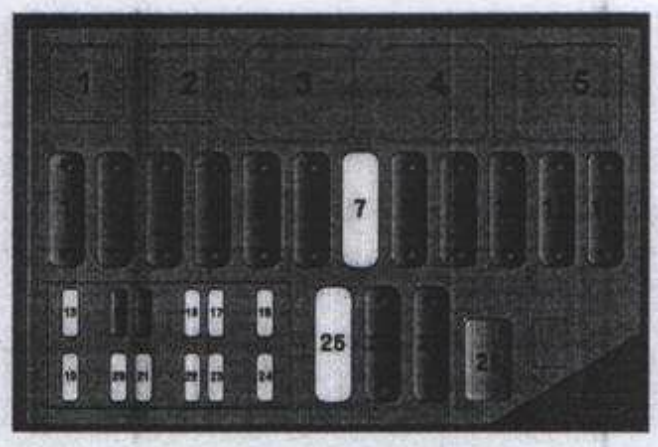
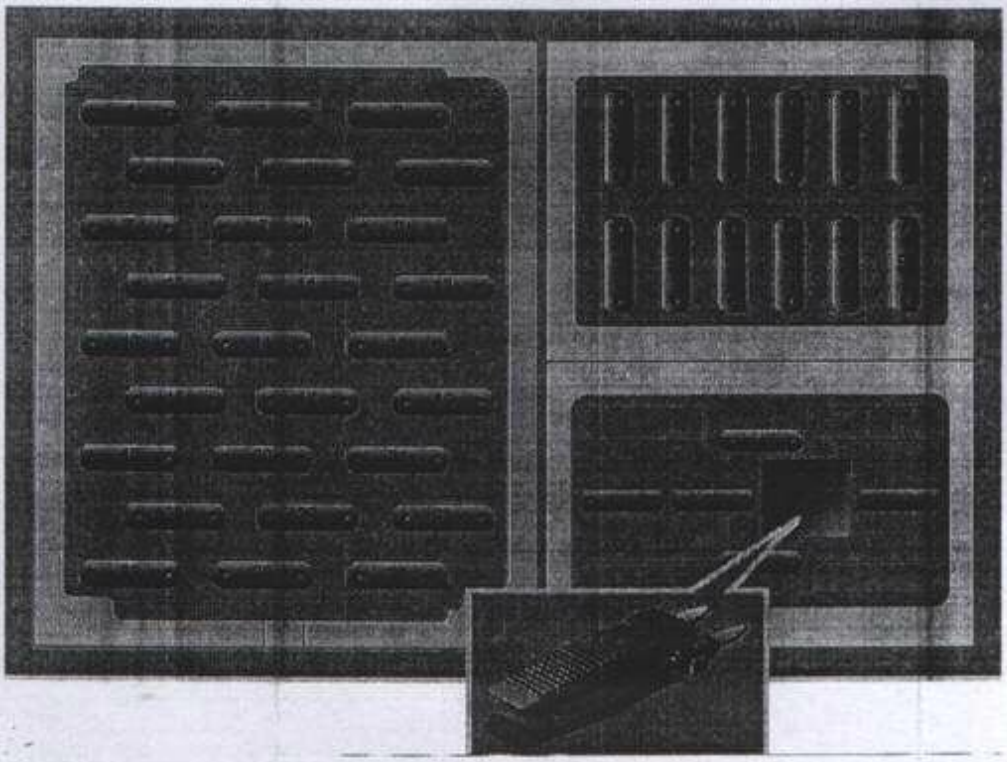
Engine Compartment Fuse Box Details



Fuse No.	Rating (amps)	Circuit Protected
1	50	Cooling fan
2	30	Headlight main beam
3	40	Ignition switch
4	40	Passenger compartment fuse box
5	40	Ignition switch
6	40	Passenger compartment fuse box
7	-	Not used
8	50	Anti-lock brakes
9	20	Auxiliary power socket
10	30	Low beam, sidelights
11	30	Rear screen demister
12	40	Windows
13	-	Not used
14	20	Fuel pump
15	10	Audio system
16	20	Horn, immobiliser
17	20	Anti-lock brakes
18	15	Hazard lights, direction indicators, immobiliser
19	-	Not used
20	-	Not used
21	-	Not used
22	-	Not used
23	-	Not used
24	-	Not used
25	-	Not used
26	30	??????
27	20	Front fog lights

Relay No	Application
1	Not Used
2	Wiper Intermittent
3	Wiper Slow/Fast
4	Starter
5	Front Fog Lamps

Passenger Compartment Fusebox Details



Fuse No.	Rating (amps)	Circuit Protected
1	10	Main/dip beam headlights, fog lights
2	5	Instrument illumination dimmer
3	20	Security system
4	10	Mirrors, windows
5	10	RH dip beam
6	10	Sports mode switch (automatic transmission)
7	10	Transmission (automatic transmission)
8	10	RH sidelight
9	10	Interior lights
10	10	Audio system, engine management
11	10	LH dip beam
12	10	Security system
13	15	Reverse/brake lights
14	10	LH sidelights
15	20	Luggage compartment release
16	30	Wipers
17	20	Engine control, air-conditioning
18	10	Instruments, ignition, immobiliser

Fuse No	Rating (amps)	Circuit Protected
19	10	Anti-lock brakes
20	15	LH main beam
21	5	Instruments
22	-	Not used
23	20	Engine control
24	10	Engine crank, ignition button
25	10	Instruments, traction control switch
26	15	RH main beam
27	10	Diagnostic socket
28	10	Brakes
29	10	Mirrors
30	10	Climate control, rear screen demister
31	10	Rear fog lights
32	-	Not used
33	-	Not used
34	-	Not used
35	15	Fuel filler flap
36	30	Audio system
37	5	Seat belt
38	-	Not used
39	-	Not used

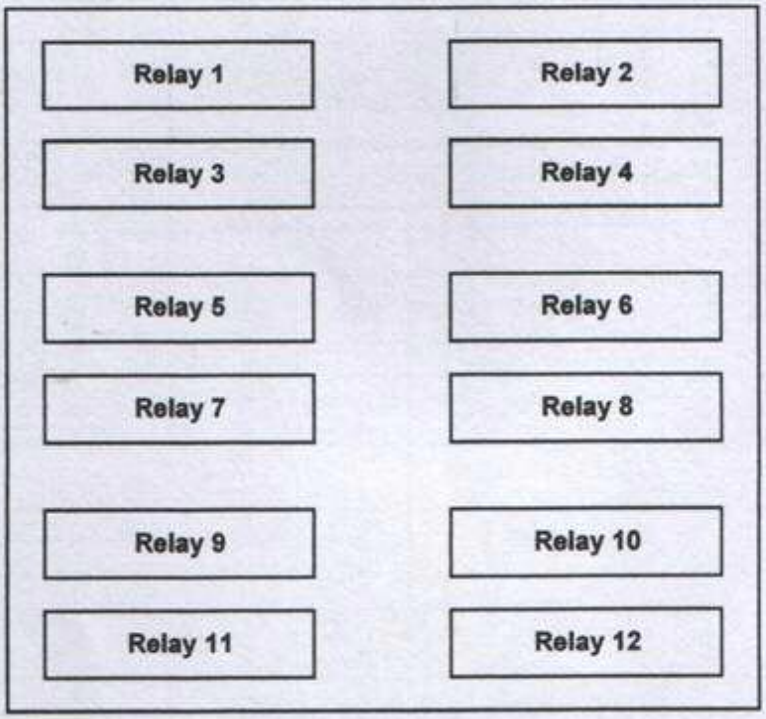
The fuse box is located behind the carpet in the left-hand foot well, adjacent to the maintenance hatch release lever. To gain access, it is necessary to pull the carpet out of its retaining channel.

Spare Fuses

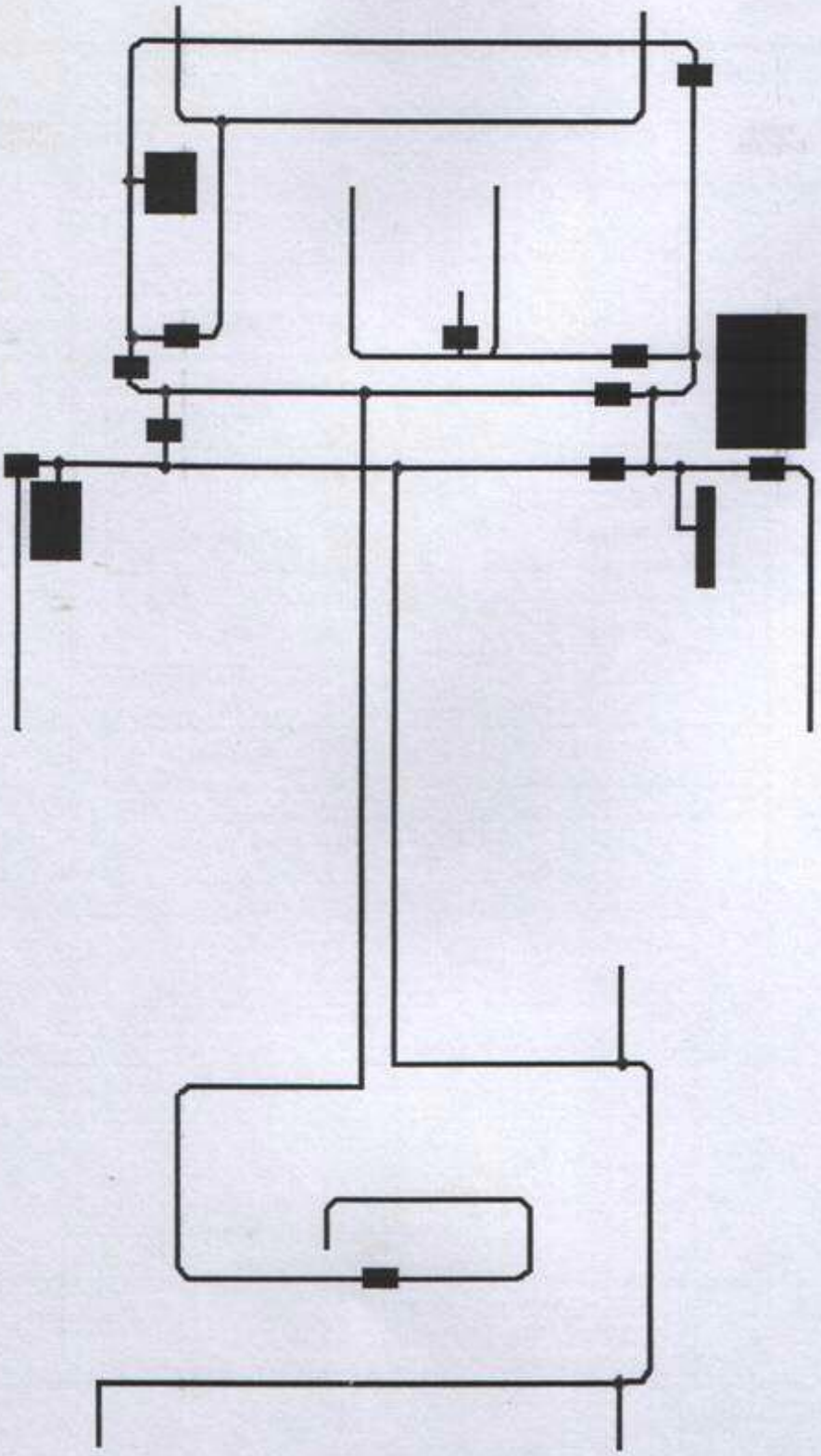
Spare mini-size and larger fuses are located in the passenger compartment fuse box; however, they are not included in the previous listings.

A double-ended fuse extractor is supplied, suitable for removing both mini-size and larger fuses.

Passenger Compartment Relay Details



Relay No	Application
1	Heated Rear Window
2	Interior Lamp Saving
3	High Beam
4	Low Beam
5	Seat Belt
6	A/C Compressor
7	Washer Pump
8	Luggage Compartment
9	RH Direction Indicator
10	LH Direction Indicator
11	Fuel Flap Release
12	Not Used



Wiring Colour Codes

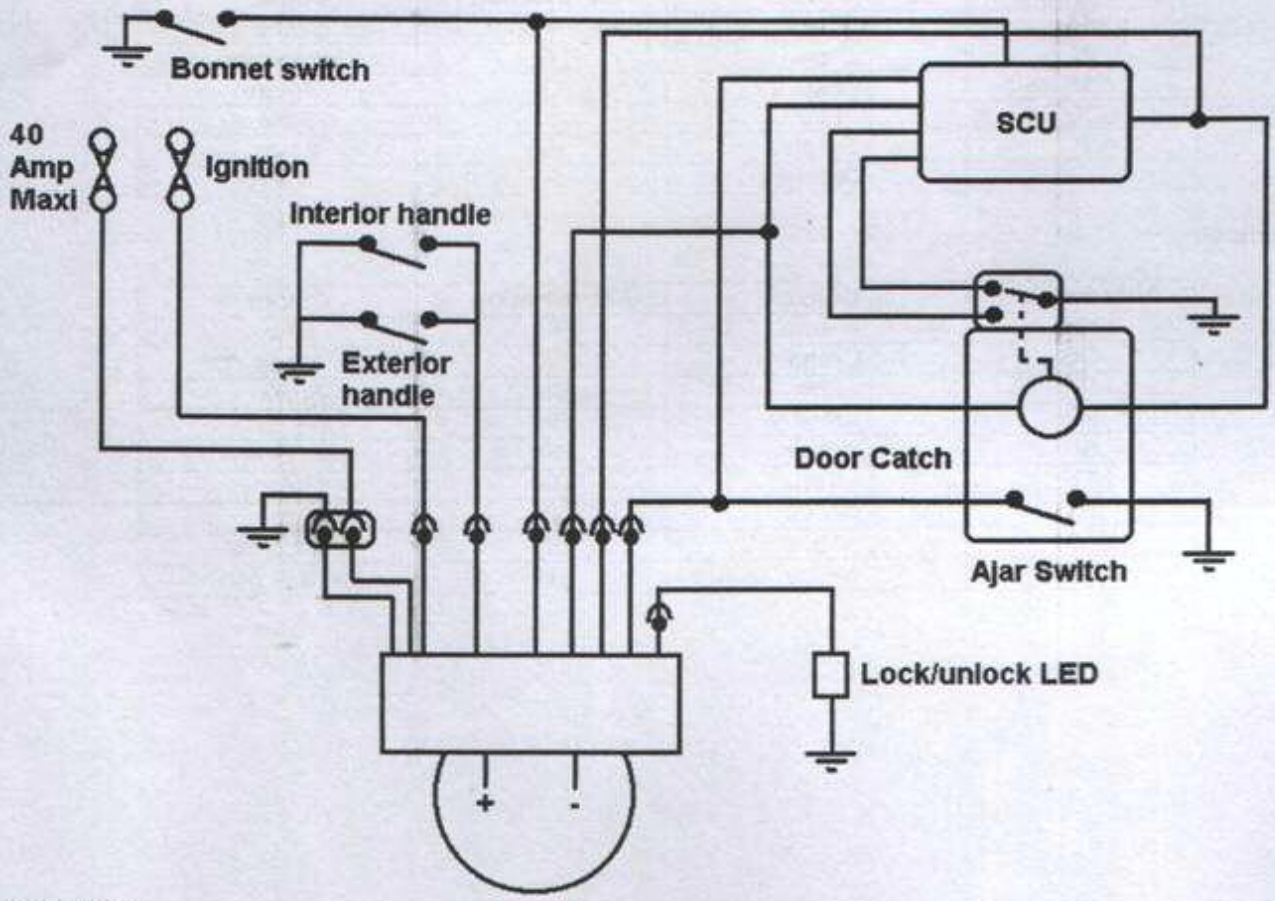
European

Abbreviation	Colour	Abbreviation	Colour
B	Black	Y	Yellow
N	Brown	LG	Light Green
U	Blue	G	Green
K	Pink	S	Slate
P	Purple	W	White
O	Orange	R	Red

American

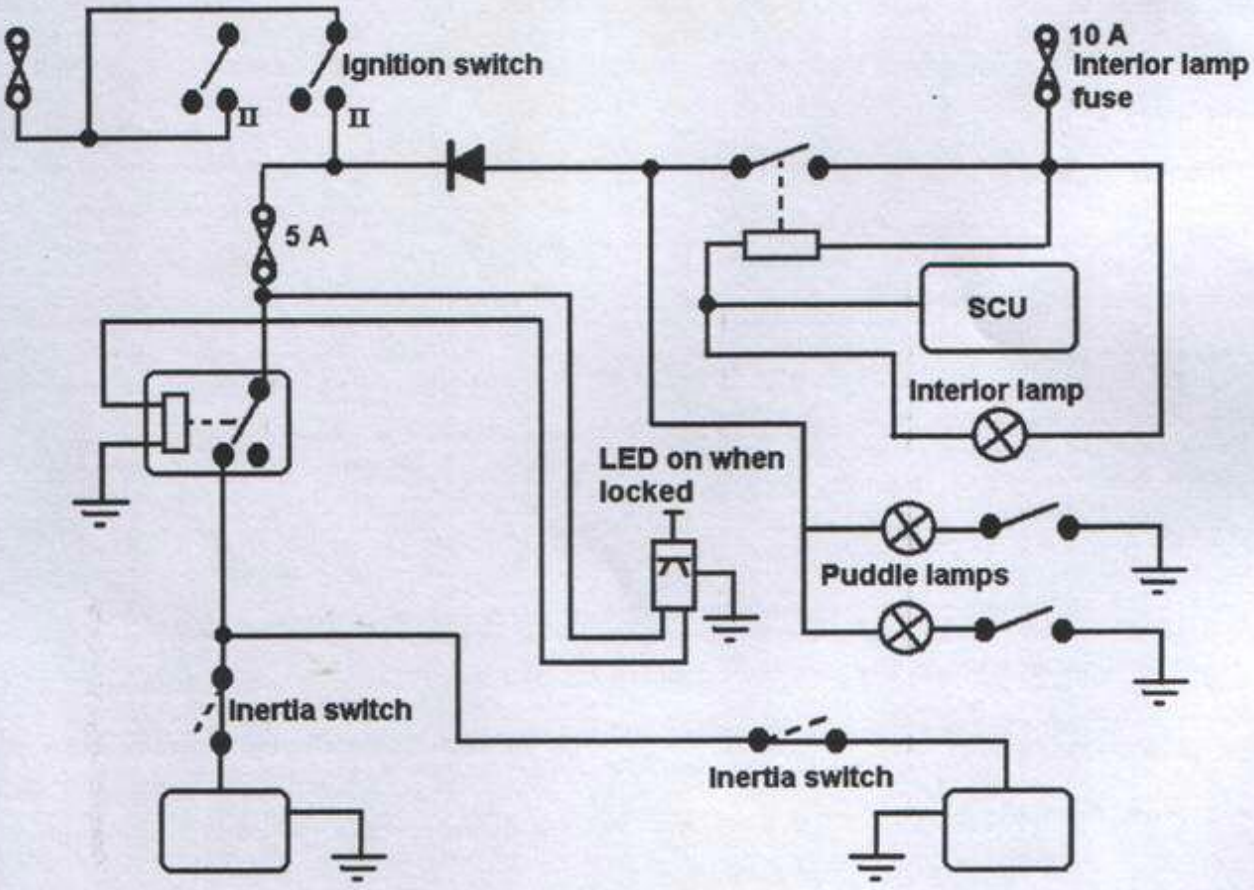
Abbreviation	Colour	Abbreviation	Colour
NA	Natural	BU	Blue
OG	Orange	BK	Black
PK	Pink	BN	Brown
RD	Red	DB	Dark Blue
SR	Silver	DG	Dark Green
TN	Tan	GN	Green
VT	Violet	GY	Grey
WH	White	LB	Light Blue
YE	Yellow	LG	Light Green

Window Lift Circuit Operation



Description

Seat Belt Circuit Operation



Description

Anti-Theft — Passive Anti-Theft System (PATS)

The passive anti-theft system (PATS) contains the following components:

- Theft indicator
- Encoded ignition key
- Transceiver module
- Instrument cluster
- Powertrain control module (PCM)
- Standard Corporate Protocol (SCP) communication network

The PATS uses radio frequency identification technology to deter a drive away theft. Passive means that it does not require any activity from the user. This system is known as SecuriLock® in North America, Safeguard® in the U.K. and PATS in continental Europe.

The PATS uses a specially encoded ignition key.

Each encoded ignition key contains a permanently installed electronic device called a transponder.

Each transponder contains a unique electronic identification code, with over 72 million billion combinations.

Each encoded ignition key must be programmed into the vehicle's instrument cluster (the instrument cluster is also known as a Hybrid Electronic Cluster [HEC), before it can be used to start the engine.

There are special diagnostic procedures that must be carried out if new encoded ignition keys are to be installed.

The encoded key is larger than a traditional ignition key. The key does not require batteries and should last the life of the vehicle.

The transceiver module communicates with the encoded ignition key.

This module is located behind the steering column shroud and contains an antenna connected to a small electronics module.

During each vehicle start sequence, the transceiver module reads the encoded ignition key identification code and sends the data to the instrument cluster.

The control functions are contained in the instrument cluster.

This module carries out all of the PATS functions such as receiving the identification code from the encoded ignition key and controlling engine enable. The instrument cluster initiates the key interrogation sequence when the vehicle ignition switch is turned to RUN or START.

The PATS uses the PCM to enable or disable the engine.

The instrument cluster communicates with the PCM over the SCP network in order to enable engine operation and uses sophisticated messages in order to prevent a theft.

They share security data (when first installed together) that makes them a matched pair. After this security data sharing, these modules will not function in other vehicles.

The shared PCM ID is remembered even if the battery is disconnected. The instrument cluster also stores the vehicle's key identification code even if the battery is disconnected.

There are special diagnostic procedures that may be carried out if either a new instrument cluster or PCM needs to be installed.

All elements of PATS must be functional before the engine is allowed to start. If any of the components are not working correctly, the vehicle will not start.

PATS uses a visual theft indicator. This indicator will illuminate and then extinguish after three seconds when the ignition switch is turned to RUN or START under normal operation.

If there is a PATS problem, this indicator will either flash rapidly or glow steadily (for more than three seconds) when the ignition switch is turned to RUN or START.

PATS also "blips" the theft indicator every two seconds at ignition OFF to act as a visual theft deterrent.

The PATS is not compatible with aftermarket remote start systems, which allow the vehicle to be started from outside the vehicle. These systems may reduce the vehicle security level, and also may cause no-start issues.

Any after market remote start systems must be removed before investigation of PATS-related non-start issues

Diagnostics

Key Programming — Erase All Key Codes and Program Two Keys

Special Service Tools required - Diagnostic Tester

This procedure is used when a customer needs keys programmed into the system and does not have two programmed ignition keys available. This procedure is also useful when programmed ignition key(s) have been lost or the ignition switch assembly has been replaced, and it is desired to erase key(s) from the passive anti-theft system (PATS) memory.

This procedure will erase all programmed ignition keys from the vehicle memory and the vehicle will not start until two keys have been reprogrammed to the vehicle.

Two PATS encoded keys with the correct mechanical cut must be available to perform this procedure. One or both of them may be the customer's original keys.

If additional keys are to be programmed, refer to Key Programming — Program a Key Using Two Programmed Keys. If the remaining keys are with the customer and are not available with the vehicle, then instruct the customer to refer to the Owners Guide under the "Programming Spare [SecuriLock ® (North America), Safeguard ® (U.K.) or PATS for all other markets] Keys Procedure" for instructions on programming the remaining keys.

1. Turn the ignition switch from OFF to RUN.
2. Connect diagnostic tester. Follow the SECURITY ACCESS PROCEDURE to obtain security access.
3. From diagnostic tester menu, select IGNITION KEY CODE ERASE.

Note:
Do NOT select any additional commands from this menu. Turn the ignition switch to OFF and disconnect diagnostic tester.

4. Insert the first encoded key into the ignition lock cylinder and turn the switch to RUN for three seconds.

5. Insert the second encoded key into the ignition lock cylinder and turn the switch to RUN for three seconds.

6. The vehicle should now start with both ignition keys.

Key Programming — Program a Key Using Two Programmed Keys

Special Service Tools - Diagnostic Tester

This procedure only works if two or more programmed ignition keys are available and it is desired to program additional key(s). If two keys are not available, follow the procedure in «Key Programming—Erase All Key Codes and Program Two Keys».

PID SPARE_KY must be enabled for this procedure to operate. If this Parameter Identification (PID) Index is not enabled, follow the security access procedure and select Spare Key Programming Switch: Enabled.

If the programming procedure is successful, the new key(s) will start the vehicle and the THEFT INDICATOR will illuminate for approximately three seconds.

If the programming procedure is not successful, the new key(s) will not start the vehicle and the THEFT INDICATOR will flash. If the programming procedure was not successful, repeat the key programming procedure from Step 1. If the failure repeats, check Circuit 729 (RD/WH) (hot at all times) in instrument cluster for proper battery voltage. Repair the circuit if voltage is not present. For additional information, refer to Diagnosis and Testing to review diagnostic trouble codes (DTCs) and perform pinpoint tests as required.

A maximum of eight ignition keys can be programmed to a passive anti-theft system (PATS) equipped vehicle. Use PID NUMKEYS to determine how many keys are programmed to the vehicle.

If the steps are not performed as outlined, the programming procedure will end.

Ignition keys must have correct mechanical key cut for the vehicle and must be a PATS encoded key.

1. Insert the first programmed ignition key into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for one second).

2. Turn the ignition switch to OFF and remove the first key from the ignition lock cylinder.

3. Within five seconds of turning the ignition switch to OFF, insert the second programmed ignition key into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for one second).

4. Turn the ignition switch to OFF and remove the second key from the ignition lock cylinder.

5. Within 10 seconds of turning the ignition lock cylinder to OFF, insert the unprogrammed ignition key (new key) into the ignition lock cylinder and turn the ignition switch from OFF to RUN (maintain the ignition switch in RUN for 1 second).

6. If it is desired to program additional key(s), repeat the key programming procedure from the beginning.

Key Programming — Additional Key With One Programmed Key

Special Service Tool - Diagnostic Tester

This procedure is used when a customer needs to have an additional key programmed into the vehicle without erasing stored key codes, but does not have two programmed keys available. This procedure is also useful when attempting to determine if an ignition key is defective, as a new key can be installed without erasing keys or without having two programmed keys available.

Before programming, the new key must have the correct mechanical cut for the ignition lock.

If eight keys are already programmed, this procedure will not allow any further ignition keys to be programmed without erasing all stored key codes first. The number of keys programmed into the system can be determined using the PID NUMKEYS.

1. Turn the ignition switch from the OFF position to the RUN position using the new, unprogrammed ignition key.
2. Connect the diagnostic tester and enter the appropriate instrument cluster.
3. Follow Security Access to obtain security access. For additional information, refer to Security Access—Procedure.
4. From the diagnostic tool menu Select: IGNITION KEY CODE PROGRAM.
5. Turn the ignition switch to the OFF position and disconnect diagnostic tool.
6. Attempt to start the engine with the new ignition key. The vehicle engine should start and run normally.

Security Access — Procedure

Special Service Tool - Diagnostic Tester

The security access procedure is utilized to obtain passive anti-theft system (PATS) security access. PATS security access must be granted to erase ignition keys, enable/disable the spare key programming switch or perform parameter resets for the instrument cluster. The security access procedure invokes an inherent 10 minute time delay prior to granting security access during which the diagnostic tool must remain connected to the vehicle. Once security access has been granted, a security access command menu is displayed that offers various command options (refer to PATS Configuration Command Index).

Select only the commands required by the appropriate pinpoint test.

From the diagnostic tester menu select the appropriate instrument cluster. Enter SECURITY ACCESS PROCEDURE. This procedure will take 10 minutes to perform, during which the ignition switch must be in RUN and the diagnostic tool must be connected to the vehicle.

After the 10-minute security access procedure has been completed, a new menu will be displayed with command options. Select only those functions required before exiting out of this menu. Once exited out of this menu, the security access procedure must be performed again to perform additional commands.

Module — Passive Anti-Theft Transceiver

Removal

Caution:
Electronic modules are sensitive to electrical charges. If exposed to these charges, damage may result. Disconnect the battery ground cable.

1. Remove the ignition switch lock cylinder. Insert the ignition key into the ignition switch lock cylinder and turn to the RUN position. Insert a punch in the access hole of the steering column and press the release tab while pushing out the ignition switch lock cylinder.
2. Unscrew the tilt wheel handle and shank and remove. Remove the instrument panel steering column opening cover. Remove the screws.
3. Remove the RH instrument panel steering column opening cover.
4. Remove the upper and lower steering column shrouds. Remove the screws. Remove the lower steering column shroud. Remove the upper steering column shroud.
5. Remove the instrument panel steering column opening cover reinforcement.
6. Remove the bolts. Remove the instrument panel steering column opening cover reinforcement.
7. The steering wheel has been removed for clarity. Remove the anti-theft transceiver module. Remove the screw from the bottom of the transceiver module. Only apply pressure or leverage below the key cylinder lower rib. Disconnect the electrical connector and remove the module.

Installation

When the battery is disconnected and reconnected, some abnormal drive symptoms may occur while the vehicle relearns its adaptive strategy. The vehicle may need to be driven 16 km (10 miles) or more to relearn the strategy.

To install, reverse the removal procedure.

SV Diagnostics

The current MG Rover hand held tester is utilised to allow full functionality of diagnostics for the MG X Power SV.

This diagnostic tester for MG X Power SV is approved equipment for MG Sport and Racing dealers.

The location of the J1962 serial connector in the MG X Power SV is in the drivers foot well.

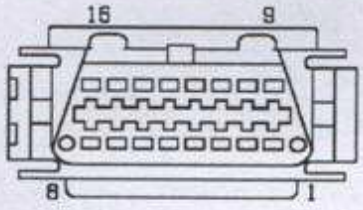
The lead used to connect the diagnostic tester and the J1962 is the same lead used previously for EOBD scan tool functionality.

Lead no: **DTC 4013A**

This one-piece lead already has a built in J1962 connector and is coloured black. This will support all diagnostics through this one lead.

The J1962 diagnostic socket pin out details for MG X Power SV is listed below:

Terminal	System	Description
1	HEVAC	Heating
2	SCP	Standard Corporate Protocol
3		
4	Ground	Earth
5	ECCV	Engine Management System
6		
7	GEM	General Electrics Module
8		
9	HEVAC	Heating
10	SCP	Standard Corporate Protocol
11		
12	SCU	Security System
13	ECCV	Engine Management System
14		
15		
16	12V	Power



The diagnostics for the MG X Power SV is only available via the hand held tester after it has been upgraded with the new HHT disc.

Disc Number DCD ORO2

Diagnostic Systems

Currently the systems that the diagnostic tester can integrate with are:

- European On Board Diagnostics (EOBD)
- Engine Management System (EMS)
- ABS
- Security
- Heating, Ventilation and Air Conditioning

Future systems to be added for diagnostics are:

- Passive Anti Theft system (PATS)
- General Electrics Module (GEM)

Engine Management

For engine management, the diagnostic tester is able to display and interact with:

- Fault codes
- Freeze frame data
- Live Data
- SCP Output test
- Component tests
- Key On Engine Off (KOEO)
- Key On Engine Running (KOER)

Anti Lock Braking System

For ABS, the diagnostic tester is able to display:

- Fault codes
- Live data

Security

For Security, the diagnostic tester has the capability to carry out:

- Programming Plip
- Force outputs
- Real time display

Heating, Ventilation and Air Conditioning (HEAVC)

For HEVAC, the diagnostic tester has the capability to display and carry out:

- ECM ident
- Clear fault codes

Omitec Telematics

Omitec have pioneered the Telematics system that has been installed into every MG X Power SV as a standard feature.

This ground-breaking achievement means that the MG X Power SV becomes the first road going production car to have such technology as a standard feature.

Telemetry is normally associated with Formula One racing where the pit crew can observe data from the vehicle during either practise or racing conditions.

The Omitec telematics system installed in the MG X Power SV consists of a hardware unit that has an internal battery and a SIM card built into it and is located in a robust an secure position with-in the vehicle.

No location details of any components are available due to the high degree of security related to the system.

Two non-visible antennas are installed in the vehicle, one consisting of a global positioning system (GPS) as used for satellite tracking, the other being a Group Special Mobile (GSM) as used for telecommunications.

A dedicated speaker is utilised in the driver's foot well area whilst the microphone will be installed in the centre line of the headlining adjacent to the interior light. This ensures that the system has a totally hands free operation.

A dual function switch is located in the fascia adjacent to the quartz clock. This is a rocker type switch that enables the driver to select either SOS for contacting the emergency services or a picture of a recovery truck for contacting the breakdown services.

This is commonly known as the "E" call, "B" call system.

Finally the system will have two coloured lights in the dashboard these are **BLUE** for emergencies and **AMBER** for breakdowns.

The MG X Power SV is installed with an integrated phone and GPS electronic tracking system that enables the driver to call the emergency or breakdown services in the event of an emergency. The driver is then able to provide the necessary information for assistance from the relevant services.

Note:
Be aware that using the SOS/breakdown assistance facility may summon police and/or other emergency services, which may involve costs. Only use the facility in a genuine emergency, as the registered owner of the car may be made liable for any misuse.

SOS assistance

In the event of an emergency where assistance from the emergency services (Police, Fire, Ambulance or Coastguard) is necessary, press the **SOS** portion of the switch for 2 seconds to activate call mode.

The two lights will flash individually, press and hold the **SOS** switch until the blue warning light illuminates constantly for approximately 6 seconds.

The integrated phone system automatically dials the emergency service number for the country in which the car is being operated. For the UK the number is 999 and European countries the number is 112.

When the call is connected, the microphone located in the head lining will pick up the drivers/passenger voice so that he/she can make the relevant emergency service request.

During the call if the volume requires adjusting, simply pulse the switch either upwards to increase or downwards to decrease the volume.

The call can be terminated at any time by simply pressing and holding the switch for 6 seconds. The warning lamp will extinguish to signal this.

Note:
There is no GPS coverage available to the emergency services. The "E" call is operated like a normal mobile phone.
Omitec Telematics are the only company that can track and monitor the MG X Power SV using the GPS.

Breakdown Assistance

In the event of an emergency where assistance from a breakdown or recovery specialist is necessary, press the **Breakdown** portion of the switch for 2 seconds to activate call mode.

The two lights will flash individually, press and hold the **Breakdown** switch for approximately 6 seconds. The integrated phone system automatically dials the number for the breakdown specialists call centre.

When the call is connected, the microphone located in the head lining will pick up the drivers voice so that he/she can make the relevant breakdown service request.

During the call if the volume requires adjusting, simply pulse the switch either upwards to increase or downwards to decrease the volume.

The call can be terminated at any time by simply pressing and holding the switch for 6 seconds. The warning lamp will extinguish to signal this.

Note:
There is no GPS coverage available to the breakdown or recovery specialist. The "E" call is operated in the same manner as a normal mobile phone.

Calls for the first 12 months will be free. After this period, the customer will be required to pay an annual subscription to continue with the service provider.

Safety Precautions

- If possible the car should be stopped away from the main thoroughfare, ensuring all occupants are waiting out of the car and away from other traffic
- The hazard warning lights should be switched on
- The engine should be switched off and the handbrake applied

In the Event of the Car Being Stolen

At the point of sale, the respected owner will register their details through their X Power dealer with Omitec Telematics.

They will agree and receive a password to authorise any requests to Omitec for any Telematic services. A dedicated phone number will be given to the owner to enable contact with Omitec Telematics.

If an owner has their vehicle stolen, they must immediately inform their local police of the theft where they will be given a crime number.

The next stage is to phone Omitec Telematics using the dedicated phone number given to them at the point of sale.

During this phone call, security checks will be undertaken to prove ownership including, personal details, crime number and password.

Omitec will then track the vehicle using the GPS. They will phone the vehicle to instigate operation of the system. Dialling the vehicle will not alert any thieves that may be in or around the vehicle.

The vehicle can be tracked all over the world 24 hours a day if necessary.

Legislation states many requirements in this country, one being that once the stolen vehicle has been traced, and this information will only be passed onto the police and not the owners.

Vehicle Lockdown

The technology to lockdown a vehicle is included in the Omitec Telematics system. When Omitec track down a stolen vehicle, a message via the phone line will disable the engine management system on the next ignition cycle to immobilise the vehicle thus preventing the vehicle from starting.

Legislation again prevents Omitec from disabling the engine whilst running.

Cost Options

Vehicle lockdown whilst the owners are away, on holiday for example, will be available as an additional cost option to the owner of a MG X Power SV.

As can be seen, the options with Telematics are vast and will be capable of more as technology evolves.

Heating, Ventilation And Air Conditioning

The manual climate control system heats or cools the vehicle depending on the function selector switch position and the temperature selected.

- The function selector switch position determines heating or cooling and air distribution.
- The temperature control setting determines the air temperature.
- The heater blower motor switch varies the blower motor speed.

Principles of Operation

There are four main principles involved with the basic theory of operation:

- Heat transfer
- Latent heat of vaporisation
- Relative humidity
- Effects of pressure

Heat Transfer

If two substances of different temperature are placed near each other, the heat in the warmer substance will transfer to the colder substance.

Latent Heat of Vaporisation

When a liquid boils (converts to a gas), it absorbs heat without raising the temperature of the resulting gas. When the gas condenses (reverts back to a liquid), it gives off heat without lowering the temperature of the resulting liquid.

Relative Humidity

The amount of moisture (water vapour content) that the air can hold is directly related to the air temperature.

The more heat there is in the air, the more moisture the air can hold. The lower the moisture content in the air, the more comfortable you feel.

Removing moisture from the air lowers its relative humidity and improves personal comfort.

Effects of Pressure on Boiling or Condensation

As the pressure is increased on a liquid, the temperature at which the liquid boils (converts to a gas) also increases.

Conversely, when the pressure on a liquid is reduced, its boiling point is also reduced. When in the gas state, an increase in pressure causes an increase in temperature, while a decrease in pressure will decrease the temperature of the gas.

Compressor Anti-Sludging Strategy (CASS)

Liquid refrigerant may accumulate in the A/C compressor under certain conditions. To alleviate damage to the A/C compressor, compressor anti-sludging strategy (CASS) is utilized.

CASS is initiated only under specific conditions:

- The ignition is off for more than 8 hours
- The ambient temperature is above -4°C (25°F)
- Battery voltage is above 8.5 volts during engine cranking

When these conditions are present, the powertrain control module (PCM) will activate the A/C control relay prior to cranking of the engine.

The A/C control relay engages the A/C compressor for approximately 4-15 A/C compressor revolutions or a maximum of 2 seconds (depending upon vehicle application), allowing the liquid refrigerant to be pushed from the A/C compressor. CASS is initiated by the PCM regardless of the function selector switch position or the EATC system settings.

The Refrigerant Cycle

During stabilized conditions (air conditioning system shut down), the refrigerant is in a vaporised state and pressures are equal throughout the system. When the A/C compressor is in operation, it increases pressure on the refrigerant vapour, raising its temperature. The high-pressure and high-temperature vapour is then released into the top of the A/C condenser core.

The A/C condenser core, being close to ambient temperature, causes the refrigerant vapour to condense into a liquid when heat is removed from the refrigerant by ambient air passing over the fins and tubing. The now liquid refrigerant, still at high pressure, exits from the bottom of the A/C condenser core and enters the inlet side of the A/C evaporator core orifice.

The A/C evaporator core orifice is the restriction in the refrigerant system that creates the high pressure build up upstream of the A/C evaporator core and separates the high and low pressure sides of the A/C system. As the liquid refrigerant leaves this restriction, its pressure and boiling point are reduced.

The liquid refrigerant is now at its lowest pressure and temperature. As it passes through the A/C evaporator core, it absorbs heat from the passenger compartment airflow passing over the plate/fin sections of the A/C evaporator core. This addition of heat causes the refrigerant to boil (convert to a gas). The now cooler passenger compartment air can no longer support the same humidity level of the warmer air and this excess moisture condenses on the exterior of the evaporator coils and fins and drains outside the vehicle.

The suction accumulator/drier is designed to remove moisture from the refrigerant and to prevent any liquid refrigerant that may not have been vaporised in the A/C evaporator core from reaching the A/C compressor. The A/C compressor is designed to pump refrigerant vapour only, as liquid refrigerant will not compress and can damage the A/C compressor.

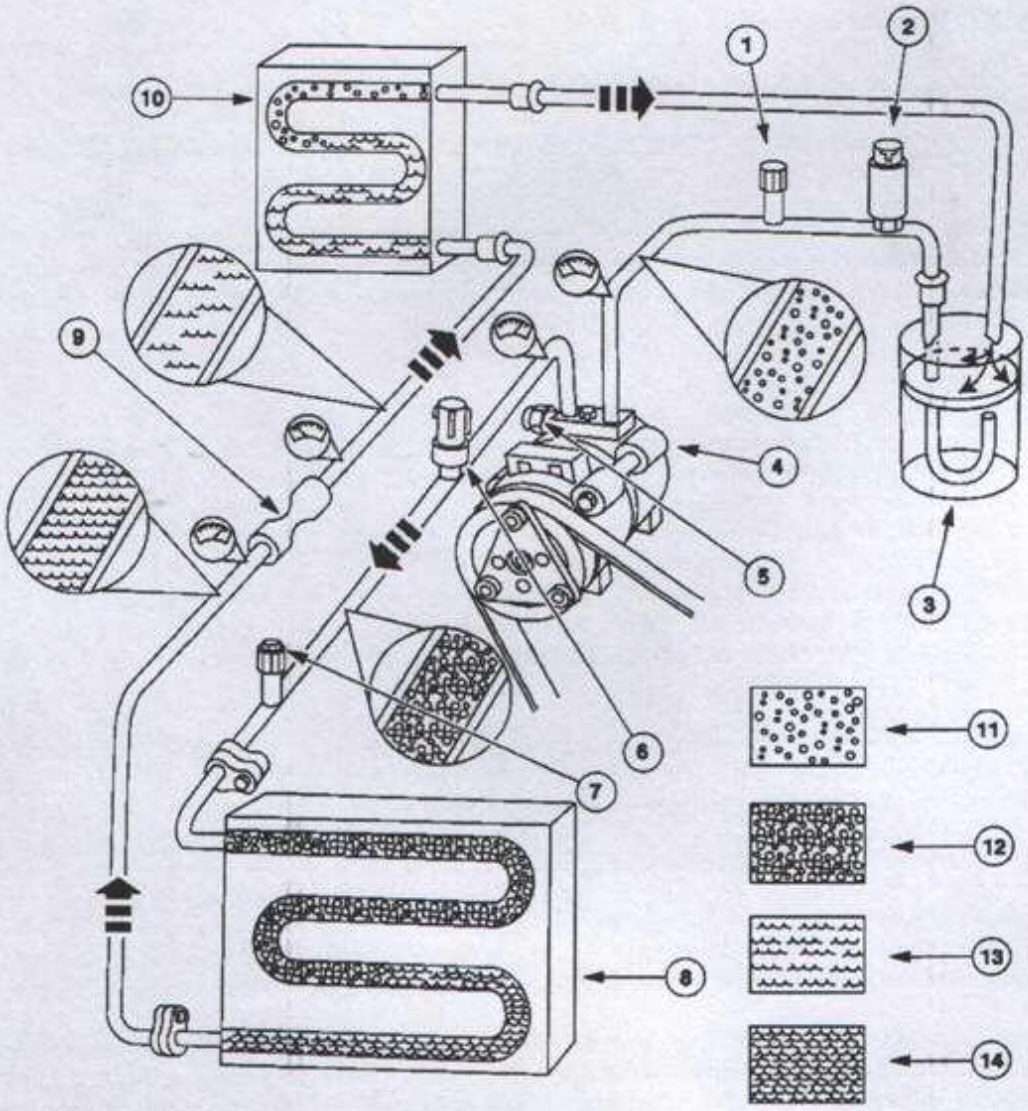
The refrigerant cycle is now repeated with the A/C compressor again increasing the pressure and temperature of the refrigerant.

The A/C cycling switch interrupts compressor operation before the external temperature of the A/C evaporator core gets low enough to cause the condensed water vapour (excess humidity) to turn to ice. It does this by monitoring low side line pressure. It is known that a refrigerant pressure of approximately 210 kPa (30 psi) will yield an operating temperature of 0°C (32°F). The A/C cycling switch controls system operation in an effort to maintain this temperature.

The high side line pressure is also monitored so that the A/C compressor operation can be interrupted if system pressure becomes too high.

The A/C compressor pressure relief valve will open and vent refrigerant to relieve unusually high system pressure.

Clutch Cycling Orifice Tube Type Refrigerant System



1. A/C charge valve port (low side)
2. A/C cycling switch
3. Suction accumulator/drier
4. A/C compressor
5. A/C compressor pressure relief valve
6. A/C pressure cut off switch
7. A/C charge valve port (high side)
8. A/C condenser core
9. A/C evaporator core orifice
10. A/C evaporator core
11. Low pressure vapour
12. High pressure vapour
13. Low pressure liquid
14. High pressure liquid

MG X Power SV Air Conditioning System

The A/C refrigerant system is a clutch cycling orifice tube type.

The system components are:

- A/C compressor
- A/C clutch
- A/C condenser core
- A/C evaporator core
- Suction accumulator
- Connecting refrigerant lines

The refrigeration system operation is controlled by the:

- A/C evaporator core orifice
- A/C cycling switch
- A/C compressor pressure relief valve
- Dual function pressure cut off switch

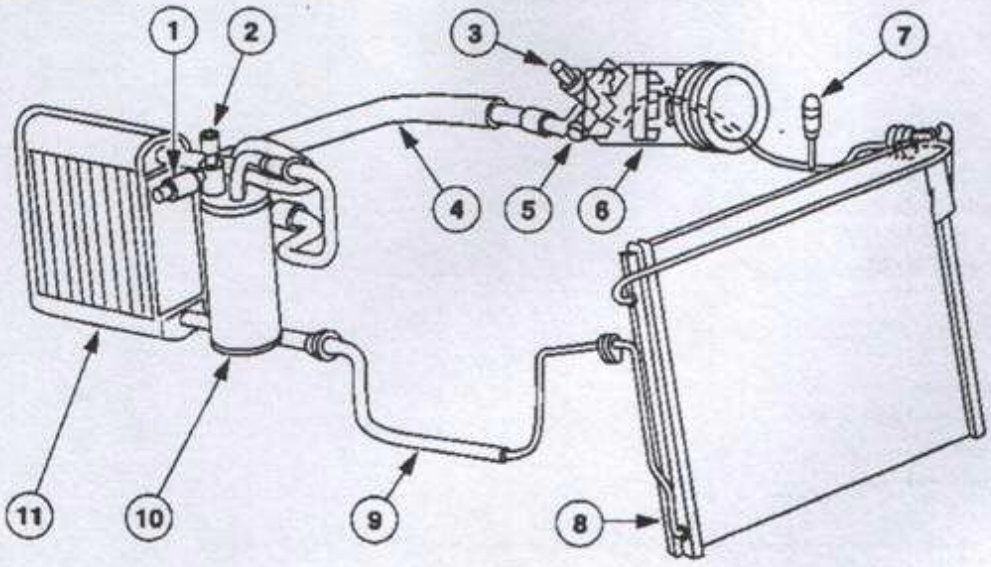
The refrigerant system incorporates an A/C compressor controlled by an A/C cycling switch.

The A/C cycling switch senses A/C evaporator core pressure to control A/C compressor operation.

An A/C compressor pressure relief valve is installed in the A/C manifold and tube to protect the refrigerant system against excessively high refrigerant pressures.

An evaporator core orifice is installed in the A/C evaporator core inlet tube to meter the liquid refrigerant into the A/C evaporator core.

Refrigeration System Components



1. A/C cycling switch
2. A/C charge port valve (low side)
3. Pressure cutoff switch Ă dual function
4. A/C manifold and tube
5. A/C compressor pressure relief valve
6. A/C compressor
7. A/C charge port valve (high side)
8. A/C condenser core
9. Condenser to evaporator tube
10. Suction accumulator
11. A/C evaporator core (part of assembly)
12. A/C Compressor and Clutch Assembly

Note:
Internal A/C compressor components are not serviced separately. The A/C compressor is serviced only as an assembly.

The A/C compressor has the following characteristics:

- A ten-cylinder swashplate design utilizing the tangential design mount.
- A one-piece lip-type seal (installed from the front of the A/C compressor) is used to seal it at the shaft opening in the assembly.
- Five double-acting pistons operate within the cylinder assembly. The pistons are actuated by a swashplate that converts the rotating action of the shaft to a reciprocating force.
- Reed-type discharge valves are located between the cylinder assembly and the head at each end of the A/C compressor.
- The A/C compressor uses PAG oil, or equivalent. This oil contains special additives required for the A/C compressor.
- The A/C compressor oil may have some dark coloured streaking while maintaining a normal oil viscosity. This is normal for the A/C compressor and is caused by break-in wear of the piston rings.

The magnetic A/C clutch has the following characteristics:

- It drives the compressor shaft.
- When the battery positive voltage (B+) is applied to the A/C clutch field coil, the clutch plate and hub assembly is drawn toward the A/C clutch pulley.
- The magnetic force locks the clutch plate and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate.
- When (B+) is removed from the A/C clutch field coil, springs in the clutch plate and hub assembly move the clutch plate away from the A/C clutch pulley.

A/C Compressor Pressure Relief Valve

An A/C compressor pressure relief valve is incorporated into the compressor A/C manifold and tube to:

- Relieve unusually high refrigerant system discharge pressure build up.
- Prevent damage to the a/c compressor and other system components.
- Avoid total refrigerant loss by closing after the excessive pressure has been relieved.

A/C Condenser Core

The A/C condenser core has the following characteristics:

- It is an aluminum fin and tube design heat exchanger located in front of the vehicle radiator.
- It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat and by condensing gas to liquid refrigerant as it is cooled.

Refrigerant Lines

The condenser to evaporator tube contains the high pressure liquid refrigerant upstream of the evaporator core orifice.

The A/C manifold and tube is attached to the A/C compressor, is sealed with O-ring seals, and has the following features:

- The upstream side contains low pressure refrigerant gas.
- The downstream side contains high pressure refrigerant gas and a fitting used to mount a serviceable high pressure A/C charge port valve.
- The downstream side also contains a fitting used to mount the pressure cut off switch —dual function. A long-travel Schrader-type valve stem core is installed in the fitting so that the dual function pressure cut off switch can be removed without discharging the A/C system.

A/C Evaporator Core

Note:
The evaporator core is not separately serviceable, it is serviced only with the evaporator core housing assembly.

Installation of a new suction accumulator is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator.

The A/C evaporator core is the plate/fin type with a unique refrigerant flow path.

- A mixture of refrigerant and oil enters the bottom of the A/C evaporator core through the A/C evaporator core inlet tube and moves out of the A/C evaporator core through the A/C evaporator core outlet tube.
- This flow pattern accelerates the flow of refrigerant and oil through the A/C evaporator core.

Evaporator Core Orifice

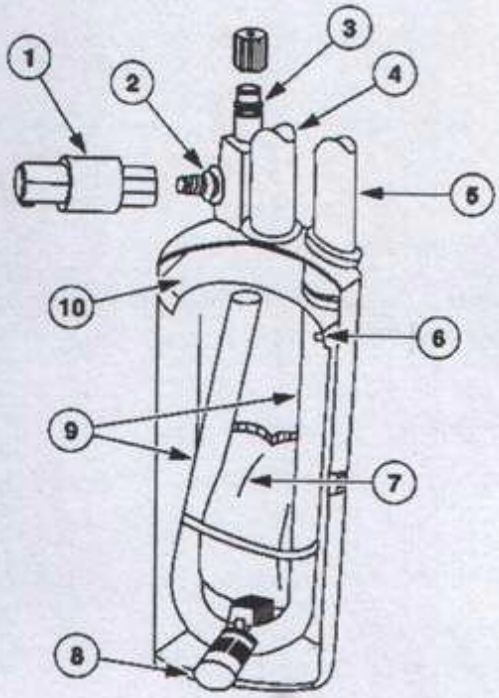
Note:
The evaporator core orifice is an integral part of the condenser to evaporator line and should be installed as an assembly with the line.

A new evaporator core orifice should be installed whenever a new A/C compressor is installed.

The evaporator core orifice has the following characteristics:

- It is located in the A/C condenser to evaporator line.
- It has filter screens located on the inlet and outlet ends of the tube body.
- The inlet filter screen acts as a strainer for the liquid refrigerant flowing through the evaporator core orifice.
- O-ring seals on the evaporator core orifice prevent the high-pressure liquid refrigerant from bypassing the evaporator core orifice.
- Adjustment or repair cannot be made to the evaporator core orifice assembly. A new evaporator core orifice must be installed as a unit.

Suction Accumulator



1. A/C cycling switch
2. O-ring seal
3. Low pressure service gauge port valve
4. Inlet from A/C evaporator core
5. Outlet to A/C compressor
6. Anti-siphon hole
7. Desiccant bag
8. Oil return orifice filter
9. Vapour return tube
10. Suction accumulator dome

Note:
Installation of a new suction accumulator is not required when repairing the air conditioning system except when there is physical evidence of contamination from a failed A/C compressor or damage to the suction accumulator.

In addition to the preceding condition, a new suction accumulator should be installed if one of the following conditions exist:

- The suction accumulator is perforated.
- The refrigerant system has been opened to the atmosphere for a period of time longer than required to make a minor repair.
- There is evidence of moisture in the system such as internal corrosion of metal refrigerant lines or the refrigerant oil is thick and dark.

The inlet tube of the suction accumulator attaches directly to the A/C evaporator core outlet tube and the outlet tube attaches to the A/C manifold and tube.

After entering the inlet of the suction accumulator, the heavier oil-laden refrigerant contacts an internally mounted dome (which serves as an umbrella) and drips down onto the bottom of the canister.

- A small diameter oil bleed hole, in the bottom of the vapour return tube, allows the accumulated heavier liquid refrigerant and oil mixture to re-enter the compressor suction line at a controlled rate.
- As the heavier mixture passes through the small diameter liquid bleed hole, it has a second chance to vaporise and recirculate through the A/C compressor without causing compressor damage due to slugging.

- A fine mesh screened filter fits tightly around the bottom of the vapour return tube to filter out refrigerant system contaminant particles.
- A desiccant bag is mounted inside the canister to absorb any moisture which may be in the refrigerant system.
- A fitting located on the top of the suction accumulator is used to attach the A/C cycling switch. A long-travel Schrader-type valve stem core is installed in the fitting so that the A/C cycling switch can be removed without discharging the A/C system.

A/C Cycling Switch

The A/C cycling switch is mounted on a Schrader valve-type fitting on the top of the suction accumulator.

- A valve core depressor, located inside the threaded end of the A/C cycling switch, presses in on the Schrader valve stem.
- This allows the suction pressure inside the suction accumulator to control the operation of the A/C cycling switch.
- The electrical switch contacts open when the suction pressure drops. The contacts close when the suction pressure rises.
- When the A/C cycling switch contacts close, the signal to energize the A/C clutch is sent to the wide open throttle A/C cut off relay.
- When the A/C cycling switch contacts open, the A/C clutch field coil is de-energized and compressor operation stops.
- The A/C cycling switch will control the A/C evaporator core pressure at a point where the plate/fin surface temperature will be maintained slightly above freezing.
- This prevents icing of the A/C evaporator core and blockage of air flow.
- It is not necessary to discharge the refrigerant system to remove the A/C cycling switch.

Dual Function Pressure Cut Off Switch

The dual function pressure cut off switch is used to interrupt A/C compressor operation in the event of high system discharge pressures.

The pressure cut off switch is mounted on a Schrader valve-type fitting on the high pressure side of the A/C manifold and tube.

- It is not necessary to discharge the refrigerant system to remove the pressure cut off switch.
- A valve depressor, located inside the threaded end of the pressure cut off switch
- This allows the pressure cut off switch to monitor the compressor discharge pressure.
- When the compressor discharge pressure rises, the switch contacts open, disengaging the A/C compressor. When the pressure drops, the contacts close to allow operation of the A/C compressor.
- The pressure cut off switch has a second set of electrical contacts used for high-speed cooling fan control.

- When the compressor discharge pressure rises, the contacts close and engage the high speed fan control. When the pressure drops, the contacts open and the high speed fan control is disengaged.

Spring Lock Coupling

The spring lock coupling is a refrigerant line coupling held together by a garter spring inside a circular cage.

- When the coupling is connected together, the flared end of the female fitting slips behind the garter spring inside the cage of the male fitting.
- The garter spring and cage then prevent the flared end of the female fitting from pulling out of the cage.
- Three O-ring seals are used to seal between the two halves of the A/C condenser core couplings. All other couplings have two O-ring seals.
- Use only the O-ring seals listed for the spring lock coupling.
- A plastic indicator ring is used on the spring lock couplings of the A/C evaporator core to indicate, during vehicle assembly, that the coupling is connected. Once the coupling is connected, the indicator ring is no longer necessary but will remain captive by the coupling near the cage opening.
- The indicator ring may also be used during repair operations to indicate connection of the coupling.
- An A/C tube lock coupling clip may be used to secure the coupling but is not required.

Service Gauge Port Valves

The high-pressure service gauge port valve is located on the A/C manifold and tube.

The low pressure service gauge port valve is located on the suction accumulator.

The fitting is an integral part of the refrigeration line or component.

- Special couplings are required for both the high side and low side service gauge ports.
- A new Schrader-type valve core can be installed if the seal leaks.
- Always install the A/C charging valve cap on the service gauge port valves after repairing the refrigerant system.

Heating, Ventilation And Air Conditioning Diagnostics

Pinpoint Test P1464: DTC P1464: A/C Demand Out Of Self-Test Range

All test are to carried out with the ignition switched on.

Make sure the function selector switch is in the off position.

PCM self-test

Is DTC P1464 retrieved?

No

The system is functioning correctly. This DTC will set if the A/C is turned on when carrying out the PCM self-test.

Yes

Check Parameter Identifier (PID) A/C Cycling Switch (ACCS) with the A/C control disconnected

Does PID ACCS read on?

No

Install a new function selector switch. Repeat the PCM self-test and verify DTC P1464 is No longer retrieved.

Yes

Check circuit 348 (VT) for a short to B+

Measure the voltage at the function selector switch pin 4, (VT), the harness side and ground.

Is there voltage present?

Yes

Repair (VT) for a short to B+.

Repeat the PCM self-test and verify DTC P1464 is no longer retrieved.

No

Install a new powertrain control module.

Repeat the PCM self-test and verify DTC P1464 is no longer retrieved.

Pinpoint Test B: Insufficient, Erratic, Or No Heat

Ensure the ignition is switched off during tests unless otherwise instructed.

Check for correct engine coolant level

Check the engine coolant level when hot and cold.

Is the engine coolant at the correct level (hot/cold) as indicated on the engine coolant recovery reservoir?

Yes

Check for hot water to the heater core inlet hose

Warning:
The heater core inlet hose will become too hot to handle and may cause serious burns if the system is working correctly.

Start engine and allow the engine to reach normal operating temperature.

Feel the heater core inlet hose.

Is the heater core inlet hose too hot to handle?

No

Check the engine cooling system including radiator cap for leaks

Fill the engine cooling system to specified level.

Pressure check the engine cooling system.

Does the engine cooling system, including the radiator cap, hold pressure?

Test the engine cooling system for correct operation

Check the heater core outlet hose for hot water

Feel the heater core outlet hose.

Is the heater core outlet hose cool or cold?

Yes

Test the heater core for a blockage or partially blocked condition.

No

Go to Pinpoint Test E.

Pinpoint Test C: The A/C Does Not Operate/Does Not Operate Correctly

All tests to be carried out with ignition in the on position unless otherwise instructed

C1 Check the Powertrain Control Module (PCM) Parameter Identifier (PID) Wide open throttle A/C Cut off (WACF)

Ensure the A/C switch is in the off position.

Monitor the PCM PID WACF whilst operating the switch.

Does the PCM PID WACF read Yes?

Yes

Refer to the powertrain control/emissions diagnosis manual.

No

Go to C2

C2 Check the PCM PID WACF with the A/C On

Operate the A/C switch to the on position.

Monitor the PCM PID WACF whilst operating the switch.

Does the PCM PID WACF read Yes?

Yes

Refer to the powertrain control/emissions diagnosis manual.

No

Go to C3

C3 Check the Powertrain Control Module (PCM) Parameter Identifier (PID) Air Conditioning Cycling Switch (ACCS) with the A/C On

Ensure the engine is at idle.

Monitor the PCM PID ACCS whilst operating the A/C switch.

Does the PCM PID ACCS read on?

No

Go to C6.

Yes

Go to C4

C4 Check PCM PID WAC with the A/C On

Note:
When PCM PID WACF is Yes, this is the same fault as DTC P1460.

Monitor the PCM PID WAC while operating the A/C switch.

Does the PCM PID WAC read on?

Yes

Go to C20.

No

Go to C6.

C5 Check The Input Signal to the PCM

Switch off ignition and disconnect the PCM

Measure the voltage at PCM pin 41, (DG/OG), harness side and ground.

Is the voltage reading greater than 10 volts?

Yes

Install a new powertrain control module.

Test the system for normal operation.

No

C6 Check the Refrigerant Pressure

Connect the manifold gauge set.

Is the system pressure 345-1,724kpa (50-250psi)?

No

Repair the leaks and retest the system for normal operation.

Yes

Go to C7

C7 Check the Supply to the A/C Selector Switch

Disconnect the A/C selector switch

Measure the voltage at the A/C selector switch pin 2, (PK/LB), harness side and ground.

Is the voltage reading greater than 10 volts?

Yes

Go to C17.

No

Go to C8

C8 Check (PK/LB) for a Short To Ground

Disconnect the A/C selector switch

Measure the resistance between the function A/C selector switch pin 2, (PK/ LB) harness side and ground.

Is the resistance less than 5 ohms?

No

Go to C11

Yes

Go to C9

C9 Check (VT) For Short To Ground

Disconnect the A/C selector switch

Measure the resistance between the A/C selector switch pin 4, (VT) harness side and ground.

Is the resistance reading less than 10,000 ohms?

Yes

Repair wiring (VT).

Test the system for normal operation.

No

Go to C10

C10 Check for a Short Circuit at the A/C Selector Switch

Reconnect the A/C selector switch

Measure the resistance between the A/C cycling switch pin 4, (VT) harness side and ground.

Operate the selector switch and note the resistance reading:

Yes

Install a new A/C selector switch.

Test the system for normal operation.

No

Go to C13

C11 Check Wiring (DG/OG) for a Short to Ground

Disconnect the A/C pressure cut off switch

Measure the resistance between the A/C pressure cut-off switch pin 3, (DG/OG), harness side and ground.

Is the resistance reading less than 10,000 ohms?

Yes

Go to C14

No

Go to C12

C12 Check the A/C Cycling Switch (ACCS) for a Short to Ground

Disconnect the ACCS

Measure the resistance between the A/C pressure cut-off switch pin 2, (DB/YE), harness side and ground.

Is the resistance reading less than 10,000 ohms?

Yes

Repair circuit (DB/YE) for a short to ground.

Test for normal operation.

No

Install a new A/C cycling switch.

Test system for normal operation.

C13 Check Circuit (DG/OG) for a Short to Ground

Reconnect the A/C pressure cut off switch

Measure the resistance between PCM pin 41, (DG/OG), harness side and ground.

Is the resistance less than 10,000 ohms?

Yes

Go to C15

No

Install a new A/C fuse (15 Amp).

Test the system for Normal operation.

If the fuse blows, install a new PCM.

C14 Check the A/C Pressure Cut-Off Switch

Disconnect the A/C pressure cut off switch

Measure the resistance between the PCM pin 41 (DG/OG), and ground.

Is the resistance less than 10,000 ohms?

Yes

Repair circuit (DG/OG) for a short to ground.

Test the system for normal operation.

No

Install a new A/C pressure cut-off switch.

Test the system for normal operation.

C15 Check the Operating Switch

Disconnect the ACCS

Switch on the A/C.

Measure the voltage between pin 4, (VT), harness side and ground.

Is the voltage reading greater than 10 volts?

Yes

Go to C17

No

Go to C16

C16 Measure the Resistance of Circuit (PK)

Disconnect the A/C selector switch

Measure the resistance between the A/C selector switch pin 1, (VT), harness side and A/C cycling switch pin 4 (VT), harness side.

Is the resistance reading less than 5 ohms?

Yes

Install a new function selector switch.

Test the system for normal operation.

No

Repair circuit (PK) for an open.

Test the system for normal operation.

C17 Measure the Voltage to the A/C Pressure Cut-Off Switch

Disconnect the A/C pressure cut off switch

Switch on the A/C

Measure the voltage at the A/C high pressure cut-off switch pin 2 (DB/YE), harness side and ground.

Is the voltage reading greater than 10 volts?

Yes

Go to C19

No

Go to C18

C18 Check the A/C Cycling Switch

Disconnect the ACCS and the A/C high pressure cut off switch

Measure the resistance between ACCS pin 2, (DB/YE), harness side and the A/C high pressure cut-off switch pin 2, (DB/YE), harness side.

Is the resistance less than 5 ohms?

Yes

Install a new ACCS.

Test the system for normal operation.

No

Repair circuit (DB/YE) for an open circuit.

Test the system for normal operation.

C19 Check the A/C Pressure Cut-Off Switch

Disconnect the A/C high pressure cut off switch

Measure the resistance between PCM pin 41 and A/C high pressure cut-off switch pin 3, (DG/OG), harness side.

Is the resistance less than 5 ohms?

Yes

Install a new A/C pressure cut-off switch.

Test the system for normal operation.

No

Repair circuit (DG/OG) for an open circuit.

Test the system for normal operation.

C20 Check the Ground Circuit at the Constant Control Relay Module (CCRM)

Disconnect the CCRM

Measure the resistance of CCRM pin 18, (BK), harness side and ground.

Is the resistance reading less than 5 ohms?

Yes

Go to C21

No

Repair circuit (BK) for an open circuit.

Test the system for normal operation.

C21 Check Circuit (WH/LB) at the Constant Control Relay Module

Disconnect the CCRM

Measure the voltage at the CCRM pin 13 (WH/LB), harness side and ground.

Is the voltage reading greater than 10 volts?

Yes

Go to C22

No

Repair circuit (WH/LB) for an open circuit.

Test the system for normal operation.

C22 Check the Power to the A/C Clutch

Switch on the A/C

Measure the voltage at the A/C clutch circuit (BK/YE), harness side and ground.

Is the voltage greater than 10 volts?

Yes

Go to C24

No

Go C23

C23 Check Circuit 331 (BK/YE) For An Open Circuit.

Disconnect the CCRM

In the active command mode, command the PCM outputs on.

Measure the resistance between the CCRM pin 22, circuit (PK/YE), harness side and ground.

Is the resistance reading less than 5 ohms?

Yes

Go to C24

No

Repair circuit (BK/YE) for an open circuit.

Test the system for normal operation.

C24 Check Circuit (BK/YE)

Ensure ignition is off

Disconnect the CCRM and the A/C clutch

Measure the resistance between CCRM pin 23, circuit (BK/YE), harness side and A/C clutch pin 1, harness side.

Is the resistance less than 5 ohms?

Yes

Go to C25

No

Repair circuit (BK/YE) for an open circuit.

Test the system for normal operation.

C25 Check Circuit (BK/YE) for a Short to Ground.

Ensure ignition is off

Disconnect the CCRM and the A/C clutch

Measure the resistance between A/C clutch pin 2, circuit (BK), harness side and the CCRM pin 16, circuit (BK) harness side.

Is the resistance less than 5 ohms?

Yes

Install a new constant control relay module.

Test the system for normal operation.

No

Repair circuit (BK) for an open circuit.

Test the system for normal operation.

Pinpoint Test D: The A/C is Always On

Ensure ignition is on unless otherwise instructed

D1 Check PCM PID WACF

Ensure the A/C switch is in the OFF position.

Does the PCM PID WACF read YES?

Yes

Repair Circuit 331 (PK/YE) for a short to ground.

Test the system for normal operation.

No

Go to D2

D2 Check PID ACCS With A/C Off

Does the PCM PID ACCS read ON?

Yes

Go to D3

No

Go to D5

D3 Check for a False Input Signal to the PCM

Ensure ignition is off and disconnect the PCM

Switch off the A/C

Measure the voltage between PCM Pin 41, (DG/OG) harness side and ground.

Is the voltage greater than 10 volts?

Yes

Go to D4

No

Install a new powertrain control module.

Test the system for normal operation.

D4 Check Circuit (DG/OG) for a Short to B+

Reconnect the PCM and disconnect the A/C selector switch

Measure the voltage at the A/C selector switch Pin 3 (PK), harness side and ground.

Is there voltage present?

Yes

Repair (PK) for a short to B+.

Test the system for normal operation.

No

Install selector switch.

Test the system for normal operation.

D5 Check for a Shorted Clutch Input

Ensure ignition is off

Disconnect the A/C clutch

Switch ignition on

Measure for voltage at the A/C clutch (BK/YE), harness side and ground.

Is there voltage present?

Yes

Install a new constant control relay module.

Test the system for normal operation.

No

Check the clutch air gap

Torque Settings

Engine

Cam Cover	10 Nm
Cylinder Head (in sequence)	40 Nm
	90°
	Loosen 1 full turn
	40 Nm
	90°
Camshaft Bearing Caps	10 Nm
Camshaft Sprocket	40 Nm
	90°
Front Engine Chest	25 Nm
Timing Chain Tensioner Bolts Primary	25 Nm
Timing Chain Tensioner Bolts Secondary	10 Nm
Front Crankshaft Damper	90 Nm
	Loosen 1 full turn
	50 Nm
	90°
Oil sump	20 Nm
Inlet Manifold	10 Nm
Plenum Chamber	10 Nm
Exhaust Manifold	25 Nm
Oil Drain Plug	14 Nm
Flywheel	85 Nm

46 NM

Note:
All the above must be secured in the sequence illustrated in the workshop manual.

Transmission (3650)

Clutch Housing to Casing bolts	31 Nm
Extension Housing to Casing Bolts	31 Nm
Gear Lever Screws	23 Nm
Bell Housing to Engine Bolts	75 Nm
Reverse Light Switch	37 Nm
Drain Plug	23 Nm
Fill Plug	17 Nm

Note:
All the above must be secured in the sequence illustrated in the workshop manual.

Torque Settings

Front Suspension

Lower Arm Inner Pivot Bolts	120 Nm
Upper Arm Inner Pivot Bolts	120 Nm
Lower Ball Pin to Arm Bolts (Inner)	90 Nm
Lower Ball Pin to Arm Bolts (Outer)	52 Nm
Ball Pin to Hub Nuts (ALL)	60 Nm
Front Brake Caliper to Hub	80 Nm
Lower Damper to Arm	90 Nm
Upper Damper Casing to Chassis	26 Nm
Front Anti Roll Bar to Chassis	26 Nm
Anti Roll Bar Links	60 Nm
Wheel Bearing Carrier to Hub	60 Nm + Loctite

Rear Suspension

Lower Arm Inner Pivot Bolts	120 Nm
Upper Arm Inner Pivot Bolts	120 Nm
Lower Ball Pin to Hub Bolts	25 Nm
Track Control Arm Inner Pivot Bolt	60 Nm
Track Control Arm to Hub Nut	40 Nm
Track Control Arm Lock Nut	40 Nm
Ball Pin to Hub Nuts (ALL)	60 Nm
Rear Brake Caliper to Hub	80 Nm
Lower Damper to Arm Inner Bolt	60 Nm
Lower Damper to Arm Outer Bolt	90 Nm
Upper Damper Casing to Chassis	26 Nm
Rear Anti Roll Bar to Chassis	26 Nm
Anti Roll Bar Links	60 Nm

Steering

Steering Rack to Chassis	50 Nm
Steering End to Hub	40 Nm
Steering Column to Rack Pinch Bolt	25 Nm

Torque Settings

General

Seat Belt Fixings	40 Nm
Wheel Nuts	80 Nm
Driveshaft Flange Bolts	52 Nm
Rear Differential Mounting to Chassis	52 Nm
Front Differential Mounting to Chassis	90 Nm
Front Differential Mounting to Differential	90 Nm
Engine Mounting to Chassis	120 Nm
Rear Gearbox Cross Member to Chassis	52 Nm
Exhaust Frontpipe to Manifold	52 Nm
Exhaust Flanges (Other)	30 Nm

Acronyms and Definitions

ABS: Anti—lock Brake System.

A/C: Air Conditioning. A vehicle accessory system that modifies the passenger compartment air by cooling and dehydrating the air.

ACC: Air Conditioning Clutch. Indicates status of the A/C clutch.

ACCS: Air Conditioning Cycling Switch. Indicates status of the A/C cycling switch.

ACD: Air Conditioning Demand. A signal input to the PCM from the Air Conditioning control panel.

ACP: Air Conditioning Head Pressure or A/C cycling switch input state.

ACPSW: Air Conditioning Pressure Switch.

ACP V: Air Conditioning Head Pressure Volts. A voltage input to the PCM from the ACP switch or sensor.

ACR: Air Conditioning Relay. Commanded output controlled by the PCM and acts as an A/C cutout control during heavy acceleration.

A/D: Analog—to—Digital. Analog—to—Digital signal conversion.

Air/Fuel Ratio: Air to fuel mixture ratio. An air/fuel mixture that is 14.7:1 is also called stoichiometry.

Ambient Air Temperature: Temperature of the air surrounding an object.

Analog (Electrical/Electronic): An electrical signal that can obtain any value within the voltage limits of the signal.

ATDC: After Top Dead Centre. The location of the piston after it has reached the top of its stroke. Measured in degrees of crankshaft rotation.

BARO: Barometric Pressure.

Base Idle: Idle rpm determined by the throttle lever hardset on the throttle body with the IAC solenoid disconnected.

Base Timing: Spark advance in degrees before top dead centre of the base engine without any control from the PCM or ICM.

Battery Positive Voltage (B+): The positive (+) voltage from the battery or any circuit connected directly to the battery. Compare "Vehicle Power (VPWR)."

BPP: Brake Pedal Position. Indicates the position of the brake pedal, based on input from the Brake Pedal Position (BPP) switch.

BRAKE _LMP or BRKL: Brake Warning Lamp Status. Activates the Brake Warning Lamp by applying voltage to the control line.

BTDC: Before Top Dead Centre. The location of the piston before it has reached the top of its stroke. Measured in degrees of crankshaft rotation.

Bus + or Bus — : Multiplex circuits that carry SCP data from module to module and to the DLC.

CANVNT: Canister Vent Solenoid.

Catalyst: Catalytic converter. An in—line exhaust system device used to reduce the level of engine exhaust emissions.

CAT EVAL: Catalyst System Evaluated. This item indicates YES when the Catalyst Efficiency Monitor has successfully completed.

CCM: Comprehensive Component Monitor.

CCRM: Constant Control Relay Module. A relay module that provides ON—OFF control of various EEC components.

CD A through J: Coil Driver 1 through 10.

CGND or CSE GND: Case Ground. Provides a ground source for the PCM or ECU case.

CID: Cylinder Identification. PCM input signal from Camshaft Position Sensor.

CKP: Crankshaft Position. Senses the position of the crankshaft.

CKP+, CKP—: CKP+ is the Crankshaft Position (CKP) sensor signal wire. CKP— is the signal return.

CL: Closed Loop. An operating condition or mode which enables operation based on sensor feedback.

CMP: Camshaft Position. Indicates camshaft position.

CMPFM: Camshaft Position Failure Mode. Indicates when the PCM identifies a CID/CMP fault.

CMS: Catalyst Monitor Sensor. Downstream HO2S.

CO: Carbon Monoxide. A colourless, odourless and toxic gas that is a component of auto exhaust emissions.

CO2: Carbon Dioxide. A colourless, odourless gas that is a normal by—product of the combustion of fuel.

Coil: A device consisting of windings around an iron core. In a spark ignition system, designed to increase voltage.

Cold Soak: Time given to a vehicle to sit at a low temperature (typically below 68° F / 20° C) until the temperature of external and internal components stabilize.

CONT: Continuous Memory. The portion of KAM (keep alive memory) used to store DTCs generated during Continuous Memory Self—Test.

Continuous Memory Self—Test: A continuous test of the EEC system conducted by the PCM whenever the vehicle is operating.

CPP: Clutch Pedal Position. Indicates clutch pedal position.

CPP Switch: Clutch Pedal Position Switch. Located on the clutch pedal and detects when the clutch pedal is depressed.

CSE GND: Case Ground.

CT: Closed Throttle Mode. A mode when the PCM varies the pulse width of the fuel injectors to obtain the air/fuel mixture appropriate for closed throttle operation.

CTO: Clean Tach Output. Signal used to drive the instrument panel tachometer.

Data Communications Link: A communication path between various in—vehicle electronic modules. Accessed by scan tools through the Data Link Connector (DLC).

DC:1. Direct Current. Electric current flowing in one direction.
2. Duty Cycle. The voltage measurement of ON time versus the full cycle period, expressed in percent.

DCL: Data Communication Link.

DI: Distributor Ignition. A system in which the ignition coil secondary circuit is sequenced by a distributor.

Digital: Controls process information by switching the current or voltage ON and OFF.

DLC: Data Link Connector. J1962 connector providing access to vehicle diagnostic information.

DOHC: Dual Overhead Cam. An engine configuration that uses two camshafts positioned above the valves.

DOL: Data Output Line. A circuit that sends certain information from the PCM to the instrument cluster.

DPFEGR: Differential Pressure Feedback Exhaust Gas Recirculation. System that uses a pressure transducer to control the operation of the EGR Vacuum Regulator Valve.

DRL: Daytime Running Lamps. A system that keeps the vehicle running lamps on at all times while the vehicle is operating.

DTM: Diagnostic Test Mode. A level of capability in an On—Board Diagnostic (OBD) system.

DTC: Diagnostic Trouble Code. An alpha/numeric identifier for a fault condition identified by the On—Board Diagnostic System.

DVOM: Digital Volt—Ohm Meter.

ECT: Engine Coolant Temperature. Displayed in either Fahrenheit or Centigrade.

ECTV: Engine Coolant Temperature Voltage. The actual voltage drop across the ECT sensor thermistor.

ECU: Electronic Control Unit. A module that handles the control strategy and monitors system inputs or outputs.

EEC: Electronic Engine Control system.

EEC—V: Fifth generation EEC system.

EGR: Exhaust Gas Recirculation. A process in which a small amount of exhaust gas is routed into the combustion chamber.

EGR EVAL: Exhaust Gas Recirculation System Evaluated. EGR EVAL will display YES when the monitor is complete.

EGRS: EGR Shutoff. A normally closed solenoid that applies vacuum to the EGR valve when energized by the PCM.

EGR Vacuum Regulator: Controls vacuum to the EGR valve by a duty cycle signal from the PCM.

EGRVR: Exhaust Gas Recirculation Vacuum Regulator. Solenoid which varies the vacuum to the EGR valve by varying the duty cycle to the regulator.

EGRVRA: Exhaust Gas Recirculation Vacuum Regulator Actual (volt). The actual state of the commanded output.

EGRVRF: Exhaust Gas Recirculation Vacuum Regulator Fault. Represents whether a fault exists in the EGRV circuit.

EI: Integrated Electronic Ignition. An Electronic Ignition system that has the Ignition Control Module (ICM) integrated into the PCM.

EI—HDR: Electronic Ignition, High Data Rate. Formerly known as Electronic Distributorless Ignition System.

EI—LDR: Electronic Ignition, Low Data Rate. Formerly known as Distributorless Ignition System.

EMI: Electromagnetic Interference. Usually caused by ignition voltage spikes, solenoids, relay operation or noisy generator contacts.

EPA: Environmental Protection Agency

EPROM: Erasable Programmable Read—Only Memory. An electronic component in the PCM that requires the electronic storage of information.

EVAP: Evaporative Emissions. A system to prevent fuel vapor from escaping into the atmosphere.

EVAPCP: Evaporative Canister Purge Solenoid. Controls a solenoid which allows venting of the evaporative purge canister.

EVAPCPF: Evaporative Canister Purge Solenoid Fault. Identifies whether an electrical fault exists for the current commanded state.

EVAPCV: Evaporative Canister Vent Solenoid. Controls a solenoid which seals the EVAP system canister from atmospheric pressure during the EVAP OBD II Monitor test.

Evaporative Emissions Canister: An evaporative emission canister, containing activated charcoal which absorbs and holds fuel vapours.

EVAPPDC: Evaporative Canister Purge Duty Cycle. The duty cycle commanded to the Evap Canister Purge Solenoid by the PCM.

Exciter Ring: A toothed or notched iron or steel disk, which is the moveable part of a wheel speed sensor.

FAN: Fan Speed. Used in conjunction with vehicles having multiple fan speed control. Displays OFF, LOW, or HIGH status.

FC: Fan Control.

FCS: Fuel Control Solenoid.

FCIL: Fuel Cap Off Indicator Lamp. Indicates that the fuel filler cap was not properly installed.

FEPS: Flash EEPROM Programming Signal. 18 volt DC signal sent by the scan tool to initiate PCM reprogramming.

FIFO: First In First Out.

FILO: First In Last Out.

FIM: Fuel Indicator Module.

FLI: Fuel Level Input. Used by the Evap monitor to calculate fuel tank vapour volume. Displayed as a percentage.

FLI V: Fuel Level Input Voltage.

FMEM: Failure Mode Effects Management. Operating strategy that maintains limited vehicle function in the event of a PCM or EEC component failure.

FP:1. Fuel Pump. Indicates whether the pump has been commanded ON or OFF by the PCM.
2. Fuel Pump (Modulated). Fuel pump duty cycle percentage.

FPDM: Fuel Pump Driver Module. A module that controls the electric fuel pump.

FPF: Fuel Pump Fault. Identifies whether a fault exists in the FP circuit.

FPM: Fuel Pump Monitor. Monitors the Fuel Pump / circuits for faults.

Freeze Frame: A block of memory containing the vehicle operating conditions at a specific time.

FRP: Fuel Rail Pressure. Based on FRP V.

FRP V: Fuel Rail Pressure Voltage. A voltage input to the PCM from the Fuel Rail Pressure Sensor.

FSC: Fail—Safe Cooling.

FTP: Fuel Tank Pressure. Displayed as inches of water, kPa, or volts.

FTP V: Fuel Tank Pressure Voltage. From the FTP transducer.

FUEL PR: Fuel Pressure. Measurement of the force of the fuel delivered via the fuel pump.

FUELPW: Fuel Pulse Width. Displays the commanded pulse width at time of last data update.

FUELPW1: Fuel Injector Pulse Width #1. Corresponds to injectors normally affected by O2S1 (HEGO1).

FUELPW2: Fuel Injector Pulse Width #2. Corresponds to injectors normally affected by O2S2 (HEGO2).

FUELSYS: Fuel System Status (OPEN/CLOSED Loop). Formerly known as LOOP.

Fuel Tank Vapour Valve: A valve mounted in the top of the fuel tank that vents excess vapor and pressure from the fuel tank into the Evaporative Emission Control System.

GEM: Generic Electronic Module.

GEN: Generator.

GENF: Generator output fault.

GENFDC: Generator field control output.

GFS: Generator field signal monitor.

GND: Ground.

GPS: Global Positioning Satellite.

GVW: Gross Vehicle Weight.

Hall Effect: A process where current is passed through a small slice of semi—conductor material and a magnetic field to produce a small voltage in the semi—conductor.

Hard Fault: A fault currently present in the system.

HC: **1.** Hydrocarbon. A by—product of combustion and a component of auto exhaust emissions.
2. High Compression.

HLOS: Hardware Limited Operating Strategy. A mode of operation where the PCM replaces output commands with fixed values in response to internal PCM malfunctions.

HO: High Output.

HO2S: Heated Oxygen Sensor. Formerly known as Heated Exhaust Gas Oxygen (HEGO) Sensor. Provides information on rich or lean exhaust conditions to the PCM.

Hot Soak : Period of time after an engine operates where localized combustion heat dissipates throughout the engine.

HTR, HTR11, HTR12, HTR21, HTR22, HTRX1, HTRX2: HO2S Heater. Heater element for the HO2S sensor.

Hydrogen: Chemical symbol H. Highly flammable gas.

Hz: Hertz. Cycles per second.

IAC: Idle Air Control. Electrical control of throttle bypass air.

IAT: Intake Air Temperature.

IATV: Intake Air Temperature Voltage. Actual voltage drop across the IAT sensor.

IC: Integrated Circuit. A small semi—conductor device capable of doing many separate circuit functions.

ICM: Ignition Control Module. The module that controls the ignition system.

IFDM: Integrated Fuel Delivery Module.

IFS: Inertia Fuel Shutoff.

IGN GND: Ignition Ground.