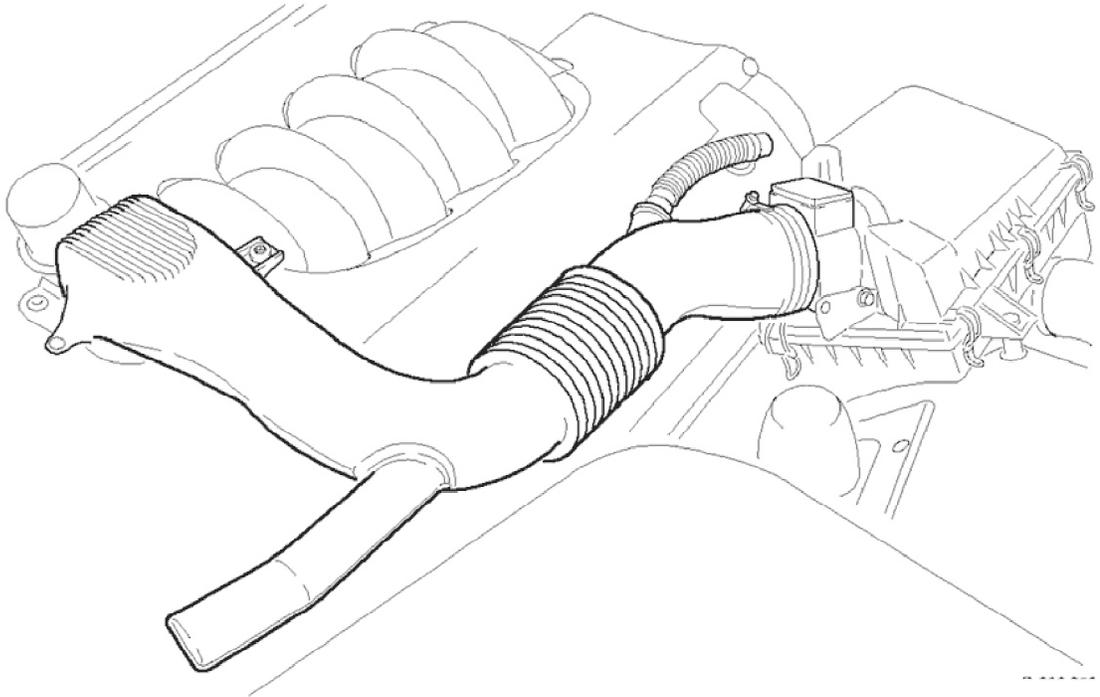


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Intake Air Distribution and Filtering

Intake Air Distribution and Filtering - Normally Aspirated Vehicles

Air Intake Assembly

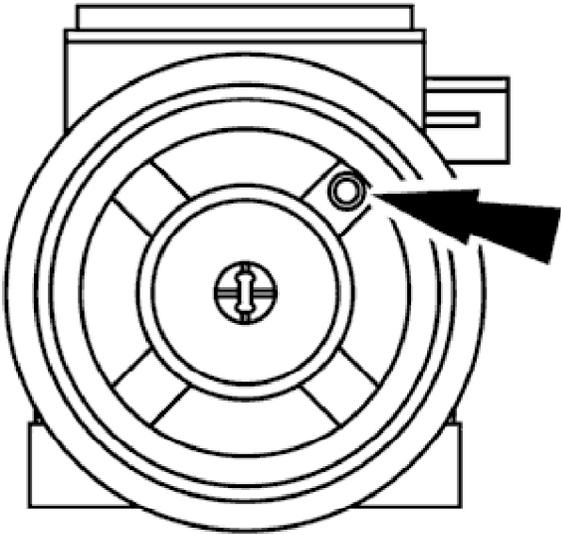


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The air cleaner assembly consists of a two piece box containing the air filter, an airflow/temperature unit and the air intake duct which connects to the top of the throttle assembly. The engine full load breather feeds into the intake duct from the bank 1 camshaft cover. A tuned stub on the air intake duct reduces the intake noise level.

Mass Air Flow and Temperature Sensors

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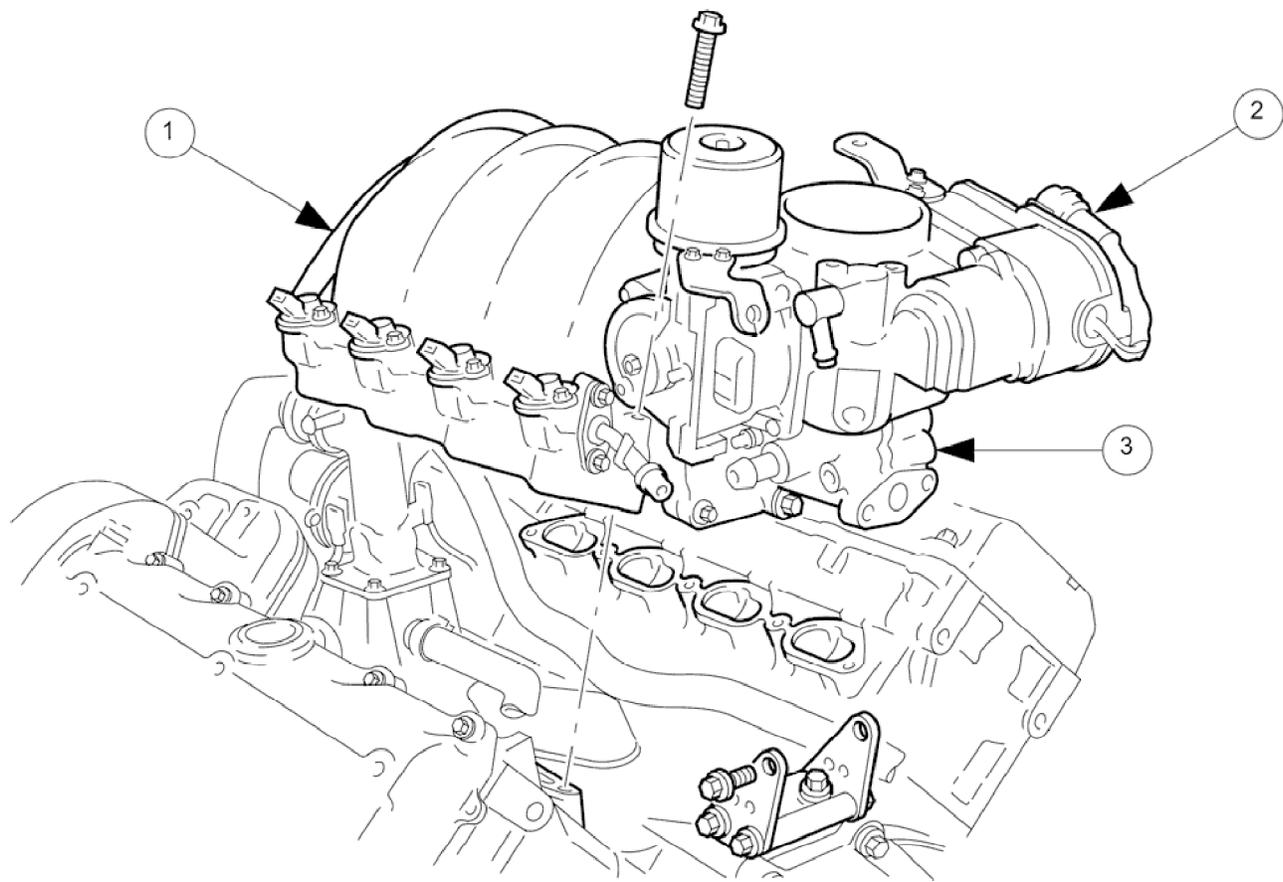


E34025

The intake air is monitored by the Mass Air Flow (MAF) sensor assembly which is fitted at the outlet of the air filter assembly. Two sensors are incorporated in the MAF sensor assembly, measuring air flow and temperature (temperature sensor arrowed); both sensors provide analogue signal inputs to the engine control module (ECM) and are further described in Section <<303-14>>.

Throttle and Manifold Assemblies

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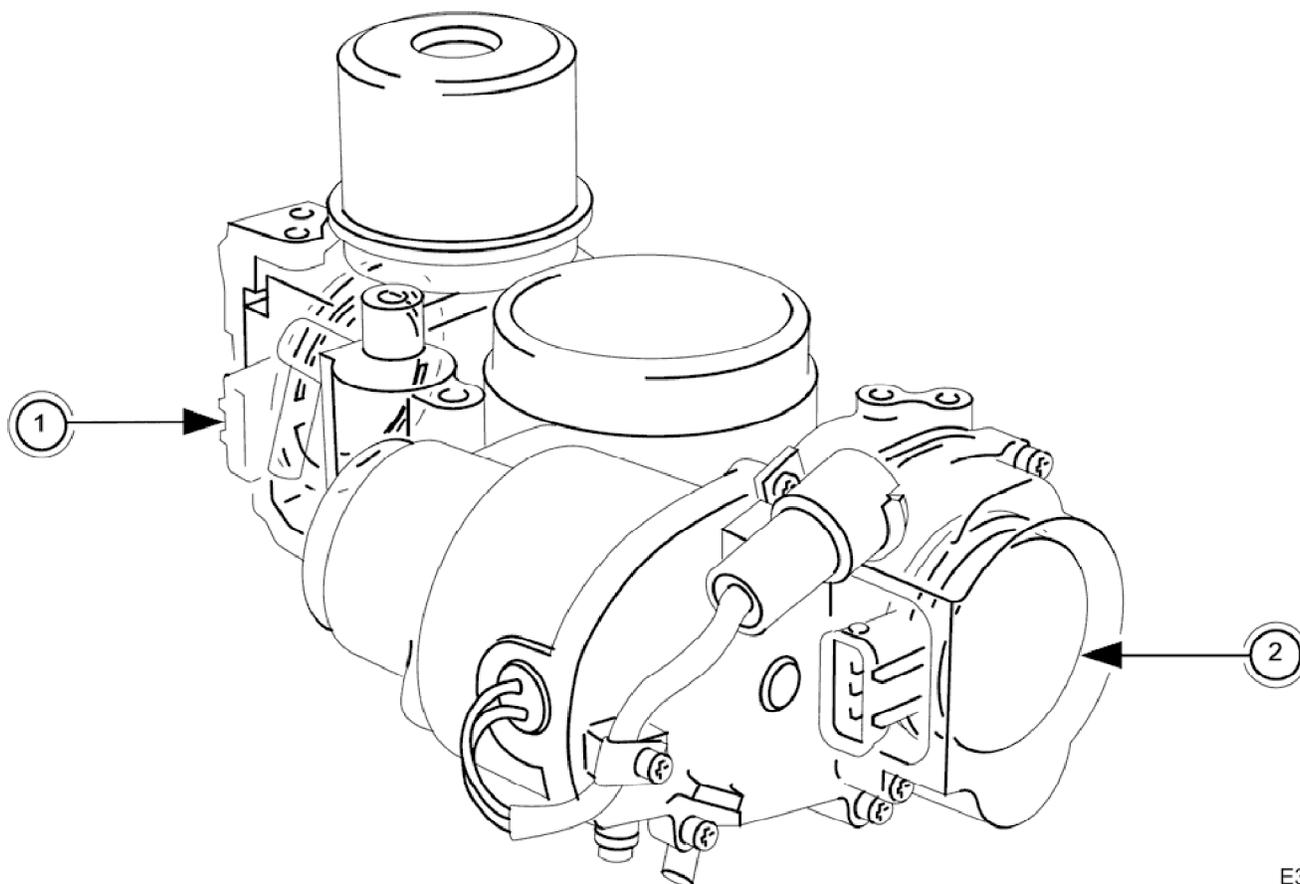


E32725

Parts List

Item	Description
1	Intake Manifold
2	Electronic Throttle
3	Intake Elbow

Throttle Body



E32673

Parts List

Item	Description
1	Accelerator pedal and mechanical guard position sensors
2	Throttle (blade) position sensor



CAUTION:

Do not attempt to renew or adjust the throttle cable without consulting the relevant procedure. Two procedures apply: reconnection of an original cable (<<19.70.04>>) or the fitting of a new cable (<<19.20.06>>).

The filtered air from the intake duct is drawn downwards through the throttle body to the intake elbow on which the throttle body is mounted. The airflow through the throttle body is varied by the electrically operated throttle valve according to driver demand and engine management system requirements.

The throttle body assembly has the following features:

- Conventional cable operated input shaft connected to the accelerator pedal.
- Mechanical guard to limit throttle angle should driver demand exceed ECM controlled parameters and a mechanical back-up in the event of a throttle motor failure.
- Vacuum actuator for operation of the mechanical guard in cruise control mode.
- Throttle valve (blade) to regulate air flow into the engine.
- Thermostatic air valve to allow and control air by-pass around the throttle.

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- DC electric motor to operate the throttle in response to ECM control.
- Three sensors (accelerator pedal, mechanical guard and the throttle valve) to relay positional information about the input shaft to the ECM.
- Return and control springs fitted to the input shaft, mechanical guard, throttle valve and dc motor drive gear.

Throttle Control Modes

There are seven throttle control modes:

1. Normal
2. Cruise
3. Mechanical guard
4. Fixed idle
5. Redundancy
6. Full authority
7. Engine shut-down

Normal mode occurs when the ECM uses the mechanical and monitoring arrangement of the throttle valve to control throttle opening. The ECM does not permit driver demand to be exceeded but it can be restricted to allow for such features as stability / traction control, or engine power limitation.

The ECM determines engine idle speed by controlling the throttle valve motor to vary the blade angle between the non-adjustable preset limits of the mechanical guard and the throttle valve motor.

Cruise mode is engaged as a result of the ECM calculating and controlling the required throttle valve opening via the vacuum system. When the driver releases the throttle pedal, the input shaft disengages from the mechanical guard or the vacuum actuator pulls the guard away from the throttle valve. The throttle pedal will feel light should it be pushed again to accelerate (pressing the pedal further will re-engage the input shaft with the mechanical guard and restore normal feel).

The ECM utilizes sensors to monitor the relative positions of the mechanical guard and throttle valve and adjusts them to maintain the set cruise speed.

Mechanical guard mode permits full mechanical operation of the throttle if the ECM detects that a problem has been encountered with the throttle valve position sensor, dc motor, associated harnesses / connectors or the ECM.

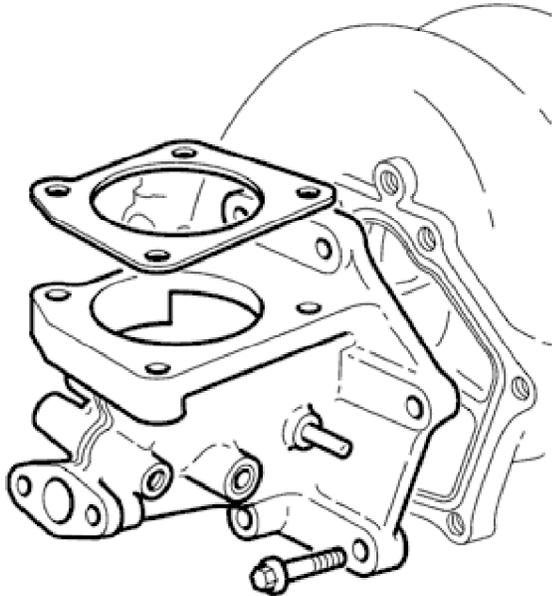
Fixed idle mode occurs when any two of the three sensors (two input shaft sensors and the mechanical guard sensor) fail. The ECM will assume values which represent a blade angle of approximately 2,5° and 1200 rpm (unloaded) maximum engine speed.

Redundancy mode occurs when any one of the three sensors (two input shaft sensors and the mechanical guard sensor) fails. The operational pair will be deemed to be safe to continue without intervention, but cruise will be inhibited.

Full authority mode is invoked when a mechanical guard failure occurs which indicates that the guard is stuck fully open. The red warning lamp will be lit and road speed will be limited to 120 kph.

Engine shut-down mode will occur following multiple failures, such as mechanical guard mode following full authority mode (or vice versa) or the throttle blade sticks.

Intake Elbow



E32722

The intake elbow directs the metered airflow from the electronic throttle to the intake manifold. Stub pipes on both sides of the intake elbow provide connections for vacuum actuators and are also used to redirect emissions into the engine.

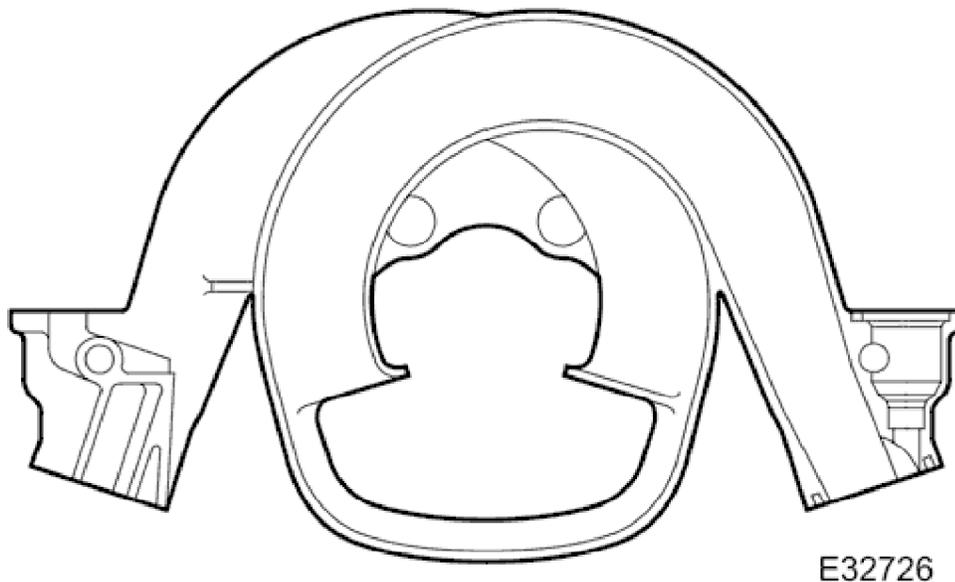
On the right-hand side of the elbow a large diameter pipe connects to the brake servo. The smaller pipe provides a vacuum feed to the fuel rail pressure regulator and throttle cruise control system. On the left-hand side of the elbow the front pipe supplies vacuum control for the evaporative emissions system valves.

Emissions from the engine part load breather (bank 2) and purged fuel vapor from the EVAP valve are drawn via a common T piece into the left-hand side of the intake elbow. Re-circulated exhaust gas enters the intake elbow via the EGR valve which is mounted directly on the rear of the elbow : where the EGR system is not used, a blanking plate is fitted.

The fuel system, throttle and emission control systems are described more fully in the relevant sections.

Intake Manifold

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Filtered air from the vehicle's intake ducting is metered by the electronic throttle and distributed to the two cylinder banks via an integral intake manifold.

The intake manifold is manufactured in plastic with integral plastic fuel rails and metal-thread inserts; the very smooth internal surfaces give excellent air flow.

Individual ducts lead off a central chamber to the inlet valves of each cylinder.

Silicon-rubber gaskets, located in channels in the intake manifold, seal the joints between the ducts and the cylinder heads.

Engine Ventilation

The engine is ventilated through two breathers; a part-load breather and a full-load breather, one on each camshaft cover. The outlet hose for the part-load breather is connected between the bank 2 camshaft cover and the intake elbow. The full-load outlet hose is connected from the bank 1 camshaft cover to the intake duct between the MAF sensor assembly and the throttle body.

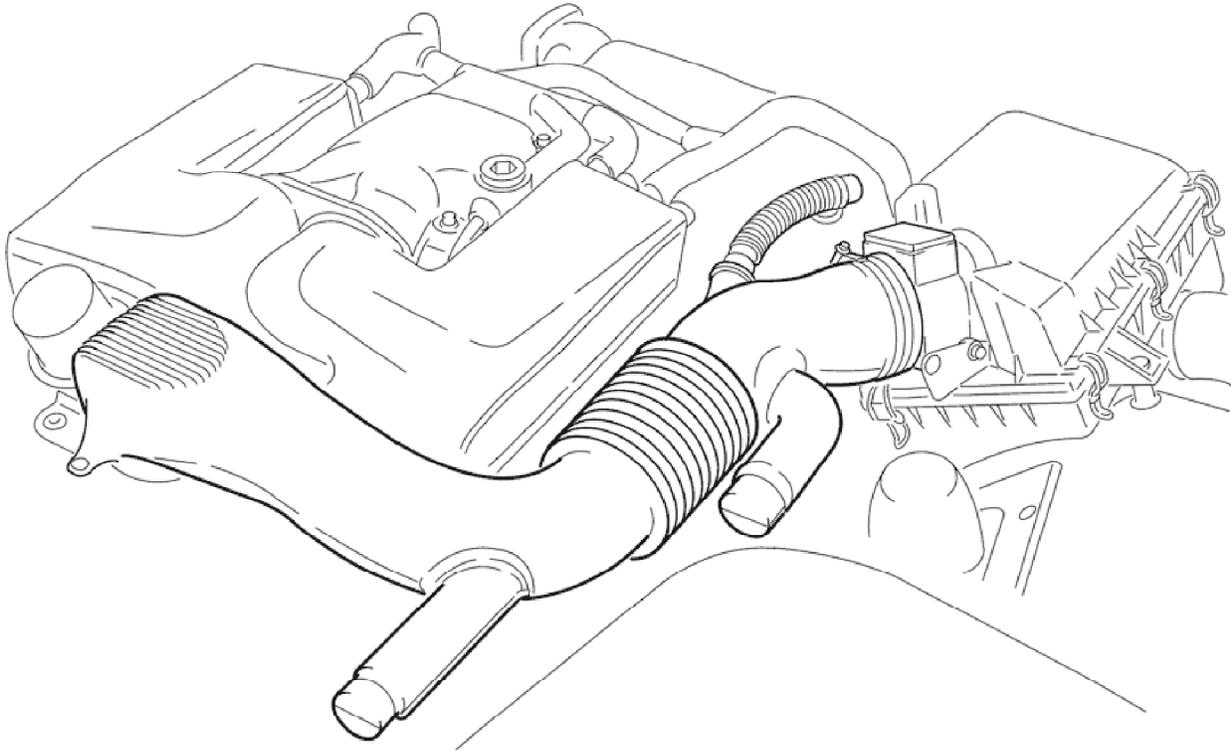
Constructed in plastic, the hoses incorporate O-ring seals and quick-release connectors; refer to Section <<303-01>>.

Intake Air Distribution and Filtering - Supercharged Vehicles

Air is supplied to the supercharger via an intake cleaner/duct, throttle assembly and intake elbow which are similar to those used for normally aspirated engines. The supercharger delivers pressurized air to two separate charge air cooler units, each unit being mounted on the cylinder bank which it supplies. Pressurized cooled air is fed from the charge air coolers directly into each inlet port.

Air Intake Assembly

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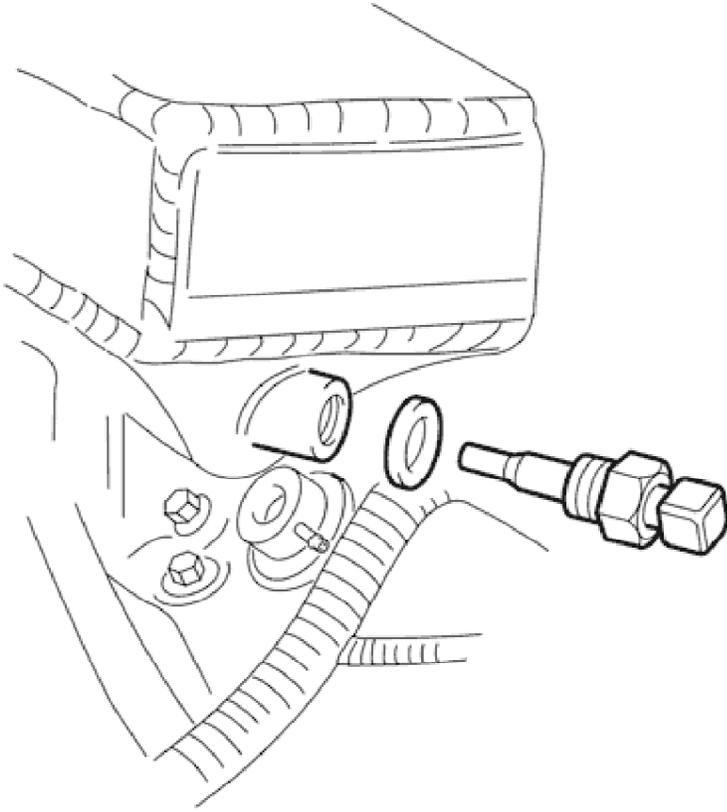


E32932

The air cleaner assembly consists of a two piece box containing the air filter, an airflow/temperature unit (MAF sensor) and the air intake duct which connects to the top of the throttle assembly. The engine full load breather feeds into the intake duct from the bank 1 camshaft cover. Two tuned stubs on the air intake duct reduce the intake noise level.

Temperature Sensor

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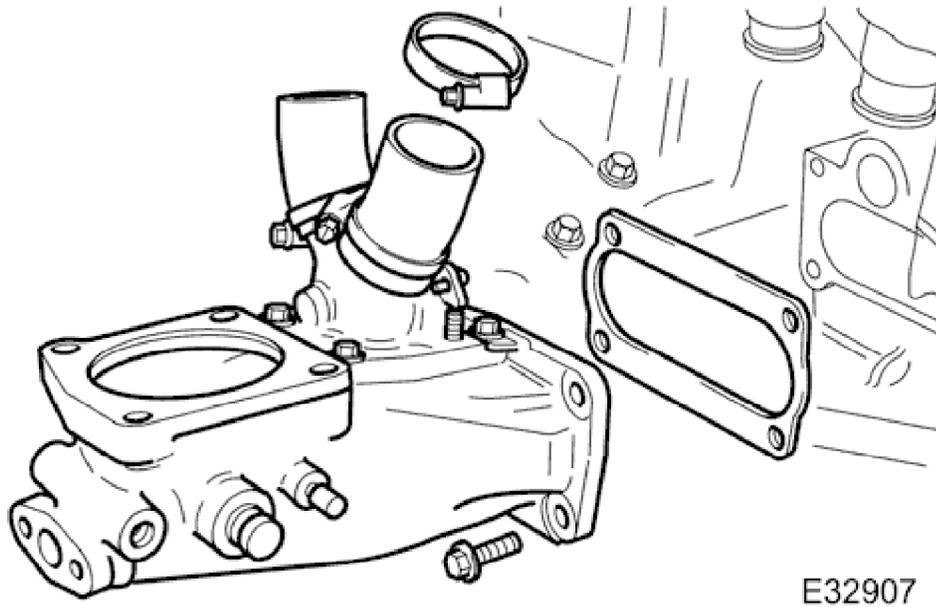


E32908

A second intake air temperature sensor (IAT sensor 2) is fitted at the outlet of the bank 1 charge air cooler. The sensor provides an input to the ECM.

Intake Elbow and Bypass

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The intake elbow directs the metered airflow from the electronic throttle outlet (underside of the throttle body) into the intake of the supercharger.

The supercharger by-pass valve assembly is bolted to the intake elbow. The butterfly valve inside the assembly is opened by a diaphragm actuator operated by vacuum feed from the elbow. At closed or partially open throttle positions, the butterfly valve opens, allowing the airflow from the two charge air cooler inlets to be directed back to the supercharger inlet. This action inhibits the supercharging effect and reduces engine torque to non supercharged levels. Progressive opening of the throttle causes the by-pass valve to gradually close.

On the right-hand side of the elbow a large diameter pipe connects to the brake servo. On the left-hand side the smaller pipe supplies vacuum control for the evaporative emissions system valves.

Emissions from the engine part load breather (bank 1) and purged fuel vapor from the EVAP valve are drawn via a common T piece into the left-hand side of the intake elbow. Re-circulated exhaust gas enters the intake elbow via the EGR valve which is mounted directly on the rear of the elbow. Where the EGR system is not used, a blanking plate is fitted.

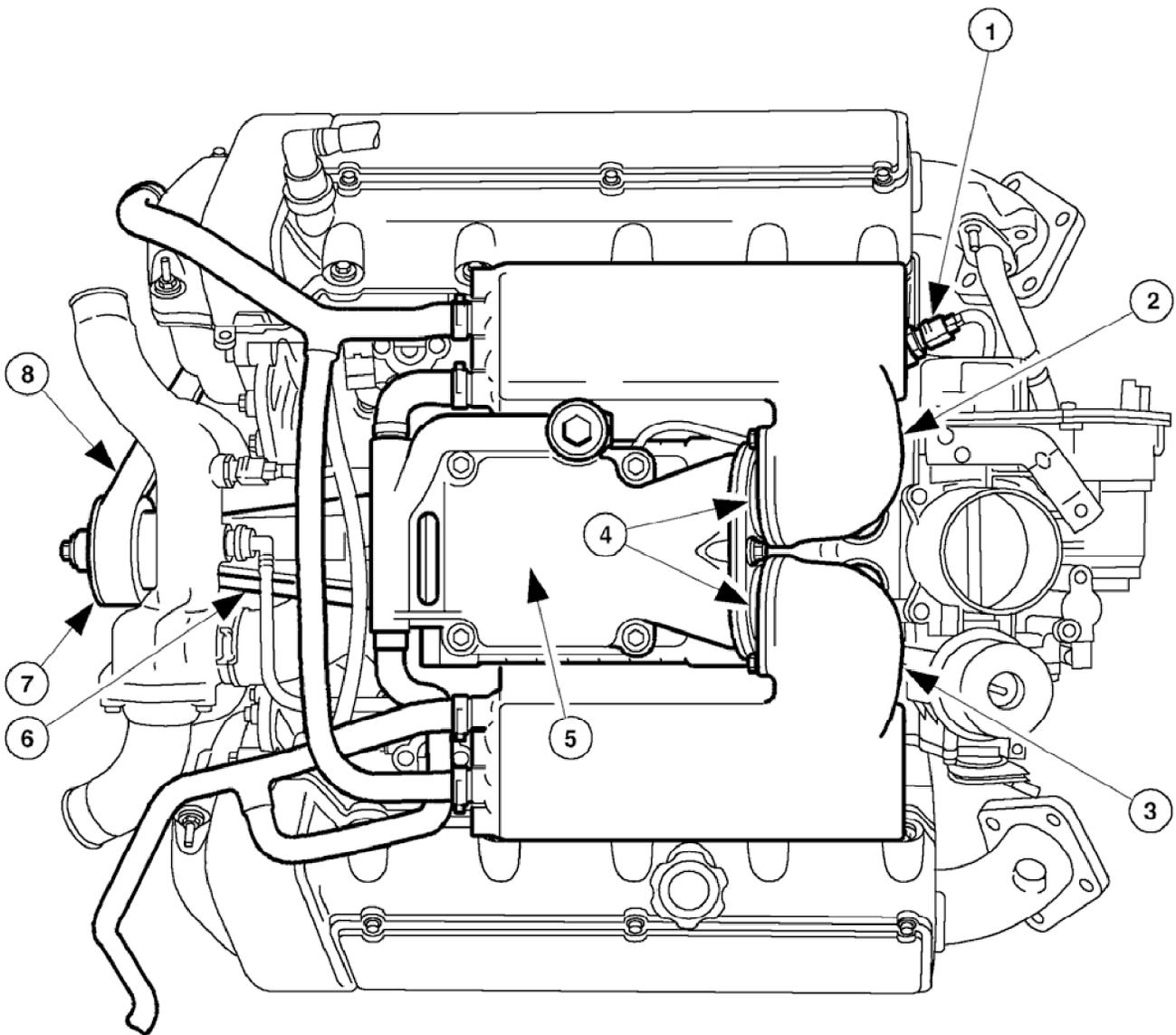
The fuel system and emission control systems are described more fully in the relevant sections.

Fuel Pressure Regulation and Cruise Control Vacuum Feed

The inlet vacuum feed for the fuel rail pressure regulator and the cruise control system is taken from the supercharger outlet duct. The feed pipe is located below the large charge air cooler coolant filler plug.

Supercharger and associated components

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Parts List

Item	Description
1	Intake Air Temperature Sensor 2
2	Charge Air Cooler - Bank 1
3	Charge Air Cooler - Bank 2
4	Charge Air Cooler - Inlet Duct
5	Supercharger Outlet Duct
6	Supercharger
7	Supercharger Pulley
8	Supercharger Drive Belt

Supercharger

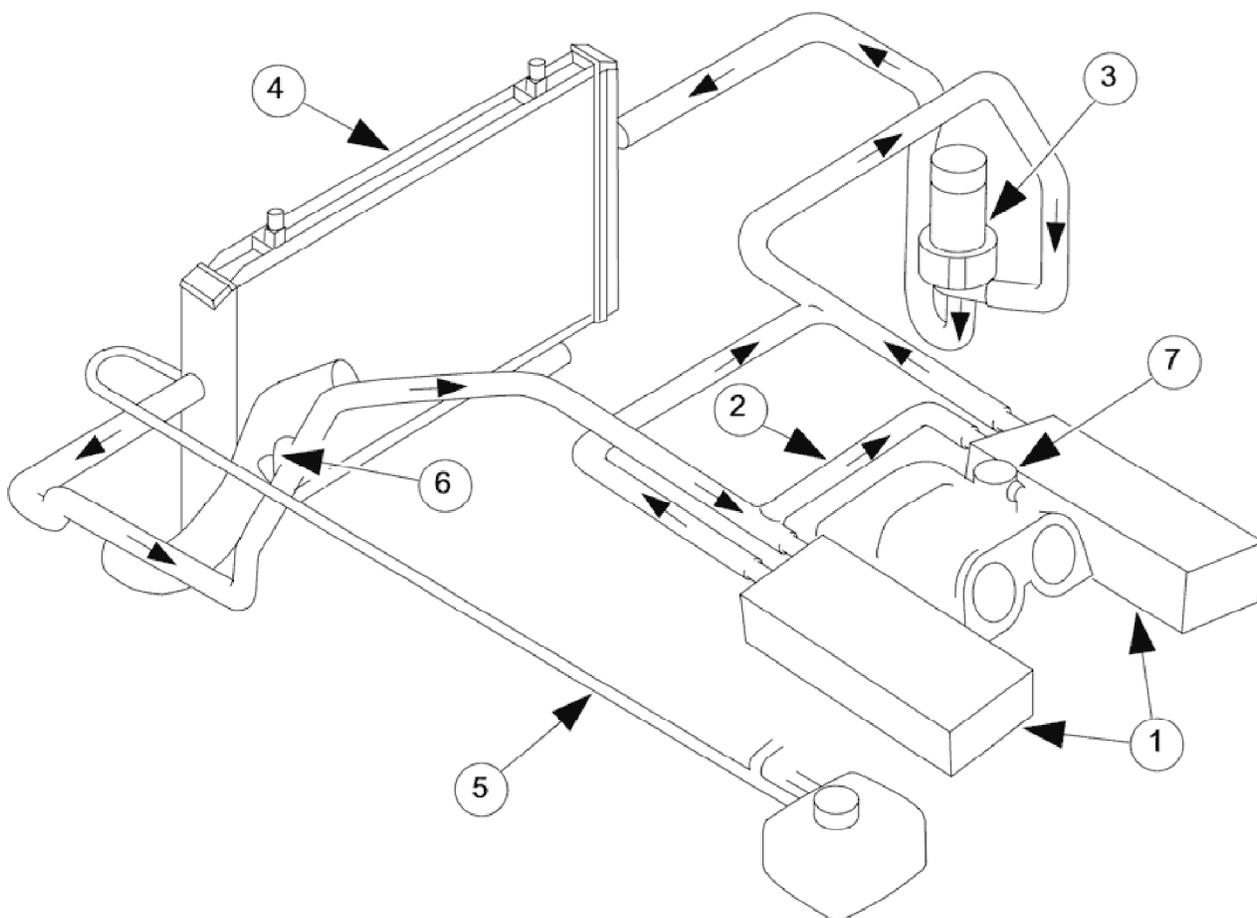
The supercharger:

- is attached to the three mounting bosses between the V of the cylinder block
- has a filled for life internal lubrication system
- is positively aligned with the drive belt by a doweled mounting bracket

Charge Air Cooler System

Each cylinder bank is fitted with a charge air cooler unit which supplies pressurized air to the four cylinders via an adaptor block. The inlet ports to the two charge air coolers are connected to the supercharger outlet by an inlet assembly consisting of rubber ducts and clamp plates. An outlet stub at the rear of each charge air cooler unit provides the connection for the by-pass valve airflow. The charge air coolers are water cooled via a radiator and coolant pump.

Charge Air Cooler Coolant System



E33194

Parts List

Item Description

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1	Charge air coolers
2	Coolant hoses
3	Coolant pump
4	Radiator
5	Bleed pipe to main coolant circuit expansion tank
6	Charge air cooler to engine coolant circuit connection
7	Coolant top up plug

Each charge air cooler unit is a fin and tube air to liquid heat exchanger. The coolant circuit for the charge air coolers consists of a pump, radiator, connecting hoses and a bleed pipe.