

3. If some of the bolt holes do not clean up completely, continue resurfacing remaining holes, repeating the operation in. 0.005 in. increments. This will clean up any holes that may not have cleaned up completely during the first cut.
4. After all counterbores have been resurfaced, remove any loose cutting chips.
5. Steam clean the complete cylinder head.
6. After steam cleaning, inspect the cylinder head for any remaining chips.
7. Reinstall the cylinder head assembly, using 38 of the new ground head bolt washers.

1.2.4 Assembly of Cylinder Head

Perform the following steps for cylinder head assembly:

 **CAUTION:**

To avoid injury from flying debris when using compressed air, wear adequate eye protection (face shield or safety goggles) and do not exceed 40 psi (276 kPa) air pressure.

NOTICE:

If the cylinder head is to be replaced, the new head must be thoroughly cleaned before installation to remove all rust and preventive compound, especially from the fuel and oil galleries. This can be done by immersion in a bath of fuel oil or mineral-spirits-based solvent and scrubbing out all openings with a soft bristle brush. When clean, blow the head dry with compressed air.

1. Install new precoated pipe plugs or coat the used plugs with pipe sealant with Teflon, PT-7260, or equivalent. Refer to section 1.A, "Engine Plug and Dowel Charts" for specifications.
2. Install all of the required cup plugs using a good grade of non-hardening sealant, such as Loctite® 620 or equivalent, on the cup plugs. Use cup plug installation tool set, J 35653. Refer to section 1.A, "Engine Plug and Dowel Charts" for specifications.
3. Ensure that all cup and pipe plugs on the front face of the cylinder head are flush or below the surface.
4. Install valve guides and seats, valves, valve stem seals, valve springs and rotators. Refer to section 1.4.8 and refer to section 1.4.7.

1.2.5 Installation of Cylinder Head

Perform the following steps for cylinder head installation:

1. Ensure piston domes and the cylinder head and cylinder block firedeck surfaces are clean and free of foreign matter. Inspect the head bolt holes in both block and head for the presence of oil, water, dirt, or damaged threads, clean or retap as necessary.

NOTE:

Series 60 Engines built after September 2002 will use a new cylinder head gasket. This gasket will be identified with a new part number and date code. This new gasket must be used with the new cylinder head bolts.

2. Position the head gasket on the block and install cylinder head guide studs, J 35784, at front and rear of the block. See Figure 1-44.

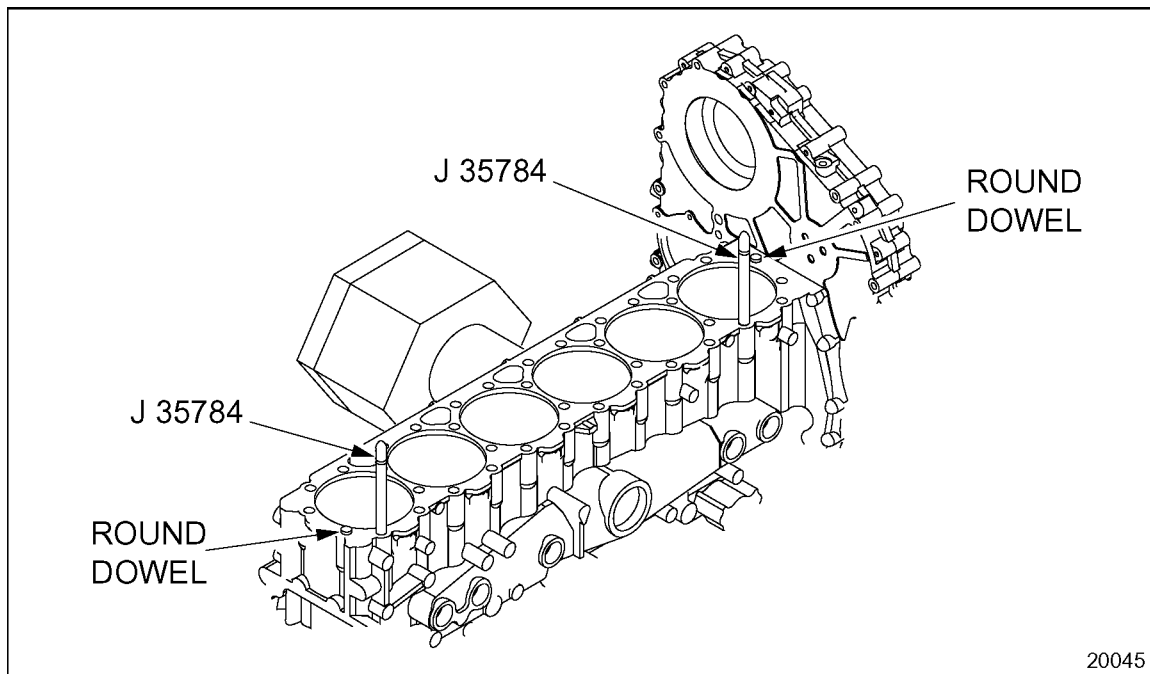


Figure 1-44 **Cylinder Head Guide Studs**

3. Lift the head into position with lift bracket, J 35641. See Figure 1-45. Lower it into place over the guide studs, J 35784, until it seats on the block deck dowels. See Figure 1-44.

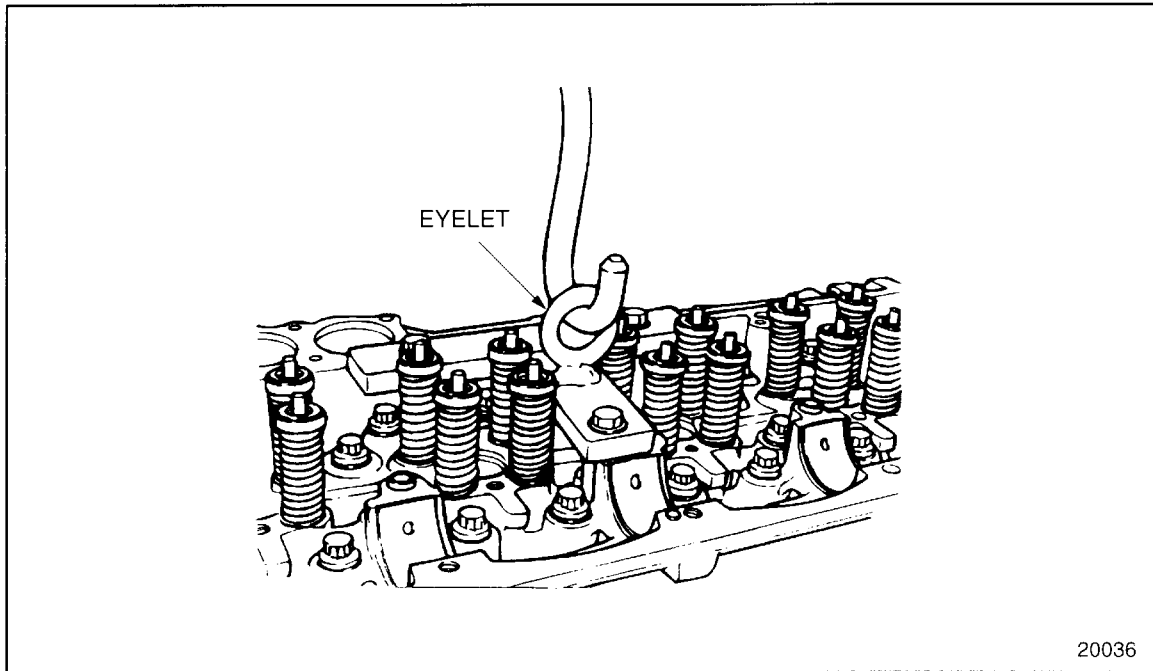


Figure 1-45 **Cylinder Head Installation**

4. Remove the guide studs.
5. Install the head bolts with special hardened washers, lubricating the threads and bolt-head contact areas with a small amount of International Compound #2[®], or equivalent.

NOTICE:

Cylinder head mounting bolts are considered single-use items and must not be reused.

Failure to install new bolts when replacing a cylinder head may result in improper bolt clamp load, which could cause gasket failure and severe engine damage.

6. Torque the head bolts to 250-285 N·m (185-210 lb·ft) in the following sequence. See Figure 1-46. After September 2002 a new cylinder head bolt will be used for all Series 60 Off-Highway and On-Highway engines. The new bolt will be identified with white paint and groove on top of bolt. See Figure 1-46a. Torque the new head bolts to 298 N·m (220 lb·ft). There is no change to the procedure other than the new torque value. The new head bolt can be used with the former cylinder head gaskets, the former head bolts cannot be used with the new head gasket. Former and new bolts must not be mixed.

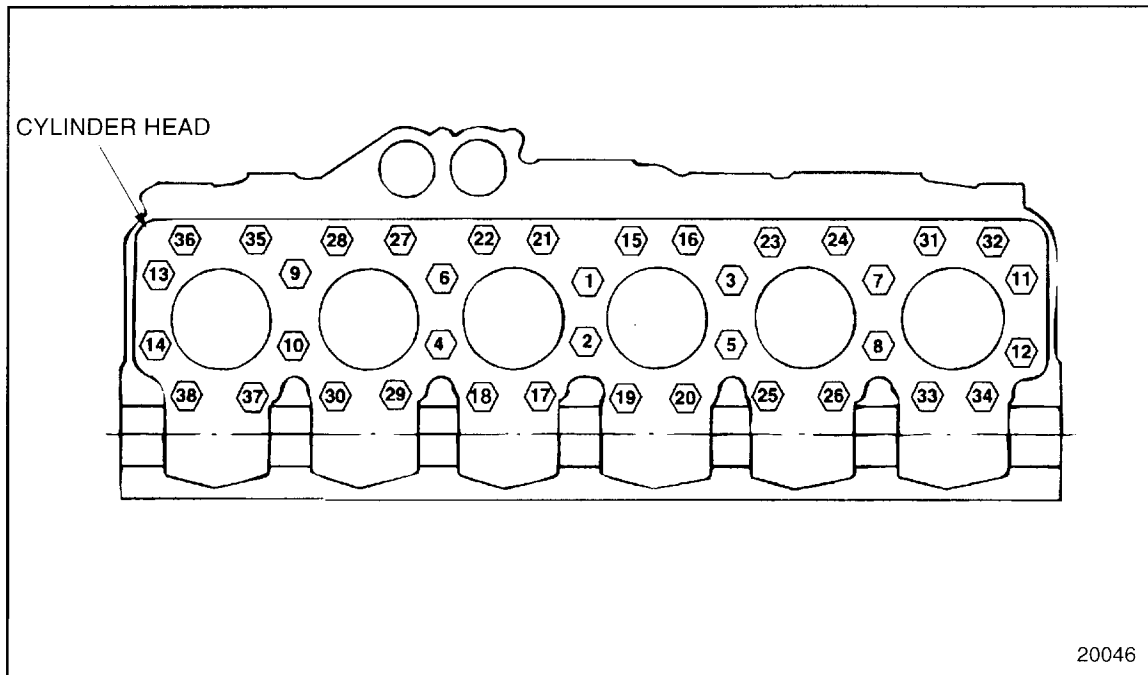


Figure 1-46 **Cylinder Head Bolt Tightening Sequence**

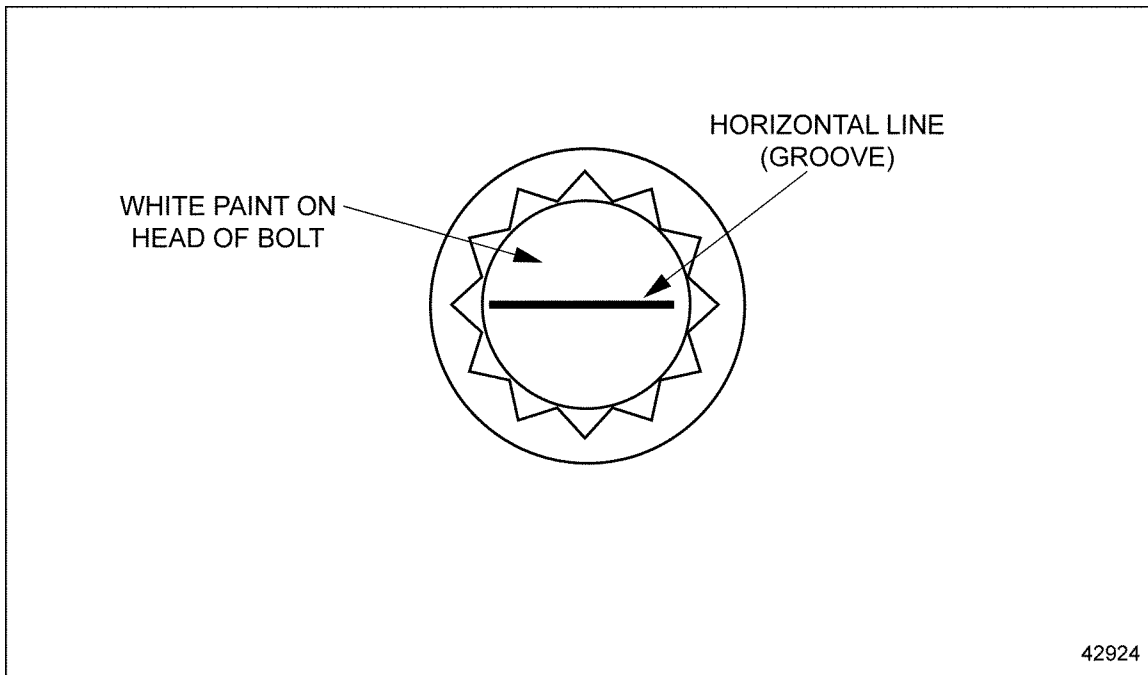


Figure 1-46a **Bolt Identification For Series 60 Engines Built After September 2002**

NOTICE:

Failure to repeat the cylinder head bolt torque tightening sequence can result in some head bolts losing their torque when others are tightened resulting in insufficient clamp load.

7. Repeat the torque sequence to verify all of the head bolts are torqued to specification.

NOTICE:

The hemispherical portion of the injector hold-down crab washers must be installed facing the crab (pointing down) in order to prevent damage to the washers. See Figure 1-47.

8. Visually inspect each injector hole tube to ensure they are clean. Install the fuel injectors. Refer to section 2.3.5. Be sure the injector hold-down crabs are clear of the valve and injector springs.

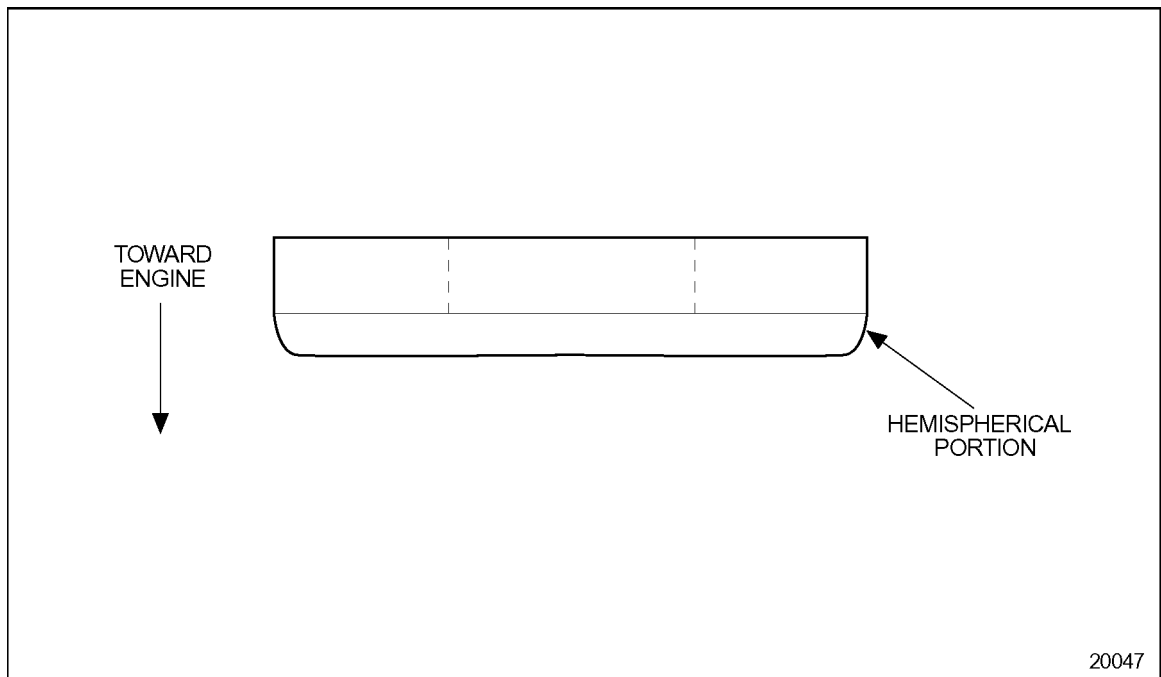


Figure 1-47 **Injector Hold-Down Crab Washer Installation**

9. Install the clamp bolts with hemispherical washers, torque to 58-66 N·m (43-49 lb·ft).
10. Install the camshaft. Refer to section 1.23.6.

NOTE:

If a cylinder head other than the one removed from the engine, or if a resurfaced cylinder head is being installed, the three nuts retaining the adjustable idler gear must be loosened before installing and torquing the camshaft drive gear retaining bolt.

NOTICE:

The camshaft drive gear-to-adjustable idler gear lash must be measured/adjusted before the rocker arm shaft assemblies are installed.

11. Measure and adjust the camshaft drive gear-to-adjustable idler gear lash. Refer to section 1.21.2.1.
12. Install the rocker arm shaft assemblies. Refer to section 1.3.3 .
13. Install Jacob's Brake assemblies (if equipped). Refer to section 1.29.5 .
14. Feed the injector harness wires through the opening at the rear of the cylinder head. Secure the harness mounting flange to the cylinder head by torque the bolts to 10-15 N·m (7-11 lb·ft).
15. Connect the injector harness wires to their respective injectors. Refer to section 2.3.5 .

NOTICE:

Bolts attaching brackets to the gear case are torqued **first** then torque the bolt(s) to the cylinder head next.

16. Install the gear case stabilizer bracket at the right and/or left front corner of the head. Refer to section 1.11.3.
17. Install the thermostats and seals to the thermostat housing. Refer to section 4.5.5 .
18. Clean the coolant outlet surfaces of the head and thermostat housing.
19. With the thermostats seated in the housing counterbores, install the housing to the cylinder head, torque the housing bolts to 58-73 N·m (43-54 lb·ft). Connect the radiator or heat exchanger and bypass hose couplings and vent line.
20. Remove all traces of the old gasket from the cylinder head and exhaust manifold joint surfaces. Install the exhaust manifold with new gaskets. Refer to section 7.2.4 .
21. Clean the exhaust manifold and turbocharger joint surfaces and install the turbocharger with a new gasket. Refer to section 6.6.7. If turbocharger is water cooled, connect coolant supply and return lines.
22. Fill and vent the cooling system. Refer to section 13.13.4. Fill the engine lubrication system. Refer to section 13.13.1 .
23. Connect the exhaust and air-to-air cooler air ducting and install the air cleaner or air separator.
24. Install any other components that were removed and fill with the required fluids, as recommended. Refer to OEM guidelines.