Section 10
Chapter 9

24 Valve, 8.3 Liter Engine

Cylinder Head

Note: All coding used in the 8.3 Liter and 9 Liter engine manuals are Cummins engine codes. These engine codes have no meaning to New Holland warranty codes and should only be used for procedure steps.
Cylinder Head

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**Service Tools**

**Cylinder Head**

The following special tools are recommended to perform procedures in this section. The use of these tools is shown in the appropriate procedure.

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<thead>
<tr>
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<th>Tool Description</th>
<th>Tool Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEM 6414</td>
<td>Valve Spring Compressor</td>
<td><img src="image1" alt="Illustration" /></td>
</tr>
<tr>
<td></td>
<td>Used to remove and install valve collets.</td>
<td></td>
</tr>
<tr>
<td>3823921</td>
<td>Capscrew Length Gauge</td>
<td><img src="image2" alt="Illustration" /></td>
</tr>
<tr>
<td></td>
<td>Used to measure capscrew free length.</td>
<td></td>
</tr>
<tr>
<td>OEM 6459</td>
<td>Gauge Block</td>
<td><img src="image3" alt="Illustration" /></td>
</tr>
<tr>
<td></td>
<td>Used to measure the injector protrusion and valve recess in the cylinder head.</td>
<td></td>
</tr>
<tr>
<td>0 CNH299152</td>
<td>Engine Barring Gear</td>
<td><img src="image4" alt="Illustration" /></td>
</tr>
<tr>
<td></td>
<td>Used to engage the flywheel ring gear to rotate the crankshaft.</td>
<td></td>
</tr>
</tbody>
</table>
Crosshead (002-001)

Remove (002-001-002)

Remove rocker lever cover and rocker levers. Refer to Procedures 003-011 and 003-008.

Inspect for Reuse (002-001-007)

Check crossheads for cracks and/or excessive wear on rocker lever and valve tip mating surfaces.

Install (002-001-026)

Install rocker lever assembly. Refer to Procedure 003-008.

Install the rocker lever cover. Refer to Procedure 003-011.

Cylinder Head (002-004)

Preparatory (002-004-000)

⚠️ WARNING ⚠️

Coolant can be toxic. Keep away from children and pets. If not reused, dispose of in accordance with local environmental regulations.

⚠️ WARNING ⚠️

Wait until the temperature is below 50°C [120°F] to avoid personal injury from hot coolant.
• Drain the coolant. Refer to Procedure 008-018.

• Remove all water and heater hoses. Remove the intake manifold cover and intake heater (if equipped). Refer to Procedure 010-023.

• Remove the injector supply. Refer to Procedure 006-051.

• Remove the fuel connection tubes. Refer to Procedure 006-052.

• Remove the valve cover. Refer to Procedure 002-020.

• Remove the rocker levers. Refer to Procedure 003-008.

• Remove the injectors. Refer to Procedure 006-026.

• Remove the pushtubes. Refer to Procedure 003-008.

• Remove the fuel drain line. Refer to Procedure 006-013.

• Remove the turbocharger. Refer to Procedure 010-033.

• Remove the exhaust manifold. Refer to Procedure 011-007.

**Remove (002-004-002)**

Remove drive belt. Refer to Procedure 008-002.

Remove the fan hub assembly.

Omit this step if the fan hub assembly is **not** attached to the cylinder head.

Remove the cylinder head capscrews in the order shown.
\textbf{WARNING}\n
The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

Cylinder Head Weight \hspace{1em} 71.2 kg \hspace{1em} [165 lb]

Remove the cylinder head and gasket from the cylinder block.

\textbf{Clean (002-004-006)}

Clean the carbon from the injector nozzle seat.

Remove the valves and springs. Refer to Procedure 002-020.

Scrape the gasket material from all gasket surfaces on the block and head.

Clean the build-up of deposits from the coolant passages. Excessive deposits may be cleaned in an acid tank but the expansion plugs must first be removed.
Clean the cylinder head combustion deck with a Scotch-Brite™, or equivalent, and diesel fuel or solvent.

**WARNING**

Wear protective eye covering while cleaning carbon deposits to prevent injury.

Clean carbon deposits from the valve pockets with a high quality steel wire wheel installed in a drill or a die grinder.

An inferior quality wire wheel will lose steel bristles during operation, thus causing additional contamination.

Wash the cylinder head in hot soapy water solution.

Dry with compressed air.

**CAUTION**

Do not use caustic or acid solutions to clean the cylinder head capscrews.

Use a petroleum-based solvent to clean the capscrews.

Clean the capscrew thoroughly with a wire brush, a soft wire wheel, or use a non-abrasive bead blast to remove deposits from the shank and the threads.
Inspect for Reuse (002-004-007)

Straight Edge and Feeler Gauge

Cylinder Block Combustion Deck Inspect

Use a straight edge and feeler gauge to measure the overall flatness of the cylinder block.

The overall flatness, end to end and side to side, must not exceed 0.075 mm [0.003 in].

Inspect the combustion deck for any localized dips or imperfections. If present, the cylinder block head deck must be ground.

Cylinder Head Cracks - Reuse Guidelines

The reuse guidelines for a cylinder head with a crack extending from the injector bore to the intake valve seat are as follows:

If the crack does not extend into the valve seat, the cylinder head is reusable.

If a crack extends into or through the valve seat, the cylinder head must be repaired by replacing the valve seat insert.

Use a straight edge and a feeler gauge to inspect the cylinder head combustion surface for flatness.

<table>
<thead>
<tr>
<th>Cylinder Head Flatness</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
</tr>
<tr>
<td>End to End</td>
</tr>
<tr>
<td>Side to Side</td>
</tr>
</tbody>
</table>
Inspect the cylinder head capscrews for damaged threads, corroded surfaces, or a reduced diameter (due to capscrew stretching).

Do not reuse cylinder head capscrews under the following conditions:

- Visible corrosion or pitting exceeds 1 sq cm [0.155 sq in] in area. Example:
  - acceptable is 9.525 x 9.525 mm [3/8 x 3/8 in]
  - unacceptable is 12.700 x 12.700 mm [1/2 x 1/2 in]
- Visible corrosion or pitting exceeds 0.12 mm [0.005 in] in depth.
- Visible corrosion or pitting is located within 3.2 mm [1/8 in] of the fillet or threads.
- Stretched beyond free length maximum. Refer to the measurement procedure below:

**Capscrew Length Gauge, Tool No. 3823921**

**Free Length Measurement**

**NOTE:** If the capscrews are not damaged, they can be reused throughout the life of the engine unless the specified free length is exceeded.

To check the capscrew free length, place the head of the capscrew in the appropriate slot with the flange against the base of the slot.
If the end of the capscrew touches the foot of the gauge, the capscrew is too long and must be discarded. The maximum capscrew free length is 162.6 mm [6.4 in].

**Install (002-004-026)**

Position the new cylinder head gasket over the dowels.

**NOTE:** Do not attempt to reuse cylinder head gasket.

**WARNING**

The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

Carefully put the cylinder head on the cylinder block and seat it onto the dowels.

**Cylinder Head Weight:** 75 kg [165 lb]

Lubricate the threads and under the heads on the head capscrews with clean 15W-40 engine lubricating oil.

**NOTE:** If new capscrews are used, capscrews threads are to be burr- nished.
Use the illustrated sequence to tighten the cylinder head capscrews.

14 mm

Torque Value:

- All Capscrews Step 1: 148 N•m [108 ft-lb]
- Recheck All Step 2: 148 N•m [108 ft-lb]
- All Capscrews Step 3: 90 degrees

Push Rods - Installation

Position the push tubes into the valve tappets.

Lubricate the push tube sockets with engine lubricating oil.
**Rocker Levers - Installation**

Lubricate the valve stems with engine lubricating oil.

Install the crossheads and rocker levers. Refer to Procedure 003-008.

Lubricate the pedestal capscrew threads and under the capscrew heads with engine lubricating oil.

Install the capscrews and tighten.

**Torque Value:** 60 N•m [44 ft-lb]

**Valve Clearance - Adjustment**

Set the valve clearance. Refer to Procedure 003-004.
• Install injectors. Refer to Procedure 006-026.
• Install fuel connection tubes. Refer to Procedure 006-052.
• Install intake manifold cover and intake heater (if equipped). Refer to Procedure 010-023.
• Install rocker lever cover. Refer to Procedure 003-011.
• Install injector supply lines. Refer to Procedure 006-051.
• Install fuel drain line. Refer to Procedure 006-013.
• Install turbocharger. Refer to Procedure 010-033.
• Install exhaust manifold. Refer to Procedure 011-007.

Install the fan hub.

**Torque Value:**

43 N·m  [32 ft-lb]

Install the fan hub pulley.

**Torque Value:**

8 mm
Capscrew 24 N·m  [18 ft-lb]
10 mm
Capscrew 43 N·m  [32 ft-lb]
Drive Belt - Installation

3/8-Inch Square Drive

Lift the tensioner and install the belt. Refer to Procedure 008-002.

Service Tip: If difficulty is experienced installing the drive belt (the belt seems too short), position the belt over the grooved pulleys first and then while holding the tensioner up, slide the belt over the water pump pulley.

Operate the engine and check for leaks.

Valve, Cylinder Head (002-020)

Preparatory (002-020-000)

⚠️ WARNING ⚠️
Coolant can be toxic. Keep away from pets and children. If not reused, dispose of in accordance with local environmental regulations.

⚠️ WARNING ⚠️
Wait until the temperature is below 50°C [120°F] to avoid personal injury from not coolant.

- Drain the coolant. Refer to Procedure 008-018.
- Remove all water and heater hose. Refer to Procedure 008-045.
- Remove the cylinder head. Refer to Procedure 002-004.
Disassemble (002-020-003)

The following disassembly and assembly procedures are provided for inspection purposes only.

Mark the valves to identify their location.

Valve Spring Compressor, Tool No. OEM-6414

Compress the valve spring and remove the valve stem collets. Use Service Tool, Tool No. OEM-6414.

Release valve spring and remove the spring retainer and spring.

Remove the remaining collets, retainers, springs and valves.

Keep the valves in a labeled rack for a correct match with companion seats while making measurements.
Remove the valve stem seals.

**Clean (002-020-006)**

*WARNING*

Wear protective eye covering when cleaning the valves.

Clean the valve heads with a soft wire wheel.

**NOTE:** Keep the valves in a labeled rack to prevent mixing prior to making measurements.

Polish the valve stem with a Scotch-Brite™ pad, or equivalent, and diesel fuel or solvent.

**Inspect for Reuse (002-020-007)**

**Valve Guide Inspection**

Inspect the valve guides for scuffing or scoring.

Measure the valve guide bore.

<table>
<thead>
<tr>
<th>Valve Guide Bore Diameter</th>
<th>mm</th>
<th>in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.019</td>
<td>MIN 0.3157</td>
</tr>
<tr>
<td></td>
<td>8.071</td>
<td>MAX 0.3185</td>
</tr>
</tbody>
</table>
Valve Seat Inspection

Inspect the valve seats for cracks or burned spots.

Service valve seats are available for seats with burned spots that will require more than 0.254 mm [0.010 in] grinding to clean up.

Inspect for abnormal wear on the heads and stems.

Measure the valve stem diameter.

<table>
<thead>
<tr>
<th>Valve Stem Diameter</th>
<th>mm</th>
<th>in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.94</td>
<td>0.3126</td>
</tr>
<tr>
<td></td>
<td>7.98</td>
<td>0.3142</td>
</tr>
</tbody>
</table>

Valve Seat Angle
- Intake 30 degrees
- Exhaust 45 degrees

Valve Depth (Installed)

<table>
<thead>
<tr>
<th>Valve Depth (Installed)</th>
<th>mm</th>
<th>in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.859</td>
<td>0.034</td>
</tr>
<tr>
<td></td>
<td>1.21</td>
<td>0.048</td>
</tr>
</tbody>
</table>
Check the valve stem tip for flatness.

Inspect for bent valves.

Measure the rim thickness to determine if there is enough stock to grind the valve.

<table>
<thead>
<tr>
<th>Valve Rim Thickness Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
</tr>
<tr>
<td>0.79</td>
</tr>
</tbody>
</table>

Inspect the valve springs.

Measure the valve spring.

Approx. Free Length (L):

| J944711 | 59 mm | 2.34 in |

Maximum Inclination:

| J944711 | 1.5 mm | 0.059 in |
A load of 906 to 1007 N [203.5 to 226.516 lb] is required to compress the spring to a height of 30.6 mm [1.20 in].

**Assemble (002-020-025)**

**NOTE:** Clean all cylinder head components before assembling.

Install new valve guides, if damaged.

Install new valve stem seals.

Lubricate the stems with SAE 90W or 15W-40 engine oil before installing the valves.

**Valve Spring Compressor**

Compress the valve spring after assembling the spring and retainer.
Install new valve collets and release the spring tension.

**Plastic Hammer**

⚠️ **CAUTION** ⚠️
Wear eye protection. If the collets are not correctly installed, they can fly out when the stems are hit with a hammer.

After assembly, hit the valve stems with a plastic hammer to make sure that the collets are seated.

**Install (002-020-026)**

⚠️ **WARNING** ⚠️
The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

Install the cylinder head and gasket. Refer to Procedure 002-004.

Install the rocker levers. Refer to Procedure 003-008.
Adjust the valve lash. Refer to Procedure 003-004.

Install the rocker lever cover and gasket. Refer to Procedure 003-011.

**Torque Value:** 12 N•m  [9 ft-lb]

Operate engine and check for leaks.

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**Injector Protrusion (002-022)**

**Measure (002-022-010)**

⚠️ **CAUTION** ⚠️

Improper injector protrusion can cause performance problems and high pressure fuel leaks due to misalignment of the fuel connector tube.

Remove the cylinder head. Refer to Procedure 002-004.
**Gauge Block, Tool No. OEM6459**

Place the injection protrusion tool on the flat surface of the head. Measure the injector protrusion to the highest point on the injector. The protrusion should be within the following specifications:

$$3.0 \text{ mm } \pm 0.4 \text{ mm} \quad [1.18 \text{ in } \pm 0.16 \text{ in}]$$

If the injector protrusion is out of specification, check the thickness of the injector sealing washer. Refer to Procedure 006-026.

If the sealing washer is the correct thickness, check to make sure the injector bore is clean and free of debris.

If dirt is present, clean the injector bore using a injector bore brush.

In addition to a single sealing washer (A) on the injector, the thickness (B) of the head gasket controls injector protrusion.

If the head has been milled then the injector protrusion will be increased.
Make sure the proper thickness head gasket is being used for the amount the head that has been milled. Also when measuring the protrusion, the head gasket is not in place, so any increase in head gasket thickness over the standard head gasket must be subtracted from the injector protrusion measurement.

**NOTE:** Measured protrusion - (new head gasket thickness - standard thickness) = protrusion. Protrusion must be within specification formula.