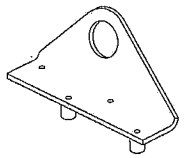
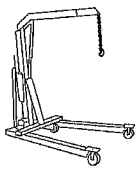
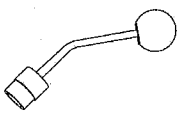
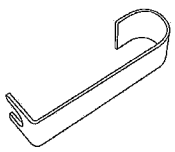
SECTION 303-01C Engine — 6.0L Diesel

CONTENTS PAGE

IN-VEHICLE REPAIR

Cylinder Head — RH

Special Tool(s)

 ST2697-A	Lifting Bracket, Cylinder Head 303-759
 ST1341-A	Heavy Duty Floor Crane 014-00071
 ST2862-A	Release Tool, Injector Connector 303-1115
 ST2861-A	Remove/Installer, Glow Plug Connector 303-1114

Material

Item	Specification
SAE 15W-40 Super Duty Motor Oil XO-15W40-QSD or equivalent	WSS-M2C171-B
High Temperature Nickel Anti-Sieze Lubricant XL-2 or equivalent	ESE-M12A4-A
Metal Brake Parts Cleaner PM-4 (Canada CPM-4)	—

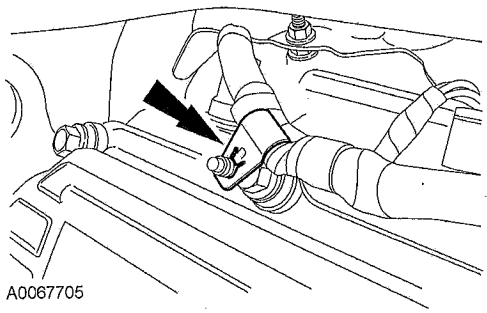
Removal

All vehicles

1. With the vehicle in NEUTRAL, position it on a hoist. For additional information, refer to Section 100-02.
2. Drain the engine oil.
3. Remove the intake manifold. For additional information, refer to Intake Manifold in this section.
4. Remove the evaporator core housing. For additional information, refer to Section 412-02.
5. **NOTE:**
   Only one retainer shown.

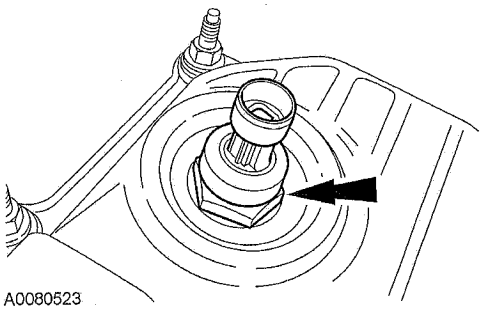
   Disconnect the wiring retainers from the studs.

IN-VEHICLE REPAIR (Continued)


A0067705

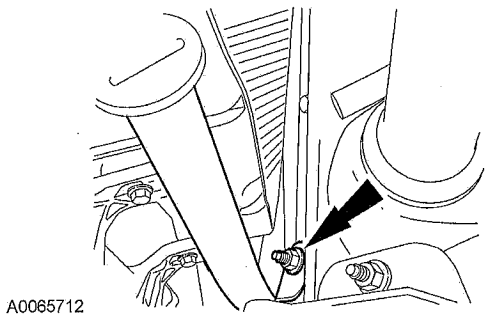
Late build

6. Remove the injection control pressure (ICP) sensor.


A0080523

All vehicles

7. If equipped, remove the nut and position the transmission fluid and indicator aside.


A0065712

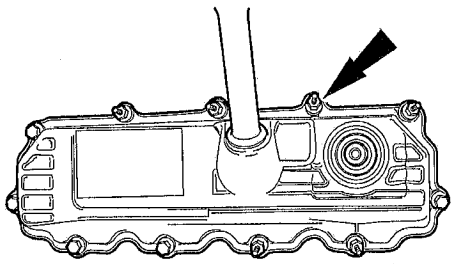
8. **NOTE:**
Late build shown, early build similar.

NOTE:
Mark the position of the valve cover bolts for the valve cover bolt installation.

Remove the bolts and the valve cover.

- Clean and inspect the valve cover gasket. Install a new gasket if necessary.

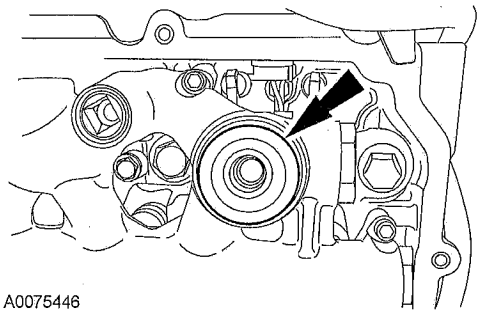
IN-VEHICLE REPAIR (Continued)



A0075676

Late build

9. Remove the high-pressure oil rail-to-valve cover gasket.



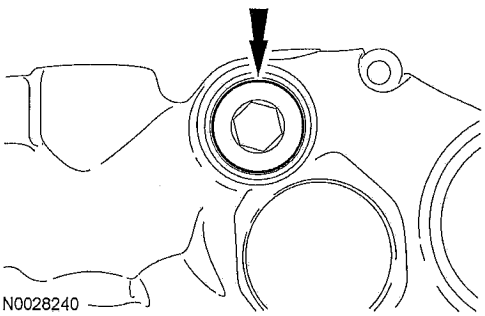
A0075446

Two-piece head tube

10. **NOTE:**
Some engines may have been updated with a new two-piece crankcase-to-head tube. If the crankcase-to-head tube has been updated it will have a hex head.

If the high-pressure oil rail has a hex head, remove the crankcase-to-head tube assembly.

- Remove and discard the O-ring seals.



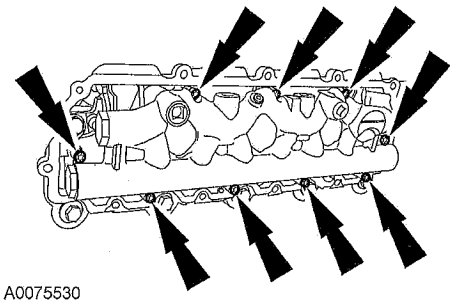
N0028240

Late build

11. **NOTE:**
Do not remove the oil rail end plugs or acoustic wave attenuator port fitting. Service parts are not available to support the components.

Remove the bolts and the high-pressure oil rail.

IN-VEHICLE REPAIR (Continued)

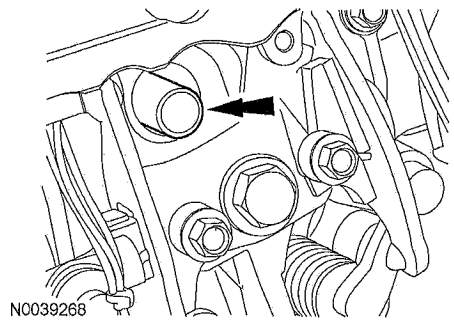


Two-piece head tube

12. *NOTICE:*
Use care not to deform the lower crankcase-to-head tube during removal. If the tube is damaged, a new tube must be installed.

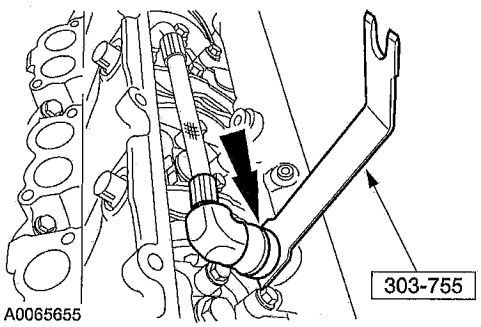
NOTE:
Use a shop towel and metal brake parts cleaner to remove the oil residue prior to removing.

If the updated crankcase-to-head tube separated, using a pair of soft jawed pliers, remove the lower crankcase-to-head tube.



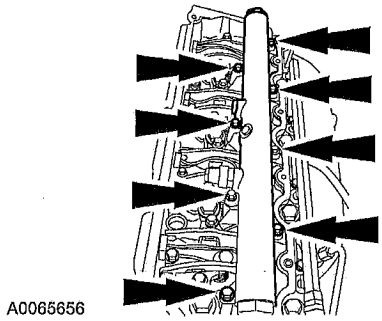
Early build

13. Disconnect the high-pressure oil rail supply line at the high-pressure oil rail.

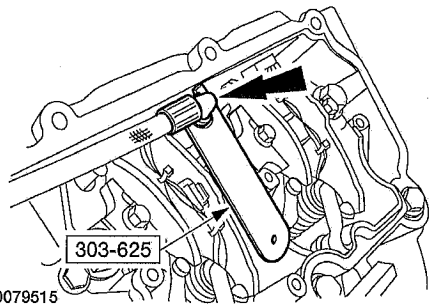


14. Remove the bolts and the high-pressure oil rail.

IN-VEHICLE REPAIR (Continued)



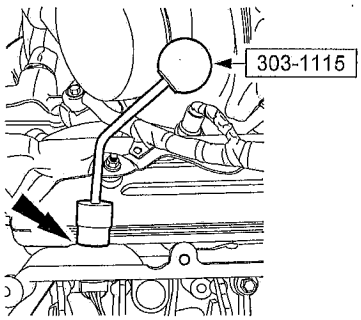
15. Disconnect and remove the high-pressure oil supply line.



All vehicles

16. *NOTICE:*
Do not attempt to apply battery voltage to the fuel injector or damage to the fuel injector will occur.

Using the special tool, push the fuel injector electrical connector out of the rocker arm carrier.



17. Prior to removing the fuel injector assembly, insert clean shop towels in the oil drain holes adjacent to each glow plug.

18. *NOTICE:*
Failure to account for all snap rings or pieces prior to placing the vehicle back in service can cause engine damage. A missing snap ring can be ingested into the lube oil system, causing severe engine damage.

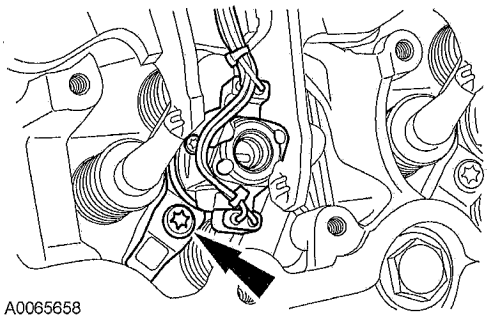
NOTICE:
To prevent engine damage, do not use air tools to remove the fuel injectors. The snap ring that extracts the injector can dislodge and fall into the oil drain hole.

NOTE:
There is no need to drain the fuel rail.

NOTE:
If engine coolant is found in the combustion chambers, it may be necessary to install a new injector sleeve. For additional information, refer to Section 303-04C.

Remove the bolt, fuel injector hold-down clamp and fuel injector.

IN-VEHICLE REPAIR (Continued)

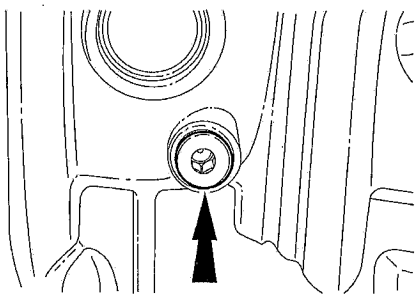

A0065658

19. **NOTE:**
If a snap ring or piece of a snap ring is missing from the injector hold-down assembly, it must be located prior to removing the shop.

Remove the shop towels.

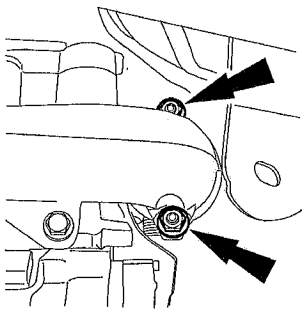
20. Remove the starter. For additional information, refer to Section 303-06B.

21. Remove the cylinder drain block.


A0079935

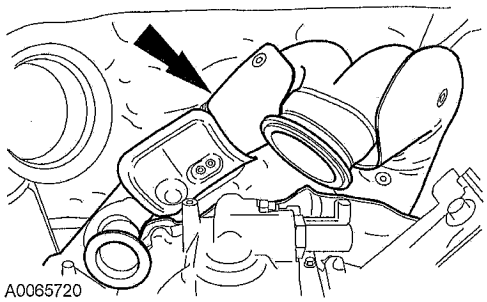
22. **NOTE:**
LH shown, RH similar.

Remove the nuts and bolts from the turbocharger adapter pipe.


A0065716

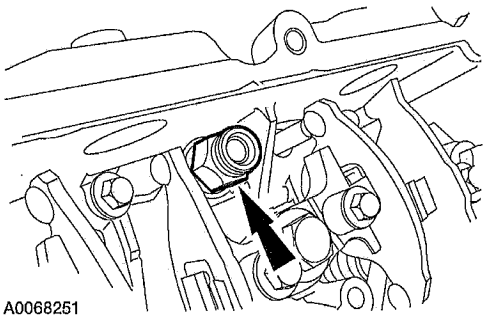
23. Remove the turbocharger adapter pipe.

IN-VEHICLE REPAIR (Continued)

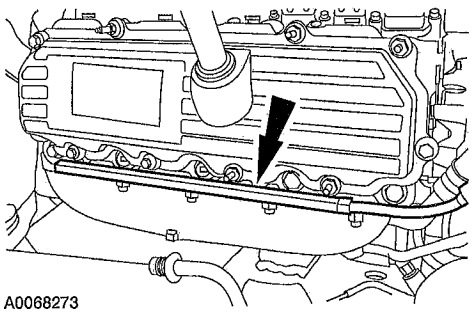

A0065720

Early build

24. Remove and discard the crankcase to head tube assembly.


A0068251

25. Remove the glow plug buss bar.

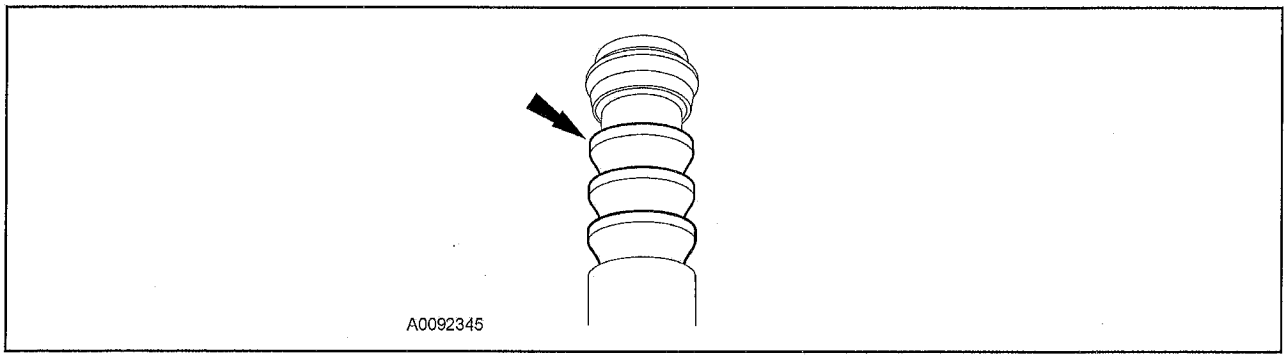

A0068273

One-piece head tube

NOTE:
The rings on the crankcase-to-head tube are to be used to pry the tube assembly from the branch tube assembly or the oil rail assembly.

26. Remove the crankcase-to-head tube assembly.
    - Remove and discard the O-rings.

IN-VEHICLE REPAIR (Continued)

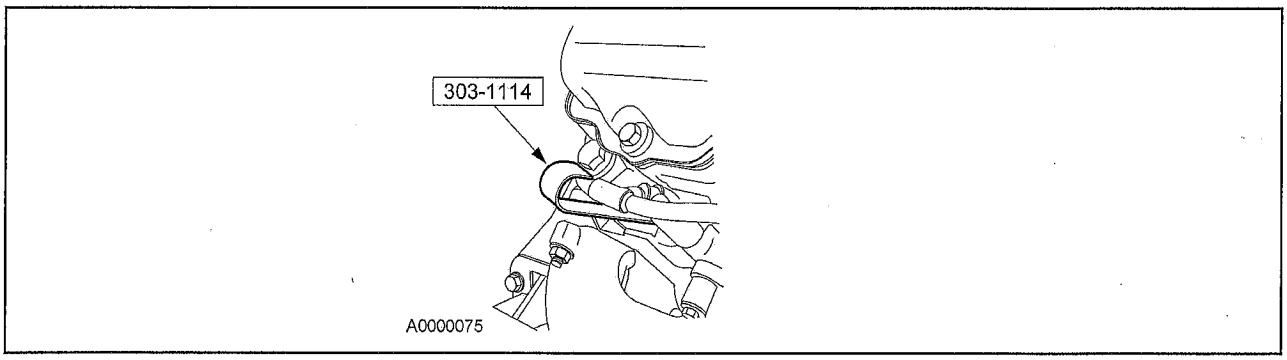


Late build

27. *NOTICE:*
Do not pull on the wiring to remove the glow plug connector or damage may occur.

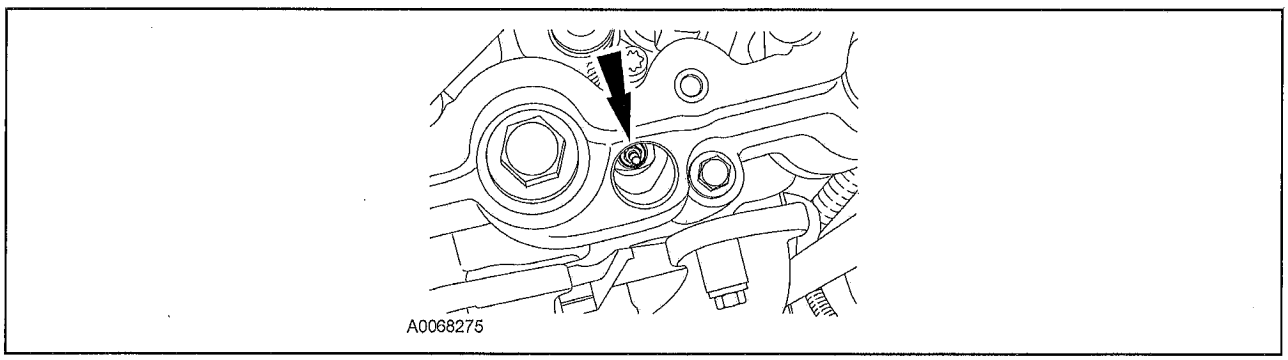
NOTE:
Only one glow plug connector shown.

Using the special tool, remove the glow plug harness.



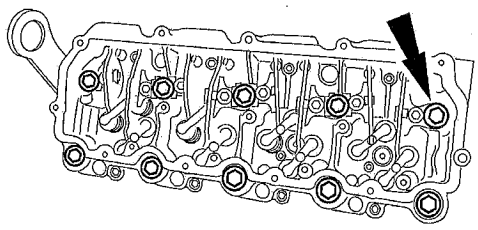
All vehicles

28. Remove the four glow plugs.

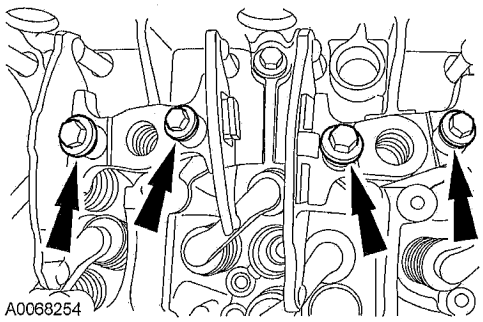


29. Remove and discard the 10 inner cylinder head bolts.

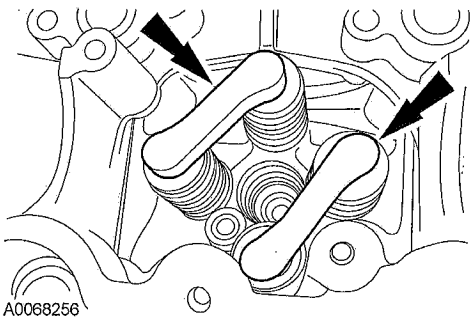
IN-VEHICLE REPAIR (Continued)


A0068253

30. Remove the eight bolts and the rocker arm assemblies.

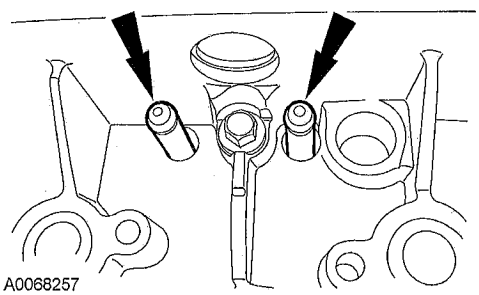

A0068254

31. Mark the eight valve bridges with a permanent marker and remove.


A0068256

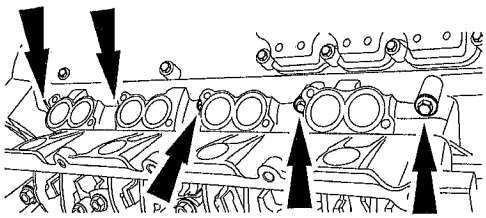
32. *NOTICE:*
To prevent engine damage, keep the push rods in the order in which they were removed. Install all push rods back in their original positions.

Mark the location and remove the eight push rods.


A0068257

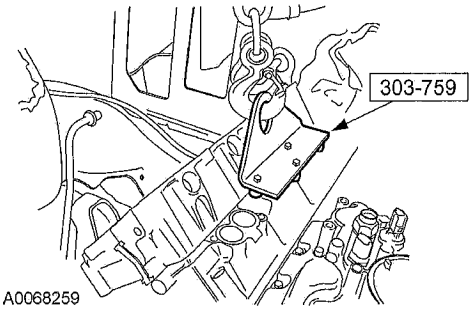
33. Remove the outer cylinder head bolts.

IN-VEHICLE REPAIR (Continued)



A0068258

34. Install the special tool and the lifting crane. With the help of an assistant, remove the cylinder head from the vehicle.

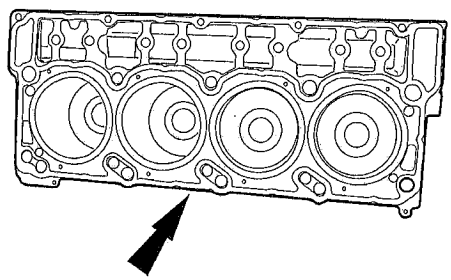


A0068259

35. Check for cylinder head distortion. For additional information, refer to Cylinder Head Distortion in this section.

36. Remove and discard the cylinder head gasket and dowels.

- Clean and inspect the gasket sealing surfaces.



A0068261

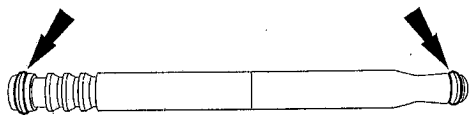
Installation

One-piece head tube

1. *NOTICE:*
Install new D-ring seals on the crankcase-to-head tube. It requires several hours after installation for the D-ring seals to relax back to their original size. If the tube assembly is installed before the D-ring seals have relaxed, damage to the D-ring seals can occur.

Install new D-ring seals on each end of the crankcase to head tube assemblies.

IN-VEHICLE REPAIR (Continued)

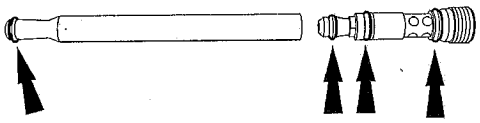


A0092346

Two-piece head tube

2. *NOTICE:*
Install new D-ring seals on the crankcase-to-head tube. It requires several hours after installation for the D-ring seals to relax back to their original size. If the tube assembly is installed before the D-rings have relaxed, damage to the D-ring seals can occur.

Install new D-ring seals on the crankcase-to-head tube.



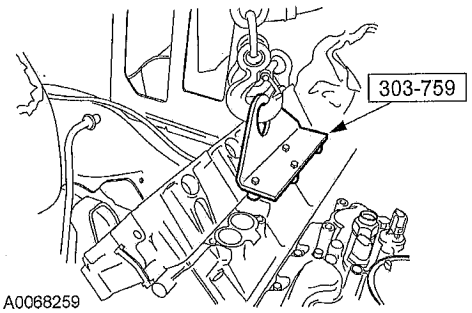
N0023969

All vehicles

3. NOTE:
Use care to avoid scratching the blue compound on the cylinder head gasket. Install a new cylinder head gasket with the part number facing up and verify the top five holes and the head gasket push rod holes line up.

Install the dowels and the cylinder head gasket.

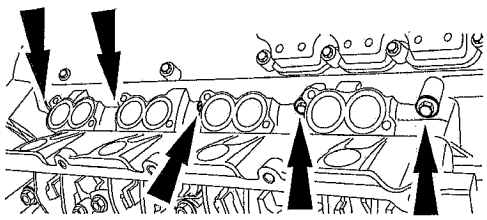
4. Using the special tools and with the help of an assistant, install the cylinder head on the engine. Remove the special tools.



A0068259

5. Install the outer cylinder head bolts finger-tight.

IN-VEHICLE REPAIR (Continued)



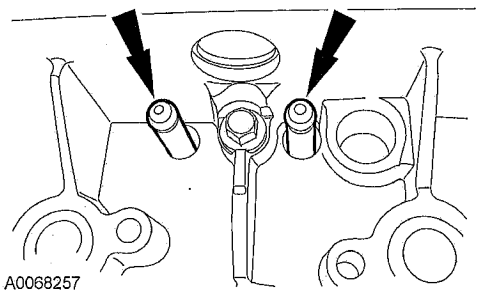
A0068258

6. *NOTICE:*
To prevent engine damage, keep the push rods in the order in which they were removed. Install all push rods back in their original positions.

NOTE:
Higher mileage engines require push rods to be cleaned so the copper colored end of the push rod can be identified.

NOTE:
If a push rod has been replaced, it may not have a copper-colored end and can be installed with either end up.

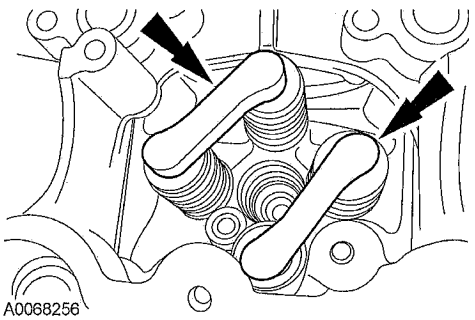
Apply clean engine oil to each end of the push rods. Insert them into their respective positions with the copper colored end up.



A0068257

7. **NOTE:**
Coat the end of each valve stem with clean engine oil.

Install the eight valve bridges.



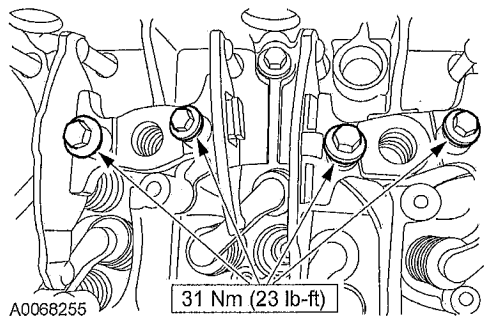
A0068256

8. *NOTICE:*
Rotate the crankshaft until the damper locating dowel notch is in the six o'clock position or engine damage can occur.

NOTE:
Apply clean engine oil to the top center of each valve bridge.

Install the rocker arm assemblies and eight bolts.

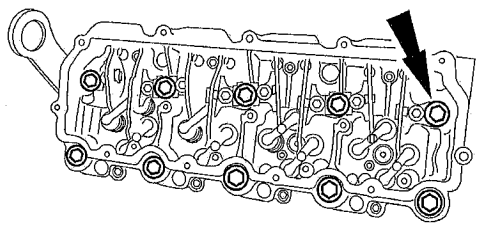
IN-VEHICLE REPAIR (Continued)



9. *NOTICE:*
Using too much engine oil on the threads of the cylinder head bolts can cause damage to the threads and poor sealing. Using anti-seize compounds, grease or any other lubricants other than engine oil on the cylinder head bolt threads can affect the true torque value of the bolts.

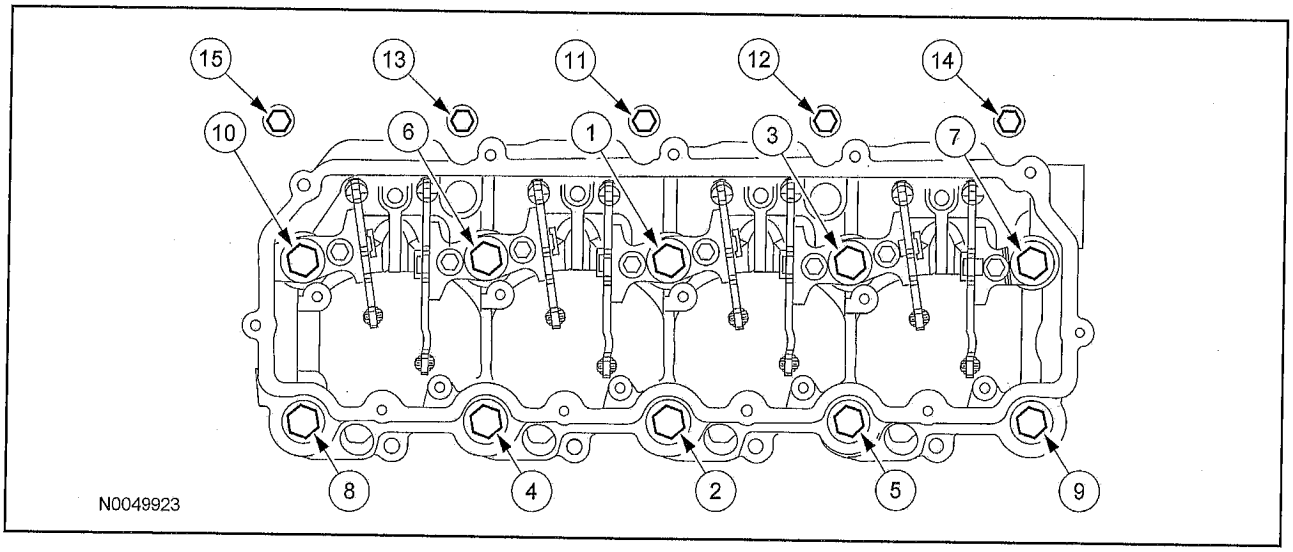
NOTE:
Lightly lubricate the new cylinder head bolt threads and flanges with clean engine oil.

Install the 10 new inner cylinder head retaining bolts finger-tight.

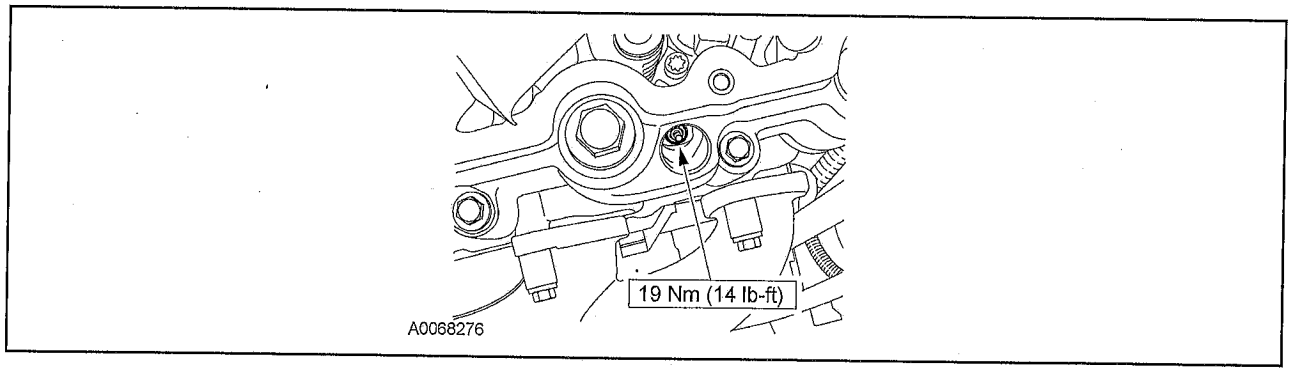


10. Tighten the head bolts in the following sequence.
    1 Tighten bolts 1 through 10 to 88 Nm (65 lb-ft).
    2 Tighten bolts 1 through 10 to 115 Nm (85 lb-ft).
    3 Tighten bolts in sequence 1 through 10, clockwise 90 degrees.
    4 Tighten bolts in sequence 1 through 10, a second time, clockwise 90 degrees.
    5 Tighten bolts in sequence 1 through 10, a third time, clockwise 90 degrees.
    6 Tighten bolts 11 through 15 to 24 Nm (18 lb-ft).
    7 Tighten bolts 11 through 15 to 31 Nm (23 lb-ft).

IN-VEHICLE REPAIR (Continued)



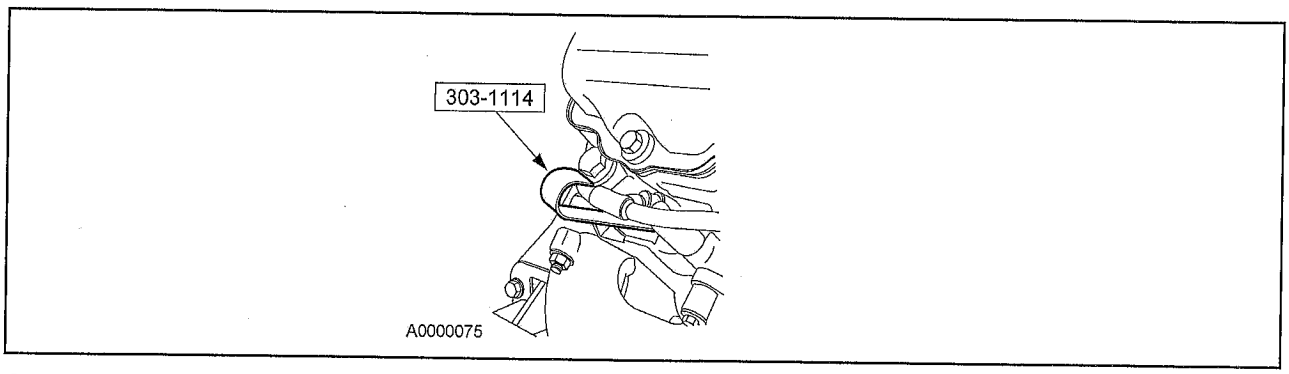
11. Install the four glow plugs.



Late build

12. **NOTE:**
Clean and apply clean engine oil to the O-rings.

Using the special tool, install the glow plug harness.

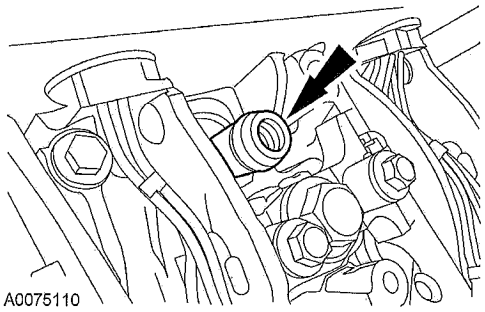


One-piece head tube

13. *NOTICE:*
To prevent engine damage, check that the crankcase-to-head tube assemblies bottom out in the branch tube assembly. The oil rail, crankcase-to-head tube and the fuel injectors will not function correctly if the tube is not bottomed out.

Apply clean engine oil and install the crankcase-to-head tube assembly.

IN-VEHICLE REPAIR (Continued)

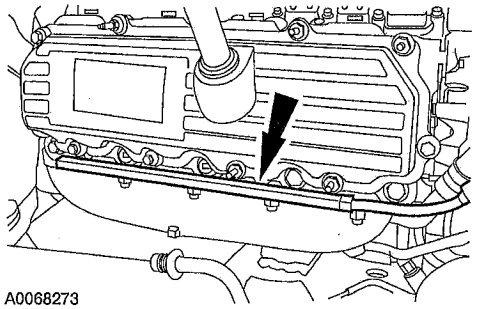


Early build

14. **NOTE:**
Clean and inspect the glow plug buss bar O-rings and install new as necessary.

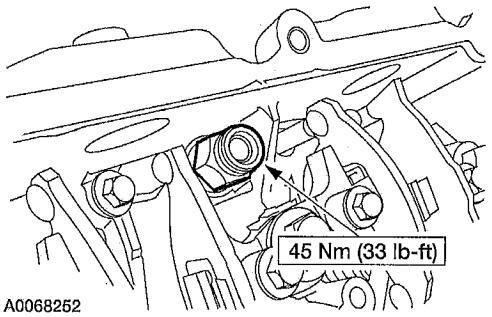
NOTE:
Apply clean engine oil to the O-rings before installing.

Install the glow plug buss bar.



15. **NOTE:**
Install a new lower O-ring.

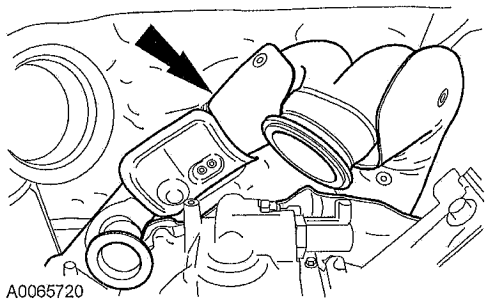
Install a new crankcase to head tube assembly.



All vehicles

16. Position the turbocharger adapter pipe.

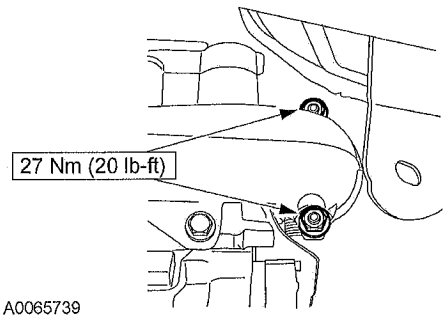
IN-VEHICLE REPAIR (Continued)



17. **NOTE:**
Apply anti-seize lubricants to the bolt threads prior to installing the bolts.

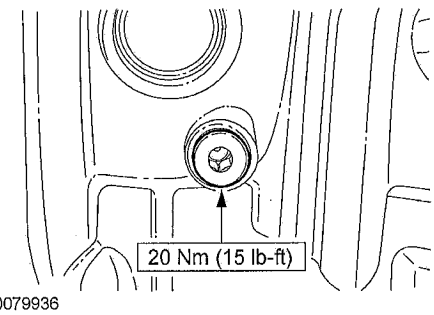
NOTE:
Do not tighten until after the turbocharger is installed.

Install the nuts and bolts in the adapter pipe.



18. **NOTE:**
Apply clean engine oil to the O-ring prior to installing.

Install the cylinder block drain plug.

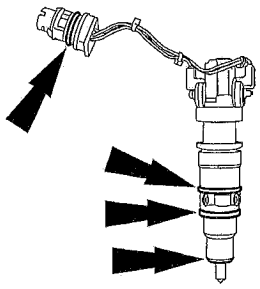


19. Install the starter. For additional information, refer to Section 303-06B.

20. *NOTICE:*
If the fuel injector oil inlet D-shaped O-ring seal is damaged, a new fuel injector must be installed.

Install new O-rings seals and copper washer on the fuel injector. Lubricate the fuel injector and O-ring seals liberally with clean engine oil.

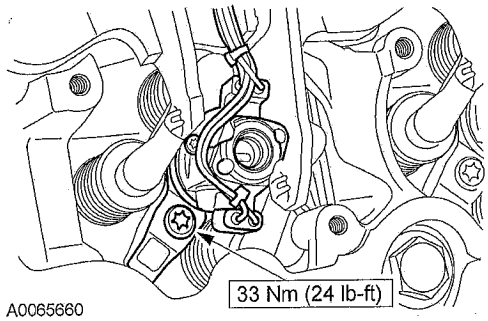
IN-VEHICLE REPAIR (Continued)


A0076006

21. *NOTICE:*
Failure to tighten the injector properly can lead to engine failure.

NOTICE:
To prevent engine damage, do not use air tools to install the fuel injectors. The snap ring that extracts the injector can dislodge and fall into the oil drain hole.

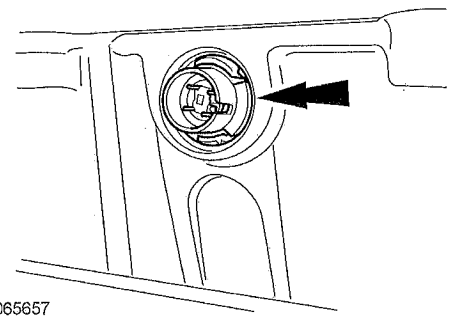
Install the fuel injector, fuel injector hold-down clamp and bolt.



A0065660

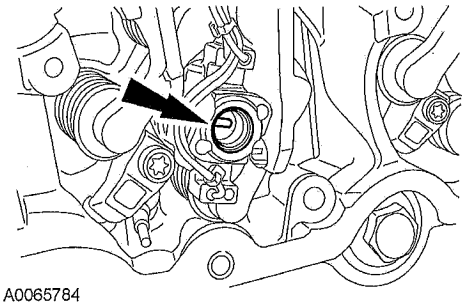
22. *NOTICE:*
Make sure the injector wiring is clear of all moving parts or engine damage can occur.

Install the fuel injector electrical connector into the rocker arm carrier.


A0065657

23. Apply engine oil to the top fuel injector O-ring seals.

IN-VEHICLE REPAIR (Continued)

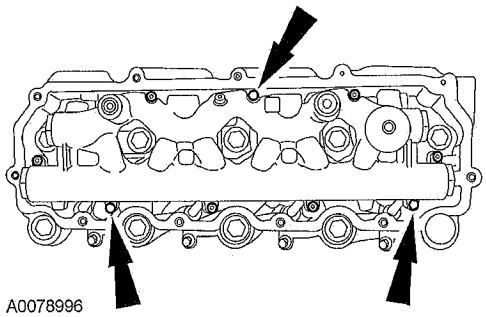

A0065784

Late build

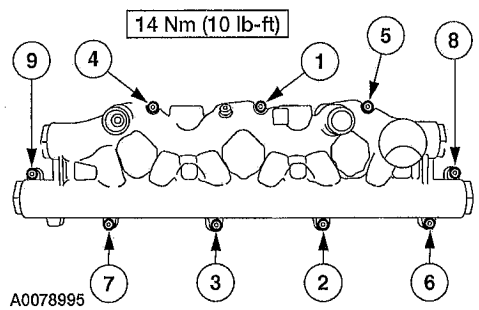
24. **NOTE:**
Apply clean engine oil to the top fuel injector D-ring before installing the high pressure oil rail.

Position the oil rail on the fuel injectors.

- Place the oil rail on top of the carrier so that the four single ball tubes are engaging the injector lead angle.
- Insert three guide bolts, two on the ends of the straight side of the oil rail and one in the middle of the wavy side of the oil rail. Install the guide studs six to seven turns.
- Press the oil rail into the fuel injectors.
- Inspect that the oil rail mounting feet are flat against the mounting surface.
- Loosely install the six bolts.


A0078996

25. Install the oil rail retaining bolts.
    - Remove the three guide bolts.
    - Loosely install the three remaining bolts.
    - Tighten the bolts in the sequence shown.



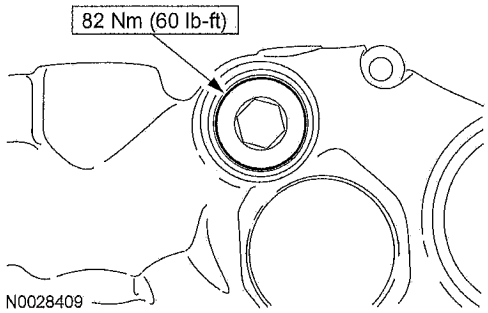
A0078995

Two-piece head tube

26. **NOTE:**
Apply clean engine oil to the crankcase-to-head tube prior to installation.

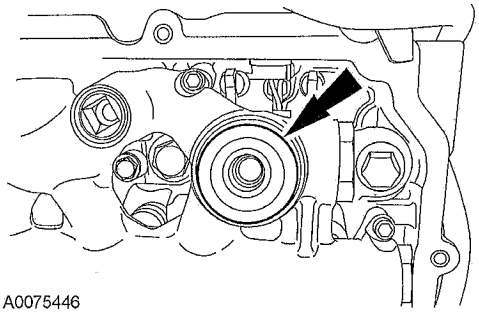
IN-VEHICLE REPAIR (Continued)

If equipped with an updated crankcase-to-head tube, install the crankcase-to-head tube assembly.



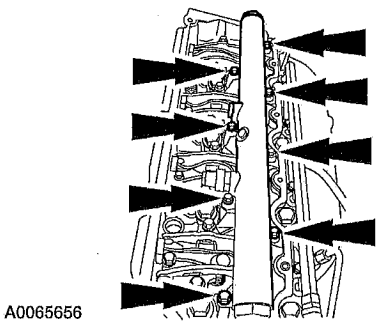
Late build

27. Install the high-pressure oil rail-to-valve cover gasket.



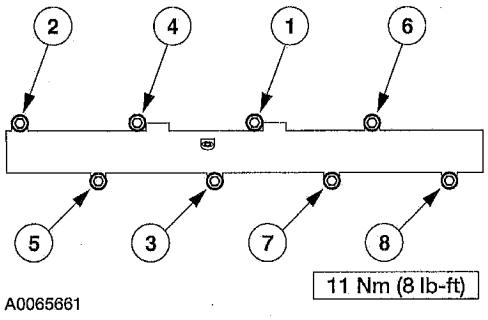
Early build

28. Install the high-pressure oil rail and bolts.
    - Install the high-pressure oil rail.
    - Install the bolts finger tight.

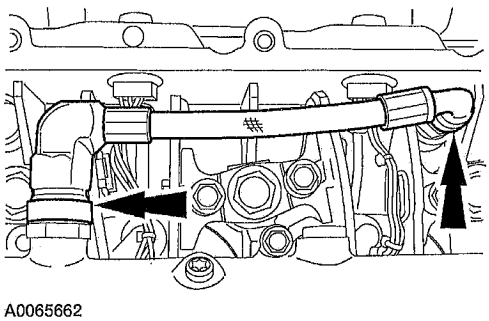


29. Tighten the bolts in the sequence shown.

IN-VEHICLE REPAIR (Continued)



30. Install the high-pressure oil line.

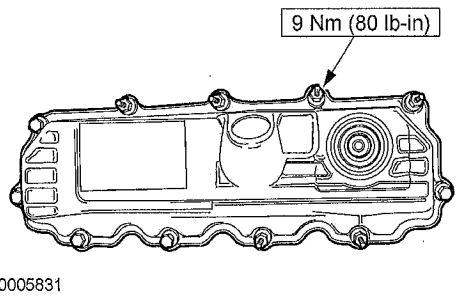


All vehicles

NOTE:
Late build shown, early build similar.

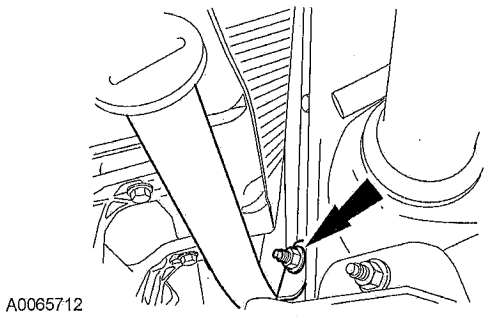
31. *NOTICE:*
To prevent engine damage, do not use air-powered tools when installing the valve cover.

Position the valve cover gasket. Install the valve cover and 11 bolts.



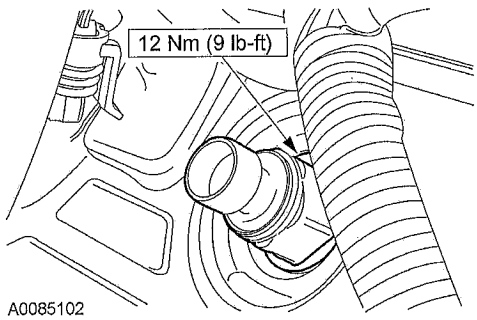
32. If equipped, position back the transmission fluid indicator and tube. Install the retaining nut.

IN-VEHICLE REPAIR (Continued)



Late build

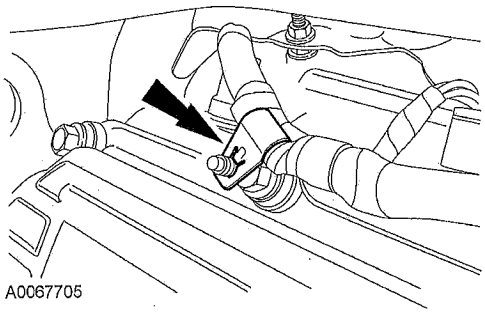
33. Install the ICP sensor.



All vehicles

34. **NOTE:**
Only one retainer shown.

Connect the wiring retainers to the studs.



35. Install the evaporator core housing. For additional information, refer to Section 412-02.

36. Install the intake manifold. For additional information, refer to Intake Manifold in this section.

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

Fill the crankcase with clean engine oil.