DESCRIPTION AND OPERATION

Noise, Vibration and Harshness (NVH)

Noise, vibration and harshness (NVH) is becoming more important as vehicles become more sophisticated and passenger comfort levels increase. This section is designed to aid in the diagnosis and testing and repair of NVH concerns.

- Noise is defined as sounds not associated with the operation of passenger compartment equipment that interface with customer satisfaction.
- Vibration is defined as impulses felt by the customer that are not caused by road surface changes.
- Harshness is a ride quality issue where the customer feels that the vehicle response to the road surface is sharply transmitted to the customer.

Diagnostic Theory

Diagnosis is more than just following a series of interrelated steps in order to find the solution to the specific condition. It is a way of looking at systems that are not functioning the way they should and finding out why. Also it is knowing how the system should work and whether it is working correctly.

There are basic rules for diagnosis. If these rules are followed, the cause of the condition is usually found the first time through the system.

Know the System

- Know how the parts go together.
- Know how the system operates as well as its limits and what happens when the system goes wrong.
- Sometimes this means checking the system against one that is known to be working correctly.

Know the History of the System

A clue in any one of these areas may save time:

- How old or new is the system?
- What kind of treatment has it had?
- Has it been serviced in the past in such a manner that might relate to the present condition?
- What is the service history?

Know the History of the Condition

- Did it start suddenly or appear gradually?
- Was it related to some other occurrence such as a collision or previous part replacement?
- Know how the condition made itself known; it may be an important clue to the cause.

Know the Probability of Certain Conditions Developing

- Look for the simple rather than the complex.
- For example:
  - Electrical conditions usually occur at connections rather than components.
  - An engine no-start is more likely to be caused by a loose wire or small adjustment rather than a sheared-off camshaft.
- Know the difference between impossible and improbable. Certain failures in a system can be improbable but still happen.
- New parts are just that, new. It does not mean they are always good functioning parts.

Do Not Cure the Symptom and Leave the Cause

Lowering the pressure in a front tire may correct the condition of a vehicle leaning to one side, but it does not correct the original condition.

Be Positive the Cause is Found

- Double check findings.
- What caused a worn component?
- A loose transmission or engine mount could indicate that other mounts are also loose.

Diagnostic Charts

Charts are a simple way of expressing the relationship between basic logic and a physical system of components. They help discover the cause of a condition in the least time. Diagnostic charts combine many areas of diagnosis into one visual display:

DIAGNOSIS AND TESTING

Power assisted steering operating condition					
Parking		Driving		Vehicle stationary with engine off	
REFER to steering system NVH concerns column A	REFER to steering system NVH concerns column B	REFER to steering system NVH concerns column C	REFER to steering system NVH concerns column D	REFER to steering system NVH concerns column E	REFER to steering system NVH concerns column F

Steering system NVH concerns

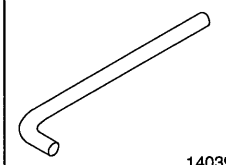
Steering System operation condition (column A to F)							
Noise	**Driving condition**	**A**	**B**	**C**	**D**	**E**	**F**
Moan	Parking between lock stops, at engine idle and also increased engine speed	X	O				
Whine	Driving, high engine rpm. Must be present from new	O	O	X	X		
Hiss	a) Parking between lock stops. Must be present from new	X	X	O	O		
	b) Holding steering wheel against lock stops. Must be present from new		X				
Lock stop impact knock	a) Parking at lock stop. Must be present from new		X				X
Mechanical knock (power assisted steering (PAS) off)	b) Parking between lock stops, engine OFF. Must be present from new					X	
Mechanical Knock (PAS on)	c) Parking between lock stops, engine ON (ball joint knock)	X					
Hammer knock	d) Parking into lock stop and release (vehicle with hydraulic power assisted steering (HPAS) only, not for vehicles with electro-hydraulic power assisted steering (EHPAS))		X				
Hydraulic knock (clonk)	e) Driving, cobble stones, rough road (clonk). Must be present from new			O	X		
Column knock	f) Parking, driving. cobble stones and rough roads	X	X	O	X	X	X
Column rattle	Mainly driving on rough roads	O		X	X	O	
Toc-toc	Steering left and right at high frequency. Must be present from new	X					
Grinding	When turning steering wheel	X			O	X	
Zip	At engine start, low temperatures below -10°C only	X	O				

- X = Noise will most likely occur in this operating condition.
- O = Noise can possibly occur in this operating condition.
- Blank = Noise is unlikely to occur in this operating condition.

REMOVAL AND INSTALLATION

Front Strut and Spring Assembly(14 781 0)

Special Tool(s)

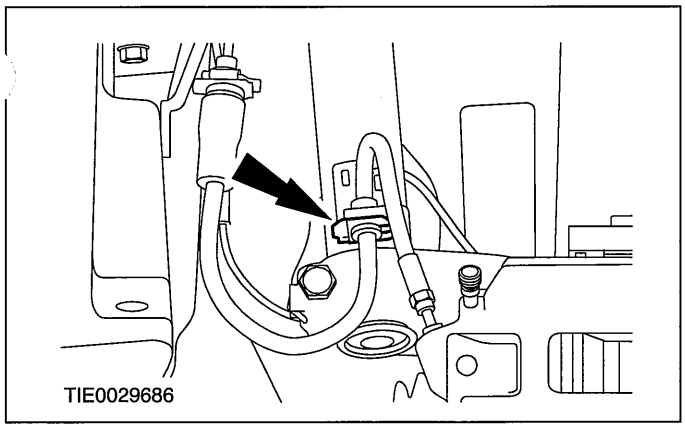
 14039	Lever, Wheel Knuckle 204-159 (14-039)

Removal

1. **Remove the wheel and tire. For additional information, refer to Section 204-04 [Wheels and Tires].**
2. **NOTE:Make a note of the position of the brake hose, to aid installation.**

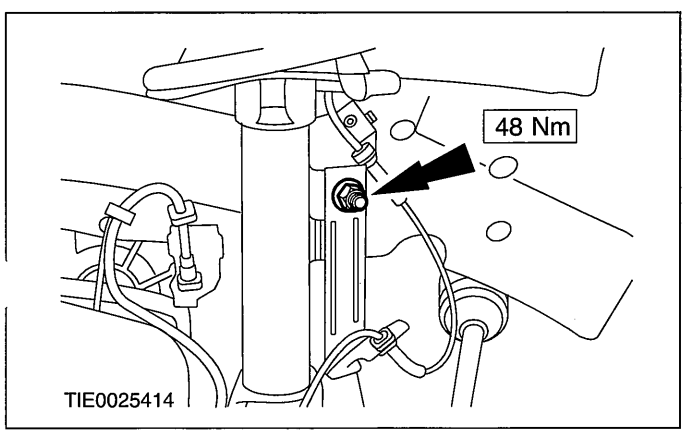
   Detach the brake hose from the brake hose support bracket.

   - Remove the retaining clip.



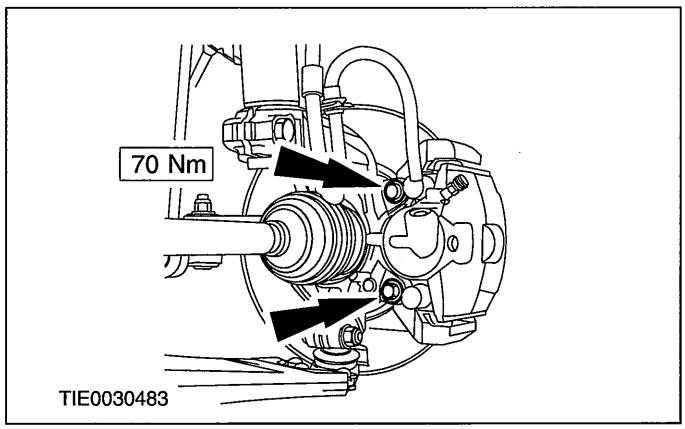
3. **NOTE:Use a 5 mm Allen key to prevent the ball joint from rotating.**

   Detach the stabilizer bar connecting link from the strut and spring assembly.



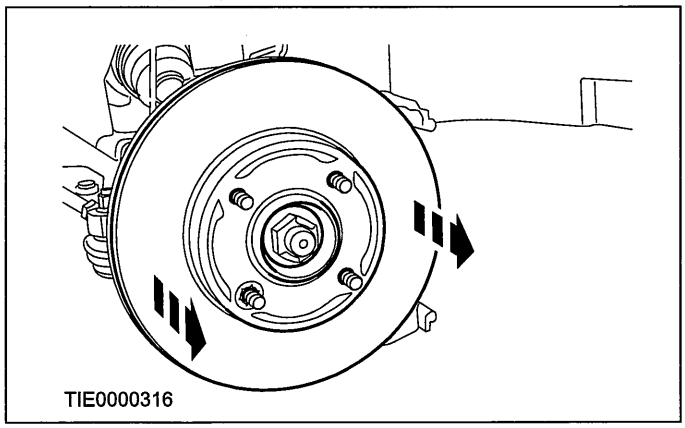
4. **⚠CAUTION:Suspend the brake caliper and anchor plate to prevent load being placed on the brake hose.**

   Detach the brake caliper and anchor plate from the wheel knuckle.



5. **Remove the brake disc.**

   - Remove and discard the retaining washer (if equipped).



6. **⚠CAUTION:Protect the ball joint seal using a soft cloth to prevent damage.**

   Detach the lower arm ball joint from the wheel knuckle.

SPECIFICATIONS

Lubricants, Fluids, Sealers and Adhesives

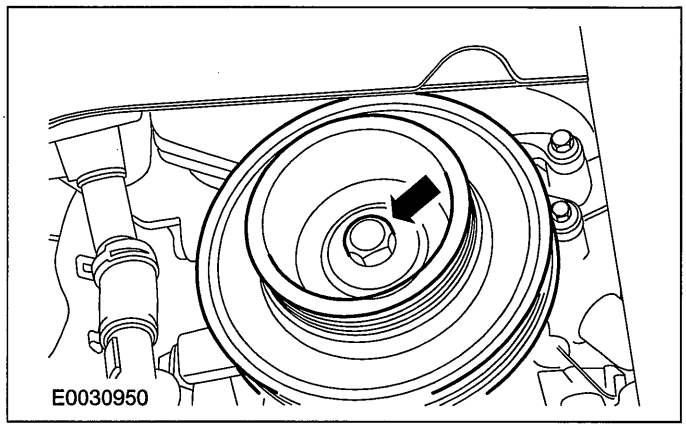
	Specifications
Super DOT 4 brake fluid	ESD-M6C57-A

Torque Specifications

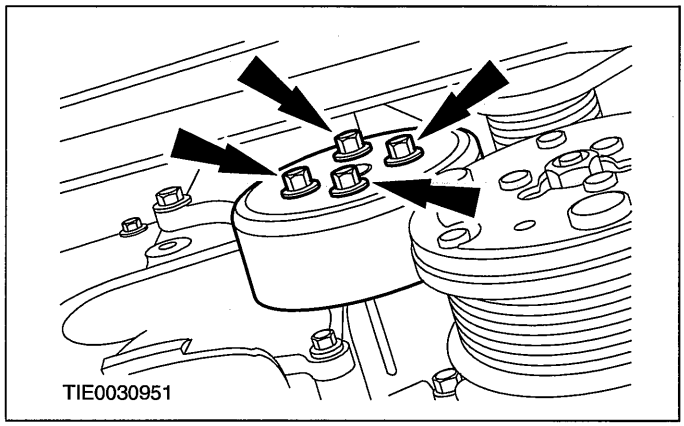
Description	Nm	lb-ft	lb-in
Hydraulic control unit (HCU) to support bracket retaining bolts	9	-	80
HCU support bracket retaining bolts	20	15	-
Brake tube to HCU unions	18	13	-
Wheel speed sensor retaining bolts	9	-	80
Stability assist module to HCU retaining bolts	5	-	44
Yaw rate sensor and accelerometer assembly retaining bolts	5	-	44
Yaw rate sensor and accelerometer assembly cover retaining bolts	4	-	35

IN-VEHICLE REPAIR

4. Remove the crankshaft pulley.



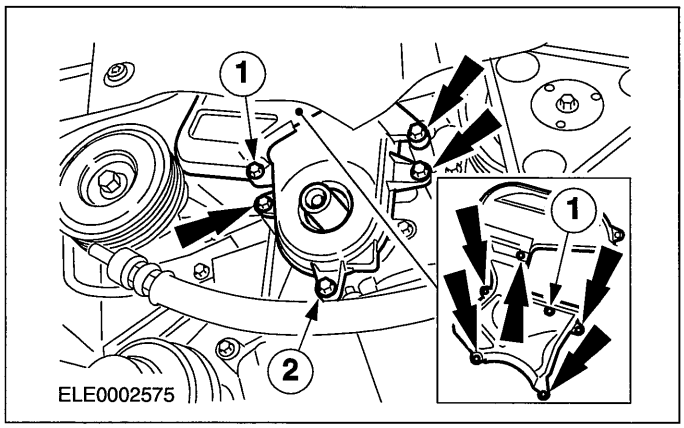
5. Remove the coolant pump pulley.



6. Remove the timing belt cover retaining bolts.

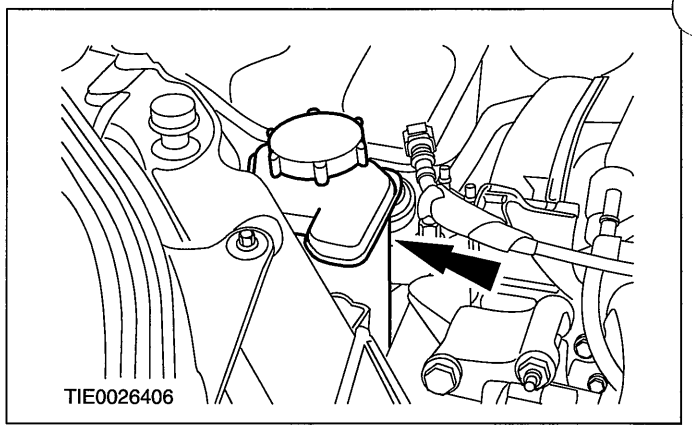
1. Remove the timing belt upper cover retaining bolts.
2. Remove the timing belt lower cover retaining bolts.

- Remove the lower cover.

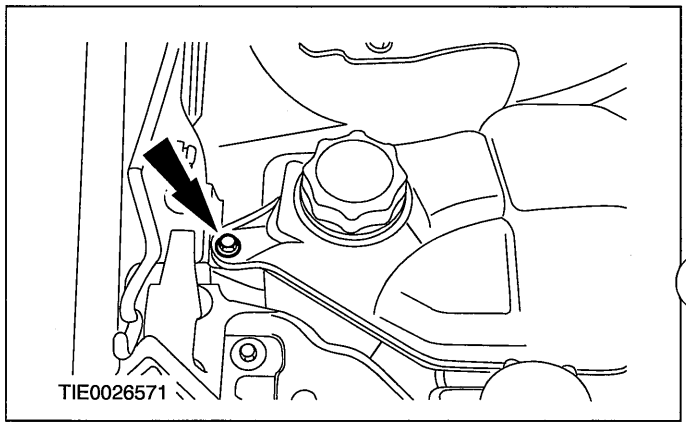


7. Lower the vehicle.

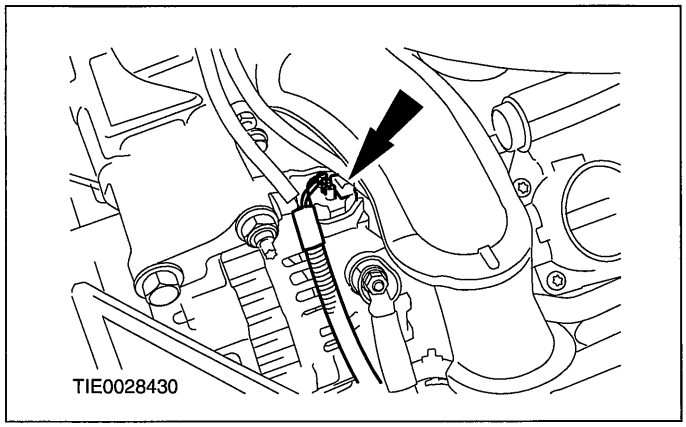
8. Detach the power steering fluid reservoir from the bracket and position it to one side.



9. Detach the coolant expansion tank from the bracket and position it to one side.



10. Disconnect the generator electrical connector.



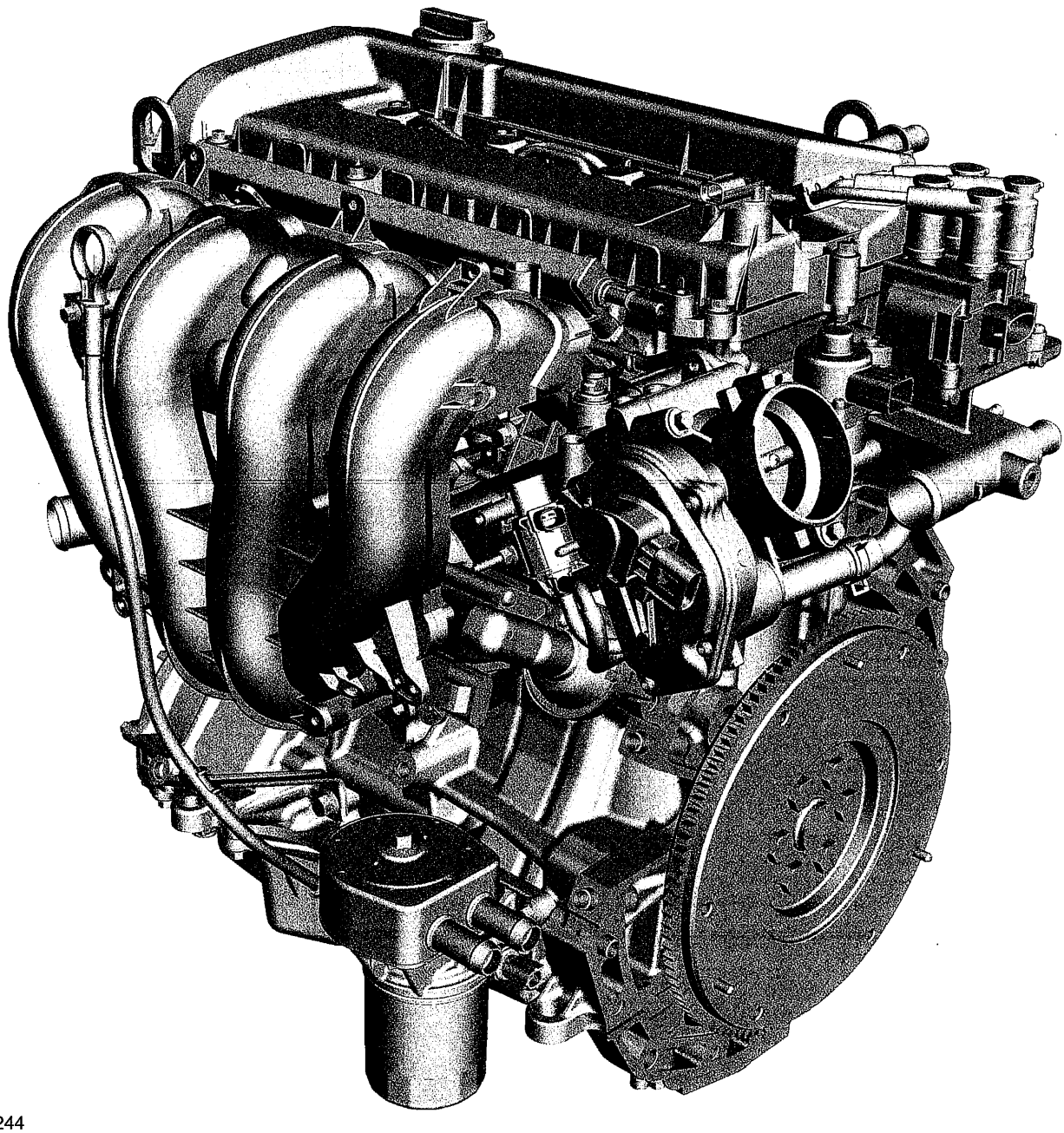
11. Detach the generator from the engine.

1. Loosen the bolt.
2. Remove the bolt.

DESCRIPTION AND OPERATION

Engine

Engine



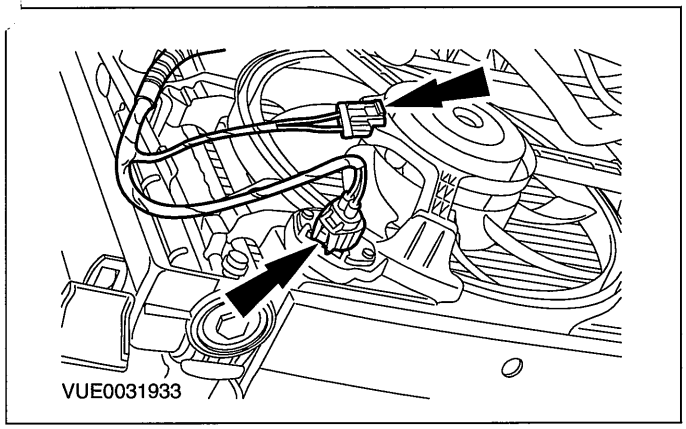
E58244

For the Fiesta ST the engine is available with the following specification:

2.0L Duratec-HE (MI4) engine	
Engine code	N4JA (Stage III), N4JB (Stage IV)
Displacement	1998 cm^3
Maximum power output	110 kW (150 PS) at 6000 rpm
Maximum torque	190 Nm at 4000 rpm

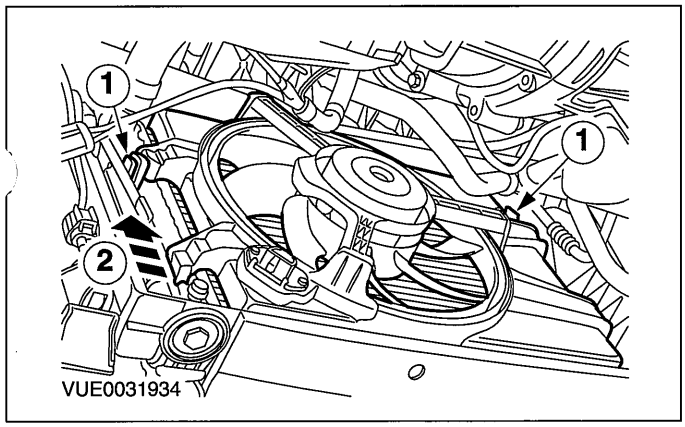
REMOVAL

8. Disconnect the cooling fan motor and cooling fan resistor electrical connectors.



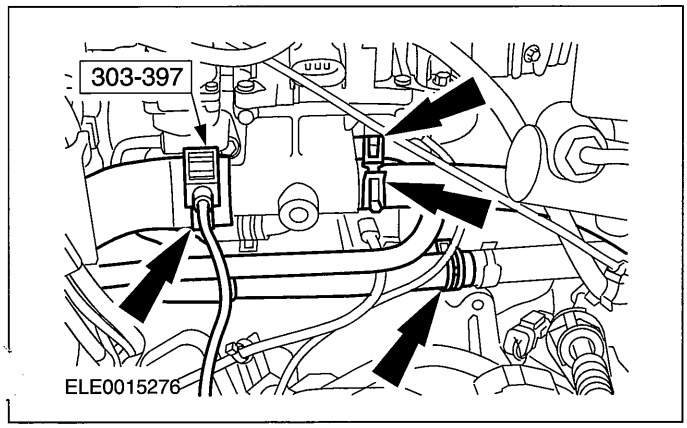
9. Remove the cooling fan motor and shroud.

1. Release the cooling fan motor and shroud from the retaining brackets.
2. Push the cooling fan motor and shroud upwards and then downwards to remove.



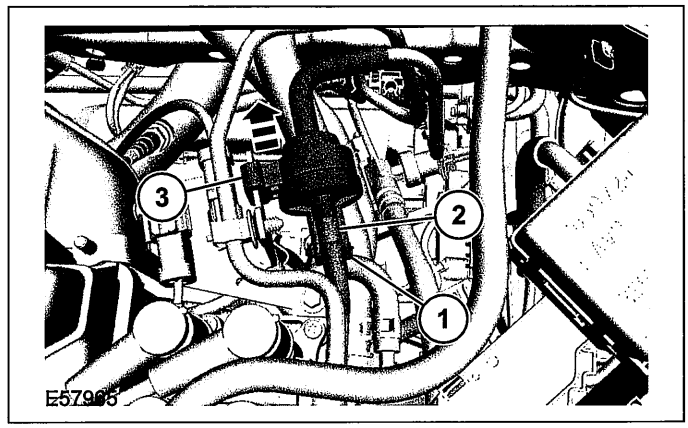
10. Lower the vehicle.

11. Using the special tool, disconnect the coolant hose from the coolant outlet connector.

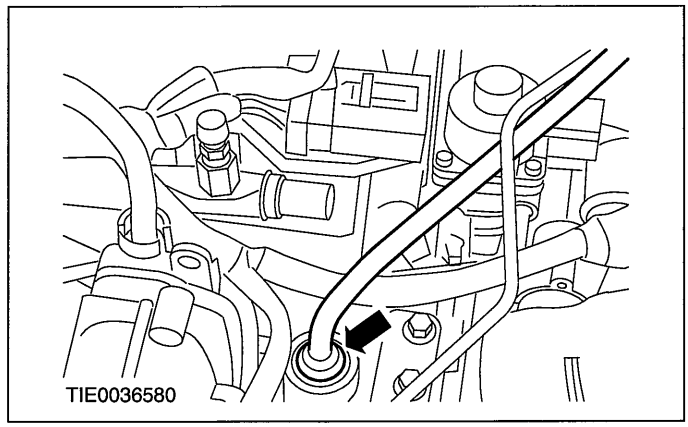


12. Detach the evaporative emission (EVAP) valve from EVAP valve support bracket.

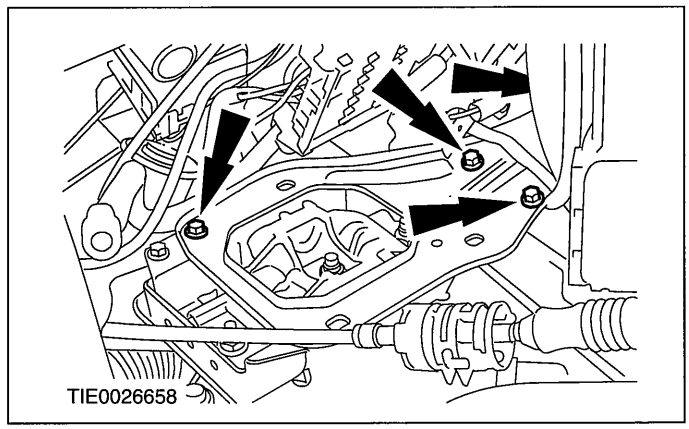
1. Disconnect the EVAP valve electrical connector.
2. Disconnect the low pressure line from the EVAP valve.
3. Push the EVAP valve from the support bracket.



13. Disconnect the brake booster vacuum line from the intake manifold.

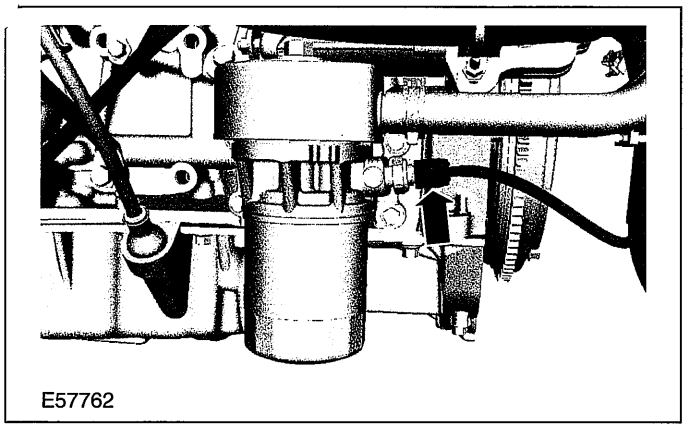


14. Remove the battery tray support bracket.

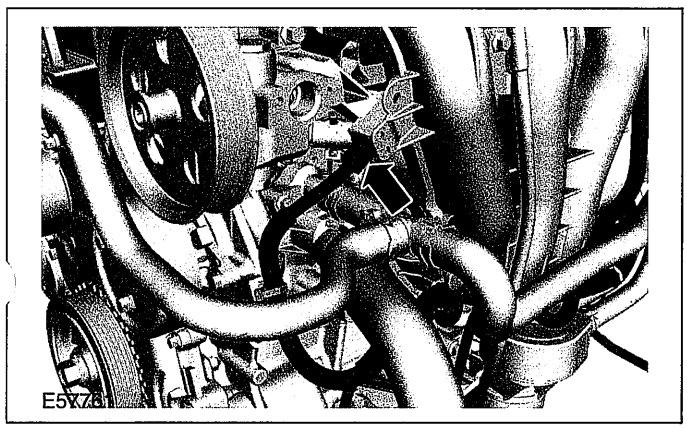


ASSEMBLY

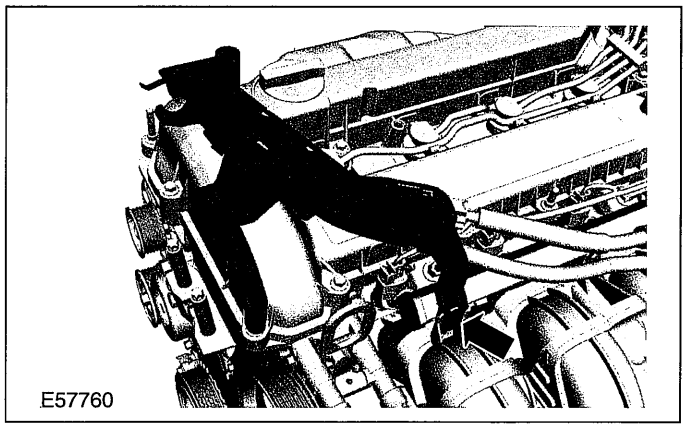
81. Connect the oil pressure switch electrical connector.



82. Connect the knock sensor (KS) electrical connector.



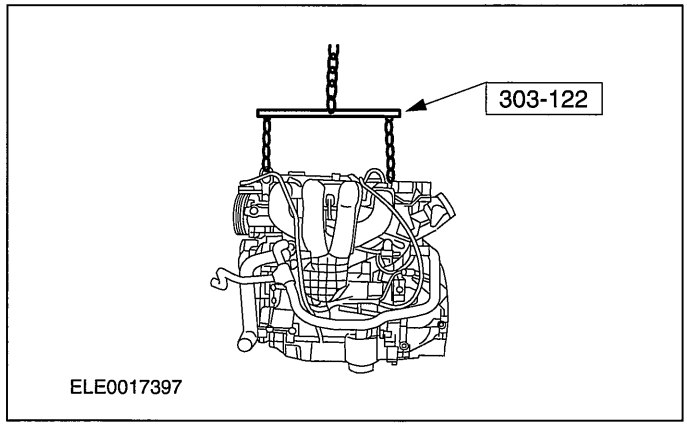
83. Attach the engine wiring harness bracket to the intake manifold.



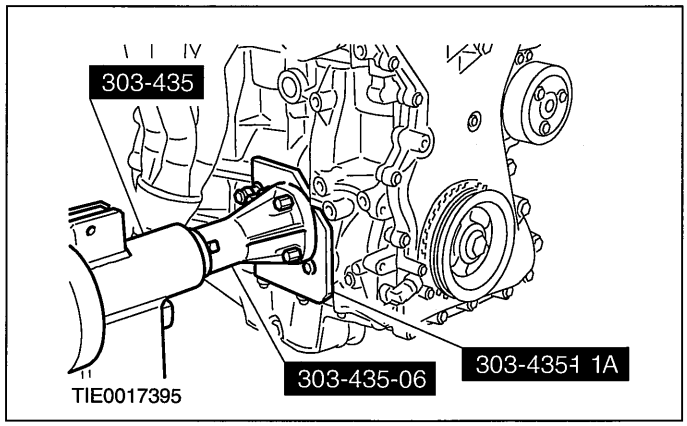
84. Fill the engine with engine oil.

For additional information, refer to: Specifications (303-01 Engine - 2.0L Duratec-HE (MI4), Specifications).

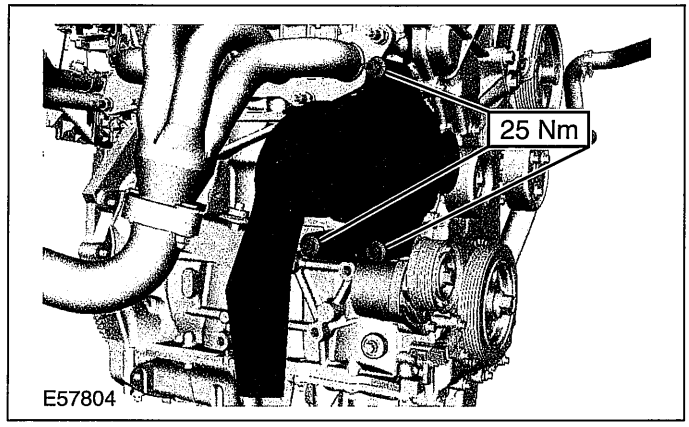
85. Using the special tool and an engine hoist, support the engine.



86. Remove the special tools.

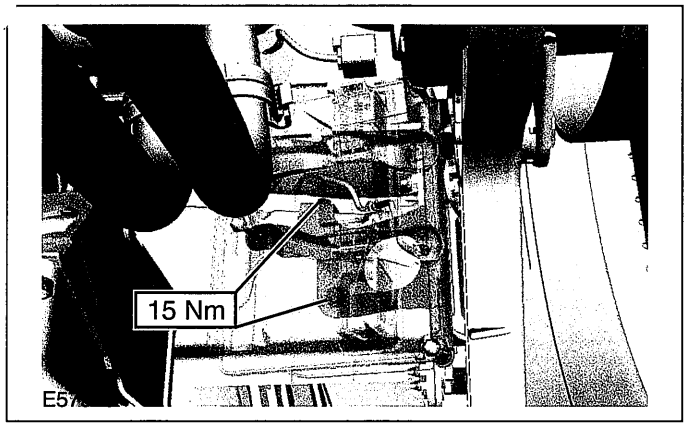


87. Install the generator.

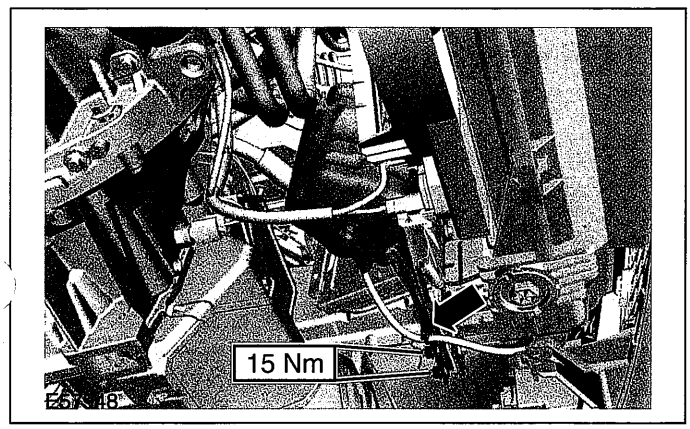


INSTALLATION

24. Attach the powertrain control module (PCM) support bracket to the side member.

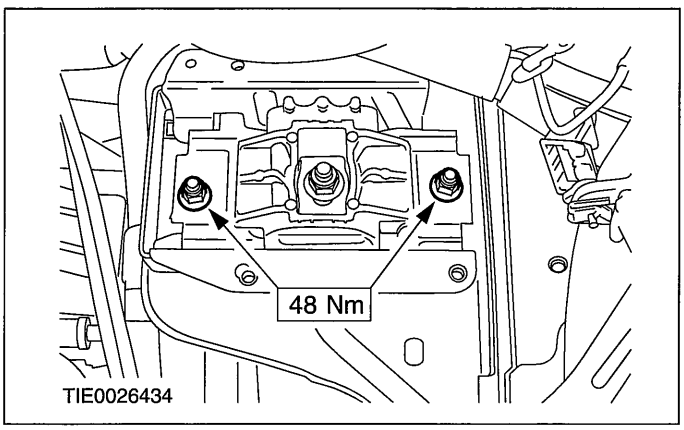


25. Install the air cleaner resonator support bracket.

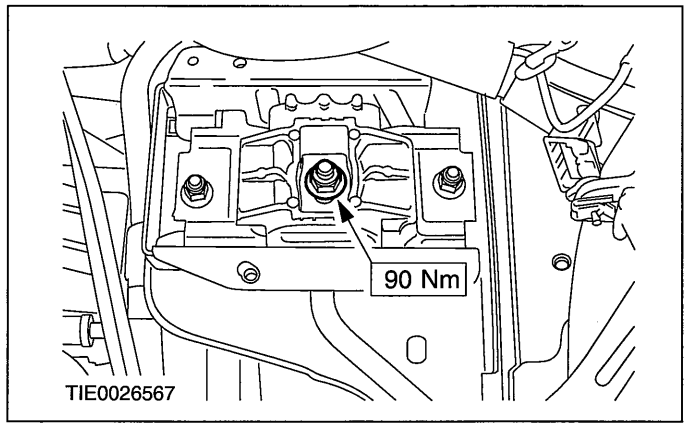


26. Lower the vehicle.

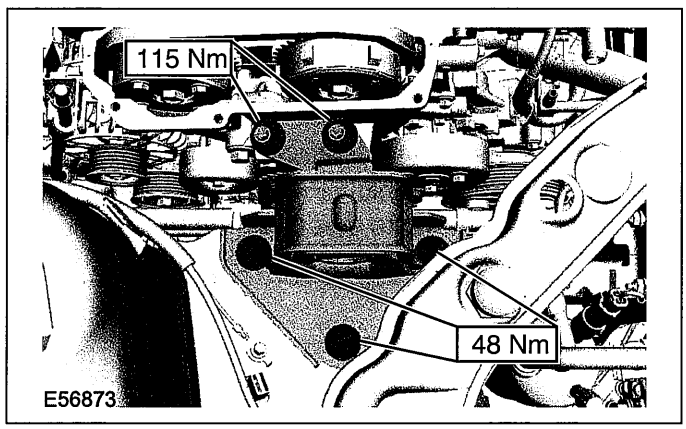
27. Tighten the engine rear mount outer retaining nuts.



28. Tighten the engine rear mount center retaining nut.

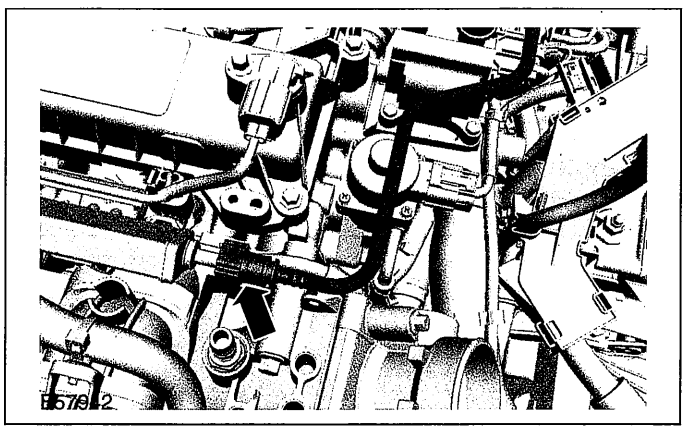


29. Tighten the engine front mount retaining nuts and retaining bolts.



30. Connect the fuel supply line.

    For additional information, refer to: Quick Release Coupling (310-00 Fuel System - General Information, General Procedures).

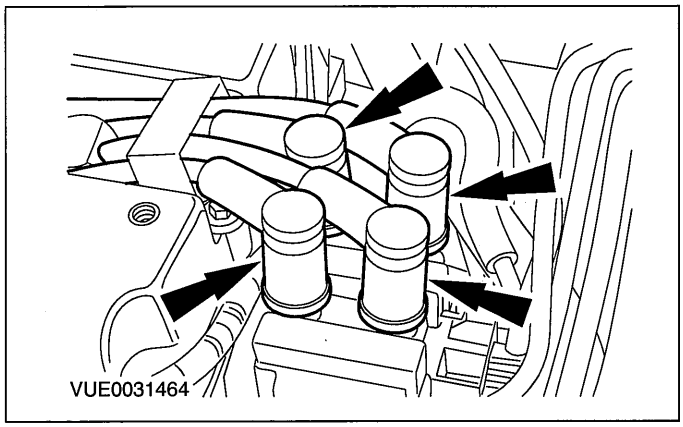


REMOVAL AND INSTALLATION

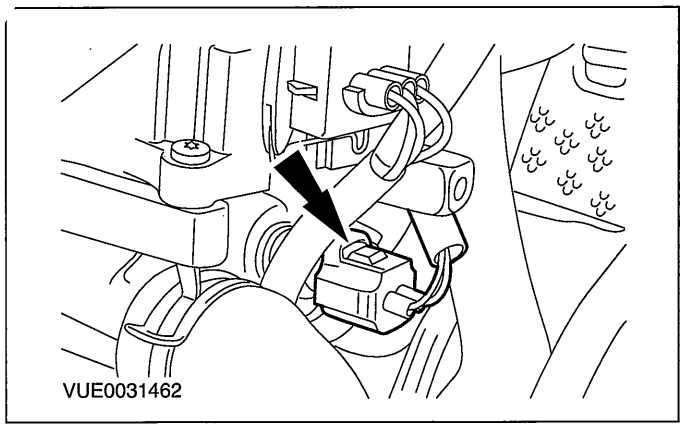
Fuel Charging Wiring Harness(36 437 0)

Removal

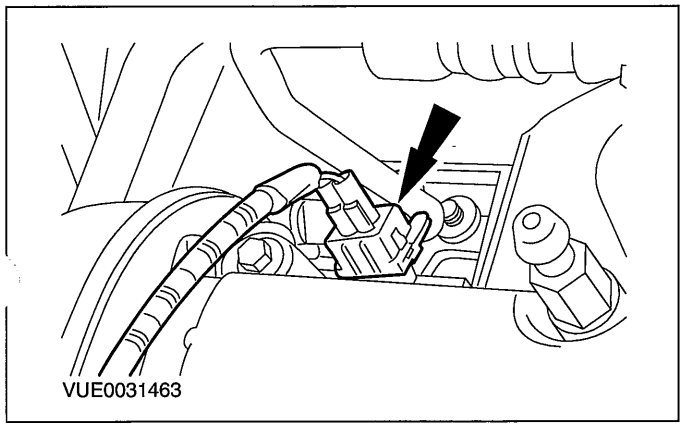
1. **Remove the air cleaner. For additional information, refer to Section 303-12 [Intake Air Distribution and Filtering].**
2. **Disconnect the spark plug wires from the ignition coil.**



3. **Disconnect the engine coolant temperature (ECT) sensor electrical connector.**

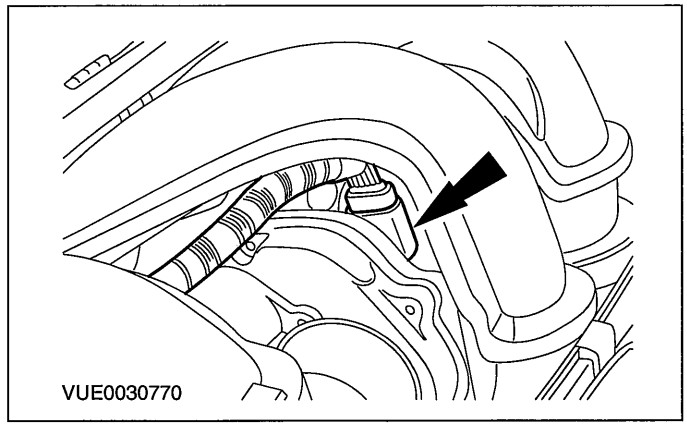


4. **Disconnect the camshaft position (CMP) sensor electrical connector.**

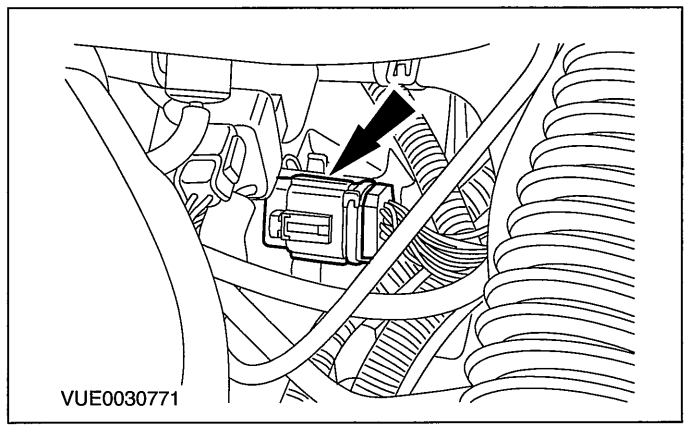


5. **NOTE:It is necessary to lift the red locking tab before the electrical connector can be disconnected.**

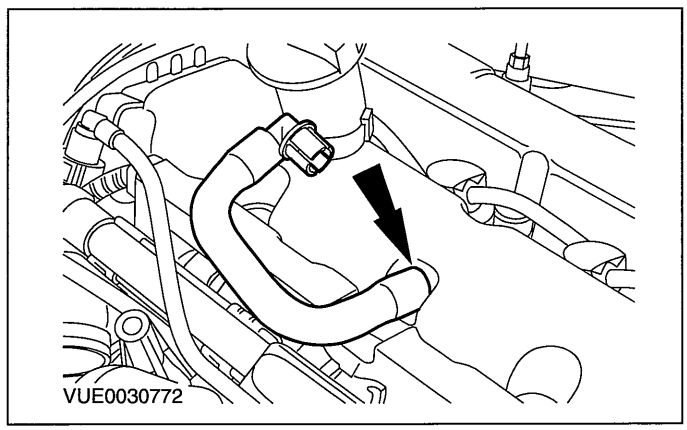
   Disconnect the throttle body electrical connector.



6. **Disconnect the fuel charging wiring harness electrical connector.**

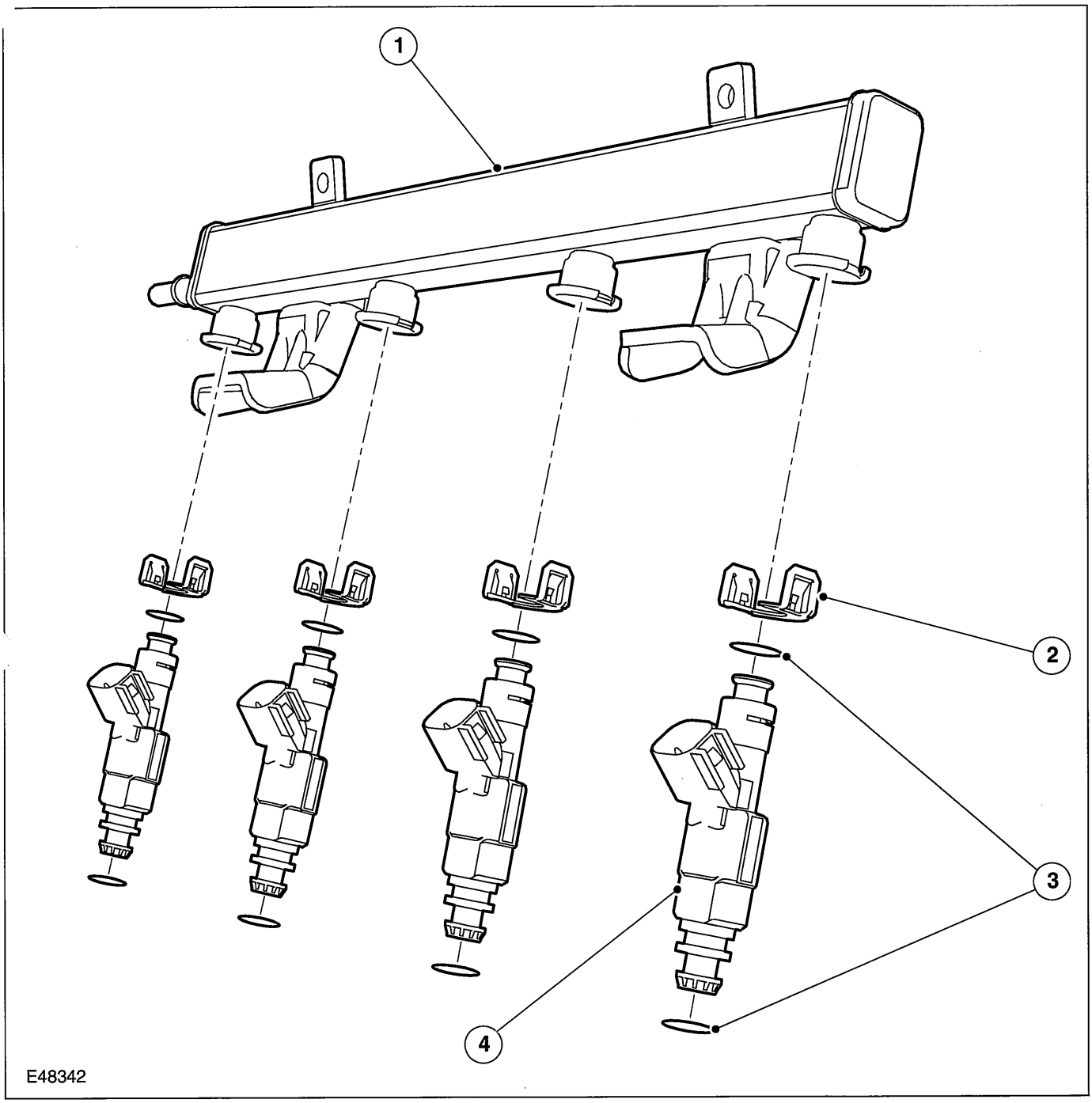


7. **Remove the positive crankcase ventilation (PCV) hose.**



DESCRIPTION AND OPERATION

Fuel Charging and Controls



Item	Description
1	Fuel injection supply manifold
2	Fuel injector retaining clip
3	Fuel injector O-ring seals
4	Fuel injector

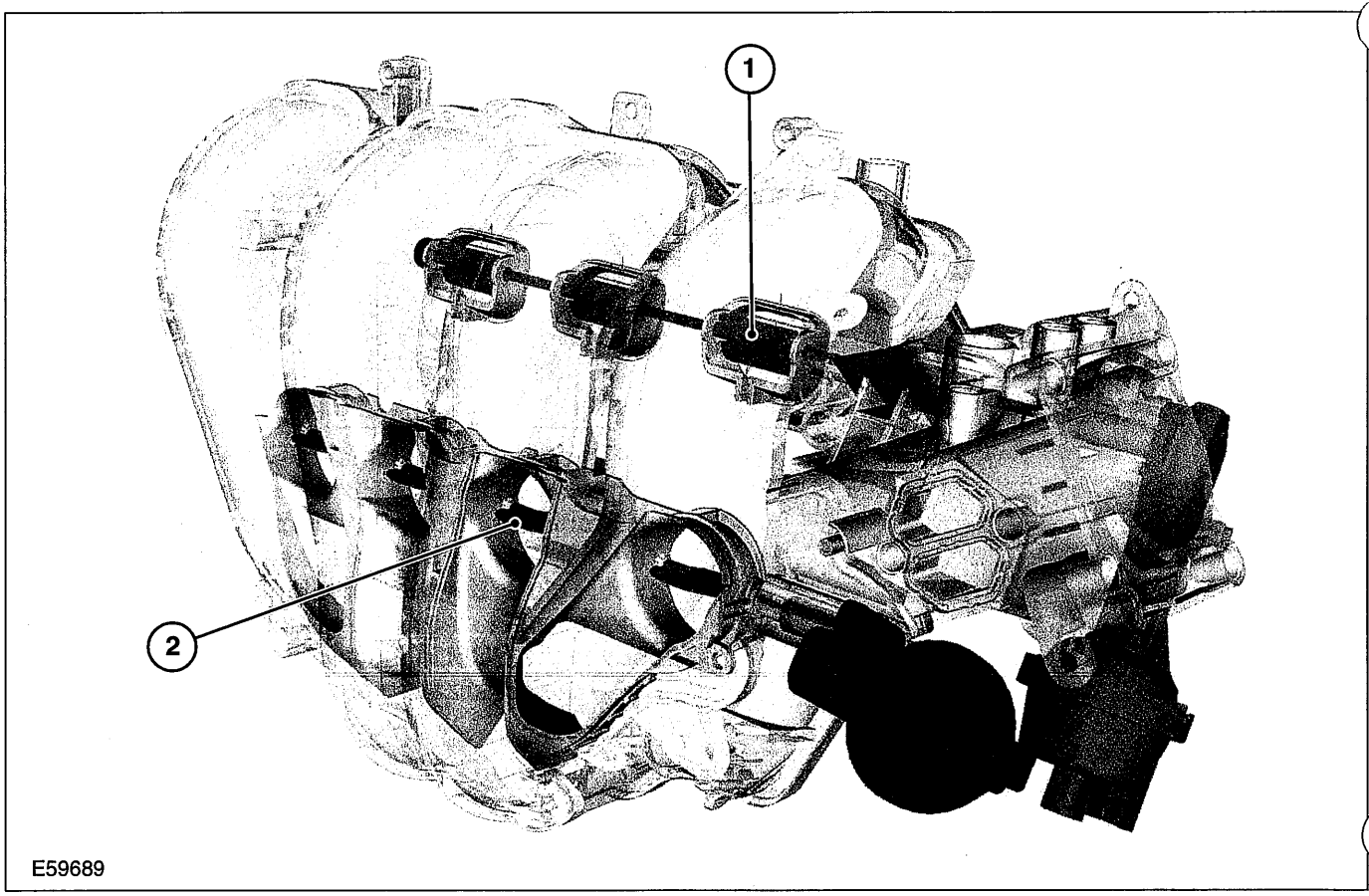
Fuel Injection Supply Manifold

The fuel injection supply manifold is retained to the engine by two bolts. The fuel injection supply manifold has pressed steel cups to house the fuel injectors.

The fuel injectors are fitted directly into the fuel injection supply manifold and are retained by the fuel injector retaining clips. Sealing between the

DIAGNOSIS AND TESTING

Intake manifold



Item	Description
1	Intake manifold tuning (IMT) swirl plates
2	Intake manifold runner control (IMRC) throttle plates

The intake manifold for both Ethanol E85 and standard unleaded fueled vehicles is the same construction.

Built into the intake manifold, are the IMRC throttle plates and IMT swirl plates.

Under low demand throttle conditions, the air charge is delivered to the cylinder head intake ports through the primary air intake chambers. The clean flow of the air charge is disturbed by the IMT swirl plates to assist in the mixing of the air fuel mixture at the fuel injectors.

During high demand throttle conditions, the IMRC throttle plates are opened and the air charge is allowed to use both primary and secondary intake chambers. This means a higher volume of air charge can be accommodated by the intake manifold. During this high demand throttle condition, the IMT swirl plates are fully open so as not to restrict the air charge flow.

Inspection and Verification

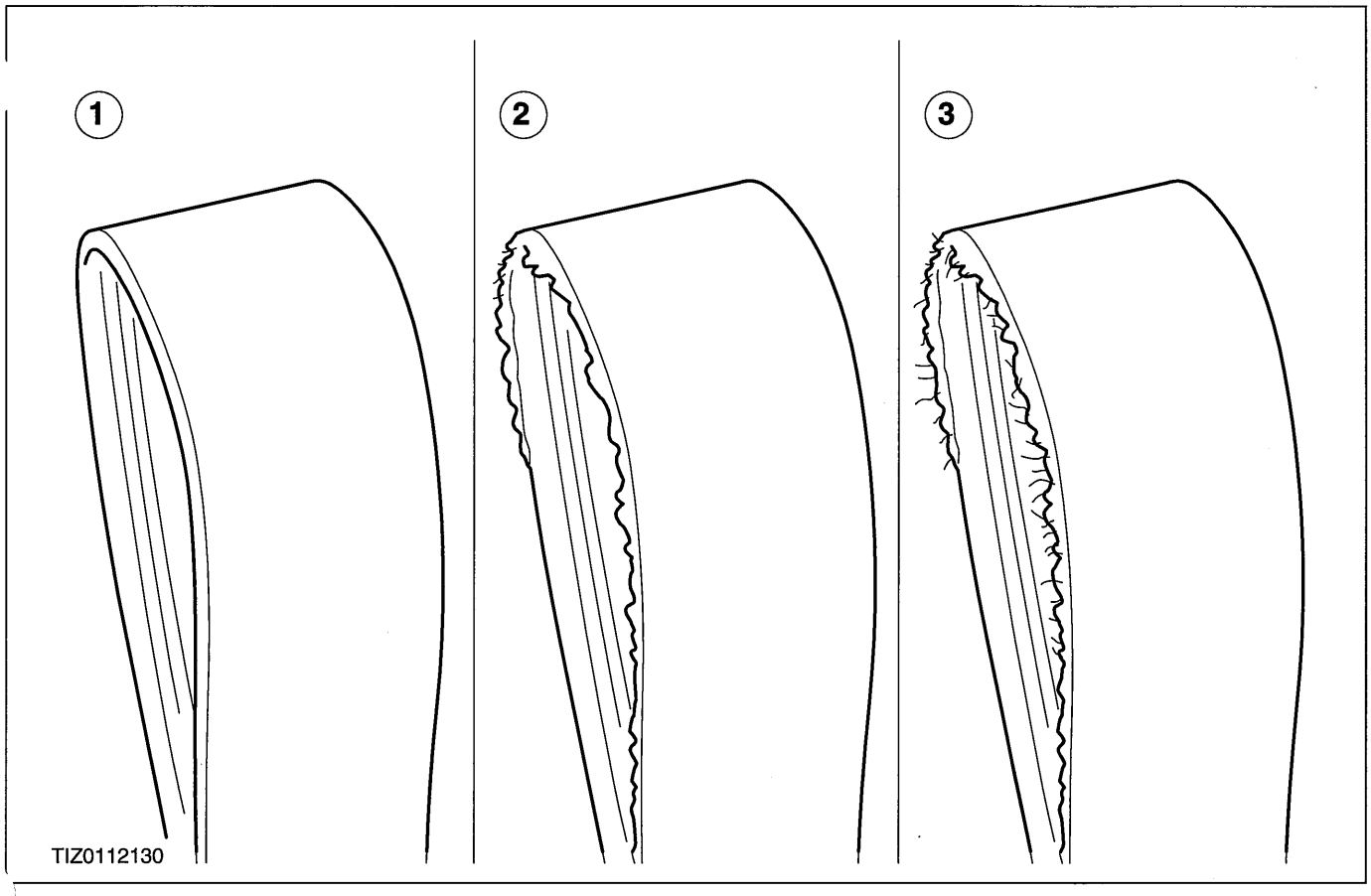
1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

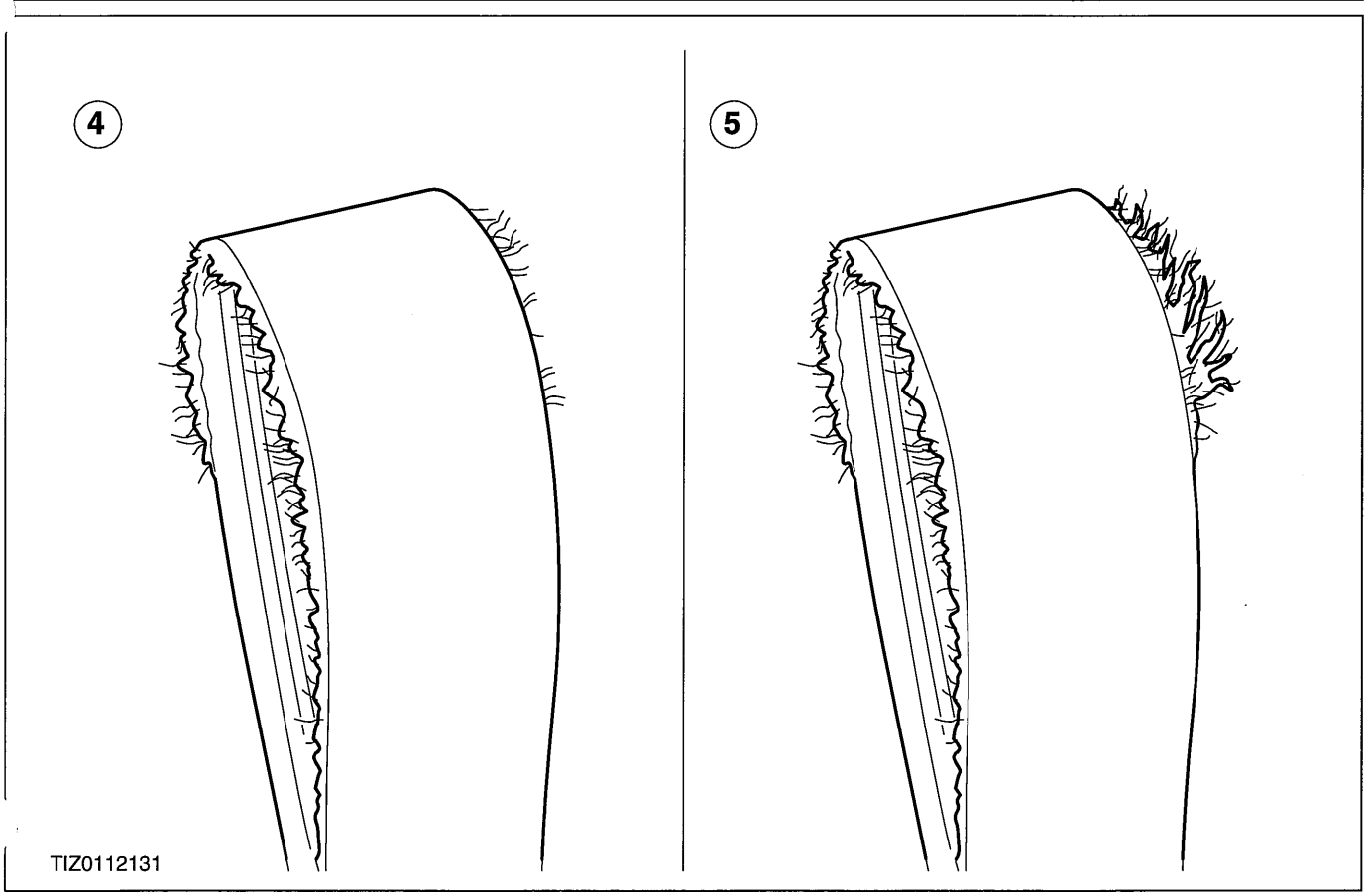
Visual Inspection Chart

Mechanical	Electrical
– Fuel leak(s) – Vacuum line(s) – Gasket(s) – Seal(s) – Fuel injector(s) – Throttle body – Fuel rail – Fuel supply line	– Powertrain control module (PCM) – Wiring harness – Electrical connector(s) – Throttle body – Fuel injector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

DIAGNOSIS AND TESTING



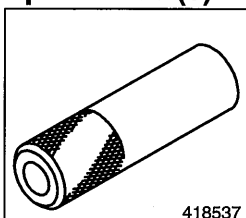


1. No fraying (new belt). Not considered a concern. No action required.
4. Check the accessory drive belt for fraying.

REMOVAL AND INSTALLATION

Powertrain Control Module (PCM) — 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma)(29 200 0)

Special Tool(s)

 418537	Drill Bush, Powertrain Control Module 418-537 (29-016)

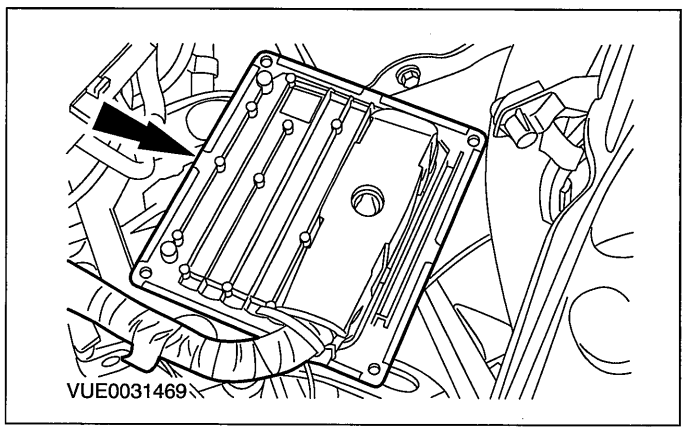
Removal

NOTE: If a new PCM is being installed connect WDS. Upload the PCM configuration information using the programmable modules installation routine prior to commencing the removal of the PCM.

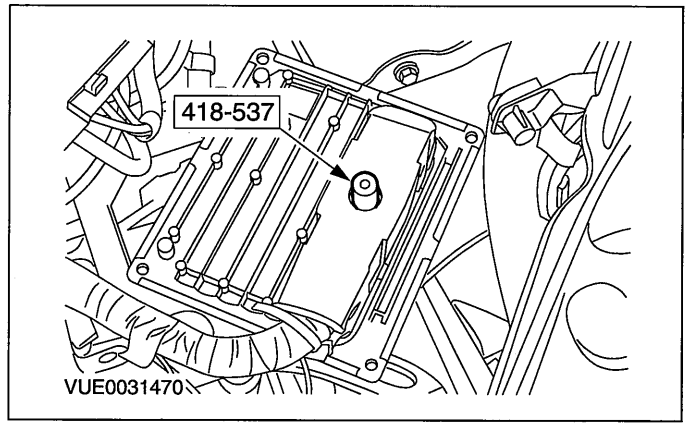
1. **Remove the battery tray.**

   For additional information, refer to: Battery Tray (414-01, Removal and Installation).

2. **Position the PCM on the battery tray support panel.**



3. **Insert the special tool into the PCM electrical connector.**

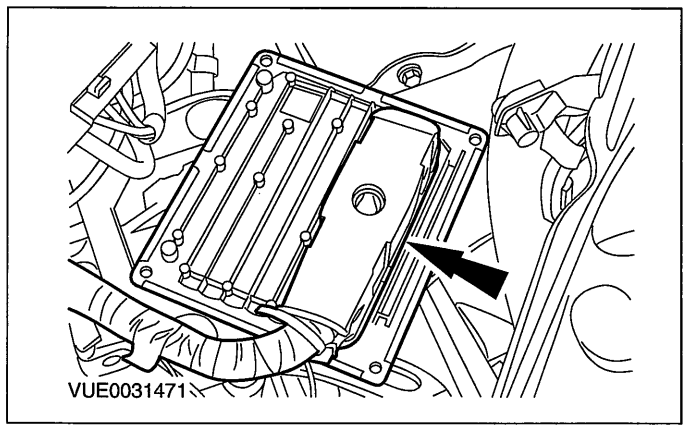


4. **⚠CAUTION:Make sure the special tool is used to guide the drill bit. Failure to follow this instruction may result in damage to the electrical connector.**

   Using the special tool as a guide, drill into the shear bolt using a 6mm drill bit, until the head is removed.

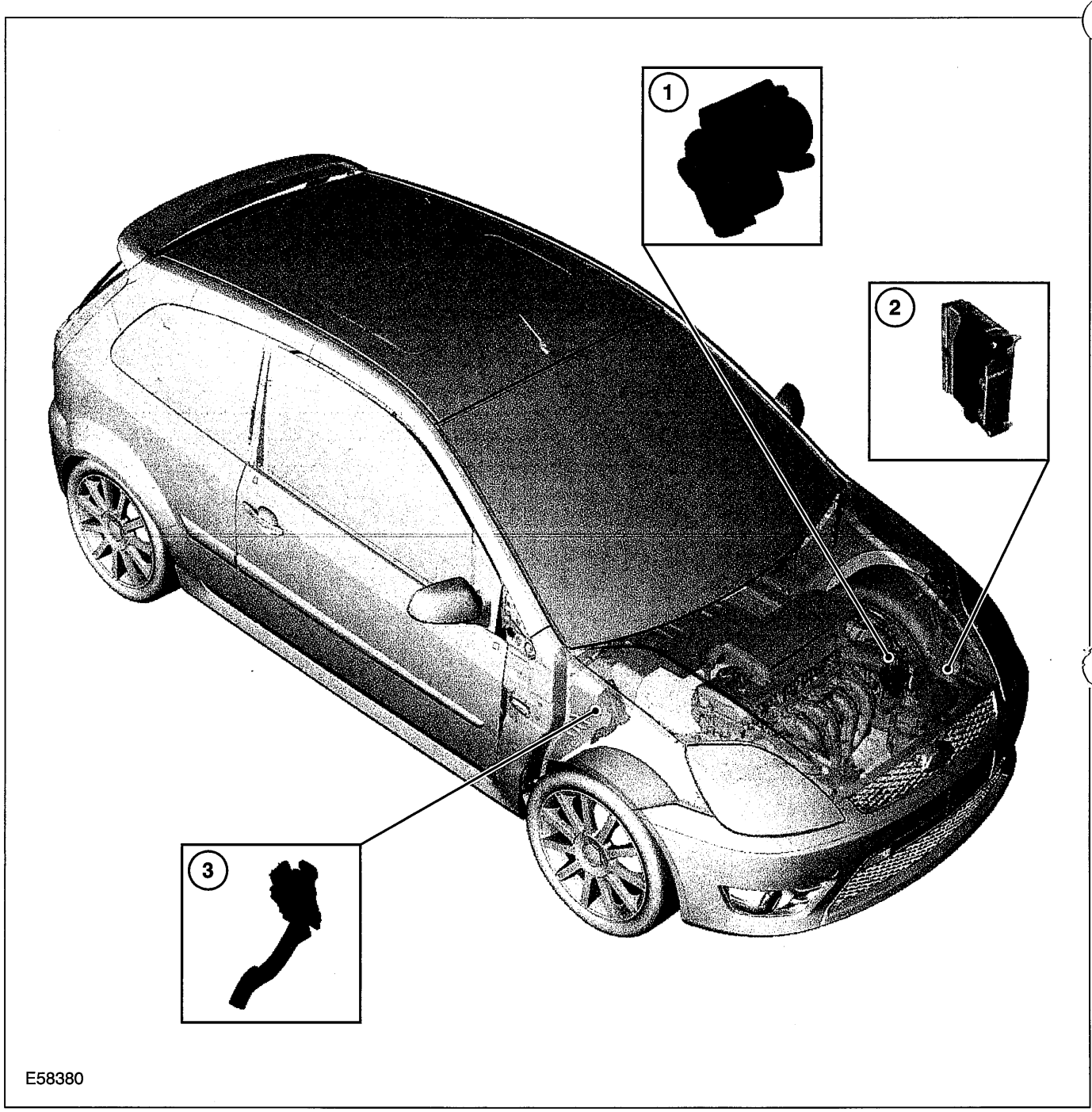
5. **Remove the special tool from the PCM electrical connector and clean all foreign material from the electrical connector.**

6. **Disconnect the PCM electrical connector and remove the PCM.**



DESCRIPTION AND OPERATION

Acceleration Control



Item	Description
1	Throttle body
2	Powertrain control module (PCM)
3	Accelerator pedal

The accelerator pedal incorporates two sensors, accelerator pedal position (APP) sensor 1, and APP sensor 2. Movement of the accelerator pedal generates a percentage of reference voltage (0-5V) on APP sensor 1 and a percentage of duty-cycle output on APP sensor 2 corresponding to that accelerator pedal position.

The PCM reads the output from both the APP sensors and converts the signals into a driver requested torque. To achieve the driver requested torque, the PCM controls the position of the throttle plate, ignition timing and fuel injection timing to produce the appropriate demanded engine torque output. The PCM monitors the actual throttle plate