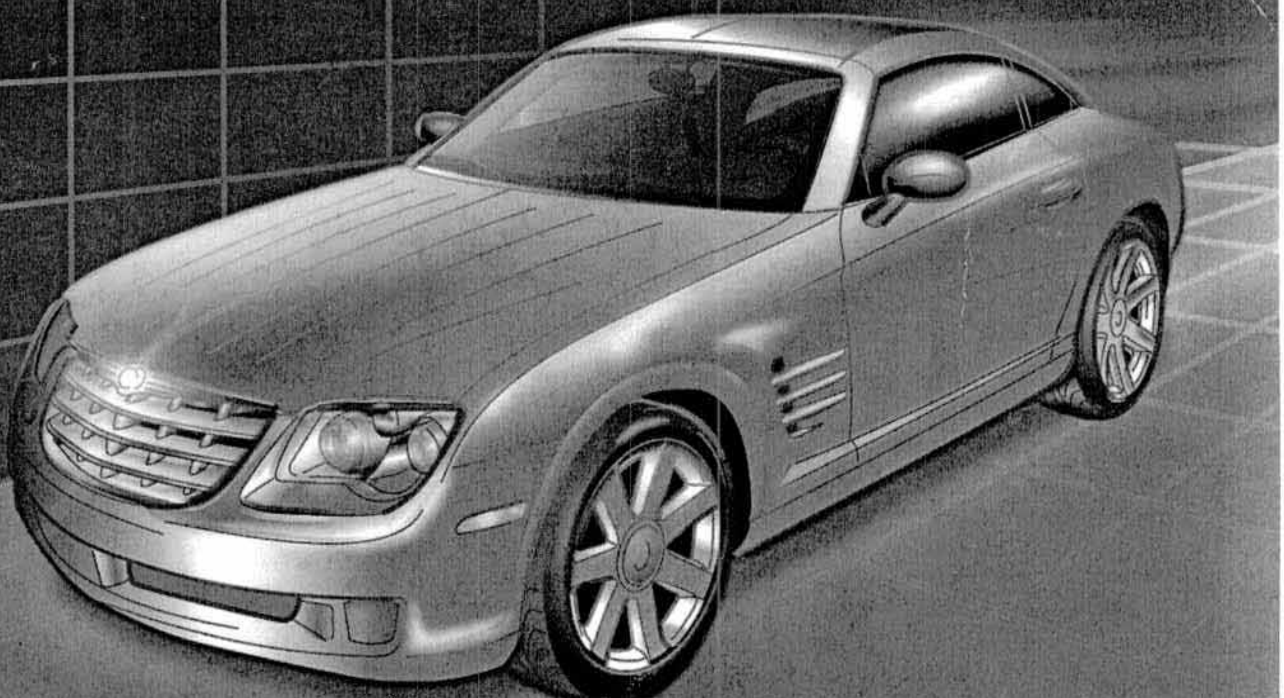
CHRYSLER

# CROSSFIRE



# Student Reference Book

DCA
DaimlerChrysler Academy
School of Technical Training

# SAFETY NOTICE

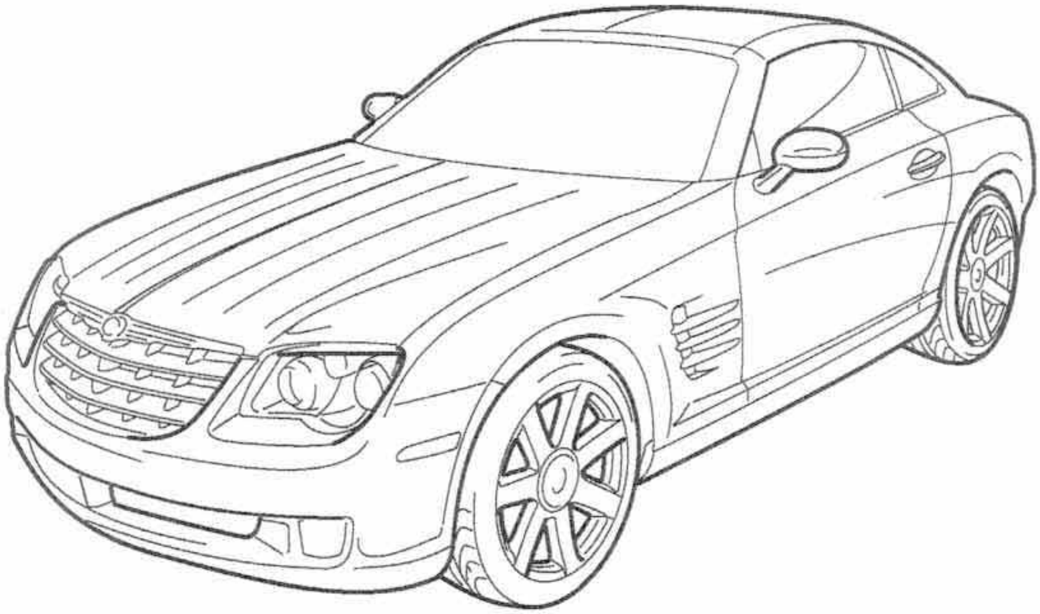
This publication's purpose is to provide Technical training information to individuals in the automotive trade. All test and repair procedures must be performed in accordance with manufacturers service and diagnostic manuals. All ***warnings, cautions,*** and ***notes*** must be observed for safety reasons. The following is a list of general guidelines:

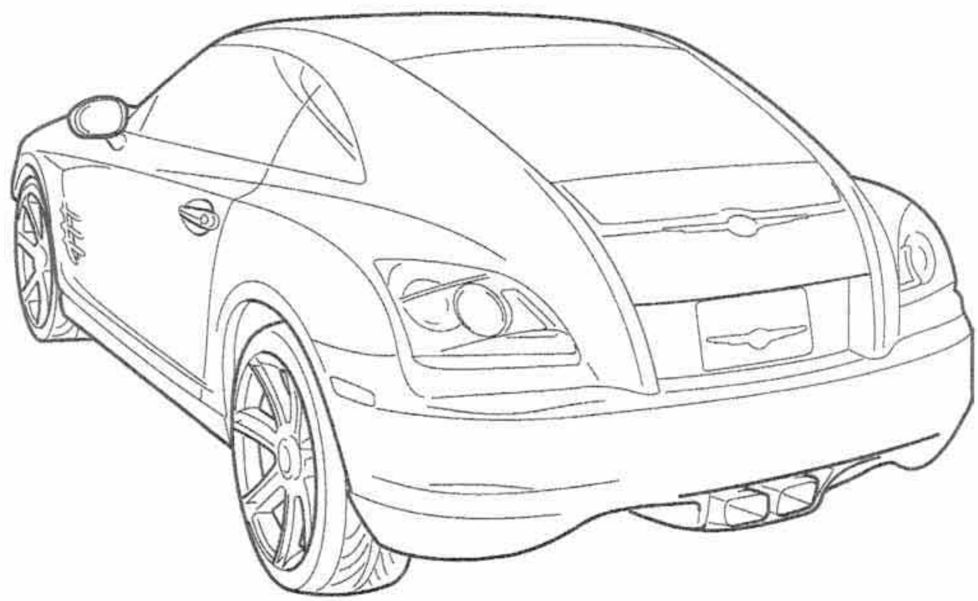
- Proper service and repair is critical to the safe, reliable operation of all motor vehicles.
- The information in this publication has been developed for service personnel, and can help when diagnosing and performing vehicle repairs.
- Some service procedures require the use of special tools. These special tools must be used as recommended throughout this Technical Training Publication, the diagnostic Manual, and the Service Manual.
- Special attention should be exercised when working with spring-or tension-loaded fasteners and devices such as E-Clips, Cir-clips, Snap rings, etc., careless removal may cause personal injury.
- Always wear safety goggles when working on vehicles or vehicle components.
- Improper service methods may damage the vehicle or render it unsafe.
- Observe all ***warnings*** to avoid the risk of personal injury.
- Observe all ***cautions*** to avoid damage to equipment and vehicle.
- ***Notes*** are intended to add clarity and should help make your job easier.

***Cautions*** and ***Warnings*** cover only the situations and procedures DaimlerChrysler Corporation has encountered and recommended. Neither DaimlerChrysler Corporation nor its subsidiaries or affiliates cannot know, evaluate, and advise the service trade of all conceivable ways in which service may be performed, or of the possible hazards for each. Consequently, DaimlerChrysler Corporation and its subsidiaries and affiliates have not undertaken any such broad service review. Accordingly, anyone who used a service procedure or tool that is not recommended in this publication, must be certain that neither personal safety, nor vehicle safety, is jeopardized by the service methods they select.



MASTERTECH





# Crossfire Specialist Introduction

# TABLE OF CONTENTS

**INTRODUCTION** ........ 1
**STUDENT LEARNING OBJECTIVES** ........ 2
**ACRONYMS** ........ 4
**2003 SERVICE AND TECHNICAL INFORMATION** ........ 7
REMOVAL AND INSTALLATION PROCEDURES ........ 8
Current Service and Diagnostics Format ........ 8
New Service and Diagnostics Format ........ 9
New Removal and Installation Exploded View Format ........ 10
Icon Based Diagnostics ........ 11
Service and Diagnosis Current Format ........ 11
New Icon Based Diagnostics Format ........ 12
COMPONENT LOCATIONS ........ 13
Current Service and Diagnosis Format ........ 13
New Service and Diagnosis Format ........ 14
CIRCUIT DIAGRAM ........ 15
WIRING DIAGRAM ........ 16
New Wiring Diagrams Format ........ 17
THUMBNAIL (MINI-SCHEMATIC) ........ 17
New Thumbnails Format ........ 18
TABLE OF CONTENTS FORMAT ........ 19
**ELECTRICAL SYSTEMS** ........ 21
BATTERY ........ 21
POWER DISTRIBUTION ........ 22
Relay Control Module ........ 22
Engine Fuse Block ........ 24
Underhood Accessory Fuse Block ........ 24
Illumination Control Module ........ 24
Charging System ........ 25
Starting System ........ 27
Fuses ........ 30
GROUNDS ........ 30

CONTROLLER AREA NETWORK – CAN DATA BUS .......... 31
Normal Operation .......... 32
Circuit Description .......... 33
Unshielded Twisted Pair .......... 36
Message Transmission .......... 36
Abnormal Operation/Failure Mode .......... 40
DATA LINK CONNECTOR (DLC) .......... 41
RESTRAINT SYSTEMS .......... 44
Active Restraints .......... 44
Supplemental Restraints .......... 44
SUPPLEMENTAL RESTRAINT COMPONENTS .......... 45
Occupant Restraint Controller (ORC) .......... 45
Side Impact Sensors .......... 46
Side Impact Airbag .......... 47
Clockspring .......... 48
Driver/PAB Squib .......... 48
PAB On/Off Switch .......... 49
Seat Belt Buckle Switches .......... 51
Passenger Seat Occupant Simulator .......... 51
Emergency Tensioning Retractors (ETRs) .......... 52
System Operation .......... 52
BODY CONTROL MODULE (BCM) .......... 54
Description .......... 54
Operation .......... 55
INSTRUMENT CLUSTER (IC) .......... 56
Gauges .......... 57
Digital Displays .......... 57
Indicator Lamps Actuated Over Direct Lines .......... 58
Indicator Lamps Actuated Over the CAN Bus .......... 58
Audible Tone And Indicator Lamps Actuated Over Direct Lines .......... 58
Audible Tone And Indicator Lamps Actuated Over the CAN Bus .......... 58
FLEXIBLE SERVICE SYSTEM (FSS) INDICATOR .......... 59
Appearance and Lighting .......... 59
REMOTE KEYLESS ENTRY (RKE) FOB .......... 59
Key Replacement .......... 60
Transmitter Functions .......... 60

CENTRAL LOCKING SYSTEM .... 61
Mechanically Operated Locks .... 62
Automatic Central Locking .... 62
CENTRAL LOCKING PUMP/SECURITY SYSTEMS MODULE (CLP/SSM) .... 63
Sentry Key Remote Electronic Entry Module (SKREEM) .... 65
A/C Heater Control Module .... 68
Tow Away Alarm Switch .... 69
Anti-Theft Tow Sensor .... 70
CAN Bus .... 71
Door Ajar Switches .... 71
Glove Box Ajar Switch .... 72
Liftgate Ajar Switch .... 73
Hood Ajar Switch .... 74
Defroster Grid .... 75
Parking Lamps .... 76
Siren .... 77
Lock Actuators .... 78
System Operation .... 78
AUTO ACCIDENT RESPONSE .... 79
SENTRY KEY® IMMOBILIZER SYSTEM (SKIS) .... 79
VEHICLE THEFT ALARM (VTA) .... 80
TIRE PRESSURE MONITOR (TPM) .... 81
UNIVERSAL GARAGE DOOR OPENER .... 83
POWER MIRRORS .... 83
Driver and Passenger Power Mirrors .... 83
Automatic Day/Night Mirror .... 84
HEATED SEATS .... 84
INTERIOR REARVIEW MIRROR .... 85
POWER SPOILER .... 85
Body Control Module (BCM .... 87
Spoiler Switch .... 88
Spoiler Limit Switches .... 89
Spoiler Motor .... 90
System Operation .... 91
AUDIO .... 92
Radio .... 92
Traffic Program (TP) .... 93
Amplifier .... 94
Speakers .... 94

**CHASSIS** .......... **95**
- SUSPENSION .......... 95
  - Front Suspension .......... 95
  - Rear Suspension .......... 96
  - Vehicle Alignment .......... 96
  - Wheels and Tires .......... 97
  - Caster, Camber, and Toe .......... 97
- POWER STEERING .......... 98
- BASE BRAKE SYSTEM .......... 99
  - Master Cylinder .......... 99
  - Parking Brake .......... 100
  - Brake Lines .......... 100
  - Brake Fluid .......... 100
  - Brake Pad Wear Sensor .......... 101
- ANTI-LOCK BRAKE SYSTEM .......... 102
  - Controller Anti-Lock Brake (CAB) .......... 103
  - Wheel Speed Sensors (WSS) .......... 105
- BRAKE ASSIST SYSTEM (BAS) .......... 106
  - BAS Release Switch and Solenoid .......... 108
  - Vacuum Booster .......... 109
  - Brake Pedal Speed Sensor .......... 110
  - Controller Anti-Lock Brake (CAB) .......... 111
  - Master Cylinder .......... 112
  - Brake Application In Normal Operation .......... 113
  - BAS Pressure Increase .......... 114
  - BAS Pressure Reduction .......... 115
  - BAS Function and Operation .......... 116
- ACCELERATION SLIP REGULATION (ASR) .......... 117
  - ASR Control Mode .......... 119
  - ASR Off Mode .......... 120
- ELECTRONIC STABILITY PROGRAM (ESP) .......... 122
  - ASR/ESP Rocker Switch .......... 123
  - Steering Angle Sensor .......... 124
  - ESP Brake Pressure Sensor .......... 125
  - Brake Lamp Switch .......... 126
  - Lateral Acceleration and Yaw Sensors .......... 127
  - Wheel Speed Sensors (WSS) .......... 128
  - ESP Indicator Lamp Functions .......... 129
  - System Operation .......... 130

Auxiliary Functions .......... 133
Indicator Lamp Actuation .......... 133
Stop Lamp Switch .......... 133
**ENGINE MECHANICAL .......... 135**
ENGINE SPECIFICATIONS .......... 136
PERFORMANCE FEATURES .......... 137
INTAKE MANIFOLD .......... 138
EXHAUST MANIFOLDS .......... 138
CYLINDER HEADS AND COVERS .......... 139
CYLINDER BLOCK .......... 141
VALVE TRAIN .......... 141
ENGINE TIMING .......... 142
PISTONS, CONNECTING RODS AND CRANKSHAFT .......... 143
BALANCE SHAFT .......... 144
ACCESSORY DRIVE .......... 145
ENGINE OIL PUMP, FILTER, COOLER AND SENSOR .......... 145
Oil Sensor .......... 146
Sensor Operation .......... 149
FLEXIBLE SERVICE SYSTEM .......... 150
ENGINE COOLING .......... 151
Coolant Flow .......... 152
Radiator Fan Control Module .......... 153
OIL AND COOLANT CAPACITIES .......... 153
**ENGINE MANAGEMENT .......... 155**
POWERTRAIN CONTROL MODULE (PCM) .......... 155
DESCRIPTION .......... 155
OPERATION .......... 155
FUEL SYSTEM .......... 156
Fuel Flow .......... 157
FUEL INJECTION AND IGNITION SYSTEMS .......... 160
FUEL SUPPLY SYSTEM .......... 161
Fuel Filter/Fuel Pressure Regulator .......... 162
INJECTORS .......... 163

FUEL SYSTEM CONTROL ........ 163
- Speed Control ........ 164
- Electronic Throttle Control (ETC) ........ 165
- Acceleration Pedal Position (APP) Sensors ........ 166
- Powertrain Control Module (PCM) ........ 167
- Throttle Body ........ 168
- Shift Lever Assembly (SLA) ........ 169
- Reverse Switch (Manual Transmission) ........ 170
- System Operation ........ 171
- Hot Film Mass Airflow (MAF)Sensor ........ 171

EMISSION CONTROL FEATURES ........ 172
- Evaporative Emission Control System (EVAP) ........ 173
- Exhaust Gas Recirculation (EGR) and Secondary AIR Systems ........ 175
- Secondary AIR System ........ 177
- Secondary AIR System Operation ........ 183

IGNITION SYSTEM ........ 184
- Ignition Strategy ........ 185

**DRIVETRAIN ........ 189**

SIX-SPEED MANUAL TRANSMISSION ........ 189
- Shifter ........ 191
- Clutch ........ 192
- Clutch-Starter Interlock ........ 192

FIVE-SPEED AUTOMATIC TRANSMISSION ........ 192
- Transmission Control Module (TCM) ........ 193
- Shift Lever ........ 194
- AutoStick® ........ 194
- Brake Interlock ........ 195
- Shift Interlock ........ 195
- Transmission Fluid ........ 195
- Transmission Cooler ........ 196

DRIVESHAFT ........ 196

REAR AXLE ........ 196
- Rear Axle and Suspension Cradle ........ 196
- Service ........ 196

HALFSHAFTS ........ 196
- Service ........ 196

**HEATING, VENTILATING AND AIR CONDITIONING** ........ **197**
OVERVIEW ........ 197
Heater Mode ........ 198
Cooling Mode ........ 198
Temperature Control ........ 199
CONTROL PANEL ........ 200
Blower ........ 201
Fan Speed Control ........ 202
Air Distribution Control ........ 203
Temperature Control ........ 203
Rear Window Defogger ........ 203
Economy Mode Button ........ 204
Air Recirculation Control ........ 204
Residual Engine Heat System (REST) Mode ........ 205
Dual Zone Temperature Control ........ 211
Residual Engine Heat System (REST) ........ 211
Front Ventilation ........ 212
Electrostatic Dust Filter ........ 213
Rear Ventilation ........ 214
Instrument Panel Ducts and Outlets ........ 214
Side Window Defroster Outlets ........ 214
Windshield Defroster Outlets ........ 214
HEATING SYSTEM COMPONENTS ........ 214
Two-Sided Heater Core ........ 214
Coolant Pump ........ 215
REFRIGERATION SYSTEM COMPONENTS ........ 217
Evaporator ........ 217
Condenser ........ 218
Receiver Drier ........ 219
Thermal Expansion Valve (TXV) ........ 220
Engine Cooling Fan ........ 222
ELECTRONIC INPUTS ........ 222
Evaporator Temperature Sensor ........ 222
Refrigerant Pressure Sensor ........ 223
**SPECIAL TOOLS** ........ **225**

# INTRODUCTION

This course is designed for a Chrysler dealership technician as a basic introduction to the unique features, systems and components of the 2004 Chrysler Crossfire. This is a two-phase course.

- Phase I provides the base knowledge to help you locate, identify and describe the basic operation of various vehicle features.
- Phase II provides testing and feedback of the knowledge obtained in Phase I. Systems covered in detail in Phase II include:
  - Controller Area Network (CAN) Bus
  - Electronic Stability Programming (ESP)
  - Brake Assist System (BAS)
  - Electronic Throttle Control (ETC)
  - Dual Zone Climate Control
  - Residual Engine Heat System (REST) Feature
  - Central Locking Pump/Security System Module
  - Power Distribution
  - Ground Distribution
  - Secondary AIR System
  - Starting System
  - Engine Oil Sensor
  - Passenger Airbag (PAB) Switch.

To successfully complete this course, you should have the following skills:

- Know how to locate information and procedures in DaimlerChrysler Service Information.
- Be familiar with basic automotive subsystems and components.
- Have experience using hand and special tools.

The information in this publication should be used with the Service Information when performing repairs. This publication only provides the information necessary to become acquainted with the new vehicle systems. The concepts learned here, when used with the Service Information, will help you diagnose and repair the Chrysler Crossfire.

## STUDENT LEARNING OBJECTIVES

Upon completion of phase one of this course, you will be able to:

- Locate and identify the unique components of the Crossfire.
- Describe the modules and components that make up these unique systems.
- Describe the features and high-level operation of these systems.

Upon completion of phase two of this course, you will be able to:

- Describe the features of the newly formatted Service Information.
- Describe the Crossfire specific features of the DRBIII® scan tool.
- Identify the system operation and characteristics of the components associated with the Controller Area Network (CAN) Bus.
- Identify the system operation and characteristics of the components associated with the Electronic Stability Programming (ESP).
- Identify the system operation and characteristics of the components associated with the Brake Assist System (BAS).
- Identify the system operation and characteristics of the components associated with the Electronic Throttle Control (ETC).
- Identify the system operation and characteristics of the components associated with the Dual Zone Climate Control.
- Identify the system operation and characteristics of the components associated with the Residual Engine Heat System (REST) feature.

- Identify the system operation and characteristics of the components associated with the Central Locking Pump/Security System Module.
- Identify the system operation and characteristics of the components associated with Power Distribution.
- Identify the system operation and characteristics of the components associated with Ground Distribution.
- Identify the system operation and characteristics of the components associated with the Secondary AIR System.
- Identify the system operation and characteristics of the components associated with the Starting System.
- Identify the system operation and characteristics of the components associated with the Engine Oil Sensor.
- Identify the system operation and characteristics of the components associated with the Passenger Airbag (PAB) Switch.

## ACRONYMS

The acronyms listed here are used in this course

- A/T Automatic Transmission
- ABS Anti-Lock Brake System
- APP Accelerator Pedal Position
- ASR Acceleration Slip Regulation
- BAS Brake Assist System
- BPS Bits Per Second
- CAB Controller Anti-Lock Brake
- CAN Controller Area Network
- CCA Cold Cranking Amps
- CCD Chrysler Collision Detection
- CKP Crankcase Position Sensor
- CLP/SSM Central Locking Pump/Security System Module
- CMP Camshaft Position Sensor
- DLC Data Link Connector
- DRBIII® Diagnostic Readout Box, 3rd Generation
- DTC Diagnostic Trouble Code
- EBD Electronic Brake Force Distribution
- EGR Exhaust Gas Recirculation
- EON Extended Traffic Program
- EEPROM Erasable Electronic Programmable Read Only Memory
- ESP Electronic Stability Program
- ETC Electronic Throttle Control
- ETR Emergency Tensioning Retractor
- EVAP Evaporative Emission Control System

| | |
|---|---|
| • FSS | Flexible Service System |
| • FTP | Fuel Tank Pressure |
| • HCU | Hydraulic Control Unit |
| • HVAC | Heating, Ventilating and Air Conditioning |
| • IC | Instrument Cluster |
| • IOD | Ignition Off Draw |
| • LATCH | Lower Anchors and Tether for Children |
| • LED | Light-Emitting Diode |
| • M/T | Manual Transmission |
| • MAF | Mass Air Flow |
| • MAP | Manifold Absolute Pressure |
| • NAG1 | New Automatic Gearbox |
| • NTC | Negative Temperature Coefficient |
| • NVM | Non-Volatile Memory |
| • ORC | Occupant Restraint Controller |
| • PAB | Passenger Airbag |
| • PCM | Powertrain Control Module |
| • RBDS | Radio Broadcast Display Stations |
| • REST | Residual Engine Heat System |
| • RF | Radio Frequency |
| • RKE | Remote Keyless Entry |
| • SCI | Serial Communications Interface |
| • SKIM | Sentry Key® Engine Immobilizer |
| • SKIS | SENTRY KEY® IMMOBILIZER System |
| • SKREEM | Sentry Key Remote Electronic Entry Module |
| • SLA | Shift Lever Assembly |
| • SRS | Supplemental Restraint System |

- TCM Transmission Control Module
- TP Throttle Position
- TPM Tire Pressure Monitor
- TXV Thermal Expansion Valve
- UGDO Universal Garage Door Opener
- VTA Vehicle Theft Alarm
- WSS Wheel Speed Sensor

## 2003 SERVICE AND TECHNICAL INFORMATION

The goals of the new 2003 Service and Technical Information are to increase your awareness and usability, and decrease the time you spend looking for information in the current Service Information.

To use current Service Information, technicians are required to use five books (Service Manual and Diagnostic) to find answers. Some technicians have complained that Wiring Diagrams contained too many pages. As a result the existing Service and Technical Information have been reorganized to condense Diagnostic, Service, and Wiring into one comprehensive manual. Visual presentation of information uses storyboards and icon based diagnostics.

The 2003 Crossfire Service and Technical Information combines five separate manuals into one comprehensive manual. All Service Manual and Wiring Diagram information are located at the system level.

The new formatting includes:

- Combined Wiring Diagram and Service Information with Diagnostic Information
- Removal and Installation Storyboard
- Removal and Installation Exploded Views
- Icon Base Diagnostics
- Component Locations
- Wiring Diagrams
- Circuit Diagrams
- Thumbnails
- Table of Contents (TOC)

## REMOVAL AND INSTALLATION PROCEDURES

### Current Service and Diagnostics Format

This is a typical removal and installation procedure page from a current Service Manual (Fig. 1).

LH — ENGINE 3.2/3.5L 9 - 113

**CYLINDER HEAD (Continued)**

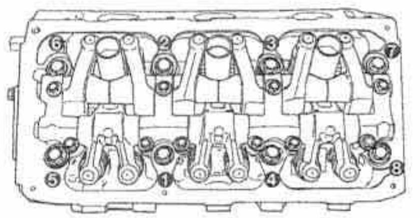


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*Fig. 15 Cylinder Head Bolt Tightening Sequence*

(8) Install rear timing belt covers (Fig. 10) and (Fig. 11). Tighten bolts to specified torque:

- M10—54 N·m (40 ft. lbs.)
- M8—28 N·m (20 ft. lbs.)
- M6—12 N·m (105 in. lbs.)

(9) Install camshaft sprockets and timing belt. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

(10) Install front timing belt covers. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION)

(11) Install crankshaft vibration damper. (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION)

(12) Install upper and lower intake manifold. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION)

(13) Connect catalytic converter to exhaust manifold using a new V-band clamp(s). Tighten clamp to 10 N·m (100 in. lbs.).

(14) Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)

(15) Connect negative cable to remote jumper terminal

#### CAMSHAFT OIL SEAL(S)

##### REMOVAL

(1) Remove camshaft sprocket(s). (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(2) Use Special Tool C-3981B to remove camshaft oil seal (Fig. 16).

##### INSTALLATION

(1) Apply light coat of engine oil to the camshaft oil seal lip.

(2) Install the oil seal using Special Tool 6788 Seal Protector Sleeve (Fig. 17) and Seal Installer 6052 (Fig. 18).

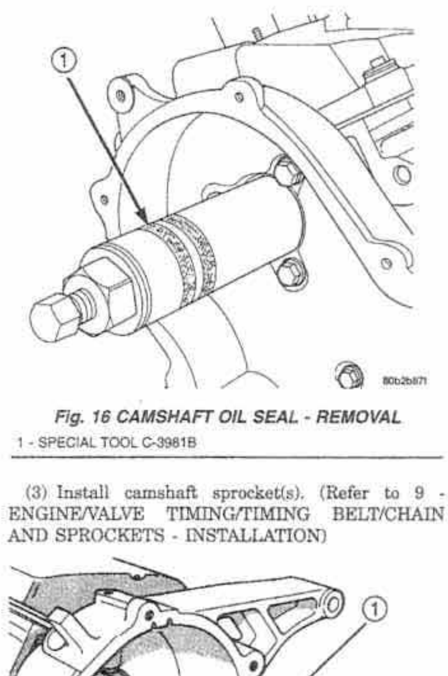


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*Fig. 16 CAMSHAFT OIL SEAL - REMOVAL*

1 - SPECIAL TOOL C-3981B

(3) Install camshaft sprocket(s). (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)

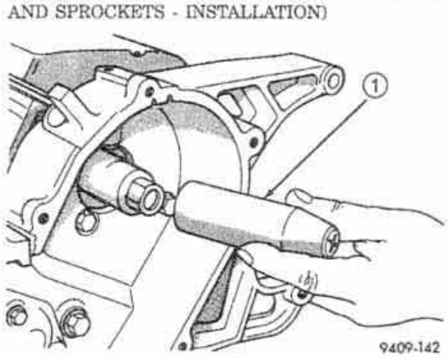


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*Fig. 17 Camshaft Oil Seal Protector Sleeve*

1 - SPECIAL TOOL 6788

#### CAMSHAFT(S)

##### DESCRIPTION

A single overhead camshaft per cylinder head provides valve actuation. The left camshaft accommodates a cam sensor pick-up wheel and is therefore longer. Each camshaft is supported by four bearing journals. Thrust for each camshaft is taken at a thrust plate attached to the rear of each cylinder head. Right and left camshaft driving sprockets are

Figure 1 Current Service and Diagnostics Format

## New Service and Diagnostics Format

Shown below (Fig. 2) is a removal and installation procedure in the new format. It is less cluttered and easier to follow. The new formatting provides:

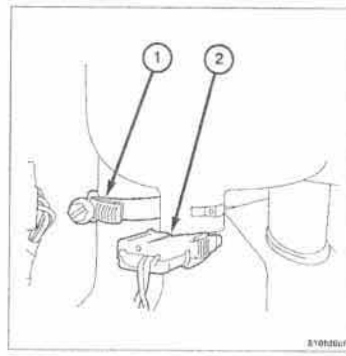
- a quick visual reference.
- the graphics represent physical steps in operation.
- the limited text is provided for the less experienced technician.

**COOLING - MECHANICAL REPAIR**

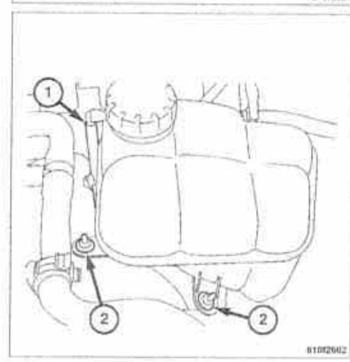
provides some reserve coolant to cover minor leaks, evaporation or boiling losses. The overflow chamber allows coolant recovery in case of an overheat.

**REMOVAL**

1. Partially drain the cooling system. Refer to Page 7-17.
2. Disconnect the coolant hose to the radiator (1).
3. Disconnect the coolant level sensor harness connector (2) at the coolant reservoir.




4. Disconnect the coolant overflow hose (1).
5. Remove the two retaining nuts (2) and lift the coolant recovery reservoir from the engine compartment.




**INSTALLATION**

1. Position the coolant reservoir in the engine compartment.

7-24

Figure 2 New Service and Diagnostics Format

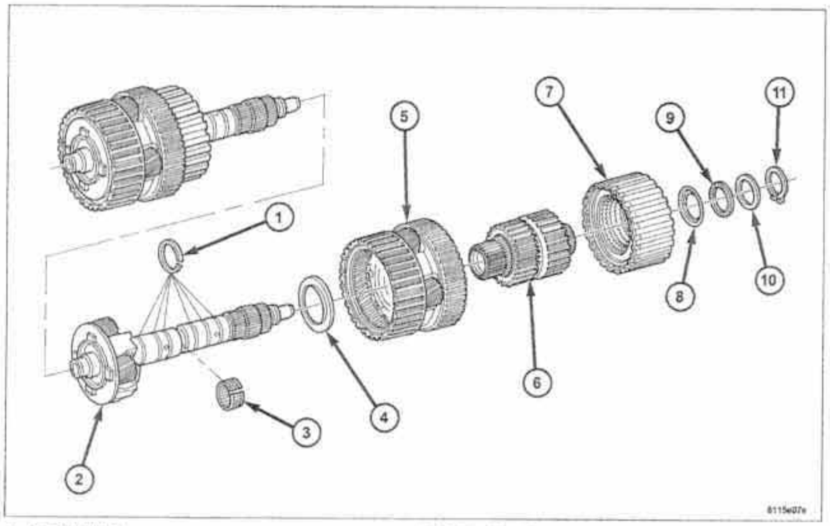
## New Removal and Installation Exploded View Format

The new removal and installation exploded view format (Fig. 3) shows detailed Removal and Installation procedure in one simple diagram.

The diagram includes all torque specification and material application requirements. The diagram also supports the removal and installation procedures in the text.

**AUTOMATIC TRANSMISSION - NAG1**

**DISASSEMBLY**




1 - TEFLON RINGS
2 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER
3 - NEEDLE BEARING
4 - THRUST WASHER
5 - REAR PLANETARY GEAR SET
6 - REAR HOLLOW SHAFT/FREEWHEEL F2
7 - DRIVING CLUTCH K3
8 - THRUST WASHER
9 - AXIAL NEEDLE BEARING
10 - SHIM
11 - RETAINING RING

1. Remove the upper two visible teflon rings (1) from the output shaft with center planetary carrier (2).
2. Remove the retaining ring (11), shim (10), axial needle bearing (9) and thrust washer (8) from the output shaft with center planetary carrier (2).
3. Remove the driving clutch K3 (7).
4. Remove the rear hollow shaft/freewheel F2 (6) from the output shaft with center planetary carrier (2).
5. Remove the rear planetary gear set (5) with integrated tubular shaft of center gear set from the output shaft with center planetary carrier (2).
6. Remove the thrust washer (4).

2158-141

Figure 3 New Removal and Installation Exploded View Format

## Icon Based Diagnostics

## Service and Diagnosis Current Format

**TRANSMISSION**

**P0750-LR SOLENOID CIRCUIT — Continued**

| TEST | ACTION | APPLICABILITY |
|---|---|---|
| 2 | With the DRBIII®, read Transmission DTC's<br>Are any of the DTC's P0888, P0890 and/or P0891 present also?<br>Yes → Refer to the Transmission category and perform the appropriate symptom.<br>Perform 42LE TRANSMISSION VERIFICATION TEST - VER 1.<br>No → Go To 3 | All |
| 3 | With the DRBIII®, Check the STARTS SINCE SET counter.<br>**NOTE: This counter only applies to the last DTC set.**<br>Is the STARTS SINCE SET counter for P0750 set at 0?<br>Yes → Go To 4<br>No → Go To 11 | All |
| 4 | Turn the ignition off to the lock position.<br>**CAUTION: Remove the Starter Relay from the PDC. This will prevent the vehicle from being started in gear.**<br>**NOTE: Failure to remove the Starter Relay can cause a TCM - No Response condition.**<br>Install Transmission Simulator, Miller tool #8333 and the FWD Adapter Cable kit, Miller tool #8333-1.<br>Ignition on, engine not running.<br>With the DRBIII®, actuate the L/R Solenoid.<br>Monitor the L/R Solenoid LED on the Transmission Simulator.<br>Did the L/R Solenoid LED on the Transmission Simulator blink on and off during actuation?<br>Yes → Go To 5<br>No → Go To 6 | All |
| 5 | If there are no possible causes remaining, view repair.<br>Repair<br>Replace the Transmission Solenoid/Pressure Switch Assembly per the Service Information.<br>Perform 42LE TRANSMISSION VERIFICATION TEST - VER 1. | All |
| 6 | Turn the ignition off to the lock position.<br>Disconnect the Transmission Solenoid/Pressure Switch Assembly harness connector.<br>Remove the Transmission Control Relay from the PDC.<br>**Note: Check connectors - Clean/repair as necessary.**<br>Connect a jumper wire between the Fused B+ circuit and Transmission Control Relay Output circuit in the Transmission Control Relay connector.<br>Using a 12-volt test light connected to ground, check the Transmission Relay Output circuit in the Transmission Solenoid/Pressure Switch harness connector.<br>**NOTE: The test light must illuminate brightly. Compare the brightness to that of a direct connection to the battery.**<br>Does the test light illuminate brightly?<br>Yes → Go To 7<br>No → Repair the Transmission Control Relay Output circuit for an open. If the fuse is open make sure to check for a short to ground.<br>Perform 42LE TRANSMISSION VERIFICATION TEST - VER 1. | All |

67

Figure 4 Service and Diagnosis Current Format

## New Icon Based Diagnostics Format

In this new diagnostics format (Fig. 5), the graphic represents the activity used to perform the task. It provides a quick visual reference for technician.

An experienced technician needs only to look at the illustration and does not necessarily need to read the procedure to perform the task.

### *RADIATOR COOLING FAN INOPERATIVE

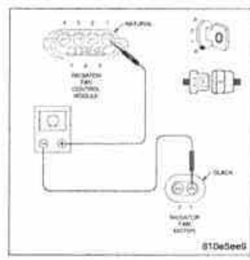
6. CHECKING THE RADIATOR FAN CONTROL MODULE GROUND CIRCUIT

Measure the resistance of the Radiator Fan Control Module Ground circuit from the Radiator Fan Control Module harness connector to the Radiator Fan Motor harness connector.

**Is the resistance below 5.0 ohms?**

Yes >> Go to 7

No >> Repair the Radiator Fan Control Module Ground circuit for an open.
Perform POWERTRAIN VERIFICATION TEST.



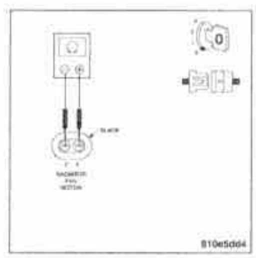
7. CHECKING THE RADIATOR FAN MOTOR

Measure the resistance of the Radiator Fan Motor.

**Is the resistance below 5.0 ohms?**

Yes >> Replace the Radiator Fan Control Module.
Perform POWERTRAIN VERIFICATION TEST.

No >> Replace the Radiator Fan Motor.
Perform POWERTRAIN VERIFICATION TEST.



7-5

Figure 5 New Icon Based Diagnostics Format

## COMPONENT LOCATIONS

### Current Service and Diagnosis Format

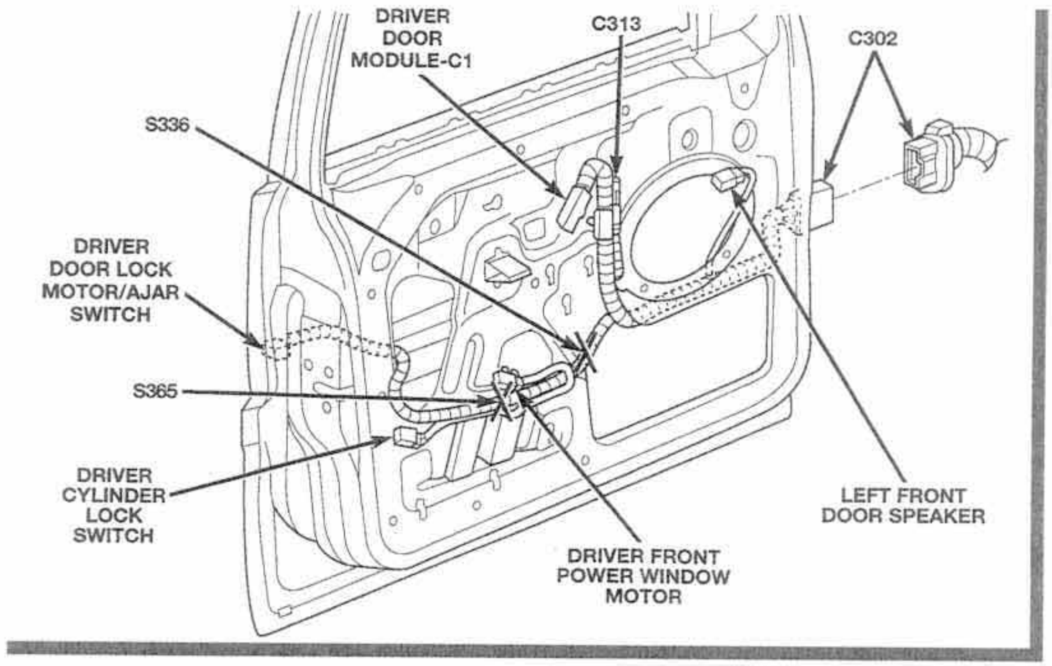



Figure 6 Current Service and Diagnosis Format

### New Service and Diagnosis Format

The new format (Fig. 7) focuses the technician's attention on the component at hand and eliminates unnecessary detail.

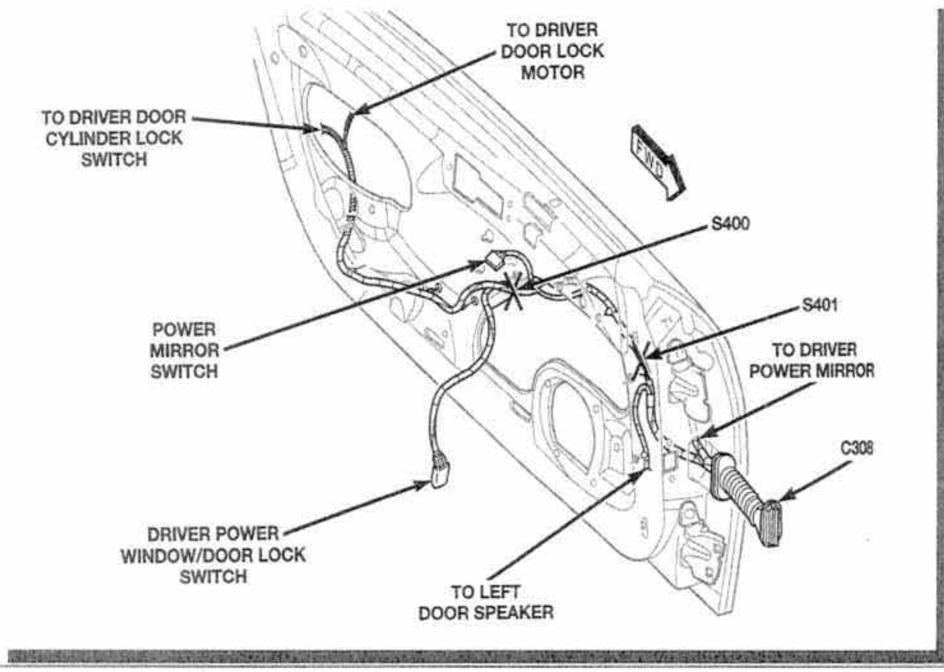



Figure 7 New Service and Diagnosis Format

## CIRCUIT DIAGRAM

Circuit Diagrams (Fig. 8) are simplified drawings of the wiring diagrams. The circuit diagram is placed with pertinent information in the system and provides a functional system overview The circuit diagrams enables a technician to easily understand all components in the system.

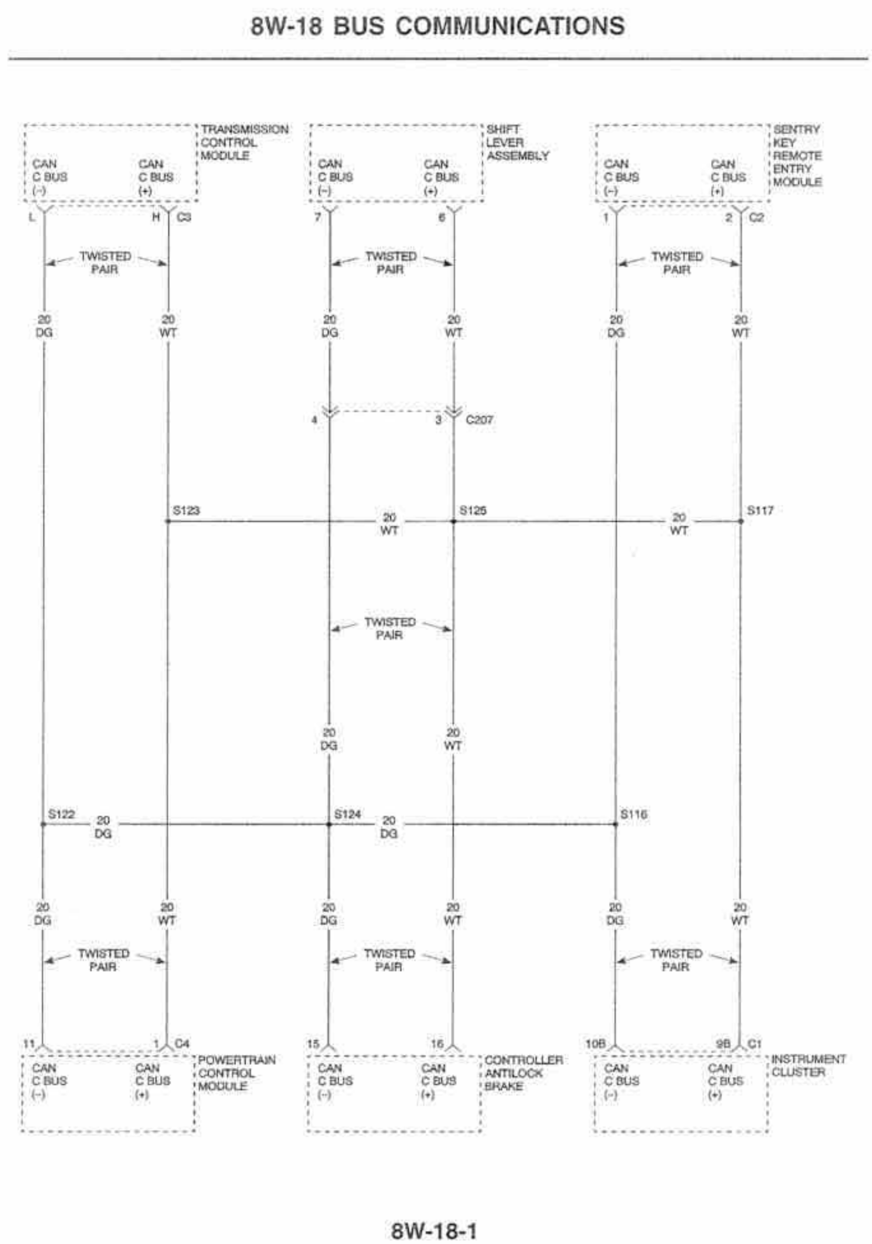



Figure 8 Circuit Diagram

## WIRING DIAGRAM

The wiring diagrams (Fig. 9) have been developed to the same level detail of previous W8 diagrams, however they are presented in condensed format.

(U140F) INVALID CONTROL MODULE VERSION

SCHEMATICS AND DIAGRAMS

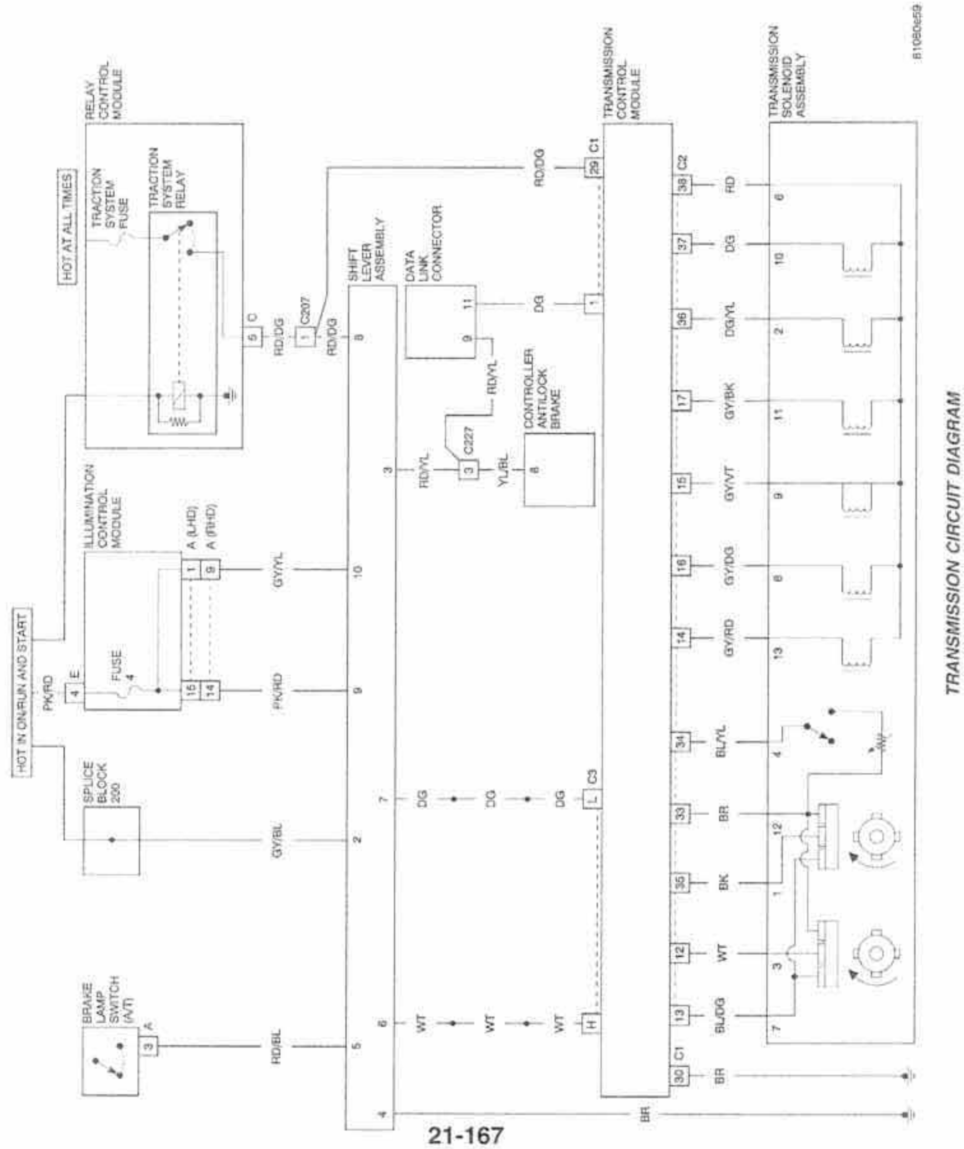



Figure 9 Wiring Diagram

**New Wiring Diagrams Format**

- Diagram fits on one page.
- Reduces Wiring from 10-15 pages down to 2-3, without sacrificing detail.
- Eliminates page turns.

**THUMBNAIL (MINI-SCHEMATIC)**

- Drawn for every Diagnostic Trouble Code (DTC) diagnostic chart.
- Affected circuits for the trouble code are highlighted.
- Thumbnails are embedded in Diagnostics.
- Thumbnails are drawn from all DTCs.
- Connector End Views displayed at bottom of thumbnails.
- For each DTC, affected circuits are highlighted.

## New Thumbnails Format

The new Thumbnails Format (Fig. 10) makes it easier to locate necessary information. The imbedded pin-out connectors eliminate cross sections and makes referencing easier. The thumbnail format also eliminates having separate Diagnostic Manuals and Service Manuals open at the same time.

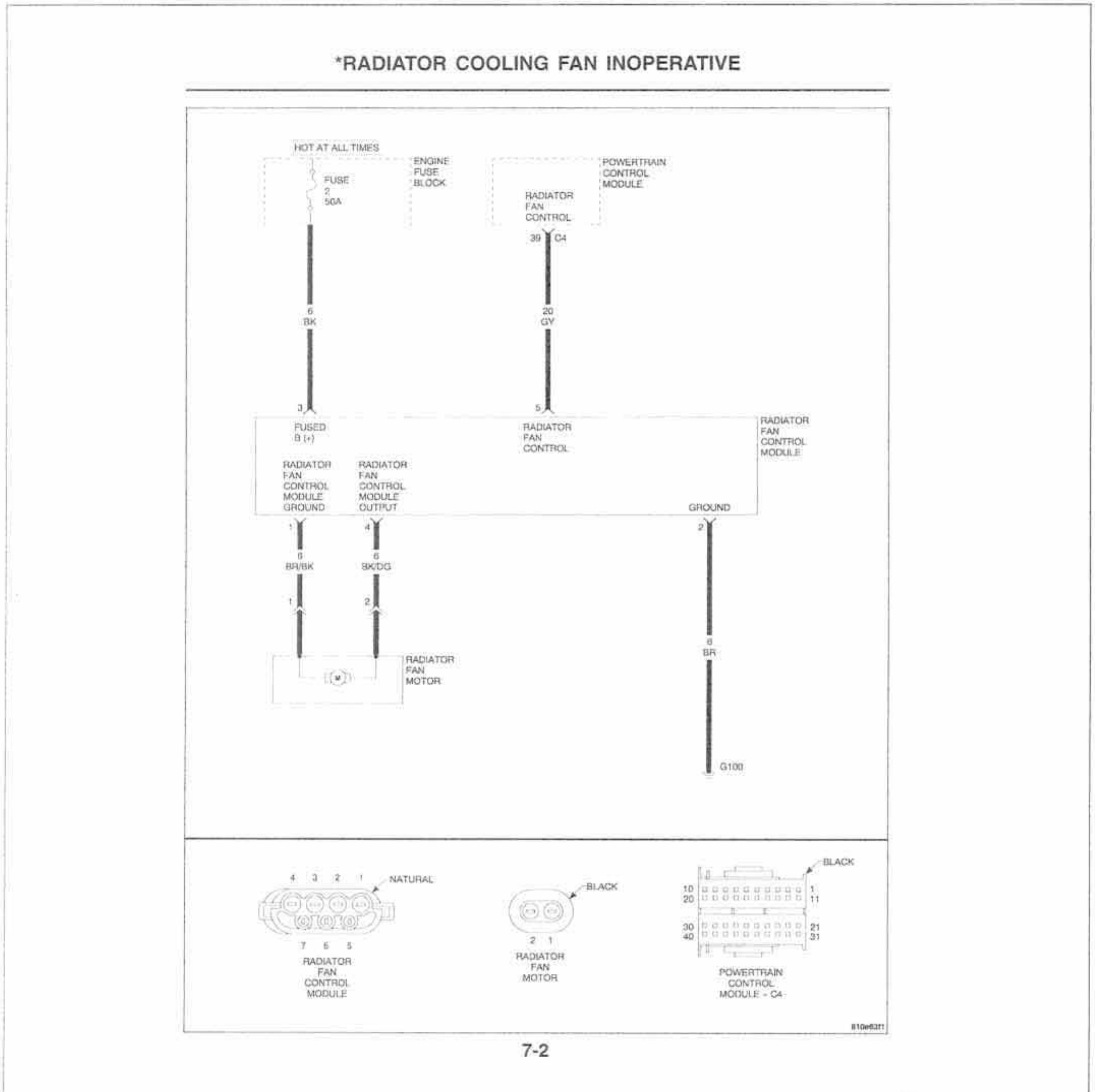



Figure 10 New Thumbnails Format

## TABLE OF CONTENTS FORMAT

All Service Manual and Wiring Diagram section numbering has been retained from the prior format.

# WIRING

TABLE OF CONTENTS


| | page |
|---|---|
| WIRING DIAGRAM INFORMATION | 8W-01-1 |
| COMPONENT INDEX | 8W-02-1 |
| POWER DISTRIBUTION | 8W-10-1 |
| FUSE BLOCK | 8W-11-1 |
| GROUND DISTRIBUTION | 8W-15-1 |
| BUS COMMUNICATIONS | 8W-18-1 |
| CHARGING SYSTEM | 8W-20-1 |
| STARTING SYSTEM | 8W-21-1 |
| FUEL/IGNITION SYSTEM | 8W-30-1 |
| TRANSMISSION CONTROL SYSTEM | 8W-31-1 |
| VEHICLE SPEED CONTROL SYSTEM | 8W-33-1 |
| VEHICLE THEFT SECURITY SYSTEM | 8W-39-1 |
| INSTRUMENT CLUSTER | 8W-40-1 |
| HORN/CIGAR LIGHTER | 8W-41-1 |
| AIR CONDITIONING-HEATER | 8W-42-1 |
| AIRBAG SYSTEM | 8W-43-1 |
| INTERIOR LIGHTING | 8W-44-1 |
| BODY CONTROL MODULE | 8W-45-1 |
| AUDIO SYSTEM | 8W-47-1 |
| REAR WINDOW DEFOGGER | 8W-48-1 |
| FRONT LIGHTING | 8W-50-1 |
| REAR LIGHTING | 8W-51-1 |
| TURN SIGNALS | 8W-52-1 |
| WIPERS | 8W-53-1 |
| POWER WINDOWS | 8W-60-1 |
| POWER DOOR LOCKS | 8W-61-1 |
| POWER MIRRORS | 8W-62-1 |
| SPLICE INFORMATION | 8W-70-1 |
| CONNECTOR PIN-OUTS | 8W-80-1 |
| CONNECTOR/GROUND/SPLICE LOCATION | 8W-91-1 |
| POWER DISTRIBUTION | 8W-97-1 |


8W-1

Figure 11 Table of Contents Format

Notes:

## ELECTRICAL SYSTEMS

### BATTERY

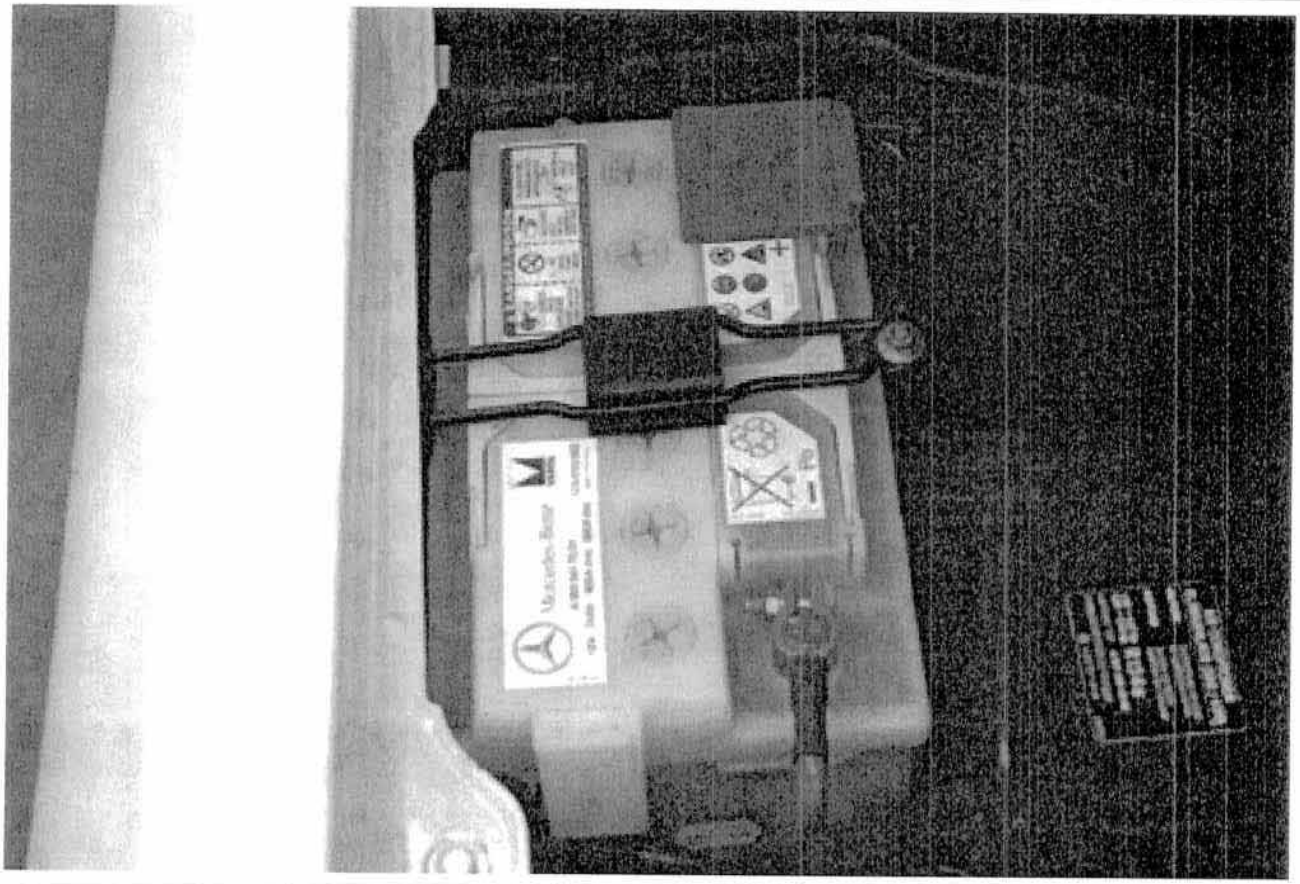


Figure 12 Battery

**Note:** The hood prop can be extended by pressing A button on the back of the prop. Extending the hood prop opens the hood to almost 90°.

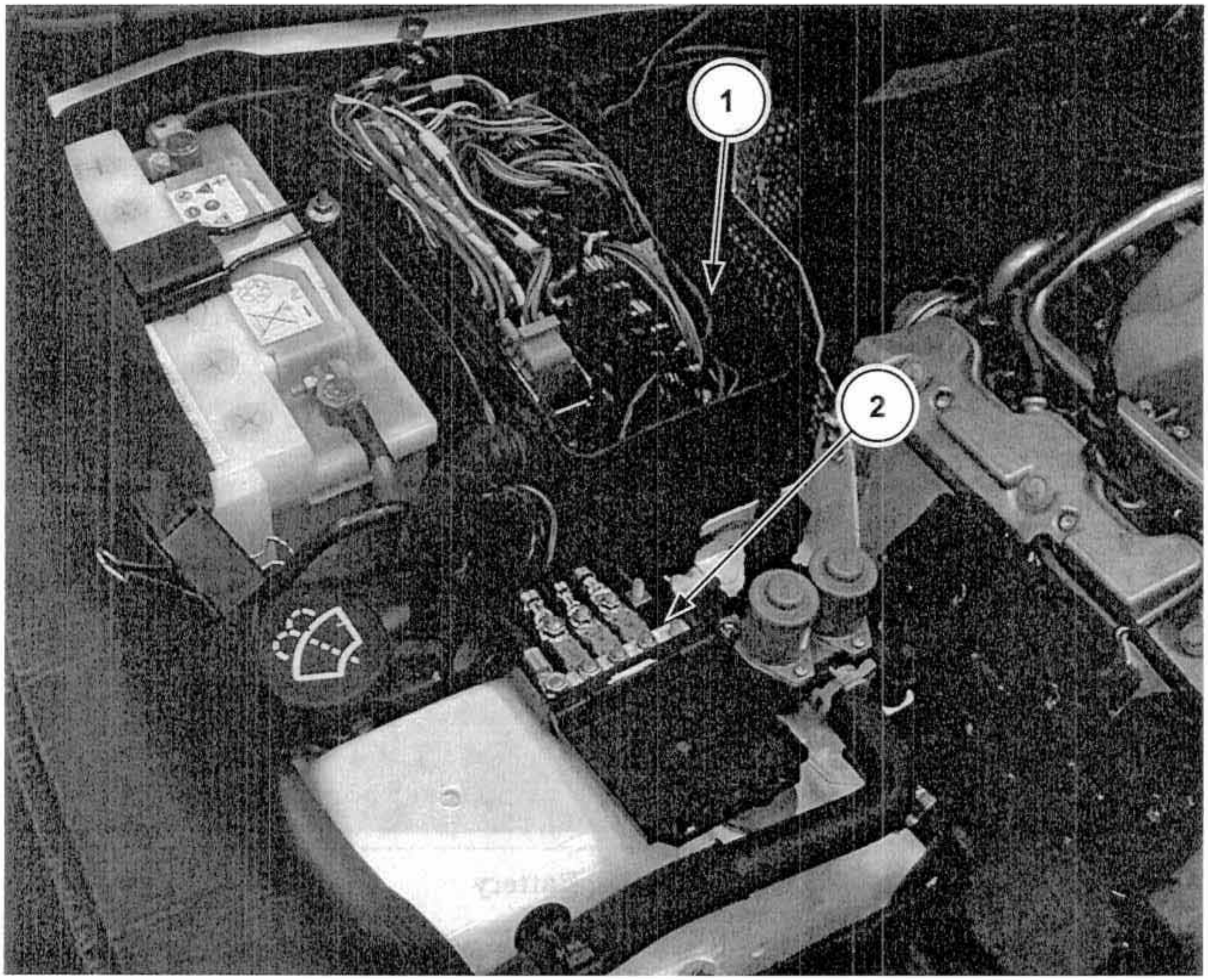
A large capacity (700 Cold Cranking Amps [CCA]), 12-volt low-maintenance storage battery (Fig. 12) is standard factory equipment on the Crossfire.

The battery, cables, hold-down and tray are located in the engine compartment.

For battery system maintenance schedules and jump-starting procedure, refer to the Owner's Manual or the Lubrication and Maintenance section of the Service Information.

## POWER DISTRIBUTION

### Relay Control Module




| | | | |
|---|---|---|---|
| 1 | Control Module Box | 2 | Engine Fuse Block |

Figure 13 Control Module Box and Engine Fuse Block

The Crossfire has a Relay Control Module that is housed in the control module box (Fig. 13) in the engine compartment, just in front of the bulkhead.

The Relay Control Module supplies voltage to some of the control modules and electrical components. It also has internal circuitry that protects the electrical circuits of these control modules and electrical components.

The Control Module Box houses three modules:

- Relay Control Module
- PCM
- BCM

The consolidation of many of the contacts means that many separate connections in the wiring have been reduced.

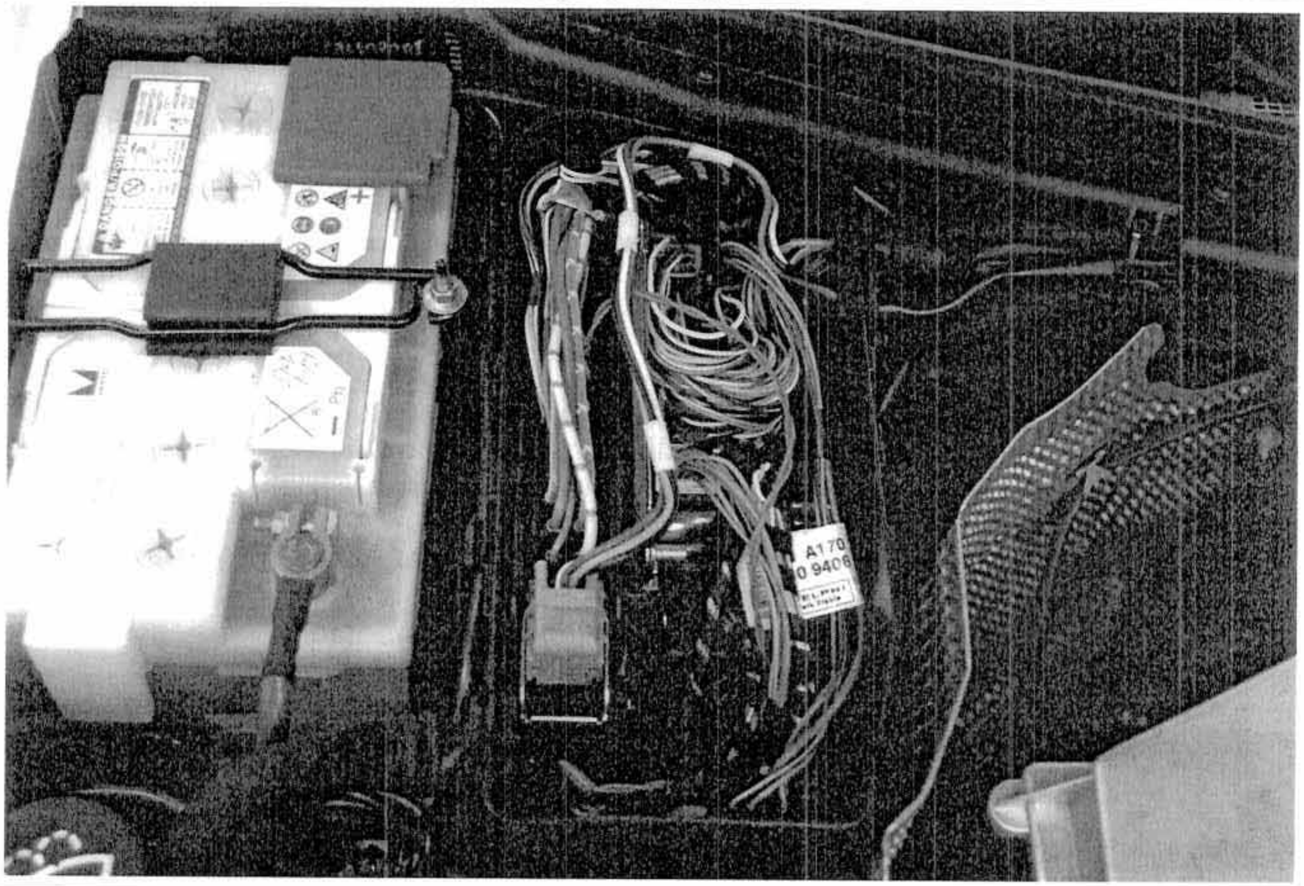


Figure 14  Control Module Box

A separate fan (controlled by the Body Control Module [BCM]), is secured to the unit housing and ventilates the box. The air is drawn from the passenger compartment and evenly circulated among the control modules in the box. The internal air pressure that arises ensures that the box remains free of dirt. Refer to Figure 14.

**Engine Fuse Block**

The engine fuse block is mounted on the right shock tower under the hood. It contains the three primary fuses through which most vehicle current flow through. A 200 amp fuse provides protection for high current circuits such as the charging system output circuit while two 50 amp fuses protect items such as the cooling fan controller and CAB. For a complete list of components that are provided circuit protection, refer to the appropriate sections of the Service Information.

**Underhood Accessory Fuse Block**

The underhood accessory fuse block contains the remainder of non-illumination related fuses and relays. The underhood accessory fuse block is mounted to the bulkhead on the driver's side of the engine compartment and is protected by a primary and a secondary cover. The primary cover, which is secured by a hinge and one catch, can be opened to reveal the fuses. The secondary cover, which is secured by five catches, can be opened to gain access to the pulse module, the brake lamp relay and the traction system relay.

**Illumination Control Module**

The illumination control module serves as the headlamp switch as well as providing a location to house the fuses to protect the illumination circuits. Removing the left side instrument panel cover allows access to the illumination fuse panel. Two fasteners that can be released by turning them ¼ turn counter clockwise secure the cover. A placard mounted on the inside of the cover gives a listing of the circuits that are protected.

**Charging System**

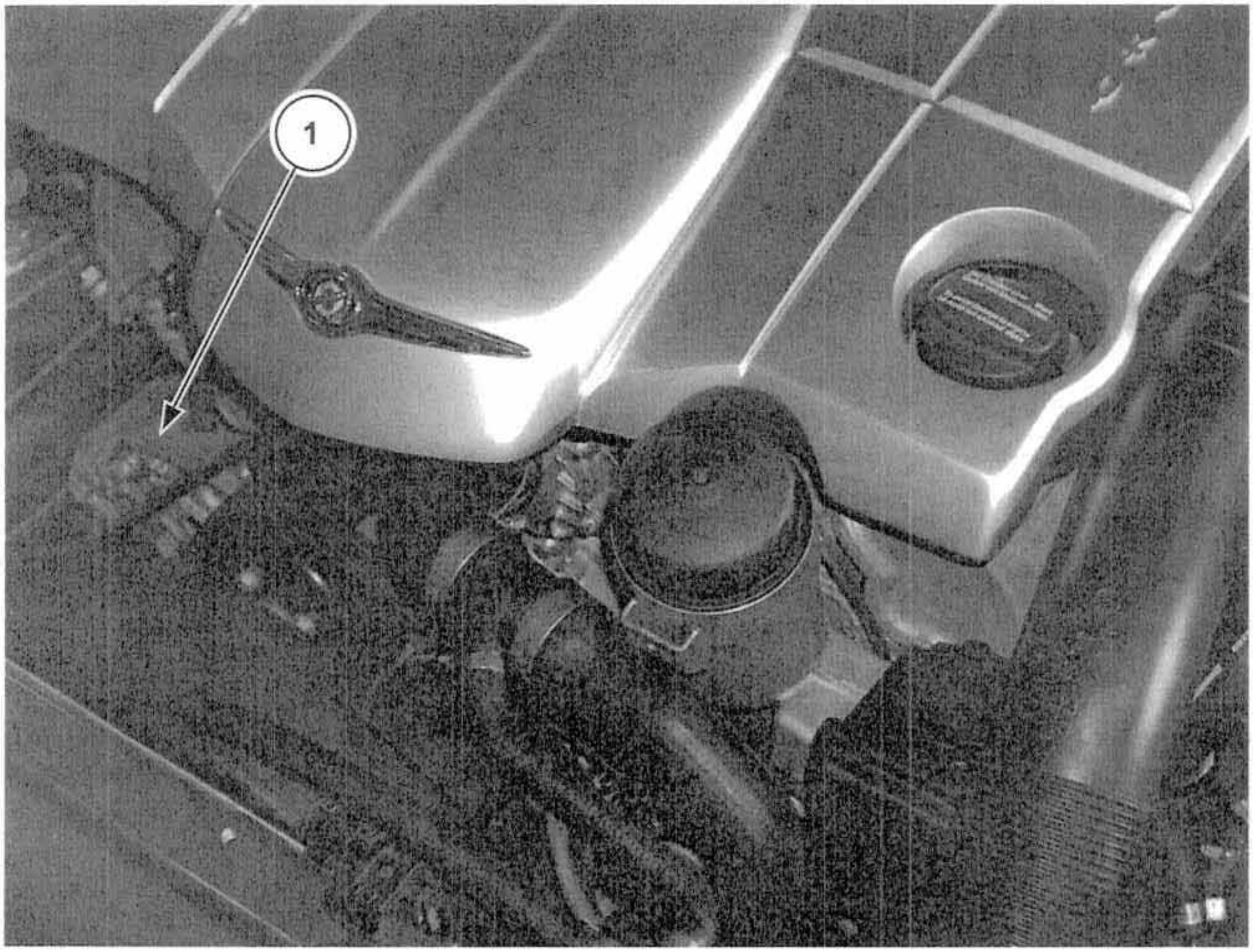
The charging system consists of:

- Generator
- Electronic Voltage Regulator
- PCM
- Ignition Switch
- Battery
- Generator Lamp
- Voltmeter
- Wiring Harness and Connections

The Check Gauges Lamp illuminates when there is fault detected with the charging system voltage, engine coolant temperature or engine oil pressure.

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A DTC is assigned to each input and output circuit monitored by the PCM. Some charging system circuits are checked continuously, and some are checked only under certain conditions.

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures Service Information and the Diagnostic Readout Box, 3rd Generation (DRBIII®) scan tool.




| | |
|---|---|
| 1 | Generator |

Figure 15 Generator

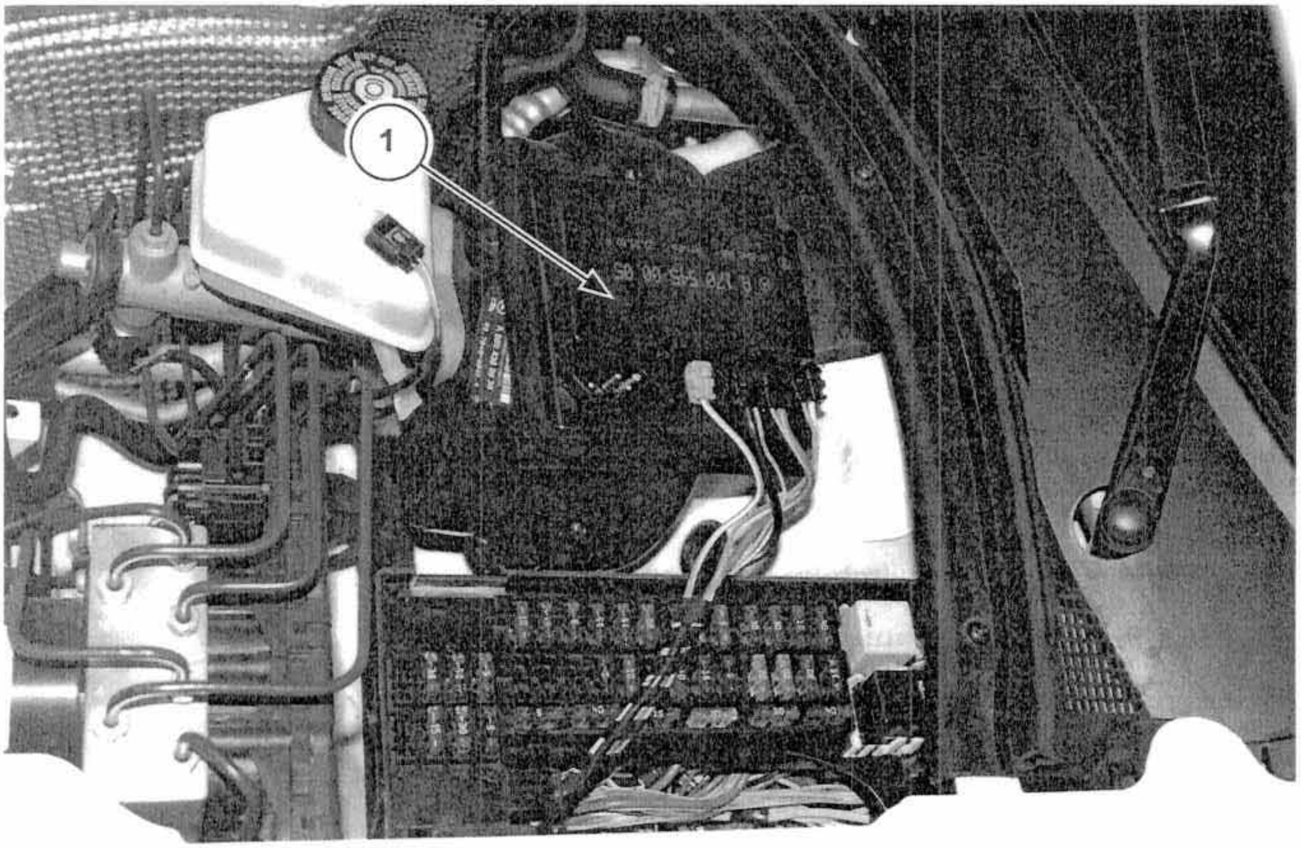
The generator (Fig. 15) is belt-driven by the engine with a serpentine-type drive belt. If the generator fails for any reason, the entire assembly must be replaced.

**Starting System**

The starting system consists of the following components:

- Battery
- Starter Motor
- Starter Solenoid
- Ignition Switch
- Pulse Module
- Clutch Interlock Switch
- PCM
- SLA
- Trans Temp and P/N Switch (with Automatic Transmission)
- Reverse Switch (with Manual Transmission)
- Wire harnesses and connections (including the battery cables)

Pulse Module




| | |
|---|---|
| 1 | Pulse Module |

Figure 16 Pulse Module Removed from Underhood Accessory Fuse Block

The pulse module (Fig. 16) is located in the Underhood Accessory Fuse Block.

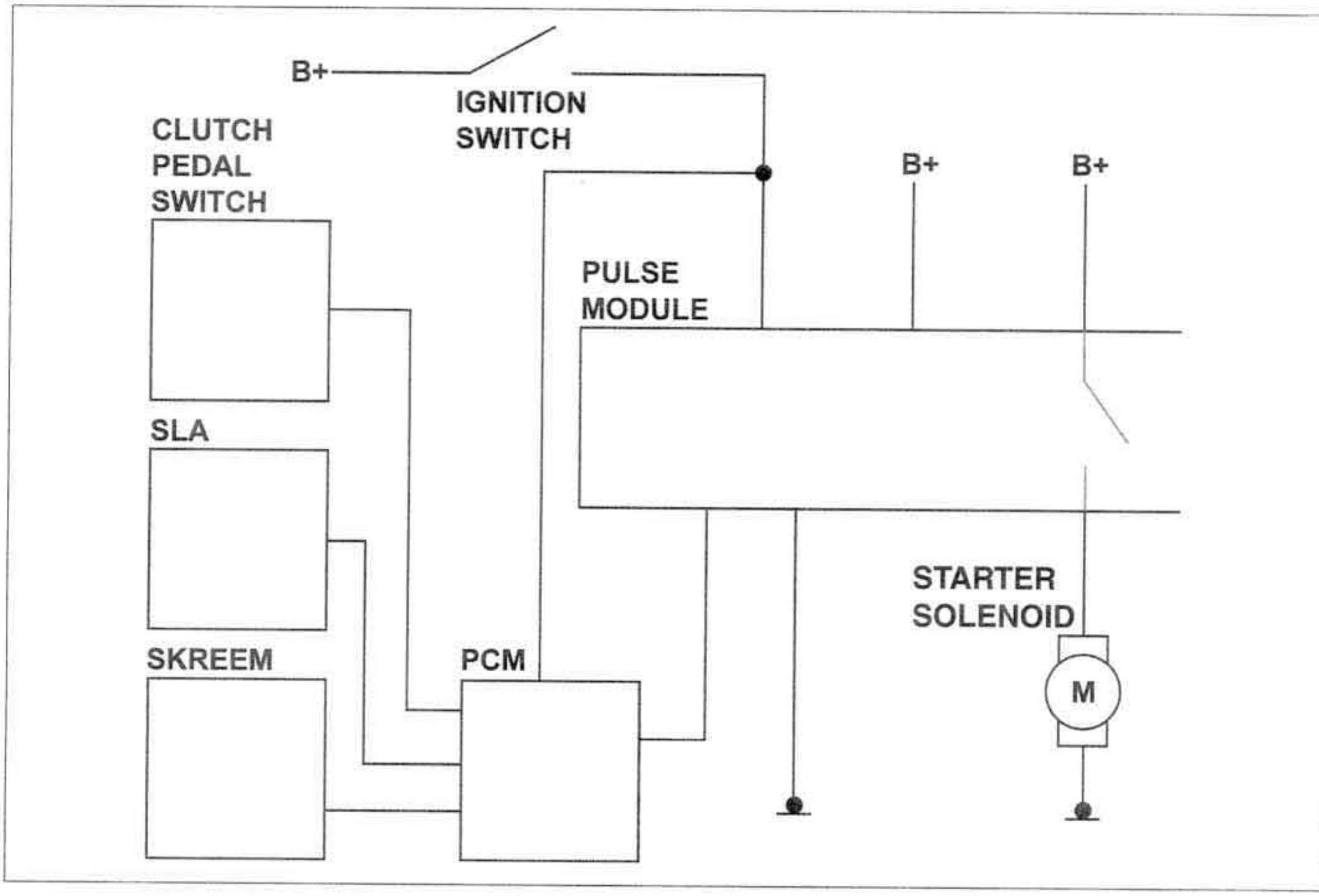



Figure 17 Pulse Module Block Diagram

The pulse module receives two constant B+ feeds and an ignition switched B+ signal during start mode. Refer to Figure 17.

The pulse module supplies a B+ feed to the starter solenoid until it receives a voltage pulse from the PCM.

The pulse from the PCM indicates that the engine has reached at least 450 RPM.

**Fuses**

Fuses are housed in three locations: the control module box and the underhood accessory fuse block in the engine compartment, and the illumination control module on the left end of the instrument panel. A fuse chart is supplied inside each box. A fuse puller is supplied with the vehicle tools.

- The illumination control module contains fuses for exterior and interior lamp circuits. Two cam locks are turned to remove the cover on the left end of the instrument panel for access to the fuse box.
- The control module box and underhood accessory fuse block contain fuses for all other vehicle circuits. A latching cover protects them.

**GROUNDS**

The Crossfire uses15 separate grounding points throughout the vehicle for its electrical system.

Table 1 Ground Locations

| Ground | Location | Ground | Location |
|---|---|---|---|
| G100 | Left front inner fender | G204 | Right side kick panel |
| G101 | Right front inner fender | G205 | Left C pillar |
| G104 | Front of engine at the PS pump | G206 | Right side kick panel |
| G107 | Right front inner fender | G300 | Left quarter panel, near wheel housing |
| G200 | Left side bulkhead, under dash | G301 | Right quarter panel, on the wheel housing |
| G201 | Left side kick panel | G302 | Front of liftgate |
| G202 | Center console at the ORC | G303 | Right C pillar |
| G203 | Center console, near the SLA | | |

## CONTROLLER AREA NETWORK - CAN DATA BUS

The Controller Area Network (CAN) is a multiplex bus system. It was developed by Bosch in the early 1980s. It is a 2-wire communication system for the transfer of data between control modules. CAN Bus was first introduced in DaimlerChrysler vehicles on the WG platform (Grand Cherokee export with MB supplied engine and transmission) and on Ram trucks with the Cummins Diesel.

DaimlerChrysler vehicles have used an electrical architecture where a few modules perform many tasks. Each module has a number of inputs and controls several outputs. The modules are connected by a Bus.

A CAN Bus allows more modules to perform fewer tasks. A sensor can be wired to the closest module and share the data with the other modules. This is possible because of the increased speed of data transfer that prevents lost and missing messages.

Table 2 Chrysler Collision Detection (CCD)/PCI/CAN Bus Comparison

| FEATURE | CCD | PCI BUS | INTERIOR CAN (CAN B) | ENGINE CAN (CAN C) |
|---|---|---|---|---|
| Transmission Media | Twisted Pair | Single Wire | Twisted Pair | Twisted Pair |
| Speed | 7.8 KBPS | 10.4 KBPS | 83.3 KBPS | 500 KBPS |
| Meets Industry Standard | No | Yes (J1850) | No | Yes (J2284) |
| OBDII Compliant | No | Yes | Yes | Yes |
| Bus Biasing Required | Yes | No | Yes | Yes |
| Maximum Number of Modules Per Bus | 13 | 31 (32 if Scan Tool is Included) | 32 | 12 |

Table 3 CCD/PCI/CAN Bus Comparison

| Interior CAN (CAN B) | Engine CAN (CAN C) |
|---|---|
| • CAN Data Bus – Lower Speed<br>• 6 times slower than CAN C at 83.3 KBPS<br>• 8 times faster than PCI, J1850 or ISO-K | • CAN Data Bus – High Speed<br>• 6 times faster than CAN B at 500 KBPS<br>• 8 times faster than normal Serial Communications Interface (SCI) (62.5 KBPS) |

Other terms used:

CAN H – Reference to CAN Bus Wire – High Side Signal Wire – also called CAN (+)

CAN L – Reference to CAN Bus Wire – Lower Side Signal Wire – also called CAN (-)

**Normal Operation**

The CAN Bus operates similar to other Bus systems, except it can carry more information. CAN Bus system modules broadcast messages almost simultaneously over the data bus.

The Interior Bus CAN B) transmission rate is specified as 83.3KBPS. Body and convenience modules that do not require real-time communication use the Interior Bus (CAN B). The Interior Bus (CAN B) with its lower operating speed is more tolerant to fault detection than the Engine Bus (CAN C). Note that these are still eight times faster than the PCI/J1850 Bus it is replacing.

The Interior Bus (CAN B) also supports Single Wire Mode for many fault problems. If a problem occurs in either CAN H or CAN L wires, this network can move to Single Wire Mode and use the remaining functional wire for messaging. The Interior Bus (CAN B) also uses the sleep and wake-up functions to lower vehicle IOD (Ignition Off Draw), the amount of current used by modules when the key is not in the ignition.

The Engine Bus (CAN C) transmission rate is specified as 500K BPS. The PCM, Electronic Stability Program and other modules, requiring real-time data, use the Engine Bus (CAN C) for network communication. The Engine Bus (CAN C) operates in the key RUN position and has no wake-up or sleep function.

The Crossfire does not use a gateway module which is the hub for the different buses. It coordinates bus messages between the bus networks (CAN C and CAN B). Crossfire does not transfer information over the Bus between the two Bus systems. It does however, use hardwired connections to sent signals between them.

**Circuit Description**

The CAN Bus is similar to the CCD Bus Communication System and includes:

- Twisted Pair Circuit
- CAN H (High Side Signal) and CAN L (Lower Side Signal) corresponding to CCD+ and CCD-
- Biasing
- Termination
- CAN Controller

The PCM and the Sentry Key Remote Electronic Entry Module (SKREEM) provide the termination resistance for the Engine Bus (CAN C). Each module provides its own bias.

Similar to other Bus systems, the CAN Bus modules distinguish between binary Zeros and Ones. When CAN H is pulled high and CAN L is pulled low, this represents a binary one. When CAN H and CAN L are the same, this represents a binary zero (Fig. 18).

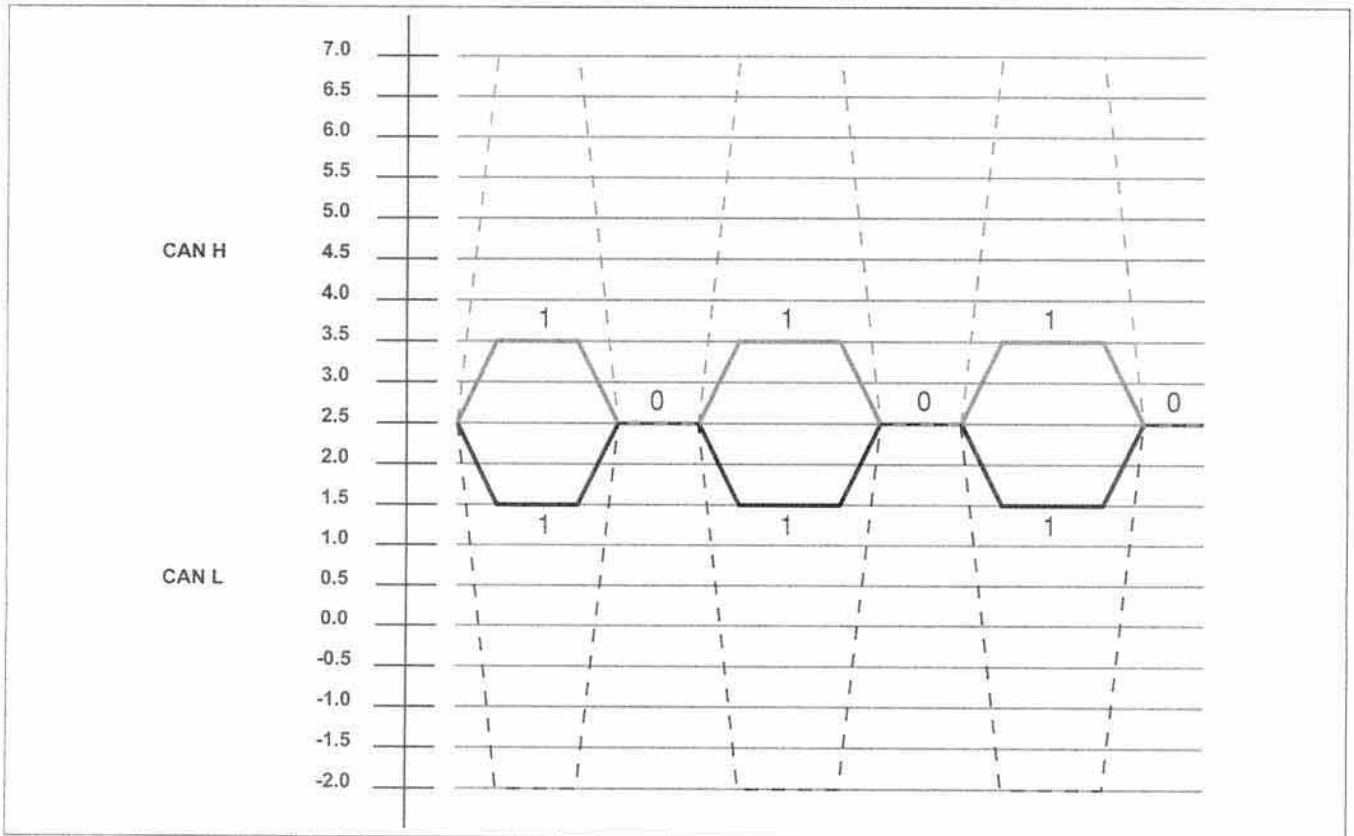



Figure 18 CAN Bus Normal and Maximum Voltages

Tables 3 through 6 provide detailed information for the CAN Bus voltages shown in Figure 18.

Table 4 Binary 0 – Bus Disconnected

| | MINIMUM VOLTS | NOMINAL VOLTS | MAXIMUM VOLTS |
|---|---|---|---|
| CAN H | 2.00 | 2.50 | 3.00 |
| CAN L | 2.00 | 2.50 | 3.00 |

Table 5 Binary 1 – Bus Disconnected

| | MINIMUM VOLTS | NOMINAL VOLTS | MAXIMUM VOLTS |
|---|---|---|---|
| CAN H | 2.75 | 3.50 | 4.50 |
| CAN L | 0.50 | 1.50 | 2.25 |

Table 6 Binary 0 – Bus Connected

| | MINIMUM VOLTS | NOMINAL VOLTS | MAXIMUM VOLTS | |
|---|---|---|---|---|
| CAN H | | 2.50 | 7.00 | At Module Ground |
| CAN L | -2.00 | 2.50 | | At Module Ground |

Table 7 Binary 1 – Bus Connected

| | MINIMUM VOLTS | NOMINAL VOLTS | MAXIMUM VOLTS | |
|---|---|---|---|---|
| CAN H | | 3.50 | 7.00 | At Module Ground |
| CAN L | -2.00 | 1.50 | | At Module Ground |

The voltages listed below are the absolute maximum DC voltages that can be connected to the Bus without damaging a module.

- CAN L 16 Volts in a 12 Volt System
- CAN H 16 Volts in a 12 Volt System

**Unshielded Twisted Pair**

CAN Bus systems use unshielded bus wires with 33 to 50 twists per meter which is similar to the CCD Bus (Fig. 19).

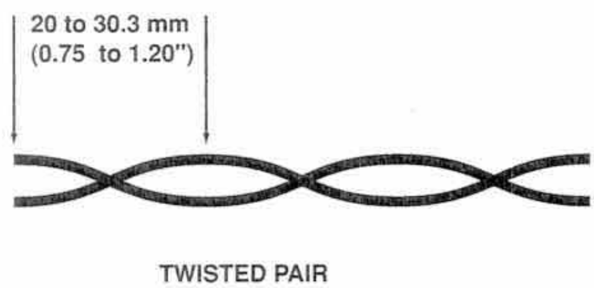



Figure 19 Unshielded Bus Wires (Normal Operation)

**Message Transmission**

CAN nodes can transmit and receive data on the Bus at the same time using a time-triggered protocol. Each node decides whether it should process the message or not based on an identifier in the reference window. The identifier also determines the priority of messages transmitted to the Bus.

All messages sent over the Bus are coded for both priority and identification. The first part of a message has an ID byte that contains message priority, message identification and content.

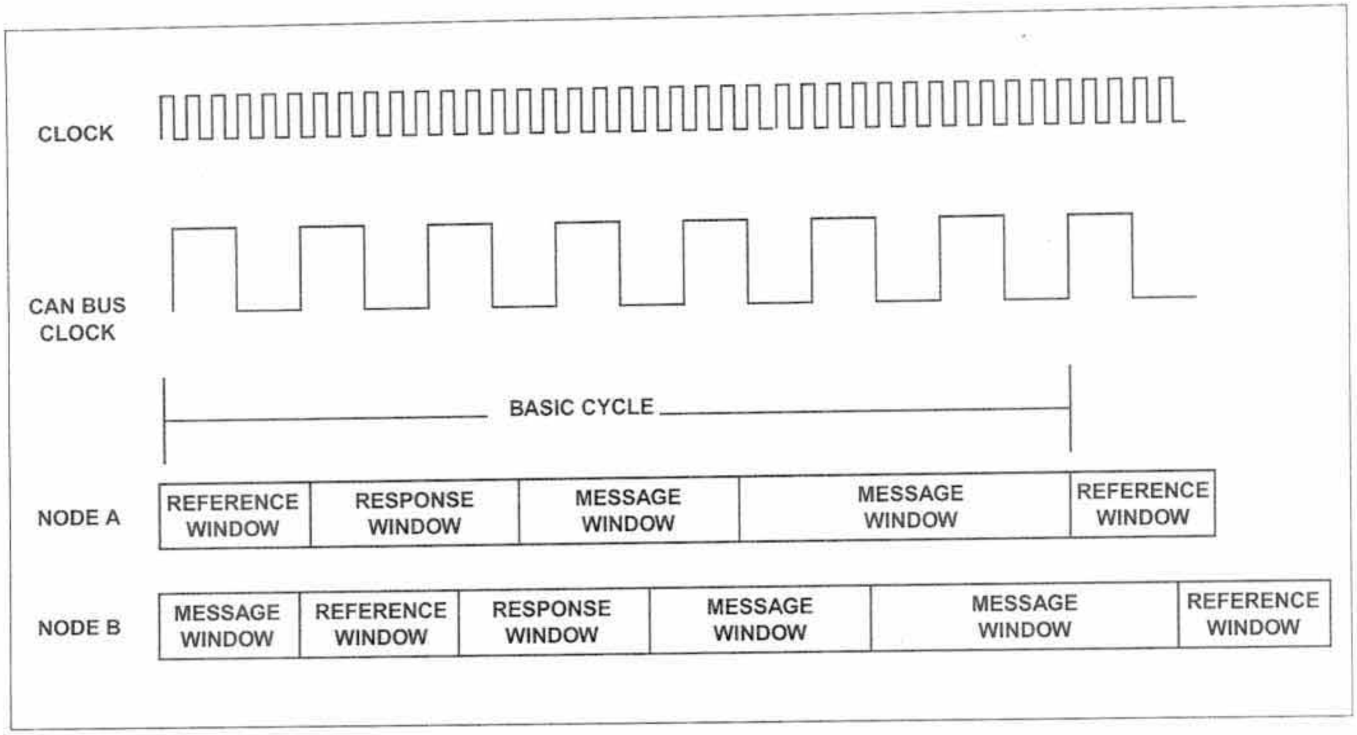



Figure 20 CAN Bus Message Communication

A CAN Bus message contains a reference window. The period between two consecutive reference windows is called a basic cycle (Fig. 20). A basic cycle is made up of a reference window and a series of message windows to carry data. Each CAN Bus message window can contain from 0 to 8 bytes of node information.

- A node does not have to be capable of receiving all of the message window segments available on the Bus.
- A specific node only receives the message windows necessary for its operation and transmits response window to the Bus.

The incoming message window data is stored in each individual module's message storage buffer (Fig. 21). The message window priority is determined by its arbitration function that determines the order of the incoming message windows to be placed on the CAN Bus

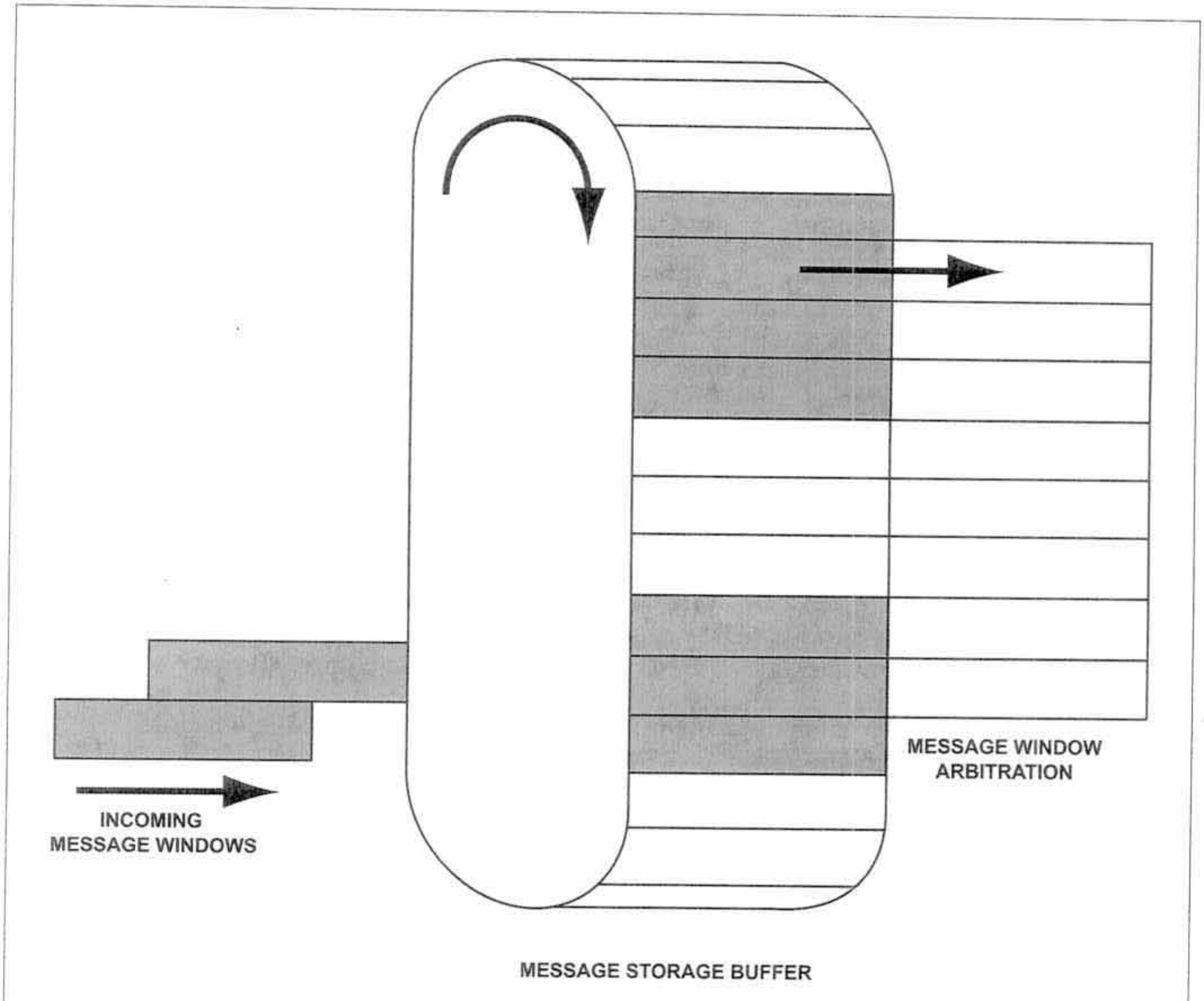



Figure 21 CAN Bus Message Buffer

This can be compared to an airport luggage carousel. The luggage is taken off of the aircraft in a random manner and is loaded onto the carousel. The passengers determine the priority of the luggage by selecting their personal bag and taking it away.

Arbitration of bus messages prevents data collision. If a module senses a higher priority message being transmitted on the Bus, the module stops transmitting its message until the higher priority message is completed without interruption. The other modules on the Bus do not allow any other messages to be broadcast.

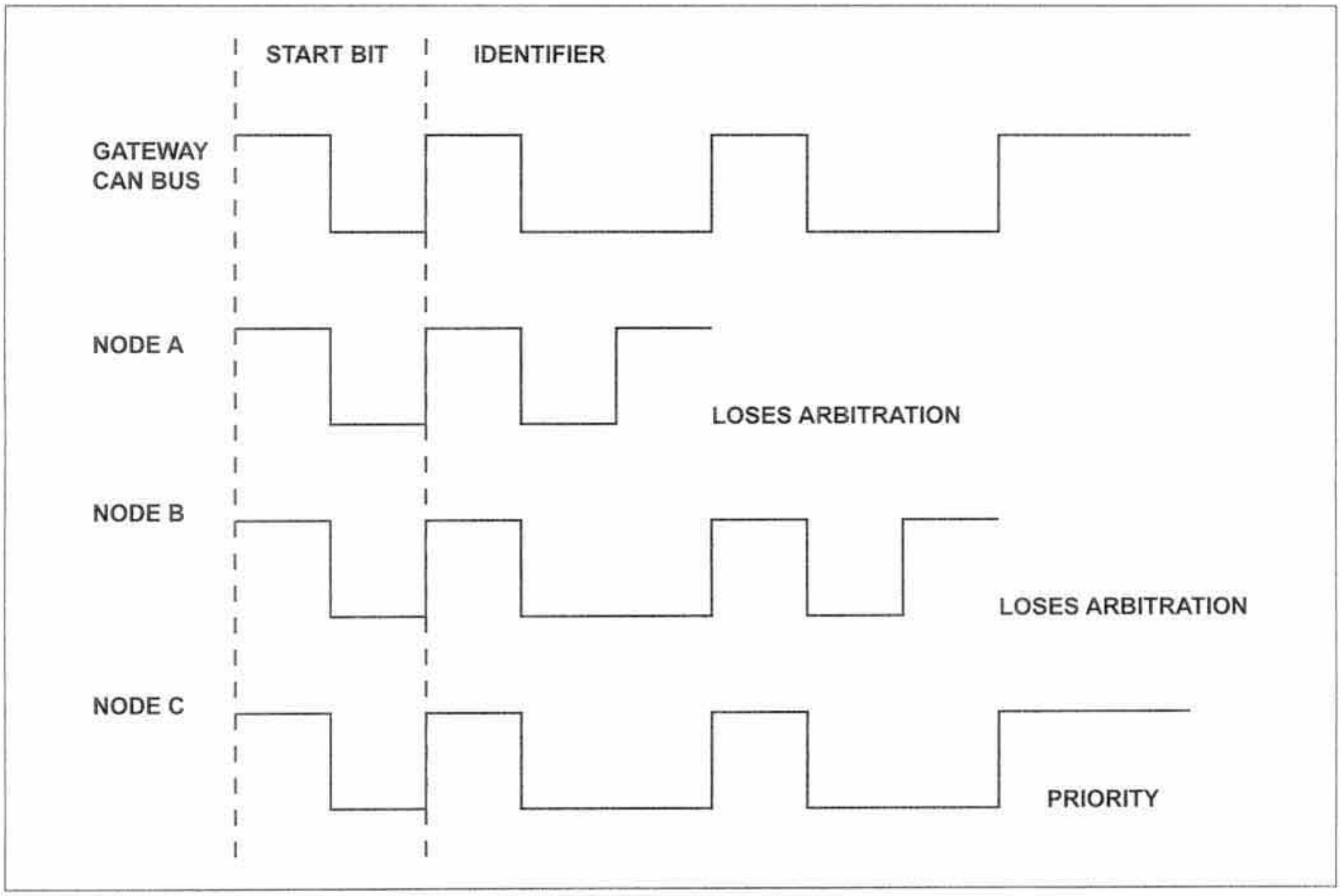



Figure 22 CAN Bus Arbitration

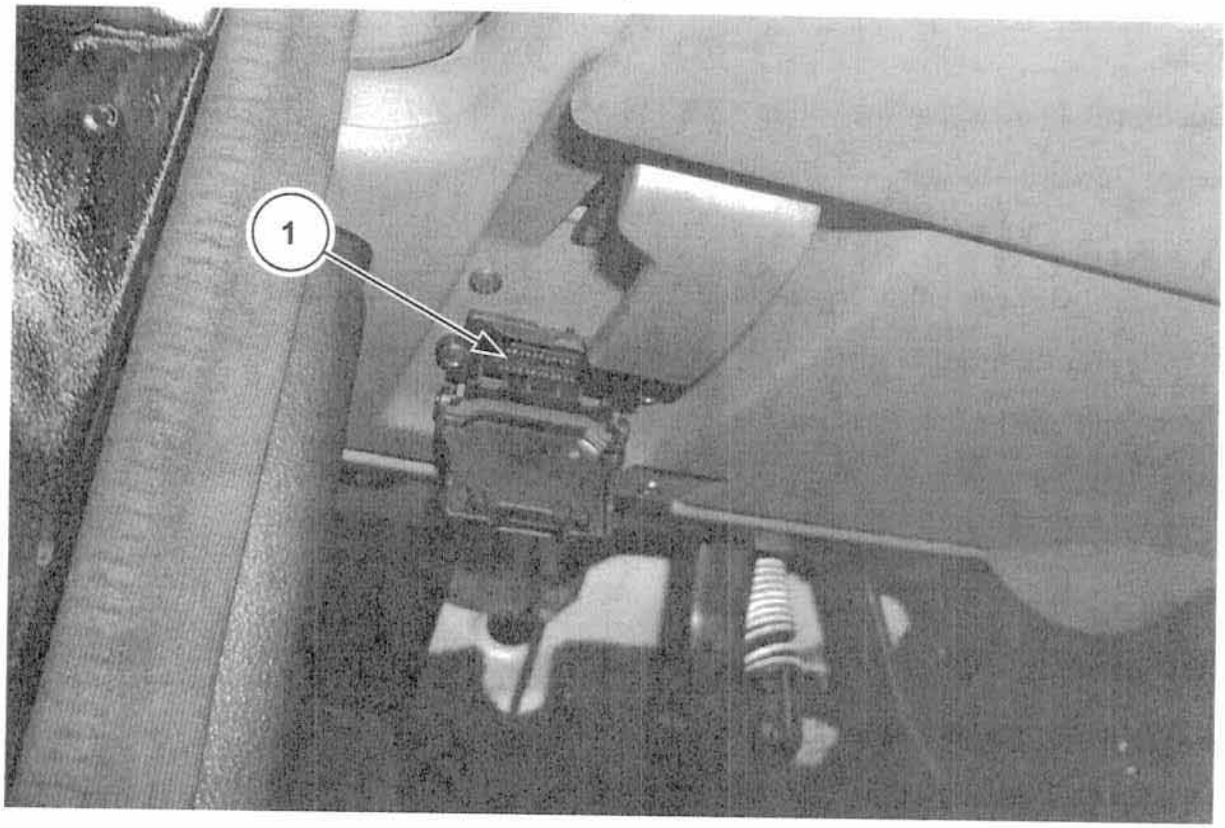
The message and response windows carry arbitration reference data (Fig. 22). This determines the priority of the window and how it is processed on the Bus.

**Abnormal Operation/Failure Mode**

Table 8 Communication Failure

| CONDITION | RESPONSE |
|---|---|
| One Non-Terminating Module Becomes Disconnected from the Bus | Remaining modules continue to communicate with no degradation (exception of daisy-chained modules). |
| Module Loss of Power or Ground Includes Low Battery Condition | Remaining modules continue to communicate with no degradation. |
| CAN H Bus Wire Open | Data communications between modules on opposite sides of the open are not affected. Data communication between modules on the same side of open can have a reduced signal-to-noise ratio. |
| CAN L Wire Open | Data communications between modules on opposite sides of the open are not affected. Data communication between modules on the same side of open has a reduced signal-to-noise ratio. |
| CAN H Shorted to Battery | No data communication. |
| CAN L Shorted to Battery | No data communication. |
| CAN H Shorted to Ground | No data communication. |
| CAN L Shorted to Ground | Data communication has a reduced signal-to-noise ratio. |
| CAN H Shorted to CAN L | Data communication has a reduced signal-to-noise ratio. |

## DATA LINK CONNECTOR (DLC)




| | |
|---|---|
| 1 | Data Link Connector (DLC) |

Figure 23 Data Link Connector (DLC)

A standard 16-pin, J1962 DLC is used on the Crossfire. The DLC is located in the passenger compartment, in the lower left instrument panel area. Refer to Figure 23.

Modules and/or components that provide diagnostic information through the DLC include the following:

- PCM
- Occupant Restraint Controller (ORC)
- Relay Control Module
- IC
- Universal Garage Door Opener (UGDO)/Tire Pressure Monitor (TPM)
- AC/Heater Control Module
- Controller Anti-Lock Brakes (CAB)
- SKREEM
- Body Control Module (BCM)
- Radio
- TCM (if equipped with Automatic Transmission [A/T])
- SLA (if equipped with A/T)
- Fuel Tank Pressure (FTP) Sensor

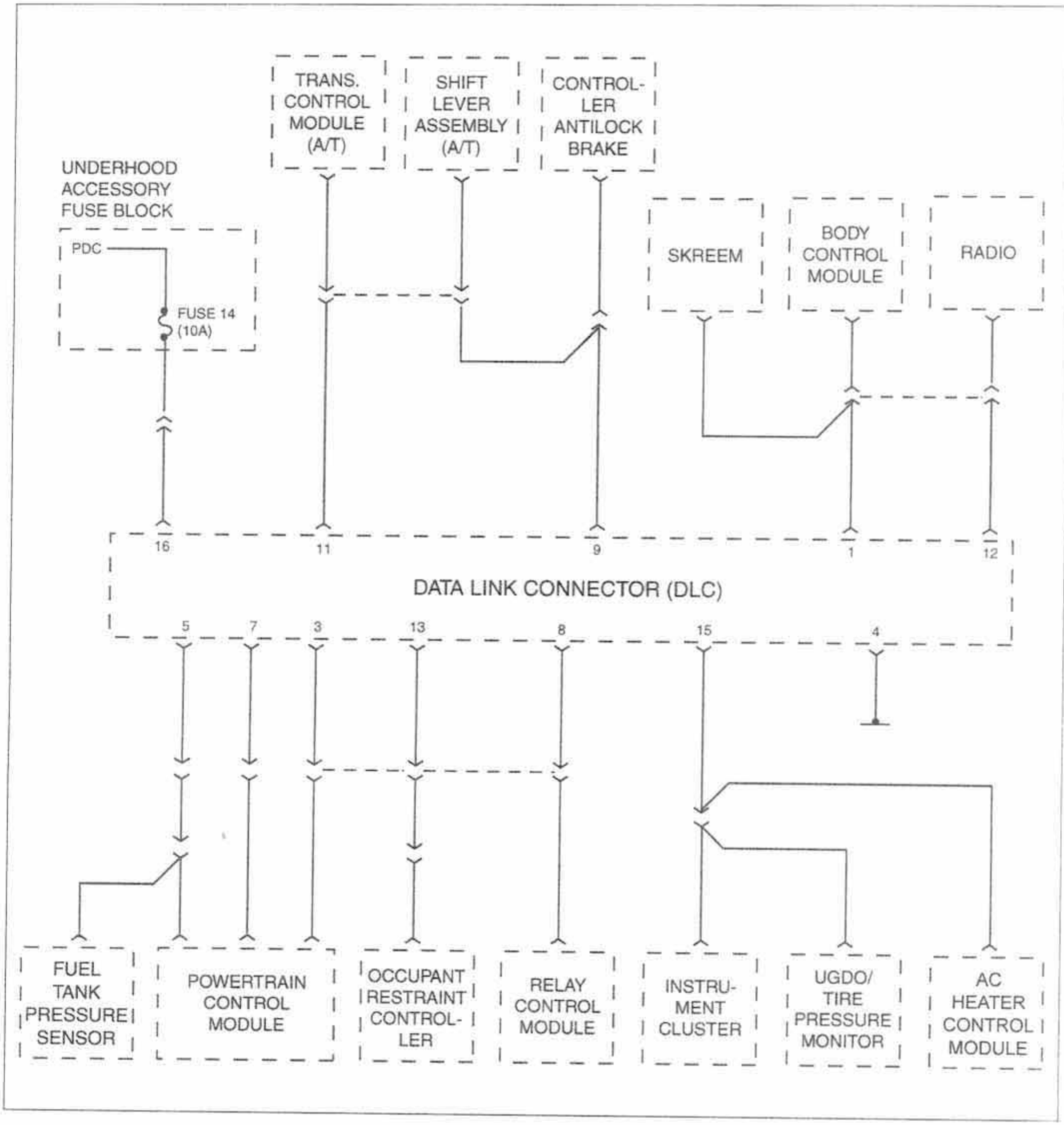



Figure 24 DLC Pin Usage

## RESTRAINT SYSTEMS

### Active Restraints

Both seating positions have a three-point restraint. Emergency Tensioning Retractors (ETRs) actuate to remove slack in the seat belts and to snug the occupant into the seat at the onset of an impact event. During the primary crash phase, the tensioning power of the ETRs guarantees optimum transmission of the passenger compartment deceleration to the passenger.

Load-limiting retractors "give" with higher seat belt loads. If a given belt force is exceeded, the belt force limiter permits a controlled forward inclination of the upper body.

The driver seat belt retractor locks only as a result of sudden vehicle stop or rapid extension of the webbing ("emergency locking") to allow free movement under normal driving conditions

Child Restraint Anchors

The passenger seat includes a LATCH (Lower Anchors and Tether for Children) Child Seat Anchorage System. LATCH-compatible child seats can be secured using this system. The child seat lower anchors attach to the seat structure with heavy-gauge wire loops at the intersection of the cushion and back. The child seat upper tether strap attaches to an anchor. Child seats can also be securely fastened in the passenger seat with the seat belts.

### Supplemental Restraints

The vehicle occupants must be wearing their seat belts to obtain the maximum safety benefit from the factory-installed Supplemental Restraint System (SRS).

The SRS uses impact severity threshold to determine the appropriate response.

- Impacts that exceed the lower deceleration threshold in frontal, front-angled and rear impacts with the seat belt fastened, trigger the pretensioners but not the airbags. If the seat belts are not fastened, the airbags will be triggered but not the pretensioners.
- Impacts that exceed the higher deceleration threshold always trigger the airbags.

Driver and passenger systems operate independently of each another based on occupancy and seat belt use. Pretensioner actuation occurs only if the belts are buckled. In addition, the PAB actuates only if the key switch on the right side of the instrument panel has not turned off the airbag.

After an impact that activates a pretensioner, the retractor and pretensioner assembly must be replaced. The control system monitors operational readiness of the SRS and illuminates the airbag indicator lamp in the IC if a malfunction occurs.

## SUPPLEMENTAL RESTRAINT COMPONENTS

The following system components are monitored or undergo a self-check at startup: ORC, side impact sensors, side impact airbags, clockspring, driver and PAB ignition circuits, PAB switch, seat belt buckle switches, passenger seat occupant simulator and the ETR. The lamp also illuminates briefly each time the engine is started, allowing the driver to verify its operation.

### Occupant Restraint Controller (ORC)

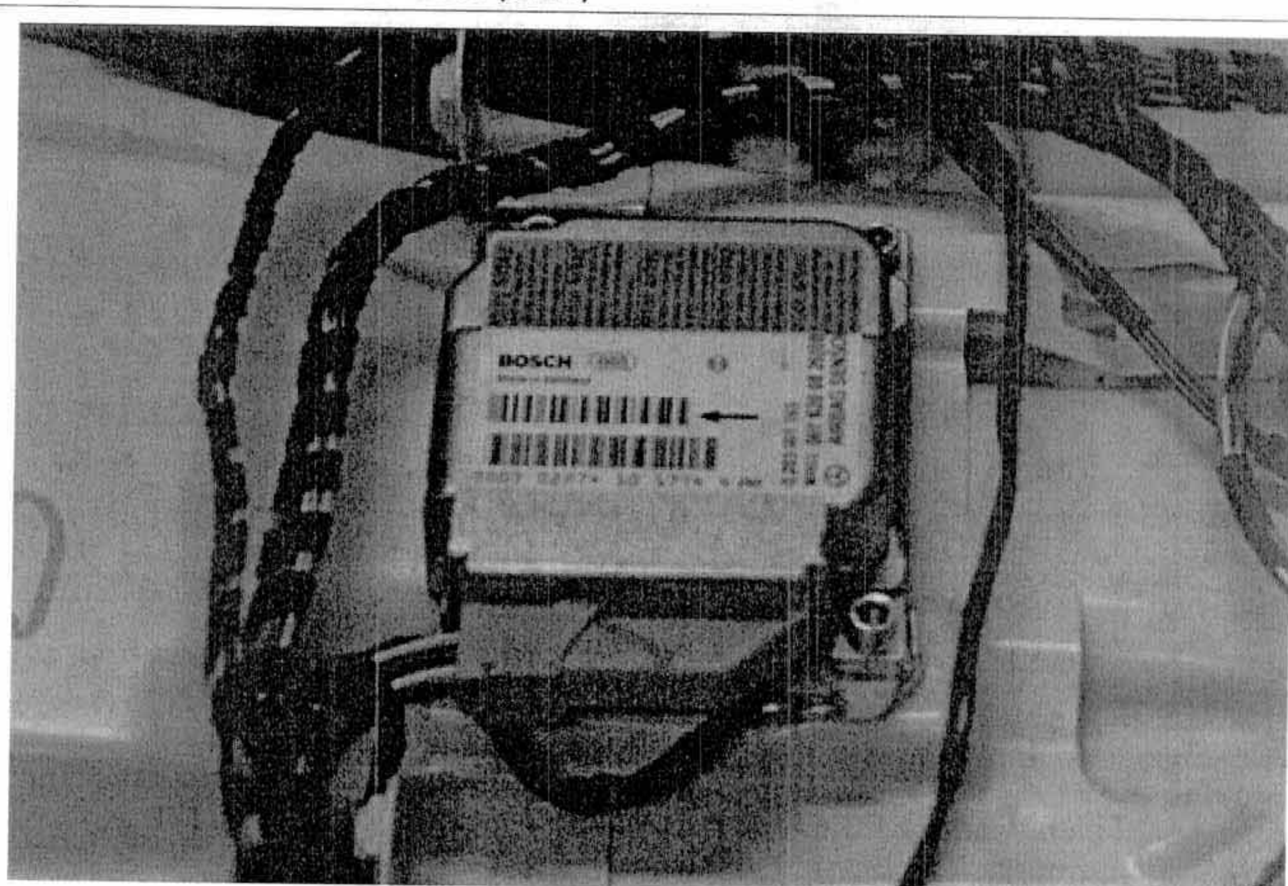


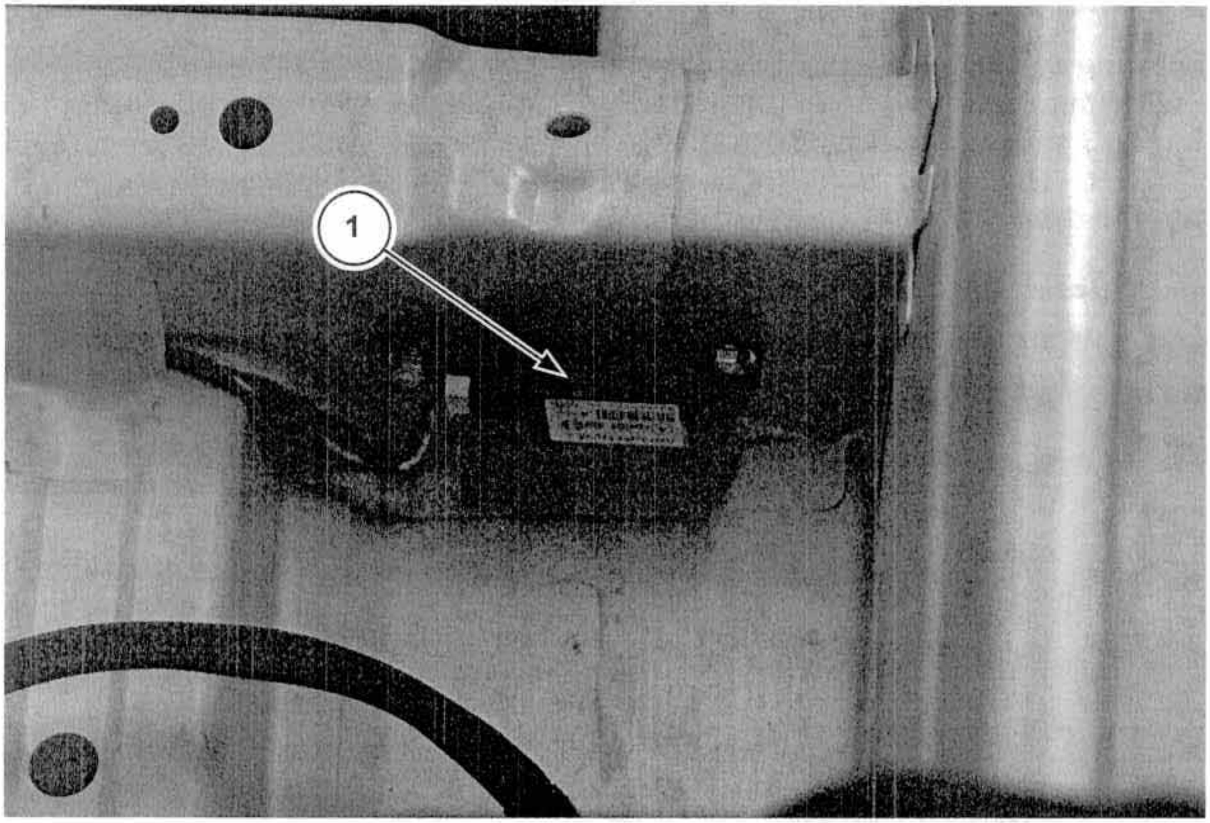

Figure 25 Occupant Restraint Controller (ORC)

The ORC is located on the floorpan under the console center stack (Fig. 25).

For PAB switch operation, the passenger seat occupant simulator sends a digital signal is indicating the requested PAB status. If the request is "enable" the PAB On/Off Indicator is off and the PAB functions normally. If the request is "disable" the

PAB On/Off Indicator is provided a ground (causing it to illuminate) and the PAB is disabled.

**Side Impact Sensors**




| | |
|---|---|
| 1 | Side Impact Sensor |

Figure 26 Side Impact Sensors

Two side impact sensors are used, one each for the left and right sides of the vehicle. These sensors are mounted remotely from a bi-directional safing sensor that is internal to the ORC. The sensors are fastened to the floor under the seats (Fig. 26). The sensor housing contains the electronic circuitry of the sensor including an electronic communication chip and an electronic impact sensor. The sensors are connected to the vehicle electrical system through a dedicated circuit and connector of the airbag overlay wire harness. The side impact sensors cannot be repaired or adjusted and, if damaged or faulty, they must be replaced.

The side impact sensors are electronic accelerometers that sense the rate of vehicle side way acceleration. Each sensor contains an electronic communication chip that allows the unit to communicate the sensor status as well as sensor fault information to the ORC. The impact sensors each receive battery current and ground through dedicated left and right sensor (+) and (-) circuits from the ORC. The impact sensors and the ORC communicate by modulating the voltage in the sensor plus circuit. The hard-wired circuits between the side impact sensors and the ORC can be diagnosed and tested with the DRBIII® scan tool.

**Side Impact Airbag**

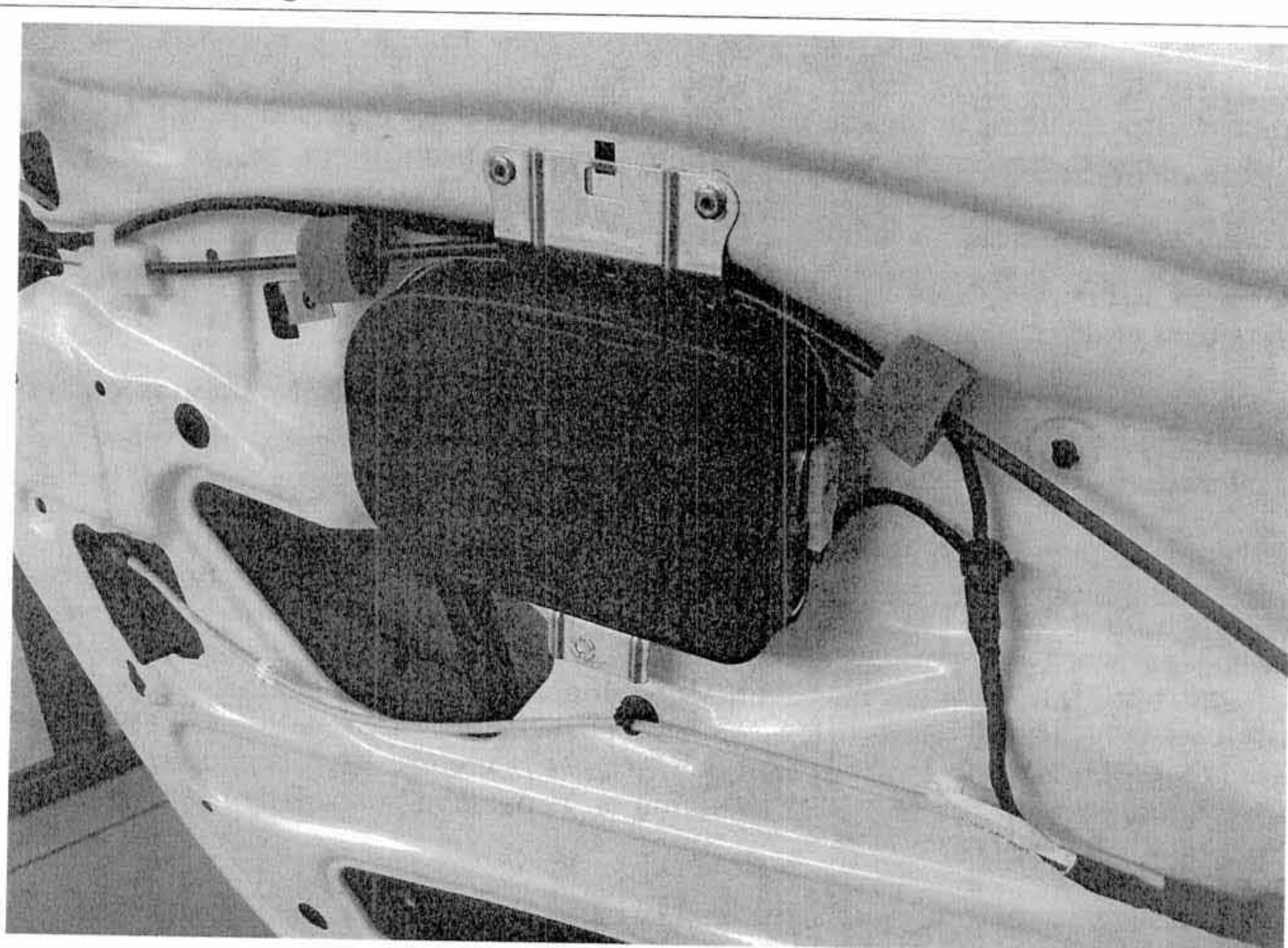


Figure 27 Side Airbag Housing

The vehicle is equipped with both driver and passenger side airbags. The airbags are concealed behind the door trim panels (Fig. 27). SRS logos on the trim panels indicate the presence of the airbags. The passenger side airbag does not deploy if the seatbelt is not buckled.

### Clockspring

The clockspring is a mechanical electrical circuit component that provides continuous electrical continuity between the fixed instrument panel wire harness and the electrical components mounted on or in the steering wheel. On the Crossfire, the electrical components include the driver airbag and the horn switch.

The clockspring case is positioned and secured to the multi-function switch mounting housing near the top of the steering column. The connectors on the tail of the clockspring case connect the clockspring to the electrical system through two takeouts with connectors from the instrument panel wire harness.

Service replacement clocksprings are shipped pre-centered and with a locking pin installed. Do not remove the pin until the clockspring been installed on the steering column. Refer to the Service Information for complete procedures.

### Driver/PAB Squib

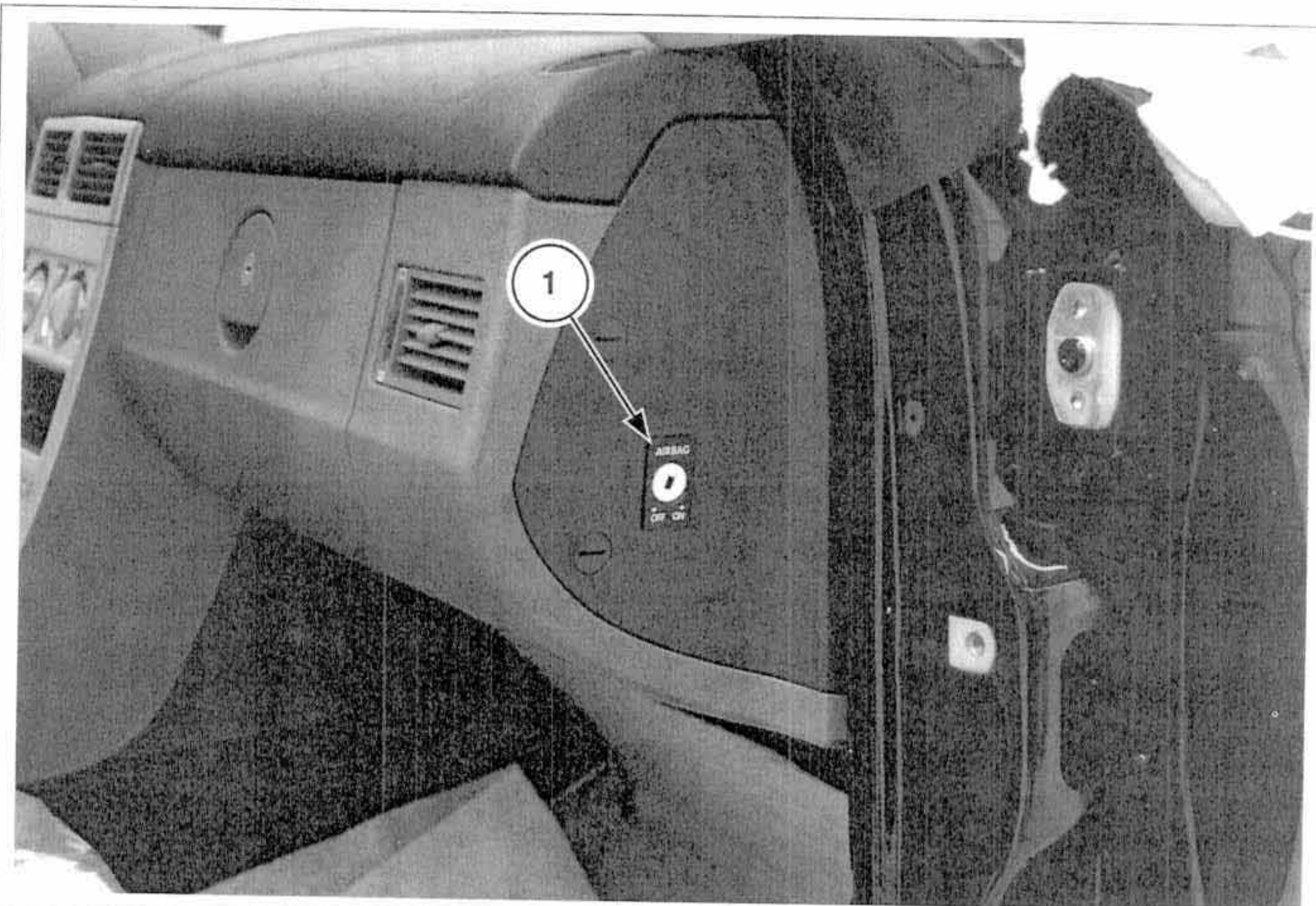
The driver airbag is located in the center of the steering wheel; behind the driver airbag trim cover.

The PAB is located on the instrument panel, under the instrument panel top pad and above the glove box on the passenger side. The PAB can be deactivated with the on/off switch when an infant or small child occupies that seat.

Multistage airbags with squibs (multiple initiators) must be checked to determine that all the squibs were used during the deployment event. The driver and passenger air bag are deployed by electrical signals generated by the ORC through the driver or passenger squib 1 and squib 2 circuits to the two initiators in the airbag inflators. Typically, both initiators are used and all potentially hazardous chemicals are burned during an airbag deployment. However, it is possible for only one initiator to be used due to an airbag deployment. Consequently, always confirm that both initiators have been used to prevent the improper handling or disposal of potentially live pyrotechnic or hazardous materials.

Use the DRBIII® scan tool to verify the status of both airbag squibs before either deployed airbag is removed from the vehicle for disposal.

**PAB On/Off Switch**




| | |
|---|---|
| 1 | PAB On/Off Switch |

Figure 28 PAB On/Off Switch

The Crossfire uses a dashboard mounted (Fig. 28), multiplexed Passenger Airbag (PAB) switch to disable the passenger airbag. To disable or enable the PAB, a key is inserted into the PAB switch and turned to the desired status. A PAB disable lamp illuminates on the center stack if the PAB is disabled.

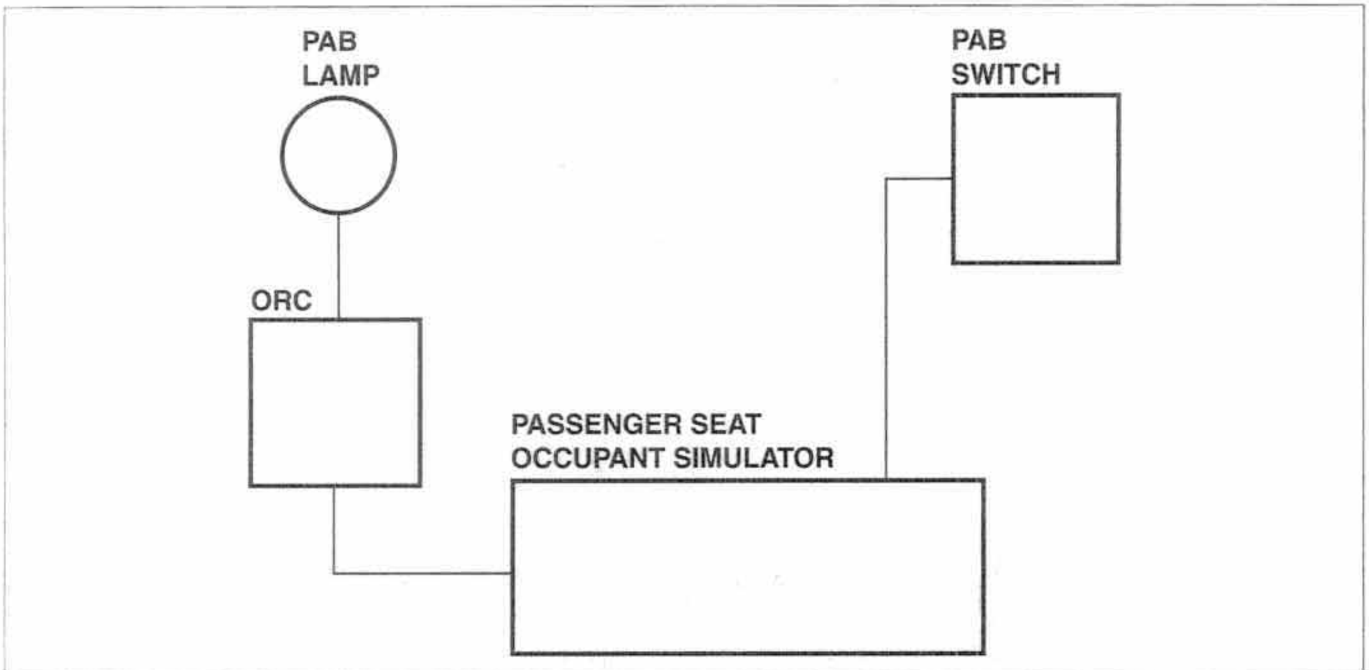



Figure 29 PAB Switch

To enable or disable the PAB, a key is inserted into the PAB switch and turned to the desired status. The PAB switch is fed a 5-volt VREF and produces a different feedback voltage that is sensed by the passenger seat occupant simulator. The passenger seat occupant simulator converts this fixed DC voltage into a digital square wave signal. This signal is sent to the ORC over the PAB On/Off Switch signal circuit. If the request is for PAB disable, the ORC provides a ground to the PAB On/Off Indicator and disables the PAB. Refer to Figure 29.

PAB On/Off Indicator

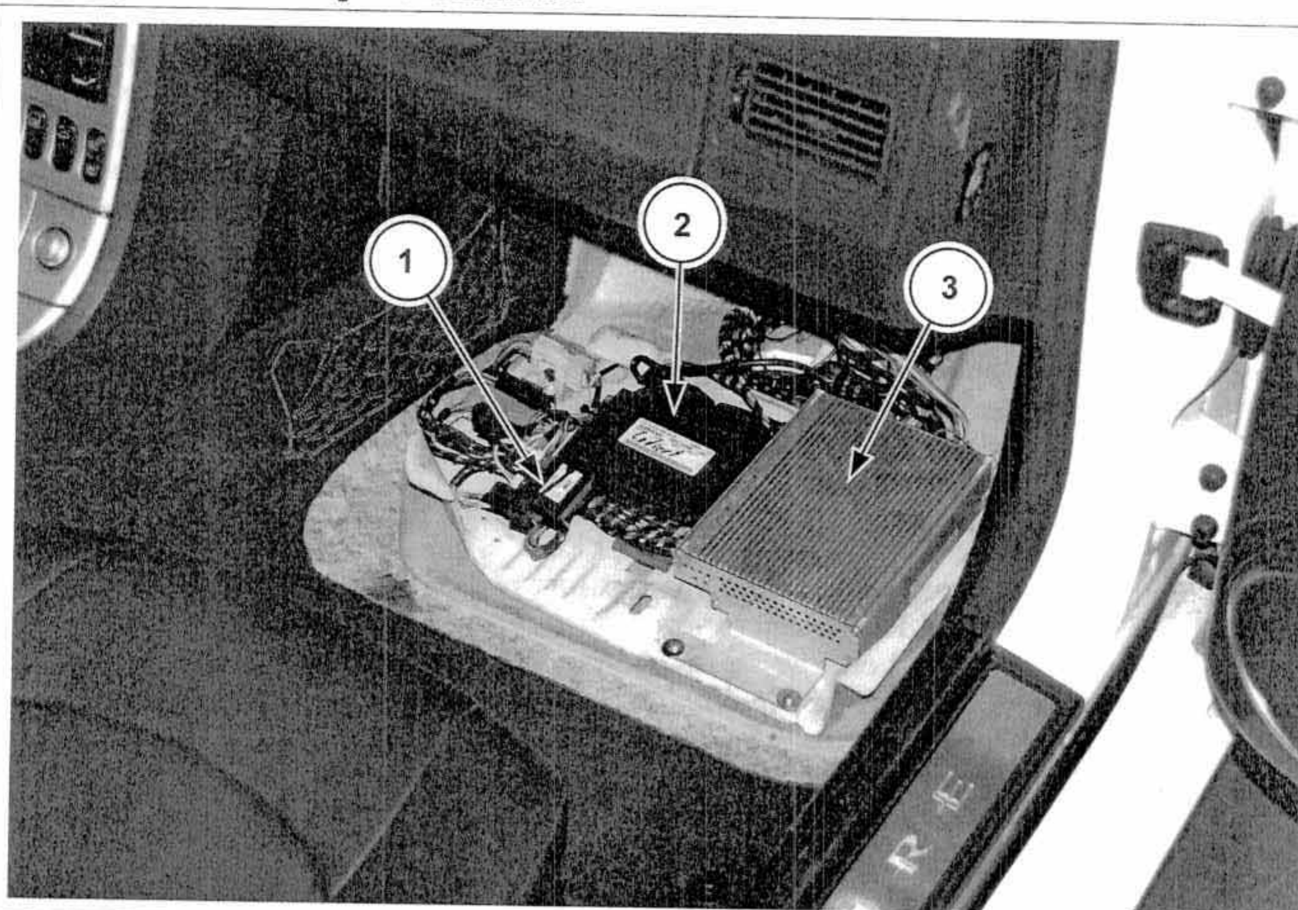

Figure 30 PAB On/Off Indicator

The PAB On/Off Indicator (Fig. 30) is located on the console center stack, forward of the SLA. It is provided a B+ feed through a 5-amp fuse whenever the ignition key is in the ACC, RUN or START position. The ORC provides the ground.

**Seat Belt Buckle Switches**

The seat belt switches are hall effect type switches and provide feedback to the ORC indicating if the respective seatbelt is latched or not.

**Passenger Seat Occupant Simulator**




| | | | |
|---|---|---|---|
| 1 | Passenger Seat Occupant Simulator | 3 | Audio Amplifier |
| 2 | Transmission Control Module (TCM) | | |

Figure 31 Passenger Seat Occupant Simulator

The passenger seat occupant simulator is located on the front side of the passenger floor access panel (Fig. 31). The multiplexed DC voltage signal received from the PAB switch is converted into a digital signal and sent to the ORC.

**Emergency Tensioning Retractors (ETRs)**

ETRs remove slack in the seat belts and to secure both the driver and the passenger in the seat during the initial moments following an impact event.

**System Operation**

The SRS electrical circuits are continuously monitored and controlled by the ORC. An airbag indicator in the IC momentarily illuminates as a bulb test each time the ignition switch is turned to RUN or START. Following the bulb test, the airbag indicator is turned on or off by the ORC to indicate the status of the SRS. If the airbag indicator comes on at any time other than during the bulb test, it means that there is a problem in the SRS electrical circuits. The problem may cause the airbags not to deploy when required, or to deploy when not required.

Deployment of the supplemental restraints depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the impact sensors. When an impact is severe enough, the microprocessor in the ORC signals the inflator of the airbag units to deploy their airbag cushions.

The ORC is located under the floor console just forward of the park brake mechanism. The ORC includes a microprocessor, electronic impact sensor, electronic safing sensor, and energy storage capacitor. Two electrical connector receptacles on the forward side of the ORC housing connect the ORC to the instrument panel wire harness, and airbag overlay wire harness connectors (both dedicated circuits). Both ORC connectors are black.

The ORC cannot be repaired or adjusted. If damaged or faulty, it must be replaced.

The ORC microprocessor contains the SRS logic circuits and controls all of the SRS components. The ORC uses self-diagnostics and can communicate with other electronic modules in the vehicle as well as with the DRBIII® scan tool. This method of communication is used to control the airbag indicator in the IC and for SRS diagnosis and testing through the 16-way DLC.

The ORC continuously monitors all of the SRS electrical circuits to determine the system readiness. If the ORC detects a monitored system fault, it sets an active and stored DTC and sends electronic messages to the IC to turn on the airbag indicator. An active fault only remains for the duration of the fault or in some cases the duration of the current ignition switch cycle.

A stored fault causes a DTC to be stored in ORC memory. For some DTCs, if a fault does not recur for a number of ignition cycles, the ORC automatically erases the stored DTC. For other internal faults, the stored DTC is latched until the fault is repaired. The ORC also monitors a Hall-effect type seat belt switch located in the buckle of each front seat belt to determine if the seatbelts are buckled. It provides an input to the IC to control the seatbelt indicator operation based on the status of the driver side front seat belt switch.

The ORC receives fused B+ from the ignition switch on two circuits that are hot in the ACC, ON/RUN and START positions. The ORC is grounded through a circuit that is part of the floor wire harness. This circuit has a single eyelet terminal connector located behind the ORC mount on the floor panel transmission tunnel.

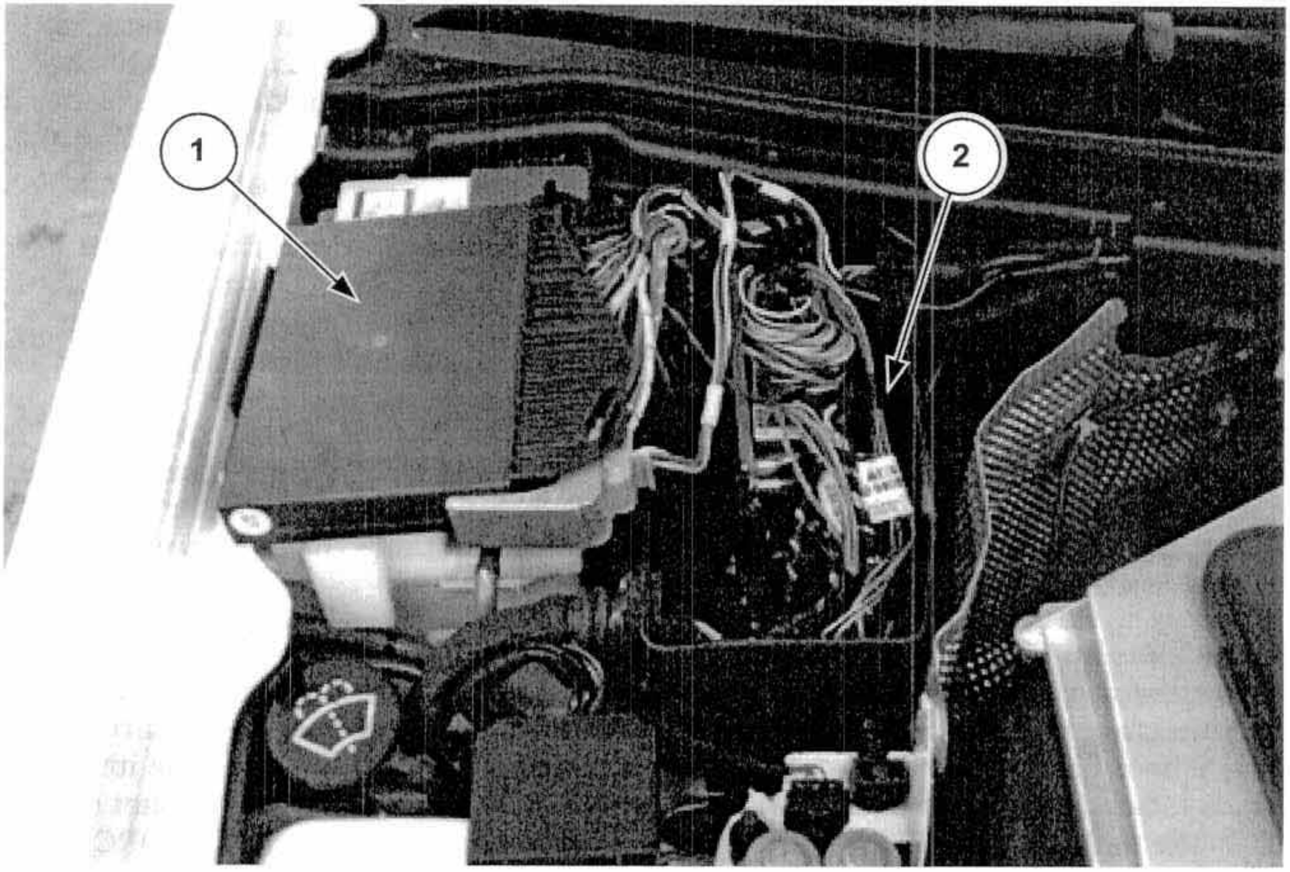
The ORC also contains an energy storage capacitor that provides backup SRS protection if there is a loss of battery current supply to the ORC during an impact. When the ignition switch is in the START or RUN positions, this capacitor is continually being charged with enough energy to deploy the airbags for up to one second following a battery disconnect or failure.

The ORC has an impact sensor and a safing sensor. The electronic impact sensors are accelerometers that sense the rate of vehicle deceleration that provide verification of the direction and severity of an impact. The ORC contains a second bi-directional safing sensor for the side airbags. It monitors inputs from two remote side impact sensors located under the seats, to control the deployment of the side impact airbag units. The safing sensor is an electronic accelerometer sensor within the ORC that provides an additional logic input to the ORC microprocessor.

The ORC determines when the deceleration rate, signaled by the impact sensors and the safing sensors, indicates an impact that is severe enough to require SRS protection. Based on the status of the seatbelt switch inputs and the severity of the monitored impact, the ORC determines the level of front airbag deployment force required for each front seating position. When the programmed conditions are met, the ORC sends the proper electrical signals to deploy the front airbags at the programmed force levels and either side curtain airbag.

The hard-wired inputs and outputs for the ORC may be diagnosed and tested with the DRBIII® scan tool.

## BODY CONTROL MODULE (BCM)




| | | | |
|---|---|---|---|
| 1 | Body Control Module (BCM) | 2 | Control Module Box |

Figure 32 Body Control Module (BCM)

### Description

The Body Control Module (BCM) is concealed in the engine compartment inside of the control module box located next to the battery (Fig. 32). The BCM utilizes integrated circuitry and information carried on the CAN B Bus along with many hardwired inputs to monitor many sensor and switch inputs throughout the vehicle. In response to those inputs, the internal circuitry and programming of the BCM allow it to control and integrate many electronic functions and features of the vehicle through both hardwired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the CAN B Bus. The BCM for this model is serviced only as a complete unit. A BCM can only be repaired by or replaced through an authorized electronic warranty repair station. Refer to the latest version of the Warranty Policies and Procedures manual for a current listing of authorized electronic repair stations.

### Operation

The BCM is designed to control and integrate many of the electronic features and functions of the vehicle. The microprocessor-based BCM hardware and software monitors many hardwired switch and sensor inputs as well as those resources it shares with other electronic modules in the vehicle through its communication over the CAN B Bus. The internal programming of the BCM microprocessor allows the BCM to determine the tasks it needs to perform and their priorities. The BCM programming then performs those tasks and provides features through both CAN bus communication with other electronic modules and hardwired outputs to a number of relays. These relays provide the BCM with the ability to control numerous high current accessory systems in the vehicle.

The BCM circuitry operates on battery current received through fuses in the underhood accessory fuse block on a non-switched fused B (+) circuit, a fused ignition switch output (start-on/run) circuit, and a fused ignition switch output (start-on/run-accessory) circuit. This arrangement allows the BCM to provide some features regardless of the ignition switch position. The BCM circuitry is grounded through the chassis behind the right side lower A-pillar kick panel.

The BCM monitors its own internal circuitry as well as many of its input and output circuits and stores a DTC in electronic memory for any failure it detects. These DTCs can be retrieved and diagnosed using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

## INSTRUMENT CLUSTER (IC)

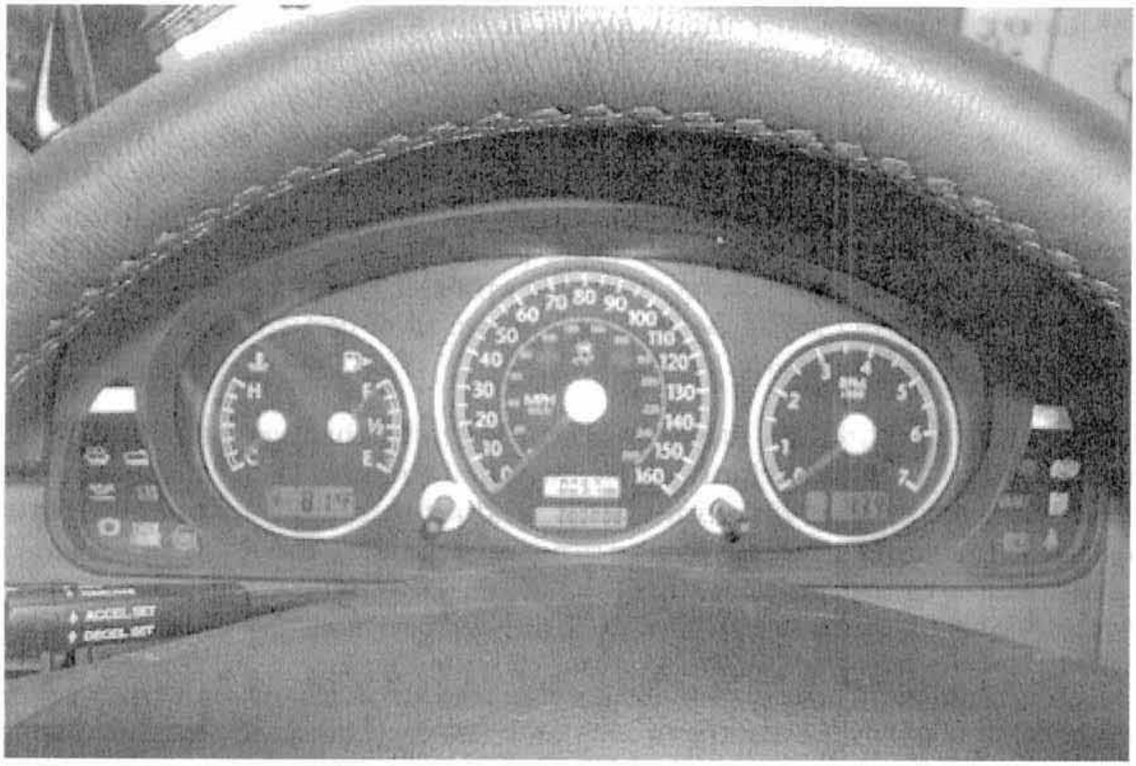


Figure 33 Instrument Cluster (IC)

The IC (Fig. 33) is used to inform the driver about important vehicle operating conditions and to warn the driver about potentially critical operating conditions. For this, the IC has indicator lamps, display gauges and audible tones. The IC's indicator lamps are displayed by text overlays that show the lamp's function. The information required for the indicator lamps and audible tones is transmitted from their sensors to the IC via direct lines or from their control modules to the IC via the CAN C data bus and SCI bus. The IC has a microprocessor for analyzing the incoming data for the indicator lamps and audible tones. The program and the data required are stored in an electronic memory chip called the erasable electronic programmable read only memory (EEPROM).

**Gauges**

The IC has four analog gauges: speedometer, tachometer, fuel level and coolant temperature.

- The speedometer has a 160-mph primary scale, with metric units (257 km/h) on a secondary scale.
- The 7000-RPM tachometer is redlined above 6200 RPM to indicate excessive engine speed.
- The temperature gauge indicates engine coolant temperature.
- When the fuel level reaches approximately 8 liters (2.1 gallons) a red warning indicator in the gauge just above the E mark illuminates to indicate a low fuel level.

An amber vehicle icon in the speedometer illuminates when the ESP is active, indicating the need to adjust driving behavior to the road conditions. The gauges are electronically controlled.

**Digital Displays**

Five electronic digital displays show cumulative odometer, trip odometer, time, outside air temperature and, with automatic transmission, transmission range or gear. The LCD transmission display shows P, R, N or D nomenclature under normal driving conditions. When Autostick® is in use, the display shows the number of the gear selected.

- The odometer display also shows the distance remaining to the next regular maintenance service as calculated by the Flexible Service System (FSS).
- The trip odometer can be reset at anytime. Pressing the knob to the left of the speedometer resets it. One press is used if the ignition switch is in the RUN position, two presses with the ignition switch in other positions or with the key removed.
- The trip and cumulative odometer displays are also used to show engine oil level.
- A knob between the tachometer and speedometer resets the digital clock, which is located at the base of the tachometer.
- The outside air temperature indicator adapts to ambient temperature in steps depending on the prevailing driving conditions (stop-and-go traffic, constant speed driving, etc.) and on the level of temperature change. During idling or slow driving, the temperature reading may be affected by road or engine heat because the sensor is near the front bumper.

**Indicator Lamps Actuated Over Direct Lines**

- Low Tire Pressure Indicator Lamp
- Left Turn Signal Indicator Lamp
- Right Turn Signal Indicator Lamp
- High Beam Indicator Lamp
- Low Fuel Level Indicator Lamp
- Low Washer Fluid Indicator Lamp
- Low Coolant Level Indicator Lamp
- Battery Voltage Indicator Lamp
- Seat Belt Indicator Lamp
- Lamp Outage Indicator Lamp
- Malfunction Indicator Lamp (MIL)
- Brake Assist System (BAS) MIL
- ESP Warning Lamp
- SRS MIL

**Indicator Lamps Actuated Over the CAN Bus**

- Brake Warning Indicator Lamp
- Brake Wear Indicator Lamp
- Anti-Lock Brake System (ABS) Warning Indicator Lamp

**Audible Tone And Indicator Lamps Actuated Over Direct Lines**

- Turn Signal Ticker (Audible Tone/Indicator Lamp)
- Seat Belt Reminder (Audible Tone/Indicator Lamp)
- Switched - On Headlamps Reminder (Audible Tone)
- Key Warning (Audible Tone)

**Audible Tone And Indicator Lamps Actuated Over the CAN Bus**

- Parking Brake Warning

**FLEXIBLE SERVICE SYSTEM (FSS) INDICATOR**

The FSS indicator draws the attention of the driver to a particular service that is due. The FSS indicator is a mileage/time-activated engine service system for recommended oil change intervals. In addition to time (in days) and distance criteria, other factors, such as extreme speeds or cold starts that are in combination with short distances, are taken into account for adjusting the programmed service intervals. If the oil level drops below a warning threshold, the remaining distance or the remaining time and the tool symbol are displayed. The FSS indicator has its own microprocessor in the IC. The FSS indicator obtains time information from the digital clock integrated into the IC. The other data required is obtained via the CAN C data bus from the Controller Anti-Lock Brake (CAB) and the PCM.

**Appearance and Lighting**

Black instrument faces have blue-green back lighting of gauge nomenclature when exterior lamps are on. Digital displays also have blue-green back lighting. A rotary knob to the left of the speedometer adjusts the light intensity. Digital displays turn on when a door is opened, when the engine is running and can also be turned on by pressing the light intensity adjustment knob when the ignition is off.

**REMOTE KEYLESS ENTRY (RKE) FOB**

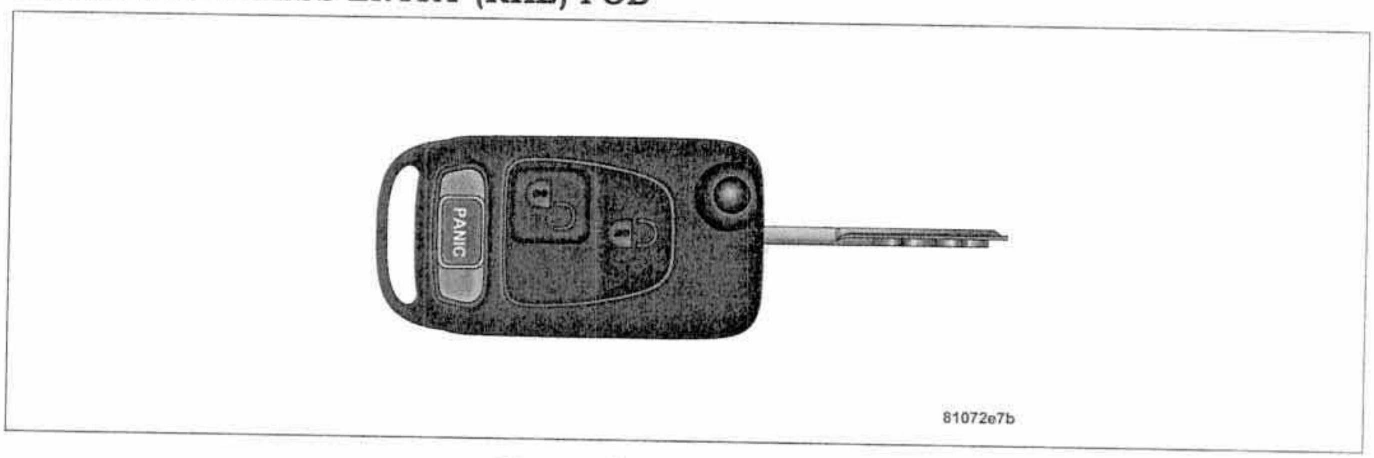



Figure 34 RKE Key Fob

The RKE module is now part of the Sentry Key Electronic Entry Module (SKREEM). The master key that operates all locks and the ignition switch is integrated with the RKE system transmitter fob. The key folds and latches into the fob when not in use. It snaps into operating position by pressing the key release button on the transmitter (Fig. 34). Two RKE fobs with folding master keys are supplied with the vehicle.

The condition of the key fob transmitter battery can be tested using the test lamp built into the fob. The lamp illuminates briefly when a Lock or Unlock button is pressed if the battery has sufficient charge; if not the battery should be replaced. The transmitter uses two, type CR 2025 lithium batteries or equivalent. The battery cover on the back of the transmitter snaps off for battery replacement.

If the RKE transmitter does not lock or unlock the vehicle and battery failure has been ruled out, the system may need to be synchronized.

**Key Replacement**

The key is an integral part of the transmitter fob. Replacing or adding keys can only be done by an authorized Chrysler dealer. Refer to the Service Information for complete key fob replacement procedures.

**Transmitter Functions**

Three transmitter buttons provide Lock, Unlock and Panic functions. The lock and unlock buttons have embossed ISO symbols. Pressing the Unlock button once, unlocks the driver's door and the fuel filler door. Pressing the Unlock button a second time, unlocks all other closures. This is called Selective Unlocking mode.

The transmitter includes a battery-check lamp that blinks each time a transmitter button is pressed. The driver can program the transmitter to unlock all closures at the first press of the Unlock button. This is called Global Unlocking mode. Pressing and holding both buttons for five seconds toggles the system between modes. The battery-check lamp in the transmitter blinks twice on completion of a mode change.

To help protect the vehicle from unauthorized entry due to unintended unlocking the vehicle automatically locks unless:

- a door is open
- the key is in the ignition switch
- the central locking switch on the center console is pressed within 40 seconds after unlocking with the RKE transmitter.

Pressing the Unlock button flashes the turn signal lamps once to indicate that the vehicle is unlocked. Pressing the Lock button flashes all turn signal lamps three times to indicate that the vehicle is locked. If the lamps do not flash during locking, a door or liftgate ajar signal is present.

The transmitter output signal includes a rolling code that changes in an indecipherable manner every time a button on the transmitter is pressed. The receiver is synchronized with a valid transmitter to accept signals with a new code, but not a previous code. However, if the transmitter unlock button is pressed repeatedly while out of range of the receiver, synchronization may have to be restored. Refer to the Service Information.

When the red PANIC button is pressed, the horn sounds and exterior lamps flash. The button must be held down for at least one second, before the alarm starts, to avoid inadvertent actuation. The alarm operates for three minutes or until either the PANIC button is pressed again or the ignition switch is turned to the RUN position.

**CENTRAL LOCKING SYSTEM**

The standard Central Locking System operates door, liftgate and fuel filler door locks. It allows the driver to lock or unlock the entire vehicle using the RKE transmitter, a key in the driver's door or from the central locking switch on the center console. The Central Locking System prevents locking with a door lock button or the RKE transmitter when the ignition switch is in the RUN position. It also prevents locking if either door is ajar.

Doors and liftgate may be locked or unlocked from inside the vehicle with the central locking switch. However, the central locking switch does not lock or unlock the fuel filler door.

- If the vehicle was locked using the central locking switch while in the Selective Remote Locking mode, opening a door from inside unlocks that door only.
- If the vehicle was locked using the central locking switch while in the Global Remote Locking mode, opening a door from inside unlocks both doors and the liftgate.
- If the vehicle was locked using the RKE transmitter, the doors and liftgate cannot be unlocked using the central locking switch.
- If the vehicle has been locked from the outside, opening a door from the inside does not unlock other openings, but it triggers the alarm.

The illuminated entry system is part of the Central Locking System.

**Mechanically Operated Locks**

Two master keys that are combined with RKE transmitters are supplied with the vehicle. All keys operate the locks in the driver door and the glove box. The driver door lock cylinder includes a cap that must be removed before inserting the key.

Each door has an interior lock button that extends through top of the trim panel at the rear of the door. It can be used to lock or unlock the door, but the driver door can only be locked in this way with the door closed. Pulling an inside release handle also unlocks the doors.

Pressing a lock or unlock button on the RKE transmitter or inserting the key in the ignition switch and turning it to the "unlock" position, silences the alarm.

**Automatic Central Locking**

The Central Locking Switch in the center console operates the Automatic Central Locking System. With automatic central locking activated, the doors and liftgate lock when vehicle speed reaches approximately 15 km/h (9 mph). With the ignition switch in the RUN position, pressing and holding the upper portion of the Central Locking Switch for at least five seconds activates automatic central locking. Conversely, pressing and holding the lower portion of the switch with the ignition switch in the RUN position for at least five seconds deactivates automatic central locking.

**CENTRAL LOCKING PUMP/SECURITY SYSTEMS MODULE (CLP/SSM)**

To unlock the vehicle, the BCM is signaled by the SKREEM. The BCM then transmits an unlocking signal to the CLP/SSM over the CAN B Bus.

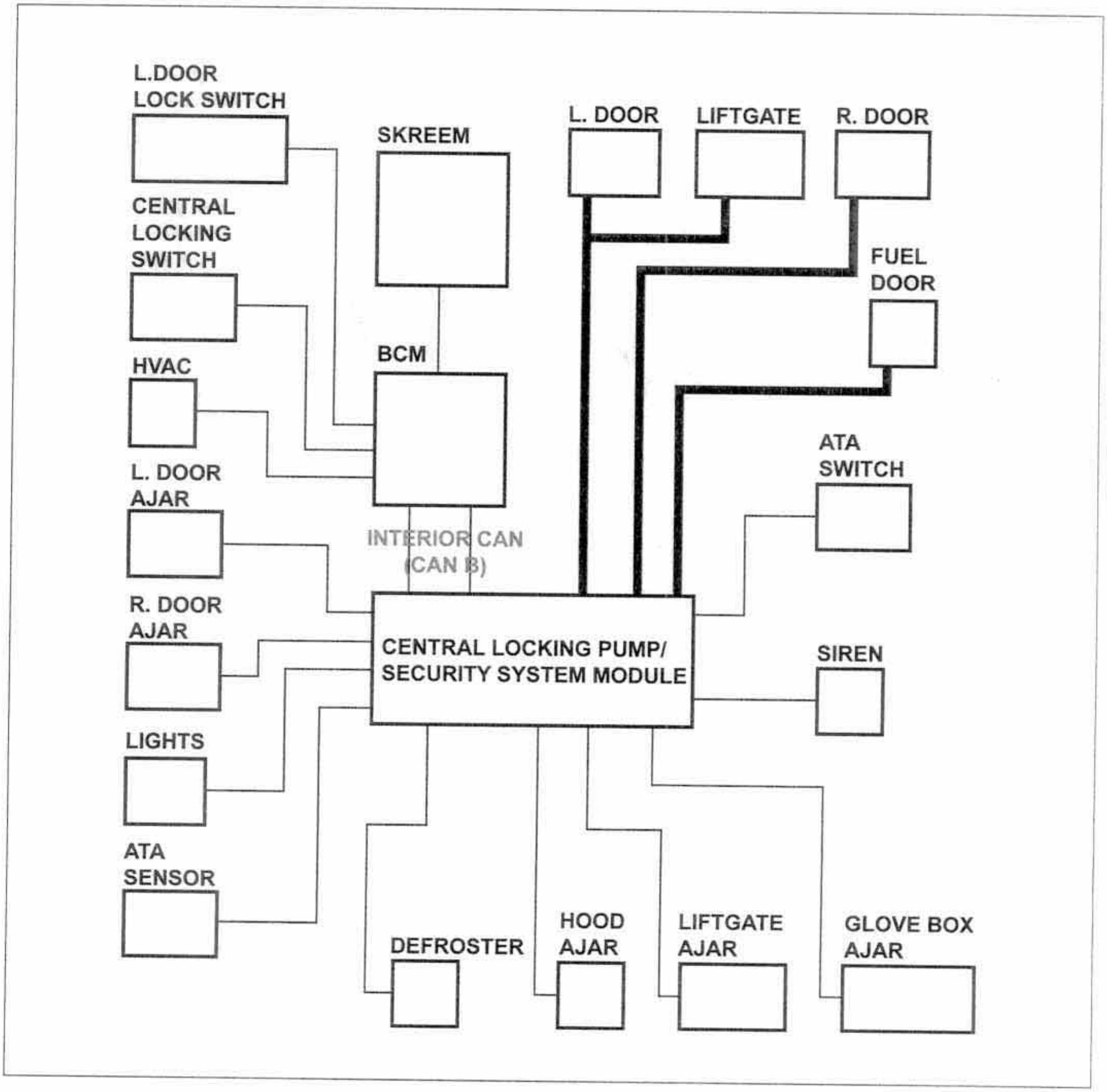
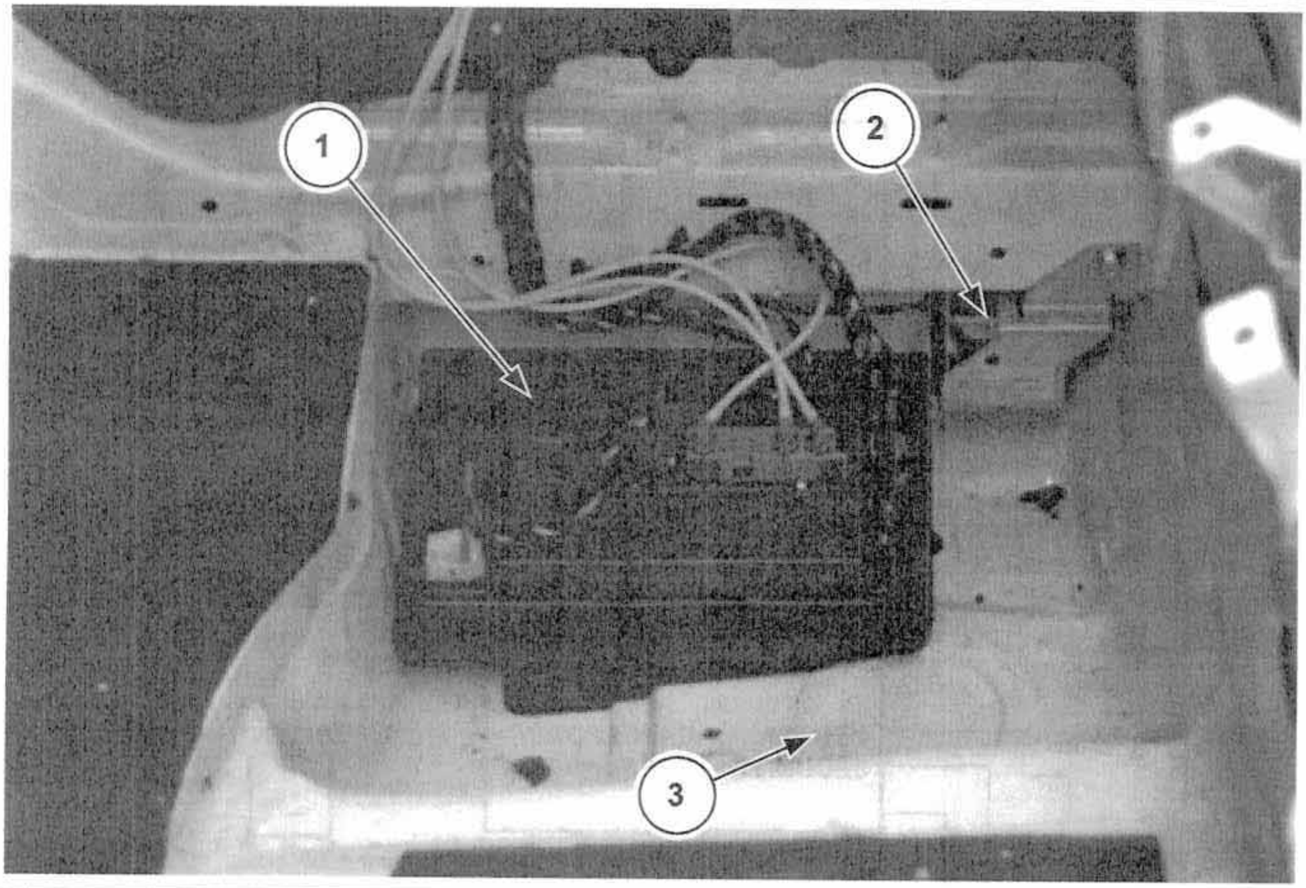



Figure 35 Central Locking Pump/Security Systems Module (CLP/SSM)

The Crossfire uses a cargo area mounted CLP/SSM to control vehicle locking, security and rear defrost operations. Associated components of these three systems include the: Tow Away Alarm Switch, BCM, SKREEM, HVAC Control Module, CAN B Bus, Defroster Grid, Anti-Theft Tow Sensor, Parking Lamps, CLP/SSM, Lock Motors, Siren, Hood, Door, Glove Box, and Liftgate Ajar Switches.

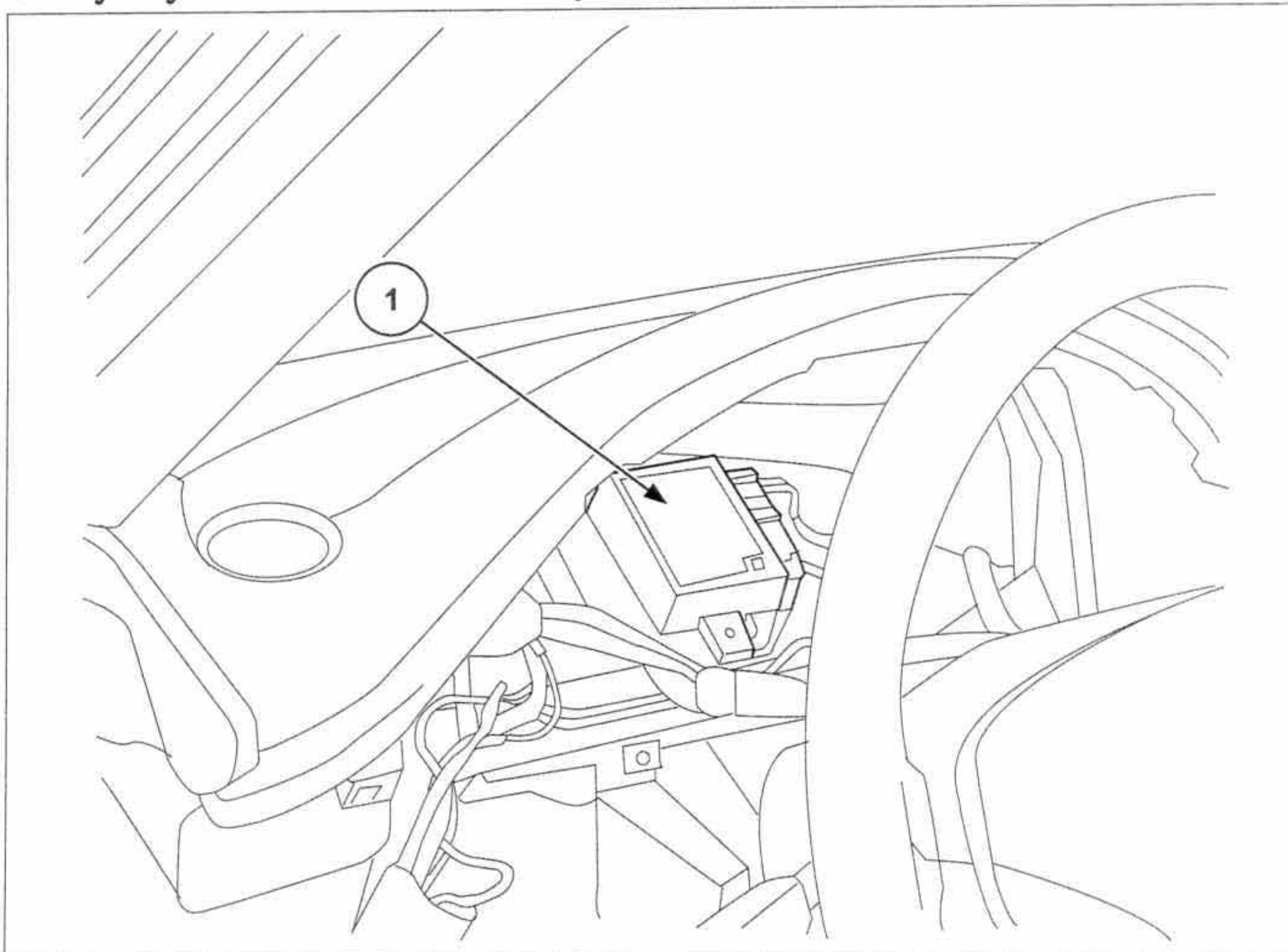



| | | | |
|---|---|---|---|
| 1 | Central Locking Pump/Security System Module (CLP/SSM) | 3 | Cargo Area Floor Pan |
| 2 | Anti-Theft Tow Sensor | | |

Figure 36 Central Locking Pump/Security System Module (CLP/SSM)

The CLP/SSM is located in the trunk area, under the right side of the floor (Fig. 36). The CLP/SSM is an integral part of three different body electrical systems. These systems are the door locking system, anti-theft alarm and the rear defroster. The CLP/SSM uses hardwired inputs and CAN B bus information (from the BCM) to control each of these systems. The CLP/SSM contains an electrical motor that actuates a pressure/vacuum pump for the pneumatic door lock system. Noise and vibration from the pump are extensively isolated from the rest of the vehicle to reduce noise and vibration complaints.

### Sentry Key Remote Electronic Entry Module (SKREEM)




| | |
|---|---|
| 1 | Sentry Key Remote Electronic Entry Module (SKREEM) |

Figure 37 Sentry Key Remote Electronic Entry Module (SKREEM)

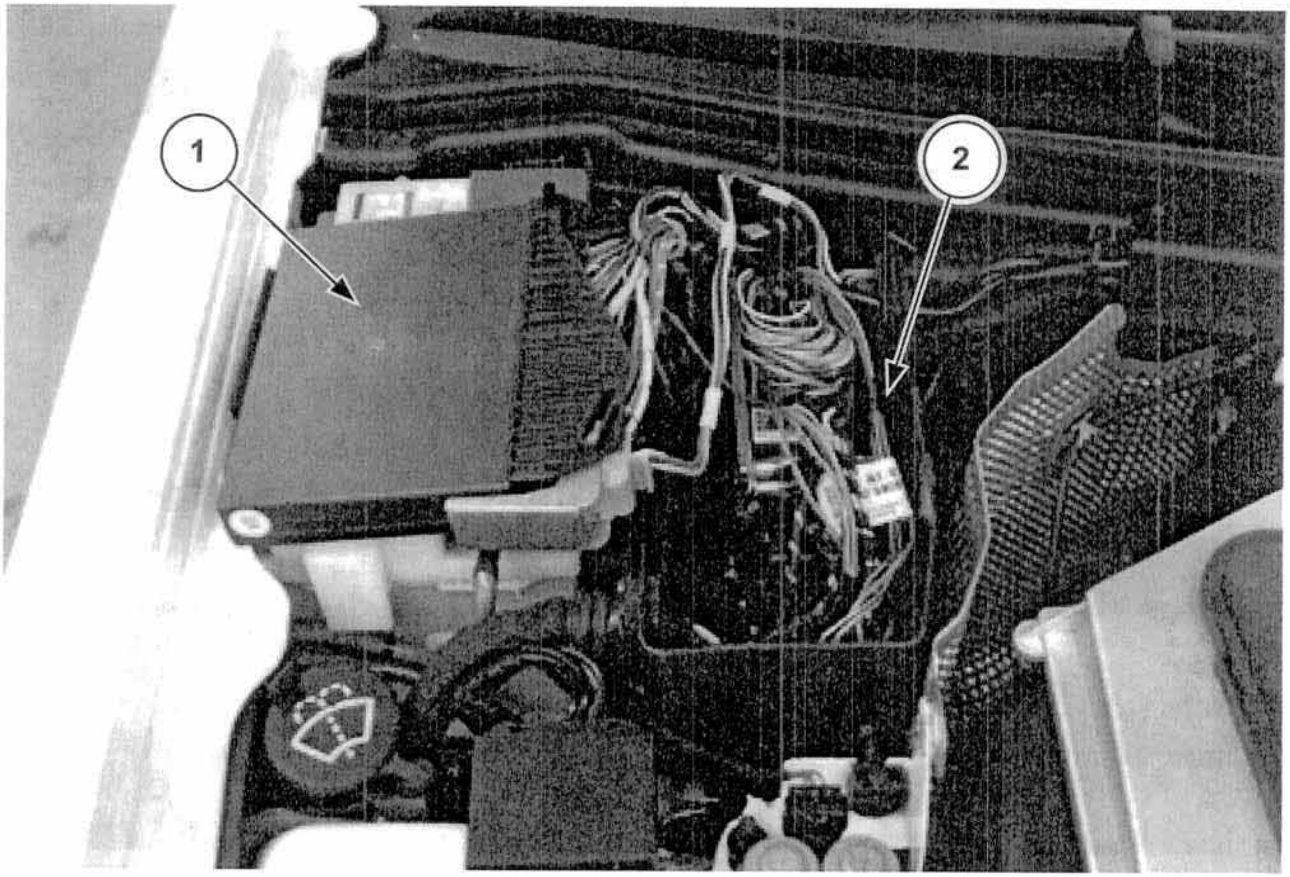
The SKREEM is located behind the IC (Fig. 37). The SKREEM houses the circuitry that controls the Sentry Key Immobilizer Module (SKIM) function and the RKE. When the operator presses the lock, unlock or panic button, the radio frequency (RF) is received by the SKREEM (for panic and for lock, unlock). The signal from SKREEM is sent to the BCM over the interior CAN B Bus.

When ignition power is supplied to the SKREEM, the SKREEM performs an internal self-test. After the test is complete, the SKREEM energizes the antenna that activates the transponder chip and sends a challenge to the transponder chip. The chip responds to the challenge by generating an encrypted response message.

After responding to the coded message, the transponder sends an ID message to the SKREEM. The SKREEM compares the transponder ID message to the available valid key codes in SKREEM memory (eight key maximum at any one time). After validating the ignition key, the SKREEM sends a CAN C Bus message request to the PCM then waits for the PCM response. If the PCM dos not respond, the SKREEM sends the request again. If the PCM does not respond again, the SKREEM stops sending the request and stores a DTC. If the PCM sends a correct response to the SKREEM, the SKREEM sends a valid/invalid key message to the PCM. Based on this message, the PCM allows or disallows engine operation.

- "Secret Key" is an identification number (electronically stored value) that is unique to each SKREEM. It is stored in the SKREEM, the PCM and all ignition key transponders
- "Challenge" is a random number that is generated by the SKREEM at each ignition key cycle.

The secret key and challenge are the two variables used in the algorithm that produces the encrypted response message. The transponder uses the crypto algorithm to receive, decode and respond to the message sent by the SKREEM. After responding to the coded message, the transponder sends a transponder ID message to the SKREEM.




| | | | |
|---|---|---|---|
| 1 | Body Control Module (BCM) | 2 | Control Module Box |

Figure 38 Body Control Module (BCM)

The BCM is located within the control module box in the engine compartment (Fig. 38). For door locking operations, the BCM receives an input signal from either the door lock switches or the key fob (via the SKREEM) and produces a corresponding output signal over the interior CAN B Bus to the CLP/SSM. For rear defrost operations, the BCM receives an input signal from the rear defrost switch (on the A/C control module) and produces a corresponding output signal over the interior CAN B Bus to the CLP/SSM. The BCM is not involved in vehicle anti-theft operations.

## A/C Heater Control Module

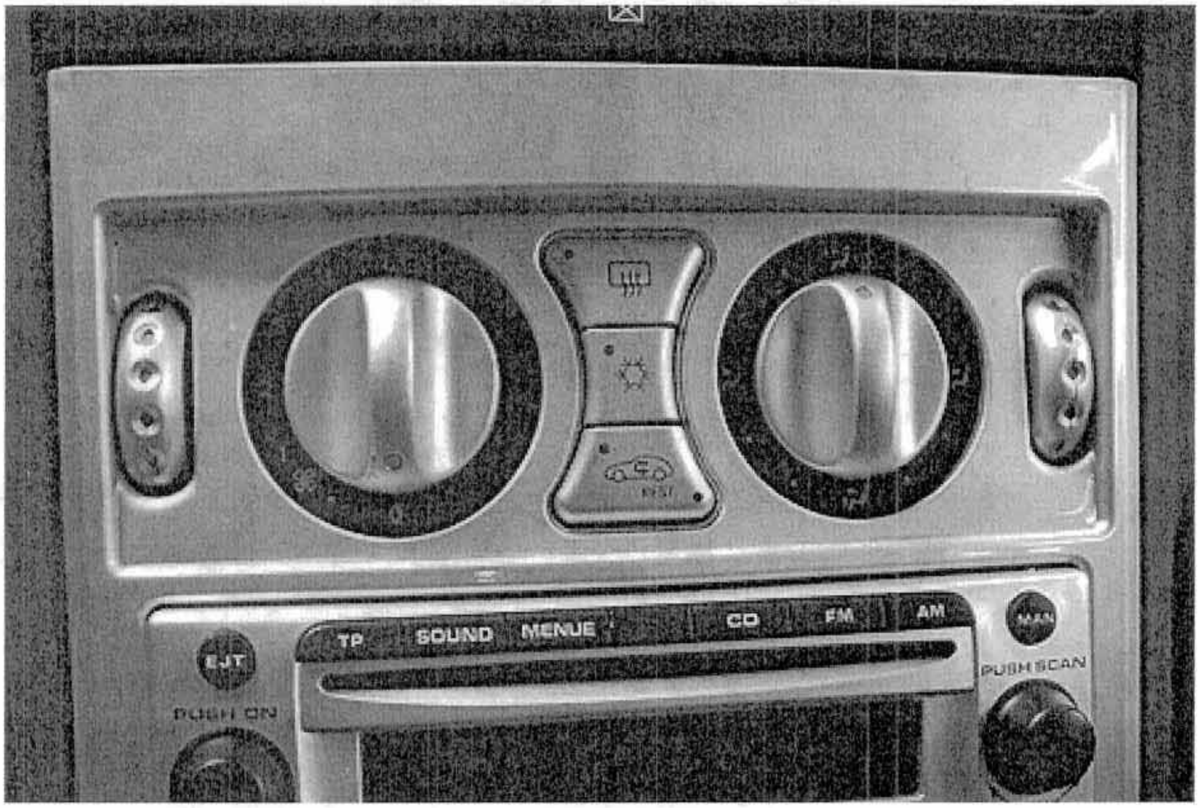
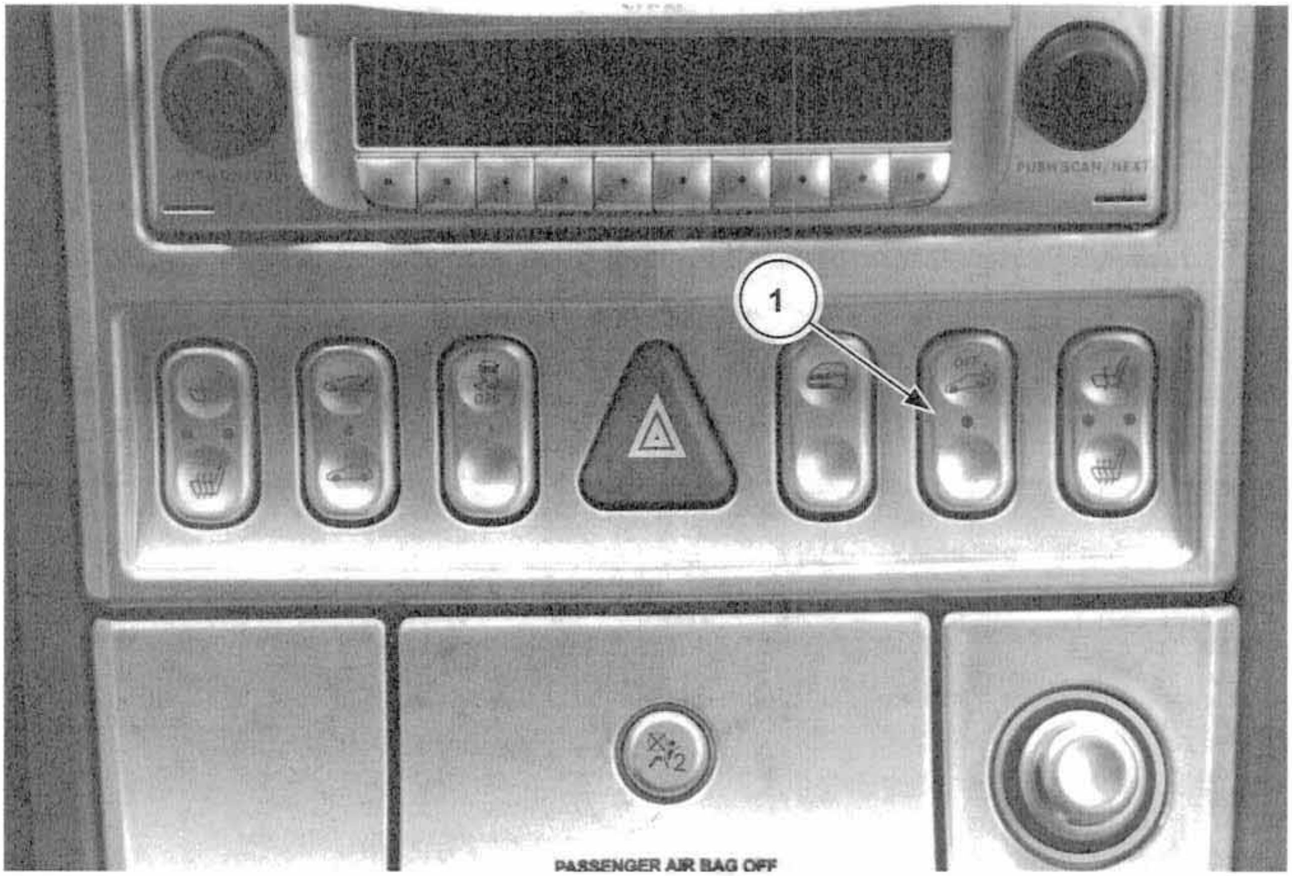



Figure 39 A/C Heater Control Module

The A/C Heater Control Module (HVAC Module) is integral with the climate controls on the vehicle's center stack. The HVAC Module houses the rear defrost switch.

When the defrost button is pressed, the HVAC Module communicates over a hardwire connection to the BCM. The BCM processes this information and uses the interior CAN B Bus to request rear defroster operation from the CLP/SSM.

**Tow Away Alarm Switch**

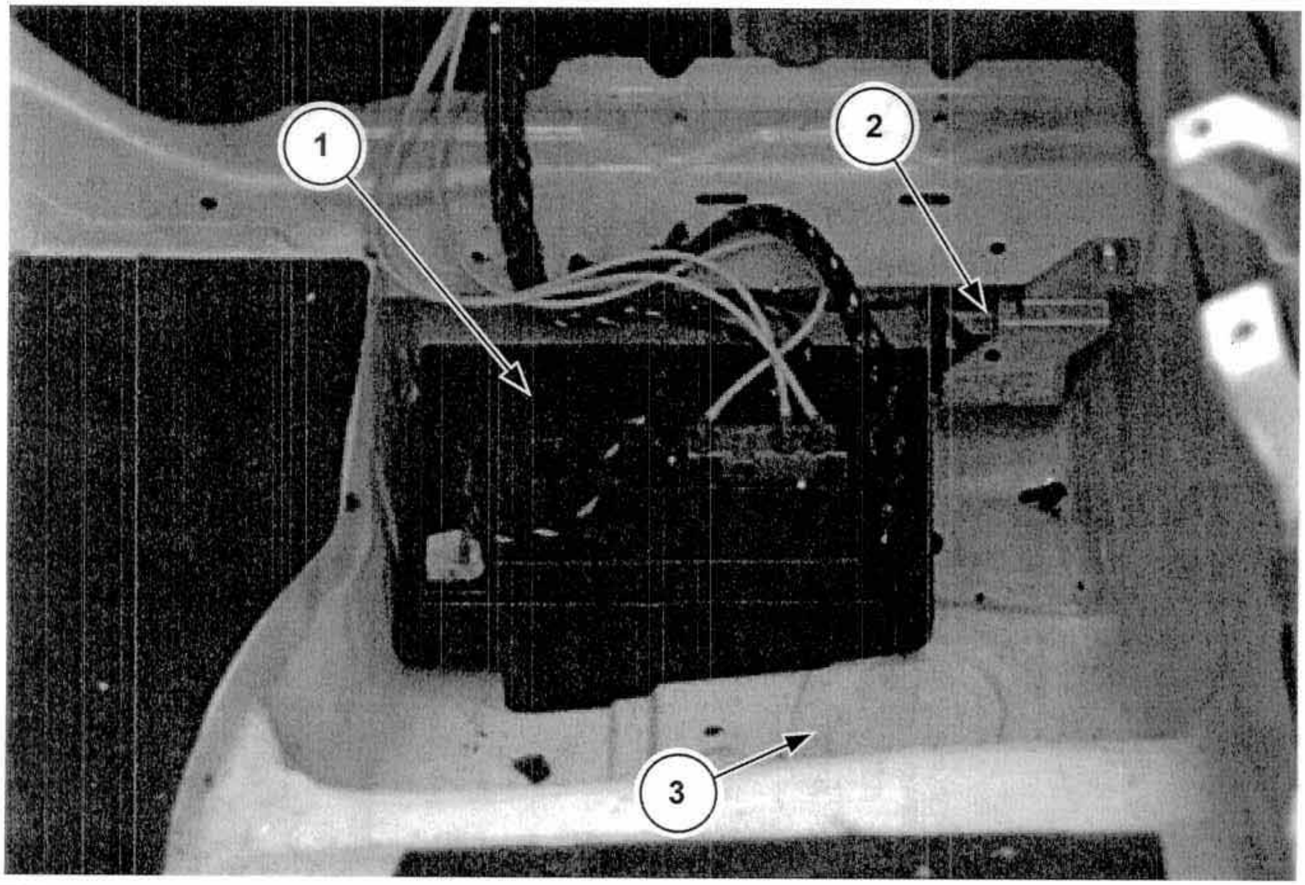



| | |
|---|---|
| 1 | Tow Away Alarm Switch |

Figure 40 Tow Away Alarm Switch

The Tow Away Alarm Switch is located in the center stack next to the passenger heated seat switch (Fig. 40). The Tow Away Alarm Switch allows the driver to override the anti-theft tow sensor. This allows the vehicle to be towed (while maintaining vehicle interior security) without sounding the alarm. The Tow Away Alarm Switch must be actuated before the alarm is set or its input to the CLP/SSM is ignored. The Tow Away Alarm Switch has a Light Emitting Diode (LED) that illuminates when the anti-theft tow sensor has been bypassed.

### Anti-Theft Tow Sensor




| | | | |
|---|---|---|---|
| 1 | CLP/SSM | 3 | Cargo Area Floor Pan |
| 2 | Anti-Theft Tow Sensor | | |

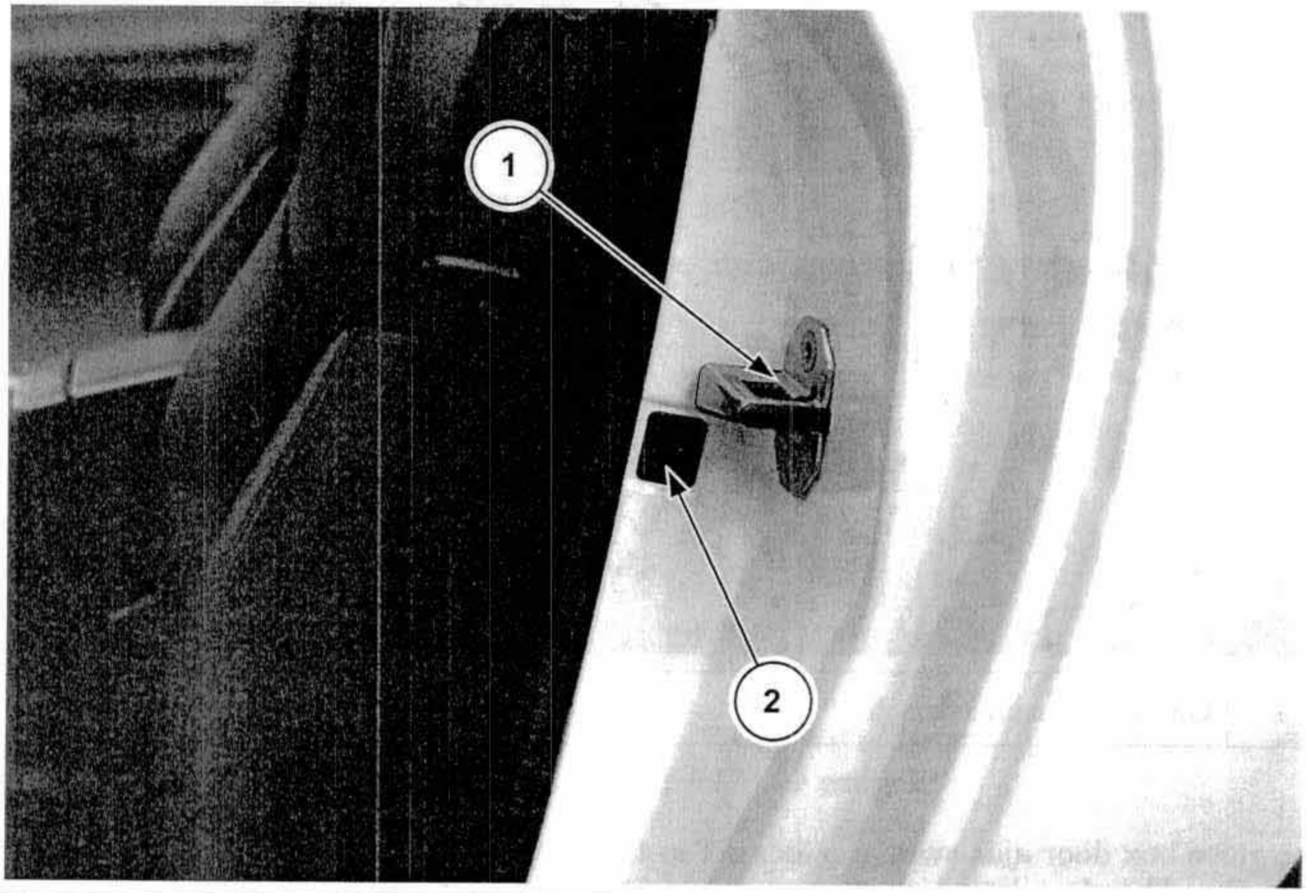
Figure 41  Anti-Theft Tow Sensor

The Anti-Theft Tow Sensor is located in the trunk area, under the right side of the floor (Fig. 41). The Anti-Theft Tow Sensor senses changes in the vehicle angular attitude. The Anti-Theft Tow Sensor is provided constant B+ and ground by the CLP/SSM. It returns a signal to the CLP/SSM to indicate a drastic change in vehicle attitude.

**CAN Bus**

The interior CAN B Bus exists between the BCM and the Central Locking Pump/Security System Module. The interior Bus is used for door locking, rear defroster and vehicle anti theft systems.

**Door Ajar Switches**

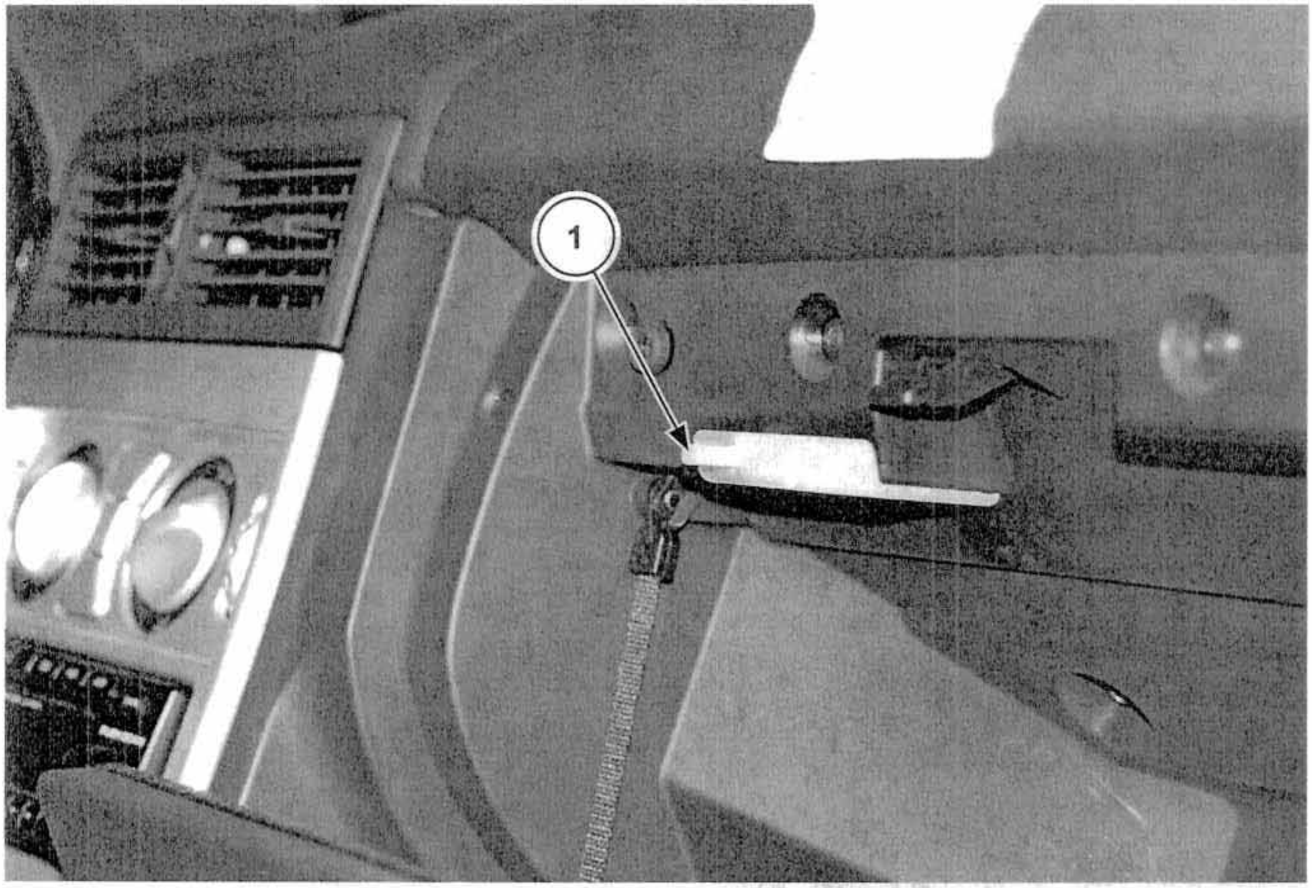



| | | | |
|---|---|---|---|
| 1 | Door Striker | 2 | Door Ajar Switch |

Figure 42 Door Ajar Switches

The door ajar switches are located in the door jams below the door strikers (Fig. 42). The door ajar switches are normally open. When either of the doors is opened the switch closes. This condition is sensed by the CLP/SSM for theft detection.

### Glove Box Ajar Switch




| | |
|---|---|
| 1 | Glove Box Ajar Switch |

Figure 43 Glove Box Ajar Switch

The glove box door ajar switch is located in the dash pad behind the glove box door (Fig. 43). The glove box door ajar switch is normally open. When the glove box door is opened the switch closes and is sensed by the CLP/SSM for theft detection.

**Liftgate Ajar Switch**

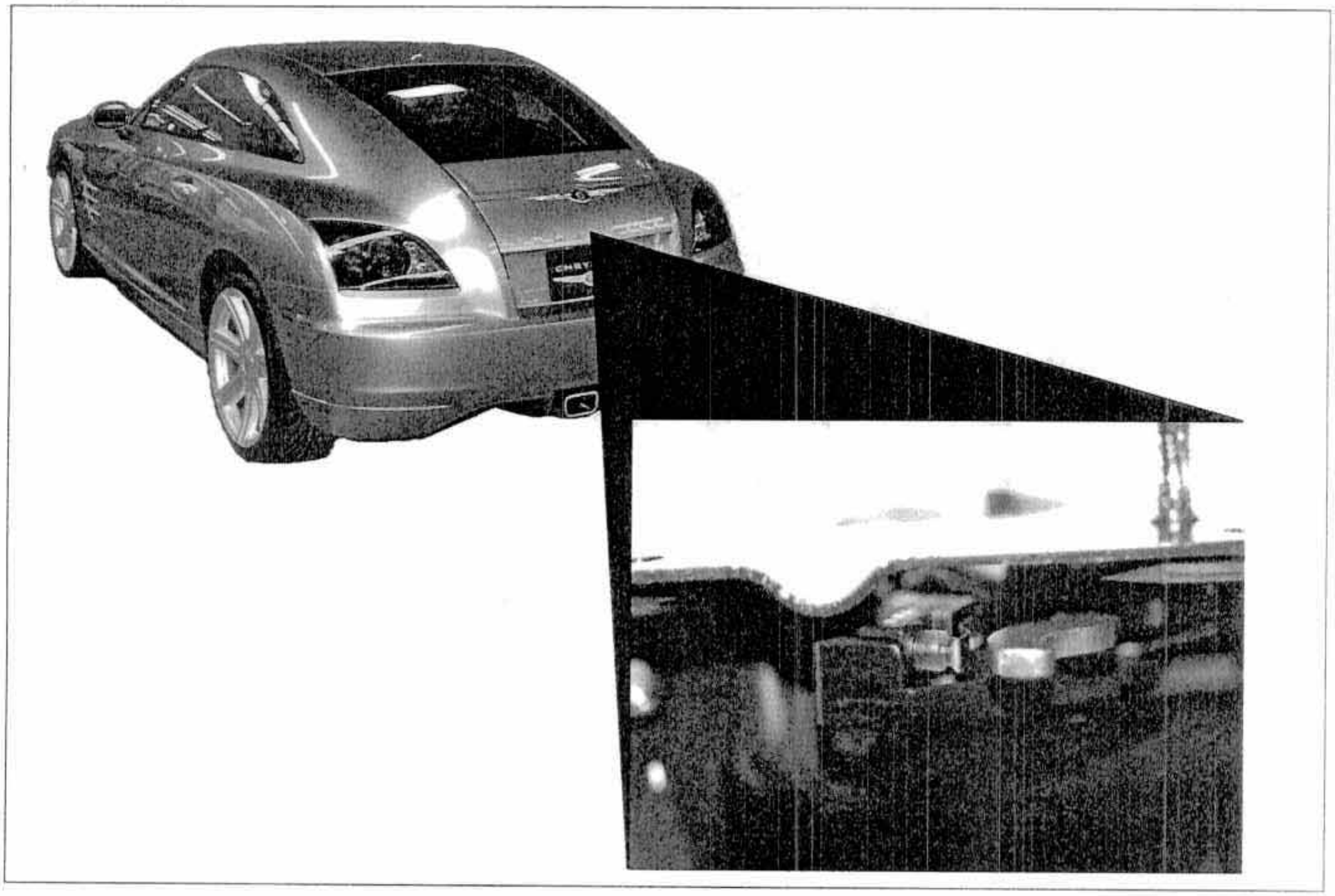


Figure 44 Liftgate Ajar Switch

The liftgate ajar switch is located in the liftgate latch mechanism (Fig. 44). The liftgate ajar switch is normally open. When the hatch is opened the switch closes and is sensed by the CLP/SSM for theft detection.

**Hood Ajar Switch**

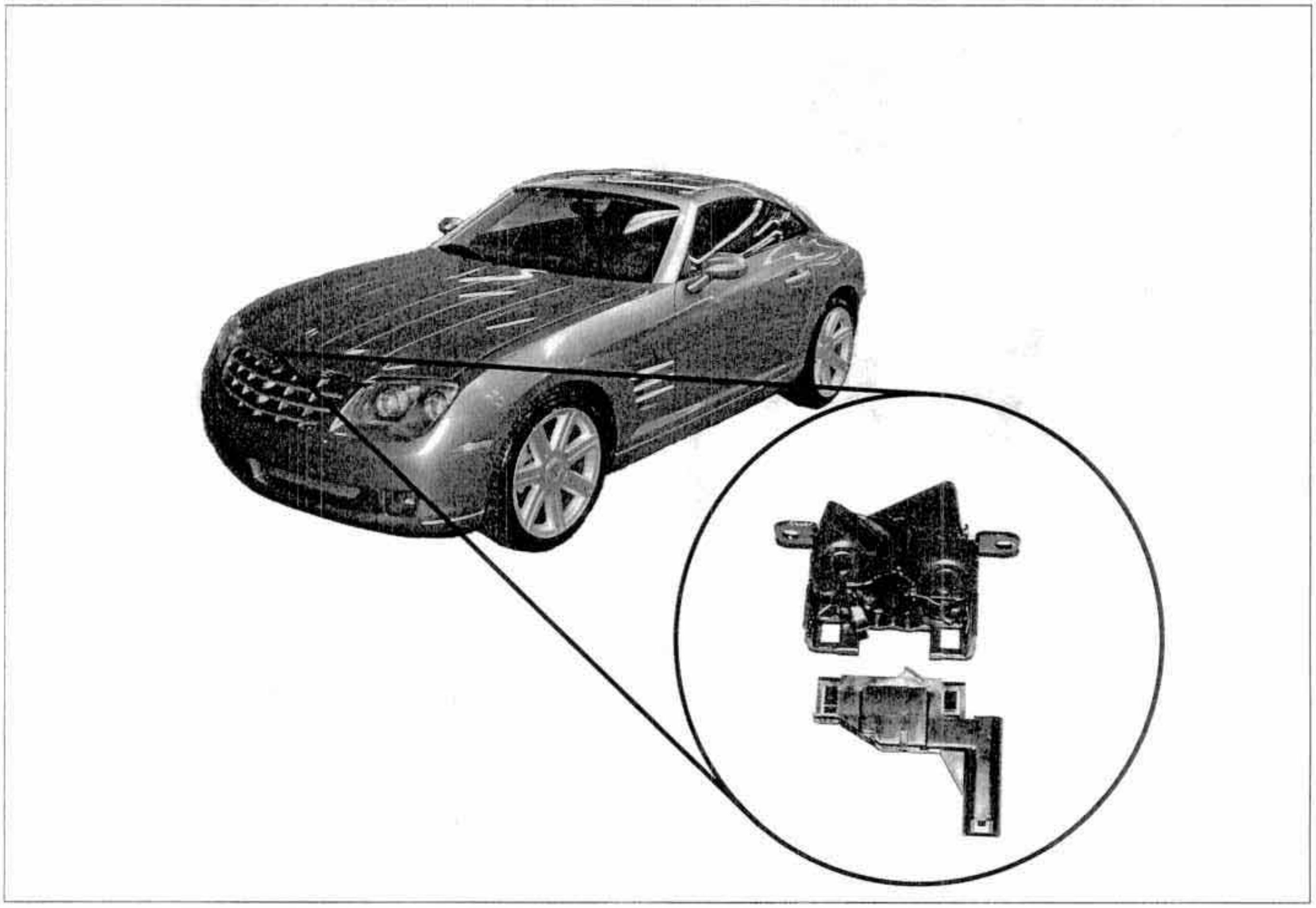


Figure 45 Hood Ajar Switch

The hood ajar switch is located in the hood latch mechanism (Fig. 45). The hood ajar switch is normally open. When the hood is opened the switch closes and is sensed by the CLP/SSM for theft detection.

**Defroster Grid**

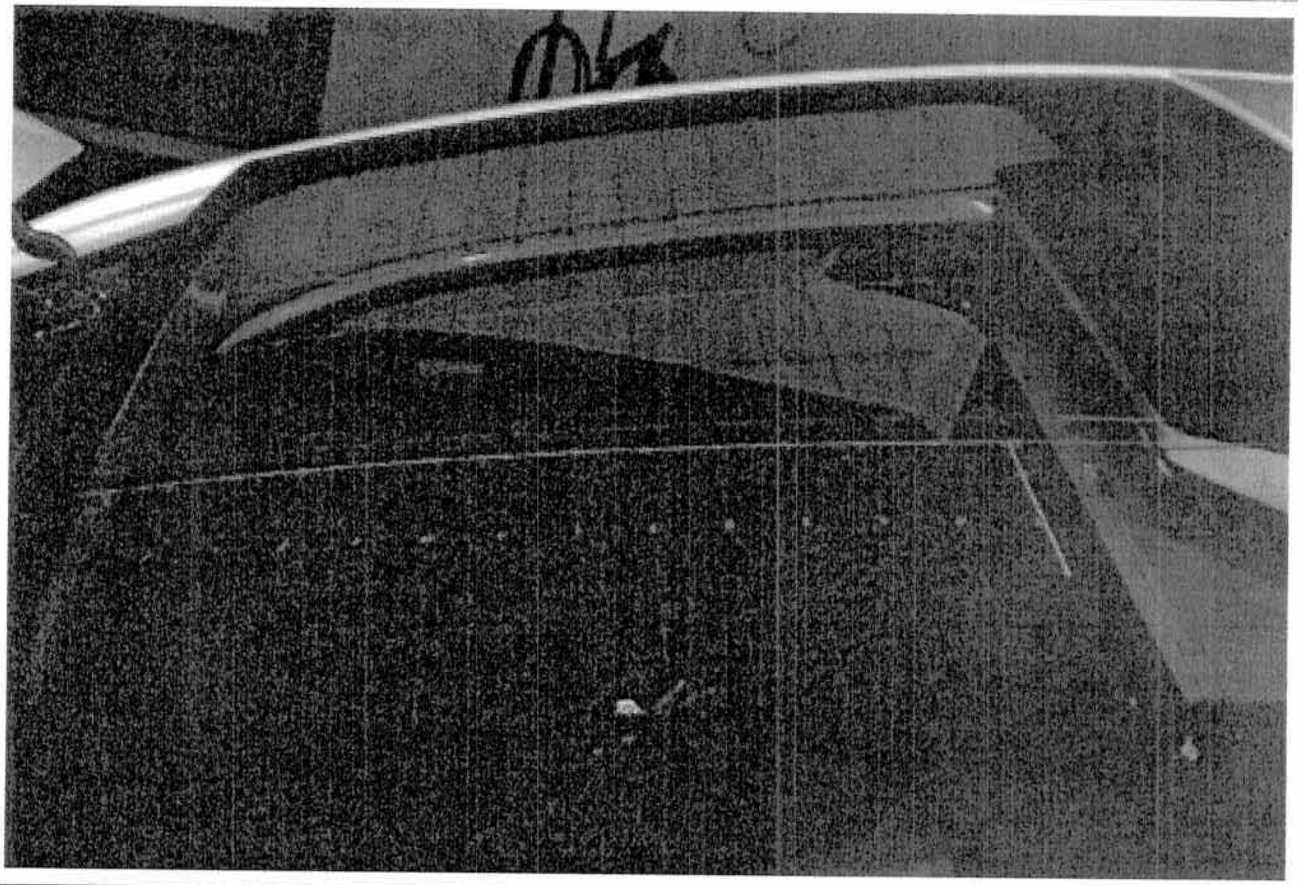


Figure 46 Defroster Grid

The defroster grid is located in the rear window (Fig. 46). The defroster grid also functions as the FM radio antenna. An isolation module mounted in the liftgate provides separation of the FM signal and rear defroster current. The AM antenna takes the place of the top two defrost grid lines. The antenna is not connected to the defrost circuit. The defroster grid receives its B+ feed from the CLP/SSM. The CLP/SSM acts on a signal provided by the BCM over the interior CAN B Bus.

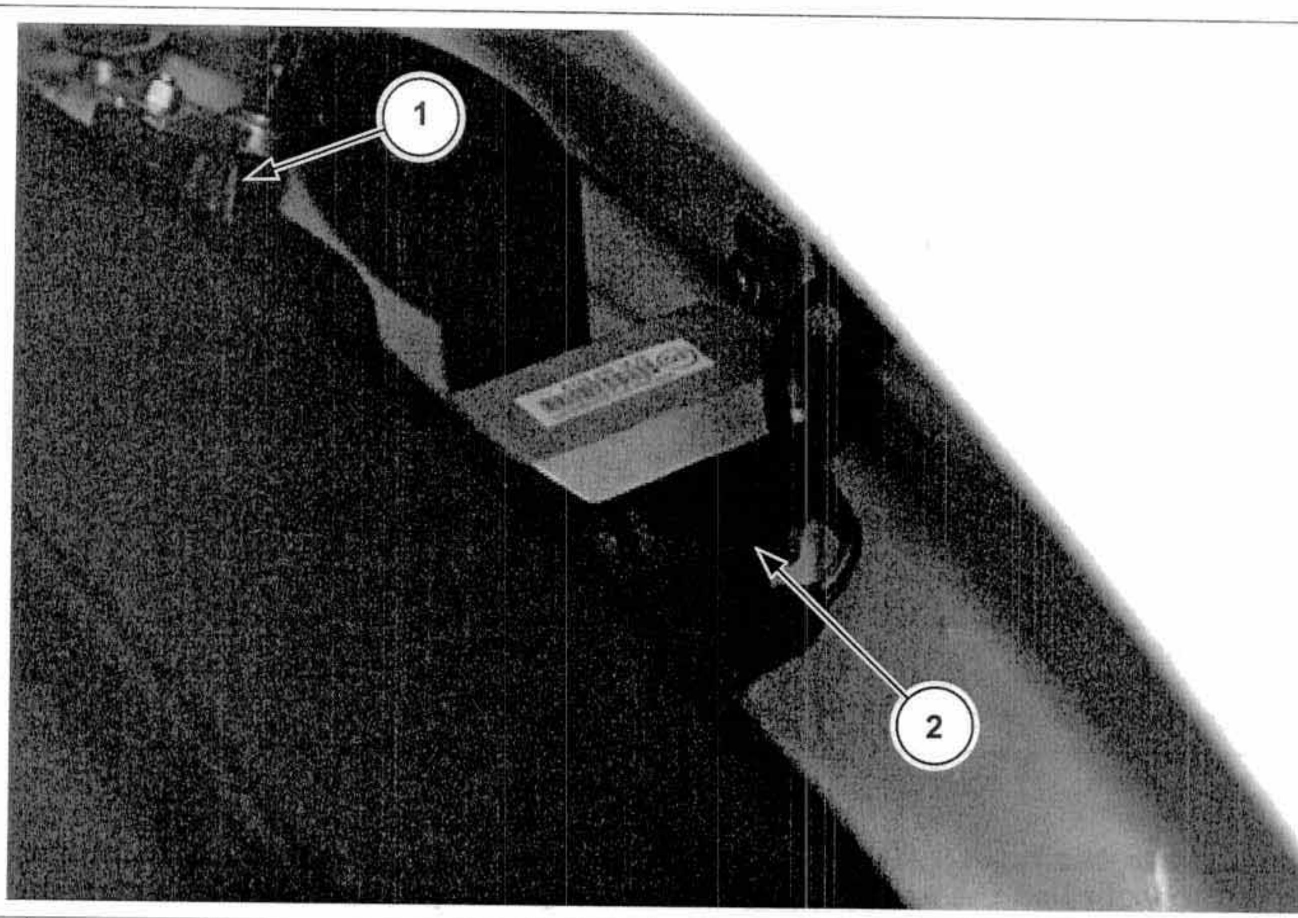
**Parking Lamps**


| | |
|---|---|
| 1 | Parking Lamps (Rear Shown) |

Figure 47 Parking Lamps

The parking lamps are located at the corners of the vehicle (Fig. 47). During a detected theft attempt, the CLP/SSM provides the parking lamps with a pulsing B+ signal.

**Siren**

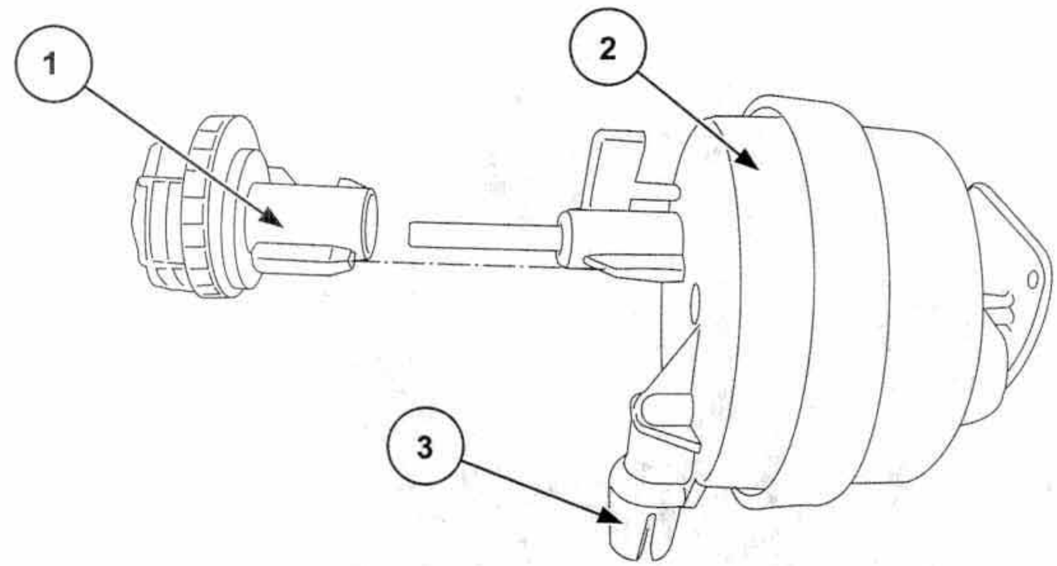



| | | | |
|---|---|---|---|
| 1 | Wiper Motor | 2 | Siren |

Figure 48 Siren

The siren is located in the air intake plenum at the base of the windshield (Fig. 48). The siren is provided constant B+ and ground and uses a signal from CLP/SSM to sound the siren.

**Lock Actuators**




| | | | |
|---|---|---|---|
| 1 | Lock Mechanism | 3 | Pneumatic Line Connection |
| 2 | Pneumatic Actuator | | |

Figure 49 Lock Actuators

Pneumatic actuators (Fig. 49) are located on each door, the liftgate and the fuel door. The drivers door and the fuel door on their own separate pneumatic circuit while the passengers door and liftgate share one circuit.

**System Operation**

The CLP/SSM receives a door lock/unlock switch signal from the BCM over the interior CAN B Bus. Depending on the command (lock or unlock) the CLP/SSM operates its pressure/vacuum motor in the appropriate direction to unlock or lock the vehicle.

If the lock or unlock command originates from the key fob, the RF is received by the RKE antenna within the SKREEM. The SKREEM sends a hardwired signal to the BCM. The BCM communicates this signal to the CLP/SSM. Depending on the command (lock or unlock) the CLP/SSM operates its pressure/vacuum motor in the appropriate direction to unlock or lock the vehicle.

The CLP/SSM receives an anti-theft enable command from the SKREEM or from the driver door lock cylinder switch (via the BCM) over the interior CAN B Bus. In order for the system to be enabled, both vehicle doors must be closed.

The CLP/SSM monitors the door, glove box, hood, liftgate ajar switches and the anti-theft tow sensor while the anti-theft system is enabled. If an ajar switch closes or the anti-theft tow sensor senses a drastic change in vehicle attitude, CLP/SSM provides a constant signal to the siren and a pulsing signal to the parking lamps.

The anti-theft tow sensor can be bypassed (for towing purposes) by using the tow away alarm switch on the center stack.

The CLP/SSM receives a rear defrost enable/disable signal from the BCM over the interior CAN B Bus. Depending on the command (enable or disable) the CLP/SSM enables or disables the B+ feed to the rear defroster.

**AUTO ACCIDENT RESPONSE**

In case of an accident, a crash sensor integrated into the CLP/SSM unlocks the doors automatically. The doors are unlocked after a delay time of 8 to 11 seconds. The emergency unlocking function interrupts all functions performed by CLP/SSM, which are reactivated only after interrupting the ignition. The emergency unlocking function is only active when the vehicle is unlocked from outside.

**SENTRY KEY® IMMOBILIZER SYSTEM (SKIS)**

The SKIS system is a function of the SKREEM.

A coded electronic transponder embedded in each master key disables the PCM to prevent unauthorized starting of the engine when the key is removed from the ignition. The driver is assured that a person without a valid key cannot drive the car because the engine will not start. The only function of the transponder is to disarm the system; it has no effect on locking the vehicle. Additional and/or replacement keys can be programmed.

To identify a valid key, the on-board SKIS communicates with the transponder that is part of the master key. The transponder is a small integrated circuit chip, which is encapsulated in the head of the key for convenience and protection from the elements. The chip includes an RF receiver and transmitter that are powered by an RF signal transmitted by the SKREEM mounted in the instrument panel near the ignition key cylinder. The key has a transponder in it. It requires no power source, but rather is simply "excited" when it comes in close proximity to the SKIS antenna which surrounds the ignition lock cylinder

The antenna for the SKREEM encircles the ignition key cylinder to help communication with the transponder. The SKREEM transmits a very low-power radio-frequency signal that is enough to energize the transponder when the ignition switch is turned to the RUN/START position. Thus energized, the transponder responds with its own RF signal containing a Valid Key command. An encryption algorithm between the key and the SKREEM increases security. If the transponder in the key is valid, the SKREEM matches it to the Valid Key information from the PCM and sends a message to the PCM over the CAN C Bus that allows the engine to run. When the driver turns off the ignition switch, communication between the transponder and the module is broken and the engine will not run.

**VEHICLE THEFT ALARM (VTA)**

The VTA system sounds an alarm siren, flashes exterior lamps and disables the ignition system when the alarm is triggered. When triggered, the siren sounds for 30 seconds and the parking lamps flash for three minutes. The alarm continues even if the triggering condition (opening a door, for example) is immediately undone. The following conditions trigger the alarm:

- Opening a door
- Opening the liftgate
- Opening the hood
- Opening the glove box
- Raising the vehicle for towing

The alarm system arms automatically within about ten seconds when the vehicle is locked from outside using the RKE transmitter or a key. When armed, an indicator lamp in the center of the Tow-Away Alarm switch in the center console blinks continuously. Unlocking with the RKE transmitter or master key disarms the alarm system.

If the alarm has been triggered, unlocking the vehicle with the key does not disarm the anti-theft alarm. The alarm sounds when unlocking with the key. Pressing a Lock or Unlock button on the RKE transmitter or inserting the key in the ignition switch and turning it to the UNLOCK position silences the alarm.

The tow-away sensor can be bypassed before towing the vehicle or when parking on a surface subject to movement such as a ferry. Pressing the Tow-Away Alarm switch, which is labeled with an ISO symbol and the word OFF, while the ignition key is in the OFF or UNLOCK positions, inhibits this aspect of the alarm system. The indicator lamp in the switch blinks once to acknowledge the action. Locking the vehicle from outside with the RKE transmitter or the key then arms the alarm without the tow-away feature. The tow-away alarm is automatically reactivated the next time the vehicle is locked from the outside.

**TIRE PRESSURE MONITOR (TPM)**

The HomeLink/TPM module monitors the tire pressure in all four tires. If the pressure falls below, or exceeds a predetermined threshold in any of the tires, a warning lamp in the IC is illuminated.

The TPM module is powered by the vehicles' battery and stores data in NVM (Non-Volatile Memory) that remains valid even if the vehicle battery is disconnected.

The Integrated HomeLink/TPM system receives transmissions from the four TPM transmitters. The TPM reports the information from these transmitters to a host system (a separate microprocessor). The host performs the TPM updates, commands, and control operations using the vehicle user interface and the CAN Data Bus.

Figure 50 Tire Pressure Sensor

The Tire Pressure Sensor (Fig. 50) monitors tire pressure. The data is transmitted via RF at regular intervals to the TPM module. The module acts on the information, and if necessary, informs the driver as to the status of the tire pressure. The sensor is encapsulated with its electronics in a potted assembly attached to a standard Schrader-type valve. The unit replaces the traditional tire valve and acts as both the valve and a TPM sensor. The potted module sits in the drop center of the wheel, and is out of the way when the tire is being installed on the wheel rim.

The TPM is designed to frequently monitor the tire pressure when the vehicle is moving. When moving, the TPM sends an RF-coded message that contains the tire pressure and TPM identification. The coded message, in addition to having pressure and ID data, also tells the function of the data.

- A **Wake Function Code** indicates the vehicle has begun moving within the last 30-35 seconds after a stationary period of more than about 15 minutes.
- A **Normal Pressure Function Code** indicates the vehicle is in monitoring mode and everything is within the TPM normal guidelines.
- A **Re-Measure Function Code** indicates there has been a pressure change more than or equal to 10 kPa (1.50 psi) from the last pressure transmission. When the TPM notes this pressure change, the TPM immediately takes another measurement to verify the change. If the change is true, this pressure is transmitted with the re-measure code.
- A **Low Battery Function Code** indicates the lithium battery that powers the electronics within the transmitter is nearing the minimum reliable voltage level. When the minimum threshold is reached, the TPM ceases to transmit any data. The life expectancy of the battery is 10 years.
- A **Learn Function Code** indicates the TPM has been forced into a learn mode and is an indicator to the receiver to program its memory for this transmitter. The receiver then stores the unique ID of that TPM.

## UNIVERSAL GARAGE DOOR OPENER

HomeLink primarily functions as a Universal Garage Door Opener (UGDO) that is built into the interior trim of the vehicle. HomeLink can learn and permanently store the frequency and data stream of three different UGDO transmitters. Each of HomeLink three momentary pushbuttons can control a different garage door, deadbolt lock, lamp, appliance module, etc. The HomeLink transmitter is powered by the vehicle electrical system, so there is no separate battery to replace; however, the ignition switch must be in the RUN position to operate HomeLink.

- HomeLink replaces up to three handheld garage door transmitters.
- It is rolling code compatible.
- It programs to user's original transmitter.
- It is powered by the vehicle ignition feed.
- Information programmed into HomeLink channels is stored in NVM and remains there even if the vehicle battery is removed. It can be reprogrammed at any time.

## POWER MIRRORS

### Driver and Passenger Power Mirrors

The power mirror system lets the driver adjust both outside mirrors electrically from the driver seat position by operating a switch on the console. The power mirror system receives battery current through a fuse in the underhood Accessory Fuse Block so that the power mirrors remain operational, regardless of the ignition switch position.

Each side mirror contains:

- two electric motors
- two drive mechanisms
- electric heating grid
- mirror housing

The driver side mirror includes an automatic dimming function. Two photocell sensors on the inside rear view mirror are used to monitor light levels and adjust the reflectance of both the inside and driver side outside mirrors. This change in reflectance helps to reduce the glare of headlamps approaching the vehicle from the rear.

The mirror housings fold manually for protection in car washes and to minimize damage from contact with nearby objects. If folded, a spring-loaded detent in the hinge snaps into place when the housing returns to its normal position.

**Automatic Day/Night Mirror**

An automatic day/night mirror system is an option on the Crossfire. The automatic dimming inside day/night rear view mirror system is a completely self-contained unit that replaces the standard equipment inside rear view mirror. This system automatically changes the reflectance of the inside rear view mirror to protect the driver from the unwanted headlight glare while driving at night.

The automatic day/night inside mirror receives ignition switched battery current through a fuse in the junction block, and only operates when the ignition switch is in the RUN position. Vehicles are also equipped with an automatic dimming outside rear view mirror for the driver side of the vehicle.

The automatic day/night mirror sensitivity cannot be repaired or adjusted. If any component of this unit is faulty or damaged, replace the entire automatic day/night inside rear view mirror unit.

Two photocell sensors monitor light levels and adjust the reflectance of the mirror. The ambient photocell sensor faces forward to detect the outside light levels.

The headlamp sensor is located on the mirror housing and faces rearward, to detect the light level received at the rear window side of the mirror. When the difference between the two light levels becomes too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), the mirror begins to darken.

**HEATED SEATS**

Standard heated seats have two heating levels and a timed automatic shutoff. Separate rocker switches for the driver and passenger heaters mount in the center console. Each switch is labeled with dual ISO icons, indicating that pressing the top of the switch turns on the normal heating level and pressing the bottom of the switch turns on the rapid heating level. Two lamps in each switch indicate the level of heat selected: one lamp illuminates for normal heating and both for rapid heating.

Without user intervention, the timer automatically switches from rapid heating to normal heating after five minutes. Normal heating continues without manual intervention for approximately 30 minutes. The heaters may automatically switch off due to high electrical system demand or a low battery. When this occurs, one or both indicator lamps blink (depending on selected heating level) until enough voltage is available.

**INTERIOR REARVIEW MIRROR**

The interior rearview mirror reflection dims in proportion to the brightness of light coming from the rear of the vehicle when the ignition system is in the RUN position. To facilitate backing, full reflectivity is provided when the transmission is in Reverse. Full reflectivity is also provided if the interior lamps are switched on.

The mirror contains an electrolytic liquid that darkens in proportion to the electric voltage applied to it, which is determined by the level of incoming light received by a sensor in the mirror housing. A signal indicating that the transmission is in Reverse overrides the sensor, providing full reflectivity for ease in backing.

**POWER SPOILER**

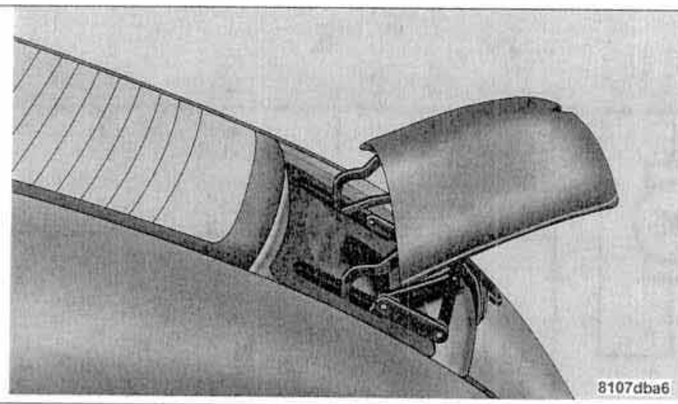



Figure 51 Rear Spoiler

The Crossfire is equipped with a dynamic rear spoiler (Fig. 51). The spoiler extends automatically at speeds over 80km/h (50 mph), and increases high-speed handling. The spoiler can be extended manually at speeds lower than 80km/h (50 mph), by using a switch mounted on the center stack. The spoiler starts to retract when the vehicle reaches 40 km/h (25 mph). When retracted, the spoiler rests between the quarter panels and aft of the liftgate window.

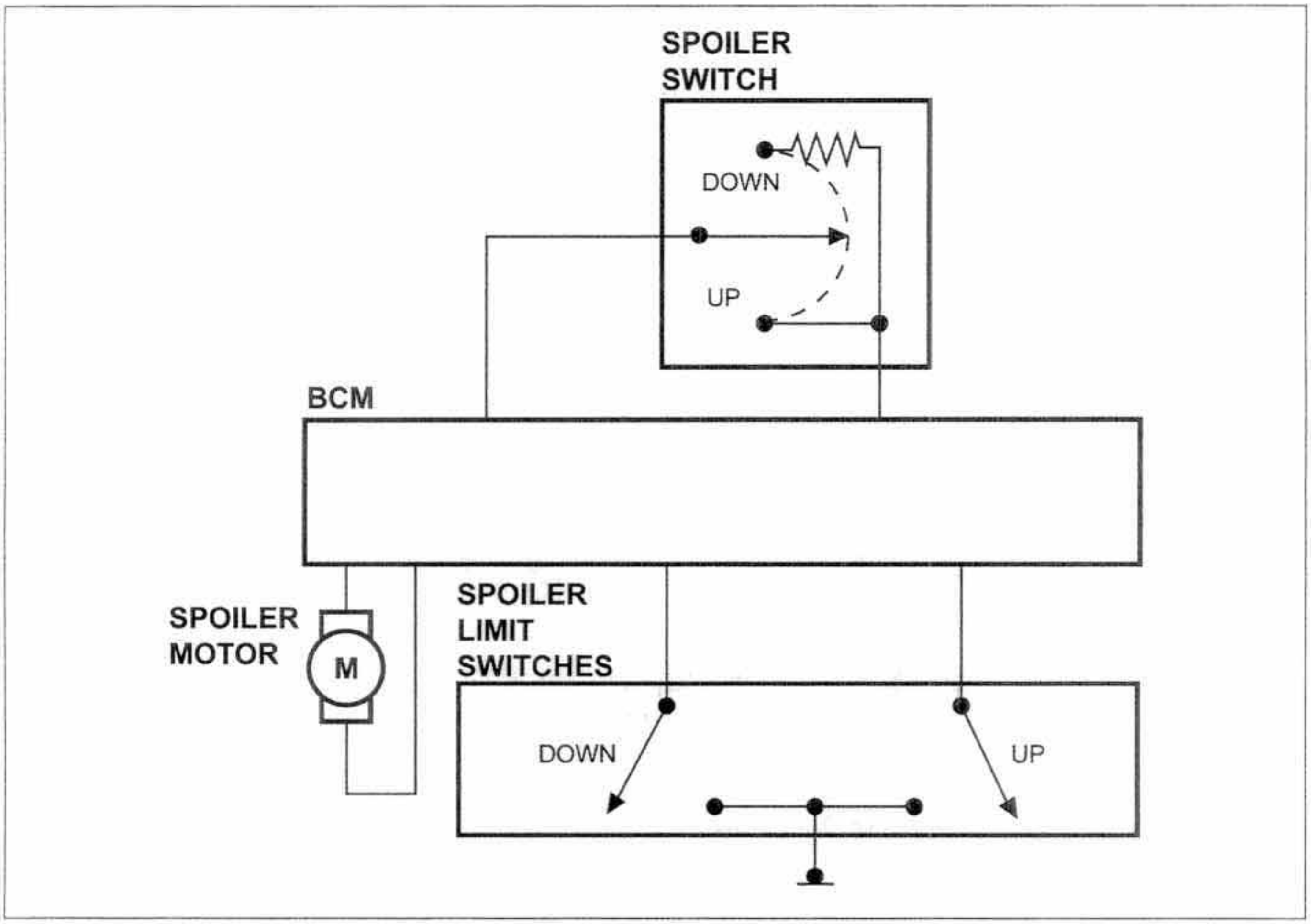
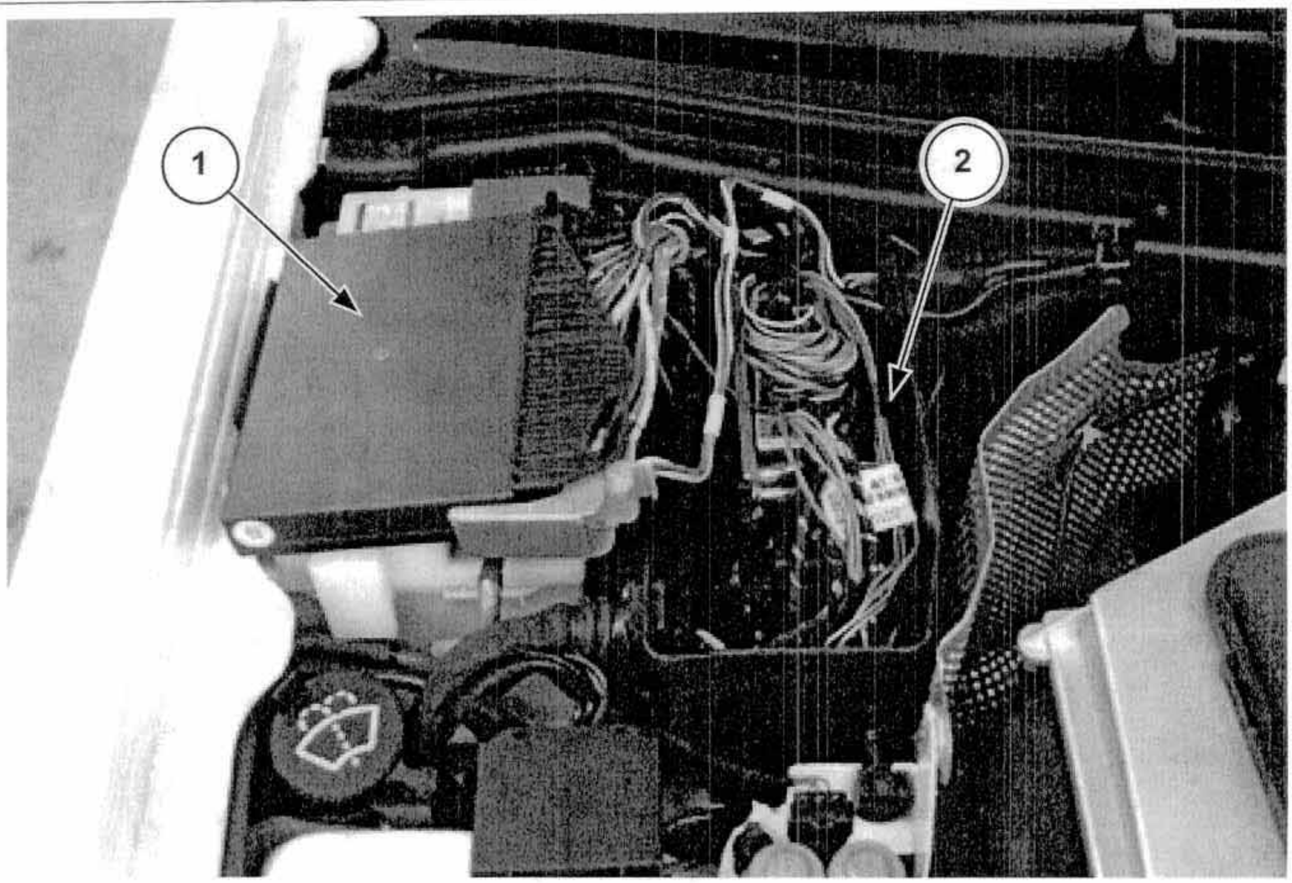



Figure 52 Rear Spoiler Block Diagram

The dynamic rear spoiler system is comprised of the following main components: rear spoiler switch, Body Control Module (BCM), rear spoiler motor, rear spoiler limit switches.

**Body Control Module (BCM**

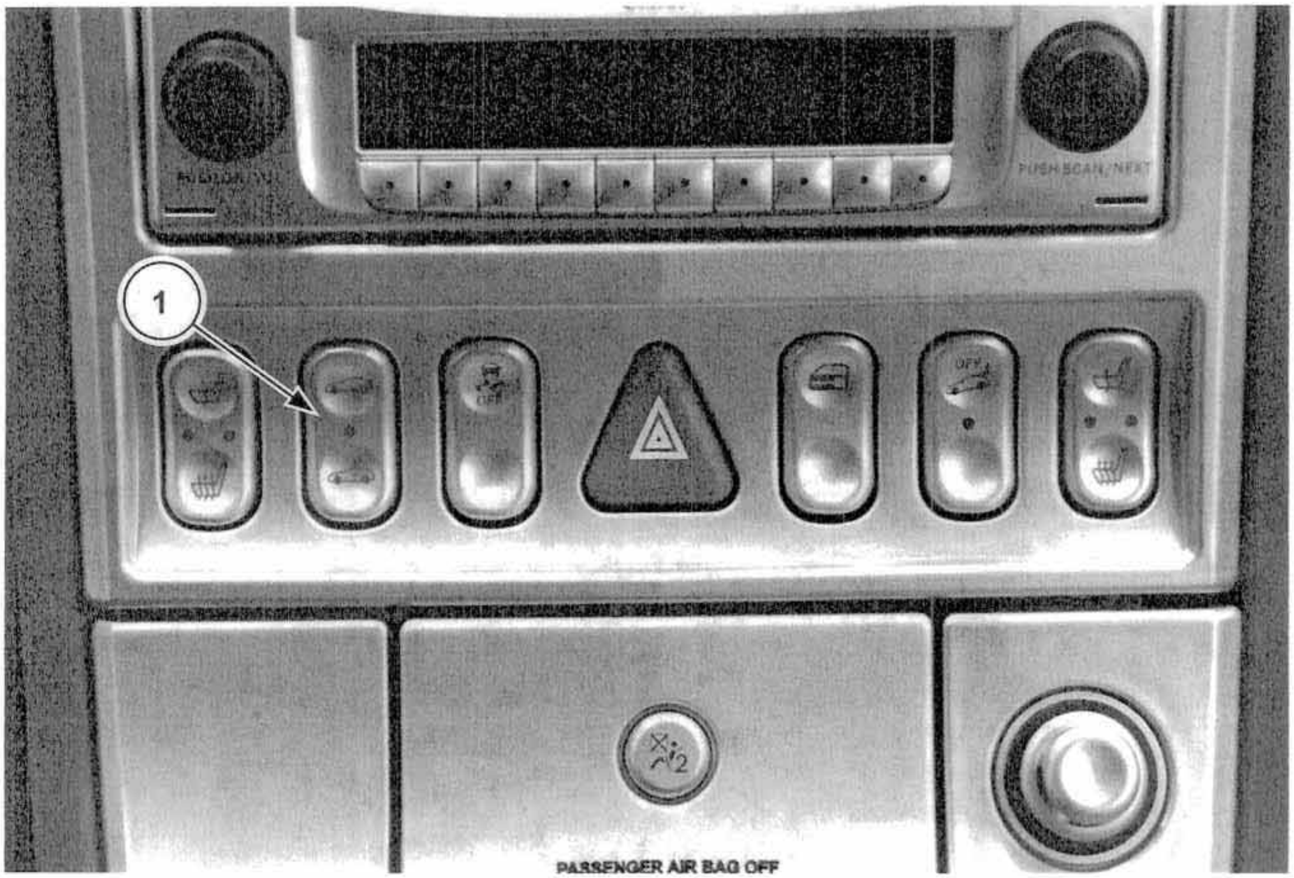



| | | | |
|---|---|---|---|
| 1 | Body Control Module (BCM) | 2 | Control Module Box |

Figure 53 Body Control Module (BCM)

The Body Control Module (BCM) is located within the control module box in the engine compartment (Fig. 53). The BCM receives an input signal from the spoiler switch and produces a corresponding output command to the spoiler motor. As the spoiler is being raised and lowered, the BCM monitors the up and down limit switches. When the spoiler reaches its up or down limit it closes the appropriate switch. The BCM switches polarity to control the spoiler motor bi-directionally.

**Spoiler Switch**

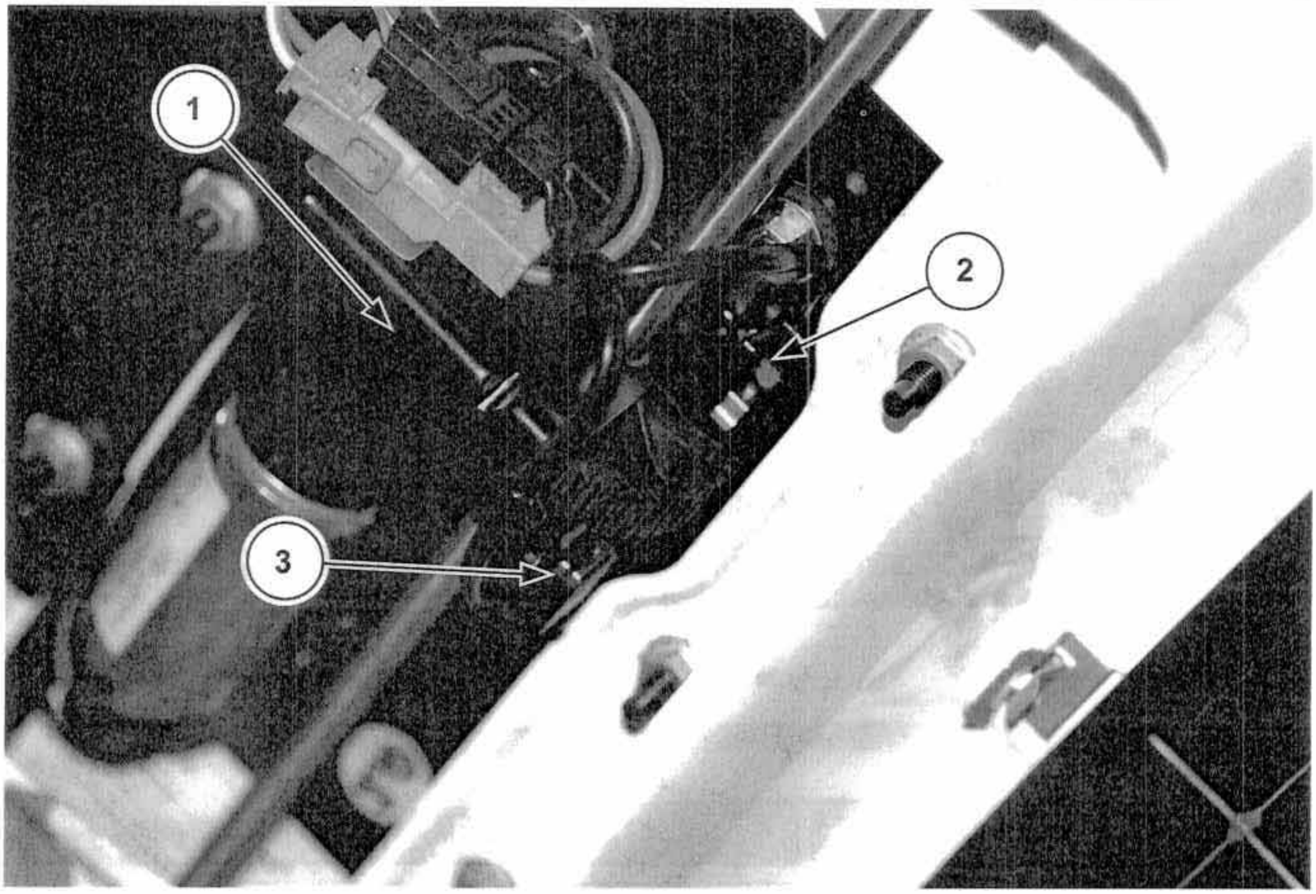



| | |
|---|---|
| 1 | Spoiler Switch |

Figure 54 Spoiler Switch

The spoiler switch is a multiplex switch that is located in the center stack of the instrument panel next to the driver heated seat switch (Fig. 54). This switch allows the driver to manually raise and lower the spoiler.

**Spoiler Limit Switches**

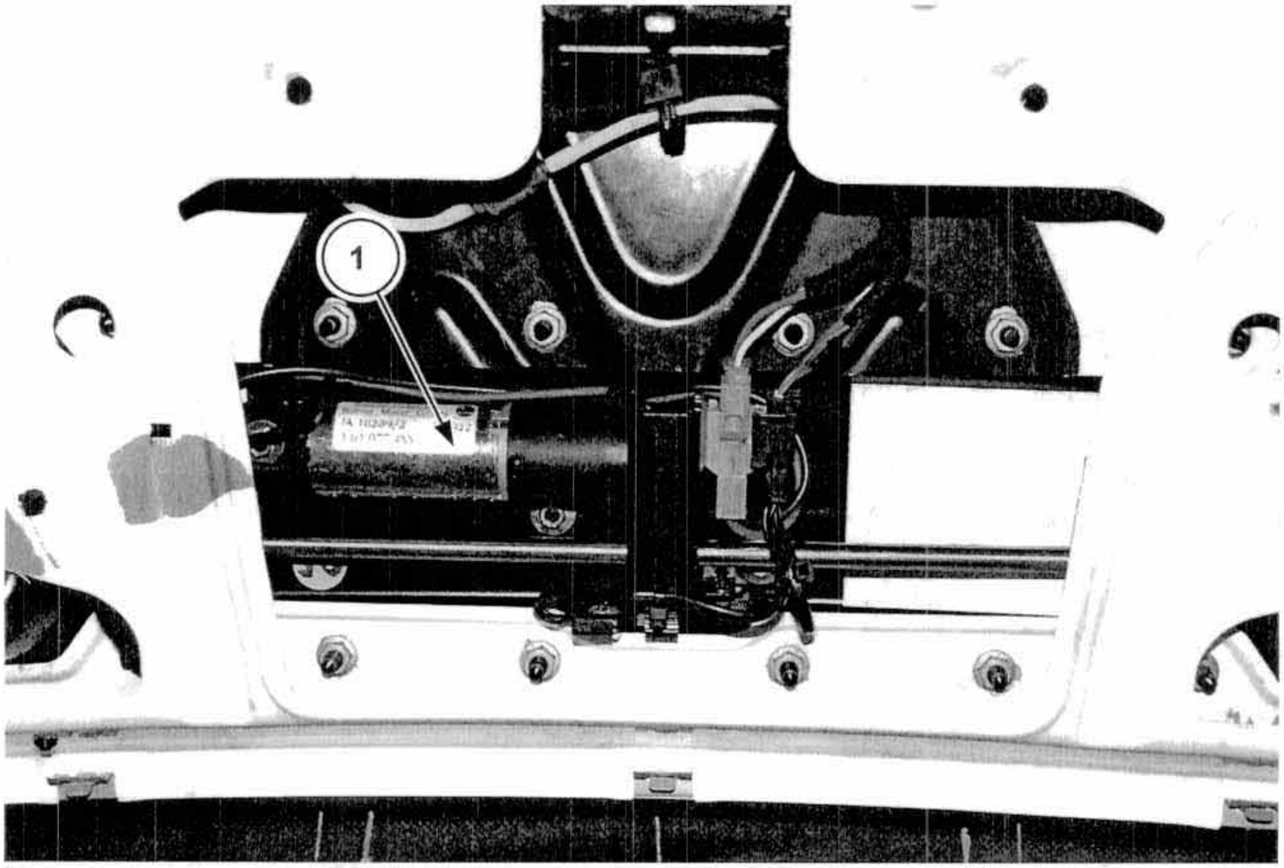



| | | | |
|---|---|---|---|
| 1 | Spoiler Motor | 3 | Spoiler Down Limit Switch |
| 2 | Spoiler Up Limit Switch | | |

Figure 55 Spoiler Limit Switches

The two (up limit/down limit) switches are located on the spoiler gear drive assembly (Fig. 55). As the spoiler reaches its upper and lower limits, a micro switch closes and indicates to the BCM that the spoiler has reached its limit of travel. The switches are NOT serviceable or adjustable individually and if one becomes defective, it must be replaced with the whole gear drive assembly.

**Spoiler Motor**




| | |
|---|---|
| 1 | Spoiler Motor |

Figure 56 Spoiler Motor

The spoiler motor is located in the liftgate (Fig. 56). The spoiler motor is a bi-directional motor that is controlled by the BCM. The spoiler motor is NOT serviceable individually and if it becomes defective, it must be replaced with the whole gear drive assembly.

**System Operation**

During passive operation, the BCM monitors vehicle speed via a hardwired signal from the CAB. At 55 MPH, the BCM provides the rear spoiler motor with a B+ feed and ground (with the correct polarity) that extends the rear spoiler. When the spoiler blade reaches its upper limit of travel, a micro switch closes, indicating that it has reached its upper limit of travel. At this point current stops flowing to the motor.

At speeds lower than 55 MPH, the BCM reverses the polarity signal to the rear spoiler motor, causing it to retract. When the spoiler blade reaches its lower limit of travel, a micro switch closes, indicating that it has reached its lower limit of travel. At this point current stops flowing to the motor.

During active operation, the spoiler position can be overridden with a center stack-mounted rear spoiler switch. This switch is a two-position multiplex switch that is monitored by the BCM. Based on the input from this switch, the driver can control the position of the spoiler at speeds of less than 55 MPH.

**AUDIO**

A universal AM/FM stereo radio with single disc CD player is standard. The radio (Fig. 57) feeds a six-channel, 240-watt amplifier that sends its output through dual subwoofers mounted in the back panel behind the seats and four door-mounted speakers. The system includes the following features:

**Radio**


Figure 57 Radio/CD Player

- Combined ON/OFF pushbutton and rotary volume knob. A numeric volume level appears in the display during and briefly after volume adjustment.
- Ten multifunction buttons below the display that perform various functions as indicated in the bottom row of the display.
- A combined rotary knob and pushbutton to the right of the display that performs various functions depending on the operating mode.
- FM radio with four memory modes that are selected by repeatedly pressing the FM button.

- Balance, Fader, Loudness, Vehicle Speed Dependent Volume, Bass and Treble controls. Repeatedly pressing the SOUND button steps through these functions. The selected function is shown in the display. Numeric values accompany the bass, treble, balance and fader displays. Turning the right rotary knob adjusts the variable settings and toggles on and off the loudness and Vehicle Speed Dependent Volume functions. Pressing the right rotary knob also steps through the functions. Bass and treble settings for AM/FM radio, traffic announcements and CD modes are stored separately. The loudness feature is not available for AM radio broadcasts. The other settings are common to all modes.
- Digital display with blue-green characters on a dark background. The intensity of the display adjusts with the IC lighting.

**Traffic Program (TP)**

The Traffic Program system only works in areas where Radio Broadcast Display Stations (RBDS) broadcast. It allows traffic announcement broadcasts on FM to override AM or FM broadcasts and CD output. RBDSs that broadcast traffic announcements transmit a TP identification, which is displayed separately. Pressing the TP button repeatedly cycles through the three functions of the system: TP ON, TP OFF and TP MUTE, which are shown in the display during the selection process.

Other features of the TP system:

- The radio automatically changes frequencies to follow the currently tuned TP station to continue listening without re-tuning when the signal weakens and a stronger signal is available.
- The volume level for traffic announcements can be different from the current listening level. This is particularly useful if the current sound level is subdued.
- Rotating the Volume knob during a traffic announcement sets the level for subsequent traffic announcements.
- During adjustments, TP information appears in the display.

TP ON

TP illuminates in the display and indicates that the Traffic Program is activated. If a station that broadcasts traffic announcements is selected when TP is activated, this is the station that interrupts the AM or CD modes. The ability to receive traffic announcements during AM broadcasts is uncommon. Most radios only provide this function during FM and CD operation. If a TP station is not selected, the receiver monitors the strongest TP station available and plays any traffic announcements transmitted by this station.

Traffic announcements received during AM or CD mode operation can be cancelled by pressing the TP button. If TP is on, the Extended Traffic Program (EON) receives traffic announcements from stations that are not currently selected, but which are included in the selected station range. EON is operative when listening to FM radio or playing a CD, but not when listening to AM radio.

TP MUTE

TP MUTE illuminates in the display when TP MUTE is selected. In this mode, only TP announcements are heard; everything else is muted. An alarm tone sounds when the traffic-programming signal becomes too weak to be received.

TP OFF

Traffic Program announcements are not received if TP OFF is selected.

**Amplifier**

A 240 Watt, six-channel power amplifier includes digital signal processing that allows the amplifier to be precisely programmed to the acoustical characteristics of the vehicle interior.

**Speakers**

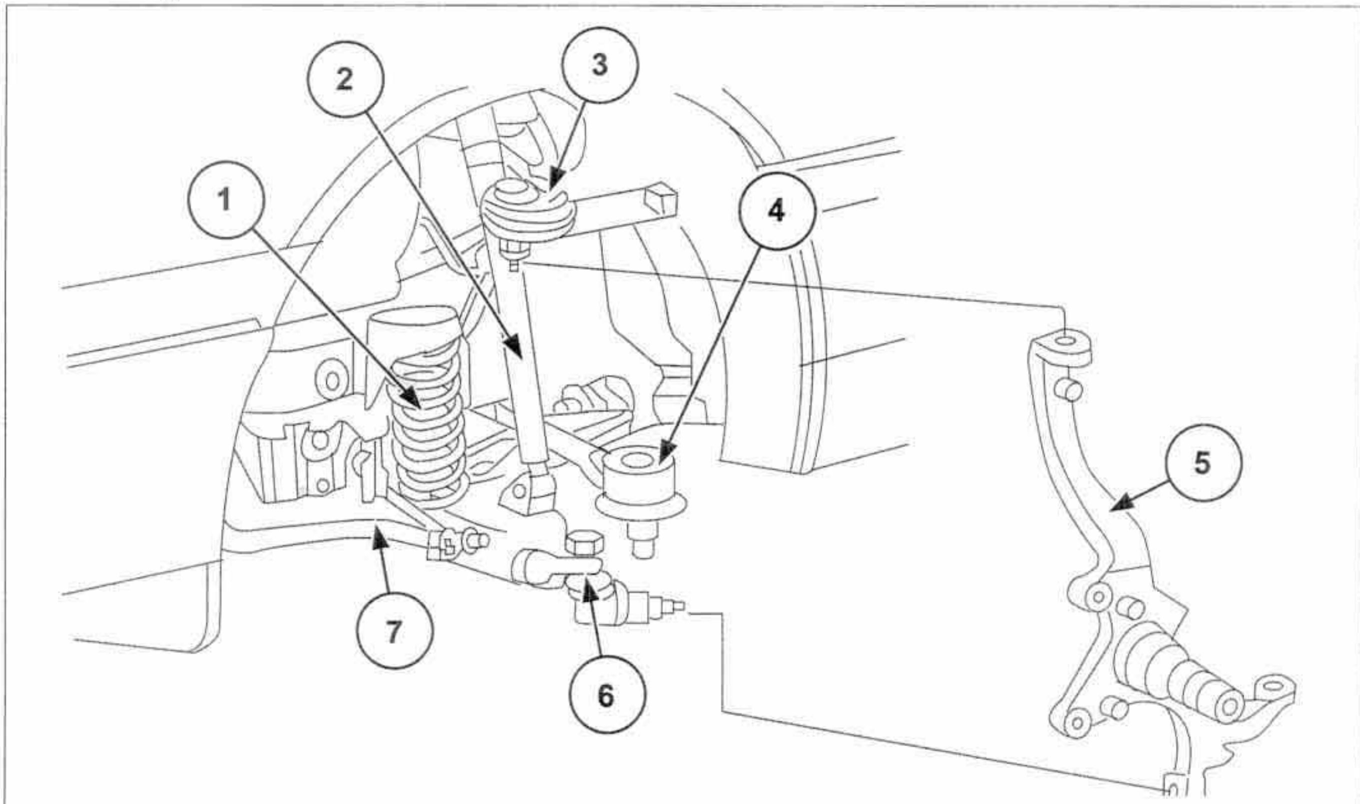
The Infinity ® sound system includes the following speakers:

- Two 168 mm (6.6 inch) metal matrix cone woofers mounted in the doors.
- Metal matrix cone tweeters (38 mm [1.5 inch]) mounted in the doors.
- Two, 168 mm (6.6 inch) metal matrix cone woofers with dual voice coils mounted in the outboard ends of the bulkhead panel, aft of the seats.

# CHASSIS

## SUSPENSION

### Front Suspension




| | | | |
|---|---|---|---|
| 1 | Spring | 5 | Spindle |
| 2 | Shock Absorber | 6 | Lower Control Arm and Ball Joint |
| 3 | Upper Control Arm and Ball Joint | 7 | Stabilizer Bar |
| 4 | Tie Rod End | | |

Figure 58 Front Suspension

The Crossfire has an independent, double wishbone, front suspension (Fig. 58) that includes coil springs, gas-charged shock absorbers and front stabilizer bar.

**Rear Suspension**

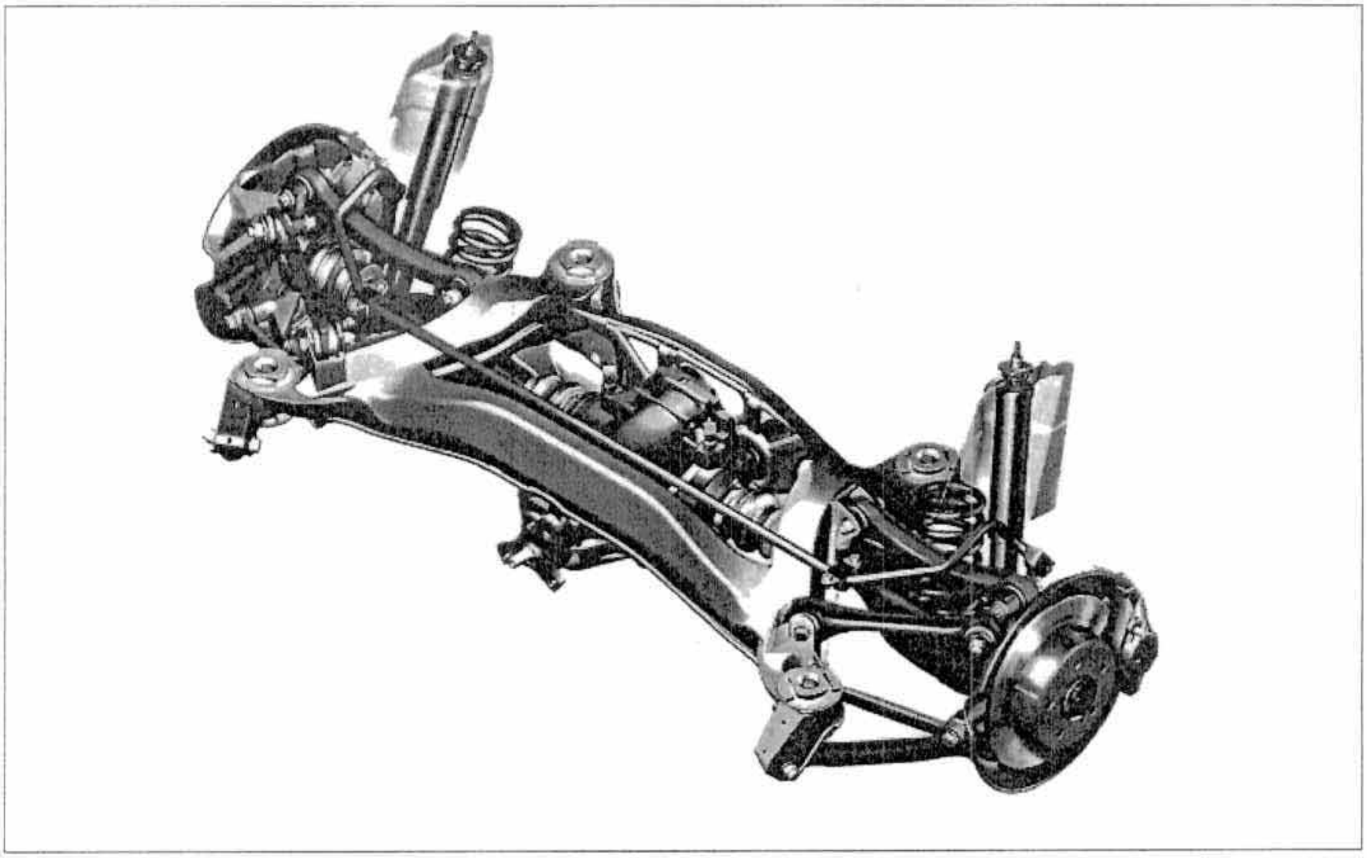


Figure 59 Rear Suspension

The rear suspension (Fig. 59) is an independent, five-link suspension that includes coil springs, gas-charged shock absorbers and a stabilizer bar.

The rear suspension mounts on a cradle that is isolated from the body structure to minimize noise, vibration and harshness and to improve ride comfort.

**Vehicle Alignment**

Refer to the Service Information for procedures performing Vehicle Alignments, Ball Joint Position, and Vehicle Level at the Front and Rear Axles with an Electronic Inclinometer.

**Wheels and Tires**

Painted aluminum alloy wheels are standard. Front rims are 18 x 7.5 inches; rears are 19 x 9 inches. Each wheel includes a snap-in center cap highlighted by an engraved Chrysler seal badge that conceals the lug bolts. For a neater appearance, adhesive wheel balance weights are attached to the rim behind the spokes, rather than clipping the weights to the outside of the rim.

Ultra-low profile high-speed-rated performance tires are staggered in size:

- 225/40ZR18 Front Tires
- 255/35ZR19 Rear Tires

Z-rated tires are optimized for performance driving and compared to all-season tires, may provide slightly reduced ride comfort, increased tire noise and substantially increased tread wear.

Tire Service Kit

The Crossfire has no spare tire. Instead, it has a tire service kit consisting of TIREFIT, a can of pressurized puncture sealant that is added to the tire through the valve stem, and a portable electric air compressor to inflate the tire. The air compressor plugs into the cigar lighter socket. The pressure hose, which screws onto the tire valve stem, includes a pressure gauge, and a vent screw to release any excess pressure. The tire service kit is stowed in the cargo area under the carpet.

**Caster, Camber, and Toe**

Refer to the Service Information for:

- a description of the proper caster, camber and toe specifications.
- adjustment procedures for front and rear toe.
- a description of the Special Tools used to service the suspension.

**POWER STEERING**

The power steering system consists of:

- Steering Gear
- Pump
- Pressure Hose
- Return Hose
- Reservoir

The power steering gear is a recirculating ball type gear. The steering gear consists of a worm gear, which is supported on each end by ball bearings in a housing. The worm gear has a spiral groove cut into it, and a ball nut (rack piston) fits over the worm gear shaft. The nut also has a groove that corresponds to the groove on the worm shaft.

Refer to the Service Information for component serviceability and procedures to adjust endplay and preload.

A tilt/telescoping steering column is standard equipment.

## BASE BRAKE SYSTEM

The Crossfire has standard four-wheel disc brakes.

- The front brakes have 300 x 28-mm (11.8 x 1.1-in.) ventilated discs that are clamped by single-piston floating calipers with 57-mm (2.25-inch) pistons.
- The rear brakes have 278 x 9-mm (10.9 x 0.35-in.) solid discs with opposed-piston fixed calipers. Each piston is 36 mm (1.4 in.) in diameter.

A vacuum operated, power brake booster supplies power brake assist. The master cylinder has an aluminum body and a nylon reservoir with a single filler cap. A fluid level sensor is mounted to the top of the reservoir.

Electronic Brake Force Distribution (EBD) controls the braking force of the rear wheels. The EBD takes the place of a rear-proportioning valve. The EBD program uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves on the Hydraulic Control Unit (HCU).

The front calipers are piston type.

The rear disc brakes consist of fixed piston style calipers and solid rotors.

### Master Cylinder

The master cylinder contains a primary and secondary piston assembly. The cylinder body, including the piston assemblies, is not serviceable. If diagnosis indicates an internal problem with the cylinder, it must be replaced as an assembly. The master cylinder has a removable reservoir and fluid level sensor. The reservoir, reservoir grommets, reservoir cap and fluid level switch are the only replaceable parts on the master cylinder.

**Parking Brake**

A lever recessed in the center console operates the parking brake system, which actuates the rear brakes. The parking brake cable has an automatic adjustment feature to maintain consistent lever travel throughout the life of the vehicle. A pushbutton in the end of the lever releases the mechanism. The brake-warning indicator in the IC illuminates when the parking brake is applied. If the vehicle is driven with the parking brake applied, a warning chime sounds.

The front cable is connected to the hand lever and the equalizer. The rear cables are attached to the equalizer and the parking brake shoe actuator. A set of drum type brake shoes is used for parking brakes. The shoes are mounted to the rear wheel hub. The parking brake drum is integrated into the rear disc brake rotor. Parking brake cable adjustment is controlled by a cable equalizer mechanism.

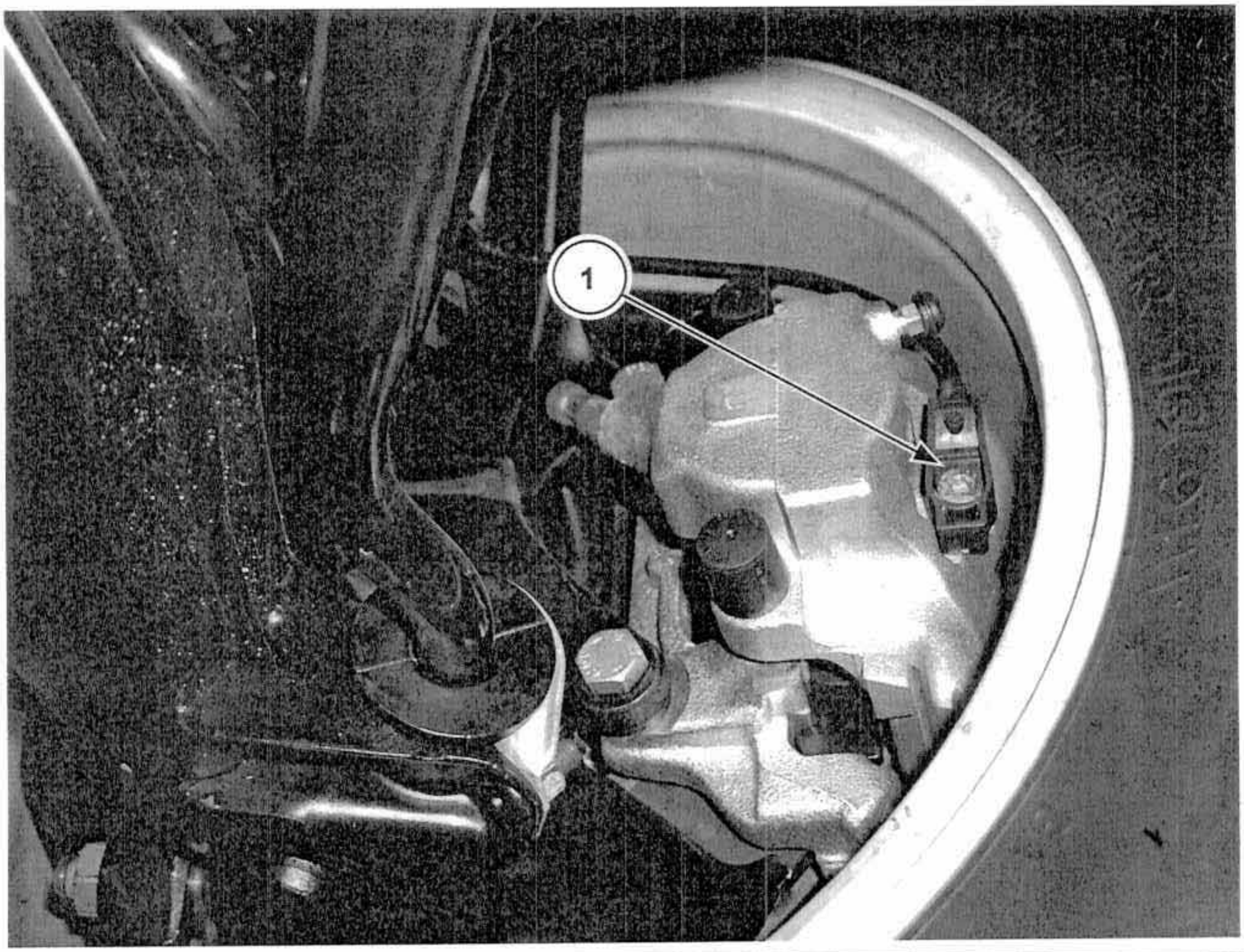
**Brake Lines**

A flexible rubber hose is used at both front brake calipers and at the rear axle junction block. Double walled steel tubing is used to connect the master cylinder to the major hydraulic braking components and then to the flexible rubber hoses. Double inverted style and ISO style flares are used on the brake lines.

**Brake Fluid**

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar DOT 3 brake fluid or an equivalent, from a tightly sealed container.

**Brake Pad Wear Sensor**




| | |
|---|---|
| 1 | Brake Pad Wear Sensor |

Figure 60 Brake Pad Wear Sensor

The Crossfire has a brake pad wear sensor at each front wheel. The sensors are mounted to the calipers (Fig. 60), and send a signal to the IC when pad thickness reaches a predetermined minimum level. The cluster then illuminates a brake pad warning lamp, indicating the need for front brake service.

## ANTI-LOCK BRAKE SYSTEM

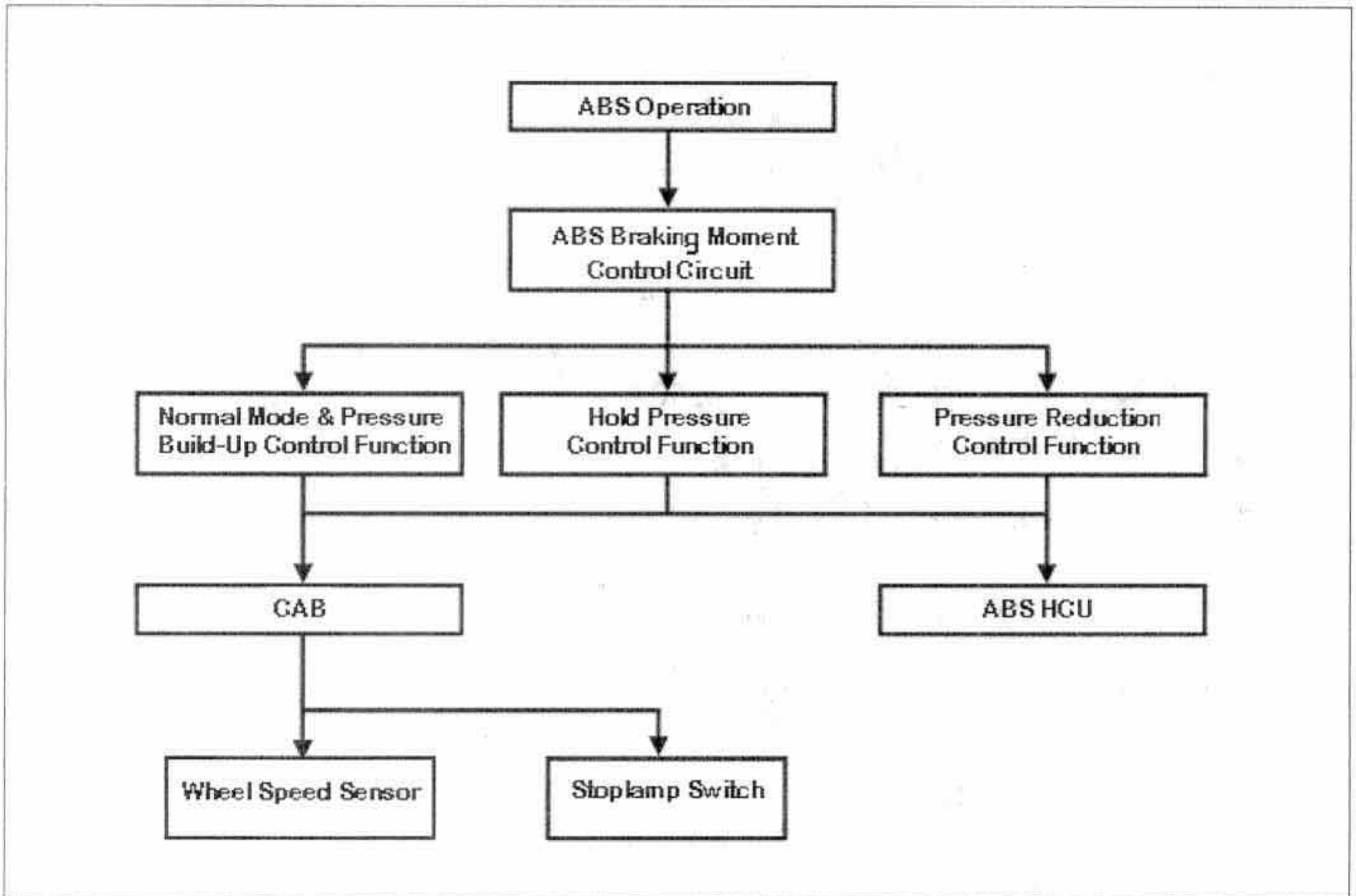


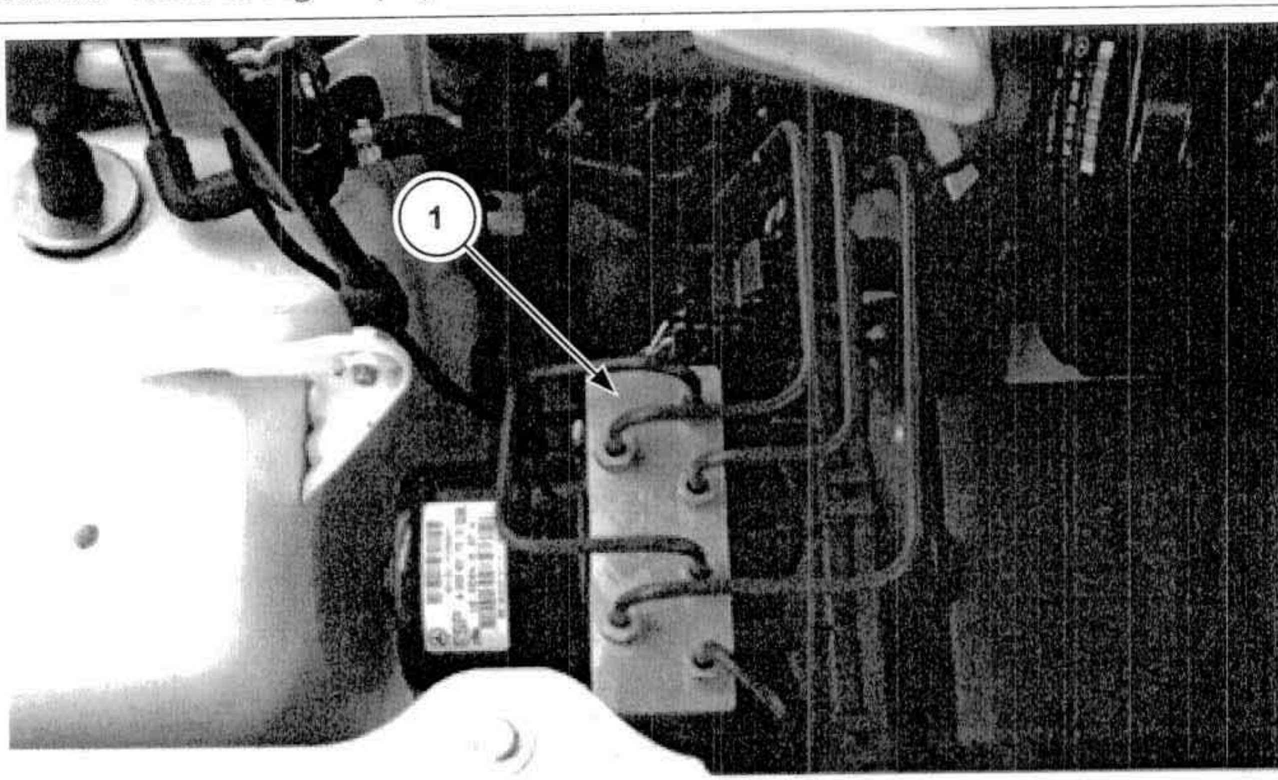

Figure 61 Anti-Lock Brake System

The ABS (Fig. 61) on the Crossfire is a Teves ESP Mark 20 system. This is similar to the Teves Mark 20 E system, except that it incorporates ESP. The main difference is that the HCU for the Crossfire has one additional hydraulic circuit (4-channel system).

- ABS becomes operational when vehicle speed exceeds 8 km/h (5 mph).
- ABS braking is cancelled when speeds drop below of 3 km/h (2 mph).

**Controller Anti-Lock Brake (CAB)**

The CAB is located in the engine compartment on the left side near the brake fluid reservoir. Refer to Figure (62).




| | |
|---|---|
| 1 | Controller Anti-Lock Brake (CAB) |

Figure 62 Controller Anti-Lock Brake (CAB)

The speeds of all four wheels are monitored and processed separately in the CAB. A reference speed that represents the approximate vehicle speed is calculated by averaging the individual wheel speeds. Slip signals are derived from comparing the wheel speed and reference speed.

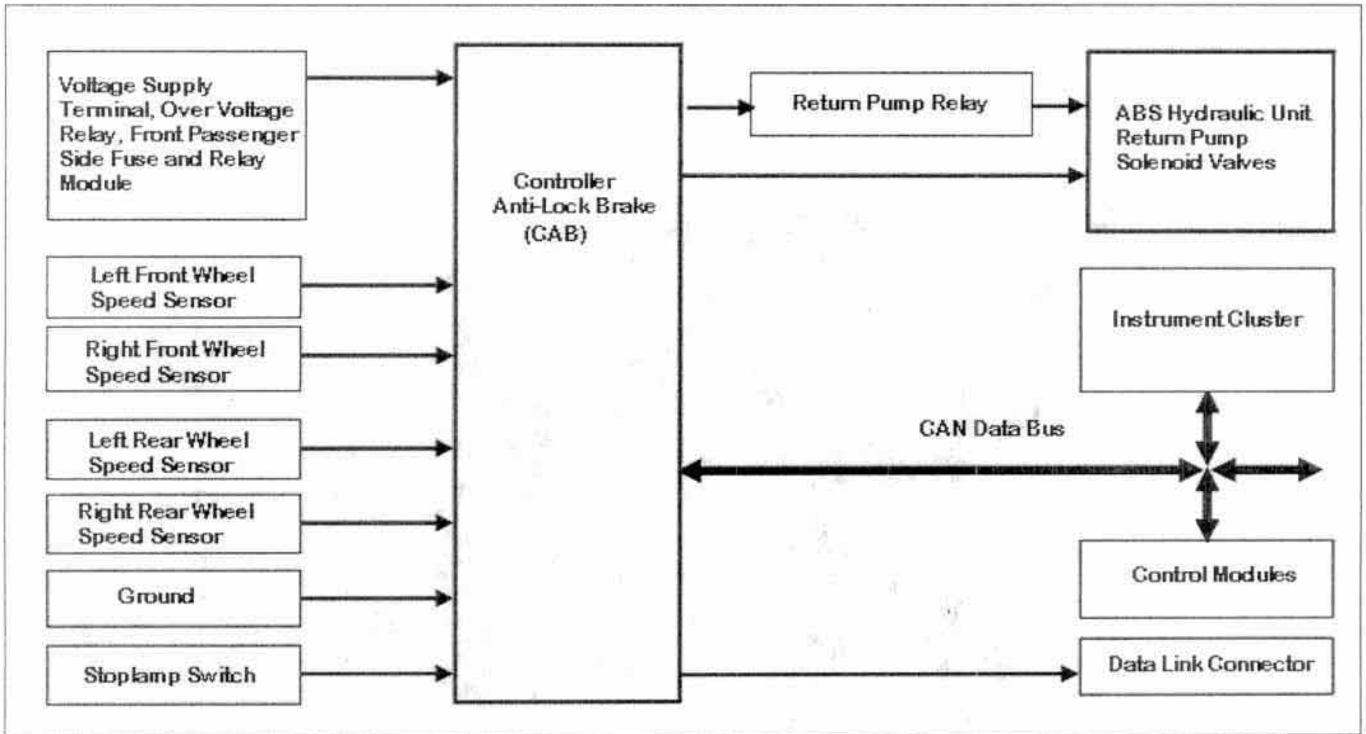



Figure 63 CAB Inputs and Outputs

The CAB is supplied with voltage through the Relay Control Module and direct fused B+ from the engine fuse block. The CAB receives input signals from the Wheel Speed Sensors (WSS) and the stop lamp switch. Refer to Figure 63.

The CAB monitors what conditions for ABS control exist based on inputs from the WSS. The ABS circuits in the CAB actuate the corresponding solenoid valves.

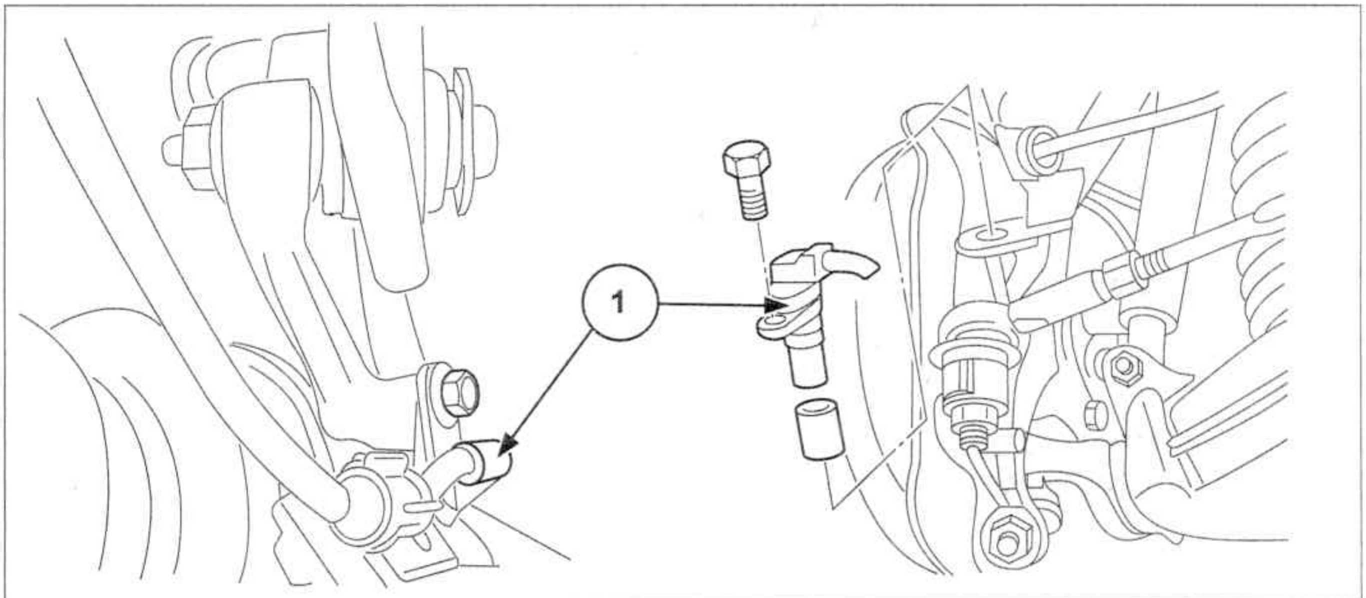
If an ABS control process is effective, a rapid change in pressure between pressure build-up, hold pressure and pressure reduction takes place at the wheel brakes.

The following conditions are required to initiate an ABS cycle:

- The CAB must successfully complete its self-tests (System Initialization).
- The vehicle must be moving more than 8 km/h (5 mph).
- At least one wheel must be approaching lockup.

**Wheel Speed Sensors (WSS)**

The purpose of the WSS (Fig. 64) is to supply the existing wheel speed to the CAB.




| | |
|---|---|
| 1 | Rear and Front Wheel Speed Sensors (WSS) |

Figure 64 Wheel Speed Sensors (WSS)

The wheel speed sensor is a magneto-resistive, or "active," type sensor. Unlike an inductive sensor, which generates a voltage through magnetic induction, the active WSS is supplied 12 volts. The WSS acts like a Hall-effect sensor, electrically sensing the teeth of the indicator ring as they pass by the sensor.

- The front wheel speed sensors are installed on the steering knuckle.
- The rear wheel speed sensors are installed in the rear hub and bearing assembly.

**BRAKE ASSIST SYSTEM (BAS)**

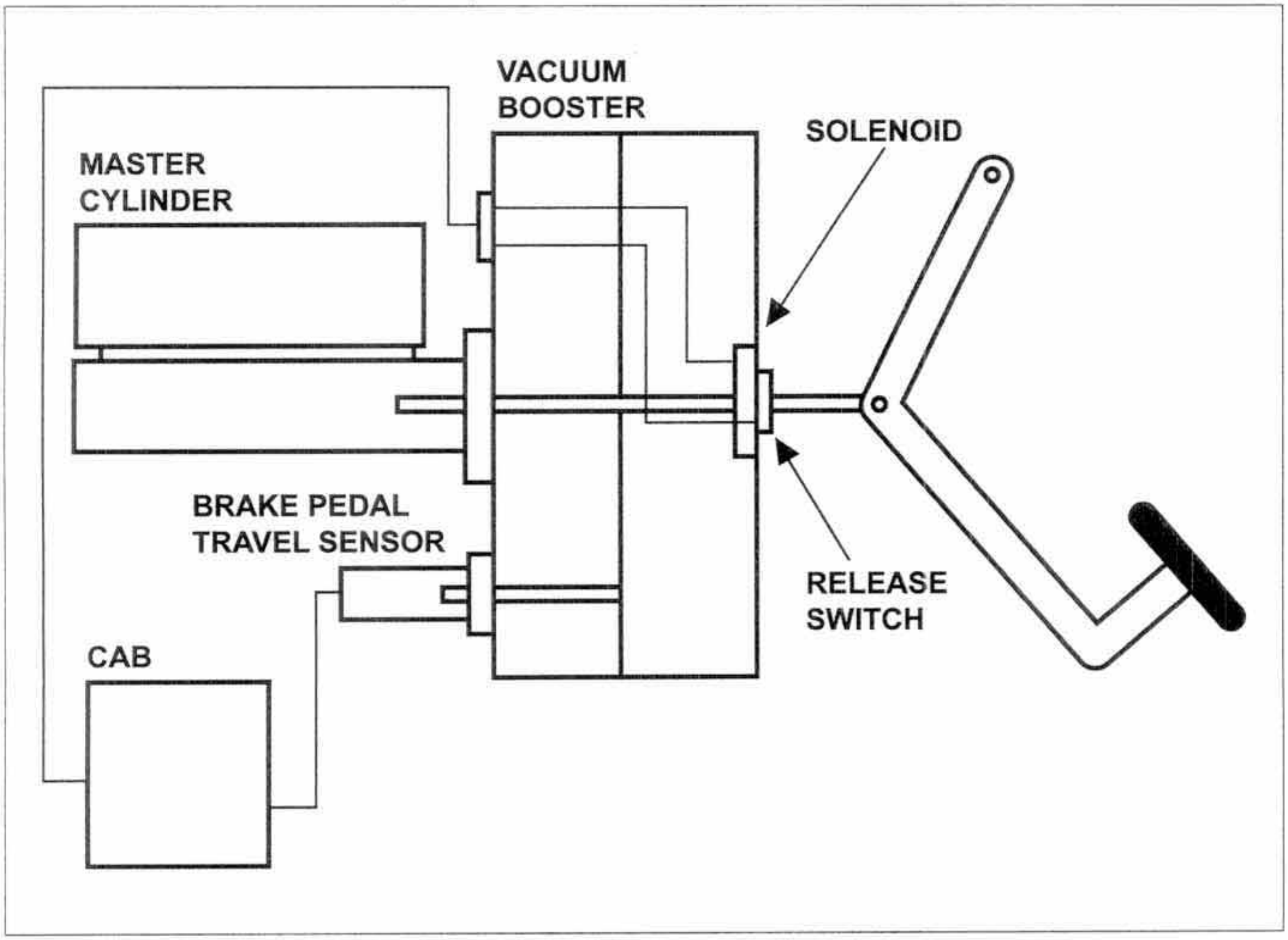
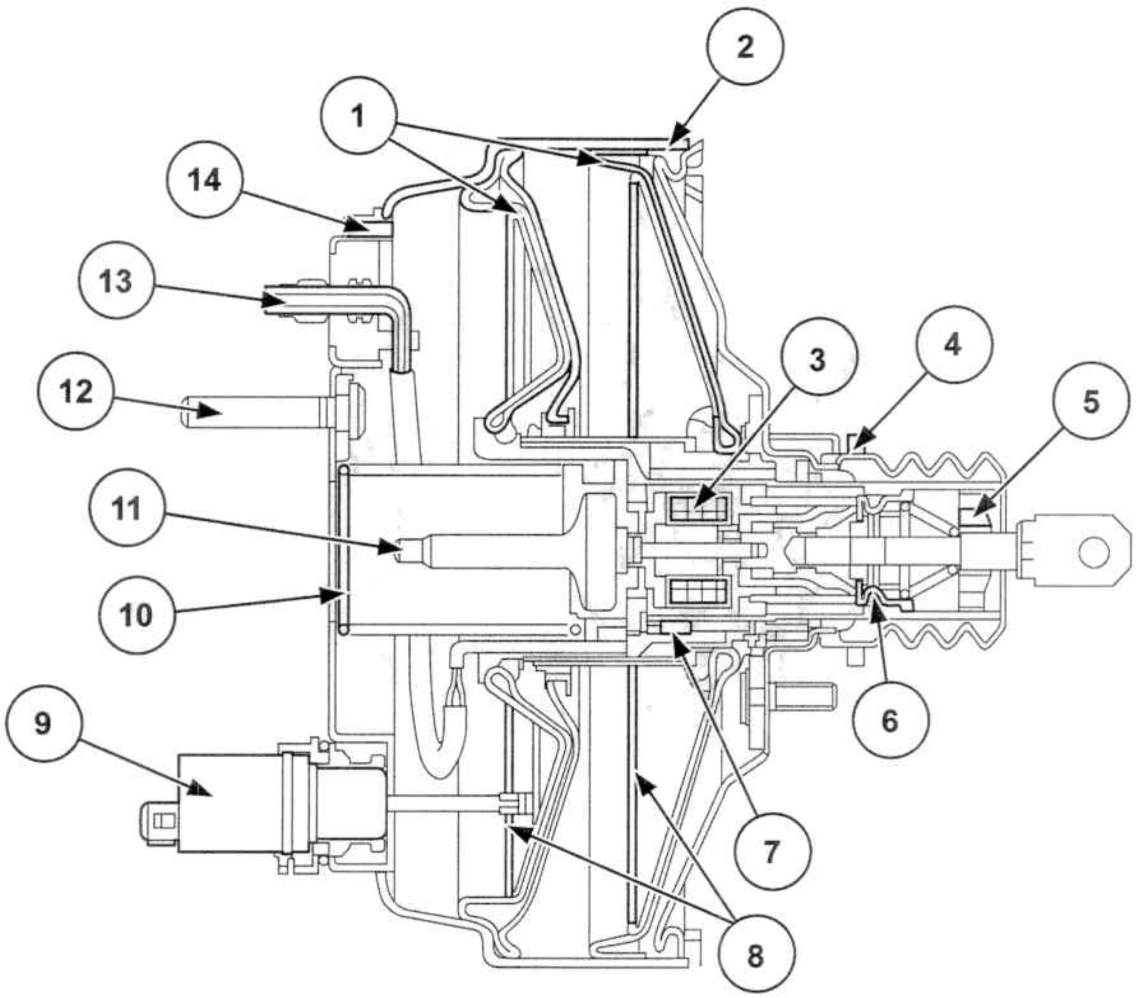



Figure 65 Brake Assist Block Diagram

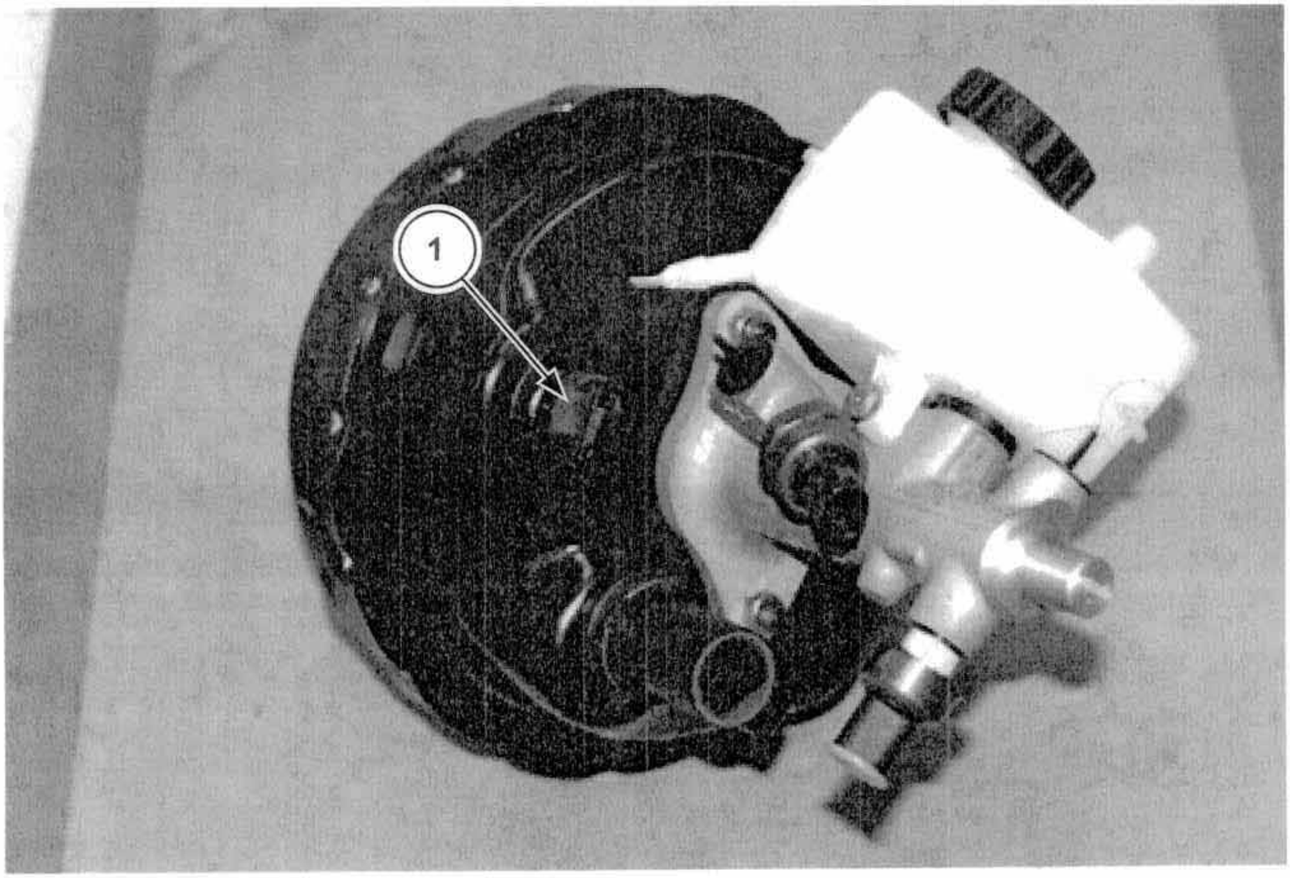
The Crossfire uses a software program called BAS to provide a faster introduction of brake boost during emergency stops. Components of the standard vacuum assist work with the brake pedal speed sensor, solenoid and release switch to accomplish BAS. Refer to Figure 65.




| | | | |
|---|---|---|---|
| 1 | Power Diaphragm | 8 | Vacuum Piston |
| 2 | BAS Brake Booster | 9 | BAS Diaphragm Travel Sensor |
| 3 | BAS Solenoid Valve | 10 | Compression Spring |
| 4 | Air Filter 1 | 11 | Output Rod |
| 5 | Air Filter 2 | 12 | Master Cylinder Attaching Point |
| 6 | Poppet Valve | 13 | Vacuum Connection |
| 7 | BAS Release Switch | 14 | Electrical Connection |

Figure 66 Brake Servo BAS Components

**BAS Release Switch and Solenoid**



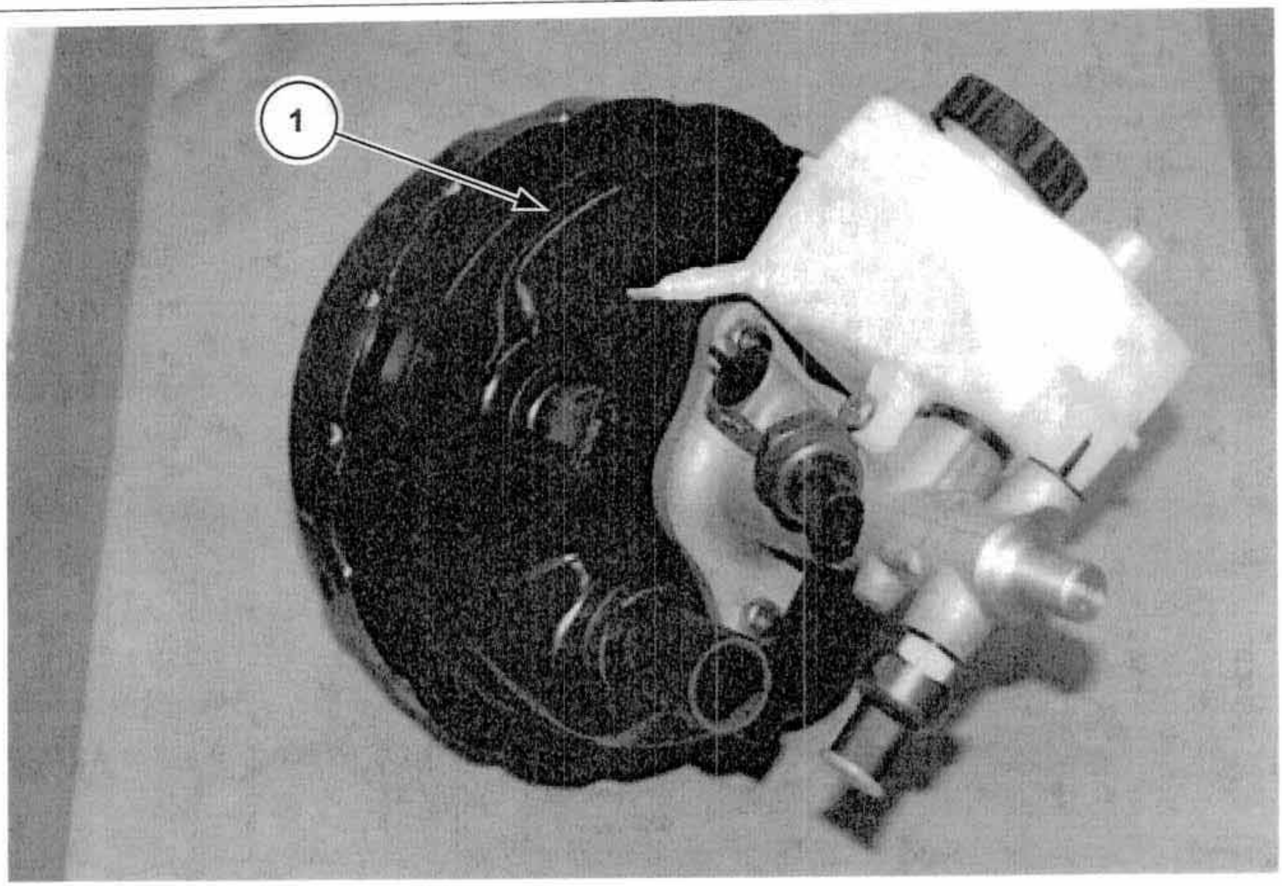

| | |
|---|---|
| 1 | BAS Release Switch and Solenoid Connector |

Figure 67 BAS Release Switch and Solenoid Connector

The BAS Release Switch (Fig. 67) is located in the power brake booster. The CAB receives a signal from the BAS release switch that an emergency braking application has terminated. The CAB de-energizes the BAS solenoid valve, and maximum brake assist is turned off.

The BAS solenoid valve is located in the power brake booster. The BAS solenoid valve admits atmospheric pressure to the driver side of the booster chamber to enable maximum brake assist when BAS is activated. The CAB actuates the BAS solenoid valve.

**Vacuum Booster**



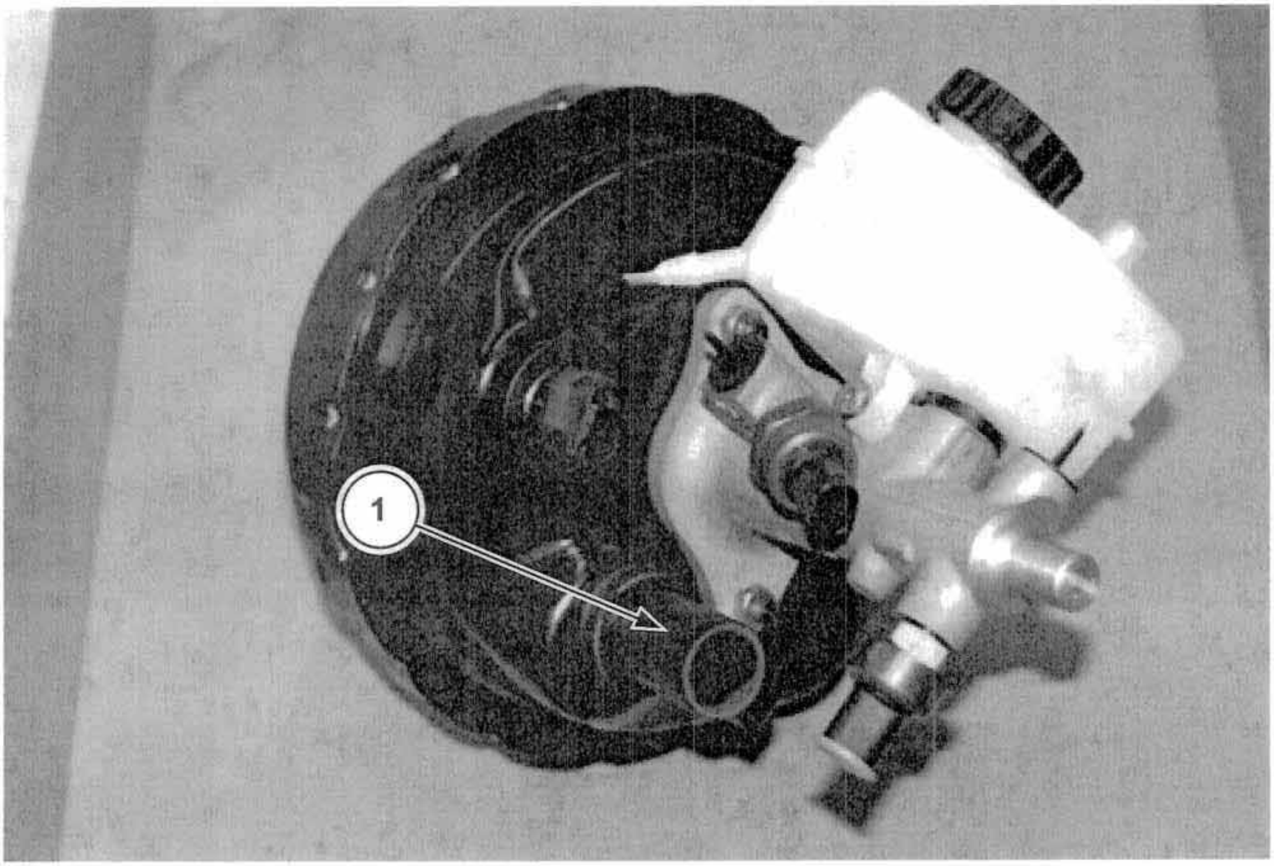

| | |
|---|---|
| 1 | Vacuum Booster |

Figure 68 Vacuum Booster

The power brake booster (Fig. 68) is located in the engine compartment near the driver side of the bulkhead. In addition to conventional booster components, the Crossfire power brake booster includes the following:

- A pedal speed sensor that measures pedal travel rate.
- A solenoid valve for active implementation of braking force support.
- A release switch to detect the end of a brake application.

**Brake Pedal Speed Sensor**

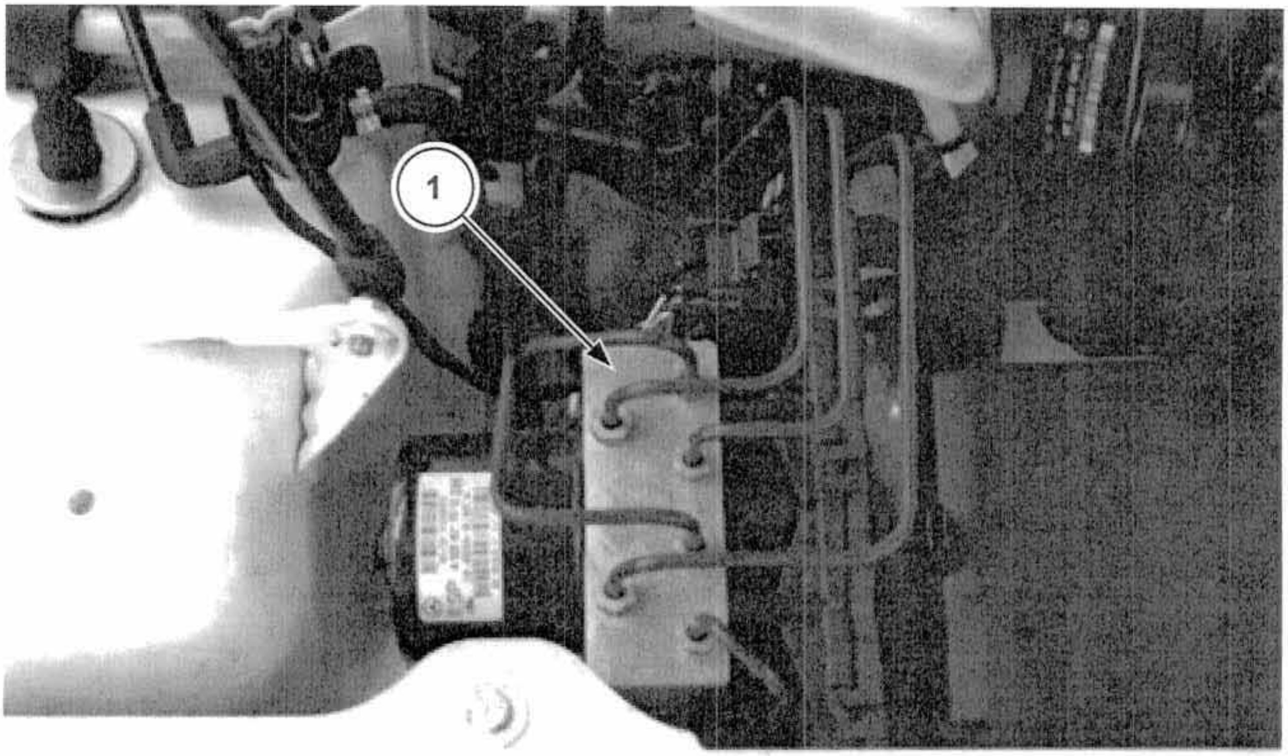



| | |
|---|---|
| 1 | Brake Pedal Speed Sensor |

Figure 69 Brake Pedal Speed Sensor

The brake pedal speed sensor (Fig.69) is mounted on the booster below the master cylinder). The main input to the CAB for brake assist functions is the brake pedal speed sensor. The brake pedal speed sensor measures the speed at which the driver applies the brake pedal. When the maximum pedal speed threshold is exceeded, a valve in the brake booster opens, applying maximum available boost. As soon as the driver releases the brake pedal, BAS returns to a standby mode.

**Controller Anti-Lock Brake (CAB)**

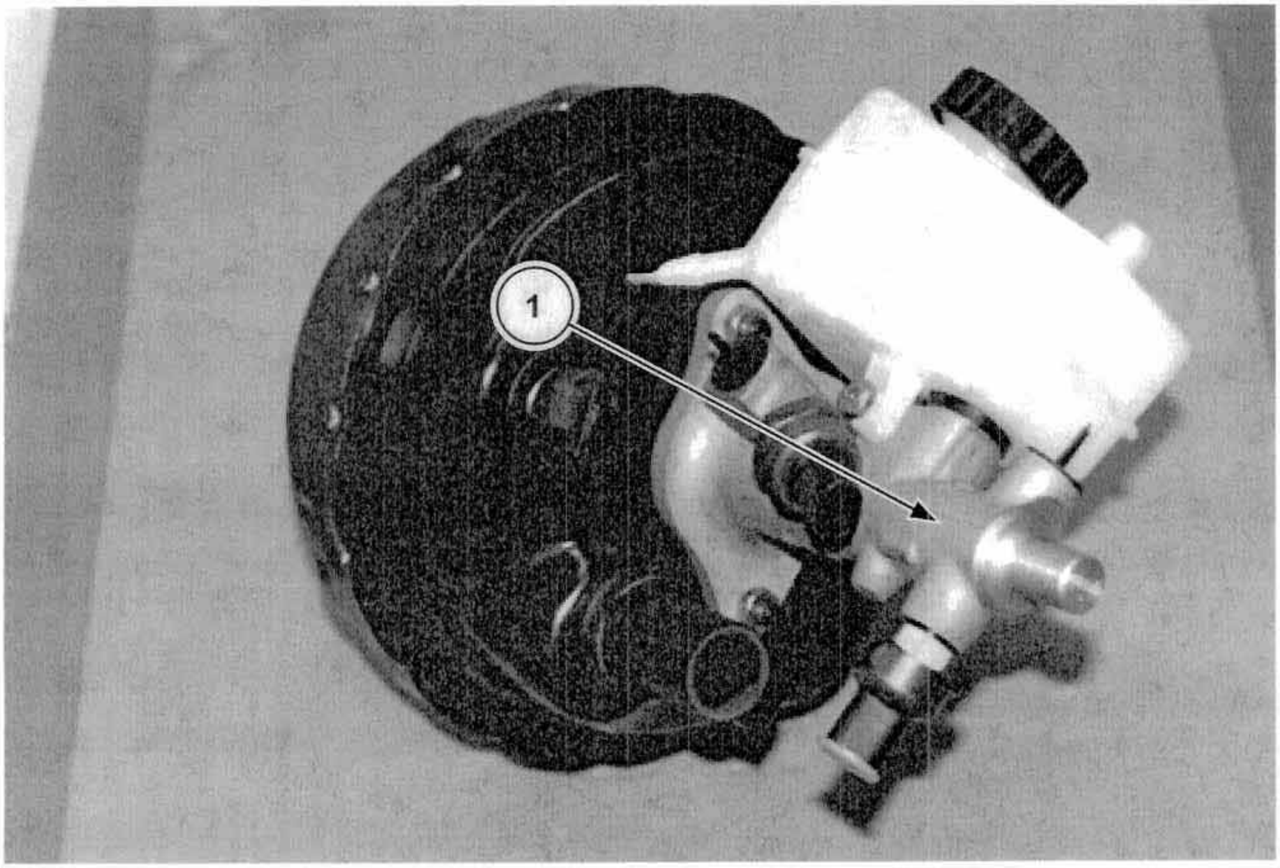



| | |
|---|---|
| 1 | Controller Anti Lock Brake (CAB) |

Figure 70 Controller Anti Lock Brake (CAB)

Another function of the CAB (Fig. 70) is the Brake Assist System, or "BAS." The CAB interprets the braking behavior of the driver and initiates maximum brake boost when it identifies an emergency stop situation. This reduces braking distance.

**Master Cylinder**

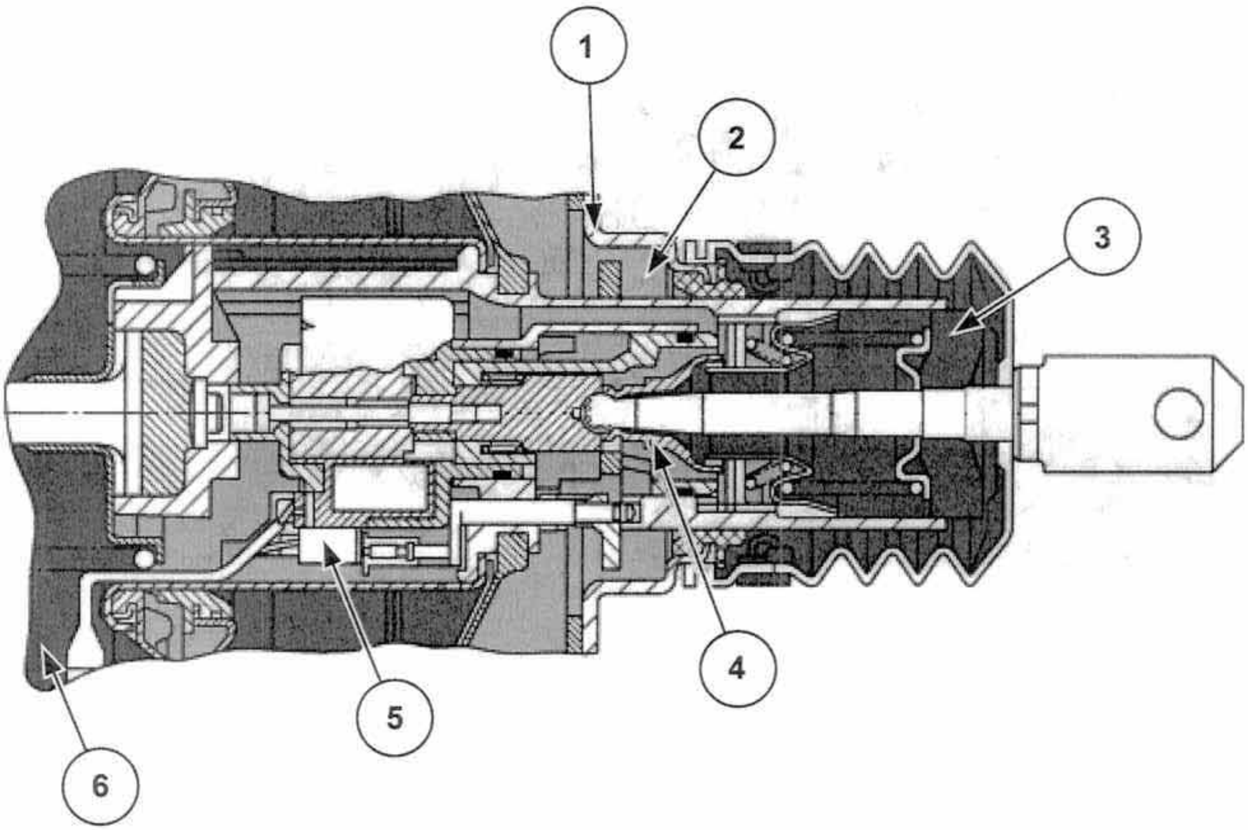



| | |
|---|---|
| 1 | Master Cylinder |

Figure 71 Master Cylinder

The master cylinder (Fig. 71) is located on the front of the power brake booster. When the CAB interprets pedal speed signals as an emergency stop, the BAS solenoid valve opens the rear chamber of the booster to allow full atmospheric pressure to provide maximum boost. This mechanical pressure is applied to the master cylinder by a push rod and converted into hydraulic pressure.

**Brake Application In Normal Operation**

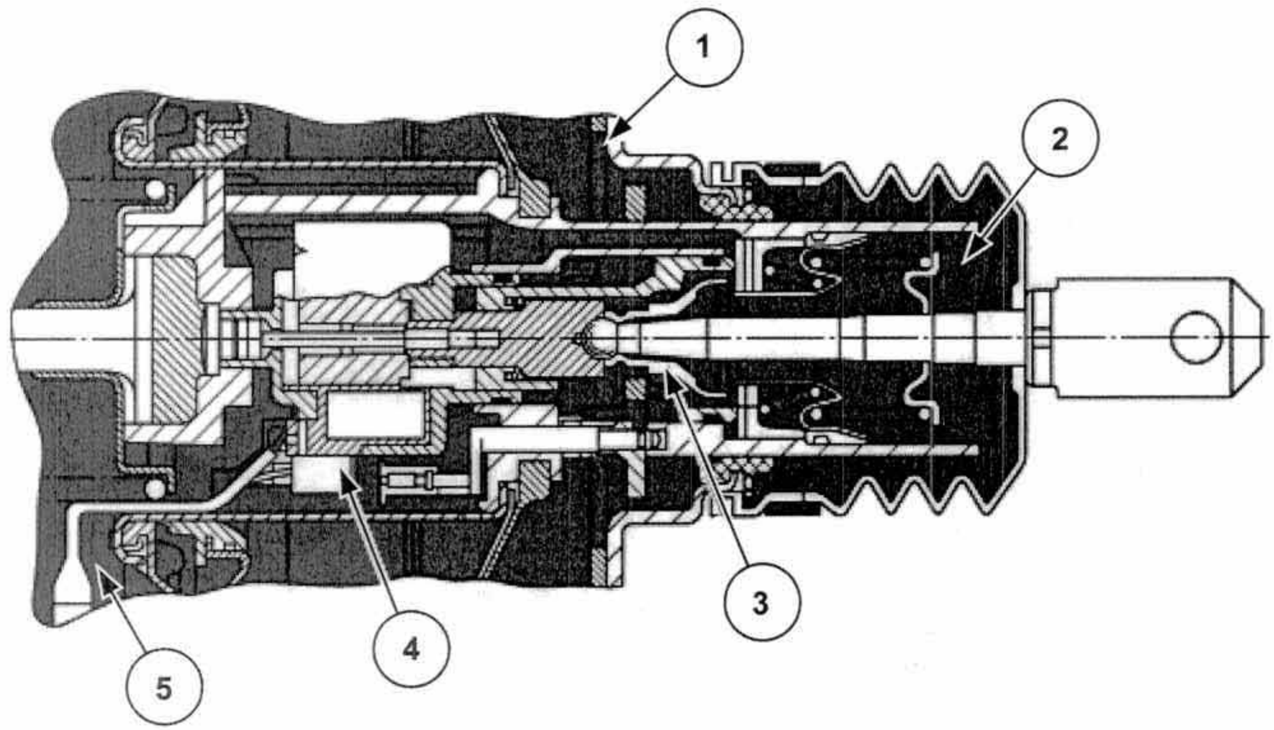



| | | | |
|---|---|---|---|
| 1 | BAS Brake Booster | 4 | BAS Release Switch |
| 2 | Reduced Vacuum | 5 | BAS Solenoid Valve (Control Valve) |
| 3 | Atmospheric Pressure | 6 | Vacuum |

Figure 72 Brake Application In Normal Operation

The brake pedal speed sensor is monitored by the BAS function of the CAB. As an emergency braking application is initiated, the brake pedal speed sensor senses the acceleration of the brake pedal. The BAS programming acts on this input by energizing the solenoid. The actuation of the solenoid provides a larger orifice to atmospheric pressure than would normally be provided for boost. Due to the added assist, brake application occurs sooner and reduces stopping distance. When the driver releases the brake pedal, a release switch provides a signal to the BAS programming which disengages the BAS function and return to normal brake assist. Refer to Figure 72.

**BAS Pressure Increase**



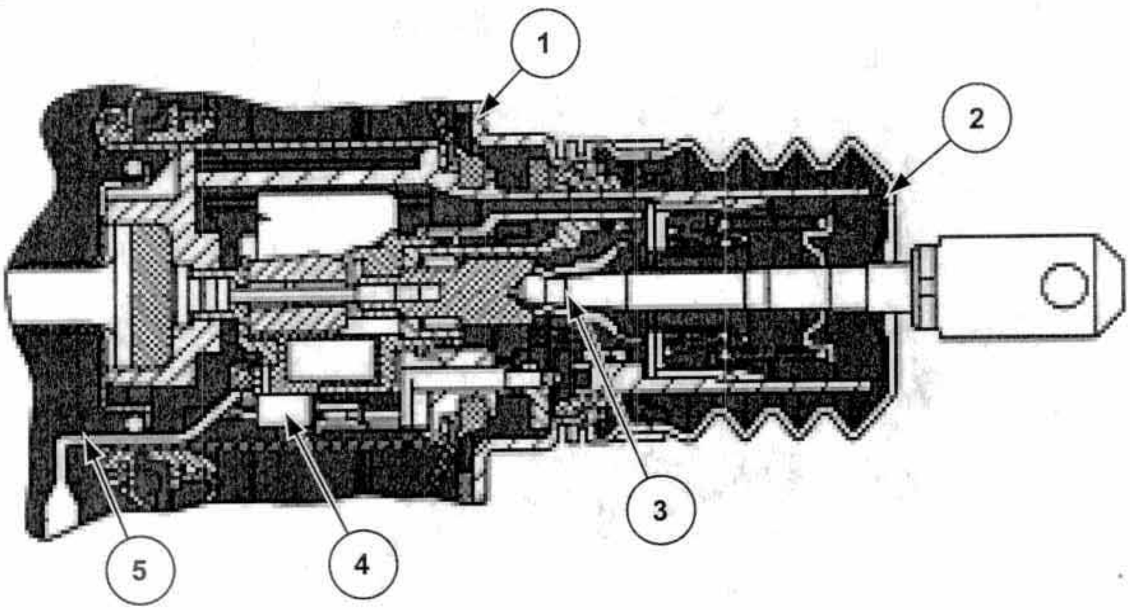

| | | | |
|---|---|---|---|
| 1 | BAS Brake Servo | 4 | BAS Solenoid Valve (Control Valve) |
| 2 | Atmospheric Pressure | 5 | Vacuum |
| 3 | BAS Release Switch | | |

Figure 73 BAS Pressure Increase

BAS is activated when the following conditions exist at the same time:

- Speed more than 8 km/h (13 mph).
- BAS release switch is operated.
- No fault is currently detected.
- The system is enabled (after self-test).
- The activation threshold of the pedal speed has been exceeded.

**BAS Pressure Reduction**




| | | | |
|---|---|---|---|
| 1 | BAS Brake Servo | 4 | BAS Solenoid Valve (Control Valve) |
| 2 | Atmospheric Pressure | 5 | Vacuum |
| 3 | BAS Release Switch | | |

Figure 74 BAS Pressure Reduction

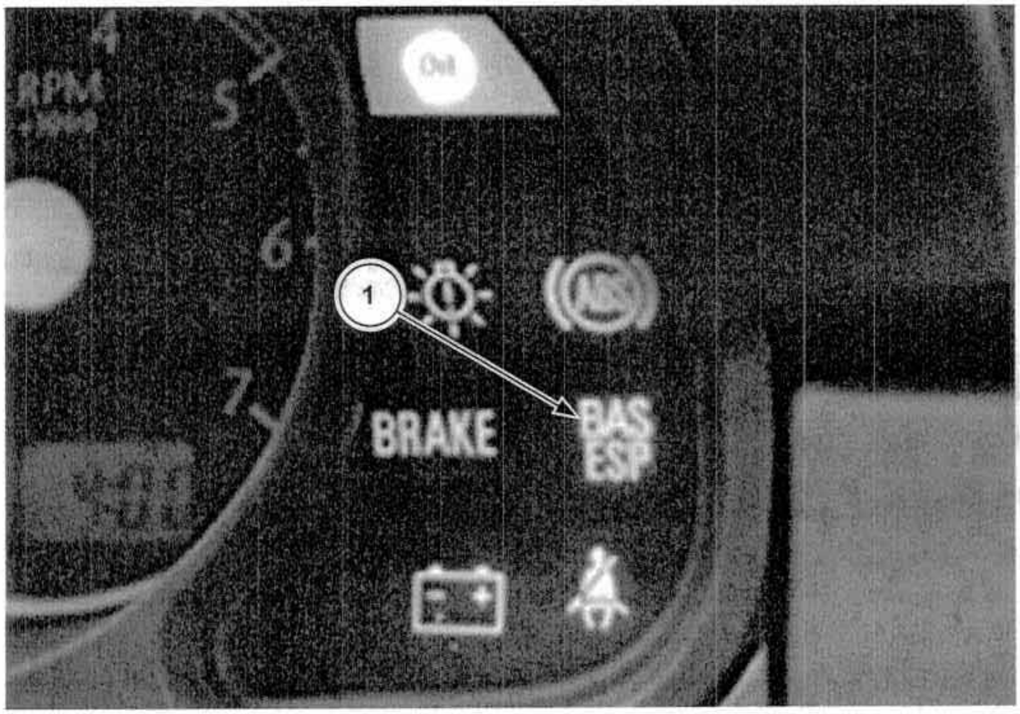
BAS is switched off when one of the following conditions exists:

- BAS solenoid valve is not actuated.
- Speed less than 3 km/h (5 mph).
- Duration of activation more than 20 seconds.
- If no signal from the stop light switch is present after activation of BAS.
- A fault is detected that causes the BAS malfunction indicator lamp to be activated.

The BAS release switch is reset automatically. The solenoid valve is switched off and only creates enough brake pressure to correspond to the position of the brake pedal.

The CAB receives information from the BAS release switch that the emergency braking application has terminated. The BAS solenoid valve is no longer activated and the maximum braking assistance force is turned off. The normal braking assistance force remains unchanged. Refer to Figure 74.

**BAS Function and Operation**




| | |
|---|---|
| 1 | BAS/ESP Indicator |

Figure 75 BAS/ESP Indicator

When the ignition is turned on the indicator lamp (Fig. 75) in the IC lights up and goes out when the engine is running.

If the BAS/ESP indicator lamp stays illuminated while the engine is running, there is a fault in the BAS system, the traction system or both. The affected system is no longer functional, but the full power braking with ABS is retained.

If the fault is located in the BAS, the traction systems remain functional. If the fault is located in the traction systems, the BAS remains functional.

System faults that occur while the vehicle is being driven also cause the BAS/ESP indicator lamp to light continuously. The BAS/ESP indicator lamp may come on while the vehicle is being driven and then go out again after a short time. This may be caused by battery under voltage.

## ACCELERATION SLIP REGULATION (ASR)

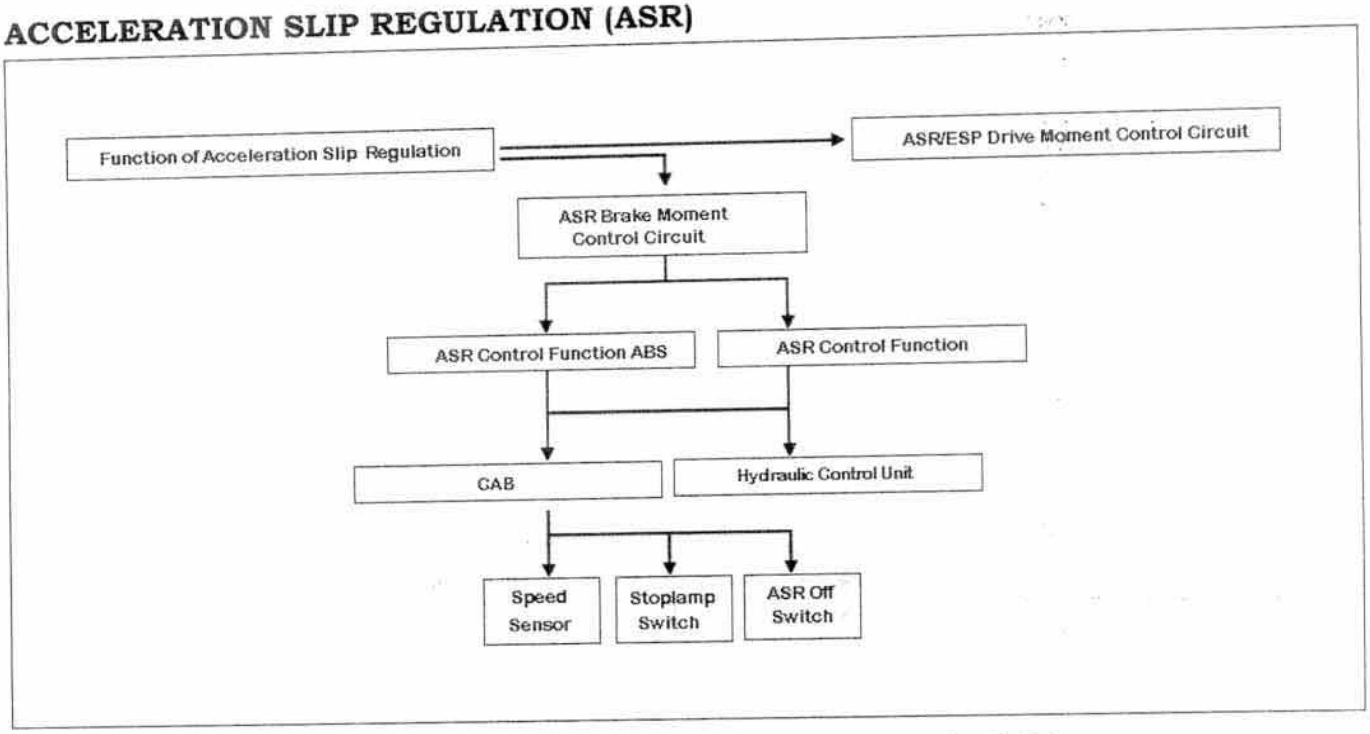



Figure 76 Acceleration Slip Regulation (ASR) Block Diagram

The CAB (Fig. 76) controls the function of the ABS hydraulic unit and the ASR. During normal operation, wheel speed signals are constantly compared with each other and then with different speeds between the front and rear wheels (specified slip thresholds), depending on vehicle speed. To perform all control functions of ASR, data is exchanged between the CAB, PCM and, if necessary, the TCM over the CAN data bus.

The following values are compared:

- Drive Slip
- Acceleration
- Front Wheel Speed
- Corner Recognition

If the values determined exceed the specified slip thresholds, an ASR control mode is introduced.

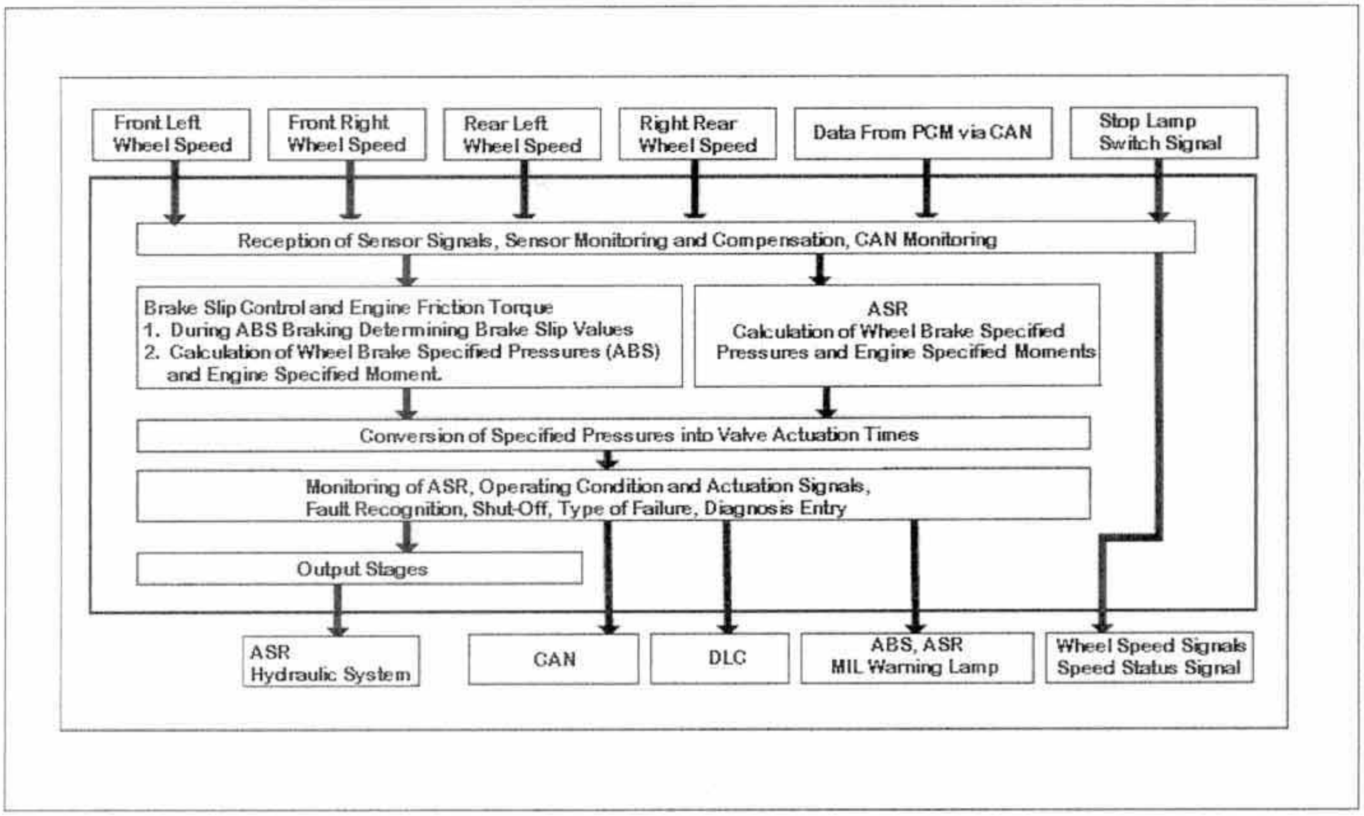



Figure 77 ASR Function Diagram

**ASR Control Mode**

In normal mode there are no wheel speed differences that require control. The solenoid valves in the ASR hydraulic unit are in their normal positions (i.e., switched to the de-energized positions). The system is ready for normal braking. Refer to Figure 47.

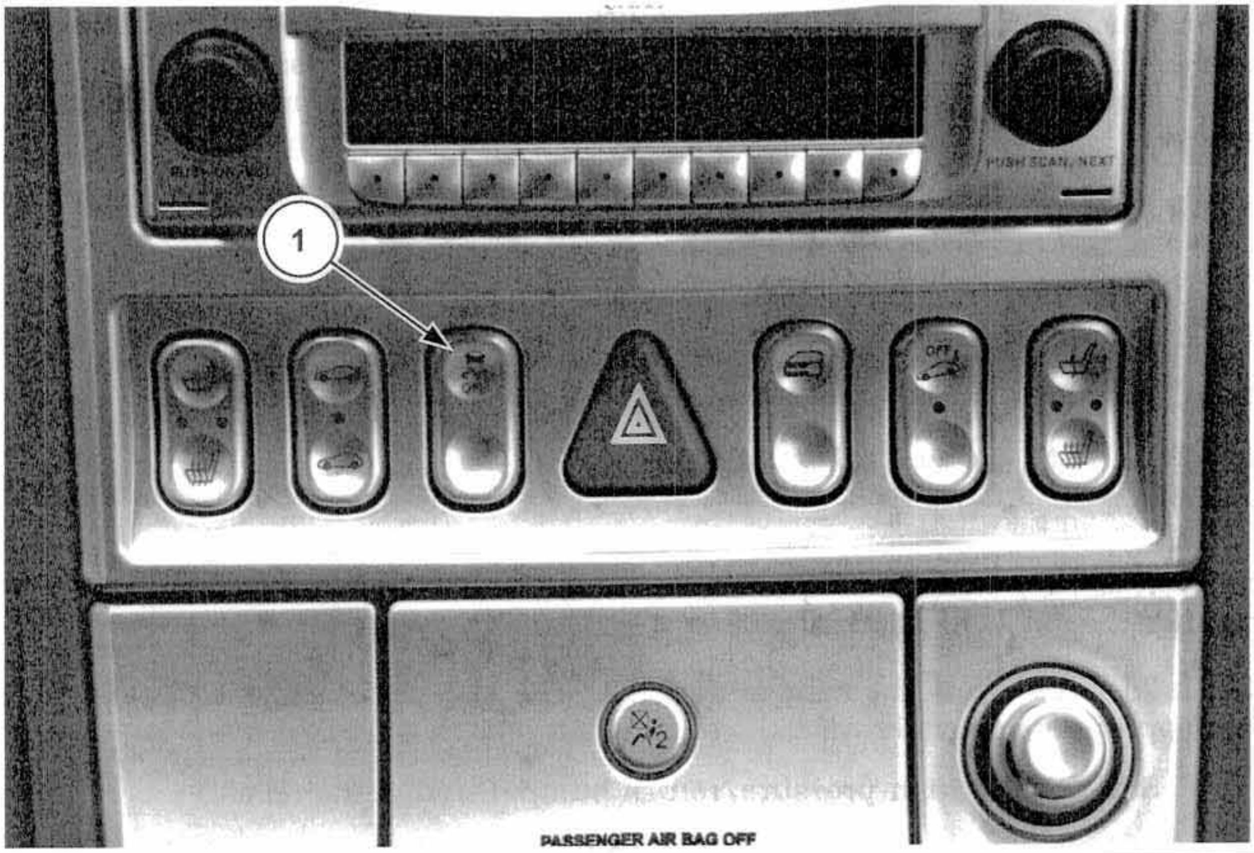
The CAB receives input signals from the following components:

- 4-Wheel Speed Sensors
- Parking Brake Switch
- Stop Lamp Switch
- PCM and TCM, if over CAN C Data Line
- ASR/ESP OFF switch

In the ASR control mode, the input signals to the CAB are processed into output signals for the following components:

- Solenoid valves (from the relay or directly). The ABS circuits in the CAB trigger the appropriate solenoid valves.
    - Self-priming high-pressure/return pump (through the relay).
    - PCM (throttle valve control valve and firing angle request or fuel cutoff over CAN C data line).
    - ASR active lamp, ABS malfunction indicator lamp and ASR malfunction indicator lamp controlled directly over CAN C data line.

**ASR Off Mode**

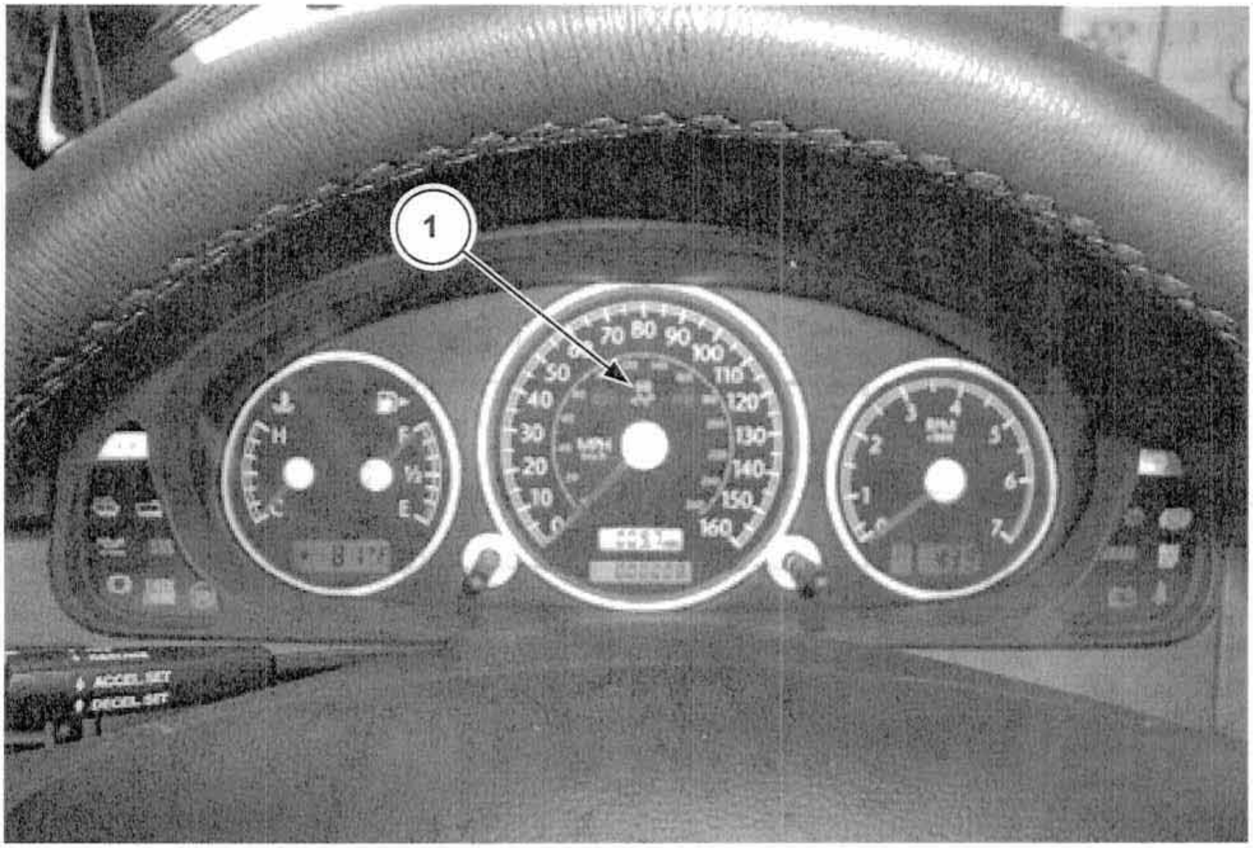



| | |
|---|---|
| 1 | ASR/ESP Rocker Switch |

Figure 78 ASR/ESP Rocker Switch

When the ASR/ESP rocker switch (Fig. 78) is in the OFF position, the brakes are still applied up to speeds of 40 km/h (25 mph) if *one* drive wheel is spinning. If other criteria for ASR control exist, the brakes may be applied up to a maximum speed of 80 km/h (50 mph) however, the braking torque is continuously reduced. The brakes are not applied on both sides.

ASR/ESP Active Lamp




| | |
|---|---|
| 1 | ASR/ESP Active Lamp |

Figure 79 ASR/ESP Active Lamp

The CAB supplies signals to the IC for the ABS MIL, BAS/ASR active lamp (Fig. 79), and the BAS/ESP MIL (used for ASR fault indication).

## ELECTRONIC STABILITY PROGRAM (ESP)

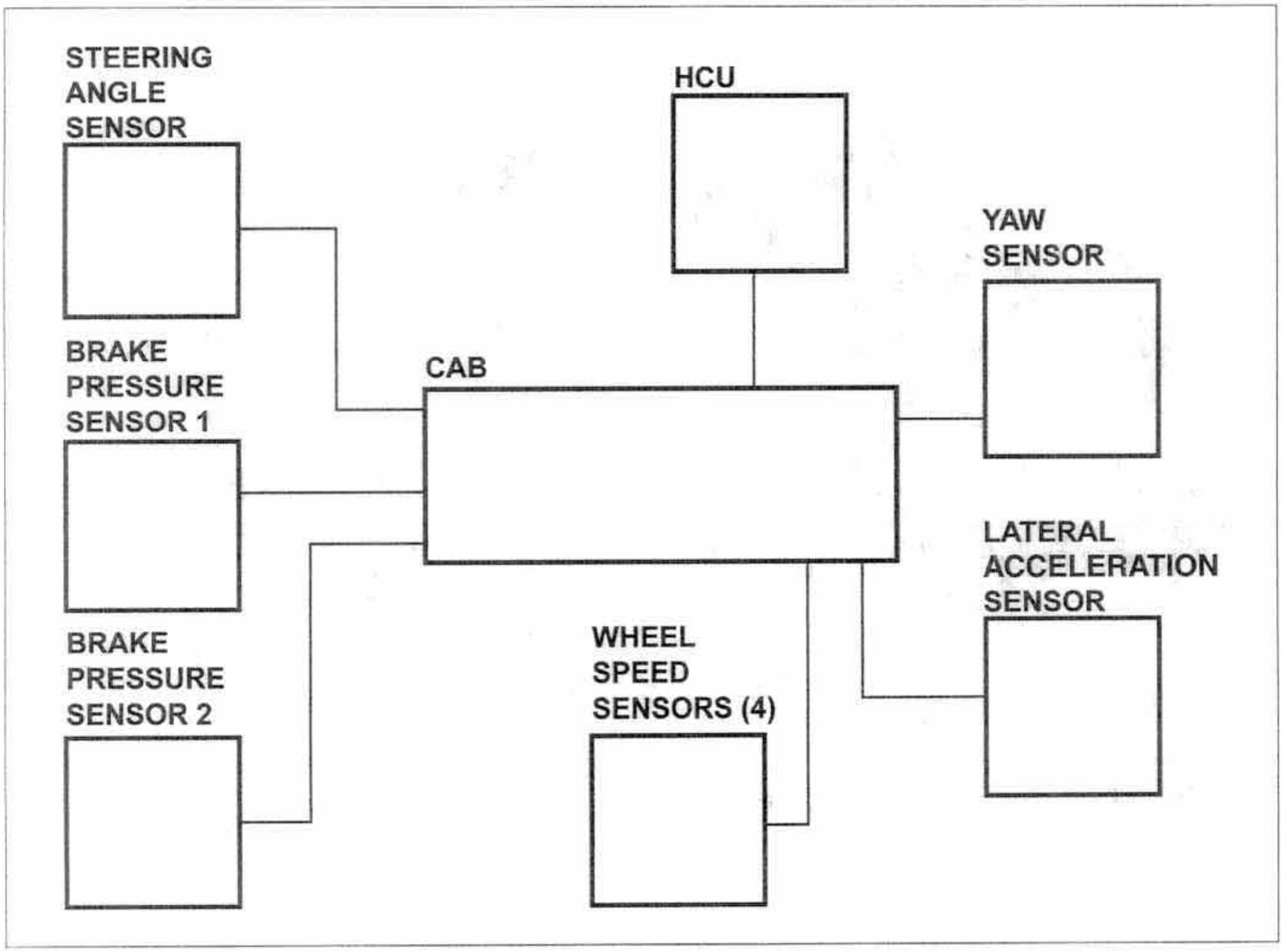
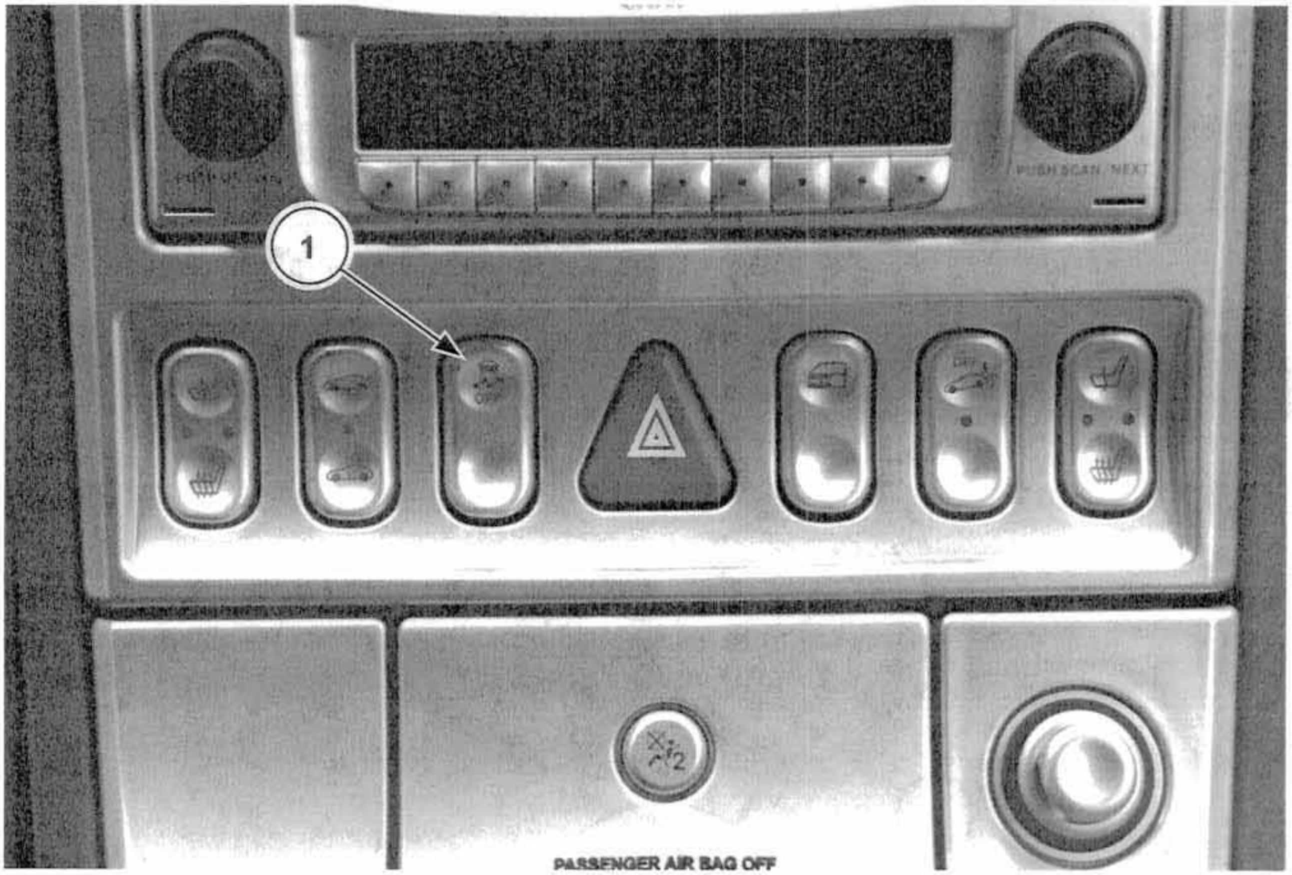



Figure 80 Electronic Stability Program (ESP) Block Diagram

The Crossfire uses a software program known as ESP to maintain proper vehicle tracking through its intended path. The ESP function can be disabled via a center stack mounted switch. Components of ABS work with the steering angle sensor, brake lamp switch, brake pedal, yaw and lateral acceleration sensors to accomplish this. The information processing takes place within the CAB. Refer to Figure 80.

ESP compares the driver's intended course, through steering angle and braking input sensors, to the vehicle response, by lateral acceleration, rotation (yaw) and individual wheel speed sensors. ESP then brakes individual front or rear wheels and/or reduces engine power as needed to help keep the vehicle cornering at an appropriate rate. ESP uses the functions of traction control, which senses drive-wheel slip and individually brakes the slipping wheel or wheels, and/or reduces engine power to help regain control.

**ASR/ESP Rocker Switch**



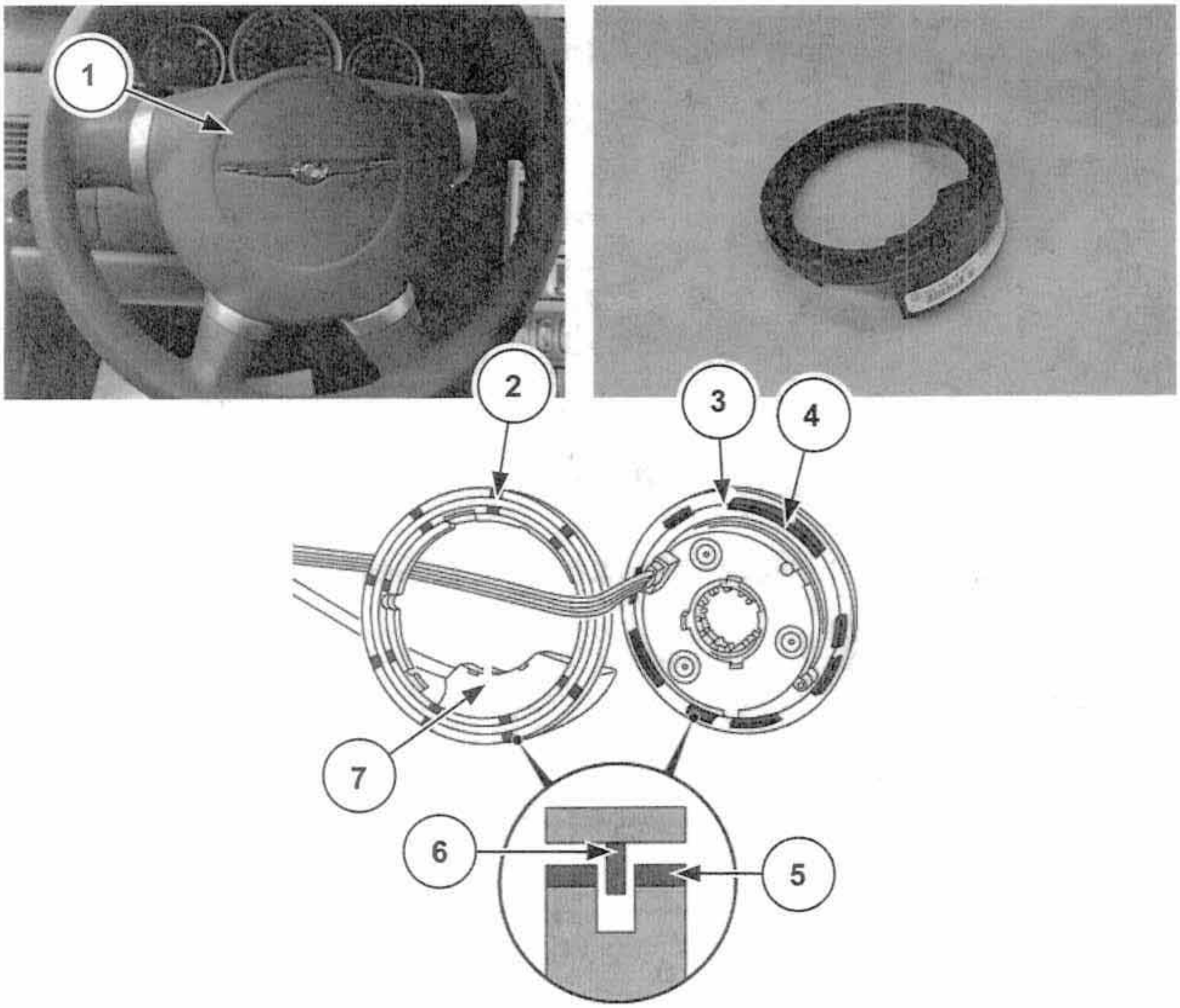

| | |
|---|---|
| 1 | ASR/ESP Rocker Switch |

Figure 81 ASR/ESP Rocker Switch

Pressing the top of the ASR/ESP rocker switch in the center console (Fig. 81) disables the system for driving in deep snow, sand or gravel when wheel spin is necessary to maintain forward motion. With ESP turned off, low-speed rear-wheel traction control remains active to prevent one wheel from spinning alone. Full traction control is operative up to approximately 40 km/h (25 mph). Low-speed traction control turns off at 80 km/h (50 mph).

The CAB controls regulation of the dynamic handling control systems at the wheel brakes, and also sends information to the PCM for engine torque management.

**Steering Angle Sensor**

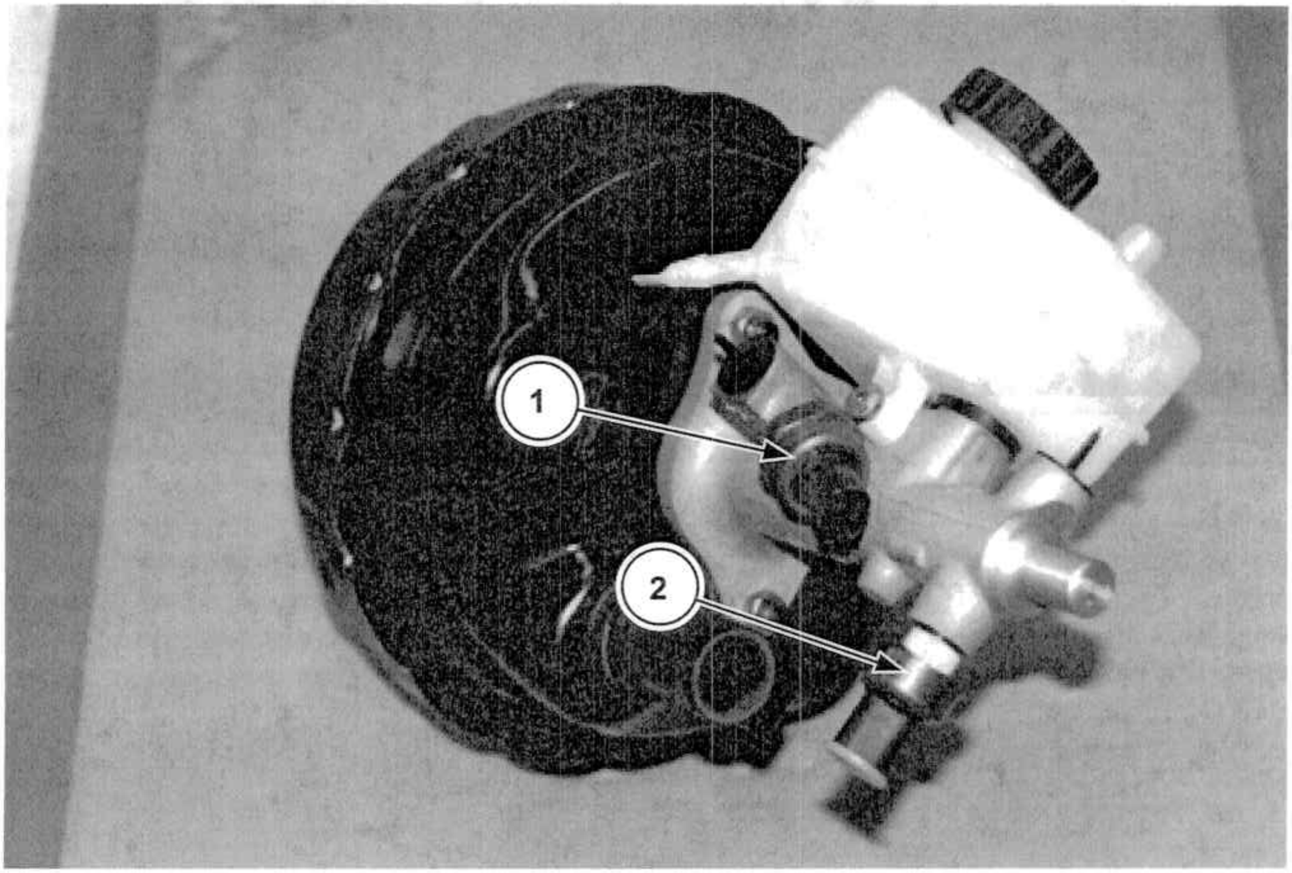



| | | | |
|---|---|---|---|
| 1 | Steering Angle Sensor Location | 5 | Photoelectric Barrier LED |
| 2 | Photoelectric Barrier LED | 6 | Blade |
| 3 | Contact Spiral | 7 | Steering Angle Sensor |
| 4 | Blade | | |

Figure 82 Steering Angle Sensor

The steering angle sensor (Fig. 82) is located on the steering column, near the clockspring. The CAB monitors the steering angle sensor to determine the direction and rate of steering wheel rotation. The steering angle sensor is provided two B+ feeds. One is provided a feed at all times and the other is provided a feed when the ignition key is in the START or RUN position. As the steering wheel is rotated, a window/shutter wheel assembly actuates a series of LEDs and light sensitive diodes. This rotation produces a digital signal that can be interpreted by the CAB.

**ESP Brake Pressure Sensor**




| | | | |
|---|---|---|---|
| 1 | ESP Pressure Sensor 1 | 2 | Brake Master Cylinder |

Figure 83 ESP Brake Pressure Sensor

ESP uses two brake pressure switches (1 and 2) that are located on the master cylinder assembly. The ESP pressure switch 1 senses the brake fluid pressure in the primary section of the master cylinder, while pressure switch 2 monitors the secondary section. The CAB uses this information to make fine adjustments to the ESP system.

**Brake Lamp Switch**

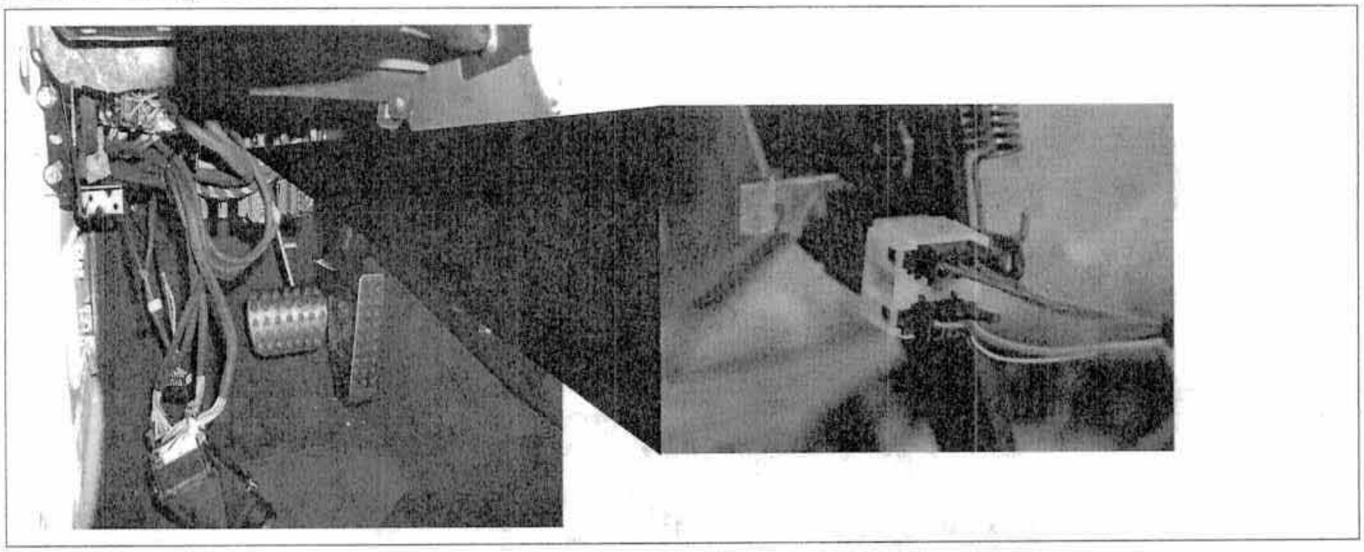
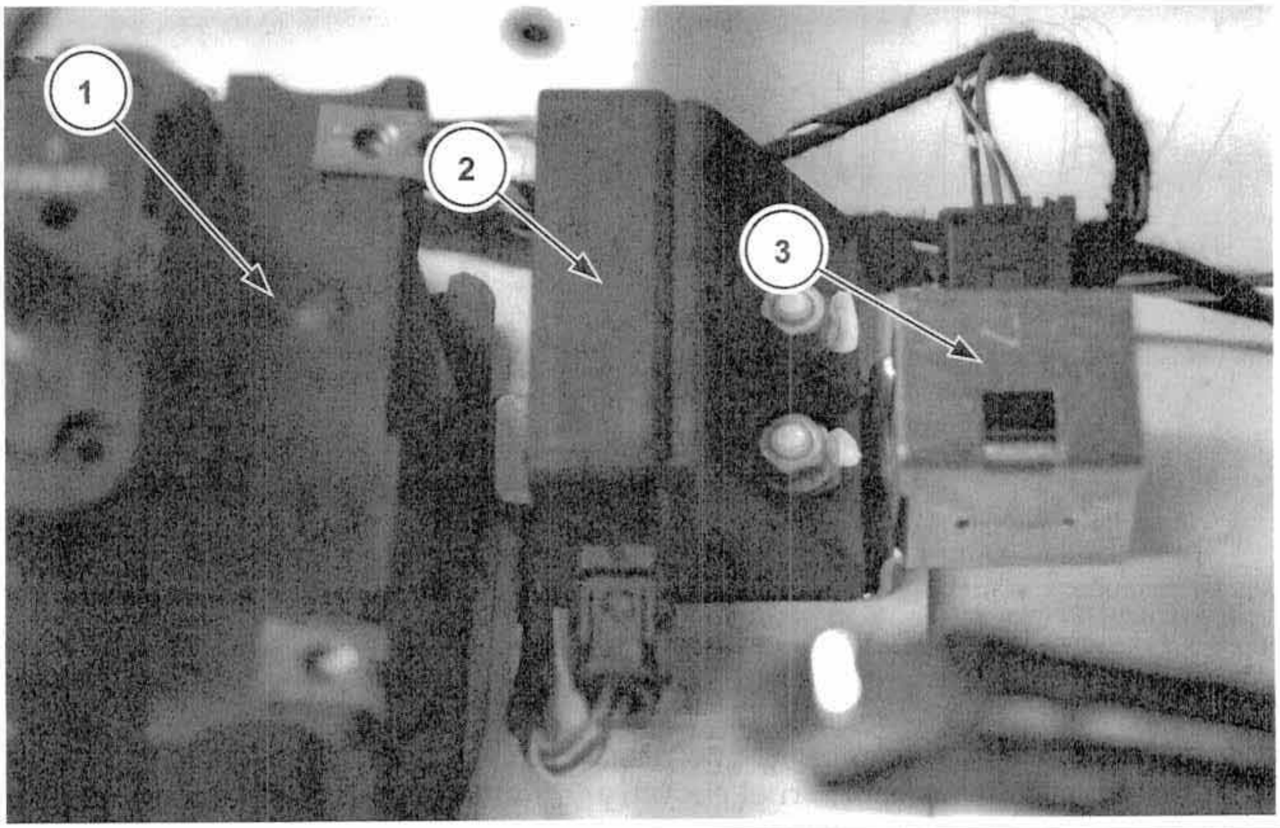


Figure 84 Brake Lamp Switch

The brake lamp switch is located on the brake pedal assembly (Fig. 84). The brake lamp switch receives a B+ feed from the traction system relay in the relay control module. The portion of the brake pedal switch that the CAB monitors is normally closed and opens when the brake pedal is pressed. When the brake pedal switch opens, the BCM senses that the brakes are being applied.

**Lateral Acceleration and Yaw Sensors**



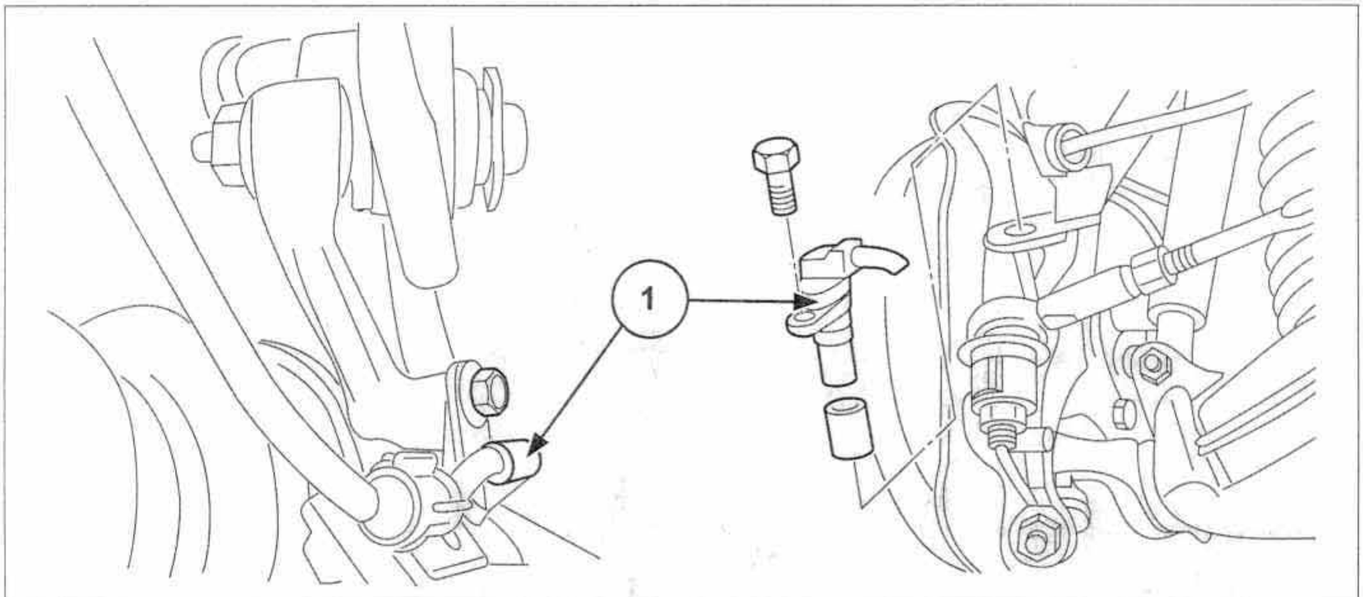

| | | | |
|---|---|---|---|
| 1 | Shift Lever Assembly (SLA) | 3 | Lateral Acceleration Sensor |
| 2 | Yaw Rate Sensor | | |

Figure 85 Lateral Acceleration and Yaw Sensors

The ESP yaw rate sensor is located on the vehicle floorpan behind the SLA (Fig. 85). The yaw rate sensor senses the vehicle's movement or force that is rotational to its vertical centerline.

The lateral acceleration sensor is located on the vehicle floor pan behind the SLA. The lateral acceleration sensor senses the vehicle's movement or force that is perpendicular to its horizontal centerline.

**Wheel Speed Sensors (WSS)**

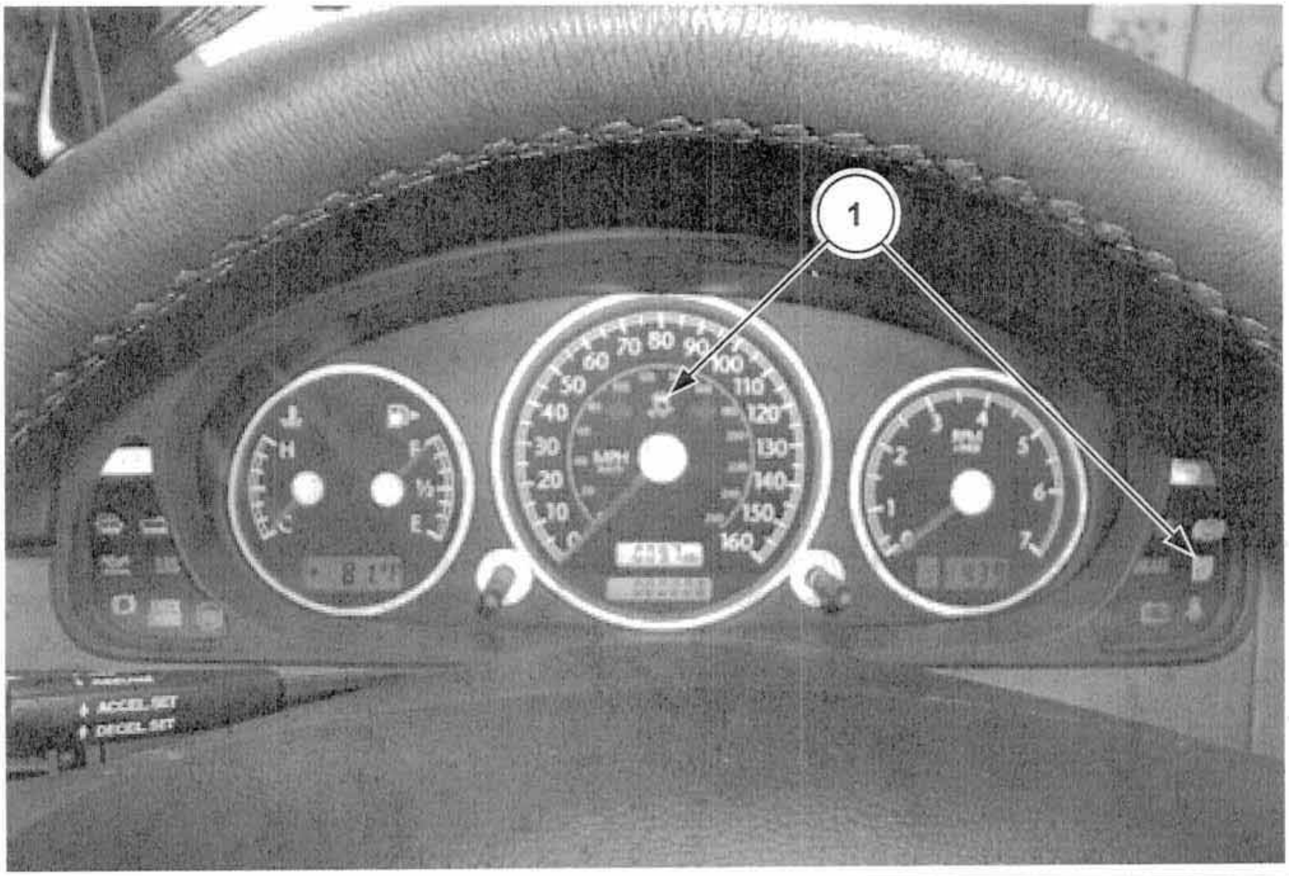



| | |
|---|---|
| 1 | Rear and Front Wheel Speed Sensors (WSS) |

Figure 86 Wheel Speed Sensors (WSS)

The WSS are mounted to each front and rear knuckle (Fig. 86). The WSS is a two-wire digital sensor that uses internal circuitry to convert wheel rotational speed to a digital signal.

**ESP Indicator Lamp Functions**




| | |
|---|---|
| 1 | ASR/ESP Indicators |

Figure 87 ASR/ESP Indicators

For ESP, there are displays with various symbols in the IC (Fig. 87). When the ignition is turned on, the indicator and malfunction indicator lamps in the IC come on and go out when the engine is running (bulb check).

In driving mode the ASR/ESP active lamp (above the speedometer) flashes if a wheel speed does not correspond to the vehicle speed. Driving can thus be better adapted to the road conditions. The warning lamp continues flashing for about one second after vehicle stability has been regained.

Due to the combined BAS/ESP malfunction indicator lamp (on the right side of the cluster), the fault may be in the BAS or in the ESP/ASR. If there is a malfunction in the BAS, ESP/ASR still functions and vice versa.

If the ABS and BAS/ESP malfunction indicator lamps come on when the engine is running, there is a fault in at least two control circuits and at least two systems are switched off. The BAS function can be retained despite the ABS and ESP being switched off.

If the BAS/ESP malfunction indicator lamp comes on in the ESP control mode and goes out after a while, a calculated temperature value of the brake linings has been exceeded. Consequently, no ESP or ASR control takes place at the appropriate wheel(s) until the temperature has dropped again to a set value. The temperature values are stored in the CAB.

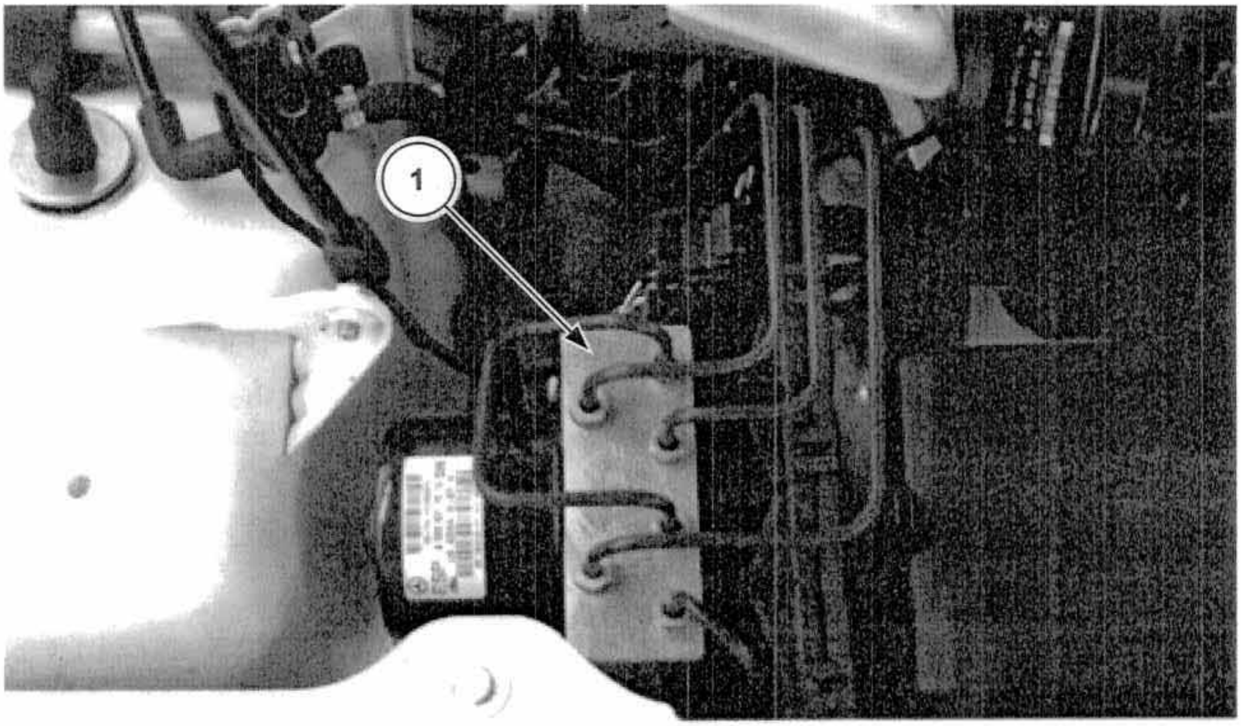
**System Operation**

As the vehicle is moving in a straight line, the ESP function of the CAB takes a baseline measurement of the WSSs, brake pedal switch, steering angle, brake pressure, yaw and lateral acceleration sensors (this baseline measurement is updated constantly). As the vehicle approaches a turn, and the driver initiates braking, the brake pressure sensors and brake pedal switch sense the increased brake pressure and the steering angle sensor senses the steering direction change. The WSS, yaw and lateral acceleration sensors provide feedback indicating the severity of vehicle slide or spin.

If the vehicle surpasses yaw and lateral acceleration limits set within the ESP programming, a force opposite of the offending condition is created. For example, if the vehicle is turned left at a high rate of speed, it typically wants to laterally accelerate to the right and yaw in a counterclockwise direction. To counteract this tendency the ESP produces a lateral acceleration to the left and a yaw in the clockwise direction.

To accomplish this, the ESP function of the CAB uses the hydraulic pump and valves of the ABS HCU to apply the brakes.

As a last resort to help maintain control of the vehicle, the ESP communicates with the PCM (over the CAN Bus) to reduce engine power output.




| | |
|---|---|
| 1 | Controller-Anti-Lock Brake (CAB) |

Figure 88 Controller-Anti-Lock Brake (CAB)

The ESP function is part of the CAB located on the left side of the engine compartment (Fig. 88).

The purpose of the CAB is to:

- Perform all brake control functions for ABS, BAS, ASR, and ESP. In the case of ASR and ESP, data transfer with the PCM and TCM takes place over the CAN Data Bus.
- Influence of engine/transmission management in ESP control mode.
- Contain complete BAS control module function.
- Supply other systems with the vehicle speed signal and the wheel speed status signal (either direct or over the CAN Data Bus).
- Supply the IC through the CAN Data Bus with the signals for the ABS indicator lamp, ESP warning lamp, and BAS/ESP indicator lamp.

- Supply the IC with the signal for the brake pad wear indicator lamp and the parking brake indicator lamp over the CAN Data Bus.

CAN C Data on Engine Torque

The CAB is informed about the engine torque output by the PCM over the CAN C Data Bus. In the case of ESP control mode, the function logic component tells the PCM to reduce engine torque.

CAN C Data on Currently Engaged Gear (Automatic Transmission Only)

Over the CAN C Data Bus, the CAB is constantly informed about the currently engaged gear by the TCM. The current gear is used to calculate the drive forces acting on the drive wheels and for drive torque control.

BAS Release Switch Signal

When the BAS release switch is not actuated and the BAS solenoid valve is active at the same time, the stop lamps are prevented from lighting when the brake pedal is not pressed. This is accomplished by activating the stop lamp suppression relay.

BAS Diaphragm Travel Sensor Signal

The signal from the BAS diaphragm travel sensor is used to calculate the speed at which the brake pedal is actuated. The brake pedal speed is used as a criterion for BAS actuation.

Lateral Acceleration Sensor Signal

The CAB uses the signal from the lateral acceleration sensor to determine the lateral forces occurring during cornering. The status controller in the CAB can detect whether the vehicle is oversteering from the lateral acceleration signal together with the yaw rate signal.

Brake Pressure Sensor Signal

The brake pressure sensor(s) detect(s) the brake pressure that is used by the logic component to calculate the wheel brake forces (longitudinal forces). If ESP control becomes necessary, the existing wheel-brake forces (longitudinal forces) are taken into consideration when the cornering forces (lateral forces) are calculated.

Stop Lamp Switch Signal

When the brake pedal is actuated, signals from the dual contact switch are registered and evaluated by the ESP logic component. This process is terminated immediately if, for example, ASR control becomes active. In the case of ESP control, these information signals are processed in addition to the signal from the brake pressure sensor.

Moreover, the safety circuit continuously monitors the battery voltage. If the voltage falls below 10.5 V or exceeds 17.5 V, the system is switched off until the voltage returns to the specified range.

**Auxiliary Functions**

- BAS - The input signals are processed in the BAS circuitry of the CAB, and BAS braking sequence is initiated if required.
- Wheel Speeds and Speed Status Signal Outputs - Wheel speed output: the CAB provides Systems that require a wheel speed signal with the current wheel speed from each wheel.

**Indicator Lamp Actuation**

The CAB receives the signals from the brake lining wear contacts and the parking brake. These signals, together with the signals for the ABS and ESP indicator and warning lamps, are passed on to the IC over the CAN C Data Bus.

**Stop Lamp Switch**

The stop lamp switch is located on the brake pedal. It is a combination 2-pin/4-pin switch. The two-pin stop lamp switch sends a signal to the brake lamps when the brake pedal is pressed. A four-pin stop lamp switch also transmits a signal to systems that need to be informed of brake actuation.

- The switch is normally open contact for brake lamp.
- The switch is normally closed contact for control modules.

**Notes:**

## ENGINE MECHANICAL

A Mercedes Benz 3.2-liter SOHC 18-valve 90-degree V-6 engine powers the Chrysler Crossfire. It has a compression ratio of 10.0:1, requiring 91-octane premium-grade fuel. Refer to Figure 89.

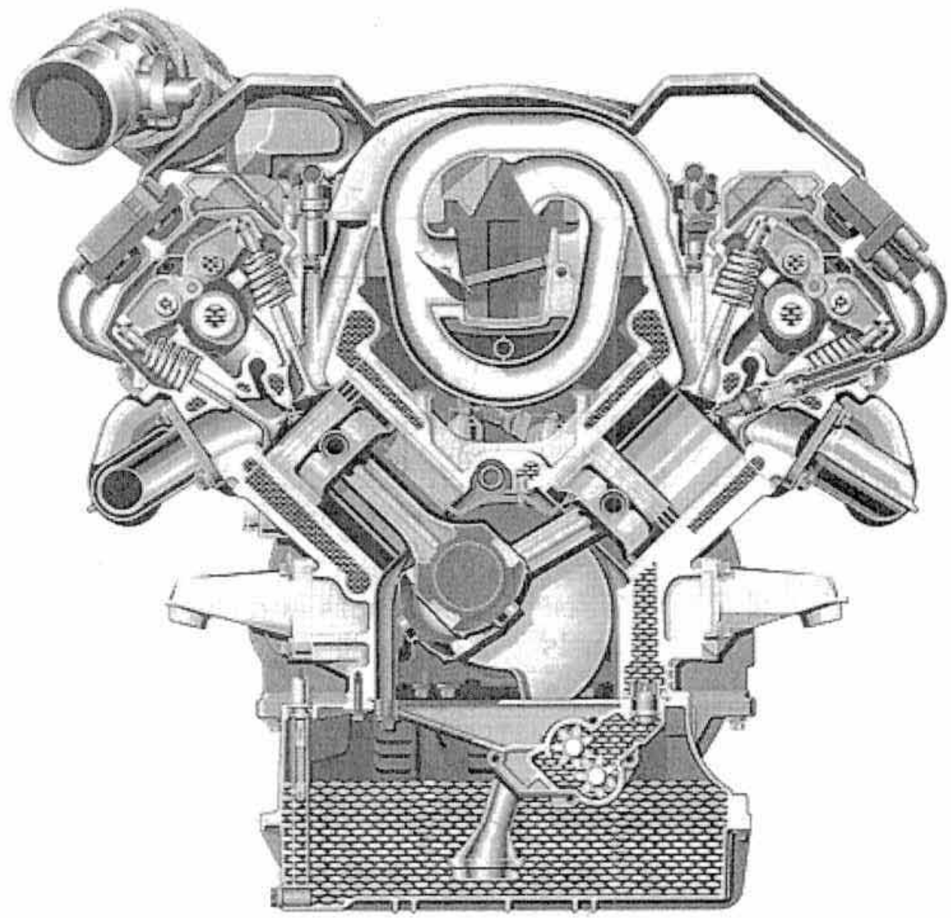


Figure 89 3.2-Liter V-6 Engine

This engine utilizes a short-stroke design which allows for larger valve diameters. This feature provides high intake airflow through two intake valves. A single exhaust valve minimizes exhaust emissions through rapid heating of the catalytic converter. Three valves allow the use of two spark plugs per cylinder for efficiency that results from low variation in combustion from one cylinder to the next, and consistent combustion for low emission of unburned fuel from the cylinders.

The engine is a modular design that can be built in various displacements. It uses a 90-degree V-angle like a typical V-8, which provides space for long intake manifold runners that offer high torque across a wide range of engine speeds. The engine has a split-pin (splayed) crankshaft for even firing and a balance shaft to compensate for the rocking motion that occurs with a 90-degree V-6.

The engine produces 215 bhp @ 5700 RPM and 230 lb.-ft. of torque @ 3000 RPM. Its 6000-RPM maximum operating speed is electronically limited by interrupting the fuel injectors. Ninety percent of max torque is available from about 2300-5300 RPM, 98% of max torque is available from 3000-4500 RPM.

**ENGINE SPECIFICATIONS**

| | |
|---|---|
| Type and Description | 90-Degree Bank Angle, Liquid-Cooled with Dual-Tuned Intake Manifold and Twin Ignition |
| Displacement | 3199 cu. cm (195.2 cu. in.) |
| Bore x Stroke | 89.9 x 84 (3.54 x 3.31) |
| Valve System | SOHC, 2 Intake Valves and 1 Exhaust Valve Per Cylinder, Roller Rocker Arms |
| Fuel Injection | Sequential, Multi-Port, Electronic |
| Construction | High-Pressure Die-Cast Aluminum Alloy Block with Silitec™ Alloy Liners and Cast Aluminum Alloy Heads |
| Compression Ratio | 10.0:1 |
| Power (SAE Net) | 160 kW (215 HP bhp) @ 5700 RPM (67.2 bhp/liter) |
| Torque (SAE Net) | 312 N•m (230 lb.-ft.) @ 3000 RPM |
| Max. Engine Speed | 6000 RPM Electronically Limited |
| Fuel Requirement | Unleaded premium, 91 Octane (R+M)/2 |
| Emission Controls | Three-Way Catalytic Converters and Internal Engine Features |
| Estimated EPA Fuel Economy (MPG City/Hwy.) | 18/27 – Manual Transmission<br>21/27 – Automatic Transmission |

**PERFORMANCE FEATURES**

A variable runner length intake manifold provides a supercharging effect to airflow entering the cylinders as the intake valve opens. Long individual tubes for each cylinder that enhance low-speed torque have a tuned length of 32.9 inches (835 mm). This length is achieved by coiling the tubes in the valley of the cylinder block. In these tubes, the air rotates 450 degrees from entry to cylinder head. To achieve a similar effect at higher speeds, a tube length of 18.3 inches (465 mm) is used. Butterfly valves in the walls of the long tubes, operated by the PCM, switch the flow between long and short flow paths at approximately 3700 RPM. The engine speed for switchover to the short tubes provides an indiscernible change in engine torque, because the maximum supercharging effect is consistent throughout the 2000- to 5000-RPM speed range.

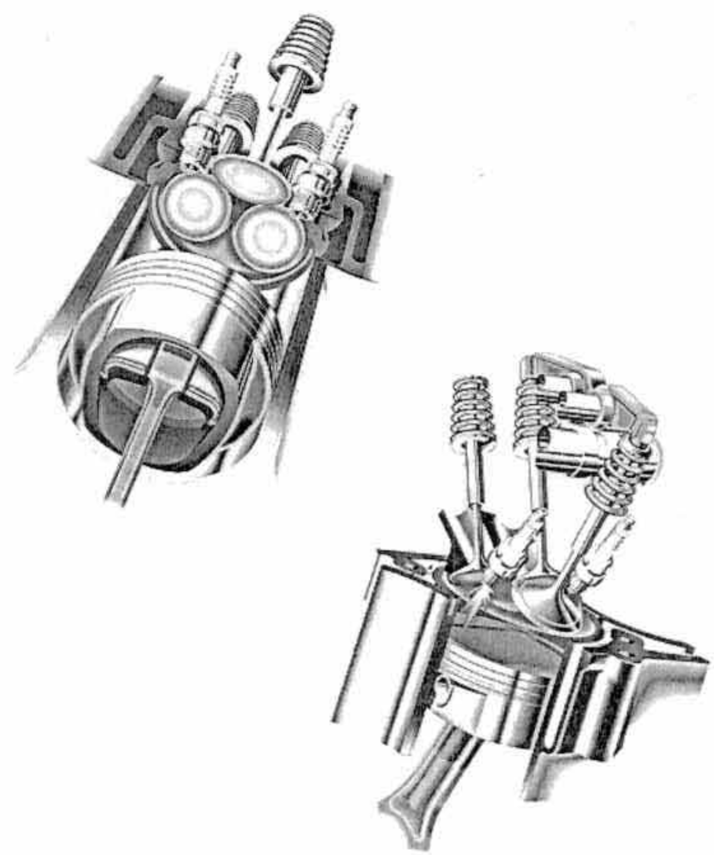


Figure 90 Valve and Spark Plug Configuration

Dual spark plugs (Fig. 90) provide uniform combustion that allows a high compression ratio to maximize power output without causing the engine to knock. Consistent combustion also allows the intake ports to provide maximum airflow.

The effect of using a single exhaust valve has been minimized by adjusting the exhaust valve timing to open the valve sooner in the cycle.

**INTAKE MANIFOLD**

A magnesium two-stage resonance intake manifold has long runners to enhance low-speed torque and shorter runners for added horsepower. The runners, and the plenum chamber that feeds them, are positioned between the cylinder banks.

Components of the multi-piece die-cast manifold are bonded together with adhesive.

**EXHAUST MANIFOLDS**

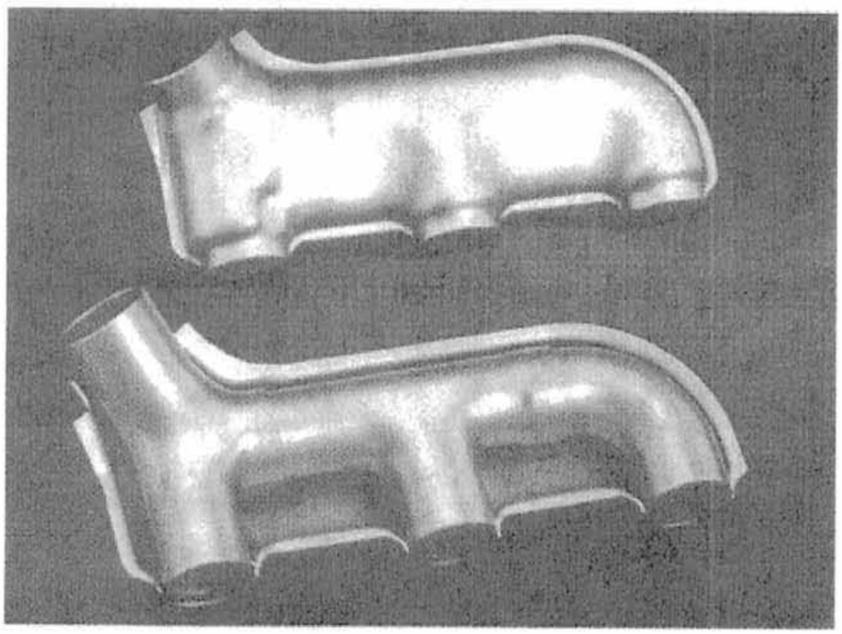


Figure 91 Exhaust Manifold

Thin-wall air-gap construction for the exhaust manifolds (Fig. 91) reduces underhood temperature by keeping heat in the exhaust stream. This also allows the catalytic converter to be mounted in a more beneficial position for packaging, under the floor instead of close to the engine. Stainless steel inner manifolds, separated by an air space from two-piece stainless steel outer shells, reduce heat loss to the air.

Hydro-formed inner manifolds are laser welded to the cylinder head flanges, exhaust pipe flanges and the outer shells.

**CYLINDER HEADS AND COVERS**

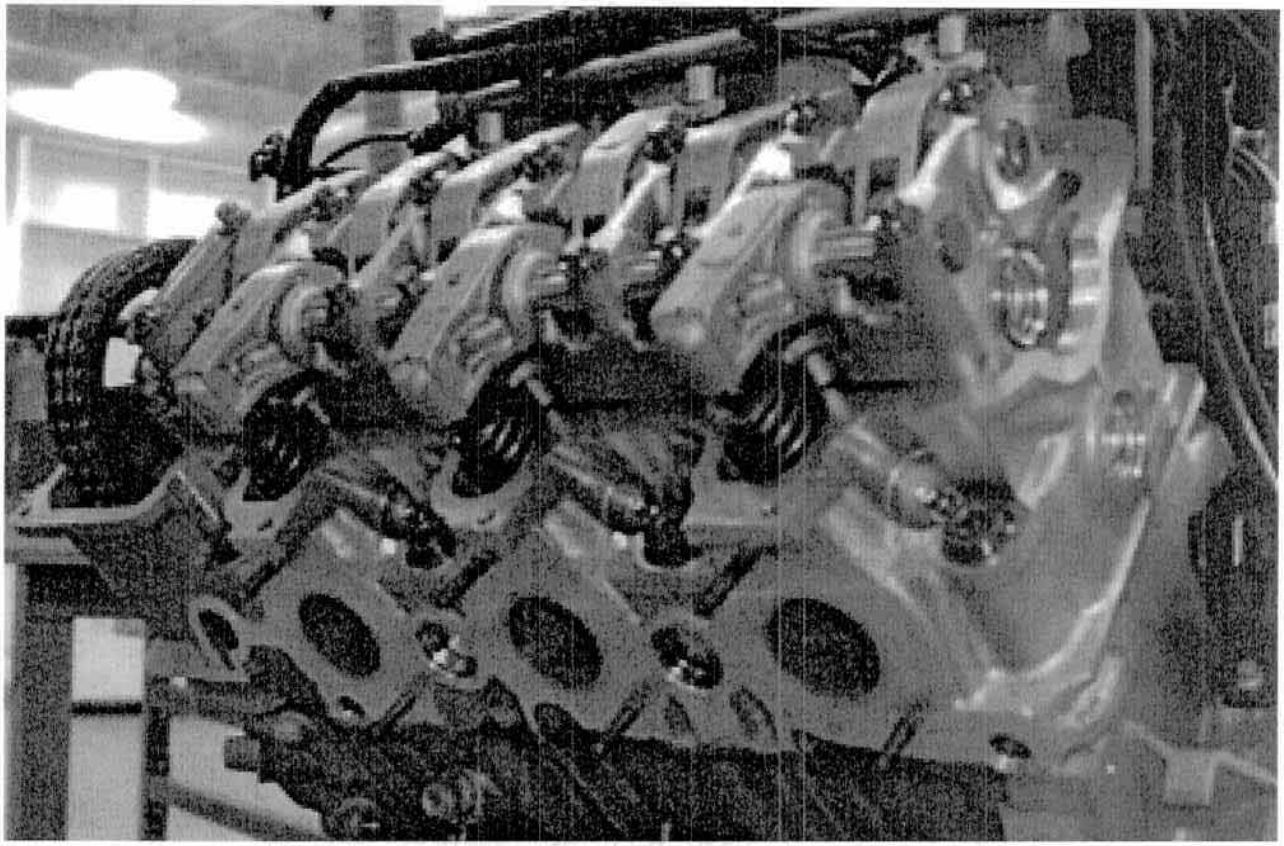


Figure 92 Cylinder Head

The single overhead camshaft aluminum alloy cylinder heads have two intake and one exhaust valve per cylinder. Three valves per cylinder minimize exhaust port surface area. Refer to Figure 92.

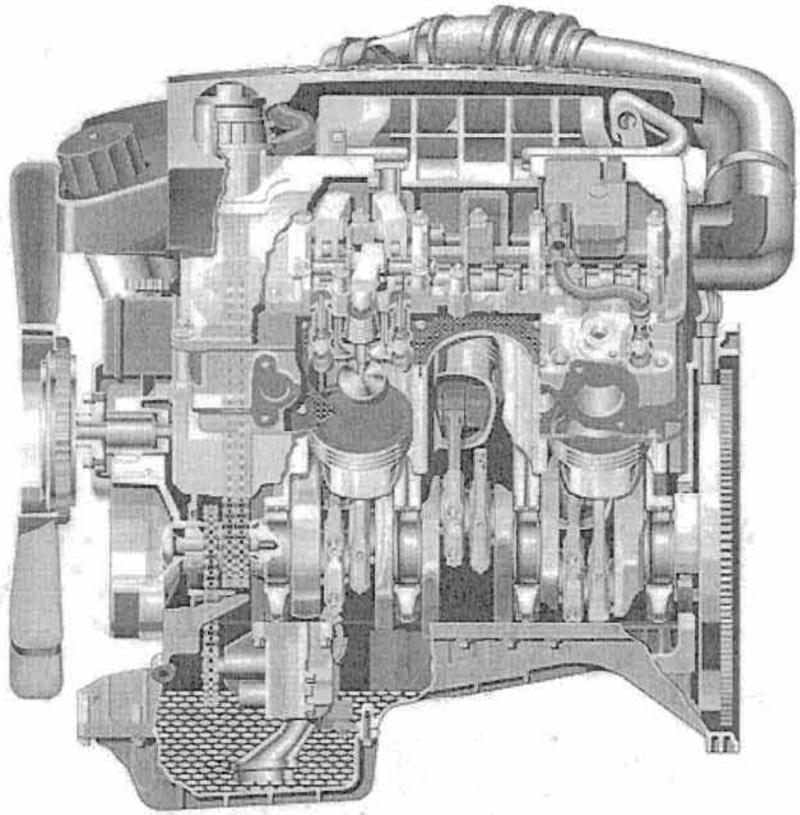


Figure 93 3.2-Liter V-6 Engine ( Longitudinal Cross Section)

The three-valve configuration simplifies the engine by allowing use of one cam per bank rather than two, and provides room in the combustion chamber for two spark plugs that provide more complete combustion (Fig. 93). The valves are set at an angle of 35.5 degrees, forming a shallow combustion chamber. A central passage in each head that connects with each cylinder, delivers recirculated exhaust if needed, to reduce exhaust emissions.

The camshafts turn directly in the head; no bearing inserts are used. Transverse coolant flow within the head provides cooling of the exhaust valve seats and minimizes heat extraction from the exhaust ports which enhances catalytic converter warm up.

Magnesium cylinder head covers are lightweight, dampen valve noise and provide trouble-free sealing. The heads are cast in two pieces to create internal ventilation passages with oil separators for crankcase vapor ventilation. This ventilation system prevents oil sludge from forming due to water vapor in the engine.

**CYLINDER BLOCK**

The cylinder block for this engine is made of a high-pressure die-cast aluminum alloy. It has cast-in-place, aluminum-silicon alloy bore liners for wear resistance. For additional stiffness, the sidewalls of the block extend below the centerline of the crankshaft, the main bearing caps are cross-bolted and the oil pan is made of structural cast aluminum.

**VALVE TRAIN**

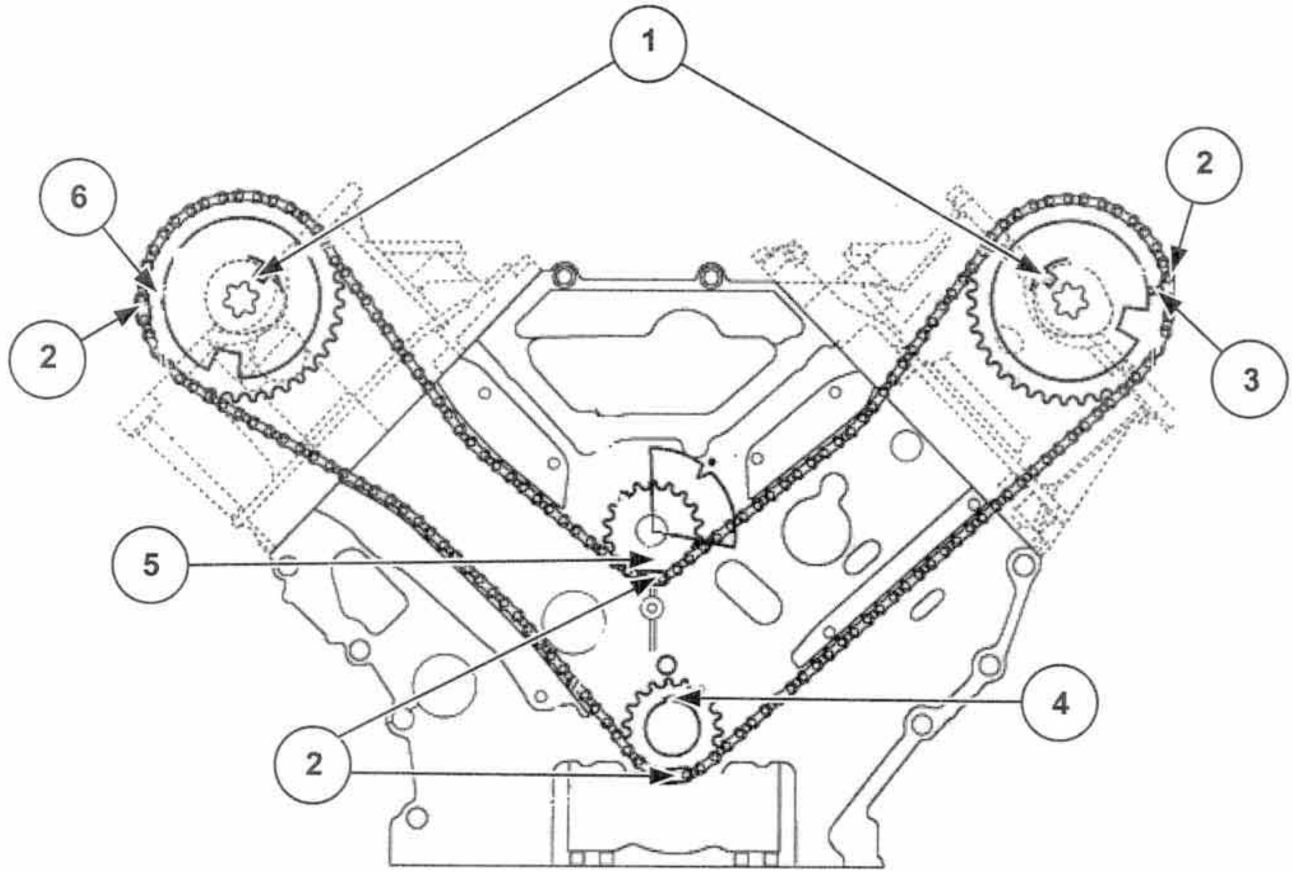
Two 36-mm (1.42-in.) intake valves, and a single 41-mm (1.61-in.) exhaust valve per cylinder are operated by a double-width, roller chain-driven camshaft per bank using roller rocker arms.

Lightweight hydraulic adjusters in the rocker arms at the valves take up valve clearance for quiet operation. The rocker arms are pressure-cast aluminum. They pivot through roller bearings on rocker shafts bolted to the heads.

Valve springs are conical which reduce spring and retainer weight, and the exhaust valve heads are sodium filled to keep them cool for long life.

The induction-hardened, forged-steel camshafts are hollow. The cam and crankshaft sprocket teeth are rubber coated, making chain noise indiscernible from other engine noise.

**ENGINE TIMING**




| | | | |
|---|---|---|---|
| 1 | Slot in Camshaft | 4 | Slot in Crankshaft |
| 2 | Copper Plate | 5 | Marking on Balancing Shaft Sprocket |
| 3 | Marking on Left Camshaft Sprocket | 6 | Marking on Right Camshaft Sprocket |

Figure 94 Timing System

The four copper plates help to install the timing chain. Each copper plate has to be matched with one of the markings (camshafts, balancing shaft). Refer to Figure 94.

Refer to the Service Information for complete timing procedures.

**PISTONS, CONNECTING RODS AND CRANKSHAFT**

This engine has flat-topped aluminum pistons with machined pockets for valve clearance, and asymmetrical skirts for low-temperature noise control. The pistons are formed from an aluminum alloy to handle the high temperatures created by dual ignition. The upper portion of the piston is hard anodized which protects the top ring. The piston skirts have an iron coating. Three, low-tension piston rings provide compression control with low oil consumption.

The connecting rods are forged in one piece from steel. The rods are cracked rather than machined along the split line that provides a perfect fit. The rods are drilled longitudinally to deliver oil under pressure to the full-floating wrist pins, minimizing wear for long life.

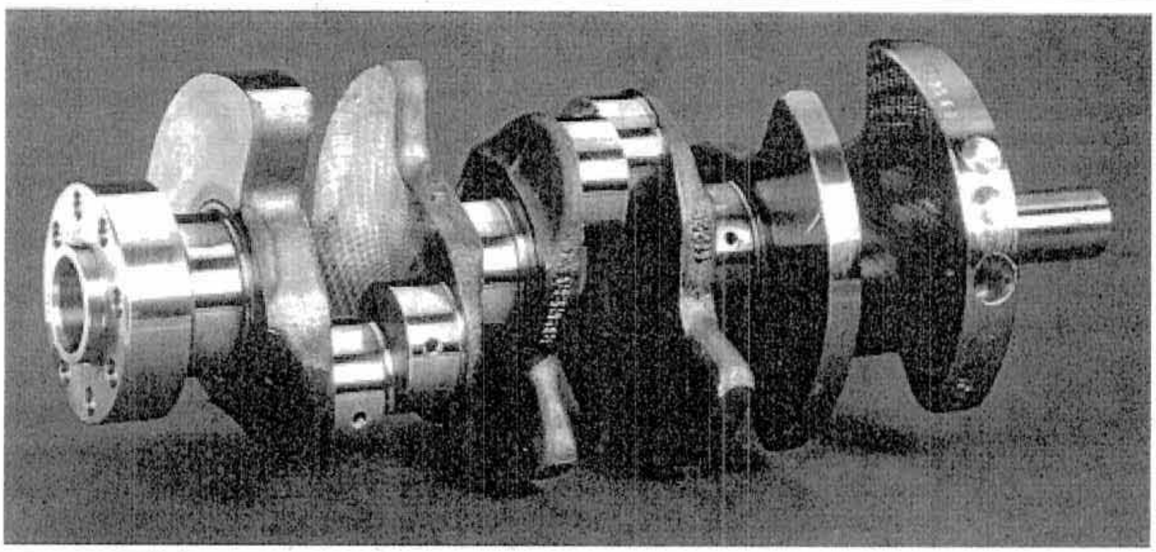
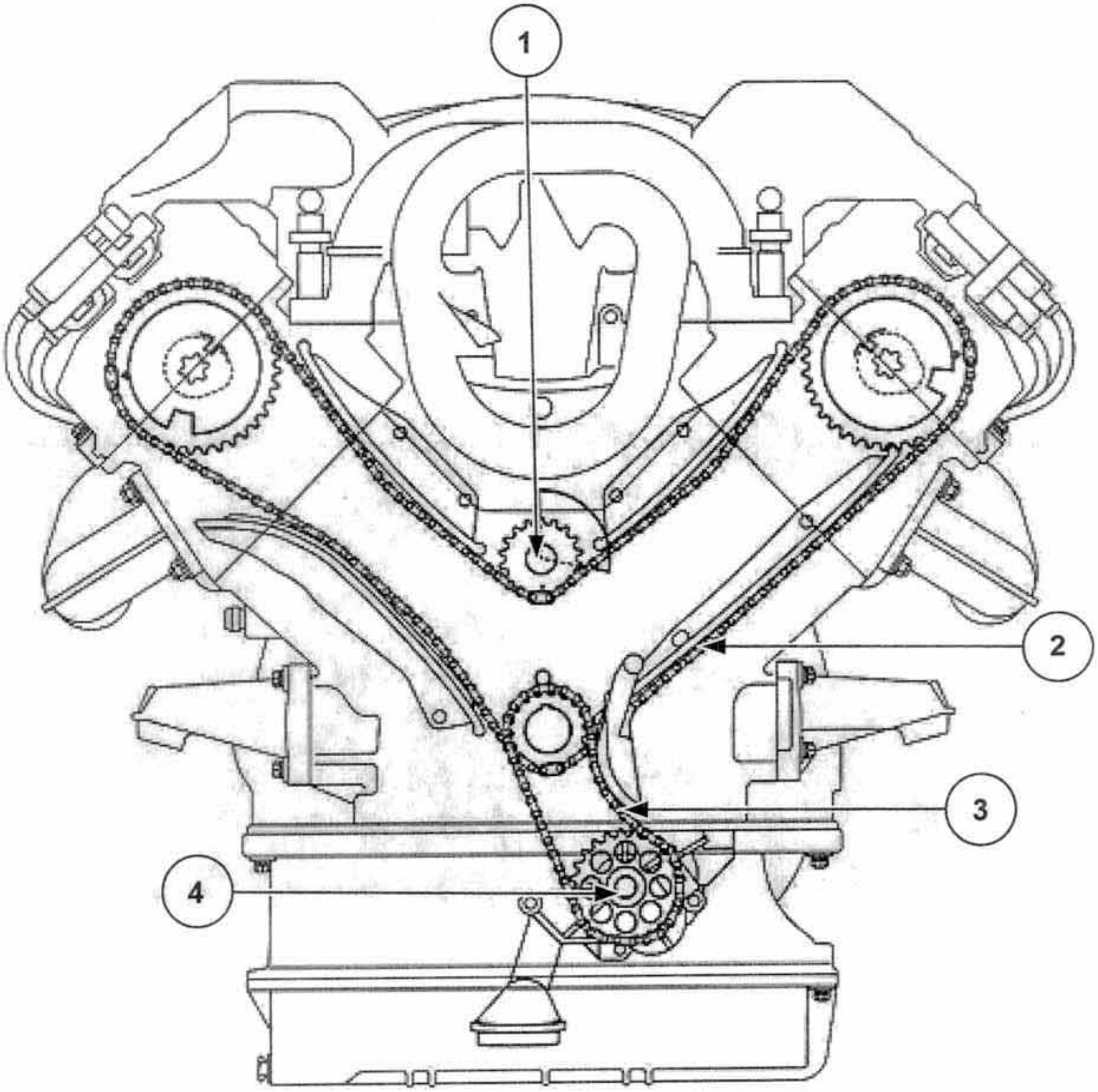


Figure 95 Crankshaft

The crankshaft (Fig. 95) is made of forged steel. Thirty-degree offset crank pins on the crankshaft, provide 120-degree firing intervals.

**BALANCE SHAFT**




| | | | |
|---|---|---|---|
| 1 | Balance Shaft | 3 | Oil Pump Drive Chain |
| 2 | Camshaft Drive Chain | 4 | Oil Pump |

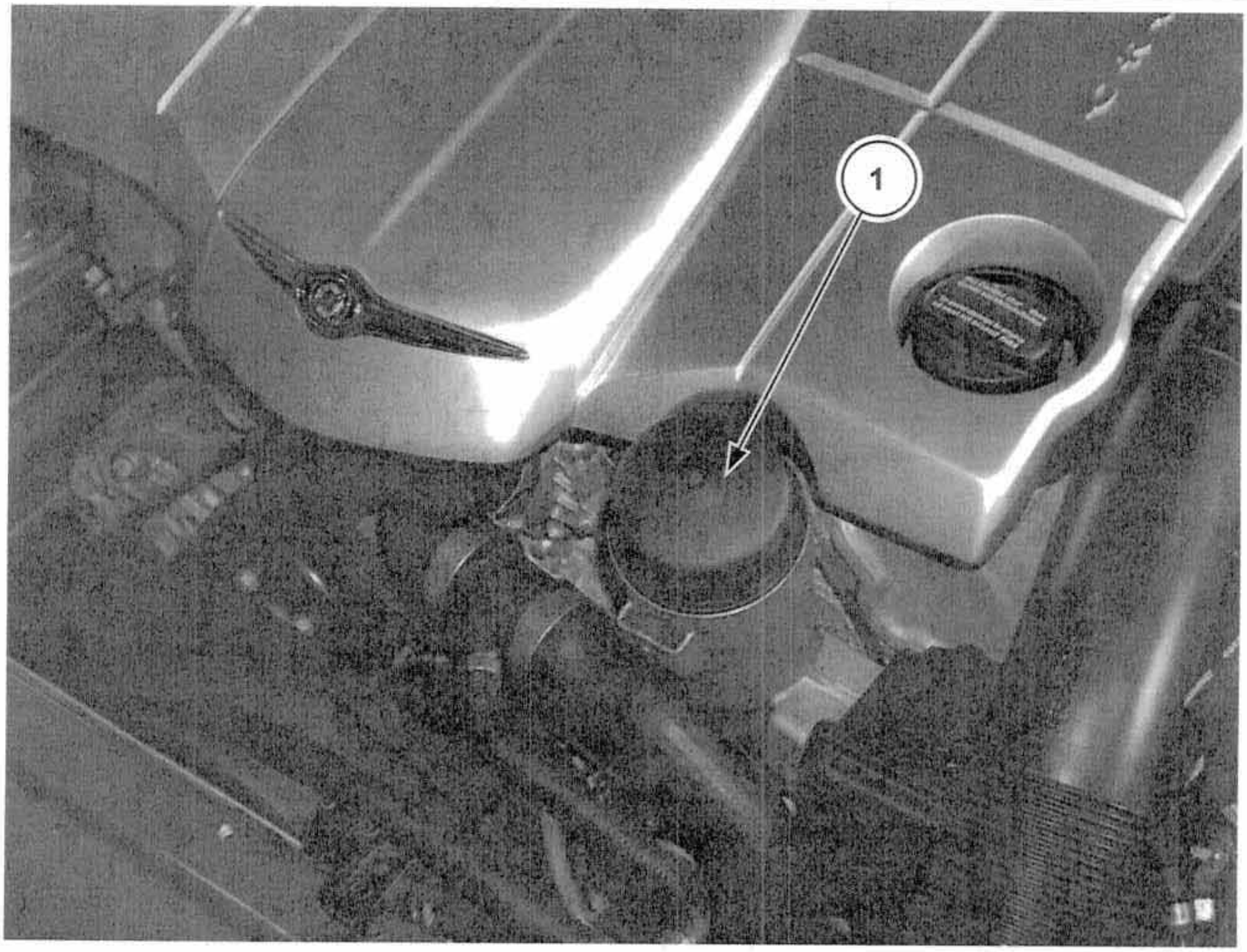
Figure 96 Chain Drives with Balance Shaft and Oil Pump

A balance shaft (Fig. 96) is used to compensate for the rocking motion inherent in a 90-degree V-6 engine. It rotates at engine speed in the opposite direction. The balance shaft is mounted above the crankshaft in the cylinder block and is driven by the camshaft timing chain.

## ACCESSORY DRIVE

A single, serpentine, poly-V belt drives the air conditioning compressor, generator, power steering pump and the engine water pump. The accessory drive includes an automatic tensioner, making adjustments unnecessary for the life of the belt.

## ENGINE OIL PUMP, FILTER, COOLER AND SENSOR




| | |
|---|---|
| 1 | Cartridge-Type Oil Filter Housing |

Figure 97 Cartridge-Type Oil Filter Housing

The gear-type oil pump is located under the crankshaft and is driven from the crankshaft by a separate roller chain. Rubber-coated sprockets for the chain reduce noise. The oil filter housing (Fig. 97) is mounted on the upper side of the front of the engine. It uses a replaceable cartridge that can be accessed by removing the plastic housing cover.

An oil cooler mounted with the filter on the engine uses coolant from the radiator to control engine oil temperature.

## Oil Sensor

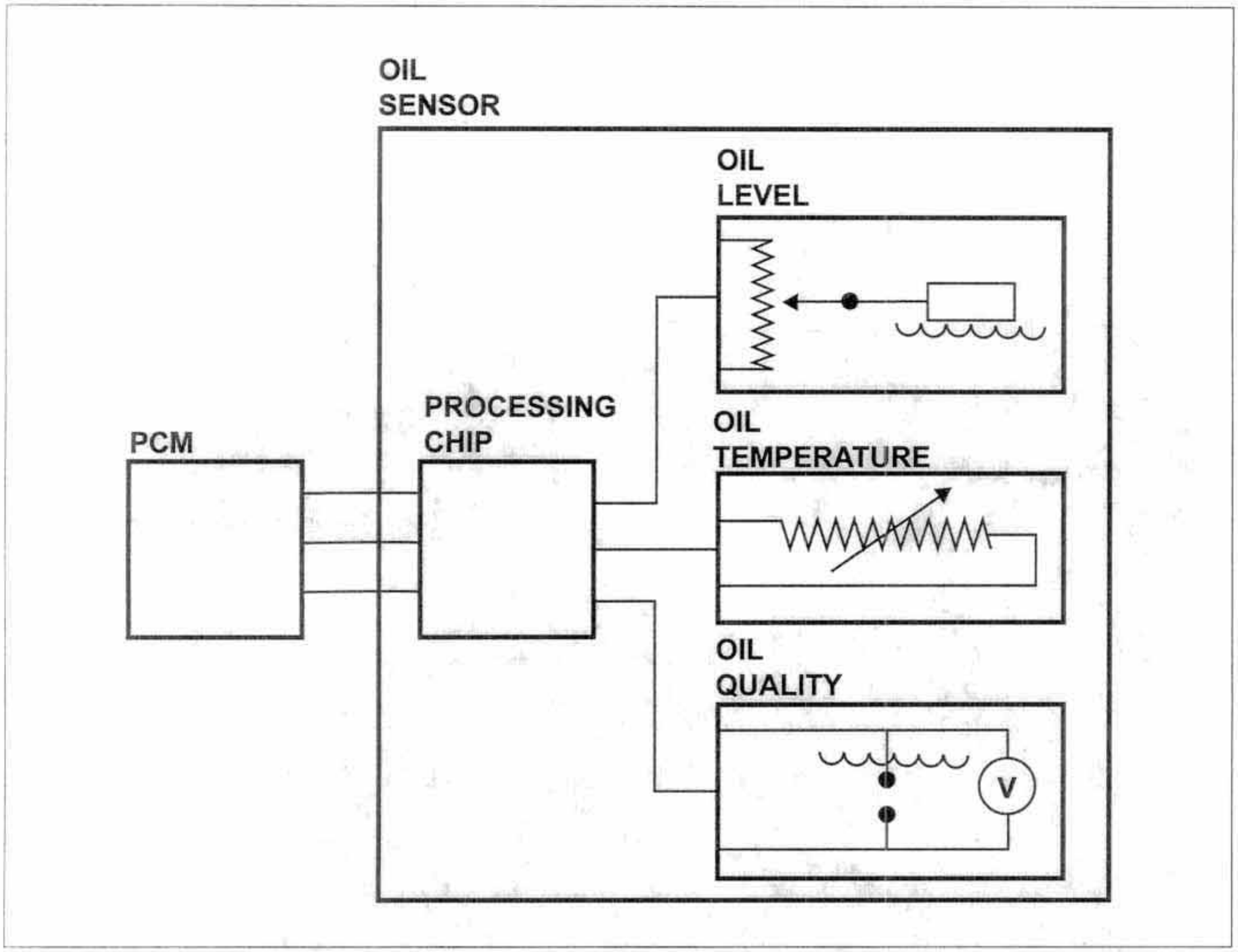
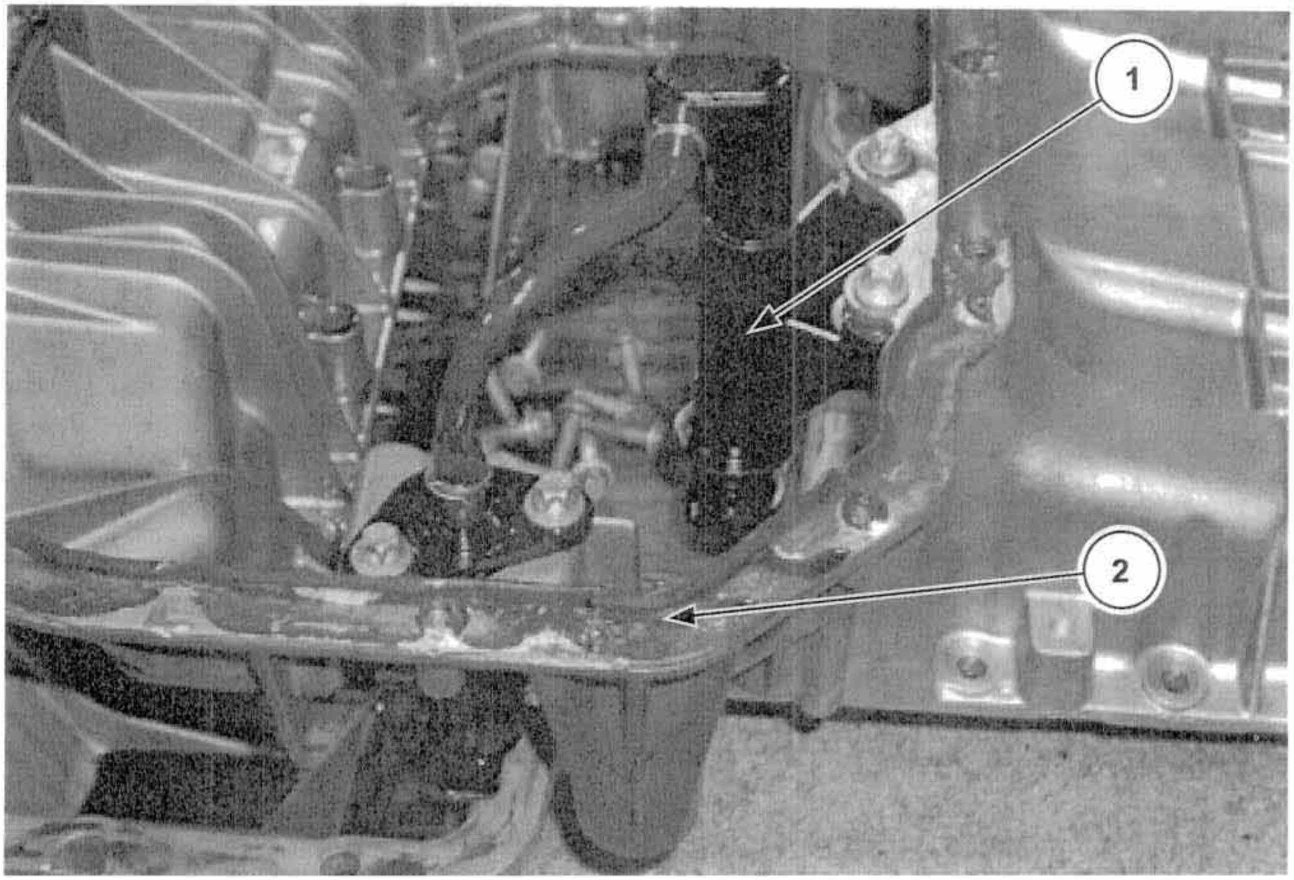



Figure 98 Oil Sensor Block Diagram

To produce an accurate determination of required oil change intervals, the Crossfire uses a sophisticated three-part oil sensor. It is used as part of the Flexible Service System (FSS). Calculations (such as oil level and time to next oil change) performed by this system can be observed in the vehicles odometer.

Oil Sensor

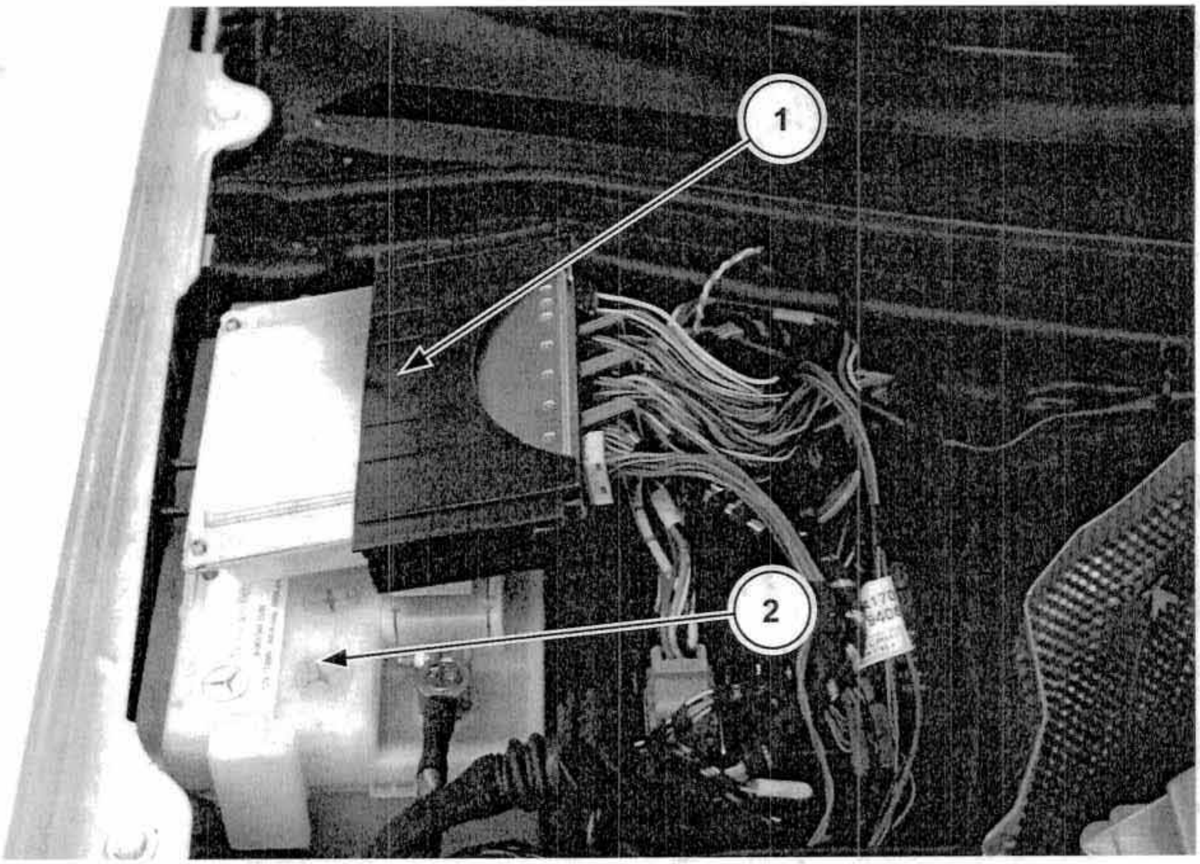



| | | | |
|---|---|---|---|
| 1 | Oil Sensor | 2 | Oil Pan |

Figure 99 Oil Sensor

The oil sensor is located on the right side of the engine oil pan (Fig. 99). The oil sensor uses a three-wire circuit, 5-volt VREF, ground and a 5-volt digital signal circuit. The oil sensor contains three sensors that act as one. It contains sensing components and circuitry to determine the level, temperature and quality of the engine oil. The processing chip within the oil sensor collects the information from these three inputs and processes it into a 0-5 volt square wave signal that it sends to the PCM over a dedicated circuit.

Powertrain Control Module (PCM)




| | | | |
|---|---|---|---|
| 1 | Powertrain Control Module (PCM) | 2 | Battery |

Figure 100 Powertrain Control Module (PCM) (Shown Removed)

The PCM is located in the control module box (Fig. 100). The PCM receives inputs from the oil sensor via a hardwired connection. It calculates the useful life of the engine oil based on the level, temperature and quality of the oil. This information is bussed over the Engine CAN C Bus to the IC.

**Sensor Operation**

The processing chip within the oil sensor receives a signal from a three-wire position sensor that uses a 5-volt reference and ground. The third (signal) wire is connected to the variable resistance wiper. As oil levels change the wiper is moved by a float and produces a signal that reflects the current oil level.

The processing chip within the oil sensor receives a signal from a Negative Temperature Coefficient (NTC) resister type temperature sensor. The sensor uses a 5-volt VREF and produces a voltage signal that is inversely proportional to engine oil temperature.

The processing chip within the oil sensor receives a signal from an oil quality sensor. The oil quality sensor runs current through an oil sample and measures its voltage drop. Fresh oil is a good insulator and would produce a high voltage drop across two probes. As the oil wears out (viscosity thins out, becomes contaminated etc...) the oil becomes more of a conductor and voltage drop decreases.

Checking Engine Oil Level

A sensor in the oil pan allows oil level to be checked without opening the hood. It provides an accurate measurement of oil level. The low engine oil level indicator warns that oil level is too low. Although this is a quick way to check the oil level, a dipstick is provided for manually checking the oil level.

With the vehicle parked on a level surface, the engine is warmed up and shut off for approximately five minutes. When the ignition switch is turned to the RUN position, an ISO oil level icon appears in the trip odometer window and a clock icon in the cumulative odometer display. Pressing the knob to the left of the speedometer twice displays one of the following messages:

1. OK
2. –1.0L (1.0 Q)
3. –1.5L (1.5 Q)
4. –2.0L (2.0 Q)
5. HI

The indicated amount of oil must be added to the engine if the message –2.0 L (–2.0Q) blinks and a signal sounds. The HI messages means that the excess oil must be removed from the pan to avoid engine or catalytic converter damage. If the oil level icon and clock icon stay on when attempting to check oil level and no message follows, or if the low engine oil level warning lamp comes on, it means there is a malfunction in the engine oil level system.

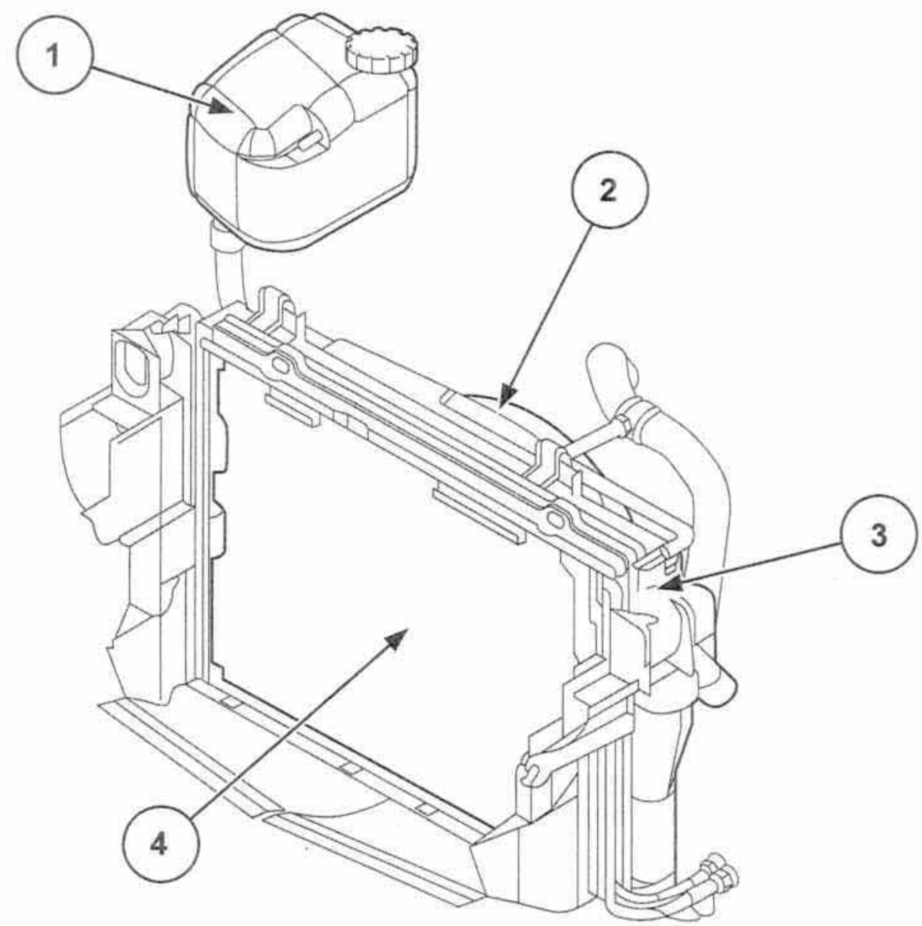
The cartridge-type oil filter on the Crossfire must be removed before draining the oil. Refer to the Service Information for procedures.

**FLEXIBLE SERVICE SYSTEM**

A computer- and sensor-supported maintenance system called FSS allows for individual vehicle maintenance intervals up to 30,000 km (18,500 miles) and servicing at intervals between one and two years. It also notifies the driver if maintenance is needed sooner.

- FSS calculates and displays in the IC the distance remaining to the next regular maintenance service based on actual driving conditions and oil quality.
- The computer keeps a running track of driving conditions and calculates a load collective that correlates to wear and tear on the oil, using equivalency factors for hard driving, normal driving and light driving.
- The display shows the number of miles under present driving style until the service interval is reached.
- The computer also monitors oil and water temperature, RPM, vehicle speed, miles driven, load and oil added. It compares this data to a model that determines when it is time to change the oil.
- An engine oil level sensor measures the dynamic oil level during driving and also senses oil (thinning) dilution or high metal content. If specific limit values are reached, the driver is notified that an oil change is needed.
- The sensor is also able to receive the static oil level and notify the driver if it is too high or too low through the trip odometer in the IC.

**ENGINE COOLING**



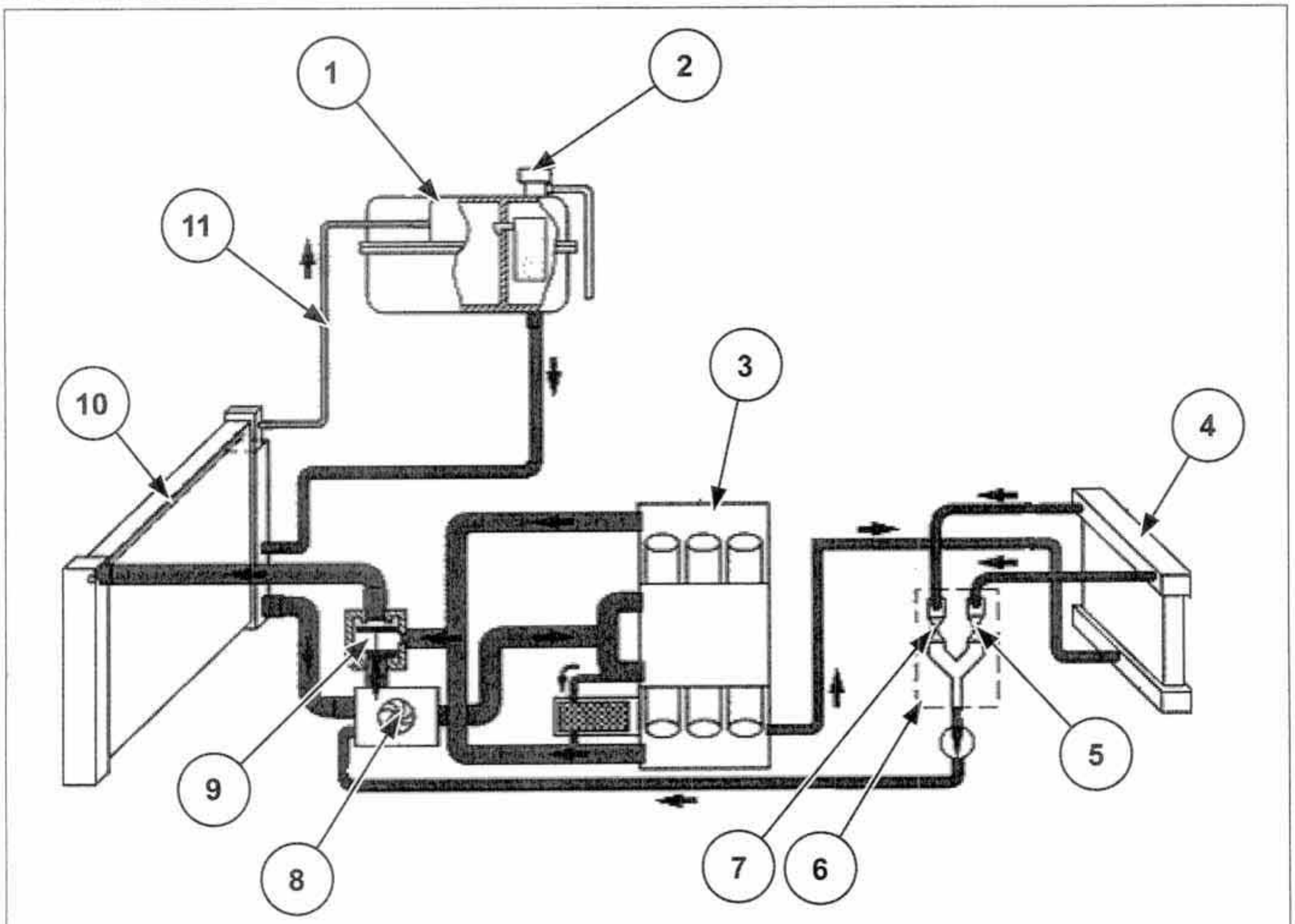

| | | | |
|---|---|---|---|
| 1 | Coolant Recovery Reservoir | 3 | Radiator |
| 2 | Fan Shroud | 4 | Condenser |

Figure 101 Cooling System Components

A conventional cross-flow aluminum core radiator cools the engine. The coolant recovery reservoir includes a coolant level sensor. A bypass circuit and additional coolant pump can continue to circulate coolant through the heater core when the engine is off. Refer to Figure 101.

A level sensor in the overflow reservoir notifies the driver if there is insufficient coolant by illuminating the low engine coolant-warning lamp in the IC. An electric fan, which is switched on and off by the PCM, draws air for added cooling when needed.

**Coolant Flow**

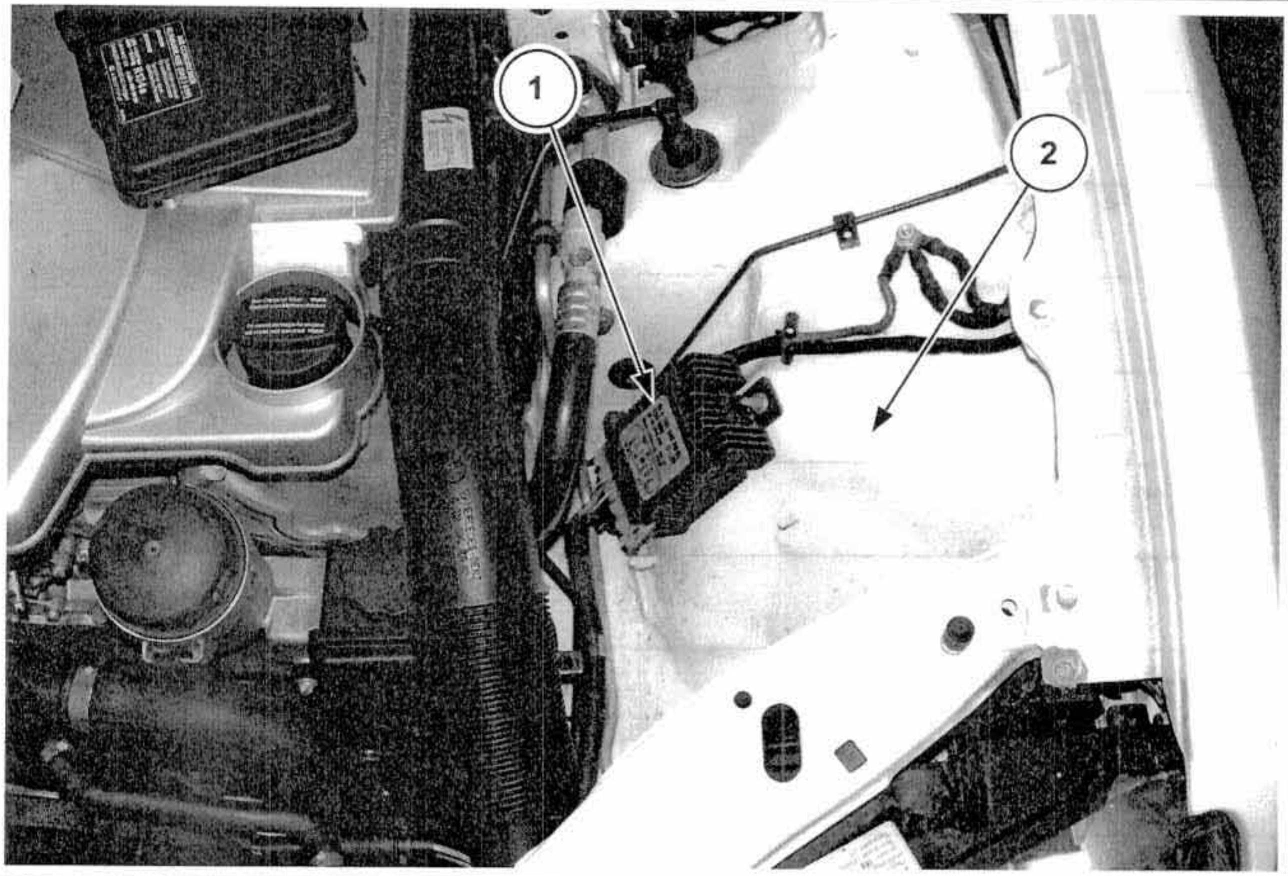



| | | | |
|---|---|---|---|
| 1 | Coolant Recovery Reservoir | 7 | Right Coolant Circulation Valve |
| 2 | Two-Stage Coolant System Cap | 8 | Coolant Circulation Pump |
| 3 | Engine | 9 | Thermostat |
| 4 | Heater Core | 10 | Radiator |
| 5 | Left Coolant Circulation Valve | 11 | Bypass |
| 6 | Heating System Delivery Unit | | |

Figure 102 Cooling System Flow Diagram

The reverse-flow cooling system (Fig. 102) sends cooled water first to the heads and then through the block for improved cooling and more even temperature distribution. The water pump is integrated into the front engine cover. It sends heated water coming from the block through the lower radiator hose into the radiator. The cooled water then passes through the upper hose into the thermostat, which is also mounted into the front cover of the engine.

**Radiator Fan Control Module**




| | | | |
|---|---|---|---|
| 1 | Radiator Fan Control Module | 2 | Left Inner Fender |

Figure 103 Radiator Fan Control Module

The PCM sends a signal to the radiator fan control module (Fig. 103) to energize the relay and operate the fans.

## OIL AND COOLANT CAPACITIES

| | |
|---|---|
| Oil Capacity | 5.75 L (6.1 qt.) with Filter |
| Coolant Capacity | 11.2 L (11.8 qt.) |

**Notes:**

# ENGINE MANAGEMENT

## POWERTRAIN CONTROL MODULE (PCM)

### DESCRIPTION

The PCM is concealed in the engine compartment inside the control module box located next to the battery. The PCM utilizes integrated circuitry and information carried on the CAN C data bus along with many hard-wired inputs to monitor many sensor and switch inputs throughout the vehicle. In response to those inputs, the internal circuitry and programming of the PCM allow it to control and integrate many electronic functions and features of the vehicle through both hardwired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the CAN C data bus. The PCM for this model is serviced only as a complete unit. A PCM can only be repaired by, or replaced through an authorized electronic warranty repair station. Refer to the latest version of the warranty policies and procedures manual for a current listing of authorized electronic repair stations.

### OPERATION

The PCM is a pre-programmed, microprocessor-based digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions. The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as PCM outputs. The sensors and switches that provide inputs to the PCM are considered PCM inputs. The PCM adjusts ignition timing based upon inputs it receives from sensors that react to:

- Engine RPM
- Manifold Absolute Pressure
- Engine Coolant Temperature
- Throttle Position (TP)
- Transmission Gear Selection (A/T)
- Vehicle Speed
- Brake Switch

The PCM adjusts idle speed based on inputs it receives from sensors that react to:

- TP
- Vehicle speed
- Transmission gear selection
- Engine coolant temperature
- Air conditioning clutch switch
- Brake switch

Based on inputs that it receives, the PCM adjusts ignition and fuel injector timing. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

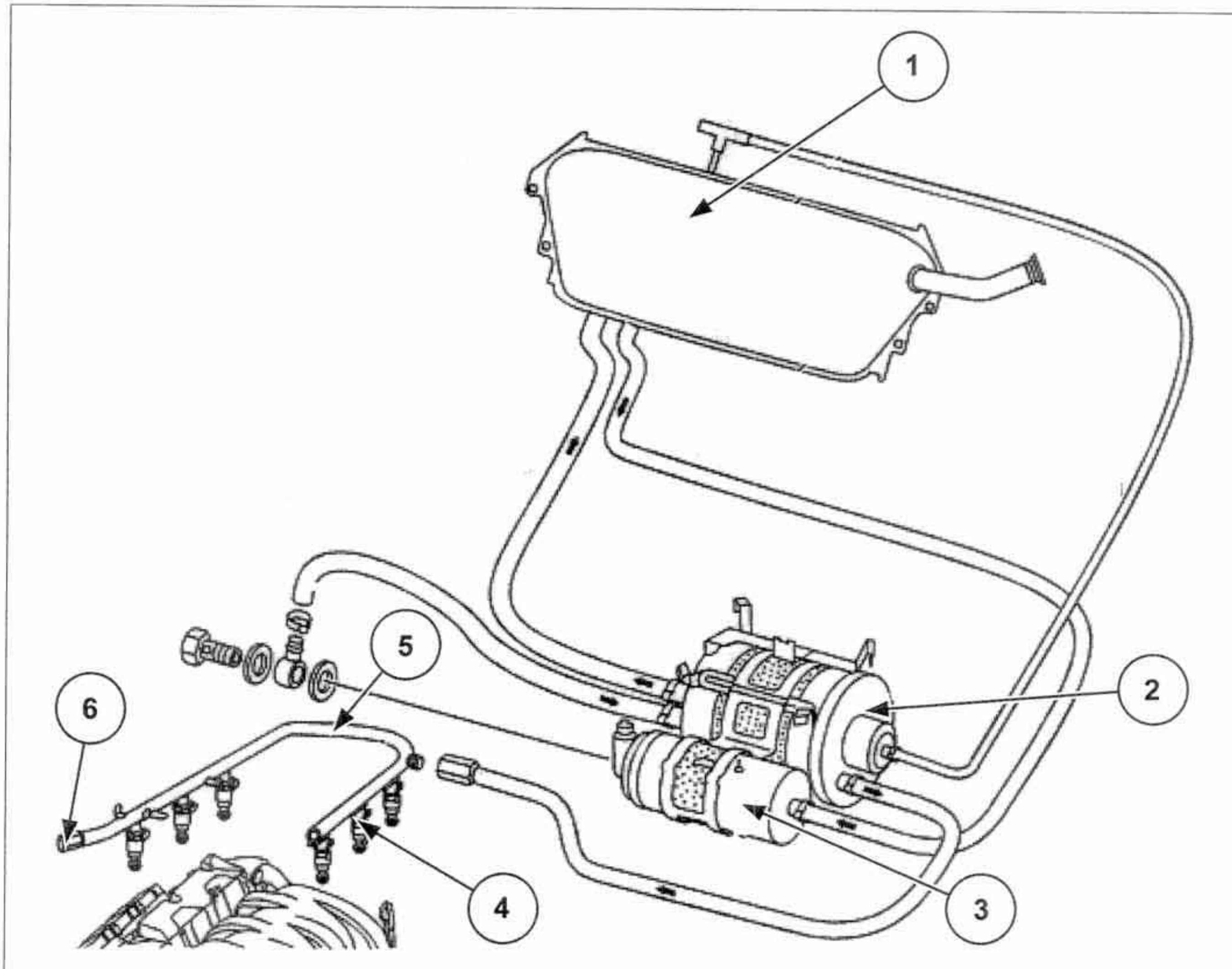
Refer to the Service Information for complete PCM replacement and SKREEM programming procedures.

**FUEL SYSTEM**

The fuel supply system provides the necessary quantity of filtered fuel from the fuel tank and at the optimum injection pressure to the fuel injectors in all operating conditions. The fuel pump draws the fuel out of the fuel tank and pumps it through the fuel filter pressure regulator to the injectors connected to the fuel rail. The diaphragm pressure regulator controls the fuel pressure. The fuel pressure is regulated despite the intake manifold pressure.

If the throttle is opened, the fuel supply is assured by the adapted acceleration enrichment. The large-volume fuel rail prevents the formation of vapor bubbles. Refer to Figure 104.

**Fuel Flow**



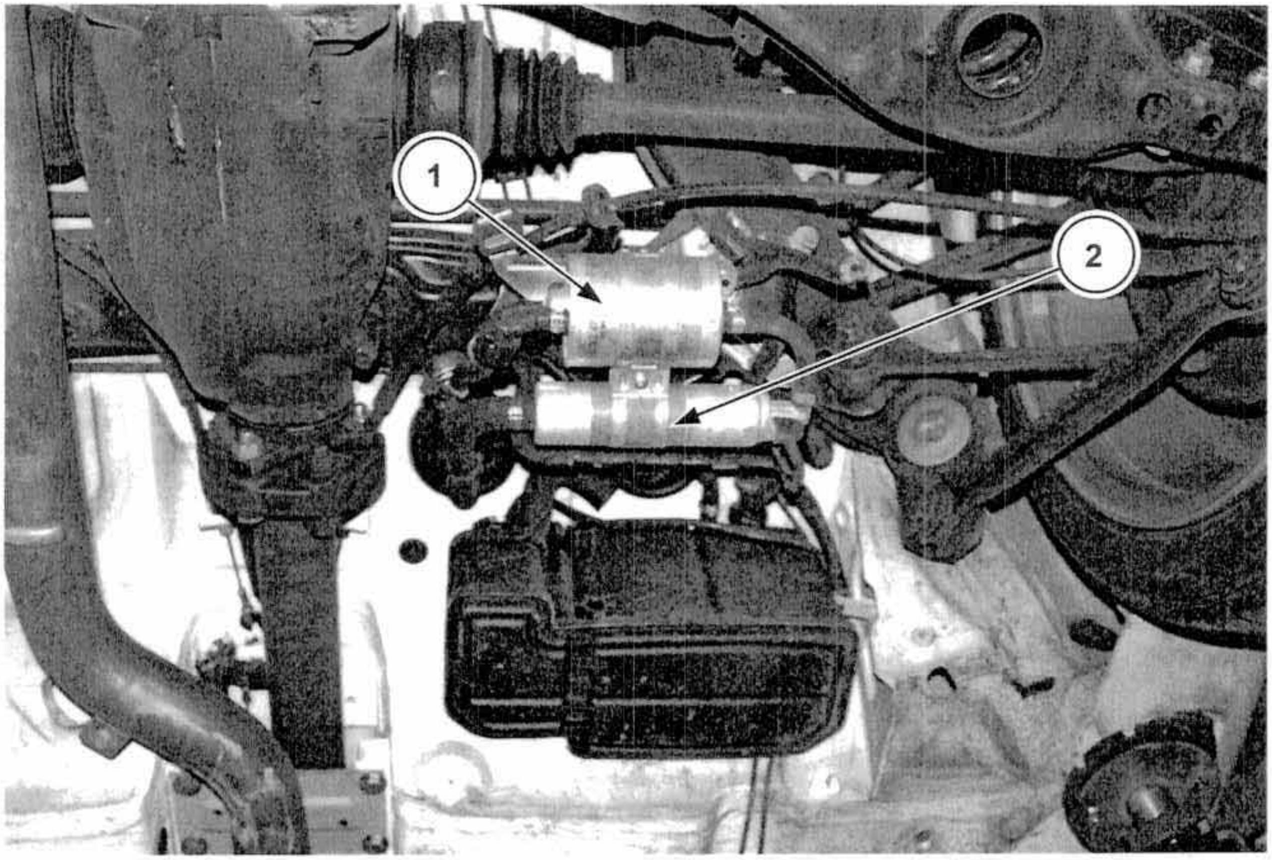

| | | | |
|---|---|---|---|
| 1 | Fuel Tank | 4 | Fuel Injectors |
| 2 | Fuel Filter w/ Pressure Regulator | 5 | Fuel Rail |
| 3 | Fuel Pump | 6 | Pressure Measuring Connection |

Figure 104 Fuel Flow Diagram

Excess fuel flows back from the diaphragm pressure regulator in the fuel filter to the fuel tank. Air is admitted to the diaphragm pressure regulator in the fuel filter by line to the evaporative emission control system.

The fuel injectors operated by the PCM spray the finely atomized fuel into the inlet port.

Fuel Filter and Fuel Pump



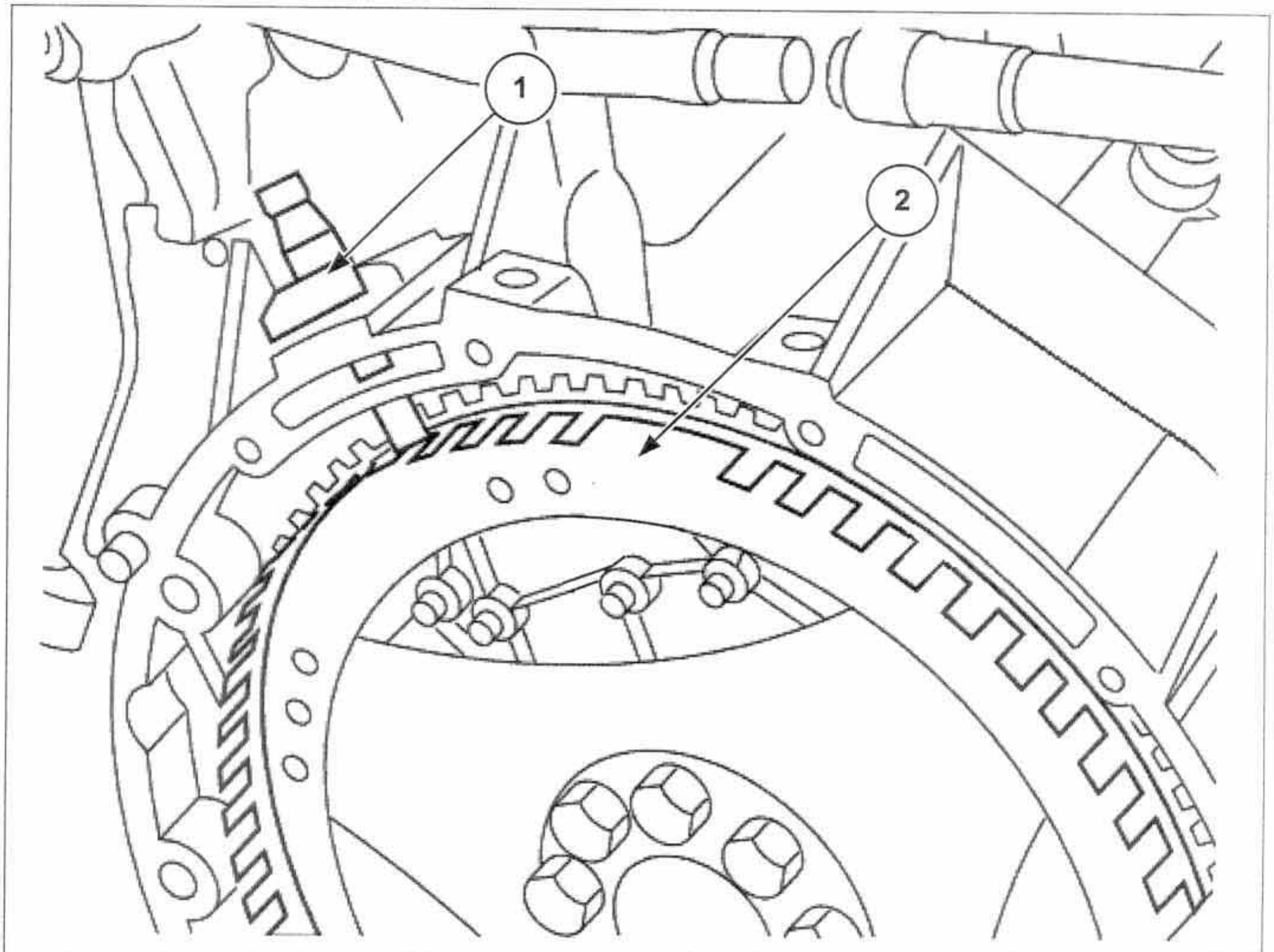

| | | | |
|---|---|---|---|
| 1 | Fuel Filter w/ Fuel Pressure Regulator | 2 | Fuel Pump |

Figure 105 Fuel Filter and Fuel Pump

The fuel pump pumps more fuel than the engine requires to maintain the pressure in the fuel system in all operating states. Refer to Figure 105. Because of this circulation, relatively cool fuel is always available for injection, which prevents the formation of vapor bubbles. A pressure relief valve is integrated in the fuel filter to limit the pressure.

The check valve in the fuel pump decouples the fuel system from the fuel tank by preventing fuel from flowing back through the fuel pump to the fuel tank. The fuel pump is actuated by the PCM through the fuel pump relay. The relay is actuated by the PCM.

Crankshaft Position Sensor




| | | | |
|---|---|---|---|
| 1 | Crankshaft Position Sensor | 2 | Flywheel |

Figure 106 Crankshaft Position Sensor

The Crankshaft Position Sensor (CKP) is an inductive sensor (coil) with a 2-pin plug contact. The position of the crankshaft and engine speed is detected without contact. The distance between the CKP and the teeth of a driven plate is fixed during assembly. When the crankshaft is turning, an alternating voltage is generated in the crankshaft position sensor by the teeth of the driven plate. Refer to Figure 106.

The front edge of a tooth generates a positive voltage pulse, and the rear edge generates a negative voltage pulse. The distance from the positive to the negative voltage peak corresponds to the length of a tooth. The gap created by two missing teeth has the effect that no voltage is generated in the CKP.

**FUEL INJECTION AND IGNITION SYSTEMS**

The Fuel Delivery System consists of the following items:

- Fuel Tank
- Electronic Fuel Pump
- In-Line Fuel Pressure Regulator
- Fuel Filter
- Lines and Hoses
- Fuel Injectors
- In-Tank Fuel Strainer

The fuel system provides fuel pressure by an external fuel pump mounted under the vehicle near the fuel tank outlet. The PCM controls the operation of the fuel system by providing battery voltage to the fuel pump through the fuel pump relay.

**FUEL SUPPLY SYSTEM**

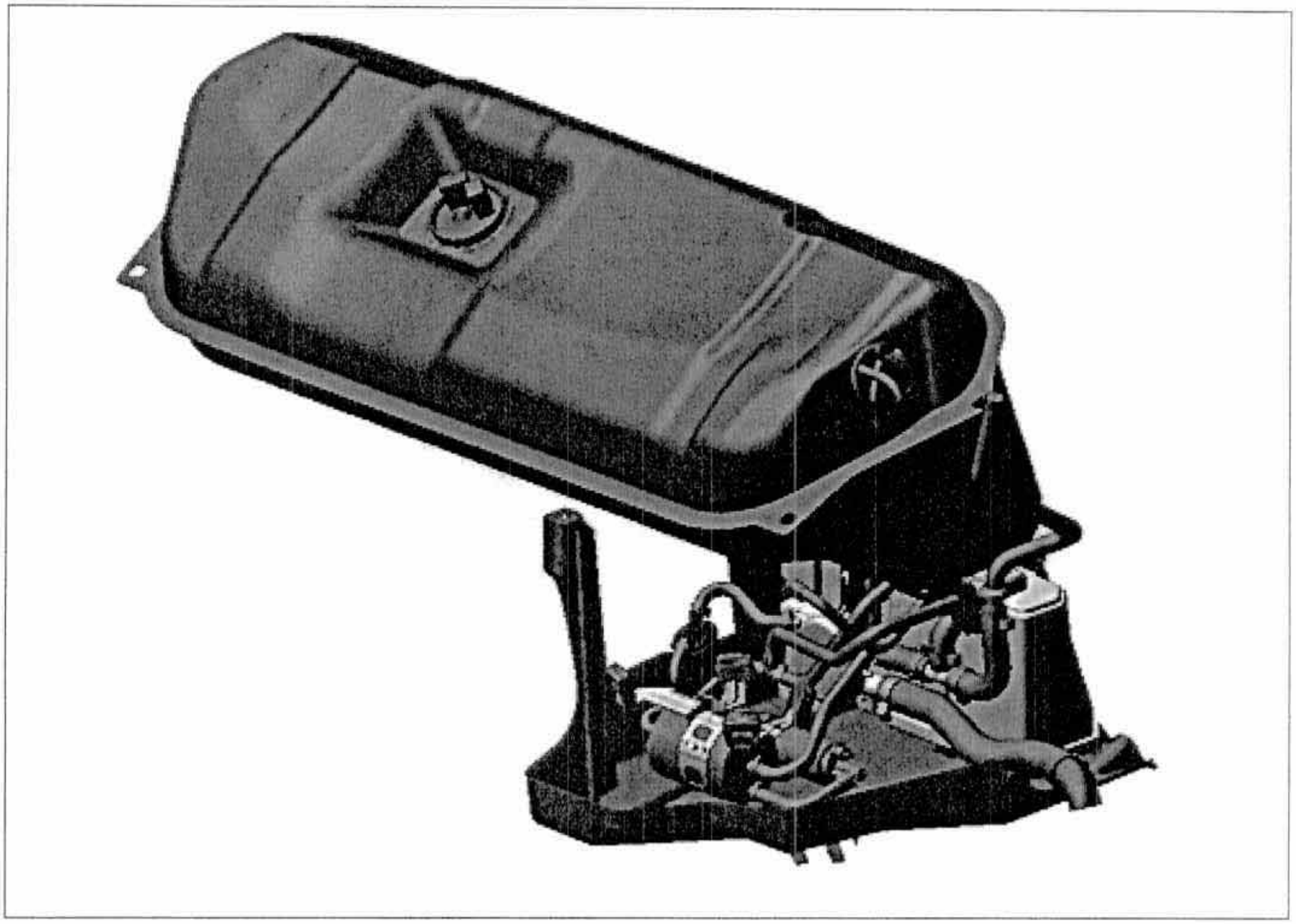
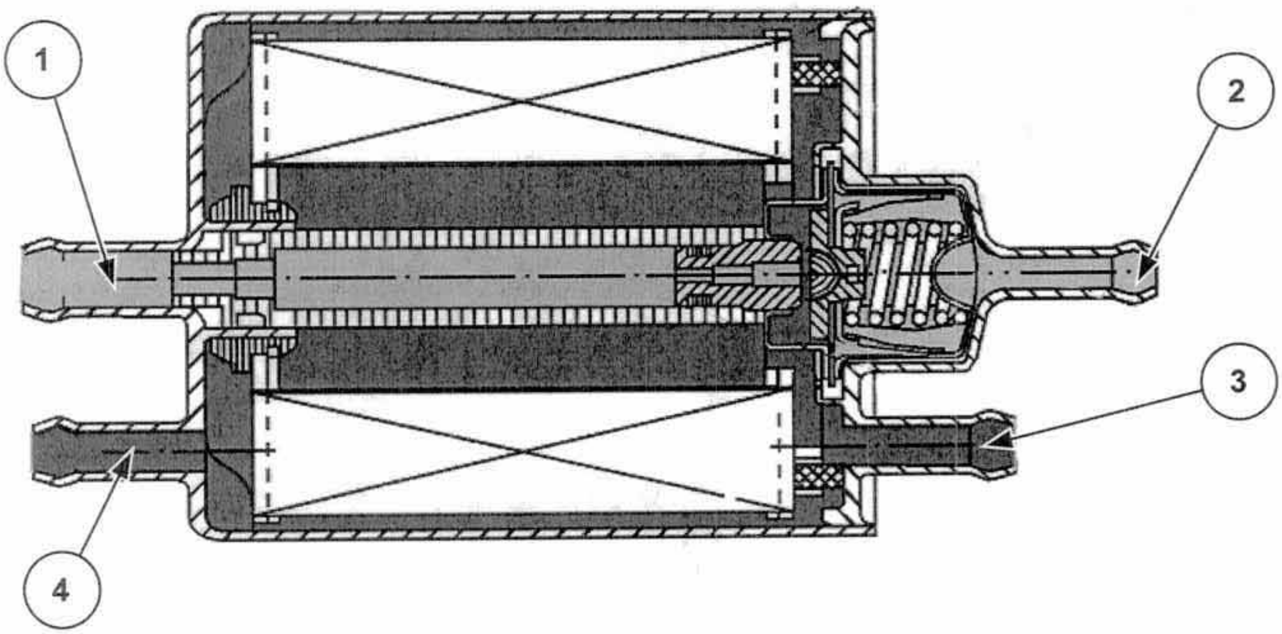


Figure 107 Fuel Supply System

The 60-liter (15.85-gallon), steel fuel tank mounts in the rear cargo area. When the fuel level drops to approximately 8 liters (2.11 gallons) the gauge unit illuminates the low-fuel lamp in the fuel gauge. Refer to Figure 107.

A door in the right quarter panel conceals the filler cap. It is locked by the central locking system when the vehicle is locked from outside. A manual release knob is provided in case the central locking system does not release the lock. The knob is located behind a removable cover in the right side cargo area trim panel. The fuel filler door has a spring-loaded hinge. Pressing on the trailing edge of the door opens it. The door has a retainer to hold the cap during refueling.

**Fuel Filter/Fuel Pressure Regulator**




| | | | |
|---|---|---|---|
| 1 | Return To Tank | 3 | To Fuel Rail |
| 2 | Engine Vacuum | 4 | From Fuel Pump |

Figure 108 Fuel Filter/Fuel Pressure Regulator

This fuel supply system has a pressure regulator (Fig. 108) located in the fuel filter.

- High vacuum reduces fuel pressure to keep the pressure difference at the injector nozzle consistent.
- Low vacuum increases fuel pressure to keep the pressure difference at the injector nozzle consistent.

With engine off, the pressure regulator functions as a check valve to maintain pressure in the fuel rail.

**INJECTORS**

- The injectors are ground controlled from the PCM.
- Power supply to the injectors is fused.
- If a severe misfire is detected, the affected injector is shut off.

The PCM checks the voltage and amperage draw on each injector. If the amperage is more than 4.2 A, and volts are less than 2.5 V for approximately five seconds after two consecutive driving-cycles, the PCM turns on the CHECK ENGINE light.

**FUEL SYSTEM CONTROL**

The fuel injection system is timed to deliver fuel to each cylinder when the intake valves are open.

The fuel management functions of the PCM are:

- to control individual injector opening time.
- to control the fuel/air mix including:
    - start, post-start, warm up
    - acceleration enrichment
    - decel shutoff
- to control injector shutoff, including shutoff via inertia switch, and ignition faults.

The fuel injectors are actuated individually, in line with the firing order (sequentially), based on the input signals and the programming stored in the PCM. The PCM calculates the opening times (injection times) of the fuel injectors.

**Ignition System Control**

The PCM actuates the ignition system based on the input signals and the maps stored in the PCM. The PCM calculates the ignition timing based on input signals from the Knock Sensor.

**Idle Speed Control**

The PCM operates the throttle valve actuator based on the input signals and the programming stored in the PCM.

**Speed Control**

Standard electronic speed control can be set to any speed above 30 km/h (18 mph). The set speed is displayed in the IC trip odometer. A chime sounds when the vehicle exceeds the set speed.

A lever on the left side of the steering column operates the speed control system. Function descriptions and arrows showing the direction to move the lever for each function are printed on the handle of the lever.

The PCM operates the throttle valve actuator for the speed control function based on the input signals and the position of the speed control switch. An additional speed control function is the variable vehicle speed limiter.

**Electronic Throttle Control (ETC)**

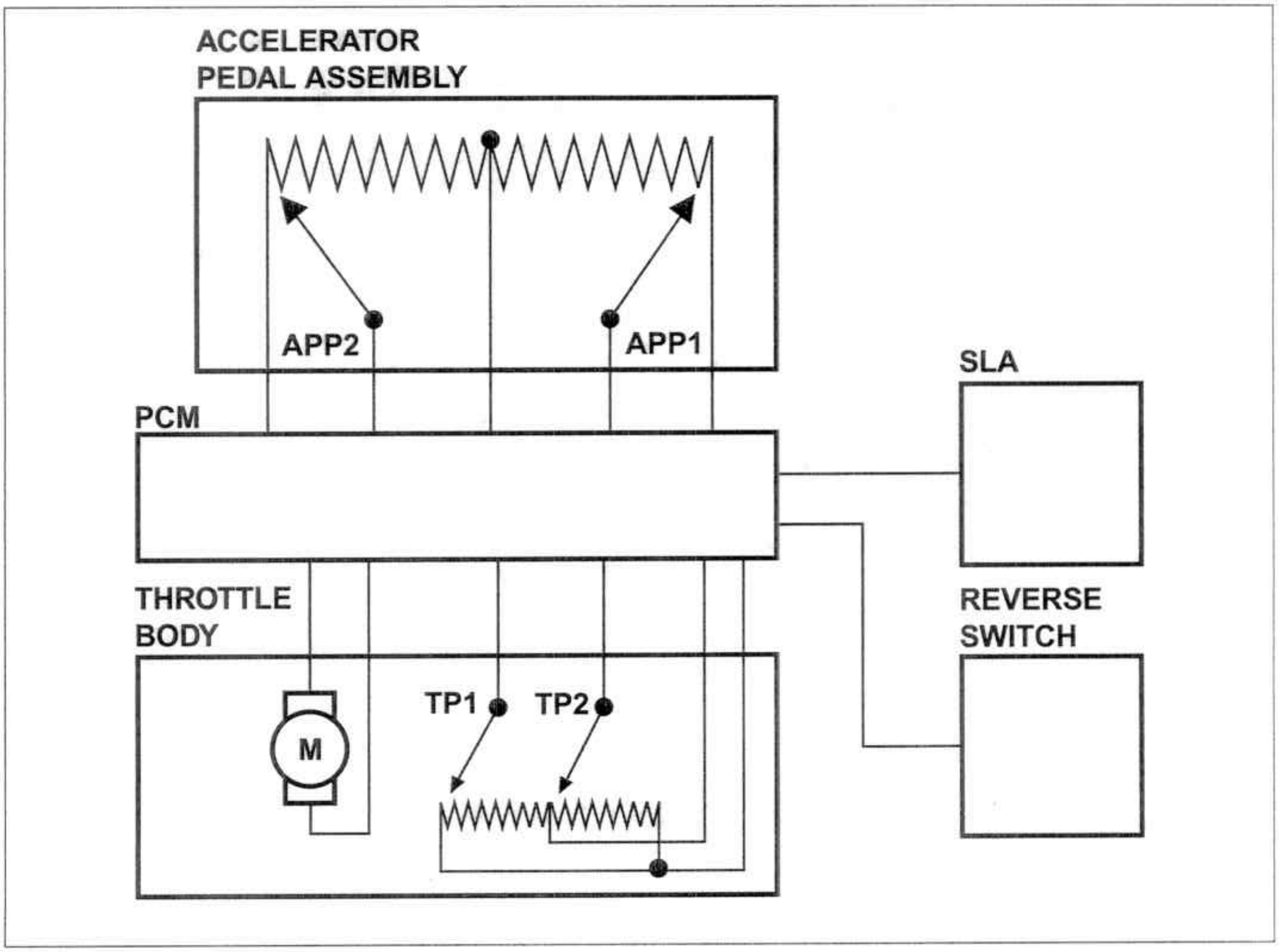
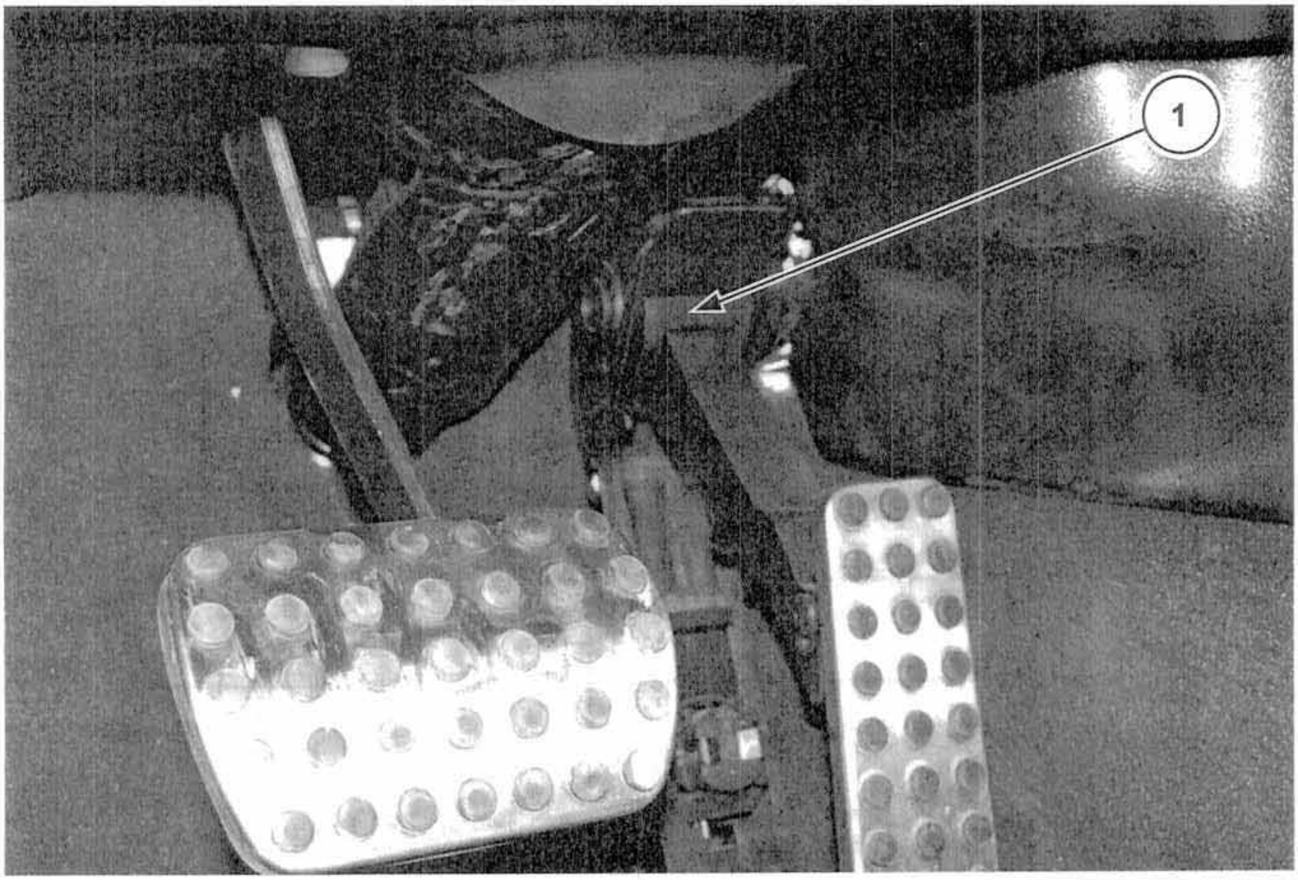



Figure 109 Electronic Throttle Control (ETC) Block Diagram

The Crossfire uses software and hardware ETC, that eliminates the need for throttle and speed control cables. Components of the ETC system include the Accelerator Pedal Position (APP) Sensors, PCM, Throttle Body, SLA (w/A/T) and Reverse Switch (w/M/T). Refer to Figure 109.

### Acceleration Pedal Position (APP) Sensors

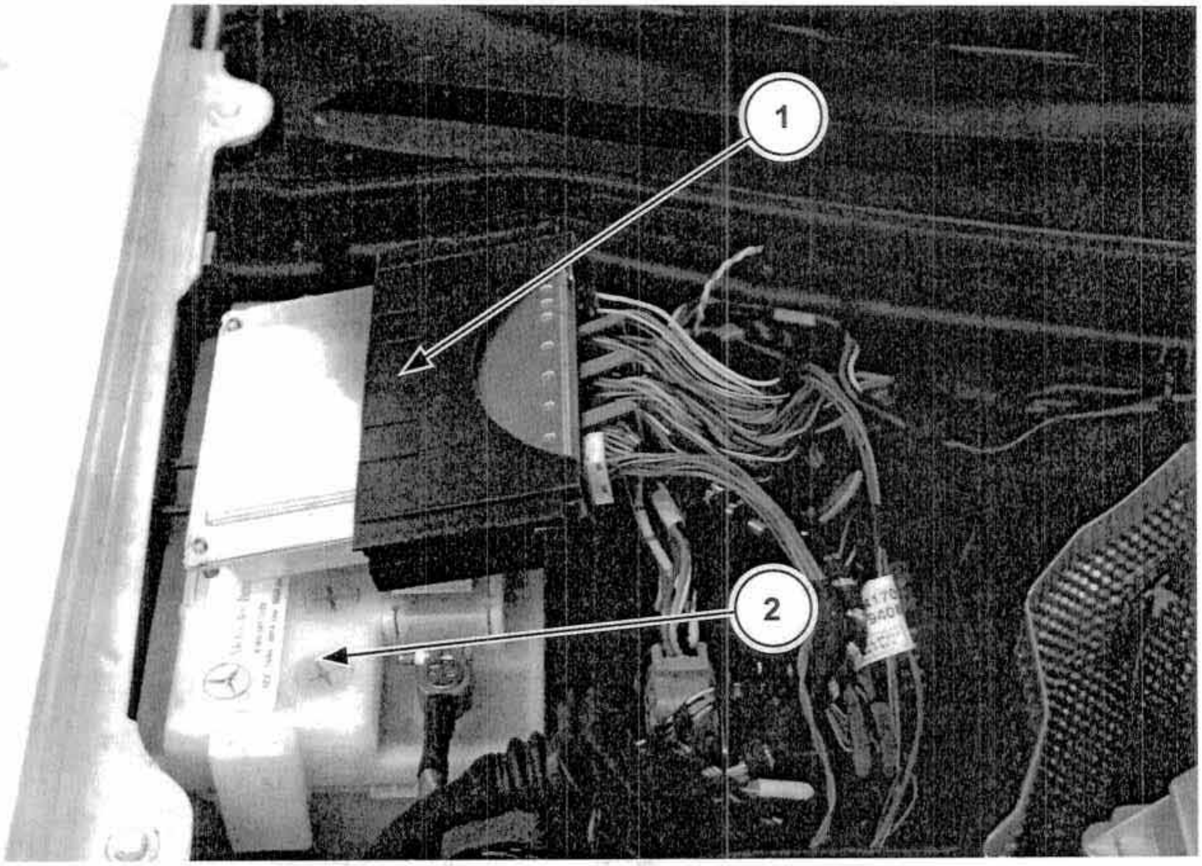



| | |
|---|---|
| 1 | Acceleration Pedal Position (APP) Sensors |

Figure 110 Acceleration Pedal Position (APP) Sensors

The APP sensors are located on the accelerator pedal assembly. The APP sensors (known as APP1 and APP2) provide the PCM two redundant accelerator pedal position inputs. As the throttle is opened, both the APP1 and APP2 signals go from low to high voltage but at different rates. APP1 is known as the high data rate sensor while APP2 is known as the low data rate sensor. This design allows the PCM to precisely control the throttle plate angle.

**Powertrain Control Module (PCM)**




| | | | |
|---|---|---|---|
| 1 | Powertrain Control Module (PCM) | 2 | Battery |

Figure 111 Powertrain Control Module (PCM)

The PCM is located in the control module box. The PCM receives inputs from the APP sensors, SLA (w/A/T), and Reverse Switch (w/M/T). It processes the status of these inputs and adjusts the throttle body plate position with the throttle body motor. The PCM uses the TP sensors to verify the proper plate angle command has been carried out.

**Throttle Body**

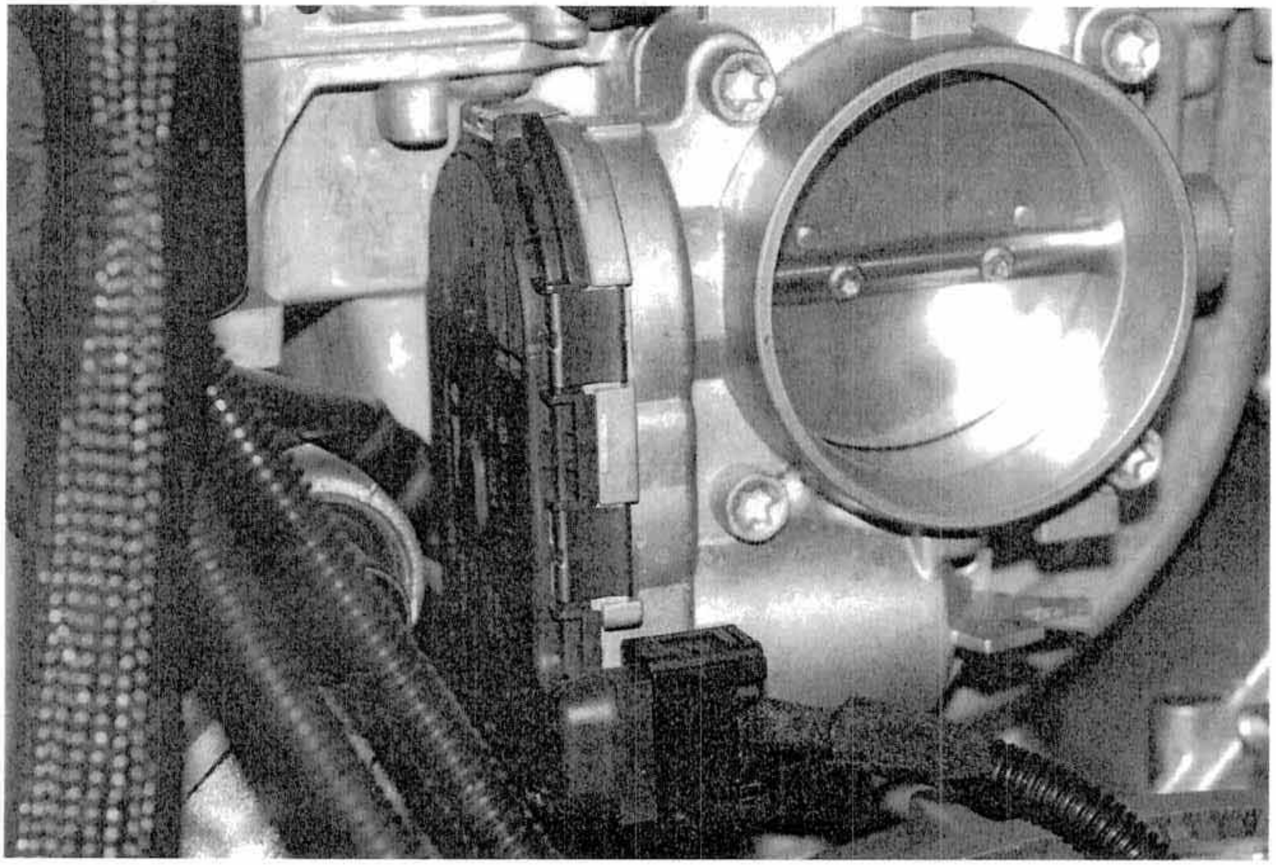


Figure 112 Throttle Body

The throttle body is located on the intake manifold at the rear of the engine compartment (Fig. 112). The throttle body uses a bi-directional DC motor to actuate the throttle body based on signals from the PCM that monitors the TP sensors to verify the proper plate angle command has been carried out.

**Shift Lever Assembly (SLA)**

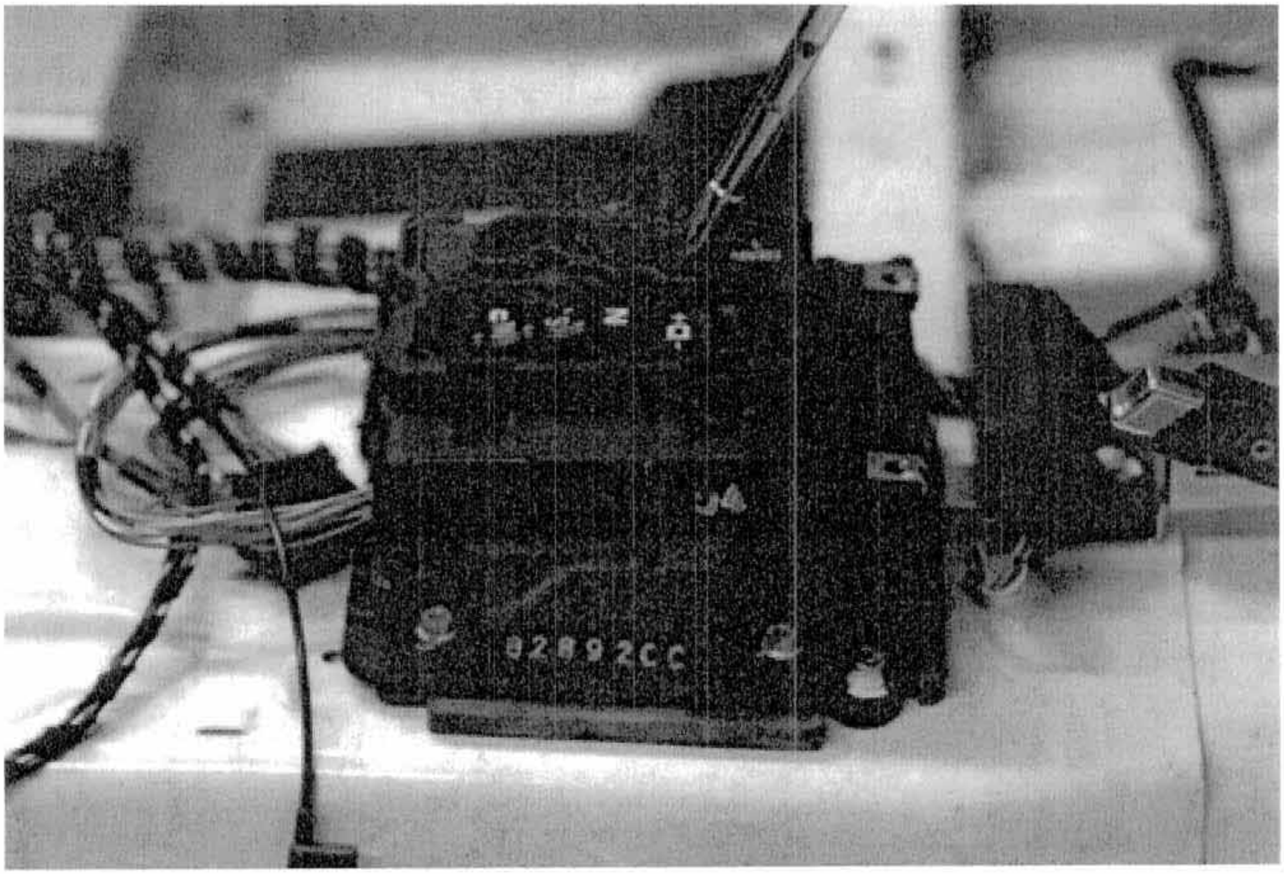
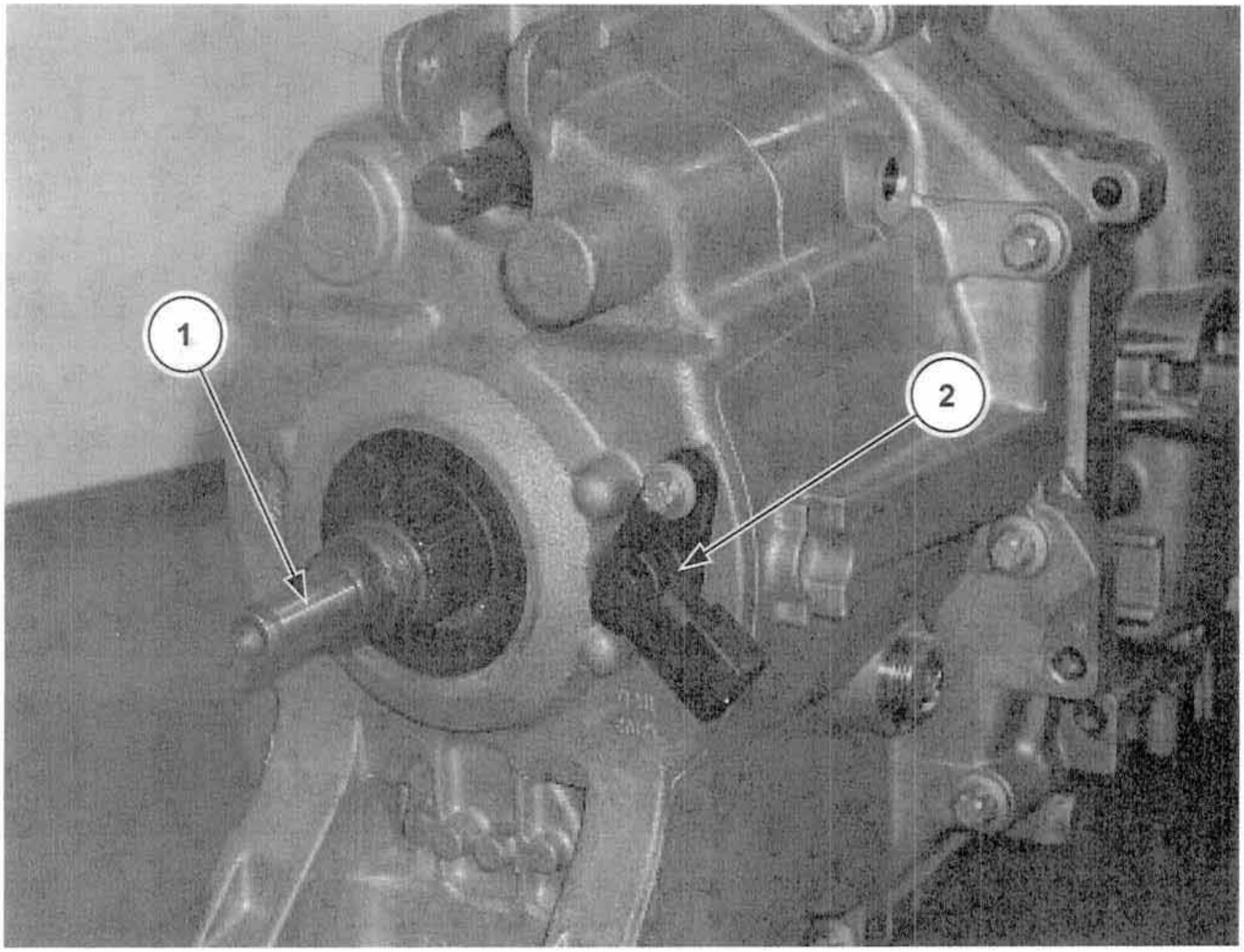


Figure 113 Shift Lever Assembly (SLA)(With Automatic Transmission)

The SLA is located on the vehicle floor pan, between the seats (Fig. 113). The SLA communicates over the high speed CAN Bus to the PCM to indicate transmission gear range.

**Reverse Switch (Manual Transmission)**




| | | | |
|---|---|---|---|
| 1 | Output Shaft | 2 | Reverse Switch |

Figure 114 Reverse Switch (With Manual Transmission)

The reverse switch is located on the right rear of the manual transmission (Fig. 114). The reverse switch is hardwired to the PCM and produces a signal indicating the manual transmission is in reverse.

**System Operation**

The ETC programming in the PCM uses the AAP1 and APP2 sensors as its primary input to control the angle of the throttle plate. As the driver presses down on the accelerator pedal, the APP sensors generate a signal that is directly proportional to pedal movement (voltage goes low to high).

The ETC programming uses the SLA or reverse switch as its secondary input to control throttle plate angle. If the SLA is in park, neutral or any forward gear (or the manual transmission is in any forward gear), the PCM provides current to the throttle plate drive motor. The throttle plate moves at a 1:1 ratio with the acceleration pedal. If either the SLA or reverse switch indicates that their respective transmissions are in reverse the PCM dampens the opening rate of the throttle plate. This prevents the vehicle from being put into an abrupt Wide Open Throttle (WOT) condition in reverse.

The throttle body houses two TP sensors to provide feedback information to the PCM. TP1 is mounted so that it provides a signal that is directly proportional to throttle plate movement (voltage goes low to high). TP2 is mounted so that it provides a signal that is inversely proportional to throttle plate movement (voltage goes high to low).

The PCM uses inputs from the speed control switch, clutch interlock switch, brake switch and vehicle speed to control speed control.

If either of the APP or the TP sensor inputs are lost, the PCM defaults to an idle only or limited RPM (up to approximately 1000 RPM) default strategy.

**Hot Film Mass Airflow (MAF)Sensor**

A Hot Film MAF sensor measures the mass of air entering the engine by measuring the electrical current required to maintain the sensor at a constant temperature. The PCM uses this measurement of the mass of air coming into the engine to precisely regulate the fuel-air mixture.

**EMISSION CONTROL FEATURES**

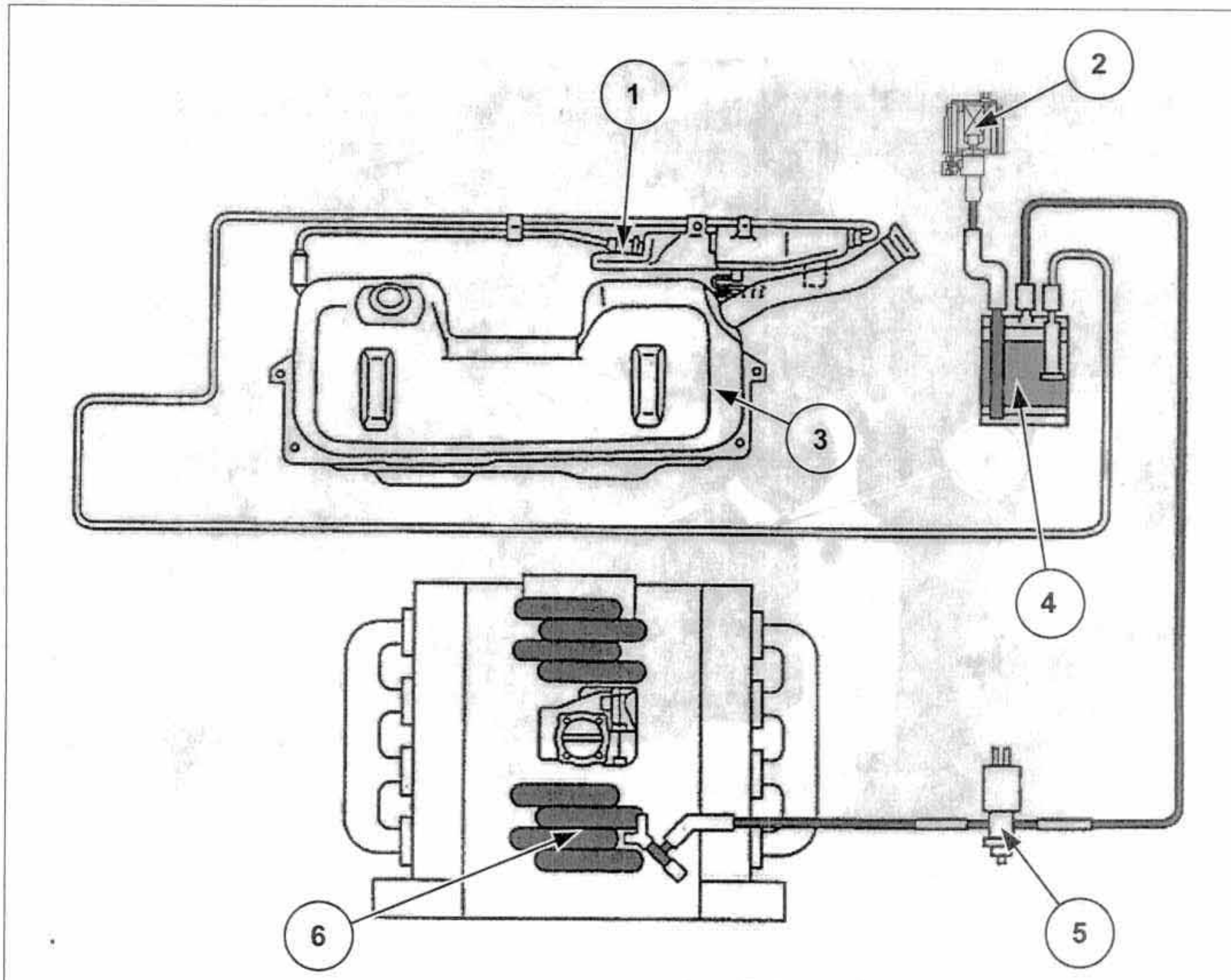
The exhaust emission control system is calibrated to meet LEV II emission standards in California, Tier 2 emission standards in other U.S. states and Stage III emission standards in Europe. The PCM and other hardware are the same for all markets, but there is some difference in the software depending on local emissions requirements.

Dual ignition reduces hydrocarbon emissions released by the engine to the catalytic converter by 20 percent compared to single ignition systems. This reduction is especially beneficial during the cold start and warm up phases of operation, which is when most of the tailpipe emissions occur on today's cars because the catalytic converter has not yet reached its operating temperature.

The evaporative emission control system has an activated charcoal filter that stores fuel vapor to prevent its discharge into the atmosphere. The low fuel-warning lamp in the fuel gauge blinks if the fuel filler cap is loose or there is a vapor leak in the fuel system. The PCM regulates purging of the vapor from the canister based on the engine coolant temperature and oxygen sensor signals. Hydrocarbons accumulating on the activated carbon are transferred to the intake manifold on a MAP-controlled basis, thus making room for more vapor from the tank. While this is happening, a corresponding reduction in the injection time corrects the fuel mix, producing a nearly stoichiometric fuel mix.

A malfunction in the fuel management system, emission control system, systems that impact emissions, and a loose fuel filler cap trigger the MIL in the IC when the engine is running. The PCM monitors emission control components that provide either input signals to, or receive output signals from, the control module. Malfunctions resulting from interruption or failure of any of these components as indicated by the MIL are stored in the PCM memory.

**Evaporative Emission Control System (EVAP)**

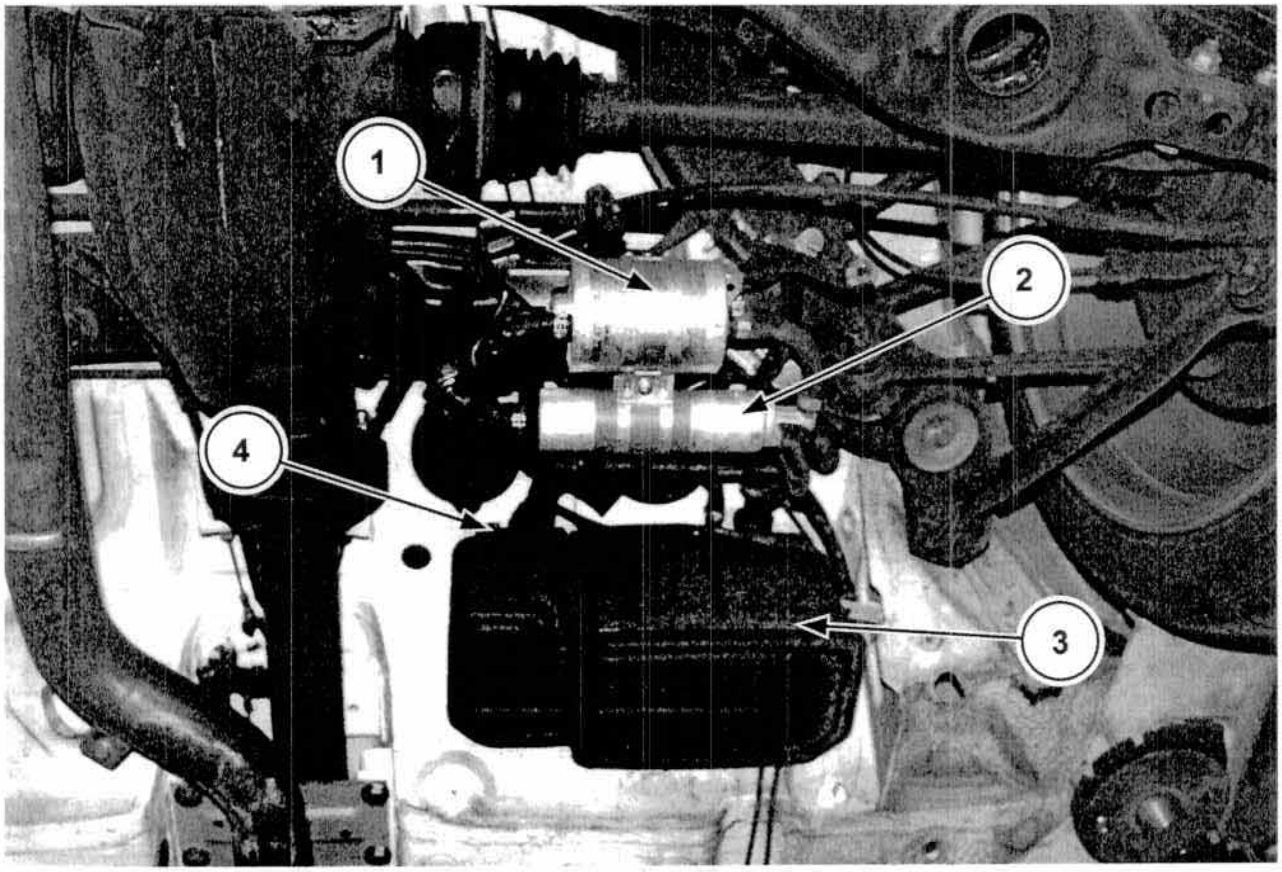



| | | | |
|---|---|---|---|
| 1 | Fuel Tank Pressure (FTP) Sensor | 4 | Charcoal Canister |
| 2 | Charcoal Canister Shutoff Valve | 5 | Purge Valve |
| 3 | Fuel Tank | 6 | Intake Manifold |

Figure 115 Evaporative Emission Control System (EVAP)

EVAP (Fig. 115) prevents fuel vapors from escaping to the atmosphere. The fuel vapors are temporarily stored in a activated charcoal canister.

Charcoal Canister




| | | | |
|---|---|---|---|
| 1 | Fuel Filter | 3 | Charcoal Canister |
| 2 | Fuel Pump | 4 | Charcoal Canister Shutoff Valve |

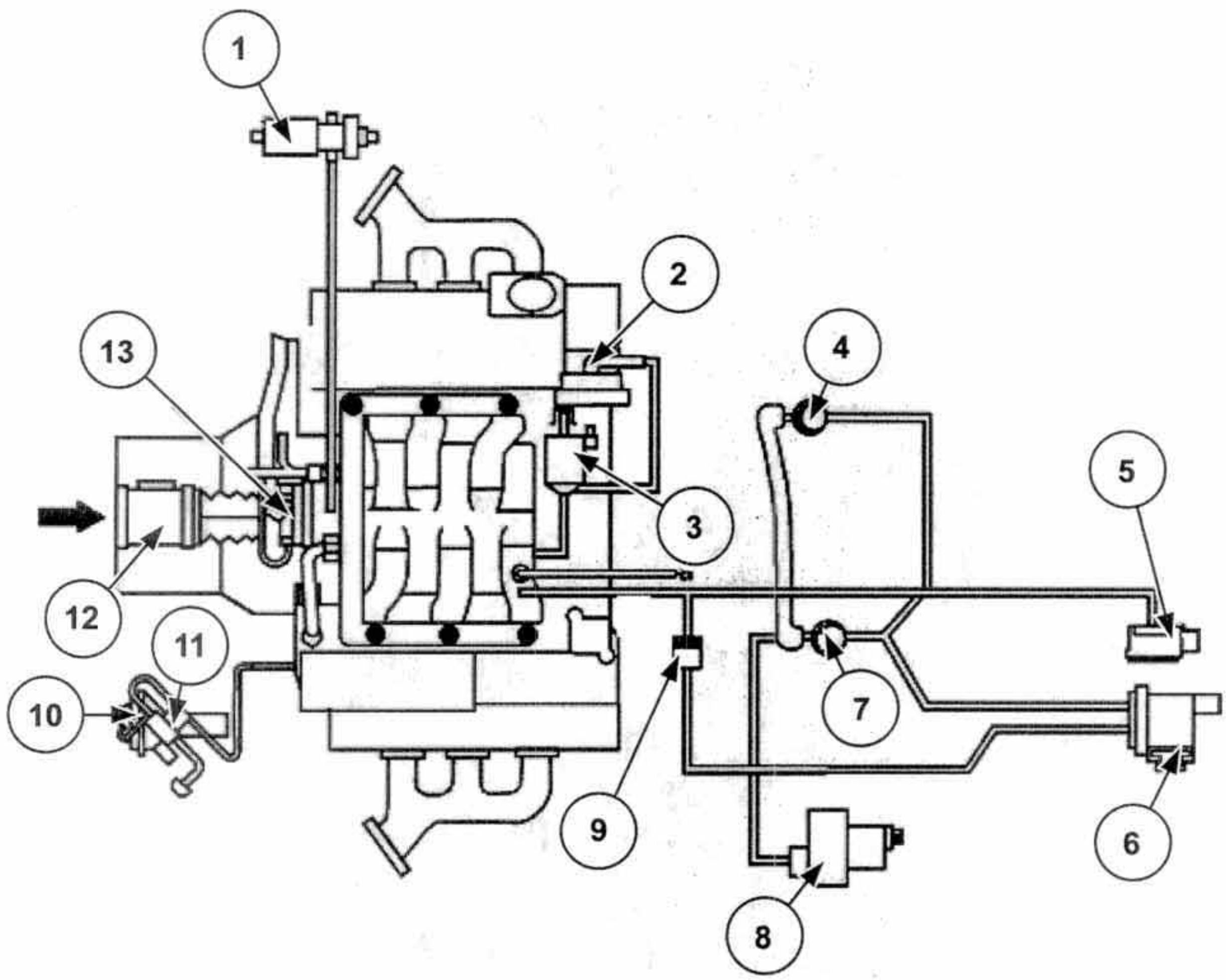
Figure 116 Charcoal Canister

When the engine is running, the fuel vapors stored in the activated charcoal canister (Fig. 116) are drawn off through the purge control valve and combusted in the engine. The activated charcoal canister is purged when the coolant temperature is more than 70°C (158°F) about two minutes after engine startup, and when the engine is not in deceleration mode.

The purge quantity is controlled by the PCM that operates the purge control valve. Constantly opening and closing the purge control valve for on and off periods of various lengths determine the purge quantity.

The idle speed control prevents changes in engine speed resulting from purging. A richer or leaner fuel-air mixture is produced in line with the charge of the activated charcoal canister with fuel vapors.

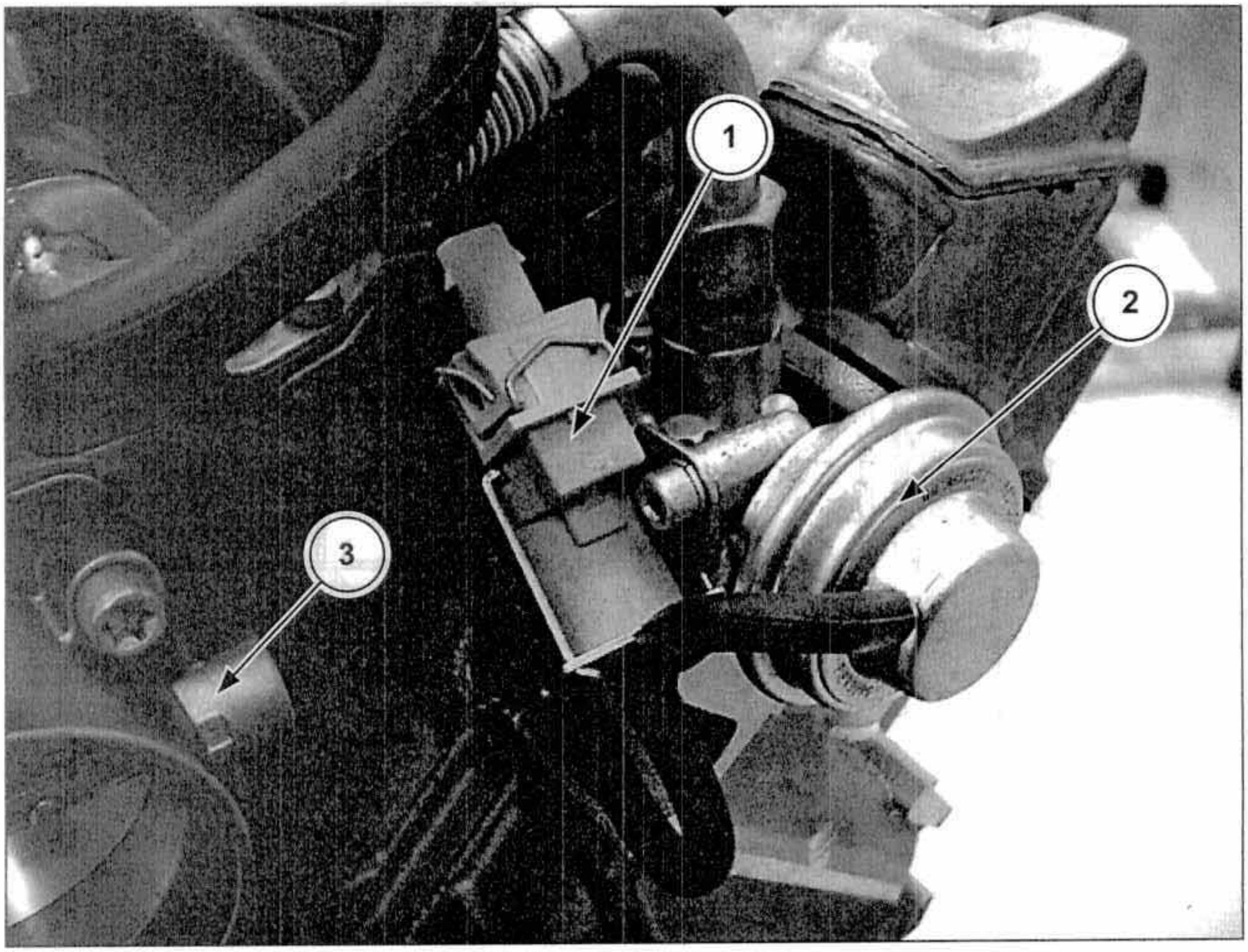
## Exhaust Gas Recirculation (EGR) and Secondary AIR Systems




| | | | |
|---|---|---|---|
| 1 | EVAP Purge Solenoid | 8 | Electric Air Pump |
| 2 | Short Runner Valve Solenoid | 9 | Check Valve (Vacuum) |
| 3 | Intake Manifold Turning Valve | 10 | EGR Valve |
| 4 | Left Air Pump Switchover Valve | 11 | EGR solenoid |
| 5 | Absolute Manifold Pressure Sensor | 12 | MAF Sensor |
| 6 | Air Pump Switchover Solenoid | 13 | Throttle Body |
| 7 | Right Air Pump Switchover Valve | | |

Figure 117 EGR and Secondary AIR Injection Systems

EGR Valve




| | | | |
|---|---|---|---|
| 1 | EGR Solenoid | 3 | Throttle Body |
| 2 | EGR Valve | | |

Figure 118 EGR Valve

The EGR System reduces $NO_X$ and improves gas mileage.

The prerequisites are

- Coolant temperature between 60°C (140°F) and 110°C (230°F)
- Less than 3500 RPM, partial load

Once per driving-cycle during decel shut-off, PCM activates the EGR valve (Fig. 118) and uses the Manifold Absolute Pressure (MAP) sensor to check for a 5.4 kPa (0.7832 psi) pressure drop for about two seconds. If a failure occurs after two consecutive drive-cycles, the CHECK ENGINE light comes on.

**Secondary AIR System**

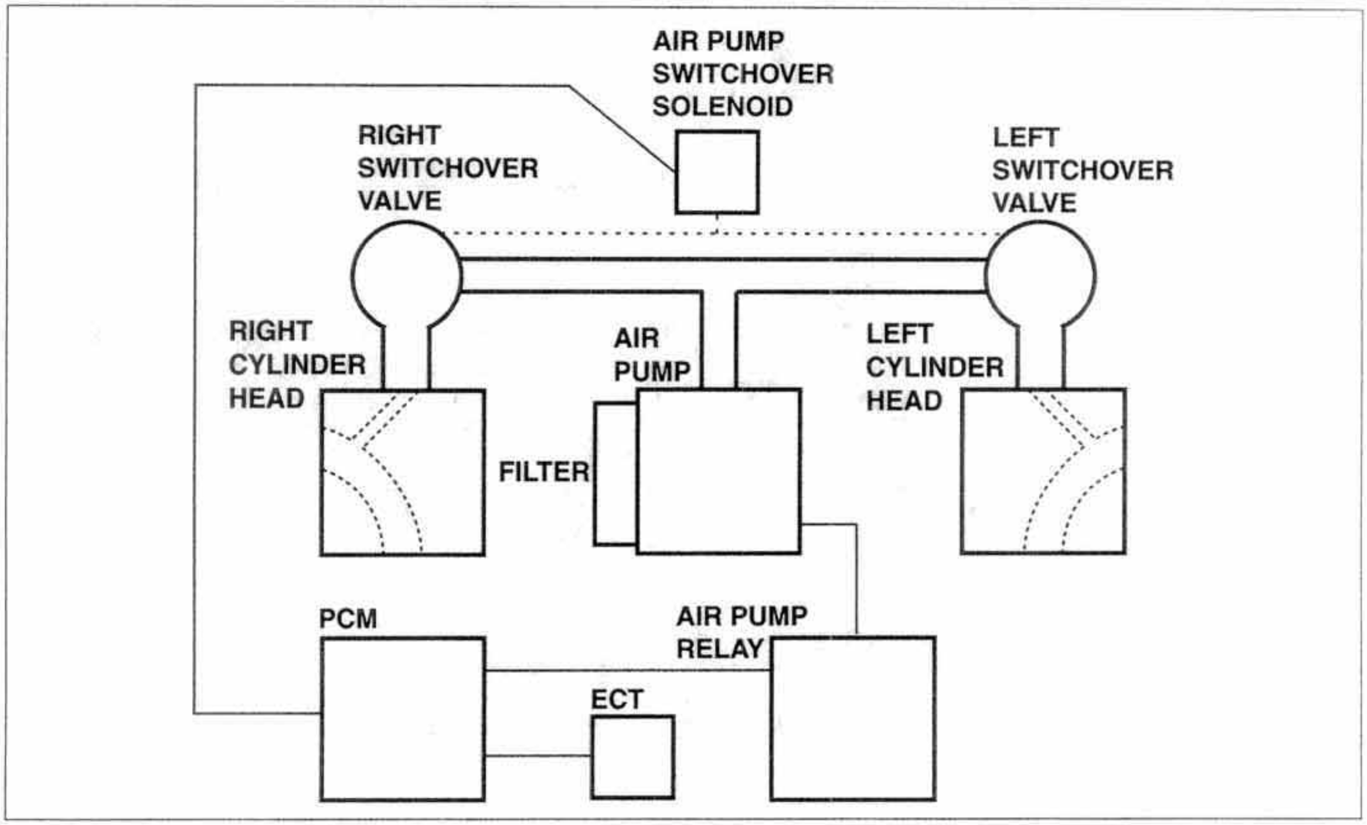
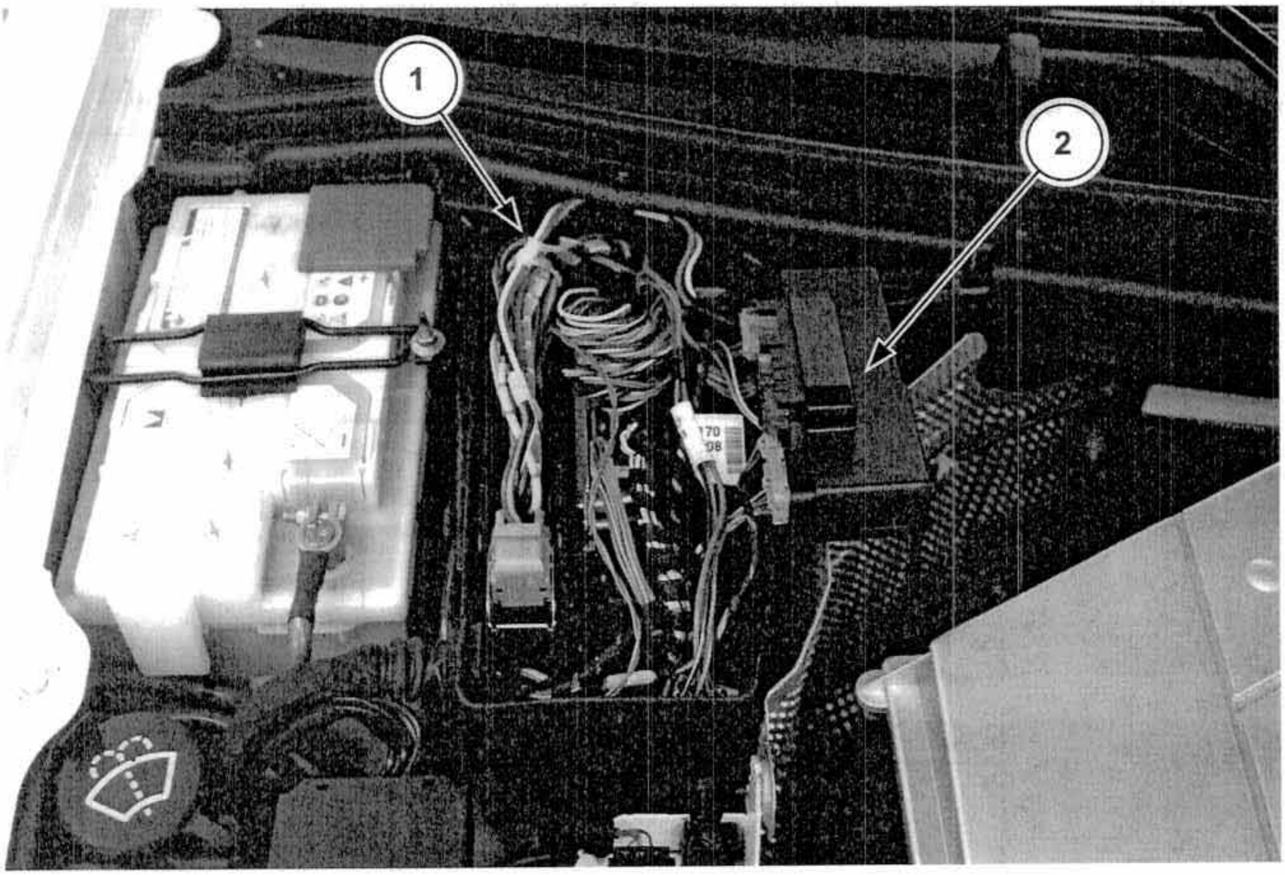



Figure 119 Secondary AIR Block Diagram

The 3.2L engine uses a secondary Air Injection Reactor (AIR) pump to meet exhaust emission regulations. The PCM controlled pump injects atmospheric air into the exhaust manifolds (through the cylinder heads) during cold engine starts (engine temperatures less than 27°C (80°F). By injecting atmospheric air into the exhaust, the catalytic converter reaches operating temperature faster. Refer to Figure 119.

Relay Control Module

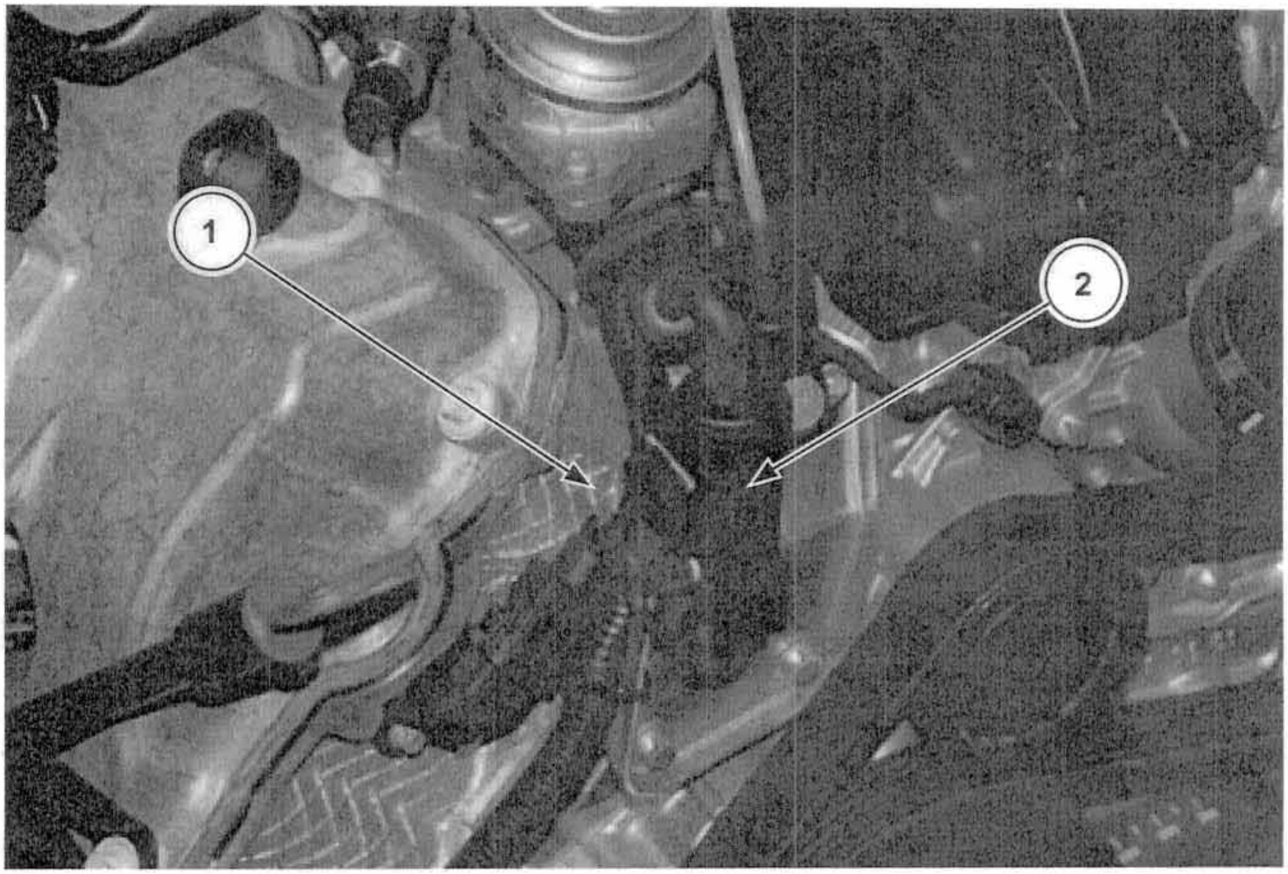



| | | | |
|---|---|---|---|
| 1 | Control Module Box | 2 | Relay Control Module |

Figure 120 Relay Control Module

The secondary AIR pump relay is located in the relay control module (Figure 120). The secondary AIR pump relay receives a constant B+ feed from the battery through a 15-amp fuse in the relay control module. When the PCM requires the secondary pump to run, it provides a ground signal to the secondary AIR pump relay. The secondary AIR pump relay contacts close and the secondary AIR pump operates.

AIR Pump Switchover Solenoid

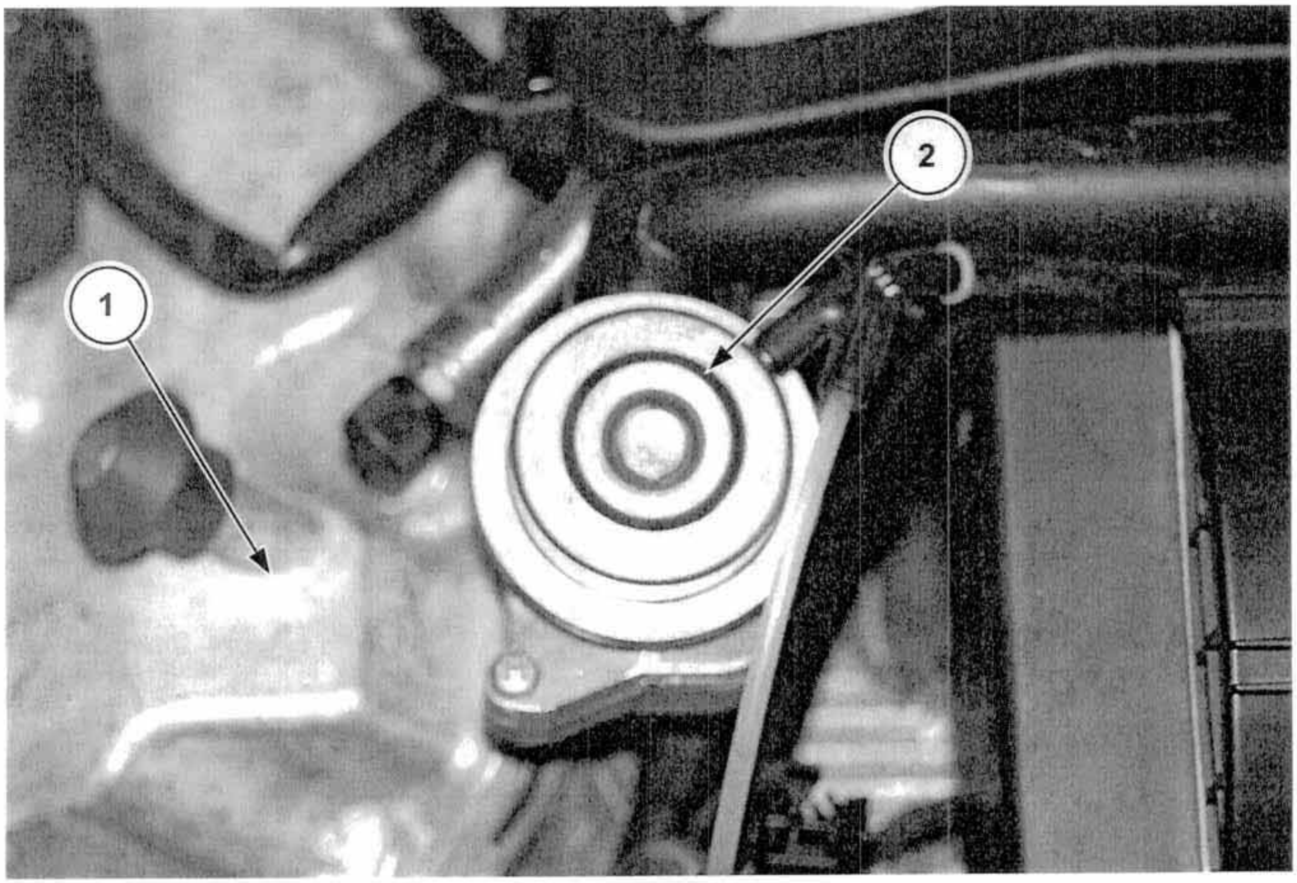



| | | | |
|---|---|---|---|
| 1 | Right Cylinder Head | 2 | AIR Pump Switchover Solenoid |

Figure 121 AIR Pump Switchover Solenoid

The AIR Pump Switchover Solenoid is located on the front of the right cylinder head (Fig. 121). The AIR Pump Switchover Solenoid receives a key-on B+ feed through a 15-amp fuse in the relay control module. The PCM provides the ground signal to energize the solenoid.

AIR Pump Switchover Valve

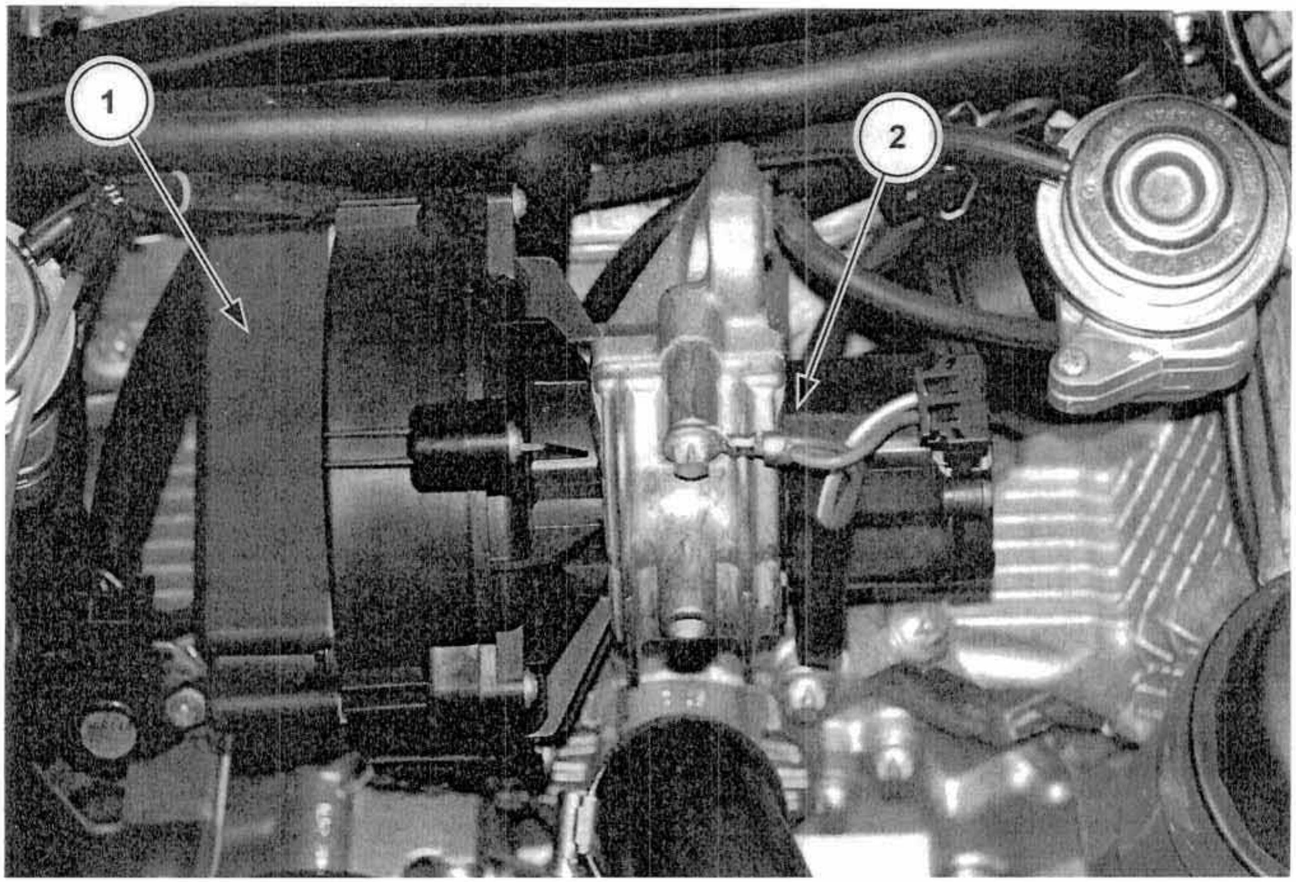



| | | | |
|---|---|---|---|
| 1 | Camshaft Cover | 2 | AIR Pump Switchover Valve |

Figure 122 AIR Pump Switchover Valve

The right and left switchover valves are located on the front of each cylinder head (Fig. 122). These valves allow the volume of air produced by the AIR pump to be admitted into the cylinder head and also prevents any exhaust gases from finding their way back to the AIR pump. Both valves are normally closed and require a PCM controlled vacuum signal to open.

AIR Pump/Filter

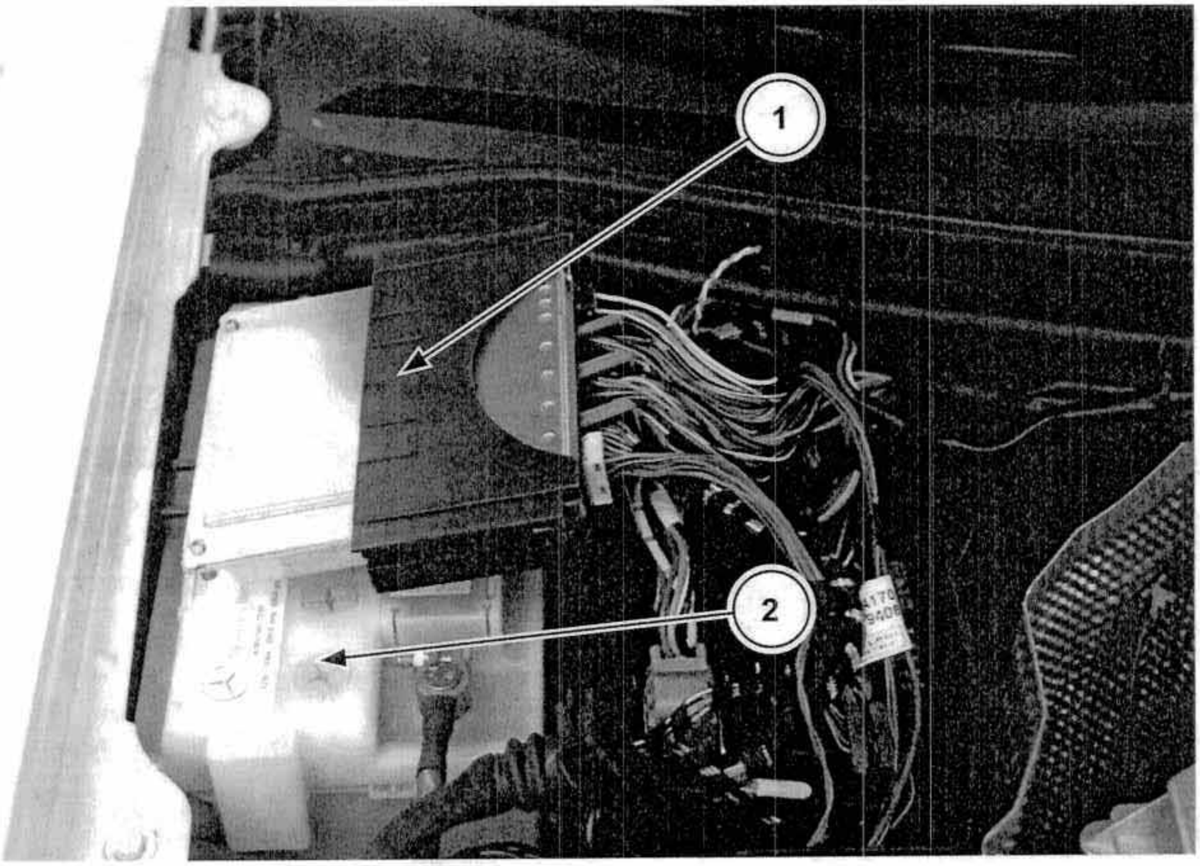



| | | | |
|---|---|---|---|
| 1 | Filter | 2 | AIR Pump |

Figure 123 AIR Pump/Filter

The AIR pump is located on top of the engine between the right and left cylinder heads (Fig. 123) and is driven by a 12-volt DC motor. A filter prevents contaminants from entering the intake side of the pump and is not serviceable.

Powertrain Control Module (PCM)

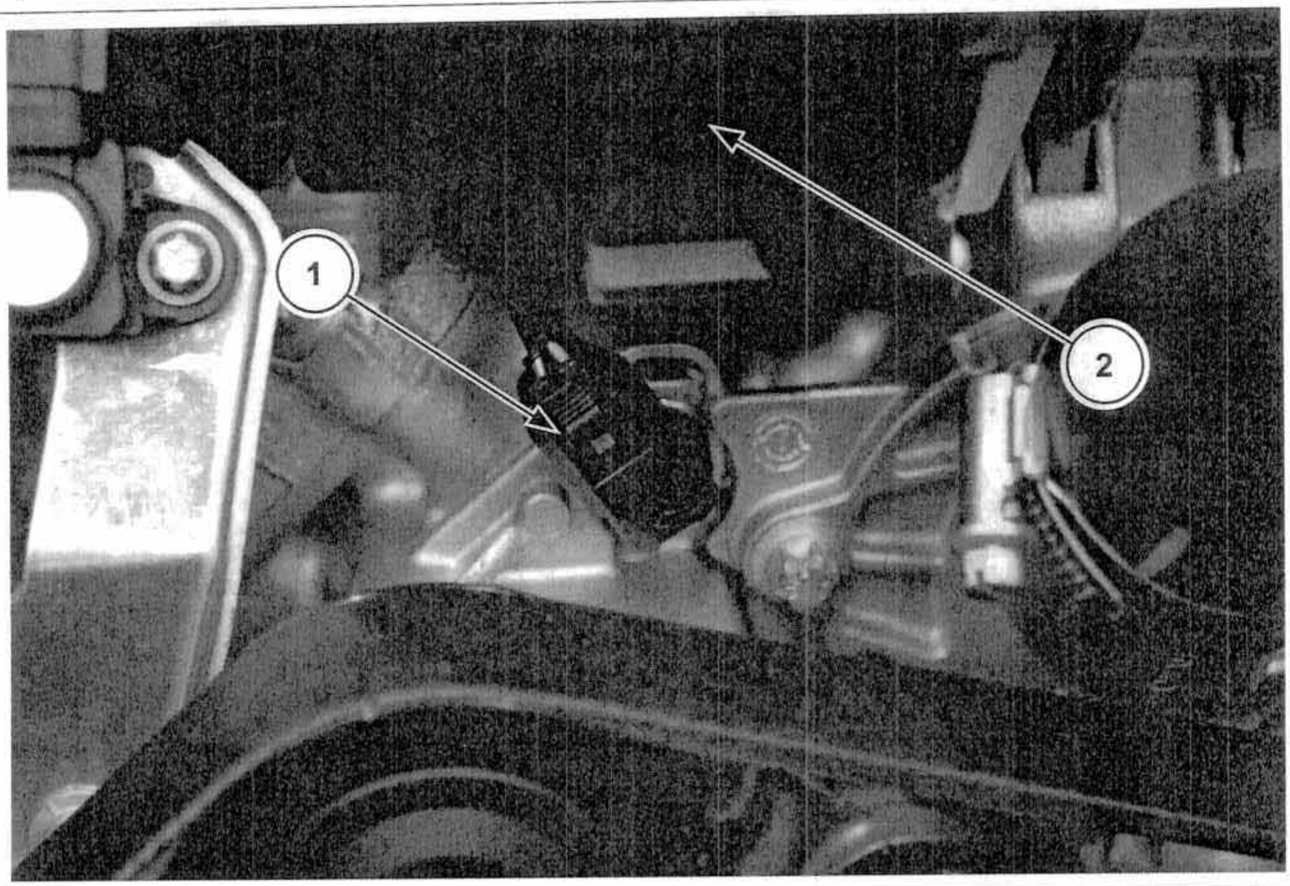



| | | | |
|---|---|---|---|
| 1 | Powertrain Control Module (PCM) | 2 | Battery |

Figure 124 Powertrain Control Module (PCM)

The PCM is located in the control module box in the right rear corner of the engine compartment (Fig. 124). The PCM receives an input from the ECT sensor and determines if secondary AIR is required.

Engine Coolant Temperature (ECT)




| | | | |
|---|---|---|---|
| 1 | Engine Coolant Temperature (ECT) | 2 | Electric AIR Pump |

Figure 125 Engine Coolant Temperature (ECT)

The Engine Coolant Temperature (ECT) sensor is located on the top of the engine front cover (Fig. 125). The PCM monitors this sensor to determine engine coolant temperature and (among other things) uses this information to control the introduction of secondary AIR. The ECT sensor is a Negative Temperature Coefficient (NTC) sensor. As coolant temperature rises, resistance in the sensor decreases. This results in a lower voltage on the signal circuit.

**Secondary AIR System Operation**

When the driver starts the engine, the PCM monitors the ECT. If the ECT indicates the engine coolant temperature is less than 27°C (80°F), the PCM grounds the AIR pump relay and the pump operates. In addition, the PCM controls a switchover solenoid (via vacuum) that opens the switchover valves. When the switchover valves are open and the AIR pump is running, atmospheric air is injected into the exhaust manifolds through a port in each cylinder head.

**IGNITION SYSTEM**

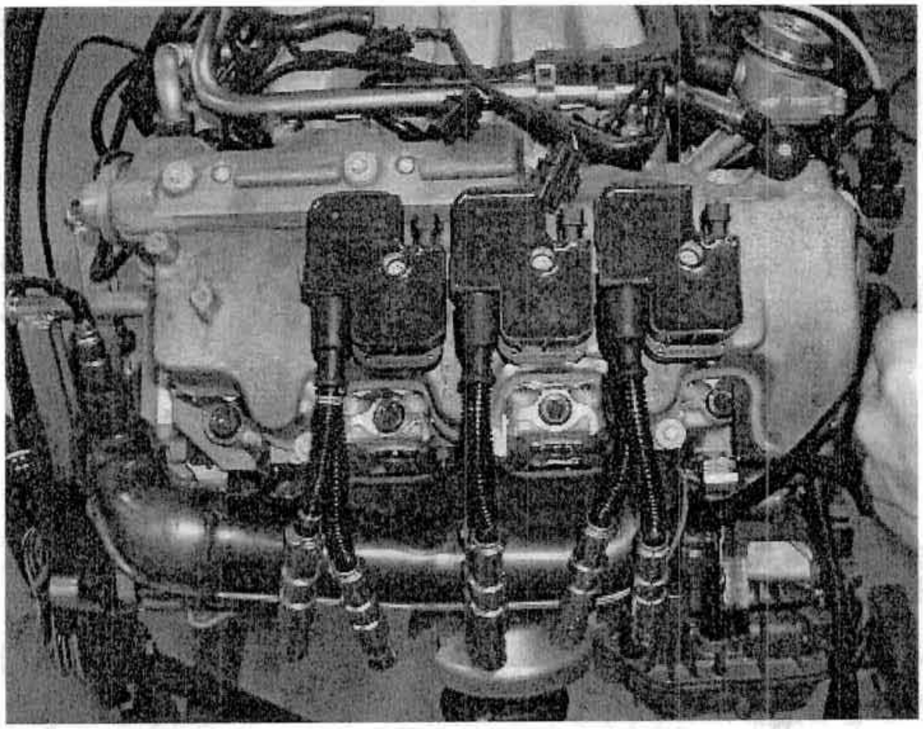


Figure 126 Two Coils and Two Spark Plugs Per Cylinder

The ignition system uses two coils and two spark plugs per cylinder. Refer to Figure 126. Individual coils for each cylinder ensures performance at high RPMs and allows individual cylinder spark control. Dual spark plugs provide more complete combustion, particularly near the cylinder walls and decrease engine-out emissions. This ignition system enhances combustion efficiency when firing mixtures are diluted by EGR, and improves overall efficiency and lowers emissions.

The two spark plugs are fired slightly out of phase to prevent the cylinder pressures from rising too quickly, which could cause knocking. To prevent one spark plug from eroding more quickly than the other, they alternately lead each other. Under normal conditions, the timing is the same for all cylinders, but the timing can be delayed in individual cylinders if knocking is present in one or more. Highly sensitive anti-knock sensors can distinguish knocking conditions in individual cylinders and retard the ignition timing on the cylinders that are knocking. This anti-knock control prevents damage to the engine and allows operation on lower grade fuel, but only in emergencies. Premium grade fuel is required under normal operating conditions to ensure full power and economy, and because the anti-knock control system may not be able to prevent knocking on low-grade fuels under all operating conditions.

Coils are mounted on the rocker cover and are connected to the spark plugs with short cables. Platinum-tip spark plugs allow 160,000 km (100,000 mile) replacement intervals under normal conditions.

The system provides emergency reduced power that allows continued engine operation in case of a misfire. After a specified number of misfires in a particular cylinder, fuel and spark are cut off for that cylinder until the engine is started again. This reduces exhaust emissions and prevents engine and catalytic converter damage.

**Ignition Strategy**

- Power supply to the coils is fused.
- The ground side of each coil is controlled by the PCM.

Ignition timing is based on:

- Hot Film MAF Sensor
- CKP
- Camshaft Position Sensor (CMP)
- Coolant Temperature Sensor
- Intake Air Temperature Sensor

Ignition Timing Adaptation

- Catalytic converter heating timing retarded for about 20 seconds in P or N.
- Idle speed is retarded up to 36° advanced up to 20°.

Decel Fuel Shutoff

- Briefly retards timing when fuel commences
- Intake/coolant temperature
- Timing is retarded under load if the intake air temperature is more than 35°C and the coolant temperature is more than 105°.

Transmission Overload Protection

- Timing briefly retarded during shift under load (1-2-1, 2-3-2).
- Input from the CAB is used to control engine torque for ASR and ESP functions.

Knock Sensor

- Piezo-type sensor that monitors vibration of the crankcase.
- Controls timing on the relevant cylinder.
- Knock Sensor System can retard the ignition angle at relevant cylinders. The PCM controls the primary by controlling the ground at terminal 1.

Dual Spark Plugs

Each cylinder has a double coil set, and its own dedicated plug wires. The two-coil set is controlled by the PCM. The two coils fire in phases.

1. Coils are "Phase-Shift" triggered which means plug A fires, then B, then B, then A, then A, then B etc. Offset between the plug firing varies from 0 to 10°.
2. Timing can be retarded by as much as 14.5°. The PCM system recognizes misfiring caused by the:

- ignition system.
- fuel injection system.
- mechanical engine components.

The signal from crankshaft sensor monitors the speed changes of the flywheel. The flywheel requires adaptation if the:

- flywheel is replaced
- PCM is replaced.
- crankshaft sensor is replaced
- engine is replaced
- battery is disconnected

The following factors are analyzed.

- Engine Speed
- Engine Load
- Recognition of Irregular Road Surfaces
- Cylinder Recognition

Misfires

The PCM continuously checks misfire signals for limit values. The limit threshold maximum is 20 combustion misfires within 1000 engine revolutions. After two consecutive driving-cycles, the CHECK ENGINE light comes on.

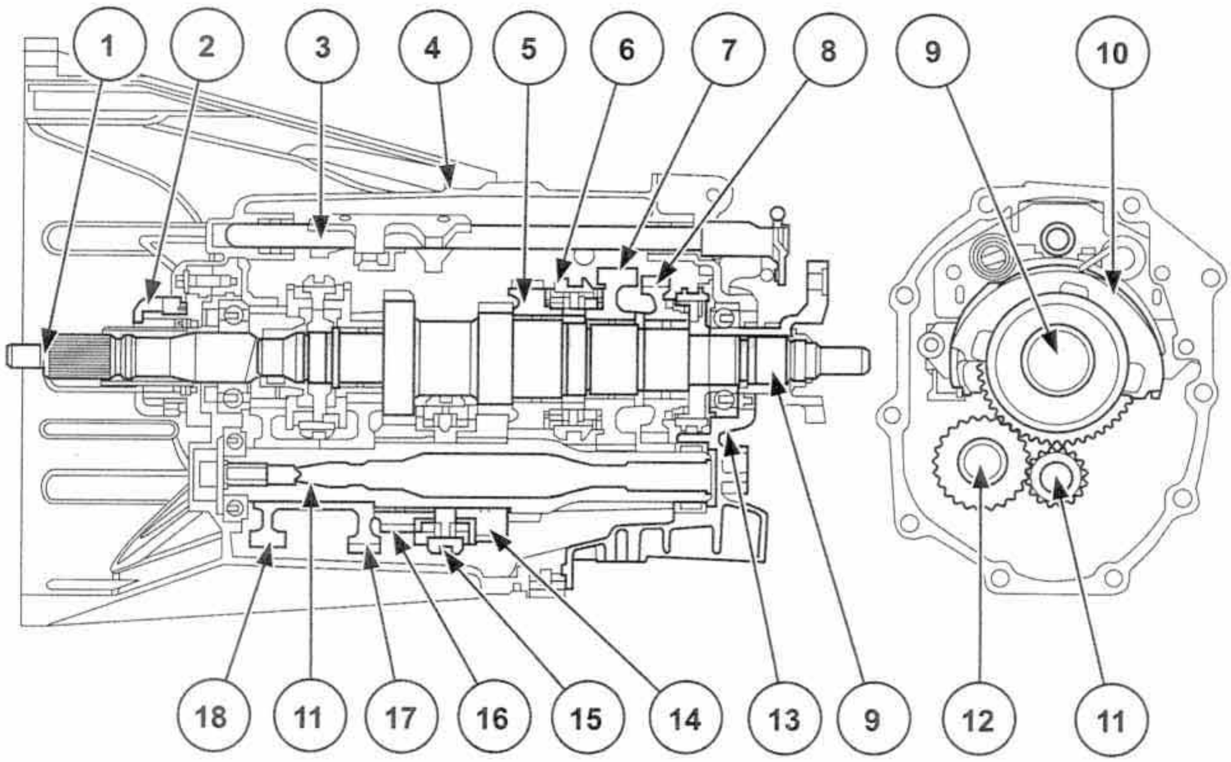
Three Way Catalyst Damage

The limit threshold maximum is 4 to 35 combustion misfires within 200 engine revolutions (varies with RPM and load). After one occurrence the CHECK ENGINE light blinks. If the misfire continues, the CHECK ENGINE light stays on. Then after two consecutive driving-cycles the CHECK ENGINE light stays on.

**Notes:**

## DRIVETRAIN

### SIX-SPEED MANUAL TRANSMISSION




| | | | |
|---|---|---|---|
| 1 | Input shaft | 10 | Inner Shift Module |
| 2 | Central Clutch Operator | 11 | Countershaft |
| 3 | Central Shift Shaft | 12 | Reverse Gear Idler Gear |
| 4 | Front Transmission Housing | 13 | Rear Transmission Housing |
| 5 | 2nd Gear | 14 | 4th Gear |
| 6 | Multiple-Cone Syncro 1st/2nd gear | 15 | Multiple-Cone Syncro 3rd/4th gear |
| 7 | 1st gear | 16 | 3rd Gear |
| 8 | Reverse Gear | 17 | 6th Gear |
| 9 | Main shaft | 18 | 5th Gear |

Figure 127 Manual Transmission Major Components

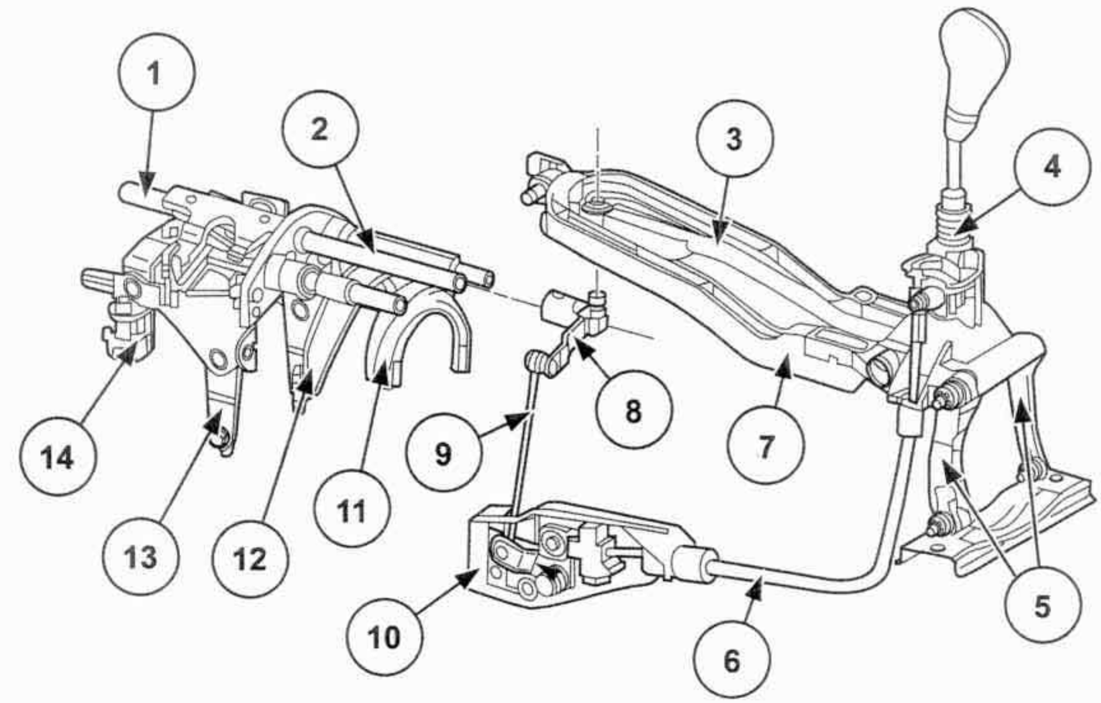
A six-speed manual transmission (Fig. 127) with overdrive is standard. All shift forks and the selector mechanism is mounted on a common shaft or rail inside the transmission case. All ratios are synchronized, including Reverse. Short throws are accomplished by multiple-cone synchronizers on 1st through 4th gears: three cones on 2nd gear and two on the other three. Mounting the 3-4 synchronizer with the cluster gear on the countershaft also helps minimize shift effort due to low inertia. Stamped steel synchronizer rings use scattered sinter friction linings to provide consistent synchronization throughout the life of the transmission.

Transmission ratios are as follows:

| **Gear** | 1st | 2nd | 3rd | 4th | 5th | 6th | Reverse |
|---|---|---|---|---|---|---|---|
| **Ratio** | 4.459 | 2.614 | 1.723 | 1.245 | 1 | 0.838 | 4.062 |

An aluminum case and hollow countershaft reduces the weight of the assembly.

**Shifter**




| | | | |
|---|---|---|---|
| 1 | Central Shift Shaft | 8 | Transfer Lever |
| 2 | Inner Shift Module | 9 | Selector Rod |
| 3 | Shift Rod | 10 | Bracket |
| 4 | Floor Shift | 11 | Reverse Gear Shift Fork |
| 5 | Swivel Lever | 12 | $1^{st}/2^{nd}$ Gear Shift Fork |
| 6 | Selector Cable | 13 | $3^{rd}/4^{th}$ Gear Shift Arm |
| 7 | Coupling Arm | 14 | $5^{th}/6^{th}$ Gear Shift Arm |

Figure 128 Shifting Gears

The body-mounted shifter changes gears through a system of rod and cable linkage. Refer to Figure 128. The lever sits atop a ball. Rod linkage between the shifter and the transmission shift rail provides gear engagement. Tuned rubber isolators in the links provide shift feel without transmitting vibration to the lever. Cable linkage provides crossover action among the four planes of the shift pattern while also providing vibration isolation. The shifter is spring centered to place neutral in the 3-4 plane. Reverse, which is selected by moving the lever to the left and back (toward the driver) from $1^{st}$ gear is protected against accidental selection by a lockout mechanism on the linkage. This mechanism requires that the knob be lifted before selecting Reverse or the movement is blocked

### Clutch

A hydraulic clutch release mechanism also provides isolation from vibration.

### Clutch-Starter Interlock

With manual transmission, a clutch-starter interlock requires that the clutch pedal be depressed before the engine starter will operate.

## FIVE-SPEED AUTOMATIC TRANSMISSION

The New Automatic Gearbox (NAG1) five-speed automatic transmission is optional. It has driver adaptive shift logic, lock up torque converter and driver-selectable Summer and Winter modes. The TCM adapts the shift points to individual driving style, driving situation and road conditions. The basic settings of the driving programs have been geared for sports-style driving. A driver recognition algorithm changes the shift points based on an accelerator pedal usage profile. Depending on driving style, the program smoothly blends from economical to sporty and back.

This five-speed automatic transmission has five forward and two reverse transmission ratios. It includes an anti-slip torque converter lockup clutch and has full electronic control. The torque converter directs the torque into the actual transmission section where three sets of planetary gears, six friction clutch elements and two overrunning clutches change the individual transmission ratios. The ratio spread from 1st to the 5th gear helps minimize fuel consumption and reduces engine noise during cruising. The small ratio intervals also have a positive effect on shift quality.

The transmission fluid is engineered to last the entire service life of the vehicle under normal operating conditions. Only under exceptional circumstances, such as extremely high continuous loads and after a very high mileage is a fluid change required.

To provide acceleration at low vehicle speeds and maintain speed on hills or when carrying heavy loads, the transmission automatically downshifts to an appropriate gear to maintain engine speed within the normal operating range. For added performance, depressing to full throttle causes the transmission to downshift to a lower gear.

Transmission ratios are as follows:

| Gear | 1st | 2nd | 3rd | 4th | 5th | R1 | R2 |
|---|---|---|---|---|---|---|---|
| Ratio | 3.95 | 2.423 | 1.486 | 1 | .833 | 3.147 | 1.93 |

A lock-up torque converter has a 1.8:1 starting torque conversion factor for quick launch performance. Lock up is available in the highest three gears only. The torque converter never completely locks up which eliminates driveline torsional vibrations. The amount of slip varies from 10 to 80 RPM, based on vehicle speed load and accelerator usage profile.

**Transmission Control Module (TCM)**

The 2004 Crossfire uses a TCM that is separate from the PCM.

The TCM determines the current operating conditions of the vehicle and controls the shifting process for optimum performance and shift comfort in various driving situations. It receives this operating data from sensors, switches, and broadcast messages from other modules.

The valve body contains the outputs of the TCM (electric solenoids), which control the pressure and direct the flow of fluid through the internal transmission passages.

The PCM, IC, SLA and CAB broadcast messages over the CAN C Data Bus for use by the TCM. The TCM uses this information, with other inputs, to determine the transmission operating conditions.

This transmission does not have a TCM relay. Power supply to the shift module and the TCM are powered directly from the traction system relay.

The TCM continuously checks for electrical problems, mechanical problems, and some hydraulic problems. When a problem is sensed, the TCM stores a DTC. Some of these codes cause the transmission to go into "Limp-In" or "default" mode. Some faults cause permanent Limp-In and others cause temporary Limp-In. The NAG1 defaults to the current gear position if a DTC is detected, then after a key cycle, the transmission goes into Limp-in, which is mechanical 2nd gear. Some DTCs may allow the transmission to resume normal operation (recover) if the detected problem goes away. Permanent Limp-In DTC recovers when the key is cycled, but if the same DTC is detected for three key cycles, the system does not recover and the DTC must be cleared from the TCM with the DRBIII® scan tool.

**Shift Lever**

The automatic transmission shift lever has four positions: Park, Reverse, Neutral and Drive. When Drive is selected, the TCM automatically selects the appropriate ratio from among the five forward ratios. A gate in the shifter mechanism prevents accidental gear selection. The lever must first be moved to the right to shift from Park to Reverse, and then to the left for succeeding shifts to Neutral and Drive. The process is reversed when returning to Park. An electromagnet in the shifter ensures that reverse gear cannot be engaged when the driving speed is higher than 8 km/h (5 mph).

The program selection switch for the two driving programs (S for the summer driving program and W for the winter driving program) is located next to the selector lever.

A lighted shift indicator assembly in the center console includes a telltale to indicate the position of the shifter.

The SAL communicates with the TCM and other modules over the CAN C data bus.

**AutoStick®**

Autostick® shift control allows the driver to manually downshift and upshift. With the shifter in the Drive position, Autostick® control allows the driver to select the next higher or lower ratio than that which is automatically selected by the TCM. To do this, press the shift lever to the right (+) or left (–) of Drive, respectively.

If the lever is held in the "+" position, the transmission shifts to the Drive range where shifting is automatically controlled. If the lever is held in the "–" position, upshifting stops and the transmission remains in the same gear. If this action occurs when the transmission is in $5^{th}$ gear, a downshift to $4^{th}$ occurs automatically. If gear ranges 4, 3, or 2 are selected, the transmission downshifts and upshifts normally for low-speed driving, but does not upshift beyond the selected gear range. The shift range (P, R, N, D) or gear range (4, 3, 2, 1) currently selected is displayed in the IC.

A rocker switch next to the shifter allows the driver to select the Winter or Summer operating modes depending on available traction. When Winter mode is selected, forward motion starts in 2nd gear and Reverse in a numerically lower ratio than in Summer mode to help improve takeoff on slippery surfaces. Upshifts also occur at lower vehicle speeds than in Summer mode. First gear starts are possible in Winter mode by pressing hard on the accelerator pedal.

The TCM recognizes all shifter positions electronically but for reliability, rod linkage also provides mechanical selection of positions P, R, N and D. This allows vehicle operation in case of an electronic system malfunction. In this "Limp-In" mode, the transmission operates in 2nd gear when the selector is placed in Drive.

**Brake Interlock**

The automatic transmission shifter has a brake interlock. This cable-operated interlock is integrated with the shifter and requires that the driver apply the brakes before shifting out of Park when the ignition is on. A solenoid in the linkage releases the shifter from the Park position when the solenoid receives a signal from a brake-pedal operated switch. In case of an electrical malfunction, the solenoid can be mechanically released.

**Shift Interlock**

With an automatic transmission, a connection between the ignition switch and the transmission shifter allows the switch to rotate into the "lock" position for key removal only when the shifter is in Park. This locks the transmission in the Park position to prevent the vehicle from moving and discourages vehicle theft.

**Transmission Fluid**

The NAG1 transmission uses MS-9602 ATF+4 Automatic Transmission Fluid. It is a fill-for-life fluid.

It has a capacity of 10 liters (10.57 quarts) that includes the transmission, torque converter, and the transmission fluid cooler. It is supplied from the plant with the proper amount of fluid and the fill tube is sealed.

A special service dipstick tool (#8863) is required to check fluid level and a funnel (#8908) is required to fill the transmission. In addition, a special cap must be used after filling the transmission.

The transmission fluid can be checked in Park or Neutral.

### Transmission Cooler

To keep the transmission at normal operating temperature, a portion of the fluid is sent through an oil cooler. Fluid passing through this cooler is cooled and then returned to the transmission through steel tubing.

## DRIVESHAFT

A two-piece driveshaft links the transmission and rear axle through four constant-velocity (CV) universal joints that minimize driveline vibrations.

## REAR AXLE

The rear axle carries a 3.27:1 ratio for the optimum combination of performance and economy.

### Rear Axle and Suspension Cradle

The differential is mounted on rubber dampers to the rear axle unit. The unit includes the differential and all members of the five-link rear suspension that is bolted onto a cradle. The cradle is attached to the body through further dampers at four points. The springs, shocks and anti-roll bar mount directly to the body, but otherwise the entire rear suspension is a self-contained unit.

### Service

Rear axles service procedures are limited to resealing the axle assembly and replacement of the differential. Refer to the Service Information for complete procedures.

## HALFSHAFTS

Articulated halfshafts deliver power from the rear axle to the wheels through constant velocity joints that minimize vibration.

### Service

Rear halfshafts can only be replaced as complete units. No CV joint service is available. Refer to the Service Information for complete procedures.

## HEATING, VENTILATING AND AIR CONDITIONING

### OVERVIEW

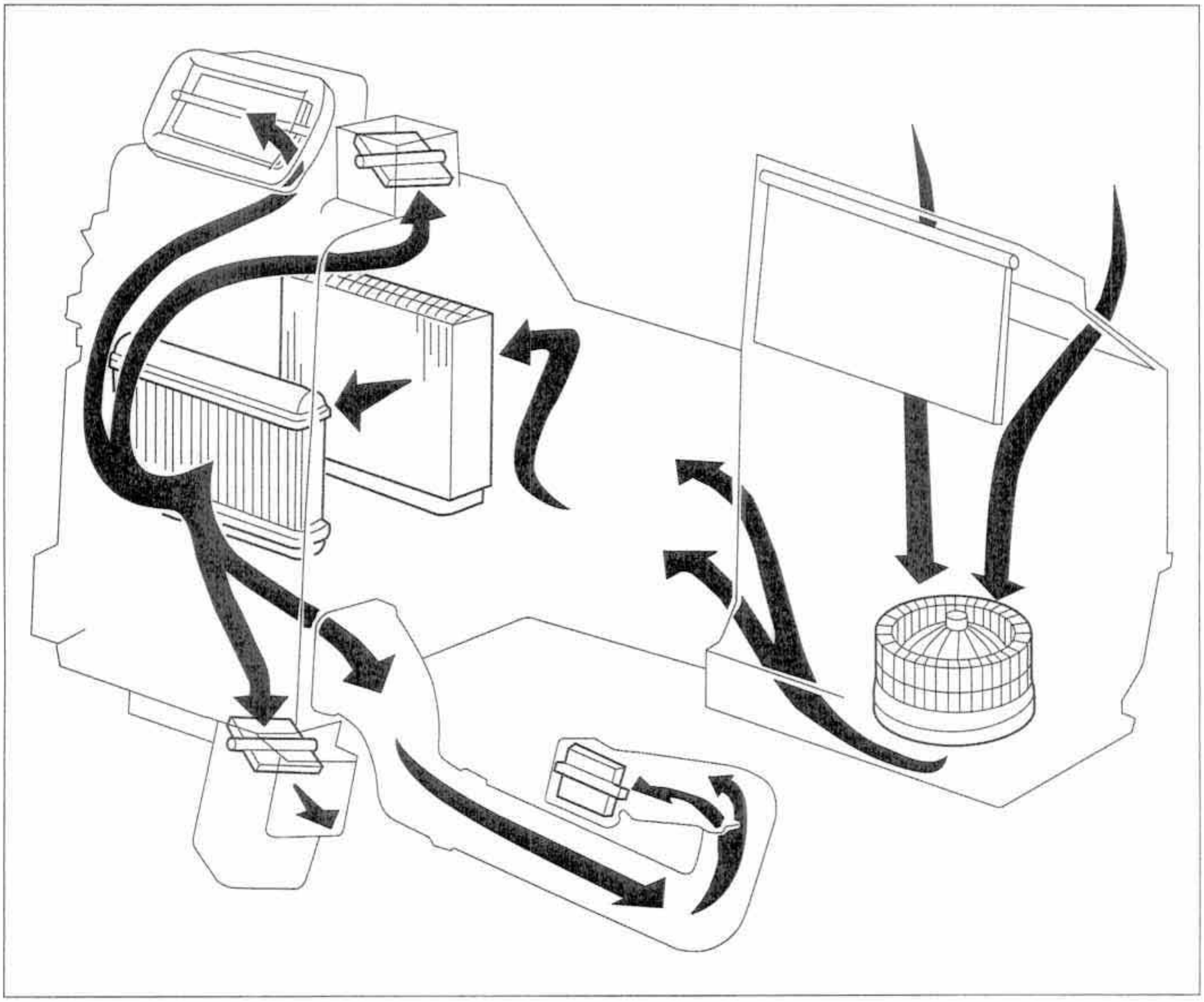


Figure 129 HVAC System

The Heating, Ventilating and Air Conditioning (HVAC) system (Fig. 129) operates continuously when the engine is running unless manually turned off. The Crossfire uses a dual-zone climate control system with a manual temperature dial on each side of the control head for driver and passenger zones. The electronically controlled HVAC system holds the desired interior temperature constant.

The refrigeration system is a Thermal Expansion Valve (TXV) type.

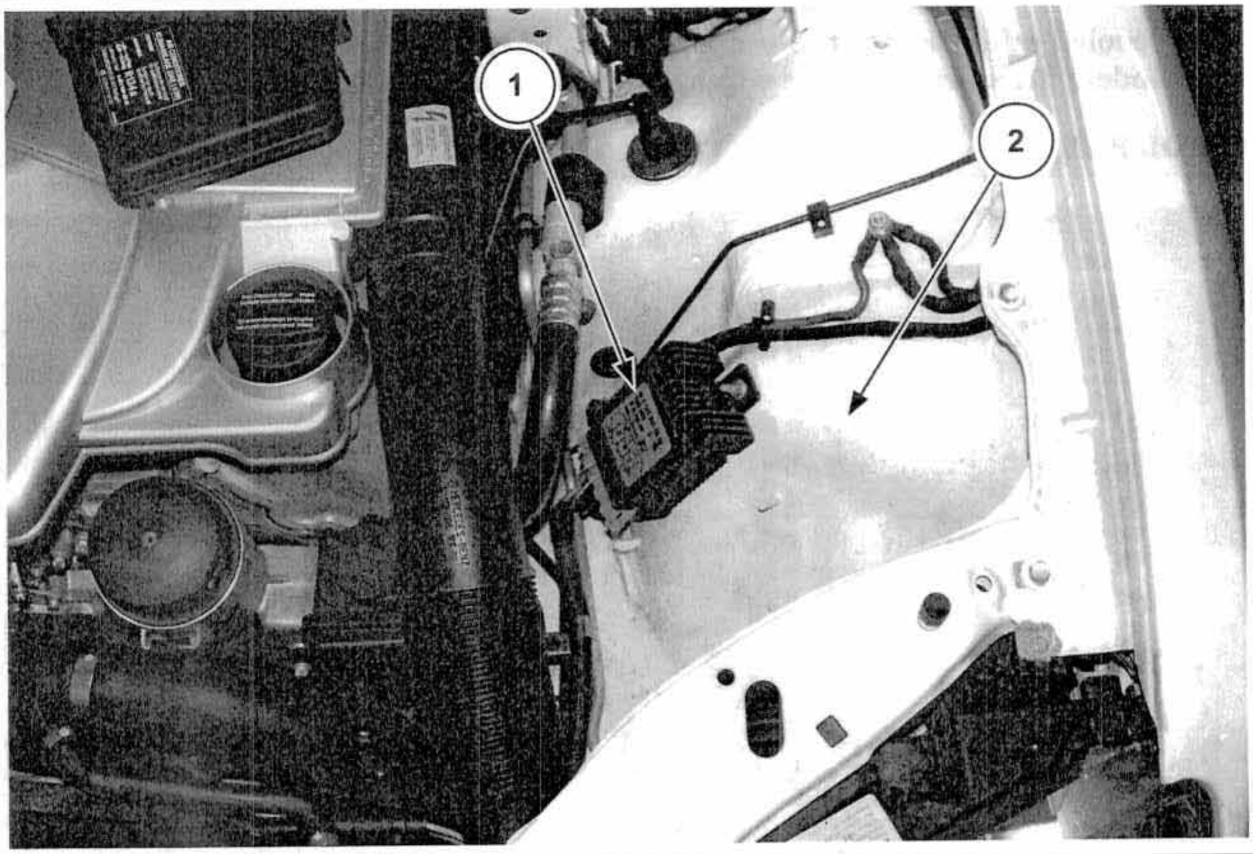
When the engine is started, the air conditioning system is always operational from blower speed 1 and works according to the "reheat" principle. This means the refrigerant compressor always runs when ambient temperature is above 1°C (33°F) and thereby cools incoming air. This is primarily for comfort since cooling also has the effect of drying air. After the cooling process, the dry air on the heater core is heated to desired temperature. The cooling system is shut off with the AC button.

**Heater Mode**

The heater core temperature sensor measures air temperature at the heater core while the ambient air temperature sensor determines current outside temperature. The system electronics compare the various measured values with the requested temperature. The electronics adjust the coolant flow to the heater core to add or remove heat, as required.

**Cooling Mode**

An evaporator temperature sensor measures temperature on the evaporator air outlet, while an ambient air temperature sensor determines current outside temperature. The system electronics compare the desired temperature set on temperature dials with ambient temperature, and control blower temperature by programming stored in the control and operating unit. Electronics adjust air conditioning or hold current settings constant, as required.




| | | | |
|---|---|---|---|
| 1 | Radiator Fan Control Module | 2 | Left Inner Fender |

Figure 130 Radiator Fan Control Module

The electric engine-cooling fan (Fig.130) is actuated by the Radiator Fan Control Module. The PCM supplies the information required for actuating the engine-cooling fan to the Radiator Fan Control Module.

**Temperature Control**

The temperature set on the temperature dials is achieved or held constant by:

- heating the air passing through the heater core
- cooling the air passing through the evaporator
- cooling and reheating the air (reheat mode)

The heater core heats the air flowing through it and on through the air ducts into the vehicle passenger compartment. The heat given up by the heater core is regulated by the Coolant Circulation Valves that control the flow rate of the heated coolant. The Coolant Circulation Valves are controlled by the HVAC Control Head.

To cool, the Coolant Circulation Valves are closed. Heated coolant cannot flow through the heater core.

The air is cooled and dried in the evaporator and heated up again in the heater core (Reheat Mode). This prevents the windows from fogging up on the inside.

**CONTROL PANEL**

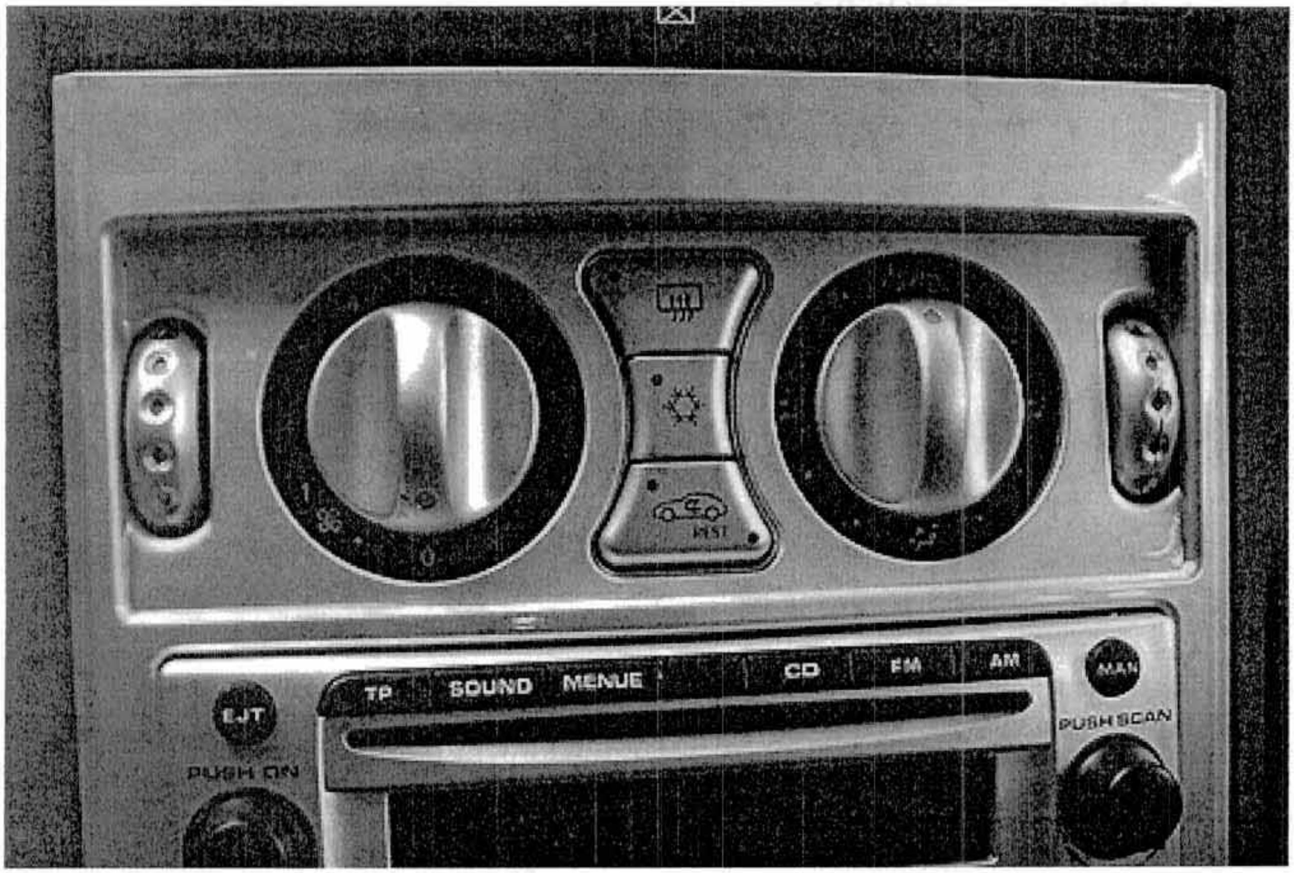
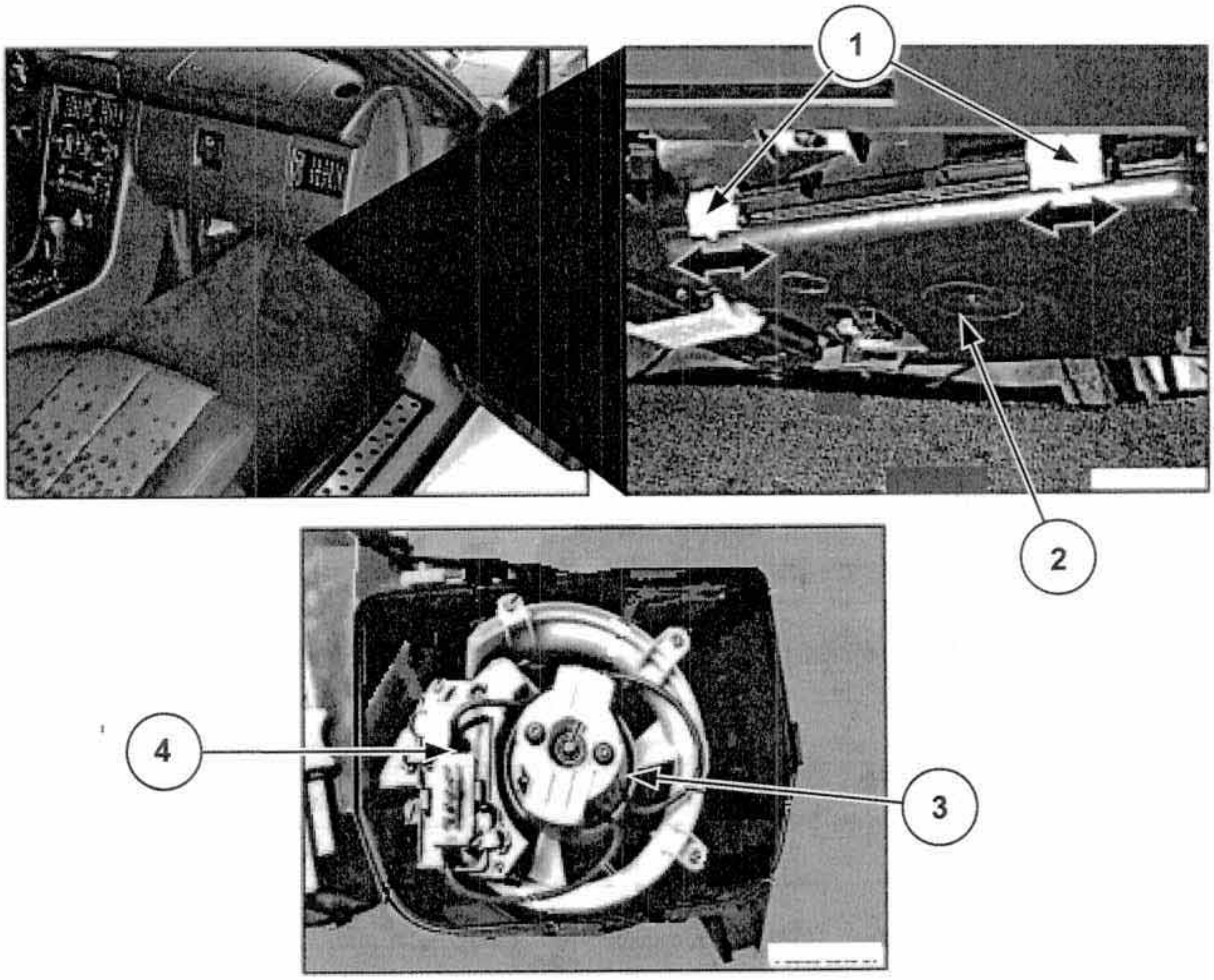



Figure 131 HVAC Controls

**Blower**




| | | | |
|---|---|---|---|
| 1 | Blower Motor Access Panel Latch | 3 | Blower Motor |
| 2 | Blower Motor Access Panel | 4 | Fan Speed Control Module |

Figure 132 Blower Control

The blower is located on the HVAC housing below the glove compartment. The electronic blower control (Fig. 132) is located below the glove compartment and is bolted to the blower.

The blower is a two-stage radial fan.

- In the fresh air mode, the blower draws in fresh air through the fresh air door.
- In the recirculated air mode, air is drawn in through the recirculated air door from the vehicle passenger compartment into the heater or air conditioning housing.
- In the REST mode, the blower circulates the air in the passenger compartment. Explain when this is used.

The blower switch integrated into HVAC control module switches the control voltage to the blower regulator. With air conditioning, the control module compares the control voltage with programming and switches it to the blower regulator which then actuates the blower. Manual operation is possible in seven stages.

The blower switch, integrated into the HVAC Control Head, has five stages. The control voltages are specified in the table below.

Table 9 Blower Switch Control Voltages

| BLOWER SWITCH STAGE | CONTROL VOLTAGE RANGE |
|---|---|
| Stage 1 | 1.1 to 1.8 V |
| Stage 2 | 2.0 to 2.6 V |
| Stage 3 | 2.8 to 3.2 V |
| Stage 4 | 3.6 to 4.2 V |
| Stage 5 | 5.0 to 6.0 V |

**Fan Speed Control**

A rotary fan speed knob, labeled with an fan icon, provides five numbered airflow rates. The knob has a telltale pointing toward the selected flow rate. An ISO defroster icon adjacent to the "5" indicates the preferred setting for defrosting. Turning the knob to the "0" position turns the HVAC system off and closes the outside air intake.

**Air Distribution Control**

A selector knob that allows 360° continuous rotation in either direction controls airflow distribution among the floor, panel and defroster outlets. Icons around the knob indicate outlets through which air is flowing. Dots between the icons indicate intermediate adjustments that allow occupants to adjust airflow. Air is delivered to the panel outlets in all modes; its volume can be modulated or shut off as desired using the thumb wheels at the vents. A telltale on the knob points toward the selected outlet configuration.

**Temperature Control**

Dual thumb wheels on the HVAC Control Head provide independent control of air temperature for driver and passenger. A colored band in the center of each thumbwheel changes from blue to white to red in the direction of increasing temperature. With the temperature set to a desired level, the control system provides optimum heating or cooling until the setting is reached. For defrosting, the thumb wheels are rotated to the maximum temperature position, which is identified by an defroster icon.

**Rear Window Defogger**

When the rear window defogger switch is placed in the RUN position, the electric heater grid on the rear window glass is energized. The heated mirrors are also equipped with heater grids located behind the outside rear view mirror glass. Each of these grids produce heat to help clear the rear window glass and outside rear view mirrors of ice, snow, or fog.

A momentary switch in the HVAC control module assembly controls the defogger system. An amber indicator lamp in the HVAC Control Head assembly illuminates to indicate when the defogger system is turned on. The defogger system automatically turns off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the defogger switch is turned on again during the same ignition cycle, the defogger system 10-minute timer resets. The defogger system automatically shuts off if the ignition switch is turned to the OFF position, or it can be turned off manually by pressing the defogger switch a second time.

**Economy Mode Button**

Pressing the "snowflake" button activates the Economy Mode. It is turned off the same way. An LED in the button illuminates when Economy Mode is active. The function of this setting corresponds to the Air Conditioning Mode. However, the air conditioning compressor does not run. Using the Economy Mode may cause window fogging.

**Air Recirculation Control**

Pressing the air recirculation button closes the outside air intake to prevent the entry of unpleasant odors or dust, or to increase interior heating or cooling. An LED in the switch illuminates during air recirculation. Pressing the button a second time cancels air recirculation.

Because air recirculation may deteriorate interior air quality and/or cause window fogging, the system automatically restores outside airflow after approximately five minutes. It does this when outside air temperature is below 5°C (40°F) and after approximately 30 minutes when outside air temperatures are above 5°C (40°F). At high outside temperatures, the system automatically switches to Recirculation Mode for approximately 30 minutes after start up to speed interior cooling.

With automatic heater and air conditioning, when the recirculated air button is pressed, the electro-magnetic fresh/ recirculated air door switchover valve is actuated for control of the recirculated air door.

**Residual Engine Heat System (REST) Mode**

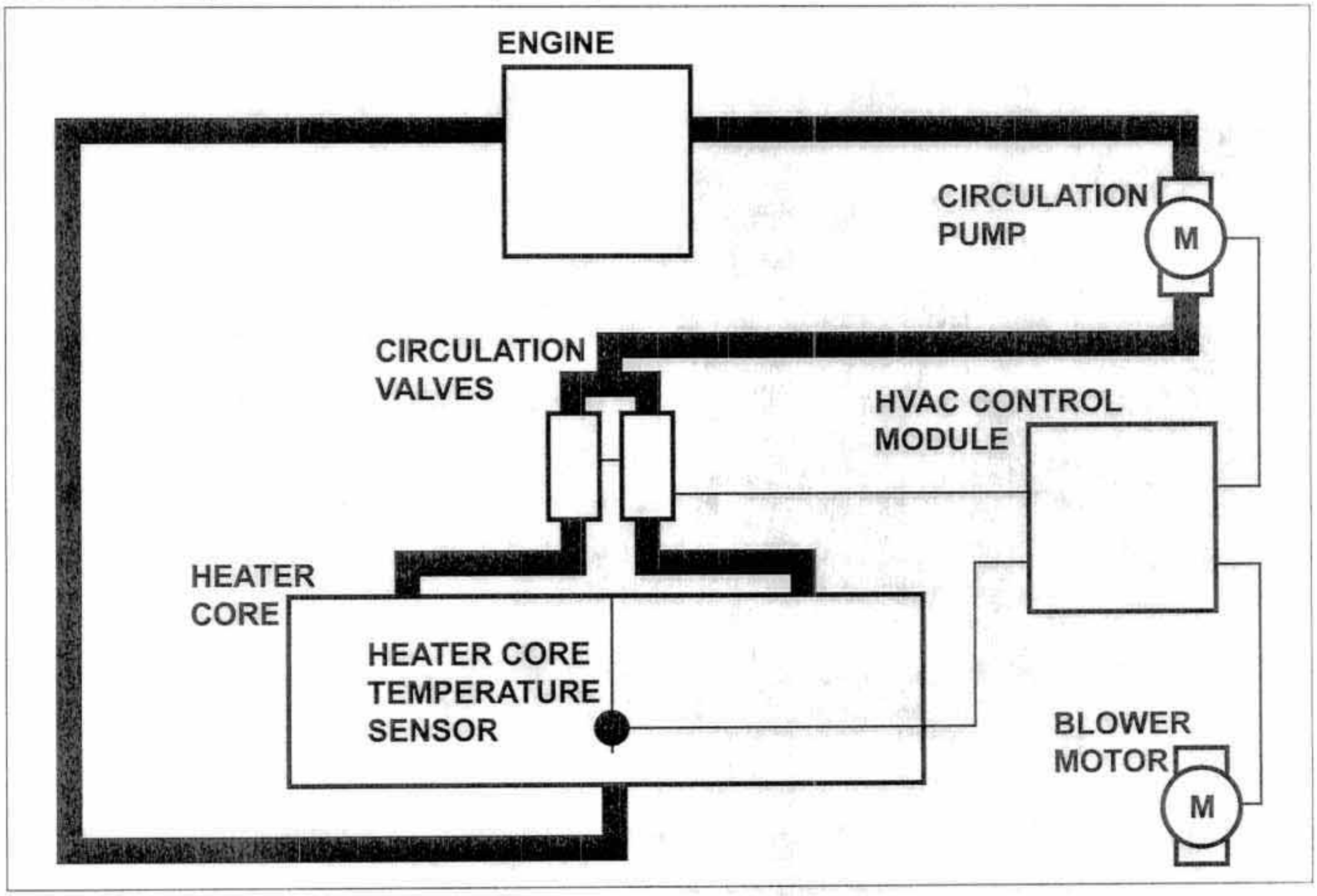



Figure 133 HVAC Block Diagram

The Crossfire has a manual dual zone climate control system. This feature allows the driver and passenger to control their respective temperatures separately. Refer to Figure 133.

An additional feature called Residual Engine Heat System (REST), allows the occupants to control heating, ventilation and air conditioning modes and temperature with the fan running on low, after the ignition has been shut off. REST functions up to a half hour after the ignition has been shut off, or until the temperature of the coolant falls below a predetermined level.

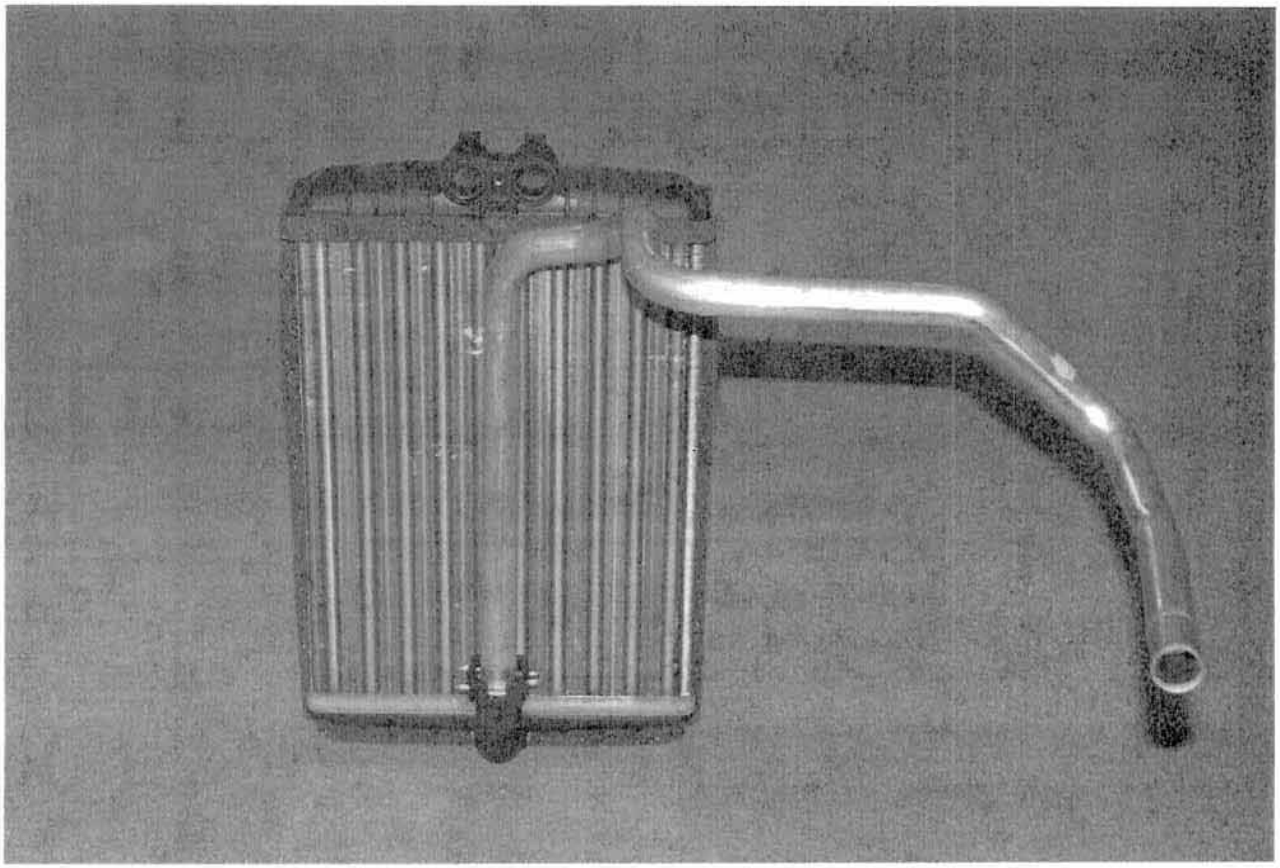
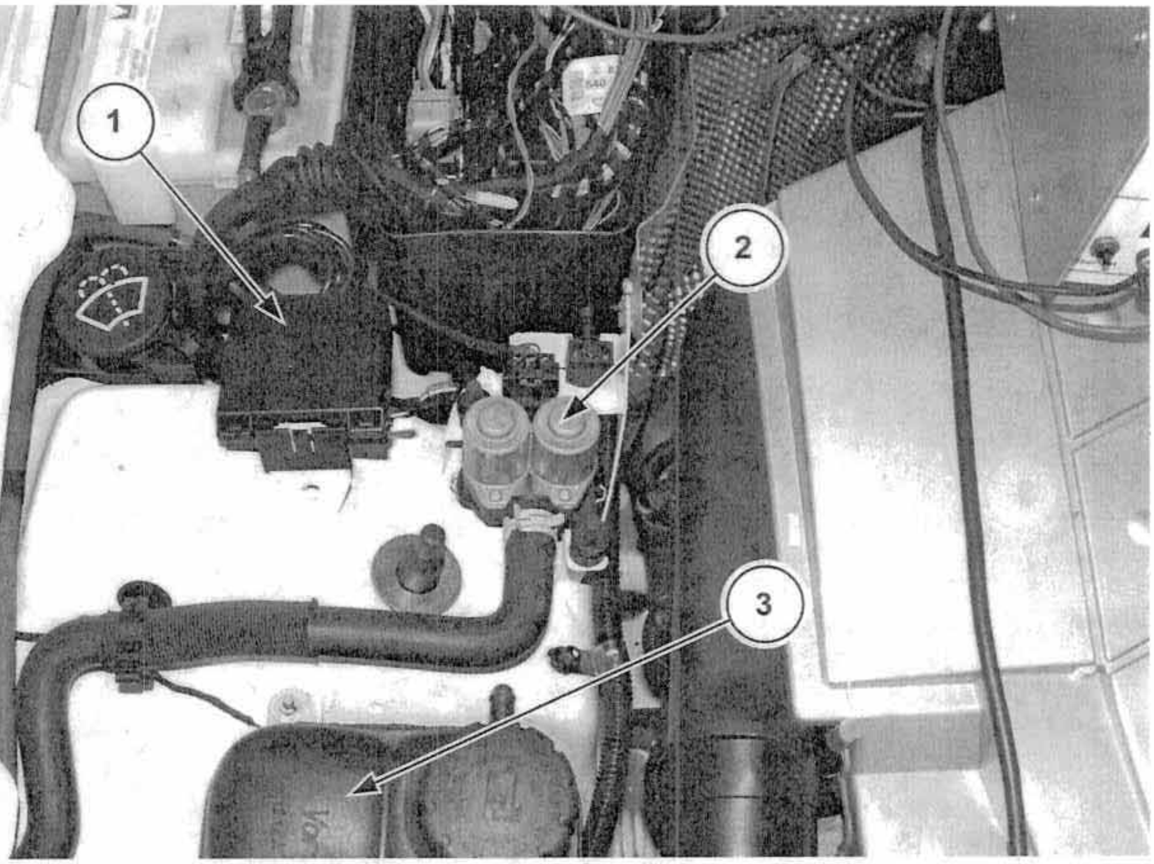


Figure 134 Heater Core

The heater core (Fig. 134) is located in the HVAC plenum. The one-piece heater core is sectioned into two halves (one for the driver and one for the passenger). Each side of the heater core has its own inlet and shares a common outlet.

Coolant Circulation Valves

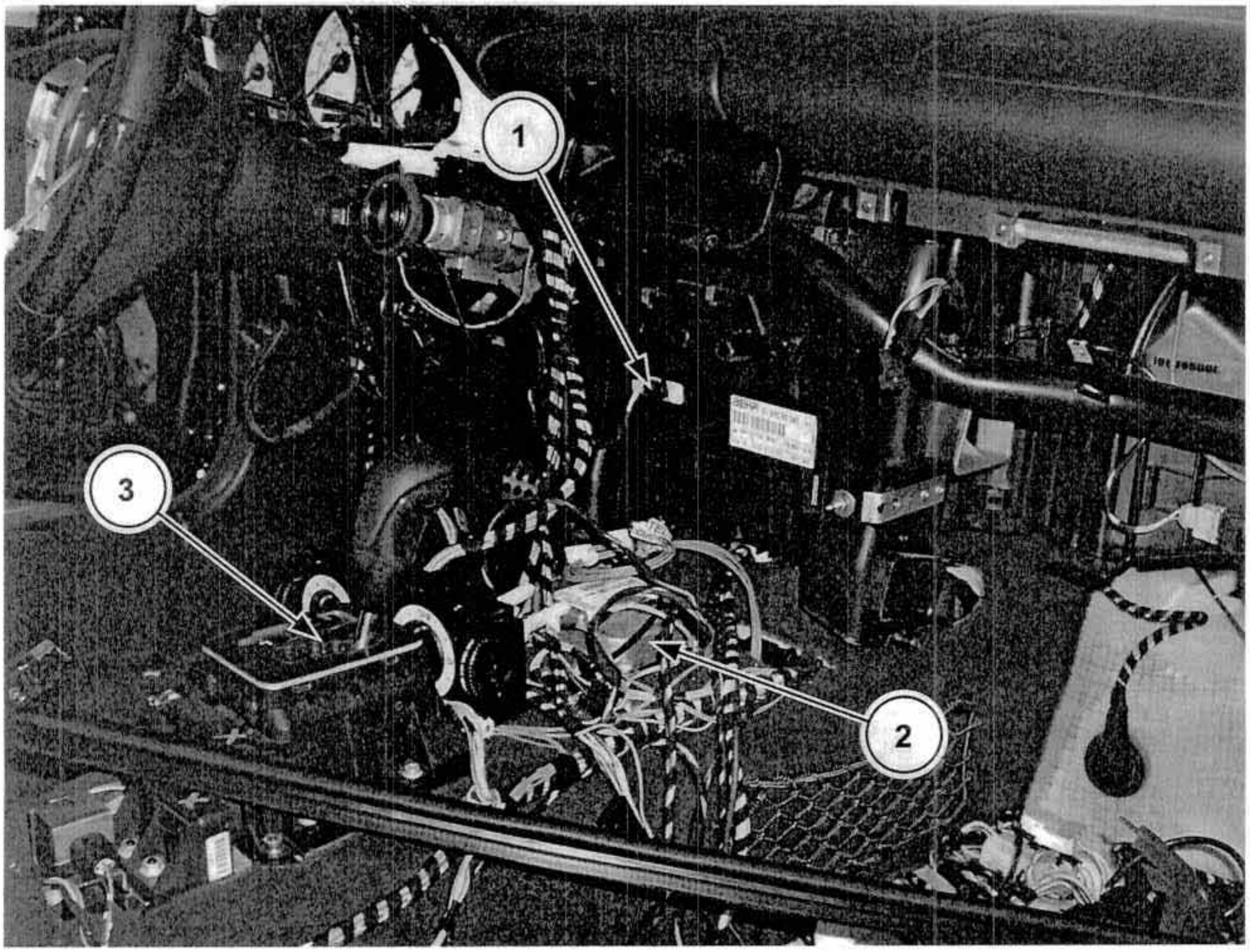



| | | | |
|---|---|---|---|
| 1 | Engine Fuse Block | 3 | Coolant Recovery Reservoir |
| 2 | Coolant Circulation Valves | | |

Figure 135 Coolant Circulation Valves

The coolant circulation valves (Fig. 135) are located near the right front inner fender. Each coolant circulation valve controls coolant flow through either the driver or passenger side of the heater core. Each coolant circulation valve receives a digital open/close signal from the A/C heater control module based on inputs from the A/C temperature controls and the heater core temperature sensor.

Heater Core Temperature Sensor




| | | | |
|---|---|---|---|
| 1 | Heater Core Temperature Sensor | 3 | Shift Lever Assembly (SLA) |
| 2 | Occupant Restraint Controller (ORC) | | |

Figure 136 Heater Core Temperature Sensor

The heater core temperature sensor (Fig. 136) is located on the HVAC plenum near the heater core. The heater core temperature sensor provides the A/C heater control module with heater core temperature information. The heater core temperature sensor is a variable resistor type sensor.

A/C Heater Control Module

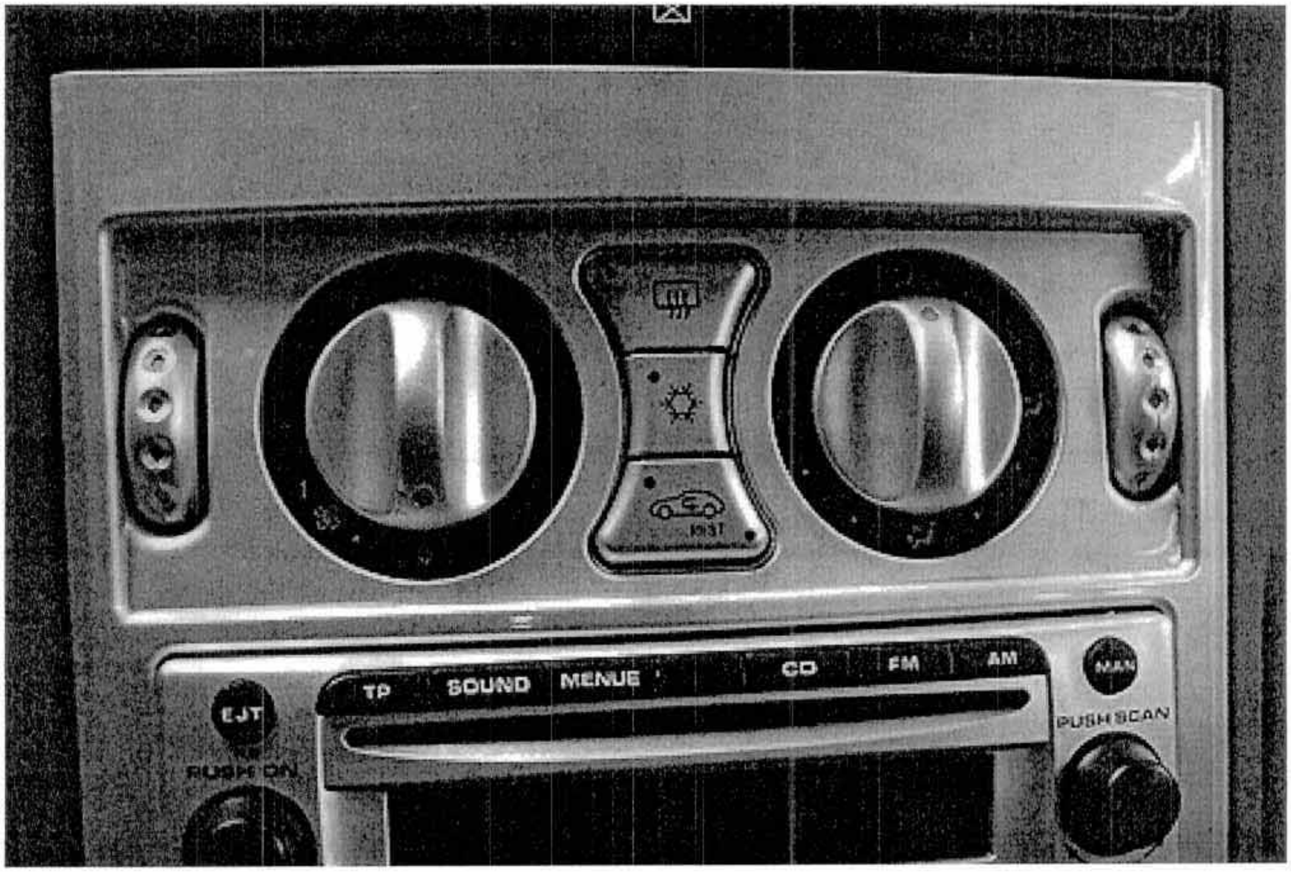
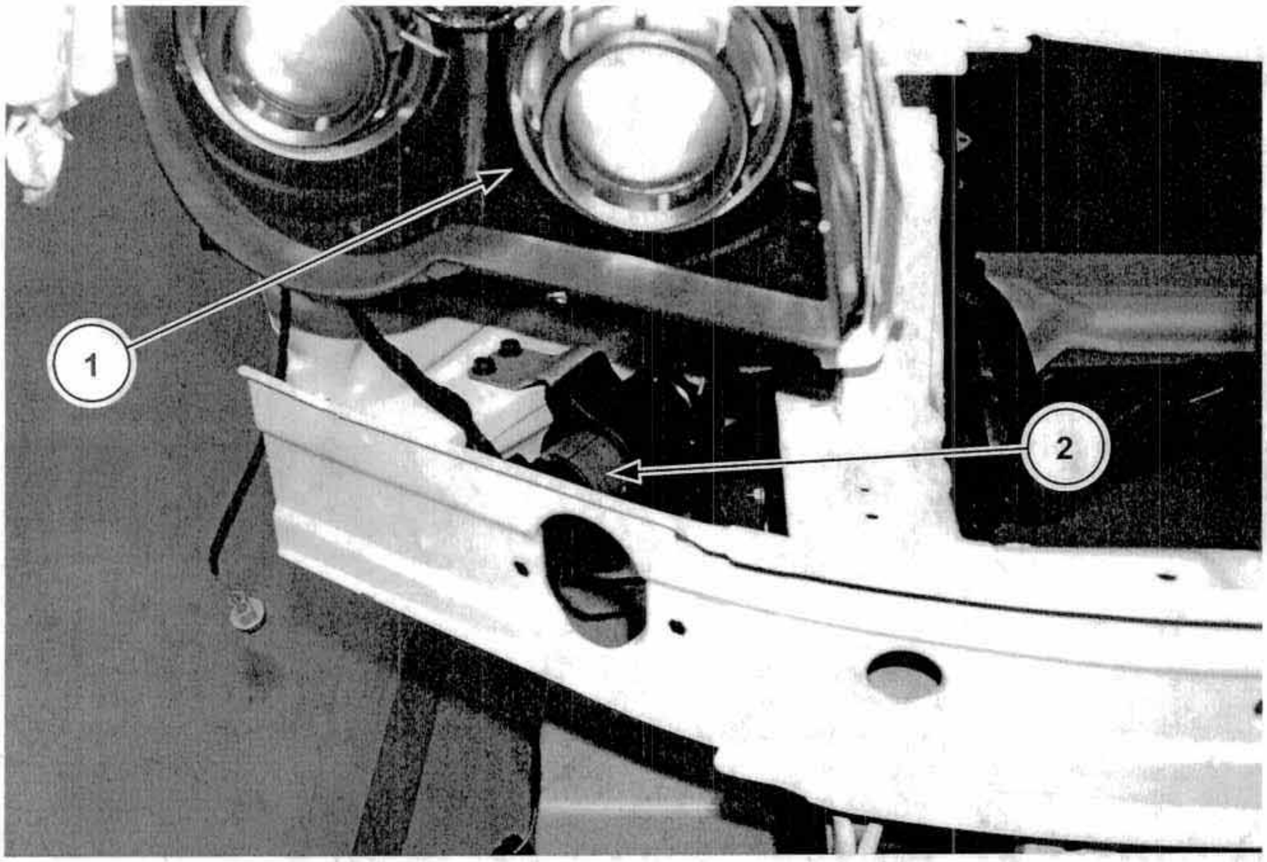



Figure 137 A/C Heater Control Module

The A/C Heater Control Module (Fig. 137) is integral with the climate controls on the vehicle center stack. The A/C Heater Control Module processes dual zone temperature requests from the climate controls and adjusts the coolant flow to each side of the heater core via the coolant circulation valves. The A/C heater control module processes input from the REST button on the A/C heater controls. If enabled, the A/C Heater Control Module provides a ground signal to the coolant circulation pump.

Coolant Circulation Pump




| | | | |
|---|---|---|---|
| 1 | Right Headlamp Assembly | 2 | Coolant Circulation Pump |

Figure 138 Coolant Circulation Pump

The coolant circulation pump (Fig. 138) is located in the right front corner of the engine compartment and is used to provide additional coolant volume during engine idle conditions or heating requests from the A/C heater control module. The coolant circulation pump receives a B+ feed from the underhood accessory fuse block and the A/C Heater Control Module controls the ground.

**Dual Zone Temperature Control**

When an occupant changes their temperature setting, the A/C Heater Control Module receives input from the temperature control wheel. If the current sensed heater core temperature is less than the requested temperature, the A/C Heater Control Module sends a command to the respective coolant control valve to stay open longer. This raises the temperature of the respective heater core.

If the A/C Heater Control Module determines that an additional volume of coolant is needed, it commands the circulation pump to come on. If the current sensed heater core temperature is more than the requested temperature, the A/C heater control module sends a command to the respective coolant control valve to stay closed for a longer time. This lowers the temperature of the respective heater core.

**Residual Engine Heat System (REST)**

REST allows occupants to adjust climate control modes and passenger compartment temperature with the ignition shut off. The circulation pump is cycled on and off on as needed. The recirculation valve is closed to outside air.

When an occupant presses the REST button on the A/C heater controls before the ignition is switched off, the REST feature is functional. An LED on the REST button indicates this.

**Front Ventilation**

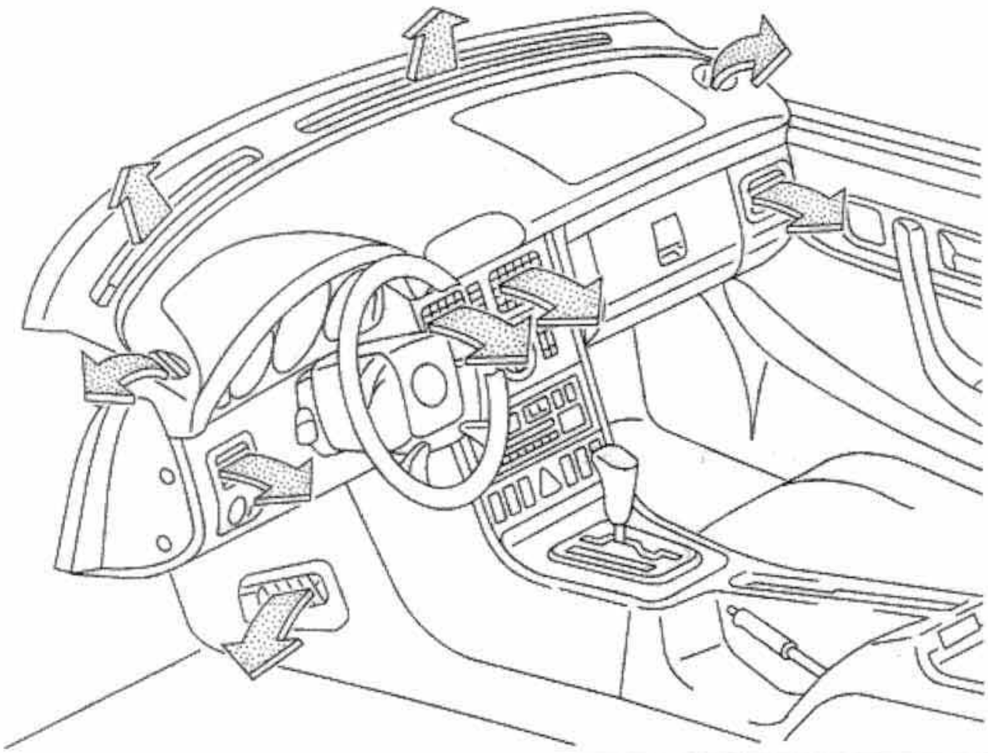


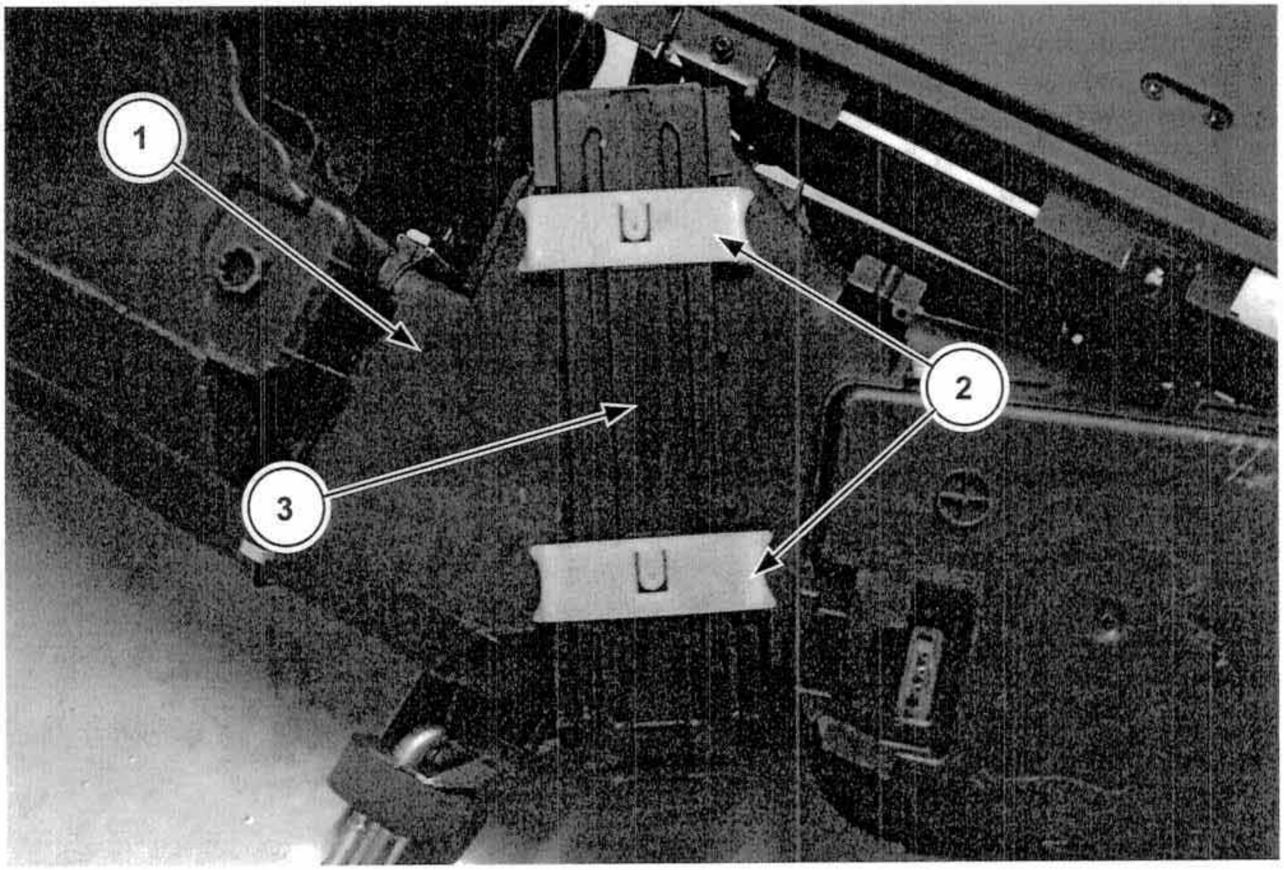
Figure 139 Front Ventilation

The ventilation provides air supply for the vehicle passengers, rapidly achieving uniform and pleasant temperatures in the passenger compartment and prevents the windows from fogging. The blower supports ventilation during normal operation when the vehicle is standing still or for increasing the airflow. Refer to Figure 139.

Outside air is drawn in by the air inlet and the outside air door in the heater/AC housing. Depending on the settings on the HVAC Control Head, air flows to the air outlets through the air ducts into the passenger compartment.

The air flows through air openings below the rear shelf into the trunk and out of the vehicle through the rear compartment nozzles. In the recirculated air mode, air is drawn out of the vehicle passenger compartment through the recirculated air door by the blower and flows into the heater/AC housing.

**Electrostatic Dust Filter**




| | | | |
|---|---|---|---|
| 1 | HVAC Plenum | 3 | Dust Filter Access Cover Latch |
| 2 | Dust Filter Access Cover | | |

Figure 140 Dust Filter

An electrostatic dust filter (Fig. 140) removes nearly all dust particles and pollen before outside air enters the passenger compartment through the air distribution system. The dust filter filters the air flowing through the heater/air conditioning housing. Outside air as well as recirculated air is filtered.

The dust filter element consists of a mat that purifies the air as the air flows through it.

- More than 80% of particles larger than 0.3 micron are removed.
- 100% of particles larger than 0.5 micron and pollen are removed.

**Rear Ventilation**

The air flowing through the vehicle passenger compartment exits the vehicle through the rear vents. Louver-type flaps installed in the rear vents open because of the pressure of the air flowing through the vehicle allowing it to escape. If a vacuum is present in the vehicle, such as can occur when driving with the windows open, the flaps close automatically by the force of gravity preventing exhaust gas, dust and moisture from being admitted into the passenger compartment.

**Instrument Panel Ducts and Outlets**

Four instrument panel outlets deliver airflow at all times that the fan is operating. Vanes in the outlets can alter the airflow direction vertically and horizontally. A thumbwheel between the center outlets can modulate or stop airflow from these outlets. Similar thumb wheels modulate or stop airflow from the outboard outlets and the side window defroster outlets.

**Side Window Defroster Outlets**

Side window defroster outlets in the outboard ends of the instrument panel can be rotated to redirect the airflow. Air flows through these outlets at all times that the fan is operating.

**Windshield Defroster Outlets**

Wide slots at the base of the windshield provide rapid defrosting.

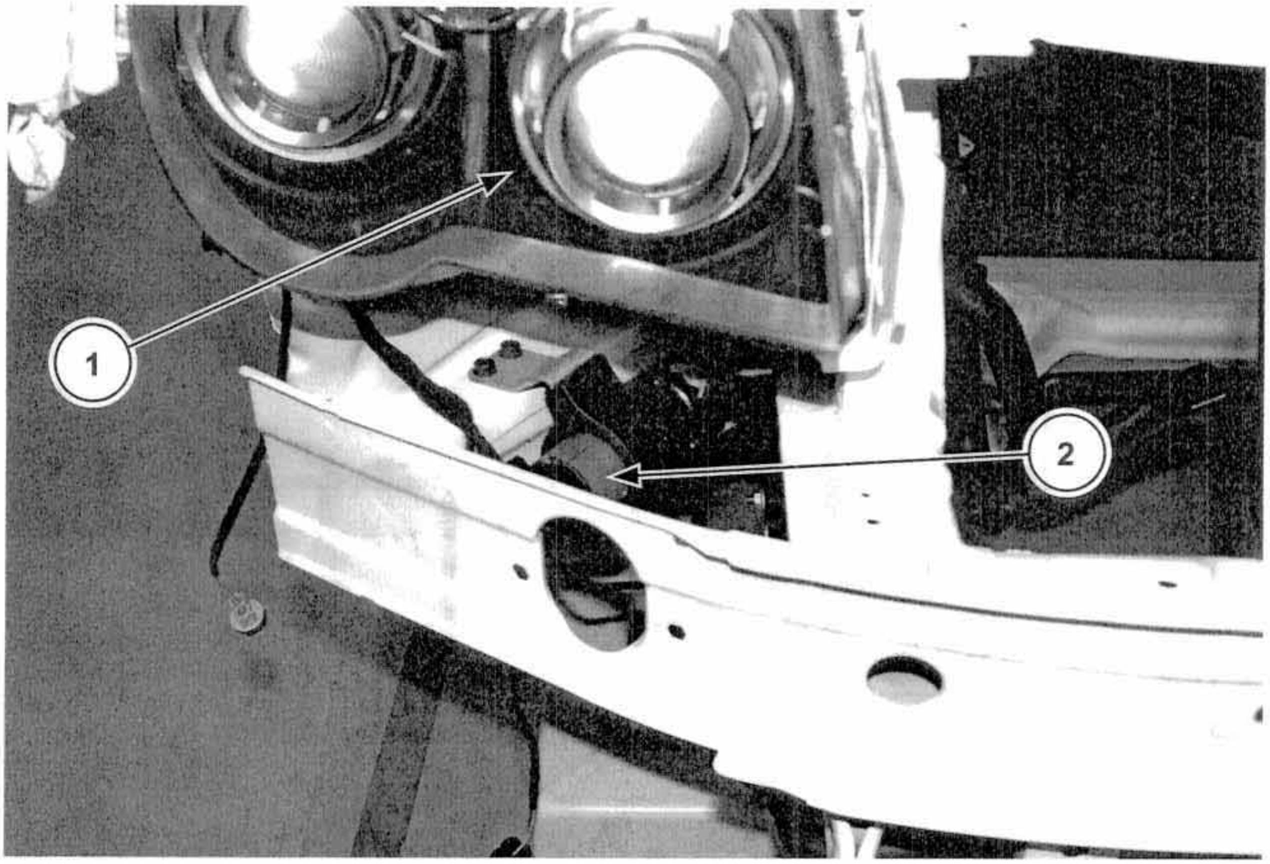
**HEATING SYSTEM COMPONENTS**

**Two-Sided Heater Core**

The heater core is used to heat the air that is drawn into the plenum. Heated coolant flows through the heater core. The heat is transferred by the aluminum tubes and fins that warm the air flowing to various defrosters, ventilation and heating nozzles in the vehicle passenger compartment.

The two-sided heater core has two inlet hoses from the Coolant Circulation Valve, and one outlet hose to return coolant to the engine cooling system. The volume of coolant in either side of the heater core is determined by the temperature thumbwheel setting on that side of the vehicle (driver or passenger). This allows for dual zone temperature control.

**Coolant Pump**

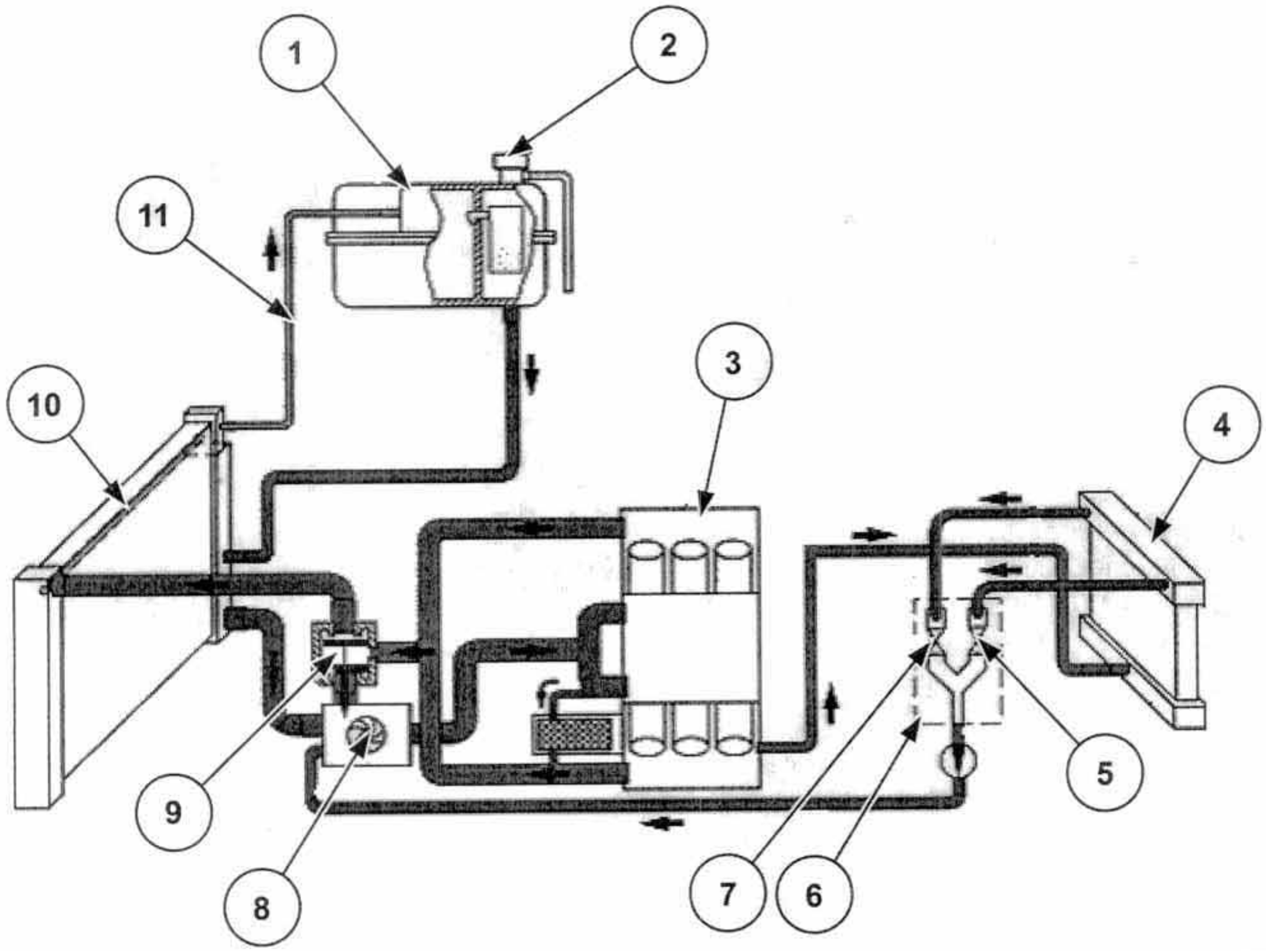



| | | | |
|---|---|---|---|
| 1 | Right Headlamp Assembly | 2 | Coolant Circulation Pump |

Figure 141 Coolant Circulation Pump

The coolant circulation pump (Fig. 141) maintains a uniform flow of heating water through the heater core even at low engine speeds and in the REST mode.

The quantity of coolant pumped to the heater core with the engine running depends on the engine-mounted water pump. The coolant circulation pump ensures that the coolant flows through the heater core uniformly without bubbles, even at low speeds. The coolant circulation pump is controlled by the HVAC Control Head. Refer to Figure 142.



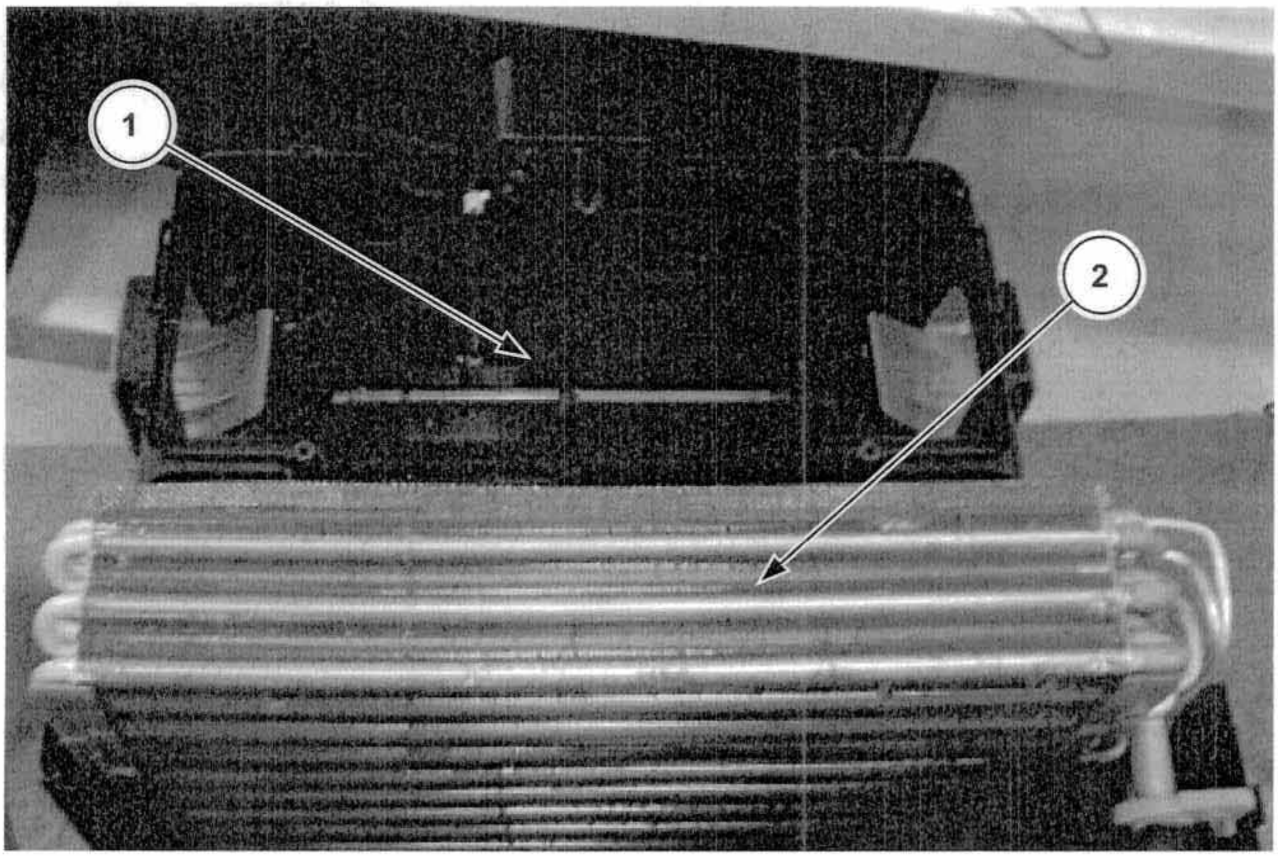

| | | | |
|---|---|---|---|
| 1 | Coolant Recovery Reservoir | 7 | Right Coolant Circulation Valve |
| 2 | Two-Stage Coolant System Cap | 8 | Coolant Circulation Pump |
| 3 | Engine | 9 | Thermostat |
| 4 | Heater Core | 10 | Radiator |
| 5 | Left Coolant Circulation Valve | 11 | Bypass |
| 6 | Heating System Delivery Unit | | |

Figure 142 Coolant Flow Through Heater Core

The coolant circulation pump (Fig. 142) provides an additional volume of coolant to the heater core when the engine is idling. When the REST button is pressed, the temperature is controlled by the HVAC Control Head (the same way as when the ignition is on). The HVAC Control Head switches the electric motor for the coolant circulation pump, which drives the impeller with a magnetic clutch.

**REFRIGERATION SYSTEM COMPONENTS**

**Evaporator**

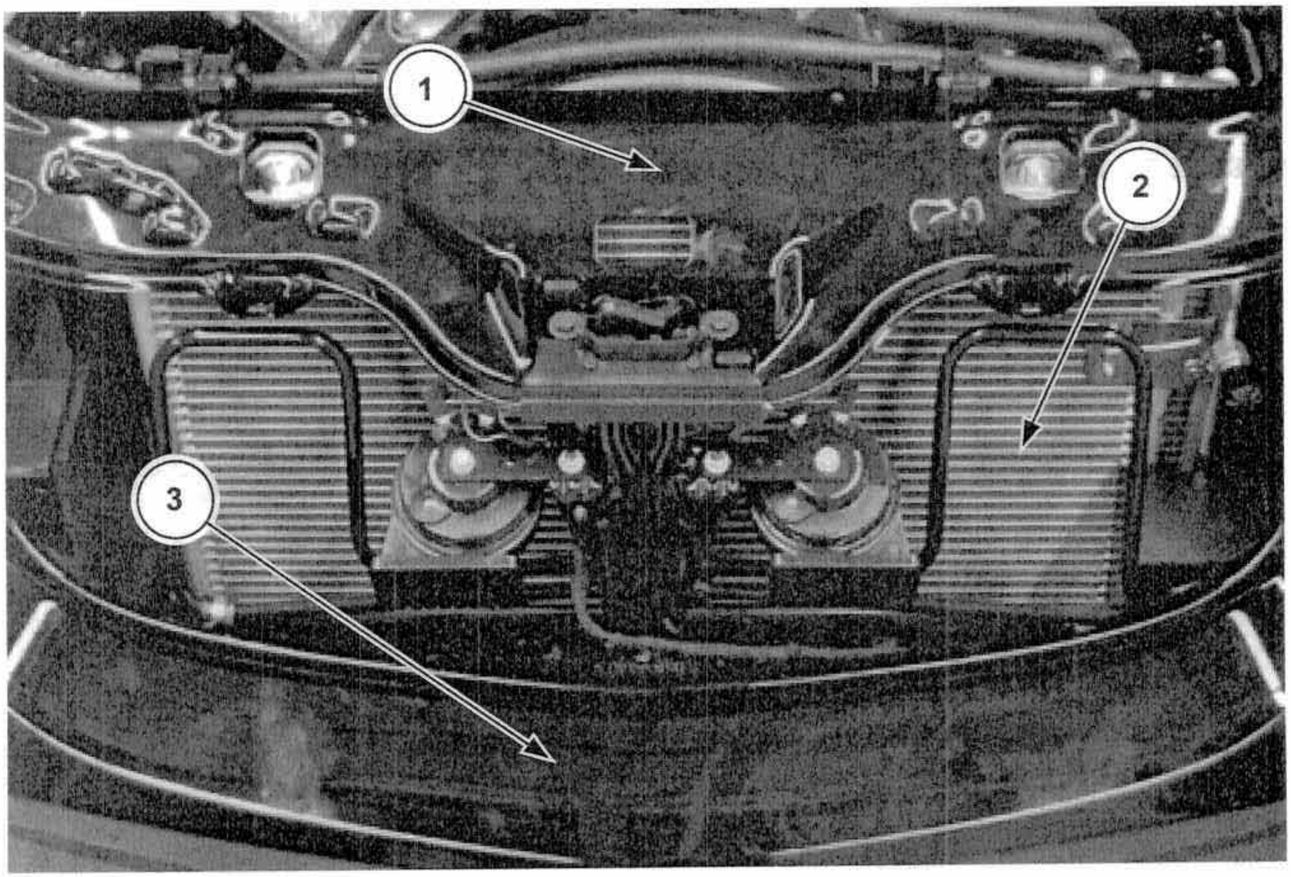



| | | | |
|---|---|---|---|
| 1 | HVAC Plenum | 2 | Evaporator |

Figure 143 Evaporator

The evaporator (Fig. 143) cools, dehumidifies and purifies the passenger compartment air. The liquid refrigerant is injected into the evaporator under high pressure. The heat required for evaporation is absorbed from the air flowing past the evaporator cooling the air. The fins or louvers provide a large evaporator surface ensuring quicker heat exchange. The moisture condensing out of the air as it cools is drained outside through condensed water drain hoses. In addition, the solid particles are removed from the air by the condensing water purifying the air.

## Condenser



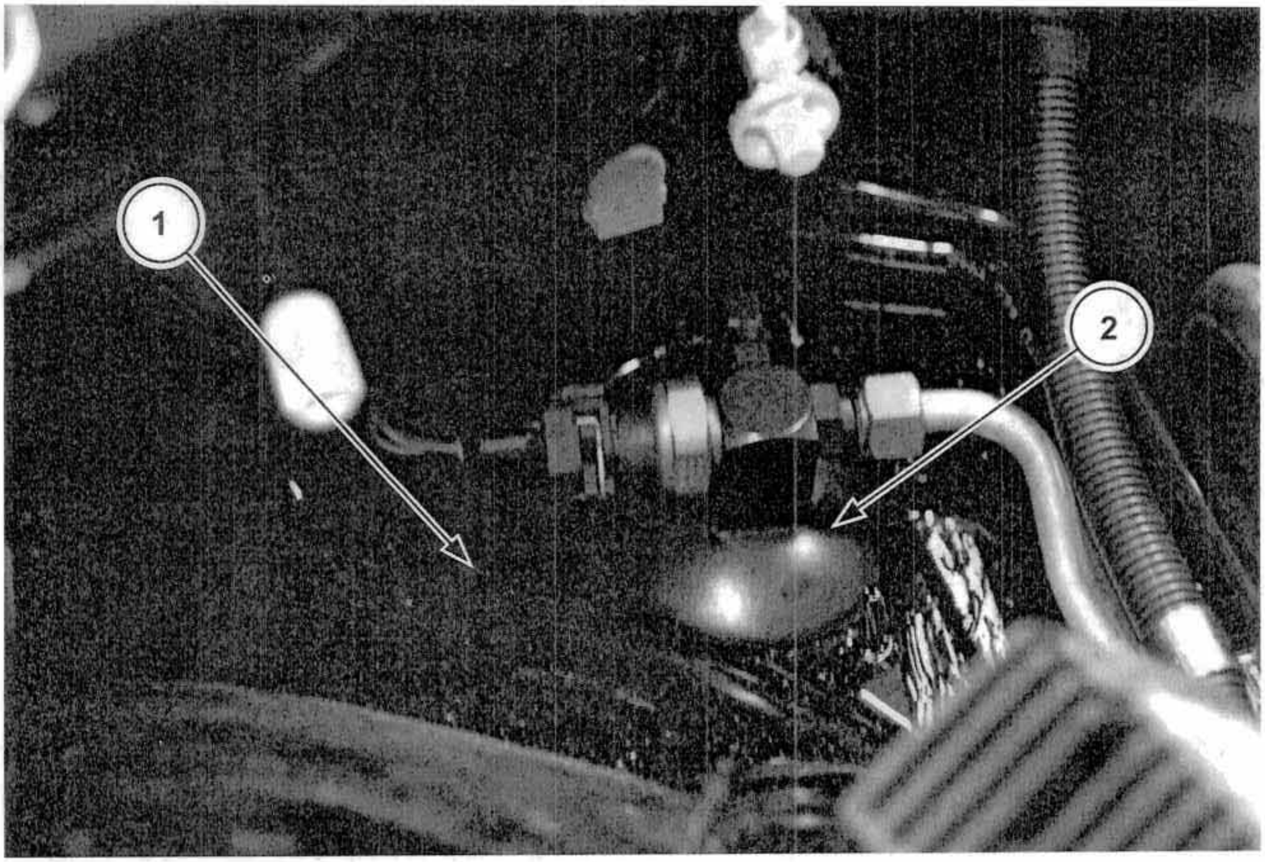

| | | | |
|---|---|---|---|
| 1 | Radiator Support | 3 | Condenser |
| 2 | Front Bumper | | |

Figure 144 Condenser

The condenser (Fig. 144) is located directly behind the radiator shell. The condenser transforms the state of the refrigerant coming from the evaporator core from gaseous into liquid. The hot refrigerant is pressed into the condenser from above coming from the A/C compressor. Banks of tubes and louvers quickly absorb this heat. Exterior air is pressed or sucked through the condenser and heated up thereby cooling the refrigerant.

As the refrigerant is cooled down to a certain temperature, depending on the pressure, the refrigerant condenses and becomes liquid. The liquid refrigerant exits from the condenser at the bottom and flows into the receiver/drier.

**Receiver Drier**



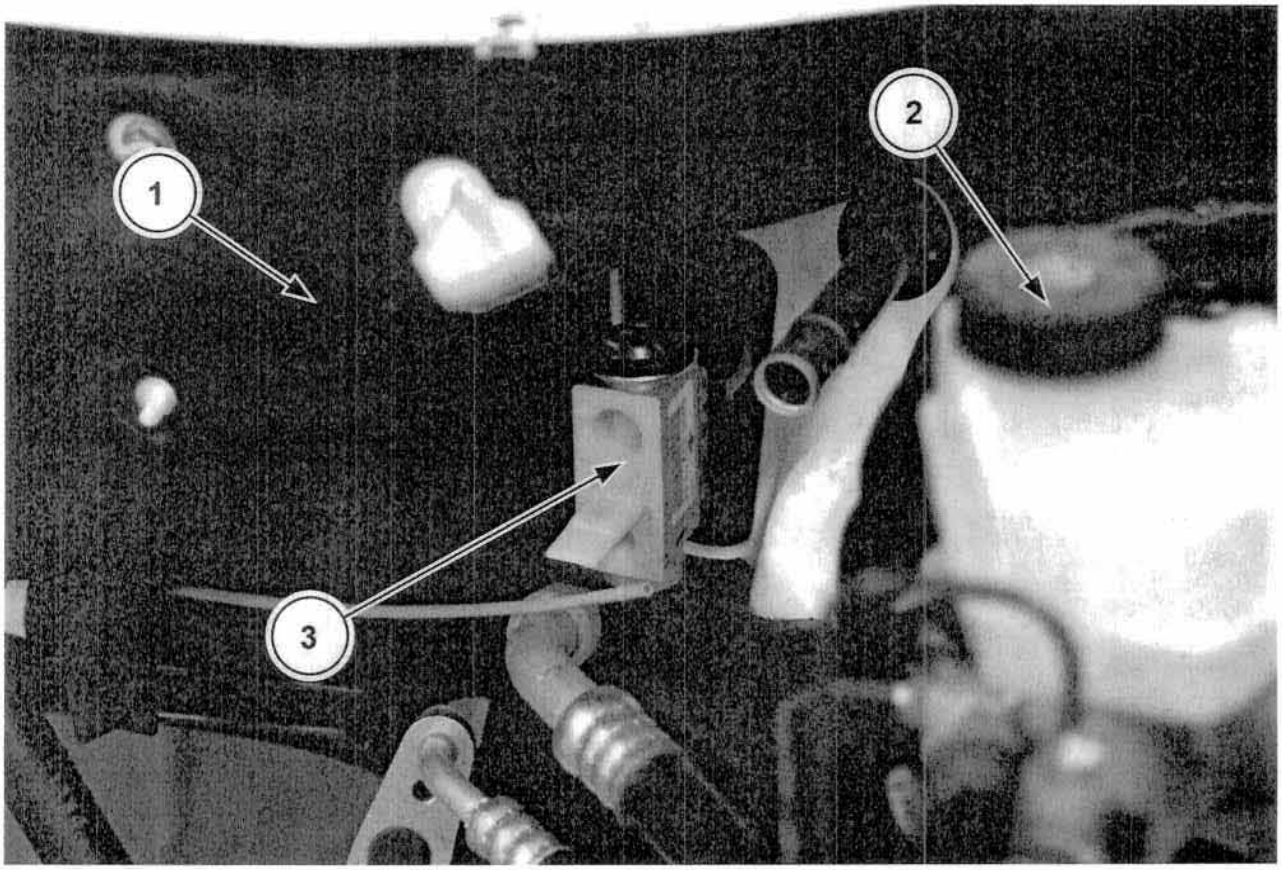

| | | | |
|---|---|---|---|
| 1 | Left Inner Fender | 2 | Receiver/Drier |

Figure 145 Receiver/Drier

The Receiver/Drier (Fig. 145) is located in the engine compartment at the front left bottom. The purpose of the receiver/drier is to:

- filter chemical and mechanical impurities out of the refrigerant
- serve as a storage reservoir for refrigerant
- remove moisture from the refrigerant

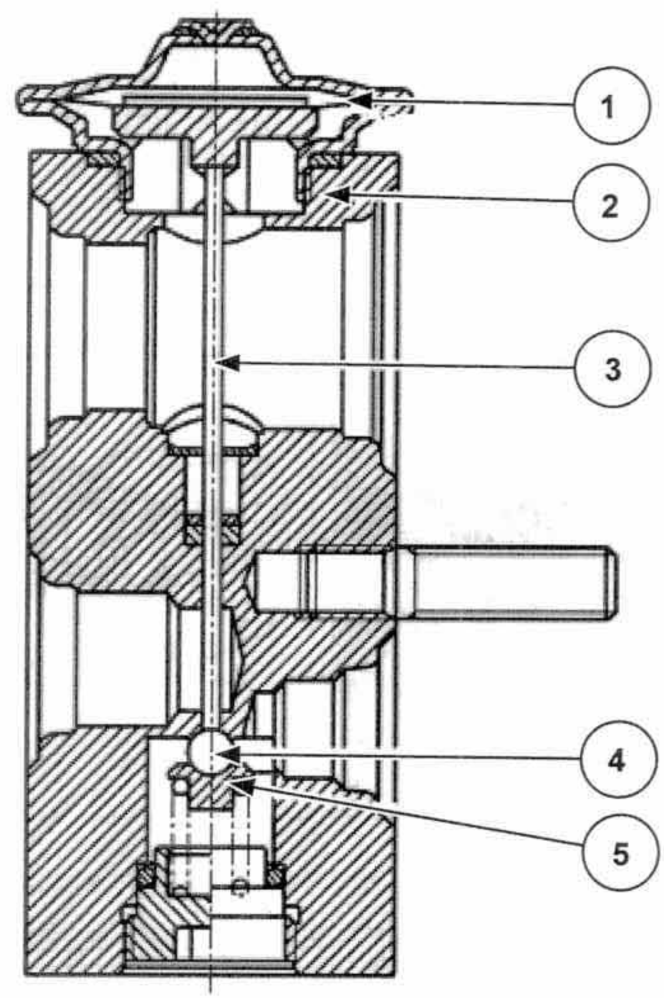
### Thermal Expansion Valve (TXV)




| | | | |
|---|---|---|---|
| 1 | Bulkhead | 3 | Master Cylinder Reservoir |
| 2 | Thermal Expansion Valve | | |

Figure 146 Thermal Expansion Valve

The TXV (Fig. 146) is located at the left rear in the engine compartment next to the power brake booster.




| | | | |
|---|---|---|---|
| 1 | Diaphragm | 4 | Valve Ball |
| 2 | Valve Housing | 5 | Spring |
| 3 | Tappet | | |

Figure 147 TXV Cut-Away View

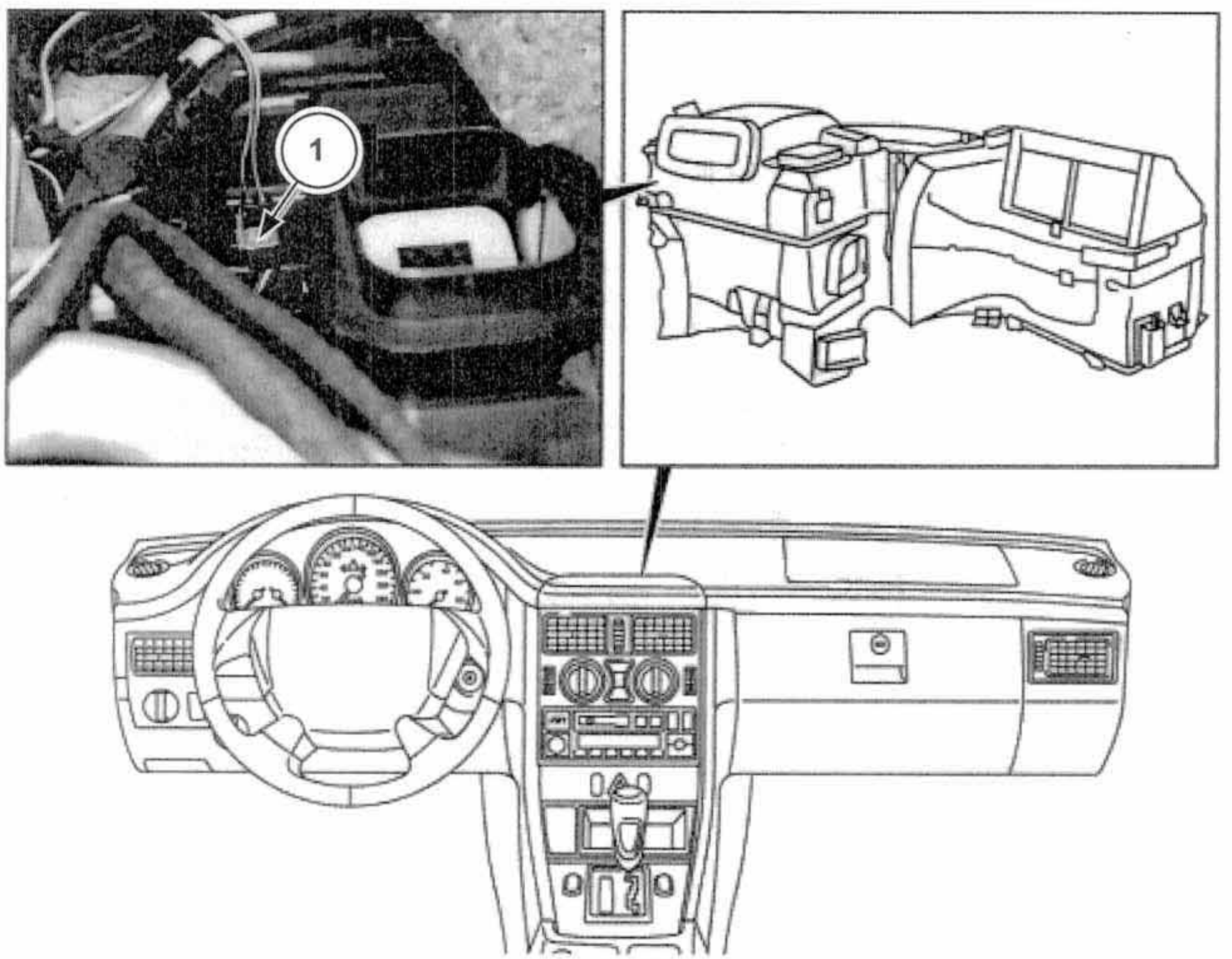
When the A/C compressor is switched on, the pressure in the evaporator decreases causing the diaphragm to flex downward in an arch. The tappet follows the motion of the diaphragm and presses the valve ball away from its seat against the force of the spring. The refrigerant is sprayed into the evaporator through the open valve. Since the motion of the diaphragm depends on the intake pressure as well as the temperature at the evaporator output, only the quantity of refrigerant that can be evaporated optimally is injected. Refer to Figure 147.

## Engine Cooling Fan

When A/C is turned on, a request for radiator fan operation is sent to IC over the serial data line. The information is sent to the PCM over the CAN Bus. The PCM sends PWM signal through the relay center to the radiator fan control module. The radiator fan control module controls the fan motor.

## ELECTRONIC INPUTS

### Evaporator Temperature Sensor

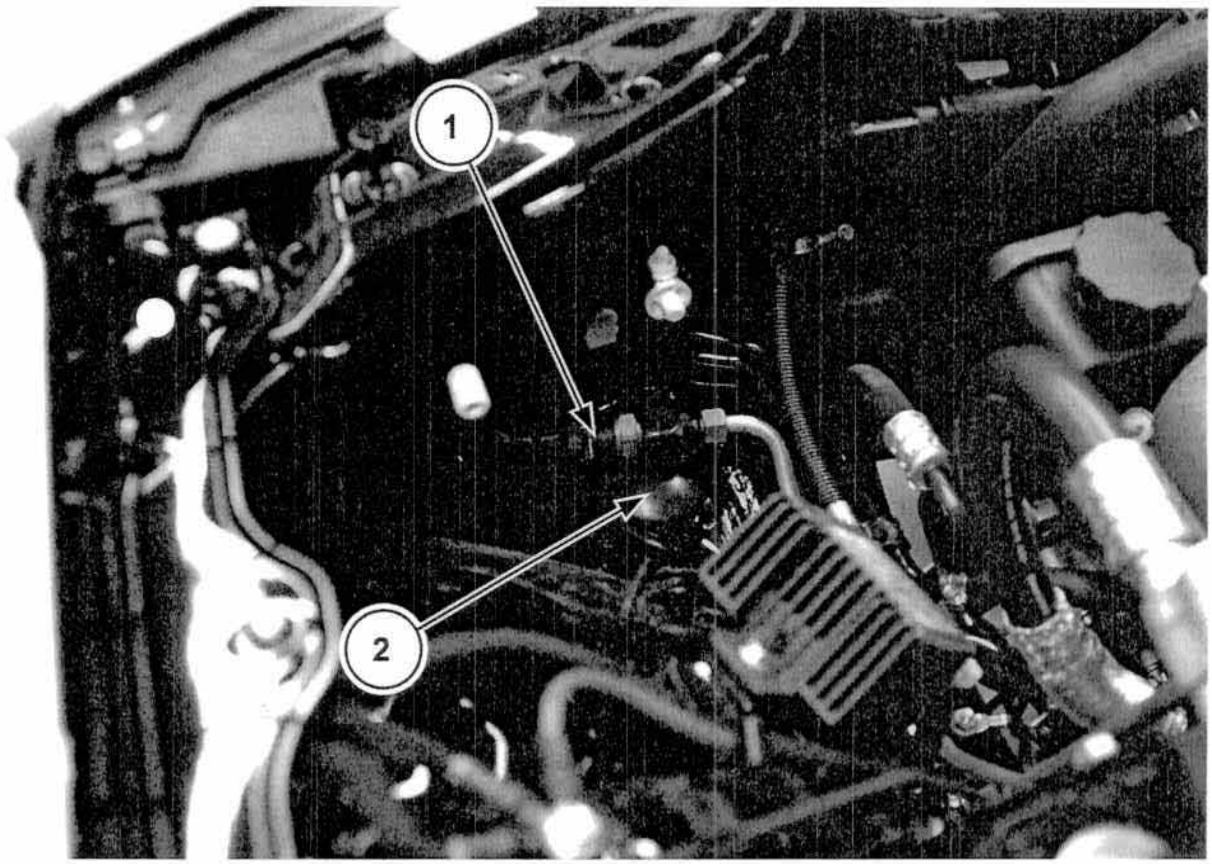



| | |
|---|---|
| 1 | Evaporator Temperature Sensor |

Figure 148 Evaporator Temperature Sensor

The evaporator temperature sensor (Fig. 148) is located in the evaporator housing. It measures the temperature of the evaporator. It relays the resistance coinciding with the temperature at the evaporator to the HVAC Control Head. At an evaporator temperature of 1 to 3.5°C (34 to 39°F), the A/C compressor is switched off which prevents the evaporator from icing up. This ensures that the outlet temperature at the nozzles deviates only slightly.

**Refrigerant Pressure Sensor**




| | | | |
|---|---|---|---|
| 1 | Refrigerant Pressure Sensor | 2 | Receiver/Dryer |

Figure 149 Refrigerant Pressure Sensor

The refrigerant pressure sensor is located (Fig. 149) at the front left in the engine compartment. The refrigerant pressure sensor serves for measuring the refrigerant pressure. The refrigerant pressure sensor transfers the current value to the HVAC Control Head.

When the following values are present, the A/C compressor is switched off by the HVAC Control Head:

- Refrigerant pressure less than 2 bar (29 psi) = A/C Compressor Off
- Refrigerant pressure more than 28 bar (406 psi) = A/C Compressor Off

The pressure measured by the refrigerant pressure sensor is also compared with a value stored in the HVAC Control Head. When the following values are present the engine cooling fan is adjusted.

- Refrigerant pressure less than 16 bar (232 psi) = Fan Speed Low
- Refrigerant pressure more than 20 bar (290 psi) = Fan Speed High

## SPECIAL TOOLS

The following list of tools are used to service the Crossfire

| MILLER SPECIAL TOOLS | | | |
|---|---|---|---|
| MERCEDES BENZ TOOL NUMBER | MILLER TOOL NUMBER | DESCRIPTION | COMMENTS |
| W000 589 88 63 00 | 9241 | Radio Tool | Used to remove the radio from the dash. |
| W716 589 00 23 00 | 9120 | Alignment Tool | Used to align the manual transmission shifter assembly |
| W111 589 08 43 00 | 9100 | Installation Tool | Used to press in the engine rear crankshaft oil seal. |
| W111 589 25 61 00 | 9106 | Valve Spring Tool Kit | Used to compress the engine valve springs-cylinder head in car. |
| W112 589 00 32 00 | 9104 | Arresting Plate | Used to hold the engine right camshaft at a 40 degree ATDC position. |
| W112 589 01 32 00 | 9105 | Arresting Plate | Used to hold the engine left camshaft at a 40 degree ATDC position. |
| W112 589 03 40 00 | 9102 | Lock | Used during engine camshaft service to lock the crankshaft at the starter. |
| W119 589 01 14 00 | 9101 | Sleeve | Used with tool 9103 for pressing in the engine front crankshaft oil seal. |
| W140 589 01 15 00 | 9159 | Drift Punch | Used for installing the Pitman shaft oil seal. |
| W140 589 08 15 00 | 9231 | Seal Installer | Used to install the pinion oil seal in the differential. |
| W140 589 10 15 00 | 9223 | Drift | Used to install the differential side oil seals. |
| W202 589 01 31 00 | 9150 | Spring Compressor | Front suspension spring compressor. Used with tool 9152. |
| W124 589 05 43 00 | 9199 | Hub Bearing Remover/ Installer | Used to remove and install the rear wheel bearings. |

| MILLER SPECIAL TOOLS | | | |
|---|---|---|---|
| MERCEDES BENZ TOOL NUMBER | MILLER TOOL NUMBER | DESCRIPTION | COMMENTS |
| W202 589 02 31 00 | 9151 | Spring Compressor | Rear suspension spring compressor. Used with tool 9152. |
| W201 589 01 33 00 | 9168 | Upper Control Arm Ball Joint Remover | Used to separate the front suspension ball joints. |
| W202 589 13 63 00 | 9152 | Clamping Plates | Spring Compressor Plates. Used with tool 9150 and 9151. |
| W210 589 01 07 00 | 9240 | Pin Wrench | Used to remove the fuel level sender from the fuel tank. |
| W210 589 03 15 00 | 9122 | Drift Punch | Used to install the manual transmission output shaft oil seal. |
| W210 589 04 15 00 | 9123 | Drift Punch | Used to install the manual transmission input shaft oil seal. |
| W611 589 00 14 00 | 9103 | Insertion Tool | Used to install the engine front crankshaft oil seal. Used with tool 9103. |
| W140 589 13 43 00 | 8900 | Multi-Use Spring Compressor | Used to compress the automatic transmission clutch springs. |
| W208 589 00 21 00 | 8901 | Pressing Tool | Used for adjusting the end play on automatic transmission clutches |
| N/A | 8902A | Drift Punch | Used to install the front and rear automatic transmission oil seal. |
| N/A | 9082 | Bearing Puller | Used to remove the automatic transmission output shaft bearing. |
| N/A | 9078 | Staking Tool | Used to stake the automatic, manual transmission and axle shaft locking nuts. |
| N/A | 9287 | Installer, Output Shaft Bearing | Used to install the automatic transmission output shaft bearing. |
| N/A | 8863A | Dipstick | Used to check the automatic transmission oil fluid level. |

| MILLER SPECIAL TOOLS | | | |
|---|---|---|---|
| MERCEDES BENZ TOOL NUMBER | MILLER TOOL NUMBER | DESCRIPTION | COMMENTS |
| N/A | 8266CF | End Play Adapter Kit | Used with tool 8266 to measure input shaft end play on the automatic transmission. |
| N/A | 6311 | Gauge Bar | Used to measure the axial play on the front and rear planetary gears. |
| N/A | C-3422CF | Valve Spring Compressor | Used to compress the engine valve springs. With the cylinder heads off of the engine. |
| N/A | C-3281 | Flange Wrench | Used to hold the axle pinion flange during torquing procedures. |
| N/A | 8870 | Detent Plug Remover | Used with tool C-3752 to remove the shifter detent on manual transmissions. |
| N/A | 1126 | Splitter | Used with tools 938 and 8019 to separate the manual transmission case. |
| N/A | 938 | Bridge | Used with tools 8019 and 1126 to separate the manual transmission case. |
| N/A | C-3752 | Slide Hammer | Used with tool 8870 to remove the manual transmission shifter detent. |
| N/A | 8019 | Adapter (2) | Used with tools 938 and 1126 to separate the manual transmission case. |
| N/A | 8443-12 | Jumper SRS Load Tool | Jumper to connect the 8443 airbag load tool to the clockspring. |
| N/A | 8443-27 | ACM Adapter | Opens the shorting clips and provides testing points to protect the ACM harness connector. |
| N/A | C-3894A | Tie Rod Puller | Used to remove the front suspension tie rods. |
| N/A | 1026 | 3-Jaw Puller | Used to remove the pinion flange from rear axle and transmission. |
| N/A | 1130 | Split Plate | Used to separate the various gears on the manual transmission mainshaft assembly. |

| MILLER SPECIAL TOOLS | | | |
|---|---|---|---|
| MERCEDES BENZ TOOL NUMBER | MILLER TOOL NUMBER | DESCRIPTION | COMMENTS |
| | | | |
| N/A | 9107 | Coolant Pressure Cap Adapter | Used with tool 7700 to check coolant pressure. |
| N/A | 6790 | Hub Puller | Used with C-637CF to remove the rear wheel hub. |
| N/A | C-637CF | Slide Hammer | Used with tool 6790 to remove the rear wheel hub. |
| N/A | C4171 | Driver Handle | Used with tool 9078. |
| N/A | CH9043 | MUX Cable | Used with the DRBIII® scan tool. |
| N/A | CH9044 | Crossfire Card | Used with the DRBIII® scan tool. |
| Kit Part Number: 9202 | | | |
| Kit Description: ZH29 Crossfire Tool Kit | | | |

**Notes:**

**Notes:**

# DaimlerChrysler Corporation

## UNITED STATES

The special service tools referred to herein are required for certain service operations. These special service tools or their equivalent, if not obtainable through a local source, are available through the following outlet.

28635 Mound Road, Warren, Michigan 48092, U.S.A.

### MILLER SPECIAL TOOLS

**OTC Division, SPX Corporation**

Telephone 1-800-801-5420 FAX 1-800-578-7375

## CANADA

The special service tools referred to herein are required for certain service operations. These special service tools or their equivalent, if not obtainable through a local source, are available through the following outlet.

C & D Riley Enterprises Ltd., P.O. Box 243, Amherstburg, Ontario N9V 2Z4

Telephone (519) 736-4600 FAX (519) 736-8433

The special tools referred to herein are required for certain service operations. These special service tools or their equivalent, if not obtainable through a local source, are available through the following outlet.

| | | |
|---|---|---|
| **MILLER SPECIAL TOOLS**<br>**OTC Division, SPX Corporation**<br>28635 Mound Road,<br>Warren, MIchigan 48092, U.S.A.<br>Telephone 01-810-582-5831420<br>FAX 01-810-582-5830 | **SPX Australia**<br>7 Expo Court<br>Mt. Waverly/Victoria<br>Australia 3149<br>FAX: 61-3-9544-5222 | **Jurubatech**<br>AV. N. SRA. DòSabara 4901<br>Sao Paulo<br>Brazil<br>FAX: 55-11-246-2793 |
| **SPX UK**<br>Churchill Way, High March<br>Daventry, Northants, NN11 4NFI<br>Tel: 44-1327-303400<br>FAX: 44-1327-871625 | **Jatek**<br>5-53 Minowacho<br>2-Chome Kohoku-Ko<br>Yokohama, Kanagawa 223-0051<br>Japan<br>FAX: 81-45-562-7800 | **SPX De Mexico**<br>AV. Cafetales 1702, Despacho 204<br>Col. Haciendi de Coyoacan<br>C.P. 04970<br>Mexico<br>FAX: 525-603-0567 |

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