

SECTION 303-01B Engine — 2.0L Duratec-HE (MI4)

VEHICLE APPLICATION:2006.0 Fiesta

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ASSEMBLY

Engine..... (21 134 8) 303-01B-3

INSTALLATION

Engine..... 303-01B-111

SPECIFICATIONS**Engine Data**

| Description | | |
|-------------------------------------|----------------------|----------------------|
| Engine code | N4JA | N4JB |
| Emission level | Stage III | Stage IV |
| Firing order | 1-3-4-2 | 1-3-4-2 |
| Bore | 87.5 mm | 87.5 mm |
| Stroke | 83.1 mm | 83.1 mm |
| Cubic capacity | 1998 cm ³ | 1998 cm ³ |
| Compression ratio | 10.8 : 1 | 10.8 : 1 |
| Power output 6000 rpm | 110 kW (150 PS) | 110 kW (150 PS) |
| Maximum torque at 4500 rpm | 190 Nm | 190 Nm |
| Maximum engine speed (intermittent) | 7000 rpm | 7000 rpm |
| Maximum engine speed (continuous) | 6500 rpm | 6500 rpm |
| Idle speed | 700 rpm | 700 rpm |
| Number of main bearings | 5 | 5 |
| Camshaft drive | Chain | Chain |
| Maximum oil consumption | 0.5l/1000 km | 0.5l/1000 km |

Engine Oil

| Viscosity /ambient temperature | Type | Specification |
|---|------------------|---------------|
| Recommended engine oil | | |
| SAE 5W-30 /below -20°C to over +40°C | Ford Formula E | WSS-M2C913-B |
| Alternative engine oils (for top-up only) | | |
| SAE 10W-40 /-20°C to over +40°C | Ford Formula XR+ | ACEA A3/B3 |
| SAE 5W-40 /below -20°C to over +40°C | Ford Formula S | ACEA A3/B3 |
| If other types of engine oil are used, these must conform at least to the respective API SH/EC viscosity class. | | |

Lubricants, Fluids, Sealers and Adhesives

| Item | Specification |
|--|---------------|
| Silicone sealant, oil pan contact surface to crankshaft rear seal retainer, oil pan to cylinder block, oil pan to engine front cover, engine front cover to cylinder block/oil pan | WSE-M4G323-A4 |
| Oil pressure switch and engine front cover blanking plug adhesive | WSK-M2G349-A7 |
| Silicone grease | ESE-M1C171-AA |

Oil system

| Description | bar |
|--|-----|
| Pressure relief valve opening pressure | 5 |

SPECIFICATIONS**Engine Oil Capacity**

| Description | Liters |
|------------------------------------|--------|
| Initial fill, including oil filter | 4.6 |
| Service fill including filter | 4.3 |
| Service fill excluding filter | 3.9 |

Valve Dimensions

| Description | mm |
|--|---------------|
| Valve clearance (engine cold), intake | 0.22 - 0.28 |
| Valve clearance (engine cold), exhaust | 0.27 - 0.33 |
| Valve stem diameter, intake | 5.470 - 5.485 |
| Valve stem diameter, exhaust | 5.465 - 5.480 |

Camshaft Dimensions

| Description | mm |
|-----------------------------|---------------|
| Camshaft journal diameter | 24.97 ± 0.01 |
| Camshaft journal clearance | 0.035 - 0.080 |
| Camshaft endplay | 0.09 - 0.24 |
| Camshaft lobe lift, intake | 8.8 |
| Camshaft lobe lift, exhaust | 7.7 |


Crankshaft Dimensions

| Description | mm |
|--------------------|---------------|
| Crankshaft endplay | 0.335 ± 0.115 |

Piston Dimensions

| Description | mm |
|---------------------------|-----------------|
| Piston diameter - Class 1 | 87.465 - 87.475 |
| Piston diameter - Class 2 | 87.475 - 87.485 |
| Piston diameter - Class 3 | 87.485 - 87.495 |

Cylinder Head

|  CAUTION: The mating face of the cylinder head must not be reworked. | |
|--|-----|
| Description | mm |
| Maximum distortion (mating face) | 0.1 |

Cylinder Block

| Description | mm |
|-------------------------------------|----------------|
| Cylinder bore diameter | 87.500 + 0.030 |
| Cylinder block distortion (maximum) | 0.1 |

SPECIFICATIONS**Torque Specifications**

| Description | Nm | lb-ft | lb-in |
|--|----|-------|-------|
| Air cleaner retaining bracket | 8 | - | 71 |
| Air cleaner resonator support bracket retaining bolts | 15 | 11 | - |
| Battery cable to generator electrical connector | 15 | 11 | - |
| Battery tray support bracket retaining bolts | 25 | 18 | - |
| Cylinder head retaining bolts | a) | - | - |
| Camshaft bearing caps retaining bolts | a) | - | - |
| Camshaft sprocket retaining bolts | 72 | 53 | - |
| Camshaft position (CMP) sensor retaining bolt | 6 | - | 53 |
| Engine front cover retaining bolts | a) | - | - |
| Engine front cover upper blanking plug | 10 | - | 89 |
| Engine front cover lower blanking plug | 12 | 9 | - |
| Engine support insulator retaining bolts | 48 | 35 | - |
| Engine wiring harness bracket to valve cover retaining nut | 10 | - | 89 |
| Generator upper retaining bolt | 25 | 18 | - |
| Hood latch lever retaining bolts | 15 | 11 | - |
| Crankshaft pulley retaining bolts | a) | - | - |
| Coolant expansion tank retaining nut | 8 | - | 71 |
| Coolant plug to cylinder block | 43 | 32 | - |
| Coolant plugs (4) to cylinder head | 75 | 55 | - |
| Power steering pump retaining bolt | 23 | 17 | - |
| Power steering reservoir retaining bolts | 9 | - | 80 |
| Power steering pipe to the power steering | 65 | 48 | - |
| Power steering bracket retaining nut | 15 | 11 | - |
| Power steering supply line to intake manifold retaining bolt | 11 | 8 | - |
| Power steering high-pressure line retaining bracket retaining bolt | 30 | 22 | - |
| Power steering return line support bracket retaining nut | 15 | 11 | - |
| Exhaust manifold bracket retaining bolts | 25 | 18 | - |
| Exhaust manifold upper heat shield retaining bolts | 10 | - | 89 |
| Exhaust manifold lower heat shield retaining bolts | 10 | - | 89 |
| Exhaust manifold to the cylinder head retaining nuts | 55 | 41 | - |
| Exhaust manifold studs to cylinder head | 17 | 13 | - |

SPECIFICATIONS

| Description | Nm | lb-ft | lb-in |
|--|----|-------|-------|
| Evaporative emission (EVAP) valve retaining bracket retaining nut and bolt | 10 | - | 89 |
| Cylinder block blanking plug | 20 | 15 | - |
| Coolant pump pulley retaining bolts | 25 | 18 | - |
| Coolant pump retaining bolts | 10 | - | 89 |
| Valve cover retaining bolts | 10 | - | 89 |
| Oil level indicator and oil level indicator tube upper retaining bolt | 10 | - | 89 |
| Oil level indicator and oil level indicator tube lower retaining bolt | 10 | - | 89 |
| Oil pressure switch | 15 | 11 | - |
| Oil pan retaining bolts | 25 | 18 | - |
| Oil drain plug | 28 | 21 | - |
| Oil cooler to oil filter adaptor retaining bolt | 34 | 25 | - |
| Crankshaft rear seal carrier retaining bolts | 10 | - | 89 |
| Flywheel retaining bolts | a) | - | - |
| Oil filter adaptor retaining bolts | 25 | 18 | - |
| Positive crankcase ventilation housing retaining bolts | 10 | - | 89 |
| Knock sensor retaining bolt | 20 | 15 | - |
| Thermostat housing retaining bolts | 10 | - | 89 |
| Oil pump retaining bolts | a) | - | - |
| Oil pump sprocket retaining bolt | 25 | 18 | - |
| Oil pump chain guide retaining bolts | 10 | - | 89 |
| Oil pump chain tensioner retaining bolt | 10 | - | 89 |
| Timing chain guide retaining bolts | 10 | - | 89 |
| Timing chain tensioner retaining bolts | 10 | - | 89 |
| Crankshaft position sensor retaining bolts | 7 | - | 62 |
| Accessory drive belt idler pulley retaining bolt | 25 | 18 | - |
| Intake manifold retaining bolts | 18 | 13 | - |
| Transaxle left-hand retaining bolts | 44 | 32 | - |
| Transaxle right-hand retaining bolts | 44 | 32 | - |
| Transaxle lower retaining bolts | 40 | 30 | - |
| Halfshaft center bearing carrier retaining bolts | 48 | 35 | - |
| Intermediate shaft bearing cap retaining nuts | 25 | 18 | - |
| Lower arm ball joint retaining bolt | 48 | 35 | - |

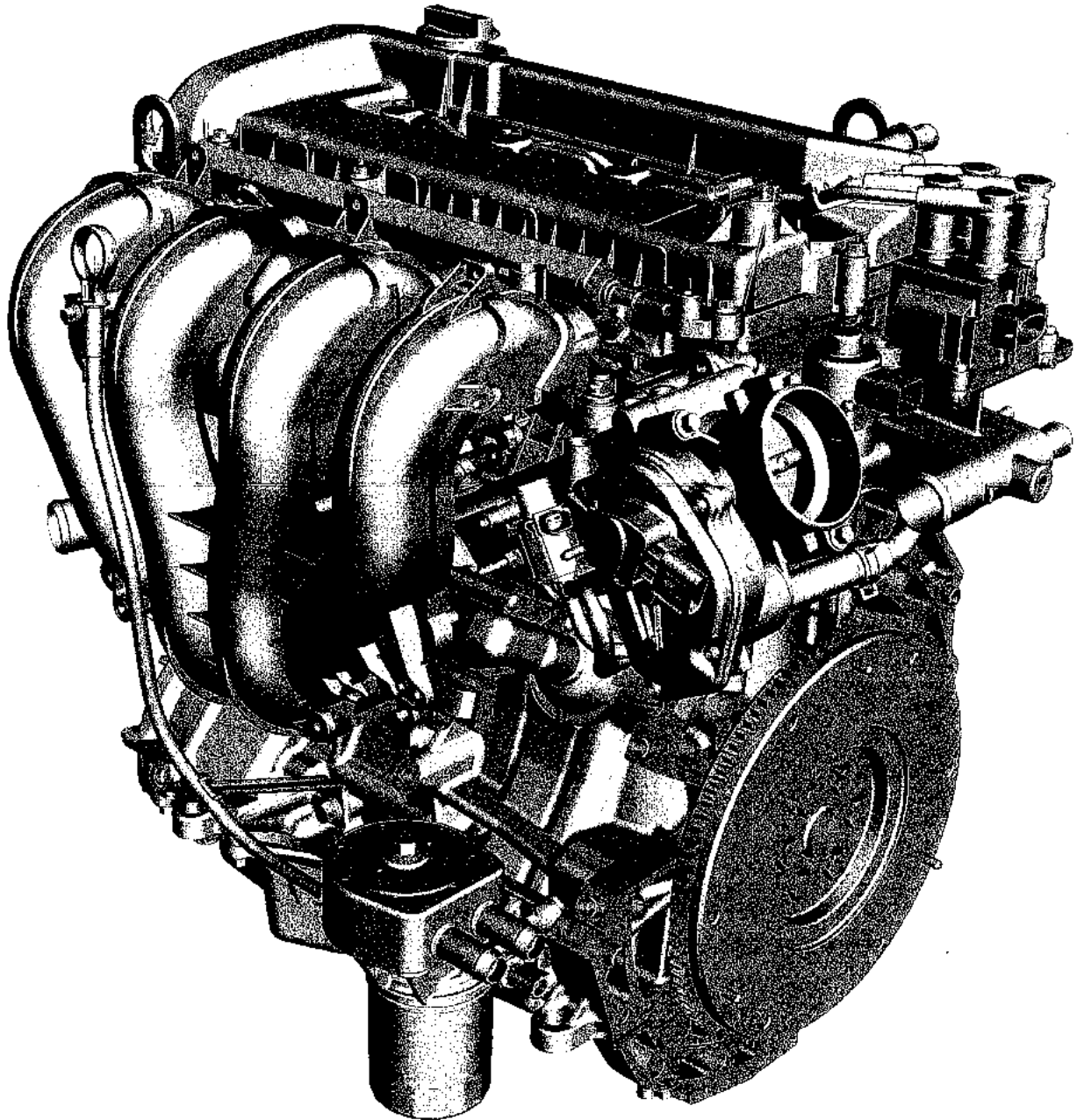
SPECIFICATIONS

| Description | Nm | lb-ft | lb-in |
|--|-----|-------|-------|
| Wiring harness retaining bracket nuts | 20 | 15 | - |
| Starter motor retaining bolts | 35 | 26 | - |
| Air conditioning (A/C) compressor retaining bolts | 20 | 15 | - |
| Engine rear mount retaining nut | 90 | 66 | - |
| Engine front mount studs to front cover | 12 | 9 | - |
| Engine front mount retaining bolts | 48 | 35 | - |
| Engine front mount retaining nuts | 115 | 85 | - |
| Strut and spring assembly top mount retaining nuts | 25 | 18 | - |
| Spark plugs | 12 | 9 | - |
| a) Refer to the procedure in this section. | | | |

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 |

DESCRIPTION AND OPERATION

| | |
|-------------------------------------|--|
| 2.0L Duratec-HE (MI4) engine | |
| Emission standard | European Emissions Standard Stage IV (Stage III, depending on country) |

The complete engine is made of cast aluminum which, when combined with the plastic intake manifold, gives a very light unit.

NOTE:Due to the fine tolerance in the bearing clearances and bearing shells, no service operations whatsoever are permitted on the crank assembly. In the event of damage, the complete cylinder block and crank assembly must be changed.

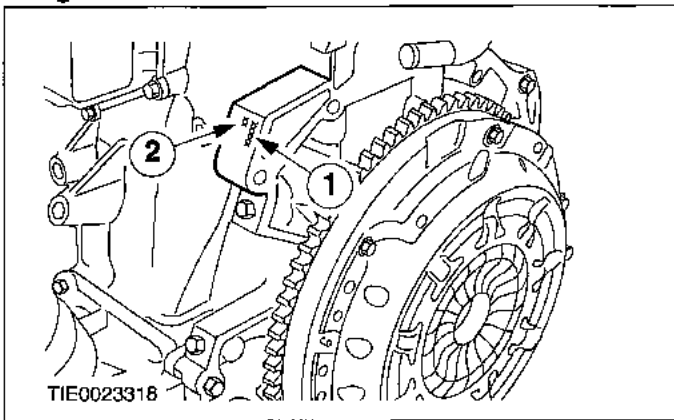
Further design features include a ladder frame incorporating the main bearing caps which support the crankshaft in the cylinder block, and the deep-drawn side walls of the cylinder block which reduce engine vibration.

The camshafts are driven by a pinned link chain which runs very quietly and is also maintenance-free.

The engine management for the 2.0L Duratec-HE (MI4) is provided by a Visteon system.

This engine management systems controls the sequential multipoint fuel injection (SFI) and the electronically controlled coolant-cooled exhaust gas recirculation (EGR) valve.

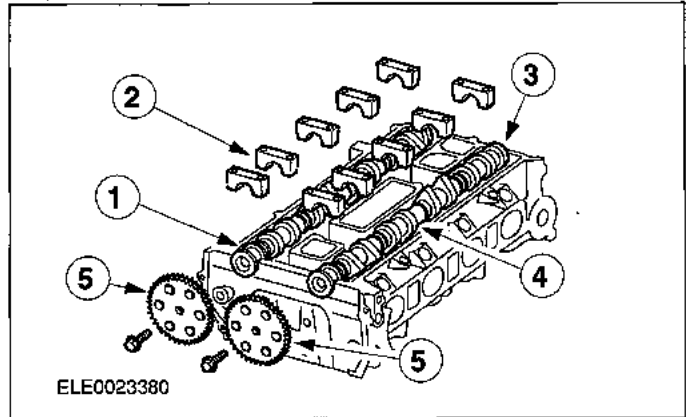
Engine codes



| Item | Description |
|------|----------------------|
| 1 | Engine code |
| 2 | Engine serial number |

The engine code and the engine serial number are stamped on the right-hand side of the cylinder block on the flywheel side of the engine.

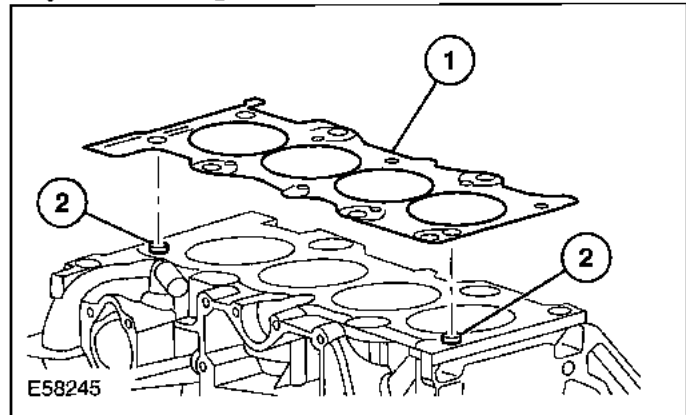
Cylinder head



| Item | Description |
|------|--------------------------------|
| 1 | Exhaust camshaft |
| 2 | Camshaft bearing cap |
| 3 | Cam to identify cylinder No. 1 |
| 4 | Intake camshaft |
| 5 | Camshaft sprockets |

The design and the valve arrangement in the cylinder head is similar to the head of the Zetec-SE engines.

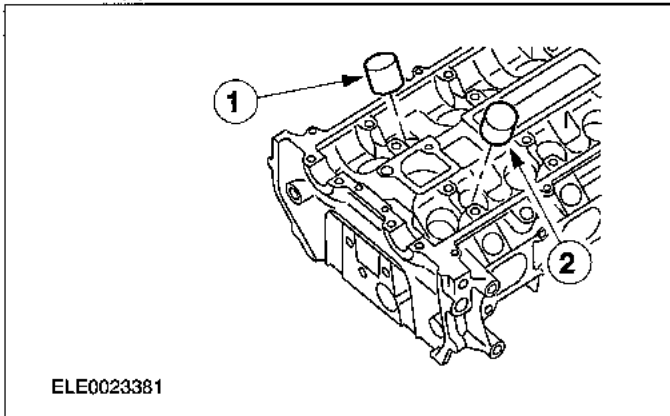
Cylinder head gasket



| Item | Description |
|------|----------------------|
| 1 | Cylinder head gasket |
| 2 | Locating dowels |

A four-layer laminated steel cylinder head gasket is used.

The cylinder head gasket and cylinder head are located with two locating dowels.

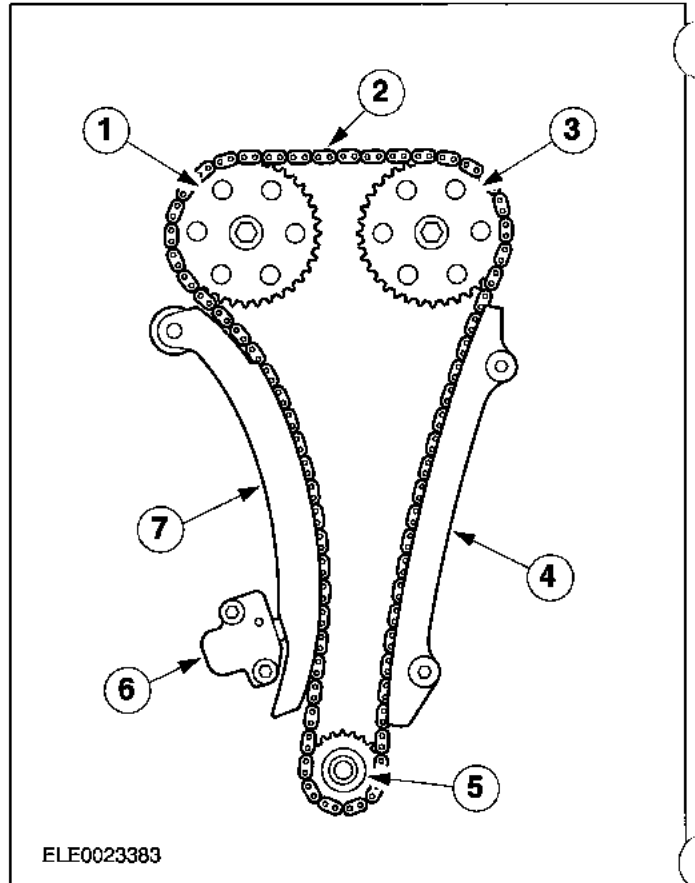
DESCRIPTION AND OPERATION**Valve tappets**

| Item | Description |
|------|----------------------|
| 1 | Exhaust valve tappet |
| 2 | Intake valve tappet |

Mechanical tappets are fitted without adjusting shims.

Due to the special materials and the optimized camshaft profiles, the wear in the area of the valve gear is so minute that checking and adjustment of the valve clearances is only necessary after the engine has been in extensive service.

Different sizes of replacement valve tappets are available in the event of wear or repairs to the valve gear.

Camshaft drive

| Item | Description |
|------|----------------------------------|
| 1 | Exhaust camshaft sprocket |
| 2 | Timing chain |
| 3 | Intake camshaft sprocket |
| 4 | Timing chain guide |
| 5 | Crankshaft sprocket |
| 6 | Hydraulic timing chain tensioner |
| 7 | Timing chain tensioner arm |

The camshafts are driven by a low-noise, maintenance-free pinned link timing chain.

The timing chain is lubricated by the engine oil circuit.

An elongated timing chain guide and a timing chain tensioner arm ensure optimum timing chain guidance and silent running.

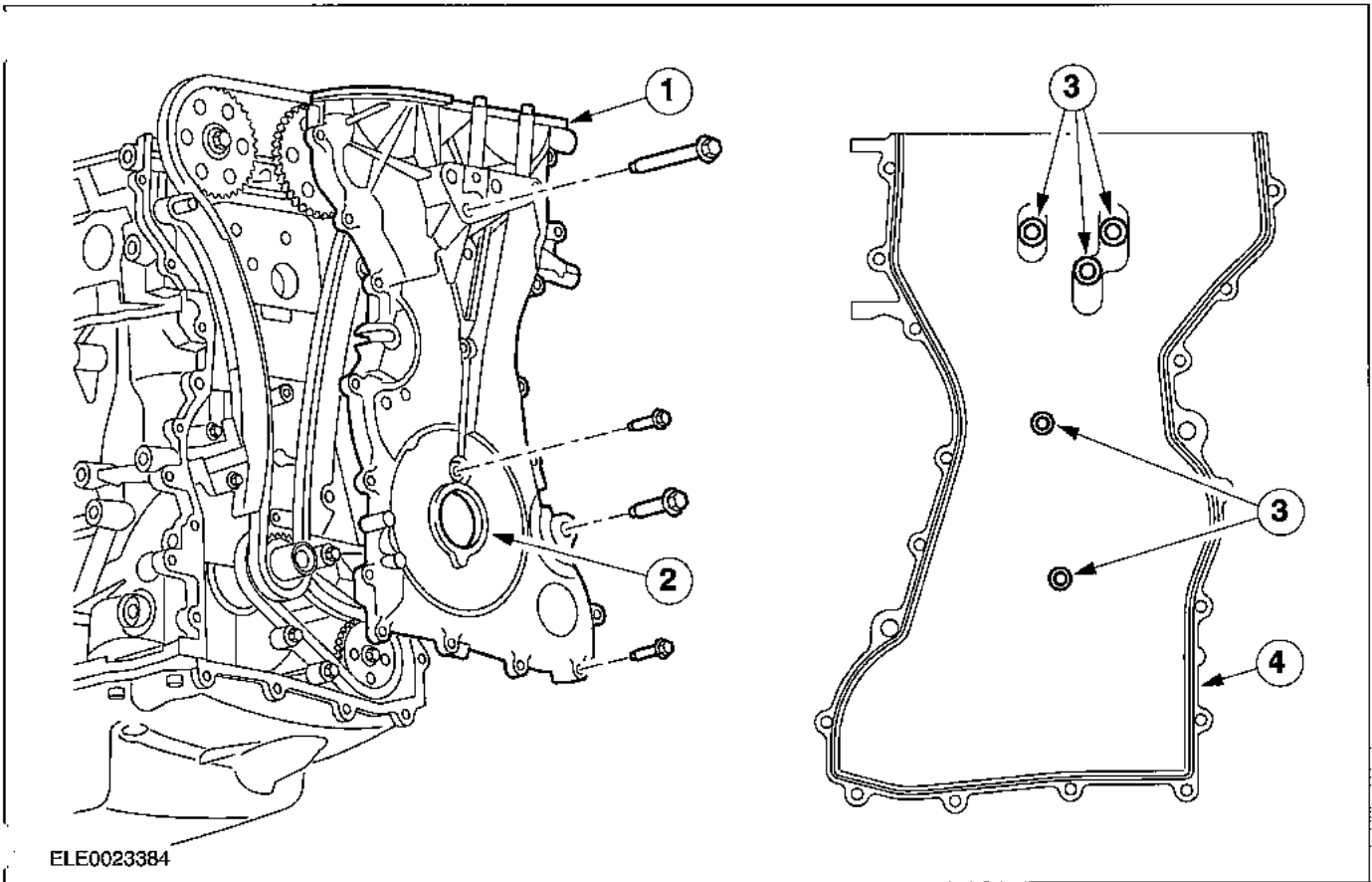
The timing chain is tensioned by a hydraulic timing chain tensioner which is supplied from the engine oil circuit.

The timing chain tensioner can be used again after removal.

The camshaft drive requires no maintenance.

DESCRIPTION AND OPERATION

Engine front cover



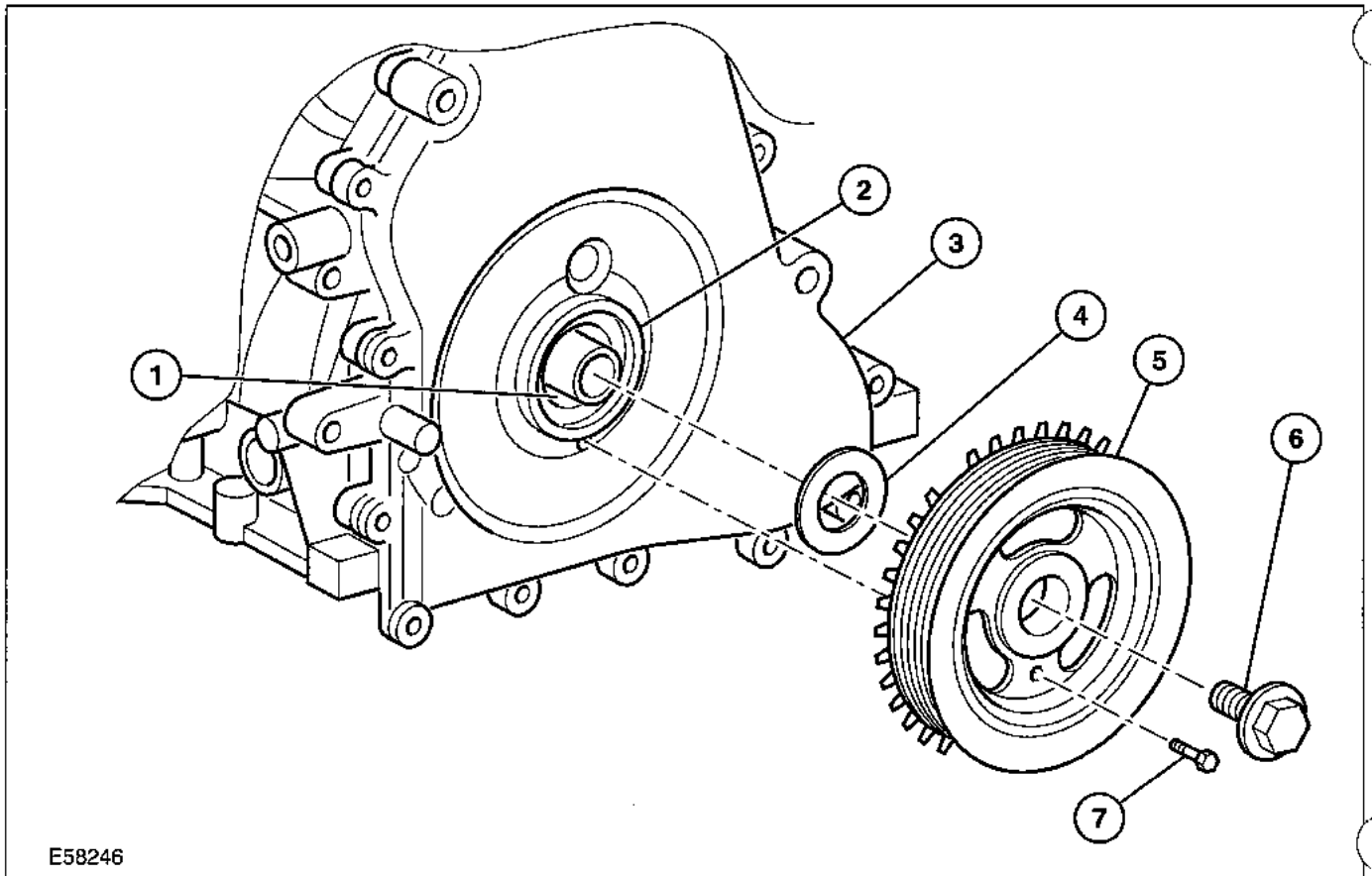
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| Item | Description |
|------|---|
| 1 | Engine front cover |
| 2 | Crankshaft front seal |
| 3 | Silicone sealant for sealing at bores |
| 4 | Silicone sealant for sealing engine front cover |

The camshaft drive is sealed with an aluminum engine front cover.

The crankshaft front seal is installed in the engine front cover.

The engine front cover is installed using silicone sealant.

DESCRIPTION AND OPERATION**Crankshaft pulley**

| Item | Description |
|------|----------------------------------|
| 1 | Crankshaft |
| 2 | Crankshaft front seal |
| 3 | Engine front cover |
| 4 | Friction washer |
| 5 | Crankshaft pulley |
| 6 | Crankshaft pulley retaining bolt |
| 7 | M6 bolt |

The crankshaft pulley forms a unit with the rotor for indicating the crankshaft position.

It is secured to the crankshaft by the contact pressure of the retaining bolt (free to turn on the seat on the crankshaft).

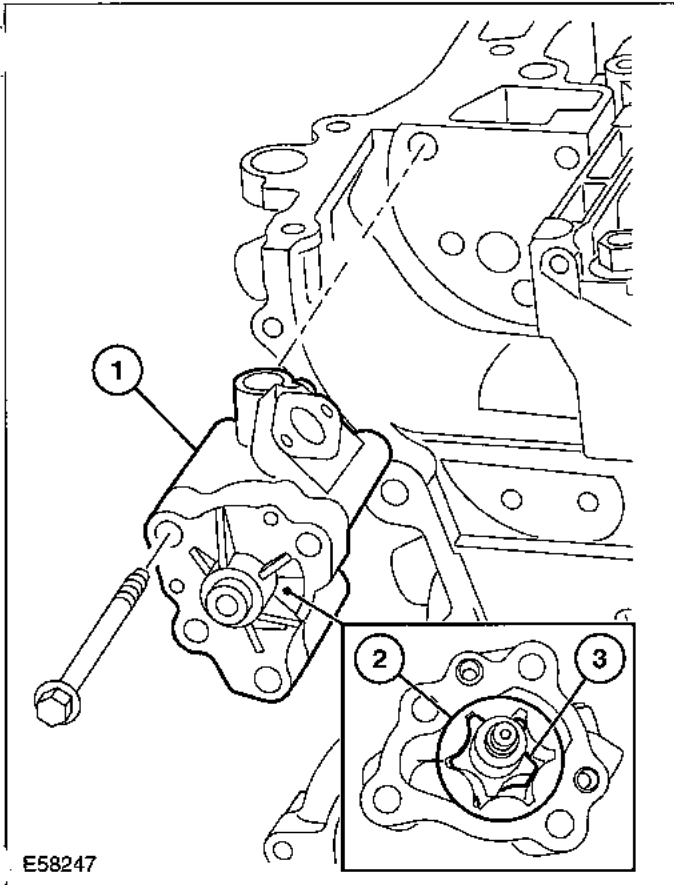
The crankshaft pulley retaining bolt must be changed after removal.

The crankshaft pulley is positioned with the aid of an M6 bolt.

NOTE: The M6 bolt must never be used as support when tightening the crankshaft pulley retaining bolt as this could damage the engine front cover.

DESCRIPTION AND OPERATION

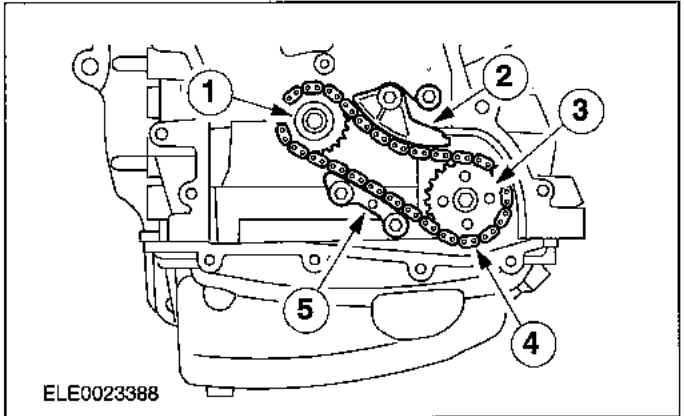
Oil pump



| Item | Description |
|------|----------------------|
| 1 | Oil pump |
| 2 | Oil pump outer rotor |
| 3 | Oil pump inner rotor |

A rotor oil pump is used for engine lubrication. The rotor oil pump is a positive displacement pump with an internally toothed outer rotor and an externally toothed inner rotor. The rotor pump works very evenly, can produce high pressures and is therefore fundamental for optimum engine lubrication.

Oil Pump Drive



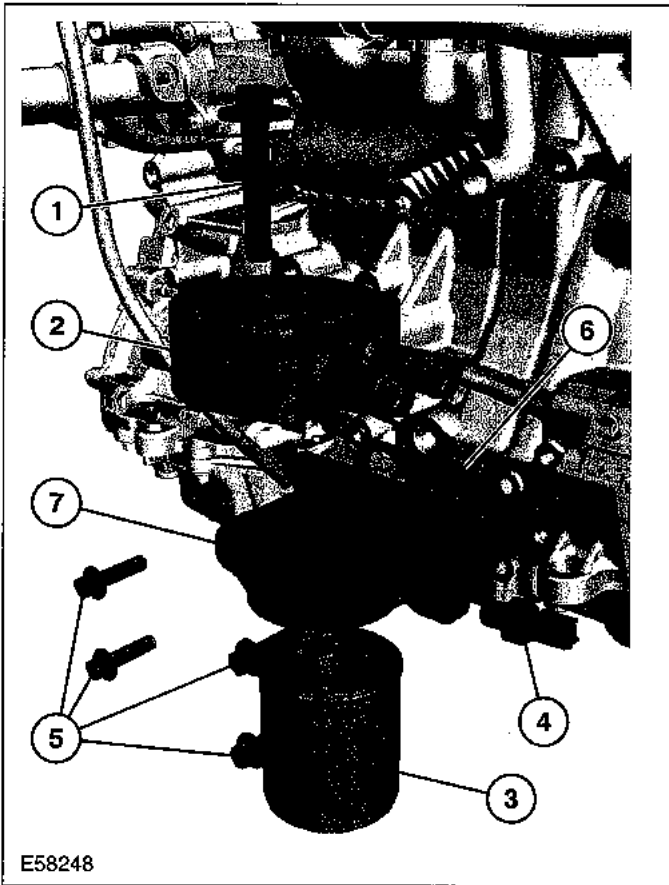
| Item | Description |
|------|--------------------------|
| 1 | Crankshaft sprocket |
| 2 | Oil pump chain tensioner |
| 3 | Oil pump sprocket |
| 4 | Oil pump chain |
| 5 | Oil pump chain guide |

The oil pump is mounted on the cylinder block, on the engine front cover side at the bottom and driven directly from the crankshaft by a separate driving chain.

A oil pump chain guide and an oil pump spring-loaded chain tensioner ensure quiet maintenance-free operation.

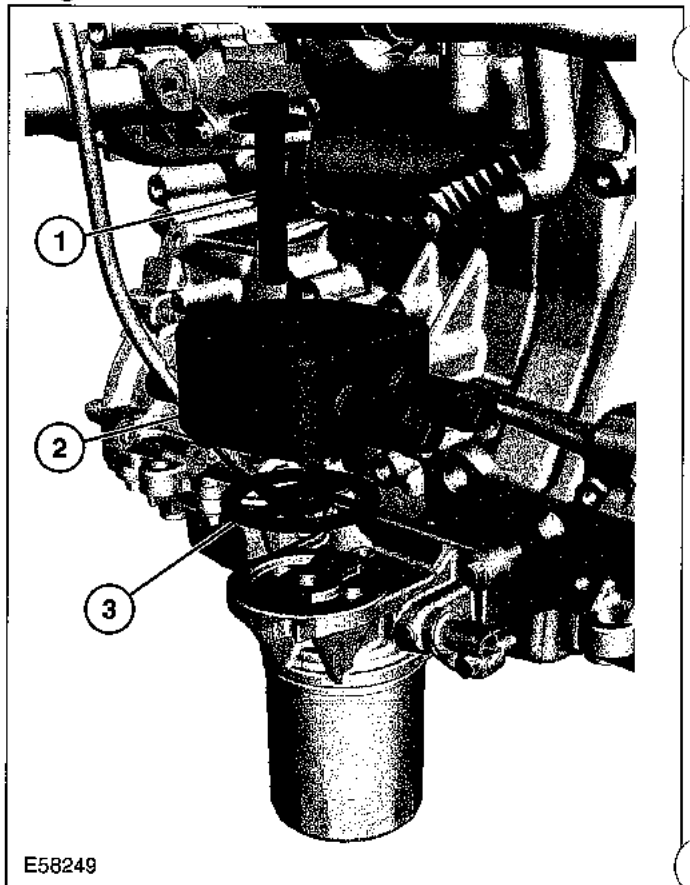
DESCRIPTION AND OPERATION

Oil filter adapter



E58248

Engine oil cooler



E58249

| Item | Description |
|------|------------------------------------|
| 1 | Oil cooler retaining bolt |
| 2 | Oil cooler |
| 3 | Oil filter |
| 4 | Oil pressure switch |
| 5 | Oil filter adapter retaining bolts |
| 6 | Oil filter adapter gasket |
| 7 | Oil filter adapter |

| Item | Description |
|------|---------------------------|
| 1 | Oil cooler retaining bolt |
| 2 | Oil cooler |
| 3 | Oil cooler O-ring seal |

The oil filter adapter is mounted on the cylinder block with a gasket.

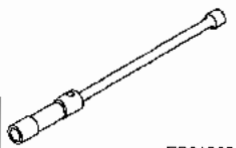
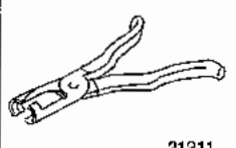
DIAGNOSIS AND TESTING**Engine**

REFER to Section 303-00 [Engine System - General Information].

GENERAL PROCEDURES

Valve Clearance Adjustment

Special Tool(s)

| | |
|--|---|
|  <p>ES21202</p> | <p>Socket, Spark Plug 303-499 (21-202)</p> |
|  <p>21211</p> | <p>Pliers, Valve Stem Seal 303-508 (21-211)</p> |

General Equipment

Feeler gauges

Materials

| Name | Specification |
|------------------|---------------|
| Silicone Sealant | WSE-M4G323-A4 |

1. Disconnect the battery ground cable.

For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

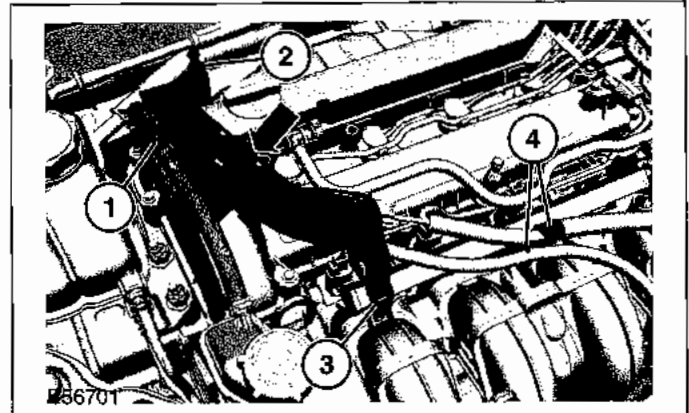
2. Remove the air cleaner.

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (M14) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

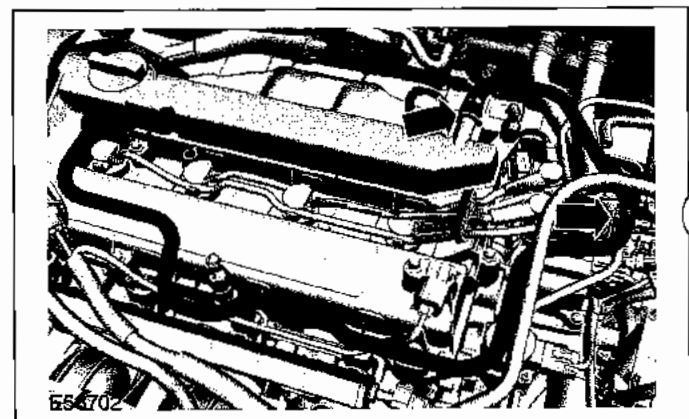
3. Detach the engine wiring harness from the valve cover.

1. Unclip the power steering return line from the engine wiring harness bracket.
2. Remove the air cleaner retaining bracket.
3. Unclip the engine wiring harness bracket from the intake manifold.

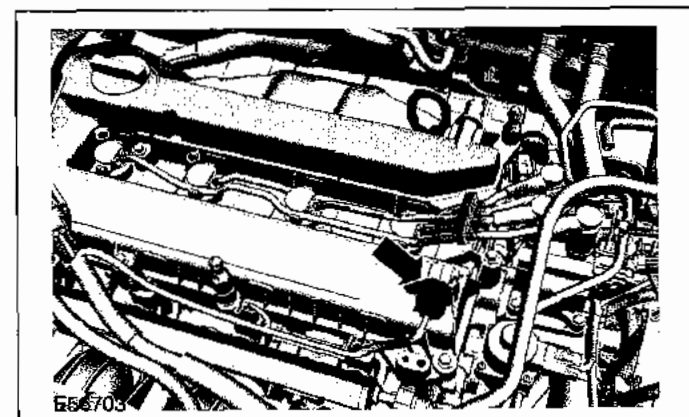
4. Unclip the engine wiring harness from the intake manifold.



4. Remove the positive crankshaft ventilation (PCV) hose.

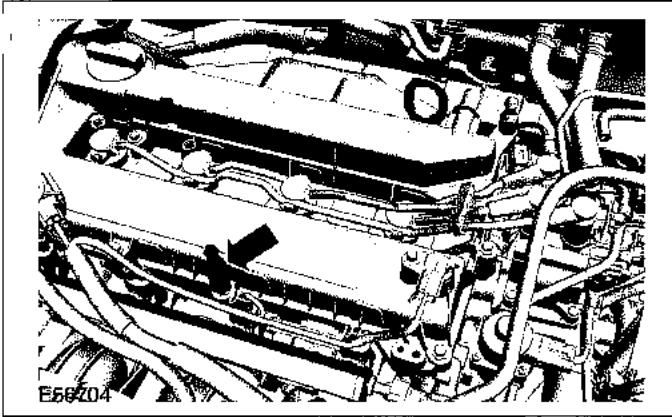


5. Disconnect the camshaft position (CMP) sensor electrical connector.

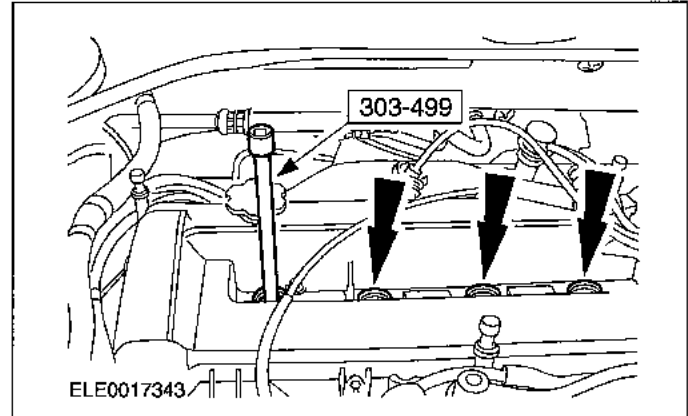


GENERAL PROCEDURES

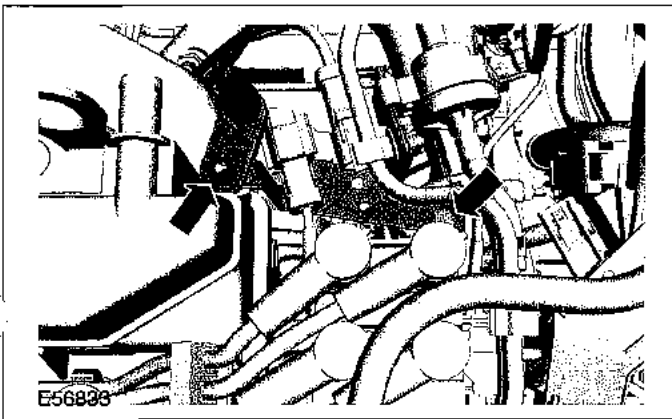
6. Remove the air cleaner retaining bracket.



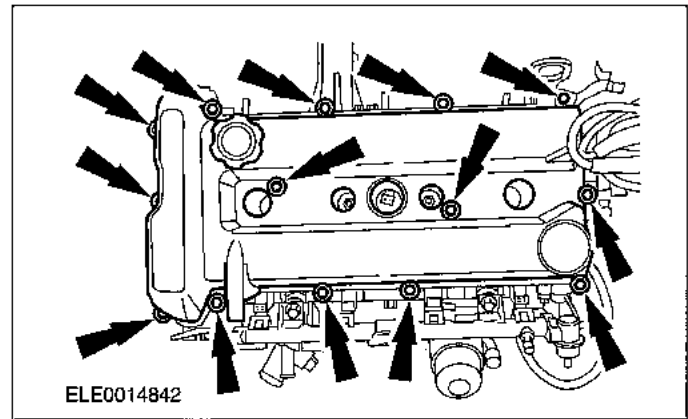
9. Using the special tool, remove the spark plugs.



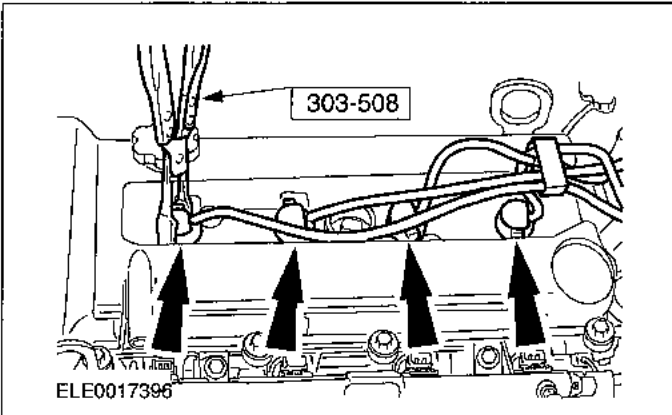
7. Remove the evaporative emission (EVAP) valve support bracket.



10. Remove the valve cover.



8. Using the special tool, disconnect the spark plug electrical connectors.

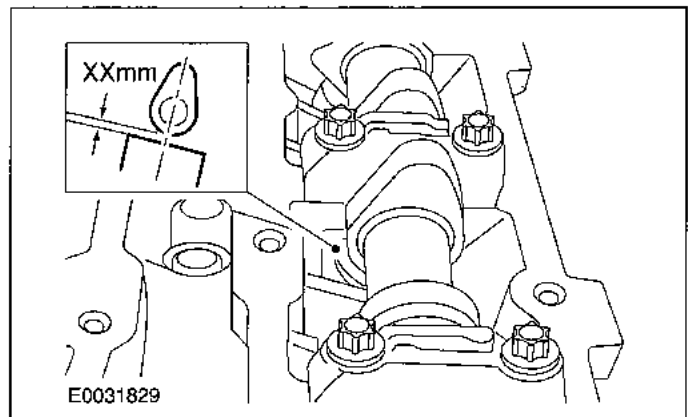


11. **CAUTION:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until piston No. 1 is at top dead center (TDC).

12. **NOTE:** Make a note of each cylinder number and the valve clearances measured.

Using a suitable set of feeler gauges, measure the valve clearances.



GENERAL PROCEDURES

13. **⚠ CAUTION:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until each piston is at TDC and measure the valve clearances.

14. **NOTE:** Only carry out the following steps when the valve clearance(s) require adjustment.

For additional information, refer to:
Specifications (303-01 Engine - 2.0L Duratec-HE (M14), Specifications).

Remove the camshafts.

For additional information, refer to:
Camshafts (303-01 Engine - 2.0L Duratec-HE (M14), In-vehicle Repair).

15. **NOTE:** The number on the valve tappet is the valve tappet thickness, however only the decimal places are marked (for example .650 = 3.650).

Determine the valve tappet thickness required:

1. Remove the valve tappet and read the thickness from the underside.
2. Valve tappet thickness required = thickness of currently installed valve tappet + the measured valve clearance - the required valve clearance.

For additional information, refer to:
Specifications (303-01 Engine - 2.0L Duratec-HE (M14), Specifications).

3. Install the correct valve tappet.

16. **NOTE:** Do not install the valve cover at this stage.

Install the camshafts.

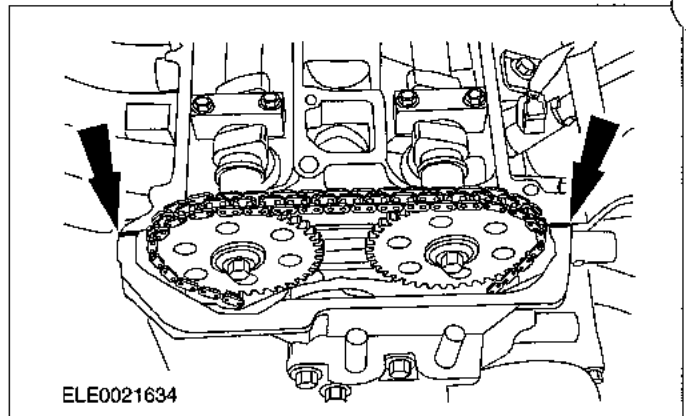
For additional information, refer to:
Camshafts (303-01 Engine - 2.0L Duratec-HE (M14), In-vehicle Repair).

17. **⚠ CAUTION:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until each piston is at TDC and measure the valve clearances.

18. Repeat this procedure as necessary until all valve clearances are within the specified tolerance.

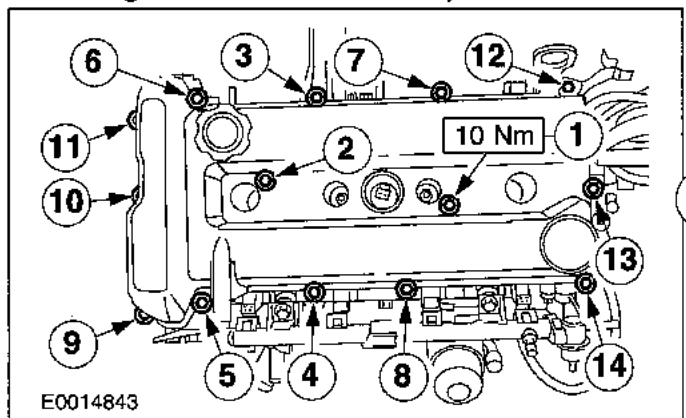
19. Apply a small bead of sealant to the areas as shown.



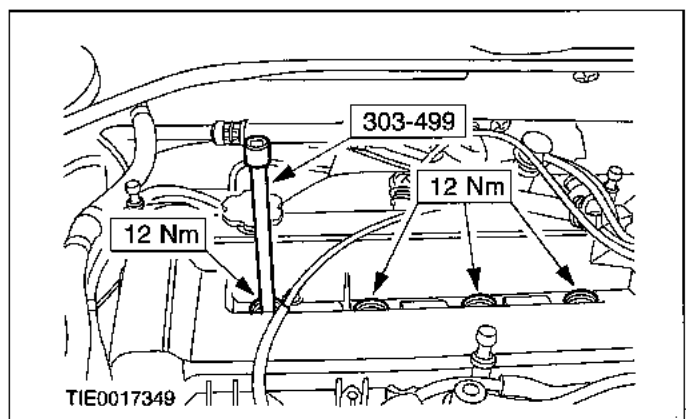
20. **NOTE:** Install a new valve cover gasket if necessary.

Install the valve cover.

- Tighten the bolts in the sequence shown.

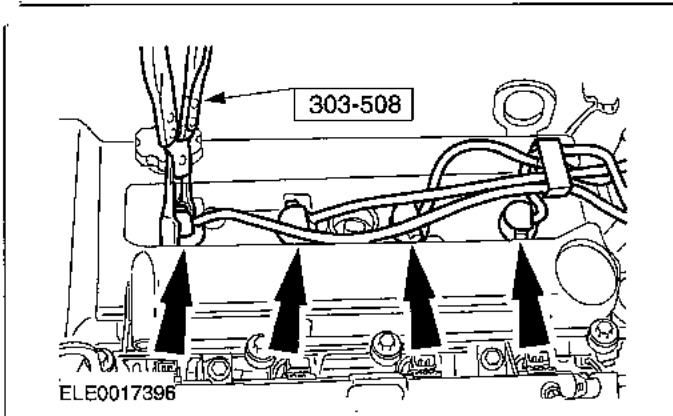


21. Using the special tool, install the spark plugs.

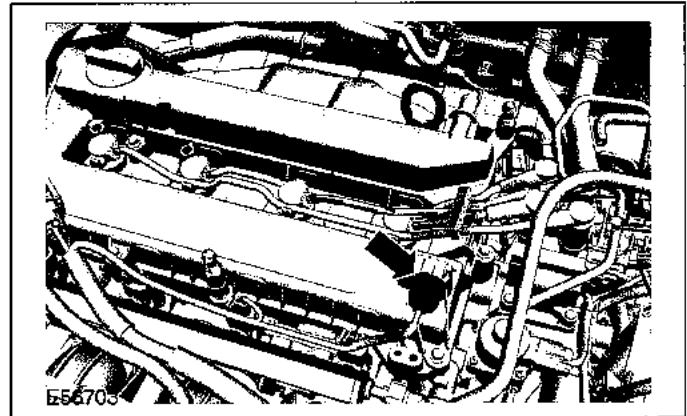


GENERAL PROCEDURES

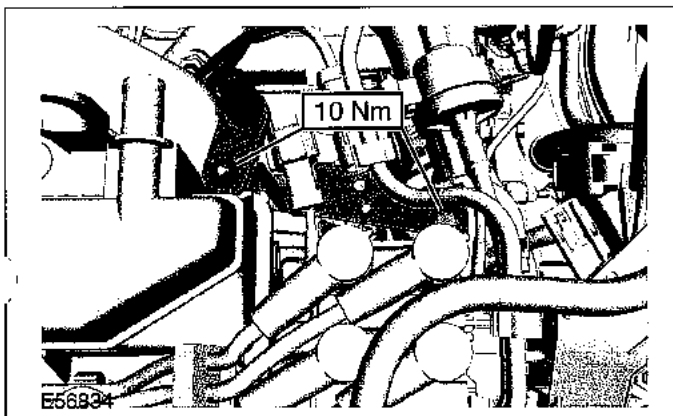
22. Using the special tool, connect the spark plug electrical connectors.



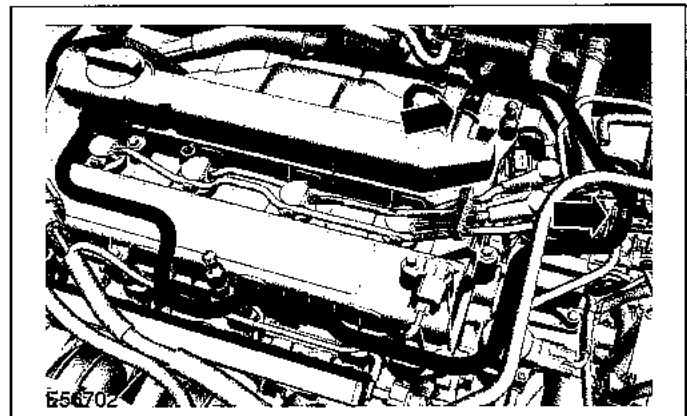
25. Connect the CMP sensor electrical connector.



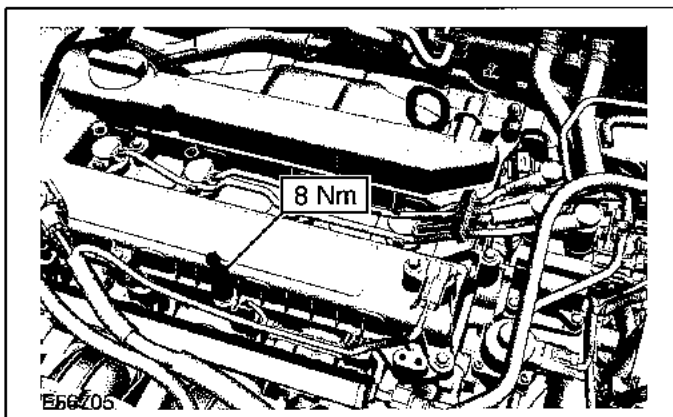
23. Install the evaporative emission (EVAP) valve support bracket.



26. Install the positive crankshaft ventilation (PCV) hose.

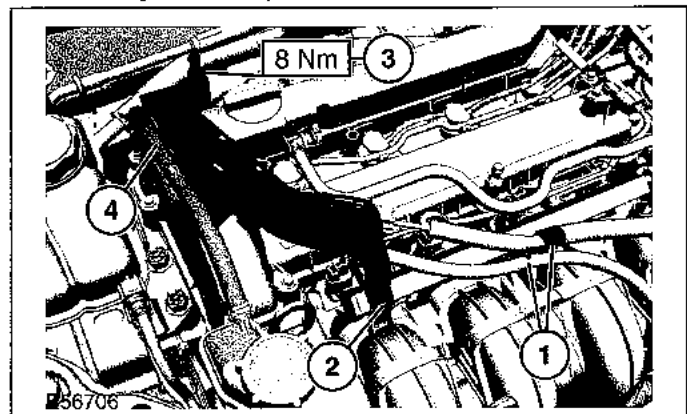


24. Install the air cleaner retaining bracket.



27. Attach the engine wiring harness to the valve cover.

1. Clip the engine wiring harness to the intake manifold.
2. Clip the engine wiring harness bracket to the intake manifold.
3. Install the air cleaner retaining bracket.
4. Clip the power steering return line to the engine wiring harness bracket.



GENERAL PROCEDURES**28. Install the air cleaner.**

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

29. Connect the battery ground cable.

For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

IN-VEHICLE REPAIR

Intake Manifold(21 183 0)

Removal

1. Disconnect the battery.

For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

2. Remove the air cleaner.

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

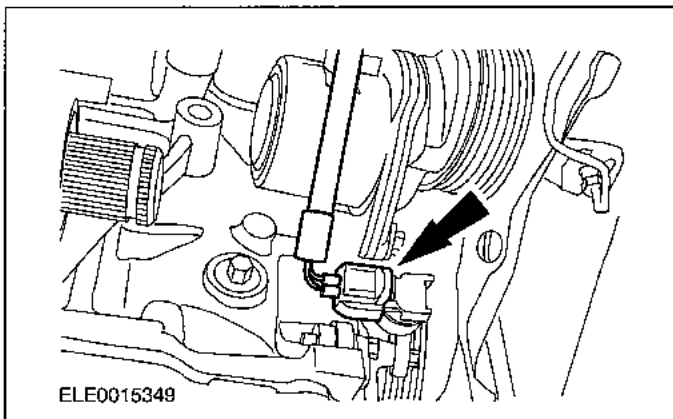
3. Remove the right-hand headlamp.

For additional information, refer to: **Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).**

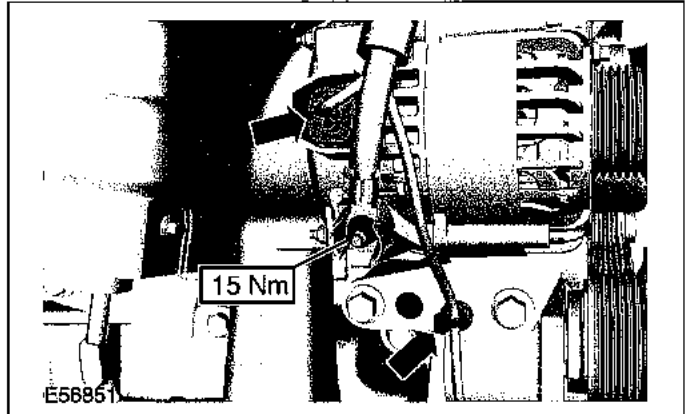
4. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

Jacking (Description and Operation), Lifting (Description and Operation).

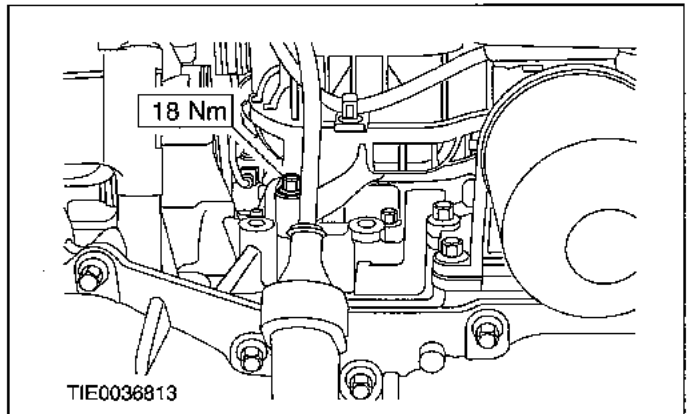
5. Disconnect the crankshaft position (CKP) sensor electrical connector.



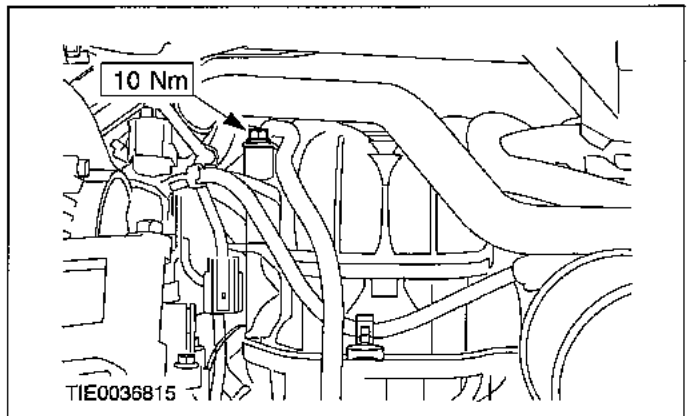
6. Disconnect the generator electrical connectors.



7. Remove the intake manifold lower retaining bolt.

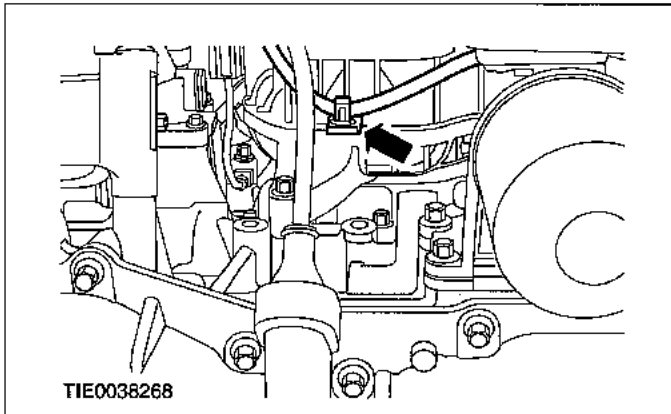


8. Remove the oil level indicator tube lower retaining bolt.

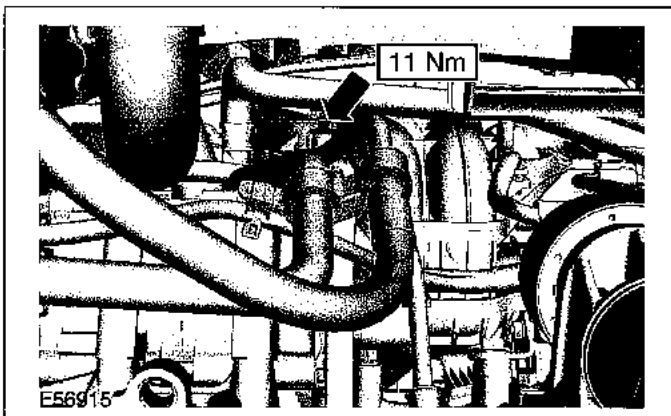


IN-VEHICLE REPAIR

9. Detach the wiring harness from the intake manifold.



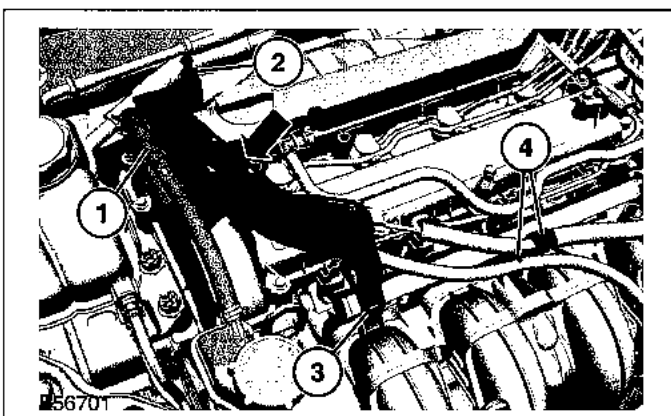
10. Detach the power steering supply line from the intake manifold.



11. Lower the vehicle.

12. Detach the engine wiring harness from the valve cover.

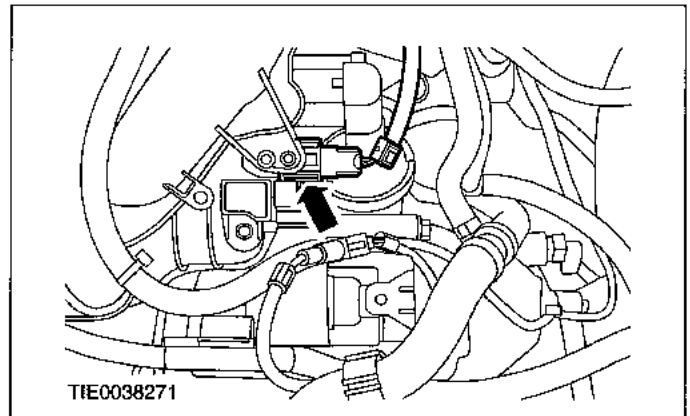
1. Unclip the power steering return line from the wiring harness bracket.
2. Remove the air cleaner retaining bracket.
3. Unclip the engine wiring harness bracket from the intake manifold.
4. Unclip the engine wiring harness from the intake manifold.



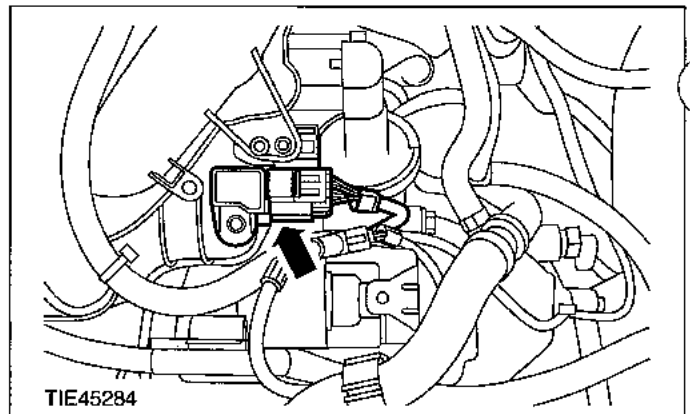
13. Remove the fuel rail.

For additional information, refer to: Fuel Rail (303-04 Fuel Charging and Controls - 2.0L Duratec-HE (MI4), Removal and Installation).

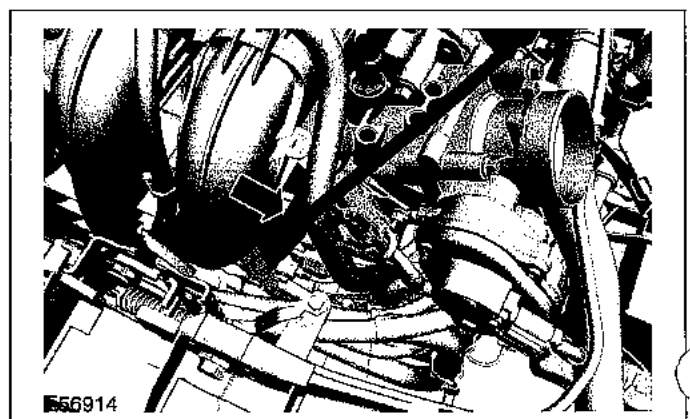
14. Detach the starter motor electrical connector from the intake manifold.



15. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.

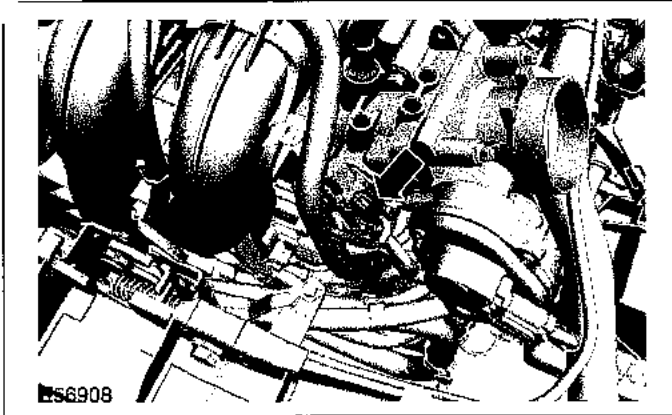


16. Detach the evaporative emission valve (EVAP) hose from the intake manifold.

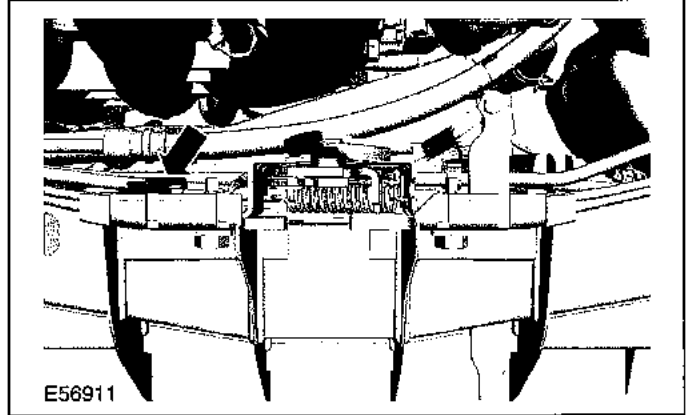


IN-VEHICLE REPAIR

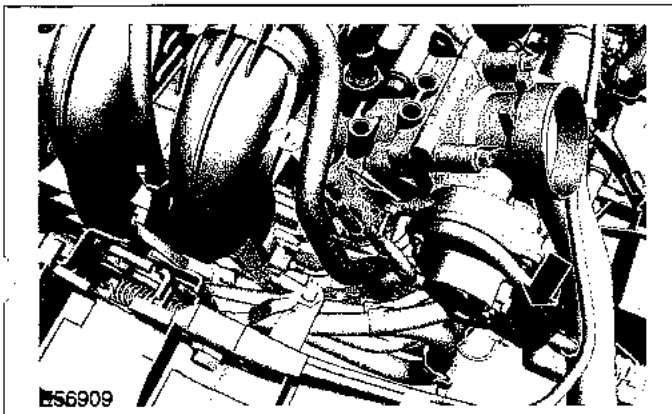
17. Disconnect the intake manifold runner control (IMRC) electrical connector.



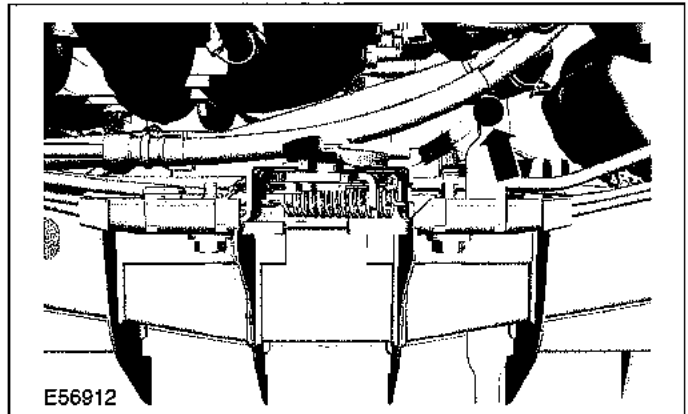
20. Disconnect the hood latch electrical connector.



18. Disconnect the throttle body electrical connector.

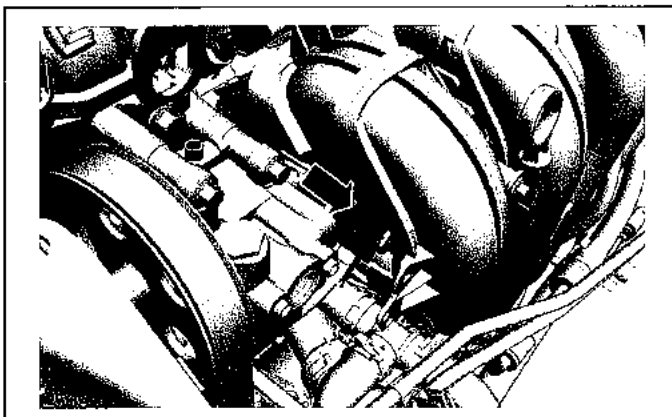


21. Remove the hood latch lever retaining bolt.

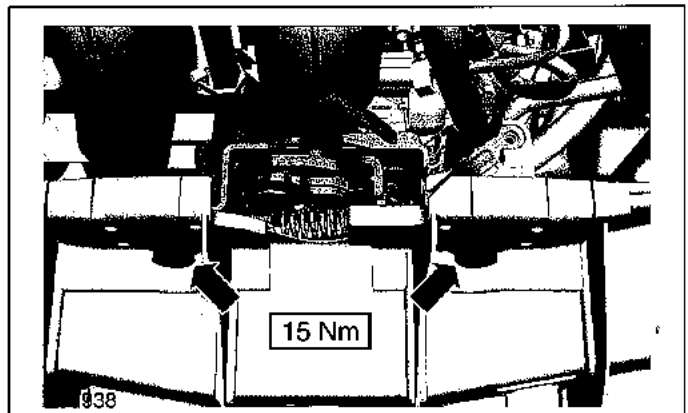


19. Disconnect the knock sensor (KS) electrical connector (power steering fluid reservoir shown removed for clarity).

- Detach the KS electrical connector from the intake manifold.

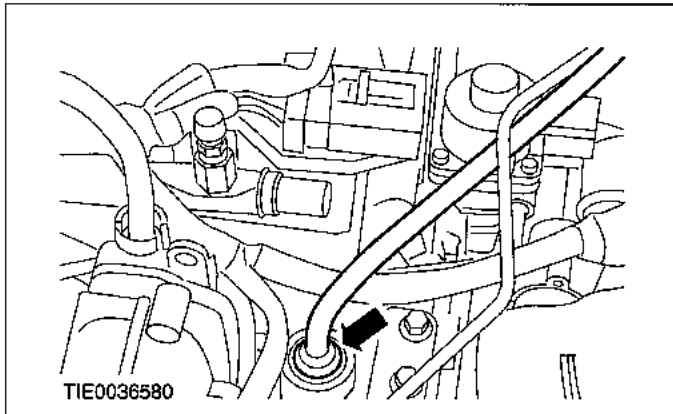


22. Detach the hood latch from the radiator grille opening panel reinforcement.

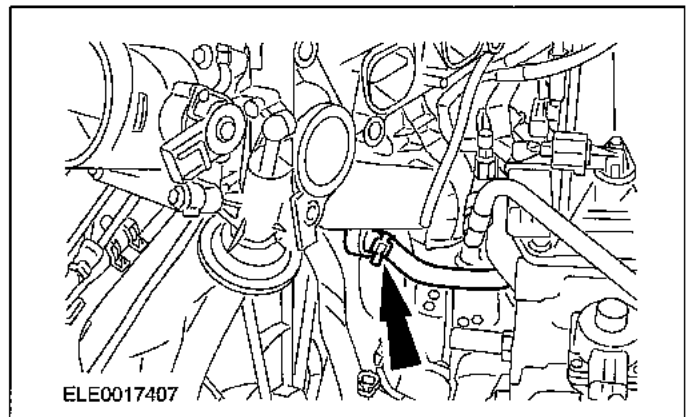


IN-VEHICLE REPAIR

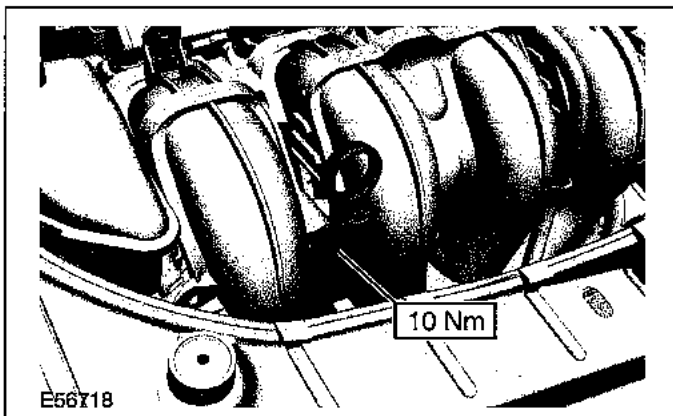
23. Disconnect the brake booster vacuum line from the intake manifold.



26. Disconnect the positive crankshaft ventilation (PCV) hose from the intake manifold.



24. Remove the oil level indicator and oil level indicator tube.



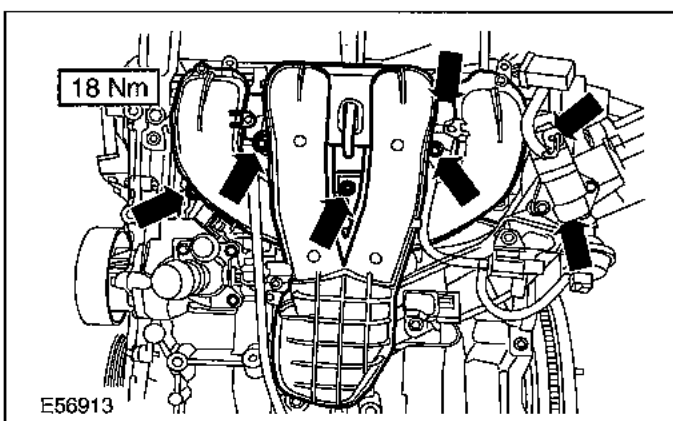
27. Remove the intake manifold.

Installation

1. **NOTE:** Install new gaskets if necessary.
To install, reverse the removal procedure.

25. Remove the intake manifold retaining bolts (engine shown removed for clarity).

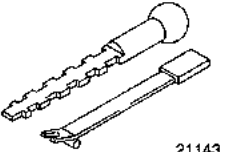
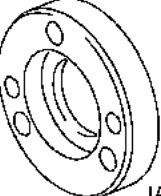
- Detach the intake manifold from the cylinder head.



IN-VEHICLE REPAIR

Crankshaft Front Seal(21 467 0)

Special Tool(s)

| | |
|--|---|
|  <p>21143</p> | <p>Remover, Crankshaft Seal 303-293 (21-143)</p> |
|  <p>IA21213</p> | <p>Remover, Vibration Damper Hub 303-509 (21-213)</p> |

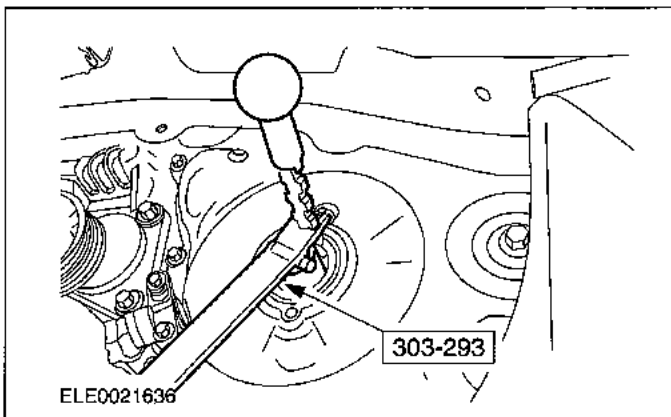
Removal

1. Remove the crankshaft pulley.

For additional information, refer to:
Crankshaft Pulley (303-01C, In-vehicle Repair).

2. Using the special tool, remove the crankshaft front seal.

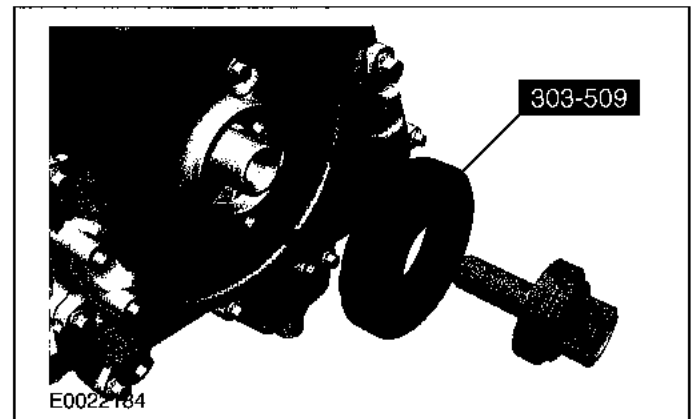
- Discard the seal.



Installation

1. **NOTE:**Install a new crankshaft front seal.

Using the special tool and the crankshaft pulley retaining bolt, install the crankshaft front seal (engine shown removed for clarity).



2. Remove the crankshaft pulley retaining bolt and the special tool.

- Discard the crankshaft pulley retaining bolt.

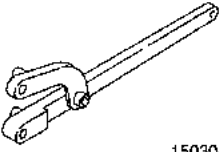
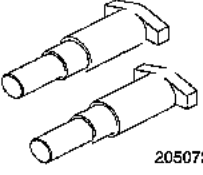
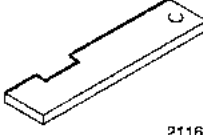
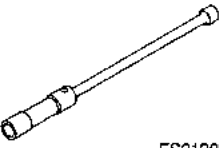
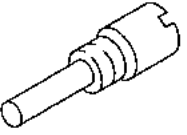
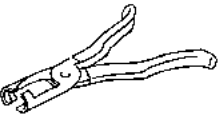
3. Install the crankshaft pulley.

For additional information, refer to:
Crankshaft Pulley (303-01C, In-vehicle Repair).

IN-VEHICLE REPAIR

Crankshaft Pulley(21 572 0)

Special Tool(s)

| | |
|--|---|
|  <p>15030A</p> | Flange Holding Wrench, Universal 205-072 |
|  <p>20507202</p> | Adapter for 205-072 205-072-02 |
|  <p>21162B</p> | Alignment Tool, Camshaft Alignment 303-376 |
|  <p>ES21202</p> | Socket, Spark Plug 303-499 |
|  <p>PZ21210</p> | Timing Peg, Crankshaft TDC position 303-507 |
|  <p>21211</p> | Pliers, Valve Stem Seal 303-508 (21-211) |

General Equipment

Bolt M6 x 18 mm

Materials

| Name | Specification |
|------------------|---------------|
| Silicone sealant | WSE-M4G323-A4 |

Removal

1. Disconnect the battery.

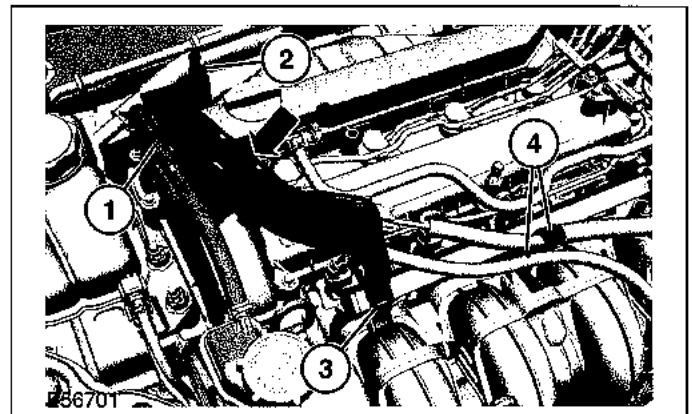
For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

2. Remove the air cleaner.

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (M14) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

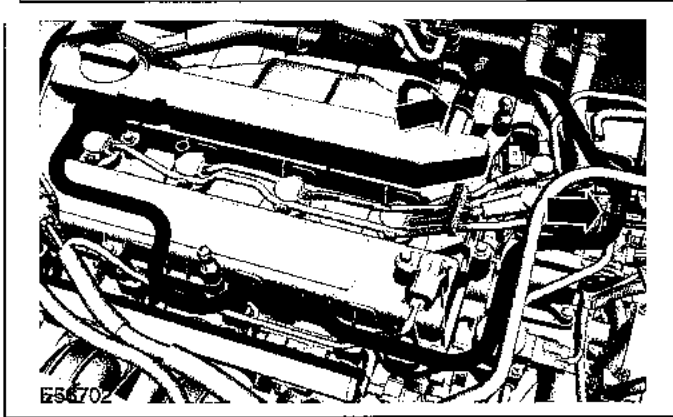
3. Detach the engine wiring harness from the valve cover.

1. Unclip the power steering fluid return line from the retaining clips.
2. Remove the air cleaner retainer.
3. Unclip the engine wiring harness bracket at the intake pipe.
4. Unclip the engine wiring harness at the intake pipe.

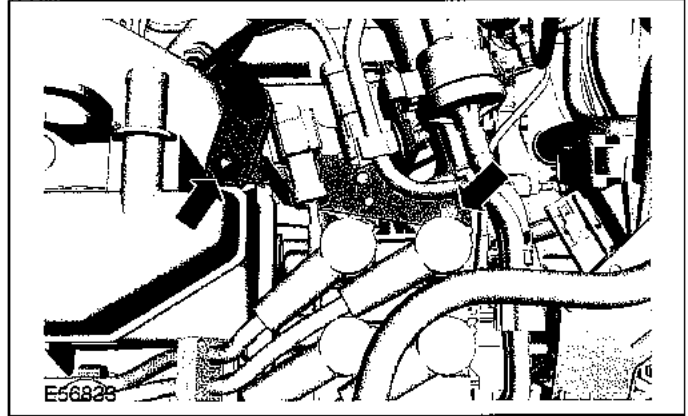


IN-VEHICLE REPAIR

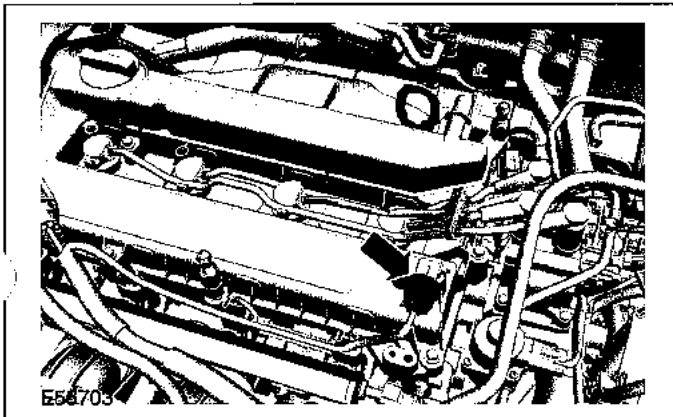
4. Detach the positive crankcase ventilation (PCV) hose from the valve cover.



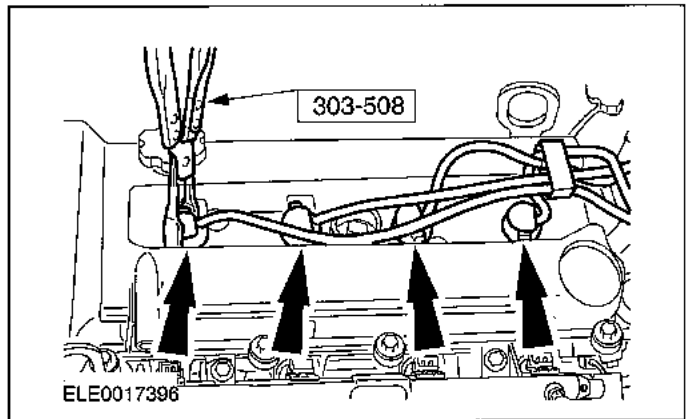
7. Remove the EVAP valve bracket.



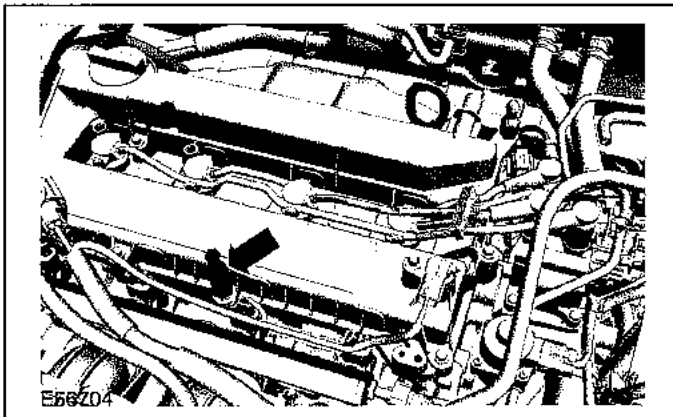
5. Disconnect the camshaft position sensor (CMP sensor) electrical connector.



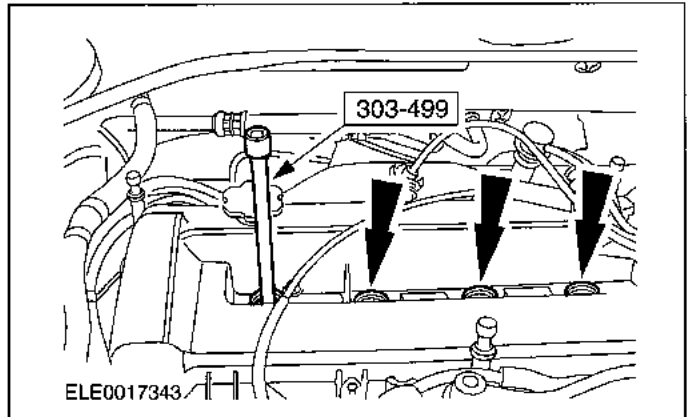
8. Using the special tool, disconnect the spark plug electrical connectors.



6. Remove the air cleaner retainer.

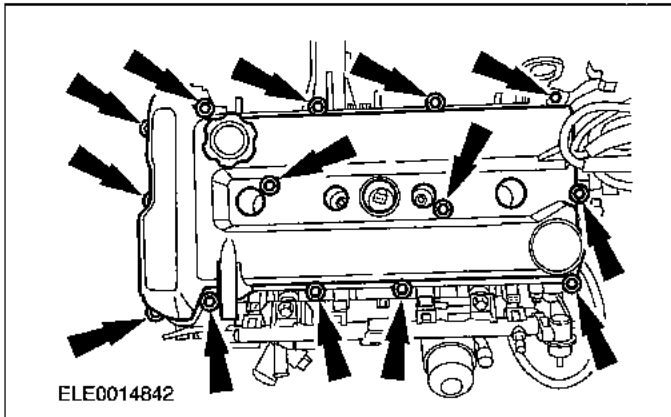


9. Using the special tool, remove the spark plugs.



IN-VEHICLE REPAIR

10. Remove the valve cover.

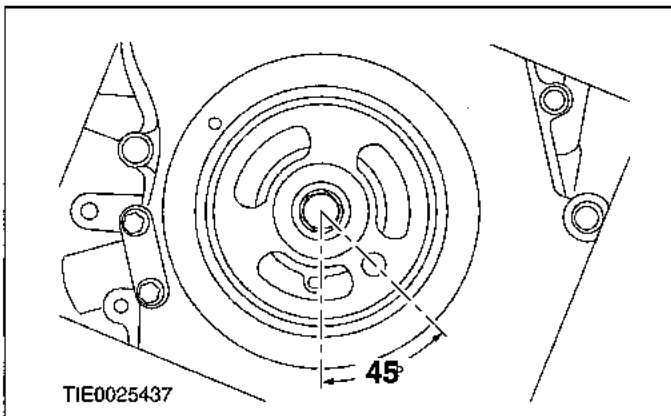


11. Remove the drive belt.

For additional information, refer to:
Accessory Drive Belt - 2.0L Duratec-HE
(MI4) (303-05 Accessory Drive, Removal
and Installation).

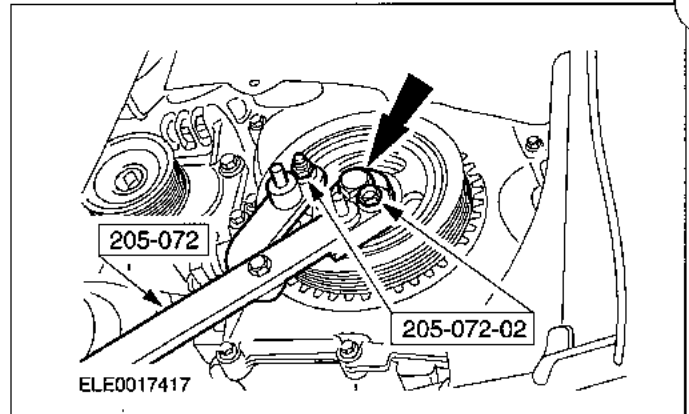
12. **NOTE:** Only rotate the crankshaft in the
normal direction of rotation.

Rotate the crankshaft until piston no. 1 is
approx. 45 degrees before TDC.



13. **NOTE:** Do not discard the crankshaft pulley
bolt.

Using the special tool, remove the crankshaft
pulley.

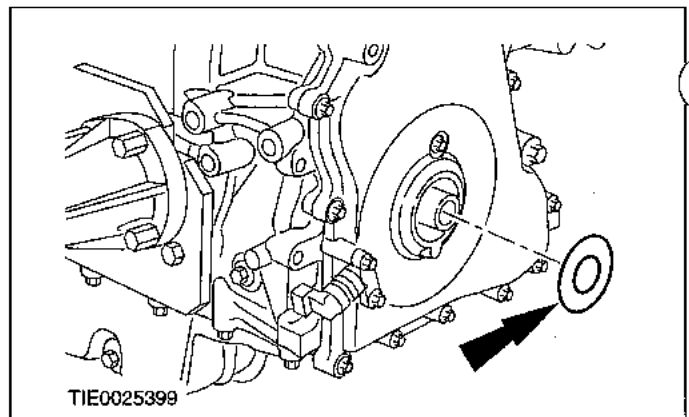


14. Remove the crankshaft front seal.

For additional information, refer to:
Crankshaft Front Seal (303-01 Engine -
2.0L Duratec-HE (MI4), In-vehicle Repair).

15. Remove the front friction washer (engine
shown removed for clarity).

- Discard the friction washer.

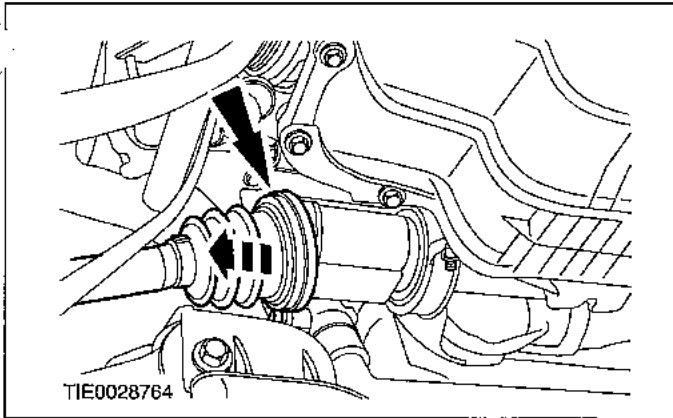


16. **NOTE:** Do not damage the inner constant
velocity (CV) joint boot.

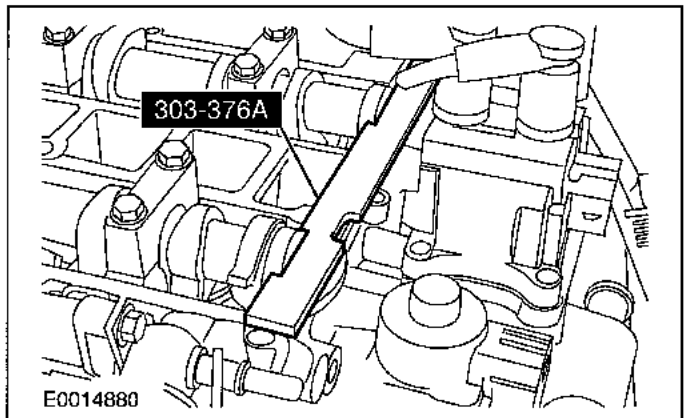
Pull the inner CV joint boot off the
intermediate shaft.

IN-VEHICLE REPAIR

- Remove and discard the CV joint boot clamp.



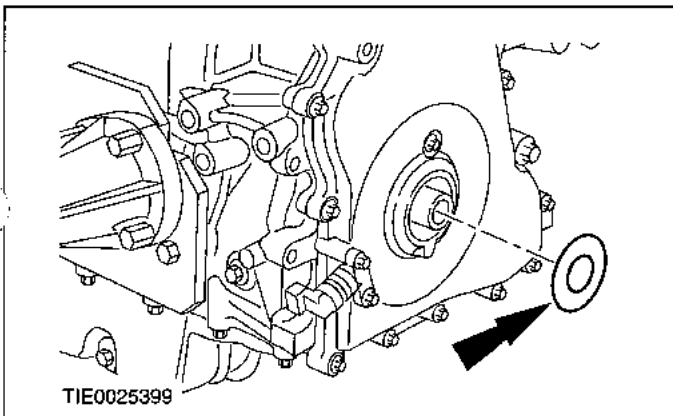
- Install the special tool.



Installation

- NOTE:** Install a new front friction washer.

Install the front friction washer (engine shown removed for clarity).



- Install the crankshaft front seal.

For additional information, refer to: Crankshaft Front Seal (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

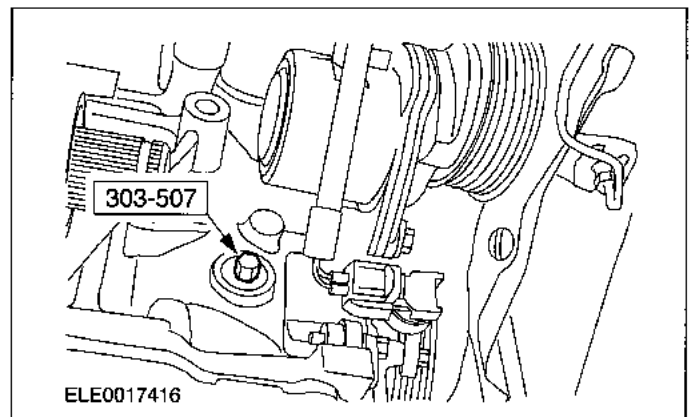
- Lower the vehicle.
- NOTE:** Only rotate the camshafts in the normal direction of rotation.

Carefully rotate the camshafts using a spanner until the cams of cylinder no. 4 are positioned at the valve overlap.

- Raise the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

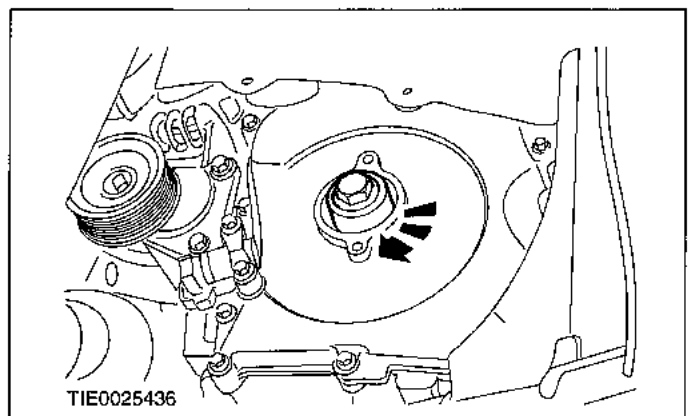
Jacking (Description and Operation), Lifting (Description and Operation).

- Remove the cylinder block lower blanking plug and install the special tool.



- NOTE:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft using the crankshaft pulley bolt until the crankshaft contacts the special tool.



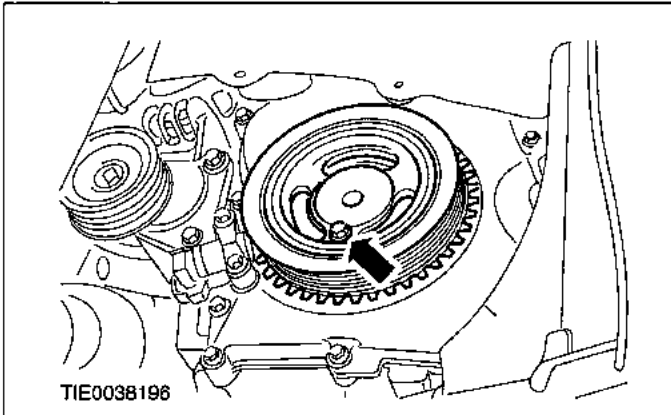
IN-VEHICLE REPAIR

9. Remove the crankshaft pulley bolt.

- Discard the bolt.

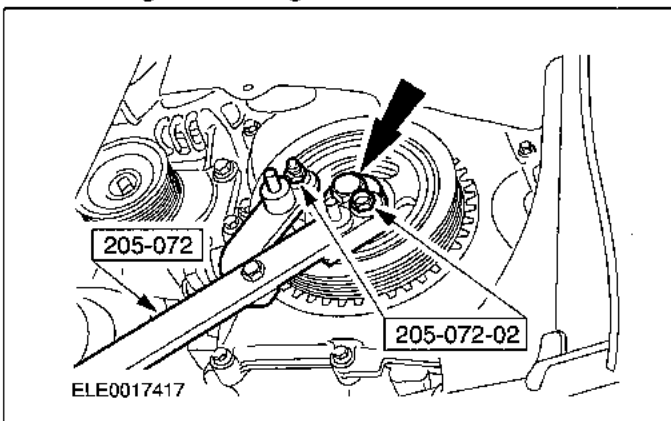
10. **CAUTION:** Tighten M6 x 18 mm bolt hand-tight only.

Install the crankshaft pulley and fasten to the engine front cover with an M6 x 18 mm bolt.

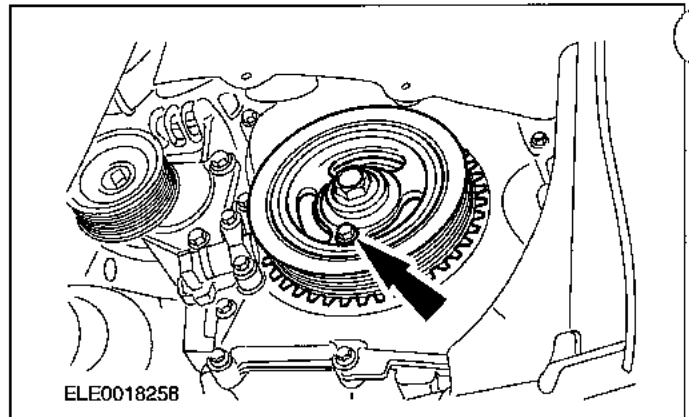
11. **NOTE:** Install a new crankshaft pulley bolt.

Counterhold the crankshaft pulley using the special tools and tighten the crankshaft pulley bolt.

- Tighten the bolt in two stages.
- Stage 1: 100 Nm.
- Stage 2: 90 degrees.

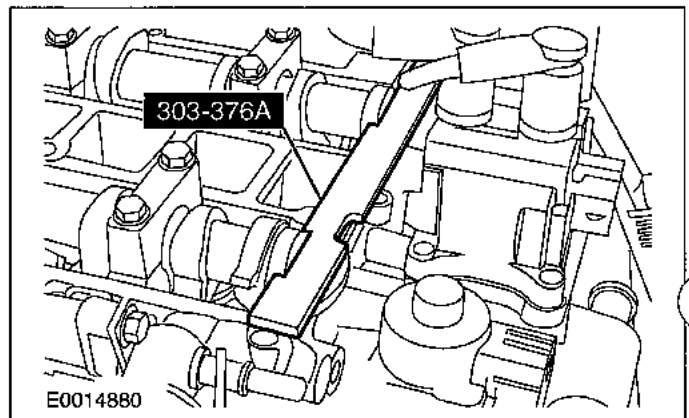


12. Remove the M6 x 18 mm bolt.



13. Lower the vehicle.

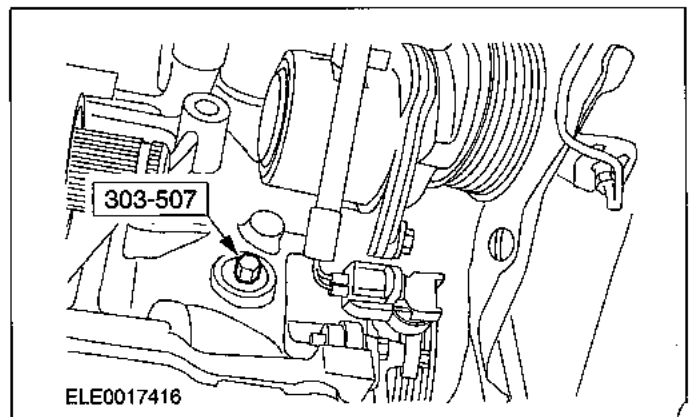
14. Remove the special tool.



15. Raise the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

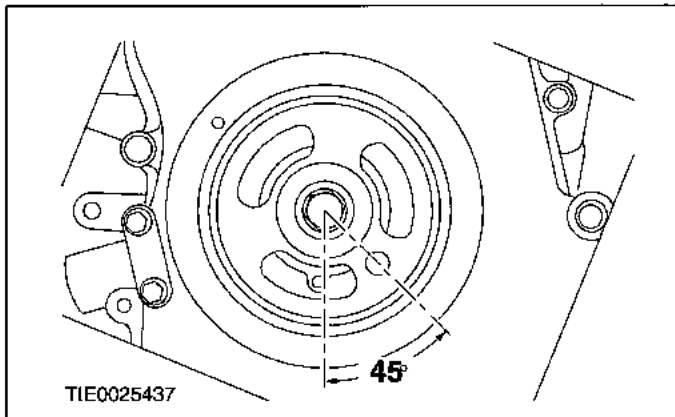
Jacking (Description and Operation),
Lifting (Description and Operation).

16. Remove the special tool.

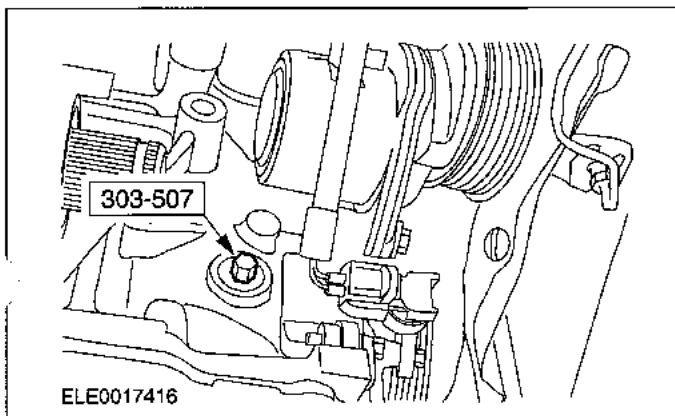
17. **NOTE:** Only rotate the crankshaft in the normal direction of rotation.

IN-VEHICLE REPAIR

Rotate the crankshaft one and three quarters of a rotation until piston no. 1 is approx. 45 degrees before TDC.



18. Install the special tool.



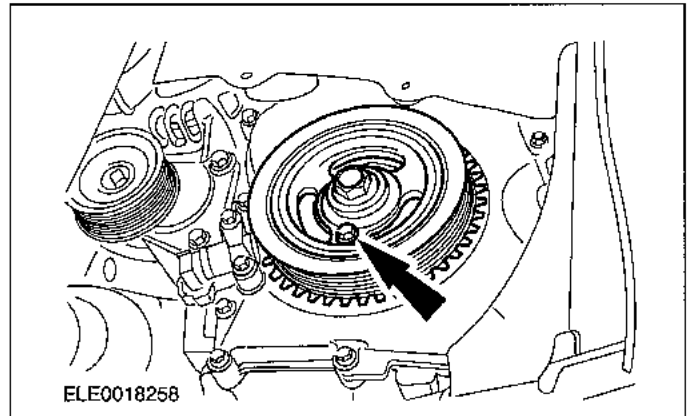
19. **NOTE:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until no. 1 piston is at TDC.

20. **CAUTION:** Tighten the M6 x 18 mm bolt finger-tight only.

NOTE: If the M6 x 18 mm bolt cannot be installed, correct the valve timing.

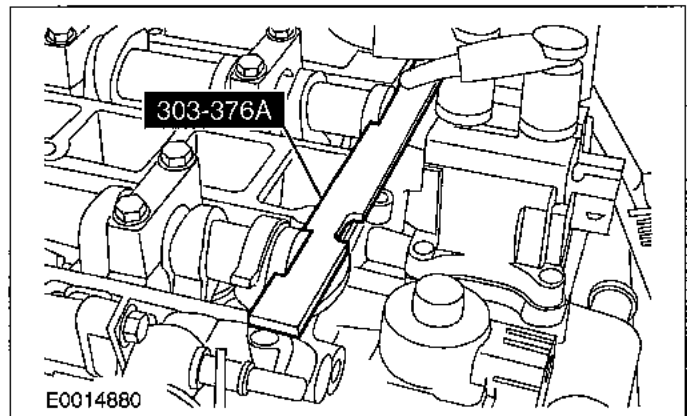
Check the position of the crankshaft pulley using the M6 x 18 mm bolt.



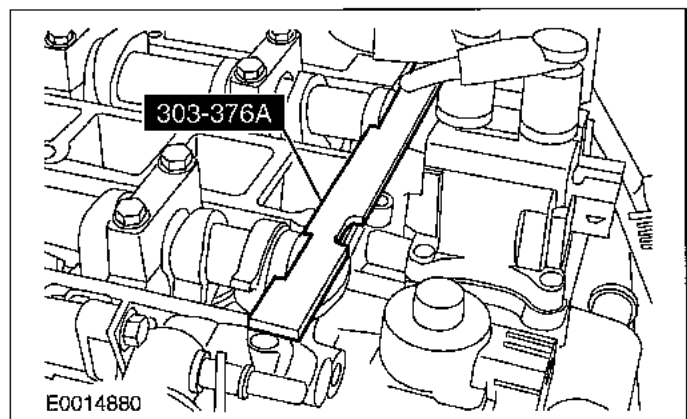
21. Lower the vehicle.

22. **NOTE:** If the special tool cannot be attached, correct the valve timing.

Check the position of the camshafts using the special tool.



23. Remove the special tool.

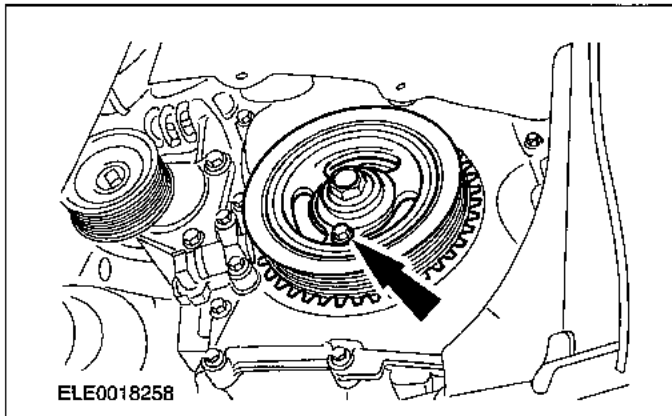


IN-VEHICLE REPAIR

24. Raise the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

Jacking (Description and Operation),
Lifting (Description and Operation).

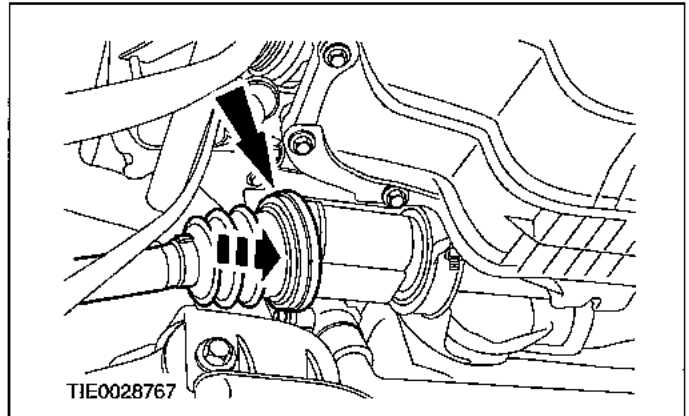
25. Remove the M6 x 18 mm bolt.



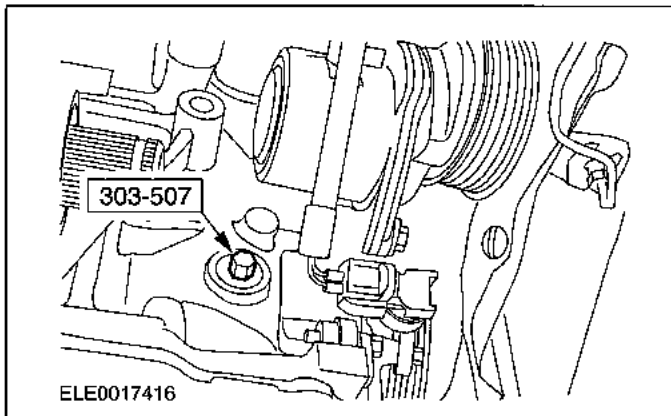
NOTE: Make sure that the contact surface for the CV joint boot on the intermediate shaft is clean.

Slide the inner CV joint boot onto the intermediate shaft.

- Use a suitable screwdriver under the boot to allow air to escape.

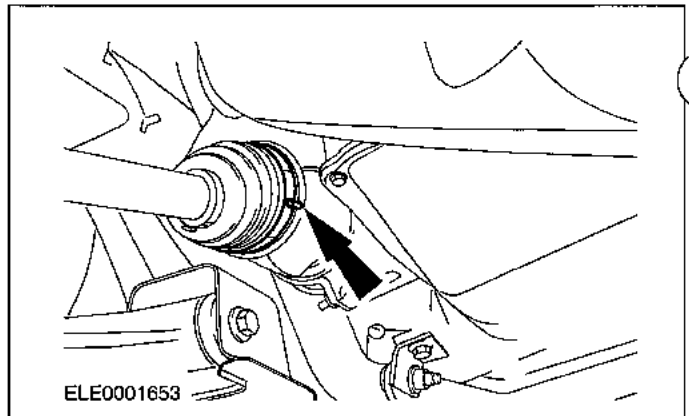


26. Remove the special tool.

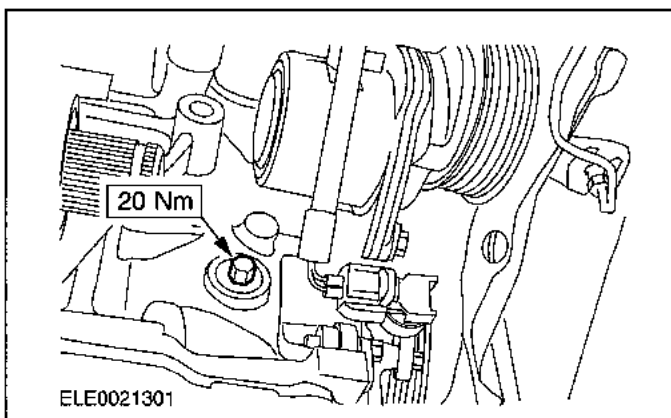


29. **NOTE:** Install a new boot clamp.

Using a suitable grip wrench, install the inner CV joint boot clamp.



27. Install the cylinder block lower blanking plug.



30. **NOTE:** When installing a new engine front cover, the crankshaft position sensor (CKP sensor) must be aligned using the tool supplied.

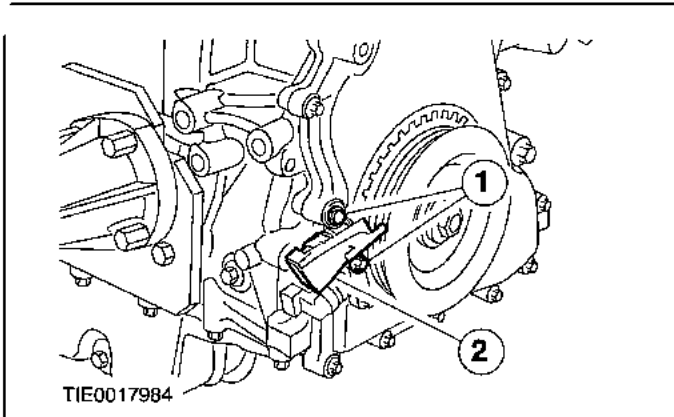
Align the CKP sensor (engine shown removed for clarity).

1. Loosen the CKP sensor bolts.

28. **NOTE:** Do not damage the boot of the inner CV joint.

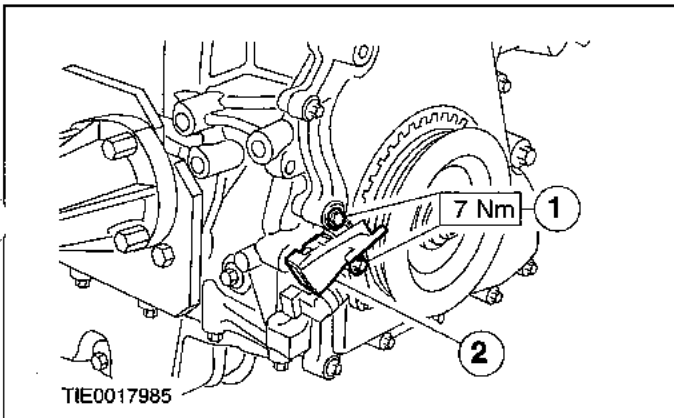
IN-VEHICLE REPAIR

2. Insert the tool supplied so that it engages with the teeth of the crankshaft pulley.



- 31. Install the CKP sensor (engine shown removed for clarity).**

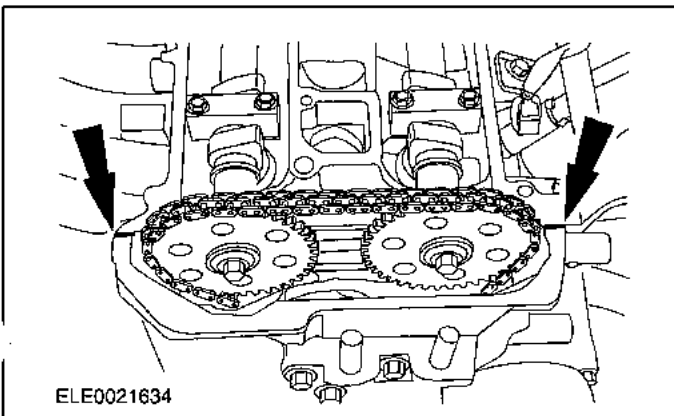
1. Install the CKP sensor bolts.
2. Remove the tool.



- 32. Install the drive belt.**

For additional information, refer to:
Accessory Drive Belt - 2.0L Duratec-HE (MI4) (303-05 Accessory Drive, Removal and Installation).

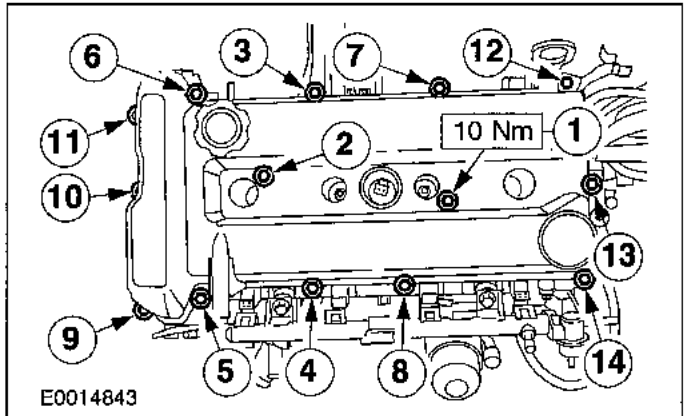
- 33. Apply sealant thinly on the areas shown.**



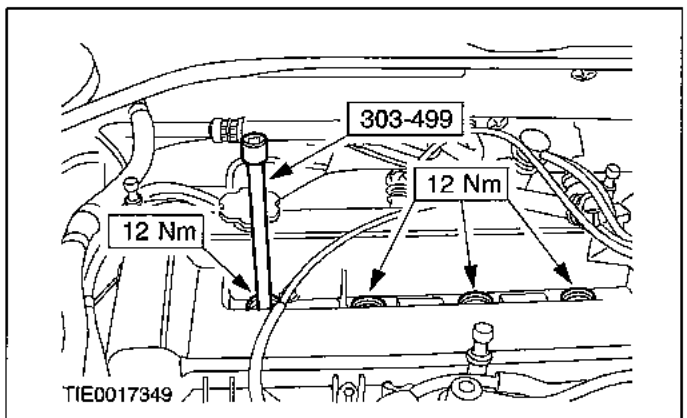
- 34. NOTE:** If necessary, install a new valve cover gasket.

Install the valve cover.

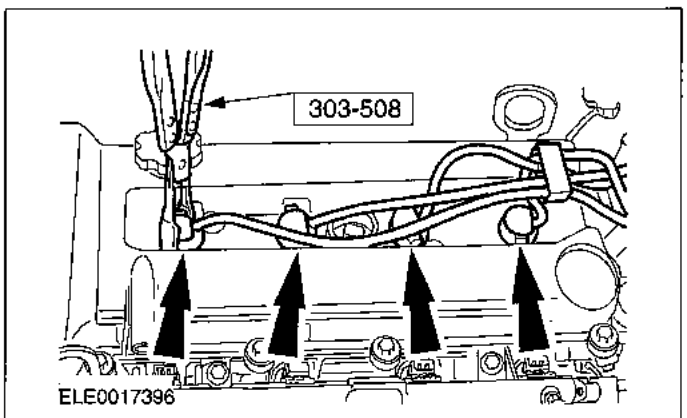
- Tighten the bolts in the sequence shown.



- 35. Using the special tool, install the spark plugs.**

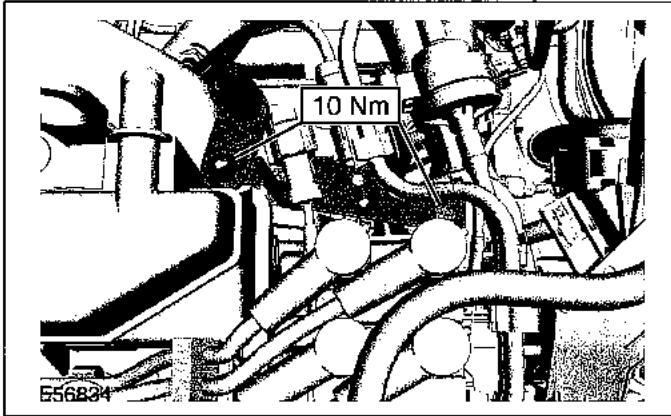


- 36. Using the special tool, connect the spark plug connectors.**

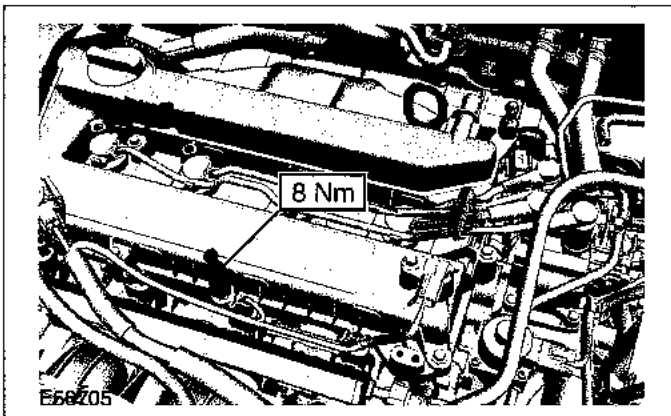


IN-VEHICLE REPAIR

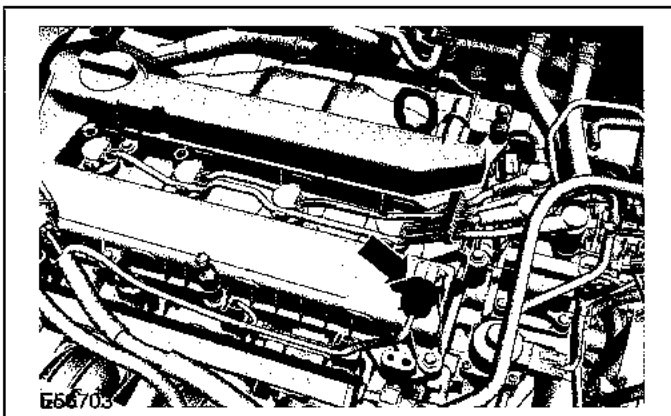
37. Install the EVAP valve bracket.



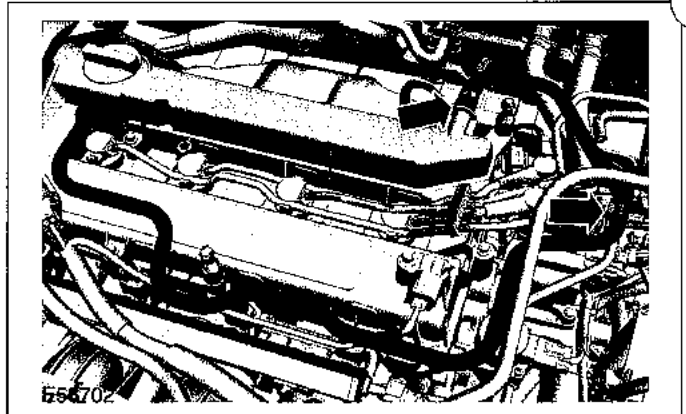
38. Install the air cleaner retainer.



39. Connect the camshaft position (CMP) sensor connector.

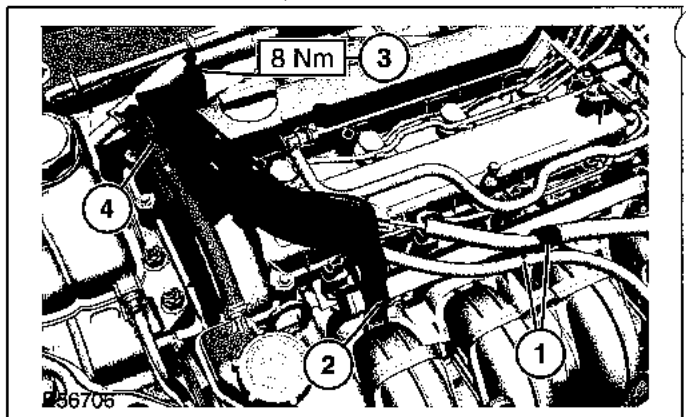


40. Attach the positive crankcase ventilation (PCV) hose to the valve cover.



41. Attach the engine wiring harness to the valve cover.

1. Clip on the engine wiring harness at the intake pipe.
2. Clip on the engine wiring harness bracket at the intake pipe.
3. Install the air cleaner retainer.
4. Connect the power steering fluid return line to the retaining clip.



42. Install the air cleaner.

For additional information, refer to: Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

43. Connect the battery ground cable.

For additional information, refer to: Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).

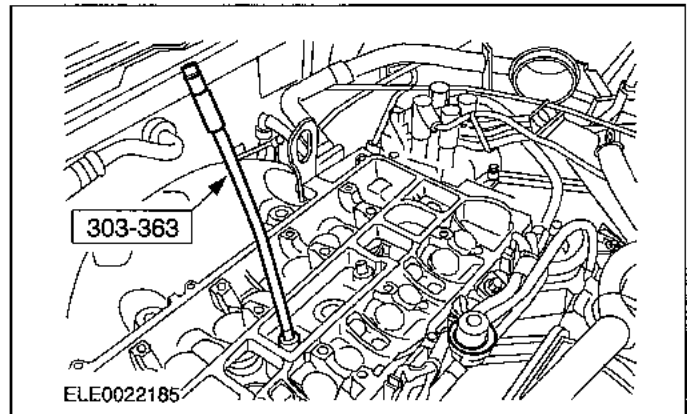
IN-VEHICLE REPAIR

Valve Seals(21 238 0)

Special Tool(s)

| | |
|-----------------|---|
| <p>21155</p> | Compressor, Valve Spring 303-361A (21-155A) |
| <p>2115502A</p> | Adapter for 303-361A 303-361-02 (21-155-02A) |
| <p>21156</p> | Installer, Valve Stem Collets 303-362 (21-156) |
| <p>21157</p> | Adapter, Air Supply (Cylinder Head) 303-363 (21-157) |
| <p>21165</p> | Pliers, Valve Stem Seal 303-508 (21-165) |

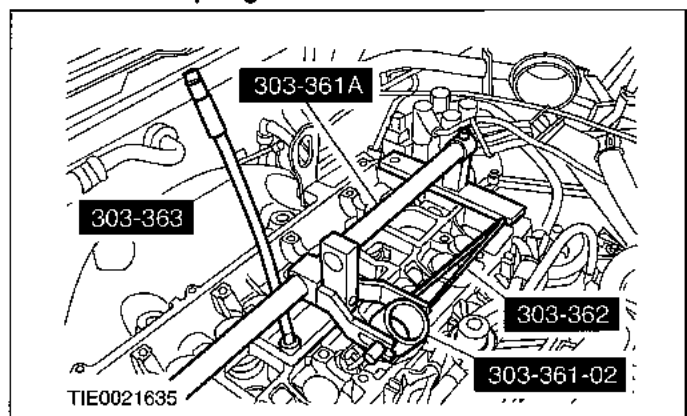
2. Using the special tool, apply 7 to 10 bar of compressed air into the cylinder.



3. Remove the valve tappets and keep them in order for reassembly.

4. Using the special tools, remove the valve springs.

- Compress the valve spring.
- Remove the valve collets.
- Release the valve spring.
- Remove the valve spring retainer and the valve spring.



5. Using the special tool, remove the valve seals.

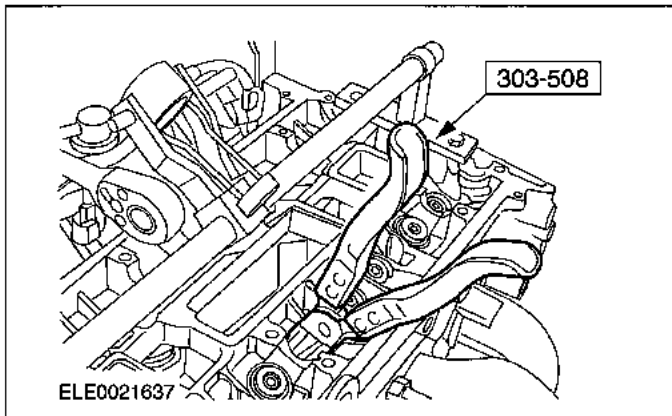
Removal

1. Remove the camshafts.

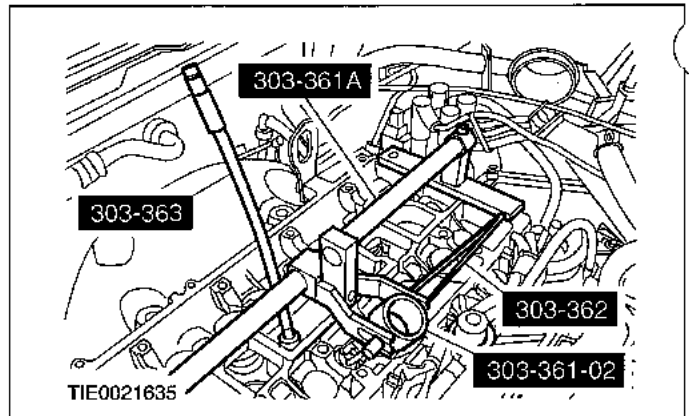
For additional information, refer to:
Camshafts (303-01 Engine - 2.0L
Duratec-HE (M14), In-vehicle Repair).

IN-VEHICLE REPAIR

- Discard the valve seals.



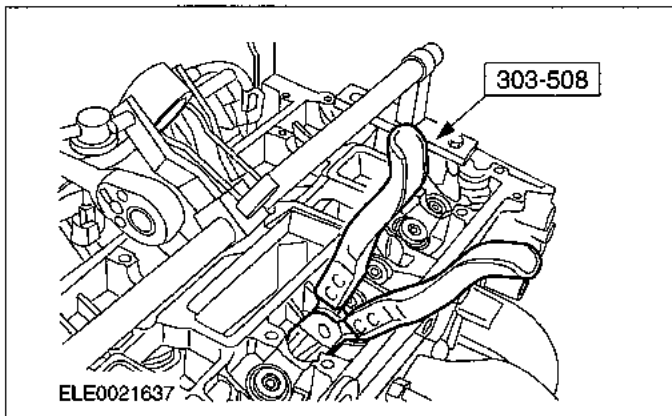
- Release the valve spring.

**Installation****1. NOTE: Install new valve seals.**

NOTE: Cover the valve collet groove on the valve stem with a protective sleeve.

Using the special tool, install the valve seals.

- Remove the protective sleeve.

**3. Remove the special tools.****4. Install the valve tappets.****5. Install the camshafts.**

For additional information, refer to:
Camshafts (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

2. Using the special tools, install the valve springs.

- Install the valve spring retainer and the valve spring.
- Compress the valve spring.
- Install the valve collets.

IN-VEHICLE REPAIR

Valves(21 215 4)

Special Tool(s)

| | |
|-----------------|---|
| <p>21155</p> | <p>Compressor, Valve Spring 303-361A (21-155A)</p> |
| <p>2115502A</p> | <p>Adapter for 303-361A 303-361-02 (21-155-02A)</p> |
| <p>21156</p> | <p>Installer, Valve Stem Collets 303-362 (21-156)</p> |
| <p>21165</p> | <p>Pliers, Valve Stem Seal 303-508 (21-165)</p> |

Removal

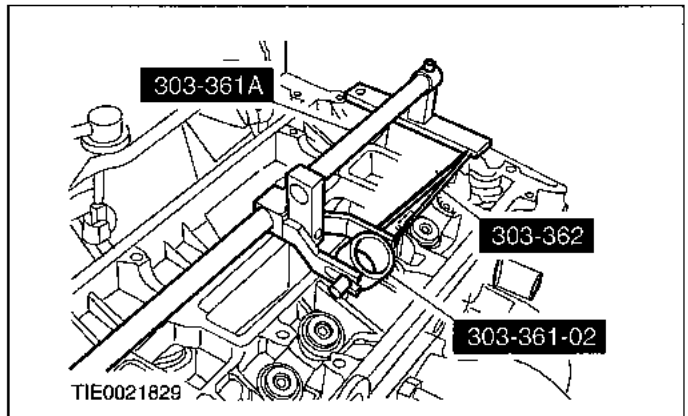
1. Remove the cylinder head.

For additional information, refer to: **Cylinder Head (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).**

2. Using the special tools, remove the valve springs.

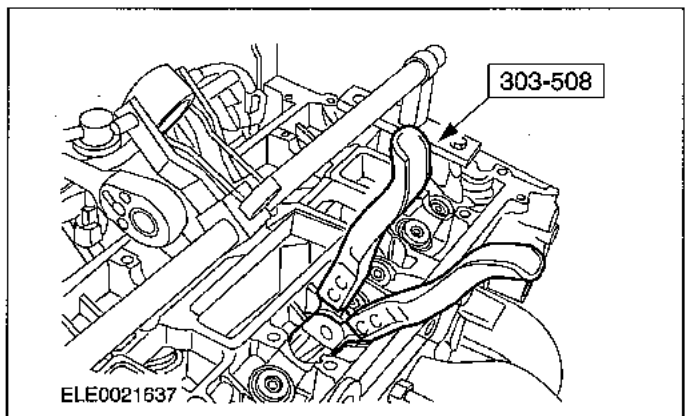
- Compress the valve spring.
- Remove the valve collets.
- Release the valve spring.

- Remove the valve spring retainer and the valve spring.



3. Using the special tool, remove the valve seals.

- Discard the valve seals.



4. Remove the valves.

Installation

1. Install the valves.

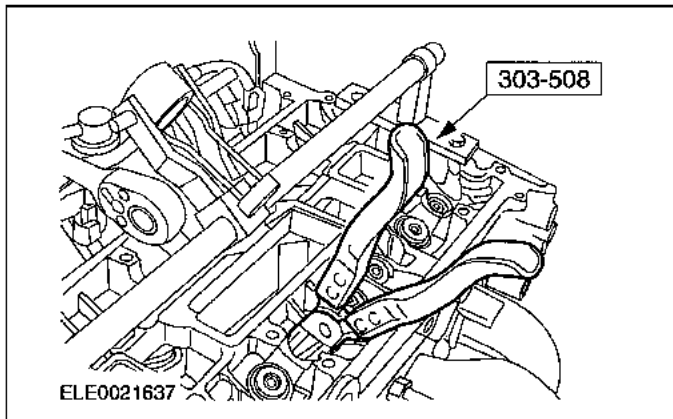
2. NOTE:Install new valve seals.

NOTE:Cover the valve collet groove on the valve stem with a protective sleeve.

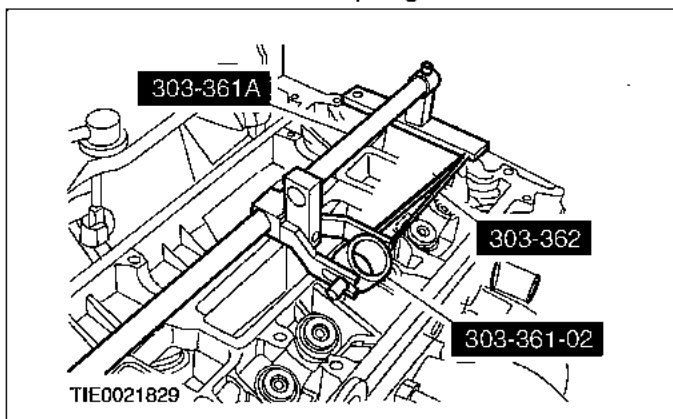
Using the special tool, install the valve seals.

IN-VEHICLE REPAIR

- Remove the protective sleeve.

**3. Using the special tools, install the valve springs.**

- Install the valve spring retainer and the valve spring.
- Compress the valve spring
- Install the valve collets.
- Release the valve spring.

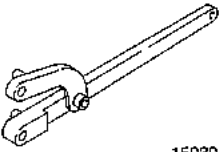
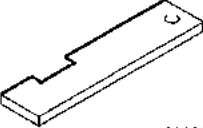
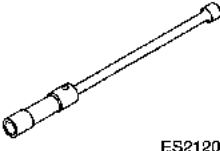
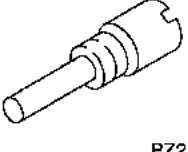
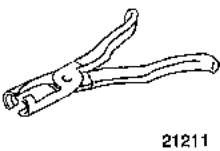
**4. Remove the special tools.****5. Install the cylinder head.**

For additional information, refer to: **Cylinder Head (303-01 Engine - 2.0L Duratec-HE (M14), In-vehicle Repair).**

IN-VEHICLE REPAIR

Camshafts(21 284 0)

Special Tool(s)

| | |
|--|--|
|  <p>15030A</p> | <p>Universal Flange Holding Wrench 205-072</p> |
|  <p>21162B</p> | <p>Alignment Plate, Camshaft 303-376A</p> |
|  <p>ES21202</p> | <p>Socket, Spark Plug 303-499</p> |
|  <p>PZ21210</p> | <p>Timing Peg, Crankshaft TDC 303-507</p> |
|  <p>21211</p> | <p>Pliers, Valve Stem Seal 303-508</p> |

General Equipment

M6 x 18 mm bolt

M6 x 25 mm bolt

Materials

| Name | Specification |
|------------------|---------------|
| Hypoid Gear Oil | SQM-2C9002-AA |
| Silicone Sealant | WSE-M4G323-A4 |

Removal

1. Disconnect the battery ground cable.

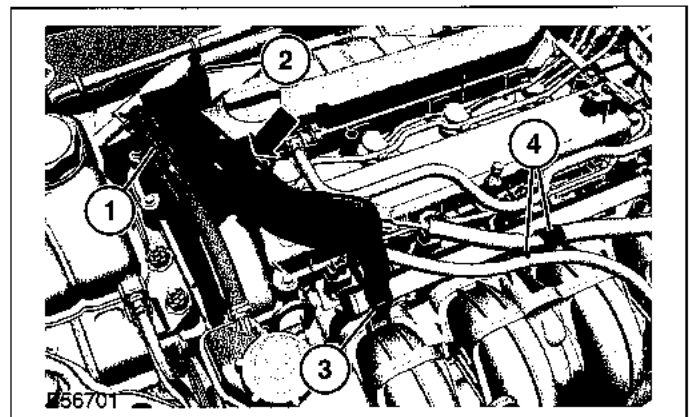
For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

2. Remove the air cleaner.

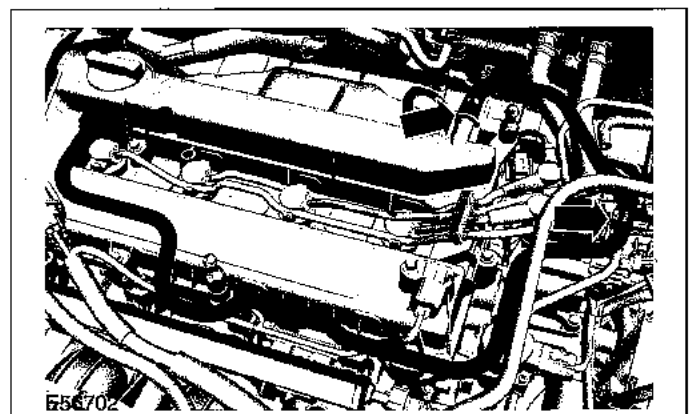
For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

3. Detach the engine wiring harness from the valve cover.

1. Unclip the power steering return line from the engine wiring harness bracket.
2. Remove the air cleaner retaining bracket.
3. Unclip the engine wiring harness bracket from the intake manifold.
4. Unclip the engine wiring harness from the intake manifold.

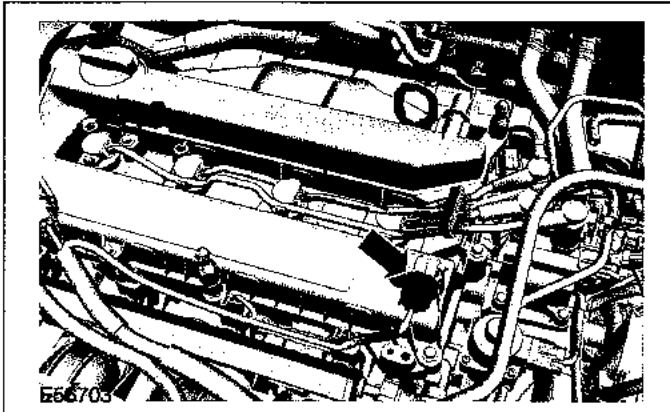


4. Remove the positive crankshaft ventilation (PCV) hose.

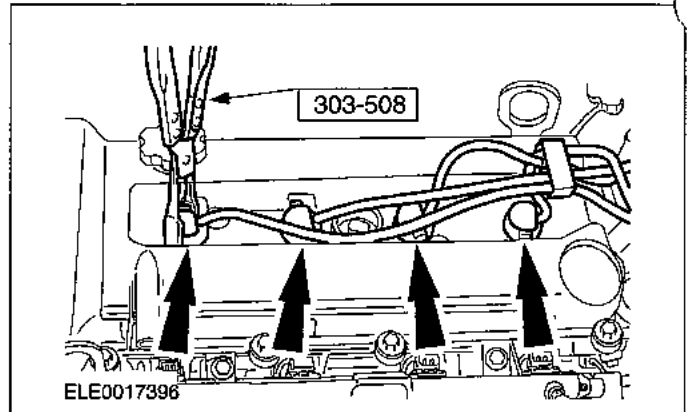


IN-VEHICLE REPAIR

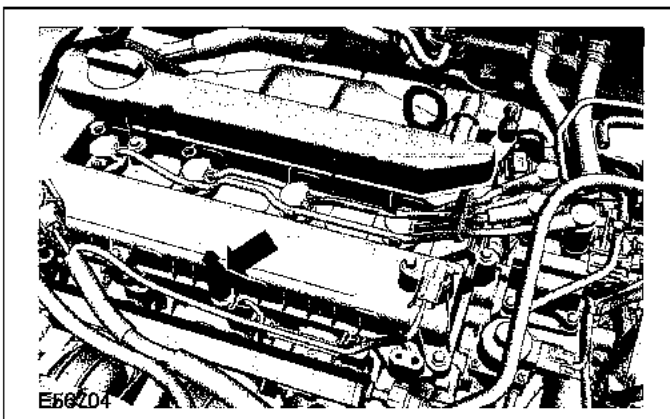
5. Disconnect the camshaft position (CMP) sensor electrical connector.



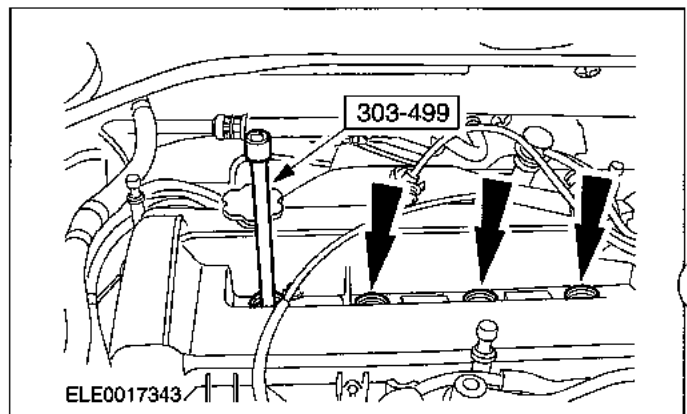
8. Using the special tool, disconnect the spark plug electrical connectors.



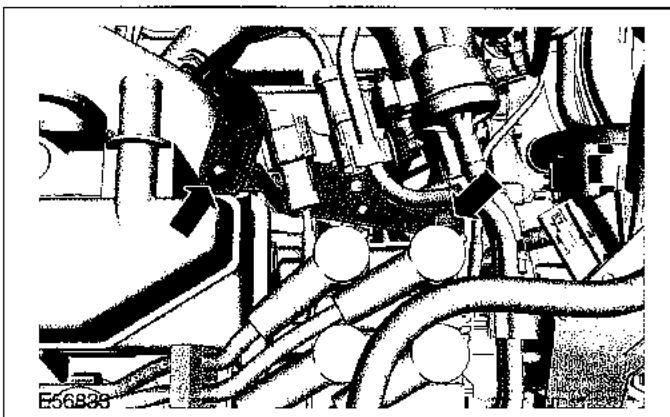
6. Remove the air cleaner retaining bracket.



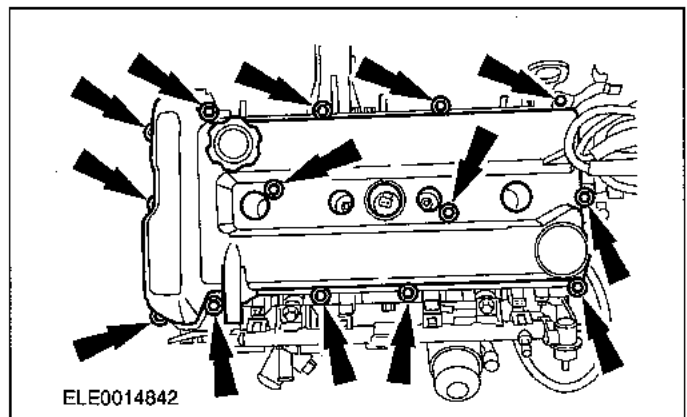
9. Using the special tool, remove the spark plugs.



7. Remove the evaporative emission (EVAP) valve support bracket.



10. Remove the valve cover.



11. Remove the accessory drive belt.

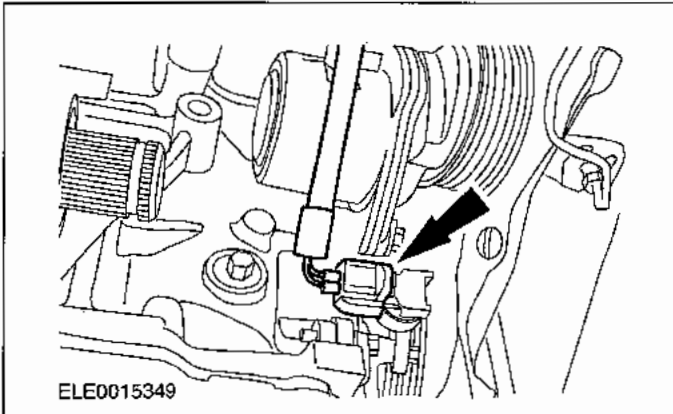
For additional information, refer to:
Accessory Drive Belt - 2.0L Duratec-HE (M14) (303-05 Accessory Drive, Removal and Installation).

IN-VEHICLE REPAIR

12. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

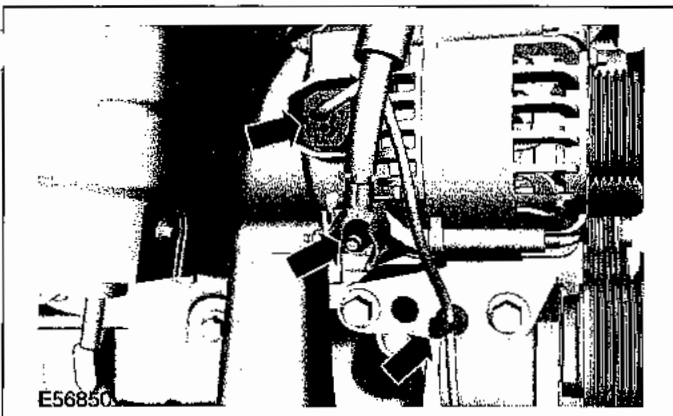
Jacking (Description and Operation),
Lifting (Description and Operation).

13. Disconnect the crankshaft position (CKP) sensor electrical connector.



14. Disconnect the generator electrical connectors.

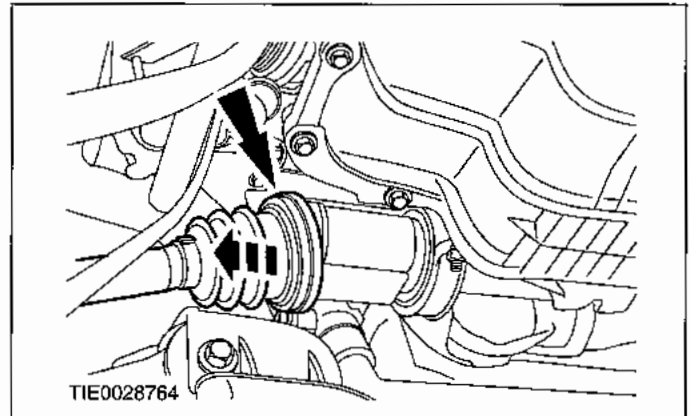
- Unclip the wiring harness.



15. **NOTE:** Do not damage the inner constant velocity (CV) joint boot.

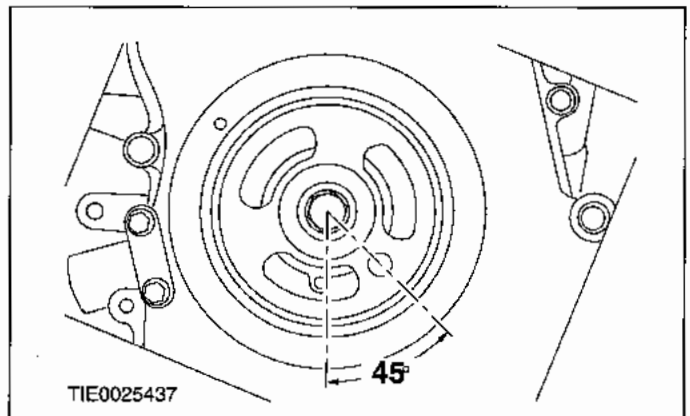
Detach the inner CV joint boot from the intermediate shaft.

- Remove and discard the constant velocity (CV) joint boot clamp.

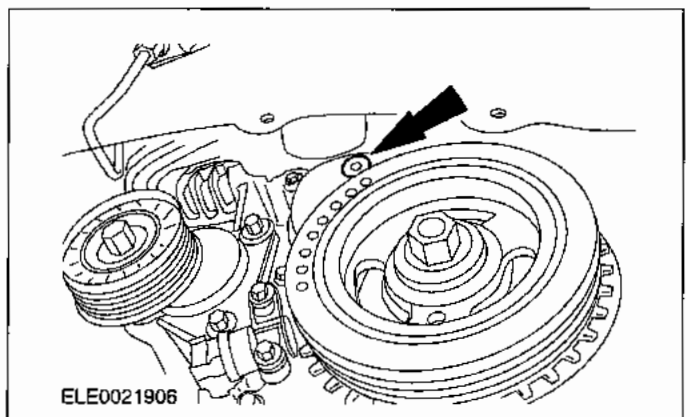


16. **NOTE:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until piston No. 1 is approximately 45 degrees before top dead center (BTDC).

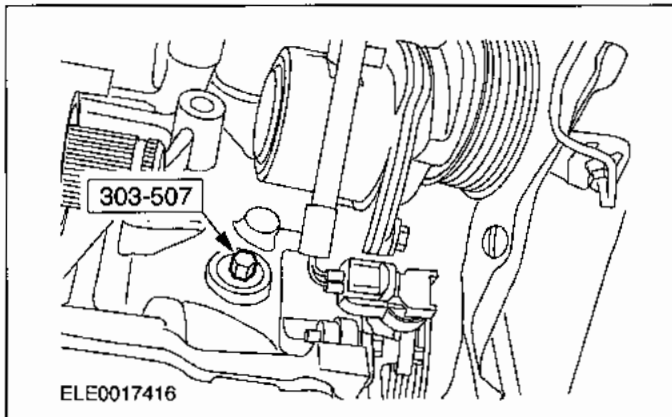


17. Remove the engine front cover lower blanking plug.



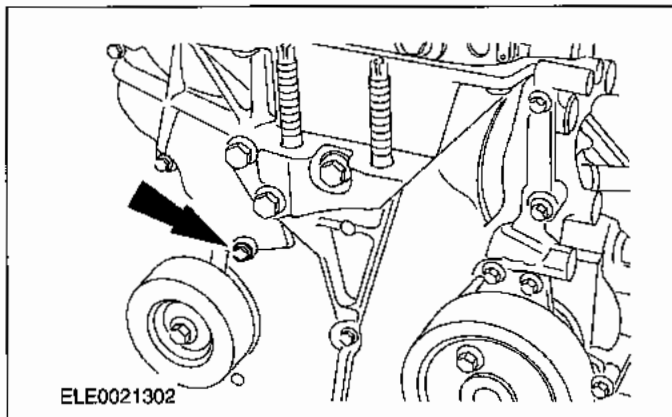
IN-VEHICLE REPAIR

18. Remove the cylinder block lower blanking plug and install the special tool.



19. Lower the vehicle.

20. Remove the engine front cover upper blanking plug.

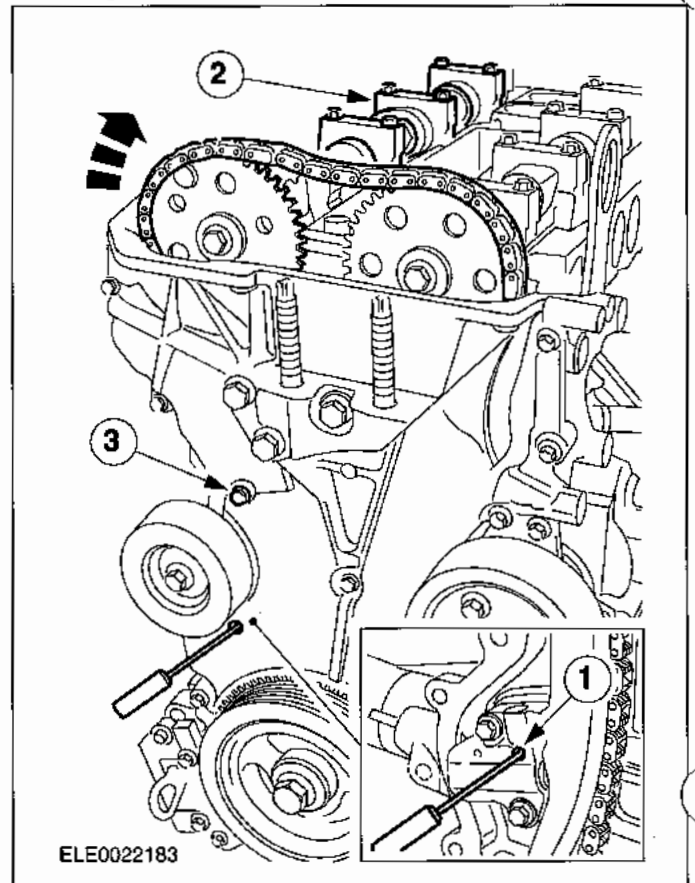


21. **CAUTION:** To detension the timing chain, make sure the timing chain tensioner ratchet is in the released position.

Detension the timing chain.

1. Using a suitable screwdriver, unlock the timing chain tensioner ratchet.
2. Carefully turn the exhaust camshaft by the hexagon in the normal direction of rotation, to detension the timing chain tensioner.

3. Install a suitable M6 x 18 mm bolt through the blanking plug to secure the timing chain guide in the detensioned position.

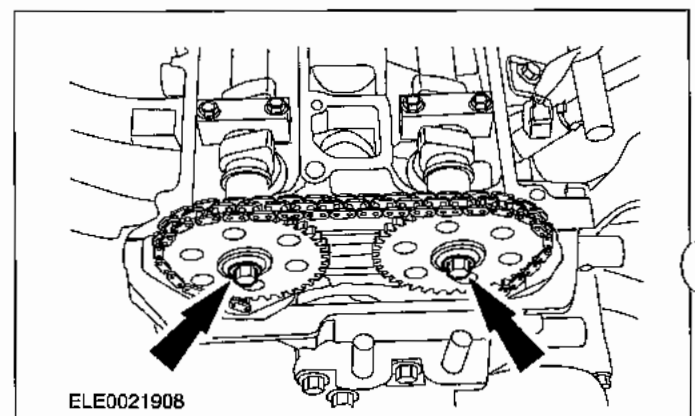


22. **CAUTION:** Hold the camshaft by the hexagon with an open-ended wrench to stop it from turning.

NOTE: Using a suitable piece of wire, prevent the timing chain and the sprocket from dropping into the timing case.

Loosen the camshaft sprockets retaining bolts.

- Detach the exhaust camshaft sprocket together with the timing chain from the exhaust camshaft.

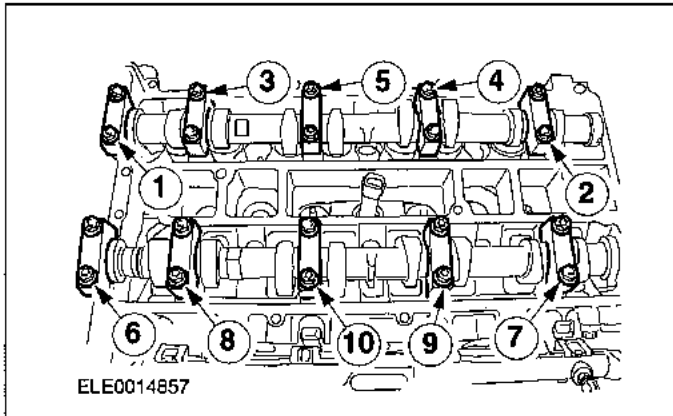


IN-VEHICLE REPAIR

23. **⚠ CAUTION:** Keep the camshaft bearing caps, the camshafts and the camshaft sprockets in order for installation.

NOTE: Working in several stages, release each camshaft bearing cap retaining bolt two turns at a time.

Remove the camshaft bearing caps in the sequence shown.



24. **NOTE:** Using a suitable piece of wire, prevent the timing chain and the sprocket from dropping into the timing case.

Detach the intake camshaft sprocket from the intake camshaft.

25. **⚠ CAUTION:** Keep the valve tappets in order for installation.

Remove the valve tappets.

Installation

1. Install the valve tappets.
2. **NOTE:** Do not tighten the camshaft sprocket retaining bolt at this stage.

Attach the intake camshaft sprocket together with the timing chain to the intake camshaft and insert the intake camshaft.

3. CAUTIONS:

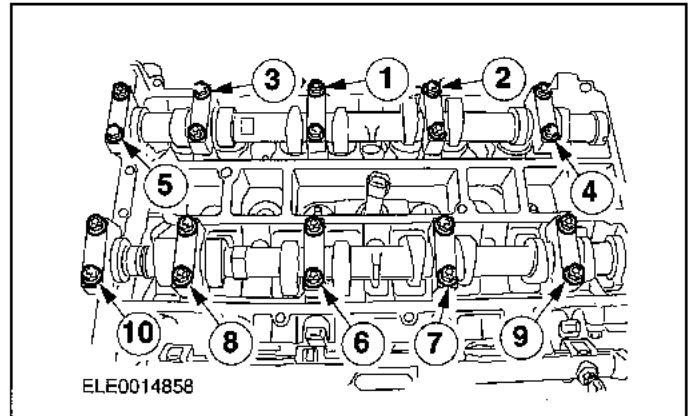
⚠ Install the camshafts approximately at valve overlap position cylinder No. 4.

⚠ Install the camshafts and bearing caps in their original location.

Install the camshafts.

- Working in several stages, evenly tighten the camshaft bearing cap bolts in the sequence shown, one half turn at a time.

- Coat the camshaft bearing caps with oil.
- Tighten the bolts in two stages:
 - Stage 1: 7 Nm.
 - Stage 2: 16 Nm.



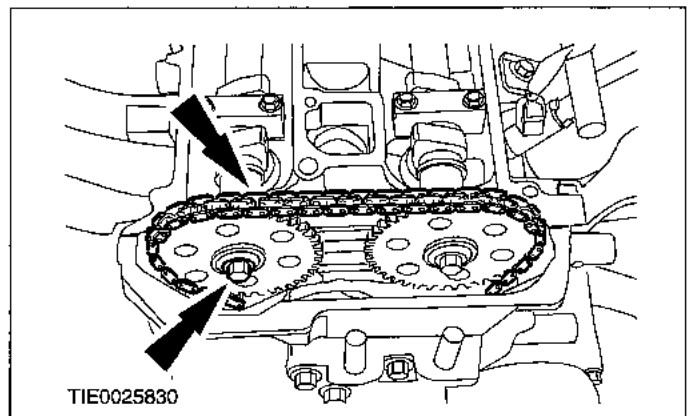
4. **NOTE:** Only carry out the following step when a new cylinder head or new valves are installed.

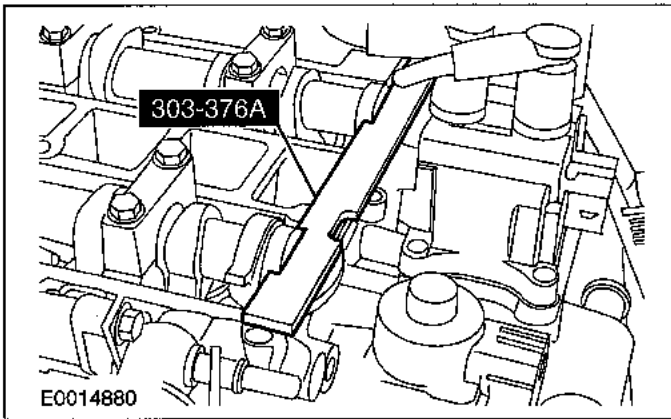
Check the valve clearance and adjust if necessary.

For additional information, refer to: Valve Clearance Adjustment (303-01 Engine - 2.0L Duratec-HE (MI4), General Procedures).

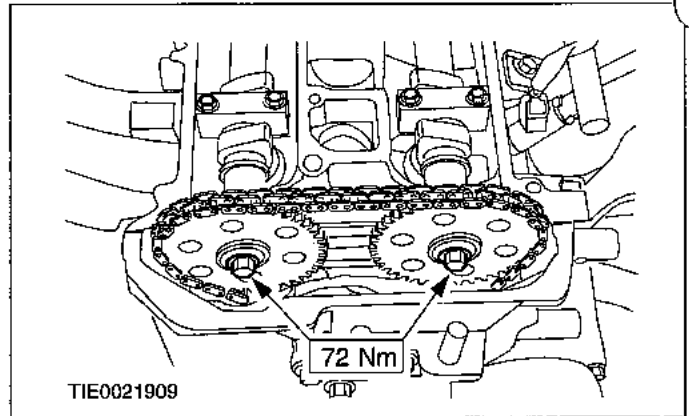
5. **NOTE:** Do not tighten the camshaft sprocket retaining bolt at this stage.

Attach the exhaust camshaft sprocket together with the timing chain to the exhaust camshaft.

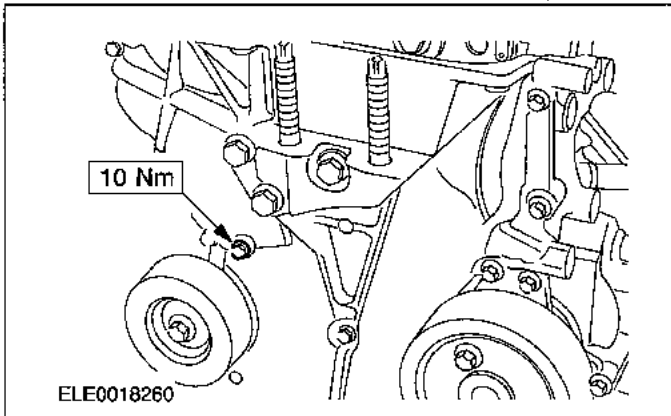
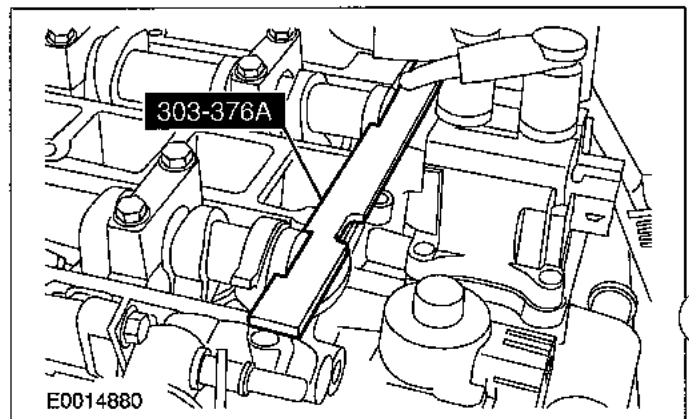


IN-VEHICLE REPAIR**6. Install the special tool.**

Tighten the camshaft sprocket retaining bolts.

**7. Coat the engine front cover upper blanking plug with sealant.****8. Tension the timing chain.**

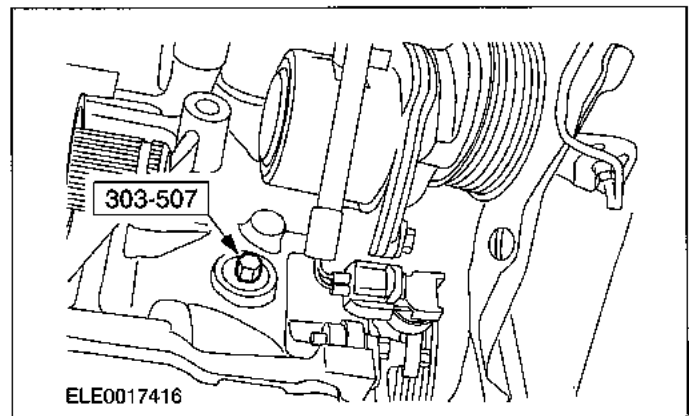
- Remove the timing chain guide securing bolt and install the engine front cover upper blanking plug.

**11. Remove the special tool.****9. NOTE: Only rotate the crankshaft in the normal direction of rotation.**

Rotate the crankshaft until piston No. 1 is at TDC.

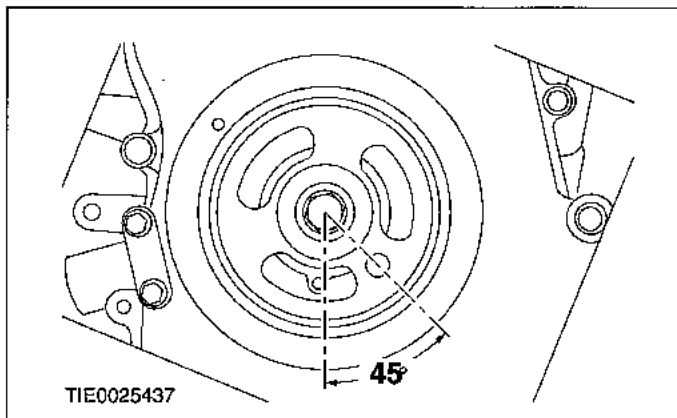
10. NOTE: Hold the camshafts by the hexagon with an open-ended wrench to stop them from rotating.**12. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)**

Jacking (Description and Operation), Lifting (Description and Operation).

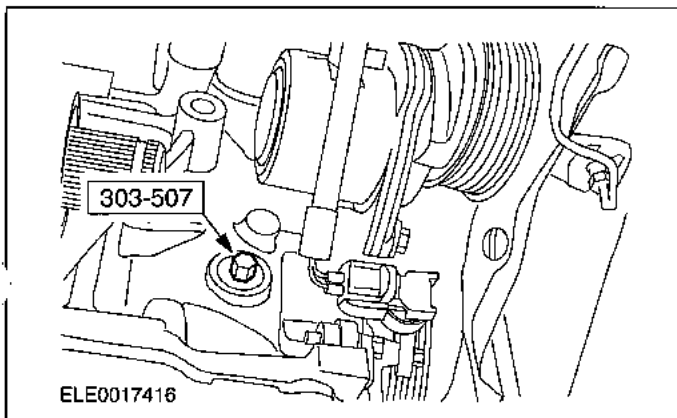
13. Remove the special tool.**14. NOTE: Only rotate the crankshaft in the normal direction of rotation.**

IN-VEHICLE REPAIR

Rotate the crankshaft approximately one and three quarter revolutions until piston No. 1 is 45 degrees before TDC.



15. Install the special tool.



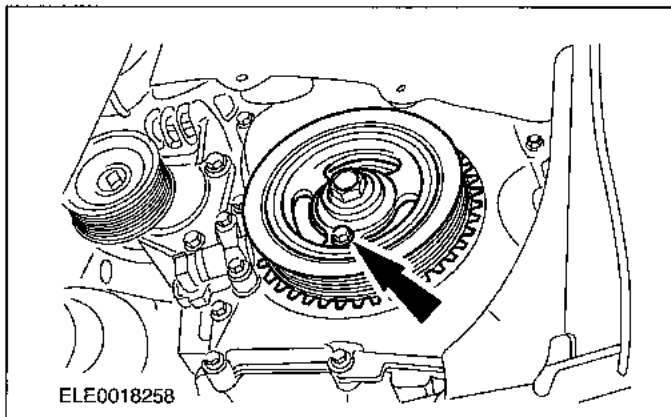
16. **NOTE:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until piston No. 1 is at TDC.

17. **CAUTION:** Only tighten the crankshaft pulley securing bolt finger tight.

NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the valve timing.

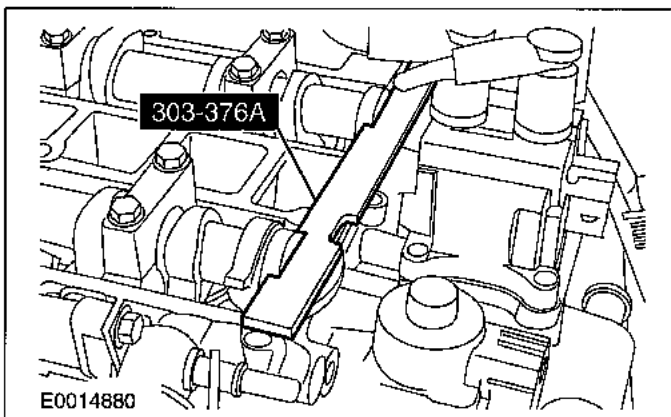
Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.



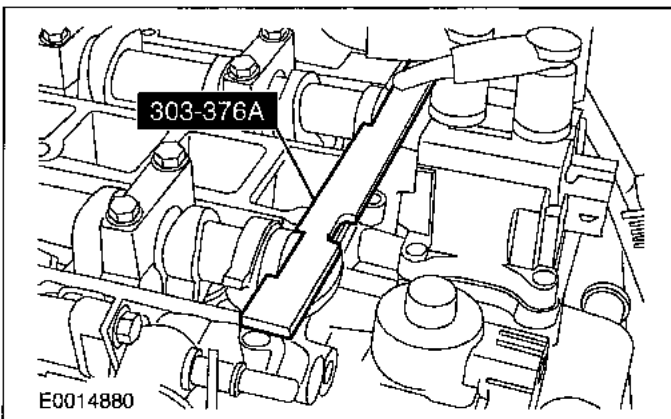
18. Lower the vehicle.

19. **NOTE:** If it is not possible to install the special tool, correct the valve timing.

Using the special tool, check the position of the camshafts.



20. Remove the special tool.

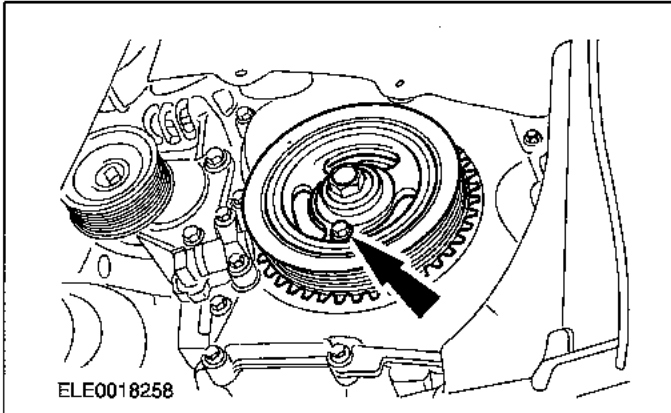


IN-VEHICLE REPAIR

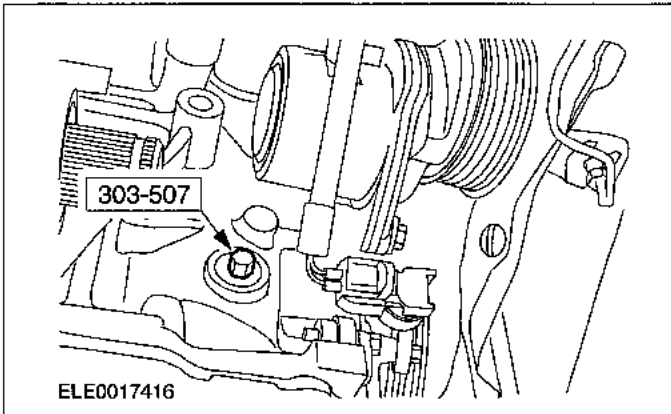
21. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

Jacking (Description and Operation),
Lifting (Description and Operation).

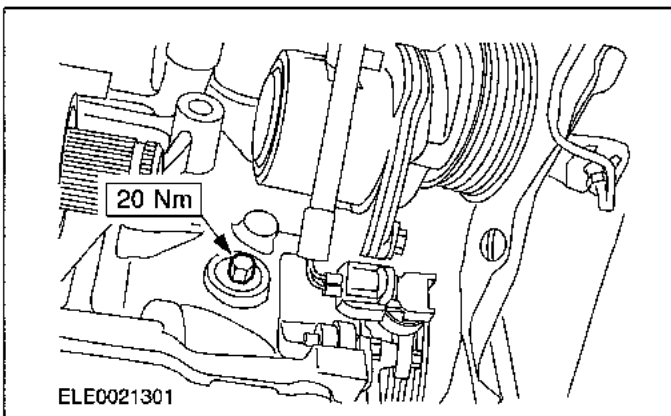
22. Remove the crankshaft pulley securing bolt.



23. Remove the special tool.

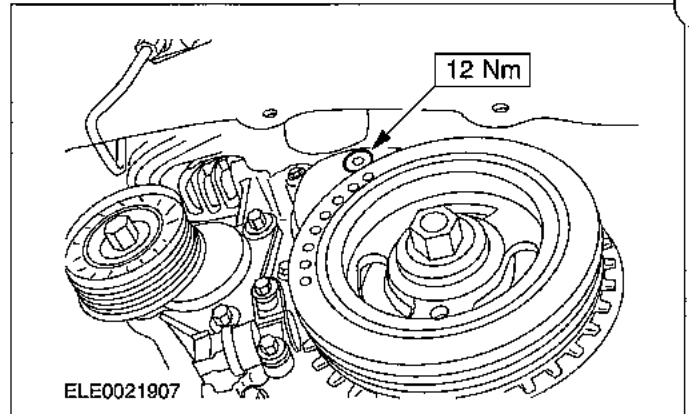


24. Install the cylinder block lower blanking plug.



25. Coat the engine front cover lower blanking plug with sealant.

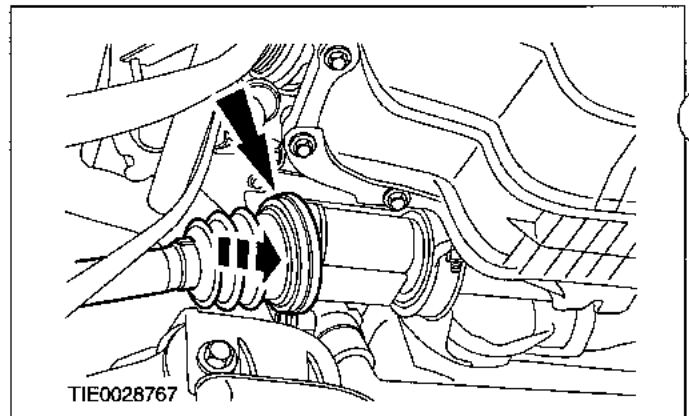
26. Install the engine front cover lower blanking plug.



27. **NOTE:** Do not damage the inner constant velocity (CV) joint boot.

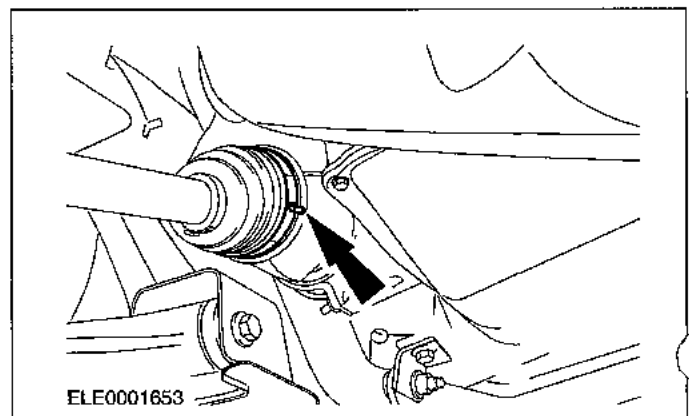
NOTE: Make sure that the intermediate shaft mating surface for the CV joint boot is clean.

Attach the inner CV joint boot to the intermediate shaft.



28. **NOTE:** Install a new CV joint boot clamp.

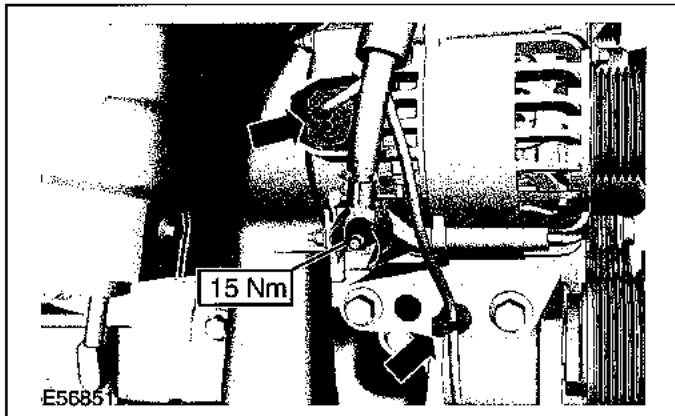
Using a suitable grip wrench, install the inner CV joint boot clamp.



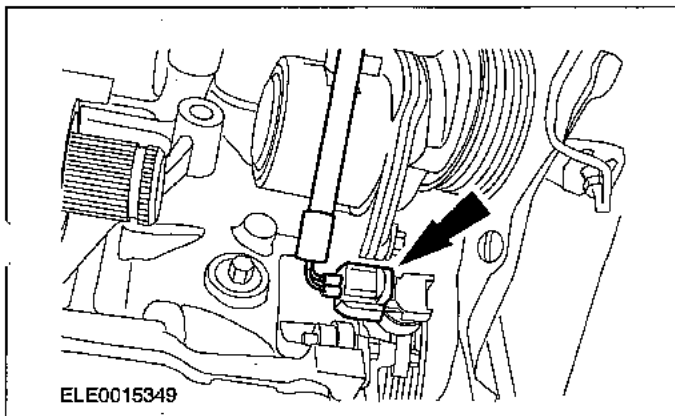
IN-VEHICLE REPAIR

29. Connect the generator electrical connectors.

- Clip the wiring harness.



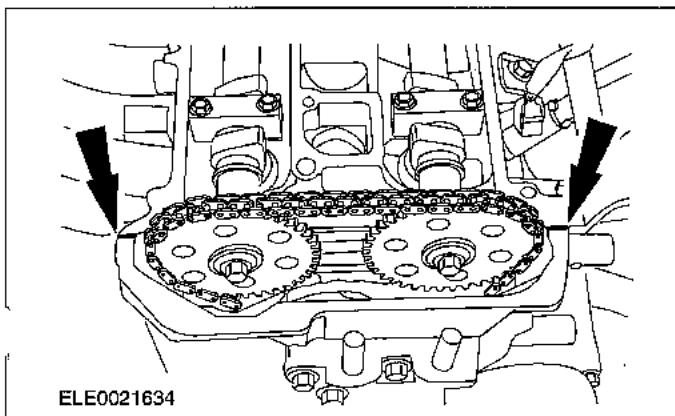
30. Connect the crankshaft position (CKP) sensor electrical connector.



31. Install the accessory drive belt.

For additional information, refer to:
Accessory Drive Belt - 2.0L Duratec-HE
(M14) (303-05 Accessory Drive, Removal
and Installation).

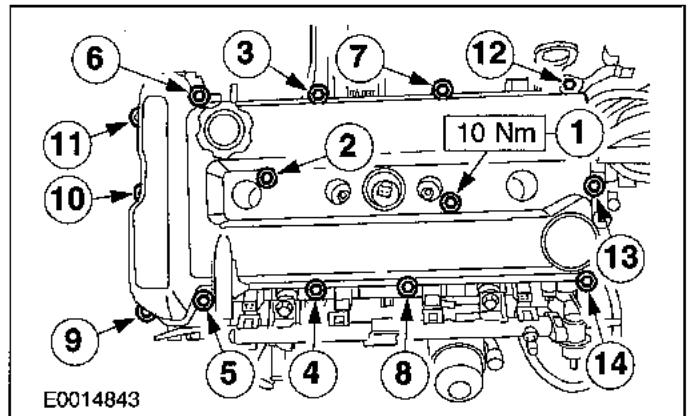
32. Apply a small bead of sealant to the areas as shown.



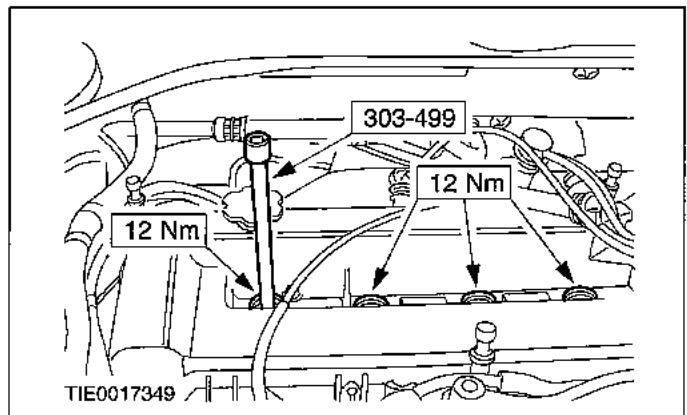
33. NOTE: Install a new valve cover gasket if necessary.

Install the valve cover.

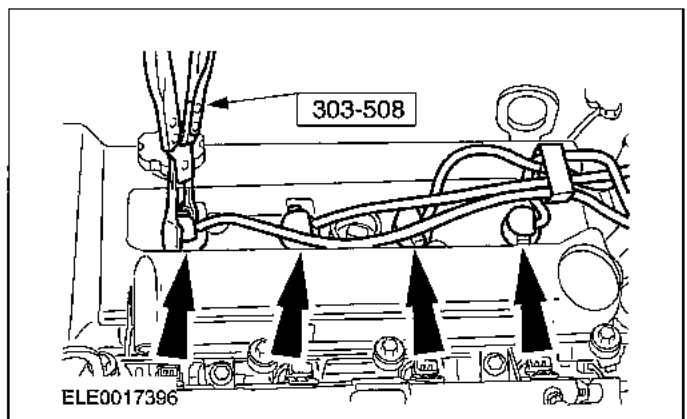
- Tighten the bolts in the sequence shown.



34. Using the special tool, install the spark plugs.

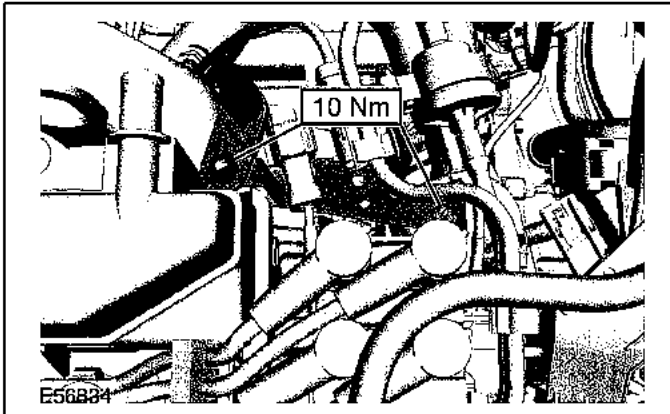


35. Using the special tool, connect the spark plug electrical connectors.

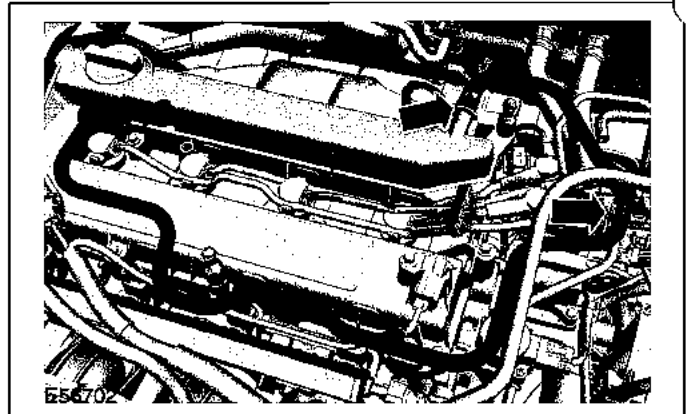


IN-VEHICLE REPAIR

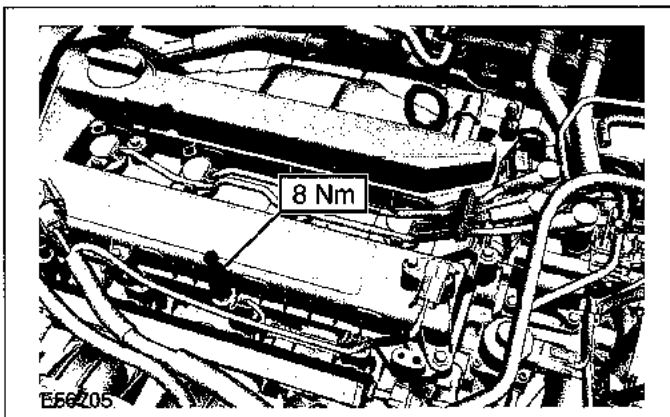
36. Install the evaporative emission (EVAP) valve support bracket.



39. Install the positive crankshaft ventilation (PCV) hose.



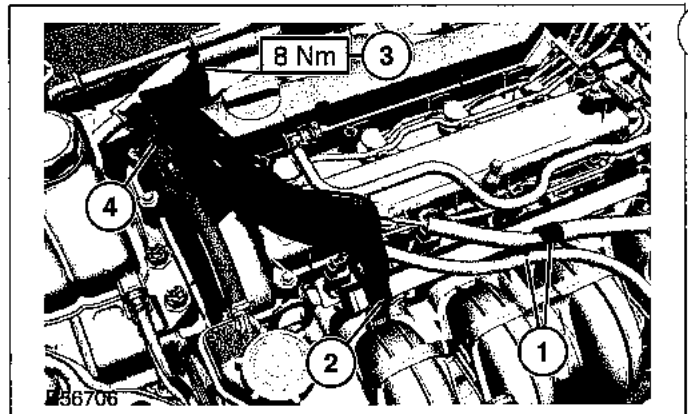
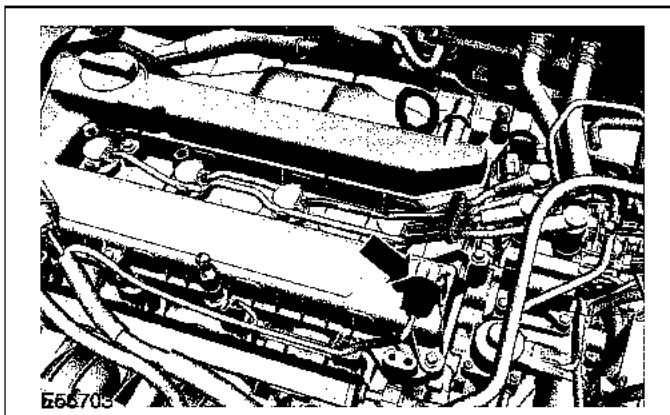
37. Install the air cleaner retaining bracket.



40. Attach the engine wiring harness to the valve cover.

1. Clip the engine wiring harness to the intake manifold.
2. Clip the engine wiring harness bracket to the intake manifold.
3. Install the air cleaner retaining bracket.
4. Clip the power steering return line to the engine wiring harness bracket.

38. Connect the camshaft position (CMP) sensor electrical connector.



41. Install the air cleaner.

For additional information, refer to: Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

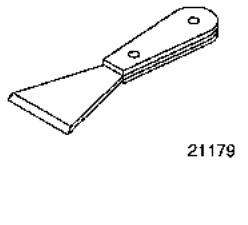
42. Connect the battery ground cable.

For additional information, refer to: Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).

IN-VEHICLE REPAIR

Oil Pan(21 154 0)

Special Tool(s)

| | |
|---|--|
|  | Separator, Oil Pan 303-428 (21-179) |
|---|--|

| Materials | |
|------------------|---------------|
| Name | Specification |
| Cleaner | WSK-M2G342-A |
| Silicone Sealant | WSE-M4G323-A4 |

Removal

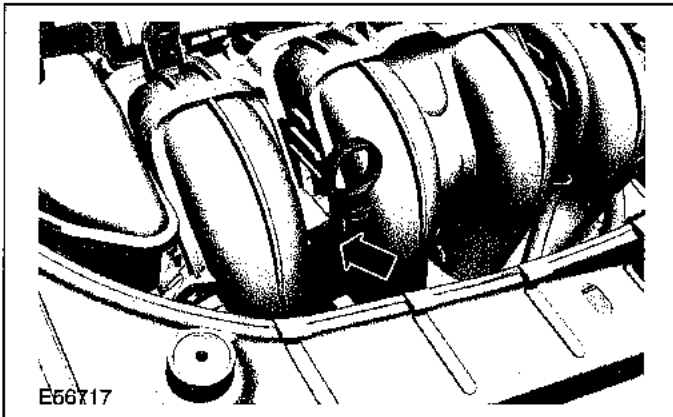
1. Disconnect the battery.

For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

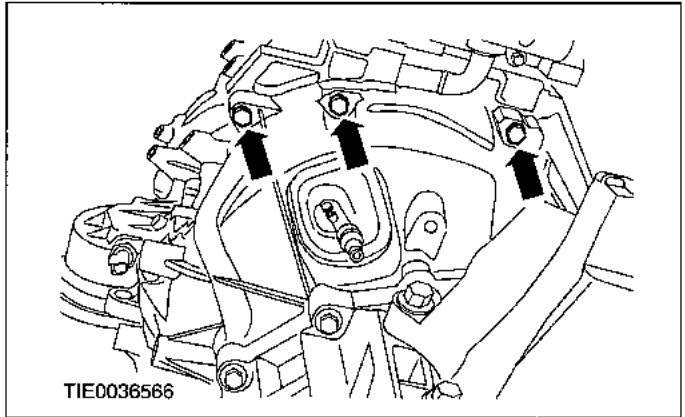
2. Remove the air cleaner.

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (M14) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

3. Remove the oil level indicator and oil level indicator tube upper retaining bolt.



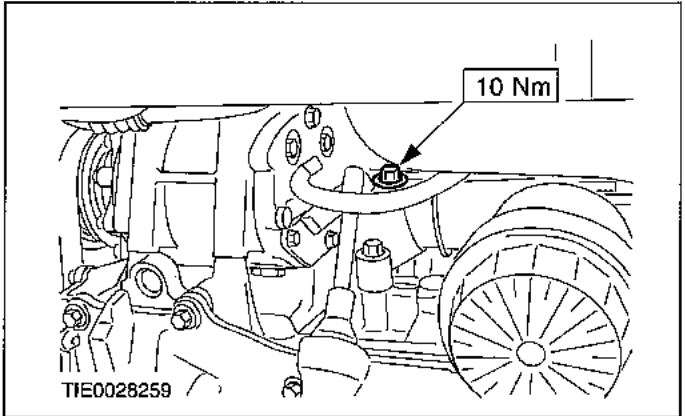
4. Loosen the transaxle upper retaining bolts approximately 10 mm.



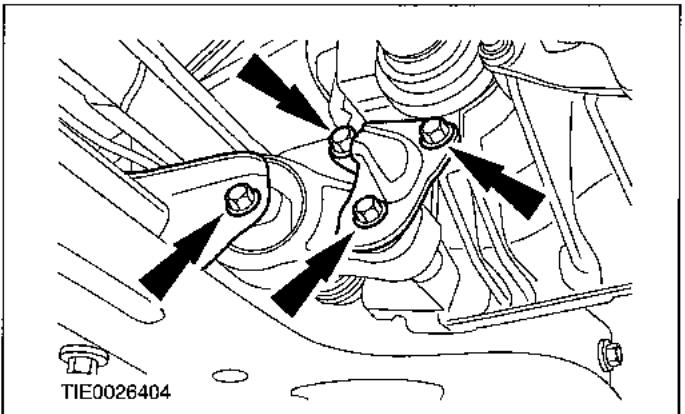
5. Raise and support the vehicle. For additional information, refer to: **(100-02 Jacking and Lifting)**

Jacking (Description and Operation), Lifting (Description and Operation).

6. Remove the oil level indicator tube lower retaining bolt.



7. Remove the engine support insulator.



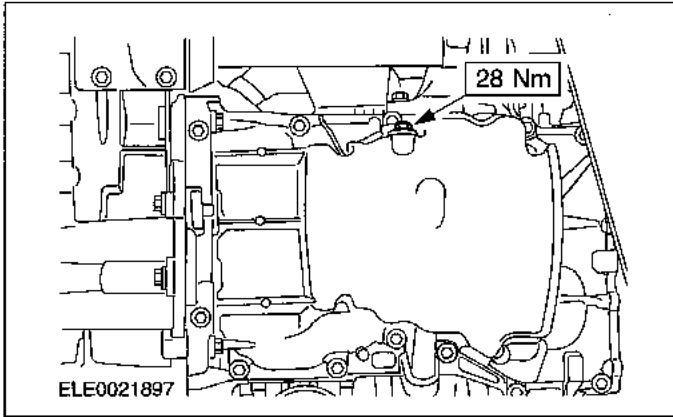
IN-VEHICLE REPAIR

8. Drain the engine.

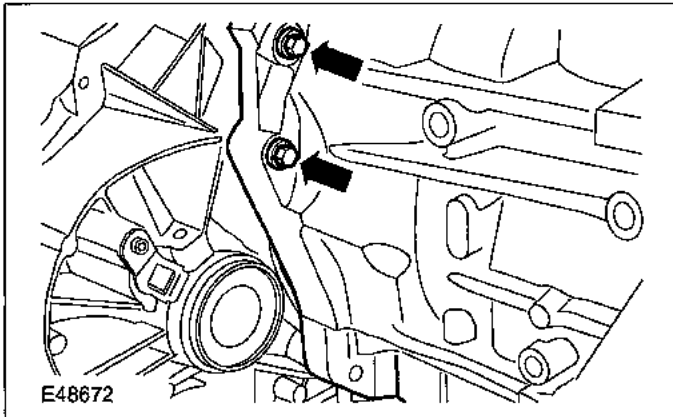
- Allow the oil to drain into a suitable container.

9. NOTE: Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

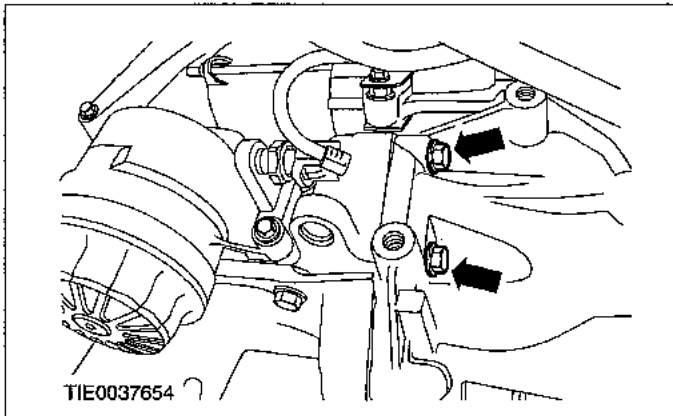
Install the drain plug.



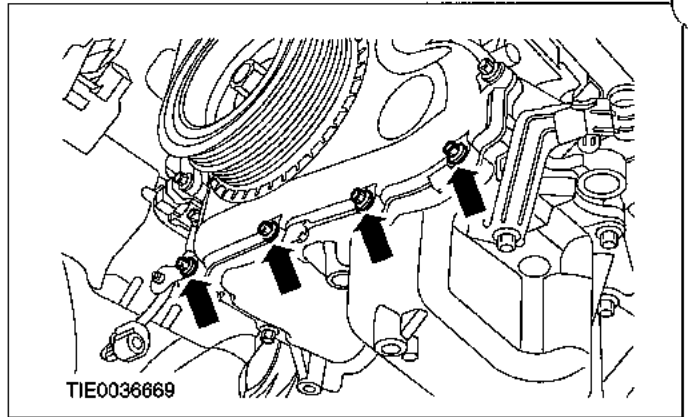
10. Loosen the transaxle right-hand retaining bolts approximately 10 mm.



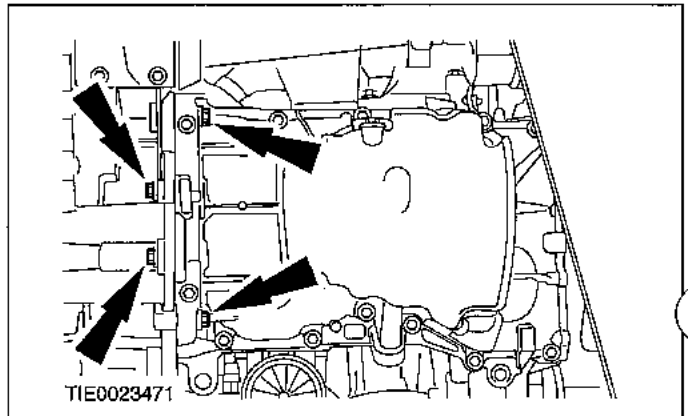
11. Loosen the transaxle left-hand retaining bolts approximately 10 mm.



12. Remove the engine front cover lower retaining bolts.

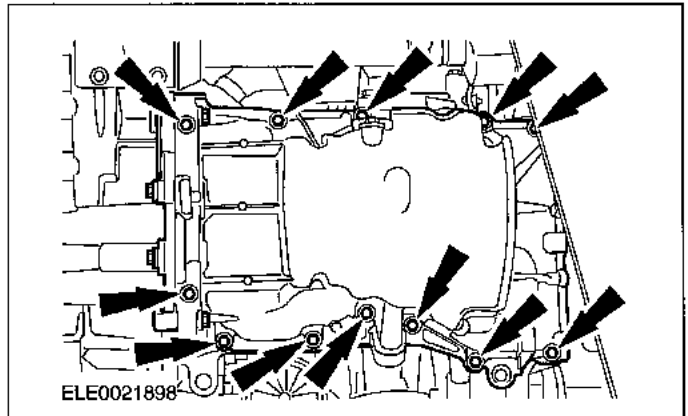


13. Remove the transaxle lower retaining bolts.



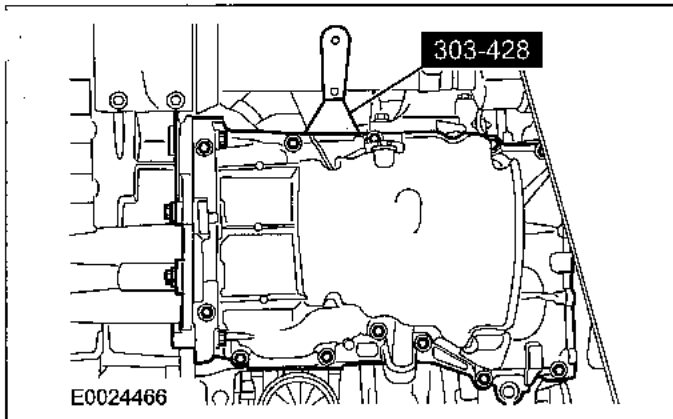
14. Slide back the transaxle approximately 8 mm.

15. Remove the oil pan retaining bolts.

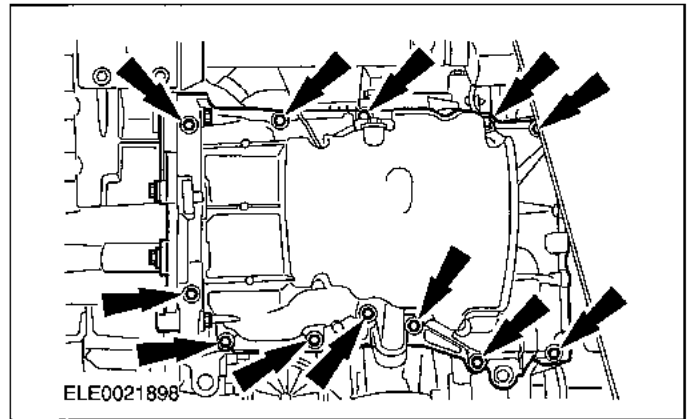


IN-VEHICLE REPAIR

16. Using the special tool, remove the oil pan.

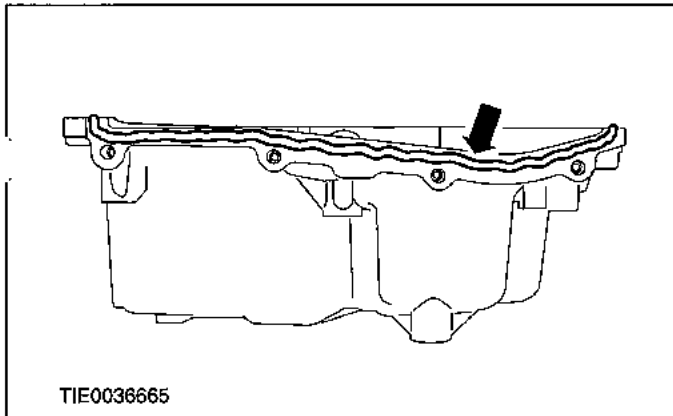


Install the oil pan.



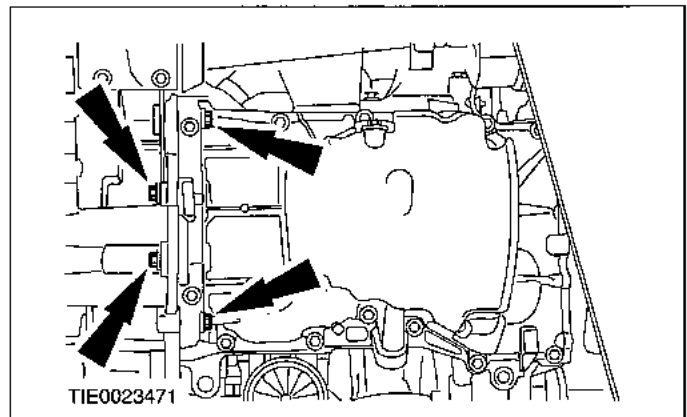
Installation

1. Clean the mating faces of the cylinder block, the oil pan and the engine front cover with cleaner.
2. Apply a 3 mm bead of sealant to the oil pan.

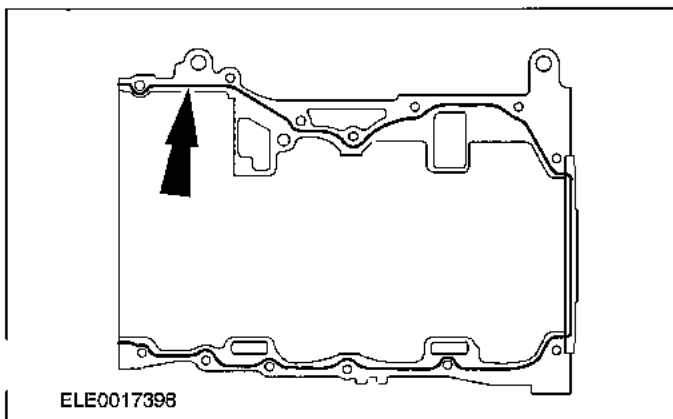


5. **NOTE:** Do not tighten the transaxle lower retaining bolts at this stage.

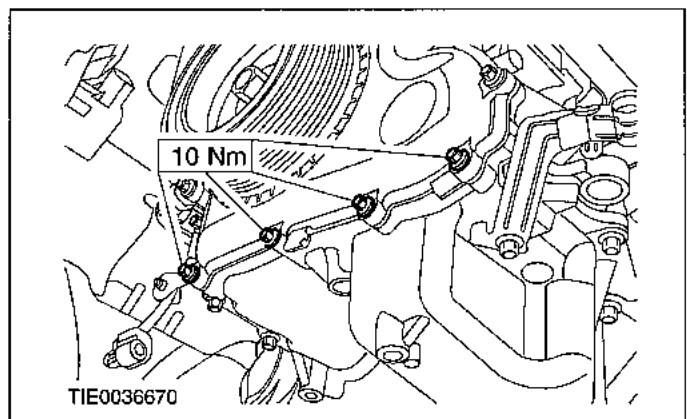
Install the transaxle lower retaining bolts.



3. **NOTE:** Install the oil pan within 10 minutes of applying the silicone sealant and tighten the retaining bolts within a further 5 minutes.
- Apply a 3 mm bead of sealant to the oil pan.



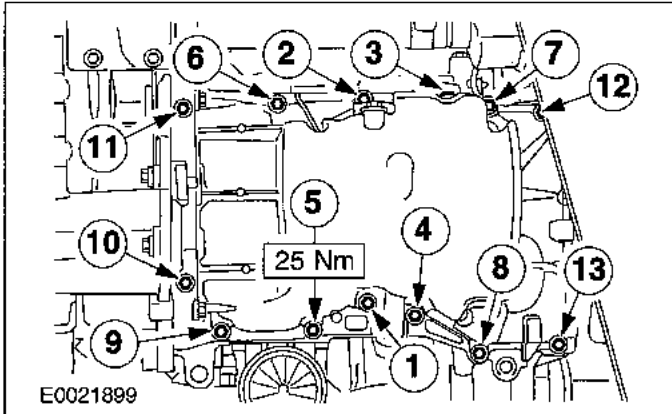
6. Install the engine front cover lower retaining bolts.



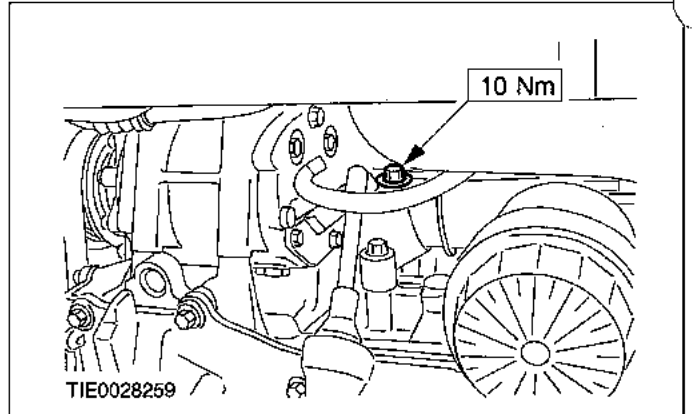
4. **NOTE:** Do not tighten the oil pan retaining bolts at this stage.

IN-VEHICLE REPAIR

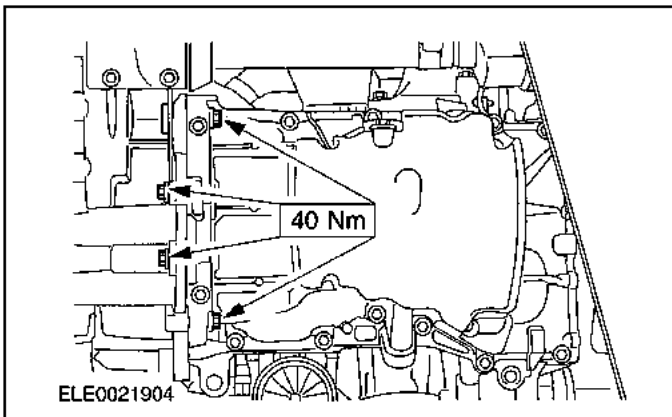
7. Tighten the oil pan retaining bolts in the sequence shown.



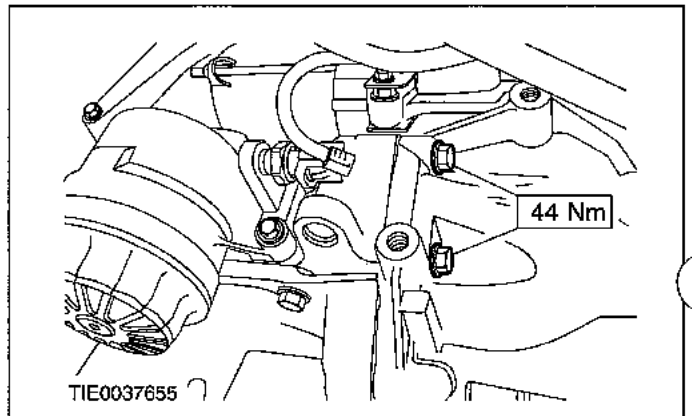
10. Install the oil level indicator tube lower retaining bolt.



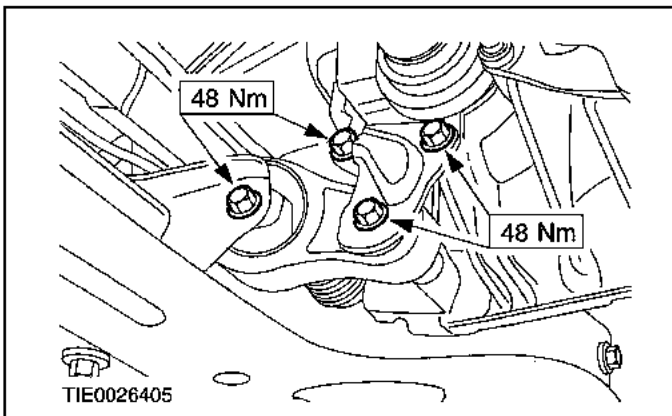
8. Tighten the transaxle lower retaining bolts.



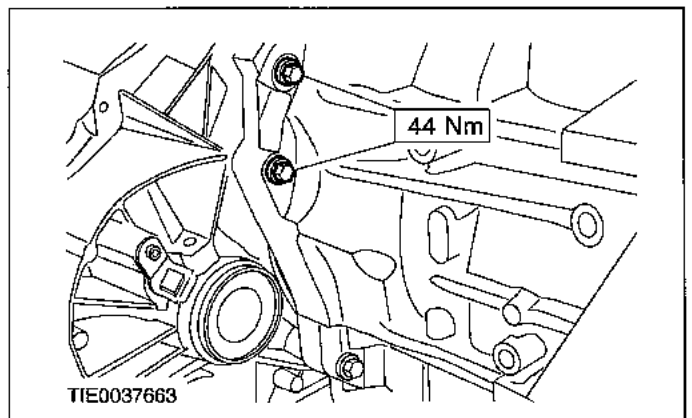
11. Tighten the transaxle left-hand retaining bolts.



9. Install the engine support insulator.



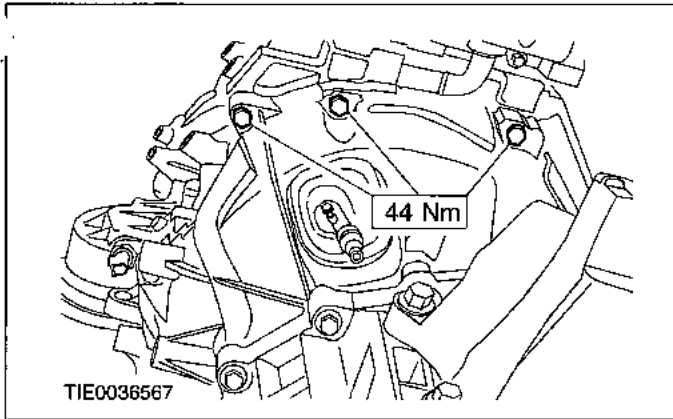
12. Tighten the transaxle right-hand retaining bolts.



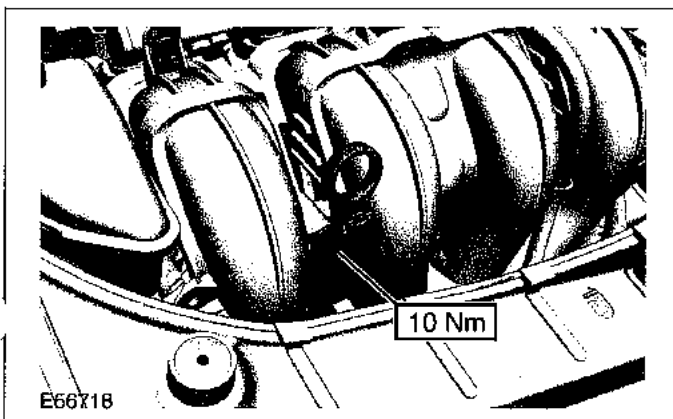
13. Lower the vehicle.

IN-VEHICLE REPAIR

14. Tighten the transaxle upper retaining bolts.



15. Install the oil level indicator and oil level indicator tube upper retaining bolt.



16. Install the air cleaner.

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

17. Connect the battery.

For additional information, refer to: **Battery Disconnect (414-01 Battery, Mounting and Cables, General Procedures).**

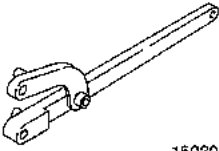
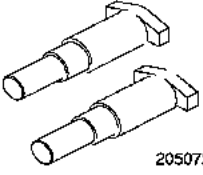
18. Fill the engine with engine oil.

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

IN-VEHICLE REPAIR

Oil Pump(21 714 0)

Special Tool(s)

| | |
|---|--|
|  <p>15030A</p> | <p>Universal Flange Holding Wrench 205-072 (15-030A)</p> |
|  <p>20507202</p> | <p>Adapter for 205-072 205-072-02 (15-030 A01)</p> |

Removal

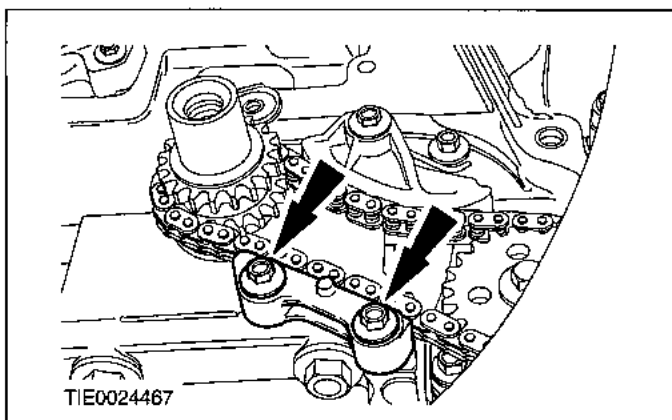
1. Remove the timing chain.

For additional information, refer to: Timing Chain (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

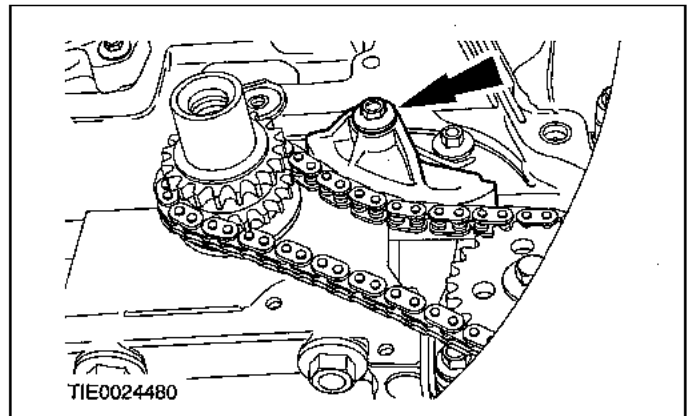
2. Remove the oil pan.

For additional information, refer to: Oil Pan (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

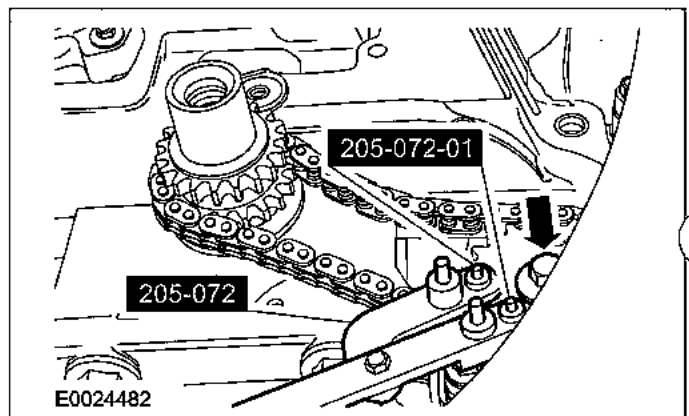
3. Remove the oil pump chain guide.



4. Remove the oil pump chain tensioner.

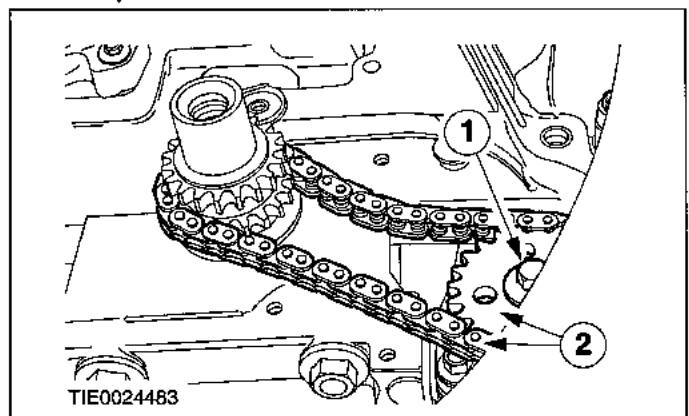


5. Using the special tools, loosen the oil pump sprocket retaining bolt.



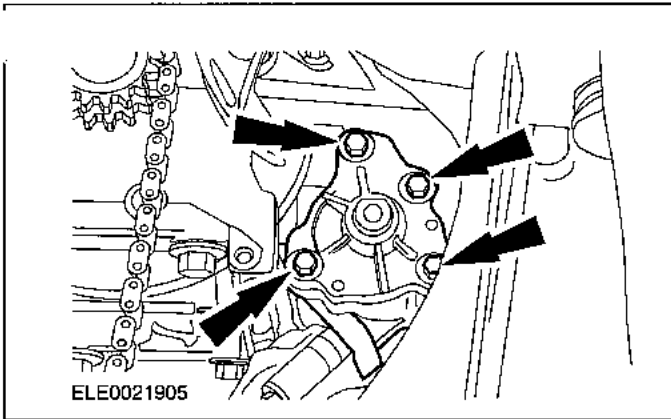
6. Remove the oil pump chain.

1. Remove the oil pump sprocket retaining bolt.
2. Remove the oil pump chain and the oil pump sprocket.



IN-VEHICLE REPAIR

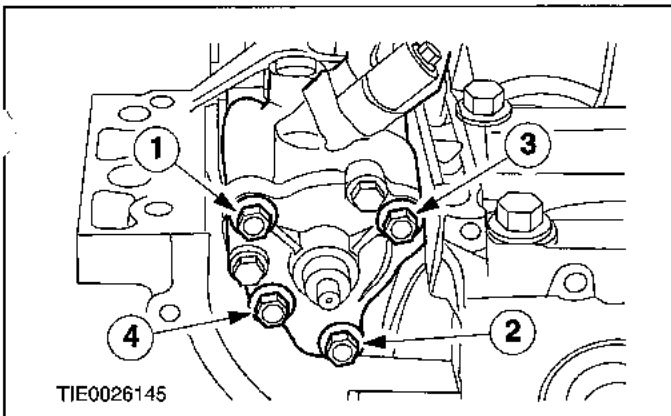
7. Remove the oil pump.



Installation

1. Install the oil pump.

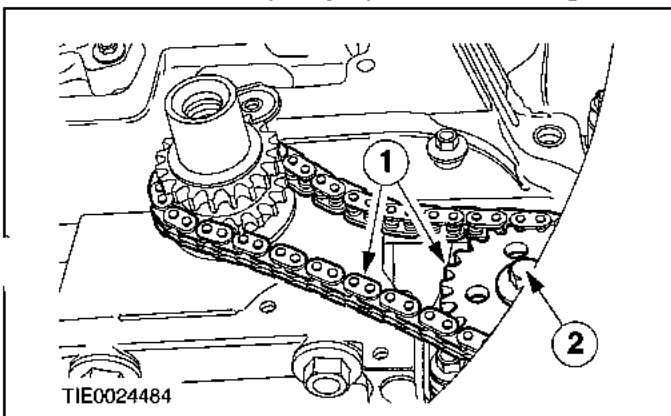
- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 10 Nm
- Stage 2: 23 Nm



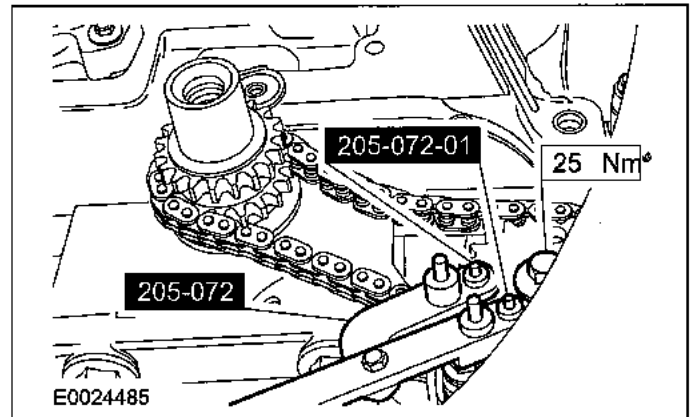
2. NOTE: Do not tighten the oil pump sprocket retaining bolt at this stage.

Install the oil pump chain.

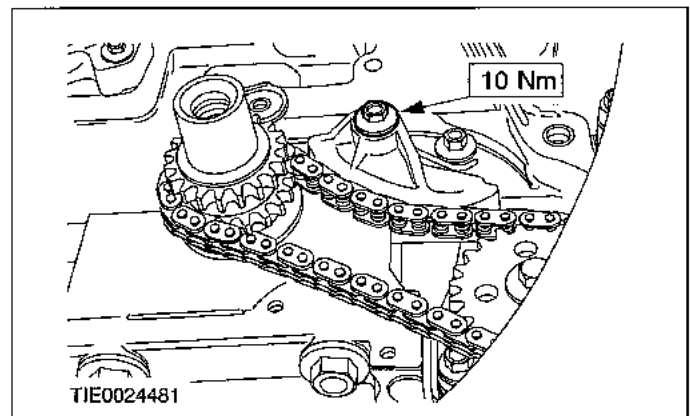
1. Install the oil pump chain and the oil pump sprocket.
2. Install the oil pump sprocket retaining bolt.



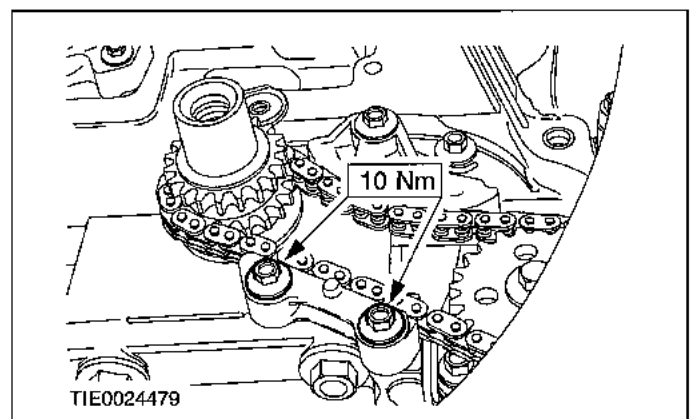
3. Using the special tools, tighten the oil pump sprocket retaining bolt.



4. Install the oil pump chain tensioner.



5. Install the oil pump chain guide.



6. Install the oil pan.

For additional information, refer to: Oil Pan (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

7. Install the timing chain.

For additional information, refer to: Timing Chain (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

IN-VEHICLE REPAIR

Crankshaft Rear Seal(21 468 4)

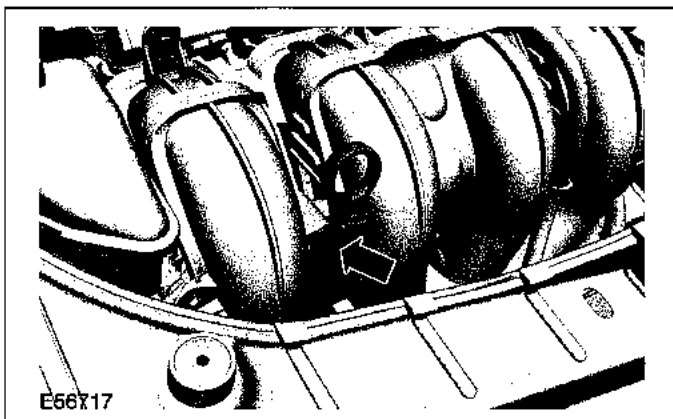
Special Tool(s)

| | |
|--------------|--|
| <p>21135</p> | <p>Locking Tool, Flywheel 303-254 (21-135)</p> |
| <p>21179</p> | <p>Separator, Oil Pan 303-428 (21-179)</p> |

| Materials | |
|------------------|----------------------|
| Name | Specification |
| Cleaner | WSK-M2G342-A |
| Silicone Sealant | WSE-M4G323-A4 |

Removal

1. Remove the oil level indicator and oil level indicator tube upper retaining bolt.

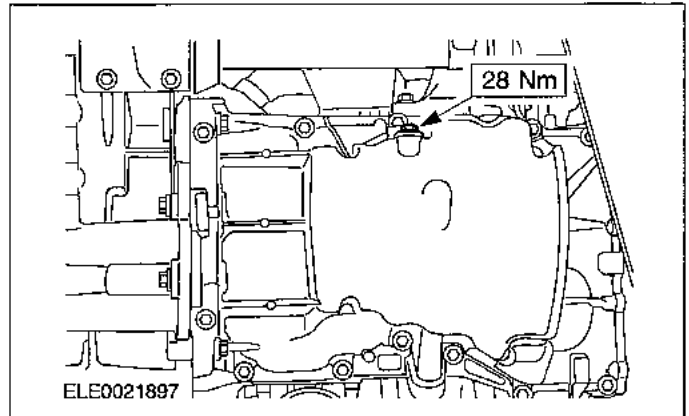


2. Remove the clutch disc and pressure plate.
For additional information, refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).

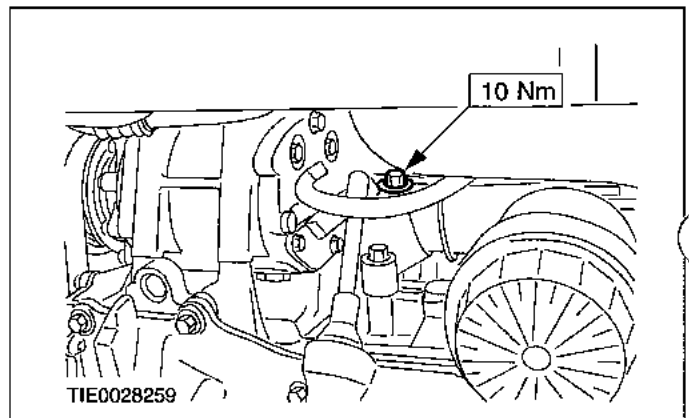
3. Drain the engine.
 - Allow the oil to drain into a suitable container.

4. **NOTE:**Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

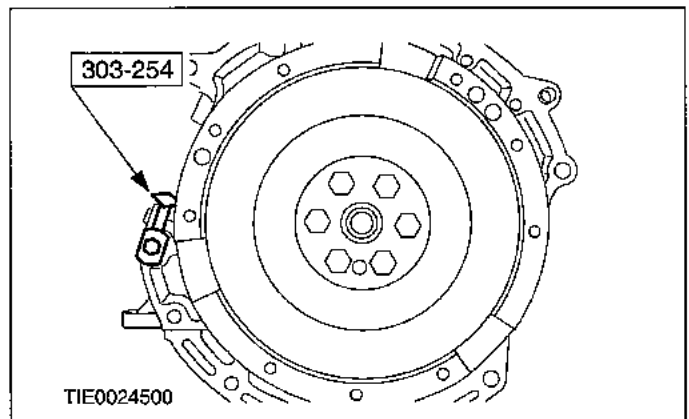
Install the drain plug.



5. Remove the oil level indicator tube lower retaining bolt.



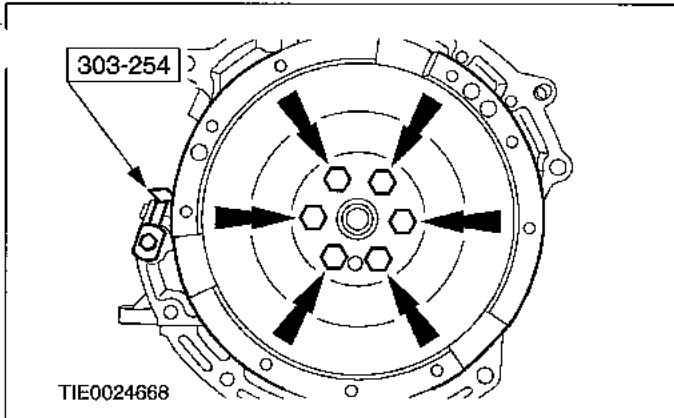
6. Using the special tool, lock the flywheel in position.



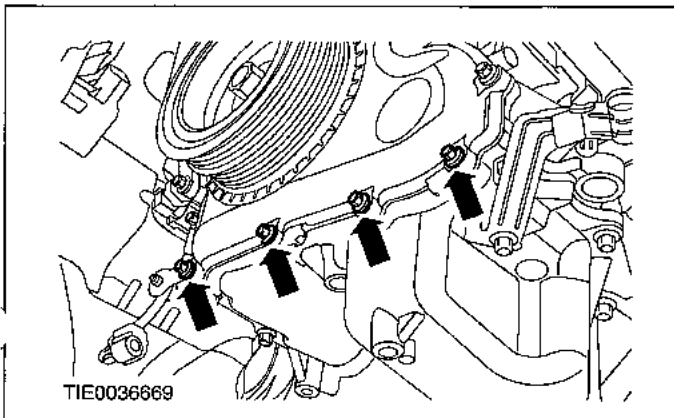
7. Remove the flywheel.

IN-VEHICLE REPAIR

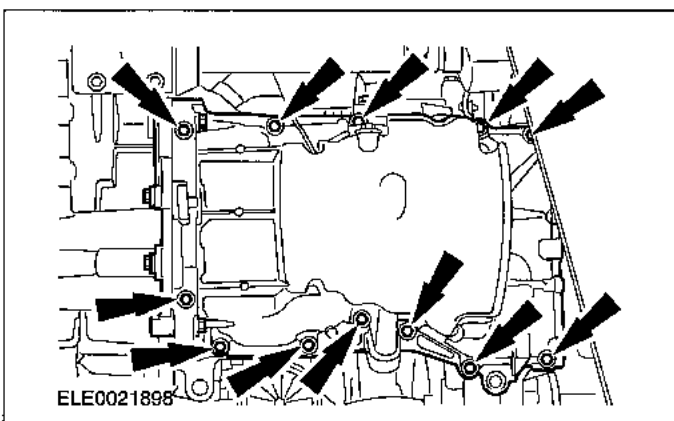
- Discard the bolts.



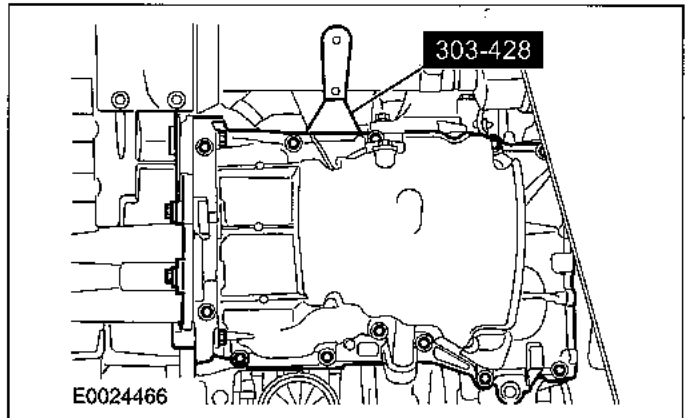
8. Remove the engine front cover lower retaining bolts.



9. Remove the oil pan retaining bolts.

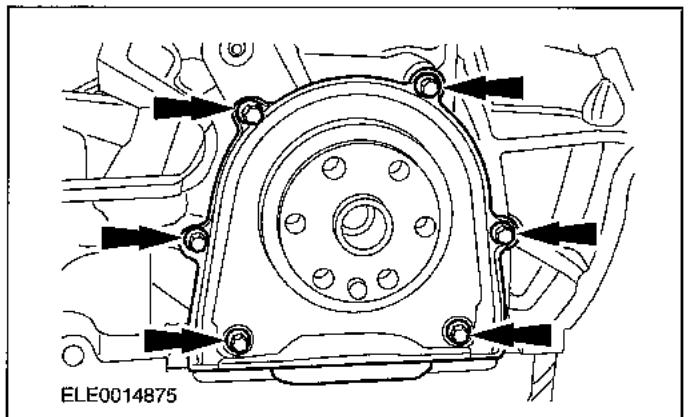


10. Using the special tool, remove the oil pan.



11. Remove the crankshaft rear seal carrier.

- Discard the crankshaft rear seal carrier.



Installation

1. **CAUTION:** Do not remove the the installation sleeve before installation.

NOTE: A new crankshaft rear seal carrier is supplied preassembled with an installation sleeve that must be removed following installation.

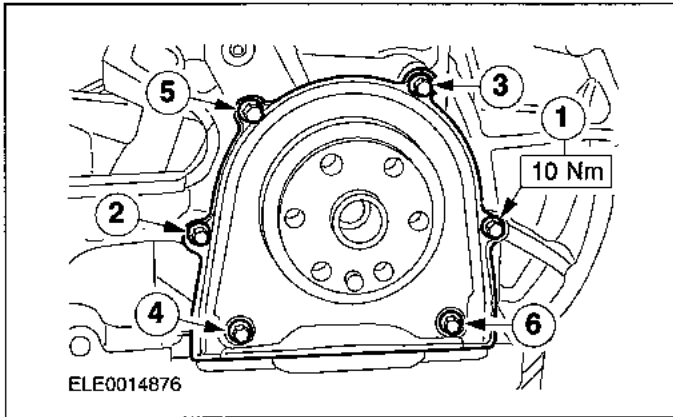
NOTE: Install a new crankshaft rear seal carrier.

Install the crankshaft rear seal carrier.

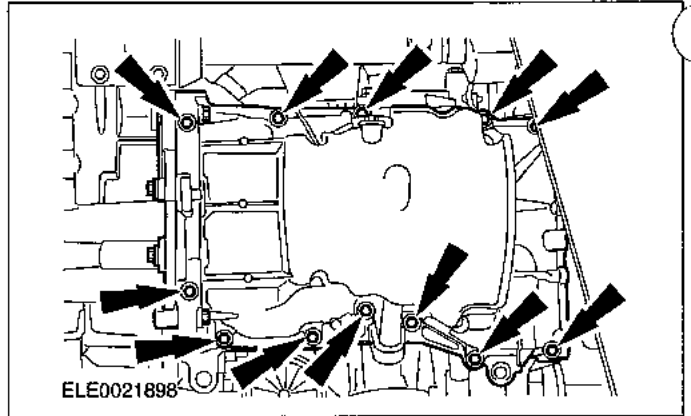
- Tighten the retaining bolts in the sequence shown.

IN-VEHICLE REPAIR

- Discard the installation sleeve.

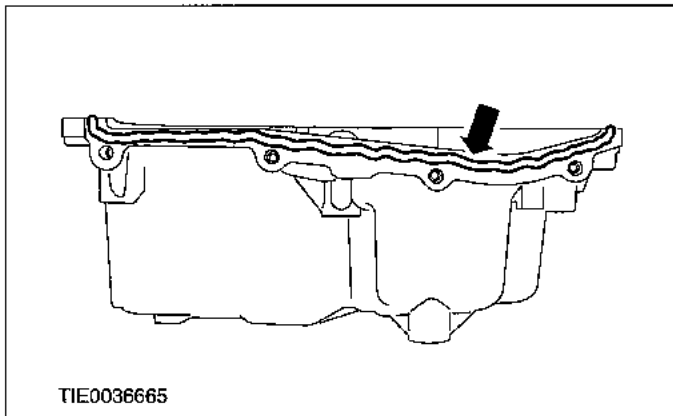


Install the oil pan.

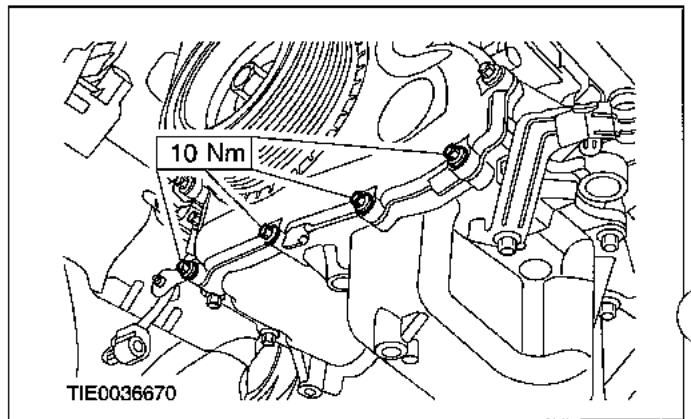


2. Clean the mating faces of the cylinder block, the oil pan and the engine front cover with cleaner.

3. Apply a 3 mm bead of sealant to the oil pan.

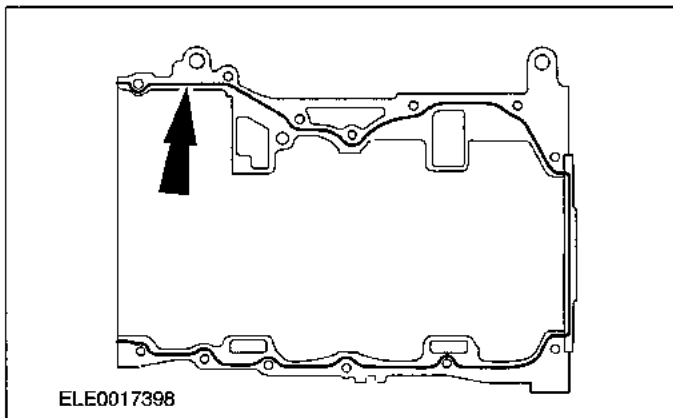


6. Install the engine front cover lower retaining bolts.

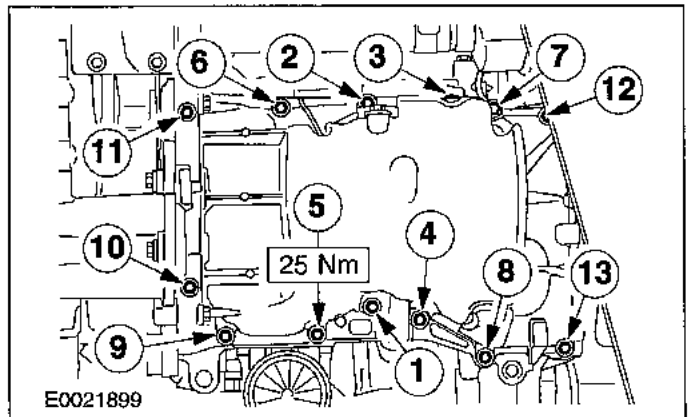


4. **NOTE:** Install the oil pan within 10 minutes of applying the silicone sealant and tighten the retaining bolts within a further 5 minutes.

Apply a 3 mm bead of sealant to the oil pan.



7. Tighten the oil pan retaining bolts in the sequence shown.

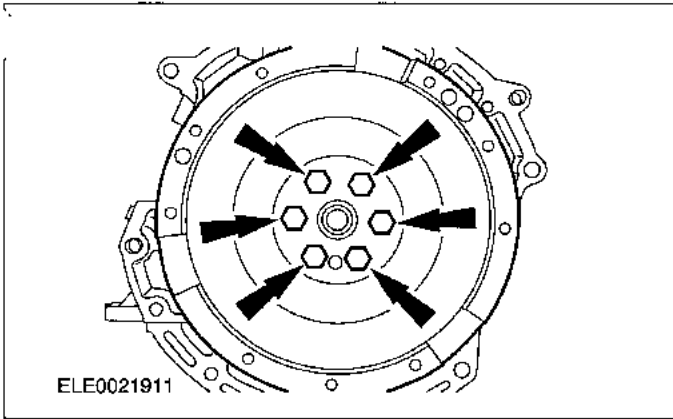


8. **NOTE:** Install new flywheel retaining bolts.
NOTE: Do not tighten the flywheel retaining bolts at this stage.

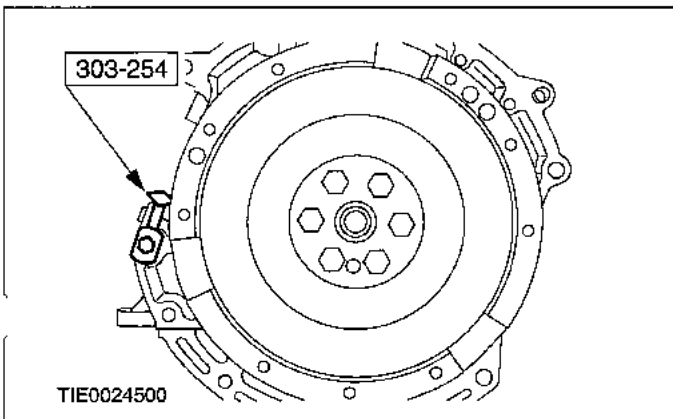
5. **NOTE:** Do not tighten the retaining bolts at this stage.

IN-VEHICLE REPAIR

Install the flywheel.

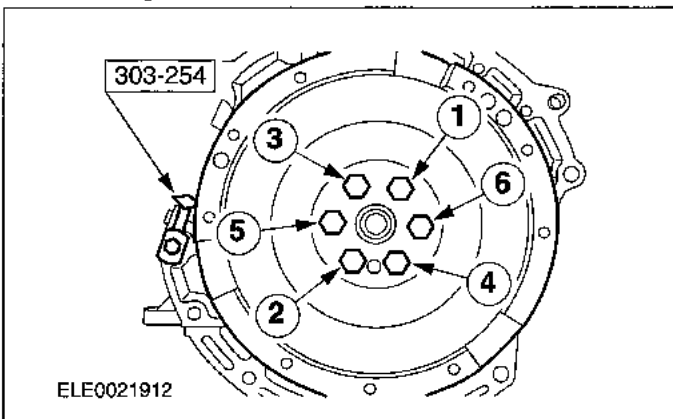


9. Using the special tool, lock the flywheel in position.



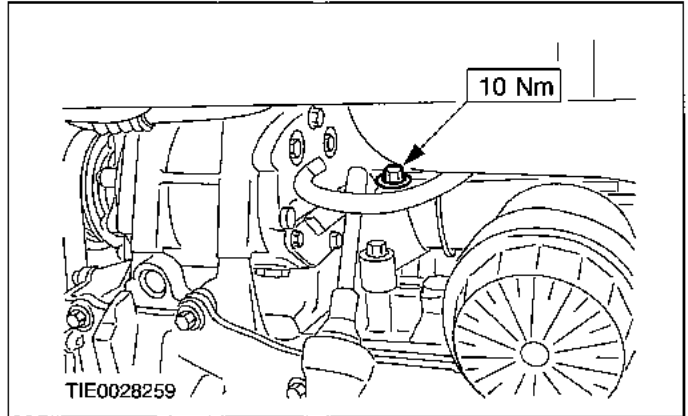
10. Tighten the flywheel retaining bolts.

- Tighten the bolts in the sequence shown in three stages.
- Stage 1: 50 Nm.
- Stage 2: 80 Nm.
- Stage 3: 112 Nm.



11. Remove the special tool.

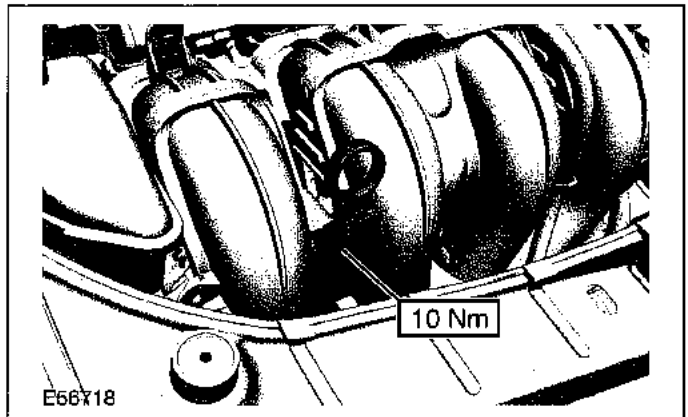
12. Install the oil level indicator tube lower retaining bolt.



13. Install the clutch disc and pressure plate.

For additional information, refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).

14. Install the oil level indicator and oil level indicator tube upper retaining bolt.



15. Fill the engine with engine oil.

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

IN-VEHICLE REPAIR

Engine Front Cover(21 148 0)

General Equipment

Vehicle jack

Materials

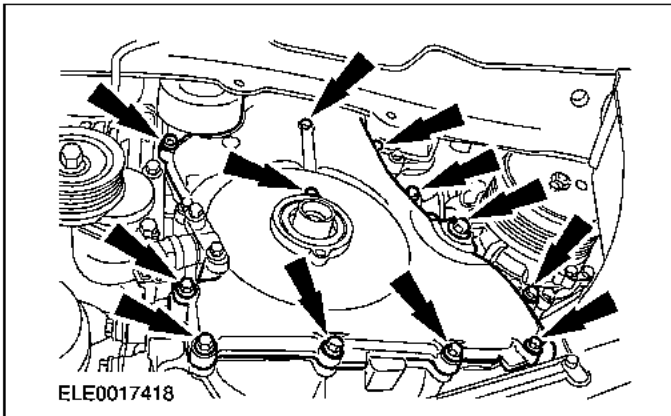
| Name | Specification |
|------------------|---------------|
| Silicone Sealant | WSE-M4G323-A4 |

Removal

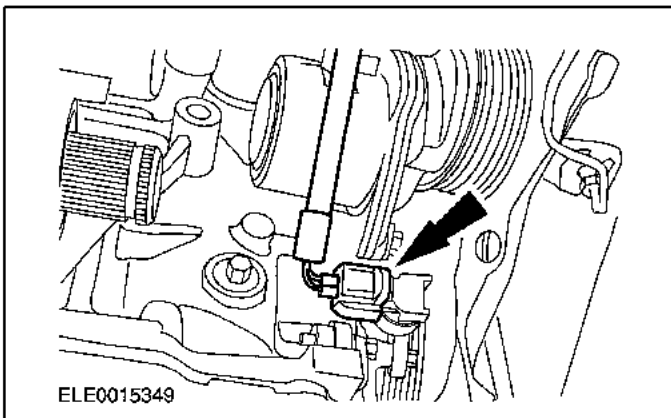
1. Remove the crankshaft belt pulley.

For additional information, refer to:
Crankshaft Pulley (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

2. Remove the timing cover lower bolts.

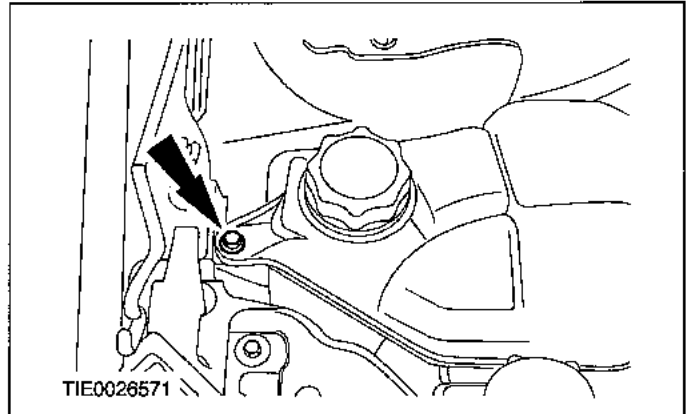


3. Disconnect the crankshaft position (CKP) sensor electrical connector.

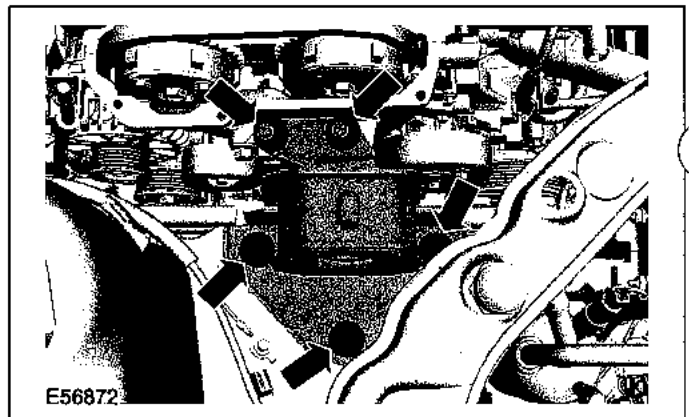


4. Lower the vehicle.
5. Remove the power steering pump.
 For additional information, refer to: **Power Steering Pump - 2.0L Duratec-HE (MI4) (211-02 Power Steering, Removal and Installation).**

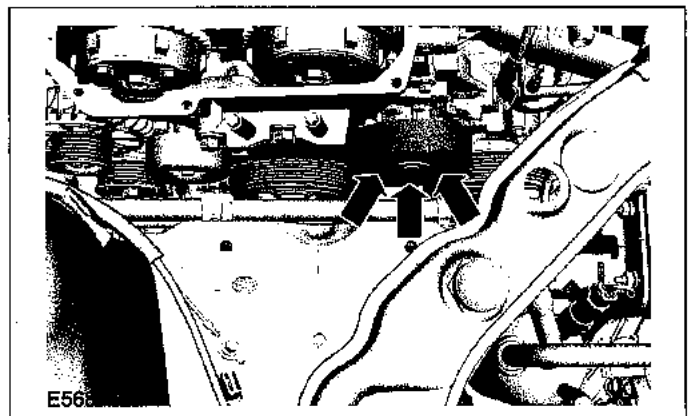
6. Detach the coolant expansion tank and lay it to one side.

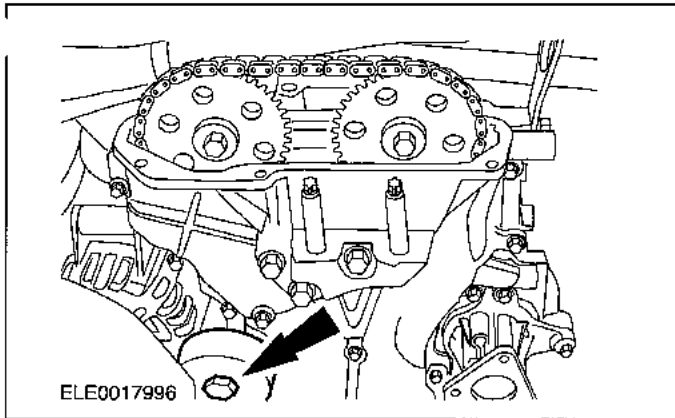


7. Support the engine with a vehicle jack.
8. Remove the front engine mount.
 - Discard the front engine mount nuts.

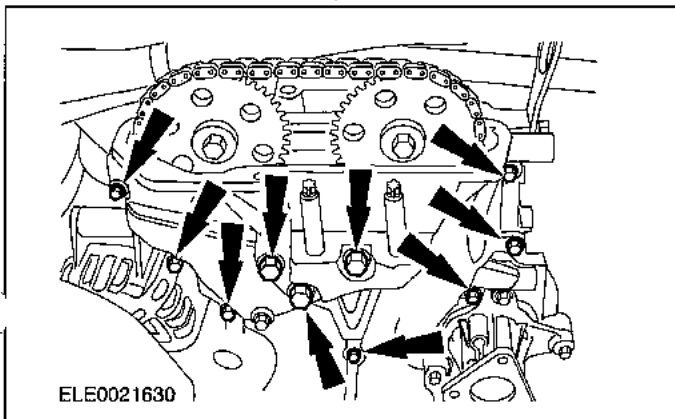


9. Remove the coolant pump pulley.



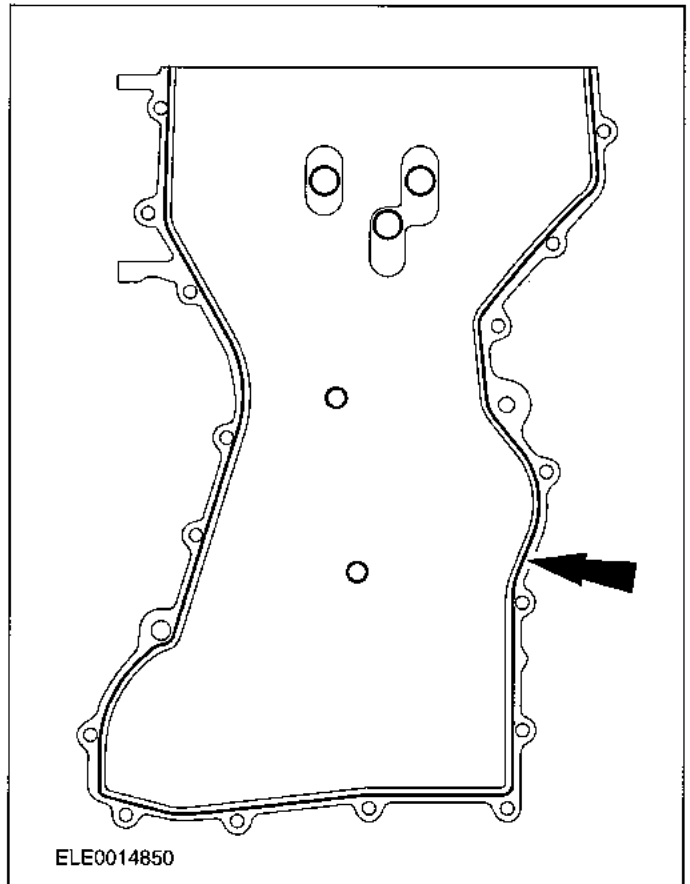
IN-VEHICLE REPAIR**10. Remove the drive belt idler pulley.****11. Remove the timing cover upper bolts.**

- Remove the timing cover.

**Installation**

- 1. Clean the sealing surfaces of the timing cover and the cylinder block.**
- 2. NOTE: Install the timing cover within 10 minutes of applying the silicon sealer.**

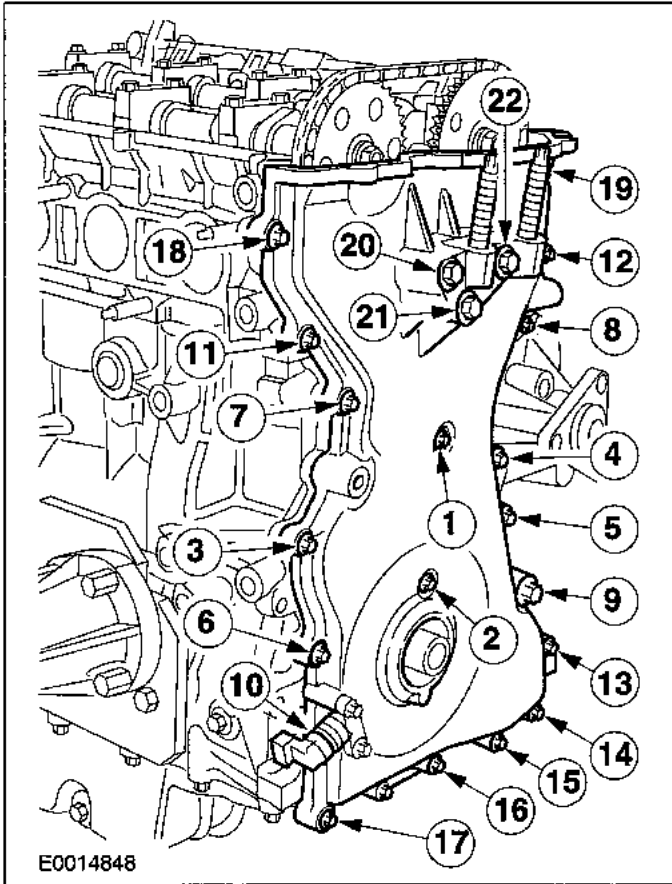
Apply sealer to the timing cover (bead diameter: 3 mm).

**3. Install the timing cover (engine shown removed for clarity).**

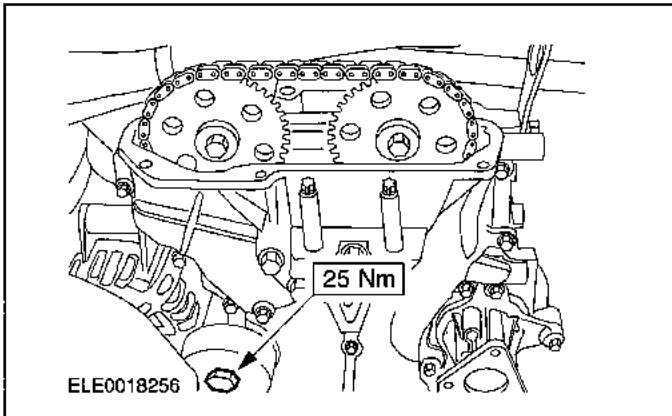
- Tighten the bolts in the sequence shown.
- Tighten bolts 1 to 8 to a torque of 10 Nm.
- Tighten bolt 9 to 48 Nm.
- Tighten bolts 10 to 19 to a torque of 10 Nm.

IN-VEHICLE REPAIR

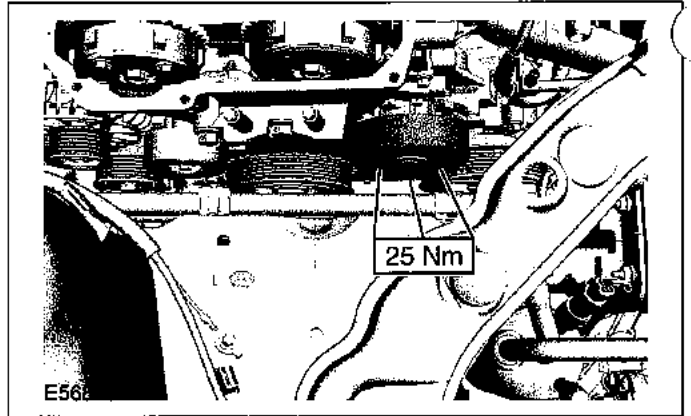
- Tighten bolts 20 to 22 to a torque of 48 Nm.



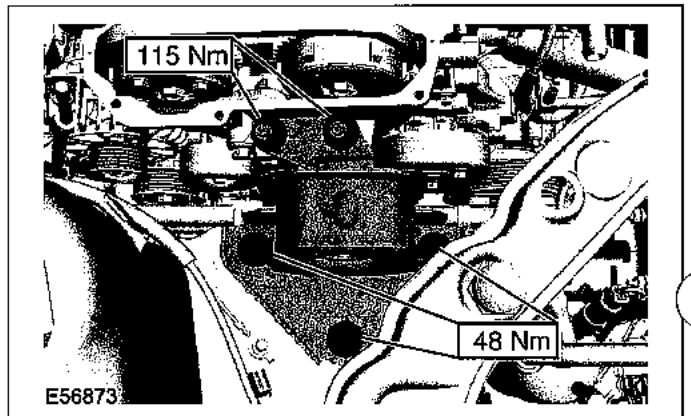
4. Install the multi-groove belt idler pulley.



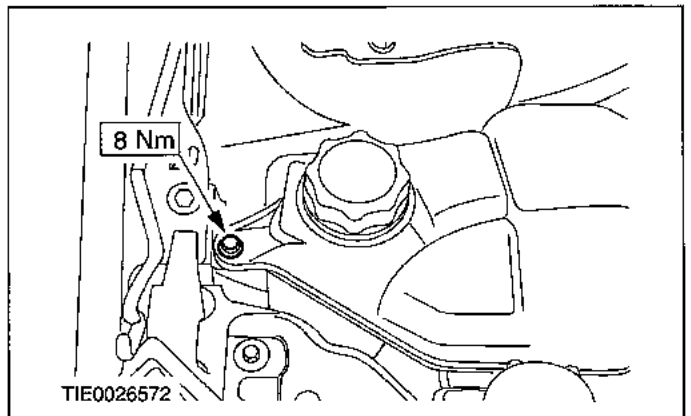
5. Install the coolant pump pulley.



6. **NOTE:** Install new front engine mount nuts. Install the front engine mount.



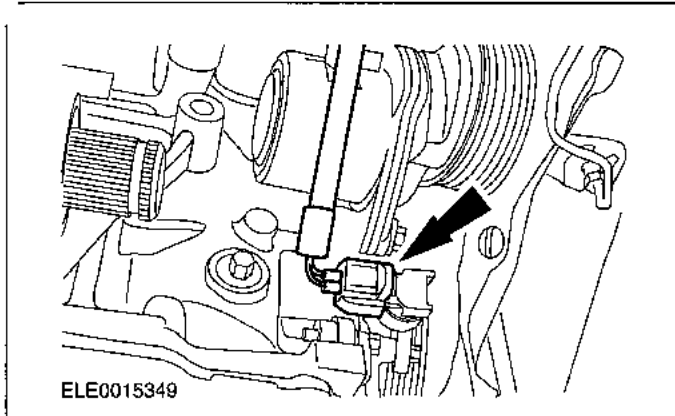
7. Install the coolant expansion tank.



8. Raise the vehicle.

IN-VEHICLE REPAIR

- 9. Connect the CKP sensor electrical connector.**



- 10. Install the crankshaft belt pulley.**

**For additional information, refer to:
Crankshaft Pulley (303-01 Engine - 2.0L
Duratec-HE (MI4), In-vehicle Repair).**

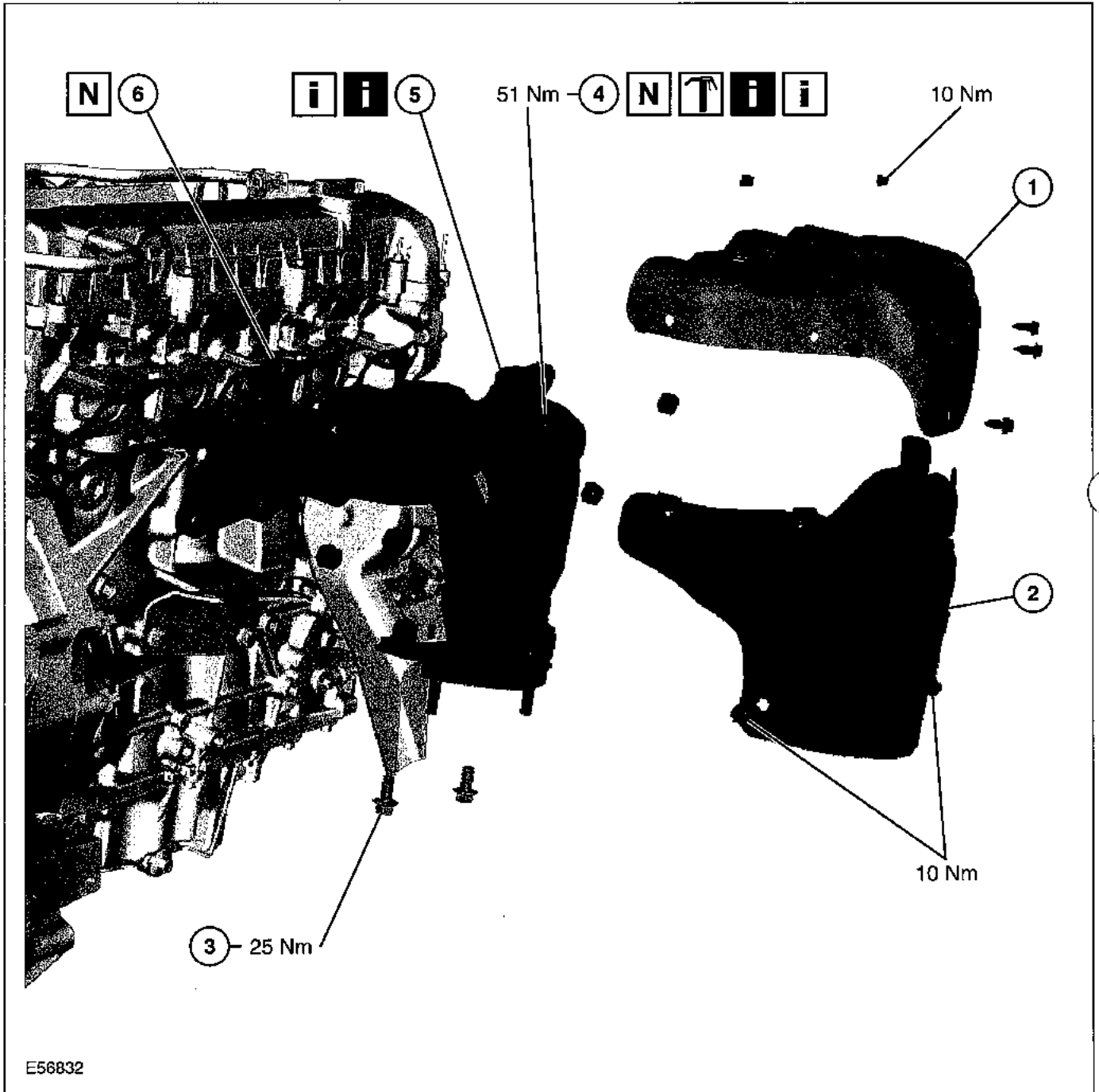
IN-VEHICLE REPAIR

Exhaust Manifold

1. Remove the air cleaner.

For additional information, refer to: Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

2. Remove the components in the order indicated in the following illustration(s) and table(s).



E56832

| Item | Description |
|------|------------------------------------|
| 1 | Exhaust manifold upper heat shield |
| 2 | Exhaust manifold lower heat shield |

| Item | Description |
|------|---|
| 3 | Exhaust manifold support bracket retaining bolts |
| 4 | Exhaust manifold retaining nuts See Removal Detail |

IN-VEHICLE REPAIR

| Item | Description |
|------|--|
| | See Installation Detail |
| 5 | Exhaust manifold See Removal Detail |

| Item | Description |
|------|-------------------------|
| | See Installation Detail |
| 6 | Exhaust manifold gasket |

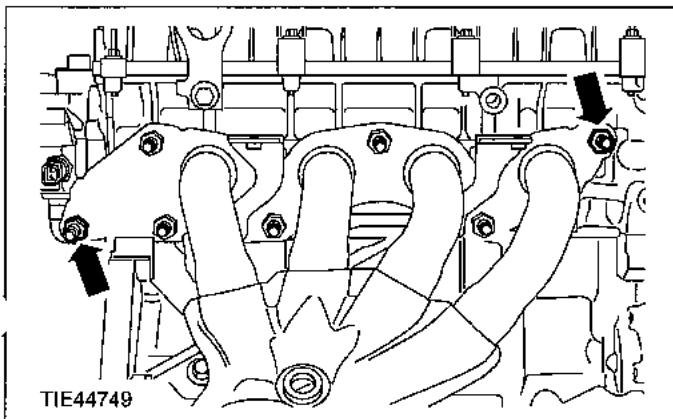
3. To install, reverse the removal procedure.

Removal Details

Item 4 Exhaust manifold retaining nuts

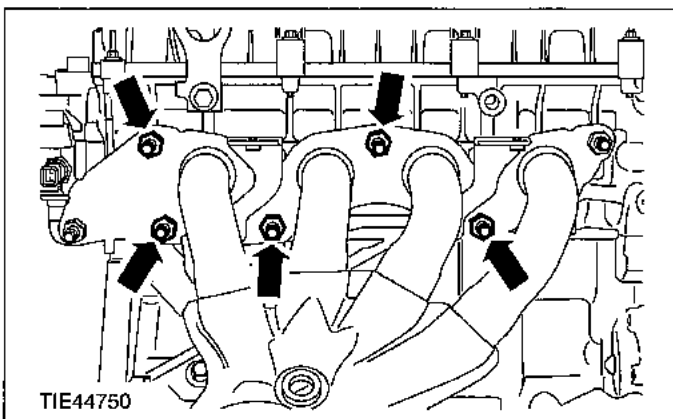
1. **NOTE:** Do not remove the exhaust manifold outer retaining nuts at this stage.

Loosen the exhaust manifold outer retaining nuts by two turns (engine shown removed for clarity).



2. Remove the exhaust manifold inner retaining nuts (engine shown removed for clarity).

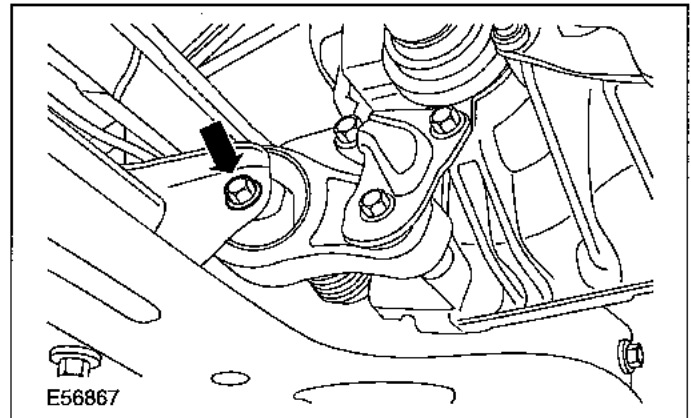
- Discard the nuts.



3. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

Jacking (Description and Operation),
Lifting (Description and Operation).

4. Remove the engine support insulator center retaining bolt.



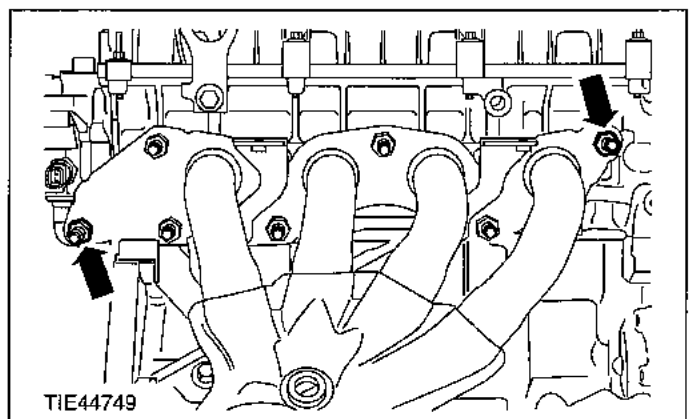
5. Remove the exhaust flexible pipe.

For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratec-HE (M14) (309-00 Exhaust System, Removal and Installation).

Item 5 Exhaust manifold

1. Remove the exhaust manifold outer retaining nuts.

- Discard the nuts.



IN-VEHICLE REPAIR**Installation Details****Item 5 Exhaust manifold**

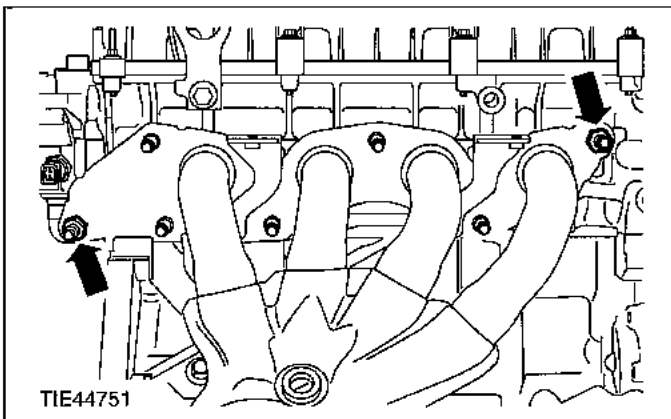
1. **⚠ CAUTION:** Never use jointing compound forward of the exhaust manifold.

NOTE: Coat the exhaust manifold studs with anti-seize grease.

NOTE: Install a new gasket and new nuts.

NOTE: Do not fully tighten the exhaust manifold outer retaining nuts at this stage.

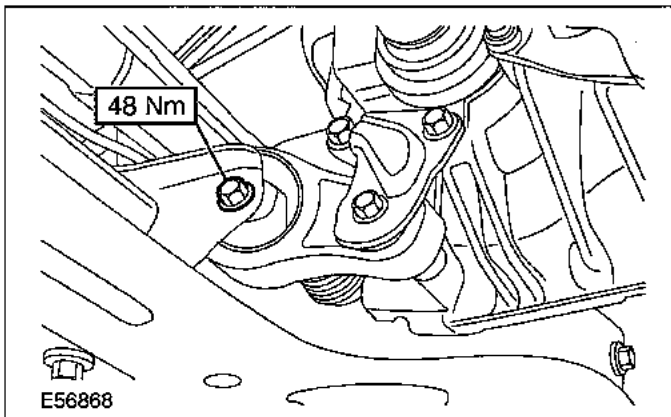
Loosely install the exhaust manifold outer retaining nuts.

**Item 4 Exhaust manifold retaining nuts**

1. Install the exhaust flexible pipe.

For additional information, refer to: **Exhaust Flexible Pipe - 2.0L Duratec-HE (M14) (309-00 Exhaust System, Removal and Installation).**

2. Install the engine support insulator center retaining bolt.



3. Lower the vehicle and fully tighten the exhaust manifold retaining nuts.

IN-VEHICLE REPAIR

Timing Chain(21 314 0)

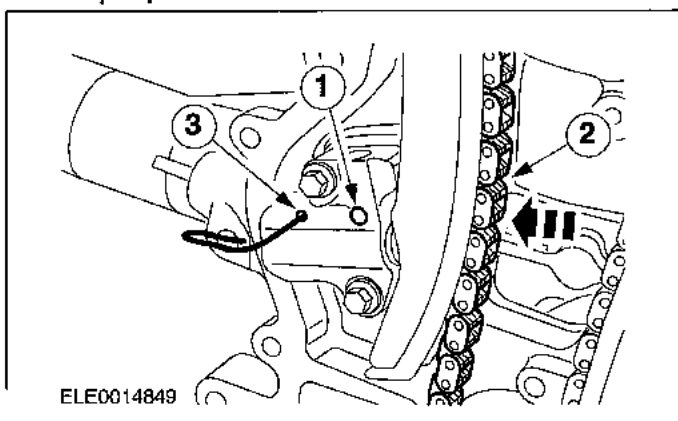
Removal

1. Remove the engine front cover.

For additional information, refer to Engine Front Cover - in this section.

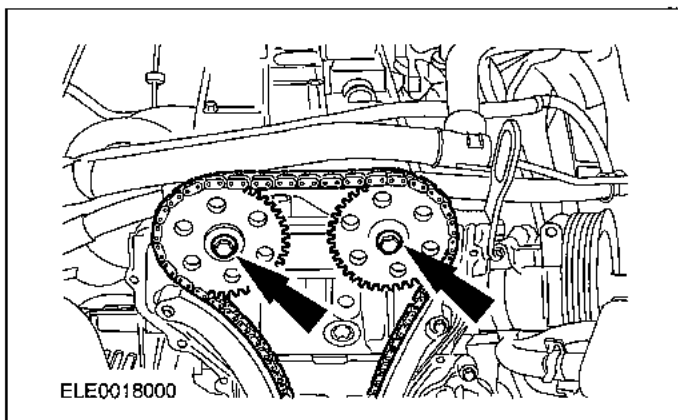
2. Detension the timing chain.

1. Unlock the timing chain tensioner ratchet.
2. Apply pressure to the timing chain guide.
3. Fix the timing chain tensioner with a suitable pin punch.

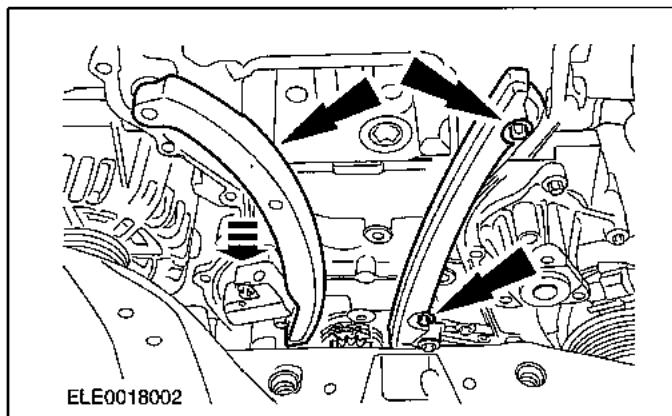


3. **NOTE:** Hold the camshafts by the hexagon with an open-ended wrench to stop them from rotating.

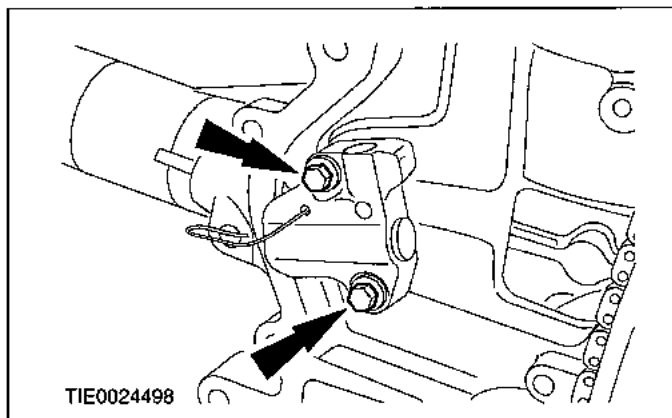
Loosen the camshaft sprocket retaining bolts.



4. Remove the timing chain guides.

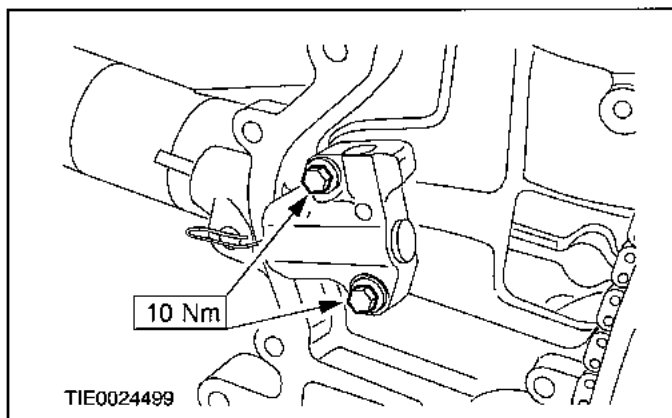


5. Remove the timing chain tensioner.



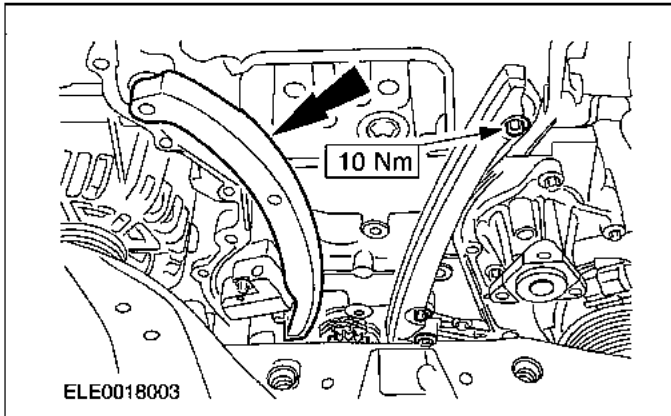
Installation

1. Install the timing chain tensioner.



IN-VEHICLE REPAIR

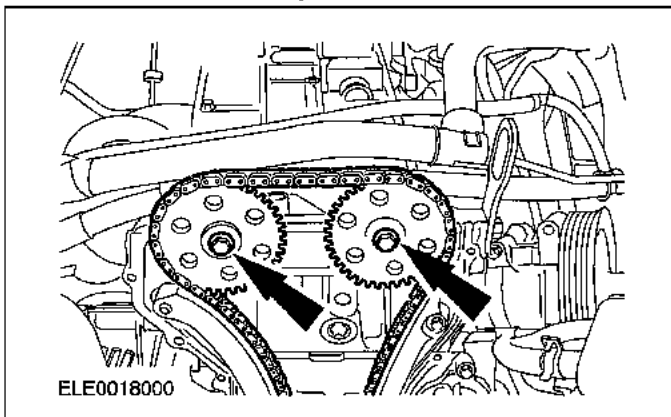
2. Install the timing chain guides.



3. **CAUTION:** Do not tighten the camshaft sprocket retaining bolts at this stage. Make sure the camshaft sprockets rotate on the camshafts.

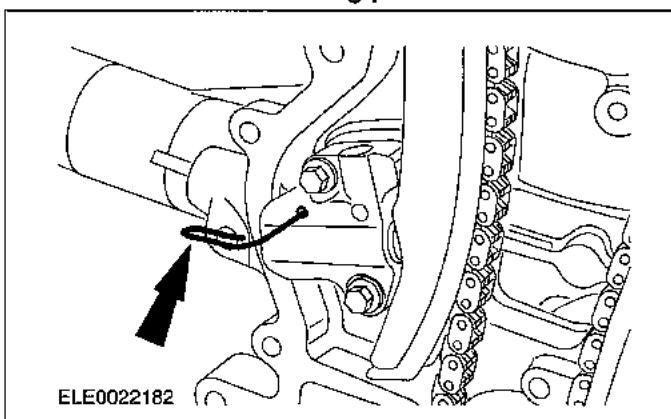
Install the camshaft sprockets.

- Install the timing chain.



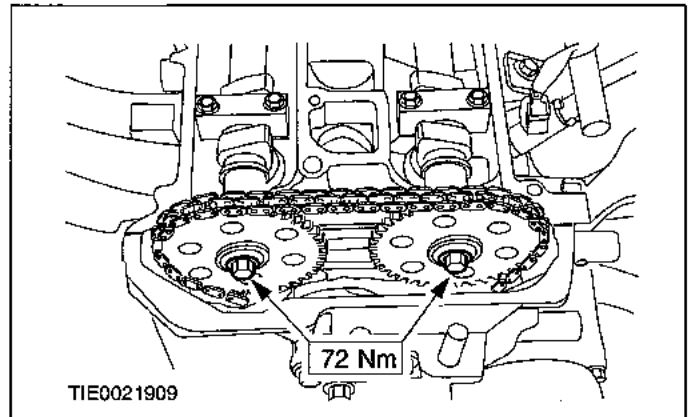
4. Tension the timing chain.

- Apply pressure to the timing chain and remove the securing pin.



5. **NOTE:** Hold the camshafts by the hexagon with an open ended wrench to stop them from rotating.

Tighten the camshaft sprocket retaining bolts.



6. Install the engine front cover.

For additional information, refer to Engine Front Cover - in this section.

IN-VEHICLE REPAIR

Cylinder Head(21 163 0)

Special Tool(s)

| | |
|--|---|
|  <p>24003</p> | Remover/Installer, Hose Clamp 303-397 |
|--|---|

Materials

| Name | Specification |
|-----------------|---------------|
| Hypoid Gear Oil | SQM-2C9002-AA |

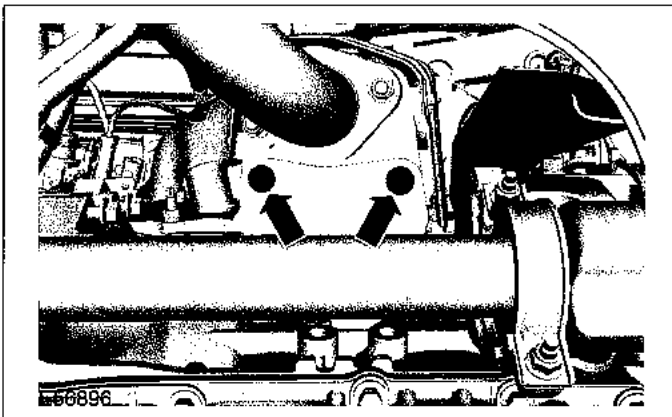
Removal

- ▲ **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Drain the cooling system.

For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.0L Duratec-HE (MI4), General Procedures).

2. Remove the exhaust manifold support bracket retaining bolts.



3. Lower the vehicle.

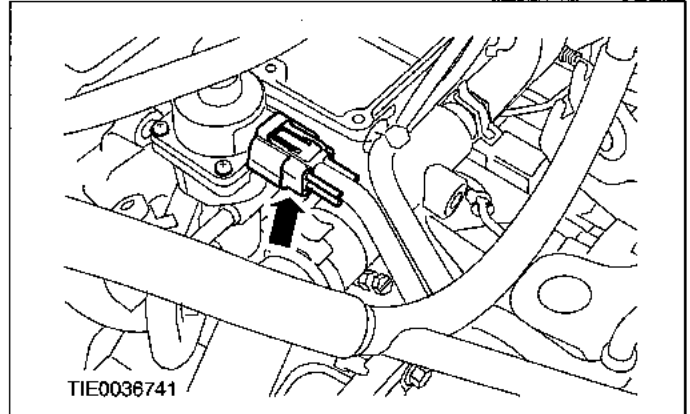
4. Remove the intake manifold.

For additional information, refer to: Intake Manifold (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

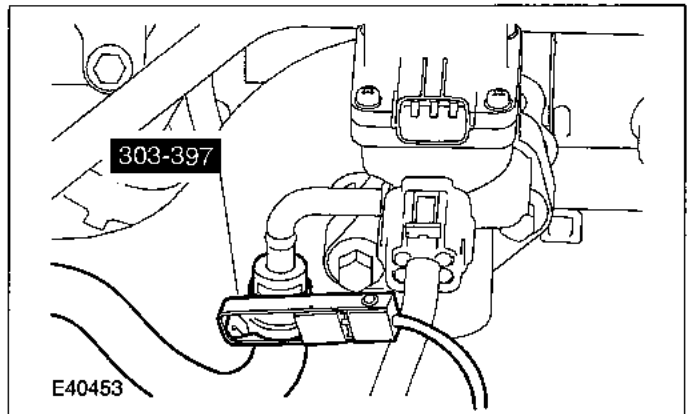
5. Remove the timing chain.

For additional information, refer to: Timing Chain (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

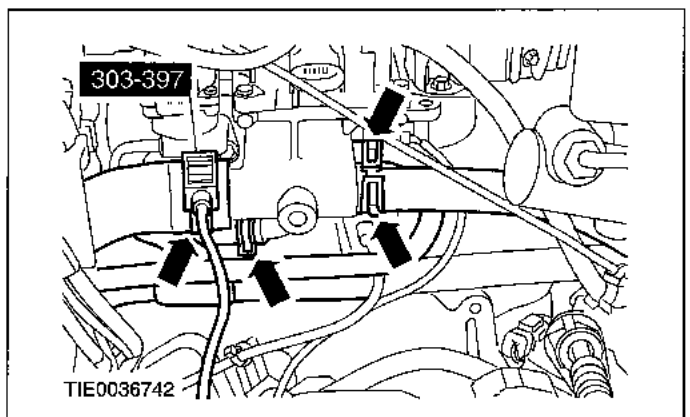
6. Disconnect the exhaust gas recirculation (EGR) valve electrical connector.



7. Using the special tool, disconnect the coolant hose from the EGR valve.

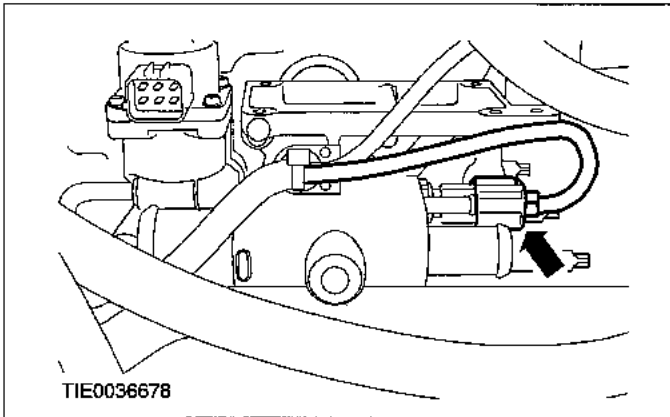


8. Using the special tool, disconnect the coolant hoses from the coolant outlet connector.

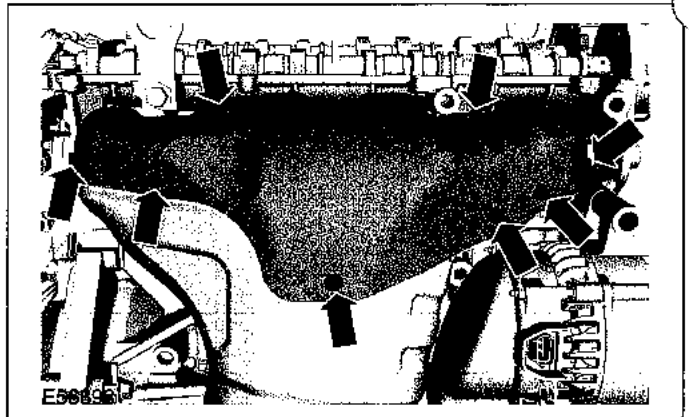


IN-VEHICLE REPAIR

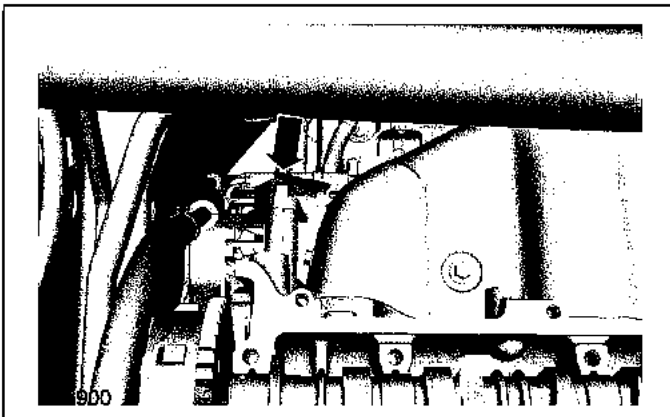
9. Disconnect the engine coolant temperature (ECT) sensor electrical connector.



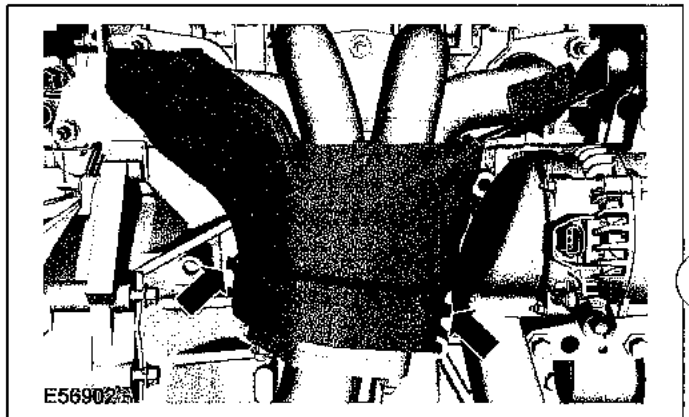
12. Remove the exhaust manifold upper heat shield (engine shown removed for clarity).



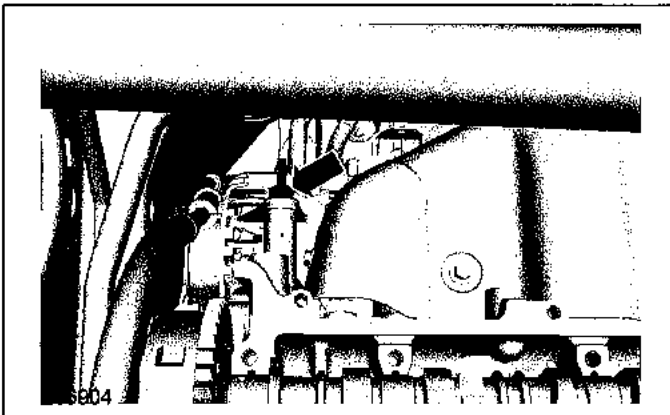
10. Remove the power steering pump return line support bracket.



13. Remove the exhaust manifold lower heat shield (engine shown removed for clarity).

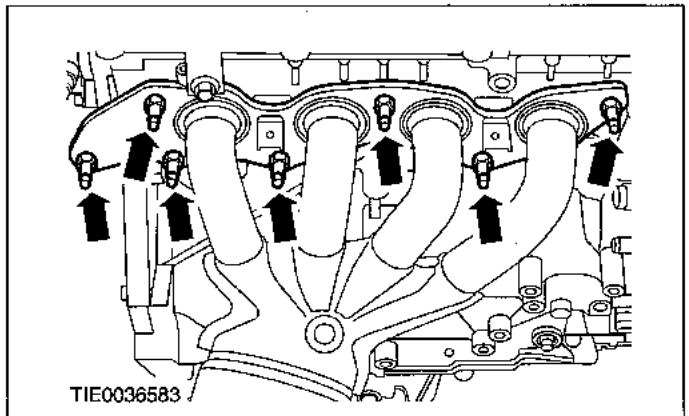


11. Remove the generator upper retaining bolt.



14. Remove the exhaust manifold retaining nuts (engine shown removed for clarity).

- Detach the exhaust manifold from the cylinder head and position it to one side.
- Discard the gasket and nuts.



15. CAUTIONS:

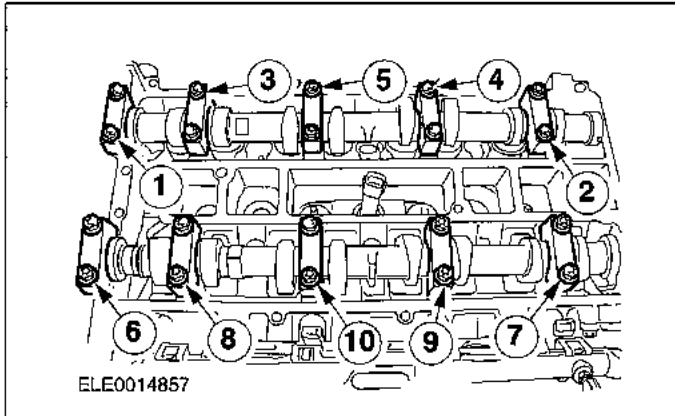
⚠ Keep the camshaft bearing caps and the camshafts in order for installation.

IN-VEHICLE REPAIR

⚠ Remove the camshaft bearing caps in the sequence shown.

NOTE: Working in several stages, release each camshaft bearing cap retaining bolt two turns at a time.

Remove the camshafts.



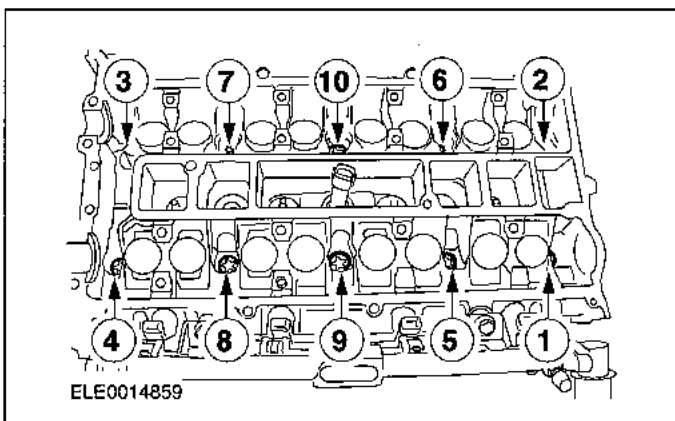
16. ⚠ CAUTION: Keep the valve tappets in order for installation.

Remove the valve tappets.

17. ⚠ CAUTION: Remove the cylinder head bolts in the sequence shown.

Remove the cylinder head.

- Discard the gasket.
- Discard the bolts.



Installation

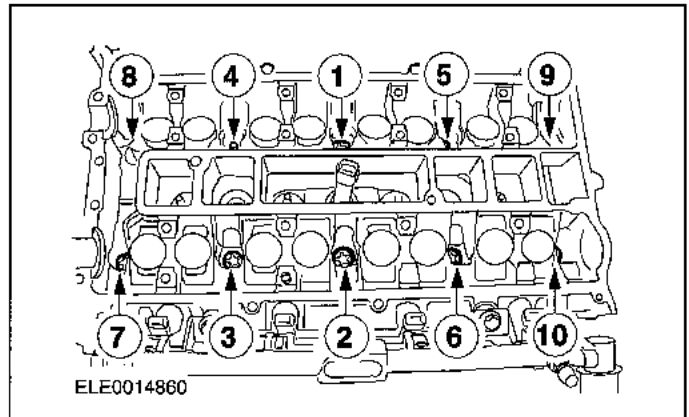
1. Check the cylinder head for distortion.

For additional information, refer to: **Cylinder Head Distortion (303-00 Engine System - General Information, General Procedures).**

2. NOTE: Install a new cylinder head gasket and bolts.

Install the cylinder head.

- Tighten the cylinder head bolts in the sequence shown in five stages:
- Stage 1: 5 Nm.
- Stage 2: 15 Nm.
- Stage 3: 45 Nm.
- Stage 4: 90 degrees.
- Stage 5: 90 degrees.

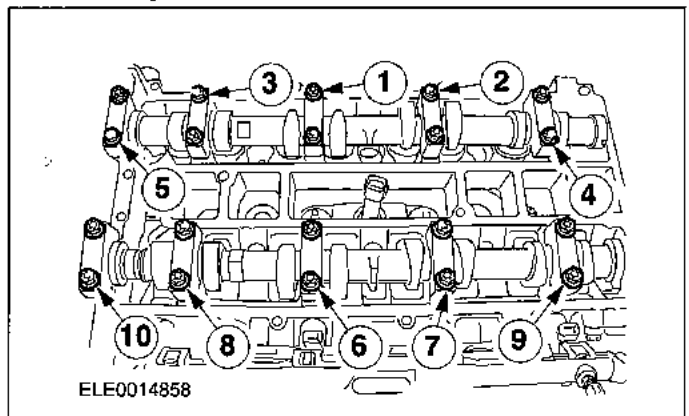


3. Install the valve tappets.

4. ⚠ CAUTION: Working in several stages, evenly tighten the camshaft bearing cap bolts in the sequence shown, one half turn at a time.

Install the camshafts.

- Coat the camshaft bearing caps with oil.
- Tighten the bolts in the sequence shown in two stages:
- Stage 1: 7 Nm.
- Stage 2: 16 Nm.



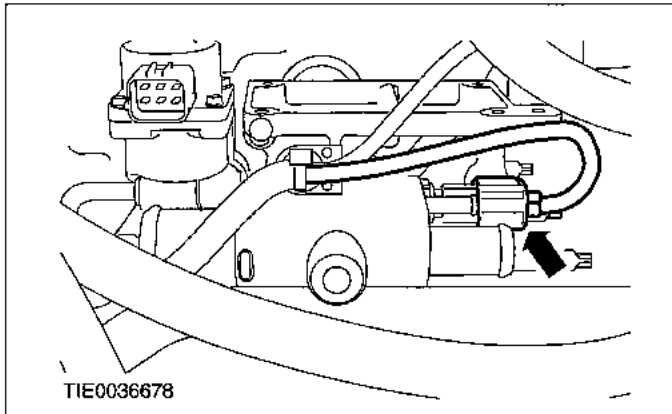
5. NOTE: Only carry out the following step when a new cylinder head or new valves are installed.

IN-VEHICLE REPAIR

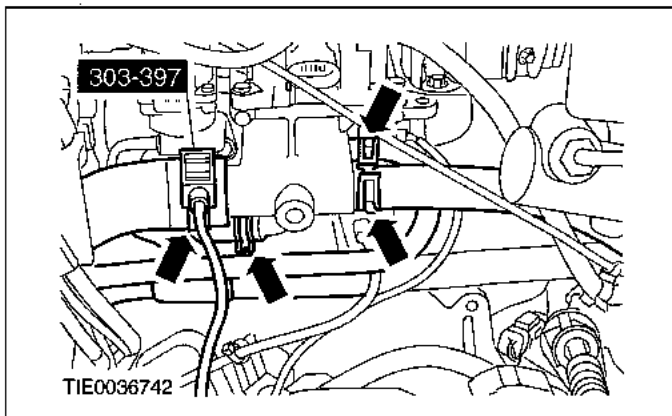
Check the valve clearance and adjust if necessary.

For additional information, refer to: Valve Clearance Adjustment (303-01 Engine - 2.0L Duratec-HE (M14), General Procedures).

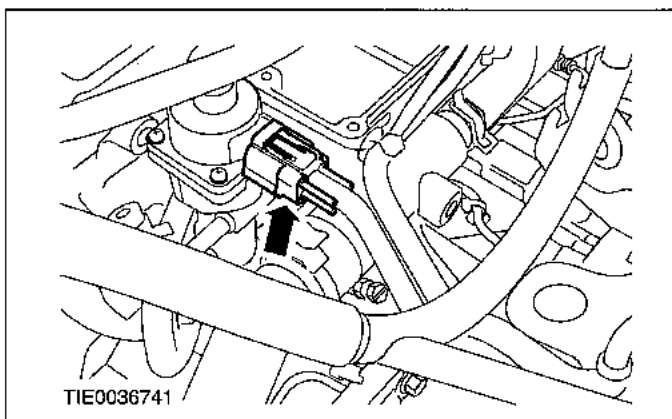
6. Connect the engine coolant temperature (ECT) sensor electrical connector.



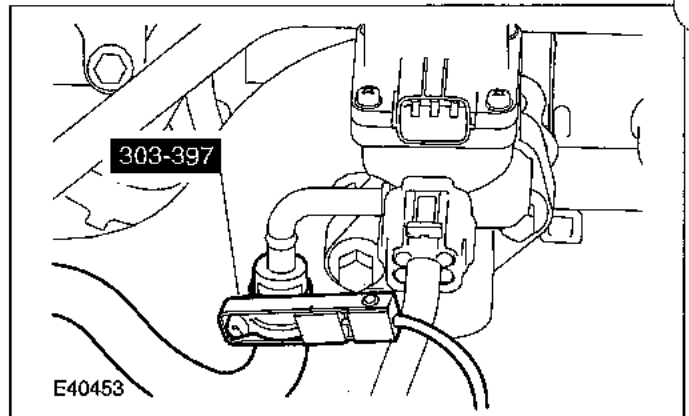
7. Using the special tool, connect the coolant hoses to the coolant outlet connector.



8. Connect the exhaust gas recirculation (EGR) valve electrical connector.

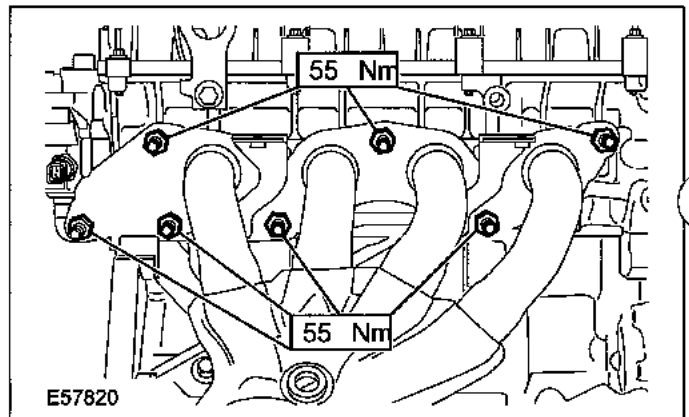


9. Using the special tool, connect the coolant hose to the EGR valve.

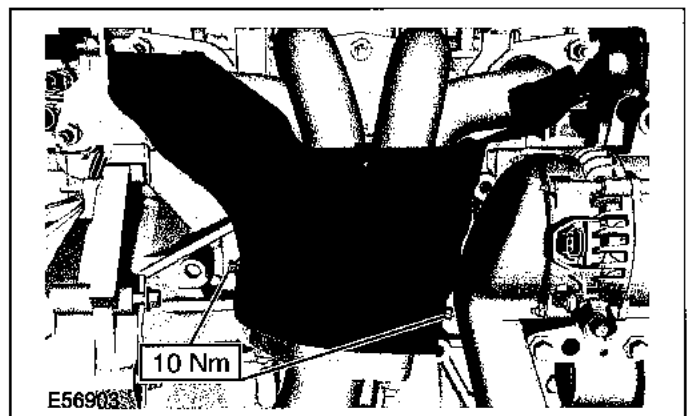


10. NOTE: Install a new exhaust manifold gasket and nuts.

Tighten the exhaust manifold retaining nuts (engine shown removed for clarity).

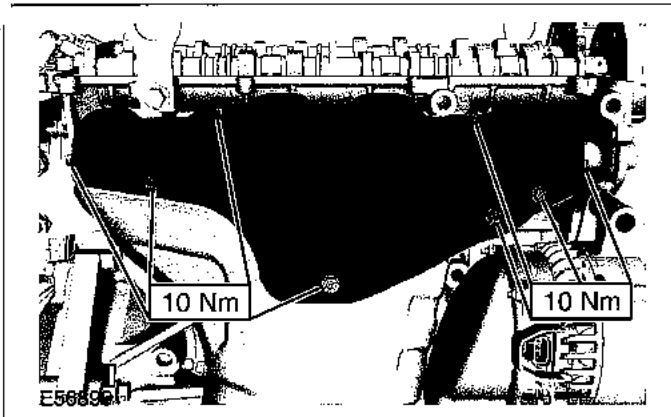


11. Install the exhaust manifold lower heat shield (engine shown removed for clarity).

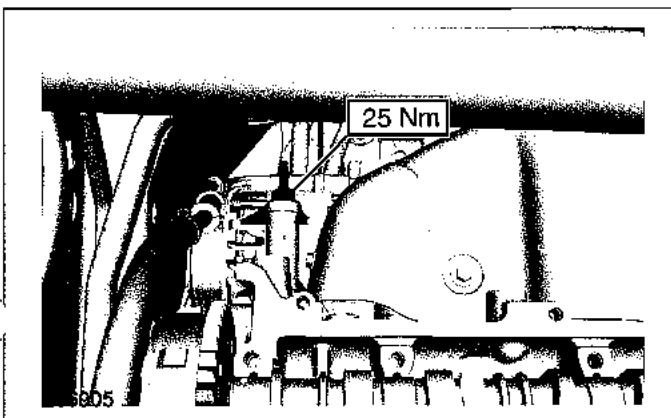


IN-VEHICLE REPAIR

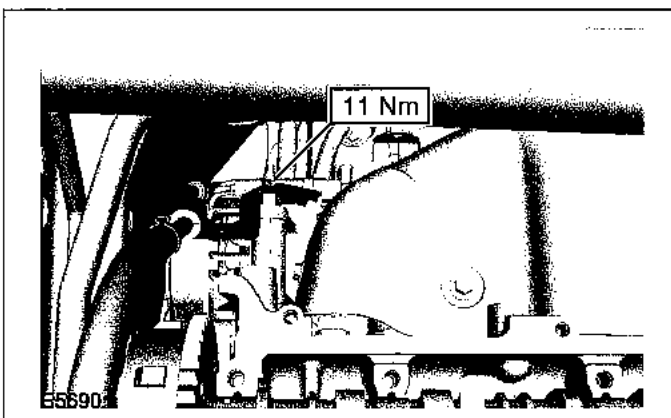
12. Install the exhaust manifold upper heat shield (engine shown removed for clarity).



13. Install the generator upper retaining bolt.



14. Install the power steering pump return line support bracket.



15. Install the timing chain.

For additional information, refer to: Timing Chain (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

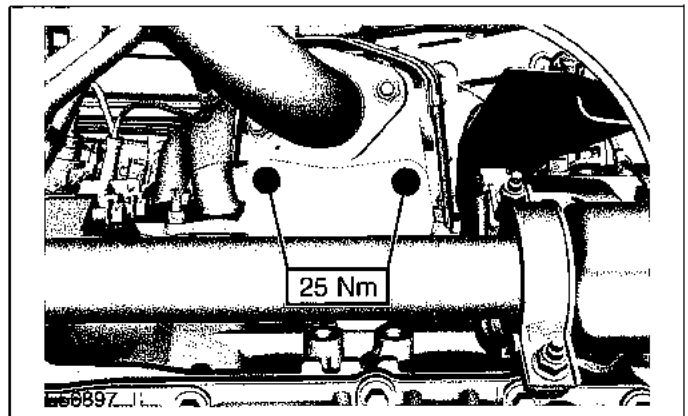
16. Install the intake manifold.

For additional information, refer to: Intake Manifold (303-01 Engine - 2.0L Duratec-HE (MI4), In-vehicle Repair).

17. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

Jacking (Description and Operation), Lifting (Description and Operation).

18. Install the exhaust manifold support bracket retaining bolts.



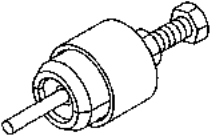
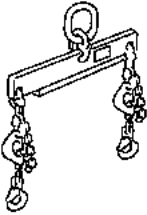
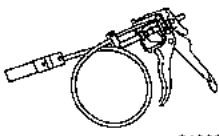
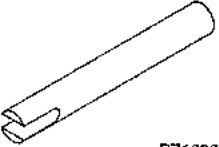
19. Fill and bleed the cooling system.

For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.0L Duratec-HE (MI4), General Procedures).

REMOVAL

Engine

Special Tool(s)

| | |
|--|--|
|  <p>ES13021</p> | <p>Remover, Power Steering Pump Pulley 211-198</p> |
|  <p>21068A</p> | <p>Lifting Bracket, Engine 303-122</p> |
|  <p>24003</p> | <p>Remover/Installer, Hose Clamp 303-397</p> |
|  <p>PZ16087</p> | <p>Remover, Halfshaft 308-237</p> |

General Equipment

| |
|------------------------|
| <p>Workshop table</p> |
| <p>Engine hoist</p> |
| <p>Securing straps</p> |

Removal

▲ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

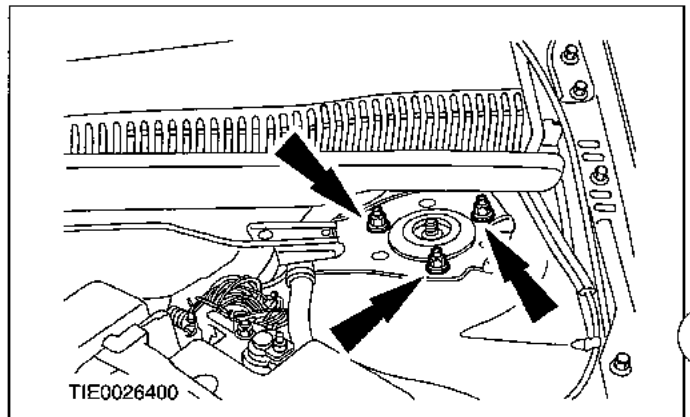
1. Remove the air cleaner.

For additional information, refer to: Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

2. Remove the battery tray.

For additional information, refer to: Battery Tray - 2.0L Duratec-HE (MI4) (414-01 Battery, Mounting and Cables, Removal and Installation).

3. Loosen the strut and spring assembly top mount nuts by three turns on both sides.



4. Remove the right-hand headlamp assembly.

For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

5. Remove the accessory drive belt.

For additional information, refer to: Accessory Drive Belt - 2.0L Duratec-HE (MI4) (303-05 Accessory Drive, Removal and Installation).

6. Drain the cooling system.

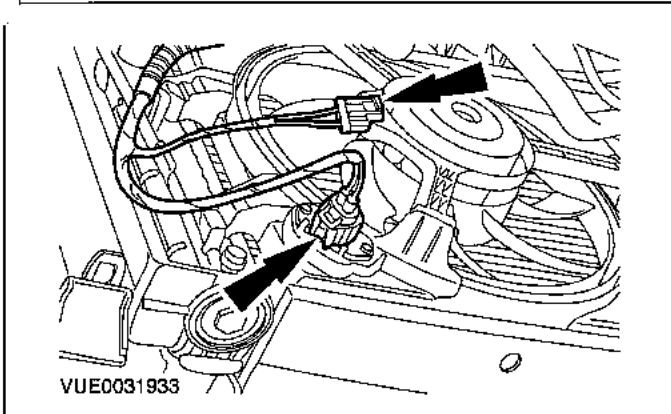
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.0L Duratec-HE (MI4), General Procedures).

7. Detach the exhaust flexible pipe from the exhaust manifold.

For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratec-HE (MI4) (309-00 Exhaust System, Removal and Installation).

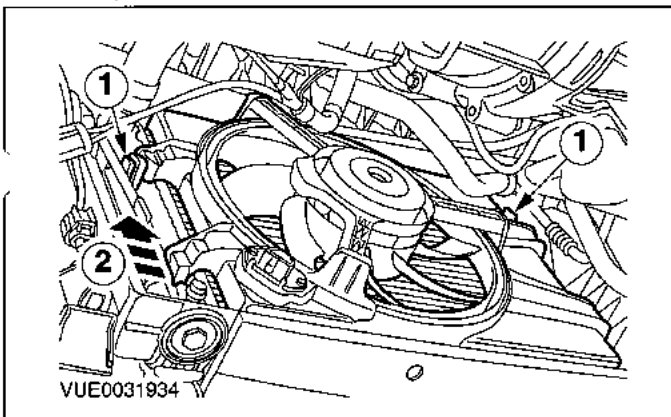
REMOVAL

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



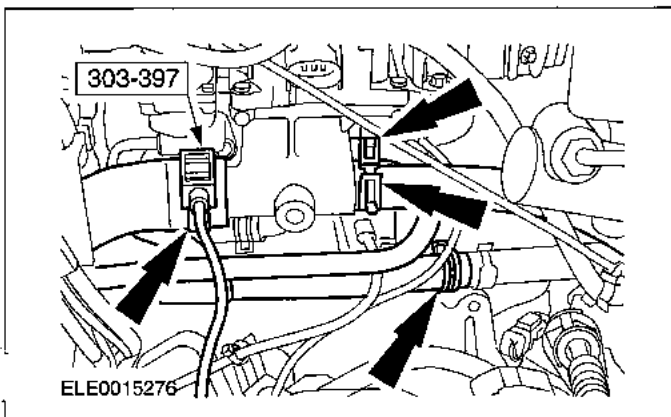
- 9. Remove the cooling fan motor and shroud.**

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.



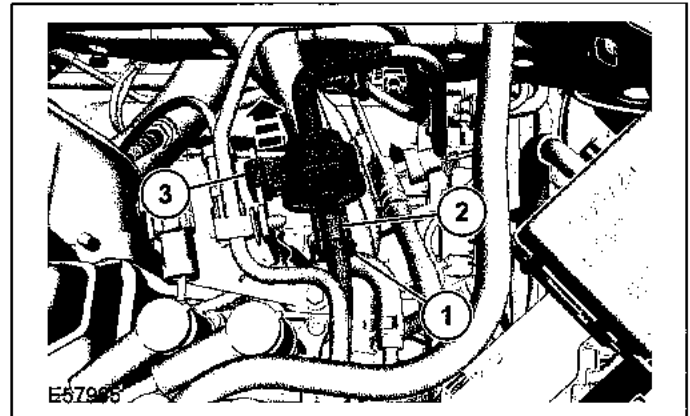
- 10. Lower the vehicle.**

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

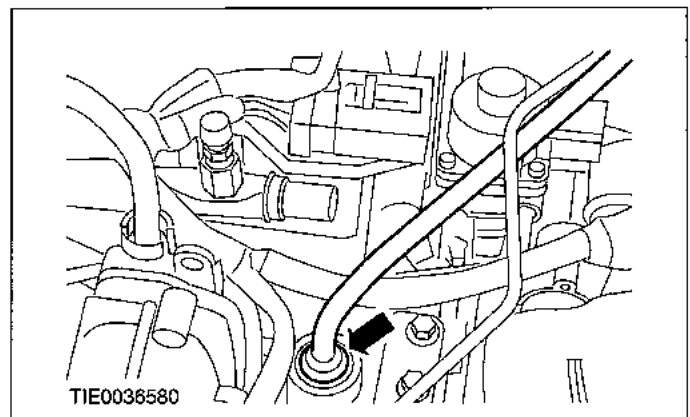


- 12. Detach the evaporative emission (EVAP) valve from EVAP valve support bracket.**

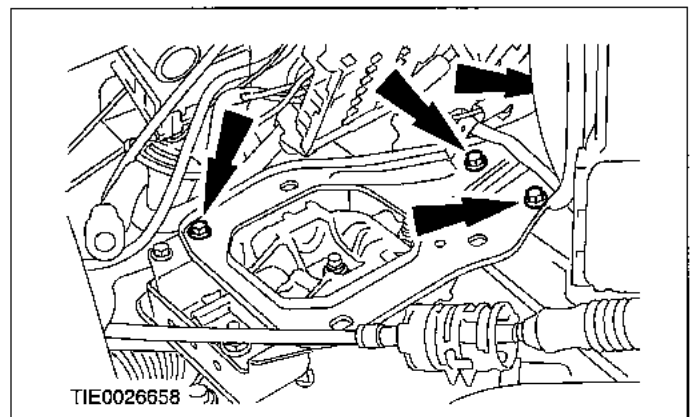
1. Disconnect the EVAP valve electrical connector.
2. Disconnect the low pressure line from the EVAP valve.
3. Push the EVAP valve from the support bracket.



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

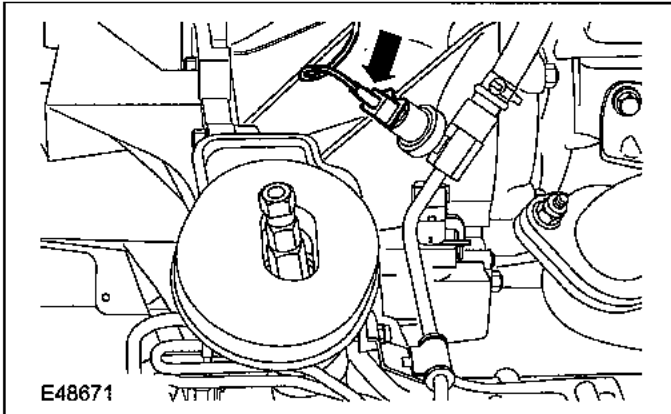


- 14. Remove the battery tray support bracket.**

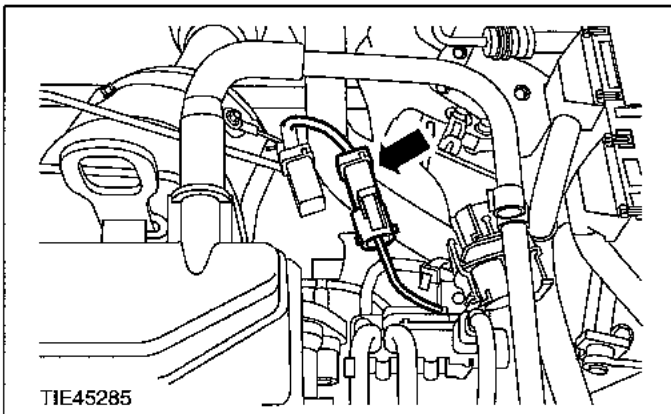


REMOVAL

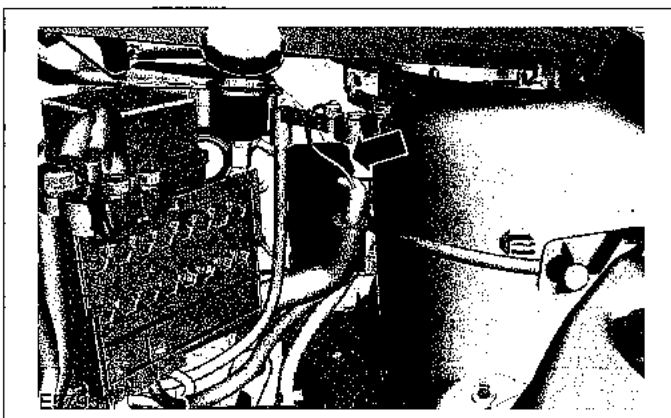
15. Disconnect the power steering pump switch electrical connector.



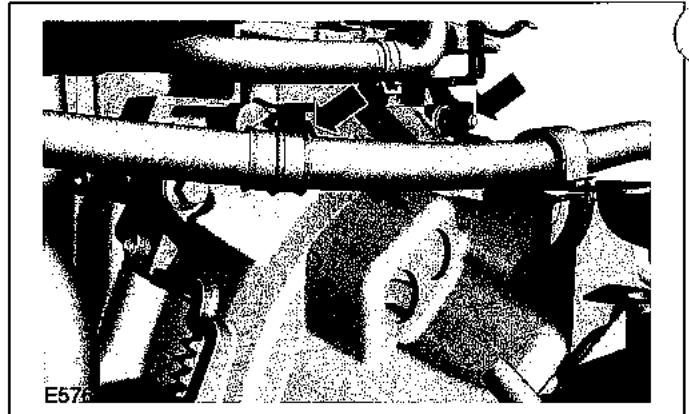
16. Disconnect the catalyst monitor sensor electrical connector.



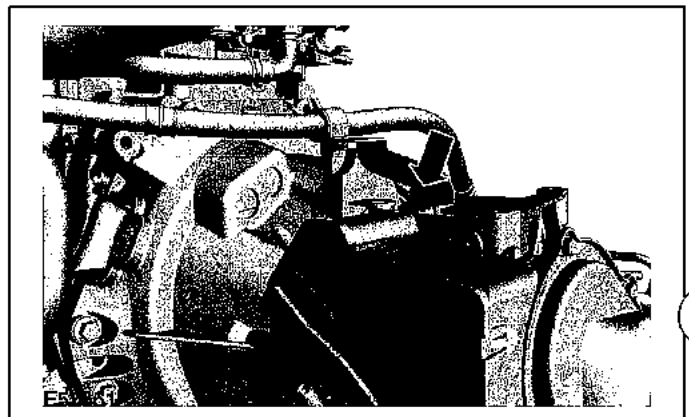
17. Disconnect the engine wiring harness electrical connector.



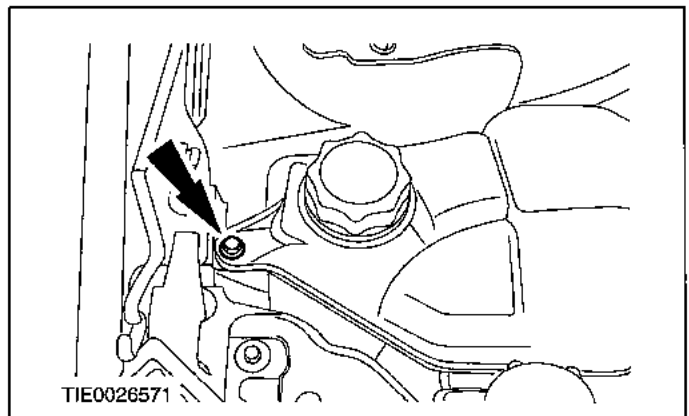
18. Remove the engine wiring harness bracket.



19. Detach the power steering high-pressure line retaining bracket from the transaxle.

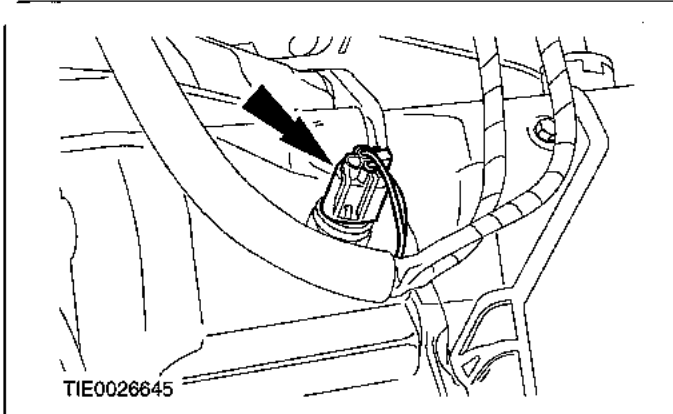


20. Remove the coolant expansion tank.

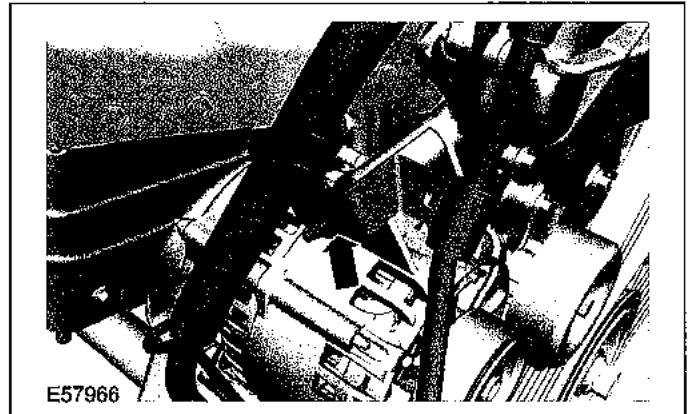


REMOVAL

21. Disconnect the reversing lamp switch electrical connector.



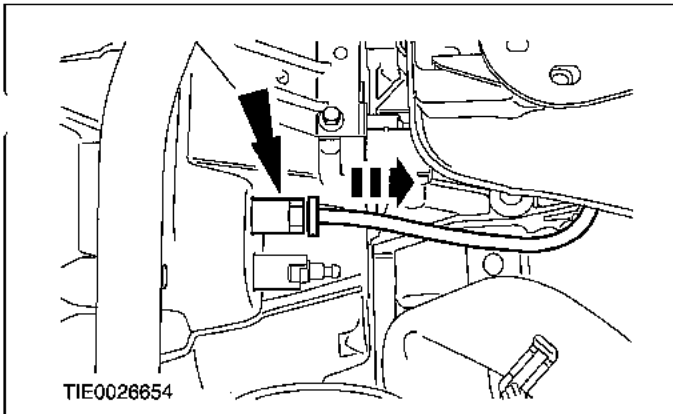
- Detach the steering gear to power steering fluid reservoir return line support bracket from the generator.



22. **⚠ CAUTION:** If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

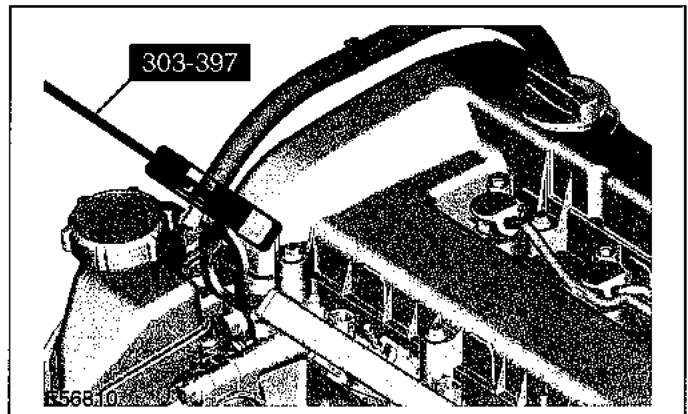
Disconnect the clutch slave cylinder supply line.

- Remove the spring clip.

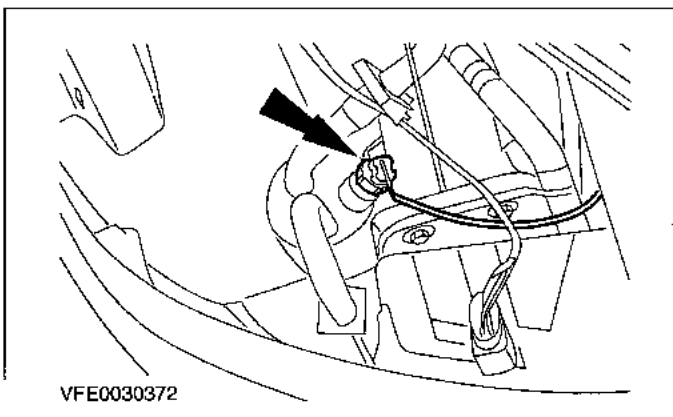


25. Using the special tool, disconnect the steering gear to power steering fluid reservoir return line from the power steering fluid reservoir.

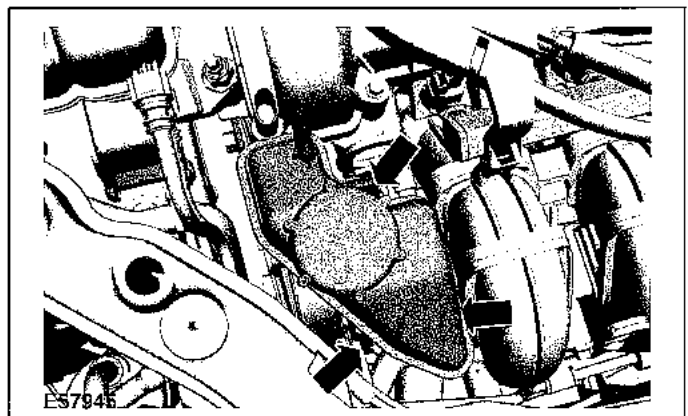
- Allow the power steering fluid to drain into a suitable container.



23. Disconnect the air conditioning low pressure switch connector.



26. Remove the power steering fluid reservoir.

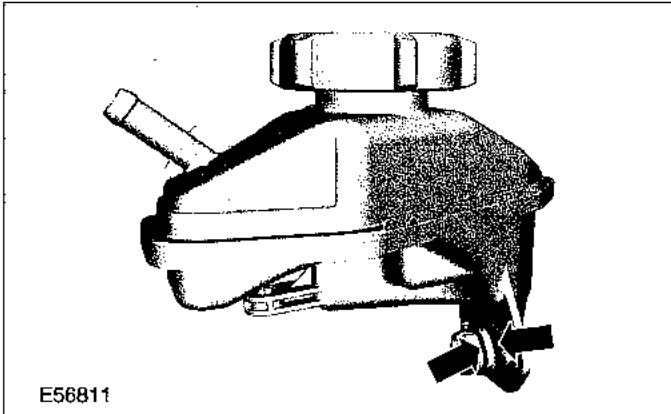


24. **NOTE:** Note the position of the steering gear to power steering fluid reservoir return line support bracket to aid installation.

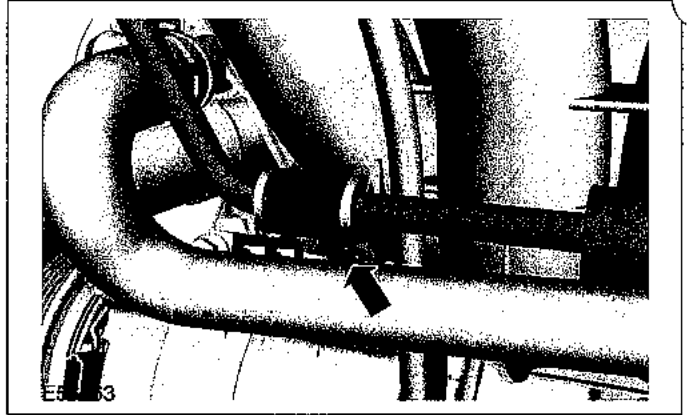
27. **⚠ CAUTION:** Cap the power steering fluid reservoir to prevent power steering fluid loss or dirt ingress.

REMOVAL

Remove and discard the power steering fluid reservoir O-rings.

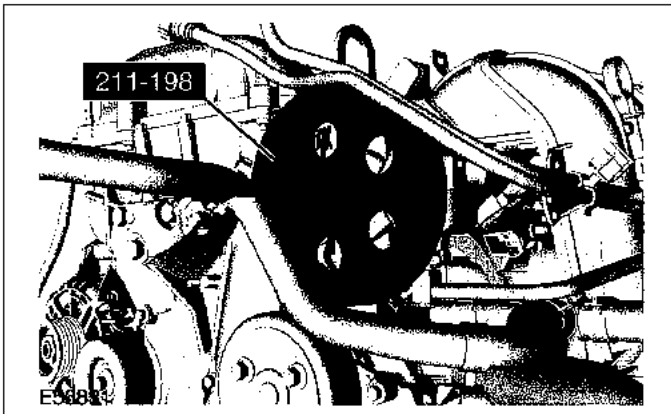


30. Detach the power steering pump to steering gear pressure line from the intake manifold.



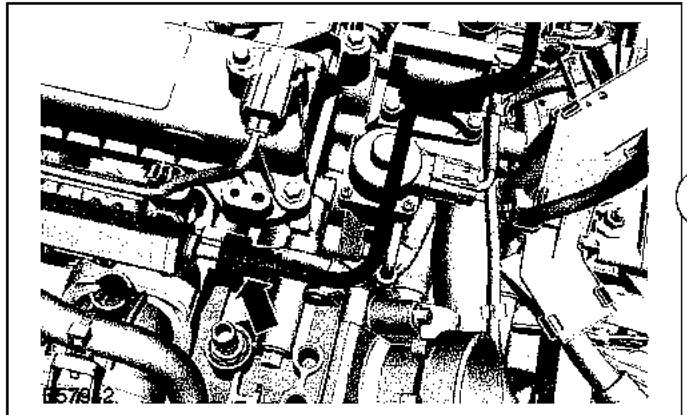
28. Using the special tool, remove the power steering pump pulley.

- Discard the power steering pump pulley.

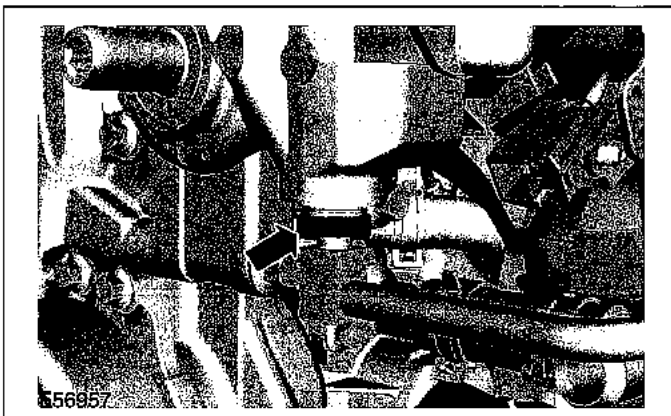


31. Disconnect the fuel supply line.

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



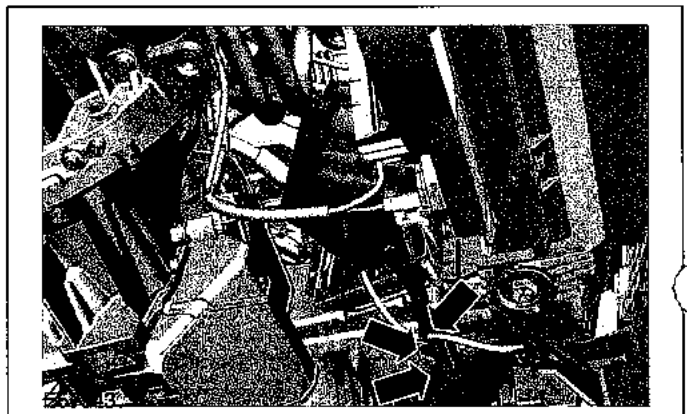
29. Detach the power steering pump to steering gear pressure line from the power steering pump.



32. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

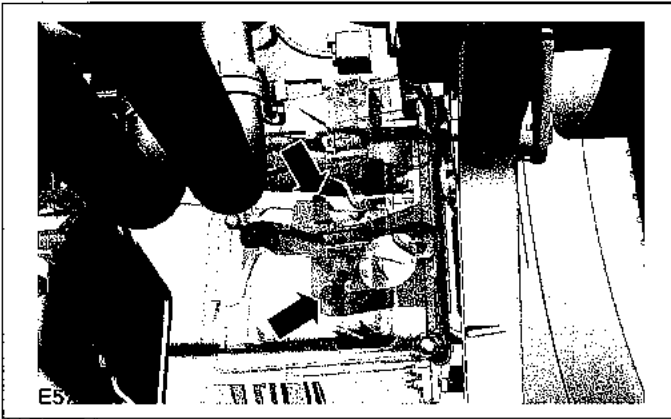
Jacking (Description and Operation), Lifting (Description and Operation).

33. Remove the air cleaner resonator support bracket.



REMOVAL

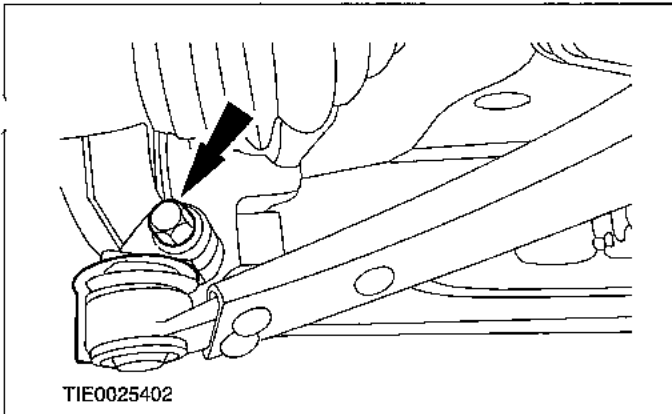
34. Detach the powertrain control module (PCM) support bracket from the side member.



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

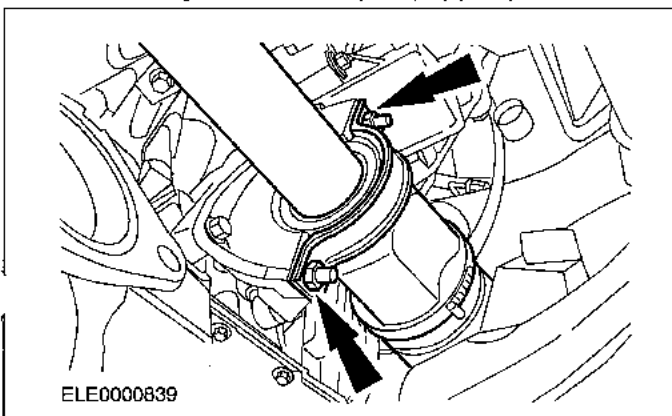
Detach the lower arm ball joint from the wheel knuckle on both sides.

- Remove the heat shield.



36. Remove the intermediate shaft center bearing cap.

- Discard the bearing cap and retaining nuts.
- Remove the intermediate shaft center bearing heat shield (if equipped).



37. CAUTIONS:

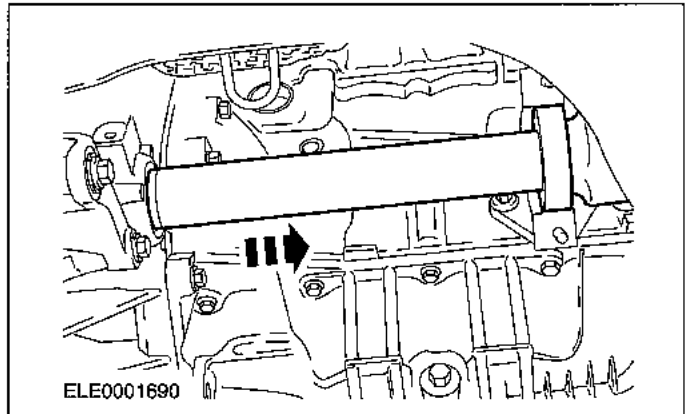
⚠ The inner CV joint must not be bent more than 23 degrees. The outer CV joint must not be bent more than 45 degrees.

⚠ Make sure the halfshaft seal is not damaged.

⚠ Plug the transaxle to prevent oil loss or dirt ingress.

Remove the halfshaft and intermediate shaft assembly.

- Allow the oil to drain into a suitable container.



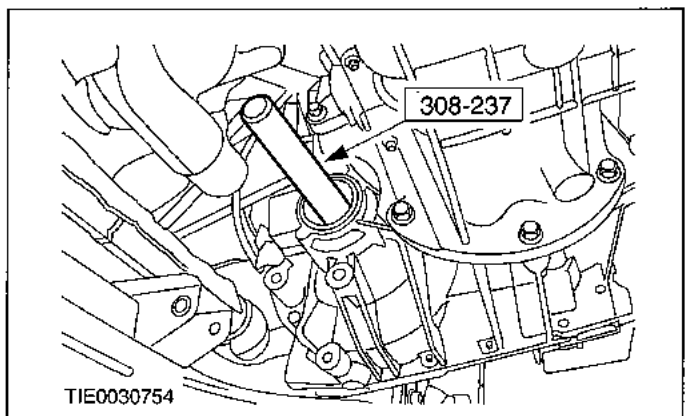
38. CAUTIONS:

⚠ Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.

⚠ Do not damage the halfshaft seal.

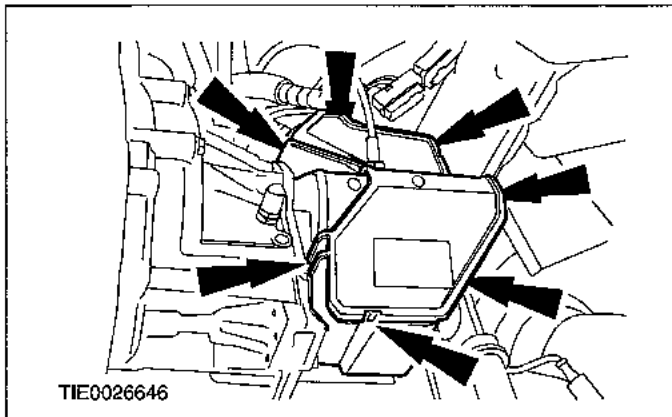
NOTE: Plug the transaxle to prevent oil loss or dirt ingress.

Remove the left-hand halfshaft.



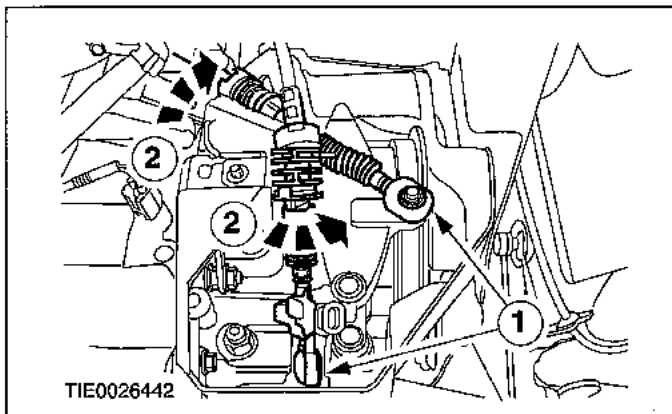
REMOVAL

39. Remove the gearshift cables cover.

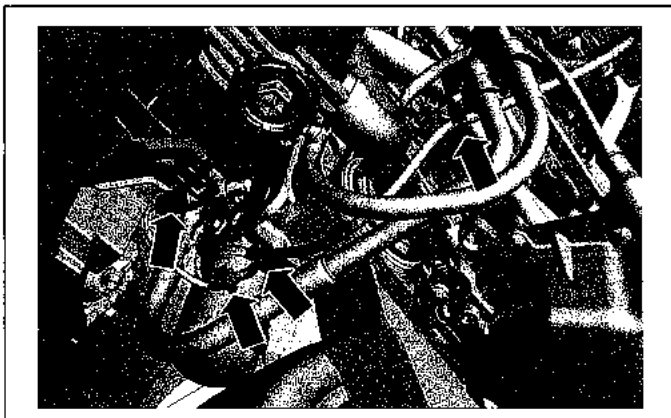


40. Detach the gearshift cables from the transaxle.

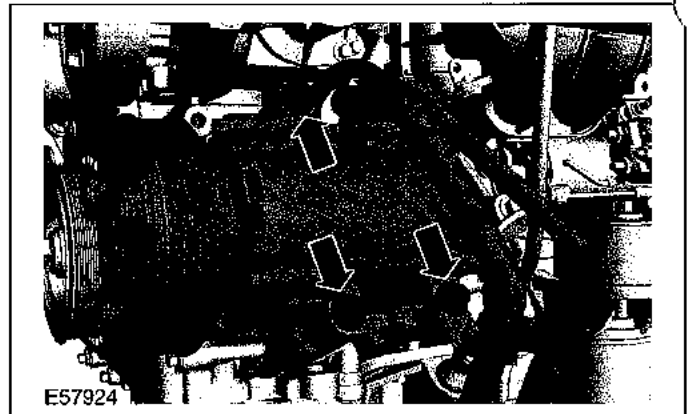
1. Detach the gearshift cables and the selector cable from the selector levers.
2. Turn the abutment sleeve clockwise and detach the cables from the bracket.



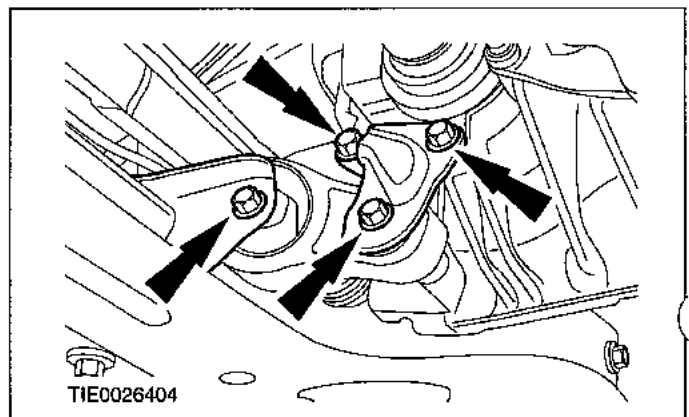
41. Disconnect the A/C high pressure switch electrical connector.



42. Detach the A/C compressor from the cylinder block and position it to one side.

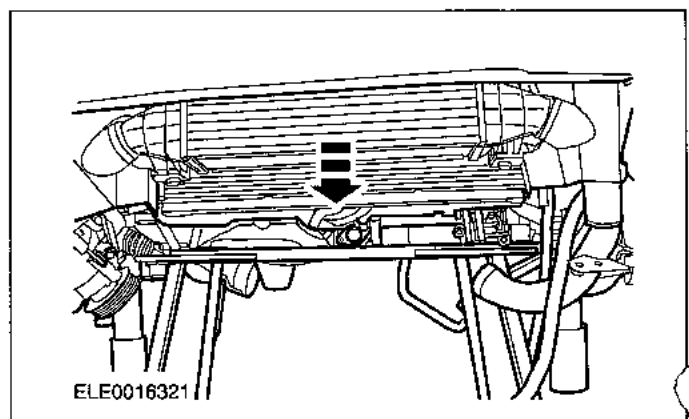


43. Remove the engine support insulator.



44. **NOTE:** Use securing straps to secure the engine and the transaxle on the workshop table.

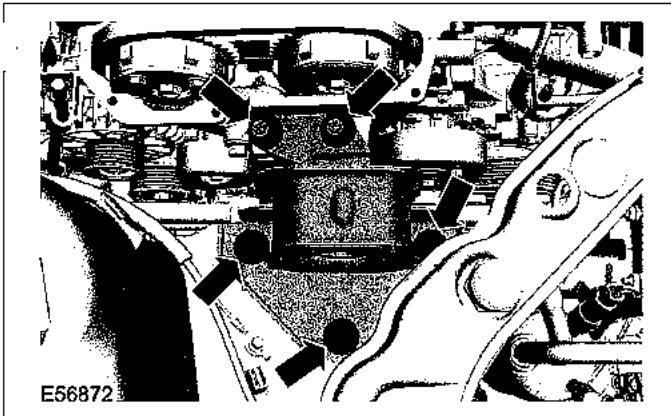
Position the workshop table under the vehicle and carefully lower the vehicle, until the engine and transaxle assembly is in the correct position to remove the engine mounts.



45. Remove the engine front mount.

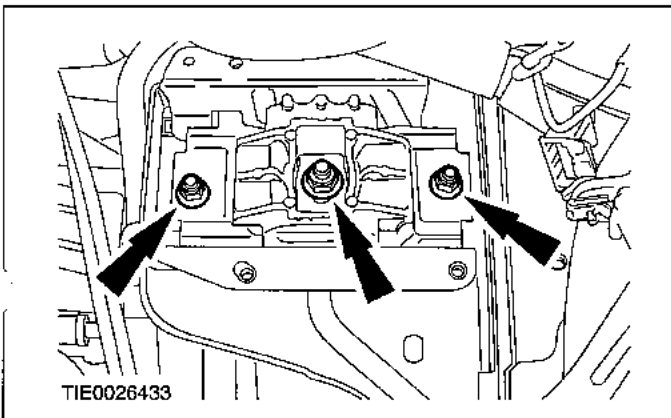
REMOVAL

- Discard the nuts.



46. Remove the engine rear mount retaining nuts.

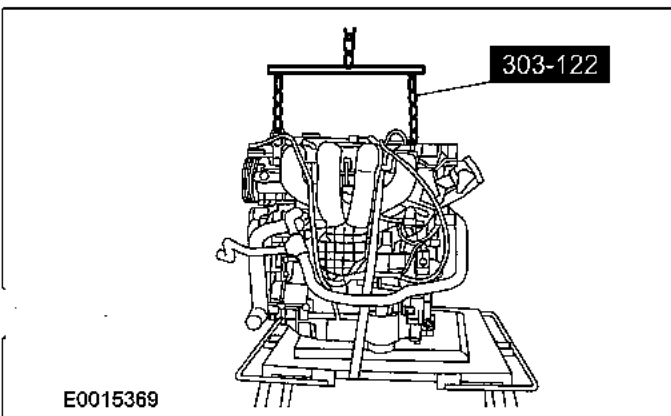
- Discard the nuts.



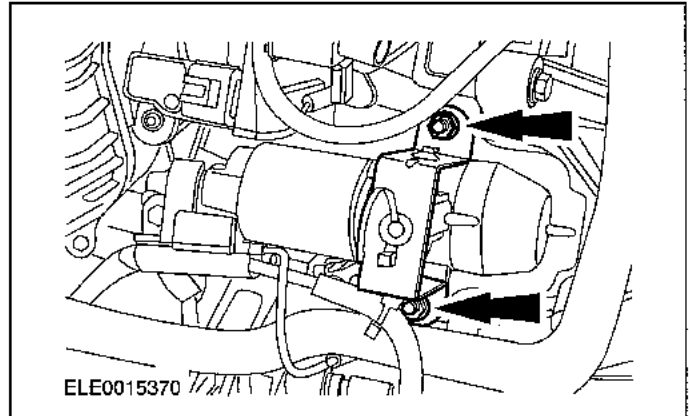
47. Raise and support the vehicle and remove the engine and transaxle assembly. For additional information, refer to: (100-02 Jacking and Lifting)

**Jacking (Description and Operation),
Lifting (Description and Operation).**

48. Using a suitable engine hoist support the engine and transaxle assembly and remove the retaining straps.

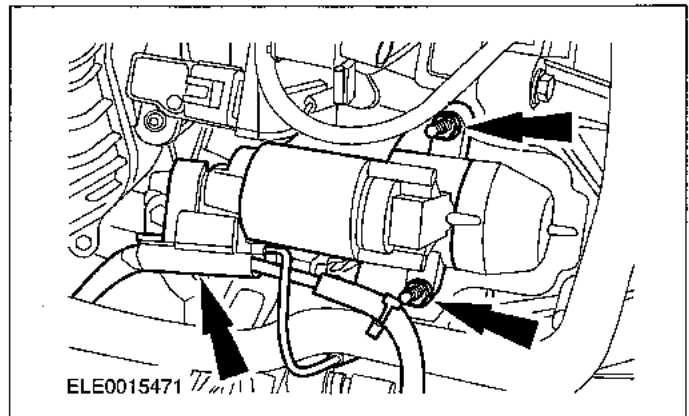


49. Remove the wiring harness retaining bracket.

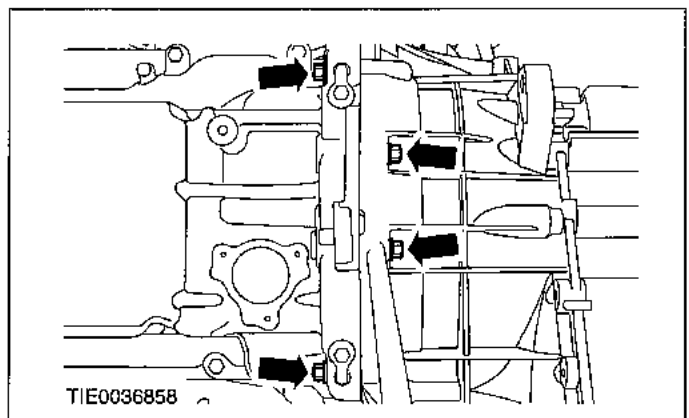


50. Remove the starter motor.

- Detach the wiring harness from the retaining bracket.

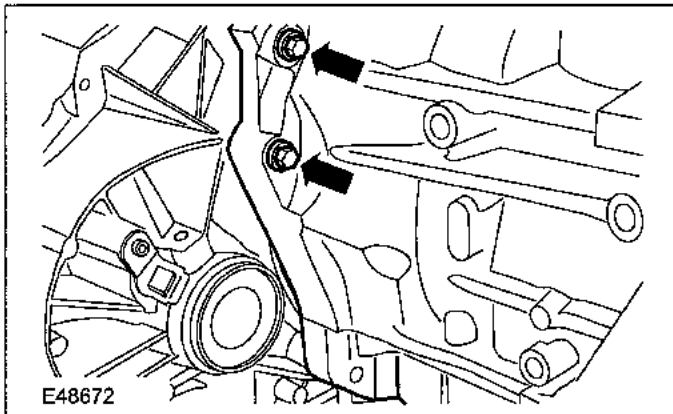


51. Remove the transaxle lower retaining bolts.

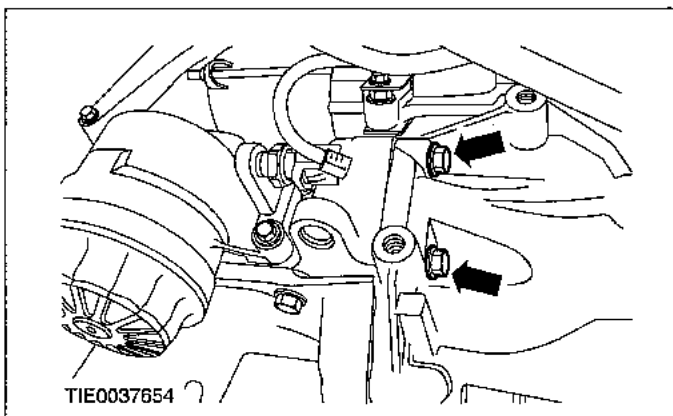


REMOVAL

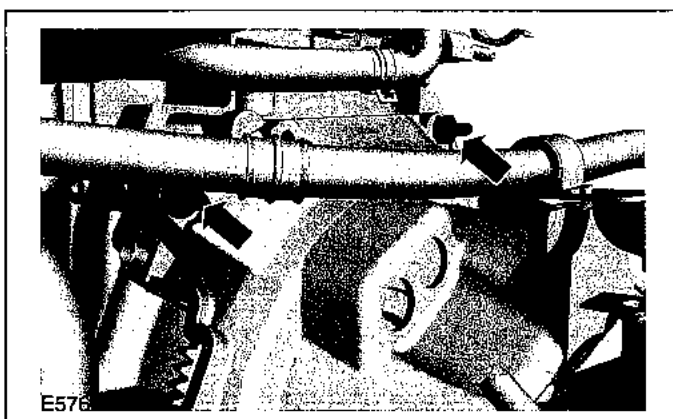
52. Remove the transaxle right-hand retaining bolts.



53. Remove the transaxle left-hand retaining bolts.



54. Remove the transaxle upper retaining bolts.

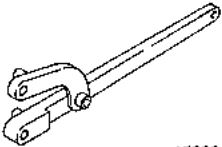
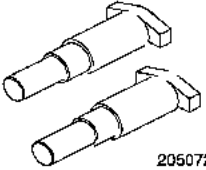
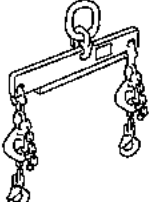
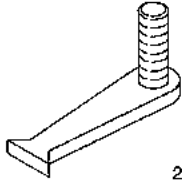

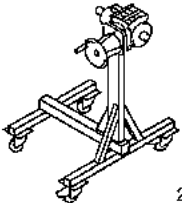


55. Remove the transaxle.

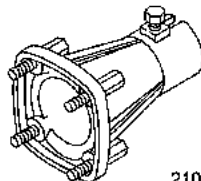
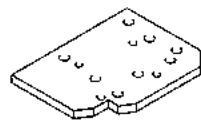
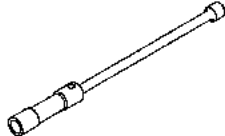
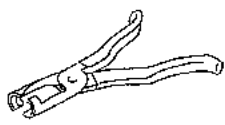
DISASSEMBLY

Engine(21 134 8)

Special Tool(s)

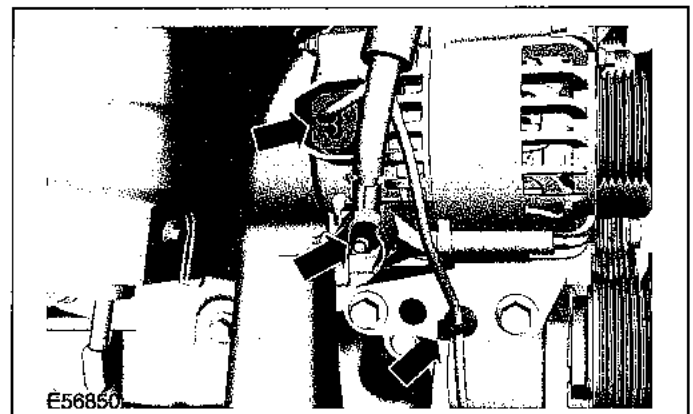
| | |
|---|--|
|  <p>15030A</p> | <p>Universal Flange Holding Wrench 205-072 (15-030A)</p> |
|  <p>20507202</p> | <p>Adapter for 205-072 205-072-02 (15-030A-02)</p> |
|  <p>21068A</p> | <p>Lifting Bracket, Engine 303-122 (21-068A)</p> |
|  <p>21135</p> | <p>Locking Tool, Flywheel 303-254 (21-135)</p> |
|  <p>24003</p> | <p>Remover/Installer, Hose Clamp 303-397 (24-003)</p> |
|  <p>21187</p> | <p>Mounting Stand 303-435 (21-187)</p> |

Special Tool(s)

| | |
|--|--|
|  <p>21031B</p> | <p>Mounting Bracket for 303-435 303-435-06 (21-031B)</p> |
|  <p>21146C</p> | <p>Mounting Plate for 303-435-06 303-435-11A (21-146D)</p> |
|  <p>ES21202</p> | <p>Socket, Spark Plug 303-499 (21-202)</p> |
|  <p>21211</p> | <p>Pliers, Valve Stem Seal 303-508 (21-211)</p> |

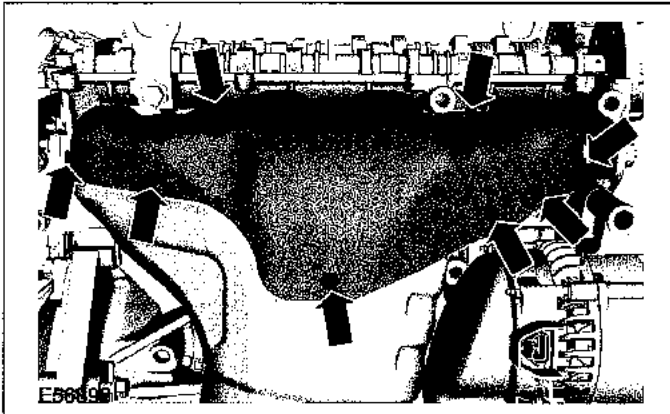
Disassembly

- 1. Disconnect the generator electrical connector.**

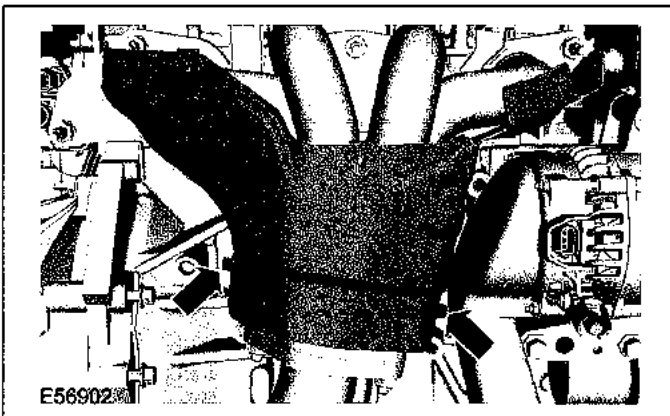


DISASSEMBLY

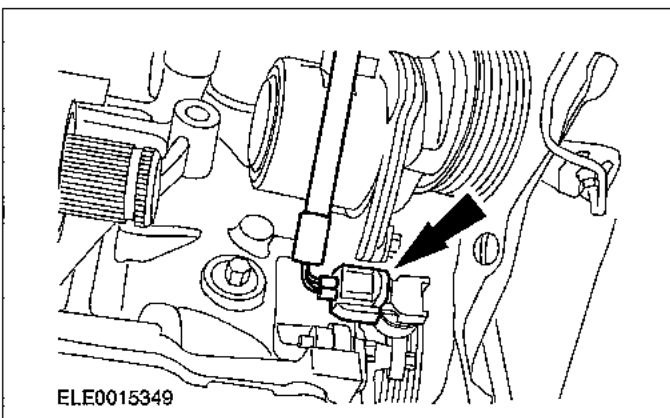
2. Remove the exhaust manifold upper heat shield.



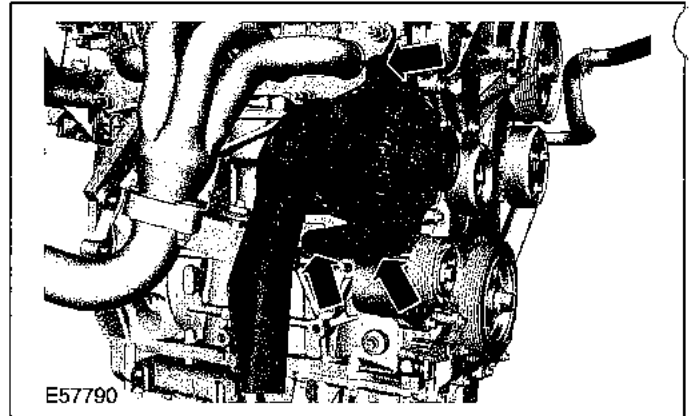
3. Remove the exhaust manifold lower heat shield.



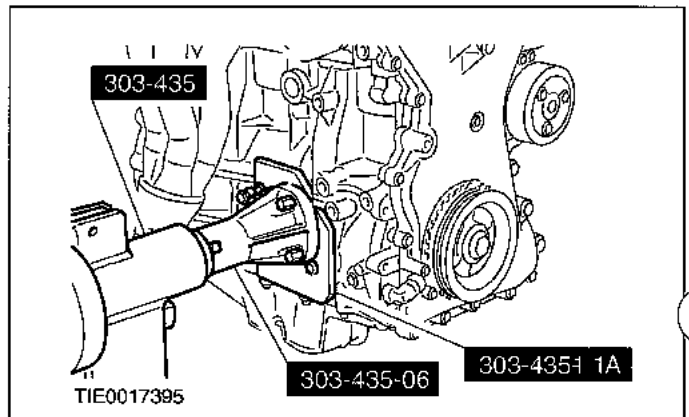
4. Disconnect the crankshaft position (CKP) sensor electrical connector.



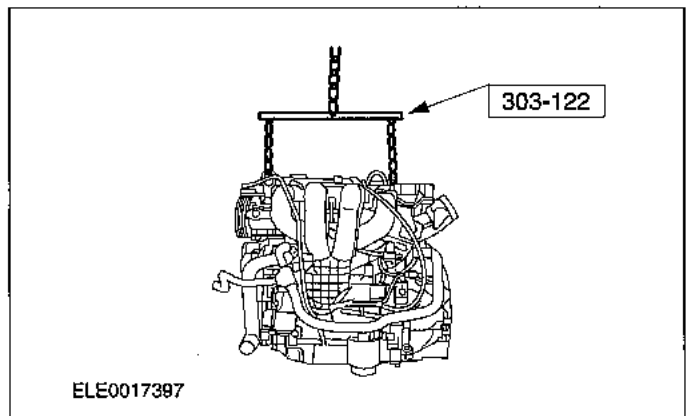
5. Remove the generator.



6. Using the special tools, mount the engine to the mounting stand.



7. Remove the special tool.



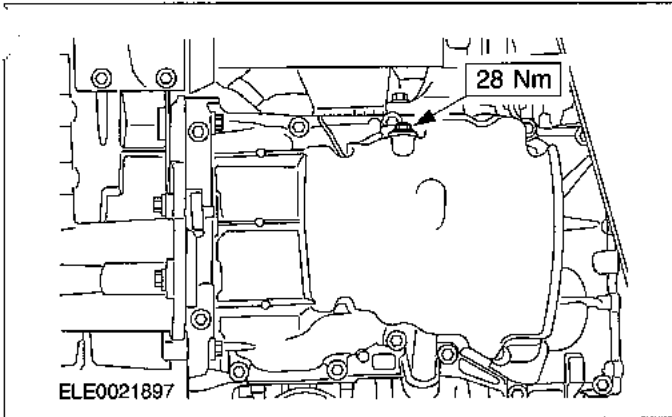
8. Drain the engine.

- Allow the oil to drain into a suitable container.

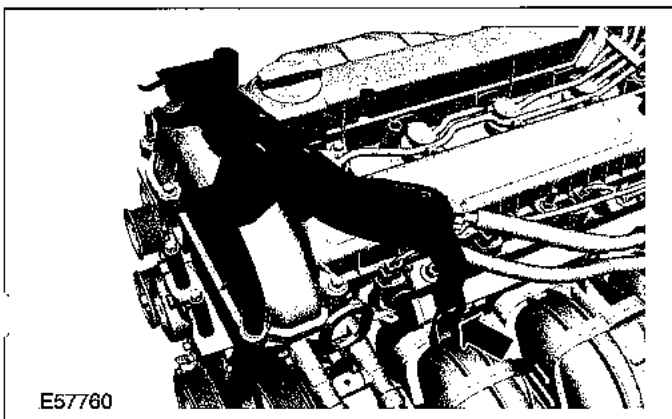
9. **NOTE:** Inspect the oil drain plug seal for damage. Install a new drain plug and seal if necessary.

DISASSEMBLY

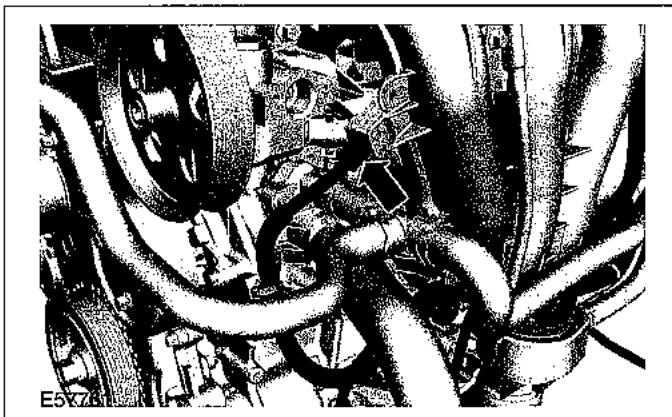
Install the drain plug.



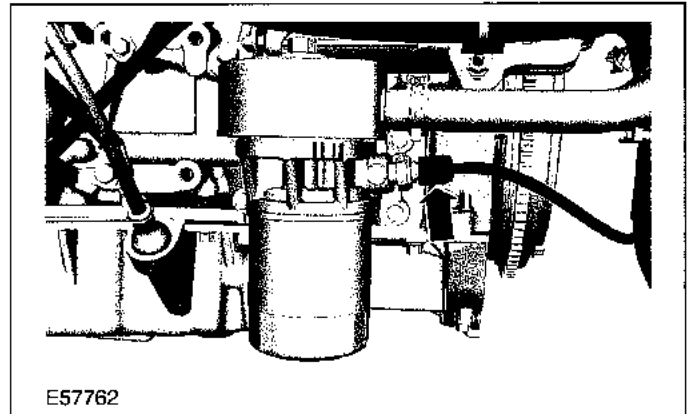
10. Detach the engine wiring harness bracket from the intake manifold.



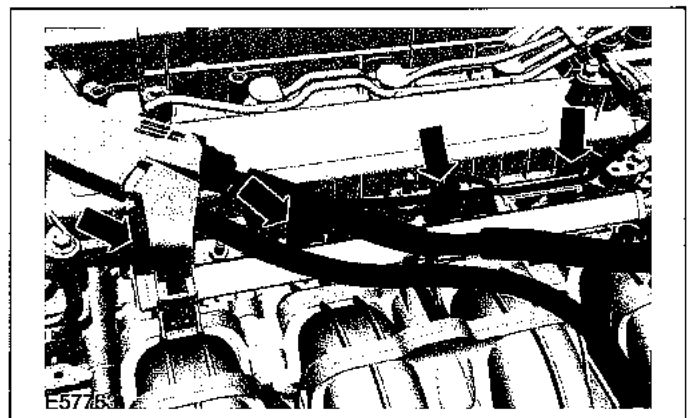
11. Disconnect the knock sensor (KS) electrical connector.



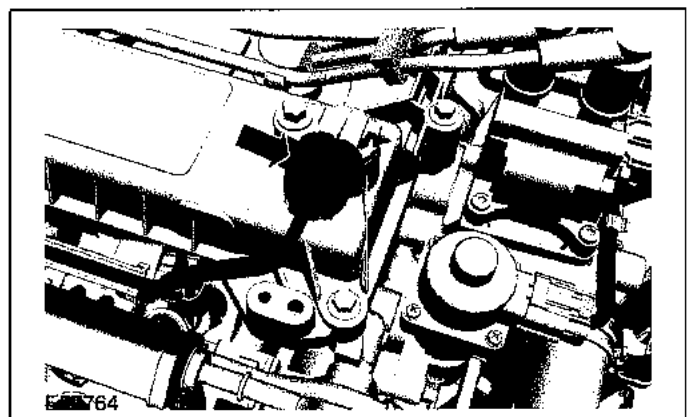
12. Disconnect the oil pressure switch electrical connector.



13. Disconnect the fuel injector electrical connectors.

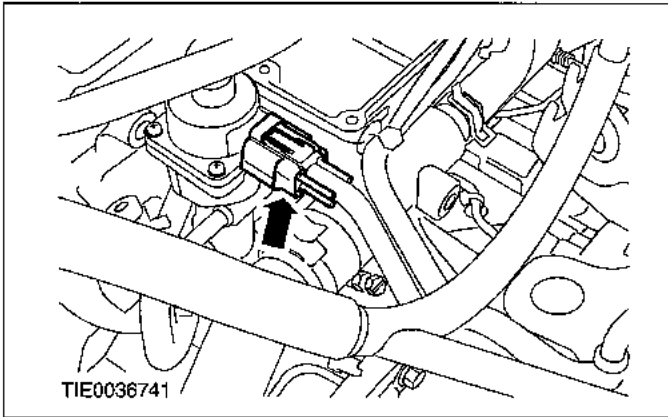


14. Disconnect the camshaft position (CMP) sensor electrical connector.

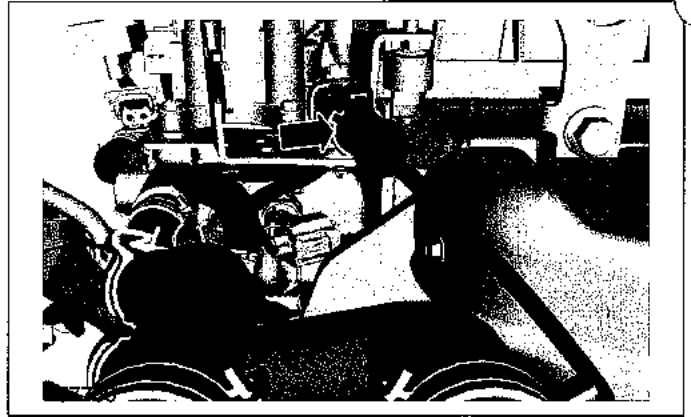


DISASSEMBLY

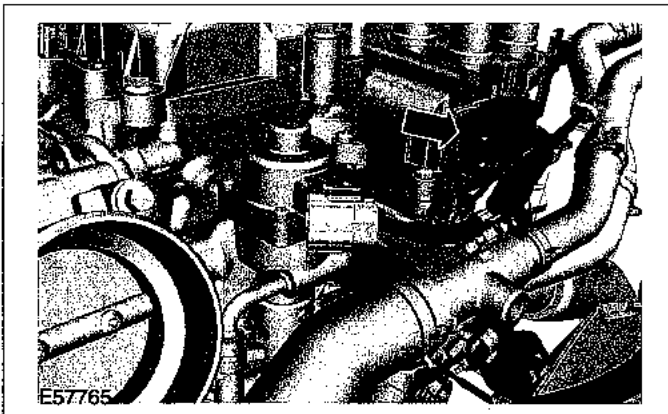
15. Disconnect the exhaust gas recirculation (EGR) valve electrical connector.



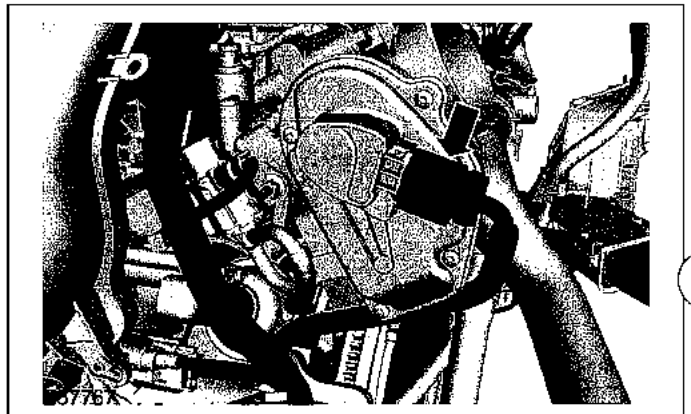
18. Disconnect the heated oxygen (H2OS) sensor electrical connector.



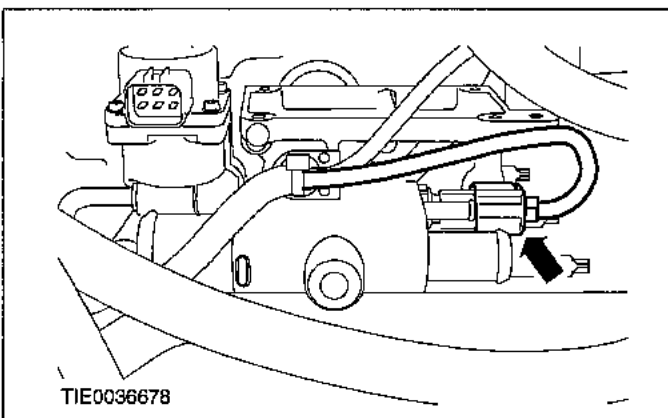
16. Disconnect the electronic ignition (EI) electrical connector.



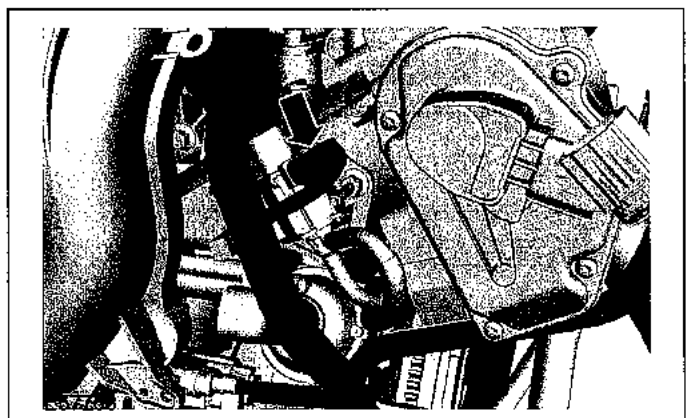
19. Disconnect the throttle body (TB) electrical connector.



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

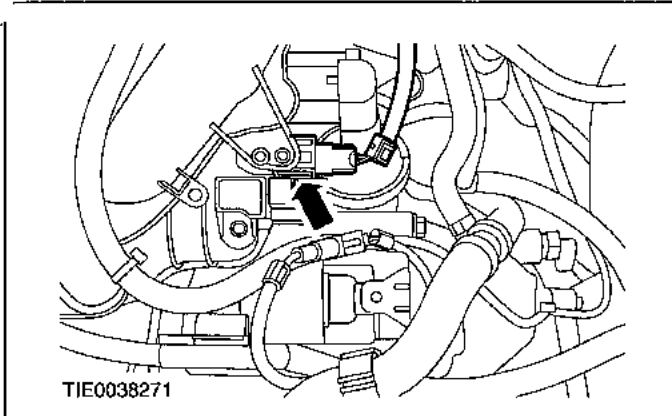


20. Disconnect the intake manifold runner control (IMRC) electrical connector.

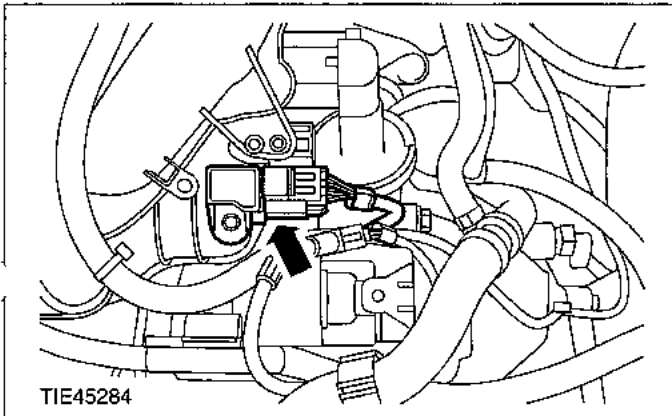


DISASSEMBLY

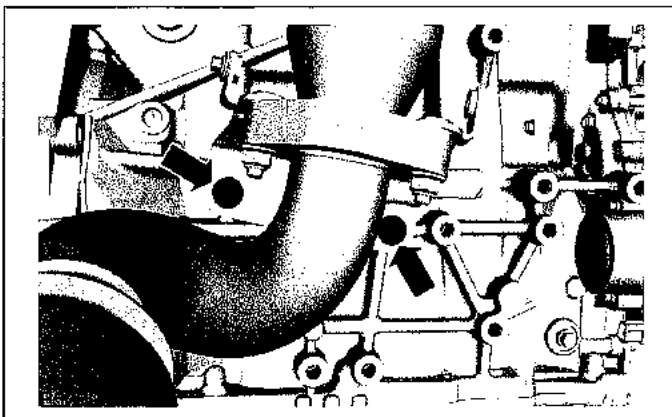
21. Detach the starter motor electrical connector from the intake manifold.



22. Disconnect the manifold absolute pressure (MAP) sensor electrical connector.

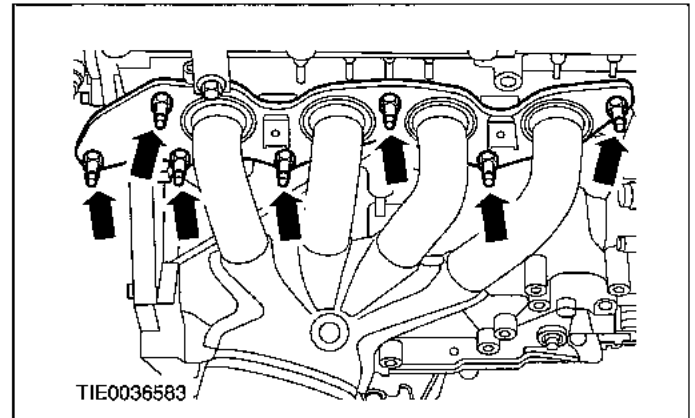


23. Remove the exhaust manifold lower retaining bolts.

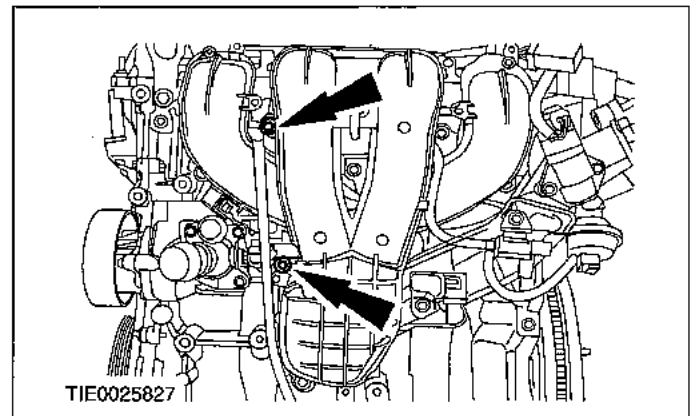


24. Remove the exhaust manifold.

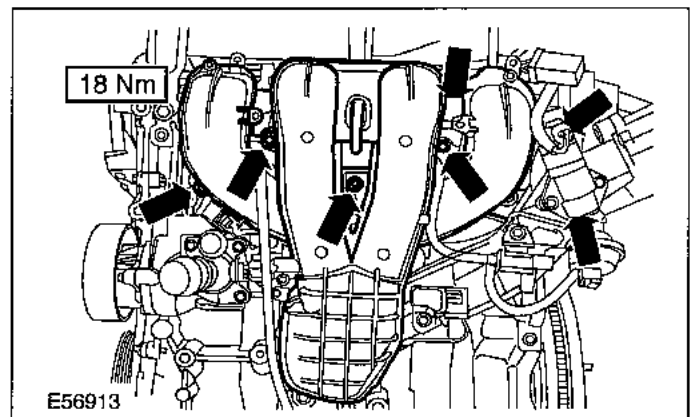
- Discard the gasket.



25. Remove the oil level indicator and oil level indicator tube.

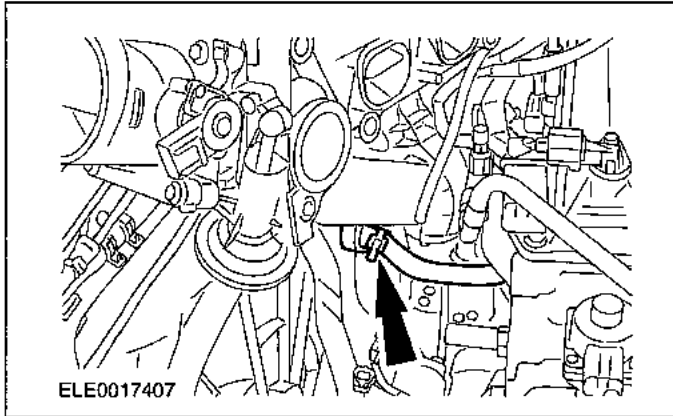


26. Remove the intake manifold.

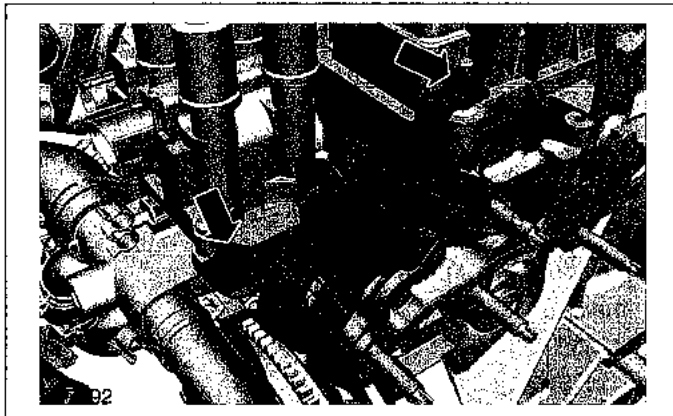


DISASSEMBLY

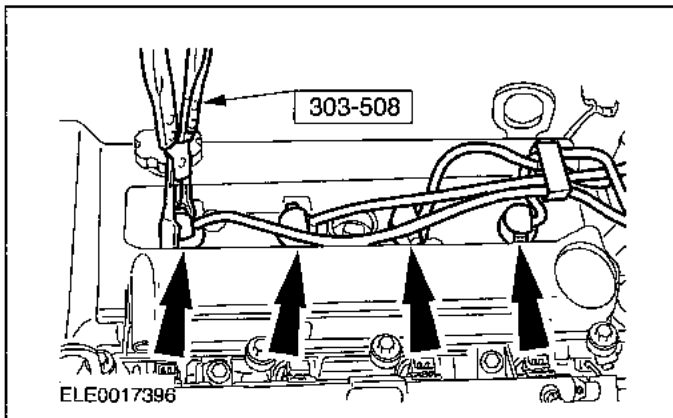
27. Disconnect the positive crankcase ventilation (PCV) hose from the intake manifold.



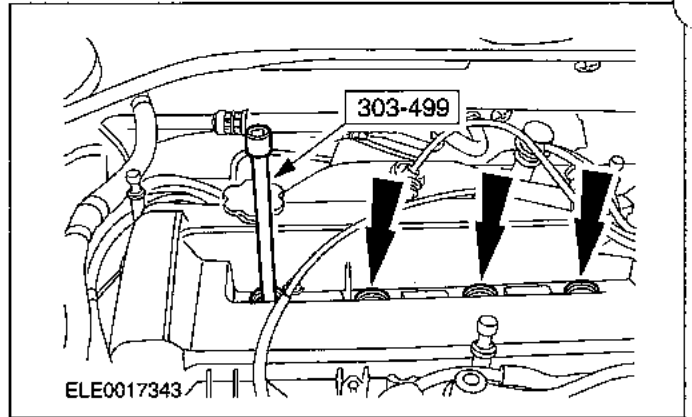
28. Remove the evaporative emission (EVAP) valve support bracket.



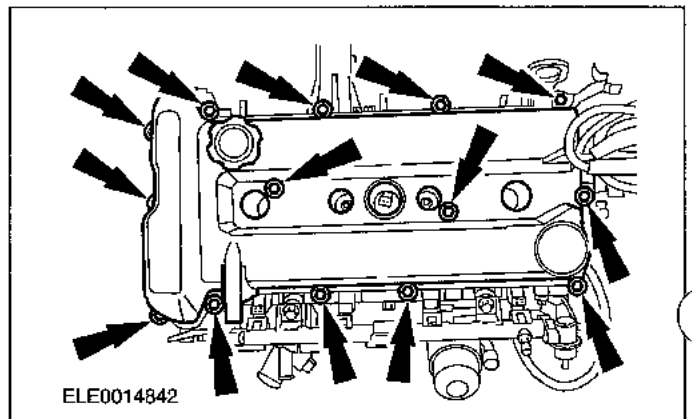
29. Using the special tool, disconnect the spark plug electrical connectors.



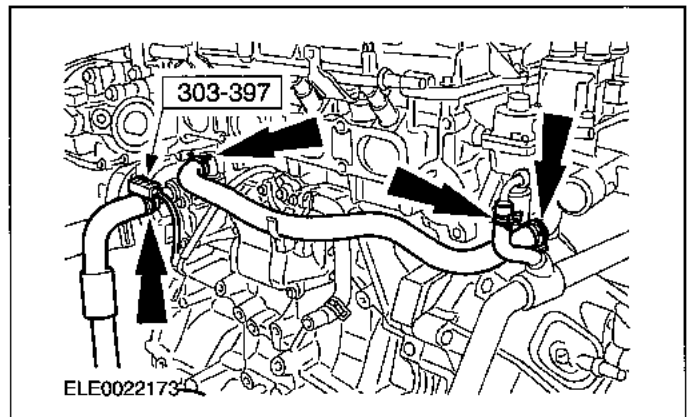
30. Using the special tool, remove the spark plugs.



31. Remove the valve cover.

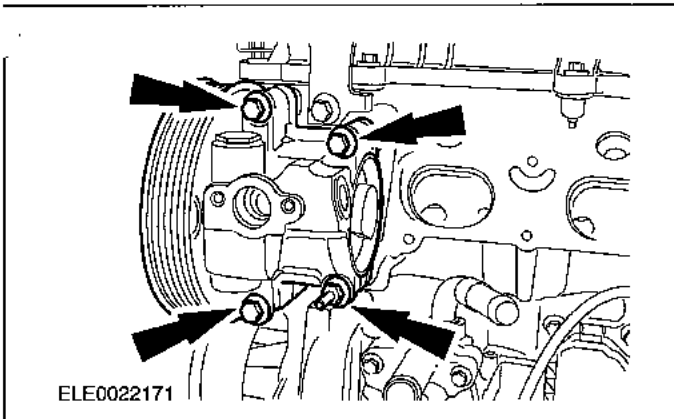


32. Using the special tool, disconnect the coolant hoses.

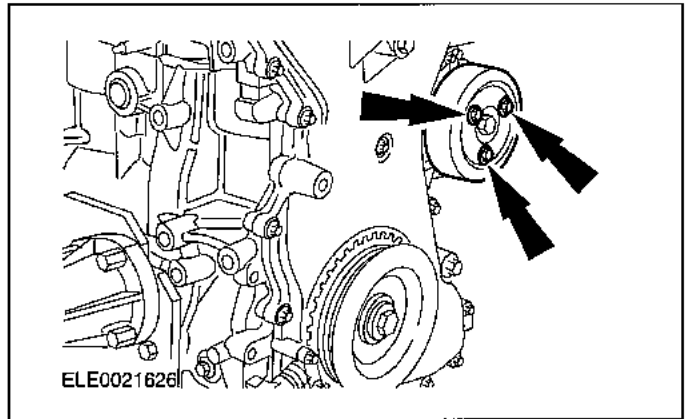


DISASSEMBLY

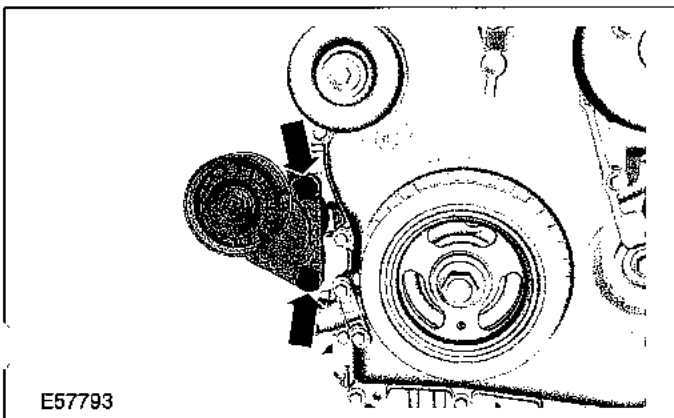
33. Remove the power steering pump.



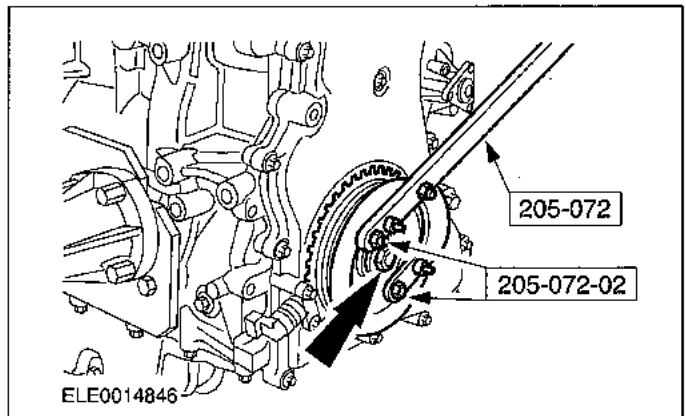
36. Remove the coolant pump pulley.



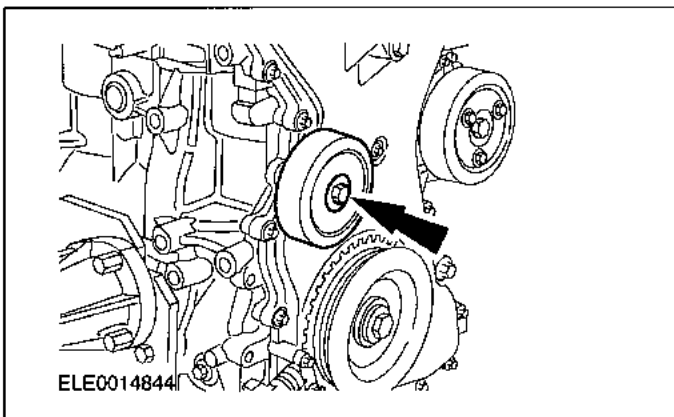
34. Remove the accessory drive belt tensioner.

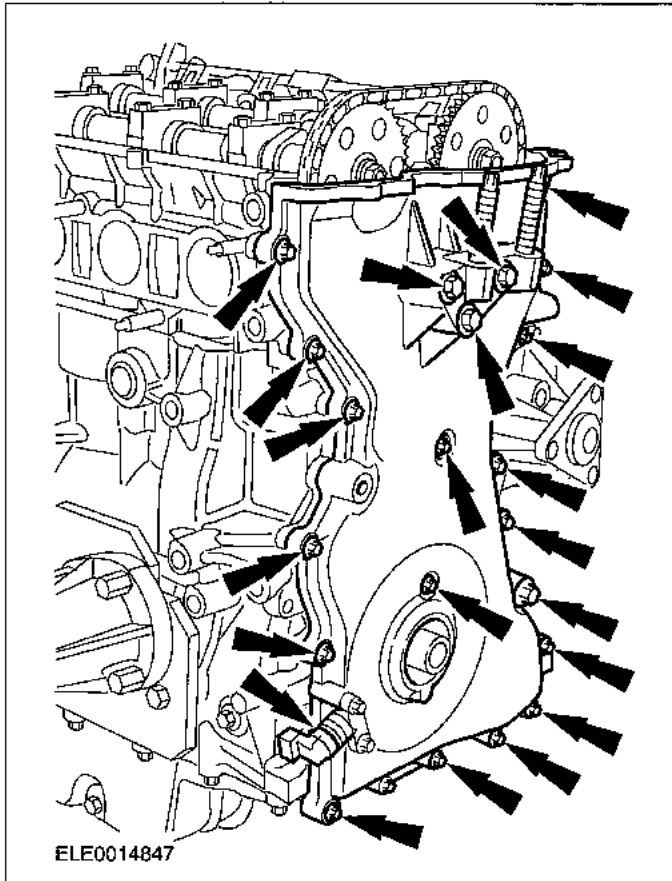


37. Using the special tools, prevent the crankshaft pulley from rotating and remove the crankshaft pulley.

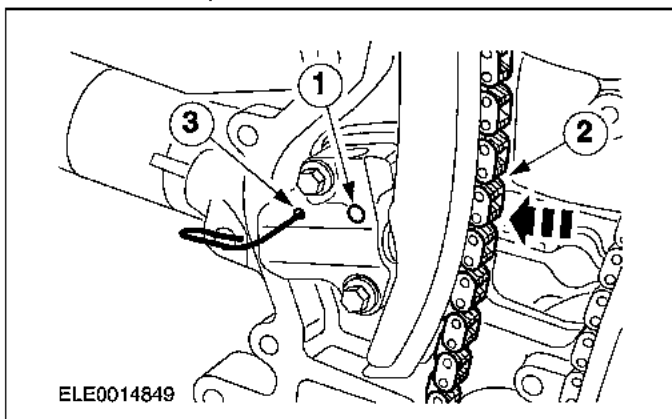
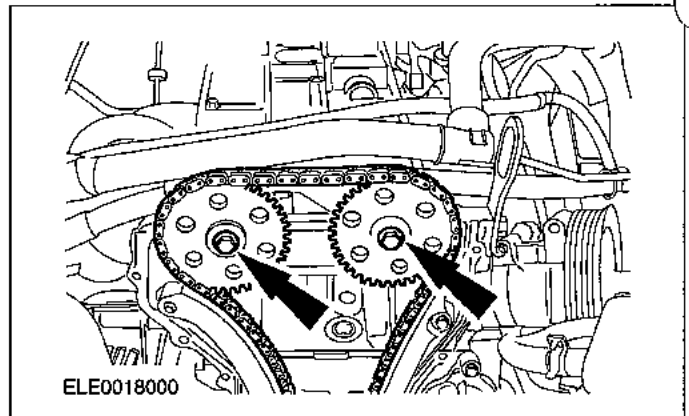
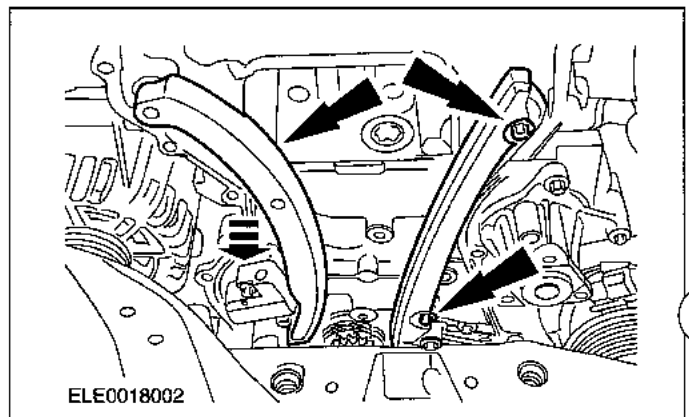
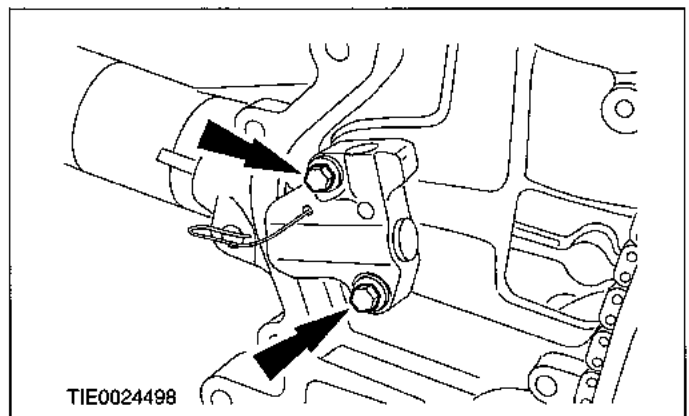


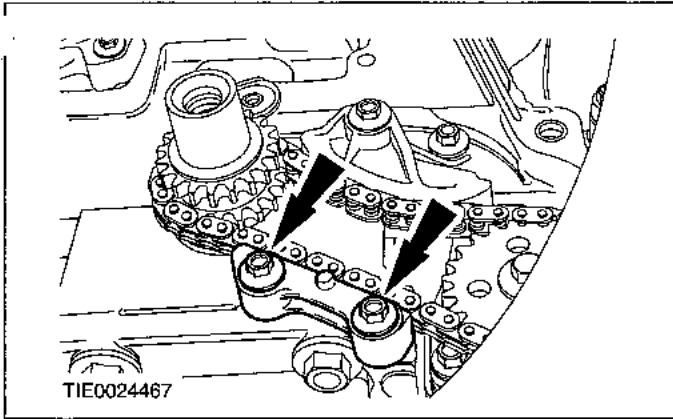
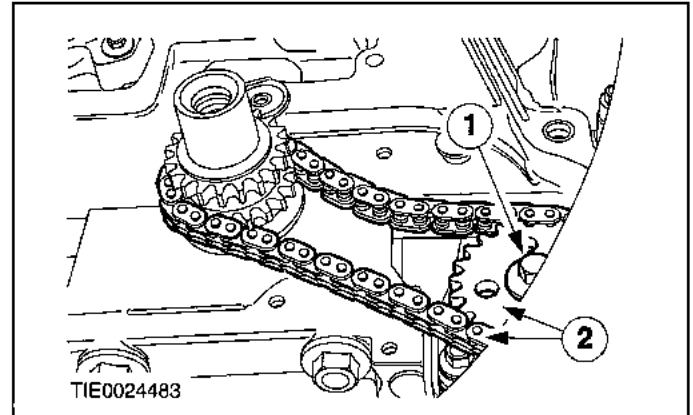
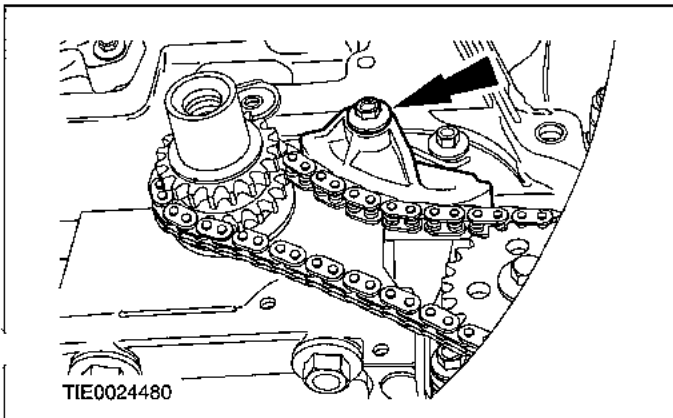
35. Remove the accessory drive belt idler pulley.



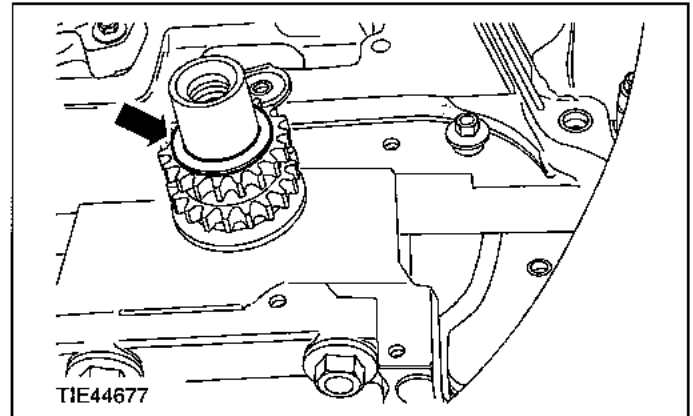
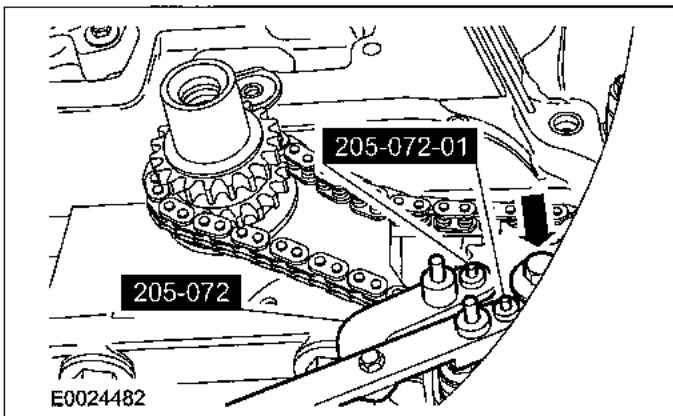
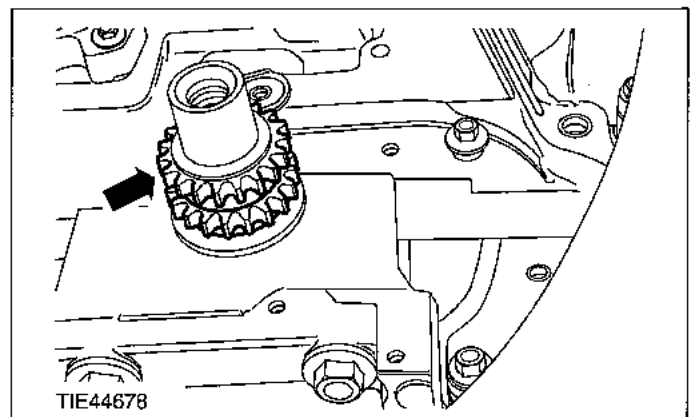
DISASSEMBLY**38. Remove the engine front cover.****39. Detension the timing chain.**

1. Unlock the timing chain tensioner ratchet.
2. Apply pressure to the timing chain guide.
3. Lock the timing chain tensioner with a suitable piece of wire.

**40. NOTE: Hold each camshaft by the hexagon with an open-ended wrench to stop it from rotating.****Remove the camshaft sprockets and the timing chain.****41. Remove the timing chain guides.****42. Remove the timing chain tensioner.**

DISASSEMBLY**43. Remove the oil pump chain guide.****2. Remove the oil pump chain and the oil pump sprocket.****44. Remove the oil pump chain tensioner.****47. Remove the front friction washer (if equipped).**

- Discard the friction washer.

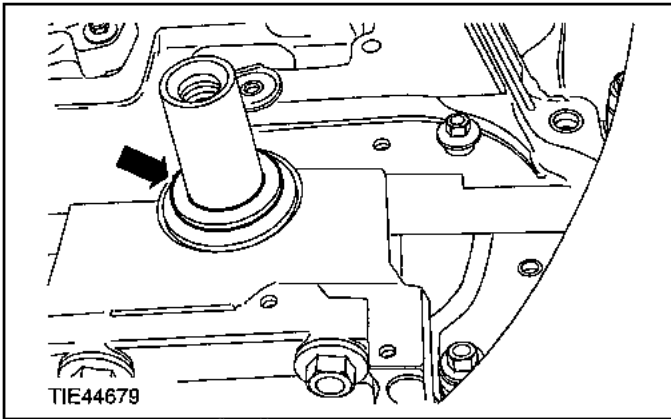
**45. Using the special tools, loosen the oil pump sprocket retaining bolt.****48. Remove the crankshaft sprocket.****46. Remove the oil pump chain.**

1. Remove the oil pump sprocket retaining bolt.

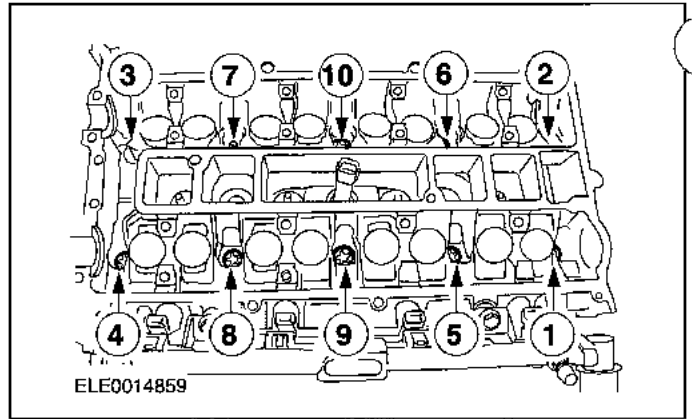
49. Remove the rear friction washer (if equipped).

DISASSEMBLY

- Discard the friction washer.



- Discard the gasket.



50. CAUTIONS:

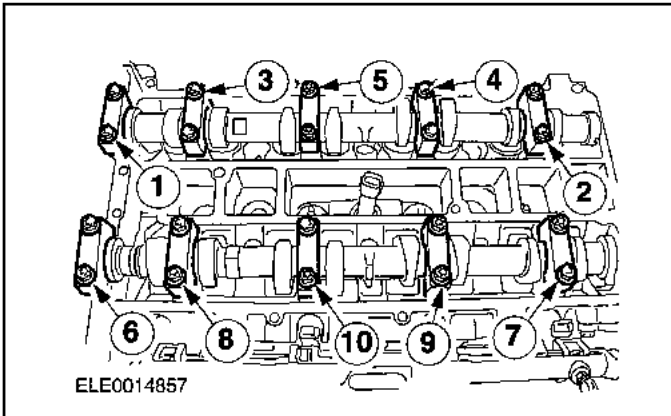
⚠ Keep the camshaft bearing caps in order for installation.

⚠ Remove the camshaft bearing caps in the sequence shown.

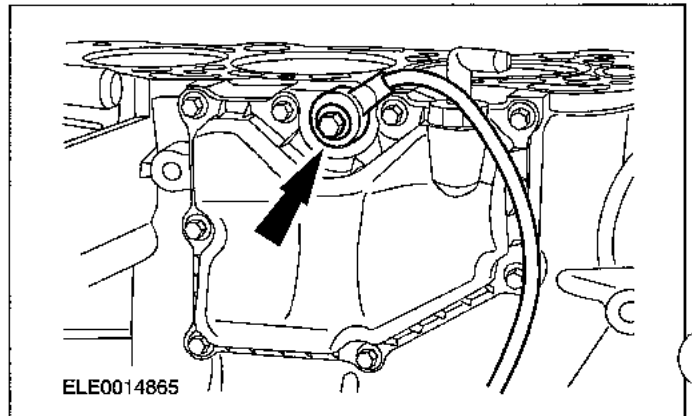
NOTE: Working in several stages, release each camshaft bearing cap retaining bolt two turns at a time.

Remove the camshaft bearing caps.

- Remove the camshafts.

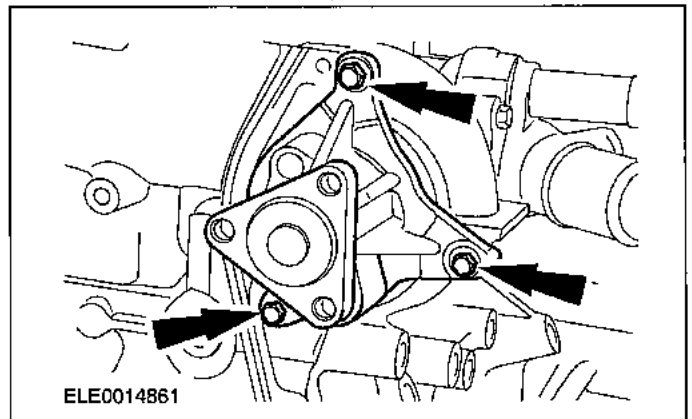


53. Remove the knock sensor (KS).



54. Remove the coolant pump.

- Discard the O-ring seal.



51. CAUTION: Keep the valve tappets in order for installation.

Remove the valve tappets.

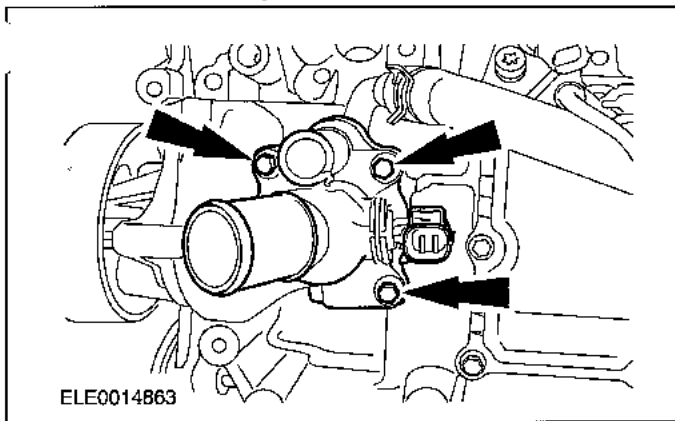
52. CAUTION: Remove the cylinder head bolts in the sequence shown.

Remove the cylinder head.

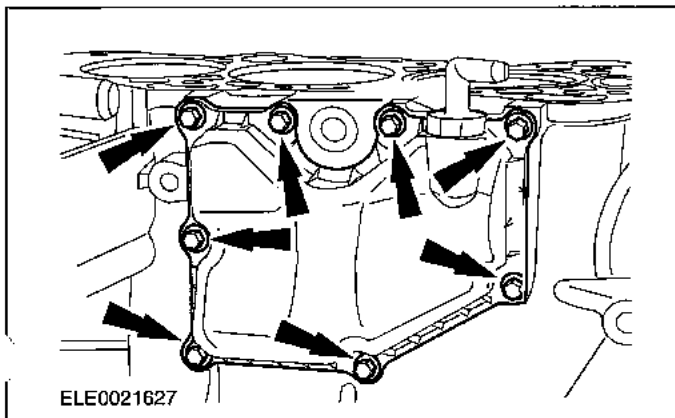
55. Remove the thermostat housing.

DISASSEMBLY

- Discard the gasket.

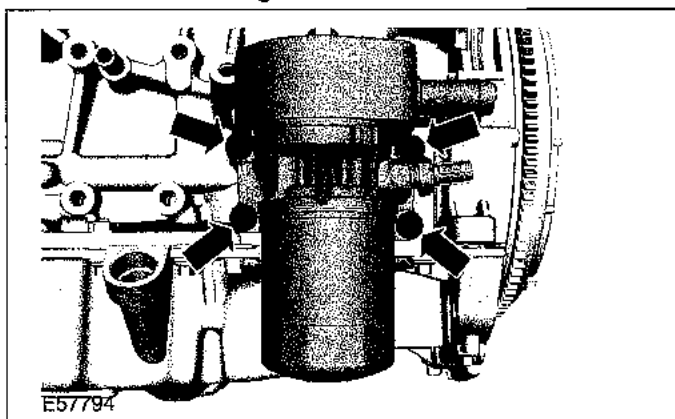


56. Remove the crankcase vent oil separator.



57. Remove the oil filter adapter.

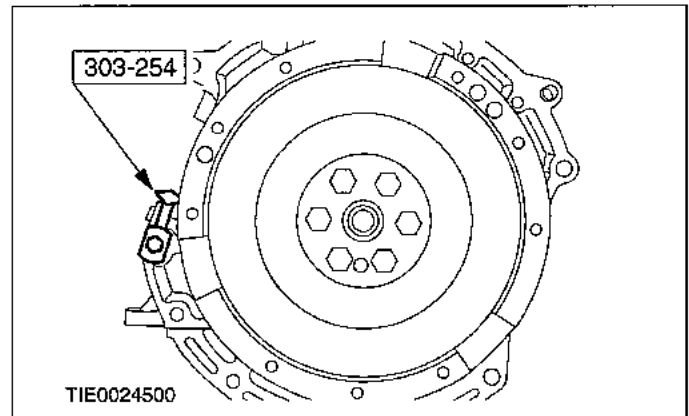
- Discard the gasket.



58. Remove the clutch disc and pressure plate.

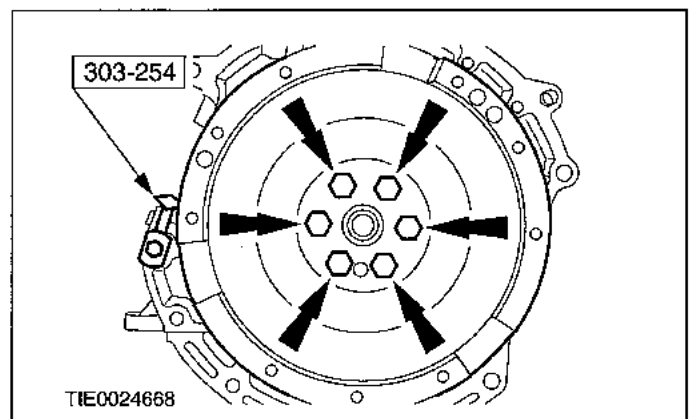
For additional information, refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).

59. Using the special tool, lock the flywheel in position.



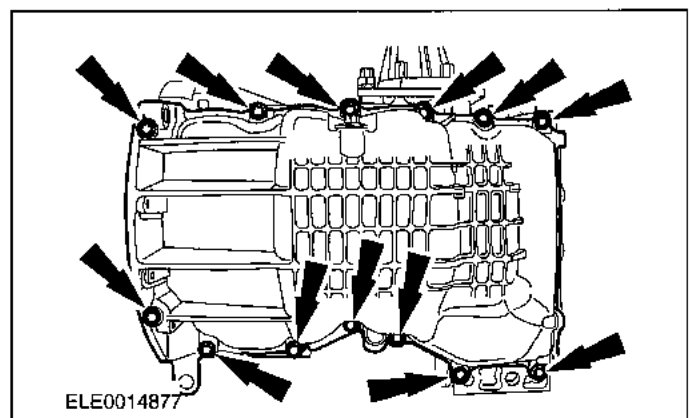
60. Remove the flywheel.

- Discard the bolts.



61. Remove the special tool.

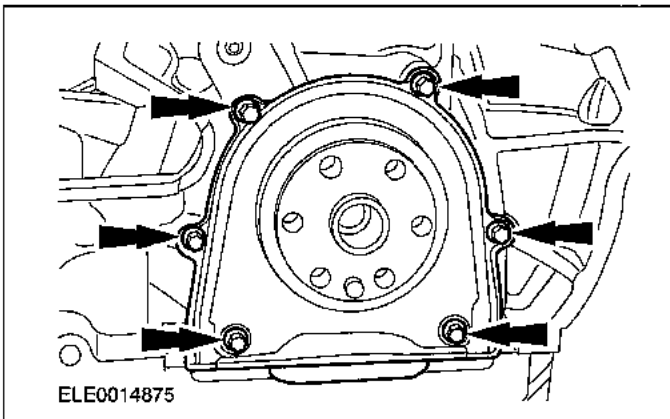
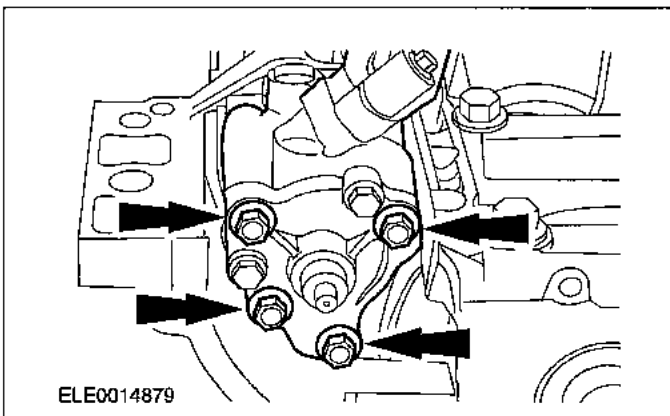
62. Remove the oil pan.



63. Remove the crankshaft rear seal carrier.

DISASSEMBLY

- Discard the seal carrier.

**64. Remove the oil pump.**

ASSEMBLY

Engine(21 134 8)

Special Tool(s)

| | |
|-----------------|--|
| <p>15030A</p> | <p>Universal Flange Holding Wrench 205-072 (15-030A)</p> |
| <p>20507202</p> | <p>Adapter for 205-072 205-072-02 (15-030A-02)</p> |
| <p>21068A</p> | <p>Lifting Bracket, Engine 303-122 (21-068A)</p> |
| <p>21162B</p> | <p>Alignment Plate, Camshaft 303-376A (21-162B)</p> |
| <p>24003</p> | <p>Remover/Installer, Hose Clamp 303-397 (24-003)</p> |
| <p>PZ21210</p> | <p>Timing Peg, Crankshaft TDC 303-507 (21-210)</p> |

Special Tool(s)

| | |
|--------------|---|
| <p>21211</p> | <p>Pliers, Valve Stem Seal 303-508 (21-211)</p> |
|--------------|---|

General Equipment

| |
|-----------------|
| Engine hoist |
| M6 x 18 mm bolt |
| Straight edge |

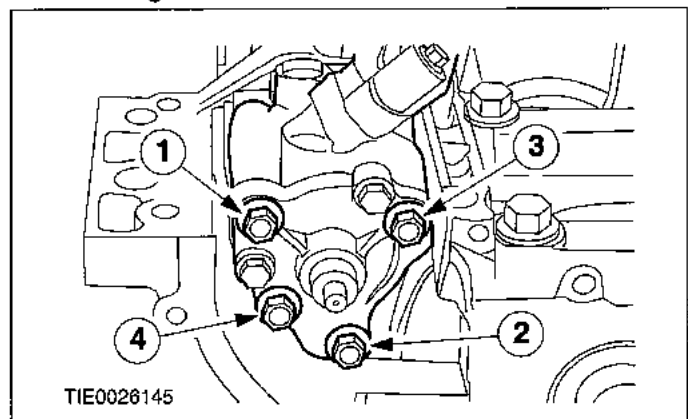
Materials

| Name | Specification |
|------------------|---------------|
| Silicone Sealant | WSE-M4G323-A4 |
| Hypoid Gear Oil | SQM-2C9002-AA |

Assembly

1. Install the oil pump.

- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 10 Nm.
- Stage 2: 23 Nm.



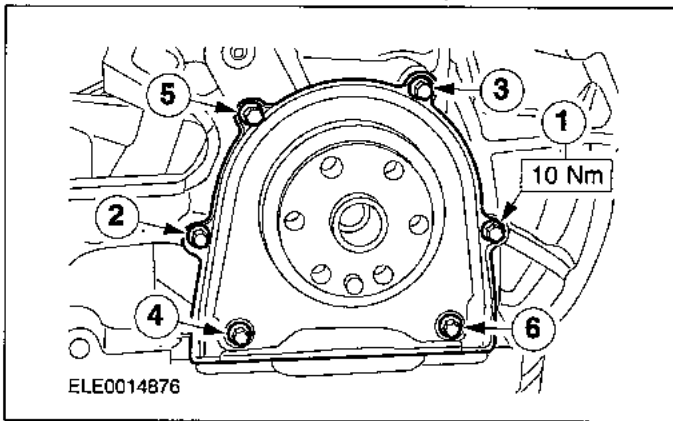
2. ⚠ CAUTION: Do not remove the the installation sleeve before installation.

NOTE:A new crankshaft rear seal carrier is supplied preassembled with an installation sleeve that must be removed following installation.

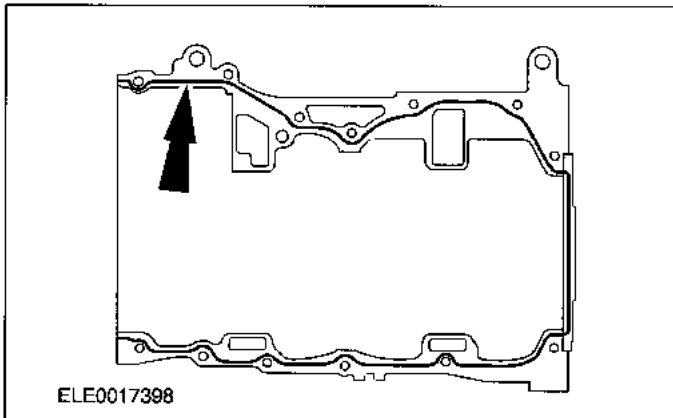
NOTE:Install a new crankshaft rear seal carrier.
Install the crankshaft rear seal carrier.

ASSEMBLY

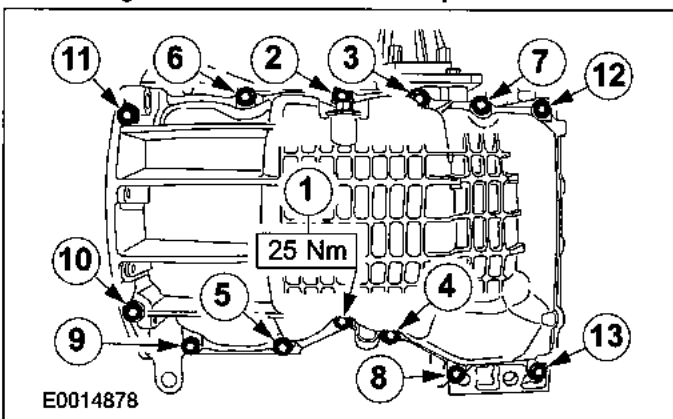
- Tighten the bolts in the sequence shown.



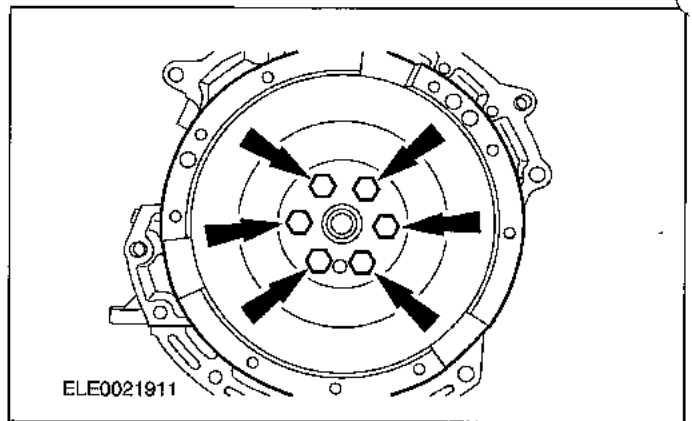
3. Clean the mating faces of the cylinder block and the oil pan with a suitable metal surface cleaner.
4. **NOTE:** Install the oil pan within 10 minutes of applying the sealant and tighten the retaining bolts within a further 5 minutes. Apply a 3 mm bead of sealant to the oil pan.



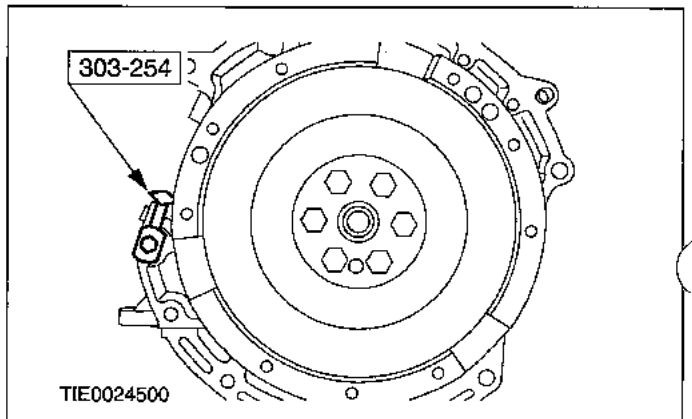
5. Using a suitable straight edge, align the oil pan to the cylinder block mating face on the timing chain side.
6. Tighten the oil pan retaining bolts.
 - Tighten the bolts in the sequence shown.



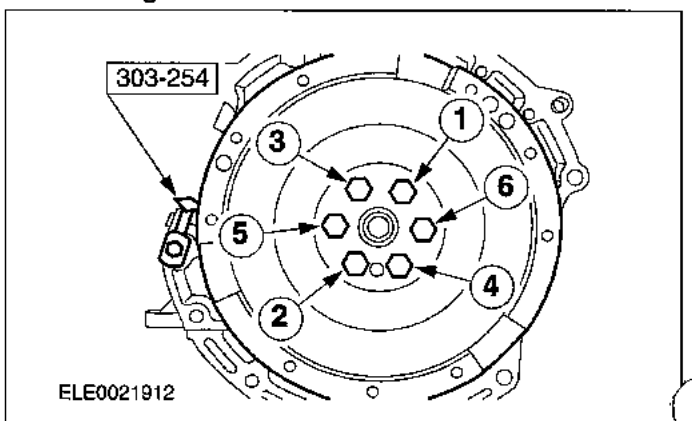
7. **NOTE:** Install new flywheel bolts. Install the flywheel.



8. Using the special tool, lock the flywheel in position.



9. Tighten the flywheel bolts.
 - Tighten the bolts in the sequence shown in three stages.
 - Stage 1: 50 Nm.
 - Stage 2: 80 Nm.
 - Stage 3: 112 Nm.



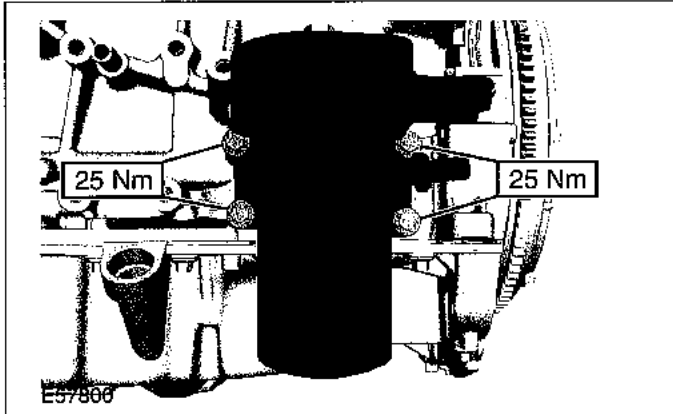
10. Remove the special tool.

ASSEMBLY

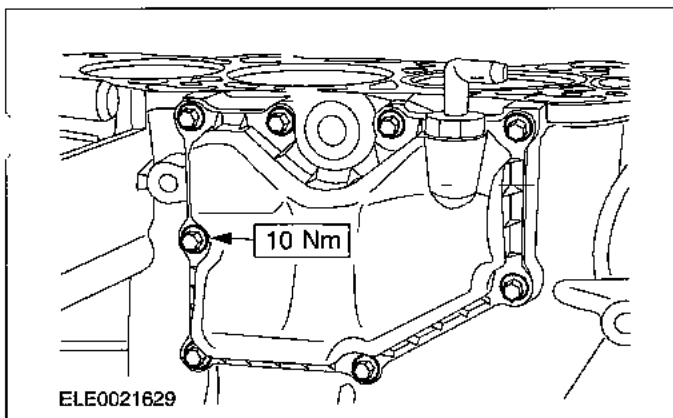
11. Install the clutch disc and pressure plate.

For additional information, refer to: Clutch Disc and Pressure Plate (308-01 Clutch, Removal and Installation).

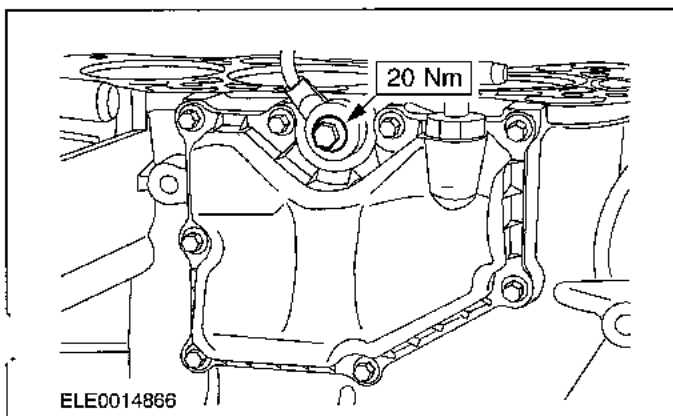
12. **NOTE:**Install a new oil filter adapter gasket.
Install the oil filter adapter.



13. Install the crankcase vent oil separator.

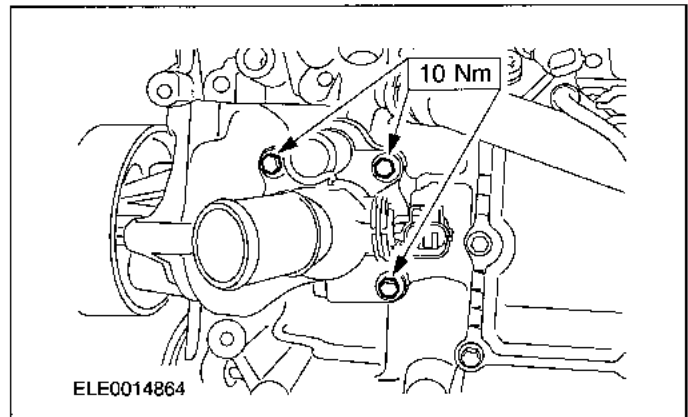


14. **NOTE:**Rotate the knock sensor (KS) as far counter-clockwise as possible without it touching the crankcase vent oil separator.
Install the KS.



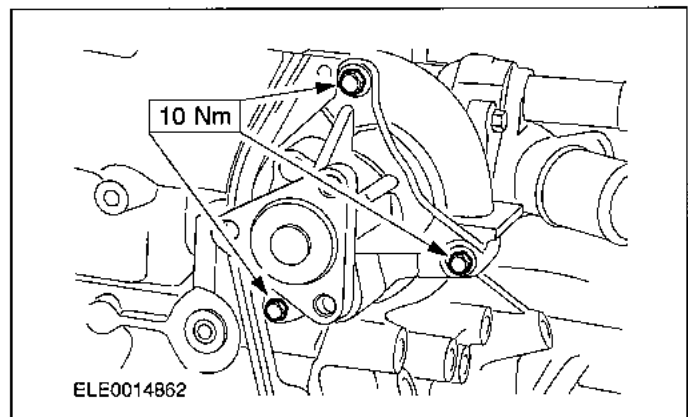
15. **NOTE:**Install a new thermostat housing gasket.

Install the thermostat housing.



16. **NOTE:**Install a new coolant pump O-ring.

Install the coolant pump.



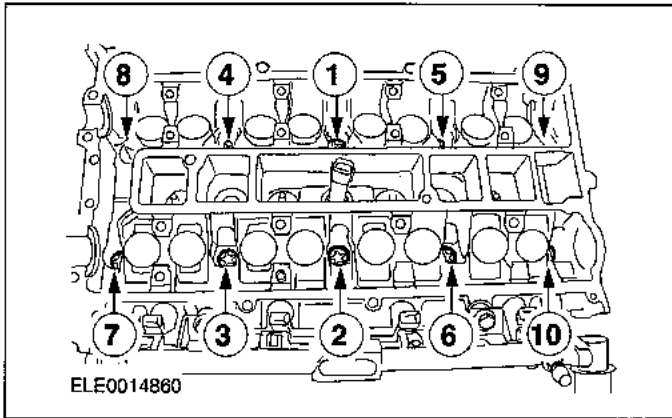
17. **NOTE:**Install new cylinder head bolts and gasket.

Install the cylinder head.

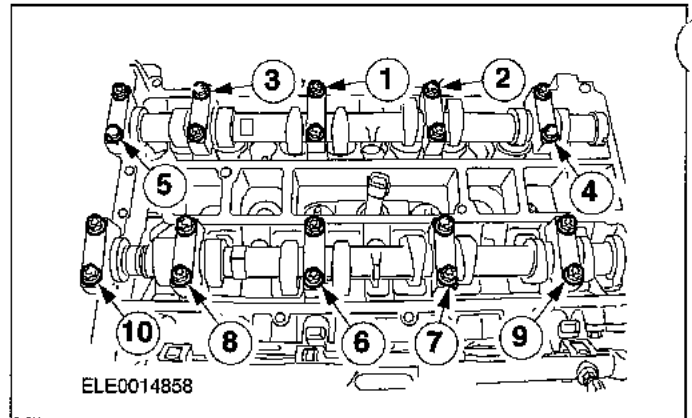
- Tighten the cylinder head bolts in five stages.
- Stage 1: 5 Nm.
- Stage 2: 15 Nm.
- Stage 3: 45 Nm.
- Stage 4: 90 degrees.

ASSEMBLY

- Stage 5: 90 degrees.

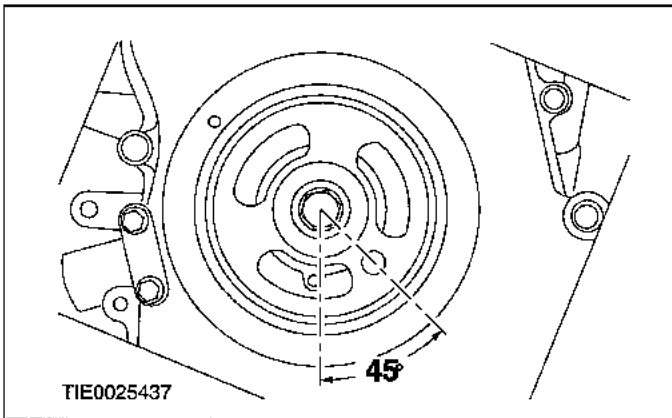


- Stage 2: 16 Nm.

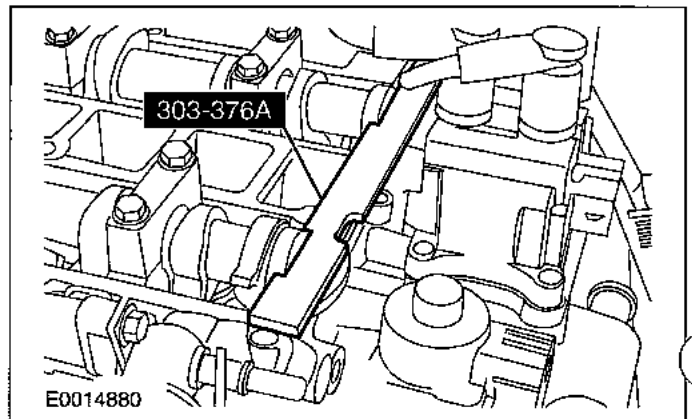


18. NOTE: Only rotate the crankshaft in its normal direction of rotation.

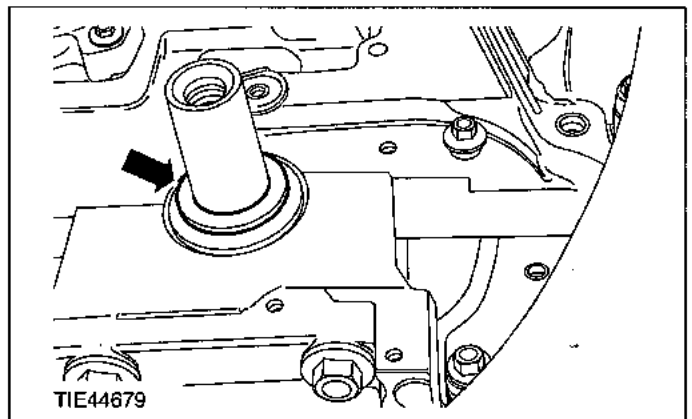
Rotate the crankshaft until piston No. 1 is approximately 45 degrees before top dead center (TDC).



21. Install the special tool.



22. NOTE: Install a new rear friction washer. Install the rear friction washer.



19. Install the valve tappets.

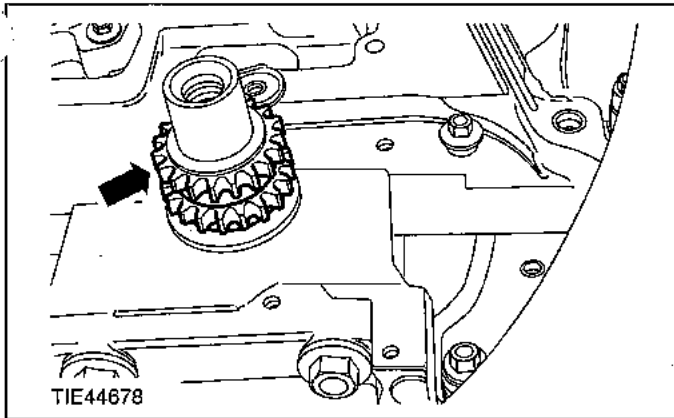
20. CAUTION: Install the camshafts approximately at valve overlap position on cylinder No. 4.

Install the camshafts.

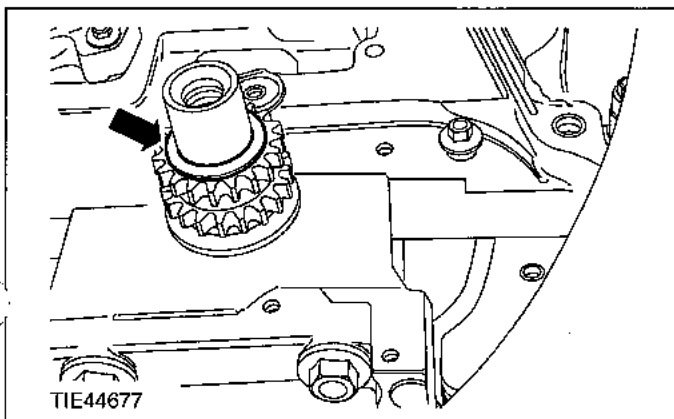
- Working in several stages, evenly tighten the camshaft bearing cap bolts in the sequence shown, one half turn at a time.
- Coat the camshaft bearing caps with oil.
- Tighten the bolts in two stages.
- Stage 1: 7 Nm.

ASSEMBLY

23. Install the crankshaft sprocket.

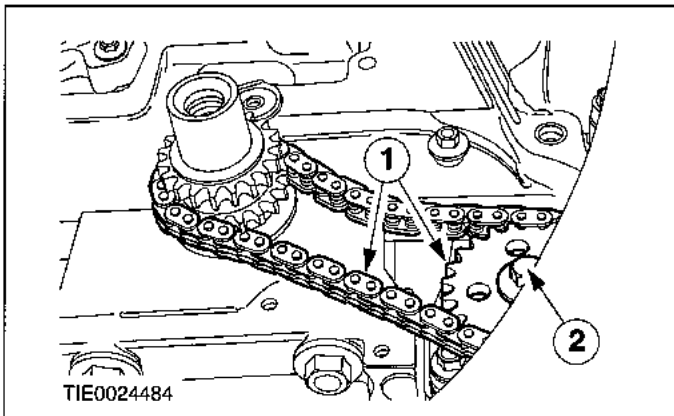


24. **NOTE:** Install a new front friction washer.
Install the front friction washer.

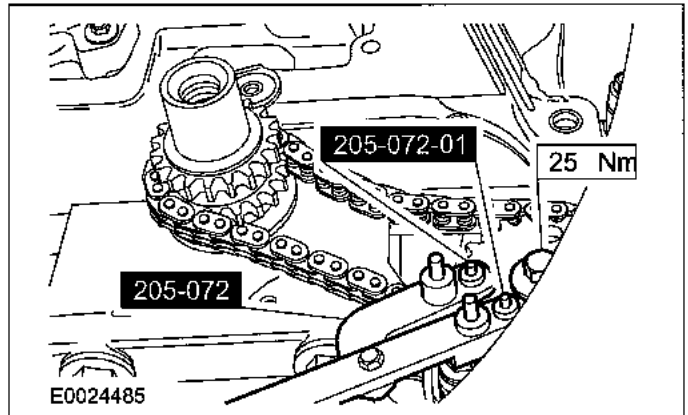


25. Install the oil pump chain.

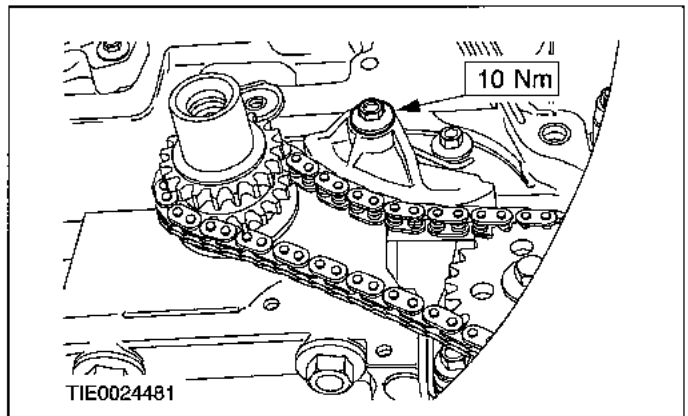
1. Install the oil pump chain and the oil pump sprocket.
2. Install the oil pump sprocket retaining bolt.



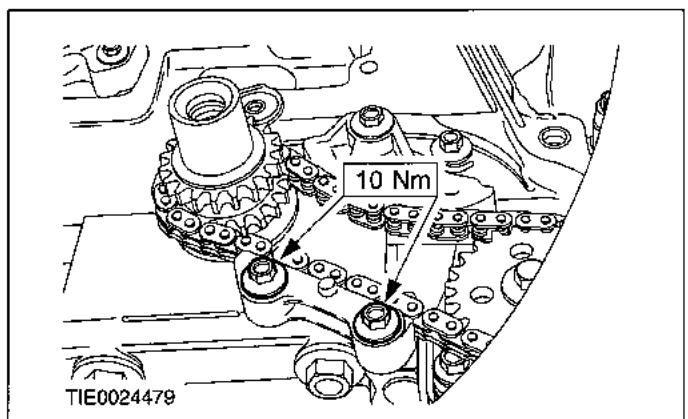
26. Using the special tools, tighten the oil pump sprocket retaining bolt.

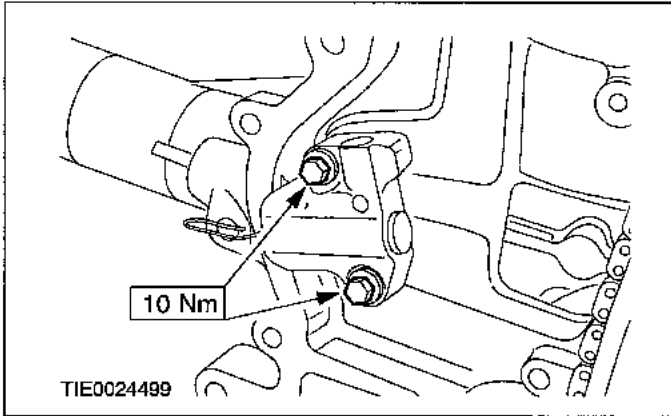


27. Install the oil pump chain tensioner.

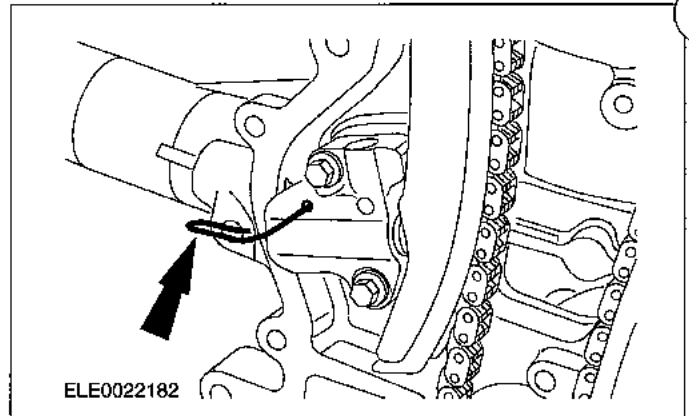
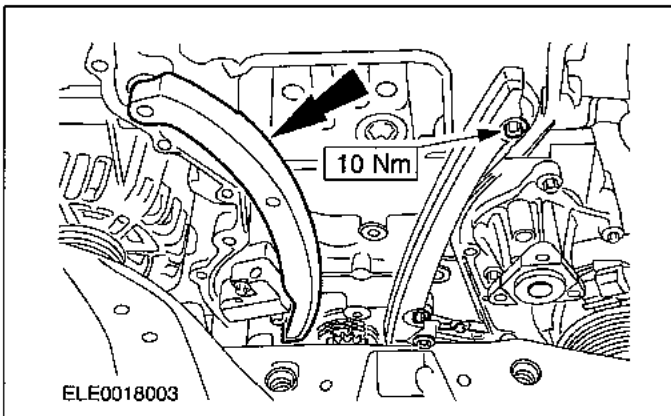


28. Install the oil pump chain guide.



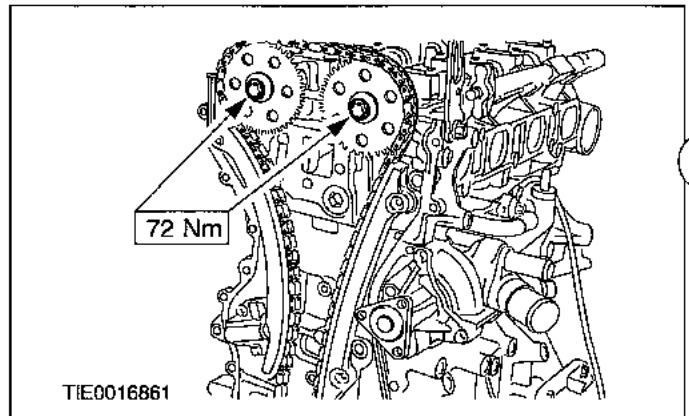
ASSEMBLY**29. Install the timing chain tensioner.**

- Apply pressure to the timing chain and remove the securing pin.

**30. Install the timing chain guides.**

33. **⚠ CAUTION:** Hold each camshaft by the hexagon with an open-ended wrench to stop it from turning.

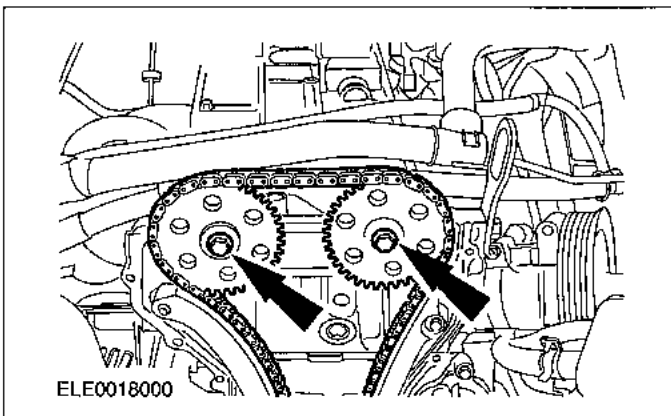
Tighten the camshaft sprockets retaining bolts.



31. **⚠ CAUTION:** Do not fully tighten the camshaft sprocket retaining bolts at this stage. Make sure the camshaft sprockets turn on the camshafts.

Install the camshaft sprockets.

- Install the timing chain.



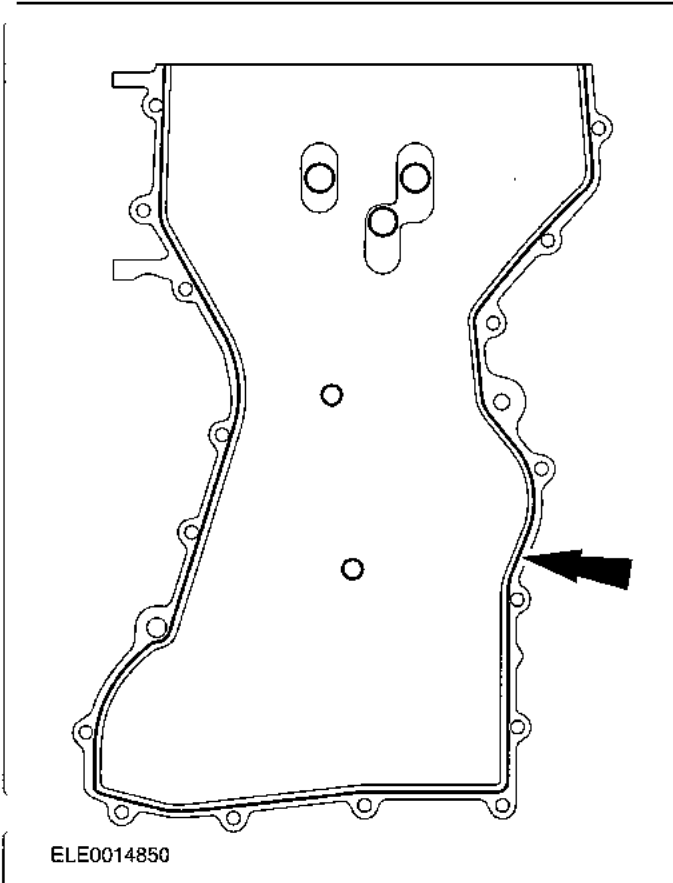
34. Clean the mating face of the engine front cover with a suitable metal surface cleaner.

35. **NOTE:** Install the engine front cover within 10 minutes of applying the sealant.

32. Tension the timing chain.

ASSEMBLY

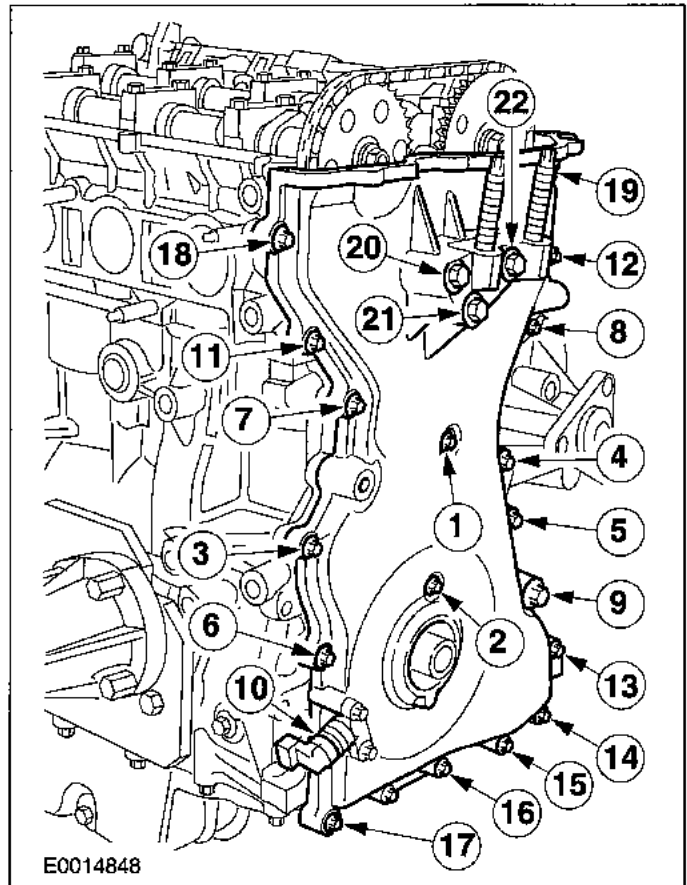
Apply a 3 mm bead of sealant to the engine front cover.



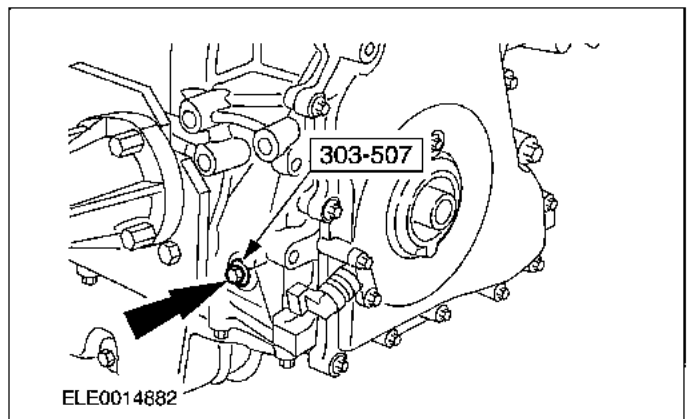
36. Install the engine front cover.

- Tighten the bolts in the sequence shown.
- Tighten bolts 1 through 8 to 10 Nm.
- Tighten bolt 9 to 48 Nm.
- Tighten bolts 10 through 19 to 10 Nm.

- Tighten bolts 20 through 22 to 48 Nm.



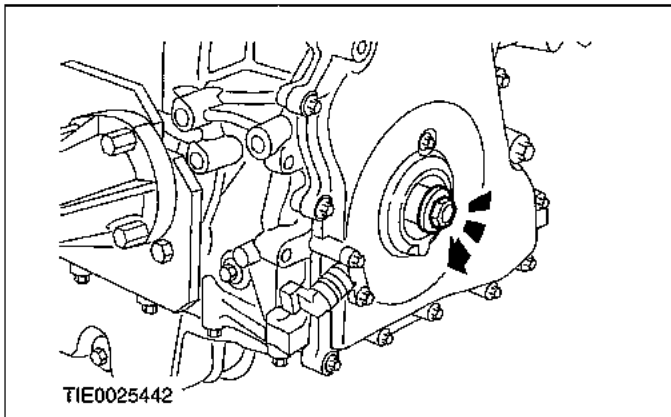
37. Remove the cylinder block lower blanking plug from the cylinder block and install the special tool.



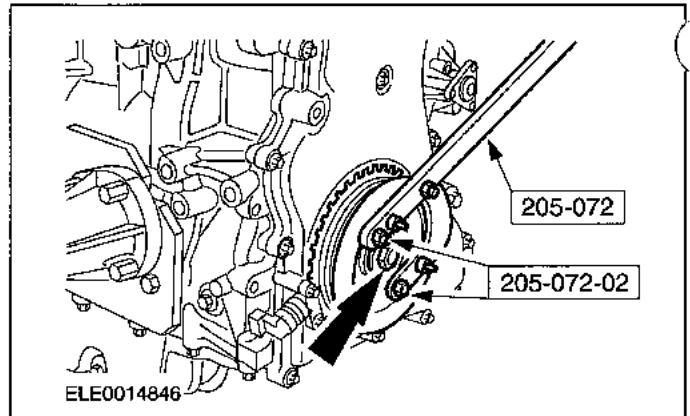
38. NOTE: Only rotate the crankshaft in the normal direction of rotation.

ASSEMBLY

Using the crankshaft pulley retaining bolt, rotate the crankshaft until piston No. 1 is at TDC.



- Stage 2: 90 degrees.

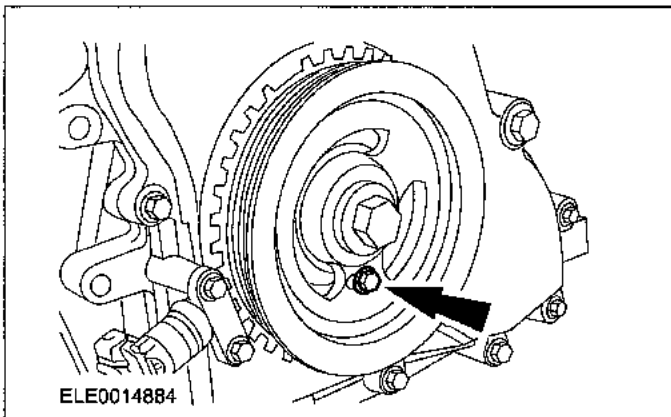


39. Remove the crankshaft pulley retaining bolt.

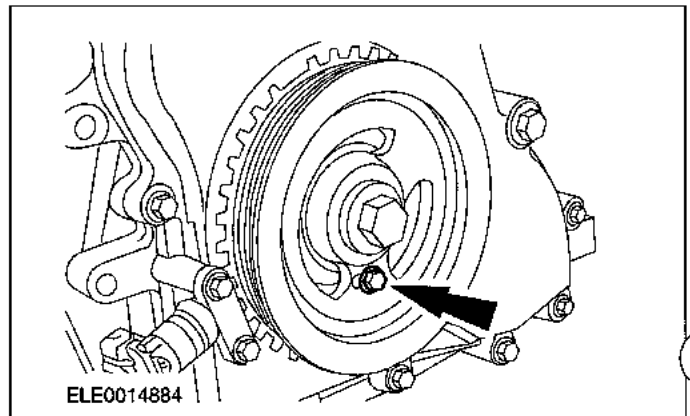
- Discard the bolt.

40. **CAUTION:** Only tighten the crankshaft pulley securing bolt finger tight.

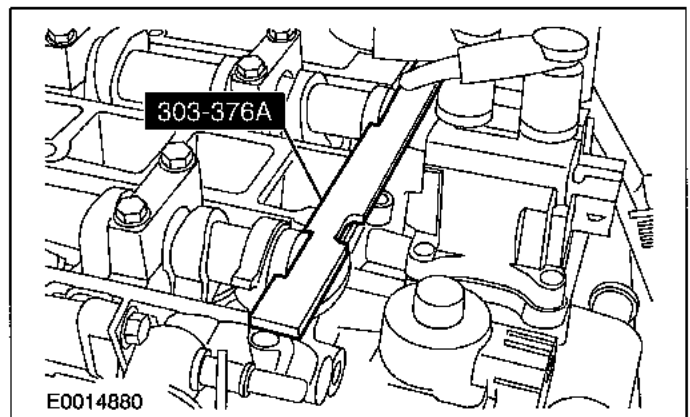
Install the crankshaft pulley onto the crankshaft and secure the crankshaft pulley to the front cover using a M6 x 18 mm bolt.



42. Remove the crankshaft pulley securing bolt.



43. Remove the special tool.



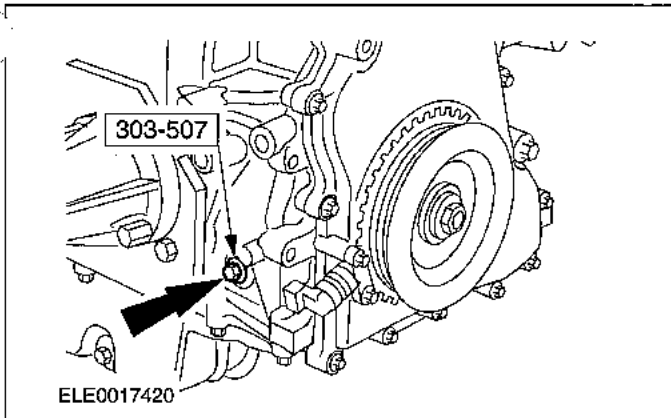
41. **NOTE:** Install a new crankshaft pulley retaining bolt.

Using the special tools, prevent the crankshaft pulley from rotating and tighten the crankshaft pulley retaining bolt.

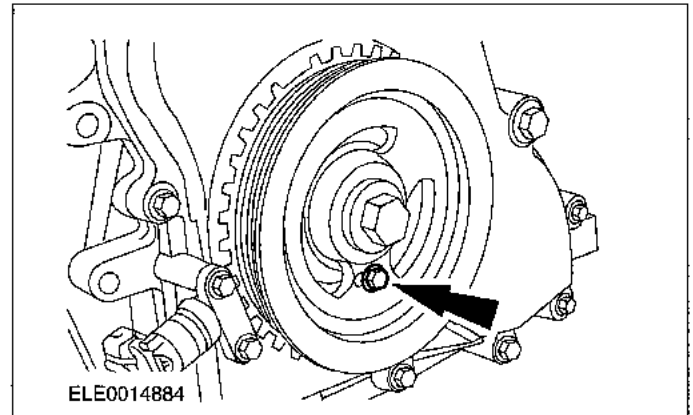
- Tighten the bolt in two stages.
- Stage 1: 100 Nm.

ASSEMBLY

44. Remove the special tool.



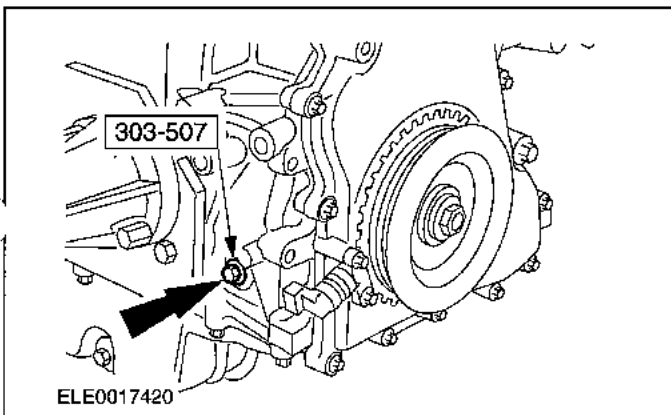
Using a M6 x 18 mm bolt, check the position of the crankshaft pulley.



45. **NOTE:** Only rotate the crankshaft in the normal direction of rotation.

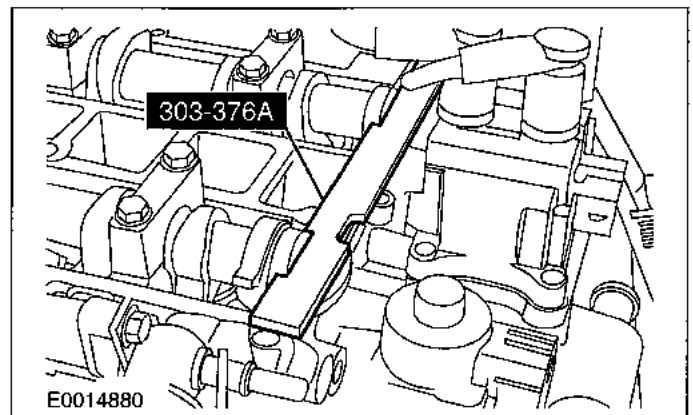
Rotate the crankshaft two revolutions.

46. Install the special tool.



49. **NOTE:** If it is not possible to install the special tool, correct the engine timing.

Using the special tool, check the position of the camshafts.



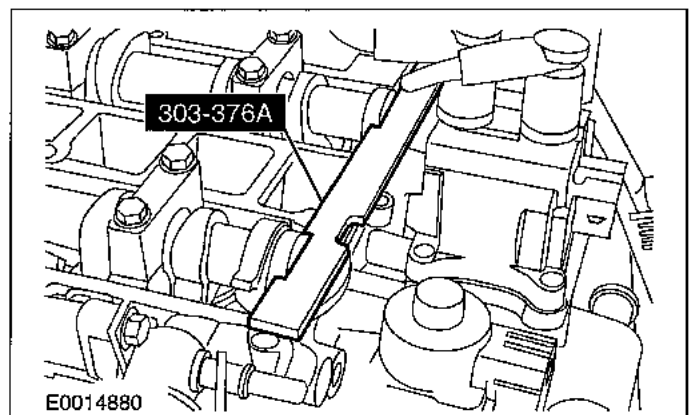
47. **NOTE:** Only rotate the crankshaft in the normal direction of rotation.

Rotate the crankshaft until piston No. 1 is at TDC.

48. **CAUTION:** Only tighten the crankshaft pulley securing bolt finger tight.

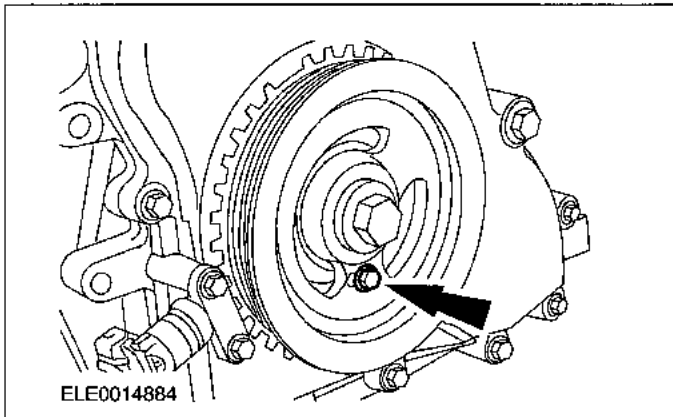
NOTE: If it is not possible to install the crankshaft pulley securing bolt, correct the engine timing.

50. Remove the special tool.

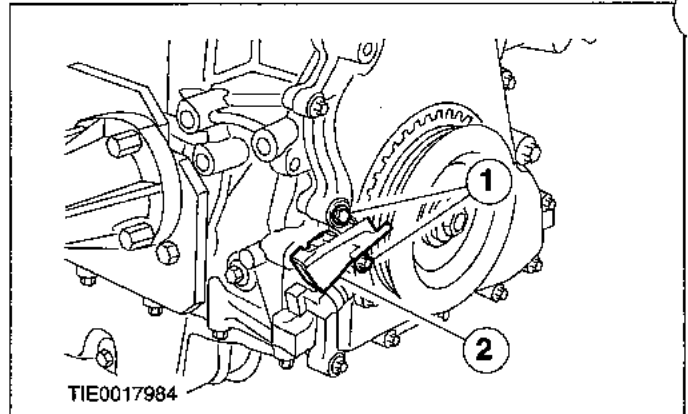


ASSEMBLY

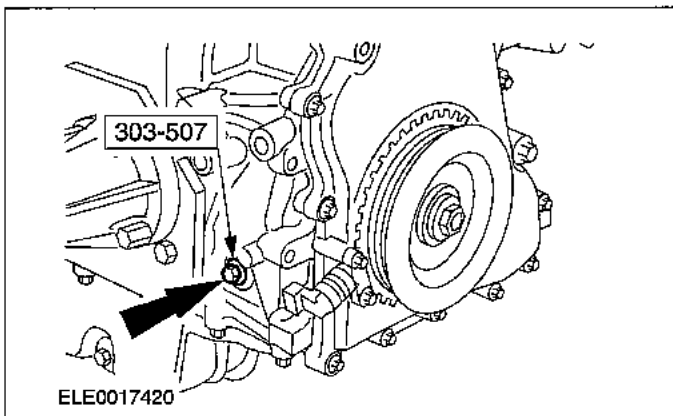
51. Remove the crankshaft pulley securing bolt.



2. Insert the alignment tool supplied, so that it is hooked in the crankshaft pulley teeth.

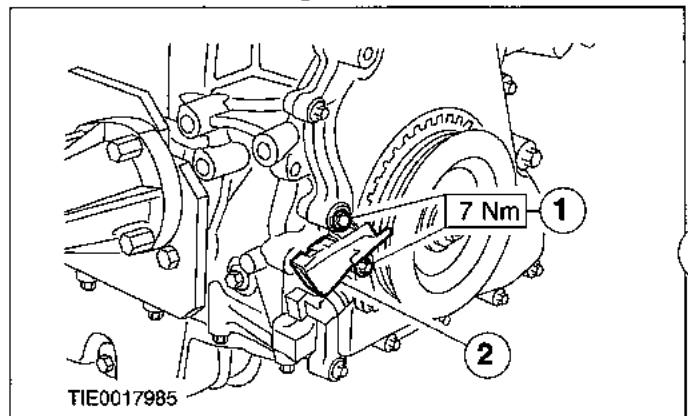


52. Remove the special tool.

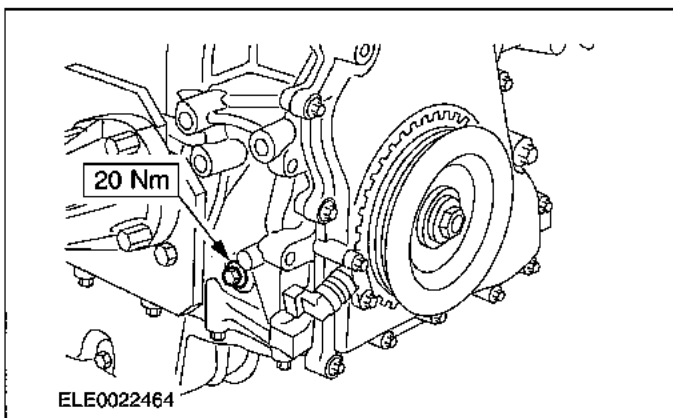


55. Install the CKP sensor.

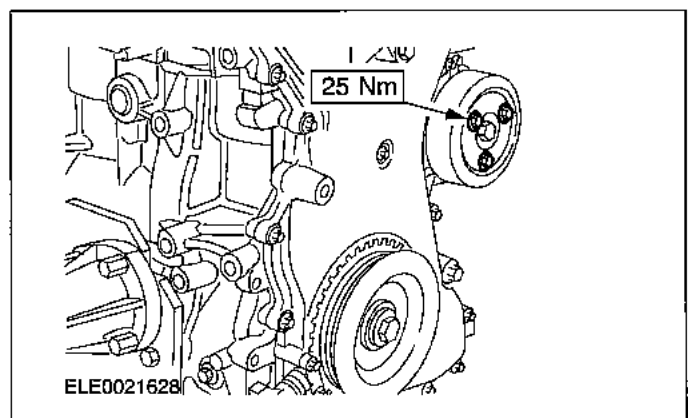
1. Tighten the CKP sensor retaining bolts.
2. Remove the alignment tool.



53. Install the cylinder block lower blanking plug.



56. Install the coolant pump pulley.



54. **NOTE:**When installing a new crankshaft pulley or engine front cover, the crankshaft position (CKP) sensor must be aligned using the alignment tool supplied with the new component.

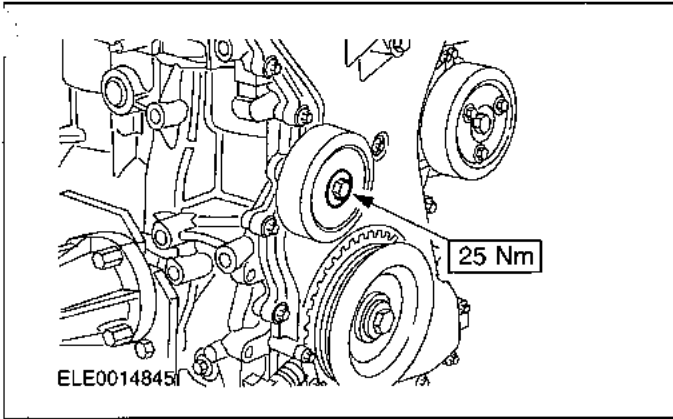
NOTE:Do not tighten the bolts at this stage.

Align the CKP sensor.

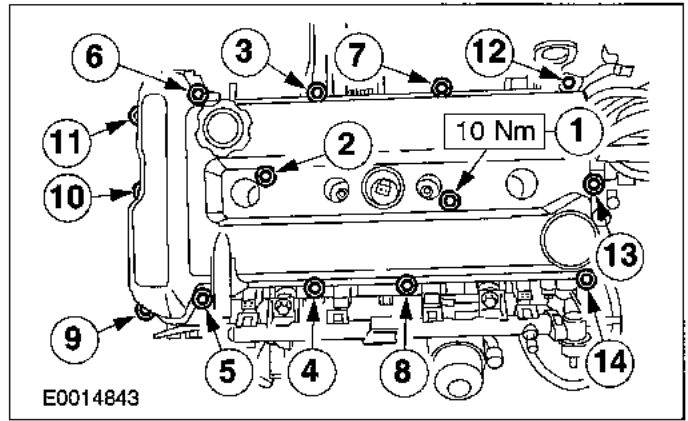
1. Loosen the CKP sensor retaining bolts.

ASSEMBLY

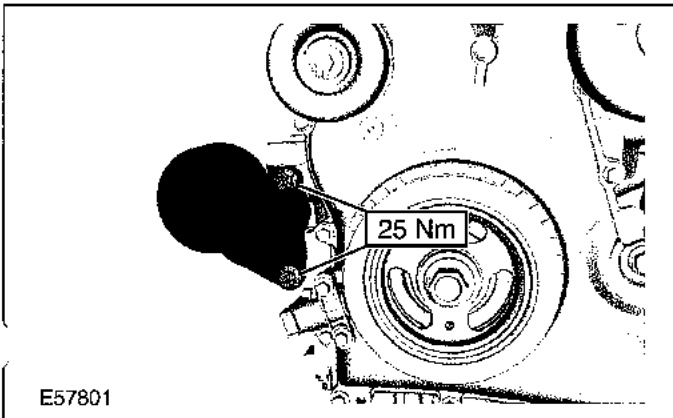
57. Install the accessory drive belt idler pulley.



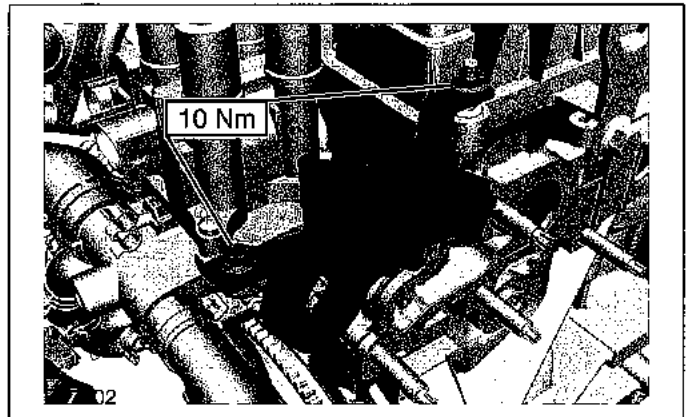
• Tighten the bolts in the sequence shown.



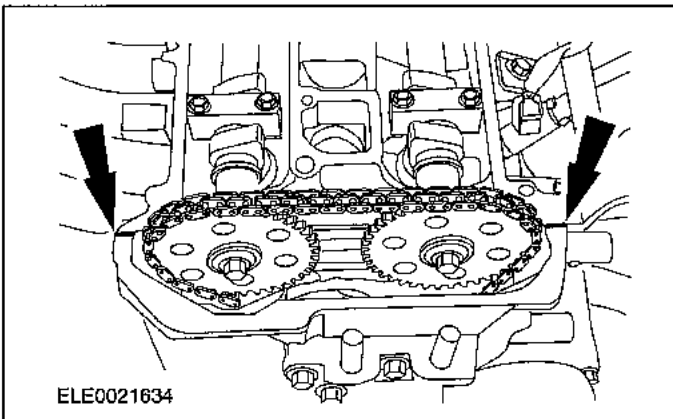
58. Install the accessory drive belt tensioner.



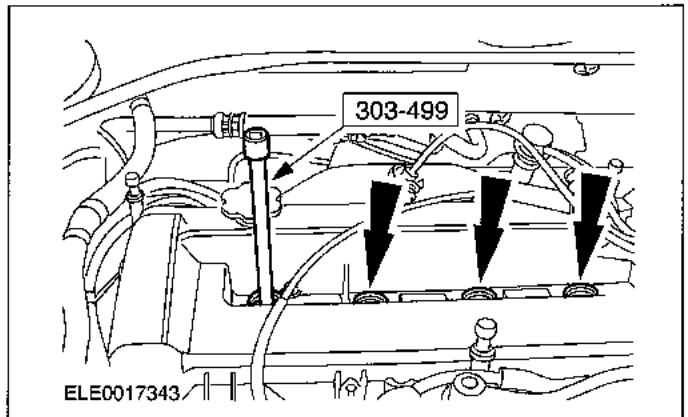
61. Install the evaporative emission (EVAP) valve support bracket.



59. Apply a small bead of sealant to the areas as shown.



62. Using the special tool, install the spark plugs.

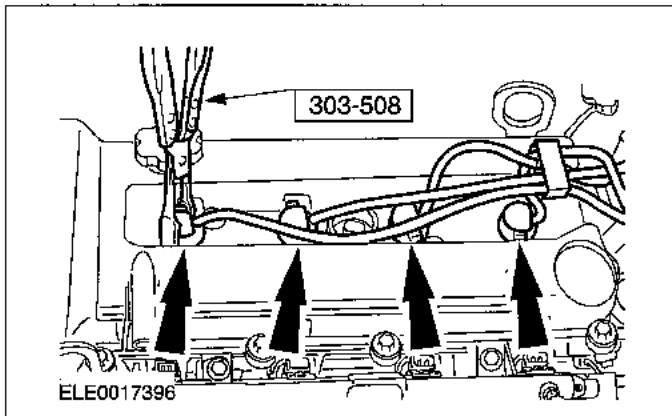


60. NOTE: Install a new valve cover gasket if necessary.

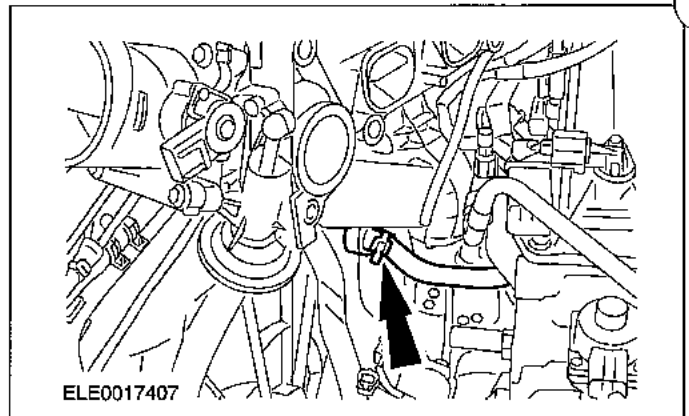
Install the valve cover.

ASSEMBLY

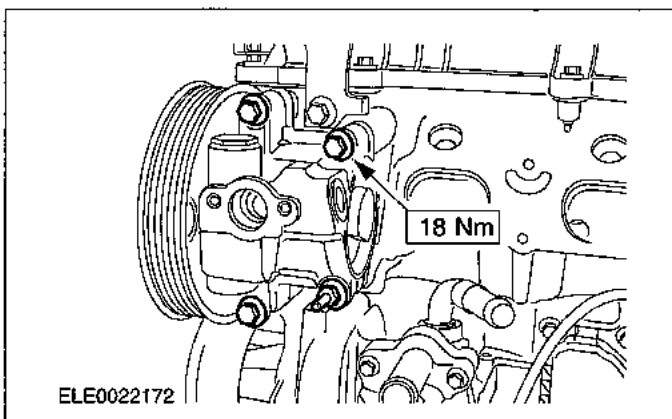
63. Using the special tool, connect the spark plug electrical connectors.



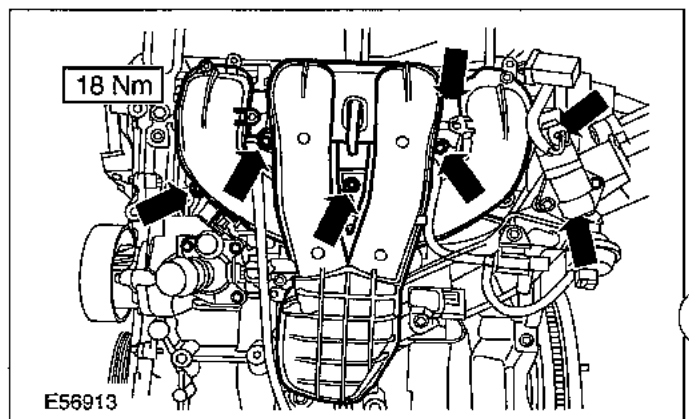
66. Connect the positive crankcase ventilation (PCV) hose to the intake manifold.



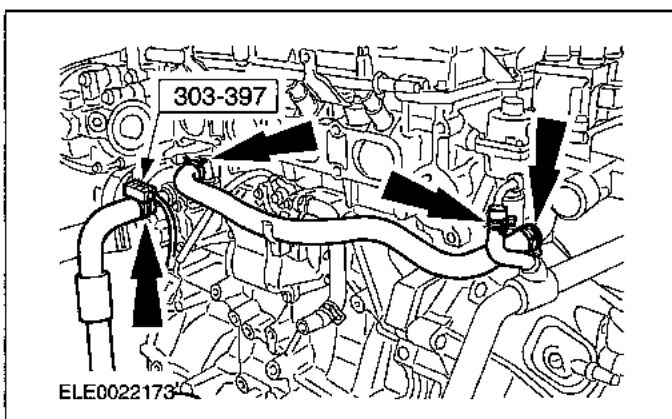
64. Install the power steering pump.



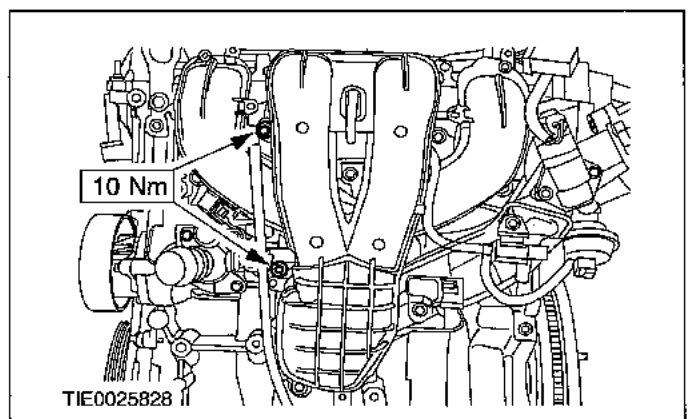
67. Install the intake manifold.



65. Using the special tool, install the coolant hoses.



68. Install the oil level indicator tube and oil level indicator.

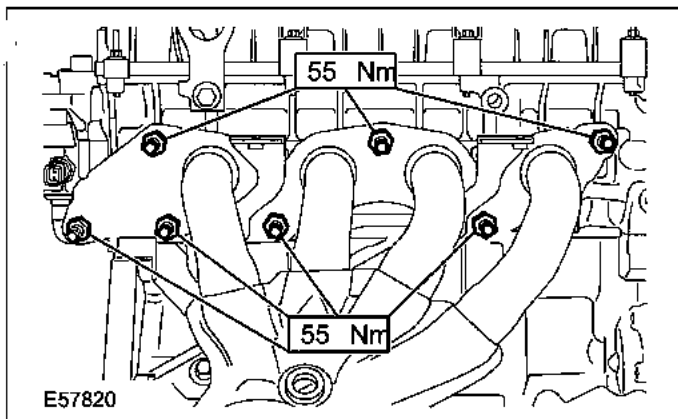


69. NOTE: Install a new exhaust manifold gasket.

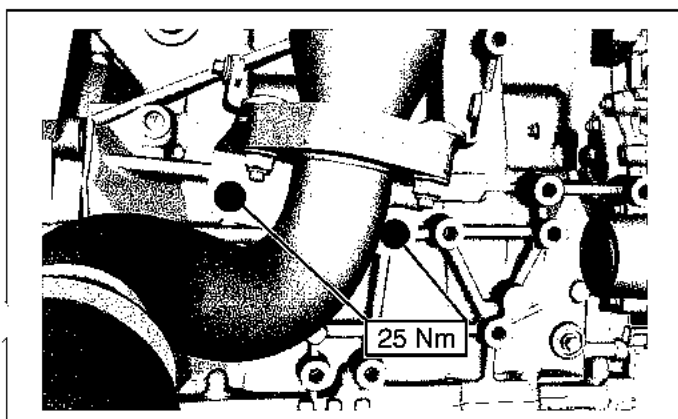
NOTE: Do not tighten the exhaust manifold retaining nuts at this stage.

ASSEMBLY

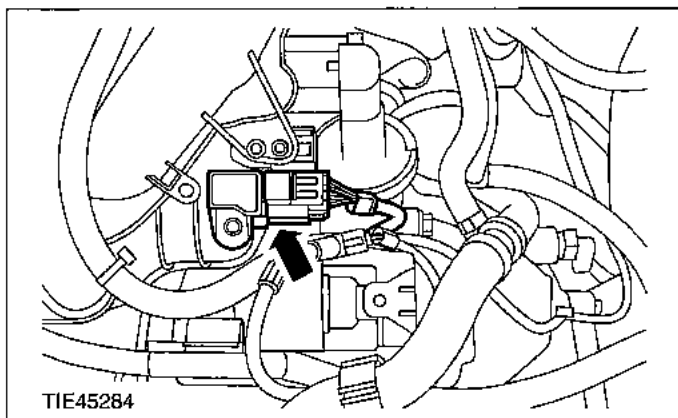
Install the exhaust manifold.



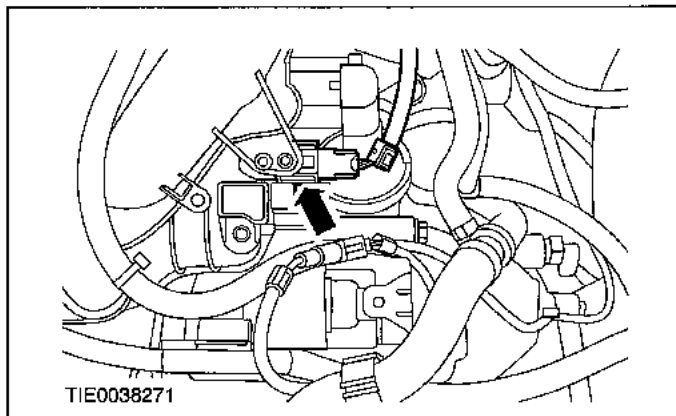
70. Install the exhaust manifold lower retaining bolts.



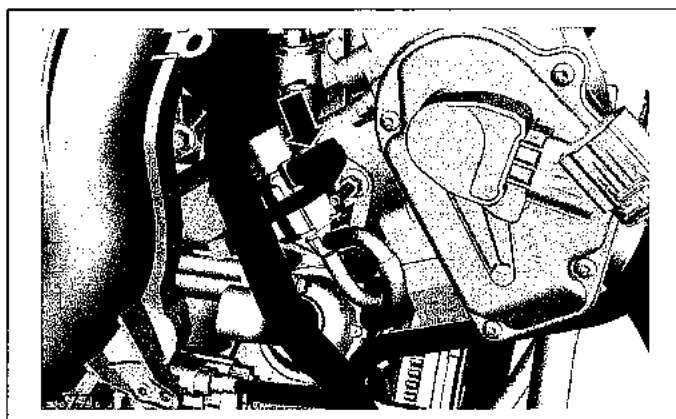
71. Connect the manifold absolute pressure (MAP) sensor electrical connector.



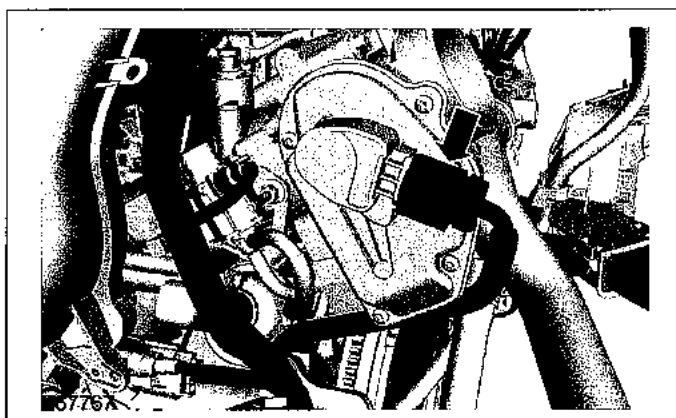
72. Attach the starter motor electrical connector to the intake manifold.



73. Connect the intake manifold runner control (IMRC) electrical connector.

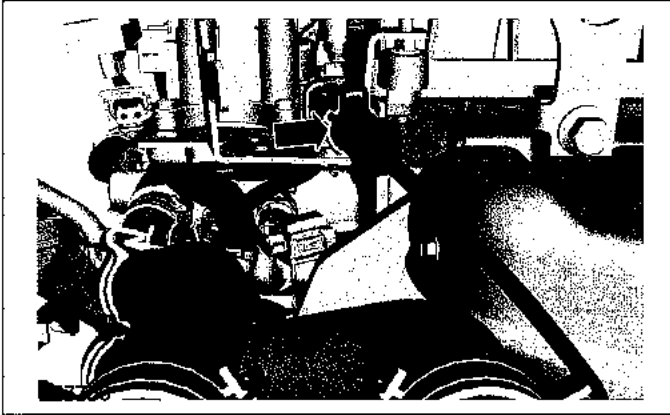


74. Connect the throttle body (TB) electrical connector.

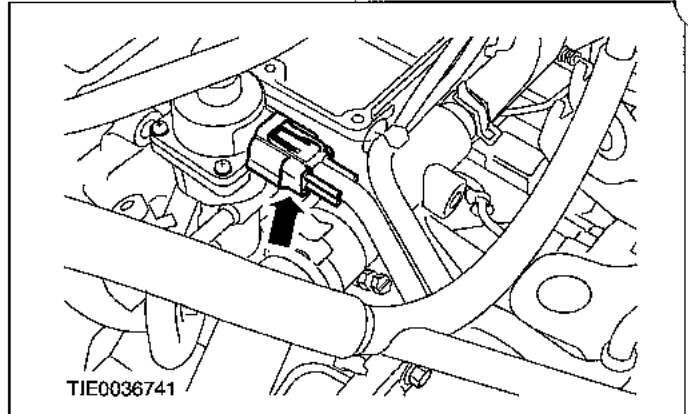


ASSEMBLY

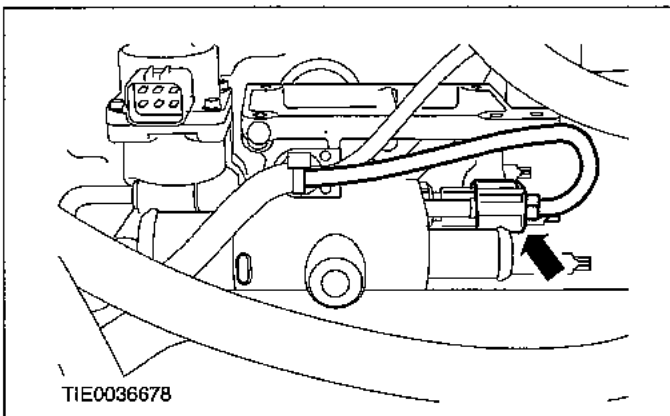
75. Connect the heated oxygen (H2OS) sensor electrical connector.



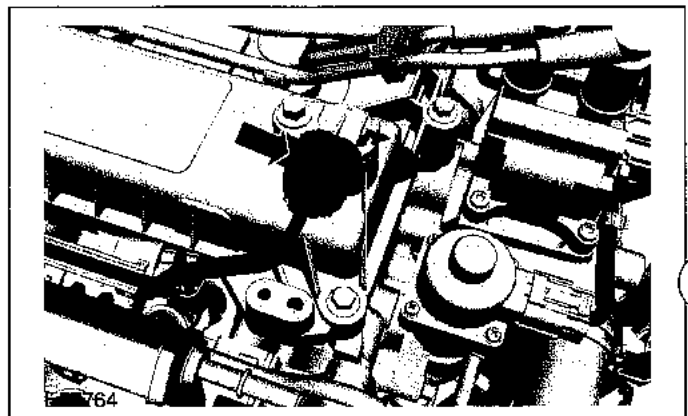
78. Connect the exhaust gas recirculation (EGR) valve electrical connector.



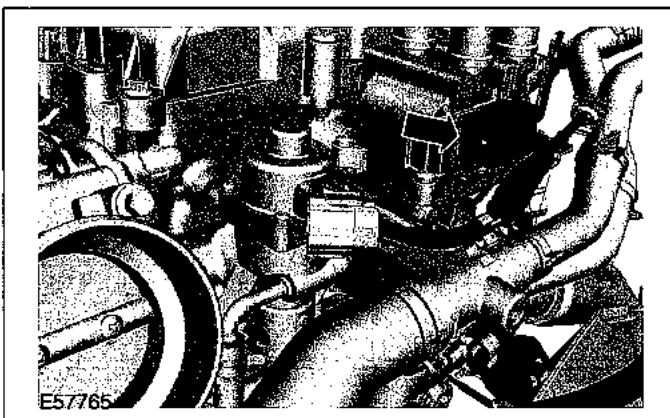
76. Connect the engine coolant temperature (ECT) sensor electrical connector.



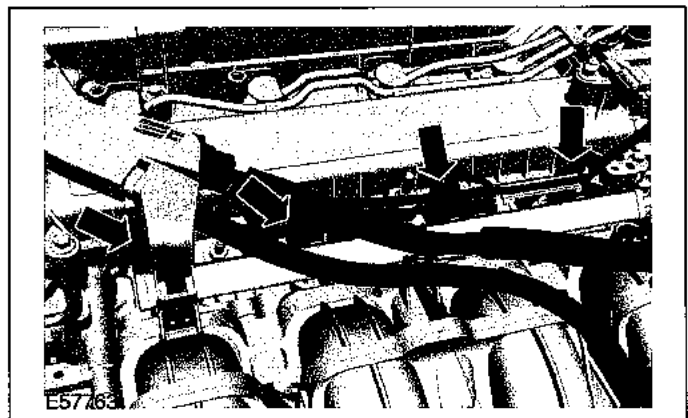
79. Connect the camshaft position (CMP) sensor electrical connector.



77. Connect the electronic ignition (EI) electrical connector.

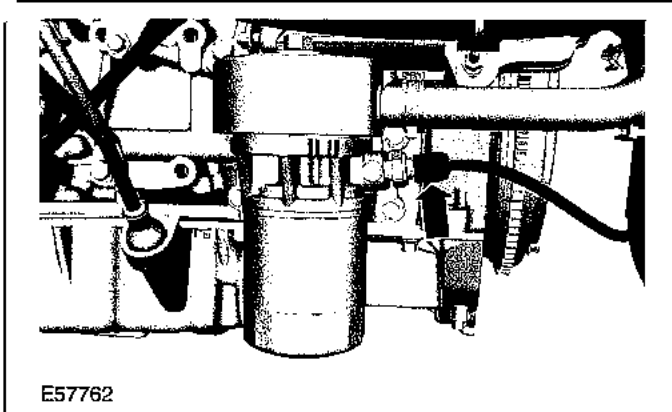


80. Connect the fuel injector electrical connectors.

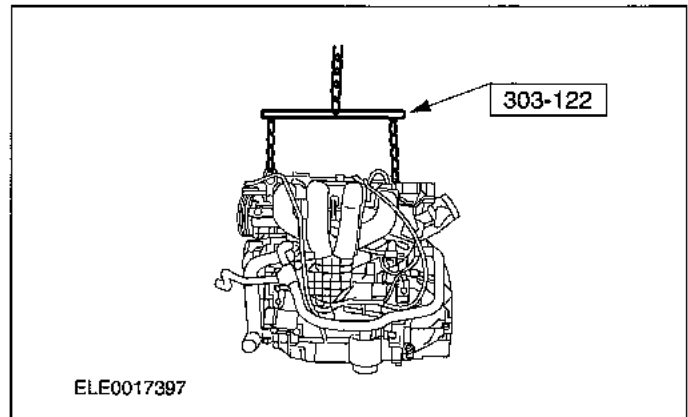


ASSEMBLY

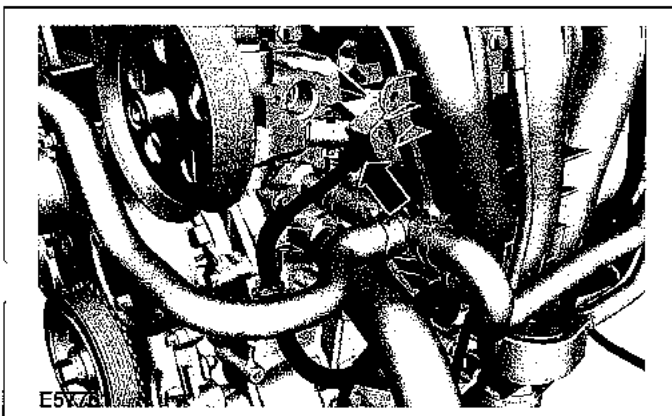
81. Connect the oil pressure switch electrical connector.



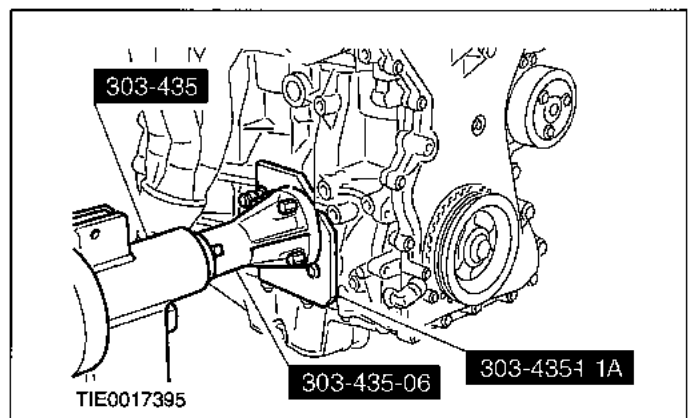
85. Using the special tool and an engine hoist, support the engine.



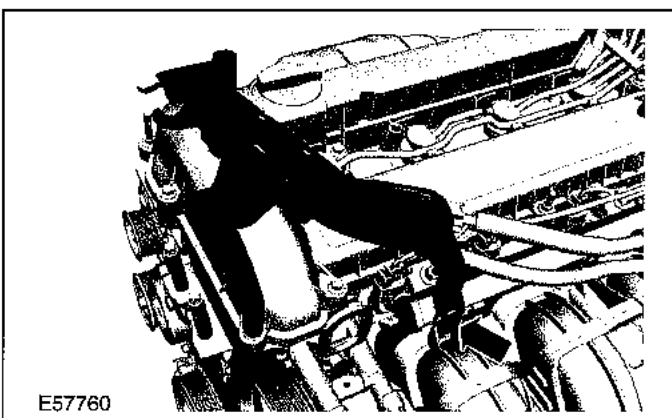
82. Connect the knock sensor (KS) electrical connector.



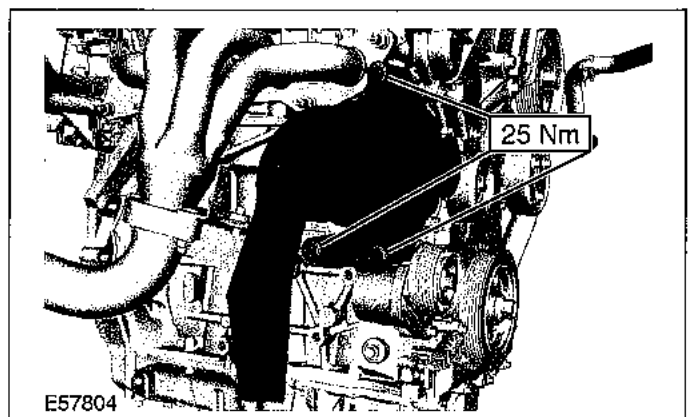
86. Remove the special tools.



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



87. Install the generator.

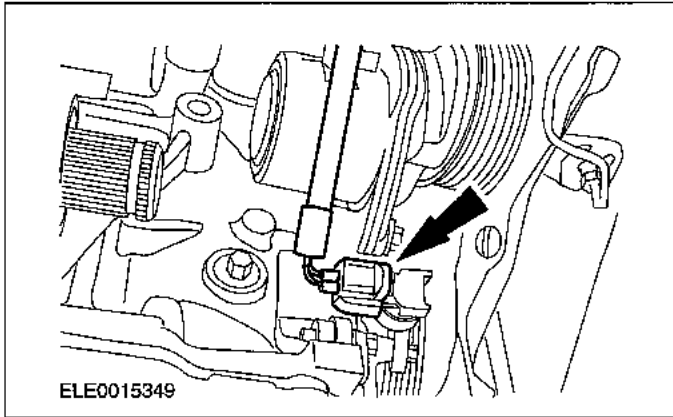


84. Fill the engine with engine oil.

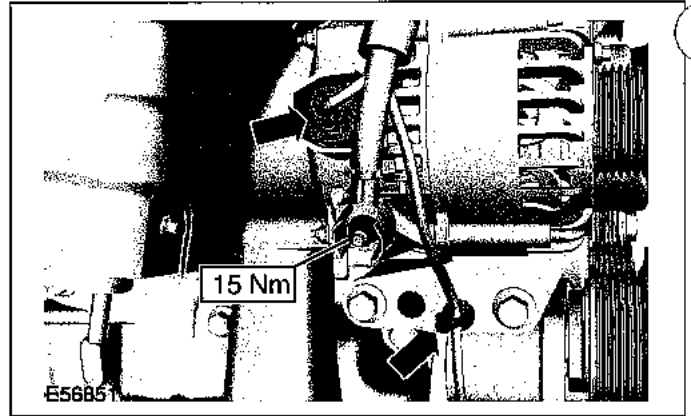
For additional information, refer to:
 Specifications (303-01 Engine - 2.0L
 Duratec-HE (M14), Specifications).

ASSEMBLY

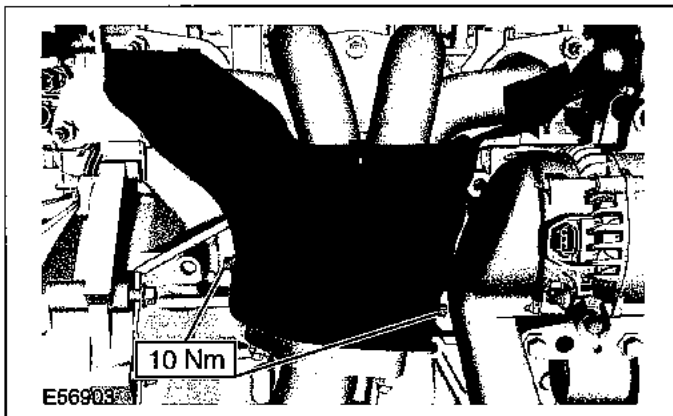
88. Connect the crankshaft position (CKP) sensor electrical connector.



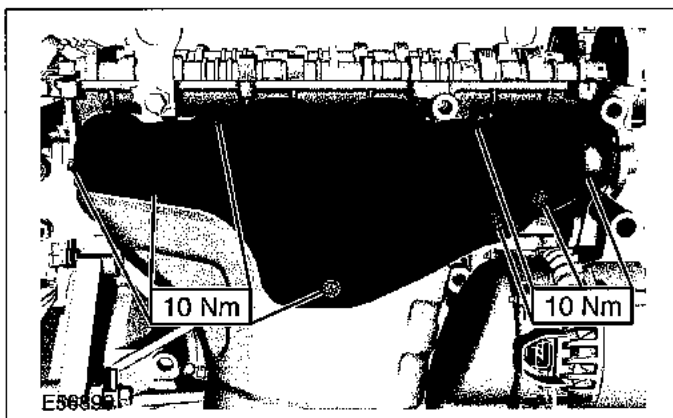
91. Connect the generator electrical connector.



89. Install the exhaust manifold lower heat shield.



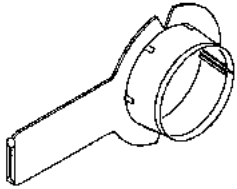
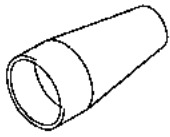
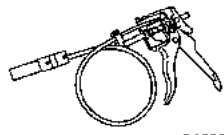
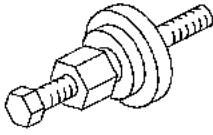
90. Install the exhaust manifold upper heat shield.



INSTALLATION

Engine

Special Tool(s)

| | |
|--|--|
|  <p>E47098</p> | <p>Protector, Halfshaft Seal 205-775</p> |
|  <p>13015</p> | <p>Expander, Teflon Seal 211-188</p> |
|  <p>24003</p> | <p>Remover/Installer, Hose Clamp 303-397</p> |
|  <p>21192</p> | <p>Installer, Camshaft Pulley 303-458</p> |

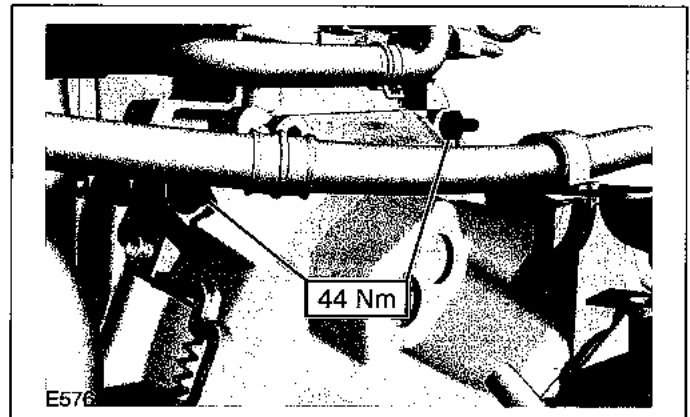
General Equipment

| |
|-----------------|
| Workshop table |
| Securing straps |
| Engine hoist |

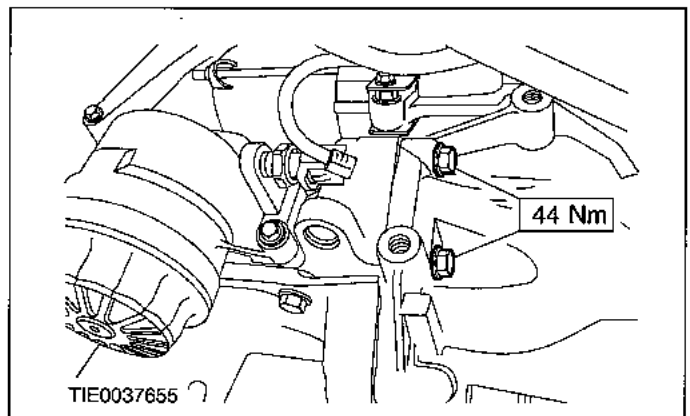
▲ WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

- NOTE: Using suitable retaining straps, secure the engine on the workshop table.
Support the engine with wooden blocks.
- Install the transaxle.

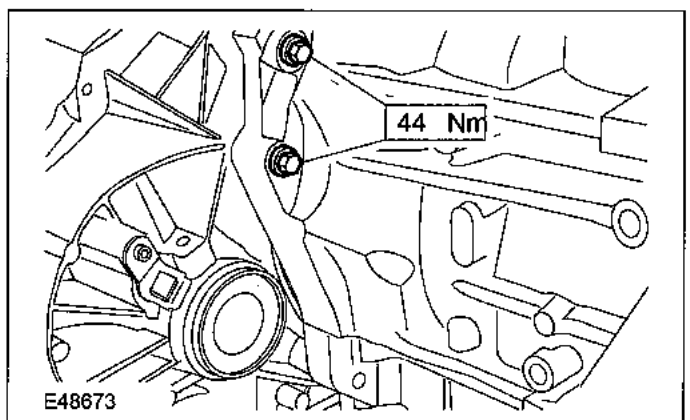
3. Install the transaxle upper retaining bolts.



4. Install the transaxle left-hand retaining bolts.

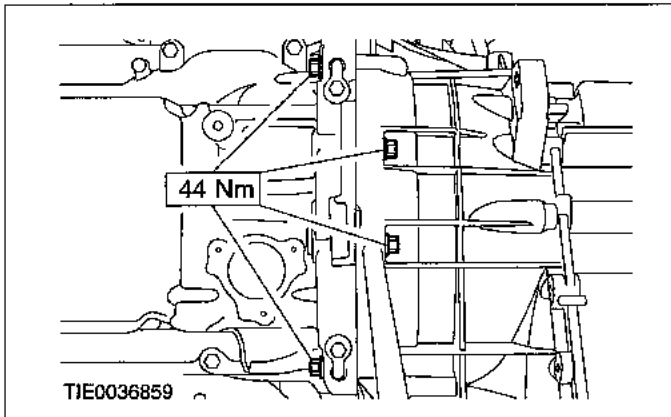


5. Install the transaxle right-hand retaining bolts.

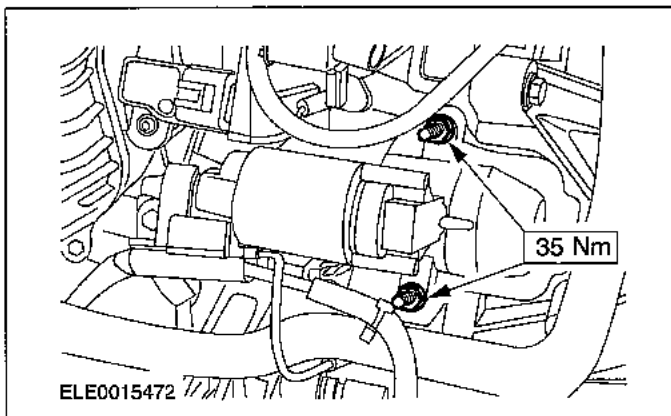


INSTALLATION

6. Install the transaxle lower retaining bolts.

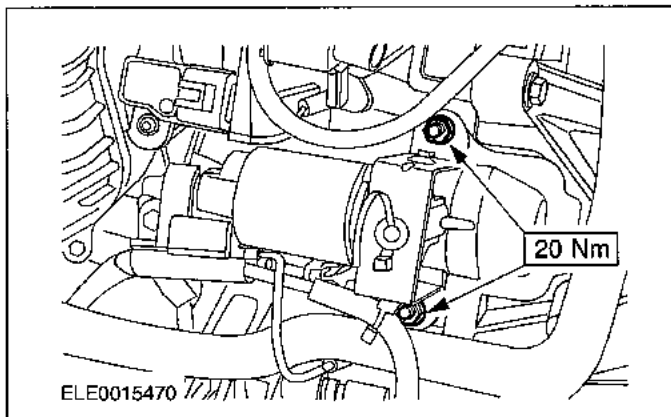


7. Install the starter motor.

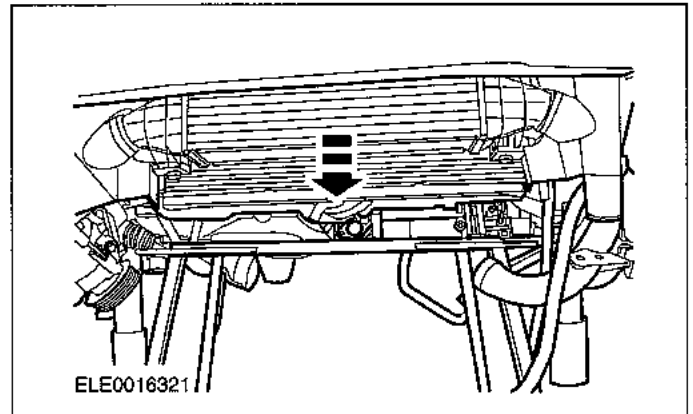


8. Install the wiring harness retaining bracket.

- Attach the wiring harness to the retaining bracket.

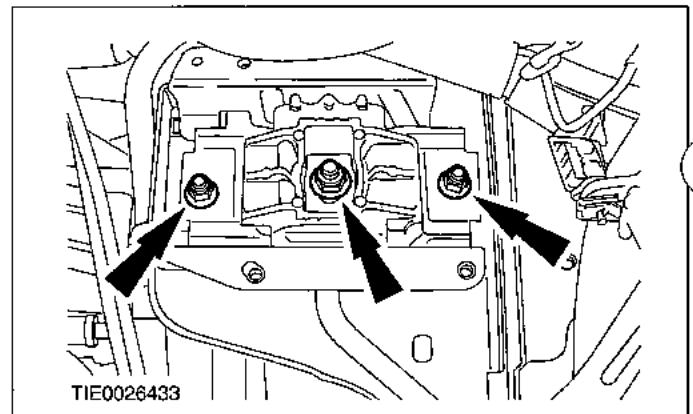


9. Position the workshop table under the vehicle and carefully lower the vehicle until the engine and transaxle assembly is in the correct position to install the engine mounts.



10. NOTE: Do not tighten the engine rear mount retaining nuts at this stage.

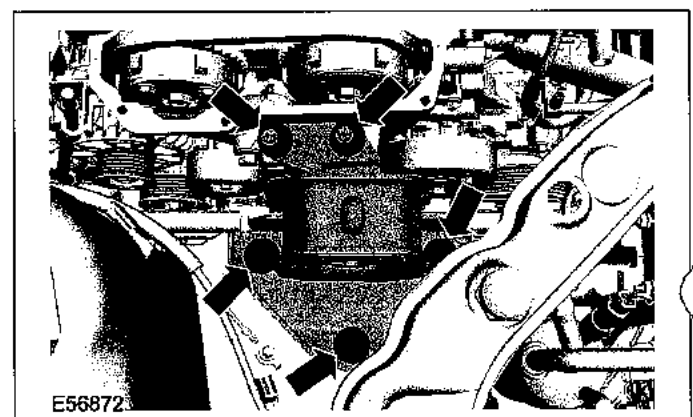
Install the engine rear mount retaining nuts.



11. NOTE: Install new engine front mount retaining nuts.

NOTE: Do not tighten the engine front mount retaining nuts and bolts at this stage.

Install the engine front mount retaining nuts and bolts.

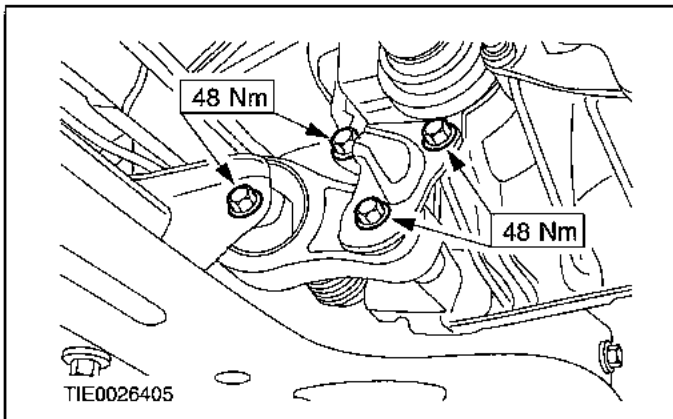


INSTALLATION

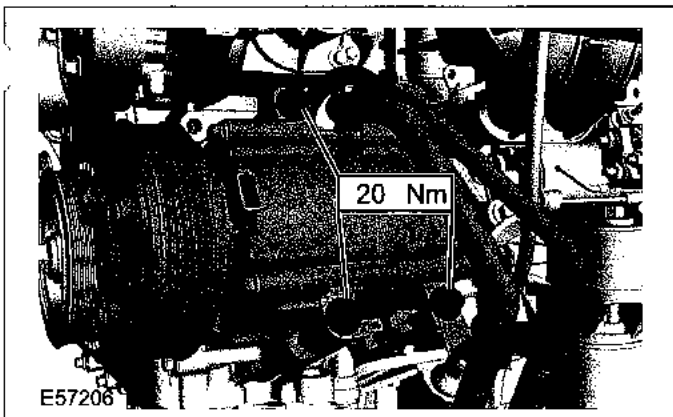
12. Remove the securing straps.
13. Raise and support the vehicle. For additional information, refer to: (100-02 Jacking and Lifting)

Jacking (Description and Operation),
Lifting (Description and Operation).

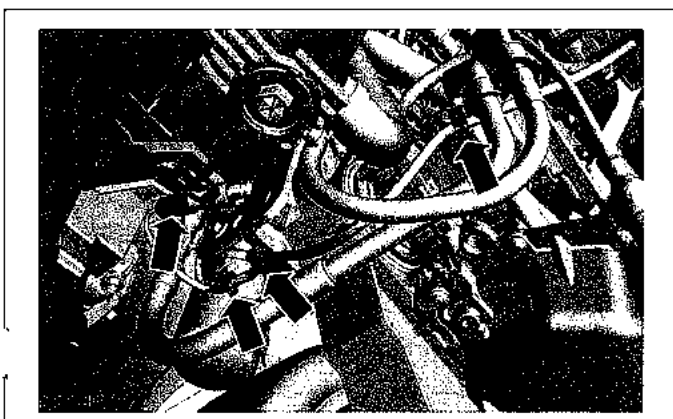
14. Install the engine support insulator.



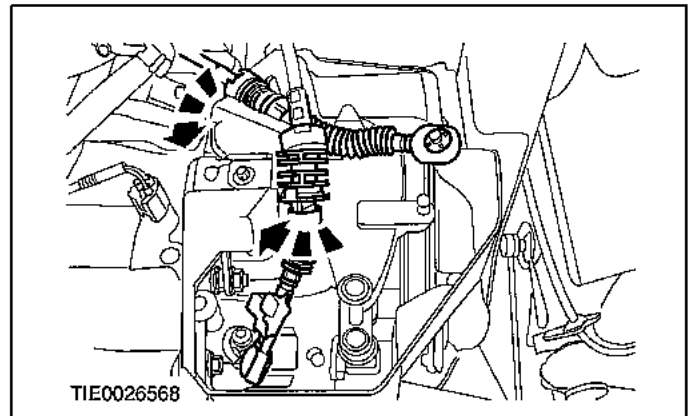
15. Attach the air conditioning (A/C) compressor to the cylinder block.



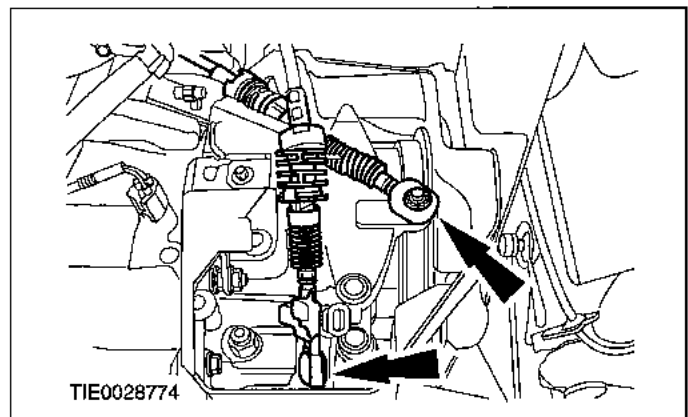
16. Connect the A/C high pressure switch electrical connector.



17. Attach the gearshift cables to the bracket and turn the abutment sleeves counterclockwise.



18. Attach the gearshift cables to the selector levers.



19. CAUTIONS:

⚠ The inner CV joint must not be bent more than 23 degrees. The outer CV joint must not be bent more than 45 degrees.

⚠ Make sure that the halfshaft seal is not damaged.

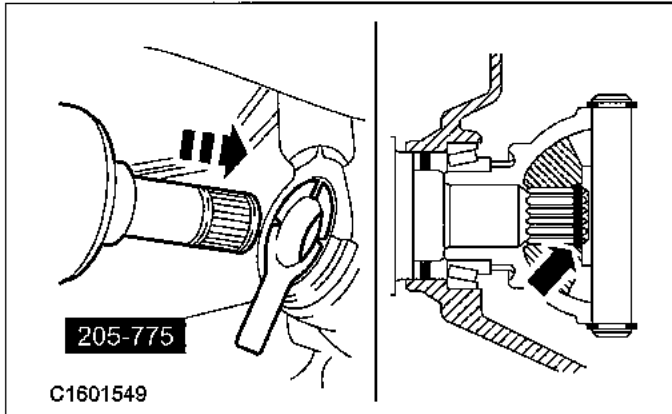
⚠ Make sure the snap ring is correctly seated.

NOTE: Install a new snap ring.

Using the special tool, attach the left-hand halfshaft to the transaxle.

INSTALLATION

- Remove the special tool before fully installing the halfshaft.



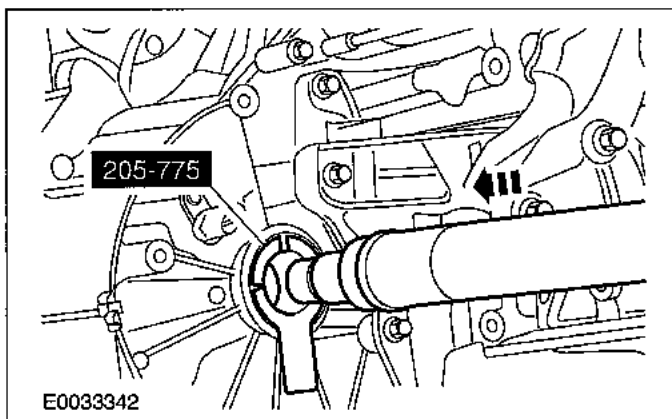
20. CAUTIONS:

⚠ The inner CV joint must not be bent more than 23 degrees. The outer CV joint must not be bent more than 45 degrees.

⚠ Make sure the halfshaft seal is not damaged.

Using the special tool, attach the right-hand halfshaft and intermediate shaft assembly to the transaxle.

- Remove the special tool before fully installing the halfshaft.



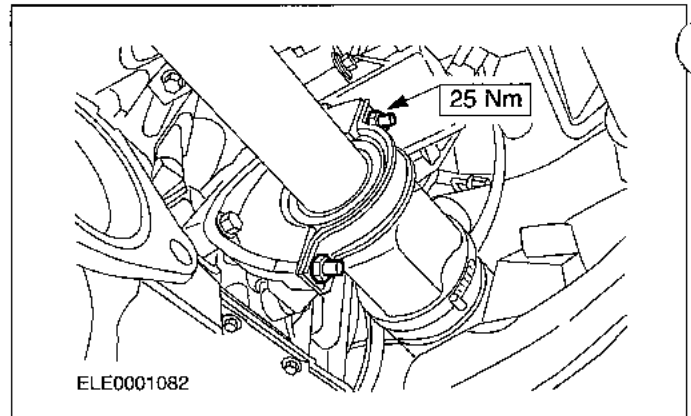
21. NOTE: Install a new intermediate shaft center bearing cap and retaining nuts.

NOTE: Make sure that the intermediate shaft center bearing is correctly positioned in the intermediate shaft center bearing retaining bracket.

Install the intermediate shaft center bearing cap.

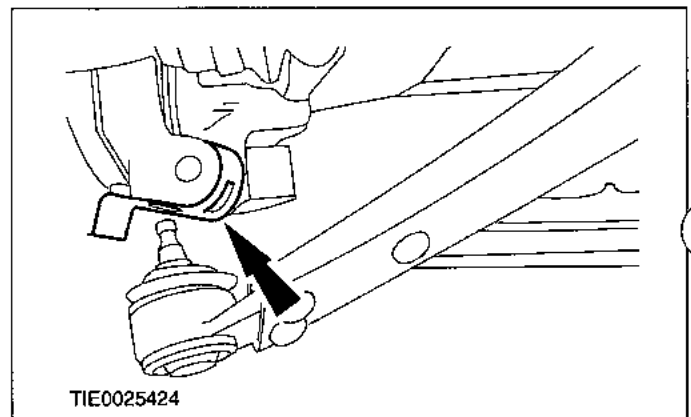
- Position the center bearing cap.
- Position the intermediate shaft center bearing heat shield (if equipped).

- Tighten the center bearing cap retaining nuts.



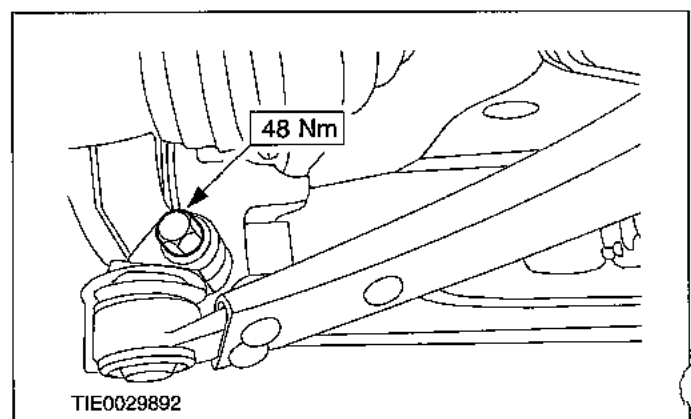
22. ⚠ CAUTION: Make sure that the lower arm ball joint heat shield is installed to prevent damage to the ball joint.

Install the lower arm ball joint heat shield.



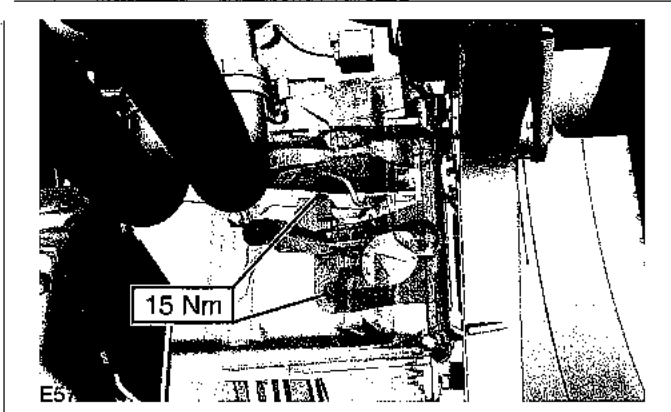
23. ⚠ CAUTION: The lower arm pinch bolt must be installed from the rear of the wheel knuckle.

Attach the lower arm ball joint to the wheel knuckle.

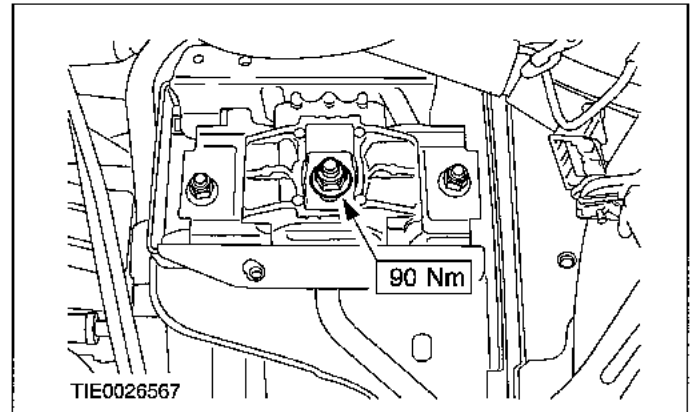


INSTALLATION

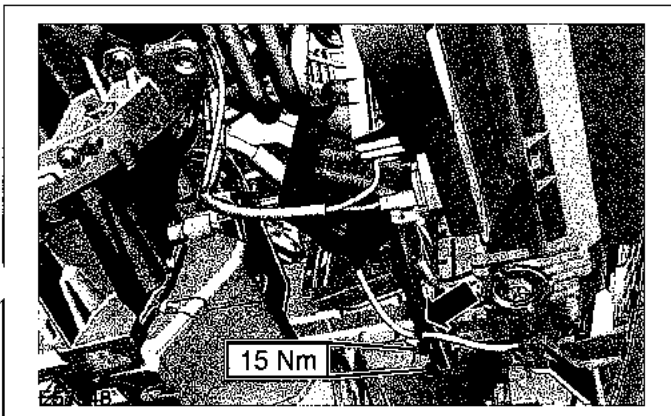
24. Attach the powertrain control module (PCM) support bracket to the side member.



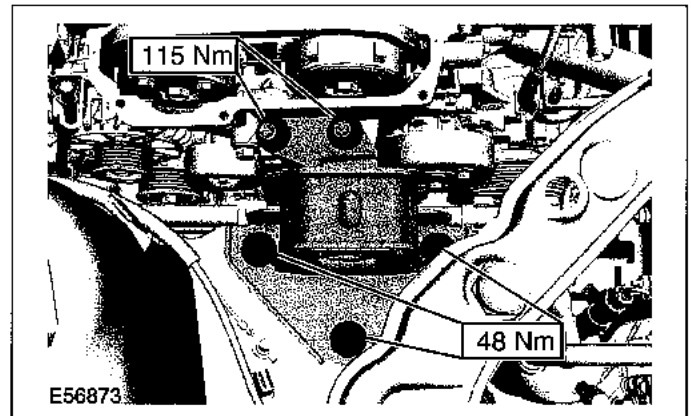
28. Tighten the engine rear mount center retaining nut.



25. Install the air cleaner resonator support bracket.

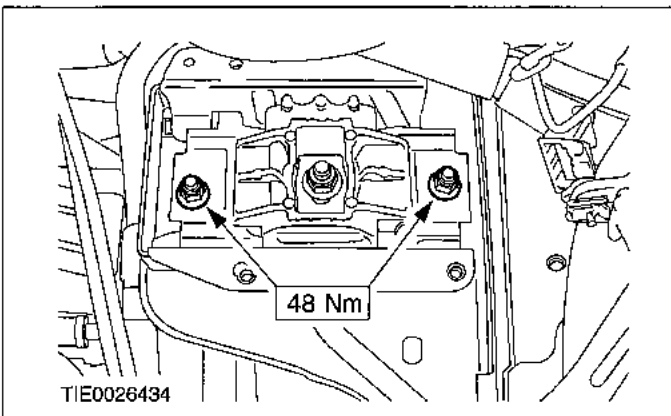


29. Tighten the engine front mount retaining nuts and retaining bolts.



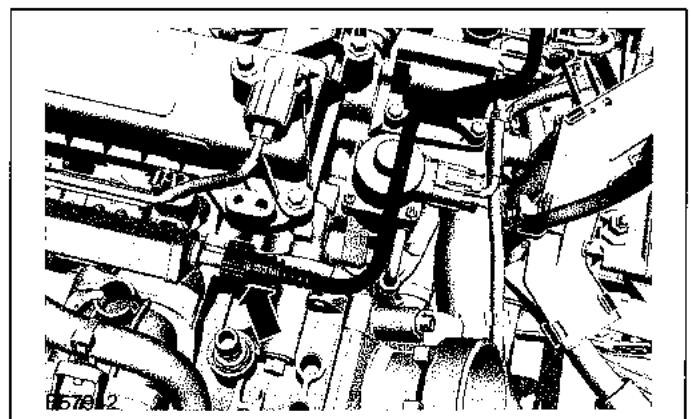
26. Lower the vehicle.

27. Tighten the engine rear mount outer retaining nuts.



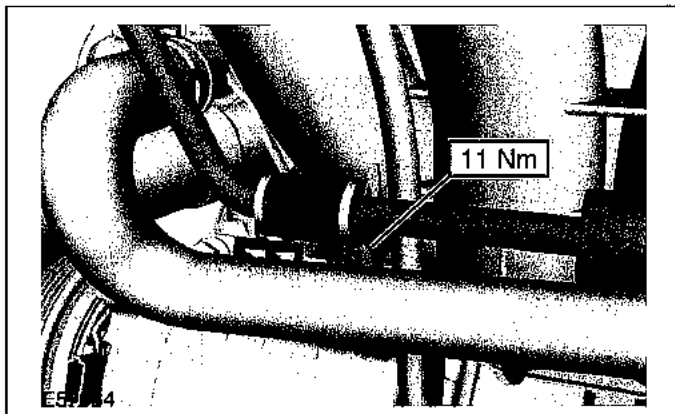
30. Connect the fuel supply line.

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



INSTALLATION

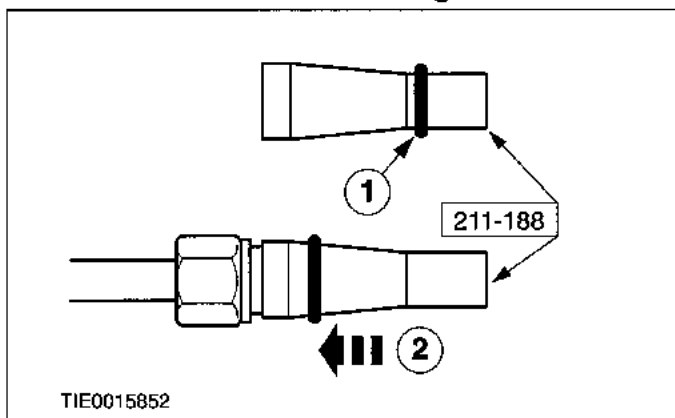
31. Attach the power steering pump to steering gear pressure line to the intake manifold.



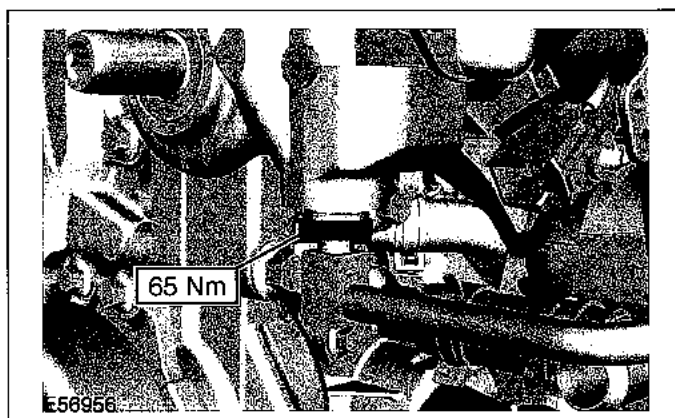
32. **CAUTION:** Care must be taken to prevent dirt ingress.

Using the special tool, install a new O-ring seal onto the power steering pump to steering gear pressure line union.

1. Push the O-ring seal onto the special tool.
2. Locate the special tool onto the power steering pump to steering gear pressure line union and install the O-ring seal.

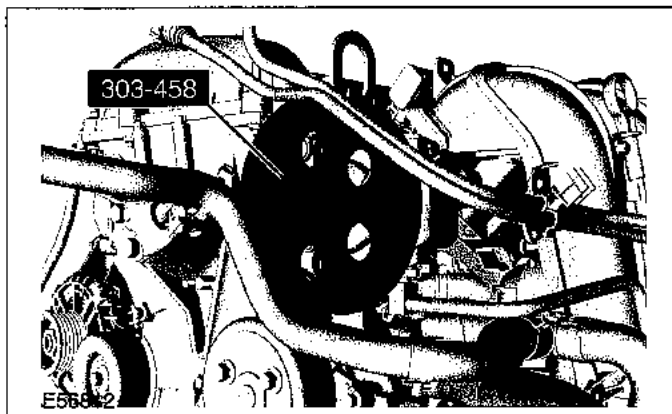


33. Attach the power steering pump to steering gear pressure line from the power steering pump.

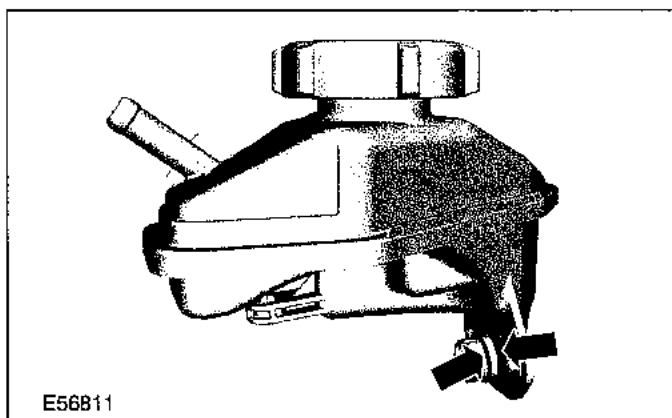


34. **NOTE:** Install a new power steering pump pulley.

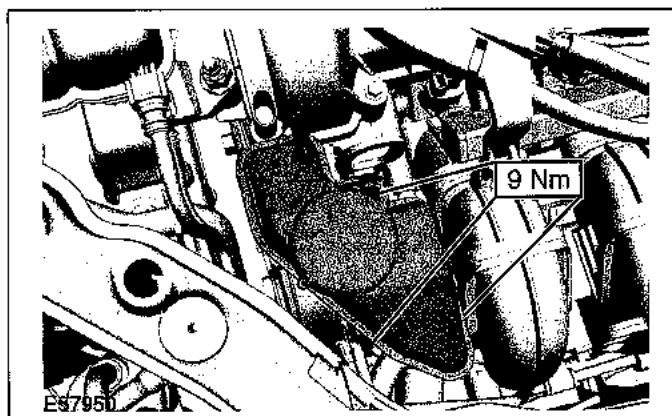
Using the special tool, install the power steering pump pulley.



35. Install new power steering fluid reservoir O-ring seals.

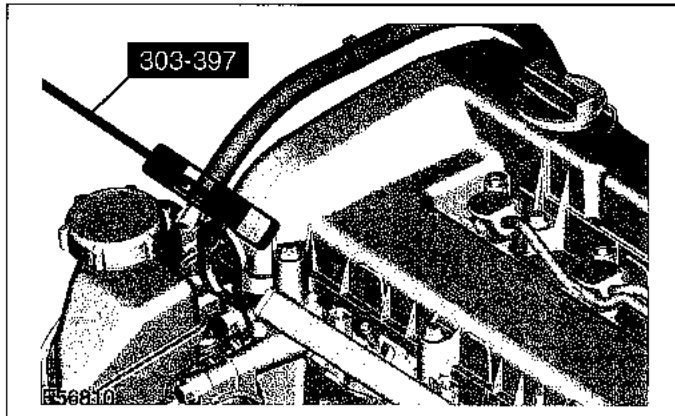


36. Install the power steering fluid reservoir.



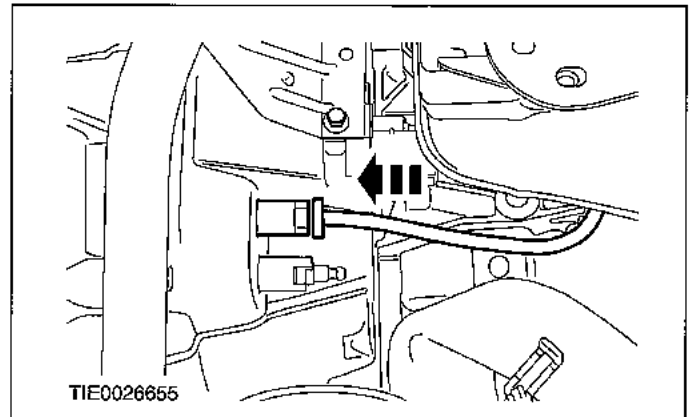
INSTALLATION

37. Using the special tool, connect the steering gear to power steering fluid reservoir return line to the power steering fluid reservoir.

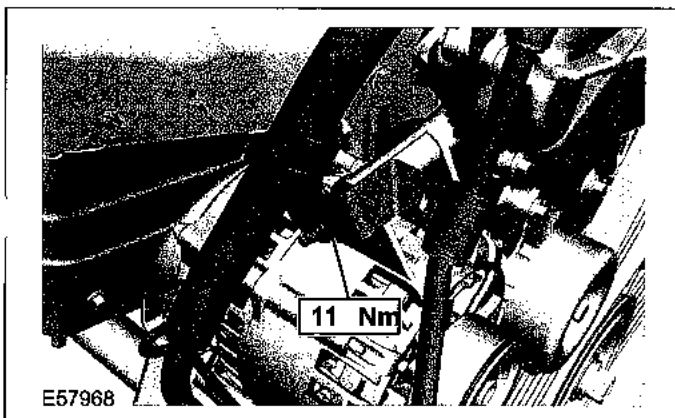


- Connect the clutch slave cylinder supply line.

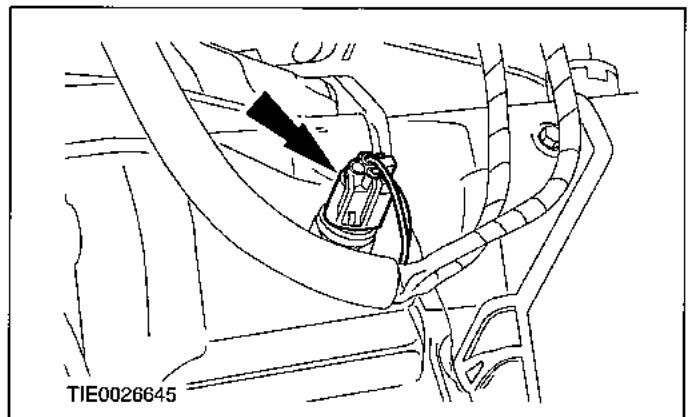
- Install the spring clip.



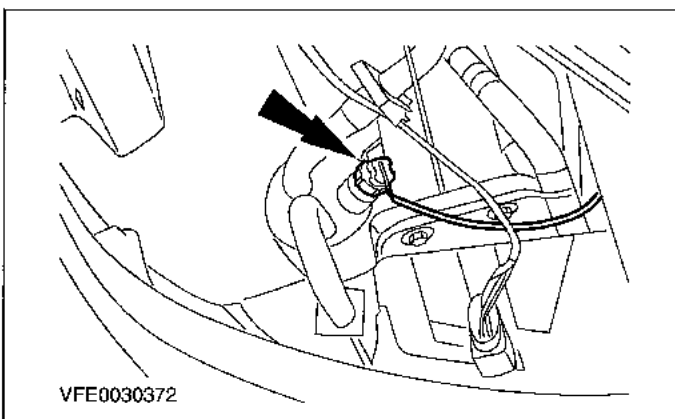
38. Attach the steering gear to power steering fluid reservoir return line support bracket to the generator.



41. Connect the reversing lamp switch electrical connector.

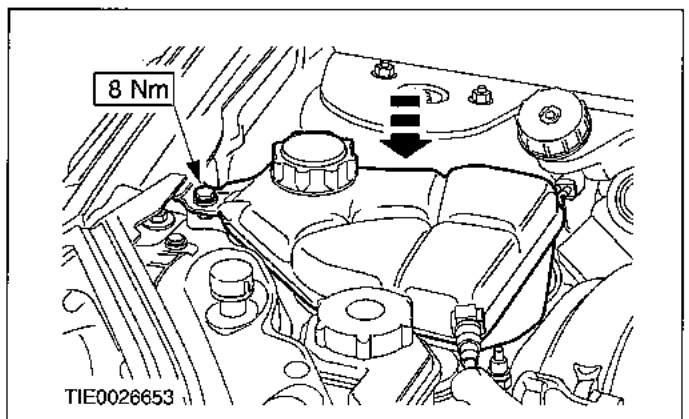


39. Connect the A/C low pressure switch connector.



42. Lower the vehicle.

43. Install the coolant expansion tank.

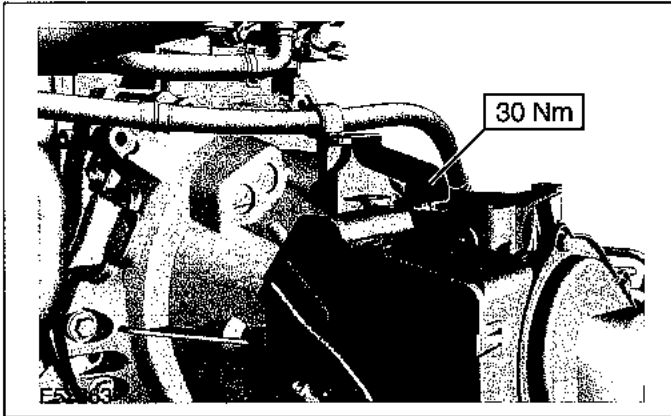


40. **CAUTION:** If brake fluid is spilled on the paintwork, the affected area must be immediately washed down with cold water.

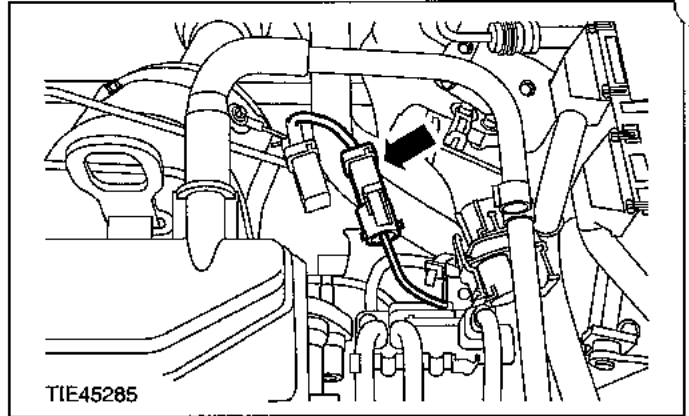
NOTE: Make sure the spring clip is correctly seated.

INSTALLATION

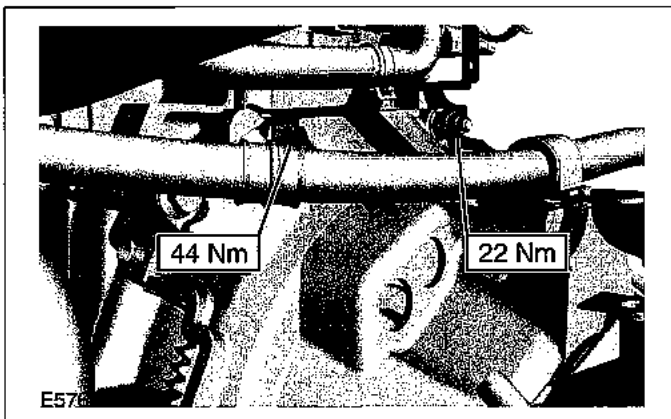
44. Attach the power steering high-pressure line retaining bracket to the transaxle.



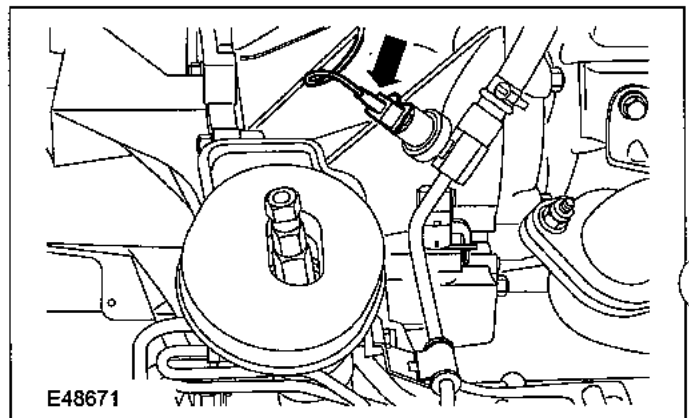
47. Connect the catalyst monitor sensor electrical connector.



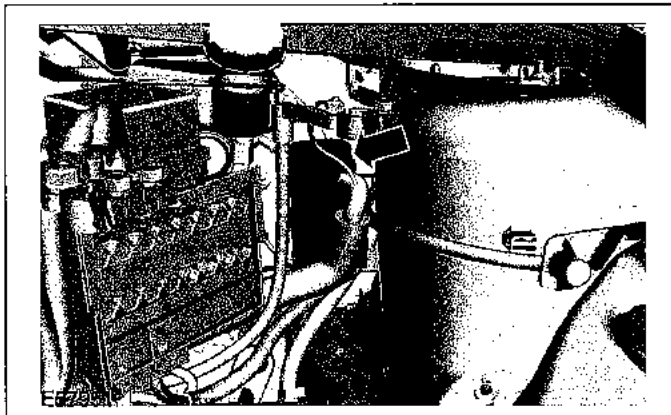
45. Install the engine wiring harness bracket.



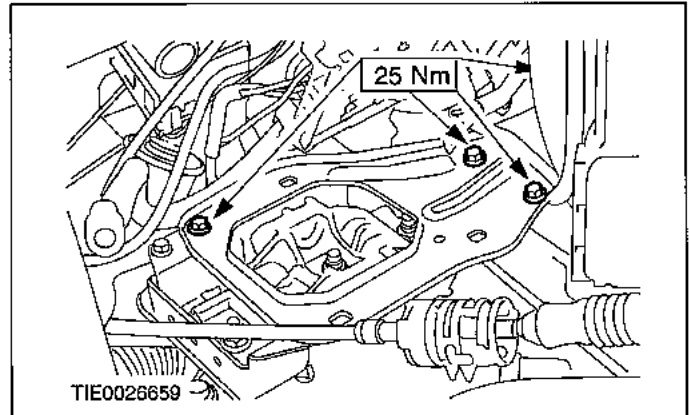
48. Connect the power steering pump switch electrical connector.



46. Connect the engine wiring harness electrical connector.

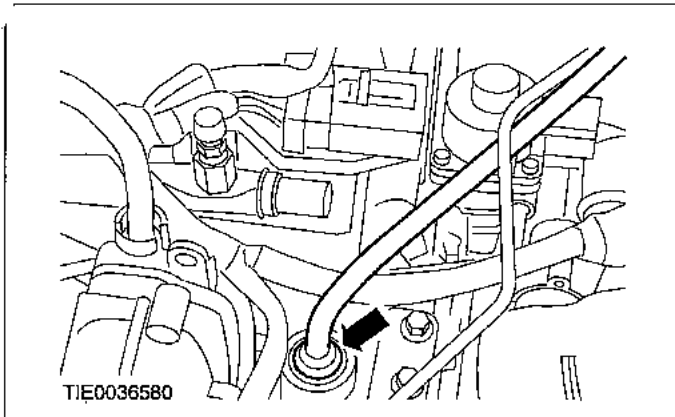


49. Install the battery tray support bracket.

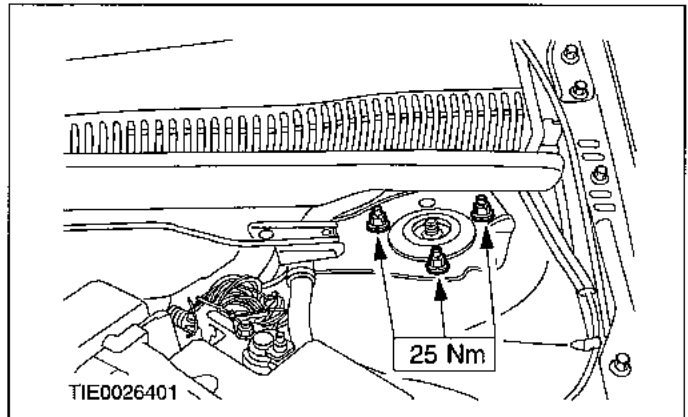


INSTALLATION

50. Connect the brake booster vacuum line to the intake manifold.

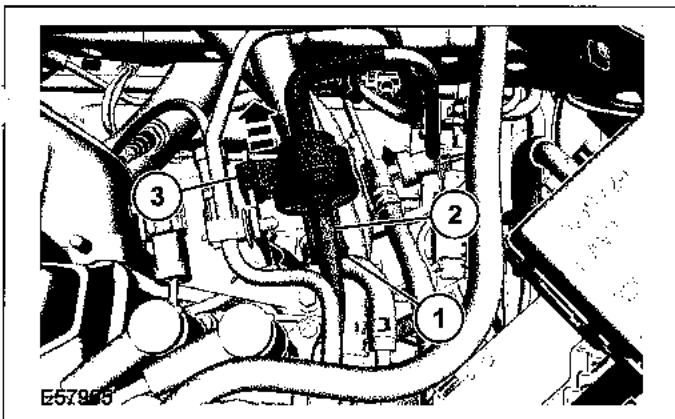


53. Tighten the strut and spring assembly top mount nuts.



51. Attach the evaporative emission (EVAP) valve from EVAP valve support bracket.

1. Connect the EVAP valve electrical connector.
2. Connect the low pressure line to the EVAP valve.
3. Push the EVAP valve onto the support bracket.



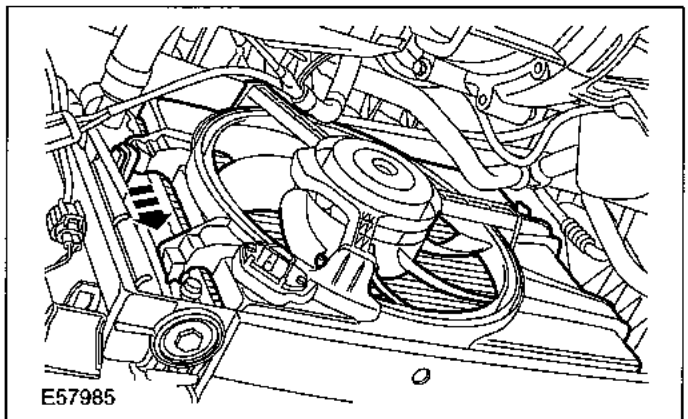
54. Install the right-hand headlamp assembly.

For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).

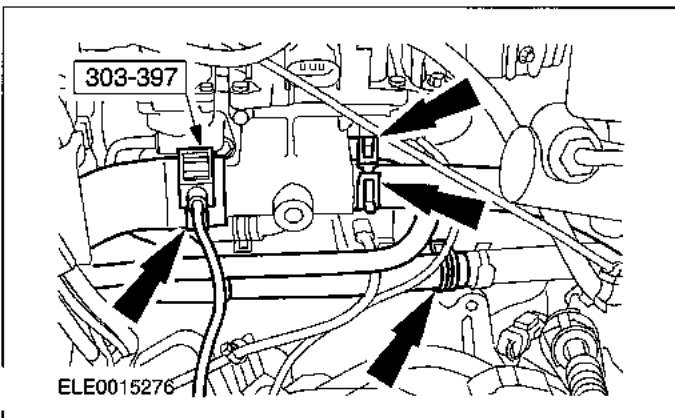
55. Attach the exhaust flexible pipe to the exhaust manifold.

For additional information, refer to: Exhaust Flexible Pipe - 2.0L Duratec-HE (M14) (309-00 Exhaust System, Removal and Installation).

56. Install the cooling fan motor and shroud.

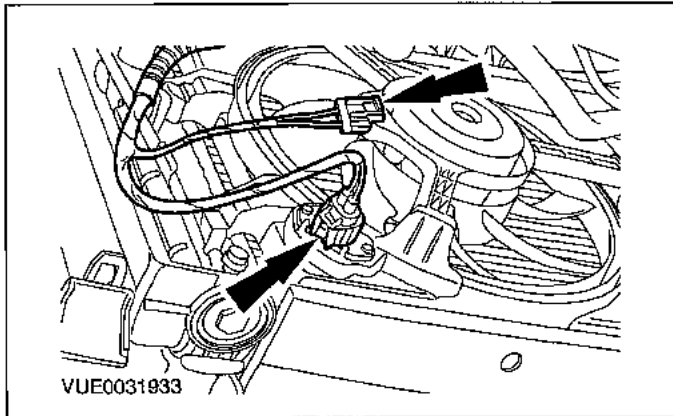


52. Using the special tool, connect the coolant hose to the coolant outlet connector.



INSTALLATION

57. Connect the cooling fan motor and cooling fan resistor electrical connectors.



58. Install the accessory drive belt.

For additional information, refer to:
Accessory Drive Belt - 2.0L Duratec-HE (MI4) (303-05 Accessory Drive, Removal and Installation).

59. Adjust the gearshift cables.

For additional information, refer to:
Gearshift Cable Adjustment (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

60. Bleed the hydraulic clutch system.

For additional information, refer to: **Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).**

61. Install the battery tray.

For additional information, refer to: **Battery Tray - 2.0L Duratec-HE (MI4) (414-01 Battery, Mounting and Cables, Removal and Installation).**

62. Install the air cleaner.

For additional information, refer to: **Air Cleaner - 2.0L Duratec-HE (MI4) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

63. Fill and bleed the cooling system.

For additional information, refer to: **Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 2.0L Duratec-HE (MI4), General Procedures).**