ASTON MARTIN

DB9

Workshop Manual

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DB9 Workshop Manual

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Introduction

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Introduction

Welcome

This Workshop Manual is part of a suite of technical manuals provided for DB9. Other technical manuals include:

- Parts manual
- OBDII Diagnostic manual
- Man hour schedules

Chapters

The DB9 suite of manuals incorporate a new chapter structure.

Each chapter in this workshop manual is associated with a 4 digit number, i.e. Transmission (07.00). Each chapter is then further broken into sections, i.e. Automatic Transmission (07.01).

Chapter Navigation

Example 1:

Previous workshop manuals would have Steering and Suspension together in one chapter. The new structure now places Steering and Suspension into their own chapters. Road wheels are also now included in Suspension.

Example 2:

Fuel, emissions and exhaust is now in three different chapters. Fuel has its own chapter and includes all fuel aspects up to the fuel rails (Fuel rails and fuel injection now come under Engine System). Exhaust, not including manifolds, has its own chapter and Emissions now come under the Engine system.

When required references are made out to other chapters.

Numbering

03.	02.
System, i.e. Engine system	
Subsystem, i.e. Engine lubrication system	

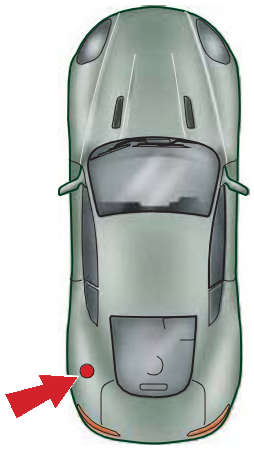
Chapters and sections within chapters are numbered using the system detailed above. All technical manuals for this vehicle use the same numbering system. When carrying out a procedure, the relevant parts illustration and spare parts list can be found using the same numbering system.

To avoid excessive repetition, each procedure is fully detailed once in its appropriate chapter. In any other location where this procedure is required, it is referenced by its title and chapter / page 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. Where the operation of a special service tool is complicated or not obvious, refer to the Appendix and Glossary for detailed operation procedures. A pictorial list of special service tools available for this vehicle can also be found in the Appendix and Glossary.

Location References



References to left, right, front or rear of the vehicle or of a component are referenced from 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 installed in the vehicle.

Warnings, Cautions and Notes

The following Warnings, Cautions and Notes are used within this workshop manual to call your attention to specific types of information.

Warnings

⚠ WARNING ⚠
IDENTIFIES PROCEDURES WHICH MUST BE FOLLOWED PRECISELY TO HELP AVOID THE RISK OF PERSONAL INJURY.

Cautions

Caution
Provided to indicate procedures which must be followed precisely to reduce the possibility of damage to the vehicle.

Notes

Provided to indicate procedures which will help to avoid difficulties in the operation of 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 installed. In certain territories, legislation prohibits the installation 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 installed. If the efficiency of a locking device is impaired during removal, it must be renewed
- The vehicle warranty may be invalidated by the installation 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 procedures detailed 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 headings highlight particular safety precautions which should be observed (The list is not intended to be exhaustive).

Battery Disconnection

Where a procedure requires the vehicle battery to be physically disconnected (disconnect the vehicle battery earth (Negative) lead), the following items will have to be reset or re-learnt on connection:

- Seats memory
- Radio pre-sets
- DTCs will be lost

Air Conditioning (A/C) System

Do not break into the A/C refrigeration system until the refrigerant has been evacuated using the procedure detailed in this manual. Do not disconnect any A/C 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

⚠ WARNING ⚠
STRICTLY ADHERE TO HANDLING AND SAFETY INFORMATION FOUND ON CONTAINERS AND LABELS.

⚠ WARNING ⚠
DO NOT STORE CHEMICALS IN UNLABELLED OR INCORRECTLY LABELLED CONTAINERS.

⚠ WARNING ⚠
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.

⚠ WARNING ⚠
DO NOT MIX CHEMICALS UNLESS INSTRUCTED TO DO SO, FOLLOWING MANUFACTURERS GUIDELINES.

⚠ WARNING ⚠
DO NOT INHALE CHEMICAL MATERIALS TO DETERMINE IDENTITY, THEY MAY BE TOXIC.

⚠ WARNING ⚠
DO NOT USE PETROL, KEROSENE, DIESEL FUEL, GAS OIL, THINNERS OR SOLVENTS FOR WASHING SKIN.

⚠ WARNING ⚠
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.

⚠ WARNING ⚠
CONTAINERS WHOSE CAPACITY IS OVER 25 LITRES (5 GALLONS) REQUIRE A BUND WALL IN ORDER TO CONTAIN SPILLAGES.

⚠ WARNING ⚠
AVOID SPLASHING THE SKIN, EYES AND CLOTHING.

⚠ WARNING ⚠
ENSURE THAT ADEQUATE VENTILATION IS PROVIDED WHEN VOLATILE DE-GREASING AGENTS ARE BEING USED.

⚠ WARNING ⚠
CLEAN CHEMICALS FROM THE SKIN AND CLOTHING AS SOON AS POSSIBLE AFTER SOILING.

⚠ WARNING ⚠
WEAR PROTECTIVE CLOTHING SUCH AS GOGGLES, NON POROUS GLOVES AND APRON WHEN HANDLING BATTERY ACID AND OTHER CORROSIVE AND TOXIC SUBSTANCES.

⚠ WARNING ⚠
DO NOT SMOKE IN THE VICINITY OF VOLATILE DE-GREASING AGENTS.

⚠ WARNING ⚠
FUME EXTRACTION EQUIPMENT MUST BE IN OPERATION WHEN SOLVENTS ARE USED E.G. TRICHLOROETHANE, WHITE SPIRIT, SBP3, METHYLENE CHLORIDE, PERCHLOROETHYLENE.

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.

Electrical Equipment

⚠ WARNING ⚠
ENSURE THAT ELECTRICAL EQUIPMENT IS IN SAFE WORKING ORDER BEFORE USE.

⚠ WARNING ⚠
INSPECT POWER LEADS OF ALL MAINS ELECTRICAL EQUIPMENT FOR DAMAGE AND SECURITY, AND CHECK THAT IT IS PROPERLY EARTHED.

⚠ WARNING ⚠
ENSURE THAT ELECTRICAL EQUIPMENT IS PROTECTED BY A FUSE OF THE CORRECT CURRENT RATING.

⚠ WARNING ⚠
DISCONNECT THE BATTERY BEFORE COMMENCING REPAIR OPERATIONS TO THE ELECTRICAL SYSTEM, FUEL SYSTEM AND ENGINE OR WHEN WORKING BENEATH THE VEHICLE.

Exhaust Fumes

⚠ WARNING ⚠
DO NOT BREATHE EXHAUST FUMES. EXHAUST FUMES CONTAIN CARBON MONOXIDE. CARBON MONOXIDE IS A DANGEROUS GAS, WHICH IS COLOURLESS AND ODOURLESS AND CAN CAUSE UNCONSCIOUSNESS AND MAY BE FATAL. NEVER START OR LEAVE THE ENGINE RUNNING IN AN ENCLOSED, UNVENTILATED AREA.

⚠ WARNING ⚠
AVOID SKIN CONTACT WITH ALL EXHAUST SYSTEM AND ENGINE COMPONENTS, ENGINE FLUIDS AND ESCAPING STEAM. THEY MAY BE HOT AND WILL BURN YOU.

Engines must only be run where there is fume extraction equipment in operation or where there is adequate ventilation.

Fire Precautions

⚠ WARNING ⚠
ENSURE THAT A SUITABLE FORM OF FIRE EXTINGUISHER IS CONVENIENTLY LOCATED NEAR THE WORK AREA.

⚠ WARNING ⚠
KEEP OILS, SOLVENTS AND COMBUSTIBLE MATERIALS AWAY FROM NAKED FLAMES AND OTHER SOURCES OF IGNITION.

⚠ WARNING ⚠
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.

⚠ WARNING ⚠
ENSURE THAT DRY SAND IS AVAILABLE TO SOAK UP ANY SPILLAGE OF FUEL OR OTHER FLAMMABLE SOLUTIONS.

⚠ WARNING ⚠
FUME EXTRACTION EQUIPMENT MUST BE AVAILABLE AND IN FULL WORKING ORDER TO REMOVE COMBUSTIBLE AND TOXIC VAPOURS.

⚠ WARNING ⚠
ALL PERSONNEL SHOULD BE AWARE OF THE FIRE DRILL PROCEDURES AND PRECAUTIONS.

Tools and Equipment

⚠ WARNING ⚠
DO NOT LEAVE TOOLS, EQUIPMENT, SPILT OIL, ETC. AROUND OR ON THE WORK AREA.

⚠ WARNING ⚠
ENSURE THAT TOOLS AND EQUIPMENT USED ARE IN GOOD CONDITION; DO NOT USE DAMAGED OR DEFECTIVE TOOLS OR EQUIPMENT.

Caution
Do not apply heat in an attempt to free stiff nuts or fittings; as well as causing damage to protective coatings, the stray heat may damage electronic equipment, harnesses and brake lines.

Use the recommended service tool where instructed to do so.

Used Engine Oil

⚠ WARNING ⚠
PROLONGED AND REPEATED CONTACT WITH USED ENGINE OILS CAN CAUSE SERIOUS SKIN DISORDERS, INCLUDING DERMATITIS AND CANCER. AVOID EXCESSIVE CONTACT, WASH THOROUGHLY AFTER CONTACT.
IN ADDITION, OBSERVE ALL LAWS REGARDING THE DISPOSAL OF WASTE OIL AND TOXIC FLUIDS.

Adequate means of skin protection and washing facilities should be provided.

Health Protection Precautions

⚠ WARNING ⚠
PROLONGED AND REPEATED CONTACT WITH USED ENGINE OILS CAN CAUSE SERIOUS SKIN DISORDERS, INCLUDING DERMATITIS AND CANCER. AVOID EXCESSIVE CONTACT, WASH THOROUGHLY AFTER CONTACT.

- Wear protective clothing, including impervious gloves where practicable.
- Do not put oily rags in pockets.
- Avoid contaminating clothes with oil.
- Overalls must be cleaned regularly. Discard un-washable clothes and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts or wounds.
- Use barrier creams, apply before each work period to help the removal of oil from the skin.
- Wash with soap and water to ensure all oil is removed. Preparations containing lanolin replace the natural skin oils which have been removed.
- Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for washing skin.
- If skin disorders develop, obtain medical advice.
- Where practicable, degrease components prior to handling.
- 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 installed; in case of doubt, contact the Local Authority for advice on disposal facilities.

Lifting and Jacking

Safety

⚠ WARNING ⚠
RECOMMENDED PROCEDURES FOR LIFTING, JACKING AND TOWING MUST BE STRICTLY OBSERVED TO ENSURE PERSONAL SAFETY.

⚠ WARNING ⚠
ALWAYS USE A VEHICLE HOIST, RAMP OR PIT FOR WORKING BENEATH THE VEHICLE IN PREFERENCE TO JACKING.

⚠ WARNING ⚠
NEVER RELY ON A JACK TO SUPPORT A CAR INDEPENDENTLY, USE AXLE STANDS OR BLOCKS CAREFULLY PLACED AT JACKING POINTS TO PROVIDE RIGID SUPPORT.

⚠ WARNING ⚠
WHEN WORKING BENEATH A VEHICLE, CHOCK WHEELS AS WELL AS APPLYING HANDBRAKE.

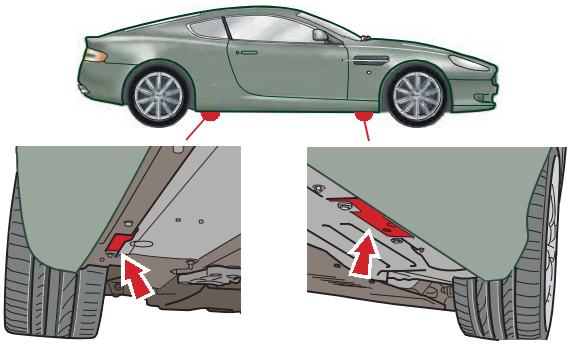
⚠ WARNING ⚠
ENSURE VEHICLE IS STANDING ON FIRM, LEVEL GROUND BEFORE JACKING OR LIFTING.

⚠ WARNING ⚠
CHECK LIFTING EQUIPMENT HAS ADEQUATE CAPACITY FOR LOAD BEING LIFTED AND IS IN FULL WORKING ORDER.

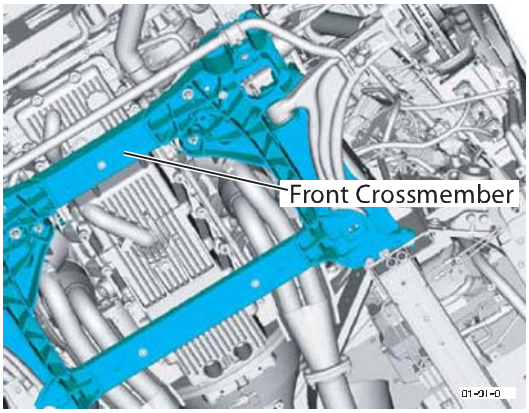
Jacking Points

Caution
Do not jack the vehicle on the lower suspension arms (front or rear).

This vehicle jacking points are at positions shown.



The vehicle may also be jacked with the jack placed on the front subframe, front crossmember.



Always use a jack with a rubber contact pad. Avoid the use of jacks with sharp contact pads which could damage the vehicle floor pan Always chock the opposite road wheels as well as applying the handbrake when using a hydraulic jack.

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

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

Stands

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

Workshop Hoist

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

Vehicle Recovery

General

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

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

If moving this vehicle in such a situation, install the towing eye to the bracket, which is located behind the registration number plate.

Caution

Take care to protect the paint work when installing the towing eye. Ensure the towing eye is tight.

Transporting

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

Suspended Towing

Caution

Do not tow with 'sling' type equipment, damage to bodywork will result.

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

Ensure the recovery team follow the following towing instructions:

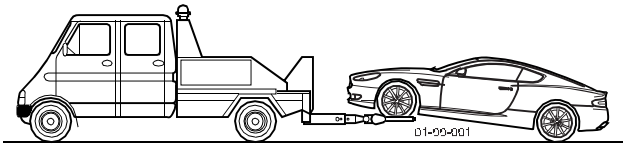
Front Suspended Tow

Automatic Transmission Only

1. Switch the ignition 'On'.
2. Pull back twice on both paddles, simultaneously, to force the gearbox into 'Neutral'.
   Switch the ignition 'Off' within three seconds.

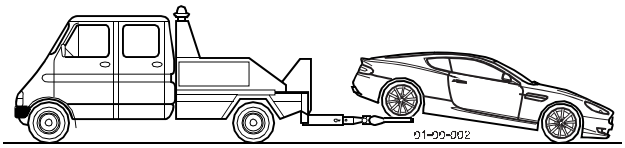
Manual and Automatic Transmissions

3. Remove the ignition key from the ignition.
4. Raise the vehicle using a 'spectacle frame' type lifting device with a cradle positioned under each front wheel as indicated below.



Rear Suspended Tow

1. Set the steering in the 'straight ahead' position.
2. Remove the ignition key from the ignition. Ensure the steering is locked in the straight ahead position.
3. Raise the vehicle using a 'spectacle frame' style lifting device where a cradle is positioned under each rear wheel as indicated below.



Towing an Automatic Vehicle

Caution

This vehicle installed with an automatic transmission can be towed on its driven wheels at not more than 70 km/h road speed and for a maximum distance of 500 km.

The selector lever must be in Neutral (N).

If the above speed and distance limits are exceeded, the automatic transmission will be severely damaged.

Towing Regulations

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

Towing by Another Vehicle

⚠ WARNING ⚠

THE BRAKE BOOSTER WILL BECOME INEFFECTIVE AFTER A FEW APPLICATIONS OF THE BRAKES. BE PREPARED FOR RELATIVELY HEAVY STEERING AND THE NEED FOR GREATLY INCREASED BRAKE PEDAL PRESSURE.

This vehicle may be towed short distances by another vehicle provided that a speed of 48 km/h (30 mph) is not exceeded. Ensure that the towed vehicle gear selection is in 'Neutral' (manual) or position 'N' (automatic), the ignition key turned to position 'II' (to release steering lock and to render the horn, indicators and brake lights operational).

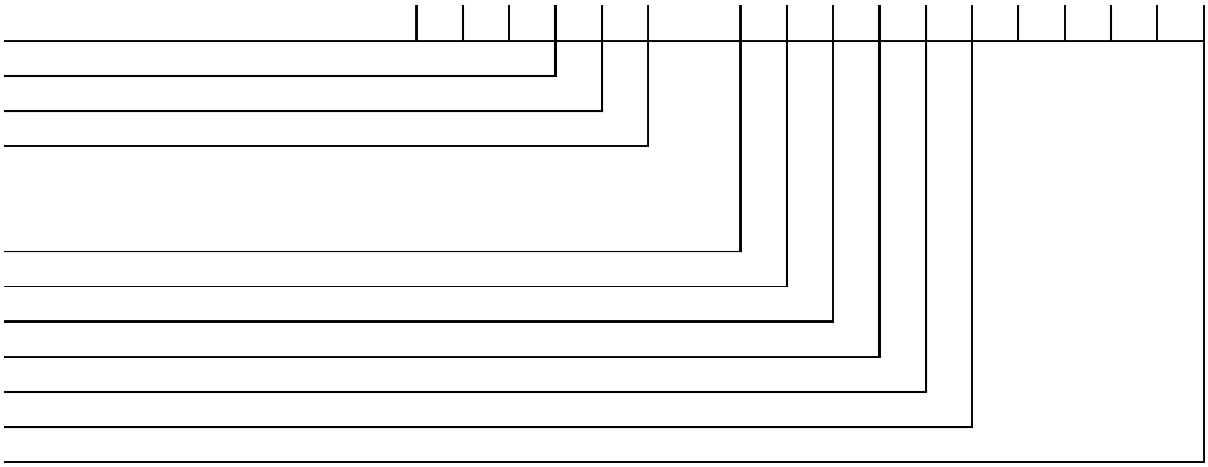
Push-start

Vehicle's installed with automatic transmissions cannot be started by push-starting.

Identification Numbers

Vehicle Identification Number (VIN)

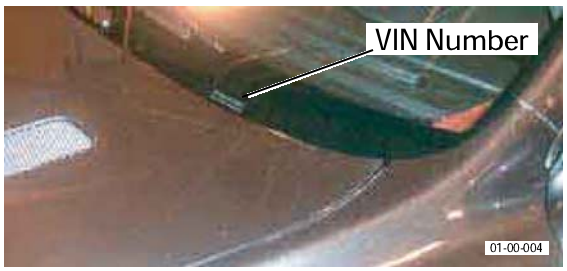
The Vehicle Identification Number (VIN) is a 17 character number which uniquely identifies the vehicle and gives fundamental data on the build site, date and initial configuration of the vehicle.



VIN Number Location

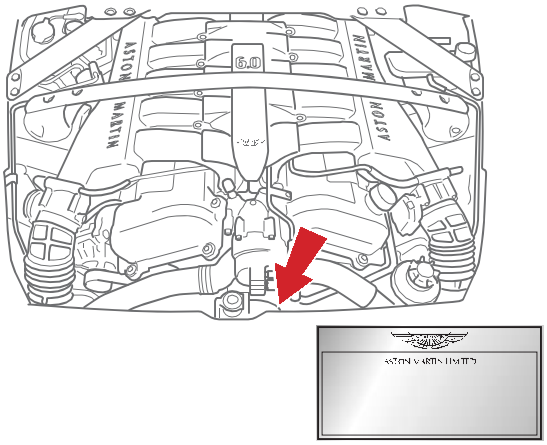
The VIN number is stamped / plated in the following locations:

Under the lower edge of the windscreen.



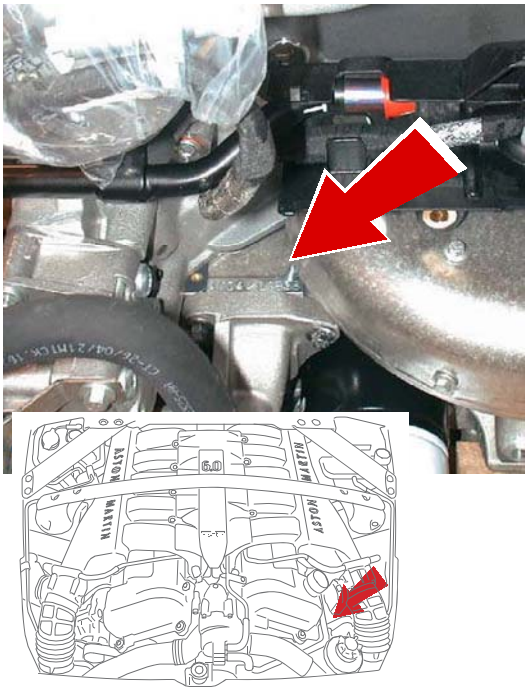
Stamped on the floorpan in the RH front footwell.

Front of the engine bay.



Engine Number

The engine number is stamped on the LH side of the engine block.



Gearbox Number

Automatic Gearbox

The automatic gearbox number plate is located on the LH side of the gearbox.

Manual Gearbox

To follow.


ASTON MARTIN

Body System (01.00)

Contents

Body System (01.00)

Body Structure (01.01)

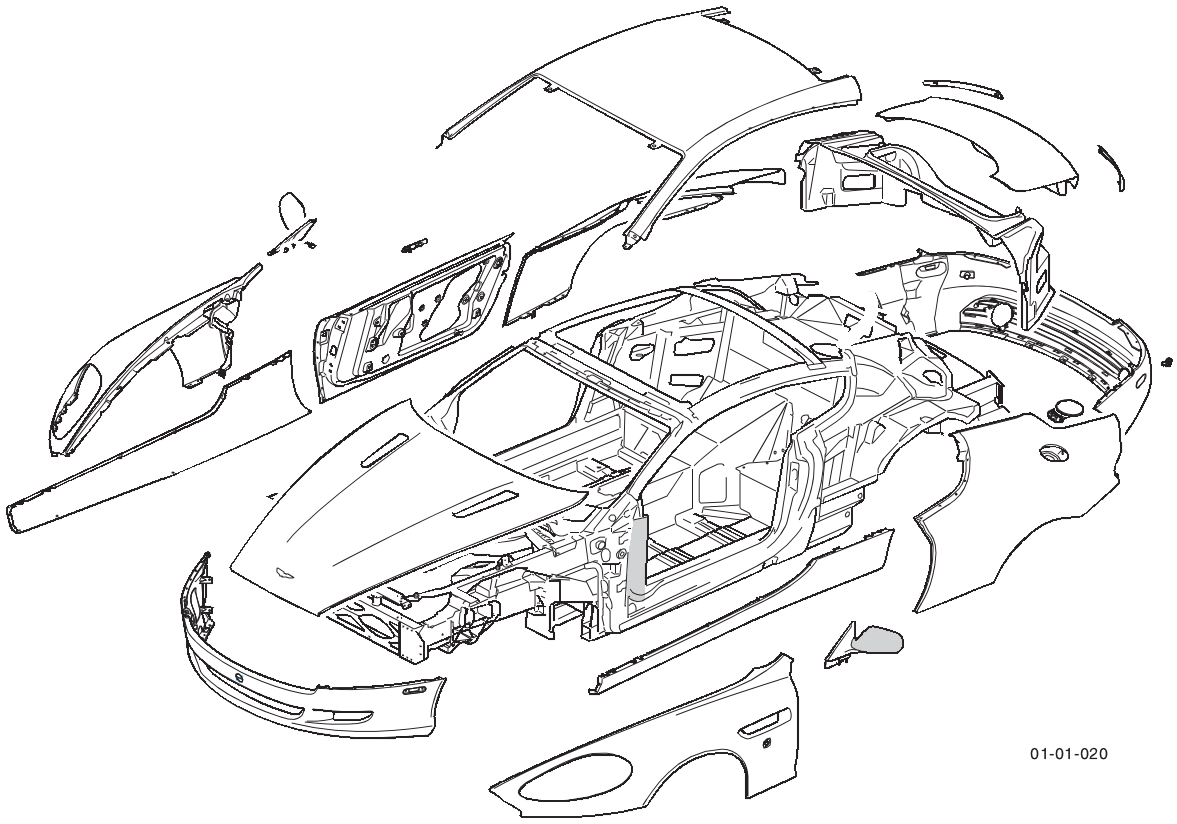
Overview

The all aluminium body underframe is bonded using an immensely strong hot-cured XD4600 red adhesive.

The rear quarter panels, roof and side mouldings are bonded to the structure using cold-cured 2810 MV adhesive. The curing cycle is improved by using a hot air impingement system. In addition, the roof panel is connected to the rear quarter panels through ultrasonic welds.

The composite front wings are bolted to the structure.

At no time should the body structure be subjected to temperatures in excess of 120°C (248°F).

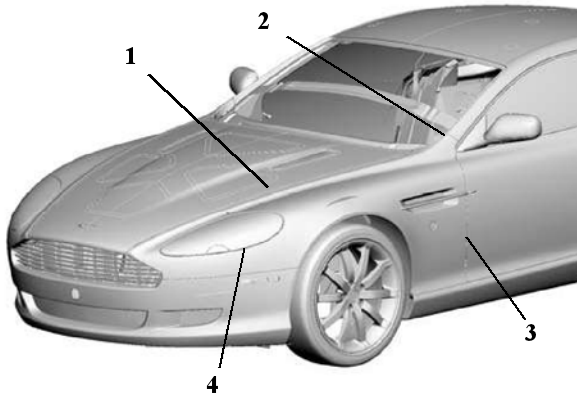


Body System (01.00)

Front End (01.02)

Front Wings

Specifications



Wing Standard (mm)				
Item	1	2	3	4
Nominal gap	3.5	2.0	3.75	3.0
Tolerance	±0.75	+0.5 / -0.0	± 0.75	±0.5
Flush	-0.0	0.0	0.0	-0.5
Tolerance	±1.5	+0.0 / -0.5	±1.5	±0.5
Taper	N/A			
Symmetry	N/A			

Torque Figures		
Description	Nm.	lbs / ft.
Wing Top	8	6
Wing Top Single nut	Tight with 'Threadlock'	
Lower Rear	8	6
Slam panel	8	6
PCM Bracket	10	7
Bonnet Damper	25	18

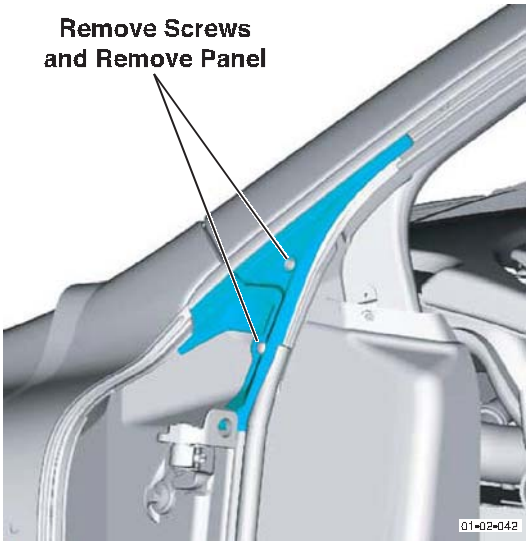
Maintenance

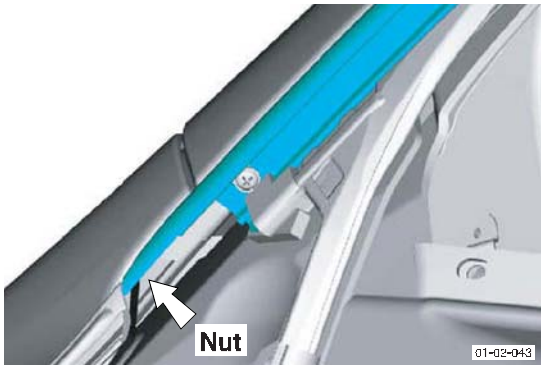
Front Wing

Repair Operation Time (ROT)		
Item		**Code**
Front Wing Renew	(LH)	**01.02.KB**
	(RH)	**01.02.LB**

Removal

1. Disconnect the vehicle battery.
2. Remove the wing top nut.

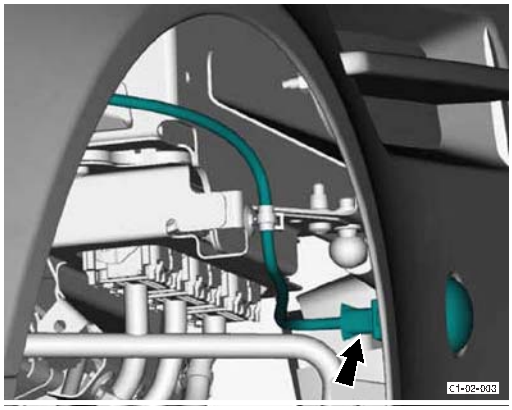




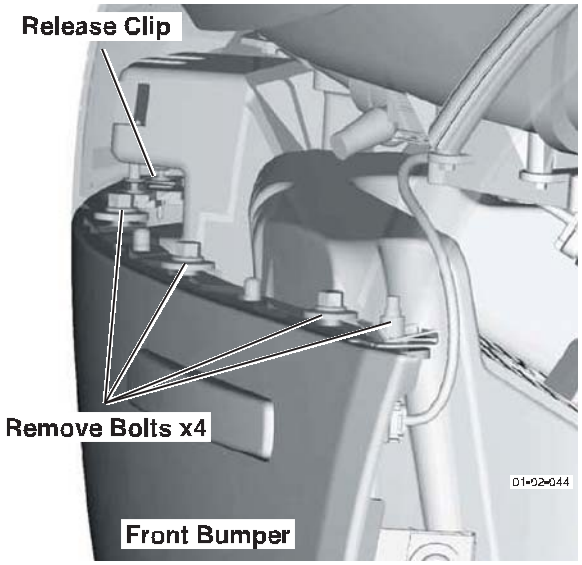
If using a two post vehicle lift, remove the screws that secure the rear section of the road wheel arch liner. Hold back the rear section of the road wheel arch liner to allow the foot of the vehicle lift to be positioned correctly. (Refer to 'Jacking Points', page I-I-IX)

3. Remove the front road wheel and road wheel arch liner.

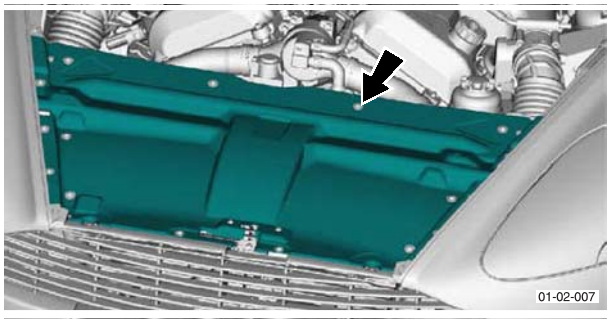
4. Disconnect the side repeater lamp wiring harness plug.



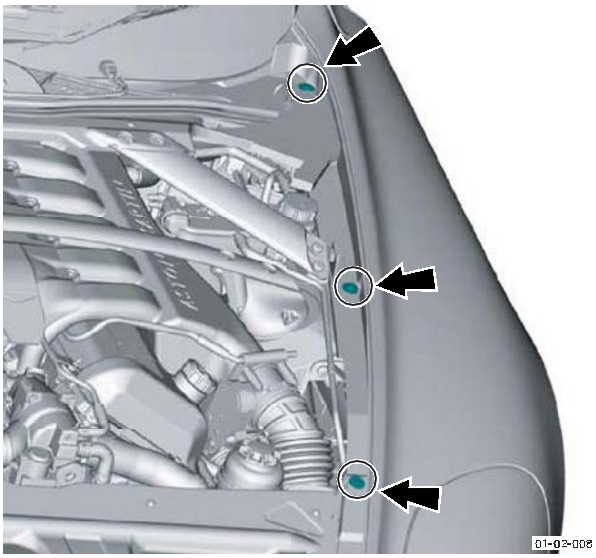
5. Disconnect the wing from the bumper (Refer to 'Front Bumper', page 1-19-1).



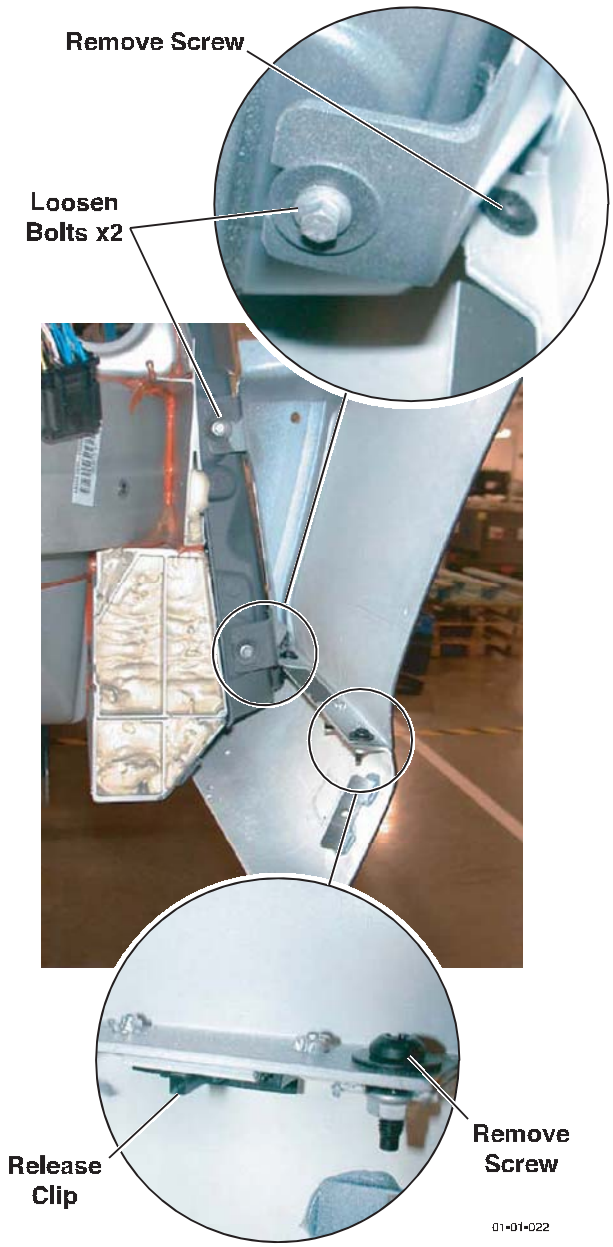
6. Remove the slam panel (bolts x12). Remove the front grill bolt (x2).



7. Remove bolts (x3).



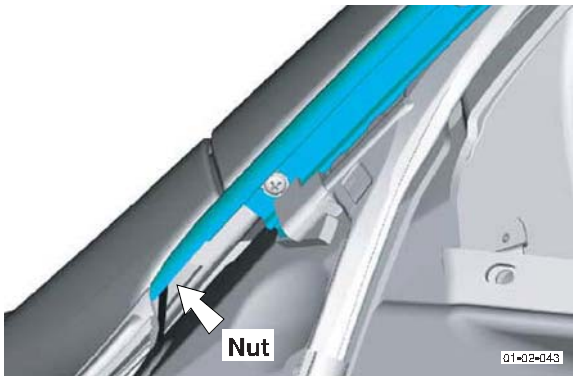
8. Loosen bolts (x2).



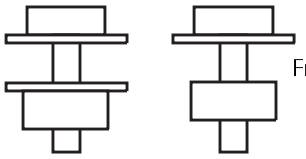
9. Lift from the rear lower edge to disengage the wing from the two loosened bolts. Pull the wing from the body.

Installation

1. Place the wing to the body.
2. Locate:
   - The wing top stud

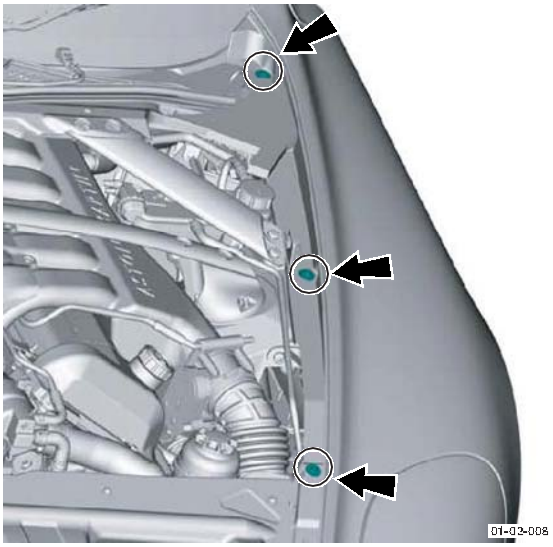


   - The rear lower wing to the loosened bolts
3. Install the wing lower edge clips and bolt.
4. Connect the wing to the bumper.
5. Install bolts to the wing top edge. Do not tighten.

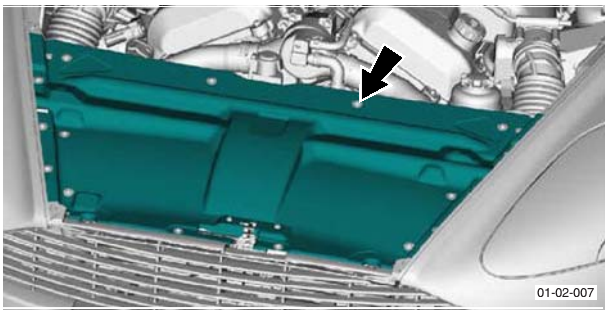


Front bolt on each wing

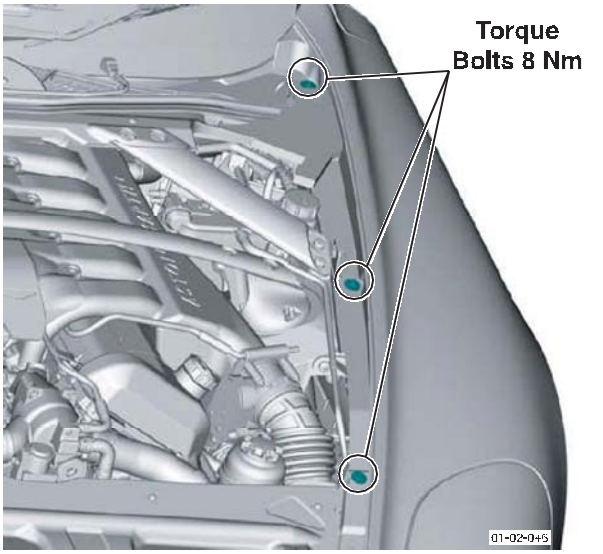
The two lower rear wing bolts have the same bolt / washer arrangement.

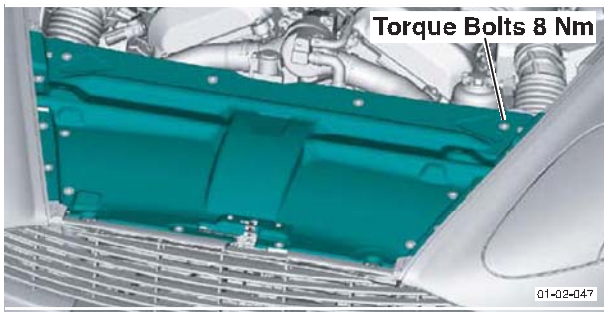


6. Install the slam panel.



7. Check wing alignment. Refer to specifications. Adjust if required.
8. Torque all wing fixings.





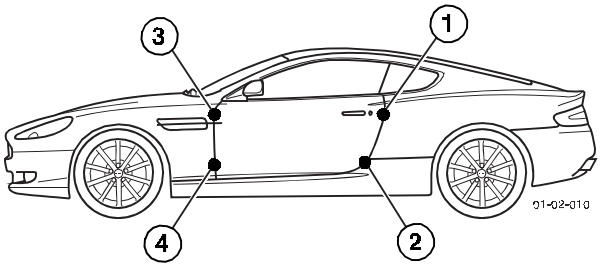
9. Connect the side repeater lamp wiring harness plug.
10. Install the road wheel and road wheel arch liner (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).
11. Connect the vehicle battery.

Body System (01.00)

Body Closures (01.03)

Specifications

Doors

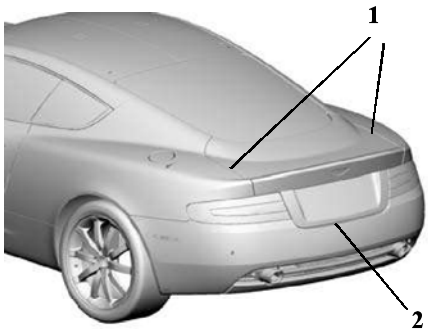


Door Standard (mm)				
Item	1	*2	3	4
Nominal gap	3.5	3.00	3.00	3.75
Tolerance	±0.75	±1.0	±1.0	± 0.75
Flush	0.0	-1.0	-1.0	0.0
Tolerance	±1.5 / 0.0	+0.0 / -1.0	±1.0	±1.5
Taper	N/A			
Symmetry	N/A			

* Flushness blends to 0.0 at the rear quarter
* Gap blends to 3.5 at rear quarter

Torque Figures		
Description	Nm.	lb. / ft.
Hinge to Door	47.5	33.5
Hinge to Body	36	26.5
Door Striker plate		

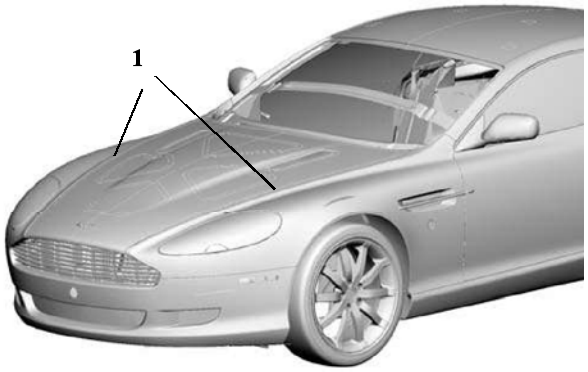
Boot Lid



Boot Standard (mm)		
Item	1	2
Nominal gap	3.5	3.5
Tolerance	±0.75	±1.0
Flush	-0.5	N/A
Tolerance	+0.5 / -1.0	N/A
Taper	1 mm Max. across the length	
Symmetry	1 mm Max. difference LH to RH	

Torque Figures		
Description	Nm	lb. / ft.
Hinge to Body	25	18

Bonnet



Bonnet Standard (mm)	
Item	1
Nominal gap	3.5
Tolerance	±0.75
Flush	-0.0
Tolerance	±1.5
Taper	N/A
Symmetry	N/A

Torque Figures		
Description	Nm	lb. / ft.
Hinge to Body	25	18

Maintenance

Doors

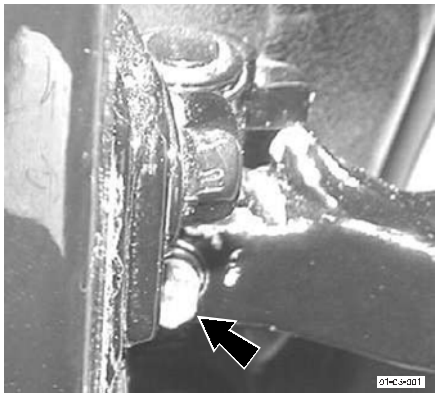
Repair Operation Time (ROT)		
Item		Code
Remove and reinstall	LH	01.03.EA
	RH	01.03.FA

Removal

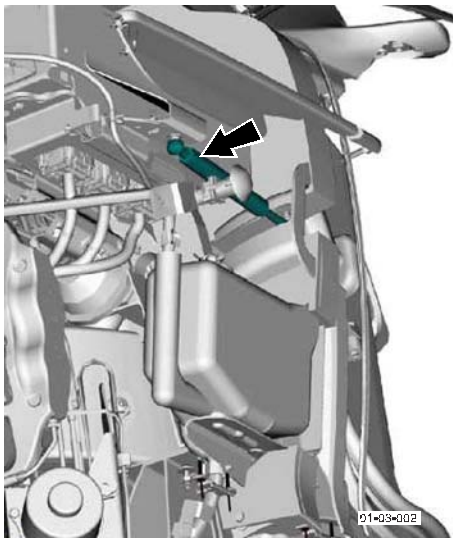
⚠ Warning ⚠
The doors are heavy. Removal is a two person operation.

Caution
Before removing the door ensure that the vehicle body work is sufficiently protected from possible damage.

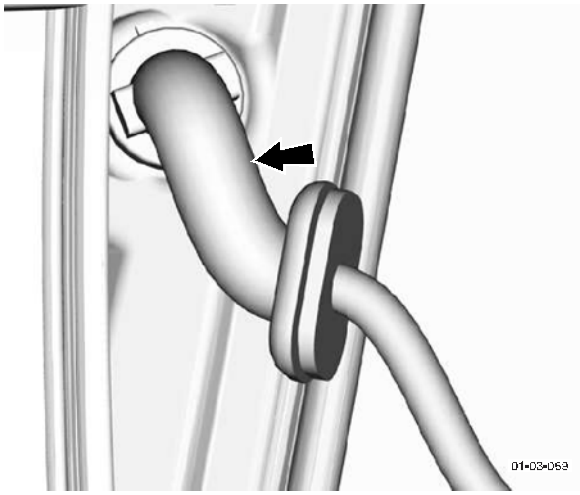
1. Disconnect the vehicle battery.
2. Open the vehicle door.
3. Slightly loosen the door hinge lock screws (x2).



4. Remove part of the roadwheel arch liner to gain access to the door check rod. Disconnect the door check rod.



5. Lift the door off the support studs and withdraw the door enough to gain access to the door wiring harness plug. Disconnect the wiring harness plug.



6. Withdraw the door from the vehicle and install on service tool (Refer to '501-F111 (Door Service Trolley)', page 20-1-8).

Installation

⚠ Warning ⚠
The doors are heavy. Replacement is a two person operation.

Caution
Before installing the door ensure that the vehicle body work is sufficiently protected from possible damage.

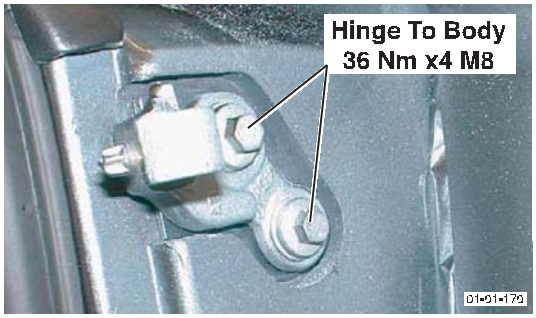
1. Place the door to the vehicle. Connect the door wiring harness plug.
2. Align the door to the upper and lower hinges. Install the door onto the hinges.

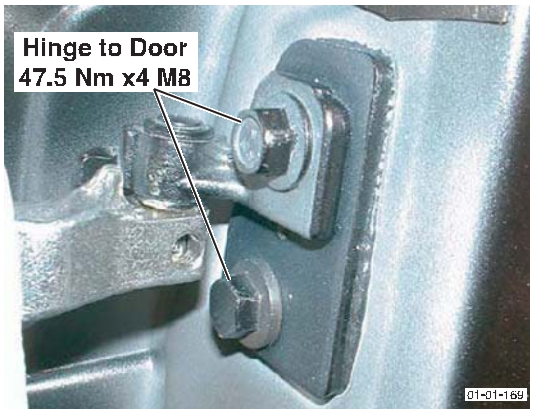
3. Connect the door check rod. Install the roadwheel arch liner.
4. Align the door. Manoeuvre the door to achieve correct gaps and flush (add / remove shims as required). Tighten the bolts. Do not torque.

5. Connect the vehicle battery.

> ⚠ *Warning* ⚠
> ***Never touch the door lock linkage with electrical power available to the door. The window mechanism can move and trap hands, arms, etc. in door frame.***

6. Check door alignment and closure of the door catch. Adjust striker plate if required.
7. When satisfied with the door install - torque the hinge bolts.
   - Hinge to Body - **36 Nm**.
   - Hinge to Door - **47.5 Nm**.





8. Check for:
   - Correct operation of all door lock functions.
   - Correct operation and sealing of the door window.

New Door Assembly

Repair Operation Time (ROT)		
Item		**Code**
Remove and install	LH	**01.03.CB**
	RH	**01.03.DB**

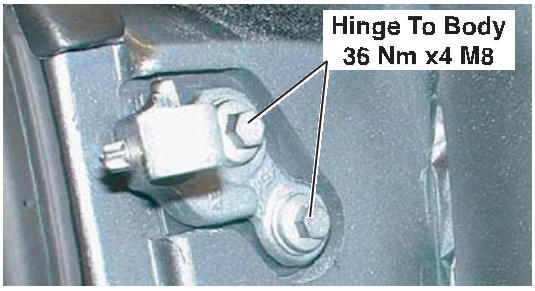
Preliminary Hinge Setup

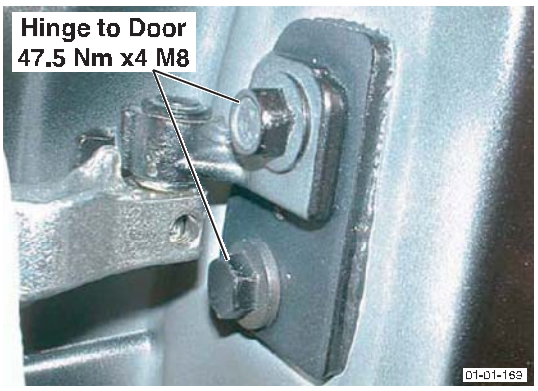
1. Install the door onto the hinges.

2. Place a weight of 16 kg (to compensate for weight of door windows, locks etc.) hanging from inner door skin as shown.

> *Weight and position are critical to accurately simulate weight and distribution of door furniture. Adjustment is difficult on a fully installed door.*

3. If removed, install the front wing (Refer to 'Front Wing', page 1-2-1).
4. Gently close the door. Check for an acceptable initial install.
5. Align the door. Manoeuvre the door to achieve correct gaps and flush (add / remove shims as required). Tighten the bolts. Do not torque.
6. Open the door and torque all hinge bolts. Remove the door weight.
   - Hinge to Body - **36 Nm**.
   - Hinge to Door - **47.5 Nm**.





7. Release the hinge locking screws and remove the door for installation of window, locks etc.

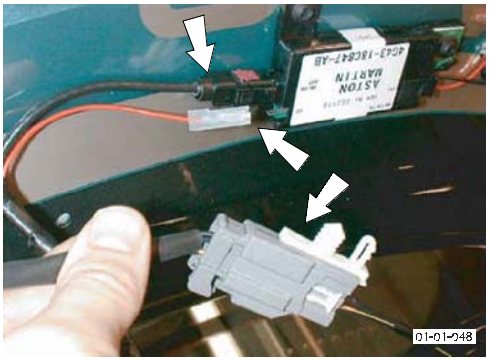
Boot Lid

Repair Operation Time (ROT)	
Item	Code
Remove and reinstall	01.03.BB

Removal

> ⚠ *Warning* ⚠
> ***The boot lid is heavy. Removal / replacement is a two person operation.***

1. Open the boot lid.
2. Remove the boot lid trim panel (Fir trees).
3. Disconnect the boot lid harness.

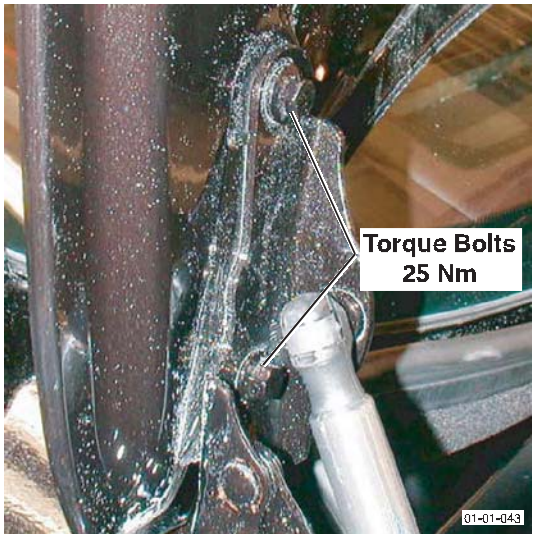


4. Slightly loosen the bolts (x4) that secure the boot lid to the boot lid hinges.
5. Support the boot lid. Remove the hinge bolts.
6. Withdraw the boot lid from the vehicle.

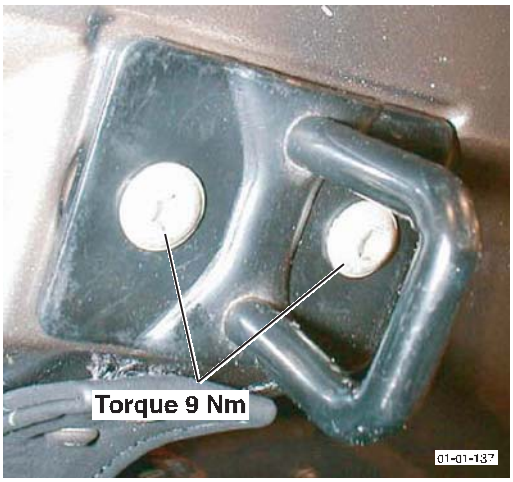
Installation

1. Align the boot lid to it's hinges. Install bolts (x4) sufficiently to manoeuvre the boot lid on it's hinges. Gently lower the boot lid rear edge, ensure the front corners do not touch the rear wings.
2. Align the boot lid front edge centrally in the boot aperture. Manoeuvre as required to achieve correct gaps.
3. Partially raise the boot lid and 'nip' up the hinge bolts.

4. Lower the boot lid. Check for correct alignment and readjust if required.
5. Fully raise the boot lid. Torque the hinge bolts to 25 **Nm**.



6. Gently close the boot lid. Check for correct engagement of the boot latch.
   Adjust the boot latch if required. Torque the boot latch bolts, to **9 Nm**.



7. Connect the boot lid wiring harness plugs.
8. Fully close the boot lid.
   Check for correct operation of the boot release switch and remote transmitter boot lid enable.
9. Install the boot lid trim.

Bonnet

Repair Operation Time (ROT)	
Item	Code
Remove and reinstall	01.03.AB

Removal

> ⚠ *Warning* ⚠
> ***The bonnet is heavy. Removal is a two person operation.***

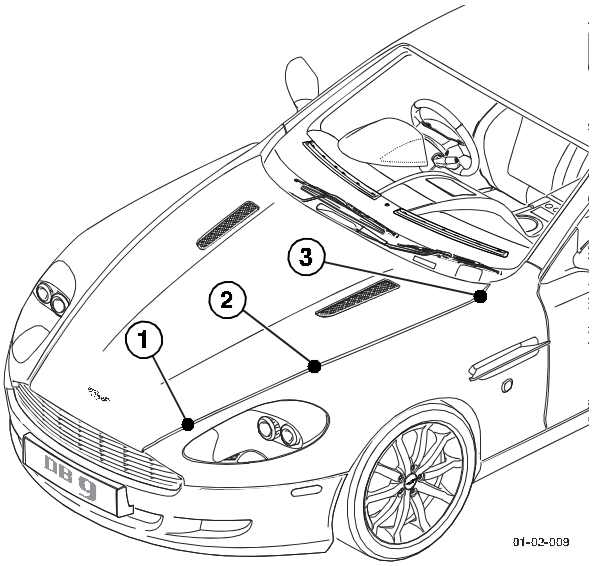
1. Open the bonnet.
2. Disconnect the windscreen wash pipe.
3. Slightly loosen the bolts (x4) that secure the bonnet to the hinge.
4. With the bonnet supported, disconnect the gas struts and remove the hinge bolts (x4).

5. Withdraw the bonnet from the vehicle.

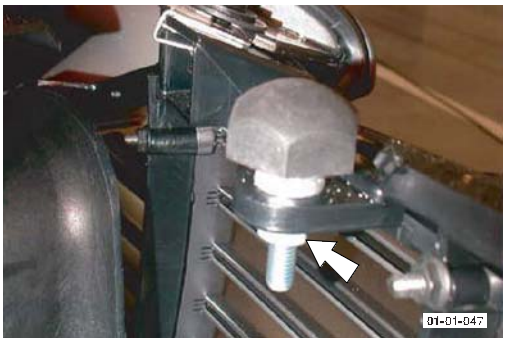
Installation / Realignment

> ⚠ *Warning* ⚠
> ***The bonnet is heavy. Replacement is a two person operation.***

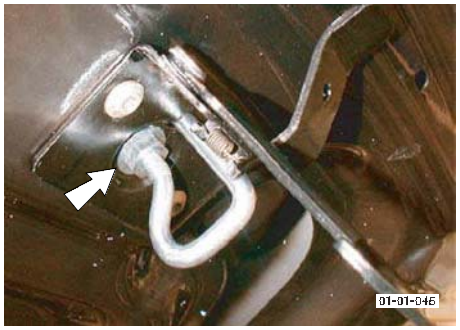
1. Align the bonnet to it's hinges. Install bolts (x4) sufficiently to manoeuvre the bonnet on it's hinges. Gently lower the bonnet. Adjust so that the corners do not touch the wings at the front and rear. Align the bonnet front edge centrally in the aperture.



2. Partially raise the bonnet. 'Nip' up one hinge bolt either side.
3. Lower the bonnet. Check for correct alignment. Readjust if required.



4. Fully raise the bonnet. Torque all hinge bolts to **25 Nm**.
5. Install the bonnet gas struts.
6. Gently close the bonnet. Check for correct engagement of the bonnet latch. Adjust if required to achieve the flush specification.
   - Turn the nut anti-clockwise to raise or clockwise to lower the bonnet catch until the bonnet is flush with the wings when closed.



7. Fully close the bonnet. Check for correct operation of the bonnet release lever.

Body System (01.00)

Interior Trim (01.05)

This section covers removal and installation of the interior mouldings and trim panels. In many instances, one component overlaps another component. If this condition is found, it will be necessary to loosen or remove the overlapping component before removal, to prevent damage to either component.

Specifications

Torque Figures

Description	Nm	lb. / ft.
Door Handle	9	6.5
Seat Belt Mounts	35	26

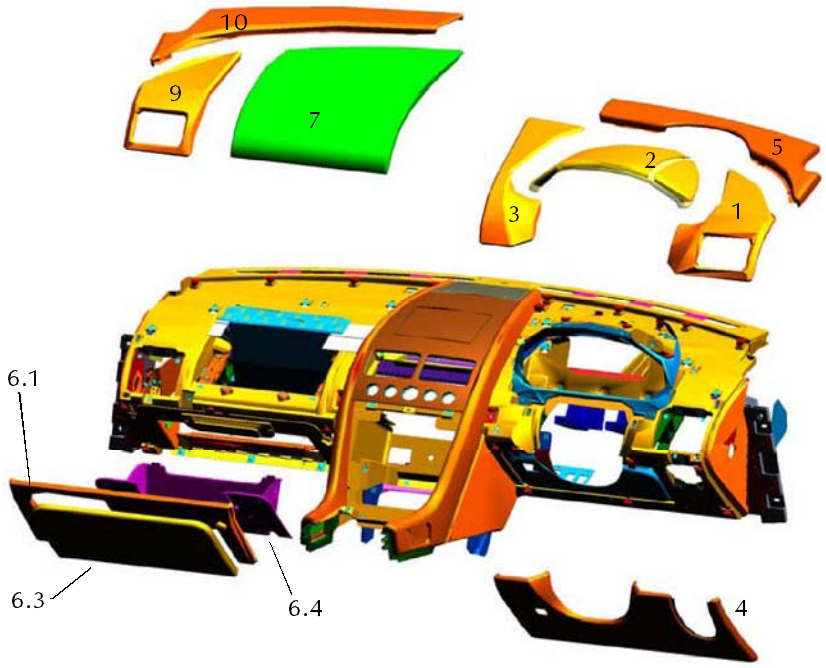
Maintenance

IP Trim

If required, removal of the IP trim can be achieved while the IP is in the vehicle.

Remove

1. Panel (1)- Pull off.
2. Hood (2) - Pull off.
3. Panel (3) - Pull off.
4. Panel (4) - Pull off. Disconnect the air temperature pipe.
5. Panel (5) - Front, screws (x3)
6. Glove box.
   - 6.1 Pull of the outer trim panel. Disconnect the glovebox release switch wiring harness plug.
   - 6.2 Release the damper cord.
   - 6.3 Remove screws (x3) from the glovebox door hinge. Remove door.
   - 6.4 Remove screws (x4) from the sight shield. Remove the sight shield and glovebox.
7. Panel, Airbag (7).



Caution
Withdraw the airbag panel carefully. The airbag panel can crease if forced out.

   - 7.1 Remove screws (x3).
   - 7.2 Lift from the front edge. Withdraw out of clips (x3).
8. Remove the airbag.

⚠ Warning ⚠
When removed, place the airbag in a sercure container to prevent personal injuries if the airbag activates.

   - 8.1 Disconnect the wiring harness plugs (x2).
   - 8.2 Remove bolts (x4). Withdraw the airbag.
9. Panel (9) - Screws (x2), then pull off.
10. Panel (10) - Screws (x4).
11. If required, remove the center stack.
    - 11.1 Pull off the veneer panel (Service tool No. TBA). Disconnect the wiring harness plugs.
    - 11.2 Remove the speaker grill - Screws (x2).
    - 11.3 Remove the center panel (Radio etc.) - Screws (x4)
    - 11.4 Remove the center stack - Screws (x6).
    - 11.5 Remove the media player - Screws (x2). Disconnect the wiring harness plugs.

Installation Notes

The panels, etc., are best replaced in the order they were removed. Note the following:

1. When installing the glovebox shield ensure that the tab in the top centre locates into the slot in the substrate.

Roof Trim

Removal

1. Remove (pull away) the cant rail.

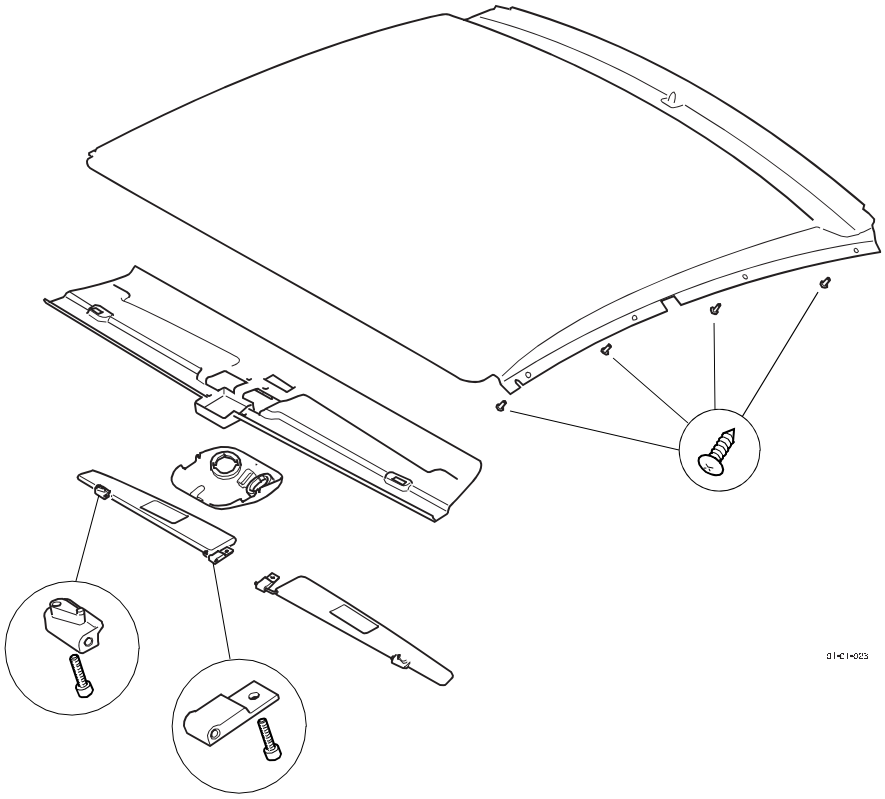
The cant rail is held in by 'FirTrees'. *The front of the cant rail is held in place by the 'IP'. Pull the cant rail away from the back first then pull the front out from the 'IP'.*

2. Remove the interior mirror (screw x1).
3. Remove the reading lamp pod (clips x2, screw x1, wiring harness plugs x2)
4. Remove the sun visors (screws x2 (x2).

The front headlining will fall away.

5. Remove the headlining.

Held in place with 'FirTrees' and two velcro panels at the rear.



Installation

1. Install the roof lining.
2. Install the front headling.

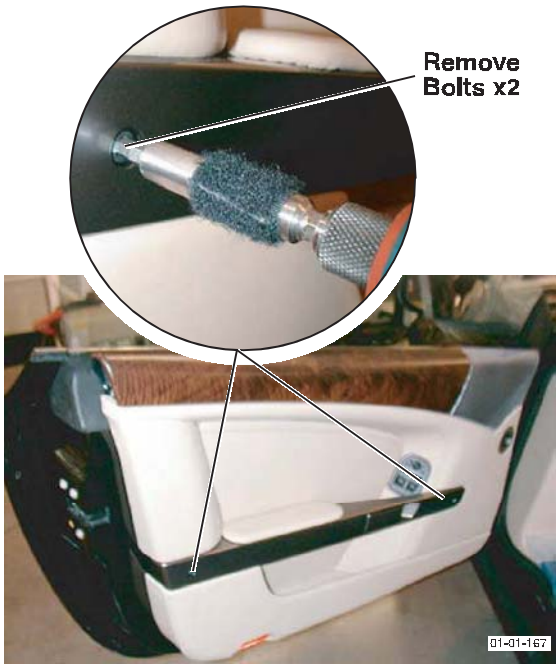
   While holding the front headling in place install the sun visors.
3. Install the interior mirror.
4. Install the cant rails.

   Place the front of the cant rail into location at the IP, and work towards the rear, locating the 'FirTrees'.

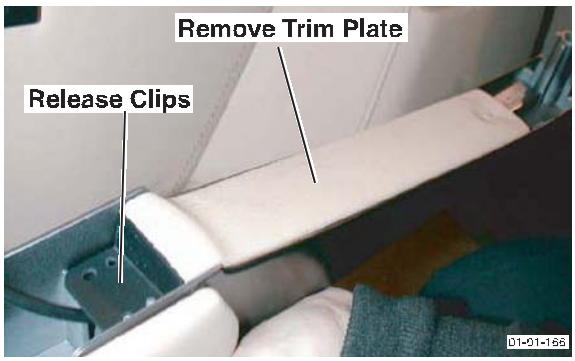
Door Trim

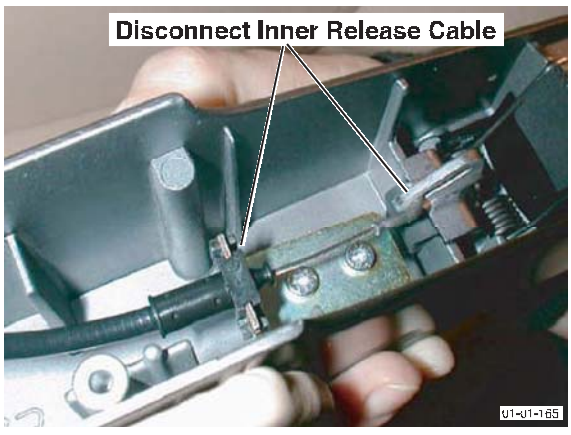
Removal

1. Lower the door glass fully.
2. Disconnect vehicle battery.
3. Release the door handle (Bolts x2).

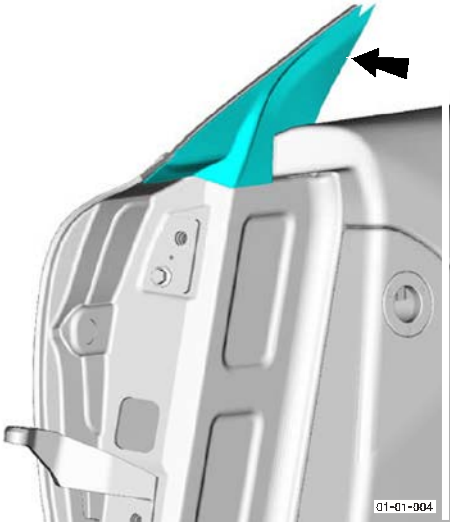


4. Remove the door handle trim plate and disconnect the release cable.

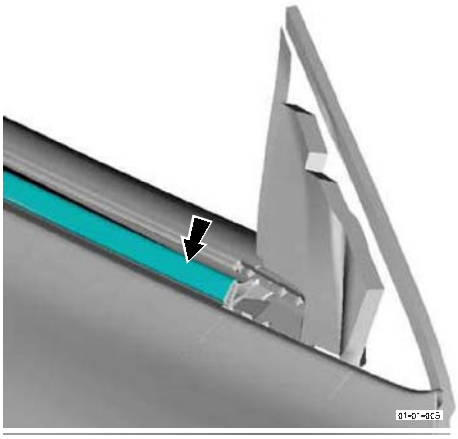




5. Remove the door mirror cheater panel.

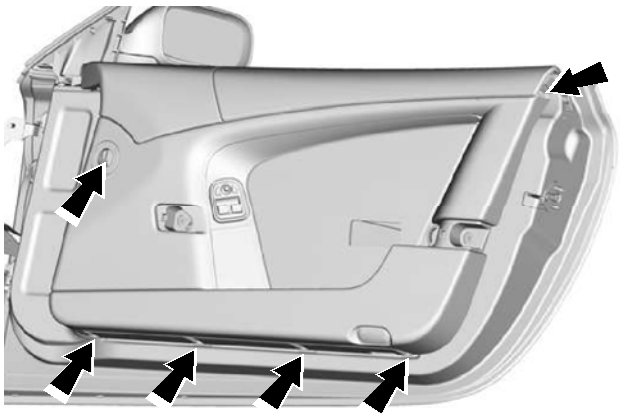


6. Remove outer chrome waist rail trim.



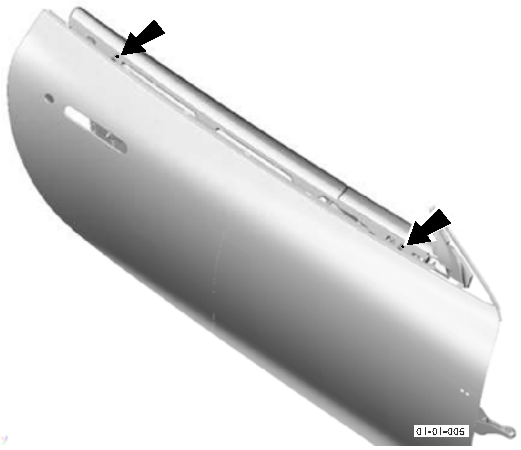
7. From the outside remove screws (x2).

8. Remove the door trim panel screws (x6). Withdraw the door trim panel to gain access to the window and mirror switches. Disconnect the switches.

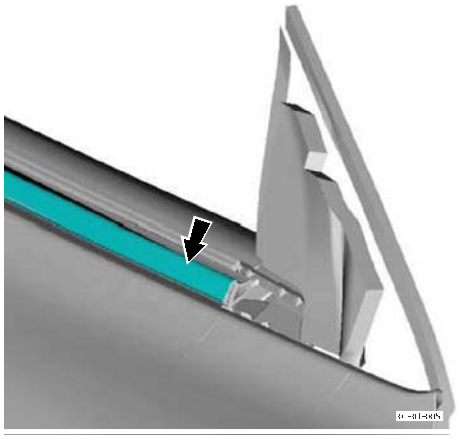


Installation

1. Place the door trim panel to the door and connect the wiring harness plugs.
2. Install the door trim panel screws (x6).
3. Install screws (x2).



4. Install the outer weather seal strip.

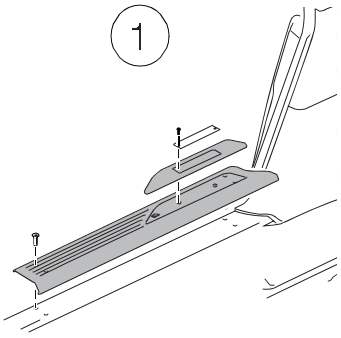


5. Install the door mirror cheater panel.
6. Install the door pull
   - 6.1 Connect the door inner release cable.
   - 6.2 Install the door pull trim plate.
   - 6.3 Install the door handle. Torque to 9 **Nm**.
7. Connect the vehicle battery.

Rear Trim

Removal (Coupe)

1



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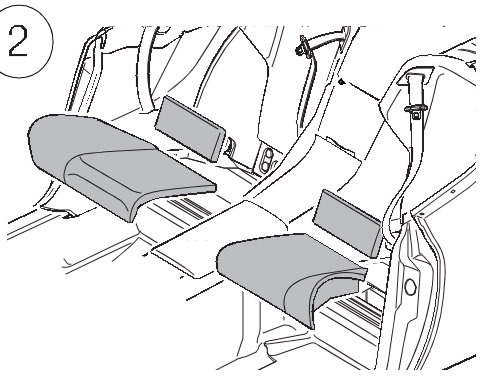

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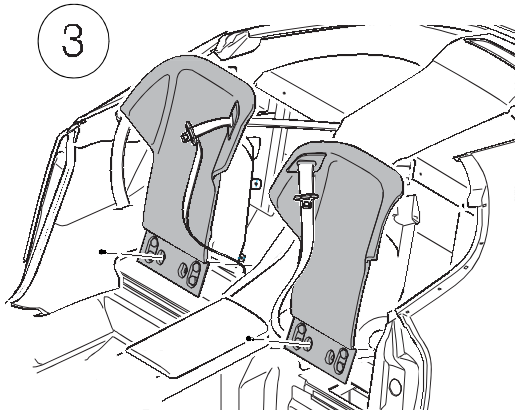

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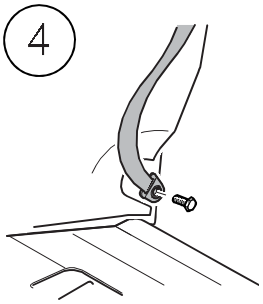

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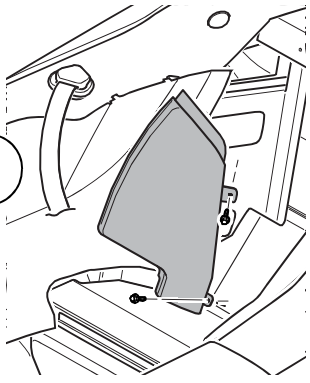

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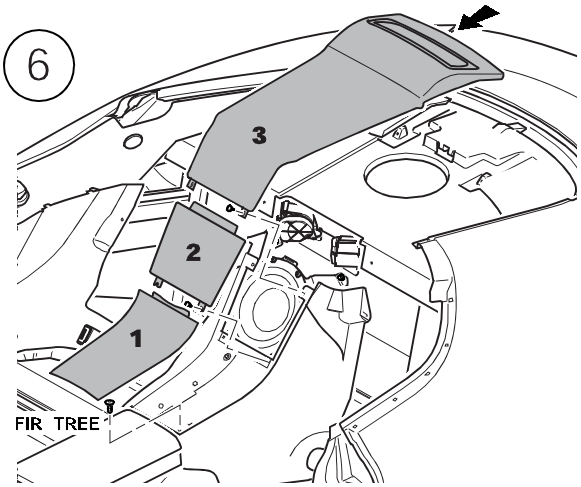

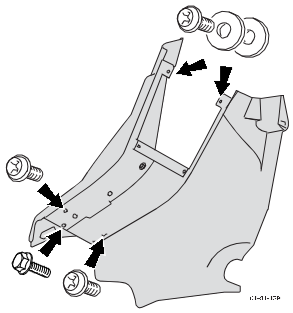

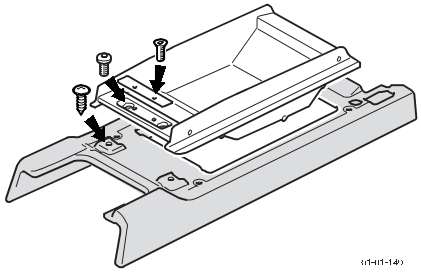

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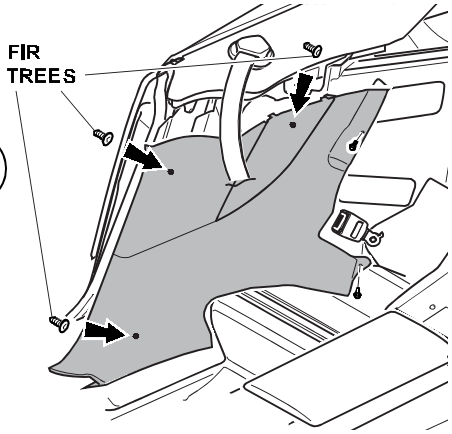
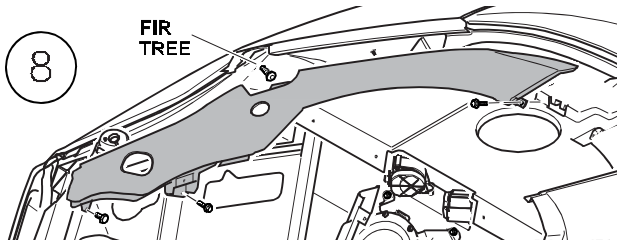
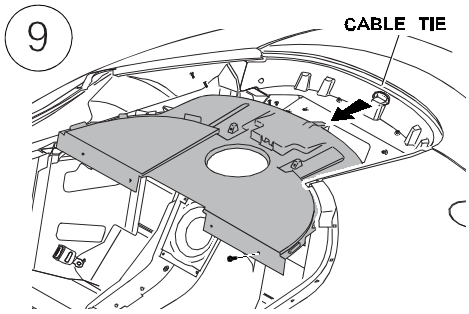






Install (Coupe)

Install the trim in reverse order to remove.

Torque seat belt mounts to **35 Nm**.

Removal (Volante)

1. Remove the seat bases.
2. Remove the seat backs.
   - 2.1 Pull off and up to remove the head support.
   - 2.2 Remove screws (x2 (Bottom) and x2 (top)).
3. Remove the door 'kick' plates.
   - 3.1 Remove screws x2.
   - 3.2 Remove screws x4. Withdraw the 'kick' plate.
   - 3.3 Repeat for the second 'kick' plate.
4. Remove the rear seat belt top mounts.
5. Remove the rear quarter panels.
   Screws (x2 (lower)), screw (x1 (upper)) and pull the front away (firtrees). Repeat for the second quarter panel.
6. Remove the 1st trim panel of the rear console.
   Pull up at the front and lift off.
7. Remove the 2nd trim (speaker) panel of the rear console.
   Remove the screws (x2).
8. Remove the 3rd trim panel of the rear console.
   Remove the screws (x2) from the bottom and screws (x2) from the rear of the ROPS closure panel.
9. Remove the rear center console.

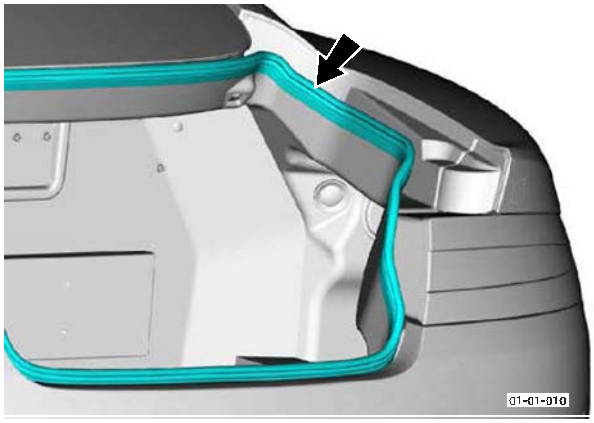
Install (Volante)

1. Install the rear center console.
2. Install the center console trim panels.
3. Install the rear quarter panels.
4. Install the door 'kick' plates.
5. Install the seat belt top mounts. Torque to **35 Nm**.
6. Install the seat backs and bases.

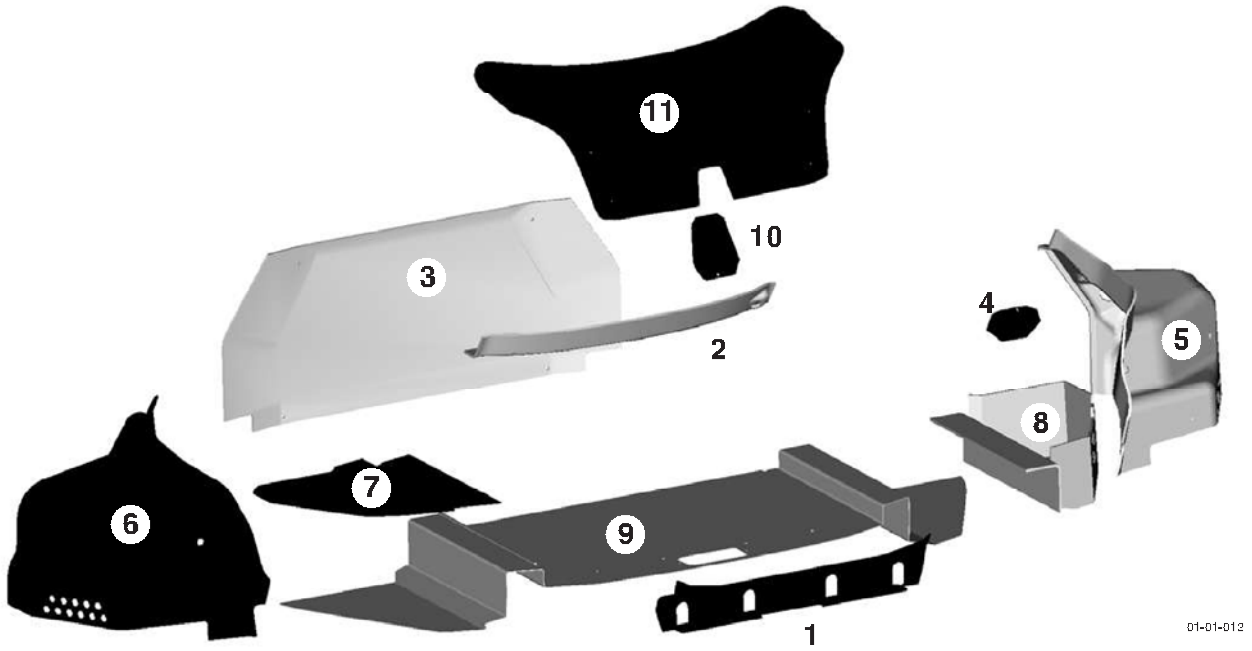
Boot Trim

Removal

1. Remove the boot weather seal.



2. Remove the boot trim in the following order detailed above.



Item	Fixings	Item	Fixings
1.	Fir trees	6.	Fir trees
2.	Fir trees	7.	Fir trees
3.	Fir trees	8.	Fir trees
4.	Fir trees	9.	Fir trees
5.	Fir trees	10.	Fir trees
		11.	Fir trees

Installation

The rear trim is best installed in reverse order of the removal procedure.

Body System (01.00)

Exterior Trim (01.08)

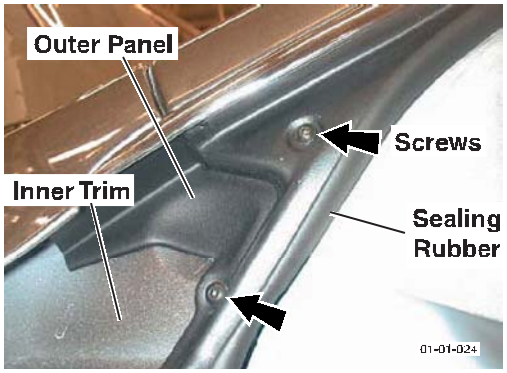
Maintenance

Side Trim

Removal

1. Remove the trim panel.
   1.1 Remove the top / bottom screws (x2). Remove the outer panel.

Pull the top of the outer panel away from the vehicle and slide it forward.



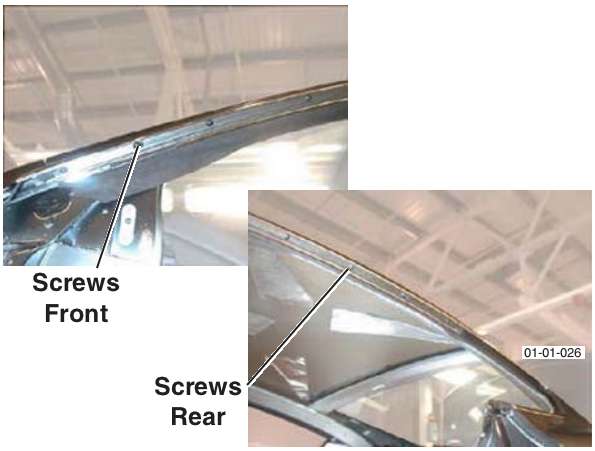
2. Pull the inner trim panel away from the vehicle.

Pull the inner trim panel downwards.

3. Remove the door sealing rubber.
4. Remove the rear ¼ glass and seal.

5. Remove the chrome trim screws (x18). Remove the chrome trim.

Support the trim as it is removed.



Installation

1. Install the chrome trim.
2. Rear ¼ glass seal and glass.
3. Install the mirror trim panels. Insert the section of door sealing rubber as the inner and outer trim panels are installed.

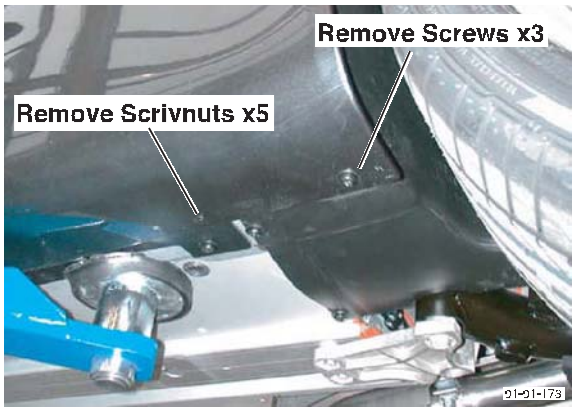
The lower screw, screws into fibre glass. Ensure that the lower screw is screwed into the original threads.

4. Install the door sealing rubber.

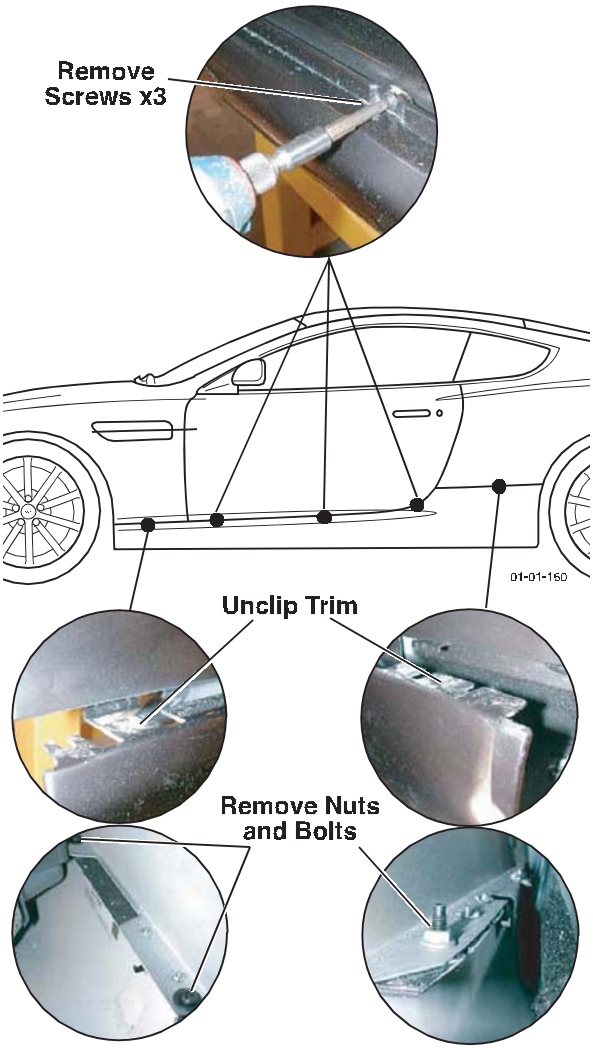
Sill Trim

Remove

1. Remove the front and rear road wheel arch liners sufficiently to gain access.
2. Remove (x3) screws and (x2) scrivnuts.



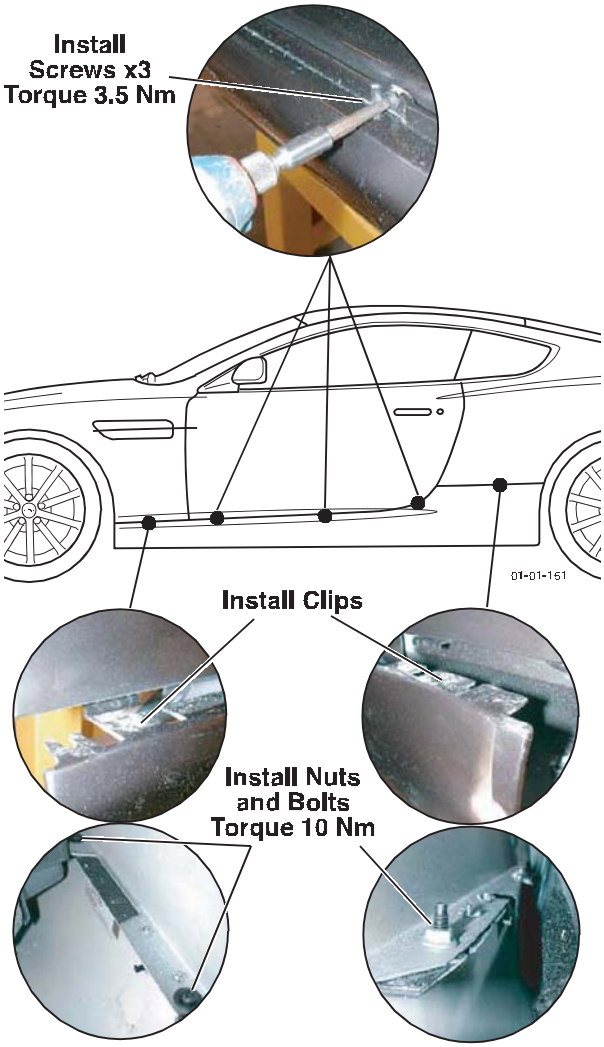
3. Remove (x3) nut and bolt (front x2, rear x1).
4. Remove the door aperture screws (x3).



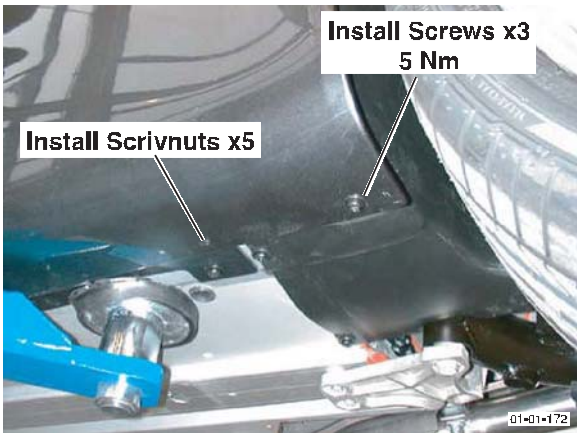
5. Unclip the sill trim from the vehicle body. Withdraw the sill trim.

Installation

1. Offer the sill trim to the vehicle.
2. Install the sill trim using 3 clips (front x1, rear x2).
3. Install the door aperture screws (x3).
4. Install (x3) nut and bolt (front x2, rear x1). Torque to **6 Nm**.



5. Install (x3) screws and (x2) scrivnuts.



6. Install the front and rear road wheel arch liners.

Body System (01.00)

Mirrors (01.09)

Specifications

Torque Figures		
Description	Nm	lb. / ft.
Mirror Mounting	20-25	15-18.5

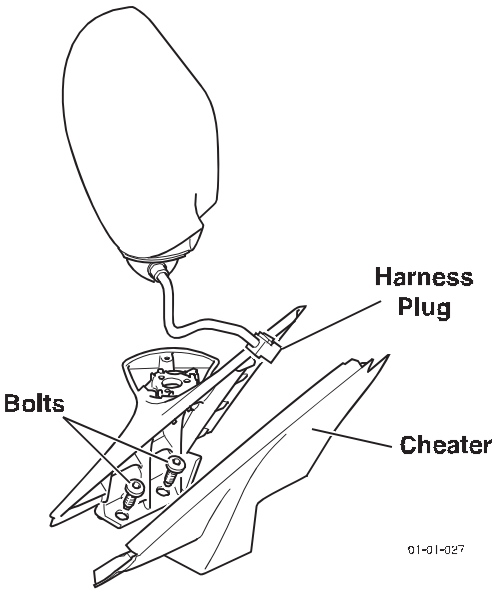
Maintenance

Repair Operation Time (ROT)		
Item		**Code**
Remove and install	LH	**01.09.AB**
	RH	**01.09.BB**

Door Mirrors

Removal

1. Remove the door trim panel (Refer to 'Door Trim', page 1-5-3).
2. Remove the door mirror 'cheater' panel (pull off).



3. Disconnect the wiring harness plug.
4. Remove bolts (x2) and withdraw mirror.

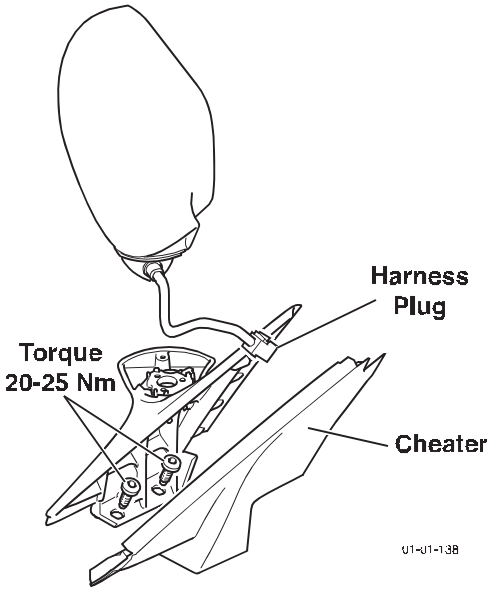
Installation

1. Place the mirror into position. Install bolts (x2).

The spring washer goes between the mirror bracket and the door. On the front bolt of each mirror, ensure that the plain washer goes between the bolt head and the mirror bracket.

Torque to **20-25 Nm**. As the front bolt is tightened ensure a flush install with the door.

The front bolt hole on each mirror has an enlarged hole, to allow a small amount of adjustment.



2. Connect the wiring harness plug.
3. Install the door mirror 'cheater' panel.
4. Install the door trim panel (Refer to 'Door Trim', page 1-5-3).

Body System (01.00)

Seating (01.10)

Description

The front seats are installed with the following features:

- Integral side airbags
- Head restraints
- Safety belt buckle / pretensioner
- Electrically adjustable seat positioning and lumbar support
- Heated seat (optional)

Heated Seats

The heated seat system comprises:

- Heated seat switches
- Backrest heater element
- Cushion heater element and thermostat

The heated seat function permits the electrical heating of the seat back and cushion on the driver and front passenger seats. The heating system of each seat is selected by separate switches located on the inside of each seat base.

Once the heated seat function has been activated, it will operate until one of the following conditions have been satisfied:

- A fixed period of time has expired (10 minutes)
- If the engine is not running and the ignition key is removed
- A malfunction is detected by the heated seat module

Confirmation that the heated seat function is active is indicated by the illumination of an amber light in the instrument cluster.

Seat Module

The seat module is located under the front edge of the seat.

Specifications

Torque Figures		
Description	Nm.	lb. / ft.
Seat mountings	20-25	15-18.5
Seat Belt Mounts	35	26

Maintenance

Front Seat - Remove and Install

Repair Operation Time (ROT)		
Item		Code
Front Seat - Remove and Install	LH	01.10.AA
	RH	01.10.BA

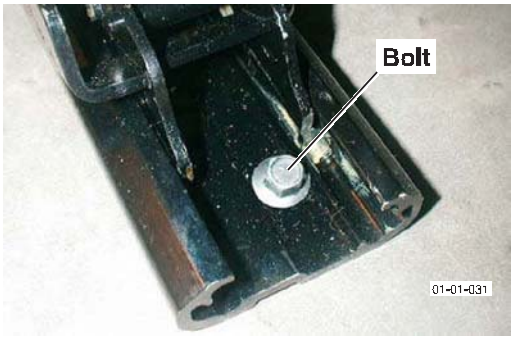
Remove

The front and rear seat rail mountings are positioned on four washers. Ensure the washers are collected during seat removal.

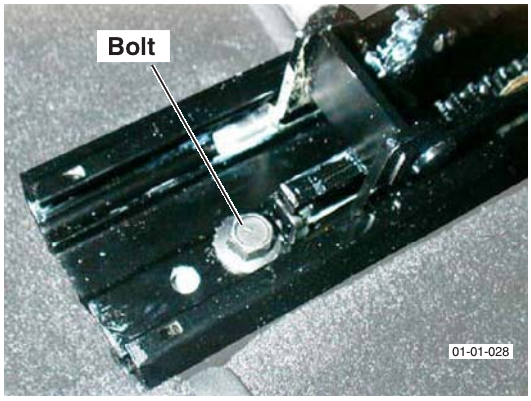
1. Motor the seat forward.

To power the drivers seat the ignition switch must be in the 'II' position

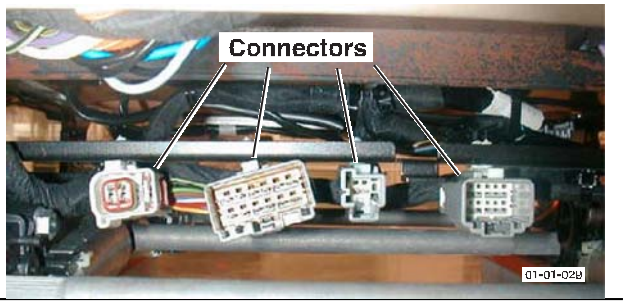
2. Remove bolts (x2) that secure the rear of the seat rails.



3. Motor the seat to the rear. Remove bolts (x2) that secure the front of the seat rails.



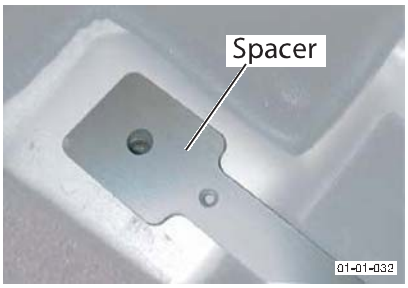
4. Tip the seat rearwards and disconnect the wiring harness plugs (x4).



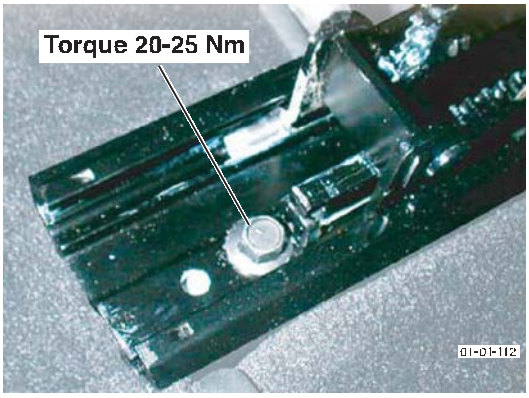
5. Remove the seat assembly.

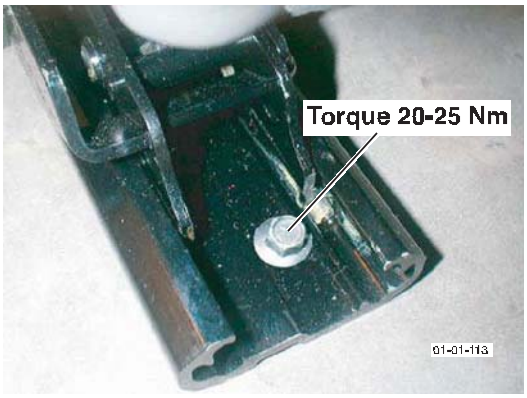
Install

1. Place the seat in the vehicle.
2. Connect the wiring harness plugs (x4).
3. Place the two spacers in position. Locate the seat over the seat mountings.



4. Install the front bolts, power the seat forwards and install the rear bolts. Torque bolts (x4) to **20-25 Nm**.





Seat Base Control Motors

The seat base control motors are an integral part of the seat base.

Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Front Seat Squab Cover Assembly (from 08MY) - Remove and Install	**01.10.AC**

Remove

Procedure to follow.

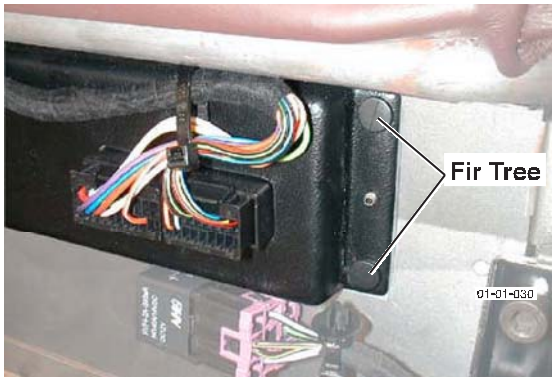
Install

Procedure to follow.

Seat Module

Remove

1. Remove seat from vehicle.
2. Remove the seat module. The seat module is held in by fir trees (x4).



Install

1. Remove seat from vehicle.
2. Remove the seat module. The seat module is held in by fir trees (x4).

Seat Module Calibration

This mode allows the seat module to learn its position. The seat needs to know exactly where it is to electronically prevent seat movement into certain areas within the mechanical seat movement envelope.

Once the seat has been put in to calibration mode it will remain in this mode until it as been re-taught its position. There is no physical indication that the seat is in calibration mode, the seat could be left in this mode for some time before a user notices.

There is nothing wrong with the seat being in calibration mode for extended periods of time, it will only be apparent to the user when a rearward / downward seat movement is required.

The seat must be calibrated before rearward / downward movement is allowed.

Calibration mode is activated by a diagnostic command or by switching on the BDS while holding up the seat height switches.

1. With the Interior light relay 'On', i.e. door open, move the seat forwards or backwards, then disconnect the vehicle battery (either physically or via the BDS) before the interior light relay switches 'Off' (five minutes unlocked, 30 second locked).

   The seat module is now in calibration mode.

The seat will not go into calibration mode if the interior light relay has been allowed to switch off since the last seat movement.

2. Drive the seat fully forward, allow the motors to stall against the seats mechanical end stops.
3. Drive the seat fully upwards, allow the motors to stall against the seats mechanical end stops.

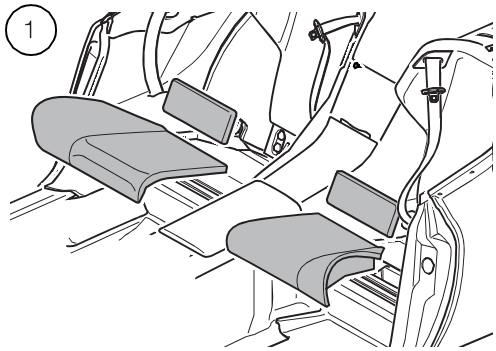
The seat up switch needs to be operated front up then back up.

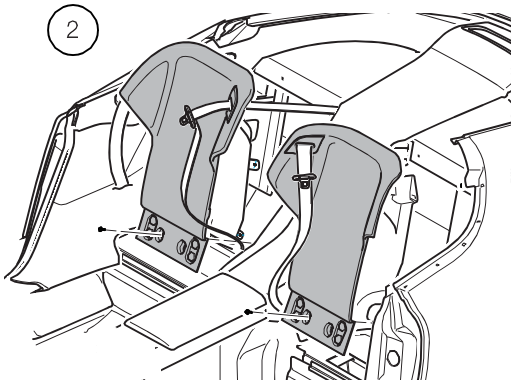
When each end stop is reached the motor will know where it is on that particular axis, the seat will only allow forward of upward movement until each axis position has been learnt

4. The seat module is now out of calibration mode.

Rear Seats

Removal (Coupe)





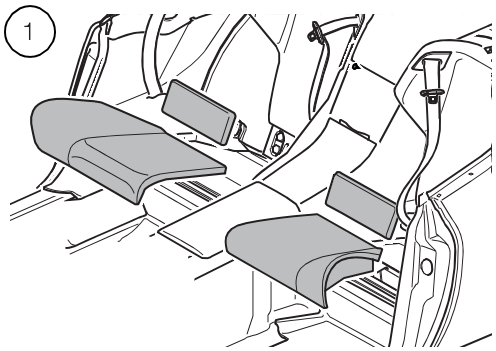
Installation (Coupe)

Install the rear seat in reverse order.

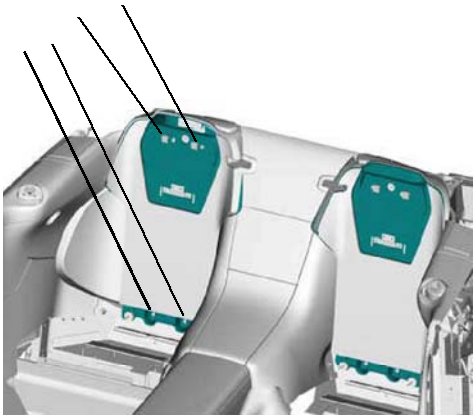
Torque seat belt mounts to **35 Nm**.

Removal (Volante)

1. Remove the seat bases. Pull off.



2. Remove the headrest panel. Pull off at the top and pull up to remove.
3. Remove screws (x4) that secure the seat back. Withdraw the seat back.



Installation (Volante)

Install the rear seat in reverse order.

Torque seat belt mounts to **35 Nm**.

Lumbar Pump for the Front Seat (From 08MY) - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Lumbar Pump for the Front Seat (From 08MY) - Remove and Install	**01.10.EF**

Remove

1. Remove the applicable front seat (Refer to 'Front Seat - Remove and Install', page 1-10-1).
2. Remove the cover for the squab from the seat (Refer to 'Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install', page 1-10-2).
3. Move the lumbar inlay to give access.
4. Remove the tape that attaches the air hoses for the bladder into the lumbar inlay.
5. Move the air pump out of the lumbar inlay.
6. Disconnect the air hoses from the pump.
7. Disconnect the electrical connector for the pump.
8. Remove the pump assembly.

Install

1. Connect the the air hose to the pump.
2. Put the air valve in position into the inlay.
3. Connect the electrical connector for the pump.
4. Put the pump into the correct position in the lumbar inlay.
5. Use applicable tape to hold the hoses into the lumbar inlay.
6. Put the lumbar inlay into the correct position.
7. Install the cover for the seat squab (Refer to 'Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install', page 1-10-2).
8. Install the seat (Refer to 'Front Seat - Remove and Install', page 1-10-1).

Lumbar Valve for the Front Seat (From 08MY) - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Lumbar Valve for the Front Seat (From 08MY) - Remove and Install	**01.10.EH**

Remove

1. Remove the applicable seat (Refer to 'Front Seat - Remove and Install', page 1-10-1).
2. Remove the cover for the squab from the seat (Refer to 'Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install', page 1-10-2).
3. Remove the tape that attaches the air hoses for the bladder into the lumbar inlay.
4. Record the air-hose connections to the air valve.
5. Move the air valve out of the lumbar inlay.
6. Disconnect the air hoses from the valve.
7. Disconnect the electrical connector for the valve.
8. Remove the valve assembly.

Install

1. Connect the the air hoses to the valve at the positions recorded during removal.
2. Connect the electrical connector to the valve assembly.
3. Put the valve into the correct position in the lumbar inlay.
4. Use applicable tape to hold the pipes into the lumbar inlay.
5. Put the lumbar inlay into the correct position.
6. Install the cover for the seat squab (Refer to 'Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install', page 1-10-2).
7. Install the seat (Refer to 'Front Seat - Remove and Install', page 1-10-1).

Lumbar Bladder for the Front Seat (From 08MY) - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Lumbar Bladder for the Front Seat (From 08MY) - Remove and Install	**01.10.EK**

Remove

1. Remove the applicable front seat (Refer to 'Front Seat - Remove and Install', page 1-10-1).
2. Remove the cover for the squab from the seat (Refer to 'Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install', page 1-10-2).
3. Release the clips that attach the lumbar bladder.
4. move the bladder to give access.
5. Release and remove the clips that attach the lumbar inlay.
6. Remove the tape that attaches the air hoses for the bladder into the lumbar inlay.
7. Record the air-hose connections to the air valve.
8. Move the air valve out of the lumbar inlay.
9. Disconnect the air hoses from the valve.
10. Remove the bladder assembly.

Install

1. Put the bladder in position on the seat.
2. Connect the the air hoses to the valve at the positions recorded during removal.
3. Put the air valve in position into the inlay.
4. Use applicable tape to hold the hoses into the lumbar inlay.
5. Put the lumbar inlay into the correct position.
6. Put the bladder into the correct position.
7. Install the bladder attachment clips.
8. Install the cover for the seat squab (Refer to 'Front Seat Squab Cover Assembly (Each, from 08MY) - Remove and Install', page 1-10-2).
9. Install the seat (Refer to 'Front Seat - Remove and Install', page 1-10-1).

Body System (01.00)

Glass, Frame and Mechanism (01.11)

Description

Power to the door window regulator motor is available when the ignition switch is at position '0' 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 regulator motor may be switched in either direction to raise or lower the glass.

Frameless doors

To avoid damaging the body seals during door opening, the door glass must be lowered before the door can be opened. This function is controlled by the door modules.

The door module senses the rotation of the latch claw as the door opens, the door module then drives the door window regulator motor briefly to lower the door glass until it clears the glass seals. After closing a door, the window regulator motor operates to raise the door glass to seat against the body seals.

Specifications

Torque Figures

Description		Nm	lb. / ft.
Door regulator	M6	9	7
	M10	10-15	7.5-11.5
Glass grip screws		5-6	4-4.5
Door Handle		9	7
Rear quarter regulator	M6	9	7
	M10	10-15	7.5-11.5
Seat belt and speaker plate		8-10	6-7.5

⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

Maintenance

Glass Regulator

Repair Operation Time (ROT)		
Item		**Code**
Door Glass Motor	LH	01.11.LH
	RH	01.11.RH
Door Glass Regulator	LH	01.11.FB
	RH	01.11.GB

Removal

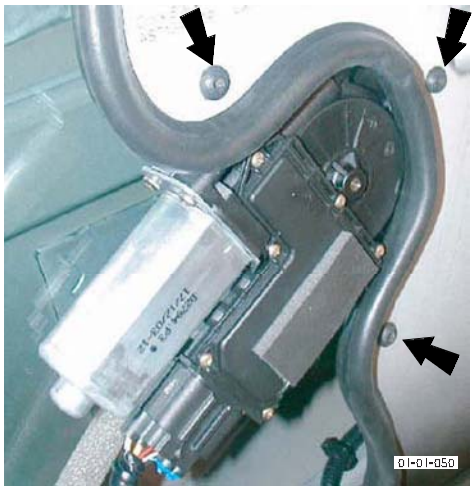
1. Remove the door trim panel (Refer to 'Door Trim', page 1-5-3).
2. Power the door glass to a 'half open' position.

To enable access to the screws which secure the door glass.

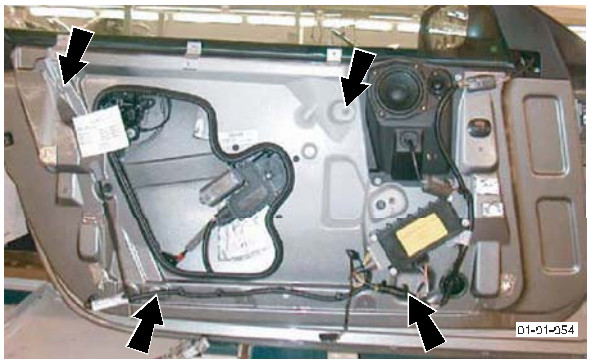
3. Disconnect the vehicle battery.

⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

4. Remove the door glass grip screws. Withdraw the door glass from the door.
5. Release the window regulator motor from the door.



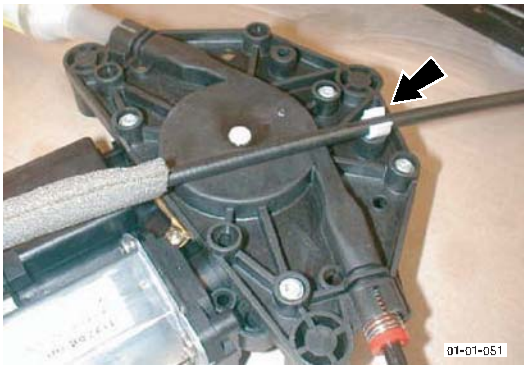
6. Release nuts (x4). Withdraw the window regulator from the door.



Installation

1. Install the window regulator assembly.

Ensure the window regulator cable remains in place during installation.



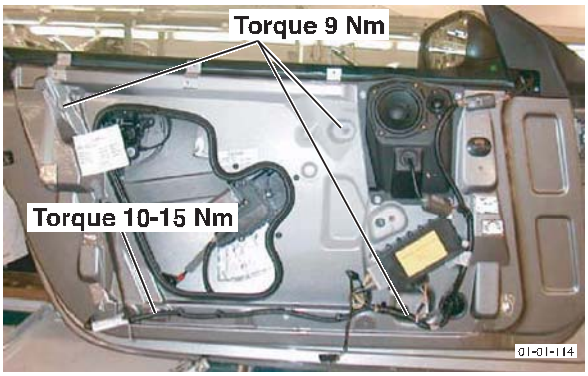
Ensure that the wiring harness running by the adjuster bolt locates above the adjuster bolt.

Ensure the wiring harness does not get 'trapped'.

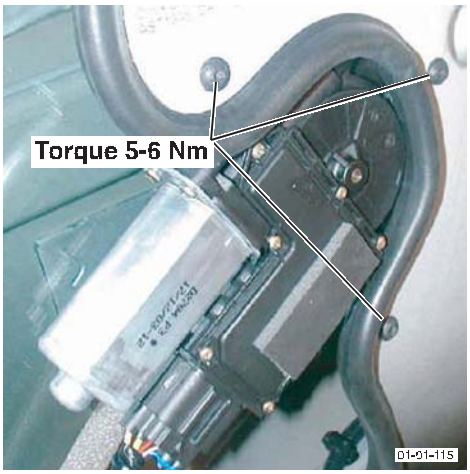
Window regulators are 'Handed' (L/H and R/H). The adjuster is always located at the bottom rear of the door.

Place the window regulator unit into position and locate the four mountings through the door inner skin.

2. Install nuts. Torque nuts (x3) M6 to **9 Nm**. and (x1) M10 **10-15 Nm**.



3. Install the window regulator motor (screws x3). Torque to **5-6 Nm**.



Ensure the window regulator motor wiring harness clips to the window regulator motor.

4. Install the weather strips (x2). If removed.

⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

5. Lower the door glass into the door.

Insert the front end of the door glass first then lower the door glass and insert the rear end.

5.1 Locate the rear end of the door glass into it's grip.

5.2 Locate the front end of the door glass into it's grip.

The front grip has to be located by feel alone.

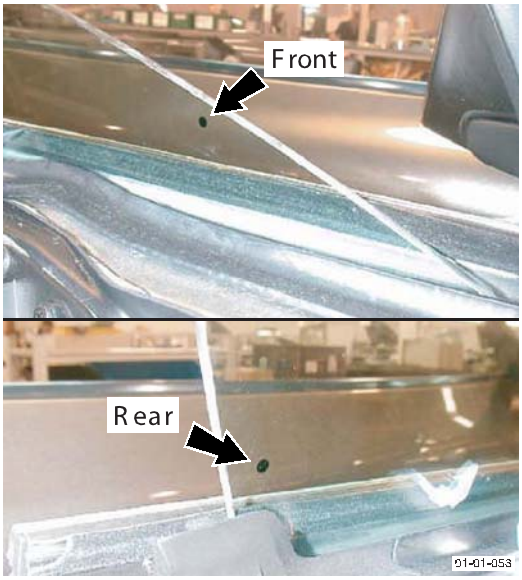
5.3 Line up the holes in door glass with the openings in the grips (x2).

6. Install the grip screws (x2). Do not tighten.

The grip screws are, apart from length, the same as the latch unit screws (x3). Do not install the, shorter, latch unit screws to the grips.

7. Align the door glass. Ensure the following when installing a new door glass.
   - The glass is flush with the mirror trim edge

   - The two dots on the door glass are equal distance from the door edge.



8. Install the door module (if removed).

⚠ WARNING ⚠

DANGER OF HANDS BEING TRAPPED IN THE WINDOW REGULATOR MECHANISM. DO NOT PUT YOUR HANDS THROUGH THE DOOR GLASS APERTURE WITH THE DOOR HARNESS CONNECTED.

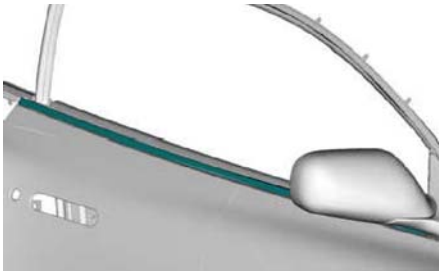
9. Connect the vehicle battery.
10. Check alignment of the door glass to the door seals.
    If required, disconnect the power to the door and realign the door glass.
    Once satisfactory alignment is achieved, torque both grip screws to **5-6 Nm**.
11. Install the door mirror. If removed.
12. Install the outer weather strip. If removed.
13. Install the door trim.

Door Glass

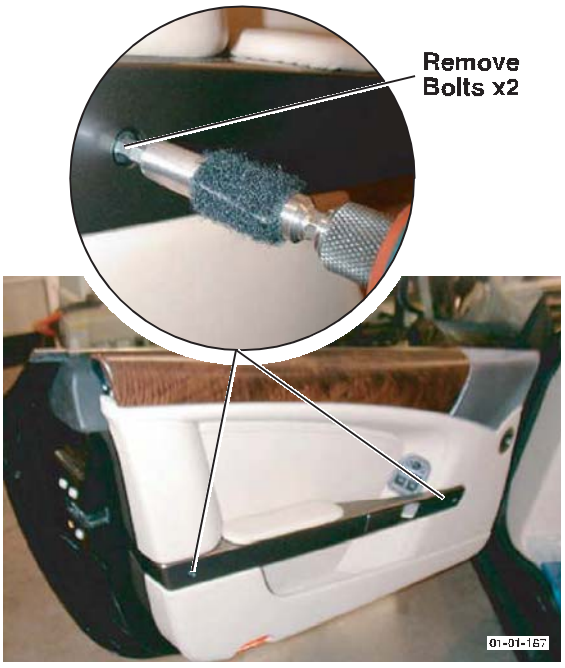
Repair Operation Time (ROT)		
Item		**Code**
Door Glass Renew	LH	01.11.BB
	RH	01.11.HB
Door Glass Adjust	LH	01.11.CD
	RH	01.11.JD

Removal

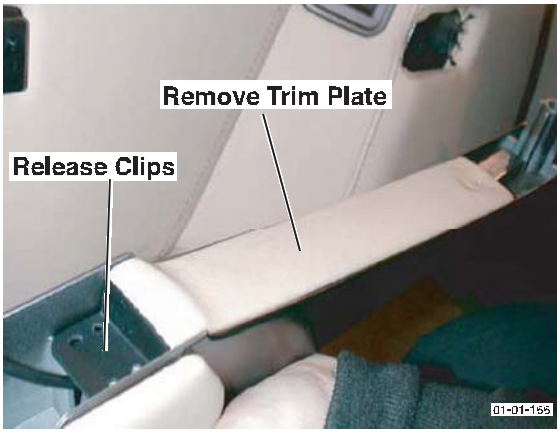
1. Remove the door outer weather strip.

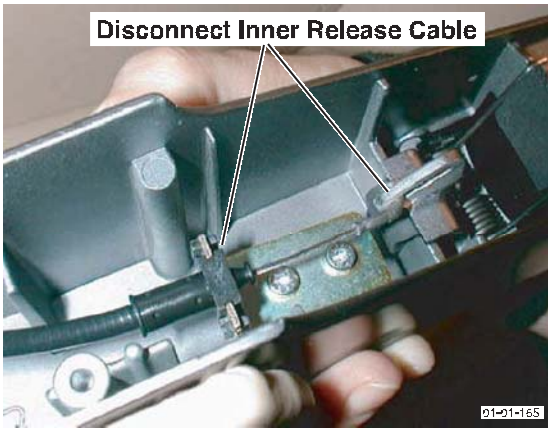


2. Release the door handle (Bolts x2).

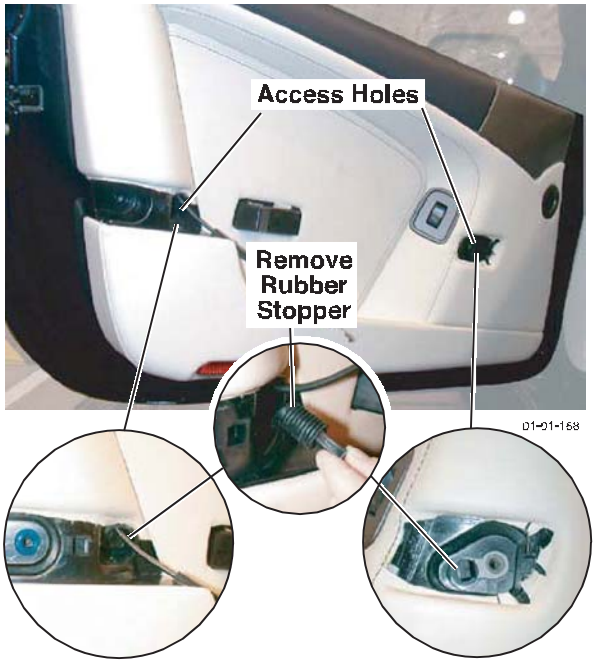


3. Remove the door handle trim plate and disconnect the release cable.





4. While looking through the access holes provided by removing the door handle, power the door glass to show the glass grip screws.



5. Disconnect the vehicle battery.

⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

6. Remove the door glass grip screws. Withdraw the door glass from the door.

Installation

⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

1. Lower the door glass into the door.

Insert the front end of the door glass first then lower the door glass and insert the rear end.

1.1 Locate the rear end of the door glass into it's grip.

1.2 Locate the front end of the door glass into it's grip.

The front grip has to be located by feel alone.

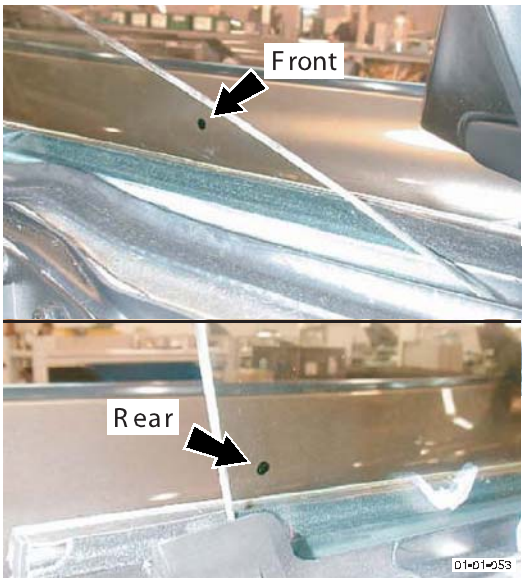
1.3 Line up the holes in door glass with the openings in the grips (x2).

2. Install the grip screws (x2). Do not tighten.

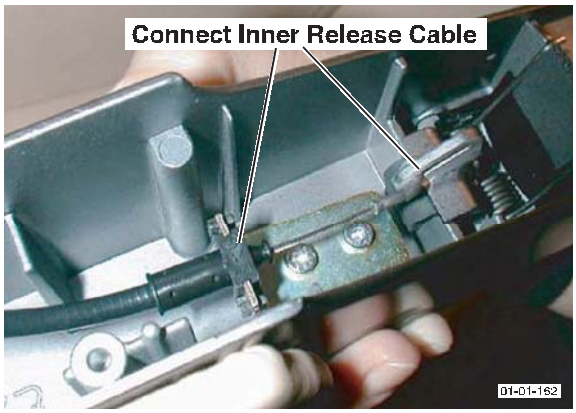
The grip screws are, apart from length, the same as the latch unit screws (x3). Do not install the, shorter, latch unit screws to the grips.

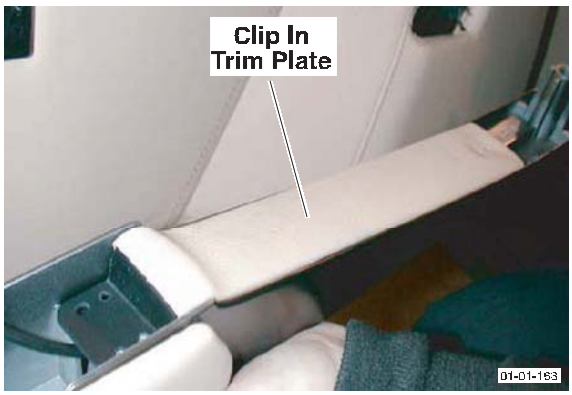
3. Align the door glass. Ensure the following when installing a new door glass.
   - The glass is flush with the mirror trim edge

   - The two dots on the door glass are equal distance from the door edge.

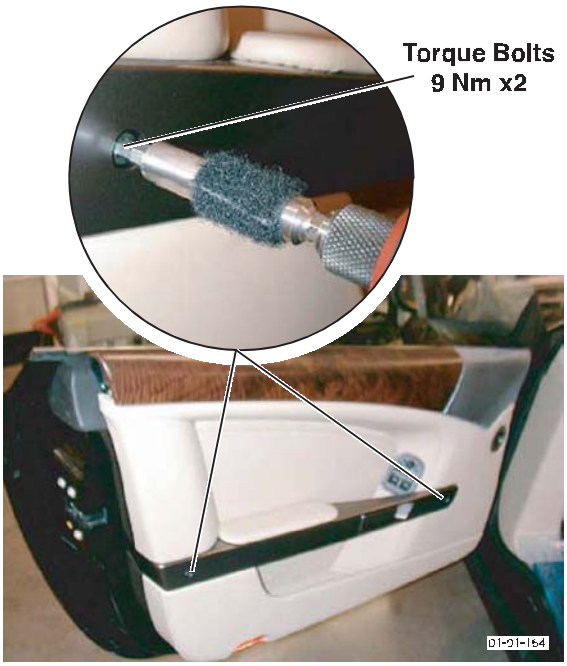


4. Connect the inner release cable and install the door handle trim plate.

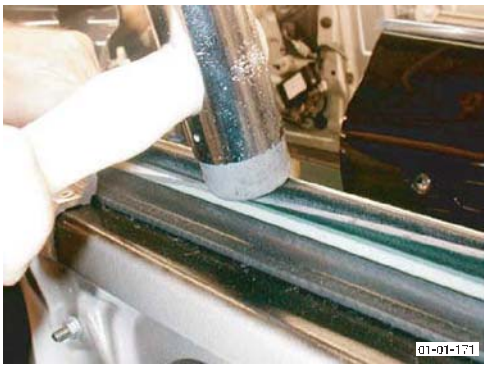




5. Install the door handle Torque bolts (x2) to **9 Nm**.



6. Install the door outer weather strip.



7. Connect the vehicle battery.
8. Check that the door glass operates correctly. Perform the 'Door glass Setup' procedure.

Door Glass Setup

1. Sit in the driver's seat.
2. Ensure both doors are closed and switch the ignition to '0'.
3. Press firmly and hold the window switch until the window is at the maximum down position. Continue to hold the button for 5 seconds then release.
4. Pull back and hold the window switch until the window is in the maximum up position. Continue to hold the switch for a further 5 seconds, then release.
5. The window is now reset. Repeat for the second window.

Rear Quarter Glass (Coupe)

Repair Operation Time (ROT)		
Item		Code
Rear Quater Glass Renew	LH	01.11.LB
	RH	01.11.MB

Remove

1. Pull the door sealing rubber away from the rear quarter glass.
2. Remove screws (x2).

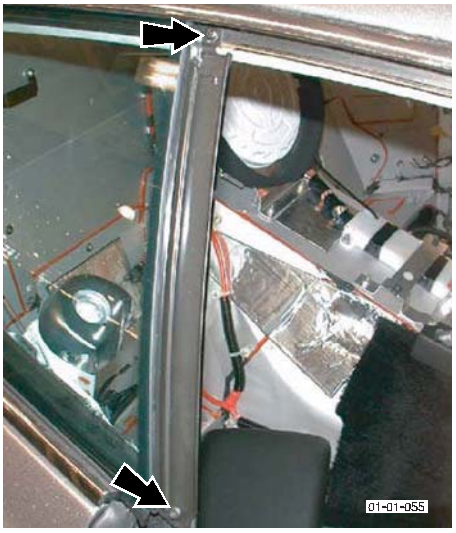
⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

3. Pull the rear quarter glass away from the body.

Installation

⚠ WARNING ⚠
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

1. Install the rear quarter glass.
2. Install screws (x2).



3. Install the door sealing rubber.

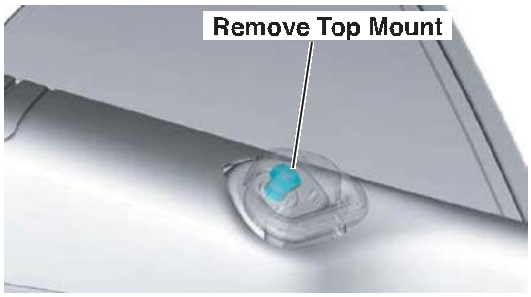
Rear Quarter Glass (Volante)

Repair Operation Time (ROT)		
Item		Code
Rear Quater Glass Renew	LH	
	RH	

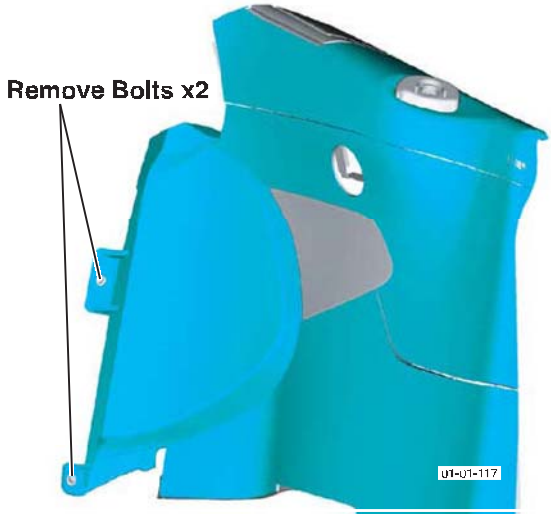
Remove

1. Power the front seat forward.
2. Lower the convertible roof.
3. Remove the rear seat back and seat base.
4. Disconnect the vehicle battery.

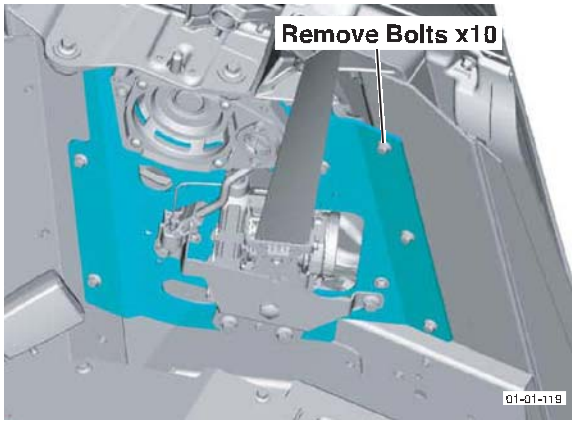
5. Remove the seat belt top mount.



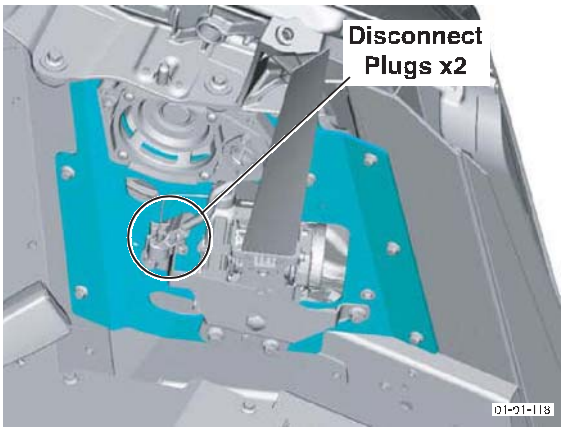
6. Remove the rear 1/4 panel.
   6.1 bolts x2
   6.2 fir trees x3



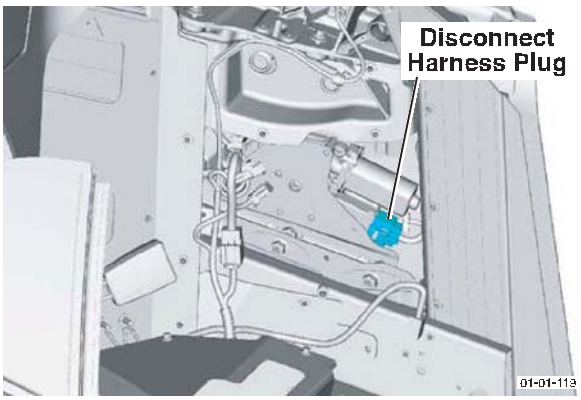
7. Remove bolts (x10) that secure the seat belt and speaker plate. Withdraw the plate.



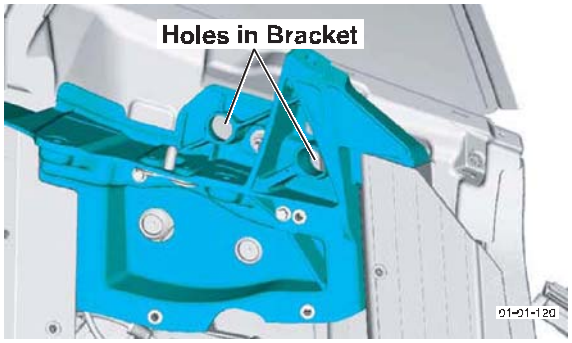
8. Disconnect the wiring harness plugs (x2).



9. Disconnect the glass regulator wiring harness plug.



10. Power up the glass regulator to line up the two glass securing screws through the two holes in the top bracket.

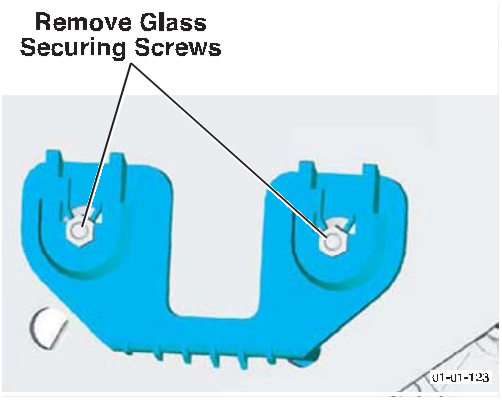


⚠ WARNING ⚠

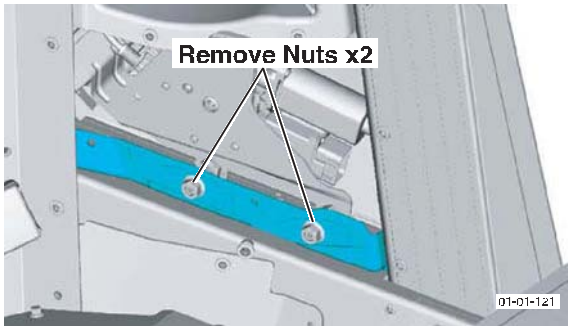
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.

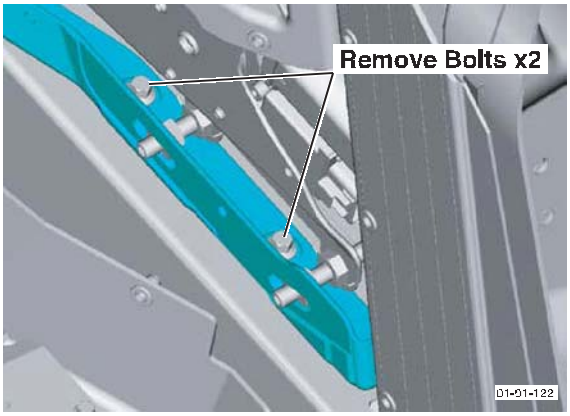
THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

11. Remove the two glass securing screws and withdraw the glass.



12. Power the glass regulator down.
13. Remove the nuts (x2) that secure the bottom of the glass regulator. Pull the bottom of the glass regulator to reveal bolts (x2). Remove the bolts (x2).

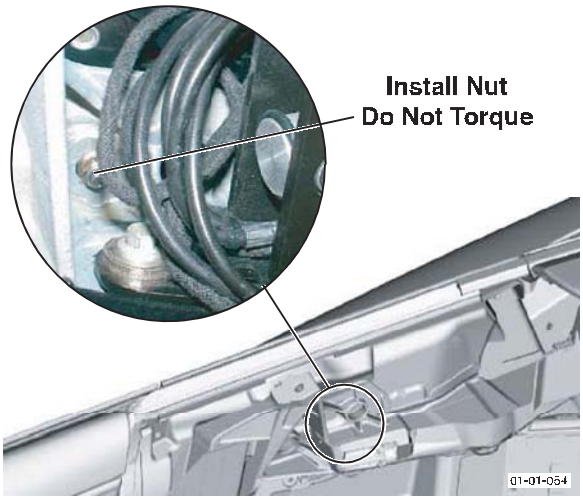




14. Remove the nut from the top of the glass regulator and withdraw the glass regulator.

Installation

1. Install the glass regulator. Install the nut to the top of the glass regulator. Do not torque.



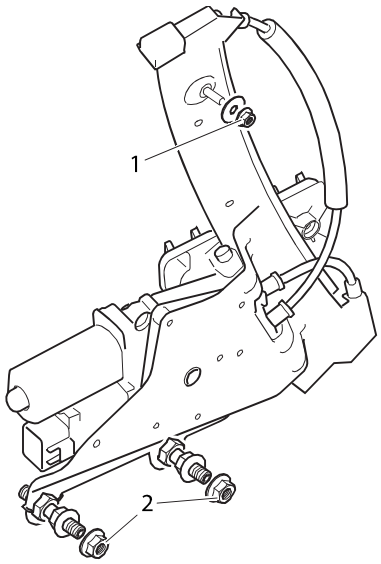
2. Install the lower bolts (x2). Push the bottom of the glass regulator into place and install nuts (x2).
3. Power up the glass regulator to line up the two glass securing screw holes through the two holes in the top bracket.

⚠ WARNING ⚠

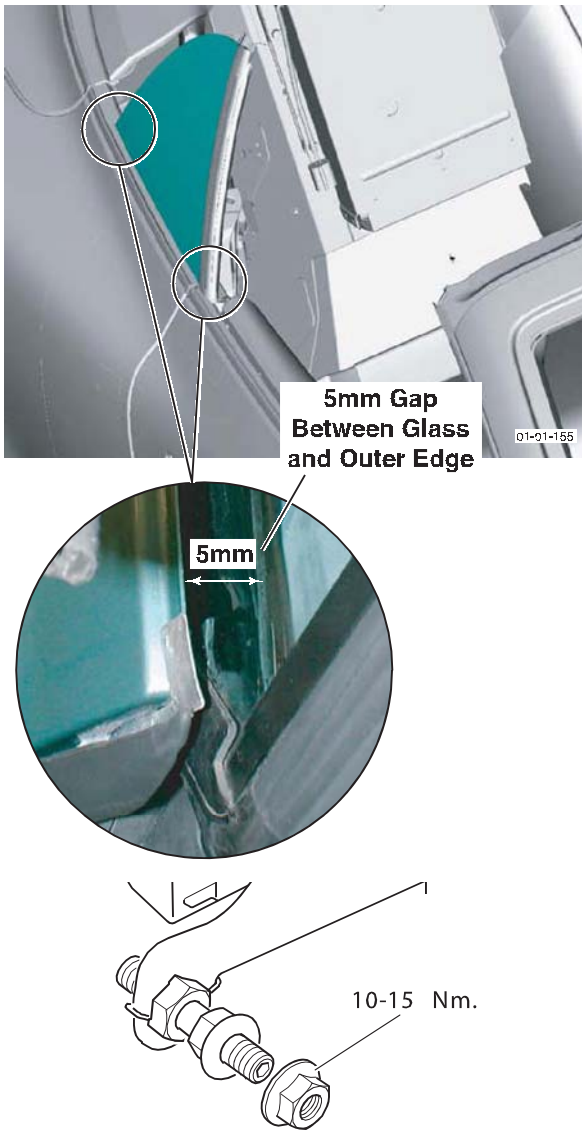
PUT ON PROTECTIVE GLOVES AND EYE PROTECTION WHEN YOU HOLD THE GLASS COMPONENTS.

THE GLASS CAN BREAK EASILY AND CAUSE INJURY.

4. Install the glass. Secure with screws (x2). Do not torque
5. Remove the outer chrome trim.
6. Torque the upper nut (1) of the glass regulator to 9 **Nm**.



7. Adjust the lower mountings (2) to achieve the 5 mm gap between the glass and the edge of the vehicle body.



When adjusted, torque the outer nuts to **10-15 Nm**.

8. Secure the qurater glass. Torque the screws to **5-6 Nm**.
9. Connect the glass regulator wiring harness plug.
10. Check glass alignment.
    10.1 Raise the convertible roof.
    Check the alignment of the glass to the door glass.
    Check the alignment of the glass with the convertible roof seals.
11. Install the seat belt and speaker plate. Torque bolts to **8-10 Nm**.
12. Connect the wiring harness plugs (x2).
13. Install the rear 1/4 panel.
14. Install the seat belt top mount. Torque bolt to **35 Nm**.
15. Install the rear seat back and seat base.
16. Power the front seat forward.

Body System (01.00)

Instrument Panel (IP) (01.12)

Specifications

Torque Figures

Description	Nm	lb. / ft.
IP Mountings	22.5	17
Glue pot bolts	8	6
Blower motor to bulkhead	10-14	7.5-10.5

Maintenance

IP

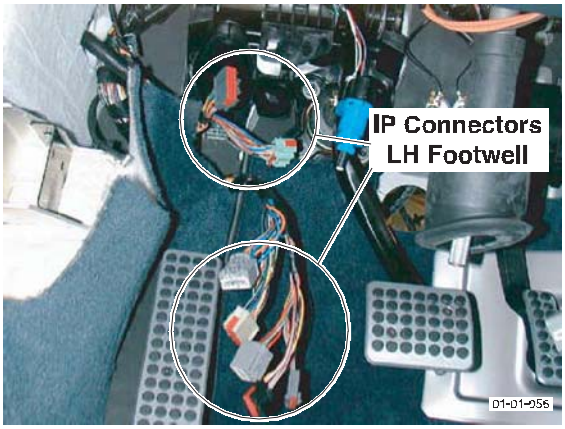
Repair Operation Time (ROT)	
Item	**Code**
IP Renew	**01.12.AA**

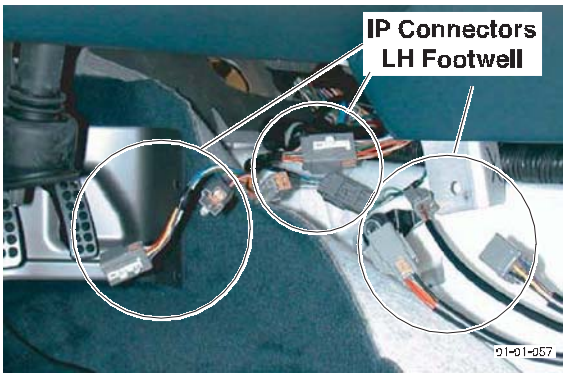
Removal

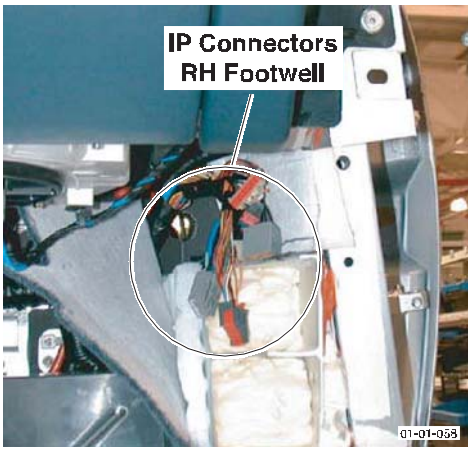
1. Evacuate the A/C system (Refer to 'Air Conditioning (A/C) System (12.03)', page 12-3-1).
2. Remove both doors (Refer to 'Body Closures (01.03)', page 1-3-1).
3. Remove both seats (Refer to 'Seating (01.10)', page 1-10-1).
4. Disconnect the vehicle battery.
5. Remove the passenger side road wheel and arch liner.
6. Remove the cant rails (pull off) (Refer to 'Roof Trim', page 1-5-2).
7. Remove the steering column (Refer to 'Steering Wheel - Remove and Install', page 11-6-1).
8. Remove the rear trim panels (Refer to 'Rear Trim', page 1-5-5). Including the centre arm rest and surround.
9. Remove / Pull back the front carpet (allowing access to the IP mounts and wiring harness plugs).
10. Remove the engine bay fusebox and fusebox mounting bracket.
11. Remove the A/C evaporator pipes.
    Cap the open ends of all pipes.

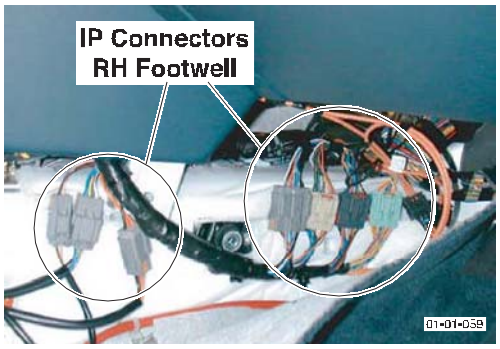
12. Disconnect the wiring harness plugs.

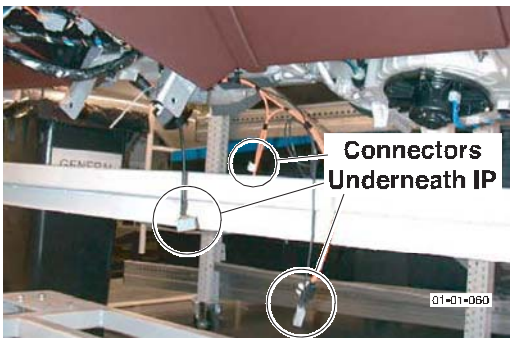
Remove the bonnet pull lever to gain access to L/H harness plugs.









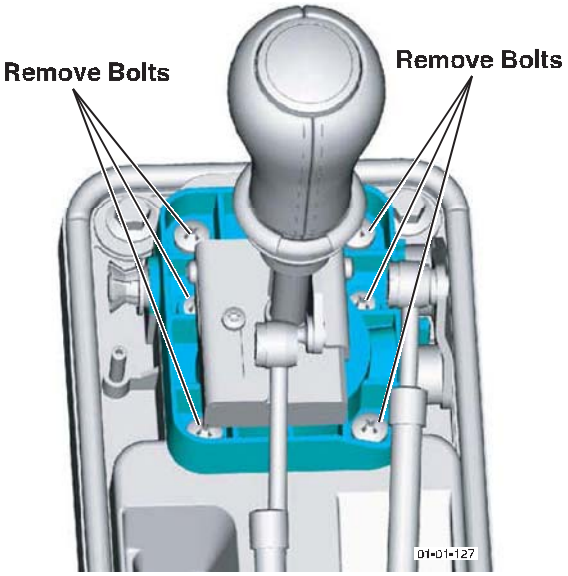


13. Manual Gearbox Only.

Remove the gear-lever.

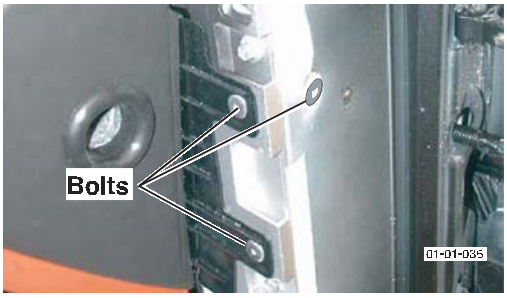
13.1 Disengage the manual shift control cables (x2).

13.2 Remove screws (x6) that secure the gear lever pivot block. Withdraw the gear lever.

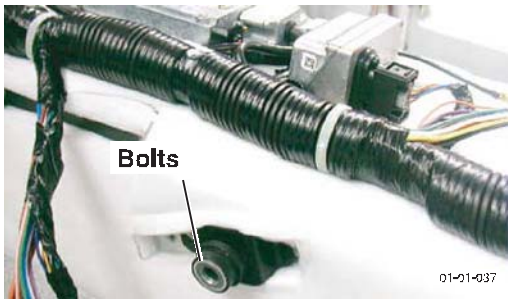


14. Remove, L/H and R/H, bolts securing the IP to vehicle.

14.1 Bolts (x6 L/H and R/H).

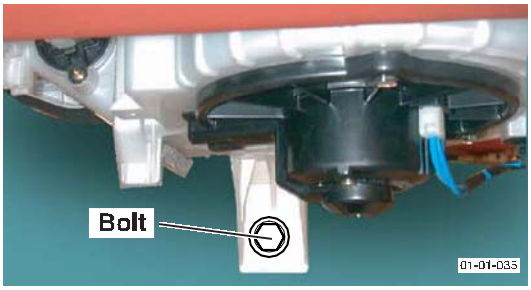


14.2 Bolts (x2).

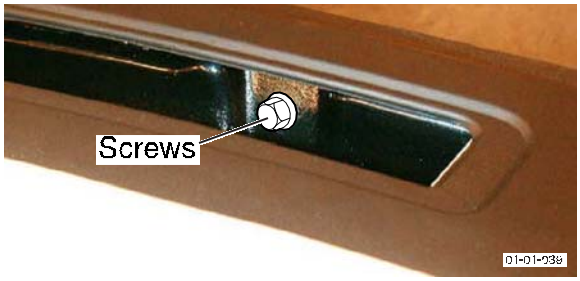


14.3 Glue pot bolts (x2).

14.4 Bolt (x1) from heater blower.



15. Remove the window defrost air duct screws (x3 each side).



To prevent the screws falling down the air ducts - place a rag / cloth into the air ducts.

15.1 Disengage clips (x3) from each window defrost air duct) to release the window defrost air ducts from the IP.

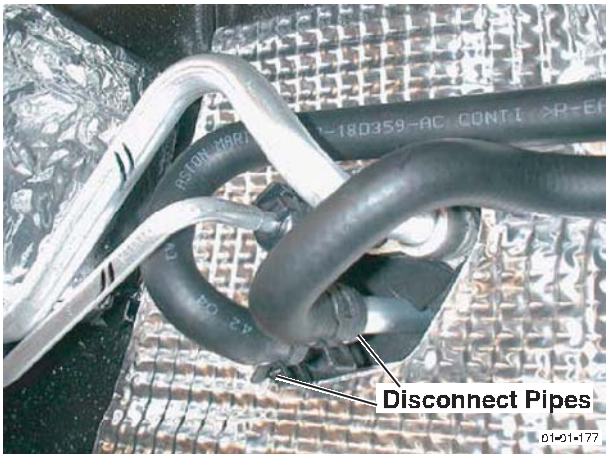
15.2 Remove screws (x3 for each duct).

16. Manoeuvre the service tool (Refer to '501-F116 (IP Removal)', page 20-1-8) into position, through the passenger side opening, and attach to the IP.

17. Move the IP rearwards sufficient to gain access to the heater pipes. Disconnect the heater pipes.

One person to open the spring clip from inside the vehicle and one person to pull the pipes off from inside the engine bay.

Caution
Take care not to let coolant drip onto the vehicle carpet.



18. Withdraw the IP from the vehicle.

As the IP is withdrawn from the vehicle the evaporator drain pipe will come with it.

Take care not to break the blower motor bracket when manoeuvring over the vehicle tunnel.

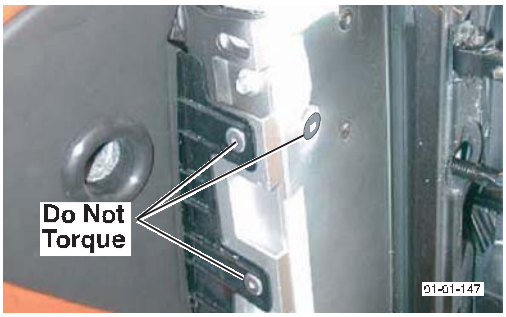
Installation

1. Manoeuvre the IP, attached to service tool, through the passenger side opening.
2. Place the A/C Evaporator drain pipe through the opening provided.

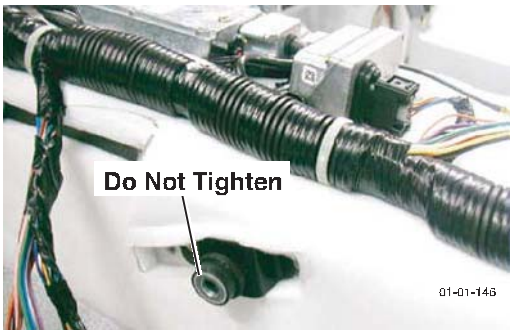
Ensure A/C breather pipe is secure and correctly located. It is not accessible once the IP is installed.

3. Install the heater pipes.
4. Raise the IP and locate into position.
5. Install the following bolts

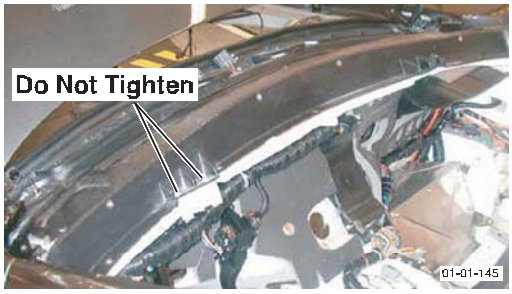
5.1 Bolts (x6 (L and R/H)). Do not torque.



5.2 Install bolts (x2 L and R/H). Do not tighten.



5.3 Install the glue pot bolts (x2). Do not tighten.

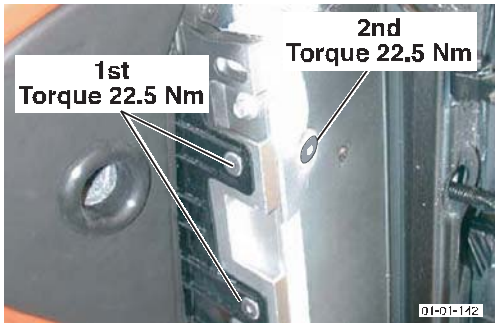


6. Torque the bolts in the following order.

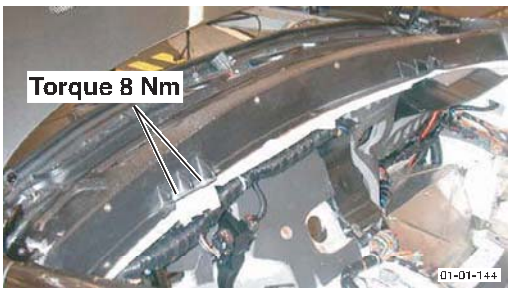
6.1 Bolts (x6 (L and R/H)).

Torque bolts (1) to **22.5 Nm**

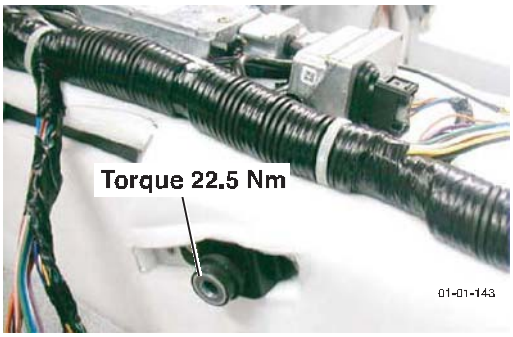
Torque bolts (2) to **22.5 Nm**.



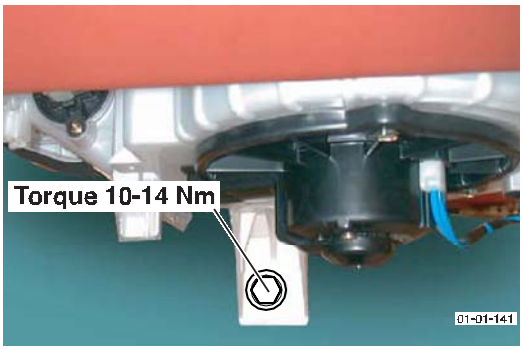
6.2 The glue pot bolts (x2). Torque bolts to **8 Nm**.



6.3 Bolts (x2 L and R/H). Torque bolts to **22.5 Nm.**



7. Install the heater blower to the bulkhead bolt. Torque to **10-14 Nm.**



8. Connect the wiring harness plugs.

If removed, install the bonnet pull lever.

9. Install screws (x3 each) that secure the window defrost air ducts.
10. Engage clips (x3) for each window defrost air duct vent panel.
11. Install the steering column (Refer to 'Steering Column - Remove and Install', page 11-4-3).

Note the steering rack to steering column position from removal.

12. Install the cant rail (Refer to 'Roof Trim', page 1-5-2).
13. Connect the A/C pipes.
14. Install the fusebox mounting bracket, fusebox and fusebox wiring harness blocks.
15. Install the rear trim (Refer to 'Rear Trim', page 1-5-5), front carpets and centre arm rest.
16. **Manual Gearbox Only.**
    Install the gear-lever.
17. Install the road wheel arch liner.
18. Install the road wheels (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).
19. Install the seats (Refer to 'Seating (01.10)', page 1-10-1).
20. Install the doors (Refer to 'Body Closures (01.03)', page 1-3-1).
21. Connect the vehicle battery.
22. Charge the A/C system (Refer to 'Air Conditioning (A/C) System (12.03)', page 12-3-1).

Body System (01.00)

Handles and Lock Mechanisms (01.14)

Description

Vehicle Key/Remote Transmitter

The vehicle key operates the ignition and the door lock, the remote transmitter operates the central locking and alarm systems.

Do not leave them in the vehicle.

Central Locking System

The Central Locking system consists of lock actuators in both doors, the boot and the fuel flap. Central locking control is through the door modules.

Each lock actuator incorporates a microswitch which signals a change of state when any motor runs to drive the actuator. The microswitches are of the change over type and provide an earth for lock/unlock signals to the door module.

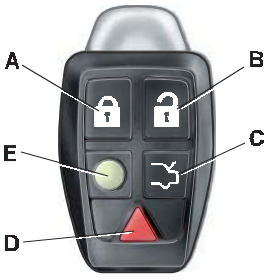
The boot will remain locked or will be unlocked simultaneously with the doors dependant on the boot lock position. The boot lock can be enabled at any time using the remote transmitter irrespective of the Central Locking status.

Remote Transmitter

The remote control system consists of a transmitter and an antenna (radio frequency system). The remote control transmitter for the radio frequency system will operate without the transmitter being directed at the vehicle. The normal range between the transmitter and the antenna is up to 5 meters. Before the remote control system can be used, each transmitter must be initialized to the vehicle. A maximum number of four transmitters can be initialized to any vehicle. All remote transmitters must be initialized at the same time.The keyless entry/remote operated locks will not operate when the ignition key is in the ignition switch.

(A) Lock - One step vehicle locking and alarm enable.

The vehicle will deadlock after 25 seconds.



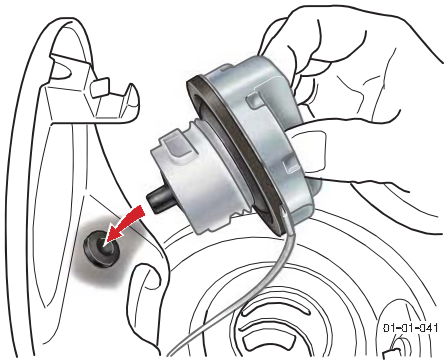
(B) Un-lock - One step vehicle unlocking or two step vehicle unlocking and alarm disable.

(C) Boot Open - Press to enable the boot catch.

(D) Panic Alarm - Activates / deactivates the panic alarm.

(E) Approach Light - Activates the front and rear side lights.

Fuel Filler Assembly



Manual Boot Release

In the event of a total loss of vehicle power the boot can be opened by pulling the manual boot release handle.

Remove the LH rear seat base and undo the two knurled bolts that secure the cover. Remove the cover and pull the boot release.

Boot Emergency Release

The boot can be opened from inside the boot by pulling the luminous emergency release handle.

Specifications

Torque Figures		
Description	Nm	lb. / ft.
Door handle	5	4
Latch	9	7

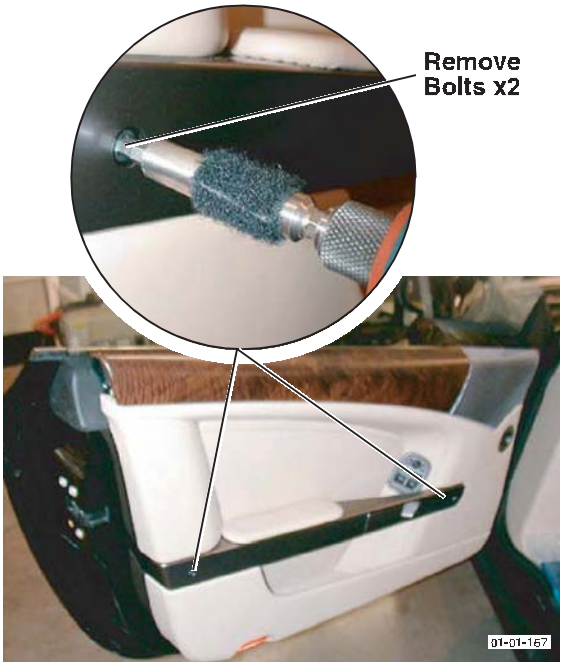
Maintenance

Door Handle / Latch Unit

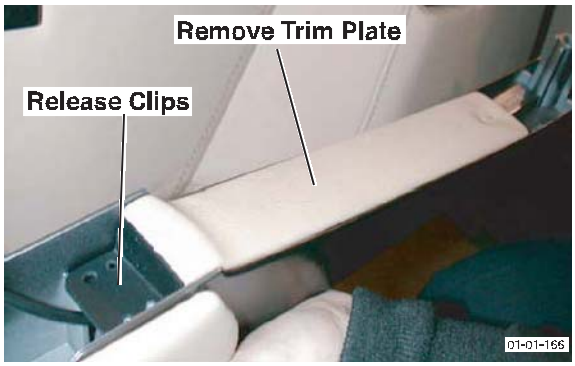
Repair Operation Time (ROT)		
Item		Code
Door Catch and Outer Lock	LH	01.14.MB
	RH	01.14.NB

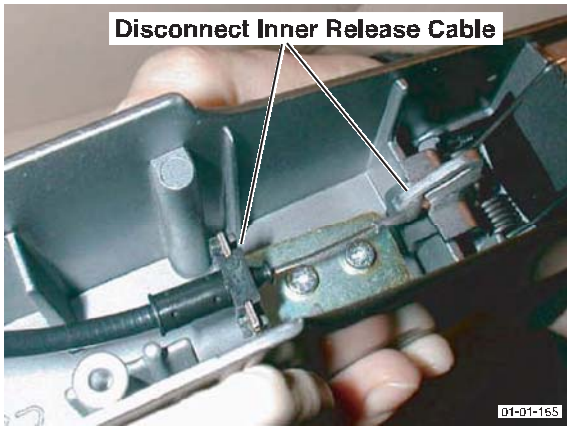
Removal

1. Disconnect the vehicle battery.
2. Remove the door handle (Bolts x2).

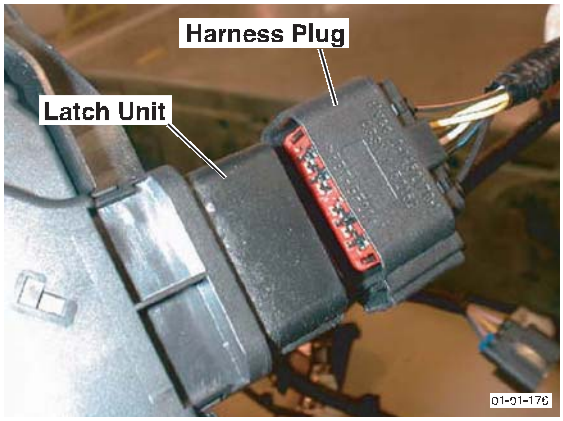


3. Remove the door handle trim plate and disconnect the inner release cable.



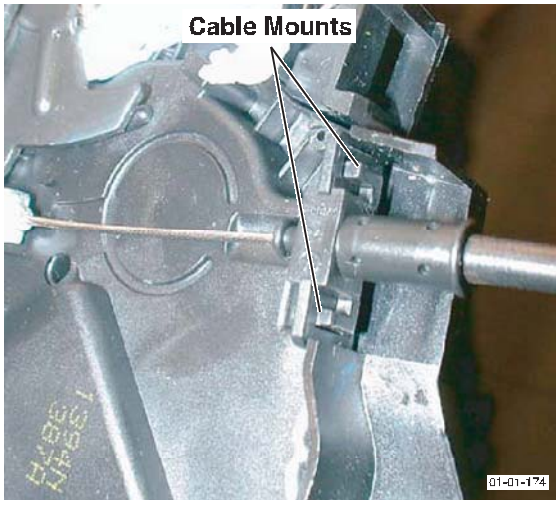


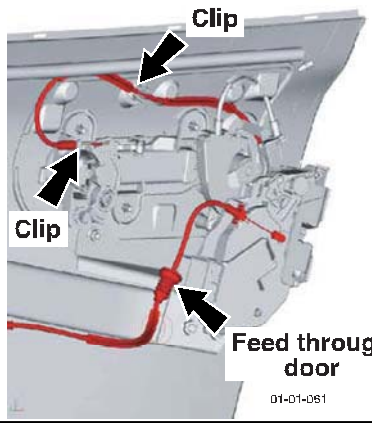
4. Remove the door trim (Refer to 'Door Trim', page 1-5-3).
5. Remove the door glass and regulator (Refer to 'Glass Regulator', page 1-11-1).
6. Disconnect the wiring harness plug.



7. Disconnect the outer release cable from the outer handle and feed the inner release cable back through the door.

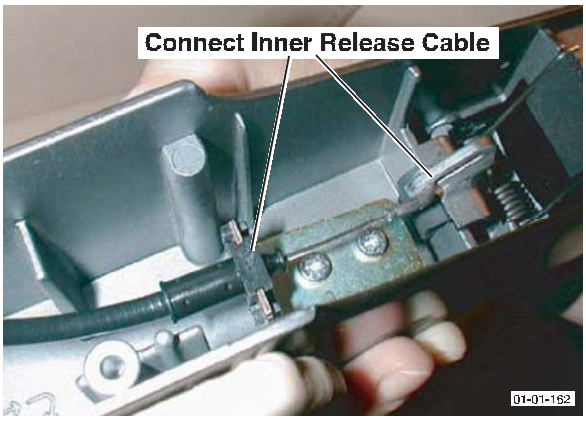
Take care not to break the cable mounts.



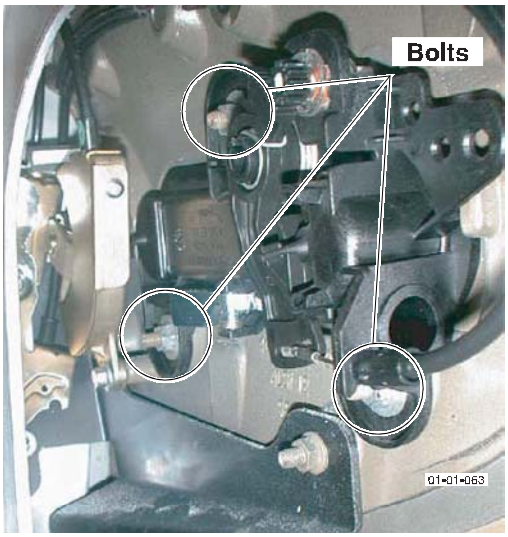


Ensure that the fir tree on the release cable is removed.

8. Remove the lock and latch assembly.
   8.1 Remove the latch screws (x3).



   8.2 Remove the lock lower bolt and loosen the top nut.
   8.3 Rotate and withdraw the lock along with latch assembly.
9. Remove the nuts (x3) from the outer handle. Withdraw the outer handle from the door.

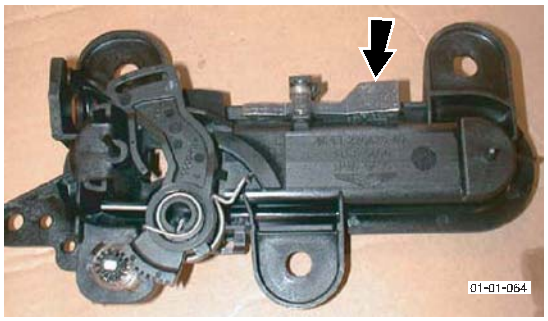


Installation

1. Install the outer door handle.

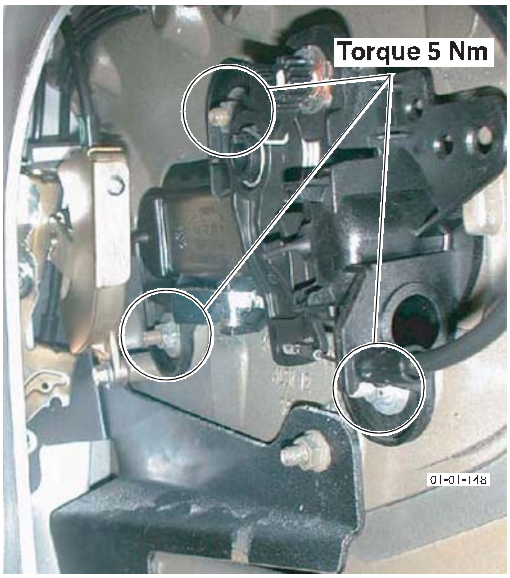
The outer door handle is reversible (installs to L/H and R/H).

Caution
Ensure the Inertia block is in the 'Floating' position.



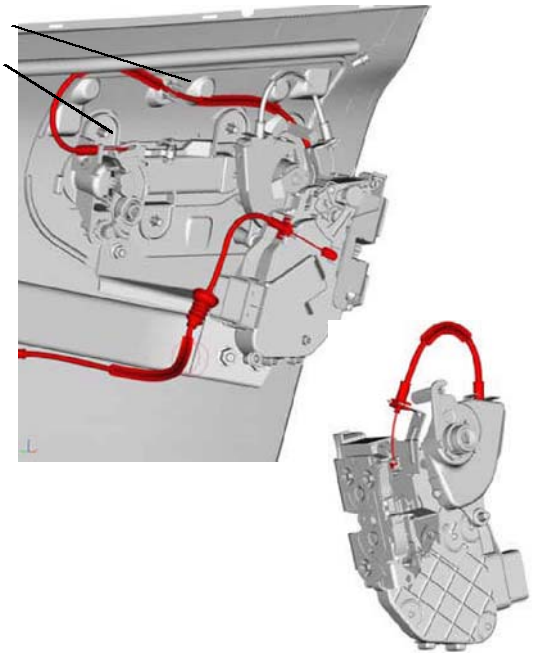
Secure with nuts (x3). Torque to **5 Nm**.

Do not over tighten. If over tightened the studs may pull from their mounts.



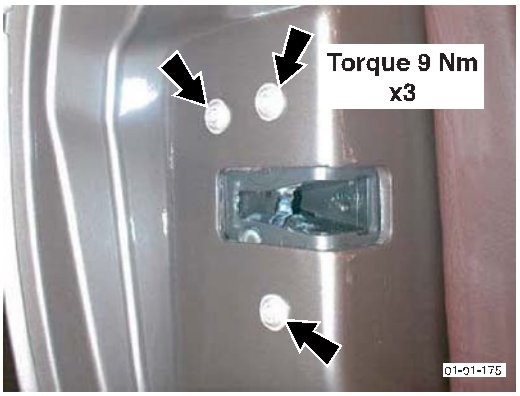
2. Connect the outer, inner and lock cables to the latch. Insert the lock and latch assembly into position. Feed the inner cable through the hole provided in the door.

Do not push the inner cable when it is hanging from the door. This may disconnect the link at the latch end.



3. Install the lock.
   - 3.1 Locate the barrel through the door and rotate the lock into position.
   - 3.2 Install nut on lower mount.
   - 3.3 Tighten both nuts.

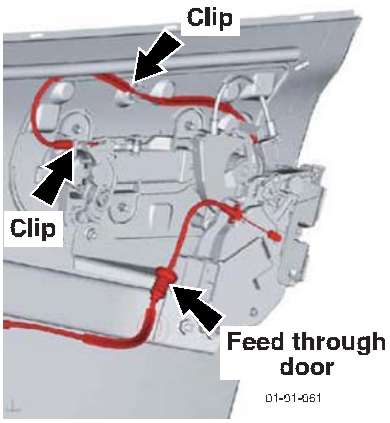
4. Install the latch (screws x3). Torque to **9 Nm**.



5. Install the outer release cable to the outer release handle.

Ensure that both the release and lock cables locate behind the lock and barrel unit top nut (rear of door).

Ensure that the fir tree on the release cable is installed.



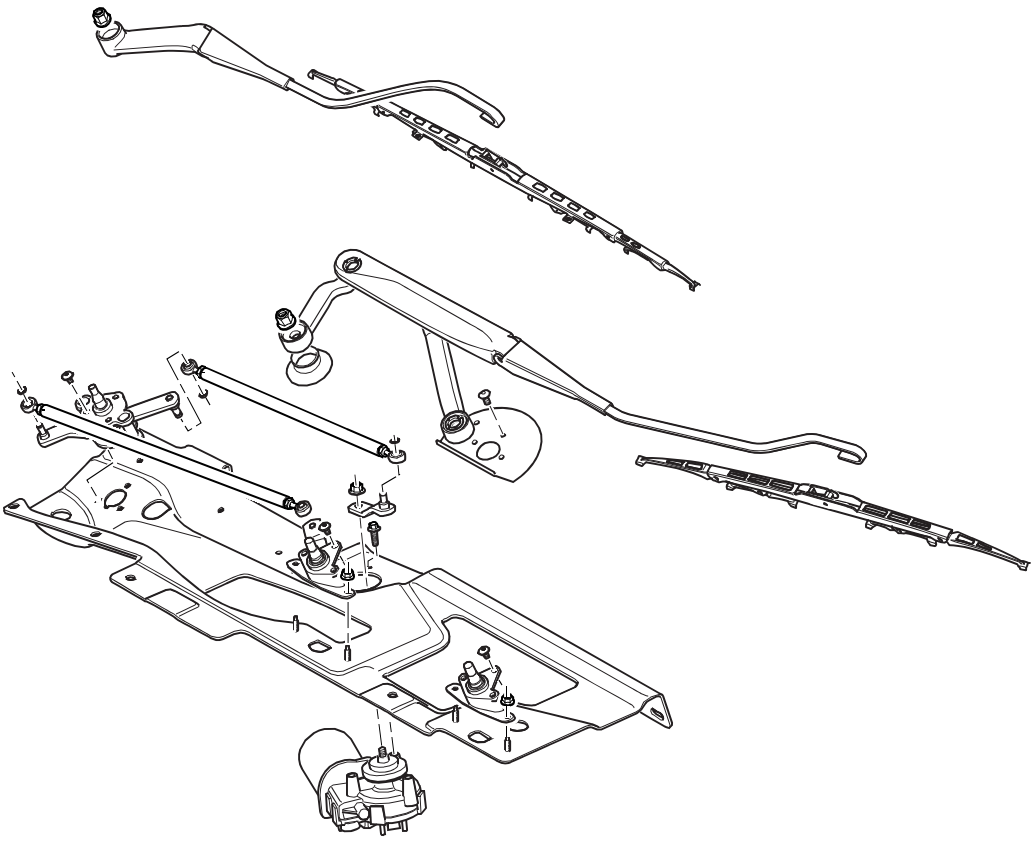
6. Connect the wiring harness plug.
7. Install the door glass and regulator (Refer to 'Glass Regulator', page 1-11-1).
8. Install the door trim and the inner release handle (Refer to 'Door Trim', page 1-5-3).
9. Connect the vehicle battery. Check operation of the door latches.

Body System (01.00)

Wipers and Washer System (01.16)

The wipers and washer system consists of the following components:

- Wipers and washers
- Mounting arm and pivot shaft
- Wiper motor
- Reservoir and washer pump
- Headlamp washing system



The wipers have a two speed control (low and high) and an intermittent wipe mode. The wipers will park automatically irrespective of their position when the 'Off' position of the ignition or control switch is selected or the bonnet is opened.

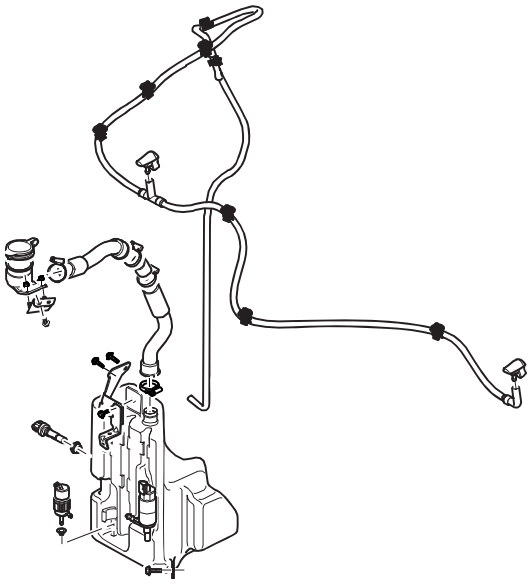
Within the wiper and washer system the following features can be attained:

- Adjustable interval intermittent wiping

  The intermittent wiping has six speed settings, 3, 6, 9, 12, 15, 18 seconds.

- Programmable wash and wipe sequences

  The programmable wash and wipe sequence is driver controlled. With a depression of the wash / wipe switch between 40 milliseconds and 1.2 seconds the wash pump will be activated for a duration of 1.2 seconds. When the wash/wipe switch is depressed for longer than 1.2 seconds the wash pump will be activated for the duration of switch depression, a 10 second duration is the maximum available.

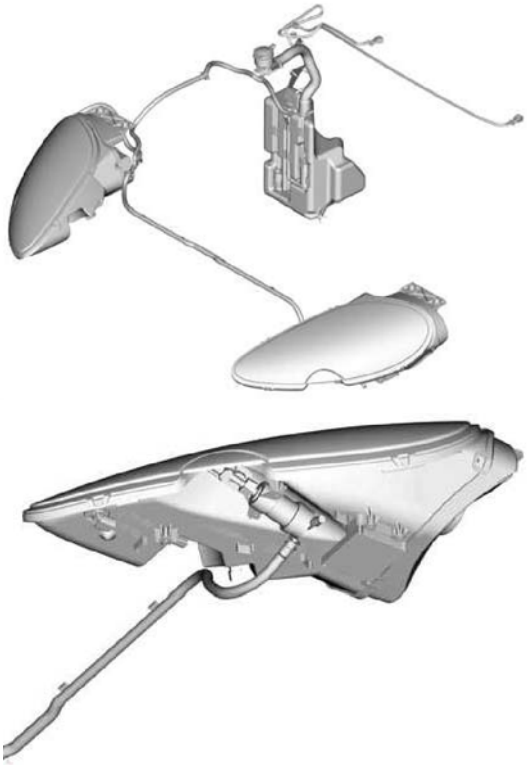


The wiping system is automatically activated with a depression of the wash switch of **more** than 0.5 seconds. If the wash switch is only pressed for 0.5 seconds **or less** then only the water pump will operate.

Headlamp Washing

The headlamp washers operate once per ignition cycle and are activated the first time the window washers are operated.

Headlamp washing is only available when the headlamps are switched on.



Specifications

Torque Figures

Description		Nm	lb. / ft.
Wiper link to wiper motor		35-42	26-31
Wiper motor mounting bolts		7-10	5.5-7.5
Wiper assembly plate	M6 Torx	6	4.5
	M6 bolt	8	6
Brake servo nuts		21-24	15.5-18
Brake master cylinder nuts		25	18.5
Wiper arm (Driver)		17	13
Wiper arm (Passenger)	M10	24	18
	M6	6	4.5

Maintenance

Windscreen Reservoir and Motor Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Windscreen Reservoir and Motor Assembly - Remove and Install	01.16.DA

Remove

1. Raise the vehicle and make it safe.
2. On Volante vehicles, remove the centre undertray.
3. Remove the front right roadwheel.
4. Remove the M6 Torx-head screws that attach the rear of the wheelarch liner.
5. Remove the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
6. Turn the steering fully to the right.
7. Move the rear of the wheelarch liner away to get access to the windscreen reservoir.
8. Disconnect the windscreen washer pipe and drain the reservoir into an applicable container.
9. Disconnect the two clips that attach the battery harness to the bottom of the reservoir.
10. Move the harness away.
11. Disconnect the clip that attaches the harness for the level sensor to the reservoir.
12. Remove the rear bottom M6 reservoir attachment screw.
13. Lower the vehicle on the lift.
14. Disconnect the electrical connector for the windscreen washer motor.
15. Release the headlamp washer pipe from the clip and turn the motor to disconnect the pipe (quickfit) and the electrical connector.
16. Release the windscreen washer pipe from the reservoir.
17. Remove the two M6 reservoir attachment screws.
18. Let the reservoir fall, then release the filler tube from the clip.
19. Move the reservoir down and forward to get access.
20. Disconnect the electrical connector from the level sensor.

Install

1. Connect the electrical connector to the level sensor.
2. Move the reservoir into position.
3. Install the filler pipe into the clip.
4. Install the three M6 attachment screws.
5. Install the windscreen washer pipe into clips on the reservoir and connect it to the motor.
6. Install the headlamp washer pipe. Connect the pipe to the pump.
7. Connect the electrical connector to the pump.

8. Connect the electrical connector for the windscreen washer motor.
9. Raise the vehicle on the lift.
10. Connect the clip that attaches the level sensor harness to the reservoir.
11. Connect the two clips that attach the battery harness to bottom of the reservoir.
12. Put the wheelarch liner back into position.
13. Turn the steering to the centre position.
14. Install the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
15. Install the M6 Torx-head screws that attach the rear of the wheelarch liner.
16. Install the front right roadwheel.
17. On Volante vehicles, install the centre undertray.
18. Lower the vehicle.
19. Fill the washer reservoir.

Low Level Water Sensor - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Low Level Water Sensor - Remove and Install	**01.16.DC**

Removal

1. Raise the vehicle and make it safe.
2. On Volante vehicles, remove the centre undertray.
3. Remove the front right roadwheel.
4. Remove the M6 Torx-head screws that attach the rear of the wheelarch liner.
5. Remove the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
6. Turn the steering fully to the right.
7. Move the rear of the wheelarch liner away to get access to the windscreen reservoir.
8. Disconnect the windscreen washer pipe and drain the reservoir into an applicable container.
9. Disconnect the two clips that attach the battery harness to the bottom of the reservoir.
10. Move the harness away.
11. Disconnect the clip that attaches the level sensor harness to the reservoir.
12. Remove the rear-lower reservoir fixing.
13. Lower the vehicle on the lift.
14. Disconnect the electrical connector from the windscreen washer motor.
15. Unclip headlamp washer pipe and turn motor to disconnect pipe (quickfit) and multiplug.
16. Unclip the windscreen washer pipe from the reservoir.
17. Remove the two reservoir attachment screws.
18. Let the reservoir fall, then release the filler tube from the clip.
19. Move the reservoir down and forward to give access.
20. Disconnect the electrical connector for the level sensor.
21. Remove level sensor and seal from reservoir.

Install

1. Install the level sensor and seal in the reservoir.
2. Connect the electrical connector for the level sensor
3. Move the reservoir into position.
4. Install the filler pipe in the clip.
5. Install the three attachment screws.
6. Clip the windscreen washer pipe into reservoir and install it onto the motor.
7. Clip the headlamp washer pipe, connect the pipe (quickfit) and the electrical connector.
8. Connect windscreen washer motor multiplug.
9. Raise ramp.
10. Connect the clip that attaches the level sensor harness to the reservoir.
11. Connect the two clips that attach the battery harness to the bottom of the reservoir.
12. Put the wheelarch liner back into position.
13. Turn the steering to the centre position.
14. Install the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
15. Install the M6 Torx-head screws that attach the rear of the wheelarch liner.
16. Install the front right roadwheel.
17. On Roadster vehicles, install the centre undertray.
18. Lower the vehicle.
19. Fill the washer reservoir.

Headlamp Wash Motor and Pump Assembly - Remove and Install

Repair Operation Time (ROT)	
Item	**Code**
Headlamp Wash Motor and Pump Assembly - Remove and Install	**01.16.EB**

Remove

1. Raise the vehicle and make it safe.
2. On Volante vehicles, remove the centre undertray.
3. Remove the front right roadwheel.
4. Remove the M6 Torx-head screws that attach the rear of the wheelarch liner.
5. Remove the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
6. Turn the steering fully to the right.
7. Move the rear of the wheelarch liner away to get access to the windscreen reservoir.
8. Disconnect the windscreen washer pipe and drain the reservoir into an applicable container.
9. Disconnect the two clipsthat attach the battery harness to the bottom of the reservoir. Move the harness away.
10. Disconnect the clip that attaches the harness for the level sensor to the reservoir.

11. Remove the rear-lower reservoir fixing.
12. Lower the vehicle on the lift.
13. Disconnect the electrical connector for the windscreen washer motor.
14. Release the headlamp washer pipe and turn the motor to disconnect the pipe (quickfit) and the electrical connector.
15. Release the windscreen washer pipe from the reservoir.
16. Remove the two reservoir attachment screws.
17. Let the reservoir fall, then release the filler tube from the clip.
18. Move the reservoir down and forward to give access.
19. Disconnect the electrical connector for the level sensor.
20. Remove the headlamp washer motor, seal and support clip from reservoir.

Install

1. Install the headlamp washer motor, seal and support clip into the reservoir.
2. Connect the electrical connector for the level sensor.
3. Move the reservoir into position.
4. Connect the filler pipe and install the clip.
5. Install the three attachment screws.
6. Clip the windscreen washer pipe into reservoir and connect it to the motor.
7. Install the headlamp washer pipe in position. Connect the pipe (quickfit) and the electrical connector.
8. Connect the electrical connector for the windscreen washer motor.
9. Raise ramp.
10. Connect the clip that attaches the level sensor harness to the reservoir.
11. Connect the two clips that attach the battery harness to the bottom of the reservoir.
12. Put the wheelarch liner back into position.
13. Turn the steering to the centre position.
14. Install the self-tapping screw that attaches the rear of the wheelarch liner into the wheelarch.
15. Install the M6 Torx-head screws that attach the rear of the wheelarch liner.
16. Install the front right roadwheel.
17. On Volante vehicles, install the centre undertray.
18. Lower the vehicle.
19. Fill washer reservoir.

Windscreen Wiper Motor

Repair Operation Time (ROT)	
Item	**Code**
Wiper Motor Renew	01.16.HB

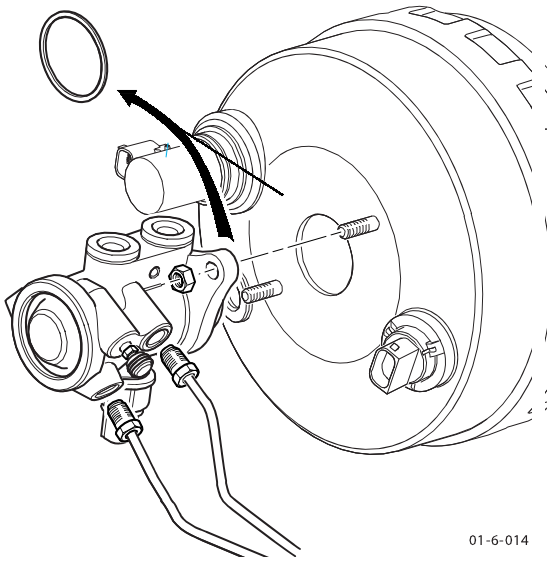
Removal

1. Disconnect the vehicle battery.
2. Remove the inlet manifolds (Refer to 'Inlet Manifold', page 3-1-7).
3. Remove the wiper arms. Note the position of the wiper arms on the glass for installation.

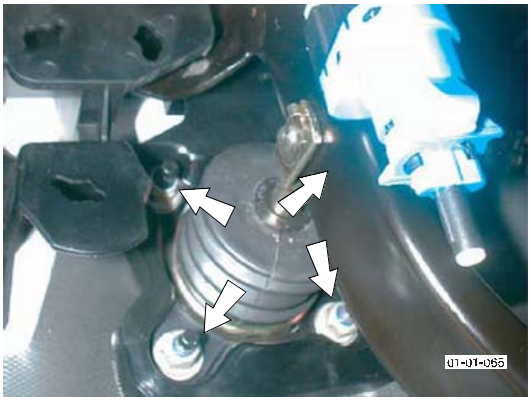
Note: Do not remove the nut that secures the idle arm to the wiper spindle. Remove the four bolts that attach the idle arm mounting plate.

4. Remove the wiper box to scuttle panel bolts (x6).

5. Remove the brake master cylinder. Lay the master cylinder to one side.

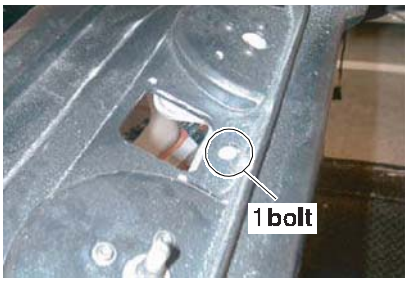


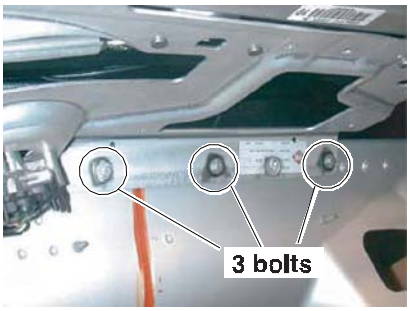
6. From inside remove the brake booster fixings. Allow the brake booster to drop slightly.

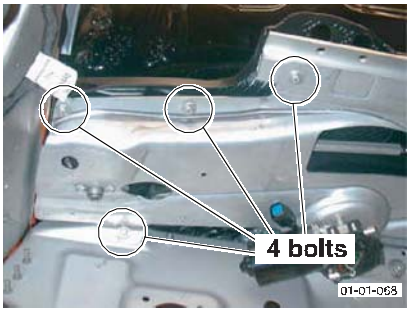


7. Disconnect the engine breather hose from the rear of the camshaft cover.

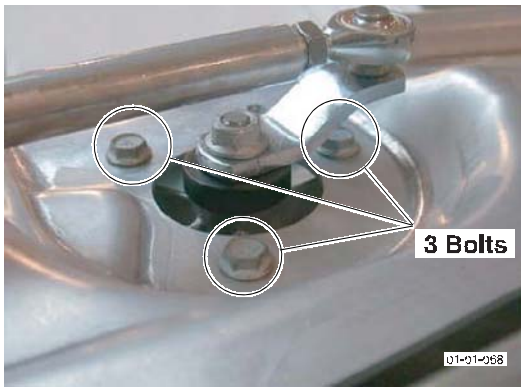
8. Remove the wiper assembly mounting bolts and allow the wiper assembly drop sufficiently to access the wiper motor bolts.



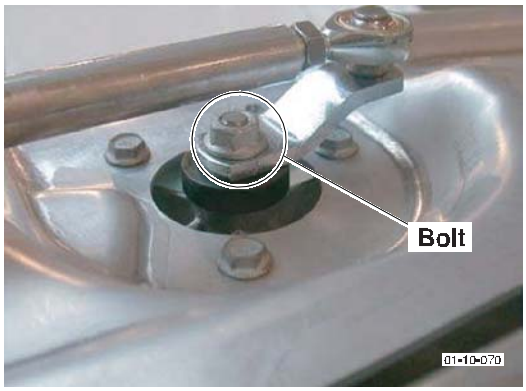




9. Remove the wiper motor bolts (x3).



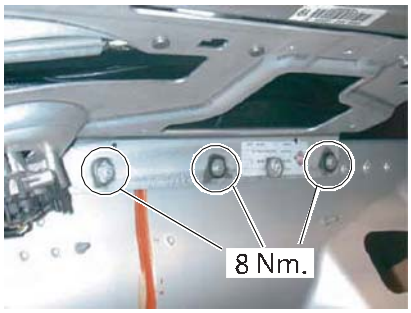
10. Disconnect the wiper linkage from the wiper motor (bolt x1). Withdraw the wiper motor.

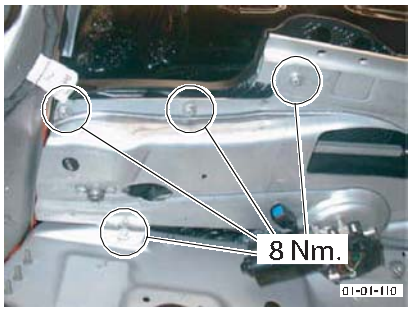


Installation

1. Connect the wiper linkage to the wiper motor (bolt x1) using service tool (Refer to '501-112 (Wiper Linkage to Wiper Motor)', page 20-1-8). Torque nut to **35-42 Nm**.

2. Install the wiper motor bolts (x3). Torque bolts to **7-10 Nm**.
3. Install the wiper assembly plate
   3.1 Torque bolts to **8 Nm**.





3.2 Torque bolt to **6 Nm**.

4. Connect the engine breather hose to the rear of the camshaft cover.
5. From inside the vehicle install the brake servo fixings. Torque to **21-24 Nm**.
6. Install the brake master cylinder. Torque to **25 Nm**.
7. Install the wiper box. Torque bolts to **7-10 Nm**.
8. Install the wiper arms. Position the wiper arms as per their position on removal.

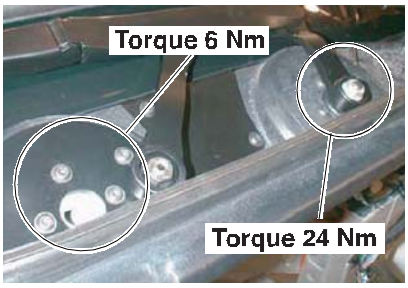
   Passenger Arm

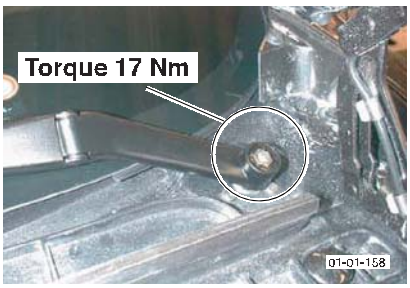
   Torque M10 nut to **24 Nm.**

   Torque M6 (x4) nuts to **6 Nm.**

   Driver Arm

   Torque M8 nut to **17 Nm**.





9. Install the inlet manifolds (Refer to 'Inlet Manifold', page 3-1-7).
10. Connect the vehicle battery.

Wiper Arms

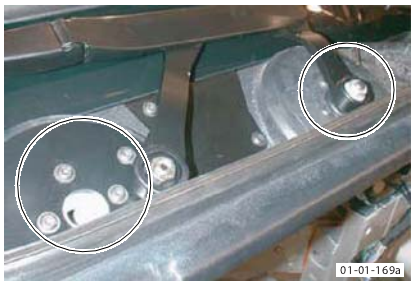
Repair Operation Time (ROT)		
Item		**Code**
Wiper Arm Renew	LHF	**01.16.KG**
	RHF	**01.16.LB**

Removal

Note the position of the wiper arms on the glass for installation.

Do not remove the nut that secures the idle arm to the wiper spindle. Remove the 3 bolts securing the idle arm mounting plate.

1. Remove the following screws and nuts.



Installation

1. Install the wiper arms. Position the wiper arms as per their position on removal.

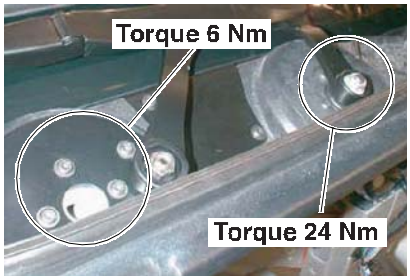
   Passenger Arm

   Torque M10 nut to **24 Nm.**

   Torque M6 (x4) nuts to **6 Nm.**

   Driver Arm

   Torque M8 nut to **17 Nm**.



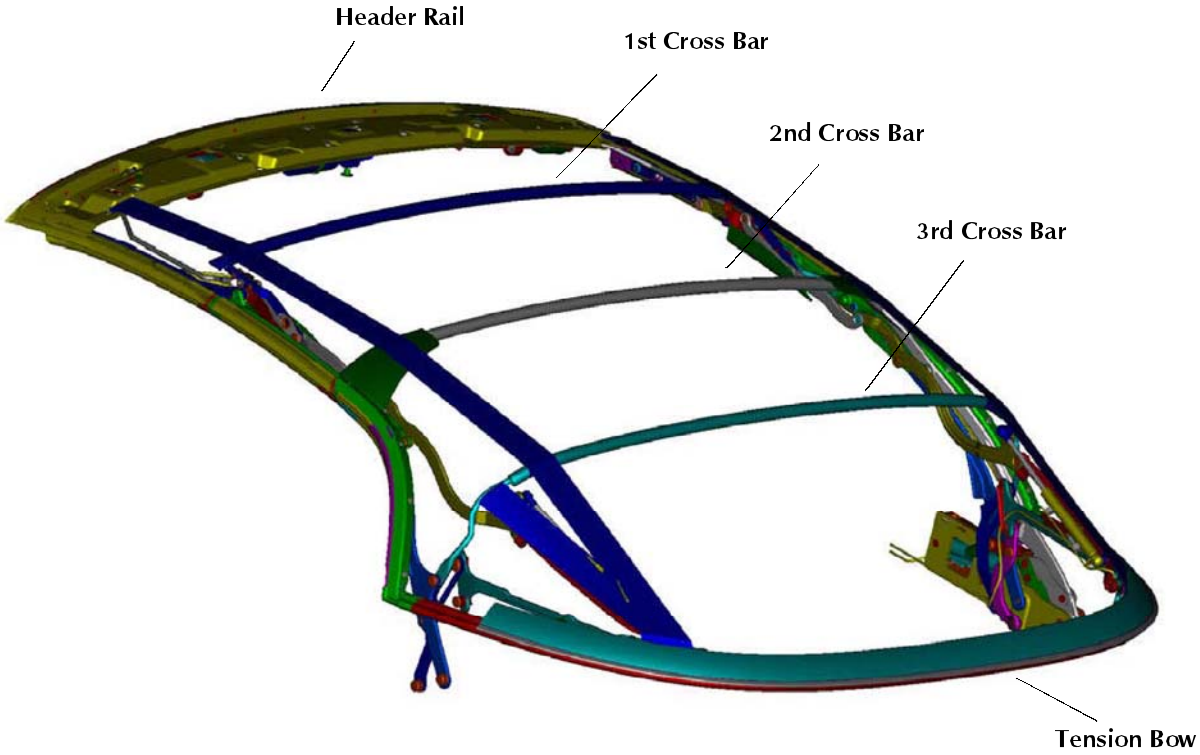
Body System (01.00)

Convertible Roof (01.17)

Description

The convertible roof system comprises an electrically driven hydraulic pump and six hydraulic rams, four for raising and lowering the roof and two for raising and lowering the tonneau cover. The pump is powered via either the 'Roof Up' or Roof Down' relay. Two further pairs of change-over relays power the rear quarter windows (one pair for each window). The roof hydraulic pump is protected by a 30A fuse.

The Roof control module is actuated by the roof switch on the centre console and controls the operation of both the roof and rear quarter window circuits. They can only be operated in a pre-programmed manner.



Specifications

Torque Figures		
Description	Nm.	lb. / ft.
Pump plate	7-10	5.5-7.5
Module plate	7-10	5.5-7.5
Roof Mountings		

Maintenance

Roof

Removal

⚠ WARNING ⚠
DO NOT PLACE ANY OBJECTS ON THE TOP OF THE DEPLOYABLE ROLLBAR COVERS BEHIND THE REAR SEAT BACKS.

⚠ WARNING ⚠
DO NOT ALLOW ANY PERSON TO SIT ON THE DEPLOYABLE ROLLBAR COVERS AT ANY TIME.

⚠ WARNING ⚠
IF THE ROOF IS NOT STOWED AND THE DEPLOYABLE ROLLBARS DEPLOY THEY WILL BREAK THROUGH THE REAR GLASS.

1. Raise the roof. Do not lock in position.
2. Remove the ignition key and wait for a minimum of five seconds. The roof can now be moved in any direction.

⚠ WARNING ⚠
KEEP FINGERS CLEAR OF THE ROOF LINKAGE WHEN MOVING THE ROOF MANUALLY.

During this time the roof hydraulics will relax allowing manual movement of the roof. Some hydraulic fluid resistance will still be present in the operating rams. It may take considerable effort to fully raise the roof manually.

3. Disconnect the vehicle battery at the negative terminal and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE DEPLOYABLE ROLLBAR SYSTEM.

⚠ WARNING ⚠
DO NOT LEAN OVER THE ROLLBARS. IF THE ROLLBARS DEPLOY WHILE SOMEONE IS LEANING OVER THEM, THEY WILL CAUSE SEVERE INJURY.

4. Remove the rear seats and trim panels (Refer to 'Rear Trim', page 1-5-5).
5. Raise the tonneau cover and secure in the fully open position.
6. Manually raise the tension bow to 90°.

For access to the hydraulic pipes and wiring harness plugs.

With the roof in the raised position and the tension bow in the 90° position the hydraulic rams have the minimum amount of hydraulic oil in them.

7. Disconnect the hydraulic pipes (x2) for each hydraulic ram.

Hydraulic pipes are self sealing.

8. Disconnect the wiring harness plug from the LH hydraulic ram unit.
9. Disconnect the two wiring harness plugs from inside the boot RH area. Route the cables into the roof storage area.
10. Remove bolts (x6 (3 each side)). Withdraw the roof mechanism.

Installation

1. Place the roof mechanism into position. Locate on the dowels provided and secure using bolts x6 (3 each side). Torque the bolts to **TBA Nm**.

The locating dowels are adjustable. In normal circumstances the dowels will not require to be adjusted.

2. Connect the hydraulic pipes.
3. Connect the LH hydraulic ram unit wiring harness plug.
4. Route the RH cable into the boot area. Connect the wiring harness plugs (x3) in the boot RH area.
5. Install the rear trim panels (Refer to 'Rear Trim', page 1-5-5).
6. Install the rear seat belt top mount. Torque to **35 Nm**.
7. Install the rear seat bases and backs.
8. Connect the vehicle battery.
9. Reset both door windows (Refer to 'Door Glass Setup', page 1-11-6).
10. Operate the roof and check for correct installation.

Roof Material

⚠ WARNING ⚠
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⚠ WARNING ⚠
DO NOT ALLOW ANY PERSON TO SIT ON THE DEPLOYABLE ROLLBAR COVERS AT ANY TIME.

⚠ WARNING ⚠
IF THE ROOF IS NOT STOWED AND THE DEPLOYABLE ROLLBARS DEPLOY THEY WILL BREAK THROUGH THE REAR GLASS.

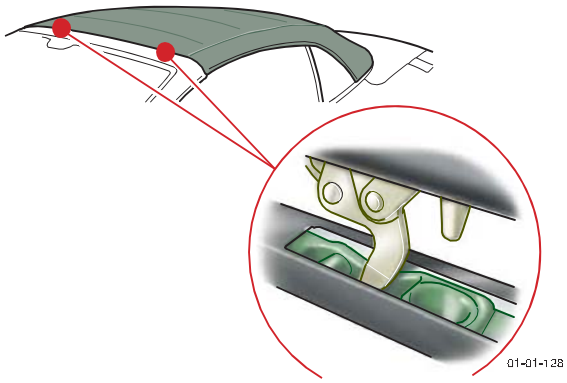
Removal

1. Disconnect the vehicle battery at the negative terminal and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE DEPLOYABLE ROLLBAR SYSTEM.

⚠ WARNING ⚠
DO NOT LEAN OVER THE ROLLBARS. IF THE ROLLBARS DEPLOY WHILE SOMEONE IS LEANING OVER THEM, THEY WILL CAUSE SEVERE INJURY.

2. If the roof is raised and locked, unlock and open, slightly.



3. Remove the ignition key and wait for a minimum of five seconds. The roof can now be moved in any direction.

⚠ WARNING ⚠
KEEP FINGERS CLEAR OF THE ROOF LINKAGE WHEN MOVING THE ROOF MANUALLY.

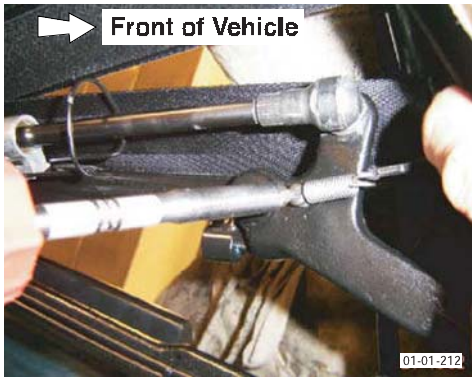
During this time the roof hydraulics will relax allowing manual movement of the roof. Some hydraulic fluid resistance will still be present in the operating rams. It may take considerable effort to fully raise the roof manually.

4. Disconnect the vehicle battery.
5. Raise the roof lid and secure in the fully raised position.
6. Raise the tension bow to 90° to the vehicle.
7. Remove the rear roof seal.

8. Remove the screws retaining the trim strip.
9. Remove the roof material from the roof frame (rear).

10. Lift the roof material from the rear of the tension bow.

11. Disconnect the window tension cord.
    11.1 Remove the window tension cord springs.

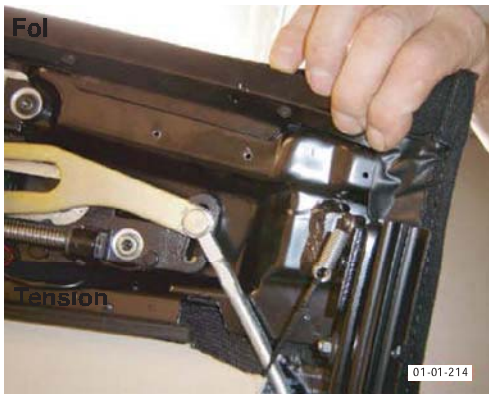


11.2 Remove the three tension cord mounts.

12. Roll the roof material back to the 3rd cross bar.
    Remove the screws that secure the roof lining to the cross bar.
    Pull the roof material from the cross bar.
13. Roll the roof material back to the 2rd cross bar.
    Remove the screws that secure the roof lining to the cross bar.
    Pull the roof material from the cross bar.
14. Remove the front of the roof material from the header rail.

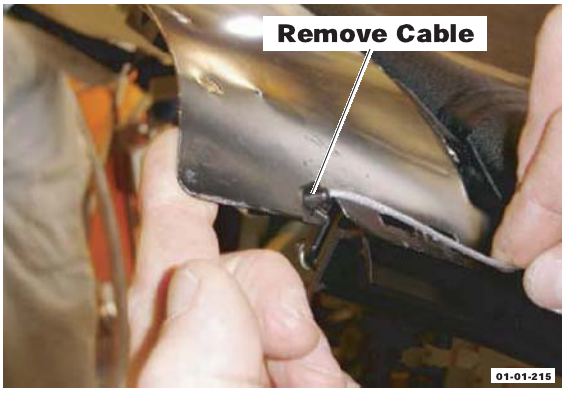
15. Remove the corners of the front of the roof material from the header plate.

The outer screws on both sides of the header plate are not currently used.



16. Pull the roof material from the roof header rail.

17. Remove the two side cable securing clips (two each side) and withdraw the side tension cables through the roof lining.



Ensure that the two cable securing clips (each side) are retained for installation.

18. Roll the roof material back to the 1st cross bar.
    Remove the screws that secure the roof lining to the cross bar.
    Pull the roof material from the cross bar.
19. Remove the strip in the roof material from the front of the header rail.

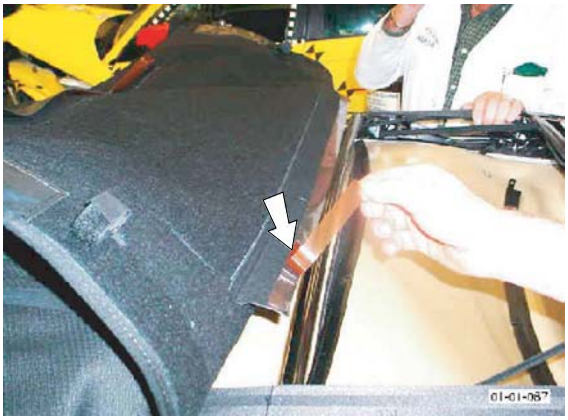
Installation

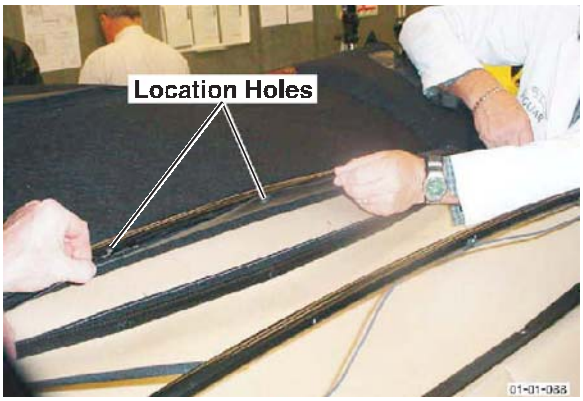
1. Manually raise the roof to the raised position.
2. Lay the roof material on the roof frame.
   2.1 Locate the strip in the roof material to the header rail. Secure with screws x4.

3. Roll the roof material to the 1st cross bar.
4. Remove the sticky strip protection and locate to the first cross bar.

   Ensuring that the material is central, stick to the frame cross bar. Affix from centre out, ensuring the holes in the material locate over the holes in the cross bar.

The material with the sticky surface goes under and up around the cross bar.



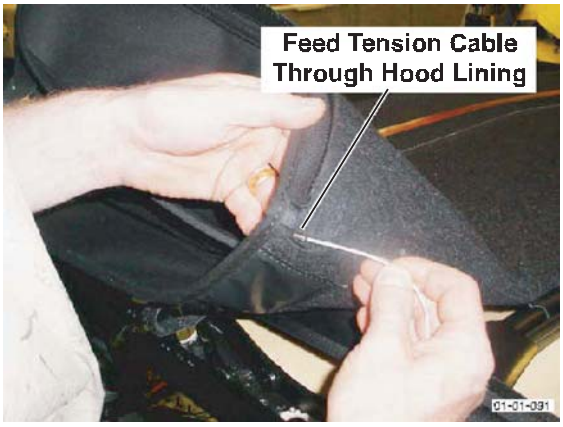


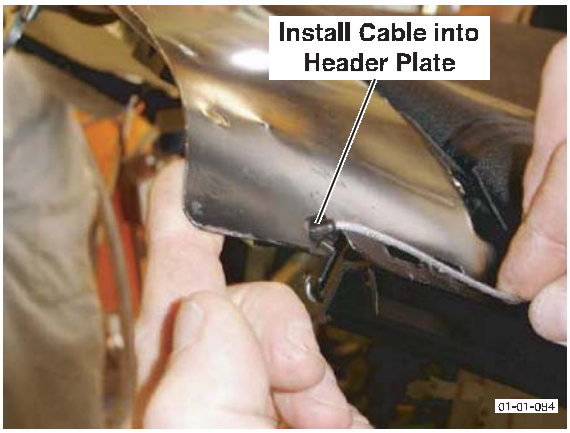
5. Locate the roof lining strip to the cross bar and secure with screws x5.

6. Roll the roof material to the 2nd frame cross bar.
7. Repeat step 6 and 7.

The material with the sticky surface goes over and down around the cross bar

8. Feed the side tension cables through the roof lining and install the end of the cables to the header rail. Ensure that the two cable securing clips are installed.

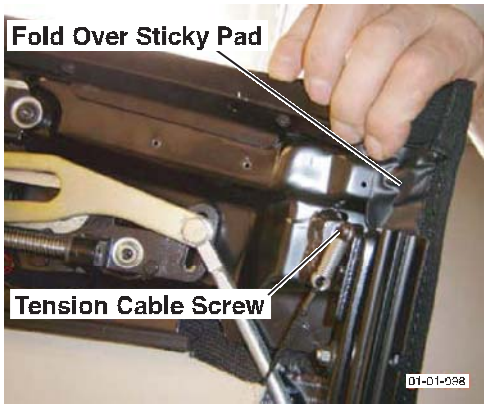




9. Install the front of the roof material to the header rail. Secure with screws.

The outer screws on both sides of the header plate are not currently used.

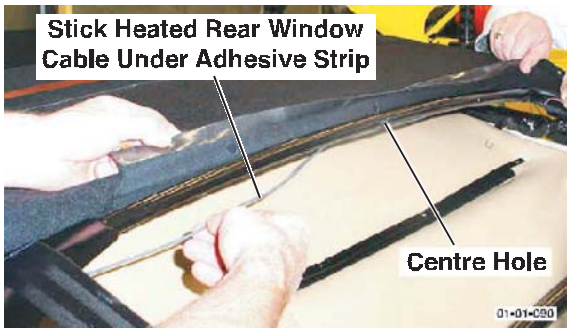
10. Place the material with the sticky pads into position. Remove the sticky pads protection and affix to the header rail.



11. Roll the roof material to the 3rd cross bar.
Repeat steps 6 and 7.

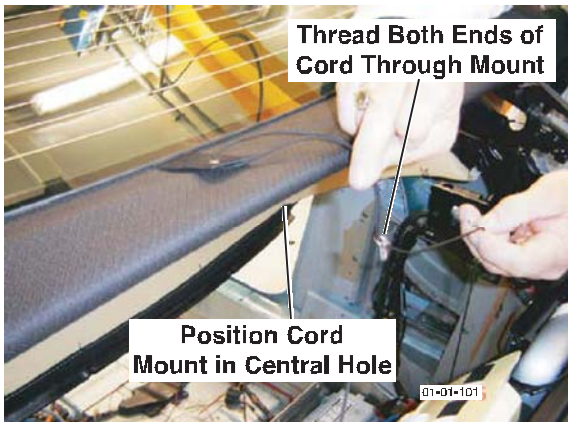
The material with the sticky surface goes over and down around the cross bar

Ensure that the heated window cable goes under the adhesive strip.



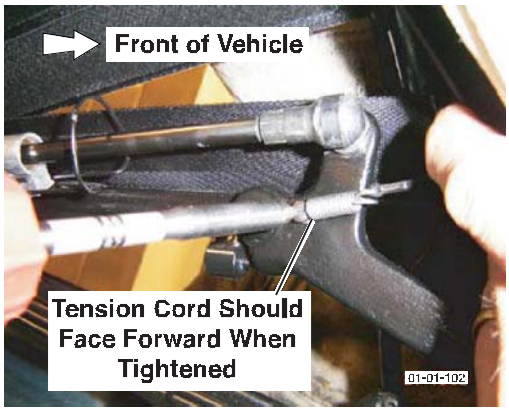
12. Install the window tension cord (if not install).
12.1 Thread the tension cord through the center hole.

12.2 Install the three tension cord mounts.



13. Install the ends of the tension cord.

Install the spring, on the end of the tension cord, facing forward.

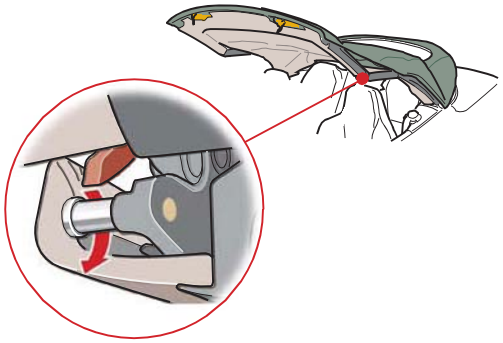


14. Raise the tension bow to 90°.
15. Slide the roof material over the rear of the tension bow.

16. Install the trim strip. Do not tighten the screws.

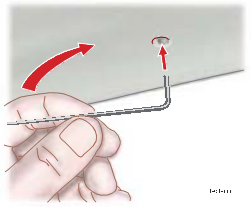
17. Raise the roof to the open position and lock into place.

Ensure the two lock arms are located in their catches.



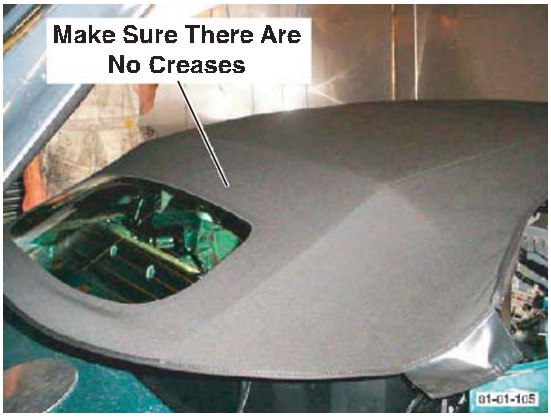
Using the allen key provided in the vehicle tool kit, lock the roof in position.

Continue to turn the allen key until no more movement is possible.



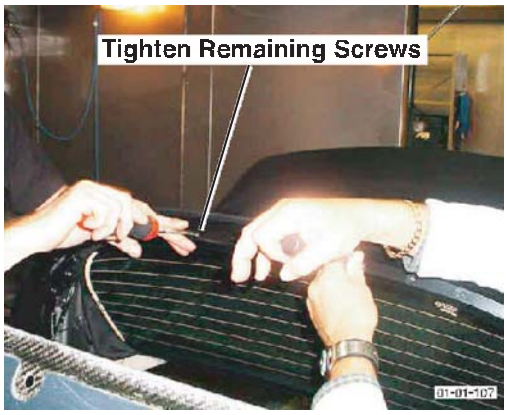
Locking the roof manually may require the assistance of a second person to push down so the catches engage while the allen key is turned.

18. Check that the roof material is correctly installed.



19. Tighten 4 or 5, evenly, trim strip screws while the roof is in the open position.

20. Unlock the roof and lower to enable access to the trim strip. Tighten the remaining screws.



21. Install the roof material over the roof side frame.

The screw holes in the roof material are used when the sealing strip is installed.

Weather Seals

Removal

1.

Installation

1.

Roof Pump

⚠ WARNING ⚠
DO NOT PLACE ANY OBJECTS ON THE TOP OF THE DEPLOYABLE ROLLBAR COVERS BEHIND THE REAR SEAT BACKS.

⚠ WARNING ⚠
DO NOT ALLOW ANY PERSON TO SIT ON THE DEPLOYABLE ROLLBAR COVERS AT ANY TIME.

⚠ WARNING ⚠
IF THE ROOF IS NOT STOWED AND THE DEPLOYABLE ROLLBARS DEPLOY THEY WILL BREAK THROUGH THE REAR GLASS.

Removal

1. Disconnect the vehicle battery at the negative terminal and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE DEPLOYABLE ROLLBAR SYSTEM.

⚠ WARNING ⚠
DO NOT LEAN OVER THE ROLLBARS. IF THE ROLLBARS DEPLOY WHILE SOMEONE IS LEANING OVER THEM, THEY WILL CAUSE SEVERE INJURY.

2. Remove the ignition key and wait for a minimum of five seconds. The roof can now be moved in any direction.

⚠ WARNING ⚠
KEEP FINGERS CLEAR OF THE ROOF LINKAGE WHEN MOVING THE ROOF MANUALLY.

During this time the roof hydraulics will relax allowing manual movement of the roof. Some hydraulic fluid resistance will still be present in the operating rams. It may take considerable effort to fully raise the roof manually.

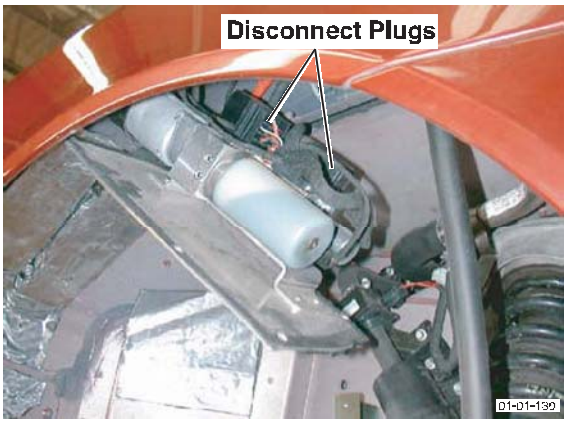
3. Disconnect the vehicle battery.
4. Remove the LH road wheel and arch liner.

The fuel filler drain off pipe is attached to the arch liner. Ensure that the fuel filler drain off pipe does not disconnect from it's stub pipe.

5. Remove bolts (x6). Support the pump plate as the screws are removed.

The pump is attached to the pump plate.

6. Disconnect two wiring harness plugs.

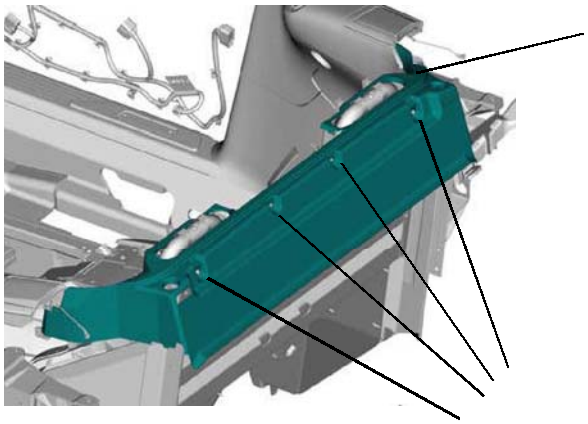


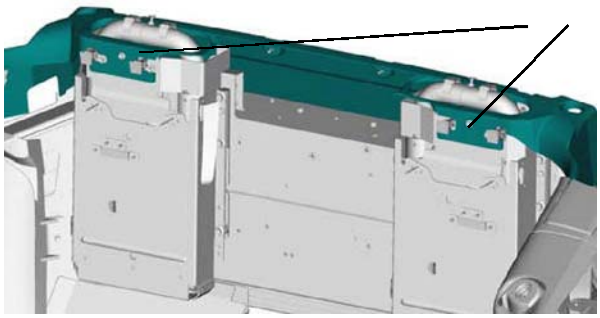
7. Manually raise the tension bow to 90°.

For access to the hydraulic pipes and wiring harness plugs.

8. Remove the rollbar trim cover.

9. Remove the rear closing panel.

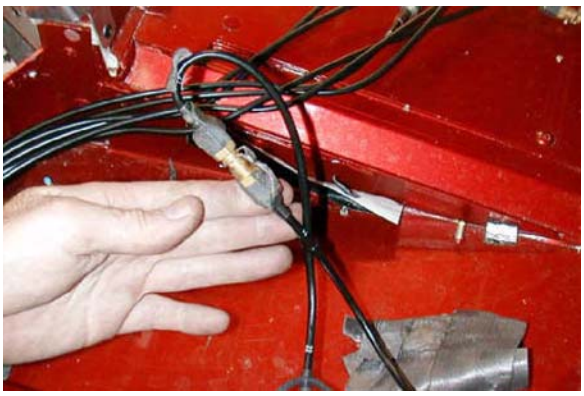




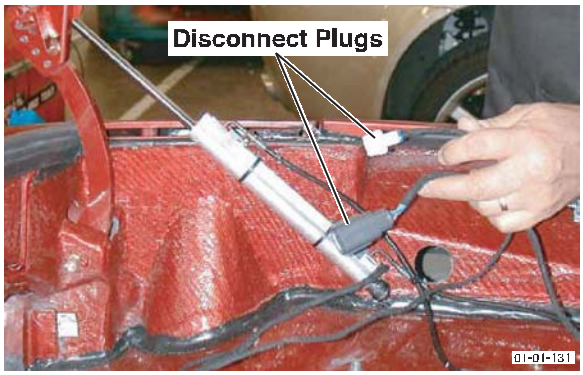
10. Disconnect the hydraulic pipes.
    Connect feed and return hydraulic pipes to create an hydraulic loop.

Creating hydraulic loops will enable the hydraulic rams to continue to operate.

Connect the hydraulic pipes, feed to return.



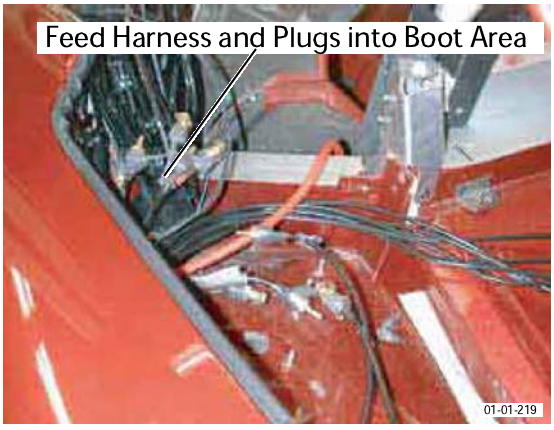
11. Disconnect the two wiring harness plugs from inside the boot area.



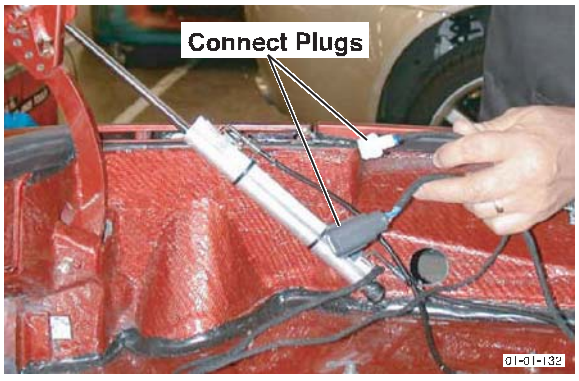
12. Withdraw the hydraulic pipes and the wiring harness cables through the vehicle body, while lowering the pump.

Installation

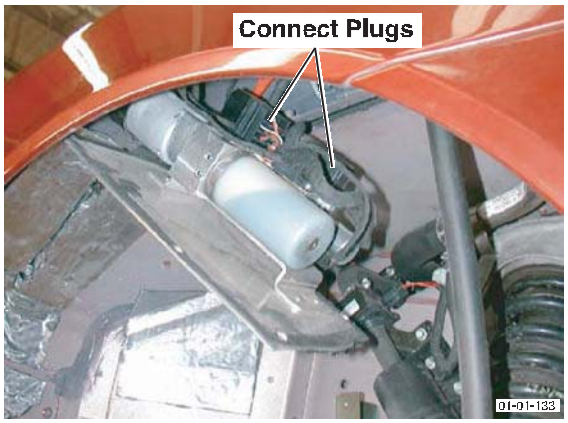
1. Feed the hydraulic pipes through the vehicle body. Feed the wiring harness plugs into the boot area.



2. Connect the two boot wiring harness plugs.



3. Connect the two pump wiring harness plugs.



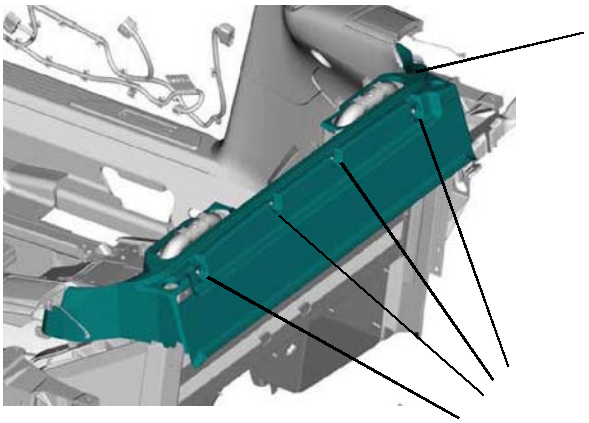
4. Raise the pump and pump plate assembly into position and secure. Torque bolts to **7-10 Nm.**

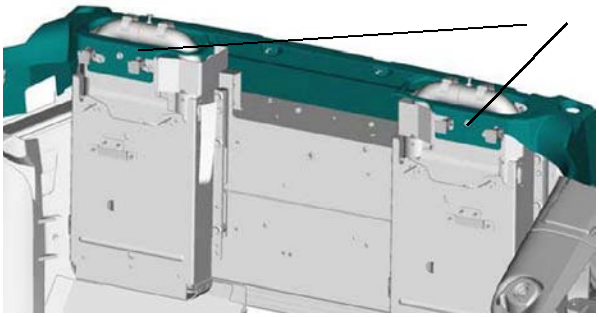
Take care not to trap hydraulic pipes and wiring harness cables.

5. Connect the hydraulic pipes.

The hydraulic pipes are numbered, i.e. connect pipes numbered 32 together, etc.

6. Install the rear closing panel.





7. Install the rollbar trim cover.
8. Install the road wheel arch liner and road wheel. (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).

Roof Module

Removal

1. Remove the ignition key and wait for a minimum of five seconds. The roof can now be moved in any direction.

⚠ WARNING ⚠
KEEP FINGERS CLEAR OF THE ROOF LINKAGE WHEN MOVING THE ROOF MANUALLY.

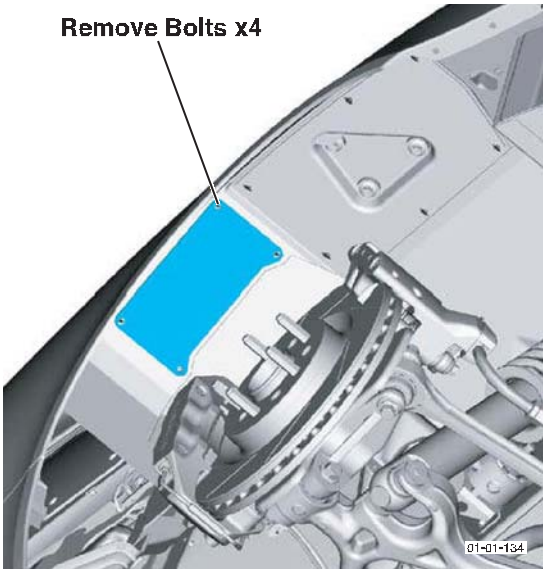
During this time the roof hydraulics will relax allowing manual movement of the roof. Some hydraulic fluid resistance will still be present in the operating rams. It may take considerable effort to fully raise the roof manually.

2. Disconnect the vehicle battery.
3. Remove the LH road wheel and arch liner.

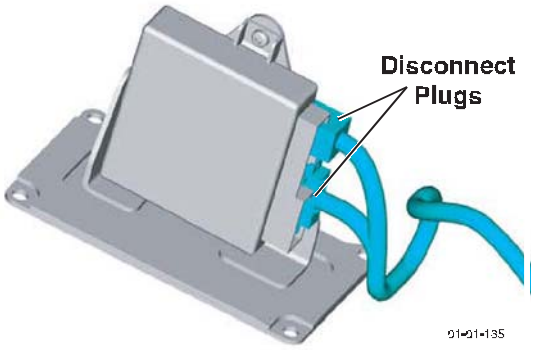
The fuel filler drain off pipe is attached to the arch liner. Ensure that the fuel filler drain off pipe does not disconnect from it's stub pipe.

4. Remove bolts (x4). Support the module plate as the screws are removed.

The roof module is attached to the plate.



5. Lower the module plate to access the two wiring harness plugs. Disconnect the two wiring harness plugs and withdraw the roof module.



Installation

1. Raise the roof module into position and connect the two wiring harness plugs.
2. Install the roof module and plate assembly. Torque bolts to **7-10 Nm**.

Roof Lid Hydraulic Rams

Removal

1. Remove the ignition key and wait for a minimum of five seconds. The roof can now be moved in any direction.

⚠ WARNING ⚠
KEEP FINGERS CLEAR OF THE ROOF LINKAGE WHEN MOVING THE ROOF MANUALLY.

During this time the roof hydraulics will relax allowing manual movement of the roof. Some hydraulic fluid resistance will still be present in the operating rams. It may take considerable effort to fully raise the roof manually.

2. Disconnect the vehicle battery.
3. Raise the tension bow to 90° to the vehicle.
4. Raise the roof lid and support.
5. **LH ram only.**
   - 5.1 Withdraw the pump and pump plate unit.
   - 5.2 Connect the vehicle battery. Open the boot lid.
   - 5.3 Disconnect the wiring harness plug. Feed the wiring harness cable through into the pump area.

⚠ WARNING ⚠
TAKE CARE TO AVOID SHARP EDGES.

   - 5.4 Close the boot lid. Disconnect the vehicle battery.
   - 5.5 Disconnect the wiring harness plugs.
6. Disconnect the hydraulic pipes.
   Connect feed and return hydraulic pipes to create an hydraulic loop.

Creating hydraulic loops will enable the hydraulic rams to continue to operate.

The hydraulic pipes are numbered, i.e. connect pipes, feed to return, numbered 32 together, etc.

7. Disconnect both ends of the hydraulic ram and withdraw the ram.

Installation

1. Connect the ram to it's mounts.
2. Connect the hydraulic pipes.

The hydraulic pipes are numbered, i.e. connect pipes, feed to return, numbered 32 together, etc.

3. **LH ram only.**
   - 3.1 Connect the wiring harness plug (x1).
   - 3.2 Feed the wiring harness cable (x1) through into the boot area.

⚠ WARNING ⚠
TAKE CARE TO AVOID SHARP EDGES.

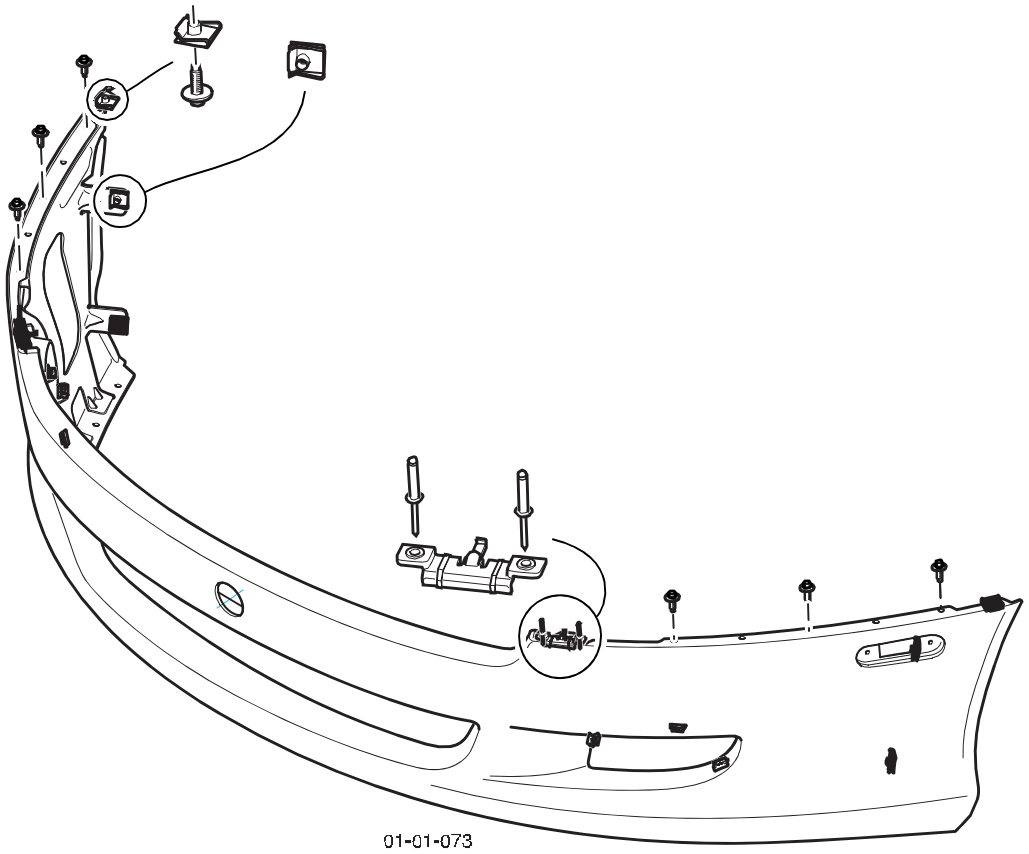
3.3 Install the pump and pump plate unit.

4. Remove the roof lid support.
5. Connect the vehicle battery. Open the boot lid.
6. Connect the boot area wiring harness plug.

Body System (01.00)

Bumpers (01.19)

Front Bumper



Specifications

Torque Figures

Description	Nm	lb. / ft.
Bumper to bumper bracket	4-5	3-4

Maintenance

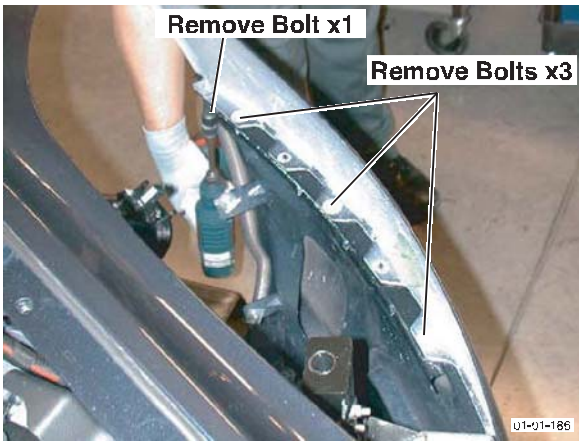
Repair Operation Time (ROT)	
Item	**Code**
Bumper Remove / Install	**01.19.AB**

Removal

1. Remove the road wheel and arch liner.
2. Remove the bolts (x6) that secure the under tray to the bumper.

The air intake for the alternator is located in the front under tray.

3. Remove the LH and RH air boxes (Refer to 'Air Filter Box', page 3-12-3).
4. Remove bolts (x8 (x4 each side)) that secure the bumper.



5. Disconnect the retaining clips (x2).

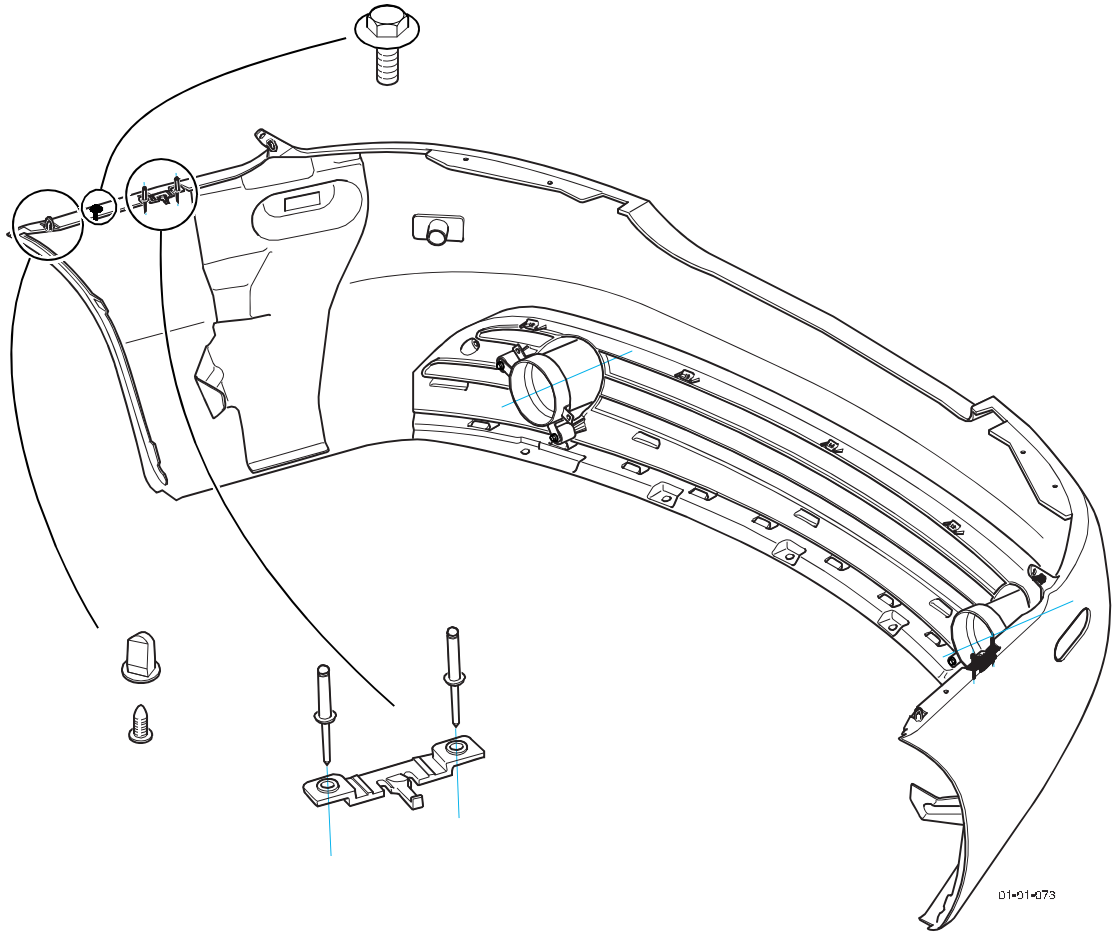
Use a tool, i.e. a long screwdriver, to unclip the bumper from the vehicle body.

6. Pull the bumper from the clips located in the front grill. Withdraw the bumper from the vehicle.

Installation

1. Place the bumper in position. Push install onto the clips located in t he front grill.
2. Locate on the retaining clips (x2).
3. Install bolts (x8 (x4 each side)) to the bumper. Torque to **4-5 Nm**.
4. Install the LH and RH air boxes (Refer to 'Air Filter Box', page 3-12-3).
5. Install the undertray.
6. Install the road wheel arch liner and wheel.

Rear Bumper



Specifications

Torque Figures		
Description	Nm	lb. / ft.
Bumper to bumper bracket	2-3	1.5-2.5

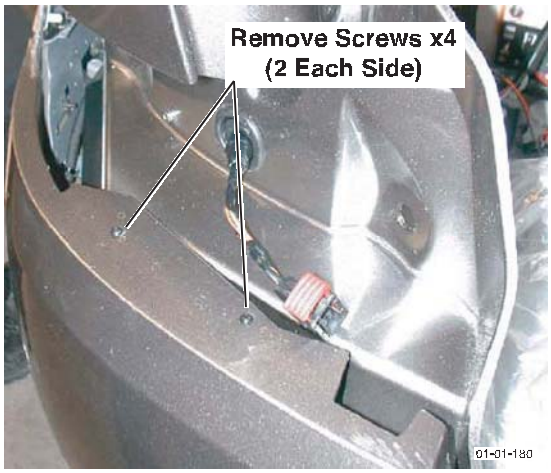
Maintenance

Repair Operation Time (ROT)	
Item	**Code**
Bumper Remove / Install	**01.19.BB**

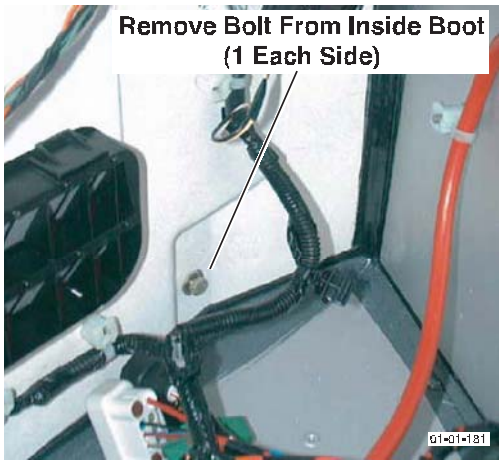
Removal

1. Remove the light clusters.
   - 1.1 Open the boot and remove the trim from around the light cluster mounts.
   - 1.2 Release and remove nuts (x3).
   - 1.3 Withdraw the rear light cluster unit. Disconnect the wiring harness plug.
2. Remove the bumper tag screw.

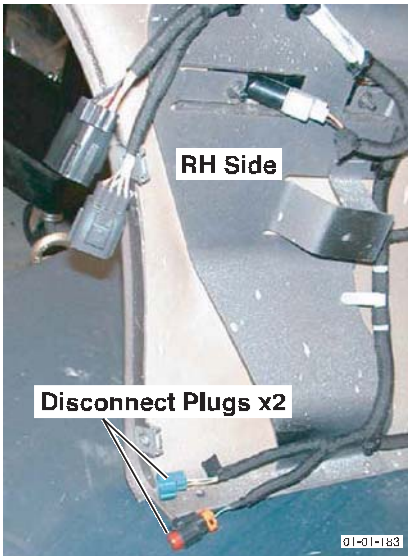
3. Remove screws x4 (2 each side).

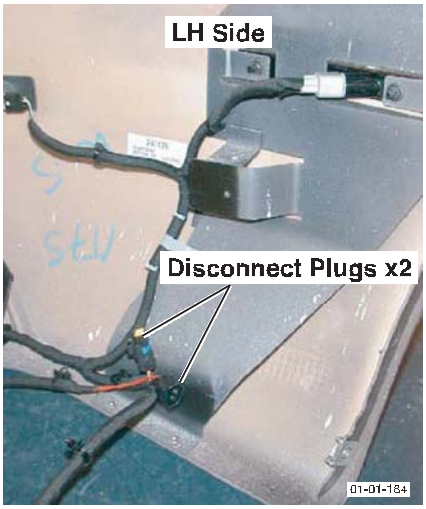


4. Remove bolt from inside the boot (1 each side).

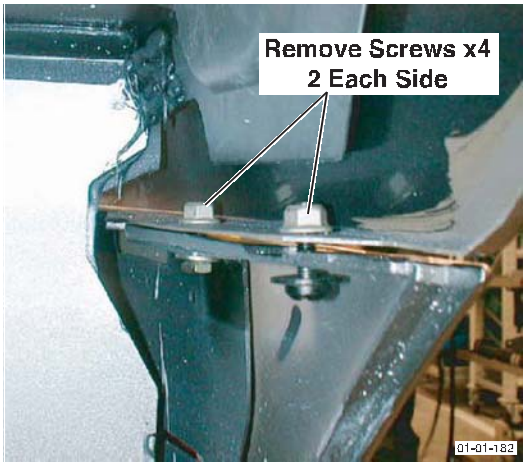


5. Remove the roadwheel and disconnect the rear section of the roadwheel arch liner.
6. Disconnect the wiring harness plugs (x2 (RH side)) and (x2 (LH side)).

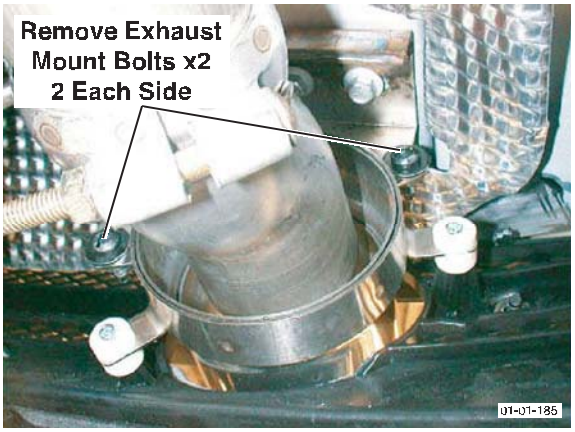




7. Remove screws (x4 (x2 each side)) from the bumper.



8. Remove bolts (x4 (x2 each) that secure the exhaust mount to the end pipe trim.



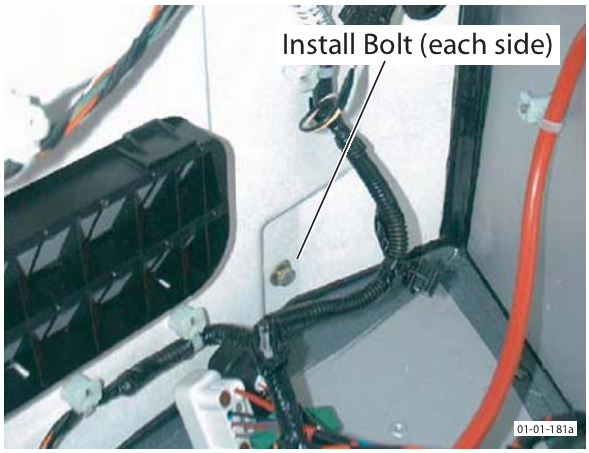
9. Disconnect the retaining clips (x2).

Use a tool, i.e. a long screwdriver, to unclip the bumper from the vehicle body.

10. Disconnect the two clips in the top centre of the bumper. Withdraw the bumper from the vehicle.

Installation

1. Place the bumper to the vehicle. Locate the two clips in the center top of the bumper.
2. Locate the retaining clips (x2).
3. Install the bumper 'Tag' screw.
4. Install screws (x4 (x2 each side)). Torque to **2-3 Nm**.
5. Install the screws (x4) in the light cluster opening.
6. Install the light clusters.
   - 6.1 Place a light cluster unit to vehicle and connect the wiring harness plug.
   - 6.2 Insert the light cluster unit into position.
   - 6.3 Ensure the rubber seal is in position. Tighten nuts (x3).
   - 6.4 Repeat for the second light cluster.
7. Install the bolts (x2) to the bumper boot mount.

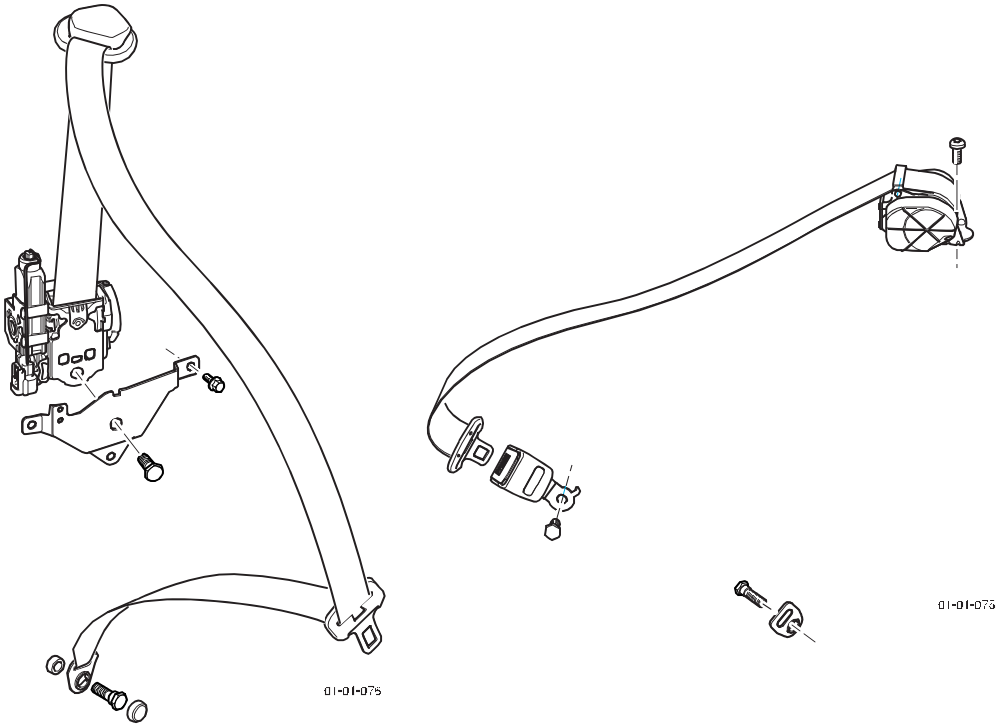


8. Install the exhaust mounts.
9. Connect the wiring harness plugs.
10. Install the road wheel arch liner and wheel.

Body System (01.00)

Restraining Devices (01.20)

Seat Belts



This vehicle has four inertia reel safety belts installed. The inertia belt reels automatically tension the belts to provide security with comfort. In the event of a collision or during severe braking, the belt reels will lock.

The driver and front passenger safety belt buckles are installed with a switch, which is connected to a warning indicator housed within the DIM. When the ignition is first turned on the warning indicator will illuminate only if the seat belt is not fastened. If the safety belt is fastened before the ignition is turned on the circuit is broken and the indicator will remain off.

Pre-tensioner and Load Limiting Systems

The driver and front passenger seat belts are equipped with pre-tensioner and load limiting systems.

When required, the front airbag and pre-tensioner systems will deploy simultaneously.

In some moderate frontal or near frontal accidents, only the pre-tensioner system will deploy.

The pre-tensioners take up slack in the front seat belts as the airbags are expanding. The load limiting system releases belt webbing in a controlled manner to reduce belt force on the occupant's chest.

The Restraints Control Module (RCM) receives information on the status of the safety belt buckles from a switch contained in the buckle. Only fastened safety belts will activate.

The safety belt retractors, which are mounted within the base of the B pillars, incorporate a torsion bar load limiting device. This device consists of a retractor reel which is mounted onto a spindle (torsion bar) which once the sensor has locked the retractor reel and a predetermined load is applied, twists and allows additional webbing into the system. The deceleration force required to initiate this sequence is approximately the same as that required to initiate airbag deployment. The torsion bar load limiting device will only react if the safety belt is in use at the time of the impact.

Caution

It should be considered that during any event that utilizes the full capability of the safety belts, the webbing may have been elongated and the torsion bar may have twisted. For this reason, if a vehicle is involved in an accident which results in the deployment of the airbag(s), all the safety belts that were in use at the time of the accident MUST be renewed.

Emergency Locking Retractor (ELR)

The retractors in all seat positions feature ELR. During any period of sudden deceleration, or under lateral load when cornering at speed, a sensor weight within the safety belt retractor moves a locking pawl against the teeth on the retractor reel, which then locks the retractor preventing any further release of webbing. As soon as the load applied onto the retractor through the safety belt webbing is removed the locking pawl releases the retractor reel and normal movement is returned to the retractor.

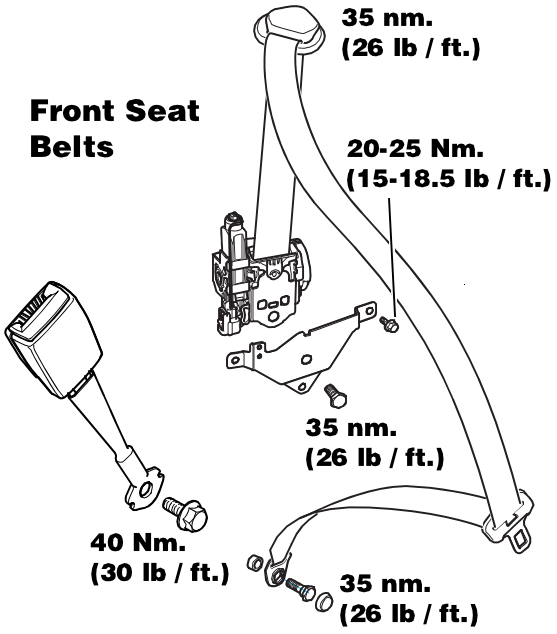
Automatic Locking Retractor (ALR)

Automatic locking retractors (ALR) are installed to all passenger seat positions.

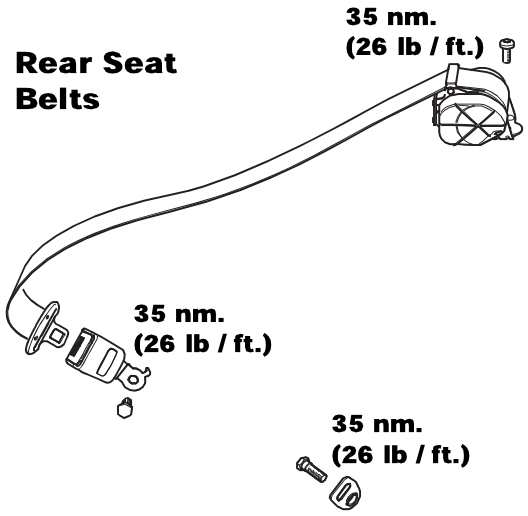
The safety belt webbing on these are clearly marked to show their operating feature. To initiate the ALR system, fasten the safety belt into it's buckle and pull all of the webbing from the retractor, as the safety belt is released the retractor locks allowing travel in only one direction thus producing a fixed length restraint and preventing the safety belt from introducing slack, making any child seat it may be restraining secure. The ALR system of the retractor is disengaged by unfastening the safety belt and allowing the safety belt to fully retract onto the reel.

Specifications

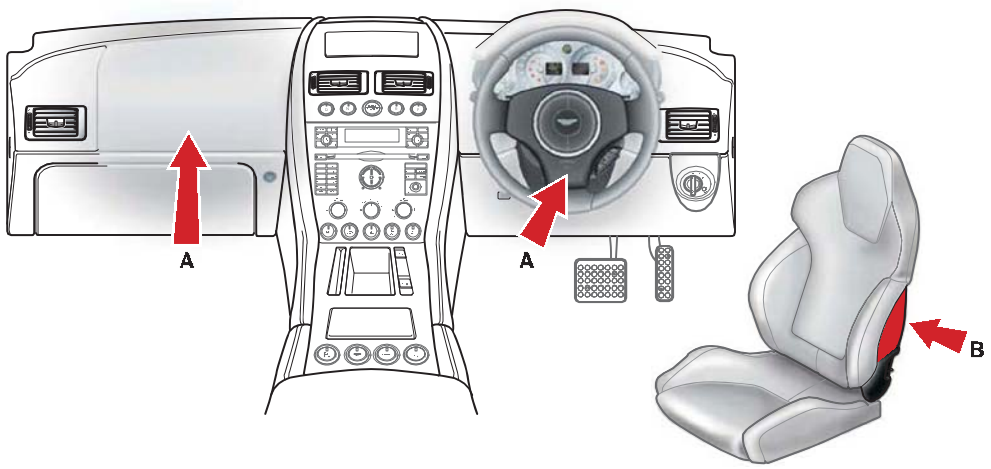
Torque Figures
Description



Torque Figures
Description



Airbag System



The airbag system is designed to provide increased collision protection for front seat occupants in addition to that provided by the safety belt system. Safety belt use is necessary to obtain the best occupant protection and to receive the full advantages of the airbag system.

This vehicle is equipped with driver, passenger, side impact airbags and seat belt pretensioners, which are electrically controlled by a Restraints Control Module (RCM).

The purpose of the driver, passenger and side airbags is to provide **additional** protection for the front seat occupants in the event of a serious impact (front or side impacts). The airbags are supplementary to the seat belts.

Airbag Deployment

⚠ WARNING ⚠

AIRBAGS INFLATE RAPIDLY AND WITH CONSIDERABLE FORCE, THERE IS THEREFORE A RISK OF DEATH OR SERIOUS INJURY SUCH AS FRACTURES, FACIAL AND EYE INJURIES OR INTERNAL INJURIES, PARTICULARLY TO OCCUPANTS WHO ARE NOT PROPERLY RESTRAINED BY SEAT BELTS OR ARE NOT SITTING CORRECTLY WHEN THE AIRBAGS DEPLOY. THE RISK OF INJURY FROM A DEPLOYING AIRBAG IS GREATEST CLOSE TO THE TRIM COVERING THE AIRBAG.

⚠ WARNING ⚠

THE WHOLE SEQUENCE OF AIRBAG DEPLOYMENT, FROM SENSING THE IMPACT TO FULL INFLATION OF THE AIRBAG TAKES PLACE IN A FRACTION OF A SECOND.

Dual Inflation Technology

When activated, the airbags will deploy at either a normal or reduced level of inflation, depending on crash severity. Various sensors determine the direction and severity of an impact. The system analyses this information then deploys the appropriate airbags.

Driver airbag Module

The driver airbag module is installed in the steering wheel, the cover forming the outer surface of the steering wheel boss. The cover has a split line moulded into its surface allowing the airbag to exit through the cover when the system deploys.

No routine maintenance is required and there are no serviceable parts. The driver airbag module is replaced as an assembly.

Passenger Airbag Module

The passenger airbag module is located above the glove compartment behind a deployment panel.

The passenger airbag deployment panel hinges up out of the way during airbag deployment.

The passenger airbag module is replaced as an assembly. There is no routine maintenance required and there are no serviceable parts.

Side Airbag Module

A side impact airbag module is mounted in the outboard bolster of each front seat. In a side airbag module deployment situation, the airbag module deploys from behind a hard trim panel.

Clockspring

The airbag clockspring continuously transfers electrical signals from the driver airbag module to the airbag sensor.

The airbag clockspring is mounted on the steering column, behind the steering wheel and does not contain any serviceable components. Ensure that the steering wheel is locked in the central position before commencing any work on the steering column, wheel or airbag.

Restrains Control Module (RCM)

The primary purpose of the RCM is to discriminate between an event that warrants an airbag system deployment and an event that does not. The RCM governs the operation of the whole system and performs continual system diagnostics. Information on the severity of an impact is received from the impact sensors.

Variations in the deployment of the front airbag modules are dependent on the status of the front safety belt buckles.

Impact Sensors

Side Impact - Side impact sensors are mounted to the base of each B-pillar. In the event of a side impact, the RCM processes the impact data sent by the side impact sensor against stored data. The RCM will deploy both side impact airbags dependant on seat belt buckle status.

Front Impact

Front impact sensors (x2) are located under the grill opening panel.

The SRS module processes the impact data sent by the front impact sensor against stored data, and deploys the front airbags, and the seat belt pre-tensioners.

Specifications

Torque Figures		
Description	Nm	lb. / ft.
Drive Airbag	8-10	6-7.5
Passenger Airbag	11.5	8.5
Side Airbag	10	7.5

Maintenance

Driver Airbag

Repair Operation Time (ROT)	
Item	**Code**
Drivers Airbag Renew	**01.20.AB**

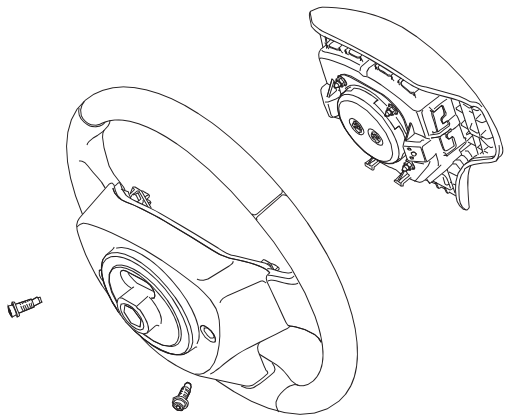
Removal

1. Remove the earth ('-ve') terminal from the vehicle battery and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE AIRBAG SYSTEM.

2. Remove bolts (x2) that secure the driver airbag.

Rotate the steering wheel to gain access to the two bolts.



3. Withdraw the driver airbag to gain access to the wiring harness plug. Disconnect the plug.
4. Withdraw the driver airbag.

Installation

1. Place the airbag module to the steering wheel. Connect the wiring harness plug.
2. Install the bolts (x2). Torque to **8-10 Nm**.
3. Connect the vehicle battery with the ignition in the 'Off' position.

Passenger Airbag

Repair Operation Time (ROT)	
Item	**Code**
Passenger Airbag Renew	**01.20.BB**

Removal

1. Remove the earth ('-ve') terminal from the vehicle battery and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE AIRBAG SYSTEM.

2. Remove the glove box.
   - 2.1 Pull of the outer trim panel. Disconnect the glovebox release switch wiring harness plug.
   - 2.2 Release the damper cord.
   - 2.3 Remove screws (x3) from the glovebox door hinge. Remove door.
   - 2.4 Remove screws (x4) from the sight shield. Remove the sight shield and glovebox.

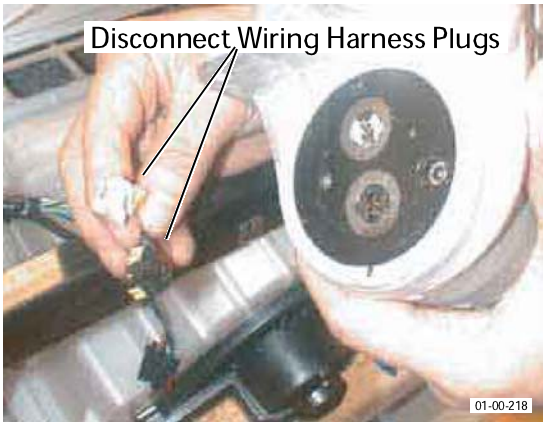
3. Remove the airbag trim panel.

Caution
Withdraw the airbag panel carefully. The airbag panel can crease if forced out.

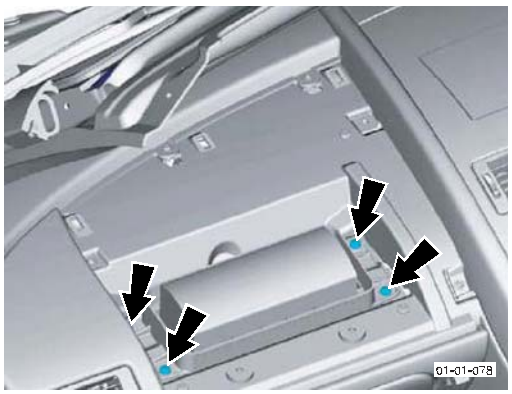
3.1 Remove screws (x3).

3.2 Lift from the front edge. Withdraw out of clips (x3).

4. Disconnect the wiring harness plugs (x2).



5. Remove bolts (x4) and withdraw the airbag.



Installation

1. Install the airbag. Torque bolts to **11.5 Nm**.
2. Connect the wiring harness plugs.
3. Install the airbag trim panel. Torque bolts to **11.5 Nm**.
4. Install the glovebox.
5. Connect the vehicle battery with the ignition in the 'Off' position.

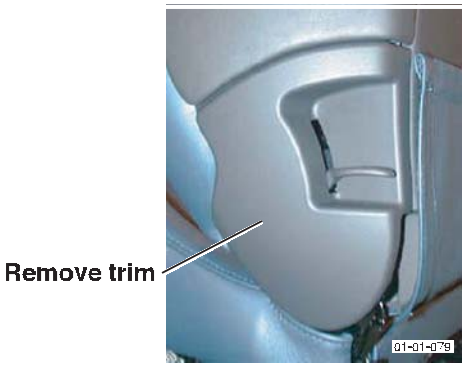
Side Impact Airbag

Removal

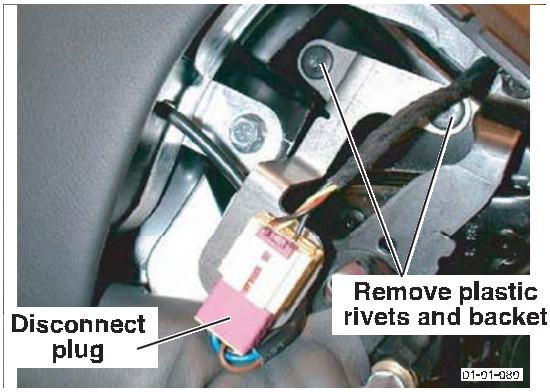
1. Remove the earth ('-ve') terminal from the vehicle battery and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE AIRBAG SYSTEM.

2. Remove the seat lower side trim.



3. Disconnect the wiring harness plug.



4. Remove bolt (x1) that secures the airbag module to the seat.

Installation

1. Place the airbag to the seat. Torque bolt to **10 Nm**.
2. Connect the wiring harness plug.
3. Install the seat lower trim panel.
4. Connect the vehicle battery with the ignition in the 'Off' position.

Deployable Rollbars

⚠ WARNING ⚠
DO NOT PLACE ANY OBJECTS ON THE TOP OF THE DEPLOYABLE ROLLBAR COVERS BEHIND THE REAR SEAT BACKS.

⚠ WARNING ⚠
DO NOT ALLOW ANY PERSON TO SIT ON THE DEPLOYABLE ROLLBAR COVERS AT ANY TIME.

⚠ WARNING ⚠
IF THE ROOF IS NOT STOWED AND THE DEPLOYABLE ROLLBARS DEPLOY THEY WILL BREAK THROUGH THE REAR GLASS.

Specifications

Torque Figures

Description	Nm	lb. / ft.
Deployable Rollbar Unit	20-30	15-22.5
Deployable Rollbar Sensor Unit	TBA	

Maintenance

Rollbar Unit

Remove

1. Disconnect the vehicle battery at the negative terminal and ensure the ignition key is removed.

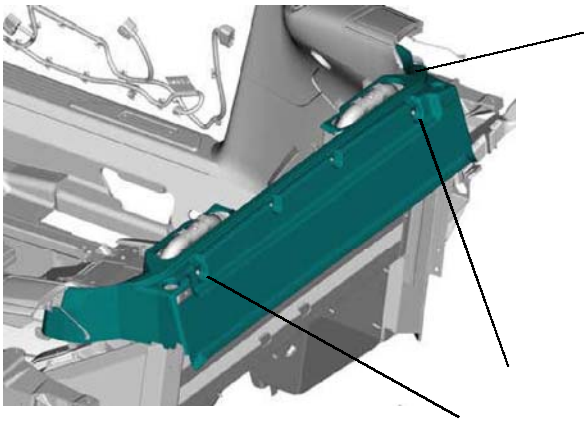
⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE DEPLOYABLE ROLLBAR SYSTEM.

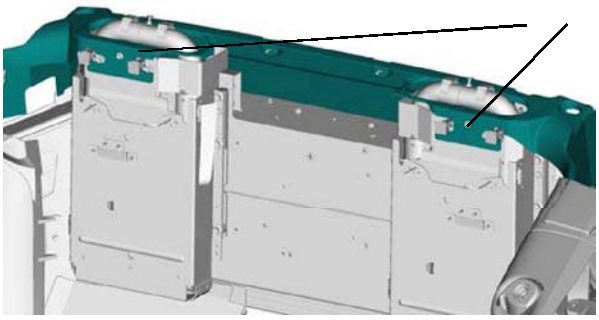
⚠ WARNING ⚠
DO NOT LEAN OVER THE ROLLBARS. IF THE ROLLBARS DEPLOY WHILE SOMEONE IS LEANING OVER THEM, THEY WILL CAUSE SEVERE INJURY.

2. Remove the rear seat bases and backs (Refer to 'Rear Seats', page 1-10-3).
3. Remove the rollbar trim cover.
4. **LH Rollbar unit only.**
   Remove the rear centre console (Refer to 'Rear Trim', page 1-5-5).

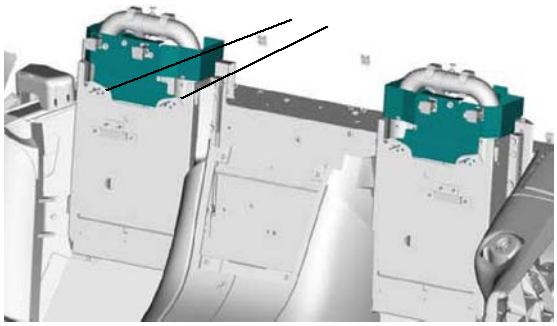
To gain access to the LH ROPS unit wiring harness plug.

5. Disconnect the wiring harness plug.
6. Remove the rear closing panel.

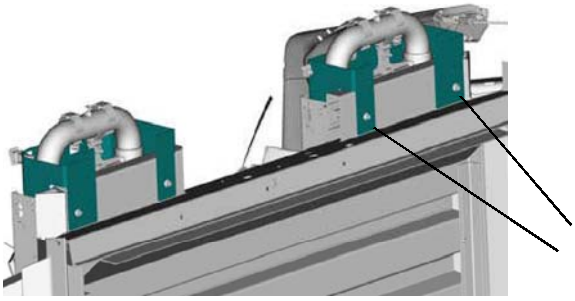




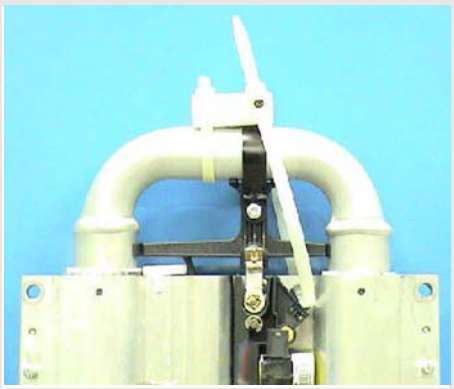
7. Drill out the pop rivits (x2) that secure the seat back bracket to the ROPS unit.



8. Remove bolts (x2 on each) that secure the seat back bracket.



⚠ WARNING ⚠
ENSURE THAT THE DEPLOYABLE ROLLBARS ARE SECURED IN THE LOWERED POSITION.

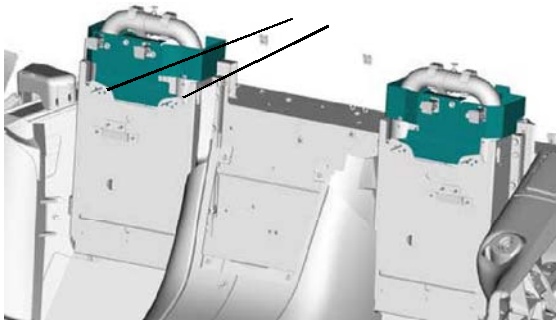


9. Remove bolts x6 that secure the deployable rollbar unit. Withdraw the ROPS unit.

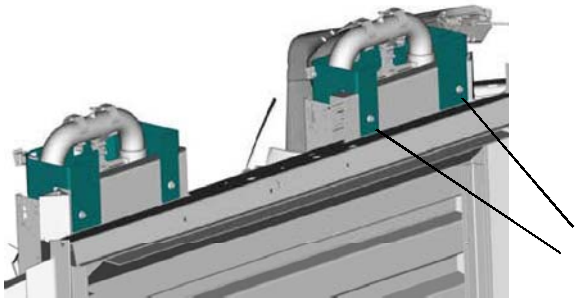
Install

⚠ WARNING ⚠
DO NOT CONNECT THE VEHICLE BATTERY UNITLL THE ROPS UNIT IS FULLY INSTALLED.

1. Install the deployable rollbar unit. Torque bolts (x6) to **20-30 Nm**.
2. Pop rivet (x2) the seat back bracket to the ROPS unit.

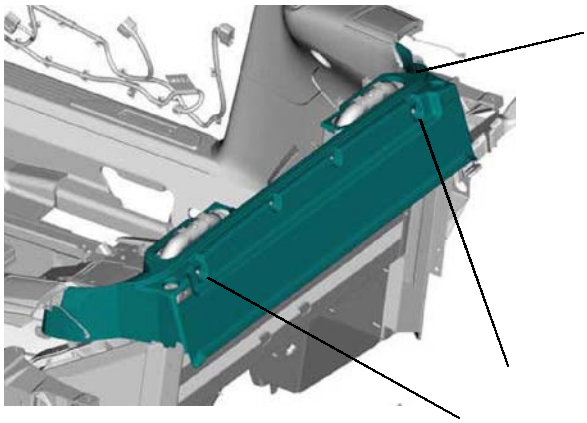


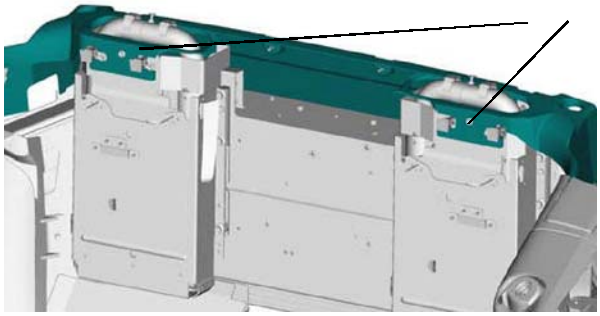
3. Install the bolts (x2) that secure the seat back bracket.



4. Install the rear closing panel.

The two center screws are installed when the 3rd center console trim panel is installed.





5. Connect the wiring harness plug.
6. **LH Rollbar Unit Only.**
   Install the rear centre console (Refer to 'Rear Trim', page 1-5-5).
7. Install the rear seat bases and backs (Refer to 'Rear Seats', page 1-10-3).

Rollbar Sensor

Remove

1. Disconnect the vehicle battery at the negative terminal and ensure the ignition key is removed.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE DEPLOYABLE ROLLBAR SYSTEM.

2. Remove the boot trim to gain access to the rollbar sensor unit.
3. Remove the bolts (x4) that secure the rollbar sensor and bracket assembly.
4. Withdraw the rollbar sensor and bracket assembly to access the wirining harness plug. Disconnect the wiring harness plug.
5. Remove the rollbar sensor unit from its bracket (screws x3).

Install

⚠ WARNING ⚠
DO NOT CONNECT THE VEHICLE BATTERY UNITLL THE ROLLBAR SENSOR IS FULLY INSTALLED.

⚠ WARNING ⚠
ALLOW A TWO MINUTE POWER DOWN PERIOD BEFORE PROCEEDING. THIS WILL ENSURE THAT THERE IS NO POWER TO THE DEPLOYABLE ROLLBAR SYSTEM.

1. Install the deployable rollbar sensor unit to it's bracket. Torque bolts (x3) to **TBA Nm**.
2. Connect the wiring harness plug.
3. Install the bolts (x4) that secure the rollbar sensor and bracket assembly. Torque to **TBA Nm**.
4. Install the boot trim.
5. Connect the vehicle battery at the negative terminal.

Frame and Mounting (02.00)

Contents

Frame and Mounting (02.00)

Subframes (02.01)

Specifications

Torque Figures		
Description	Nm.	lb. / ft.
Subframe to Front Structure	105-125	77.5-92.5
Subframe to Body	105-125	77.5-92.5
Engine Mounts	47	35
Steering Rack	115	85
Torque tube (rear)	43-57	32-42.5
Drive Plate (auto only)	60-85	45-63
Spring and Damper top mounting (rear)	85	63
Rear subframe to Body	175	129.5
Rear subframe reinforcement plates	62	46

Maintenance

Front Subframe

Repair Operation Time (ROT)	
Item	Code
Front Subframe	02.01.AB

Removal

1. Disconnect the vehicle battery.
2. Support the engine from above (Refer to '303-1080 (Engine Support Adaptor)', page 20-1-6).

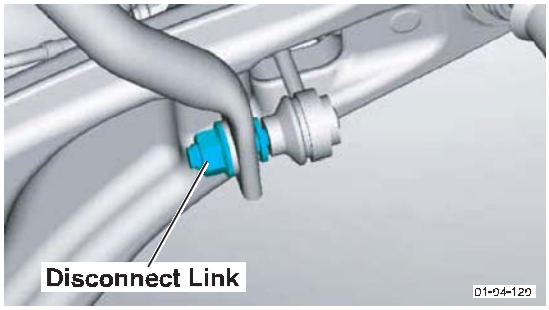
If using a two post vehicle lift, remove the screws that secure the rear section of the road wheel arch liner. Hold back the rear section of the road wheel arch liner to allow the foot of the vehicle lift to be positioned correctly. (Refer to 'Jacking Points', page I-I-IX)

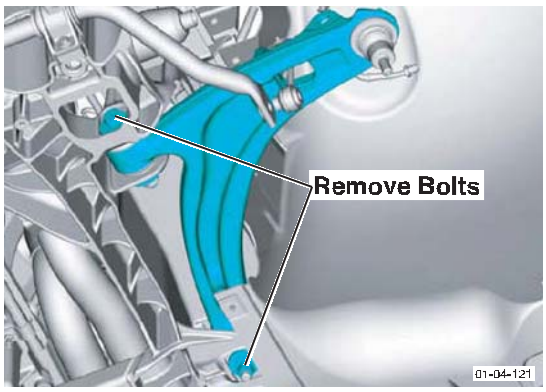
3. Raise the vehicle and make safe.
4. Remove the front road wheels and road wheel arch liners.
5. Remove the undertray.

Lower the undertray to reveal the air intake for the alternator. Release the jubilee clip and part flex pipe from the undertray. Remove the front undertray.

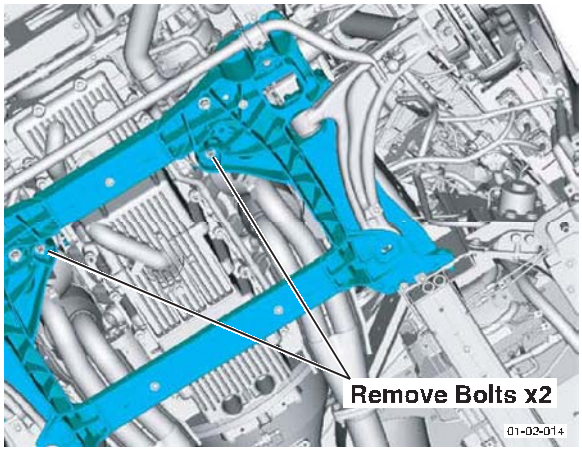
6. Disconnect the lower suspension arms (Refer to 'Front Suspension (04.01)', page 4-1-1).

Disconnect the anti-roll bar from the lower arms. Leave the anti-roll bar attached to the subframe.



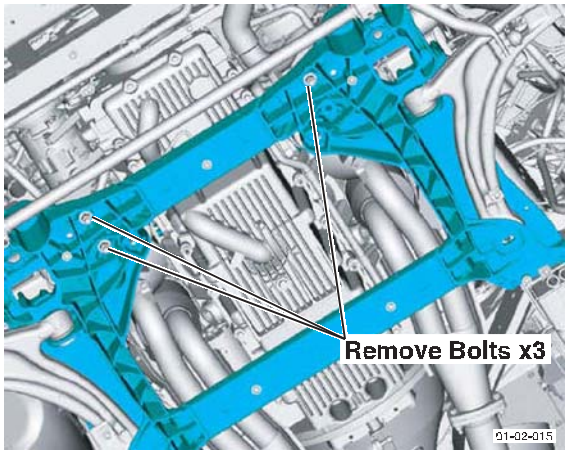


7. Remove bolts (x2) that secure the engine mounts to the subframe.



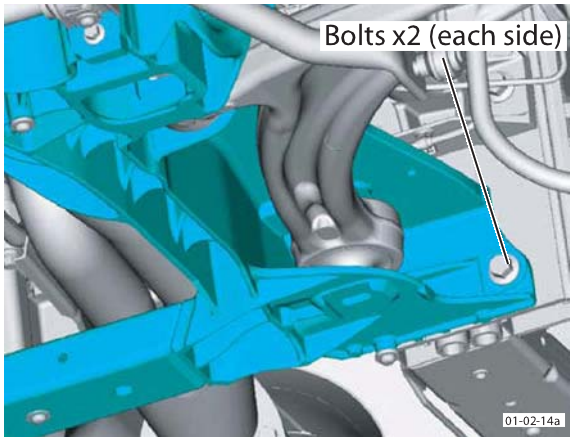
8. Remove bolts (x3) that secure the steering rack to the subframe.

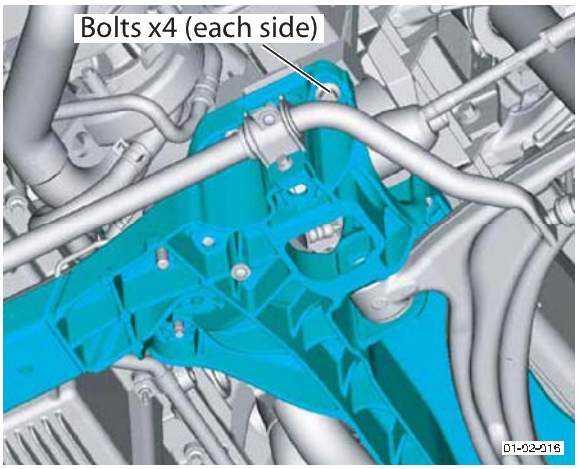
Cable-tie the steering rack in position.



9. Support the subframe.
10. Ensure that the relation of the subframe to the front structure and the vehicle body is marked (scribed), for accurate installation.

11. Remove bolts (x12) that secure the subframe to the body and the front structure.
    Withdraw the subframe.





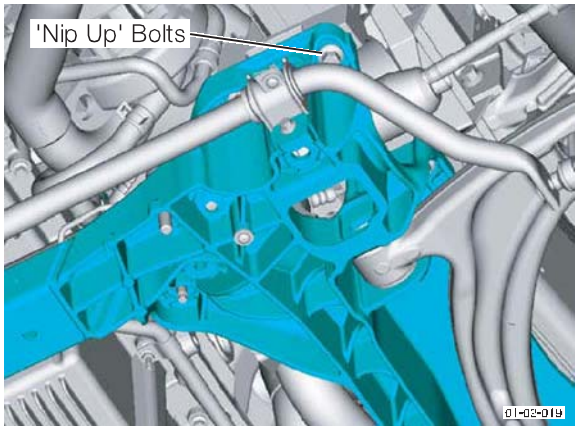
Installation

1. Raise the subframe to the front structure. Install the subframe mounting bolts (x12).

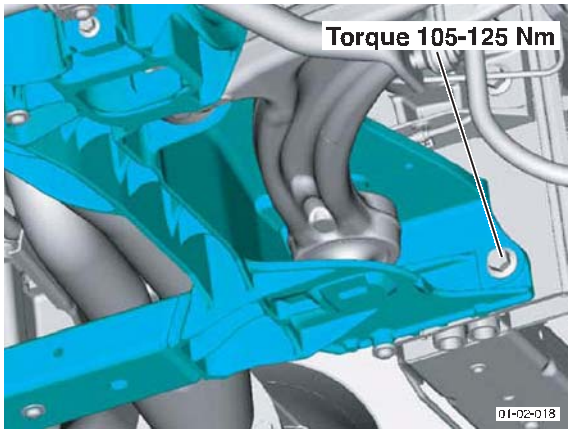
Ensure that the subframe to the front structure and the vehicle body alignment marks are lined up.

Tighten the bolts in three stages:

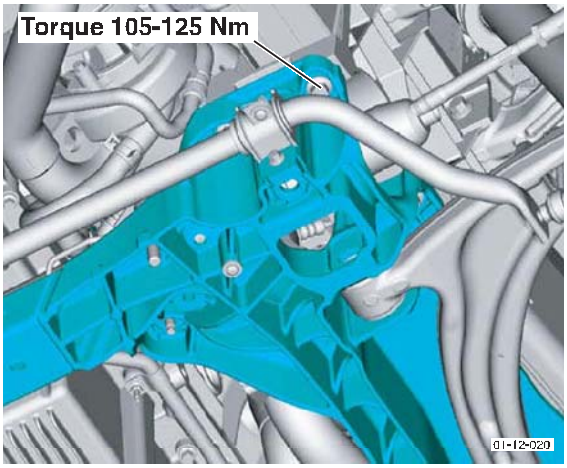
1 'Nip-up' the bolts that secure the subframe to the front structure.



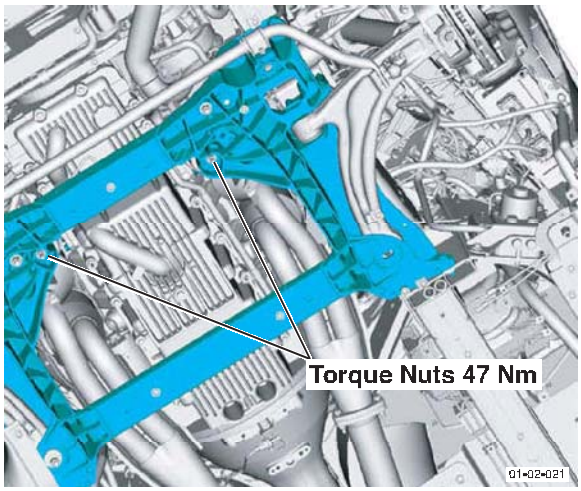
2 Torque the bolts that secure the subframe to the body to **105-125 Nm**.



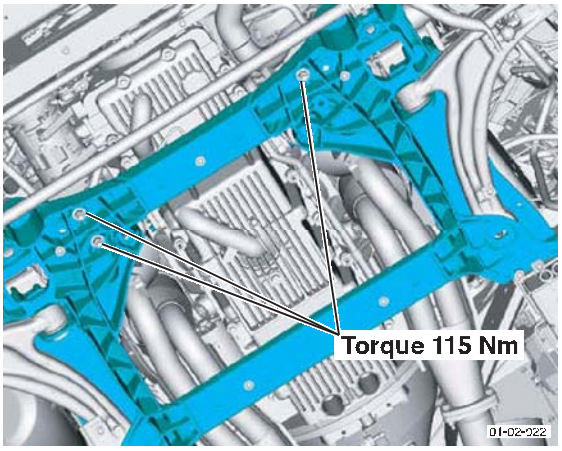
3 Torque the bolts that secure the subframe to the front structure to **105-125 Nm**.



2. Install the engine mount nuts (x2). Torque nuts to **47 Nm**.



3. Install the steering rack bolts (x3). Torque bolts to **115 Nm**.
   Release the 'Ty-wraps' on the steering rack.



4. Install the lower suspension arms (Refer to 'Front Suspension (04.01)', page 4-1-1).

The bolts that secure the lower suspension arm must be torqued only when the vehicle is at normal ride height (Refer to 'Road Wheel Alignment (04.00)', page 4-0-2).

5. Remove the engine support service tool.
6. Install the undertray.
7. Install the road wheel arch liners and road wheels. (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).
8. Connect the vehicle battery.
9. Check / Adjust the camber, Toe and Castor settings (Refer to 'Road Wheel Alignment (04.00)', page 4-0-2).

Rear Subframe

Repair Operation Time (ROT)	
Item	**Code**
Rear Subframe	02.01.CA

Removal

1. Disconnect the vehicle battery.

⚠ WARNING ⚠
IF RASING VEHICLE ON A 'TWO POST' RAMP (VEHICLE SUPPORTED BY UNDERBODY), ENSURE THAT THE REAR END OF THE VEHICLE IS SECURELY STRAPPED TO THE RAMP. FAILURE TO STRAP THE REAR OF VEHICLE DOWN MAY LEAD TO THE VEHICLE FALLING OFF THE RAMP.

Caution
If using a two post vehicle lift, remove the screws that secure the rear section of the road wheel arch liner. Hold back the rear section of the road wheel arch liner to allow the foot of the vehicle lift to be positioned correctly (Refer to 'Jacking Points', page I-I-IX).

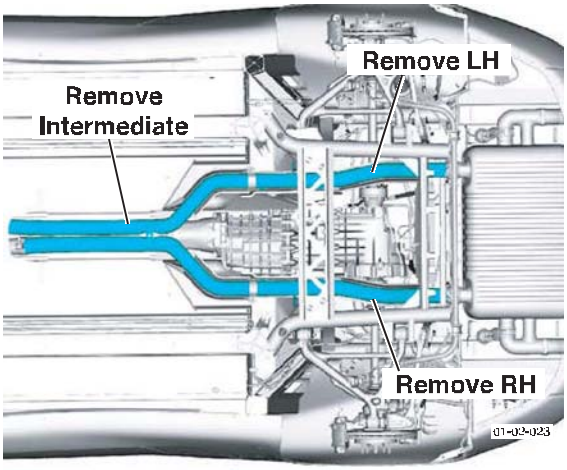
2. Raise the vehicle and make safe.
3. Remove the rear road wheels and road wheel arch liners.

The fuel filler drain off pipe is attached to the arch liner. Ensure that the fuel filler drain off pipe does not disconnect from it's stub pipe.

4. Remove the following:
   - Front and rear undertrays

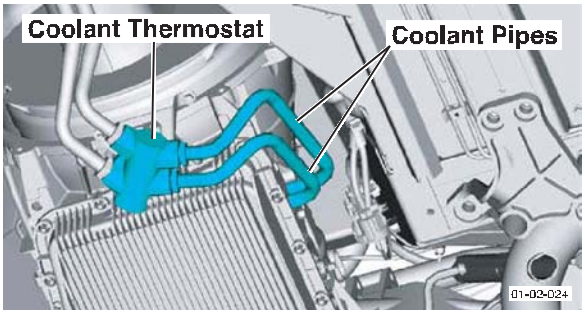
Lower the undertray to reveal the air intake for the alternator. Release the spring clip and part the flex pipe from the undertray.

   - Shear plate
5. Remove the intermediate exhaust pipe and the rear LH and RH exhaust pipes (Refer to 'Pipes and Supports (09.03)', page 9-3-1).

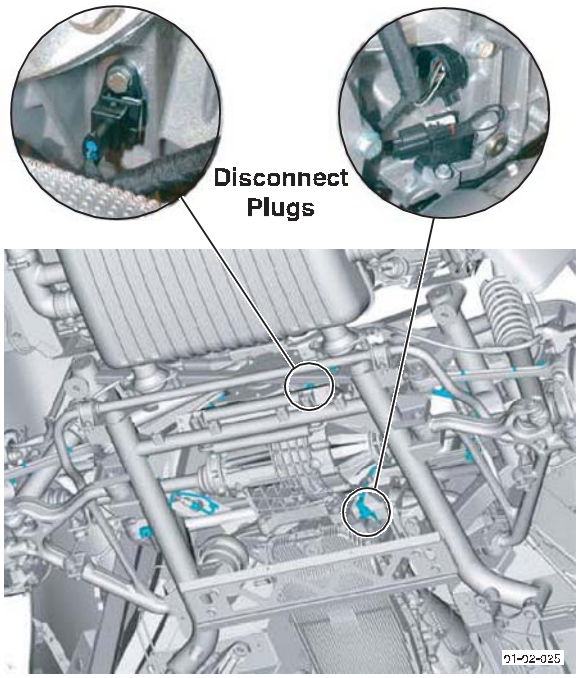


6. Remove the silencer assembly.
7. **Automatic Gearbox Only.**
   Remove the gearbox coolant pipes.
   7.1 Remove the coolant thermostat from it's mounting bracket.
   7.2 Disconnect the coolant pipes from the gearbox.
   7.3 Cap the pipes open ends.

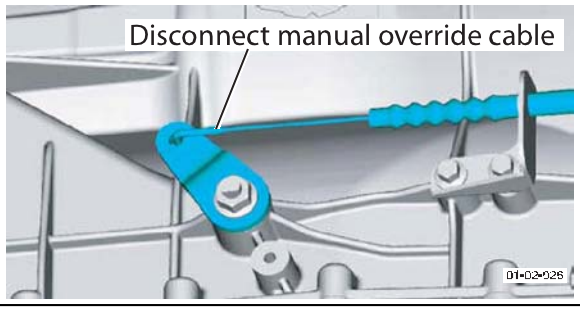
Gearbox ends are self sealing.



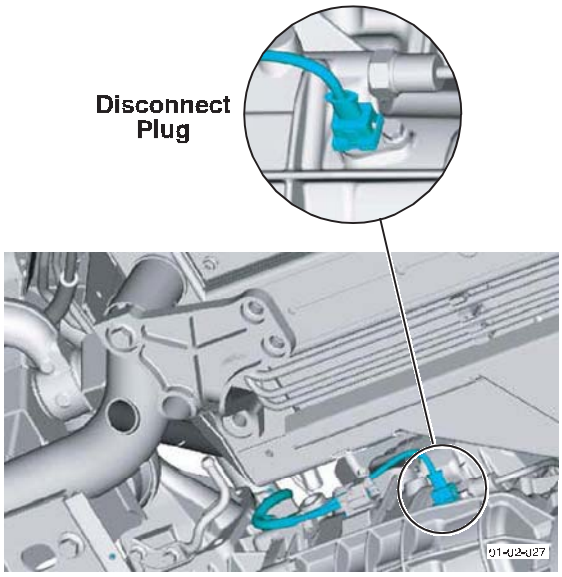
8. **Automatic Transaxle Only.**
   Disconnect the following from the transaxle:
   • Wiring harness plugs



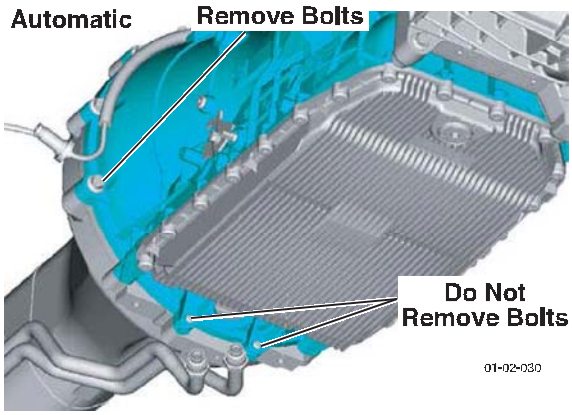
   • Manual override cable

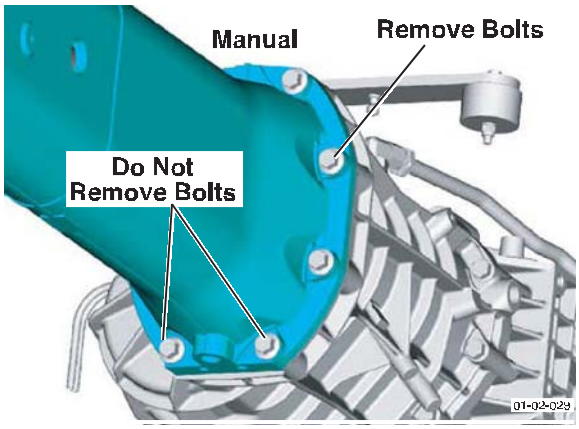


9. **Manual Transaxle Only.**
   Disconnect the wiring harness plug.

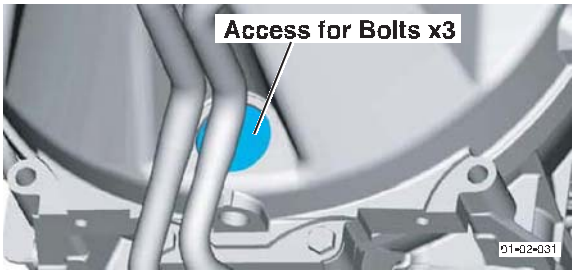


10. Remove accessible bolts from around the torque tube.
    Do not remove the lower bolts (x2) facing towards the gearbox.

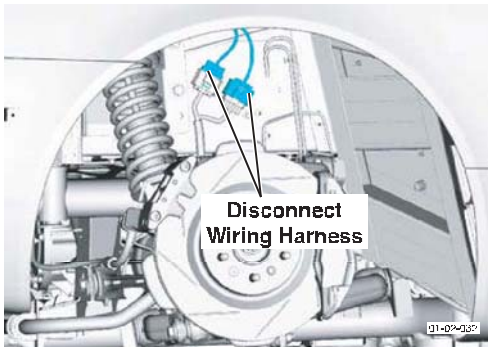




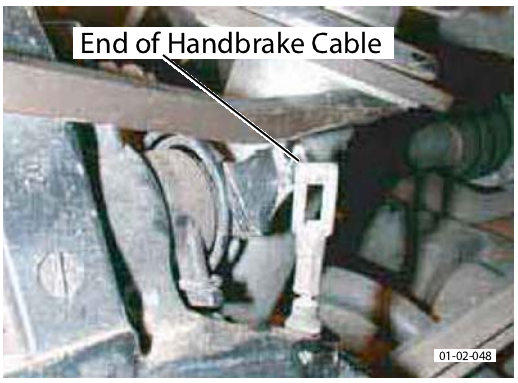
11. **Automatic Transaxle Only.**
    Remove the bolts (x3) that secure the torque tube drive plate to the torque converter.



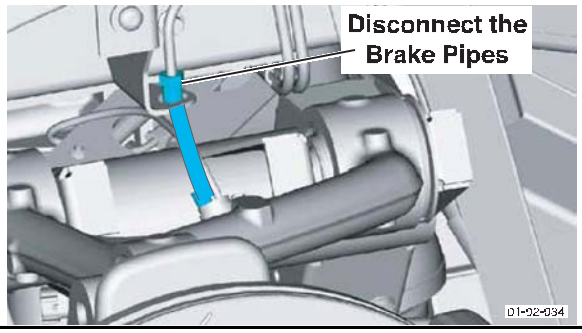
12. Disconnect the subframe wiring harness.



13. Disconnect the handbrake cable from the calipers and subframe (Refer to '206-103 (Handbrake Cable Removal)', page 20-1-4).



14. Disconnect the brake pipes.



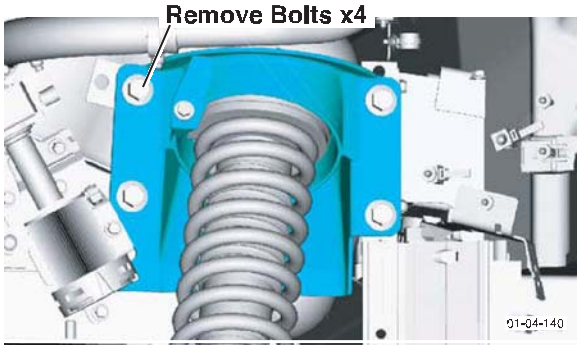
Caution
Brake fluid must not be allowed to contact vehicle paint work. Remove spilt brake fluid from paint work by rinsing away with running water.

15. Position the subframe trolley (Refer to '303-F715 (Multi-purpose Trolley) x2', page 20-1-5) under the subframe. Lower the vehicle until the subframe rests on the subframe support.

16. Remove bolts (x4) that secure the spring and damper units.

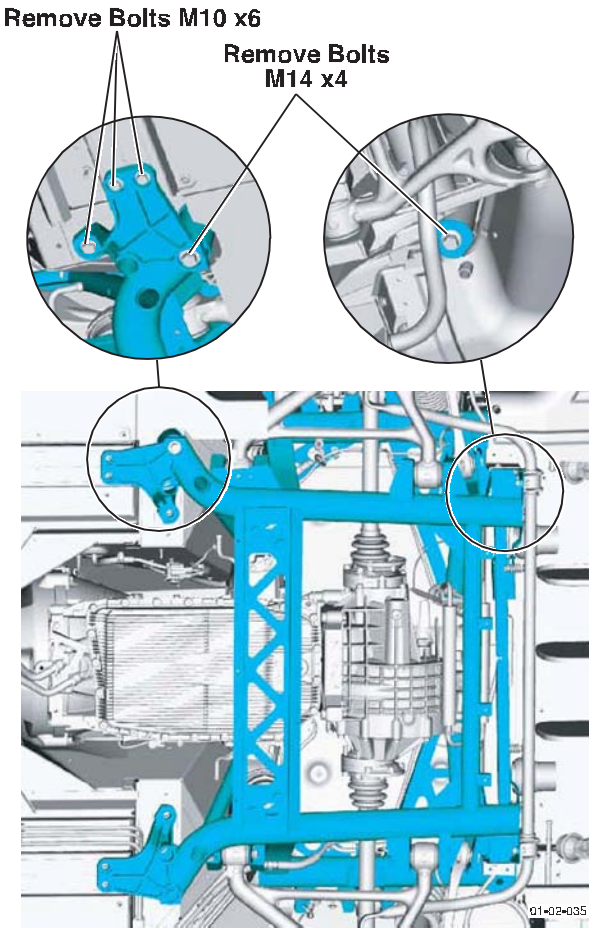
Ensure the spring and damper assemblies are fully extended to release spring tension. A small amount of tension will remain.

Lever spring and damper mounting turret against spring tension to allow removal of bolts.



17. Remove the subframe securing bolts.

The anti-roll bar must be removed before the two rear bolts can be completely removed.



18. **Manual Transaxle only.**

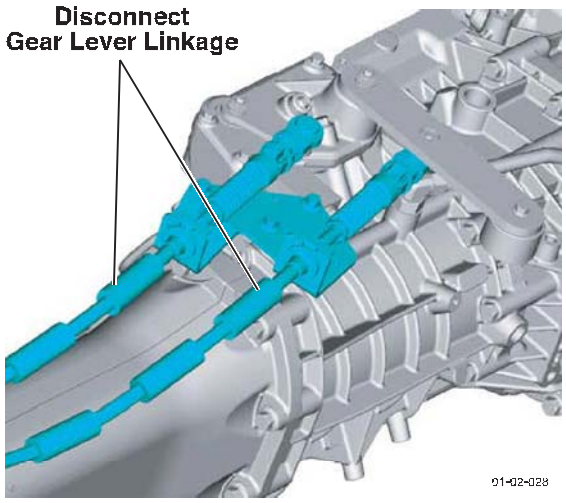
Raise the vehicle to allow access to disconnect the gear selector cables.

Use the service tool (Refer to '501-F116 (IP Removal)', page 20-1-8) to remove the horseshoe clips (x2) and lever the cables from the ball joints.

Caution

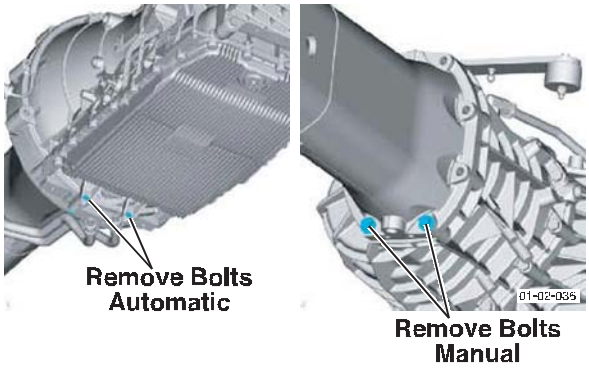
There is a risk of bending the end of the cable. Lever cable from ball joint at a point closest to the ball joint.

Ensure the vehicle raises without catching pipes, cables, etc.



19. Raise the vehicle for access and remove the bolts that secure the torque tube to the gearbox.

Ensure the vehicle raises without catching pipes, cables, etc.



20. Move the subframe rearwards on its support to give a clearance between the torque tube and the gearbox.

Slowly raise the vehicle from the subframe.

Ensure the vehicle raises without catching pipes, cables, etc.

21. **Automatic Gearbox Only.**
    Install a torque converter transit bracket.
22. Retain the spacers from each rear subframe mounting pad. These should be installed in the same positions when the subframe is installed.
23. If required, remove the transaxle from the subframe (Refer to 'Transmission (07.00)', page 7-1-1)

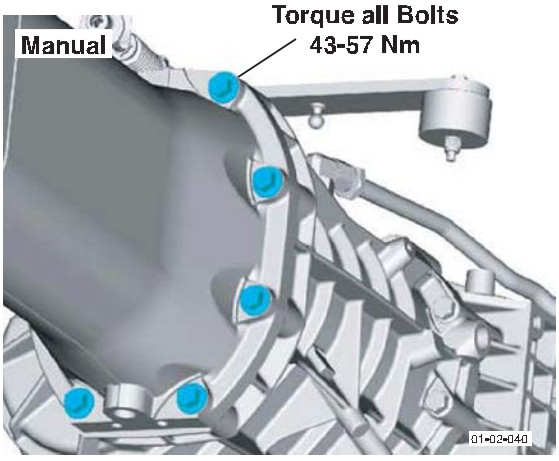
Installation

1. If removed, install the transaxle.
   - Automatic (Refer to 'Automatic Transaxle (07.01)', page 7-1-2)
   - Manual (Refer to 'Manual Transmission (07.03)', page 7-3-1).
2. Ensure the spacers from each rear subframe mounting pad are located correctly.
3. Lower the vehicle to the subframe.

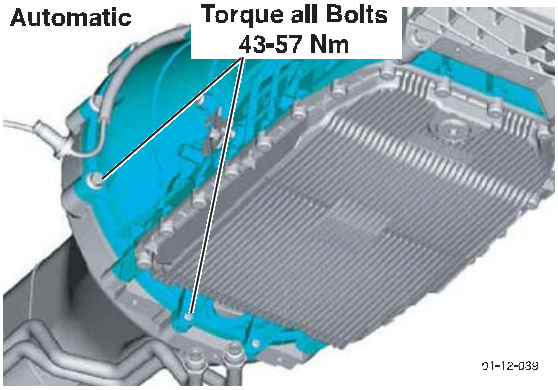
Ensure the vehicle lowers without catching pipes, cables, etc.

Ensure the suspension assembly is placed slightly to the rear of the final position. This will enable installation to the torque tube.

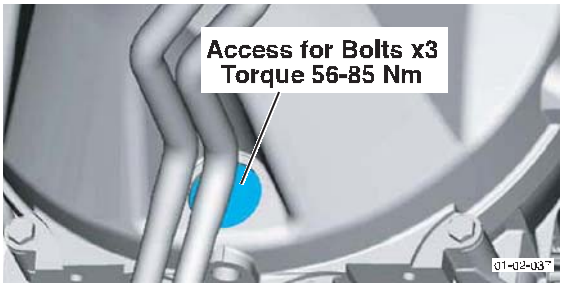
4. **Manual Gearbox Only.**
   Install the gearbox to the torque tube.
   4.1 Lower the vehicle to enable the gearbox to line up with the propshaft splines.
   4.2 Move the subframe forward. Engage the gearbox to the propshaft splines.
   4.3 Install the bolts around the torque tube. Torque to **43-57 Nm**.



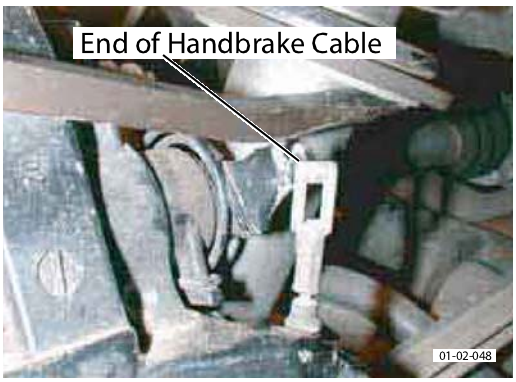
5. **Manual Gearbox Only.**
   Install the gear selector cables.
6. **Automatic Gearbox Only.**
   Install the gearbox to the torque tube.
   6.1 Remove the torque converter transit bracket.
   6.2 Move the subframe forward. Place the torque converter to the torque tube drive plate.
   6.3 Install the bolts around the torque tube. Torque to **43-57 Nm**.



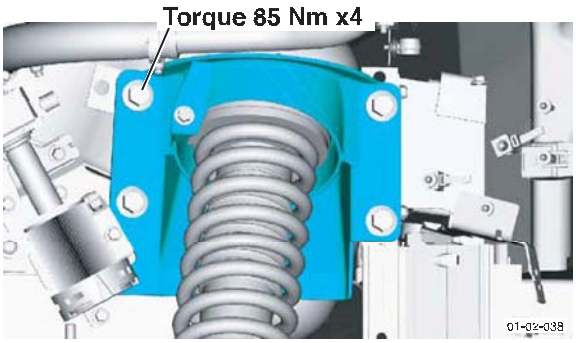
7. **Automatic Gearbox Only.**
   Connect the drive plate.
   7.1 Install bolts (x3). Torque bolts to **60-85 Nm**.



8. Install the handbrake cable to the subframe and the calipers.

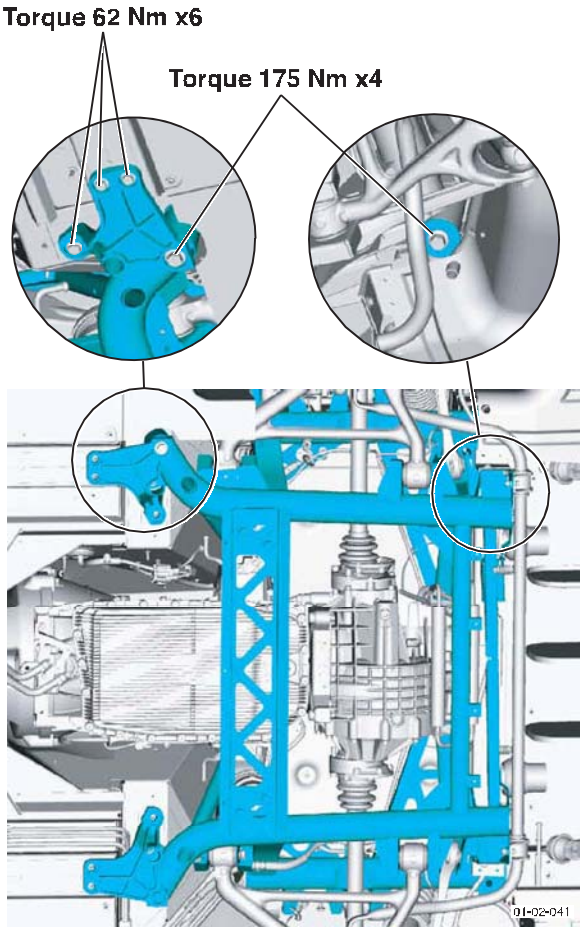


9. Install the spring and damper units.
   9.1 Lower the vehicle to line up the spring and damper mounts to the body.
   9.2 Install bolts (x4) to each mount. Torque to **85 Nm**.



10. Lower the vehicle to meet the subframe mounts.
    Install bolts (x4) that secure the subframe to the body. Torque bolts to **175 Nm**.

If the anti-roll bar was removed ensure the two rear bolts are installed.



11. Install the subframe reinforcement plates. Torque bolts to **62 Nm**.
12. Connect the subframe wiring harness plugs.
13. **Automatic Gearbox Only.**
    Install to the gearbox:
    - Manual override cable
    - Coolant pipes
    - Wiring harness plugs
    - Breather pipe
14. **Manual Gearbox Only.**
    Install the wiring harness plugs.

Caution
Brake fluid must not be allowed to contact vehicle paint work. Remove spilt brake fluid from paint work by rinsing away with running water.

15. Connect the brakes pipes.
16. Install the exhaust system.
17. Install the front and rear undertrays and the shear plate.
18. Bleed the brakes. (Refer to 'Brake Bleeding - AMDS', page 6-6-4).
19. Install the road wheel arch liners.

The fuel filler drain off pipe is attaches to the arch liner.

20. Install the road wheels (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).
21. Remove the vehicle securing strap, if installed.
22. Connect vehicle battery.

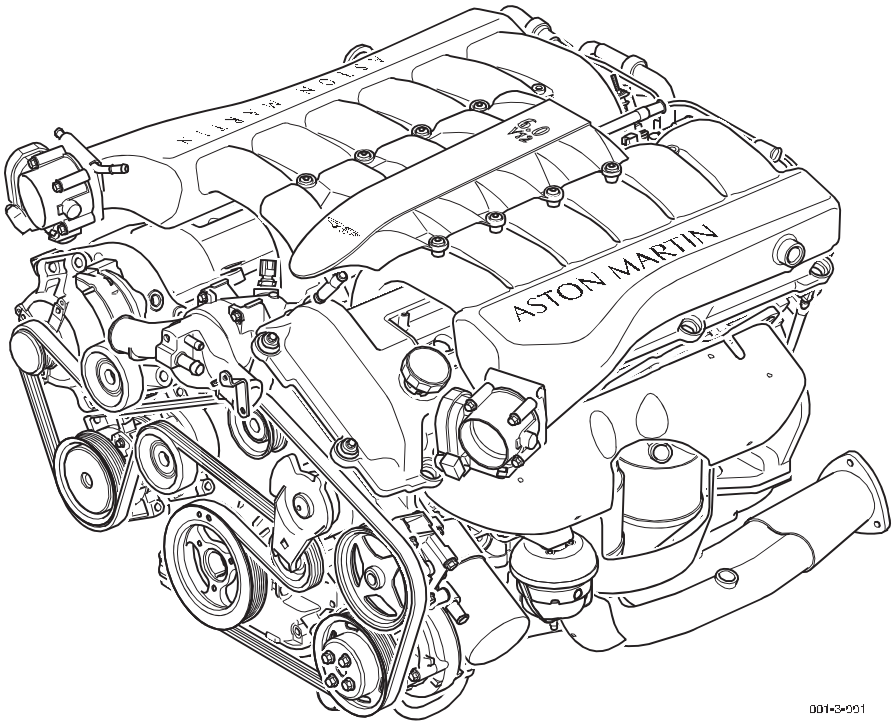
Engine System (03.00)

Contents

Engine (03.00)

Engine Assembly (03.00)

Description



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

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

The engine runs on unleaded fuel only.

Maintenance

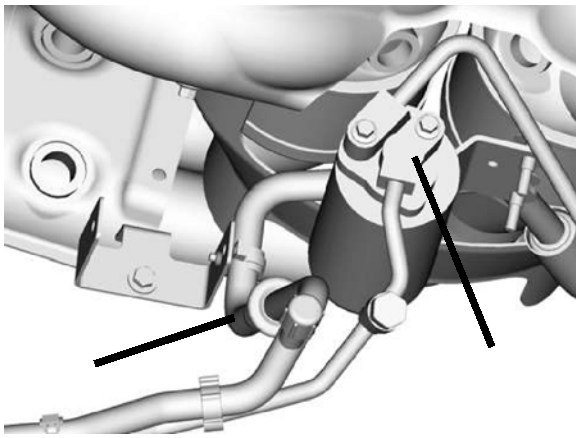
Engine

Repair Operation Time (ROT)	
Item	**Code**
Engine Remove and Install	**03.00.AA**
Including engine Remove from the frame	

Remove

To remove the engine from the vehicle, the complete power train will be removed.

1. Disconnect the earth ('- ve) terminal from the vehicle battery.
2. Evacuate the A/C unit (Refer to 'Air Conditioning (A/C) System (12.03)', page 12-3-1).
3. Disconnect the A/C pipes.

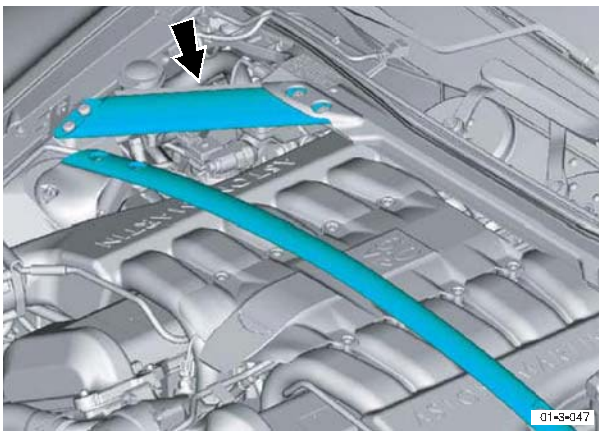


4. Drain the coolant (Refer to 'Coolant Drain / Fill', page 3-3-3).

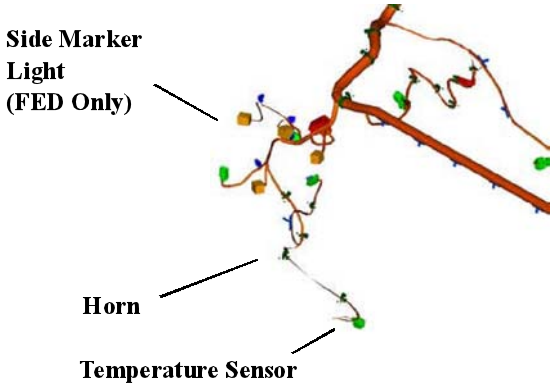
Caution

Before removing the engine bay corner cross-braces ensure that the at the vehicle is resting on it's roadwheels.

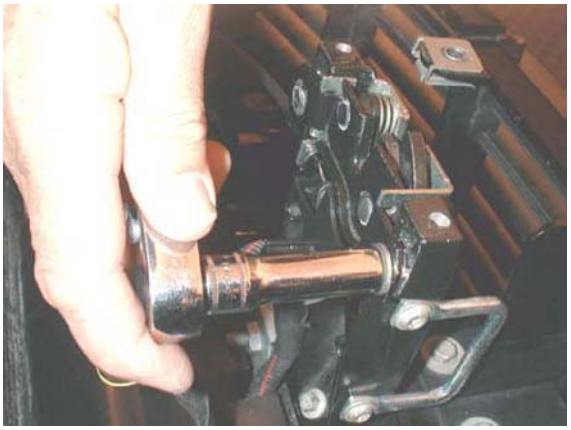
5. Remove the engine bay **corner** cross-braces. Do not remove the engine bay cross brace.



6. Remove the washer bottle neck bracket.
7. Remove the 'slam' panel.
8. Withdraw the plastic cover and disconnect the forward wiring harness plugs.



9. Remove the bonnet release cable.



10. Disconnect the following from the forward cross member.
    - The reinforcement struts

    - The 'Jump start' plug

    - The power steering reservoir

11. **Manual Gearbox Only.**
    Disconnect the clutch pipe.

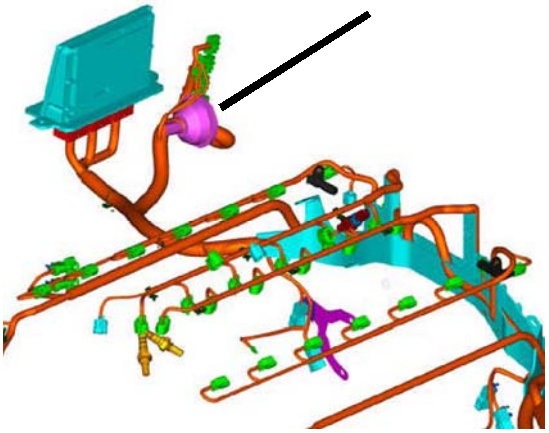
12. Remove the bolts and the reinforcement brackets from the inner wing.

Remove the header tank to gain access. There is a wiring harness plug connected to the header tank on the under side.

13. Centre the steering wheel. Remove the ignition key and engage the steering lock with the wheel as accurately centred as possible.

If you do not centre the steering wheel,the restraint bag clock-spring can be damaged and it can be difficult to align the steering wheel in the straight-ahead position.

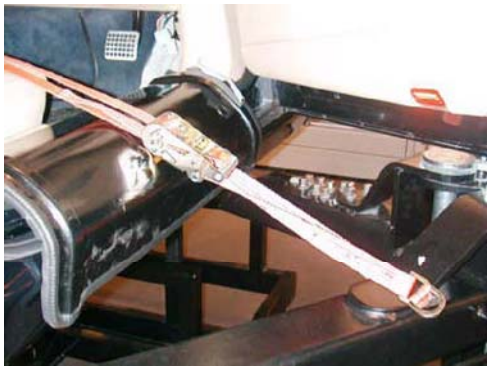
14. From inside the cabin, pull back the steering colum bulkhead seal. Remove the pinch bolt that attaches the upper column to the intermediate shaft.
15. Disconnect the engine harness from inside the vehicle cabin.



16. Lift the vehicle and make it safe.

Remove the screws that attach the rear section of the road wheel arch liner. Hold back the rear section of the road wheel arch liner to allow the foot of the vehicle lift to be positioned correctly.
(Refer to 'Jacking Points', page I-I-IX).

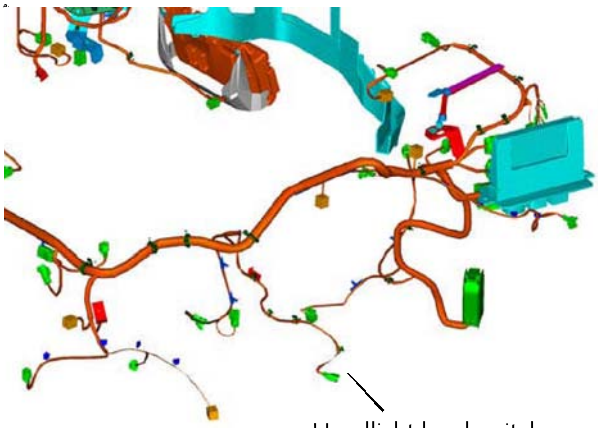
Caution
MAke sure that the vehicle is 'strapped' to the lift.



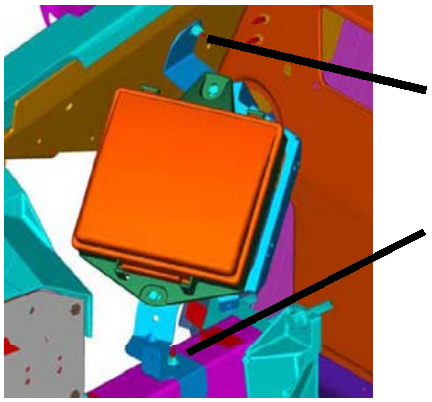
17. Remove the undertrays and the shear plates.

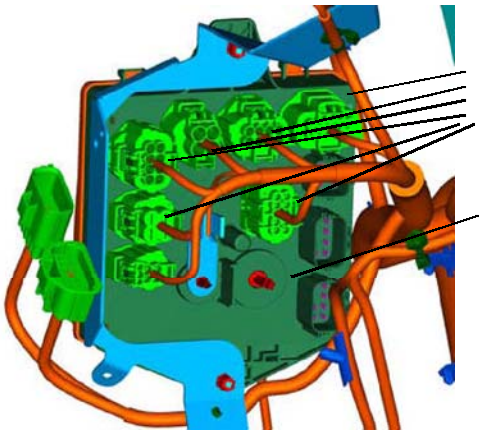
Record the positions of the (x4) spacers when removing the front shear plate.

18. Remove all of the road wheels and the arches.
19. Remove the air filter boxes.
20. Remove the front bumper.
21. Disconnect the lower mount for the headlight units.
22. Disconnect the forward wiring harness plugs that follow:
    - Fan pack
    - Headlight levelling sensor
    - MAF sensor
    - ABS speed sensor
    - Header tank level sensor



24. Remove the engine bay fusebox and bracket.





25. Disconnect the earth points from the bulkhead. Make a mark on the leads at the clean earth studs.

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

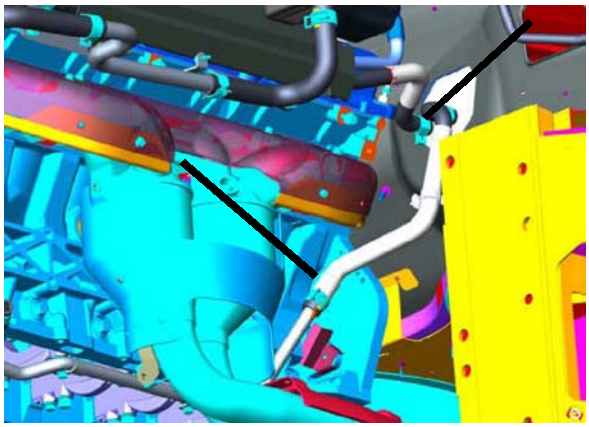
- Right Hand side

- Left Hand Side

26. Remove the PCMs. Disconnect the engine wiring harness plugs and remove the three screws that secure the PCM (each side).
27. Move the removed engine wiring harness plugs into the engine bay and attach them to the engine cross brace.

28. Remove the brake booster vacuum pipe
29. Disconnect the heater coolant pipes.

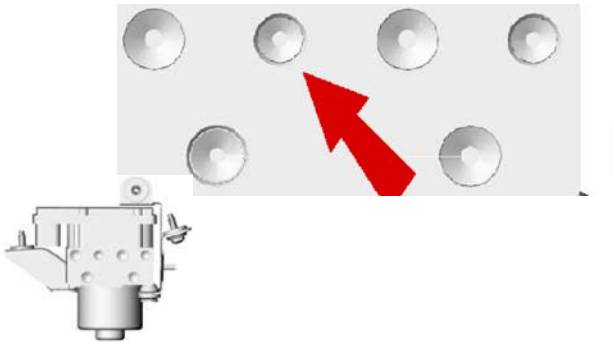
On LH drive vehicles, the heater coolant pipes go into the bulkhead on the right side.



30. Disconnect the front brake pipes:

Caution
Do not let brake fluid touch the vehicle paint work. Flush all spilled brake fluid from paint work with water.

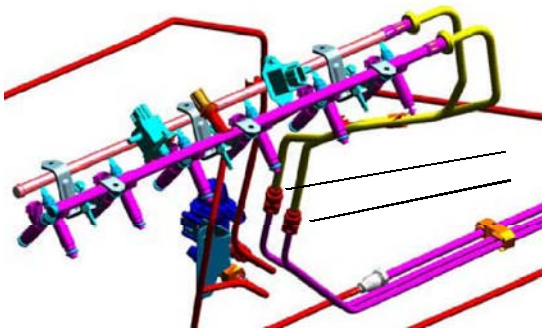
30.1 Disconnect the brake pipe from the brake modulator to the left front brake caliper.



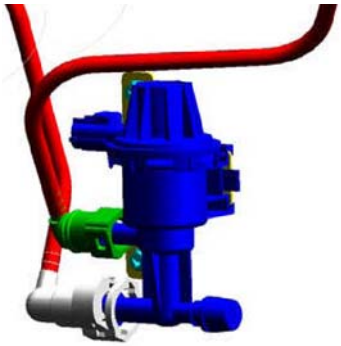
30.2 Disconnect the brake pipe in the right wing.

31. Remove the intermediate steering shaft.
    31.1 Remove the lower pinch bolt. Open the lower mount.
    31.2 Pull the intermediate steering shaft downwards and remove.

32. Disconnect the fuel lines.



33. Remove the VMV to the inlet manifold pipe from the VMV.



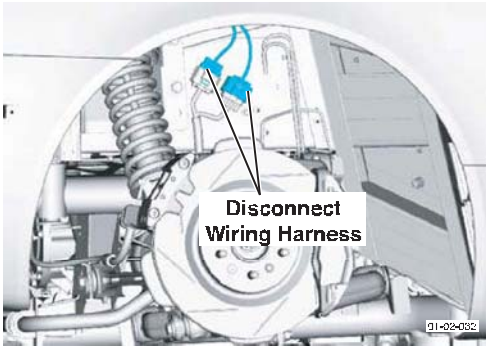
34. Disconnect the torque tube to the body (engine) earth lead.
35. Disconnect the Starter/Alternator/Jump terminal cable from the chassis.

36. Disconnect the silencer from the two rear exhaust pipes.

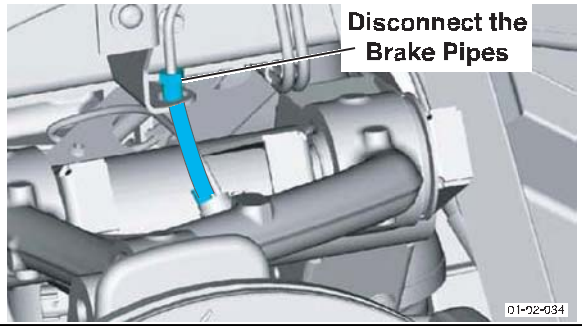
37. Disconnect the handbrake cable from the rear subframe (Refer to 'Hand Brake (06.05)', page 6-5-1).

Use the brake cable release tool (Refer to '206-103 (Handbrake Cable Removal)', page 20-1-4).

38. Disconnect the subframe wiring harness.



39. Disconnect the rear brake pipes.



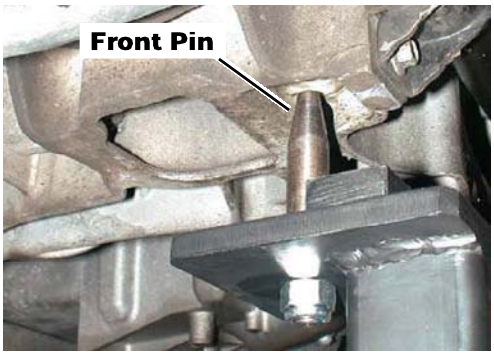
Caution
Do not let brake fluid touch the vehicle paint work. Flush all spilled brake fluid from paint work with water.

40. Remove the rear brake pipe brackets.

41. **Automatic Gearbox Only.**
Disconnect the manual override cable.

42. Put the front and rear subframe trolleys (Refer to '303-F715 (Multi-purpose Trolley) x2', page 20-1-5) in position under the subframes. Lower the vehicle until the front and rear subframes are on the subframe trolleys.

Connect the two trolleys together (Refer to '303-F715-06 (Trolley Brace Bars)', page 20-1-5).

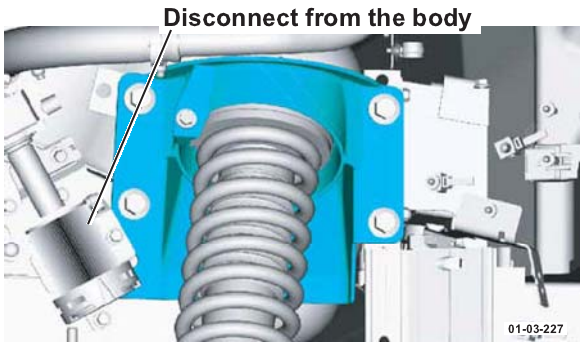


Rear Pin Image to Follow

43. Put scribe marks to show the relation of the front subframe and front structure to the vehicle body for accurate Install.
44. Remove the bolts (x12) that attach the front subframe and front structure to the body.

Image to Follow

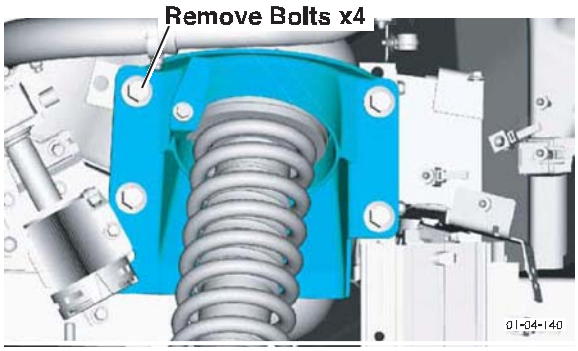
45. Remove the bolts (x3) that attach the emmisions filter unit. This will give access to the top mount of the spring and damper unit.



46. Remove the bolts (x4) that attach the rear spring and damper units.

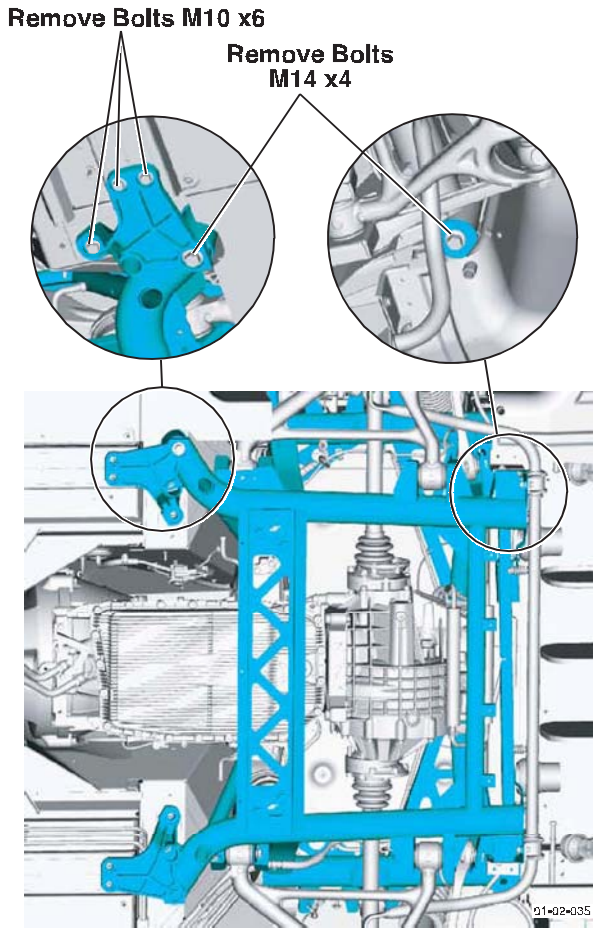
Make sure that the rear spring and damper assemblies are fully extended to release spring tension. A small amount of tension will remain.

Lever the mounting turret of the rear spring and damper against the spring tension to let you remove the bolts.



47. Remove the bolts that attach the rear subframe.

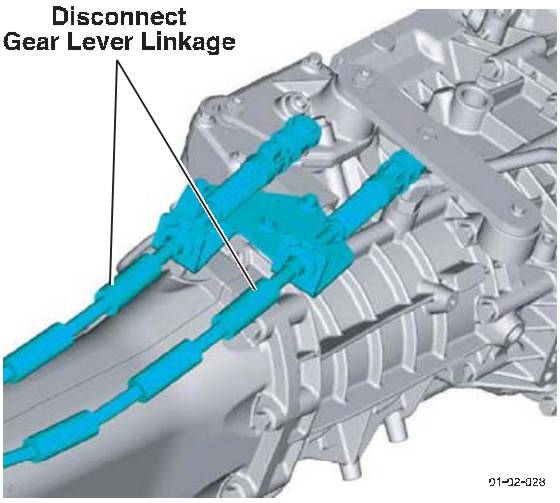
You must remove the anti-roll bar before the two rear bolts can be fully removed.



48. **Manual Transaxle only.**
Lift the vehicle to get access to disconnect the gear selector cables.
Use the service tool (Refer to '501-F116 (IP Removal)', page 20-1-8) to remove the horseshoe clips (x2) and then prise the cables from the ball joints.

Caution
Prise the cable from the ball joint close the ball joint. If you do not do this, you can bend the end of the cable.

When you raise the vehicle, make sure that all cables and pipes do not catch.



49. Slowly lift the vehicle.
When the vehicle lifts, disconnect the wings from the front grill.

When you raise the vehicle, make sure that all cables and pipes do not catch.

On LH drive vehicles - make sure that the coolant pipe is in front of the brake booster.

50. Keep the spacers from each rear subframe mounting pad. You must install them in the same positions when you install the subframe.

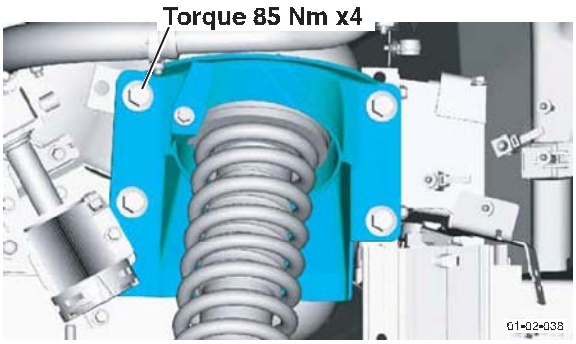
Install

1. Lower the vehicle on to the powertrain assembly.
   Make sure that all pipes and cables are not caught as you lower the vehicle.
   While the vehicle lowers, pull the wings from thefront grill.

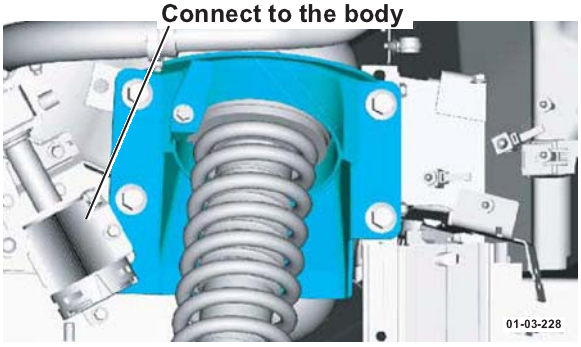
2. Install the rear spring and damper assemblies. Do not tighten the bolts.
3. Install the front subframe and front structure mounting bolts (x12). Do not tighten.
4. Install the rear subframe mounting bolts (x4). Do not tighten.

Install the spacers from rear subframe mounting pads in the same positions that you removed them.

5. Install the reinforcement plates for the rear subframe.
6. Torque-tighten the rear spring and damper assemblies to **85.5 Nm**.



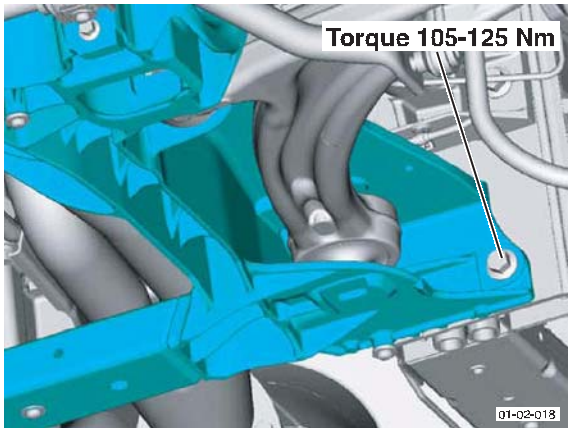
7. Install the emmisions filter unit.



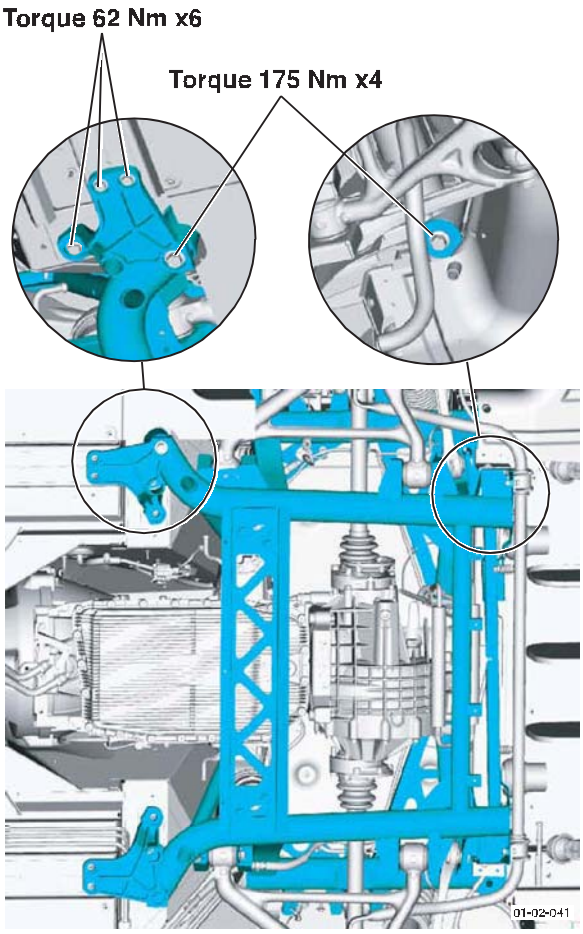
8. Torque-tighten the front subframe and front structure bolts:

Align the marks on the front subframe and front structure to the body.

Torque-tighten the bolts (x12) to **105-125 Nm**.



9. Torque-tighten the rear subframe mounting bolts:
   1 Torque-tighten the bolts that attach the subframe to the body to **175 Nm**.
   2 Torque-tighten the bolts that attach the subframe reinforcement plates to **62 Nm**.



10. Connect the rear subframe wiring harness.

11. **Automatic Gearbox Only.**
    Install the manual override cable.
12. **Manual Gearbox Only.**
    - Install the gear change linkage
    - Install the wiring harness plugs
13. **Manual Gearbox Only.**

Caution
Do not let clutch fluid touch the vehicle paint work. Flush all spilled clutch fluid from paint work with water.

    Install the clutch pipe.
14. Install the brake pipes:

Caution
Do not let brake fluid touch the vehicle paint work. Flush all spilled brake fluid from paint work with water.

    - Install the LH front brake caliper pipe to the modulator
    - Install the rear brake pipe brackets.
    - Install the brake pipes to all remaining brake calipers.
15. Install the handbrake cable to the handbrake lever
16. Connect the earth lead from the torque tube to the body.
17. Connect the Starter/ Alternator/ Jump terminal cable to the body.

18. Install the heater coolant pipes.
19. Connect the VMV.
20. Connect the fuel lines.
21. Install the headlight units (Left and Right).
22. Install the two air filter boxes.
23. Install the PCMs. Connect the engine wiring harness plugs.
24. Connect the forward wiring harness plugs that follow.
    - Fan pack
    - Headlight levelling sensor
    - MAF sensor
    - ABS speed sensor
    - Header tank level sensor
25. Connect the earth points to the bulkhead.
    - Right side

    - Left Side

26. Install the steering intermediate shaft.
27. Install the fusebox.
    27.1 Connect the wiring harness plugs.
    27.2 Connect the main power feed.
    27.3 Install the fusebox bracket and the fusebox.
28. Install the power steering reservoir.
29. Install the jump-start cable.
30. Install the A/C pipes.
31. Install the bolts and the reinforcement struts along the inner wings.
32. Install the header tank.

Caution
Before you install the engine bay cross-braces, the vehicle must be on it's roadwheels.

33. Install the engine bay corner cross braces. **Do not tighten** at this step.
34. Install the front bumper.
35. Install the arch liners for the road wheels.
36. Install the items that follow:
    - The front and rear undertrays
    - The shear plates

Install the spacers (x4) on the front shear plates in the positions recorded during Remove.

37. Bleed the brakes (Refer to 'Brake Bleeding - AMDS', page 6-6-4).
38. Install the road wheels (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).
39. Torque-tighten the engine bay cross-braces to **49 Nm.**
40. Fill the coolant (Refer to 'Coolant Drain / Fill', page 3-3-3)

41. Charge the A/C unit (Refer to 'Air Conditioning (A/C) System (12.03)', page 12-3-1).
42. Check the road wheel alignment (Refer to 'Road Wheel Alignment (04.00)', page 4-0-2).

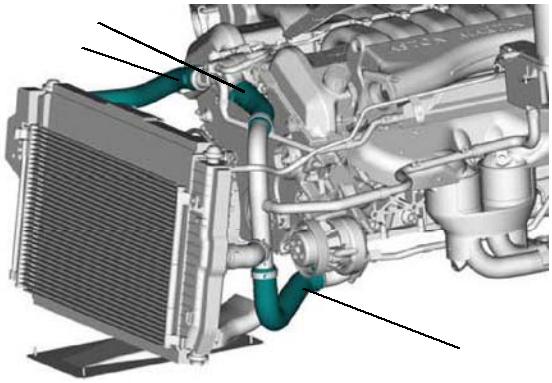
Always use WDS to check the steering angle sensor after you do work on the steering or the suspension systems or the yaw rate sensor.

43. Connect the vehicle battery.

Engine Remove from the Frame

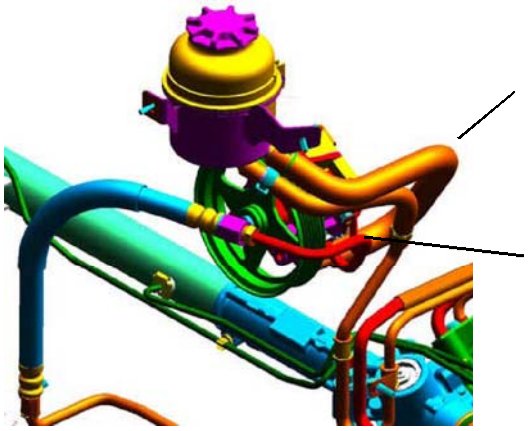
Remove

1. Release the exhaust manifolds from the catalysts.
2. Remove the hoses that follow:

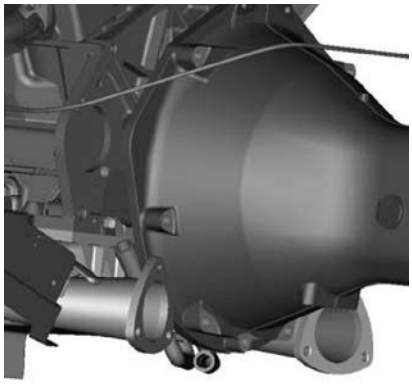


3. Disconnect the A/C pipe from the condenser.
4. Remove the hose from the header tank.

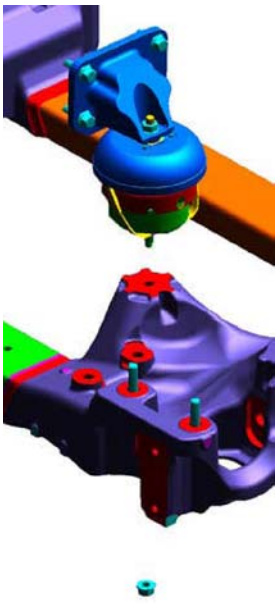
5. Disconnect the cables from the starter motor and the alternator.
6. Remove the power steering pump hoses.



7. Attach the lifting eyes (x4) to the cylinder heads.
8. Attach the engine lifting gear to an applicable hoist.
9. Lift the hoist to tension the lifting gear.
10. Remove the torque tube.
    10.1 Make sure that the torque tube is supported.
    10.2 Remove the bolts that attach the torque tube to the engine block.
    10.3 Make sure that the torque tube and the engine are correctly supported. Move the engine frame and the hoist forward until there is room to move the torque tube away from the engine block and the exhaust manifolds.



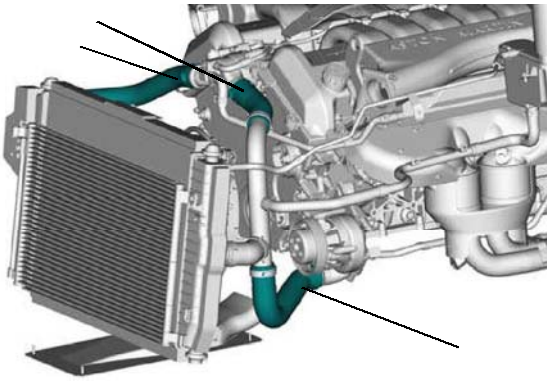
11. Remove the engine mount nuts (x2).



12. Lift the engine until it is away from the frame assembly. Attach the engine to an applicable stand.
    Remove the lifting gear.

Install

1. Install the engine lifting gear to an applicable hoist.
2. Raise and move the engine to the frame.
3. Make sure that the torque tube is adequately supported and move the engine to the torque tube.
4. Engage the propshaft splines and align the engine block to the torque tube.
5. Install the bolts that attach the torque tube to the engine block. Torque-tighten the bolts to:
   - M8 - **25 Nm**.
   - M10 - **50 Nm**.
6. Install the engine mounts. Torque-tighten the nuts (x2) to **47 Nm**.
7. Remove the lifting equipment and lifting eyes.
8. Install the hose to the header tank.
9. Connect the A/C pipe to the condenser.
10. Install the hoses that follow:



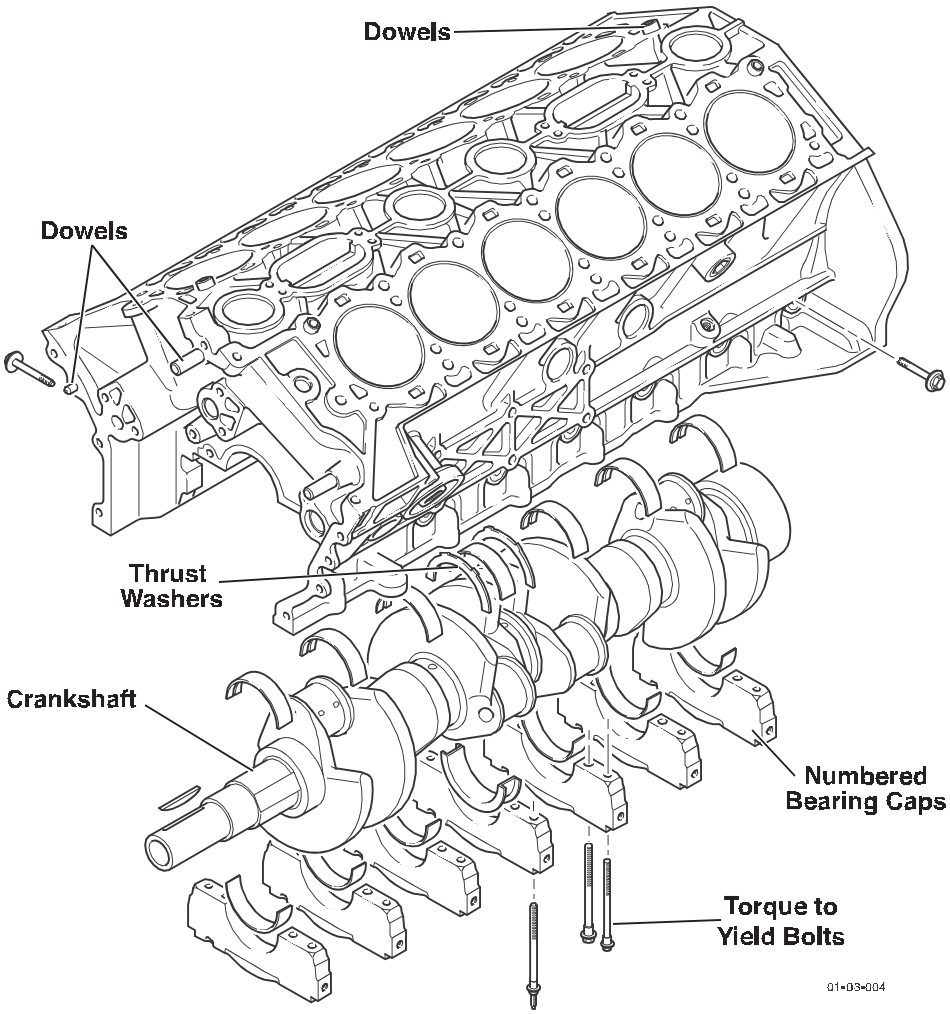
11. Install the hoses for the power steering pump.
12. Install the cables to the starter motor and the alternator.
13. Install the exhaust manifolds to the catalysts. Torque-tighten the nuts and bolts to **25.5 Nm**.

Engine (03.00)

Engine Structure (03.01)

Description

Engine Block



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

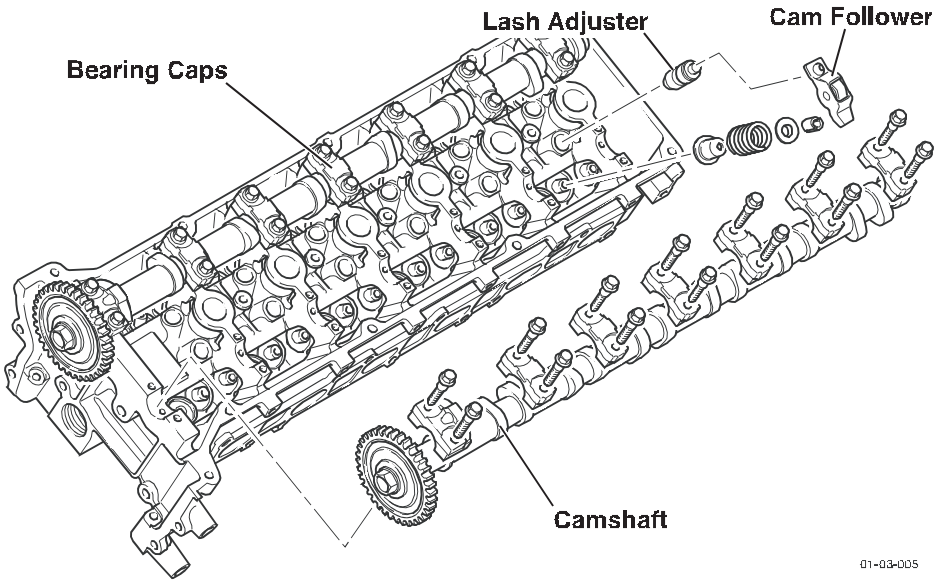
The 60° V12 aluminium engine block incorporates paths for water cooling, oil distribution and positive crankcase ventilation. The seven main bearing caps supporting the crankshaft are bolted laterally as well as vertically to provide additional crankcase stiffening whilst keeping engine weight to a minimum. 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.

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 installed to the front end of the crankshaft drives the camshaft chains. A damper pulley installed on the crankshaft nose drives the engine auxiliaries via a polyvee drive belt. Also at the front of the engine a timing disc is installed together with two crankshaft sensors. The sensors provide engine position signals to the two Engine control modules.

Cylinder Heads

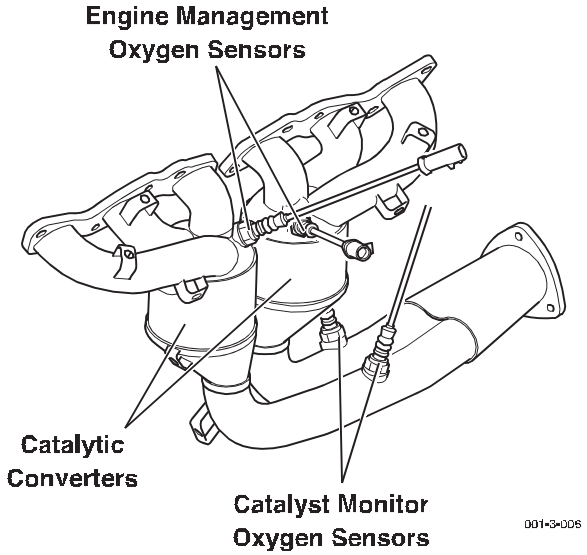
Each cylinder has two inlet and two exhaust valves. The valves are operated by cam followers below each camshaft. Valve clearances are kept at zero by a hydraulic tappet system (lash adjuster) that is pressurised from the main engine lubrication system.



Inlet / Exhaust Manifolds

Two six-branch exhaust manifolds have four primary catalytic converters and eight oxygen sensors attached.

Four engine management oxygen sensors are installed before the primary catalysts. Four oxygen sensors to monitor the catalysts are mounted after the primary catalysts.



Air from the intake is filtered. The air then goes through mass air-flow meters (MAF) and into the throttle bodies. It then goes into the six-branch inlet manifolds.

Specifications

Block	**MM**
Cylinder Bore Grade 2	89.010 - 89.020
Main Bearing Bore (without shells)	72.400 - 72.424
Cylinder Heads	**MM**
Head Face-Roof Button	14.75 - 15.25
Valve Seat Width - Inlet	1.10 - 1.40
Valve Seat Width - Exhaust	1.40 - 1.70
Camshaft Bore	26.987 - 27.012
Camshaft Journals	26.936 - 26. 962
Head Volume	46.70 - 49.70 ml.

Camshaft End Play

0.025 - 0.165 mm (using a force of 30-50 lbs - do not exceed 50 lb. as damage may occur to the thrust washer).

Camshaft Sensors	**MM**
Air Gap	1 (±0.5)

Torque Figures

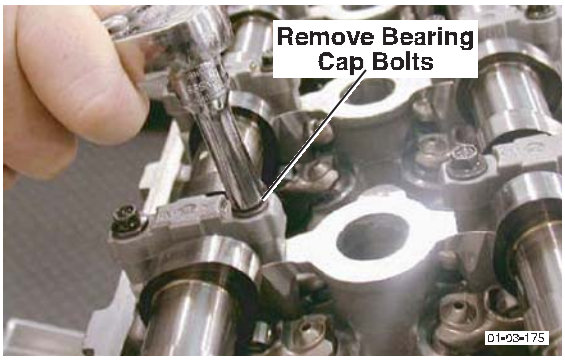
Description		Nm.	lb./ft.
Cylinder head	1. Bolts 1 to 14	37-43	27.5-32
	2. Bolts 15-16	15-20	11.5-15
	3. Bolts 1-14	85°-95°	
	4. Release bolts 1-14	Min. 360°	
	5. Bolts 1 to 14	37-43	27.5-32
	6. Bolts 15-16	23-27	17-20
	7. Bolts 1 to 14	85°-95°	
	8. Bolts 1 to 14	85°-95°	
Camshaft bearing caps		8-12	6-9

Maintenance

Cylinder Head

Remove

1. Remove the engine from vehicle (Refer to 'Engine', page 3-0-4)
2. Remove the inlet manifold (Refer to 'Inlet Manifold', page 3-1-7).
3. Remove the exhaust manifold (Refer to 'Exhaust Manifold', page 3-1-11).
4. Drain the engine coolant (Refer to 'Coolant Drain / Fill', page 3-3-3).
5. Remove the accessory drive belt (Refer to 'Drive Belt', page 3-5-1).
6. Remove the thermostat housing (Refer to 'Thermostat - Remove and Install', page 3-3-5).
7. Remove the camshaft cover (Refer to 'Camshaft Cover', page 3-10-1).
8. Remove the timing cover (Refer to 'Timing Cover', page 3-10-3).
9. Remove the timing chains (Refer to 'Valve Timing Chains', page 3-9-1)
10. Remove both camshafts.



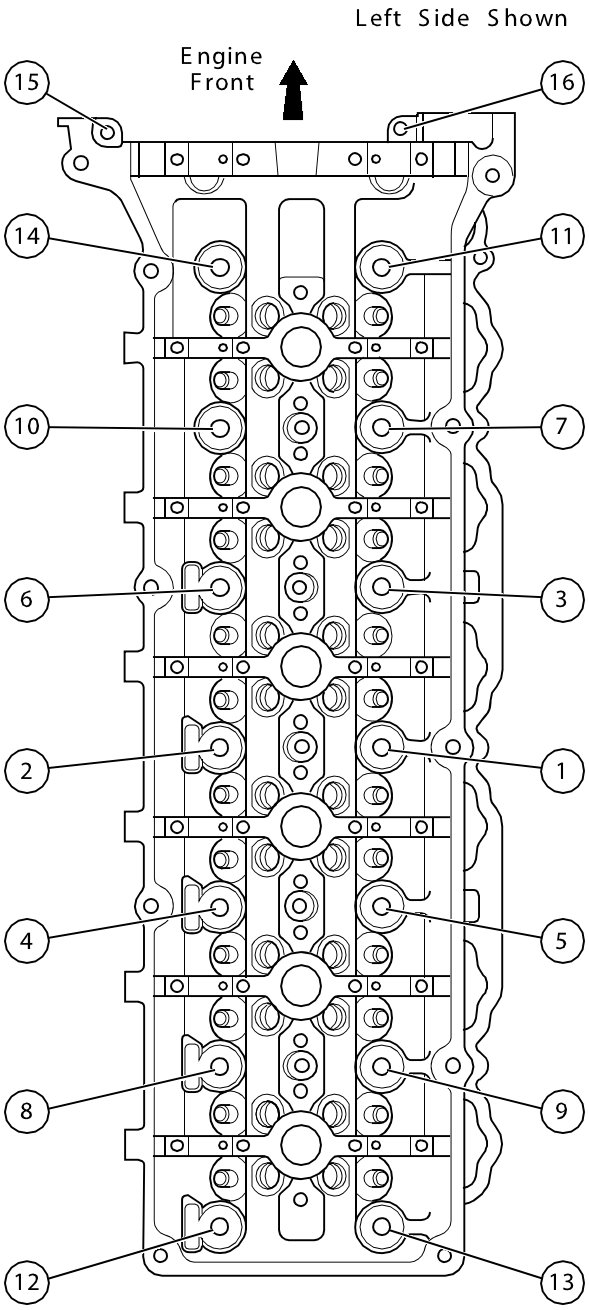
10.1 Gradually release all bolts that attach each bearing cap.

Caution
You must remove the thrust camshaft bearing cap of each camshaft (No.1 and No. 8 cap) first and install it last.

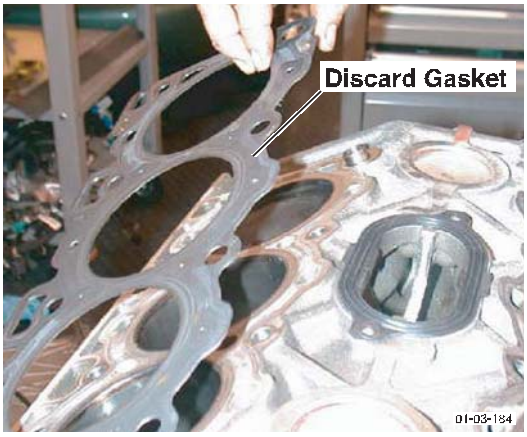
10.2 Remove the bearing caps. Keep them in the sequence that they are removed. Remove the camshafts.

11. Remove the camshaft followers and lash adjusters. Keep them in the sequence that they are removed.

12. Remove the two M8 bolts and the 14 M10 bolts from the cylinder head in the sequence shown in the figure below.



13. Remove the cylinder head. Discard the cylinder head gasket.
    Cover the engine block to prevent contamination.



14. Remove the second cylinder head if required.
15. Overhaul the cylinder head(s) as required (Refer to 'Cylinder Head', page 3-1-3).

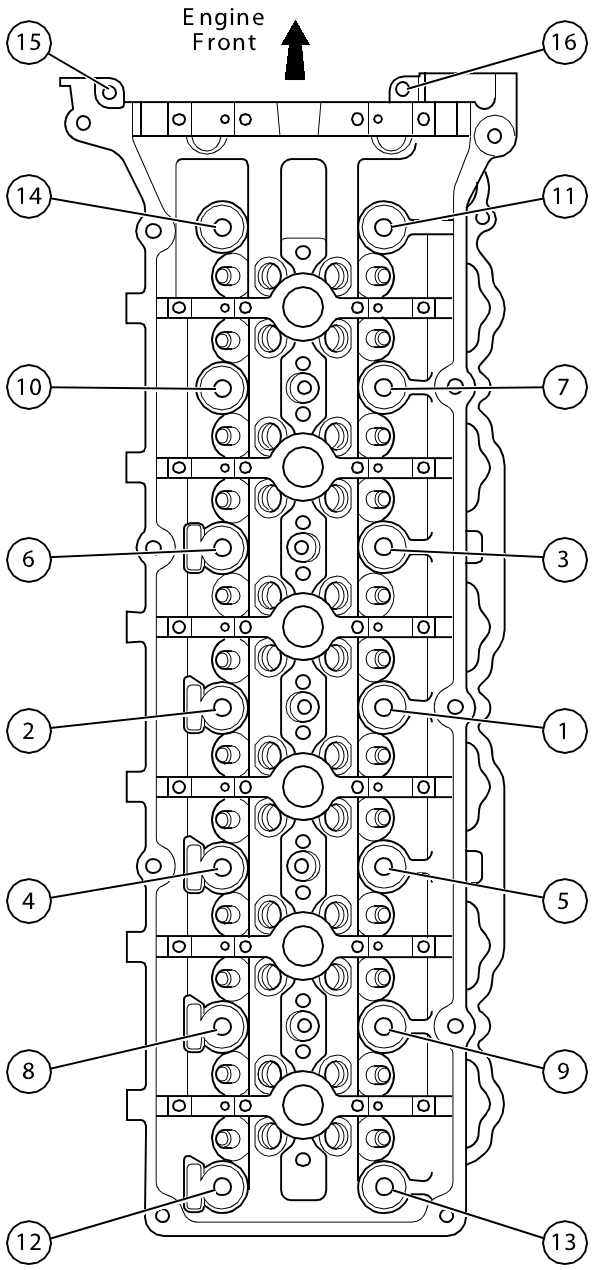
Install

Make sure that all mating surfaces are clean, smooth and do not have any contamination.

1. Put a new cylinder head gasket in position over the location dowels.
2. Apply a thin layer of engine oil below the heads of the 14 M10 and two M8 cylinder head bolts. **Do not lubricate the threads.**
   Loosely install the bolts into the cylinder head.

Caution
Do the following "Torque - Release - Torque" sequence exactly as specified, to make sure that the cylinder head seals to the engine block correctly.

3. Do the procedure that follows to torque-tighten the cylinder head bolts in steps:



3.1 Initial Torque

1 Torque-tighten the M10 bolts 1-14 to **37-43 Nm**. in the sequence shown.

2 Torque-tighten the M8 bolts 15-16 to **15-20 Nm**.

3 Torque-tighten the M10 bolts 1-14 an angle of **85-95 degrees** more in the sequence shown.

3.2 Release

1 Loosen the M10 bolts 1-14 a minimum of **one full turn** (360 degrees).

3.3 Final Torque

1 Torque-tighten the M10 bolts 1-14 to **37-43 Nm.** in the sequence shown.

2 Torque-tighten the M8 bolts 15-16 to **23-27 Nm**.

3 Torque-tighten the M10 bolts 1-14 an angle of **85-95 degrees** more in the sequence shown.

4 Torque-tighten the M10 bolts 1-14 an angle of **85-95 degrees** more in the sequence shown.

4. Do the procedure again for the second cylinder head.
5. Install all lash adjusters.

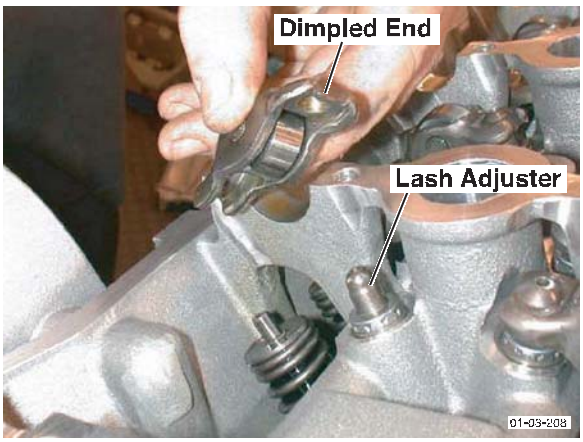
Soak the lash adjusters in engine oil.

Install each lash adjuster into its correct recess in the cylinder head.

6. Install the camshaft followers to their correct valves.

Caution
Make sure that the dimpled end of the camshaft followers are installed to the lash adjusters.

Soak the cam followers in engine oil.



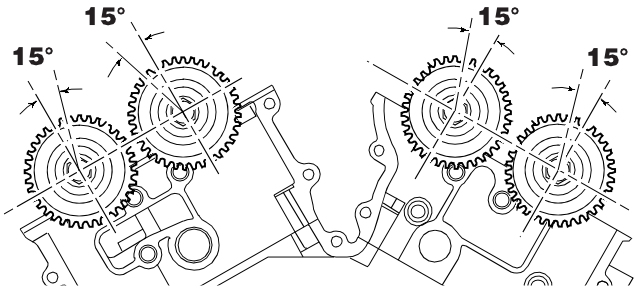
7. Lubricate the camshaft journals and camshaft bearing caps with engine oil.
8. Make sure that the crankshaft key is vertical.

Caution
The crankshaft key must stay in the vertical position until the camshaft chains are correctly installed and tensioned. If the crankshaft moves before the valve timing is completed, valves and pistons can be damaged.

The crankshaft key is exactly in line with No.1 crankshaft throw. With the crankshaft key vertical, No.1 piston is 30° ATDC and all of the pistons are below the engine block surface.

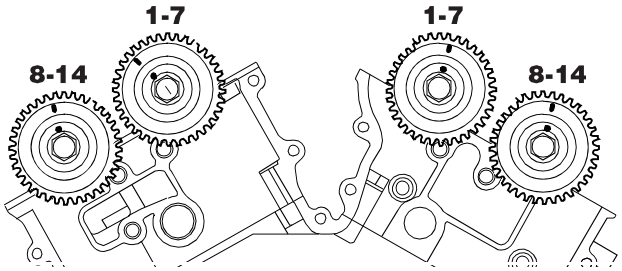
9. Put the camshafts in position with the timing marks in the positions shown in the figure below.

In the positions shown, the camshafts will be at their lowest in the journals.



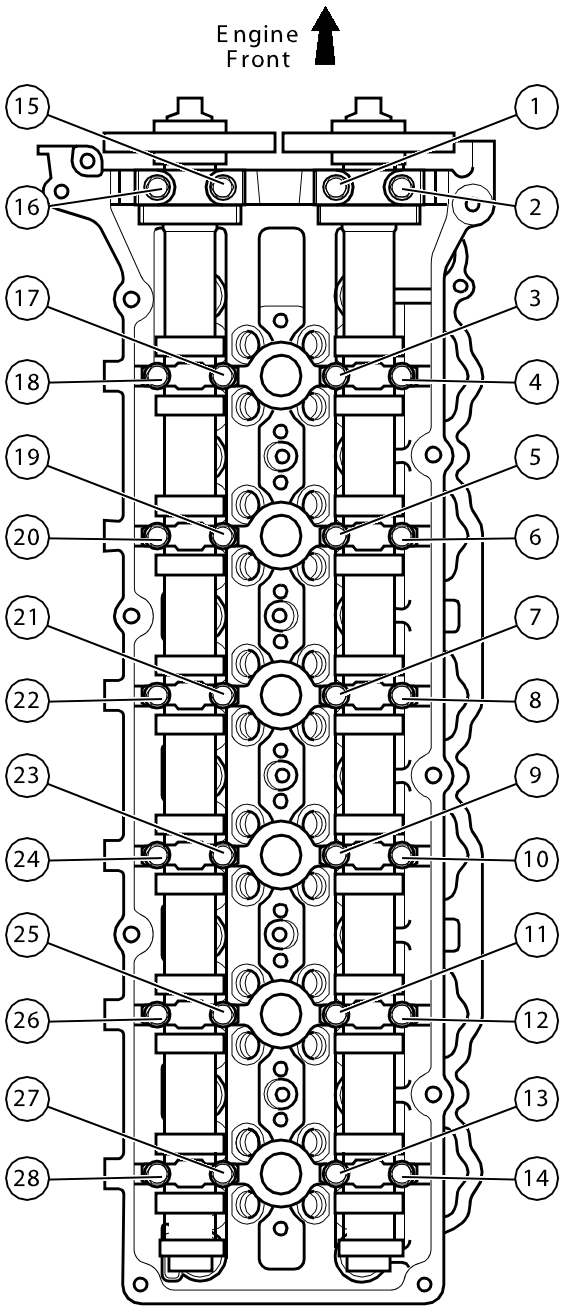
10. In the steps that follow, do work on one cylinder head at a time.
11. Install all camshaft bearing caps except the two thrust camshaft bearing caps (No.1 and No. 8 cap) at the front of each camshaft. Loosely install each cam cap.

Bearing Caps



The bearing caps are numbered and agree with the numbers that are stamped on the cylinder head adjacent to the journal.

12. Install No.1 and No. 8 bearing caps over their thrust flanges. If the bolt holes do not correctly align, move the camshafts forward or rearward as required until the bearing caps engage correctly. Loosely install the bearing cap attachment bolts.
13. Do the steps that follow to torque-tighten the camshaft attachment bolts:-
    13.1 Gradually tighten all of the bolts in the sequence shown. Make sure that the mating faces of the camshaft bearing caps correctly touch the cylinder head.
    13.2 In the sequence shown, torque-tighten the attachment bolts for the camshaft bearing caps to **8-12 Nm**.



14. Do steps 10 to 13 again for the second cylinder head.
15. Install the timing chains. Do the camshaft timing procedure (Refer to 'Valve Train (03.09)', page 3-9-1).

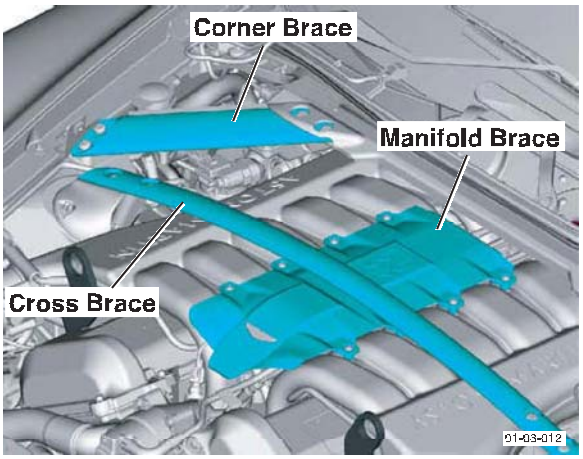
16. Install the timing cover (Refer to 'Timing Cover', page 3-10-3).
17. Install the accessory drive belt (Refer to 'Drive Belt', page 3-5-1)
18. Install the camshaft cover (Refer to 'Camshaft Cover', page 3-10-1).
19. Install the thermostat housing (Refer to 'Thermostat - Remove and Install', page 3-3-5).
20. Fill the engine coolant system (Refer to 'Coolant Drain / Fill', page 3-3-3).
21. Install the exhaust manifold (Refer to 'Exhaust Manifold', page 3-1-11).
22. Install the inlet manifold (Refer to 'Inlet Manifold', page 3-1-7).
23. Install the engine to the vehicle (Refer to 'Engine', page 3-0-4).

Inlet Manifold

Repair Operation Time (ROT)		
Item		**Code**
Inlet Manifold Renew	LH	**03.01.BB**
	RH	**03.01.DB**

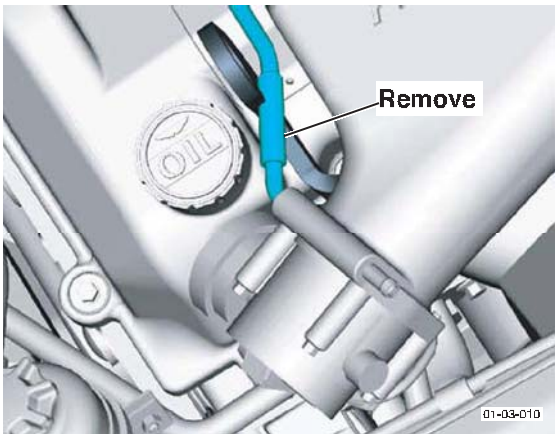
Remove

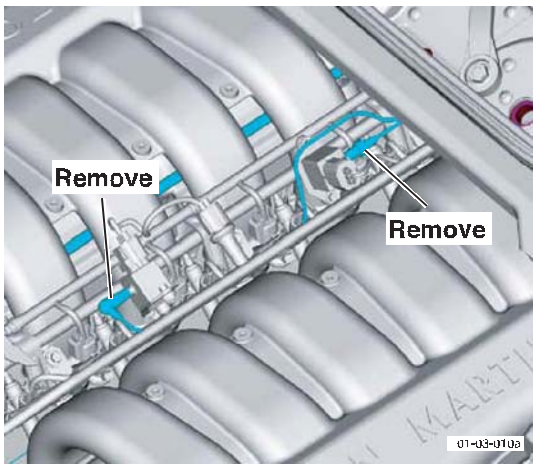
1. Depressurise the fuel system (Refer to 'Fuel System - Depressurise', page 10-1-10).
2. Disconnect the vehicle battery.
3. Remove the engine bay corner braces (x2), engine bay cross brace and the manifold brace.

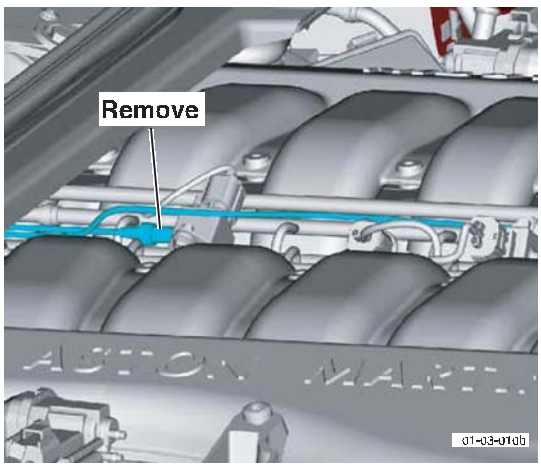


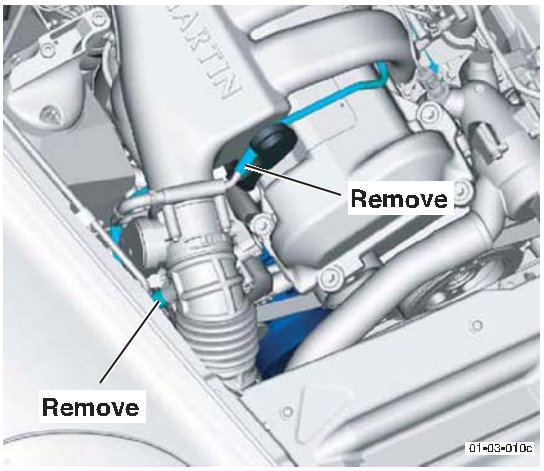
4. Remove the air intake pipe.

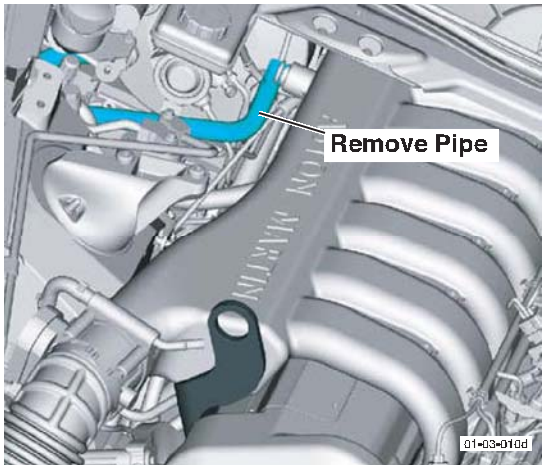
5. Remove the items that follow from the inlet manifold:-



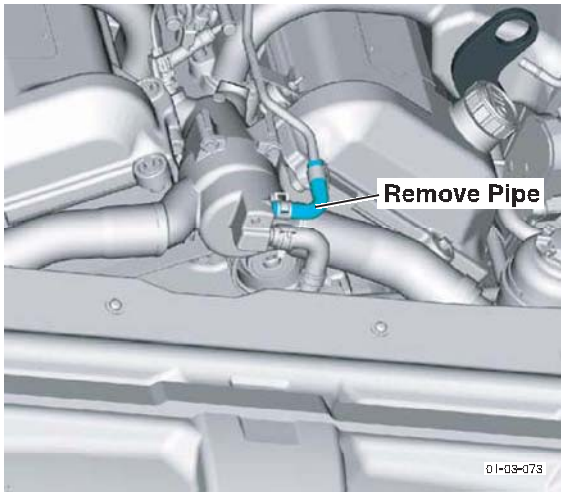




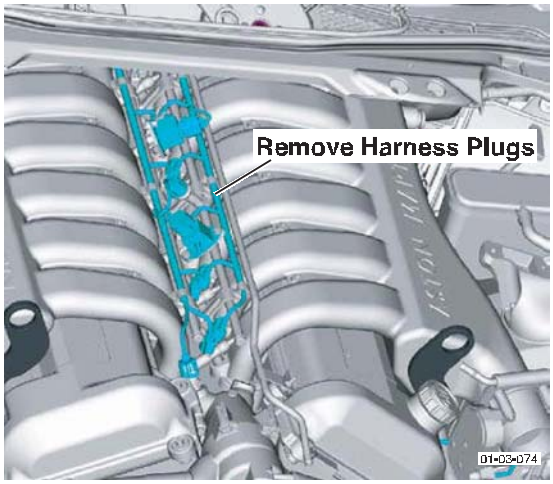




6. Remove the thermostat housing by-pass hose. Seal the open ends.

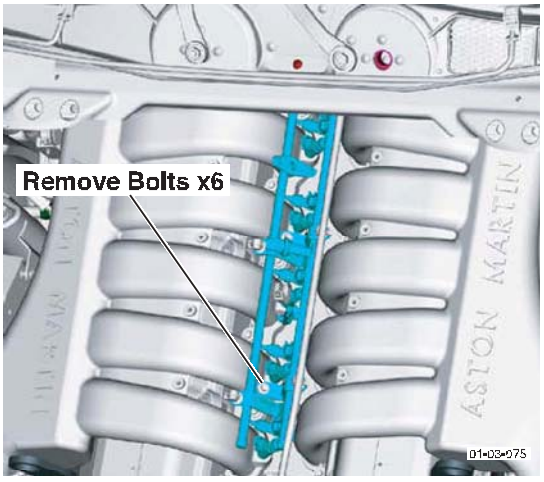


7. Remove the connectors that follow:
   - The harness plug for the temperature sender wiring on the fuel rail
   - The harness plug for the pressure sensor wiring on the fuel rail
   - The plugs for the injector wiring harness



> ⚠ *Warning* ⚠
> ***If the fuel system is pressurised, fuel will be released and can contaminate eyes and the skin.***

8. Remove the fuel rails and the injectors:-
   8.1 Remove the bolts (x6) that attach the fuel rails.
   8.2 Remove the fuel rails sufficiently to remove the injectors.
   8.3 Remove and discard the injector O-rings.

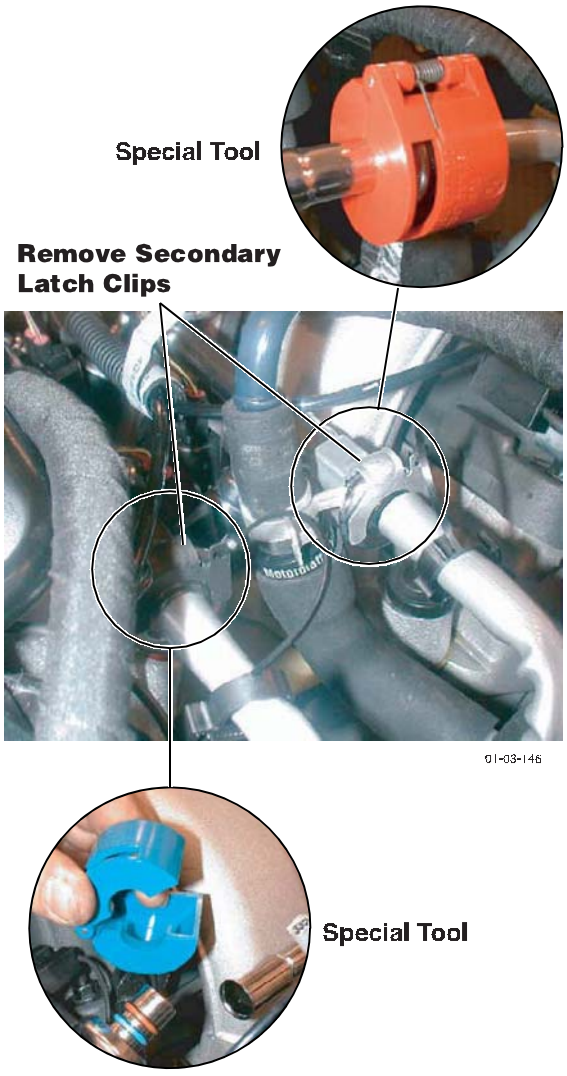


9. Disconnect the fuel rails from the fuel supply hoses.

> *The hose unions on the fuel supply for the left and right fuel rails are different sizes.*

   9.1 Remove the secondary latch clip from each fuel line.
   9.2 Install the correct size of service tool around the union.
   - (Refer to '412-038 (Quick Disconnect Tool)', page 20-1-7)
   - (Refer to '412-040 (Quick Disconnect Tool)', page 20-1-7)

   9.3 Push back on the tool. While the tool is pushed back, remove the fuel rail.

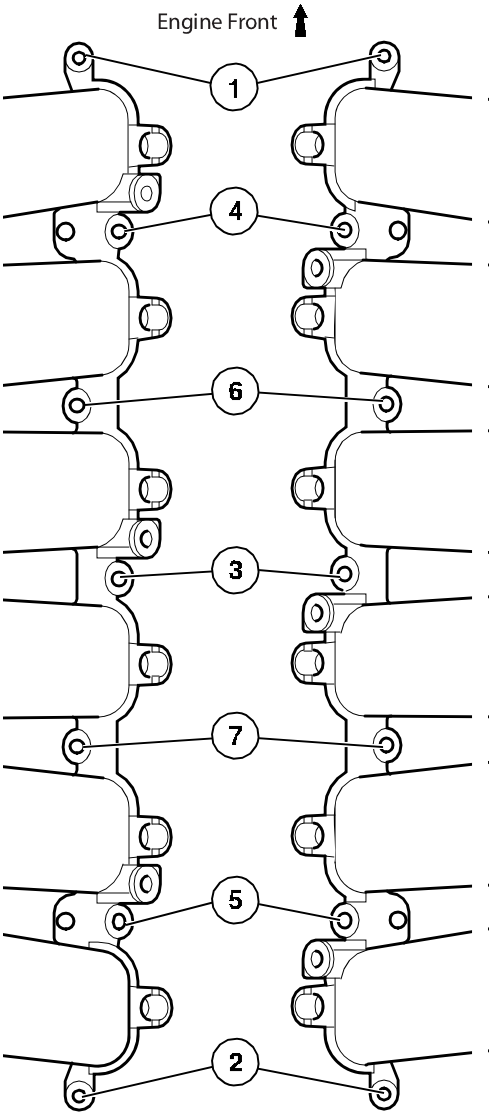


10. Remove the inlet manifold:-
   10.1 Remove the bolts (x7) that attach the inlet manifold to the cylinder head.
   10.2 Remove the inlet manifold sufficiently to gain access to its rear and disconnect the vacuum harness.
   10.3 Withdraw the inlet manifold. Discard the gaskets.
11. Put a cover on the inlets to the cylinder head to prevent contamination of the cylinders.

Install

Make sure that all mating faces are clean and there is no damage or contamination.

1. Install a new inlet manifold gasket to the inlet manifold. Engage the two 'lipped' holes in the gasket through the two corresponding bolt inserts in the inlet manifold.
2. Install the inlet manifold:-
   2.1 Install the vacuum harness to the rear of the inlet manifold.
   2.2 Put the inlet manifold in position on the cylinder head. Make sure that the gasket stays in position.
   2.3 Install the bolts that attach the inlet manifold to the cylinder head.
   2.4 Torque-tighten the bolts (x7), in the order shown in the figure below, to **8 - 12 Nm**.



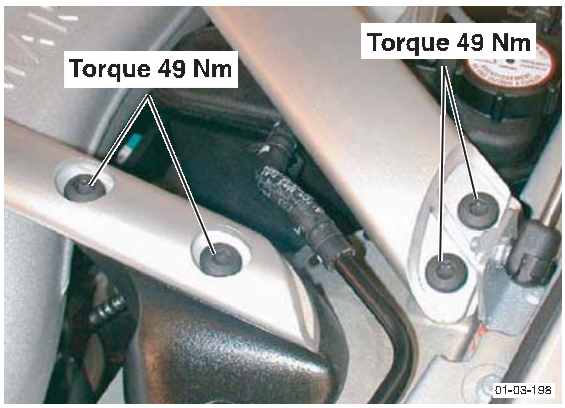
3. Install new O-rings on the injectors.

Note position of O-rings
• *Blue (top)*
• *Green (bottom)*

4. Install the injectors to the inlet manifold.
5. Install the fuel rails:-
   5.1 Install the fuel rails over the injectors.
   5.2 Install the bolts (x3) that attach the fuel rail to the injectors.
   5.3 Torque-tighten the bolts to **8-12 Nm**.
6. Connect the fuel rails to fuel supply lines.

Ensure each fuel rail and fuel supply line are 'in-line' before connection.

7. Install the secondary latch clips to the fuel lines.
8. Connect the wiring harness plugs that follow:-
   - The temperature sender to the fuel rail
   - The pressure sensor to the fuel rail
   - To the injectors
9. Connect the thermostat housing by-pass pipe.
10. Install the air intake hose.
11. Install the engine bay corner braces (x2), the engine bay cross brace and the manifold brace.
12. Tighten the bolts to these torques:-
    - Engine cross brace - **49 Nm.**
    - Manifold brace - **8-12 Nm**.
    - Corner braces - **49 Nm.**

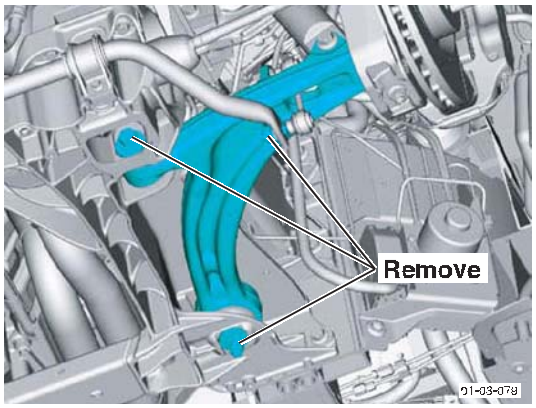


Exhaust Manifold

Repair Operation Time (ROT)		
Item		Code
Exhaust Manifold Renew	LH	09.03.DB
	RH	09.03.EB

Remove

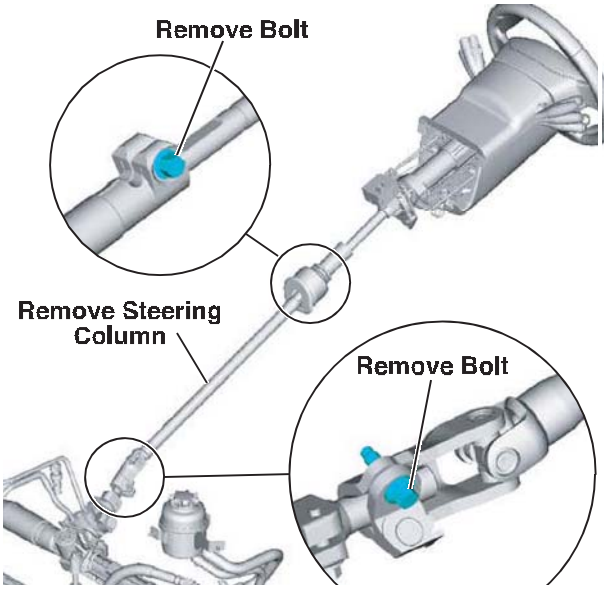
1. Disconnect the vehicle battery.
2. Raise the vehicle and make safe.
3. Remove the front roadwheels and the wheel arch liners.
4. Remove the undertray.
5. Remove the lower suspension arms.



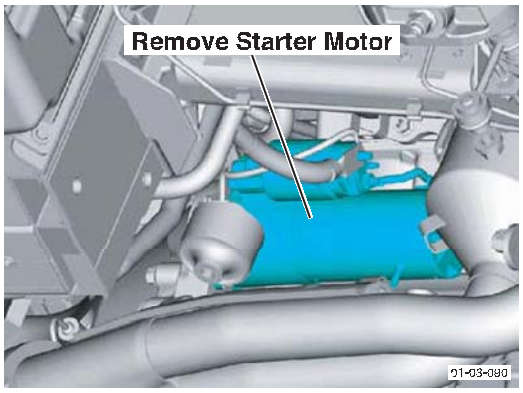
6. Disconnect the anti-roll bar links.
7. Remove the front subframe (Refer to 'Front Subframe', page 2-1-2).

Right manifold

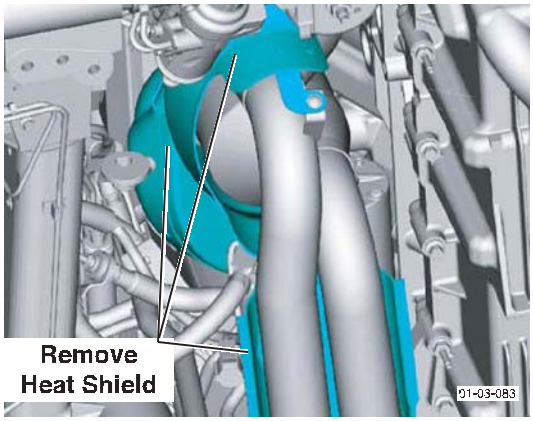
1. On RH drive vehicles, remove the steering column.



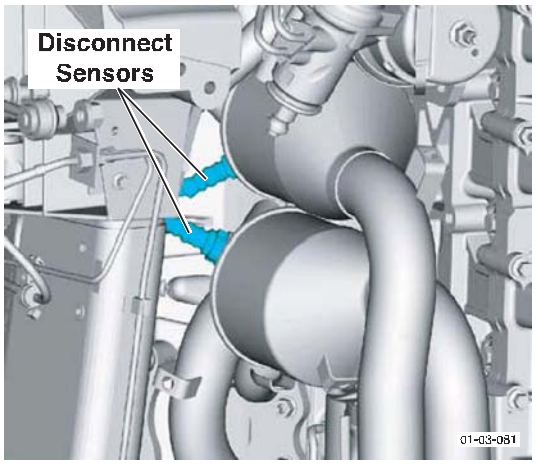
2. Remove the starter motor.



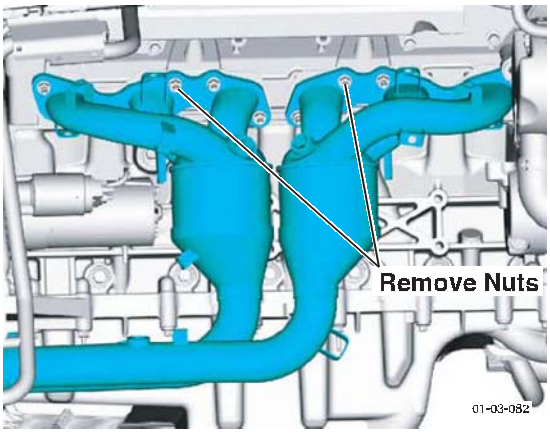
3. Disconnect the heated oxygen sensors (x2) and the Catalyst Monitor sensors (x2).
4. Remove the exhaust heat shields.



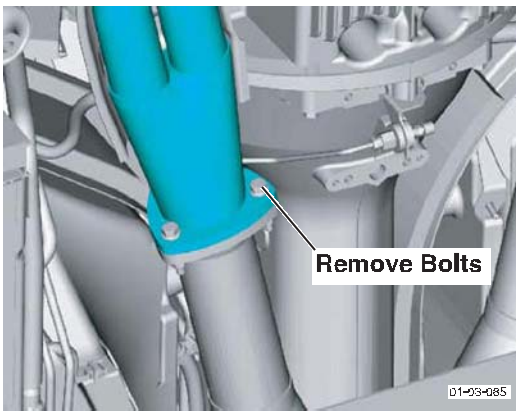
5. Disconnect the heated oxygen sensors (x2) and the Catalyst Monitor sensors (x2).



6. Remove the exhaust manifold:-
   6.1 Remove the manifold nuts (x12).



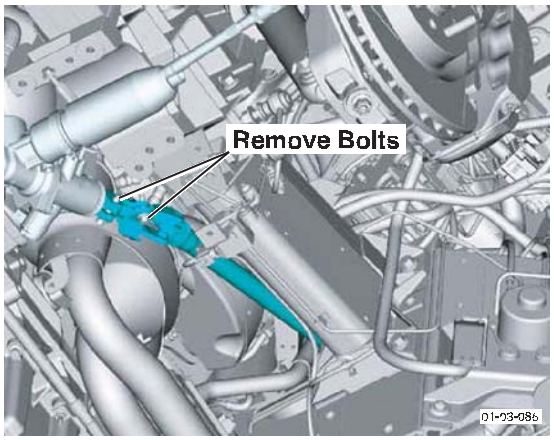
   6.2 Remove the nuts and bolts (x3) (refer to the figure below).



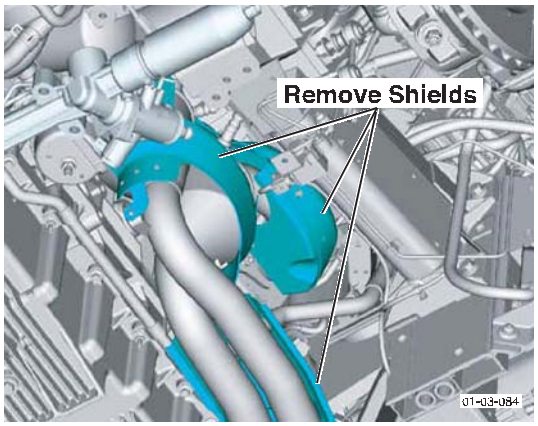
   6.3 Remove the manifold.
   6.4 Discard the manifold gasket.

Left Manifold

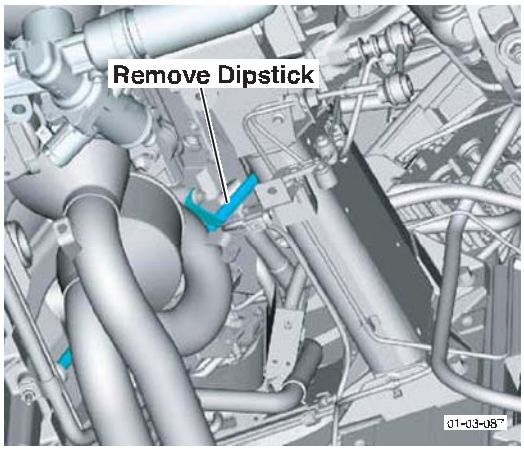
1. Remove the lower steering column (LH drive only).



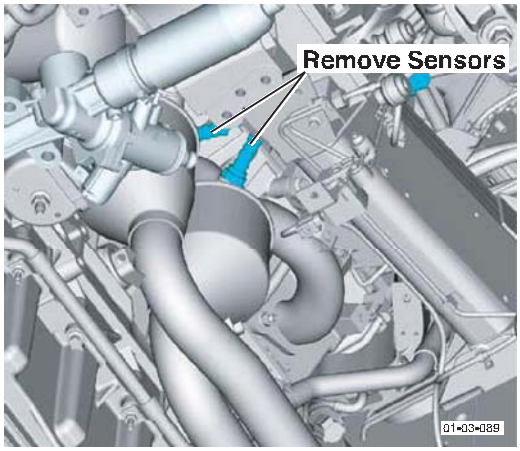
2. Remove the exhaust heat shields.



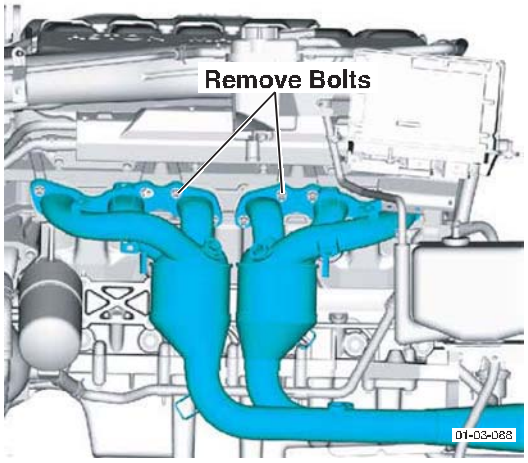
3. Remove the dip stick.



4. Disconnect the heated oxygen sensors (x2) and the catalyst monitor sensors (x2).



5. Remove the exhaust manifold:-
   5.1 Remove the manifold nuts (x12).



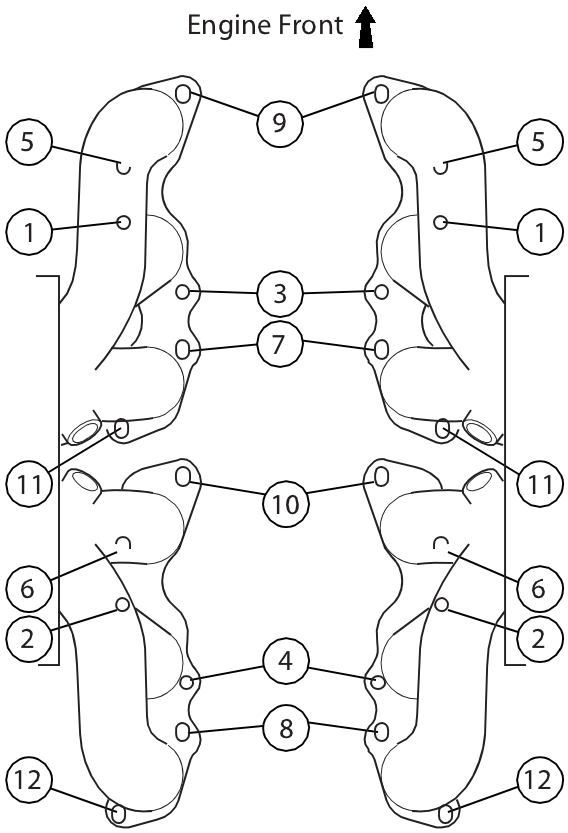
   5.2 Remove the nuts and bolts (x3) (refer to the figure below).

   5.3 Remove the manifold.
   5.4 Discard the manifold gasket.

Install

Use new gaskets.

1. Put a new gasket and the exhaust manifold in position on the cylinder head.
2. Install the nuts (x12) that attach the exhaust manifold.
3. Torque-tighten the nuts, in sequence shown, to **18-22 Nm** (refer to the figure below).



4. Install the Heated Oxygen sensors (x2) and the Catalyst Monitor sensors (x2).
5. Install the exhaust heat shields.
6. Install the parts that follow:-
   6.1 **Left Manifold**.
   - The dip-stick
   - The lower steering column (LH drive only)

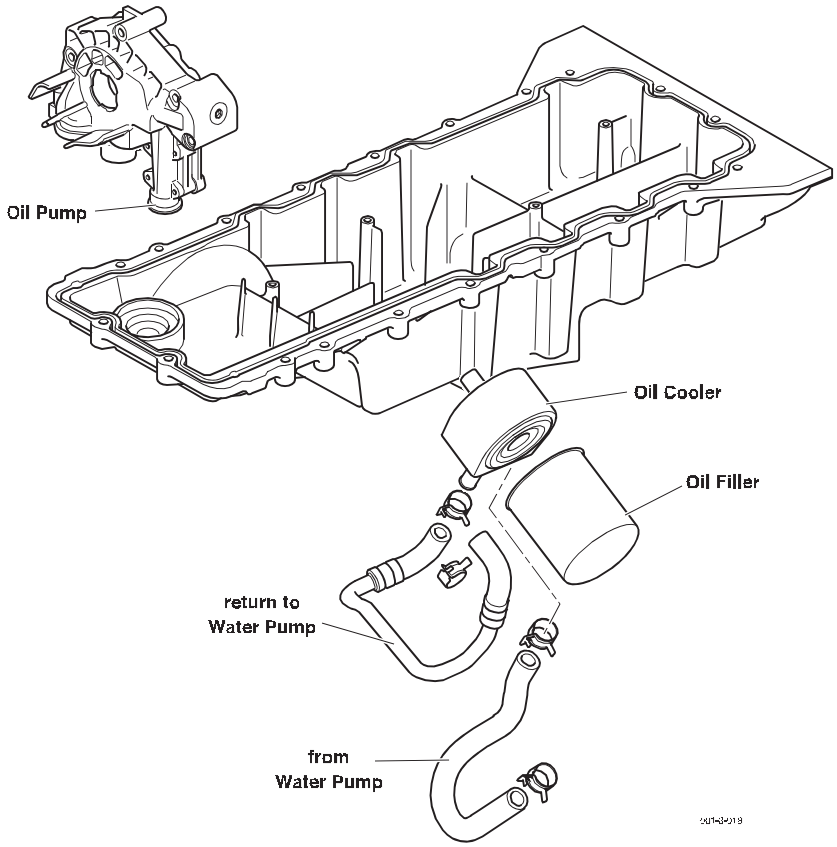
   6.2 **Right Manifold**.
   - The Alternator
   - The Starter motor
   - The Lower steering column (RH drive only)

7. Install the front subframe (Refer to 'Front Subframe', page 2-1-2).
8. Install the lower suspension arms and the anti-roll bar links (Refer to 'Front Suspension (04.01)', page 4-1-1).
9. Install the undertray.
10. Install the road wheels. (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).

Engine (03.00)

Lubrication System (03.02)

Description

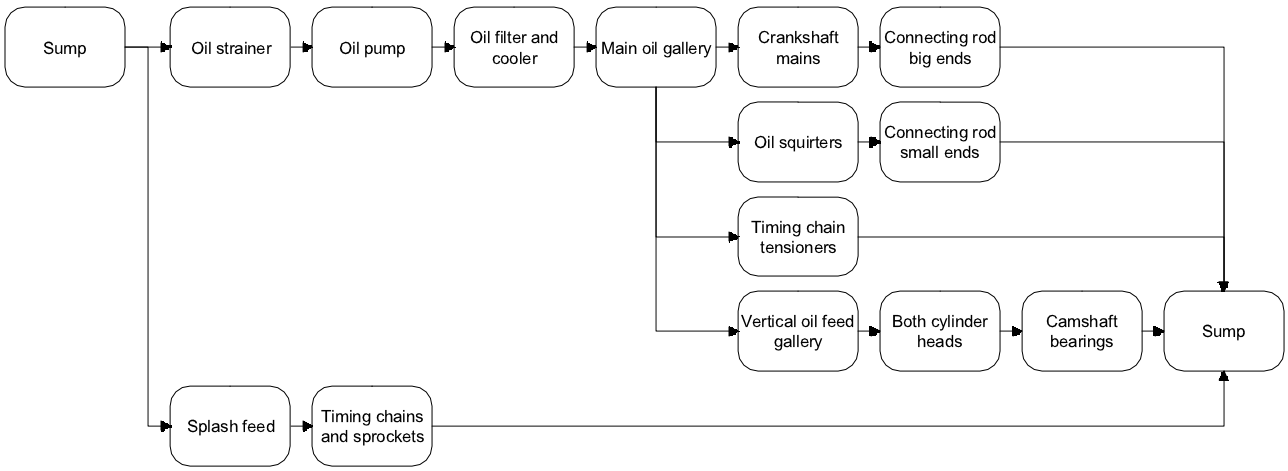


The engine has a wet-sump lubrication system.

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

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

Oil flow



Specifications

Engine oil		Mobil 1
	Europe / Aus	0W-40
	USA	0W-30 or 0W-40

To achieve the required high performance of synthetic lubricants, do not mix with mineral oils.

Capacity	**Europe (Litres)**	**UK (Pints)**	**USA (Qts.)**
Engine sump (incl. filter)	10.40	18.3	11
Engine sump (excl. filter)	9.46	16.6	10

Torque Figures

Description		Nm.	lb. / ft.
Sump plug		23-27	17-20
Sump bolts (two stage)	1.	15	11.5
		(in sequence)	
	2.	A further 90° (same sequence)	
Oil pump bolts	M8	23-27	17-20
	M6	8-12	6-9

Engine Oil Specification

An oil of 0W-30 viscosity that is equal to Aston Martin specification WSS M2C913-A/B or 0W-40 viscosity that is equal toAston Martin specification WSS-M2C937-A is recommended. Where this is not possible, oil that is equal to the following standards can be used.

0W-30	
Authority	Standard
API	SL / SJ / EC / CF
ACEA	A1 / A5 / B1 / B5
ILSAC	GF3

0W-40	
Authority	Standard
API	SL / SJ / EC / CF
ACEA	A3 / B3 / B4
ILSAC	GF3

Maintenance

Oil Drain

1. Remove the front undertray.
2. Remove the sump plug. Drain the oil into an applicable container.
3. Install a new sump plug. Torque-tighten the sump plug to **23-27 Nm**.

Caution
Always install a new oil sump plug.

4. Clean the area before you install the front undertray. Install the front undertray.

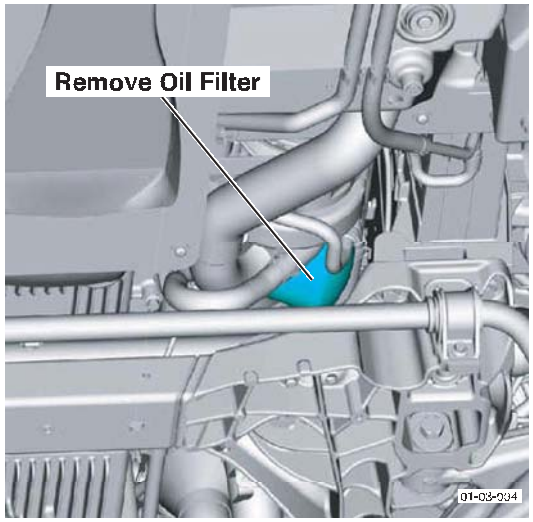
Oil Filter

Repair Operation Time (ROT)		
Item		**Code**
Oil Filter Renew	LHD	**TBA**
	RHD	**03.02.AB**

Remove

RH Drive.

1. Remove the front undertray.
2. Remove the oil filter.



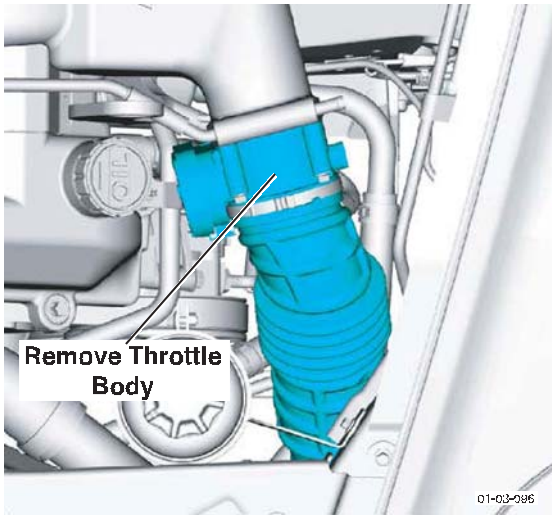
To help prevent spilled engine oil, cover the oil filter with a plastic bag.

3. Clean all unwanted oil from around and below the oil filter.

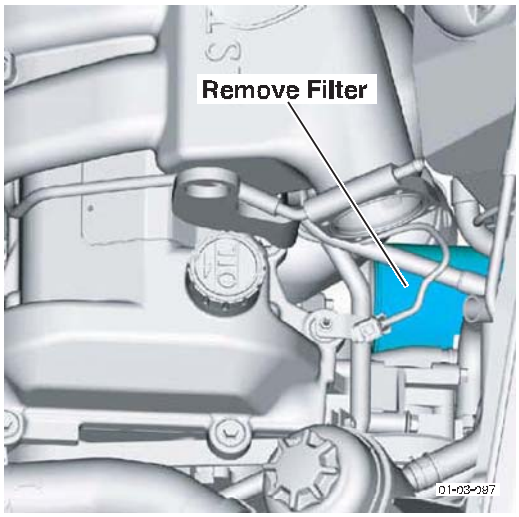
Caution
Engine oil can drain onto the steering rack and rubber hoses. Make sure that unwanted engine oil is removed before you install the undertray.
Remaining engine oil can drip onto the undertray and can incorrectly show an engine oil leak.

LH Drive.

1. Remove the front undertray.
2. Remove the air intake from the throttle body.
3. Remove the throttle body.



4. Remove the oil filter.



To help prevent spilled engine oil, cover the oil filter with a plastic bag.

5. Clean unwanted oil from around and below the oil filter.

Caution

Engine oil can drain onto the steering rack and rubber hoses. Make sure that unwanted engine oil is removed before you install the undertray.

Remaining engine oil can drip onto the undertray and can incorrectly show an engine oil leak.

Install

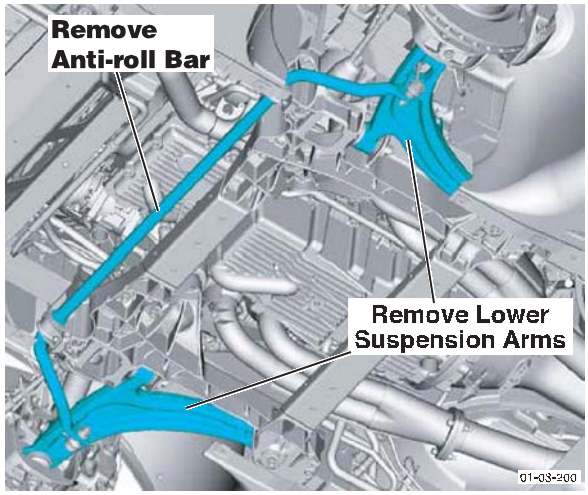
1. Apply a thin layer of clean engine oil to the lip of the oil filter.
2. Install the oil filter to the engine block. Tighten the oil filter hand-tight.
3. **LH drive only.**
   Install the throttle body and air intake pipe.
4. Install the front undertray.

Sump

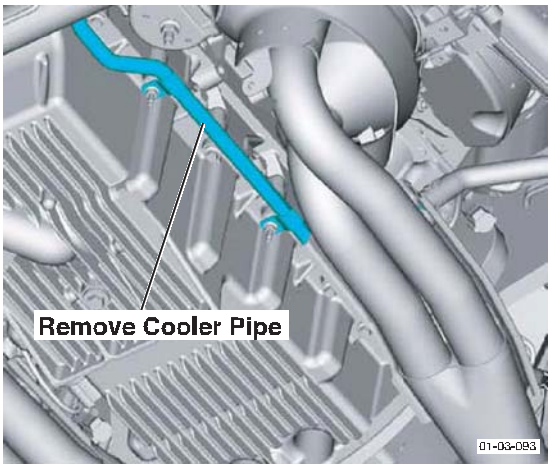
Repair Operation Time (ROT)		
Item		**Code**
Sump Remove / Install	LH	**03.02.BN**

Remove

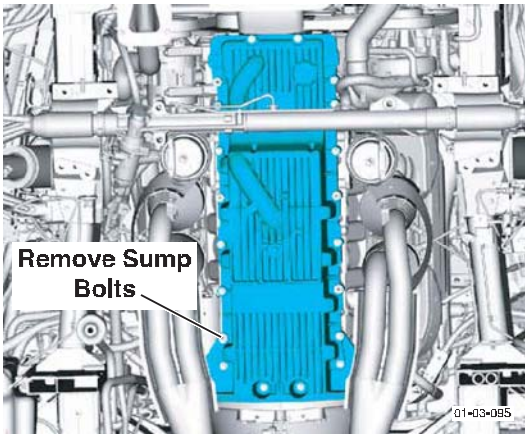
1. Drain the engine oil.
2. Remove the lower suspension arms (from the front subframe) and the anti-roll bar (Refer to 'Front Suspension (04.01)', page 4-1-1).



3. Use the correct support to hold the engine from above (Refer to '303-1080 (Engine Support Adaptor)', page 20-1-6).
4. Remove the front subframe (Refer to 'Front Subframe', page 2-1-2).
5. Remove the coolant pipe from the sump.



6. Remove the bolts (x15 M8) and (x5 M6) that attach the sump. Remove the sump.
7. Discard the sump gasket and the oil seal for the oil pump.

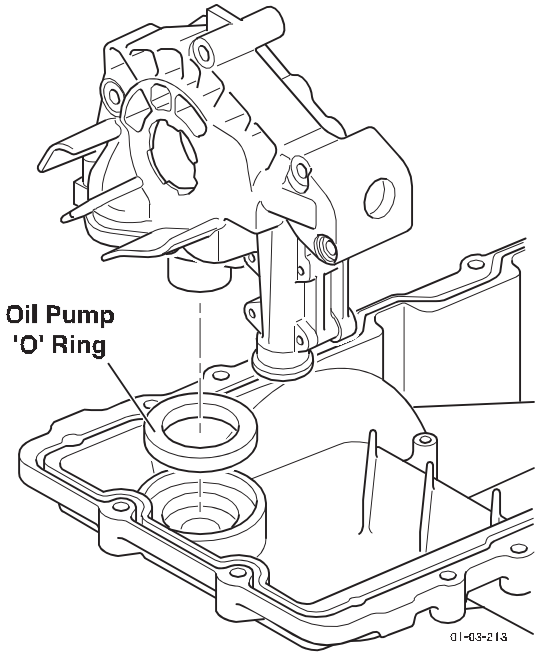


8. Clean the sump and the engine block mating surfaces.

Install

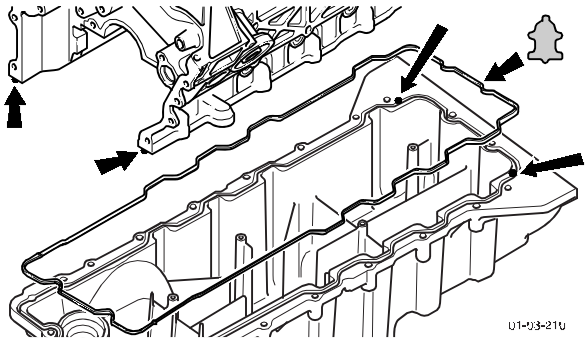
1. Make sure the sump is clean.
2. Install a new sump gasket. Make sure that the gasket is above its groove equally all around the sump.

3. Install a new oil seal for the oil pump to the sump.



4. Apply dots (10 mm Dia approximately) of sealant to the sump sealing surface in the positions shown in the figure below.

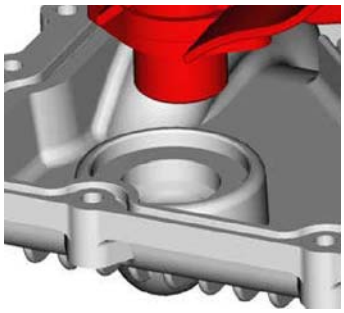
Installed and attach the sump in less than 6 minutes after you apply the beads of sealant.



5. Install the sump.

Make sure that the oil outlet seal for the sump correctly engages with the oil pump inlet before you put the sump in position on the engine block.

Do not use a mallet etc. to align the sump to the engine block.



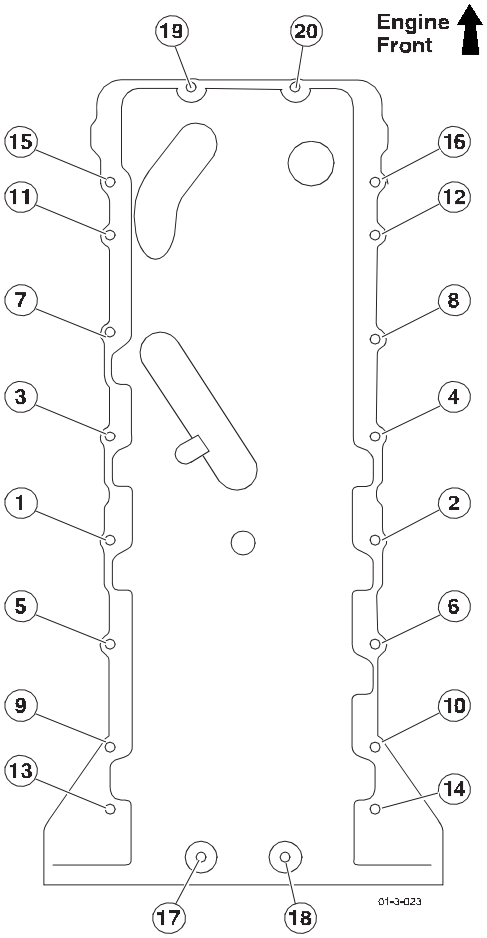
Make sure that the sump is flush to 0.25mm underflush to the rear face of the cylinder block.

Install the bolts (x15 M8) and (x5 M6) to attach the sump.

Do the steps that follow to tighten the bolts:-

1 Tighten all of the bolts to **15 Nm.** in the sequence shown in the figure.

2 Follow the sequence again and tighten all of the bolts an angle of **90 degrees** more.



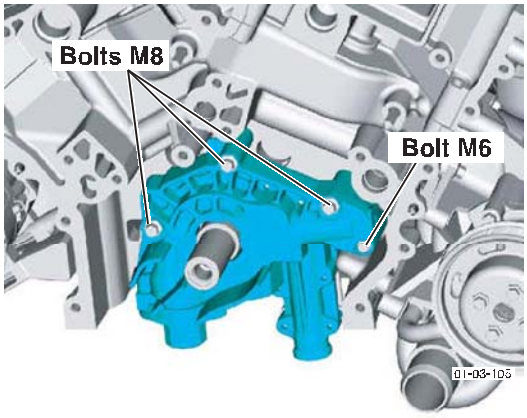
6. Install the coolant pipe.
7. Install the front subframe (Refer to 'Front Subframe', page 2-1-2).
8. Install the lower suspension arms (Do not torque-tighten the bolts at this step).
9. Install the anti-roll bar. Torque-tighten the stabiliser nut to **110 Nm**.
10. Remove the support from the engine.
11. Fill the engine with the recommended quantity and grade of engine oil (Refer to 'Specifications', page 3-2-2).
12. Torque-tighten the suspension fixings with the vehicle at the normal ride height (Refer to 'Front Suspension (04.01)', page 4-1-1):
    - Lower suspension arms to the subframe - **115 Nm**.
13. Do a check of the the front wheel alignment and adjust it if necessary (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).
14. Lift the vehicle and install the front undertray.

Oil Pump

Repair Operation Time (ROT)	
Item	**Code**
Oil Pump Renew	**TBA**

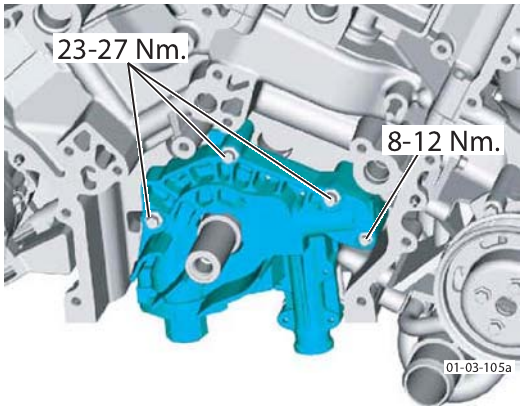
Remove

1. Drain the engine oil.
2. Remove the engine from the vehicle (Refer to 'Remove', page 3-0-4).
3. Remove the sump (Refer to 'Sump', page 3-2-3).
   Discard the sump gasket and the oil seal for the oil pump.
4. Remove the timing chains (Refer to 'Valve Timing Chains', page 3-9-1).
5. Remove the bolts (x1 M6) and (x3 M8) that attach the oil pump. Remove the oil pump.



Install

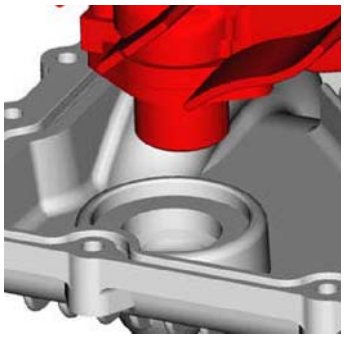
1. Locate the oil pump on the crankshaft.
   Install the oil pump.
   - Torque-tighten the bolts (M8 x3) to **23-27 Nm.**
   - Torque-tighten the bolts (M6 x1) to **8-12 Nm.**



2. Install the timing chains (Refer to 'Valve Timing Chains', page 3-9-1).
3. Install the timing cover (Refer to 'Timing Cover', page 3-10-3).
4. Install the sump (Refer to 'Sump', page 3-2-3) with a new gasket and a new oil seal for the oil pump.

Make sure that the oil outlet seal for the sump correctly engages with the oil pump inlet before you put the sump in position on the engine block.

Do not use a mallet etc. to align the sump to the engine block.



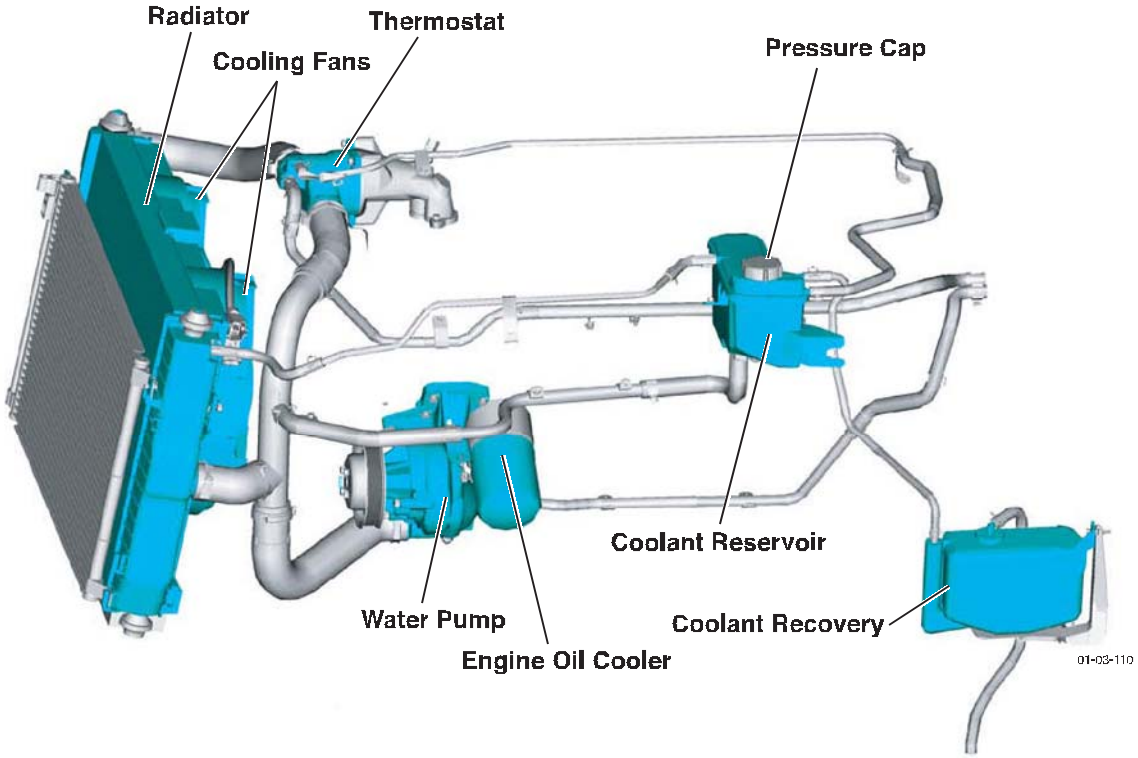
Make sure that the sump is flush to 0.25mm underflush to the rear face of the cylinder block.

5. Install the engine in to the vehicle (Refer to 'Engine', page 3-0-4).
6. Fill the engine with the recommended quantity and grade of engine oil (Refer to 'Specifications', page 3-2-2).
7. Do a check of the the front wheel alignment and adjust it if necessary (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).

Engine (03.00)

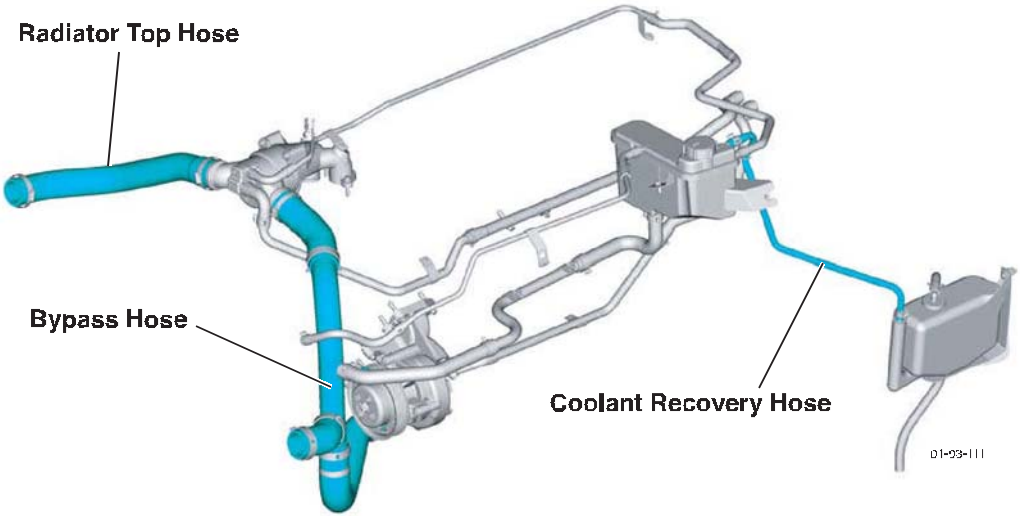
Cooling System (03.03)

Description



Water pump	Radiator	Coolant Reservoir	Cooling fan motor control module
Thermostat	Pressure cap	Electric cooling fans (x2)	Engine oil cooler

Coolant Circuit



Water Pump

The water pump is of a standard design and it is installed at the front of the engine. It is driven by the accessory drive belt.

Thermostat

The thermostat lets the engine warm-up quickly by keeping the coolant flow through the engine below 88.3°C (190.9°F). The thermostat also helps to keep the engine operating temperature between 88.3 - 92.2°C (190.9 - 198°F). It is fully open at 103.9°C (219°F).

Cold Engine (By-pass Circuit) - When the engine is cold and the thermostat is closed, coolant flows from the water pump through the engine and then directly back to the water pump.

Warm Engine - When the engine is warm and the thermostat is open, coolant flows from the water pump, then through the engine, to the thermostat. After the thermostat, the coolant flows into the radiator top coolant-hose and into the radiator. The coolant then goes back to the water pump through the radiator bottom coolant-hose.

Note: Because the heater core is on a parallel circuit, the position of the thermostat does not have an effect on the heater core.

Radiator

The radiator core is made from aluminium with plastic end tanks. There are foam seals installed on the radiator so that the cooling air does not bypass the radiator core. The radiator is installed on four isolator mountings and it is supported by the radiator support beam. A coolant drain plug is provided in the lower RH side for the draining of the coolant. The Cooling fan shroud is attached to the radiator.

Cooling Fans

Two variable-speed electric fans are housed in the cooling-fan pack to cool the radiator. The speed of the fans is adjusted by the Powertrain Control Module (PCM).

Coolant Reservoir

A pressurized Coolant Reservoir system is used that continuously removes air from the cooling system. A vent from the engine and radiator to the coolant expansion tank prevents air-locks in the cooling system. There are no manual bleed points in the system.

The Coolant Reservoir should be at the "MAX" level mark when the coolant system is cold.

Engine Oil Cooler

Coolant for the engine oil cooler is supplied from the water pump outlet and returns to the water pump inlet. A heat exchanger enables the engine oil temperature to be cooled by the engine coolant.

In-Vehicle Heating

A hose from the front of the thermostat housing directs coolant to the heater water valve which remains closed below 30°C ± 10°C (86°F ± 50°F). Above this temperature, the heater water valve will open and warm water will be available to the heater water pump. This pump will only run when the temperature is > 10°C (50°F) and will supply warm water to the air conditioning heater matrix. The A/C heater matrix outlet is connected through the return side of the water valve, back to the rear of the engine water pump.

Specifications

Antifreeze Mix	50% OAT coolant / 50% water.
Pressure Cap	150 kpa.
Thermostat	Starts to opens between 88.3 - 92.2°C (190.9 - 198°F).
	Fully open at 103.9°C (219°F).
Leakage Rates	30 cm / Min. 150 - 180 kpa.
	60 cm / Min. 10 kpa Man.
	Up to 75 kpa @ 150 c m / h.

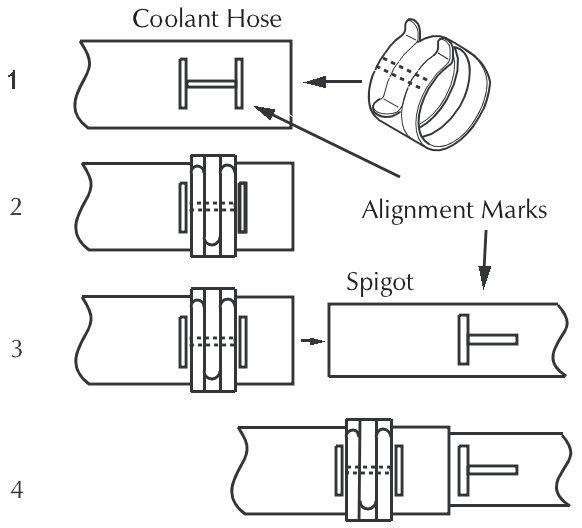
The anti-freeze is unique and cannot be mixed with other anti-freeze solutions. The OAT coolant/water mixture has a life of 150,000 miles or 5 years (which ever comes first).

Torque Figures

Description	Nm.	lb./ft.
Condenser A/C pipes	8-10	6-7.5
Thermostat housing	8-12	6-9
Thermostat housing support bracket	23-27	17-20
Water pump	23-27	17-20
Water pump pulley	23-27	17-20

Maintenance

Caution
'Spring-Band' Clips
Install'Spring-band' clips As shown below:



Remove all grease from coolant hoses and spigots before assembly.

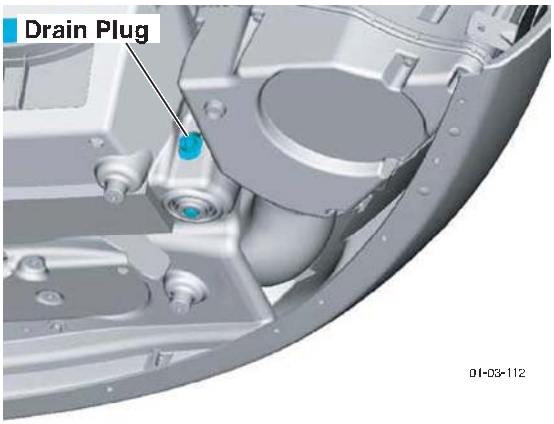
Coolant Drain / Fill

Repair Operation Time (ROT)	
Item	**Code**
Drain / Fill	**03.03.BE**

1. Remove the front undertray.

⚠ WARNING ⚠
DO NOT REMOVE THE PRESSURE CAP WHEN THE COOLANT IS HOT. LET THE ENGINE AND COOLANT COOL BEFORE YOU DO WORK. IF YOU DO NOT, PERSONAL INJURY CAN OCCUR.

2. Remove the pressure cap from the coolant reservoir.
3. Loosen the drain plug. Drain the coolant into an applicable container.



4. Install the drain plug.
5. Fill the cooling system with the specified coolant to the maximum level mark in the coolant reservoir.
6. Install the pressure cap.

⚠ WARNING ⚠
DO NOT REMOVE THE PRESSURE CAP WHEN THE COOLANT IS HOT. LET THE ENGINE AND COOLANT COOL BEFORE YOU DO WORK. IF YOU DO NOT, PERSONAL INJURY CAN OCCUR.

7. Operate the engine until it is fully warm. Stop the engine and let it cool. Coolant that expands out of the coolant reservoir will go back back when the system cools.
8. Do a check of the level at the coolant reservoir again. Fill as necessary to the maximum level.
9. Make sure that you correctly install the filler cap after you have filled the coolant reservoir.

Caution
Do not tighten the filler cap too much.

10. Install the front undertray.

Pressure Tests

Cooling System

1. Use the correct pressure tester adaptors and install the pressure tester on the coolant reservoir.
2. Operate the engine until it is at the normal operating temperature.
3. Follow the pressure tester manufacture's instructions to do a test of the cooling system.
   Pressure leakage (Refer to 'Specifications', page 3-3-2).

Pressure Cap

1. Use the correct pressure tester adaptors and install the pressure tester on the pressure cap.

Rinse the pressure cap with water to remove all sediment

2. Follow the pressure tester manufacture's instructions to do a test of the cooling system.
3. Pressure leakage (Refer to 'Specifications', page 3-3-2).
   If you need to replace a pressure cap, make sure that the replacement has the same pressure specification as the original equipment.

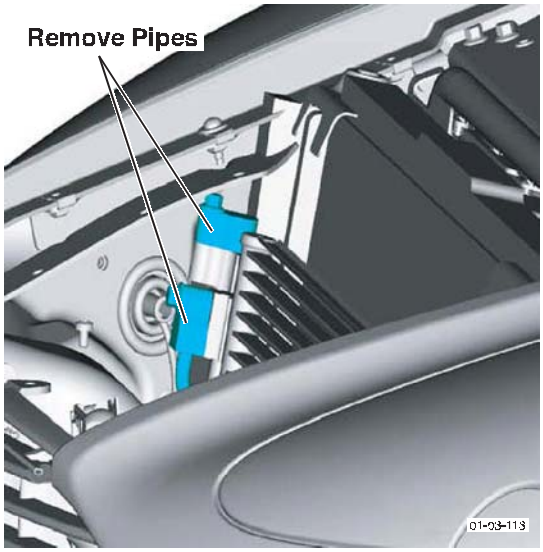
Radiator - Remove and Install

Repair Operation Time (ROT)	
Item	Code
Radiator - Remove and Install	03.03.EB

Remove

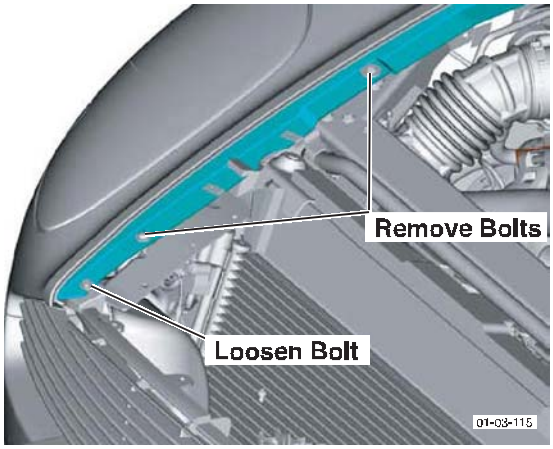
1. Drain the engine coolant.
2. Discharge the A/C system.
3. Remove the 'Slam' panel.
4. Remove the A/C pipes from the condenser.

Caution
Seal all open ends of the air conditioning parts after you disconnect them.
If you get moisture or contamination in the air conditioning system, it can cause damage or malfunction.



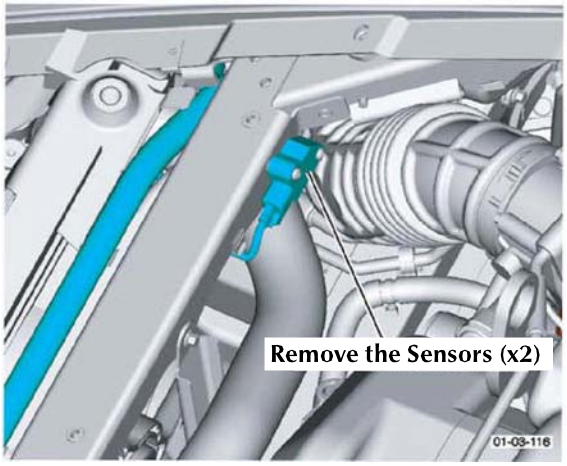
5. Remove the front crossmember.

Move the vehicle wings to get access to remove the crossmember.
Remove the bolts (x4) and loosen the bolts (x2) from the wings (Refer to the figure below). Carefully pull the wings to let you remove the crossmember.

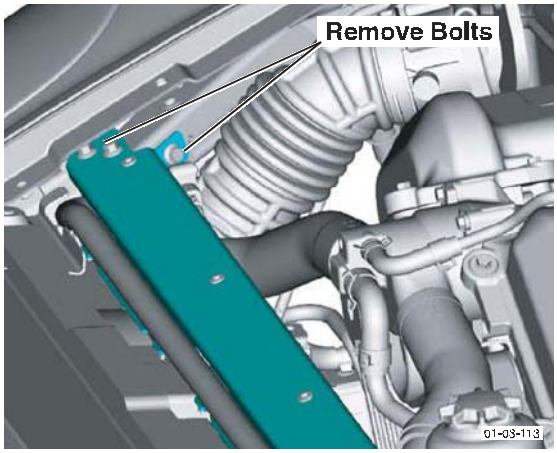


5.1 Disconnect the wiring harness plug from the crash sensors (x2).

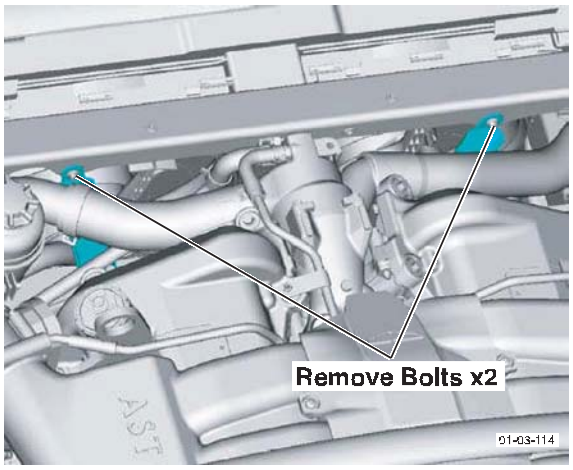
5.2 Remove wiring harness locators (x2).



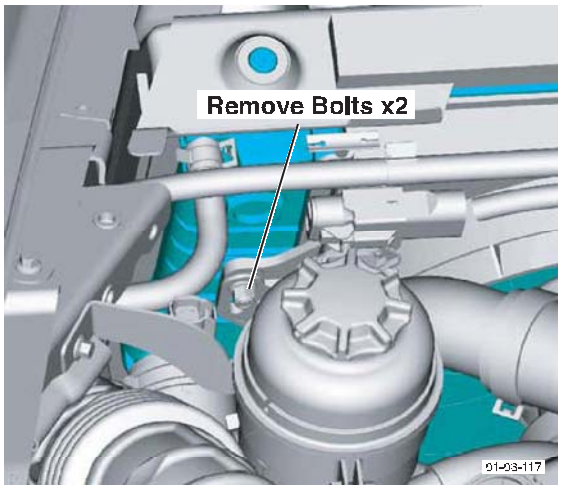
5.3 Remove the bolts (x6).



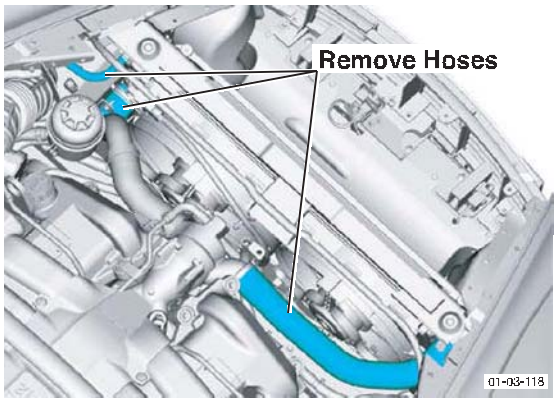
5.4 Remove the bolts (x2).
Remove the front crossmember.



6. Remove bolts (x2) that secure the fan pack to the radiator.
7. Remove the fan pack from the radiator.



8. Remove the hoses (shown in figure below) from the radiator.



9. Remove the radiator with the condenser.

Install

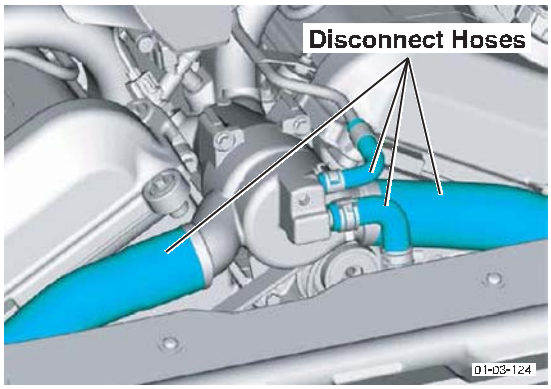
1. Install the radiator, complete with the condenser. Connect the radiator hoses.
2. Install the fan pack.
3. Install the front crossmember.
4. Install the screws that attach the wings.
5. Install the condenser A/C pipes. Torque the bolts to **8-10 Nm**.
6. Install the 'Slam' panel.
7. Fill the coolant system.
8. Fill the A/C system.

Thermostat - Remove and Install

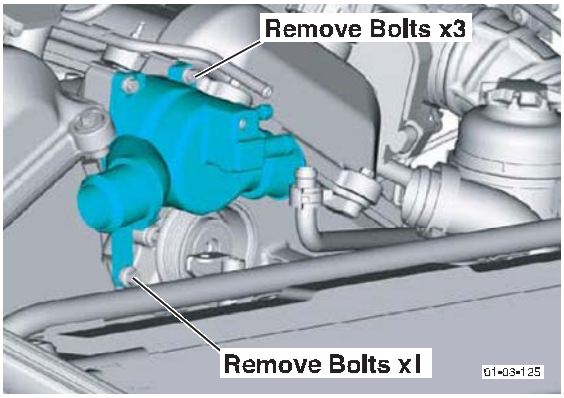
Repair Operation Time (ROT)	
Item	Code
Thermostat - Remove and Install	03.03.GB

Remove

1. Drain the engine coolant.
2. Disconnect the hoses shown in the figure below.



3. Remove the bolt (x1) that attaches thermostat housing support bracket from the timing cover.
4. Remove the bolts (x3) to release the thermostat housing.



5. Discard the gasket from thermostat housing.
6. Remove the thermostat from the thermostat housing.

Install

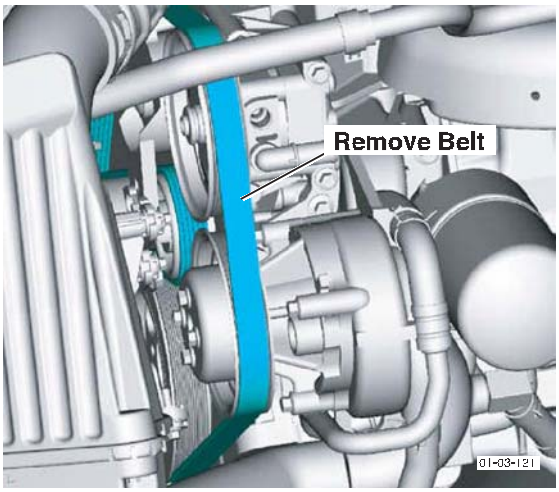
1. Clean the mating surfaces and install a new gasket for the thermostat housing.
2. Install the thermostat into the thermostat housing.
3. Install the bolts to attach the thermostat housing support bracket, do not tighten at this step.
4. Install the thermostat housing. Torque the bolts (x3) to **8-12 Nm**. Torque the bolt (x1) that attaches thermostat housing support bracket to **23-27 Nm.**
5. Fill the cooling system.

Water Pump - Remove and Install

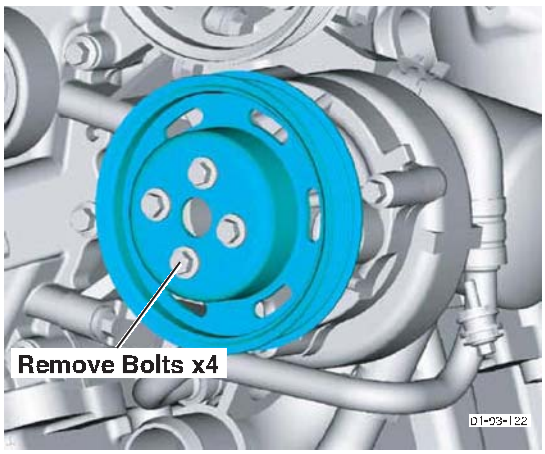
Repair Operation Time (ROT)	
Item	Code
Water Pump - Remove and Install	03.03.LB

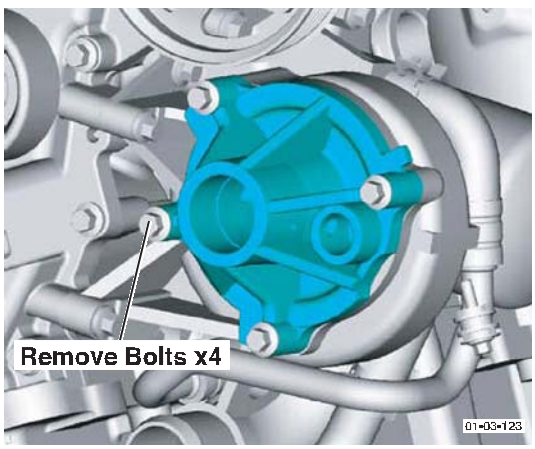
Remove

1. Drain the cooling system.
2. Remove the accessory drive belt (Refer to 'Drive Belt', page 3-5-1).



3. Remove the water pump (Refer to the Figures that follow).





4. Remove and discard the water pump O-ring.

Install

1. Clean the mating surface of the water pump and install a new O-ring.
2. Put the water pump in position in the water pump body. Install the bolts (x4) that attach the water pump. Torque the bolts (x4) to **23-27 Nm**.
3. Attach the water pump pulley to the water pump with the bolts (x4). Torque bolts (x4) to **23-27 Nm**.
4. Install the accessory drive belt (Refer to 'Drive Belt', page 3-5-1).
5. Fill the cooling system.

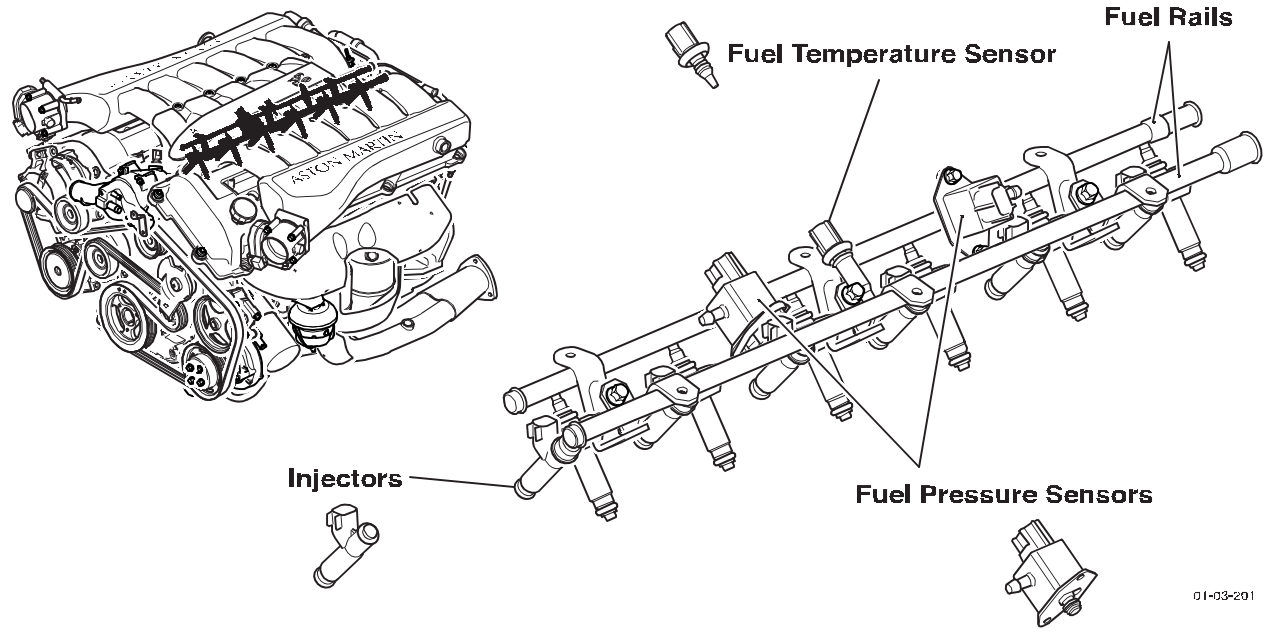
Engine (03.00)

Fuel Charging System (03.04)

Description

The fuel system is an electronic return-less that has the advantages that follow: there is less fuel tank vapour, it needs less electrical power and it does not need a fuel return line. Fuel is supplied at high-pressure to the injectors through two fuel rails (primary and secondary). Each fuel rail has six fuel injectors and a fuel pressure regulator. A fuel temperature sensor is installed in the primary fuel rail. Powertrain Control Modules (PCMs) keep 280 kPa in the injectors by increasing the pulse-width modulation signal to the fuel pump controller. This controls the voltage output to the fuel pump.

Fuel rails and injectors are included in this chapter. For the fuel delivery to the fuel rails and injectors, refer to Chapter 10 (Fuel System).



Safety Precautions

When you do work on the fuel system, fuel liquid and vapour will be in the work area. This can a very dangerous risk. Obey the precautions that follow:

⚠ WARNING ⚠
ONLY APPROVED PERSONNEL MUST WORK ON THE FUEL SYSTEM.

⚠ WARNING ⚠
DO NOT SMOKE NEAR THE WORKING AREA. PUT "NO SMOKING" NOTICES AROUND THE WORK AREA.

⚠ WARNING ⚠
DO NOT DO WORK NEAR THE WORK AREA THAT CAN CAUSE SPARKS OR NAKED LIGHTS (FOR EXAMPLE:- BATTERY TESTING, WELDING, METAL GRINDING, ETC.).

⚠ WARNING ⚠
KEEP A CO2 FIRE EXTINGUISHER NEAR TO THE WORK AREA.

⚠ WARNING ⚠
KEEP DRY SAND NEAR TO THE WORK AREA TO SOAK-UP SPILLED FUEL.

⚠ WARNING ⚠
IF YOU NEED TO DRAIN FUEL FROM THE VEHICLE, USE FIREPROOF FUEL HANDLING EQUIPMENT TO EMPTY THE FUEL INTO AN EXPLOSION PROOF CONTAINER.

⚠ WARNING ⚠
THERE MUST BE A GOOD AIRFLOW IN THE WORK AREA.

⚠ WARNING ⚠
DISCONNECT THE BATTERY BEFORE YOU DO WORK ON THE FUEL SYSTEM.

⚠ WARNING ⚠
DEPRESSURISE THE FUEL SYSTEM BEFORE YOU DISCONNECT A FUEL LINE.

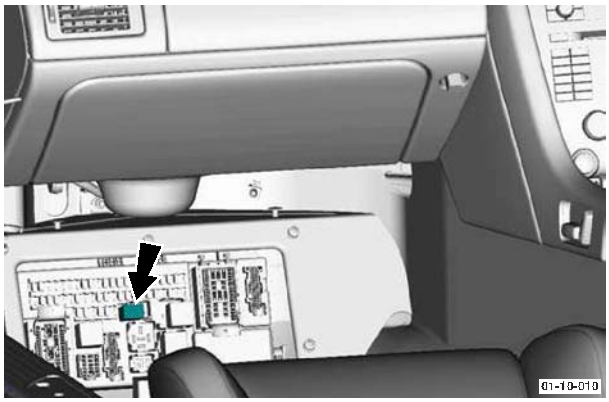
⚠ WARNING ⚠
MAKE SURE THAT THE ENGINE IS COOL BEFORE YOU DO WORK ON THE FUEL SYSTEM.

Maintenance

Depressurising the Fuel System

Repair Operation Time (ROT)	
Item	**Code**
Fuel System Depressurising	**10.01.EK**

1. Obey the fuel system safety precautions (Refer to 'Safety Precautions', page 3-4-1).
2. Remove the fuel pump relay from the CEM.



3. Try to start the engine.
   The engine will operate for approximately 11 seconds and then stop. This will depressurise the fuel lines.

Two fault codes will show on each bank:
- *P0087 'fuel pressure too low'*
- *P1233 'fuel pump driver module disabled or off line'.*

You can erase these codes from each bank after the repairs to the fuel system are complete.

⚠ WARNING ⚠

Disconnect the earth lead from the vehicle battery before you do work on the fuel system. If you do not, an explosion or a fire can occur that can cause injury to personnel.

4. Switch off the ignition
5. Install the fuel pump relay to the CEM.

Fuel Rails

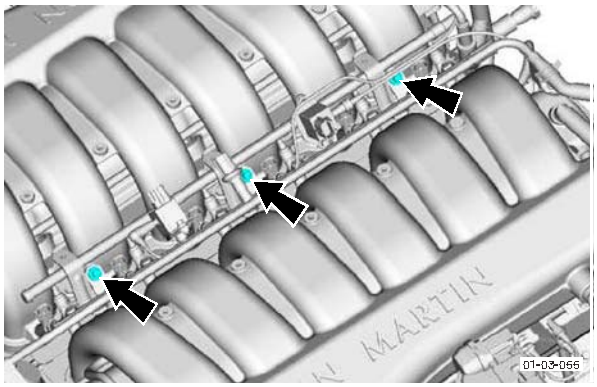
Repair Operation Time (ROT)		
Item		**Code**
Fuel Rail Renew	x1	**03.04.AB**
	x2	**03.04.BB**

Remove

1. Depressurise the fuel lines.
2. Disconnect the earth (- ve) lead from the vehicle battery.
3. Remove the engine bay cross-brace and the inlet manifold brace.

To help injector and fuel rail Remove it is possible that you will need to disconnect the coolant pipe from the thermostat housing. This is installed between the two inlet manifolds.

4. Disconnect the wiring harness plugs that follow:
   - Temperature sender plugs
   - Pressure sensor plugs
   - Injector harness plugs
5. Remove the bolts (x3) that attach the fuel rail to the inlet manifold.



6. Remove the secondary latch clip from each fuel line.
7. Disconnect the fuel rails from their supply pipes.

Use a cloth to collect fuel that spills from the opened fuel pipe.

The hose unions from the left and right fuel rails to fuel-supply are different sizes.

Install the correct size of service tool around the union.
(Refer to '412-038 (Quick Disconnect Tool)', page 20-1-7)
(Refer to '412-040 (Quick Disconnect Tool)', page 20-1-7)
Push back on the tool. While you push the tool back, pull out the fuel rail. Record the left and right hand fuel rail for the Install procedure.

Install

1. Put the the fuel rails in position over the injectors.
2. 'Pull down' the fuel rails onto the injectors by tightening bolts (x3). Tighten bolts to **8-12 Nm**.
3. Connect the fuel rails to their supply pipes.

Make sure that the fuel rail and the fuel supply line are aligned before you connect them.

4. Install the secondary latch clip to each fuel line.
5. Connect the wiring harness plugs that follow:
   - Temperature sender plugs
   - Pressure sensor plugs
   - Injector harness plugs
6. If necessary, connect the coolant pipe to the thermostat housing.
7. Install the inlet manifold brace and the engine bay cross -brace.

Injectors

Repair Operation Time (ROT)		
Item		Code
Fuel Injectors	x1	03.04.GB
	x12	03.04.FB

Remove

1. Remove the fuel rails.
2. Remove the injectors. Discard the O-rings.

Install

1. Install the injectors, complete with new O-rings.

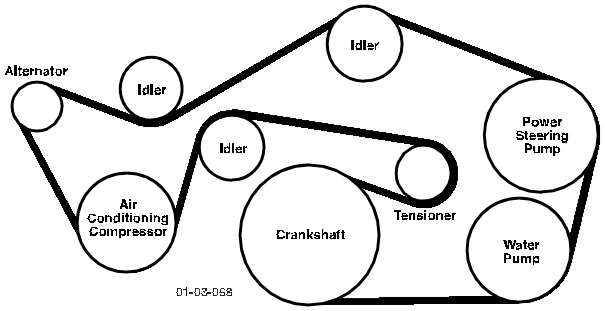
Put the O-rings in the positions that follow: *Blue at the top,* *Green green at the bottom.*

2. Install the fuel rails.

Engine (03.00)

Accessory Drive System (03.05)

Description



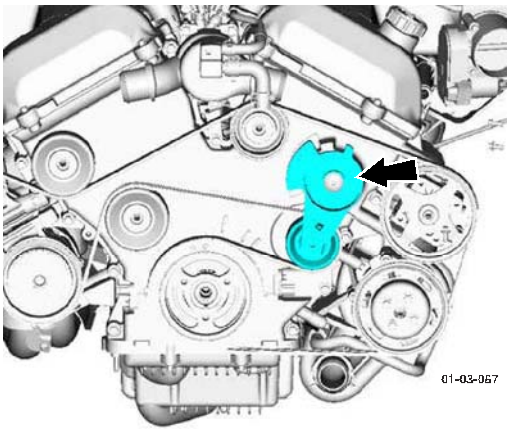
Auxiliary Drives

A damper pulley is installed on the front of the crankshaft that drives a 'polyvee' drive belt to drive the engine auxiliaries that follow:

- The air conditioning compressor
- The alternator
- The power steering pump
- The water pump

Automatic Belt Tensioner

The automatic belt tensioner has an idler-pulley that can rotate on a bearing. It is attached to the end of a spring-loaded pivot arm. The pivot arm can be turned clockwise (seen from the front of the engine) to let you remove or install the belt.



Maintenance

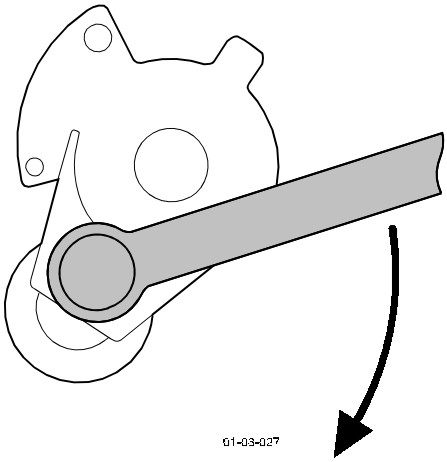
Drive Belt

Repair Operation Time (ROT)	
Item	Code
Drive Belt Renew	03.05.AB

Remove

1. Remove the undertray.
2. Use a 3/8 in. ratchet handle 'T'-bar to rotate the drive belt tensioner clockwise and remove the drive belt from the idler pulley.

   Remove the drive belt from the remaining drive pulleys.
3. Examine the drive belt. If necessary, replace the belt.



Install

1. Install the drive belt around all drive pulleys but not the idler pulley.
2. Rotate the tensioner assembly clockwise. Install the drive belt to the idler pulley then release the tensioner.
3. Do a check that the belt is correctly installed around all of the pulleys.

Engine (03.00)

Engine Cranking System (03.06) Maintenance

Starting System

The starting system has the parts that follow:

- A pre-engaged type starter motor
- A battery
- A remote control switch (ignition switch)
- A relay.

The starter relay is controlled by the Powertrain Control Module (PCM).

To prevent damage to the starter motor, the PCM prevents the starter from being engaged when the engine operates. To do this, the PCM prevents operation of the starter relay. The PCM will only operate the starter relay if the conditions that follow are met:

- The ignition switch has been in the start position for the correct time
- There is an approved condition between the the PCM and the Driver Information Module (DIM).
- The engine is not running
- The transmission range switch is in the Neutral or Park position (on vehicles that have automatic transmission installed)
- The clutch pedal is operated (on USA vehicles that have a manual transmission installed).

The starter relay remains energized until one of the conditions occur that follow:

- The PCM senses a signal that the engine is in operation
- The starter button has been pushed for a longer period
- The transmission range switch is not in the Neutral or Park position (vehicles installed with an automatic transmission)
- The clutch pedal is released (USA vehicles with a manual transmission installed).

With the ignition switch in the start position, if the PCM start conditions are correct, the starter relay is energized. The starter relay causes the engagement lever to move the pinion into mesh with the flywheel ring-gear teeth. The electrical contacts in the solenoid complete the high-power circuit and the starter motor operates to turn the engine.

Specifications

Torque Figures

Description	Nm.	lb./ft.
Starter motor	50	37

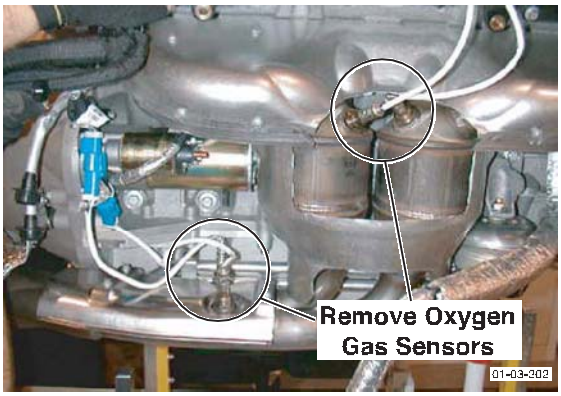
Starter Motor

Repair Operation Time (ROT)	
Item	**Code**
Starter motor Renew	**03.06.AB**

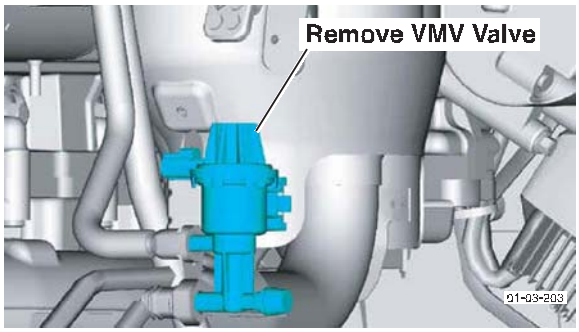
Remove

1. Disconnect the vehicle battery.
2. Raise the vehicle and make safe.
3. Remove the R/H road wheel, road wheel arch liner and the front undertray.
4. Remove the oxygen gas sensors. Disconnect the oxygen gas sensors electrics.

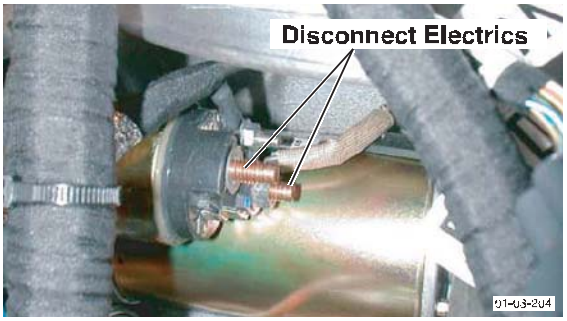
This may provide better access to remove the starter motor.



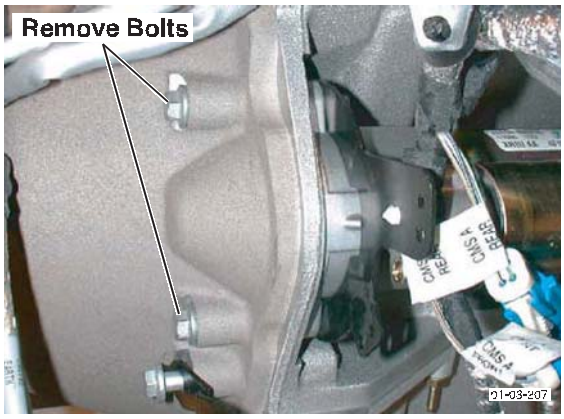
5. Remove the VMV valve.



6. Remove the heat shield.
7. Disconnect the starter motor electrics.



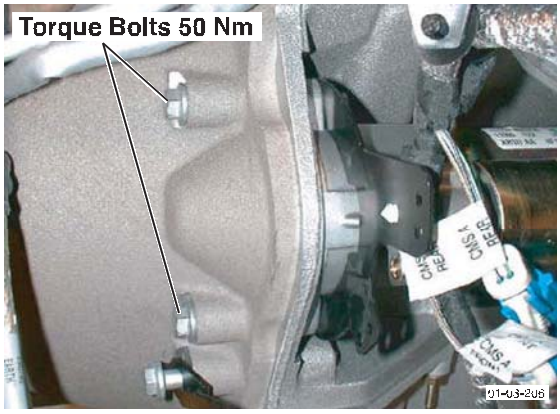
8. Remove bolts (x2) that secure the starter motor.



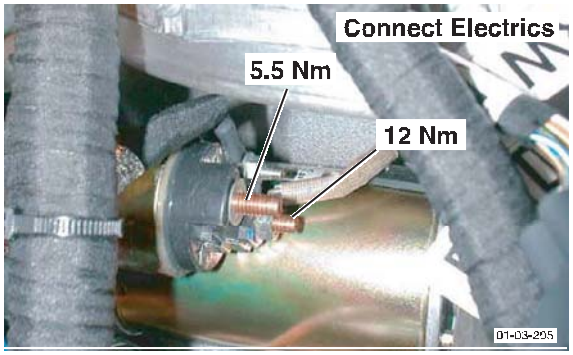
9. Remove the starter motor and the bracket for the oxygen gas sensors.

Install

1. Put the starter motor and the bracket for the oxygen gas sensors in position on the bell housing. Torque the bolts to **50 Nm**.



2. Connect theelectrical connections for the starter motor.



3. Install the heat shield.
4. If required, install the oxygen gas sensors.
5. Install the front under-tray and road wheel-arch liner.
6. Install the road wheels and install road wheel nuts. Do not fully tighten the wheel nuts at this step.
7. Lower the vehicle. Tighten the road wheel nuts (Refer to 'Torque Tightening of Road Wheel Nuts', page 4-4-7).

Engine (03.00)

Ignition System (03.07)

Description

There is an ignition coil attached to each spark-plug. Each cylinder has one spark-plug and ignition coil assembly.

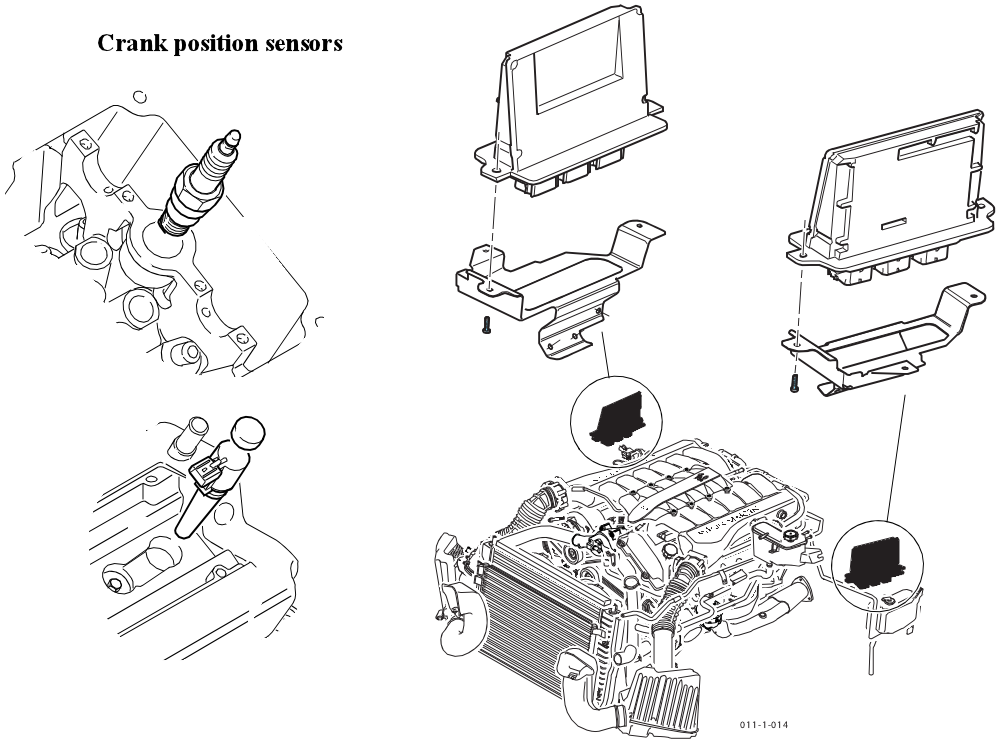
There are two crankshaft sensors installed on the front of the engine - only the right sensor is used. The second crankshaft sensor is installed on the left side of the flywheel housing.

The Powertrain Control Modules (PCMs)convert the alternating voltage signal from the two Crankshaft Position Sensors (CPS)into a digital signal. This digital signal is then used to set the 'On' and 'Off' time of the primary circuit of the ignition coil. The range for control of the ignition timing is increased because there are no parts that rotate. The PCMs refer to the engine speed and load inputs to give the correct ignition timing. This function also uses other inputs. For example:- The engine temperature, the throttle position and the transmission control module (TCM) inputs.

- A short circuit to ground between the fusebox and the coil, or the coil and the PCM will cause the fuse to blow. This will cause all of the ignition coils on that bank to stop.
- If an ignition coil has an internal short-circuit, the ignition coil will fail and not its fuse. This will let the remaining ignition coils continue to operate.
- If the wiring harness fails between the PCM and the ignition coil, the ignition coil will fail and not its fuse. This will let the remaining ignition coils continue to operate.

The twelve spark plugs are fired in sequence by the two PCMs. The Ignition timing can vary from 55 degrees before TDC to 10 degrees after TDC.

Crank position sensors



Specifications

Spark Plugs	
Firing order	1 - 7 - 5 - 11 - 3 - 9 - 6 - 12 - 2 - 8 - 4 - 10.
Type	Dual Platinum Fine Wire
Gap	1.2 - 1.3 mm
Torque	16-20 Nm
Camshaft Sensors	
Air Gap	1 ±0.5 mm

Torque Figures

Description	Nm	lb./ft.
Spark plugs	16-20	12-15
Ignition coils	5-7	4-5.5
Spark plug cover	2.5-3.5	2-3

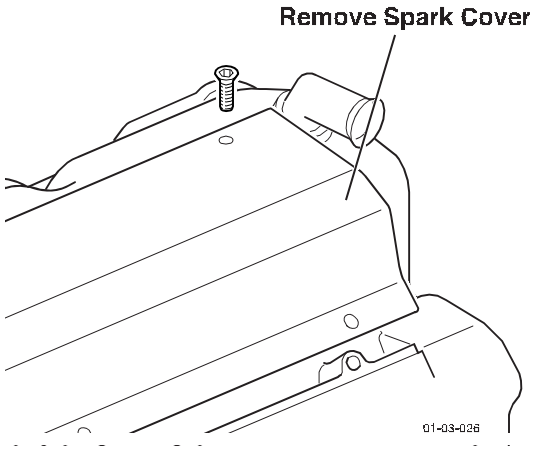
Maintenance

Spark Plugs

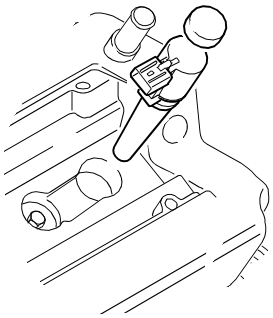
Repair Operation Time (ROT)		
Item		**Code**
Spark Plug Renew	All	**03.07.DB**
	LH Bank	**03.07.EB**
	RH Bank	**03.07.FB**

Remove

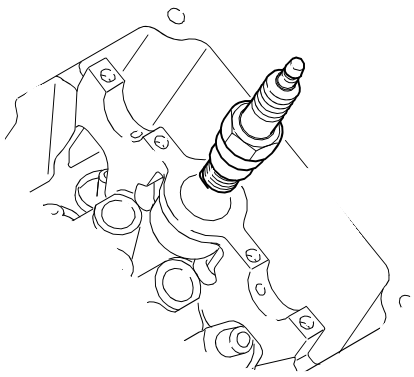
1. Remove the inlet manifold (Refer to 'Inlet Manifold', page 3-1-7).
2. Remove the spark plug cover.



3. Disconnect the ignition coils.
4. Remove the ignition coils.



5. Remove the spark plugs.



Install

1. Install the spark plugs. Torque to **16-20 Nm**.
2. Install the ignition coils. Torque the bolts to **5-7 Nm**.
3. Connect the wiring harness plugs to ignition coils.
4. Install the spark plug cover. Torque the bolts to **2.5-3.5 Nm**.
5. Install the inlet manifold (Refer to 'Inlet Manifold', page 3-1-7).

Engine (03.00)

Emission Control (03.08)

System Description

To prevent pollution, the crankcase gases (blow-by) go into the engine intake system. All poisonous fumes will be burned when the engine operates.

There is a part-load (1) and a full-load (2) breather system that vents the engine correctly during all conditions of operation.

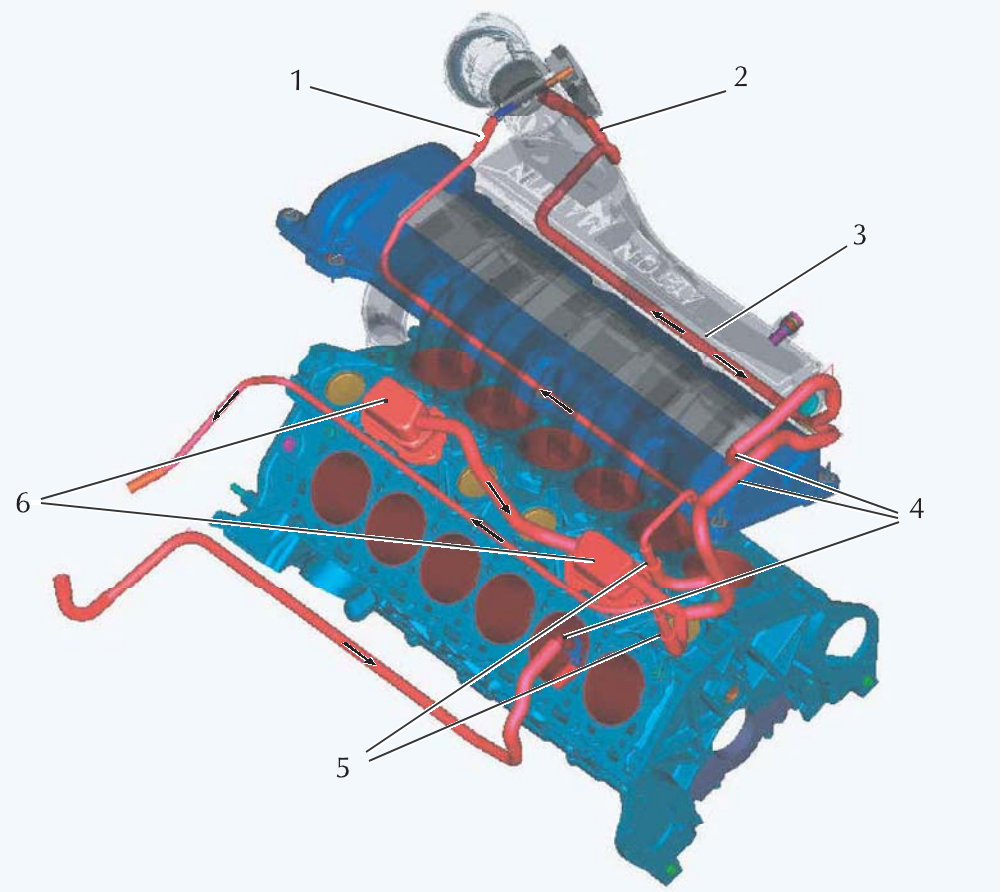
The crankcase gases are released through channels in the walls of the cylinder block. The gases then go into oil-separators (6) to remove the oil. At part-load, the gases from the oil-separators (6) go into the intake manifold. At full-load, the gases go into the intake system.

In part-load conditions, the system is controlled by the PCV (Positive Crankcase Ventilation) valve (5), which supplies a constant flow of vent gases. The flow through the PCV valve (5) is balanced by the 'make-up air' pipes (3) to the cam covers. The PCV valve (5) is operated by the pressure difference across the ends of the 'make-up air' pipes (3).

At full-load, the gases flow through a 1-way valve to the right inlet system (before the throttle) only.

The diameter of the pipes in the system is important for the control of the full-load and part-load operation.

Vacuum Pipework Layout



1. Part-load Breather Pipe - After the throttle body.
2. Full-load Breather Pipe - Before the throttle body.
3. Make-up-air.
4. One-way Valves
5. PCV Valve
6. Oil Separators

Engine (03.00)

Valve Train (03.09)

Description

Camshafts

The Inlet and exhaust camshafts in each cylinder head are chain-driven by 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 crankshaft and the camshaft sprockets during valve-timing. Because the timing chains have an odd number of links, the timing marks and the marked links will only align once every 122 revolutions of the engine.

Specifications

Valves, Guides & Springs	Nm.
Spring Force at 40mm Spring Height	290
	MM
Installed Spring Height (Exhaust/Inlet)	39.69-40.29
Valve Guide Internal Diameter	6.015 - 6.044
Valve Guide Maximum Runout	0.030
Valve Stem Diameter - Inlet	5.975 - 5.995
Valve Stem Diameter - Exhaust	5.950 - 5.970
Valve Stem Clearance - Inlet	0.020-0.069
Valve Stem Clearance - Exhaust	0.046-0.095
Valve Face Maximum Runout	0.050
Valve Lash Adjusters	
Bore	16.018 - 16.057
Outside Diameter	15.988 - 16.000
Clearance	0.018 - 0.069

Torque Figures

Description	Nm	lb. / ft.
Timing chain guide	20-30	15-22.5
Tensioners	20-30	15-22.5
Timing cover bolts	23-27	17-20

Maintenance

Valve Timing Chains

Repair Operation Time (ROT)	
Item	**Code**
Timing Chain Renew LH RHD	**0309AA**
Timing Chain Renew RH RHD	**0309AB**
Timing Chain Renew LH LHD	**0309AC**
Timing Chain Renew RH LHD	**0309AD**

Remove

1. Remove the camshaft covers (Refer to 'Camshaft Cover', page 3-10-1).
2. Remove the timing cover (Refer to 'Timing Cover', page 3-10-3).
3. Remove the crankshaft timing disc.

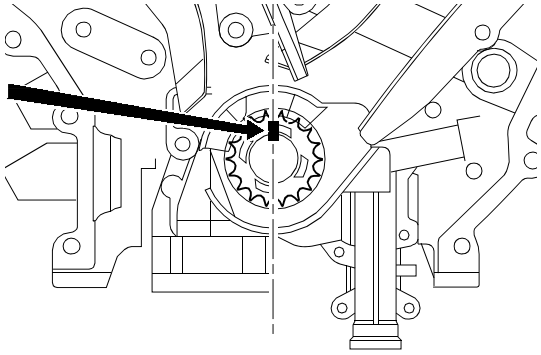
Record the correct position of the disc for the Install procedure.

4. Turn the crankshaft until the crankshaft key is in the vertical position.

Caution

The crankshaft key must stay in the vertical position until the camshaft chains are correctly installed and tensioned. If the crankshaft moves before the valve timing is completed, valves and pistons can be damaged.

The crankshaft key is exactly in line with No.1 crankshaft throw. With the crankshaft key vertical, No.1 piston is 30° ATDC and all pistons are below engine block surface.



5. Insert the camshaft set tool (Refer to '303-713 (Camshaft Set)', page 20-1-5).

With the crankshaft Key in the vertical position the flats on the camshaft will accept the camshaft set tool.

6. Remove the right or left timing chain tensioner, the tensioner arm and the timing chain guides:-

   Do not remove the timing chain.

   6.1 Compress the timing chain tensioner and install the locking pin (Refer to '303-1072 (Timing Chain Tensioner Pins)', page 20-1-6). Remove the bolts (x2) and release the timing chain tensioner.

   6.2 Remove the floating tensioner arm.

6.3 Remove the fixed timing chain guide (bolts x2).

Repeat steps 6.1 to 6.3 for the second timing chain tensioner and timing chain guides.

7. Remove the two timing chains and the crankshaft twin sprocket from the crankshaft.

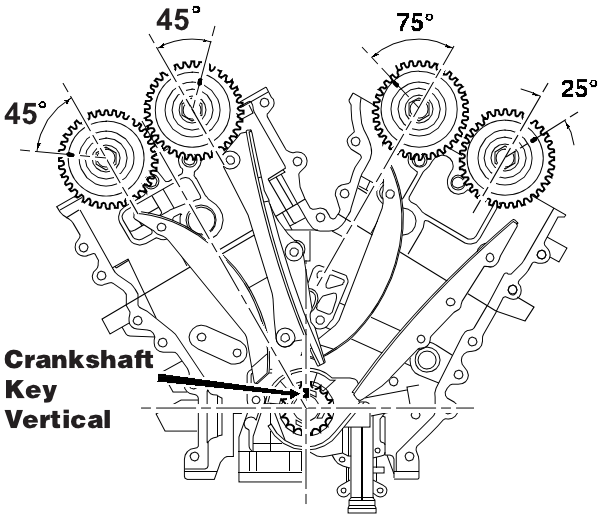
Install

Caution

The crankshaft key must stay in the vertical position until the camshaft chains are correctly installed and tensioned. If the crankshaft moves before the valve timing is completed, valves and pistons can be damaged.

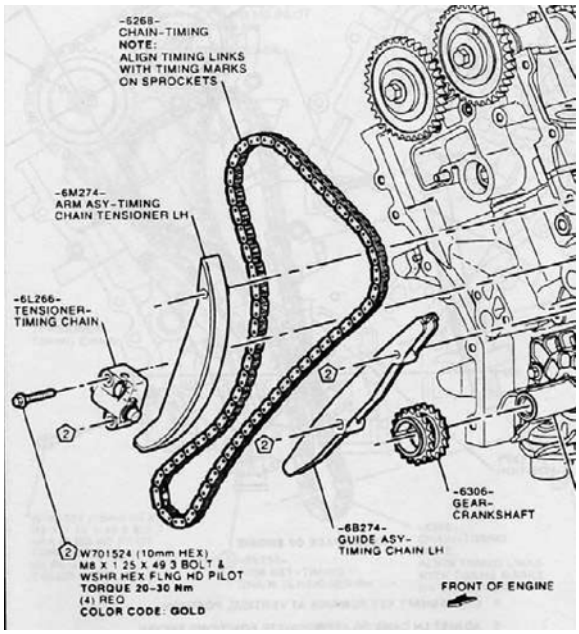
1. Do a check that the crankshaft key is vertical and that all camshafts are in the initial positions shown.

The crankshaft key is exactly in line with No.1 crankshaft throw. With the crankshaft key vertical, No.1 piston is 30° ATDC and all pistons are below engine block surface.

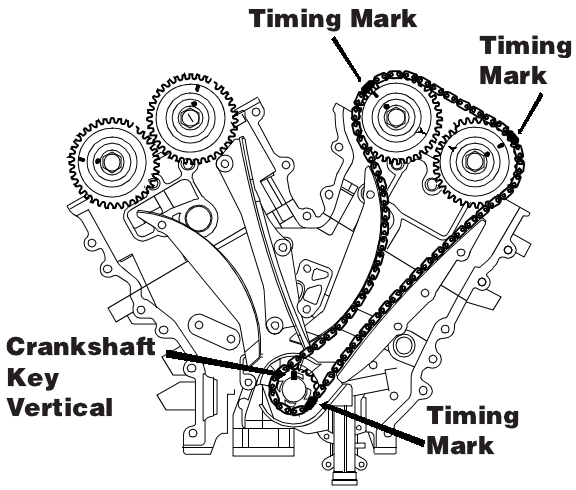


Left Cylinder Head (Cylinders 7-12)

2. Engage the camshaft timing service tool (Refer to '303-713 (Camshaft Set)', page 20-1-5) to the flats on the camshafts.
3. Install the fixed timing chain guide.



4. Install the timing chain with the marked links (x3) aligned with the marks on the crankshaft and the camshaft sprockets.



5. Install and tension the timing chain arm and tensioner. Remove the lock-pin for the timing chain tensioner.
6. Make sure that all of the three marked links on the timing chain, align with the timing marks on the camshaft and crankshaft sprockets.