

# SECTION 303-01A Engine — 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma)

## VEHICLE APPLICATION:2006.0 Fiesta

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**SPECIFICATIONS****Engine Data - 1.25L**

Description	
Code - Stage III	FUJB/M7JA
Code - Stage IV	FUJA/M7JB
Firing order	1-3-4-2
Bore	71.9 mm
Stroke	76.5 mm
Displacement	1242 cc
Compression ratio	10:1
Power output at 5700 rpm (Engine codes M7JA/M7JB)	51 kW (70 PS)
Power output at 5700 rpm (Engine codes FUJA/FUJB)	55 kW (75 PS)
Torque at 3500 rpm	110 Nm
Maximum permissible engine speed continuous	5950 rpm
Maximum permissible engine speed intermittent	6175 rpm
Idle speed	750 rpm
Maximum oil consumption	0.5L/1000km

**Engine Data - 1.4L**

Description	
Code	FXJA/FXJB
Firing order	1-3-4-2
Bore	76.0 mm
Stroke	76.5 mm
Displacement	1388 cc
Compression ratio	11:1
Power output at 5700 rpm	59 kW (80 PS)
Torque at 3500 rpm	124 Nm
Maximum permissible engine speed continuous	6450 rpm
Maximum permissible engine speed intermittent	6800 rpm
Idle speed	750 rpm
Maximum oil consumption	0.5L/1000km

**Engine Data - 1.6L**

Description	
Engine code	FYJA/FYJB
Firing order	1-3-4-2
Bore	79.0 mm
Stroke	81.4 mm

**SPECIFICATIONS**

Description	
Displacement	1595 cc
Compression ratio	11:1
Power output at 6000 rpm	74 kW (100 PS)
Torque at 4000 rpm	146 Nm
Maximum permissible engine speed continuous	6450 rpm
Maximum permissible engine speed intermittent	6800 rpm
Idle speed	750 rpm
Maximum oil consumption	0.5L/1000km

**Oil pressure**

Description	bar
Oil pressure (minimum, oil temperature 80°C) at 800 rpm	1.0
Oil pressure (minimum, oil temperature 80°C) at 2000 rpm	2.5
Pressure relief valve opening pressure	4

**Engine Oil Capacity - 1.25L/1.4L**

Description	Liters
Initial fill including oil filter	4.25
Service fill including oil filter (EFL500)	3.75
Service fill including oil filter (EFL10)	3.80
Service fill excluding oil filter	3.50

**Engine Oil Capacity - 1.6L**

Description	Liters
Initial fill including oil filter (EFL600)	4.50
Initial fill including oil filter (EFL10)	4.30
Service fill including oil filter (EFL600)	4.25
Service fill including oil filter (EFL10)	4.10
Service fill excluding oil filter	3.75

**Valve Clearance - 1.25L/1.4L**

Description	mm
Valve clearance (engine cold), intake	0.17 - 0.23
Valve clearance (engine cold), exhaust	0.27 - 0.33

**Valve Clearance - 1.6L**

Description	mm
Valve clearance (engine cold), intake	0.17 - 0.23
Valve clearance (engine cold), exhaust	0.31 - 0.37

**SPECIFICATIONS****Cylinder block - 1.25L**

Description	mm
Cylinder bore diameter, class 1	71.900 - 71.910
Cylinder bore diameter, class 2	71.910 - 71.920
Cylinder bore diameter, class 3	71.920 - 71.930
Crankshaft end float	0.300 - 0.800

**Cylinder block - 1.4L**

Description	mm
Cylinder bore diameter, class 1	76.000 - 76.010
Cylinder bore diameter, class 2	76.010 - 76.020
Cylinder bore diameter, class 3	76.020 - 76.030
Crankshaft end float	0.300 - 0.800

**Cylinder block - 1.6L**

Description	mm
Cylinder bore diameter, class 1	79.000 - 79.010
Cylinder bore diameter, class 2	79.010 - 79.020
Cylinder bore diameter, class 3	79.020 - 79.030
Crankshaft end float	0.300 - 0.800

**Cylinder head**

Description	mm
Maximum distortion (mating face)	0.03

**Piston -1.25L**

Description	mm
Piston diameter, class 1 (uncoated)	71.875 - 71.885
Piston diameter, class 2 (uncoated)	71.885 - 71.895
Piston diameter, class 3 (uncoated)	71.895 - 71.905
Piston ring gaps, upper	0.170 - 0.270
Piston ring gaps, middle	0.700 - 0.900
Piston ring gaps, lower	0.200 - 0.900
Piston ring end float, upper	0.040 - 0.080
Piston ring end float, middle	0.025 - 0.070

**Piston -1.4L**

Description	mm
Piston diameter, class 1 (uncoated)	75.960 - 75.970
Piston diameter, class 2 (uncoated)	75.970 - 75.980
Piston diameter, class 3 (uncoated)	75.980 - 75.990

**SPECIFICATIONS**

Description	mm
Piston ring gaps, upper	0.170 - 0.270
Piston ring gaps, middle	0.700 - 0.900
Piston ring gaps, lower	0.200 - 0.900
Piston ring end float, upper	0.040 - 0.080
Piston ring end float, middle	0.025 - 0.070

**Piston - 1.6L**

Description	mm
Piston diameter, class 1 (coated)	78.975 - 79.005
Piston diameter, class 2 (coated)	78.985 - 79.015
Piston diameter, class 3 (coated)	78.995 - 79.025
Piston ring gaps, upper	0.180 - 0.280
Piston ring gaps, middle	0.700 - 0.900
Piston ring gaps, lower	0.200 - 0.900
Piston ring end float, upper	0.040 - 0.080
Piston ring end float, middle	0.025 - 0.070

**Lubricants, Fluids, Sealers and Adhesives**

Item	Specification
Ford Formula E SAE 5W-30 Engine Oil	WSS-M2C913-B
Sealant, oil pan contact surface to oil seal carrier, oil pan to cylinder block, oil pan to oil pump	WSE-M4G323-A4
Oil pressure switch sealer (Loctite 243)	WSK-M2G349-A7
Sealant, camshaft bearing cap to cylinder head	WSK-M2G348-A2
Silicone grease	ESE-M1C171-AA

**Torque Specifications**

Description	Nm	lb-ft	lb-in
Exhaust flexible pipe to catalytic converter retaining nuts	44	33	-
Lower arm to wheel knuckle pinch bolt	48	35	-
Intermediate shaft center bearing bracket to cylinder block retaining bolts	24	18	-
Starter motor cable retaining nut	12	9	-
Exhaust manifold heat shield retaining bolts	12	9	-
Ground cable to transaxle retaining bolt	47	35	-
Ground cable to automatic transaxle	25	18	-
Coolant expansion tank retaining bolts	8	-	71

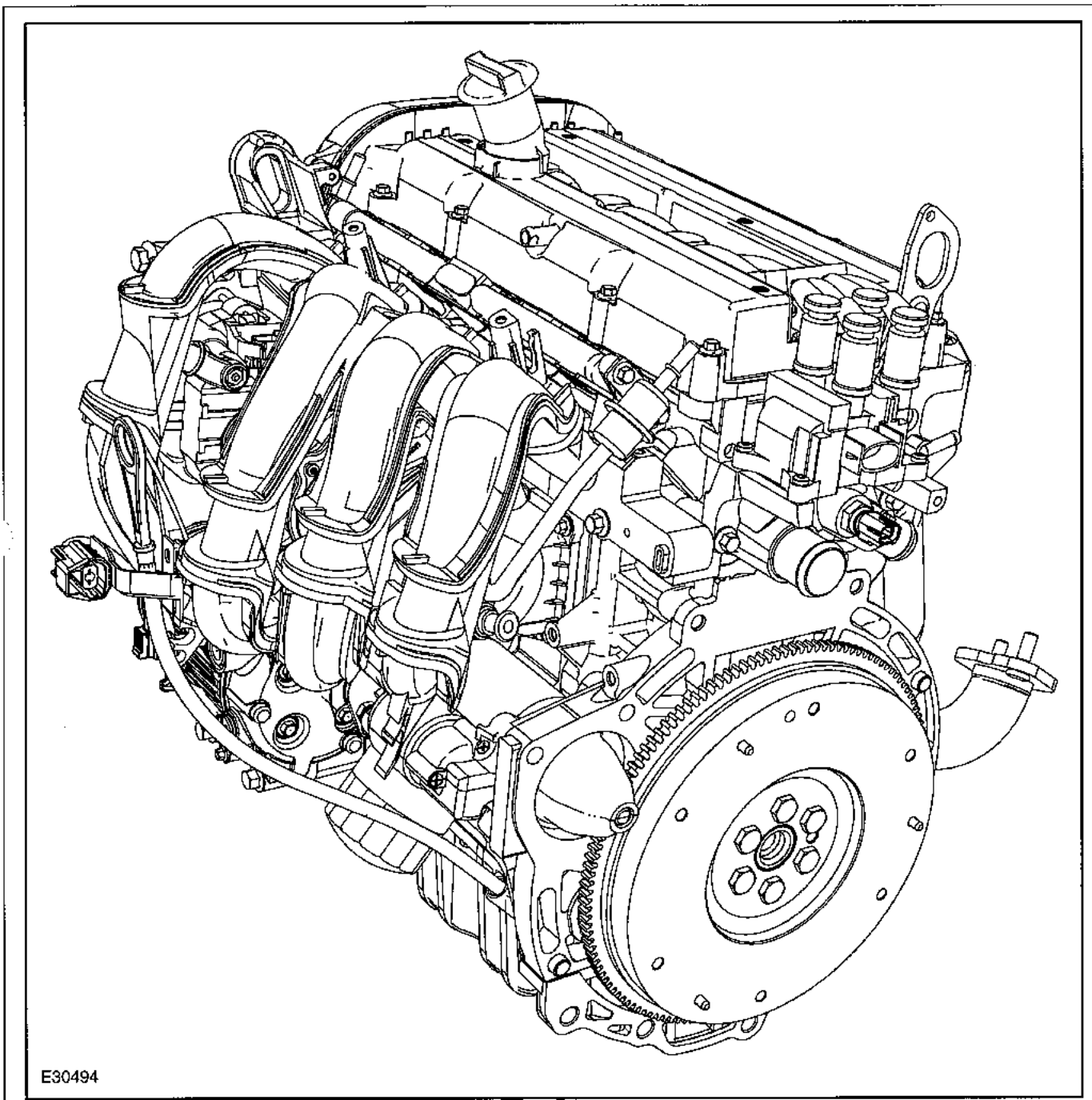
**SPECIFICATIONS**

Description	Nm	lb-ft	lb-in
Engine front mount bracket to cylinder block retaining bolts	55	41	-
Engine front mount retaining nuts and bolts	48	35	-
Engine rear mount center retaining nut	90	66	-
Engine rear mount outer retaining nuts	48	35	-
Engine support insulator retaining bolts	48	35	-
Power steering line support bracket retaining bolts	25	18	-
Power steering line to power steering pump	40	30	-
Air conditioning (A/C) compressor to cylinder block retaining bolts	25	18	-
Generator to cylinder block top rear and lower retaining bolts	47	35	-
Water pump retaining bolts	9	-	80
Water pump pulley retaining bolts	27	20	-
Oil pump to cylinder block retaining bolts	9	-	80
Oil pan to cylinder block retaining bolts	20	15	-
Oil level indicator tube bracket retaining bolt	4	-	35
Engine oil drain plug	28	21	-
Oil pump pickup pipe to cylinder block retaining bolts	9	-	80
Oil pressure switch	15	11	-
Cylinder head bolts	a)	-	-
Valve cover retaining bolts	a)	-	-
Intake manifold to cylinder head retaining bolts	18	13	-
Exhaust manifold to cylinder head	a)	-	-
Exhaust manifold to cylinder block	47	35	-
Camshaft position (CMP) sensor	9	-	80
Timing belt rear cover retaining bolts	9	-	80
Spark plugs	15	11	-
Engine rear lifting eye retaining bolts	20	15	-
Coolant distribution housing retaining bolts	20	15	-
Ignition coil to coolant distribution housing	6	-	53
Camshaft bearing cap retaining bolts	a)	-	-
Timing belt upper cover to cylinder block retaining bolts	9	-	80
Timing belt lower cover to cylinder block retaining bolts	9	-	80

**SPECIFICATIONS**

Description	Nm	lb-ft	lb-in
Timing belt tensioner two bolts fixing	20	15	-
Timing belt tensioner central bolt fixing	25	18	-
Camshaft pulley retaining bolt	60	44	-
Crankshaft position (CKP) sensor bracket to cylinder block retaining bolts	9	-	80
Crankshaft rear oil seal carrier retaining bolts	9	-	80
Cylinder block blanking plug	20	15	-
Crankshaft pulley retaining bolt	a)	-	-
Engine coolant temperature (ECT) sensor	18	13	-
Exhaust manifold studs	10	-	89
Fuel rail to intake manifold	15	11	-
Knock sensor (KS) retaining bolt	20	15	-
Positive crankcase ventilation (PCV) cover retaining bolts	9	-	80
Thermostat housing retaining bolts	9	-	80
Flywheel to crankshaft retaining bolts	a)	-	-
Transaxle retaining bolts	47	35	-
Torque converter retaining nuts	27	20	-
Selector lever cable bracket to transaxle	20	15	-
Intermediate shaft center bearing cap retaining nuts	25	18	-
Ground cable to cylinder head retaining bolt	18	13	-
Suspension strut and spring assembly top mount retaining nuts	25	18	-
a) Refer to procedure in this section.			



**DESCRIPTION AND OPERATION****Engine****1.4L/1.6L Duratec 16V engine****Overview**

E30494

The 1.4L and 1.6L Duratec 16V inline engines have already been installed on Focus vehicles under the name of the Zetec-SE engine.

Details of this engine have been modified. The routing of the pipes in the intake manifold has been revised, and for the first time the throttle valve is electronically controlled.

The intake air routing and the air cleaner housing have also been changed. The pistons and piston rings have been modified. The cylinder head cover is made of plastic.

In addition, the auxiliary drive belt is an elastic multi-groove belt without a separate tensioning roller.

**DESCRIPTION AND OPERATION**

**Engine**

Cross-mounted 16-valve DOHC engines with 59 kW (80 PS) and 74 kW (100 PS) respectively.

Valve train with mechanical bucket tappets

Cylinder block and cylinder head made of an aluminium alloy

Auxiliary drive via a self-tensioning belt without a belt tensioner

**Engine management**

Sequential multi-port fuel injection (SFI)

temperature and manifold absolute pressure (T-MAP) sensor in conjunction with a Siemens powertrain control module (PCM).

Knock control

PCM with 84 pins and integrated passive anti-theft system (PATS) immobiliser.

**Engine emission control**

European emissions level IV

European on-board diagnosis (EOBD) for the monitoring of emissions-relevant components.

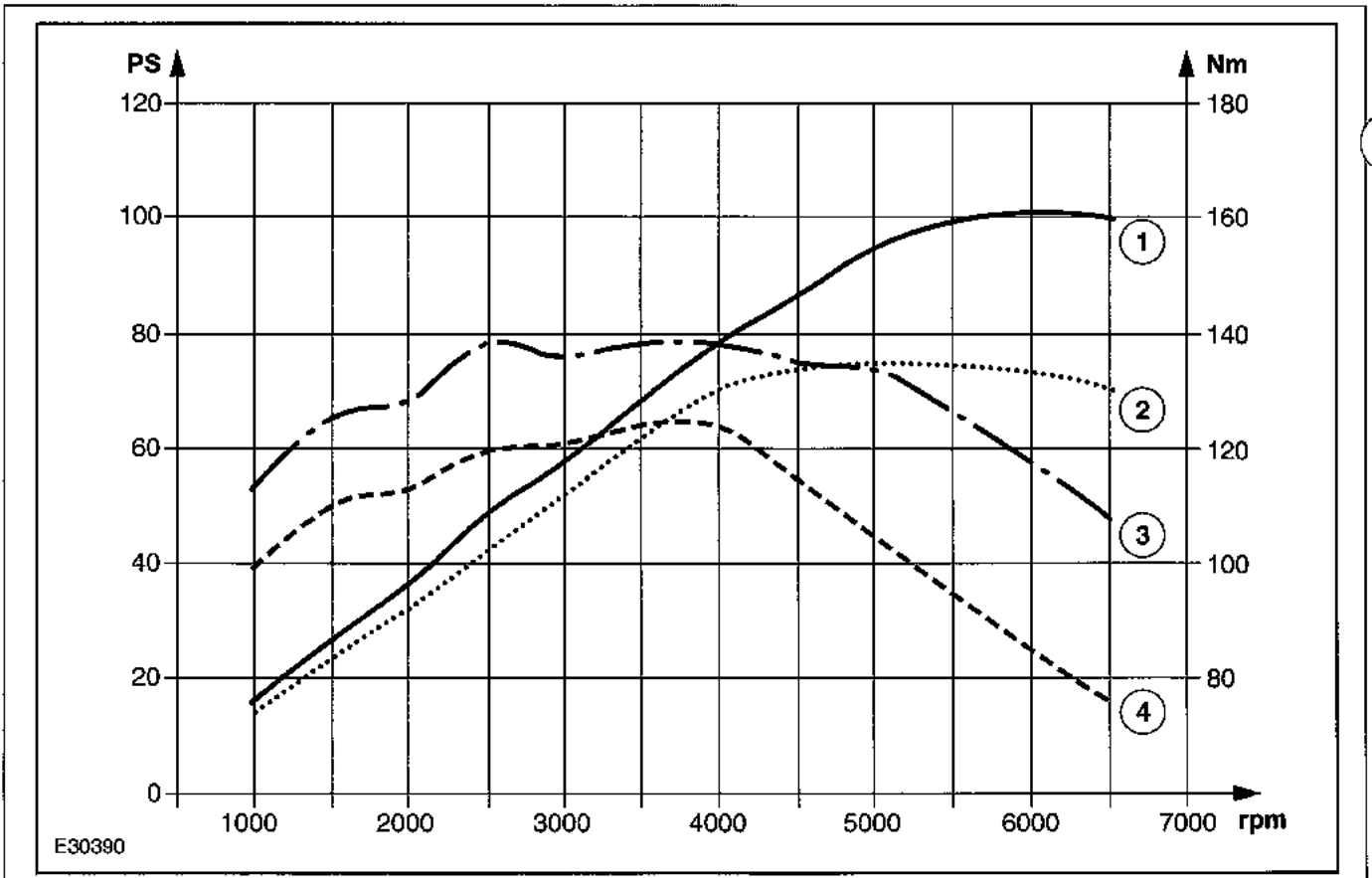
**Diagnosis**

WDS diagnosis CD B17.

Instrument cluster (engine indicator lamp)

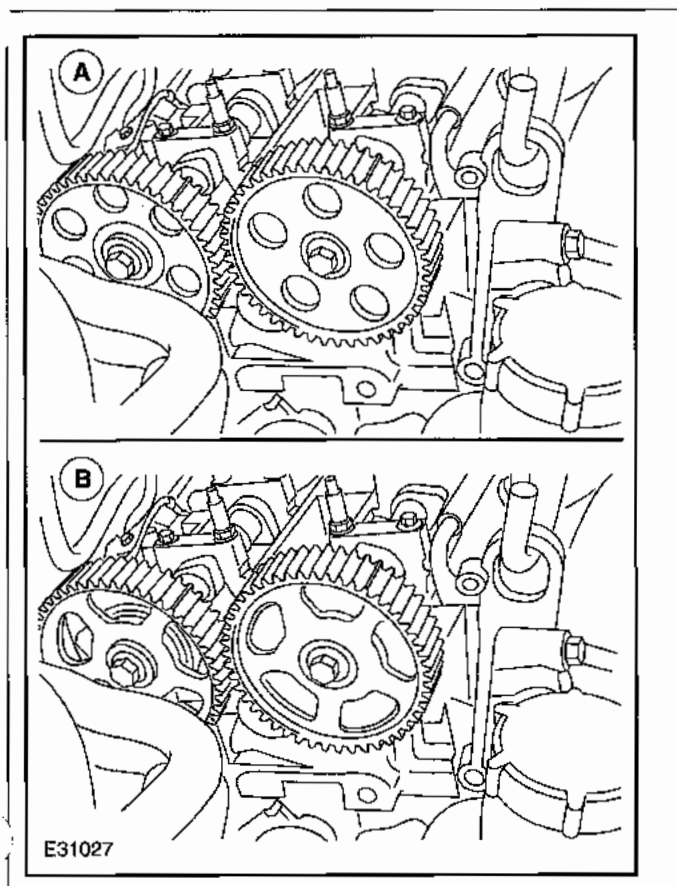
**Torque/power**

The Duratec 16V engines are characterised by their high level of running refinement, low emission levels and balanced development of power.



Item	Description
1	Power curve for the 1.6L-Duratec 16V engine
2	Power curve for the 1.4L-Duratec 16V engine

Item	Description
3	Torque curve for the 1.6L-Duratec 16V engine
4	Torque curve for the 1.4L-Duratec 16V engine

**DESCRIPTION AND OPERATION****Valve train**

Item	Description
A	Camshaft timing belt pulleys, 1.4/1.6L Zetec SE engine
B	Camshaft timing belt pulleys, 1.4/1.6L Duratec 16V engine

As a significant modification of the valve train, the camshaft timing belt pulleys are now made of reinforced plastic. The design has also been changed in the process.

The basic procedure for installing the camshaft timing belt pulleys remains the same.

It should however be noted that plastic sleeves are located above the stud on Special Tool 205-072 (15-030 A) in order to protect the camshaft timing belt pulley against damage.

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**DIAGNOSIS AND TESTING****Engine**

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

**GENERAL PROCEDURES****Valve Clearance Adjustment****General Equipment**

Feeler gauges

**1. Remove the valve cover.**

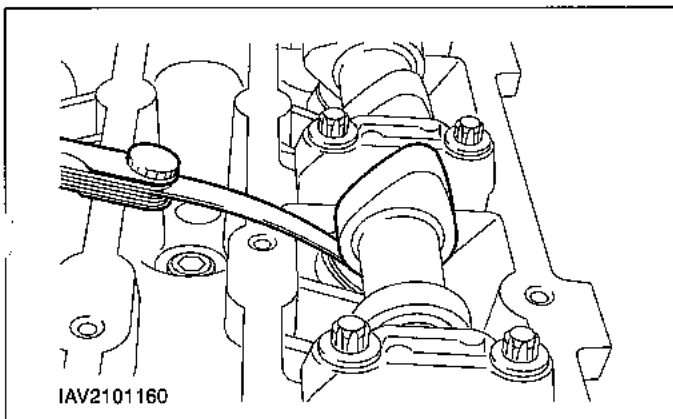
For additional information, refer to **Valve Cover** in this section.

**2. ⚠CAUTION: Only turn the engine in the normal direction of rotation.**

Turn the engine until piston No. 1 is at top dead center (TDC).

**3. NOTE: Note down each cylinder number and the valve clearances measured.**

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

**4. ⚠CAUTION: Only turn the engine in the normal direction of rotation.**

Turn the engine until each piston is at TDC and measure the valve clearances.

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

For additional information, refer to **Specifications** in this section.

Remove the camshafts.

For additional information, refer to **Camshafts** in this section.

**6. NOTE: The number on the tappet indicates the tappet thickness.**

Determine the tappet thickness required:

1. Remove the tappet and read the thickness from the underside.

2. Tappet thickness required = thickness of currently installed tappet + the measured valve clearance - the required valve clearance.

For additional information, refer to **Specifications** in this section.

3. Install the correct tappet.

**7. NOTE: Do not install the timing belt at this stage.**

Install the camshafts.

For additional information, refer to **Camshafts** in this section.

**8. NOTE: Turn the camshafts to measure the valve clearances.**

Measure the valve clearances and repeat this procedure as necessary until all valve clearances are within the specified tolerance.

**9. Install the timing belt.**

For additional information, refer to **Timing Belt** in this section.

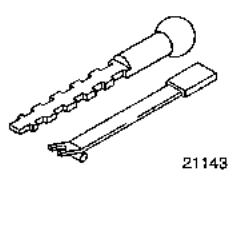
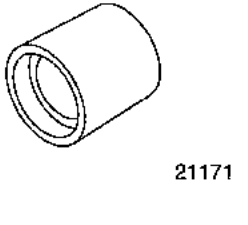
**10. Install the valve cover.**

For additional information, refer to **Valve Cover** in this section.

**IN-VEHICLE REPAIR**

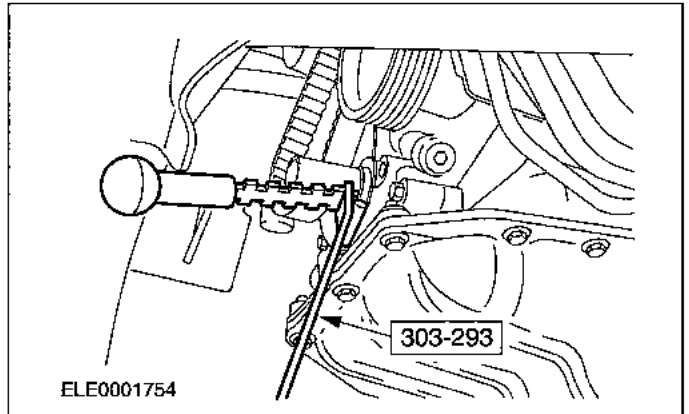
**Crankshaft Front Seal(21 467 0)**

**Special Tool(s)**

 <p>21143</p>	<p>Remover, Crankshaft Oil Seal 303-293 (21-143)</p>
 <p>21171</p>	<p>Installer, Crankshaft Oil Seal 303-395 (21-171)</p>

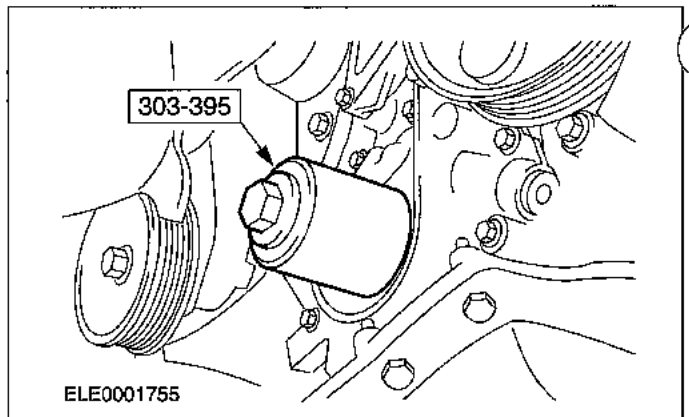
Materials	
Name	Specification
Engine Oil	WSS-M2C912-A1

3. Using the special tool, remove the crankshaft front oil seal.



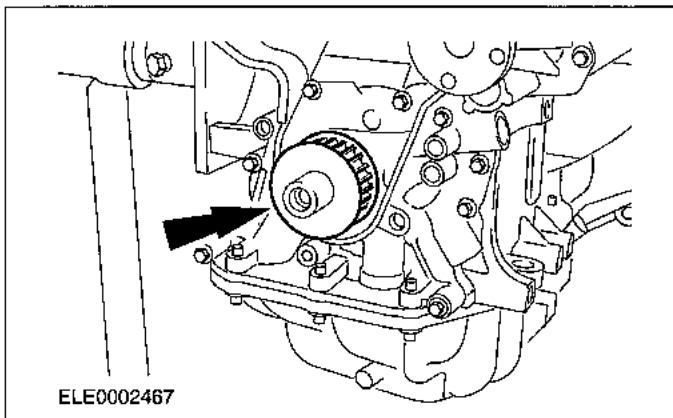
**Installation**

1. Coat the crankshaft front oil seal lip with clean engine oil.
2. Using the special tool, install the crankshaft front oil seal.

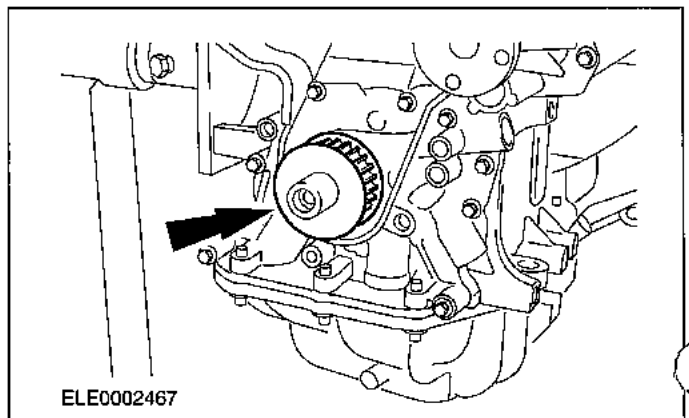


**Removal**

1. Remove the timing belt.  
For additional information, refer to: Timing Belt (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).
2. Remove the crankshaft timing pulley.



3. Install the crankshaft timing pulley.



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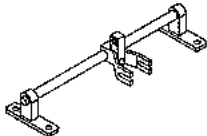
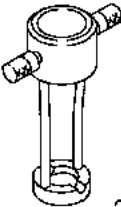
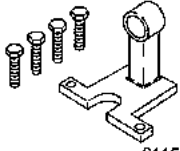
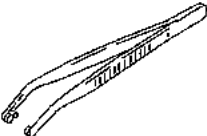
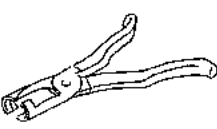
**IN-VEHICLE REPAIR****4. Install the timing belt.**

For additional information, refer to: Timing Belt (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).

**IN-VEHICLE REPAIR**

**Valves(21 215 4)**

**Special Tool(s)**

 <p>21155</p>	<p>Compressor, Valve Spring 303-361 (21-155)</p>
 <p>2115504</p>	<p>Adaptor for 303-361 303-361-04 (21-155-04)</p>
 <p>2115505</p>	<p>Adaptor for 303-361- 303-361-05 (21-155-05)</p>
 <p>21156</p>	<p>Installer, Valve Stem Collets 303-362 (21-156)</p>
 <p>21211</p>	<p>Pliers, Valve Stem Oil Seals 303-508 (21-211)</p>

Materials	
Name	Specification
Engine Oil	WSS-M2C912-A1

**Removal**

**1. Remove the cylinder head.**

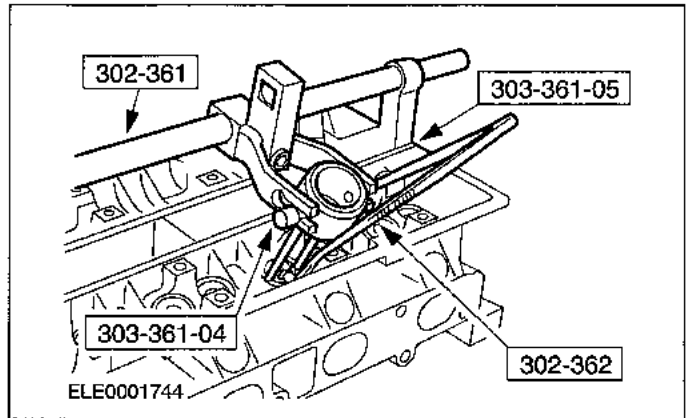
For additional information, refer to **Cylinder head** in this section.

**2. ⚠ CAUTION:** Keep the valve tappets in order for reassembly.

Remove the valve tappets.

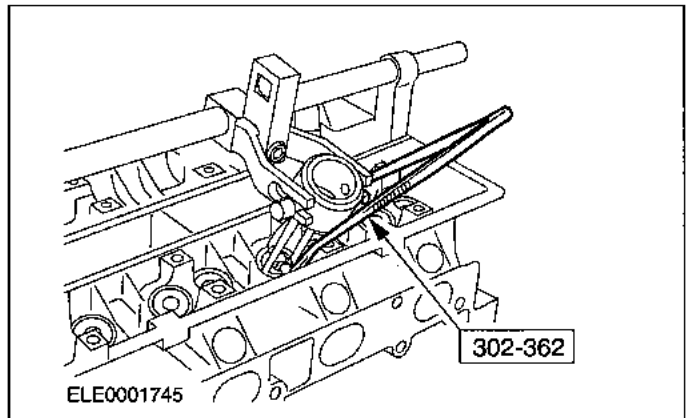
**3. NOTE:** Insert wooden wedges in the combustion chamber recesses in the cylinder head so that the valves are held in place for removal.

Install the special tools.



**4. Remove the valve springs.**

- Compress the valve springs.
- Remove the valve collets.
- Remove the valve spring retainers and the valve springs.

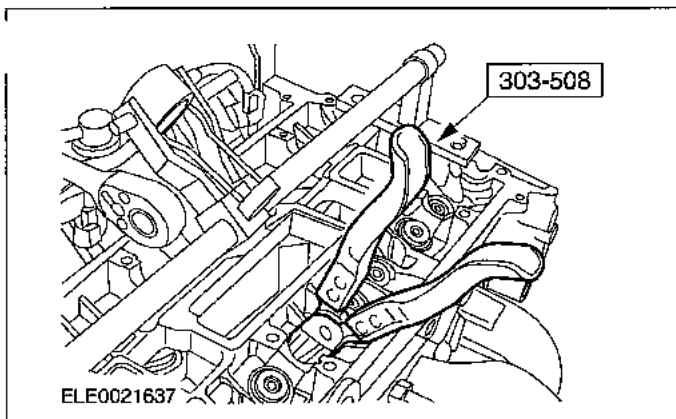


**5. Using the special tool, remove the valve seals.**

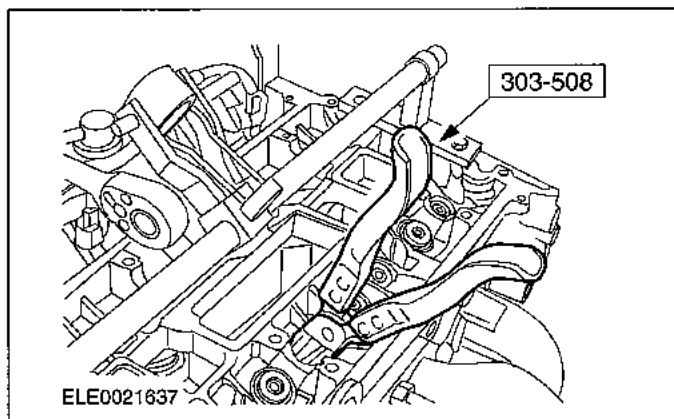


**IN-VEHICLE REPAIR**

- Discard the valve seals.



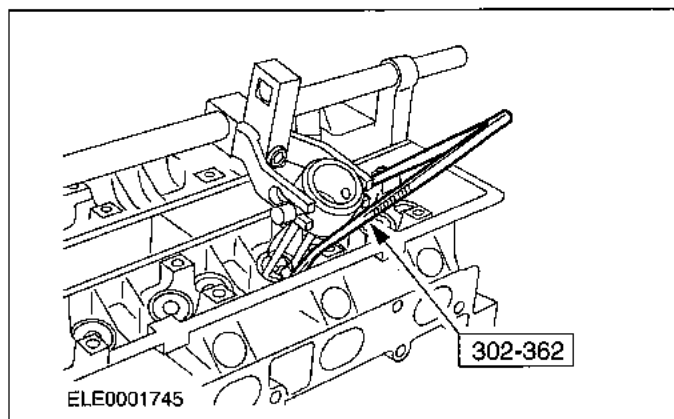
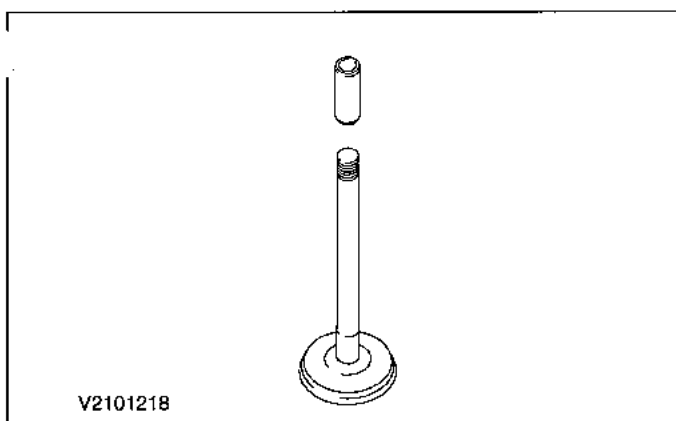
Using the special tool, install the valve seals.

**6. Remove the valves.****Installation**

1. Coat the valve stem with clean engine oil.
2. Install the valves.
3. Install a valve stem mounting sleeve over the valve collet groove (valve shown removed for clarity).

**5. Using the special tool, install the valve springs.**

- Install the valve spring retainers and the valve springs.
- Compress the valve springs.
- Install the valve collets.

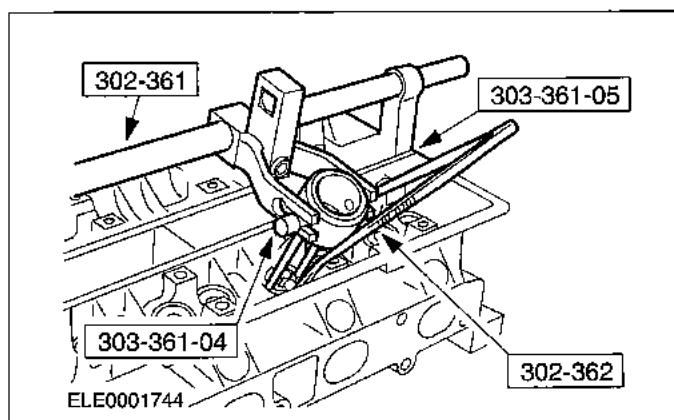


4. **CAUTION:** The valve seal for the intake valve is green. The valve seal for the exhaust valve is brown.

**NOTE:** Insert wooden wedges in the combustion chamber recesses in the cylinder head so that the valves are held in place for installation.

**NOTE:** Install new valve seals.

**NOTE:** Coat the valve seal lip and the valve stem with clean engine oil.

**6. Remove the special tools.**

7. **CAUTION:** The valve tappets must be installed in their original locations.  
Install the valve tappets.

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**IN-VEHICLE REPAIR****8. Install the cylinder head.**

For additional information, refer to Cylinder head in this section.

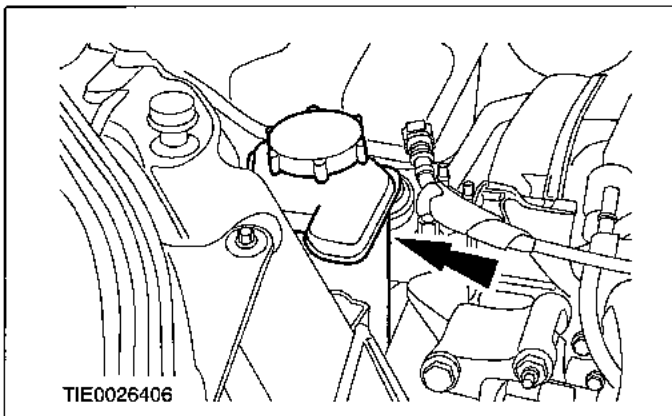
## IN-VEHICLE REPAIR

## Intake Manifold(21 183 0)

## Removal

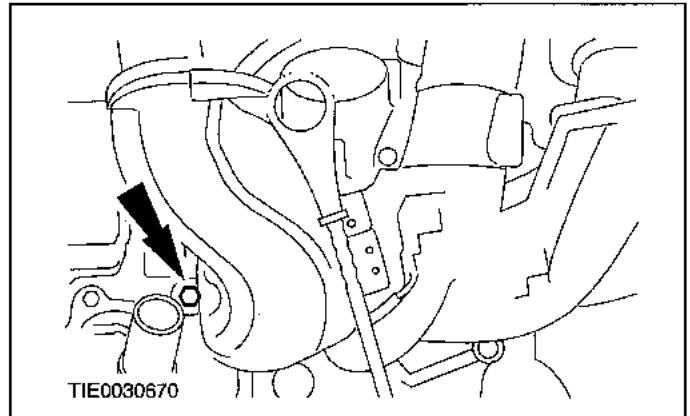
▲ **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Release the fuel system pressure. For additional information, refer to Section 310-00 [Fuel System - General Information].
2. Disconnect the battery ground cable. For additional information, refer to Section 414-01 [Battery, Mounting and Cables].
3. Remove the air cleaner. For additional information, refer to Section 303-12 [Intake Air Distribution and Filtering].
4. Detach the power steering fluid reservoir from the bracket and position it to one side.

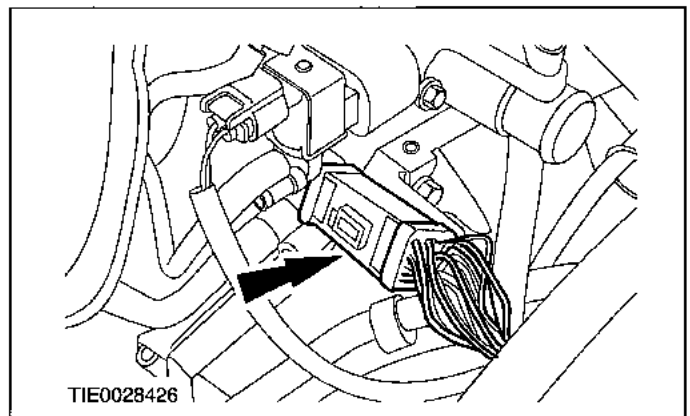


5. Remove the accessory drive belt. For additional information, refer to Section 303-05 [Accessory Drive].

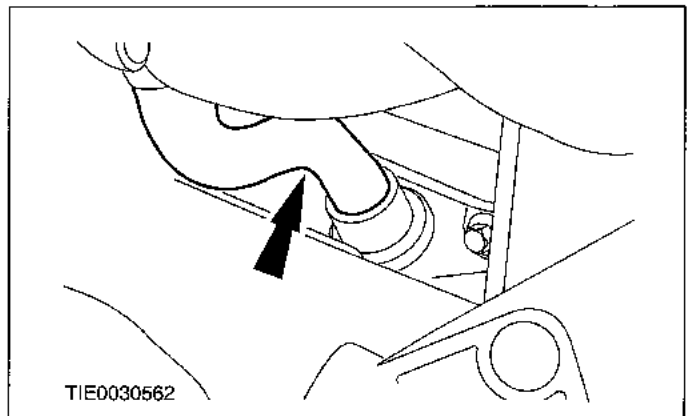
6. Remove the intake manifold lower retaining bolt.



7. Disconnect the engine wiring harness electrical connector.

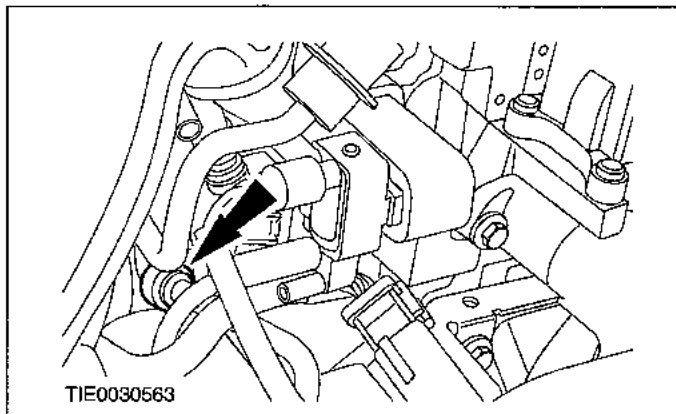


8. Disconnect the positive crankcase ventilation (PCV) hose from the PCV.

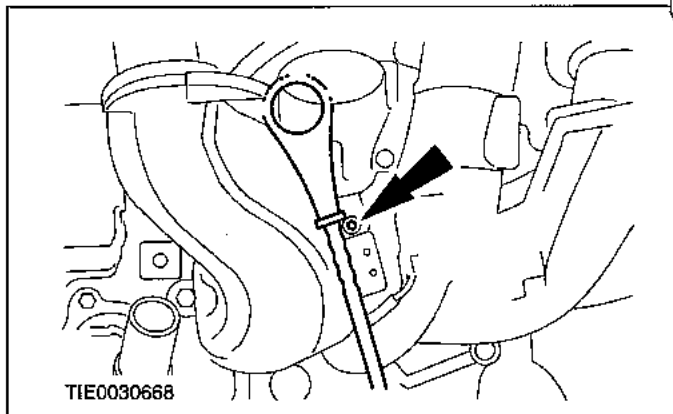


**IN-VEHICLE REPAIR**

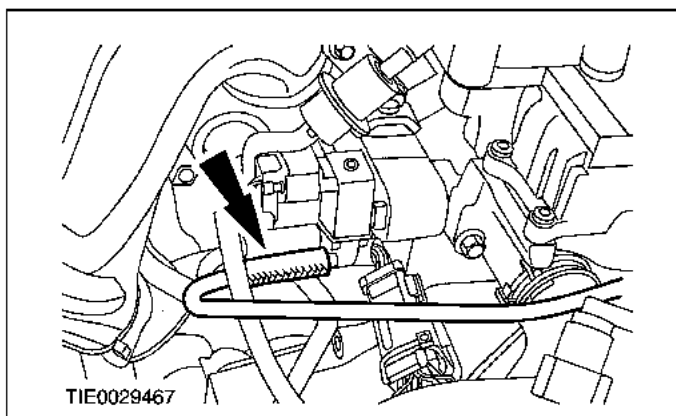
9. Disconnect the brake booster vacuum line from the intake manifold.



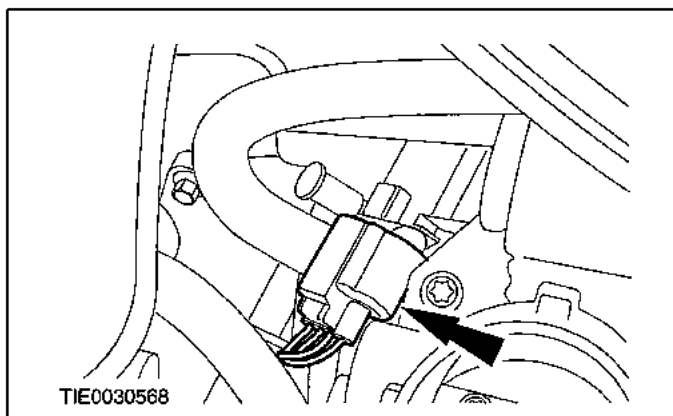
12. Detach the oil level indicator tube from the intake manifold.



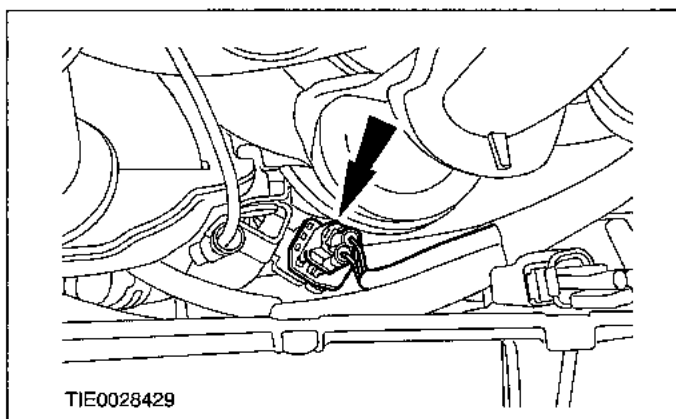
10. Disconnect the evaporate emission (EVAP) hose from the EVAP valve.



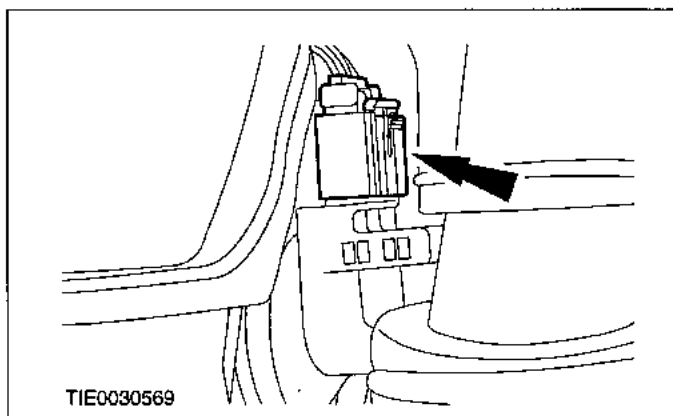
13. Disconnect the temperature and manifold absolute pressure (T-MAP) sensor electrical connector.



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

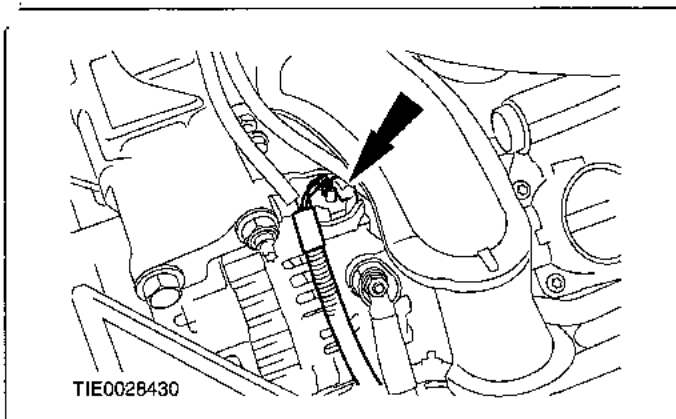


14. Disconnect the throttle plate control motor (DC-ISC) electrical connector.



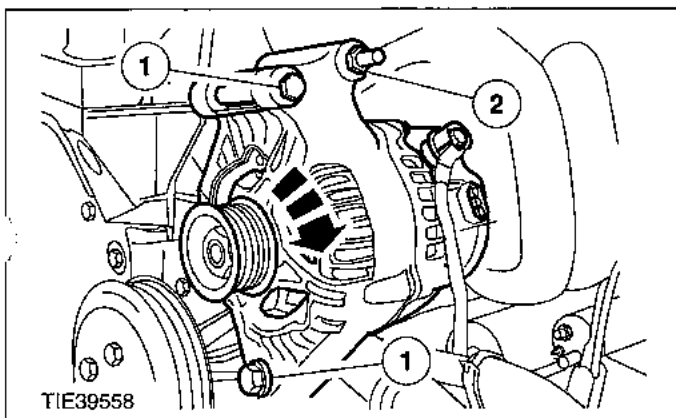
**IN-VEHICLE REPAIR**

15. Disconnect the generator electrical connector.

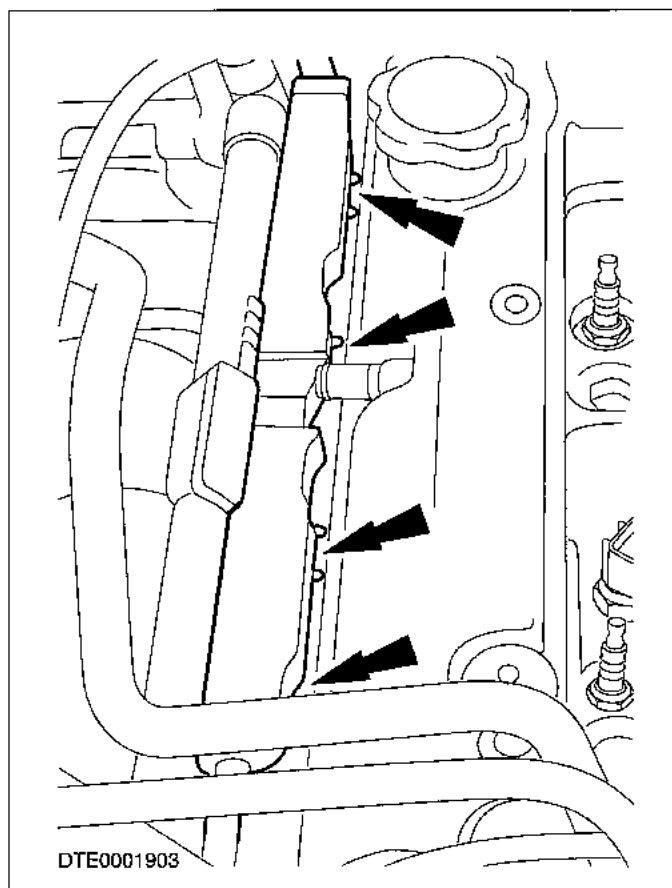


16. Detach the generator from the engine.

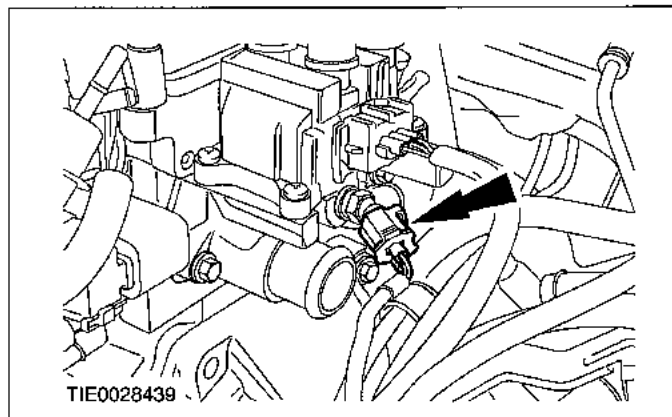
1. Remove the bolts.
2. Remove the nut and the stud.



17. Disconnect the fuel injector electrical connectors and position it with the engine wiring harness to one side.

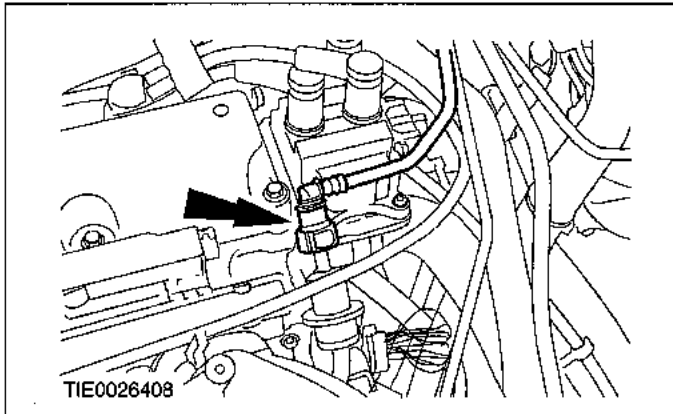


18. Disconnect the engine coolant temperature (ECT) sensor electrical connector.

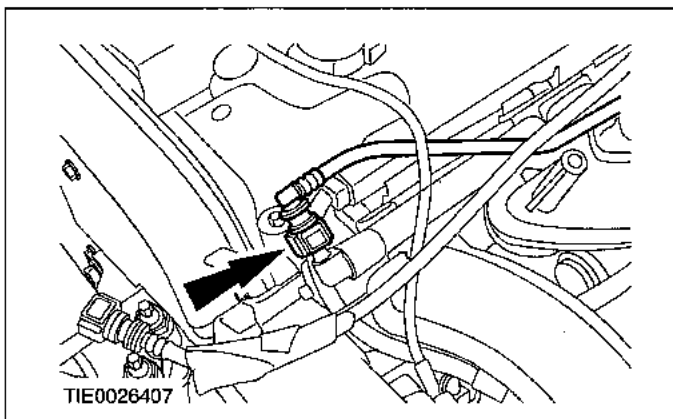


**IN-VEHICLE REPAIR**

- 19. Disconnect the fuel supply line quick release coupling. For additional information, refer to Section 310-00 [Fuel System - General Information].**

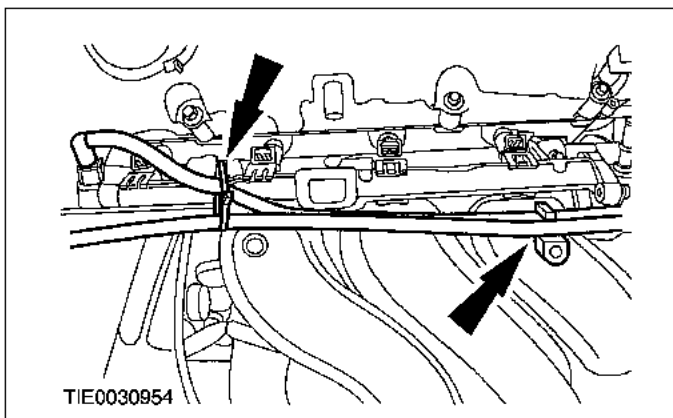


- 20. Disconnect the fuel return line quick release coupling. For additional information, refer to Section 310-00 [Fuel System - General Information].**



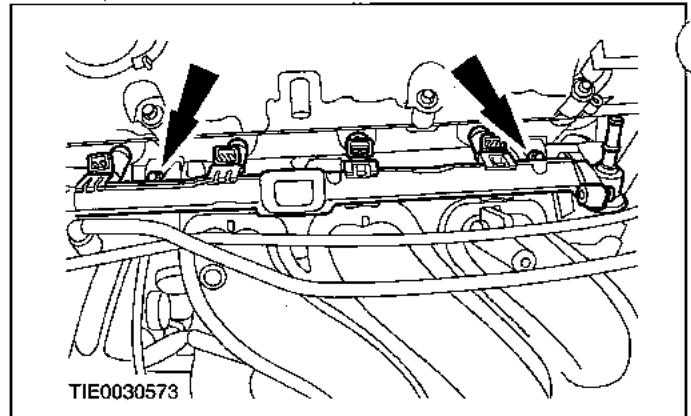
- 21. Detach the fuel line from the intake manifold and position it to one side.**

- Remove the cable tie.

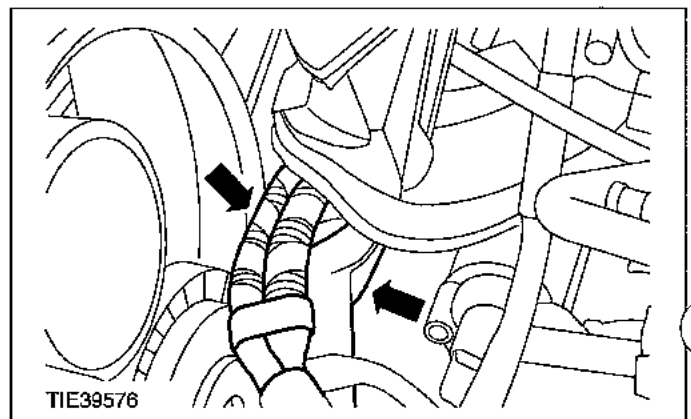


- 22. Remove the fuel supply manifold.**

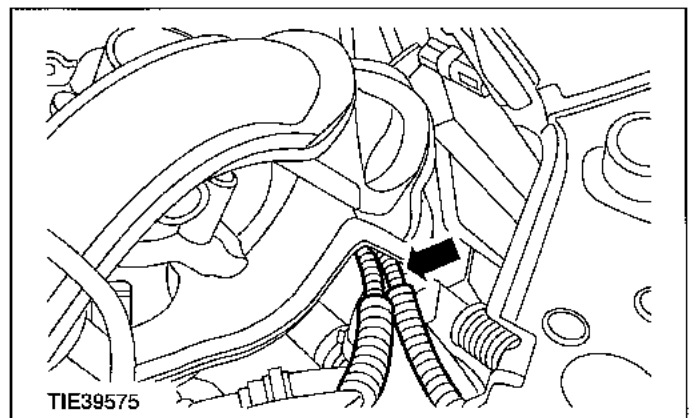
- Discard the O-ring seals.



- 23. Detach the wiring harness and the coolant hose from the intake manifold.**



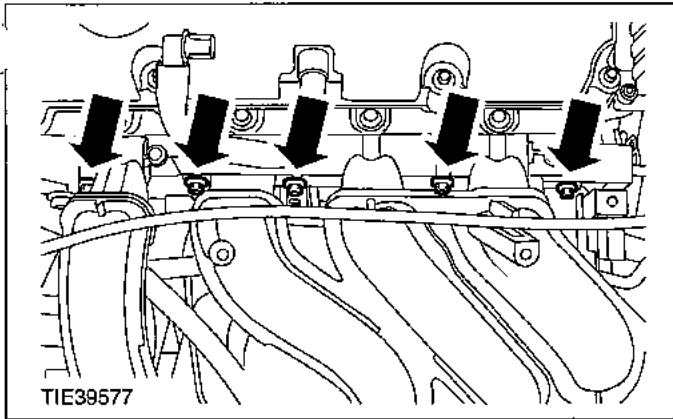
- 24. Detach the wiring harness from the intake manifold.**



- 25. Remove the intake manifold.**

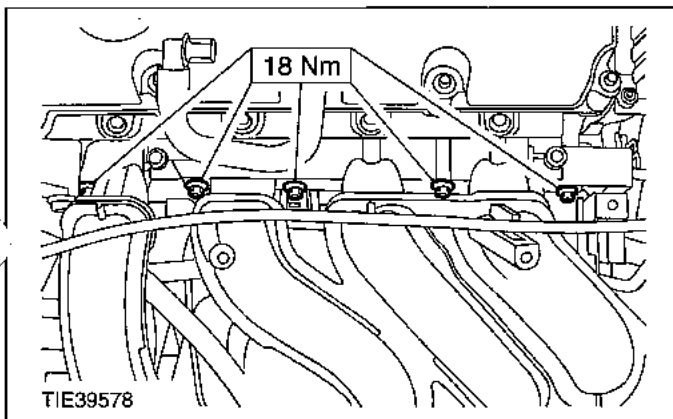
## IN-VEHICLE REPAIR

- Discard the gaskets.

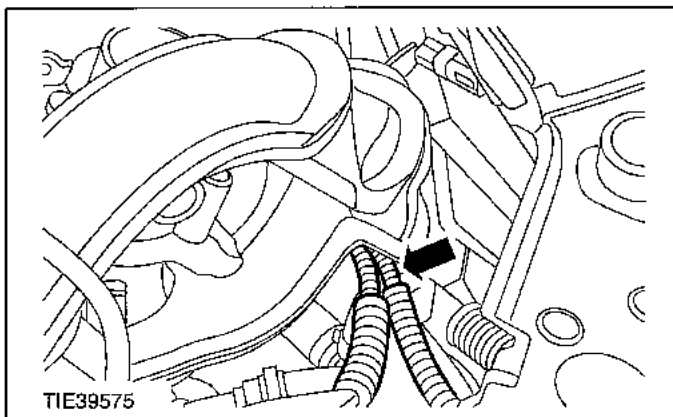


## Installation

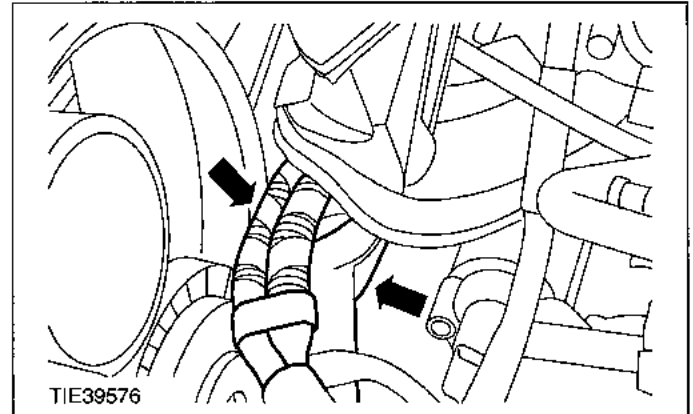
1. **NOTE:** Install new intake manifold gaskets.  
Install the intake manifold.



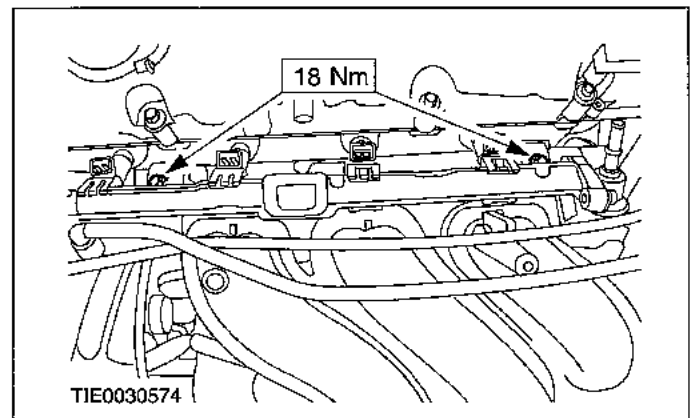
2. Attach the wiring harness to the intake manifold.



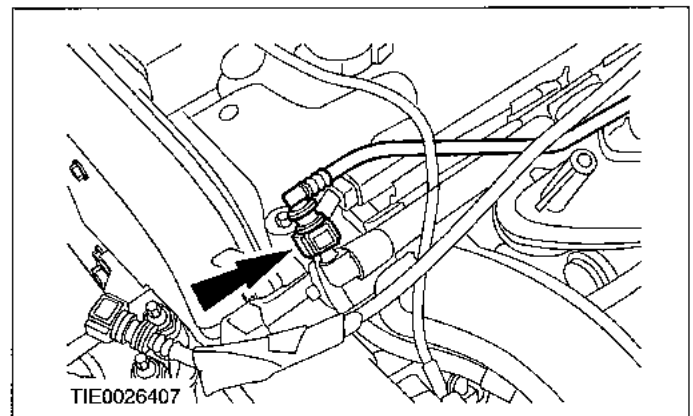
3. Attach the wiring harness and the coolant hose to the intake manifold.



4. **NOTE:** Install new injector O-ring seals.  
**NOTE:** Coat the O-ring seals with clean engine oil.  
Install the fuel supply manifold.

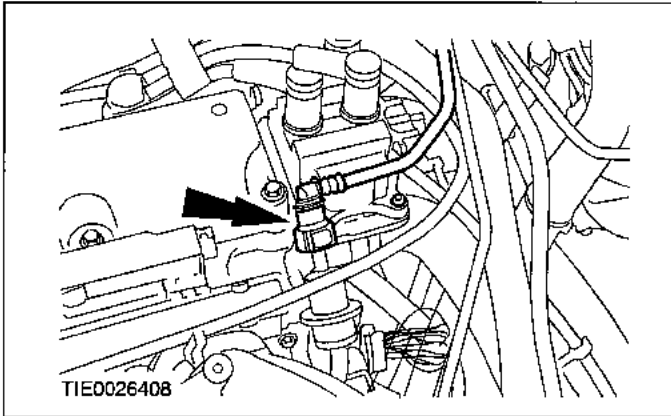


5. Connect the fuel return line quick release coupling. For additional information, refer to Section 310-00 [Fuel System - General Information].



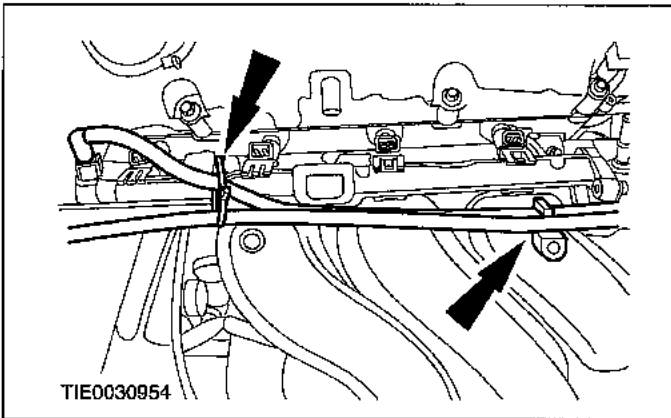
**IN-VEHICLE REPAIR**

6. Connect the fuel supply line quick release coupling. For additional information, refer to Section 310-00 [Fuel System - General Information].

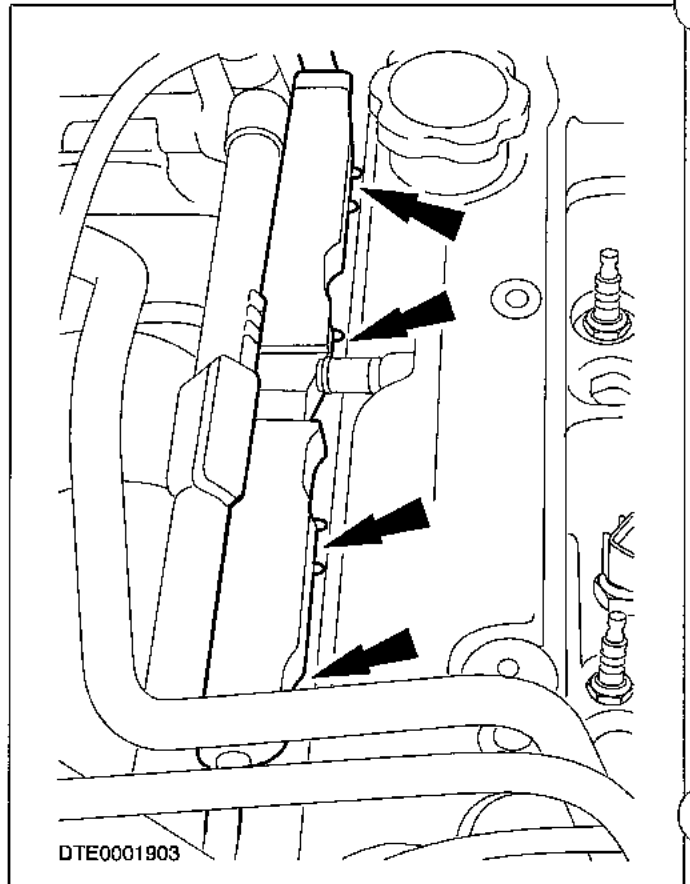


7. Attach the fuel line to the intake manifold.

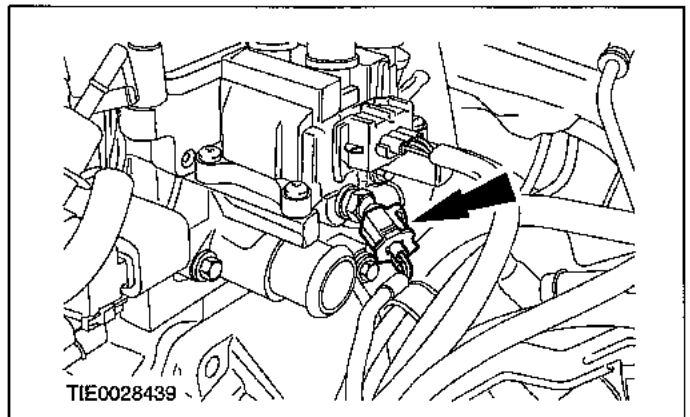
- Install the cable tie.



8. Connect the fuel injector electrical connectors.



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



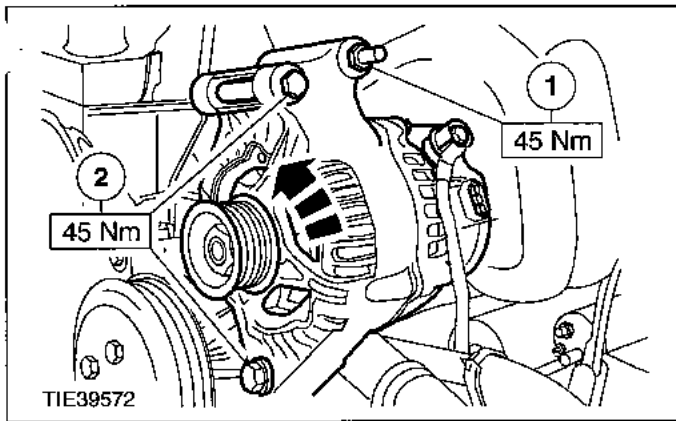
10. Attach the generator to the engine.

1. Install the stud and nut.

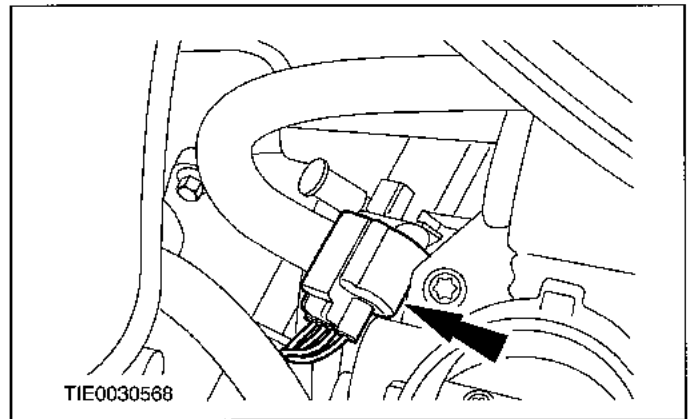


**IN-VEHICLE REPAIR**

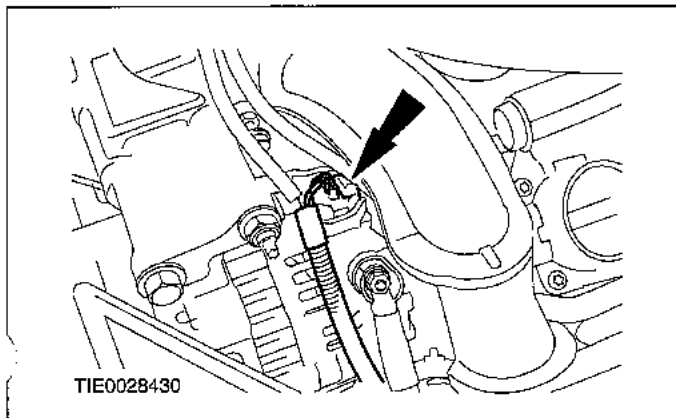
2. Install the bolts.



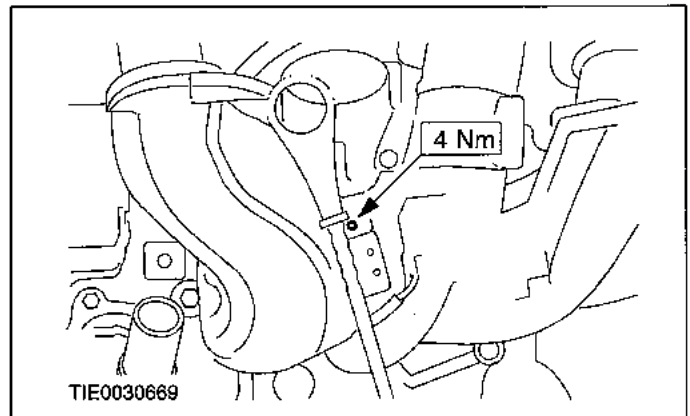
13. Connect the temperature and manifold absolute pressure (T-MAP) sensor electrical connector.



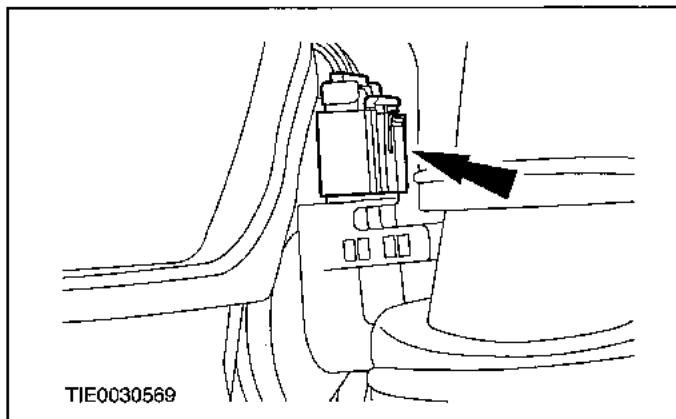
11. Connect the generator electrical connector.



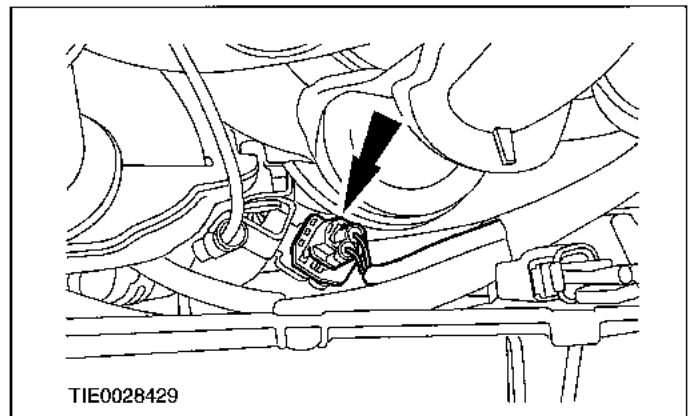
14. Attach the oil level indicator tube to the intake manifold.



12. Connect the throttle plate control motor (DC-ISC) electrical connector.

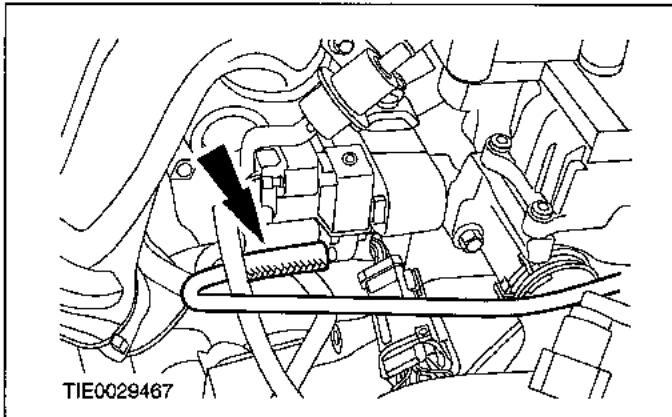


15. Connect the knock sensor (KS) electrical connector.

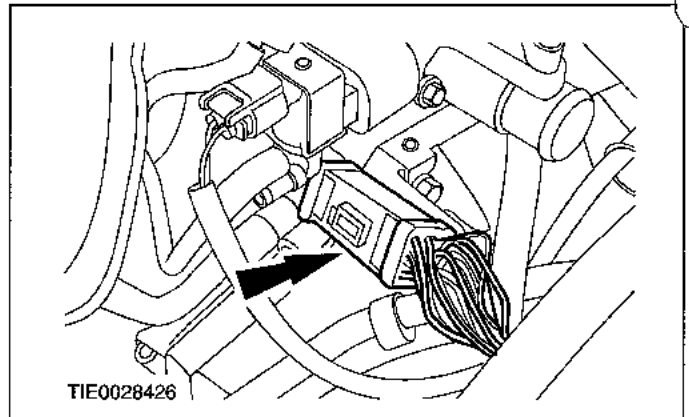


**IN-VEHICLE REPAIR**

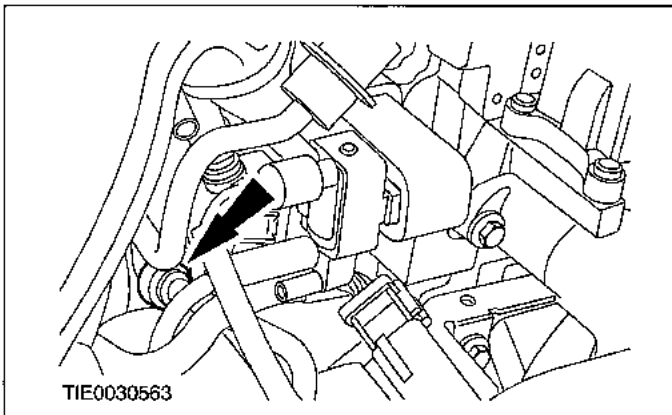
16. Connect the evaporate emission (EVAP) hose to the EVAP valve.



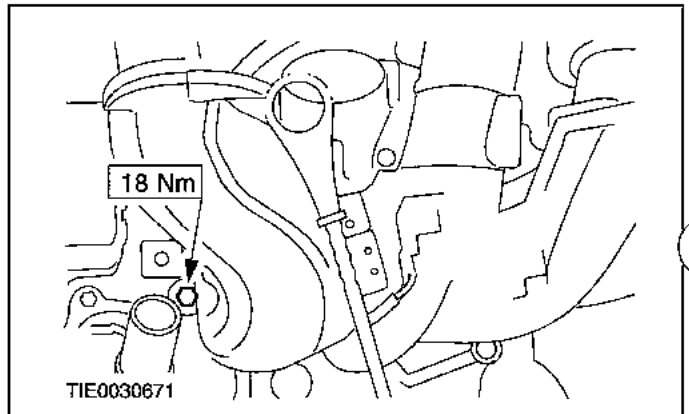
19. Connect the engine wiring harness electrical connector.



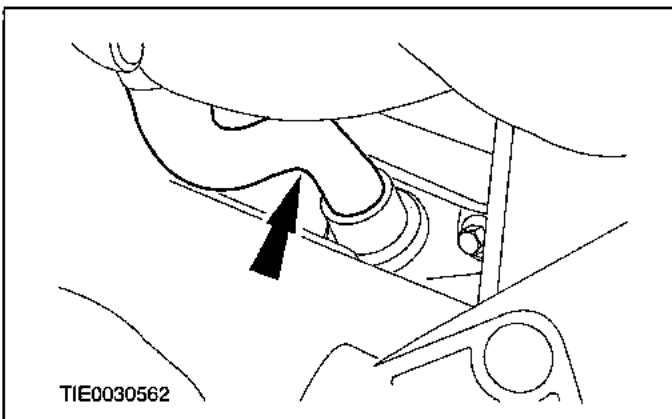
17. Connect the brake booster vacuum line to the intake manifold.



20. Install the intake manifold lower retaining bolt and the generator bracket retaining bolts.

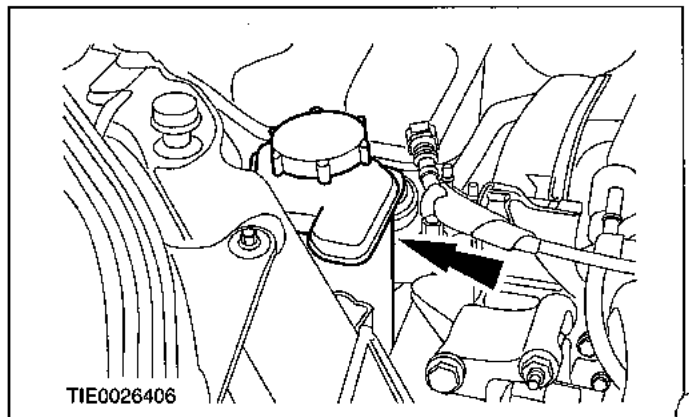


18. Connect the positive crankcase ventilation (PCV) hose to the PCV.



21. Install the accessory drive belt. For additional information, refer to Section 303-05 [Accessory Drive].

22. Attach the power steering fluid reservoir to the bracket.



23. Install the air cleaner. For additional information, refer to Section 303-12 [Intake Air Distribution and Filtering].

**IN-VEHICLE REPAIR**

24. Connect the battery ground cable. For additional information, refer to Section 414-01 [Battery, Mounting and Cables].

IN-VEHICLE REPAIR

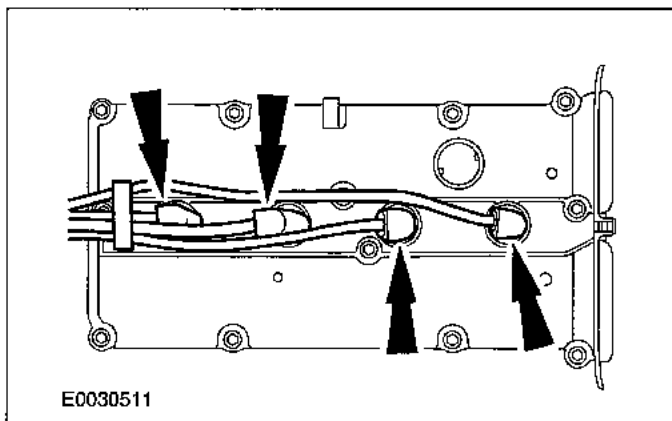
Valve Cover(21 141 0)

Materials	
Name	Specification
Silicone grease	ESE-M1C171-AA

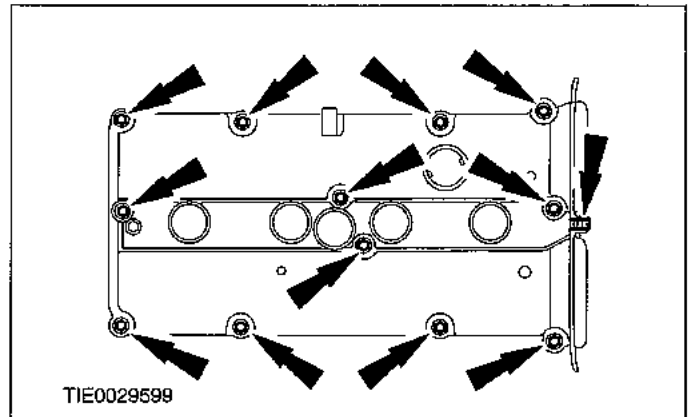
Removal

**▲ 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 mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Disconnect the battery ground cable. For additional information, refer to Section 414-01 [Battery, Mounting and Cables].
2. Remove the air cleaner. For additional information, refer to Section 303-12 [Intake Air Distribution and Filtering].
3. Disconnect the spark plug electrical connectors and detach the wires from the valve cover.



4. Remove the valve cover.



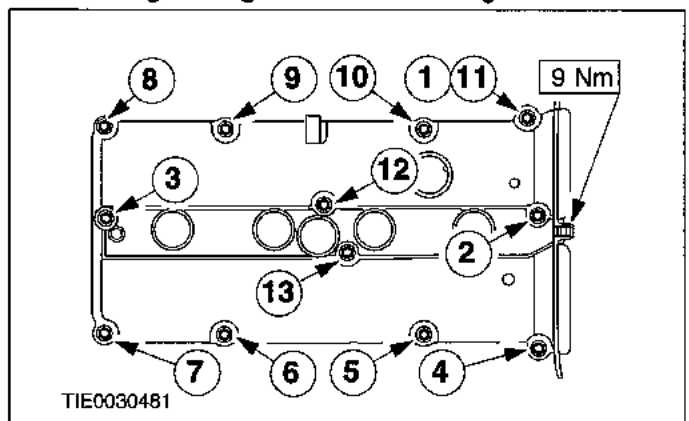
Installation

1. **NOTE:** Check the valve cover gasket for damage and install a new valve cover gasket if necessary.

**NOTE:** Install the stud bolts to positions 5 and 6.

Install the valve cover.

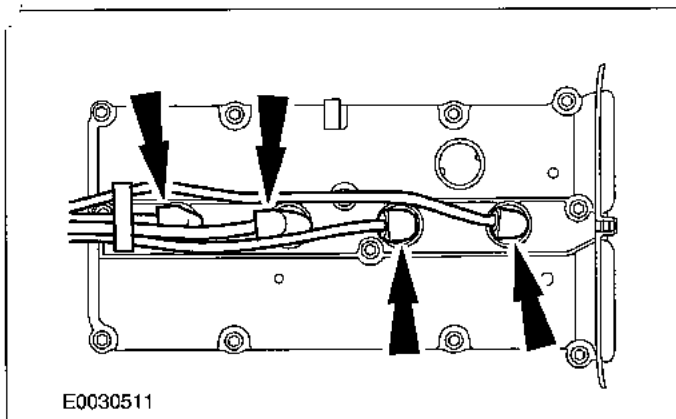
- Tighten the bolts in the sequence shown in three stages.
- Stage 1: Tighten bolt 1 by 3 to 4 turns.
- Stage 2: Tighten bolts 1 through 13 to 3 Nm.
- Stage 3: Tighten bolts 1 through 13 to 9 Nm.



2. **▲ CAUTION:** Use a suitable blunt object to avoid damage to the spark plug connector gasket. Coat the inside of the spark plug connector with silicone grease to depth of 5-10 mm.

**IN-VEHICLE REPAIR**

Connect the spark plug electrical connectors and attach the wires to the valve cover.

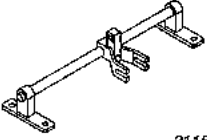
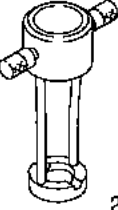
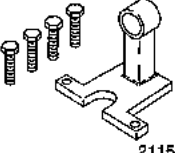
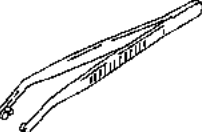
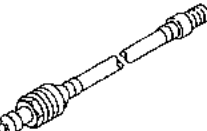
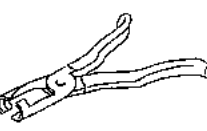


3. Install the air cleaner. For additional information, refer to Section 303-12 [Intake Air Distribution and Filtering].
4. Connect the battery ground cable. For additional information, refer to Section 414-01 [Battery, Mounting and Cables].

**IN-VEHICLE REPAIR**

**Valve Seals(21 238 0)**

**Special Tool(s)**

 <p align="center">21155</p>	<p>Compressor, Valve Spring 303-361 (21-155)</p>
 <p align="center">2115504</p>	<p>Adapter for 303-361 303-361-04 (21-155-04)</p>
 <p align="center">2115505</p>	<p>Adapter for 303-361 303-361-05 (21-155-05)</p>
 <p align="center">21156</p>	<p>Installer, Valve Stem Collets 303-362 (21-156)</p>
 <p align="center">21157</p>	<p>Adapter, Air Supply (Cylinder Head) 303-363 (21-157)</p>
 <p align="center">21211</p>	<p>Pliers, Valve Stem Oil 303-508 (21-211)</p>

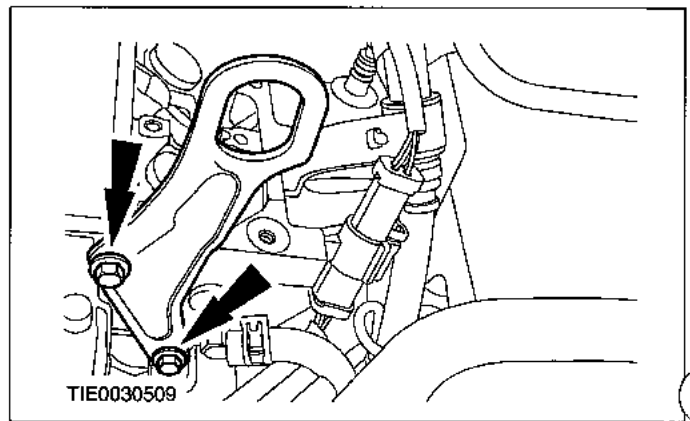
Materials	
Name	Specification
Engine oil	WSS-M2C912-A1

**Removal**

1. Remove the camshafts.

For additional information, refer to **Camshafts** in this section.

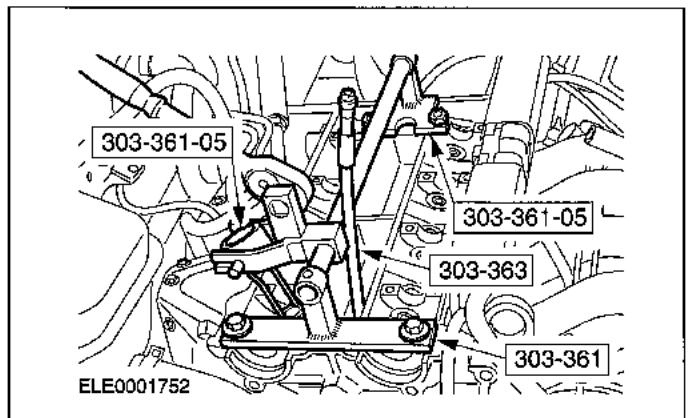
2. Remove the engine rear lifting eye.



3. **CAUTION:** Keep the valve tappets in order for reassembly.

Remove the valve tappets.

4. Install the special tools.



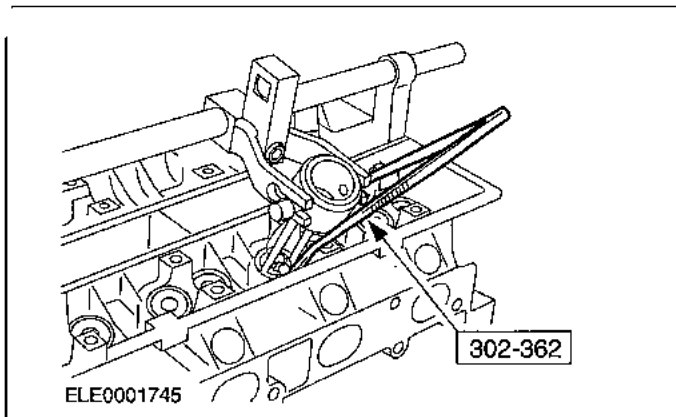
5. Apply 7 to 10 bar of compressed air into the cylinder.

6. Using the special tool, remove the valve springs.

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

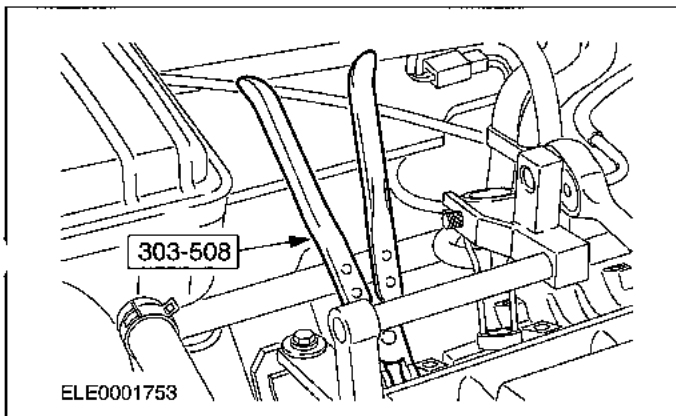
## IN-VEHICLE REPAIR

- Remove the valve spring retainer and the valve springs.



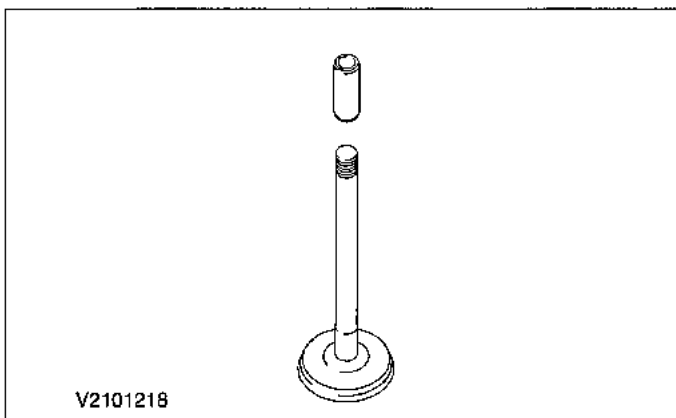
## 7. Using the special tool, remove the valve seals.

- Discard the valve seals.



## Installation

- Install a valve stem mounting sleeve over the valve collet groove (valve shown removed for clarity).

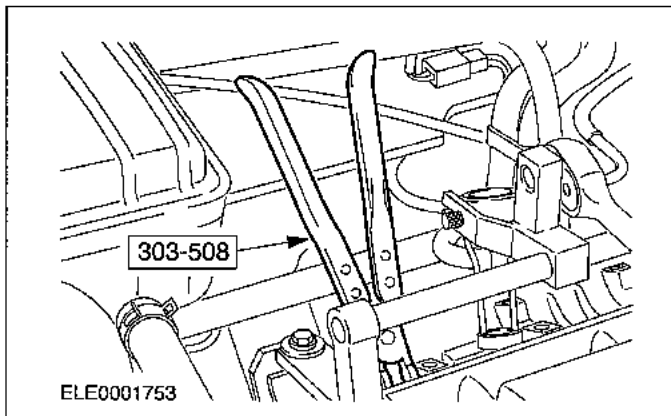


- CAUTION:** The intake valve seal are colored green, and the exhaust valve seals are colored brown.

**NOTE:** Install new valve seals.

**NOTE:** Coat the valve seal lip and the valve stem with clean engine oil.

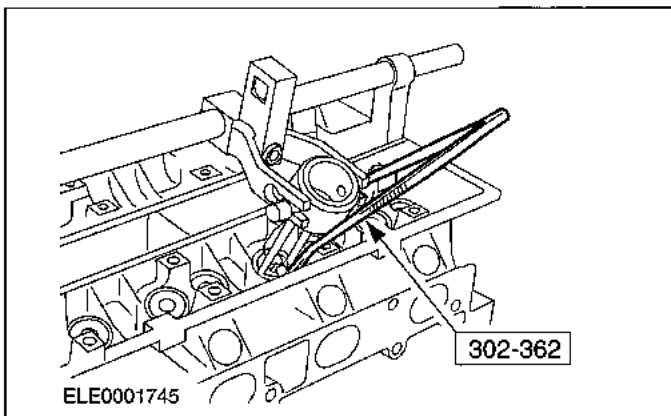
Using the special tool, install the valve seal.



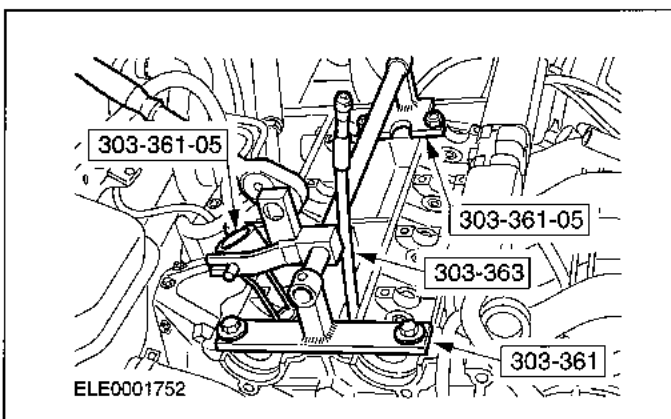
## 3. Remove the mounting sleeve.

## 4. Using the special tool, install the valve springs.

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



## 5. Remove the special tools.

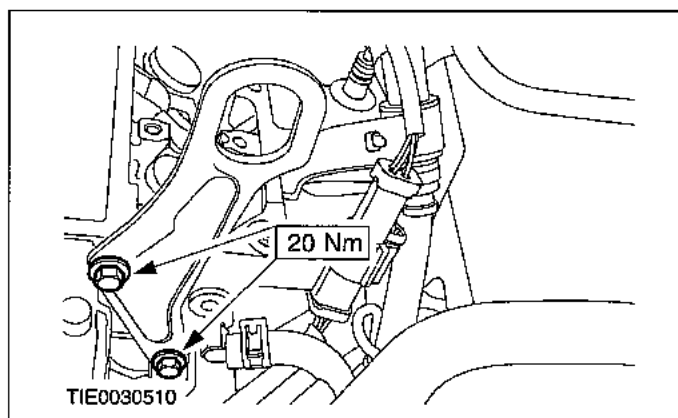


**IN-VEHICLE REPAIR**

6. **⚠ CAUTION:** The valve tappets must be installed in their original locations.

Install the valve tappets.

7. Install the engine rear lifting eye.



8. Install the camshafts.

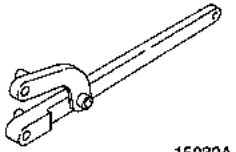
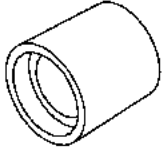
For additional information, refer to  
**Camshafts** in this section.



**IN-VEHICLE REPAIR**

**Camshafts(21 284 0)**

**Special Tool(s)**

 <p>15030A</p>	<p>Universal Flange Holding Wrench 205-072</p>
 <p>21171</p>	<p>Installer, Crankshaft Seal 303-395</p>

Materials	
Name	Specification
Sealant	WSK-M2G348-A2
Engine Oil	WSS-M2C912-A1

**Removal**

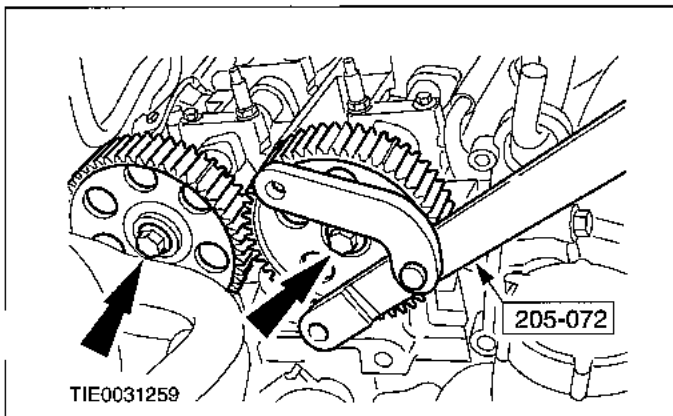
1. Remove the timing belt.

For additional information, refer to: Timing Belt (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).

2. **CAUTION:** Install a hose (order no. E890438S) to the special tool studs, to prevent damage to the camshaft pulleys.

Remove the camshaft pulleys.

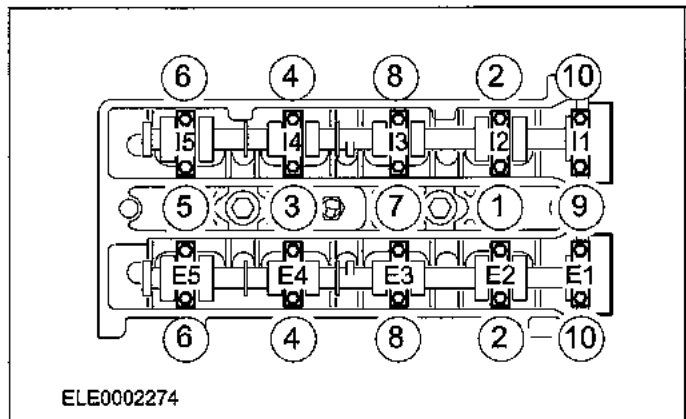
- Discard the retaining bolts.



3. **CAUTION:** Keep the camshaft bearing caps in order for installation.

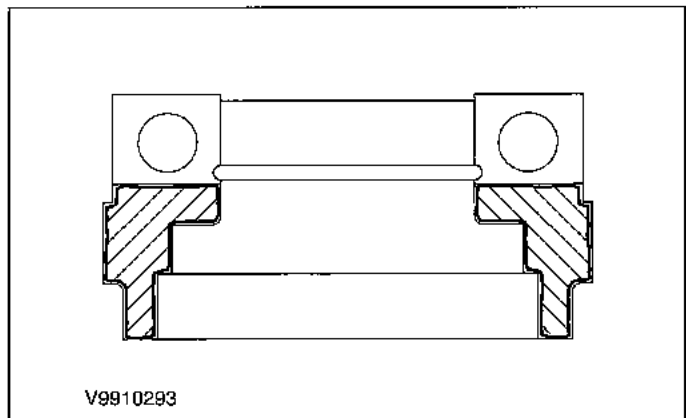
Remove the camshafts.

- Slacken each camshaft bearing cap retaining bolt in the sequence shown by one turn until the camshaft is released.
- Remove the camshaft bearing caps.
- Remove and discard the camshaft seals.



**Installation**

1. Apply sealant to the points indicated on the camshaft bearing cap no. 1 and to the mating surface of the cylinder head.



2. Coat the camshafts and the camshaft bearing caps with clean engine oil.

3. **CAUTION:** Position the camshafts in place so that none of the cams are at full lift.

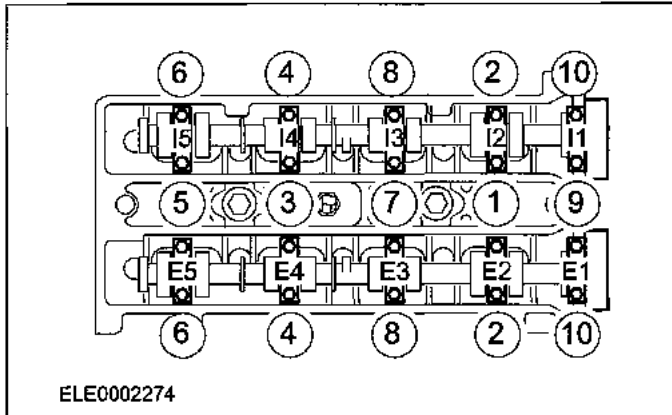
**NOTE:** The camshaft bearing cap numbering starts at the timing belt end with E1 on the exhaust side and with I1 on the intake side.

**NOTE:** The exhaust camshaft has an additional cam for the camshaft position (CMP) sensor.

**IN-VEHICLE REPAIR**

**Install the camshafts and camshaft bearing caps.**

- Tighten the camshaft bearing cap retaining bolts in the sequence shown in three stages.
- Stage 1: One half turn on each bolt until all of the camshaft bearing caps are in contact with the cylinder head.
- Stage 2: 7 Nm.
- Stage 3: 45 degrees.

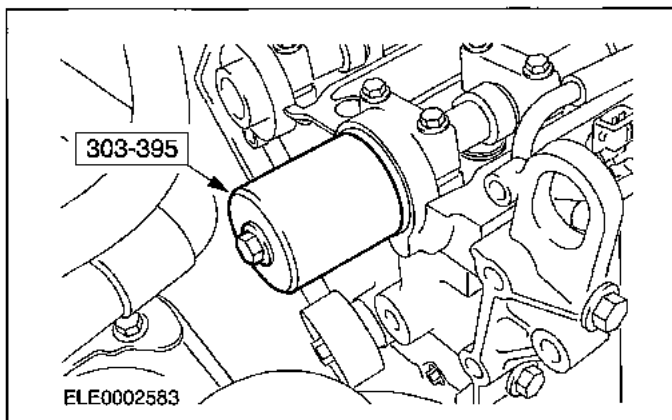
**4. Adjust the valve clearances.**

For additional information, refer to: **Valve Clearance Adjustment (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), General Procedures).**

**5. NOTE: Install new camshaft seals.**

**NOTE:** Coat the camshaft journals and camshaft seal lip with clean engine oil.

Using the special tool, install the camshaft seals.



- 6. NOTE: Do not fully tighten the camshaft pulley retaining bolts at this stage. Make sure the camshaft pulleys turn on the camshafts.**
- Install the camshaft pulleys.**

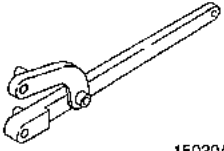
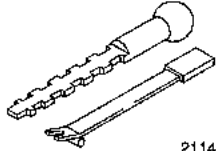
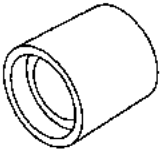
**7. Install the timing belt.**

For additional information, refer to: **Timing Belt (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).**

**IN-VEHICLE REPAIR**

**Camshaft Seal(21 288 0)**

**Special Tool(s)**

 <p>15030A</p>	<p>Universal Flange Holding Wrench 205-072</p>
 <p>21143</p>	<p>Remover, Crankshaft Seal 303-293</p>
 <p>21171</p>	<p>Installer, Crankshaft Seal 303-395</p>

<b>Materials</b>	
<b>Name</b>	<b>Specification</b>
Engine Oil	WSS-M2C912-A1

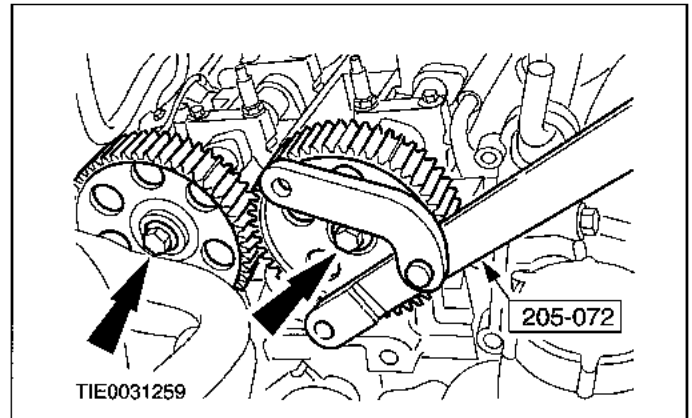
**Removal**

1. Remove the timing belt.

For additional information, refer to: **Timing Belt (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).**

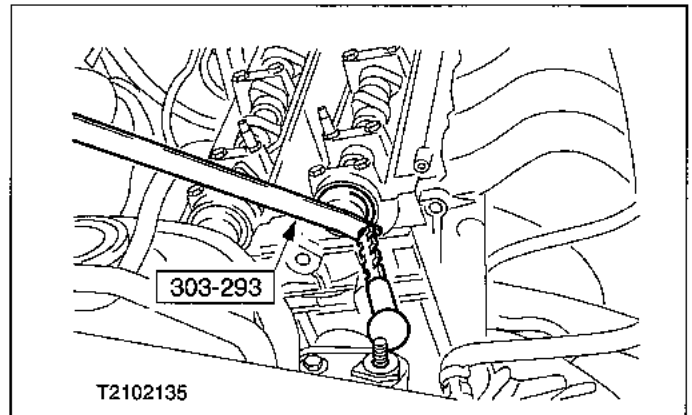
2. **CAUTION:** Install a hose (order no. E890438S) to the special tool studs, to prevent damage to the camshaft pulleys. Remove the camshaft pulleys.

- Discard the retaining bolts.



3. Using the special tool, remove the camshaft seal.

- Discard the oil seal.

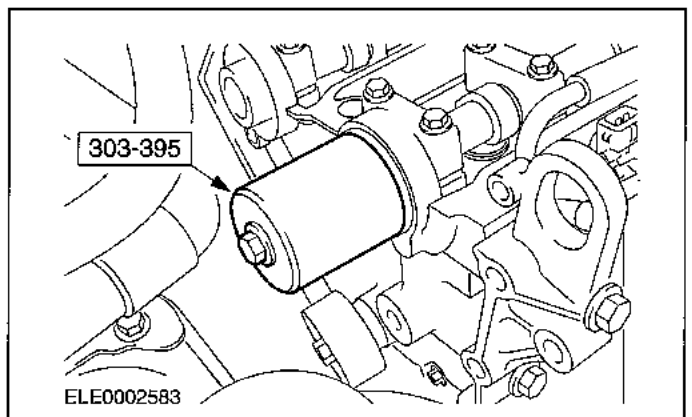


**Installation**

1. **NOTE:** Install a new camshaft seal.

**NOTE:** Coat the camshaft journals and camshaft seal with clean engine oil.

Using the special tool, install the camshaft oil seal.



**IN-VEHICLE REPAIR**

2. **NOTE:** Do not fully tighten the camshaft pulleys retaining bolts at this stage. Make sure the camshaft pulleys turn on the camshafts.

**NOTE:** Install new camshaft pulley retaining bolts.

Install the camshaft timing pulleys.

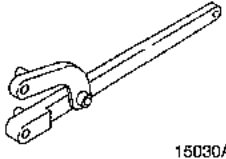
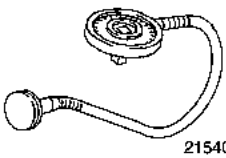
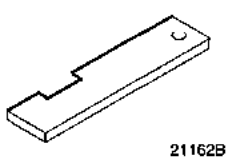
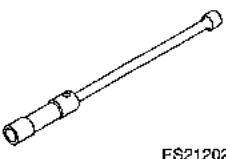
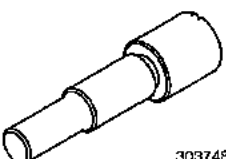
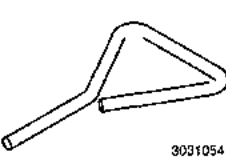
3. Install the timing belt.

For additional information, refer to: Timing Belt (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).

## IN-VEHICLE REPAIR

## Timing Belt(21 304 0)

## Special Tool(s)

 15030A	Universal Flange Holding Wrench 205-072
 21540	Gauge, Bolt Angle 303-174
 21162B	Alignment Plate, Camshaft 303-376B
 ES21202	Socket, Spark Plug 303-499
 303748	Locking Tool, Crankshaft 303-748
 3031054	Locking Tool, Timing Belt Tensioner 303-1054

## General Equipment

Trolley jack
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## General Equipment

Wooden block
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## Materials

Name	Specification
High-Temperature Grease	ESD-M1C220-A

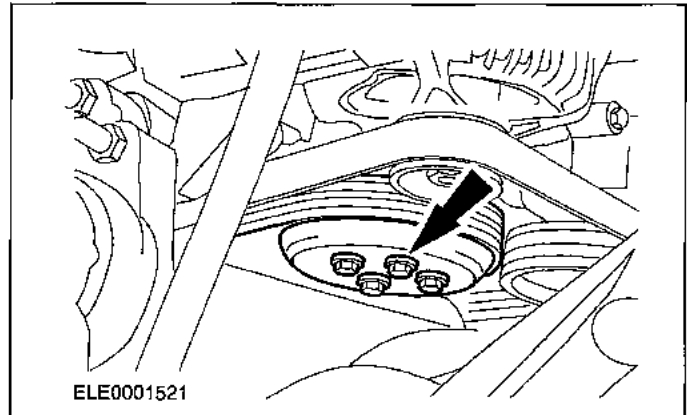
## Removal

All vehicles

## 1. Remove the valve cover.

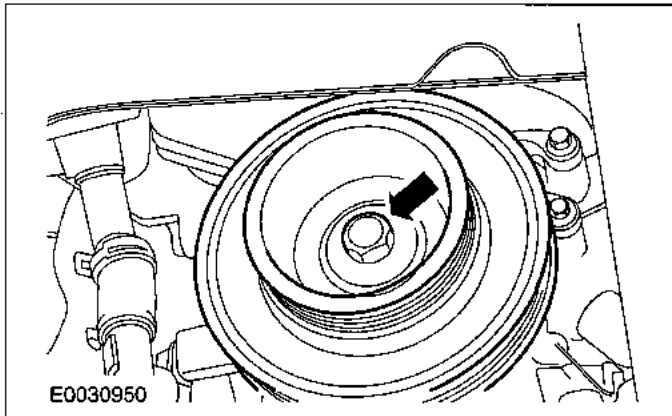
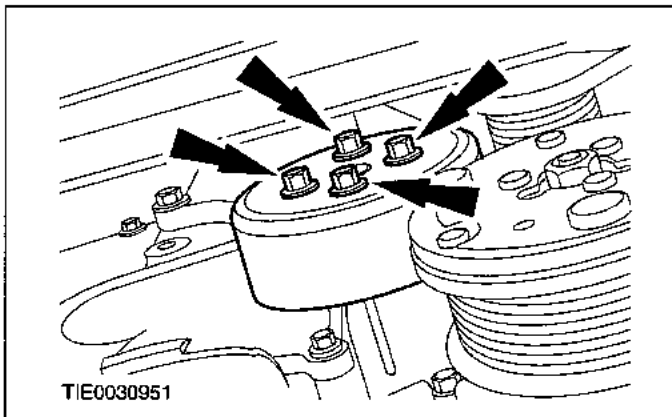
For additional information, refer to: Valve Cover (303-01A Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).

## 2. Loosen the coolant pump pulley retaining bolts.

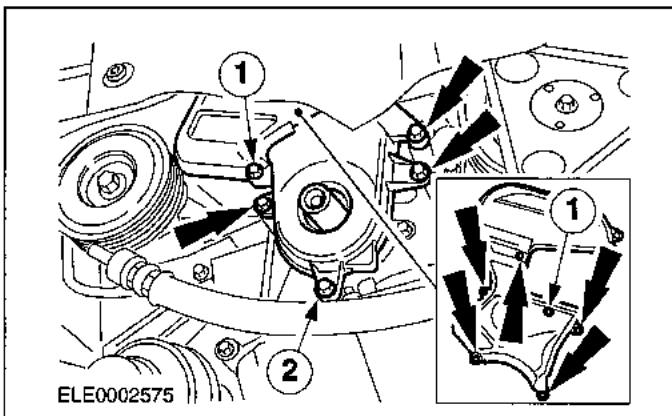
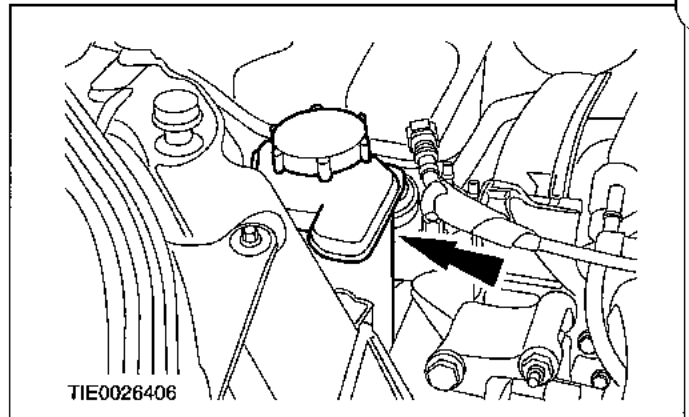
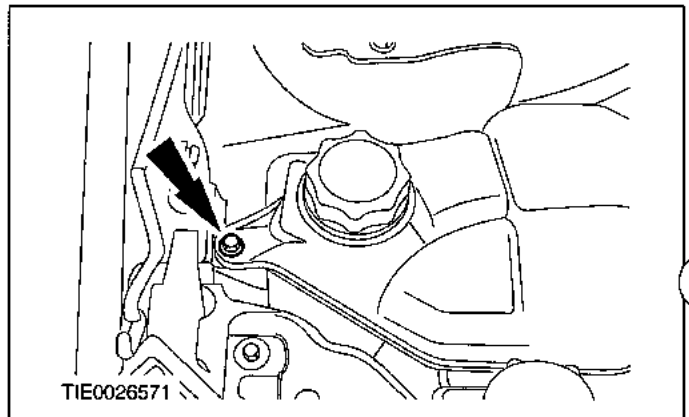
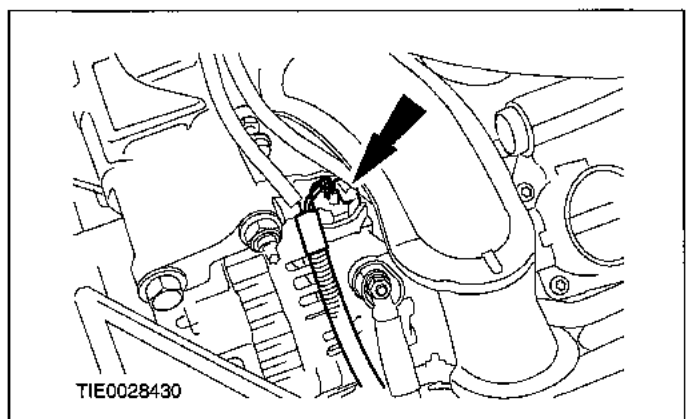


## 3. Remove the accessory drive belt.

For additional information, refer to: Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles With: Air Conditioning (303-05 Accessory Drive, Removal and Installation).

**IN-VEHICLE REPAIR****4. Remove the crankshaft pulley.****5. Remove the coolant pump pulley.****6. Remove the timing belt cover retaining bolts.**

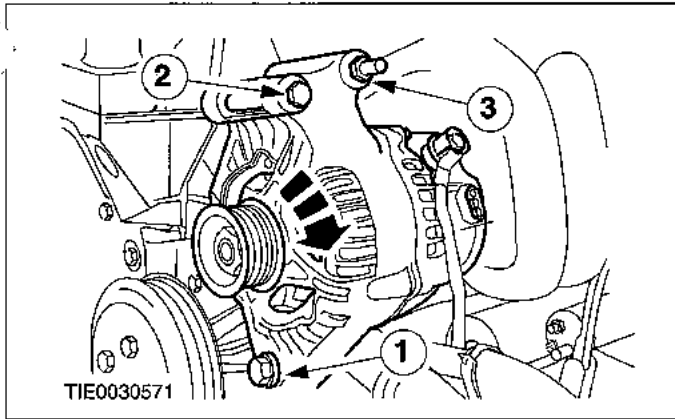
1. Remove the timing belt upper cover retaining bolts.
  2. Remove the timing belt lower cover retaining bolts.
- Remove the lower cover.

**7. Lower the vehicle.****8. Detach the power steering fluid reservoir from the bracket and position it to one side.****9. Detach the coolant expansion tank from the bracket and position it to one side.****10. Disconnect the generator electrical connector.****11. Detach the generator from the engine.**

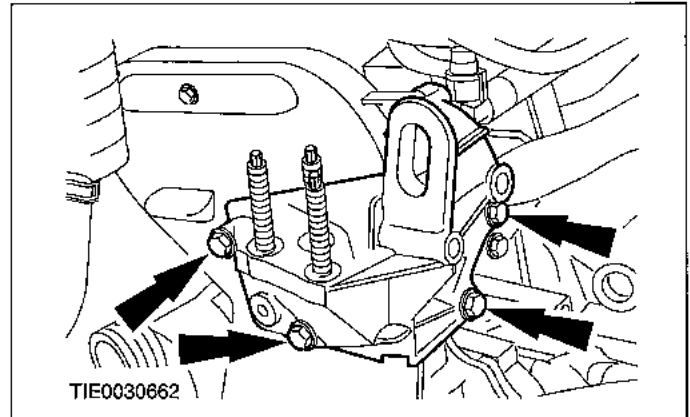
1. Loosen the bolt.
2. Remove the bolt.

## IN-VEHICLE REPAIR

3. Remove the nut and the stud.



15. Remove the engine front mount bracket.

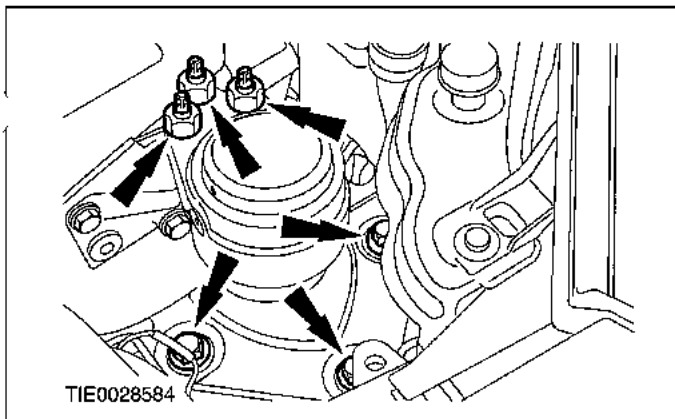


12. **CAUTION:** Do not support the engine directly on the oil pan.

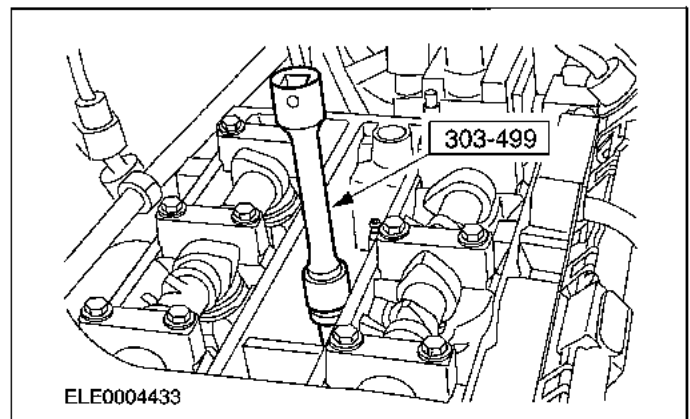
Place the trolley jack with a wooden block under the engine and raise it slightly until the engine front mount is free from strain.

13. Remove the engine front mount.

- Discard the nuts.



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

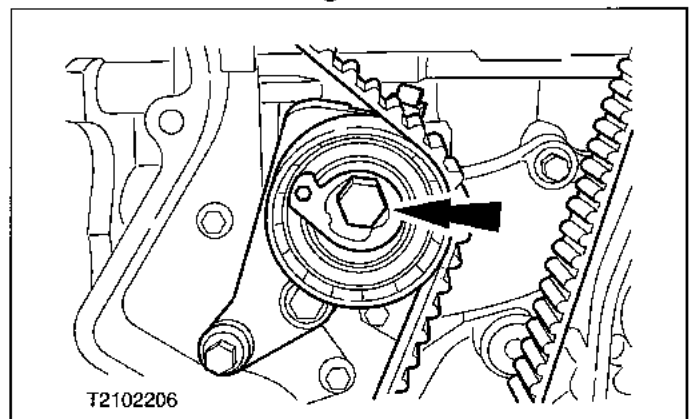
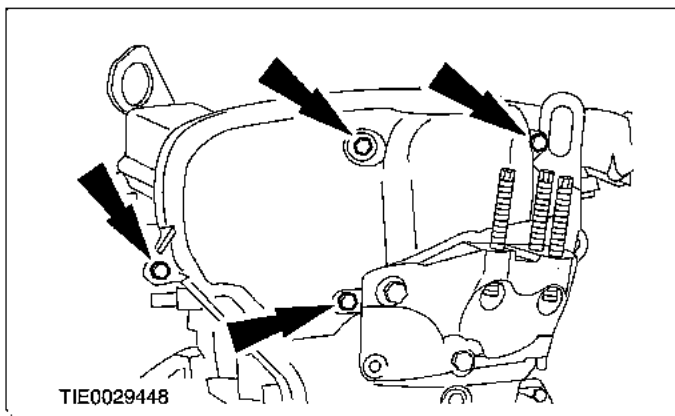


Engines with eccentric cam timing belt tensioner

17. Slacken the timing belt tensioner and remove the timing belt.

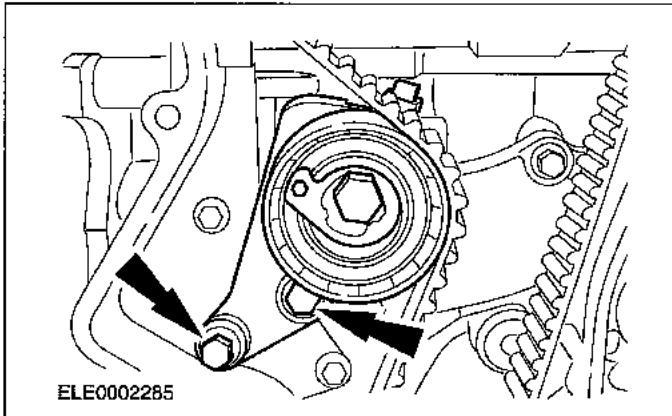
- Discard the timing belt.

14. Remove the timing belt upper cover.



IN-VEHICLE REPAIR

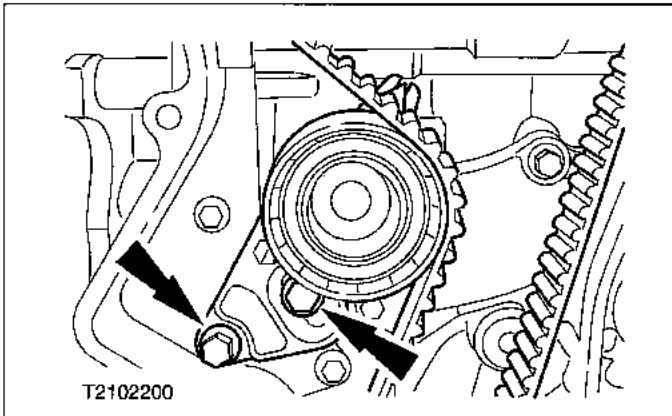
18. Remove the timing belt tensioner.



Engines with slotted bracket timing belt tensioner

19. Remove the timing belt tensioner and the timing belt.

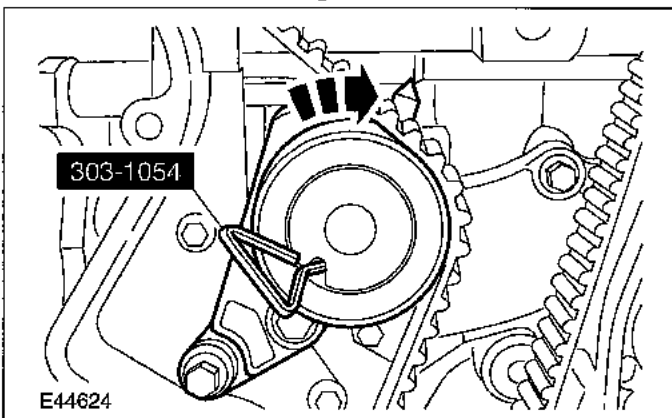
- Discard the timing belt.



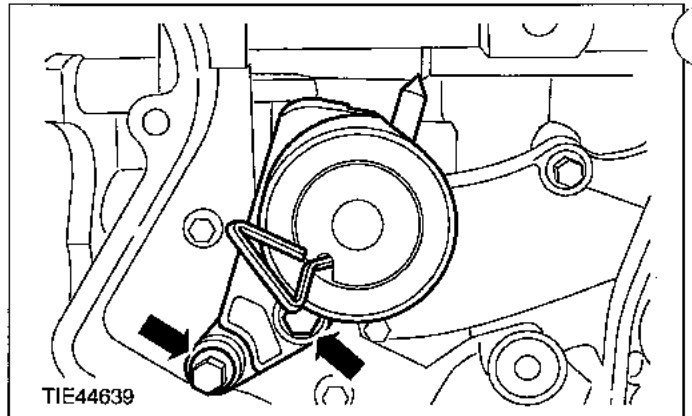
Vehicles built 09/2003 onwards

20. Remove the timing belt.

- Detension the timing belt and lock the timing belt tensioner with the special tool.
- Discard the timing belt.



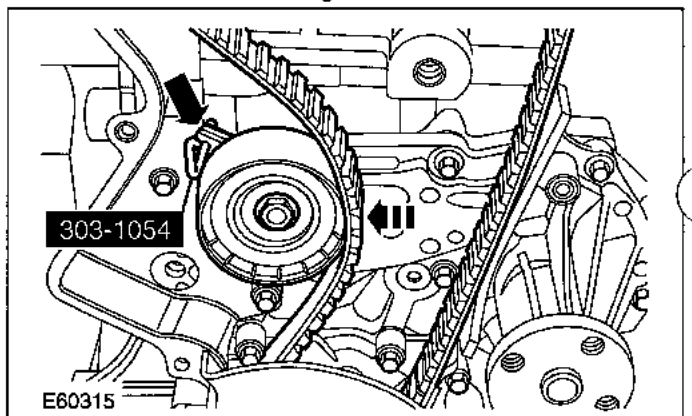
21. Remove the timing belt tensioner.



Vehicles built 04/2005 onwards

22. Remove the timing belt.

- Detension the timing belt and lock the timing belt tensioner with the special tool.
- Discard the timing belt.



Installation

All vehicles

1. Set the crankshaft to approximately 20 degrees before TDC.

2. **CAUTION:** Install a hose (order no. E890438S) to the special tool studs, to prevent damage to the camshaft pulleys.

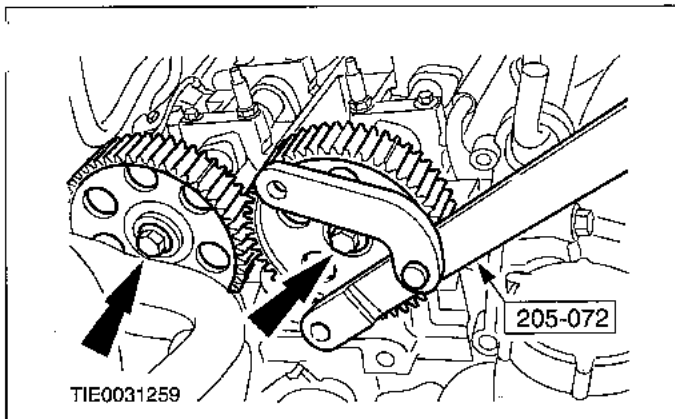
**NOTE:** Make sure the camshaft pulleys turn on the camshafts.

Loosen the camshaft pulley retaining bolts.

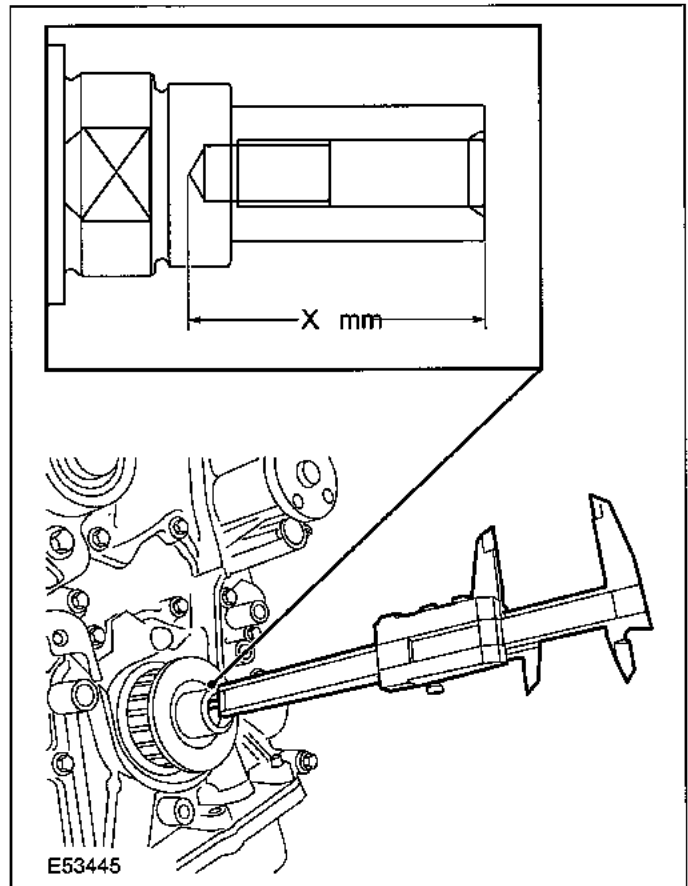


## IN-VEHICLE REPAIR

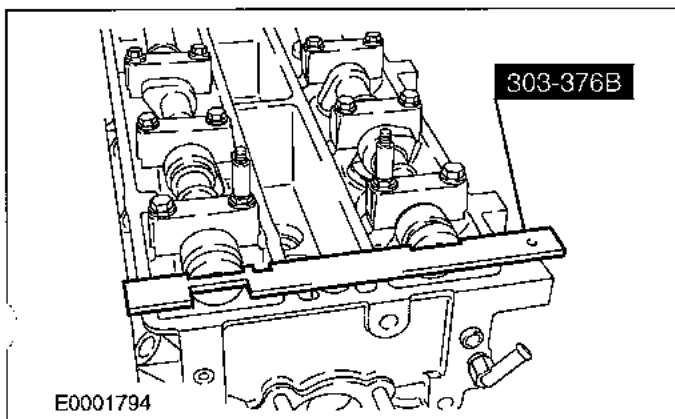
- Discard the retaining bolts.



- Depth of the threaded = 42 mm: Use an M12x29 mm crankshaft pulley center bolt.
- Depth of the threaded = 52 mm: Use an M12x44,5 mm crankshaft pulley center bolt.

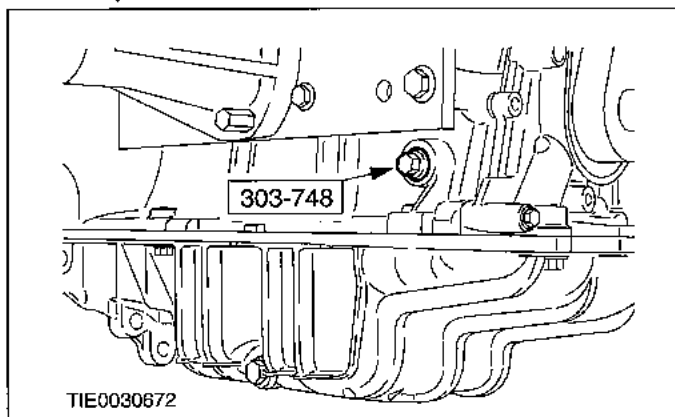


3. Turn the camshafts to TDC on cylinder number 1 and install the special tool.

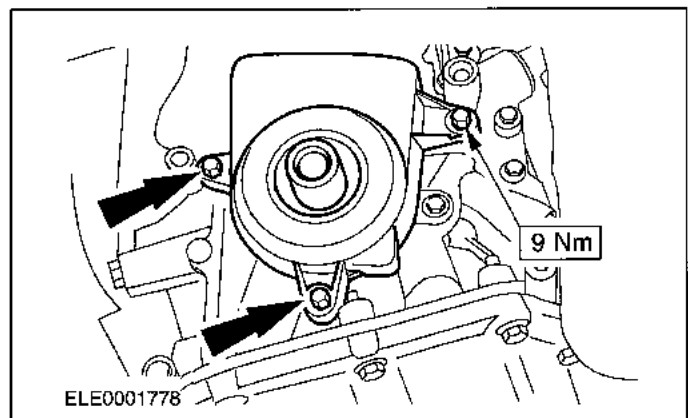


4. Remove the blanking plug and install the special tool.

- Carefully turn the crankshaft against the special tool.



7. Attach the timing belt lower cover.



5. NOTE: Install a new timing belt.

**NOTE:** Install the timing belt, beginning with the crankshaft timing pulley working counterclockwise.

Install the timing belt.

6. Measuring the depth of the threaded hole in the crankshaft.

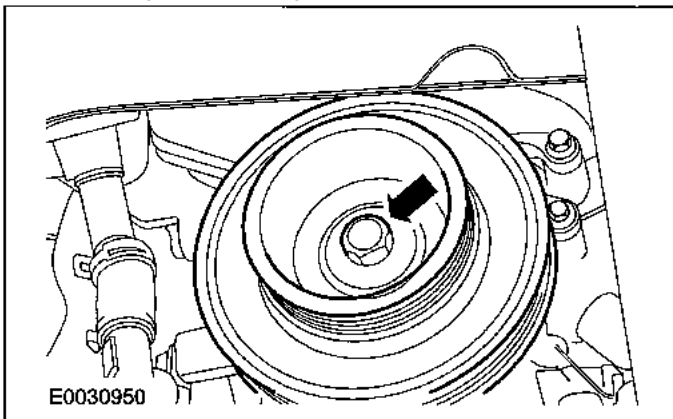
8. NOTE: Install a new crankshaft pulley retaining bolt.

Install the crankshaft pulley.

- Tighten the crankshaft pulley retaining bolt in two stages.
- Stage 1: 45 Nm.

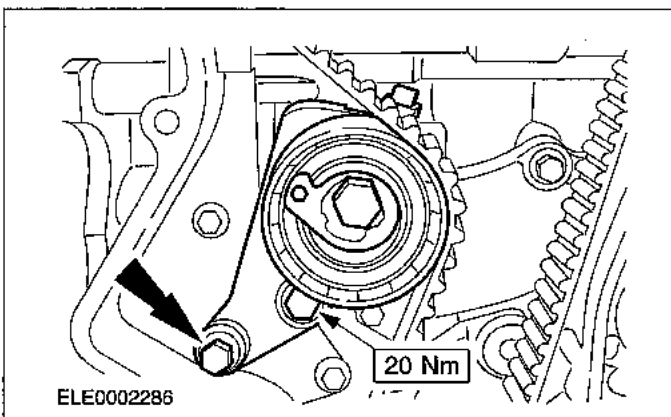
## IN-VEHICLE REPAIR

- Stage 2: 90 degrees.



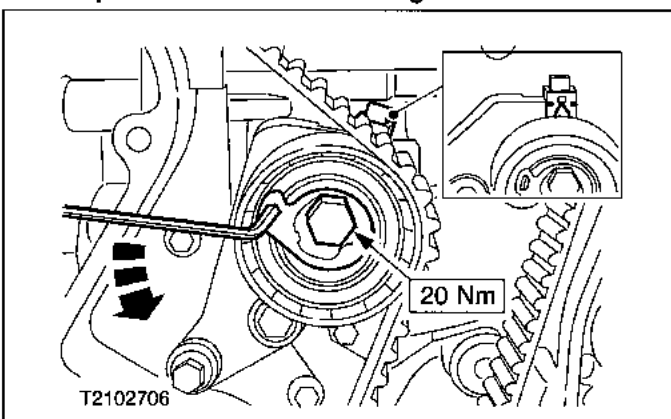
Engines with eccentric cam timing belt tensioner

### 9. Install the timing belt tensioner.



### 10. Tension the timing belt.

- Tension the timing belt by turning the tensioner counterclockwise until the arrow points at the mark and tighten the bolt.

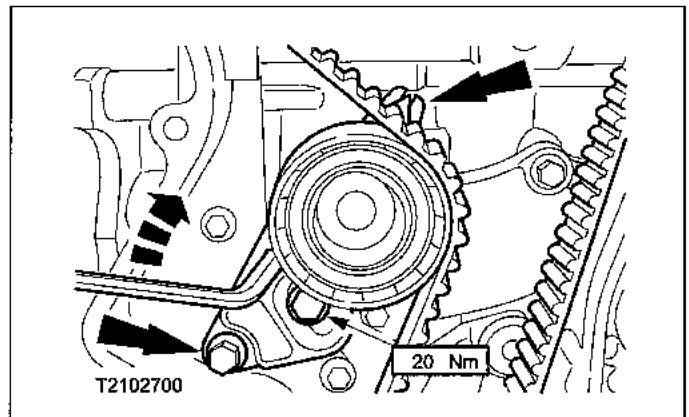


Engines with slotted bracket timing belt tensioner

### 11. Install the timing belt tensioner and tension the timing belt.

- Screw in the bolts finger tight.

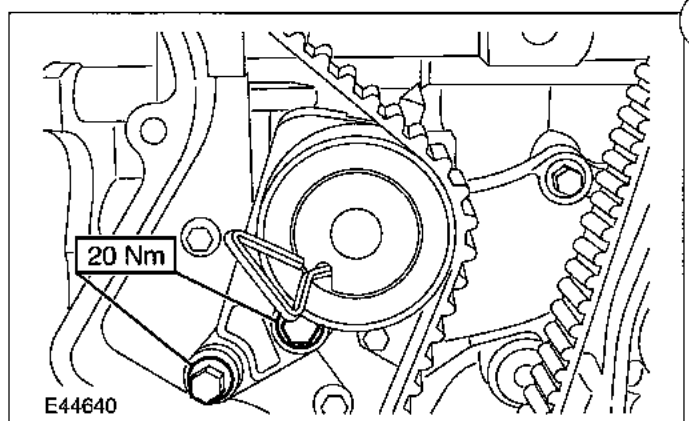
- Tension the timing belt by turning the tensioner clockwise until the arrow points in line with the center of the rectangular hole and tighten the bolt.



Vehicles built 09/2003 onwards

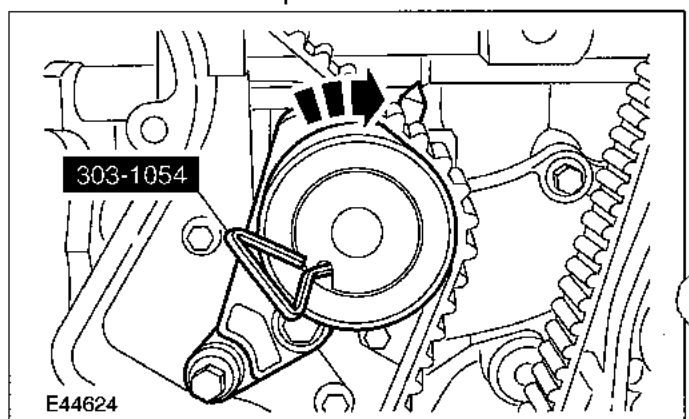
12. **▲WARNING:** Do not remove the special tool, until the timing belt is correctly positioned. Failure to follow this instruction may result in personal injury, or may damage the timing belt tensioner.

Install the timing belt tensioner.



### 13. Tension the timing belt.

- Remove the special tool.



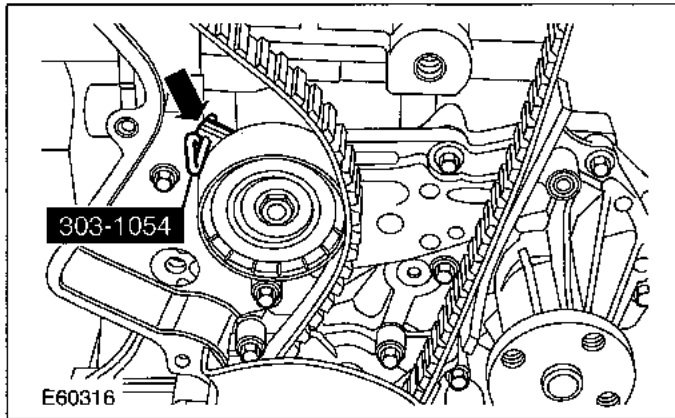
## IN-VEHICLE REPAIR

Vehicles built 04/2005 onwards

14. **▲WARNING:** Do not remove the special tool, until the timing belt is correctly positioned. Failure to follow this instruction may result in personal injury, or may damage the timing belt tensioner.

**Tension the timing belt.**

- Remove the special tool.



All vehicles

## 15. CAUTIONS:

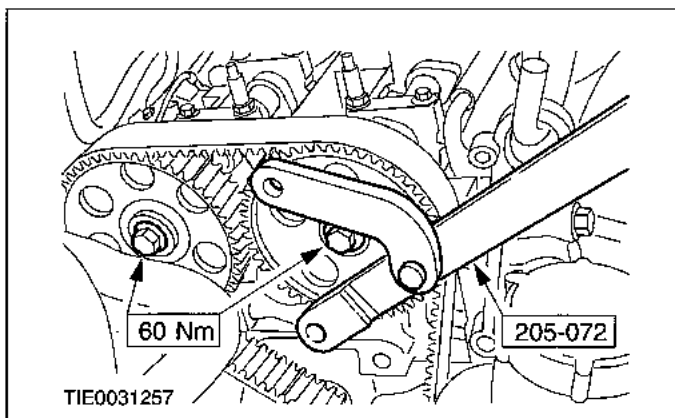
▲ Install a hose (order no. E890438S) to the special tool studs, to prevent damage to the camshaft pulleys.

▲ Do not tighten the camshaft pulley bolts against the timing plate.

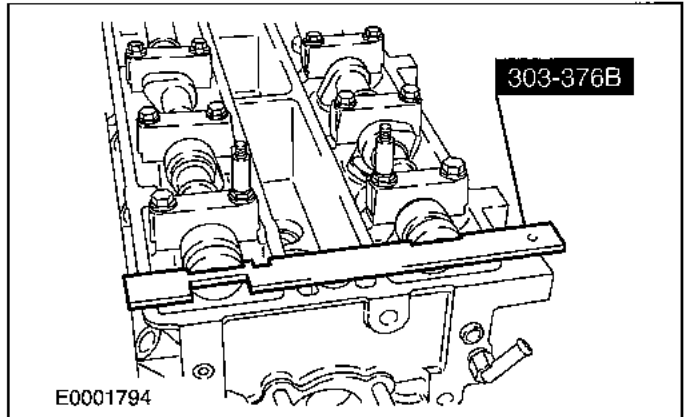
**NOTE:** The camshafts must remain at TDC.

**NOTE:** Install new camshaft pulley retaining bolts.

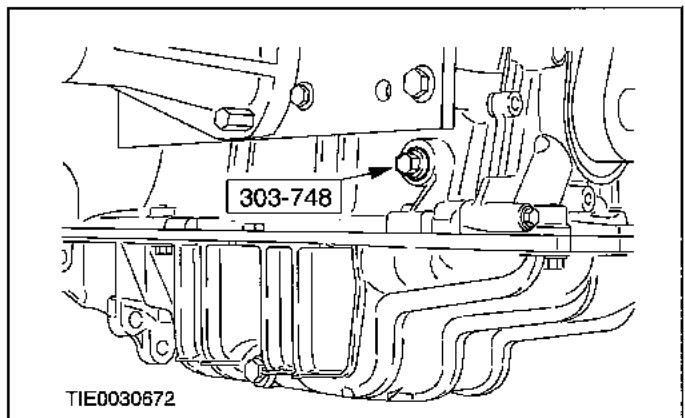
**Using the special tool, tighten the camshaft pulleys.**



## 16. Remove special tool.



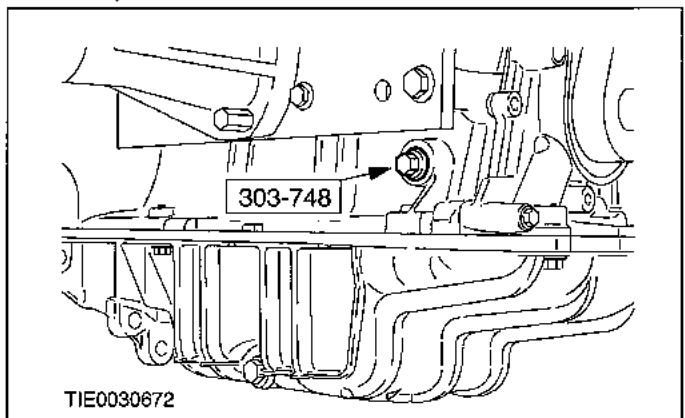
## 17. Remove the special tool.

18. **NOTE:** Only turn the engine in its normal direction of rotation.

**Turn the engine two revolutions.**

## 19. Install the special tool.

- Carefully turn the crankshaft against the special tool.

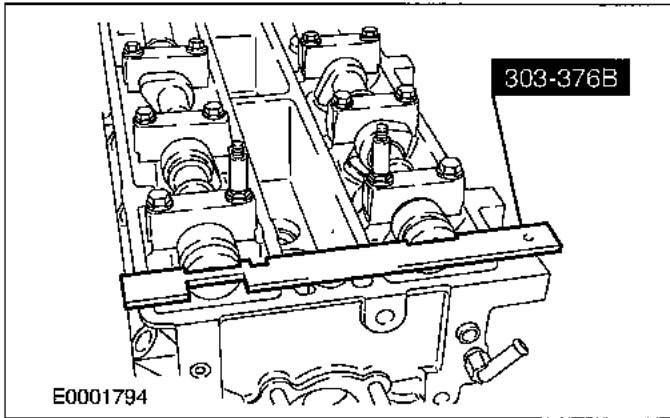


## 20. Check the valve timing.

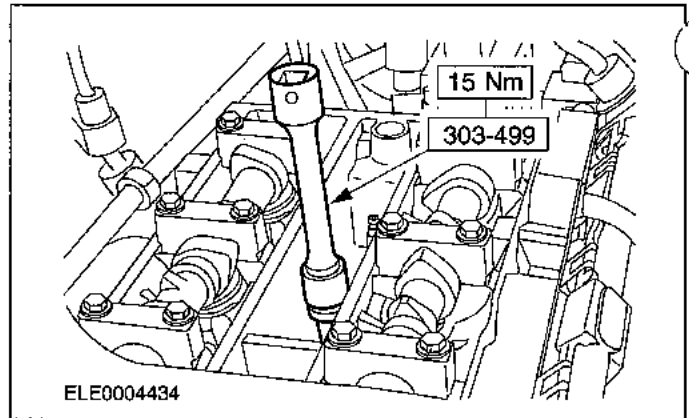
- If necessary loosen the camshaft pulleys and correct the camshaft alignment.

## IN-VEHICLE REPAIR

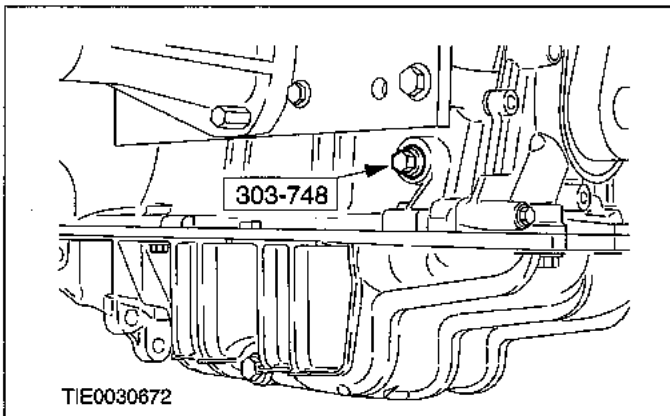
- Remove the special tool.



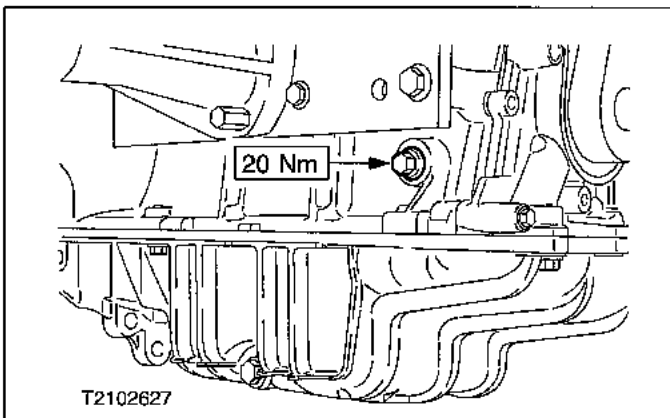
- Apply grease to the spark plug threads.



## 21. Remove the special tool.



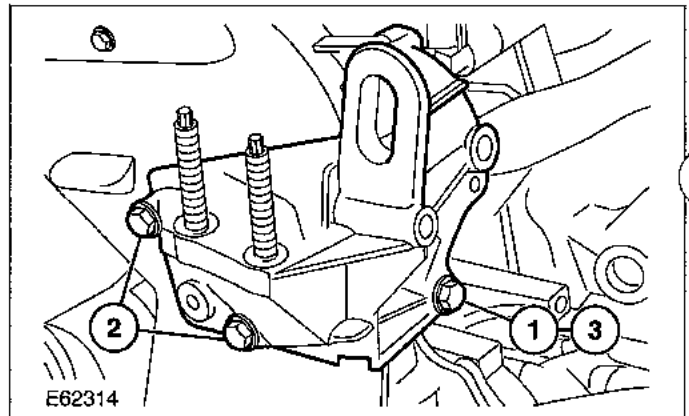
## 22. Install the blanking plug.



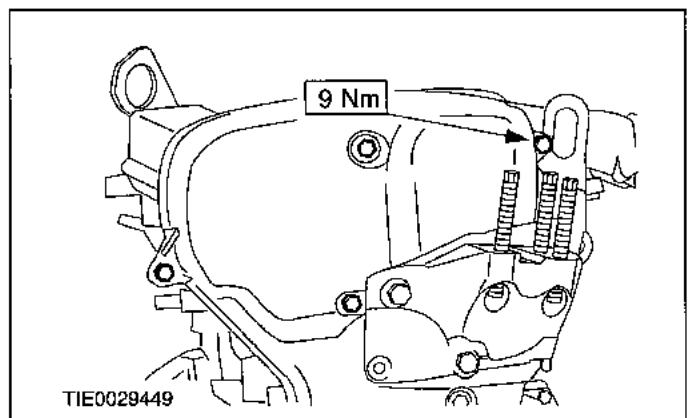
## 23. Using the special tool, install the spark plugs.

## 24. Install the engine front mount bracket.

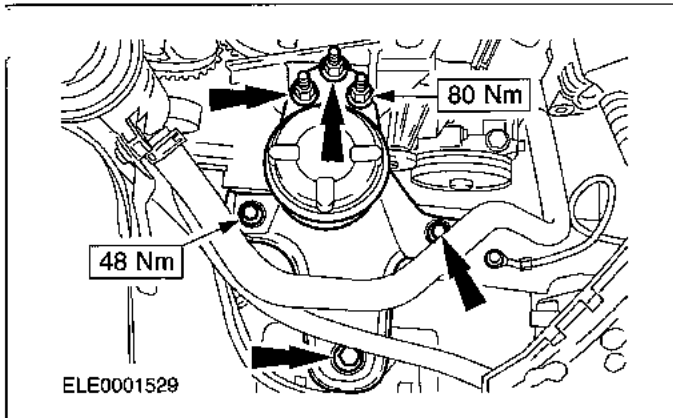
- Tighten the bolts in the indicated order in three stages.
- Stage 1: Hand tighten bolt 1.
- Stage 2: Tighten bolts 2 to 55 Nm.
- Stage 3: Tighten bolt 3 to 55 Nm.



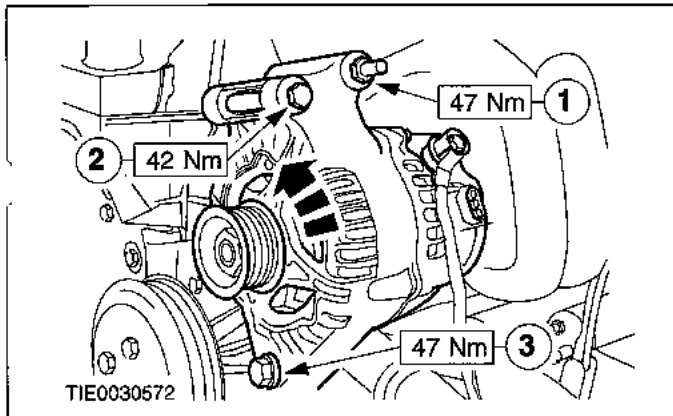
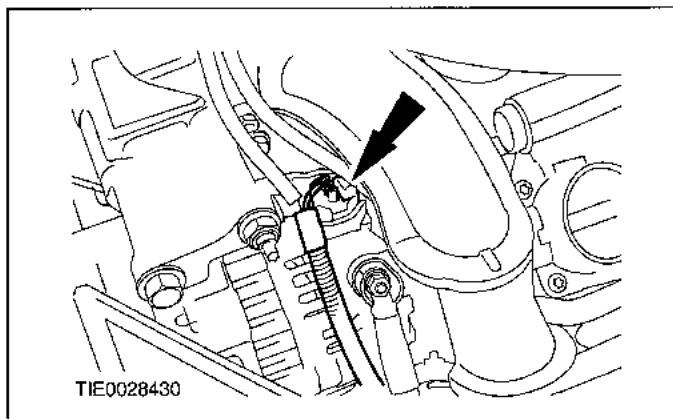
## 25. Install the timing belt upper cover.



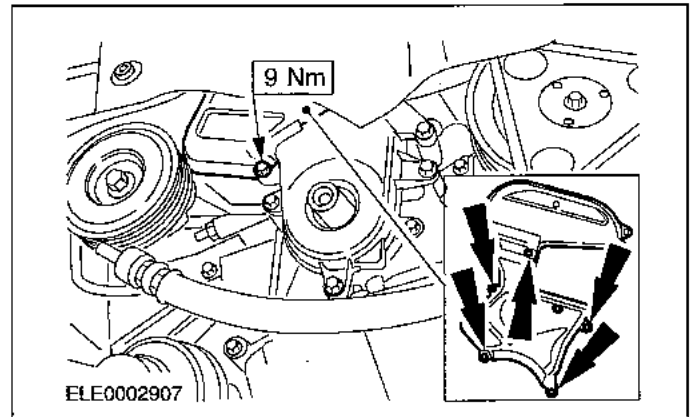
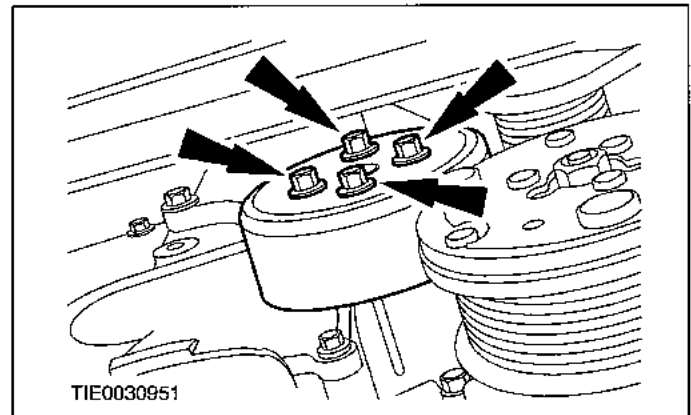
## 26. NOTE: Install new engine front mount retaining nuts.

**IN-VEHICLE REPAIR****Install the engine front mount.****27. Remove the trolley jack.****28. Attach the generator.**

1. Install the stud and nut.
2. Install the bolt.
3. Tighten the bolt.

**29. Connect the generator electrical connector.****30. Raise and support the vehicle.**

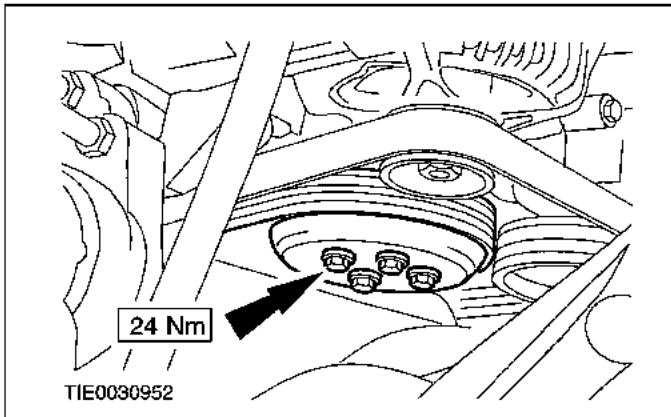
For additional information, refer to: **Lifting (100-02 Jacking and Lifting, Description and Operation).**

**31. Install the timing belt upper cover retaining bolts.****32. NOTE: Do not tighten the coolant pump pulley retaining bolts at this stage.****Install the coolant pump pulley.****33. Install the accessory drive belt.**

For additional information, refer to:  
**Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles With: Air Conditioning (303-05 Accessory Drive, Removal and Installation).**

**IN-VEHICLE REPAIR**

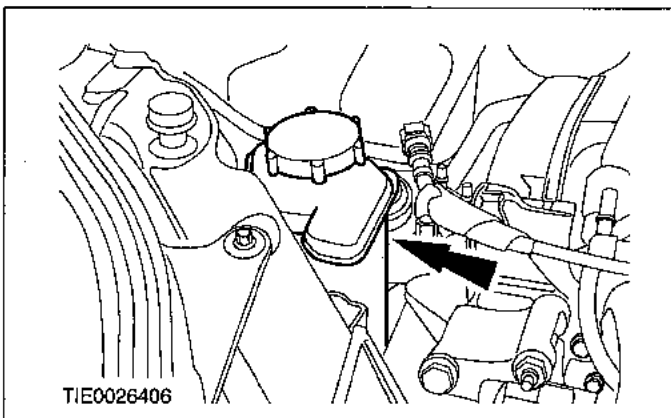
34. Tighten the coolant pump pulley retaining bolts.



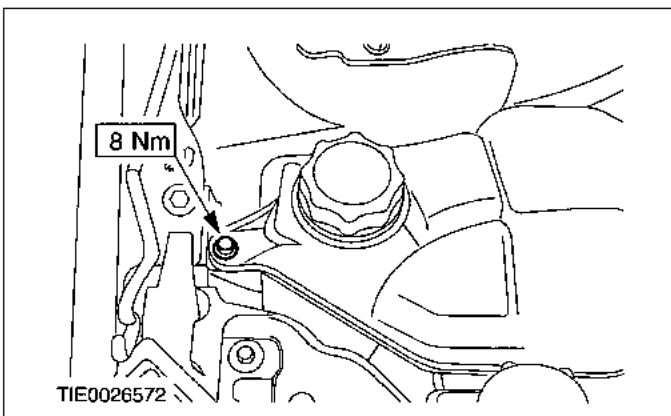
35. Install the valve cover.

For additional information, refer to: Valve Cover (303-01A Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).

36. Attach the power steering fluid reservoir to the bracket.



37. Attach the coolant expansion tank to the bracket.



## IN-VEHICLE REPAIR

## Exhaust Manifold(21 187 0)

## Special Tool(s)

<p>21140</p>	Support Bar, Engine 303-290A (21-140A)
<p>2114001</p>	Adapter for 303-290A 303-290-01 (21-140-01)
<p>2114002</p>	Adapter for 303-290A 303-290-02 (21-140-02)
<p>2114003</p>	Adapter for 303-290A 303-290-03A (21-140-03A)
<p>303290A14</p>	Adapter for 303-290A 303-290A-14

## General Equipment

Exhaust wrap

## 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.

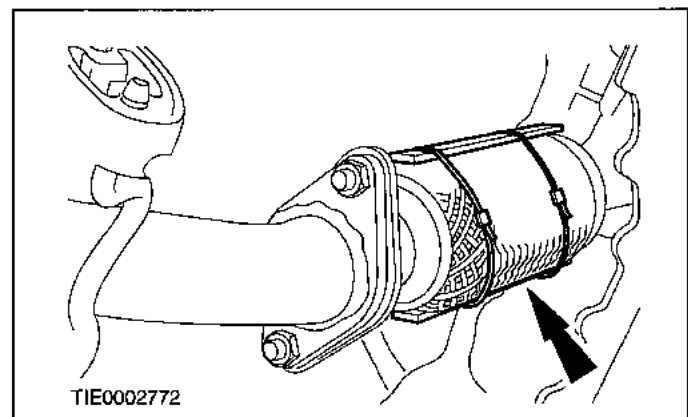
For additional information, refer to: Air Cleaner - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

## 3. Raise and support the vehicle.

For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

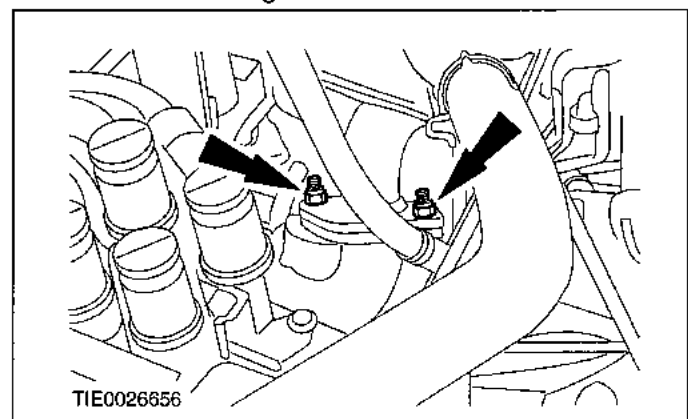
4. **CAUTION:** Over bending of the exhaust flexible pipe may cause damage resulting in failure.

Support the exhaust flexible pipe with a support wrap or suitable splint.



## 5. Detach the exhaust flexible pipe from the catalytic converter.

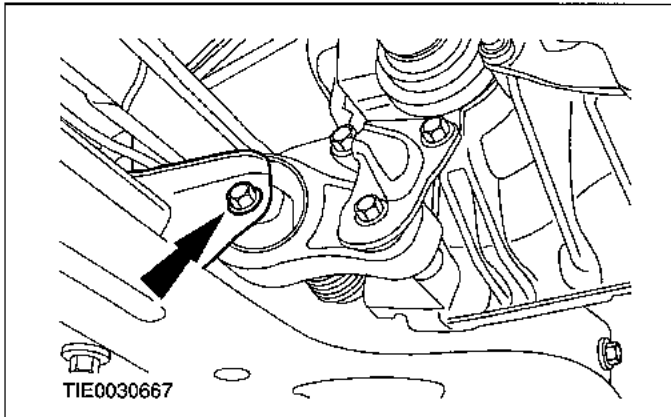
- Discard the gasket and the nuts.



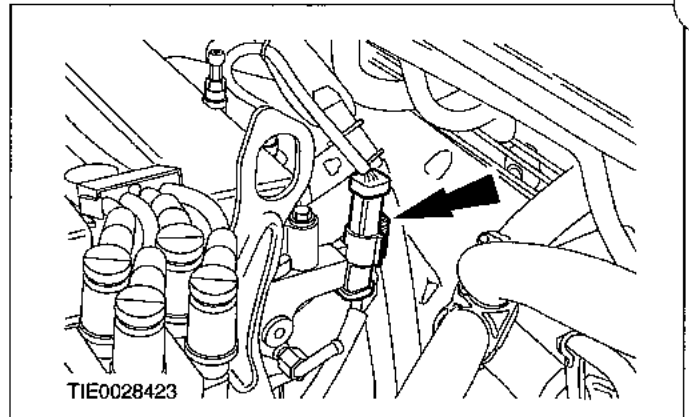
## 6. Detach the exhaust system insulators from the exhaust brackets and position it to one side.

**IN-VEHICLE REPAIR**

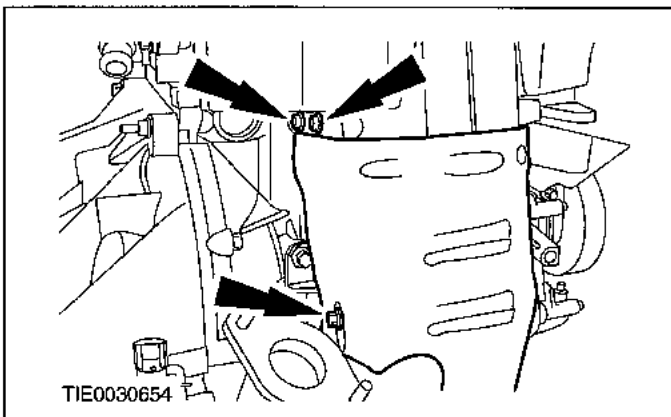
7. Remove the engine support insulator retaining bolt.



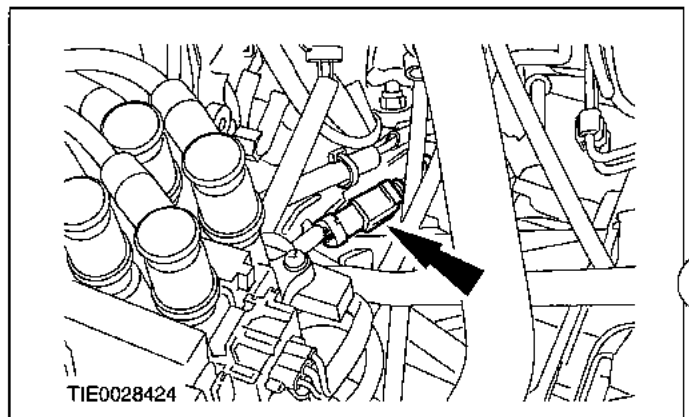
11. Disconnect the heated oxygen (HO2S) sensor electrical connector.



8. Remove the exhaust manifold lower heat shield left-hand retaining bolts.

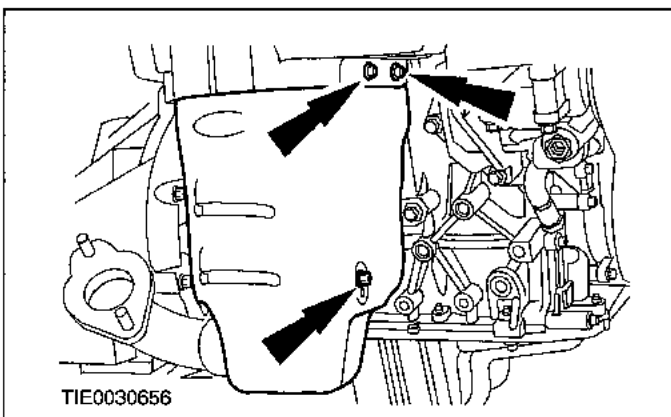


12. Disconnect the catalyst monitor sensor electrical connector.

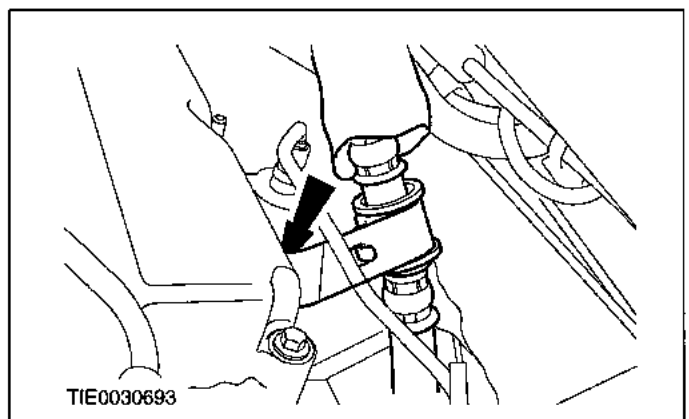


9. Remove the exhaust manifold lower heat shield right-hand retaining bolts.

- Remove the lower heat shield.



13. Detach the power steering line support bracket from the cylinder head.

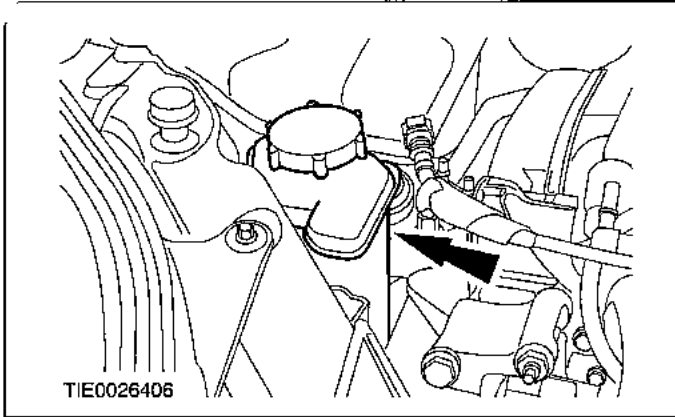


10. Lower the vehicle.

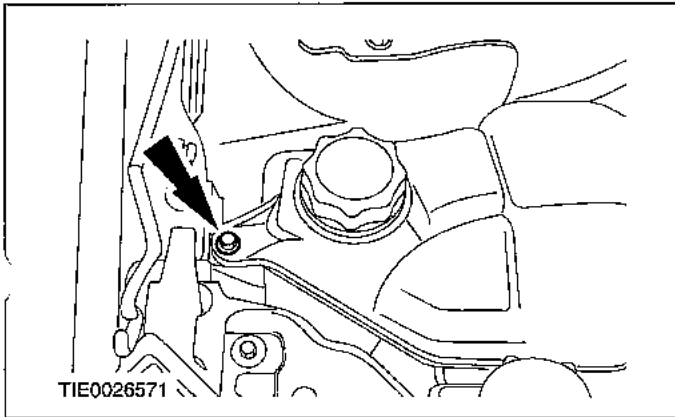


**IN-VEHICLE REPAIR**

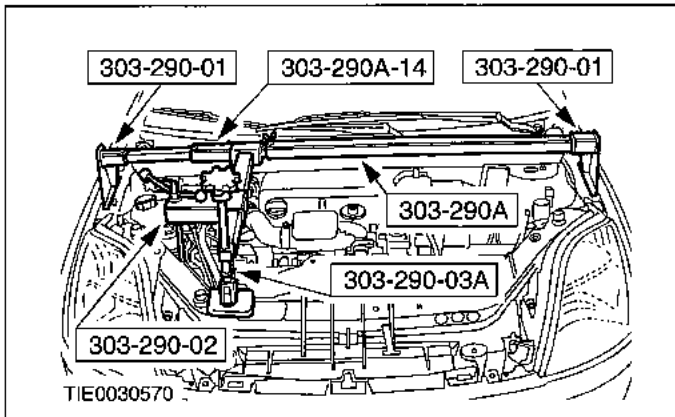
**14. Detach the power steering fluid reservoir from the bracket and position it to one side.**



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

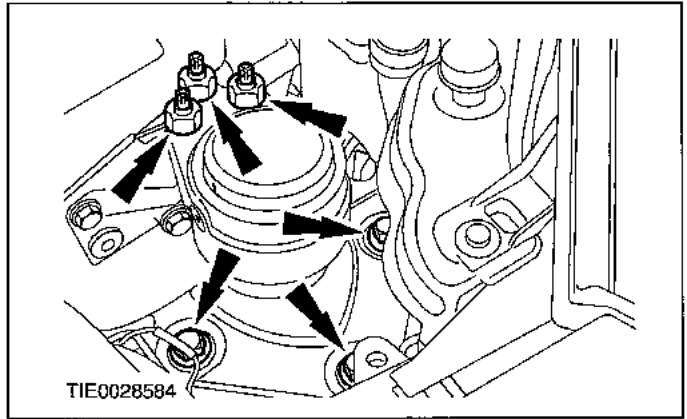


**16. Install the special tools.**

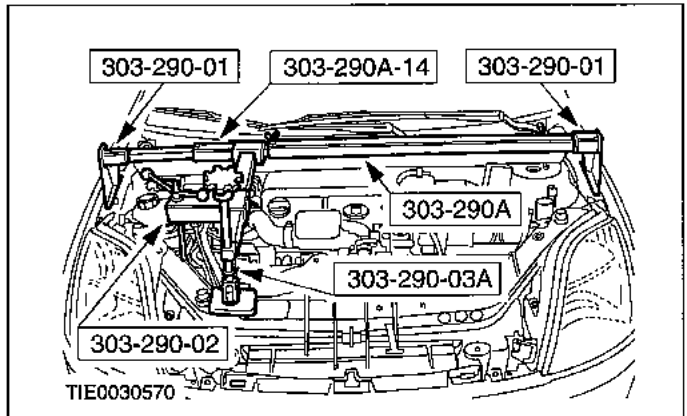


**17. Remove the engine front mount.**

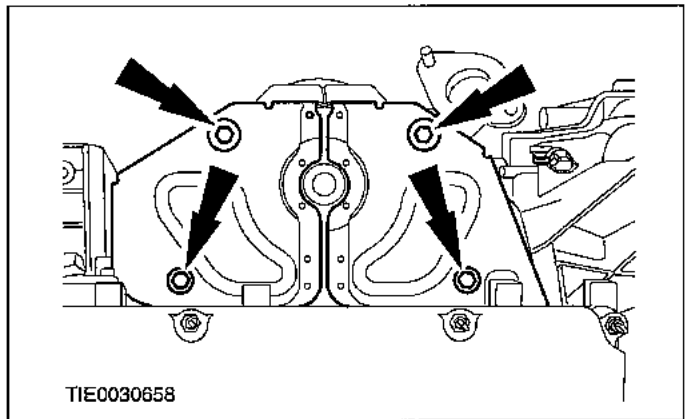
• Discard the nuts.



**18. Using the special tools lower the engine.**



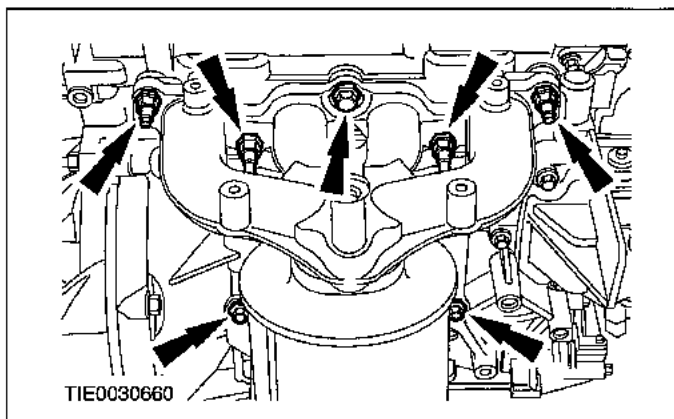
**19. Remove the exhaust manifold upper heat shield.**



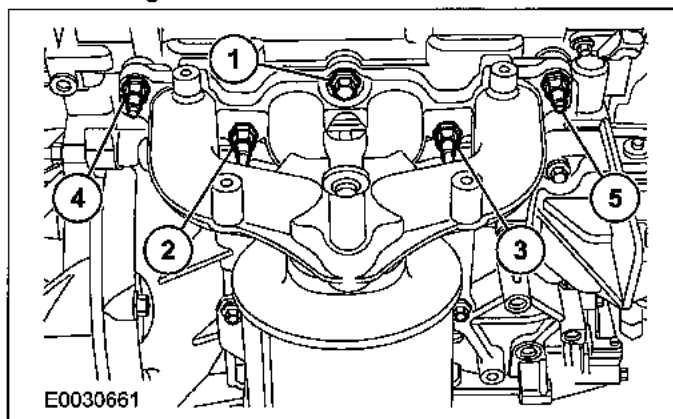
**20. Remove the exhaust manifold retaining bolts and the nuts.**

## IN-VEHICLE REPAIR

- Discard the nuts.



- Stage 2: 55 Nm.



## 21. Raise and support the vehicle.

For additional information, refer to: **Lifting (100-02 Jacking and Lifting, Description and Operation).**

## 22. Remove the exhaust manifold.

- Discard the gasket.

## Installation

## 1. NOTE: Install a new exhaust manifold gasket.

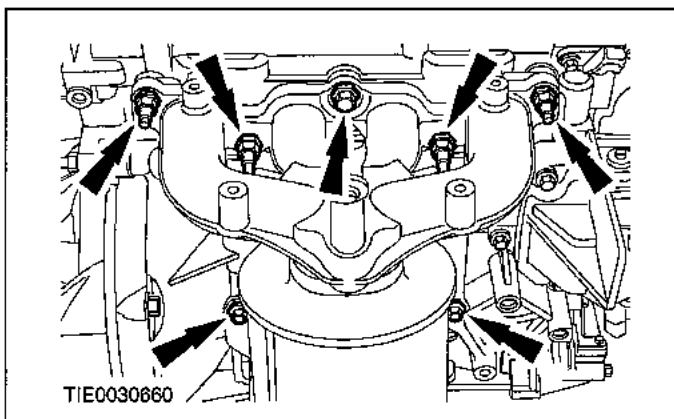
Attach the exhaust manifold to the cylinder head.

## 2. Lower the vehicle.

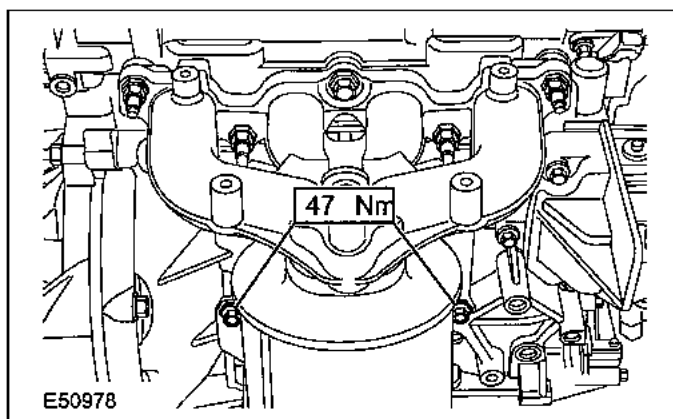
## 3. NOTE: Install a new exhaust manifold gasket and new exhaust manifold retaining nuts.

**NOTE:** Do not fully tighten the nuts and bolt at this stage.

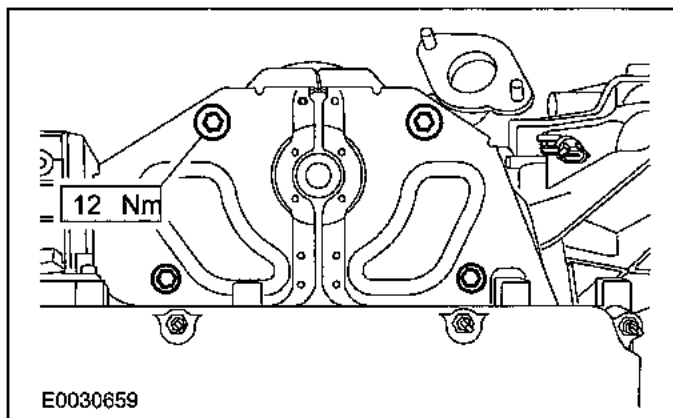
Install the exhaust manifold.



## 5. Tighten the exhaust manifold lower retaining bolts.



## 6. Install the exhaust manifold upper heat shield.

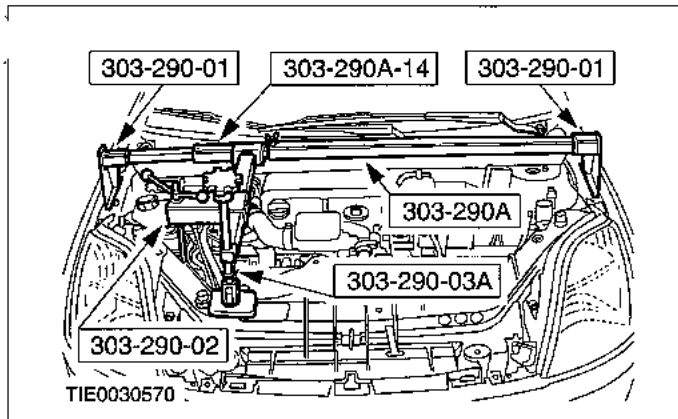


## 4. Tighten the exhaust manifold upper retaining nuts and bolt in the sequence shown in two stages.

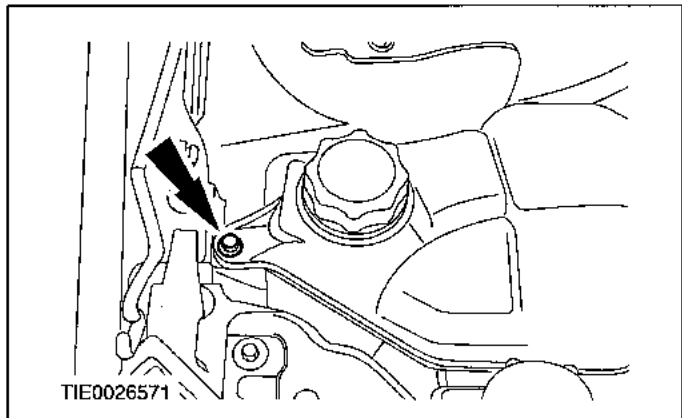
- Stage 1: 20 Nm.

**IN-VEHICLE REPAIR**

**7. Using the special tools, raise the engine.**

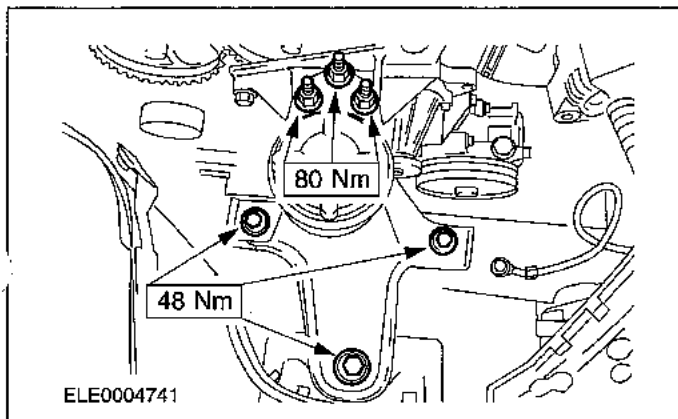


**10. Attach the coolant expansion tank to the bracket.**

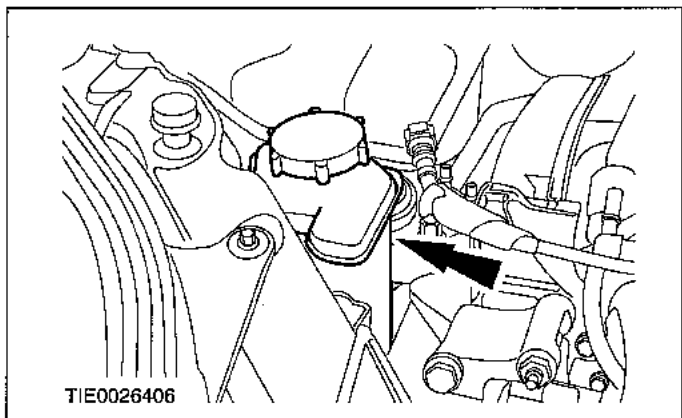


**8. NOTE: Install new engine front mount retaining nuts.**

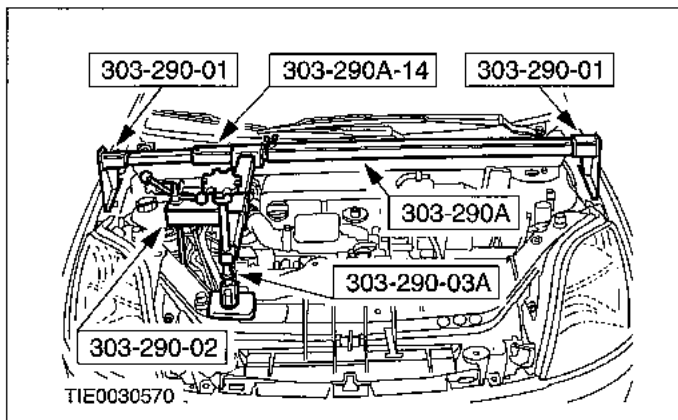
**Install the engine front mount.**



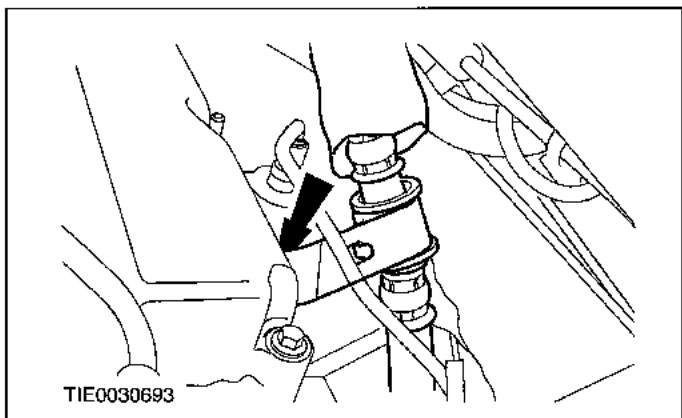
**11. Attach the power steering fluid reservoir to the bracket.**



**9. Remove the special tools.**

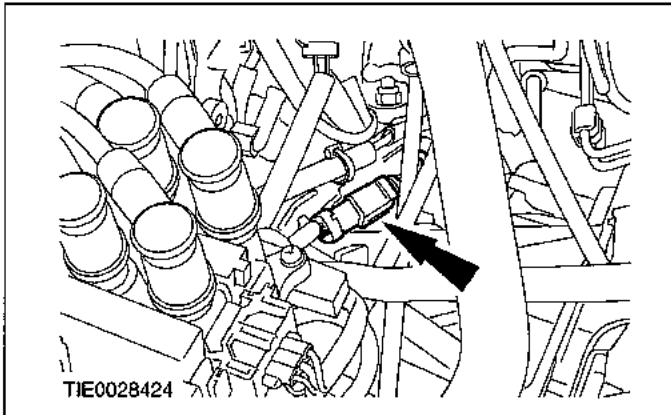


**12. Attach the power steering line bracket to the cylinder head.**

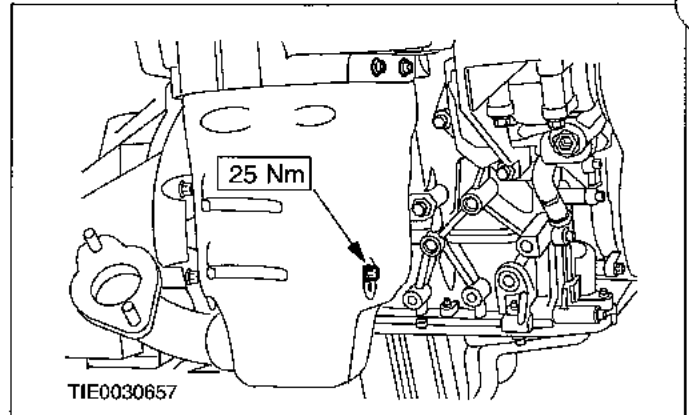


**IN-VEHICLE REPAIR**

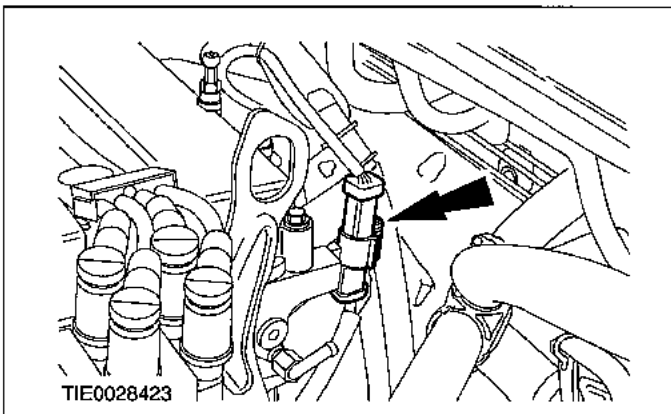
13. Connect the catalyst monitor sensor electrical connector.



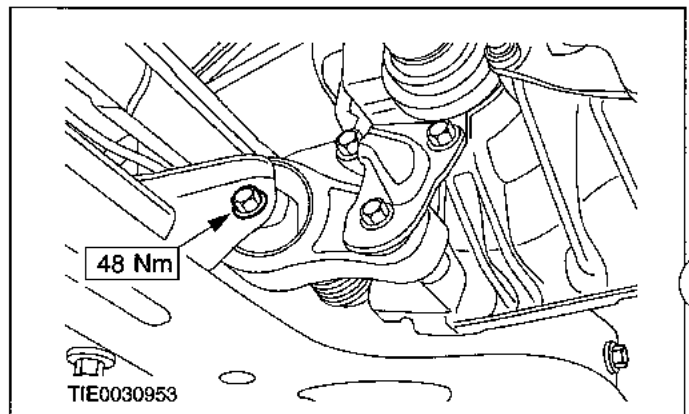
17. Install the exhaust manifold lower heat shield left-hand retaining bolts.



14. Connect the heated oxygen (HO2S) sensor electrical connector.



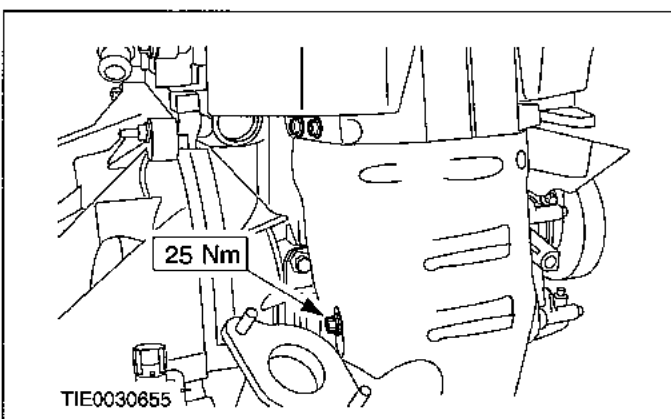
18. Install the engine support insulator retaining bolt.



15. Raise and support the vehicle.

For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

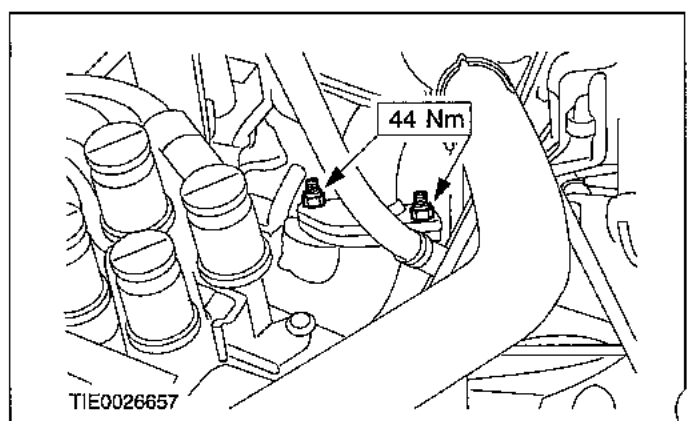
16. Position the exhaust manifold lower heat shield and install the right-hand retaining bolt.



19. Attach the exhaust system insulators to the exhaust brackets.

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

Attach the exhaust flexible pipe to the catalytic converter.



21. Remove the exhaust flexible pipe support wrap or splint.

**IN-VEHICLE REPAIR**

22. Lower the vehicle.

23. Install the air cleaner.

For additional information, refer to: Air Cleaner - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

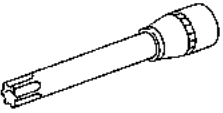

24. Connect the battery ground cable.

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

## IN-VEHICLE REPAIR

## Cylinder Head(21 163 0)

## Special Tool(s)

 <p>21167</p>	<p>Socket, Cylinder Head Bolts 303-392 (21-167)</p>
 <p>24003</p>	<p>Remover/Installer, Hose Clamp 303-397 (24-003)</p>

## Materials

Name	Specification
Engine oil	WSS-M2C912-A1

## Removal

## 1. Release the fuel system pressure.

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

## 2. Drain the cooling system.

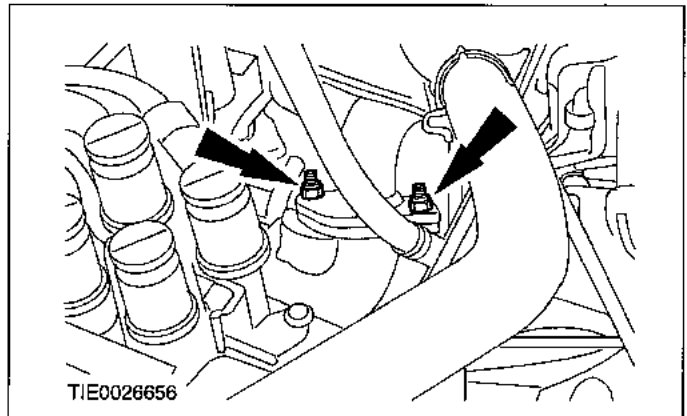
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 1.4L Duratorq-TDCi (DV) Diesel, General Procedures).

## 3. Remove the camshaft.

For additional information, refer to: Camshafts (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).

## 4. Detach the exhaust flexible pipe from the catalytic converter.

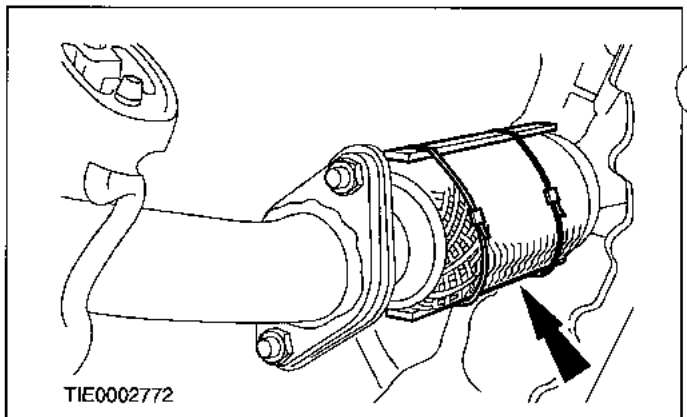
- Discard the gasket and the nuts.



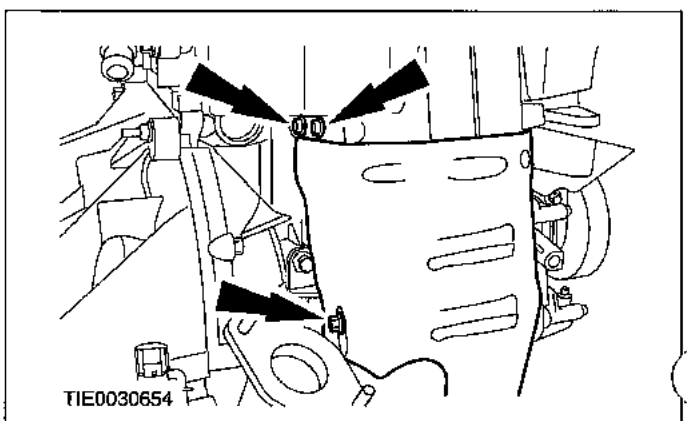
## 5. Raise and support the vehicle.

For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

## 6. Using a suitable splint or wrap support the exhaust flexible pipe.



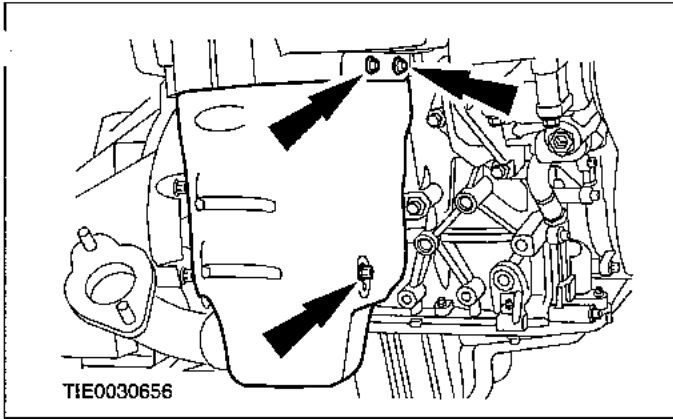
## 7. Remove the exhaust manifold lower heat shield left-hand retaining bolts.



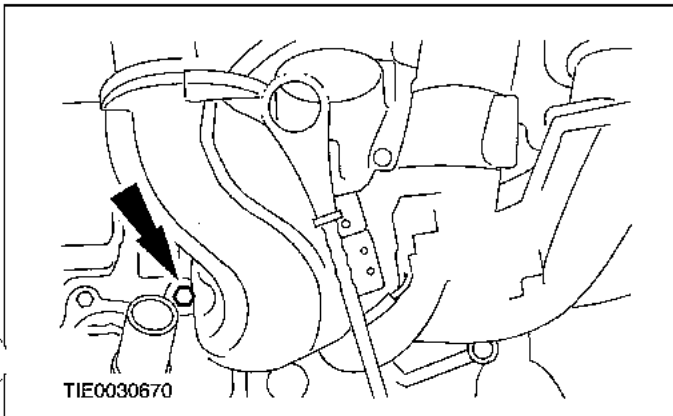
## 8. Remove the exhaust manifold lower heat shield right-hand retaining bolts.

**IN-VEHICLE REPAIR**

- Remove the lower heat shield.

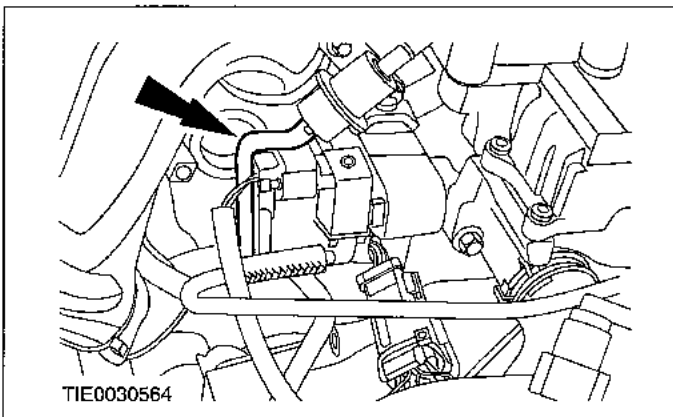


9. Remove the intake manifold retaining bolt.

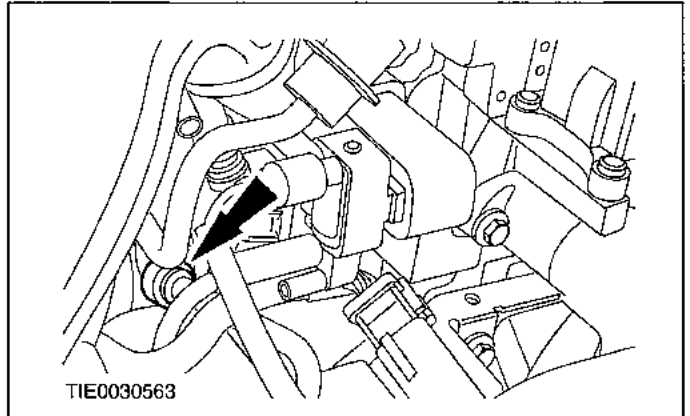


10. Lower the vehicle.

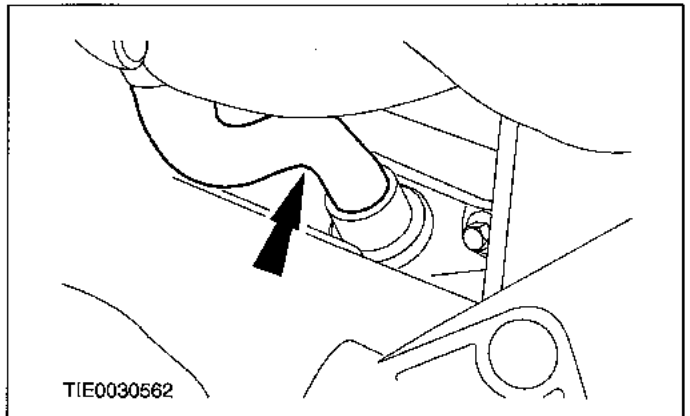
11. Disconnect the vacuum hose from the fuel pressure regulator.



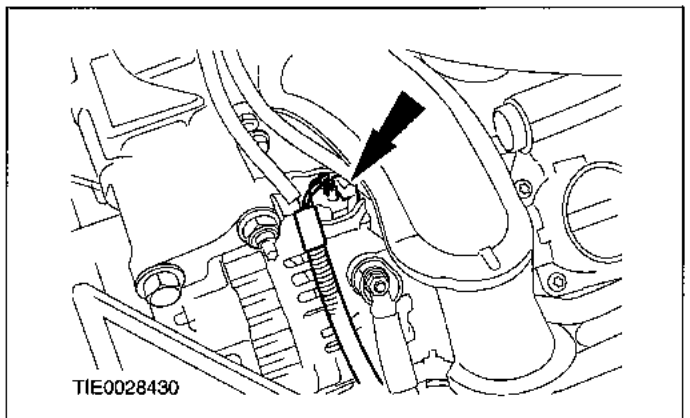
12. Disconnect the brake booster vacuum line from the intake manifold.



13. Disconnect the positive crankcase ventilation (PCV) hose from the PCV.

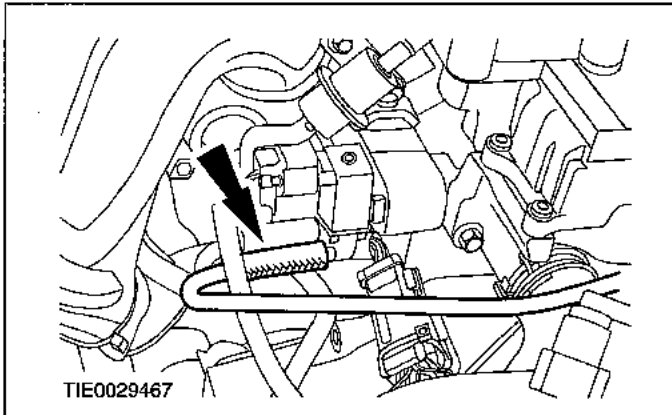


14. Disconnect the generator electrical connector.

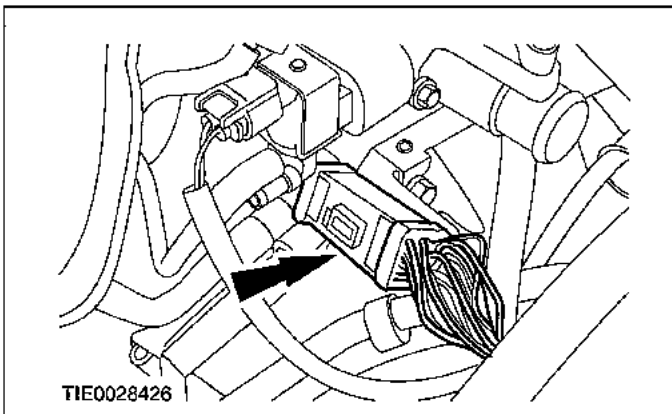


### IN-VEHICLE REPAIR

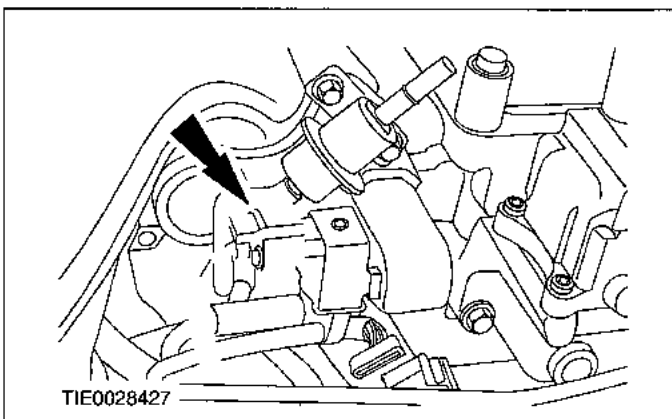
15. Disconnect the evaporative emissions (EVAP) hose from the EVAP valve.



16. Disconnect the engine wiring harness electrical connector.

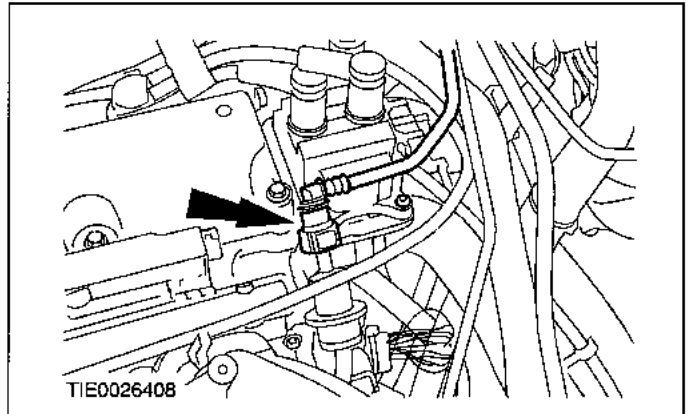


17. Disconnect the EVAP valve electrical connector.



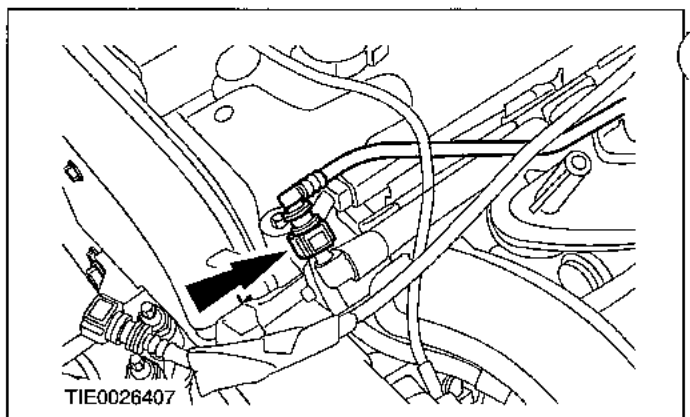
18. Disconnect the fuel supply line quick release coupling.

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

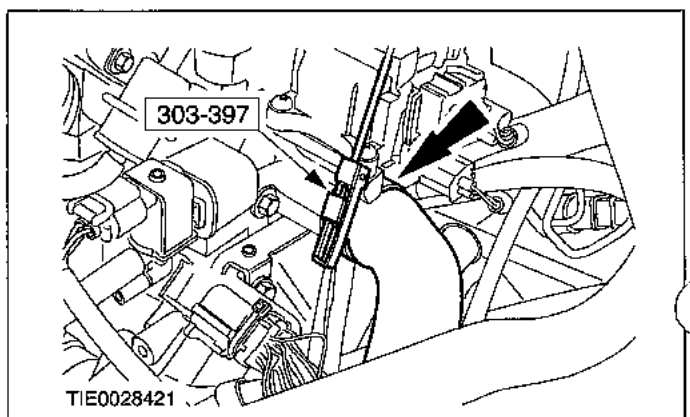


19. Disconnect the fuel return line quick release coupling.

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



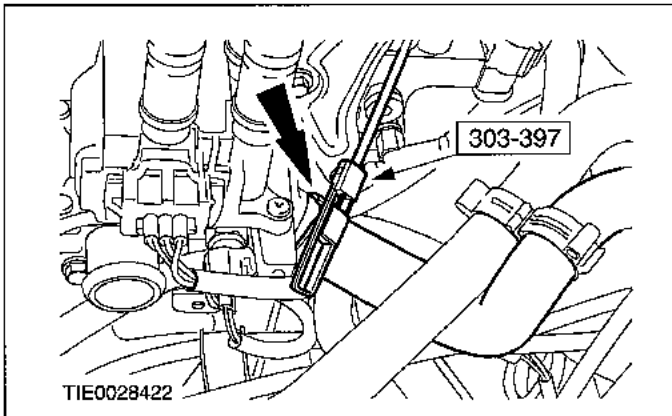
20. Using the special tool, disconnect the coolant hose from the coolant distribution assembly.



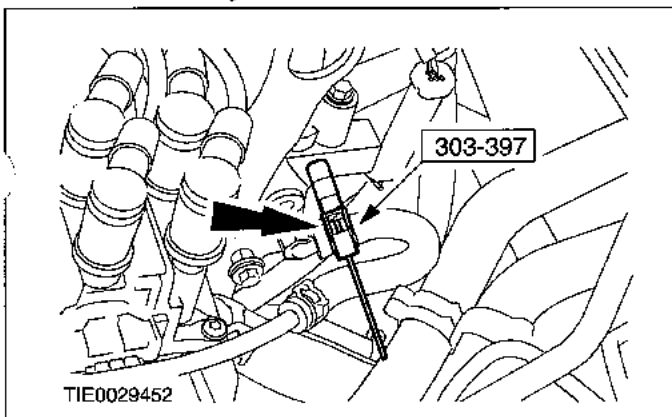


**IN-VEHICLE REPAIR**

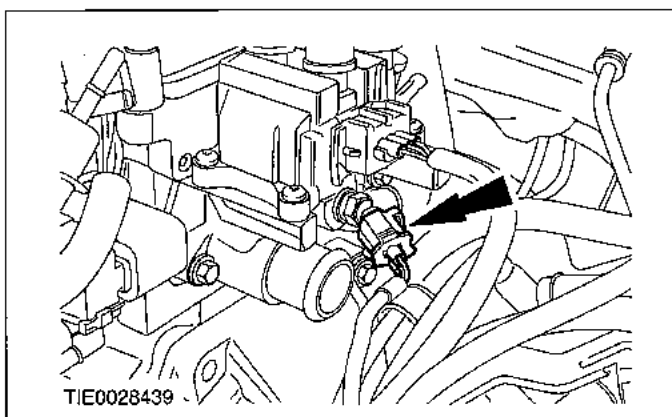
21. Using the special tool, disconnect the coolant hose from the coolant distribution assembly.



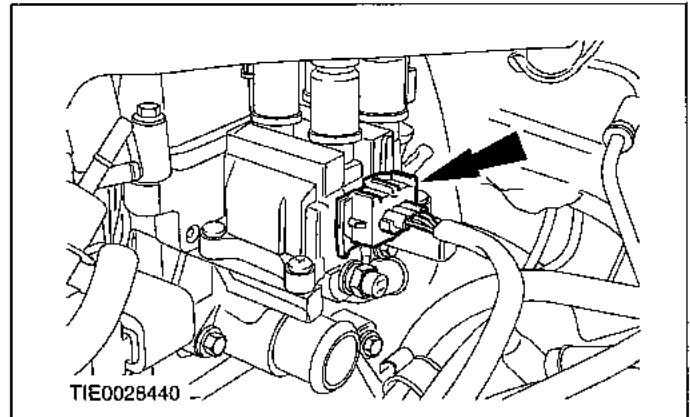
22. Using the special tool, detach the degas hose from the cylinder head.
- Using the special tool, detach the degas hose from the cylinder head.



23. Disconnect the engine coolant temperature (ECT) electrical connector.

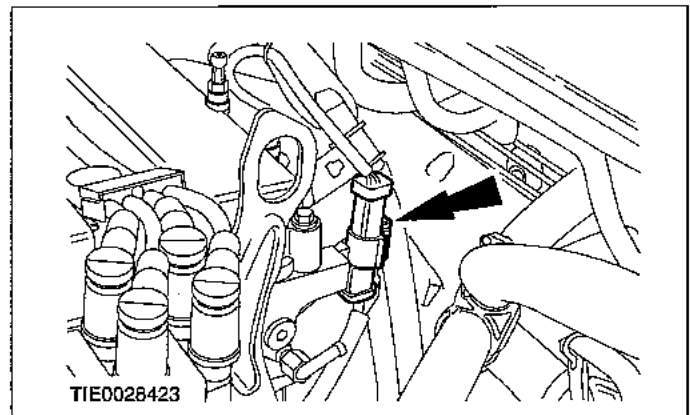


24. Disconnect the electronic ignition (EI) coil electrical connector.

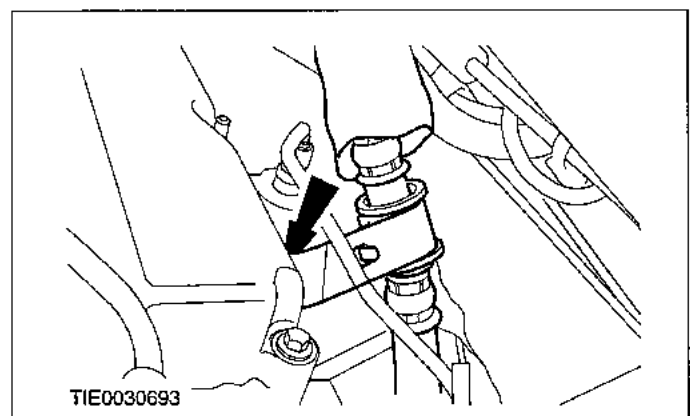


25. Disconnect the heated oxygen (HO2S) sensor electrical connector.

- Detach the electrical connector from the bracket.

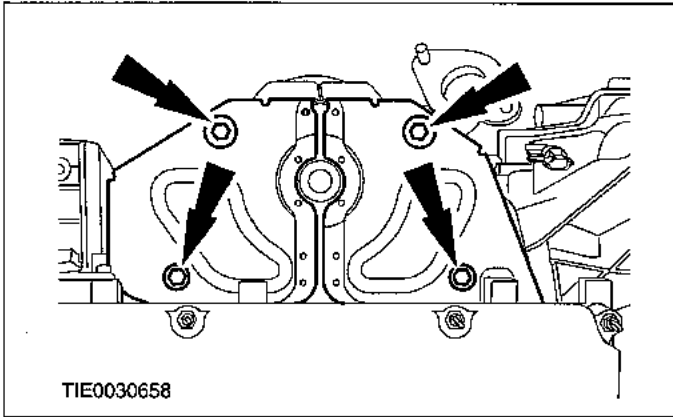


26. Detach the power steering line bracket from the cylinder head.

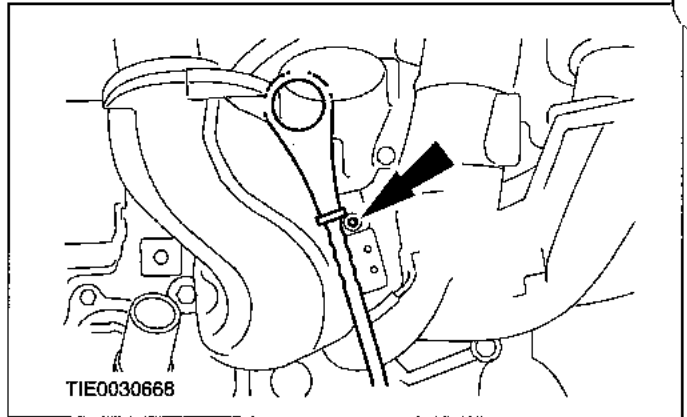


**IN-VEHICLE REPAIR**

**27. Remove the exhaust manifold upper heat shield**

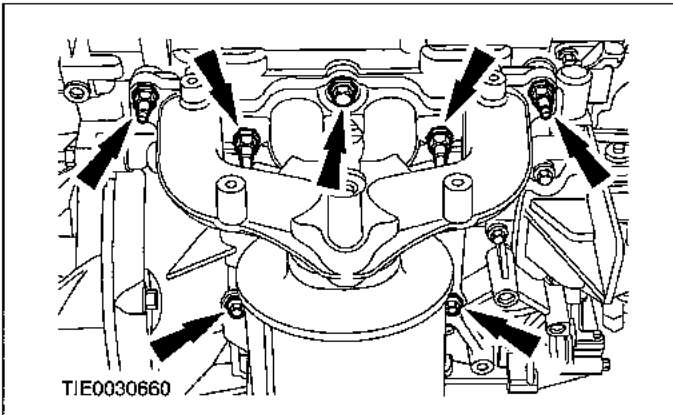


**30. Detach the oil level indicator tube from the intake manifold.**



**28. Detach the exhaust manifold and position it to one side.**

- Discard the nuts and the exhaust manifold gasket.



**31. CAUTIONS:**

⚠ The cylinder head must have cooled to below 30°C before removal.

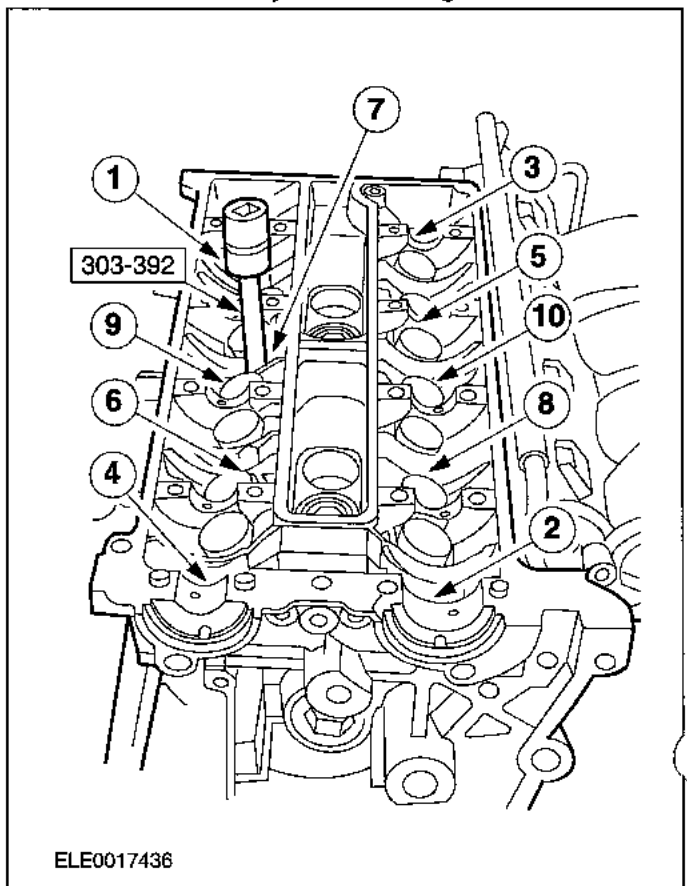
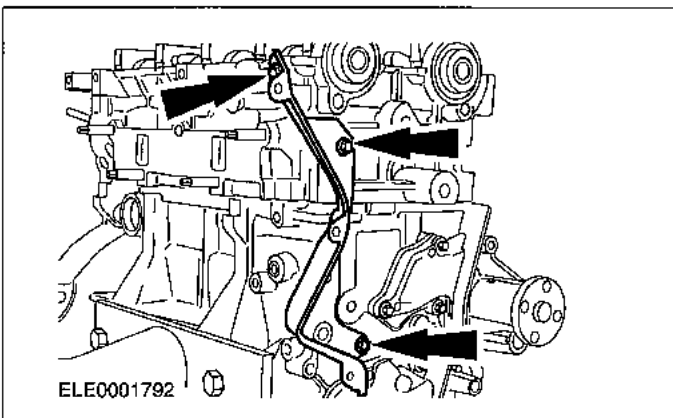
⚠ Position the cylinder head on a soft surface.

⚠ Remove the cylinder head bolts in the sequence shown.

Using the special tool, remove the cylinder head bolts.

- Discard the cylinder head gasket.

**29. Remove the timing belt rear cover (engine shown removed for clarity).**



## IN-VEHICLE REPAIR

## Installation

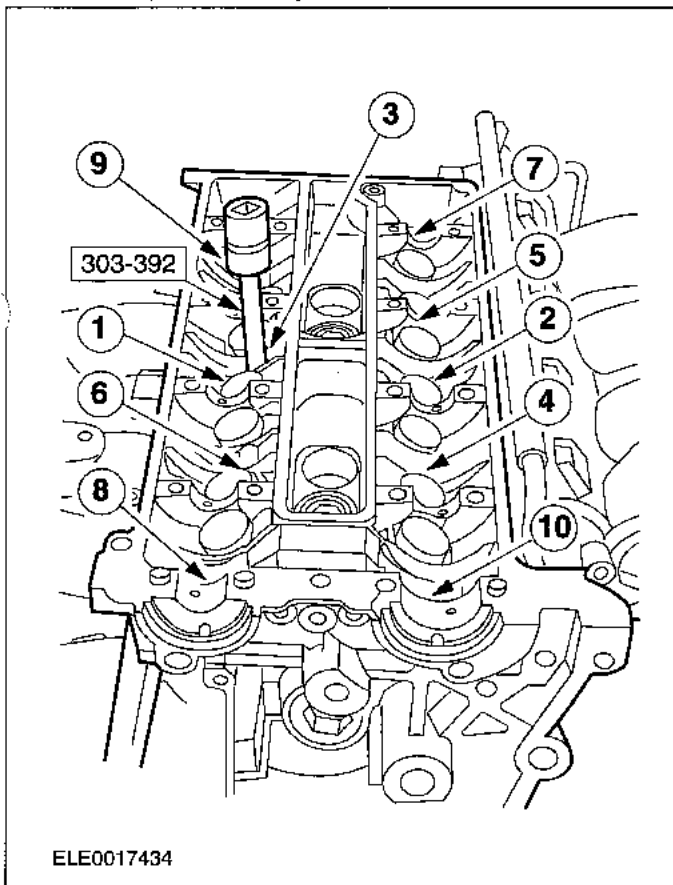
1. **CAUTION:** The thickness of the new cylinder head gasket must be the same as that of the old one (hole marked).

**NOTE:** Install a new cylinder head gasket.

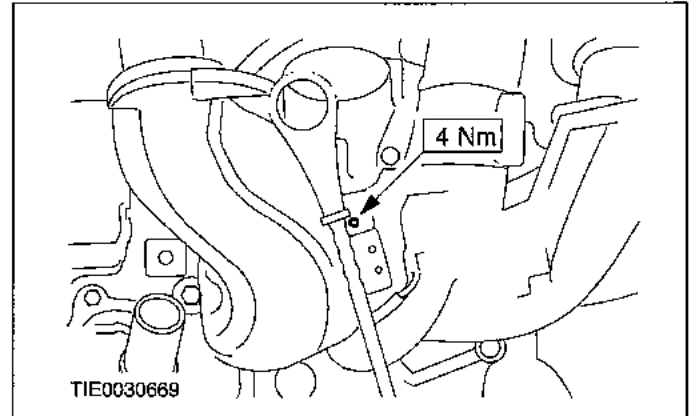
**NOTE:** Position the cylinder head into the two guide sleeves.

Using the special tool, install the cylinder head.

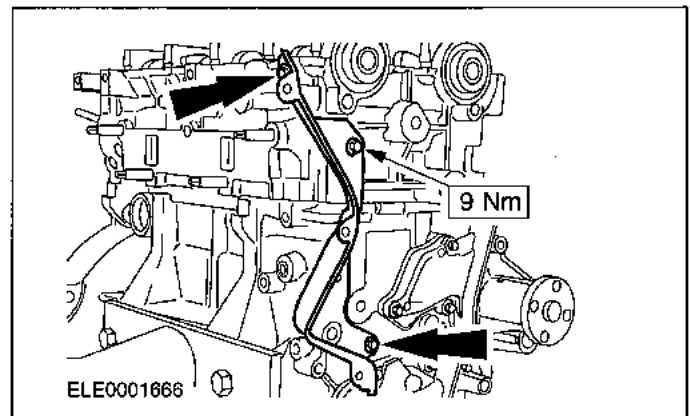
- Tighten the cylinder head bolts in the sequence shown in three stages.
- Stage 1: 15 Nm.
- Stage 2: 30 Nm.
- Stage 3: 90 degrees.



2. Attach the oil level indicator tube to the intake manifold.



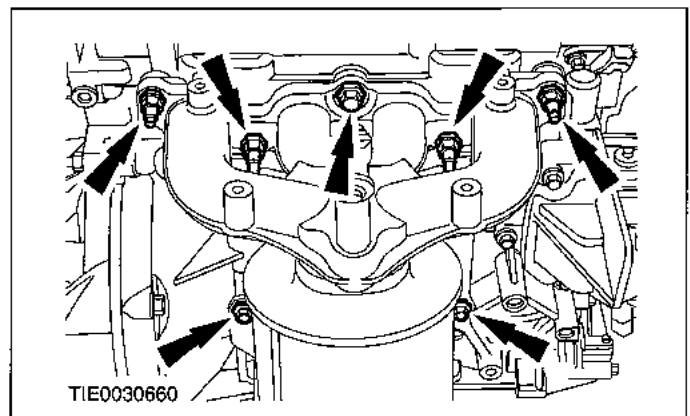
3. Install the timing belt rear cover (engine shown removed for clarity).



4. **NOTE:** Install a new exhaust manifold gasket and new exhaust manifold retaining nuts.

**NOTE:** Do not fully tighten the nuts and bolt at this stage.

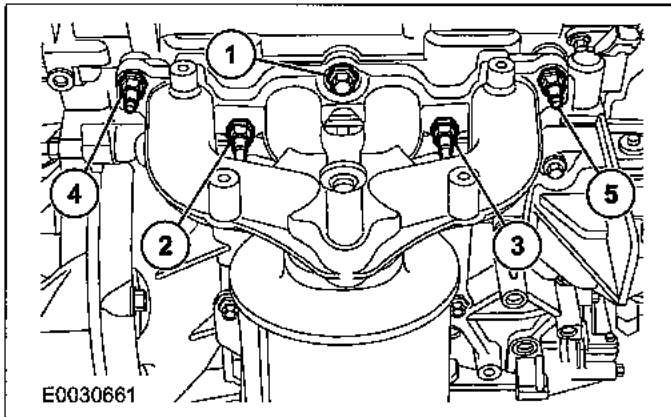
Install the exhaust manifold.



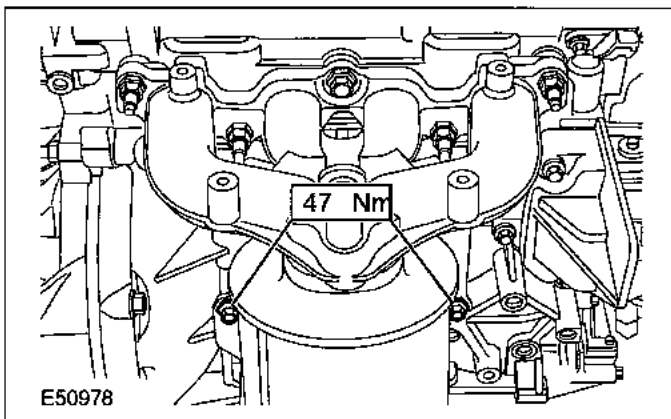
5. Tighten the exhaust manifold upper retaining nuts and bolt in the sequence shown in two stages.

**IN-VEHICLE REPAIR**

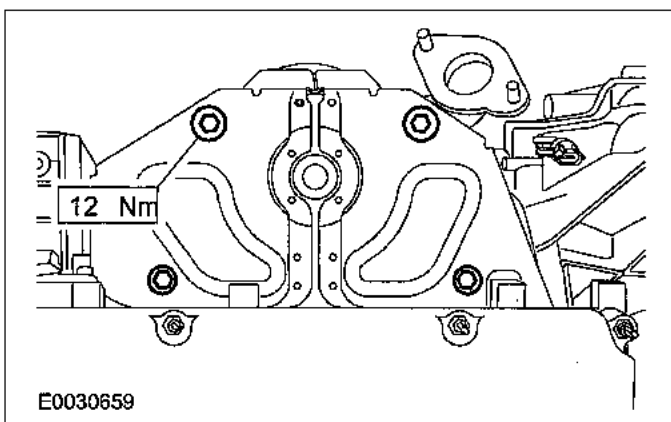
- Stage 1: 20 Nm.
- Stage 2: 55 Nm.



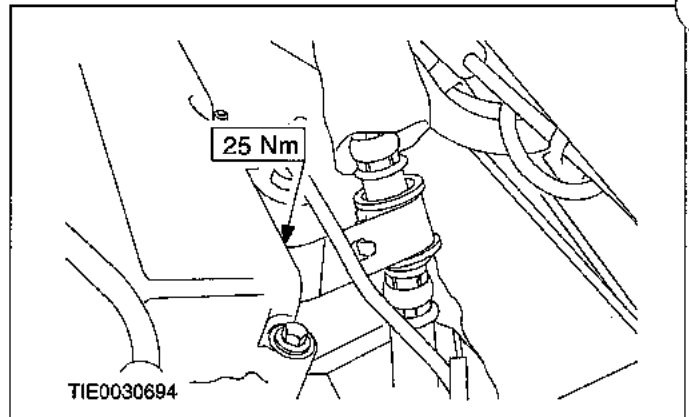
- 6. Tighten the exhaust manifold lower retaining bolts.**



- 7. Install the exhaust manifold upper heat shield.**

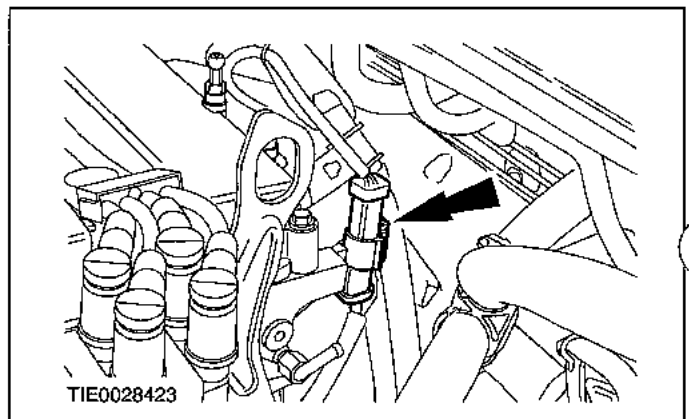


- 8. Attach the power steering line bracket to the cylinder head.**

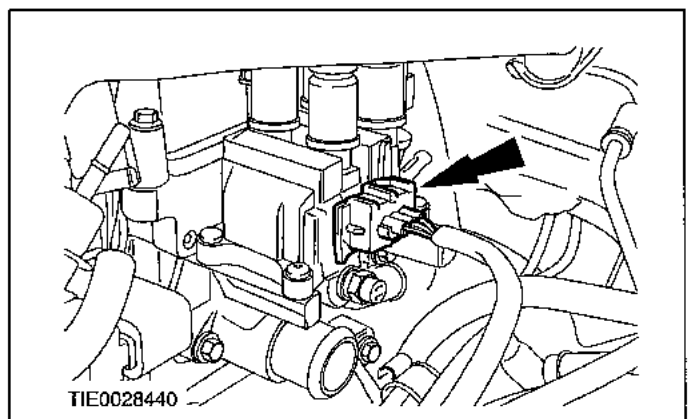


- 9. Connect the heated oxygen (HO2S) sensor electrical connector.**

- Attach the electrical connector to the bracket.

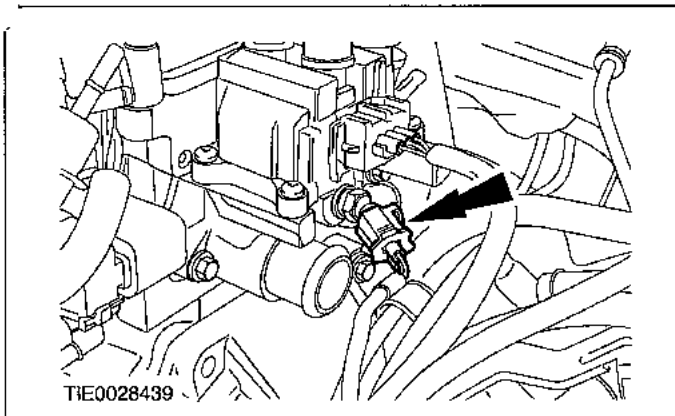


- 10. Connect the electronic ignition (EI) coil electrical connector.**

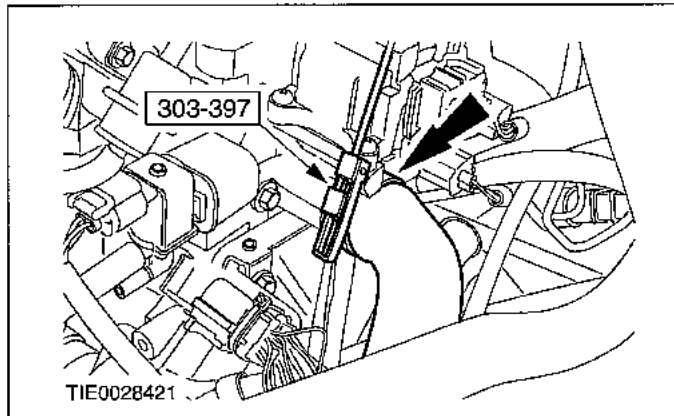


**IN-VEHICLE REPAIR**

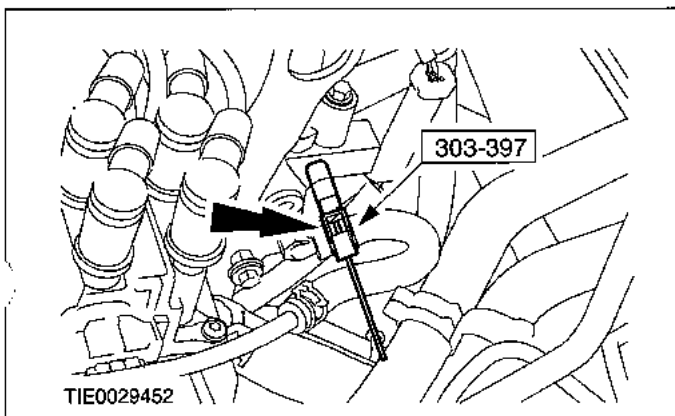
11. Connect the engine coolant temperature (ECT) sensor electrical connector.



14. Using the special tool, connect the coolant hose to the coolant distribution assembly.

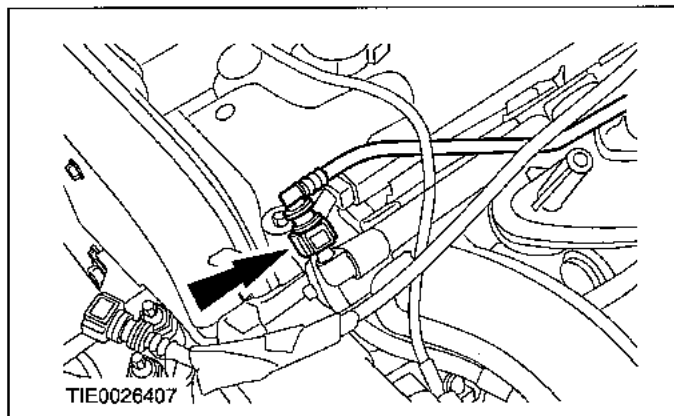


12. Using the special tool, connect the degas hose to the cylinder head.

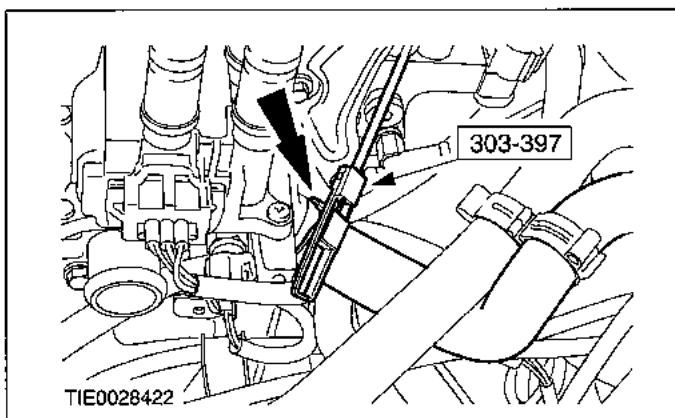


15. Connect the fuel return line quick release coupling.

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

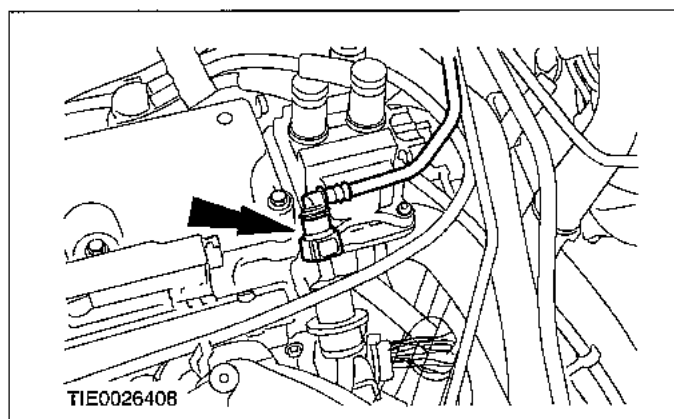


13. Using the special tool, connect the coolant hose to the coolant distribution assembly.



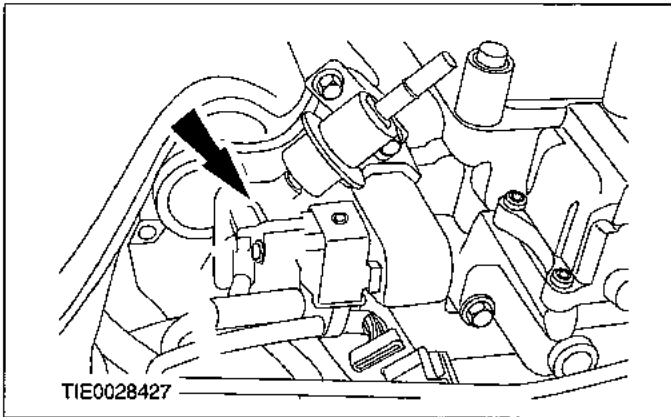
16. Connect the fuel supply line quick release coupling.

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

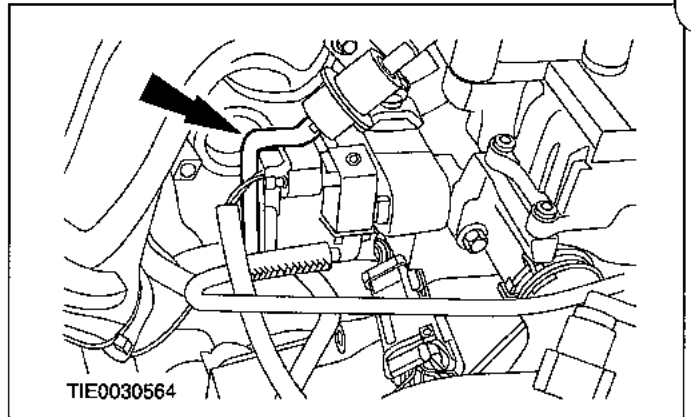


**IN-VEHICLE REPAIR**

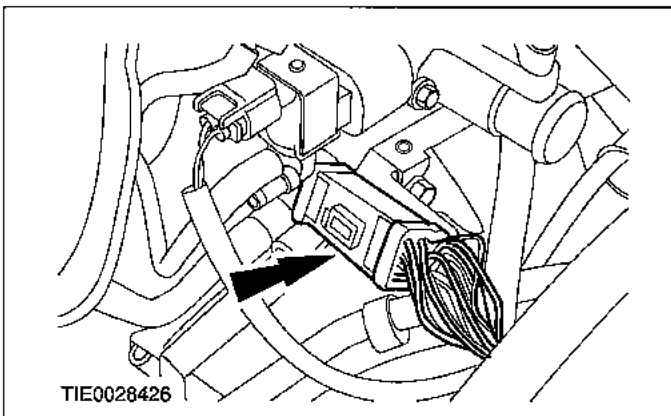
**17. Connect the evaporate emission (EVAP) valve electrical connector.**



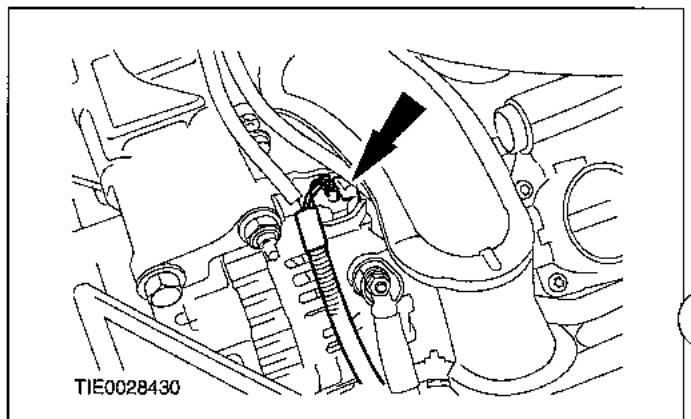
**20. Connect the vacuum hose to the fuel pressure regulator.**



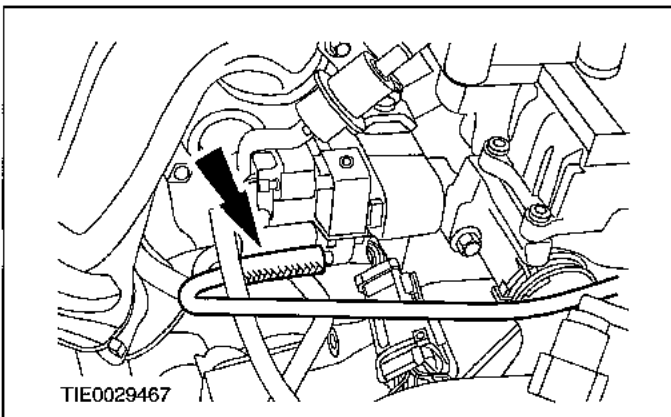
**18. Connect the engine wiring harness electrical connector.**



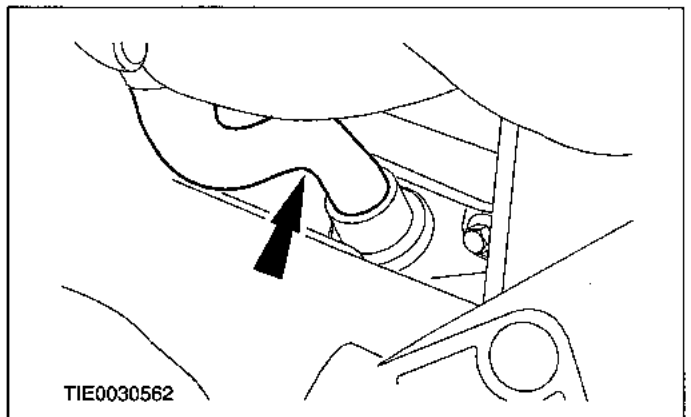
**21. Connect the generator electrical connector.**



**19. Connect the EVAP hose to the EVAP valve.**

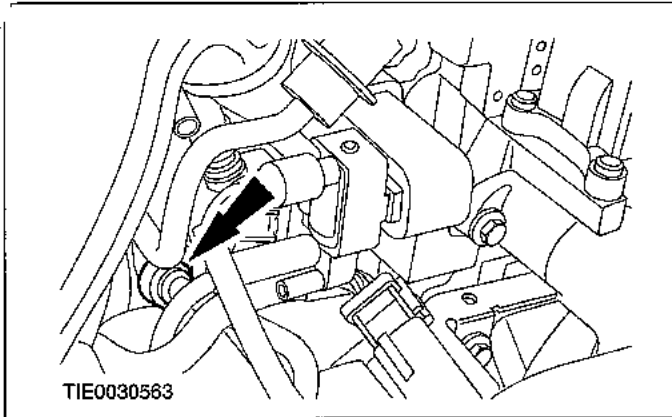


**22. Connect the positive crankcase ventilation (PCV) hose to the PCV.**

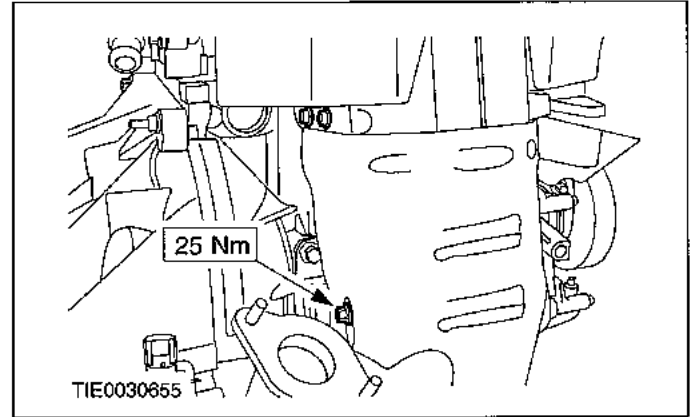


## IN-VEHICLE REPAIR

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



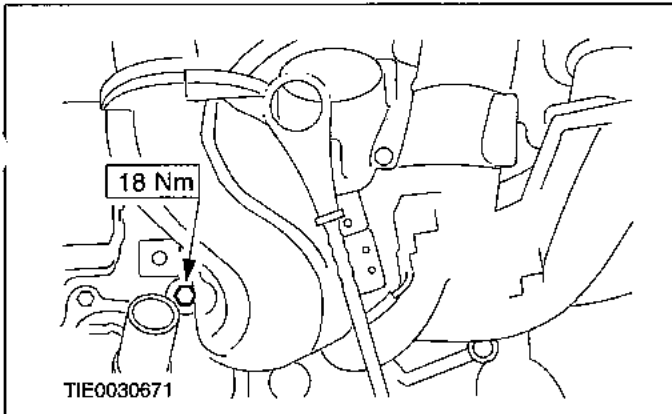
27. Install the exhaust manifold lower heat shield left-hand retaining bolts.



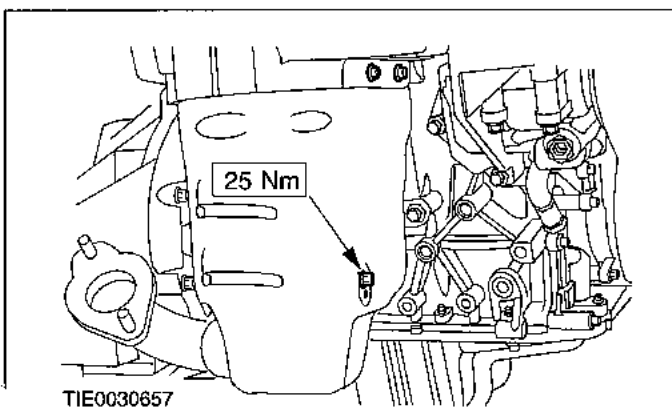
24. Raise and support the vehicle.

For additional information, refer to: **Lifting (100-02 Jacking and Lifting, Description and Operation).**

25. Install the intake manifold retaining bolt.

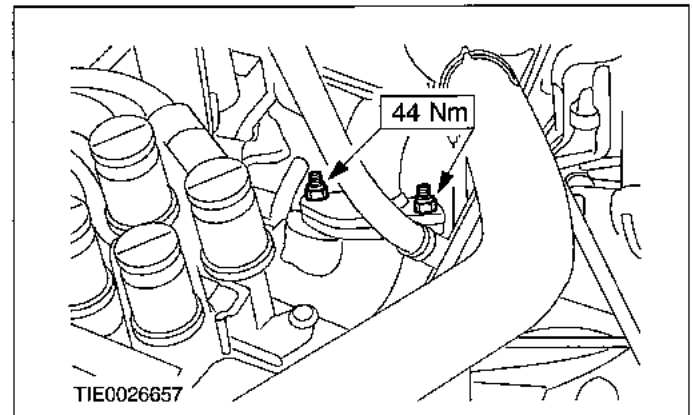


26. Position the exhaust manifold lower heat shield and install the right-hand retaining bolts.



28. **NOTE:** Install a new flexible pipe gasket and new nuts.

Attach the flexible pipe to the catalytic converter



29. Remove the exhaust flexible pipe support.

30. Install the camshaft.

For additional information, refer to: **Camshafts (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), In-vehicle Repair).**

31. **NOTE:** Install a new oil filter.

Change the engine oil.

32. Fill and bleed the cooling system.

For additional information, refer to: **Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 1.4L Duratorq-TDCi (DV) Diesel, General Procedures).**

**IN-VEHICLE REPAIR**

**Oil Pan(21 154 0)**

**Special Tool(s)**

<p>15011</p>	<p>Slide Hammer 205-047 (15-011)</p>
<p>21227</p>	<p>Adapter for 205-047 303-633 (21-227)</p>

**General Equipment**

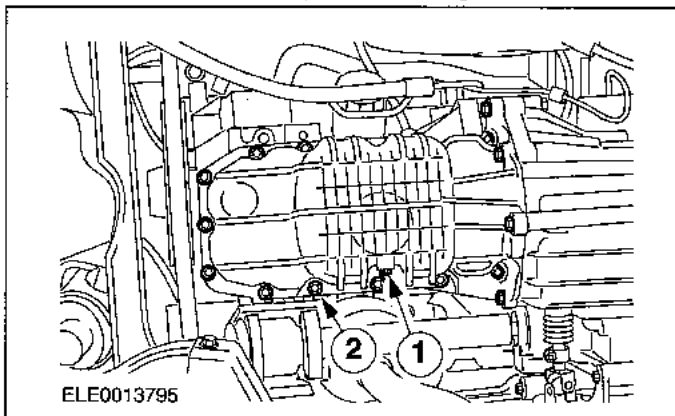
Five M8 x 20 mm studs

**Materials**

Name	Specification
Engine oil	WSS-M2C912-A1
Loctite 7070	
Sealant	WSE-M4G323-A4

**Removal**

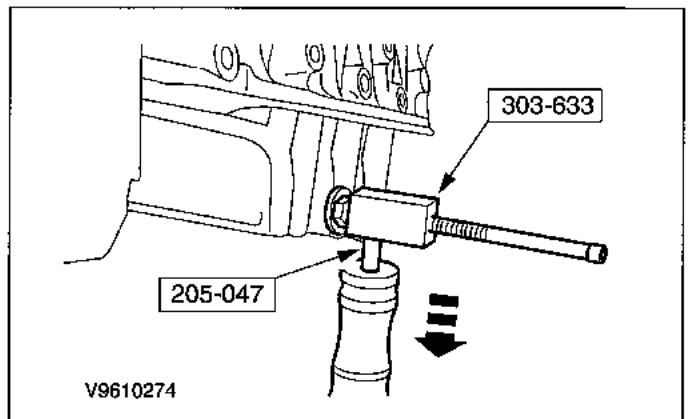
- 1. Raise and support the vehicle. For additional information, refer to Section 100-02 [Jacking and Lifting].**
- 2. Drain the engine and remove the oil pan retaining bolts.**
  1. Remove the oil drain plug.
  2. Remove the oil pan retaining bolts.



- 3. ⚠ CAUTION:** In order to prevent damage to the sealing surfaces, only use the designated special tool to remove the oil pan. Do not use a chisel or a screwdriver for removal.

**NOTE:** Tighten the lock nut against the oil pan and use several taps to release the oil pan from the cylinder block.

Using the special tool, remove the oil pan.



**Installation**

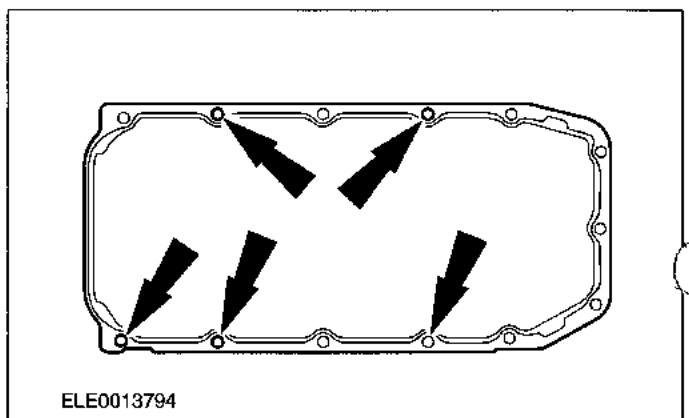
**1. CAUTIONS:**

⚠ The oil pump gasket projects over the cylinder block sealing surface and must not be damaged.

⚠ Do not damage the rubber sealing surface of the crankshaft rear oil seal carrier.

Using Loctite 7070, clean the engine cylinder block and oil pan mating faces.

- 2. ⚠ CAUTION:** The crankcase may be damaged if sealant enters the blind holes. Install five M8 x 20 mm studs into the blind holes where shown.

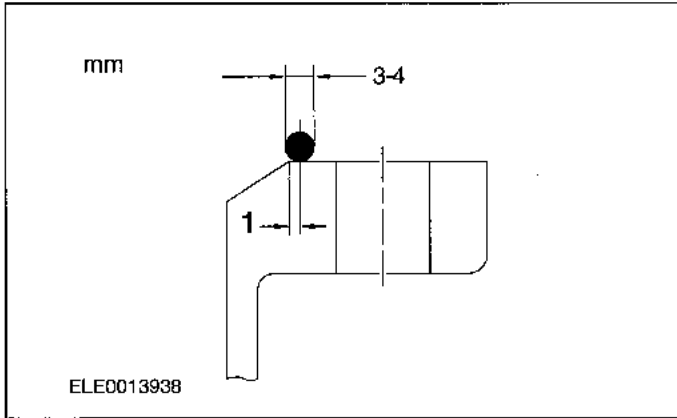




**IN-VEHICLE REPAIR**

**3. NOTE:**Install the oil pan within ten minutes of applying sealant and tighten the bolts within a further 5 minutes.

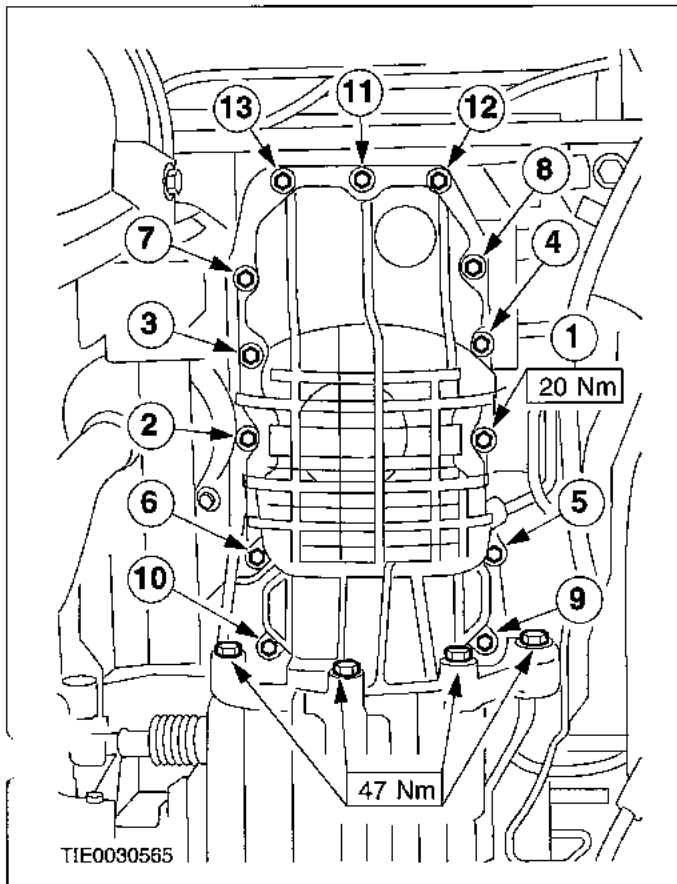
Apply a 3-4 mm diameter bead of sealant to the oil pan flange.



**4. NOTE:**Align the oil pan flush with the cylinder block at the transaxle end.

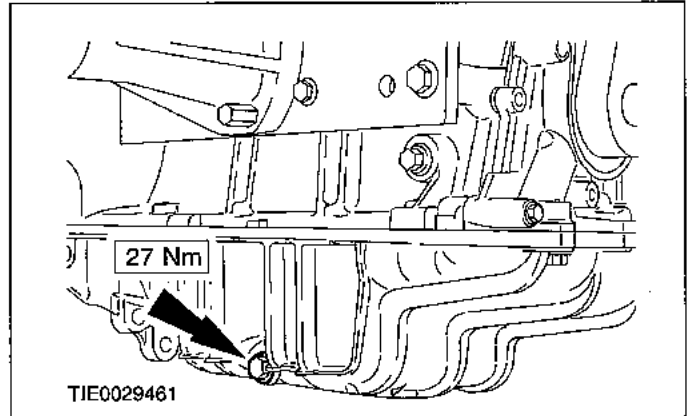
**Install the oil pan.**

- Tighten the oil pan retaining bolts in the sequence shown in two stages.
- Stage 1: 10 Nm.
- Stage 2: 20 Nm.
- Remove the studs and install retaining bolts.



**5. NOTE:**Check the oil drain plug seal for damage and install a new drain plug if necessary.

Install the oil drain plug.

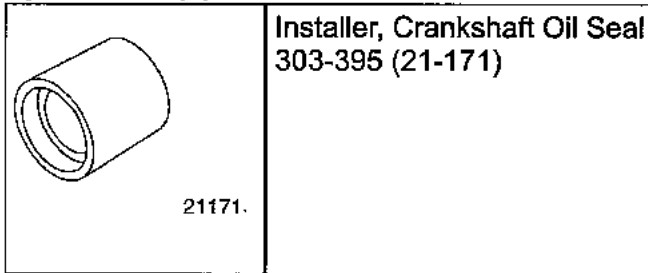


**6. Fill the engine with engine oil.**

## IN-VEHICLE REPAIR

## Oil Pump(21 714 0)

## Special Tool(s)

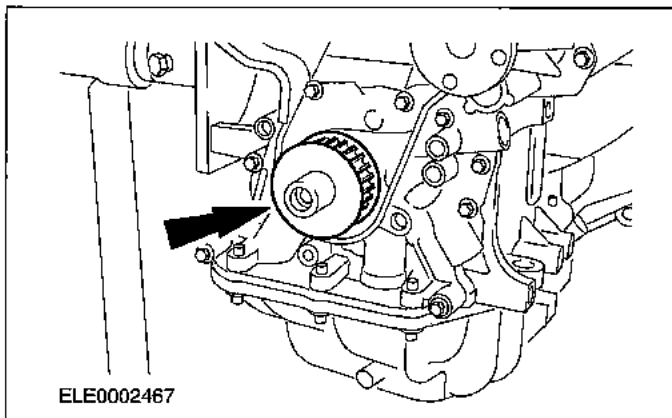


## Removal

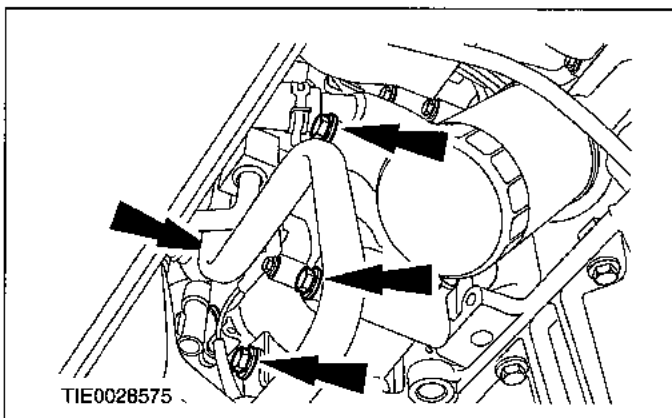
## 1. Remove the timing belt.

For additional information, refer to Timing Belt in this section.

## 2. Remove the crankshaft timing belt pulley.



## 3. Detach the air conditioning (A/C) compressor from the cylinder block and position it to one side.

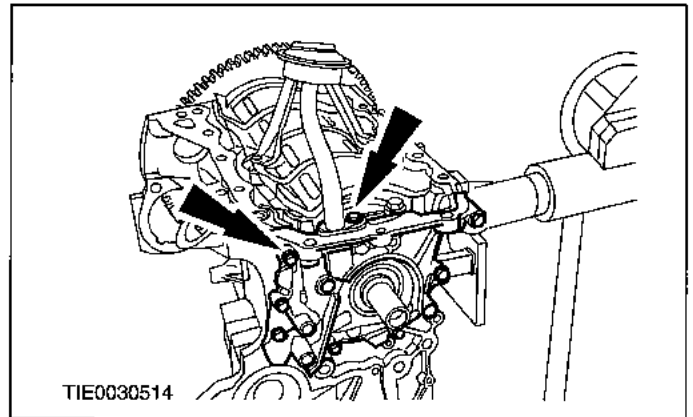


## 4. Remove the oil pan.

For additional information, refer to Oil Pan in this section.

## 5. Detach the oil pick-up tube from the oil pump and remove the oil pump (engine shown removed for clarity).

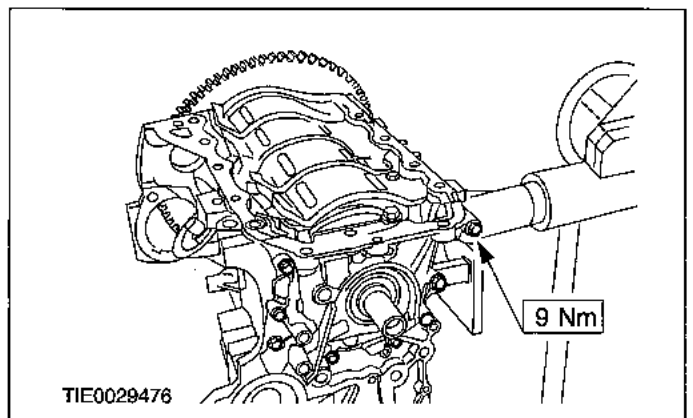
- Discard the gaskets.
- Remove and discard the crankshaft front oil seal.



## Installation

## 1. NOTE: Install a new oil pump gasket.

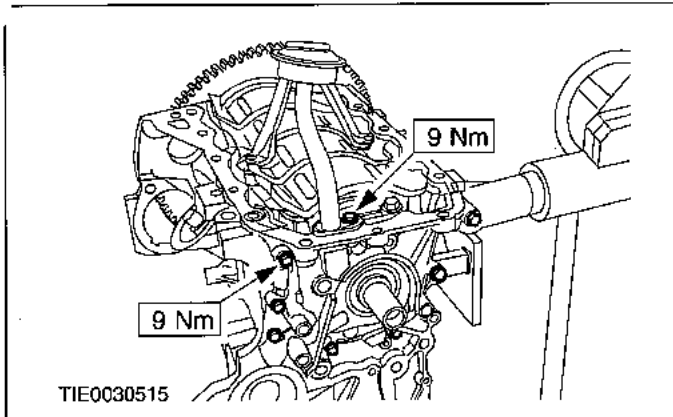
Install the oil pump (engine shown removed for clarity).



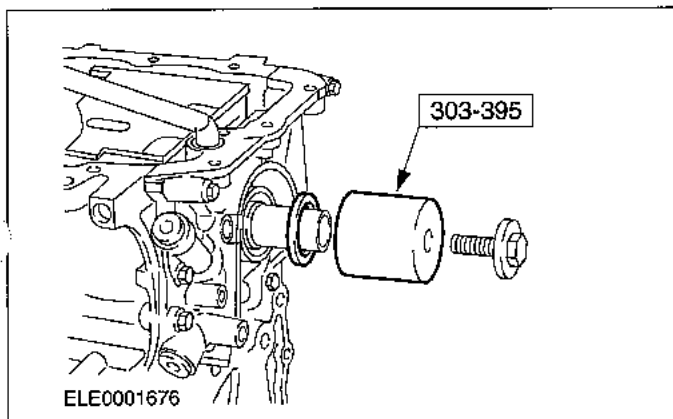
## 2. NOTE: Install a new oil pump intake pipe gasket.

**IN-VEHICLE REPAIR**

Attach the oil pick-up tube to the oil pump (engine shown removed for clarity).



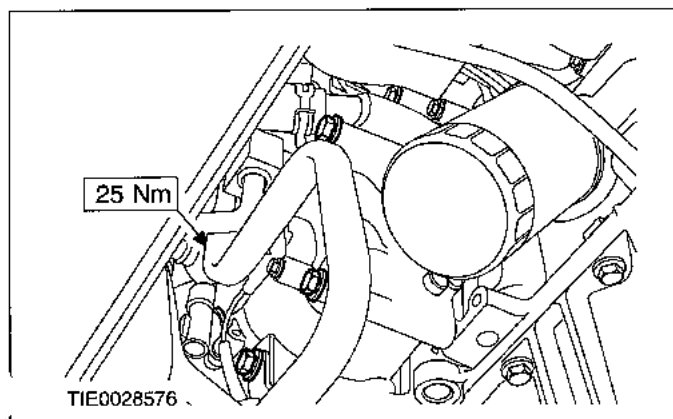
3. **NOTE:** Install a new crankshaft front oil seal. Using the special tool, install the crankshaft front oil seal.



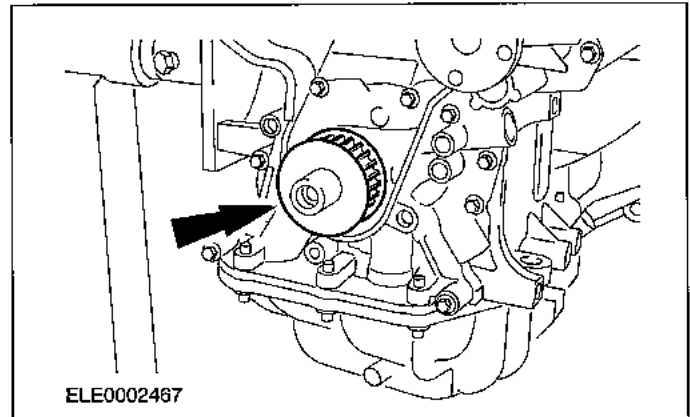
4. Install the oil pan.

For additional information, refer to Oil Pan in this section.

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



6. Install the crankshaft timing belt pulley.



7. Install the timing belt.

For additional information, refer to Timing Belt in this section.

## IN-VEHICLE REPAIR

## Crankshaft Rear Seal(21 468 4)

## Special Tool(s)

<p>21168</p>	<p>Locking Tool, Flywheel 303-393 (21-168)</p>
<p>21540</p>	<p>Gauge, Bolt Angle 303-174 (21-540)</p>

## Removal

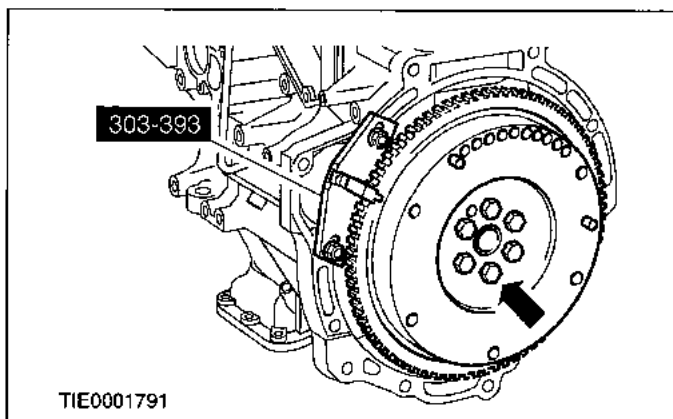
Vehicles with manual transaxle

1. Remove the clutch disc and pressure plate.

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

2. Using the special tool, remove the flywheel.

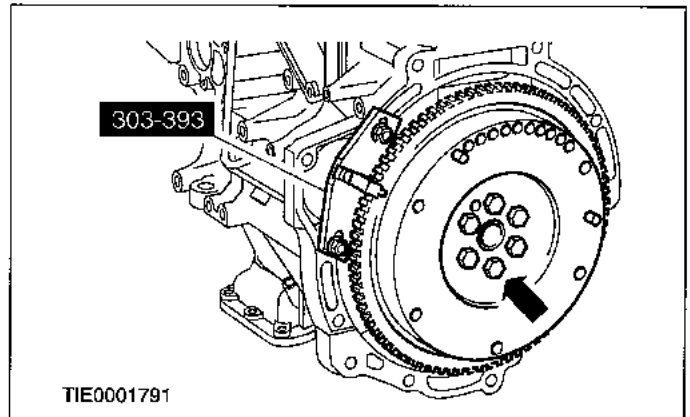
- Discard the bolts.



Vehicles with automatic transaxle

3. Using the special tool, remove the flexplate.

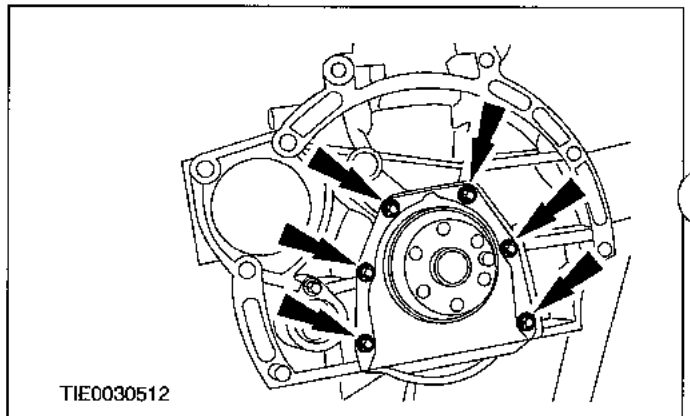
- Discard the bolts.



All vehicles

4. Remove the crankshaft rear oil seal carrier.

- Discard the crankshaft rear oil seal carrier.



## Installation

All vehicles

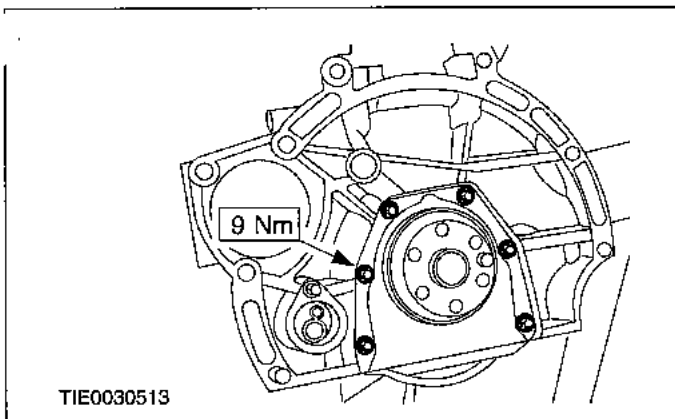
1. Clean the crankshaft journal.
2. **NOTE:** Install a new crankshaft rear oil seal carrier.

**NOTE:** A new crankshaft rear oil seal carrier is supplied with an alignment sleeve which must be removed following installation.

**NOTE:** Do not lubricate the oil seal or crankshaft journal.

**IN-VEHICLE REPAIR**

Install the crankshaft rear oil seal carrier.



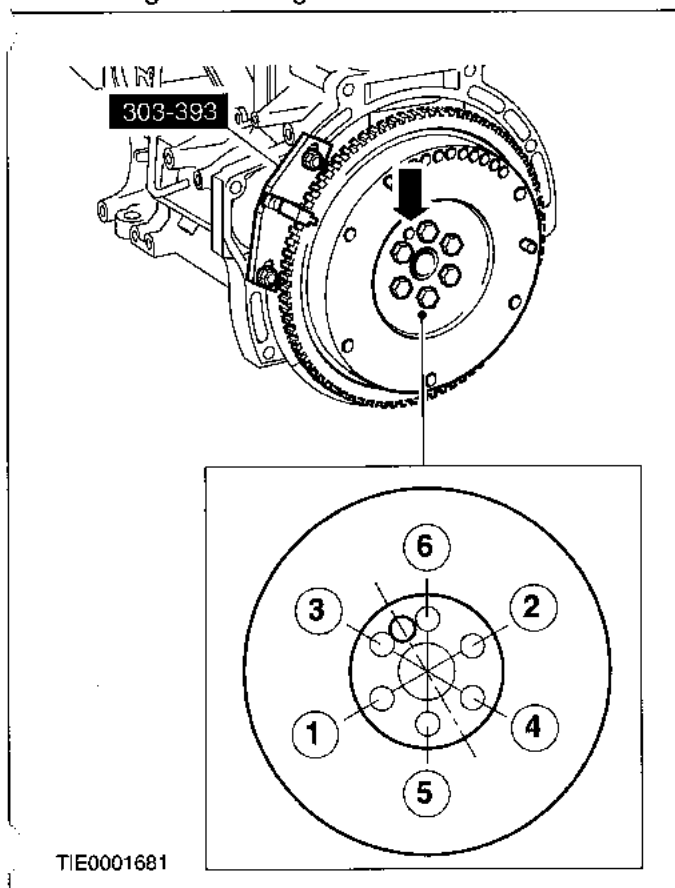
Vehicles with manual transaxle

**3. NOTE:**Position of location stud for the flywheel.

**NOTE:**Install new flywheel retaining bolts.

Using the special tool, install the flywheel.

- Tighten the bolts in the sequence shown in two stages:
- Stage 1: 30 Nm.
- Stage 2: 80 degrees.



**4. Install the clutch disc and pressure plate.**

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

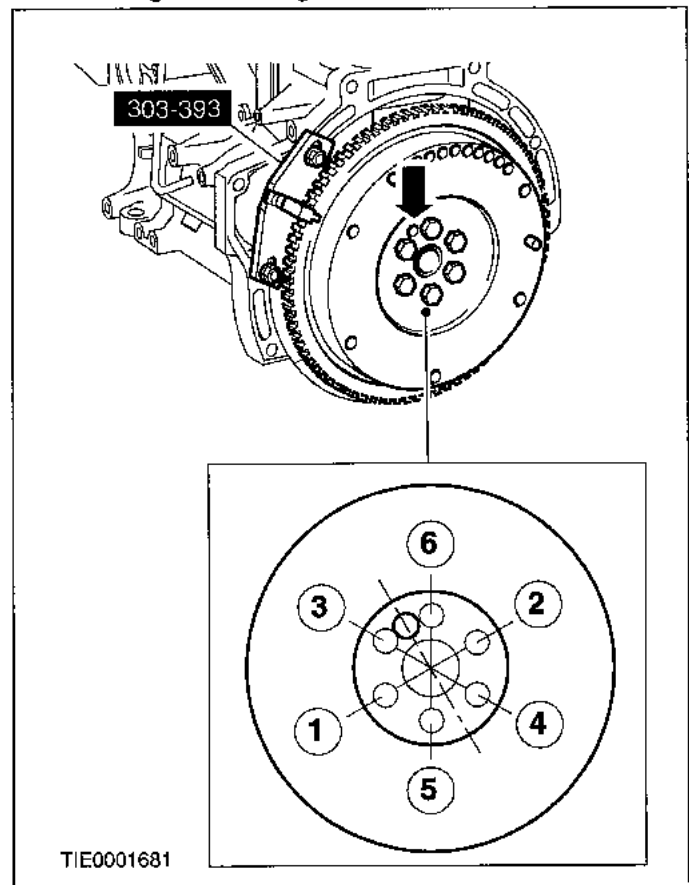
Vehicles with automatic transaxle

**5. NOTE:**Position of location stud for the flexplate.

**NOTE:**Install new flexplate retaining bolts.

Using the special tool, install the flexplate.

- Tighten the bolts in the sequence shown in two stages:
- Stage 1: 30 Nm.
- Stage 2: 80 degrees.

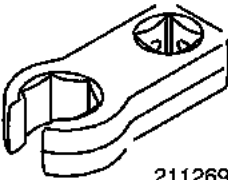
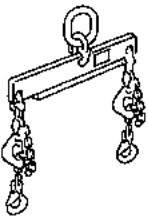
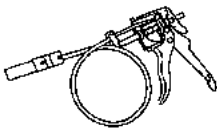
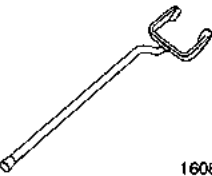


**6. Remove the special tool.**

**REMOVAL**

**Engine**

**Special Tool(s)**

 <p>211269</p>	<p>Wrench, Hydraulic Line Union Nut 211-269 (13-027)</p>
 <p>21068A</p>	<p>Lifting Bracket, Engine 303-122 (21-068A)</p>
 <p>24003</p>	<p>Remover/Installer, Hose Clamp 303-397 (24-003)</p>
 <p>16089</p>	<p>Remover, Halfshaft 308-256 (16-089)</p>

**General Equipment**

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

**Removal**

**All vehicles**

**▲ 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 mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

1. Release the fuel system pressure.

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

2. Remove the air cleaner.

For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 1.4L Duratorq-TDCi (DV) Diesel, General Procedures).

3. Drain the cooling system.

For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 1.4L Duratorq-TDCi (DV) Diesel, General Procedures).

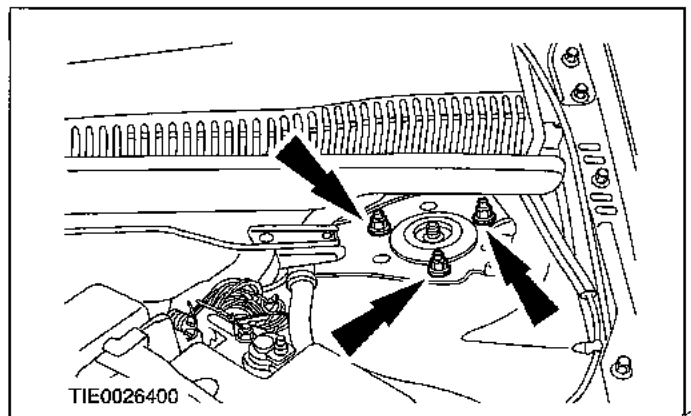
4. Remove the front wheels and tires.

For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

5. Disconnect the powertrain control module (PCM) electrical connector.

For additional information, refer to: Powertrain Control Module (PCM) - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-14 Electronic Engine Controls, Removal and Installation).

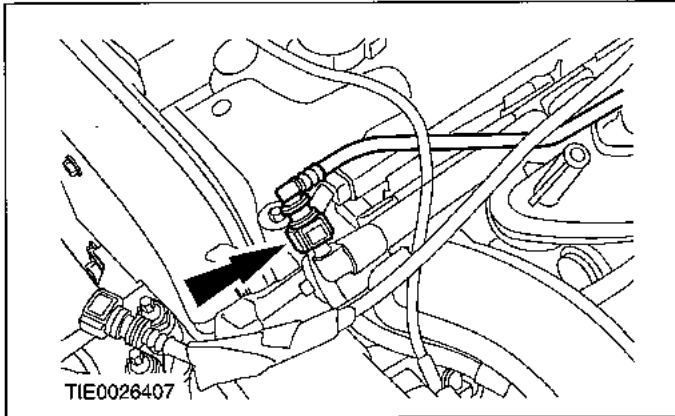
6. Loosen the strut and spring assembly top mount nuts by three turns on both sides.



**REMOVAL**

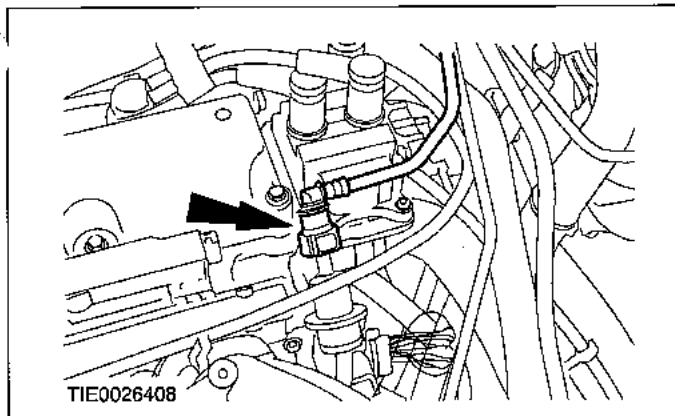
7. Disconnect the fuel return line quick release coupling.

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



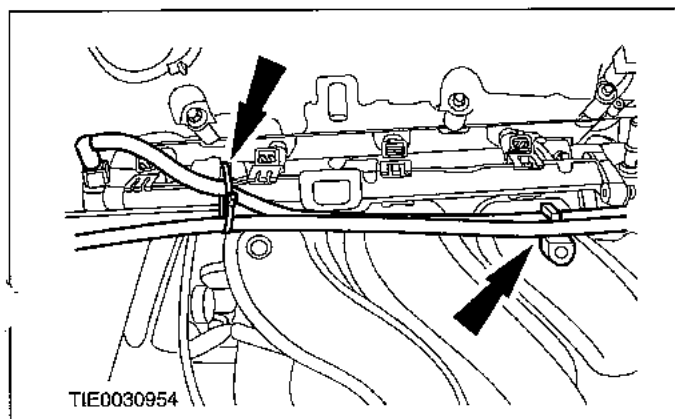
8. Disconnect the fuel supply line quick release coupling.

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

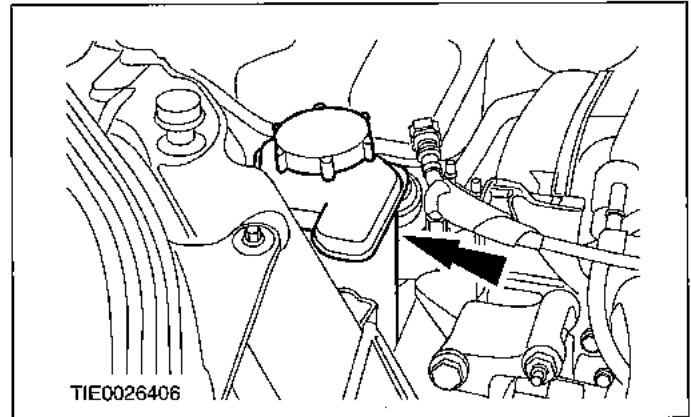


9. Detach the fuel line and the degas line from the intake manifold.

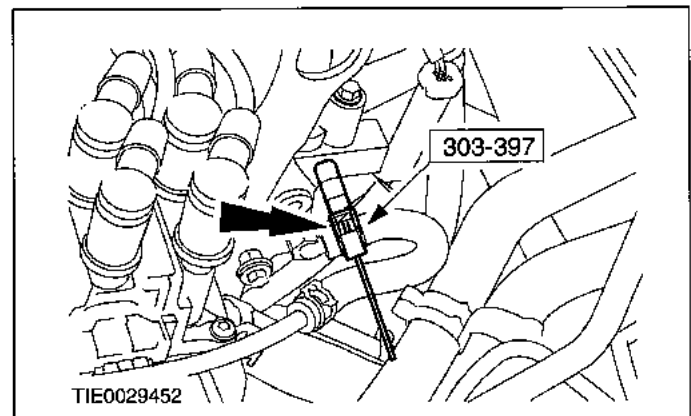
- Remove the cable tie.



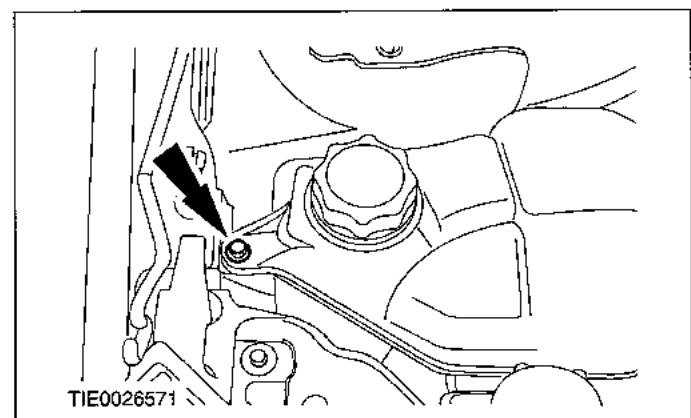
10. Detach the power steering fluid reservoir from the bracket and position it to one side.



11. Using the special tool, disconnect the degas hose from the cylinder head.

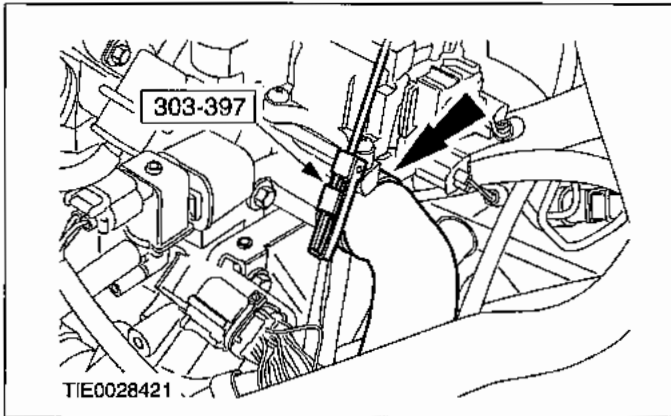


12. Detach the coolant expansion tank from the bracket and position it to one side.

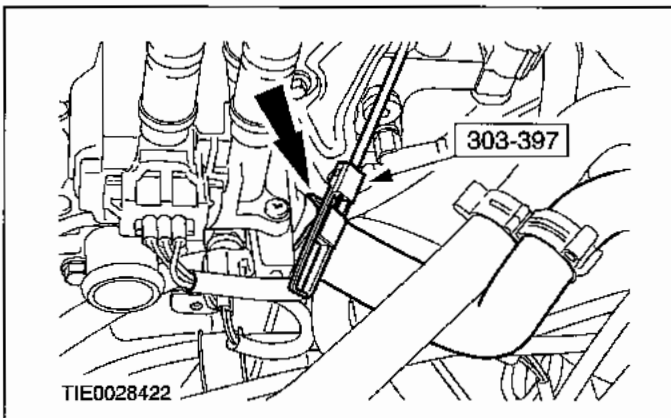


**REMOVAL**

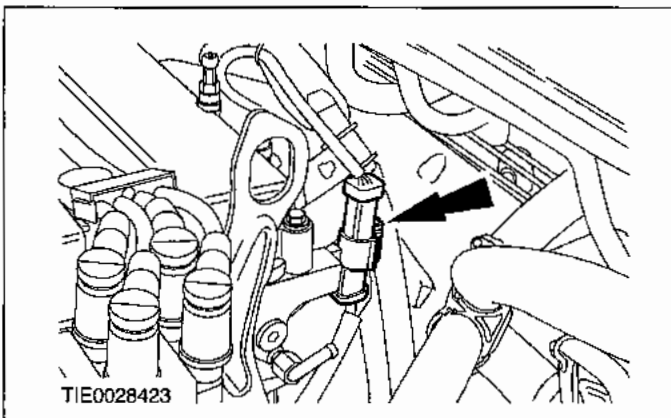
13. Using the special tool, disconnect the coolant hose from the coolant distribution housing.



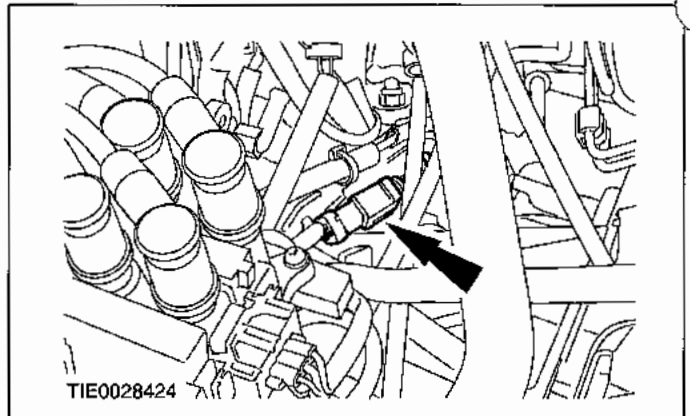
14. Using the special tool, disconnect the hose from the coolant distribution housing.



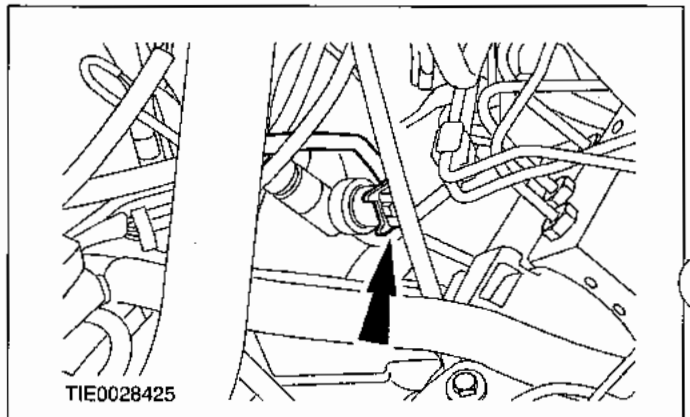
15. Disconnect the heated oxygen (HO2S) sensor electrical connector.



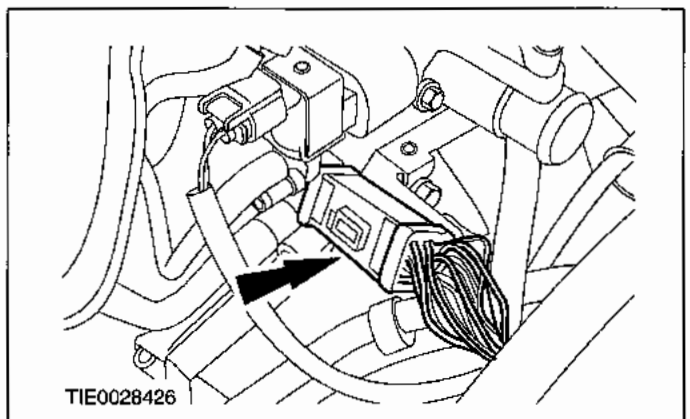
16. Disconnect the catalyst monitor sensor electrical connector.



17. Disconnect the power steering pressure (PSP) switch electrical connector.



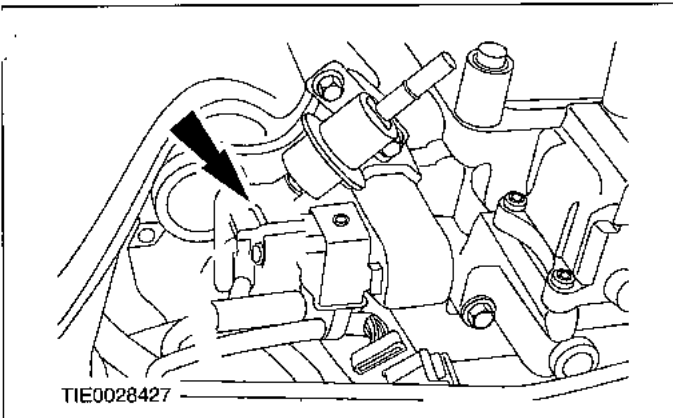
18. Disconnect the engine wiring harness electrical connector.



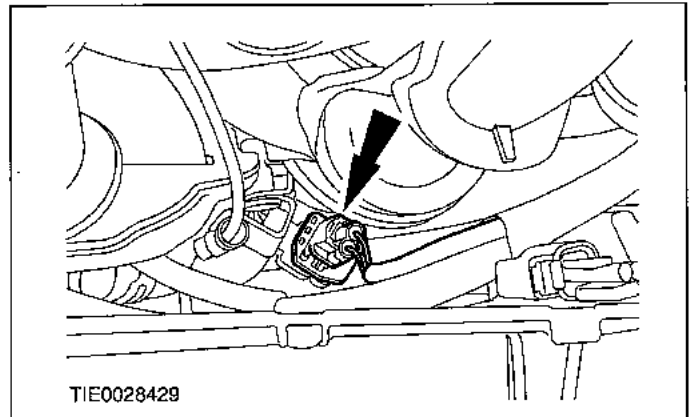


**REMOVAL**

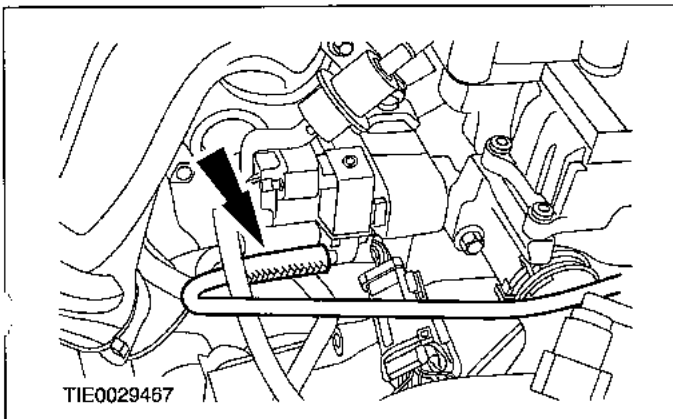
19. Disconnect the EVAP electrical connector.



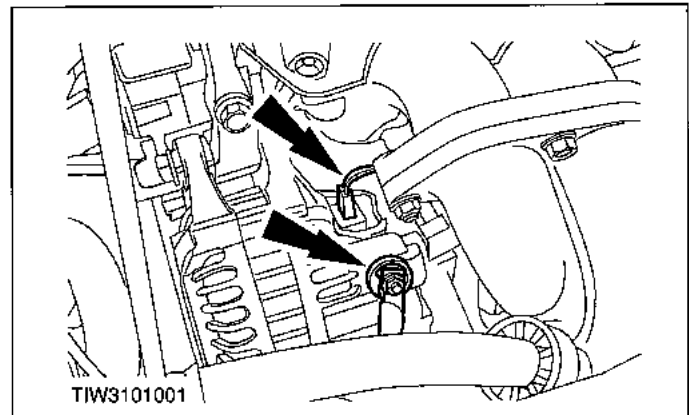
22. Disconnect the knock sensor (KS) electrical connector.



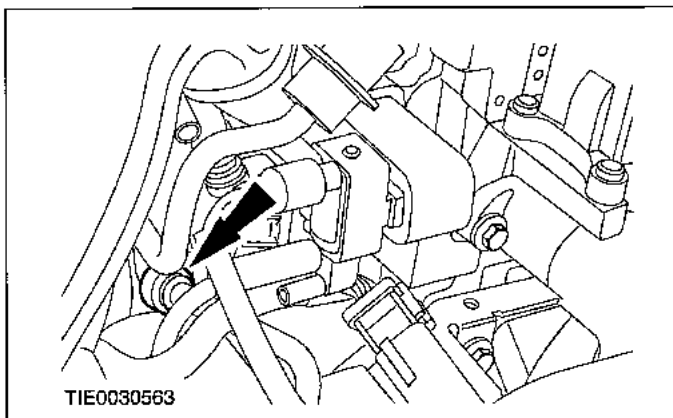
20. Disconnect the low pressure evaporate emission (EVAP) hose from the EVAP valve.



23. Disconnect the generator electrical connectors.



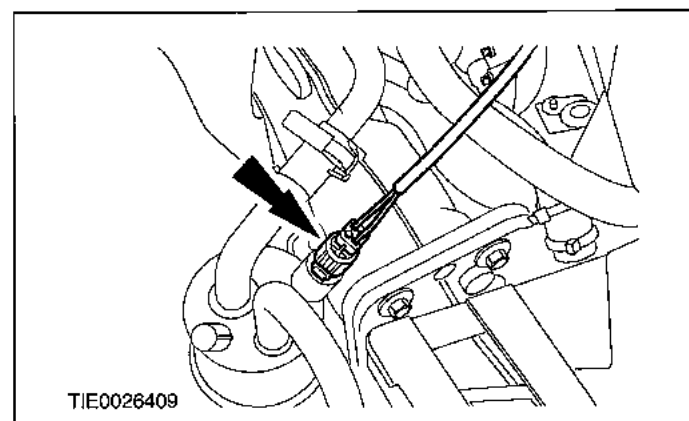
21. Detach the brake booster vacuum line from the intake manifold.



24. Remove the right-hand headlamp assembly.

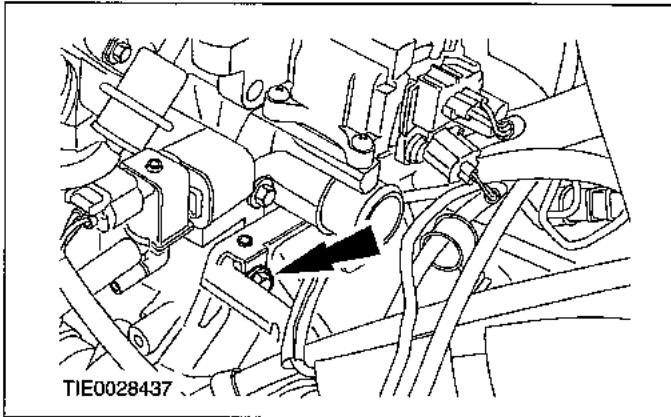
For additional information, refer to:  
Headlamp Assembly (417-01 Exterior  
Lighting, Removal and Installation).

25. Disconnect the air conditioning (A/C) lower-pressure cut-off switch electrical connector.

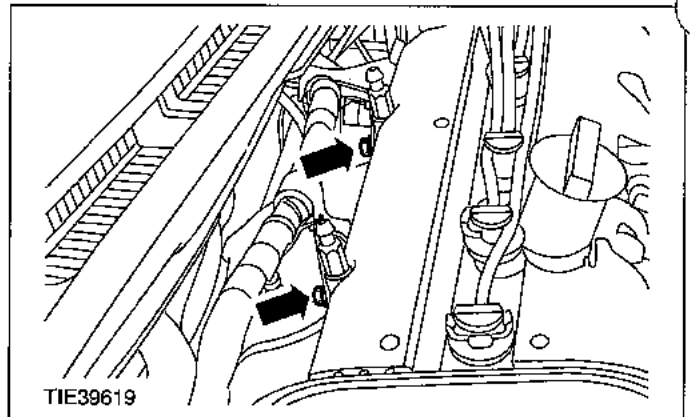


**REMOVAL**

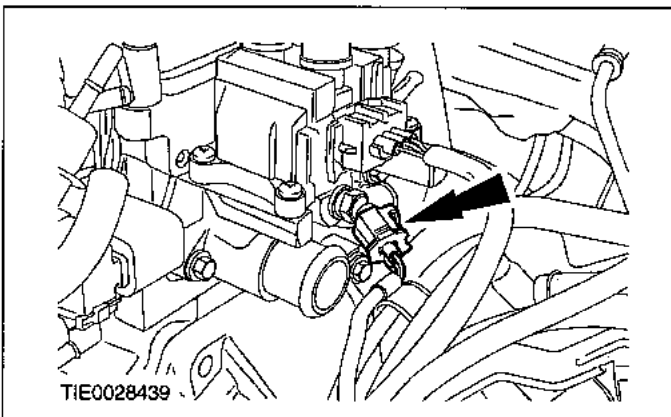
26. Remove the engine wiring harness support bracket.



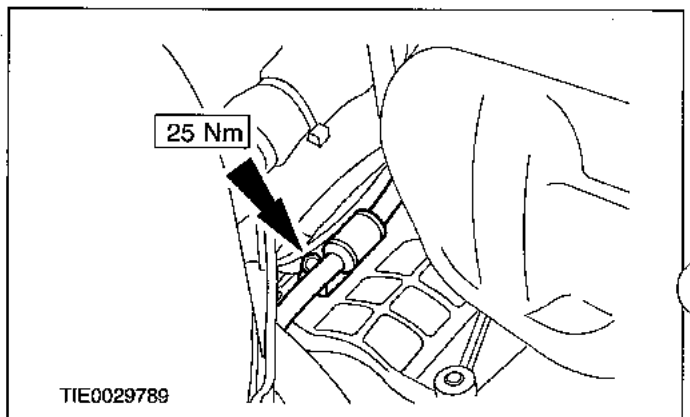
29. Detach the power steering line support bracket from the cylinder head.



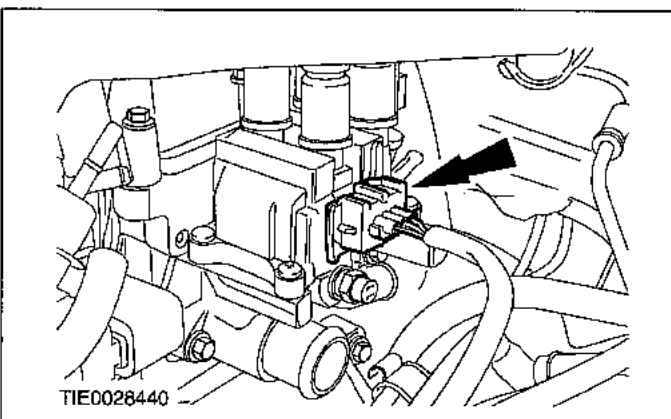
27. Disconnect the engine coolant temperature (ECT) electrical connector.



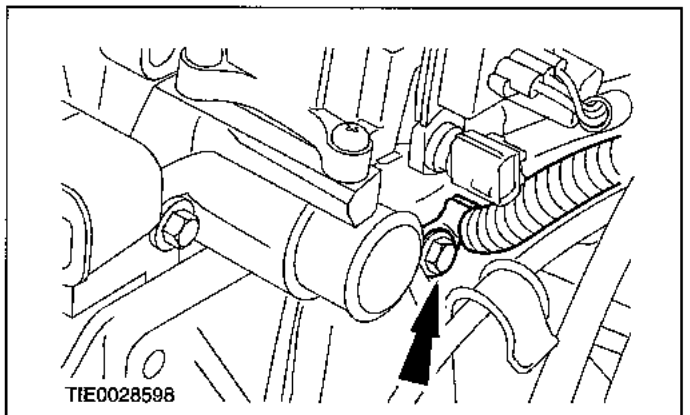
30. Detach the power steering line from the power steering pump mounting bracket.



28. Disconnect the electronic ignition (EI) coil electrical connector.



31. Disconnect the engine ground cable.

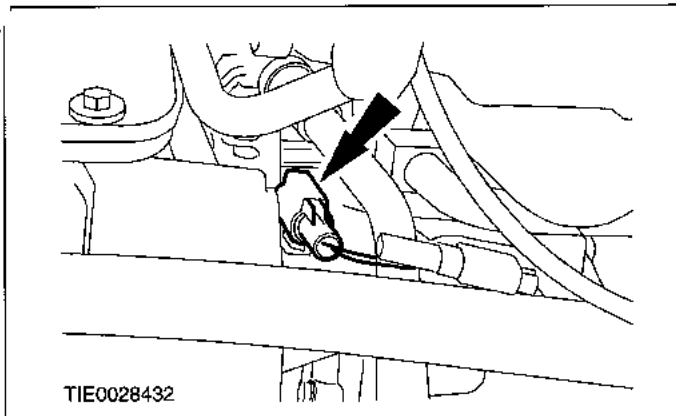


32. Raise and support the vehicle.

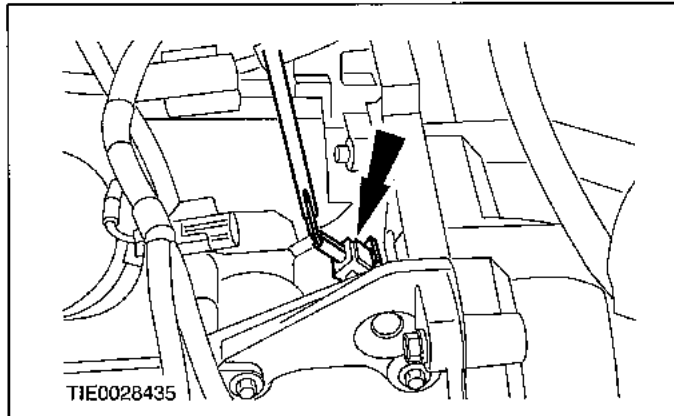
For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

## REMOVAL

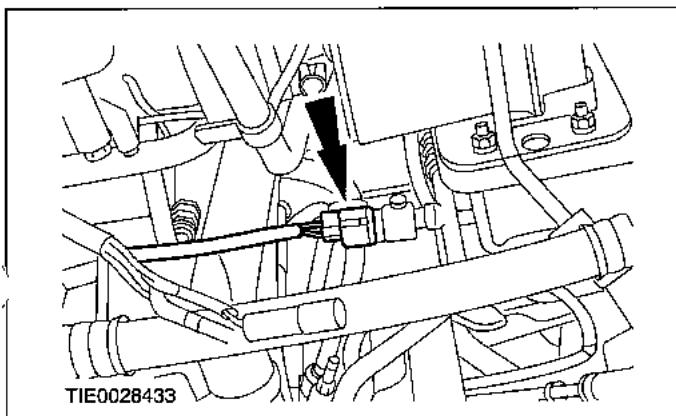
33. Disconnect the A/C compressor clutch electrical connector.



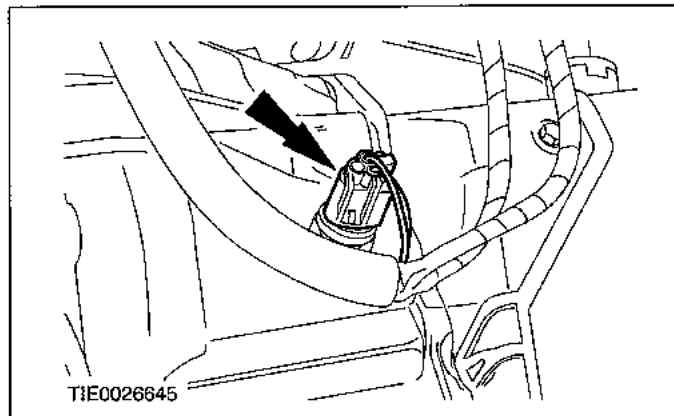
36. Disconnect the crankshaft position (CKP) sensor electrical connector.



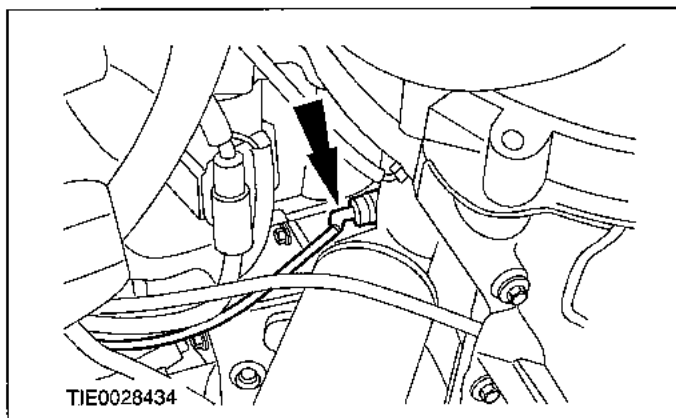
34. Disconnect the A/C high-pressure cut-off switch electrical connector.



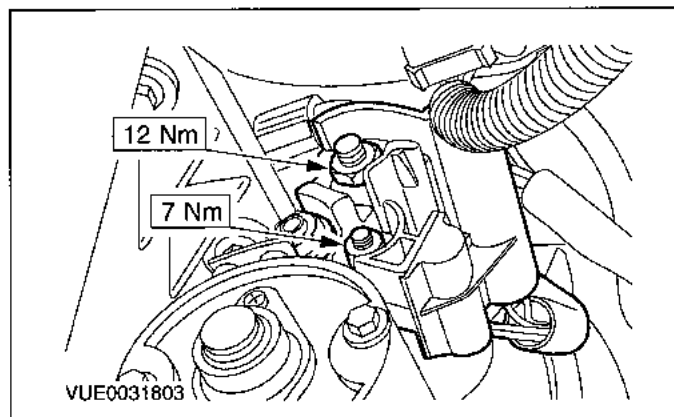
37. Disconnect the reversing lamp switch electrical connector.



35. Disconnect the oil pressure switch electrical connector.



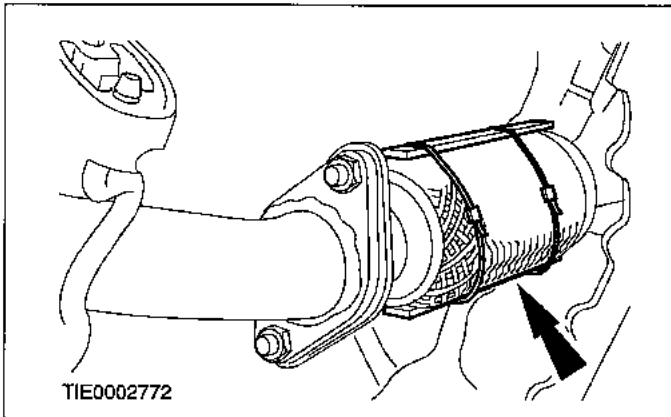
38. Disconnect the ignition switch to starter motor solenoid and battery to starter motor solenoid cables.



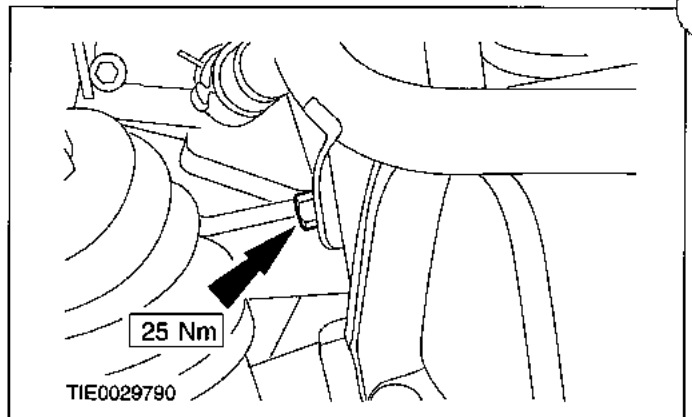
39. **CAUTION:** Over bending of the exhaust flexible pipe may cause damage resulting in failure.

**REMOVAL**

Support the exhaust flexible pipe with a suitable support wrap or suitable splint.

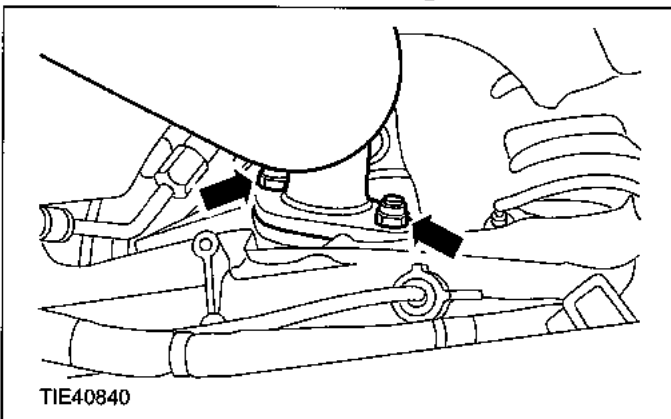


43. Detach the power steering line support bracket from the engine block.



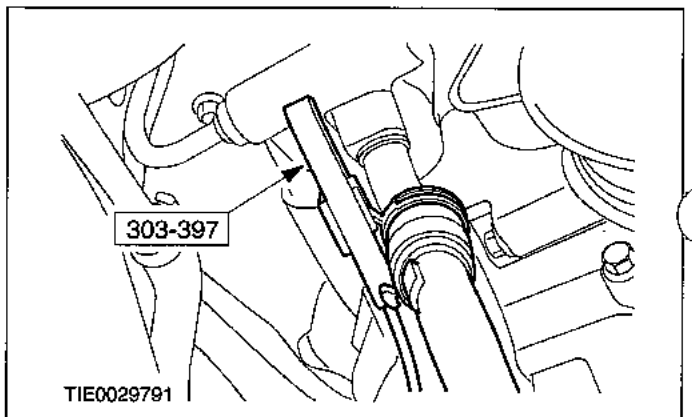
40. Detach the exhaust flexible pipe from the catalytic converter.

- Discard the nuts and the gasket.



44. Disconnect the power steering line from the steering pump.

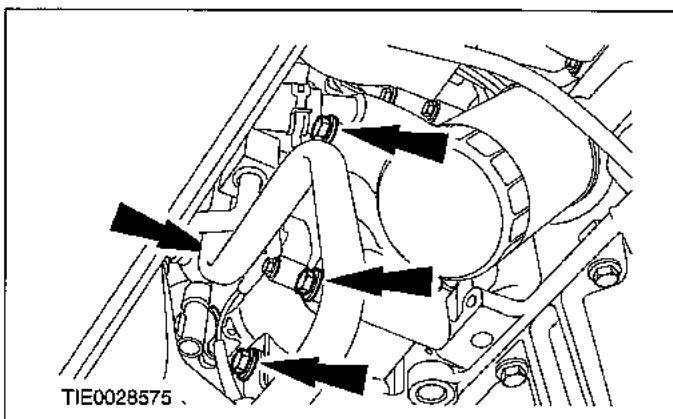
- Allow the fluid to drain into a suitable container.



41. Remove the accessory drive belt.

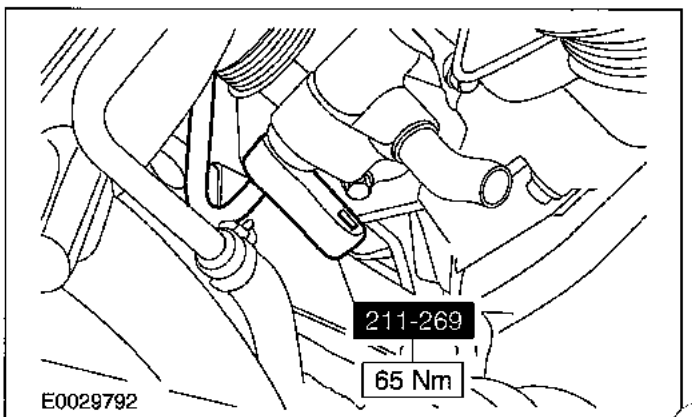
For additional information, refer to:  
**Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles With: Air Conditioning (303-05 Accessory Drive, Removal and Installation).**

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



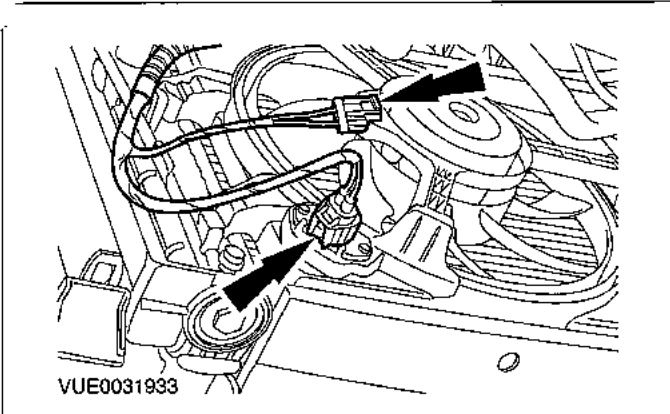
45. Using the special tool, detach the power steering line from the power steering pump.

- Allow the fluid to drain into a suitable container.

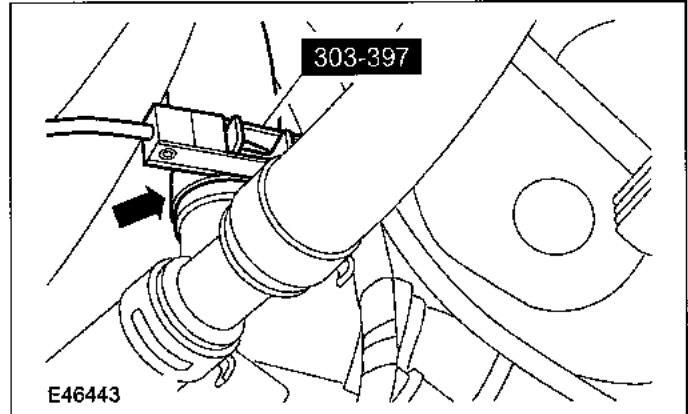


**REMOVAL**

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

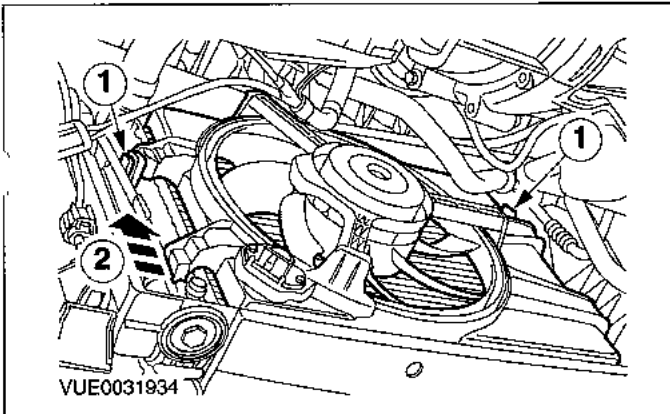


49. Using the special tool, disconnect the coolant hose from the distribution pipe.



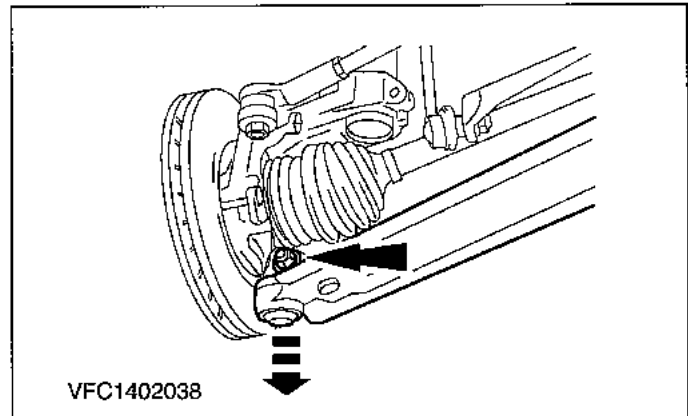
47. Remove the cooling fan motor and shroud.

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.

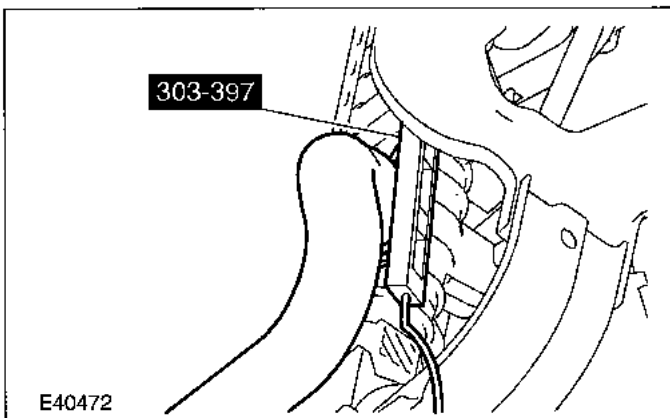


50. Detach the lower arm from the wheel knuckle on both sides (right-hand side shown).

- Remove the heat shield.



48. Using the special tool, disconnect the coolant hose from the radiator.



51. 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 oil seal.

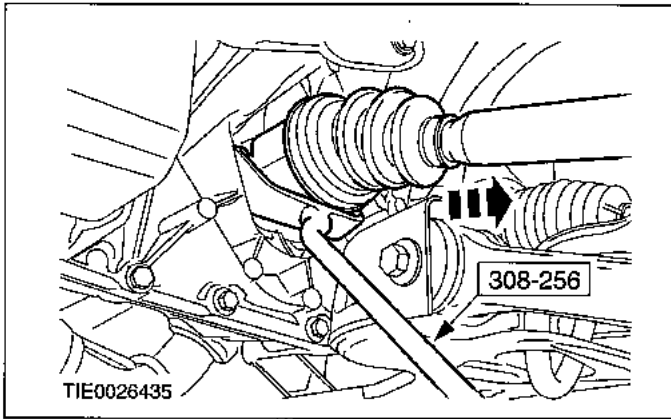
**NOTE:** Plug the transaxle to prevent oil loss or dirt ingress.

Using the special tool, detach the left-hand halfshaft from the transaxle and secure it to one side.

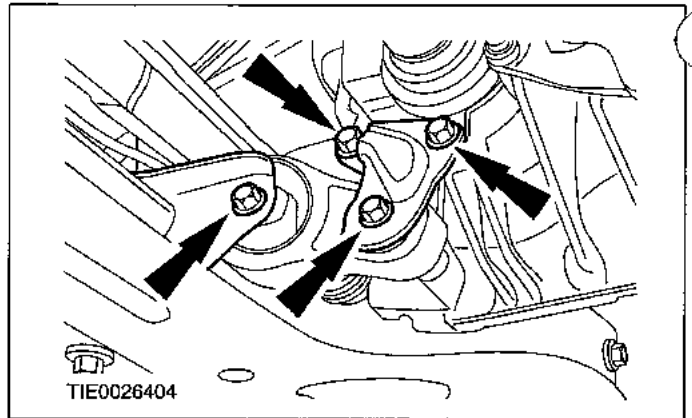
- Allow the oil to drain into a suitable container.

**REMOVAL**

- Discard the snap ring.



**53. Remove the engine support insulator.**



**52. CAUTIONS:**

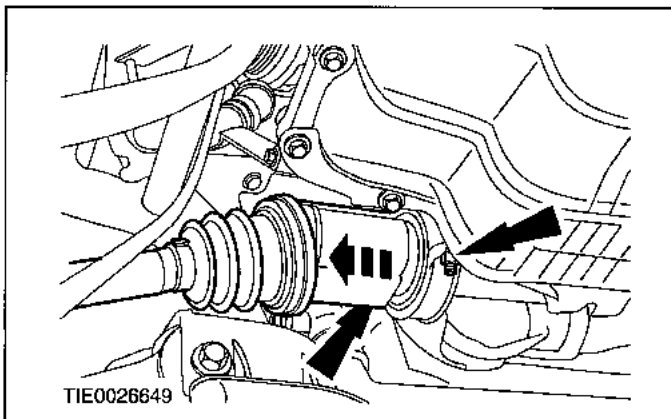
⚠ **Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.**

⚠ **Do not damage the halfshaft oil seal.**

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

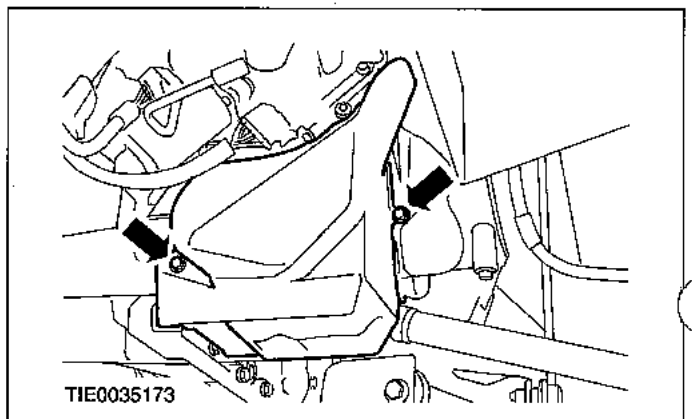
**Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.**

- Discard the center bearing cap and locknuts.
- Allow the oil to drain into a suitable container.

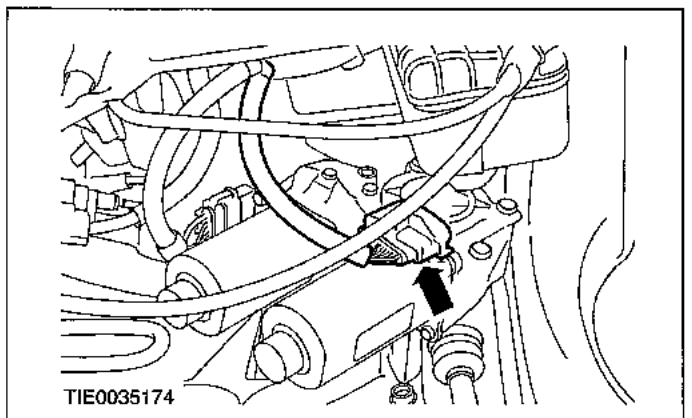


Vehicles with automated gearshift

**54. Remove the gearshift actuator cover.**

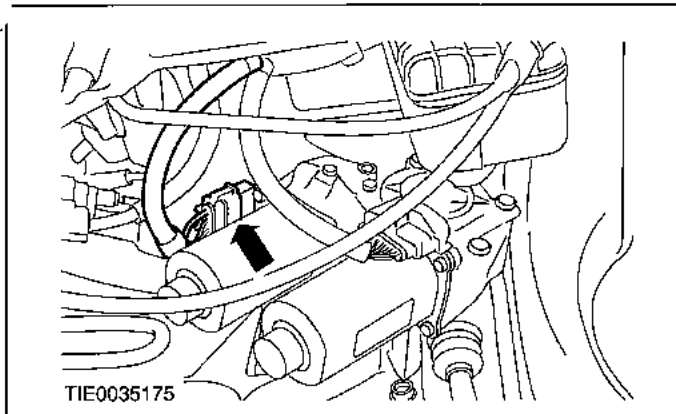


**55. Disconnect the gearshift actuator electrical connector (colored black).**

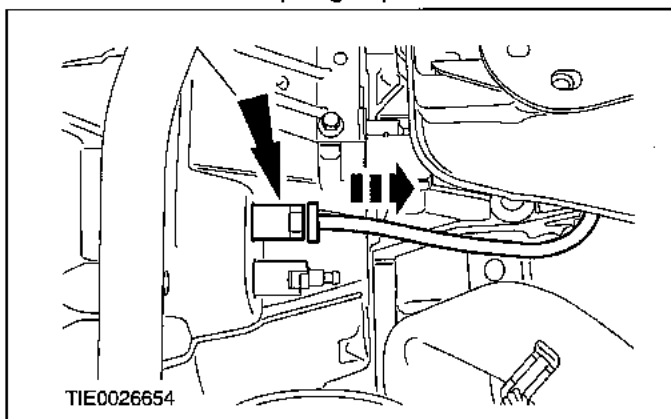


**REMOVAL**

56. Disconnect the gearshift actuator electrical connector (colored grey).



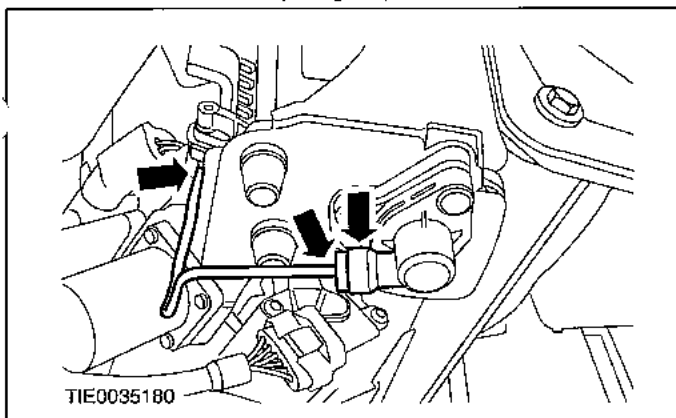
- Remove the spring clip.



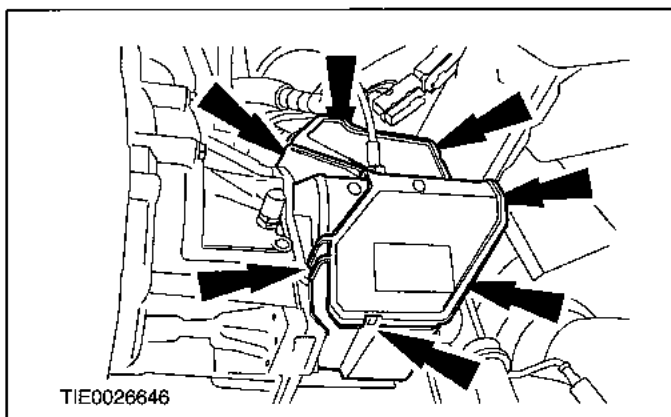
57. **⚠ CAUTION:** If brake fluid is spilt on the paintwork, the affected area must be immediately washed down with cold water.

Disconnect the clutch slave cylinder supply line.

- Remove the spring clip.

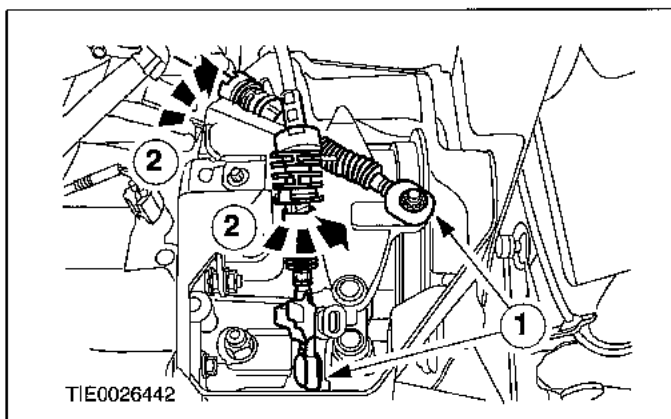


59. Remove the gearshift cables cover.



60. Detach the gearshift cables from the transaxle.

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



Vehicles without automated gearshift

58. **⚠ 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.

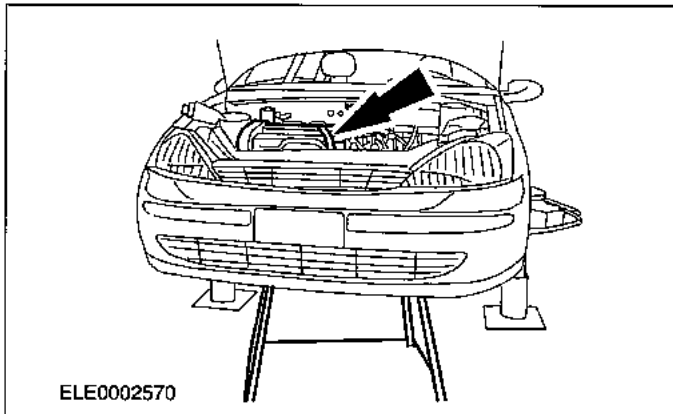
All vehicles

61. **⚠ CAUTION:** Do not support the engine directly on the oil pan.

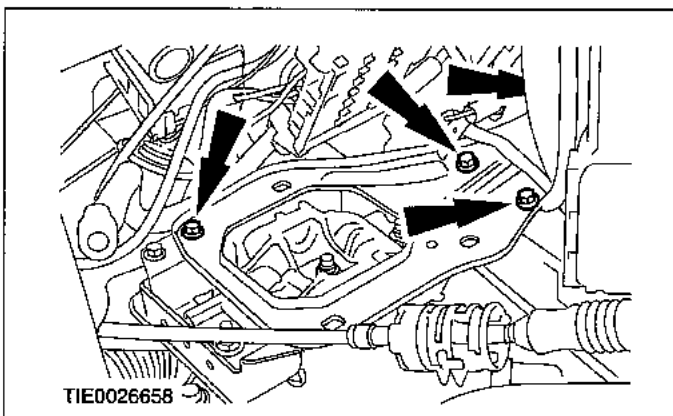
**REMOVAL**

**NOTE:** Using suitable securing straps, secure the engine and the transaxle on a workshop table.

Using suitable wooden blocks support the engine and transaxle assembly.

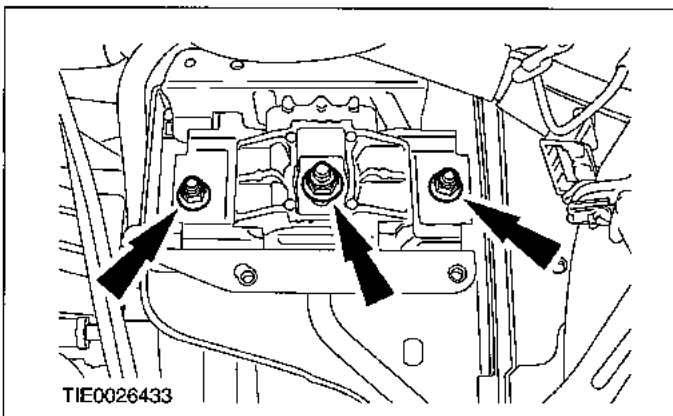


**62. Remove the battery tray support bracket.**



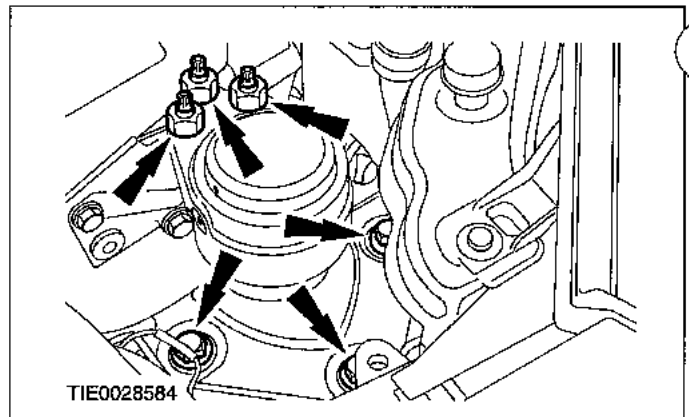
**63. Remove the engine rear mount.**

- Discard the nuts.



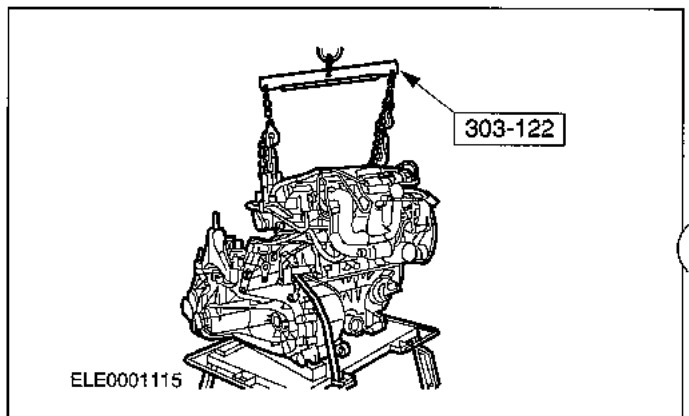
**64. Remove the engine front mount.**

- Discard the nuts.

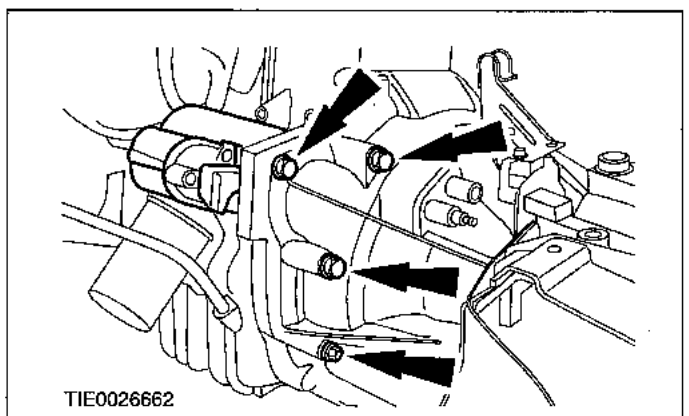


**65. Raise the vehicle and remove the engine and transaxle assembly.**

**66. Using the special tool, attach the engine and transaxle assembly to the engine hoist.**



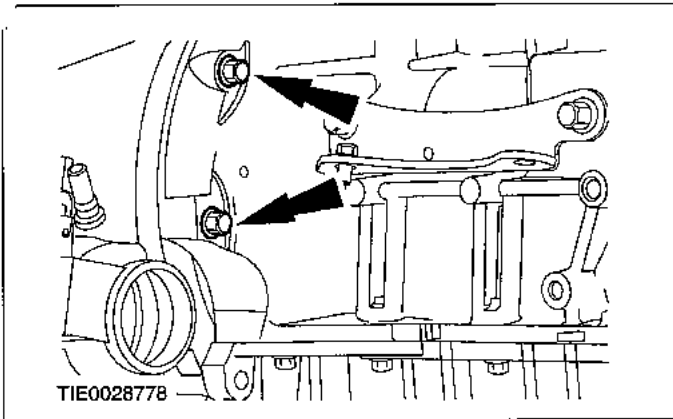
**67. Remove the starter motor and the transaxle left-hand retaining bolt.**



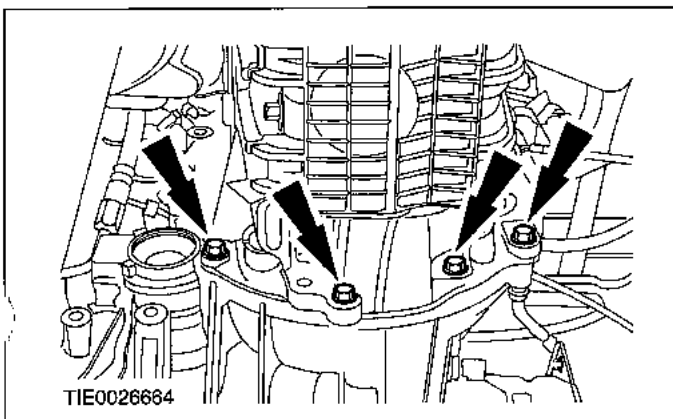


**REMOVAL**

68. Remove the transaxle right-hand retaining bolt.



69. Remove the transaxle lower retaining bolts.

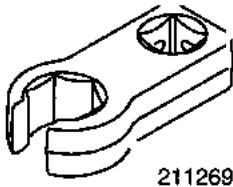
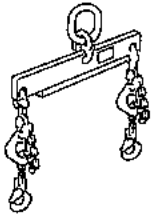
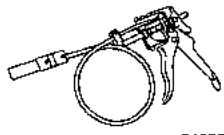


70. Remove the transaxle from the engine.

## REMOVAL

## Engine — Vehicles With: Automatic Transaxle

## Special Tool(s)

 <p>211269</p>	<p>Wrench, Hydraulic Line Union Nut 211-269 (13-027)</p>
 <p>21068A</p>	<p>Lifting Bracket, Engine 303-122 (21-068A)</p>
 <p>24003</p>	<p>Remover/Installer, Hose Clamp 303-397 (24-003)</p>

## General Equipment

Engine hoist
Securing straps
Workshop table

All vehicles

## WARNINGS:

- ▲ Refer to the Material Safety Data Sheets for the Automatic Transmission Fluid E-AW. Failure to follow this instruction may result in personal injury. Certain Transmission and Power Steering fluids supplied to Ford contain additives which may cause skin irritation or other skin reactions after contact.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation). See - Transmission Fluids.

- ▲ 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. Release the fuel system pressure.

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

2. Remove the air cleaner.

For additional information, refer to: Air Cleaner - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

3. Drain the cooling system.

For additional information, refer to: Cooling System Draining, Filling and Bleeding - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma)/1.3L Duratec-8V (Rocam) (303-03A, General Procedures).

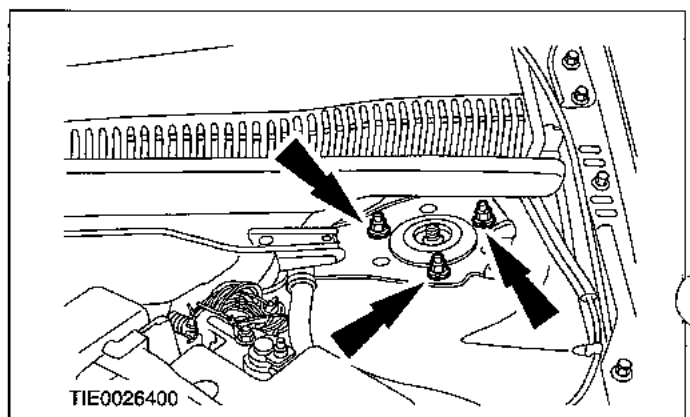
4. Remove the front wheels and tires.

For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

5. Disconnect the powertrain control module (PCM) electrical connector.

For additional information, refer to: Powertrain Control Module (PCM) - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-14 Electronic Engine Controls, Removal and Installation).

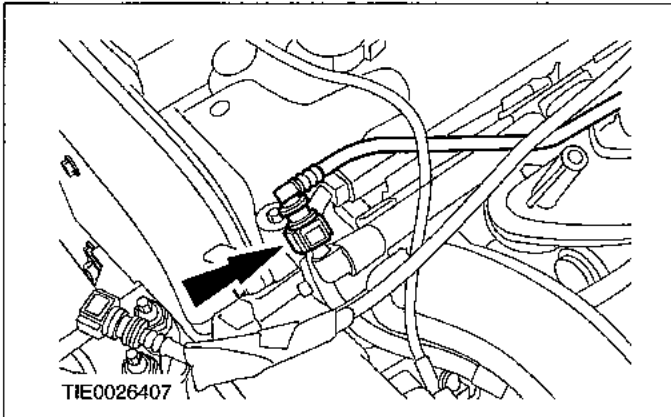
6. Loosen the strut and spring assembly top mount nuts by three turns on both sides.



**REMOVAL**

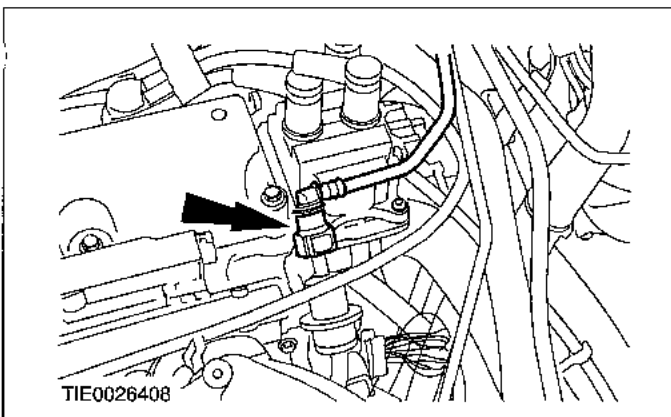
7. Disconnect the fuel return line quick release coupling.

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



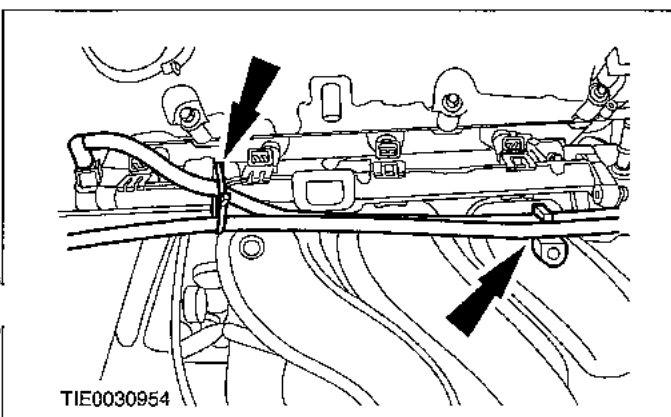
8. Disconnect the fuel supply line quick release coupling.

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

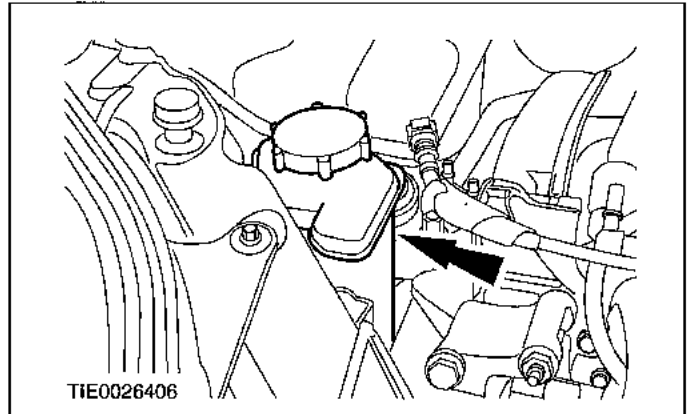


9. Detach the fuel line and the degas line from the intake manifold.

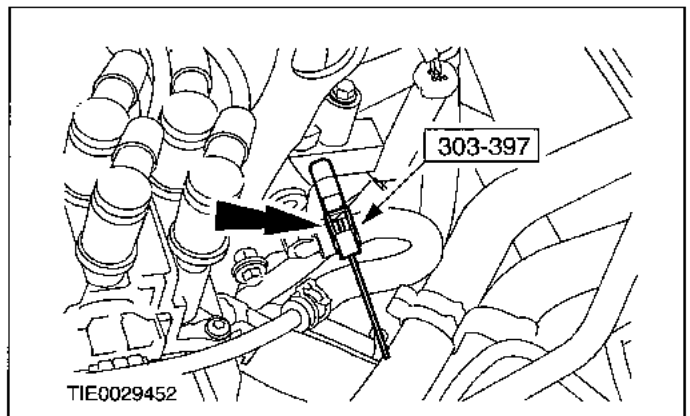
- Remove the cable tie.



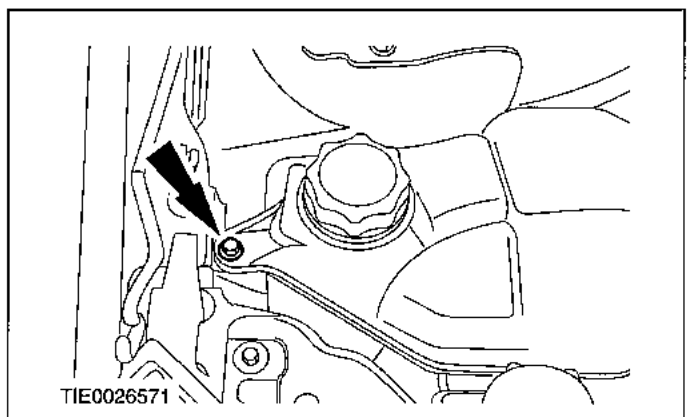
10. Detach the power steering fluid reservoir from the bracket and position it to one side.



11. Using the special tool, disconnect the degas hose from the cylinder head.

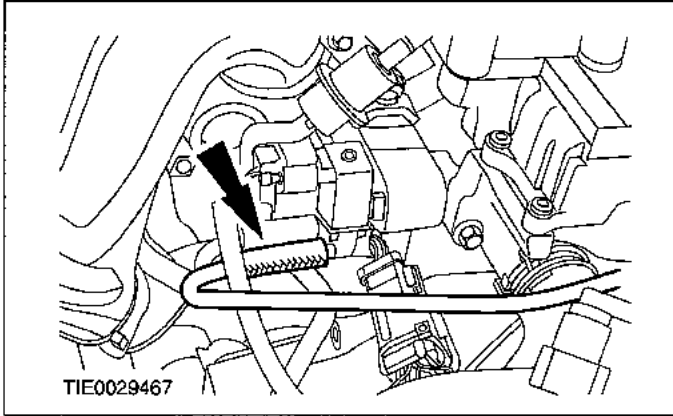


12. Detach the coolant expansion tank from the bracket and position it to one side.

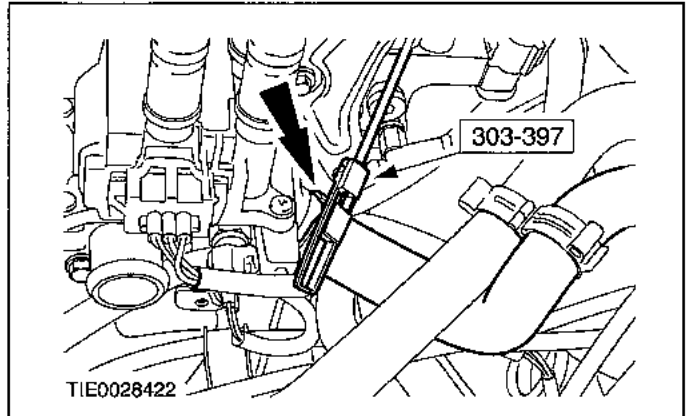


**REMOVAL**

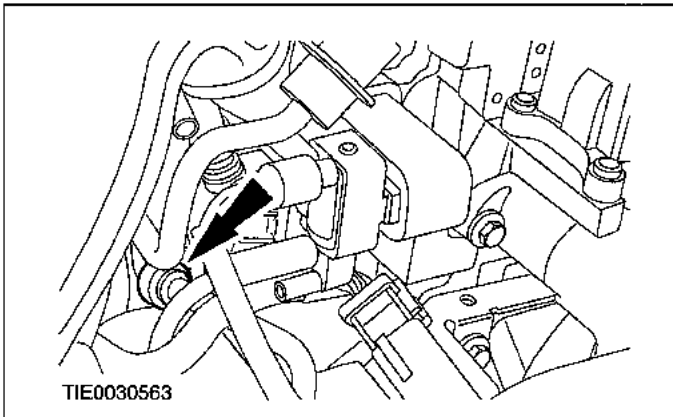
**13. Disconnect the low pressure evaporate emission (EVAP) hose from the EVAP valve.**



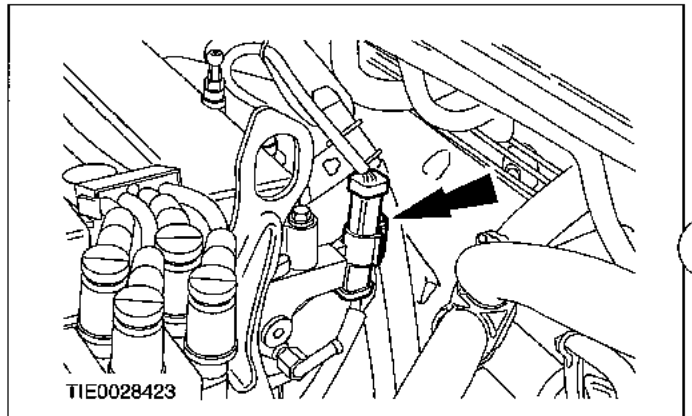
**16. Using the special tool, disconnect the coolant hose from the coolant distribution housing.**



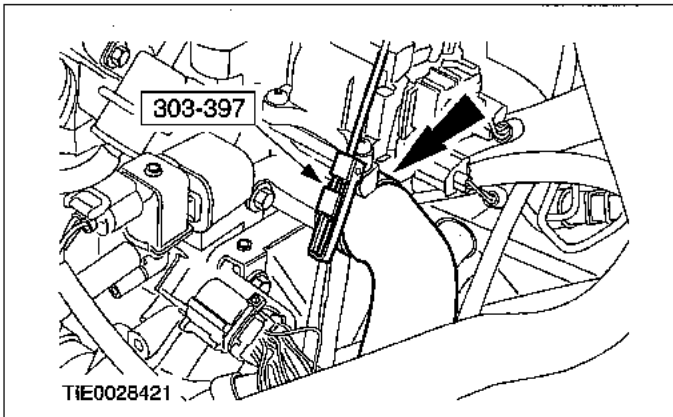
**14. Detach the brake booster vacuum line from the intake manifold.**



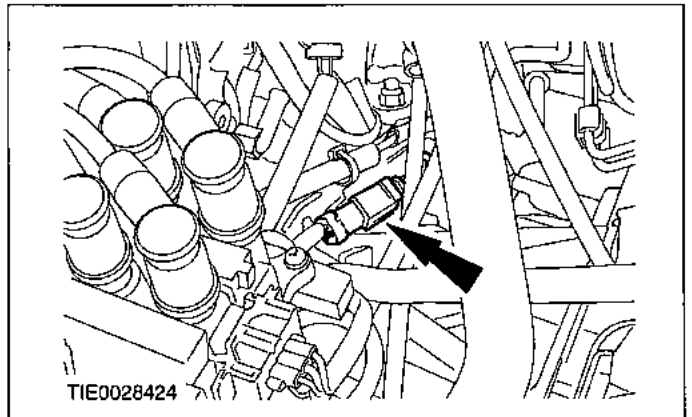
**17. Disconnect the heated oxygen (HO2S) sensor electrical connector.**



**15. Using the special tool, disconnect the coolant hose from the coolant distribution housing.**

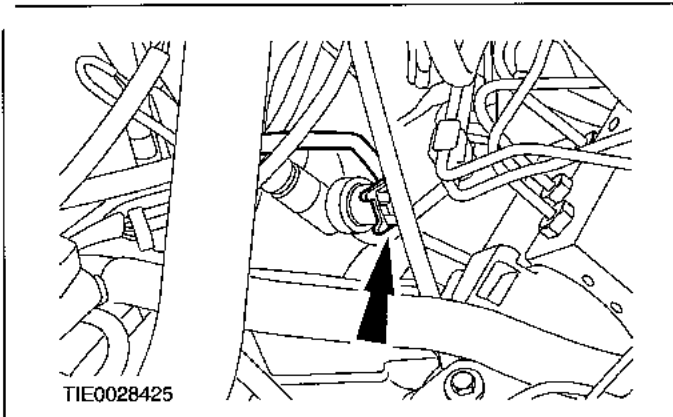


**18. Disconnect the catalyst monitor sensor electrical connector.**

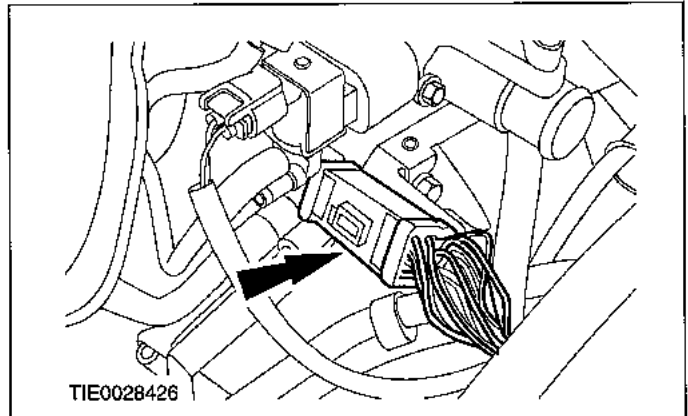


**REMOVAL**

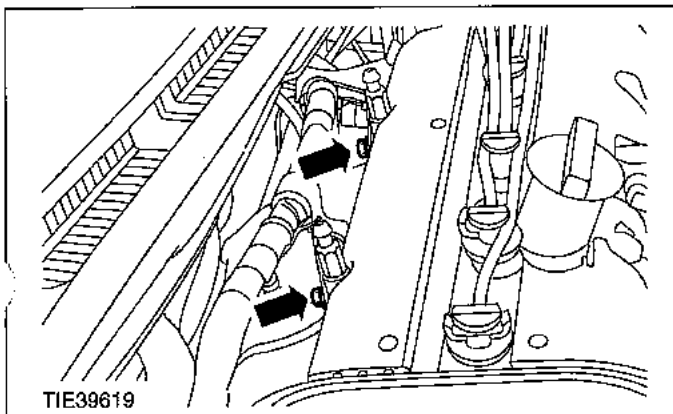
19. Disconnect the power steering pressure (PSP) switch electrical connector.



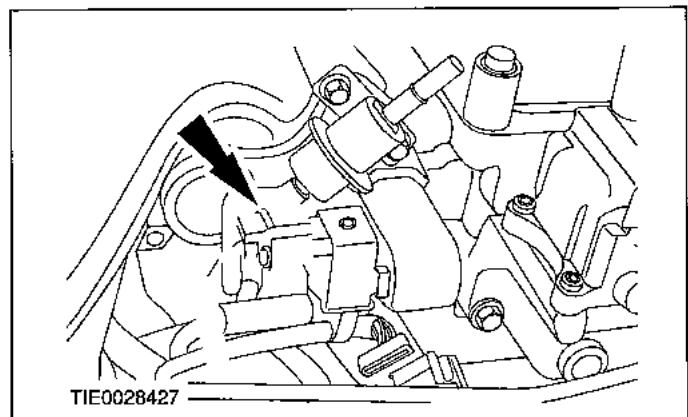
22. Disconnect the engine wiring harness electrical connector.



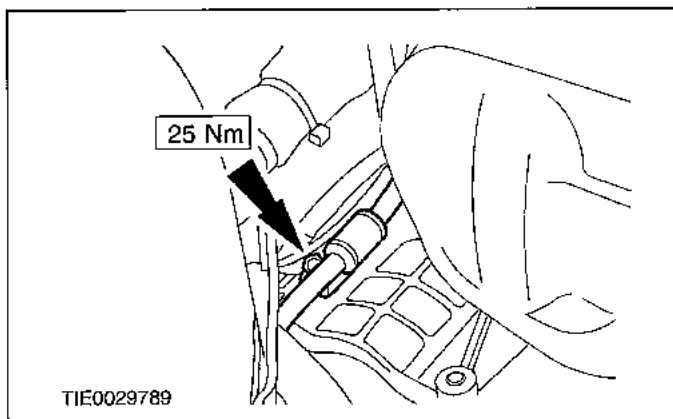
20. Detach the power steering line support bracket from the cylinder head.



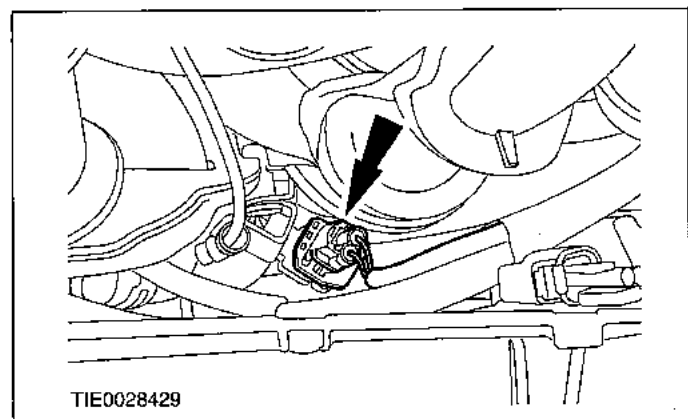
23. Disconnect the EVAP electrical connector.



21. Detach the power steering line from the power steering pump mounting bracket.

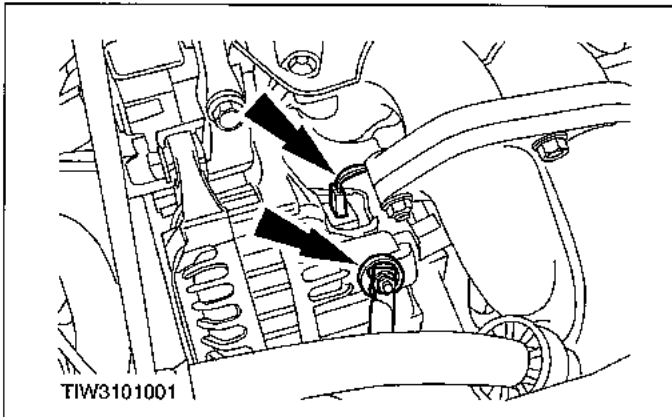


24. Disconnect the knock sensor (KS) electrical connector.

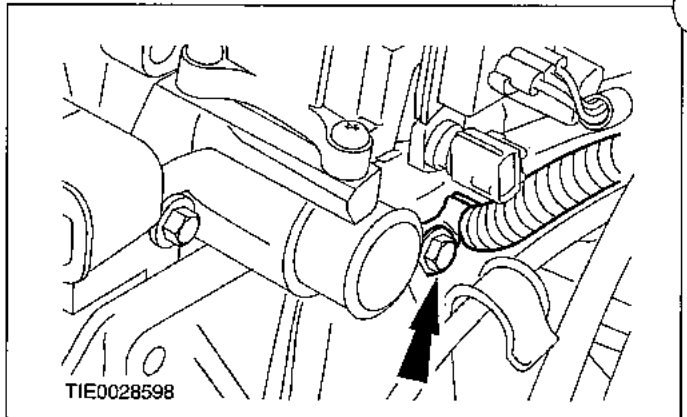


**REMOVAL**

25. Disconnect the generator electrical connectors.



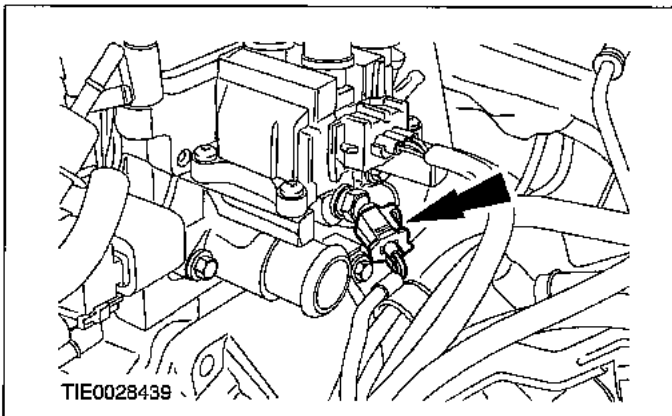
29. Detach the engine ground cable from the transaxle.



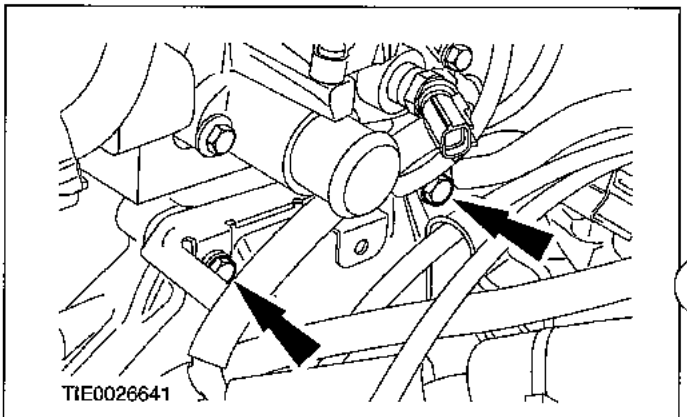
26. Remove the right-hand headlamp assembly.

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

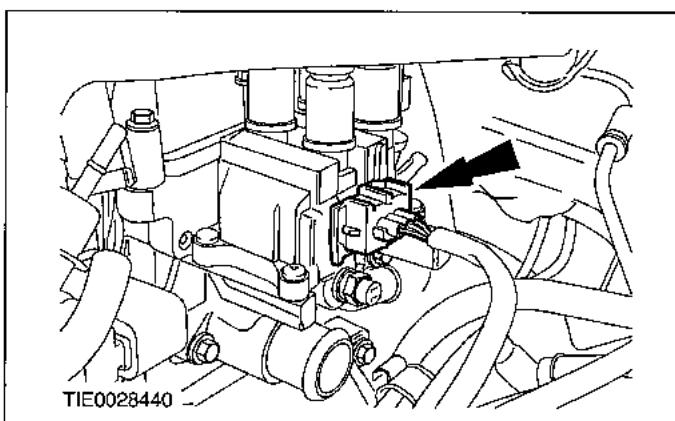
27. Disconnect the engine coolant temperature (ECT) electrical connector.



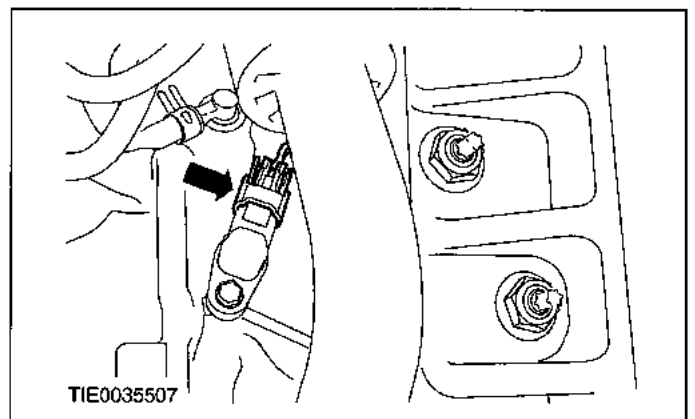
30. Remove the engine wiring harness support brackets.



28. Disconnect the electronic ignition (EI) coil electrical connector.

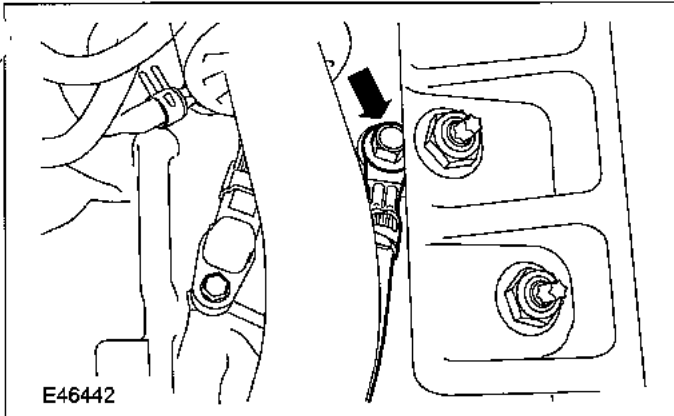


31. Disconnect the turbine shaft speed (TSS) sensor electrical connector.

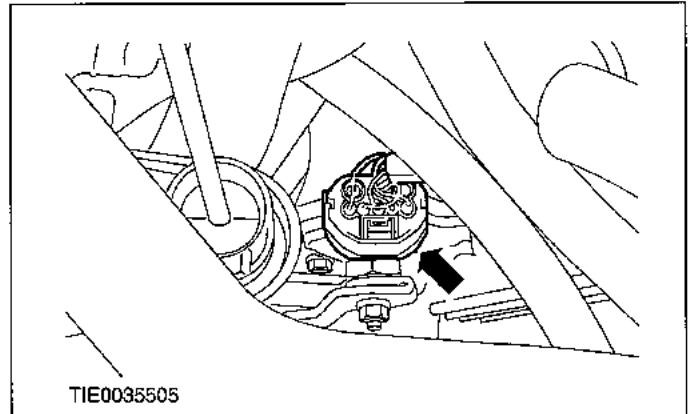


**REMOVAL**

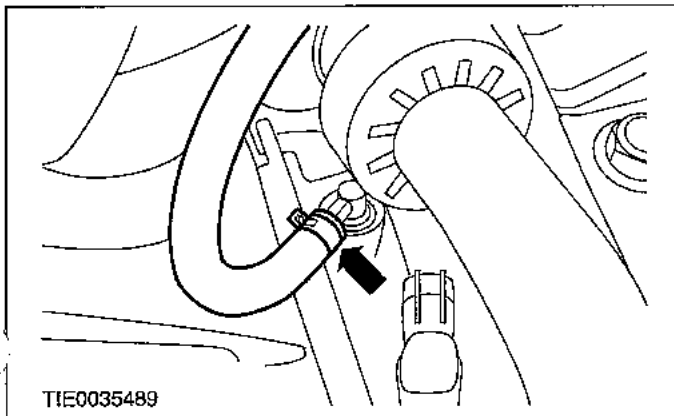
32. Detach the ground cable from the transaxle.



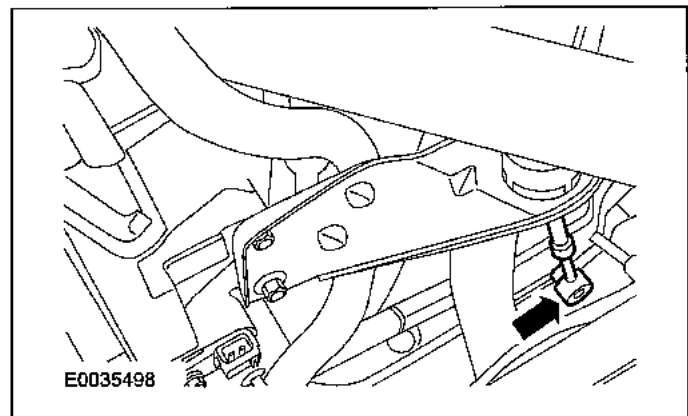
35. Disconnect the transmission range (TR) sensor electrical connector.



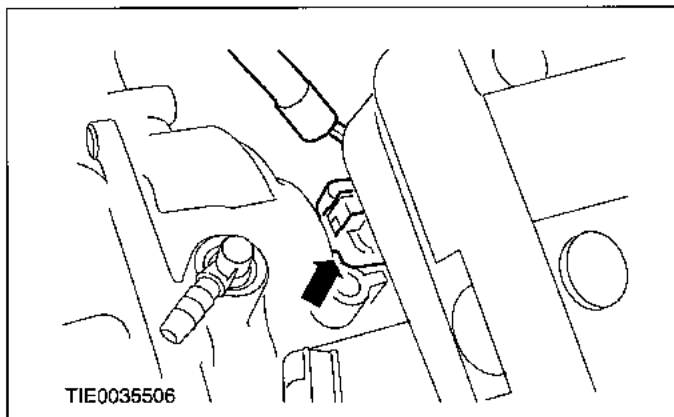
33. Disconnect the transaxle breather hose.



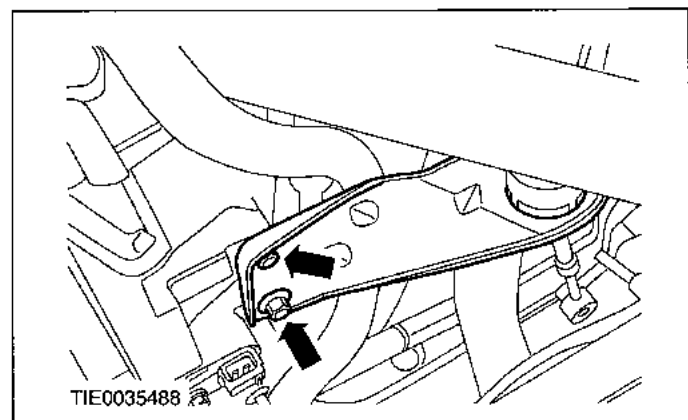
36. Detach the selector lever cable from the transaxle.



34. Disconnect the transaxle wiring harness electrical connector.

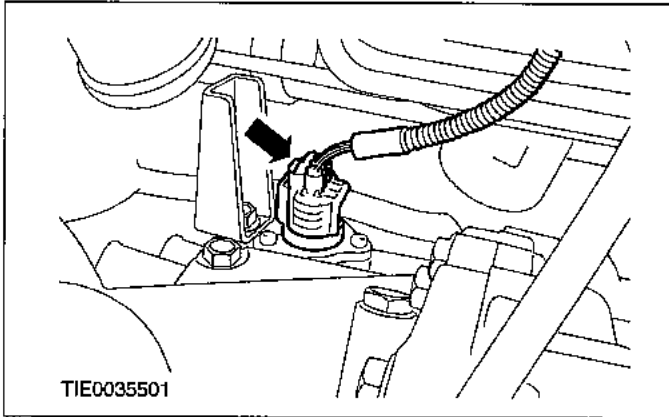


37. Detach the selector lever retaining bracket from the transaxle.

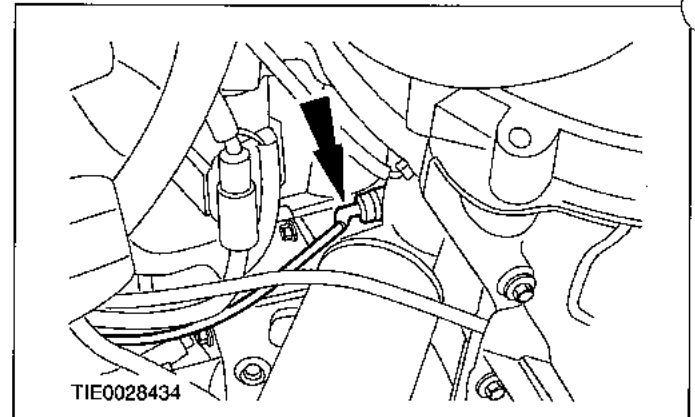


**REMOVAL**

38. Disconnect the vehicle speed (VSS) sensor electrical connector.



40. Disconnect the oil pressure switch electrical connector.



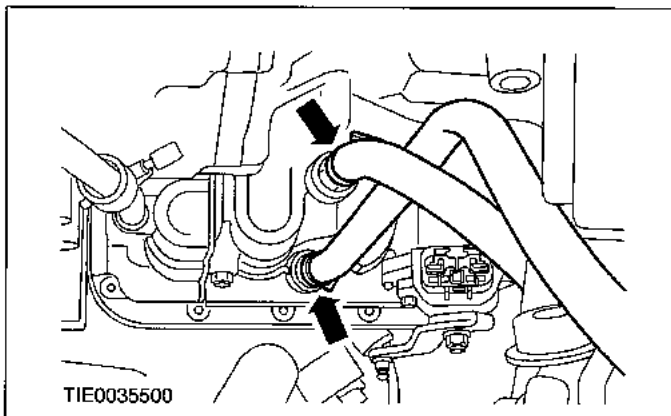
39. **NOTE:** Mark the position of the transmission fluid cooler supply line and the transmission fluid cooler return line.

Disconnect the transmission fluid cooler lines from the transaxle.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation). See - Transmission Fluids.

- Allow the fluid to drain into a suitable container.

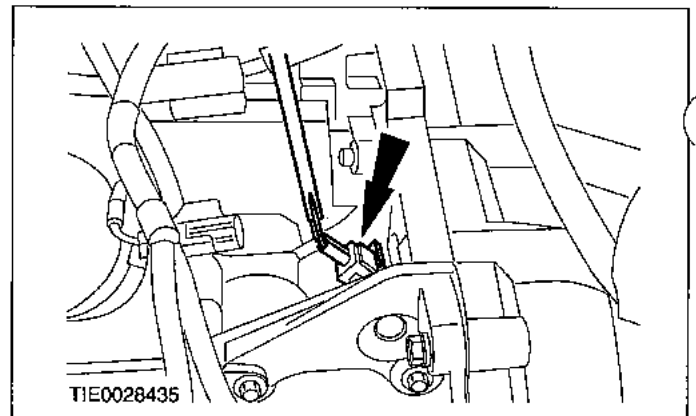
For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation). See - Transmission Fluids.



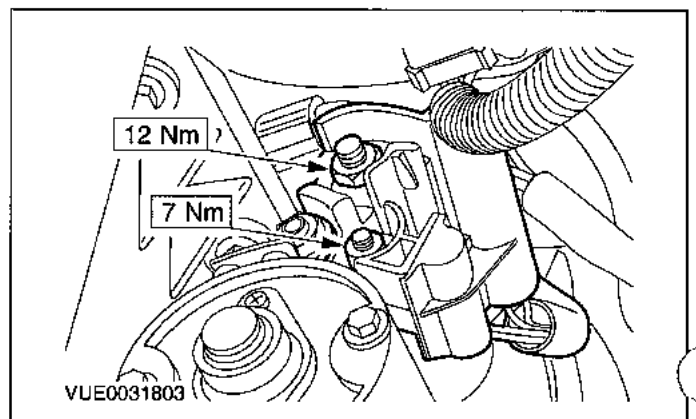
41. Raise and support the vehicle.

For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

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



43. Disconnect the ignition switch to starter motor solenoid and battery to starter motor solenoid cables.

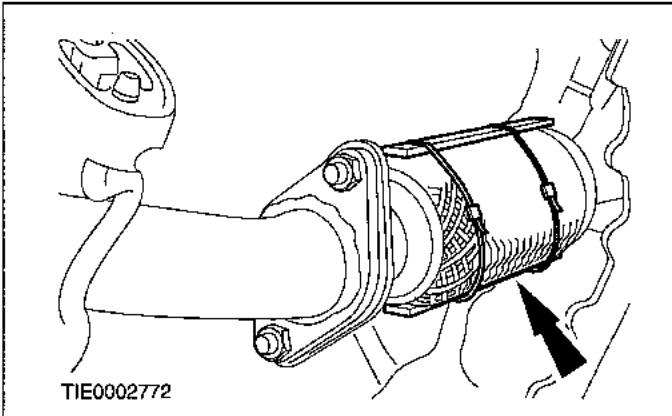




**REMOVAL**

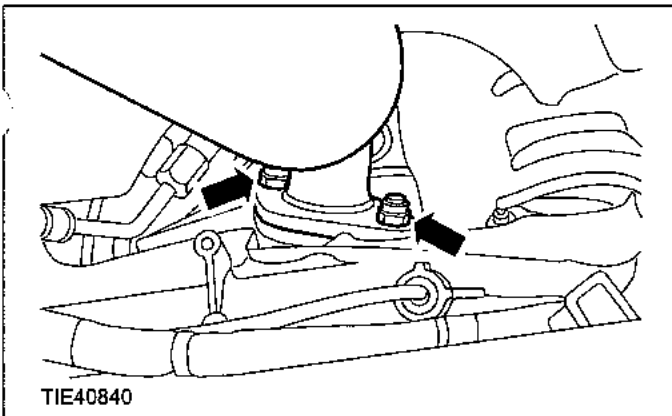
44. **⚠ CAUTION:** Over bending of the exhaust flexible pipe may cause damage resulting in failure.

Support the exhaust flexible pipe with a suitable support wrap or suitable splint.



45. Detach the exhaust flexible pipe from the catalytic converter.

- Discard the nuts and the gasket.



46. Remove the accessory drive belt.

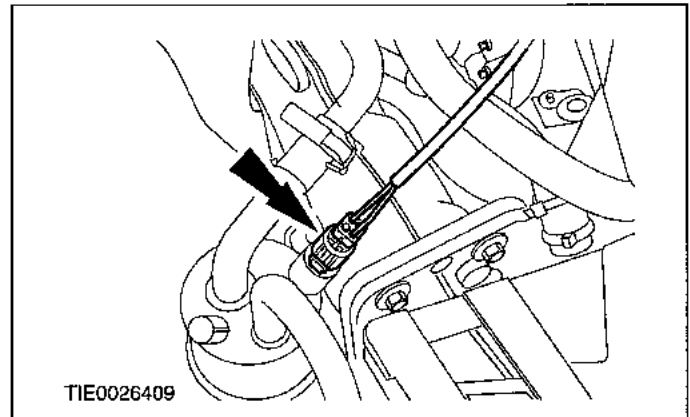
For additional information, refer to:

**Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles With: Air Conditioning (303-05 Accessory Drive, Removal and Installation)**

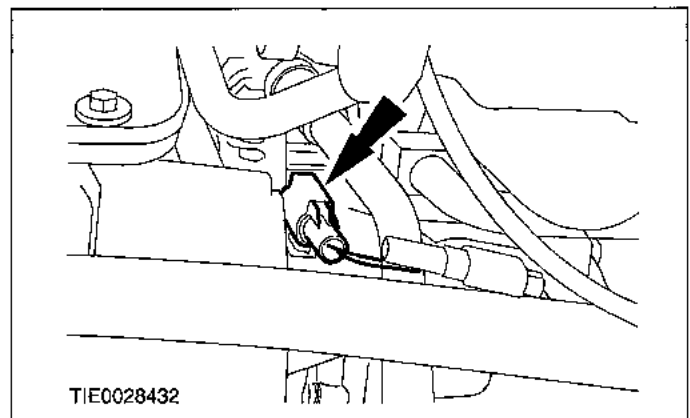
**Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles Without: Air Conditioning (303-05 Accessory Drive, Removal and Installation).**

Vehicles with air conditioning

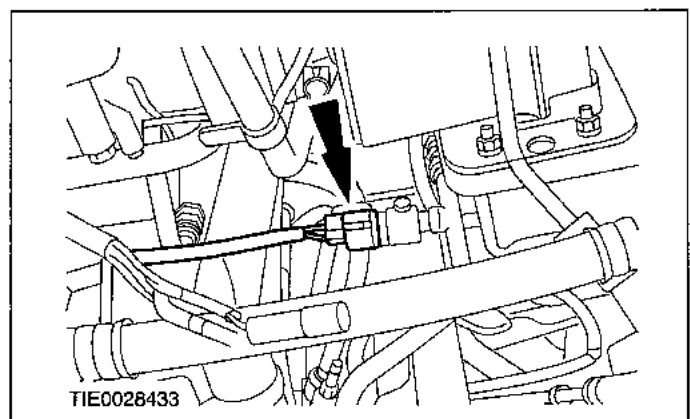
47. Disconnect the air conditioning (A/C) low-pressure cutoff switch electrical connector.



48. Disconnect the A/C compressor clutch electrical connector.

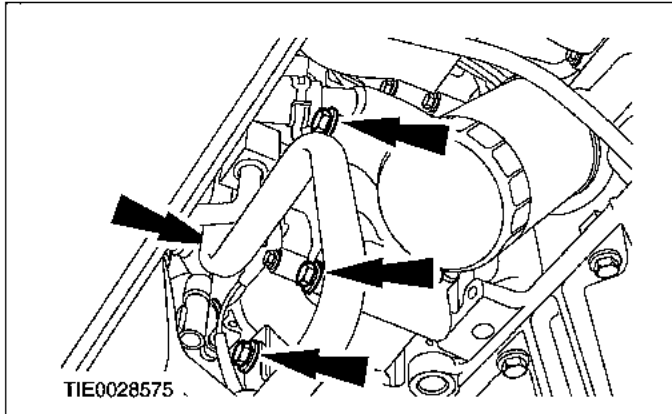


49. Disconnect the A/C high-pressure cutoff switch electrical connector.



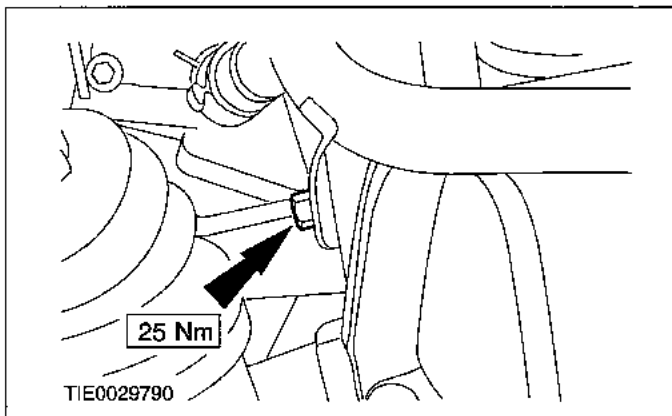
**REMOVAL**

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



All vehicles

51. Detach the power steering line support bracket from the engine block.



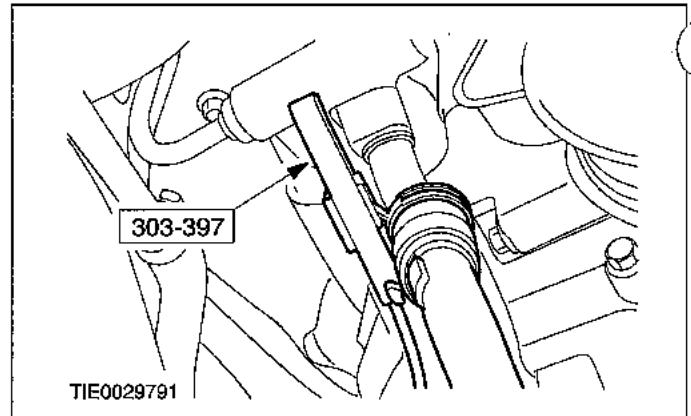
52. Disconnect the power steering line from the steering pump.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).  
See - Transmission Fluids.

- Allow the fluid to drain into a suitable container.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

See - Transmission Fluids.

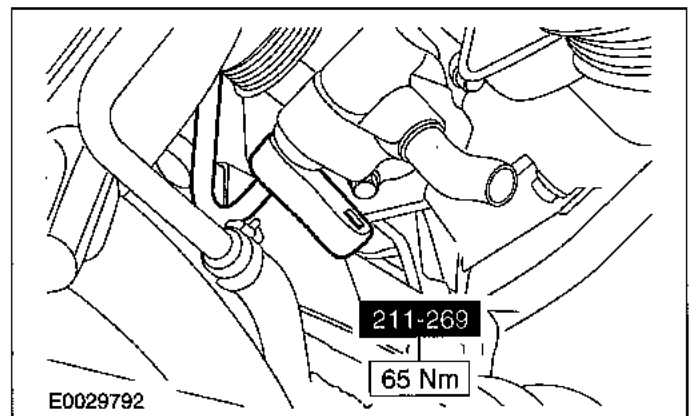


53. Using the special tool, detach the power steering line from the power steering pump.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).  
See - Transmission Fluids.

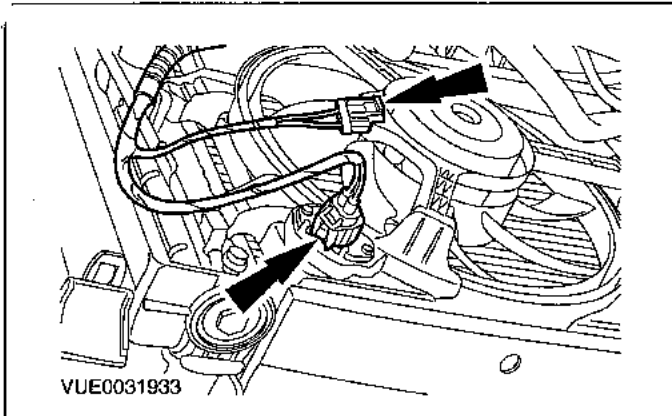
- Allow the fluid to drain into a suitable container.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).  
See - Transmission Fluids.

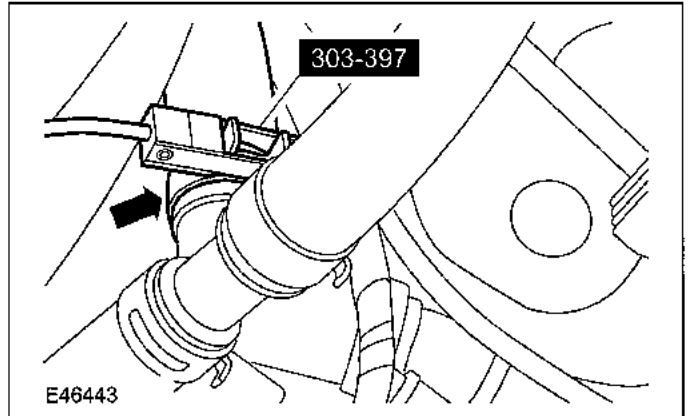


**REMOVAL**

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

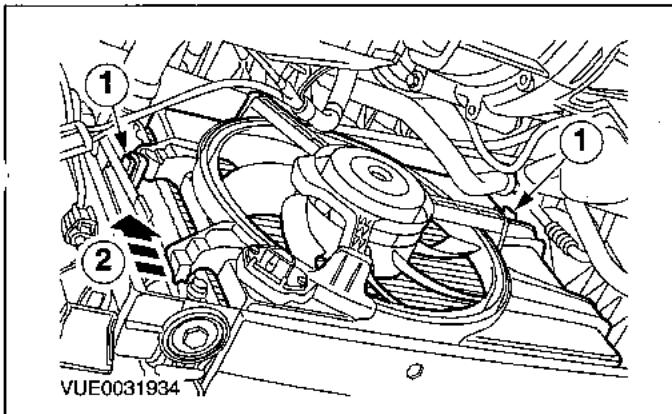


57. Using the special tool, disconnect the coolant hose from the distribution pipe.



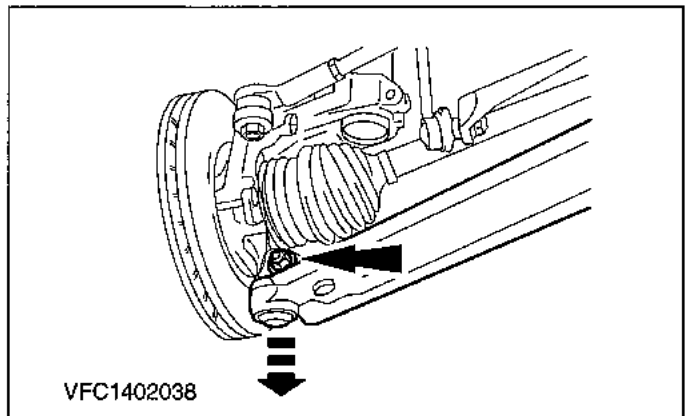
55. Remove the cooling fan motor and shroud.

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.

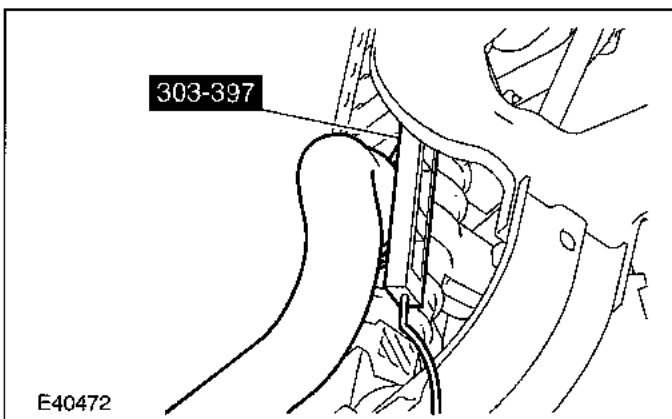


58. Detach the lower arm from the wheel knuckle on both sides.

- Remove the heat shield.



56. Using the special tool, disconnect the coolant hose from the radiator.



59. 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 fluid loss or dirt ingress.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

See - Transmission Fluids.

Using a suitable tire lever, detach the left-hand halfshaft from the transaxle and secure it to one side.

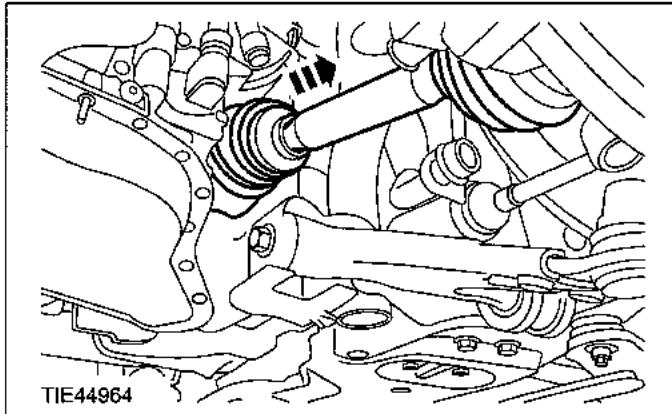
**REMOVAL**

- Allow the fluid to drain into a suitable container.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

See - Transmission Fluids.

- Discard the snap ring.

**60. 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 fluid loss or dirt ingress.

For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

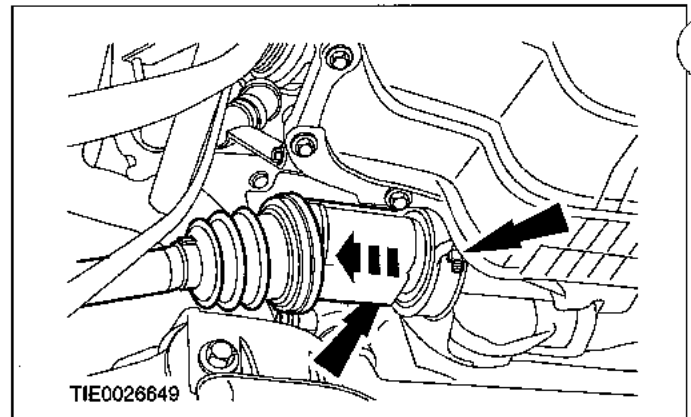
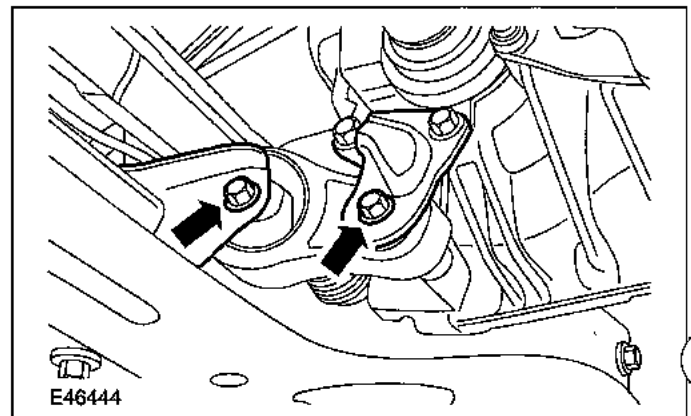
See - Transmission Fluids.

**Detach the right-hand halfshaft and the intermediate shaft from the transaxle and secure it to one side.**

- Discard the center bearing cap and locknuts.
- Allow the fluid to drain into a suitable container.

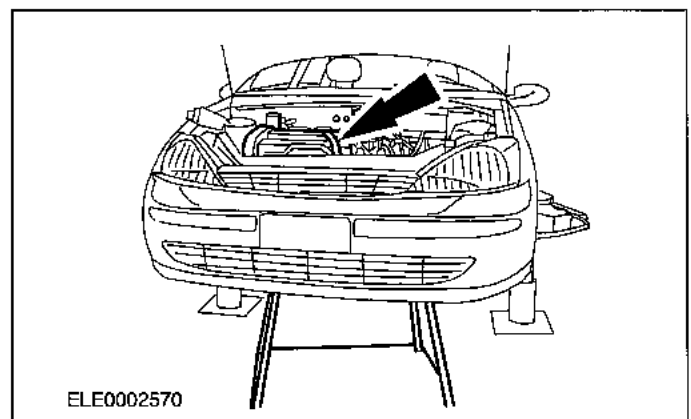
For additional information, refer to: Health and Safety Precautions (100-00 General Information, Description and Operation).

See - Transmission Fluids.

**61. Remove the engine support insulator.****62. ⚠ CAUTION: Do not support the engine directly on the oil pan.**

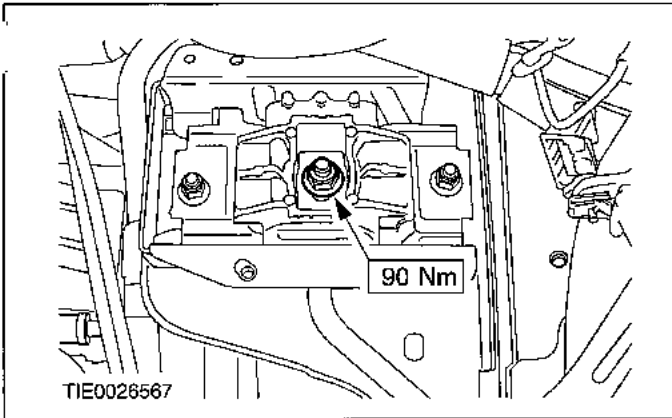
**NOTE:** Using suitable securing straps, secure the engine and the transaxle on a workshop table.

**Using suitable wooden blocks, support the engine and transaxle assembly.**

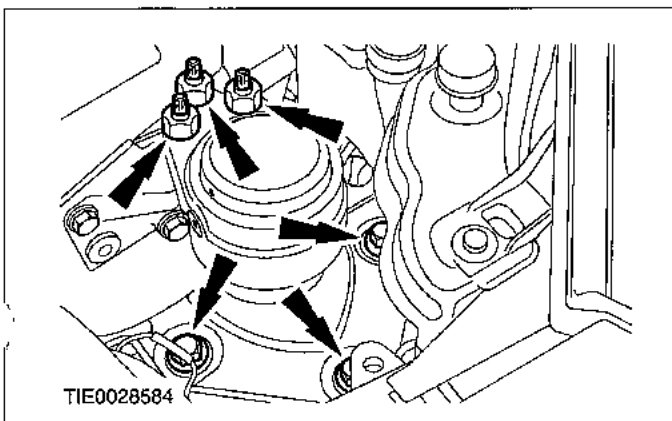
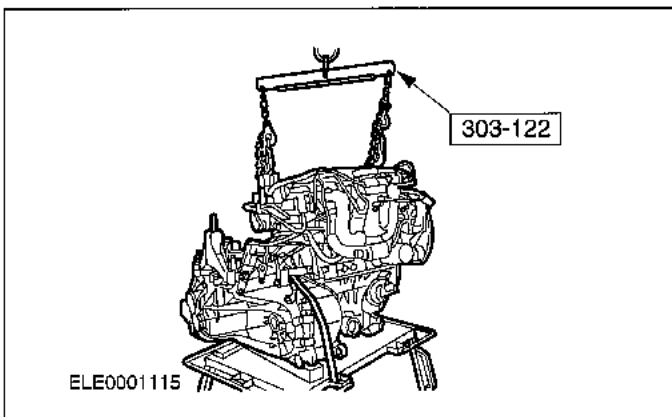
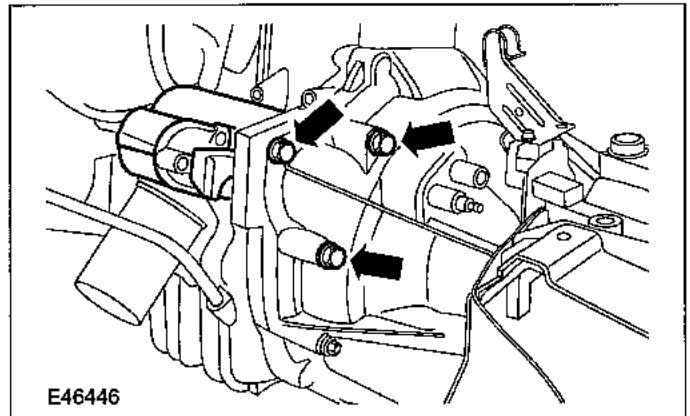
**63. Remove the engine rear mount nut.**

**REMOVAL**

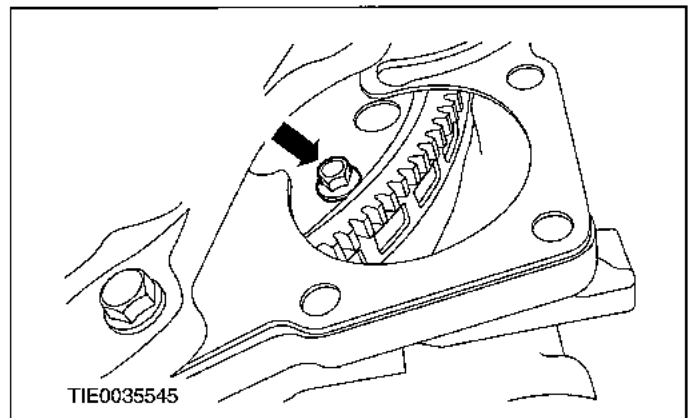
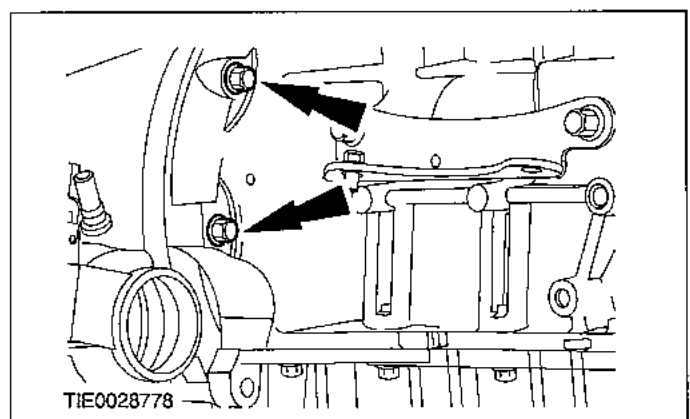
- Discard the nut.

**64. Remove the engine front mount.**

- Discard the nuts.

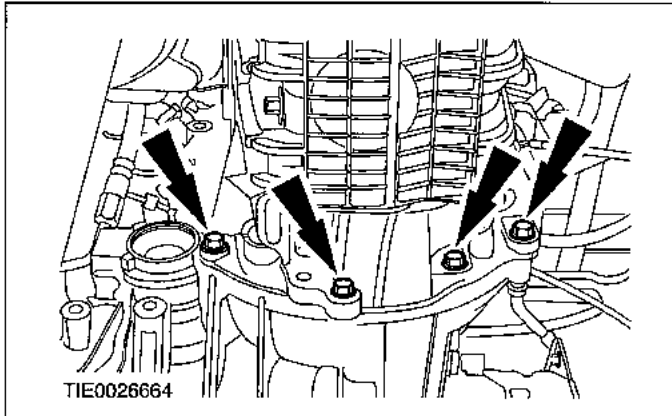
**65. Raise the vehicle and remove the engine and transaxle assembly.****66. Using the special tool, attach the engine and transaxle assembly to the engine hoist.****67. Remove the starter motor.****68. Remove the torque converter retaining nuts.**

- Rotate the torque converter to gain access to the remaining nuts.
- Discard the nuts.

**69. Remove the transaxle right-hand retaining bolts.**

**REMOVAL**

70. Remove the transaxle lower retaining bolts.

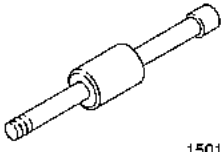
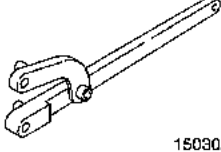
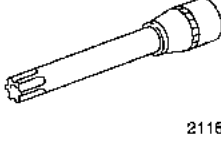
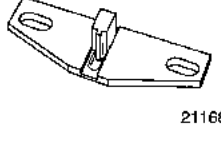
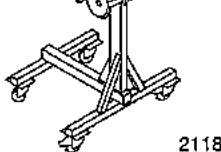
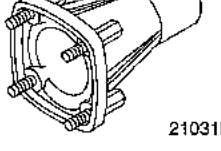


71. **▲WARNING:** Make sure the torque converter remains in the converter housing.  
Remove the transaxle from the engine.

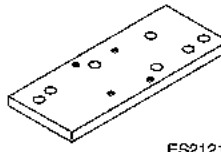
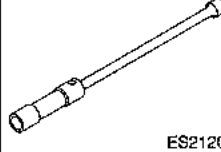
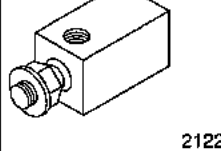
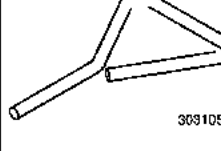
**DISASSEMBLY**

**Engine(21 134 8)**

**Special Tool(s)**

 <p>15011</p>	<p>Slide Hammer 205-047 (15-011)</p>
 <p>15030A</p>	<p>Universal Flange Holding Wrench 205-072 (15-030A)</p>
 <p>21167</p>	<p>Socket, Cylinder Head Bolt 303-392 (21-167)</p>
 <p>21168</p>	<p>Locking Tool, Flywheel 303-393 (21-168)</p>
 <p>21187</p>	<p>Mounting Stand 303-435 (21-187)</p>
 <p>21031B</p>	<p>Mounting Bracket for 303-435 303-435-06 (21-031B)</p>

**Special Tool(s)**

 <p>ES21212</p>	<p>Mounting Plate for 303-435-06 303-435-14A (21-212A)</p>
 <p>ES21202</p>	<p>Socket, Spark Plug 303-499 (21-202)</p>
 <p>21227</p>	<p>Adapter for 205-047 303-633 (21-227)</p>
 <p>3031054</p>	<p>Locking Tool, Timing Belt Tensioner 303-1054</p>

**General Equipment**

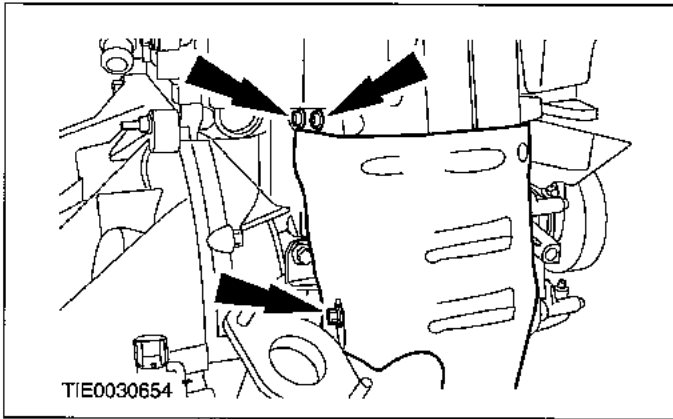
<p>Securing straps</p>
<p>Engine hoist</p>
<p>Oil filter strap wrench</p>

All vehicles

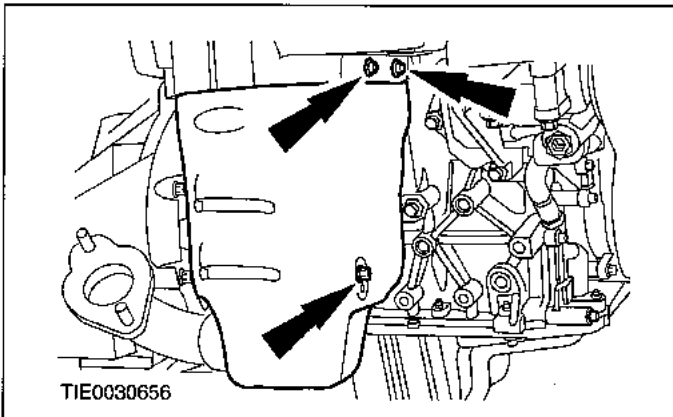
**1. Remove the engine wiring harness.**

**DISASSEMBLY**

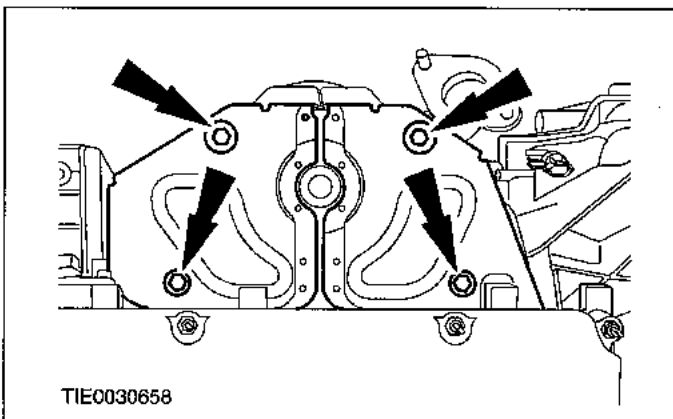
**2. Remove the exhaust manifold lower heat shield left-hand retaining bolts.**



**3. Remove the exhaust manifold lower heat shield right-hand retaining bolts.**

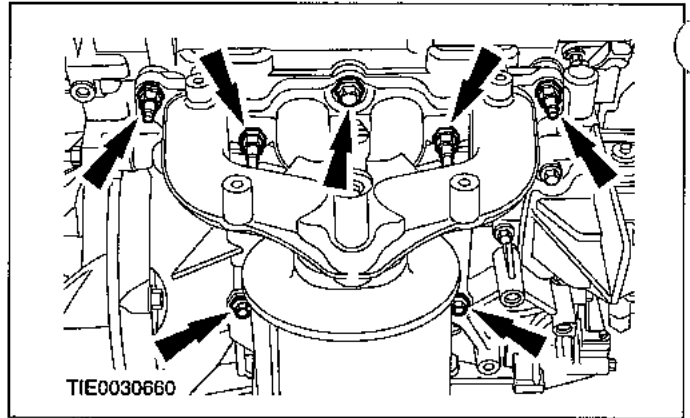


**4. Remove the exhaust manifold upper heat shield.**

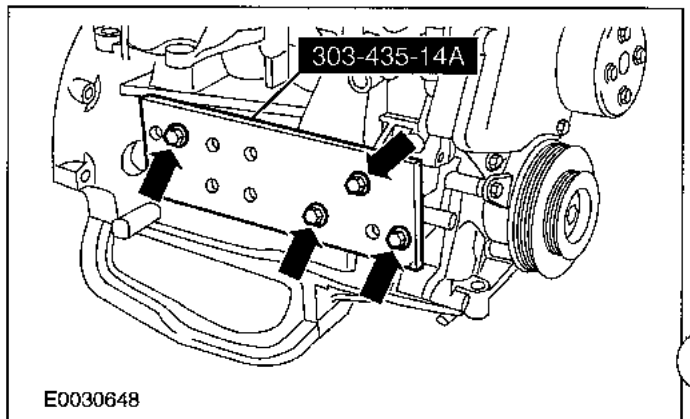


**5. Remove the exhaust manifold.**

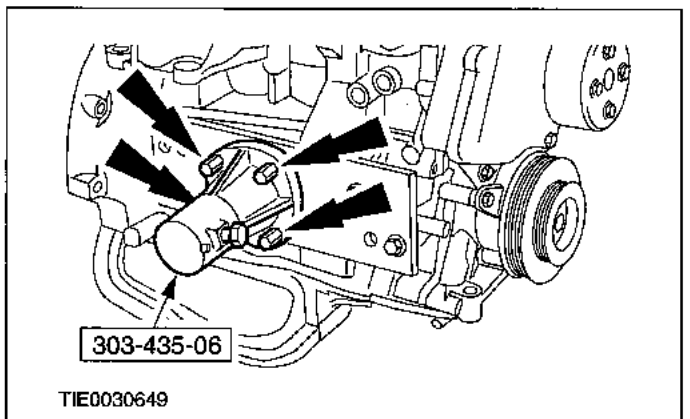
- Discard the gasket.



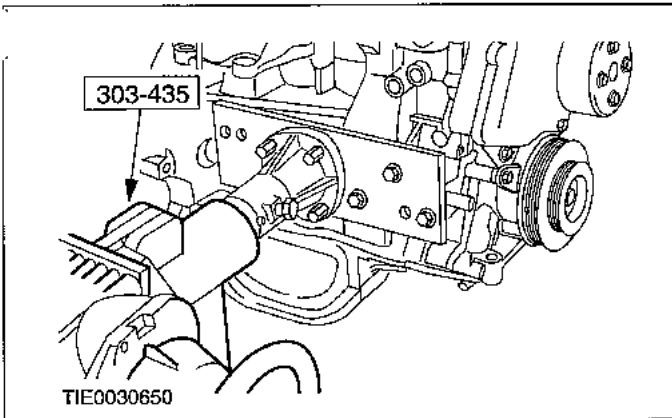
**6. Install the mounting plate to the engine.**



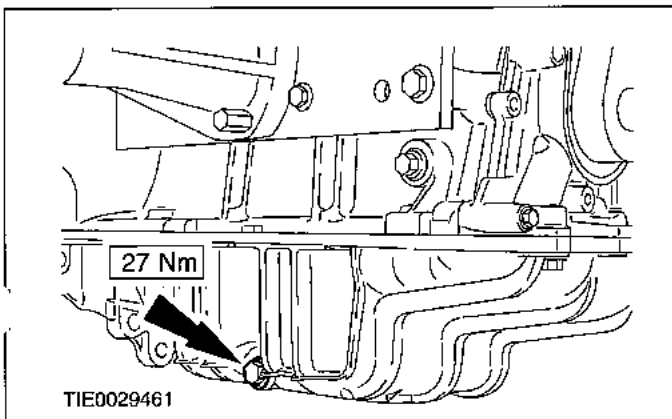
**7. Install the mounting bracket to the mounting plate.**



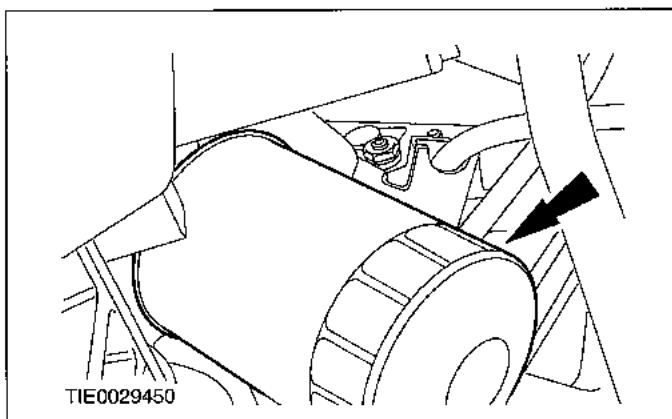
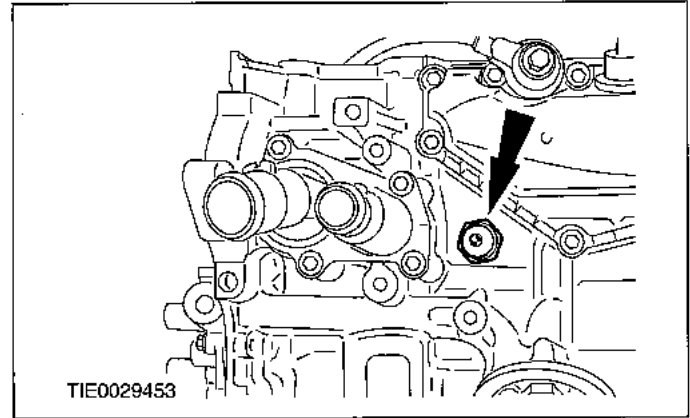
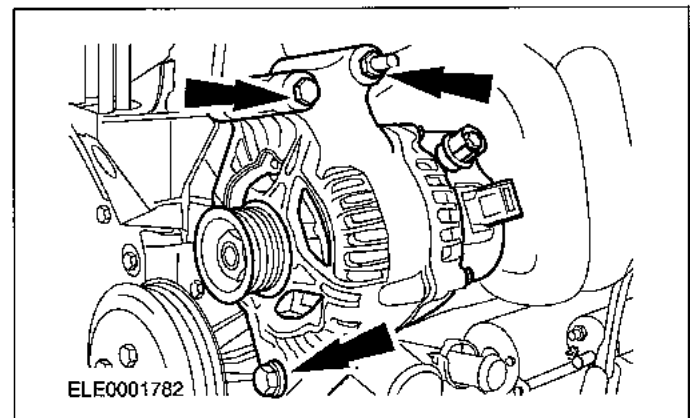
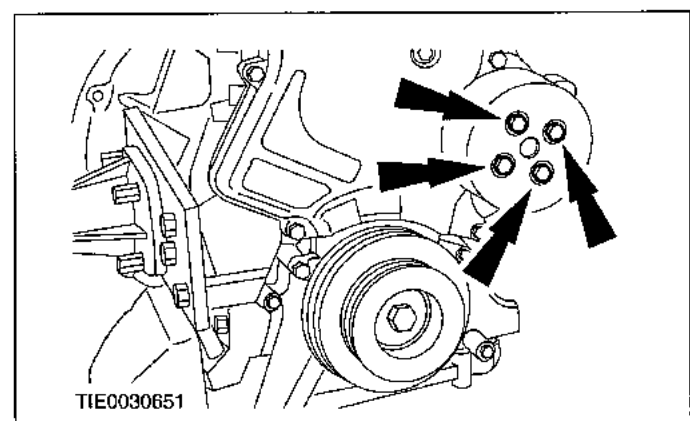


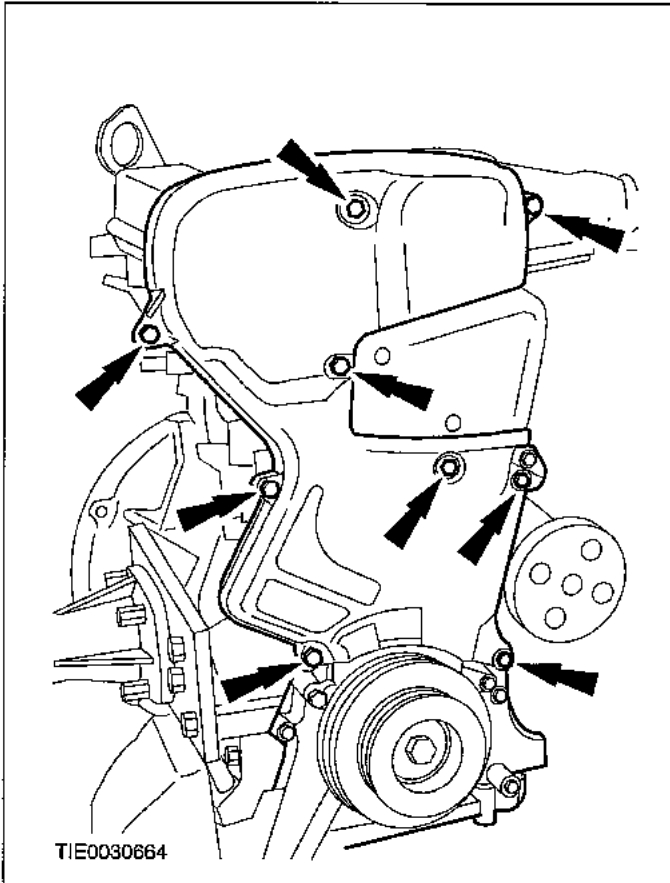
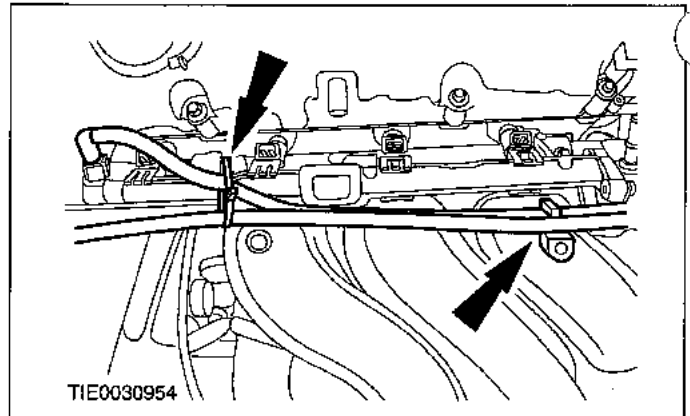
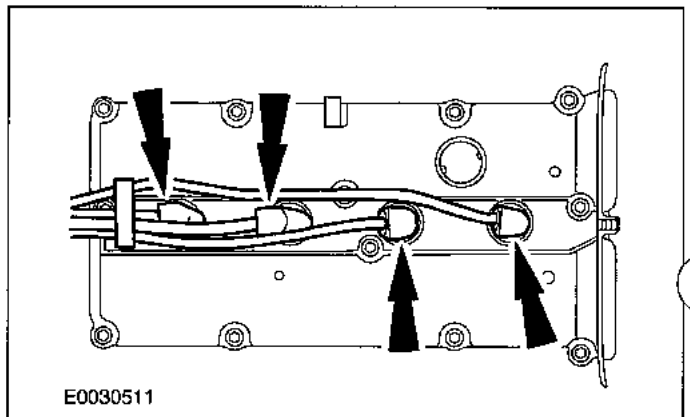
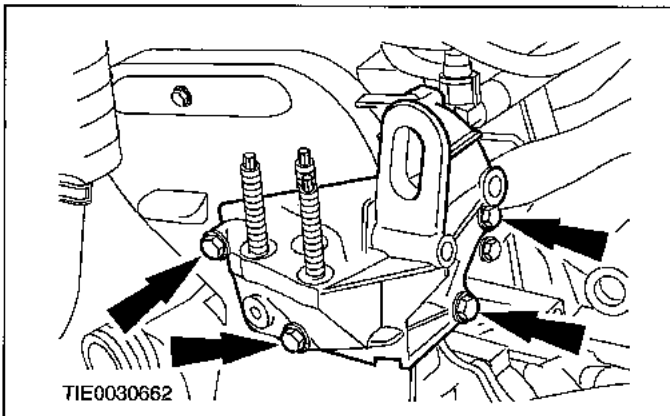
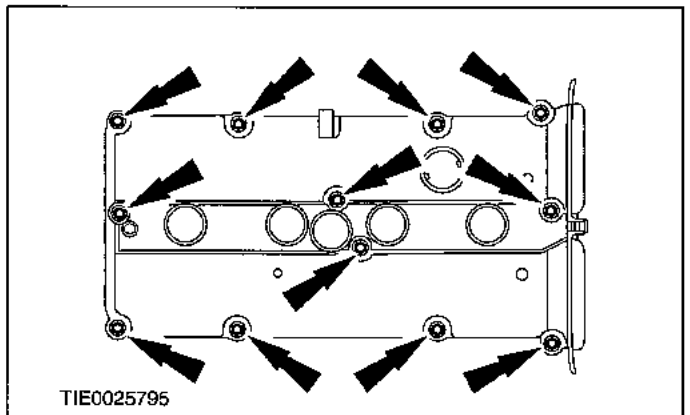
**DISASSEMBLY****8. Install the engine to the mounting stand.****9. Drain the engine oil.**

- Allow the oil to drain into a suitable container.

**10. Using a suitable oil filter strap wrench, remove the oil filter.**

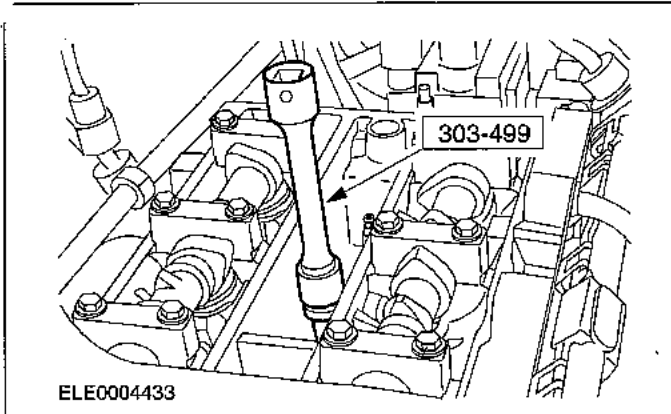
- Discard the oil filter.

**11. Remove the oil pressure switch.****12. Remove the generator.****13. Remove the coolant pump pulley.**

**DISASSEMBLY****14. Remove the timing belt upper cover.****16. Remove the fuel supply and return lines.****17. Disconnect the spark plug electrical connectors and detach the wires from the valve cover.****15. Remove the engine front mount bracket.****18. Remove the valve cover.**

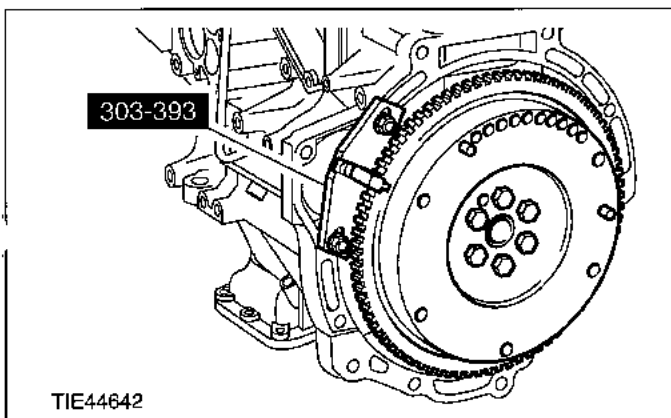
**DISASSEMBLY**

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



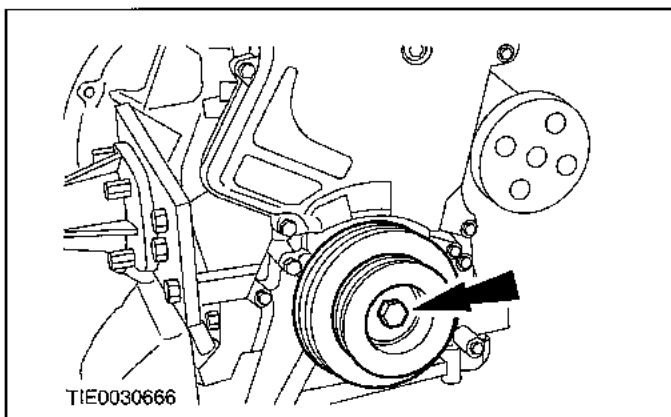
20. Set the crankshaft to approximately 20 degrees before TDC.

21. Using the special tool, lock the crankshaft.

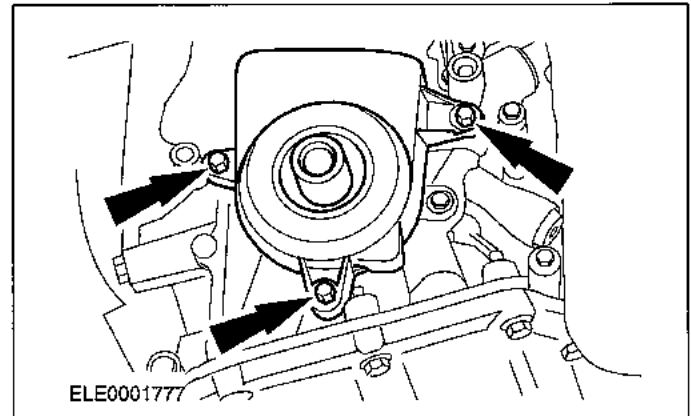


22. Remove the crankshaft pulley.

- Discard the bolt.



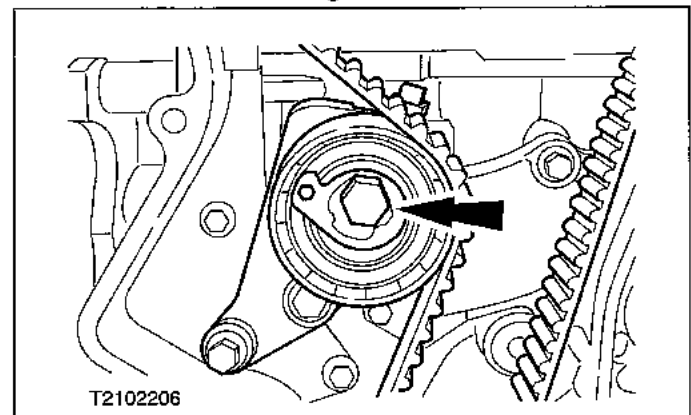
23. Remove the timing belt lower cover.



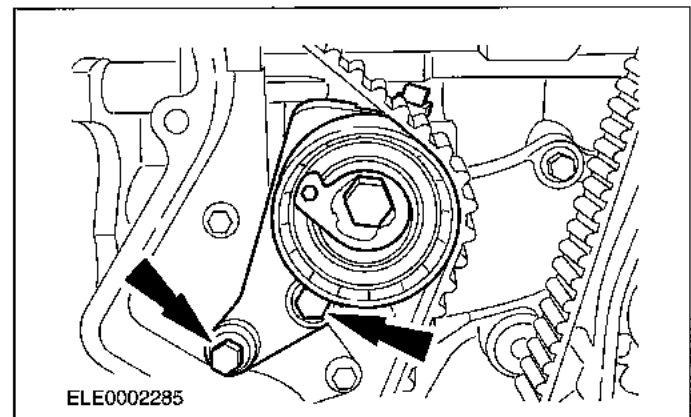
Engines with eccentric cam timing belt tensioner

24. Slacken the timing belt tensioner and remove the timing belt.

- Discard the timing belt.



25. Remove the timing belt tensioner.

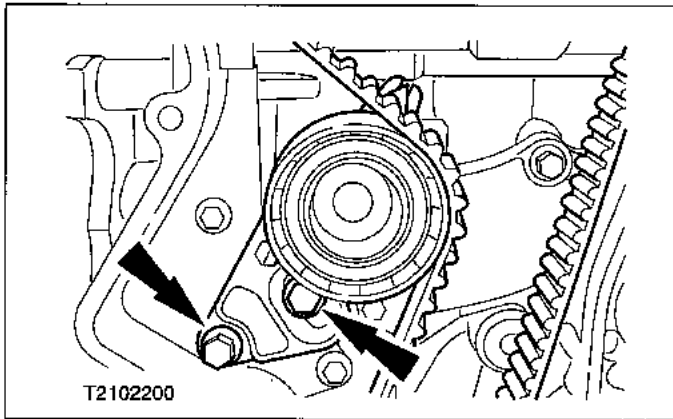


Engines with slotted bracket timing belt tensioner

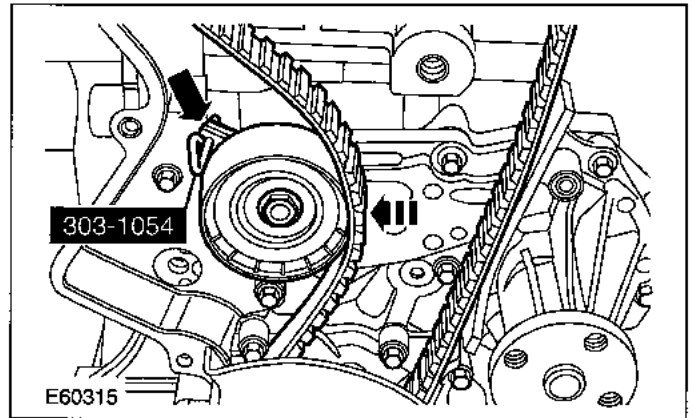
26. Remove the timing belt tensioner and the timing belt.

**DISASSEMBLY**

- Discard the timing belt.



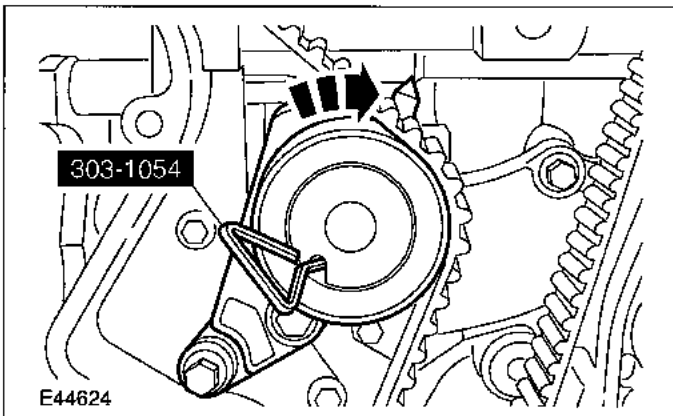
- Tension the timing belt tensioner by pulling the timing belt and lock it with the special tool.
- Discard the timing belt.



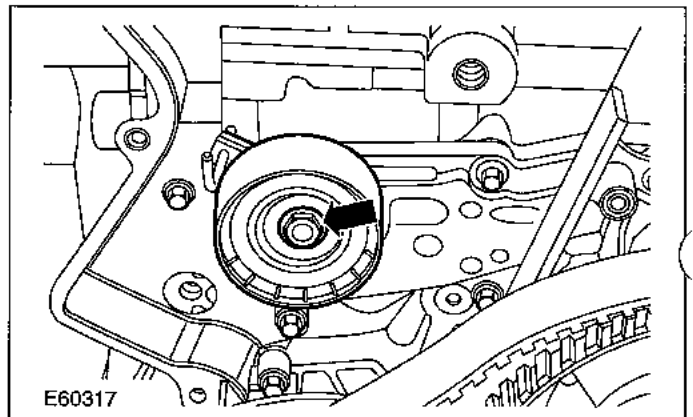
Vehicles built 09/2003 onwards

**27. Remove the timing belt.**

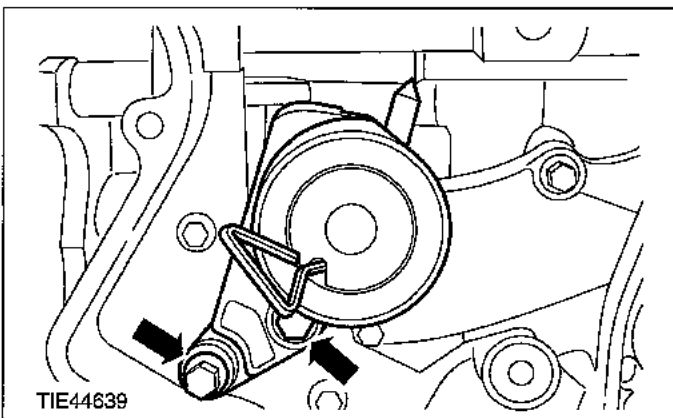
- Tension the timing belt tensioner by pulling the timing belt and lock it with the special tool.
- Discard the timing belt.



**30. Remove the timing belt tensioner.**



**28. Remove the timing belt tensioner.**

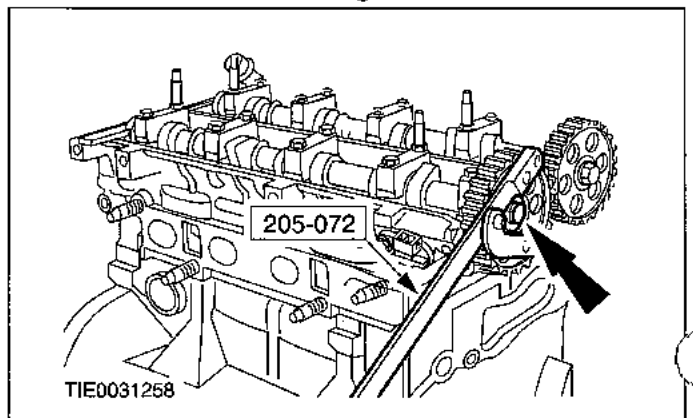


All vehicles

31. **⚠ CAUTION:** Install a hose (order no. E890438S) to the special tool studs, to prevent damage to the camshaft sprockets.

**Remove the camshaft pulleys.**

- Discard the retaining bolts.

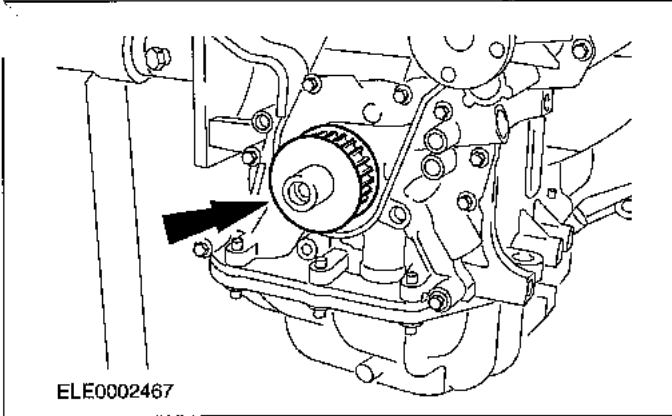


Vehicles built 04/2005 onwards

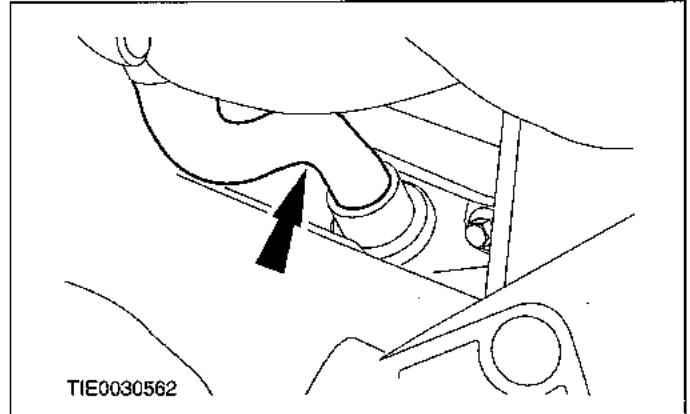
**29. Remove the timing belt.**

**DISASSEMBLY**

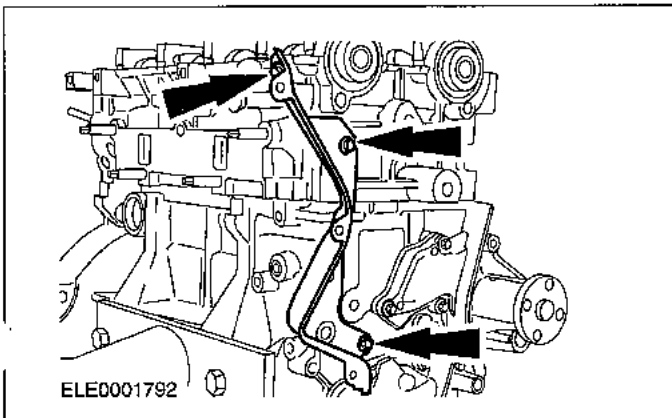
32. Remove the crankshaft timing belt pulley.



35. Disconnect the positive crankcase ventilation (PCV) hose from the PCV cover.

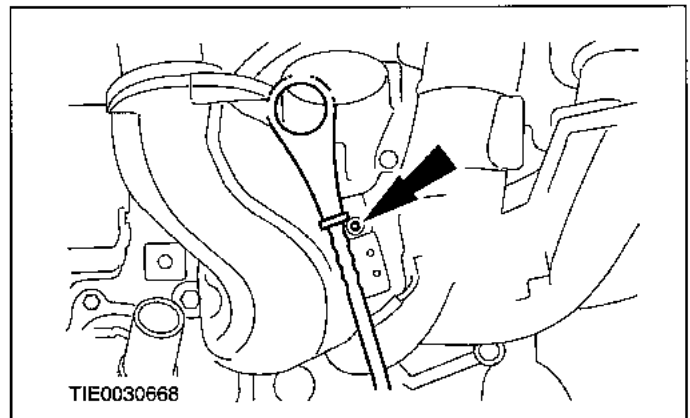


33. Remove the timing belt rear cover.



36. Detach the oil level indicator and tube from the intake manifold.

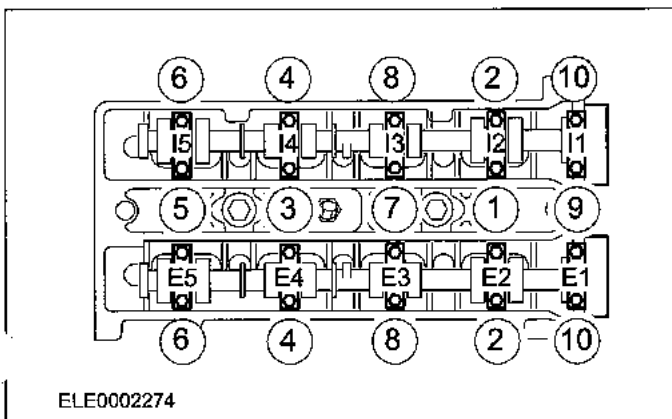
- Detach the knock sensor (KS) electrical connector from the oil level indicator tube.



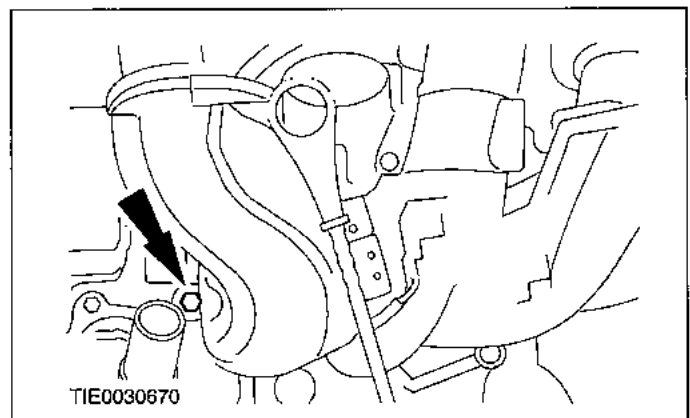
34. **CAUTION:** Keep the camshaft bearing caps and the camshafts in order for installation.

**Remove the camshafts.**

- Slacken each camshaft bearing cap retaining bolt in the sequence shown by one turn until the camshaft is released.
- Remove the camshaft bearing caps.
- Remove and discard the camshaft seals.



37. Remove the intake manifold lower bolt.



38. **CAUTIONS:**

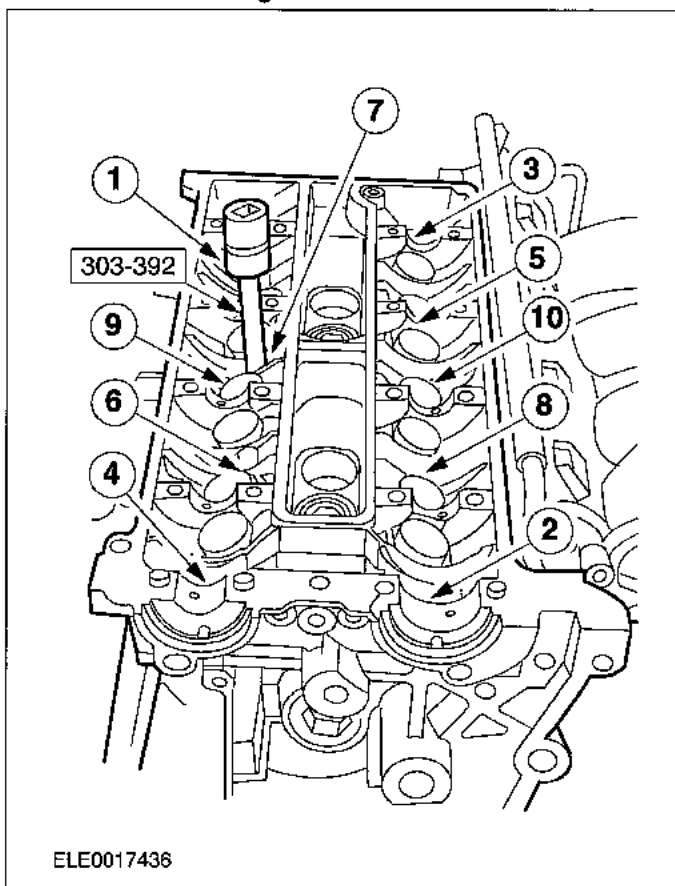
**CAUTION:** Place the cylinder head on a suitable soft surface.

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

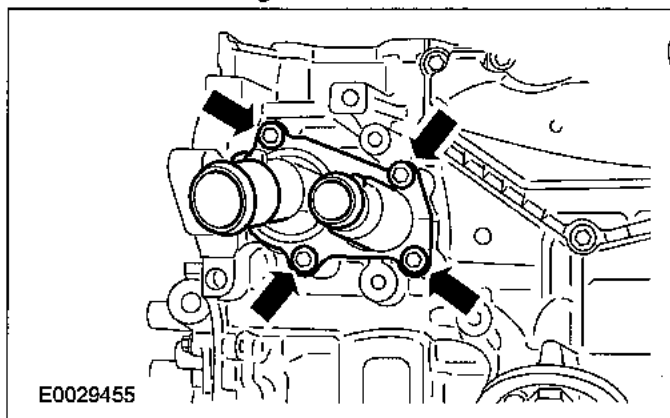
**DISASSEMBLY**

Using the special tool, remove the cylinder head.

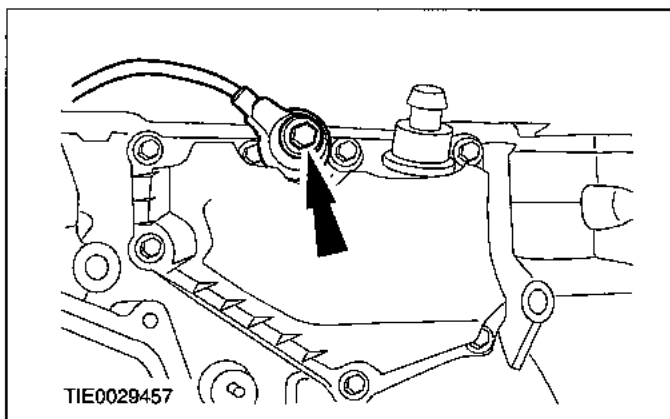
- Discard the gasket.



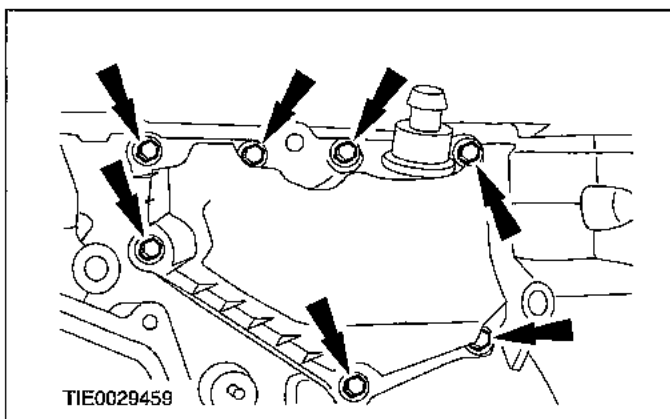
- Discard the gasket.



**41. Remove the KS.**



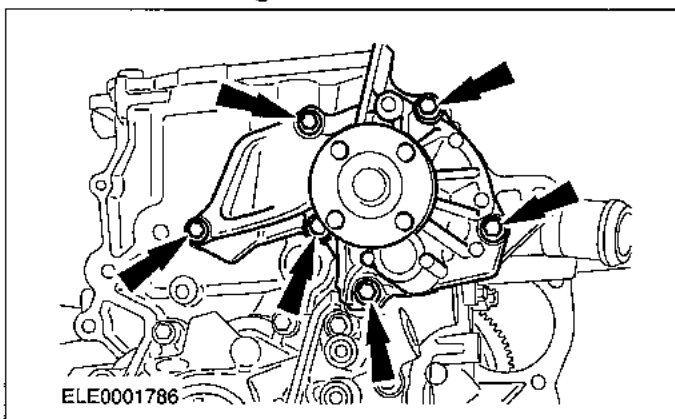
**42. Remove the the PCV cover.**



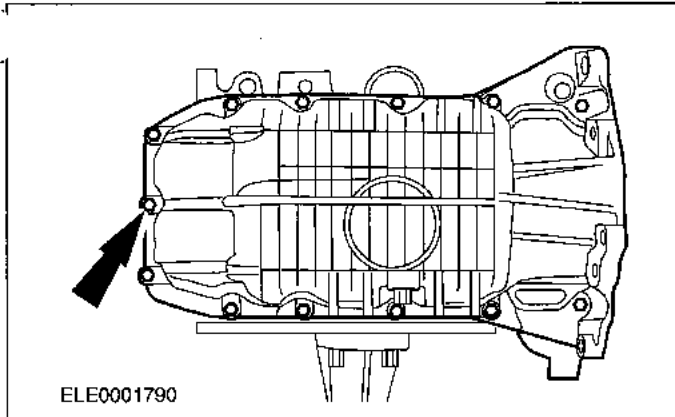
**39. ⚠ CAUTION: Do not damage the coolant pump impeller.**

Remove the coolant pump.

- Discard the gasket.



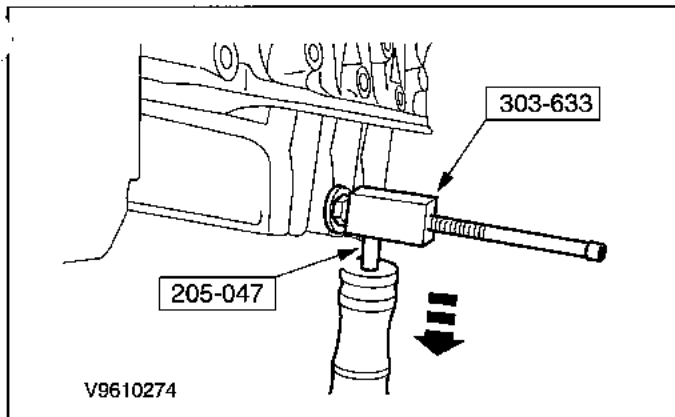
**40. Remove the thermostat housing.**

**DISASSEMBLY****43. Remove the oil pan retaining bolts.**

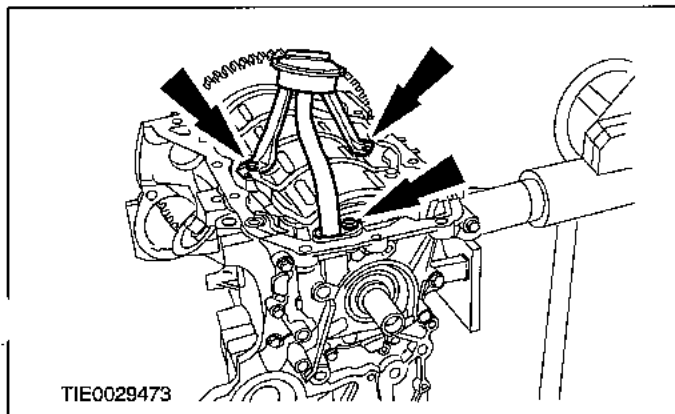
- 44. ⚠ CAUTION:** In order to prevent damage to the sealing surfaces, only use the designated special tool to remove the oil pan. Do not use a chisel or screwdriver for removal.

**NOTE:** Tighten the lock nut against the oil pan and use several taps to release the oil pan from the cylinder block.

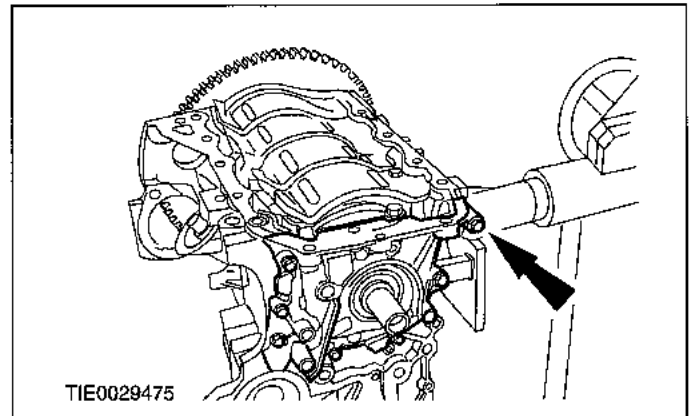
Using the special tools, remove the oil pan.

**45. Remove the oil pump pickup pipe.**

- Discard the gasket.

**46. Remove the oil pump.**

- Discard the gasket.
- Discard the crankshaft front seal.



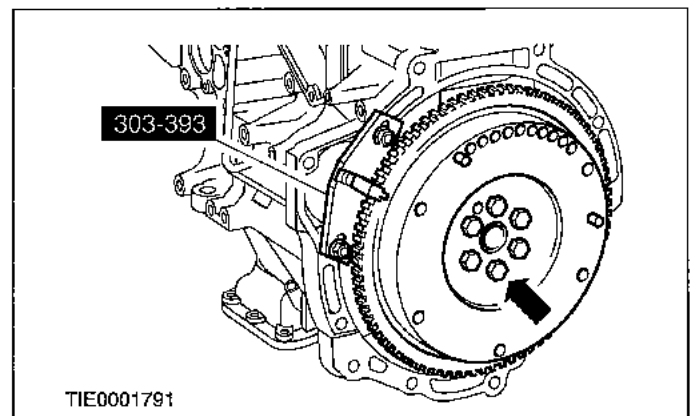
Vehicles with manual transaxle

**47. Remove the clutch disc and pressure plate.**

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

**48. Using the special tool, remove the flywheel.**

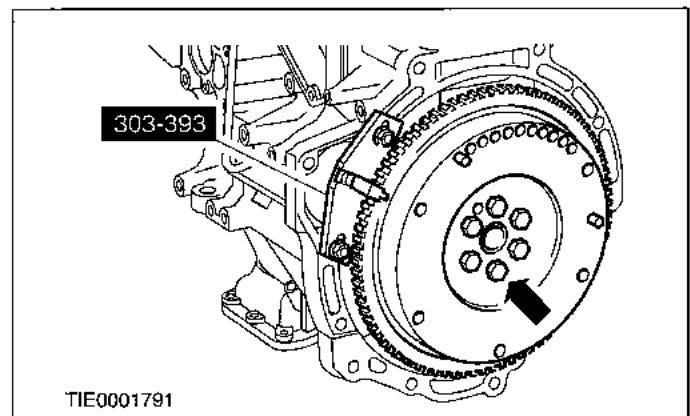
- Discard the bolts.



Vehicles with automatic transaxle

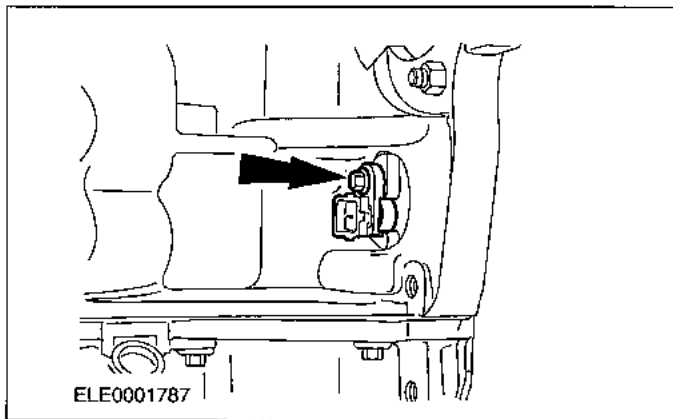
**49. Using the special tool, remove the flexplate.**

- Discard the bolts.

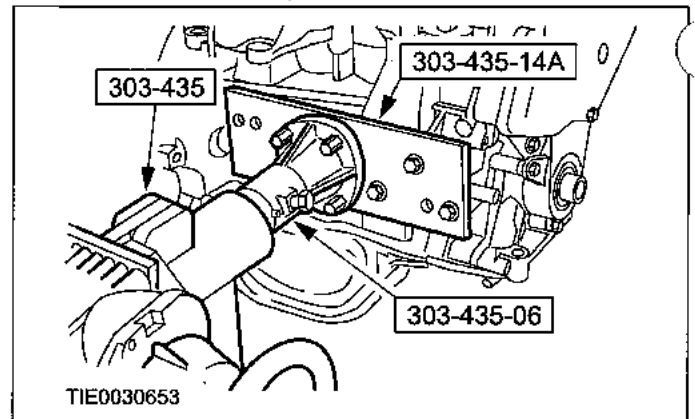
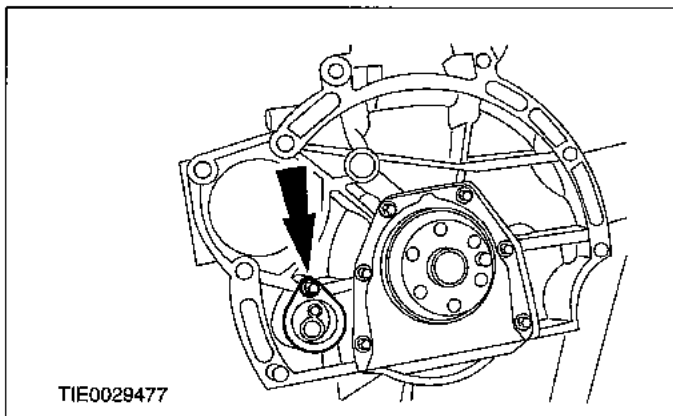


**DISASSEMBLY**

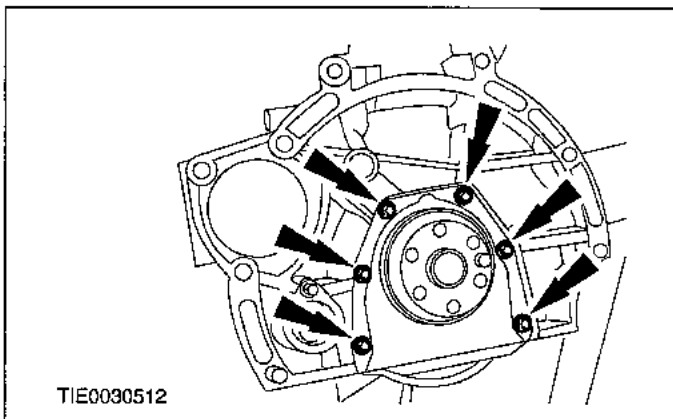
All vehicles

**50. Remove the crankshaft position (CKP) sensor.**

- Remove the special tools.

**51. Remove the CKP sensor bracket.****52. Remove the crankshaft rear seal carrier.**

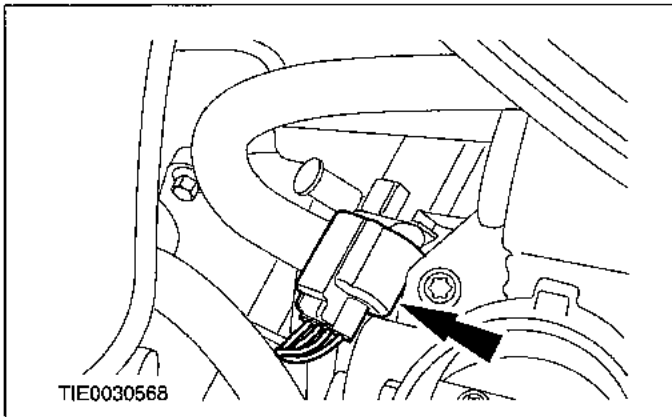
- Discard the crankshaft rear seal carrier.

**53. Detach the cylinder block (short block) from the mounting stand.**

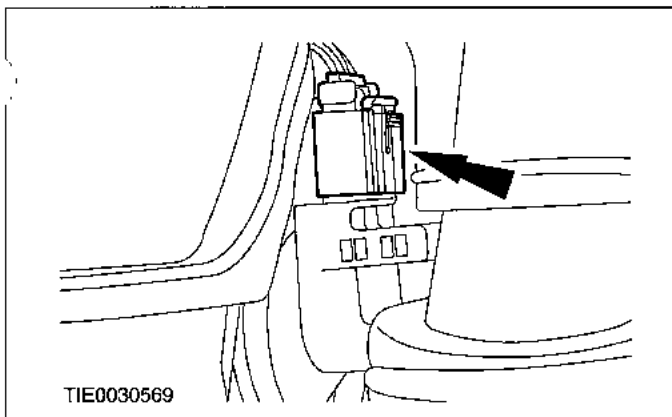


**DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES****Cylinder Head(21 165 6)****Disassembly**

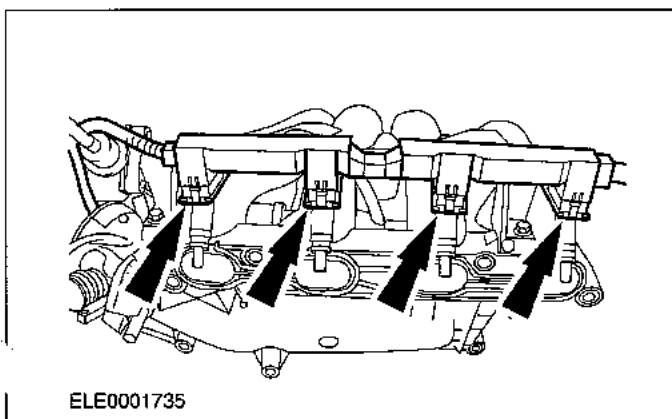
1. Disconnect the temperature and manifold absolute pressure (T-MAP) sensor electrical connector.



2. Disconnect the throttle plate control motor (DC-ISC) electrical connector.



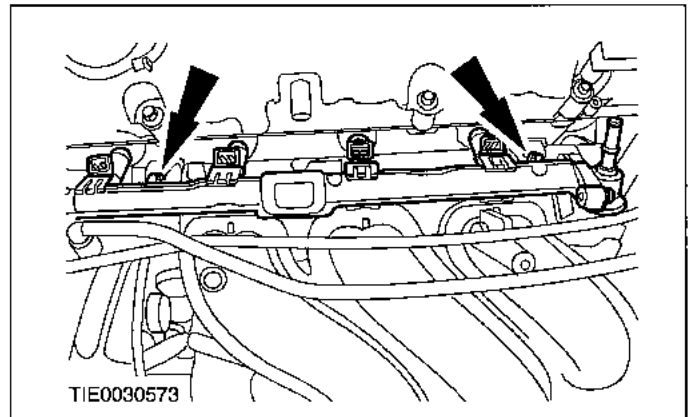
3. Disconnect the fuel injector electrical connectors.



4. Remove the engine wiring harness.

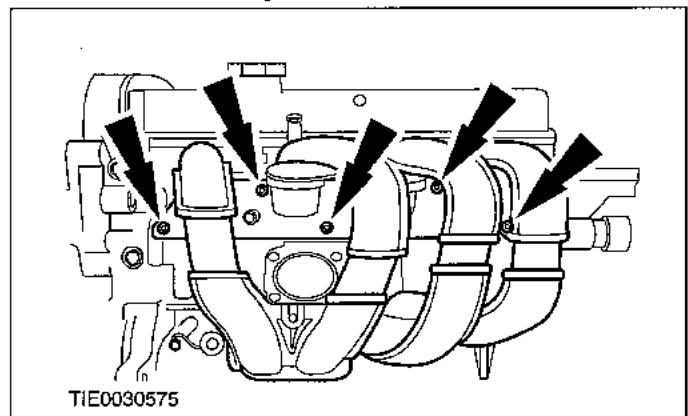
5. Remove the fuel supply manifold.

- Discard the O-ring seals.

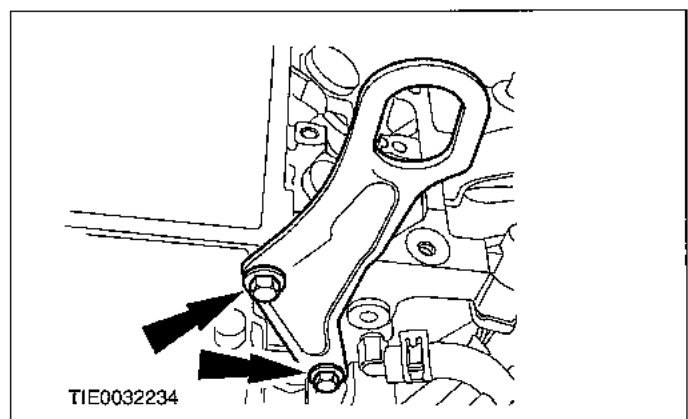


6. Remove the intake manifold.

- Discard the gaskets.



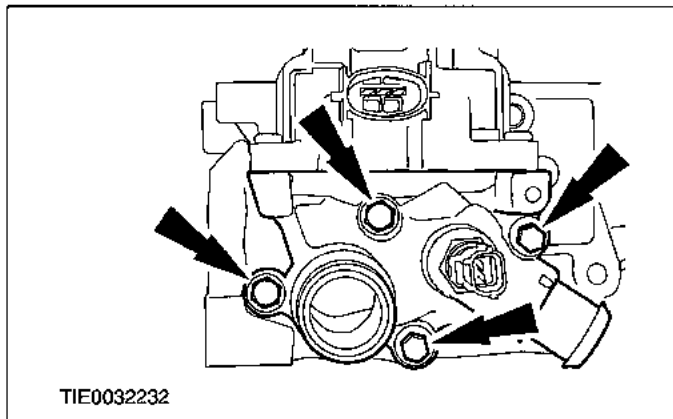
7. Remove the engine rear lifting eye.



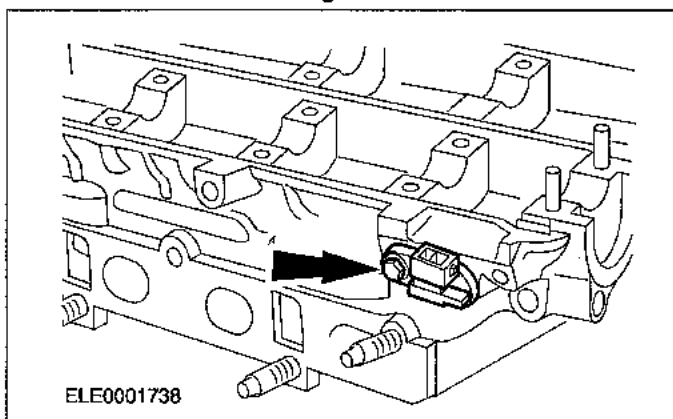
8. Remove the coolant distribution housing and the ignition coil (EI).

**DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES**

- Discard the gasket.

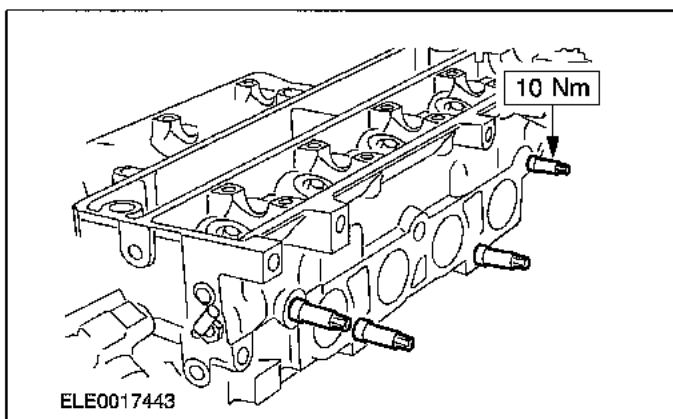
**9. Remove the camshaft position (CMP) sensor.**

- Discard the O-ring seal.

**Assembly**

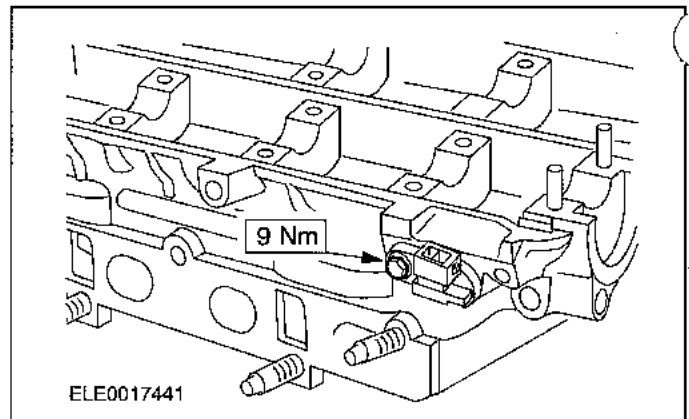
- NOTE:**A new cylinder head is supplied without exhaust manifold studs.

Install the exhaust manifold studs if necessary.



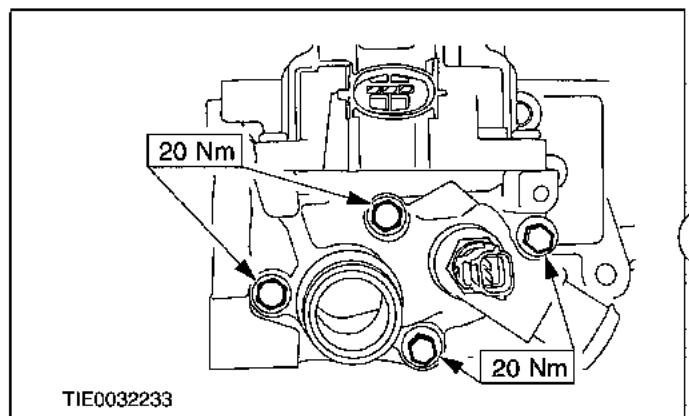
- NOTE:**Install a new camshaft position (CMP) O-ring seal.

Install the CMP sensor.

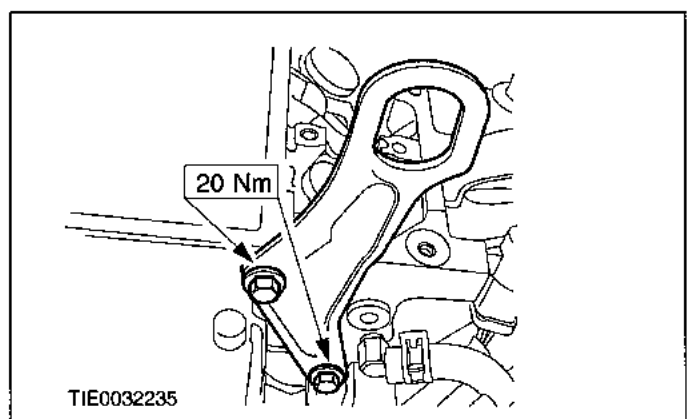


- NOTE:**Install a new coolant distribution housing gasket.

Install the coolant distribution housing and the ignition coil (EI).



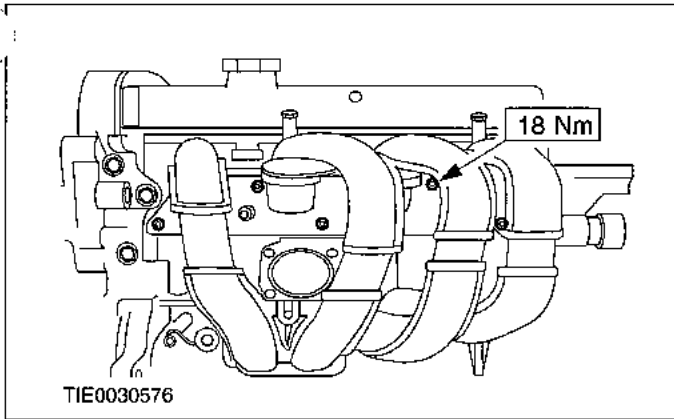
- Install the engine rear lifting eye.



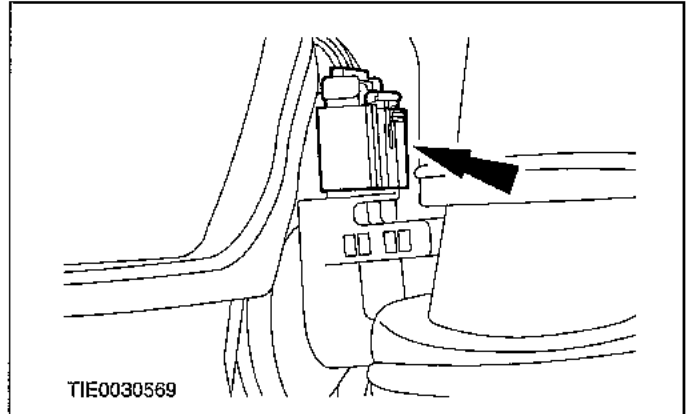
- NOTE:**Install new intake manifold gaskets.

**DISASSEMBLY AND ASSEMBLY OF SUBASSEMBLIES**

**Install the intake manifold.**

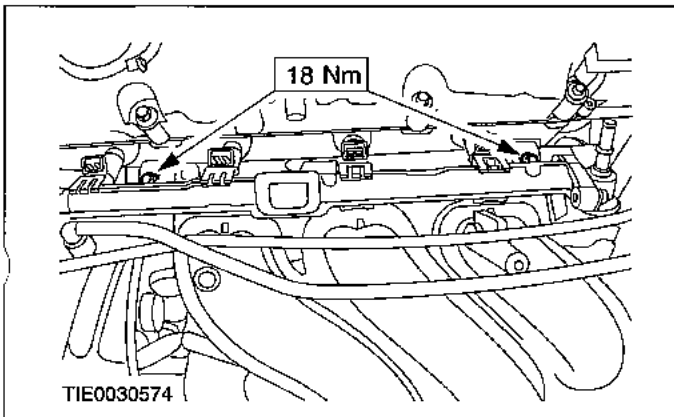


**9. Connect the throttle plate control motor (DC-ISC) electrical connector.**

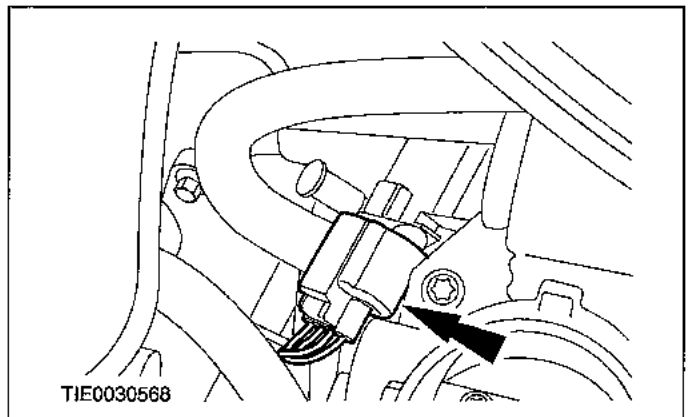


**6. NOTE: Install new fuel supply manifold O-ring seals.**

**Install the fuel supply manifold.**

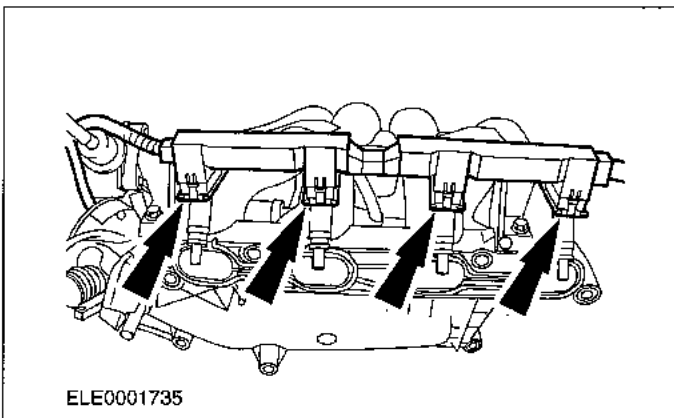


**10. Connect the temperature and manifold absolute pressure (T-MAP) sensor electrical connector.**



**7. Install the engine wiring harness.**

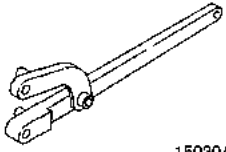
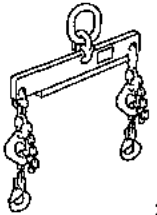
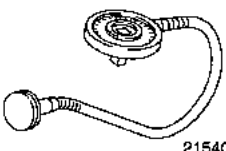
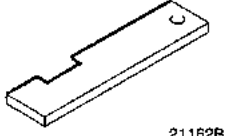
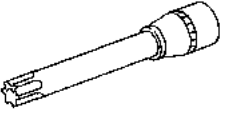
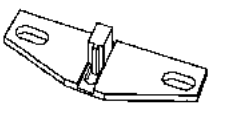
**8. Connect the fuel injector electrical connectors.**



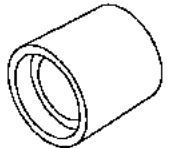
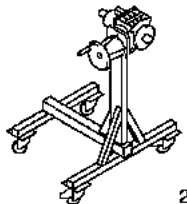
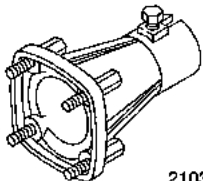
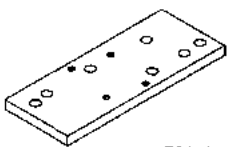
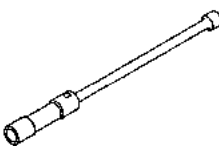
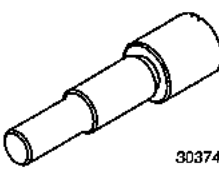
**ASSEMBLY**

**Engine(21 134 8)**

**Special Tool(s)**

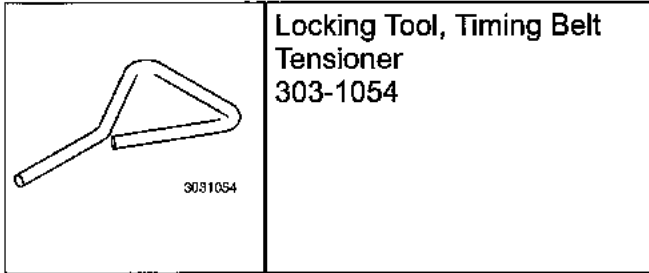
 <p>15030A</p>	<p>Universal Flange Holding Wrench 205-072 (15-030A)</p>
 <p>21068A</p>	<p>Lifting Bracket, Engine 303-122 (21-068A)</p>
 <p>21540</p>	<p>Gauge, Bolt Angle 303-174 (21-540)</p>
 <p>21162B</p>	<p>Alignment Plate, Camshaft 303-376B (21-162B)</p>
 <p>21167</p>	<p>Socket, Cylinder Head Bolt 303-392 (21-167)</p>
 <p>21168</p>	<p>Locking Tool, Flywheel 303-393 (21-168)</p>

**Special Tool(s)**

 <p>21171</p>	<p>Installer, Crankshaft Seal 303-395 (21-171)</p>
 <p>21187</p>	<p>Mounting Stand 303-435 (21-187)</p>
 <p>21031B</p>	<p>Mounting Bracket for 303-435 303-435-06 (21-031B)</p>
 <p>ES21212</p>	<p>Mounting Plate for 303-435-06 303-435-14A (21-212A)</p>
 <p>ES21202</p>	<p>Socket, Spark Plug 303-499 (21-202)</p>
 <p>303748</p>	<p>Locking Tool, Crankshaft 303-748 (21-259)</p>

**ASSEMBLY**

**Special Tool(s)**



**General Equipment**

- Five M8 x 20 mm studs
- Engine hoist

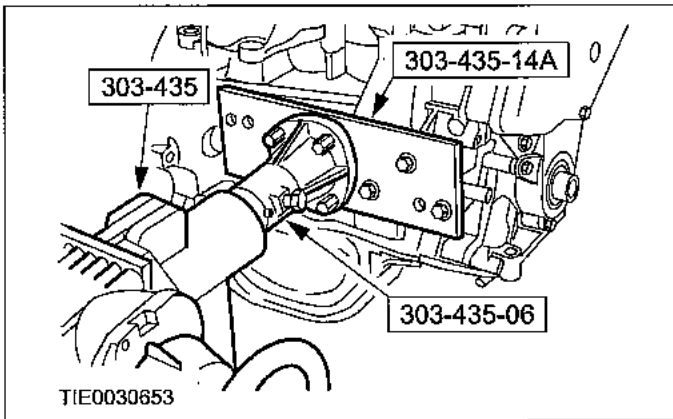
**Materials**

Name	Specification
Engine Oil - 5W-30	WSS-M2C913-B
Silicone Sealant	WSE-M4G323-A4
Adhesive - Loctite 243	WSK-M2G349-A7
Gasket Eliminator Sealant	WSK-M2G348-A5
High-Temperature Grease	ESD-M1C220-A

All vehicles

**1. Attach the cylinder block (short block) to the mounting stand.**

- Install the special tools.

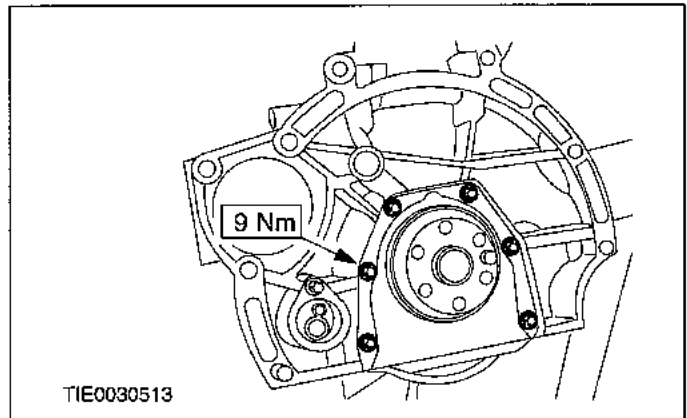


**2. NOTE: Install a new crankshaft rear seal carrier.**

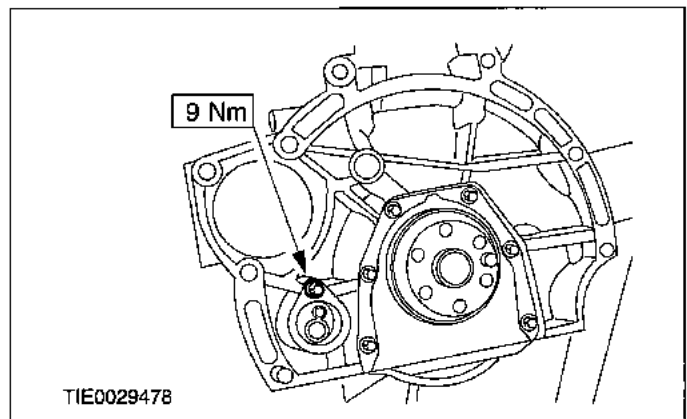
**NOTE:**A new crankshaft rear seal carrier is supplied with an alignment sleeve which must be removed following installation.

**NOTE:**Do not lubricate the seal lip.

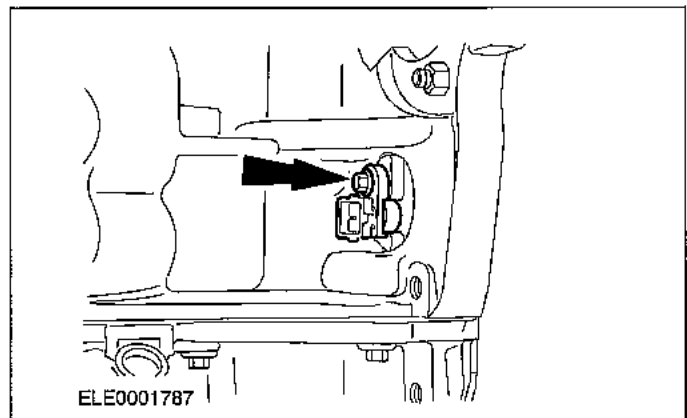
**Install the crankshaft rear seal carrier.**



**3. Install the crankshaft position (CKP) sensor bracket.**



**4. Install the CKP sensor.**



Vehicles with manual transaxle

**5. NOTE: Install new flywheel retaining bolts.**

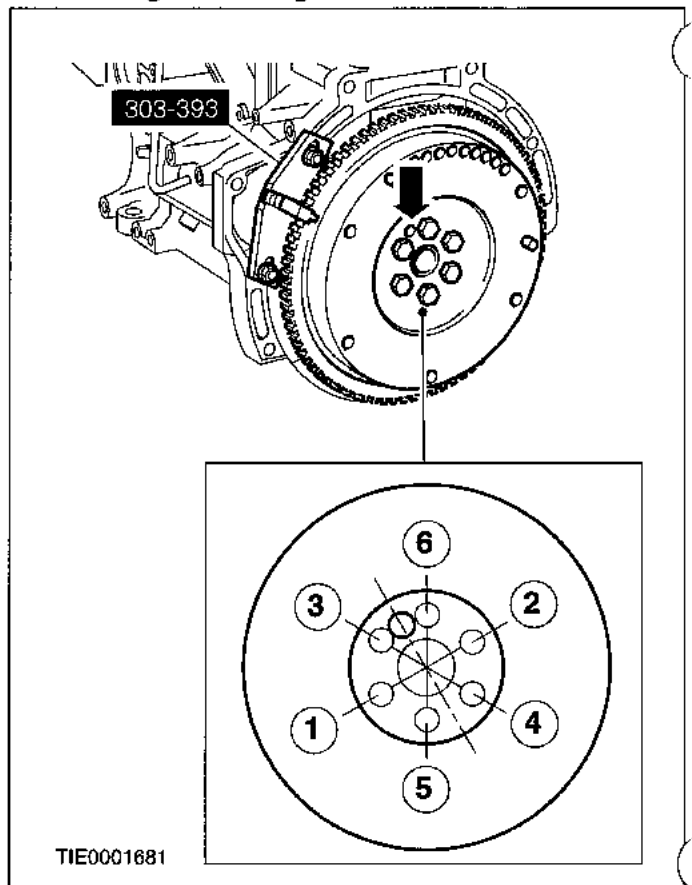
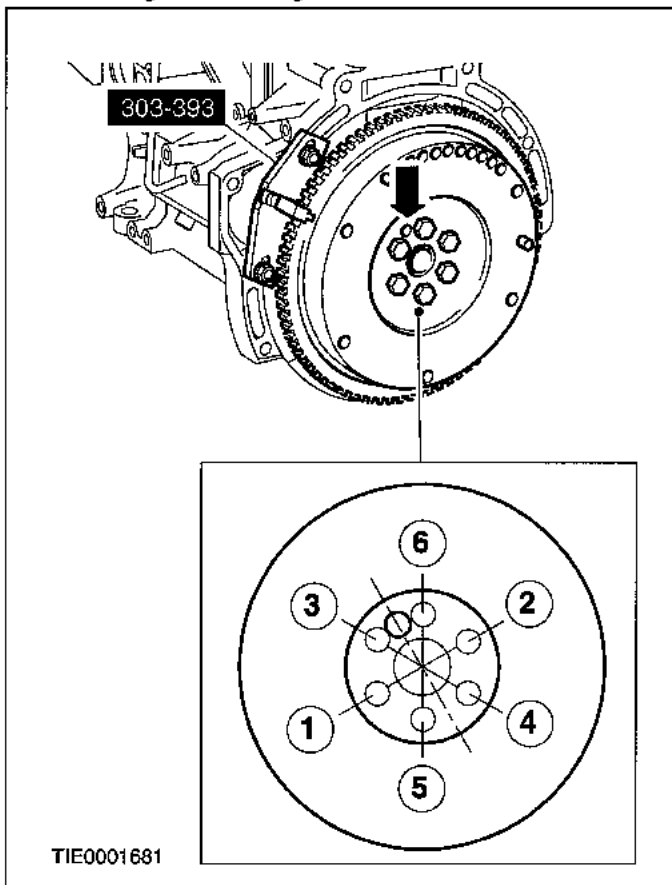
**Using the special tool, install the flywheel.**

- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 30 Nm.

**ASSEMBLY**

- Stage 2: 80 degrees.

- Stage 2: 80 degrees.



**6. Install the clutch disc and pressure plate.**

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

**7. Remove the special tool from the flywheel.**

Vehicles with automatic transaxle

**8. NOTE: Install new flexplate retaining bolts.**

Using the special tool, install the flexplate.

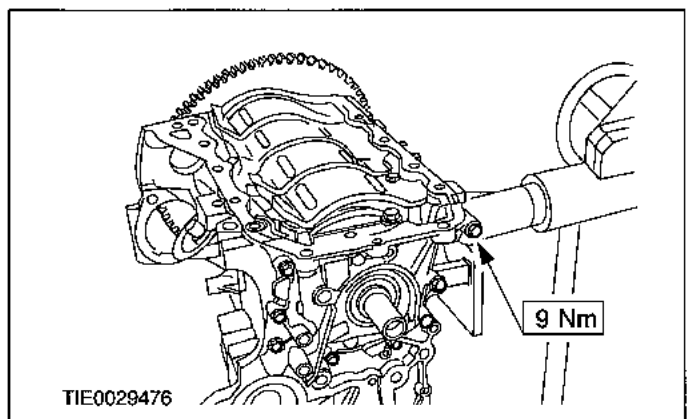
- Tighten the bolts in the sequence shown in two stages.
- Stage 1: 30 Nm.

**9. Remove the special tool from the flexplate.**

All vehicles

**10. NOTE: Install a new oil pump gasket.**

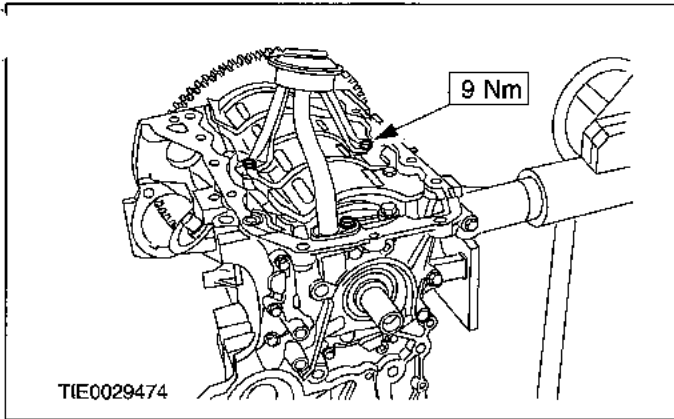
Install the oil pump.



**11. NOTE: Install a new pickup pipe gasket.**

**ASSEMBLY**

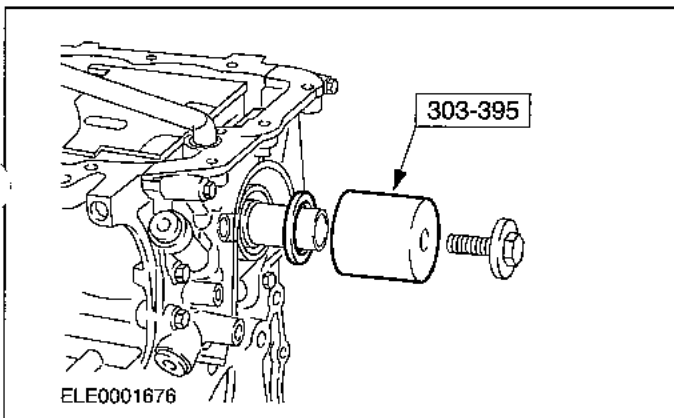
Install the oil pump pickup pipe.



12. Coat the crankshaft front seal lip with clean engine oil.

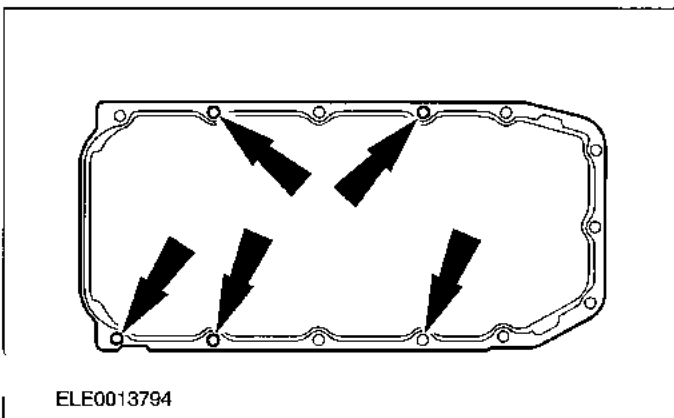
13. NOTE: Install a new crankshaft front seal.

Using the special tool, install the crankshaft front seal.



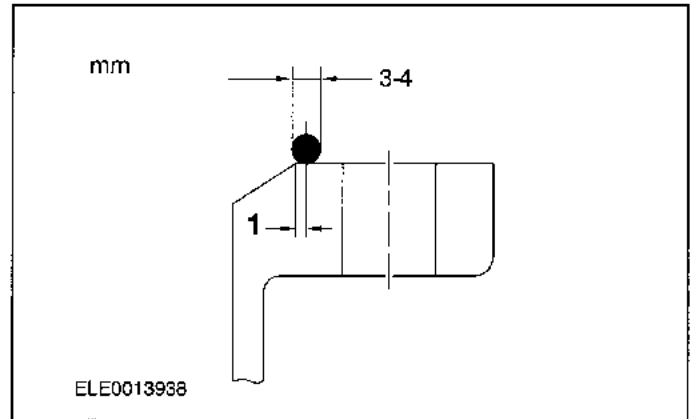
14. **CAUTION:** The crankcase may be damaged if sealant enters the blind holes.

Install five M8 x 20 mm studs into the blind holes as shown.



15. NOTE: Attach the oil pan within ten minutes of applying sealant and tighten the bolts within a further five minutes.

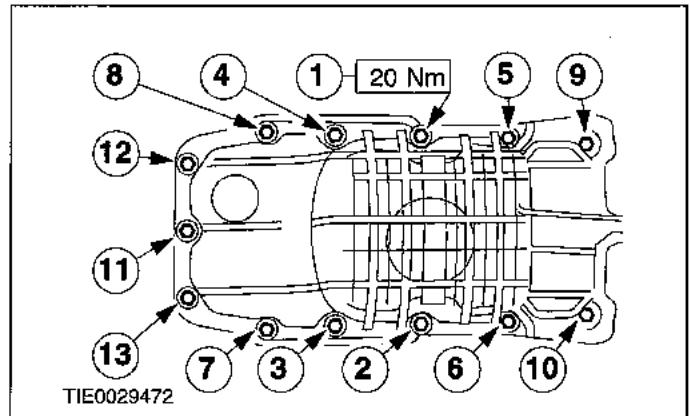
Apply a 3 to 4 mm diameter thick bead of sealant to the oil pan flange.



16. NOTE: Align the oil pan so that the cylinder block is flush with the oil pan on the flywheel side.

Install the oil pan, loosely install the retaining bolts.

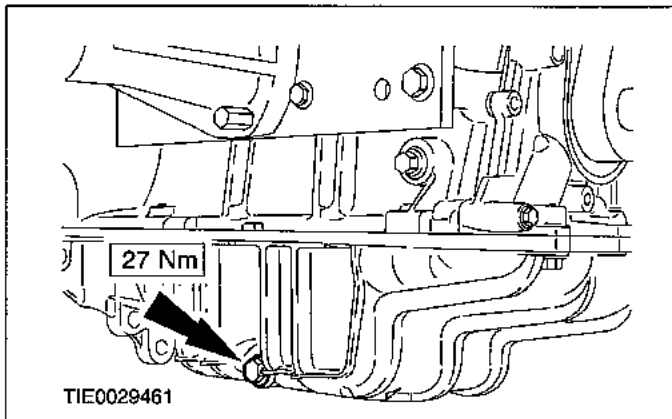
- Remove the studs and install retaining bolts.
- Tighten the oil pan retaining bolts in the sequence shown in two stages.
- Stage 1: 10 Nm.
- Stage 2: 20 Nm.



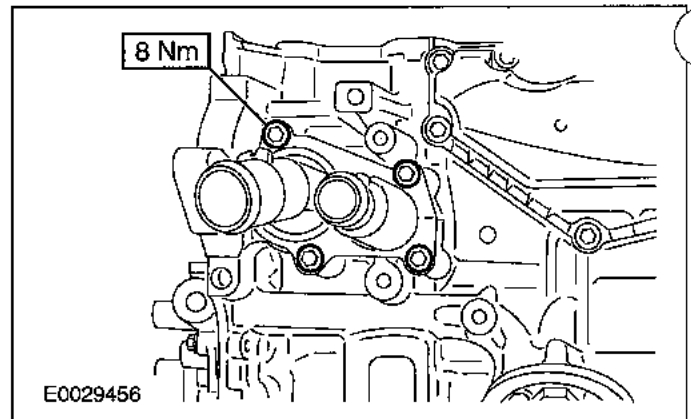
17. NOTE: Inspect the oil pan drain plug seal for damage. Install a new drain plug and seal if required.

**ASSEMBLY**

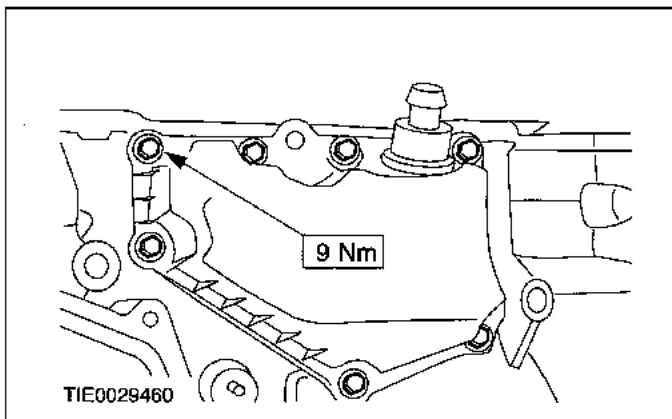
Install the drain plug.



Install the thermostat housing.

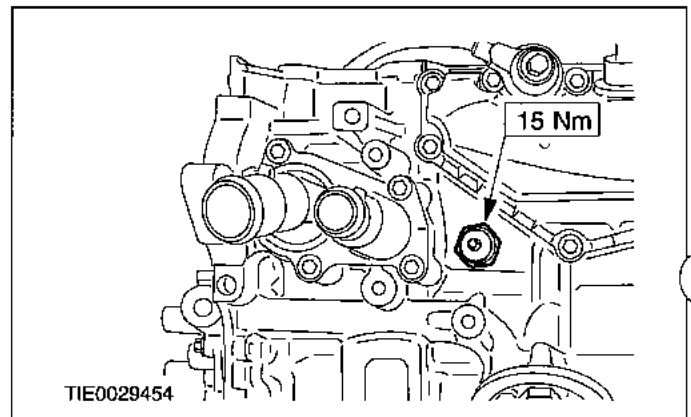


18. Install the positive crankcase ventilation (PCV) cover.



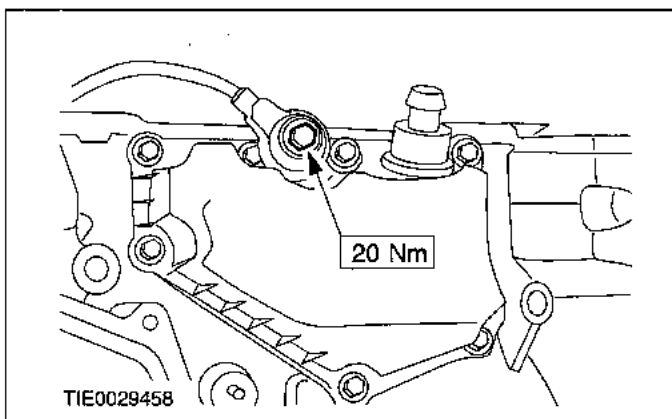
21. Install the oil pressure switch.

- Apply adhesive to the oil pressure switch threads.



19. **⚠ CAUTION:** The knock sensor (KS) cable must not touch the cylinder head or the PCV cover. Position the KS cable at approximately the 10 o'clock position.

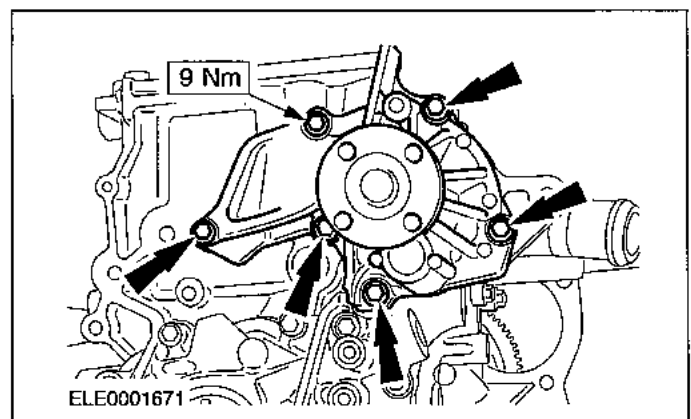
Install the KS.



22. **⚠ CAUTION:** Do not damage the coolant pump impeller.

**NOTE:** Install a new coolant pump gasket.

Install the coolant pump.



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

23. Turn the crankshaft to approximately 25 mm before top dead center (BTDC) on cylinder number 1.



**ASSEMBLY**

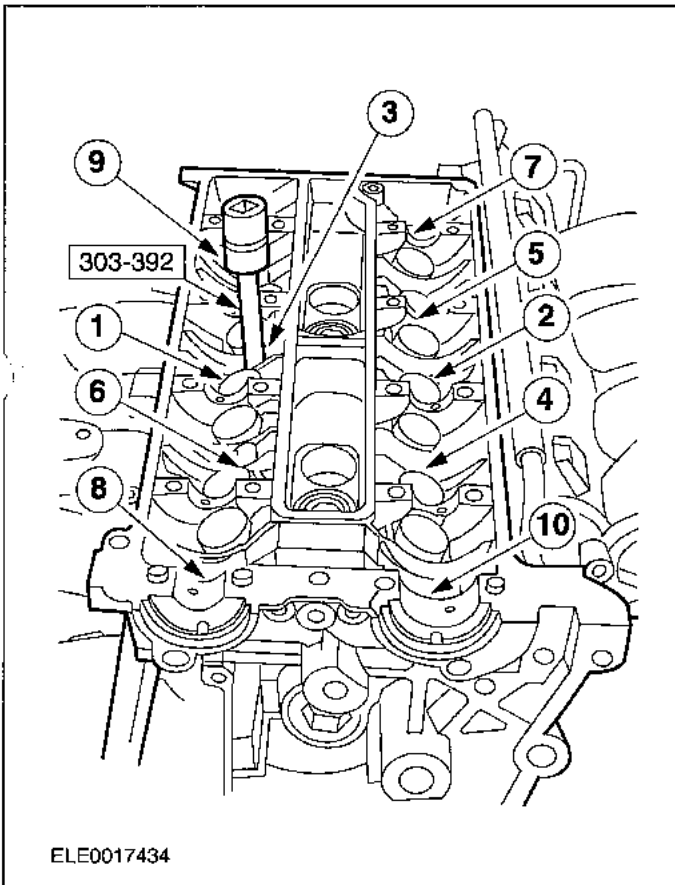
24. **CAUTION:**The thickness of the new cylinder head gasket must be the same as that of the old one (hole marked).

**NOTE:**Install a new cylinder head gasket.

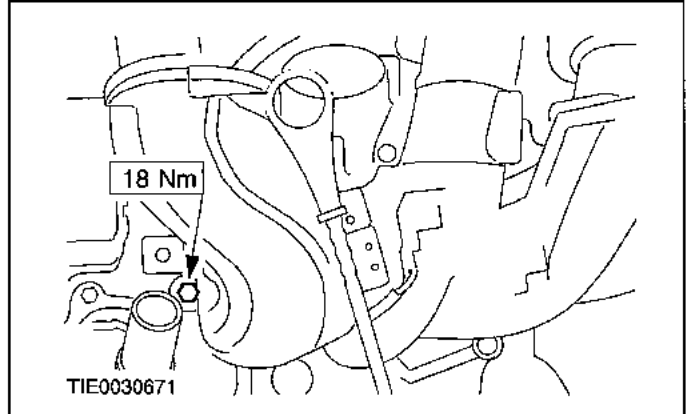
**NOTE:**Position the cylinder head onto the two guide sleeves.

**Using the special tool, install the cylinder head.**

- Tighten the cylinder head bolts in the sequence shown in three stages.
- Stage 1: 15 Nm.
- Stage 2: 30 Nm.
- Stage 3: 90 degrees.

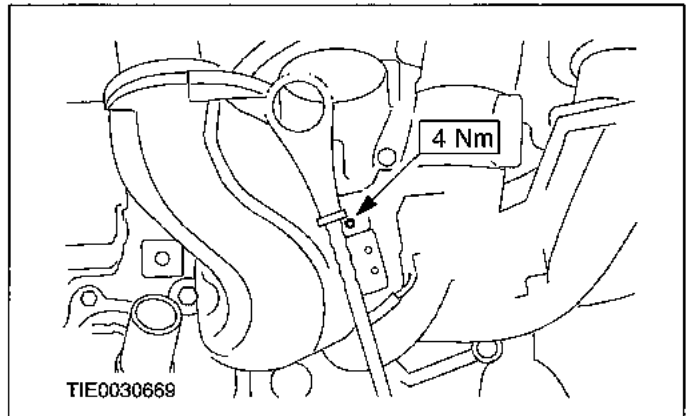


25. Install the intake manifold lower retaining bolt.

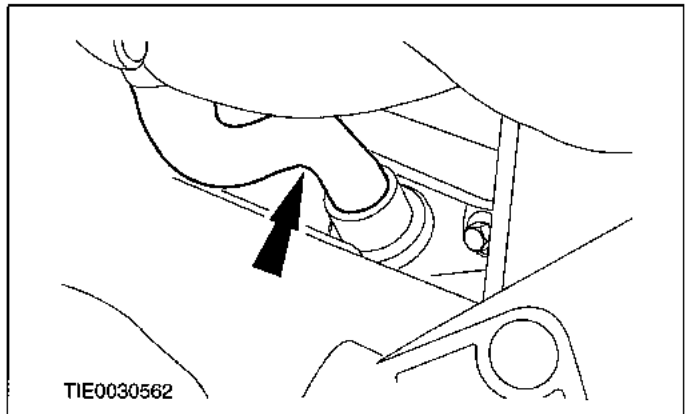


26. Attach the oil level indicator tube to the intake manifold.

- Attach the KS electrical connector to the oil level indicator tube.



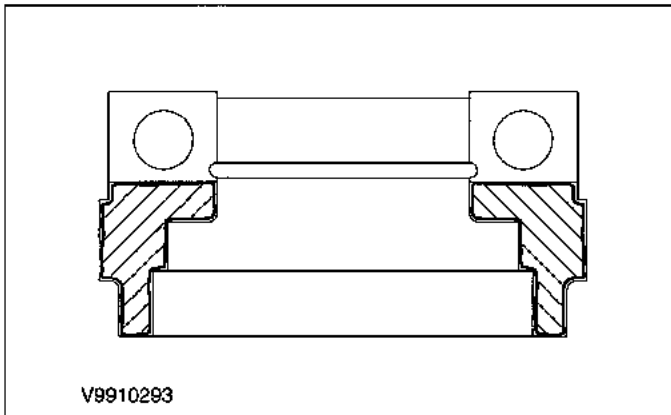
27. Connect the PCV hose to the PCV cover.



28. **NOTE:**Identification numbers are provided on the outer face of the camshaft bearing caps.

## ASSEMBLY

Apply sealant to the points indicated on the camshaft bearing cap no. 1 and to the mating surface of the cylinder head.



29. Coat the camshafts and the camshaft bearing caps with clean engine oil.

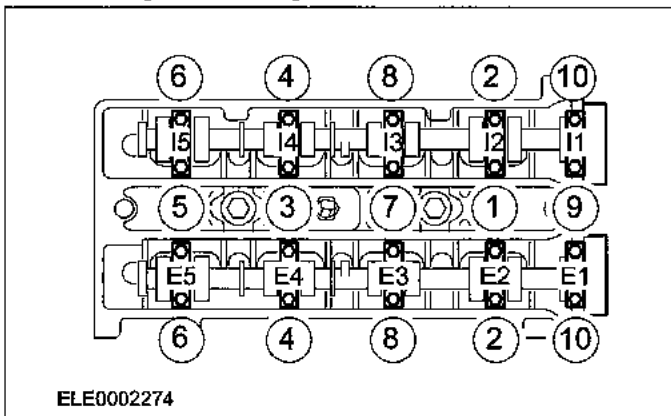
30. **CAUTION:** Position the camshafts in place so that none of the cams are at full lift.

**NOTE:** The camshaft bearing cap numbering starts at the timing belt end with E1 on the exhaust side and with I1 on the intake side.

**NOTE:** The exhaust camshaft has an additional cam for the camshaft position (CMP) sensor.

**Install the camshafts and camshaft bearing caps.**

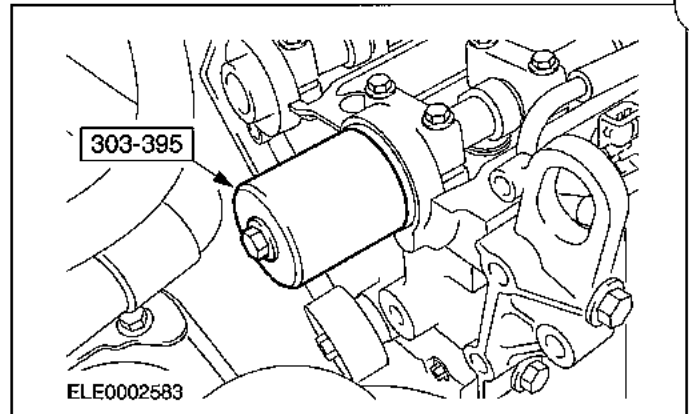
- Tighten the camshaft bearing cap retaining bolts in the sequence shown in three stages.
- Stage 1: One half turn on each bolt until all of the camshaft bearing caps are in contact with the cylinder head.
- Stage 2: 7 Nm.
- Stage 3: 45 degrees.



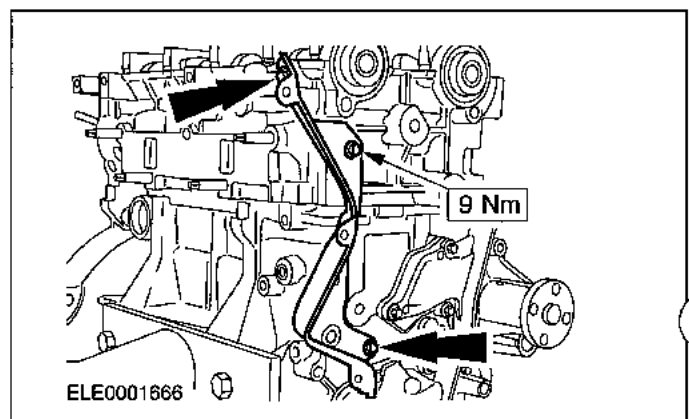
31. Coat the camshaft journals and seal lips with clean engine oil.

32. **NOTE:** Install new camshaft seals.

Using the special tool, install the camshaft seals.

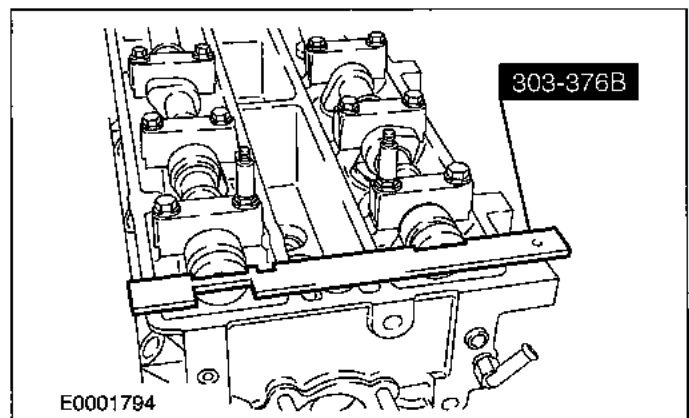


33. Install the timing belt rear cover.



34. Set the crankshaft to approximately 20 degrees before TDC.

35. Turn the camshafts to top dead center (TDC) on cylinder number 1 and install the special tool.

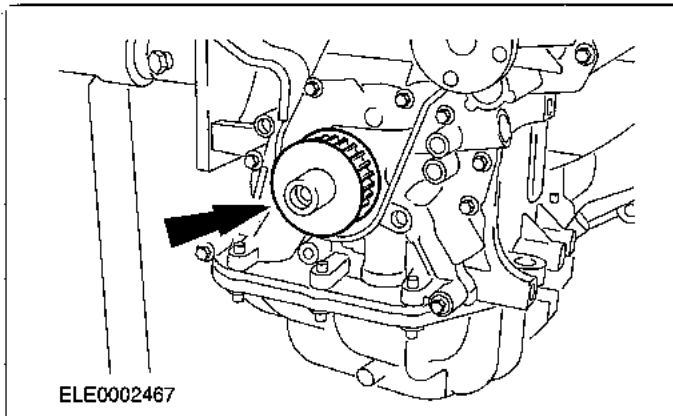


36. **NOTE:** Do not fully tighten the camshaft timing pulley retaining bolts at this stage. Make sure the camshaft pulleys turn on the camshafts.

**NOTE:** Install new camshaft pulley retaining bolts.

**ASSEMBLY**

Install the camshaft timing pulleys.

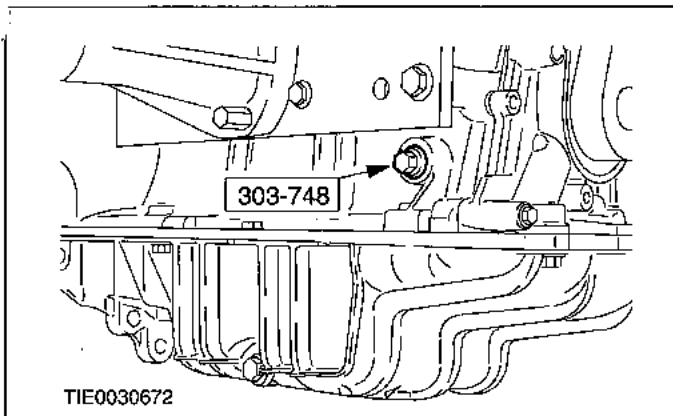
**37. Install the crankshaft timing belt pulley.****38. NOTE: Install a new timing belt.**

**NOTE:** Install the timing belt, beginning with the crankshaft timing pulley working counterclockwise.

Install the timing belt.

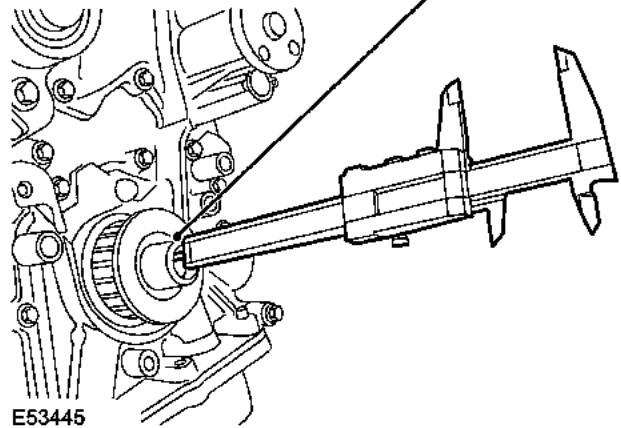
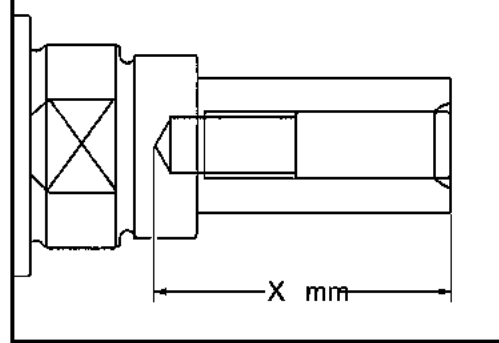
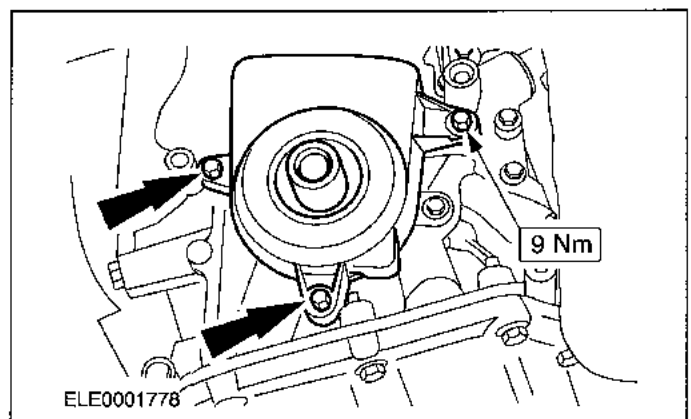
**39. Remove the blanking plug and install the special tool.**

- Carefully turn the crankshaft against the special tool.

**40. Measuring the depth of the threaded hole in the crankshaft.**

- Depth of the threaded = 42 mm: Use an M12x29 mm crankshaft pulley center bolt.

- Depth of the threaded = 52 mm: Use an M12x44,5 mm crankshaft pulley center bolt.

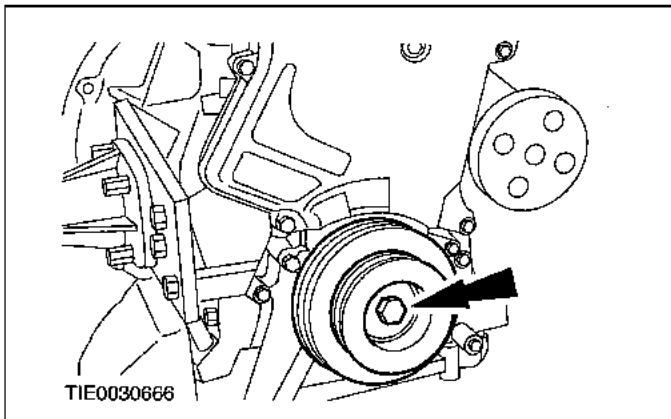
**41. Install the timing belt lower cover.****42. NOTE: Install a new crankshaft pulley retaining bolt.**

Install the crankshaft pulley.

- Tighten the crankshaft pulley retaining bolt in two stages.
- Stage 1: 45 Nm.

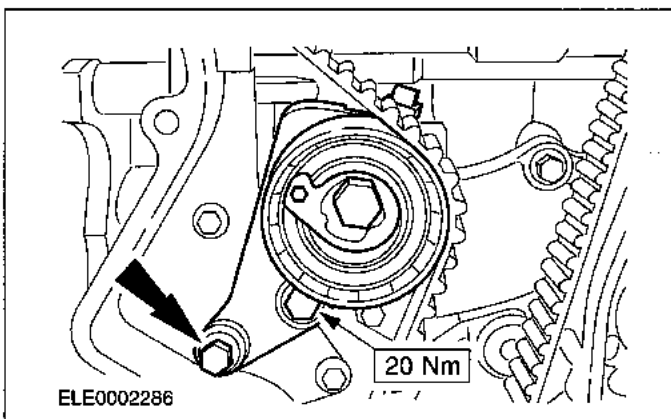
**ASSEMBLY**

- Stage 2: 90 degrees.



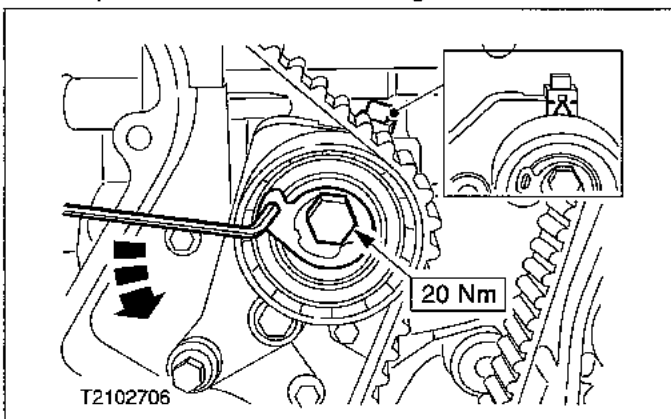
Engines with eccentric cam timing belt tensioner

**43. Install the timing belt tensioner.**



**44. Tension the timing belt.**

- Tension the timing belt by turning the tensioner counterclockwise until the arrow points at the mark and tighten the bolt.

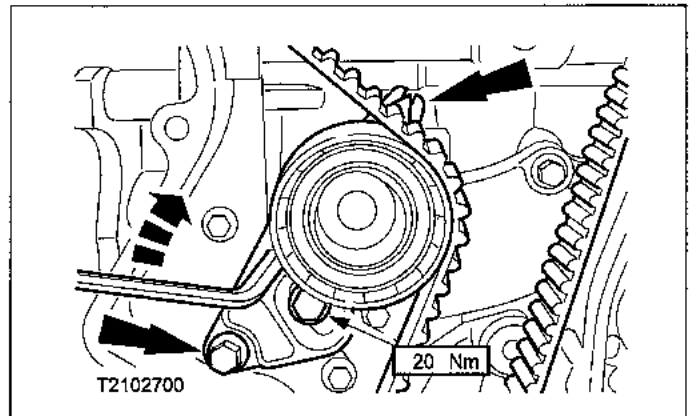


Engines with slotted bracket timing belt tensioner

**45. Install the timing belt tensioner and tension the timing belt.**

- Install the bolts finger tight.

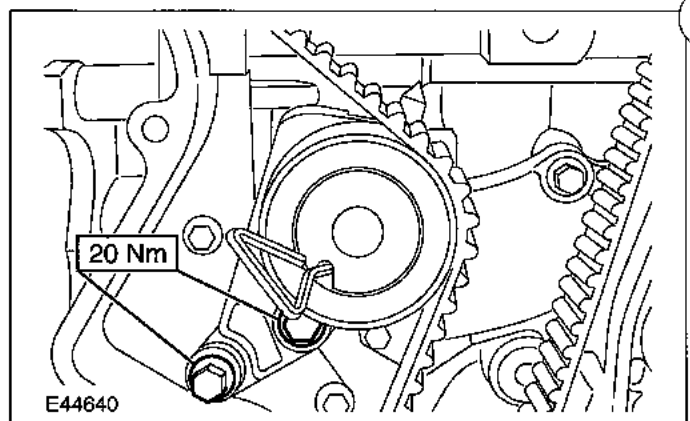
- Tension the timing belt by turning the tensioner clockwise until the arrow points in line with the center of the rectangular hole and tighten the bolts.



Vehicles built 09/2003 onwards

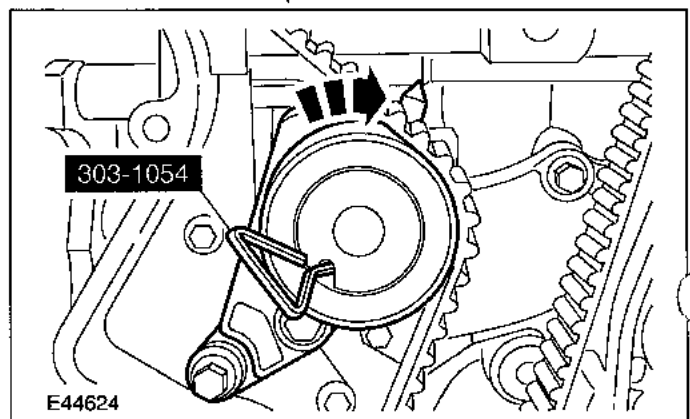
- 46. ▲WARNING: Do not remove the special tool, until the timing belt is correctly positioned. Failure to follow this instruction may result in personal injury, or may damage the timing belt tensioner.**

**Install the timing belt tensioner.**



**47. Tension the timing belt.**

- Remove the special tool.

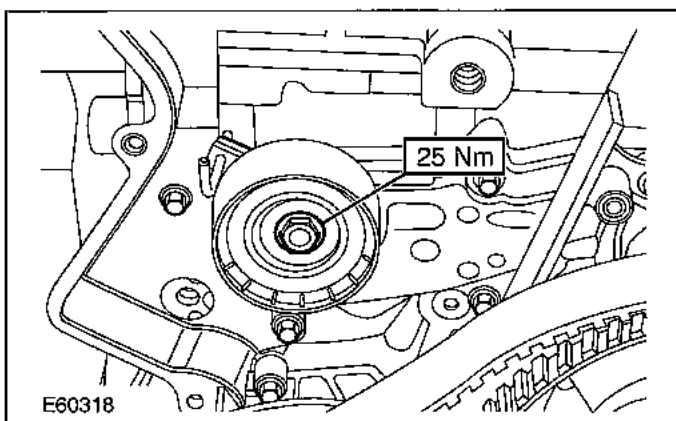


**ASSEMBLY**

Vehicles built 04/2005 onwards

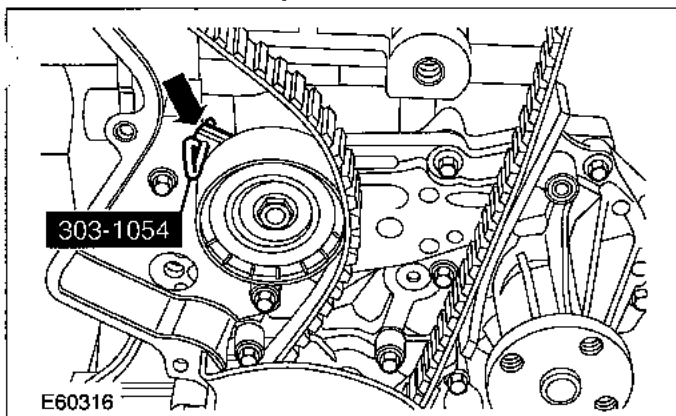
48. **▲WARNING:** Do not remove the special tool, until the timing belt is correctly positioned. Failure to follow this instruction may result in personal injury, or may damage the timing belt tensioner.

Install the timing belt tensioner.



49. Tension the timing belt.

- Remove the special tool.



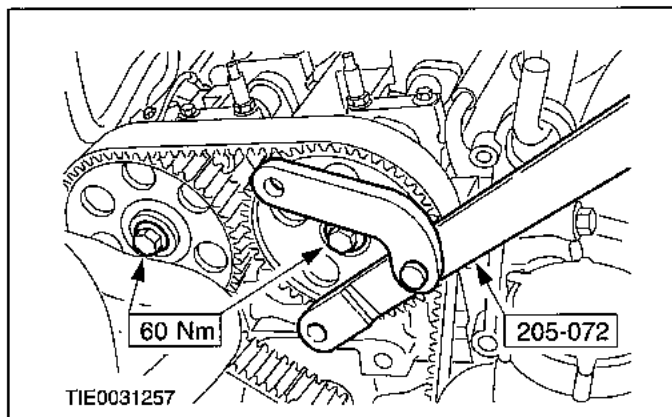
All vehicles

50. **CAUTIONS:**

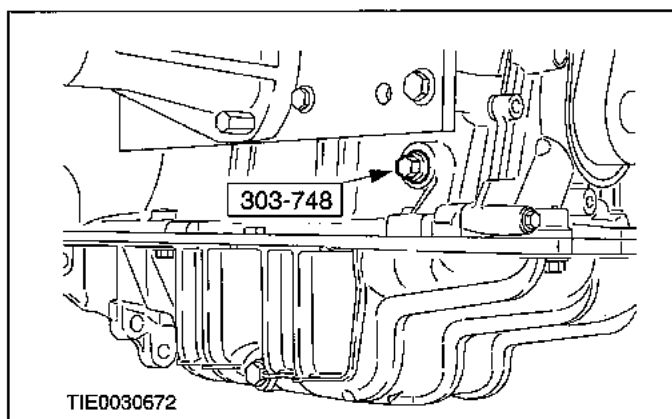
▲ Install a hose (order no. E890438S) to the special tool studs, to prevent damage to the camshaft pulleys.

▲ Do not tighten the camshaft pulley bolts against the timing plate.

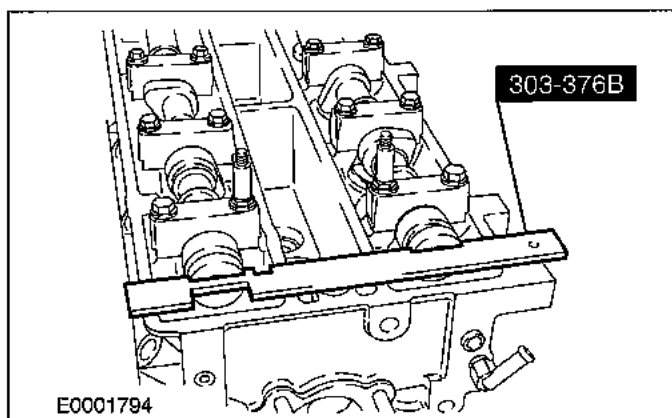
Using the special tool, tighten the camshaft pulleys.



51. Remove the special tool.



52. Remove the special tool.



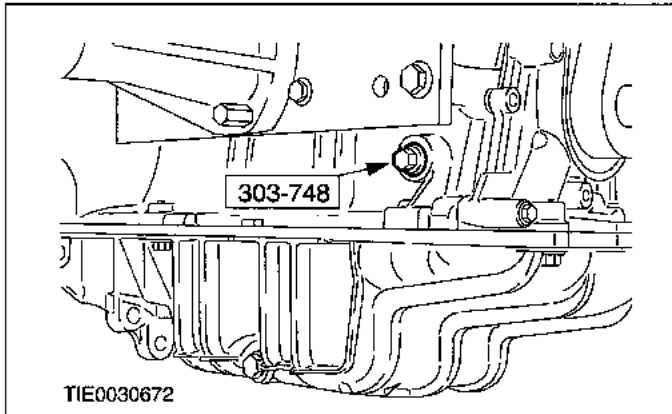
53. **NOTE:** Only turn the crankshaft in its normal direction of rotation.

Turn the crankshaft two revolutions.

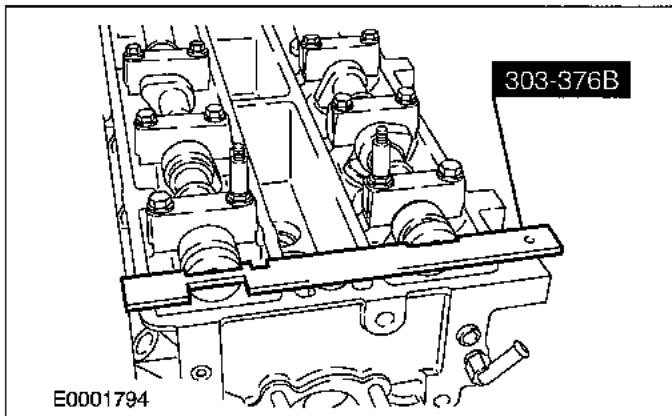
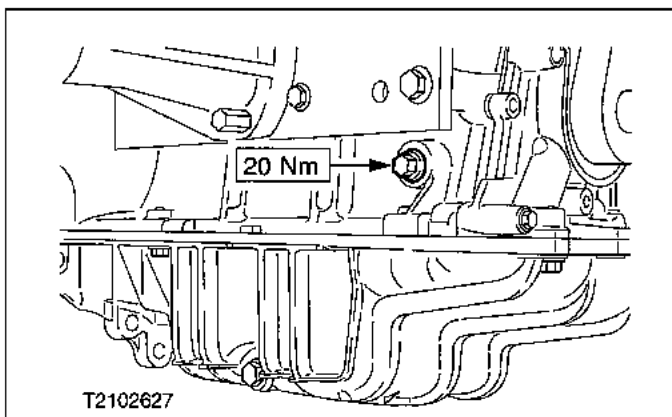
54. Install the special tool.

**ASSEMBLY**

- Carefully turn the crankshaft against the special tool.

**55. Check the valve timing.**

- If necessary loosen the camshaft pulleys and correct the camshaft alignment.

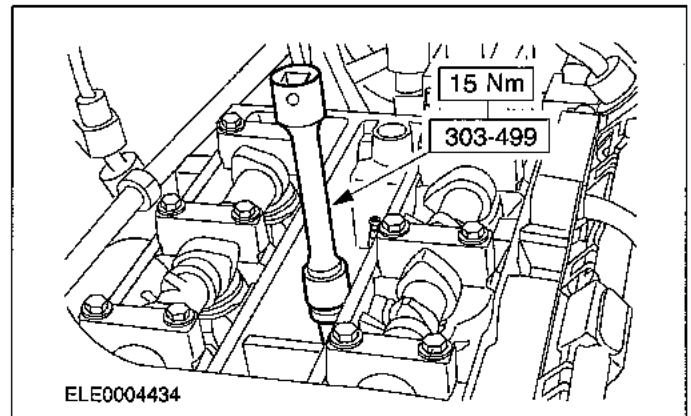
**56. Remove the special tools.****57. Install the blanking plug.**

- 58. Check the valve clearances, adjust if necessary.**

For additional information, refer to: Valve Clearance Adjustment (303-01 Engine - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), General Procedures).

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

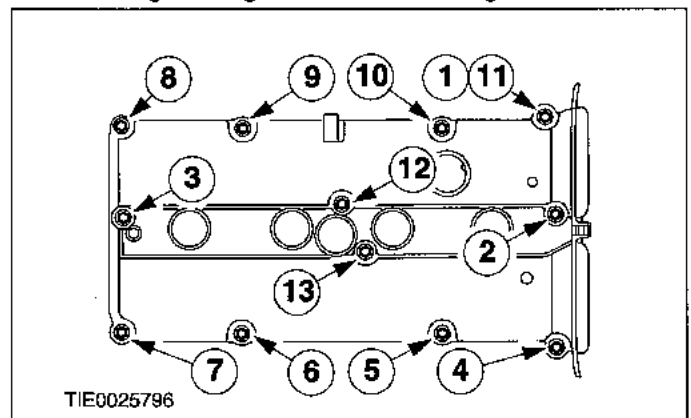
- Apply grease to the spark plug threads.



- 60. NOTE: Install the stud bolts to positions 5 and 6.**

**Install the valve cover.**

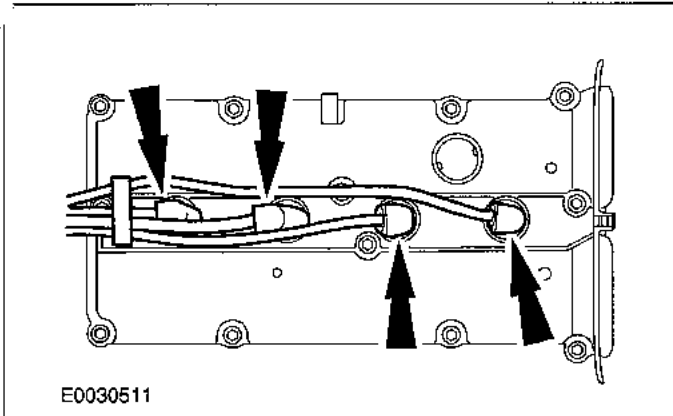
- Tighten the bolts in the sequence shown in three stages.
- Stage 1: Tighten bolt 1 by 3 to 4 turns.
- Stage 2: Tighten bolts 1 through 13 to 3 Nm.
- Stage 3: Tighten bolts 1 through 13 to 9 Nm.



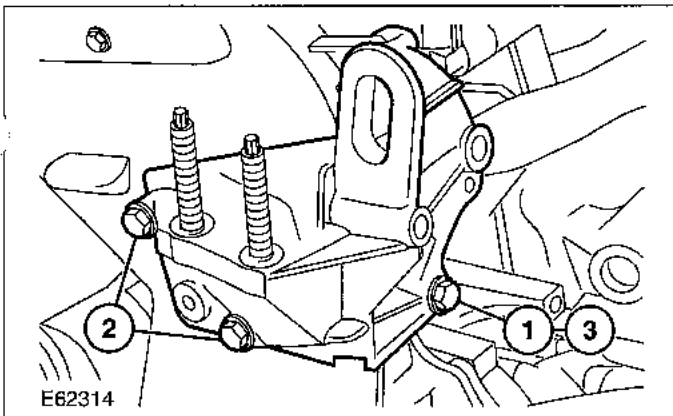
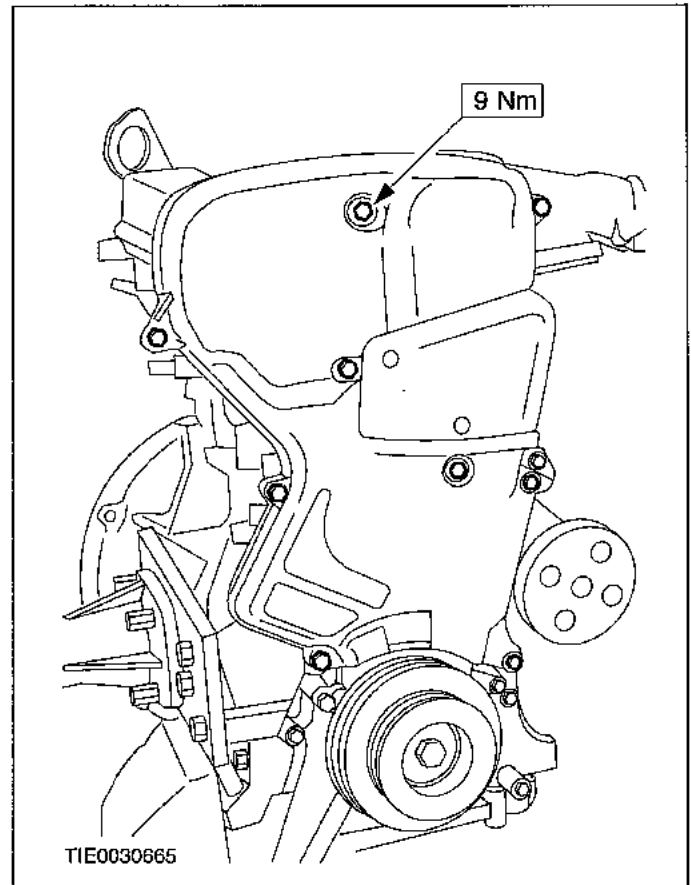
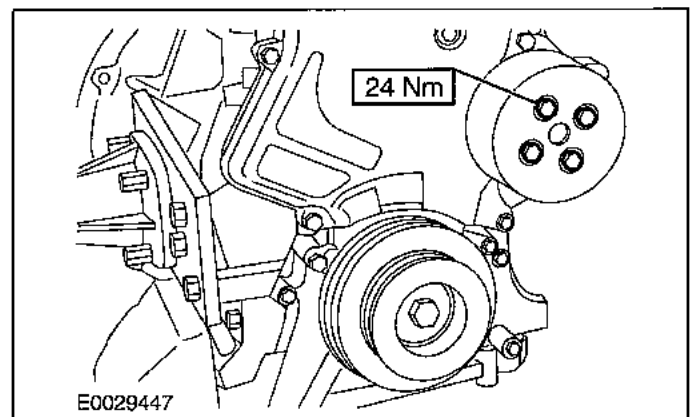
- 61. CAUTION:** Use a suitable blunt object to avoid damage to the spark plug connector gasket. Coat the inside of the spark plug connector with silicone grease to a depth of 5-10 mm.

**ASSEMBLY**

Connect the spark plug electrical connectors and attach the wires to the valve cover.

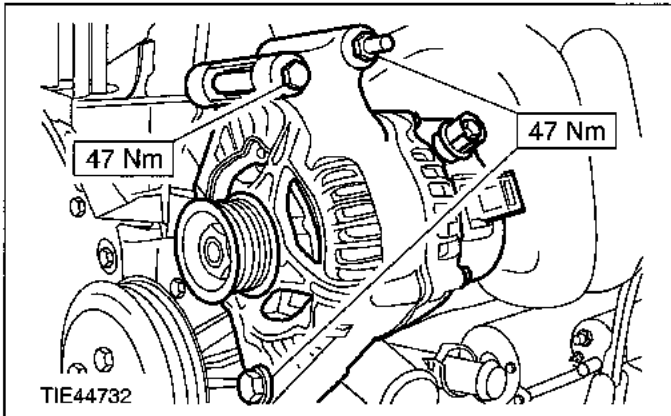
**62. Install the engine front mount bracket.**

- Tighten the bolts in the indicated order in three stages.
- Stage 1: Hand tighten bolt 1.
- Stage 2: Tighten bolts 2 to 55 Nm.
- Stage 3: Tighten bolt 3 to 55 Nm.

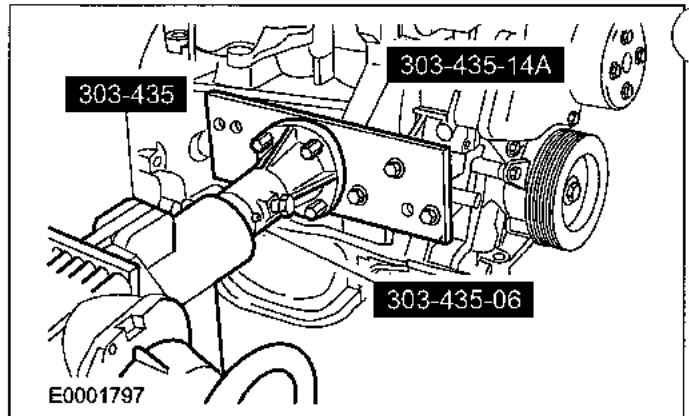
**63. Install the timing belt upper cover.****64. Install the coolant pump pulley.**

**ASSEMBLY**

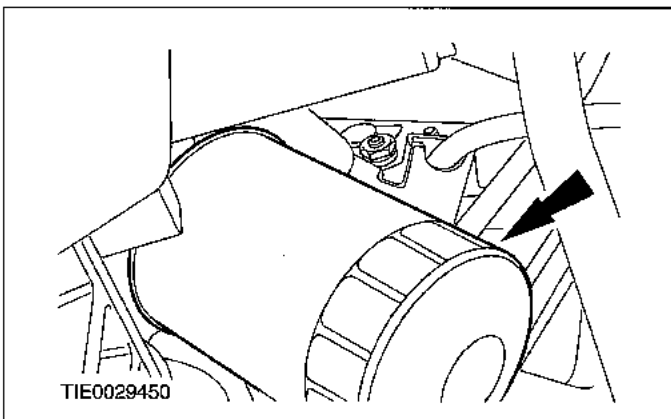
**65. Install the generator.**



**69. Remove the special tools.**



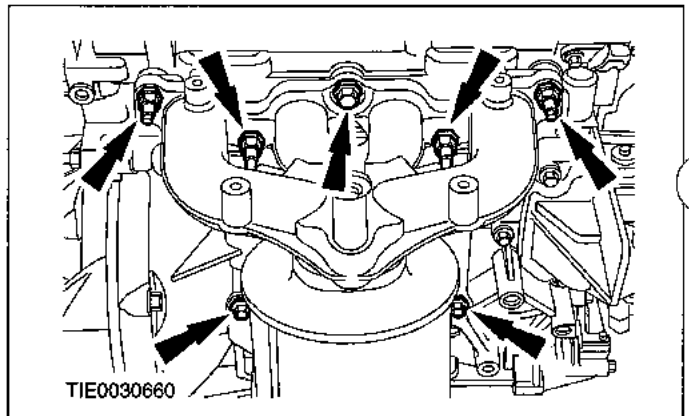
**66. NOTE: Install a new oil filter.**  
**Install the oil filter.**



**70. NOTE: Install a new exhaust manifold gasket and new exhaust manifold retaining nuts.**

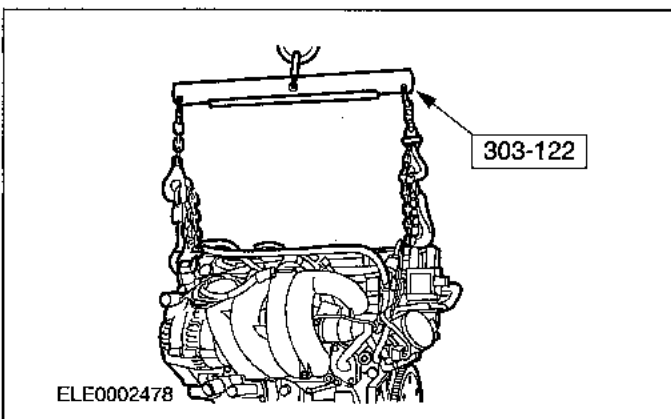
**NOTE: Do not fully tighten the nuts and bolt at this stage.**

**Install the exhaust manifold.**



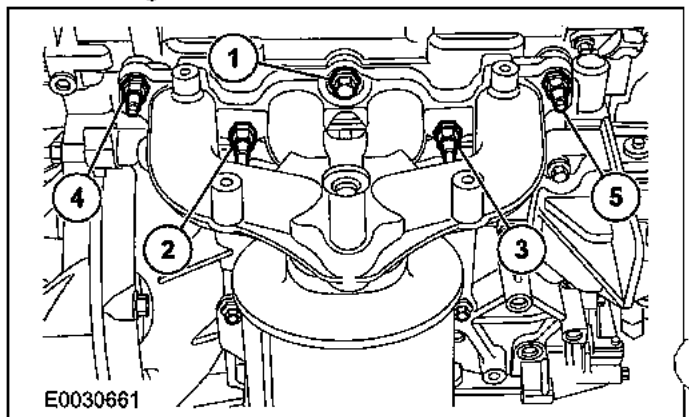
**67. Install the engine wiring harness.**

**68. Using the special tool attach the engine to an engine hoist.**



**71. Tighten the exhaust manifold upper retaining nuts and bolt in the sequence shown in two stages.**

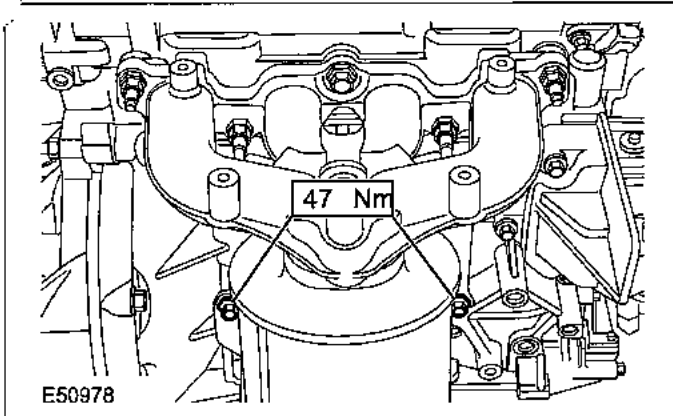
- Stage 1: 20 Nm.
- Stage 2: 55 Nm.



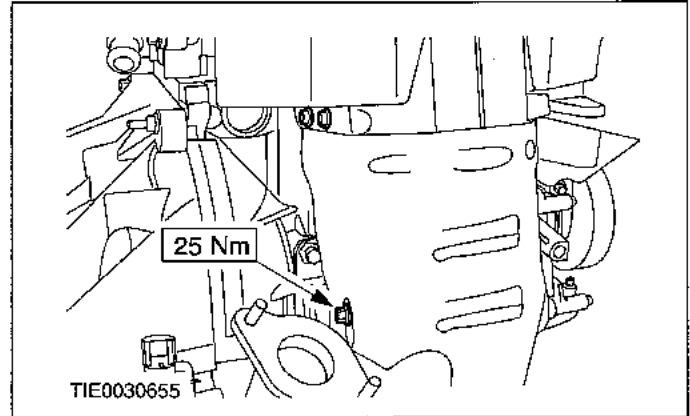


**ASSEMBLY**

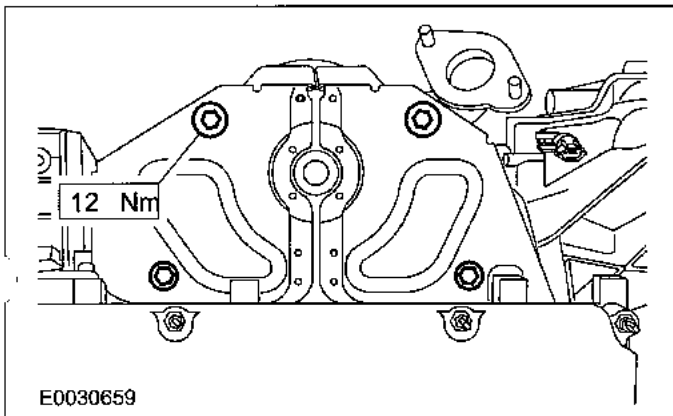
**72. Tighten the exhaust manifold lower retaining bolts.**



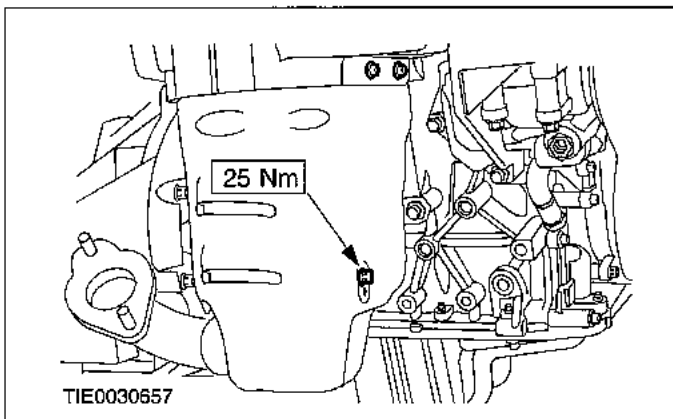
**75. Install the exhaust manifold lower heat shield left-hand retaining bolts.**



**73. Install the exhaust manifold upper heat shield.**



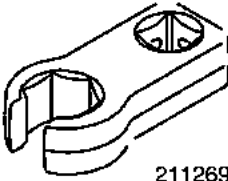
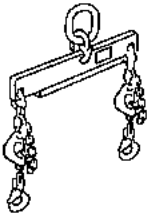
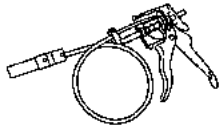
**74. Install the exhaust manifold lower heat shield right-hand retaining bolts.**



## INSTALLATION

## Engine

## Special Tool(s)

 <p>211269</p>	<p>Wrench, Hydraulic Line Union Nut 211-269 (13-027)</p>
 <p>21068A</p>	<p>Lifting Bracket, Engine 303-122 (21-068A)</p>
 <p>24003</p>	<p>Remover/Installer, Hose Clamp 303-397 (24-003)</p>

## General Equipment

Securing straps

Workshop table

Engine hoist

## Installation

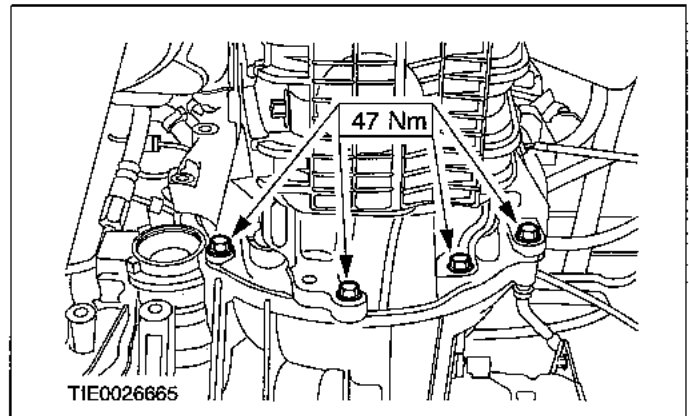
## All vehicles

- ▲ **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 mixtures are always present and may ignite. Failure to follow these instructions may result in personal injury.

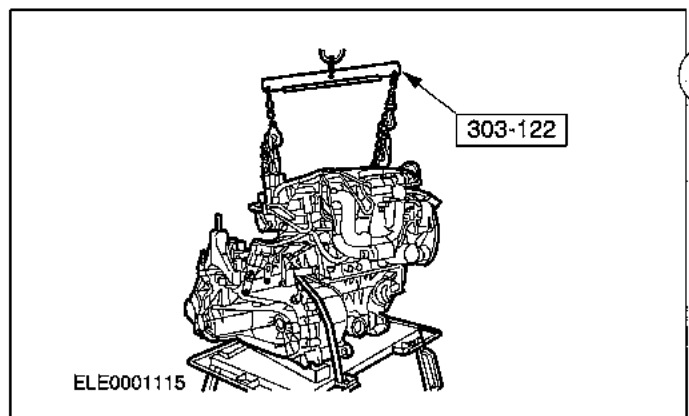
1. ⚠ **CAUTION:** Make sure that the two locating dowels are installed.

Install the transaxle to the engine.

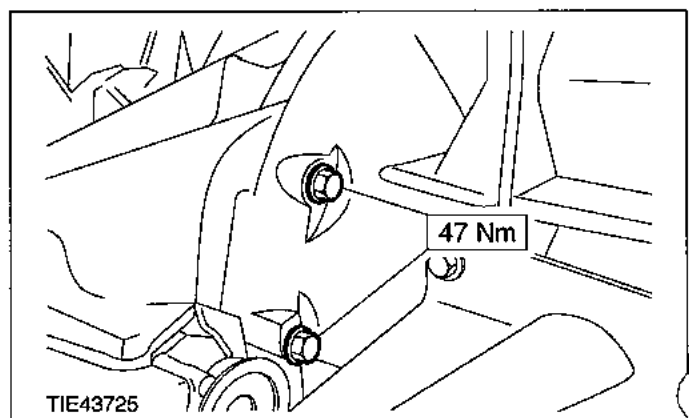
2. Install the transaxle lower retaining bolts.



3. ▲ **WARNING:** Support the engine and transaxle assembly on wooden blocks and secure it with suitable securing straps. Using the special tool and the engine hoist position the engine and transaxle assembly on the workshop table.

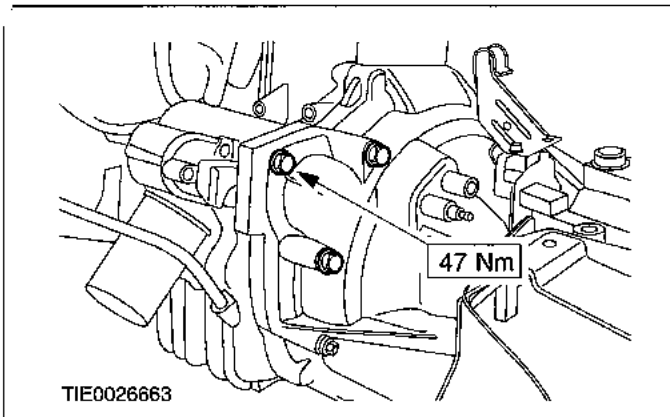


4. Install the transaxle right-hand retaining bolt.



**INSTALLATION**

5. Install the starter motor and the transaxle left-hand retaining bolt.



6. Raise and support the vehicle.

For additional information, refer to: **Lifting (100-02 Jacking and Lifting, Description and Operation).**

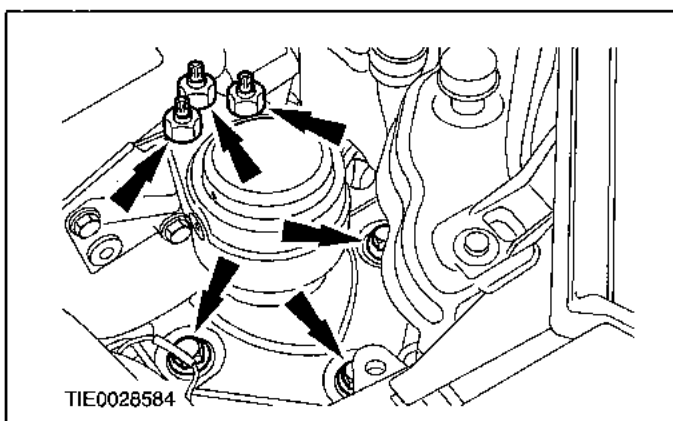
7. Position the engine and transaxle assembly in the engine compartment.

- Carefully lower the vehicle.

8. **NOTE:** Install new engine front mount retaining nuts.

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

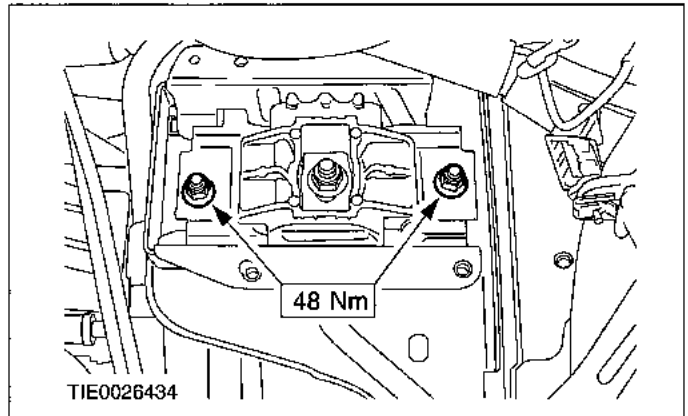
Install the engine front mount.



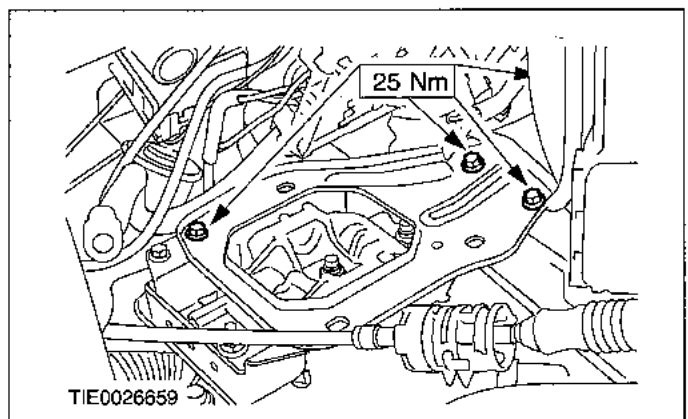
9. **NOTE:** Install new engine rear mount retaining nuts.

**NOTE:** Do not tighten the engine rear mount center retaining nut at this stage.

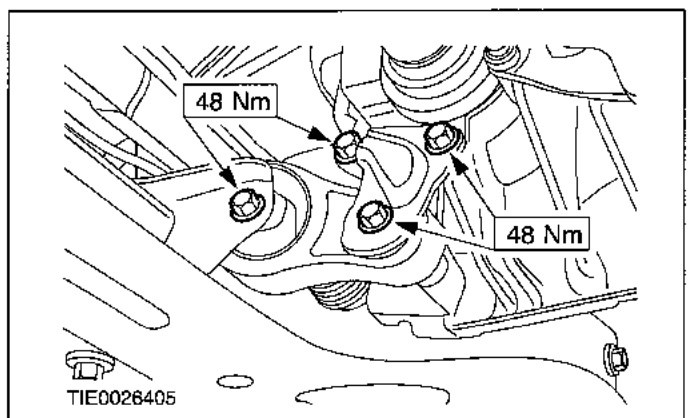
- Install the engine rear mount.



10. Install the battery tray support bracket.



11. Install the engine rear support insulator.



12. **CAUTIONS:**

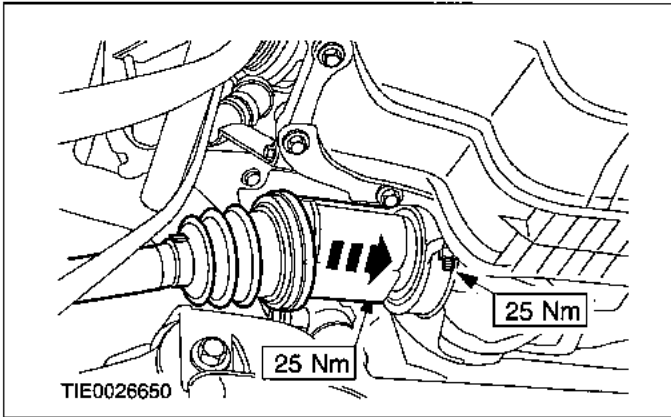
⚠ Support the halfshaft. The inner joint must not be bent more than 18 degrees. The outer joint must not be bent more than 45 degrees.

⚠ Do not damage the halfshaft oil seal.

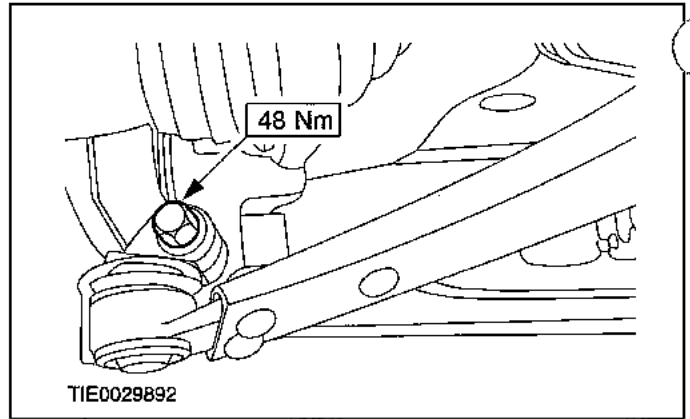
**NOTE:** Install a new center bearing cap and locknuts.

**INSTALLATION**

Attach the right-hand halfshaft and the intermediate shaft to the transaxle.



- Install the heat shield.



**13. 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.

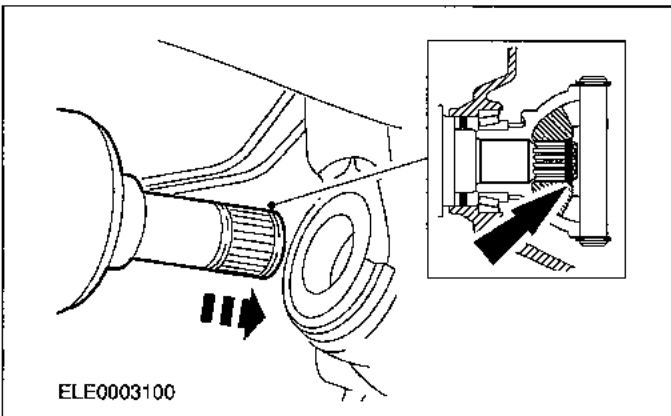
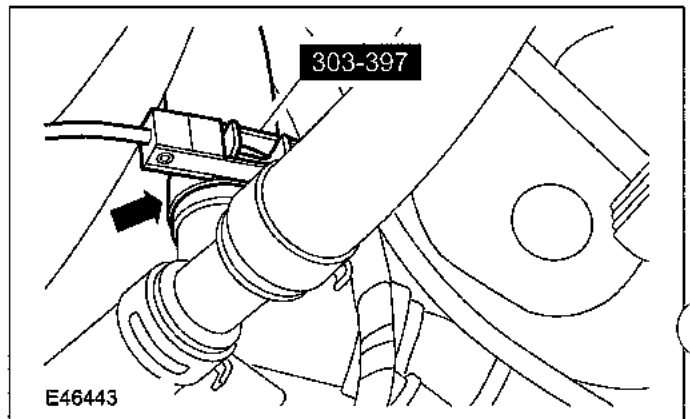
⚠ Do not damage the halfshaft oil seal.

⚠ Make sure the snap ring is correctly seated.

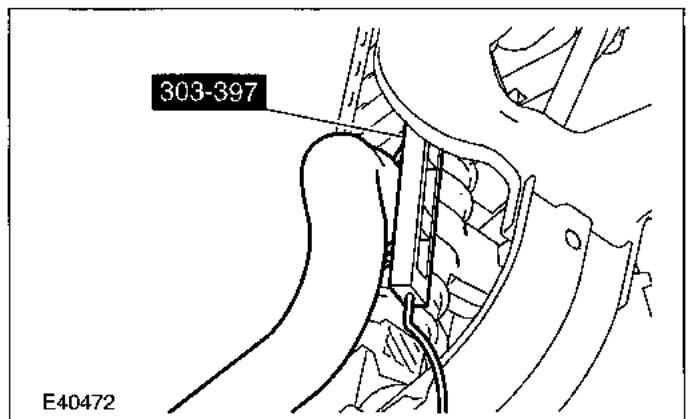
**NOTE:** Install a new snap ring.

Attach the left-hand halfshaft to the transaxle.

**15. Using the special tool, connect the coolant hose to the distribution pipe**



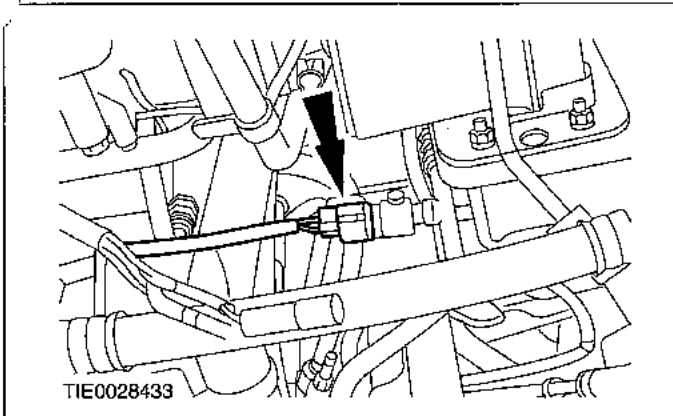
**16. Using the special tool, connect the coolant hose to the radiator.**



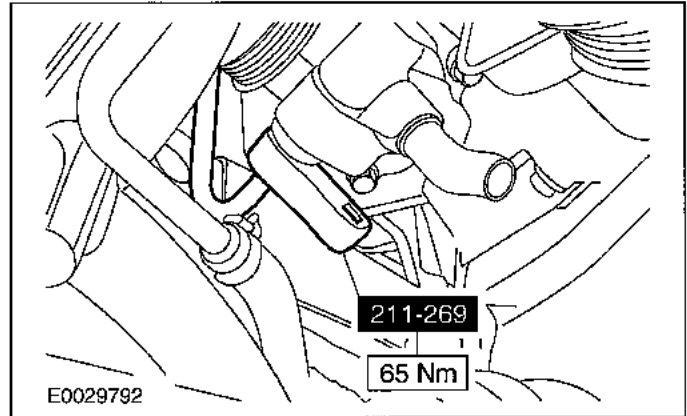
**14. Attach the lower arm to the wheel knuckle on both sides (right-hand side shown).**

**INSTALLATION**

17. Connect the A/C high-pressure cut-off switch electrical connector.

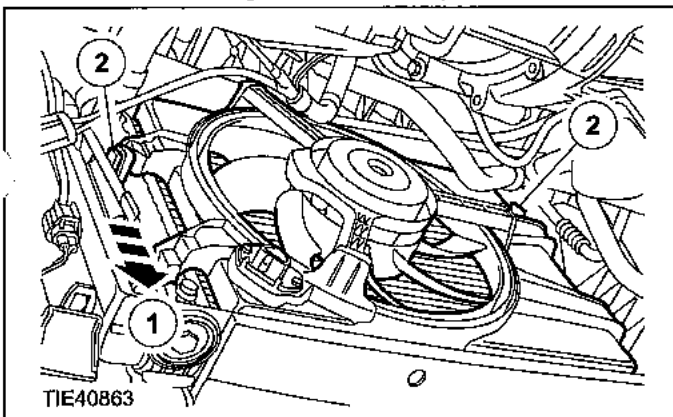


20. Using the special tool, attach the power steering line to the power steering pump.

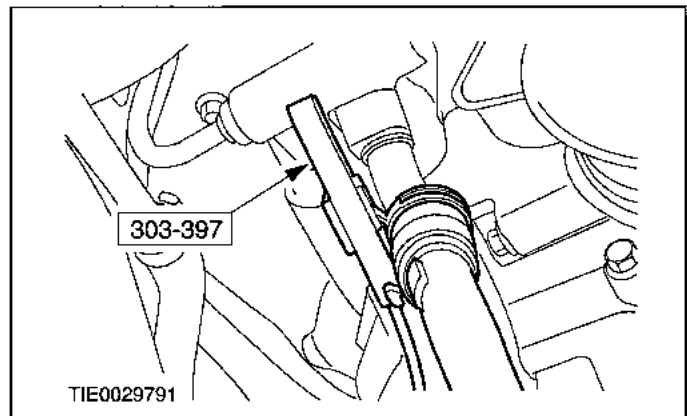


18. Install the cooling fan motor and shroud.

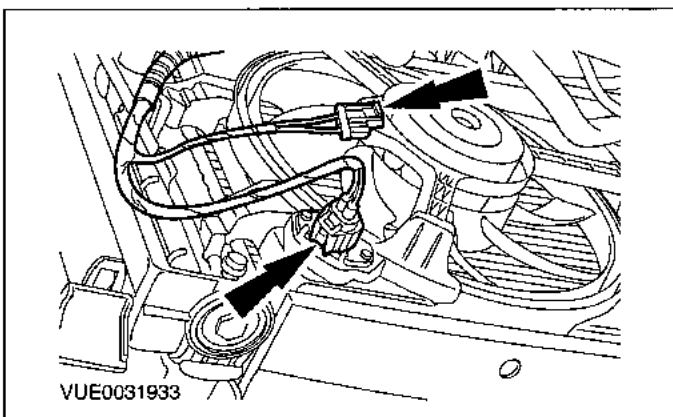
1. Push the cooling fan motor and shroud upwards and then downwards to install.
2. Install the cooling fan motor and shroud to the retaining brackets.



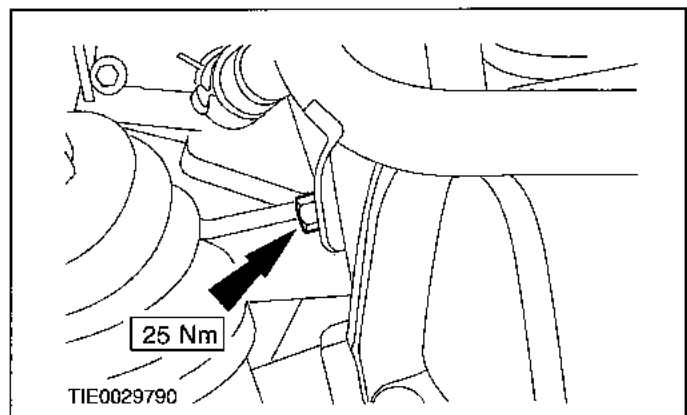
21. Connect the power steering line to the steering pump.



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

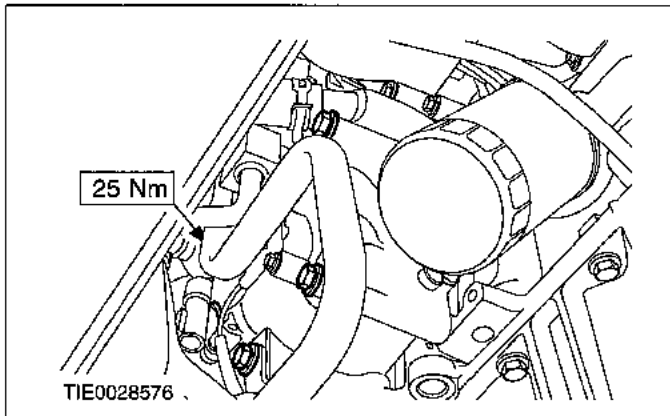


22. Attach the power steering line support bracket to the engine block.

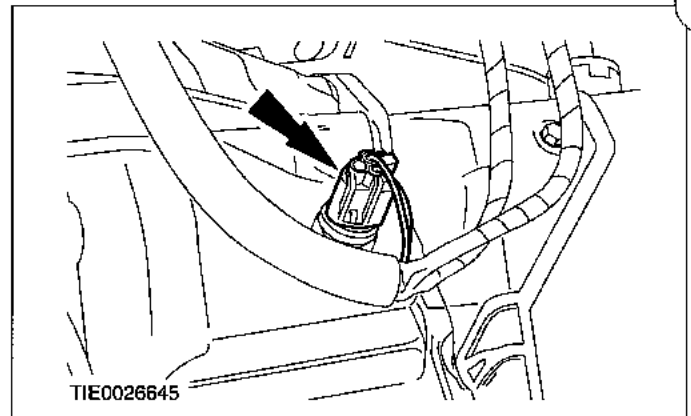


**INSTALLATION**

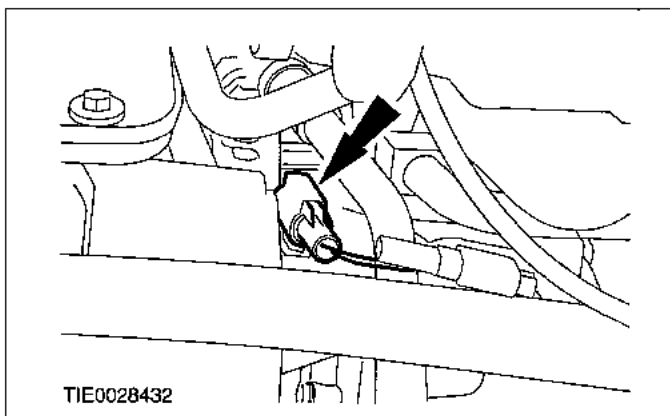
23. Attach the air conditioning (A/C) compressor to the cylinder block.



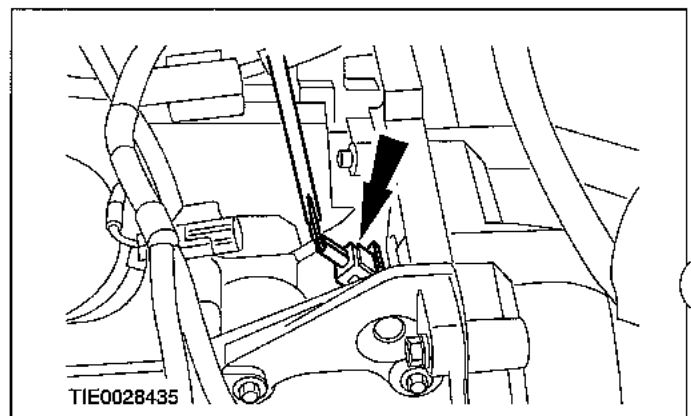
27. Connect the reversing lamp switch electrical connector.



24. Connect the A/C compressor clutch electrical connector.



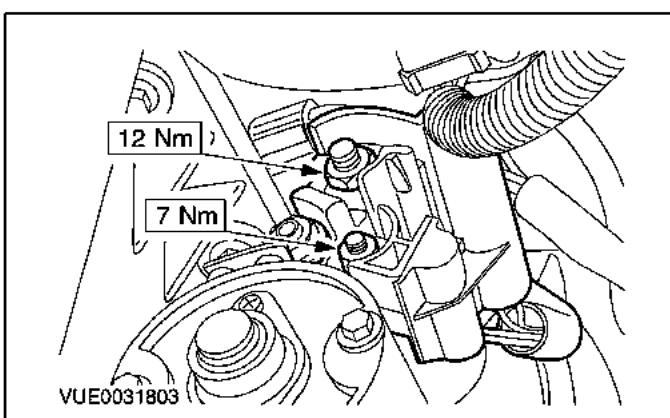
28. Connect the crankshaft position (CKP) sensor electrical connector.



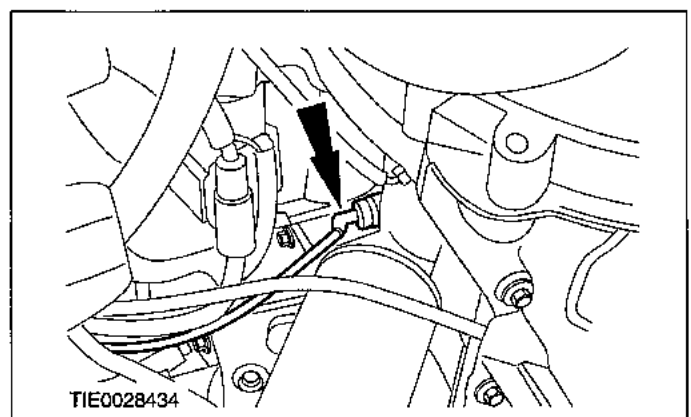
25. Install the accessory drive belt.

For additional information, refer to:  
Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma),  
Vehicles With: Air Conditioning (303-05  
Accessory Drive, Removal and  
Installation).

26. Connect the starter motor electrical connectors.



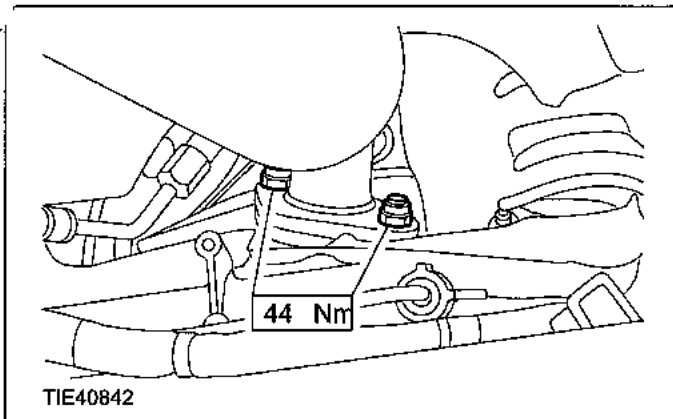
29. Connect the oil pressure switch electrical connector.



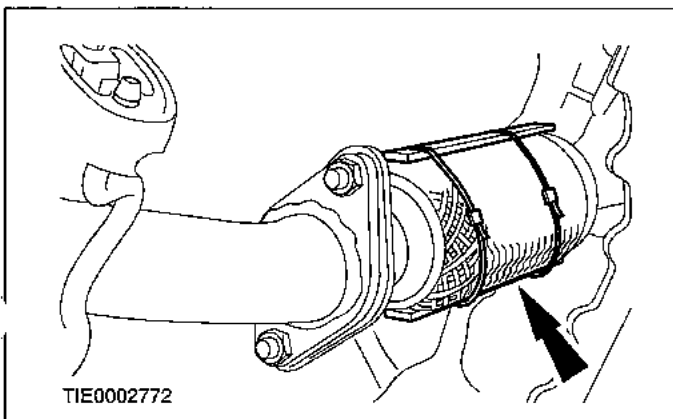
30. **NOTE:** Install new exhaust flange nuts and a new exhaust flange gasket.

## INSTALLATION

Attach the exhaust flexible pipe to the catalytic converter.



31. Remove the exhaust flexible pipe support.



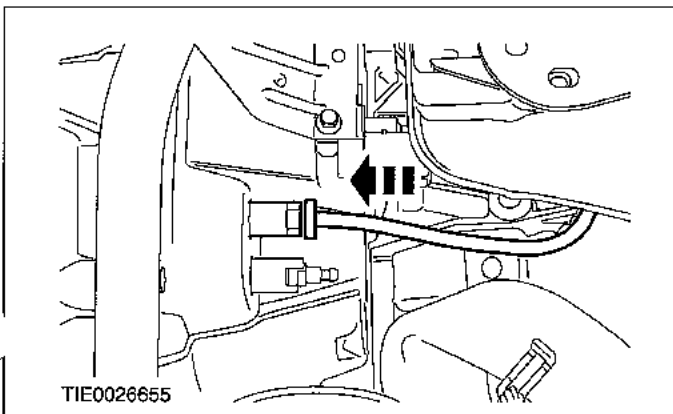
Vehicles without automated gearshift

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

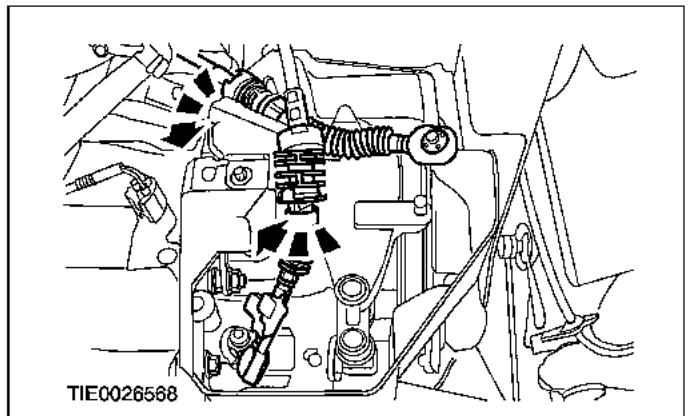
**NOTE:** Make sure the spring clip is correctly seated.

Connect the clutch slave cylinder supply line.

- Install the spring clip.



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



34. **NOTE:** Do not install the air cleaner at this stage.

Adjust the gearshift cable.

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

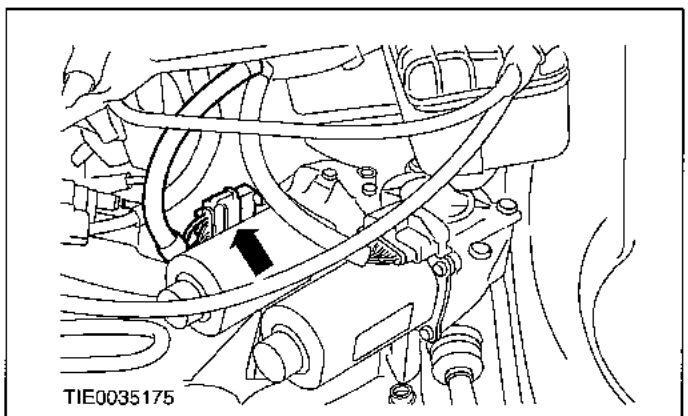
35. **NOTE:** Do not install the air cleaner at this stage.

Bleed the hydraulic clutch system.

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

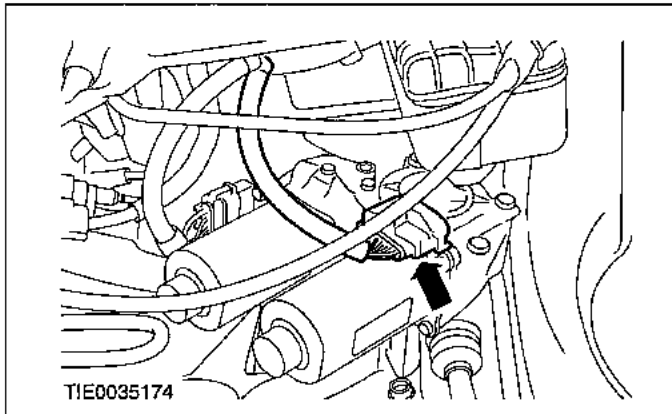
Vehicles with automated gearshift

36. Connect the gearshift actuator electrical connector (colored grey).

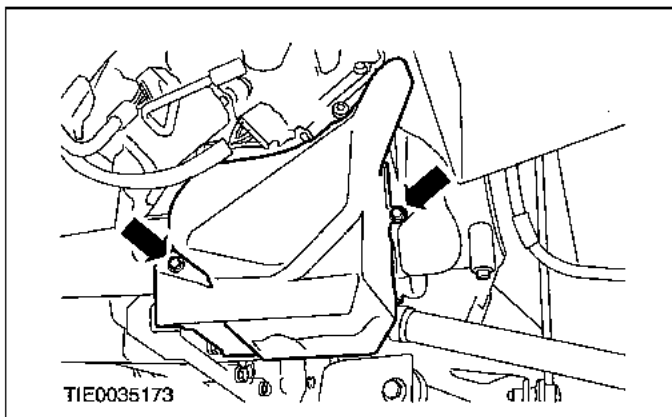


**INSTALLATION**

37. Connect the gearshift actuator electrical connector (colored black).

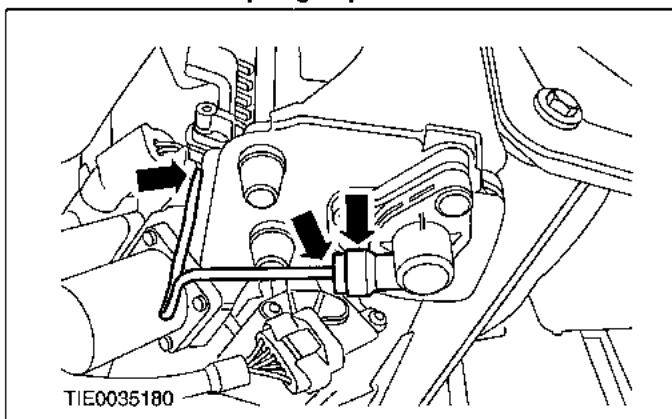


38. Install the gearshift actuator cover.



39. Connect the clutch slave cylinder supply line.

- Install the spring clip.



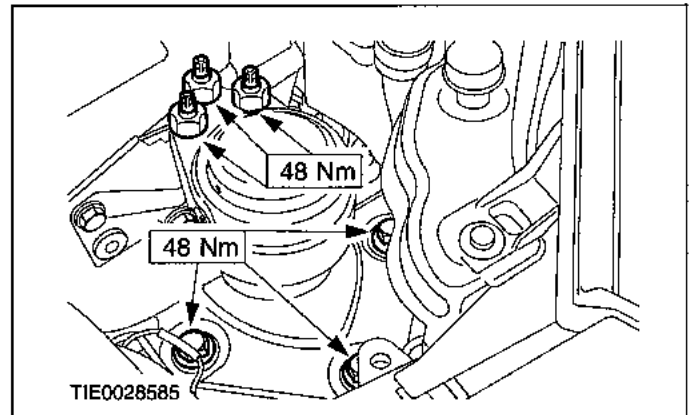
40. Bleed the hydraulic clutch system.

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

All vehicles

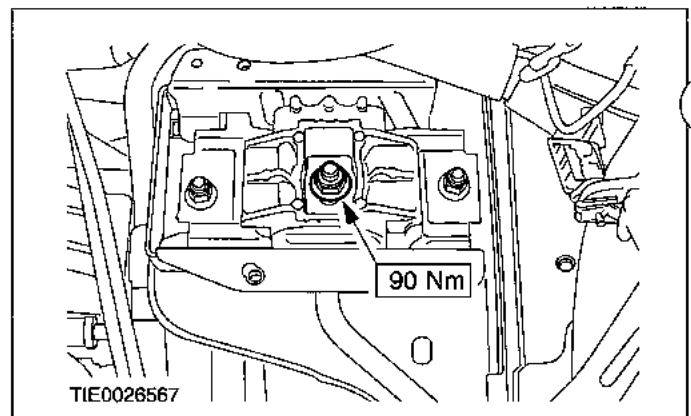
41. Lower the vehicle.

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

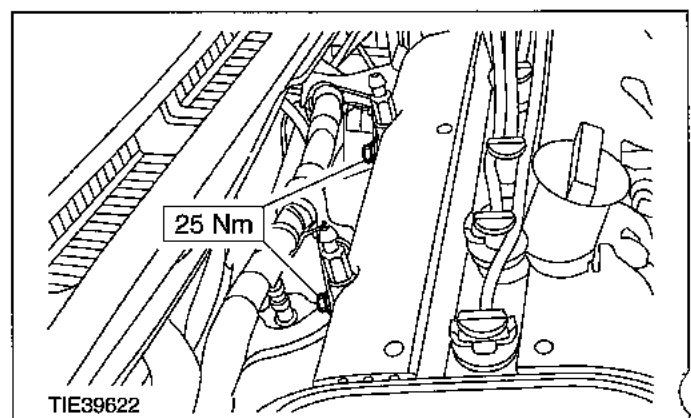


43. **NOTE:** Install a new engine rear mount center retaining nut.

Tighten the engine rear mount center retaining nut.



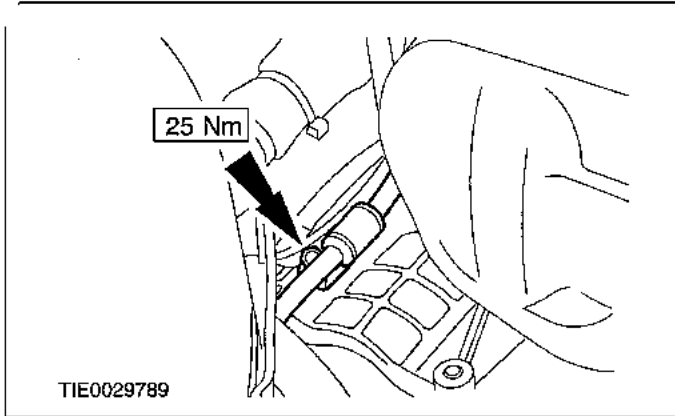
44. Attach the power steering line support bracket to the cylinder head.



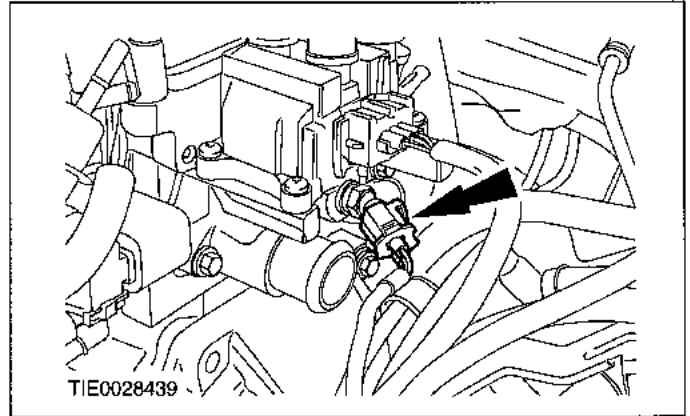


**INSTALLATION**

**45. Attach the power steering line to the power steering pump mounting bracket.**

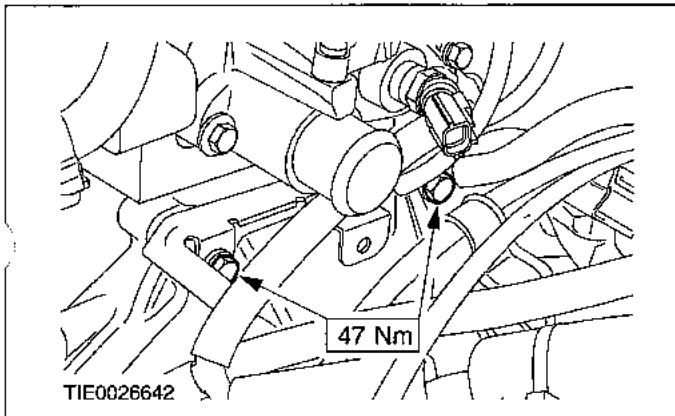


**48. Connect the engine coolant temperature (ECT) sensor electrical connector.**

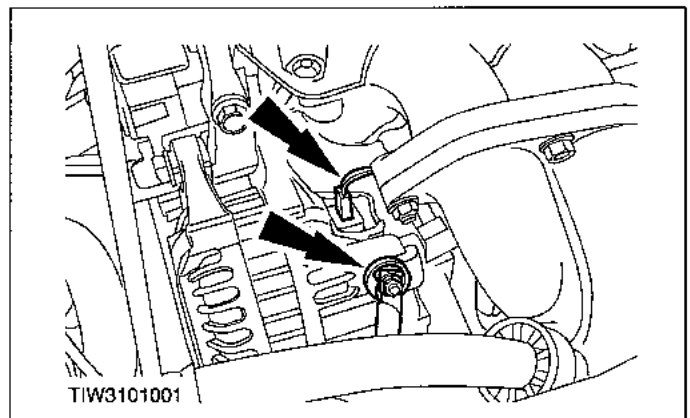


**46. Install the engine wiring harness support brackets.**

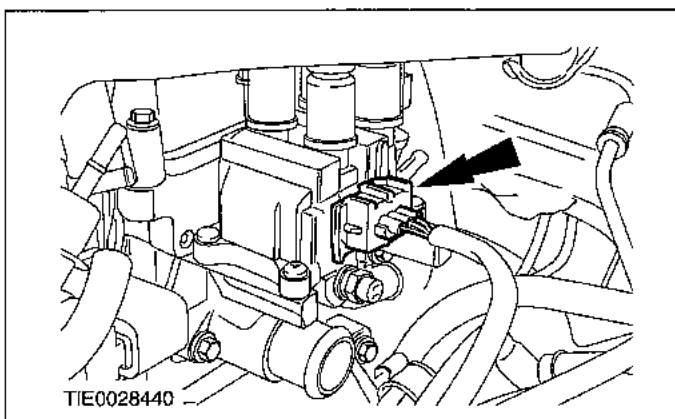
- Connect the engine ground cable.



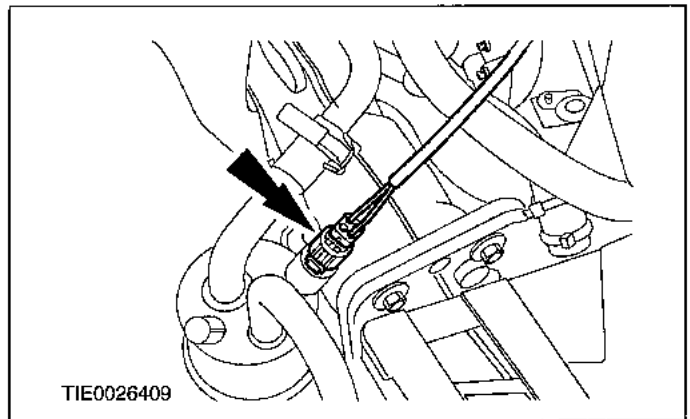
**49. Connect the generator electrical connectors.**



**47. Connect the electronic ignition (EI) coil electrical connector.**



**50. Connect the air conditioning (A/C) lower-pressure cut-off switch electrical connector.**

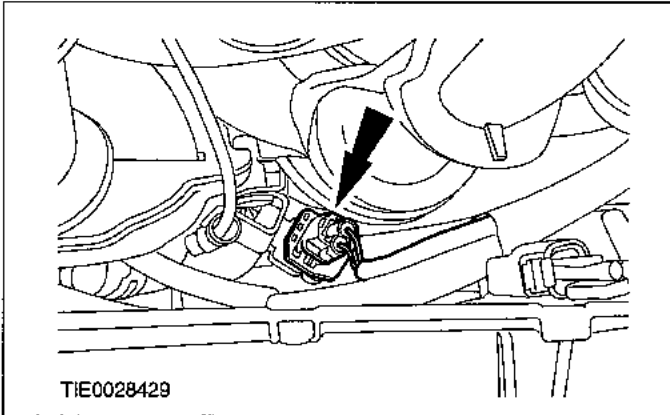


**51. Install the right-hand headlamp assembly.**

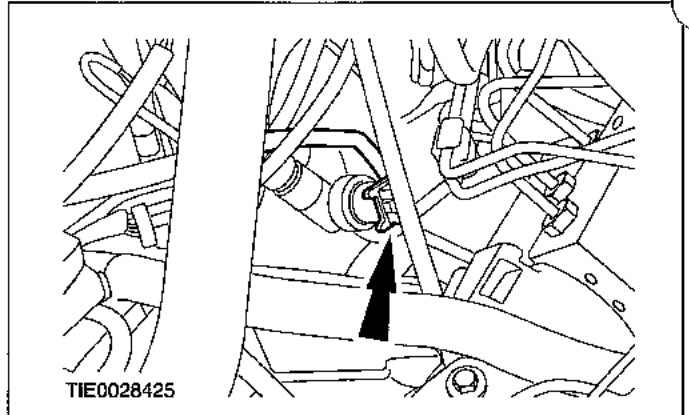
**For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).**

**INSTALLATION**

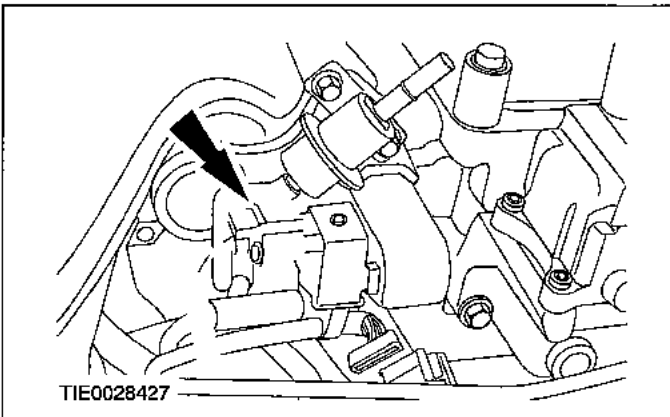
**52. Connect the knock sensor (KS) electrical connector.**



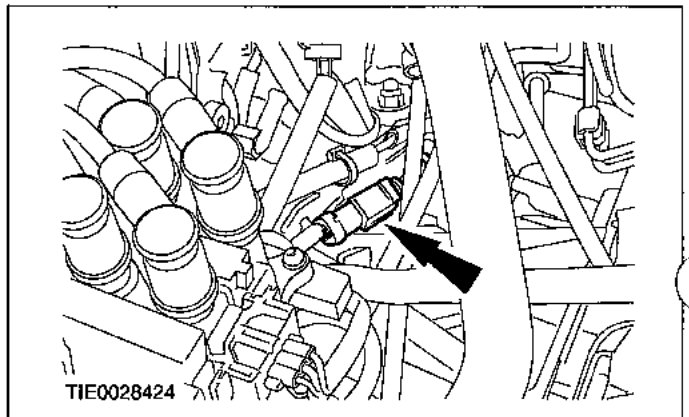
**55. Connect the power steering pressure (PSP) switch electrical connector.**



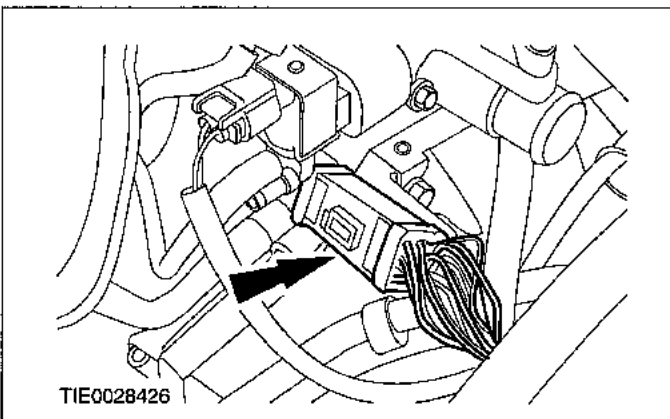
**53. Connect the evaporative emission (EVAP) electrical connector.**



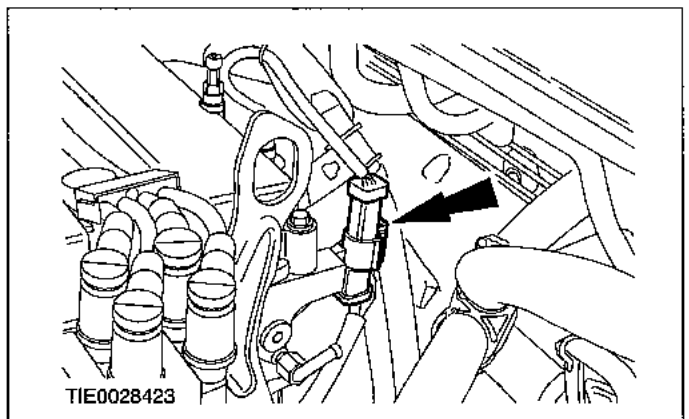
**56. Connect the catalyst monitor sensor electrical connector.**



**54. Connect the engine wiring harness electrical connector.**

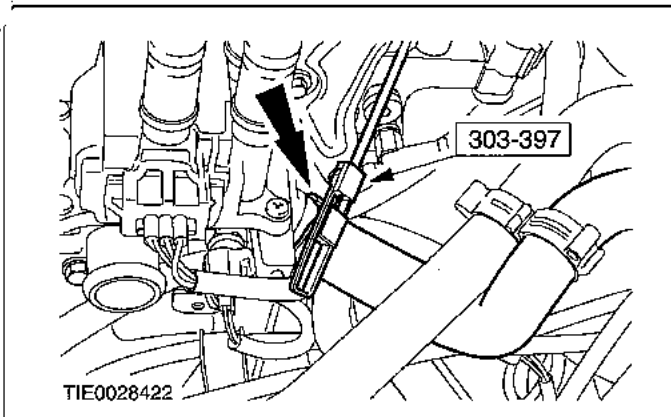


**57. Connect the heated oxygen sensor (HO2S) electrical connector.**

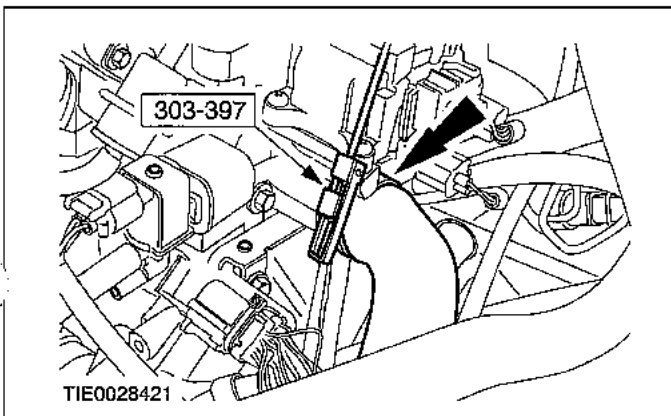


**INSTALLATION**

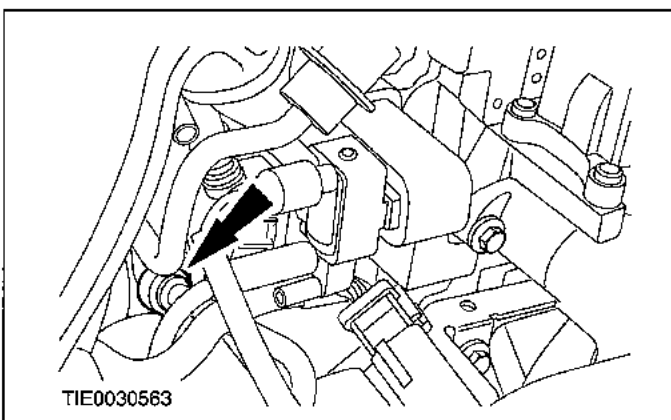
58. Using the special tool, connect the coolant hose to the coolant distribution housing.



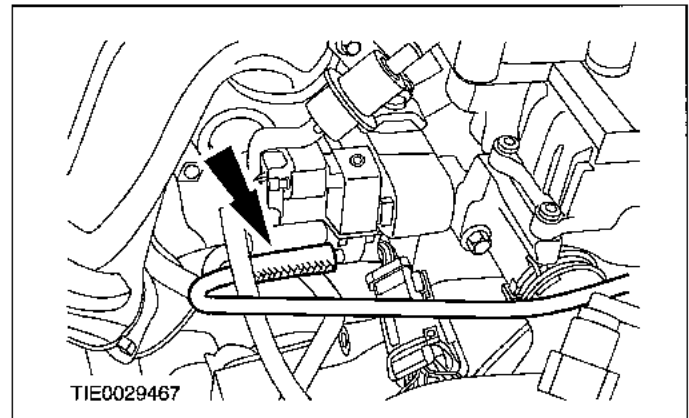
59. Using the special tool, connect the coolant hose to the coolant distribution housing.



60. Attach the brake booster vacuum line to the intake manifold.

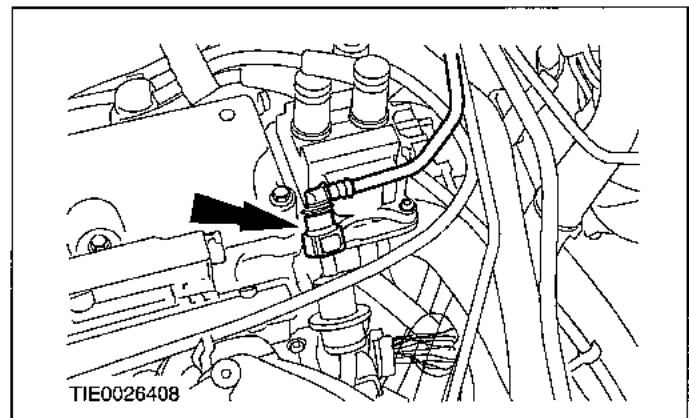


61. Connect the low-pressure EVAP hose.



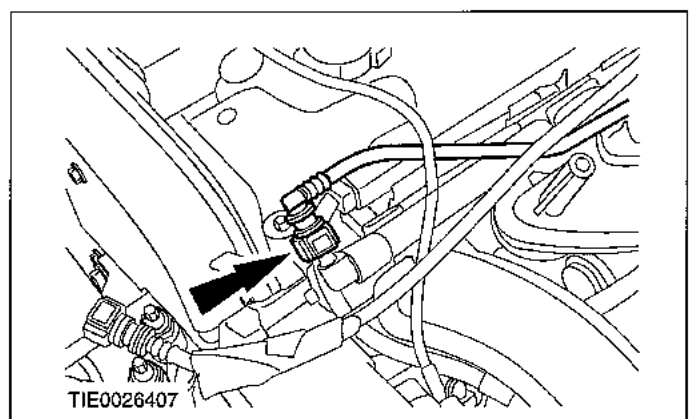
62. Connect the fuel supply line quick release coupling.

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



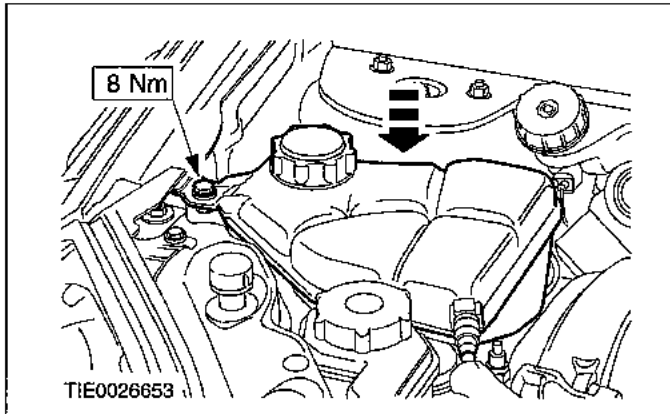
63. Connect the fuel return line quick release coupling.

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

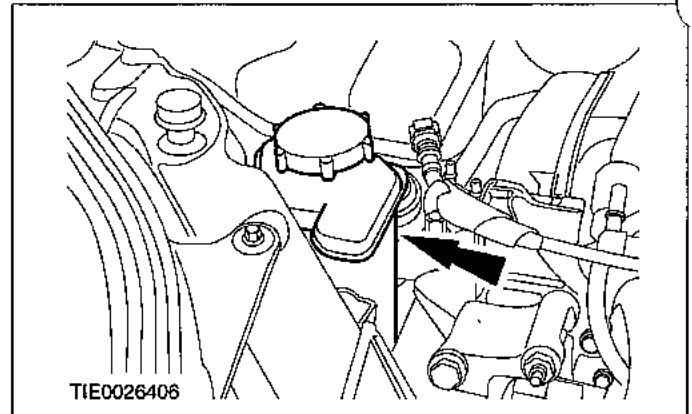


## INSTALLATION

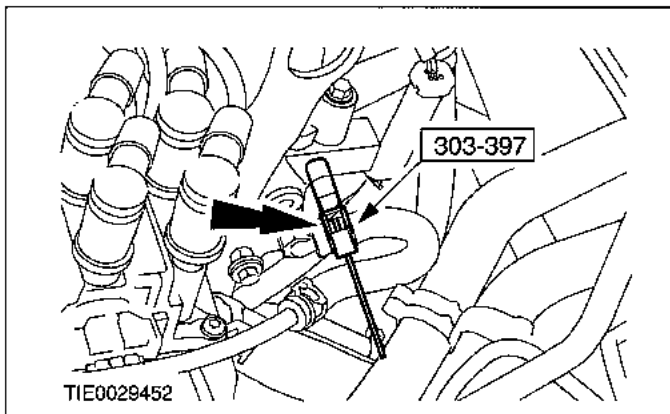
64. Attach the coolant expansion tank to the bracket.



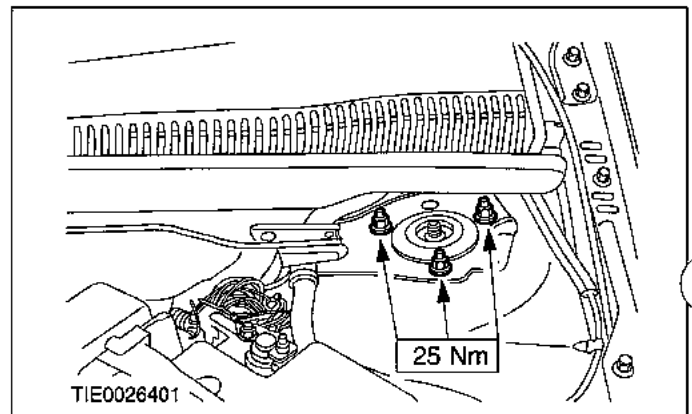
67. Attach the power steering fluid reservoir to the bracket.



65. Using the special tool, connect the degas hose to the cylinder head.

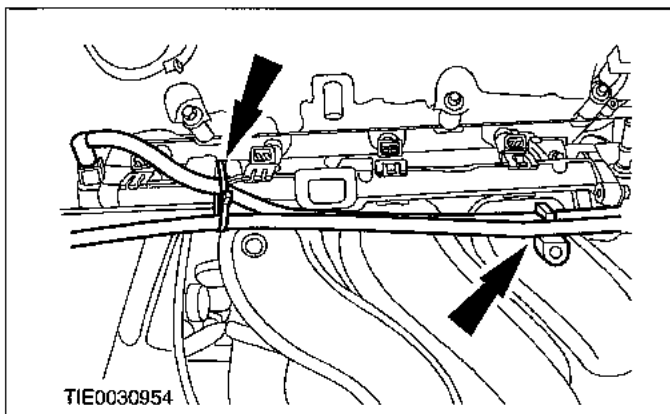


68. Tighten the strut and spring assembly top mount nuts on both sides.



66. Attach the fuel line and the degas line to the intake manifold.

- Install the cable tie.



69. Connect the powertrain control module (PCM) electrical connector.

For additional information, refer to:  
Powertrain Control Module (PCM) - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-14 Electronic Engine Controls, Removal and Installation).

70. Install the air cleaner.

For additional information, refer to: Air Cleaner - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-12 Intake Air Distribution and Filtering, Removal and Installation).

71. Install the front wheels and tires.

For additional information, refer to: Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).

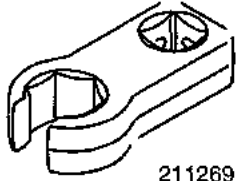
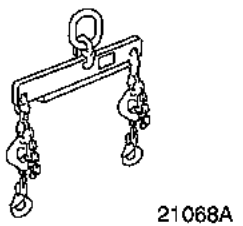
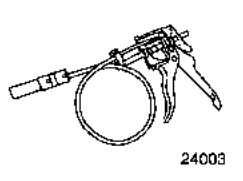
**INSTALLATION****72. Fill the engine cooling system.**

For additional information, refer to: **Cooling System Draining, Filling and Bleeding - 1.25L Duratec-16V (Sigma)/1.3L Duratec-8V (Rocam)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-03A Engine Cooling - 1.25L Duratec-16V (Sigma)/1.3L Duratec-8V (Rocam)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), General Procedures).**

## INSTALLATION

## Engine — Vehicles With: Automatic Transaxle

## Special Tool(s)

 <p>211269</p>	<p>Wrench, Hydraulic Line Union Nut 211-269 (13-027)</p>
 <p>21068A</p>	<p>Lifting Bracket, Engine 303-122 (21-068A)</p>
 <p>24003</p>	<p>Remover/Installer, Hose Clamp 303-397 (24-003)</p>

## General Equipment

Straight edge
Securing straps
Workshop table
Engine hoist

## All vehicles

- ▲ **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.

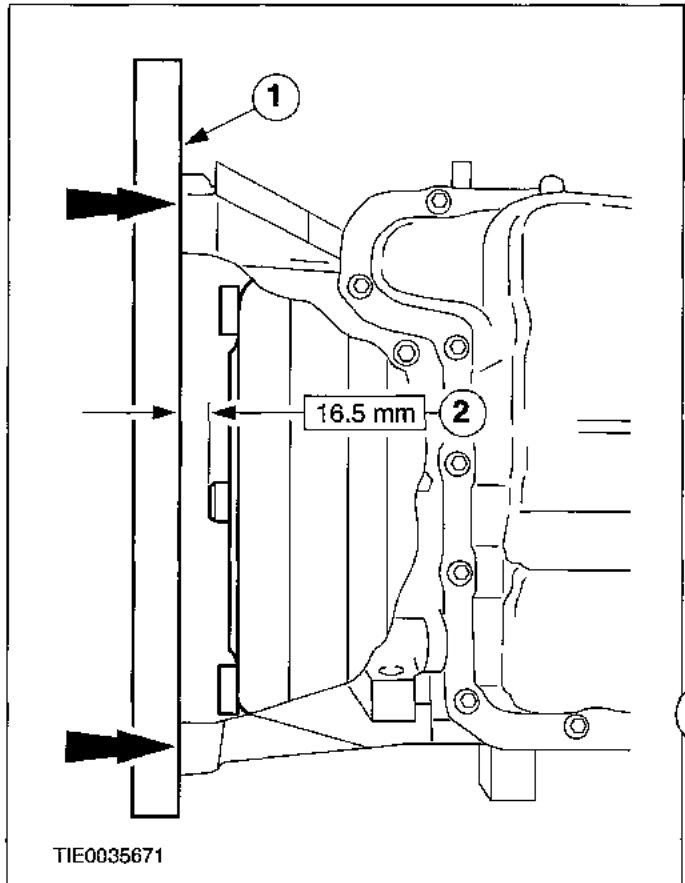
1. ⚠ **CAUTION:** The torque converter must remain at the correct installation depth throughout the whole installation procedure.

**NOTE:** The torque converter hub must engage fully in the oil pump drive gear.

**Check the installation depth of the torque converter.**

1. Lay a straight edge on the transaxle flange.

2. Check the installation depth between the transaxle flange and the torque converter centering spigot.

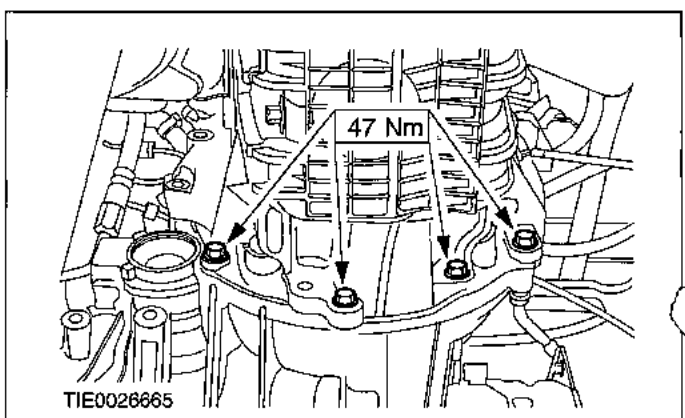


2. ⚠ **CAUTION:** Make sure that the two locating dowels are installed.

**NOTE:** Make sure the torque converter centering spigot engages in the flexplate and the transaxle engages on the engine flange dowels.

**Install the transaxle to the engine.**

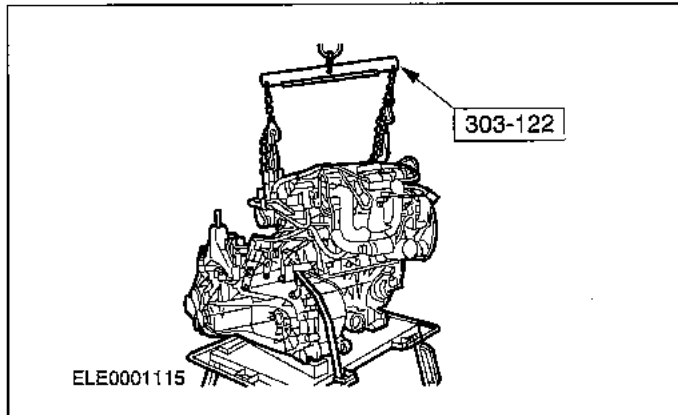
3. Install the transaxle lower retaining bolts.



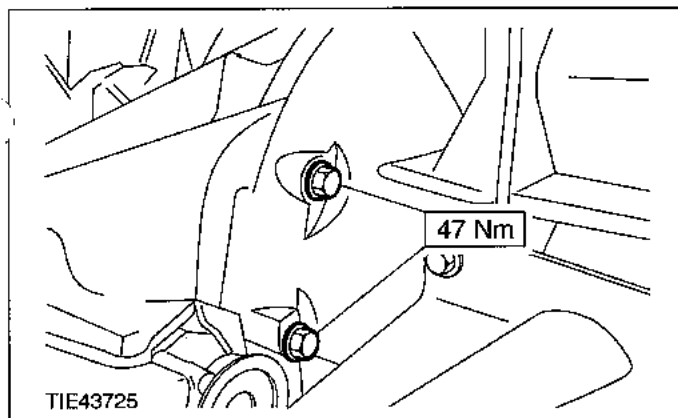
**INSTALLATION**

4. **▲WARNING:**Support the engine and transaxle assembly on wooden blocks and secure it with suitable securing straps.

Using the special tool and the engine hoist position the engine and transaxle assembly on the workshop table.



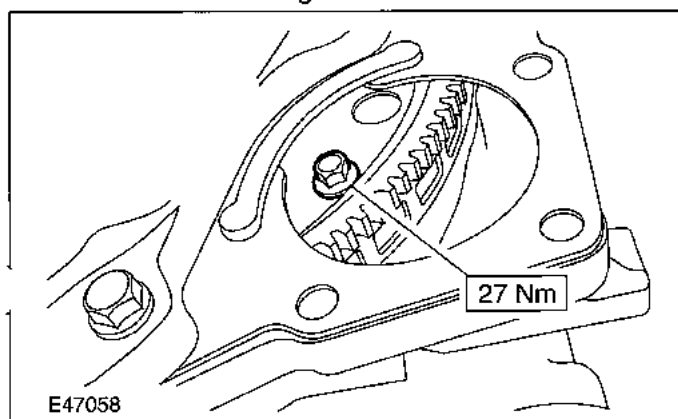
5. Install the transaxle right-hand retaining bolts.



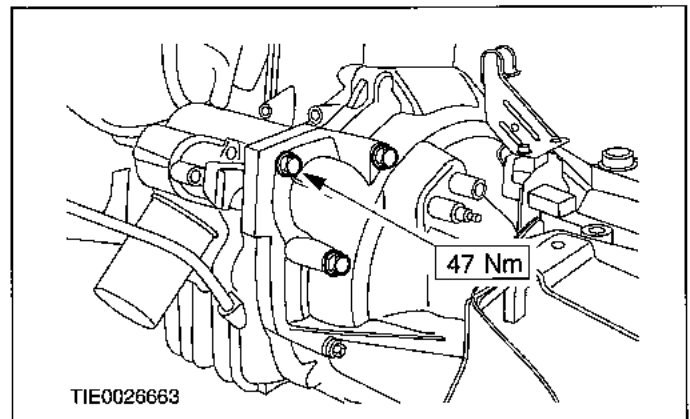
6. **NOTE:**Install new torque converter retaining nuts.

Install the torque converter retaining nuts.

- Rotate the torque converter to gain access to the remaining studs.



7. Install the starter motor.



8. Raise and support the vehicle.

For additional information, refer to: Lifting (100-02 Jacking and Lifting, Description and Operation).

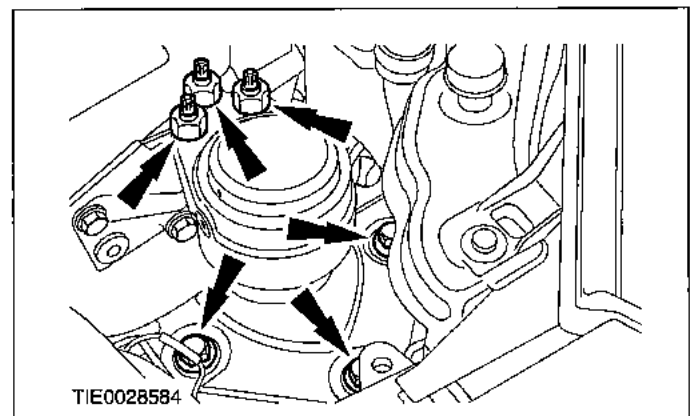
9. Position the engine and transaxle assembly in the engine compartment.

- Carefully lower the vehicle.

10. **NOTE:**Install new engine front mount retaining nuts.

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

Install the engine front mount.

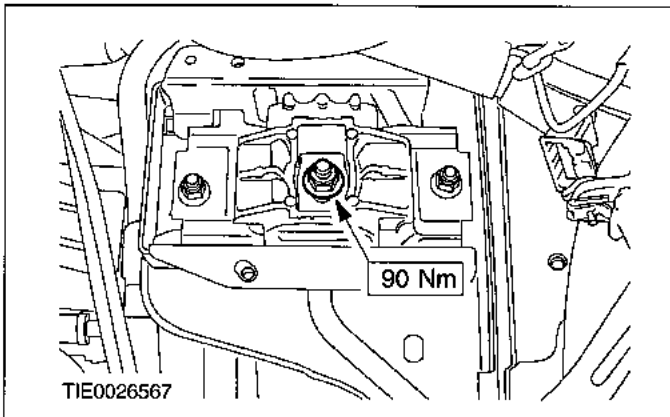


11. **NOTE:**Install new engine rear mount center retaining nut.

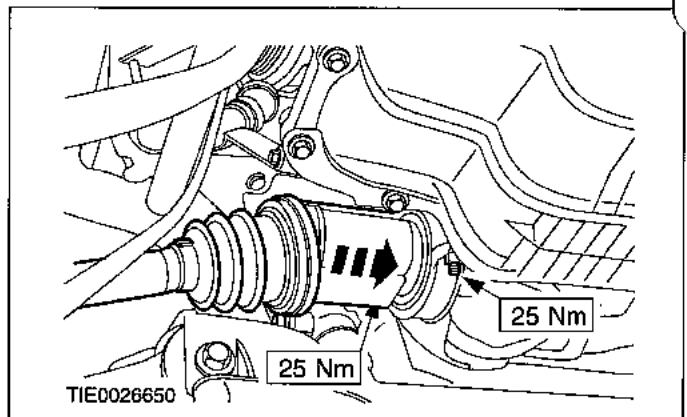
**NOTE:**Do not tighten the engine rear mount center retaining nut at this stage.

**INSTALLATION**

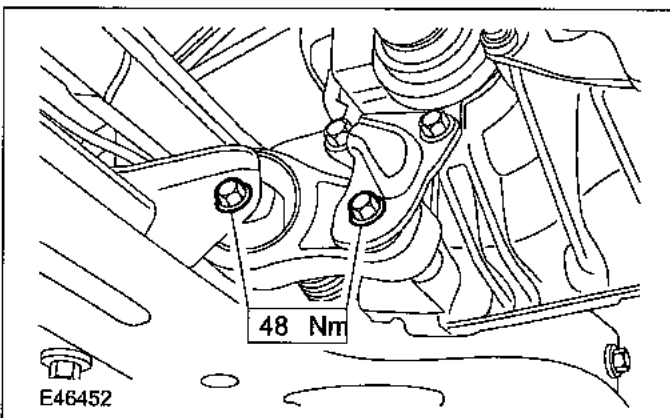
Install the engine rear mount center retaining nut.



Attach the right-hand halfshaft and the intermediate shaft to the transaxle.



12. Install the engine support insulator.



14. 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.

⚠ Make sure the snap ring is correctly seated.

**NOTE:** Install a new snap ring.

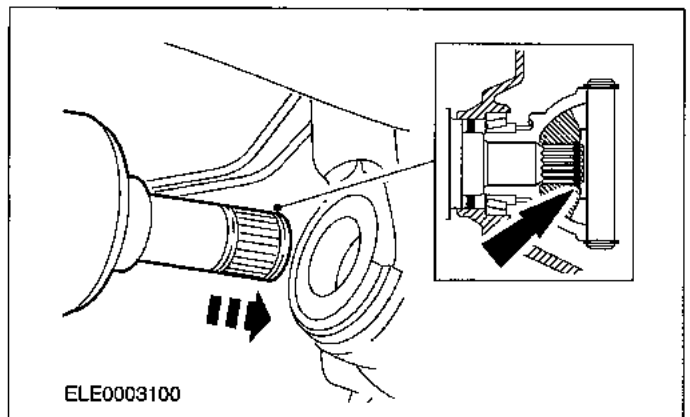
Attach the left-hand halfshaft to the transaxle.

13. 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:** Install a new center bearing cap and locknuts.

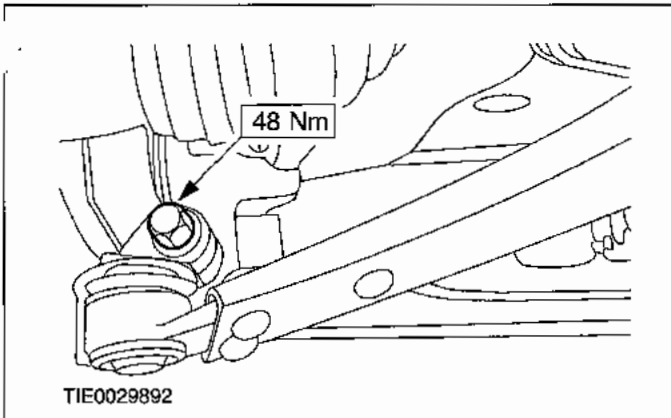


15. Attach the lower arm to the wheel knuckle on both sides (right-hand side shown).

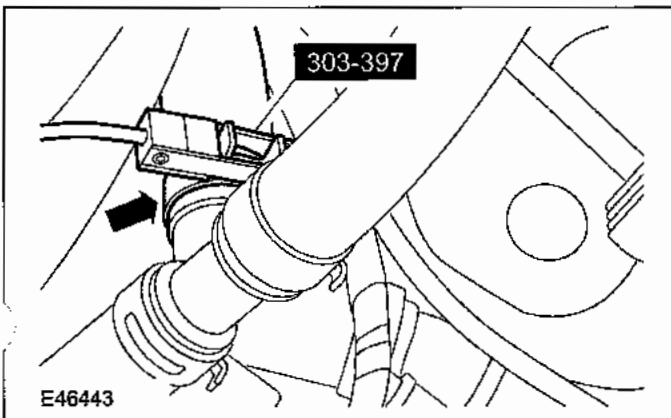


**INSTALLATION**

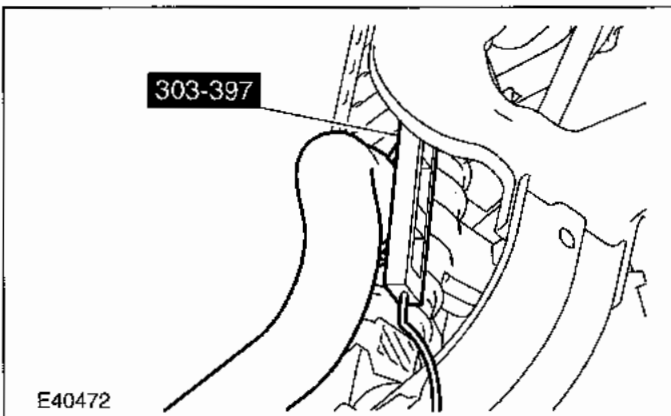
- Install the heat shield.



- 16. Using the special tool, connect the coolant hose to the distribution pipe.**



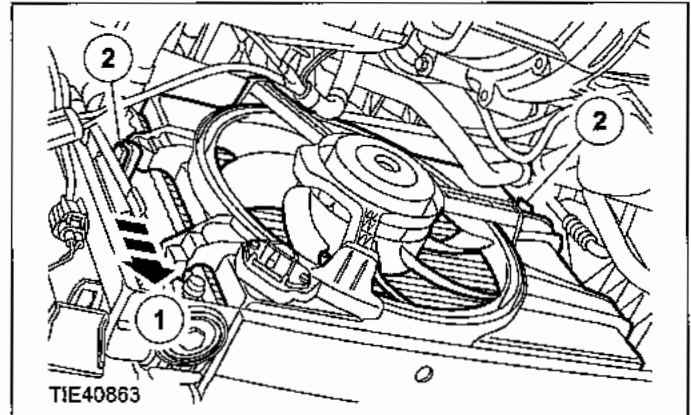
- 17. Using the special tool, connect the coolant hose to the radiator.**



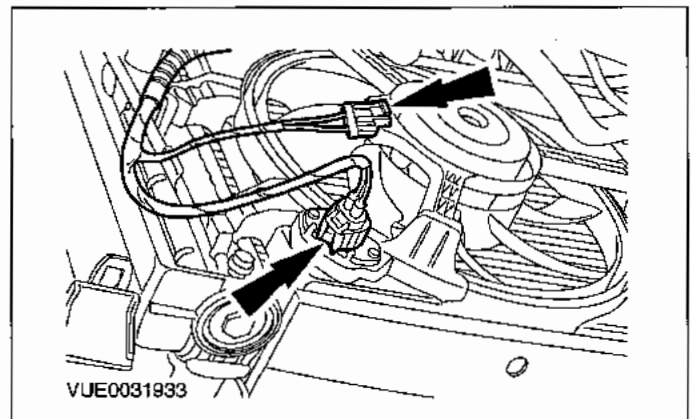
- 18. Install the cooling fan motor and shroud.**

1. Push the cooling fan motor and shroud upwards and then downwards to install.

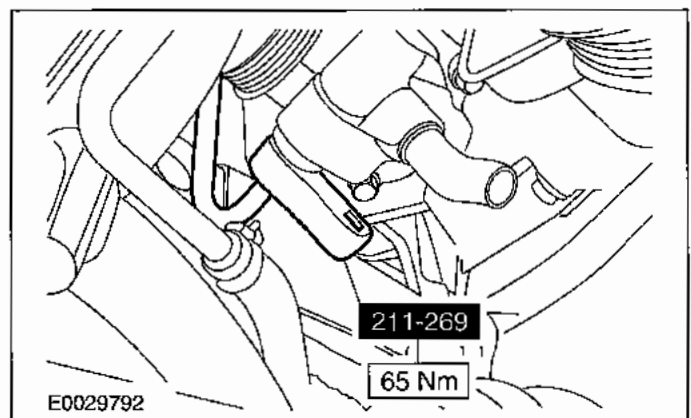
2. Install the cooling fan motor and shroud to the retaining brackets.



- 19. Connect the cooling fan motor and cooling fan resistor electrical connectors.**

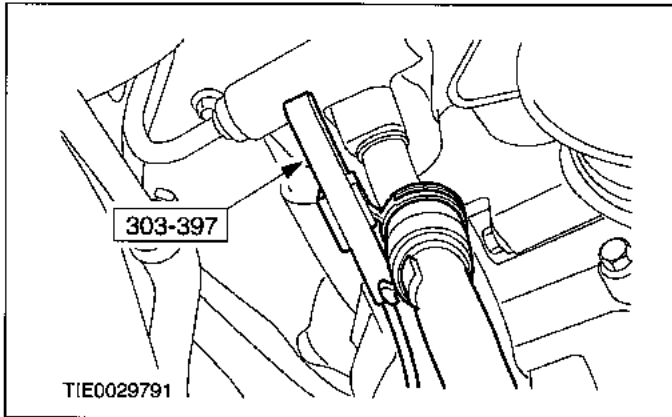


- 20. Using the special tool, attach the power steering line to the power steering pump.**

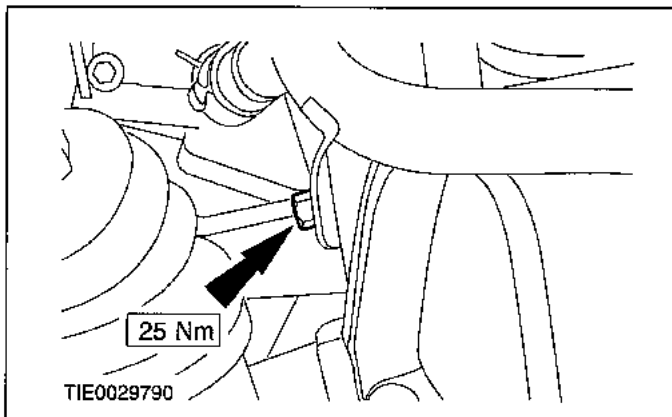


**INSTALLATION**

21. Connect the power steering line to the steering pump.

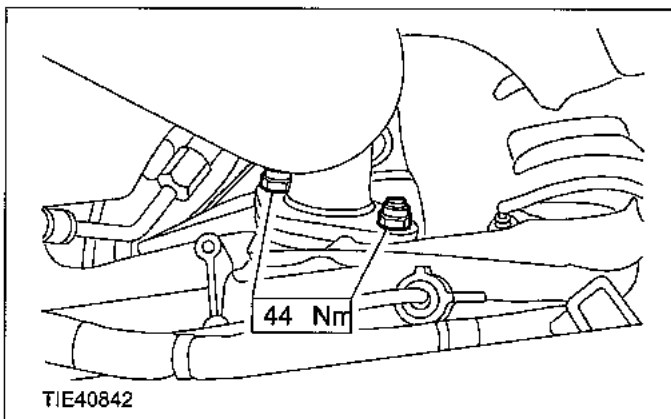


22. Attach the power steering line support bracket to the engine block.



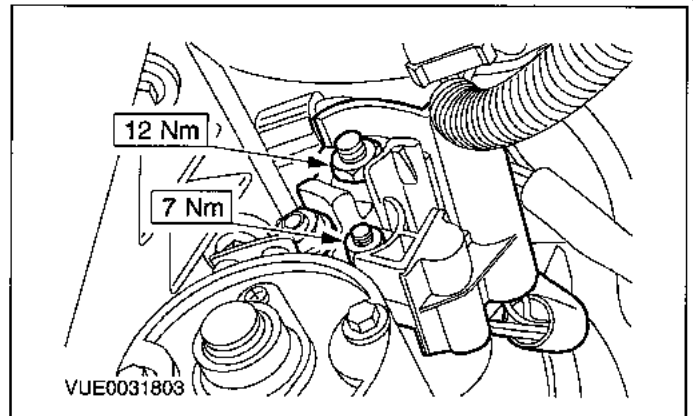
23. **NOTE:** Install new exhaust flange nuts and a new exhaust flange gasket.

Attach the exhaust flexible pipe to the catalytic converter.

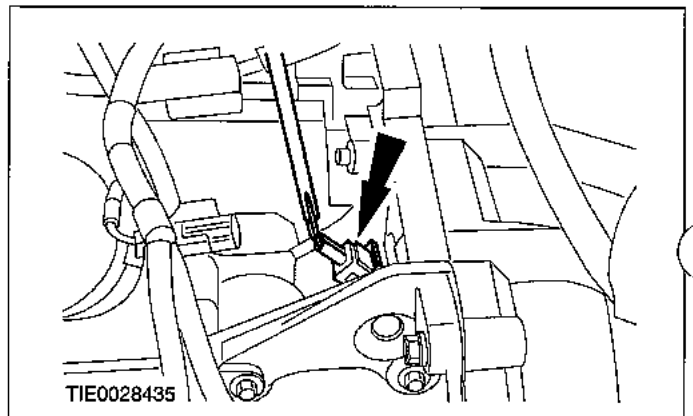


24. Remove the exhaust flexible pipe support.

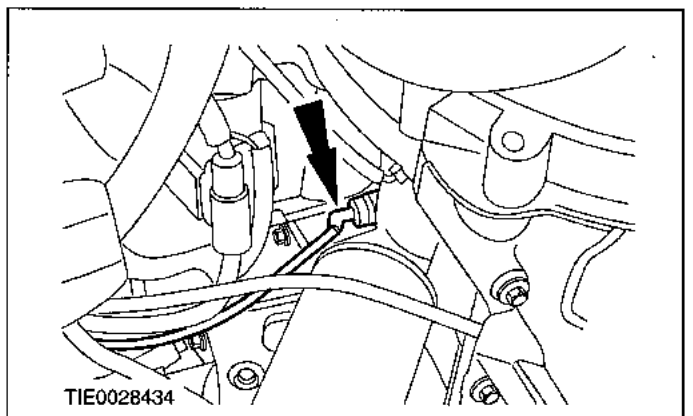
25. Connect the ignition switch to starter motor solenoid and battery to starter motor solenoid cables.



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



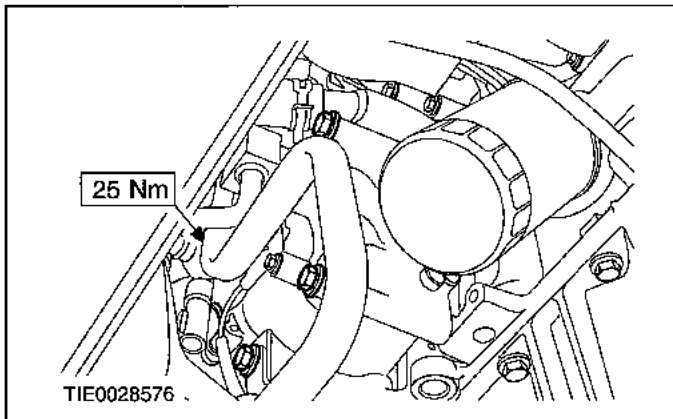
27. Connect the oil pressure switch electrical connector.



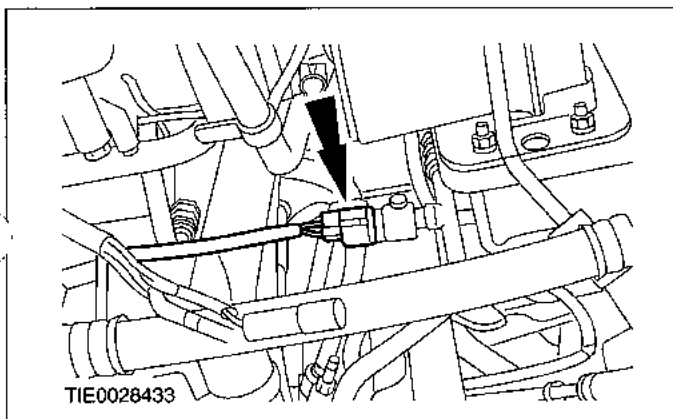
**INSTALLATION**

Vehicles with air conditioning

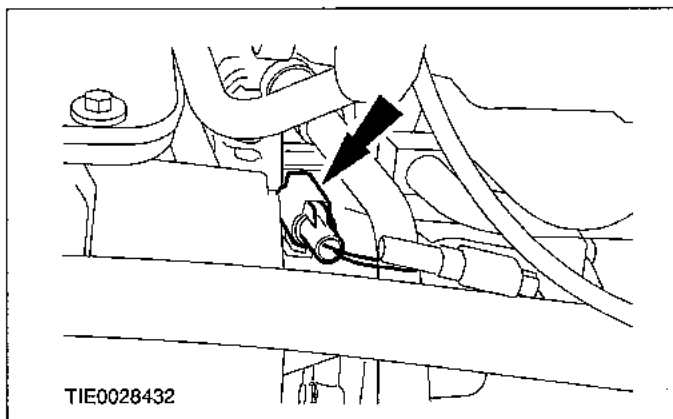
- 28. Attach the air conditioning (A/C) compressor to the cylinder block.**



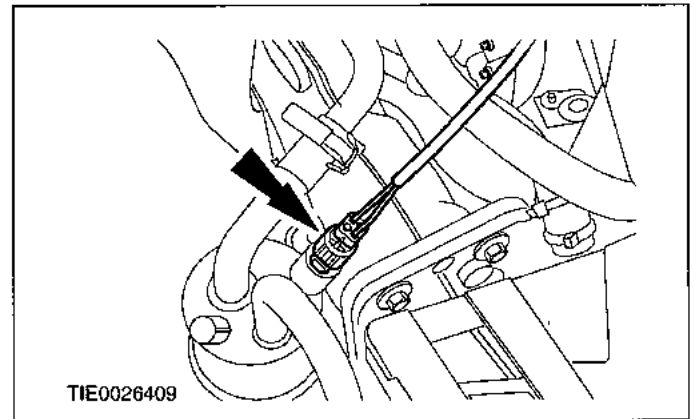
- 29. Connect the A/C high-pressure cutoff switch electrical connector.**



- 30. Connect the A/C compressor clutch electrical connector.**



- 31. Connect the air conditioning (A/C) low-pressure cutoff switch electrical connector.**



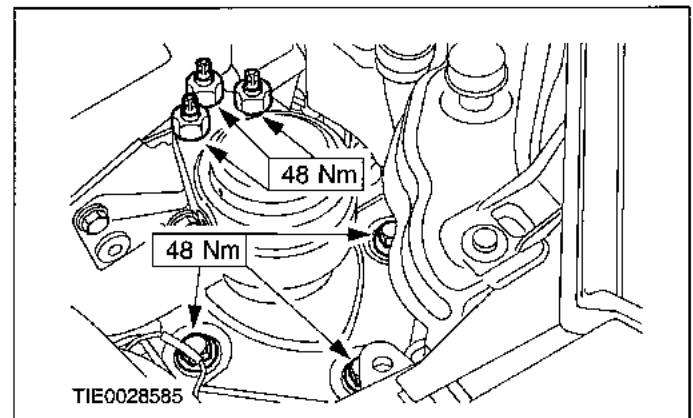
All vehicles

- 32. Install the accessory drive belt.**

For additional information, refer to:  
**Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles With: Air Conditioning (303-05 Accessory Drive, Removal and Installation)**  
**/ Accessory Drive Belt - 1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma), Vehicles Without: Air Conditioning (303-05 Accessory Drive, Removal and Installation).**

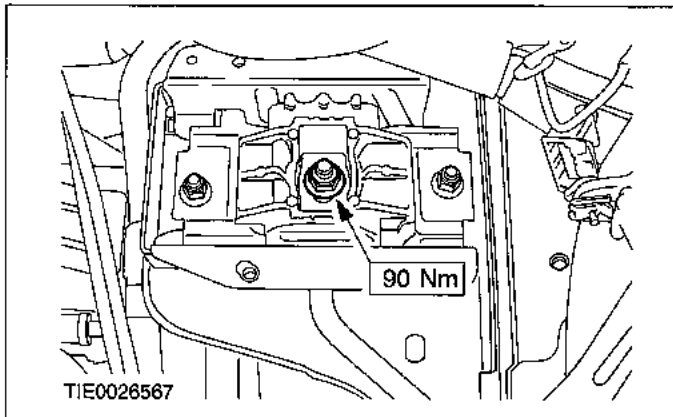
- 33. Lower the vehicle.**

- 34. Tighten the engine front mount retaining nuts and bolts.**

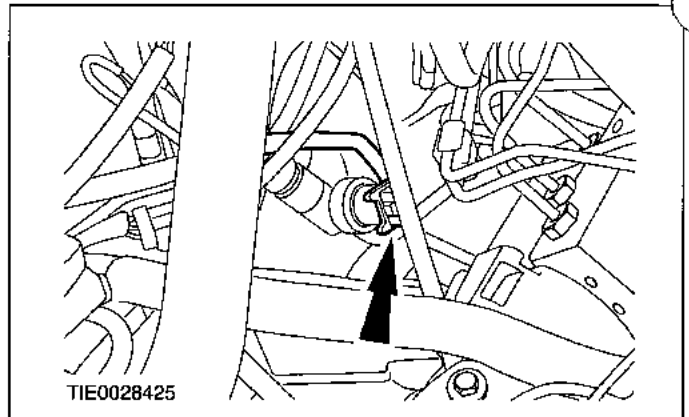


**INSTALLATION**

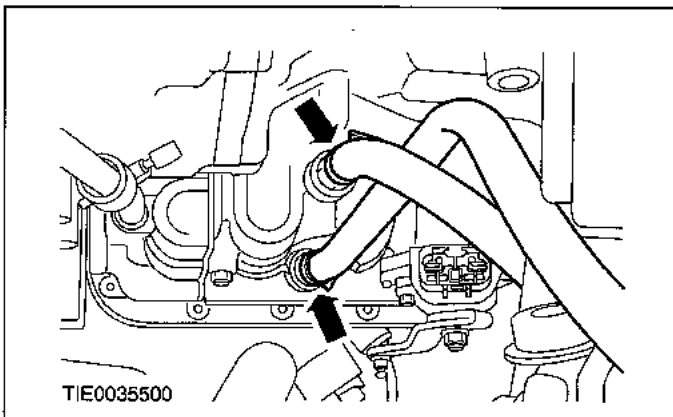
35. Tighten the engine rear mount center retaining nut.



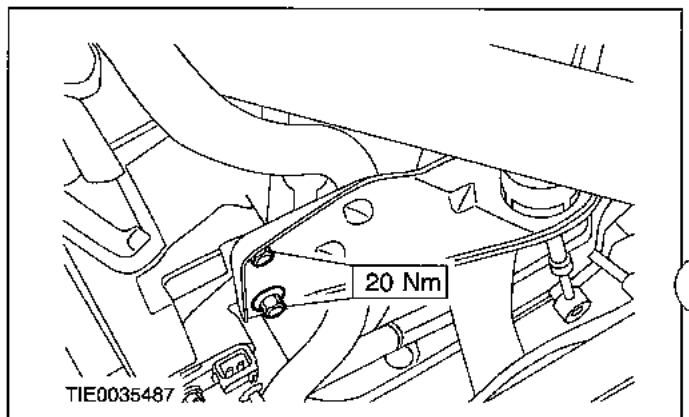
38. Connect the power steering pressure (PSP) switch electrical connector.



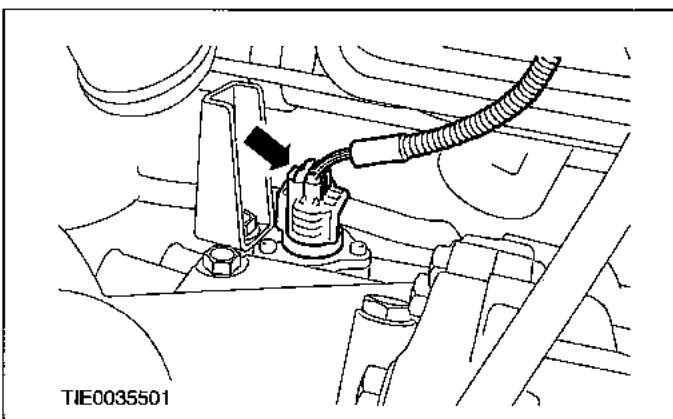
36. Connect the transmission fluid cooler line to the transaxle.



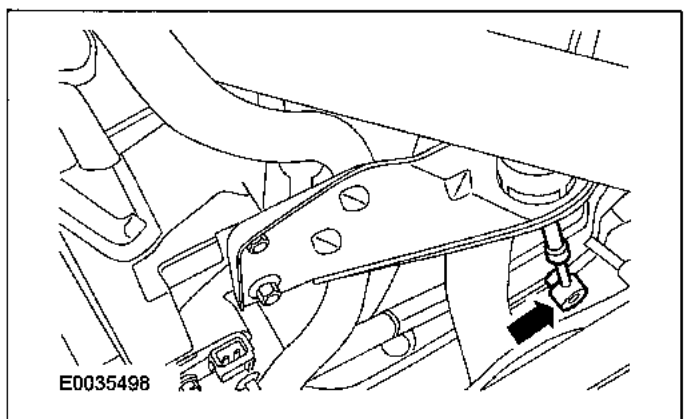
39. Attach the selector lever cable retaining bracket to the transaxle.



37. Connect the vehicle speed (VSS) sensor electrical connector.



40. Attach the selector lever cable to the transaxle.

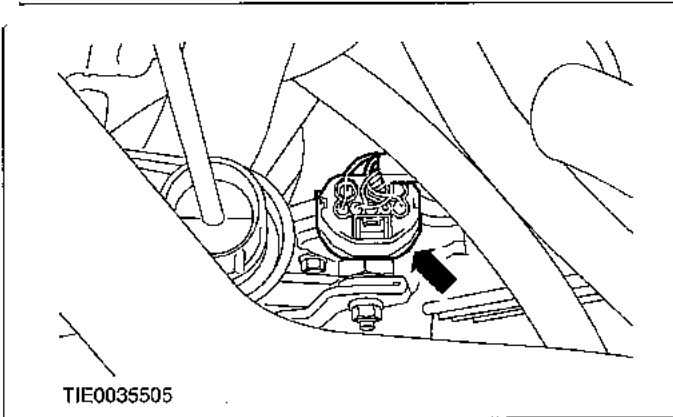


41. Adjust the selector lever cable.

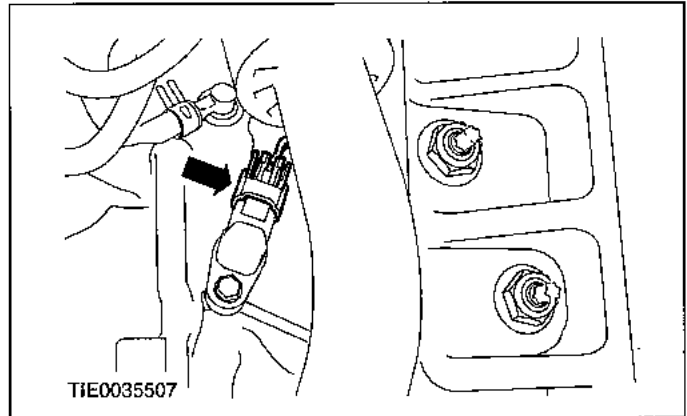
For additional information, refer to: Selector Lever Cable Adjustment (307-05 Automatic Transmission/Transaxle External Controls - Vehicles With: 4-Speed Automatic Transmission (AW81-40), General Procedures).

**INSTALLATION**

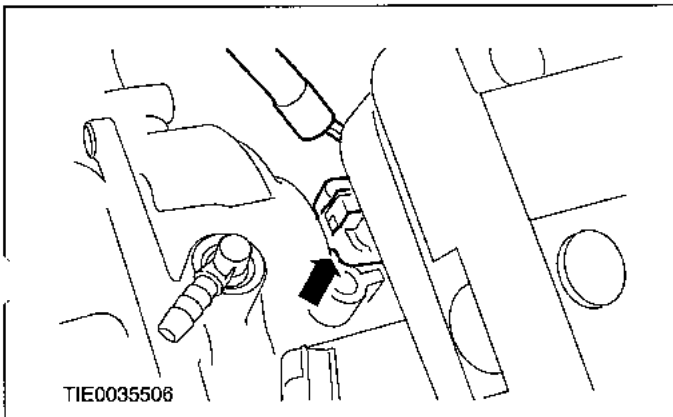
42. Connect the transmission range (TR) sensor electrical connector.



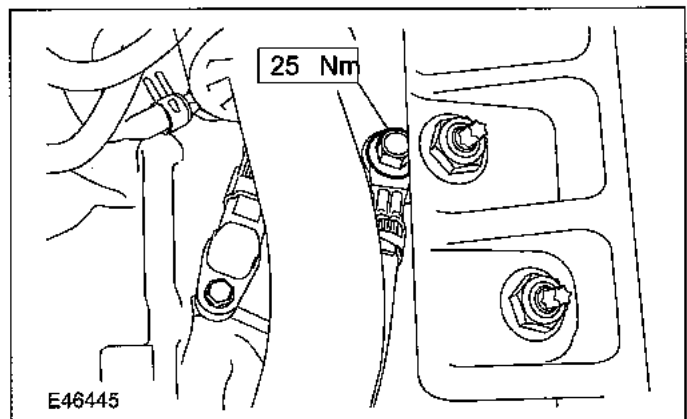
45. Connect the turbine shaft speed (TSS) sensor electrical connector.



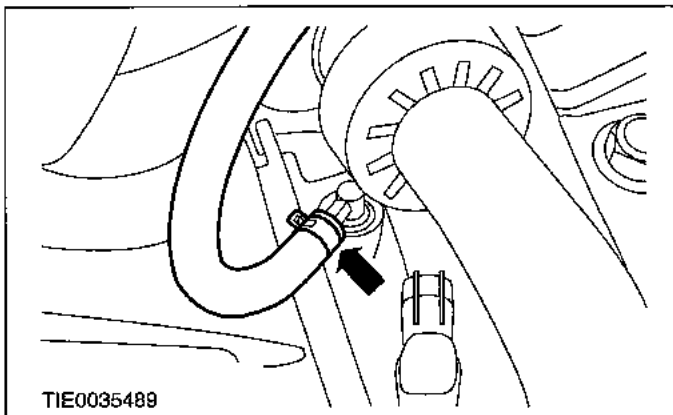
43. Connect the transaxle wiring harness electrical connector.



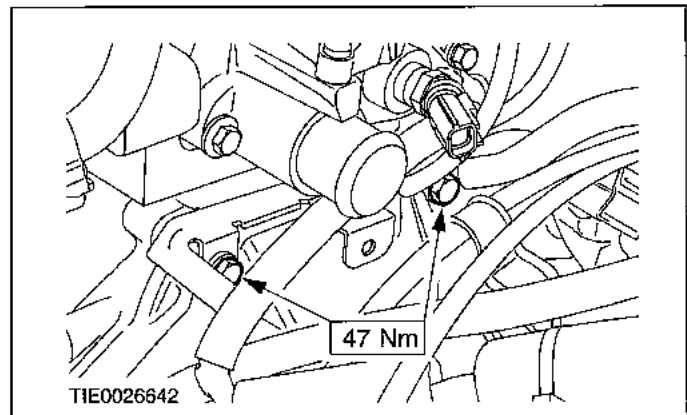
46. Attach the ground cable to the transaxle.



44. Connect the transaxle breather hose.

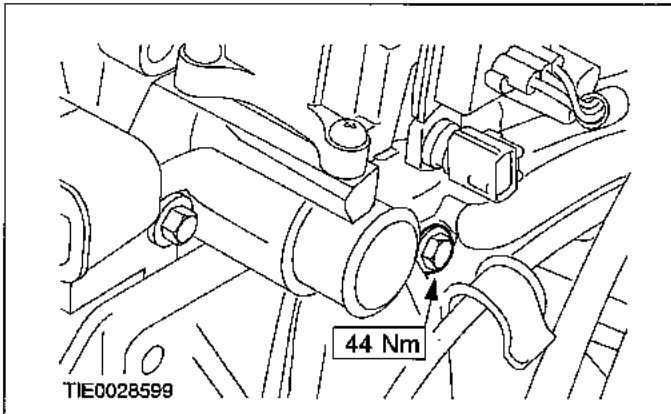


47. Install the engine wiring harness support brackets.

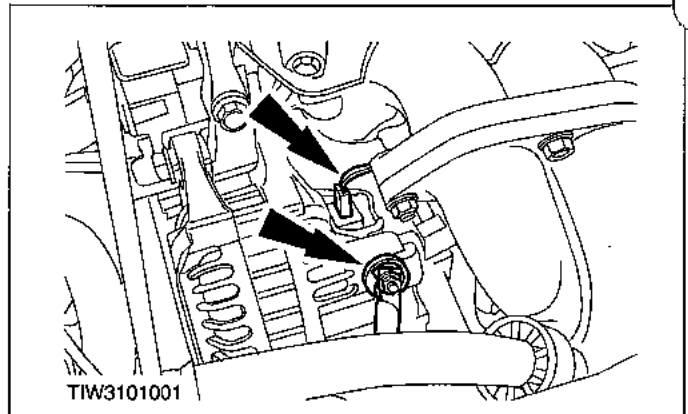


**INSTALLATION**

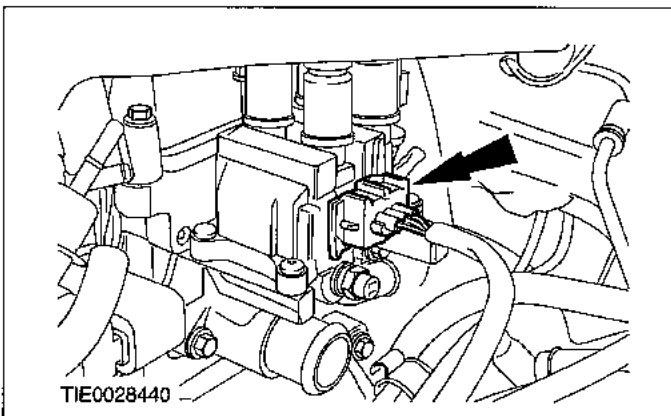
48. Attach the engine ground cable to the transaxle.



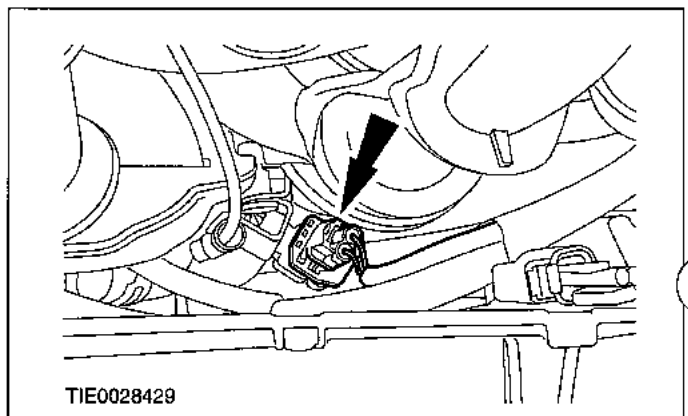
52. Connect the generator electrical connectors.



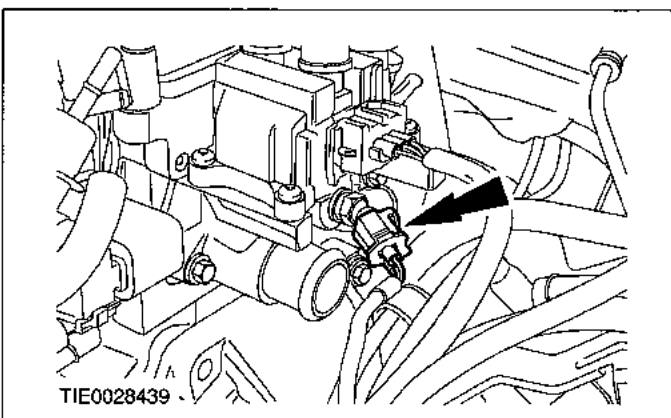
49. Connect the electronic ignition (EI) coil electrical connector.



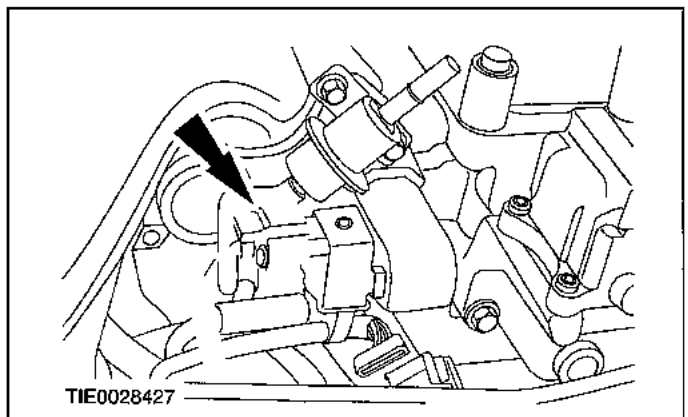
53. Connect the knock sensor (KS) electrical connector.



50. Connect the engine coolant temperature (ECT) electrical connector.



54. Connect the EVAP electrical connector.

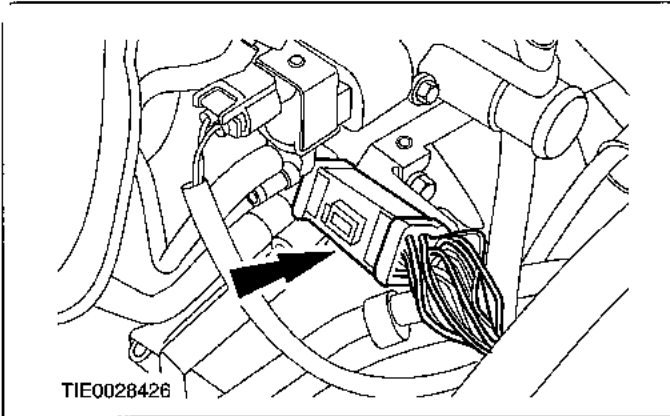


51. Install the right-hand headlamp assembly.

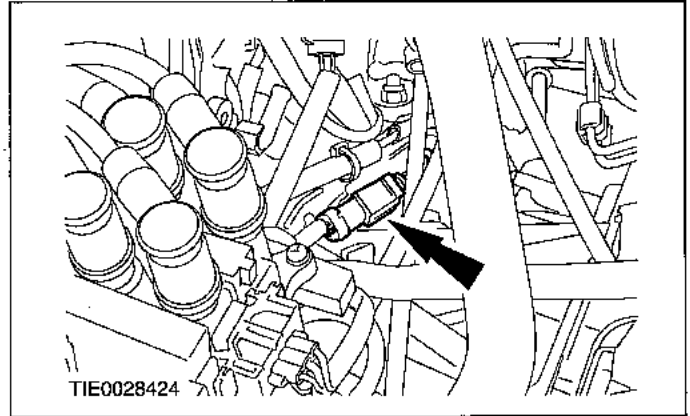
For additional information, refer to:  
Headlamp Assembly (417-01 Exterior  
Lighting, Removal and Installation).

**INSTALLATION**

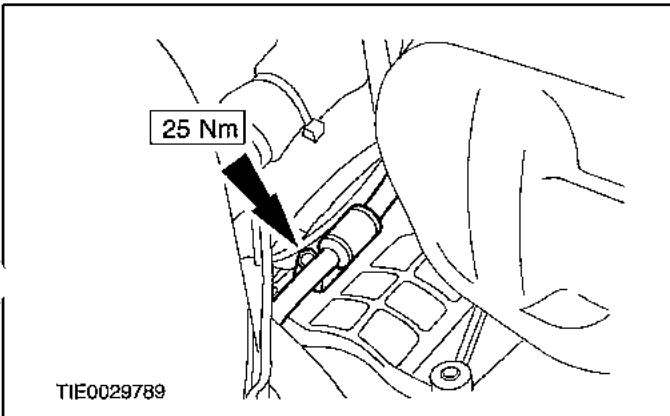
**55. Connect the engine wiring harness electrical connector.**



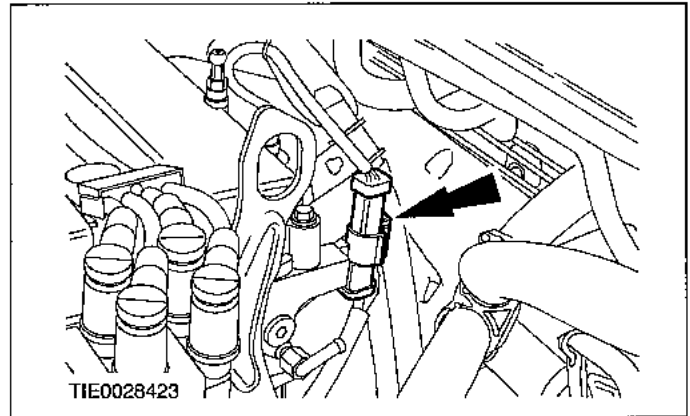
**58. Connect the catalyst monitor sensor electrical connector.**



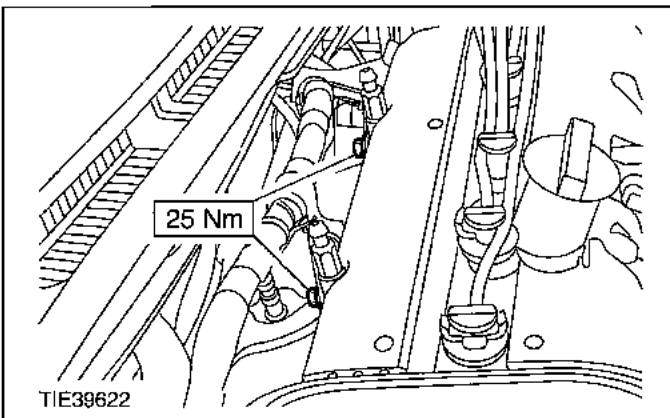
**56. Attach the power steering line to the power steering pump mounting bracket.**



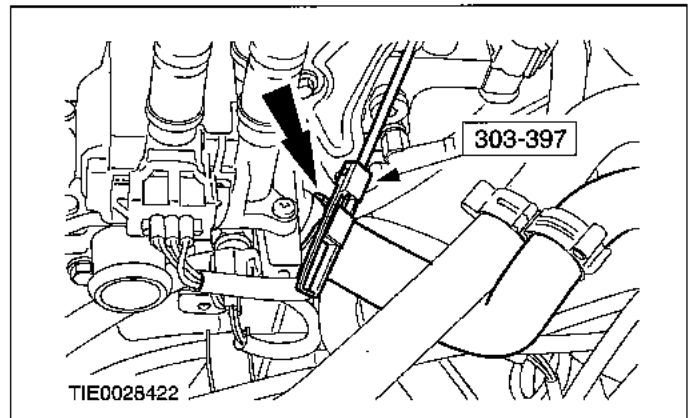
**59. Connect the heated oxygen (HO2S) sensor electrical connector.**



**57. Attach the power steering line support bracket to the cylinder head.**

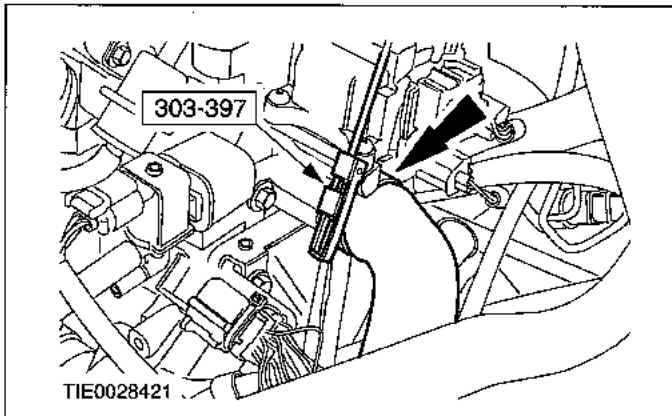


**60. Using the special tool, connect the coolant hose to the coolant distribution housing.**

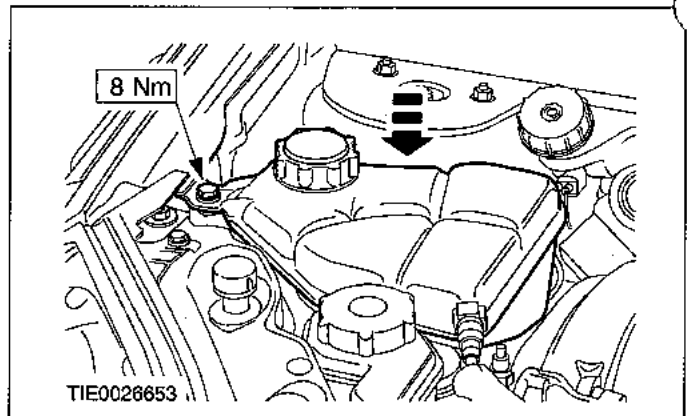


**INSTALLATION**

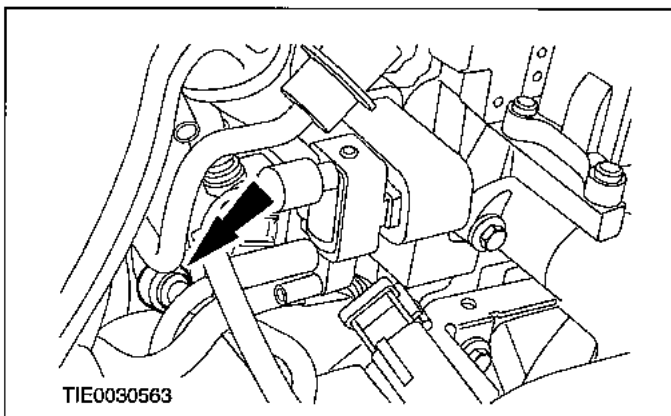
61. Using the special tool, connect the coolant hose to the coolant distribution housing.



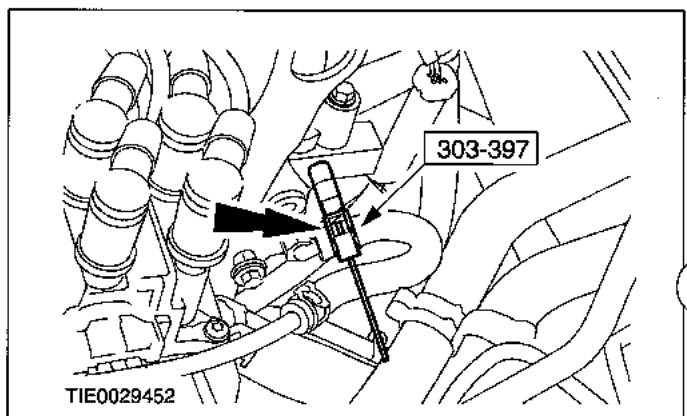
64. Attach the coolant expansion tank to the bracket.



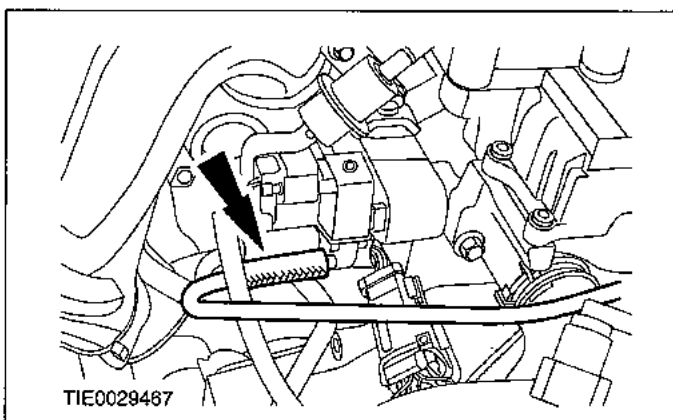
62. Attach the brake booster vacuum line to the intake manifold.



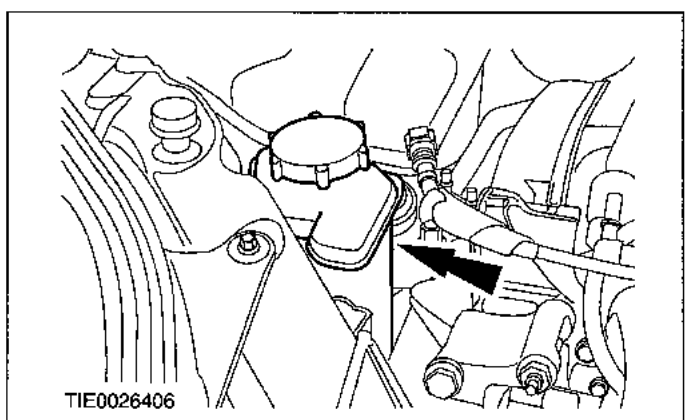
65. Using the special tool, connect the degas hose to the cylinder head.



63. Connect the low pressure evaporate emission (EVAP) hose to the EVAP valve.



66. Attach the power steering fluid reservoir to the bracket.

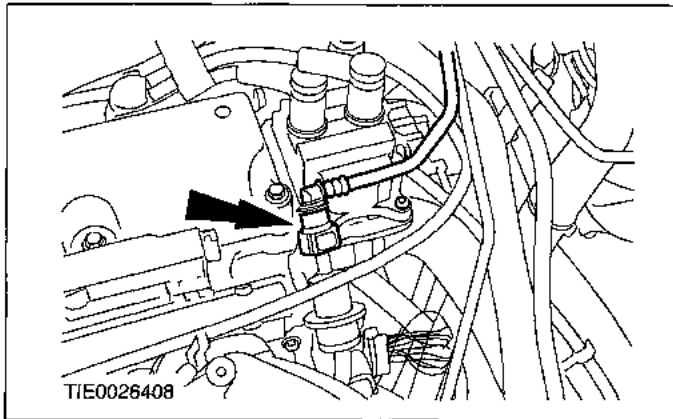




**INSTALLATION**

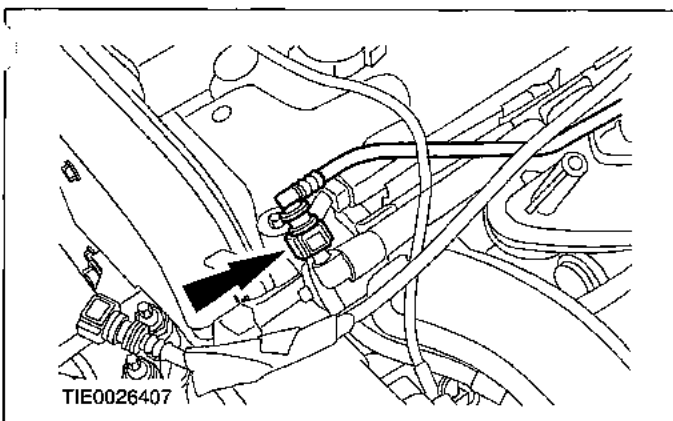
67. Connect the fuel supply line quick release coupling.

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



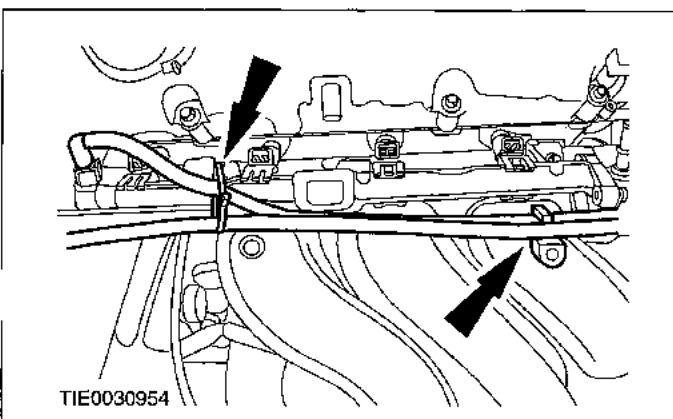
68. Connect the fuel return line quick release coupling.

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

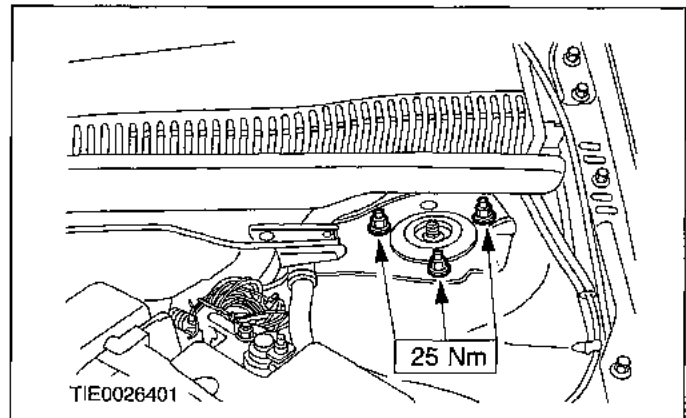


69. Attach the fuel line and the degas line to the intake manifold.

- Install the cable tie.



70. Tighten the strut and spring assembly top mount nuts on both sides.



71. Connect the powertrain control module (PCM) electrical connector.

For additional information, refer to: **Powertrain Control Module (PCM) - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-14 Electronic Engine Controls, Removal and Installation).**

72. Install the air cleaner.

For additional information, refer to: **Air Cleaner - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma) (303-12 Intake Air Distribution and Filtering, Removal and Installation).**

73. Install the front wheels and tires.

For additional information, refer to: **Wheel and Tire (204-04 Wheels and Tires, Removal and Installation).**

74. Fill the engine cooling system.

For additional information, refer to: **Cooling System Draining, Filling and Bleeding - 1.25L Duratec-16V (Sigma)/1.4L Duratec-16V (Sigma)/1.6L Duratec-16V (Sigma)/1.3L Duratec-8V (Rocam) (303-03A, General Procedures).**

75. Check the transmission fluid level and top up with clean automatic transmission fluid if necessary.

For additional information, refer to: **Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle - Vehicles With: 4-Speed Automatic Transmission (AW81-40), General Procedures).**

