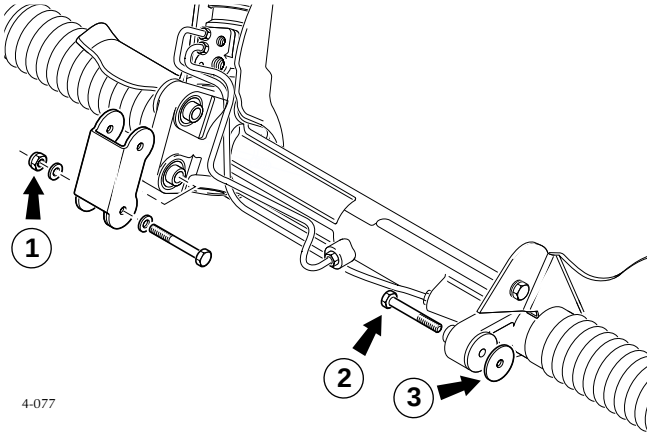


8. Remove the pinch bolt that secures the lower steering column universal joint, to the rack pinion shaft.



9. Remove the steering rack

   1 Remove two M8 bolts, nuts and washers
   2 Remove one M8 bolt
   3 Record the number and position of the packing washers



10. Release the steering rack from the crossmember and retrieve the packing washers.

11. Clean all components thoroughly, examine all components for wear and damage. Replace worn or damaged components.

Installation

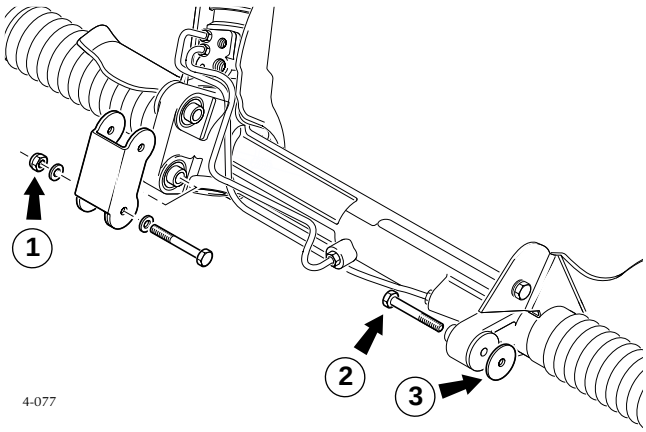
1. Ensure that the steering wheel is set exactly to the straight ahead position. Support the new rack and raise it into position. Check that the rack centering pin is fitted and fully engaged.

WARNING: The airbag circuits in the cable reel cassette behind the steering wheel will be irreparably damaged on turning the steering to full lock if the rack and steering wheel are not both centred before being connected together at the lower column universal joint.

2. Connect the column universal joint to the rack pinion shaft. Refit the pinch bolt and secure the universal coupling.

3. Ensure that the single rack mounting lug is shimmed so that it is central between the crossbeam brackets.

4. Insert the rack mounting bolts, fit and fully tighten the nuts.



5. Fit the trackrod locknuts to the rods with the correct number of threads exposed as noted in step 17. Fit the outer ball joint up to the locknut and nip up the nut. This gives an approximate 'toe in' setting prior to accurate checking of the front wheel alignment.

6. Refit the ball joints to the steering arms and secure using new self locking nuts.

7. Refit and secure the hydraulic hose feed pipes.

8. Refit the road wheels, fit and nip up the wheel nuts.

9 Lower the vehicle to the ground.

10. Tighten the wheel nuts to their torque settings.

WARNING: Do not attempt to drive the vehicle until steps 11, 12 and 13 are completed. The rack is still locked with the centering pin, there is no power steering fluid and the track rod lock nuts are only nipped up awaiting a steering geometry check.

11. Check and adjust the front wheel alignment and then fully tighten the trackrod locknuts.

12. Remove the rack centering pin and fit a new blanking plug and sealing washer.

13. Refill the power steering system with recommended fluid and carry out the bleed procedure (4.4.02). Refit the steering reservoir cap.

4.4.04 Steering Rack Bushes Renew

Data

Torque Figures

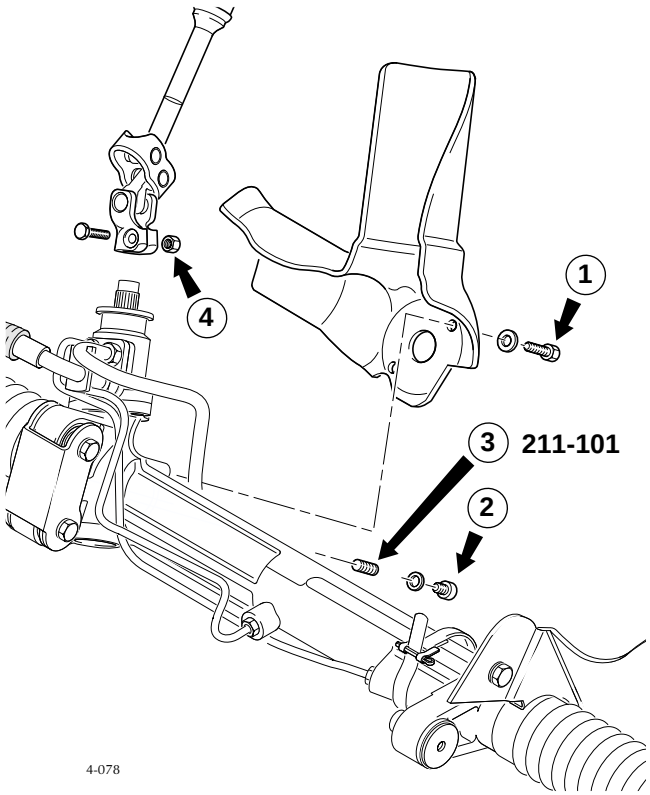
Rack hydraulic pipe
1/2" UNF pipe connection 18-22 Nm
5/8" UNF pipe connection 23-27 Nm
Universal joint pinch bolts 24-30 Nm

Procedure

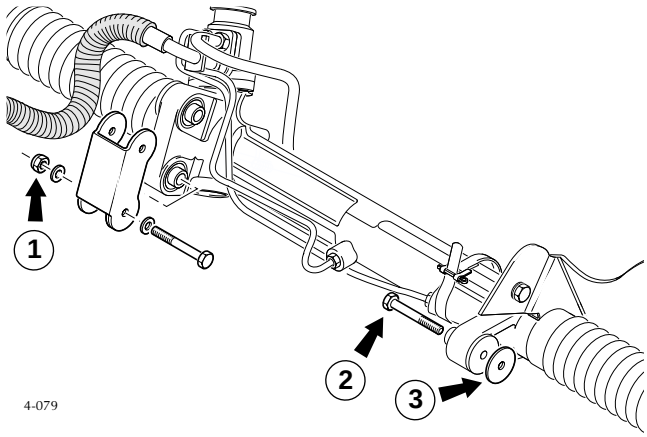
Caution: Do not rotate the steering wheel when disconnected from the steering rack. The airbag cable reel cassette may be irreparably damaged.

Note: Lower type mounting bushes can be identified by their steel faced thrust washers.

1. Raise the vehicle on a four point hoist. Set the steering wheel straight ahead.
2. Remove the ignition key and engage steering lock
3. Remove the steering rack heat shield.
4. Remove the centering pin access plug and washer.
5 Fit and accurately locate the steering rack centering pin. Scribe the column universal joint and the rack pinion shaft for accurate reassembly.
6. Remove the securing nut and bolt from the steering column lower universal joint.

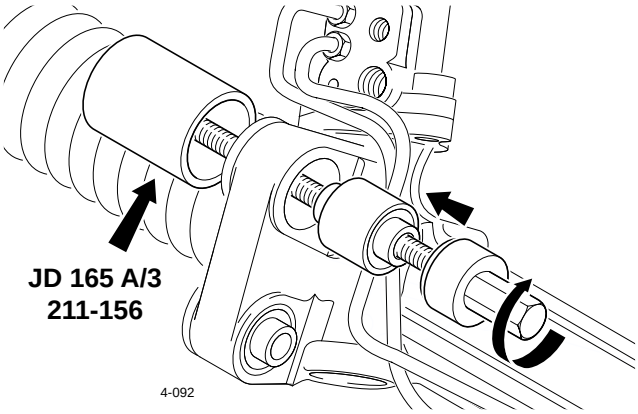


7. Remove the steering rack to crossbeam lower and upper securing nuts and bolts.
8. Lower the rack, releasing the universal joint from the rack pinion shaft.



Upper mounting bush removal

1. Assemble the tool to the upper mounting bush housing.
2. Tighten the bolt to draw the mounting bush into the tool body.



Lower mounting bushes removal

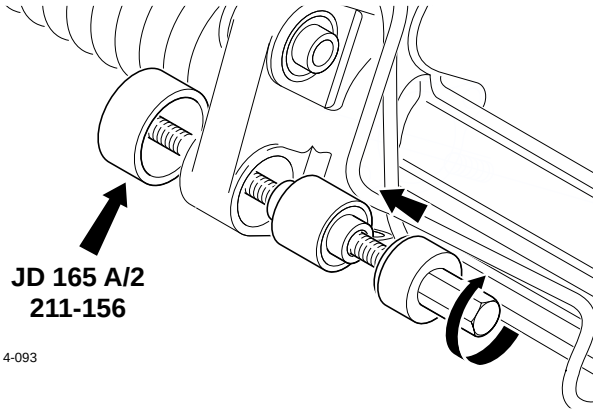
1. Carefully drift out the lower bushes using a suitable drift.

Mounting bushes installation

1. Clean the mounting bush housings and crossbeam mounting locations.

   Note: Lower mounting bushes are to be secured in position with Loctite 601. Clean the outside diameter of these bushes prior to application.

2. Assemble JD165 for bush insertion.



   Note: The 'Press' part of the tool may be too large for some bush types. Use a suitable washer to protect the bush.

3. ***Caution: When the bush is fully seated, leave the installation tool in place for 15 minutes without loosening the drawbolt. This will prevent the bush from moving while the loctite is curing.***

   Tighten the draw bolt to fully seat the bush into the housing. Repeat the procedure for the other bushes.

4. Accurately centre the steering rack using the rack centering pin.

5. Check that the steering wheel is accurately centred in the straight ahead position.

4. Raise the steering rack assembly and align the crossbeam mountings and column universal joint.

5. Fit the shims as necessary between the steering rack lower mounting bush and the crossbeam.

6. Fit and tighten the steering rack mounting bolts and nuts.

7. Tighten the column universal joint bolt

8. Remove the centralising pin and refit the access plug.

9. Lower the vehicle.

4.4.05 Steering Rack Feed Hose Renewal

Data

Oils, Greases and Lubricants

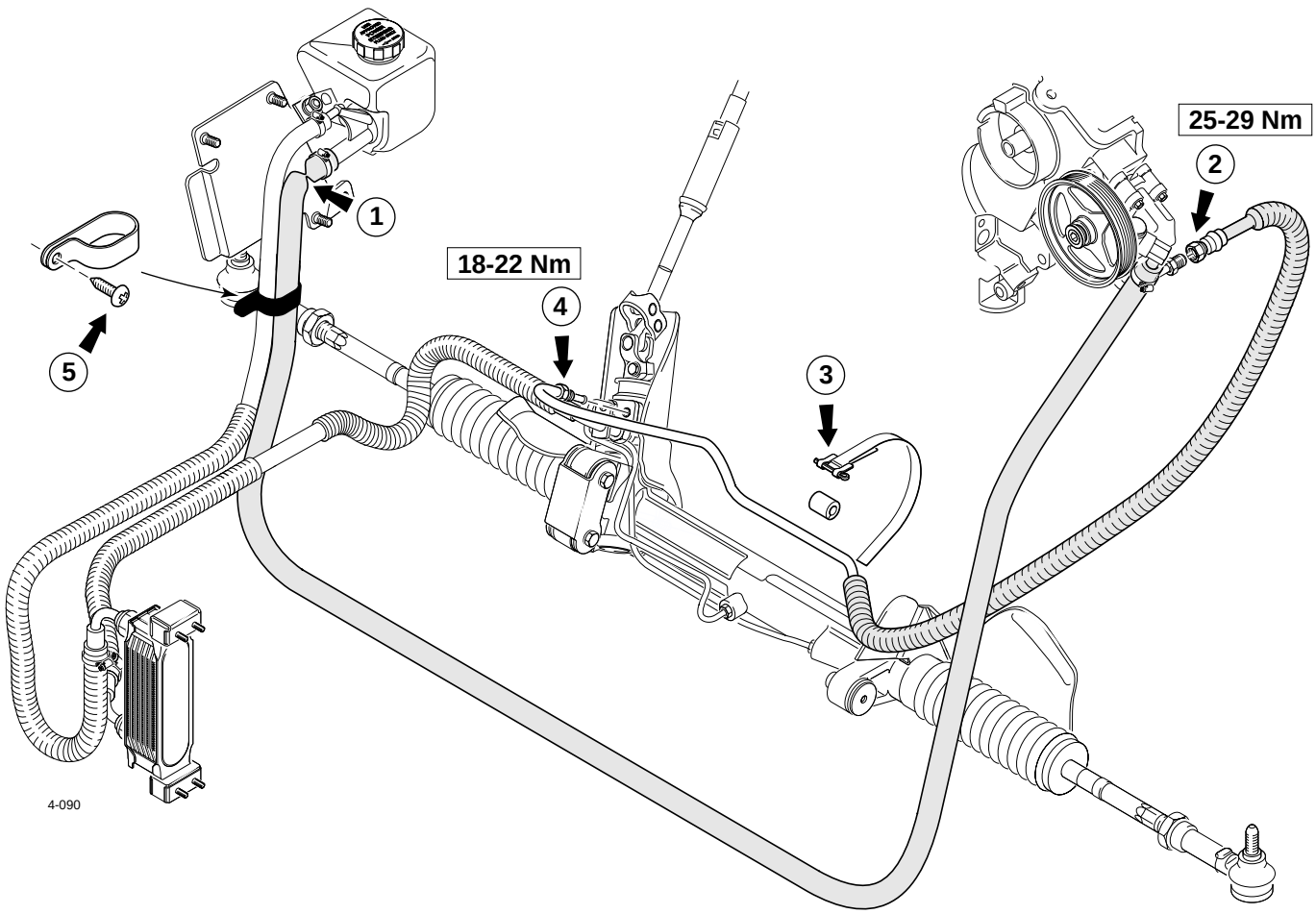
Power steering reservoir DEXRON 11D

Removal

1. Clamp the power steering reservoir to pump hose.
2. Release the union that secures the pressure hose to the rear of the steering pump, collect any fluid spillage with waste rags.
3. Release the feed hose from the rack pinion housing.
4. Remove the feed hose from the vehicle.

Installation

5. Fit the new hose into position.
6. Connect the hose to the pinion housing and to the power steering pump.
7. Fit the hose securing clips.
8. Refill the system with recommended fluid and carry out the bleed procedure (4.4.02).



4.4.06 Steering Rack Return Hoses Renew

Data

Oils, Greases and Lubricants

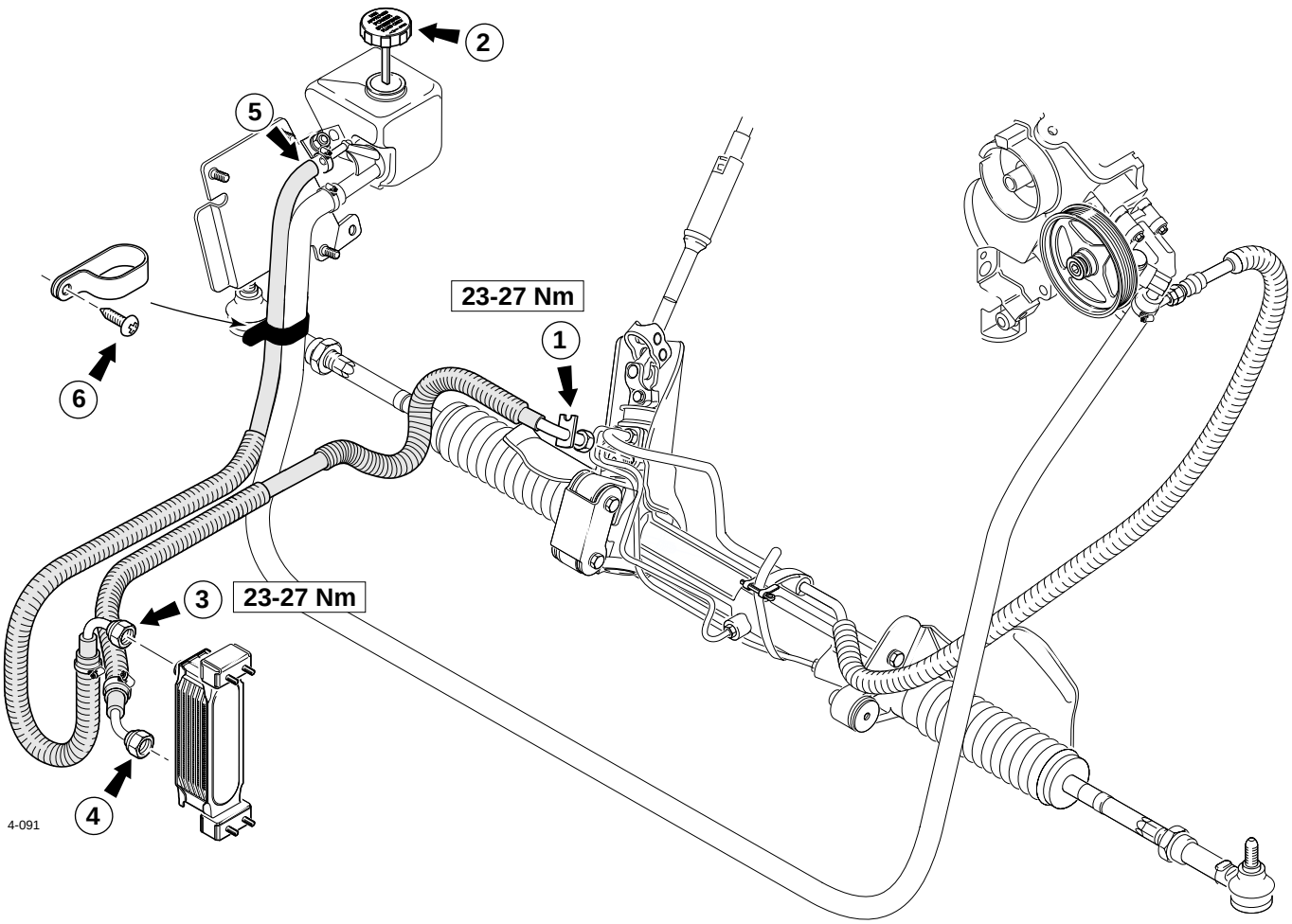
Power steering reservoir DEXRON 11D

Removal

1. Release the lower return hose from the steering rack and insert it into a suitable drain can.
2. Remove the reservoir cap and drain the steering fluid reservoir into the drain can.
3. Remove the radiator grille. Disconnect the lower and upper return hoses from the cooler.
4. Disconnect the upper return hose from the reservoir.

Installation

5. Fit new upper and lower return hoses from the reservoir to cooler and from cooler to the rack. Secure the union and hose clips.
6. Refill the reservoir to the maximum level with the recommended fluid.
7. Bleed the power steering system (4.4.02).



4.4.07 Power Steering Rack Gaiter Renew

Data

Front wheel alignment 20' ± 10', 2.6mm toe in

Special Tools

JD 24 Ball joint separator

Torque Figures

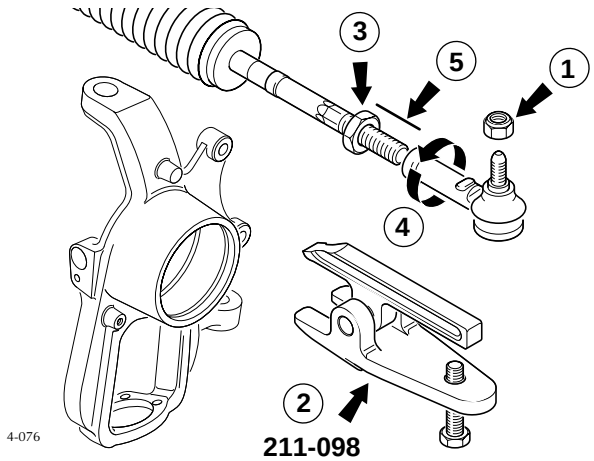
Outer ball joint locknut 61-69 Nm
Track adjustment locknut 67-81 Nm
Wheel nut to wheel stud 88-102 Nm

Removal

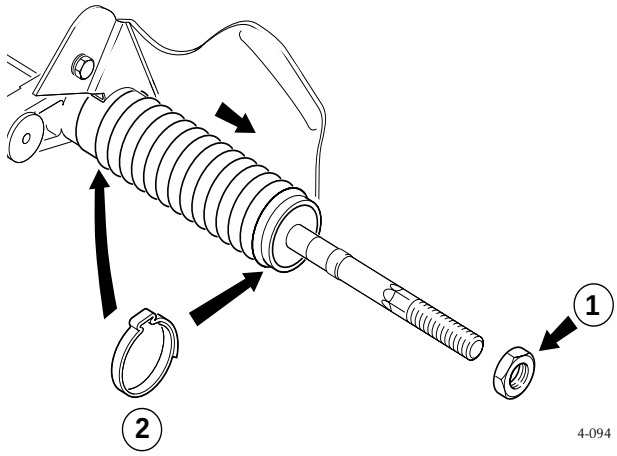
1. Raise the vehicle on a four point hoist.
2. Remove the road wheel.
3. Detach the track rod
   1 Remove the self locking nut that secures the outer ball joint to the steering arm.
   2. Using the special tool, detach the ball joint.

   Note: It may be necessary to substitute a two inch long 1/2 in UNF socket head grub screw, for the existing bolt of JD 24.

   3. Release the outer ball joint locknut. Unscrew the ball joint from the tie rod.
   4. Count and note the number of exposed threads between the outer face of the locknut and the end of the trackrod. Remove the locknut



4. Remove the gaiter securing clips.
5. Ease the gaiter from the rack tube, slide the gaiter along the tie rod and remove.



6. Clean the old grease from the inner rod joints.

Installation

1. Coat the inner ball joint with 60 g (2 oz.) of grease.
2. Fit the new gaiter, fit and tighten the securing clips.
3. Refit the tie rod locknut and rotate it until the same number of threads are exposed as previously noted. Refit the ball joint up to the locknut and nip up the nut.
4. Refit the ball joint to the steering arm and secure using a new self locking nut.
5. Refit the roadwheel in its original position.
6. Fit and nip up the wheel nuts.

WARNING: Do not drive the vehicle until step 9 is completed. The track rod lock nuts are only nipped up awaiting a steering geometry check.

7. Lower the vehicle to the ground.
8. Tighten the wheel nuts to their torque settings.
9. Check and adjust the front wheel alignment. (4.3.01)

4.4.08 Power Steering Pump Renewal

Data

Oils, Greases and Lubricants

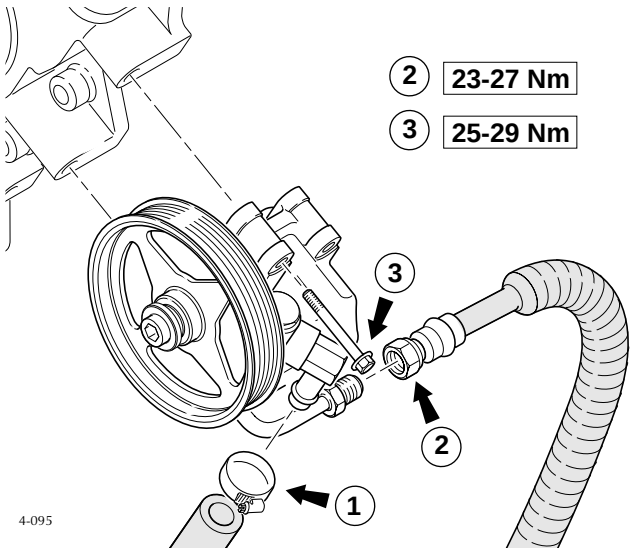
Power steering reservoir DEXRON 11D

Removal

1. Remove the cap from the steering fluid reservoir.
2. Loosen the hose clip and disconnect the low pressure feed hose from the pump stub pipe. Drain the fluid into a suitable container.
3. Blank off the hose and pump inlet stub pipe to prevent the ingress of dust and dirt.

Caution: Under no circumstances must the fluid be re-used.

4. Disconnect the pump outlet hose union from the pump. Drain off any residual fluid into a suitable container. Blank off the hose and pump outlet stub pipe to prevent the ingress of dust and dirt.
5. Remove the four bolts that secure the pump to the cylinder block and remove the pump assembly.



Note: The lower front bolt cannot be fully removed with the pump in situ. Loosen the bolt as far as possible, then move the pump outboard as you complete the bolt removal.

Installation

1. Fit the replacement pump assembly to the engine and secure with four bolts.
2. Fit a new 'O' ring seal to the pump outlet port, remove the blanking plug from the feed hose and secure the hose union to the pump.
3. Tighten to the correct torque.
4. Remove the plug from the pump inlet hose, refit the hose to the inlet, secure with the hose clip.
5. Refill the system with recommended fluid and carry out the bleed procedure (4.4.02).

4.4.10 Power Steering Fluid Cooler Renew (RHD only)

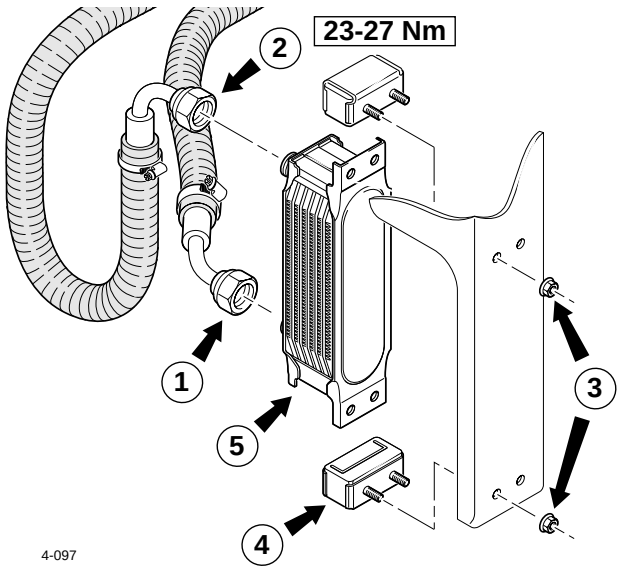
Data

Oils, Greases and Lubricants

Power steering reservoir DEXRON 11D

Removal

1. Remove 7 screws and remove the upper radiator grille. Place rags beneath the power steering fluid cooler to catch any spilt fluid.
2. Release the supply and return fluid hoses from the cooler. Plug the hose ends and the cooler stub pipes to minimise fluid leakage.
3. Remove 2 nuts and displace the oil cooler lower support. Displace the oil cooler from the upper support.



Installation

1. Fit the new oil cooler and secure with 2 nuts.
2. Reconnect the supply and return hoses. Remove the rags and clean the area.
3. Bleed the power steering system and top-up the power steering reservoir as necessary.
4. Refit the upper radiator grille and secure with 7 screws.

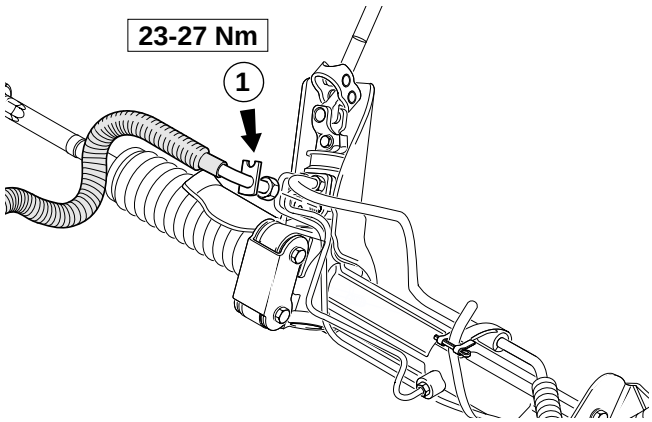
4.4.11.1 Power Steering Reservoir Renew

Oils, Greases and Lubricants

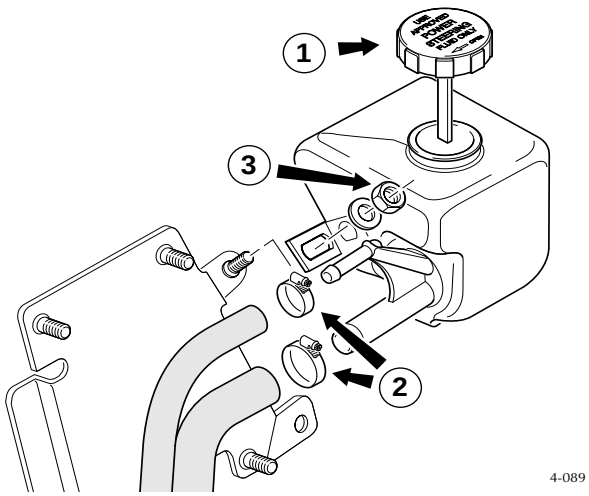
Power steering reservoir DEXRON 11D

Procedure

1. Release the lower return hose from the steering rack and insert it into a suitable drain can.



2. Remove the reservoir cap and allow the steering fluid reservoir to drain into the can.
3. Place absorbent material to catch residual fluid and disconnect both hoses from the reservoir.
4. Remove two M8 nuts and washers and remove the reservoir.



Installation

1. To install, reverse the removal procedure.
2. Refill the reservoir to the maximum level with recommended fluid.
3. Bleed the power steering system (4.4.02).

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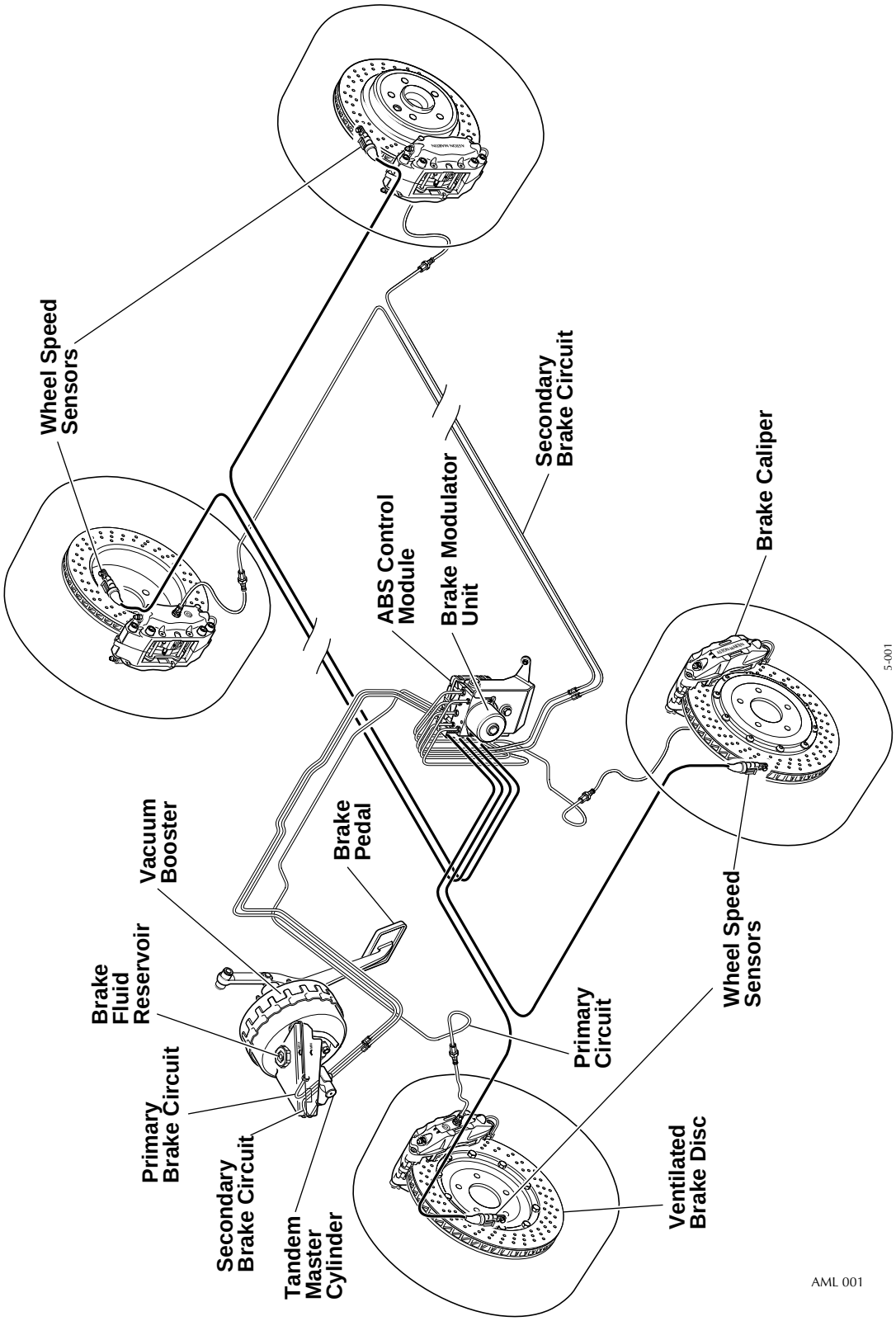
Brakes - General Description

The DB7 Vantage is equipped with outboard disc brakes on all wheels. Anti-lock braking (ABS) and a traction control system (TCS) are also fitted. Separate braking circuits are used for the front and rear brakes. The primary 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 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 controls 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, and to control initial 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.

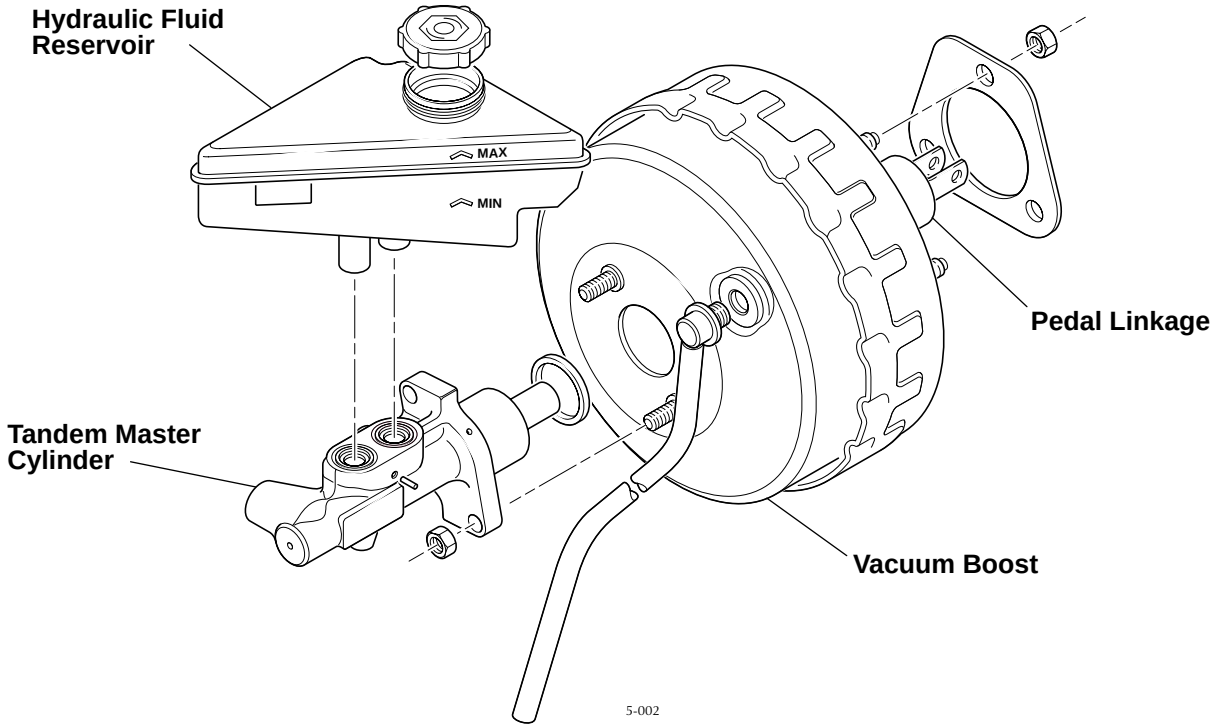
ABS and TCS hydraulics are described in detail in **Hydraulic Circuit Operation.**

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.

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.

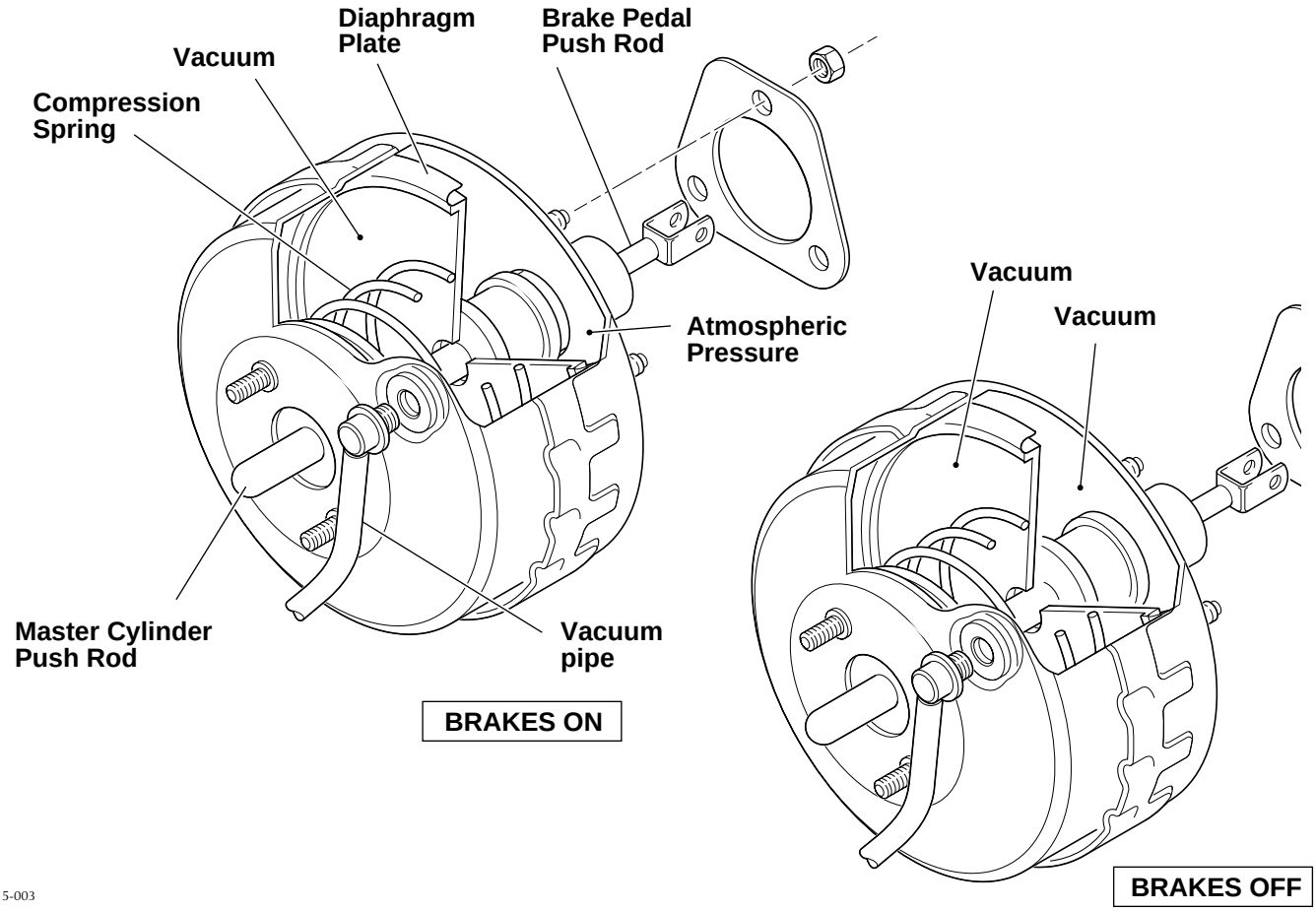


Brake Vacuum Booster

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. The chamber nearest the driver is the working chamber, the other is the vacuum chamber.

Brake Vacuum Booster Operation

When the brakes are released, both sides of the diaphragm have equal vacuum applied and the diaphragm is held in the release position by a compression spring.



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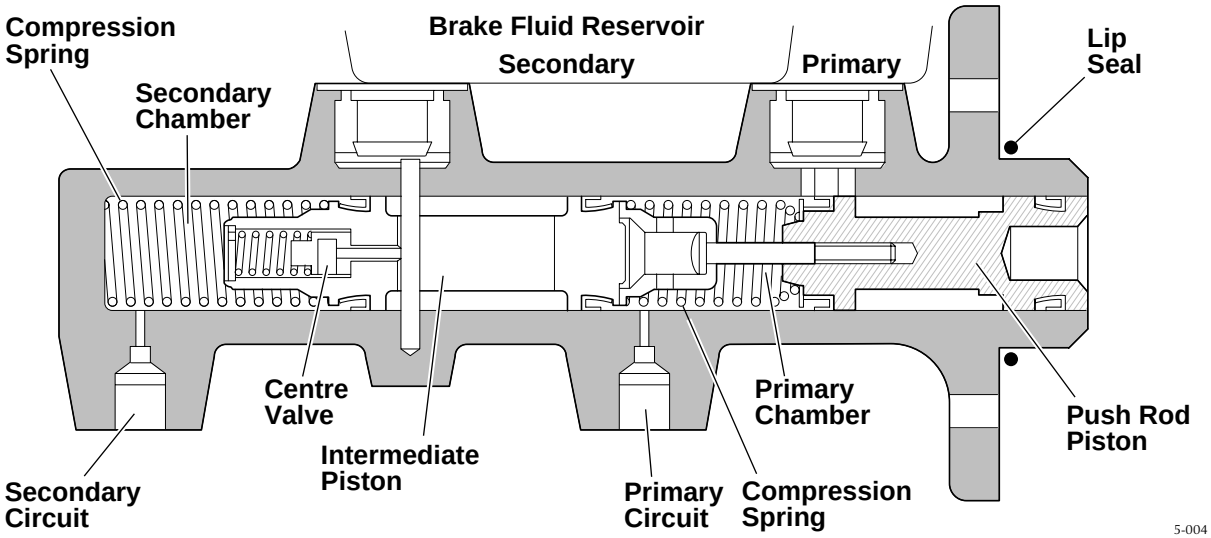
As the brake pedal is pressed, a poppet valve opens allowing atmospheric pressure into the drivers side of the diaphragm. Atmospheric pressure builds up on the drivers side of the diaphragm and boosts the applied brake pedal force up to 6.5 times.

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.

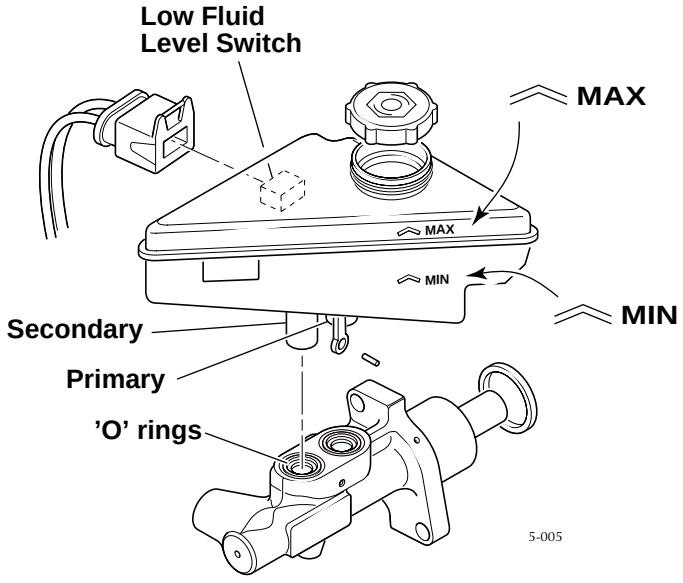
The two brake circuits work independently of each other. In the event of a failure of one of the circuits, the other circuit will continue to operate and transmit hydraulic pressure to its respective wheel cylinders.

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.

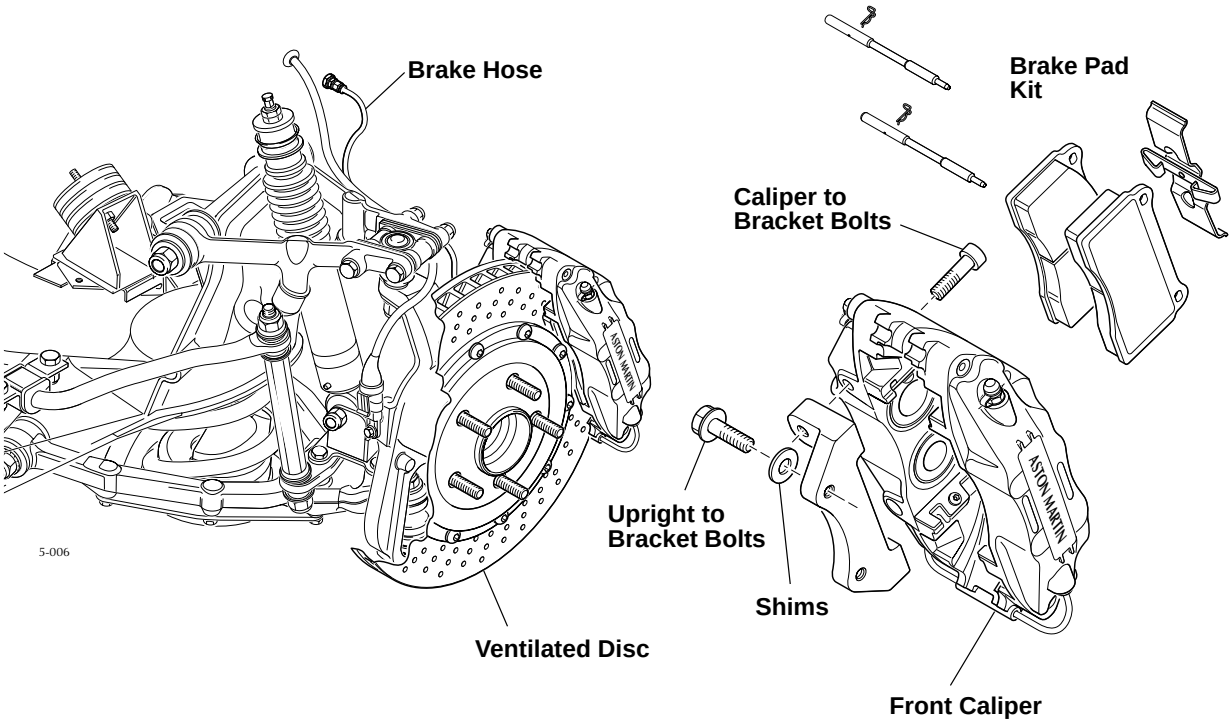


Front Brake Calipers

The front brakes are fitted with four piston calipers acting upon 355 mm diameter, 32 mm thick ventilated brake discs. The caliper is bolted to a mounting bracket on the suspension vertical link.

New Disc Size	Wear Limit
32.0 mm	30 mm

Renew discs when the wear limit is reached.

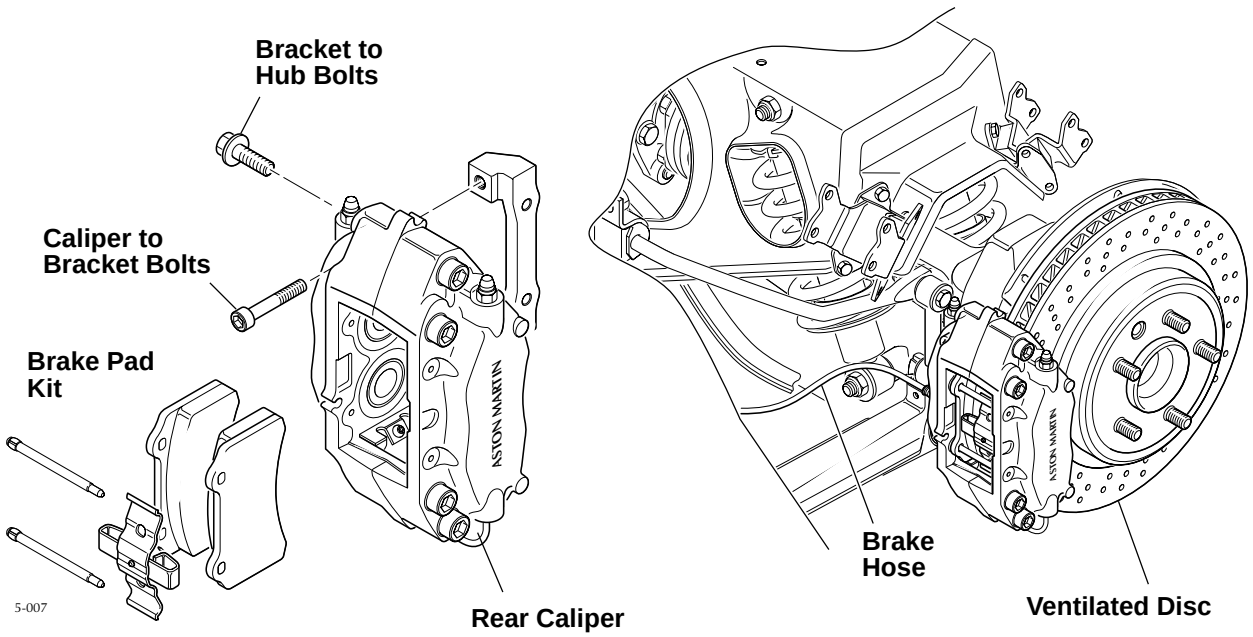


Rear Brake Calipers

The rear brakes are also fitted with four piston calipers. These act upon 330mm diameter, 28 mm thick ventilated brake discs . The rear discs incorporate brake drums for the shoe operated hand brake mechanism.

New Disc Size	Wear Limit
28 mm	26 mm

Renew discs when the wear limit reached.



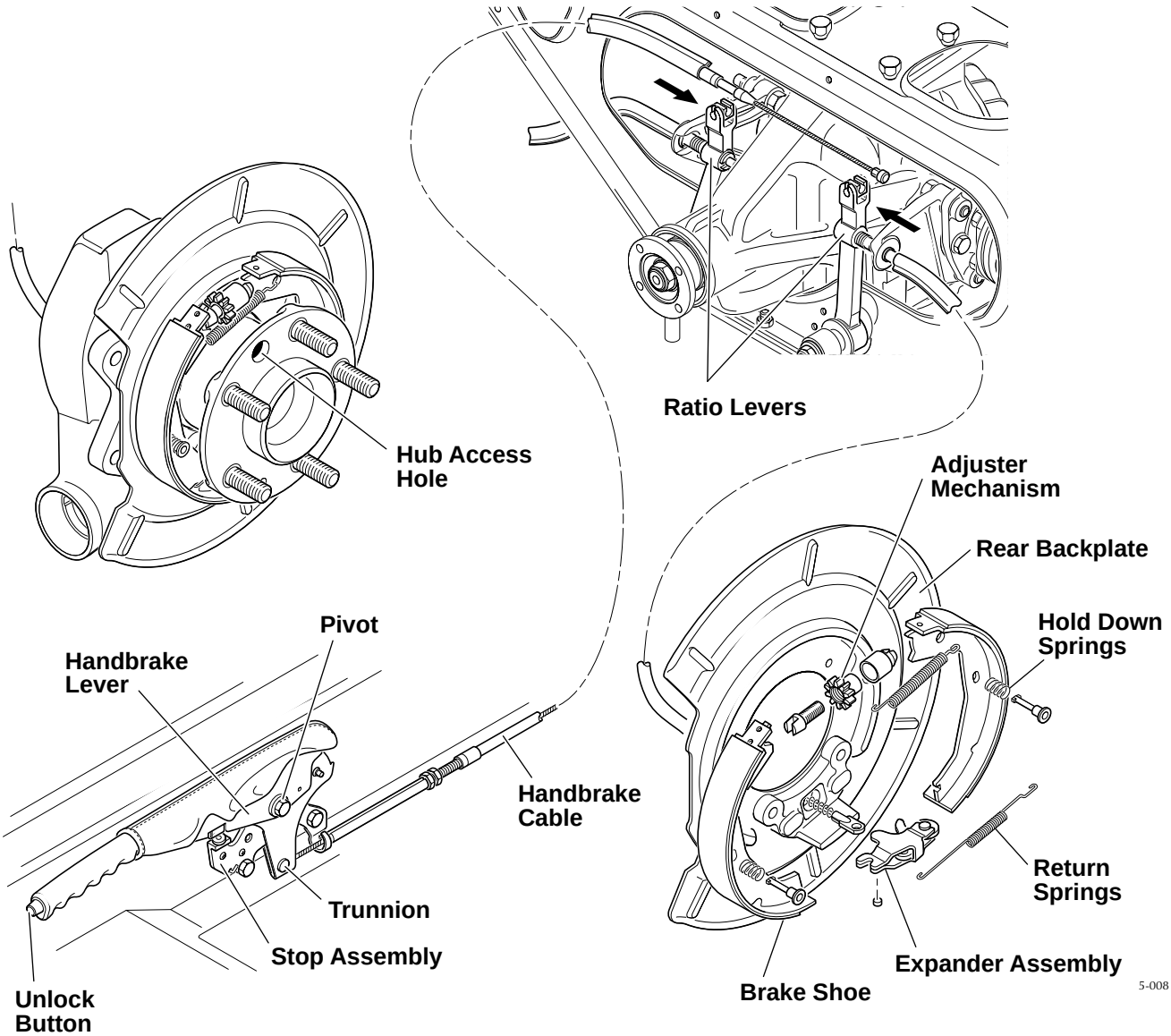
Handbrake

The handbrake operates on brake drums formed in the centre of each rear wheel brake disc. The handbrake shoes are connected by cables to the handbrake lever located between the drivers seat and the inner sill.

When the handbrake is applied, the handbrake cable applies equal force, via the ratio levers, to both left and right parking brake cables. The brake cables expand the brake shoes and press the shoes against the brake drums, locking the rear wheels.

The handbrake shoes are mounted on the backplate by hold-down springs and are connected by upper and lower return springs. The upper and lower return springs retract the shoes when the handbrake is released. Wear in the handbrake shoes can be taken up using the manual adjuster mechanism.

The handbrake switch is 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:

1. The ABS Control Module.
2. The modulator valve block.
3. Four inductive wheel speed sensors mounted one on each wheel hub.
4. The ABS warning lamp mounted on the instrument panel.

The valve block houses eight solenoid operated valves which are activated by the ABS control module. The signals are generated when necessary by the control program 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.

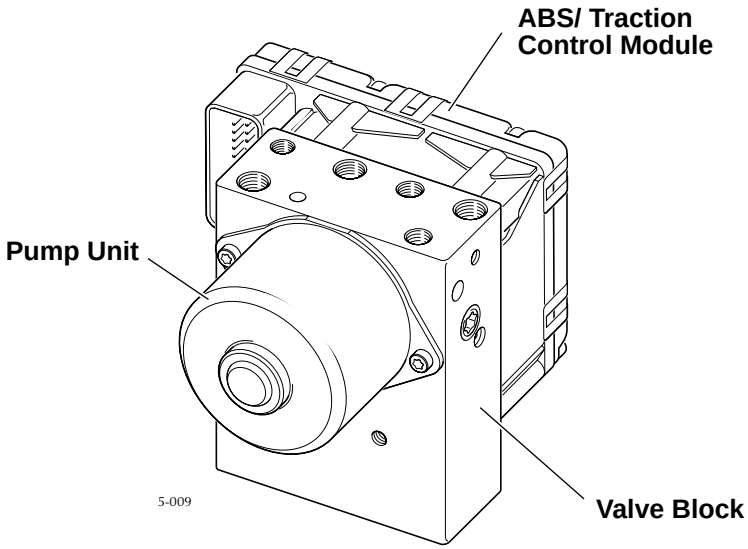
During the ABS system self check and during normal operation system performance is monitored and any faults will be logged in the system memory. When a fault is detected, the ABS warning lamp will be lit. If an ABS system fault is detected and logged, the ABS system is inhibited and the system reverts 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 CM problem).
- Redundancy error (internal CM problem).
- Over voltage / Under Voltage.
- Pump Motor Failure.

ABS Modulator Unit

The brake modulator unit, comprising: the pump motor, two accumulators, the modulator valve block and the control unit is located on the engine bulkhead at the passenger side of the vehicle. 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.



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/TC 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/TC control module can be replaced separately.

ABS Control Module

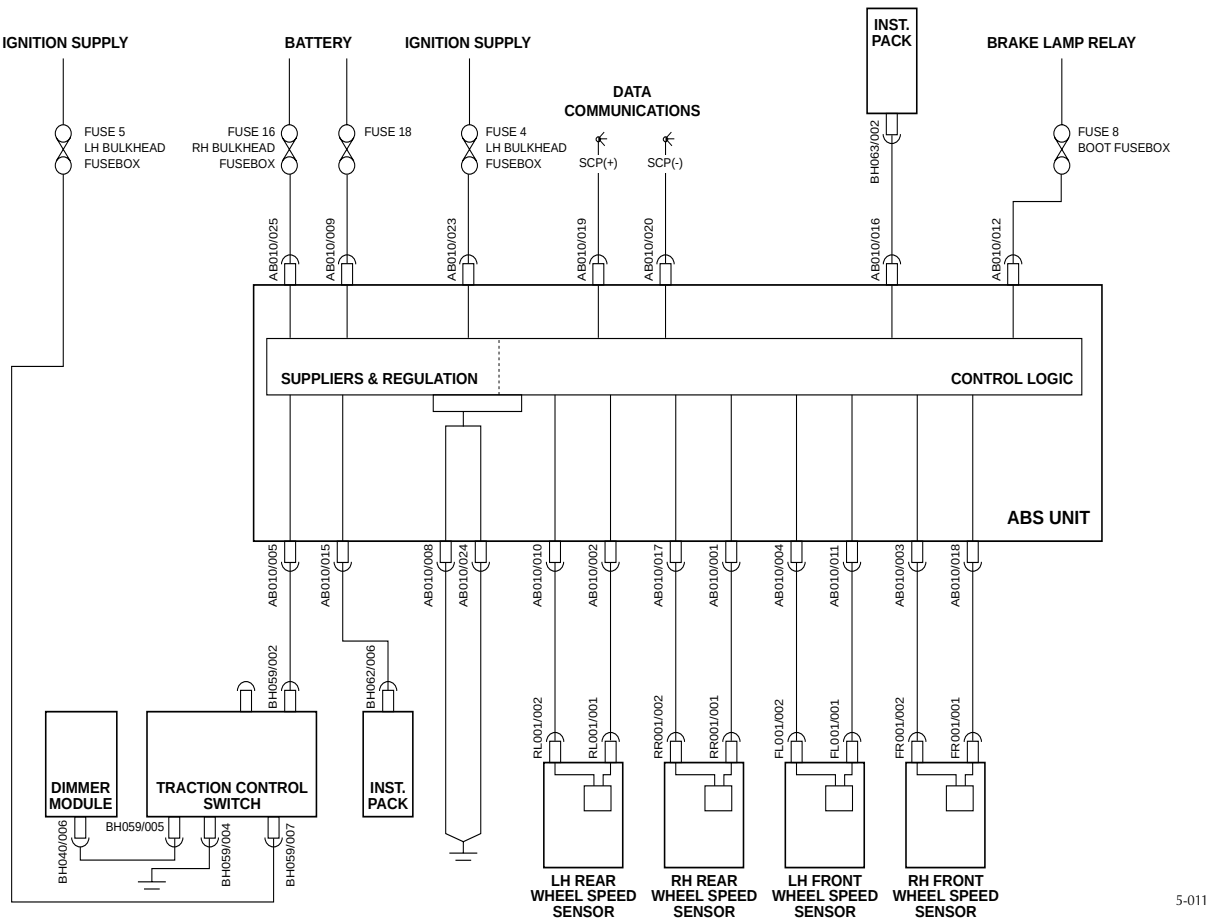
The ABS control module processes all the information supplied from the external wheel speed sensors. The signals from the four sensors are independently processed and compared by the control module during driving. If the wheel speed signal frequency from one wheel drops significantly below that of the 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		

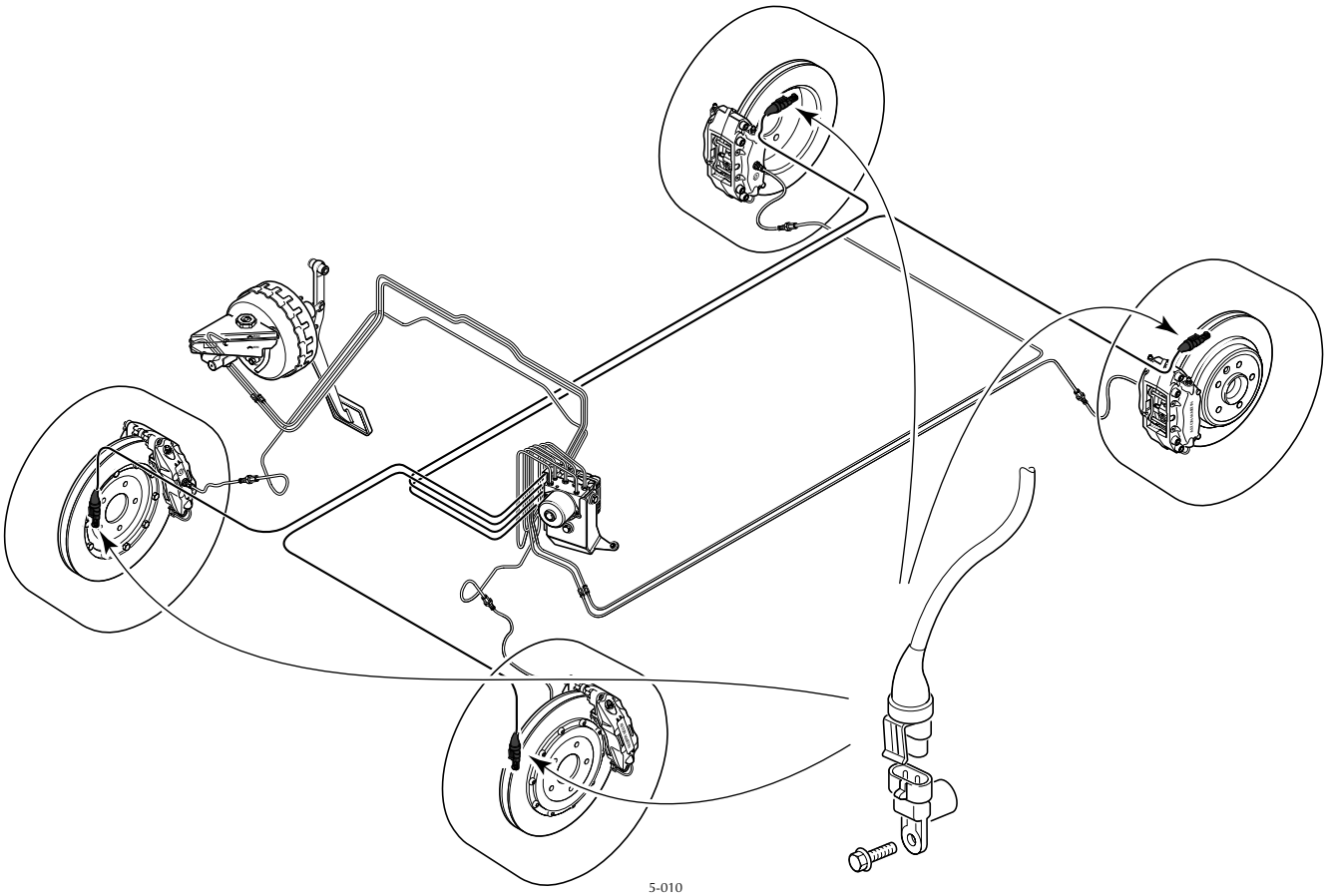
Wheel Speed Sensors

Speed sensors are fitted in the vertical link for each road wheel. Each sensor is secured with 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.



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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.

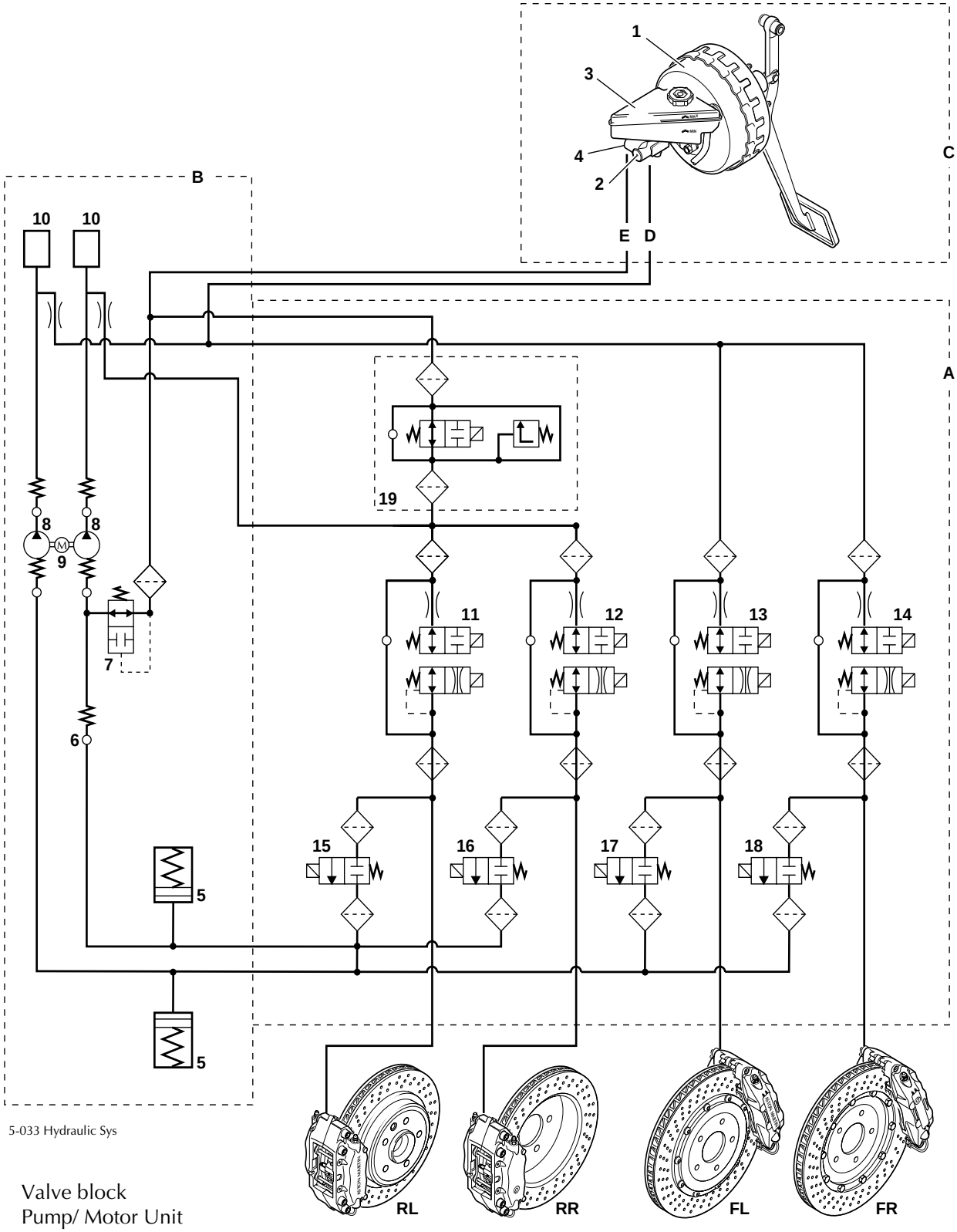
The Traction Control System

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.



5-033 Hydraulic Sys

Key

A	Valve block	4	Proportioning Valve	12	Inlet Valve (NO) RR
B	Pump/ Motor Unit	5	Low Pressure Accumulator	13	Inlet Valve (NO) FL
C	Actuation Unit	6	Check Valve	14	Inlet Valve (NO) FR
D	Primary Circuit	7	Traction Control Valve	15	Outlet Valve (NC) RL
E	Secondary Circuit	8	Hydraulic Pump	16	Outlet Valve (NC) RR
RL	Rear Brake Circuit (Left)	9	DC Motor	17	Outlet Valve (NC) FL
RR	Rear Brake Circuit (Right)	10	Noise Dampening Chamber	18	Outlet Valve (NC) FR
FL	Front Brake Circuit (Left)	11	Inlet Valve (NO) RL	19	Isolation Valve (NO)
FR	Front Brake Circuit (Right)				
1	Vacuum Booster				
2	Tandem Master Cylinder				
3	Fluid Reservoir				

Non-ABS Diagnostics

Symptom Vibration during braking

Cause

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)

Symptom Poor brake performance

Cause

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

Symptom Brakes pull to one side

Cause

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

Non-ABS Diagnostics (continued)

Symptom Brakes do not release

Cause
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

Symptom Excessive pedal travel

Cause
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 wheel bearings
e) Brake caliper piston(s) sticking.
Service or renew caliper or caliper guide pins.
f) Worn/damaged brake pads.
Renew brake pads

Symptom Brakes grab

Cause
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

Symptom Brakes drag

Cause
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

Non-ABS Diagnostics (continued)

Symptom Excessive pedal force required

Cause

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

Symptom Excessive brake noise

Cause

a) Worn brake pads
Renew brake pads

b) Bent or cracked handbrake shoes
Renew handbrake shoes

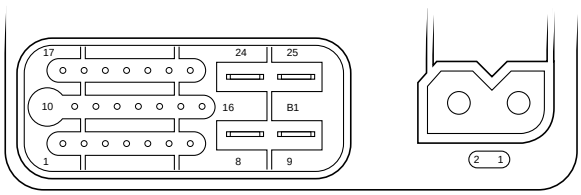
c) Foreign objects in brake pads or handbrake shoes
Examine brake pads and handbrake shoes. Clean or renew as necessary.

d) Broken/loose handbrake hold-down springs or 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. Right rear wheel speed sensor feed
2. Left rear wheel speed sensor feed
3. Right front wheel speed sensor signal
4. Left front wheel speed sensor signal
5. Traction control switch signal
6. Not Used
7. Not Used
8. Ground
9. +12V solenoid valve power
10. Left rear wheel speed sensor signal
11. Left front wheel speed sensor feed
12. Brake input (+12V with brakes on)
13. Not Used
14. Not Used
15. Traction control warning lamp
16. ABS Warning lamp
17. Right rear wheel speed sensor signal
18. Right front wheel speed sensor feed
19. SCP data bus (-ve)
20. SCP data bus (+ve)
21. Not Used
22. Not Used
23. +12V Ignition feed
24. Ground
25. +12V motor power



5-035

ABS Module Quick Checks

Test	Ignition On/Off	Test Procedure	Specification

1. ABS Module Voltage Supplies

Battery Power	Ign Off	RH Bulkhead F,box F18 - Chassis Ground	+12V
Battery Power	Ign Off	RH Bulkhead F,box F16 - Chassis Ground	+12V
Ignition Feed	Ign On	LH Bulkhead F,box F4 - Chassis Ground	+12V

2. Wheel Speed Sensor Resistance

Disconnect the ABS module connector

Left Front	Ign Off	Pin 4 - Pin 11	0.8 - 1.4 kΩ
Right Front	Ign Off	Pin 3 - Pin 18	0.8 - 1.4 kΩ
Left Rear	Ign Off	Pin 2 - Pin 10	0.8 - 1.4 kΩ
Right Rear	Ign Off	Pin 1 - Pin 17	0.8 - 1.4 kΩ

3. Wheel Speed Sensor Insulation from Ground

Sensor Ground	Ign Off	Pins 8/24 - Chassis Ground	∞
Left Front	Ign Off	Pin 4 - Pin 8/24	∞
Right Front	Ign Off	Pin 3 - Pin 8/24	∞
Left Rear	Ign Off	Pin 2 - Pin 8/24	∞
Right Rear	Ign Off	Pin 1 - Pin 8/24	∞

4. 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	approx 5mph
RF_WSPD	Ign On	Spin the wheel at approx 1rev/second	approx 5mph
LR_WSPD	Ign On	Spin the wheel at approx 1rev/second	approx 5mph
RR_WSPD	Ign On	Spin the wheel at approx 1rev/second	approx 5mph

5. ABS Warning Lamp

ABS Self-Check	Off-On then off	Observe ABS warning lamp	Lamp on for 5 seconds

ABS Diagnostics

Diagnostic Trouble Code (DTC) List

DTC	Description
C1095	Hydraulic pump motor failure
C1145	Right Front Speed Sensor - Input circuit failure
C1155	Left Front Speed Sensor - Input circuit failure
C1165	Right Rear Speed Sensor - Input circuit failure
C1175	Left Rear Speed Sensor - Input circuit failure
C1233	Left Front Wheel Speed - Input signal missing
C1234	Right Front Wheel Speed - Input signal missing
C1235	Right Rear Wheel Speed - Input signal missing
C1236	Left Rear Wheel Speed - Input signal missing
B1342	ABS control unit defective
B1485	Brake pedal position switch failure
B1676	Battery voltage out of range

ABS Module Parameter Identification (PID) List

Parameter	Description	
CCNTABS	Number of continuous DTCs on the ABS system	One count per bit
BOO_ABS	Brake switch input On/Off	
T/A_VAL	T/A control valve On/Off	
ABSRR_O	Right rear ABS outlet valve	
ABSLR_O	Left rear ABS outlet valve	
ABSRF_O	Right front ABS outlet valve	
ABSLF_O	Left front ABS outlet valve	
ABSRF_I	Right front ABS inlet valve	
ABSLF_I	Left front ABS inlet valve	
ABSRR_I	Right rear ABS inlet valve	
ABSLR_I	Left rear ABS inlet valve	
LF_WSPD	Left front wheel speed	
RF_WSPD	Right front wheel speed	
LR_WSPD	Left rear wheel speed	
RR_WSPD	Right rear wheel speed	

C1095 Hydraulic Pump Motor Failure

1. Check the following voltage supplies

Battery Power	Ign Off	RH Bulkhead F,box F16 - Chassis Ground	+12V
Battery Power	Ign Off	ABS module Pin 25 - Chassis Ground	+12V
Ground	Ign Off	ABS module Pins 8/24 - Chassis Ground	0Ω

2. Connect the PDU and command the ABS pump motor to run.

   If the pump motor runs correctly, clear the logged DTCs and road test the car to ensure that the problem is cleared.

   If the pump motor does not run, go to step 3.

3. Disconnect the motor two-pin connector from the control module. Ground the brown wire and apply 12V to the red wire.

   If the motor runs, replace the control module. Retest the system.

   If the motor does not run, replace the pump and valve block assembly. Refit the original controller to the new assembly. Retest the system to ensure that the problem is resolved.

C1145/1155/1165/1175 Wheel Speed Sensor Input Circuit Failure

C1145 Right Front Speed Sensor - Input circuit failure

C1155 Left Front Speed Sensor - Input curcuit failure

C1165 Right Rear Speed Sensor - Input curcuit failure

C1175 Left Rear Speed Sensor - Input curcuit failure

1. Initial Checks

   Check the relevant ABS sensor and rotor for damage. Even small defects can cause false signals.

   Check the ABS loom from the relevant sensor for damage.

   Check the sensor air gap (0.8 - 1.0mm)

   Check the sensor security.

   If no faults are found, go to step 2.

   If any faults are found, service the system as necessary and retest to ensure that the problem is resolved.

2. Check the sensor and wiring by disconnecting the control module connector and measuring continuity between the following points.

Right front wheel speed sensor	pin 3 to pin 18	800 - 1400Ω
Left front wheel speed sensor	pin 4 to pin 11	800 - 1400Ω
Right rear wheel speed sensor	pin 1 to pin 17	800 - 1400Ω
Left Rear wheel speed sensor	pin 2 to pin 10	800 - 1400Ω

   If any resistance value is out of range, go to step 3.

   If the resistance values are in range, go to step 4.

3. Disconnect the affected sensor at the road wheel. Measure the sensor resistance.

   If in range (800 - 1400Ω), service the ABS wiring from the control module to the affected sensor.

   If out of range, replace the sensor.

   Reconnect all components and road test the car to ensure that the problem is resolved.

4. Measure the output voltage from the suspect sensor at the control module harness connector whilst spinning the affected wheel at approximately one revolution per second.

Right front wheel speed sensor	pin 3 to pin 18	0.1 to 3.5 volts
Left front wheel speed sensor	pin 4 to pin 11	0.1 to 3.5 volts
Right rear wheel speed sensor	pin 1 to pin 17	0.1 to 3.5 volts
Left Rear wheel speed sensor	pin 2 to pin 10	0.1 to 3.5 volts

   If the voltage is in the specified range, go to step 5.

   If the voltage is outside the specified range, check for incorrect air gap, loose sensor or loose rotor. Service as necessary and retest to ensure that the problem is resolved.

5. Check the sensor resistance to ground. Measure between the following pins at the harness connector.

Right front wheel speed sensor	pin 3 to pin 8	greater than 10,000Ω
Left front wheel speed sensor	pin 4 to pin 8	greater than 10,000Ω
Right rear wheel speed sensor	pin 1 to pin 8	greater than 10,000Ω
Left Rear wheel speed sensor	pin 2 to pin 8	greater than 10,000Ω

   If the resistance is greater than 10,000Ω, go to step 7.

   If any resistance is less than 10,000Ω, go to step 6.

6. Disconnect the suspect sensor and measure from the connector pin on the sensor to chassis ground.

   If the resistance is greater than 10,000Ω, service the short to ground in the ABS sensor wiring. Reconnect all components and retest to ensure that the problem is resolved.

   If the resistance is less than 10,000Ω, there is an internal short within the sensor. Replace the sensor. Reconnect all components and retest to ensure that the problem is resolved.

7. Check the grounding of the ABS control module. Measure the resistance from module connector pins 8 and 24 to chassis ground.

   If the resistance is below 5Ω, go to step 8.

   If the resistance is above 5Ω service the module ground circuit as necessary. Retest the vehicle to ensure that the problem is resolved.

8. Raise the affected wheel from the ground. Check for excessive end-play or other slack in the wheel bearing.

   Check for security and concentricity of the ABS rotor as the wheel is rotated.

   Check for damaged teeth on the ABS rotor.

   If any faults are identified, service as necessary. Retest the vehicle to ensure that the problem is resolved.

   If no faults are identified, replace the ABS control module. Retest the vehicle to ensure that the problem is resolved.

C1233/1234/1235/1236 Wheel Speed Sensor Input Signal Missing

C1233 Left Front Wheel Speed - Input signal missing

C1234 Right Front Wheel Speed - Input signal missing

C1235 Right Rear Wheel Speed - Input signal missing

C1236 Left Rear Wheel Speed - Input signal missing

1. Initial Checks

   Check the relevant ABS sensor and rotor for damage. Even small defects can cause false signals.

   Check the ABS loom from the relevant sensor for damage.

   Check the sensor air gap (0.8 - 1.0mm)

   Check the ABS rotor for damaged teeth.

   Check the rotor for concentricity whilst rotating the wheel.

   Check the sensor security.

   If no faults are found, go to step 2.

   If any faults are found, service the system as necessary and retest to ensure that the problem is resolved.

2. Check the sensor and wiring by disconnecting the control module connector and measuring continuity between the following points.

Right front wheel speed sensor	pin 3 to pin 18	800 - 1400Ω
Left front wheel speed sensor	pin 4 to pin 11	800 - 1400Ω
Right rear wheel speed sensor	pin 1 to pin 17	800 - 1400Ω
Left Rear wheel speed sensor	pin 2 to pin 10	800 - 1400Ω

   If any resistance value is out of range (800 - 1400Ω), go to step 3.

   If the resistance values are in range, go to step 4.

3. Disconnect the affected sensor at the road wheel. Measure the sensor resistance.

   If in range (800 - 1400Ω), service the ABS wiring from the control module to the affected sensor.

   If out of range, replace the sensor.

   Reconnect all components and road test the car to ensure that the problem is resolved.

4. Measure the output voltage from the suspect sensor at the control module harness connector whilst spinning the affected wheel at approximately one revolution per second.

Right front wheel speed sensor	pin 3 to pin 18	0.1 to 3.5 volts
Left front wheel speed sensor	pin 4 to pin 11	0.1 to 3.5 volts
Right rear wheel speed sensor	pin 1 to pin 17	0.1 to 3.5 volts
Left Rear wheel speed sensor	pin 2 to pin 10	0.1 to 3.5 volts

   If the voltage is in the specified range, go to step 5.

   If the voltage is outside the specified range, check for incorrect air gap, loose sensor or loose rotor. Service as necessary and retest to ensure that the problem is resolved.

5. Check the sensor resistance to ground. Measure between the following pins at the harness connector.

Right front wheel speed sensor	pin 3 to pin 8	greater than 10,000Ω
Left front wheel speed sensor	pin 4 to pin 8	greater than 10,000Ω
Right rear wheel speed sensor	pin 1 to pin 8	greater than 10,000Ω
Left Rear wheel speed sensor	pin 2 to pin 8	greater than 10,000Ω

   If the resistance is greater than 10,000Ω, go to step 7.

   If any resistance is less than 10,000Ω, go to step 6.

6. Disconnect the suspect sensor and measure from the connector pin on the sensor to chassis ground.

   If the resistance is greater than 10,000Ω, service the short to ground in the ABS sensor wiring. Reconnect all components and retest to ensure that the problem is resolved.

   If the resistance is less than 10,000Ω, there is an internal short within the sensor. Replace the sensor. Reconnect all components and retest to ensure that the problem is resolved.

7. Check the grounding of the ABS control module. Measure the resistance from module connector pins 8 and 24 to chassis ground.

   If the resistance is less than 5Ω, go to step 8.

   If the resistance is more than 5Ω service the module ground circuit as necessary. Retest the vehicle to ensure that the problem is resolved.

8. Raise the affected wheel from the ground. Check for excessive end-play or other slack in the wheel bearing.

   Check for security and concentricity of the ABS rotor as the wheel is rotated.

   Check for damaged teeth on the ABS rotor.

   If any faults are identified, service as necessary. Retest the vehicle to ensure that the problem is resolved.

   If no faults are identified, replace the ABS control module. Retest the vehicle to ensure that the problem is resolved.

B1342 ABS control unit defective

1. Check the ground supply to the ABS control module.

   Switch off the ignition. Disconnect the ABS module connector.

   Check for continuity from ABS module harness connector pins 8 and 24 to chassis ground.

   If continuity is good (less than 5Ω, go to step 2.

   If continuity is poor, (5Ω or above) service the module ground wires as necessary. Reconnect all components and retest the vehicle to ensure that the problem is resolved.

2. Check 12V ignition power to the ABS control module.

   Measure the voltage from connector pin 23 to connector pin 8, the voltage should read 0V.

   Switch on the ignition, the voltage should rise to +12V.

   If 12V is present, go to step 3.

   If 12V is not present, service the +12V ignition supply to pin 23 as necessary. Reconnect all components and retest the vehicle to ensure that the problem is resolved.

3. Check the 12V battery power to the ABS control module.

   Switch off the ignition. Measure the voltage from pins 9 and 25 (+12V batt) to pins 8 and 24 (ground).

   If 12V is available on pins 9 and 25, go to step 4.

   If 12V is not available on pins 9 and 25, service the wiring from bulkhead fusebox (RHS) fuses F16 and F18 to the ABS control module. Reconnect all components and retest the vehicle to ensure that the problem is resolved.

4. Replace the ABS control module. Reconnect all components and retest the vehicle to ensure that the problem is resolved.

B1485 Brake pedal position switch failure

1. Switch on the ignition and press the brake pedal.

   Check that the left hand rear stop lamp illuminates (boot fusebox F8 supplies LH stop lamp and ABS controller)

   If the left rear stop lamp illuminates, the stop lamp relay and boot fusebox F8 are good, go to step 2.

   If the left rear stop lamp does not illuminate, service the stop lamp relay, boot fusebox F8 and the brake switch as necessary. Reconnect all components and retest the vehicle to ensure that the problem is resolved.

2. Switch off the ignition. Disconnect the ABS control module.

   Check continuity from boot fusebox F8 to ABS control module harness connector pin 12.

   If continuity is good (less than 5Ω), go to step 3.

   If continuity is poor (5Ω or more) service the wiring from boot fusebox F8 to ABS module harness connector pin 12. Reconnect all components and retest to ensure that the problem is resolved.

3. Check for ground supply to the ABS control module.

   Measure continuity from ABS module harness connector pins 8 and 24 to chassis ground.

   If continuity is good (less than 5Ω), go to step 4.

   If continuity is poor (5Ω or more) service the wiring from pins 8 and 24 to chassis ground. Reconnect all components and retest to ensure that the problem is resolved.

4. Replace the ABS control module.

   Reconnect all components and retest to ensure that the problem is resolved.

B1676 Battery Voltage out of Range

1. Switch off the ignition and disconnect the ABS control module. Check that all lights, radio and other consumers are turned off.

   Measure the voltage from ABS module harness connector pins 9 and 25 (+12V battery) to pins 8 and 24 (ground).

   If the voltage is above 12 volts, the battery condition is not the cause of the B1676 code. Go to step 3.

   If the battery 'no load' voltage measured at the ABS control module is below 12 volts, note the voltage reading and go to step 2.

2. Recheck the supply voltage at the battery terminals.

   If the voltage is above 12 volts, service the wiring from the boot fusebox to ABS module harness connector pin 9 or 25 as necessary. Reconnect all components and retest to ensure that the problem is resolved.

   If the voltage is the same as that noted in step 1, recharge or service the battery as necessary. Reconnect all components and retest to ensure that the problem is resolved.

3. Ignition voltage to the ABS control module.

   Switch on the ignition and measure the voltage from ABS module harness connector pin 23 (+12V ignition) to pins 8 and 24 (ground).

   If the voltage is above 12 volts, replace the ABS control module. Reconnect all components and retest to ensure that the problem is resolved.

   If the ignition supply voltage is below 12 volts, service the wiring from bulkhead fusebox (LHS) fuse F4 to ABS module harness connector pin 23. Reconnect all components and retest to ensure that the problem is resolved.

5.0.03.1 Brake Bleeding Procedure

Data

Torque Figures

Bleed screw to caliper 7-13 Nm
Wheel nuts 88-102 Nm

WARNING:

Exercise great care when servicing or repairing the system. Avoid skin/eye contact or ingestion of brake fluid. If skin or eyes are accidentally splashed with brake fluid, rinse the affected area immediately with plenty of running water and seek medical attention. If brake fluid is ingested, seek medical attention immediately.

Throughout the following servicing procedures, observe absolute cleanliness to prevent foreign matter contaminating the brake system.

Caution:

Brake fluid must not be allowed to contact the vehicle paintwork. Remove any spilt fluid from the paintwork by rinsing away with running water. Methylated spirit (denatured alcohol) must not be used to clean the contaminated area. Use only a proprietary brake cleaning fluid.

Procedure

Use a brake bleed bottle with a clear bleed tube and one-way valve. Ensure that there is sufficient brake fluid in the reservoir throughout the bleeding procedure.

The following bleed sequence should be used to ensure that all trapped air is expelled from the hydraulic system.

Right Hand Drive	Left Hand Drive
Rear Left	Rear Right
Rear Right	Rear Left
Front Left	Front Right
Front Right	Front Left

1. Check and if necessary top up the brake fluid reservoir to the maximum level.
2. Take the weight of the vehicle on a four point hoist and remove the road wheels.
3. Remove the dust caps and clean all eight bleed nipples (two per caliper).
4. Connect a bleed tube and one-way valve to the outer nipple of the first caliper (see previous list) and open the bleed screw
5. Have an assistant actuate the brake pedal to the floor; holding for approximately two seconds and then release the pedal. Pause for about two seconds for the master cylinder to reprime. Actuate the brake pedal again for two seconds. Repeat this operation until a continuous stream of clear, bubble-free, brake fluid is observed flowing from the bleed tube. Whilst holding the brake pedal pressed, close the bleed screw.
6. Transfer the bleed tube to the inner nipple of the first caliper and repeat the bleed procedure (step 5).
7. Check that there is sufficient fluid remaining in the reservoir. Top up as necessary with fresh brake fluid from a newly opened container.
8. Repeat the bleeding procedure (steps 4 and 5) at each of the remaining calipers in the relevant list.

   Always start with the outer nipple of each caliper.

   Top up the brake fluid reservoir as necessary after each caliper is bled.
9. After bleeding the final caliper, remove the bleed equipment. Refit the eight bleed nipple dust caps.
10. Test the brake pedal 'feel'. Repeat the bleeding procedure if the pedal feels 'spongy' when the brakes are applied.
11. Refit the road wheels. Nip up the wheel nuts.
12. Lower the vehicle to the ground and torque all wheel nuts to 88-108 Nm.
13. Check and top up the brake fluid reservoir to the MAX level.

Caution: Do not overfill the reservoir. If overfilled when the brake pads are worn, fluid will overflow when pads are replaced.

5.1.01 Front Brake Caliper Renew

Data

Specification

Wheel nuts	88-108 Nm

Oils / Greases

Brake & Clutch Fluid to or exceeding DOT 4 spec. (Not silicon based fluid)

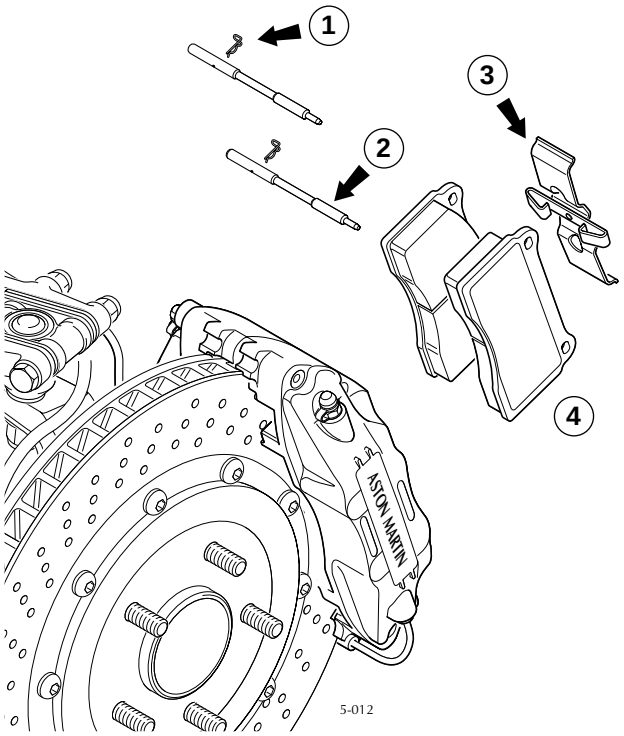
Removal

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.

   1 Remove the spring clips
   2 Remove the pad locating pins
   3 Remove the anti rattle spring
   4 Remove the brake pads
   5 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.

   WARNING: Brake lining dust can, if inhaled, damage your health. Always use a vacuum brush or aqueous brake cleaner to remove brake lining dust. Never use an air line.

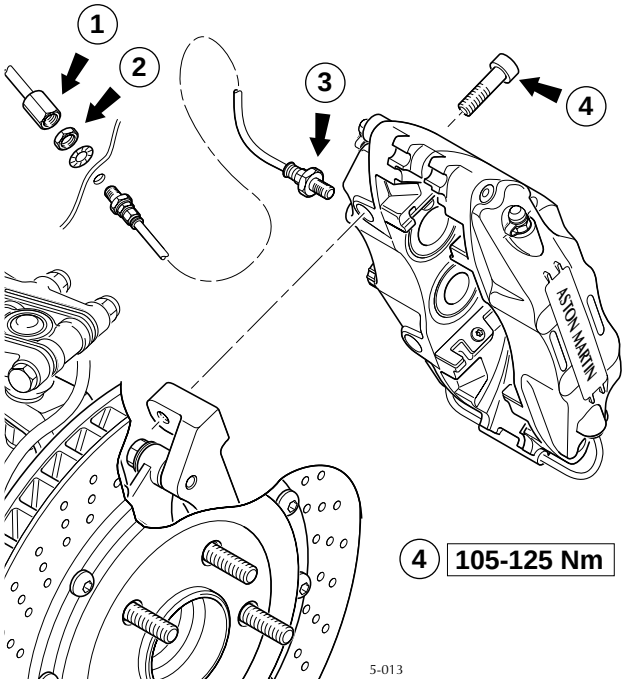


3. Remove the brake caliper.

   1 Disconnect the brake hose union.
   2 Remove the hose securing clip
   3 Detach the hose from the mounting bracket. Crimp the hose and plug the brake pipe end.
   4 Remove two bolts securing the caliper to the bracket.
   5 Remove the brake caliper assembly.

   Note: Only remove the caliper bracket if required for wheel bearing/hub replacement. If the bracket is removed, retain any shims and refit between the bracket and vertical link during reassembly. Check that the caliper is centralised over the disc when reassembly is completed.

   Note: Refer to the special instructions in the Installation section regarding refitting of the front brake hose.

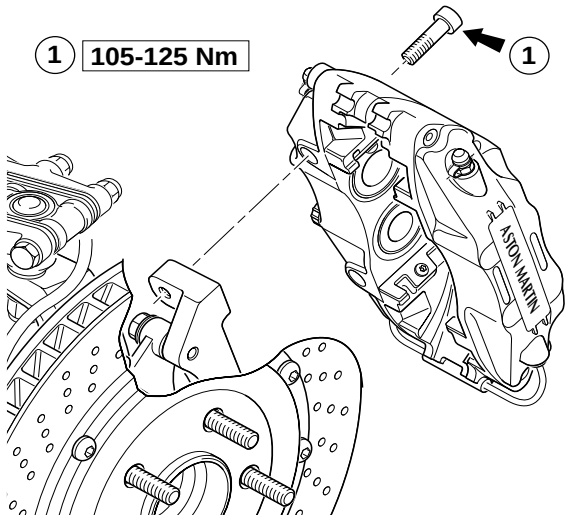


Installation

1 Fit and tighten two bolts.

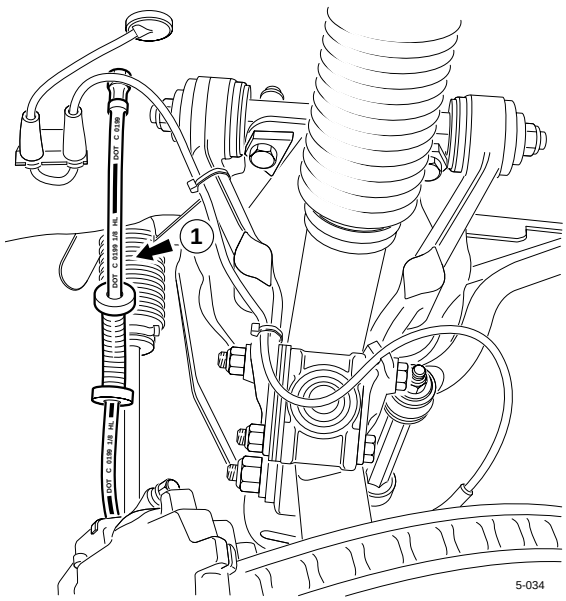
Caution: Check for an even and parallel gap between the caliper and the disc. Any shims removed from between the caliper mounting bracket and the vertical link must be refitted.

If necessary use shims to achieve the correct caliper to disc alignment. Use the same type of shims used for front camber angle setting.



2. Align the brake hose.

WARNING: Make sure that the brake hose is not twisted when the unions are fully tightened. The hose should be straight when viewed from above. Text on the hose will indicate that the hose is not twisted. A twisted hose can flex under full lock, causing chafing and possible brake fluid loss.



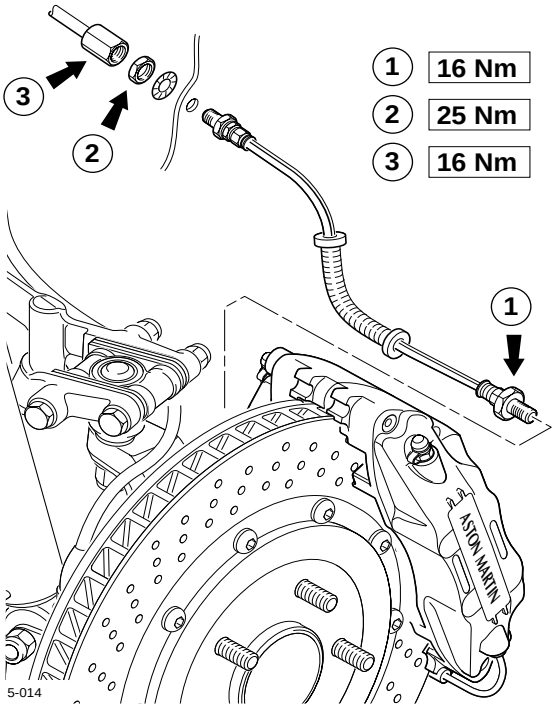
3. Secure the brake hose

1 Screw the flexi hose into the brake caliper using the shorter threaded end fitting

2 Push the other end through the inner wing panel, making sure the hose is not twisted.

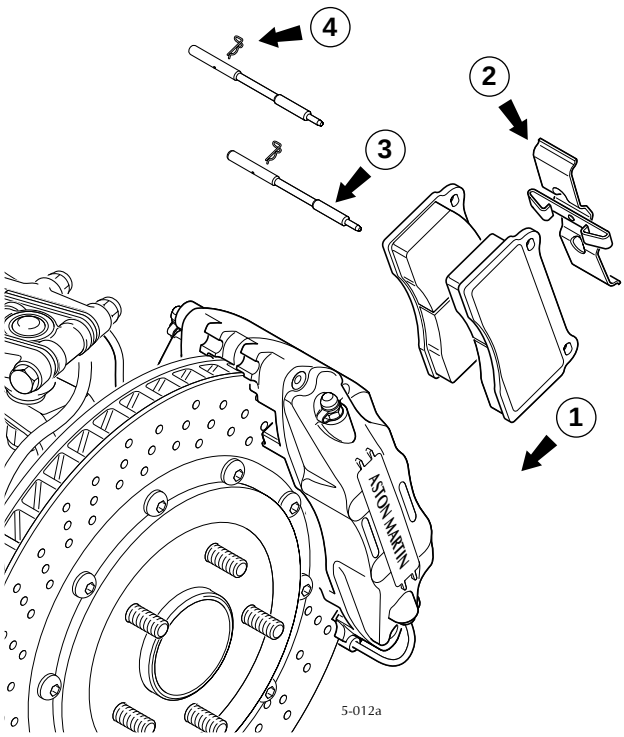
Fit an M10 locknut on the inner side of the wing panel. Tighten the locknut.

3 Fit the steel bundy brake pipe nut. Tighten the bundy nut, holding the integral hex nut within the wheel housing, with a spanner to prevent twisting of the flexi hose.



4. Fit the brake pads.

   1 Apply copper grease to the back of the brake pads and to the locating pins. Fit the brake pads to the caliper.
   2 Fit the anti-rattle spring
   3 Fit the pad locating pins.
   4 Secure the pins with spring clips.



5. Refit the road wheel and tighten the wheel nuts to specification.

6. Carry out brake bleed procedure (5.0.03.1).

5.1.03 Front Brake Pads Renew

Specification

New pad thickness	18 mm
Minimum pad thickness	7.5 mm
Wheel nuts	88-102 Nm

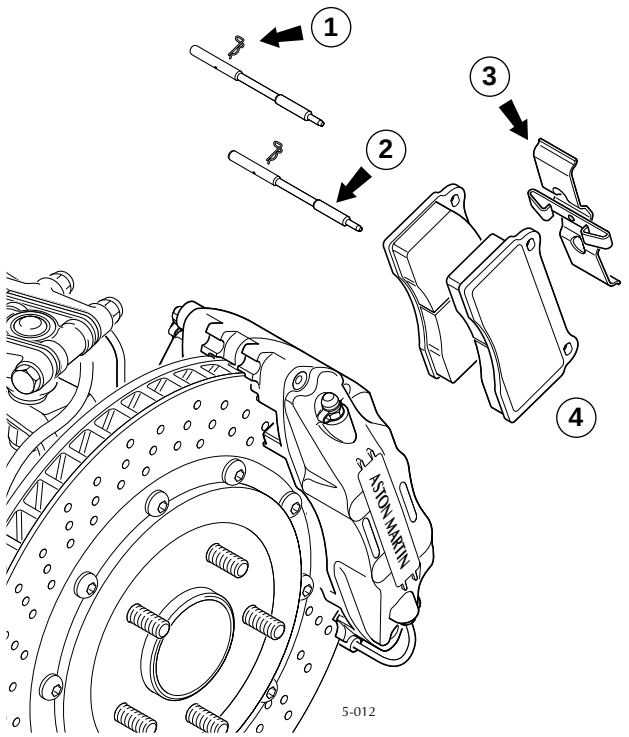
Consider renewing brake pads when 1/3 of the friction material remains, especially if the car is regularly used and some time remains before the next service.

Procedure

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.

   1 Remove the spring clips
   2 Remove the pad locating pins
   3 Remove the anti rattle springs
   4 Remove the brake pads
   5 Consider replacing the pads if less than 1/3 of friction material remains.



WARNING: Brake lining dust can, if inhaled, damage your health. Always use a vacuum brush or aqueous brake cleaner to remove brake lining dust. Never use an air line.

5.1.04 Front Brake Disc Renew

Specification

Brake disc initial thickness	32 mm
Brake disc minimum thickness	30 mm
Wheel nuts	88-102 Nm

Brake Disc Surface Checks

It is quite normal for small surface cracks to appear on the brake disk rotors in proximity to the ventilation holes when the discs are subjected to high speed braking. Discs should be replaced only if surface cracks exceed the following specifications:

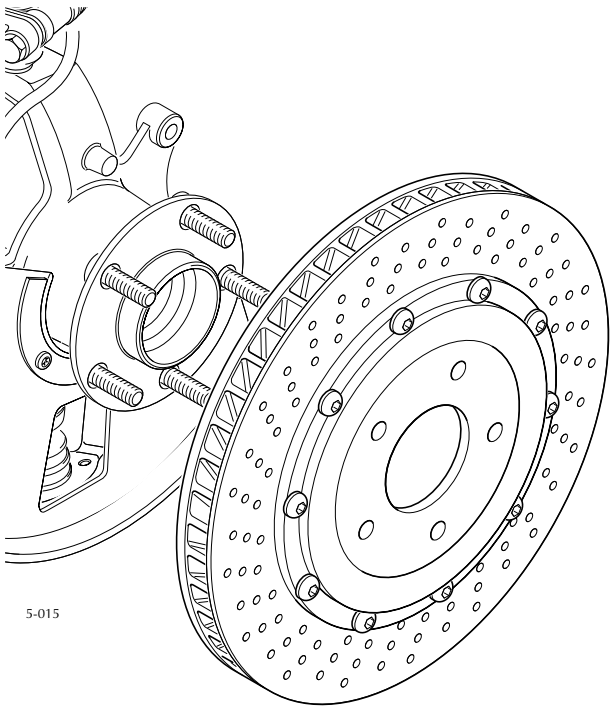
a) Cracks must not exceed 30mm in length.

b) 2 or more ventilation holes must not be linked by 1 or more cracks.

c) Cracks must not extend to the inner or outer radial boundary of the disc - pad contact area.

Procedure

1. Remove the front road wheel.
2. Remove the front brake caliper from the caliper bracket (5.1.01).
3. 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.

4. Fit the replacement brake disc.
5. Refit the brake caliper to the caliper bracket (5.1.01). Check that the caliper is centralised to the brake disc and shim if necessary.
6. Refit the road wheels and nip-up the wheel nuts.
7. 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 cover.

WARNING: 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.

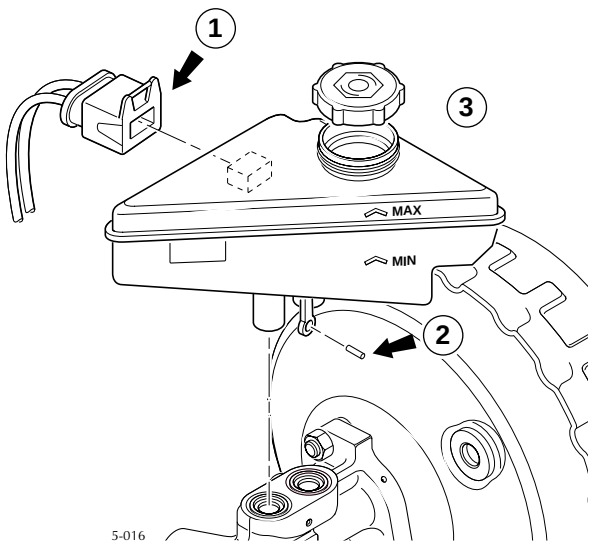
Caution: Fluid must not be allowed to contact the vehicle paintwork. Remove any spilt fluid from the paintwork by rinsing away with running water.

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.

   1 Disconnect the reservoir multiplug.
   2 Remove the reservoir securing pin.
   3 Remove the reservoir taking care not to spill any fluid. If fluid is spilled in removing the reservoir, immediately wash it away with clean water.

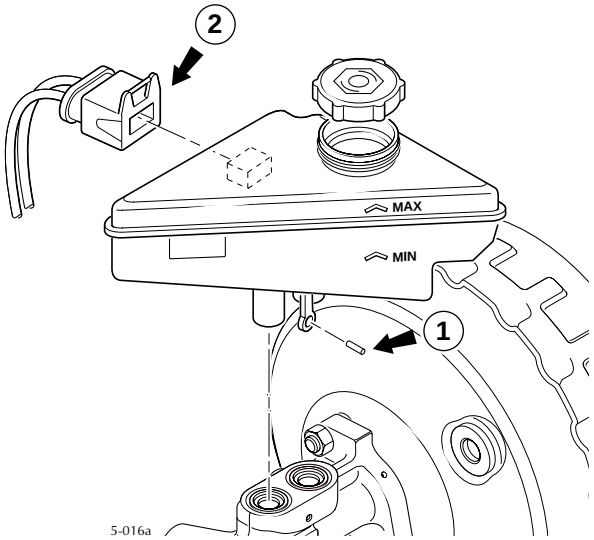


Installation

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.

   1 Fit the reservoir securing pin.
   2 Connect the reservoir multiplug.



3. Refill the reservoir with the specified brake fluid from a new unopened container.

4. Bleed the brake system (5.0.03.1).

5.1.06 Master Cylinder Assembly Renew

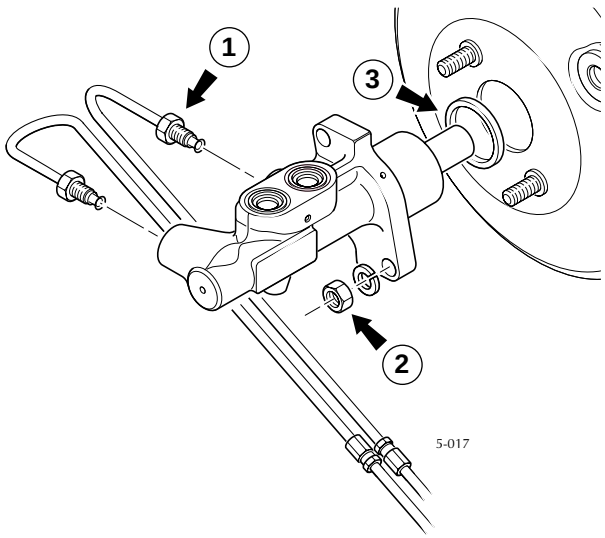
Data

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.
   1 Disconnect the two outlet pipes from the master cylinder. Fit blanking plugs to all ports and pipe ends to prevent fluid leakage.
   2 Remove the two nuts and washers securing the master cylinder to the brake servo then remove the master cylinder.
   3 Discard the lipseal gasket.



Installation

1. Fit a new gasket to the master cylinder.
2. Fit the master cylinder to the brake servo.
   1 Secure the master cylinder with the two nuts and washers.
   2 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 and Control Module Renew

Data

Oils / Greases

Universal Brake and Clutch Fluid to/or exceeding DOT 4 specification.

WARNING: 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.

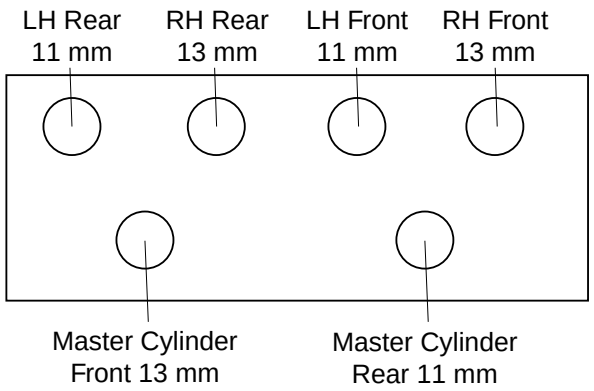
If brake fluid is ingested, obtain immediate medical attention.

Removal

1. Disconnect the vehicle battery.
2. Place suitable absorbent material around the modulator area to catch any spilt fluid.

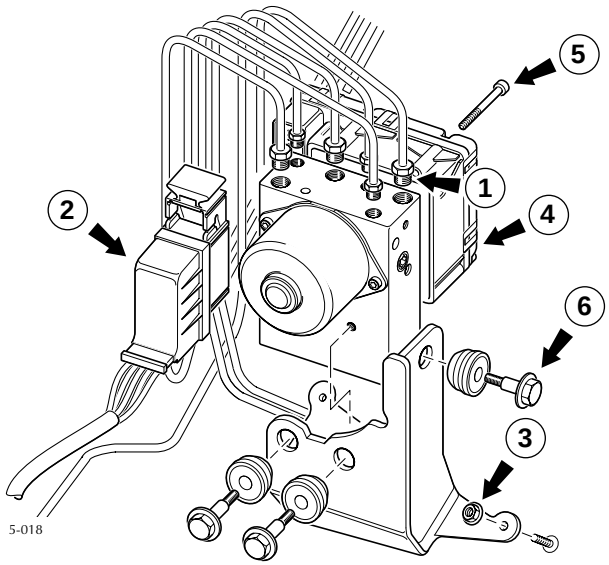
Caution: Fluid must not be allowed to contact the vehicle paintwork. Remove any spilt fluid from the paintwork by rinsing away with running water.

3. Release the six unions from the valve block one at a time and drain the brake fluid from each line in turn. Cap each pipe and plug each valve block outlet to prevent further leakage.



4. Disconnect the modulator electrical connector.
5. Remove three bolts securing the modulator bracket to the vehicle body.
6. Remove the modulator control module assembly.
7. Remove four torx head screws and separate the control module and modulator.
8. Remove three screws and remove the modulator bracket from the modulator.

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 modulator bracket to the modulator and secure with three screws.
2. Fit the control module using four torx screws.
3. Locate the modulator assembly to its mounting holes on the vehicle body and secure with three bolts.
4. Reconnect the ABS control module electrical connector.
5. Remove sealing caps from the brake pipes. Fit the 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. Bleed the brake system (5.0.03.1).

5.2.02 Rear Brake Disc Renew

Data

Torque Figures

Caliper carrier to hub carrier 56-70 Nm
Wheel nut to wheel stud 88-102 Nm

Oils / Greases / Sealants

Brake fluid to a minimum DOT 4 specification.

Brake Disc Surface Checks

It is quite normal for small surface cracks to appear on the brake disk rotors in proximity to the ventilation holes when the discs are subjected to high speed braking. Discs should be replaced only if surface cracks exceed the following specifications:

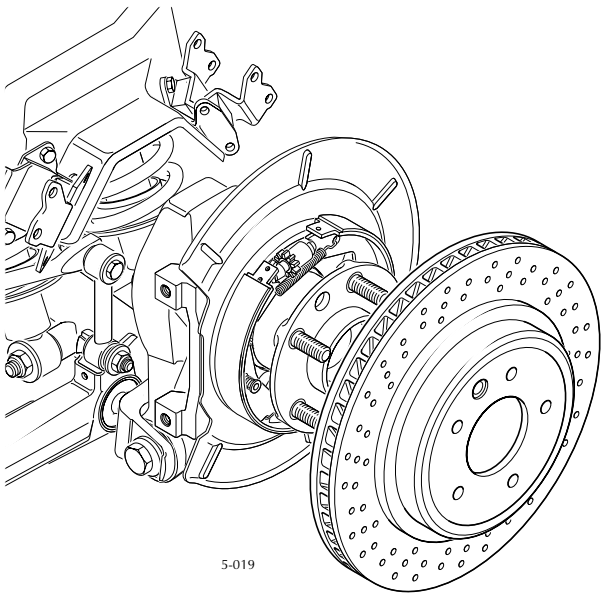
a) Cracks must not exceed 30mm in length.

b) 2 or more ventilation holes must not be linked by 1 or more cracks.

c) Cracks must not extend to the inner or outer radial boundary of the disc - pad contact area.

Removal

1. Remove the rear road wheels.
2. Remove the rear brake caliper (5.2.04).
3. Remove the rear brake disc
   1 Remove the disc securing screw.
   2 Release the handbrake.
   3 Remove the brake disc.



4. Clean all brake dust from the handbrake mechanism.

WARNING: Brake pad / lining dust can contain asbestos which, if inhaled, can damage your health. Always use a vacuum brush to remove brake pad dust. Never use an air line.

5. Fit a new rear brake disc. Operate the handbrake lever to centralize the handbrake shoes.
6. Adjust the handbrake (5.3.02).
7. Refit the brake caliper (5.2.04).
8. Refit the road wheel and tighten the wheel nuts.
9. 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.

10. Check the brake fluid and top up as necessary. Torque all fixings to the specified tolerances.

5.2.03 Rear Brake Pad Renew

Specification

New pad thickness	14.75mm
Minimum lining thickness	7.5 mm
Wheel nuts	88-108 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.

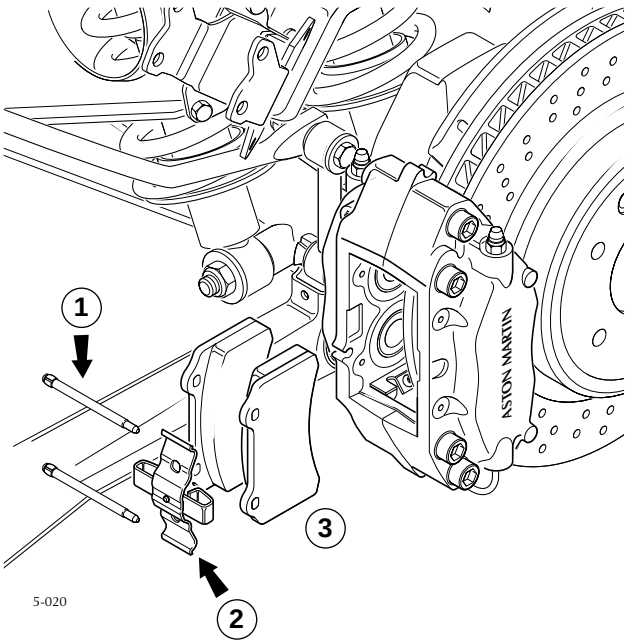
Removal

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.

   1 Drift out the pad locating pins
   2 Remove the anti rattle springs
   3 Remove and discard the brake pads
   4 Clean all brake dust from the caliper area using approved brake cleaning equipment.

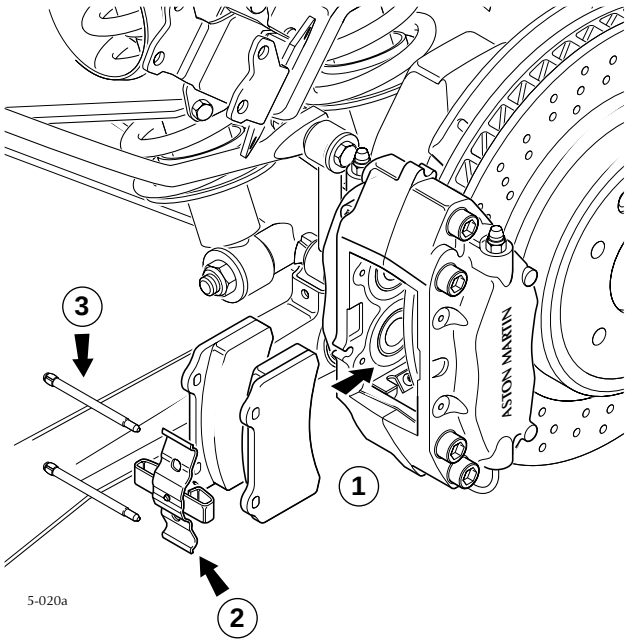
   WARNING: Brake lining dust can, if inhaled, damage your health. Always use a vacuum brush or aqueous brake cleaner to remove brake lining dust. Never use an air line.



Installation

1. Fit the rear brake pads.

   1 Apply copper grease to the back of the brake pads and to the locating pins. Fit the brake pads to the caliper.
   2 Fit the anti rattle springs
   3 Fit the pad locating pins



2. Refit the road wheel and tighten the wheel nuts to specification.

5.2.04 Rear Brake Caliper Renew

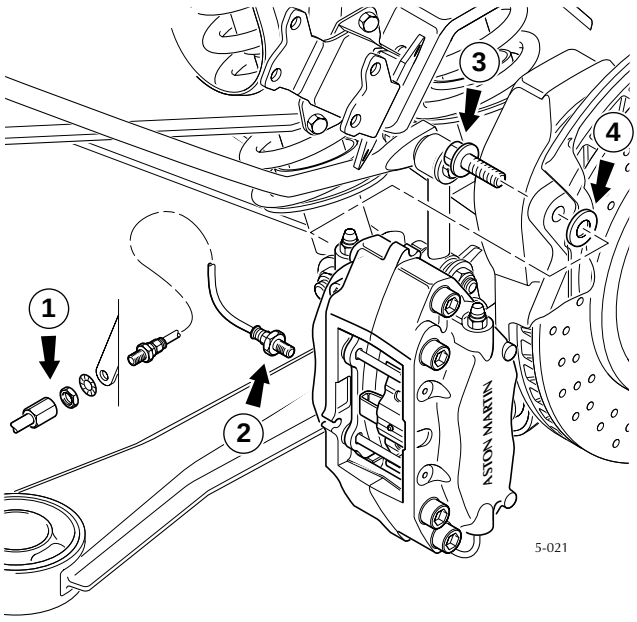
Data

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. Jack up the rear of the vehicle and place on stands. Remove the road wheel and tyre assembly.
3. Remove the rear caliper assemblies.
   1 Disconnect the flexible hose at the brake pipe union.
   2 Disconnect the flexible hose from the caliper.
   3 Remove the carrier to bracket securing bolts and remove the caliper, leaving the bracket to hub joint intact.
   4 Retain any shims fitted between the carrier and the caliper.



4. Remove the brake pads from the caliper.
5. Clean all brake dust from the components using approved brake cleaning equipment.

   WARNING: Brake pad / lining dust can contain asbestos which, if inhaled, can damage your health. Always use a vacuum brush to remove brake pad dust. Never use an air line.

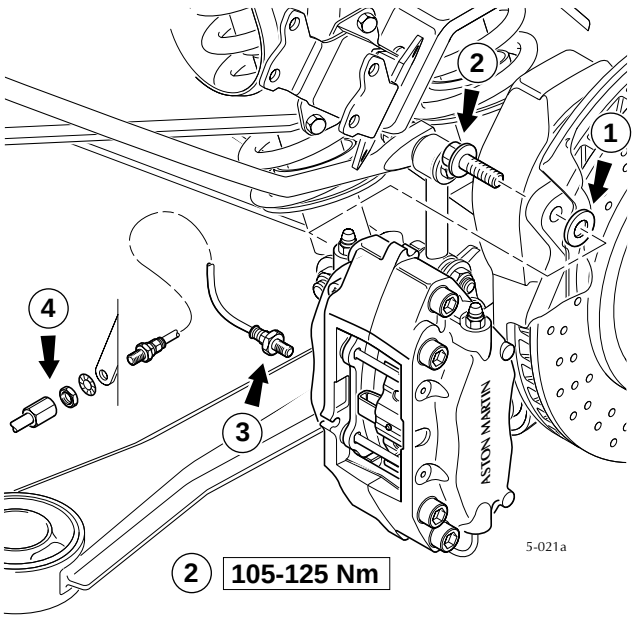
Installation

1. Fit the caliper to the hub assembly and tighten the securing bolts.
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 brake caliper
   1 Refit the caliper to carrier bolts.

   Caution: Check for an even and parallel gap between the caliper and the disc. Any shims removed from between the carrier and the caliper must be refitted.

   If necessary add shims to achieve the correct caliper to disc alignment. Use the same type of shims used for front camber angle setting.

   2 Reconnect the flexible hose to the caliper.
   3 Refit the flexible hose to the brake pipe union.



5. Refit the road wheel and tyre assembly and tighten the wheel nuts.
6. Lower the vehicle from the axle stands and torque the wheel nuts to 88-102 Nm.
7. Bleed the brakes (5.0.03.1.

5.3.02 Handbrake Setting Procedure

Data

Torque Figures

Fulcrum shaft nut 70-80 Nm
Handbrake lever cover screw 0.6-1.0 Nm
Handbrake cable adj. / locknuts 19-25 Nm
Wheel nut to wheel stud 88-102 Nm

Removal

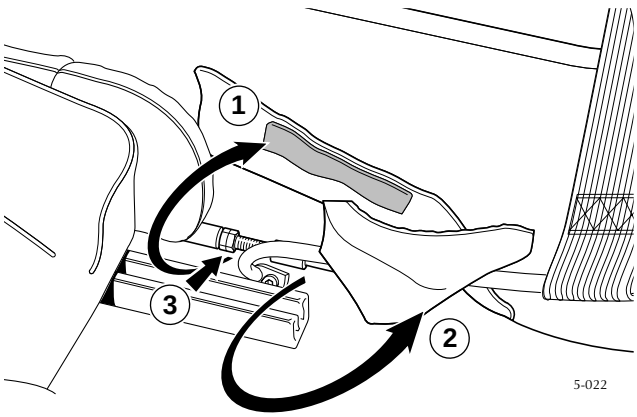
1. Move the driver's seat fully forward. Position the seat squab fully forward. Switch off the ignition.

2. Access the handbrake cable adjuster locknuts.

   3 Release the velcro fastening in the inner sill carpet and fold up the carpet.

   4 Fold back the sound insulation to access the cable adjuster.

   5 Loosen the hand bake cable adjuster locknuts.

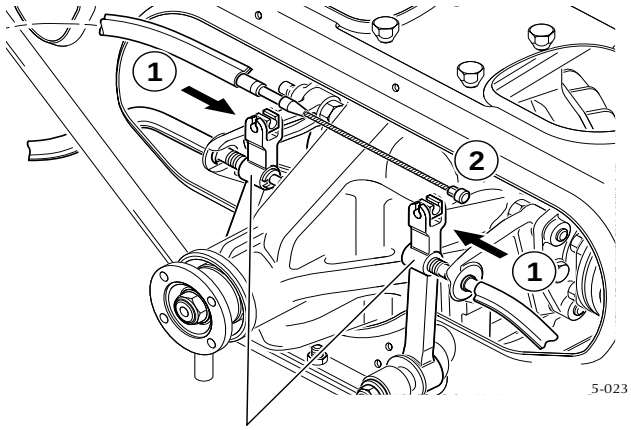


3. Raise the vehicle on a ramp.

4. Disconnect the handbrake cables.

   1 Move the handbrake ratio levers inward.

   2 Disconnect the main handbrake cable from the ratio levers



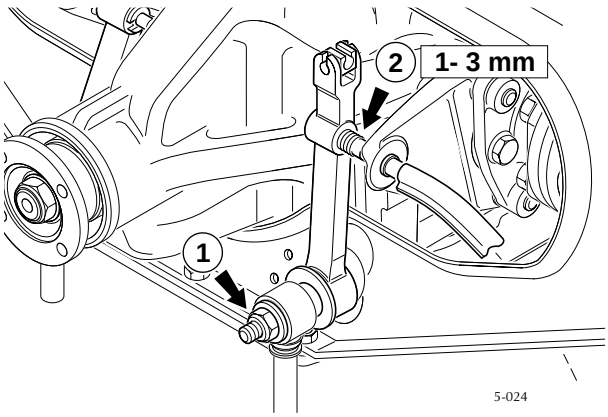
Ratio Levers

5. Set the relaxed position of the ratio lever bushes.

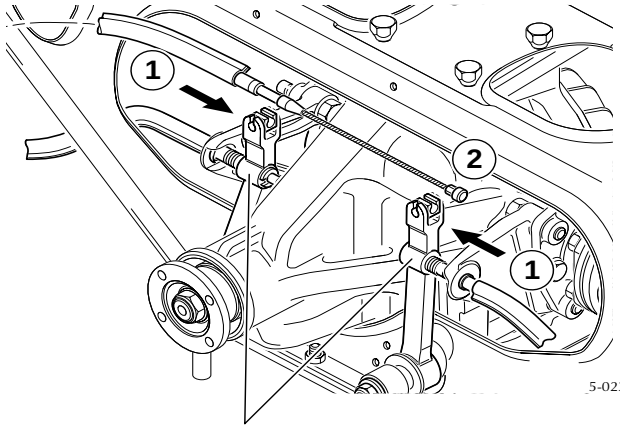
   1 Unscrew, but do not remove the ratio lever fulcrum shaft securing nuts to release the ratio lever bottom bushes.

   2 Position the ratio levers 1mm to 3mm (0.039 to 0.118 in.) from the abutment brackets.

   3 Tighten the fulcrum shaft / ratio lever securing nuts to secure the ratio lever bushes.



6. Refit the handbrake cable to the ratio levers.



Ratio Levers

7. Adjust the ramp to a suitable working position to carry out the following procedures. Raise the rear end of the vehicle and support on stands.

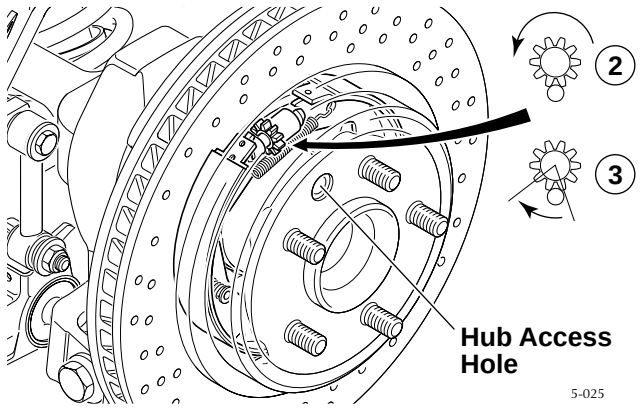
8. Remove the road wheel.

9. Adjust the handbrake shoe engagement.

   1 Turn the hub assembly and align the disc / hub access hole to the handbrake shoe adjuster.

   2 Turn the adjuster anticlockwise until the shoes firmly contact the drum.

   3 Turn the adjuster clockwise about 2 clicks until the disc can be turned quite freely.



10. Repeat the procedure to adjust the opposite side rear handbrake shoes.

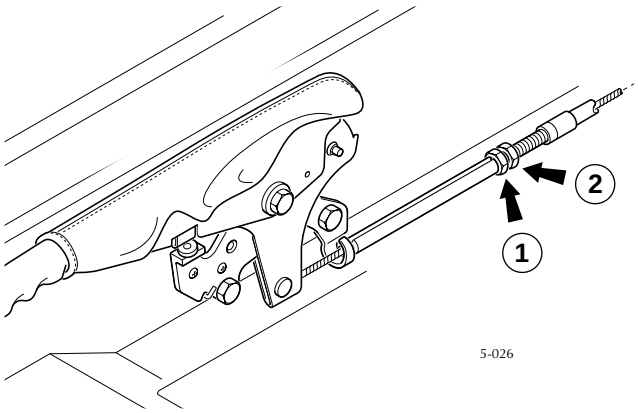
11. Refit the road wheels and tighten the wheel nuts.

12. Lower the ramp.

13. Adjust the handbrake lever cable.

   1 From inside the vehicle, adjust the cable until upon application of the handbrake, only three to four notches of the ratchet are felt / heard.

   2 Tighten the locknuts.



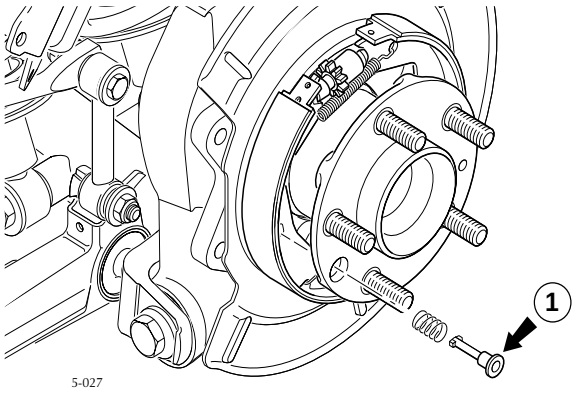
14. Refit the sound insulation and secure the sill carpet velcro fastener.

15. Lower the vehicle to the ground and torque the wheel nuts to 88-102 Nm.

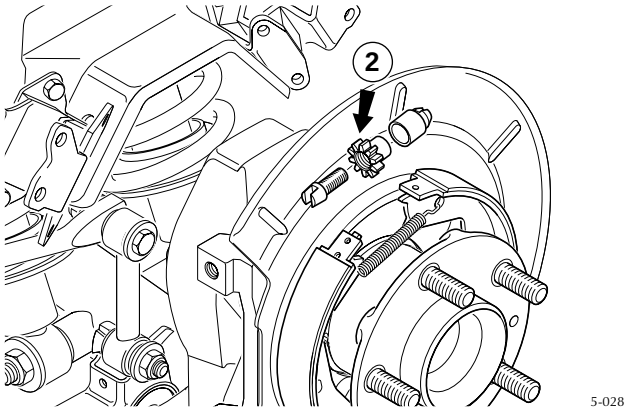
5.3.03 Handbrake Shoes - Renew

Removal

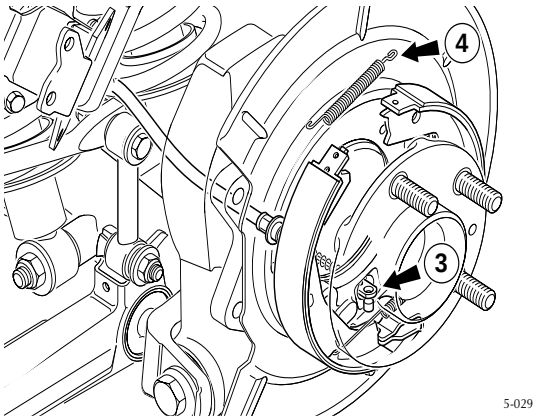
1. Raise the vehicle on a four point hoist and remove the rear road wheels.
2. Remove the rear brake calipers (5.2.04).
3. Remove the rear discs.
4. Position the hub access hole to expose each handbrake shoe retaining pin in turn. Release both retaining pins.



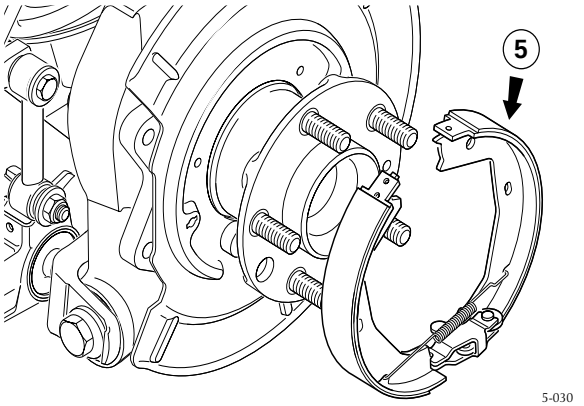
5. Remove the upper adjuster.



6. Release the handbrake cable.



7. Remove the shoe /lower spring assembly from the brake backplate.



Warning:

Brake pad / lining dust can contain asbestos which, if inhaled, can damage your health. Always use a vacuum brush or aqueous brake cleaner to remove brake pad dust. Never use an air line.

8. Carefully remove brake dust / dirt from the brake system components.

Installation

1. To install reverse the removal procedure.
2. Carry out the handbrake setting procedure (5.3.02).

Wheels and Tyres

Specifications

Normal Use

Unique Aston Martin lightweight aluminium alloy wheels. 8J x 18 Front, 9J x 18 Rear

Bridgestone SO2 unidirectional tyres. 245 x 40 FZ 18 Front, 265 x 35 CZ 18 Rear

Tyre Pressures:

For normal use:

Front: 2.4 bar 240 kPa 34psi **Rear**: 2.4 bar 240 kPa 34psi

For additional comfort at speeds below 160 km/h (100mph)

Front: 2.0 bar 200 kPa 29psi **Rear**: 2.0 bar 200kPa 29 psi

Winter Wheels and Tyres

Wheels: Four standard DB7 Vantage front wheels - 10 spoke lightweight aluminium alloy 8J x 18 wheels.

Tyres: Pirelli 235/40 Winter 210 tyres.

This wheel tyre combination should be fitted to both axles and may be fitted with DB7 Vantage snow chains.

Winter Tyre Pressure

2.5 bar 250kPa 37psi

Spare Wheel

Pirelli 115/85 R18

Tyre Pressure: 4.14 bar 414 kPa 60psi

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.

Pressure

The tyre inflation pressures specified provide optimum ride and handling characteristics for all normal conditions.

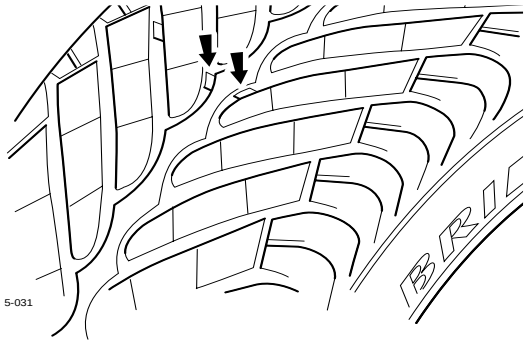
Tyre pressures should be checked and, if necessary, adjusted weekly with the tyres cold i.e. not immediately following use as pressure increases with temperature due to road friction. 'Bleeding' a warm tyre to the recommended pressure will result in under-inflation which can be both dangerous and reduce 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/cm^2) 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.

Description

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.

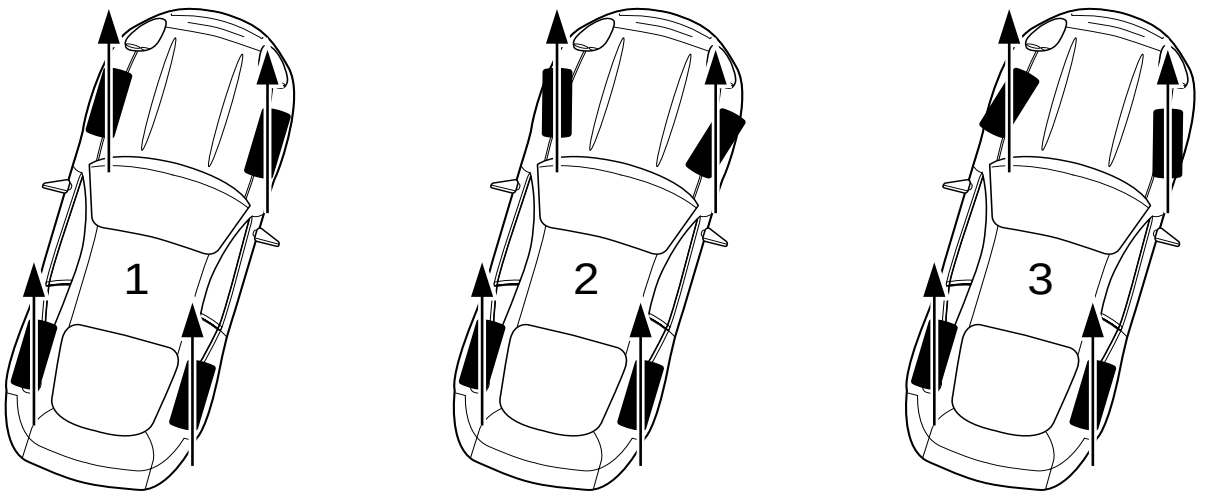
'Fins' on the inside edges of the pattern ribs, particularly on the nearside tyre, indicate toe-in. 'Fins' on the outside edges, particularly on the offside tyre, indicate toe-out.

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 as illustrated in an exaggerated form in Fig. 1-1. 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.

5.5.01 Road Wheel Removal and Refitting

Procedure

1. Apply the handbrake.
2. Remove the trim cap from the special nut using the extractor tube from the toolkit.
3. Slacken the four normal wheel nuts in turn. Using the special socket from the toolkit, slightly loosen the fifth special wheelnut.
4. Jack up the relevant axle and place on stands.
5. Remove the road wheel securing nuts.
6. Remove the road wheel and tyre assembly.
7. Fit the replacement road wheel and tyre assembly up to the hub and secure the wheel with the wheel nuts. Tighten the wheel nuts sufficiently to accurately locate the wheel and to bear the vehicle weight.
8. Take the weight of the vehicle with a jack, remove the axle stands, lower the vehicle and torque the wheel nuts to 88 - 102 Nm.
9. Refit the special nut cap.

5.5.02 Spare Wheel

Description

The spare wheel is intended for temporary use only and must be replaced with the standard wheel type as soon as possible.

WARNINGS:

WHEN A TEMPORARY-USE SPARE IS FITTED, THE FOLLOWING PRECAUTIONS MUST BE OBSERVED:

READ THE WHEEL'S WARNING LABEL AND ADHERE TO THE INSTRUCTIONS. FAILURE TO COMPLY CAN BE DANGEROUS.

DRIVE WITH CAUTION, AND REFIT THE STANDARD ROAD WHEEL AS SOON AS POSSIBLE.

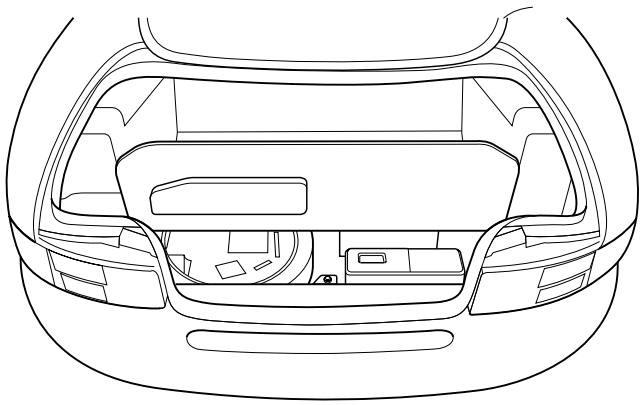
NEVER FIT MORE THAN ONE TEMPORARY-USE SPARE WHEEL AT A TIME.

ALWAYS CHECK THAT THE SPARE TYRE IS INFLATED TO THE SPECIFIED PRESSURE.

NEVER EXCEED 80 KM / H (50 MILE / H).

Spare Wheel Access

1. The spare wheel, tools and jacking equipment are stowed in the luggage compartment.



2. Lift the rear edge of the floor cover and fold it forwards. Then lift the folded floor cover and remove it from the boot.
3. Lift out the wheel insert containing the jack and tool kit
4. Unscrew and remove the wheel retaining bolt. Lift out the wheel.

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Electrical Systems General Description

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.

This module initiates the deployment of both airbags and simultaneously fires the Seat belt pretensioners, when a front impact above a pre-set threshold is detected. Safing sensors are 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 one signal provided by the occupant restrain module (single point sensing). The system is not designed to Individually deploy or fire an airbag or seat belt pretensioner.

The system is only active when the ignition is on and for approximately one minute after the ignition is switched off.

Security Systems

Vehicle protection is provided by the security module mounted beneath the boot fusebox. 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 two button key fob. The left (key symbol) button controls the normal locking/unlocking of the car and arms/disarms the alarm system. The right (boot open symbol) button controls the unlocking of the boot. The Panic Alarm feature is operated using the left key fob button.

The security system aerial is located below the rear window. The normal operating range of the key fob is approximately 10 metres (30 feet).

Note: The security system description is for restricted circulation and may not appear in this manual.

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 encoded ignition key identification code 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 inside the drivers side 'A' post.

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.

DB7 Vantage 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.

Battery Disconnection and Reconnection

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 sounder unit.

To prevent the alarm from sounding when the battery is disconnected for workshop procedures, disconnect the battery within 10 seconds of disarming the vehicle.

Many procedures require the vehicle battery to be disconnected. The following electrical systems are affected by battery disconnection. Carry out the following procedures upon reconnection of the battery.

1. Reset the clock (the radio preset will also be lost).
2. Reset the window maximum up and maximum down settings.
    1 Close both doors and turn on the ignition key.
    2 Press and hold each window down button in turn until the window motor stalls in the maximum down position.
    3 Press and hold each window up button in turn until the window motors stall against the door seal in the maximum up position.

    Each window should open fully when the down switch is momentarily pressed and close in one movement if the up button is held pressed.

Transmission Effects

Disconnection of the vehicle battery (and some control modules) will cause shift adaptations to be lost; this may be apparent by slight shift quality degradation. Shift quality adaptations are made to compensate for changing transmission characteristics due to wear in the clutches over time. Following reconnection, a period of adaptation will be required as the TCM re-learns the transmissions operating characteristics.

Fault codes may be introduced reconnection. Make sure that no induced codes exist in the TCM memory.

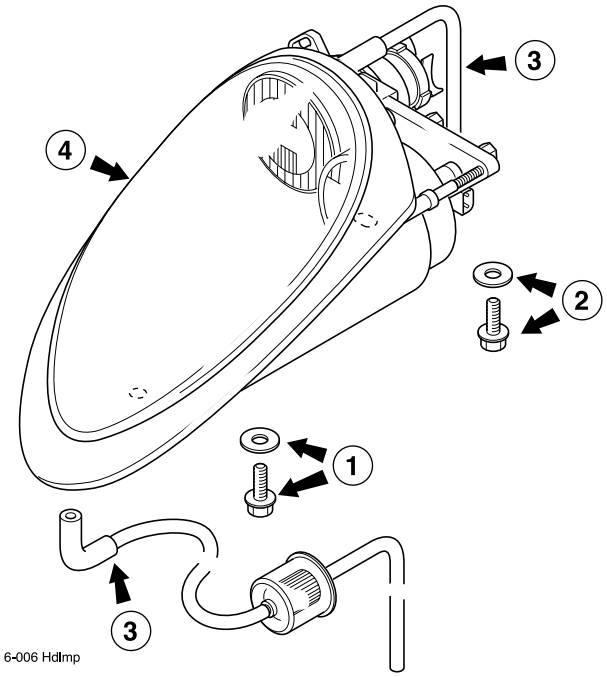
Engine Effects

Disconnection of the vehicle battery (and some control modules) will cause the engine Keep Alive Memory (KAM) to be lost. Gradual adjustments made by the PCM to the air / fuel ratio, to compensate for changing engine characteristics over a period of time, will be lost. A short period of uneven running will be experienced, for five to ten miles, while the PCM re-learns the vehicle characteristics and makes the necessary adjustments.

6.1.01 Headlamp Unit

Removal

1. Remove the front apron undertray and remove the complete nose assembly.



2. Release the headlamp plug from the body clip and disconnect the plug.
3. Remove one bolt from the front headlamp mounting.
4. Remove the main beam lamp access cover and loosen the rear headlamp mounting bolt.
5. Disconnect the front and rear headlamp vent tubes.
6. Lift off the headlamp assembly.
7. On refitting the headlamp assembly, carry out the headlamp alignment procedure.

Headlamp Alignment

Data

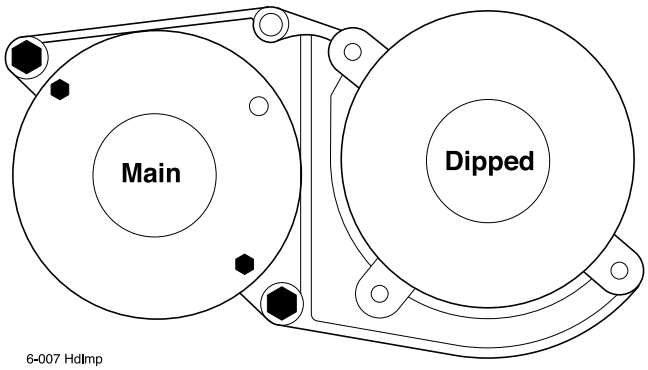
Main Beam Alignment	1.5° Down
Dipped Beam Alignment	1.5° Down

Tools

Headlamp Alignment Gauge

Procedure

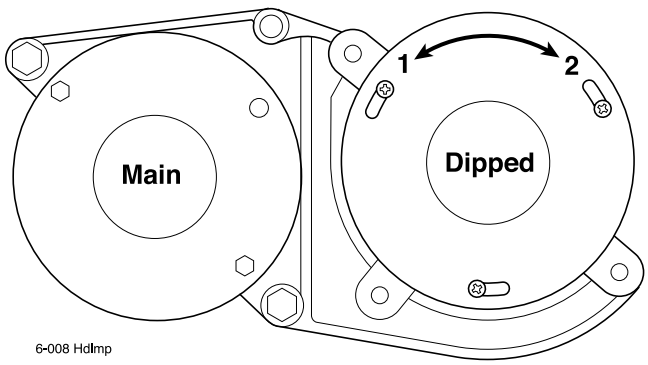
1. Headlamp alignment should be carried out with the vehicle at half laden weight.
2. Lift the bonnet and remove the main beam access cover from the headlamp unit.
3. Using the large hex adjusters, align the outer dipped beams to the correct pattern in alignment gauge.



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.

Dipped Beam Conversion - UK - Europe - UK

1. Access the dipped beam lamps through the panels in the wheel arch liners.
2. Cut the tie strap securing the rubber gaiter and pull back the gaiter.
3. Slacken 3 screws securing the lamp backplate and rotate the plate to the right for UK or to the left for Europe to the limit of the bolt slots.

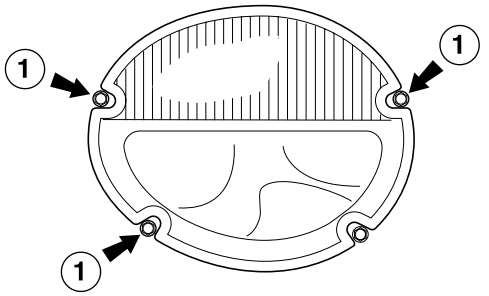


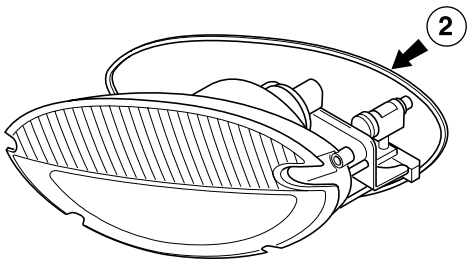
4. Tighten the three screws, replace the gaiter and secure it with a new tie strap.

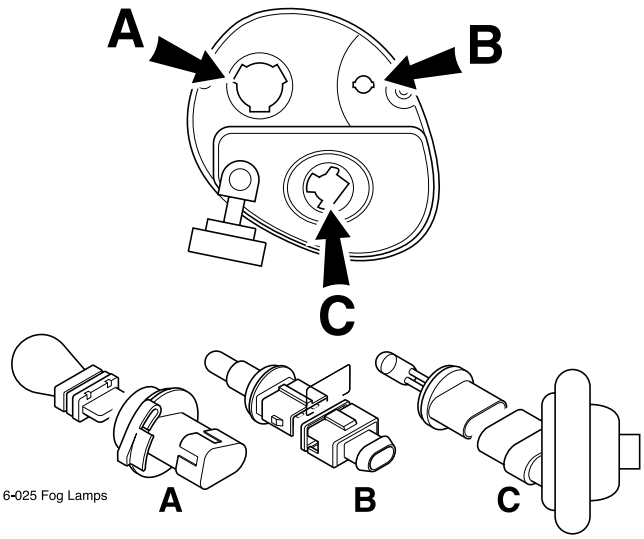
6.1.03 Front Indicator/Parking/Fog Lamp Unit

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



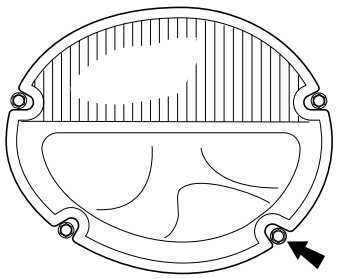




6-025 Fog Lamps

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.

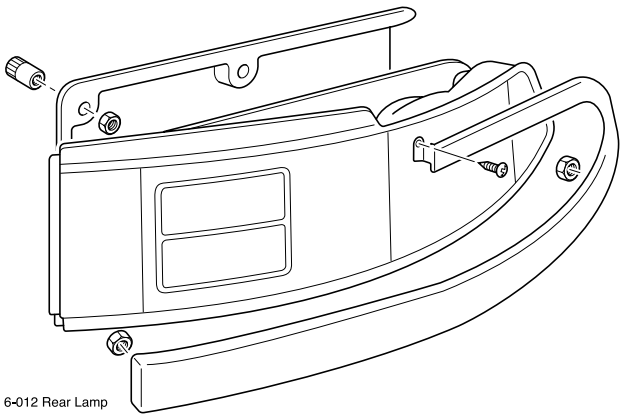


6-004 Fog Lamp

6.7.02 Rear Lamp Cluster

Removal

1. Remove the rear lamp cluster inner cover.
2. Release the boot rear liner.
3. Release the two nuts and one screw securing the rear lamp surround and remove the surround.



6-012 Rear Lamp

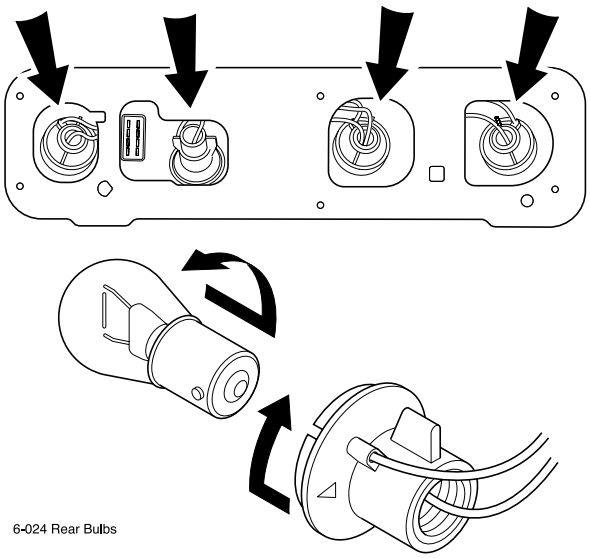
4. Disconnect the rear lamp cluster multi-plug.
5. Remove six nuts from the rear of the assembly and lift out the lamp cluster

Bulb Renewal

To renew a rear lamp cluster bulb only:

1. Pull forward the rear boot lining to access the defective light cluster.
2. Remove the foam pad.
3. Rotate the light holder a quarter turn anticlockwise and remove it.
4. Rotate the bulb anticlockwise in the holder and remove the bulb.
5. Fit a new bulb and turn it clockwise to lock it into the holder.

   NOTE: All cars except North America - The stop/rear light bulb has two filaments and offset bayonet pins. Ensure correct orientation when fitting.
6. Refit the bulb holder to the light cluster and refit the foam pad and boot lining.

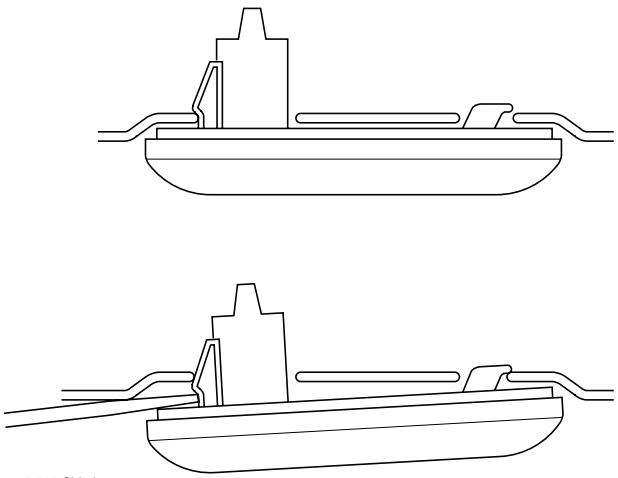


6-024 Rear Bulbs

6.1.05 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

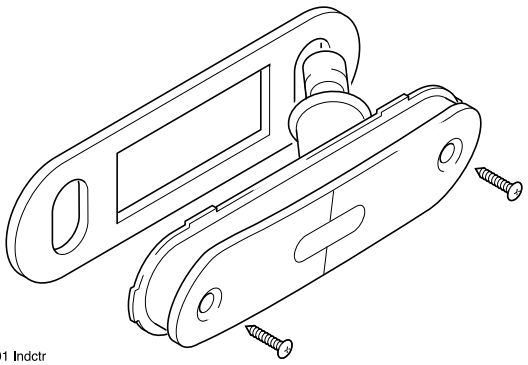


6-009 Side Lamp

6.1.06 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.



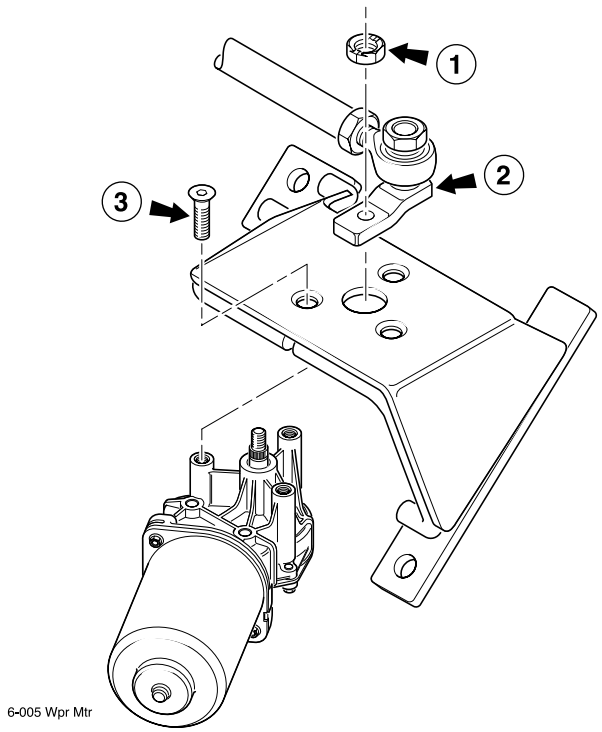
6-001 Indctr

6.2.01 Windscreen Wiper Motor

Removal

1. Disconnect the battery earth lead.
1. Remove the nut and lock plate and remove the drive bracket from the motor shaft.

   Displace the rod and drive bracket.
2. Remove three bolts and separate the wiper motor from mounting bracket.
3. Disconnect the wiper motor multi-plug and remove the motor.

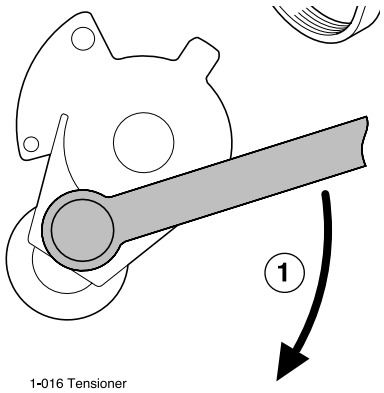


6-005 Wpr Mtr

6.3.01 Alternator

Removal

1. Disconnect the battery earth lead.
2. Remove the polyvee drive belt from the alternator drive pulley
   1 Using a 1/2 inch ratchet handle 'T' bar, rotate the drive belt tensioner clockwise and slip the belt from behind the tensioner pulley.
   2 Slip the belt off the alternator drive pulley

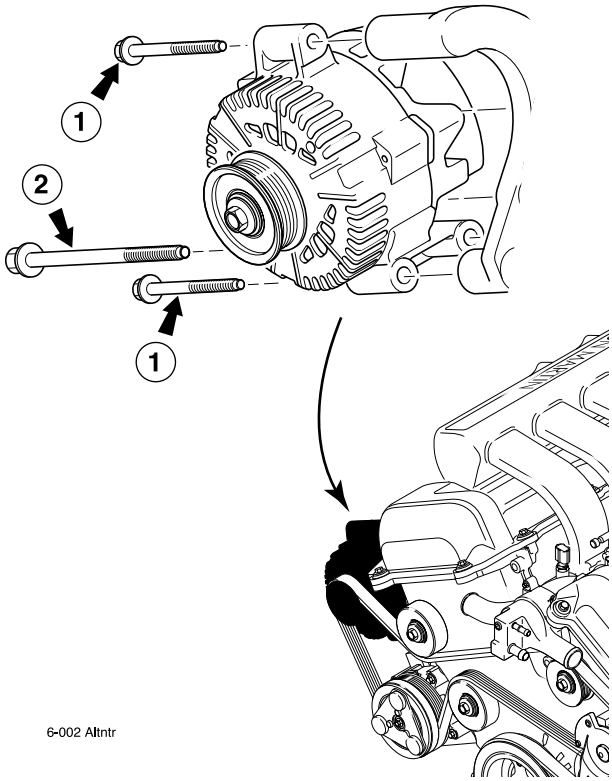


1-016 Tensioner

3. Remove the alternator output lead cover, remove the nut and washers and disconnect the alternator output lead.
4. Disconnect the electrical plug on the rear of the alternator.
6. Remove two M10 x 100 bolts and washers and one M10 x 150 bolt and washer from the alternator bracket. Remove the alternator.

Installation

To install, reverse the removal procedure. Refit the polyvee drive belt as follows:



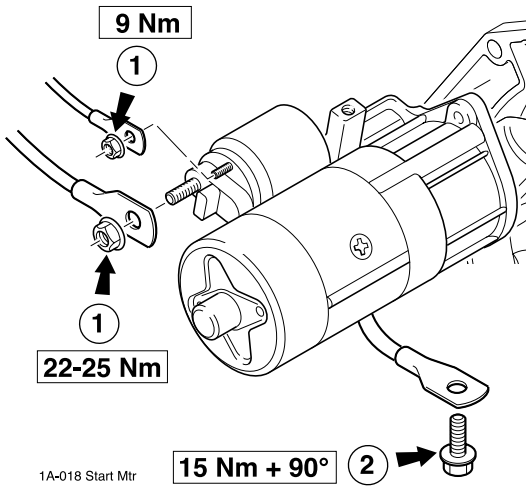
6-002 Altntr

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.

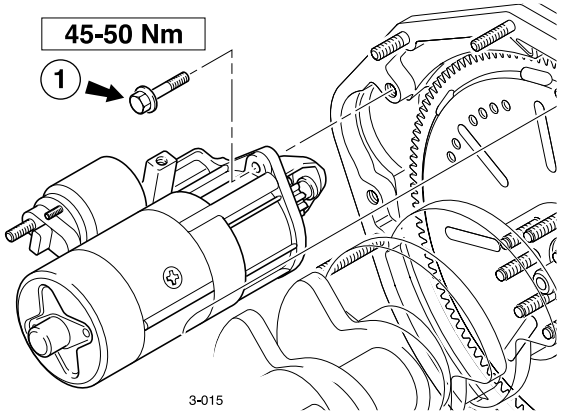
6.3.02 Starter motor

Removal

1. Disconnect the battery earth lead.
2. Raise the vehicle.
3. Disconnect the starter motor solenoid connector and the starter motor power lead.



4. Remove two bolts and remove the starter motor.

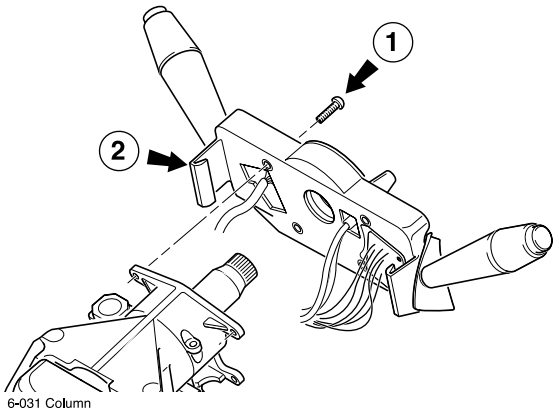


6.5.02 Column Switches

Removal

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.

1. Remove the airbag (4.5.01.3). See Electrics - Section 6.
2. Remove the steering wheel (4.3.05.1).
3. Remove five M4 screws and remove the upper and lower steering column cowls.
4. Remove four torx screws
5. Disconnect the loom electrical connections.
6. Unclip the switch assembly from the steering column and remove.



Installation

1. To install, reverse the removal procedure.

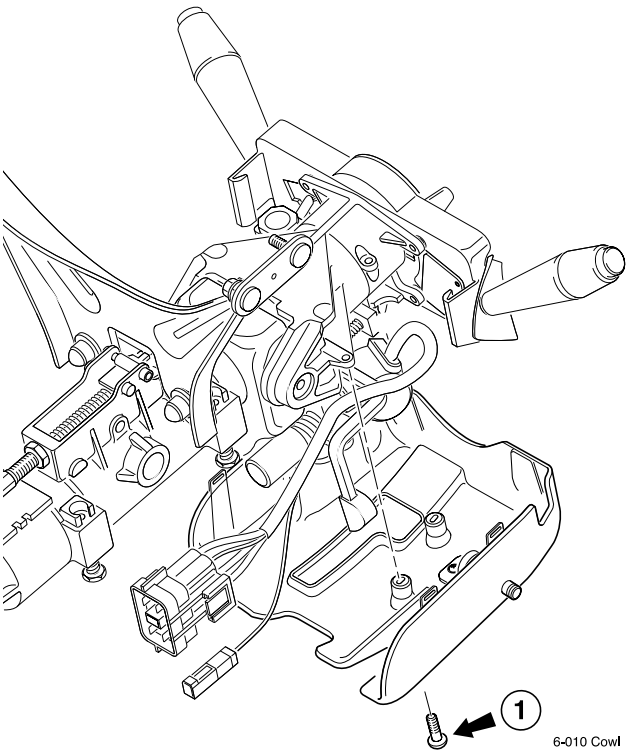
WARNING: DO NOT refit the airbag without first reading and fully understanding the warnings related to airbag removal. Follow the step by step procedure for refitting the airbag.

2. Refit the airbag (4.5.01.3). See Electrics - Section 6.

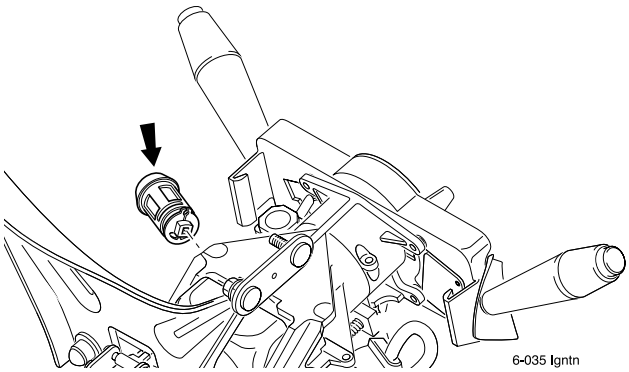
6.5.03 Ignition Switch

Removal

1. Disconnect the vehicle battery.
2. Remove three M4 screws and remove the steering column lower cowl.



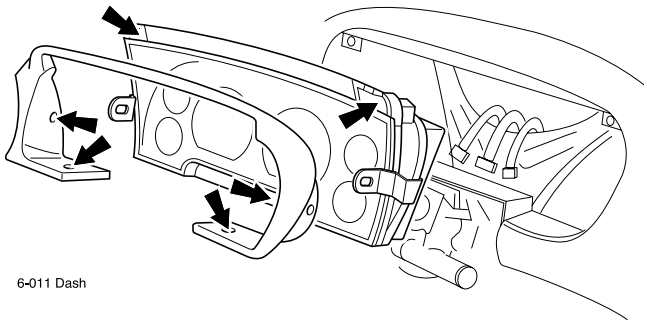
3. Loosen the grub screw securing the switch and ease the switch from its location.
4. Disconnect the multi-plug and remove the switch.



6.5.04 Instrument Panel

Removal

1. Disconnect the vehicle battery.
2. Disconnect the four screws from the instrument panel surround and remove the surround.
3. Remove two screws from the top edge of the instrument panel and withdraw the panel.
4. Detach three electrical connectors and remove the instrument panel.



5. Panel warning lamps are 1.2W bayonet fit. The larger panel illumination lamps are also 1.2W bayonet fit.

6.5.05 Radio

Removal

1. A special tool is required to remove the radio trim. When the trim is removed, two keys are required to remove the radio unit from the centre console.

   The special tool and the keys are supplied by the radio manufacturer. Full instructions for the removal of the radio are given in the radio manufacturers handbook.

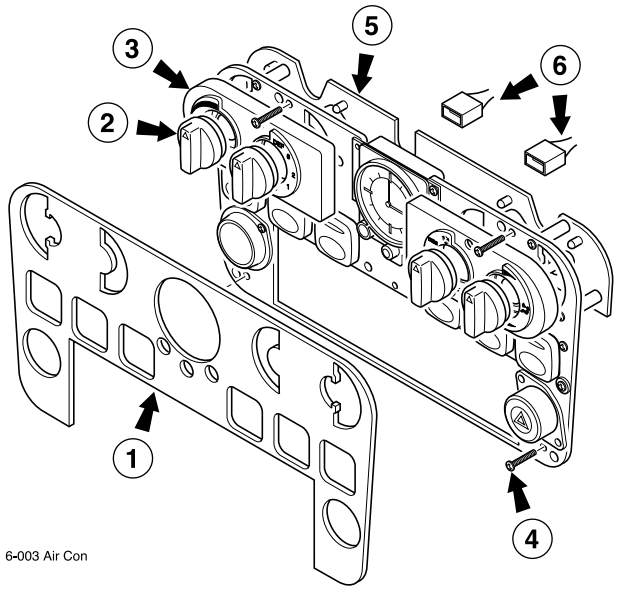
6.5.06 Air Conditioning and Switch Panel

Removal

1. Remove the radio (6.5.05)
2. Remove the air conditioning switch panel.
   1. Carefully remove the veneer finisher panel.
   2. Pull off four control knobs.
   3. Remove two finisher mouldings.

   Note: The finisher mouldings are secured in position by the control knobs.

   4. Remove four screws
   5 Pull the air conditioning control panel forward.
   6. Disconnect all electrical connectors and remove the control panel.



6-003 Air Con

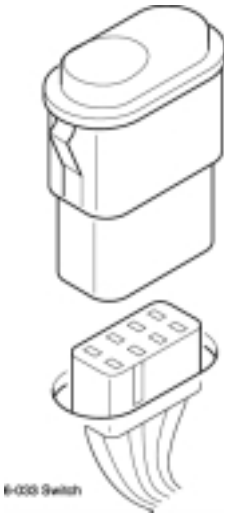
6.5.07 Window, Hood, Transmission Mode and Traction Control Switches

Removal

1. ***Caution: Make sure that the wood finisher is protected before levering out the switch***

   Using a suitable lever, raise each end of the switch to release the spring clips.

2. Pull the switch clear of the wood finisher and disconnect the electrical connector.



6.5.08 Seat Control Switch Panel

Removal

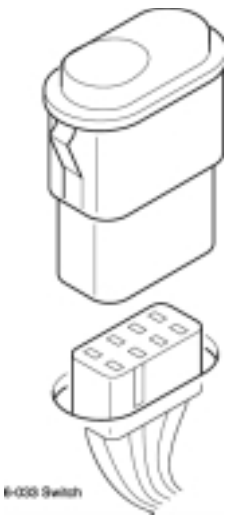
1. Drive the seat forward to access the switch panel.

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.

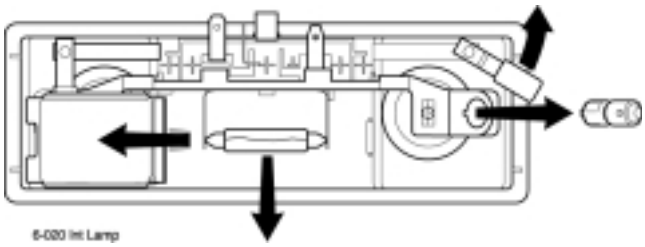
4. Pull the switch clear of the finisher and disconnect the electrical connector.



6.6.01 Front Interior Lamps

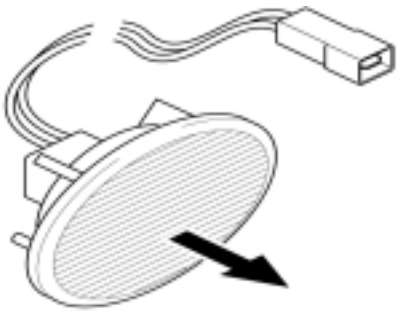
Removal

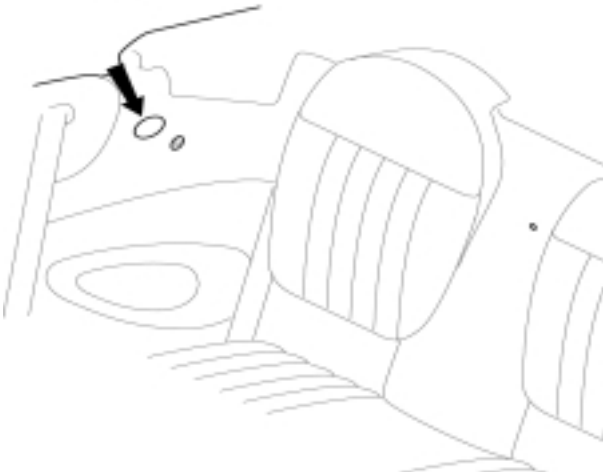
1. Release the quarter turn fastener on the light assembly and lower from the roof liner.
2. To renew an interior light festoon bulb, pull the defective bulb from its clips and insert a new one.
3. To renew a map reading light bulb, swing the bulb contact away from the bulb. Lift out the defective bulb and fit a replacement. Swing the bulb contact back to its original position.
4. Refit the light assembly to the roof lining and secure by turning the quarter turn fastener clockwise.



6.6.02 Rear Interior Lamps

1. Taking care not to damage the interior lining, prise the rear interior light assembly from the lining.
2. Disconnect the electrical connector and remove the assembly.





6.6.03 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. Lift the footwell carpet, release the access plate securing screws and remove the plate to gain access to the seat control unit.
4. Remove the tie wraps securing the seat loom.
5. Disconnect all harness connectors.
6. Remove the seat assembly.

6.6.04 Front Seat Runner Assembly

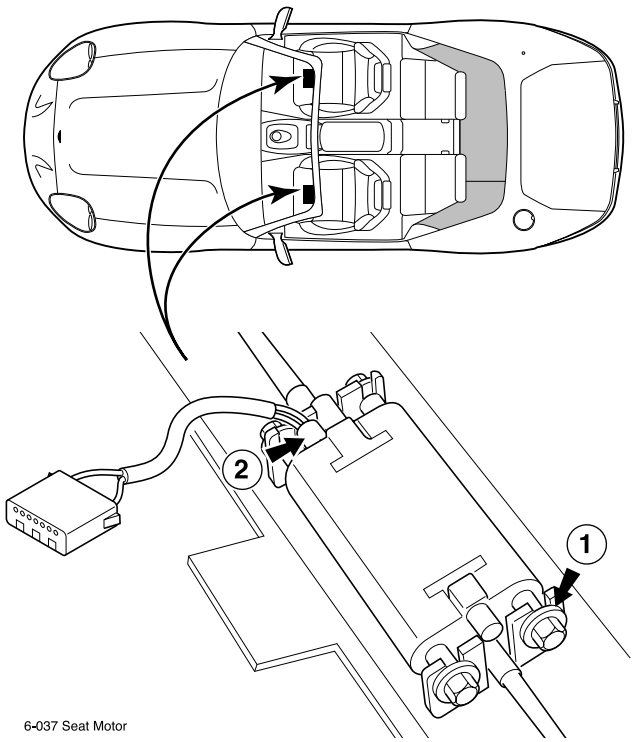
Removal

1. Remove the seat from the car (6.6.03).
2. Cut the tie wraps securing the seat belt buckle harness and disconnect the buckle harness plug.
3. Position the runner as required and release the bolts securing the front and rear of the seat frame.
4. Release the front harness from its retaining clips and disconnect the multi-plugs.
5. Remove the complete seat runner assembly .
6. ***WARNING: Before working on the seat belt, disconnect the battery and wait for ten minutes to allow the occupant restraint module's back-up power supply to dissipate.***
7. Remove the seat belt bolt trim cover and remove the seat belt bolt, buckle and buckle bracket.
8. Fit and secure the seat belt buckle to the replacement seat runner assembly.

6.6.05 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.



6-037 Seat Motor

6.6.06 Lumber Support Motor

Removal

1. Remove the seat from the car (6.6.03) and remove the seat back finisher panel.
2. Disconnect the lumbar motor plug and the lumbar diaphragm air line and remove the motor.

6.6.07 Seat Recline Motor

Procedure

1. Remove the seat from the car (6.6.03) and remove the seat back finisher panel.
2. Disconnect the recline motor connector.
3. Disconnect the trigger cable from the motor.
4. Loosen two screws and remove the recline motor from its bracket.

6.6.08 Seat Control Module

Remove

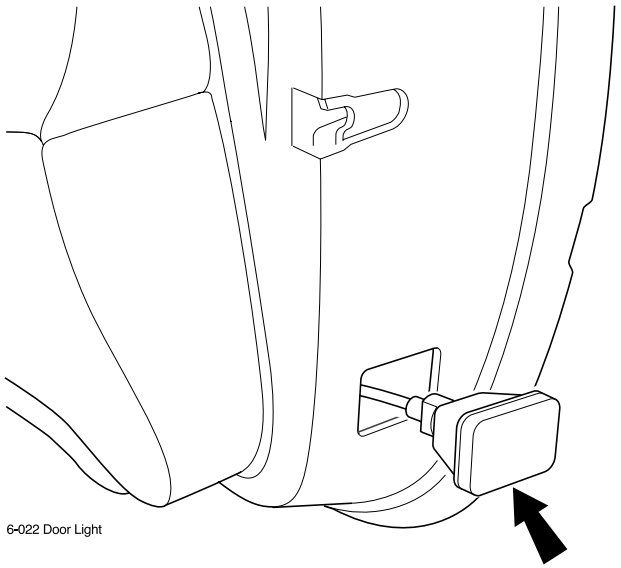
1. Lift the footwell carpet.
2. Release the access plate securing screws and remove the plate to gain access to the seat control module.
3. Disconnect the multi-plug from the control unit.
4. Release the securing screws and remove the seat control unit.

6.7.01 Door Edge Lamps

Remove

1. ***Caution: Make sure that the paintwork is protected before levering out the assembly.***

   Lever the lamp assembly from the door edge.
2. Disconnect the electrical connector and remove the lamp assembly.



6-022 Door Light

Supplementary Restraint System (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.

Airbags are installed in the centre of the steering wheel and the passenger side fascia. Single point sensing of the SRS is controlled by the occupant restraint control module, centrally mounted on the transmission tunnel. This module initiates the deployment of both airbags and simultaneously fires the Seat belt pretensioners, when a front impact above a pre-set threshold is detected. Safing sensors are 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 one signal provided by the occupant restrain module. The system is not designed to Individually deploy or fire an airbag or seat belt pretensioner.

The system is only active when the ignition is on and for approximately one minute after the ignition is switched off.

Airbags

Driver Airbag

The driver airbag module is fitted in the centre of the steering wheel and is of conventional design.

The airbag module is secured by two screws on the left and right underside of the steering wheel.

Passenger Airbag

WARNING: Do not place objects on the passenger airbag deployment pane. Injury could occur if the airbag contacts an object during inflation.

The passenger airbag uses a heated gas inflator (HGI) system instead of a solid propellant. This system is inherently clean since the inflation gas is a lean hydrogen/air mixture and the by products are water vapour and air.

Although the gas is classified as an explosive, the possible effects of accidental deployment when handling or working close to the unit are similar to those of other types of airbag.

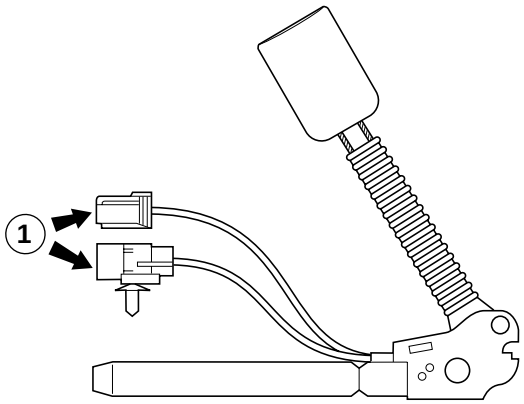
It is recommended that current safety procedures are also followed when handling the HGI modules.

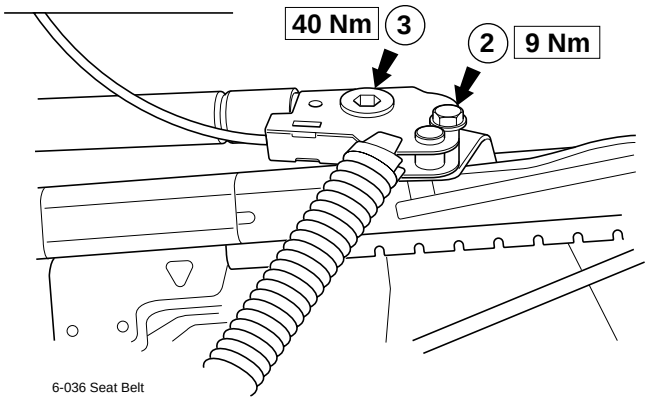
The igniter is electrically triggered by the restraints control module. When triggered the igniter fires a high speed 'dart' along the length of the pressured cylinder, producing a heated trail (due to friction) which causes rapid and even combustion of the gas throughout the cylinder. The igniter also ruptures the burst disc in the end plug, allowing the expanding gases from the pressure vessel to inflate the airbag.

The airbag deployment door is an integral part of the fascia moulding. Two webbing straps are attached between the door and the anchor bracket of the airbag module. Four integral pegs retain the door in clips in the fascia. Note that the clips should be replaced each time the door is removed.

Front Seat Belt Pretensioners

Each of the front seat belts has a pyrotechnic pretensioning retractor unit mounted inboard of the occupant on the seat frame. The pyrotechnic device is easily recognisable by the long piston tube attached to the unit. These offer protection in the event of a severe frontal impact by firing and removing excess slack from the seat belt system.





6-036 Seat Belt

The pretensioner firing signal is provided by the occupant restraint module which simultaneously deploys the airbags.

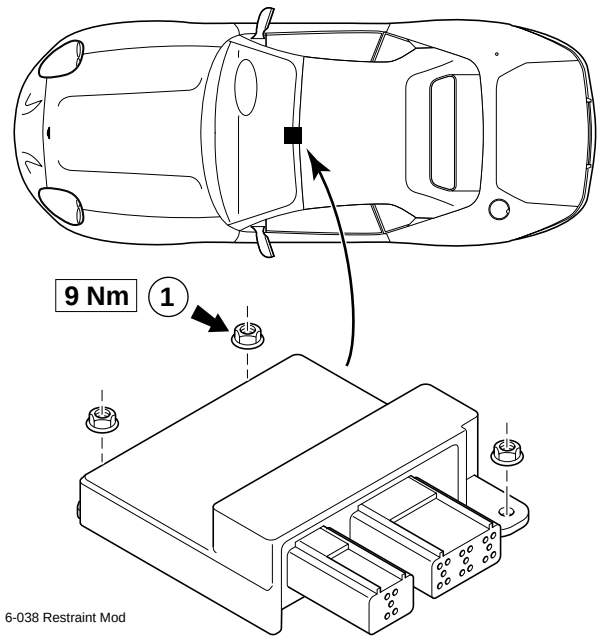
When the seat belt pretensioners are fired a gas generator is ignited which initiates a chemical reaction which creates gases under pressure. These gases drive the piston/cable assembly which removes the excess slack from the belt.

Note: If the seat belt pretensioner activates, a small quantity of gas (less than 1 litre) is produced, containing nitrogen, oxygen and water vapour.

Occupant Restraint Module

The occupant restraint module:

- Houses the electro-mechanical single point sensor which detects a frontal impact.
- Provides a single firing signal to both airbags and seat belt pretensioners.
- Performs on-board testing of the airbag and pretensioner firing circuits, warning indicator circuits and module status.
- Stores fault codes in non-volatile memory.
- Drives the airbag warning lamp on the instrument pack. If the warning lamp is faulty (fault code recorded) an audible warning tone is sounded.
- In the event of an impact, sends a signal to the PCM to indicate that a crash has occurred.
- Is connected to the data link connector via the SCP data bus to enable communication with an external PDU or scan tool.
- Provides temporary back-up power to operate the airbags in the event of loss of battery power in an impact.
- In the event of an impact, records certain data for subsequent access via the data link connector. This data includes deceleration information, firing delay and fault codes.



6-038 Restraint Mod

The module is mounted beneath the cubby box, on a bracket on top of the transmission tunnel and is secured by three nuts. Due to the importance of the module being securely fixed to the vehicle body, the ground connection is made via the fixing nuts and is monitored by the diagnostic system.

Occupant Restraint System Diagnostics

The occupant restraint module performs all SRS diagnostics. When the ignition is switched on, the module carries out a system prove out over an eight second period. During this period, the airbag warning lamp on the instrument pack is lit for the first six seconds, while all circuits connected to the module are tested.

If any faults are detected, the airbag warning lamp flashes a two digit code five times and then remains lit until the ignition is switched off. This is repeated on each cycle until the fault is cleared.

Fault codes are allocated a priority and if more than one fault is stored in the occupant restraint module memory, the highest priority fault is flashed, when this fault is rectified, the next priority fault is indicated.

The module communicates the current and historical fault codes through the data link connector using the portable diagnostic unit.

The module includes an internal back up supply. This feature provides sufficient backup power to deploy the airbags in the event the battery or battery cables are damaged in a collision before the safing function closes.

The backup power supply gives sufficient power for 150 milliseconds to close safing functions to fire or deploy airbags and seat belt pretensioners. The backup power supply will deplete its stored energy approximately minute after the battery ground cable is disconnected.

Safety Precautions and Warnings

The following procedures and safety precautions must be adhered to while handling, installing and testing airbag modules. Failure to observe these precautions could cause the airbag to inadvertently deploy with the risk of personal injury.

The procedures and precautionary guidelines conform to the 'Handling and storage - The Explosives Act 1875 & 1923' and to the 'Health and Safety at Work Act - 1974' or local guidelines as appropriate.

Handling Undeployed Airbags

The electrically actuated airbag module contains sodium azide and sodium nitrate which are poisonous and extremely flammable substances.

Their contact with acid, water or heavy metals may produce harmful, irritant gases or combustible compounds.

WARNING: Sodium azide has been listed as an 'Extraordinary Hazardous Substance or Carcinogen' by the state of Massachusetts, USA. Sodium azide has been listed on the 'Right to Know Hazardous Substance List' by the state of New Jersey and is also regarded as a 'Special Health Hazard Substance' by the state. The propellant mixture is sensitive to premature ignition by electrical sources if not properly protected and isolated.

Storage

Store modules in a secure lockable cabinet, in a dry environment at ambient temperatures

Ensure that the module connector is protected to prevent damage.

Good housekeeping and engineering practices should be employed to prevent the generation and accumulation of dusts. Store in compliance with all local state and federal regulations

WARNING: Keep away from heat, sparks and open flames. Do not store at temperatures exceeding 93°C (200°F).

WARNING: Keep away from electrical equipment as electrical contact may cause ignition

WARNING: Do not drop or impact the airbag module. Always position the module 'cover-up'.

Servicing

The airbag module is non-serviceable and must not be dismantled, punctured, incinerated or welded.

Tampering or mishandling can result in personal injury.

WARNING: As the airbag control module is equipped with a back-up power source. To avoid the risk of the airbag being inadvertently deployed, wait ten minutes or longer after disconnecting the battery before starting work on the airbag module.

WARNING: Do not attempt any repairs or electrical measurements on the airbag module.

WARNING: Never measure the resistance of the airbag module, as this may cause the airbag to deploy. Suspect modules must be returned to Aston Martin Lagonda Limited, or their importer for replacement.

General Handling Advice

The chemical propellant mixture deploying the airbag is a solid and therefore inhalation exposure is unlikely even if the module is ruptured without deployment.

As far as practical, avoid skin contact with, or ingestion of, the materials present after combustion. Exposure to high concentrations of propellant mixture may cause headache, nausea, blurred vision, faintness, cyanosis, lowering of blood pressure, tachycardia and shortness of breath.

WARNING: Never carry the airbag module by the wires or connector.

WARNING: Never position material over the undeployed module which could be projected and cause injury in the event of inadvertent deployment.

WARNING: Do not wrap arms around the module when carrying and always carry the module with the cover and vents facing away from the body to avoid personal injury in the event of inadvertent deployment.

WARNING: Always wear safety glasses when handling undeployed airbags or working on the SRS system.

Emergency First Aid Procedures

If the airbag is ruptured without deployment and exposure to the propellant mixture occurs, observe the following first-aid treatments:

- Ingestion - Do not induce vomiting. Seek prompt medical attention.
- Skin contact - Immediately wash skin with soap and water and seek medical attention.
- Eyes - Immediately flush eyes with water for at least 20 minutes and seek prompt medical attention.
- Inhalation - Immediately move victim to fresh air and seek medical attention.
- Physical trauma, e.g. burns, abrasions, or impact due to premature ignition or deployment of the inflator assembly - Treat symptomatically and seek prompt medical attention.

Health and Safety

When Handling Deployed (Fired) Modules

See 'Emergency First Aid Procedures'

Prevent contact of the inflator with liquids, combustibles and flammable materials. Failure to follow these instructions could result in chemical burns and personal injury.

Ensure that the modules are cool before handling.

After deployment, the airbag surface contains small deposits of sodium hydroxide which can cause irritation to the skin and eyes.

When handling deployed airbags, always wear rubber gloves to BS 1651 grade 2 or equivalent, and chemical resistant goggles to BS 2092 grade 2 or equivalent.

After handling deployed airbags, immediately wash hands and exposed skin surface areas with mild soap and water.

When Handling Undeployed Damaged Modules

The material inside the module is hermetically sealed and is completely consumed during deployment.

No attempt should be made to open the module as this leads to a risk of exposure to sodium azide.

In the unlikely event of a gas generator being damaged, it must be examined by trained personnel before any attempt is made to remove and/or deploy.

Full protective clothing must be worn when dealing with any spillage.

Ruptured units must be stored away from acids, halogens, heavy metals and metal salts. Damaged units may produce hydrazoic acid if exposed to liquids.

Failure to comply with these instructions may result in fire, noxious fumes and severe personal injury or death.

Fire Hazard Information

Thermal decomposition or combustion may produce dense smoke and other dangerous fumes which in fire situations form a highly toxic explosive.

In the event of a fire, the surrounding area must be evacuated and all personnel kept well upwind of the area.

Full fire fighting protective gear and a self contained breathing apparatus operating in positive pressure mode must be worn for combating fire. Material near the fire must be cooled with water spray to prevent ignition.

Fires should be allowed to burn themselves out if not threatening to life or property. If fire is threatening to life or property, use copious quantities of water to extinguish.

Ventilation

Local exhaust ventilation designed by a professional engineer should be provided if vapours, fumes or dusts are generated whilst working with the airbag module.

Respiratory Precautions

To prevent the inhalation of dangerous fumes and dusts, an approved mask should be worn.

Eye Protection

Chemical protective goggles are recommended where there is a possibility of eye contact with the propellant. Safety glasses with side shields are recommended for all other operations.

Protective Clothing

Approved protective gloves, overalls and shoes/boots should be worn.

Scrapping Vehicles with Live Airbags

Equipment required:

Four insulation displacement connectors (scotchlocks).
Charged 'slave' battery.
Two 10 metre lengths of 1mm^2 wire fitted with crocodile clips on one end.

See the Safety Precaution and Warnings at the beginning of this section.

If the airbags are to be removed, see the airbag module removal and installation instructions.

WARNING: Always connect to the airbag first, as the bag will deploy immediately on connection to the battery.

Procedure

When scrapping a vehicle with live airbags, first deploy the airbags in accordance with the following procedure. This procedure assumes that the airbag wiring is undamaged

WARNING: The deployment procedure must be carried out outdoors away from other personnel.

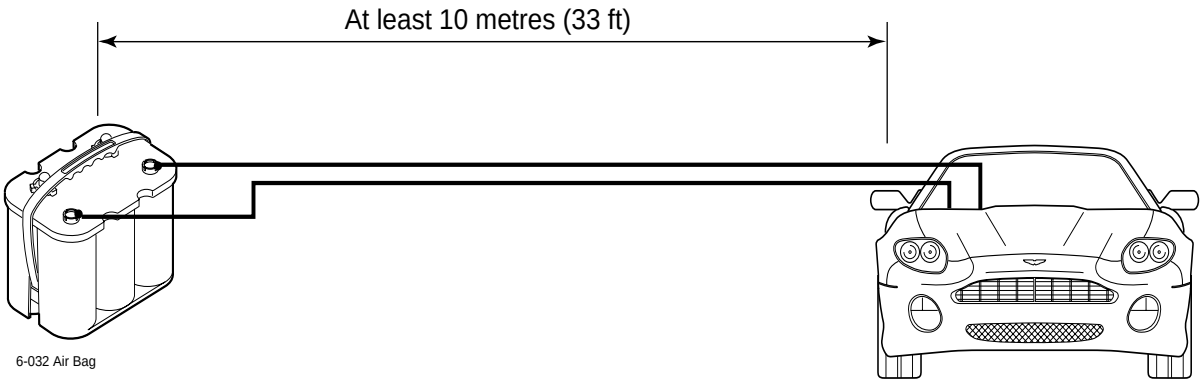
1. Remove any loose debris from around the airbag modules and ensure that no flammable liquids are present.
2. Disconnect the vehicle battery
3. Wait for 10 minutes for the module backup power supply to dissipate.
3. Remove the passenger side airbag deployment door and underscuttle panel.
4. Remove the drivers side underscuttle panel.

WARNING: Make the battery connections last. The airbag will deploy as the battery connections are made.

5. Disconnect the airbag connector to the spiral cassette (under fascia) and at the wire (drivers side).
6. Locate the harness connectors and cut the wires leading from the airbag just above the mating plug (passengers side).

Note: The harness connected between the driver's airbag and the connector has one red/Purple feed wire and one pink/orange return wire. The harness connected between the passenger's airbag and the connector has one red/green feed wire and one pink/purple return wire.

7. Pass the cut ends of the two 10 metre link wires through an open window and connect using two scotchlocks to the feed and return wires for one airbag.
8. Close the vehicle doors and leave the window with the link wires open.
9. Check that no personnel are in the car or in the area around the car. Warn personnel in adjacent areas of the impending airbag deployment.
10. Move back 10 metres and connect the link harness clips to the positive and negative terminals of the slave battery; deploying the airbag immediately.
11. Allow the deployed unit to cool for at least 20 minutes and monitor continuously to ensure that the heat generated during deployment does not create a fire with spilled liquids or other debris.
12. Using all appropriate safety precautions (see all warnings and precautions after the 'Safety Precautions and Warnings' Heading), enter the vehicle and cut the link harness wires from the deployed airbag.
13. Using two new scotchlocks, connect the link harness to the feed and return wires for the second airbag and deploy it by repeating steps 7 to 11.
14. The vehicle may now be scrapped in the normal manner with the deployed airbag modules installed.
15. If you have any problems or queries, contact Aston Martin Lagonda - Technical Services Department.



6-032 Air Bag

Scrapping Vehicles with Deployed Airbags

1. When scrapping a vehicle with a deployed airbag, first check that all installed airbags have been deployed or removed.

2. In the event that only one airbag has been deployed, it must be assumed that the second airbag is still live and therefore must be treated using the 'Scrapping Vehicles with Live Airbags' procedure.

3. When it is verified that both airbags have been deployed or removed, the vehicle may be scrapped in the normal manner.

Disposal of Live Airbags

Modules removed/renewed by Aston Martin dealers are to be deployed using the following procedure.

WARNING: Never use a customer's vehicle to deploy airbags.

Equipment Required:

Link harness
'Slave' battery
Safety goggles to BS 2092 grade 2 or equivalent
Rubber gloves to PrEN 374 class 2 or equivalent
Ear protectors
Particulate respirator to EN 149 grade FFP 25
Deployment cage

Note: If you do not have access to a deployment cage, please contact Aston Martin Lagonda Limited Technical Support Department for advice.

Procedure

This procedure must be performed outdoors, away from other personnel.

1. Remove any loose debris from around the airbag and ensure that no flammable liquids are present.
2. Assemble the disposal cabinet and fit the airbag in accordance with the following procedures:
   a) Remove the mesh guard from the rig frame.
   b) Attach the guard to the frame by bolting the hinges to the frame.
   c) Ensure the relevant plate is fitted and rotate into position.
   d) Fit and secure the airbag module onto the plate.
   e) Clamp the plate down using the two toggle clamps.
   f) Close the mesh guard.

   Note: The harness connected between the driver's airbag and the connector has one red feed wire and one grey/orange return wire. The harness connected between the passenger's airbag and the connector has one blue/ orange feed wire and one pink/black return wire.
3. Connect the 10 metre link harness to the airbag.
4. Ensure that no personnel are in the vicinity of the cabinet.
5. Move 10 metres and connect the link harness crocodile clips to the 'slave' battery; the airbag will deploy immediately.
6. Allow the unit to cool for at least 20 minutes.
7. Open the mesh guard and remove the deployed airbag module.

   Note: Should the design of your deployment cage differ from that described above, please contact the cage manufacturer for advice on mounting the airbag.
8. Seal the deployed module into a plastic bag ready for disposal.
9. In the event of any problems or queries, contact Aston Martin Lagonda Limited - Technical Services Department.

Disposal of Deployed Airbags

Deployed airbags are to be disposed of as special waste and disposal must comply with local environmental requirements. If in any doubt, contact the local authority for disposal instructions.

Note; The storage, transportation, disposal and/or recycling of airbag module components must be performed in accordance with all applicable federal, state and local regulations including, but not limited to, those governing building and fire codes, environmental protection, occupational health and safety and transportation.

Modules removed and deployed by Aston Martin Dealers are to be returned to Aston Martin Lagonda Limited for disposal following prior consultation.

General Servicing Instructions

WARNING: In the event of a vehicle impact where the airbags and the seat belt pretensioner are deployed, the following actions MUST be performed:

- ***Check the condition of the seat belts, steering wheel, steering column, all connections to airbags, and the column switchgear connectors for integrity and damage. If in any doubt, replace suspected parts for new parts.***
- ***Replace the crash sensor, the safing sensor and the seat belt pretensioner module.***
- ***On completion of all repair procedures, switch on the ignition and check that the Airbag/SRS warning light comes on when the ignition is switched on and extinguishes after approximately six seconds indicating satisfactory completion of the airbag and pretensioner system self tests.***

WARNING: Before starting work, ensure that the ignition switch is in position 'O' and the ignition key is removed. Disconnect the battery negative lead within 12 seconds of switching off the ignition to prevent the alarm system triggering.

WARNING: As the airbag control module is equipped with a back-up power source. To avoid the risk of the airbag being inadvertently deployed, wait ten minutes or longer after disconnecting the battery before starting work on the airbag module.

When working on the SRS:

- Disconnecting the battery negative cable cancels the memory for the 'one-touch' window down system and stops the vehicle clock. Reset the window memory and the clock when work is completed.
- Never use airbags from other vehicles, always use new parts.
- After work is completed, reconnect the battery and perform the airbag warning light check
- Never use electrical probes to check voltage or electrical resistance of the airbag modules.
- Disconnect the airbag before carrying out any work on, or in the vicinity of the module, or when using electric welding equipment.
- Always ensure that the battery negative lead has been disconnected for at least one minute before commencing any removal procedure.

Spillage and Leakage

If material is spilled or released, contact Aston Martin Technical Support for advice on clean-up procedures. All personnel must be kept away from the contaminated area.

Do not dispose of contaminated propellant or water into storm or sanitary sewers, ground water or soil.

Spills may be reportable to state and/or federal authorities.

Materials must be disposed of by incineration or chemical oxidation under carefully controlled conditions by specially trained individuals and in accordance with local state and federal regulations.

4.5.01.3 Driver's Airbag Module Renew

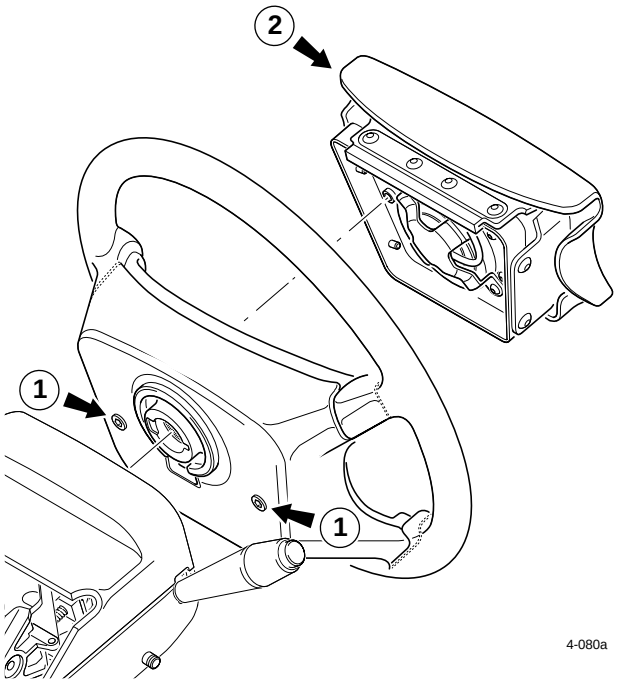
Read and follow all warnings and safety procedures and the General Service Instructions before working on airbag modules.

1. Ensure that the steering system is centralised and that the steering wheel is in the lowest tilt position.

2. Disconnect the vehicle battery and insulate the battery lead to avoid accidental reconnection. Wait for ten minutes before proceeding with work on the removal of the airbag.

   Note: The vehicle battery must be disconnected within 12 seconds of switching off the ignition to avoid the alarm siren sounding.

3. Insert the ignition key and turn to position I. Turn the steering wheel to the left and right to access the module securing torx screws at the back of the steering wheel.



4. Carefully remove the module from the steering wheel and disconnect the module multi-plug.

5. To ensure personal safety, check that the battery is disconnected and the battery lead safely insulated. Connect the new airbag module multi-plug. Fit and align the new module to the steering wheel and tighten the two securing torx screws. Return the steering to the straight ahead position.

6. Remove the battery lead insulation and reconnect the battery lead.

   Note: The vehicle clock and the window control unit will need resetting after completion of this procedure.

7. Switch on the ignition and check that the airbag warning light comes on when the ignition is switched on and extinguishes after approximately six seconds indicating satisfactory completion of the airbag system self tests.

6.4.21.1 Occupant Restraint Module Renew

Read and follow all warnings and safety procedures and the General Service Instructions before working on airbag modules.

WARNING: The occupant restraint module does not need to be renewed at every airbag / pretensioner deployment The only time a module must be renewed is when the system has incurred five separate deployments.

WARNING: The occupant restraint module orientation is critical for correct SRS operation. If a vehicle has been involved in a collision in which the centre tunnel area has been damaged, inspect the mounting and bracket for deformation and correct location. If damaged, the module must be renewed whether or not the airbags / pretensioners have been deployed. In addition, make sure the module mounting area is restored to its original condition.

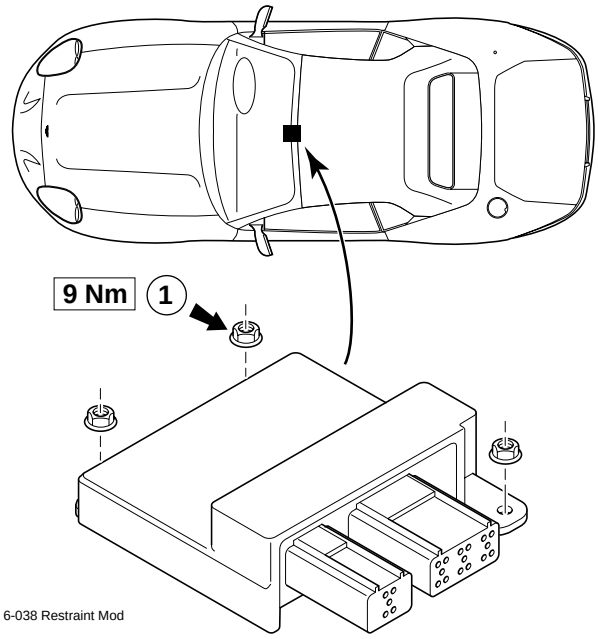
Caution: Electronic modules are sensitive to static electrical charges. If exposed to static charges, damage may result.

1. Disconnect the battery and wait for ten minutes before working on the airbag system.

   Note: The vehicle battery must be disconnected within 12 seconds of switching off the ignition to avoid the alarm siren sounding.

2. Disarm the airbags (6.4.21.4)

3. Remove the centre console (see Section 7, Body and Trim).



6-038 Restraint Mod

4. Disconnect the occupant restraint module electrical connectors.

   1 Remove the red safety clasp on top of the electrical connector and pivot on the harness side.

   2 Remove the occupant restraint module.

Installation

To install, reverse the removal procedure.

WARNING: The tightening torque of the occupant restraint module retaining bolts is critical for correct system operation and safety.

6.6.24.1 Pretensioner Assembly Renew

Read and follow all warnings and safety procedures and the General Service Instructions before commencing.

WARNING: If a pretensioning unit is ruptured without deployment and exposure to the propellant by ingestion or inhalation occurs, apply first aid and then seek medical advice.

WARNING: Never attempt to dismantle an undeployed pretensioner. It is not serviceable.

WARNING: Never point the piston housing towards yourself or other persons. Hold it with the piston pointing downwards. Keep fingers away from the take-up spool mechanism.

WARNING: If a unit has been dropped from a height of 0.3M and above, it must not be fitted.

Removal

1. Motor the drivers seat to its rearmost position. Disconnect the battery ground (black) lead and wait 10 minutes for the pretensioner power supply to fully discharge before working on the pretensioner system.

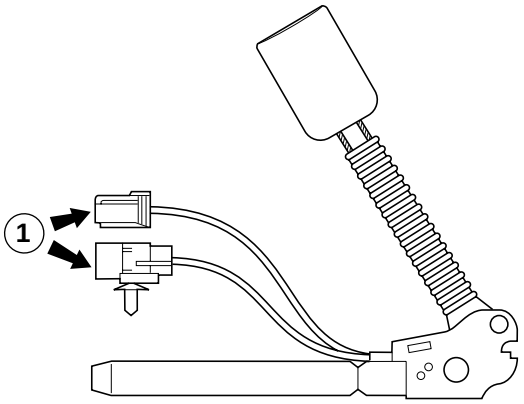
   Note: Disconnect the battery within 12 seconds of switching off the ignition to avoid the alarm siren sounding.

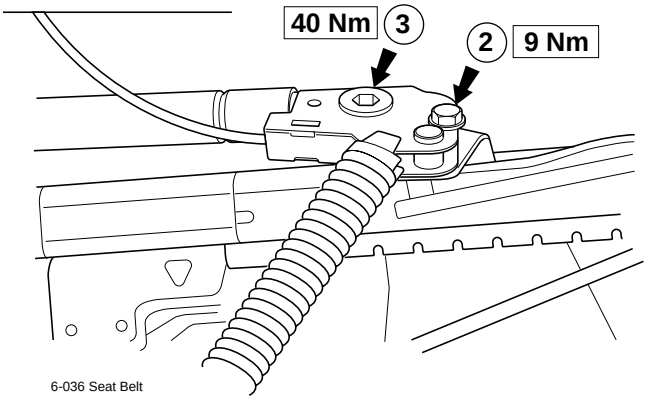
2. Remove the seat (6.6.03).

3. Locate two electrical connectors under the seat frame and disconnects

   The Firing signal multiplug is fitted with an integral 'fir tree' type fixing which must be released from the body and retained with the multiplug.

4. Remove two bolts securing the pretensioner to the seat frame and remove the pretensioner.





6-036 Seat Belt

Installation

1. Locate the pretensioner to the seat frame and partially fit the main buckle securing bolt (3).

2. Align the rear buckle cut-out with rear frame nut and partially secure.

3. Fully tighten the main buckle bolt (3) and the anti-rotation bolt (2) evenly to ensure a flush fit to the frame.

4. Route the harness under the seat frames and reconnect to the seat harness.

5. Rfefit the seat (6.6.03).

6. Reconnect the battery ground (black) lead.

   Note: The vehicle clock and the window control unit will need resetting after completion of this procedure.

7.8.02.6 Passenger's Airbag Module Renew

Read and follow all warnings and safety procedures and the General Service Instructions before working on airbag modules.

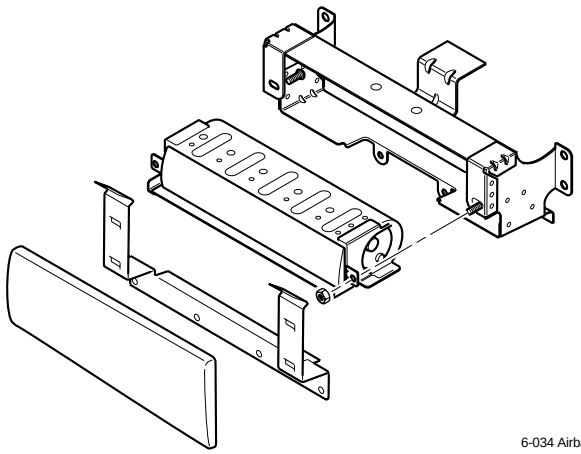
1. Disconnect the battery and wait for ten minute before proceeding with the airbag removal.

   Note: The vehicle battery must be disconnected within 12 seconds of switching off the ignition to avoid the alarm siren sounding.

2. Open the passenger airbag deployment door.

3. Release four nuts and remove the airbag module.

4. Disconnect the airbag harness multi-plug.



6-034 Airbag

5. Connect and fit the new module and secure with four nuts.

6. Refit the airbag deployment door.

   Note: The vehicle clock and the window control unit will need resetting after completion of this procedure.

7. Reconnect the battery. Switch on the ignition and check that the airbag warning light comes on when the ignition is switched on and extinguishes after approximately six seconds indicating satisfactory completion of the airbag system self tests.

Airbag System Diagnostics

System Description

The airbag system installation comprises:

- Occupant Restraint Module with internal 'safing sensor'
- Driver and passenger airbag modules
- Dedicated wiring harness
- SRS indicator/warning lamp

The system is designed to provide protection for both driver and front seat passenger by automatically deploying airbags and firing pretensioners in the event of a collision during forward travel.

Any faults in system components, installation or wiring will be indicated by a flashing code on the SRS/AIRBAG warning lamp. Fault code information may also be monitored using the PDU or scan tool.

Note: See sheet 25 of the circuit diagrams, inserted at the back of this section, for details of the SRS wiring.

Component Descriptions

Occupant Restraint Module

The occupant restraint module is mounted on top of the transmission tunnel on the centre line of the vehicle and contains the safing sensor. The module contains the microprocessor which is connected to the complete airbag system. The state of the sensors, the two airbag modules, the seat belt pretensioners and the wiring harness is constantly monitored by the microprocessor for faults and for sensor activation (crash) conditions.

The module also confirms correct supply voltage by comparing a direct battery voltage input with a similar input via the ignition switch.

The module contains a reserve power supply, enabling the airbags and pretensioners to fire even if the supply voltage is lost due to collision damage. The reserve power charge will be retained for approximately one minute if the positive battery supply is lost in a collision.

Wiring Harness

A dedicated electrical wiring harness is used to connect all system components to the bulkhead harness. To allow free movement of the steering mechanism, a cable reel cassette is used to connect the drivers airbag in the steering wheel to the airbag harness on the steering column.

Airbag Modules

The two airbag modules contain a charge of sodium azide/copper oxide which will generate a sufficient volume of nitrogen gas to fully inflate the airbag when ignited by an electrical impulse. The volume of gas is greater in the passenger side airbag due to its larger size.

Both airbag modules, including the surrounding trim of the drivers airbag, are non-serviceable and once deployed, must be renewed as a complete assembly.

Safing Sensor

The safing sensor is an integral part of the occupant restraint module. The safing sensor determines when airbag deployment and pretensioner firing is necessary in a crash condition.

The sensor contacts will only close when the vehicle suffers a forward impact of sufficient force.

6.4.21.4 Airbag Disarming/Arming Procedures

WARNINGS AND CAUTIONS:

WARNINGS:

Disarm the airbags by disconnecting the battery ground (black) lead, waiting ten minutes and then removing the airbag modules before servicing of any airbag or steering column component.

After disconnecting the battery ground lead, allow a minimum of ten minutes delay for the back-up power supply to discharge before servicing the airbag system.

The system components are non-serviceable, if faults are suspected, change components for new items only.

Failure to observe the above procedures may result in accidental deployment of the airbags.

Always wear safety glasses when working on airbag equipped vehicles.

Personnel carrying an airbag module must ensure that the module and trim cover are pointing away from the body. When positioning on a bench or work surface, ensure that the airbag module and trim cover face upwards to limit motion on accidental deployment.

Always wear gloves when handling deployed airbag modules. Deposits of sodium hydroxide may be present on the module surface. If sodium hydroxide contacts any area of the skin, wash the affected area immediately with mild soap and water. Dispose of the deployed airbag using the correct procedures referred to in this section.

Cautions:

When scrapping vehicles, ensure that the airbags have been deployed (see Scrapping Vehicles with Live Airbags).

If a component has been renewed and the fault does not clear, refit the original item and repeat the diagnostic procedure.

After servicing, repeat the diagnostic procedures to ensure correct system operation.

Renew the airbag module if the surrounding trim panels are damaged. Do not attempt to repaint trim covers as paint may damage cover material.

Disarming the Airbags

WARNING: Carry out the following disarming procedure before attempting any work on the vehicles electrical systems.

Note: The battery ground (black) lead must be disconnected within 12 seconds of switching off the ignition to avoid the alarm siren sounding.

1. Disconnect the battery ground lead. Allow a minimum of ten minutes delay for the back-up power supply to discharge.
2. Remove the drivers side airbag module and replace it with an airbag simulator from the simulator kit (Pt No. 418-047).
3. Remove the passengers airbag module and replace it with an airbag simulator from the simulator kit.
4. Reconnect the battery ground.

Re-arming the Airbags

WARNING: Carry out the following procedure to re-arm and check the airbags after completing all work on the vehicles electrical systems.

Note: The vehicle battery must be disconnected within 12 seconds of switching off the ignition to avoid the alarm siren sounding.

1. Disconnect the battery ground lead. Allow a minimum of ten minutes delay for the back-up power supply to discharge.
2. Remove the drivers side airbag simulator and replace it with the drivers airbag module. Secure the airbag module with the two captive torx screws.
3. Remove the passengers side airbag simulator and replace it with the passenger side airbag module. Secure the module with four nuts and washers. Close the passenger side airbag door.
4. Reconnect the battery ground.
5. Switch on the ignition and check for correct indications from the SRS/AIRBAG warning light. The SRS/AIRBAG lamp should come on after a brief delay and remain on for approximately six seconds during the airbag system self check. The lamp will extinguish upon satisfactory completion of the self check, or will flash a diagnostic code if an airbag system fault is detected. Continuous illumination of the warning lamp may indicate a seat belt pretensioner fault

Note: Reset the clock and window ECUs on completion.

Airbag Diagnostic Fault Codes

Fault codes may be extracted in one of two ways: As a series of flashes of the SRS/AIRBAG warning lamp, or through the upper diagnostic connector using the PDU.

Each series of flashes of the SRS/AIRBAG warning lamp represents a two digit number, representing a fault code from the list below. The codes will flash in priority order (i.e. If two faults are present, the highest priority code will flash. Clear the first code, then the second priority code will flash).

- No airbag warning lamp - Inoperative airbag warning lamp or no ignition voltage to the diagnostic module.
- Continuous airbag warning lamp - Diagnostic module disconnected, inoperative, or lost/low ignition feed.
  - Restraint Control Module (RCM) Disconnected
  - Ignition circuit (RCM pin 2) open circuit
  - Ignition voltage below minimum required for full functionality
  - Ground circuit (RCM pin 21) open circuit
  - RCM inoperative
- Flashing airbag warning lamp - Vehicle option content not programmed

Code Possible Causes

15 Driver airbag squib shorted to ground
- Less than 1000Ω nominal resistance to ground or battery detected on RCM pins 3 or 4

16 Passenger airbag squib shorted to ground or battery
- Less than 1000Ω nominal resistance to ground or battery detected on RCM pins 6 or 7

17 Driver pretensioner squib shorted to ground or battery
- Less than 1000Ω nominal resistance to ground or battery detected on RCM pins 18 or 22

18 Passenger pretensioner squib shorted to ground or battery
- Less than 1000Ω nominal resistance to ground or battery detected on RCM pins 15 or 16

19 Restraint control module crash data memory full

21 Restraint control module bracket ground resistance high
- Resistance between module mounting and vehicle ground greater than 10Ω

24 Restraint control module internal fault
- Accelerometer faulty, back-up power supply faulty, internal circuit fault, RAM/ROM/EEPROM failure, or allowable deployment counter = 0

29 Incorrect vehicle identification code
- Mismatch in the code from the identification pins (RCM pins 10, 13 and 14) and the preprogrammed code

32 Driver airbag squib resistance high
- Drivers airbag circuit open or very high resistance

33 Passenger airbag squib resistance high
- Passengers airbag circuit open or very high resistance

34 Driver airbag squib resistance low
- Drivers airbag circuit short to ground or very low resistance

35 Passenger airbag squib resistance low
- Passengers airbag circuit short to ground or very low resistance

46 Driver pretensioner squib resistance fault
- Drivers pretensioner circuit short to ground or very low resistance
- Drivers pretensioner circuit open or very high resistance
- Less than 1000Ω nominal resistance to ground or battery detected on the pretensioner pins (RCM pins 15 and 16 left hand drive. RCM pins 18 and 22 right hand drive)

47 Passenger pretensioner squib resistance fault
- Passenger pretensioner circuit short to ground or very low resistance
- Passenger pretensioner circuit open or very high resistance
- Less than 1000Ω nominal resistance to ground or battery detected on the pretensioner pins (RCM pins 15 and 16 right hand drive. RCM pins 18 and 22 left hand drive)

Diagnostic Trouble Codes Extracted using the PDU

Fault codes may be extracted through the upper diagnostics connector using the PDU. The following codes are applicable to the DB7 Vantage restraint control module

B1318 Battery voltage low

B1869 Airbag warning indicator lamp circuit open

B1870 Airbag warning indicator lamp circuit short to battery

B1877 Driver's pretensioner circuit open

B1878 Driver's pretensioner circuit short to battery

B1879 Driver's pretensioner circuit short to ground

B1881 Passenger's pretensioner circuit open

B1882 Passenger's pretensioner circuit short to battery

B1883 Passenger's pretensioner circuit short to ground

B1885 Driver's pretensioner circuit resistance low on squib

B1886 Passenger's pretensioner circuit resistance low on squib

B1887 Driver's airbag circuit short to ground

B1888 Passenger's airbag circuit short to ground

B1891 Airbag tone warning indicator short to battery

B1892 Airbag tone warning indicator circuit failure

B1901 Airbag crash sensor feed/return circuit short to ground

B1916 Driver's airbag circuit short to battery

B1925 Passenger's airbag circuit short to battery

B1932 Driver's airbag circuit open

B1933 Passenger's airbag circuit open

B1934 Driver's airbag inflator circuit low resistance

B1935 Passenger's airbag inflator circuit low resistance

B1941 Airbag crash sensor feed/return circuit open

Refer to Circuit Sheet 25 in this section for wiring information on the restraint system

The Passive Anti-Theft System (PATS)

Description and Operation

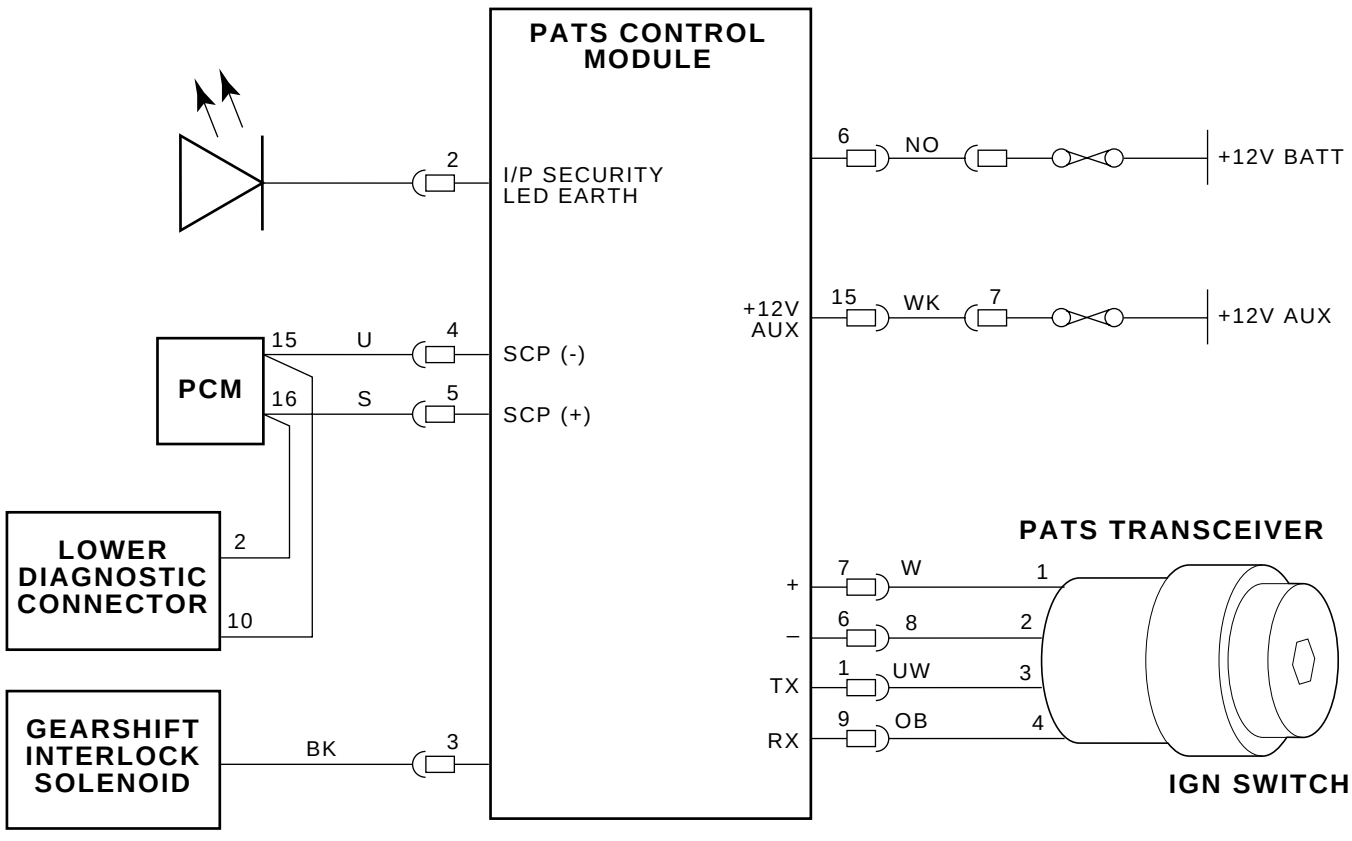
The Passive Anti-Theft System (PATS) Uses radio frequency identification technology to deter a driveaway theft by engine immobilisation. Passive means that it does not require any activity from the user.

PATS uses a specially encoded ignition key. Each encoded ignition 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. Instructions for encoding keys are included later in this section.

A transceiver module is located behind the steering column cowl. The transceiver module communicates with the encoded ignition key. During each vehicle start sequence, the transceiver module reads the encoded ignition key identification code 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.



6-041 Pats Circuit

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 a bracket behind the passenger airbag module. Renewing the PATS module entails disarming and removing the passenger airbag module for access.

The PATS module 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 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
- PCM 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. This 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

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. Initiate the key learning mode by following steps 1 to 4 above.
2. Within five seconds use the second valid key and turn it again to ignition position II.
3. Take the key out within five seconds.
4. Within five seconds insert the first valid key and turn it to ignition position II.
5. The PATS LED starts to flash rapidly for a period of five seconds.
6. 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

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?

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 PCM configuration/type
	D147	U1147	Invalid PCM 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 PCM ID after the key has been turned for the first time to ignition position II. If no PCM ID is stored or the PCM ID has been cleared, this code will be displayed.
23	A139	B2139	**SCP not configured, PCM ID does not match** This based on a system error. The PCM verify message indicate disable due to a responce error. Codes of SCP PATS module and PCM 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 PCM and PATS modules share the SCP communications lines to the lower diagnostic socket).

   If communications to the PCM 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.

PDU 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.

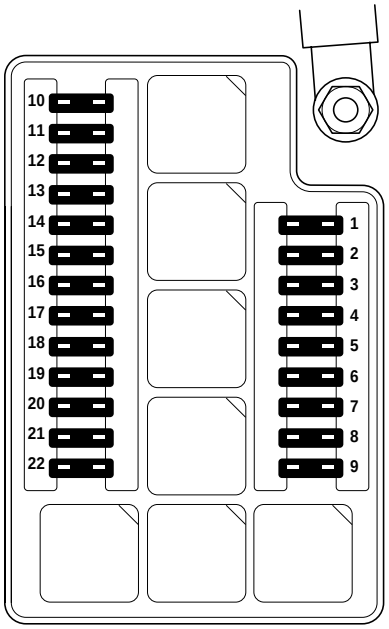
Electrical Component Location and Wiring Information

The following pages contain electrical component location information and electrical wiring diagrams.

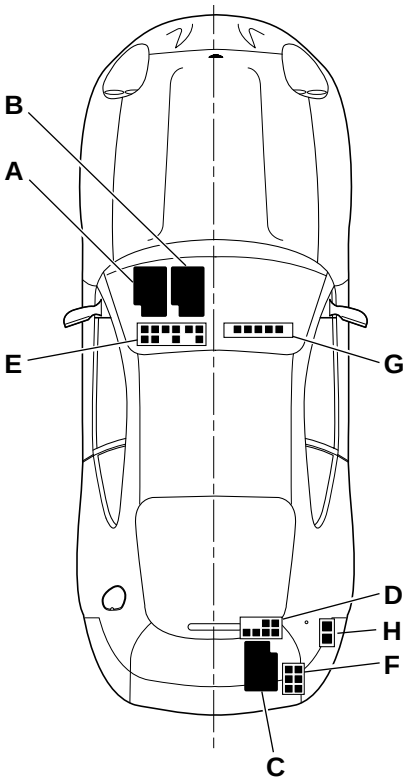
Fuse and Relay Locations

Three fuse/relay boxes are located around the vehicle as shown on the illustration below. The forward left and right fuse boxes (A and B) are located beneath a plate in the passenger side footwell. The rear fuse box is located in the boot, close to the battery. Fuse layout is the same in all three fuseboxes. Four additional relay chassis (D, E, F and G) are fitted in the positions shown.

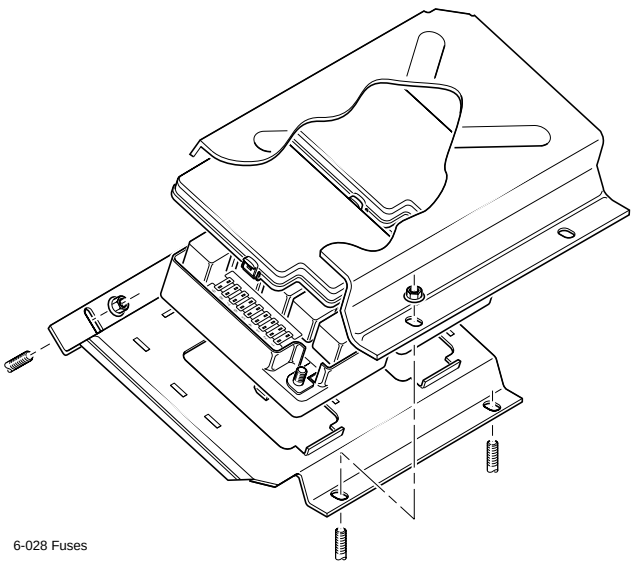
Note: The illustration shows the RHD version with the passenger footwell fuseboxes on the left hand side. On a LHD vehicle these fuseboxes would be on the right hand side.



6-026B Fuses

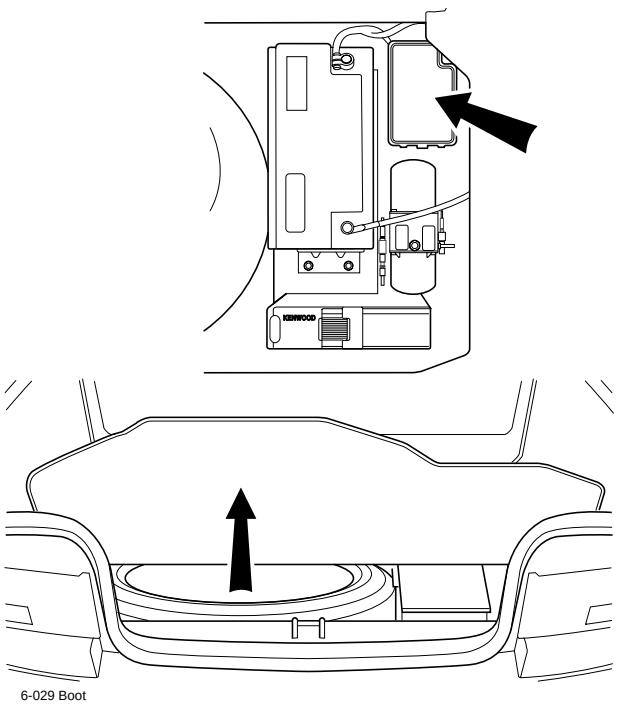


Access to Passenger Footwell Fuseboxes



6-028 Fuses

Access to the Boot Fusebox



6-029 Boot

Fuse Lists

WARNING: Do not install a fuse which exceeds the amperage for each location listed below.

A - Passenger Bulkhead Fusebox - Left Hand

1	15A	Accessory Terminal
2	10A	Transmission Control Module
3	5A	Headlamp Relay, Instrument Pack, Dimmer Unit
4	10A	Multi Function Unit, A/C In-Car Sensor, ABS Control Unit
5	5A	Traction Control Switch, Alternator Regulator, Heated Front Screen Control
6	10A	Rear Fog Switch, RH Dip Beam
7	30A	Starter Relay
8	10A	LH Dip Beam
9	20A	LHS Seat Heater Relay, LHS Seat Module
10	40A	Heated Front Screen Controller
11	10A	RH Horn
12	30A	LH Rad Cooling Fan
13	10A	LH Horn
14	30A	RH Rad Cooling Fan
15	30A	Primary PCM RHS
16	10A	MFU, Central Locking, A/C Control Panel, Alarm Sounder
17	30A	Secondary PCM LHS
18	5A	Interior Map Lights, Instrument Pack, RH Rad Module
19	10A	RH Main Beam
20	20A	Window Lift Cut Out, Accessory Terminal, A/C Clutch Relay
21	10A	Instrument Pack, LH Main Beam
22	25A	Front Fog Relay

B - Passenger Bulkhead Fusebox - Right Hand

1	5A	Unused.
2	20A	Cigar Lighter
3	10A	Diagnostic Body & Powertrain, ICE, A/C Unit, Aux Power Hood
4	5A	Seat Switches and Heaters
5	10A	Indicator Flasher
6	10A	Ignition Coils 1-6
7	10A	Interior Lamp Cluster
8	10A	Ignition Coils 7-12
9	20A	RHS Seat Heater Relay, RHS Seat Module
10	10A	Dimmer, PATS, ICE
11	10A	Heated Rear Window Telltale, Door Mirrors
12	5A	Diagnostic Socket, Alternator
13	25A	Heated Rear Window
14	10A	Hazard Flasher Unit
15	20A	Wiper Logic Module and Wiper Stalk
16	30A	ABS Control Unit
17	20A	Wiper Motor, Logic Module and Wiper Stalk
18	30A	ABS Control Unit
19	10A	A/C LH Blower Motor
20	5A	Gearshift Interlock Module, Traction Control Switch, Interior Lamp
21	10A	A/C RH Blower Motor
22	10A	PCM and TCM Keep Alive Power

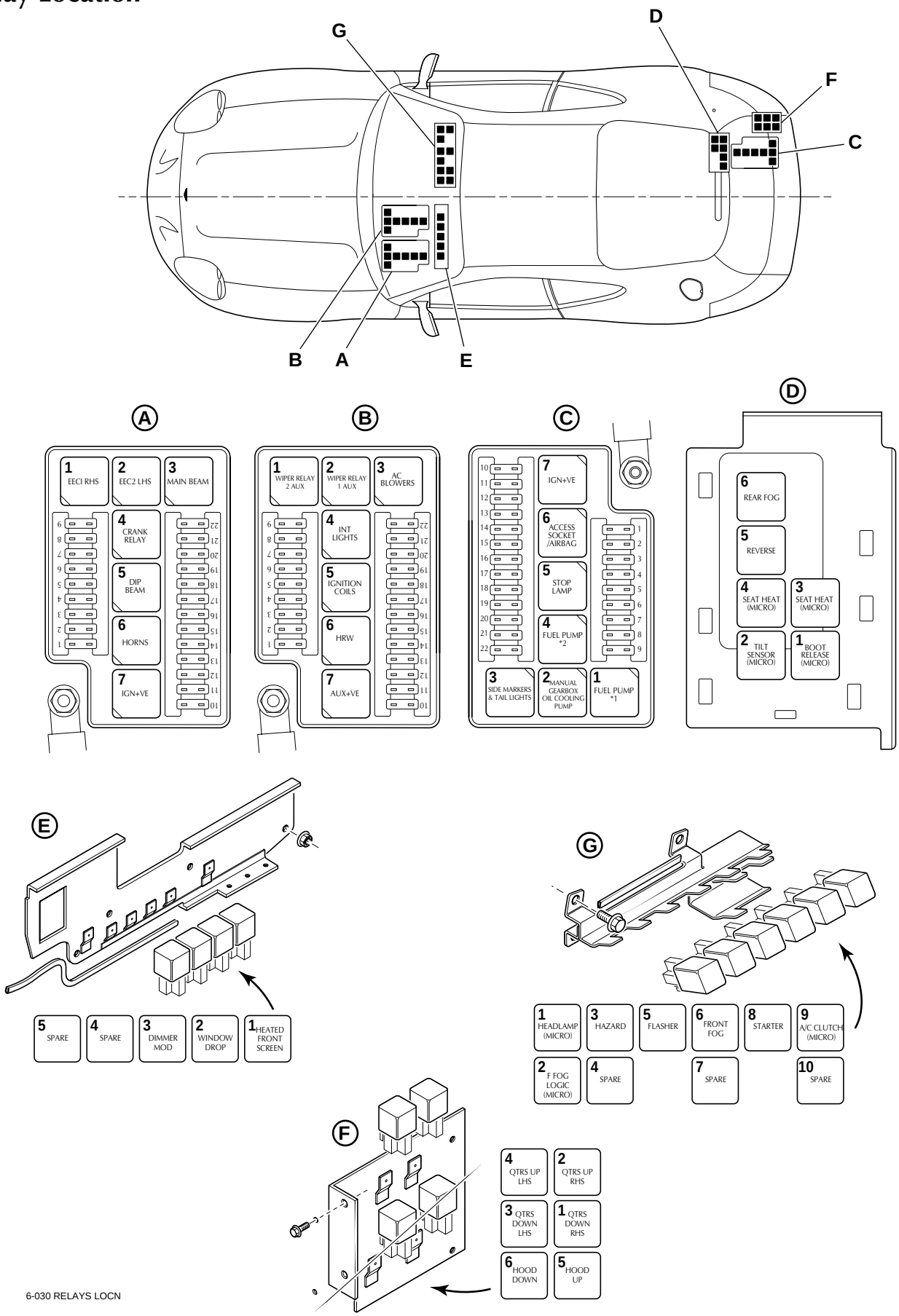
C - Boot Fusebox

1	10A	Reverse Light Relay
2	20A	Security ECU, Glass Break Sensor
3	5A	+12V Ignition, Fusebox Sense
4	5A	Trunk Logic Relay, hood, security system control module
5	30A	Accessory Terminal
6	5A	RH Fog Lamp, RHS EEC, LHS EEC, Brake Switch Input
7	20A	Fuel Pump 2, LHS EEC
8	10A	HM Stop Light, LH Stop Light
9	10A	Boot Lamps, Radio Aerial Motor
10	10A	Accessory Socket
11	20A	LH Quarter Light Up/Down Relay
12	20A	RH Quarter Light Up/Down Relay
13	10A	Airbag ECU
14	30A	Hood Up/Down Relay
15	20A	Fuel Pump 1, RHS EEC
16	10A	Rear Fog Light Relay
17	10A	Manual Gearbox Cooling Pump
18	10A	Accessory Terminal
19	10A	RH Tail, Side, Side Marker and Number Plate Lamps
20	20A	Premium ICE Amplifier
21	10A	LH Tail, Side, Side Marker and Number Plate Lamps
22	20A	Premium ICE

Note: Spare bayonet fuses are located in each fuse box

Note: A spare 40A (Maxi) fuse for the heated front screen and a Fuse extractor are supplied in the bulb/fuse replacement kit, stored in the spare wheel insert under the boot floor covering.

Relay Location



6-030 RELAYS LOCN

Relay List

Each fusebox houses seven relays. The layout of the relays is the same for each fusebox. In addition to these, several relays are mounted on two bulkhead brackets located behind the fascia, one on the drivers side and one on the passengers side. Access to these is gained by removing the drivers / passengers underscuttle (see section 7).

Note: The bulkhead brackets are handed and change side with the hand of the vehicle. The placement of the bulkhead mounted relays therefore varies between left and right hand drive vehicles. See the separate bulkhead mounted relay listings for left hand and right hand drive vehicles.

A - Footwell Fusebox (Left Hand)

1 PCM 1 RHS
2 PCM 2 LHS
3 Main Beam
4 Crank Relay
5 Dip Beam
6 Horns
7 Ignition +Ve

B - Footwell Fusebox (Right Hand)

1 Wiper Relay 2 aux
2 Wiper Relay 1 aux
3 AC Blowers
4 Interior lights
5 Injector coils
6 Heated Rear Windscreen
7 Auxiliary +Ve

C - Boot Fusebox

1 Fuel Pump No.1
2 Manual Geabox Oil Cooling Pump
3 Side markers, Number Plates and tail lights
4 Fuel Pump No.2
5 Stop Lamp
6 Accessory Socket
7 Ignition +Ve

D - Boot Fusebox Brackets

1 Boot Release (micro)
2 Tilt Sensor (micro)
3 Seat Heater (micro)
4 Seat Heater (micro)
5 Reverse Light
6 Rear Fog Light

E - Bulkhead Bracket (Right Hand Drive)

1 Heated Front Windscreen Timer
2 Window Drop
3 Dimmer Module
4 Not used
5 Not used

E - Bulkhead Bracket (Left Hand Drive)

1 Hazard Unit
2 Flasher Unit
3 Front Fog
4 Starter
5 Window Drop (Volante only)

F - Hood Harness Bracket

1 RH Quarter Light Down Micro Relay
2 RH Quarter LIght Up Micro Relay
3 LH Quarter Light Down Micro Relay
4 LH Quarter Light Up Micro Relay
5 Hood Up
6 Hood Down

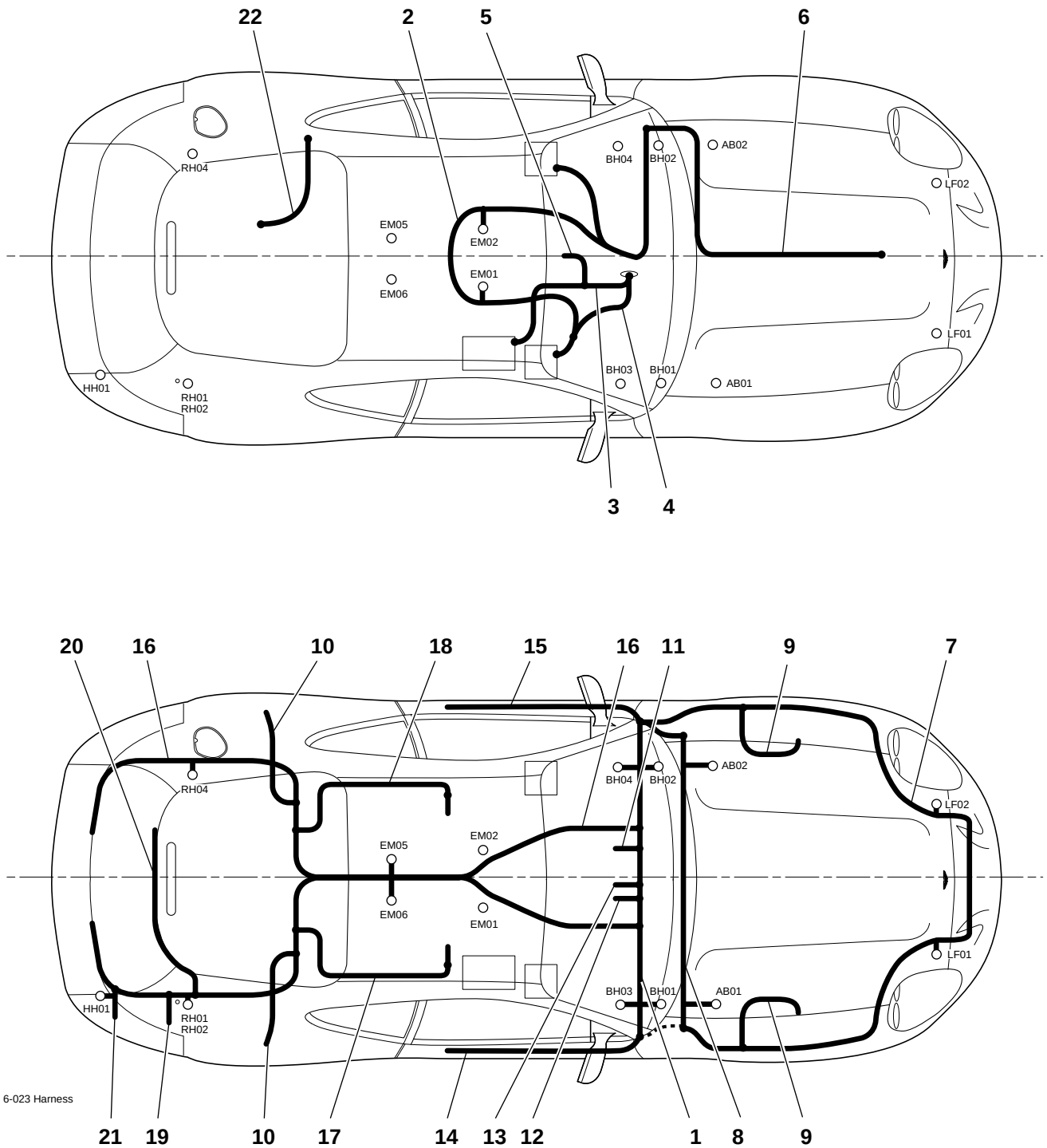
G - Bulkhead Bracket (Right Hand Drive)

1 Headlamp (micro)
2 Front Fog Logic (micro)
3 Hazard
4 Not used
5 Flasher
6 Front Fog
7 Not used
8 Starter
9 AC Clutch (micro)
10 Not used

G - Bulkhead Bracket (Left Hand Drive)

1 Heat Front Windscreen Timer
2 Not used
3 AC Clutch (micro)
4 Not used
5 Dimmer Relay Control
6 Headlamp (micro)
7 Front Fog Logic (micro)
8 Not used
9 Not used
10 Not used

Wiring Harness Locations



1	Bulkhead Harness	9	ABS Front Link Harness	17	Driver Seat Harness
2	Engine Management Harness	10	ABS Rear Link Harness	18	Passenger Seat Harness
3	Transmission Harness (auto)	11	ICE Harness	19	Radio Aerial
4	Gearbox Harness (manual)	12	Binnacle Harness	20	Boot Lid Harness
5	Gearshift Harness	13	Air Conditioning Harness	21	Hood Lift Harness
6	Engine Harness	14	Driver Door Harness	22	Amp Board Harness
7	Left Forward Harness	15	Passenger Door Harness		
8	ABS Stub Harness	16	Rearward Harness		

How to Locate an Electrical Component

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 (5 in this example) and item number for each component (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 and alpha/numeric coordinates 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 a critical supply will originate on another sheet. Where this occurs, the source of the signal will be identified by circuit diagram number and coordinates.

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. BHS13 = Bulkhead Harness - Splice 13). A note beside each splice lists all circuits connected at that splice.

If you wish to investigate another component connected to a particular splice, locate the component name in the index and follow the circuit or physical location entries to find the component and its wiring.

The following pages contain the Component Location Index, component location diagrams and electrical circuit diagrams.

Component Location Index

Component Name	Physical Location	Circuit Location
ABS Control Unit	5-1	23-C5
ABS Fluid Level Sensor	5-2	23-C7
Aerial - Radio	4-4	15-C6
Air Conditioning - Clutch Relay	13-5	19-C4
Air Conditioning - Compressor Clutch	13-4	19-D4
Air Conditioning - Trinary Switch	13-3	19-C3
Airbag - Driver's	7-10	25-E4
Airbag - Passenger's	7-9	25-E5
Airbag Single Point Sensor	7-11	25-C5
Alarm Sounder	7-8	8-E2
Alternator	11-4	21-C1
Battery	11-3	21-B8
Boot Lamp - LH	1-15	9-C6
Boot Lamp - RH	1-16	9-C6
Boot Lock Actuator	7-4	8-E3
Boot Lock Microswitch	7-4	8-E2
Boot Lock Microswitch	7-4	9-D6
Cannister Vent Valve (Left Hand)	9-5	18-C8
Cannister Vent Valve (Left Hand)	9-5	17-C8
Catalyst Monitor Sensor (Rear Left)	9-6	18-B4
Catalyst Monitor Sensor (Rear Right)	9-4	17-B4
Central Locking Control Unit	-	7-B4
Cigar Lighter	10-4	26-D4
Cooling Fan - Radiator Left Side	13-1	19-D2
Cooling Fan - Radiator Right Side	13-2	19-C2
Cooling Fans Control Module	?	19-C2
Diagnostic Socket - Body (Security, Airbag)	7-12	27-C6
Diagnostic Socket - Powertrain (Engine, Trans, PATS, ABS)	7-12	27-C6
Dimmer Module	-	16-C4
Door Ajar Switch - Driver's	7-2	8-F3
Door Ajar Switch - Driver's	7-2	9-D4
Door Ajar Switch - Passenger's	7-2	8-F3
Door Ajar Switch - Passenger's	7-2	9-D5
Door Lock - Driver's	7-1	7-D4
Door Lock - Passenger's	7-7	7-D5
Door Mirror - Driver's	-	4-E4
Door Mirror - Passenger's	-	4-E6
Door Mirror Switch - Driver's	10-2	4-C4
Door Window Controller (Convertible) - Driver's Door	3-17	14-C2
Door Window Controller (Convertible) - Passenger's Door	3-16	14-C3
Door Window Controller (Coupe) - Driver's Door	3-17	14-C2
Door Window Controller (Coupe) - Passenger's Door	3-16	14-C3
EGR Vacuum Regulator (Left Hand)	6-18	18-B4
EGR Vacuum Regulator (Right Hand)	6-19	17-B4
Flasher Unit - Direction Indicators	3-1	10-B6
Flasher Unit - Direction Indicators	3-2	11-B6
Flasher Unit - Hazard Lamps	3-3	10-B5
Flasher Unit - Hazard Lamps	3-4	11-B5
Fuel Filler Flap Solenoid	7-14	7-D4
Fuel Injectors 1-6 (Right Hand Bank)	6-6	17-B5

Component Name	Physical Location	Circuit Location
Fuel Injectors 7-12 (Left Hand Bank)	6-7	18-B5
Fuel Pump 1	2-4	19-B5
Fuel Pump 1	2-5	21-C6
Fuel Pump 2	2-2	19-B5
Fuel Pump 2	2-3	21-C7
Fuel Tank Sender Unit	2-1	19-C4
Fusebox - Bulkhead Left Side	see pg 6-48	32-A4/C4
Fusebox - Bulkhead Right Side	see pg 6-48	33-A6/C4
Fusebox - Boot	see pg 6-48	34-A4/C4
Gearshift Interlock Module	-	8-D1
Gearshift Interlock Module	-	20-D2
Gearshift Interlock Solenoid	3-15	20-F2
Glass Break Sensor	7-5	8-B2
Heated Front Screen - Heater Elements	-	26-D5
Heated Front Screen Controller	see pg 6-53	26-C6
Heated Oxygen Sensor (Front Left)	9-7	18-B3
Heated Oxygen Sensor (Front Right)	9-3	17-B3
Heated Rear Window - Heater Element	-	26-D6
Hood Control Module (Convertible)	3-9	14-E6
Horn - Left Hand	12-2	8-B7
Horn - Right Hand	12-3	8-B7
Horn Switch	-	8-B7
Idle Air Control Valve (Left Hand)	9-8	18-B4
Idle Air Control Valve (Right Hand)	9-2	17-B4
Ignition Coils 1-6 (Right Hand Bank)	11-1	17-C7
Ignition Coils 7-12 (Left Hand Bank)	11-2	18-C7
Illumination Control Pot	12-1	16-B5
Instrument Pack	10-28	24-C4
Interior Lamp - Front	1-33	9-E4
Interior Lamp - LH Rear	1-35	9-D3
Interior Lamp - RH Rear	1-36	9-D3
Key In Warning	-	8-D3
Key-In Solenoid	-	8-B1
Keylock Solenoid	-	20-F2
Lamp - Dip Beam LH	1-28	10-F3
Lamp - Dip Beam RH	1-29	10-F4
Lamp - Direction Indicator - Rear LH	1-13	11-F2
Lamp - Direction Indicator - Rear RH	1-14	11-F5
Lamp - Direction Indicator Front LH	1-26	10-F2
Lamp - Direction Indicator Front RH	1-27	10-F4
Lamp - Direction Indicator Side Repeater LH	1-20	10-F2
Lamp - Direction Indicator Side Repeater RH	1-21	10-F5
Lamp - Driver's Door Puddle Lamp	1-34	9-D3
Lamp - Fog - Rear LH	1-5	11-F2
Lamp - Fog - Rear RH	1-6	11-F4
Lamp - Front Fog LH	1-24	10-F3
Lamp - Front Fog RH	1-25	10-F3
Lamp - High Mounted Stop	1-37	11-B2
Lamp - Main Beam LH	1-30	10-F3
Lamp - Main Beam RH	1-31	10-F4
Lamp - Map Reading	1-32	9-E4
Lamp - Number Plate LH	1-3	11-F3
Lamp - Number Plate RH	1-4	11-F3

Component Location Index

Component Name	Physical Location	Circuit Location
Lamp - Passenger's Door Puddle Lamp	1-17	9-D3
Lamp - Reverse - Rear LH	1-7	11-F2
Lamp - Reverse - Rear RH	1-8	11-F4
Lamp - Side Lamp LH	1-22	10-F2
Lamp - Side Lamp RH	1-23	10-F4
Lamp - Side Marker - Rear LH	1-1	11-F1
Lamp - Side Marker - Rear RH	1-2	11-F5
Lamp - Side Marker LH	1-18	10-F2
Lamp - Side Marker RH	1-19	10-F4
Lamp - Stop - Rear LH	1-9	11-F2
Lamp - Stop - Rear RH	1-10	11-F4
Lamp - Tail - Rear LH	1-11	11-F3
Lamp - Tail - Rear RH	1-12	11-F4
Mass Airflow Sensor (Left Hand)	9-11	18-B4
Mass Airflow Sensor (Right Hand)	9-10	17-B4
Misfire Detection Module (Left Hand Bank)	9-9	18-B6
Misfire Detection Module (Right Hand Bank)	9-1	17-B6
Motor - Hood Pump (Convertible)	8-4	14-D7
Motor - Left Quarter Light Lift (Convertible)	8-5	14-D4
Motor - Radio Aerial	8-3	15-C6
Motor - Right Quarter Light Lift (Convertible)	8-6	14-D6
Motor - Window Lift (Convertible) - Driver's Door	-	14-E1
Motor - Window Lift (Convertible) - Passenger's Door	-	14-E4
Motor - Window Lift (Coupe) - Driver's Door	-	14-E1
Motor - Window Lift (Coupe) - Passenger's Door	-	14-E4
Passive Anti-Theft Module	7-3	8-C5
Passive Anti-Theft Transceiver	7-13	8-B6
Powertrain Control Module (Primary - Right Hand)	3-6	17-D4
Powertrain Control Module (Primary - Right Hand)	3-7	19-E3/6/7
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Relay - Ignition +ve (Bulkhead Left Fusebox - Relay 7)	Page 6-52	13-A2
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Relay - V Power 1 (Bulkhead Left Fusebox - Relay 1)	Page 6-52	19-A6
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Seat Heater Switch - Driver's	10-11	5-E5
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Component Name	Physical Location	Circuit Location
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Switch - Ignition Switch	10-20	13-E3
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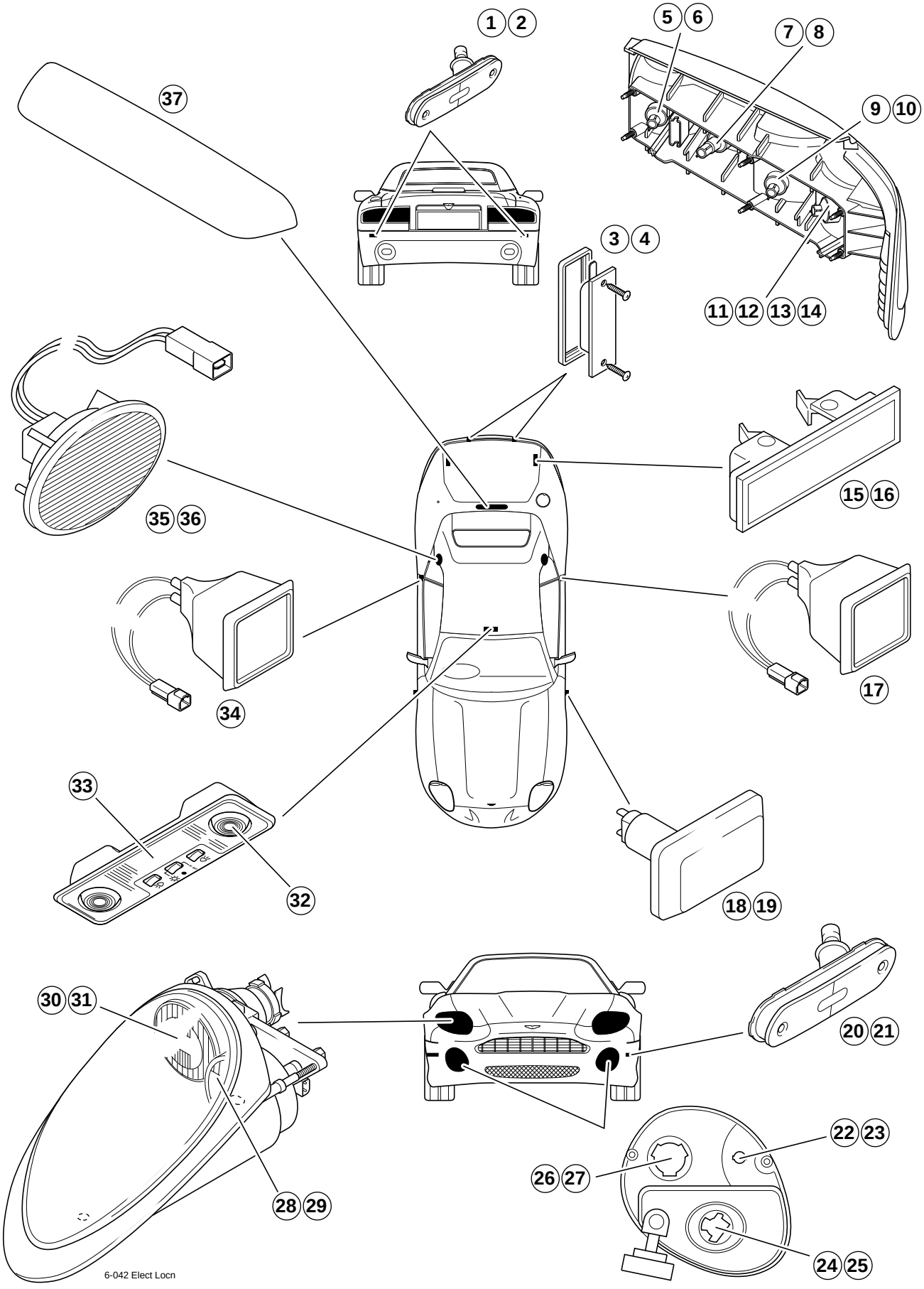
Figure 1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6-042 Elect Locn

Figure 2

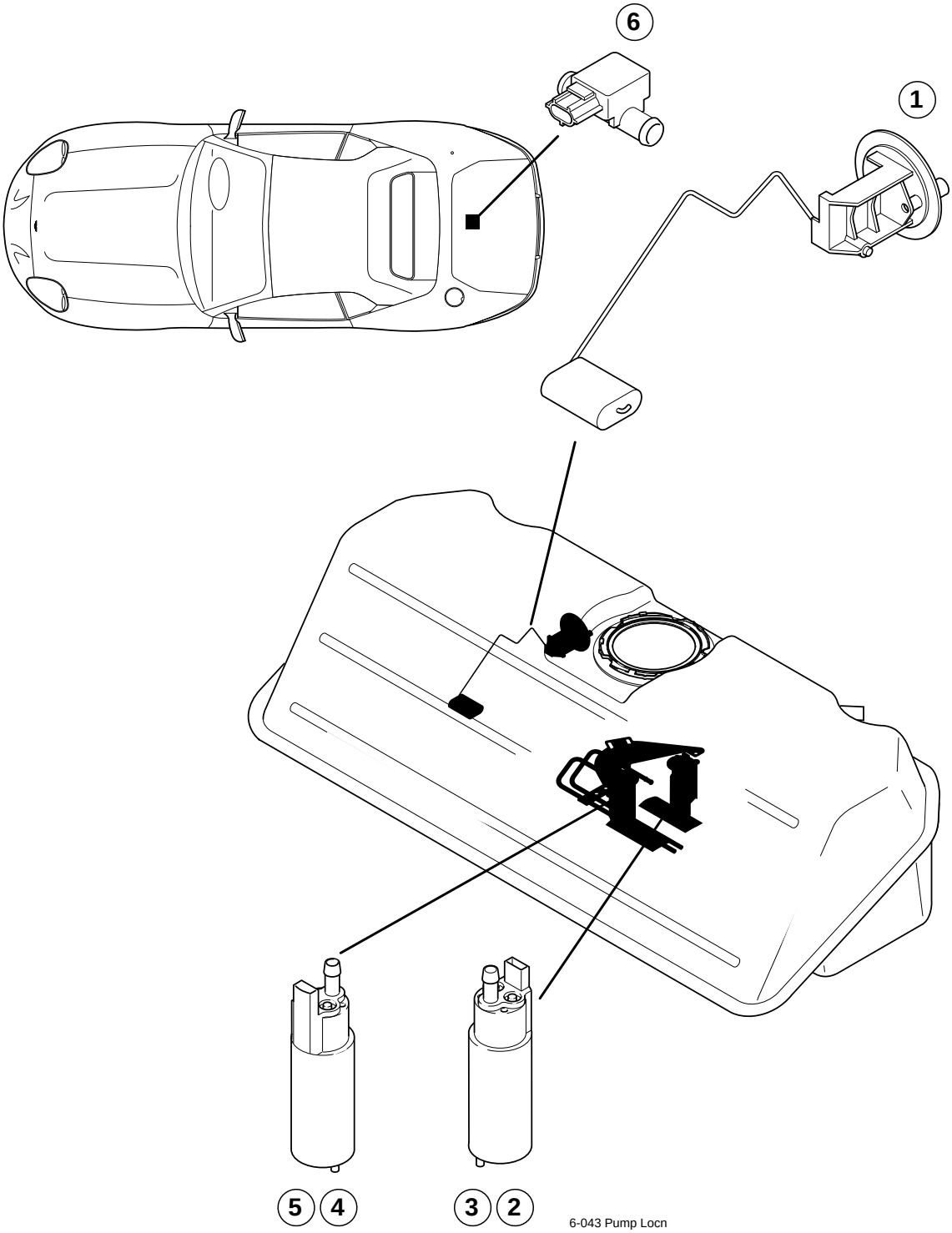
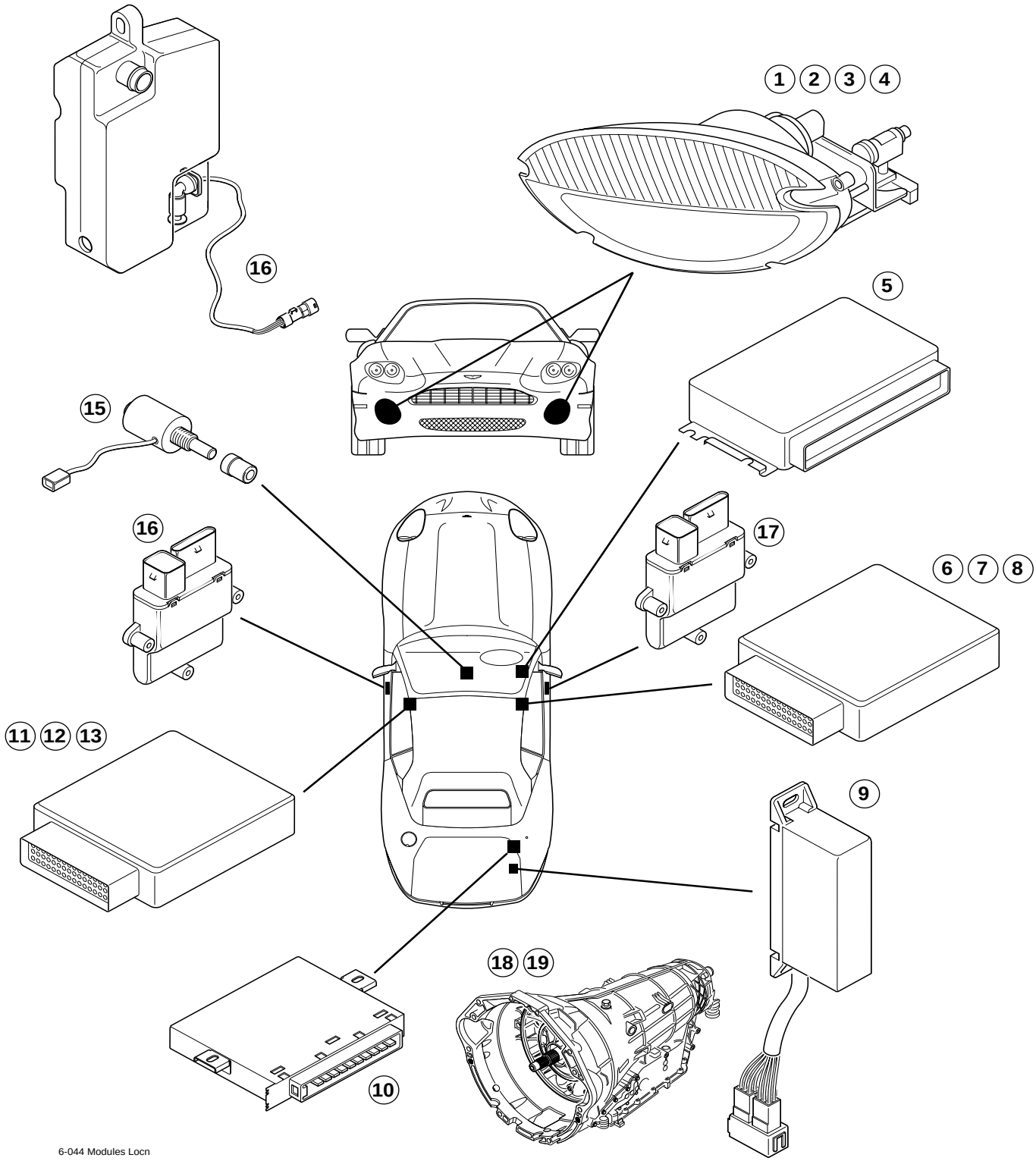


Figure 3



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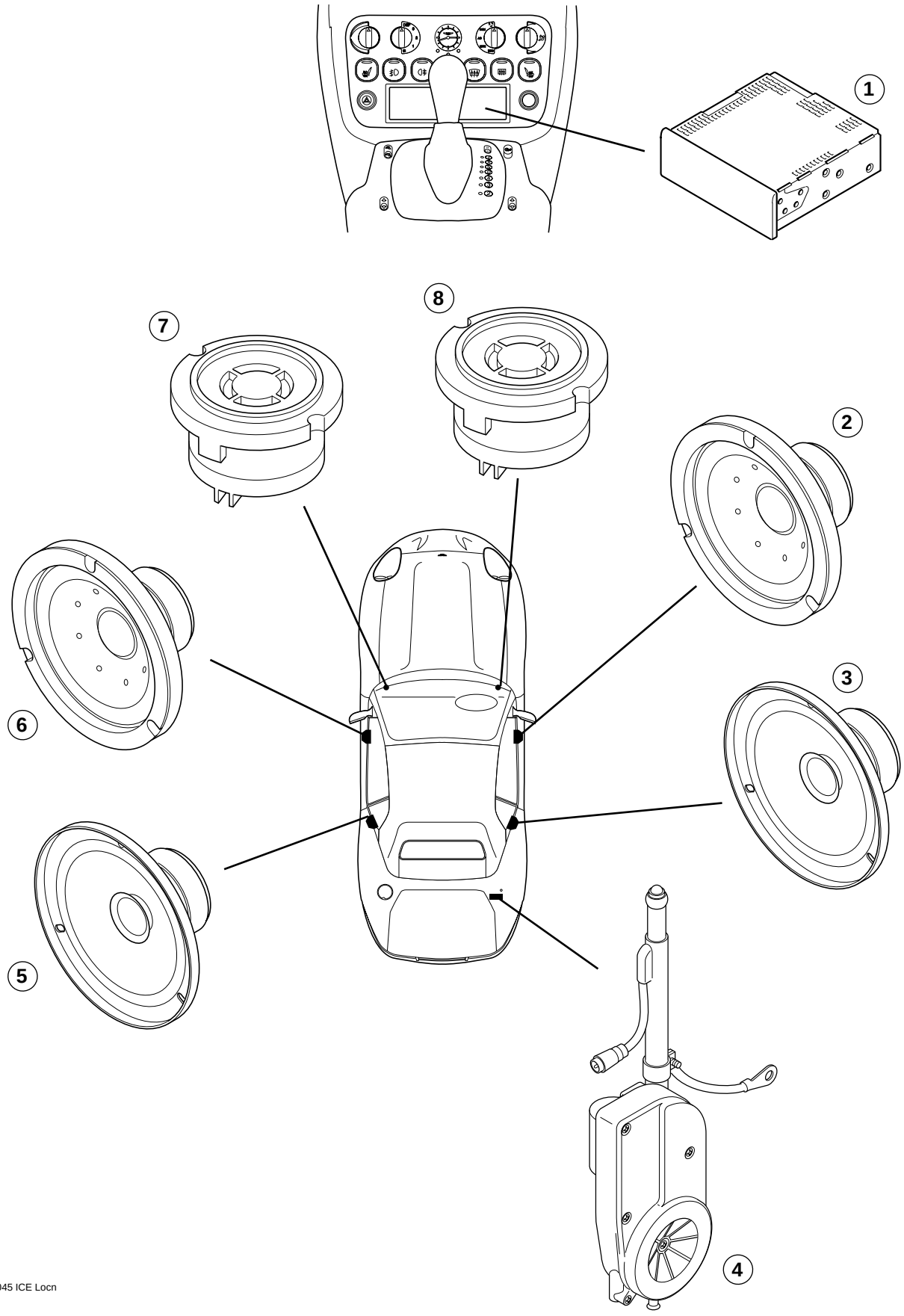
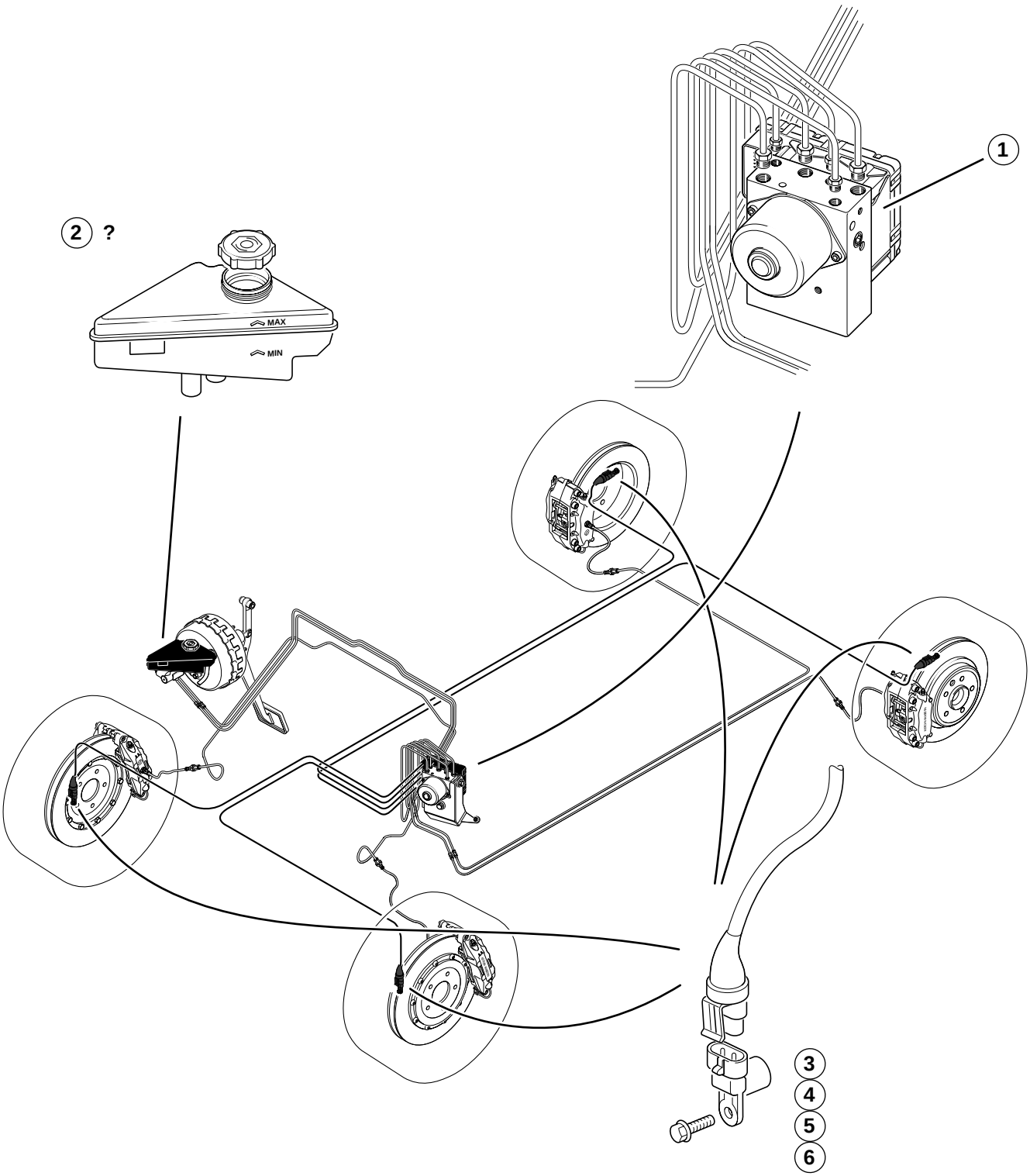
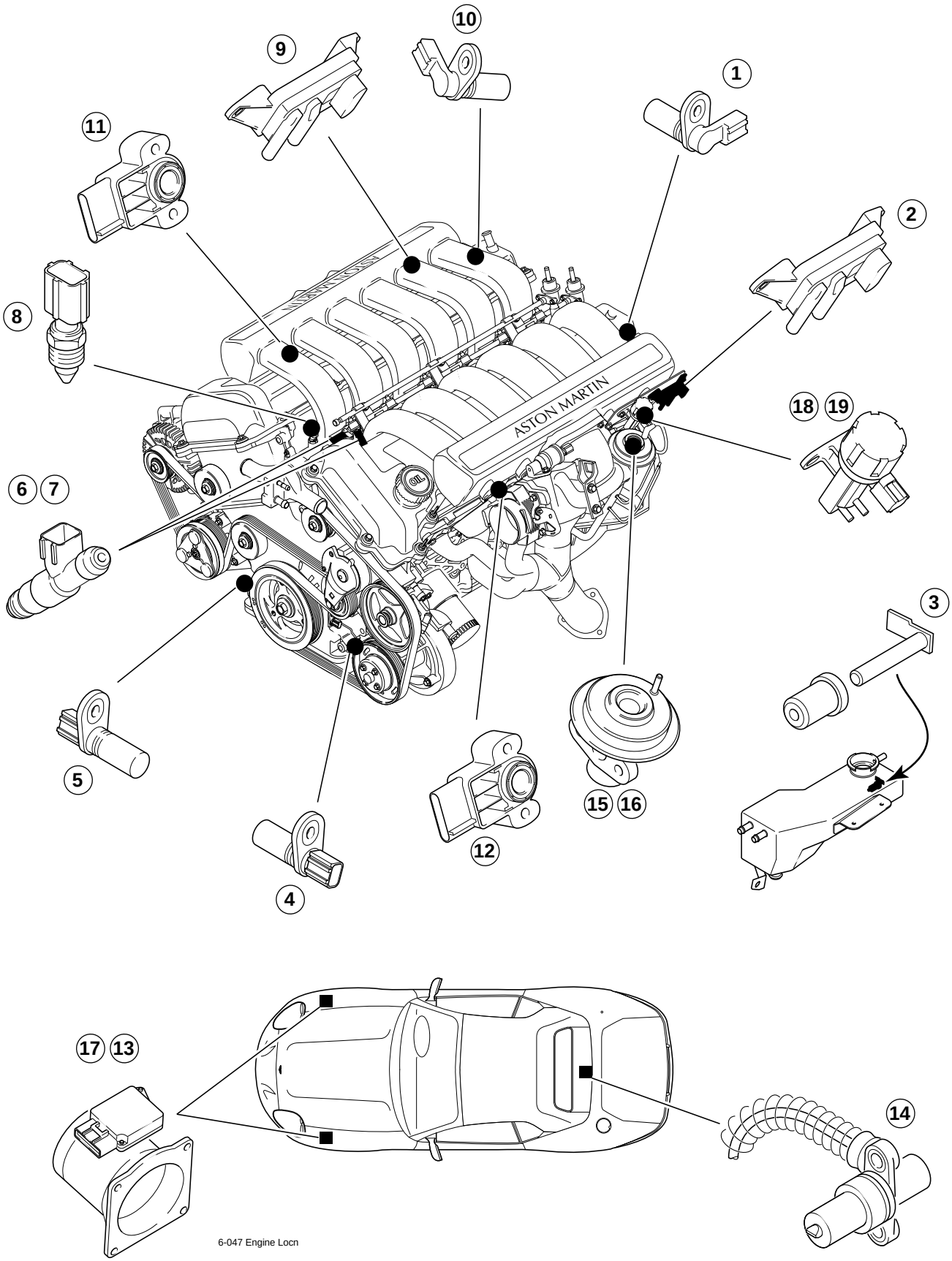


Figure 5



6-046 BR Locn

Figure 6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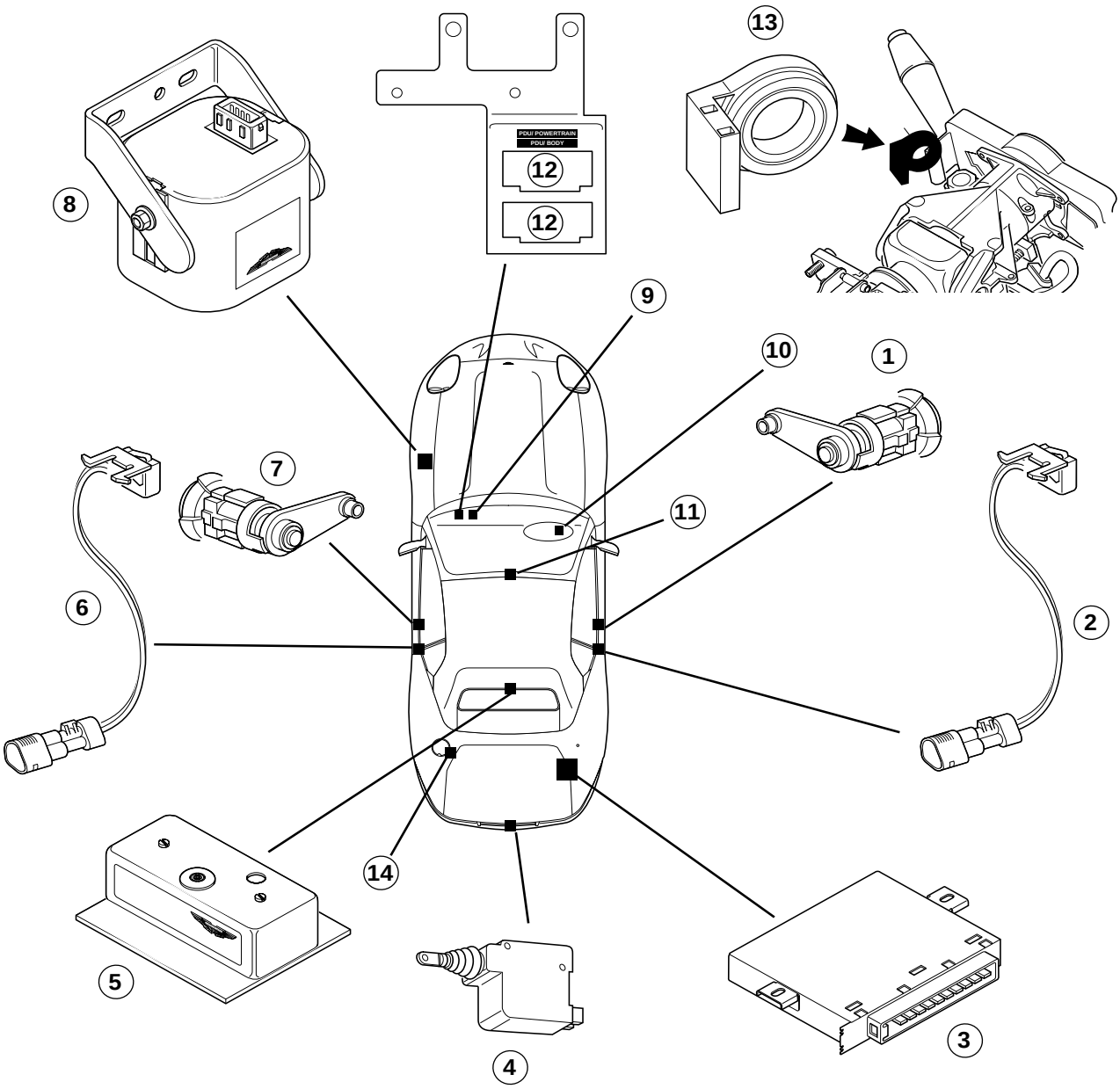
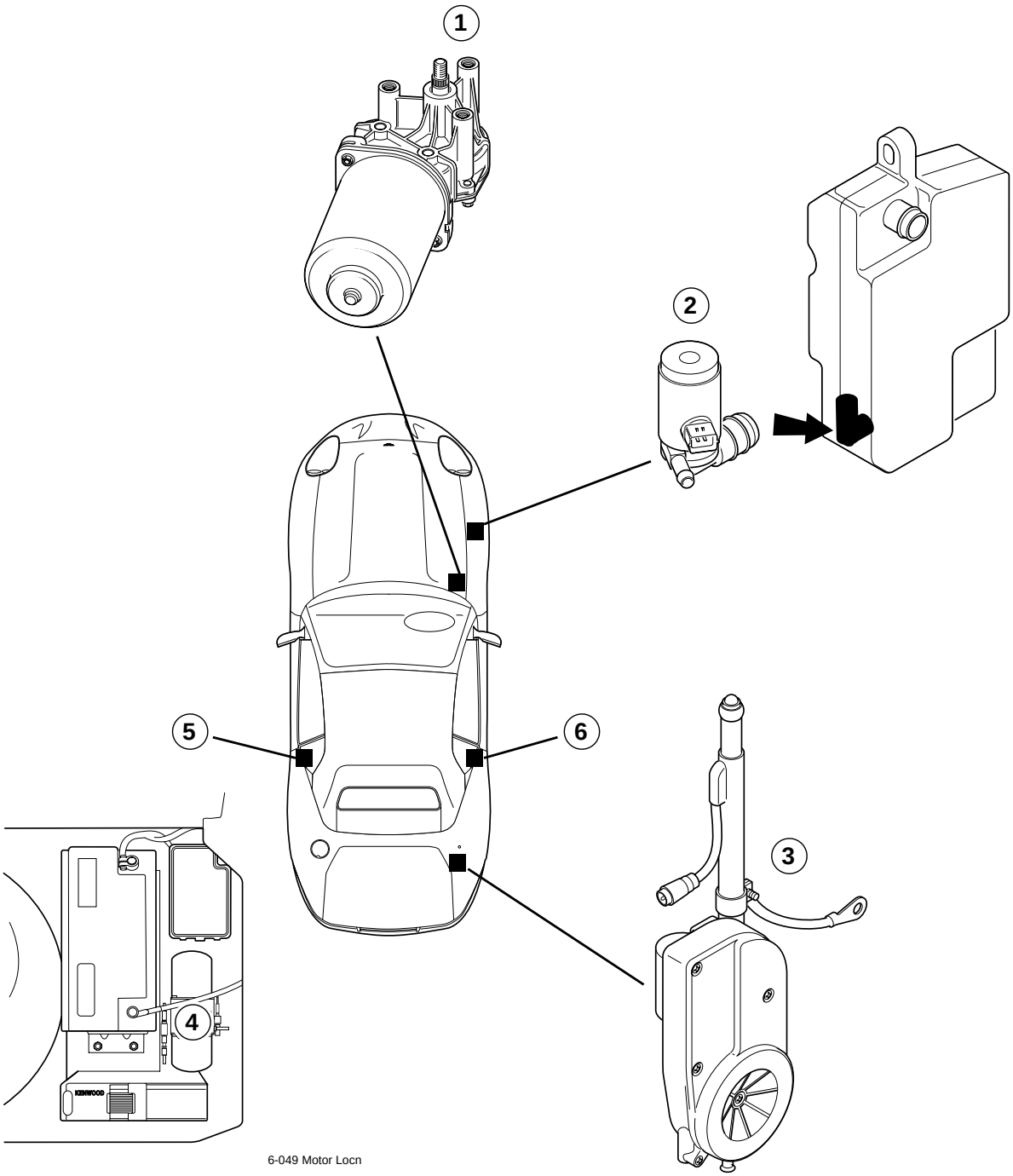
ASTON MARTIN
6-047 Engine Locn

Figure 7



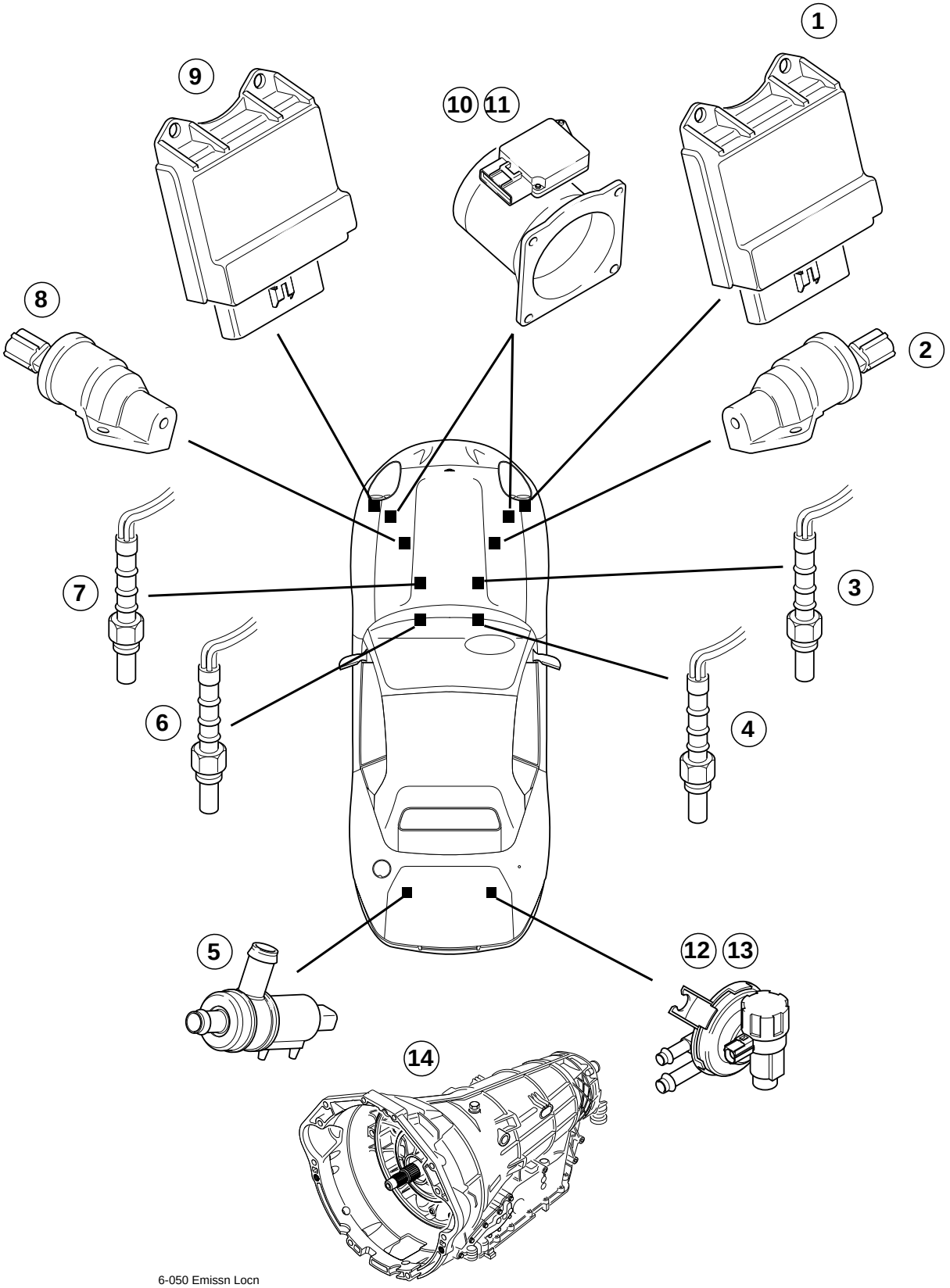
6-048 Security Locn

Figure 8



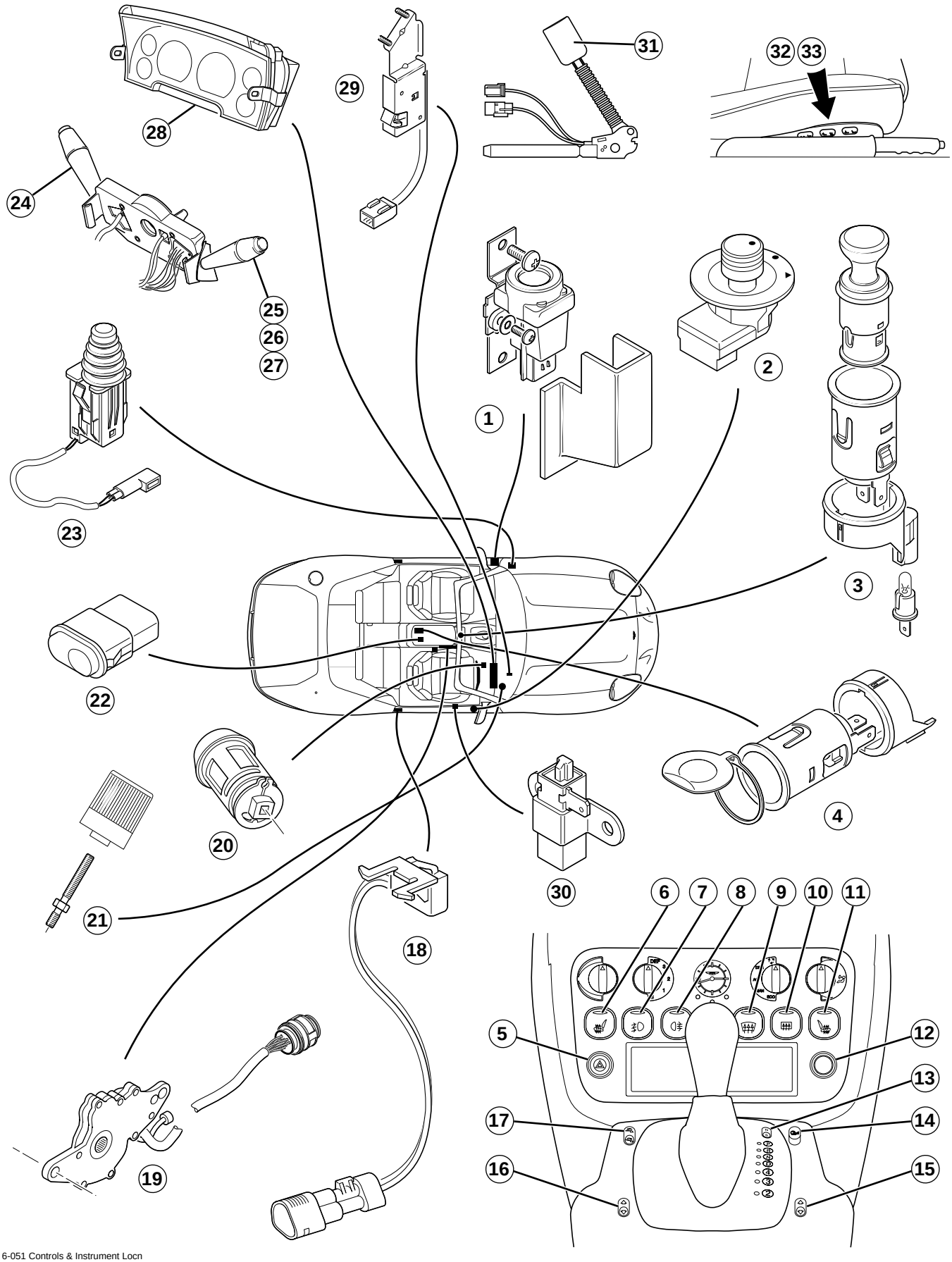
6-049 Motor Locn

Figure 9



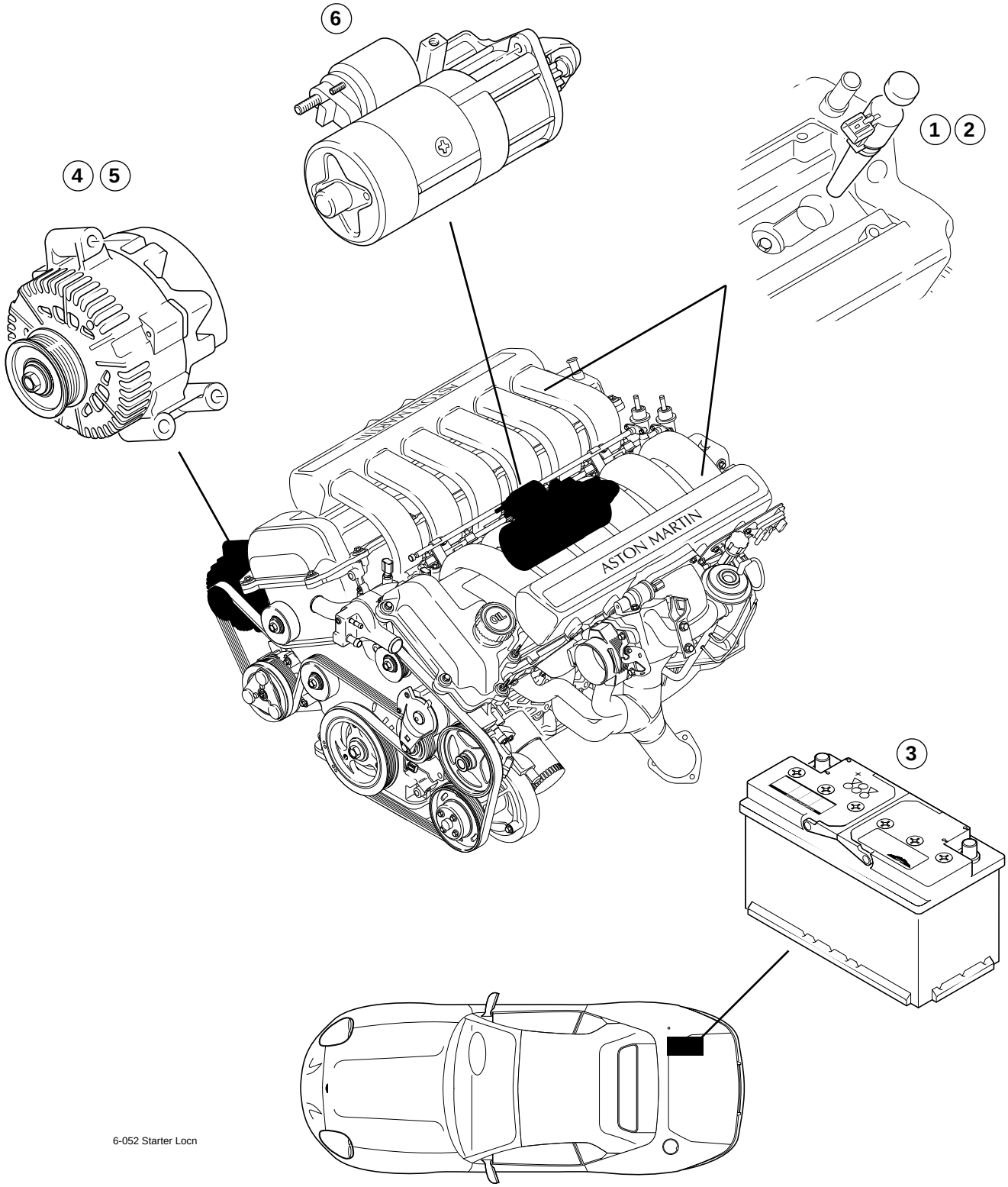
6-050 Emissn Locn

Figure 10



6-051 Controls & Instrument Locn

Figure 11



6-052 Starter Locn

Figure 12

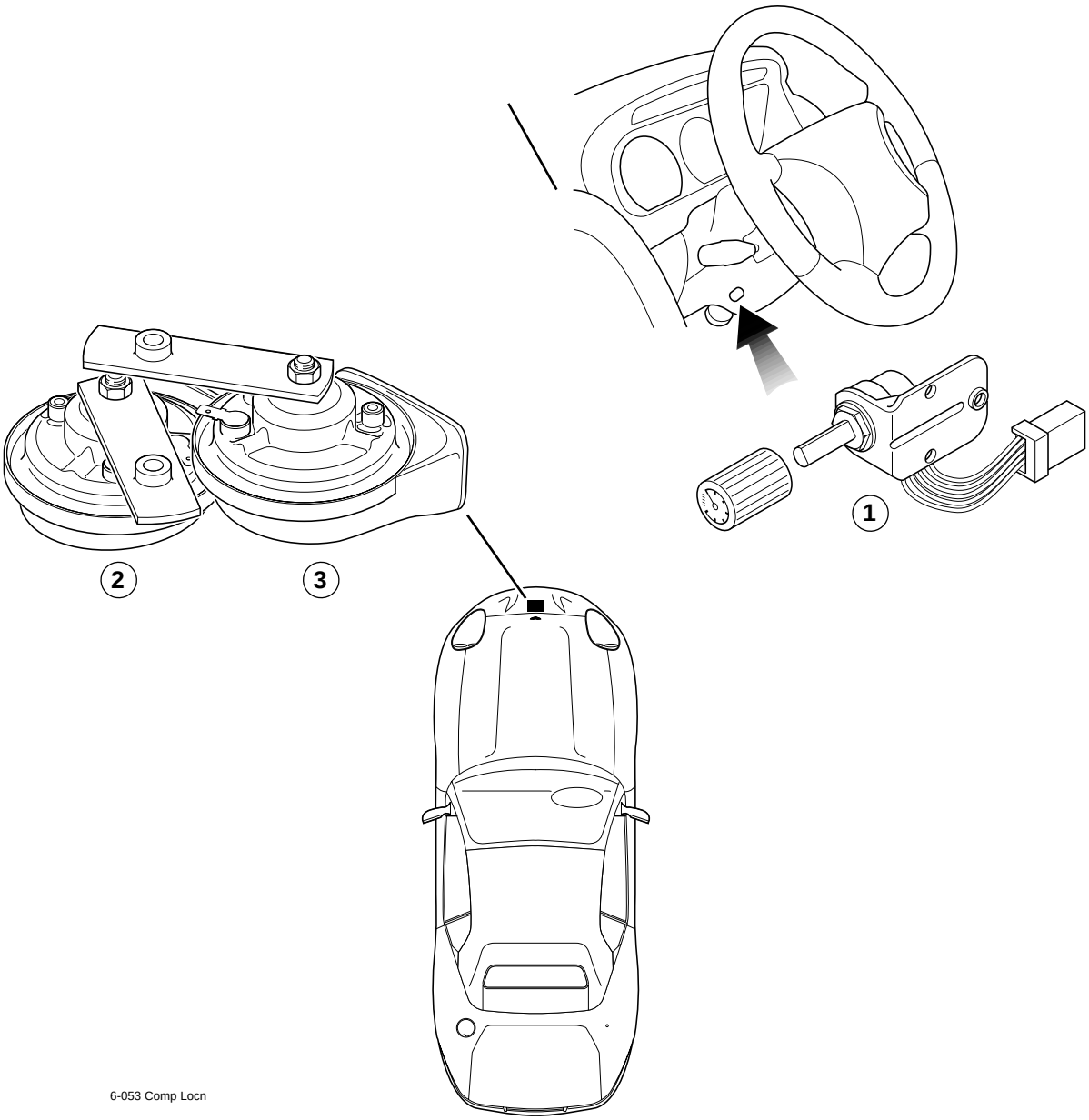
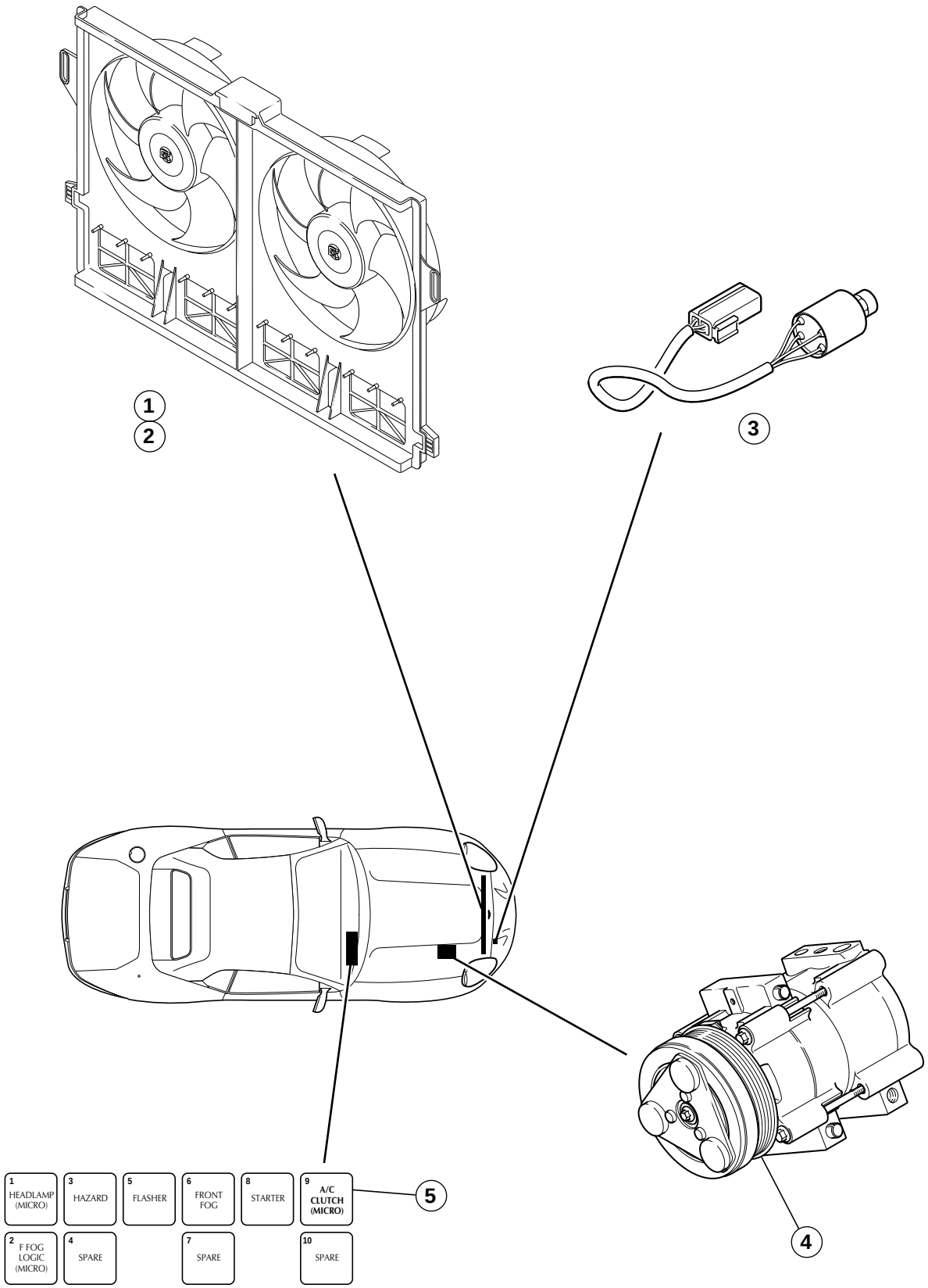


Figure 13



6-054 Air Con Locn

Circuit Diagrams

The following circuit diagrams contain all the wiring, earthing and splice information for the DB7 Vantage.

Use the Component Location Index to locate electrical components on the appropriate circuit diagram from the following list. Circuit location references in the index (e.g. 11-B6) relate to the sheet number and alpha/numeric coordinates.

Sheet	Title
0.	Fuse, Relay and Earth Locations
1.	Harness Layout and Connector Location
2.	System and Component Index
3.	Vehicle Earths (Grounds) - LHD
3.	Vehicle Earths (Grounds) - RHD
4.	Door Mirrors LHD
4	Door Mirrors RHD
5.	Right Hand Seat
5	Left Hand Seat
6.	Passengers Seat - Non-Memory
7.	Central Door Locking
8.	Security System
9.	Interior Lighting
10.	Exterior Lighting - Front
11.	Exterior Lighting - Rear
12.	Wash/Wipe System
13.	Auxiliary Ignition Circuits.
14.	Window and Hood Lift (Coupe and Convertible)
15.	In Car Entertainment System (LHD)
15.	In Car Entertainment System (RHD)
16.	Dimmer Circuitry
17.	Engine Management System - RHS (Primary)
18.	Engine Management System - LHS (Secondary)
19.	Cooling, A/C, Fuel Pumps and Engine Man System Power
20.	Gearbox Controller (ZF 5HP30)
20	Manual Gearbox
21.	Starting Circuit
22	Air Conditioning
23.	ABS System
24.	Instrument Pack
25.	Restraint Systems
26.	Ancillaries
27.	Data Buses
28.	Bulkhead Left Fusebox
29.	Bulkhead Right Fusebox
30.	Boot Fusebox
31	Multi Function Unit

The Security System

The DB7 security system has the following features:

- Alarm aerial below the rear window.
- Sensing via boot, bonnet, door and ignition switches.
- Glass breakage detector.
- Remote arming/disarming.
- Random code encryption to prevent grabbing of the remote transmitter signal.
- Boot release on the remote transmitter.
- 120dB siren with battery back-up.

System Programming

System features such as the audible and visual signals described below may be programmed On or Off and their timings may be changed to suit the alarm regulations in the country of sale. These changes may be made using the Special Features Programming function of the PDU security system software. Therefore, expect possible differences between the following descriptions and the system programming for your market.

Operation

Arming - Press the left remote transmitter button, the green light on the key fob will light while this button is pressed.

The car doors and fuel filler flap will lock, the direction indicators will flash once (in markets where visible alarm signals are permitted) and the alarm system will be switched on.

Disarming - Press the left remote transmitter button, the green light on the key fob will light while the left button is pressed.

The car doors and fuel filler flap will unlock, the direction indicators will flash (in markets where visible alarm signals are permitted and programmed) and the alarm system will be switched off.

With the system armed, any attempt to:-

- Open a door
- Open the bonnet
- Open the boot
- Break a window
- Tilt the vehicle for towing
- Start the car

- will cause the alarm to activate. The siren will sound for 30 seconds and the direction indicators will flash for five minutes. After five minutes, the system returns to the armed state. Alternatively, the alarm can be deactivated by pressing the left remote transmitter button; this will also disarm the alarm and unlock the doors.

Panic Alarm

Press and hold the left remote transmitter button for at least 3 seconds. The siren will sound for 30 seconds and the indicators will flash for five minutes. Press the left remote transmitter button again to cancel the panic alarm and return the system to the state prior to panic alarm activation.

Boot Locking/Unlocking

When the vehicle is locked, press the right remote transmitter button to unlock the boot, the key fob red lamp will stay on so long as the right hand button is pressed. The direction indicators will flash once (in markets where visible alarm signals are permitted), the siren will chirp once (in markets where audible sirens are permitted and programmed) and the boot will unlock.

The remainder of the system will remain armed and the doors will remain locked.

System Protection

Any attempt to disable the system by disconnecting the siren or cutting of the alarm wiring will result in immediate activation of the siren.

Security LED

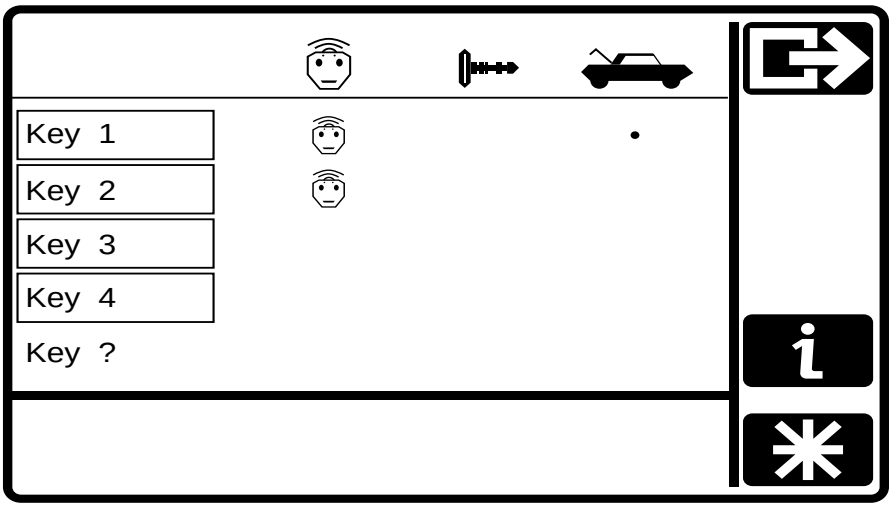
The security LED mounted beneath the clock in the centre console, does not indicate the status of the security system. It only indicates the status of the Passive Anti-Theft System (PATS).

RF Transponder Key Learning

The security system allows up to four remote transmitters to be used for controlling the system functions. The codes for both the 'Key' and 'Boot' buttons of each remote transmitter must be 'learned' by the system in a particular vehicle. Then only signals from the 'learned' remote transmitters will be accepted as valid inputs to operate the security functions for that particular vehicle.

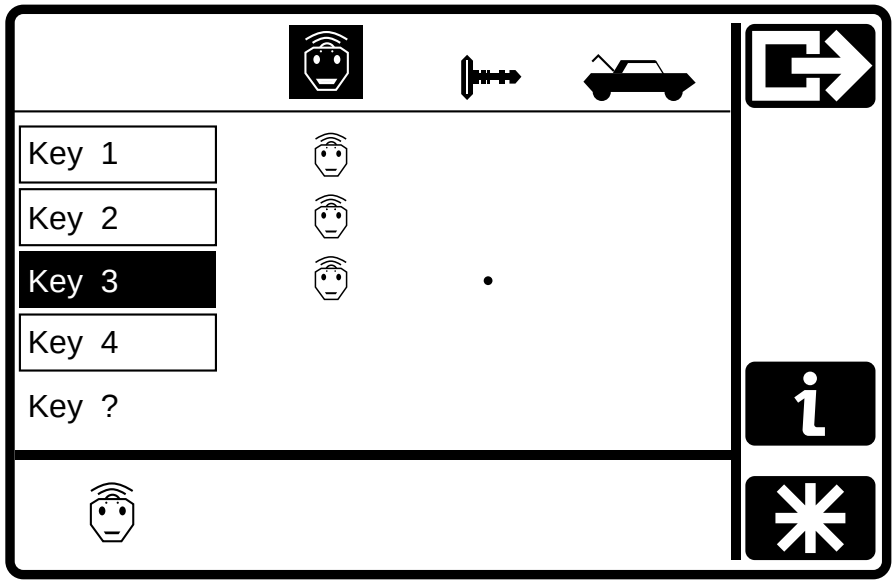
Key Learning Operations

Selecting 'RF Transponder Key Learning' from the security system menu on the PDU will bring up a screen similar to that below. The two currently programmed (learned) remote transmitters are indicated by a transmitter icon beside the key number (see keys 1 and 2 in this example). The display dynamically monitors button presses and displays a bullet mark against the key pressed in either the Key or Boot columns. The bullet display is erased when the button is released. If a proper but unrecognised key code is received, KEY ? will appear and a bullet will be shown against the button pressed on this unrecognised transmitter.



Program Transponder

Selecting a key which is currently clear (e.g. KEY 3 in the example below) will enable the Program Transponder button (at the bottom of the screen). Selecting this button puts the security system into Key Learn mode.



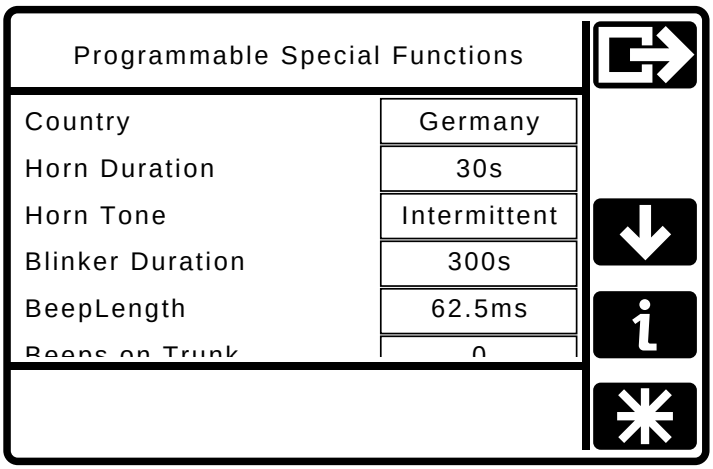
The next valid key press of the Lock and Boot buttons on a replacement or new remote transmitter will be learned against the selected key position. As the lock and then the boot button is pressed on the new remote transmitter, a bullet will appear under the key or boot icons indicating that the button code has been correctly received. As the code is learned for the first button pressed, the program transponder icon will appear against the key number. If an invalid code is received or if a code allocated to another remote transmitter is received, the key learn session will be terminated.

Key Clearing

Selecting a remote transmitter which is currently programmed will enable the Clear button. If Clear is selected and confirmed, the codes currently in memory for the selected transmitter will be erased. This function should be used to delete codes for a defective transmitter. A new set of codes may then be entered for the replacement remote transmitter using the Program Transponder function.

Special Features Programming

This menu allows selection of default security system settings to meet legal requirements of typical European countries. Where defaults are not programmed, each feature of the system may be set to suit local laws and individual requirements.



The following options are programmable:

Horn Duration

Sets the total time that the horn or sounder will operate when the alarm is triggered.

Horn Tone

Sets the type of tone the horn will make during an alarm. The option is set either by the preset default for the selected country or by the relationship of horn duration and horn period.

Horn Period

This is the length of time equal to the mark/space ratio that the horn will operate during the time set by the horn duration when the alarm is triggered.

Blinker Duration

This is the total time for which the indicators will flash when the alarm is triggered.

Blinker Period

This is the length of time equal to the mark/space for which the indicators will flash during the time set by the blinker duration when the alarm is triggered.

Beep Length

This is the length of beeps from the sounder when any beep option is selected. The options are 62.5mS and 10mS.

Beeps on Boot Open

This is the number of beeps on the sounder when the boot is opened. The options are:- None, One, Two or Three.

Beeps on Disarm

This is the number of beeps on the sounder when the alarm system is disarmed. The options are:- None, One, Two or Three beeps.

Beep on Arm

This is the number of beeps on the sounder when the alarm system is armed. The options are:- None, One, Two or Three beeps.

Blink on Alarm

When enabled and an alarm has occurred during the last arming cycle, Disarm with Remote causes the direction indicators to flash five times. Light on Disarm and Blink on Disarm have no function. Options are:- Enabled or Disabled.

Blink on Disarm

When enabled, Light on Disarm has no function. Instead, Disarm with Remote causes the direction indicators to flash 3 times (half second on, half second off).

Light on Boot Open

This is the length of time the lights will come on when the boot is opened.

Light on Disarm

This is the length of time the lights will come on when the alarm is disarmed.

Light on Arm

This is the length of time for which the lights will come on when the alarm is armed.

Passive Arming

When Enabled:- If the drivers door is opened while the ignition is switched off, the delay time before Passive Arming/ Passive Immobilisation starts as soon as the drivers door is shut. If the drivers door is opened and shut again during the delay time, the timer is reset and starts again from zero. The delay timer is stopped when the ignition is switched on during the delay period.

When the delay time has expired, the anti-theft warning system is armed or the immobilisation function is activated.

The anti-theft warning system acts as if it had been armed normally. The immobilisation system is activated when the alarm is triggered. The anti-theft re-armed state can be recognised by the flashing of the status LED at one flash per two seconds.

The passive functions can be disabled by remote control (left button) or the car key (door is opened). If this function is desired, the Disarm Only with Remote function must not be programmed.

The options are:- Enabled or Disabled.

Passive Arming Delay Time

This is the time from ignition off/drivers door closed to activation of Passive Arming/Passive Immobilisation.

Remote Disarm Only

When this is enabled, the anti-theft warning system can only be disarmed (or the passive functions disabled) by the remote control. If a programmed remote transmitter is not available and the anti-theft warning system is in an armed state, the car cannot be started even in the workshop since the diagnostic mode cannot be initiated in the armed state.

The options are:- Enabled or Disabled.

List Options

If the country code is selected, the List Options icon is displayed. On selecting this icon, a list of the available countries is shown on the PDU screen. If the 'Programmable' option is selected, then the horn duration, horn tone, and direction indicator actions become selectable. For other country selections, the display indicates the current default settings for that country. The remaining programmable options are selected by either toggle switches, enabling or disabling the feature as required, or by the keypad allowing timing durations to be entered.

The features will only be programmed upon confirmation, following the selection of the Tick icon.

Datalogger

The following security system signals may be monitored using the PDU connected to the upper diagnostic socket.

Signal Name	Description
DOORS	This signal indicates if one of the following are open or shut:- Drivers door, Passengers door or Bonnet. The signal is generated by latch switches in the door lock mechanisms, and for the bonnet, a plunger switch is located at the front left hand side wheel arch. When a device is open, (switch closed), the voltage on this pin should be less than 1 volt.
BOOT	This signal indicates if the boot is open or closed. It is generated by a plunger switch located by the right hand boot hinge which is open when the boot is shut. When the boot is open (switch closed), the voltage on this pin should be less than 1 volt.
IGN+	This signal indicates the state of the ignition supply line to the security module. When the ignition is switched on, the signal indicates ON.
GLASS	The glass break sensor is located between the two rear seat squabs. The security system only monitors this signal when it is armed
LED	This output from the security module provides an indication of the state of the alarm system. The LED will flash when the security system is armed. Datalogger provides an actuator control capability for this signal from the bargraph display.
DI	This output from the security module operates the direction indicators. Datalogger provides an actuator control capability for this signal from the bargraph display.
HORN	This output from the security module operates the horn when activated. Datalogger provides an actuator control capability for this signal from the bargraph display.
BOOTRLY	This signal indicates the status of the boot release relay operated by the remote transmitter. Datalogger provides an actuator control capability for this signal from the bargraph display.
RFKEY1	This signal identifies if a remote transmitter code has been learned against one of the security memory locations. Up to four remote transmitters can be programmed for use by the security system. NOKEY identifies that this location has not been programmed. KEY identifies that a valid remote transmitter has been programmed into the location.
RFKEY2	This signal identifies if a remote transmitter code has been learned against the second security memory location.
RFKEY3	This signal identifies if a remote transmitter code has been learned against the third security memory location.
RFKEY4	This signal identifies if a remote transmitter code has been learned against the fourth security memory location.
KEYPRESS	This signal identifies the security system's recognition of an activated remote transmitter button. The number identifies the memory location in which the code has been stored. L or R indicates that the Left or Right button was pressed.
LOCK	This signal displays the security output instructing the central locking system to lock the doors.
UNLOCK	This signal displays the security output instructing the central locking system to unlock the doors.

Diagnostic Trouble Codes and Alarm History

On selecting DTC and Alarm History, the PDU will request a snapshot from the security module of the DTC and alarm history memory locations. This information will be decoded and displayed on the PDU screen.

The diagnostic trouble codes detail the status of the security module during selftests performed during each ARM request.

Code	Description
20	Current fault
19	Intermittent horn fault
38	Current internal control module fault
37	Intermittent internal control module fault

The following alarm history codes detail the possible triggers detected by the alarm system:

Code	Description
1	Bonnet (Not currently used on DB7)
2	Boot
3	Passenger door (Will flag if either of the doors or the bonnet are triggered)
4	Drivers door (Not currently used on DB7)
5	Ignition
6	Sensor disregard
7	Panic alarm
8	Intrusion sensor
9	Key in ignition
10	Starter
15	Not detected - 2 alarms triggered simultaneously

The Clear button will erase the memory locations used to store both logged DTCs and Alarm History Codes.

Diagnostic Procedures

If either of diagnostic trouble codes 37 or 38 are logged, the security system ECU is faulty and should be replaced.

If DTCs 19 or 20 are logged, note the related alarm history code, investigate and repair the relevant part of the security system circuit - Circuit sheet 08.

Note: If alarm history code 15 is recorded, clear the DTC and Alarm History files. Retest the vehicle to generate a single code and then investigate the relevant part of the security system circuit.

Note: Note: See sheet 08 of the circuit diagrams, inserted at the back of this section, for details of the Security System wiring.

Introduction

This supplement to the DB7 Vantage Workshop Manual is provided to show the updates to vehicle electrical systems from Coupe chassis 300556 and Volante chassis 400557.

The following sections are included

Instrument Panel Diagnostics

Fuse and Relay Chassis Locations

Fuse Lists

Relay Locations

Relay Lists

Circuit Diagrams 00 - 31

Airbag System Diagnostic Fault Codes

The airbag system diagnostic fault codes listed in the initial issue of the DB7 Vantage Workshop Manual require updating. Please remove page 6-33/34 and replace it with the updated page included in this revision pack.

Instrument Panel Diagnostic Procedures

Instrument panel diagnostics may be entered using the PDU connected to the lower diagnostic socket. Instrument panel diagnostics may also be entered at the instrument panel using the following technique:

Press and hold the trip button whilst switching on the ignition. The instrument panel will enter diagnostic mode. Immediately release the trip button. The trip display will show '**tESt**' to indicate that the panel has successfully entered diagnostic mode.

Diagnostic mode may be exited by holding the trip button pressed for more than 3 seconds. The panel will also exit diagnostic mode if the ignition is switched off.

Diagnostic Mode Functions

After entering diagnostic mode, press the reset button briefly (less than 3 seconds) to toggle through each of the following diagnostic functions:

Gauge All instrument panel gauges perform a sweep (minimum to maximum and return to minimum)

888888 All LCD segments on

Bulb All warning lamps (except Sport and Gearbox warning) will illuminate

RXXX ROM level in HEX. Manufacturers use only.

ErXXX NVM target ROM level. Manufacturers use only.

EXXX NVM level. Manufacturers use only.

DXXX Manufacturers Date Code.

DtXXXX List of logged diagnostic trouble codes. Press the trip button briefly to toggle through any logged DTCs

VSXXXX Road speed (in tenths mph) from incoming CAN signal

VSXXXX Road speed (in tenths kph) from incoming CAN signal

RPXXXX Engine speed from incoming CAN signal

OdXXXX Odo rolling count message. Raw CAN message from PCM

IFXXXX Instantaneous fuel level (decimal) 0 = empty. 255 = full

AFXXXX Average fuel level (%). Uses gauge indication. 0 = empty. 255 = full

XXXC ECT temp in degrees centigrade

BatXXX Battery voltage in A/D counts

Following the BatXXX function is a listing of the microprocessor digital ports and some panel configuration features. These are for manufacturers use only and are of no practical significance to workshop technicians. Skip these displays by pressing the trip button for more than 3 seconds.

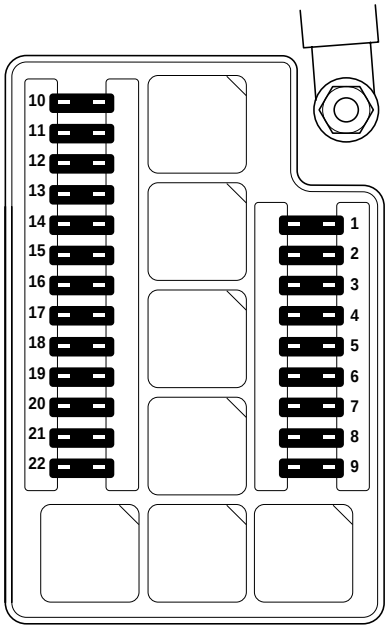
Instrument Pack Diagnostic Trouble Codes (DTCs)

9202	Fuel Sender circuit open	Fuel sender out of range high. Logged after 33 seconds continuous open circuit.
9204	Fuel sender circuit short to ground	Fuel sender out of range low and fuel sender circuit is short to ground. Logged after a single occurrence.
9254	Air temperature external sensor circuit failure	In range check
9342	ECU is defective	
9342	Trip reset button is stuck shut	
9342	NVM memory failure	'Error' displayed in odometer
9317	Battery voltage high	Overvoltage
9318	Battery voltage low	Low voltage
9359	Ignition run/accesory circuit failure	Accessory is ground or open circuit
A477	Module configuration failure	Configuration never programmed or configuration write failure
E196	Invalid data for engine rpm	Invalid CAN message from PCM = $FFFF. Logged for single occurrence
E197	Invalid data for vehicle speed	Invalid CAN message from PCM = $FFFF. Logged for single occurrence
E199	Invalid data for engine coolant temp	Invalid CAN message from PCM = $FF. Logged for single occurrence
E200	Invalid data for odometer	Invalid CAN message from PCM = $FF. (odo rolling count message) Logged for single occurrence

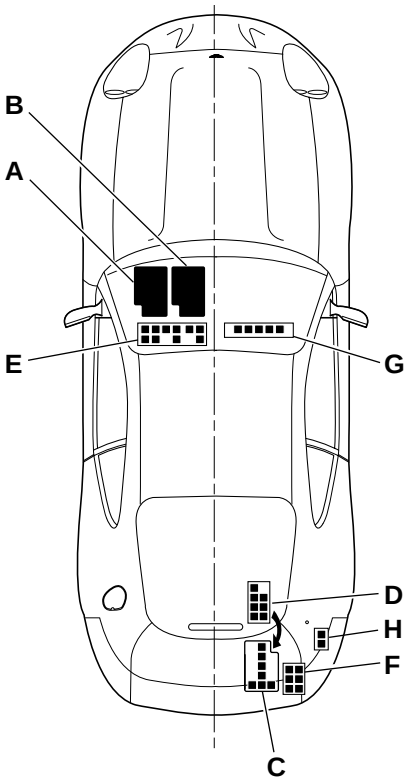
Fusebox and Relay Chassis Locations

Three fuse/relay boxes are located around the vehicle as shown on the illustration below. The forward left and right fuse boxes (A and B) are located beneath a plate in the passenger side footwell. The rear fuse box (C) is located in the boot, close to the battery. Fuse layout is the same in all three fuseboxes. Five additional relay chassis (D, E, F, G and H) are fitted in the positions shown. Relay chassis 'D' is mounted beneath the boot fusebox chassis 'C'

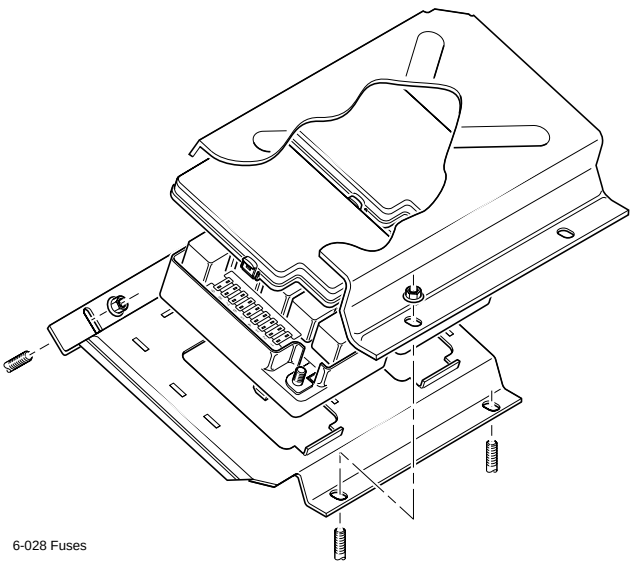
Note: The illustration shows the RHD version with the passenger footwell fuseboxes on the left hand side. On a LHD vehicle these fuseboxes would be on the right hand side.



6-026B Fuses

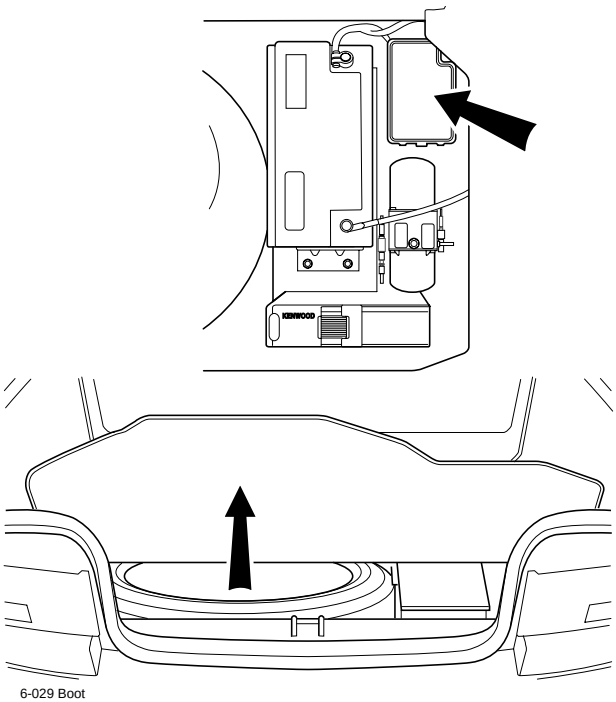


Access to Passenger Footwell Fuseboxes



6-028 Fuses

Access to the Boot Fusebox



6-029 Boot

Fuse Lists

WARNING: Do not install a fuse which exceeds the amperage for each location listed below.

A - Passenger Bulkhead Fusebox - Left Hand

1	15A	Accessory Terminal
2	10A	Transmission Control Module
3	5A	Headlamp Relay, Instrument Pack, Dimmer Unit
4	10A	Multi Function Unit, A/C In-Car Sensor, ABS Control Unit
5	5A	Traction Control Switch, Alternator Regulator, Heated Front Screen Control
6	10A	Rear Fog Switch, RH Dip Beam
7	30A	Starter Relay
8	10A	LH Dip Beam
9	20A	LHS Seat Heater Relay, LHS Seat Module
10	40A	Heated Front Screen Controller
11	10A	RH Horn
12	30A	RH Rad Cooling Fan
13	10A	LH Horn
14	30A	LH Rad Cooling Fan
15	30A	RH Main Beam
16	10A	MFU, Central Locking, A/C Control Panel, Alarm Sounder
17	30A	LH Main Beam
18	5A	Interior Map Lights, Instrument Pack, RH Rad Module
19	10A	Not Used
20	20A	Window Lift Cut Out, Accessory Terminal, A/C Clutch Relay
21	10A	Not Used
22	25A	Front Fog Relay

B - Passenger Bulkhead Fusebox - Right Hand

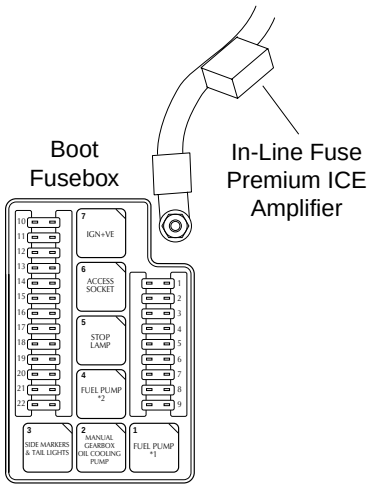
1	5A	Unused.
2	20A	Cigar Lighter
3	10A	Diagnostic Body & Powertrain, ICE, A/C Unit, Aux Power Hood
4	5A	Seat Switches and Heaters
5	10A	Indicator Flasher
6	10A	Ignition Coils 1-6
7	10A	Interior Lamp Cluster
8	10A	Ignition Coils 7-12
9	20A	RHS Seat Heater Relay, RHS Seat Module
10	10A	Dimmer, PATS, ICE
11	10A	Heated Rear Window Telltale, Door Mirrors
12	5A	Diagnostic Socket, Alternator
13	25A	Heated Rear Window
14	10A	Hazard Flasher Unit
15	20A	Wiper Logic Module and Wiper Stalk
16	30A	ABS Control Unit
17	20A	Wiper Motor, Logic Module and Wiper Stalk
18	30A	ABS Control Unit
19	10A	A/C LH Blower Motor
20	5A	Gearshift Interlock Module, Traction Control Switch, Interior Lamp
21	10A	A/C RH Blower Motor
22	10A	PCM and TCM Keep Alive Power

C - Boot Fusebox

1	10A	Reverse Light Relay
2	20A	Security ECU, Glass Break Sensor
3	5A	+12V Ignition, Fusebox Sense
4	5A	Trunk Logic Relay, hood, security system control module
5	5A	EEC Relay Ignition
6	5A	RH Fog Lamp, RHS EEC, LHS EEC, Brake Switch Input
7	20A	Fuel Pump 2, LHS EEC
8	10A	HM Stop Light, LH Stop Light
9	10A	Boot Lamps, Radio Aerial Motor
10	10A	Accessory Socket
11	20A	LH Quarter Light Up/Down Relay
12	20A	RH Quarter Light Up/Down Relay
13	10A	Airbag ECU
14	30A	Hood Up/Down Relay
15	20A	Fuel Pump 1, RHS EEC
16	10A	Rear Fog Light Relay
17	10A	Manual Gearbox Cooling Pump
18	10A	EECV Power
19	10A	RH Tail, Side, Side Marker and Number Plate Lamps
20	20A	EECV Power
21	10A	LH Tail, Side, Side Marker and Number Plate Lamps
22	20A	Not Used

In Line Fuse (in the loom at the boot fusebox +ve terminal)

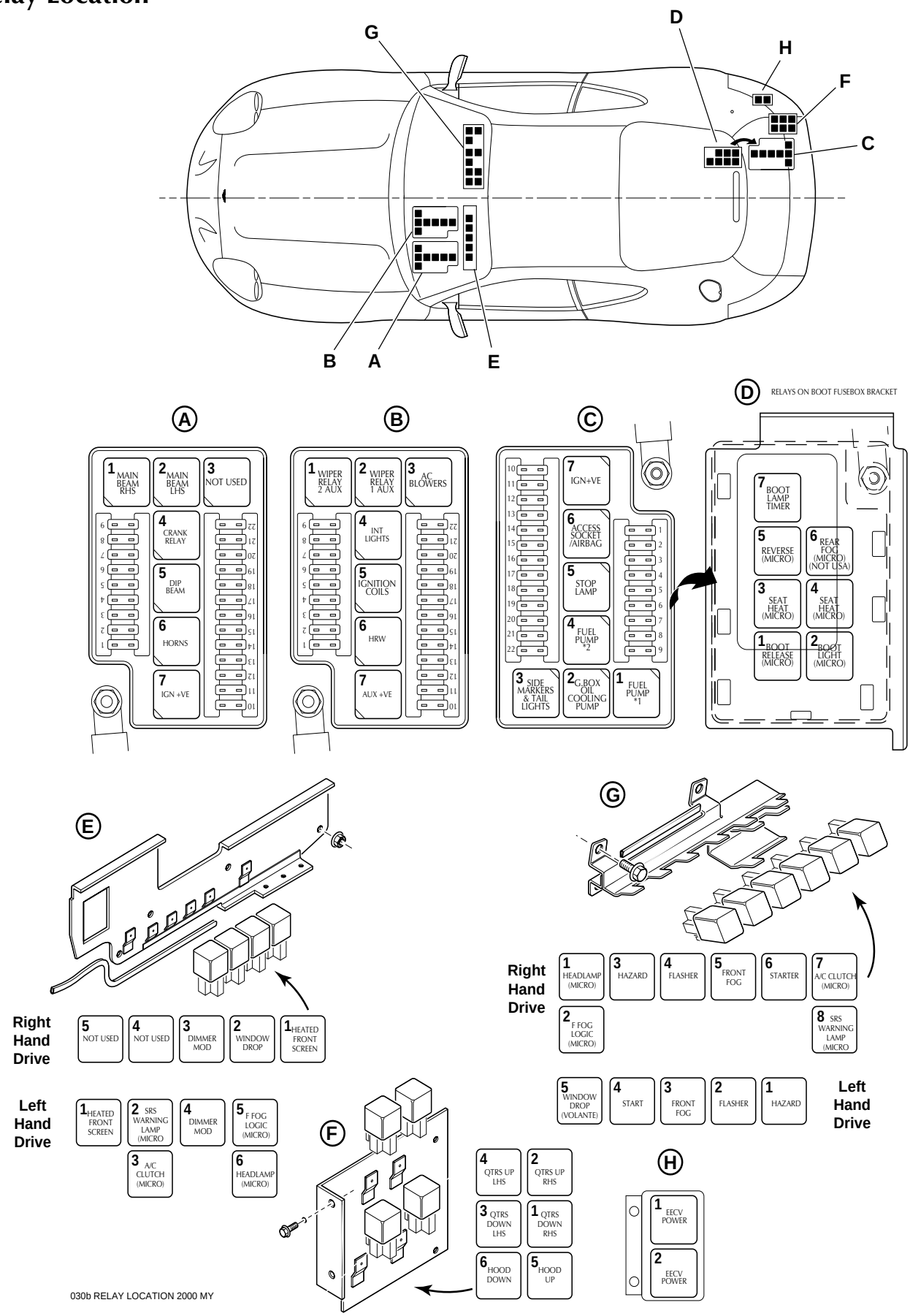
1	30A	Premium In-Car Entertainment



Note: Spare bayonet fuses are located in each fuse box

Note: A spare 40A (Maxi) fuse for the heated front screen and a Fuse extractor are supplied in the bulb/fuse replacement kit, stored in the spare wheel insert under the boot floor covering.

Relay Location



Relay List

Each fusebox houses seven relays. The layout of the relays is the same for each fusebox. Additional relays are mounted on brackets located behind the fascia and in the boot.

Note: The bulkhead brackets are handed and change side with the hand of the vehicle. The placement of the bulkhead mounted relays therefore varies between left and right hand drive vehicles. See the separate bulkhead mounted relay listings for left hand and right hand drive vehicles.

A - Footwell Fusebox (Left Hand)

1 Main Beam RHS
2 Main Beam LHS
3 Not Used
4 Crank Relay
5 Dip Beam
6 Horns
7 Ignition +Ve

B - Footwell Fusebox (Right Hand)

1 Wiper Relay 2 aux
2 Wiper Relay 1 aux
3 AC Blowers
4 Interior lights
5 Injector coils
6 Heated Rear Windscreen
7 Auxiliary +Ve

C - Boot Fusebox

1 Fuel Pump No.1
2 Manual Geabox Oil Cooling Pump
3 Side markers, Number Plates and tail lights
4 Fuel Pump No.2
5 Stop Lamp
6 Accessory Socket
7 Ignition +Ve

D - Boot Fusebox Brackets

1 Boot Release (micro)
2 Boot Light (micro)
3 Seat Heater (micro)
4 Seat Heater (micro)
5 Reverse Light (micro)
6 Rear Fog (micro) (not Federal Cars)
7 Boot Lamp Timer

E - Left Bulkhead Bracket (Right Hand Drive)

1 Heated Front Windscreen Timer
2 Window Drop (Volante only)
3 Dimmer Module
4 Not used
5 Not used

E - Left Bulkhead Bracket (Left Hand Drive)

1 Heat Front Windscreen Timer
2 Airbag Warning Lamp (micro)
3 AC Clutch (micro)
4 Dimmer Relay Control
5 Front Fog Logic (micro)
6 Headlamp (micro)

F - Hood Harness Bracket

1 RH Quarter Light Down Micro Relay
2 RH Quarter LIght Up Micro Relay
3 LH Quarter Light Down Micro Relay
4 LH Quarter Light Up Micro Relay
5 Hood Up
6 Hood Down

G - Right Bulkhead Bracket (Left Hand Drive)

1 Hazard Unit
2 Flasher Unit
3 Front Fog
4 Starter
5 Window Drop (Volante only)

G - Right Bulkhead Bracket (Right Hand Drive)

1 Headlamp (micro)
2 Front Fog Logic (micro)
3 Hazard
4 Flasher
5 Front Fog
6 Starter
7 AC Clutch (micro)
8 Airbag Warning Lamp

H - Engine Management Relay Bracket

1 EECV Power
2 EECV Power

Circuit Diagrams

The following circuit diagrams contain all the wiring, earthing and splice information for the DB7 Vantage from Coupe chassis number 300556 and Volante chassis number 400557.

Component locations have not changed significantly, the original DB7 Vantage diagrams may be used to locate components on all vehicles after chassis number 300556.

Sheet	Title
00.	Fuse, Relay and Earth Locations
01.	Harness Layout and Connector Location
02.	System and Component Index
03.	Vehicle Earths (Grounds) - LHD
03.	Vehicle Earths (Grounds) - RHD
04.	Door Mirrors LHD
04	Door Mirrors RHD
05.	Right Hand Seat
05	Left Hand Seat
06.	Passengers Seat - Non-Memory
07.	Central Door Locking
08.	Security System
09.	Interior Lighting
10.	Exterior Lighting - Front
11.	Exterior Lighting - Rear
12.	Wash/Wipe System
13.	Auxiliary Ignition Circuits.
14.	Window and Hood Lift (Coupe and Convertible)
15.	In Car Entertainment System (LHD)
15.	In Car Entertainment System (RHD)
16.	Dimmer Circuitry
17.	Engine Management System - RHS (Primary)
18.	Engine Management System - LHS (Secondary)
19.	Cooling, A/C, Fuel Pumps and Engine Man System Power
20.	Gearbox Controller (ZF 5HP30)
20	Manual Gearbox
21.	Starting Circuit
22	Air Conditioning
23.	ABS System
24.	Instrument Pack
25.	Restraint Systems
26.	Ancillaries
27.	Data Buses
28.	Bulkhead Left Fusebox
29.	Bulkhead Right Fusebox
30.	Boot Fusebox
31	Multi Function Unit

Circuit Diagrams 2002 Model Year (From chassis 302253)

From chassis number 302253 a number of significant wiring changes are introduced into DB7 Vantage cars. The attached component location charts and circuit diagrams reflect these changes. There are no major changes in the component location diagrams. This update package contains the following pages:-

Component Index

Component Location Diagrams 1 - 13

Circuit Diagrams 00 - 32

Note: some circuits are duplicated for left and right hand drive.

Sheet	Title
00.	System and Component Index
01.	Harness Layout
02.	Harnesses, Fuses and Earths
3.	Earth Sheet - LHD
3.	Earth Sheet - RHD
4.	Door Mirrors LHD
4	Door Mirrors RHD
5.	Right Hand Seat
6	Left Hand Seat
7.	Central Door Locking
8.	Security System
9.	Interior Lighting
10.	Exterior Lighting - Front
11.	Exterior Lighting - Rear
12.	Wash/Wipe System
13.	Auxiliary Ignition Circuits.
14.	Window and Hood Lift (Coupe and Convertible)
15.	In Car Entertainment System
16.	Dimmer Circuitry
17.	Primary PCM
18.	Secondary PCM
19.	Cooling Pumps
20.	Auto Gearbox
20	Manual Gearbox
21.	Starting Circuit
22	Air Conditioning
23.	ABS System
24.	Instrument Pack
25.	Airbag Systems
26.	Ancillaries
27.	Data Buses
28.	Bulkhead Left Fusebox
29.	Bulkhead Right Fusebox
30.	Boot Fusebox
31	Multi Function Unit
32	Sine Wave Convertor, Tracker and Keep Alive Memory

Component Location Index

Component Name	Physical Location	Circuit Location 2000 MY	Circuit Location 2002 MY
ABS Control Unit	5-1	23-C5	23-C3
ABS Fluid Level Sensor	5-2	23-C7	23-D6
Aerial - Radio	4-4	15-C6	15-A5
Air Conditioning Blower Motor LH			22-F3
Air Conditioning Blower Motor RH			22-F8
Air Conditioning Control Panel			22-A5
Air Conditioning Unit			22-C7
Air Conditioning - Clutch Relay	13-5	19-C4	19-B3
Air Conditioning - Compressor Clutch	13-4	19-D4	19-D3
Air Conditioning - Trinary Switch	13-3	19-C3	17-F6/19-C2
Air Conditioning - Trinary Switch			22-D2
Airbag - Driver's	7-10	25-E4	25-F1
Airbag - Passenger's	7-9	25-E5	25-E5
Airbag ECU / Single Point Sensor	7-11	25-C5	25-C5
Alarm Sounder	7-8	8-E2	8-E1
Alternator	11-4	21-C1	21-D1
Amplifier - In Car Entertainment			15-E6
Auto Gearbox			20-E7
Battery	11-3	21-B8	21-B8
Battery Disconnect Switch			32-E3
Boot Lamp - LH	1-15	9-C6	9-C6
Boot Lamp - RH	1-16	9-C6	9-C6
Boot Lock Actuator	7-4	8-E3	8-E4
Boot Lock Microswitch	7-4	8-E2	8-E3
Boot Lock Microswitch	7-4	9-D6	9-F6
Cannister Vent Valve (Left Hand)	9-5	18-C8	-
Cannister Vent Valve (Left Hand)	9-5	17-C8	17-B3
Catalyst Monitor Sensor (Rear Left)	9-6	18-B4	-
Catalyst Monitor Sensor (Rear Right)	9-4	17-B4	17-B3
CD Auto Changer			15-B8
Central Locking Control Unit	-	7-B4	7-B2
Cigar Lighter	10-4	26-D4	26-D6
Cooling Fan - Radiator Left Side	13-1	19-D2	19-E1
Cooling Fan - Radiator Right Side	13-2	19-C2	19-B1
Cooling Fans Control Module	?	19-C2	19-C1
Diagnostic Socket - Body (Security, Airbag)	7-12	27-C6	27-C1
Diagnostic Socket - Powertrain (Engine, Trans, PATS, ABS)	7-12	27-C6	27-D8
Dimmer Module	-	16-C4	10-A7/16-B3
Door Ajar Switch - Driver's	7-2	8-F3	9-D4
Door Ajar Switch - Driver's	7-2	9-D4	9-D4
Door Ajar Switch - Passenger's	7-2	8-F3	9-D5
Door Ajar Switch - Passenger's	7-2	9-D5	9-D5
Door Lock - Driver's	7-1	7-D4	7-D3
Door Lock - Passenger's	7-7	7-D5	7-D4
Door Mirror - Driver's	-	4-E4	4-E2
Door Mirror - Passenger's	-	4-E6	4-E7
Door Mirror Switch - Driver's	10-2	4-C4	4-C2
Door Window Controller (Convertible) - Driver's Door	3-17	14-C2	9-D4/14-E1
Door Window Controller (Convertible) - Passenger's Door	3-16	14-C3	9-D4/14-E3
Door Window Controller (Coupe) - Driver's Door	3-17	14-C2	14-E1
Door Window Controller (Coupe) - Passenger's Door	3-16	14-C3	14-E3
EGR Vacuum Regulator (Left Hand)	6-18	18-B4	18-B4

Component Name	Physical Location	Circuit Location 2000 MY	Circuit Location 2002 My
EGR Vacuum Regulator (Right Hand)	6-19	17-B4	17-B4
Flasher Unit - Direction Indicators	3-1	10-B6	10-B6
Flasher Unit - Direction Indicators	3-2	11-B6	11-B7
Flasher Unit - Hazard Lamps	3-3	10-B5	10-B5
Flasher Unit - Hazard Lamps	3-4	11-B5	11-B6
Fuel Filler Flap Solenoid	7-14	7-D4	7-D2
Fuel Injectors 1-6 (Right Hand Bank)	6-6	17-B5	17-B5
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Figure 1

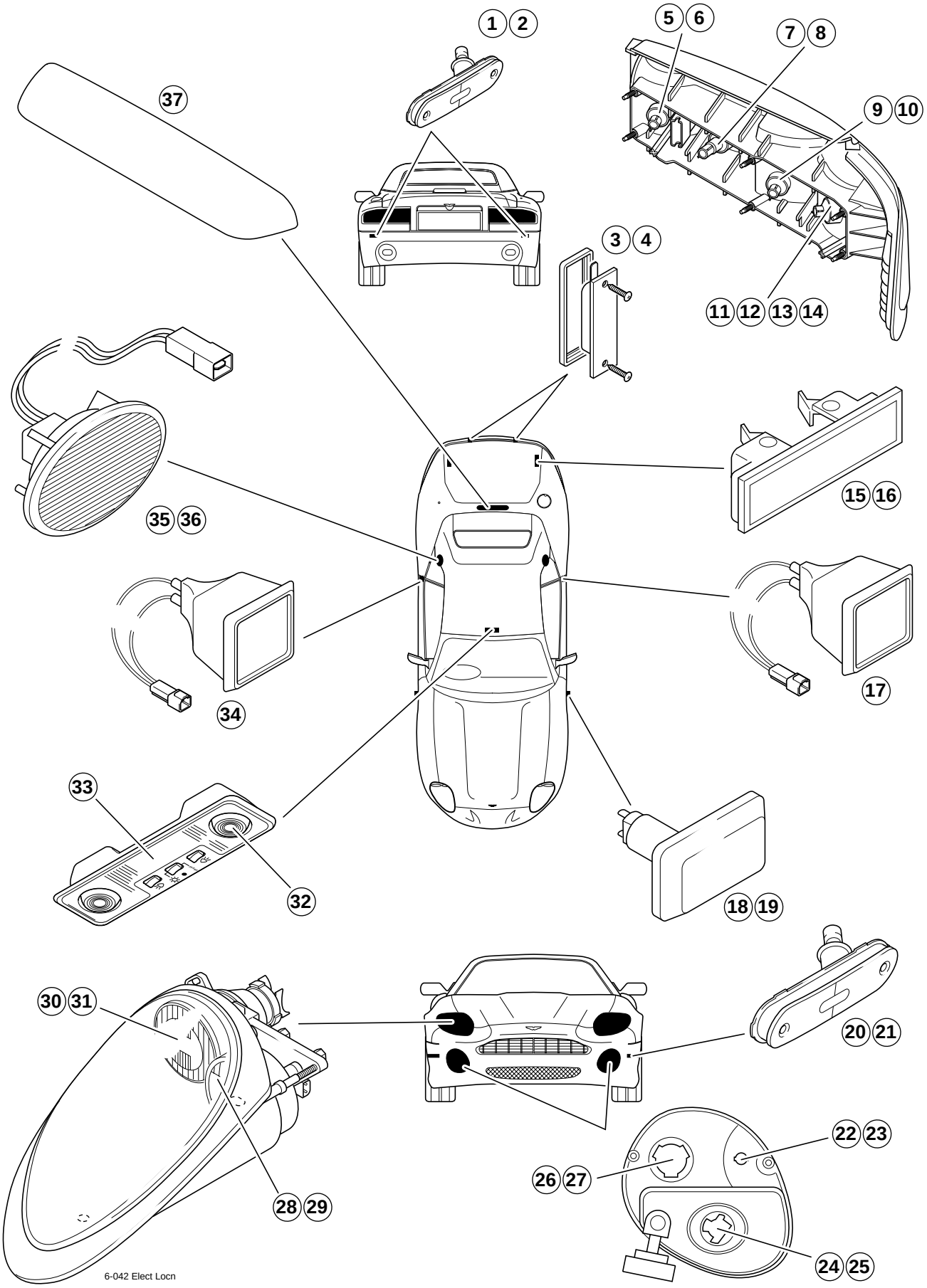
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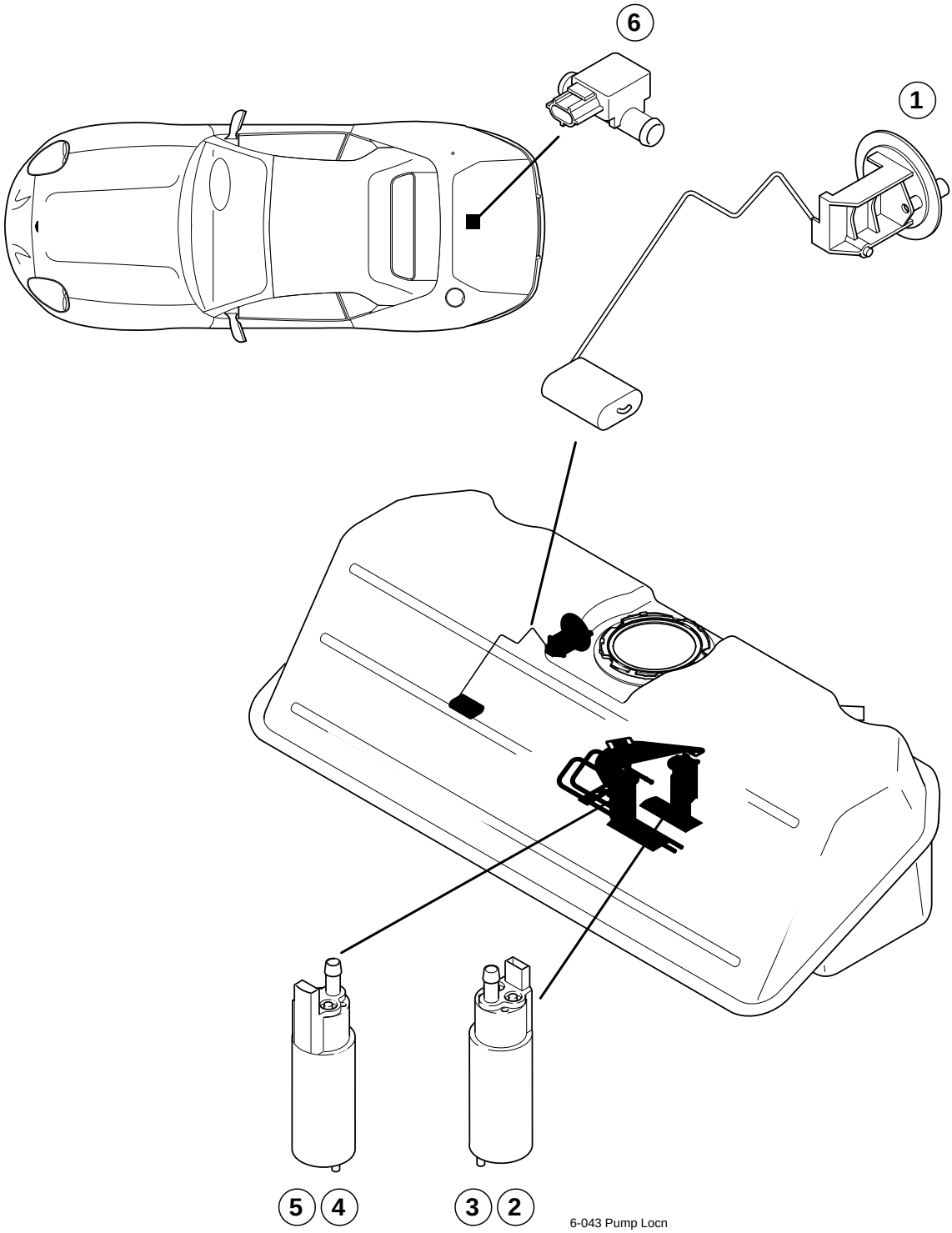
Figure 2



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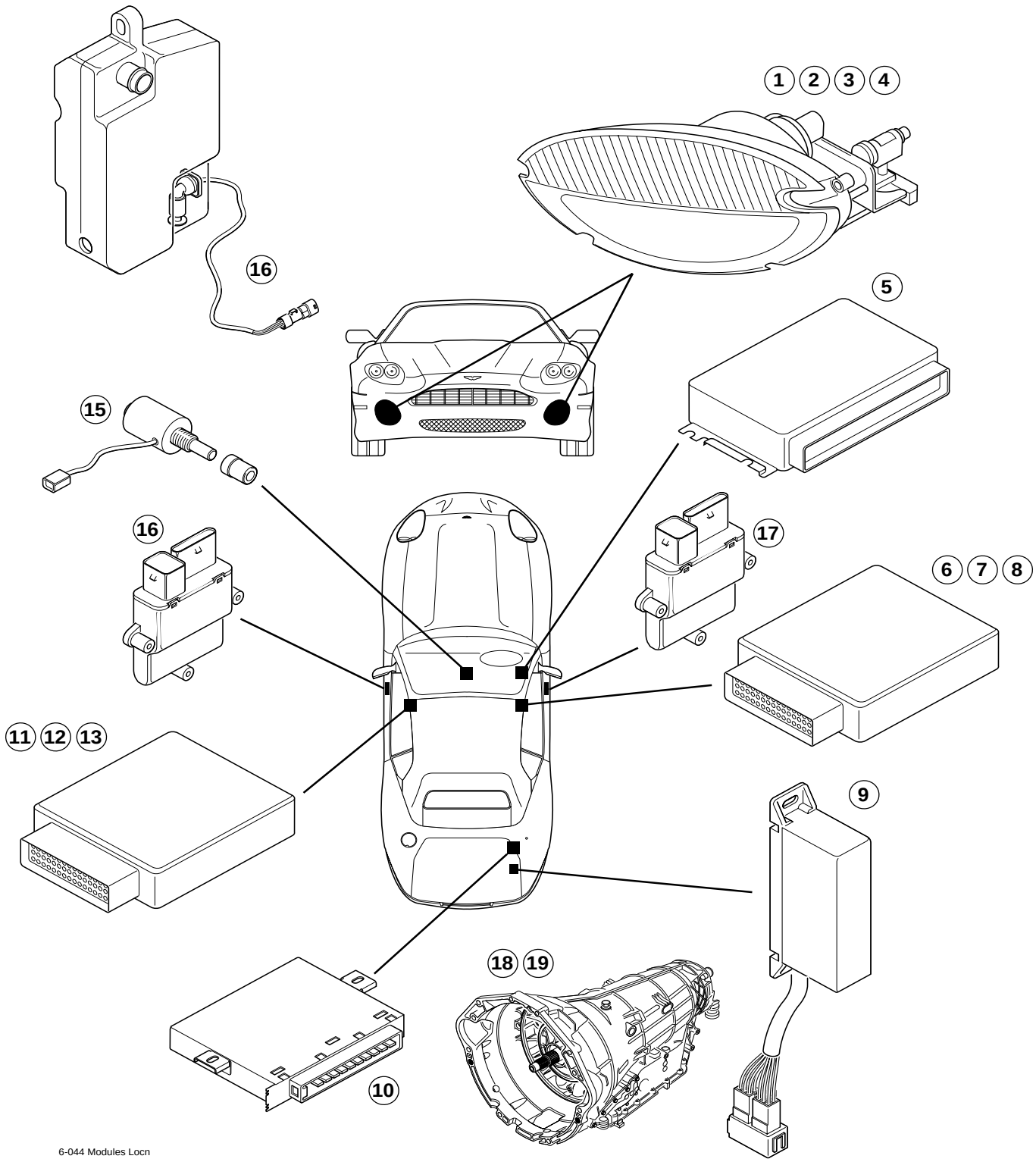

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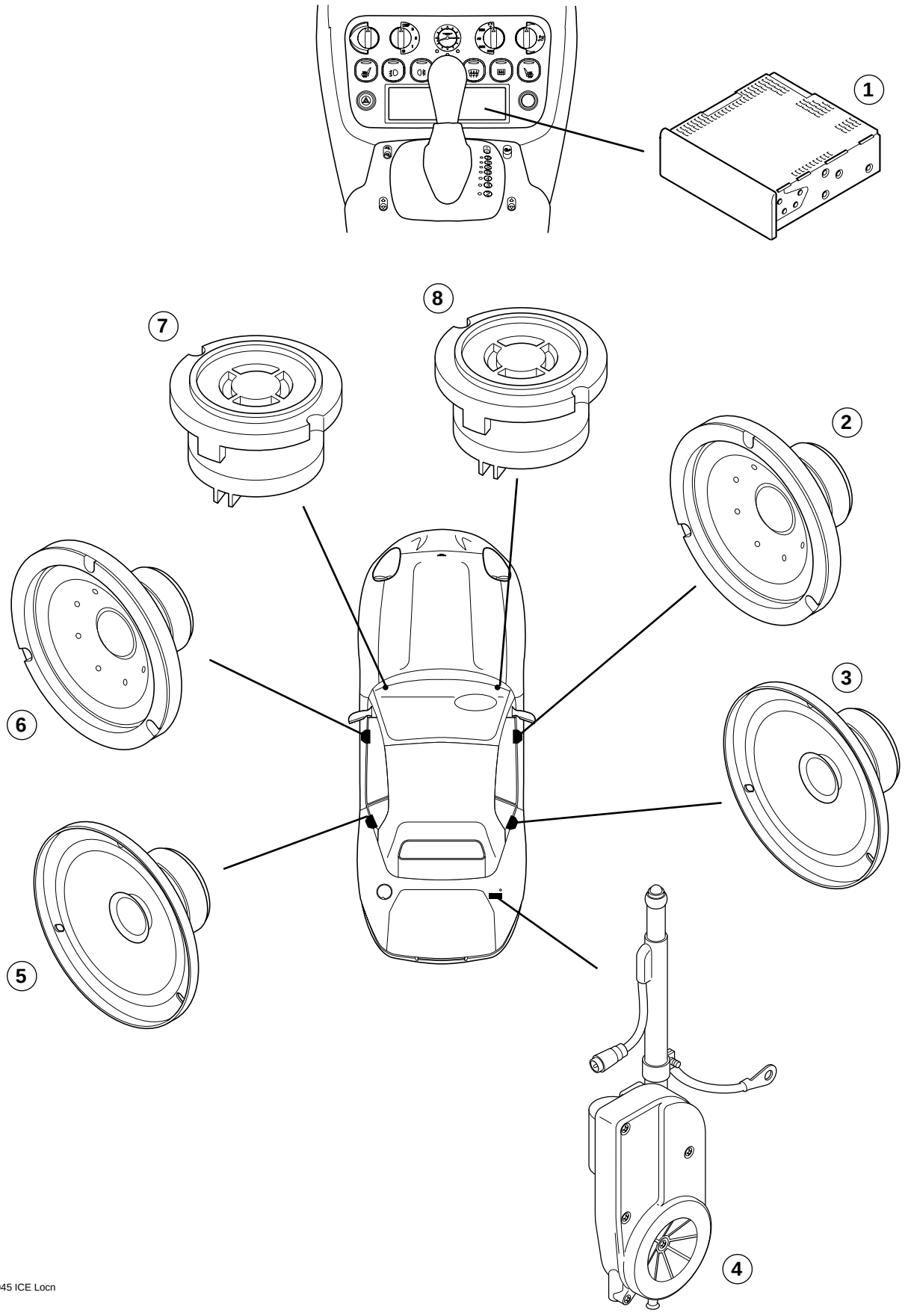

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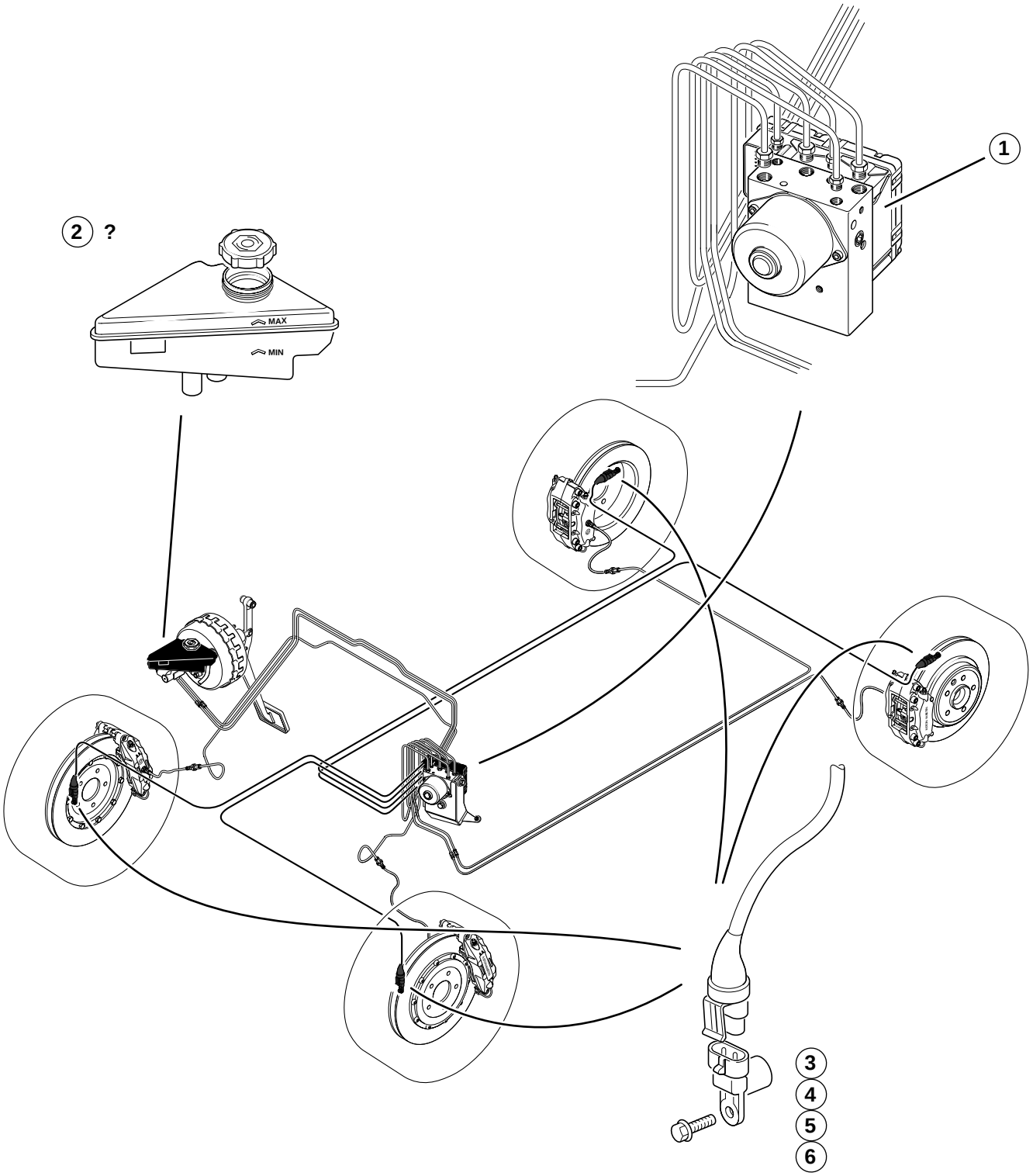


6-046 BR Locn

Figure 6

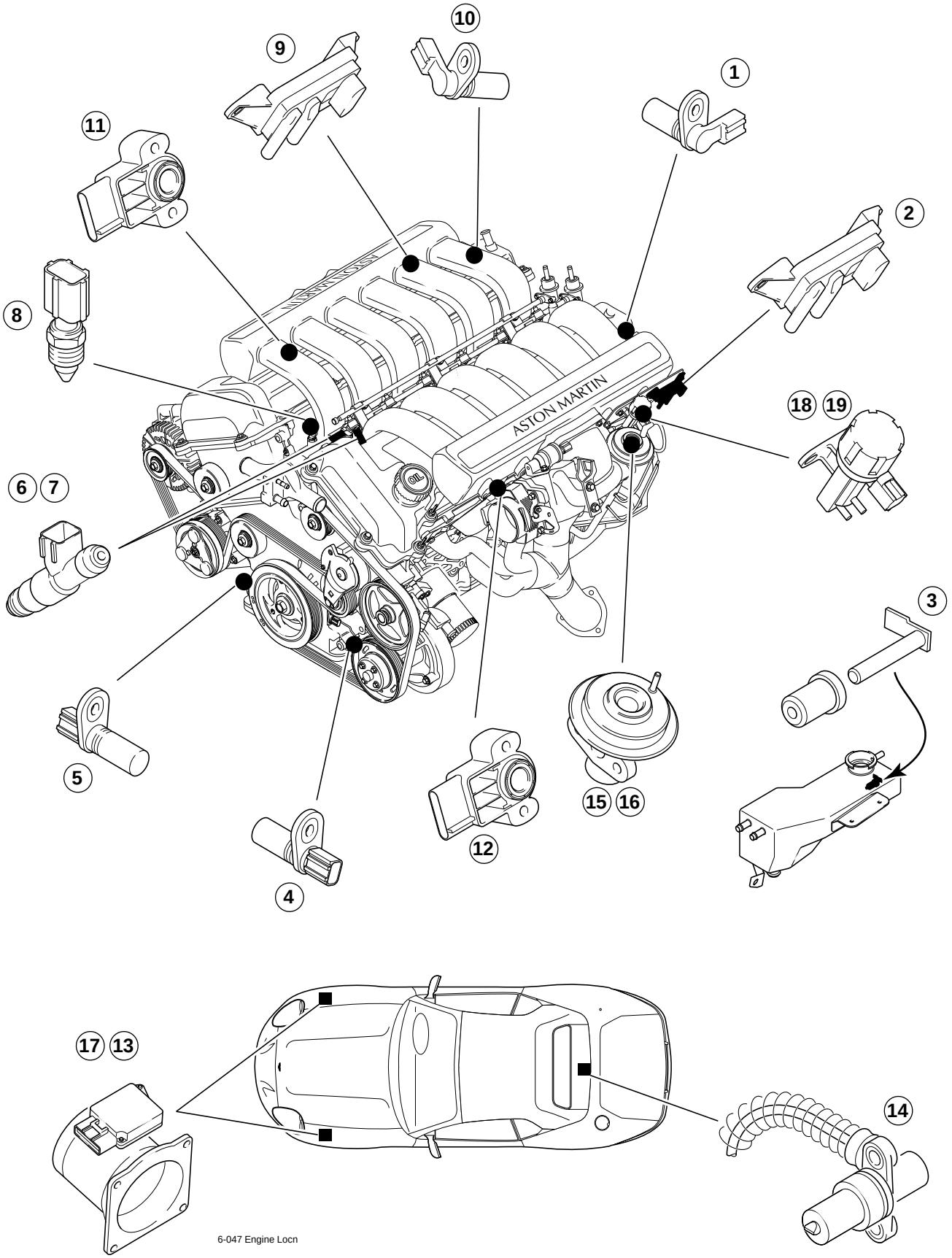
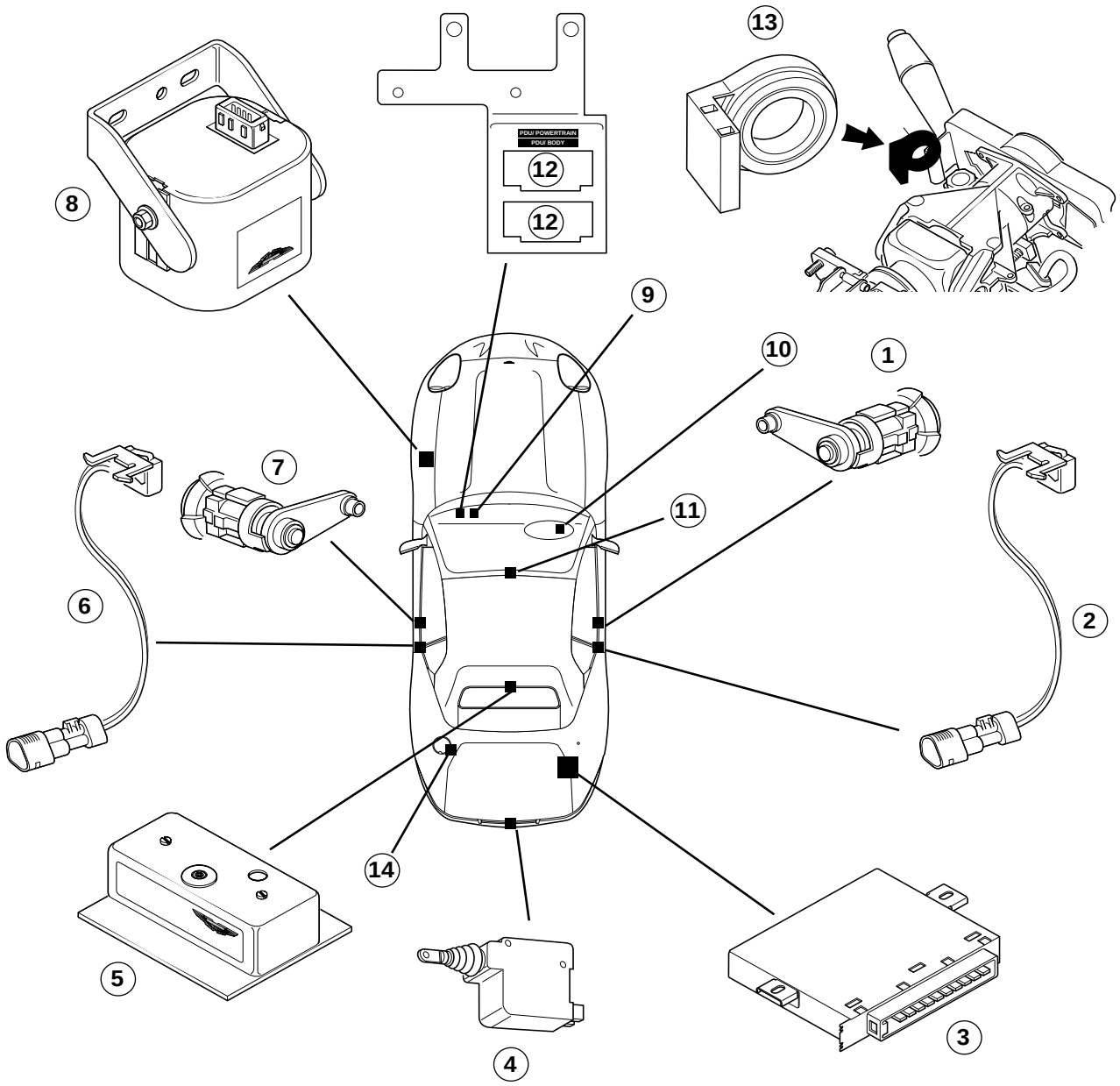
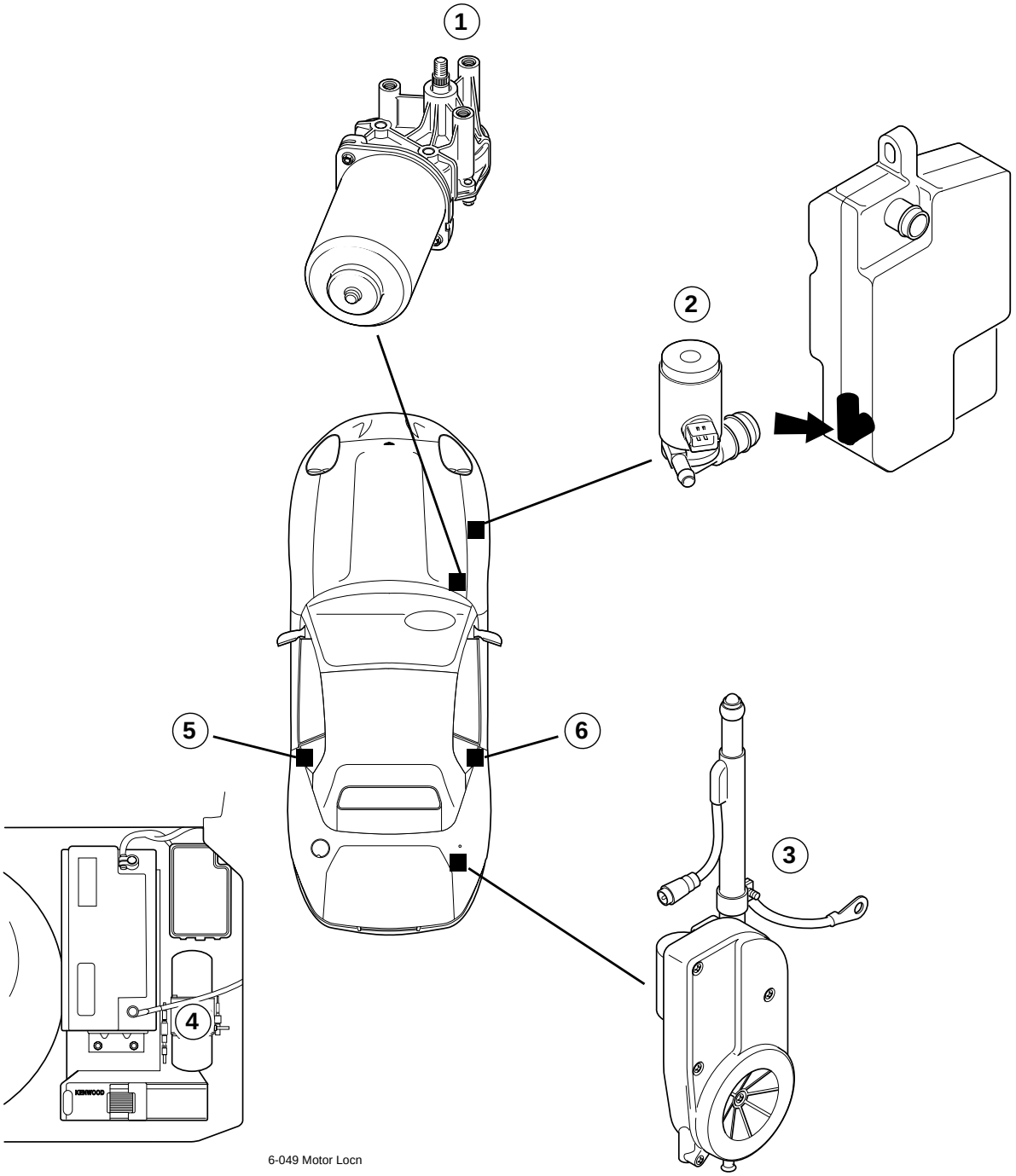

10
9
1
11
2
8
ASTON MARTIN
18
19
6
7
3
5
15
16
12
4
17
13
14
6-047 Engine Locn

Figure 7



6-048 Security Locn

Figure 8



6-049 Motor Locn

Figure 9

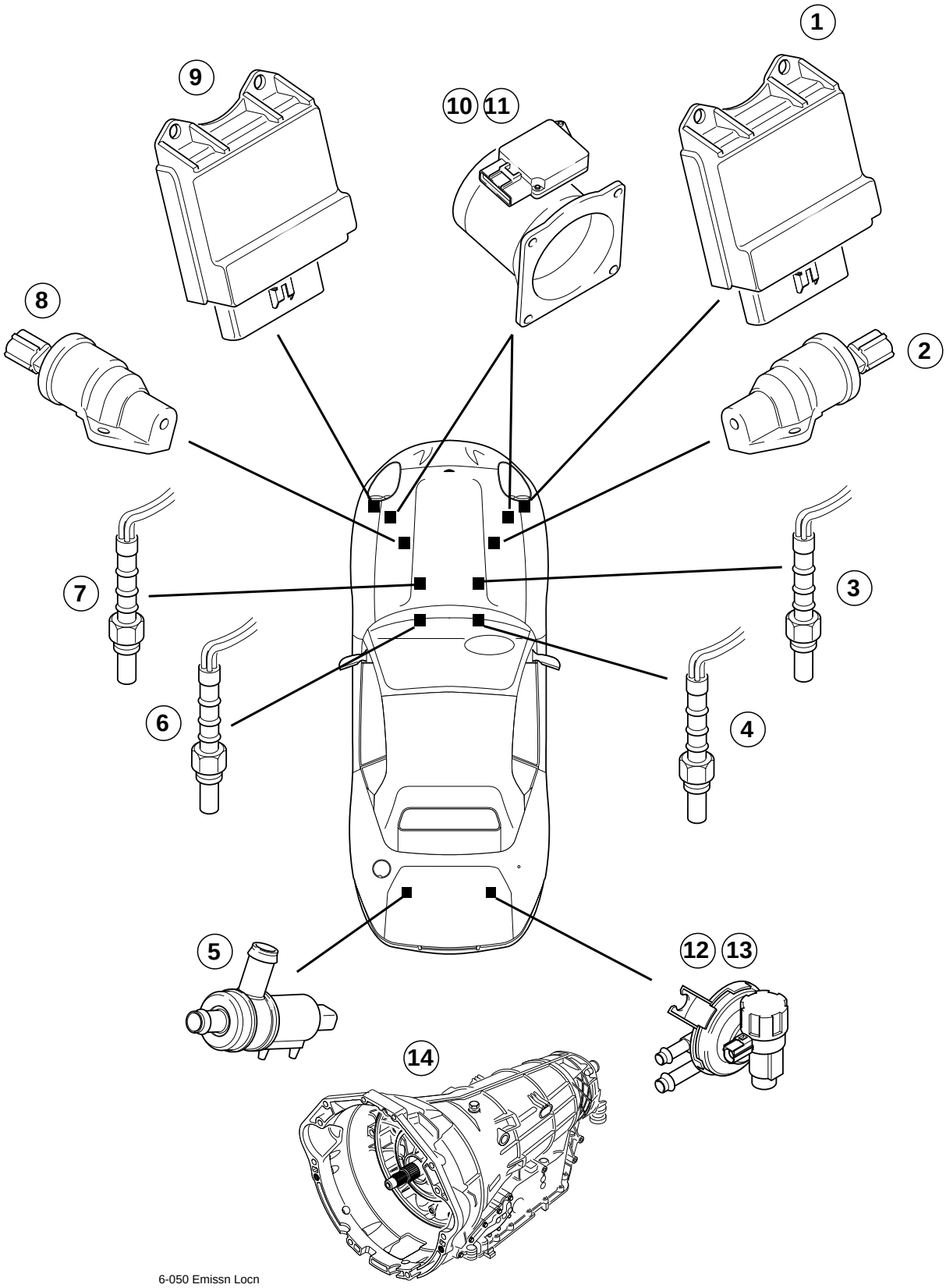
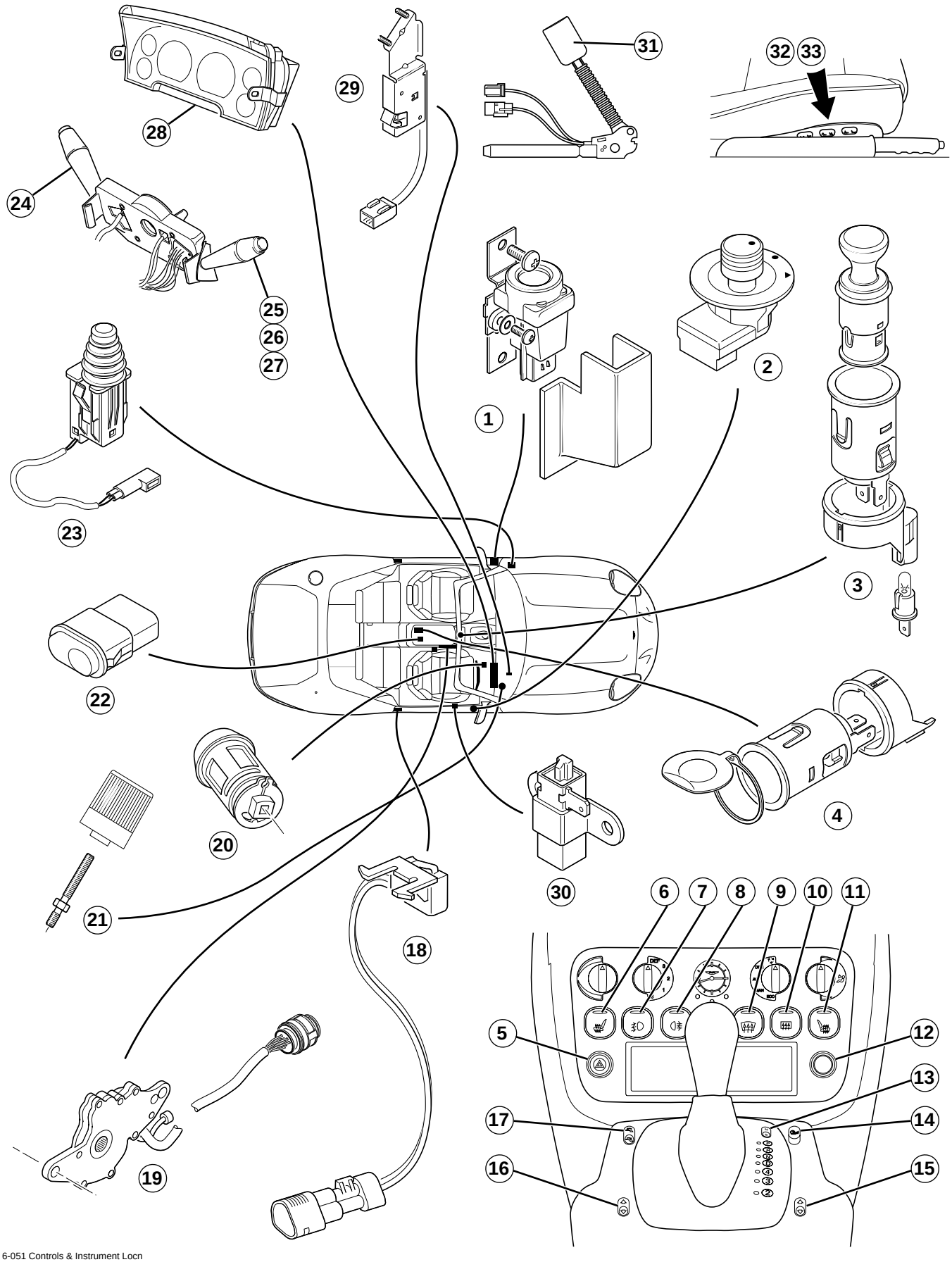


Figure 10



6-051 Controls & Instrument Locn

Figure 11

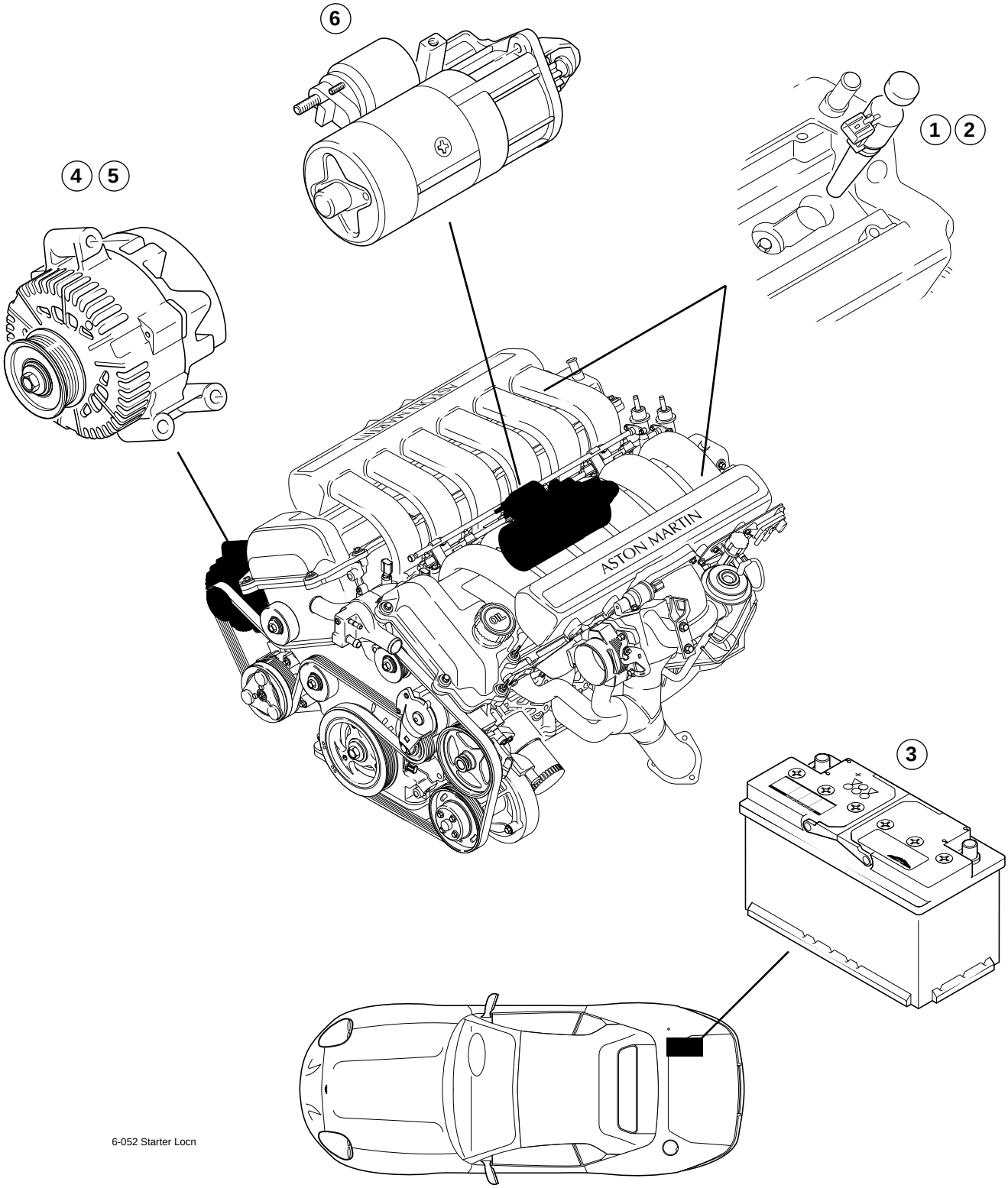


Figure 12

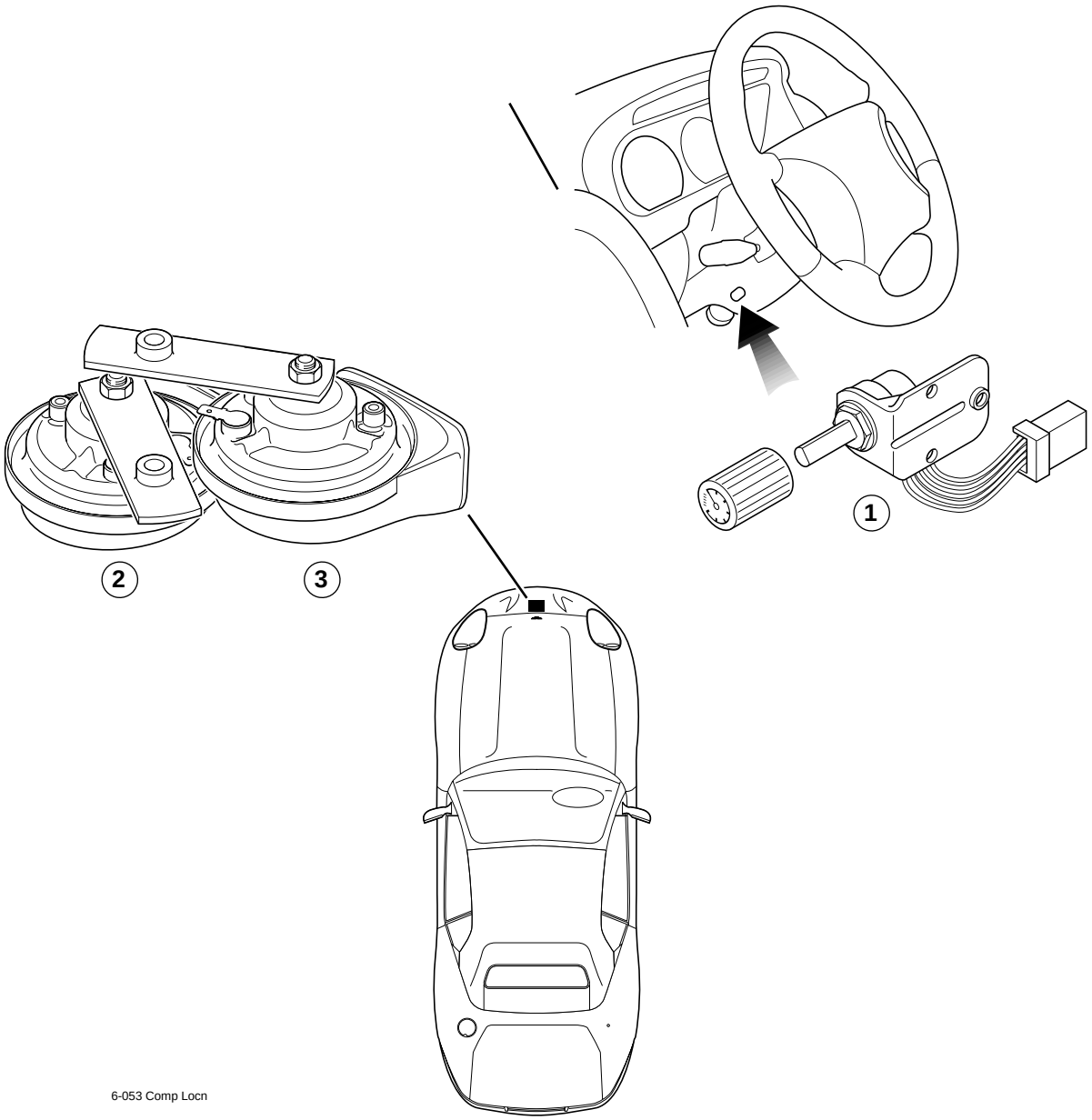
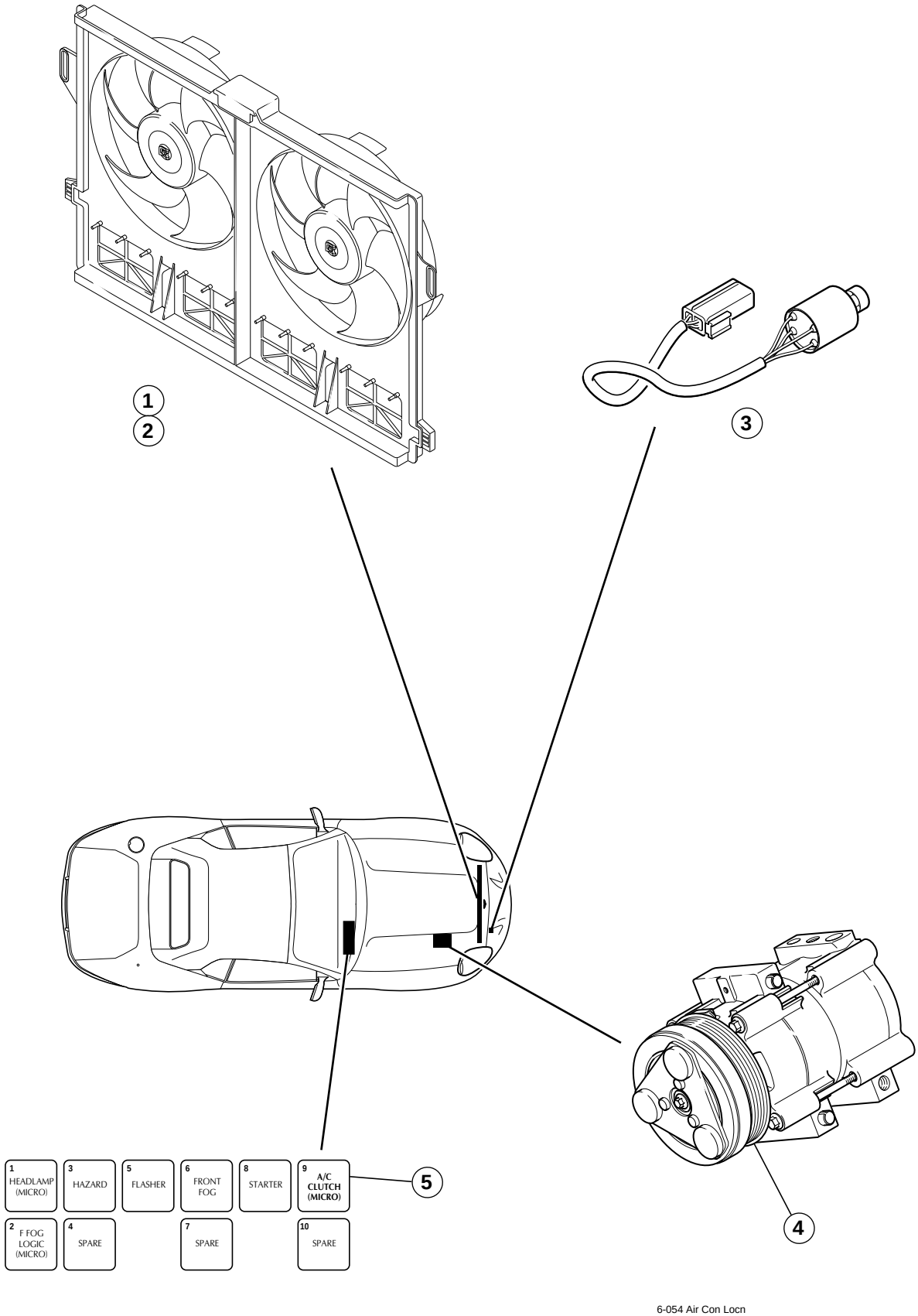


Figure 13



6-054 Air Con Locn

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CIRCUIT DESCRIPTION	SHEET NUMBER
INDEX SHEET	00
HARNESS LAYOUT	01
HARNESSES, FUSE, RELAYS, etc.	02
EARTH SHEET RHD	03
EARTH SHEET LHD	03
DOOR MIRROR RHD	04
DOOR MIRROR LHD	04
SEAT RIGHT HAND	05
SEAT LEFT HAND	06
CENTRAL DOOR LOCKING	07
SECURITY SYSTEM	08
INTERIOR LIGHTING	09
EXTERIOR LIGHTING FRONT	10
EXTERIOR LIGHTING REAR	11
WASH/WIPE SYSTEM	12
AUX,IGN & START CIRCUITS	13
WINDOW/HOOD LIFT	14
IN-CAR ENTERTAINMENT	15
DIMMER CIRCUIT	16
PRIMARY PCM	17
SECONDARY PCM	18
COOLING,A/C,FUEL PUMPS ETC	19
GEARBOX CONTROL (AUTO)	20
GEARBOX MANUAL	20
STARTING CIRCUIT	21
AIRCONDITIONING SYSTEM	22
ABS SYSTEM	23
INSTRUMENT PACK	24
AIRBAG SYSTEM	25
ANCILLARIES	26
DATA BUSES	27
FUSEBOX BULKHEAD LHS 22WAY	28
FUSEBOX BULKHEAD RHS 22WAY	29
FUSEBOX BOOT 22WAY	30
MFU CIRCUITRY	31
SINE WAVE CONVERTOR TRACKER	
KEEP ALIVE MEMORY	32

CONNECTOR NUMBER BREAKDOWN

HARNESS ID
- AB = ABS HARNESS
- AC = AIRCON HARNESS
- BH = BULKHEAD HARNESS
- BL = BOOT (TRUNK) LID
- CS = COLUMN SWITCH
- DD = DOOR DRIVERS
- DP = DOOR PASSENGER
- EM = ENGINE MANAGEMENT
- FL = FRONT LEFT ABS
- FR = FRONT RIGHT ABS
- GB = GEARBOX HARNESS
- GS = GEARSHIFT HARNESS
- HH = HOODLIFT HARNESS
- LF = LEFT FOWARD HARNESS
- PI = ENGINE HARNESS
- RH = REARWARD HARNESS
- RL = REAR LEFT ABS
- RR = REAR RIGHT ABS
- SD = SEAT DRIVERS
- SP = SEAT PASSENGER
- TR = TRANSMISSION HARNESS

COMPONENT INDEX

DESCRIPTION	CIRCUIT SHEET NUMBER
A.B.S. ECU & FUSES	23
A.B.S. FLUID RESERVOIR	23
A.B.S. WHEELSPEED SENSORS	23
ACCESSORY SOCKET	26
AERIAL MOTOR	15
AIR BAG - DIAGNOSTIC MONITOR	25
AIR BAGS - DRIVER & PASSENGER	25
AIR CON - TRINARY PRESSURE SWITCH	19,22
AIR CON - UPPER & LOWER SERVOS	22
AIR CON - CLUTCH, RELAY & FUSES	19
AIR CON - CONTROL PANEL	22
AIR CON - ECU & FUSES	22
AIR CON - PANEL GENERAL ILLUMINATION	22
AIR MASS FLOW METER	17,18
AIR TEMP SENSOR (AIR CON)	22
AIR TEMP SENSOR (IN-CAR)	22
ALTERNATOR & REGULATOR	21
AMBIENT AIR TEMP SENSOR (AIR CON)	22
AMPLIFIER	15
ASPIRATOR MOTOR	22
AUXILLARY +IVE RELAY	29
BATTERY & POWER CABLES	21
BATTERY CONDITIONER	32
BATTERY DISCONNECT SWITCH	32
BLOWER MOTORS,RELAY & CONTROLS (AIR CON)	22
BOOT LAMPS	9
BOOT OPEN SWITCH	8
BOOT LOCK ACTUATOR	8
BOOT RELEASE SWITCH	8
BRAKE FLUID LEVEL SWITCH	23
BRAKE SWITCH (FOOT)	21
BRAKE SWITCH (HANDBRAKE)	13
CID SENSOR	17,18
CENTRAL LOCKING UNIT	7,8
CIGAR LIGHTER & FUSE	26
COLUMN SWITCHGEAR - DIMMER SWITCH	24
COLUMN SWITCHGEAR - DI SWITCH	10
COLUMN SWITCHGEAR - HORN SWITCHES	8
COLUMN SWITCHGEAR - H/LAMP FLASH SWITCH	10
COLUMN SWITCHGEAR - IGN SWITCH/ AUX POSITION	21
COLUMN SWITCHGEAR - IGN SWITCH/ IGN POSITION	21
COLUMN SWITCHGEAR - KEY IN SWITCH	8
COLUMN SWITCHGEAR - WASH/WIPE SWITCH	12
COOLANT TEMPERATURE SENSOR	17
COOLING FANS	19
COURTESY LAMPS - ROOF	9
DATA BUSES - CAN,SCP & ISO	27
DEFROST SOLENOID (AIR-CON)	22
DIFF CONTROL POT (AIR-CON AIR TEMP)	22
DIMMER UNIT & ILLUMINATION CIRCUITS	16
DOOR LOCKING	7
DOOR MIRRORS - HEATERS & RELAY	26
DRIVERS DOOR - WINDOW CONTROLLER	14
DRIVERS DOOR - MIRROR & MOTORS	4
DRIVERS DOOR - SWITCHPACK	4, 14
DRIVERS DOOR - PUDDLE LAMP	9
DRIVERS SEAT - LUMBAR PUMP	5
DRIVERS SEAT - MOTORS & SWITCHES	5
DRIVERS SEAT - SEAT BELT BUCKLE SWITCH	10
EARTHING	3
EGR VALVE	17
ENGINE MANAGEMENT - ECM & FUSES	17,18
EVAP SENSOR (AIR-CON)	22
EXTERIOR LIGHTING (FRONT) & FUSES	10
EXTERIOR LIGHTING (REAR) & FUSES	11
FUEL FILLER FLAP SOLENOID	7
FUEL INJECTORS & RELAY	17,18
FUEL PUMPS & RELAY	19,21
FUEL TANK LEVEL SENSOR	19
FUSEBOX - BULKHEAD LHS	13
FUSEBOX - BULKHEAD RHS	13
FUSEBOX - BOOT	13
GEARBOX	20
GEARBOX - TCM & FUSES	20
GEARBOX - MODE SWITCH	20
GEARBOX - SELECT SWITCHES	20
GEARBOX - SPEED SENSOR	20
GEARSHIFT INTERLOCK SOLENOID	20
GEARSHIFT ROTARY SWITCH	20
GLASS BREAKAGE SENSOR	8
GLOVEBOX LIGHT & SWITCH	

DESCRIPTION	CIRCUIT SHEET NUMBER
HEADER CONSOLE - ROOF COURTESY LAMPS	9
HEADER CONSOLE - MAP LIGHTS & SWITCHES	9
HEATED FRONT SCREEN - HEATERS & RELAYS	26
HEATED REAR SCREEN - HEATERS & RELAYS	26
HIGH MOUNTED STOP LAMP	11
HOOD CONTROL MODULE	14
HOOD SWITCH (UP/DOWN)	14
HOOD PUMP MOTOR & FUSES	14
HORNS - RELAY,SWITCHES	8
ICE AERIAL/MOTOR & FUSES	15
ICE HEAD UNIT & SPEAKERS	15
IGNITION COILS & RELAY	17,18
IGNITION +IVE RELAY BULKHEAD FUSEBOX	13
IGNITION SWITCH	13,21
INERTIA SWITCH	13
INSTRUMENT PACK	5,24
INTERIOR LIGHTING - SWITCHES & FUSES	9
KEEP ALIVE POWER FUSES	32
KEYLOCK SOLENOID	20
KICKDOWN SWITCH	20
LAMPS FRONT - PILOT,DIP & MAIN BEAM	10
LAMPS FRONT - SIDE MARKER	10
LAMPS FRONT - DI/HAZARD & SIDE REPEATER	10
LAMPS FRONT - FOG	10
LAMPS FRONT - RELAYS	10
LAMPS REAR - TAIL,SIDE MARKER & No PLATE	11
LAMPS REAR - DI/HAZARD	11
LAMPS REAR - STOP & REVERSE	11
LAMPS REAR - FOG	11
LAMPS REAR - RELAYS	11
LIGHTING SWITCHES (EXTERIOR)	10,11,16
MAP LIGHTS - LH,RH & SWITCHES	9
MIRROR JOYSTICK - DRIVER & PASSENGER DOORS	4
MODULE - MFU	4,8,9
MODULE - DOOR DRIVERS	14
MODULE - DOOR PASSENGERS	14
MODULE - SECURITY & LOCKING	8
OBD2 (DIAGNOSTIC CONNECTORS)	27
OIL PRESSURE SENSOR	24
OXYGEN SENSORS & HEATERS	17,18
PASS DOOR - WINDOW CONTROLLER	14
PASS DOOR - MIRROR & MOTORS	4
PASS DOOR - SWITCHPACK	14
PASS DOOR - PUDDLE LAMP	9
PASS DOOR - WINDOW LIFT SWITCHES,MOTOR &FUSES	14
PASS SEAT - DRIVERS/PASSENGERS IDENT	6
PASS SEAT - HEATERS,TH/STAT & SWITCH	6
PASS SEAT - LUMBAR PUMP	6
PASS SEAT - MOTORS & SWITCHES	6
PATS MODULE	8
PATS TRANSCEIVER	8
POWER FOLD MIRRORS	4
RADIATOR COOLING FANS	19,22
RADIO - HEAD UNIT	15
RADIO - SPEAKERS	15
REAR QUARTER LIGHTS	9
REAR QUARTER WINDOW LIFT MOTORS & RELAYS	14
SCREENWASH HEATERS/PUMP	12
SECURITY ACTIVE INDICATOR & SOUNDERS	8
SECURITY/LOCKING SYSTEM ECU & FUSES	7,8
SIDELAMP SWITCH	10
SERVO LOWER (AIR-CON)	22
SOLENOID VALVES (AIR_CON)	22
STARTER MOTOR/SOLENOID & RELAY	13,21
STARTER PUSH BUTTON	13
SINE WAVE CONVERTOR	32
SINGLE POINT CRASH SENSOR	25
THROTTLE POSITION SENSOR	17, 18
TRACKER UNIT	32
TRACTION CONTROL SWITCH	23
VENT SOLENOID (AIR-CON)	22
WASHER LEVEL SENSOR	12
WATER TEMP SENSOR	17
WIPER MOTOR ASSEMBLY (FRONT)	12
WIPER MOTOR RELAY	12
WIPER STALK - FRONT SCREEN	12

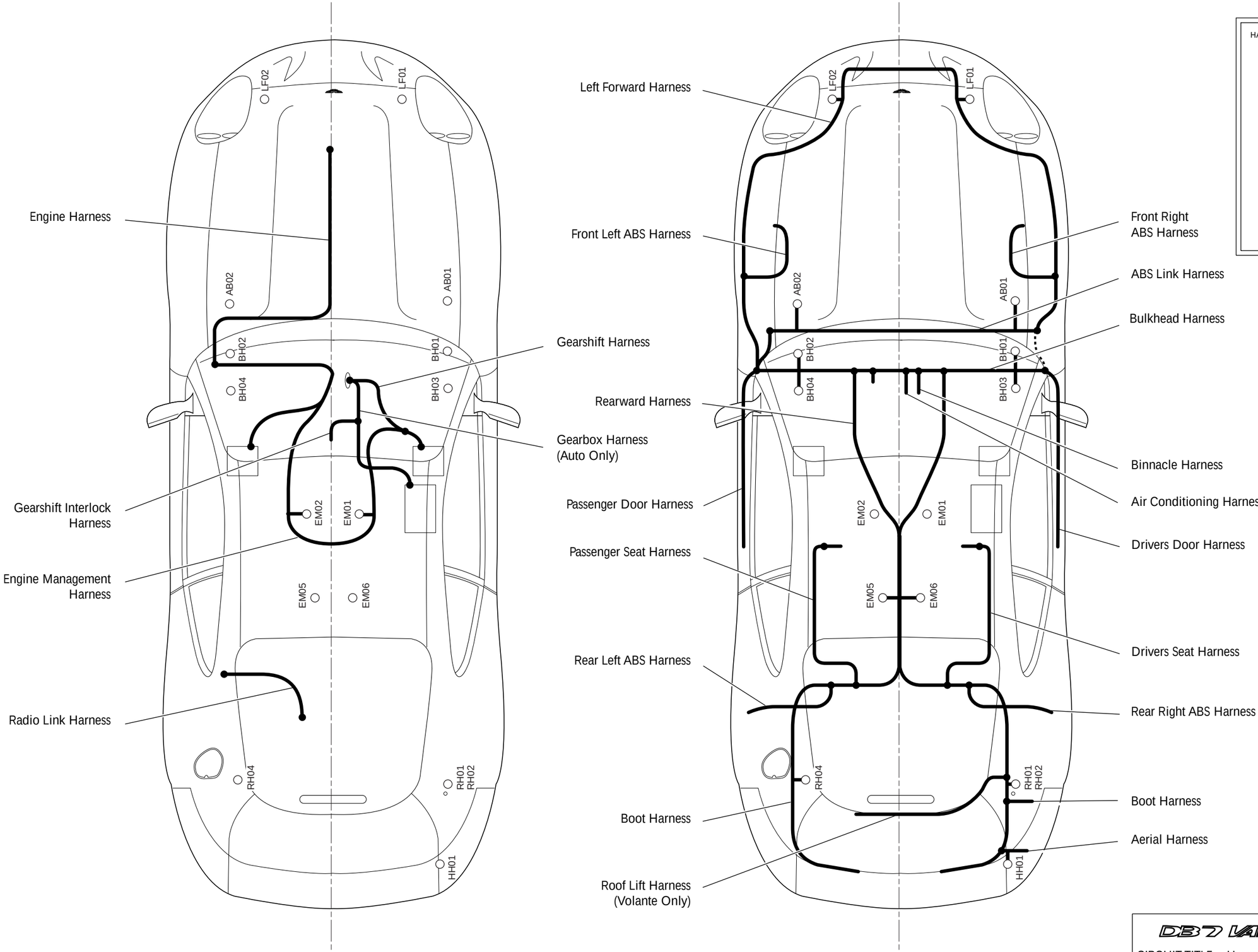
CABLE COLOURS

R	Red
K	Pink
G	Green
P	Purple
O	Orange
B	Black
S	Slate (Gray)
Y	Yellow
W	White
U	Blue
N	Brown
L	Light
GIN	Green inside a screen
RIN	Red inside a screen
BRD	Braided screen

DB7 VANTAGE

CIRCUIT TITLE	Index Sheet
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 00



HARNESS IDENTIFICATION

- AB = ABS HARNESS
- AC = AIRCON HARNESS
- BH = BULKHEAD HARNESS
- BL = BOOT (TRUNK) HARNESS
- CS = COLUMN SWITCH
- DD = DOOR DRIVERS
- DP = DOOR PASSENGER
- EM = ENGINE MANAGEMENT
- FL = FRONT LEFT ABS
- FR = FRONT RIGHT ABS
- GB = GEARBOX HARNESS
- GS = GEARSHIFT HARNESS
- HH = HOODLIFT HARNESS
- LF = LEFT FOWARD HARNESS
- PI = ENGINE HARNESS
- RH = REARWARD HARNESS
- RL = REAR LEFT ABS
- RR = REAR RIGHT ABS
- SD = SEAT DRIVERS
- SP = SEAT PASSENGER
- TR = TRANSMISSION HARNESS

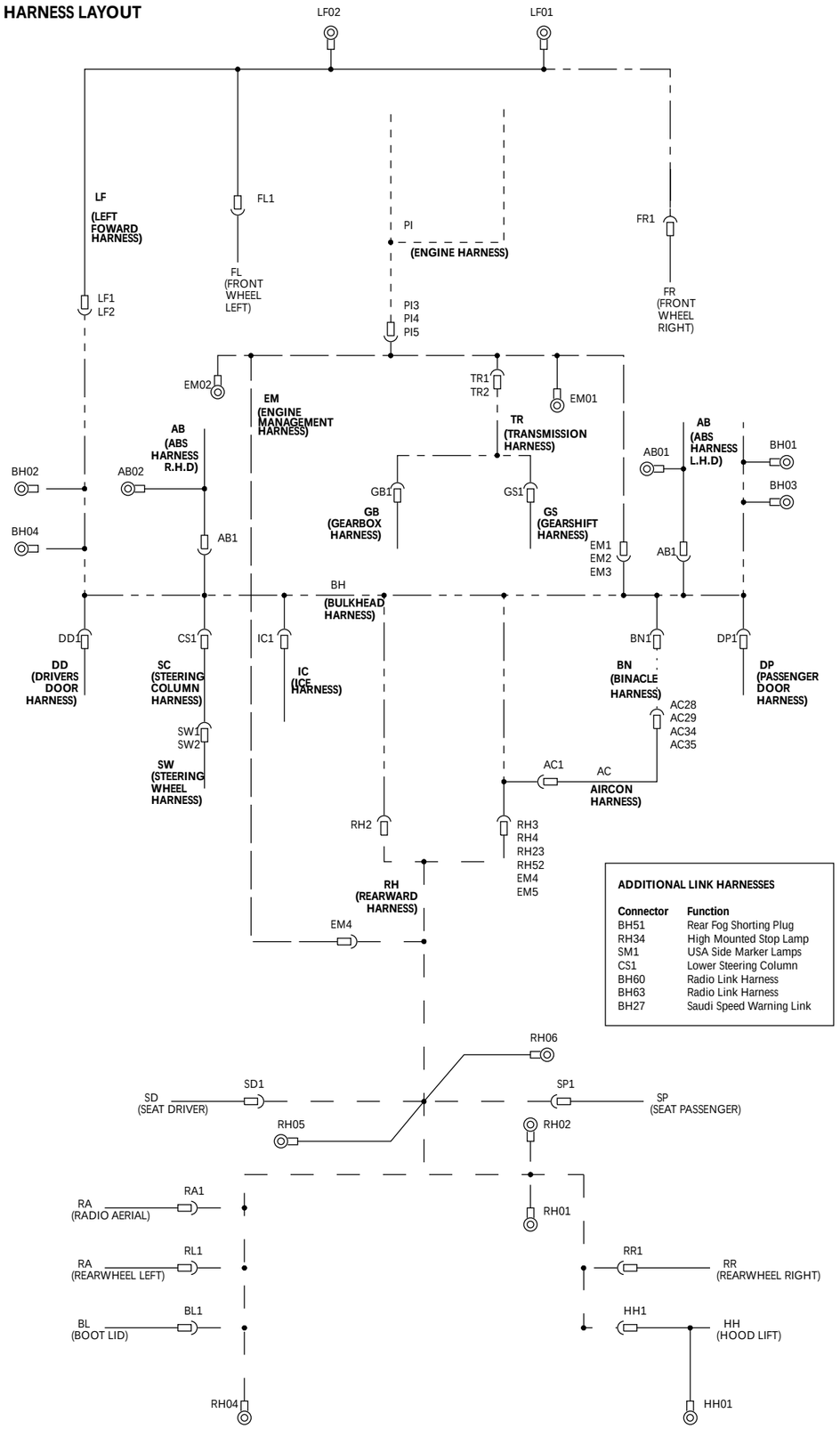
DB7 VANTAGE

CIRCUIT TITLE	Harness Layout
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 01

SOURCE No. 37-124650

HARNESS LAYOUT



ADDITIONAL LINK HARNESSES

Connector	Function
BH51	Rear Fog Shorting Plug
RH34	High Mounted Stop Lamp
SM1	USA Side Marker Lamps
CS1	Lower Steering Column
BH60	Radio Link Harness
BH63	Radio Link Harness
BH27	Saudi Speed Warning Link

FUSES - FUNCTION AND RATING

BULKHEAD FUSEBOX (LHS)

	DESCRIPTION	FUSE
"A" BATTERY FUSES		
9	LHS SEAT HTR & UNIT	20A
10	HTR FRONT SCREEN UNIT	40A
12	LH RADIATOR FAN	30A
14	RH RADIATOR FAN	30A
16	COL,MFU,A/C,ALARM SOUNDER	10A
18	INST PACK RAD FAN MODULE	5A
20	A/C CLUTCH RELAY, ACCESS	20A
22	TERMINAL, FRONT FOG	25A
"B" IGNITION FUSES		
1	ACCESSORY TERMINAL	15A
2	TRANSMISSION ECU etc	10A
3	IGN,H/LAMP RELAY,INST PACK	5A
4	ABS,CLUTCH SW,MFU,A/C,PATS	10A
5	HEATER FRONT SCREEN etc	5A
6	RH DIP BEAM etc	10A
7	STARTER RELAY	30A
8	LH DIP BEAM	10A
11	RH HORN	10A
13	LH HORN	10A
15	RH MAIN BEAM	10A
17	LH MAIN BEAM	10A
19	NOT USED	10A
21	NOT USED	10A

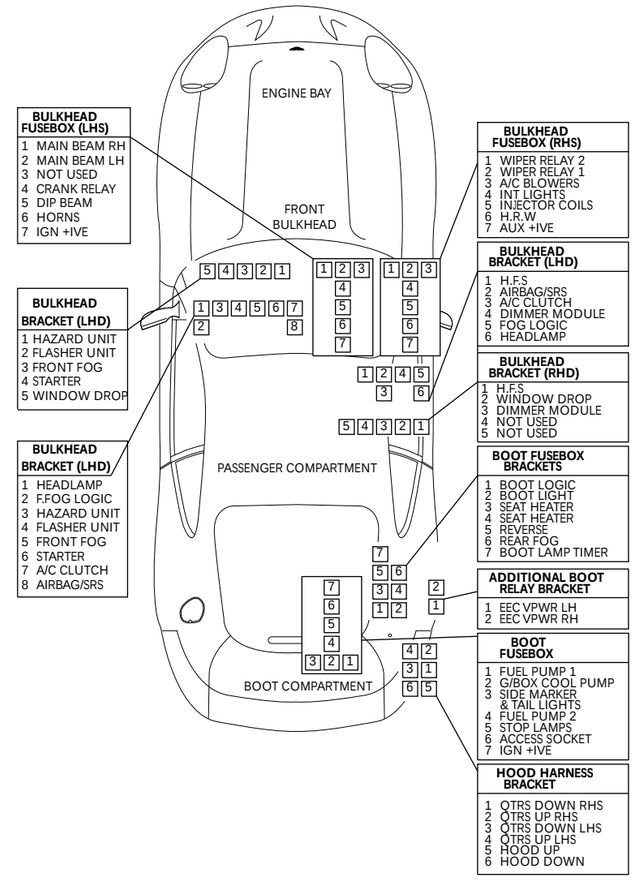
BULKHEAD FUSEBOX (RHS)

	DESCRIPTION	FUSE
"A" BATTERY FUSES		
9	RHS SEAT HTR & UNIT	20A
10	PATS MODULE & RADIO	10A
12	DIAGNOSTIC SOCKET	5A
14	HAZARD UNIT	10A
16	ABS ECU (MOTOR)	30A
18	ABS ECU (VALVES)	30A
20	INTERLOCK ECU	5A
22	TCM RH/LH EEC	10A
"B" IGNITION FUSES		
1	SPARE	5A
2	CIGAR LIGHTER	20A
3	AUX IGNITION ON +IVE	10A
4	SEATS HEATER & SWITCH	5A
5	DIRECTION INDICATOR UNIT	10A
6	IGNITION COILS 1-6	10A
7	INTERIOR LAMPS	10A
8	IGNITION COILS 7-12	10A
11	MIRROR HEATERS	10A
13	H.R.W	25A
15	WIPER STORK & UNIT	20A
17	WIPER MOTOR & STORK	20A
19	A/C LHS BLOWERS	10A
21	A/C RHS BLOWERS	10A

BOOT FUSEBOX

	DESCRIPTION	FUSE
"A" BATTERY FUSES		
1	REVERSE LIGHTS/QTRS	10A
2	SECURITY SYSTEM	20A
9	BOOT LAMP & AERIAL	10A
11	LH QTRS RELAY	20A
12	RH QTRS RELAY	30A
14	HOOD RELAYS	30A
16	REAR FOG RELAY	10A
18	EEC UNIT PRIMARY	10A
20	EEC UNIT SECONDARY	20A
22	NOT USED	
"B" IGNITION FUSES		
3	IGNITION ON	5A
4	SECURITY SYSTEM	5A
5	EEC RELAY IGNITION	5A
6	RH FOG LAMPS & EECS	20A
7	FUEL PUMP 2 & EEC	10A
8	HMSL & LH STOP LAMP	10A
10	ACCESSORY SOCKET	10A
13	AIRBAG ECU	20A
15	FUEL PUMP 1 & RH EEC	10A
17	GEARBOX COOLER PUMP	10A
19	RH TAIL & RH FRONT SIDE LIGHT	10A
21	LH TAIL & LH FRONT SIDE LIGHT	

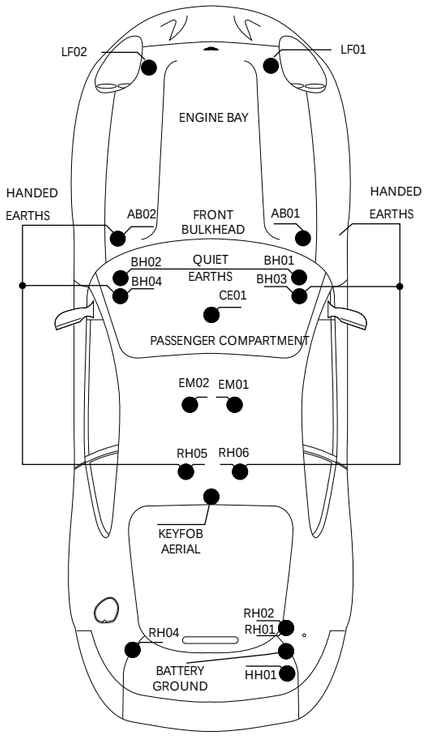
RELAYS - LOCATION AND FUNCTION



DB7 VANTAGE FUSING & RELAYS

FUSEBOX & RELAY LOCATIONS - LHD VERSION SHOWN ABOVE
BULKHEAD FUSEBOX & RELAY - CHANGE OVER WITH HAND OF DRIVE

EARTH POINTS - LOCATION



DB7 VANTAGE EARTHING

STUD/WELDNUT LOCATIONS & DESIGNATIONS
LHD VERSION SHOWN ABOVE

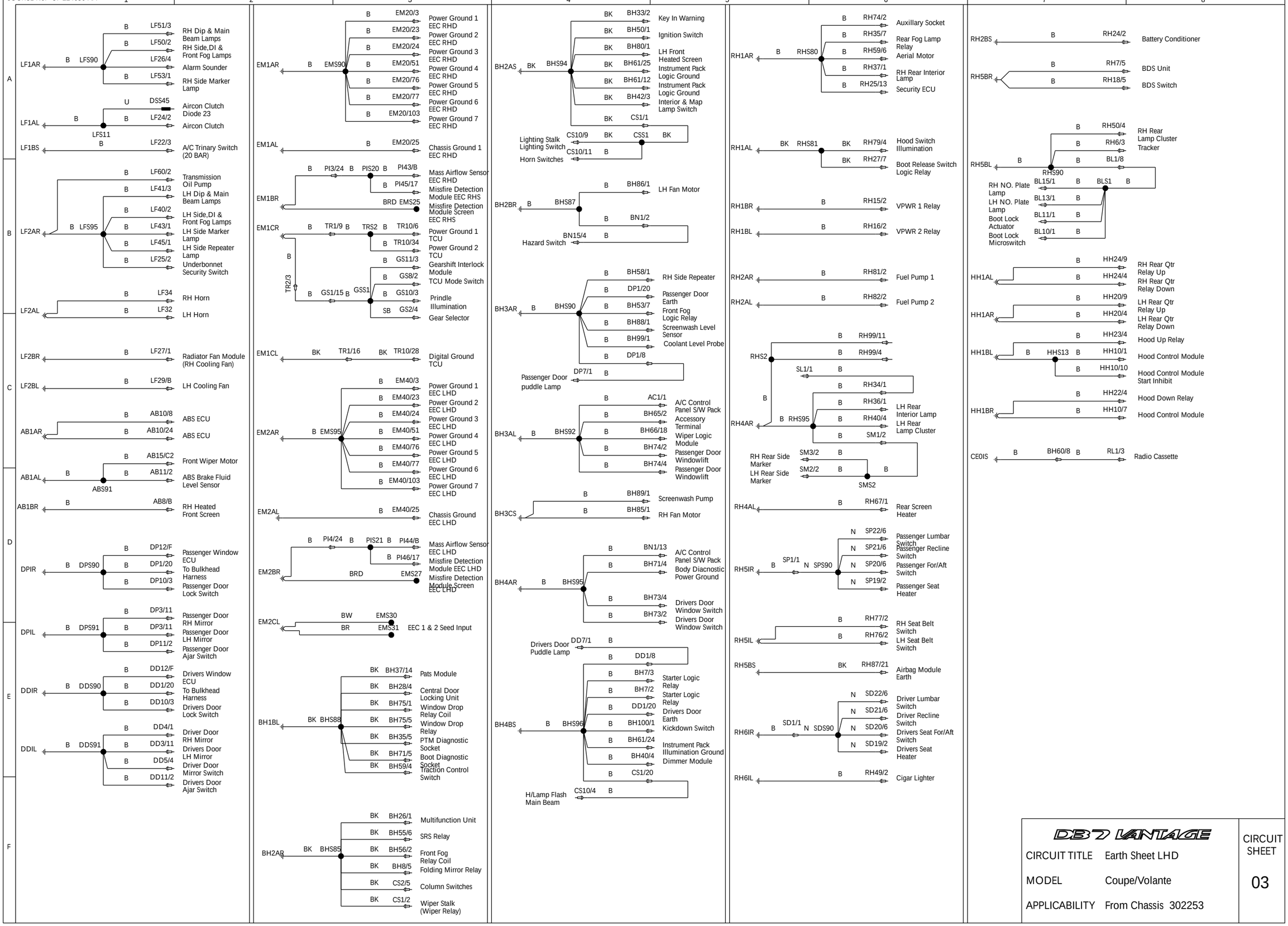
QUITE EARTH = LOW NOISE
HANDED EARTHS = CHANGE OVER WITH HAND OR DRIVE

DB7 VANTAGE

CIRCUIT TITLE	Harnesses, Fuses and Earths
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 02

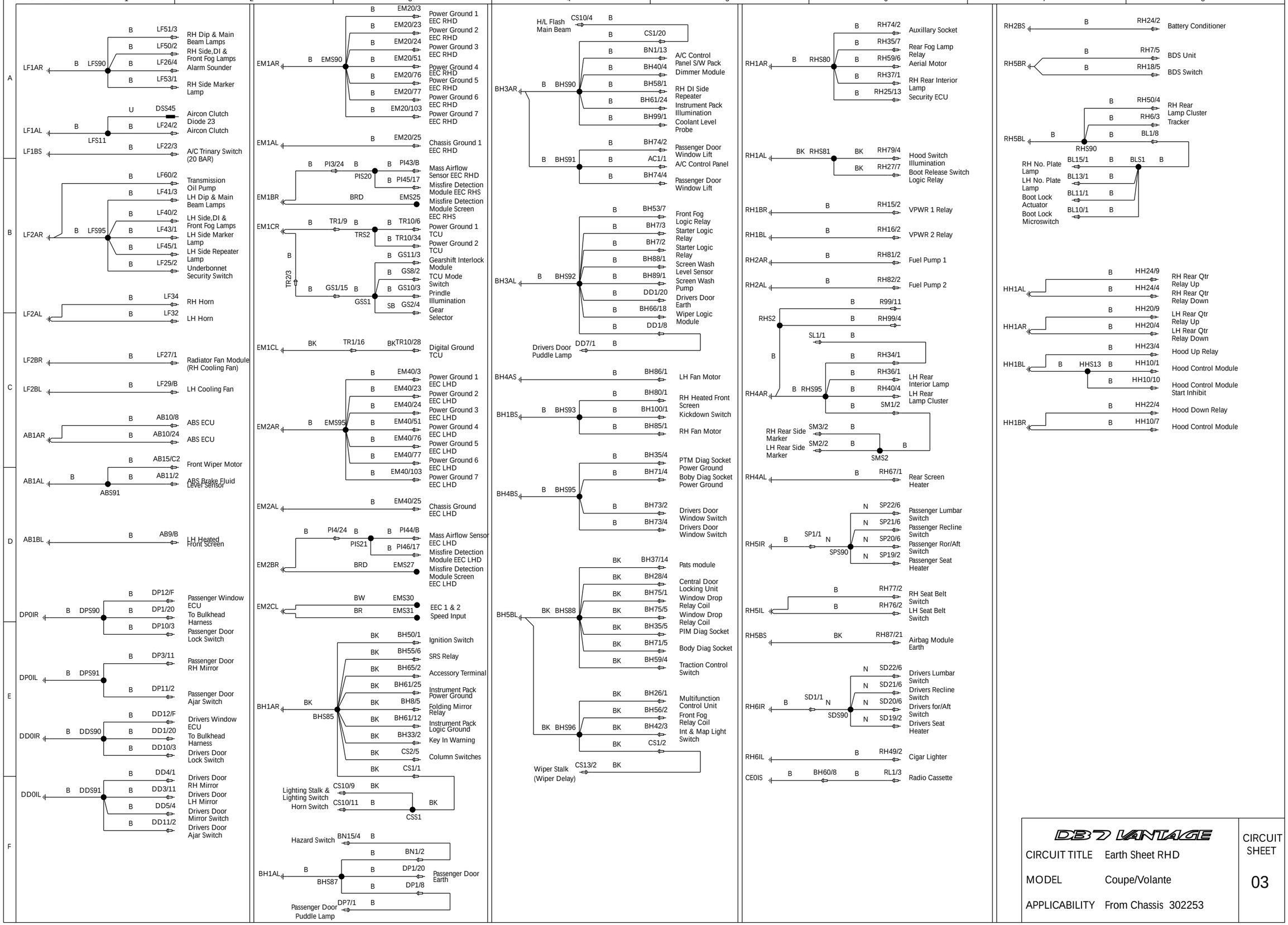
SOURCE No. 37-124650-AA



DB7 VANTAGE	
CIRCUIT TITLE	Earth Sheet LHD
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 03

SOURCE No. 37-124650-AA

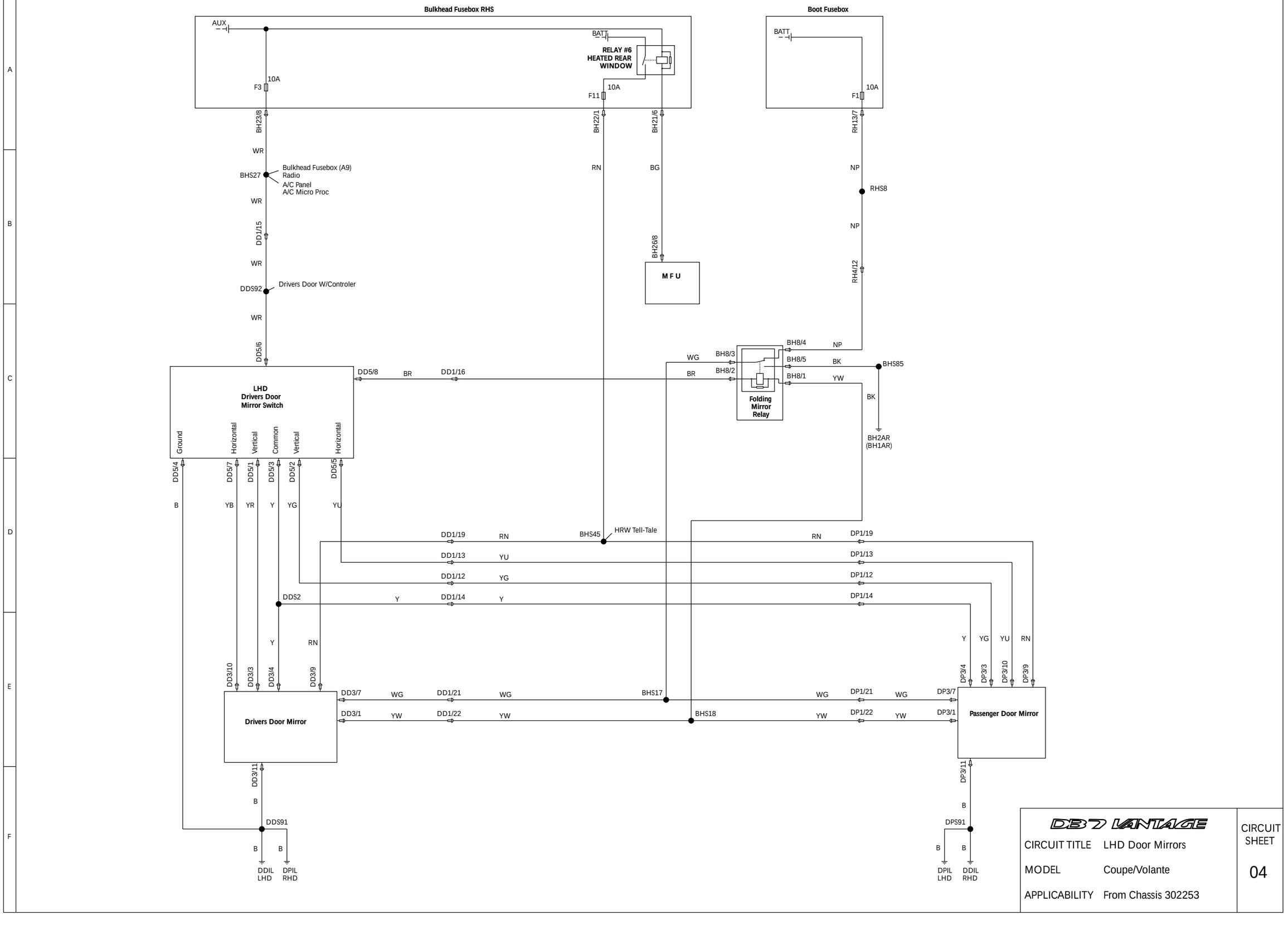


DB7 VANTAGE

CIRCUIT TITLE	Earth Sheet RHD
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 03

SOURCE No. 37-124650

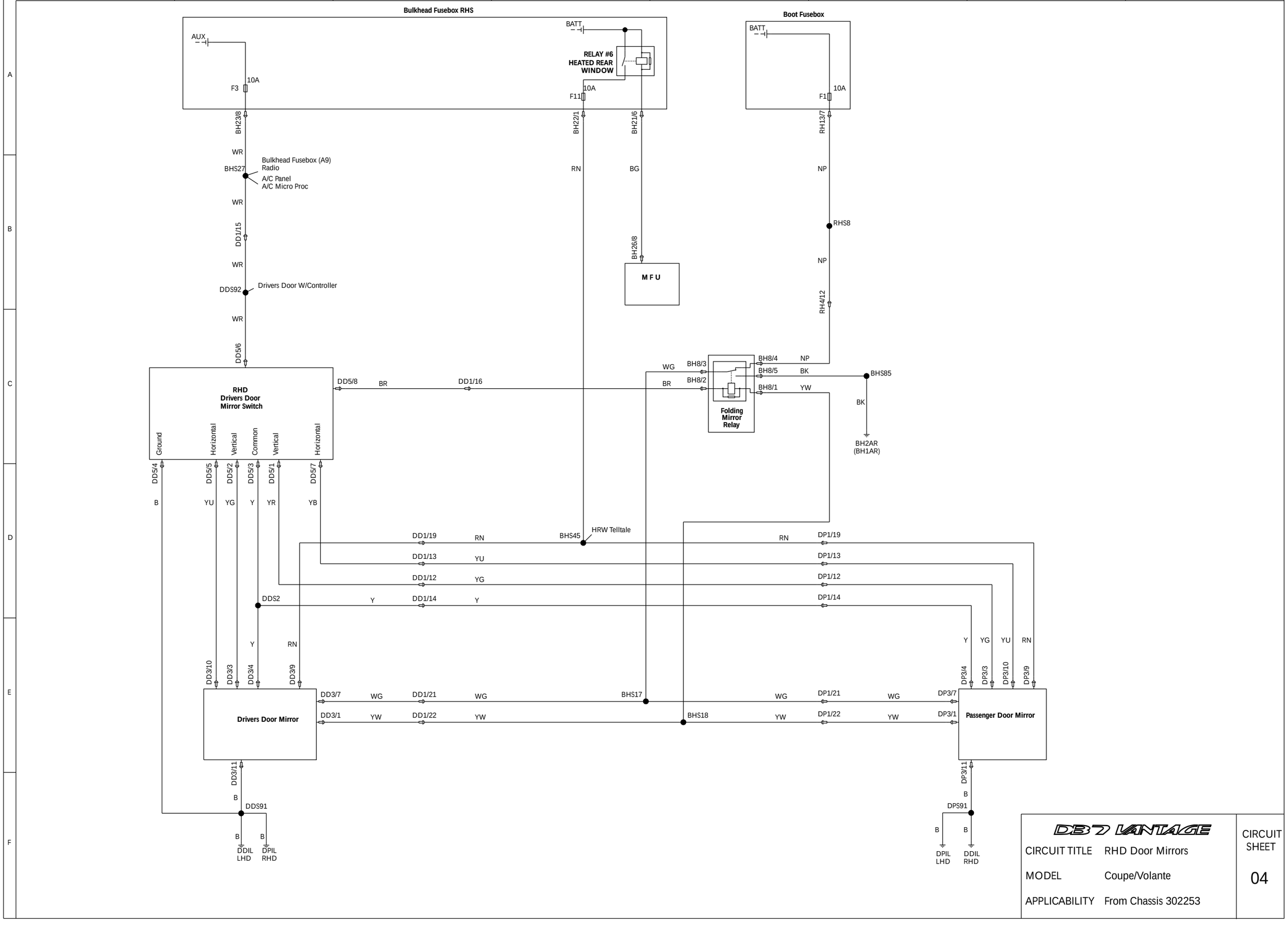


DB7 VANTAGE

CIRCUIT TITLE	LHD Door Mirrors
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 04

SOURCE No. 37-124650

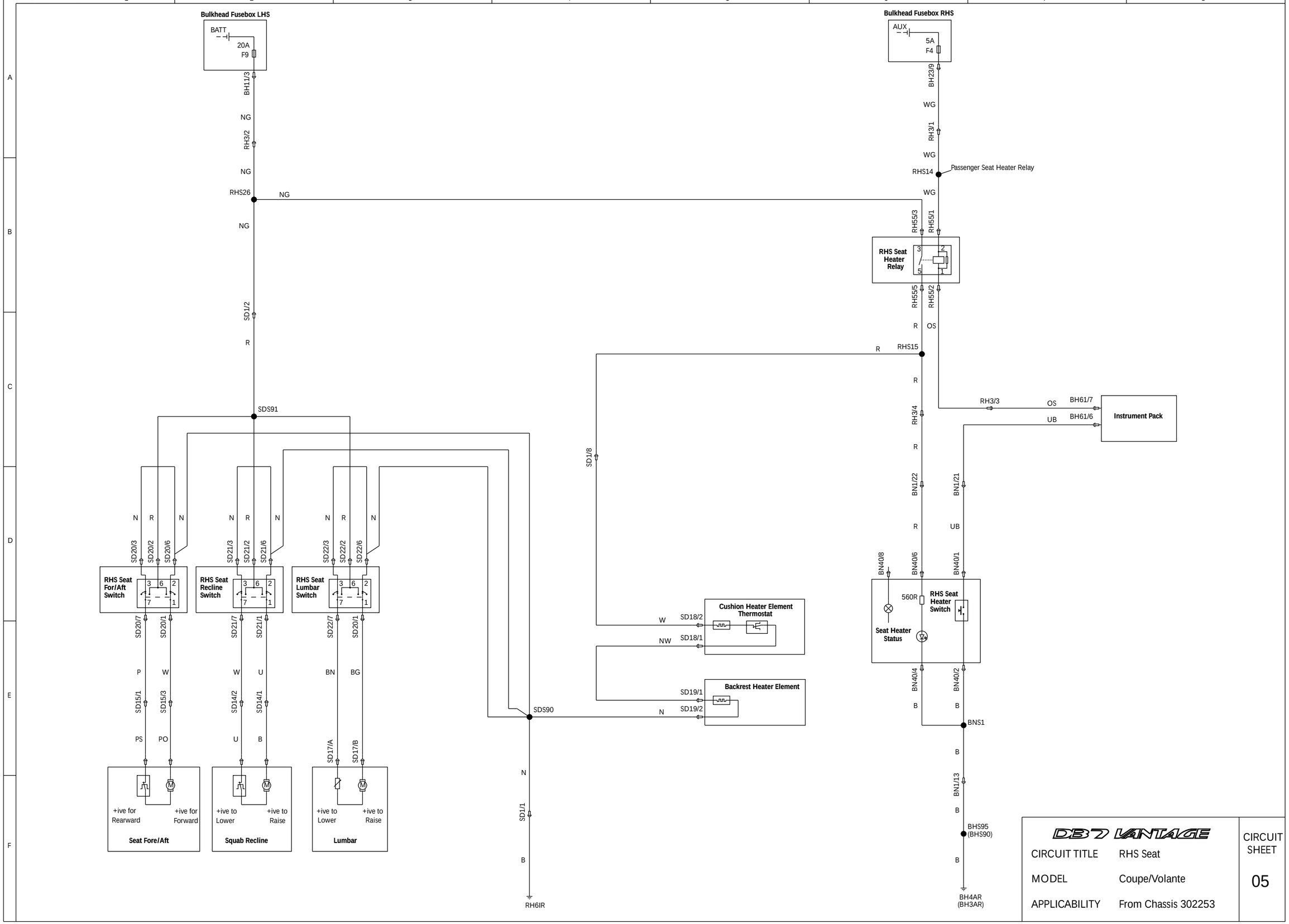


DB7 VANTAGE

CIRCUIT TITLE	RHD Door Mirrors
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 04

SOURCE No. 37-124650

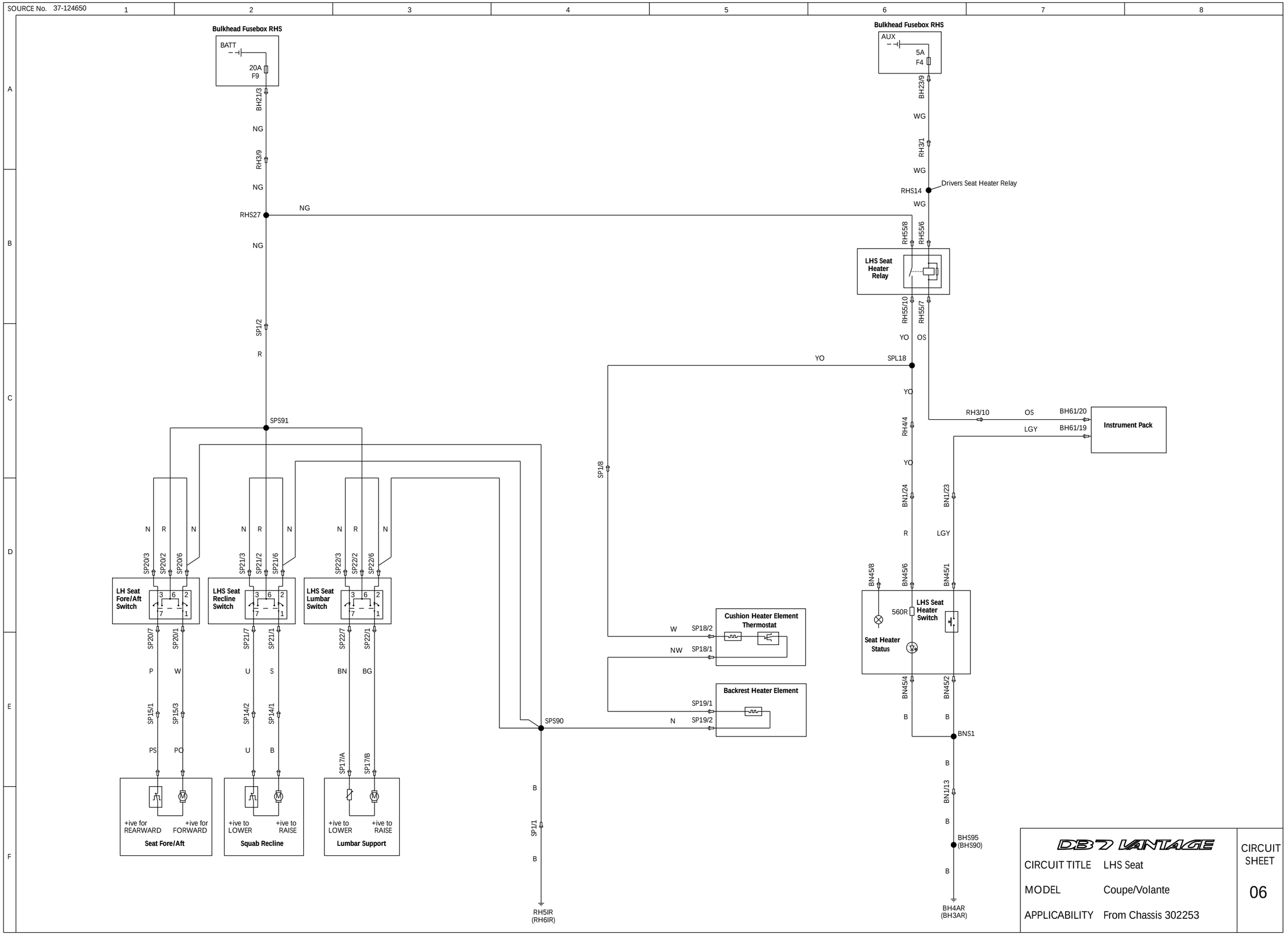


DB7 VANTAGE

CIRCUIT TITLE	RHS Seat
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 05

SOURCE No. 37-124650

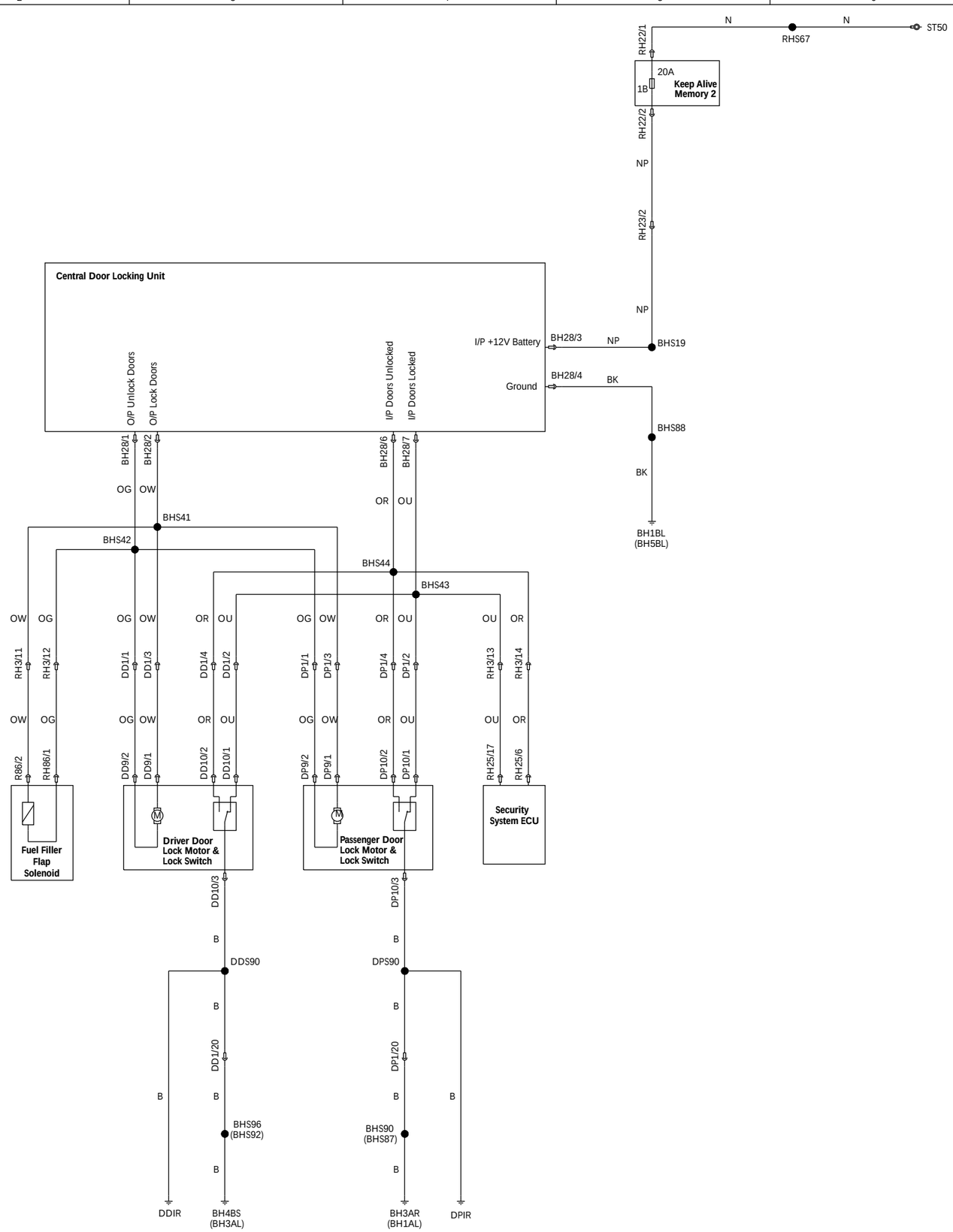


DB7 VANTAGE

CIRCUIT TITLE	LHS Seat
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 06

SOURCE No. 37-124650



DB7 VANTAGE

CIRCUIT TITLE Central Door Locking

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 07

SOURCE No. 37-124650

1 2 3 4 5 6 7 8

A B C D E F

Bulkhead Fusebox LHS
BATT
10A F16
BH12/4
NP
BHS69
MFU Col Module A/C Control Panel
RHS2
YS
Key In Solenoid
BH34/1 BH34/2
YN YB
EM2/16 EM2/17
TR2/1 TR2/2
GS11/1 GS11/2
GS11/9 GS11/12
Gearshift Interlock Module
LF1/19 LF1/3 LF1/2
LF26/2 LF26/3 LF26/1
Alarm Sounder
LF26/4
B
LFS90
LF1AR
N N ST50
RHS65
RH21/5
20A 3A Keep Alive Memory 1
RH21/6
NS
RHS3
RSS1
10K_0.25W
RSS2
RH28/4
Glass Breakage Sensor
RH28/1 RH28/2
Drivers Lock S/W
Pass Lock S/W
Boot Fusebox
IGN
5A F4
RH13/9
WY
Hood Switch
RHS4
Central Door Locking Module RHS45
BH28/7 BH28/6
OU OR
BHS43 BHS44
RH3/13 RH3/14
OBDII Upper Diagnostic Connector
BH71/7
O
RH4/1
RHS50
Airbag ECU
RH2/14
GR
RHS36
LH Rear DI Lamp
Alarm Aerial
RHB1 RHU1
BRD TIN
RH25/11 RH25/20 RH25/25 RH25/7 RH25/5 RH25/17 RH25/6 RH25/19 RH25/10 RH25/12 RH25/14 RH25/1
+12V Poten Supply
+12V Battery Supply
I/P Glass Sensor Broke
I/P Doors Locked
I/P Doors Unlocked
+12v IGN Supply
LHS DI Lamps
Alarm Aerial Screen
I/P Alarm Aerial
Security System ECU
I/P Alarm Sounder
MFU & Under Bonnet Switch
Ground
I/P Hazard Relay
I/P Boot Lock Switch
I/P Boot Lock Actuator
Trunk Switch Enable
RH25/22 RH25/4 RH25/13 RH25/24 RH25/3 RH25/23 RH25/16 RH25/8
Key In Warning
BH33/2 BH33/1
BHS 85 BHS 94
BH26/11
Multi Function Unit
BH26/12 BH26/3 BH26/2
BH1AR RHD BH2AS LHD
RH2/7 RH2/4
LF1/3 LF1/2
BP GP RB
DD1/18 DP1/18
Drivers Window ECU
DDS1 DPS1
Passenger Window ECU
DD11/1 DP11/1
Drivers Door Ajar Switch
Passengers Door Ajar Switch
DD11/2 DP11/2
DDS91 DPS91
DPIL RHD DDIL LHD DPIL LHD DDIL RHD
RH25/4
RB
RH2/2
BHS1
LF1/1
LF25/1
Underbonnet Security Switch
LF25/2
LFS95
LF2AR
RH25/13
B
RHS80
RH1AR
RH25/24
GW
RHS33
RH2/13
BHS8
Inst Pack RH Front DI DI Switch
W
DSS01
Diode 1
DSS2
U
BHS6
LH DI Lamps
GN
BH32/5
Hazard Relay
LH Boot Lamp RH Boot Lamp Inst Pack
RHS11
RHS39
BR PG
BL1/1 BL1/2
BL10/2 BL11/2
Boot Lock Switch
Boot Lock Actuator
BL10/1 BL11/1
BLS1
BL1/8
RHS90
RH6BL
RH25/8
G
RH89/7
Trunk Switch
RH89/2
BG WY
RH27/6 RH27/8
Boot Switch Logic Relay
RH27/7 RH27/10
BK
RHS81
RH1AL
Bulkhead Fusebox RHS
BATT
10A F10
BH23/2
NO
BHS29
Radio Dimmer Module
Coolant Level MFU
A/C In-Car Sensor
A/C Clutch Relay Coil
A/C Clutch Switch
ABS ECU
BHS14
PATS Transceiver
BH38/1 BH38/2 BH38/3 BH38/4
W B UW OB
BH37/7 BH37/6 BH37/1 BH37/9
I/P +8V
O/P 0V
I/P TX
I/P RX
PATS Module
I/P PATS Led Flash
SCP -ive
SCP +ive
Ground
12V BATT
12V AUX
BH37/8 BH37/15
NO WK
BH37/2 BH37/4 BH37/5 BH37/14
KB U S BK
BH1/1
BH3/2
PATS LED
BH34 BH33
BHS88
BK BK
BH1BL LHD BH5BL RHD
Bulkhead FuseboxLHS
BATT
IGN
Relay #6 Horns
10A F4 10A F13 10A F11
BH13/9 BH12/5 BH12/1 BH11/6
W PW PW P
LF1/4 LF1/18 CS2/5
PW PW P
LF31 LF33
LH Horn
RH Horn
LF32 LF34
B B
LF2AL
Horn Switch
CS10/10 CS10/11
B
Lighting Switch
CSS1
BK
CS1/1
BK
BHS94 (BHS85)
BK
BH2AS (BH1AR)

DB7 VANTAGE

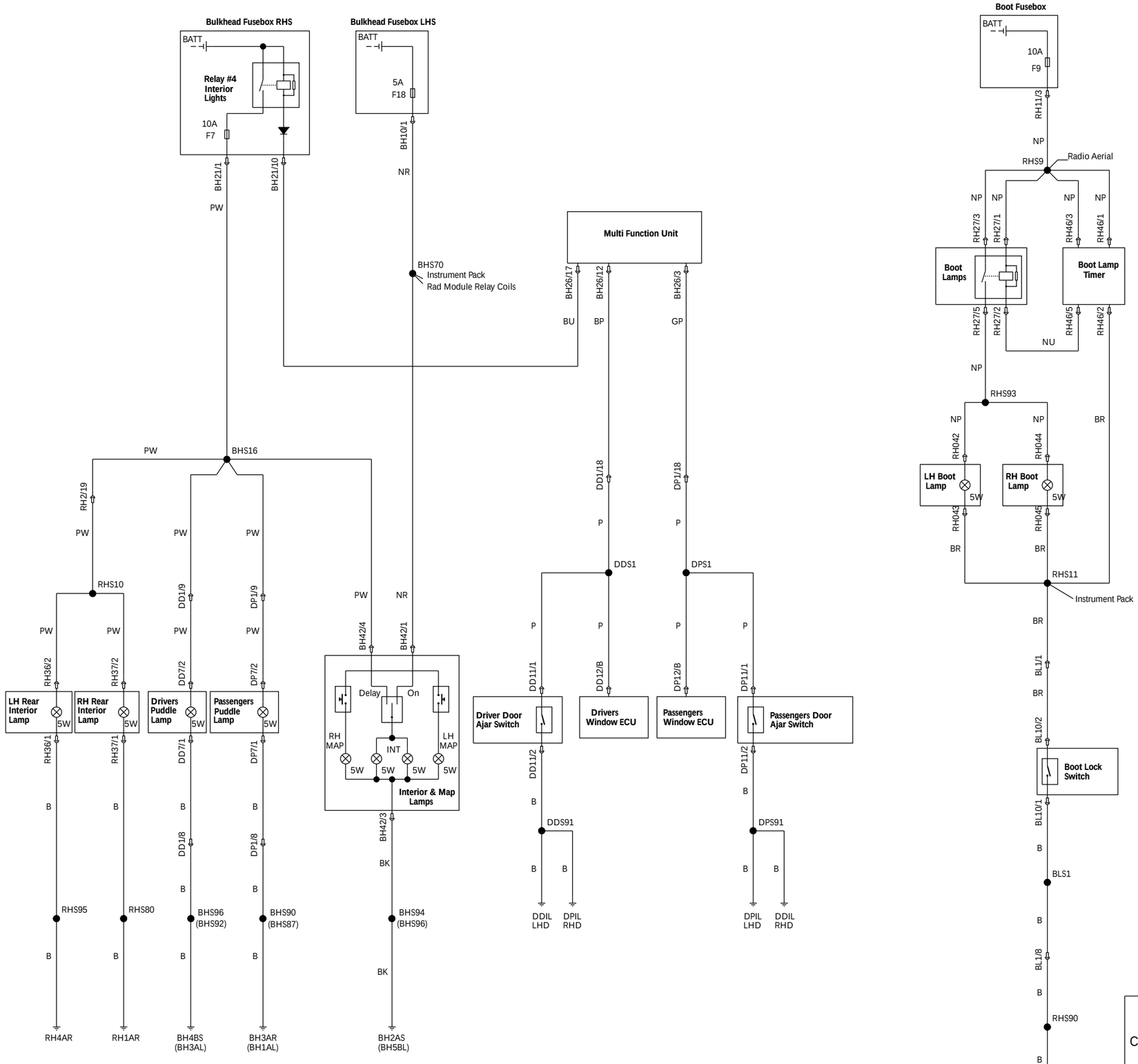
CIRCUIT TITLE Security System

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 08

SOURCE No. 37-124650



DB7 VANTAGE

CIRCUIT TITLE	Interior lighting
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 09

SOURCE NO. 37-124650-AA

1 2 3 4 5 6 7 8

A B C D E F

Bulkhead Fusebox LHS

Boot Fusebox

Bulkhead Fusebox LHS

Bulkhead Fusebox RHS

Bulkhead Fusebox LHS

Bulkhead FuseboxX RHS

BATT

IGN

AUX

Relay #7 Ign + IVE

Relay #5 Dip Beam

Relay #2 LH Main Beam

Relay #1 RH Main Beam

Relay#3 Side, No Plate & Marker Lamps

F3 5A

F8 10A

F6 10A

F17 10A

F15 10A

F21 10A

F19 10A

25A F22

F14 10A

F16 10A

F4 10A

F5 10A

Dimmer Unit

Front Fog Switch

Dimmer Unit Inst Pack

BHS26

BHS30 Inst Pack

BHS99

BHS97

Alarm Sounder A/C Panel COL

BHS69

BHS14

A/C Sensor
A/C Clutch Relay
Clutch Switch
ABS ECU
Coolant Level ECU

Radio Head Unit
TCM Mode Switch

Front Fog Switch
Seat + Screen Heaters

Hazard Indicator Flasher Unit

Multifunction Unit

Direction Indicator Flasher Unit

LHS Seat Belt Latch

RHS Seat Belt Latch

Drivers Side F/Box
Boot F/Box

BHS13

LH Tail Lamp

RH Tail Lamp

Fog Logic Relay

Front Fog Relay

BHS6

BHS85 (BHS96)

BH2AR (BH5BL)

RHS32

RH5IL

Hazard Switch

BHS90 (BHS92)

BH3AR (BH3AL)

BHS98

Diode 2

Diode 1

Inst Pack
LH Rear DI Lamps

Inst Pack
RH Rear DI Lamps

BHS7

BHS8

Headlamp Relay

Inertia Switch

BH49/1

Diode 4

BHS4U

BHS4W

DI

H/L Flash

Main Beam

DIP

SIDE

OFF

CS1
Column Switchgear

BHS11

RH2/9

BHS9

Inst Pack
Dimmer Unit

BHS94 (BHS85)

BHS96 (BHS90)

BH4BS (BH3AR)

BH2AS (BH1AR)

BH4AR LHD

BH3AR RHD

Sidelamp Shorting Link

Fitted To Daylight Running Cars Only

Inertia Switch
Brake Switch
Reverse Switch

BHS10

Ignition Switch

BHS94

BHS85

BH2AS LHD

BH1AR RHD

LH Side Repeater

LH Side Marker

LH DI Lamp

LH Side Lamp

LH Fog Lamp

LH Dip Beam

LH Main Beam

RH Main Beam

RH Dip Beam

RH Fog Lamp

RH Side Lamp

RH DI Lamp

RH Side Marker

RH Side Repeater

LFS3

LFS2

LFS5

LFS1

LFS95

LFS90

LF2AR

LF1AR

BH3AR

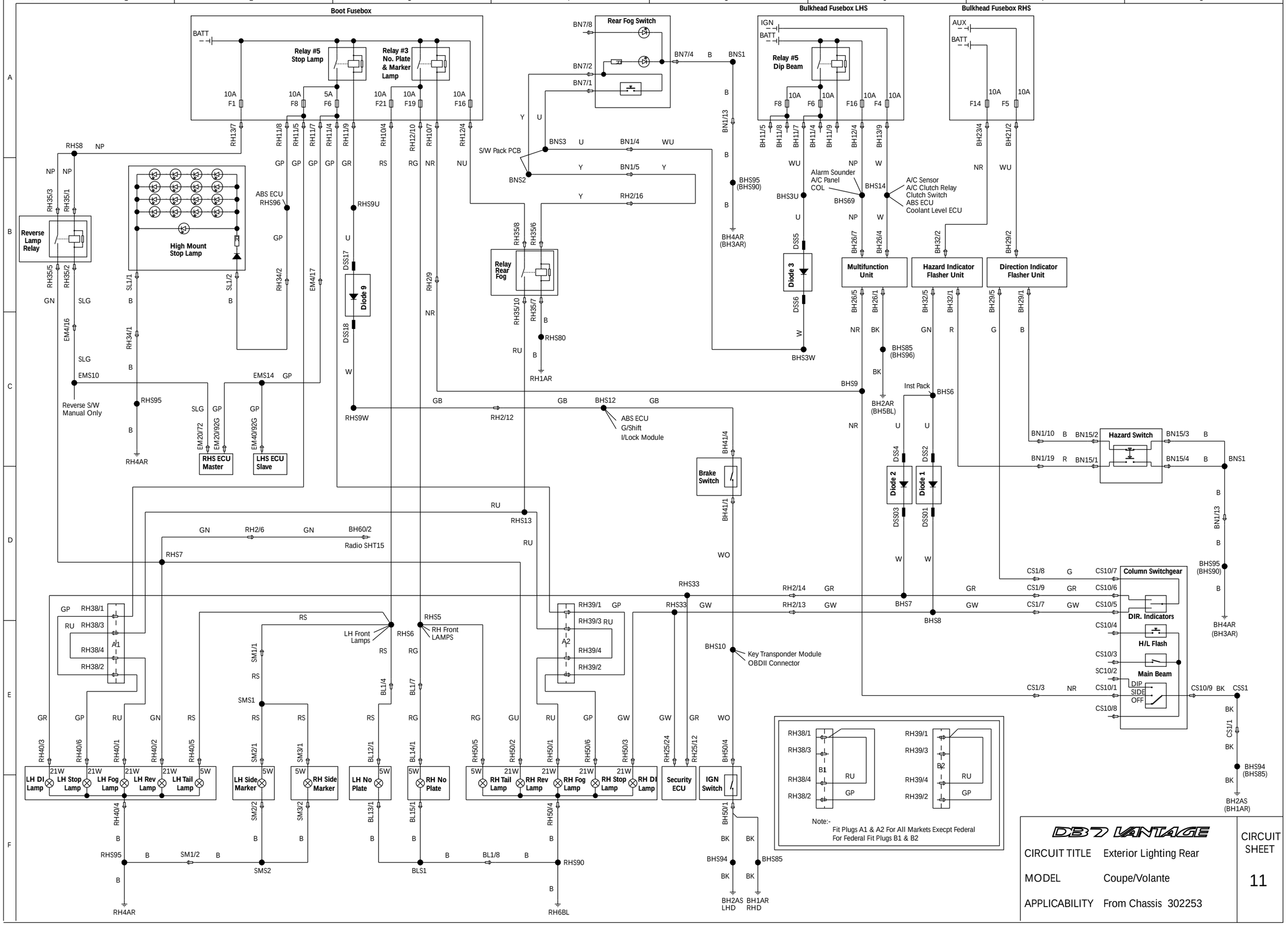
BHS90

DB7 VANTAGE

CIRCUIT TITLE	Exterior lighting Front
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 10

SOURCE No. 37-124650

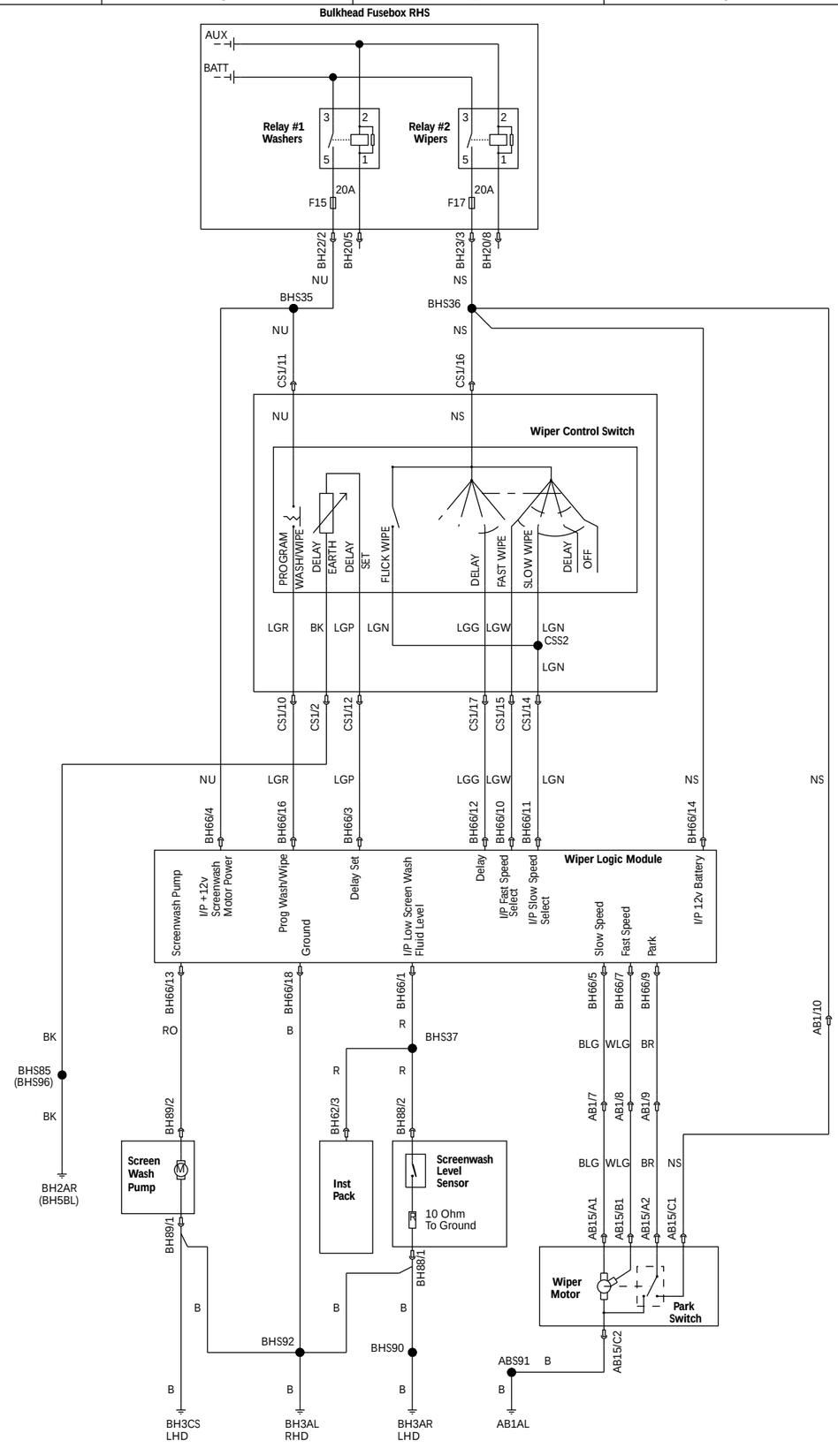


DB7 VANTAGE

CIRCUIT TITLE	Exterior Lighting Rear
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 11

SOURCE No. 37-124650



CIRCUIT TITLE	Wash Wipe System
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 12

SOURCE No. 37-124650-AA

Bulkhead Fusebox LHS

BATT
12v IGN
Relay #7 Ignition + ive
Relay #1 LH Main Beam
Relay #2 RH Main Beam
Relay #4 Starter Crank
F1 15A, F2 10A, F3 5A, F4 10A, F5 5A, 1A 600V
F15 10A
F17 10A
F7 30A, 1A 600V
BH10/9 BH13/7 BH13/1 BH13/8 BH13/9 BH11/2 BH12/9
BH12/2 BH10/5
BH13/3 BH13/10 BH10/8
BH11/1 BH11/10
WR WR WO NY BR
BHS26
Headlamp Relay Coil
Security Sounder

Bulkhead Fusebox RHS

BATT
12v IGN
Relay #5 Ignition Coils
Relay#7 Auxillary + ive
Relay#1 Wiper 2
Relay 2 Wiper 1
Relay #3 Aircon Blower
F8 10A, F6 10A, F1 5A, F2 20A, F3 10A, F4 5A, F5 10A, 1A 600V
F15 20A
F17 20A
F21 10A, F19 10A
BH20/9 BH21/5 BH21/8 BH21/7 BH21/4 BH21/9 BH23/7 BH23/1 BH23/8 BH23/9 BH23/2 BH22/9
BH22/2 BH20/5
BH23/10 BH23/3 BH20/8
BH20/4 BH22/10 BH20/7
WR W WR WN WS WS WR
BHS27
Radio
A/C Panel
A/C Micro Pro
Door Mirror Switches
RG
BHS5U
BHS6U
BHS7U
BHS8U
U
DSS09 Diode 5 DSS10
DSS11 Diode 6 DSS12
DSS13 Diode 7 DSS14
DSS15 Diode 8 DSS16
W
BH49/2 BH49/3
Inertia Switch
BH49/1
WO
BHS5W
BHS15

Boot Fusebox

BATT
12v IGN
Relay #7 Ignition + ive
Relay #1 Fuel Pump 1
Relay #2 G'box Oil Pump
Relay #4 Fuel Pump 2
Relay #5 Stop Lamp
Relay #6 Accessory Socket
F3 5A, F4 5A, F5 30A, 1A 600V
F15 20A
F17 10A
F7 20A
F8 10A, F6 5A
F10 10A, F13 10A
RH10/9 RH13/8 RH13/9 RH11/2 RH12/9
RH12/2 RH10/5
RH13/10 RH13/3 RH10/8
RH11/1 RH11/10 RH11/5 RH11/8 RH11/7 RH11/4 RH11/9
RH12/1 RH12/5 RH11/6
WG RG
RH2/17
GR WO
RHS9U
U
DSS17 Diode 9 DSS18
W
RHS9W
GB
RH2/18

Reverse Lamp Switch

GB5/A WO TR1/10 WO EM1/10 WO

Side Lights Shorting Link (Daylight Running)

BH39/2 WO

DIagnostic Connector

BH35/1 WO
BH35/8 WN

BHS10
WO WO WO WO WO WO WO WN

Brake Switch

BH41/1 BH41/4 GB BHS12 GB RH2/12
ABS ECU
G/Shift
I/Lock Module

Gearbox Rotary Switch

GB2/2 BG
TRS3
BN1/11 BG EM1/16 BG TR1/13 BG
WN BN1/6
BN1/14

Instrument Pack

BH61/22 BG BHS80 BG
BN1/3

Starter Button

BG BN22/3
BG BN22/2
WN BN22/5
WN BN22/4
B BN22/1
BR BN22/6

Ok To Start Warning Lamp

Micro Relay on CCT Board

Ignition Switch

BH50/4 BH50/2
Ignition Auxillary
BH50/1
BG BG
BHS94 BHS85
BG BG
BH2AS LHD
BH1AR RHD

Starter Motor Relay

WR BH25/5 BH25/3
BH25/1 BH25/2 BG W DSS44 Diode 22 DSS43
BHS22W

Starter Logic Relay

BG RH2/8 BG RH7/3 BDS
BH7/5 BH7/3 B
BHS13 WR BH7/1 BH7/2 B BHS96 (BHS92)
To Starter Motor
B
BH4BS (BH3AL)

BNS1
B
BN1/13
B
BHS95
B
BH4AR LHD
BH3AR RHD

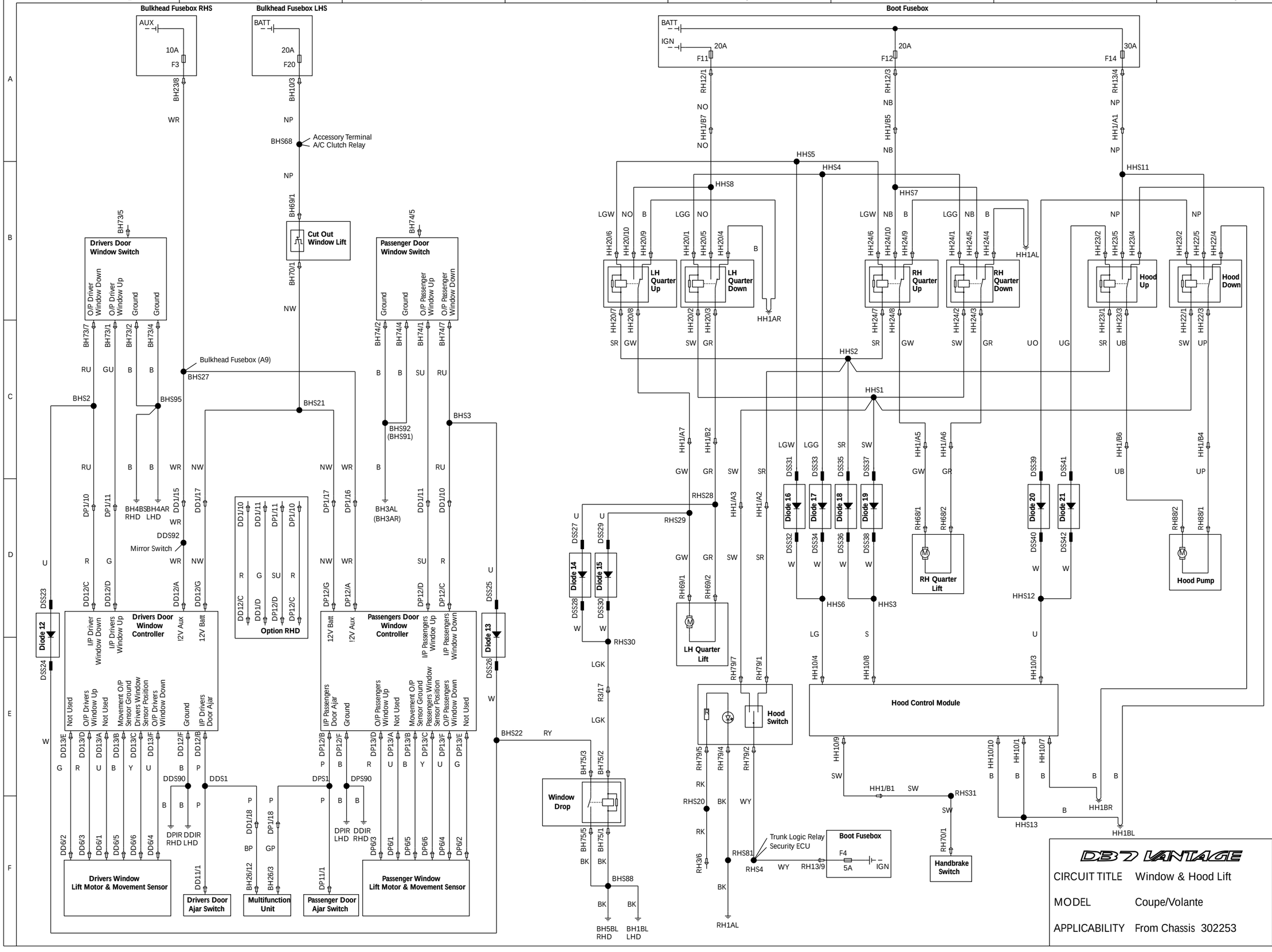
DSS47 Diode 24 DSS48 BR BN1/9
Ok To Start Primary PTEC
EM20/19 BR EM1/13 BR BHS56

DB7 VANTAGE

CIRCUIT TITLE	Aux/Ign & Start
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 13

SOURCE No. 37-124650



DB7 VANTAGE

CIRCUIT TITLE	Window & Hood Lift
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 14

SOURCE No. 37-124650-AA

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8

A | B | C | D | E | F

Bulkhead Fusebox RHS

ST50 — N — RHS65 — N — RH21/3 — 25A 2A **Keep Alive Memory 1** — RH21/4 — RY — RY

Dimmer Module

AUX — 10A F3 — BH23/8 — WR

BH40/6 — RK — BHS05 — RK — BH60/6 — RK — RL1/12

BH60/7 — WR — BHS27 — WR — RL1/10

Drivers Window ECU
Mirror Switch
Aircon Unit

Front Fog Switch
TCM Mode Switch

SHT36 — BH60/1 — WU — RL1/9

SHT12 — BH60/2 — GN — RL1/15

R — R — ST2 — RHS66

RH22/3 — 10A 2B **Keep alive Memory 2** — RH22/4 — NO — RHS64 — NO — RH23/3 — NO — BH60/4 — NO — YG — RL1/11 — RL1/4

Aerial Motor

RH59/6 — B — RHS80 — B — RH1AR

RH59/4 — YG

RH59/3 — NP — RHS9

BATT — 10A F9 — RH11/3 — NP

RH Boot Lamp
LH Boot Lamp

RHS97 — YG

BH60/5 — YG — RH3/7 — YG

RH17 **Navigation Aerial**

RH18 **CD Audio Changer**

RH14

RH15

Phono 3 & 4

RH5 — RH6 — RH7

Audio Head Unit

Speed Input — Reverse — Ground — Dimmer Module — LH Rear + — LH Rear - — RH Rear - — RH Rear + — 12v Ignition — RH Front - — RH Front + — 12v Battery — Remote Aerial — LH Front - — LH Front + — Navigation Aerial — Green — Blue

CD Audio changer Audio Lead

RL1/3 — B — BH60/8 — B — CE0IS

RL1/6 — BR — RL1/5 — B — BH63/7 — BH63/8

RL1/13 — B — RL1/14 — BY — BH63/2 — BH63/1

RL1/8 — SP — RL1/7 — BP — BH63/4 — BH63/3

RL1/1 — SN — RL1/2 — BN — BH63/5 — BH63/6

BN — RH3/8 — RH4/16 — SN — BP — RH3/15 — RH3/20 — SP — BY — RH4/8 — RH4/5 — B — B — RH4/7 — RH4/6 — BR

RH99/6 — LH Front +
RH99/1 — LH Front -
RH99/2 — RH Front +
RH99/7 — RH Front -
RH99/9 — RH Rear +
RH99/10 — RH Rear -
RH99/8 — LH Rear -
RH99/3 — LH Rear +
RH99/12 — Power
RH99/5 — Power
RH99/4 — Ground
RH99/11 — Ground
RH98/10 — LH Rear +
RH98/2 — LH Rear -
RH98/3 — RH Rear -
RH98/11 — RH Rear +
RH98/13 — RH Front -
RH98/14 — RH Front +
RH98/12 — LH Front -
RH98/4 — LH Front +
RH98/18 — Sub
RH98/8 — Sub

Amp On Signal — RH98/1

Amplifier

RHS2 — B — RH4AR

BHS47 — BHS48 — BHS49 — BHS50

SN BN — DP1/7 — DP1/6 — DP8/2 — DP8/1 — **LHS Door RHD Speaker**

SN BN — DD1/7 — DD1/6 — DD8/2 — DD8/1 — **LHS Door LHD Speaker**

SN BN — BH76/2 — BH76/1 — **LHS Bulkhead Tweater**

RH73/1 — RH73/2 — **LHS Rear Speaker**

RH72/2 — RH72/1 — **RHS Rear Speaker**

BP SP — DP1/6 — DP1/7 — D8/1 — DP8/2 — **RHS Door LHD Speaker**

SP BP — BH77/2 — BH77/1 — **RHS Bulkhead Tweater**

SP BP — DD1/7 — DD1/6 — DD8/2 — DD8/1 — **RHS Door RHD Speaker**

SU BU — BH54/1 — BH54/2 — **Sub Woofer Premium Only**

Ice Link Harness

RH98/12	SN	RH99/1
RH98/4	BN	RH99/6
RH98/14	BP	RH99/2
RH98/13	SP	RH99/7
RH98/11	BY	RH99/9
RH98/2	B	RH99/10
RH98/10	BR	RH99/3
RH98/3	B	RH99/8

DB7 VANTAGE

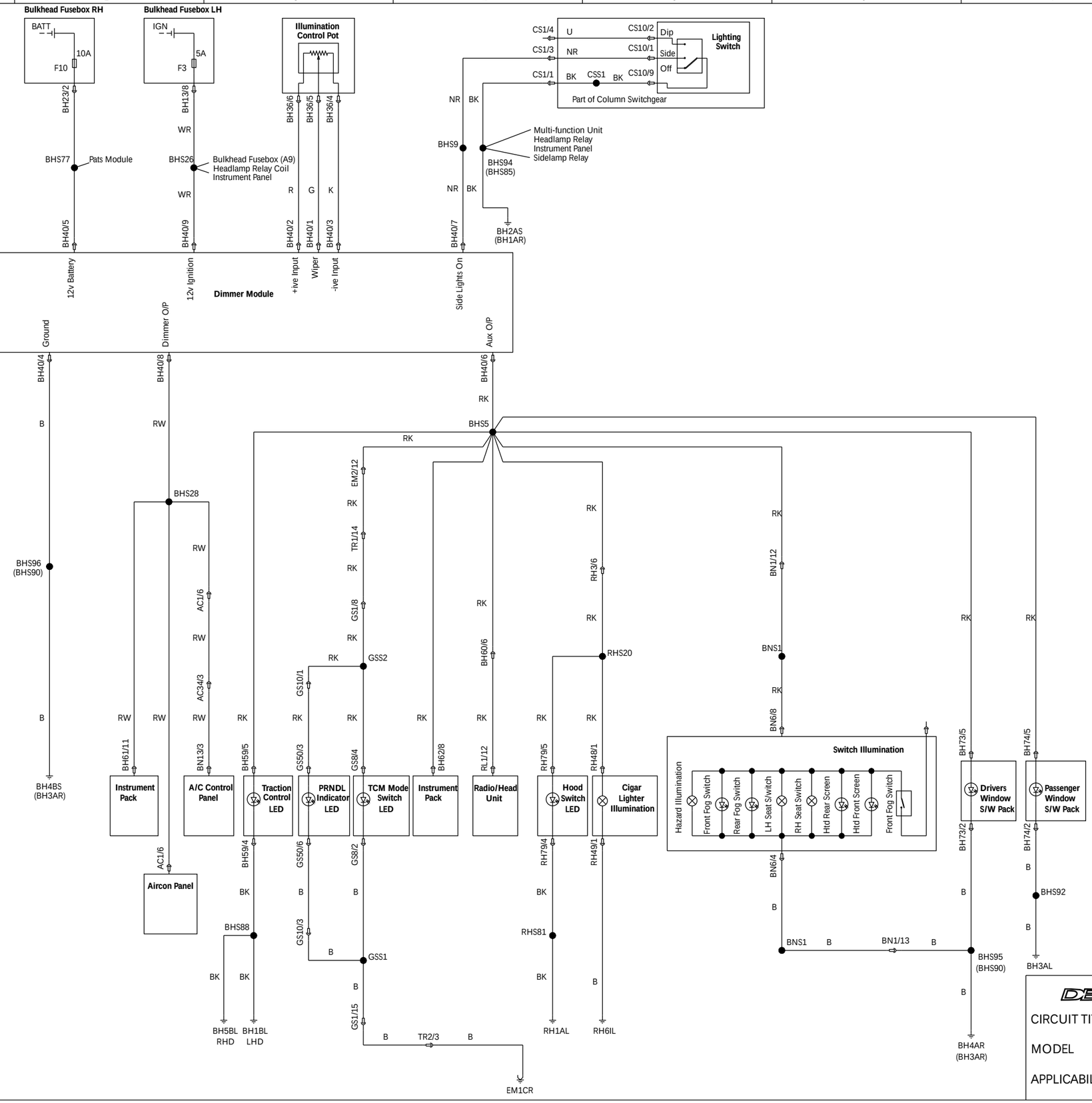
CIRCUIT TITLE Ice System

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 15

SOURCE No. 37-124650



DB7 VANTAGE

CIRCUIT TITLE	Dimmer Circuit
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 16

SOURCE No. 37-124650-AA

Primary PCM

Boot Fusebox
BATT
Relay #5 Stop Lamp
10A
5A
F8
F6
RH11/8
RH11/5
RH11/7
RH11/4
RH11/9
GP
EM4/17
EMS14
EM20/92
Brake Signal
Master/Slave Switch
EM20/30
BP
EMS11
BRD
EMS33
PI3/25
Signal Return
EM20/91
Sensor Ref Supply
EM20/90
UW
EMS12
Fuel Tank Pressure Transducer
EM20/62
S
EM4/4
PI3/22
PI3/9
EM4/6
RH83/3
RH83/1
RH83/2
Delta Pressure Feedback Exhaust
EM20/65
K
PIS7/2
PI57/3
PI57/1
PIS9
Throttle Pot
EM20/89
W
PI3/8
PIS5/2
PI55/3
PI55/1
PIS2
Clutch Switch Input
EM20/64
UB
EM1/20
AB1/20
AB3/2
CL2
Starter Relay
EM20/19
BR
EM1/13
BHS56
BH11/10
Intake Air Temp
EM20/39
Y
PI43/F
PI43/E
Engine Coolant Temp
EM20/38
P
PI3/13
PI49/2
PI49/1
Cylinder ID Sensor
EM20/85
UIN
PI3/18
PIS1/2
PIB5
PIB6
PIS19
CPS +ive
CPS -ive
EM20/21
EM20/22
OIN
BIN
PI3/21
PI3/17
PI47/1
PI47/2
VSS +ive
VSS -ive
EM20/58
EM20/33
EMB3
EMS32
EMS31
EMS 30
EM4/10
EM4/9
EM4/7
RHS1
RH75/3
RH75/1
RH75/2
+ ive
Screen
- ive
Vehicle Road Speed Sensor
EM2CL
Fuel Level Indicator
EM20/9
BW
EM4/15
RHS25
RH84/1
Fuel Tank Sender Unit
ACPSW
ACCS
EM20/86
EM20/41
WU
EM1/12
EM1/11
LF1/15
LF1/16
LF22/4
LF22/1
Aircon Trinary Switch
WAC
EM20/69
GR
EM1/10
BH55/2
Aircon Clutch Relay
CAN -ive
CAN +ive
SCP +ive
SCP -ive
FEPS
EM20/72
EM20/49
EM20/50
EM20/16
EM20/15
EM20/13
SLG
G
Y
S
U
LGY
Reverse S/W Manual
EMS10
EMS 21
EMS 20
EMS 1
EMS 2
EMS22
EM4/16
EM1/6
EM1/8
EM1/7
EM1/4
EM1/5
BH35/13
EEC (FEPS)
Diagnostic Socket
RH35/2
Reverse Lamp Relay
Power Ground 1
Power Ground 2
Power Ground 3
Power Ground 4
Power Ground 5
Power Ground 6
Power Ground 7
Chassis Ground
EM20/3
EM20/23
EM20/24
EM20/51
EM20/76
EM20/77
EM20/103
EM20/25
EMS90
EM1AR
EM1AL
Boot Fusebox
BATT
IGN
5A
10A
F3
F18
RH11/2
RH10/1
WP
RHS98
PW
RH15/1
RH15/3
Relay #1 VPWR 1
RH15/2
RH15/5
B
RH1BR
EM5/1
NY
EMS5
VPWR
EM20/71
EM20/97
PI3/7
EM4/3
RHS21
Vapour Management Valve
RH61/1
RH61/2
EM4/1
RY
EM20/56
Vapor Management Valve
Canister Vent Valve
RH60/2
RH60/1
EM4/2
RU
EM20/67
Hego Heater HTR-11
Hego Right Front HO2S-11
Signal Return
HEGO 11
PI23/1
PI23/4
PI23/2
PI23/3
PI3/14
PI3/10
PI3/8
EMS11
PU
RIN
BP
R
EM20/93
EM20/60
EM20/91
CMS Right Rear HO2S-2
CMS Heater HTR-2
CMS 2
PI25/4
PI25/1
PI24/3
PI24/2
PI3/9
PI3/11
GIN
PS
G
EM20/35
EM20/95
EGR Vacumn Regulator
EGR Vac Regulator
PI29/2
PI29/1
PI3/26
RG
EM20/47
Idle Air Control
PI27/2
PI27/1
PI3/27
RP
EM20/83
PIS4
PIS2
PIS3
PI31/2
PI32/2
PI33/2
PI34/2
PI35/2
PI36/2
PI31/1
PI32/1
PI33/1
PI34/1
PI35/1
PI36/1
1
2
3
4
5
6
Fuel Injectors
Injector 1
Injector 2
Injector 3
Injector 4
Injector 5
Injector 6
BU
BS
BK
BW
BY
BR
PI3/5
PI3/6
PI3/10
PI3/11
PI3/12
PI3/15
EM20/75
EM20/101
EM20/74
EM20/100
EM20/73
EM20/99
Mass Airflow Sensor
PI43/A
PI43/C
PI43/D
PI43/B
UG
UR
B
PI3/23
PI3/16
EM20/36
EM20/88
Mass Airflow Signal Return
I/P Mass Airflow Sensor
PIS20
PI45/4
PI45/17
EMS24
BRD
EMB1
EMS25
EMS26
PI3/24
EM20/48
Missfire Detection Module
PIB1
PI45/1
PI45/21
PI45/8
PI45/25
PI45/26
PI45/12
RIN
YIN
PIN
PI3/2
PI3/1
PI3/3
EM20/18
EM20/7
CTO
IONODM
MFD
PI62
PIS5
PIS6
PIS7
PIS1
WP
PI5/7
LGU
LGY
LGR
PI11/3
PI11/1
PI12/3
PI12/1
PI13/3
PI13/1
PI14/3
PI14/1
PI15/3
PI15/1
PI16/3
PI16/1
Coil 1
Coil 2
Coil 3
Coil 4
Coil 5
Coil 6
PI11/2
PI12/2
PI13/2
PI14/2
PI15/2
PI16/2
GU
GS
GK
GW
GB
GR
PI5/1
PI5/2
PI5/3
PI5/4
PI5/5
PI5/6
EM20/26
EM20/78
EM20/52
EM20/53
EM20/1
EM20/27
Ignition Coil 1
Ignition Coil 2
Ignition Coil 3
Ignition Coil 4
Ignition Coil 5
Ignition Coil 6
ST2
R
RHS66
Bulkhead Fusebox RHS
IGN
10A
F6
BH21/4
EM1/17
RH22/5
5A
3B
Keep Alive Memory 2
RH22/6
NO
RH23/4
EM1/18
EMS3
KAPWR
EM20/55

DB7 VANTAGE

CIRCUIT TITLE Primary PCM

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 17

SOURCE No. 37-124650-AA

Secondary PCM

Boot Fusebox

BATT, IGN, Relay #5 Stop Lamp, Relay #2 Transmission Oil Pump, 5A F3, 10A F20, 10A F8, 5A F6, 10A F17, RH11/8, RH11/5, RH11/7, RH11/4, RH11/9, RH13/3, RH13/10, RH10/8, RH11/2, RH10/3, WP, RHS98, WP, PW, RH16/1, RH16/3, RH16/2, RH16/5, B, NY, EM5/2, NY, RH1BL, EMS6, NY, NY, EM40/71, E40/97, Relay #2 VPWR 2, PI4/7, EM4/18, RH62/1, RH62/2, Vapour Manage-ment Valve, EM40/56, YR, EM4/19, YR, PI28/1, PR, PI4/27, PR, EM40/83, Idle Air Control, PI28/2, PI30/1, GR, PI4/26, GR, EM40/47, EGR Vac Regulator, PI30/2, PI26/2, PS, PI5/24, PS, EM40/95, CMS Heater HTR-2, PI26/1, PI26/3, GIN, PI5/22, GIN, EM40/35, CMS Left Front HO2S-2, PI26/4, PI24/3, PU, PI5/21, PU, EM40/60, Hego Left Front HO2S-11, PI24/4, PI24/2, PU, PI5/23, PU, EM40/93, Hego Heater HTR-11, PI24/1, PI4/14, BP, EMS13, BP, EM40/91, Signal Return, HEGO HO2S-11, PIS16, NY, NY, PIS11, NY, PIS12, NY, PI37/2, PI38/2, PI39/2, PI40/2, PI41/2, PI42/2, 7 8 9 10 11 12, Fuel Injectors, PI37/1, PI38/1, PI39/1, PI40/1, PI41/1, PI42/1, UB, SB, KB, WB, YB, RB, PI4/5, PI4/6, PI4/10, PI4/11, PI4/12, PI4/15, EM40/100, EM40/99, EM40/73, EM40/101, EM40/75, EM40/74, Injector 7, Injector 8, Injector 9, Injector 10, Injector 11, Injector 12, PI44/A, Mass Airflow Sensor, PI44/C, PI44/D, PI44/B, GU, RU, B, PI4/23, PI4/16, EM40/36, EM40/88, Mass Airflow Sensor Return, I/P Mass Airflow Sensor, PI46/4, PIB3, PI46/8, PI46/1, PI46/21, PI63, PIS13, PIS14, PIS15, PIS2, NY, BRD, LGU, LGY, LGR, Missfire Detction Module, PI46/17, B, PIS21, PI46/26, YIN, PI46/12, PIN, PI46/25, RIN, EMB2, PI4/1, PI4/3, PI4/2, B, BRD, PI4/24, EMS27, B, BRD, EM2BR, YIN, PIN, RIN, EM40/18, EM40/7, EM40/48, IDM, MFD, CTO, PI17/3, PI17/1, PI18/3, PI18/1, PI19/3, PI19/1, PI20/3, PI20/1, PI21/3, PI21/1, PI22/3, PI22/1, LGU, WN, LGY, WN, LGR, WN, LGR, WN, LGY, WN, LGU, WN, +1, 3, Coil 7, Coil 8, Coil 9, Coil 10, Coil 11, Coil 12, 2, PI17/2, PI18/2, PI19/2, PI20/2, PI21/2, PI22/2, UG, SG, KG, WG, BG, RG, PI5/14, PI4/15, PI5/16, PI5/17, PI5/18, P5/19, Ignition Coil 7, Ignition Coil 8, Ignition Coil 9, Ignition Coil 10, Ignition Coil 11, Ignition Coil 12, EM40/53, EM40/27, EM40/1, EM40/78, EM40/26, EM40/52, PI5/20, WN, PIS5, PIS4, PIS3, PIS1, PIS0, PIS6, PIS7, PIS8, PIS9, PIS10, PIS11, PIS12, PIS18, PIS19, PIS20, PIS22, PIS23, PIS24, PIS25, PIS26, PIS27, PIS28, PIS29, PIS30, PIS31, PIS32, PIS33, PIS34, PIS35, PIS36, PIS37, PIS38, PIS39, PIS40, PIS41, PIS42, PIS43, PIS44, PIS45, PIS46, PIS47, PIS48, PIS49, PIS50, PIS51, PIS52, PIS53, PIS54, PIS55, PIS56, PIS57, PIS58, PIS59, PIS60, PIS61, PIS62, PIS63, PIS64, PIS65, PIS66, PIS67, PIS68, PIS69, PIS70, PIS71, PIS72, PIS73, PIS74, PIS75, PIS76, PIS77, PIS78, PIS79, PIS80, PIS81, PIS82, PIS83, PIS84, PIS85, PIS86, PIS87, PIS88, PIS89, PIS90, PIS91, PIS92, PIS93, PIS94, PIS95, PIS96, PIS97, PIS98, PIS99, PIS100, PIS101, PIS102, PIS103, PIS104, PIS105, PIS106, PIS107, PIS108, PIS109, PIS110, PIS111, PIS112, PIS113, PIS114, PIS115, PIS116, PIS117, PIS118, PIS119, PIS120, PIS121, PIS122, PIS123, PIS124, PIS125, 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PIS1000

Bulkhead Fusebox RHS

ST2, R, R, RHS66, IGN, 10A F6, BH21/8, EM2/2, WN, RH22/5, 5A 3B, Keep Alive Memory 2, RH22/6, NO, RH23/4, NO, NO, EM1/18, NO, EMS3, NO, EM40/55

Relay #2 VPWR 2, Vapour Manage-ment Valve, HEGO HO2S-11, CMS HO2S-2, EGR Vac Regulator, Idle Air Control, Fuel Injectors, Mass Airflow Sensor, Missfire Detction Module, Coil 7, Coil 8, Coil 9, Coil 10, Coil 11, Coil 12, Relay #5 Stop Lamp, Relay #2 Transmission Oil Pump, Keep Alive Memory 2, Transmission Oil Pump, EMS14, LF2AR, LF60/2, LF60/1, LF2/B3, EM4/17, EM4/8, RH2/3, EM4/18, RH62/1, RH62/2, PI4/7, RHS98, WP, PW, RH16/1, RH16/3, RH16/2, RH16/5, RH11/2, RH10/3, RH11/8, RH11/5, RH11/7, RH11/4, RH11/9, RH13/3, RH13/10, RH10/8, GP, Y, NG, GP, Y, B, GP, B, Y, GP, NG, EM40/92, EM40/68, EM40/90, UW, EM40/65, K, W, EM40/89, EM40/39, Y, EM40/85, UIN, EM40/21, EM40/22, GIN, BIN, EM40/58, EM40/28, LGW, EM40/12, LGN, EM40/49, EM40/50, EM40/16, EM40/15, EM40/13, LGY, EM40/3, EM40/23, EM40/24, EM40/51, EM40/76, EM40/77, EM40/103, EM40/25, B, Signal Return, Sensor Ref Supply, Delta Pressure Feedback Exhaust, Throttle Pot, Intake Air Temp, Cylinder ID Sensor, CPS +ive, CPS -ive, VSS +ive, VSS -ive, Overspeed Chime (Saudi Only), Reverse Inhibit Switch, CAN -ive, CAN +ive, SCP +ive, SCP -ive, FEPS, Power Ground 1, Power Ground 2, Power Ground 3, Power Ground 4, Power Ground 5, Power Ground 6, Power Ground 7, Chassis Ground, PI4/25, PI4/14, PI4/9, PI58/2, PI58/3, PI58/1, PI56/2, PI56/3, PI56/1, PI44/F, PI44/E, PI52/2, PI48/1, PI48/2, PIB7, PIB8, BRD, BRD, PIS17, PIS16, PIS19, EMS13, BRD, BRD, BP, EMS54, BP, BP, UW, UW, BP, UW, BP, BP, BP, BP, EMB2, EMS32, EMS31, EMS30, UIN, BRD, RIN, BW, BR, EM4/10, EM4/9, EM4/7, EM2CL, RHS1, RH75/3, RH75/1, RH75/2, + ive, Screen, - ive, PI4/21, PI4/17, PI4/4, PI4/18, PI4/8, PI4/22, EMS21, EMS20, EMS1, EMS2, EMS22, EMS95, EM1/6, EM1/8, EM1/7, EM1/4, EM1/5, BH35/13, EM2AR, EM2AL, Data Sheet, EEC (FEPS), Diagnostic Socket, Multifunction Unit, Reverse Inhibit Solenoid, Vehicle Road Speed Sensor, Intake Air Temperature, Cylinder I.D. Sensor, Crank Position Sensor, Delta Pressure Feedback, Throttle Position Sensor

DB7 VANTAGE

CIRCUIT TITLE Secondary PCM

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 18

SOURCE No. 37-124650-AA

1 2 3 4 5 6 7 8

A B C D E F

Bulkhead Fusebox LHS

BATT
30A F12 · 30A F14 · 5A F18
BH12/3 · BH13/4 · BH10/1
NLG · NG · NR
LF2/A3 · LF2/B1 · BHS70 Instrument Pack Int/Map Lights
NLG · NR
LF28/A · LF3/3
Right Hand Radiator Cooling Fan (M)
LF28/B
OG · NG · NR
LF27/2 · LF27/3 · LF27/8
Radiator Fans Module D1 D2
LF27/1 · LF27/5 · LF27/7 · LF27/9
B · OY · UW · W
LF2/B2 · LF2/B3
UW · W
EM2/8 · EM2/1
UW · W
LF29/A
Left Hand Radiator Cooling Fan (M)
LF29/B
B
LF2BL
LF2BR

Aircon Unit

AC3/5 · UB · AC1/3 · UB · LF1/17 · UB
B
LF1BS
LF22/3 · LF22/2
Aircon Trinary Switch 20 bar · 2-30 bar
LF22/4 · LF22/1
WU · BP · LF1/15 · LF1/16
WU · BP
EM1/12 · EM1/11
WU · BP
EM20/86 · EM20/41

Bulkhead Fusebox LHS

BATT
IGN
10A F4 · 20A F20
BH13/9 · BH10/3
W · NP
BHS14 · BHS68 Window Lift Cut-Out Accessory Terminal
ABS ECU
Clutch Switch
A/C Sensor
Multifunction Unit
W · NP
BH55/1 · BH55/3
Relay Air Con Clutch
BH55/2 · BH55/5
GR · GU · LF1/14 · GU
LFS10
GU · W · LF24/1 · DSS46
Air Con Clutch · **Diode 23**
LF24/2 · DSS45
B · B
LFS11
B
LF1AL

Fuel Tank Sender Unit

RH84/1
BW
RHS25
BW
EM4/15
BW
EM20/9

EM1/10
GR
EM20/69

KN · NY
EM20/80 · EM20/40

Boot Fusebox

BATT
IGN
Relay #1 Fuel Pump 1 · 20A F15
Relay #4 Fuel Pump 2 · 20A F7
10A F18 · 5A F3 · 10A F20
RH10/5 · RH12/2
KN · NY
RH11/1 · RH11/10
NO · KW
RH10/1 · RH11/2 · RH10/3
PW · WP · PW
RHS23
RHS24
RHS98
NY · NY · NO · NO
WP · WP
RH15/3 · RH15/1
RH16/1 · RH16/3
Relay #1 VWPR 1 · **Relay #2 VPWR 2**
RH15/5 · RH15/2
RH16/2 · RH16/5
NY · B
B · NY
RH1BR
RH1BL
RH81/1 · RH82/1
Fuel Tank Fuel Pump 1 · Fuel Pump 2
RH81/2 · RH82/2
B · B
RH2AR
RH2AL
EM4/12 · EM4/11
EM4/13 · EM4/14
KN · NY
NO · KW
EM20/80 · EM20/40
NO · KW
EM40/40 · EM40/80

Vehicle Road Speed Sensor

RH75/3 + ive · RH75/1 Screen · RH75/2 - ive
UIN · BRD · RIN
RHS1
UIN
EM4/10 · EM4/9 · EM4/7
UIN · BRD · RIN

EM5/1
NY
EMS5
NY · NY
EM20/71 · EM20/97

EM5/2
NY
EMS6
NY · NY
EM40/71 · EM40/97

EMS30
EMS32
EMS31
BRD · UIN · RIN · BW · BR · RIN · UIN · BRD
EMB3 · EMB2
EM20/58 · EM20/33 · EM40/33 · EM40/58
EM2CL

Powertrain Control Module - 1
EMS - V RHS (Primary)

Powertrain Control Module - 2
EMS - V LHS (Secondary)

PCM -1
EEC -V
RHS Primary

PCM -2
EEC -V
RHS Secondary

PCM -1
EEC -V
RHS Primary

PCM -2
EEC -V
RHS Secondary

DB7 VANTAGE

CIRCUIT TITLE Cooling Pumps

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 19

SOURCE No. 37-124650-AA

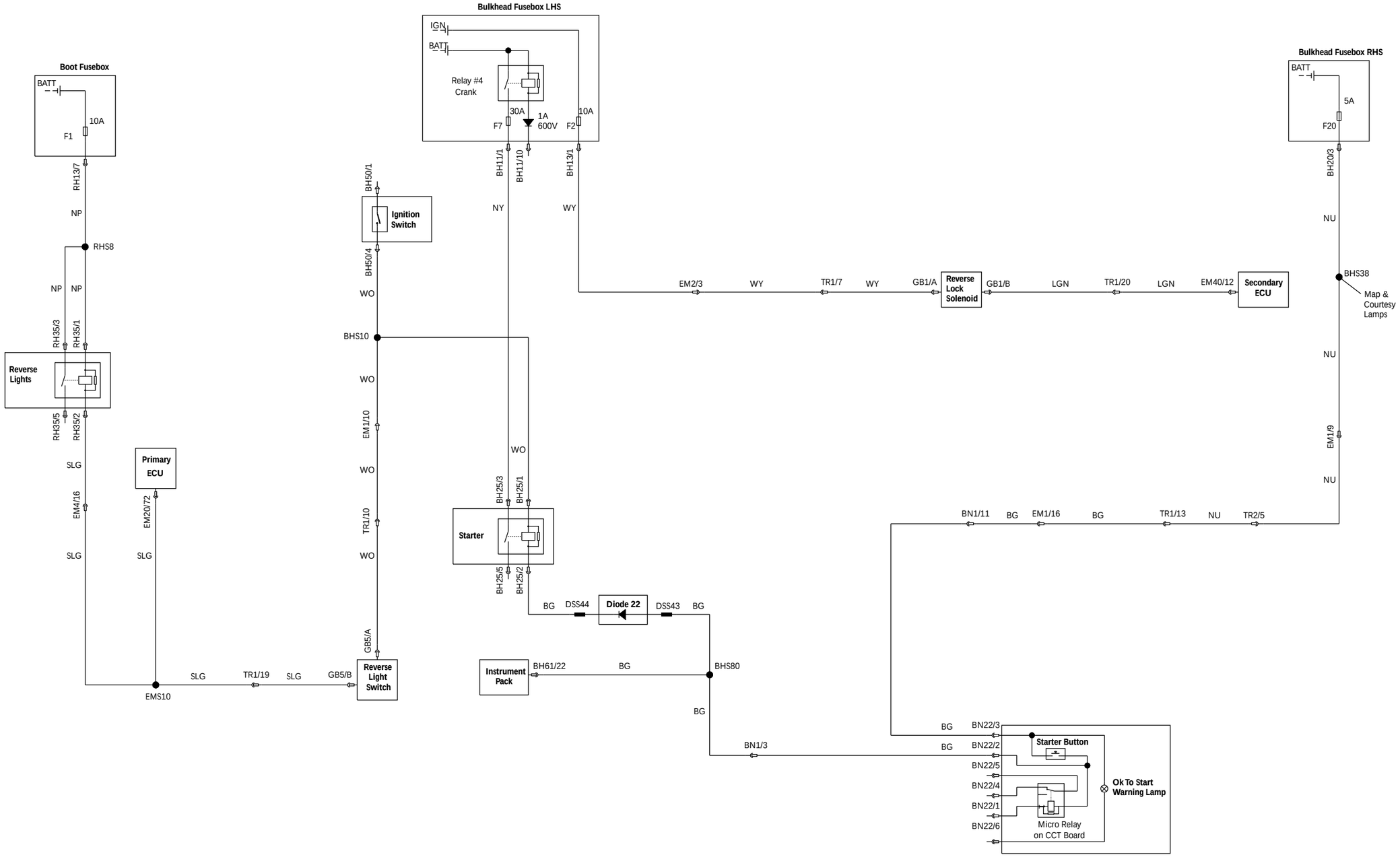
Selector Position	L1 (Pin 36)	L2 (Pin 8)	L3 (Pin 37)	L4 (Pin 9)
	Voltage Readings For Rotary Switch Positions At TCM - 1 = High 0 = Low			
P	1	1	0	1
R	1	0	0	0
N	1	1	1	0
D	0	0	1	0
4	0	0	0	1
3	0	0	1	1
2	1	0	1	1

Boot Fusebox
Bulkhead Fusebox LHS
Bulkhead Fusebox RHS
Bulkhead Fusebox LHS
Primary ECU
PRINDL Switch
Instrument Pack
Starter Button
Micro Relay On CCT Board
Ok To Start Warning Lamp
Diode 24
Diode 22
Interlock ECU
Reverse Lights
Reverse Light Switch Manual Only
Starter
To Starter Motor
Binnacle Harness
Gearbox Rotary Switch
Keep Alive Memory 2
EMS03
LHS EEC
RHS EEC
Gearshift Interlock Module
Gearshift Interlock Solenoid
Steering Wheel Switches
Gear Selector
Touchtronic +/- Illumination
Switch Mode
Kick Down Switch
Speed Sensors
Turbine Speed Sensor
Vehicle Speed Sensor
Keylock Solenoid
Brake Switch
Stop Lamp Relay ABS ECU
Transmission Control Unit
Gearbox
Shift Solenoid 1
Shift Solenoid 2
Shift Solenoid 3
Pressure Regulator 1
Pressure Regulator 2
Pressure Regulator 3
Pressure Regulator 4
Pressure Regulator 5
Transmission Temperature Sensor

CIRCUIT TITLE	Auto Gearbox
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 20

SOURCE No. 37-124650-AA



DB7 VANTAGE

CIRCUIT TITLE	Manual Gearbox
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 20

SOURCE NO. 37-124650-AA

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8

A | B | C | D | E | F

ST10 BH91 N
ST1 RH92 N
RHS Battery Stud
LHS Battery Stud
EM90 RH94
BH92

Bulkhead Fusebox RHS
BATT
5A F12
BH22/3
NB
Heated Front Screen Controller Traction Switch
Diagnostic Socket
BHS67 BHS51
NB WU
LF1/20 LF3/6
NB WU N
LF20/1 LF20/2 ST011
Regulator Alternator
LF20/4
SW
LF2/A6
SW
BH62/24
Charge Warning
Instrument Pack

Bulkhead Fusebox LHS
BATT
IGN
Relay #4 Crank
5A F5
30A F7
1A 600V
BH11/2 BH11/1 BH11/10
WU NY BR
Starter Switch Ilumination
BHS56 BR
BH25/3 BH25/1
Starter Motor
BH25/5 BH25/2
WR BG
BHS04
WR
LF2/A1
BHS22W
W
N WR
DS44
ST001 LF39/2
Diode 22
Starter Motor
DS43
U
BHS80 BG
BG
BH61/22
Instrument Pack

Bulkhead Fusebox RHS
IGN
BATT
10A F18
5A F3
10A F20
RH10/1 RH11/2 RH10/3
PW WP PW
RHS98
WP WP
RH15/3 RH15/1 RH16/1 RH16/3
Relay #1 VPWR 1
Relay #2 VPWR 2
RH15/5 RH15/2 RH16/2 RH16/5
NY B B NY
RH1BR RH1BL
EM5/1 EM5/2
NY NY
UB UB
AB1/20 AB3/2
EMS5 EMS6
EM1/13 EM1/20
BR NY NY UB UB NY NY
EM20/19 EM20/71 EM20/97 EM20/64 CL2 EM40/71 EM40/97
EEC 1 Primary
Clutch Switch
EEC 1 Secondary
WO

Bulkhead Fusebox RHS
BATT
Relay #5 Ignition Coils
10A F8
10A F6
BH21/8 BH21/4 BH21/9
WN WP W
EM2/2 EM1/17
WN WP
PI5/20 PI5/7
WN WP
PIS2 PIS1
7 8 9 10 11 12
Ignition Coils LHS
1 2 3 4 5 6
Ignition Coils RHS

BHS5U
U
DSS9
Diode 5
DSS10
W
BHS5W
WO
BHS10

Gearshift Interlock Module
Footbrake
Pedal Depressed
GS11/1
GR
GS1/13
GR
TR1/15
GR
EM2/13
GR

Boot Fusebox
Stop Lamp Relay Coil
Fuse Boot F8
RH11/9 RH11/8
GR GP
RHS9U
U
DSS17
Diode 9
DSS18
W
RHS9W
GB
RH2/12
GB
BHS12 GB

ABS ECU
Footbrake
Pedal
Depressed
AB10/12
GP
RHS96
GP
RH4/14 AB1/11
GP
BH41/4
Brake Switch
BH41/1

Bulkhead Fusebox LHS
BH93
Relay #7 Ignition + ive
1A 600V
BH12/9
WO

Bulkhead Fusebox RHS
BH90
Relay #7 Auxillary + ive
1A 600V
BH22/9

Boot Fusebox
RH96
IGN
Relay #1 Fuel Pump 1
Relay #4 Fuel Pump 2
20A F15
20A F7
RH10/5 RH12/2 RH11/1 RH11/10
KN NY NO KW
RHS24
RHS23
NY NY NO NO
RH81/2 RH82/2
Fuel Pump 1
Fuel Pump 2
Fuel Tank
EM4/12 EM4/11 EM4/13 EM4/14
KN NY B B NO KW
RH81/1 RH82/1
RH2AR RH2AL
EM20/80 EM20/40 EM40/40 EM40/80
FP FMP FMP FP
PMC-1 EEC-V RHS Primary
PMC-2 EEC-V LHS Secondary

B
RH95 RH93
Battery
RH098
B
RH99

To Starter Motor
WR
BH7/5 BH7/1
BH7/3 B
BH7/2 B
BHS96 (BHS92)
Starter Logic Relay
See SHT 15
B
BH4BS (BH3AL)

Lighting Stalk
Reverse Light Switch
Diagnostic Socket
Sidelight Shorting link

BN1/11 BG
EM1/16
BG
TR1/13
TO G/Box Rotary Switch SHT 20

BN22/3
BN22/2
BN22/5
BN22/4
BN22/1
BN22/6
Starter Button
Micro Relay on CCT board
OK To Start Warning Lamp

WN
WN
BG
BN1/14 WN
BN1/6 WN

WO
BHS15 WN
Diagnostic Socket
Ignition Switch Ignition
Auxillary
BH50/4 BH50/2
BH50/1
BK BK
BHS85 BHS94
BK BK
BH1AR RHD
BH2AS LHD

DB7 VANTAGE

CIRCUIT TITLE	Starter Circuits
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 21

SOURCE No. 37-124650

Bulkhead Fusebox LHS

IGN
BATT
30A F12
30A F14
5A F18
10A F4
20A F20
10A F16
GU
BH12/3 NLG
BH13/4 NG
BH10/1 NR
BH13/9 W
BH10/3 NP
BH12/4 NP
BHS70
BHS14
BHS68
LF2/A3
LF2/B1
NR
W
NP
BHS69
NLG
LF3/3
BH55/1
BH55/3
LF28/A
Relay Air Con Clutch
RH Cooling Fan
BH55/2
BH55/5
GU
LF28/B
OG NG NR
LF27/2 LF27/3 LF27/8
Module Radiator Fans
D1
D2
LF27/1 LF27/5 LF27/7 LF27/9
B OY UW W
LF2BR
LF29/A
LF2/B2 LF2/B3
LH Cooling Fan
UW W GR WU BP
LF29/B EM2/8 EM2/1 EM1/10 LF1/15 LF1/16
B WU BP
LF2BL
EM1/12 EM1/11
UW W GR WU BP
EM20/46 EM20/45 EM20/69 EM20/86 EM20/41
EDF ACPSW ACCS WAC
Primary Powertrain Control Module

LFS10
GU W
LF24/1
Air Con Clutch
Diode 23
DSS46
DSS45
LF24/2
B U
LFS11
B
LF1AL
LF1/14
NP

Dimmer Module
BH40/8 RW
Instrument Pack
BHS28
RW
AC1/6
AC1/5

Air Conditioning Controls
Control Panel Module
Mode Control Switch
Temperature Demand Switch
12v Battery
Illumination
+12V Ignition
Differential
+5V Supply
Ground
Ground
Aircon
Econ
Manual
Demist
Off/Recirc
Defrost
Defrost
High
Med
Low
OFF
BN13/3 RW
BN12/3 NP
BN12/2 WR
BN14/2 OW
BN14/1 S
BN13/1 B
BN13/10 B
BN13/4 K
BN13/5 G
BN13/6 U
BN13/7 O
BN13/8 WR
BN13/9 WB
BN11/1 B
BN11/2 N
BN11/3 S
BN11/10 OB
BN11/9 WB
BN11/8 RB
BN11/7 SB
BN11/6 KB
BN11/5 WR
BN11/4 B
BN11/1 SU
AC34/3 RW
AC34/1 NP
AC34/4 WR
AC34/5 OB
AC34/7 S
AC34/8
AC34/9
AC34/10
AC34/11
AC34/12
AC35/1
AC35/2
AC35/3 WR
AC35/4 WB
AC28/1 B
AC28/2 S
AC28/3 S
AC29/7 OB
AC29/6 WB
AC29/5
AC29/4
AC29/3
AC29/2 WR
AC29/1
AC29/8 SU
ACS9
ACS8
ACS5
ACS2
ACS1
WR
AC1/2 WR
UB WR OB OW K G U O WR WB N RB SB KB SU
AC3/5 AC2/1 AC4/14 AC4/13 AC3/11 AC3/8 AC3/4 AC2/8 AC2/9 AC3/12 AC4/5 AC2/15 AC2/14 AC2/13 AC2/12
Blower Common
Trinary Switch
+12v Aux Ignition
Blower LH Feedback
Blower LH Control
12v Ignition Return
Coolant Switch
Differtial I/P
Lower Servo
Lower Servo
Upper Servo
Upper Servo
A/C Function
Econ Function
Manual I/P
Demist I/P
Off/Recirc Mode
Defrost I/P
Lower Feedback
Upper Feedback
Temp Demand
+5V Supply
Evap Temp
Ambient Temp
Blower High
Blower Med
Blower Low
In-Car Temp
IN-CAR TEMP
+12V Ignition
Coolent Solenoid
Center Solenoid
Recirc Solenoid
Defrost Solenoid
Ground
Ground
Ground
Ground
Blower RH Control
Blower RH Feedback
AC3/1 O
AC3/7
AC4/1 BR
AC3/6
AC4/11 WB
AC4/7 PR
AC4/12 YU
AC4/10 SB
AC3/14 R
AC3/15 Y
AC4/13 S
AC2/5 K
AC4/4 YR
AC2/4 U
AC2/10 G
AC3/2 RS
AC3/3 SG
AC2/3 RU
AC2/11 OR
AC4/15 B
AC4/8 B
AC2/6 B
AC2/2 B
AC4/2 K
AC4/3 KB
NY SU
BHS14
W
AC1/4 B
ACS7
ACS3
ACS4
AC1/1 B
BHS92
B
BH3AL

Air Conditioning ECU

Bulkhead Fusebox RHS
BATT
AUX
Relay #3 RH & LH Blowers
10A F3
10A F19
10A F21
BH23/8 WR
BH22/10
BH20/4
BH20/7

BHS27
Diagnostic Socket
Drivers Window ECU
Drivers Mirror S/W
Radio
Hood ECU

Aircon Trinary Switch
20 bar
2-30 bar

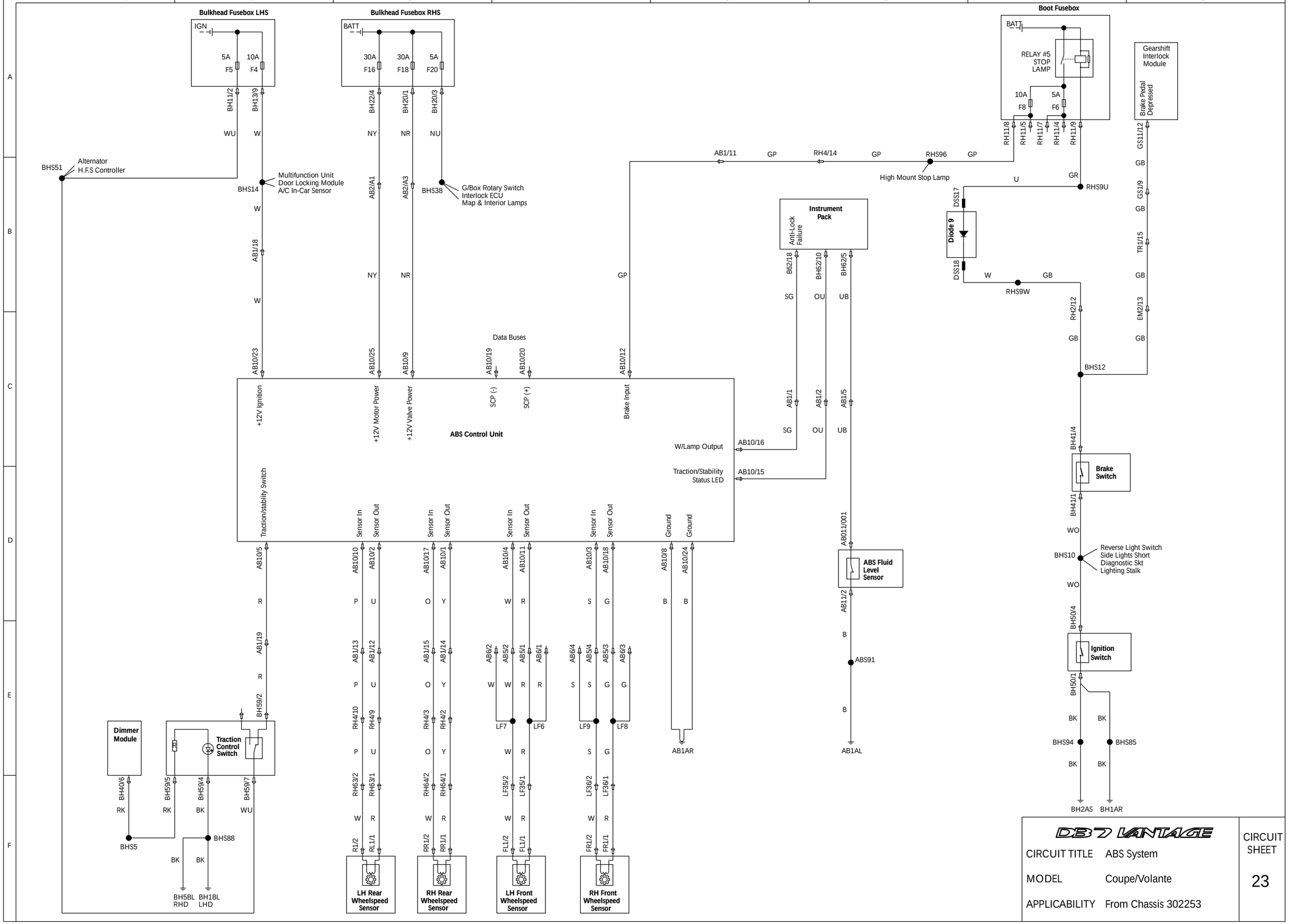
BHS87
BH2BR LHD
BH4AS RHD
BH86/1
BH86/2
AC5/1
AC5/2
AC5/4
AC5/3
LH Blower Assy
AC15/1
AC15/2
Coolant Temperature Switch
AC12/1
AC12/2
Lower Servo
AC13/1
AC13/2
Upper Servo
AC11/3
AC11/2
AC11/1
Lower Feedback Pot
AC10/3
AC10/2
AC10/1
Upper Feedback Pot
AC9/3
AC9/2
AC9/1
Evaporator Temperature Sensor
AC31/3
AC31/2
AC31/1
Ambient Temperature Sensor
AC7/4
AC7/5
AC7/6
AC7/1
AC7/2
In-Car Aspirated Temperature Sensor
AC32/5
AC32/4
AC32/3
AC32/2
AC32/6
AC32/1
Coolant
Centre Vent
Recirculation
Defrost
Solenoid Valve Block
AC6/3
AC6/4
AC6/2
AC6/1
BH85/2
BH85/1
RH Blower Assy
BHS93
BH3CS LHD
BH1BS RHD
LF1BS
LF1/17 UB
LF22/3
LF22/2
LF22/4
LF22/1
LF1/16
LF1/11
BP
EM1/11

DB7 VANTAGE

CIRCUIT TITLE	Aircon System
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 22

SOURCE No. 37-124650

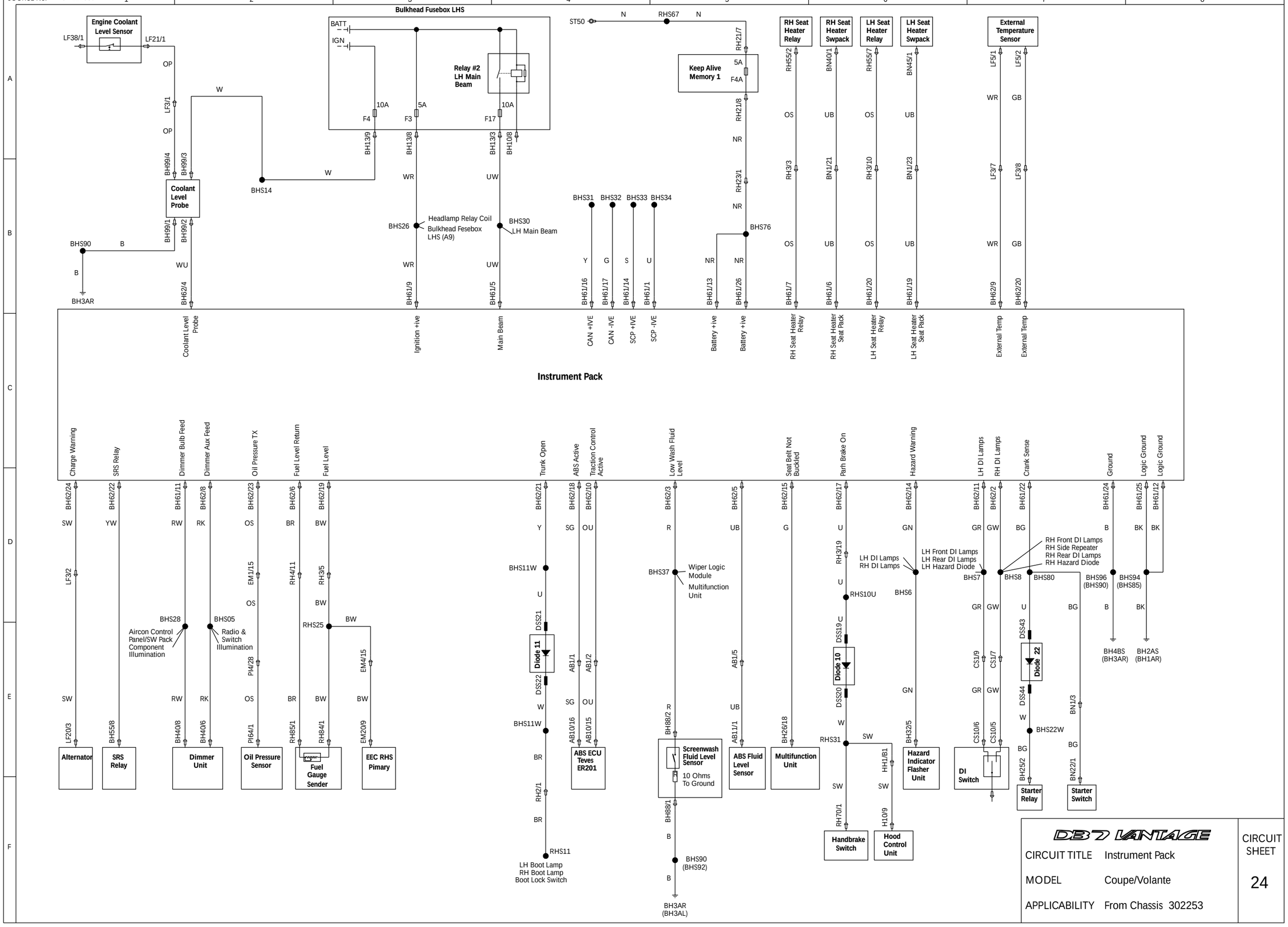


DB7 VANTAGE

CIRCUIT TITLE	ABS System
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 23

SOURCE No. 37-124650

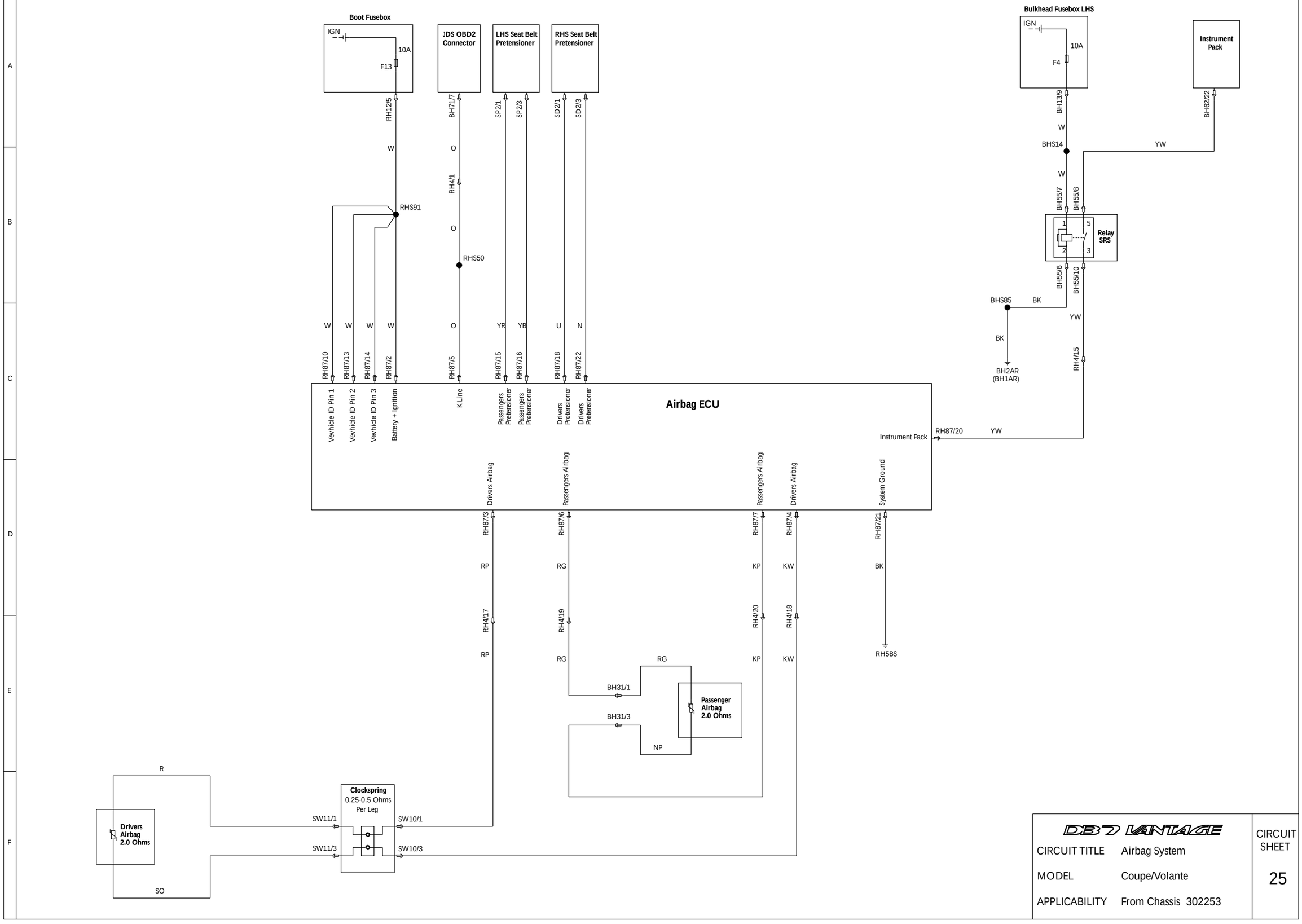


DB7 VANTAGE

CIRCUIT TITLE	Instrument Pack
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 24

SOURCE No. 37-124650

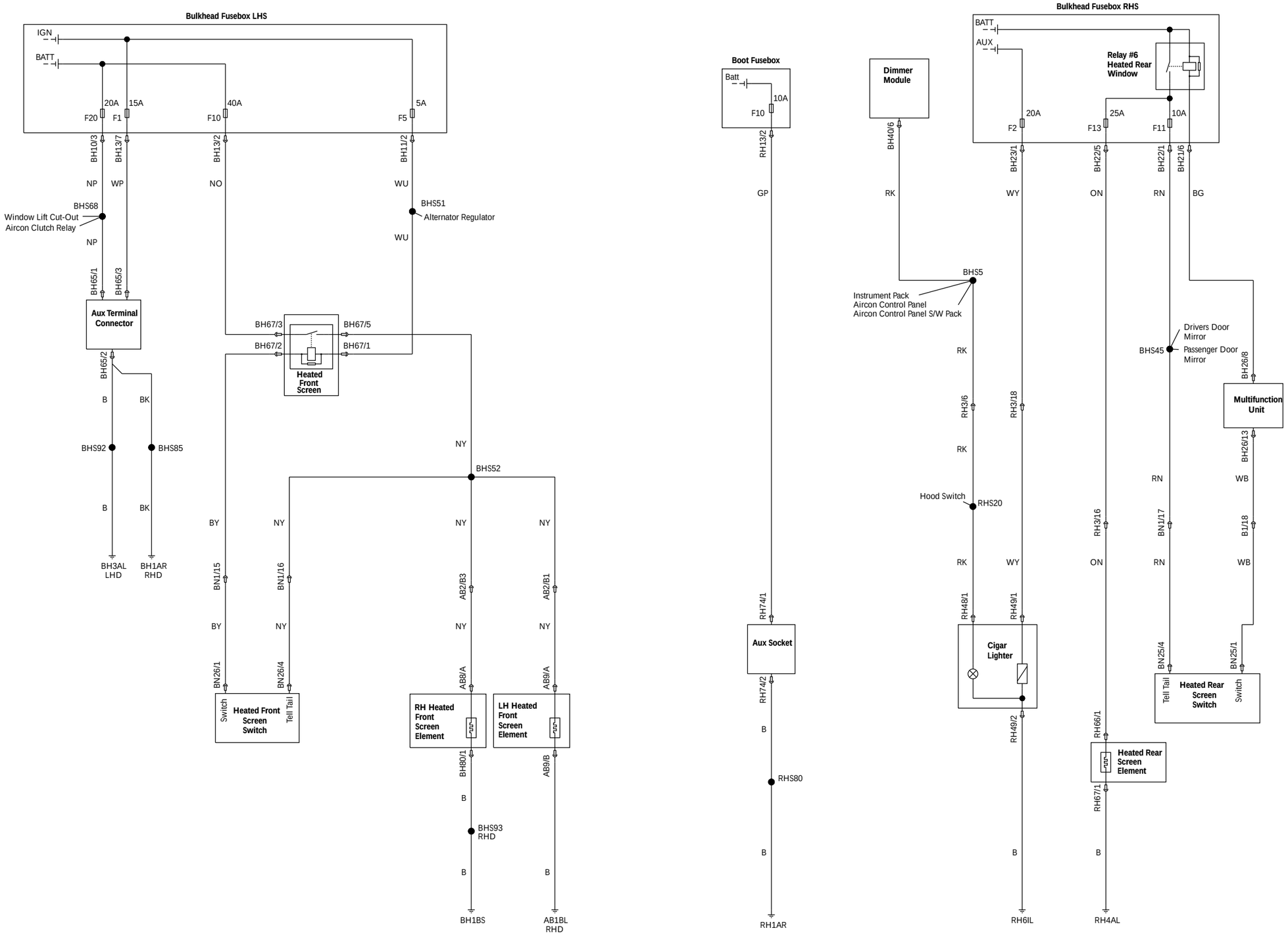


DB7 VANTAGE

CIRCUIT TITLE	Airbag System
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 25

SOURCE No. 37-124650



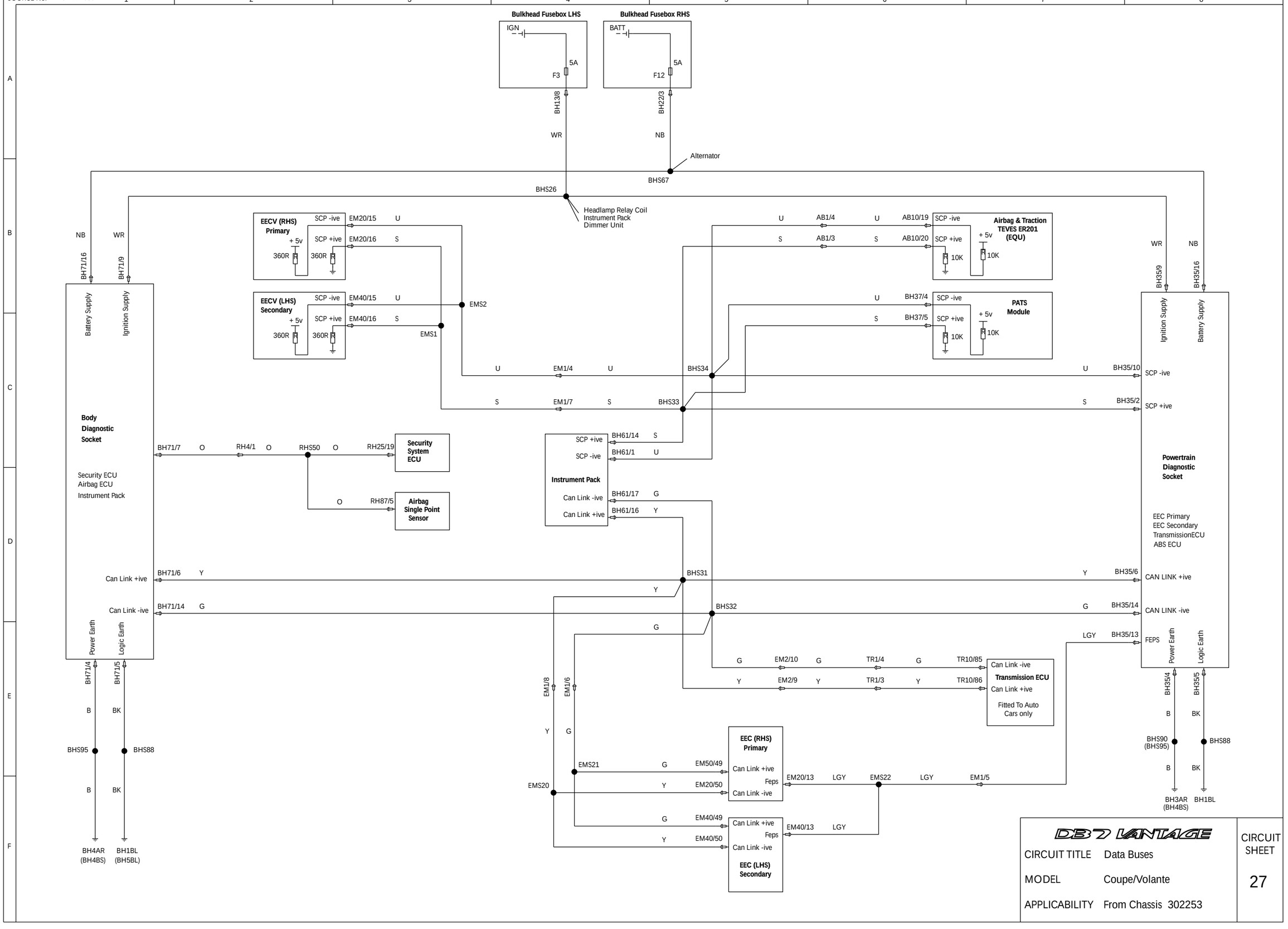
DB7 VANTAGE

CIRCUIT TITLE	Ancillaries
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET

26

SOURCE No. 37-124650



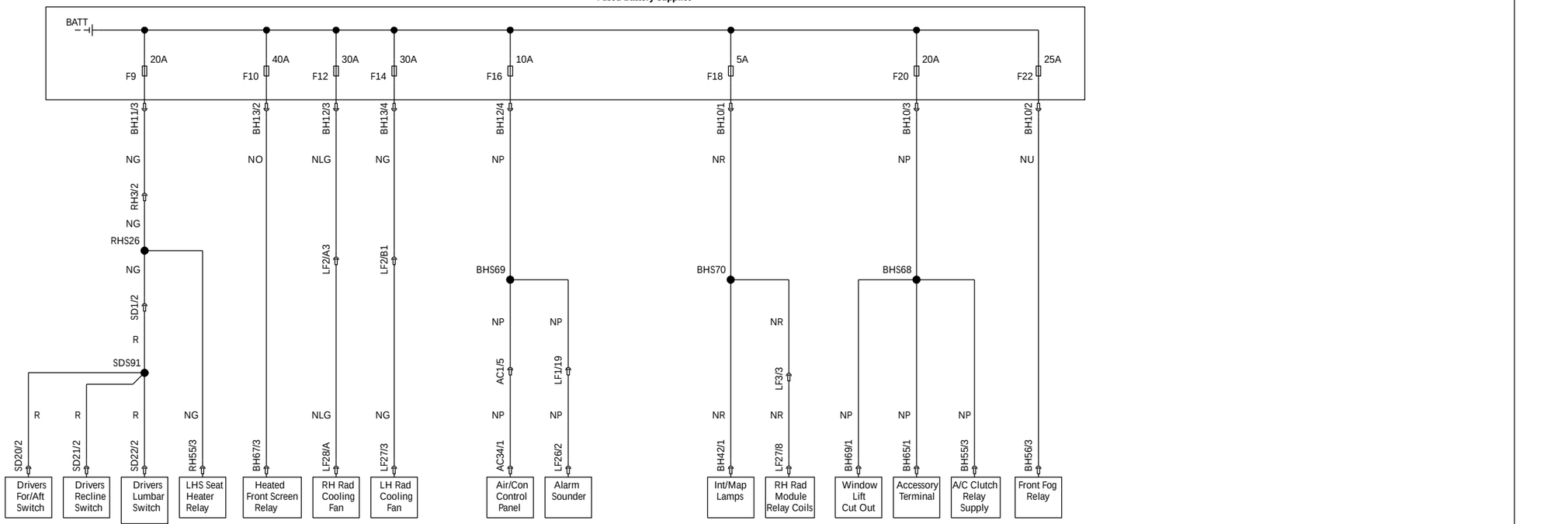
DB7 VANTAGE

CIRCUIT TITLE	Data Buses
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

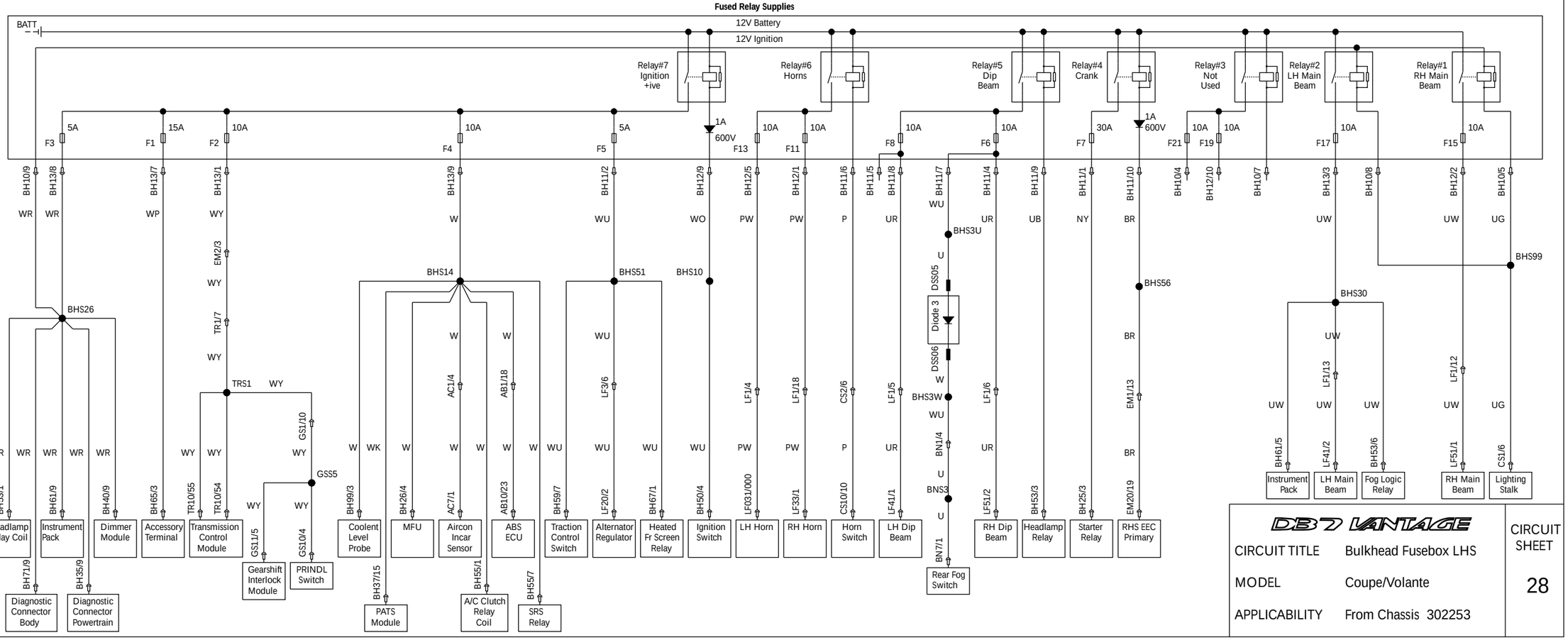
CIRCUIT SHEET 27

SOURCE No. 37-124650-AA

Bulkhead Fusebox LHS
Fused Battery Supplies



Bulkhead Fusebox LHS
Fused Relay Supplies



DB7 VANTAGE

CIRCUIT TITLE	Bulkhead Fusebox LHS
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 28

SOURCE No. 37-124650-AA

1 | 2 | 3 | 4 | 5 | 6 | 7 | 8

A | B | C | D | E | F

Bulkhead Fusebox RHS
Fused Battery Supplies

IGN

BATT

Relay#7
Auxillary +ive

F3 10A
F1 5A
F2 20A
F4 5A
F5 10A
1A 600V
F9 20A
F10 10A
F12 5A
F14 10A
F16 30A
F18 30A
F20 5A
F22 10A

BH20/9 WR
BH23/8 WR
BH23/7
BH23/1 WY
BH23/9 WG
BH21/2 WU
BH22/9 WN
BH21/3 NG
BH23/2 NO
BH22/3 NB
BH23/4 NR
BH22/4 NY
BH20/1 NR
BH20/3 NU
BH20/2

BHS27
WR WR WR WR
DD1/15 WR
BH60/7
DP1/16
AC1/2 WR
DDS92
ACS01
WR WR WR WR WR WR WY
DD12/A
DD5/6
RL1/10
DP12/A
AC2/1
AC34/4
RH49/2

Drivers Door Window Controller
Drivers Door Mirror Switch
Radio
Pass Door Window Controller
Aircon Unit Mirco 'C'
Aircon Control Panel
Cigar Lighter

RH3/1 WG
RHS14
WG WG
RH55/1
RH55/6

LH Seat Heater Relay
RH Seat Heater Relay

BH29/2
BN22/4
BN1/14
WN
RH3/9 NG
RHS27
NG
SP1/2 R
SPS91
NG R R R
SP21/2
SP22/2
SP20/2

Indicators Flasher Unit
Starter Switch
RH Seat Heater Relay
Pass Recline Switch
Pass Lumbar Switch
Pass For/Aft Switch

BHS77
NO NO
BH40/5
BH37/8

Dimmer Module
PATS Module

BHS67
NB NB NB
BH71/16
BH35/16
LF20/1
LF1/20
NB

Diagnostic Socket
Diagnostic Socket
Alternator

BH32/2
AB10/25
AB10/9
AB2/A1
AB2/A3
NY NR

Hazard Flasher Unit
ABS ECU Motor Power
ABS ECU Valve Power

BHS38
NU
EM1/9
NU NU
TR2/5
NU
TRS5
NU
GS1/1
NU NU NU
GS11/1
GB2/5
BN1/8
BN12/10

Gearshift Interlock Module
Gearbox Rotary Switch
Binnacle Harness (Not Used)

BATT

12 V Aux Ignition

Bulkhead Fusebox RHS
Fused Relay Supplies

Relay #6 Heated Rear Window
Relay #5 Ignition Coils
Relay #4 Interior Lights
Relay #3 RH & LH Blowers
Relay #2 Wipers 1
Relay #1 Wipers 2

F13 25A
F11 10A
F8 10A
F6 10A
F7 10A
1A 600V
F21 10A
F19 10A
F17 20A
F15 20A

BH20/9
BH22/5 ON
BH22/1 RN
BH21/6 BG
BH21/5
BH21/8 WN
BH21/7
BH21/4 WP
BH21/9 W
BH21/1 PW
BH21/10 BU
BH20/4 NY
BH22/10 NU
BH20/7 WR
BH23/10
BH23/3 NS
BH20/8 WS
BH22/2 NU
BH20/5 WS

BHS45
RN RN RN
RH3/16
BN1/17
DP1/19
DD1/19
ON RN RN RN
RH66/1
BN25/4
DP3/9
DD3/9
BH26/8

Heated Rear Window
H.R.W Telltail
Pass Door Mirror Conns
Drivers Mirror Conns
MFU

EM2/2
WN
PI5/20
WN
PIS2
WN WN WN WN WN WN
PI17/1
PI18/1
PI19/1
PI20/1
PI21/1
PI22/1

Ignition Coil 7
Ignition Coil 8
Ignition Coil 9
Ignition Coil 10
Ignition Coil 11
Ignition Coil 12

EM1/17
WP
PI5/7
WP
PIS1
WP WP WP WP WP WP
PI11/1
PI12/1
PI13/1
PI14/1
PI15/1
PI16/1

Ignition Coil 1
Ignition Coil 2
Ignition Coil 3
Ignition Coil 4
Ignition Coil 5
Ignition Coil 6

BHS5U
U
DSS09
Diode 5
BHS16
DSS10
W
BHS5W
WO
BHS10
WO
BH50/4

Ignition Switch Ground

BH42/4 PW
BH26/17

Interior Lamp Cluster
MFU

BH85/2
BH86/2

AIR/CON RH Blower Motor
AIR/CON LH Blower Motor

BHS8U U
AB1/10 NS
AB15/C1 NS

Wiper Motor

BHS36
NS NS NS
CS1/16
BH66/14

Front Screen Wiper Stalk
Wiper Logic Module

BHS7U
U
DSS15
Diode 8
DSS16
DSS13
Diode 7
DSS14
DSS11
Diode 6
DSS12
W W W
BHS15
WN
BH50/2

Aux Ign Switch Ground

BHS6U
U
BHS35
NU NU
CS1/11
BH66/4

Front Screen Wiper Stalk
Wiper Logic Module

DB7 VANTAGE

CIRCUIT TITLE Bulkhead Fusebox RHS

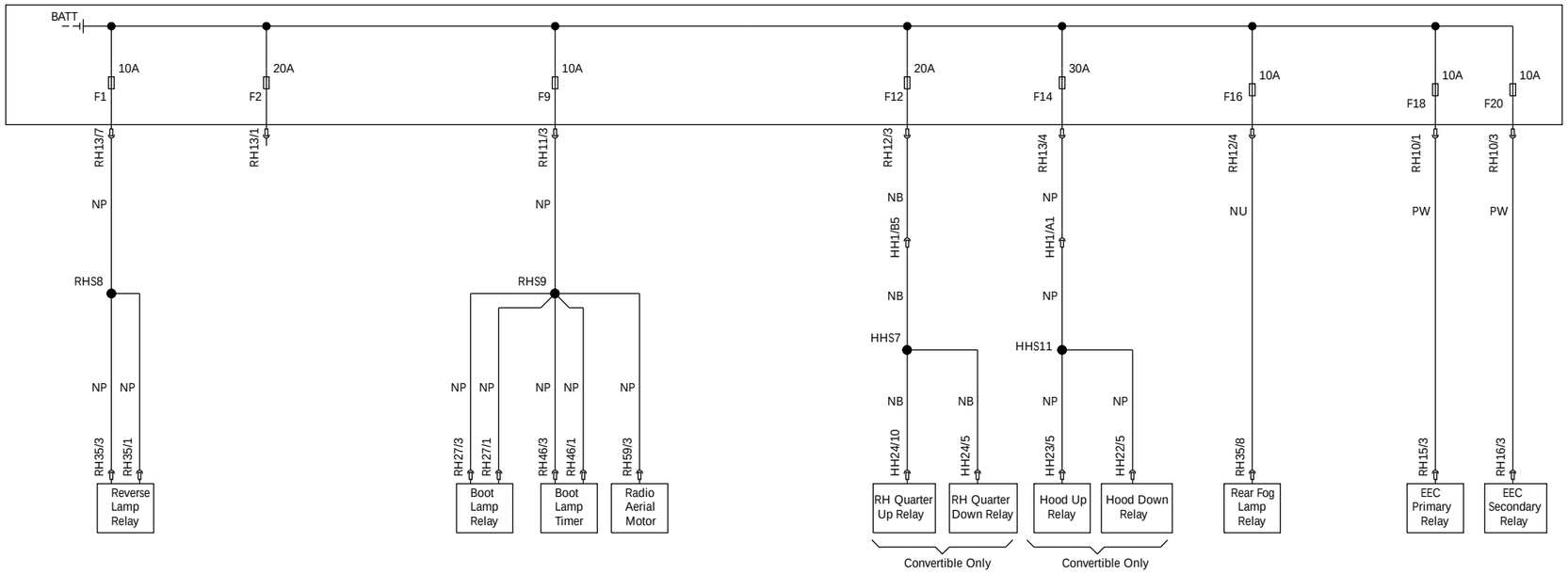
MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

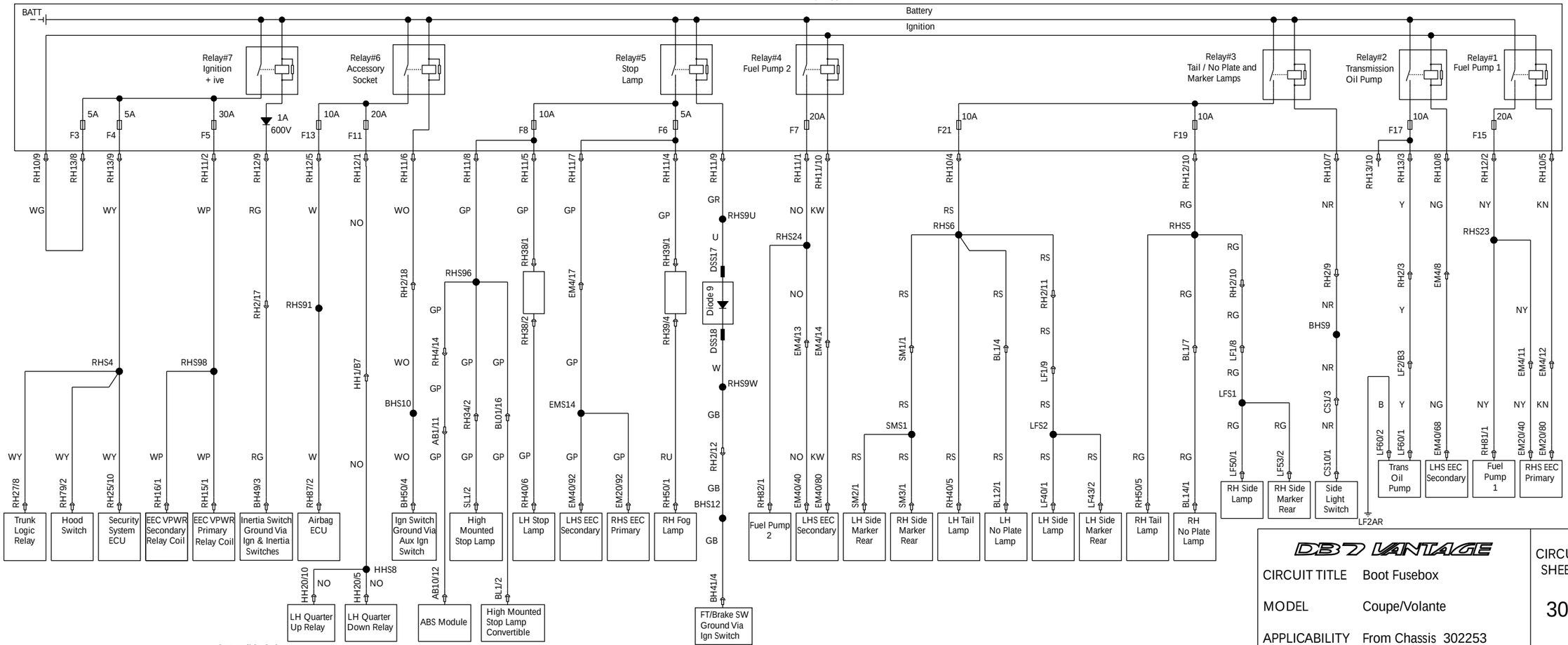
CIRCUIT SHEET 29

SOURCE No. 37-124650-AA

Boot Fusebox
Fused Battery Supplies



Boot Fusebox
Fused Relay Supplies

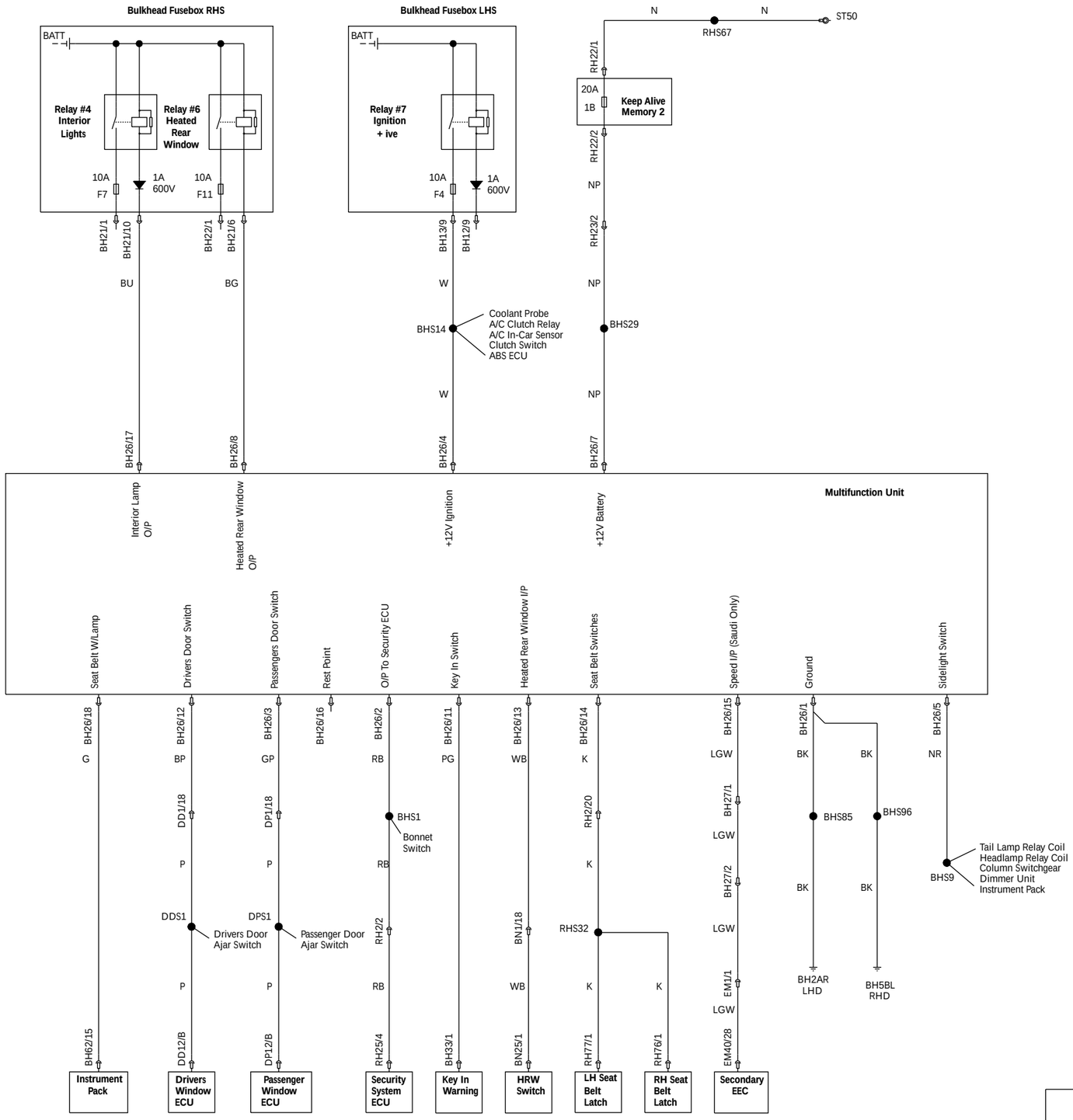


DB7 VANTAGE

CIRCUIT TITLE	Boot Fusebox
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 30

SOURCE No. 37-124650-AA



DB7 VANTAGE

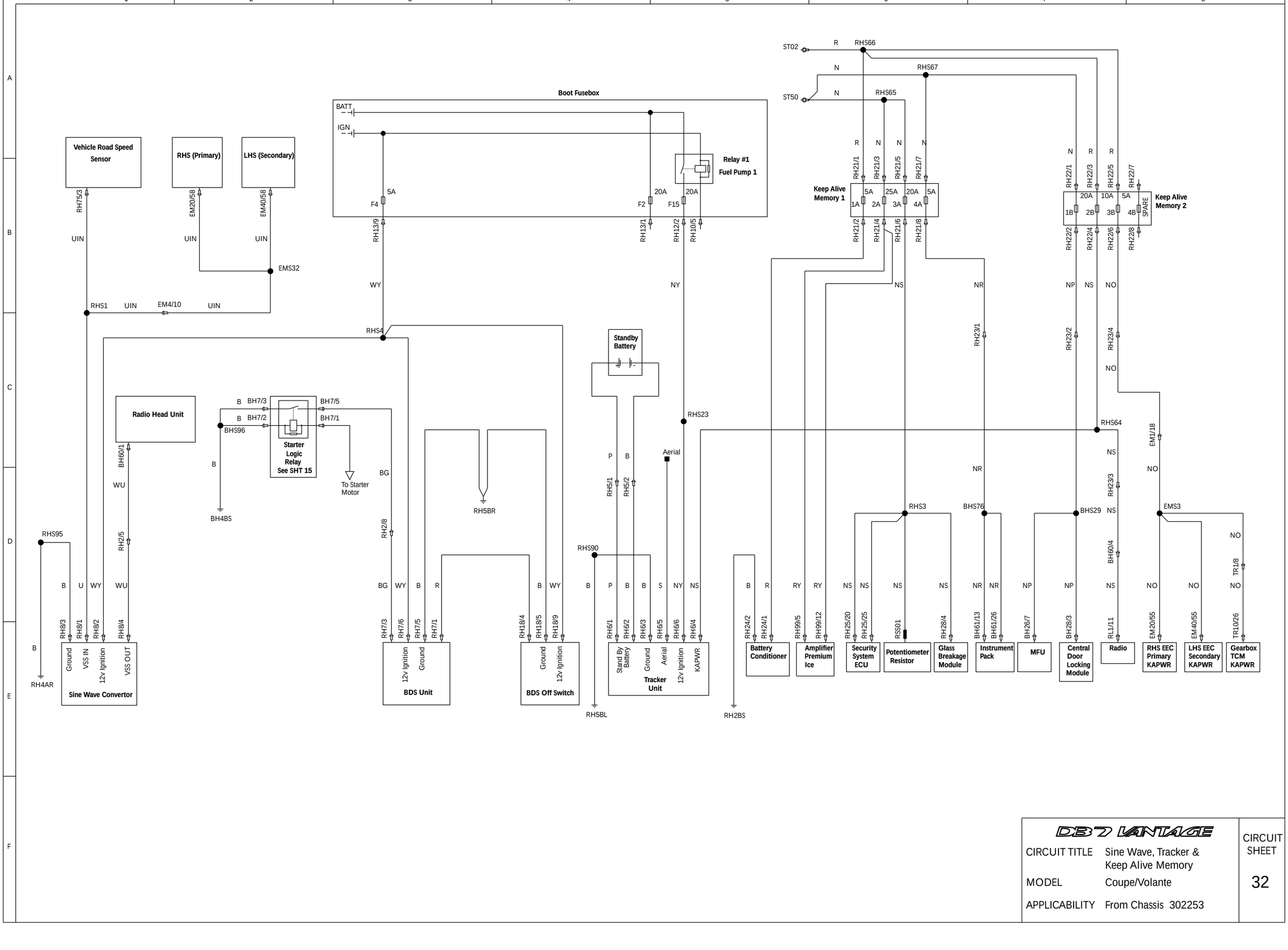
CIRCUIT TITLE Multifunction Circuits

MODEL Coupe/Volante

APPLICABILITY From Chassis 302253

CIRCUIT SHEET 31

SOURCE No. 37-124650-AA



DB7 VANTAGE

CIRCUIT TITLE	Sine Wave, Tracker & Keep Alive Memory
MODEL	Coupe/Volante
APPLICABILITY	From Chassis 302253

CIRCUIT SHEET 32

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Body Repair

Introduction

This section contains information for the body repair and rectification of the vehicle. Wherever possible the vehicle must be returned to its original manufactured condition. Following repair the vehicle must be fully checked and, if necessary, the braking system and steering must be fully reset.

Health and Safety

Ensure that the correct working practices are established before beginning work.

Observe that the correct working practices are followed whether they be legislative or common sense.

Be aware of the potential material risks when repairing body and paintwork and take the appropriate precautions.

Warning: Make sure that the working practices for the air conditioning system are followed: do not vent the refrigerant directly into the atmosphere and always use the approved recovery/recycle /recharge equipment, always wear suitable protective garments to prevent injury to the eyes and the skin.

Potential Risks

Paint

If the organic solvents, contained in paints, are inhaled for any length of time damage can be caused to the liver, kidneys, respiratory tract and the digestive system.

Prolonged exposure to isocyanates can cause lung sensitisation and asthma-like symtoms can develop with subsequent re-exposure to even low concentrations.

Solvent inhilation can cause dizziness or loss of consciousness.

Inhalation of spray dust and sanding debris can cause lung damage.

Paint activators and additives will damage the eyes or can cause dermatitis if allowed to splash and come into contact with these areas. Peroxide and acid catalysts can cause burns.

Applied heat

There is considerable risk of damage to the eyes and skin when welding or flame cutting.

Fire is a serious danger as many materials and fluids in the vehicle are inflammable.

Toxic and dangerous fumes can be liberated when the following are subjected to heat; expanded foam, corrosion protection, adhesive and sealing compounds, trim, seat material and paints that contain isocyanates.

When heated to a temperature of 300°C, polyurethane based compounds can liberate small quantities of isocyanate. Many types of nitrogen containing chemicals may be liberated as breakdown products, these chemicals can contain isocyanates, oxides of nitrogen and hydrogen cyanide.

Potentially toxic or asphyxiant fumes and gases are produced by welding, for example; zinc oxide with zinc coated panels and ozone gas from the MIG process.

Metal repair

There is considerable risk of damage to the eyes, ears and skin when metal cutting, forming and dressing is being carried out.
Soldering may be hazardous because of heat generated fumes and skin contact with the materials.

Precautions

Paint

Ensure that there is efficient ventilation at all times. Paint spraying should be confined to spray booths.

Anyone with a history of asthma should not be engaged in any process which involves the use of isocyanates.

Any operator working inside a spray booth where isocyanates are present must use air-fed breathing equipment. Supplied air to the visor should be fed at the recommended pressure and filtered to remove oil, water and fumes.

Operators involved in handling, mixing or spraying should wear protective clothing, gloves and goggles to avoid skin and eye contact. A particle mask or canister type respirator should be worn when sanding.

Applied heat

When welding, flame cutting or brazing etc, goggles, masks or fume extractors and flameproof protective clothing should always be used.

It is especially important when working with polyurethane compounds to use air-fed breathing equipment.

Ensure that at all times the appropriate fire fighting equipment is available and that personnel are trained in its use.

Metal repair

Wear appropriate eye and hand protection when sanding, drilling, cutting, chiselling, flatting or welding. Wear a face mask or air-fed visor when sanding or flatting either body solder or fillers. When a soldering operation has been completed, remove swarf from the work area and wash your hands thoroughly.

General Repair Notes

The following precautions should be noted before any work is carried out:

- Disconnect the vehicle battery ground lead, taking note of the reconnection procedures
- Make sure that you have read and understood the safety related procedures in this section.

Caution: Electric arc welding must not be used on the vehicle as the high voltages produced by this process will cause irreparable damage to the electrical control and microprocessor systems.

All trim and electrical components in the locality of the repair must be removed or disconnected prior to panel removal or replacement.

Welding and Gas Process Special Notes

Resistance spot welding, MIG welding and all gas processes may only be carried out on bare, unpainted or unplated metal. The flanges of panels, which are to be welded together, must be clean, corrosion free and treated as appropriate with either weld-through or inter-weld sealer.

The resistance spot welding equipment used in vehicle repair does not always produce a weld of equivalent strength to that produced in manufacturing. This means that a single row of spot welds should be spaced on a pitch of 19-25 mm, which will usually result in more spot welds than found in the original factory joint.

Use a resistance spot weld cutter to remove resistance spot welds. Where a new joint is to be MIG welded, cut the old resistance spot welds from the panel that is to be retained; the resulting holes are then used for plug welding. Suitable holes may be drilled or punched as follows:

- 8.0 mm for sections up to 1.6 mm thickness
- 10.0 mm for thicker sections.

Always refer to the welding equipment manufacturers diagrams and tables for the relevant procedure.

Steel Body Parts - Repair, Remove and Replace

Removal

1. Expose the resistance spot weld. For those spot welds that are not obviously visible use a rotary wire brush fitted to an air drill or a hand held wire brush.

Caution: Do not burn off underseal, use a 'hot knife' or a suitable solvent.

2. Cut out the spot welds using a Zipcutter or roto-Bor. At this point it may be necessary to cut out the bulk of a panel using a pneumatic saw.

Note: On some panels, before removing the bulk of the panel, brazed areas and MIG welded seams should be removed.

3. Separate the spot welded joints and remove the panel remnants.

Preparing Old Surfaces

1. Remove the weld nuggets with a sander and 36 grit disc.
2. Clean all flanges to a bright smooth finish.
3. Straighten existing panel joint edges as required.

Preparing New Surfaces

1. Mark off the area of the new panel and cut to size leaving approximately two inches overlap on the existing panel
2. Offer up the new panel or section and align it with the associated parts.
3. Clamp the panel into position.
4. Where necessary, cut the new and original panels to form a but joint.
5. Remove all clamps and the new panel.
6. If required, apply the inner panel protection and or sound insulation.
7. Prepare the new panel joint edges for welding by cleaning to bright metal, both interior and exterior edges.
8. Apply weld through primer or inter-weld sealer to all surfaces to be resistance spot welded.
9. Where appropriate, apply metal-to-metal adhesive or sealer in accordance with the manufacturer's instructions.

Panel Alignment

1. Align the replacement panel with the associated panel and clamp it in position.
2. With certain panels it may be necessary to tack weld or use PK screws.

Welding

1. MIG tack the butt joints.
2. Re-check the alignment and the panel contours as necessary.
3. Select the correct arms for resistance spot welding and ensure that the tips are correctly trimmed.

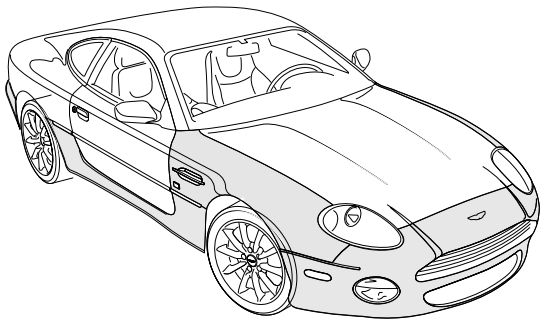
Note: It is recommended that the arms are not more than 12 in (300 mm) in length.

4. Test the equipment for satisfactory operation using test coupons.

   In the absence of test equipment a satisfactory weld can be verified by pulling the test coupons apart and viewing the welded condition.
5. Resistance spot weld where required. Note the presence of zinc coated panels and treat as previously described.
6. Dress back all MIG tack welds.
7. MIG seam weld the butt joints.
8. Dress all welds as required.
9. Final braze and lead load as necessary prior to paint preparation.

RTM Body Parts

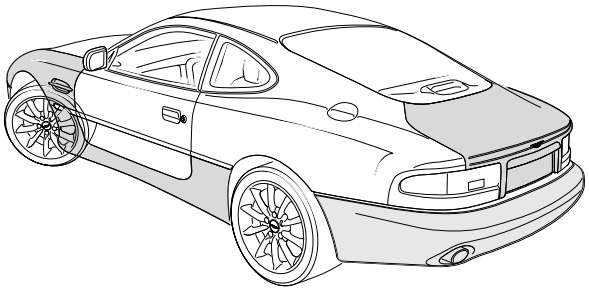
Certain exterior panels of the vehicle are manufactured from RTM. They are shown as shaded areas in the accompanying illustrations. The front and rear bumpers are made from R-RIM



Damage Recognition

Before any remedial action is carried out the damaged should be assessed. If the cover has been holed or torn it must be replaced. Repair should be attempted only if the damage falls into one of the following three categories.

Cosmetic	Abrasion to the surface paint finish
Substrate surface	Deep scratches, gouges or localised radial stress cracks.
Substrate penetration	Splits not exceeding 100 mm. Splits radiating from a gouge and accompanied by localised stress cracks.



Repair Procedures

Cosmetic Damage

Repair the paintwork using standard procedures.

Substrate surface

Where the defect does not affect the physical strength of the panel, fill and repaint using standard techniques.

Substrate Penetration

No reliable repair procedures are possible to correct major physical damage to RTM panels. Any small defect which do not affect the integrity or security of the panel may be filled and repainted at the owners risk.

Note: Because of the inherent flexibility of plastic panels, hard filler may crack. Such repairs cannot therefore be guaranteed.

Where the damage affects the security and or the integrity of the panel, it must be replaced.

Precautions during Paint Operations

When any repair operation is being completed on the vehicle paintwork, take particular care to protect the leather upholstery and trim from paint contamination.

Volante Roof

Description

(See section 6, circuit sheet 14 for details of the roof and rear quarter light circuits.)

The system comprises an electrically driven hydraulic pump and two hydraulic rams for raising and lowering the roof. The pump is powered via either the 'Hood Up' or 'Hood Down' relay. Two further pairs of changeover relays power the rear quarter windows (one pair for each window). The roof hydraulic pump is protected by a 30A fuse, the rear quarter light circuits are protected by two 20A fuses.

The hood control module is actuated by the roof switch on the centre console. The hood control module controls the operation of both the roof and rear quarter window circuits so that they can only be operated in a pre-programmed manner.

When the roof switch is moved into the open (Roof Down) position, the roof and rear windows move together until approximately four seconds has elapsed. At this time, the control module will remove power from the rear window circuits, leaving the roof motor running. The roof motor will stop after 12 seconds (i.e. a further 8 seconds after the rear window motors stop).

The signals will be removed from the rear window relay after 4 seconds and from the roof relay after 12 seconds if the roof switch is held in either position for longer than 12 seconds.

In order to comply with legislation, the following features are built into the system:

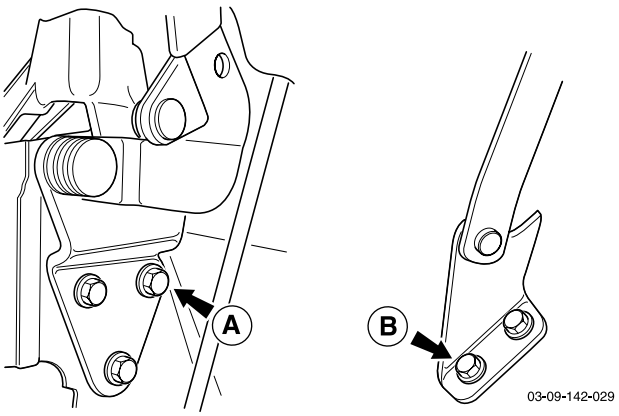
If the roof switch is operated in either direction and then released before that operation is complete, the roof and rear quarter windows will stop immediately. If, whilst the system is in operation, the ignition switch is turned to the off position, the system will immediately stop.

If the roof switch is pressed again after pausing during a roof movement, the timing sequence will be as follows:

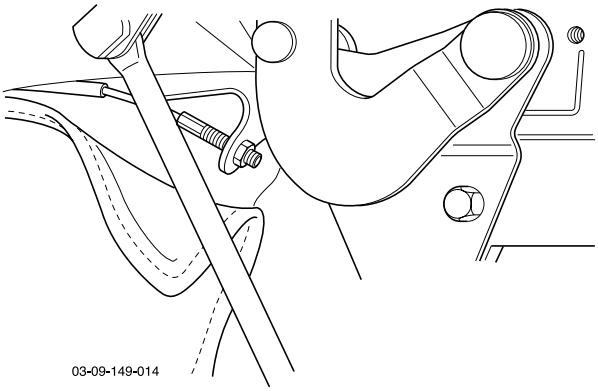
1. If the previous direction is selected, the timing recommences from where it left off and will continue to completion. If the ignition has been turned off, the timing will start from the beginning of its cycle.
2. If the opposite direction is selected, the timing sequence will commence from the beginning of the newly selected direction and continue to completion.

9.0.02.1 - Roof Removal/Replacement

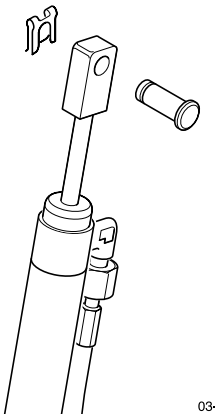
1. Move the front seats fully forward for access.
2. Remove the rear seat squab and cushion. Remove the rear quarter trim panel.
3. Release the roof side curtain clips.
4. Release the rear window support bracket bolts
5. Remove the side curtain clips (2 per side).
6. Release the side curtain rods and move the curtains aside.
7. Disconnect the heated rear window connector.
8. Release the rear window support bracket from the body.
9. Release the roof catches.



10. Select Manual on the roof motor control switch. Lower the roof to the midway position. Select Electric on the roof motor control switch - the roof will remain in a raised position.
11. Raise the trim and remove the cable securing nuts.
12. Release the roof outer finisher securing screws and remove the finisher.
13. Release the cable and roof material from the body channel.



14. Select the Manual position on the roof motor control switch. Fold the roof and remove the ram to roof securing pins.

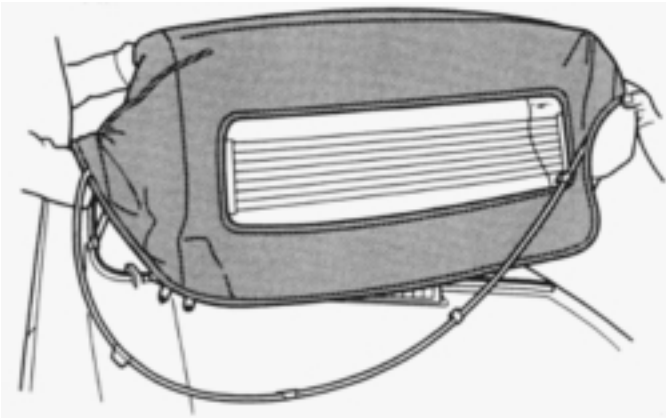


15. Remove the six roof to body securing bolts.
16. Remove the roof assembly.

Refitting

1. Fit the roof into position on the vehicle, aligned with the fixing holes.
2. Refit the six roof to body securing bolts.
3. Locate the rams to the pivot.
4. Select Manual on the roof motor control switch. Place the roof in the partially open position to align the ram fixing holes. Fit but do not tighten the securing bolts.
5. Fit the pivot pins and securing clips.
6. Finally tighten all bolts.
7. Position the rear window support bracket, fit and tighten the securing bolts.
8. Fully raise the roof. Select Electric on the roof motor control switch.
9. Position the rear edge of the roof to the body.
10. Position the rear cable to the roof lower edge. Position the loops on the cable (approximately 17in equi-spaced apart). Position the cable to the mounting brackets, fit but do not tighten the securing nuts.

11. Align the rear edge of the roof material to the body and commence tightening the cable nuts evenly. Stop frequently and check that the cable and roof channel are correctly bedding into the body channel. Continue tightening and checking until the roof is fully seated in the body channel.



12. Fit and secure the roof finishers.

13. Reconnect the heated rear window connector.

14. Position the roof inner curtain. Fit clips to the curtain rods. Fit and tighten the securing screws.

15. Refit all trim and check the roof mechanism for correct operation and fitting.

9.0.02.3 - Roof Hydraulic Control System

Procedure

1. Move the front seats forward for access.

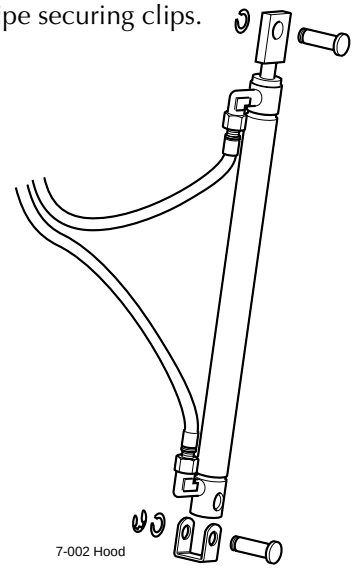
2. Fully lower the roof.

3. Remove the rear seat squab and cushion. Remove the rear quarter trim panels.

4. Remove both the cylinder pivot pins. Release the ram cylinder assemblies (take care not to kink the pipes).

5. Remove the screws from the hydraulic pipe grommet in the rear of the roof stowage well. Remove the grommet.

6. Release the pipe securing clips.



7. Open the boot and remove the boot floor trim panel. Remove the pump mounting plate securing bolts.

8. Release and remove the pump cover.

9. Disconnect the pump multi-plug.

10. Release the pump mounting rubbers from the plate.

11. Feed both ram cylinders into the boot through the aperture in the roof well rear wall.

12. Remove the complete hydraulic system from the boot.

Note: Check that the reservoir fluid level is correct. Always bleed the hydraulic system before topping up.

Refitting is the reverse of the removal procedure.

On completion of the refitting, check the roof operation.

9.0.02.5 - Bleeding the Roof Hydraulic System

Procedure

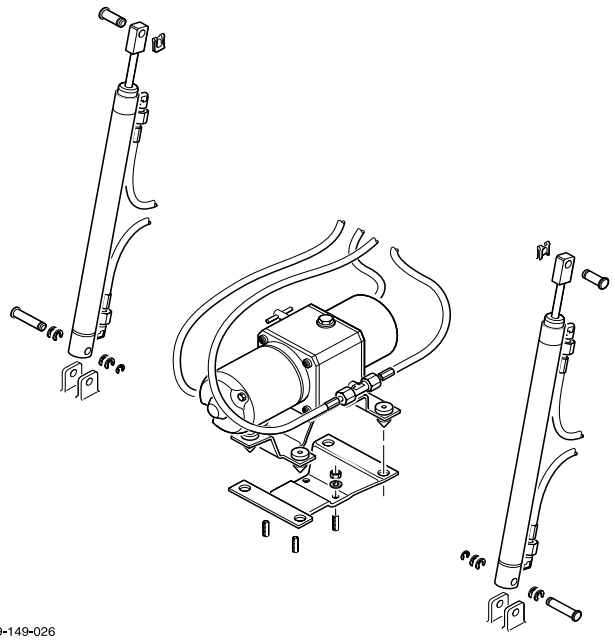
This procedure is completed in two stages:

a) Bleed the left hand ram by disconnecting it from the pump.

b) Bleed the right hand ram and pump by disconnecting both from the left hand ram.

Bleed the left hand ram:

1. Remove the roof hydraulic system.
2. Disconnect the left cylinder union nuts at the pump.



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3. Submerge the two tubes in hydraulic fluid.
4. Fully extend the left hand ram to draw in clean hydraulic fluid.
5. Invert the cylinder, pause for any air in the cylinder to rise to the top and then fully retract the ram to expel any remaining air.
6. Reconnect the tubes to the pump and tighten the union nuts.
7. Remove the reservoir filler plug and fill to the maximum level indicated on the fluid reservoir. Refit the filler plug.

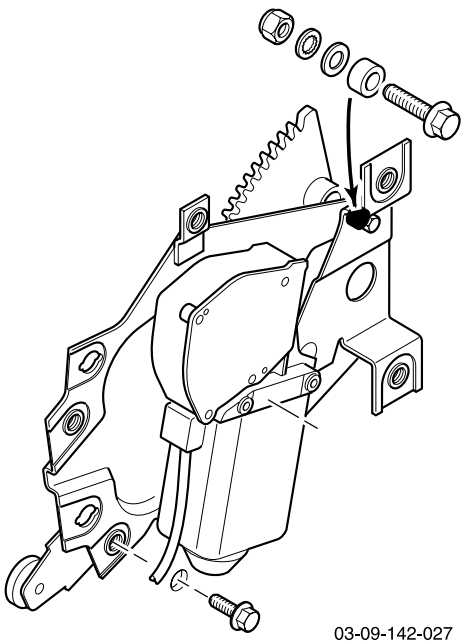
Bleed the right hand ram and pump:

8. Release the left hand cylinder tubes at the cylinder and submerge the tubes in hydraulic fluid.
9. Turn the motor control valve to the Electric position.
10. Fully extend the right hand ram to draw in clean fluid.
11. Invert the right hand cylinder and pause for any trapped air to rise to the top.
12. Fully retract the right hand ram to expel any trapped air.
13. Reconnect the two pipes to the left hand cylinder and tighten the union nuts.
14. Remove the filler plug and top up the reservoir with clean fluid to the maximum level indicated on the reservoir. Refit the filler plug.
15. Refit the roof hydraulic system.

9.1.01.1 - Rear Quarter Window Renewal

Procedure

1. Move the front seat forward to gain access.
2. Switch on the ignition, release the roof locking latches and lower the roof to approximately the midway position. Switch off the ignition.
3. Remove the rear seat squab and cushion. Remove the rear quarter trim panel.
4. Remove the roof cylinder support bracket securing bolts.
5. Support the roof, remove the cylinder to roof securing bolt. Remove the cylinder bracket.
6. Disconnect the cylinder from the pivot and carefully lower the roof.
7. Remove the window motor cover. Disconnect the window motor feed wires.



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8. Release and remove the window motor finisher, feeding the wires through the grommet.
9. Remove the window motor mounting bracket securing bolts.
10. Remove the motor assembly, disengaging it from the glass.
11. Remove the window carrier securing nuts and special washers
12. Remove the window adjusters, displace and remove the window carrier.

Reassembly

Reassembly is the reverse of the removal procedure.

On reconnection of the motor, check the window height as follows:

1. Switch on the ignition and raise the rear quarter windows.
2. Check that the top of the glass is exactly level with the top edge of the fully raised door window.
3. Check for a complete vertical seal between the rear quarter window and the door window.
4. If the rear window alignment is not correct, adjust it using the procedure in the Wind Noise and Sealing section.
5. Switch off the ignition and complete the reassembly.
6. Switch on the ignition, raise the roof and recheck for complete sealing at the rear window top edge.

9.1.01.2 - Rear Quarter Glass Adjustment

The rear quarter glass can be adjusted in three planes, Lateral, Up and Down, and Front to Rear. During initial assembly, assuming that the door is correctly gapped and profiled, the door glass is set to the upper 'A' post seal and the front frame seal. The rear quarter glass is then set to the door glass.

Both glass tops should be accurately aligned and there should be a minimum 2mm gap between the glasses. Any minor adjustments are then made using the following procedures.

Lateral Adjustment

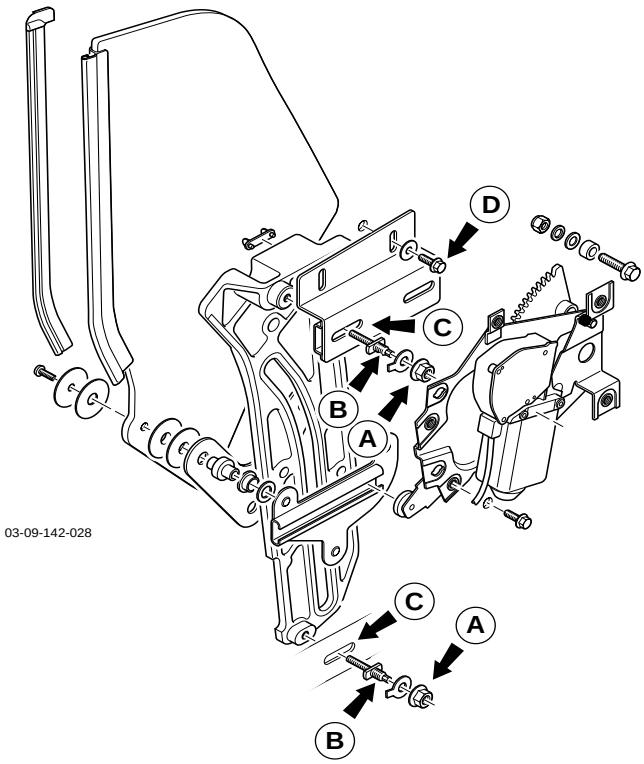
Remove the rear quarter trim panel. Remove the adjuster stud locknuts and special washers (Fig 7-A). Using a 5mm box spanner, rotate the adjuster screw clockwise to move the glass inboard or anti-clockwise to move the glass outboard (Fig 7-B). Refit the special washers, refit and tighten the locknuts. Refit the rear quarter trim panel.

Front to Rear Adjustment

Remove the rear quarter trim panel. Loosen the three adjuster stud locknuts. Adjust the glass front to rear as requiredin the horizontal slots (Fig 7-C). Re-tighten the locknuts. Check and readjust as required. Refit the rear quarter trim panel.

Up and Down Adjustment

Remove the rear quarter trim panel. Slacken off the lockbolt (Fig 7-D) two or three turns. Adjust the vertical position of the glass in the vertical slots as required. Re-tighten the lockbolt. Recheck the glass position and readjust as required. Refit the rear quarter trim panel.



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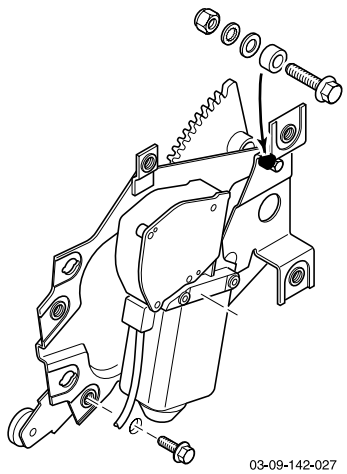
9.1.01.4 - Rear Quarter Window Lift Motor - Left Hand

Procedure

1. Move the front seat forward to gain access.
2. Switch on the ignition, release the roof locking latches and lower the roof. Switch off the ignition.
3. Remove the rear seat squab and cushion. Remove the rear quarter trim panel.
4. Disconnect the window motor feed wires.



5. Release and remove the window motor finisher, feeding the wires through the grommet.
6. Remove the window motor mounting bracket securing bolts.
7. Remove the motor assembly, disengaging it from the glass.
8. Remove the motor to carrier securing bolts and remove the motor.

Reassembly

Reassembly is the reverse of the removal procedure.

On reconnection of the motor, check the window height as follows:

1. Switch on the ignition and raise the rear quarter windows.
2. Check that the top of the glass is exactly level with the top edge of the fully raised door window.
3. Check for a complete vertical seal between the rear quarter window and the door window.
4. If the rear window alignment is not correct, adjust it using the procedure in the Wind Noise and Sealing section.
5. Switch off the ignition and complete the reassembly.
6. Switch on the ignition, raise and latch the roof, recheck for complete sealing at the rear window top edge.

9.1.01.5 - Rear Quarter Window Lift Motor - Right Hand

Procedure

1. Move the front seat forward to gain access.
2. Switch on the ignition, release the roof locking latches and lower the roof. Switch off the ignition.
3. Remove the rear seat squab and cushion. Remove the rear quarter trim panel.
4. Disconnect the window motor feed wires.
5. Release and remove the window motor finisher, feeding the wires through the grommet.
6. Remove the window motor mounting bracket securing bolts.
7. Remove the motor assembly, disengaging it from the glass.
8. Remove the motor to carrier securing bolts and remove the motor.

Reassembly

Reassembly is the reverse of the removal procedure.

On reconnection of the motor, check the window height as follows:

1. Switch on the ignition and raise the rear quarter windows.
2. Check that the top of the glass is exactly level with the top edge of the fully raised door window.
3. Check for a complete vertical seal between the rear quarter window and the door window.
4. If the rear window alignment is not correct, adjust it using the procedure in the Wind Noise and Sealing section.
5. Switch off the ignition and complete the reassembly.
6. Switch on the ignition, raise and latch the roof, recheck for complete sealing at the rear window top edge.

9.2.01.8 - Door Glass Adjustment

The door glass can be adjusted in three planes, Lateral, Up and Down, and Front to Rear. It is advisable however to avoid forward and rearward adjustment if possible, as this will affect the height and overall position of the glass relative to the seals. Use this adjustment only to correct serious misalignment.

Lateral Adjustment

Remove the door trim pad. Partially lower the window to allow access to the glass channel mounting bracket (Fig 6-A). Slacken off the four nuts to allow lateral adjustment. Move the glass to the desired position and tighten the nuts. Close the window and recheck the alignment. Repeat the adjustment until the optimum alignment is achieved. Refit the door trim pad.

Upward Adjustment

Remove the door trim pad. Slacken off the regulator locknut (Fig 6-B). With the door closed, operate the window to the fully closed position and tighten the locknut. Refit the door trim panel.

Front to Rear Adjustment

Remove the door trim pad. Partially lower the window to allow access to the glass channel mounting bracket (Fig 6C). Slacken the four screws to allow glass movement, Move the glass to the required position and tighten the screws. Close the window and recheck the alignment. Repeat the adjustment as necessary until the optimum front to rear alignment is achieved. Refit the door trim pad.

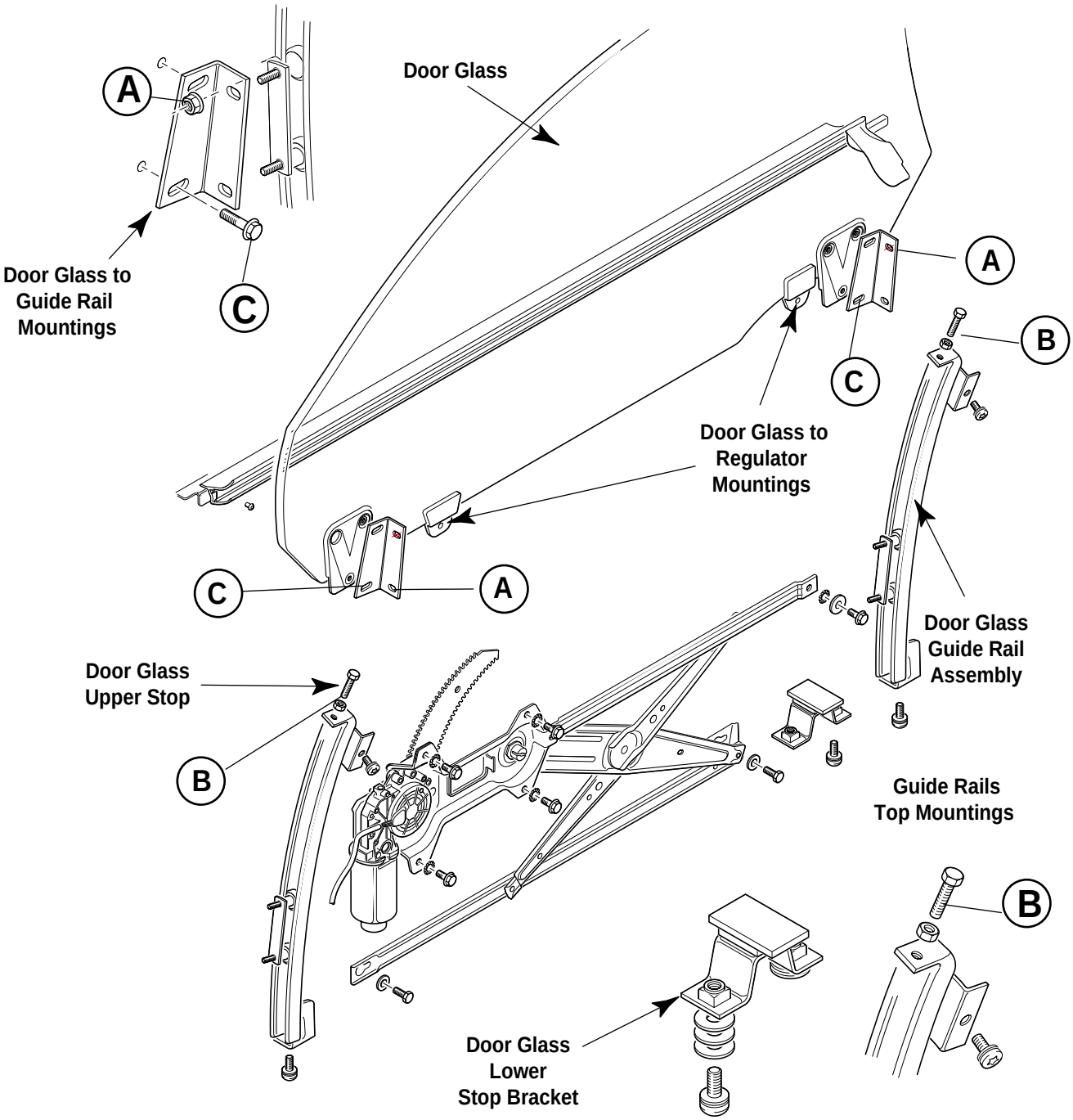


Figure 6. Door Glass Adjustments

Roof Sealing and Wind Noise

Roof seal channels and window glasses have been provided with a range of adjustments to prevent water ingress and excessive wind noise.

The following diagram details the final positions for seal channels and window glasses. These positions are the nominal settings used in production when assembling new vehicles. They may need some fine tuning if for example the vehicle is being re-commissioned after accident repair.

Using the data from the diagrams, set the seal channels and then the window glasses to the dimensions specified using the following sequence.

Glass and Seal Adjustment

Coupe

1. Remove the complete door seal and seal retainer. Close the door and raise the window glasses. Check and if necessary adjust the glass guides and stops (9.2.01.8). With the glass fully raised, set the specified clearances from the glass to the body at points A, B and C.

2. Refit the seal retainer and door seal. Raise the glasses and ensure accurate alignment and full engagement of each glass with its seals.

Glass and Seal Adjustment

Volante

1. Remove the seals from the "A' post and all seal mounting rails on the roof.

2. Check and if necessary adjust the seal channel to roof lip clearance to 9mm at the front and rear of each section of the seal channel.

3. With all seals removed from the seal channels, raise the window glasses fully and adjust the glasses (9.2.01.8) to set the specified clearances from the glass to the seal channel.

4. Lower the glasses and fit all seals. Raise the glasses and ensure accurate alignment and full engagement of each glass with its seals.

Wind Noise and Water Leak Testing

7. Road test the vehicle to detect any wind noise. Fine tune the glass adjustments if necessary to eliminate the noise.

8. Water test the vehicle to ensure that it is waterproof. DO NOT use a high pressure water spray.

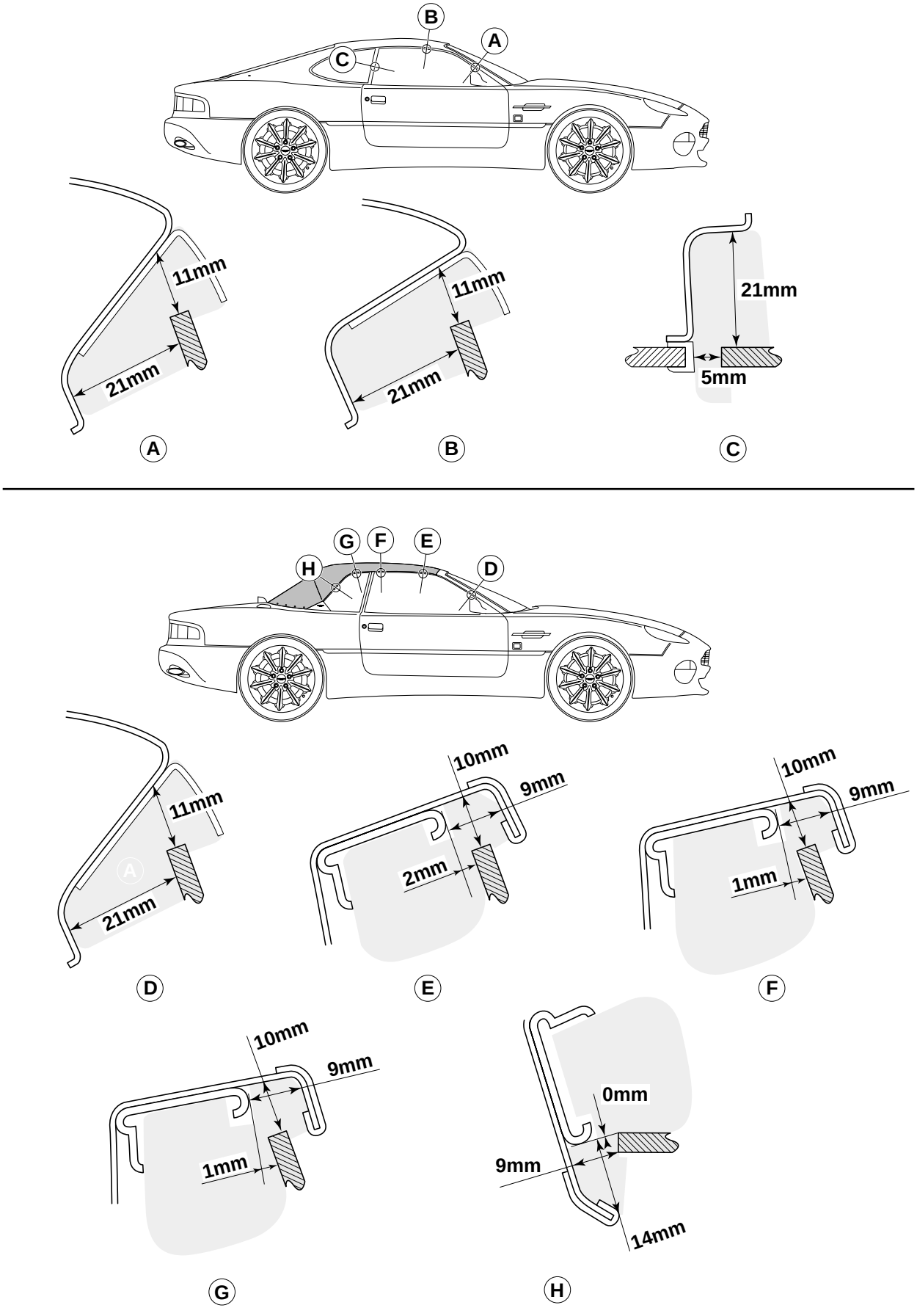


Figure 1. Window and Roof Seal Adjustment

Cleaning of Alcantara Trimmed Roof Lining and Interior Components

Recommendations

1. Clean the stain immediately.
2. Clean the stain working from the edge to the centre of the spot to prevent a ring forming.
3. Delicately remove most of the dirt with a blunt scraper and immediately blot the spot with a clean white cloth.
4. Once you've identified the type of stain, follow the instructions in the spot removal chart.
5. Never pour a solvent directly on the spot; instead pour the solvent on a clean cloth.
6. After you've applied the spot remover, remove it with a dry clean cloth. Afterwards, brush the area against the material nap.
7. Let the spot dry. Do not sit on a humid part. Afterwards, vacuum the spot with a vacuum cleaner.

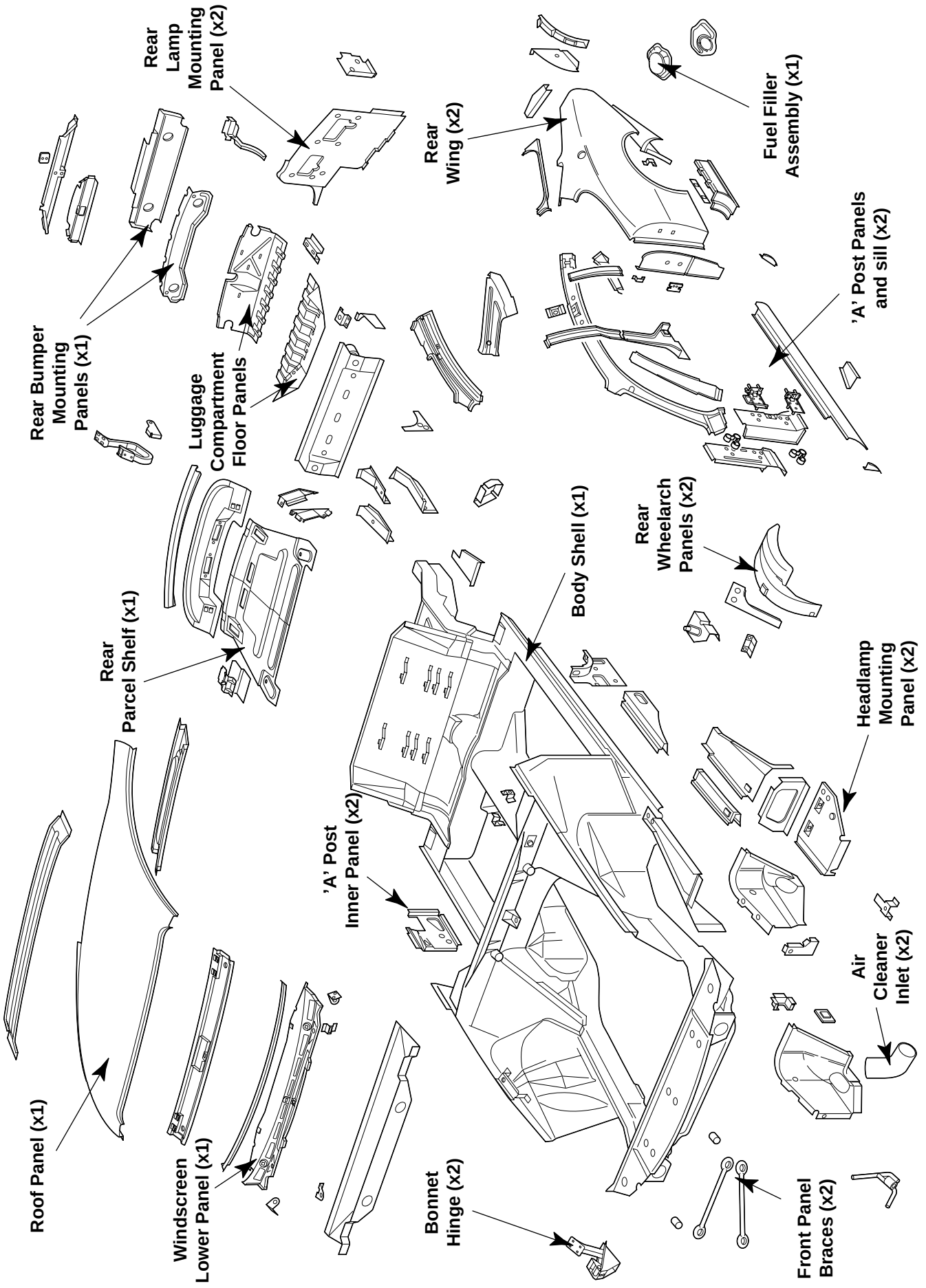
Spot Removal Chart

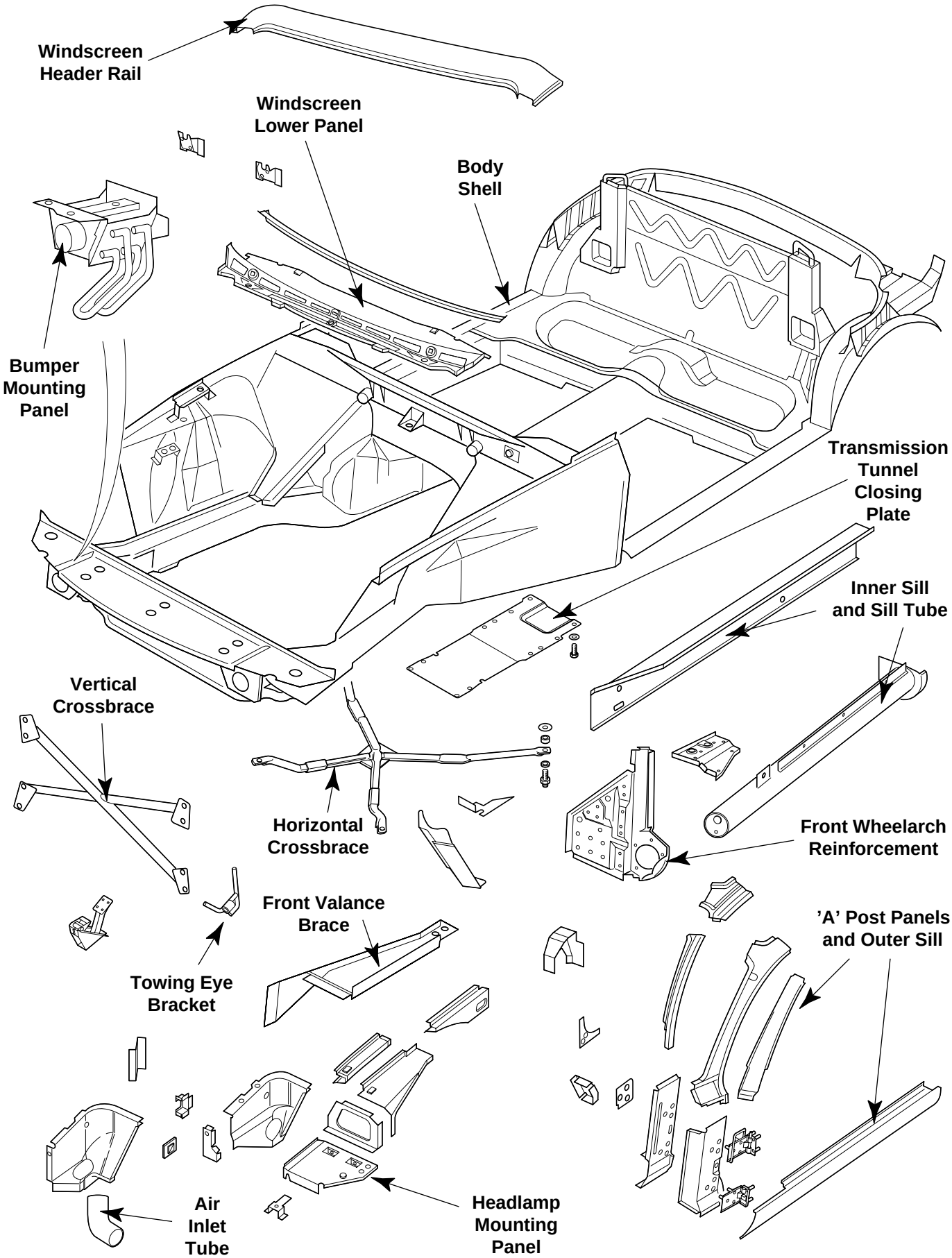
Type of Stain	Cleaning Product and Cleaning Method
Alcohol-Liquors	Wash with mild soap, then blot with denatured alcohol
Beer	Blot with lukewarm water (max 50°C) and denatured alcohol at 3%
Coffee, Tea, Milk	Wash with mild soap. If the stain persists, blot with denatured alcohol or ammonia diluted at 10%.
Chocolate, Confectionary	Blot with lukewarm water (max 50°C) or with ammonia diluted at 5%.
Paints	Oil Paint - Blot with ethyl alcohol then wash with mild soap. Water Based Paint - If the stain is fresh, blot with cold water. An old stain is very difficult to remove, consult a specialist.
Cosmetics	Apply ethyl alcohol or perchloroethylene, then wash with mild soap. If the stain persists, use ammonia diluted at 5% or denatured alcohol.
Grass, Plants	Blot with lukewarm water (max 50°C) then wash with mild soap.
Chewing Gum	Blot with acetone.
Ink	Remove as much as possible with a paper towel. Blot with a solution of 30% denatured alcohol and 70% water, then wash with mild soap. Lemon juice also gives good results.
Marmalade, Syrup, Fruit Juice	Blot with lukewarm water (max 50°C). If the stain persists, use ethyl alcohol or perchloroethylene
Oil, Grease	Blot with denatured alcohol, then wash with mild soap.
Ballpoint Pen	Blot with perchloroethylene and denatured alcohol.
Wine Beverages	Blot with water and vinegar (50%), then wash with mild soap.

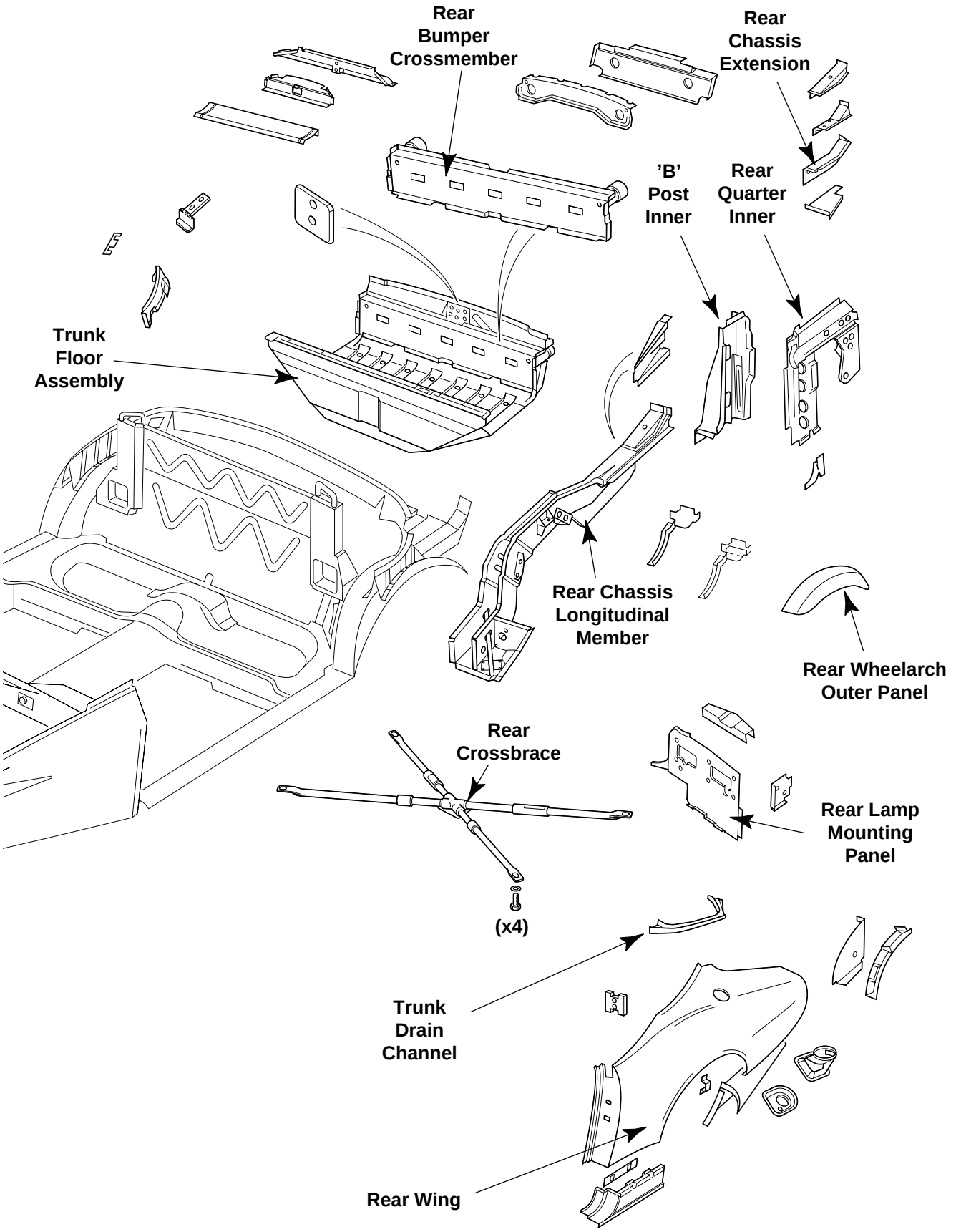
Body Panel and Trim Removal

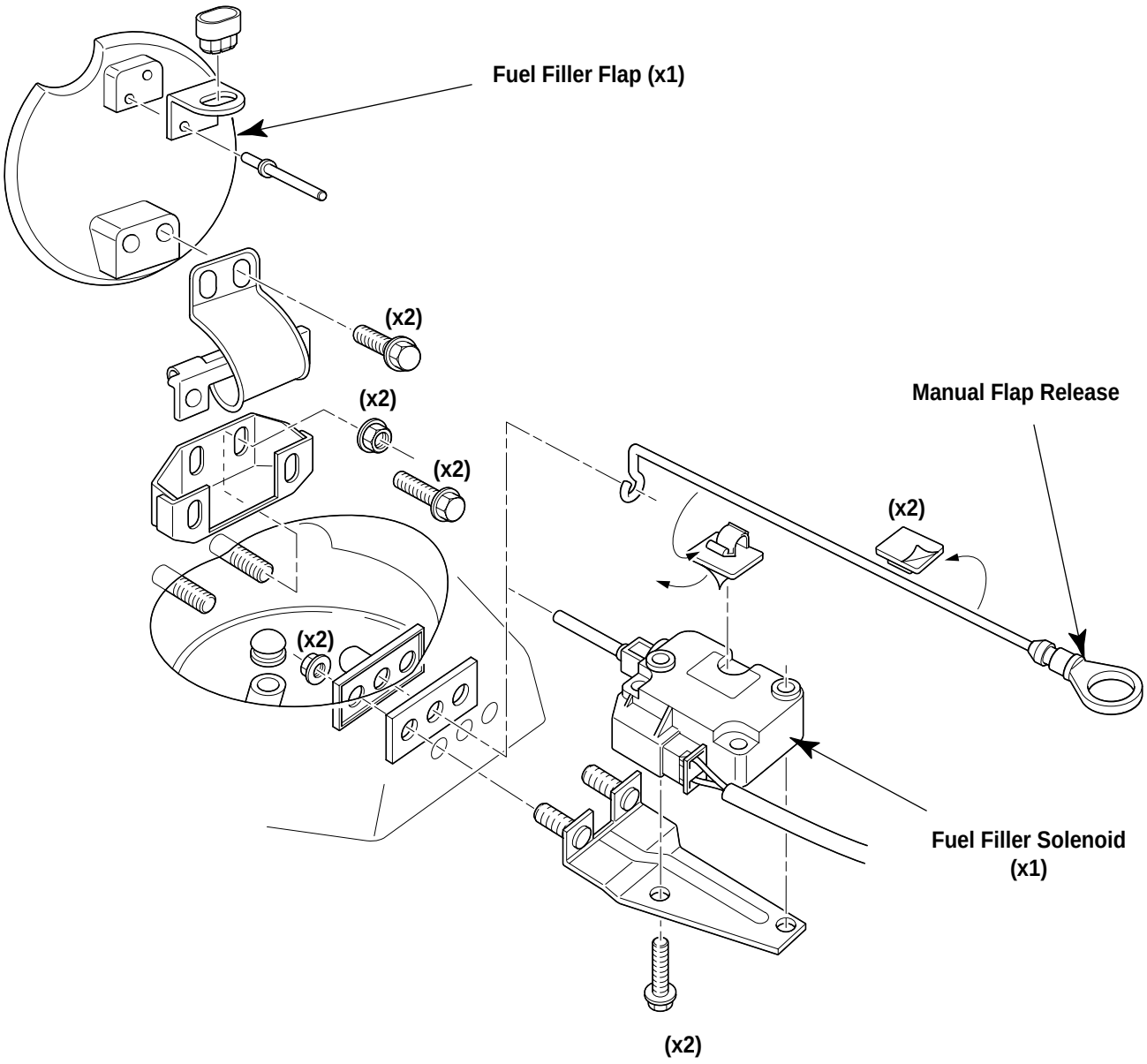
The following illustrations show the fixings for removeable body and trim panels.

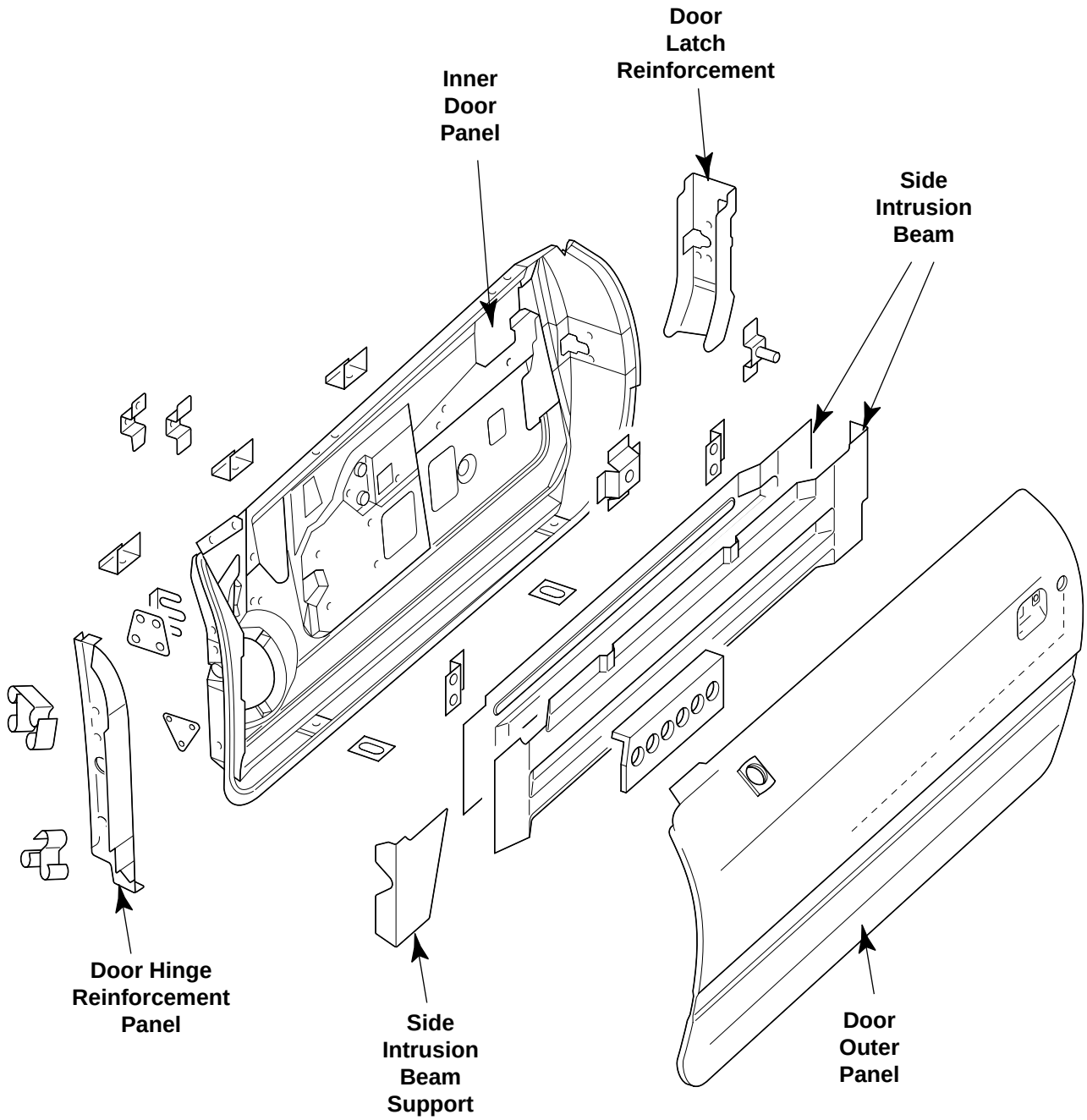
Sheet 1	Coupe Body Panels
Sheet 2	Volante Body - Front End
Sheet 3	Volante Body - Rear End
Sheet 4	Filler Flap
Sheet 5	Door Panels
Sheet 6	Door Lock and Latch
Sheet 7	Bonnet
Sheet 8	Front Wings
Sheet 9	Boot Lid
Sheet 10	Body Fittings
Sheet 11	Front Bumper
Sheet 12	Rear Bumper - European
Sheet 13	Rear Bumper - Federal
Sheet 14	Glass
Sheet 15	Door Glass
Sheet 16	Volante Rear Quarter Glass
Sheet 17	Facia and Trim
Sheet 18	Coupe Centre Console
Sheet 19	Volante Centre Console
Sheet 20	Door Casings and Fittings
Sheet 21	Volante Seals
Sheet 22.	Coupe Door Seals
Sheet 23	Upper Trim and Roof
Sheet 24	Volante Upper Trim and Roof
Sheet 25	Volante Roof Lift Pump and Header Trim
Sheet 26	Front Seats and Belts
Sheet 27	Rear Sheets and Belts

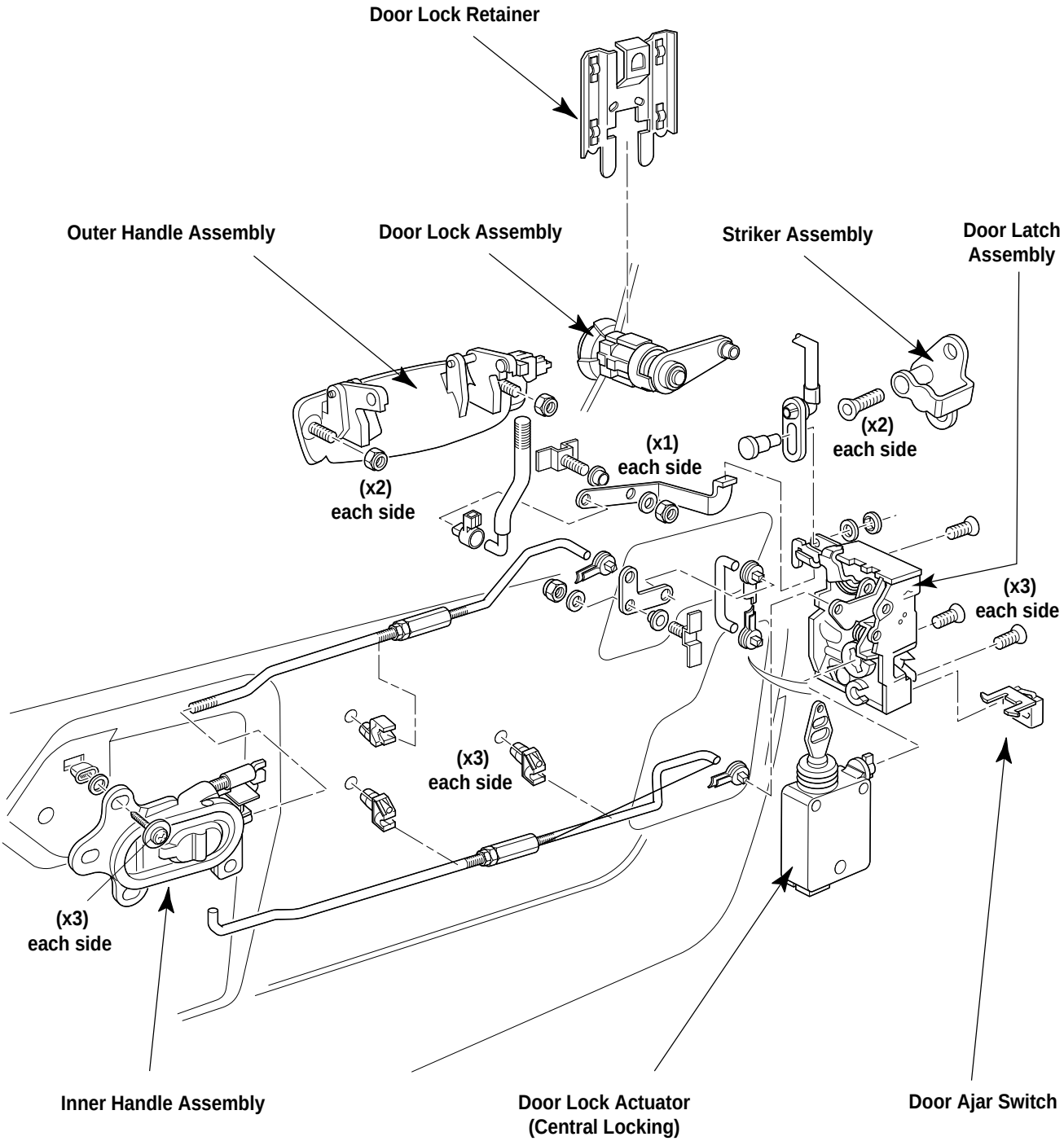

Rear Lamp Mounting Panel (x2)
Rear Wing (x2)
Fuel Filler Assembly (x1)
Rear Bumper Mounting Panels (x1)
Luggage Compartment Floor Panels
'A' Post Panels and sill (x2)
Rear Parcel Shelf (x1)
Body Shell (x1)
Rear Wheelarch Panels (x2)
Headlamp Mounting Panel (x2)
'A' Post Inner Panel (x2)
Air Cleaner Inlet (x2)
Roof Panel (x1)
Windscreen Lower Panel (x1)
Bonnet Hinge (x2)
Front Panel Braces (x2)

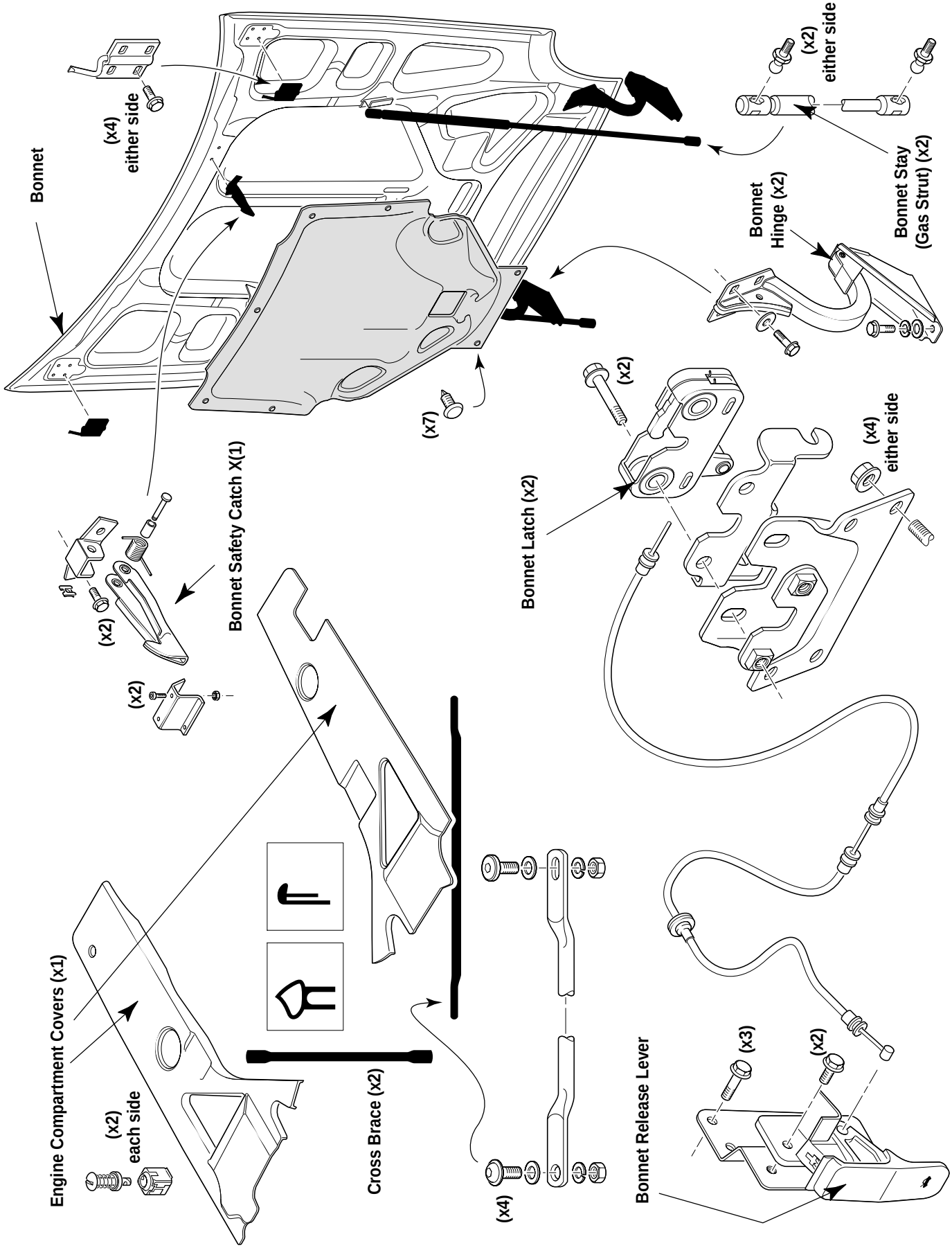

Windscreen Header Rail
Windscreen Lower Panel
Body Shell
Bumper Mounting Panel
Transmission Tunnel Closing Plate
Inner Sill and Sill Tube
Vertical Crossbrace
Horizontal Crossbrace
Front Wheelarch Reinforcement
Front Valance Brace
'A' Post Panels and Outer Sill
Towing Eye Bracket
Air Inlet Tube
Headlamp Mounting Panel

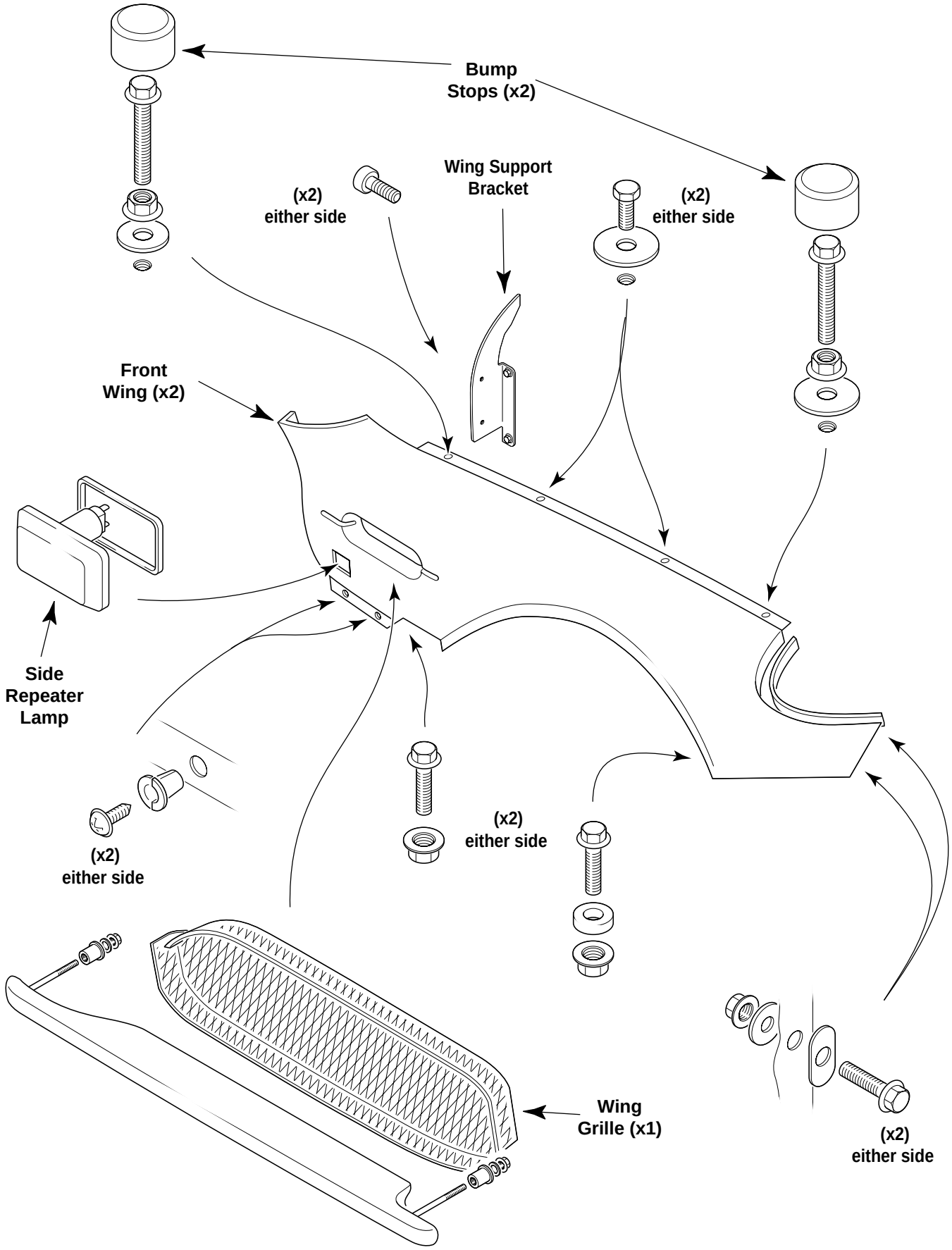

Rear
Bumper
Crossmember
Rear
Chassis
Extension
'B'
Post
Inner
Rear
Quarter
Inner
Trunk
Floor
Assembly
Rear Chassis
Longitudinal
Member
Rear Wheelarch
Outer Panel
Rear
Crossbrace
Rear Lamp
Mounting
Panel
(x4)
Trunk
Drain
Channel
Rear Wing

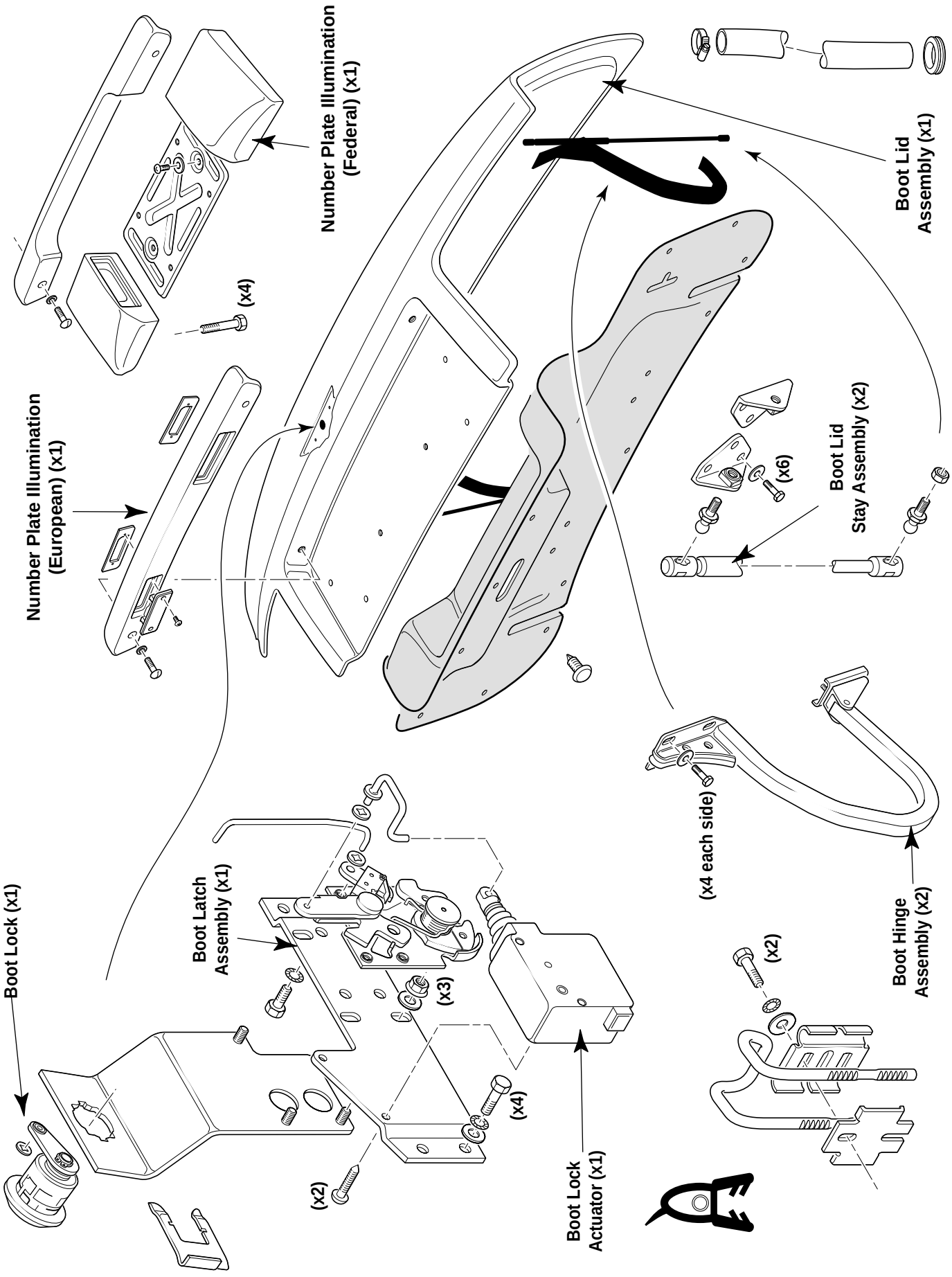

Fuel Filler Flap (x1)
(x2)
(x2)
(x2)
(x2)
Manual Flap Release
(x2)
Fuel Filler Solenoid
(x1)
(x2)

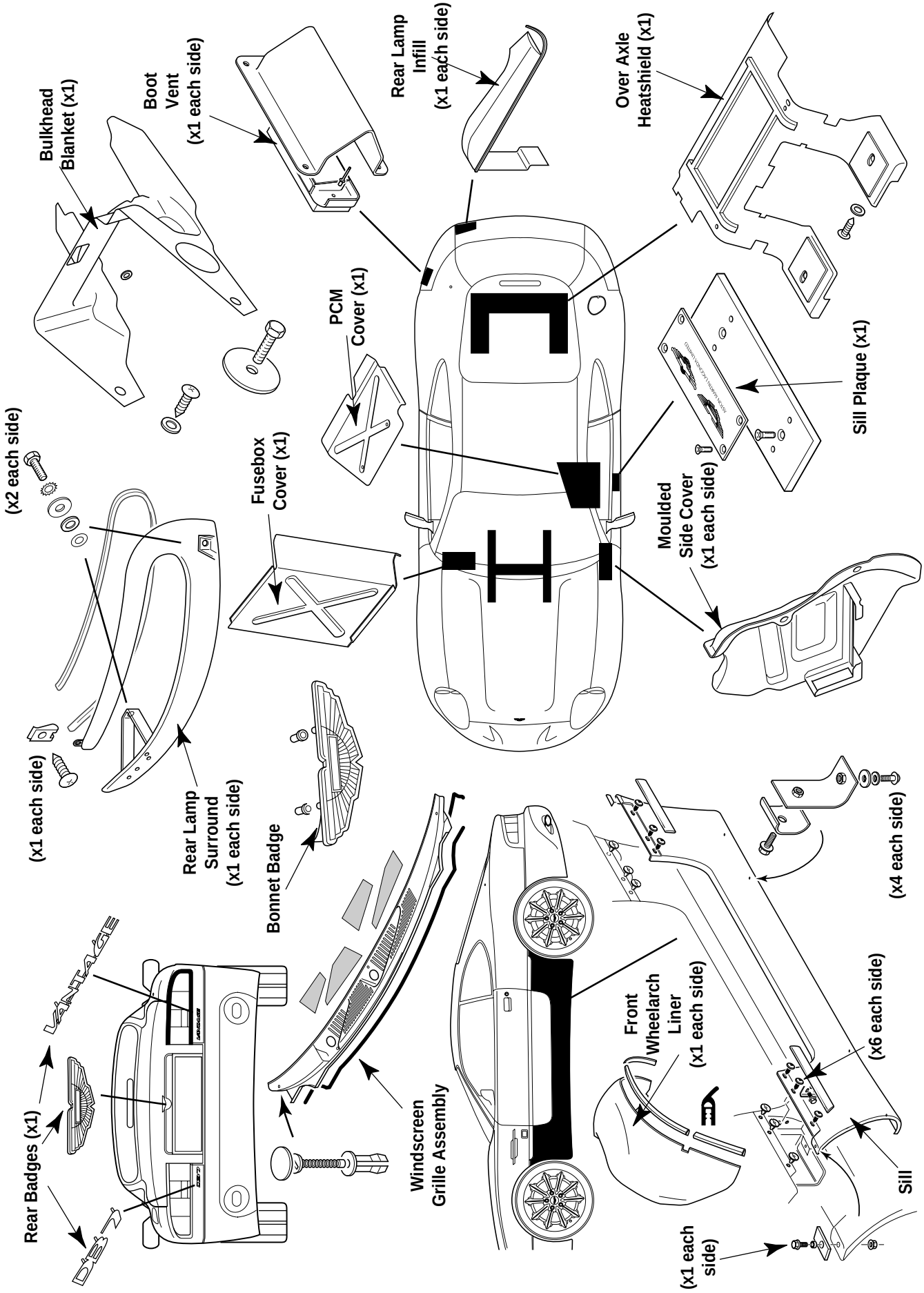

Door
Latch
Reinforcement
Inner
Door
Panel
Side
Intrusion
Beam
Door Hinge
Reinforcement
Panel
Side
Intrusion
Beam
Support
Door
Outer
Panel

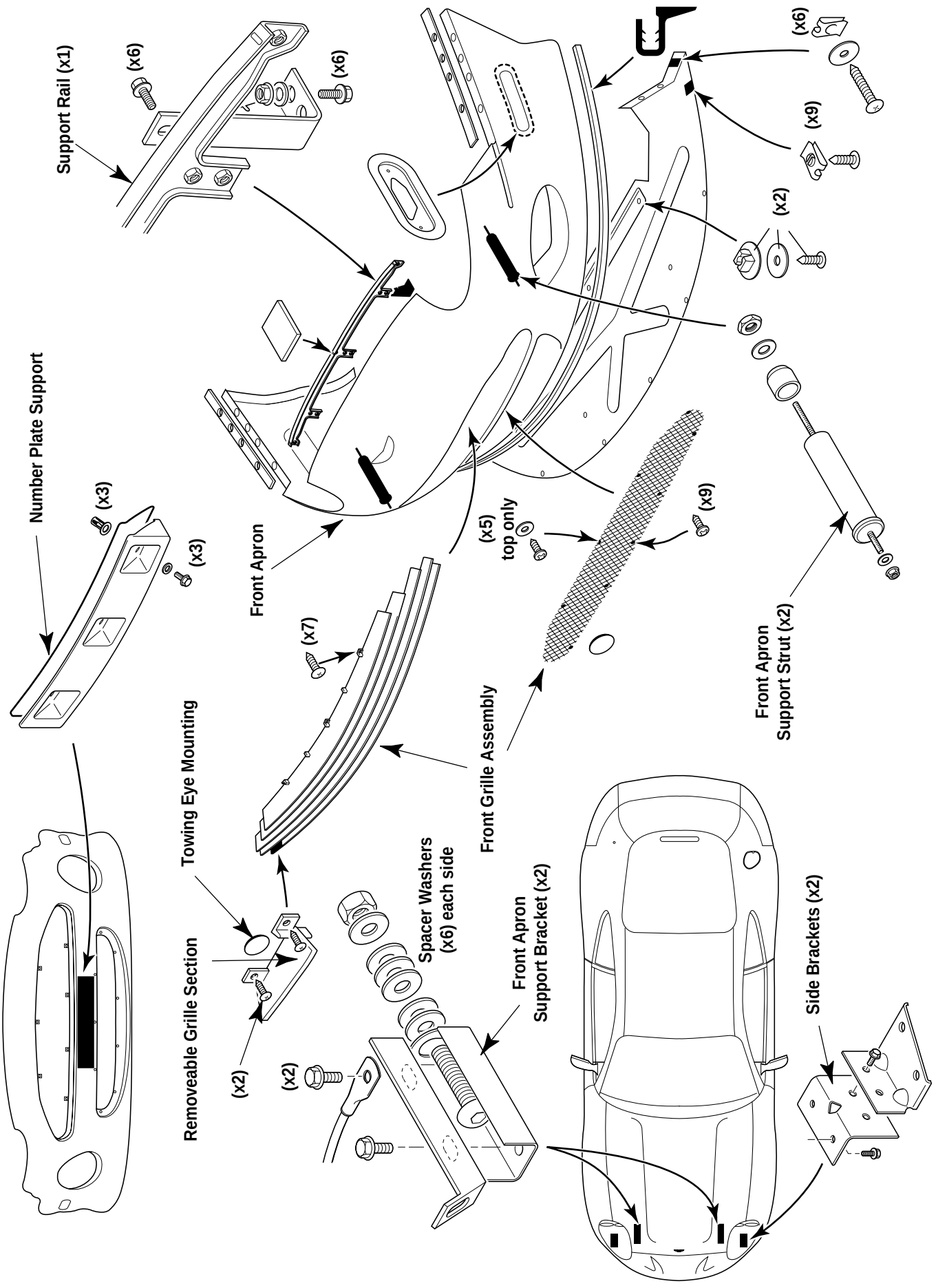

Door Lock Retainer
Outer Handle Assembly
Door Lock Assembly
Striker Assembly
Door Latch Assembly
(x2) each side
(x1) each side
(x2) each side
(x3) each side
(x3) each side
(x3) each side
Inner Handle Assembly
Door Lock Actuator (Central Locking)
Door Ajar Switch

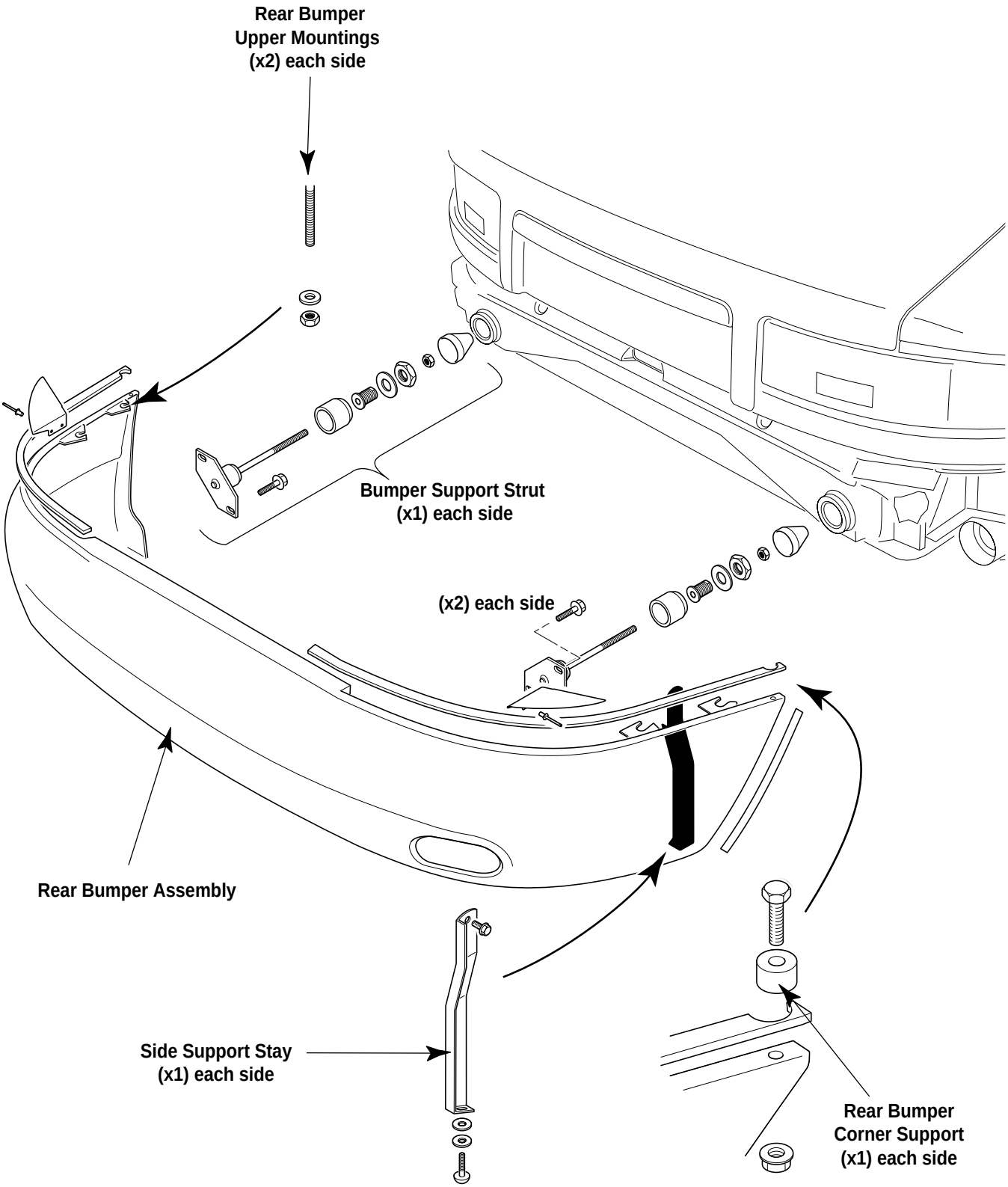

Bonnet
(x4) either side
(x2) either side
Bonnet Stay (Gas Strut) (x2)
Bonnet Hinge (x2)
(x7)
(x2)
(x4) either side
Bonnet Latch (x2)
Bonnet Safety Catch X(1)
(x2)
(x2)
Engine Compartment Covers (x1)
(x2) each side
Cross Brace (x2)
(x4)
Bonnet Release Lever
(x3)
(x2)

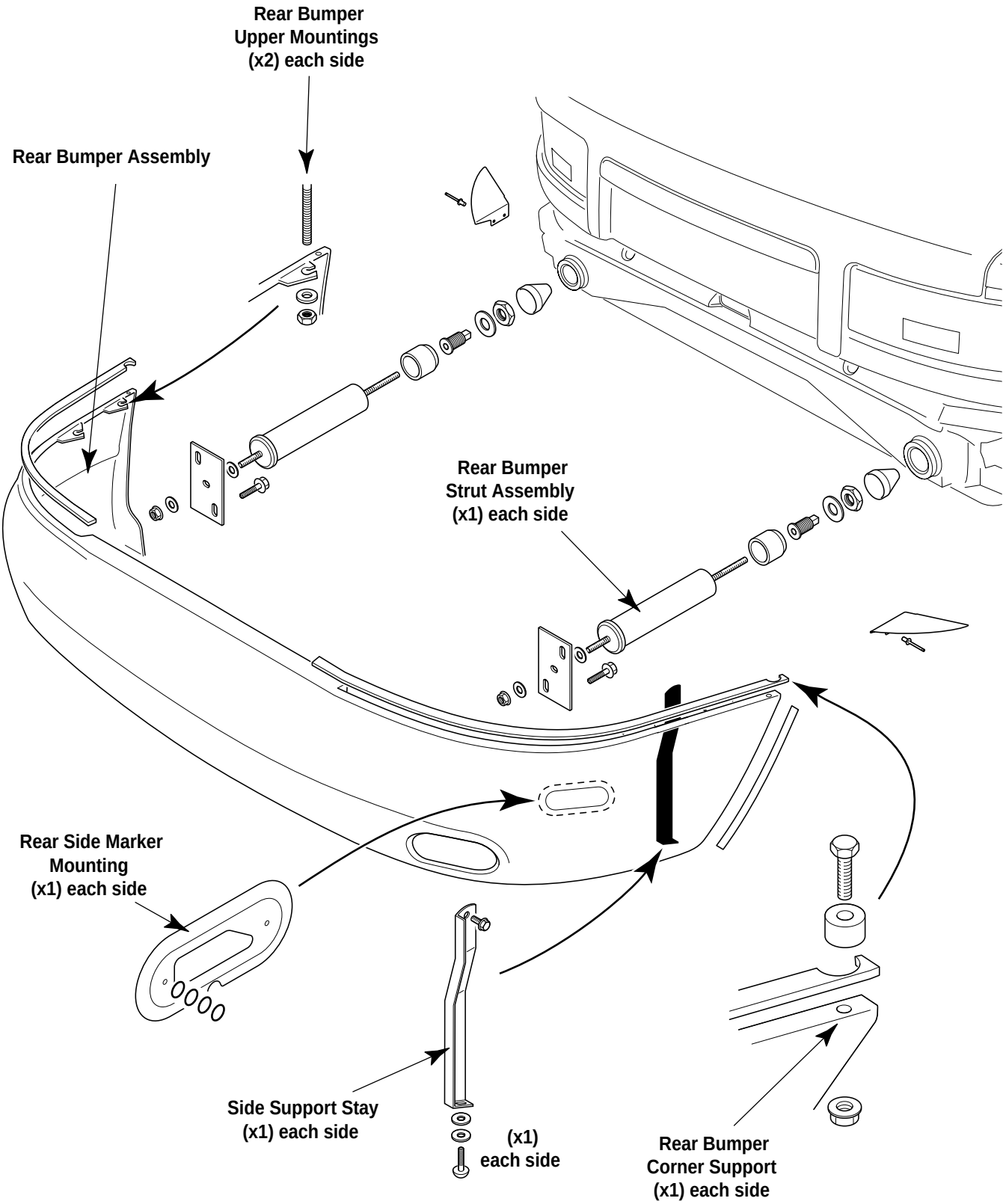

Bump
Stops (x2)
(x2)
either side
Wing Support
Bracket
(x2)
either side
Front
Wing (x2)
Side
Repeater
Lamp
(x2)
either side
(x2)
either side
(x2)
either side
Wing
Grille (x1)

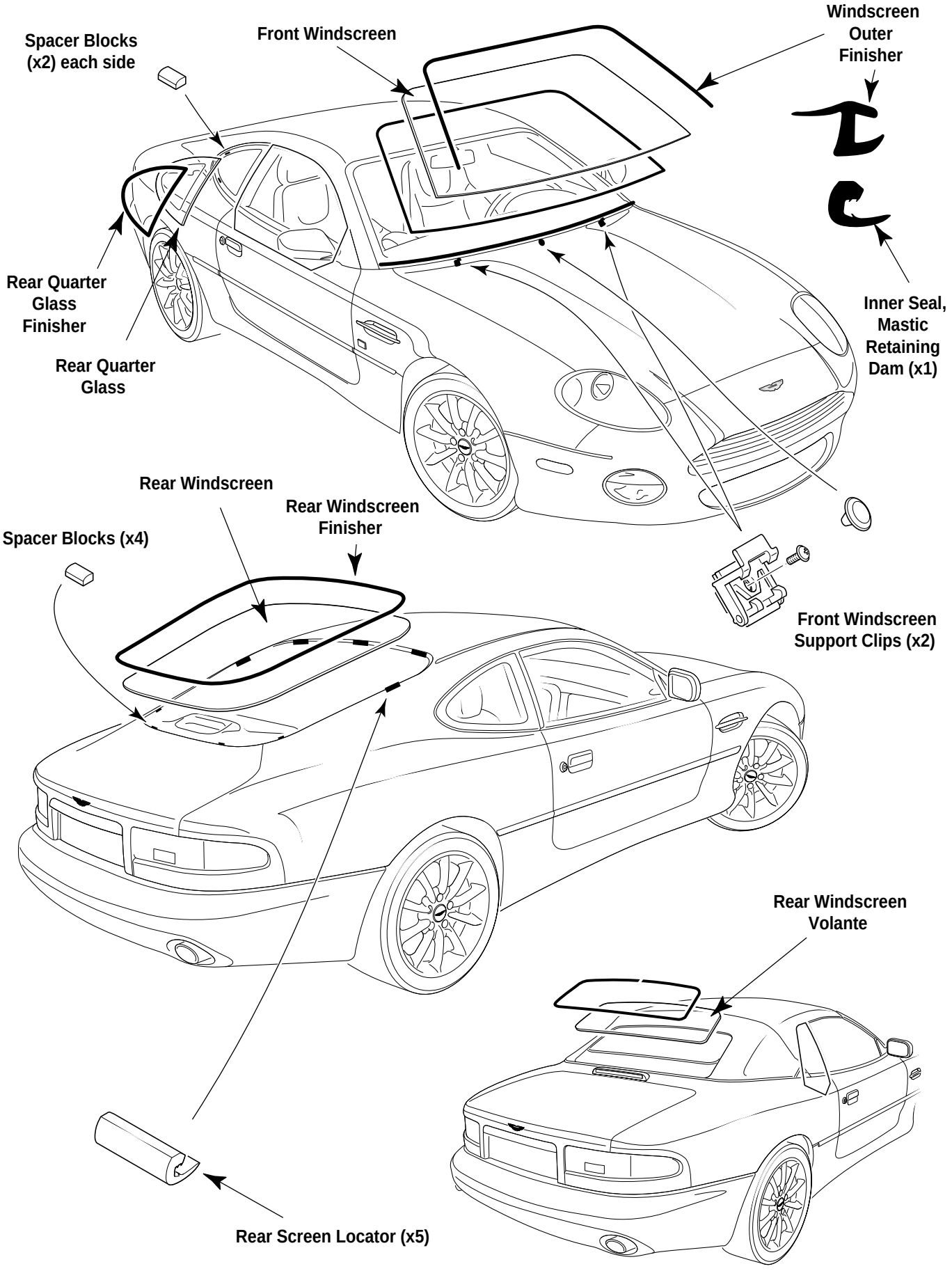

Number Plate Illumination (Federal) (x1)
(x4)
Number Plate Illumination (European) (x1)
Boot Lid Assembly (x1)
(x6)
Boot Lid Stay Assembly (x2)
(x4 each side)
Boot Hinge Assembly (x2)
(x2)
Boot Lock (x1)
Boot Latch Assembly (x1)
(x3)
(x4)
(x2)
Boot Lock Actuator (x1)

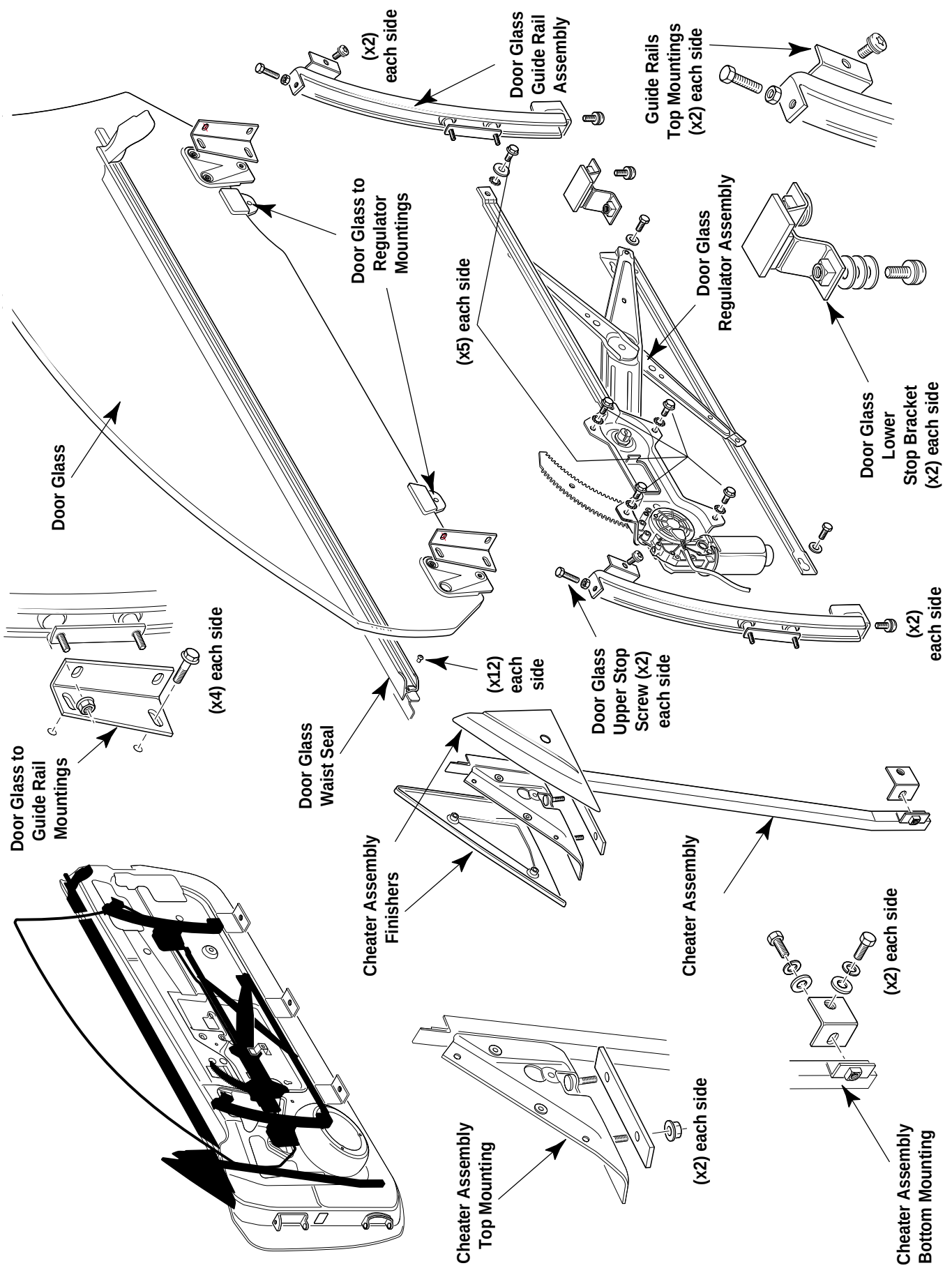

Bulkhead Blanket (x1)
Boot Vent (x1 each side)
Rear Lamp Infill (x1 each side)
Over Axle Heatshield (x1)
PCM Cover (x1)
Sill Plaque (x1)
(x2 each side)
Fusebox Cover (x1)
Moulded Side Cover (x1 each side)
(x1 each side)
Rear Lamp Surround (x1 each side)
Bonnet Badge
(x4 each side)
Front Wheelarch Liner (x1 each side)
(x6 each side)
Rear Badges (x1)
Windscreen Grille Assembly
Sill
(x1 each side)

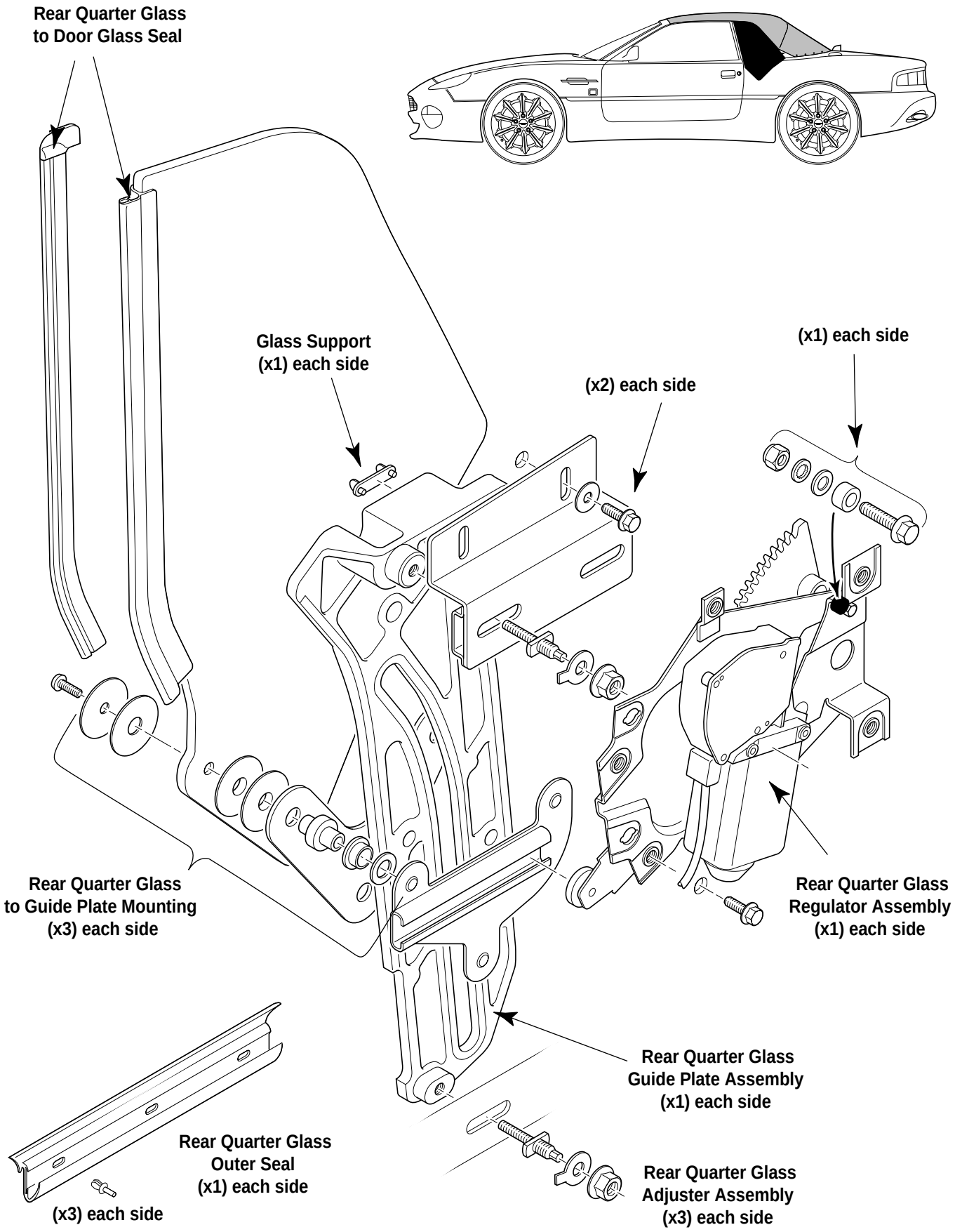

Support Rail (x1)
(x6)
(x6)
(x6)
(x9)
(x2)
Number Plate Support
(x3)
(x3)
Front Apron
(x5)
top only
(x9)
Front Apron
Support Strut (x2)
(x7)
Front Grille Assembly
Towing Eye Mounting
Removeable Grille Section
(x2)
(x2)
Spacer Washers
(x6) each side
Front Apron
Support Bracket (x2)
Side Brackets (x2)

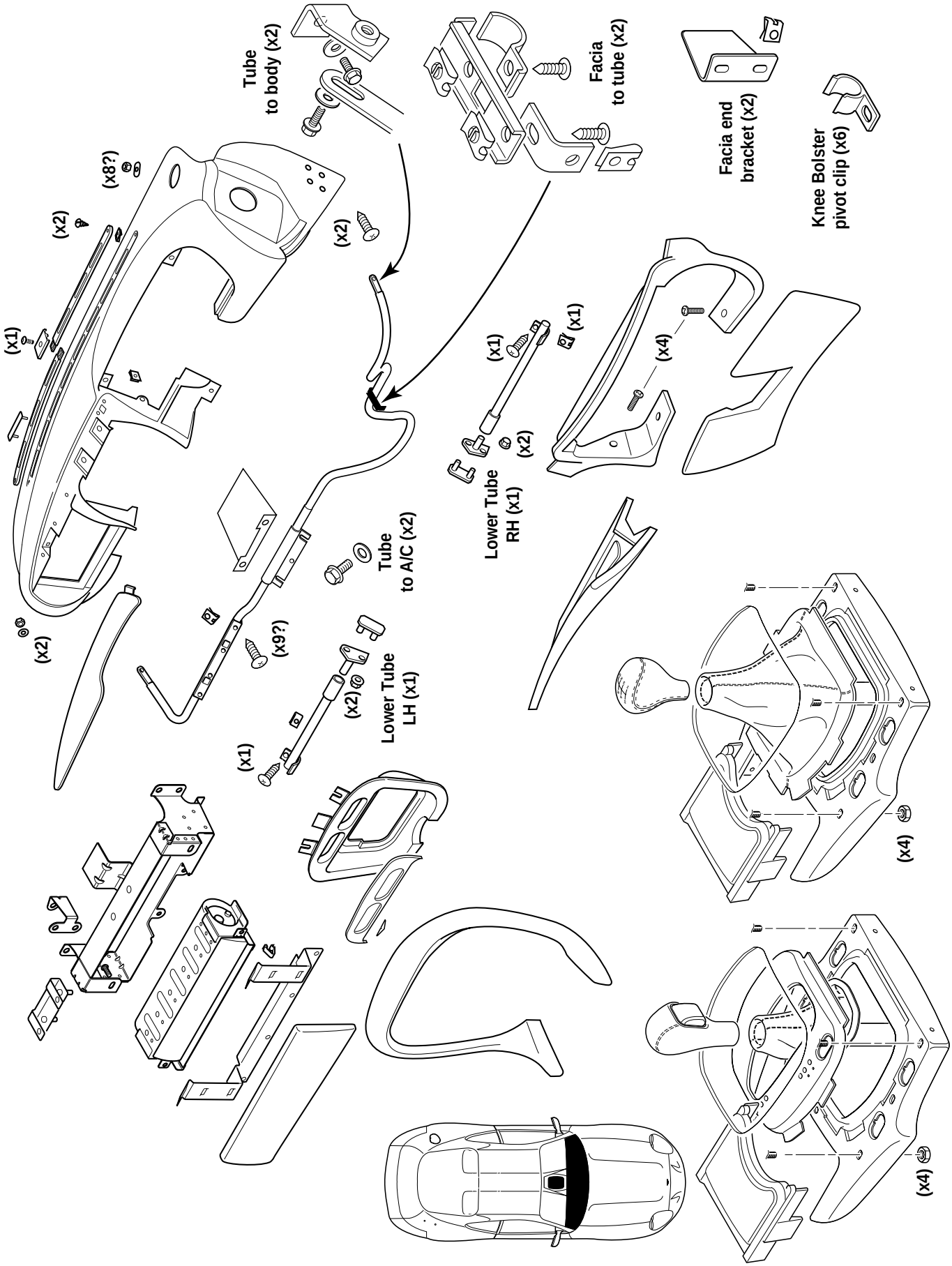

Rear Bumper
Upper Mountings
(x2) each side
Bumper Support Strut
(x1) each side
(x2) each side
Rear Bumper Assembly
Side Support Stay
(x1) each side
Rear Bumper
Corner Support
(x1) each side

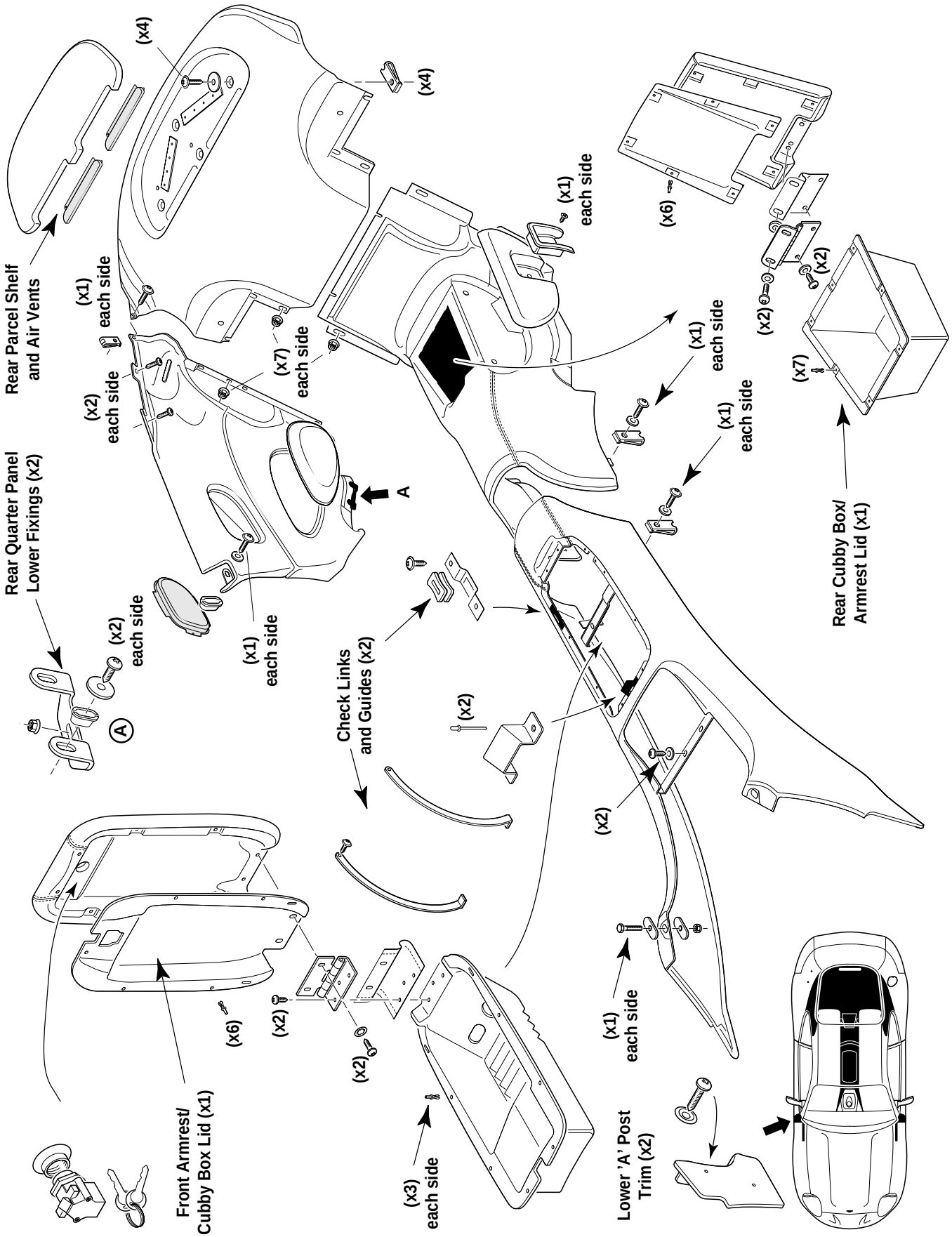

Rear Bumper
Upper Mountings
(x2) each side
Rear Bumper Assembly
Rear Bumper
Strut Assembly
(x1) each side
Rear Side Marker
Mounting
(x1) each side
Side Support Stay
(x1) each side
(x1)
each side
Rear Bumper
Corner Support
(x1) each side

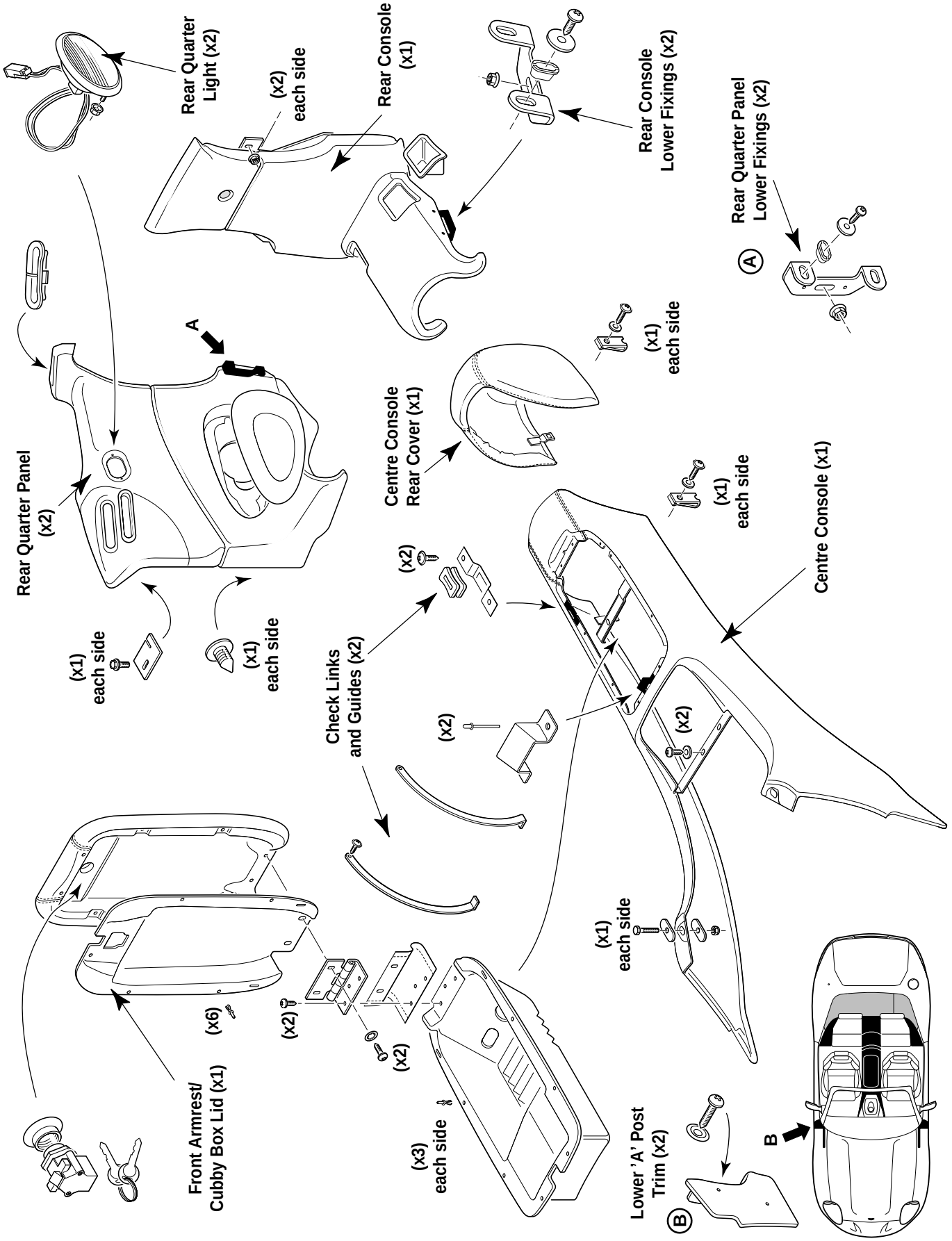

Spacer Blocks (x2) each side
Front Windscreen
Windscreen Outer Finisher
Rear Quarter Glass Finisher
Rear Quarter Glass
Inner Seal, Mastic Retaining Dam (x1)
Rear Windscreen
Rear Windscreen Finisher
Spacer Blocks (x4)
Front Windscreen Support Clips (x2)
Rear Windscreen Volante
Rear Screen Locator (x5)

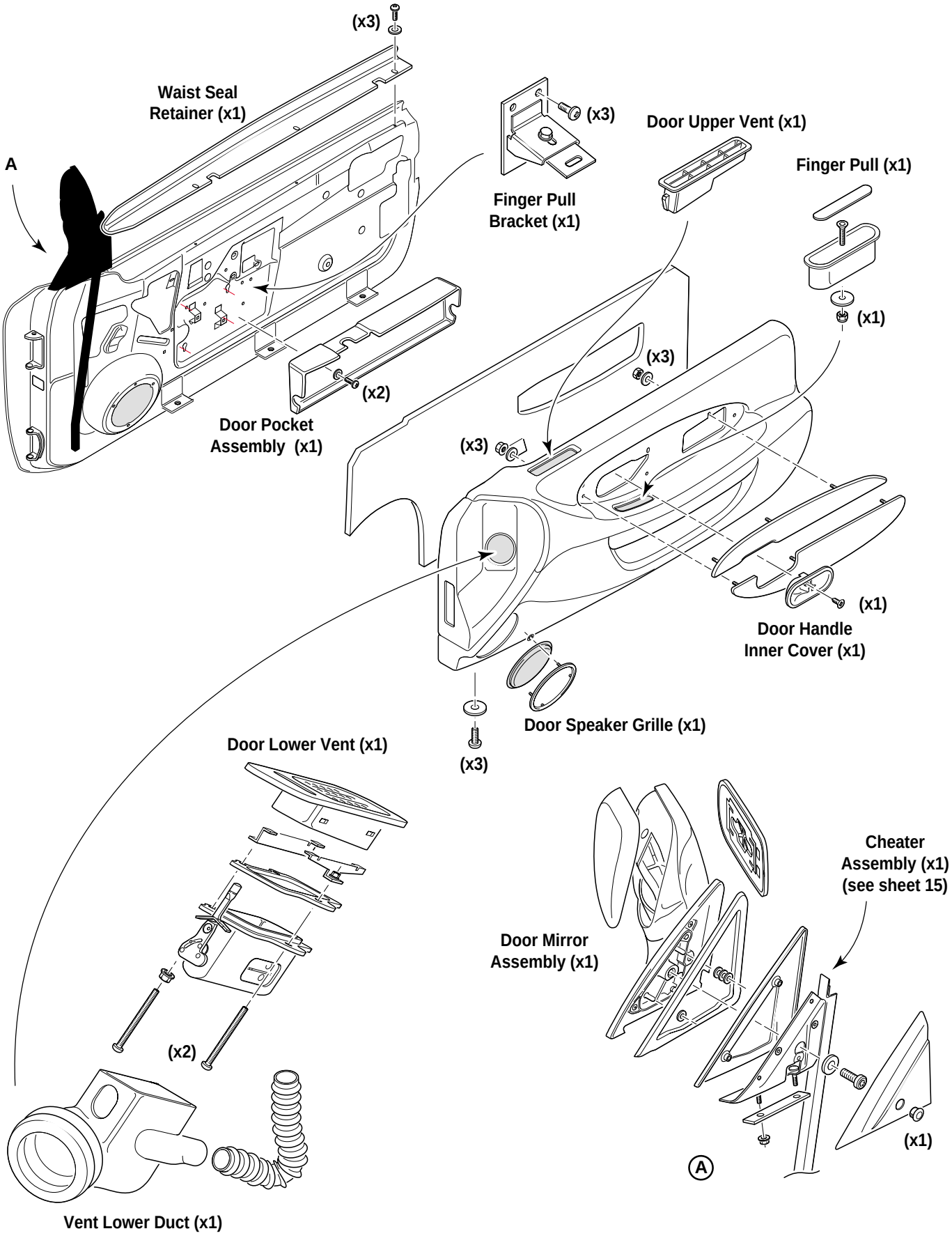

(x2) each side
Door Glass Guide Rail Assembly
Guide Rails Top Mountings (x2) each side
Door Glass to Regulator Mountings
(x5) each side
Door Glass Regulator Assembly
Door Glass
Door Glass Lower Stop Bracket (x2) each side
(x4) each side
(x12) each side
Door Glass Upper Stop Screw (x2) each side
(x2) each side
Door Glass to Guide Rail Mountings
Door Glass Waist Seal
Cheater Assembly Finishers
Cheater Assembly
(x2) each side
(x2) each side
Cheater Assembly Top Mounting
Cheater Assembly Bottom Mounting

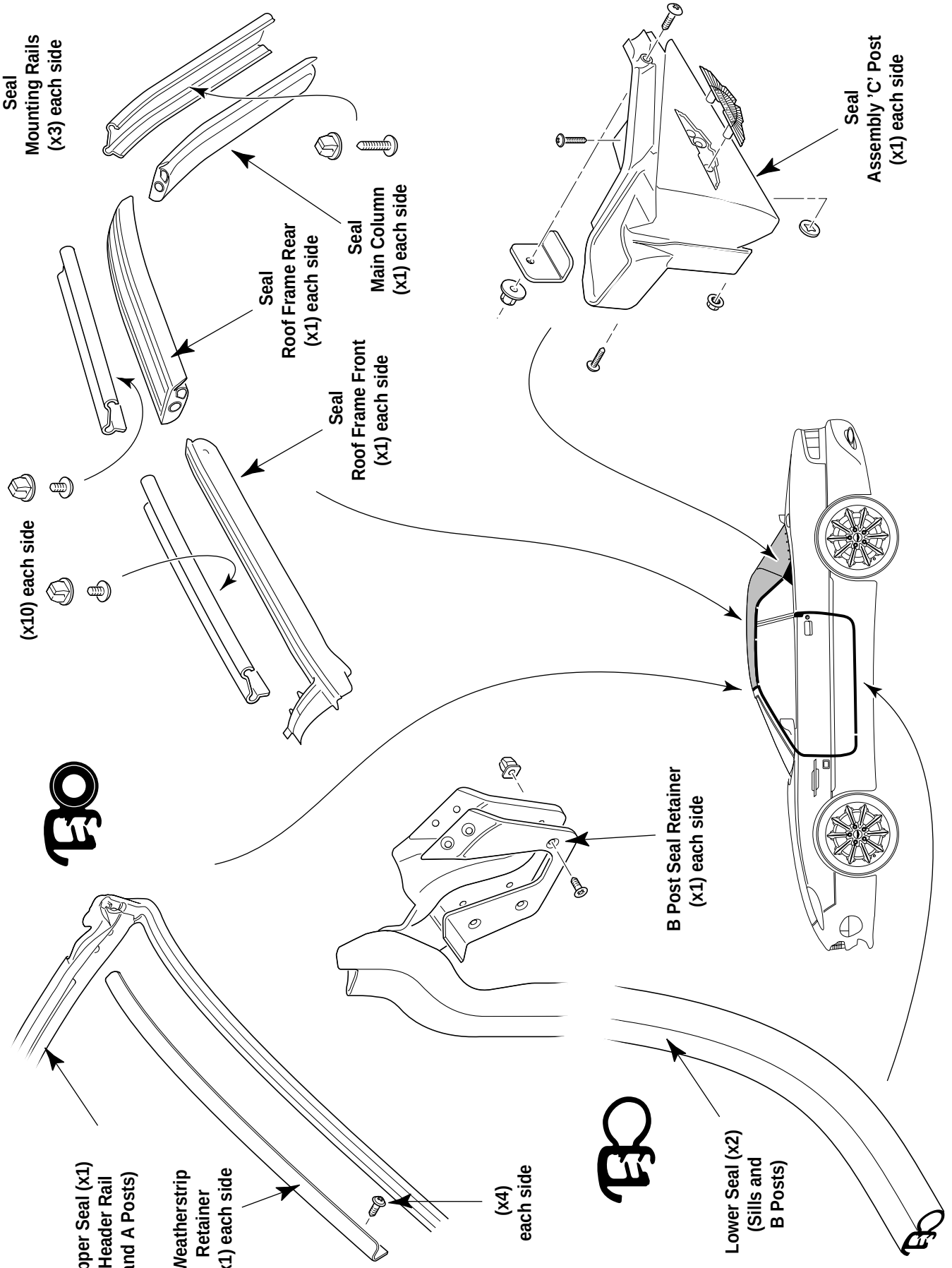

Rear Quarter Glass
to Door Glass Seal
Glass Support
(x1) each side
(x2) each side
(x1) each side
Rear Quarter Glass
to Guide Plate Mounting
(x3) each side
Rear Quarter Glass
Regulator Assembly
(x1) each side
Rear Quarter Glass
Guide Plate Assembly
(x1) each side
Rear Quarter Glass
Outer Seal
(x1) each side
(x3) each side
Rear Quarter Glass
Adjuster Assembly
(x3) each side

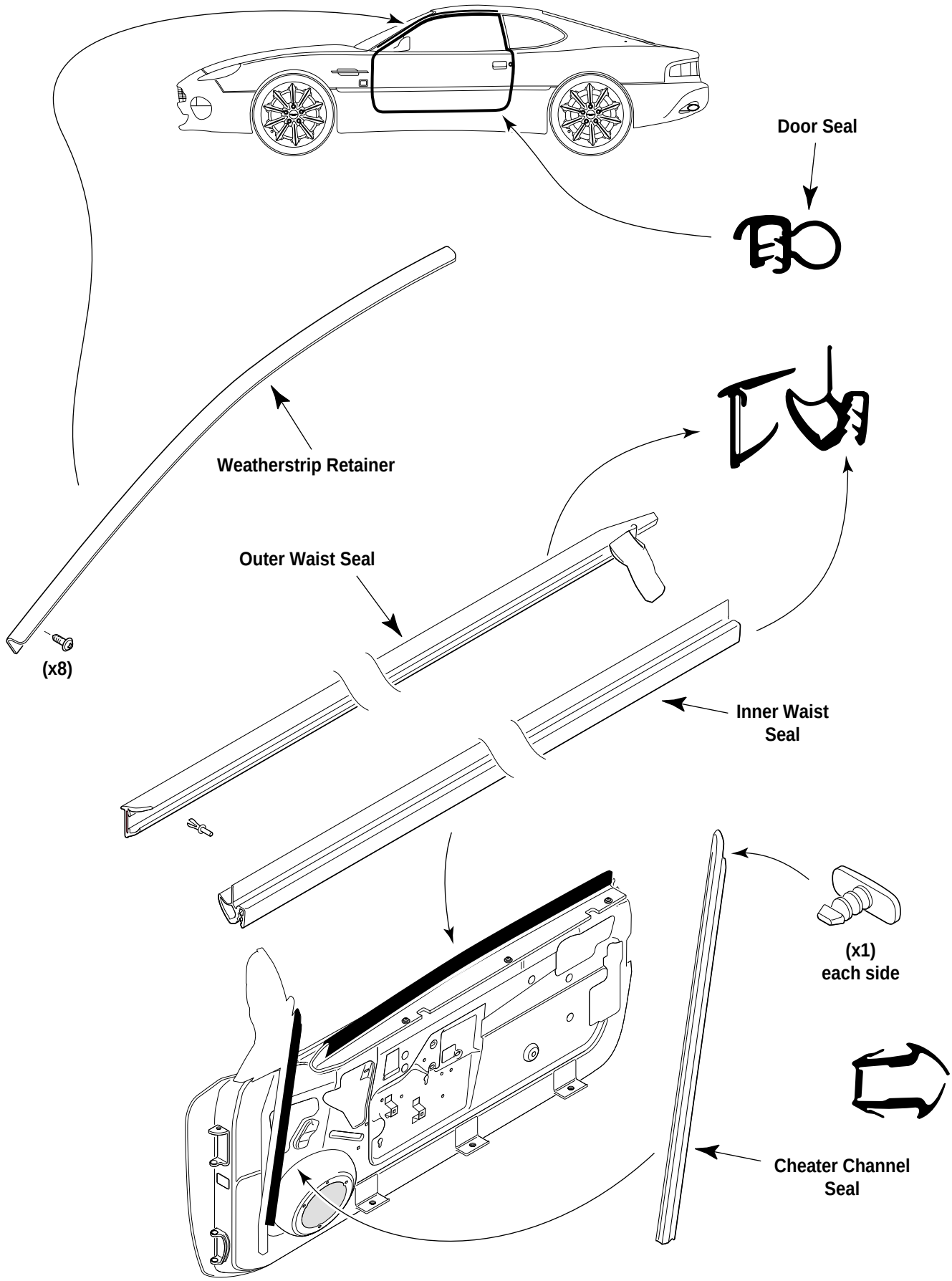

Tube to body (x2)
Facia to tube (x2)
Facia end bracket (x2)
Knee Bolster pivot clip (x6)
(x8?)
(x2)
(x2)
(x1)
(x1)
(x1)
(x4)
(x2)
Lower Tube RH (x1)
Tube to A/C (x2)
(x2)
(x9?)
(x2)
Lower Tube LH (x1)
(x1)
(x4)
(x4)

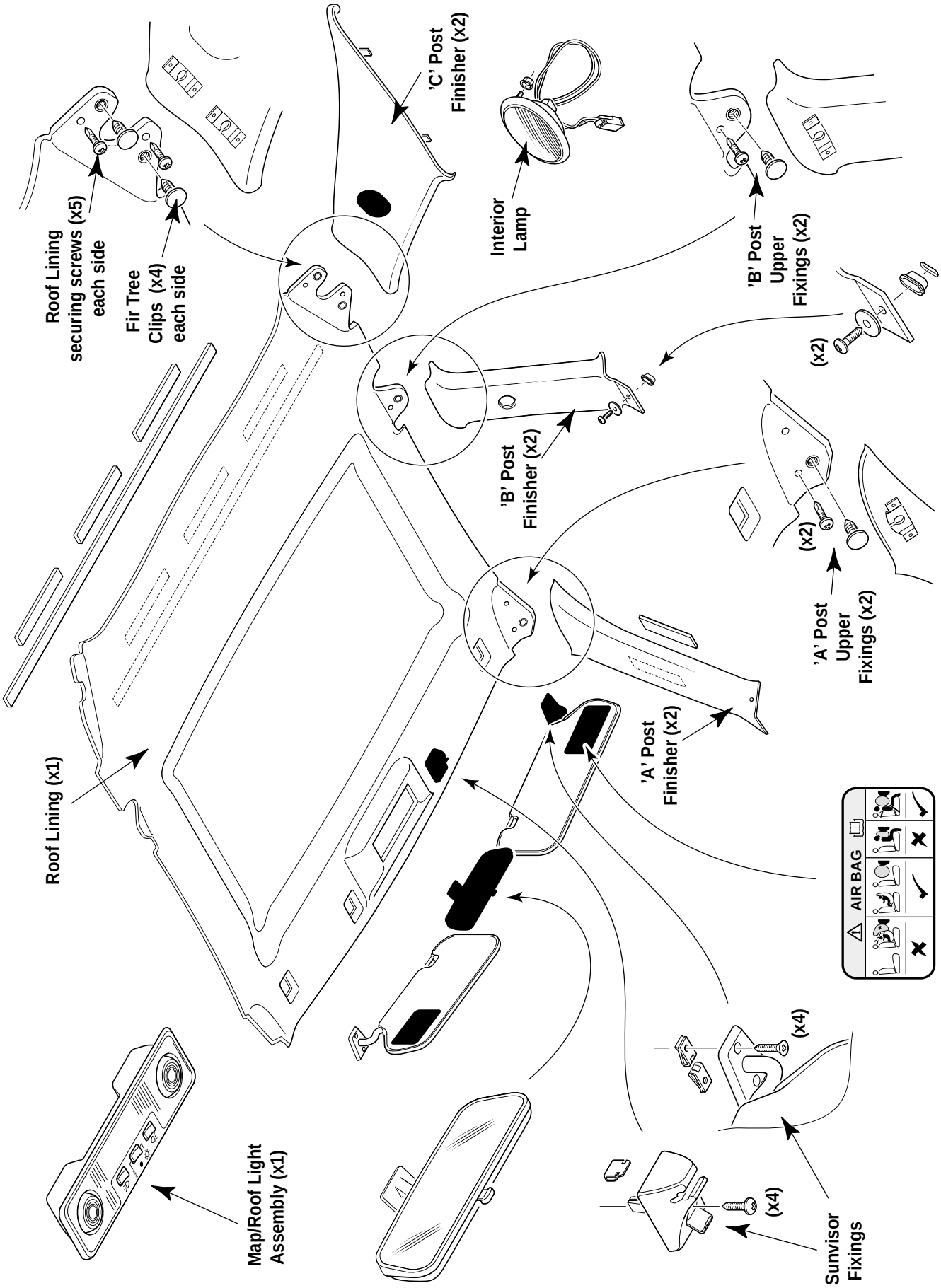

(x4)
(x4)
Rear Parcel Shelf and Air Vents
(x1) each side
(x2) each side
(x7) each side
(x1) each side
(x6)
(x2)
(x2)
(x7)
(x1) each side
(x1) each side
A
Rear Quarter Panel Lower Fixings (x2)
(x2) each side
A
(x1) each side
Check Links and Guides (x2)
(x2)
Rear Cubby Box/ Armrest Lid (x1)
(x2)
(x1) each side
(x6)
(x2)
(x2)
(x3) each side
Front Armrest/ Cubby Box Lid (x1)
Lower 'A' Post Trim (x2)

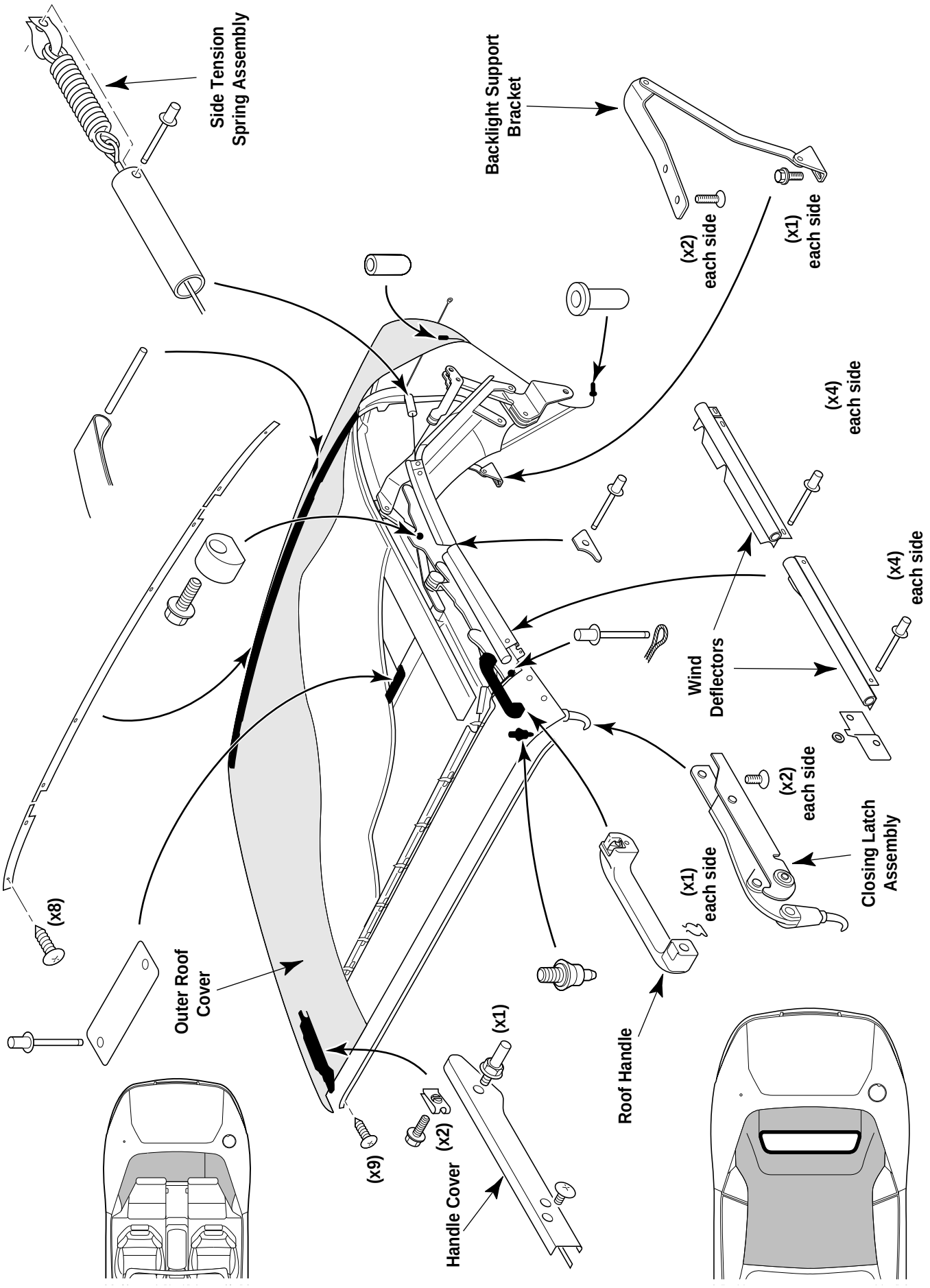

Rear Quarter Light (x2)
(x2) each side
Rear Console (x1)
Rear Console Lower Fixings (x2)
Rear Quarter Panel Lower Fixings (x2)
A
(x1) each side
Centre Console Rear Cover (x1)
Rear Quarter Panel (x2)
(x1) each side
(x1) each side
(x2)
Check Links and Guides (x2)
(x2)
(x2)
Centre Console (x1)
(x1) each side
(x6)
(x2)
(x2)
Front Armrest/ Cubby Box Lid (x1)
(x3) each side
Lower 'A' Post Trim (x2)
B
B

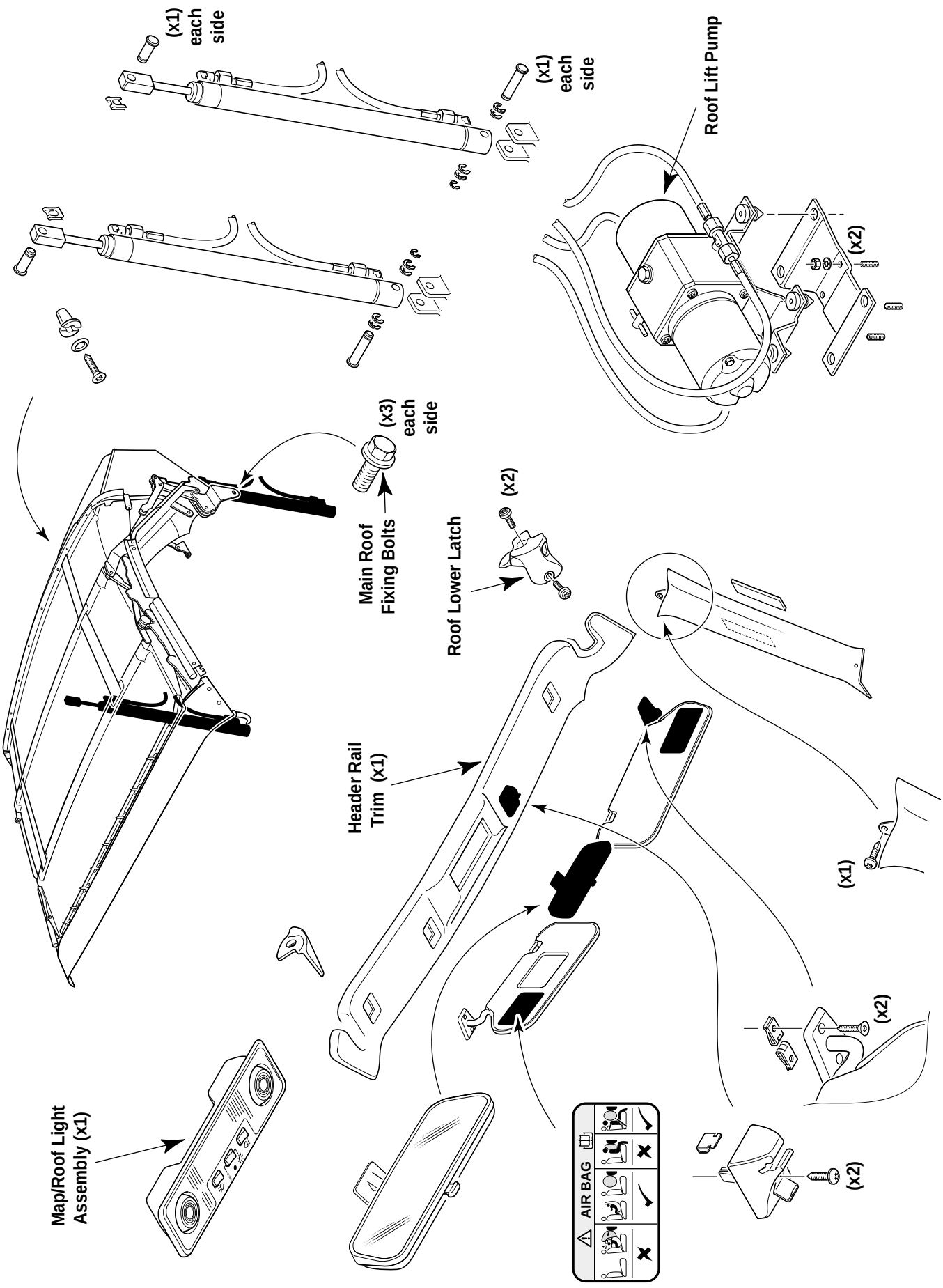

(x3)
Waist Seal Retainer (x1)
A
(x3)
Door Upper Vent (x1)
Finger Pull (x1)
Finger Pull Bracket (x1)
(x1)
(x3)
(x2)
Door Pocket Assembly (x1)
(x3)
(x1)
Door Handle Inner Cover (x1)
Door Speaker Grille (x1)
(x3)
Door Lower Vent (x1)
Cheater Assembly (x1) (see sheet 15)
Door Mirror Assembly (x1)
(x2)
(x1)
A
Vent Lower Duct (x1)

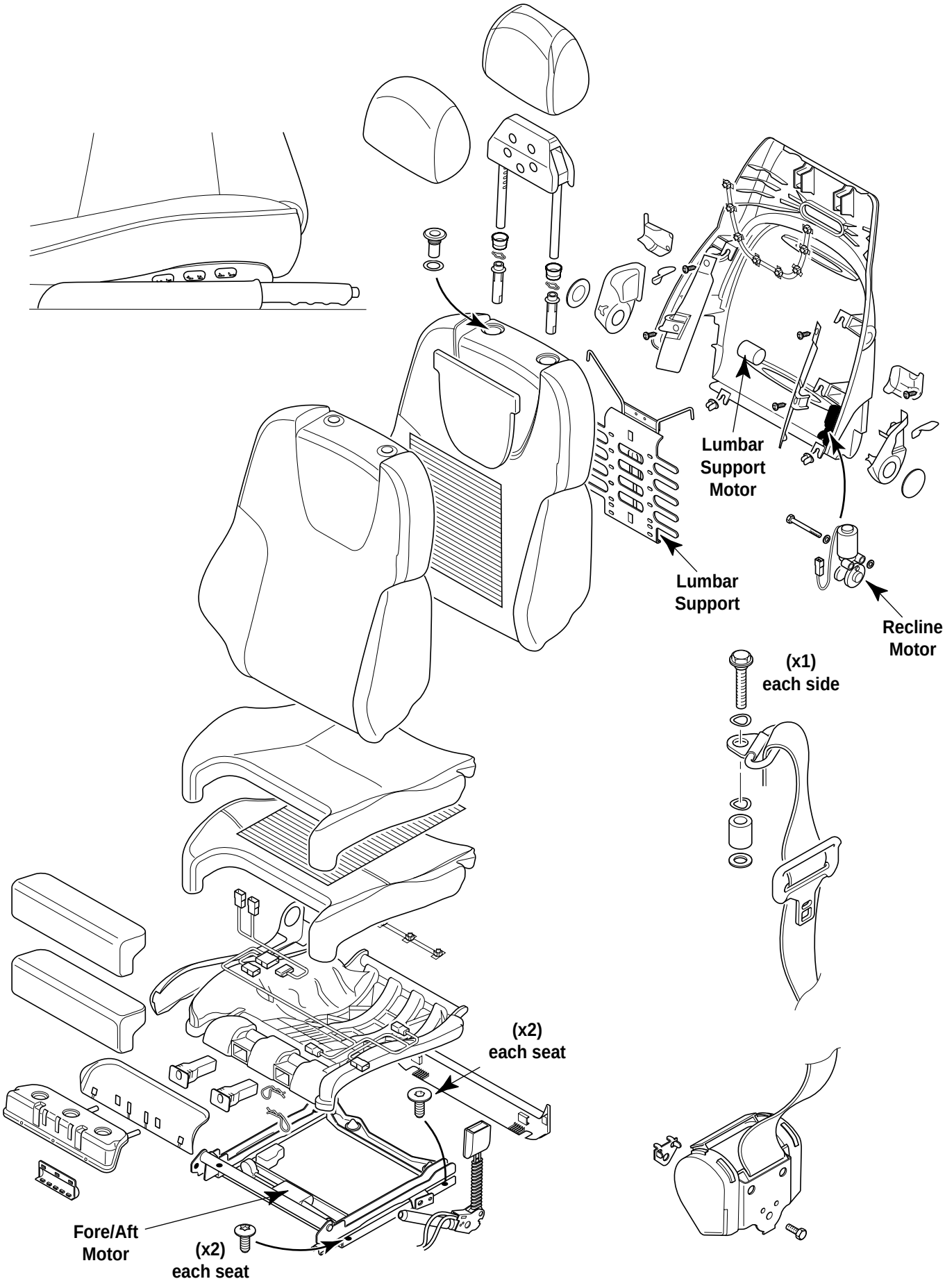

Seal
Mounting Rails
(x3) each side
Seal
Roof Frame Rear
(x1) each side
Seal
Main Column
(x1) each side
Seal
Roof Frame Front
(x1) each side
(x10) each side
Seal
Assembly 'C' Post
(x1) each side
B Post Seal Retainer
(x1) each side
Upper Seal (x1)
(Header Rail
and A Posts)
Weatherstrip
Retainer
(x1) each side
(x4)
each side
Lower Seal (x2)
(Sills and
B Posts)

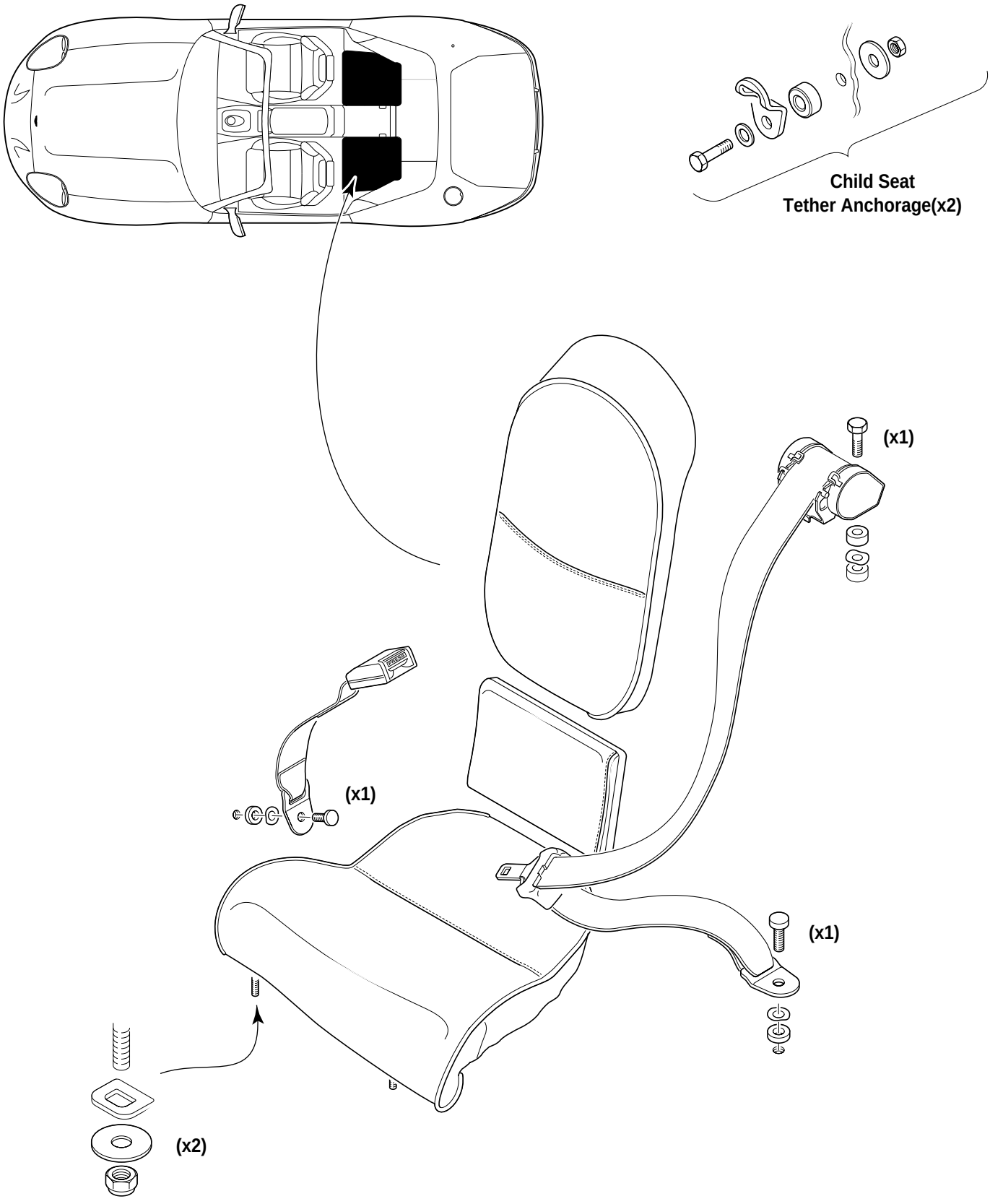

Door Seal
Weatherstrip Retainer
Outer Waist Seal
(x8)
Inner Waist Seal
(x1) each side
Cheater Channel Seal


'C' Post Finisher (x2)
Interior Lamp
'B' Post Upper Fixings (x2)
(x2)
Roof Lining securing screws (x5) each side
Fir Tree Clips (x4) each side
'B' Post Finisher (x2)
(x2)
'A' Post Upper Fixings (x2)
'A' Post Finisher (x2)
Roof Lining (x1)
AIR BAG
(x4)
(x4)
Map/Roof Light Assembly (x1)
Sunvisor Fixings


Side Tension Spring Assembly
Backlight Support Bracket
(x2) each side
(x1) each side
(x4) each side
(x4) each side
Wind Deflectors
(x2) each side
Closing Latch Assembly
(x1) each side
(x8)
Outer Roof Cover
Roof Handle
(x1)
(x2)
(x9)
Handle Cover


(x1) each side
(x1) each side
Roof Lift Pump
(x2)
(x3) each side
Main Roof Fixing Bolts
(x2)
Roof Lower Latch
Header Rail Trim (x1)
(x1)
(x2)
Map/Roof Light Assembly (x1)
AIR BAG
(x2)


Lumbar
Support
Motor
Lumbar
Support
Recline
Motor
(x1)
each side
(x2)
each seat
Fore/Aft
Motor
(x2)
each seat


Child Seat
Tether Anchorage(x2)
(x1)
(x1)
(x1)
(x2)

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General Description

Specifications

Refrigerant

Designation	Charge weight	Type
Refrigerant R-134A	950 g ± 30 g	Ford YN-11, ICI Klea or equivalent

Compressor

Type & model	Configuration	Manufacturer
Visteon FS-10	10 cylinder swash plate 154cc displacement	Visteon

Compressor Lubricants

Designation	System Capacity	Type
Polyalkylene glycol (PAG)	207 ml	Ford YN-12-c or F2AZ-19577-AC

Standard for Recovery, Recharge and Recycle Equipment.

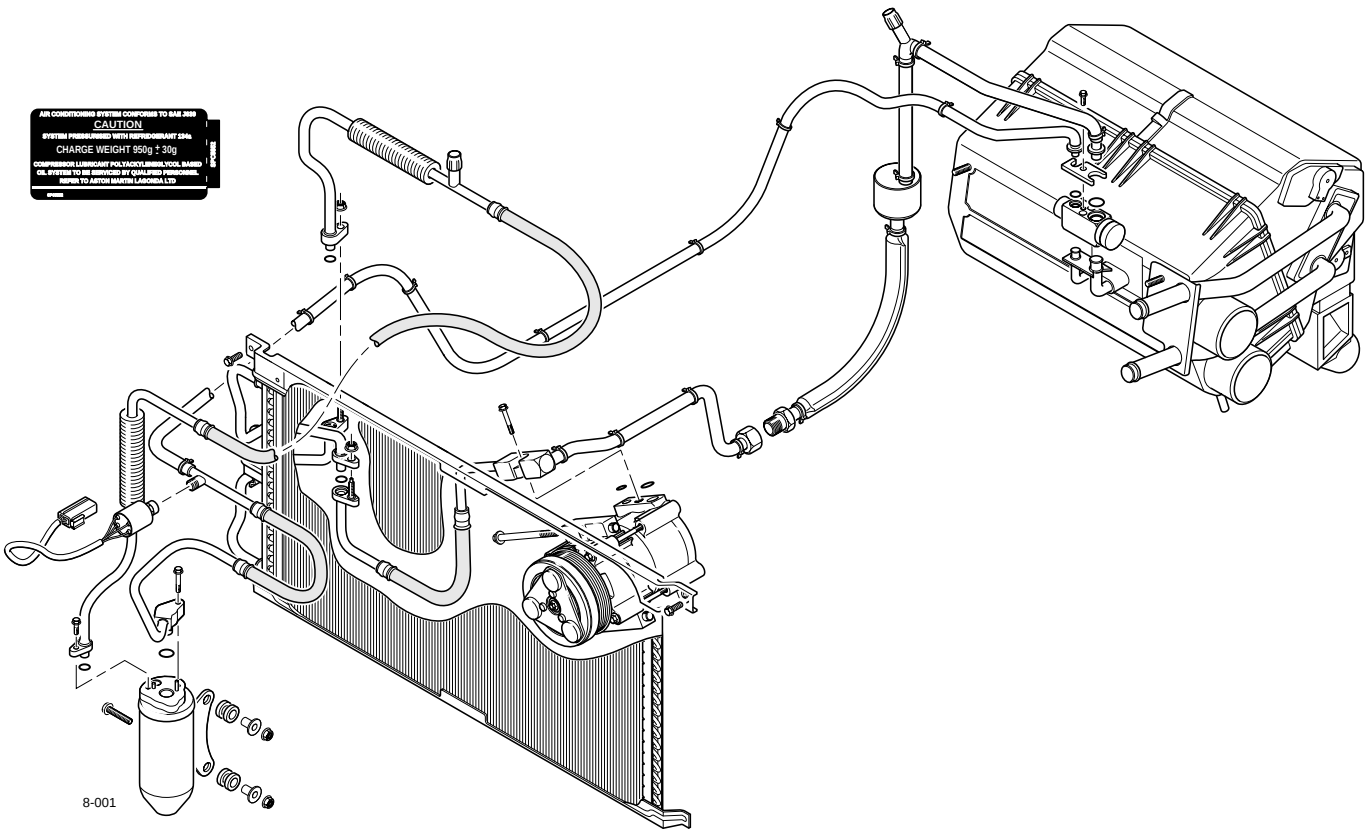
Feature	Requirement
Recovery rate	0.014-0.062 m^3/min. (1.36 kg in 20 minutes)
Cleaning capability	15 ppm moisture; 4000 ppm oil; 330 ppm non-condensable gases in air
Oil separator	With hermetic compressor and automatic oil return
Vacuum pump	2 stage 0.07 -0.127 m^3/min.
Filter	Replaceable with moisture indicator
Charge	Selectable charge weight and automatic delivery
Hoses	Dedicated Refrigerant R134A port connections.
Charge pressure	Heating element to increase pressure

System Description

The in-car temperature and humidity are regulated by the electronically controlled air conditioning system. The system comprises four subsystems:

- heater system, supplied with hot water from the engine cooling system
- refrigeration system, self contained cooling system with engine driven compressor pump.
- vacuum system to control airflow flaps and water valve.
- electronic control system with inputs from the control panel and temperature sensors.

Apart from the ambient temperature sensor and the aspirated in-car temperature sensor, most of the components are housed in the air conditioning unit (Fig. 1) situated behind the dash board, or in the engine compartment.



Key to illustration- Air Conditioning Unit LH End

1. Upper feedback potentiometer
2. Water temperature switch
3. Lower feedback potentiometer
4. Vacuum valve block
5. Vacuum restrictor
6. Condensate drain tube

Key to illustration - Air Conditioning Unit RH End

1. Upper servo motor
2. Electronic control module
3. Lower servo motor
4. Evaporator sensor
5. Condensate drain tube

Special Servicing Tools and Equipment

1 PDU system
1 Charging station
1 Leak detector
1 Temperature test box
1 Digital multimeter

Working Practices

General

Be aware of, and comply with, all health and safety requirements.

Before beginning any repair or service procedure, disconnect the vehicle battery ground connection and protect the vehicle from dirt or damage.

Work in a well ventilated, clean and tidy area.

Handling Refrigerant

Wear eye protection at all times.

Use gloves, keep skin that may come into contact with refrigerant covered. If the refrigerant comes into contact with your eyes or skin wash the affected area *immediately* with cool water and seek medical advice, *do not* attempt to treat yourself.

Avoid inhaling refrigerant vapour, it will irritate your respiratory system.

Never use high pressure compressed air to flush out a system. Under certain circumstances a combination of HFC 134A and compressed air in the presence of a source of combustion (for instance, welding or brazing equipment), results in an explosion that releases toxic compounds into the atmosphere.

The refrigerant and CFC 12 must never come into contact with each other as they form an inseparable mixture that can only be disposed of by incineration.

Do not vent refrigerant directly into the atmosphere, always use approved recovery equipment. *Refrigerant is costly but it can be recycled*. Clean the refrigerant, using the recovery equipment and reuse it.

Carry out Leak Tests only with an electronic analyser dedicated to Refrigerant E134A.

Do not attempt to guess the amount of refrigerant in a system, always recover it and recharge with the correct charge weight. Do not depress the charge or discharge port valves to check for the presence of refrigerant.

Handling Lubricating Oil

Avoid breathing lubricant mist, it will cause irritation to your respiratory system.

Always decant fresh oil from a sealed container. Do not leave oil exposed to the atmosphere for any reason other than to fill or empty a system; PAG oil is hygroscopic (it absorbs water) and is contaminated rapidly by atmospheric moisture.

Following the recovery cycle *do not* reuse the oil when it has been separated from the refrigerant; dispose of the oil safely.

System Maintenance

Do not leave the system open to the atmosphere. If a unit or part of the system is left open for more than five minutes, it is advisable to renew the receiver-dryer. There is not a safe period in which work is to be carried out. *Always* plug pipes and units immediately after disconnection and only remove plugs when re-connecting.

If replacement parts are supplied without transit plugs and seals do not use the parts. Return them to your supplier.

Diagnostic equipment for pressure, mass and volume should be calibrated regularly and certified by a third party organisation.

Use extreme care when handling and securing aluminium fittings, always use a backing spanner and take special care when handling the evaporator.

Use only the correct or recommended tools for the job and apply the manufacturer's torque specifications.

Keep the working area, all components and tools clean.

The Air Conditioning System

The heating and ventilation unit case consists of three sections:

- the front, which contains the air conditioning system evaporator (cooler)
- the rear section, which contains the heater matrix and rotary flaps
- the upper and lower outlets which direct air to the screen, fasia outlets, footwell outlets and window outlets.

Temperature variation within the car is achieved by cooling incoming air in the evaporator and then heating it as required in the heater matrix before distributing it from the various outlets under the control of the rotary flaps:

- Full heating (Fig.1)
- Defrost (Fig. 2)
- Full cooling (Fig. 3)
- Blend (Fig. 4)

Figure 1. Full Heating

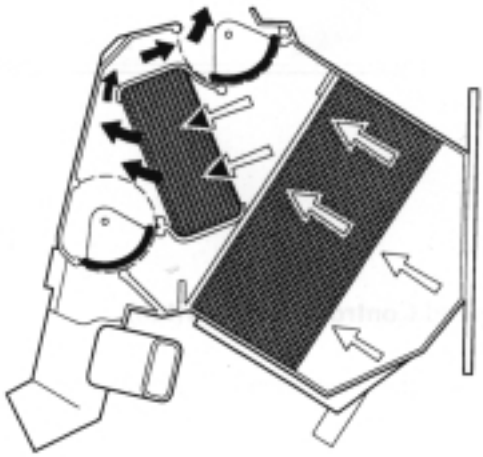


Figure 2. Defrost

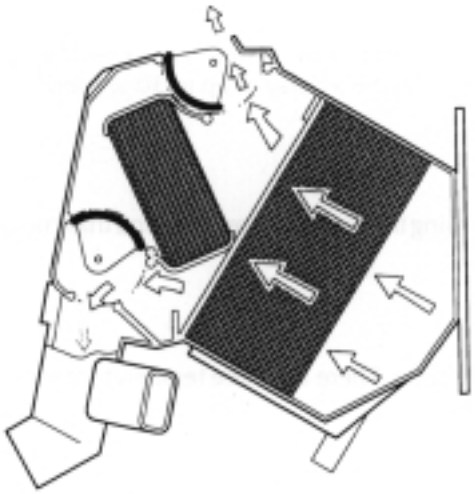


Figure 3. Full Cooling

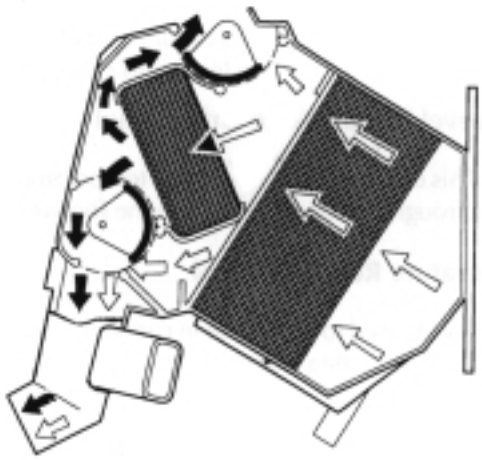


Figure 4. Blend

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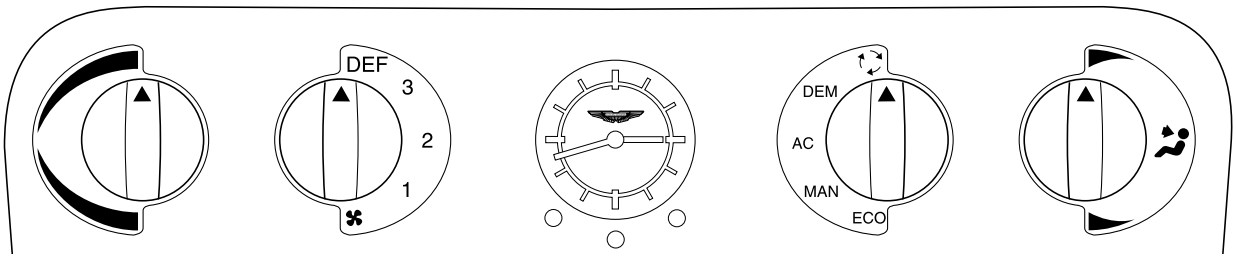
The rotary flaps are opened or closed by servo motors, as directed by the control system, and flap position information is relayed back to the ACCM by feedback potentiometers.

(Solid arrow = Hot, Line arrow = Cold)

The Control Panel (Fig. 4) contains:

- Temperature control,
- Fan speed / defrost switch
- Air Conditioning Function Switch (Mode-Switch),
- Temperature differential control

The control panel is connected directly to the Air Conditioning Control Module (ACCM)



Temperature Control

This control is used to set the target in car temperature in either automatic or manual mode. In order to determine if heating or cooling is required, three temperature sensors are located in the system:

- Exterior ambient temperature sensor
- In-car aspirated temperature sensor
- Evaporator (cooler) temperature sensor

The sensors are semiconductor devices which provide a voltage output proportional to the sensed temperature.

Fan Speed / Defrost Switch

The rotary switch controls airflow from the blower motors. The switch has five positions: ✻, 1, 2, 3 and DEFROST.

✻	The system is not operational; a residual signal is sent to the Electronic Control Module (ACCM) to ensure that the blower flaps are closed to prevent outside air from entering the system.
1, 2,3	These settings determine the maximum fan speed in Manual mode. In AC (automatic) mode, fan speed is controlled over its full range by the ACCM without regard to the position of this switch.
DEFROST	The fans operate at maximum speed, front screen vents open fully, lower flaps close fully and maximum output is directed to the windscreen (there may be a delay of up to 30 seconds from selection to execution of this function).

Face Level Temperature Differential

This control is used to vary the temperature difference between the air coming through the face vents and that coming through the footwell vents.

It operates in conjunction with the temperature control setting. With the temperature control in its mid position, the differential control may be rotated anticlockwise to give cooler air from the face vents than from the footwell ducts. with the differential control fully clockwise, the air temperature from the face and footwell ducts will be the same.

If the temperature control is turned to full cooling (anticlockwise, the differential control will have no additional cooling effect (the system is already at maximum cooling effect).

If the temperature control is turned to full heating (clockwise), the temperature demand will override the differential demand. Thus the differential control will have little or no cooling effect.

Air Conditioning Mode Switch

ECO (Economy)

In the ECO position, the air conditioning compressor is switched off and no cooling or dehumidifying is available. Incoming air can be heated if required and the fan speed can be adjusted to increase or decrease the airflow in the vehicle. This mode puts minimum load on the engine and gives the best fuel economy.

MAN (Manual)

In Manual mode, the air delivered from the vents remains at the target temperature regardless of the temperature inside the passenger compartment. In this mode, the air conditioning compressor is running and incoming air is dehumidified and blended.

AC (Auto Control)

This is the automatic mode of operation in which the heating and cooling functions of the system operate automatically, as required, to maintain the selected in-car temperature. In this mode, incoming air is also dehumidified and blended.

Note: If the incoming air requires little heating or cooling when in AC mode, the centre vent will close reducing the air flow in the upper part of the passenger compartment. If more airflow is required, the Demist function can be used to provide the same temperature level but with increased air flow to the screen vents.

DEM (Demist)

When this mode is selected heated air is directed to the screen vents for demisting as well as to the face level, footwell and door vents. Air speed and temperature depend upon the fan speed, in-car temperature selected and engine temperature.

Recirculation

In Recirculation mode, all external air inlets are closed and conditions within the vehicle are maintained by drawing air from within the cabin and heating or cooling it as required before returning it to the passenger compartment.

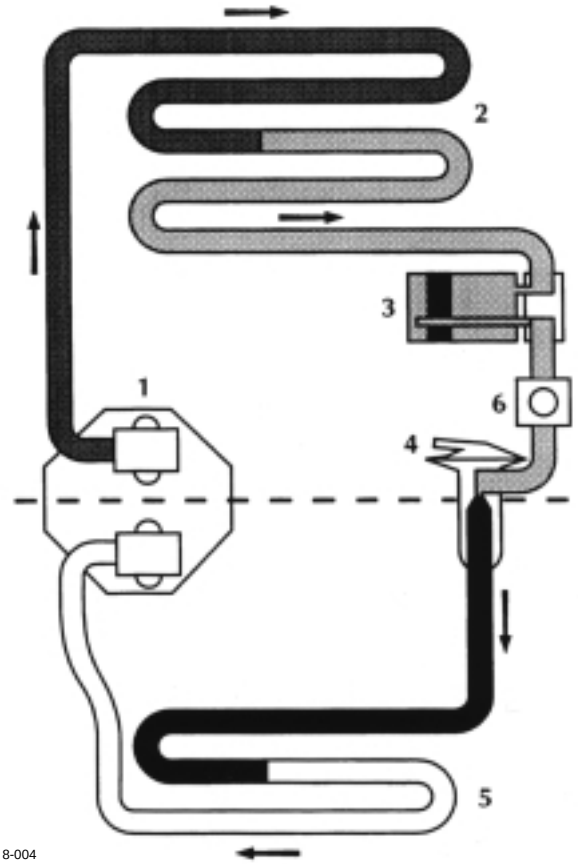
Recirculation mode avoids drawing noxious fumes into the vehicle from outside. This mode is not recommended for continuous use since no fresh air is drawn into the vehicle and drowsiness may occur.

The car interior may be rapidly cooled in recirculation mode by selecting Recirculation, Minimum Temperature and Fan Speed 2.

Refrigeration Cycle

The Compressor draws low pressure refrigerant vapour from the evaporator, compresses it, and feeds it to the Condenser where it is cooled by the flow of ambient air. As the refrigerant cools in the condenser, it changes from a vapour to a liquid.

Key
1. Compressor
2. Condenser
3. Receiver-Drier
4. Expansion Valve
5. Evaporator
6. Triple Pressure Switch (Trinary switch)



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From the condenser the liquid passes into the Receiver-Drier which has three functions:

- Storage vessel
- Filter to remove system contaminants.
- Moisture removal via the desiccant.

From the receiver/drier, the high pressure liquid enters the Expansion Valve where it is metered through a controlled orifice. This has the effect of reducing the refrigerant pressure and temperature. The reduced pressure causes the liquid refrigerant to convert into a fine spray.

The refrigerant, now in a cold atomised state, flows into the Evaporator and cools the air which is passing through the matrix.

As heat is absorbed by the refrigerant it once again changes state, into a vapour, and returns to the compressor for the cycle to be repeated (Fig. 5).

There is an automatic safety valve incorporated in the compressor which operates should the system pressure be in excess of 41 bar. The valve re-seats when the pressure drops below 35 bar.

Note: The division of HIGH and LOW side is simply the system pressure differential created by the compressor discharge (pressure), suction (inlet) ports and the relative inlet and outlet ports of the expansion valve. This differential is critical to system fault diagnosis and efficiency checks.

System Protection

The trinary pressure switch, located in the liquid line, cuts electrical power to the compressor clutch if the system pressure is outside of the range of 2 Bar (1st Function) to 30 Bar (2nd Function).

The third function is to switch on the engine cooling fans when pressure exceeds 20 bar. In this situation, the additional air flow helps to cool the condenser which is mounted in front of the engine cooling radiator.

General System Procedures

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. When checking for non visible leaks use only a dedicated Refrigerant E134A electronic analyser and apply the probe all round the joint connection. Should a leak be traced to a joint, check that the fixing is secured to the correct tightening torque before any other action is taken.

Do not forget to check the compressor shaft seal and evaporator.

Note: Never use a dedicated CFC 12 or naked flame type analyser.

Charge Recovery (System Depressurisation)

The process of refrigerant recovery depends on the basic characteristics of your chosen recovery equipment, therefore, follow the manufacturers instructions carefully. Remember that compressor oil may be drawn out of the system by this process, take note of the quantity recovered so that it may be replaced.

Caution: Observe all relevant safety requirements.

- ***Do not vent refrigerant directly to atmosphere. Always use approved recovery equipment.***
- ***Wear suitable eye and skin protection.***
- ***Do not mix the refrigerant with CFC 12.***
- ***Take note of the amount of recovered refrigerant, it indicates the state of the system and thus the magnitude of any problem.***

Evacuating the System

System evacuation is primarily designed to extract all refrigerant from the components prior to opening any hoses or removing any components for service. A secondary function is the removal of unwanted moisture. This is critical to the correct operation of the air conditioning system. The evacuation procedures depend on the characteristics of the recovery equipment and must be carried out exactly in accordance with the manufacturers instructions.

Moisture can be highly destructive and may cause internal blockages due to freezing, but more importantly, water suspended in the PAG oil will damage the compressor. Once the system has been opened for repairs, or the refrigerant charge recovered, all traces of moisture *must* be removed before recharging with new or recycled refrigerant.

Adding Compressor Lubricating Oil

Oil can be added by two methods:

- via the recovery-recycle-recharge station
- by direct filling of the compressor.

Equipment manufacturer's instructions must be adhered to when using the recovery-recycle-recharge station.

Direct filling of the compressor may be required because of rectification work to the existing compressor, or the need to fit a new compressor. From an existing compressor, drain the oil into a measuring cylinder and record the amount. Flush the unit out with fresh PAG oil and drain thoroughly. Refill the compressor with the same amount of PAG oil that was drained out originally and plug all orifices immediately ready for refitting to the vehicle. The transit lubricating oil must be drained and discarded from a new compressor before it may be fitted. An adjustment should be made to the system oil level by taking into account:

- the quantity found in the original compressor
- the quantity deposited in the recovery equipment oil separator from the charge recovery operation.

Provided that the refrigerant is recovered slowly, most of the lubricating oil will remain in the system and only a few mililitres will be found in the oil separator. The total quantity of oil in the system must be made up to 207 ml when completing service work on the system.

Caution: Always decant fresh oil from a sealed container and do not leave oil exposed to the atmosphere. PAG oil is very hygroscopic (absorbs water) and rapidly attracts atmospheric moisture.

PAG oil must NEVER be mixed with mineral based oils.

Do not reuse oil following a recovery cycle, dispose of it safely.

Depending on the state of the air conditioning system immediately prior to charge recovery and the rate of recovery, a small amount of oil is drawn out with the refrigerant. It is most important that the oil separator vessel in the recovery equipment is clean and empty at the start of the process so that the amount drawn out may be accurately measured.

Adding Refrigerant

In order that the air conditioning system may operate efficiently it must contain a full refrigerant charge. A low refrigerant charge is a probable cause of several system defects. In such cases the charge should be fully recovered from the system and the correct weight of refrigerant should be installed. Follow the manufacturers instructions precisely when recharging the air-conditioning system.

Note: Never attempt to guess the amount of refrigerant in a system. Always recover and recharge with the correct charge weight, this is the only accurate method.

Caution: If oil is drawn out during the recovery process, the correct amount can be added directly from your recovery-recycle-recharge station (if so equipped) prior to the charging process. It must be stressed that the need to protect compressor oil from moisture is vital, observe the procedures in Handling Lubricating Oil.

WARNING: Liquid refrigerant boils at -29°C (-20°F) at atmospheric pressure. Serious injury, even blindness, can occur if the refrigerant comes into contact with the eyes.

Goggles and gloves must be warn while working with refrigerant.

First Aid

If refrigerant should contact the eyes or skin, bathe the eyes or affected area with cold water for several minutes. Do not rub. As soon as possible thereafter, obtain treatment from a doctor or eye specialist.

Functional Check

This functional check procedure is provided as a simple system validation and is structured to augment the Portable Diagnostic Unit (PDU).

Stage 1 (Cold engine only, if not proceed to Stage 2)

	Procedure	Normal System Reaction
1.	Ignition ON Select MIN temperature, MAN, speed 3, Mid face. (Engine Stationary)	Fans Start
2.	Select MAX temperature	Fans continue to run
3.	Ignition OFF Select MAX temperature and defrost Ignition ON	Fans start at maximum speed
4.	Select fan speed 1	Fan speed adjusts accordingly - system OK

Stage 2

	Procedure	Normal System Reaction
1.	Start up engine and warm up Select fan speed 1, MAN, MAX TEMPERATURE and mid face	
2.	Open all vents	Fans start after 3 seconds
2.	Select fan speed 2	Fan speed increases then stabilises
3.	Select fan speed 3	Fan speed increases then stabilises
4.	Select Defrost	Fan speed steady at high All air at screen and dash end
5.	Re-select fan speed 1 Select AUX ignition key position	
6.	Slowly select MIN temperature	Solenoids switch 1. centre vent 2. water valve 3. Re-circulation
7.	Re-select MID temperature	
8.	Select DEM	Solenoid clicks Air at screen
9.	Select manual re-circulation	Solenoid click
10.	Check flap for position	
11.	Run Engine to normal temperature	
12.	Select: MAN, 3/4 MAX heat and fan speed 2.	Air from door vents cool, air temp from footwell outlet slightly warm
13.	Select MAX temperature and air differential to hot face	All vent outlets max temp except screen vent
14.	Select temperature approx. 1/4 MAX heat and mid face level	Cool air from centre vents
15.	Select MIN temperature	Blower flaps at re-circulation position All outlets blowing cold air except screen vent

Procedure	Normal System Reaction
16. Select ECO	Blower flaps revert to fresh air position
17. Select AC	Engine revs change then stabilise
18. Select fan speed 3	Small increase in fan speed
19. Select fan speed 2	Fan speed lower Centre vent and dash end cold footwell cool
20. Select MAX temperature allow in-car temperature to stabilise	Hot air from footwell, warm from dash end
21. Select MIN temperature and mid face level	System goes to full cooling automatically Cold air from all vent except from screen vent Centre vent open Blower at re-circulation
22. Select DEMIST and full heat	Demist vents open, centre vent closes and blower flaps revert to fresh air position
System check now complete	**System good.**

Note: A small amount of air will bleed from the ends of the demist-defrost vents in all cases, but there should be no leak along the length of the vents.

System Trouble Shooting

There are five basic symptoms associated with air conditioning fault diagnosis. It is very important to identify the area of concern before starting a rectification procedure. Spend time with your customer on problem identification, and use the following trouble shooting guide. The following conditions are not in order of priority.

No Cooling

1. Is the electrical circuit to the compressor clutch functional?
2. Is the electrical circuit to the blower motor(s) functional?
3. Slack or broken compressor drive belt.
4. Compressor partially or completely seized.
5. Compressor shaft seal leak (see 9).
6. Compressor valve or piston damage (may be indicated by small variation between HIGH & LOW side pressures relative to engine speed).
7. Leak in system (causing total loss of refrigerant).
8. Blocked filter in the receiver drier.
9. Evaporator sensor disconnected?
10. Dual pressure switch faulty?

Note: Should a leak or low refrigerant be established as the cause, follow the procedures for Recovery-Recycle -Recharge, and observe all refrigerant and oil handling instructions.

Insufficient Cooling

1. Blower motor(s) sluggish.
2. Restricted blower inlet or outlet passage
3. Blocked or partially restricted condenser matrix or fins.
4. Blocked or partially restricted evaporator matrix.
5. Blocked or partially restricted filter in the receiver drier.
6. Blocked or partially restricted expansion valve.
7. Partially collapsed flexible pipe.
8. Expansion valve temperature sensor faulty (this sensor is integral with valve and is not serviceable).
9. Excessive moisture in the system.
10. Air in the system.
11. Low refrigerant charge.
12. Compressor clutch slipping.
13. Blower flaps or distribution vents closed or partially seized.
14. Water valve not closed.
15. Evaporator sensor detached from evaporator.

Intermittent Cooling

1. Is the electrical circuit to the compressor clutch consistent?
2. Is the electrical circuit to the blower motor(s) consistent?
3. Compressor clutch slipping.
4. Faulty air distribution flap potentiometer or motor.
5. In-car aspirated temperature sensor or evaporator temperature sensor faulty, causing temperature variations.
6. Blocked or partially restricted evaporator or condenser.

Noisy System

1. Loose or damaged compressor drive belt.
2. Loose or damaged compressor mountings.
3. Compressor oil level low, look for evidence of leakage.
4. Compressor damage caused by low oil level or internal debris.
5. Blower(s) motor(s) noisy.
6. Excessive refrigerant charge, witnessed by vibration and 'thumping' in the high pressure line (may be indicated by high HIGH & high LOW side pressures).
7. Low refrigerant charge causing 'hissing' at the expansion valve (may be indicated by low HIGH side pressure).
8. Excessive moisture in the system causing expansion valve noise.

Note: Electrical faults may be more rapidly traced using PDU.

Insufficient Heating

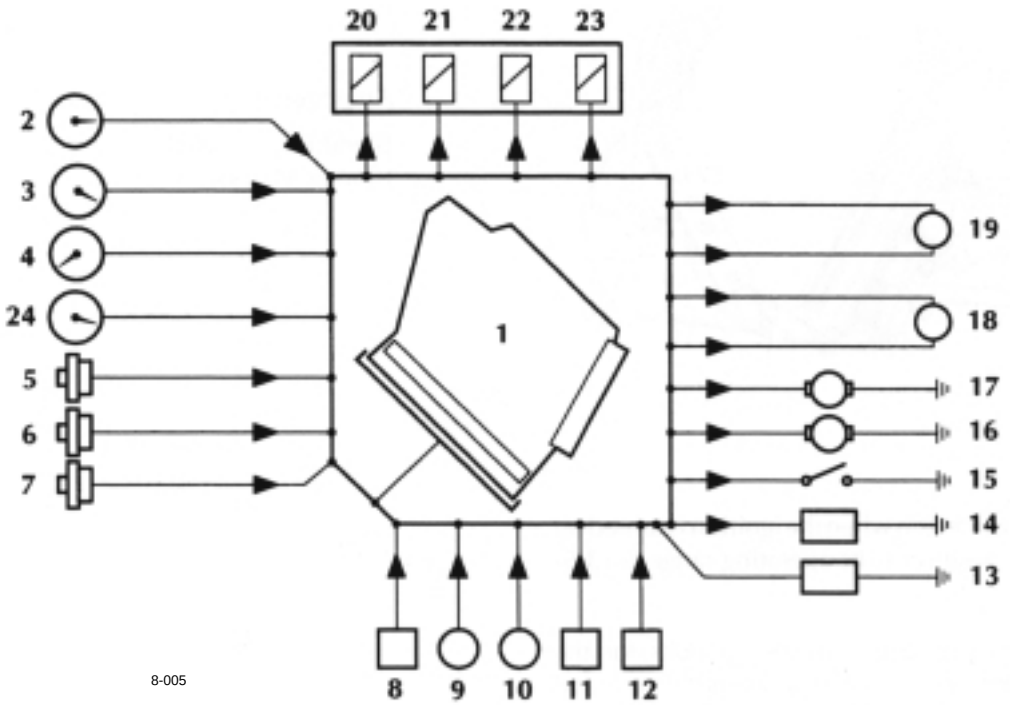
1. Water valve stuck in the closed position.
2. Motorised in-car aspirator seized.
3. Blend flaps stuck or seized.
4. Blocked or restricted blower inlet or outlet.
5. Low coolant level.
6. Blower fan speed low.
7. Coolant thermostat faulty or seized open.

Air Conditioning Control Module (ACCM)

The Air Conditioning Control Module (ACCM) is located on the right hand side of the heater unit.

The ACCM has a digital microprocessor that allows the air conditioning system to maintain the selected in-car conditions. To do this it compares the signals from the in-car controls with those it receives from the system temperature sensors and feedback devices. On the basis of these comparisons it makes appropriate voltage changes to vary the blower motor speed, flap position and the state of other solenoids that effect the selected temperature demand.

The ACCM is a non-serviceable component but may be interrogated for system testing. Care must be exercised when connecting the test equipment as the control module may be irreparably damaged should any of the test pins be shorted or bent.



Key

1. Air Conditioning Control Module (ACCM)
2. Differential temperature control
3. Temperature control
4. Fan speed control
5. Ambient temperature sensor
6. Motorised in-car aspirator
7. Evaporator temperature sensor
8. Coolant temperature switch
9. Lower flap feedback potentiometer
10. Upper flap feed back potentiometer
11. Left hand blower motor feedback
12. Right hand blower motor feedback
13. High speed relay
14. High speed relay
15. Compressor clutch
16. Blower motor
17. Blower motor
18. Lower flap servo motor
19. Upper flap servo motor
20. Defrost vacuum solenoid
21. Auto re-circulation vacuum solenoid
22. Centre vent vacuum solenoid
23. Water valve vacuum solenoid
24. Air conditioning mode switch

Description

The ACCM (Fig 1) controls the air conditioning system so that selected temperatures are maintained. It cannot be repaired but input and output signals can be measured, using the PDU, for diagnostic purposes.

The ACCM is turned on when the ignition is turned on to auxiliary position 1. Its operating range is 13.5-14.2 volts.

The ACCM power unit supplies +5 volts for the temperature sensors, feedback potentiometers and high speed relays.

An integrated circuit protects the ACCM against reversed polarity and voltage surges.

Caution: Take care when connecting test equipment. If test pins are allowed to be shorted together, to ground or to positive supplies the ACCM will be damaged.

Input-Output Voltage Signals

The following voltage signal levels are input and output from the ACCM:

Digital Input Levels:

Low	0.16 to 1.1V
High	3.70 to 4.50V

Analogue input levels:

General	0 to 0.2885 V
Blend Flap Potentiometer	0 to 5.0V

Digital Output Levels

Relays	On	8.0V
	Off	1.0 to 5.0V
Vacuum manifold	Pull-in	5.6V (typical)
	Drop-out	3.5V (typical)

Analogue Output Levels

Blend Flap Servo Motors	0.5 to 6.5V
Blower Motors	0.5 to 2.5V

In-Car Controls

Temperature Demand Switch

In-car temperatures are selected by the temperature demand switch.

The switch is coupled to a 590 ohm potentiometer supplied with +5 volts from pin 4/13 of the ACCM. The output voltage is from zero to 2.885 volts which represents a range of temperatures from 16 to 38°C. Rotation of the switch is restricted mechanically to 180° of travel.

Face Level Differential Controller

The face level differential control alters the temperature of the air distributed through the face level vents. The switch is coupled to a 10 K ohm potentiometer supplied with +5 volts from pin 4/13 of the control module. Temperature, from the face vents, is decreased by moving the switch anti-clockwise and increased by moving it clockwise.

The differential control is only fully effective when the temperature control is in the mid position.

Air Conditioning Mode Switch

The air conditioning mode switch has five positions: Economy (ECO), Air conditioning (AC), Manual (MAN), Re-circulation and Demist (DEM). These settings have the following functions:

ECO **(Economy)** In this setting the air conditioning compressor is switched off. No cooling is available but incoming air may be heated to the selected temperature. This mode puts a minimum load on the engine. Pin 3/8 at the ACCM is earthed through the switch to select economy mode.

Mode switch circuit

AC This setting allows the heating and cooling functions to be performed automatically, the required in-car temperature is maintained and the air is dehumidified. Pin 3/11 at the ACCM is earthed through the switch to select this mode.

MAN **(Manual)** In the Manual mode the fan speed and temperature control can be set at any level and heating or cooling will be performed despite the internal temperature of the car. Pins 3/11 and 3/4 at the ACCM are earthed through the switch to select this mode

(Re-circulation) With this setting selected the external air inlets are closed and conditions are maintained by circulating the air within the car. Heating and cooling functions are controlled automatically to give the required in-car temperature. Pins 2/9 and 3/11 at the ACCM are earthed through the switch to select the manual Re-circulation.

DEM **(Demist)** Air is directed directly onto the screen in this mode. Air speed and temperature depend on the selected fan screen and in-car temperature. Heating and cooling functions are still controlled automatically to give the required in-car temperature. Pin 2/8 and 3/11 at the ACCM are earthed through the switch to give the required in-car temperature.

Fan Speed Control Switch

Fans Off

The fans are off and the blower flaps are closed to prevent air entering the vehicle. Not recommended for long term use. Can cause internal misting and stale air for occupants unless some supplementary ventilation is used, e.g. an open window.

ACCM pin 2/9 on the ACCM is grounded through the switch and through a resistor to bulkhead ground BH3AL.

1. Blowers at Low Speed

   The fan speed is low. Pin 2/13 on the ACCM is grounded through the switch and through a resistor to bulkhead ground BH3AL.

2. Blowers at Medium Speed

   The fan runs at medium speed. Pin 2/14 on the ACCM is grounded through the switch and through a resistor to bulkhead ground BH3AL.

3. Blowers at High Speed

   The fan speed is high. Pin 2/15 on the ACCM is grounded through the switch and through a resistor to bulkhead ground BH3AL.

DEF Defrost Blower Mode

The fan speed is high, the function switch and temperature switch are not operational, front screen vents are fully open and lower flaps are fully closed. Pin 3/12 at the ACCM is earthed through the switch and a 12V signal is returned to Pin 4/15.

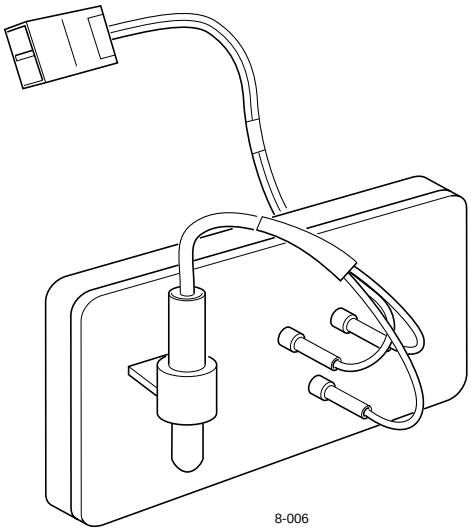
Fan Speed Control

Whilst operating in ranges 1 or 2, the ACCM varies the fan speeds within the range limits as necessary using the power transistor gating signals from pins 4/1 (LH Blower) and 4/2 (RH Blower)

Temperature Sensors

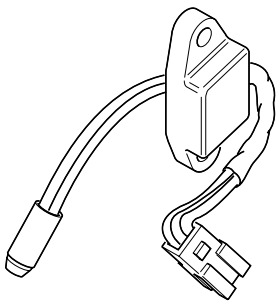
The system has three temperature sensors:

- the ambient sensor



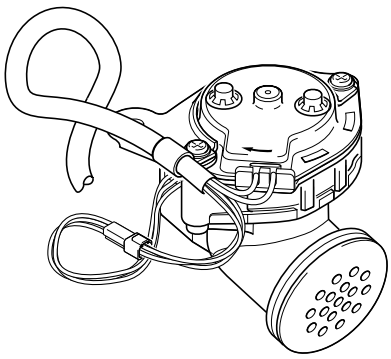
8-006

- the evaporator sensor



8-007

- and the in-car aspirated sensor.



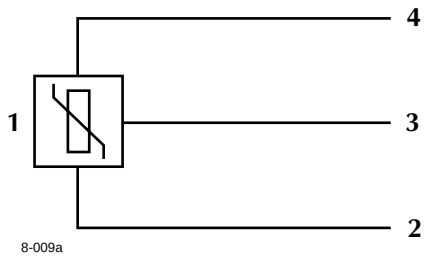
8-008

Each sensor contains a semiconductor whose output or sensing voltage varies with temperature changes. All three are supplied via pin 4/13 of the ACCM. The sensing voltages are fed back into the module via the following pins (Fig. 7):

- ambient temperature sensor - pin 4/4
- in-car aspirated sensor - pin 2/4
- evaporator temperature sensor - pin 2/5

At 0°C the sensing voltage should be 2.732 volts. This voltage rises or falls by 0.01 volts for every 1°C change in temperature; for instance, if the temperature rises 5°C above zero, the voltage rises by 0.05 volts to 2.782 volts. Sensors have built in potentiometers which are preset at the factory and must not be adjusted.

Key to Illustration



8-009a

1. Sensor
2. Pin 4/13 control module
3. Sensing voltages:
   Pin 2/4 In-car aspirated temp sensor
   Pin 2/5 Evap temp sensor
   Pin 4/4 Ambient temp sensor
4. Earth-ground

Ambient Temperature Sensor

The ambient temperature sensor is fitted in the plenum air intake to provide the ACCM with information on the temperature of the air entering the air conditioning unit and so offset the in-car temperature at extremes of ambient. The voltage signal output from the sensor is proportional to the temperature of the surrounding air. The sensor temperature range is -30°C to 85°C. At 0°C the output of the sensor is 2.732V ± 0.005V. The rate of change is + 0.01V ± 0.002V per 1°C.

Evaporator Sensor

The evaporator sensor allows the ACCM to monitor the temperature of the refrigerant in the evaporator core continuously. When the temperature falls below 0°C the ACCM de-energises the compressor clutch and prevents refrigerant from flowing through the system. The clutch is re-engaged when the temperature rises.

Motorised In-Car Aspirated Sensor

The motorised aspirator, which is fitted to the passenger side facia underscuttle panel, incorporates a motor driven fan (Fig. 8-1) that draws air continuously over the in car temperature sensor.

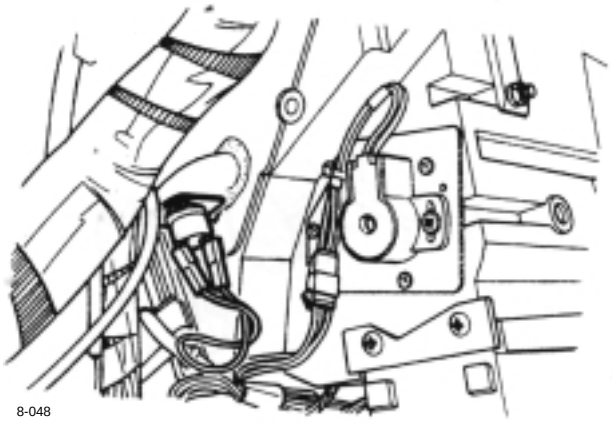
The motor is supplied from the ignition switch (position 2). The sensor has a temperature operating range of -30°C to +85°C.

The sensor reference supply of 5 volts is fed from the ACCM (pin 4/13). The sensor signal voltage is fed back to pin 2/4 of the ACCM.

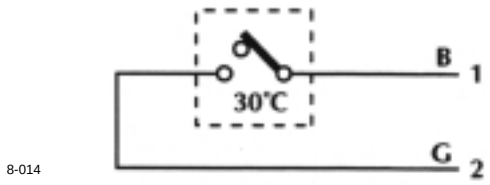
At 0°C the sensing voltage is 2.732V ± 0.002V. The rate of change of sensing voltage is 0.01V ± 0.002V per 1°C.

Water Temperature Switch

The water temperature switch is fitted to the lower side of the heater matrix inlet pipe.


8-048

It is connected to pin 3/6 of the ACCM. The switch contacts are open to prevent the blower motors operating until the temperature of the water in the heater matrix reaches 30°C. The water temperature switch is overridden when cold air is demanded, defrost mode is selected and fan speed 3 is selected.



8-014

Key to Illustration

1. Earth-ground
2. Output to Pin 3/6 ACCM

Blower Motors

The air conditioning system has two blower motors that operate together to maintain the flow of air into the car at the desired level.

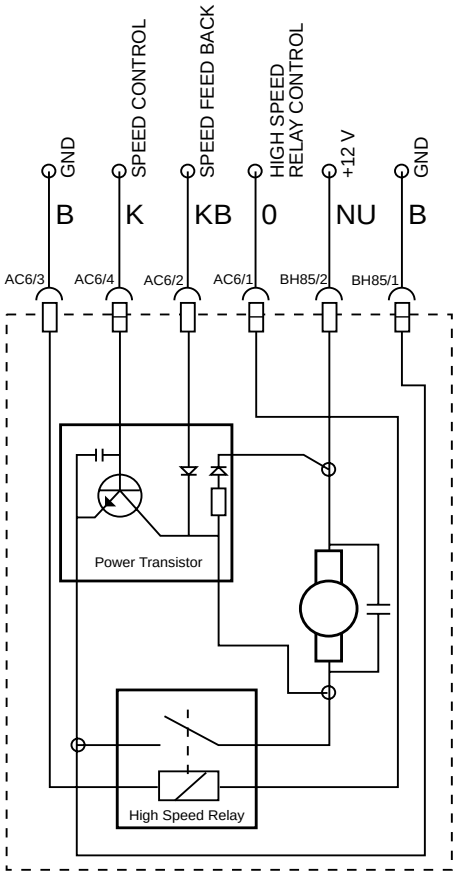
Each motor is supplied from an ignition switched supply through a transistorised control circuit fitted in the motor outlet. Each circuit varies the speed of the motor when the 1 or 2 setting of the fan speed switch is selected.

When position 3 of the fan speed switch is selected, the high speed relay is energised and the fan motors run at maximum speed.

The high speed relay is energised by grounding pin AC3/1 of the ACCM, allowing full battery voltage to be applied to the motor.

At Low and Medium speed, the motor is supplied with +12V and the motor ground is controlled by the power transistor to provide a continuously variable motor speed within the low and medium speed ranges.

Both motor circuits are identical, the right hand blower circuit is illustrated. (See Circuit Sheet 22 for full details)



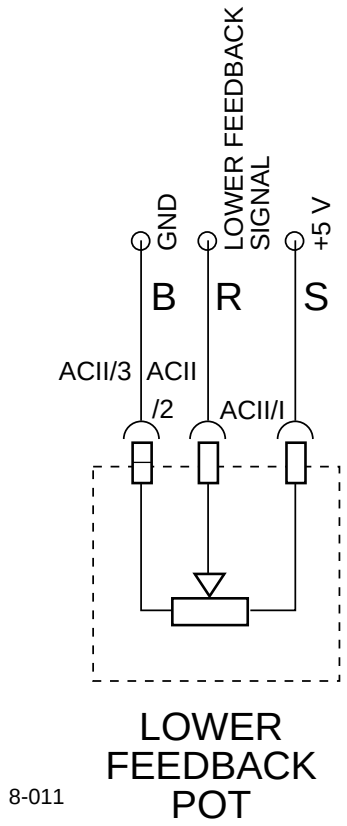
8-010

RH BLOWER

Potentiometers

Lower Feedback Potentiometer

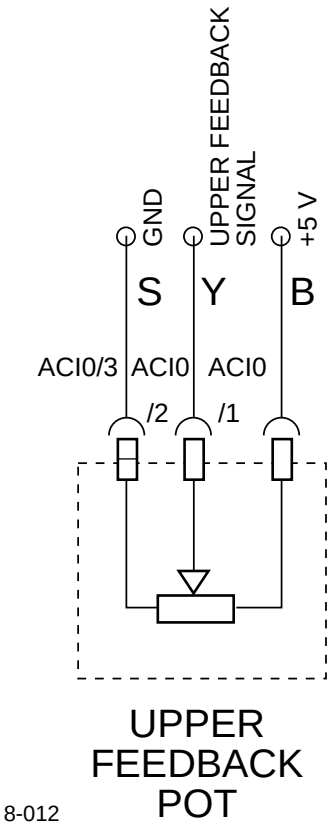
The lower feedback potentiometer senses the position of the lower blend flap in the air conditioning unit and feeds this information back to the ACCM. The ACCM is thereby able to command the lower flap servo motor to move the flap to a new position and maintain the desired air temperature to the lower A/C outlets.



The potentiometer is supplied with +5V from pin 4/13 of the ACCM and returns its feedback signal via pin 3/14. The feedback signal is 100mV (COLD AIR) to 1.2V (HOT AIR). The potentiometer provides a feedback signal of 2.9V when the blend flap is in DEFROST. In this position, the lower outlets are closed and all air is directed to the screen.

Upper Feedback Potentiometer

The upper feedback potentiometer senses the position of the upper blend flap in the air conditioning unit and feeds this information to the ACCM enabling it to command the upper flap servo motor to move the flap to a new position and maintain the desired temperature of the air from the dashboard, centre, screen and side demist vents.

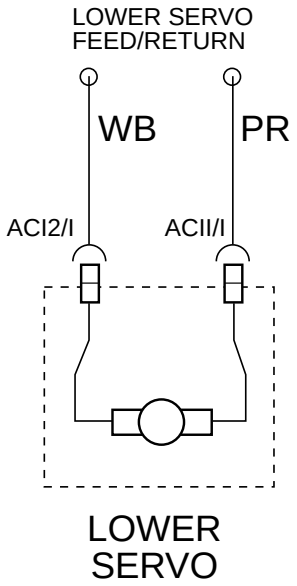


The potentiometer is supplied with +5V from pin 4/13 of the ACCM and returns its feedback signal via pin 3/15. The feedback signal is 100mV (COLD AIR) to 1.9V (HOT AIR).

Servo Motors

Lower Servo Motor

The lower blend flap assembly has two inlets and a single outlet which are wholly or partially blocked by the flap to control the temperature of air entering the lower half of the vehicle.



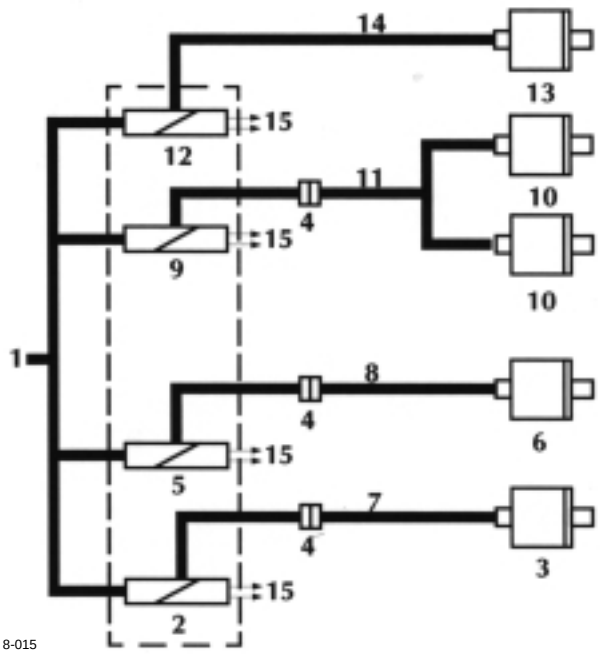
8-013

A servo motor drives the lower blend flap to the desired position via a 1500:1 reduction gear box. The motor is bidirectional and energised from pins 7 and 11 of the ACCM. The servo motor runs at high speed for major flap movements when 7.0 - 9.5 volts is applied. As the final flap position is approached, the motor voltage is reduced to 0.0 - 2.0 volts.

Upper Servo Motor

The upper servo motor drives the upper blend flap to the desired position through a 1500:1 reduction gearbox. Like the lower servo motor it is bi-directional and is energised from pins 10 and 12 of the ACCM. The motor runs at high speed for major flap movements when 7.0 - 9.5 volts is applied. As the final flap position is approached, the motor voltage is reduced to 0.0 - 2.0 volts.

Vacuum System



8-015

Key to Illustration

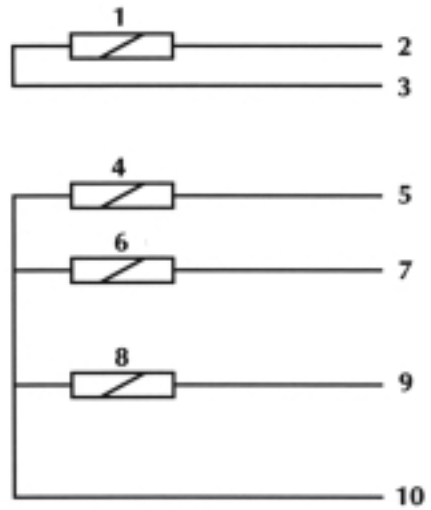
1. Vacuum reservoir
2. Defrost solenoid
3. Defrost-demist actuator
4. Restrictors
5. Centre vent solenoid
6. Centre vent actuator
7. Defrost vacuum pipe
8. Centre vent vacuum pipe
9. Recirc. solenoid
10. Recirc actuator
11. Recirc. vacuum pipe
12. Water valve solenoid
13. Water valve actuator
14. Water valve vacuum pipe
15. Vents to atmosphere

The flaps in the cabin air distribution vents and the water valve in the pipeline from the engine coolant system to the heater matrix are all operated by vacuum actuators. The vacuum for these is supplied by four solenoids mounted in a block beneath the air con unit. Each solenoid and its associated pipe work is identified by a colour:

- Defrost Green
- Auto Re-circulation Blue
- Water valve Red
- Centre vent Black.

The vacuum supply pipes to the re-circulation and centre vent actuators are fitted with restrictors in order to slow down the operation of the flaps and avoid hunting. The re-circulation flaps can take up to 30 seconds to move to a new position.

Vacuum is piped to the solenoids from the right hand throttle body adaptor. The solenoids are energised as required by signals from the ACCM.



8-016

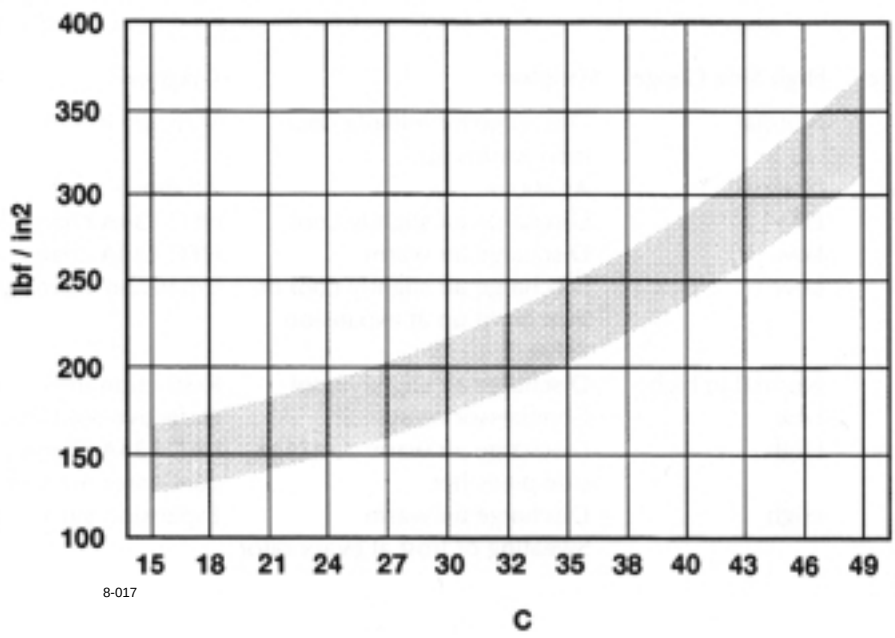
Key to Illustration

1. Defrost (Green) solenoid
2. +12V Defrost input from ACCM pin 2/12
3. Defrost output to ACCM Pin 2/11
4. Recirc (Blue) solenoid
5. +12V Recirc. input from ACCM Pin 2/3
6. Water valve (Red) solenoid
7. +12V Water valve input ACCM Pin 3/2
8. Centre vent (Black) solenoid.
9. +12V Centre vent input ACCM Pin 3/3
10. ACCM earth-ground

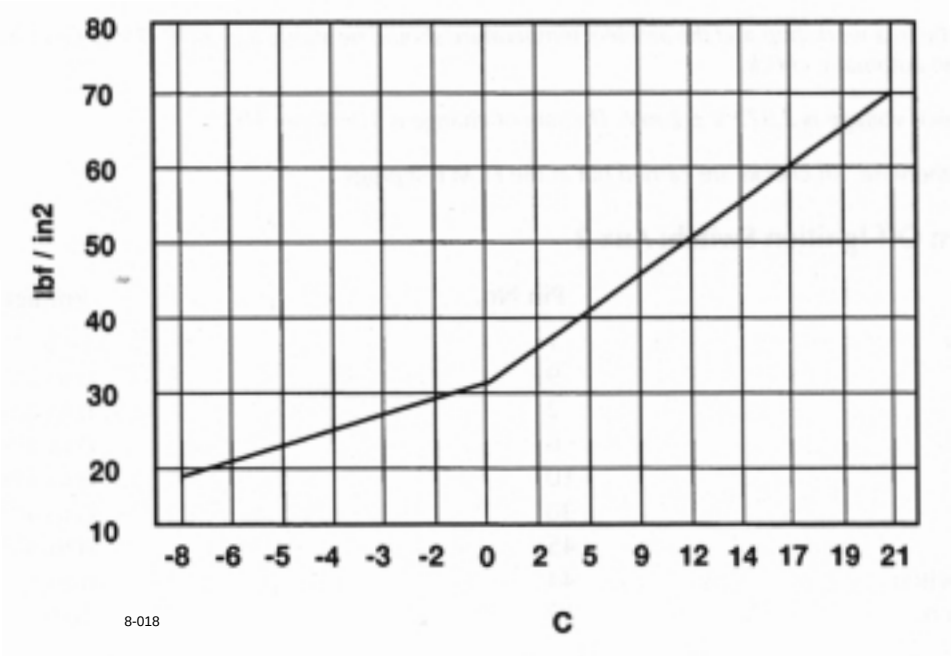
Pressure/Temperature Graphs - Guide

To obtain Bar multiply the lbf/in^2 by 0.068
To obtain kgf/cm^2 multiply lbf/in^2 by 0.07

High Side (lbf/in^2) - Ambient (°C)



Low Side (lbf/in^2) - Ambient (°C)



System Fault Diagnosis

Probable causes of faults can be found by comparing actual system pressures, registered on the manifold gauge set or recovery-recharge-recycle station, and the pressure to temperature relationship graphs found on the previous page. The chart below shows the interpretation that may be made by this difference. The 'Normal' condition is that which is relevant to the prevailing ambient and evaporator temperatures.

Note: If erratic or unusual gauge movements are experienced, check the equipment against a known manifold gauge set.

Low Side Gauge	High Side Gauge	Symptom	Diagnosis
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	HFC 134A charge low
Low	Low	Discharge air warm	HFC 134A charge very low
Low	Low	Discharge air slightly cool or frost build up at expansion valve	Expansion valve stuck closed
Low	Normal to high	Discharge air slightly cool	Restriction in High side of system
High	Low	Compressor noisy	Defective reed valve
High	High	Discharge air warm and high side pipes hot	HFC 134A charge high or condenser malfunction
High	High	Discharge air warm Sweating or frost at evaporator	Expansion valve stuck open

Fault Finding

Caution: The microprocessor is extremely sensitive and should only be tested using a digital multimeter with no less than a 3.5 digit display and a resistance of no less than 2 M ohms. The use of any other form of multimeter will damage the microprocessor irreparably.

Note: Always allow time for the servo motors and blower motors to come to a rest before starting a check.

The car should be in a workshop and the ambient temperature should be stable e.g. 24°C (75°F) for at least 30 minutes before commencing the automatic check.

At 24°C the sensor voltage is 2.972 V ± 2 mV. The rate of change is 10mV per 1°C.

Unless stated otherwise, all checks are carried out at the ACCM test plugs

Fan Switch: Off Mode Switch ECO

Signal	Pin No.	Voltage
Battery supply	2/1	11 to 14V
Recirc input	2/9	0 to 2V
Earth-ground	2/2	0 to 40mV
Earth-ground	2/6	0 to 40mV
Earth-ground	4/8	0 to 40mV
Earth-ground	4/15	0 to 40mV
+12V from control panel	4/14	0 to 12V
+12V to control panel	2/12	10 to 13.3V

Fan Switch: 1 **Mode Switch: MAN**

Fan speed 1 input	2/13	150 to 350mV
Clutch output- Evap sensor below 2.72V	3/5	0.6V
Clutch output- Evap sensor above 2.72V	3/5	11.4V
Fan speed 2 input	2/14	3 to 5V
Fan speed 3 input	2/15	3 to 5V
Defrost	3/12	3 to 5V
+12V from ON-OFF Switch.	4/14	10.3 to 13.3V
+5V Output	4/13	4.73 to 5.2V
Recirculation solenoid	2/3	0 to 200mV
High Speed Fan Relays	3/1	0 to 200mV
Water valve solenoid	3/2	0 to 200mV
Centre vent solenoid	3/3	0 to 200 mV

Fan Switch: 2 **Mode Switch: MAN**

Fan speed 1 input	2/13	3 to 5V
Fan speed 2 input	2/14	150 to 350mV
Fan speed 3 input	2/15	3 to 5V
Fan speed DEF input	3/12	3 to 5V

Fan Switch: 3 **Servo Motors Stationary** **Mode Switch: MAN**

Fan speed 1 input	2/13	3 to 5V
Fan speed 2 input	2/14	3 to 5V
Fan speed 3 input	2/15	150 to 350V
Fan speed DEF input	3/12	3 to 5V

Fan Switch: DEF **Mode Switch: MAN**

Fan speed 1 input	2/13	3 to 5V
Fan speed 2 input	2/14	3 to 5V
Fan speed 3 input	2/15	3 to 5V
Fan speed DEF input	3/12	150 to 350mV

Fan Switch: 1, 2 or 3 **Mode Switch: MAN**

Temperature Differential - cold face	3/13	2.665 to 3.105V
Temperature Differential - hot face	3/13	0 to 200mV

Fan Switch: 1, 2 or 3 **Mode Switch: MAN**

Temperature Demand - Max	4/5	4.75 to 5.25V
Temperature Demand - Min	4/5	0 to 200mV

Fan Switch: 1 or 2 **Temperature Demand: Mid-Range** **Mode Switch: AC**

Servo motor lower flap +ve	4/7	0 to 2.0V
Servo motor lower flap -ve	4/11	0 to 2.0V
Servo motor upper flap +ve	4/10	0 to 2.0V
Servo motor upper flap -ve	4/12	0 to 2.0V

Fan Switch: 1, 2 or 3 **Temperature Demand: High** **Mode Switch: AC**

Servo motor lower flap +ve	4/7	7.0 to 9.5V
Servo motor lower flap -ve	4/11	7.0 to 9.5V
Serve motor upper flap +ve	4/10	7.0 to 9.5V
Servo motor upper flap -ve	4/12	7.0 to 9.5V

Fan Switch: 1 or 2	**Temperature Demand Switch: Mid-Range**	**Mode Switch: AC**
Recirc. input	2/9	3 to 5V
Recirc. output	2/3	0 to 500mV
Reference voltage	2/7	2.875 to 2.895V
Defrost output	2/11	0 to 500mV
High speed relays	3/1	0 to 500mV
Lower feedback pot.	3/14	0.6 to 0.9V
Upper feedback pot.	3/15	1.15 to 1.45V
Water temp. switch engine cold	3/6	260 to 460mV
Water temp. switch engine hot	3/6	4.5 to 5.5V
Defrost output	2/11	0 to 500mV
Clutch output- evaporator above 2.745 V	3/5	10.3 to 13.3V
Right hand Blower feedback	4/3	10 to 13V
Left hand Blower feedback	3/7	10 to 13V
Right hand Blower control	4/2	0 to 0.5V
Left hand Blower control	4/1	0 to 0.5V
Water valve solenoid	3/2	0 to 500mV
Centre vent solenoid	3/3	0 to 500mV

Fan Switch: 1 Temperature Demand Switch: Minimum

Face Level to mid-range	3/13	1.43 to 1.45V

Servo Motors Stopped

Servo motor lower flap	4/7	0 to 40mV
Servo motor lower flap	4/11	0 to 40mV
Servo motor upper flap	4/10	0 to 40mV
Servo motor upper flap	4/12	0 to 40mV
Lower feedback pot.	3/14	0 to 0.2V
Upper feedback pot.	3/15	0 to 0.2V

Fan Switch: 1 Temperature Demand Switch: Mid-Position

Temperature demand	4/5	1.43 to 1.45V

Servo Motors Stopped

Servo motor lower flap	4/7	0 to 40mV
Servo motor lower flap	4/11	0 to 40mV
Servo motor upper flap	4/10	0 to 40mV
Servo motor upper flap	4/12	0 to 40mV
Lower feedback pot.	3/14	0.57 to 0.87V
Upper feedback pot.	3/15	0.6 to 0.9V

Fan Switch: 1 Temperature Demand Switch: Maximum

Temp demand	4/5	2.665 to 3.105V
Lower flap feedback pot	3/14	0.979 to 1.279V
Upper flap feedback pot.	3/15	1.518 to 1.9V

Fan Switch: 1 Face Level Temperature Control: Maximum Cold

Differential temp.	3/13	2.665 to 3.105V
Lower flap feedback pot.	3/14	0.979 to 1.279V
Upper flap feedback pot.	3/15	1.340 to 1.640V

Blower Motor Test

Face Level Temperature Control: to Hot Face **Temperature Demand Switch: Minimum**

Differential temp.	3/13	0 to 200mV
Temperature demand	4/5	0 to 200mV

Note: Allow the servo motors to come to rest before checking voltage levels. Typical figures are given in brackets.

Fan Switch	RH Control	LH Control	RH Feedback	LH Feedback
Position	**Pin No. 4/2**	**Pin No. 4/1**	**Pin No. 4/3**	**Pin No. 3/7**
1	1 - 2V (1.77V)	1 - 2V (1.77V)	4 - 6V (5.8V)	4 - 6V (5.63V)
2	2 - 3V (2.28V)	2 - 3V (2.27V)	3 - 5V (3.7V)	3 - 5V (3.4V)
3	1 - 2v (1.17V)	1 - 2V (1.19V)	1 - 2V (1.22V)	1 - 2V (1.27V)

Set Face Differential Pot. to Mid Point

Fan Switch	RH Control	LH Control	RH Feedback	LH Feedback
Position	**Pin No. 4/2**	**Pin No. 4/1**	**Pin No. 4/3**	**Pin No. 3/7**
1	1 - 2V (1.24V)	1 - 2V (1.27V)	6.5 - 9V (8.7V)	6.5 - 9V (8.7V)
2	1 - 2V (1.4V)	1 - 2V (1.4V)	6.9 - 9V (7.5V)	6.5 - 9V (7.5V)
3	2 - 3V (2.2V)	2 - 3V (2.2V)	3 - 5V (4.1V)	3 -5V (4.0V)

Set Face Differential Pot. to Cold Face

Fan Switch	RH Control	LH Control	RH Feedback	LH Feedback
Position	**Pin No. 4/2**	**Pin No. 4/1**	**Pin No. 4/3**	**Pin No. 3/7**
1	1 - 2V(1.67V)	1 - 2V(1.63V)	6.5 - 9V(6.25)	6.5 - 9V(6. IV)
2	2 - 3V(2.17)	2 - 3V(2.1V)	3 - 5V(4.25V)	3 - 5V(4.2V)
3	2 - 3V(2.3V)	2 - 3V(2.2V)	3 - 5V (3.7V)	3 - 5V(3.SV)

Open Water Temperature Switch Leads

Set Temperature Demand Switch to Midpoint **Pin No. 4/5 1.43 -1.45V**

RH Servo control	Pin 4/2	0 - 0.5V
LH Servo control	Pin 4/1	0 - 0.5V

Short Water Temperature Switch Leads

Fan Switch: 1

Clutch output	Pin 3/5	9.3 - 12.3V
RH Servo control	Pin 4/2	1 - 2V
LH Servo control	Pin 4/1	1 - 2V
Set diff to hot face	Pin 3/13	0 - 200mV
Set temp demand to minimum	Pin 4/5	0 - 200mV
Recirc. output	Pin 2/3	9.3 - 12.3V
High speed relays	Pin 3/1	0 - 200mV
Water valve solenoid	Pin 3/2	9.3 - 12.3V
Centre vent solenoid	Pin 3/3	9.3 - 12.3V
Defrost output	Pin 3/12	0 - 500mV
Fan Switch: to DEFROST	Pin 3/12	150 - 350mV
High speed relays	Pin 3/1	9.3-12.3V
Lower feedback pot.	Pin 3/14	2.709-3.100V
Upper feedback pot.	Pin 3/15	1.714 -2.014V
MODE SWITCH: OFF	Pin 4/14	0-IV
Recirc. output	Pin 2/3	9.3-12.3V

Refrigeration

Safety Precautions

The air conditioning system is designed to use only Refrigerant E134A (dichlorodifluoromethane). Extreme care must be taken NOT to use a methylchloride refrigerant. The chemical reaction between methylchloride and the aluminium parts of the compressor results in the formation of products which burn spontaneously on exposure to air, or decompose with violence in the presence of moisture.

WARNING: Take care when handling refrigerant. Serious damage will occur if it is allowed to come into contact with the eyes. Always wear with goggles and gloves when working with refrigerant.

First Aid

If refrigerant should come into contact with the eyes or skin, splash the eyes or affected area with cold water for several minutes. DO NOT RUB. As soon as possible thereafter, obtain treatment from a Doctor or an eye specialist.

Good Practice

1. Protective sealing plugs must be fitted to all disconnected pipes and units.
2. The protective sealing plugs must remain in position on all replacement components and pipes until immediately before assembly.
3. Any part arriving for assembly without sealing plugs in position must be returned to the supplier as defective.
4. It is essential that a second backing spanner is always used when tightening or loosening all joints.

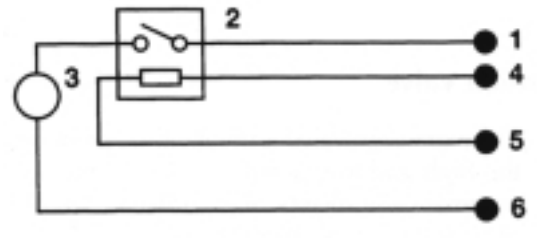
   This minimises distortion or strain on components or connecting hoses.
5. Components must not be lifted by connecting pipes, hoses or capillary tubes.
6. Care must be taken not to damage fins on the condenser or evaporator matrices. Any damage must be rectified by the use of fin combs.
7. Before assembly of tube and hose joints, use a small amount of clean new refrigerant oil on the sealing seat.
8. Refrigerant oil for any purpose must be kept very clean and capped at all times. This prevents the oil absorbing moisture.
9. Before assembly the condition of joints and flares must be examined. Dirt and even minor damage will cause leaks at the high pressure points encountered in the system.
10. Dirty end fitting can only be cleaned using a cloth wetted with alcohol.
11. After removing sealing plugs and immediately before assembly, visually check the bore of pipes and components. Where any dirt or moisture is discovered, the part must be rejected.
12. All components must be allowed to reach room temperature before sealing plugs are removed.

    This prevents condensation should the component be cold initially.
13. Before finally tightening hose connections ensure that the hose lies in the correct position, is not kinked or twisted and will not be trapped by subsequent operations, e.g., refitting or closing bonnet.
14. Check that hoses are correctly fitted in clips or straps.
15. The compressor must be stored horizontally with the sump down. It must not be rotated before fitting and charging. Do not remove the shipping plate until immediately before assembly. Always use new “O” ring seals in those joints that incorporate them. “O” ring seals should be coated with compressor oil before fitting.
16. Components or hoses removed must be sealed immediately after removal.
17. After the system has been opened the receiver-drier must be renewed.
18. Before testing, run the engine until normal running temperature is reached. This ensures that sufficient vacuum is available for test. For cooling tests the engine must be running for the compressor clutch to operate.

Compressor

Compressor Clutch Control

The compressor pulley is driven continuously when the engine is running. An electromagnetic clutch allows the compressor to be engaged or disengaged. The clutch is energised by battery supply voltage when the clutch relay is closed by a signal from the Powertrain Control Module (pin 69).



8-019

Key to Illustration

1. +12V battery supply
2. Air Con Clutch relay
3. Compressor clutch
4. PCM Pin 69 ground supply to air con clutch
5. +12V Ignition supply
6. Ground

Trinary Switch

High Side Low Pressure Switch

The high side low pressure switch (HSLP) is connected to the ACCS input to pin 41 of the PCM. The switch checks for low pressure on the high side of the refrigeration system.

If the pressure drops below 2 bar (approx 30 psi) the contacts open. The PCM de-energises the clutch coil and disengages the compressor clutch.

Low pressure occurs when there is serious refrigerant loss. This can occur either when there is a leak in the system, or when there is a blockage upstream of the trinary switch.

High Side High Pressure Switch

The high side high pressure switch (HSHP) is connected to the same ACCS input to pin 41 of the PCM. The switch checks for high pressure on the high side of the refrigeration system.

If the pressure rises above 30 bar (approx 450 psi) the contacts open. The PCM de-energises the clutch coil and disengages the compressor clutch.

High pressure occurs when the system has been charged with excess refrigerant or when there is a blockage downstream of the trinary switch.

Air Conditioning Pressure Switch

The third function of the trinary switch is to control the engine cooling fans. If the system pressure rises above 20 bar, this switch closes. A ground will then be applied to the PCM pin 86 (ACPSW).The PCM will switch on the engine cooling fans at high speed to provide additional cooling for the air conditioning condenser.

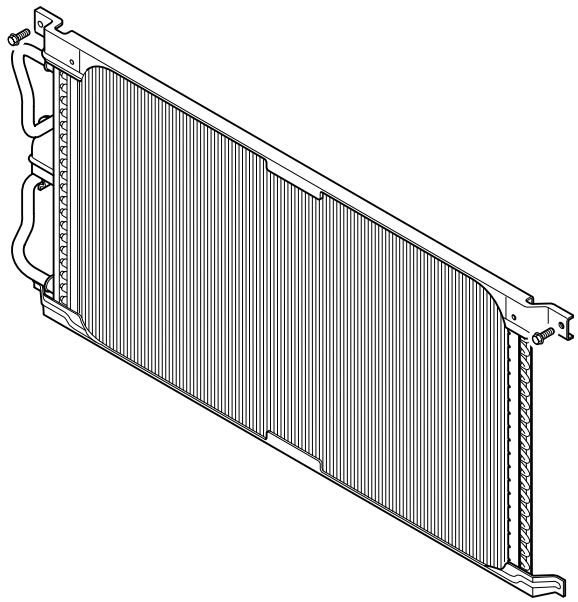
Trinary switch circuit from sheet 22

Key to Illustration

1. Clutch relay supply
2. Compressor clutch
3. HSLP switch
4. Protection diode
5. Earth-ground

Condenser

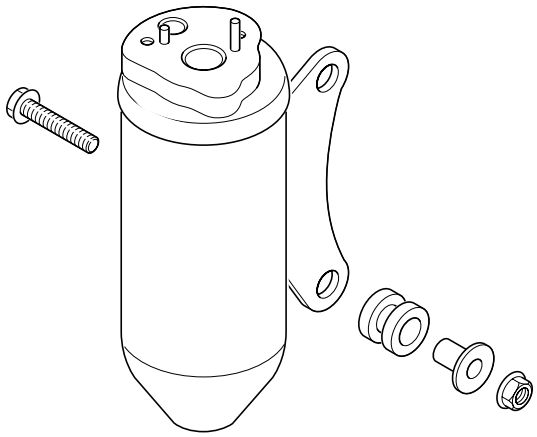
The condenser consists of a parallel flow radiator mounted directly in front of the car radiator and receives the full flow of ram air induced by the forward motion of the car and the suction of the cooling fan. Refrigerant enters the condenser as a high pressure hot vapour. As the vapour passes through the condenser heat is transferred to the outside air and the refrigerant changes to a high pressure warm liquid.



8-021

Receiver-Drier

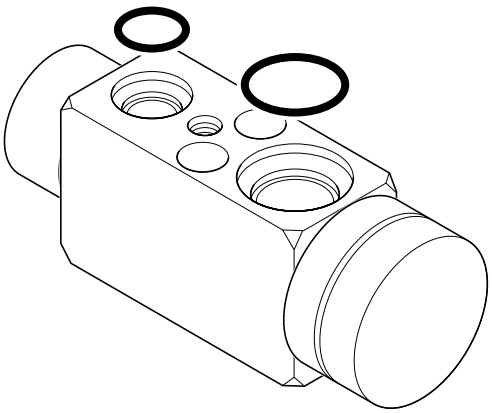
The receiver drier accepts refrigerant liquid from the condenser and delivers it via an expansion valve to the evaporator. The receiver drier contains a quantity of molecular sieve desiccant to remove moisture from the refrigerant, and a filter to remove contaminants. It also a provides a reservoir of refrigerant for the evaporator under varying operating conditions.



8-022

Expansion Valve

The expansion valve is the dividing point between the high and low pressure sides of the system. It automatically meters high pressure liquid refrigerant via a metering orifice into the low pressure, cold side of the evaporator matrix. The valve senses engine compartment temperature, and regulates the flow of refrigerant into the evaporator to ensure that only vaporised refrigerant appears at the outlet.

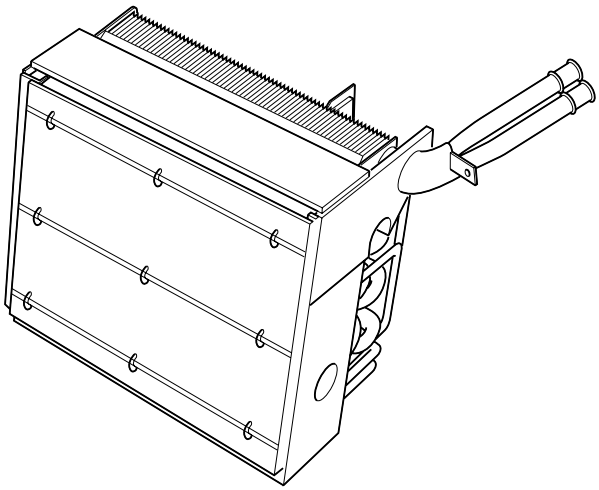


8-023

Evaporator

The evaporator consists of a refrigerant coil mounted in a series of thin fins to provide a maximum amount of heat transfer in a minimum amount of space. It is housed in the air conditioning unit and all air entering the system passes across its coil.

The evaporator receives refrigerant from the expansion valve as a low pressure atomised liquid. As this cold liquid passes through the evaporator coils, it absorbs heat from the surrounding air and changes into a low pressure vapour.



8-024

Visteon Compressor FS-10

The Visteon FS-10 compressor is a 10 cylinder machine (5 double acting pistons) with a displacement of 154cc (9.4 cubic inches) per rev.

The compressor is driven from the engine crankshaft via the polyvee drive belt and the compressor clutch.

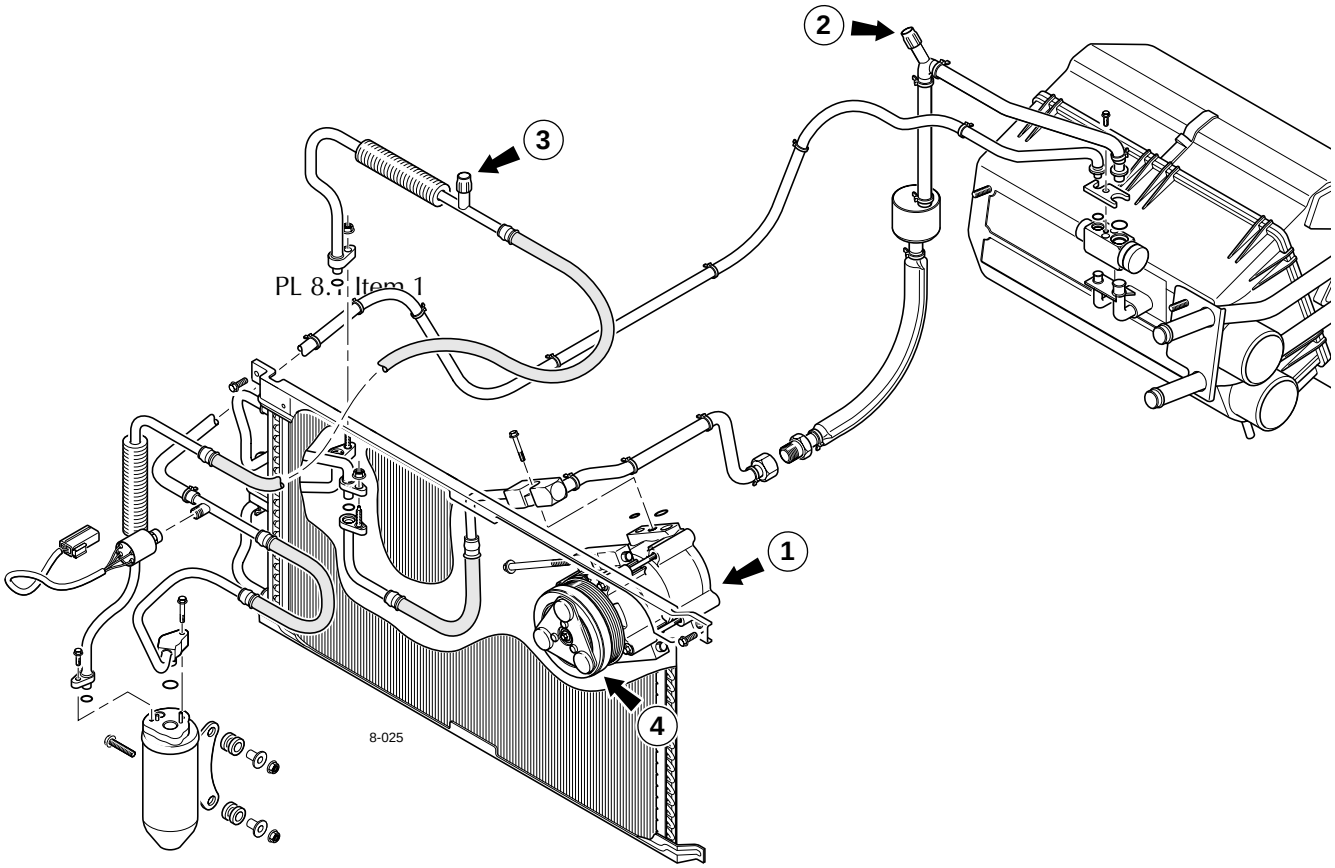
The compressor is initially charged with 207 cc (7.0 fluid oz) of Ford YN-12-c oil. Only this oil or one of equivalent specification should be used.

Key to Fig. Illustration

1. Compressor
2. Low side service port
3. High side service port
4. A/C compressor clutch

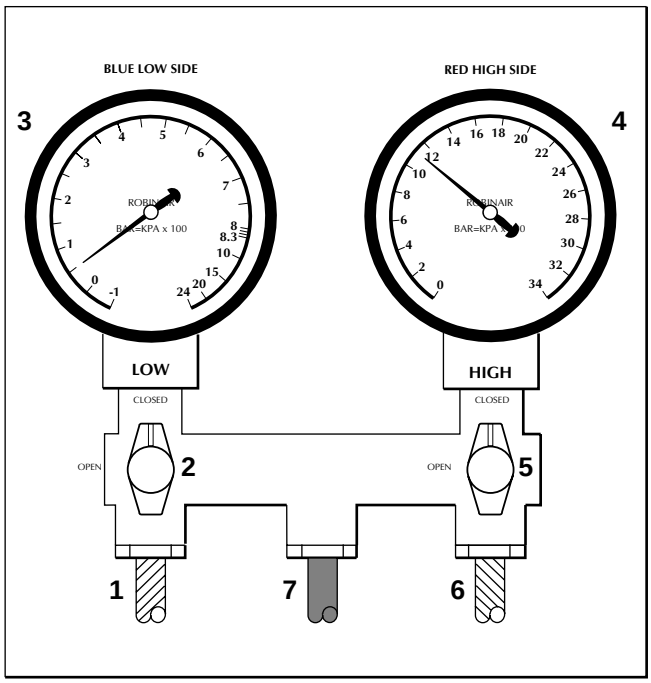
Compressor Oil

Ford YN-12-c or F2A2-19577-AC



Manifold Gauge Set

The manifold gauge set is a most important tool for fault diagnosis and system efficiency assessment. The relationship to each other of HIGH and LOW pressures and their correlation to AMBIENT and EVAPORATOR temperatures must be compared to determine system status. 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.



8-026

The gauge set above consists of a manifold fitted with:

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 COLOUR (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 centre (service) hose.

Low Side Pressure Gauge.

This compound gauge is designed to register positive and negative pressure and may be calibrated as follows:

- Full Scale Deflection - 0 to 24 bar pressure in a clockwise direction
- 0 to 1 bar FSD negative pressure in a counter clockwise direction.

High Side Pressure Gauge.

This pressure gauge may be calibrated from 0 to 34 bar 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

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.

Assessment of the system's operating system can be carried out by using the facilities of the Recovery-Recharging-Recycling station. Follow the manufacturer's instructions carefully and closely observe the safety procedures.

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.

Stabilising the System

Accurate test gauge data can be attained only if the system temperatures and pressures are stabilised.

Ensure that equipment and its hoses cannot come into contact with moving parts or heat sources.

It is recommended that a free standing air mover is placed in front of the vehicle to provide mass air flow through the condenser-cooling system.

Checking Procedure

1. Start the engine and allow it to attain normal working temperature then set it at fast idle (typically 1200 to 1500 rpm).
2. Select full air conditioning performance.
3. With all temperatures and pressures stable or displaying symptoms of faults, begin relevant test procedures.

Connecting the Gauge Set.

A test hose connected to the fitting directly under the low side gauge is used to connect the low side of the test manifold into the low side of the system, and a similar connection is found on the high side. When connecting the gauge manifold set to the air conditioning system an access valve core removing tool is available for connecting the test hoses to the high and low sides of the system.

Using the valve removing tool it enables the valve core to be removed and held back inside the tool eliminating restrictions and, thereby, providing a full flow of refrigerant.

WARNING: Do not open the high side hand valve while the air conditioning system is in operation because, high pressure refrigerant will be forced through the high side gauge and to the refrigerant container, if it is attached. This could cause the container to rupture or the fitting at the safety container valve to burst resulting in damage and personal injury.

1. With the engine switched off, remove the protective caps from the service ports.
2. Fit the high and low side hoses and valve extractors from the manifold gauge set to the high and low service ports. Ensure that both the manifold hand valves are in the closed position.
3. Using the access valve removal tool loosen and screw out the valve cores.

Purging the Test Hoses

1. With the manifold test set attached to the system.

2. Purge the high pressure test hose by cracking open the high pressure side hand valve on the manifold gauge set for 3 to 5 seconds. This allows the system refrigerant to purge the air from the test hose and discharge through the manifold centre test hose. Immediately close the high pressure side hand valve.

3. Purge the low pressure test hose in the same manner by cracking open the low pressure side hand valve manifold gauge set for 3 to 5 seconds, then close the hand valve.

Stabilising the System

The manifold gauge set is now attached to the system and the test hoses purged of air. With both hand valves closed, the system must be operated for a few minutes to stabilise all pressures and temperatures throughout the system in order to obtain accurate test gauge readings.

Proceed as follows:

1. Place all test hoses, gauge set and other equipment away from all engine moving parts. Also keep the hoses from touching the hot engine manifold.

2. Start the engine and adjust engine speed to fast idle

3. Turn on the air conditioning and set for maximum cooling with blower fans on high speed

4. Open the car doors and/or windows (to quickly eliminate car interior heat).

5. Operate the system under these conditions for 5 to 10 minutes to stabilise the system ready for testing.

6. Check the system for full refrigerant by noting the sight glass indications. Some refrigerant loss occurs over a period of time.

Note: The air conditioning system must contain a full refrigerant charge before an accurate system check can be made. An insufficient charge is indicated by a stream of bubbles or foam. If the refrigerant charge is low, the system must be fully discharged into a refrigerant recovery station and recharged with the correct weight of refrigerant 82.30.08. Do not top up a system with refrigerant.

Leak Test

A high proportion of all air conditioning work consists of locating and repairing leaks.

Many leaks are located at connections and are caused by vibration. They may only require the re-tightening of a connection or clamp.

Occasionally a hose rubs on a structural part of the vehicle and creates a leak, or a hose deteriorates which will require a replacement.

The specified maximum leakage rate at each fitting is 0.5 kg of R 134a in 40 years and a leak detector capable of operating to this accuracy must be provided. To check place the leak detector probe at the lowest point of each joint, pause for two seconds. Do not wave the probe about as refrigerant is heavier than air and flows to the lowest point. If a leak is greater than 0-5 kg in forty years is detected identify the leak point for rectification.

Check that the leaking fitting has been tightened to the correct torque. If the torque is low, rectify and repeat leak test. If the torque is satisfactory, depressurise the system, dismantle the leaking connection and check the quality of the fitting.

If the fitting is satisfactory, clean and reassemble after applying a thin film of refrigerant to the seat of a flare fitting, or a new oiled “O” ring to an “O” ring fitting.

Tighten to the correct torque.

Charge the system with 200 g of E134A and leak test the rectified system. If the system is satisfactory, depressurise, evacuate and recharge the system.

If the system is unsatisfactory, i.e. leakage greater than 0.5 kg in forty years, depressurise and replace the leaking assembly.

Pressure Temperature Relationship.

Note: Pressures shown are under exact conditions (see test conditions) and are not necessary true for every car checked. Ambient Temperature is given as the air surrounding the condenser and is taken 5 cm in front of the condenser.

Test Conditions.

Use a large fan to substitute for normal ram air through the condenser. Engine adjusted to fast idle speed.

All conditions equivalent to 30 m.p.h. or 48 km/h.

Ambient Evaporator Temp °C	High Pressure Gauge Reading Ibf/in2	Low Pressure Gauge Reading Ibf/in2	Temp °C
16	95-115	10	-16
18	105-125	12	-14
21	115-125	14	-12
24	130-150	16	-10
27	150-170	18	-8
29	165-185	20	-6
32	175-195	22	-5
35	185-205	24	-4
38	210-230	26	-3
41	230-250	28	-1
43	250-270	30	0
46	265-285	35	2
49	280-310	40	5
		45	9
		50	11
		55	14
		60	17
		65	19
		70	21

Normal ambient temperature range is:-24 to 43°C.

Normal evaporator temperature range is: -12 to 0°C.

Normal running system pressure should be, as follows:

Low side:

1.05 - 2.10 kgf/cm^2 1.034 - 2.06 bar 15 - 30 Ibf/in^2

High side:

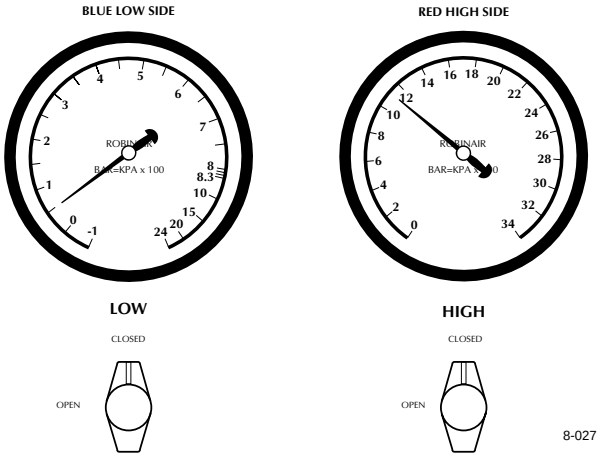
13.00 - 14.40 kgf/cm2 12.75 - 14.34 bar 185 - 205 Ibf/in^2

Manifold Gauge Set Check Procedures

Refrigerant Slightly Low.

Complaint.

Little or no cooling.



Condition.

1. The low side gauge reading is too low.
2. The high side gauge reading is too low.
3. A stream of bubbles evident in the sight glass.
4. The discharge air from the evaporator only slightly cool.

Diagnosis.

The system low on refrigerant due to slight leak.

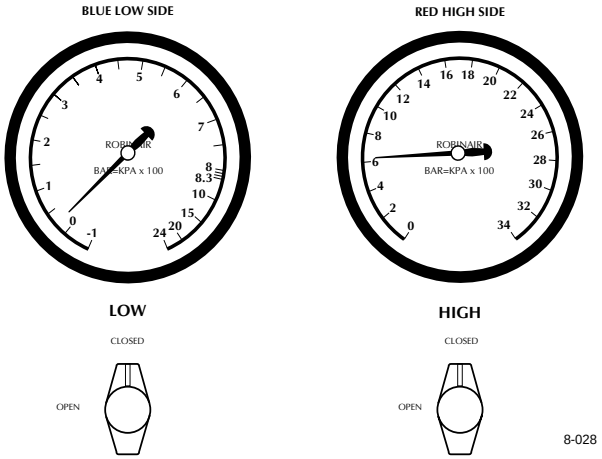
Correction.

1. Test the system for leaks.
2. Depressurise the system.
3. Repair the leaks, and if necessary renew hoses or units.
4. Check the compressor oil level. The system may have lost oil due to leakage.
5. Evacuate the system using a vacuum pump.
6. Recharge the system with new refrigerant.
7. Operate the system and check the performance.

Refrigerant Excessively Low.

Complaint.

Cooling is not adequate.



Condition.

1. The low side gauge is reading very low.
2. The high side gauge reading very low.
3. No bubbles or liquid evident in the sight glass.
4. The discharge air from the evaporator is warm.

Diagnosis.

System refrigerant excessively low. Serious leak indicated.

Correction.

1. Test the system for leaks.

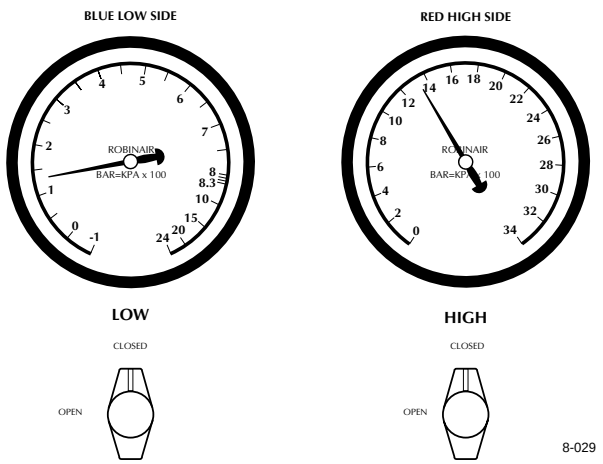
Note: Partially recharge the system before testing the system for leaks to ensure that leak detection is obtained.

2. Depressurise the system.
3. Repair the leaks, and if necessary renew hoses or units.
4. Check the compressor oil level. The system may have lost oil due to leakage.
5. Evacuate the system using a vacuum pump.
6. Recharge the system with new refrigerant.
7. performance.

Air In The System.

Complaint.

Cooling is not adequate.



Condition.

1. The low side gauge reading is constant and does not drop. The pressure should drop until the compressor cycles (thermostat control)
2. The high side gauge reading is slightly high (or slightly lower especially if a large fan is used to substitute ram air).
3. The sight glass is free of bubbles or only shows an occasional bubble.
4. The discharge air from the evaporator is only slightly cool.

Diagnosis.

Non condensables present in the system. Air or moisture present instead of a full refrigerant charge.

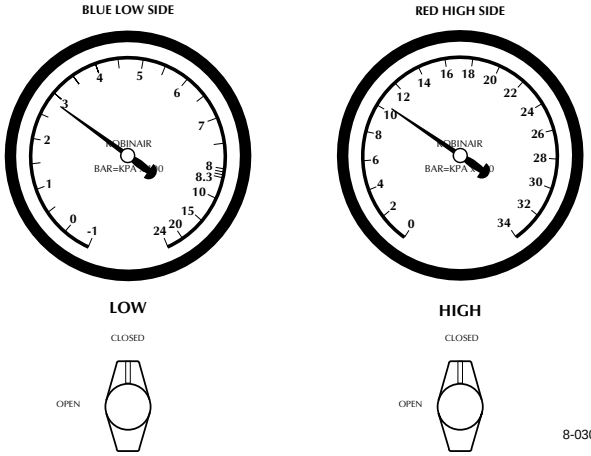
Correction.

1. Test the system for leaks. Test the compressor seal area very carefully.
2. Depressurise the system. Repair the leaks, and if necessary renew hoses or units.
3. Renew the drier bottle, probably water saturated .
5. Check the compressor oil level.
6. Evacuate the system using a vacuum pump.
7. Recharge the system with new refrigerant.
8. Operate the system and check the performance.

Compressor Malfunction

Complaint.

Cooling is not adequate.



Condition

1. The low side gauge reading is too high.
2. The high gauge reading is too low.
3. The sight glass is free of bubbles and the system is fully charged.
4. The discharge air from the evaporator is not sufficiently cool.

Diagnosis.

Internal leak in the compressor.

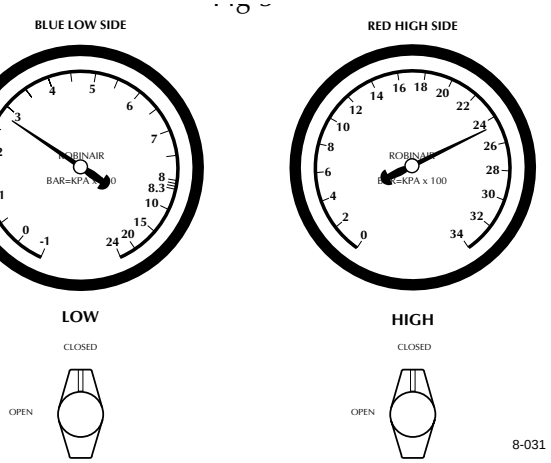
Correction.

1. Depressurise the system.
2. Renew the compressor and the drier bottle.
3. Evacuate the system using a vacuum pump.
4. Charge the system with new refrigerant.
5. Operate the system and check the performance.

Condenser Malfunction or System Overcharge

Complaint.

Little or no cooling. Overheating of the engine may also be noted.



Condition.

1. The low side gauge reading excessively high.
2. The high side gauge reading is also excessively high.
3. Bubbles may appear occasionally in the sight glass and the liquid line to the evaporator is very hot.
4. The discharge air from the evaporator is warm.

Diagnosis.

The condenser not operating correctly through lack of cooling caused by too high a high side pressure. The system may have either a normal or overcharge of refrigerant.

Correction.

1. Check the compressor drive belt for correct tension.
2. Check the condenser for clogged air passages preventing air flow through the condenser.
3. Inspect the condenser mounting for correct radiator clearance.
4. Check for correct fan operation.
5. Check the coolant pressure cap for correct type and operation.

After making the above checks operate the system and check the performance. If the Condition is not rectified.

1. Inspect the system for overcharge of refrigerant and rectify as follows.

   A. Discharge the system, until a stream of bubbles appear in the sight glass and both gauge readings drop to below normal.

   B. Add new refrigerant until the bubbles disappear and the pressures are normal. Then add 0.25 to 0.5 lb. of additional refrigerant.

2. Operate the system and check the performance.

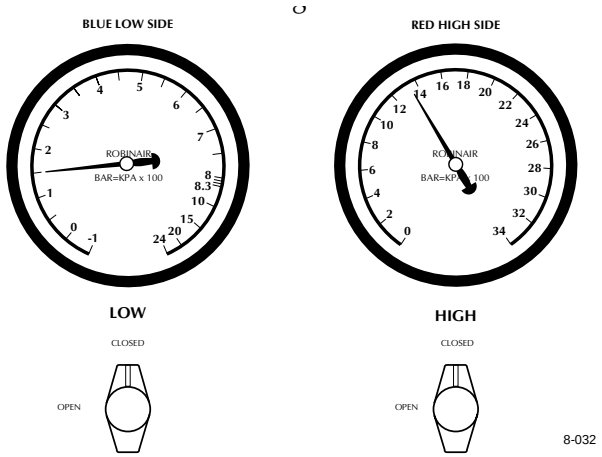
   If the gauge readings are still too high.

3. Depressurise the system.
4. Remove and inspect the condenser for oil clogging. Clean and flush the condenser to ensure the free passage refrigerant or renew the condenser.
5. Renew the receiver-drier.
6. Evacuate the system using a vacuum pump Recharge the system with new refrigerant. Operate the system and check the performance

Moisture in the System

Complaint.

Cooling not adequate during the hot part of the day.



Note: Cooling may be satisfactory during early morning / late evening but inadequate during the hot part of the day.

Condition.

1. The low side gauge reading normal but may drop into vacuum during testing.
2. The high side gauge reading normal but drops when the low side drops into vacuum. The sight glass may show tiny bubbles.
3. The discharge air from the evaporator is cold but becomes warm when the low side gauge drops into vacuum.

Diagnosis.

Excessive moisture in the system.

Desiccant agent saturated with moisture which is released during high temperatures. The moisture collects and freezes in the expansion valve which stops the refrigerant flow.

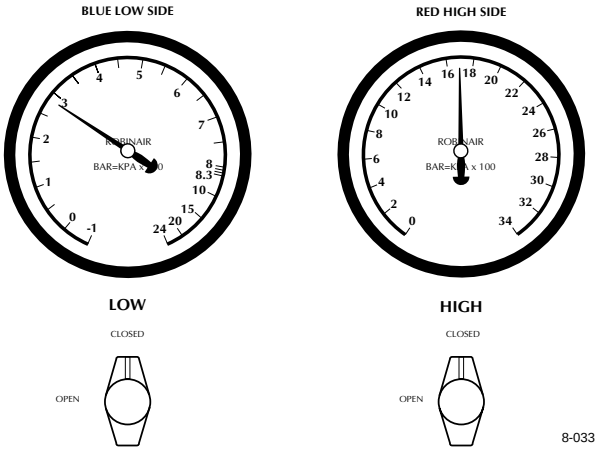
Correction.

1. Depressurise the system.
2. Renew the drier bottle.
3. Evacuate the system using a vacuum pump.
4. Recharge the system with new refrigerant.
5. Operate the system and check the performance.

A Large Amount of Air in the System.

Complaint.

Little or no cooling.



Condition.

The low side gauge reading is too high. The high side gauge reading is too high. An occasional bubble in the sight glass. The discharge air from the evaporator is not cool.

Diagnosis.

Air in the system. The refrigerant contaminated by non-condensables (air and/or moisture).

Correction.

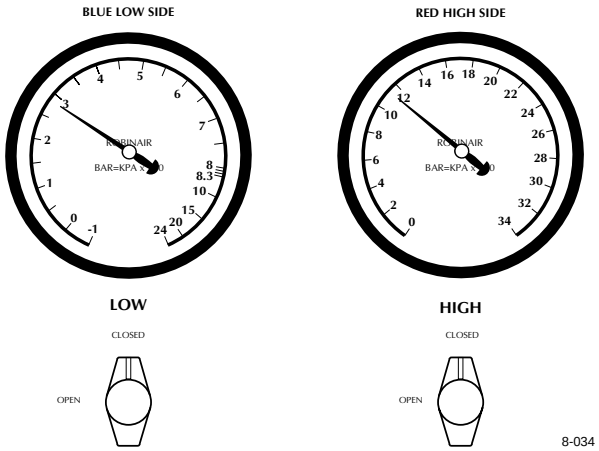
1. Depressurise the system.
2. Renew the receiver-drier.
3. Evacuate the system using a vacuum pump.
4. Recharge the system with new refrigerant.
5. Operate the system and check the performance.

Expansion Valve Malfunction.

The valve stuck open.

Complaint.

Little or no cooling.



Condition.

The low side gauge reading is too high.

The high side gauge reading is normal or slightly low.

The discharge air from the evaporator is warm. The suction hose and the evaporator show signs of heavy sweating.

Diagnosis.

The expansion valve allowing excessive flow of refrigerant through the evaporator coils causing flooding of the coils.

Correction.

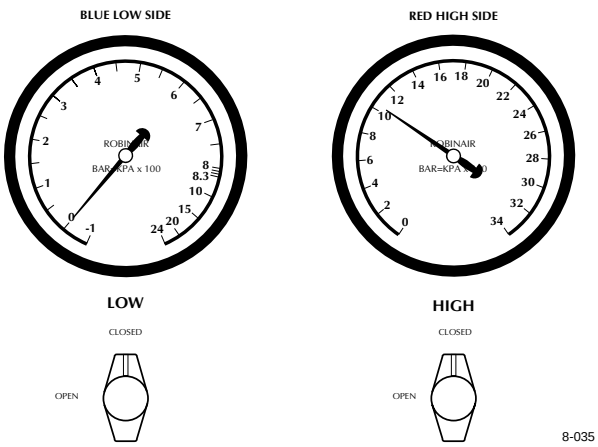
1. Depressurise the system.
2. Renew the expansion valve.
3. Renew the drier bottle.
4. Evacuate the system using a vacuum pump.
5. Recharge the system with new refrigerant.
6. Operate the system and check the performance.

Expansion Valve Malfunction

The valve stuck closed.

Complaint.

Cooling is not adequate.



Condition.

1. The low gauge reading is too low (0 or a vacuum).
2. The high side gauge reading is too low.
3. The discharge air from the evaporator only slightly cool.
4. The expansion valve shows signs of heavy sweating or frost.

Diagnosis.

The expansion valve restricting the refrigerant flow.

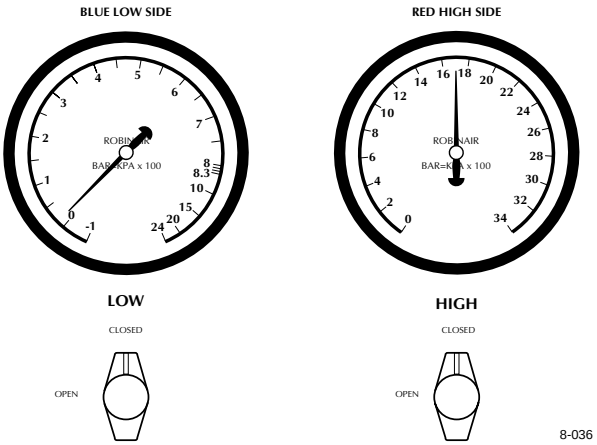
Correction.

1. Depressurise the system.
2. Renew the expansion valve.
3. Renew the drier bottle.
4. Evacuate the system using a vacuum pump.
5. Recharge the system with new refrigerant.
6. Operate the system and check the performance.

Restriction in the High Pressure Side.

Complaint.

Cooling is not adequate.



Condition.

1. The low side gauge reading is low.
2. The high side gauge reading builds up to an excessively high reading.
3. The discharge air only slightly cool.
4. The high pressure liquid hose from the drier bottle to the evaporator is cool to the touch or shows signs of heavy sweating or frost.

Diagnosis.

A restriction in the receiver-drier or the high pressure liquid hose from the drier bottle. Which results in the compressor removing refrigerant from the evaporator faster than it can enter. This results in a starved evaporator.

Correction.

1. Depressurise the system.
2. Renew the drier bottle and/or the high

   pressure liquid hoses or other defective parts.
3. Evacuate the system using a vacuum pump.
4. Recharge the system with new refrigerant.
5. Operate the system and check the performance.

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).

Torque Levels for the Hose Connections

COMPONENT	TORQUE
Evaporator Hose	
Hose to Expansion Valve	32.0 ± 4.0
Hose to Compressor	34.0 ± 2.0
Condenser Hose	
Hose to Compressor	34.0 ± 2.0
Hose to Compressor	25.0 ± 4.0
Condenser Pipe	
Pipe to Drier Bottle	6.0 ± 1.5
Evaporator Pipe	
Pipe to Expansion Valve	16.0 ± 1.5

8.0.02.1 Compressor Oil Level Check

Procedure

Whenever a component has been replaced in the refrigerator system or there is an obvious oil leak, the following procedure should be carried out.

1. If possible, run the compressor for 10 minutes at engine idle speed.
2. Evacuate the system.

Caution: Recover the refrigerant at a slow rate to avoid dragging compressor oil from the system.

3. Remove the compressor from the vehicle.
4. Drain the compressor oil from the high side port of the compressor. Rotate the compressor as necessary to completely drain all oil from the cylinders.
5. Pour the drained oil into a measuring vessel and note the volume.
6. The total system should contain 207 cc (7.0 fl.oz.) of compressor oil. Some of this oil will be distributed around the rest of the system. The following allowance should be made:

   Receiver drier - 28 cc (1 fl oz)
   Condenser - 56 cc (2 fl oz)
   Evaporator - 56 cc (2 fl oz)

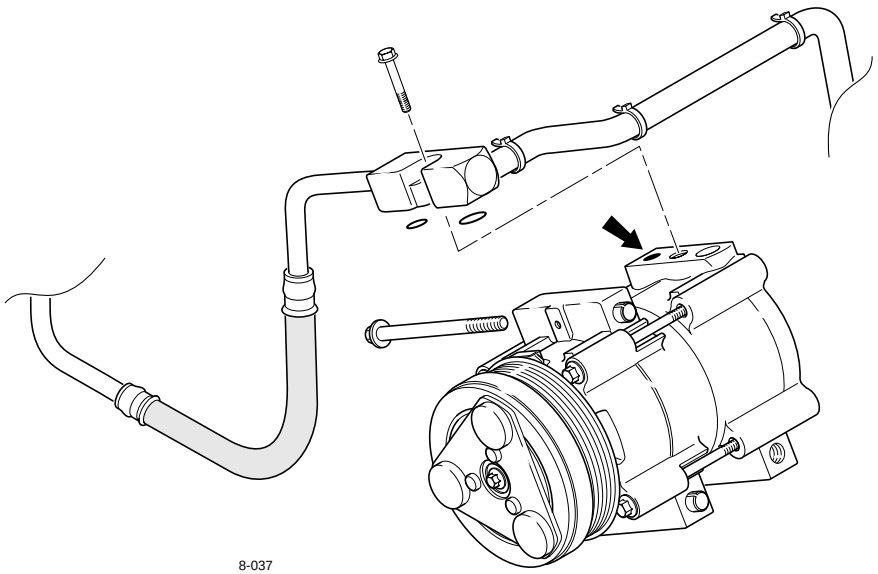
7. Add together the drained volume from the compressor plus the volume allowances for the other system components.
8. Subtract the calculated volume from 207 cc. The result is the deficiency in the total oil content of the system.
9. Add the volume drained from the compressor to the deficiency figure to give the total volume required to refill the compressor and to top up the oil deficiency. Pour this volume into the compressor high port and refit the compressor.

Example

from compressor	50cc
receiver drier - allow	28cc
condenser - allow	56cc
evaporator - allow	56cc
Total oil in system	190
Deficiency = 207 - 190	17cc

Therefore insert 67cc of compressor oil (i.e. 50cc from the compressor plus the 17cc deficiency to bring the system oil content back to 207cc

10. Recharge the system with 950±30 gms of refrigerant.



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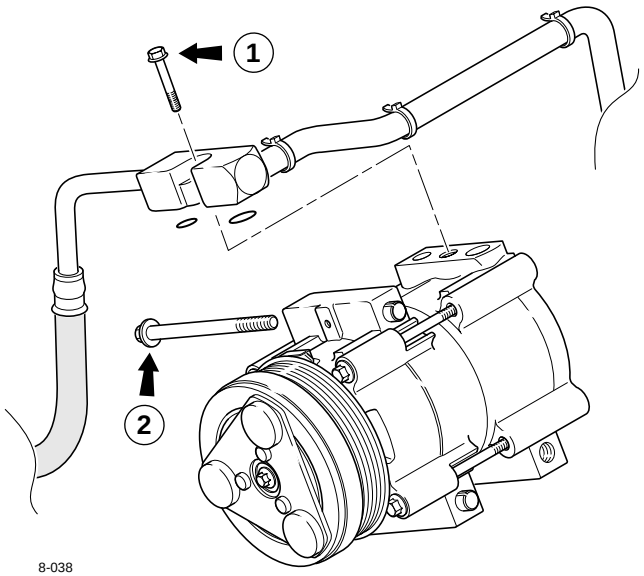
8.1.01.1 Compressor Removal/Renewal

Procedure

1. Depressurise the air conditioning system (8.0.01.1).
2. Remove the tension from the polvee drive belt.
3. Raise the vehicle to working height on a ramp.
4. Disconnect the low and high pressure hoses from the rear of the compressor. Plug the hose ends to prevent the ingress of dirt.



5. Slip the polyvee drive belt from the compressor pulley.
6. Disconnect the compressor multi-plug.
7. Remove four bolts and remove the compressor from the engine.

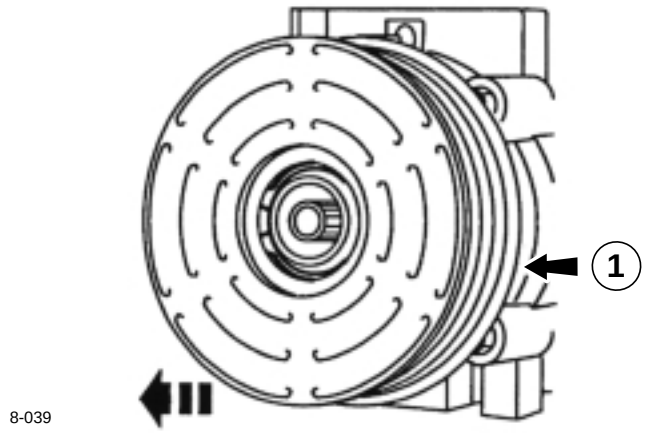
Replacement

1. Complete the compressor oil level check procedure.
2, Refit the compressor using the reverse of the removal procedure. Use new 'O' rings at the refrigerant connections.
3. Recharge the system with 950±30 gms of refrigerant.

8.1.02.1 Clutch Field Coil Renew

Procedure

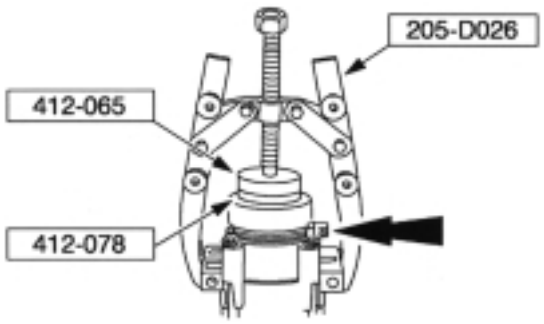
1. Open the bonnet and fit a wing cover.
2. Depressurise the air conditioning system.
3. Remove the compressor. (8.1.01.1)
4. Remove the centre bolt from the compressor drive clutch.
5. Use an M8 x 1.25 mm bolt to draw the clutch from the compressor shaft. Remove the clutch and the hub spacer.
6. Remove the compressor pulley snap ring



7. Remove the clutch pulley from the compressor shaft.
8. Note the position of the field coil connector. Use a two-leg puller remove the clutch field coil.

Replacement

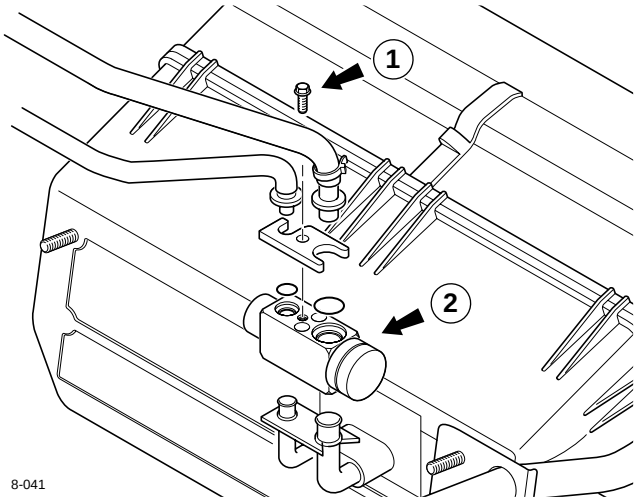
1. Clean the mating face of the compressor with a cloth moistened with an approved cleaning fluid.
2. Position the new field coil on the compressor in the same orientation as the original one. Use the two leg puller as shown to secure the coil on to the compressor body.



3. Route the wire to the compressor and fit the wire clamp, tighten the securing screw.
4. Fit the clutch pulley and secure with the snap ring (bevel side outwards).
5. Fit the compressor drive clutch with one clutch hub spacer.
6. Hold the clutch hub and secure the clutch with one centre bolt.
7. Measure the clutch air gap and adjust if necessary to 0.35 - 0.85 mm (0.014 - 0.033 in) by adding or removing hub spacers.
8. Refit the compressor to the engine.
9. Recharge the system with 950±30 gms of refrigerant.
10. Remove the wing cover and close the bonnet.

8.1.05.1 Expansion Valve Renew

1. Depressurise the air conditioning system.
2. Undo the pipe to expansion valve clamp bolt and retaining plate and disconnect the pipes.

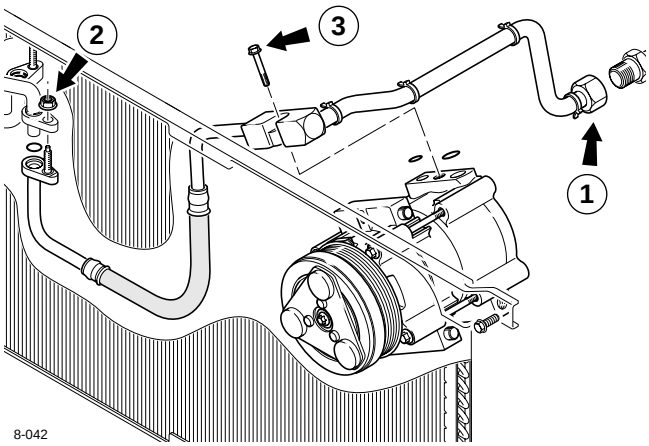


3. Fit blanking plugs to the expansion valve and to the pipes.
4. Reposition the pipes to one side.
5. Unscrew the two torx head retaining screws and remove the expansion valve from the air conditioning unit.
6. Remove and discard the 'O' rings.
7. Fitting a new valve is the reversal of the removal procedure.
8. Ensure new 'O' rings to all union connections are fitted.
9. Evacuate the system.
10. Recharge the system with 950±30 gms of refrigerant.

8.1.06.1 Compressor Hose Assembly - Renew

Procedure

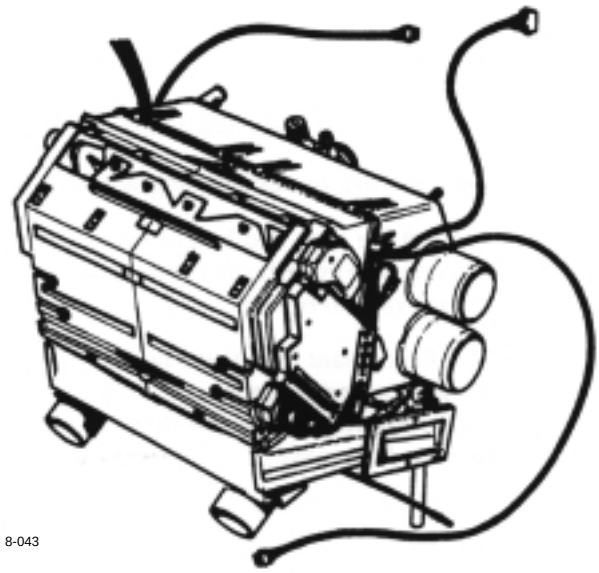
1. Open the bonnet and fit a wing cover.
2. Depressurise the air conditioning system.
3. Disconnect the compressor hose assembly.
   1 Disconnect the pipe to hose connector
   2 Disconnect the hose assembly from the condenser inlet pipe.
   3 Remove the clamp bolt and the hose assembly from the compressor.



4. Fit blanking plugs to the open ends of the system connections if to be left open for some time.
5. Fit the new compressor hose assembly using new seals.
6. Recharge the system with 950±30 gms of refrigerant.
7. Remove the wing cover and close the bonnet.

8.2.01.1 Air Conditioning Unit Renew

1. Disarm and remove the airbags
1. Disconnect the battery earth lead.
2. Drain the engine coolant.
3. Depressurise the air conditioning system.



4. Disconnect the high and low pressure hoses and expansion valve from the air conditioning unit (see expansion valve renewal).
5. Disconnect the coolant hoses to the heater matrix.
6. Remove the following items from inside the car:
   - front seats
   - underscuttle panels/knee bolsters
   - glove box assembly
   - facia trim (walnut trim)
   - radio and ashtray
   - centre console switch panel assembly
   - instrument panel and surround trim
   - steering wheel and column
   - facia assembly complete
   - hoses - distribution box to door vents
   - facia support frame

   Details and drawings of the above operations can be found in the electrical and trim sections.

7. Disconnect the vacuum hoses from the blower motors, water valve and reservoir.

8. Release the electrical harness from the air conditioning unit.

9. Displace and remove the footwell ventilator ducts and hoses (Fig. 1-1).

10. Disconnect the pliable trunking from the unit (Fig. 1-2).

11. Twist and pull out the four air conditioning unit stub pipes (Fig. 1-3)

12. Remove the screws securing the air conditioning unit support stays.

13. Displace the tunnel carpet for access to the lower fixing bolts and remove the stays.

14. Disconnect the condensate drain tubes.

15. Peel off the tape securing the windscreen demist duct to the distribution box (Fig. 1-4).

16. Remove the air conditioning unit to bulkhead securing nuts.

17. Carefully lift out the air conditioning unit complete with the distribution box.

18. Remove the distribution box securing screws and remove the assembly (Fig. 1-5).

19. Reverse the removal procedure to refit the air conditioning unit.

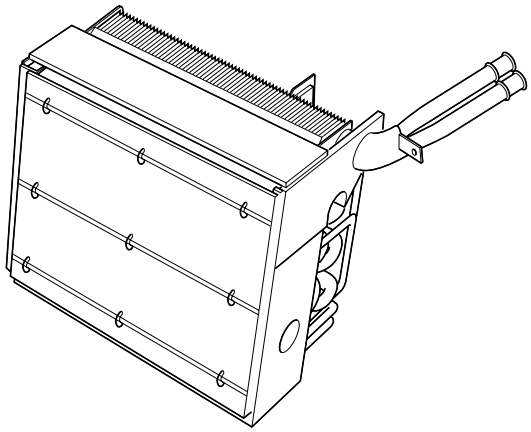
Note: Ensure new 'O' rings are fitted to all air conditioning hose connections.

20. Recharge the system with 950±30 gms of refrigerant.

8.2.02.1 Evaporator Unit Renew

1. Remove the air conditioning unit assembly.

2. Remove the heater pipe guide plate securing screws and remove the guide plate.



8-024

3. Remove the screws securing the evaporator sensor and withdraw the sensor from the evaporator.

4. Remove the screws securing the solenoid mounting plate and displace the mounting plates from the unit.

5. Remove the harness to casing earth bolt and displace the harness.

6. Cut and remove the harness to casing securing ratchet straps and displace the harness from the casing.

7. Displace the vacuum hose from the casing.

8. Displace and remove the casing securing clips.

9. Split the casing and remove the evaporator from the unit.

10. Remove the expansion valve guide securing screws and remove the plate.

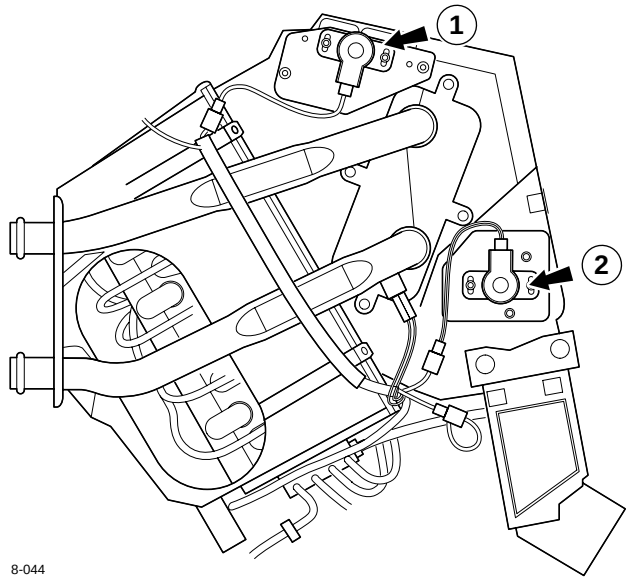
11. Displace and remove the plate from the evaporator.

12. Fitting the new evaporator is the reversal of the removal procedure.

13. Refill the engine cooling system with coolant.

14. Recharge the system with 950±30 gms of refrigerant.

8.2.03.1 Upper Feedback Potentiometer Renew

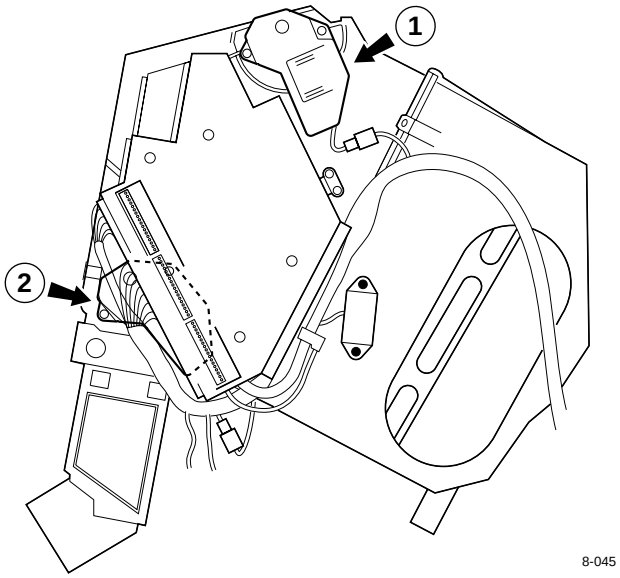


1. Disconnect the battery earth lead.
2. **(On left hand cars)** Remove the instrument pack and surround trim.
2. **(On right hand cars)** Remove the glove box assembly.
3. Remove the securing screws and the potentiometer assembly. Disconnect the electrical connector.
4. Fitting a new potentiometer is the reverse of the removal procedure.

8.2.04.1 Lower Feedback Potentiometer Renew

1. Disconnect the battery earth lead.
2. Un-clip and remove the left hand underscuttle casing.
3. Disconnect the electrical block connector (Fig. 1).
4. Remove the securing screw and the potentiometer assembly.
5. Fitting a new potentiometer is the reversal of the removal procedure.

8.2.05.1 Upper Flap Motor Assembly Renew



1. Disconnect the battery earth lead.
2. Remove the electronic control module.
3. Disconnect the motor block connector.
4. Remove the securing screws and motor assembly (Fig 1).
5. Fitting a new motor is the reverse of the removal procedure.

8.2.06.1 Lower Flap Motor Assembly Renew

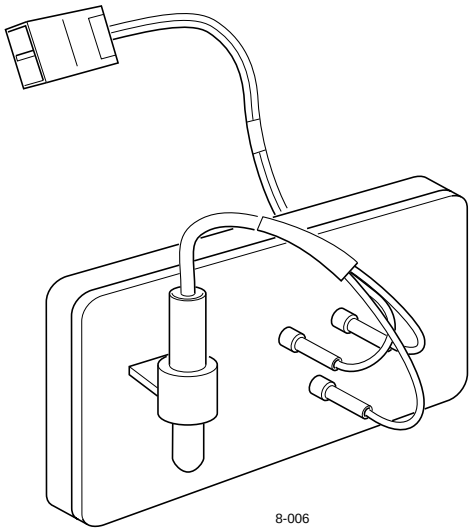
1. Disconnect the battery earth lead.
2. Remove the right hand side underscuttle casing.
3. Remove the electronic control unit.
4. Disconnect the block connector.
5. Remove the screws securing the motor to the air conditioning unit.
6. Displace the 'P' clip.
7. Withdraw and remove the motor from the air conditioning unit .
8. Fitting a new motor is the reversal of the removal procedure.

8.2.07.1 Ambient Temperature Sensor Renew

The ambient temperature sensor is located in the left hand side of the air plenum chamber under the lower windshield panel (above).

Procedure

1. Disconnect the battery earth lead.
2. **(On left hand cars)** Remove the steering wheel (mark the position on the column shaft for re-assembly), instrument pack and surround trim.
2. **(On right hand cars)** Remove the glove box lid and liner.



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3. Disconnect the hose from the distribution box to the side vent outlet. Reposition the hose for access.
4. Disconnect the sensor block connector.

   The sensor has locating clips and is a push fit into the plenum chamber.
5. Lever the sensor free.

8.2.08.1 Blower Motor Driver Side Renew

8.2.09.1 Blower Motor Passenger Side Renew

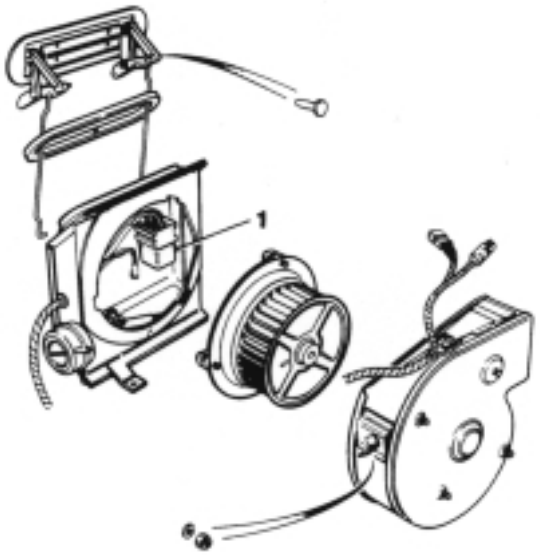
1. Move seat fully rearward.
2. Disconnect vehicle battery ground lead.
3. Remove the under scuttle/knee pad bolster.
4. Remove the lower brace bar/facia assembly underscuttle knee pad.

Driver Side Only

5. Remove the instrument pack, bonnet release handle mounting bracket and steering column..
6. Disconnect the air hose from the facia side air outlet.

Passenger Side Only

7. Remove the glove box lid and liner.



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Both

8. Remove the nuts securing the component panel (Fig. 1-1).

9. Ease the component panel clear for access to the blower assembly mounting bolts.

10. Disconnect the pliable trunking from the stub pipes on either side of the air conditioning unit (Fig. 1-3).

11. Disconnect the blower motor electrical harness at the block connector.

12. Disconnect the vacuum pipe from the flap actuator (Fig. 1-4).

13. Open the re-circulation flap in the base of the blower assembly and fit a wedge to retain it in the open position (Fig. 1-5).

14. Remove the bolts securing the blower assembly and ease the blower unit from its location (Fig. 1-6).

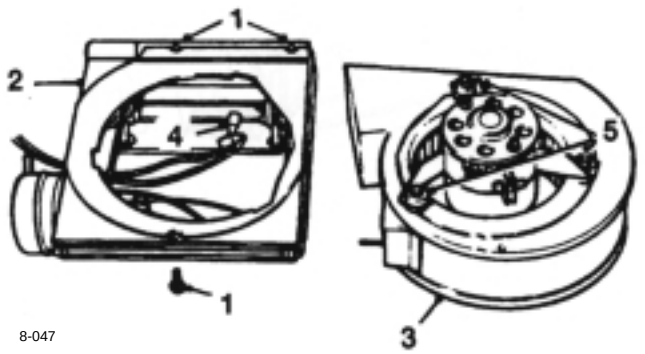
15. Remove the tape securing the ducting to the assembly and remove the ducting (Fig. 1-7).

Note: To remove the blower motor assembly from the vehicle, the lower flap must be opened to allow the upper flap to disengage from the upper body aperture.

8.2.10.1 Blower Assembly Driver/ Passenger Side Overhaul

Note: Blower assemblies under warranty must not be dismantled.

1. Remove the three self tapping screws (Fig. 1-1) from the air intake casing.



2. Part the air intake casing (Fig. 1-2) from the motor assembly (Fig. 1-2) and disconnect the electrical connections at the lucar connectors (Fig. 1-4).

Note: Mark the position of the various components with paint or a scriber. This facilitates re-assembly.

3. One lucar connector has a raised projection which matches the aperture in the motor casing to ensure that the connections are replaced correctly and that the rotation of the motor is unaffected.

4. Remove the bolts securing the motor mounting bracket to the fan housing (Fig. 1-5).

5. Remove the motor and fan assembly from the fan housing.

6. Remove the mounting bracket from the motor.

7. Using appropriate Allen key, remove the impellor fan from the spindle.

Re-assembling

1. Refit the fan to the motor and secure it to the spindle.

2. Refit the mounting bracket tot he motor.

3. Locate the fan and mounting assembly into the fan housing.

4. Place the flap box assembly to the fan housing and reconnect the electrical connections.

5. Fit and tighten the screws securing the flap box to the housing.

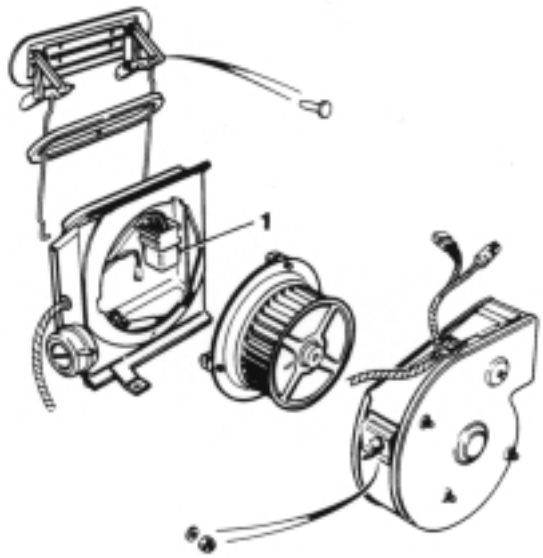
6. Raise the re-circulation flap, fit and tighten the remaining screw.

7. Refit the blower motor assembly.

8. Reconnect the battery earth-ground lead.

8.2.11.1 Blower Motor High Speed Relay Renew

1. Remove the blower motor assembly complete.



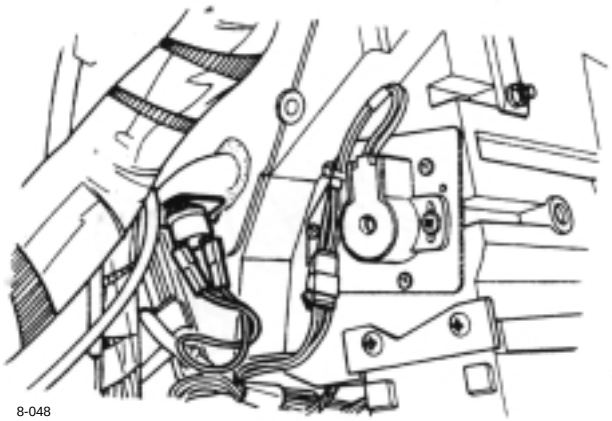
8-046

Figure 1.

2. Open the flap for access.
3. Using a suitable tool remove the relay from the blower assembly (Fig. 1-1).
4. Fit a new relay and refit the blower motor assembly.

8.2.12.1 Water Temperature Switch Renew

1. Disconnect the battery earth lead.
2. Un-clip and remove the left hand underscuttle casing.

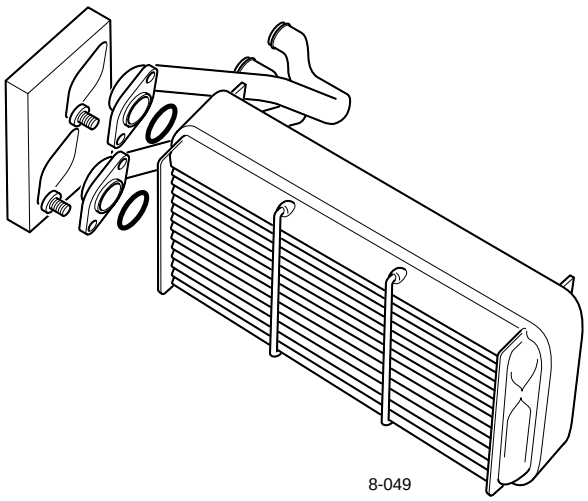


8-048

3. Note and disconnect the feed wires from the switch (Fig. 1-1).
4. Displace and remove the switch from the water pipe.
5. Fitting a new switch is the reversal of the removal procedure.

8.2.13.1 Heater Matrix Renew

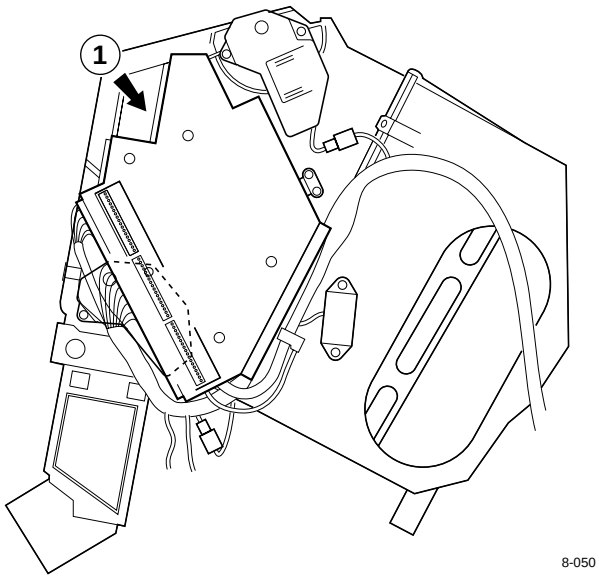
1. Disconnect the battery earth lead.
2. Remove the left hand underscuttle panel.
3. **(On right hand cars)** Remove the glove box assembly.
3. **(On left hand cars)** Remove the instrument pack and surround trim, steering column and mounting bracket.



4. Drain the coolant into a suitable container.
5. Remove the matrix cover panel securing screws.
6. Remove the rear panel, displace the front panel and foam seal for access.
7. Place rag in position.
8. Remove screws securing the feed pipe and disconnect the pipe from the matrix.
9. Remove and discard the gasket.
10. Remove the screws securing the return pipe and disconnect the pipe from the matrix.
11. Remove and discard the gasket.
12. Disconnect the water temperature switch feed wires.
13. Remove the foam pad from the pipes.
14. Remove the front panel from the unit.
15. Undo the heater hose matrix pipe hose clips and disconnect the hoses from the pipes.
16. Reposition the pipes from the matrix.
17. Remove the matrix from the air conditioning unit.
18. Fitting a new matrix is the reversal of the removal procedure.
19. Ensure that new gaskets are fitted.

8.2.14.1 Electronic Control Module Renew

1. Disconnect the battery earth lead.
2. Remove the right hand underscuttle casing.
3. **(On left hand cars)** Remove the glove box assembly.
3. **(On right hand cars)** Remove the instrument pack and surround trim.



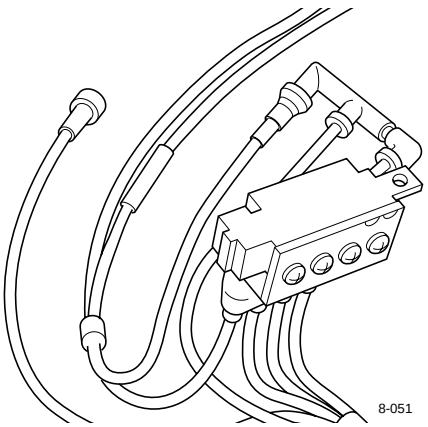
4. Disconnect the earth wire and three block connectors from the control module.
5. Remove the securing screws and module from the air conditioning unit.
6. Fitting a new module is the reversal of the removal procedure.

8.3.01.1 Vacuum System Solenoid Renew

The flaps in the cabin air distribution vents and the water valve in the pipe line from the engine coolant system to the heater matrix are all operated by vacuum actuators. The vacuum for these is supplied by four solenoids mounted in a manifold pack located beneath the air conditioning unit. Failure of a solenoid will require replacement of the manifold pack.

Procedure

1. Disconnect the battery earth lead.
2. Remove the following:
   - glove box and lid
   - facia trim (walnut strip)
   - radio and ashtray
   - centre console switch assembly
   - left hand underscuttle casing/knee bolster
3. Remove the fixings joining the centre console to the facia. This allows the front of the console to be repositioned for access.
4. Disconnect the ducting from the left hand footwell outlet.
5. Remove the two plastic fixings that secure the slotted footwell outlet and slide the outlet out of the unit.



6. Cut the tie strap holding the vacuum lines and electrical harness to the underside of the air conditioning unit.
7. Remove the screws that secure the manifold pack to the underside of the air conditioning unit and slide out the plate complete with the manifold pack.
8. To fit a new manifold pack reverse the steps for the removal.

The Air Conditioning System Diagnostics

The air-conditioning control module (A/CCM) is located at the right end of the air-conditioning unit.

A digital microprocessor within the A/CCM receives data signals from the operator controlled switches. Comparison of these signals with those returned from the system temperature sensor and feedback devices results in the appropriate voltage changes necessary to vary: blower motor speed, flap positions and system solenoids to respond to the drivers selected temperature demand.

The air from the two blower motors is passed through the evaporator matrix which, depending on the A/C mode selected, removes heat from the incoming air. Depending on the position of the two blend flaps, the cold air passes either directly into the vehicle outlet vents, or is passed through the heater matrix to be reheated and then passed to the vehicle outlet vents.

The amount of air passing through the heater matrix is infinitely variable depending on ambient temperature and the temperature selected within the vehicle.

Air Conditioning Diagnostics

Cable Connections to the A/CCM

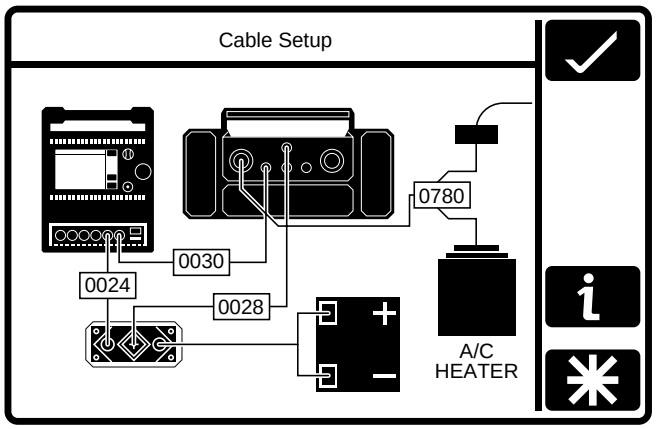


Figure 1. PDU connections to the A/CCM

1. Remove the right side underdash trim panel.
2. Connect the VBA (0024) to the vehicle battery
3. Connect the PDU to the VBA (0024).
4. Connect the VIA to the PDU using the VIA-PDU cable (0030).
5. Connect the AirCon DataLogger harness (0780) between the VIA Channel A and the Air-Conditioning Control Module on the vehicle.

Air Conditioning Signal Monitoring

The following signals can be monitored using the PDU. The abbreviated name of the signal is shown on the PDU display.

Display Name	Full Signal Name
AMBTEMP	Ambient temperature sensor
ARECIP	Auto-Recirculation input
ARECOP	Auto-Recirculation output
AUX+	Auxiliary battery positive
CLUREL	Clutch relay drive output
CVSOL	Centre vent solenoid
DEFSOL	Defrost solenoid
DIFF	Temperature differential
EVSEN	Evaporator sensor
FANDEF	Fanspeed defrost
FANHIG	Fanspeed high
FANLOW	Fanspeed low
FANMED	Fanspeed medium
FIVEV	Five volt supply voltage
FORSERL	Lower servo forward drive
FORSERU	Upper servo forward drive
GND10	Ground voltage
GND2	Ground voltage
GND38	Ground voltage
GND45	Ground voltage
GND6	Ground voltage
HSREL	High speed relay drive
ICSEN	In-Car sensor
LBLOFB	Left blower feedback voltage
LBLOWOP	Left blower output voltage
LSERFB	Lower servo feedback potentiometer
MPROBE	Measurement probe
POWIN+	Switched power input
POWOP+	Power output
RBLOFB	Right blower feedback voltage
RBLOWOP	Right blower output voltage
REF	Reference signal
REVSERL	Lower servo reverse drive
REVSERU	Upper servo reverse drive
TEMPDEM	Temperature demand
USERFB	Upper servo feedback potentiometer
WATSW	Water switch
WATVAL	Water valve

The following signals are supported on the Air-Conditioning Control Module. For each signal, the signal name, mnemonic and background information are detailed.

Ambient Temperature Sensor

(AMBTEMP) A/CCM Pin 34 ref Pin 6

This sensor is located in the right hand blower motor. This signal is used to enable the A/C system to compensate for changes in ambient air temperature. The output to pin 34 is 2.732 volts at 0 degrees Celsius and changes by 0.01 volts for each degree Celsius above or below zero.

Auto-Recirculation Input

(ARECIP) A/CCM Pin 9 ref Pin 6

This is effectively an On/Off switch for the A/C system and forms part of the fan control switch.

Switch Off - Pin 9 should be at ground
Switch On - Pin 9 should be at 10+ volts.

When pin 9 is at ground, pin 3 will be at 10+ volts causing the recirculation flaps to open.

Auto-Recirculation Output

(ARECOP) A/CCM Pin 3 ref Pin 6

This signal will cause the recirculation flaps to close. Operating conditions should be:

A/C Off - 10+ volts at pin 3, flaps open.
Temp demand minimum - 10+ volts at pin 3, flaps open.
Defrost - 0 volts at pin 3, flaps closed.
Temp demand max - 0 volts at pin 3, flaps closed.

Auxiliary Battery Positive

(AUX+) A/CCM Pin 1 ref Vehicle Battery -ve

This signal is the auxiliary supply to the A/CCM. Pin 1 should read battery voltage if the ignition switch is in the auxiliary or ignition on positions. Pin 1 should read 0 volts when the ignition switch is in the Off position or in position III whilst cranking the engine. Loss of this supply will cause total failure of the A/C system.

Clutch Relay Drive Output

(CLUREL) A/CCM Pin 20 ref Pin 6

This signal responds to the input at pin 5 (evaporator sensor). When pin 5 is between 2.715 and 2.725 volts, pin 20 should read below 1 volt, and the compressor clutch will be switched off. When pin 5 is between 2.735 and 2.745 volts, pin 20 will rise to 10+ volts and the compressor will re-engage.

Centre Vent Solenoid

(CVSOL) A/CCM Pin 18 ref Pin 6

The centre vent solenoid controls the operation of the centre vent flap. The centre vent will open to increase the cooling capabilities of the vehicle when cooling is selected. In all other conditions, the centre vent will be closed.

Solenoid energised: pin 18 should read 10+ volts and the centre vent will be open.

Solenoid de-energised; pin 18 should read below 0.5 volts and the centre vent should be closed.

Defrost Solenoid

(DEFSOL)

A/CCM Pin 11 ref Pin 6

The defrost solenoid controls the operation of the screen vents. When the solenoid is energised, the screen vents will be held closed by the vacuum created. To open the vents the solenoid is de-energised.

The solenoid is energised when a ground supply is provided to pin 11. The solenoid is de-energised when the ground supply is removed, at which point 10+ volts can be read at pin 11.

Temperature Differential

(DIFF)

A/CCM Pin 28 ref Pin 6

This sets the differential between the position of the upper and lower flaps. With minimum differential selected, pin 28 should read between 0 and 100 millivolts. The voltage at pin 28 will rise smoothly as the differential is increased, up to a maximum of 2.885 volts.

Evaporator Sensor

(EVSEN)

A/CCM Pin 5 ref Pin 6

This sensor monitors the temperature of the evaporator matrix, the output is used to trigger the compressor circuit via the A/CCM pin 20. Operating conditions are 2.732 volts at 0 degrees Celsius ±0.01 volts for every degree Celsius above or below zero.

Fanspeed Defrost

(FANDEF)

A/CCM Pin 27 ref Pin 6

This signal is normally held at 3.6 ±0.8 volts by the control module. When Defrost is selected from the control panel, the line is pulled down to 0.6 volts or below. This will cause the defrost flaps to open by applying system voltage (approx 11 volts) to pin 11. In addition, both fans will go to full speed i.e. high speed fan relay energised .

Fanspeed High

(FANHIG)

A/CCM Pin 15 ref Pin 6

This signal is generated from the fan speed control switch.
Switch at High, pin 15 should read 0.6 volts.
Switch at Off, L, M or D positions, pin 15 should read 3.6 ±0.8 volts.

Fanspeed Low

(FANLOW)

A/CCM Pin 13 ref Pin 6

This signal is generated from the fanspeed control switch.
Switch at Low, pin 13 should read 0.6 volts.
Switch at Off, M, H or D positions, pin 13 should read 3.6 ±0.8 volts.

Fanspeed Medium

(FANMED) A/CCM Pin 14 ref Pin 6

This signal is generated from the fanspeed control switch.
Switch at Low, pin 14 should read 0.6 volts.
Switch at Off, L, H or D positions, pin 14 should read 3.6 ±0.8 volts.

Five Volt Supply

(FIVEV) A/CCM Pin 43 ref Pin 6

This 5 volt rail provides the power supply for all the sensors and the feedback potentiometers. Any variation in this signal would totally upset the balance of the whole system.

Flap Servo Drive Signals

The servo drive signals control the position of the upper and lower flaps. The drive signals work in pairs, two for the upper and two for the lower flaps.

Lower Servo Forward Drive

(FORSERL) A/CCM Pin 37 ref Pin 6

Upper Servo Forward Drive

(FORSERU) A/CCM Pin 40 ref Pin 6

Lower Servo Reverse Drive

(REVSERL) A/CCM Pin 41 ref Pin 6

Upper Servo Reverse Drive

(REVSERU) A/CCM Pin 42 ref Pin 6

When the flaps are stationary, all signals will be at 0.6 volts approximately. When the flap(s) is being driven, the drive line(s) will rise to approximately 6 volts.

As the flap approaches its final position, the drive signal will be pulsed to nudge the flap to the exact position required.

Note: If a drive signal rises to above 8.5 volts and the servo motor does not operate, suspect an open circuit within the servo.

Ground Voltage

(GND10) A/CCM Pin 10 ref Pin 6

This is the ground supply from the A/CCM to the in-car sensor and should read below 10 millivolts.

Failure of this line will cause the in-car sensor to believe the vehicle temperature to be at maximum all the time, thus forcing the system into permanent cooling. Under these circumstances, pin 4 (in-car sensor output) will be approximately 5 volts.

Ground Voltage

(GND2) A/CCM Pin 2 ref Pin 6

Ground Voltage

(GND38) A/CCM Pin 38 ref Pin 6

Ground Voltage

(GND45) A/CCM Pin 45 ref Pin 6

Ground Voltage

(GND6) A/CCM Pin 6 ref Battery -ve

The four ground signals above must be at battery negative voltage at all times.

High Speed Relay Drive

(HSREL) A/CCM Pin 16 ref Pin 6

The high speed relay drive signal is used to energise the high speed relay and to run the blowers at full speed, bypassing the normal fan control circuit. The high speed relay will be energised whenever Defrost or High speed Fans is selected.

Relay energised, pin 16 should read 10+ volts

Relay de-energised, pin 16 should read below 0.5 volts.

If the signal at pin 16 is correct but only one fan responds, suspect a fault in the harness or relay.

In-Car Sensor

(ICSEN) A/CCM Pin 4 ref Pin 6

The in-car temperature sensor operates in the range 0-5 volts. Actual output is 2.732 volts at 0 degrees Celsius ±0.01 volts for every degree Celsius above or below zero. The sensor signal forms a reference point for the whole system.

If the signal on this pin remains at less than 1 volt, suspect either a short to ground on the signal wire or an open circuit on the 5 volt supply line to the sensor.

If the signal rises to approximately 3 volts, then suspect an open circuit on the ground supply to the sensor.

Left Blower Feedback Voltage

(LBLOFB)

A/CCM Pin 22 ref Pin 6

This signal informs the control module of the present voltage applied to the left blower. The control module can then monitor and vary this voltage to change blower motor speed. With Manual selected, the blower operates in four basic ranges:

Low Speed
- Temp Min: pin 22 = 5±1 volt
- Temp Med: pin 22 = 9±1volt
- Temp Max: pin 22 = 5±1 volt

Medium Speed
- Temp Min: pin 22 = 2±1 volt
- Temp Med: pin 22 = 6±1volt
- Temp Max: pin 22 = 2±1 volt

High Speed
- Pin 22 = 1±1 volt at all temperature settings

Defrost
- Pin 22 = 1±1 volt at all temperature settings

Left Blower Output Voltage

(LBLOWOP)

A/CCM Pin 31 ref Pin 6

This signal is produced by the control module to drive the blower motor. The signal can vary from 0-3 volts depending on blower motor speed. The higher the voltage, the higher the blower motor speed. This signal is amplified by a simple amplifier circuit inside the blower motor. This circuit also supplies the feedback signals to pins 22 and 33.

Note: If the signal rises above 5 volts, then suspect a fault in the amplifier circuit.

Lower Servo Feedback Potentiometer

(LSERFB)

A/CCM Pin 29 ref Pin 6

This feedback signal informs the control module of the exact position of the flaps, enabling accurate control of flap position.

Defrost - Lower flap signal should be 2.9 volts (flap closed) upper flap signal should read 1.9 volts.

Max Temp - Lower flap signal should read 1.14 volts, upper flap signal should read 1.9 volts.

Min Temp - Both lower and upper flap signals should read 130 ± 80 millivolts.

Note: If the feedback sticks low, with the fan continually running, suspect an open circuit in the 5 volts supply to the feedback potentiometer or the potentiometer itself.

Measurement Probe

(MPROBE)

Measurement probe (RED) with reference to measurement probe (BLACK).

Switched Power Input

(POWIN+) A/CCM Pin 44 ref Pin 6

Switched power-in is a signal from the control module. Unlike the unswitched power available on pins 1 and 12, this signal is only available when the A/C is switched on.

Power Output

(POWOP+) A/CCM Pin 12 ref vehicle battery +ve

This is the ignition power for the whole A/C system. It passes through the A/CCM via pins 1 and 12 (and a feedback protection diode) before supplying the fan control switch. Pin 12 should normally read battery voltage with the ignition switch in positions I or II. With the ignition switch off, pin 12 should read 0 volts.

Right Blower Feedback Voltage

(RBLOFB) A/CCM Pin 33 ref Pin 6

The purpose of the blower feedback is to inform the control module of the present blower speed. This enables the control module to directly monitor and control blower motor speed. With Manual selected, the blower operates in four basic ranges:

Low Speed
- Temp Min: pin 33 = 5±1 volt
- Temp Med: pin 33 = 9±1volt
- Temp Max: pin 33 = 5±1 volt

Medium Speed
- Temp Min: pin 33 = 2±1 volt
- Temp Med: pin 33 = 6±1volt
- Temp Max: pin 33 = 2±1 volt

High Speed
- Pin 33 = 1±1 volt at all temperature settings

Defrost
- Pin 33 = 1±1 volt at all temperature settings

Right Blower Output Voltage

(RBLOWOP) A/CCM Pin 32 ref Pin 6

This signal is produced by the control module to drive the blower motor. The signal can vary from 0-3 volts depending on blower motor speed. The higher the voltage, the higher the blower motor speed. This signal is amplified by a simple amplifier circuit inside the blower motor. This circuit also supplies the feedback signals to pins 22 and 33.

Note: If the signal rises above 5 volts, then suspect a fault in the amplifier circuit.

Reference Signal

(REF)

A/CCM Pin 7 ref Pin 6

This is the main reference signal for the A/CCM. All the sensors reference against this voltage. Drift in this signal will cause inconsistent temperature control.

Normal voltage should read 2.885 ±10 millivolts

Temperature Demand

(TEMPDEM)

Temperature demand control either selects the required temperature of the system (auto mode) or the outlet temperature of the vents (manual mode). Pin 35 will vary from 0 volts at full cooling up to 2.885 volts at full heating.

Note: When defrost is selected, the signal at pin 35 is ignored. The system will go into full heating through the upper flaps only.

Upper Servo Feedback Potentiometer

(USERFB)

A/CCM Pin 30 ref Pin 6

The feedback signal informs the control module of the exact position of the flaps, enabling accurate control of the flap position.

Defrost - Lower flap signal should read 2.9 volts (flap closed, the upper flap signal should read 1.9 volts.
Max Temperature - Lower flap signal should read 1.14 volts, upper flap signal should read 1.9 volts.
Min Temperature - Both upper and lower flap signals should read 130 ±80 millivolts.

Note: If the feedback sticks low, with the fan continually running, suspect an open circuit in the 5 volt supply to the feedback potentiometer or the potentiometer itself.

Water Switch

(WATSW)

A/CCM Pin 21 ref Pin 6

The water switch monitors the temperature of the coolant and inhibits heating by restricting fan operation at coolant temperatures below 30 degrees celsius. This enables the vehicle to warm up at a faster rate. It can be overridden by selecting Defrost.

Water Valve

(WATVAL)

A/CCM Pin 17 ref Pin 6

The water valve controls the flow of hot coolant to the heater matrix. When manual full cooling is selected, the valve will close inhibiting the heating effort of the matrix, thus enhancing the cooling effect

Full cooling selected; pin 17 should read 10+ volts and the water valve should be closed.

All other conditions, pin 17 should read below 0.5 volts and the water valve should be open.

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Introduction

This guide contains instructions for the installation of the Portable Diagnostic Unit hardware in Aston Martin Dealer workshops. To achieve maximum benefit from the system, please follow the instructions carefully. The following System Diagram shows the principal system components and panel details.

This introduction briefly describes the system and its capabilities. This is followed by the Installation and Power-Up procedures which give detailed instructions on how to start the system and access the self-contained Interactive Training Programme.

The subsequent sections detail the fault diagnosis and maintenance procedures.

WARNING: The equipment must only be used by trained personnel. Care should be taken to use the equipment in accordance with the operating procedures. Observe all safety warnings in this guide. If any part of the system is damaged do not use it. Call your local GenRad Service Centre immediately for a substitute part. Refer to 'Parts Ordering'.

WARNING: If the system is used to measure high voltages, these voltages can appear on the pins of other connectors in the system. Ensure that socket covers are fitted on unused sockets. Ensure that all connections are made prior to applying the high voltage to the probes. Do not leave the equipment unattended in this state. The maximum voltage that may be applied between the test probes is 150 volts AC or DC.

Radio Interference Statements

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

This equipment has been tested and found to comply with the limits for Class A digital device pursuant to part 15 of the Federal Communications Commission (FCC) rules. However, operation in close proximity to domestic communication equipment may cause interference. It is the responsibility of the user to avoid or correct this condition.

The Aston Martin Diagnostic System

The Aston Martin Diagnostic System is a new generation diagnostic tool which fulfils a number of functions in aiding the technician to quickly and accurately locate faults. The heart of the system is the Portable Diagnostic Unit, a lightweight powerful computer/measurement system providing a step-by-step user friendly interface for the technician.

PDU functions include:

Data Logger - The ability to monitor and record control module signals even whilst the vehicle is being driven.

On-Line Help - Containing detailed descriptions in the operation of the vehicles electronic components.

Vehicle Setup - The ability to setup various adjustable parameters to their optimum settings.

Diagnostic Trouble Codes - The ability to extract recorded fault information from the DB7's control modules.

Each of these functions is described in detail in the PDU Users Guide.

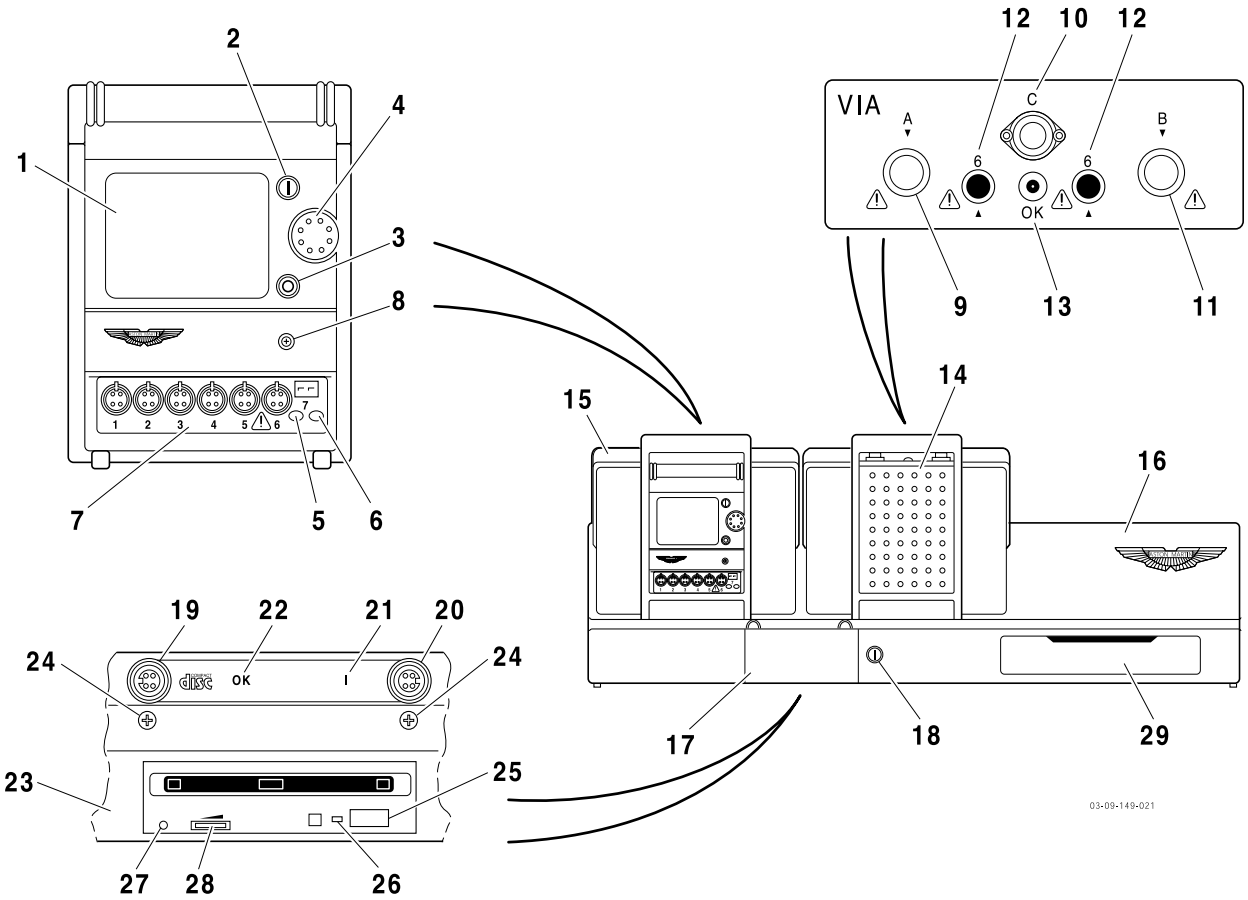


Figure 1. The Aston Martin Diagnostic System

Key to Figure 1

1. LCD touch screen
2. Power on switch
3. Power off switch
4. Screen contrast control
5. Battery charge indicator (Orange/Yellow)
6. Power on indicator (Green)
7. PDU interface connectors
   - 7.1. Black probe
   - 7.2. Red probe
   - 7.3. Current clamp
   - 7.4. Pressure transducer
   - 7.5. Vehicle battery adaptor (VBA)
   - 7.6. VIA, base station, serial interface and system test
   - 7.7. Temperature probe
8. Battery cover
9. Connector A for vehicle cable
10. VIA power input cable
11. Connector B for vehicle cable
12. Connector for PDU cable
13. VIA status indicator
14. Vehicle Interface Adaptor (VIA)
15. Portable Diagnostic Unit (PDU)
16. Base Station
17. Base station door
18. Base station door lock
19. Charging and loading data connector
20. Secondary charging connector
21. Power on indicator (Green)
22. Status Indicator (Red)
23. CD-ROM drive
24. Electronic module securing screws
25. CD-ROM eject button
26. CD-ROM drive active light
27. Audio output (not used)
28. Audio level (not used)
29. Base station drawer.

Component Identification

Base Station (Fig 1-16)

The Base Station is a wall or bench mounted steel unit on which up to two Portable Diagnostic Units and a Vehicle Interface Adaptor can be stored.

Portable Diagnostic Unit (PDU) (Fig 1-15)

The PDU is a hand held diagnostic tool utilising a touch sensitive screen and serial communications capability

Electronics Module

The Electronics Module is located behind the base station door (Fig 1-17) and facilitates the charging of the PDU battery. Also contained in the module is the CD-ROM drive (Fig 1-23) for the storage of all system software. The PDU must be connected to the electronic module whenever it is located on the base station.

Vehicle Interface Adaptor (VIA) (Fig 1-14)

The VIA enables the PDU to interface with vehicle systems not equipped with serial communications.

Vehicle Battery Adaptor (VBA)

The VBA provides the correct voltage to power the PDU from the vehicle battery and also protects the PDU from any interference from the vehicles electrical systems.

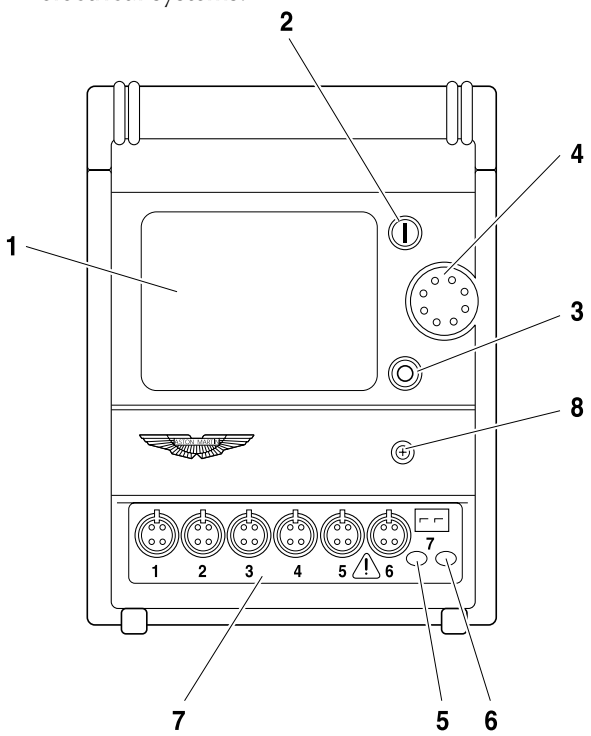


Figure 2. The Portable Diagnostic Unit

Controls

Touching the Power On button (Fig 2-2) will switch on the unit and bring on the screen backlight. Also note that the Power On Indicator (Fig 2-6) will illuminate.

Touching the Power Off button (Fig 2-3) will turn off the unit, screen backlight and power on indicator.

The Touch Sensitive Screen (Fig 2-1) is used to display information in digital or in graphic forms. Program options are also displayed and may be selected by touching the appropriate area of the screen.

CAUTION: The use of sharp pointed implements will damage the touch sensitive screen. Use only light finger pressure to operate the PDU.

To adjust the screen contrast, rotate the contrast control (Fig 2-4) to the required position.

In order to preserve the battery charge, the power to the screen backlight is automatically switched off after 5 minutes of inactivity. In this state, the Power On indicator (Fig 2-6) remains illuminated to indicate that the PDU is in stand-by mode. Touching the screen will return the PDU to normal operating mode.

Diagnostic System Cables

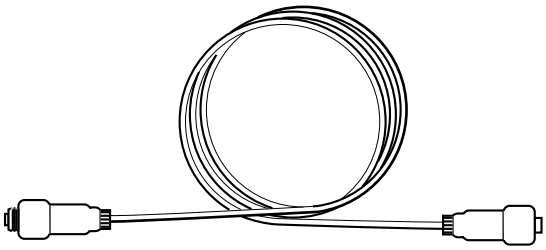
Cables

The cables connecting the diagnostic system elements together and to the electronic units of the vehicle are identified in the following illustrations.

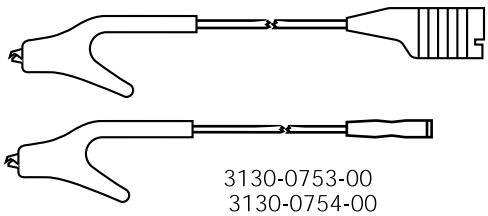
The cables should be stowed in the base station drawer or in the pockets of the PDU and VIA carrying cases.

CAUTION: Care must be taken when using the vehicle cables since they are capable of passing high currents. Short Circuits are a fire risk.

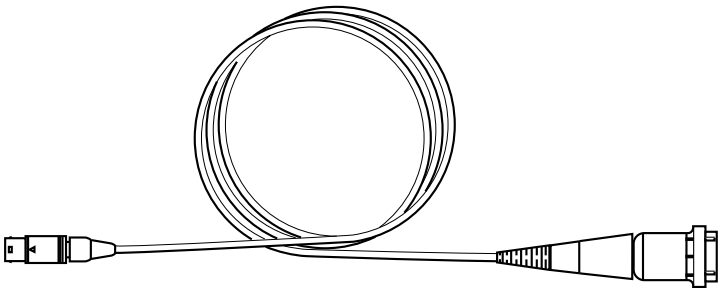
Diagnostic System Cables



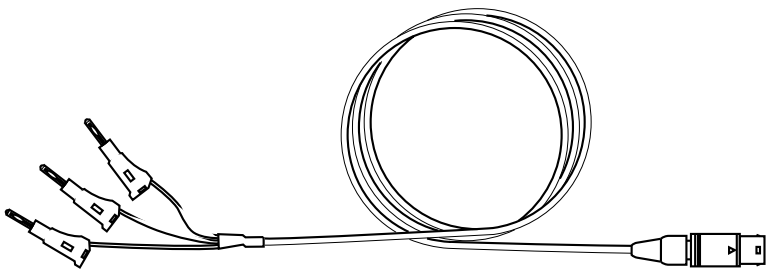
3130-0028-01 VIA-VBA Cable



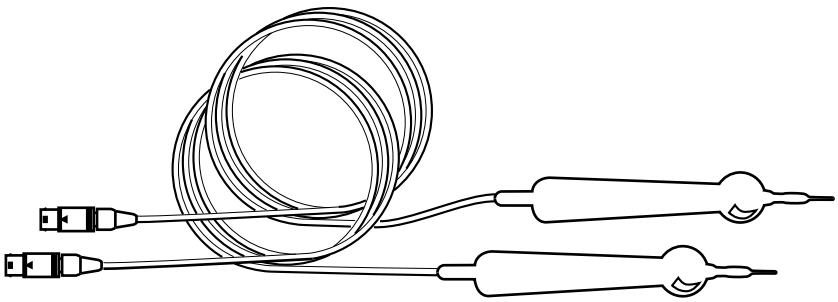
3130-0753-00
3130-0754-00
Red and Black Croc Clips



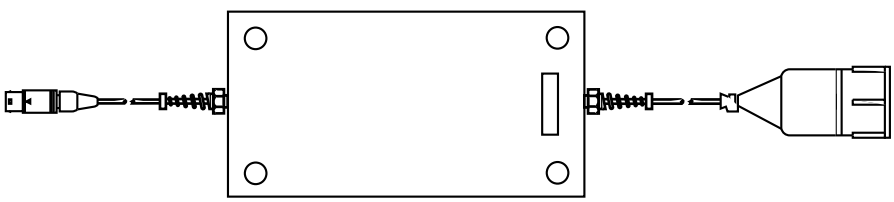
3130-0756-00 Transmission Test Cable



3130-0026-01 Scope and Self Test Adaptor Cable



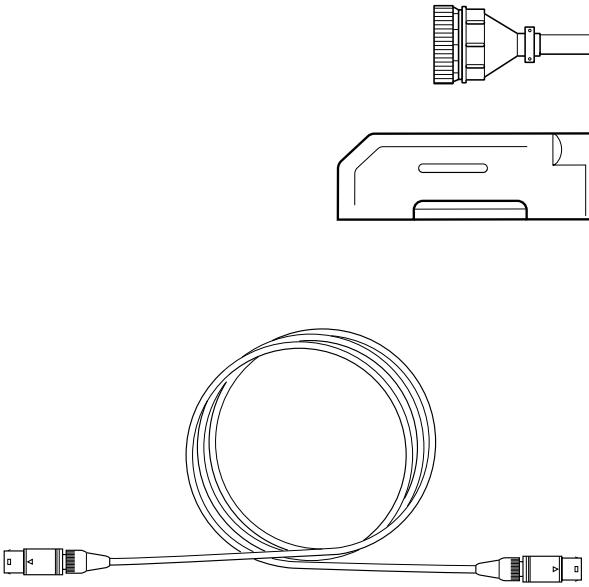
3130-022-01 Red Probe
3130-023-01 Black Probe



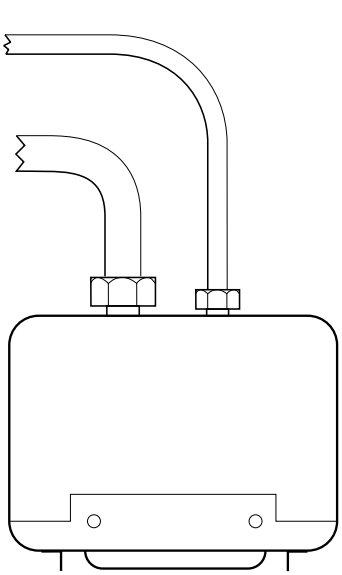
3130-1242-00 Aston Martin Protocol Adaptor

009-PDU Cables Page 5

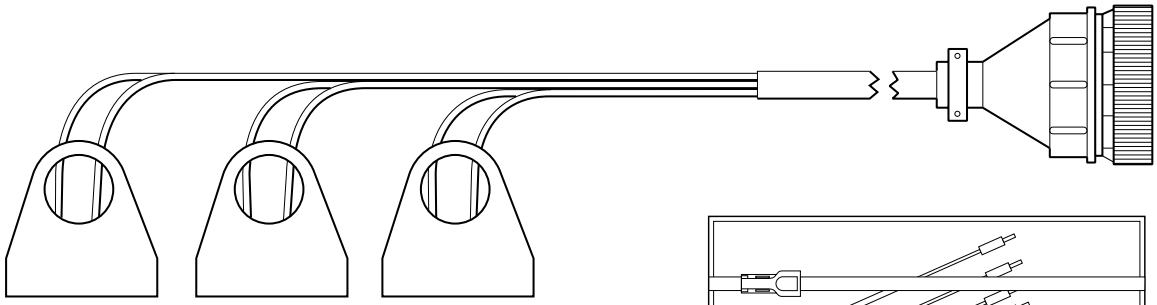
Diagnostic System Cables



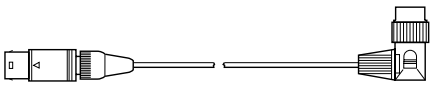
3130-0030-01 VIA-PDU Cable



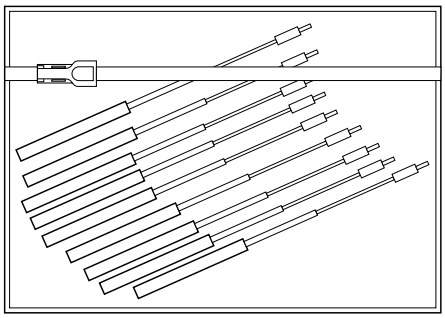
3130-0778-00-B Anti-Lock Brakes



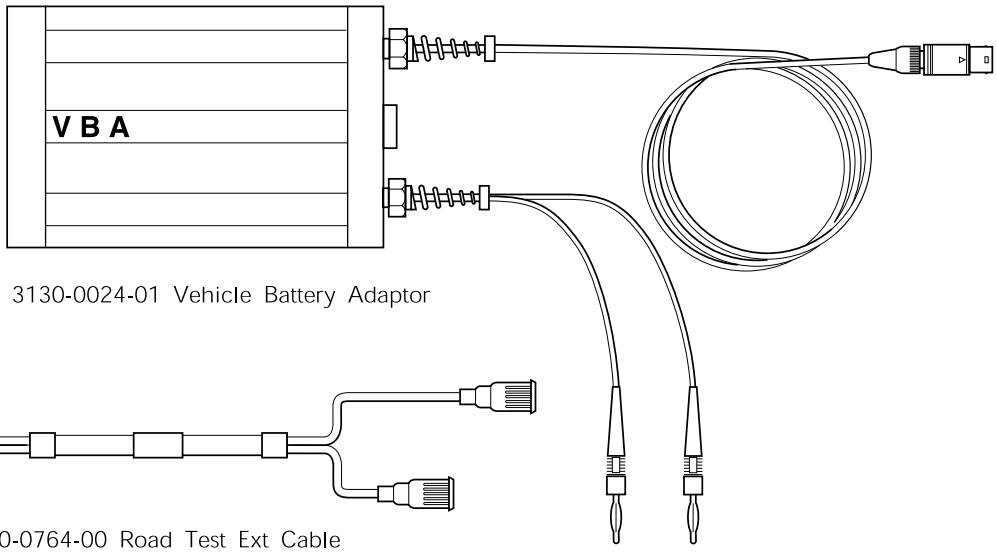
3130-0780-00-B Air Conditioning Test Cable Cable



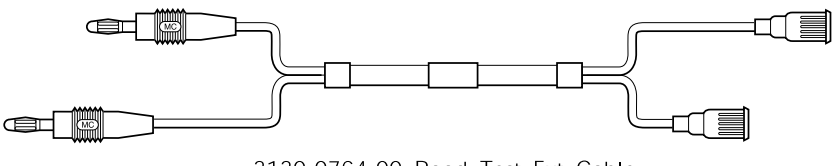
3130-0064-01 Base Station-PDU Cable



3130-0475-00 Test Probes



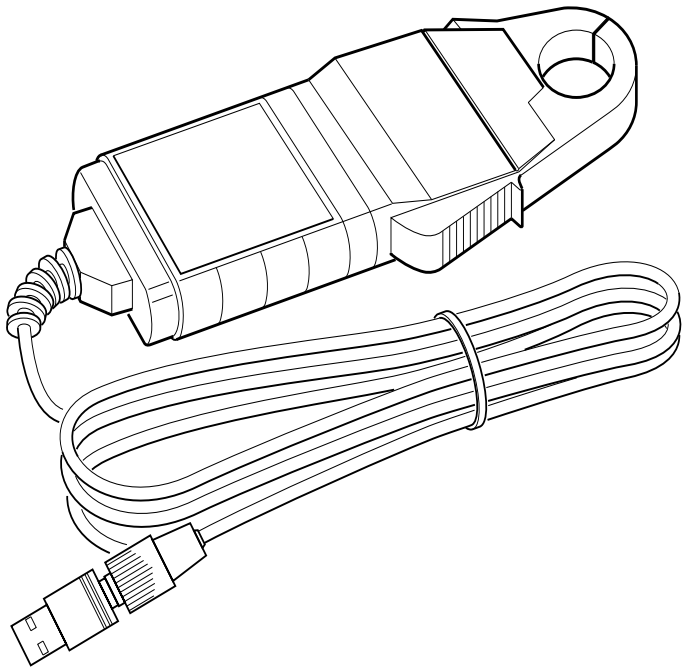
3130-0024-01 Vehicle Battery Adaptor



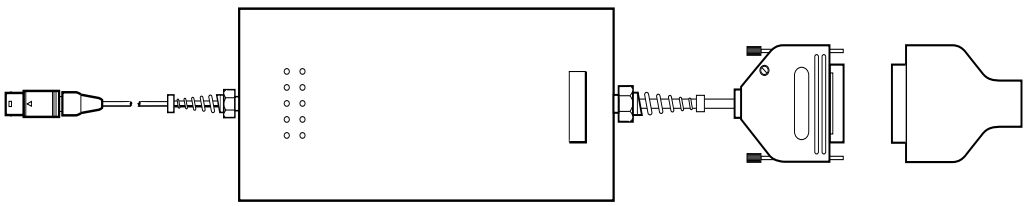
111-PDU Cables Page 6

3130-0764-00 Road Test Ext Cable

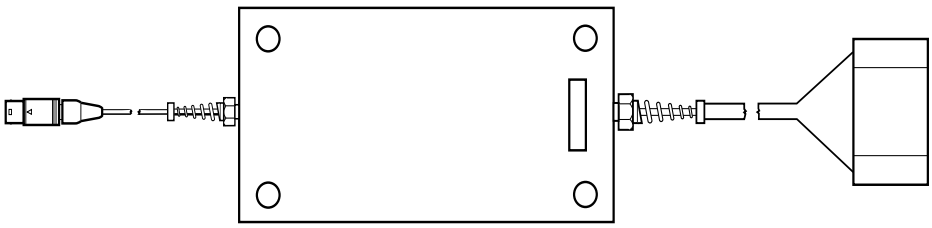
Diagnostic System Cables



3130-1213-01 Aston Martin Current Probe



3539-1169-02 Aston Martin Printer Lead

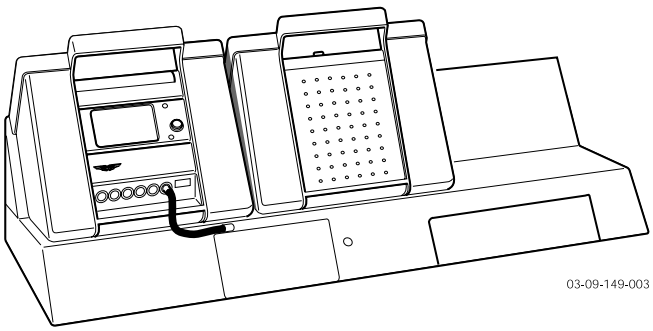


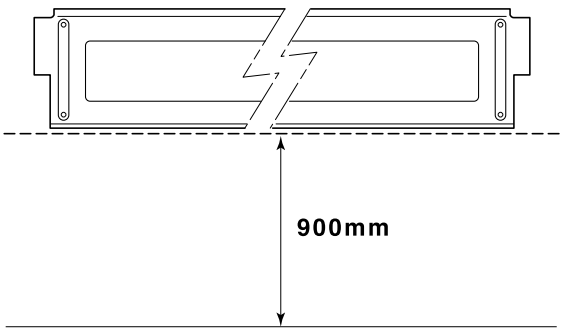
3538-0100-01 Aston Martin Multi Protocol Adaptor

Base Station Installation

It is recommended that the base station is wall mounted (Fig 3). Alternatively it may be mounted on a bench. The base station houses the CD-ROM drive and power supplies.

Note: The electronic module should only be fitted after the base station has been installed.





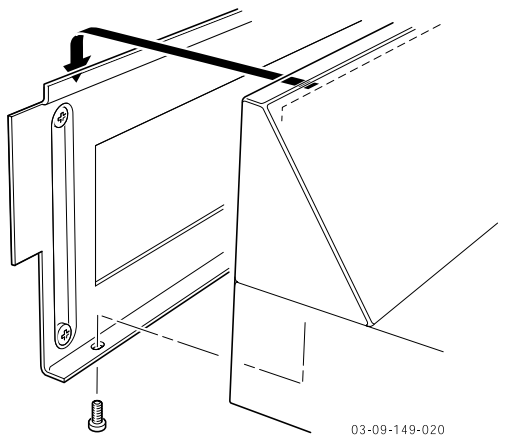


Figure 3. Wall Mounted installation

Wall Mounting

It is important that the following points be considered before carrying out the mounting procedure.

1. The location should be close to the vehicle repair bays. The base station will require a power outlet close by, such that the 2m mains lead will comfortably reach the outlet.

2. The wall plate should be attached with four fasteners, each of which has a minimum pull-out strength of 300 kg (662 lb). The four fasteners are not supplied, as the type of fastening will depend on the wall material. The mounting holes in the wall plate are 8mm diameter with a maximum clearance for a socket spanner of 30mm. It is recommended that 6mm diameter bolts are used to secure the wall plate.

WARNING: The mains power outlet must be close to the equipment and be clearly recognisable as the power source for safety reasons.

French Market Only: Do not connect the PDU equipment to IT (Impedante Terre) power systems.

WARNING: This equipment must be earthed via the mains lead through the outlet socket. In markets where three pin main power outlets are not available, a separate earth point must be used

Procedure

1. Select a suitable location.

2. Mark a horizontal line on the wall 900mm above the floor (Fig 3)

3. Remove the two screws securing the wall mounting plate to the base station and remove the wall mounting plate.

4. Hold the wall mounting plate up to the marked line and mark four hole positions for the wall mounting plate bolts.

5. Drill the wall to the correct diameter and depth required for the four bolts.

6. Securely fasten the wall mounting plate to the wall. Lift the base station onto the wall mounting plate, fit and tighten the two screws/washers to secure the base station to the mounting plate.

CAUTION: The gap beneath the base station should be maintained free from obstructions to allow a flow of air under the unit for cooling.

Bench Mounting

The base station may also be mounted on a bench, which must be in a safe position, stable and protected form hazards and impacts. The base station must be mounted at the back of the bench. 'Z' clips are provided for permanent mounting. The bench surface must be kept free from dust at all times.

CAUTION: A gap under the base station must be maintained free from obstructions to allow a flow of air under the unit for cooling.

Electronic Module Installation

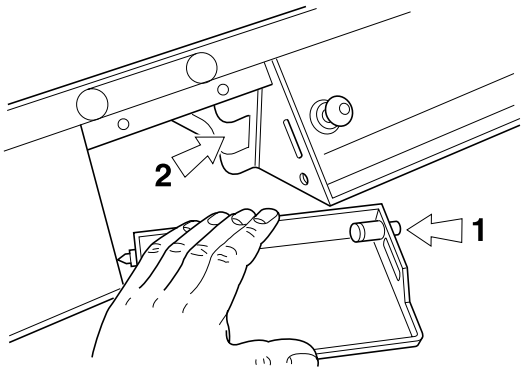
WARNING: The base station electronic module must be disconnected from the mains supply prior to installation/ removal from the base station assembly. DO NOT reconnect to the mains supply until the module is safely fitted into the base station. This unit must be earthed.

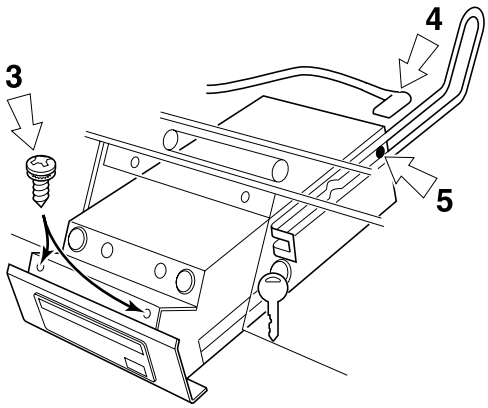
Note: Users in North America are advised to replace the ceramic mains fuse in the electronic module with the glass fuse supplied.

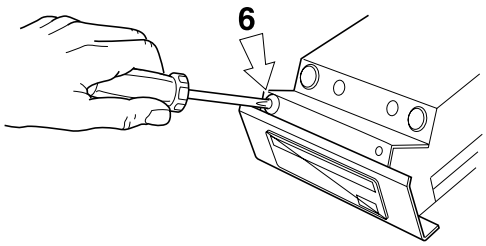
Procedure

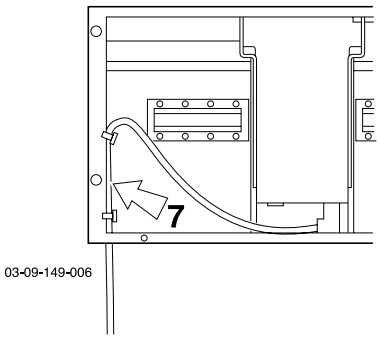
1. Unlock the base station door
2. Pull the right spring-loaded hinge (Fig 4-1) and remove the door.
3. Remove the electronics module from the packaging and place it on a firm surface.
4. Remove the two screws and washers from the front of the module (Fig 4-3).
5. Insert the mains power lead into the socket at the rear of the module Fig 4-4), DO NOT CONNECT TO THE MAINS SUPPLY.
6. Insert the two guide pins on the sides of the module (Fig 4-5) into the base station slots.
7. Slide the module into the base station until fully home, raise the front so that it is level and draw it slightly forward.
8. The two connectors on the front of the module will appear through the matching holes in the base station. Support the module whilst refitting the two retaining screws and washers (Fig 4-6).
9. Secure the mains lead to the underside of the base station using the two cable ties provided (Fig 4-7).
10. If bench mounting, the base station will need to be turned on its back to install and secure the mains lead.
11. Refit the base station door.

CAUTION: Take care to avoid the sharp edges of the module whilst installing. Take care to support the module from the underside until the mounting









screws are secured.

Figure 4. Electronic Module Installation

Powering-Up the Base Station

When first operating the System or when first using a PDU fitted with substitute batteries, it will take up to 36 hours to achieve full charge. In the meantime, the PDU can be used whilst connected to the base station or to the vehicle battery.

WARNINGS:

When using the system equipment, basic safety precautions should always be followed, including:

Carefully read and follow all instructions.

Care should be taken as burns can occur from touching hot parts.

Do not operate the appliance with a damaged mains lead or if the appliance has been dropped or damaged. Call your local GenRad Service Centre immediately for a substitute part.

Do not let the mains lead hang over the edge of the table, bench or counter or come into contact with hot manifolds or moving fan blades.

The Aston Martin Portable Diagnostic Unit is fitted with an auto switching power supply suitable for voltage supplies of 100 - 240 VAC 50 - 60 Hz. You need only check that the power cord connector is of the correct type for your power outlets.

1. Connect the mains lead to the mains outlet.
2. Check that the green indicator lamp above the base station door is illuminated. If the green lamp does not come on, see the problem solving section for advice.
3. After a few seconds, during which the electronics module completes its self-test, the red OK indicator lamp should illuminate. If the red lamp does not come on, see the problem solving section for advice.
4. Allow the base station electronics module to reach working temperature. This will take approximately 30 minutes, after which time the base station will be ready to accept the software on CD-ROM.
5. Slide the PDU into its carrying case and place the associated cables and probes in the carrying case compartments.
6. Place the carrying case onto the base station at the far left side (Fig 5). This is the normal place for charging the battery, loading software and storing the PDU. Note that it is retained by raised retaining blocks which fit inside the recesses under the carrying cases (Fig 5).
7. Remove the protective cover from the PDU interface panel socket (Fig 1-7.6)
8. Using the PDU to base station cable (0064) connect panel socket 6 to the base station left socket (Fig 1-19). The indicator lamp will glow orange during fast charge and yellow during trickle charging.
9. A second PDU can be fitted on the central position on the base station and may be connected to the right charging socket using a second cable (0064). Note that both units may be charged simultaneously but software may only be loaded from CD-ROM using the left base station socket.

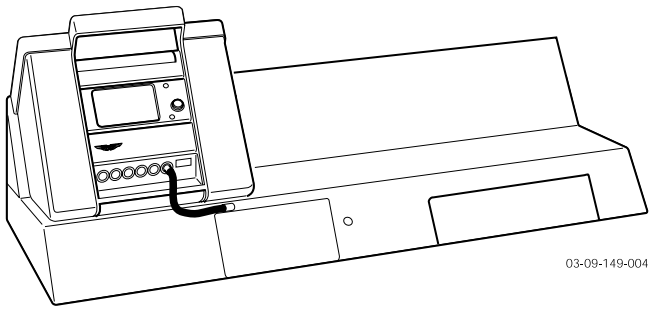


Figure 5. Normal PDU position

Installing the CD-ROM (Early Systems)

1. Ensure that your hands are clean before touching the CD-ROM disc, disc caddy, or the CD-ROM drive.
2. Open the base station door to gain access to the CD-ROM drive.
3. Open the CD caddy by squeezing the sides whilst lifting the hinged door upwards (Fig 6).
4. Handling the CD by the edges only, remove it from the protective sleeve and insert it into the caddy with the image side uppermost. Close the caddy door.
5. Insert the CD caddy into the CD drive in the base station. Close and lock the CD-ROM drive door. The base station is now ready for use.

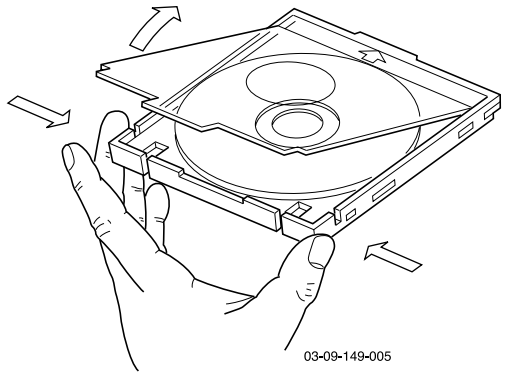


Figure 6. CD-ROM Installation (Early Systems)

Installing the CD-ROM (Later Systems)

Later PDU systems have an improved CD-ROM drive incorporating a tray loading mechanism for the CD-ROM disc.

1. Ensure that your hands are clean before touching the CD-ROM disc, or the CD-ROM drive.
2. Open the base station door to gain access to the CD-ROM drive.
3. Press the tray eject button on the CD-ROM drive (Fig 7). The tray will open automatically.
4. Remove the CD from its protective sleeve and place it on the tray with the image side uppermost.
5. Gently push on the tray and the motorised mechanism will start to retract the tray automatically.

   Alternatively, pressing the eject button will cause the tray to close.
6. Close and lock the CD-ROM drive door. The base station is now ready for use.

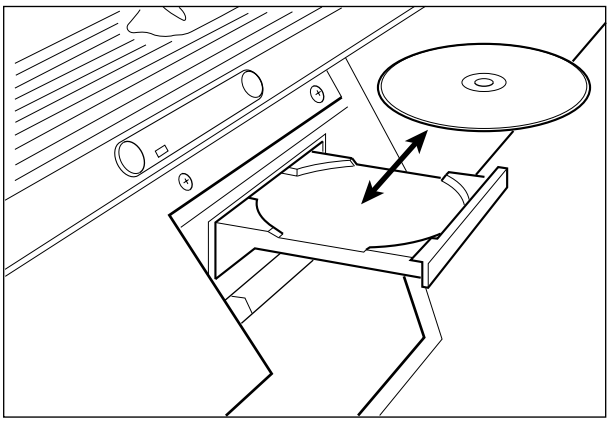


Figure 7. CD-ROM Installation (Later Systems)

Removing the CD-ROM (Early Systems)

1. Ensure that your hands are clean before touching the CD-ROM disc, disc caddy, or the CD-ROM drive.
2. Unlock and open the CD-ROM drive door.
3. Press the eject button on the CD-ROM drive (Fig 1-25).
4. After a short delay, the CD caddy will be ejected. Remove the caddy from the CD drive.
5. Open the caddy and remove the CD. Place the CD into its storage sleeve and store in the base station drawer (Fig 8).

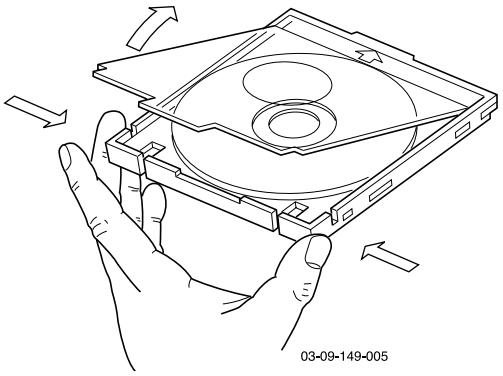


Figure 8. CD-ROM Removal (Early Systems)

Removing the CD-ROM (Later Systems)

1. Ensure that your hands are clean before touching the CD-ROM disc, or the CD-ROM drive.
2. Unlock and open the CD-ROM drive door.
3. Press the eject button on the CD-ROM drive (Fig 1-25).
4. The CD tray will open fully. Remove the CD from the tray.
5. Gently push on the tray or press the eject button again to close the motorised tray (Fig 9).

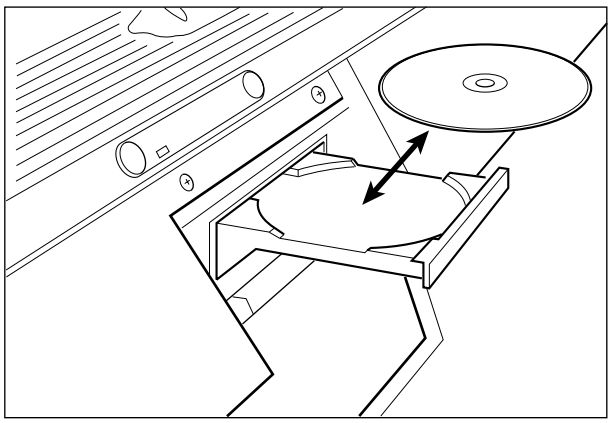


Figure 9. CD-ROM Removal (Later Systems)

Powering-Up the PDU

1. Install the CD-ROM.
2. Press the PDU power on switch (Fig 1-2). An audible tone will be heard and the green PDU power on indicator (Fig 1-6) will illuminate. The touch sensitive screen will also be activated. If this does not happen, see the problem solving section.
3. Adjust the contrast control (Fig 1-4).
4. When the PDU is switched on, it will perform an automatic self-check to test the internal components. On successful completion of the self-check, a PDU symbol will appear with a 'tick' next to it (Fig 10). The PDU will then display the language selection screen (Fig 11).
5. Select the required language and confirm the selection (Fig 11).

   Note: PDU text is available in English, German, French, Italian and Japanese.
6. The PDU will then load its software from the CD-ROM and display the 'main menu' (Fig 12).
7. New users may select 'Training' and press the 'tick' icon to enter the on-screen PDU training programme.

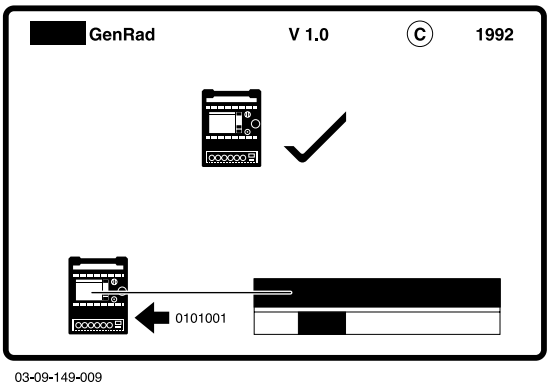


Figure 10. Self-check completed screen

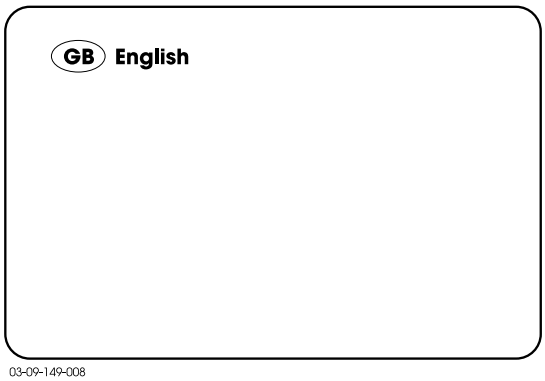


Figure 11. Language selection screen

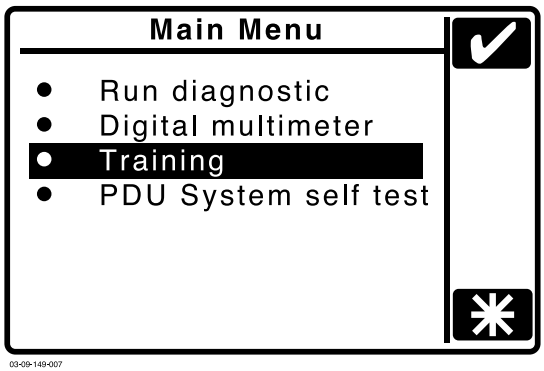


Figure 12. The main menu

Battery Charging

The PDU is fitted with internal NICAD batteries which allow the PDU to be transported whilst retaining programs. The batteries are not designed to be used as a general power source. A special circuit monitors the amount of charge in the batteries so that they cannot be overcharged.

From the time when first operating the system or a PDU fitted with substitute batteries, it will take up to 36 hours to achieve full charge. In the meantime, the PDU can be used whilst connected to the base station or to the vehicle battery. Keep transit times to and from the vehicle as short as reasonably possible to preserve battery charge.

Subsequent battery charges should take six to seven hours from fully discharged. The PDU must always be left connected to the base station when not in use in order to keep the batteries fully charged.

CAUTION: The rechargeable NICAD batteries fitted to the PDU are of a special type and must only be replaced with GenRad approved parts. Do not substitute the batteries with any other type. Always dispose of old batteries in compliance with local recycling regulations. The procedure for changing the battery pack is described later in this installation guide.

Using the PDU on the Vehicle

At the vehicle, the PDU may be removed from its carrying case if required. The PDU should always be connected to the vehicle using the Vehicle Battery Adaptor (VBA) (0024). The PDU will continue to charge from the vehicle battery.

Vehicle Battery Adaptor

This unit transforms battery voltage to the correct level for the PDU. The VBA (Fig 13) also contains electrical filters to protect the PDU from any voltage spikes or other interference from the vehicle which could affect PDU operation.

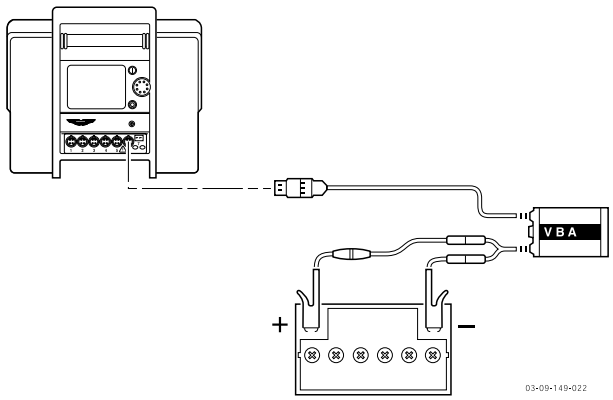
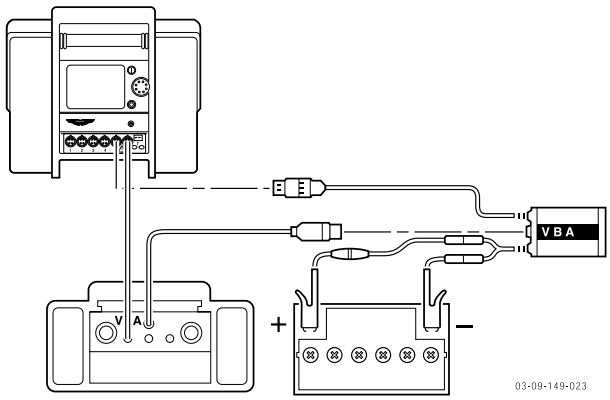


Figure 13. The vehicle battery adaptor

Vehicle Interface Adaptor

When the software requires the Vehicle Interface Adaptor to be used, it is powered from the vehicle battery (Fig 14). The Vehicle Battery Adaptor incorporates a socket into which the VIA to VBA cable (0028) is inserted. The opposite end of this cable is inserted into the connector on the VIA panel.

Figure 14. The vehicle interface adaptor



Finishing the Test

When data analysis is finished, switch off the PDU and disconnect it from the vehicle. Store the PDU and cables in the carrying case and refit the case to the base station.

Connect the PDU to the base station using cable 0064. The base station will keep the PDU batteries fully charged at all times (Fig 15).

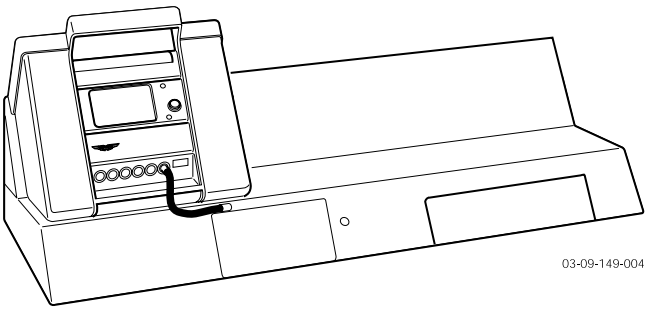


Figure 15. PDU connected for recharging

Care of the Equipment

CAUTION: With the exception of those parts referred to in the Servicing and Maintenance section, there are no user serviceable parts. All servicing must be carried out by GenRad Service Centres.

Switch off the power before cleaning the equipment. The Aston Martin Diagnostic System should only be cleaned using a non-abrasive, mild cleaning agent. Dust and other particles should be lightly brushed from the surface before cleaning. Cleaning agent should be applied to a soft lint-free cleaning cloth and never directly to the unit. Do not soak the cleaning cloth and take care not to allow cleaning fluid to enter connectors.

CAUTION: If any liquid is spilt on the equipment, switch off immediately. Ensure that the equipment has dried out completely before operating it again, especially in connectors where fluid can lodge.

Problem Solving

CAUTION: If any part of the system is damaged, do not use it. Call your local GenRad Service Centre immediately for a substitute part. Refer to 'Parts Ordering'.

CAUTION: With the exception of those parts referred to in the Servicing and Maintenance section, there are no user serviceable parts. All servicing must be carried out by GenRad Service Centres.

PDU Self-Test

The system self test routine should be run periodically even if there are no apparent problems with the system. Running the system self-test will identify any problems before they impact on productivity.

If it is suspected that the system is operating incorrectly, run the PDU system self test option on the main menu).

If the system self test will not run, or the PDU will not switch on, the instructions in this section must be followed carefully.

If one of the following test steps advises you to order or fit a new part, make a note of the test step, part number and description. Then follow the parts ordering procedure later in this section.

Step 1

Connect the mains power to the base station. Is the green base station indicator illuminated?

YES - Go to step 4

NO - Go to step 2

Step 2

Check the mains supply, then check the mains lead. Is the mains lead faulty?

YES - Renew the mains lead.

NO - Go to step 3

Step 3

Remove the electronic module from the base station.
Using a small screwdriver, open the fuse drawer below the power socket on the rear of the module (Fig 16). Remove the fuse and fit the spare fuse. The fuse must be IEC 127 approved ceramic type 250V 2A (T). Re-install the module into the base station, power up the system. Is the base station green indicator illuminated?

YES - The fuse was faulty

NO - Renew the electronic module (0019)

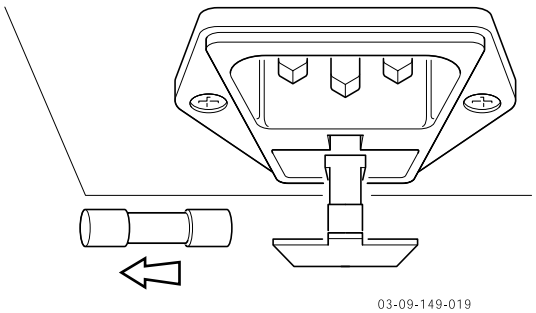


Figure 16. Electronic Module Fuse Replacement

Step 4

Connect the mains power to the base station. Is the base station red indicator illuminated?

YES - Go to step 5

NO - Renew the electronic module (0019)

Step 5

Switch off the PDU and disconnect all cables. Set up the PDU to charge from the left charge socket on the base station using one of the PDU to base station cables. Is the PDU charge indicator (Fig 1-5) illuminated.

YES - Go to step 9

NO - Go to step 6

Step 6

Set up the PDU to charge from the right socket on the base station using the same PDU to base station cable. Is the PDU charge indicator (Fig 1-5) illuminated.

YES - Go to step 8

NO - Go to step 7

Step 7

Using the VBA, connect the PDU to a charged vehicle battery. Is the PDU charge indicator illuminated?

YES - Go to step 8

NO - Renew the PDU (0017)

Step 8

Switch off the PDU and disconnect all cables. Connect the PDU to the base station left connector using the second PDU to base station cable (0064). Is the PDU charge indicator illuminated?

YES - The first PDU to base station cable (0064) is faulty, renew the cable.

NO - Renew the electronic module (0019).

Step 9

Switch on the PDU. Is the PDU power indicator (Fig 1-6) illuminated?

YES - Go to step 10.

NO - Renew the PDU (0017).

Step 10

Is the PDU touch screen illuminated?

YES - Go to step 12.

NO - Go to step 11.

Step 11

Adjust the contrast control. Is the PDU touch screen illuminated?

YES - Go to step 12

NO - Renew the PDU (0017)

Step 12

Observe the display screen. Is the screen displaying a PDU hard error symbol similar to that shown in Fig 17

YES - Note the number and refer to 'Parts Ordering'.

NO - Go to step 13

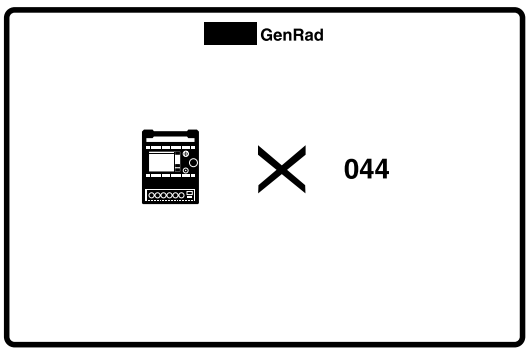


Figure 17. PDU hard error code

Step 13

Observe the screen display. Is the screen displaying the main menu (Fig 9)?

YES - Go to step 14

NO - Go to step 15

Step 14

Select the PDU system self test option and press the 'tick' icon. Does the screen respond?

YES - Go to step 15

NO - Renew the PDU (0017)

Step 15

Observe the display screen. Is the screen displaying the symbol shown in Fig 18?

YES - Connection problem, go to step 17

NO - Go to step 16

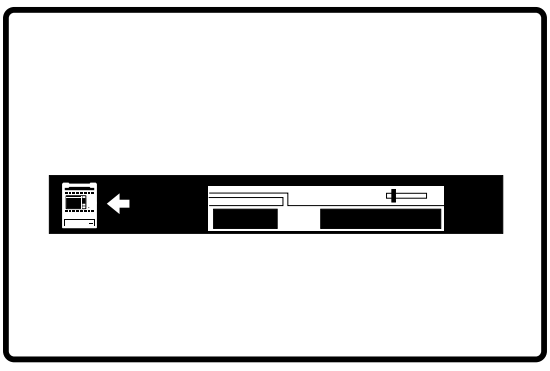


Figure 18. Communications blocked

Step 16

Observe the display screen. Is the screen displaying either of the symbols shown in Fig 19?

YES - Remove the CD caddy and check the CD-ROM. Re-install the CD-ROM. Go to step 13.

NO - Go to step 19

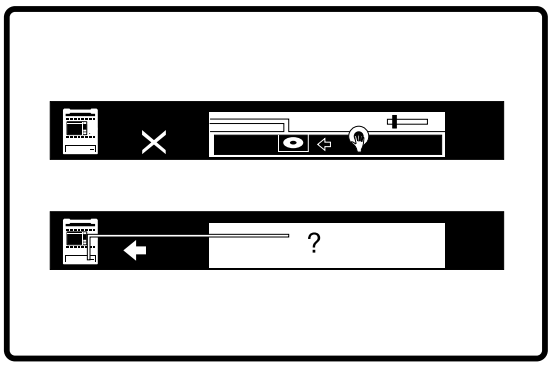


Figure 19. Reload the CD and retry

Step 17

Connect the PDU to the base station top left connector using the second PDU to base station cable (0064) (Fig 34). Is the screen displaying the symbol shown in Fig 15?

YES - Go to step 18

NO - The first PDU to base station cable is faulty, renew the cable (0064)

Step 18

Connect the PDU to the VIA using cable (0030) and connect the VIA to the VBA using cable (0028). Connect the VBA to a charged battery. Does the VIA panel indicator flash for more than 5 seconds after pressing the 'tick' icon.

YES - Renew the electronic module (0019)

NO - Renew the PDU (0017)

Step 19

Observe the screen display. Is the screen displaying the symbol shown in Fig 20?

YES - During the data transfer, the connection was lost. Check to see if the cable connections are intact, if not, reconnect and go back to step 13.

NO - Go to step 20

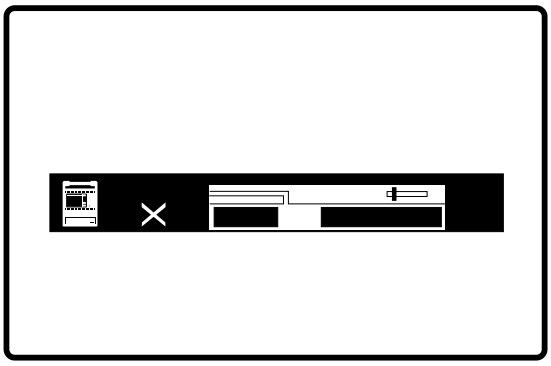


Figure 20. Data transfer connection lost

Step 20

Observe the screen display. Is the language selection screen displayed (Fig 21)?

YES - Try to select a language, go to step 21

NO - Call your local GenRad Service Centre for advice.

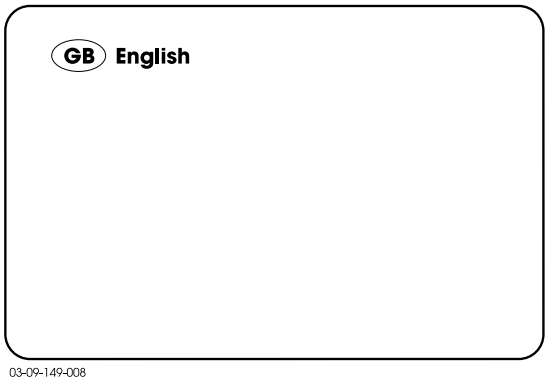


Figure 21. Language selection screen

Step 21

Observe the screen display. Is the system loading from the CD-ROM?

YES - Go to step 13.

NO - Renew the PDU (0017).

Parts Ordering

Before calling GenRad, it is essential that the system self test is run from the main menu. If the system self test will not run or the PDU does not switch on, follow the Problem Solving procedures.

The system self test option will identify any fault and display a fault code on the PDU screen. This fault code number must be recorded. When in contact with your local GenRad Service Centre, they will require this number in order to send the correct substitute parts.

Before calling the GenRad Service Centre, please have the following information available.

- Dealer Name and Address
- Name of the contact at that address
- PDU Serial Number (base station LHS - Fig 22)
- Fault Code, Component Name and Serial Number as given on the PDU screen during self test.

If the system self test will not run, GenRad will require the name and part number of the component identified during the Problem Solving Procedures.

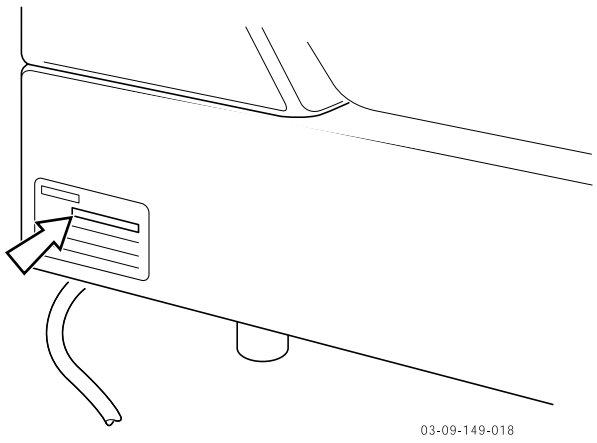


Figure 22. Diagnostic System Serial Number

Genrad Service

The following list gives the 'Service Hotline' telephone numbers for Genrad service worldwide.

UK	0800 917 8812
Ireland	1 800 552 173
France	0800 913 145
Germany	0800 180 8200
Austria	0800 291 038
Netherlands	0800 023 1009
Belgium	0800 75634
Italy	167 791 036
Spain	900 983 127
Portugal	0800 831 431
Sweden	020 790 092
Norway	800 18019
Finland	08001 13005
Denmark	808 81749
Switzerland	0800 836 442
Singapore	0065 2784400
Japan	0081 3 5666 1555
Australia (New Zealand)	0061 39497 3633

Service for PDU users outside the European Community and in countries not listed above.

For PDU users in those countries not included in the above list and outside the European Community, contact the Genrad UK Service Hotline using the following 'UK Remote' telephone number.

UK Remote	+31 53 484 9255

Return Parts

The return address for parts is:

Genrad Ltd, Orion Business Park, Bird Hall Lane, Stockport, Cheshire. SK3 0XG

Warranty

The Aston Martin Diagnostic System is covered by a one year warranty. Should any of the electrical components fail during the warranty period, contact your local GenRad Service Centre for a replacement part. Note that the warranty does not include physical damage.

Spare Parts

Refer to the Aston Martin Diagnostic System Users Guide for a full parts list. All spare parts should be obtained from your local GenRad Service Centre who can advise you on current prices.

Servicing and Maintenance

CAUTION: With the exception of those parts listed in this section, there are no user serviceable parts within the system. All servicing must be carried out by GenRad Service Centres.

Battery Testing.

The NICAD batteries fitted in the PDU are designed to be rechargeable and should normally last through many recharge cycles. Battery life of three to five years can be expected. The capacity of new batteries improves after several charging cycles. After extended use, they may require renewing. The following procedure will assist you to determine when renewal is required. Do not use this procedure with new batteries or with a new PDU.

Testing Procedure

1. Remove all cables from the PDU.
2. Switch the PDU on and leave it until it switches off (the power on indicator will extinguish)
3. Connect the PDU to the base station for at least 12 hours charging.
4. Remove all cables from the PDU, switch on the PDU and start timing.
5. If the PDU switches off in less than 30 minutes, the batteries should be renewed.

Changing the Battery Pack

CAUTION: Always read and follow safety warnings and instructions printed on the equipment. The rechargeable NICAD batteries fitted to the PDU are of a special type. They must only be substituted by GenRad approved parts. Do not substitute the batteries with any other type. Always dispose of old batteries in compliance with local recycling regulations.

Battery Changing Procedure

A spare battery pack kit (0975) is available from your local GenRad Service Centre.

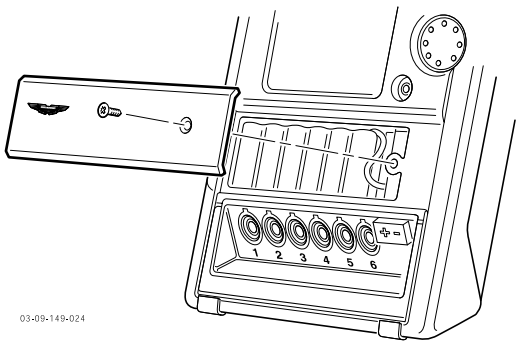


Figure 23. Battery cover screw

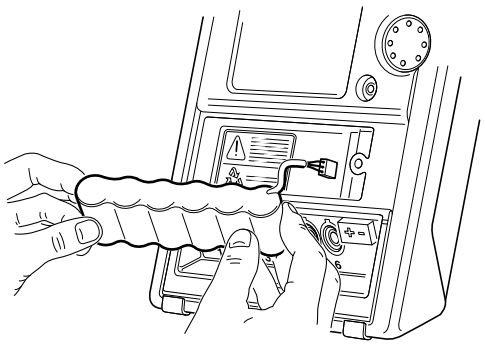


Figure 24. Battery pack

1. Switch off the PDU and remove all cables.
2. Remove the cover screw (Fig 23) and remove the cover.
3. If damaged, remove the old foam gasket from the cover and replace with the new one supplied.
4. Note the orientation of the connector. Disconnect the connector and remove the old battery pack.
5. Fit and connect the new battery pack (Fig 24) with the black cable towards the touch screen.
6. Refit the cover and cover screw.
7. Refer to the Battery Charging instructions for recharging times.

Changing the Dust Filter

The electronic module has a dust filter fitted to the underside of the module. Every three months a new filter will be supplied. To change the filter, proceed as follows:

1. Switch off the mains supply and pull out the old filter (Fig 25).
2. Feed in the new filter with the blue side facing in, pushing it well into the corners of the holder.
3. Switch on the mains supply.

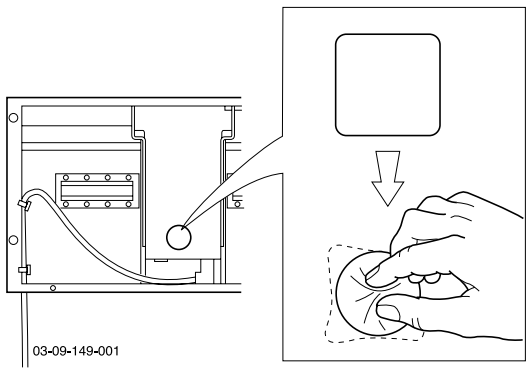


Figure 25. Dust filter replacement

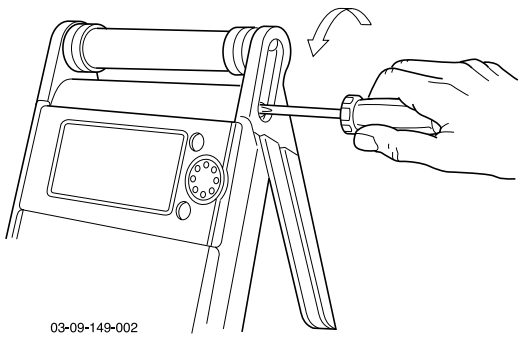


Figure 26. Support arm adjustment

Support Arm Adjustment

Periodically the support arm mechanism may require adjustment.

1. Remove the cross head arm fixing screw.
2. Using a suitable screwdriver, turn the tensioning screw (Fig 26) anti-clockwise half a turn.
3. Refit the leg fixing screw and repeat the operation on the opposite side.
4. Check that the arm tension is enough to support the weight of the PDU without movement.

VIA Carrying Case

The VIA unit (0018) is secured into its carrying case with two fixing screws from the underside of the case. If a new VIA is required, remove the two fixing screws and lift the VIA from the carrying case. Return only the VIA for replacement, do not return the carrying case.

New CD-ROM Releases

The latest version of the Aston Martin Diagnostic System software will be supplied with the system. When necessary, new releases of software will be issued by mail to each user of the system. Immediately fit the new CD-ROM to the disc caddy, retaining the old CD in its protective case as a backup. The new software should be loaded at the next use of the PDU.

In order to identify the revision level of the software, the version number is included on the disc.

e.g. PDU 004 is version 004 of the PDU software.

Technical Specifications

Electronics Module

Voltage Supply	100-240 VAC
Frequency	50-60 Hz
Current Consumption	1.0-0.5 Amp
Operating Temperature	0 - 45°C
Operating Humidity	15 - 85% non-condensing

PDU and VIA

Voltage Supply	12 VDC
PDU Current Consumption	2.5 Amp
VIA Current Consumption	6.5 Amp
Operating Temperature	0 - 50°C
Operating Humidity	95% max non-condensing 12 hours
Storage Humidity	60% RH max non-condensing 1000 hours
Storage Temperature	-20°C to 70°C

Weights

Base Station	20.5 kg (45.2 lb)
Electronic Module	3.7 kg (8.16 lb)
PDU	3.7 kg (8.16 lb)
Carrying Case	2.0 kg (4.4 lb)
VIA	4.3 kg (9.48 lb)

Statement of Calibration

Product Range Aston Martin Diagnostic System

Product Type Portable Diagnostic Unit

Product Number 3130-0017

We certify that the above product has been tested and found to conform to the product specification, prior to dispatch from GenRad. The measurements performed by this equipment are traceable to international measurement standards. Calibration records, including the date of calibration and the serial numbers of the measurement instruments are maintained by GenRad and are traceable through the PDU System serial number.

NOTE: The PDU will not require any periodic adjustment in order to maintain specified measurement accuracy.

Calibration Measurements

Ambient temperature during calibration 20±1°C.

The test resistances in the table below are applied between the red and black probes. The PDU is set to measure resistance between these probes using the DMM function. The PDU reading must be between the limits shown.

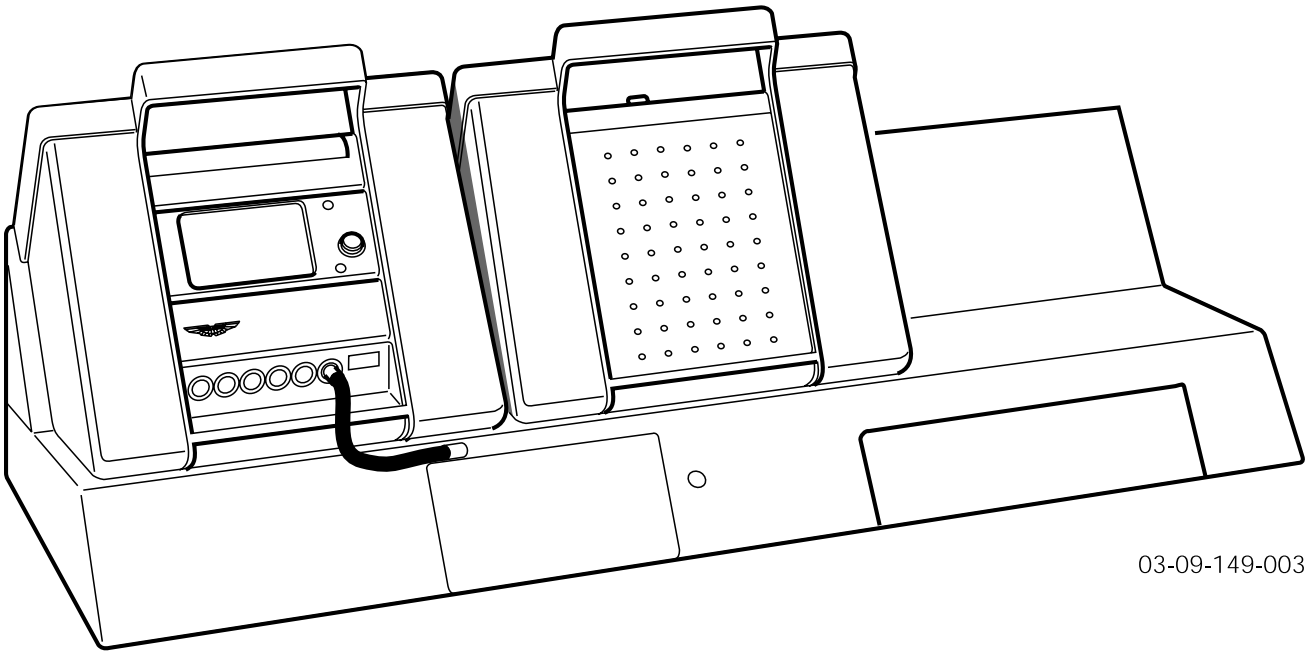
Test Resistance	PDU Reading Limits
10Ω	9.84Ω - 10.16Ω
10MΩ	8.22MΩ - 11.78MΩ

The test voltages in the table below are applied between the red and black probes. The PDU is set to measure voltage between these probes using the DMM function. The PDU reading must be between the limits shown.

Test Voltage	PDU Reading Limits
50mV	48mV - 52mV
100mV	98mV - 102mV
160mV	157mV - 163mV
350mV	345mV - 355mV
720mV	712mV - 728mV
1.45V	1.43V - 1.47V
2.90V	2.86V - 2.94V
7.25V	7.17V - 7.33V
14.5V	14.35V - 14.65V
29V	28.7V - 29.3V
49V	48.5V - 49.5V
98V	97.0V - 99.0V
175V	173.7V - 176.3V

The Aston Martin Lagonda Diagnostic System

The Aston Martin Lagonda Diagnostic System fulfils a number of functions in aiding the technician to quickly and accurately locate faults. The heart of the system is the Portable Diagnostic Unit (PDU), a lightweight powerful computer/ measurement system providing a step-by-step user friendly interface for the technician.



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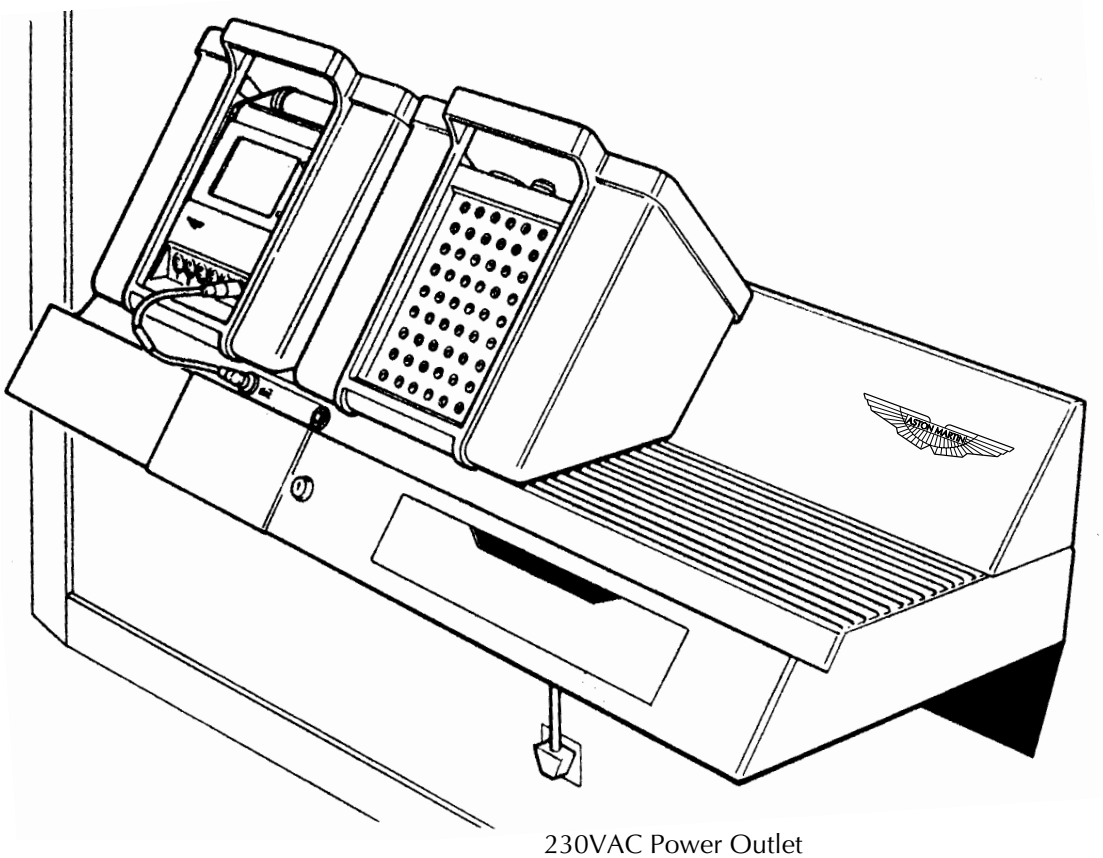
PDU Power

Power for the PDU is supplied via an internal rechargeable battery pack which can keep the PDU operational for approximately one hour when disconnected from the base station and the vehicle. In order to preserve PDU battery charge, power to the screen backlight is automatically cut after five minutes of inactivity. The power ON indicator remains lit, indicating that the PDU is in 'stand-by' mode. One touch of the screen will restore backlight power.

When connected to the base station, power is supplied to the PDU from the Electronic Module to recharge the PDU battery pack as necessary.

When connected to either diagnostic socket on the DB7 Vantage, power is supplied via diagnostic socket pin 4 (chassis ground) and pin 16 (battery power) to maintain PDU power at all times even when the vehicle ignition is switched off.

When connected to the air conditioning system using the VIA, the vehicle battery adaptor (VBA) must also be used to maintain PDU power.



230VAC Power Outlet

Software

DB7 Vantage Software for the PDU system is supplied on a CD ROM disc and supports diagnosis on the following control units:

- EEC-V Powertrain Control Modules (PCMs)
- ZF 5 HP-30 Transmission Controller (via the PCM)
- PATS - Passive Anti Theft System
- Teves Mk 20 ABS and Traction Control System
- Valeo Air Conditioning System
- Security System
- Airbag and Seat Belt Pretensioner Systems

All of these systems are supported in English, French, Italian, German and Japanese.

In addition to the specific system software listed above, the PDU is also equipped with general purpose software to provides multimeter, printing, PDU to PC download, and PDU training options.

Communication with control units is principally via the Aston Martin multi-protocol adaptor to the 2 inbuilt diagnostic sockets in the vehicle. Only the air conditioning unit requires the VIA.

If the multimeter function is used, the Vehicle Battery Adaptor (VBA) will be required to provide the basic +12 volt and ground reference levels for the multimeter.

Software Loading and Selection

Ensure that the system is powered up and that the PDU is correctly connected to the base station. Check and if necessary load the PDU software CD Revision 004.

Switch ‘on’ the PDU which will run through two front screens and then load initial PDU software.

If the PDU has previously been used, you will be given the option to continue using the current software or load another application.

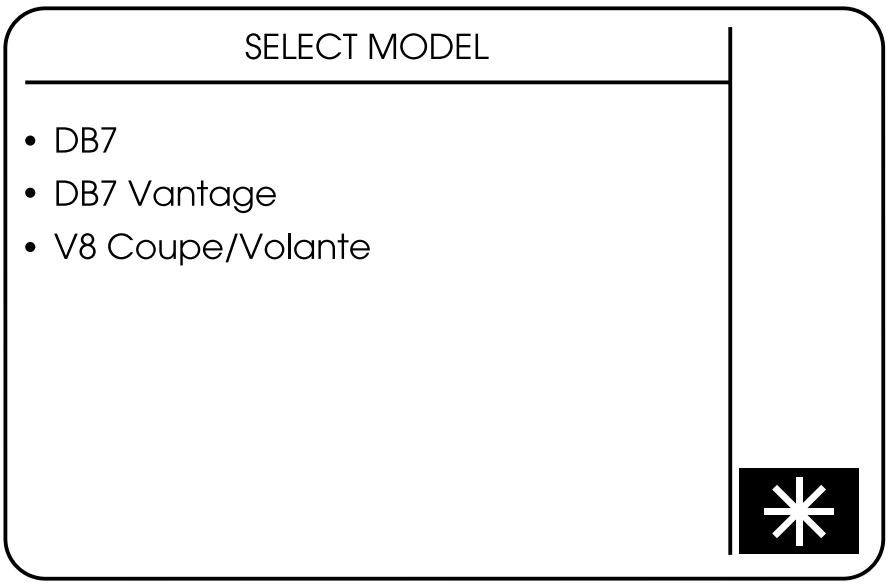
User Question

After responding to the User Question "Do you wish to use the currently loaded software or load another application", the "Select Model" screen will appear.

Select Model

PDU diagnostic software is provided for the following models:

- DB7 - 95 model year six cylinder vehicles with Zytec engine management systems
- DB7 - 97 model year six cylinder vehicles with EECV engine management systems
- DB7 Vantage - V12 6 litre vehicles with EECV engine management systems
- V8 Coupe and Volante - V8 5.3 litre vehicles with "Alpha Plus' engine management system



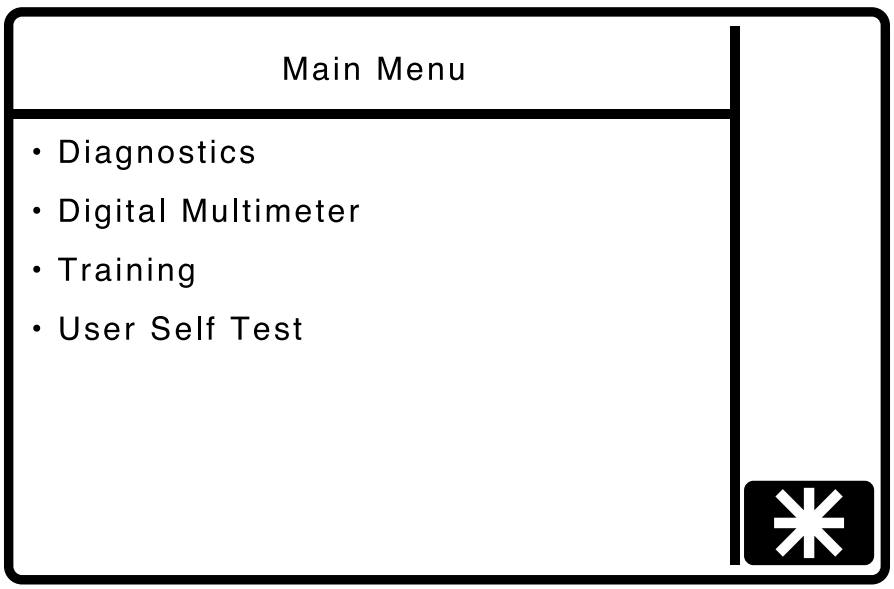
067-Select Model

This version of the PDU Users Guide will describe only those applications relevant to DB7 Vantage.

PDU Main Menu

The PDU main menu appears after the vehicle model is selected and provides access into the principal PDU functions:

- Diagnostics
- Training
- Digital Multimeter
- User Self Test



028-Main Menu

Diagnostics

Vehicle Area (DB7 Vantage)

The 'Vehicle Area' screen allows selection of any item from the following list of areas to be diagnosed:

- Engine Diagnostics
- Engine Datalogger
- OBD II Scan Tool
- OBD II Report
- Climate Control
- Anti-Lock Braking System
- Airbag
- PATS System
- Security
- Exit

Engine Diagnostics (DB7 Vantage)

Caution: Many signals and functions occur in both the Primary (Cylinders 1-6) and Secondary (Cylinders 7-12) Powertrain Control Modules (PCMs). Ensure that you are working on the correct half of the engine.

The 'Engine Diagnostics' menu contains the following options:

- Diagnostic Trouble Codes
- KOEO Primary (On Demand Self-Test)
- KOEO Secondary (On Demand Self-Test)
- KOER Primary (On Demand Self-Test)
- KOER Secondary (On Demand Self-Test)
- OBD II Readiness Test
- Output State Control
- Throttle Checks
- Exit

Digital Multimeter

The Digital Multimeter function provides the capability to measure voltage, current, resistance, frequency, pulse width, pulse period, and duty cycle. These measurements are usually made using the PDU measurement probes. Measurements may also be made using the module pin selection function on the Air Conditioning system.

Training

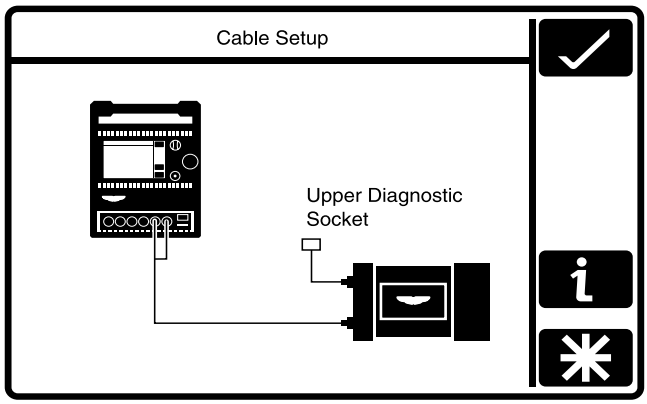
An on-screen programme is provided to train new users in the use of screen icons and in the use of the digital multimeter and datalogger functions.

User Self Test

In order to prove that the equipment is functioning correctly, a complete user self test is incorporated. The user is directed to test the PDU itself and then to progressively connect each part of the PDU system which will be tested by the software. Any fault identified during the test is notified to the user. If no faults are identified, the user is advised on the correct functioning of the system.

Cable Setup

On selecting the required vehicle area, the selected software will be loaded and then the 'Cable Setup' screen will appear.



007-Cable Setup

Connections will be shown directly to the selected control unit using the Aston Martin Multi-Protocol Adaptor and one of the two diagnostic sockets for most vehicle systems.

Air Conditioning Diagnostics

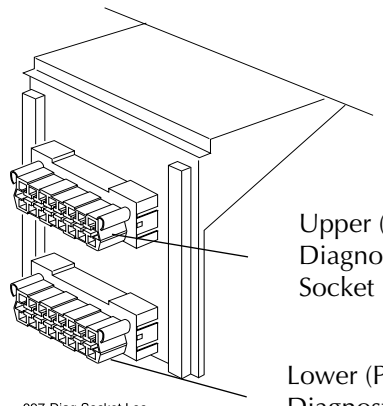
The Valeo air-conditioning system uses a unique communications protocol and therefore the vehicle interface adaptor (VIA) is required and is connected directly to the air-con CPU in order to carry out diagnostics work on the system.

It is also necessary to use the vehicle battery adaptor (VBA) to provide the necessary +12V and 0V reference levels for voltage measurements on the air-conditioning system.

Diagnostic Sockets

The diagnostic sockets are located behind the passenger side underscuttle panel on the initial V12 cars. The sockets will be mounted behind the driver's side underscuttle panel on later vehicles.

The sockets are mounted on a bracket and labelled Upper and Lower. The following lists describe the systems accessed from each socket.



097-Diag Socket Loc

Upper (Body) Diagnostic Socket

Security System

Instrument Pack

Airbag and Seatbelt Pretensioner Systems

Lower (Powertrain) Diagnostic Socket

EEC V Powertrain Control Modules (PCMs)

Transmission Controller (via the primary PCM)

ABS and Traction Control Systems

Passive Anti-Theft System

Establishing Communications

When cable connections are completed, switch on the vehicle ignition. The electronic control units will 'wake up' and communication between the selected control unit and the PDU will be established.

As communication is established with the selected system, a system menu will be displayed.

System Menu Selections

The options for each vehicle system are described in detail on the following pages but menu entries fall into the following general areas:

Datalogger

The Datalogger function enables you to monitor individual signals relevant to the chosen vehicle area.

The Datalogger function is described in detail using a worked example at the end of this PDU Users Guide.

Diagnostic Trouble Codes

This application enables the PDU to provide the following functions:

- Decode and display any trouble codes logged by the control module being monitored.

  Note: Take care to note whether reading a primary or secondary PCM code when logged into the DTC function for the powertrain controllers.
- When supported by the module, decode and display enhanced trouble codes, together with any count of the number of occurrences
- Clear all of the trouble codes and freeze frame data logged in the control module.

  The EECV engine management system only permits clearing of all logged codes. Ensure that all required data has been recorded before clearing all logged codes.
- Monitor other data such as the alarm history.

System Specific Tests

These menu entries cover special tests required to program or test system specific features. The following are examples of tests provided:

Engine	KOEO and KOER tests
	OBDII Readiness test
	Output State Control test
	Throttle Potentiometer track test
PATS	Ignition Key Learn Menu
Security	Remote Transmitter Key Learn Tests
	Special Functions Programming

Exit

Selecting and then confirming the exit option will return the PDU to the Main Menu.

PDU Use

In the following pages, the use of the PDU on each vehicle system is described.

Engine Diagnostics

Transmission Diagnostics

Climate Control Diagnostics

Anti-Lock Brakes Diagnostics

Passive Anti-Theft (PATS) Diagnostics

Security System Diagnostics

Airbag Diagnostics

Seat Belt Pretensioner Diagnostics

After these system specific descriptions, the following general purpose functions are described:

Datalogger

Digital Multi-Meter

Diagnostic Trouble Codes

Printing

Training

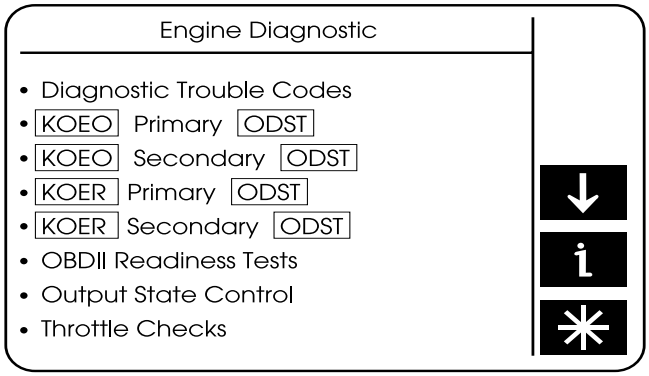
OBD II Scan Tool

User Self-Test

PDU Matrix (Print, E-Mail via PC)

Engine Diagnostics

Selecting Engine Diagnostics from the Vehicle Area screen brings up the Engine Diagnostics Screen.



142-Engine Diagnostics

Diagnostic Trouble Codes (DTCs)

On selecting Diagnostic Trouble Codes, the PCM memory will be scanned and any recorded DTCs will be decoded and displayed.

The engine and transmission DTCs are integral to the On Board Diagnostics (OBD II) system and are fully described in the DB7 Vantage OBD II Diagnostics Manual.

Before attempting to clear the logged DTCs, record all logged DTCs for use in subsequent fault analysis.

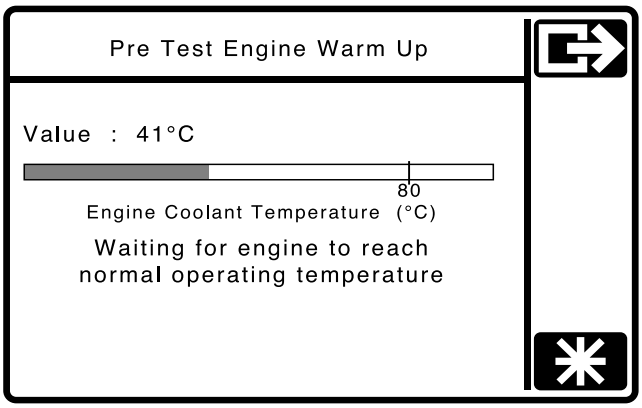
All logged DTCs may be cleared by selecting the EEC-V EMS DTCs title. This will bring up the Clear (C) icon which may be selected and confirmed to clear all logged DTCs.

Note that on clearing all logged DTCs you will also clear the associated timers, counters and fault history files (and extinguish the engine management warning light for North American vehicles). The OBD II readines test status will also clear down and a P1000 (OBD II readiness test incomplete) trouble code will be set. A full drive cycle (see DB7 OBD II Diagnostics Manual) must be completed to clear the P1000 code if required. The P1000 code will clear automatically after some miles of driving when all required tests have satisfactorily completed.

Caution: If a transmission code is logged in the PCM, the TCM DTCs must be cleared first and then clear the PCM DTCs. If the PCM DTCs are cleared without clearing the TCM, the TCM code will immediately reset in the PCM when power is restored.

Key On Engine Off (KOEO) and Key On Engine Running (KOER) On Demand Self Tests (ODST)

Before either the KOEO or KOER test will run, the engine coolant temperature must be in excess of 80°C. Select and confirm either the KOEO or KOER test. If the coolant temperature is too low, the Pre Test Engine Warm Up screen will appear. Start the engine and run until coolant temperature is at 80+°C.



043-Pre Test Engine Warm Up

KOEO Test

As coolant temperature rises through the 80°C level, the technician will be requested to turn the ignition off and then on again. The KOEO test will then commence. Static inputs to the PCM will be checked and any faults detected will be recorded and displayed as DTCs. If any DTCs other than P1000 are logged, go to the OBD II Diagnostics Manual and resolve the concern(s) using the OBD II diagnostic procedures.

KOER Test

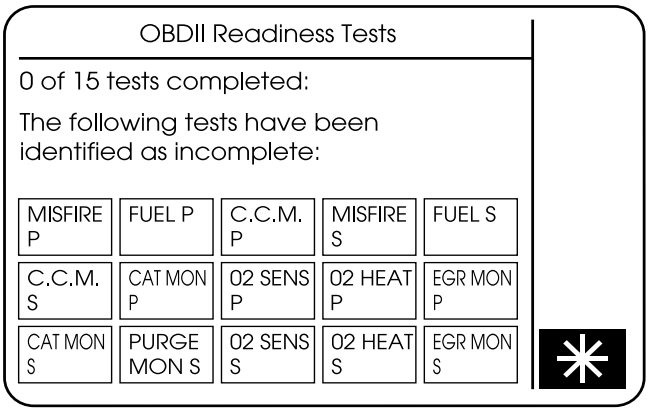
If coolant temperature level is below 80°C, the technician will be prompted to start and run the engine until coolant temperature rises above 80°C. As the temperature passes the 80°C level, the KOER test will commence automatically.

If coolant temperature is above the 80°C level, the technician will be requested to start the engine. The KOER test will commence as the engine is started. Dynamic inputs to the PCM will be checked and any faults detected will be recorded and displayed as DTCs. If any DTCs other than P1000 are logged, go to the OBD II Diagnostics Manual and resolve the problem(s) using the OBD II diagnostic procedures.

OBD II Readiness Test Monitor

Selecting OBD II Readiness Tests will bring up the following screen.

This software monitors the status of all significant components and parameters required to control vehicle emissions. When the tests are satisfactorily completed, the test boxes will be empty and the P1000 status code will be removed from the DTC list.



146-Readiness Tests

If any problem is detected, the tests will be terminated and the status will be shown as on the screen above e.g.: 0 of 15 tests completed.

Incomplete test titles will remain in the screen boxes. Completed test titles are deleted from the screen boxes.

Details of any trouble codes may be accessed using the Diagnostic Trouble Code function.

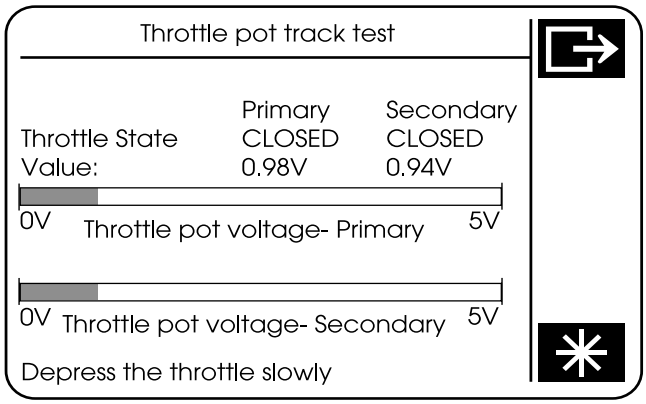
The tests incorporated into this routine are as follows:

- Misfire Monitoring
- Fuel System Monitoring
- Comprehensive Component Monitoring
- Catalyst Monitoring
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Purge System Monitor
- Exhaust Gas Recirculation Monitor

Throttle Position Sensor Track Test

This test is used to detect any problems with the tracks of the throttle potentiometers which could cause faulty throttle position signals to enter the PCMs. Such signals would result in incorrect calculation of engine power demand and possibly create excessive fuelling and high emissions.

Selecting Throttle Checks from the Engine Diagnostics screen will bring up the Throttle Position Sensor Track Test screen:



145-Throttle Pot

Follow the screen instructions to test the tracks of the throttle position sensors. The throttle must be moved slowly from fully closed to fully open without hesitation. Any pause in throttle movement will be interpreted as a track fault.

If a fault is detected, repeat the test several times to elliminate hesitant throttle movement errors from actual potentiometer faults. If a repeatable fault is detected, the potentiometer must be replaced.

Output State Control

This menu item provides a quick test of the basic electro-mechanical components controlled by the PCM. These tests should be performed in a key on engine off state.

The selections available are:

- Low Speed Cooling Fans
- High Speed Cooling Fans
- Idle Speed Control Valve Duty Cycle
- Purge Valve Duty Cycle
- Canister Vent Valve Duty Cycle
- Fuel Pump Duty Cycle
- Gearbox Cooling Pump (Manual)

The selected output may be toggled On/Off to aid in fault analysis but note that some components have a limited duty cycle and may switch off automatically to avoid damage to the component.

Transmission Diagnostics

The controller for the ZF 5 HP 30 automatic transmission may not be accessed directly.

Transmission diagnostics are accessed via the primary powertrain controller. Transmission related parameters are included in the following PID list and are identified by the TR_ prefix.

Engine and Transmission Datalogger - (PIDs) Parameter Identifications

The datalogger software is designed to aid the technician in identifying permanent or intermittent faults in the DB7's electrical and electronic systems. It can provide a recorded view of selected signals over a chosen time period. This recording may be captured in a static, rolling road or road test situation. Data recorded during such tests may then be analysed on completion of the test or printed out for later analysis.

Datalogger operation is described using a fully worked example at the end of this PDU Users Guide. The full list of datalogger signal names and descriptions is provided in the DB7 OBD II Diagnostic Manual and on the PDU screen. The following list is a summary of the signals which may be monitored at the PCMs.

Signal	PCM		Description
	Prim	Sec	
AC stat	-P	-S	A/C cut-out circuit status. 1 = fault present
ACCS	-P	-S	Air-Con Control Switch - 1 = A/C On
ACP	-P	-S	Air-Con Pressure Sensor - 1 = A/C pressure high
Adapt Fuel	-P	-S	Adaptive long-term fuel trim
ADPT1F	-P	-S	Adaptive Fuel - Table 1 status
AST	-P	-S	After Start Timer - (seconds, max = 255)
B+	-P	-S	Battery Positive - Volts
BARO	-P	-S	Barometric Pressure (calculated)
Brake	-P	-S	Brake input to the PCM. HI (=12V) when brake pedal pressed.
CAN_FAIL	-P	-S	Failure of the CAN network
CMP	-P	-S	Cam position sensor signal
CMP STAT	-P	-S	Cam Position Sensor - 1 = fault
DRVCNT	-P	-S	Number of OBDII Drive Cycles Completed
DSDRPM	-P	-S	Desired engine speed (RPM) during closed loop
DTCCNT	-P	-S	DTC Count (Fault codes + pending codes. MIL + non-MIL)
ECT STAT	-P	-S	Engine Coolant Temperature. Sensor Fault - 1 = fault
ECT-C	-P	-S	Engine Coolant Temperature - °C
ECT-V	-P	-S	Engine Coolant Temperature - Volts
EGR stat	-P	-S	EGR system fault. 1 = fault
EGRDC	-P	-S	EGR duty cycle
ENGLOAD	-P	-S	Engine Load (percent)
ENGRPM	-P	-S	Engine Speed - RPM
EPT	-P	-S	Exhaust Pressure Transducer (DPFE) Sensor feedback
EVAP DC	-P	-S	Cannister Purge Duty Cycle (% on)
EVROC	-P	-S	EVR Valve Open Circuit. 1 = fault
EVRSC	-P	-S	EVR Valve Short Circuit to battery voltage. 1 = fault
FP	-P	-S	Fuel pump commanded on. 1 = On
FPM	-P	-S	Fuel pump monitor status. 1 = fault
FP stat	-P	-S	Primary fuel pump relay circuit status. 1 = fault
HFC	-P	-S	High Speed Fan commanded On. 1 = On
HFC stat	-P	No	High speed fan status. 1 = fault

Signal	PCM		Description
	Prim	Sec	
H02S1	-P	-S	Upstream Sensor Output - Volts
H02S1st	-P	-S	HO2S1 Status. 1 = fault
H02S2	-P	-S	Downstream Sensor Output - Volts
H02S_FAULT	-P	-S	HO2S1 Status. 1 = fault
HO2S_Fdback	-P	-S	Oxygen sensor feedback
HTR1	-P	-S	Upstream heater command. 1 = on
HTR2	-P	-S	Downstream heater command. 1 = on
HTRCM1	-P	-S	Upstream heater current when tested
HTRCM2	-P	-S	Downstream heater current when tested
HTRF1	-P	-S	Upstream heater status. 1 = fault
HTRF2	-P	-S	Downstream heater status. 1 = fault
IACDTCY	-P	-S	Idle Air Control Duty Cycle (% open)
IACOC	-P	-S	IAC circuit open circuit or short to ground
IACSC	-P	-S	IAC circuit short circuit to battery voltage
IAT-C	-P	-S	Intake Air Temperature (°C)
IAT stat	-P	-S	Air Temperature - Temperature sensor failure
IAT-V	-P	-S	Intake Air Temperature - Volts or raw counts
IGN	-P	-S	Desired Ignition Timing - ° BTDC
INJ1F	-P	-S	Injector 1 commanded on
INJ2F	-P	-S	Injector 2 commanded on
INJ3F	-P	-S	Injector 3 commanded on
INJ4F	-P	-S	Injector 4 commanded on
INJ5F	-P	-S	Injector 5 commanded on
INJ6F	-P	-S	Injector 6 commanded on
INDS	-P	-S	Input from manual lever position sensor (counts)
IPW	-P	-S	Injector Pulse Width in mS
LAMSE	-P	-S	Current Short Term Fuel Trim, adjustment from stoichiometric - (% of range)
LFC stat	-P	-No	Low Speed Fan Status
LFC	-P	-S	Low Speed Fan commanded On. 1 = On
LOOP	-P	-S	Fuel Control - 1 = Open Loop, 0 = Closed Loop
MAF STAT	-P	-S	Mass Air Flow Meter - MAF sensor failure
MAF_V	-P	-S	MAF sensor output voltage
MIL	-P	-S	Malf. Indicator Lamp Status - 1 = Lamp On
MIL stat	-P	No	MIL lamp or wiring malfunction
MISF	-P	-S	Engine currently misfiring - 1 = misfire
MIS_MON_KAM	-P	-S	Misfire OBDII trip flag
MIS	-P	-S	Total suspected misfires - all cylinders
Mis1	-P	-S	Cumulative misfires detected by cylinder 1 misfire test
Mis2	-P	-S	Cumulative misfires detected by cylinder 2 misfire test
Mis3	-P	-S	Cumulative misfires detected by cylinder 3 misfire test
Mis4	-P	-S	Cumulative misfires detected by cylinder 4 misfire test
Mis5	-P	-S	Cumulative misfires detected by cylinder 5 misfire test
Mis6	-P	-S	Cumulative misfires detected by cylinder 6 misfire test

Signal	PCM		Description
	Prim	Sec	
ODCODES	-P	-S	Total number of on-demand codes currently stored.
OL_CLFAIL	-P	-S	Open Loop due to closed loop failure
OL_DRIVE	-P	-S	Open Loop due to driving conditions
OL_HOLD	-P	-S	Hold Open Loop - conditions not satisfied for closed loop
PGM CVS	-P	No	Purge Management - Canister Vent Duty Cycle % (primary only)
PGM_CVS stat	-P	No	Purge Management - Canister Vent Valve failure (primary only)
PIP	-P	-S	Profile Ignition Pick-Up - Toggles with CTO output
PNP	-P	-S	Park Neutral Position Switch
R-BIAS	-P	-S	Rear bias trim
RATCH	-P	-S	Lowest Throttle Pot reading during driving (Idle value)
SHO2S1	-P	-S	Signed upstream O2 sensor voltage (can go negative)
SHO2S2	-P	-S	Signed downstream O2 sensor voltage (can go negative)
TANKPRS	-P	No	Fuel tank pressure (primary only)
TMODE	-P	-S	Throttle mode - switch closed/part/full
TP_REL	-P	-S	Actual TP voltage, current reading (TP) minus idle value (RATCH))
TP stat	-P	-S	Throttle Position Sensor failure. 1 = fault
TP	-P	-S	Throttle Potentiometer signal - Volts or counts
TPR-V	-P	-S	Fuel tank pressure sensor voltage
TRIP	-P	-S	OBDII Drive Cycle Complete (except cat monitor) - 1 = Trip completed
TRIPCNT	-P	-S	Number of Completed OBDII Trips
TR_GEAR	-P	No	Gear currently engaged (primary only)
TR_ISS	-P	No	Transmission input speed (primary only)
TR_KICKDOWN	-P	No	Kickdown switch state (primary only)
TR_OILTEMP	-P	No	Transmission oil temperature (primary only)
TR_OSS	-P	No	Transmission output speed (primary only)
TR_PRND	-P	No	Reported position of the gear selector lever (primary only)
TR_TQFINAL	-P	No	Torque value from the PCM (primary only)
TR_TQMAX	-P	No	Maximum torque for the ZF 5HP-30 transmission (primary only)
TR_TQRAT	-P	No	Maximum torque during a gear change (primary only)
VS stat	-P	No	Vehicle Speed Sensor fault (primary only)
VS	-P	-S	Vehicle Speed - MPH
WAC	-P	-S	Wide Open Throttle A/C Cut-Off - 1 = On
WHICH_PCM	-P	-S	PCM identifier. 0 = primary

Diagnostic Trouble Codes

Introduction

The 'Diagnostic trouble codes' application enables the PDU to monitor the trouble codes logged in selected control module's and provides the following functions:

- Decode and display any trouble codes logged by the control module(s) being monitored.
- Decode and display enhanced diagnostic information, together with any count of the number of occurrences, when supported by the control module(s).
- Clear all of these trouble codes on the PDU screen, when supported by the control module(s).

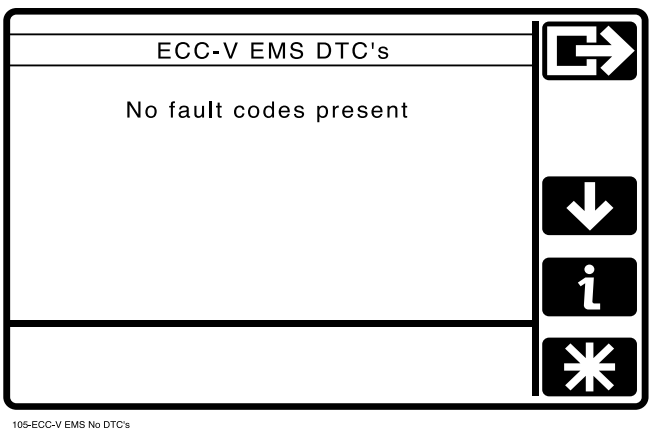
Diagnostic Trouble Codes are logged by most control units and can be accessed using the PDU. The Air Conditioning control unit does not log trouble codes.

Operation

From the Main Menu make the following selections:

- Select Diagnostics
- Select the vehicle model and system to be checked
- The PDU will then load the appropriate software
- Select Diagnostic Trouble Codes
- Connect the PDU to the car as shown on the screen diagram
- Select the ✓ icon to confirm connection
- The PDU will then interrogate the chosen control unit and will display any logged trouble codes.

If no trouble codes have been logged by the control module, the PDU will display a screen as shown below.

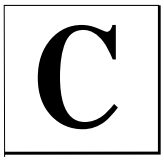


The No Fault Codes screen

The trouble code screen will be headed by a module title block followed by a list showing all logged trouble codes for the selected module.

Note: There may be more logged diagnostic trouble codes than displayed on the first screen. Use the 'up arrow' and 'down arrow' icons if necessary to scroll through the total display.

On EEC V engine management systems, the 'Clear All' icon will appear.



'Clear All Codes' Icon

Freeze Frame Data

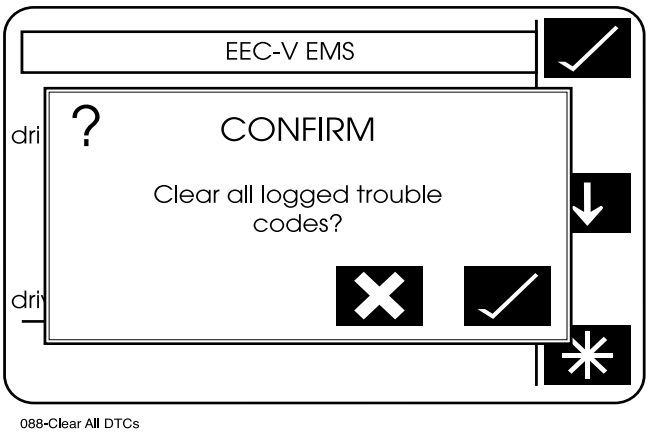
As any engine management MIL trouble code is logged, the system takes a snapshot (freeze frame) and records the state of all signals at that time.

On DB7 Vantage EEC V engine management system, freeze frame data may be accessed using the OBD II scan tool function.

Clear all Trouble Codes

CAUTION: Make a note of all logged DTCs before using the 'Clear All' function. Carry out appropriate corrective action for all logged codes (except P1000) before returning the vehicle to the owner.

Selecting the clear all trouble codes icon will invoke a confirmation window.



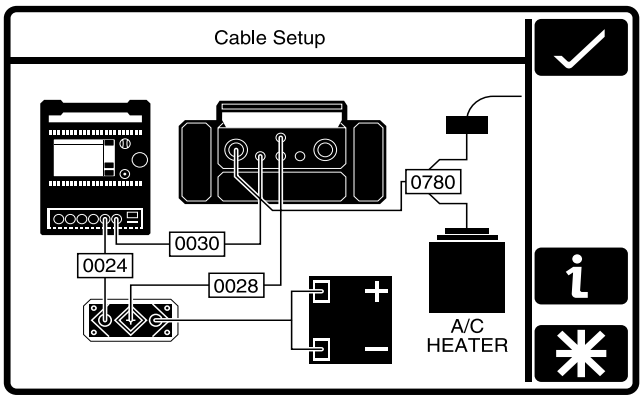
'Clear All Codes' confirmation screen

Selecting the 'tick' will instruct the PDU to clear all logged trouble codes in the selected module and return to the no logged codes screen.

Select the 'tick' icon to exit Diagnostic Trouble Codes.

Climate Control Diagnostics

The air conditioning control module is located at the right end of the air conditioning unit. Since this controller uses a unique communications protocol, the PDU must be connected directly to the unit via the Vehicle Inerface Adaptor as shown in the following cable setup screen.



001-A/C PDU

A digital microprocessor within the control module receives data signals from the operator controlled switches. Comparison of these signals with those returned from system temperature sensors and feedback devices results in the appropriate output voltage changes needed to vary: Blower motor speed, flap position and the solenoids which respond to operator selected temperature demand.

The air from two blower motors is passed through the evaporator matrix which, depending on the positions of the humidity buttons, removes heat from the incoming air. Depending on the position of the two blend flaps, the cold air either passes directly to the vehicle outlet vents, or is passed through the heater matrix to be reheated and then to the vehicle outlet vents.

The amount of air passing through the heater matrix is infinitely variable depending on ambient temperature and the temperature selected within the vehicle.

Selecting 'Climate Control' from the vehicle area menu, will present the technician with the datalogger tool selection screen.

Details of the signals which may be monitored in the system may be found in the DB7 Workshop Manual - Section 8 - Air Conditioning'

Anti-Lock Braking Diagnostics

The Teves Mk 20 Braking System Control Module consists of three sub-systems, servo-assisted braking, anti-lock braking and traction control.

The ABS and Traction Control functions will be automatically engaged if the frequencies of the four wheel speed sensor signals show significant differences in wheel speed rotation.

All wheel speed signals the same frequency

Normal servo-assisted braking

Any wheel speed signal at a much lower frequency than the other three wheels

ABS control cuts in

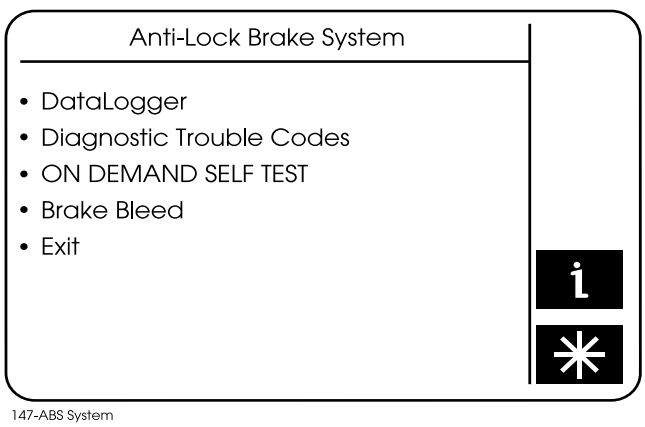
Any driven wheel speed signal at a much higher frequency than the other driven wheel

Traction Control cuts in.

The ABS and Traction Control Systems are controlled and continuously monitored by the ABS control module, which automatically switches off the ABS and Traction Control systems if a failure is identified, illuminating a warning lamp and leaving full, servo-assisted braking to all wheels.

The DataLogger function will permit monitoring of the complete system apart from the solenoid valves. The ABS control module transmits short duration test pulses of 25 to 100 microseconds to the solenoid valves. These pulses are too fast for the PDU to monitor and as a result would cause confusing waveforms.

Selecting 'Anti-Lock Braking' from the Area Menu, will present the technician with the following menu of diagnostic tools screen:



147-ABS System

ABS Diagnostic Trouble Codes

The DTCs which are supported in the Teves Mk 20 ABS system are listed in the workshop manual - Section 5 Brakes Wheels and Tyres.

ABS Datalogger

The following signals in the Teves Mk 20 ABS system may be monitored using the datalogger function.

DTCs Number of DTCs Logged

The Diagnostic status manager (DSM) receives and processes fault information and decides when a DTC should be logged and the MIL turned on. The actual total stored is indicated by the parameter.

FBRAKE Brake Switch

The signal from the brake switch is used by the CM to ensure that traction control is inhibited when the brakes are applied. The input circuitry within the CM is a 10K pull-up to ignition voltage. When the switch is closed the parameter is set to 1.

FLWS Front Left Wheel Speed Sensor

An indication sensor outputs a sinusoidal wave form 48 pulses per revolution. The output is processed by the CM to control braking and traction. The sensor is continually monitored for open and short failure and operating range. If its output exceeds 330km/h it is deemed to be faulty and the CM is disabled. The parameter tracks the sensor weaveform through 255 steps.

FRWS Front Right Wheel Speed Sensor

An indication sensor outputs a sinusoidal wave form 48 pulses per revolution. The output is processed by the CM to control braking and traction. The sensor is continually monitored for open and short failure and operating range. If its output exceeds 330km/h it is deemed to be faulty and the CM is disabled. The parameter tracks the sensor weaveform through 255 steps.

RLWS Rear Left Wheel Speed Sensor

An indication sensor outputs a sinusoidal wave form 48 pulses per revolution. The output is processed by the CM to control braking and traction. The sensor is continually monitored for open and short failure and operating range. If its output exceeds 330km/h it is deemed to be faulty and the CM is disabled. The parameter tracks the sensor weaveform through 255 steps.

RRWS Rear Right Wheel Speed Sensor

An indication sensor outputs a sinusoidal wave form 48 pulses per revolution. The output is processed by the CM to control braking and traction. The sensor is continually monitored for open and short failure and operating range. If its output exceeds 330km/h it is deemed to be faulty and the CM is disabled. The parameter tracks the sensor waveform through 255 steps.

Passive Anti Theft (PATS) Diagnostics

Security System Diagnostics

Because of the requirement to maintain vehicle security, the PATS and Security System operating instructions and diagnostics are covered in the Vehicle Security supplement to section 6 of the workshop manual. This supplement has restricted circulation and is only available to Aston Martin Dealers.

Airbag / Pretensioner Diagnostics

WARNING: Whilst it is completely safe to access and read the airbag diagnostic module memory at the diagnostic socket, significant personal risks exist in the performance of any other tasks on the airbag system or components. The airbags and seat belt pretensioners MUST BE DISARMED before any work is performed on the airbag system. Read all safety precautions and warnings in the Supplementary Restraint System section of the DB7 Vantage Workshop Manual. All safety procedures must be followed before, during and on completion of 6.4.21.4 Airbag Disarming/Arming Procedure.

System Description

The airbag / seat belt pretensioner system installation comprises:

- Restraint Control Module
- One single point airbag sensor
- SRS indicator/warning lamp
- Driver and passenger airbag modules
- Driver and Passenger seatbelt pretensioner modules

The system is designed to provide protection for both driver and front seat passenger by automatically deploying airbags in the event of a collision during forward travel.

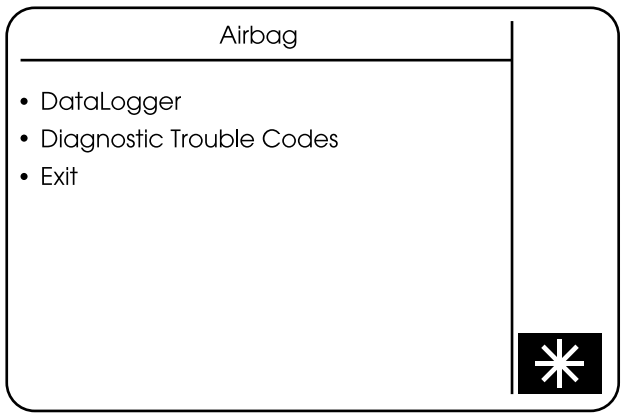
In the event of a collision, the single point crash sensor in the restraint control module will operate, completing the firing circuit and causing the airbags to inflate and the seat belt pretensioners to operate.

Any faults in system components, installation or wiring will be indicated by a flashing code on the SRS/ AIRBAG warning lamp. Fault code information may also be monitored using the PDU or scan tool.

Airbag Diagnostics

The Restraint Control Module indicates a fault by transmitting a pulsed signal to flash the SRS/AIRBAG warning lamp. The fault code is repeated continuously. If there are two or more faults, the fault code with the highest priority is transmitted first. The second fault code is only transmitted when the first fault has been rectified.

At the top left of the PDU screen there is a bullet mark which indicates the current state of the Airbag System Failure line. As a code is transmitted the bullet mark can be seen to flash.The PDU reads the fault code, and writes the code number and fault description to the screen. The PDU continues to monitor the transmitted code. If the transmitted code changes, the new code number and description will appear below the first.



068-Airbag

When remedial action has been taken to correct a fault, press the Clear Button to clear down the PDU display. Then use the PDU to ensure that no further faults are reported.

A series of audible beeps, continuously transmitted by the Restraint Control Module, indicates that there is an Airbag System fault but the Airbag System Failure line is open circuit. The PDU is not able to monitor the fault line in this situation as there is no pull-up resistor, normally provided by a warning lamp in the instrument pack.

Airbag Diagnostic Trouble Code Monitor

Any fault in the restraint control module, circuits or components will be detected and a fault code will be logged. Logged fault information may be accessed via the PDU Diagnostic Trouble Codes function or may be accessed by monitoring the flashing of the ABS Warning Lamp. The following diagnostic trouble codes are supported by the Airbag Control Module:

Fault Code	Description	ABS Lamp Code or Tone Warning
B1318	Battery voltage low	None
B1869	Airbag warning indicator lamp circuit open	Tone
B1870	Airbag warning indicator lamp circuit short to battery	Tone
B1877	Driver's pretensioner circuit open	46
B1878	Driver's pretensioner circuit short to battery	17
B1879	Driver's pretensioner circuit short to ground	17
B1881	Passenger's pretensioner circuit open	47
B1882	Passenger's pretensioner circuit short to battery	18
B1883	Passenger's pretensioner circuit short to ground	18
B1885	Driver's pretensioner circuit resistance low on squib	46
B1886	Passenger's pretensioner circuit resistance low on squib	47
B1887	Driver's airbag circuit short to ground	15
B1888	Passenger's airbag circuit short to ground	16
B1891	Airbag tone warning indicator short to battery	None
B1892	Airbag tone warning indicator circuit failure	None
B1901	Airbag crash sensor feed/return circuit short to ground	14
B1916	Driver's airbag circuit short to battery	15
B1925	Passenger's airbag circuit short to battery	16
B1932	Driver's airbag circuit open	32
B1933	Passenger's airbag circuit open	33
B1934	Driver's airbag inflator circuit low resistance	34
B1935	Passenger's airbag inflator circuit low resistance	35
B1941	Airbag crash sensor feed/return circuit open	41

Print Facility

The 'Print Screen' and 'Print Trace' facilities provided on the compact disc PDU 004 will enable technicians to capture screen images or trace data. The captured data may then be downloaded to a PC. These images may then be printed directly to any PC printer or may be included into other PC files for illustration purposes.

Aston Martin PDU - PC Software

This software is included on compact disc PDU 004. Insert the CD into the CD drive of your computer. The Aston Martin PDU - PC software will automatically load and create a PDU - PC icon on your desktop.

PC Connection

The PDU is connected to the serial port of a PC using PDU printer cable 43-26878 and PDU to PC adaptor 43-27435. The PDU to PC adaptor is connected to the serial port of the PC. This cable and adaptor are designed to provide full electrical isolation between the Portable Diagnostic Unit (PDU) and the PC. The cable is constructed with an in-line module that contains the optical isolation circuitry, powered from the PDU.

Self Test Adaptor

Each cable type is supplied with a User Self Test (UST) adaptor. This allows the function of the cable to be verified independently of a printer. Future releases of UST software will include testing procedures for this cable.

Print Screen

The Print Screen function dumps a bitmap image of the current screen display into PDU memory. This function is particularly useful for recording data such as waveforms captured by the datalogger application.

The print screen function is supported in English, French, German, Italian and Japanese.

Print Trace

The Trace Buffer is used to record technician use of the PDU. As the diagnostics are executed, the following information is written to trace:

- Screen Title
- Menu options selected
- Operator questions selected
- Operator actions
- Control module information
- Test limits and results
- P codes detected by the DTC monitor
- Snapshot data from the datalogger
- OBD II freeze frame data

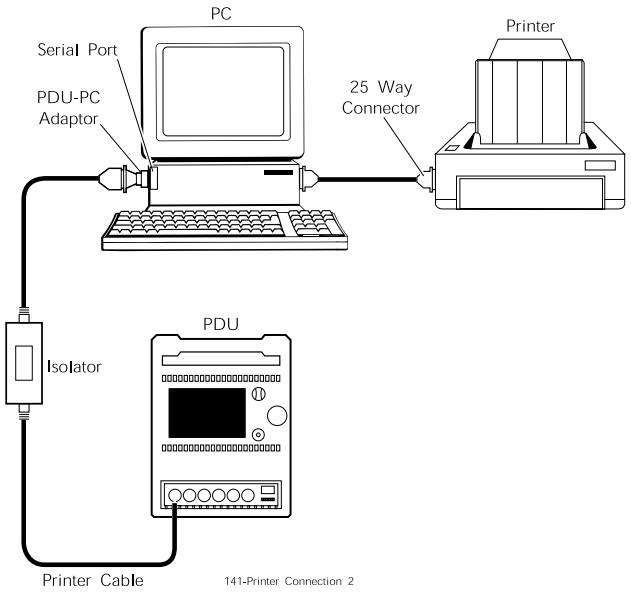
Print trace is supported in English, French, German and Italian.

Image Capture and Download

Select the ❋ icon.

Select either 'Print Screen' or Print Trace' to create the desired image in the PDU memory.

Follow the instructions to connect the PDU to the PC and Printer. Confirm connection using the ✔ icon.



The image file will then copy onto the PC hard disc and may be printed directly or included in other PC files.

Digital Multimeter

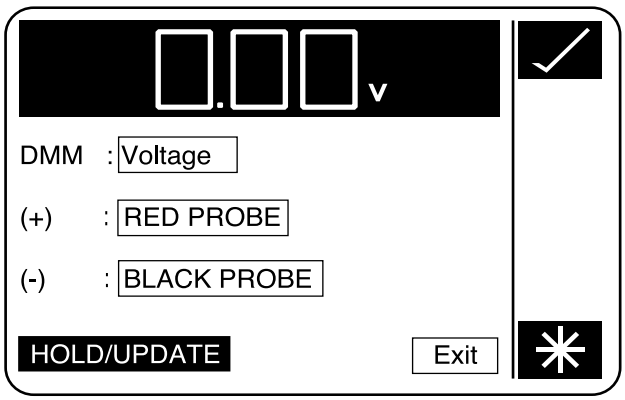
Introduction

The Digital Multi-Meter provides the capability to measure voltage, current, resistance, frequency, pulse width, pulse period and duty cycle using measurement probes or vehicle interface adaptor channels.

WARNING: DMM measurements must not be taken while the PDU is connected to the base station. The PDU measurement system becomes referenced to earth when connected to the base station. Serious measurement errors may be present because of any voltage difference between vehicle ground and base station earth. Operation of the PDU in this mode has both functional and safety implications and therefore must be avoided.

A digital multimeter (DMM) is resident within the PDU software toolbox.

The DMM application can be accessed from the main menu. On selection of "Digital Multimeter" from the main menu, the PDU will always display the same screen, known as the DMM general screen.



099-DMM General

The DMM General Screen

The DMM is used to display measured values, to three significant figures, in the correct units.

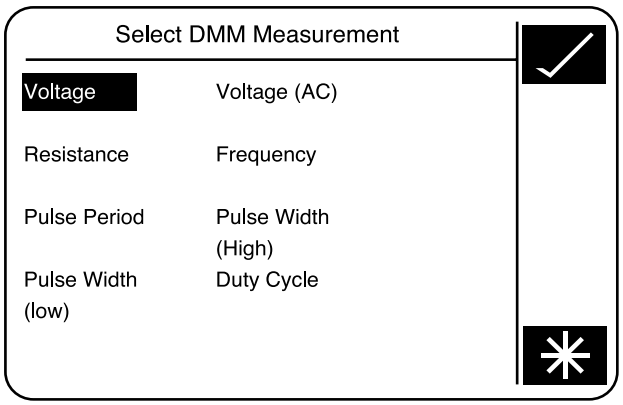
Modes of measurement are Voltage, Voltage (AC), Resistance, Frequency, Pulse Period, Pulse Width (High/Low) and Duty Cycle. Current measurements up to 50A may be made using the current probe. Measurements are usually made directly using the PDU measurement probes. On the air conditioning system only, when using the VIA, measurements may be made between specific module pins. If required, this mode must be specified when specifying the measurement to be made.

Operation

On selection of DMM the general screen, as shown in Fig. 1, will be displayed.

Voltage is the default selection for measurement, with red and black probes selected as sources. To choose alternatives to these options, press the relevant description for change followed by the 'tick' icon in the top, right-hand, corner.

If the measurement mode (Voltage) is selected for change, followed by a confirming 'tick', a screen as show will be displayed.



101-DMM Measurement

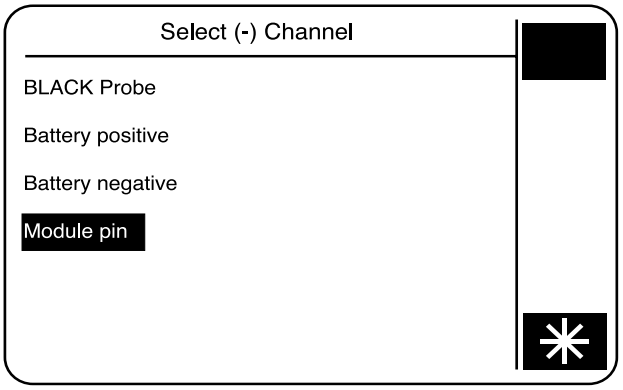
DMM Measurement Selection

Selection of any option from this screen, followed by a confirming 'tick', will return the operator to the general screen but with the new mode displayed against DMM.

If 'Resistance' is selected an additional icon, showing an audio symbol, will appear above the "EXIT" display. This icon allows the enabling / disabling of an audible signal which sounds when measured value falls below 0.5 ohms. Touch the icon to toggle the warning ON / OFF directly, no confirming 'tick' is necessary. A 'cross' is displayed over the icon when warning is turned OFF.

Measurement Source Selection

If a measurement source (either RED or BLACK PROBE) is selected, a screen as shown will be displayed. This screen may vary depending upon the various probes which can be connected to the PDU. A full list of possible sources will be displayed on the 'Source Select' screen.



098-DMM Channel

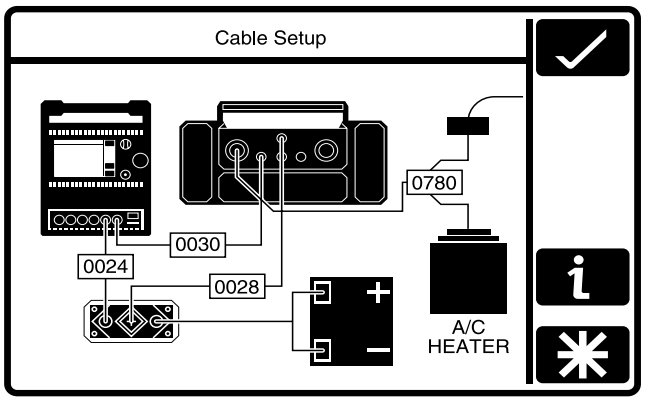
Selection of (+) and (-) measurement channels

Selection of any source option, except "Module Pin", will return the user to the general screen, which will display the revised source.

Module Pin Selection (Air-Con only)

Selection of "Module Pin" will display a screen as shown.

Selection of one of the options displayed on this screen allows the operator to make measurements on designated pins of the air conditioning control module. When the air conditioning module is selected PDU will display a wiring connection diagram, as shown.

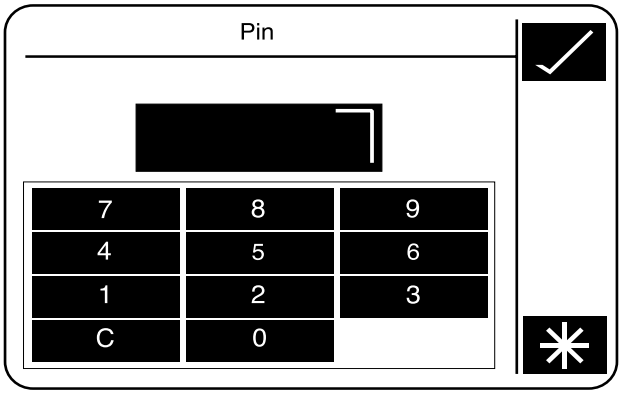


001-A/C PDU

Module Connection

The PDU will then check the cable connections. Until all connections are correct, the PDU will not allow progression beyond this screen. Pressing the 'asterisk' icon and selecting abort returns the operator to the general screen if an incorrect system has been chosen.

If selection and wiring are correct a numeric keypad will be displayed. The operator can now enter a pin number to be tested, using this keypad.

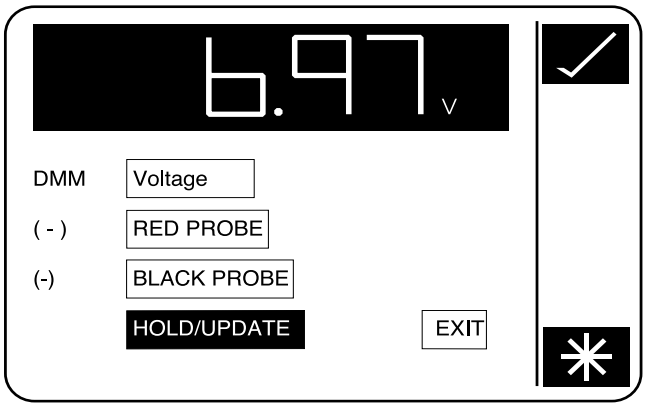


102-DMM Pin

Numeric Keypad

Display Freezing

To assist the operator a "HOLD/UPDATE" option is displayed on the general screen. This option is selected as default on the general screen and allows a reading to be 'frozen' on screen when the 'tick' icon is pressed. A 'tick' button is also incorporated into the red probe so that a remote 'freeze' command can be sent to PDU, holding the reading until the operator can view the screen. A frozen value is displayed on a 'grey' background indicating that the value is on HOLD. Re-pressing the 'tick' icon (either local or remote) unfreezes the display and restores the normal display background.



100-DMM Hold Update

The Hold/Update option

The "HOLD/UPDATE" option operates on one touch of the 'tick' icon (or 'tick' button) irrespective of the state of the screen backlight. Therefore it is not necessary to reinstate the screen backlight if there has been no operator contact with the PDU for five minutes (or longer). Pressing "HOLD/UPDATE" reinstates the backlight and initiates/releases display 'freeze' automatically.

System Exit

At any point during DMM operation it is possible to exit the system by either pressing the 'asterisk' icon and selecting abort, or pressing "EXIT" (where available) followed by a confirming 'tick'.

Datalogger

Introduction

DataLogger is software produced to identify permanent or intermittent faults on vehicle electronics. The objective of DataLogger is to provide a view of the vehicle's electrical behaviour, such that intermittent activity can be recorded and interpreted quickly and accurately. Running on the Portable Diagnostic Unit (PDU), the DataLogger application can capture vehicle information in three ways.

- Serial communications direct from the control unit.
- Parallel communications using the MPA
- Direct measurement using the measurement probes.

Serial Communication

Serial Communication is a two-wire communication link between the PDU and most vehicle control modules providing digital measurements for connected components. The serial communication link allows the tester to determine the current condition of components connected to the control module, and to identify any history of faults.

On later vehicles, the PDU is connected to the vehicle diagnostic sockets via the multi Protocol Adaptor (MPA) to gather serial data from the control modules.

Parallel Communication

The Vehicle Interface Adapter (VIA) provides an interface between the PDU and the vehicle harnesses for the acquisition of multiple analogue measurements. The VIA is connected between the relevant vehicle control module and it's harness connector. This allows the PDU to capture information from a multitude of channels entering the control module. This vehicle interface is used with control modules not equipped with a serial communication link (Teves Mk II braking system and the air conditioning system).

Measurement Probes

The measurement probes permit readings to be taken directly from any connector on the vehicle.

DataLogger Applications

Datalogger may be used to interrogate the following DB7 systems:

- ABS braking system controller
- Engine Management Controller
- Air Conditioning Controller
- Automatic Transmission Controller
- Passive Anti Theft (97 MY)
- Security System (97 MY)

Using the Datalogger

Configure the vehicle to the normal operating conditions for the system under test.

From the PDU main menu screen:

Highlight 'Diagnostics'.

Press the 'tick' icon to confirm the selection.

Enter the Transmission Type and confirm the selection.

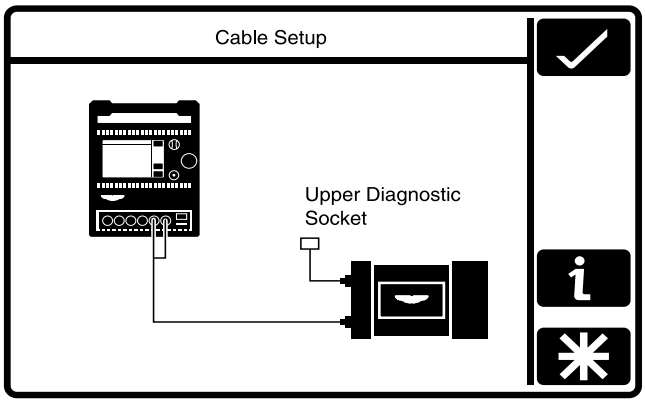
Select the Vehicle Area to be tested and confirm the selection.

The PDU tools screen should now be displayed.

Highlight 'DataLogger'.

Confirm the selection with the 'tick' icon.

The PDU connection screen should now be displayed.



PDU Connections for Datalogger

Connect the PDU to the vehicle as described in the Cable Setup screen.

Switch On the ignition and press the 'tick' icon.

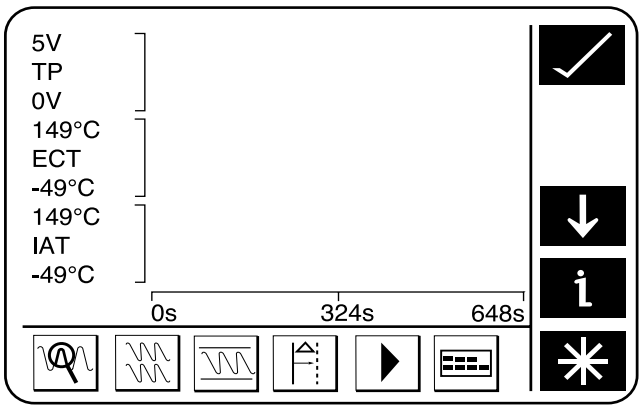
'Establishing connection to control module' should now be displayed on the screen.

If for any reason the PDU cannot communicate with the relevant vehicle control module a 'communications failure screen' will be displayed with a retry option.

Check all connections before retrying.

Once communications are successful 'Starting DataLogger' will appear on the screen momentarily.

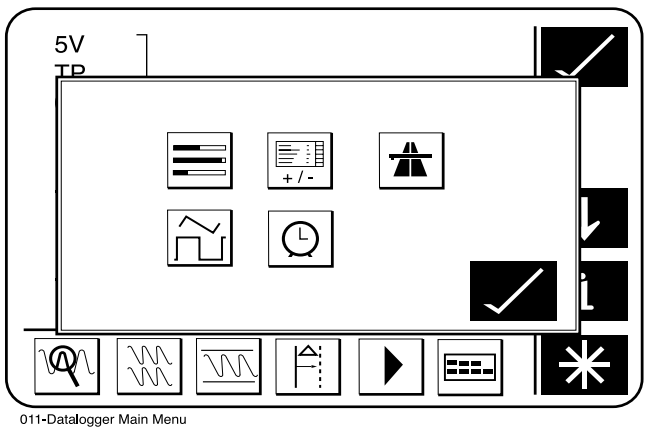
DataLogger will automatically default to the waveform screen.



Datalogger Waveform Screen

The default waveform screen will display previous selected parameters. If these parameters are ideal for the test procedure then DataLogger can be started immediately, simply by pressing the record icon.

Select the main menu icon to go to the main menu screen.



Datalogger Main Menu

Main Menu

The datalogger main menu is the main control screen, and can be selected from any of DataLogger's screens.

The main menu provides a single touch entry to each of DataLogger's features.

These features include (left to right, top to bottom):

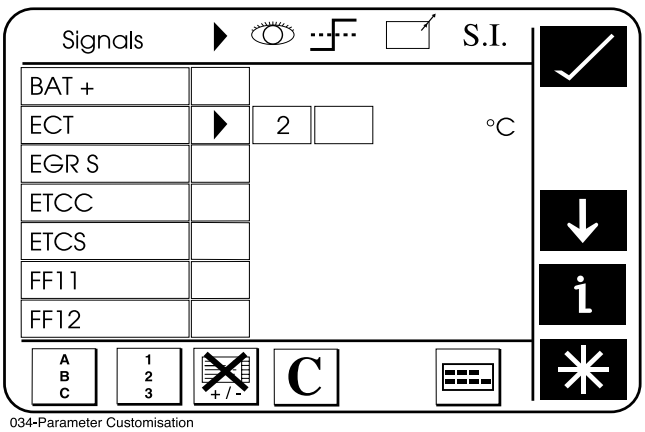
- Bargraph Display
- Parameter Customisation
- On-Road Manual Trigger
- Waveform Display
- DataLogger timing

Parameter Customisation

Parameter customisation enables the selection of signals to be recorded by DataLogger. It also enables the signal units to be selected, the order in which the signals are displayed, and whether the displayed signals are to be used as a trigger.

The Parameter Customisation screen presents selections in a five column table. Each column from left to right represents:

- Parameter name or acronym.
- Record enabled.
- Display order.
- Trigger action.
- Display S.I. Units.



Parameter Customisation

Parameter Name

Parameters can be fault codes, inputs to, or specific outputs from, a vehicle control module.

The number of parameters selectable is limited to 32.

If the number of parameters available for customization exceeds the display area, the arrow buttons will be present, allowing display area scrolling.

The parameters declared to DataLogger are initially presented in alphabetical order.

Record Enabled

Record enabled is used to select which signals are to be recorded.

To select a signal for recording, touch the rectangle next to the signal name.

The record button will then be displayed.

Note: Additional rectangles may appear in other columns beside a selected signal name, indicating that the signal units may be changed or that the signal may be used as a trigger.

It should be noted that the more parameters you select to record the slower the PDU's sample rate will be for each parameter e.g. The PDU may be able to monitor six parameters sampling each parameter twice a second. If the number of parameters is increased to twelve then the PDU would only be able to sample each parameter once per second, thus reducing its ability to capture fast faults; therefore it is recommended that the number of parameters is kept to a minimum.

Display Order

Parameters may be displayed on the waveform / bargraph screen in any order.

To set the parameter display order, press the required rectangle to create a numbered list.

Note: It is not necessary to display all of the parameters required to be recorded.

This has particular benefits if a parameter is to be used as a trigger but is not required to be displayed.

Trigger Action

For a detailed description of trigger action, refer to the Trigger Customisation description on the following page.

S.I. Units

Certain parameters can be measured / displayed in a number of different units eg temperature in °C or °F. If a rectangle appears around the displayed units in the 'S.I.' column then the units are selectable. Each time the rectangle is pressed, the selectable units scroll one step through the available options.

Other Features

To make parameter customization easier two icons have been introduced on to the bottom of the screen, these are:

This icon simply puts all of the signals selected for recording in alphabetical order irrespective of the language.

This icon will put all of the signals selected for recording at the top of the parameter list in numerical order.

After the parameter customization process is completed, return to the DataLogger main menu.

Default Customisation

To cancel all customisations, press the Customisation Reset icon. This will reset the customisation on all parameters to the default setting.

Trigger Customisation

DataLogger operates using a 'rolling memory'.

When the Record icon is selected on the waveform display, PDU will start to record data, it will then continue to record data until its memory is full.

At this point it will continue recording by overriding the oldest data. This process will continue indefinitely or until the trigger is activated.

When the trigger is activated it performs a number of functions.

a) The first function is to place a zero time point within the stored data, this enables the trigger point to be easily accessible in later stages.

b) The second function is to set a timer, ensuring that the PDU will only continue recording for the time selected in 'test-duration'.

Only the data within the selected time period will be stored. A trigger is used to define the zero time point on any waveform display. This is used to make it easier to locate the actual point at which the fault occurred on the waveform display. Triggers may take three forms.

1. Manual Trigger

A manual trigger would be used in circumstances where the technician can clearly identify the point when the fault occurs and has access to the PDU at this point.

The trigger icon should be pressed on the waveform / bargraph display (or the on-road trigger icon) at the instant the fault occurs. This will then become the zero point for the waveform / bargraph display. The waveform / bargraph display up to this point would have a negative form.

2. Fault Code Trigger

The fault code trigger is used when the first indication of a fault is normally by the appearance of a warning lamp within the instrument pack. For some vehicle systems DataLogger can trigger on specific fault codes, this type of triggering is more precise than simply triggering on the warning lamp.

This trigger is selected during the parameter customisation process. To select a fault code to trigger 'on', set the fault code (parameter) to record.

Asign the display order by touching the rectangle below the Eye icon repeatedly until the desired display order number is shown.

Press the rectangle in the trigger column.

Highlight the fault code parameter again and select the magnifying glass icon. The trigger customisation screen will be displayed.

Select the appropriate trigger style icon and select the tick icon to confirm.

Press the Tick icon again to return to the main DataLogger screen.

Select the Record icon to start data capture.

The unit will trigger when the fault code appears and will set the zero time point of the waveform / bargraph display.

3. Specific Signal Trigger

It is possible to select a specific parameter or signal to trigger DataLogger.

Triggering on specific signals is likely to be used when the vehicle system has no on-board diagnostics or when diagnostic information is not readily available at the time the fault occurs, e.g. air-conditioning.

This type of trigger should only be used when it is known that a particular signal has certain characteristics at the time the fault occurs, e.g. one signal will always go from 12 Volts to ground, bringing on a warning lamp when a particular fault occurs, as this is a known event, this signal may be used to trigger the PDU.

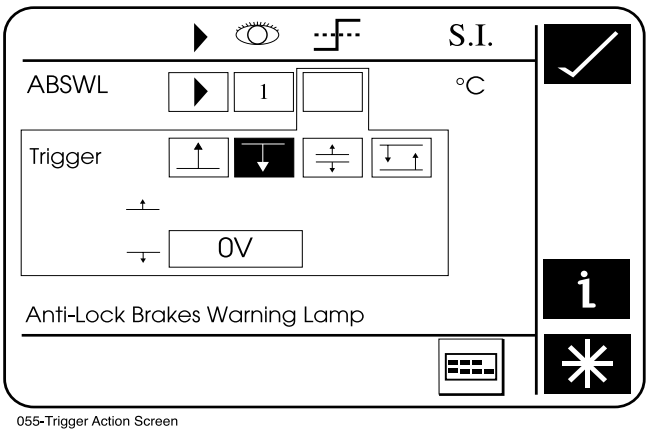
Trigger Selection

Any of the record enabled parameters may be used to trigger DataLogger.

To select a trigger highlight the parameter name, a magnifying glass type icon will appear at the bottom of the screen.

Select the magnifying glass type icon.

The trigger action screen should be displayed.



Trigger Action Screen

The following trigger options are available:-

Triggers when the signal passes above a specified value, i.e. stop lamp.

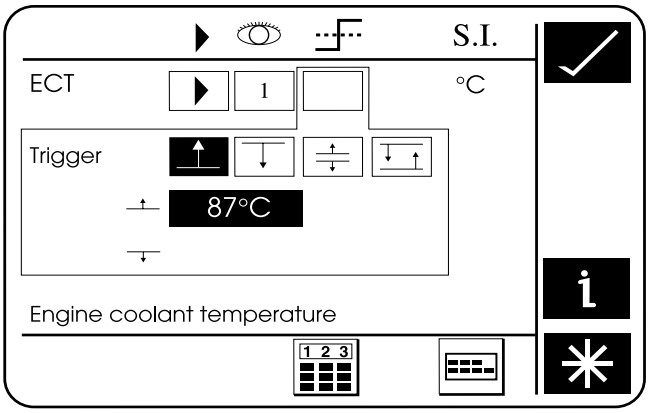
Triggers when the signal passes below a specified value, i.e. Anti-Lock brakes warning lamp.

Triggers when the signal passes outside a specified band, i.e. oxygen sensor feedback.

Triggers when the signal passes into a specified band.

Once the type of trigger has been selected the trigger value(s) (i.e. the signal level at which the trigger point will occur) should be set.

These values are set by highlighting the existing value.

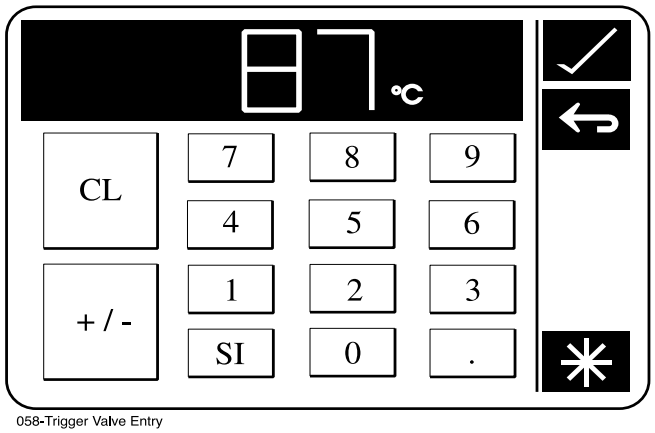


026-Highlighted Trigger Valve

Highlighted Trigger Value

Press the calculator-style icon.

A new screen should now be displayed.



058-Trigger Valve Entry

Trigger Value Entry

Enter the required trigger value using the calculator-style screen buttons.

The S.I. button enables unit selection, where applicable, refer to S.I. Units.

Confirm the trigger value by pressing the 'tick' icon.

The trigger screen will now be re-displayed.

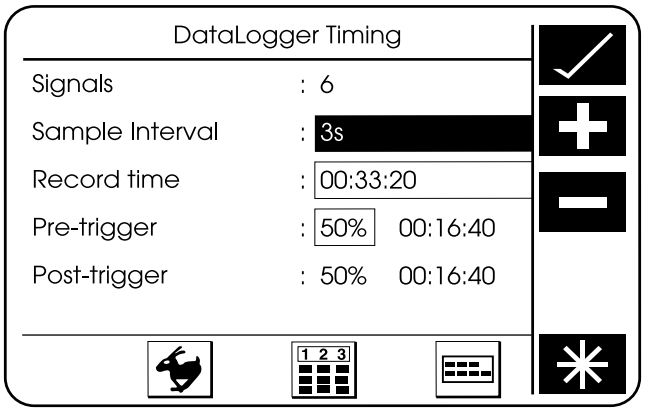
Press the 'tick' icon to go back to the Parameter Customisation screen.

Press the 'tick' icon again to return to the datalogger main menu.

Datalogger Timing

Select the 'clock' icon from the main menu screen. Confirm the selection using the 'tick' icon.

The DataLogger timing screen should now be displayed.



013-Datalogger Timing

Datalogger Timing

The DataLogger timing screen allows customisation of the sample interval and duration of data capture.

The display will identify the number of parameters (channels) which have been selected to be recorded by DataLogger.

Timing changes can only be made while data capture is inactive. Entering DataLogger timing while vehicle data is being captured will display the current settings, but disable selection.

Signals

The signals are the number of parameters set for sampling by DataLogger.

Sample Interval

The sample interval (frequency) defines the time interval between successive block requests for all recorded parameters.

The sample interval is selectable to enable fast response to intermittent faults.

Note: Very short sample intervals may reduce test duration because the PDU memory becomes full of data.

Select the sample interval rectangle.

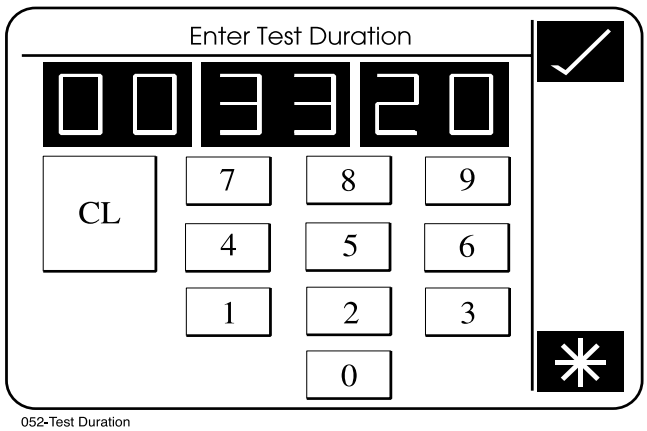
A calculator-style icon should now be displayed.

As well as a calculator-style icon being displayed there will be a hare icon, selecting this icon will automatically set the fastest sample rate for the selected parameters.

Note: The fastest sample rate set using the 'hare' icon may be too fast for some applications.

Select the calculator-style icon.

A new screen should now be displayed.



052-Test Duration

Test Duration

Enter the required value in milliseconds up to a maximum of 60,000 mS (1 min). At this stage DataLogger will not verify if the entered sample interval can be achieved.

When DataLogger is actioned to start recording vehicle data, and the sample interval is shorter than the fastest achievable capture time, a warning screen will be displayed, requesting changes to the sample interval.

Record Time

The record time (test duration) defines the length of the data slice which will be preserved for analysis after the fault occurs. The selected time will be split equally before and after the fault trigger. e.g. a 10 minutes recording will preserve data from 5 minutes before to 5 minutes after the fault.

At the end of the record time the PDU will automatically stop recording.

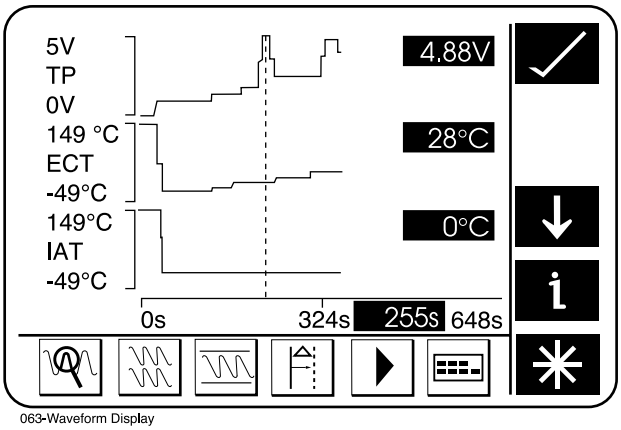
The record time is entered in the same way as the sample interval, by enabling the rectangle and selecting the calculator-style icon.

Pre-trigger and Post-trigger

The pre-trigger and post-trigger represent the duration of the tests before and after the trigger point respectively.

Waveform

Select the waveform icon from the main menu, confirm selection using the 'tick' icon; the waveform screen should now be displayed.



Waveform Display

The screen consists of three parts:

- Waveform Display
- System icons
- DataLogger Specific icons

Waveform Display

The waveform display provides a graphical indication of activity occurring within the displayed parameters. This feature provides a display of various waveforms simultaneously. Each waveform represents a vehicle parameter indicating measured activity in relation to time. The display is dynamically updated at the frequency of the sample interval.

To the right-hand side of the waveform is a digital read-out of that signal.

A vertical dotted line (cursor) on the screen represents the point in time displayed by the digital read-out.

This cursor may be moved by applying finger pressure to the screen in the position the cursor is required.

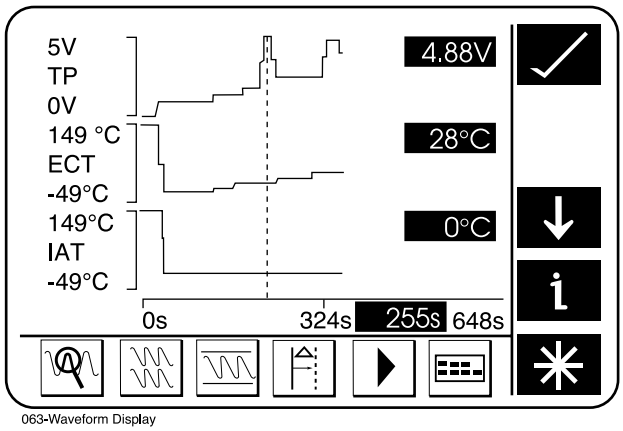
The system up or down icons can be used to scroll the waveform display up or down respectively to look at the other displayed waveforms.

System Icons

For a detailed description of each of the system icons, refer to the on-screen Dataslogger Training Programme.

DataLogger Specific Icons

The DataLogger specific icons are those at the bottom of the screen.

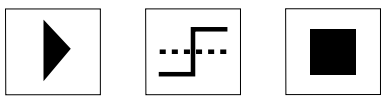


Datalogger Icons

Record Icon

Press the record icon to start capturing data, a trigger icon will replace the record icon.

Press the trigger icon to instigate the manual trigger.



Once the trigger procedure has occurred, a stop icon will replace the trigger icon.

Press the stop icon to stop capturing data.

The following icons are to aid viewing / analysis.

Split Cursor Icon

The split cursor icon splits the vertical cursor into two parts.

One permanent static cursor represented by a solid vertical line in the waveform display, and one moveable cursor represented by a dotted vertical line, this is moved by applying finger pressure to the screen in the position the cursor is required.

The digital display of the waveforms will now represent the difference in levels between the two cursors and not the absolute signal level as detailed earlier.

Re-scale Vertical Icon

Normally all of the waveforms are displayed with the vertical axis representing the maximum possible variation of the signal, e.g. battery voltage 0 to 16 V.

The re-scale icon causes the waveform to scale such that the recorded variation determines the scale, this normally enlarges the vertical scale.

The scaling operation can be performed on any of the displayed waveforms by highlighting the parameter name prior to the operation.

Once auto-scaling has taken place, further manual scaling may be achieved by using the '+' and '-' system icons.

Waveform Display Number

This icon enables control of the number of waveforms displayed on the screen at any one time.

Pressing this icon causes the '+' and '-' system icons to appear. Using these system icons increase or decrease the number of displayed waveforms.

It should be noted that the more waveforms displayed the poorer the detail becomes, therefore the number of displayed waveforms should be kept to a minimum.

Horizontal Scale

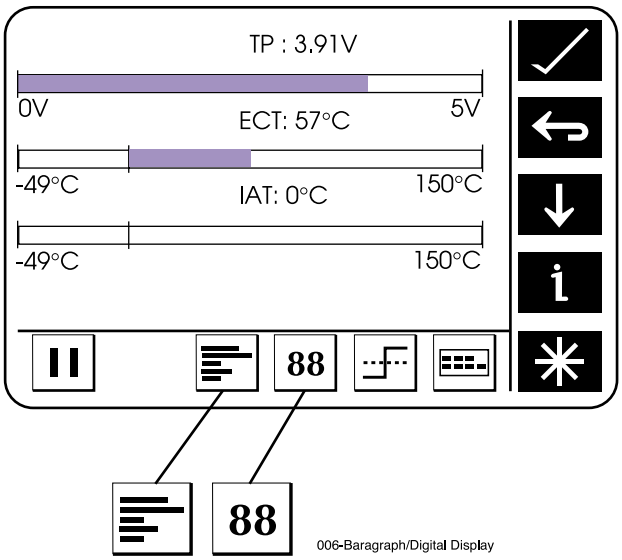
This icon performs the same function as the re-scale vertical icon only for the horizontal axis.

By expanding the scale more detail will be available, thus proving easier to analyse. However the amount of time displayed on any one screen will be reduced.

Bargraph / Digital display

Bargraph / Digital display provides another format in which to display recorded date.

The DataLogger icons operate similar to those used in the waveform display. However one new icon is provided as a toggle option from bargraph to digital display.



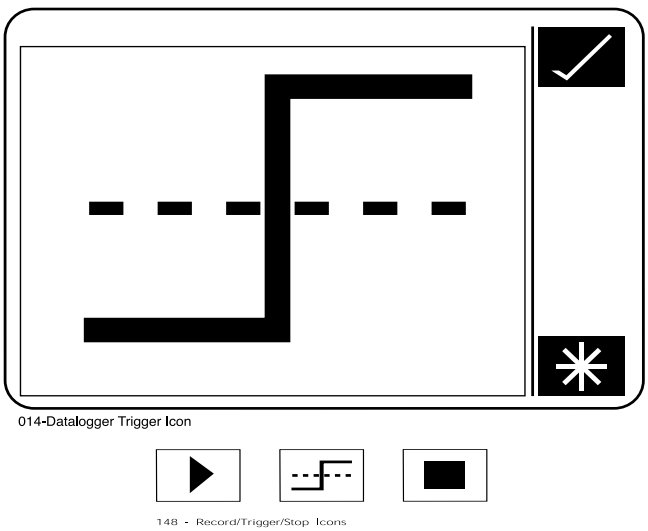
Bargraph / Digital Display

On-Road Trigger

When on-road trigger is selected using the motorway icon from the main menu a symbol is displayed over the entire screen display area.

This option is intended for use during on-road tests to ensure that the PDU screen does not distract the driver.

Press the record icon to start capturing data, a trigger icon will replace the record icon.



Datalogger Trigger Icon

Press the trigger icon to instigate the manual trigger.

Once the trigger procedure has occurred, a stop icon will replace the trigger icon. Press the stop icon to stop capturing data.

Datalogger Example

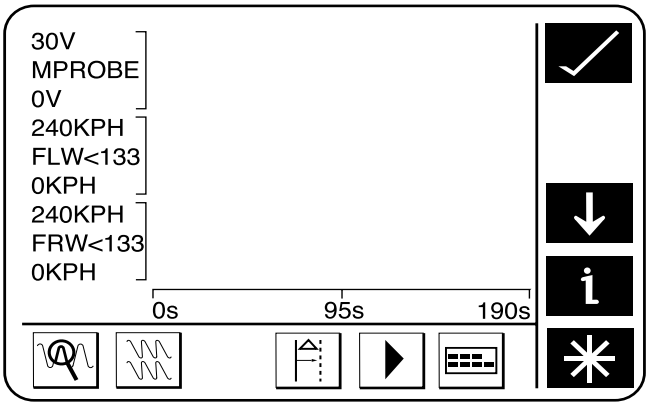
A customer reported intermittent illumination of the anti-Lock Brakes (ABS) warning lamp.

The ABS control module was interrogated, producing fault code 33 (95 MY), right-rear wheel speed sensor.

The PDU was used to check the wheel speed sensor output using the ABS warning lamp as a trigger.

The PDU was setup to the vehicle's configurations and DataLogger was accessed.

DataLogger automatically defaulted to the waveform screen.

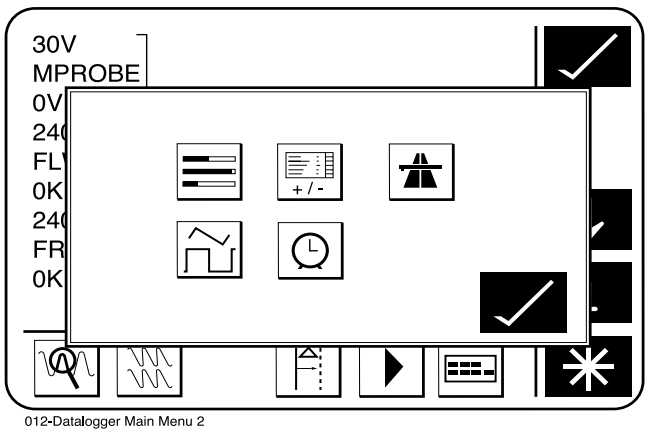


091-Datalogger ABS Waveform

Datalogger Waveform Screen

The main menu icon was selected to access the main menu screen.

The main menu screen is the main control screen for access to DataLogger's subsystems.

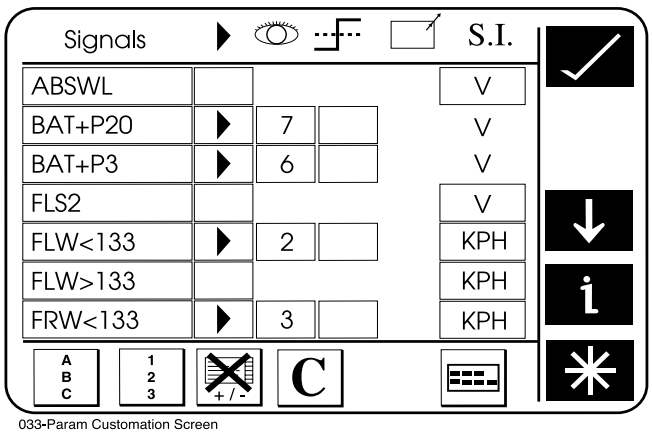


012-Datalogger Main Menu 2

Datalogger Main Menu

The customisation icon was selected, and the selection was confirmed using the 'tick' icon.

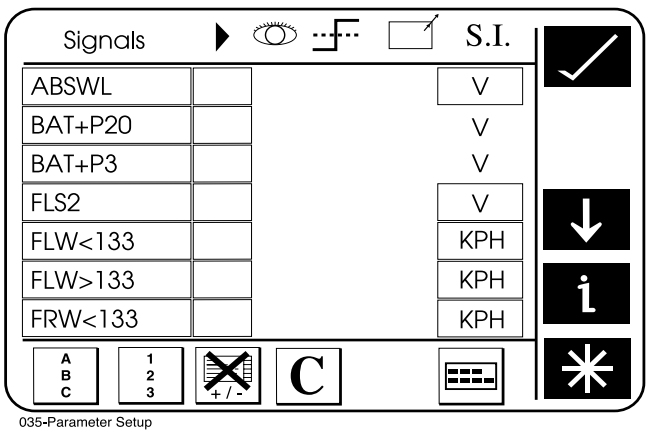
The parameter customisation screen was then displayed.



033-Param Customation Screen

Parameter Customisation Screen

All pre-defined parameters were cancelled using the 'C' icon, the screen was now similar to that below.



035-Parameter Setup

Parameter Setup

The rectangle below the play icon next to 'ABSWL' (Anti-Lock Brakes System Warning Lamp) was selected to be recorded.

The rectangle below the 'eye' icon in the 'ABSWL' row was selected to be recorded.

The screen was scrolled down until 'RLW<133' was displayed.

The rectangle below the play icon in row 'RLW<133' was selected.

The rectangle below the eye icon in row 'RLW<133' was selected.

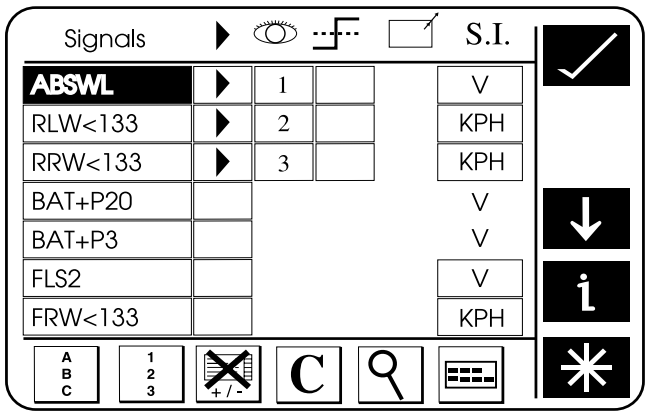
The screen was scrolled down until 'RRW<133' was displayed.

The rectangle below the play icon on row 'RRW<133' was selected.

The rectangle below the eye icon in row 'RRW<133' was selected.

The 're-order' icon was then selected; this places the record enabled parameters at the top of the parameter list in numerical order.

The 'ABSWL' parameter was then selected and the trigger switched on by touching the rectangle in the ABSWL line below the trigger symbol.

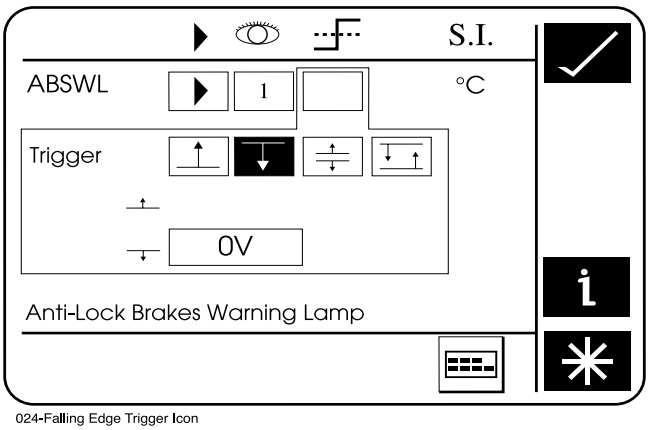


032-Para Cust - Final Step

ABS Warning Light selection

The magnifying-glass type icon was then selected to lead to the trigger customization screen.

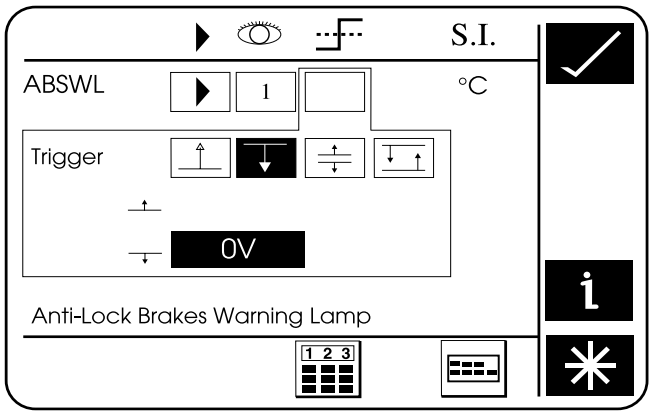
The 'falling-edge' trigger icon was then selected. DataLogger will then trigger from the ABSWL when the signal passes below a specified value.



024-Falling Edge Trigger Icon

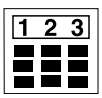
Falling Edge Trigger Icon

The 'OV' rectangle was then selected.



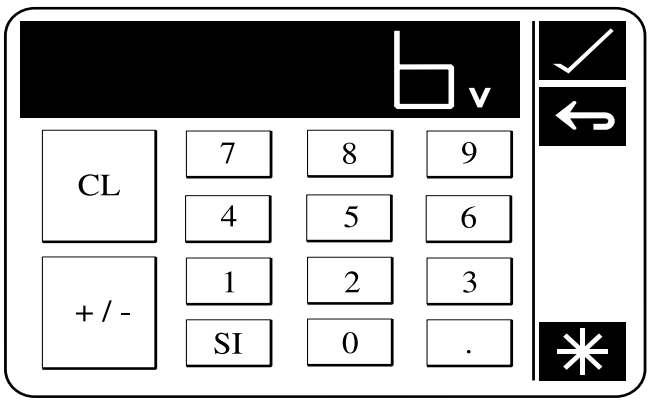
050-Selec of the OV trigger Poi

Selection of the 0V trigger point



The calculator-style icon was then selected to alter the trigger value.

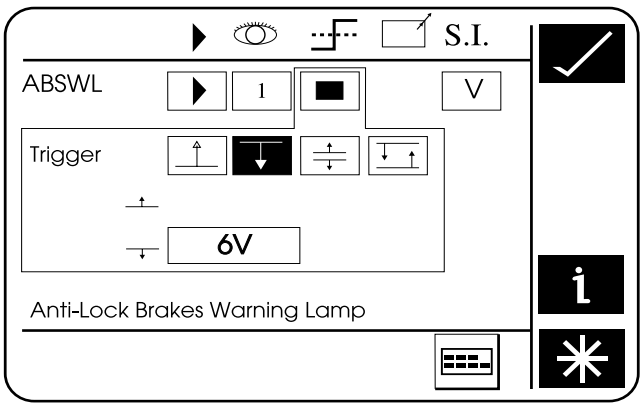
Using the calculator-style screen buttons, a threshold value of 6 Volts was entered.



127-Trigger 6V

Trigger Point setting to 6V

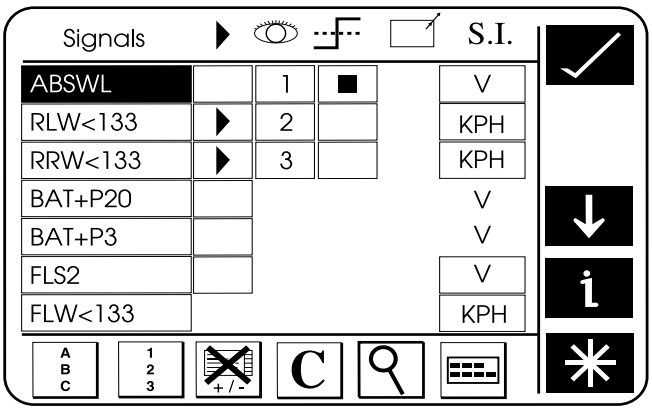
The 'tick' icon was selected to return to the trigger screen which will then be as shown overleaf.



083-ABSWL 6V Trigger

The Trigger Set-Up Screen

The 'tick' icon was then selected to return to the parameter customisation screen. The screen should now look similar to that below.



106-Final Parameter Setup

Parameter Customisation - Final Setup

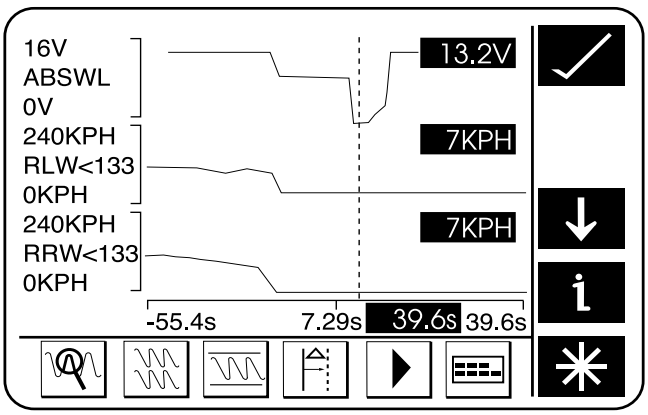
The 'tick' icon was pressed to access the waveform display.

The PDU was now ready to start recording data.

The 'record' icon was selected to start recording data.

When the fault occurred, the ABS warning lamp automatically triggered the PDU. This will place a fixed cursor on the screen and set the time base to zero. The PDU will stop recording after the preset record time. If no record time has been entered, the PDU will use its default record time of 16minutes and 40 seconds. 8m20s pre-trigger and 8m20s post trigger.

The following figure indicates the typical waveform display for the wheel speed sensor fault. The dotted vertical line represents the trigger point.



064-Wheel speed sensor display

Wheel Speed Sensor Display

Training

The training programme incorporated into the PDU software is designed to cover the needs of new users and those who have basic PDU skills but require further training on the DMM and Datalogger functions.

Select 'Training' from the PDU main menu to bring up the training menu.

New User Training

The new user training program takes the student through a structured sequence of activities to learn the meaning and use of the basic screen icons. The traineemay then work through programmed exercises to learn the digital multi-meter and then the datalogger functions.

Existing User Training Menu

In this program the existing user may select training from the following list:

- User Screen Controls
- Digital Multi-Meter
- Datalogger

OBD II Scan Tool

The OBD II Scan Tool is designed to access the memories of the engine and transmission control units to monitor and extract data relative to emissions control.

The following types of data may be accessed:

- Current Powertrain Data
- Monitor Freeze Frame Data
- Request Trouble Codes
- Clear Trouble Codes
- Request Oxygen Sensor Test Results
- Monitor Oxygen Sensors
- Display Pending Trouble Codes
- Request On-Board Monitoring Test Results
- Examine Readiness Tests
- Malfunction Lamp Status

The data to be monitored is selected from the OBD II main menu.

For example if Monitor Freeze Frame Data is selected, the system will display up to 11 parameters which are always recorded when a fault code is logged. The parameters are as follows:

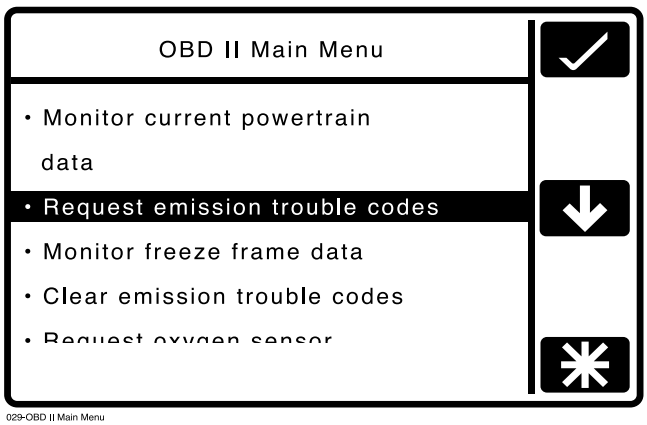
0 : SUPP	Supported
2 : FCFF	Fault Causing Freeze Frame
3 : FSS	Fuel System Status
4 : CLV	Calculated Load Value
5 : ECT	Engine Coolant Temperature
6 : STFT-B1	Short Term Fuel Trim - bank 1 (Cyl 1-3)
7 : LTFT-B1	Long Term Fuel Trim - bank 1 (Cyl 1-3)
8 : STFT-B2	Short Term Fuel Trim - bank 2 (Cyl 4-6)
9 : LTFT-B2	Long Term Fuel Trim - bank 2 (Cyl 4-6)
12 : RPM	Engine Speed
13 : VS	Vehicle Speed

Accessing Freeze Frame Data

The freeze frame data is vital in analysing unresolved trouble codes. If an emissions related trouble code occurs, complete a diagnostic trouble code report form including the vehicle data, logged trouble codes and the freeze frame data. Fax a copy of the form to Aston Martin Service Operations Department who will assist in resolving the concern.

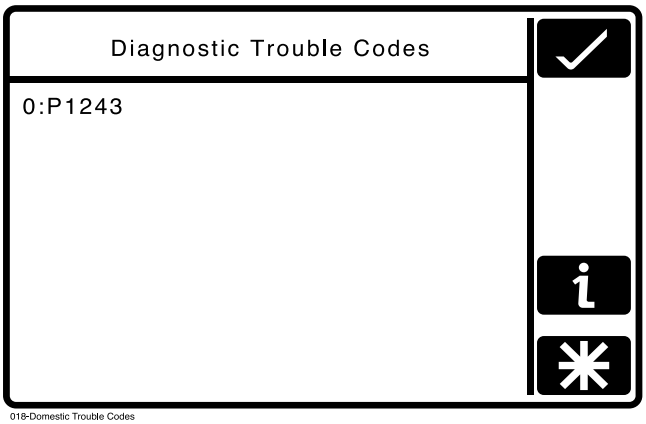
To access freeze frame data, proceed as follows:

1. Switch on the PDU and select 'Engine Diagnostics.
2. Select 'OBD II Scan Tool'. The scan tool software will load and the 'Cable Setup' screen will appear.
3. Connect the PDU to the lower diagnostic socket using the multi protocol adaptor (MPA). Switch on the ignition. After communications are established, the OBD II Main Menu will appear.



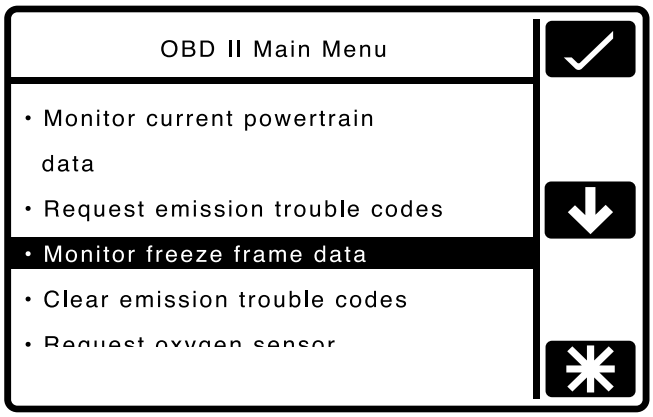
029-OBD II Main Menu

4. Select 'Request Emission Trouble Codes' and press the 'tick' icon.



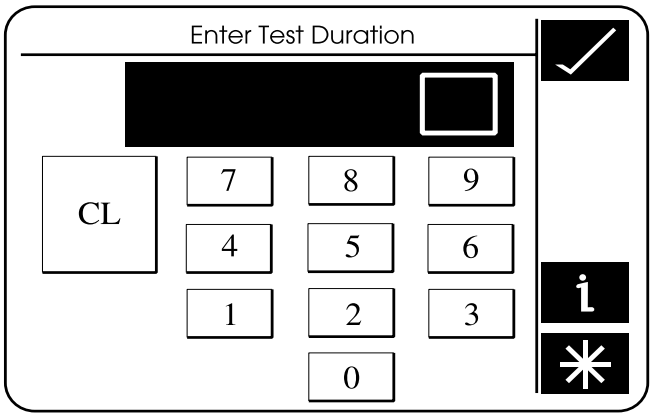
018-Domestic Trouble Codes

5. Any logged diagnostic trouble codes will be displayed on the screen (e.g. 0:P1243). Record both the list number (e.g. 0, 1, 2, etc) and the logged 'P' codes (e.g. P1243, etc).
6. Press the 'tick' icon and return to the OBD II main menu.



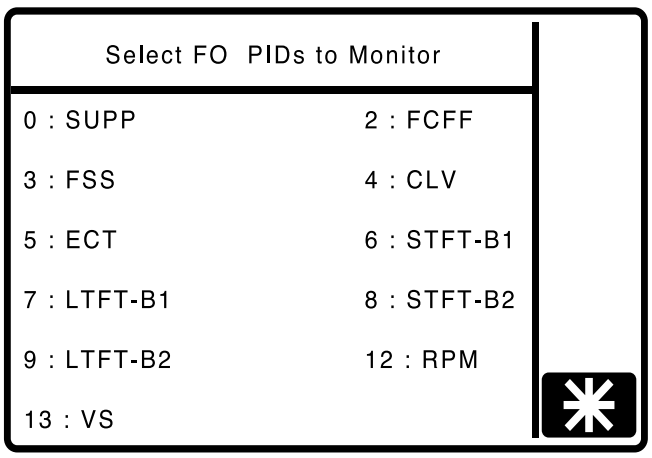
030-OBD II Main Menu 2

7. Select 'Monitor Freeze Frame Data' and press the 'tick' icon.
8. The numeric keypad screen will appear. Enter the list number noted in step 5 for the fault code to be investigated and press the 'tick' icon.



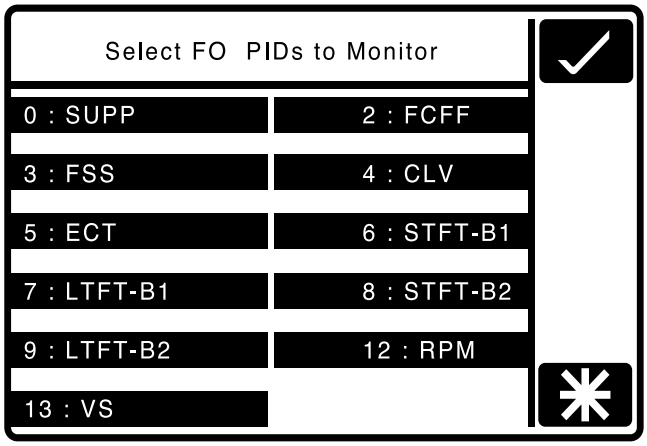
025-Freeze Frame

9. The 'Select PIDS to Monitor' screen will appear.



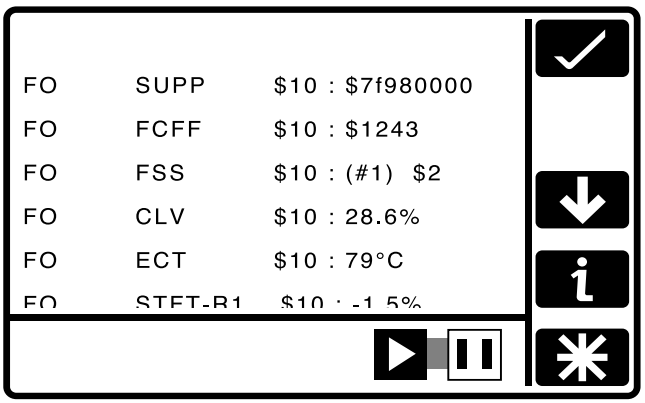
048-Select FO PIDs to monitor

10. Select all PIDS (Parameter Identifications) and press the 'tick' icon.



049-Select FO PIDs to mon (Blac

11. The freeze frame data for the selected parameters will appear (Press the down arrow to scroll to the lower part of the display).



130-Untitled G

140-Untitled G 2

12. Enter the freeze frame data onto the DTC Report Form together with the vehicle details and 'P' codes.

13. Select the 'asterisk' icon and return to the main PDU menu.

User Self Test

The self-test function built into the PDU software enables users to completely test the system for faulty modules and cables. By following the screen instructions, faulty system components can be identified.

Procedure

Select User Self-Test from the PDU main menu. The self-test software will load from the CD.

The first screen shows the cable setup with the PDU connected to the base station. After confirming that the connections are correct, the self-test sequence begins.

The initial test is of the PDU and base station electronics and takes slightly less than 2 minutes.

The user is then directed to connect the various external elements of the system in turn and confirm the cable setup at each stage. As each element is connected and tested, the sequence will either direct that the next element is connected or will report a fault in the last element tested.

Using this procedure, any faulty element in the system will be identified. If the self-test concludes with no fault reported, any problem encountered must be in the vehicle or as a result of incorrect use.

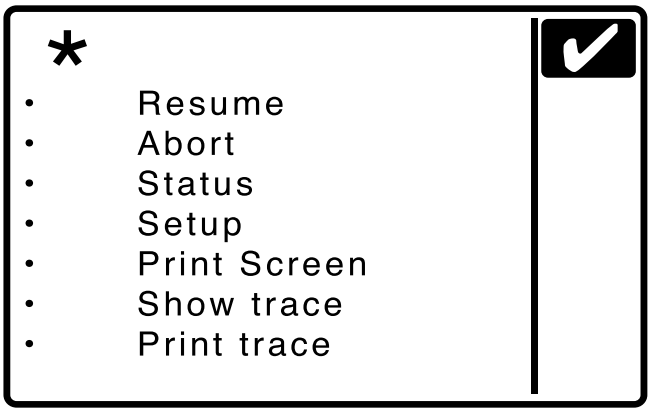
Self-Test Problems

If the self test software will not load or if unidentified problems are encountered during the self-test, go to the problem solving procedure in the PDU installation guide.

Be prepared to record any problem codes which are reported during problem solving. The Genrad Service Centre will require the problem code number to identify the correct remedial action and replacement parts.

The Asterisk (*) Icon

When available, selecting the asterisk icon will bring up the following menu of general facilities:



084-Asterisk Menu

Resume

Return to the screen from which you selected the asterisk icon.

Abort

Return to the PDU Main Menu.

Status

Show the current software level and the application currently loaded.

Print Screen

Send the current screen display to the printer.

Show Trace

Display the current contents of the trace memory on the screen (Use the Down and Up arrows to scroll through the display if more than one screenful).

Print Trace

Send the current contents of the trace memory to the printer.

System Setup

The System Setup Menu may be accessed at any time from the asterisk (*) menu. The menu provides system configuration options for the following parameters:

Display Mode

Sets the screen to either Black on White or White on Black display

Trace Mode

Sets the trace information gathering to All the Time or Only After a Fault.

Trace Type

Sets the trace system to gather Everything or Only Test Information.

Fault Overide

If fault overide is OFF, the trace recording will stop when a fault occurs. With fault overide set to ON, trace recording will continue after fault occurence and show vehicle performance after the fault.

Language

Permits selection of one of the following languages:

- English
- German
- French
- Italian
- Japanese

Caution: Check that the correct language is selected. If you accidentaly select and confirm the wrong language, it may be difficult to configure the system back to a familiar language.