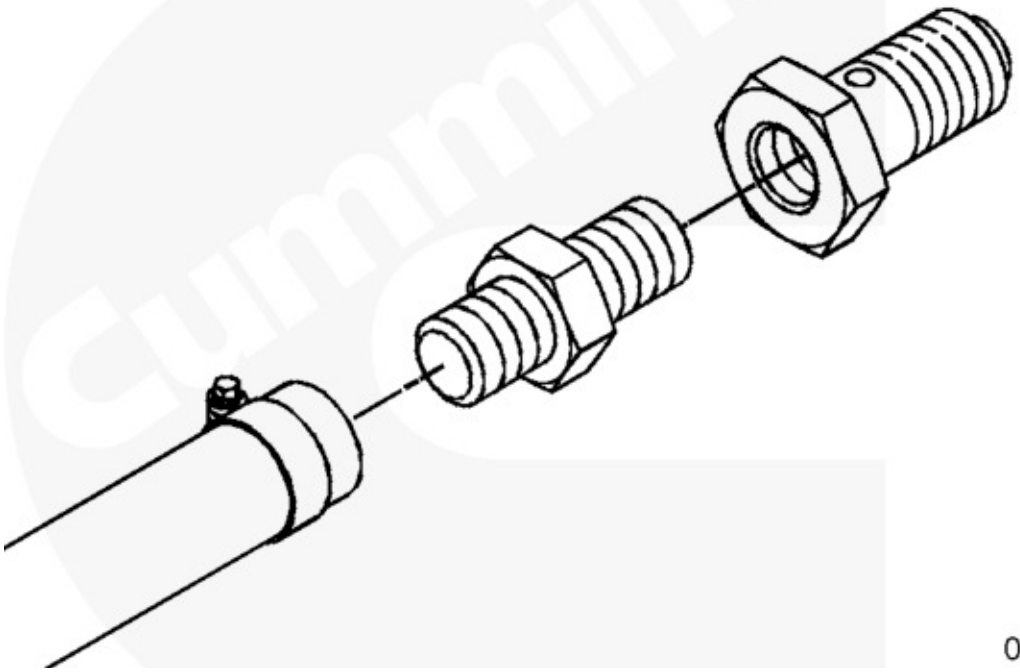
(/qs3/pubsys2/xml/en/manual/4022250/4022250-titlepage.html)

Initial Check

Use the following procedure for instructions to measure the fuel pump head drain. Refer to Procedure 005-236 in Section 5. (/qs3/pubsys2/xml/en/procedures/132/132-005-236-tr-mixar5.html)



05d00790

Preparatory Steps

⚠ WARNING ⚠

Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable

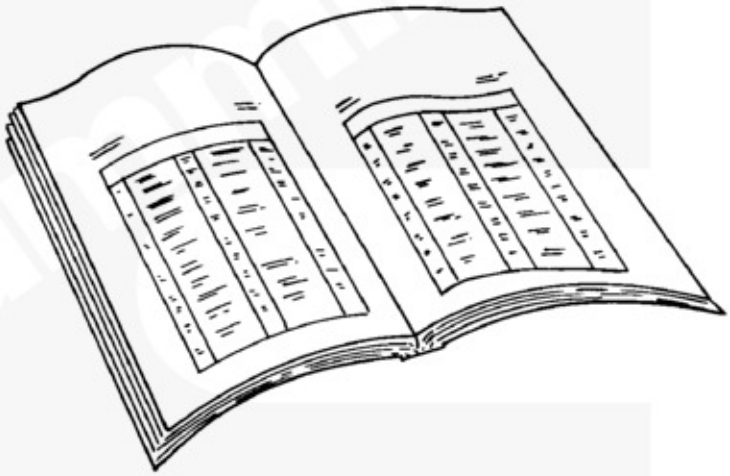
last.

- Disconnect the batteries. See equipment manufacturer service information.

Before servicing **any** fuel system components, (such as fuel lines, fuel pump, injectors, etc.) which would expose the fuel system or internal engine components to potential contaminants prior to disassembly, clean the fittings, mounting hardware, and the area around the components to be removed. Dirt or contaminants can be introduced into the fuel system and engine if the surrounding areas are **not** cleaned, resulting in damage to the fuel system and engine.

Clean the fuel pump head and surrounding area with electrical contact cleaner, Part Number 3824510, or equivalent.

To prevent damage from debris and contamination, cover, cap, or plug any openings as soon as possible when servicing the fuel system. Caps and plugs can be found in Fuel System Clean Care Kit, Part Number 4919073.



ck800wa

⚠ WARNING ⚠

Normal engine operation creates highly pressurized fuel in the fuel line which will remain in the fuel line after engine shutdown. Never open the fuel system when the engine is operating. Before servicing the fuel system, always loosen the pump-to-rail fuel line at the rail to vent the pressure. Keep hands clear of the line when loosening. High pressure fuel spray can penetrate the skin, resulting in serious personal injury or death.

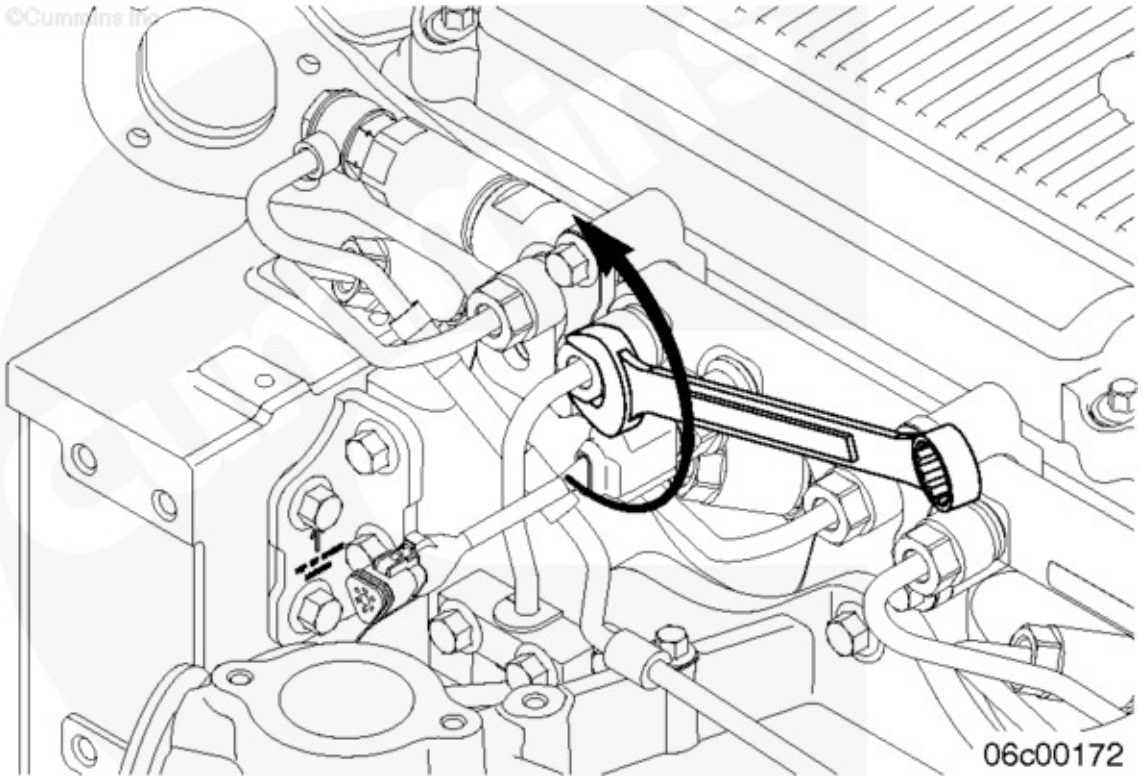
Before servicing the fuel system, loosen the pump-to-rail line at the rail to vent the pressure.

When loosening the nut, keep hands clear of the line.

Tighten the fuel rail nut.

Torque Value: 47 n•m [35 ft-lb]

Note : A machined slot in this fitting directs the fuel spray toward the engine block.



⚠ WARNING ⚠

When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

⚠ WARNING ⚠

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

⚠ CAUTION ⚠

Clean all fittings before disassembly. Dirt or contaminants can damage the fuel system.

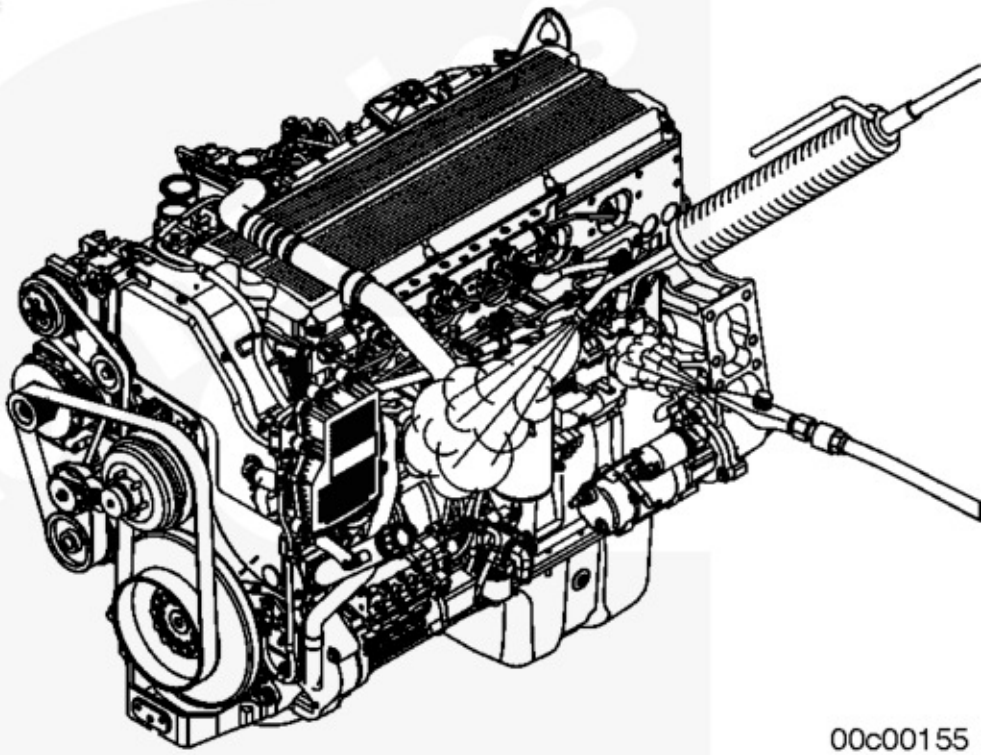
- Disconnect the high-pressure pump-to-rail fuel line from the high-pressure fuel pump head. Refer to Procedure 006-051 in Section 6. (/qs3/pubsys2/xml/en/procedures/132/132-006-051-

tr-mixar5.html)

- Remove the fuel drain connection from the fuel pump actuator housing. Refer to Procedure 006-013 in Section 6. (/qs3/pubsys2/xml/en/procedures/132/132-006-013-tr-mixar5.html)

Note : The fuel line from the engine control module (ECM) cooling plate to the high-pressure fuel pump contains a filter screen at the high-pressure fuel pump banjo fitting. The screen **must** be examined and cleaned, or the banjo bolt replaced if the screen is damaged.

- Remove the fuel supply line from the fuel pump actuator housing. Mark the banjo bolt and return it to its original location. **Not** returning the bolt to its original location will result in system contamination. Refer to Procedure 006-024 in Section 6. (/qs3/pubsys2/xml/en/procedures /132/132-006-024-tr-mixar5.html)
- Disconnect the wiring harness from the fuel pump actuator.



00c00155

Remove

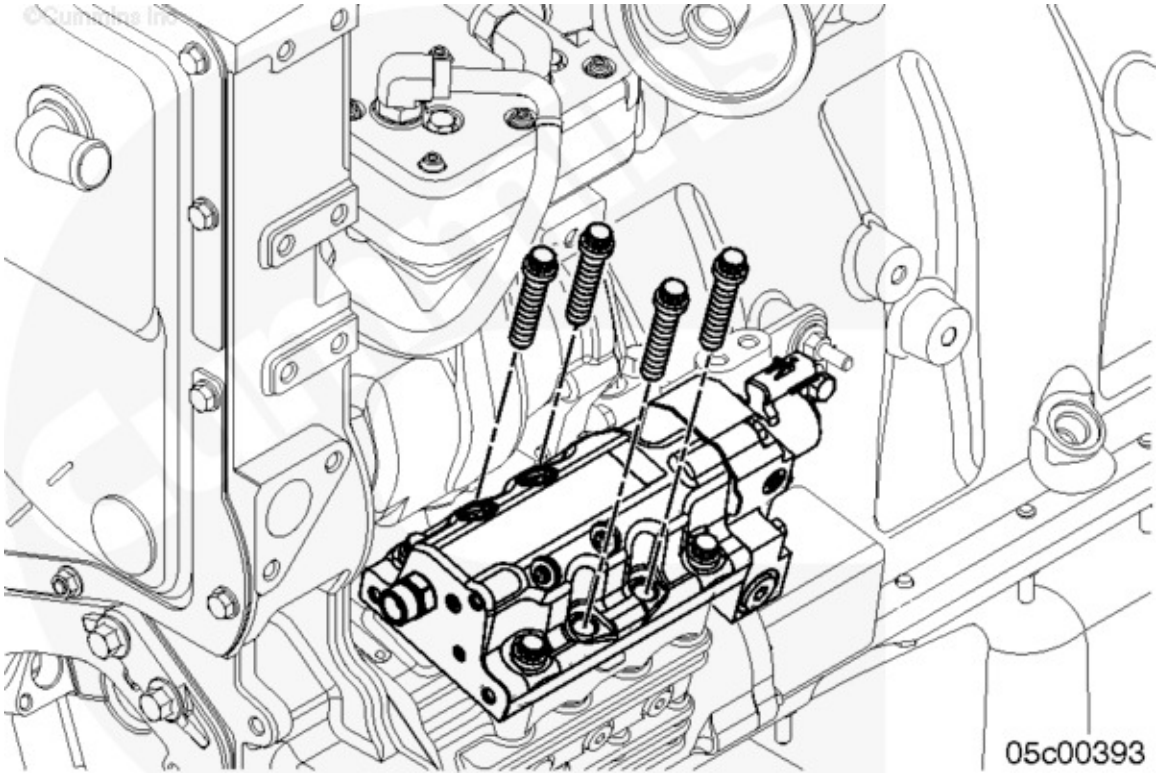
Three Cylinder, Two Piston Pump

⚠ CAUTION ⚠

Do not use an air tool. The use of air tools can possibly damage the fuel pump.

Remove the four center capscrews that attach the fuel pump head to the fuel pump camshaft

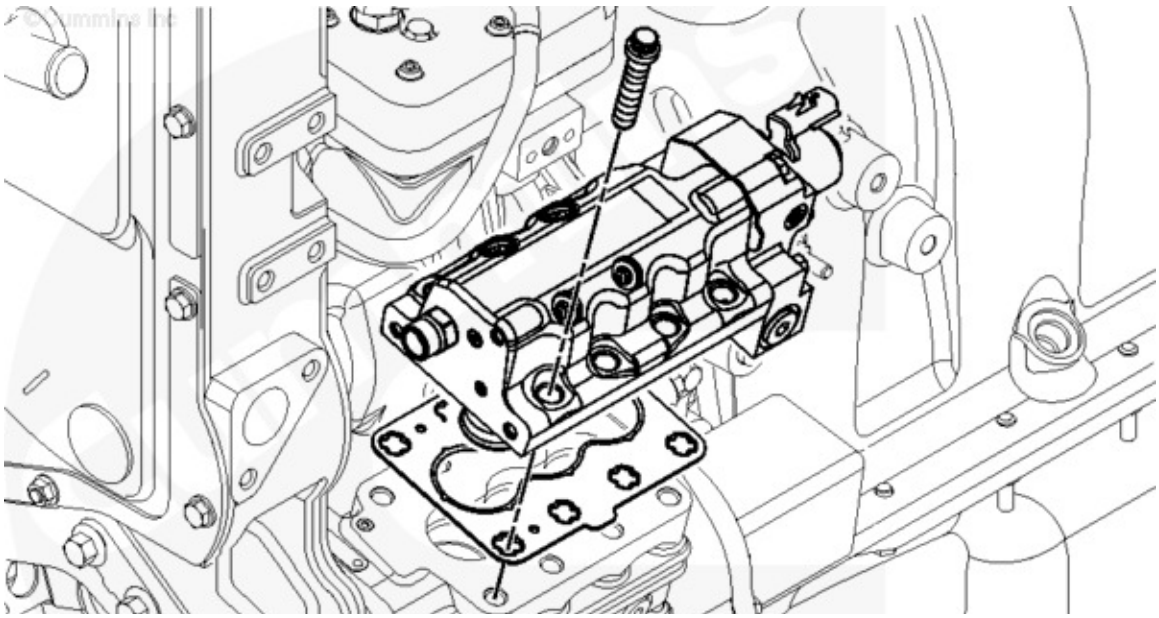
housing.

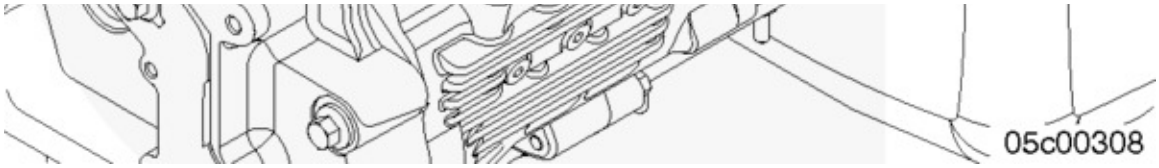


Remove the last four capscrews. Alternately loosen each capscrew to avoid binding. Loosen each capscrew one turn at a time.

Carefully lift the fuel pump head and gasket from the fuel pump camshaft housing, being careful to keep the tappet springs attached to the fuel pump head. Place the fuel pump head on a clean surface. Discard the gasket.

Remove the fuel pump actuator housing. Refer to Procedure 005-228 in Section 5. (/qs3/pubsys2/xml/en/procedures/132/132-005-228-tr-mixar5.html)



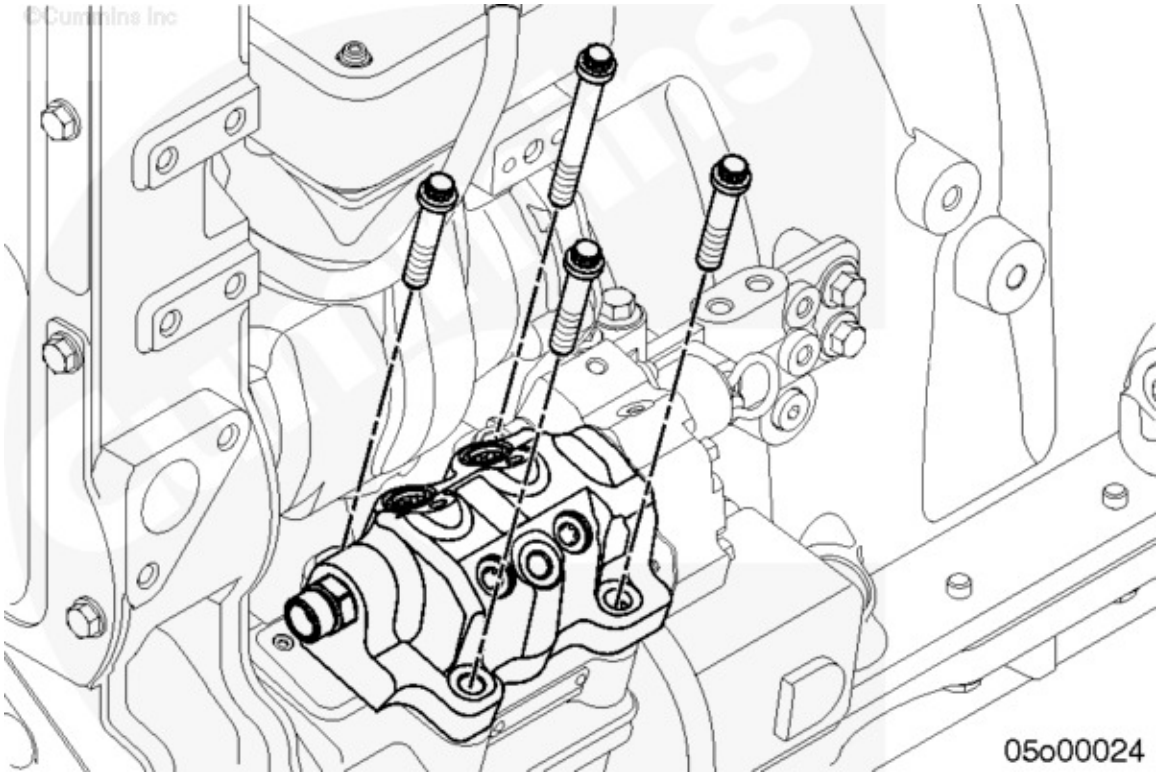


Two Cylinder Pump

⚠ CAUTION ⚠

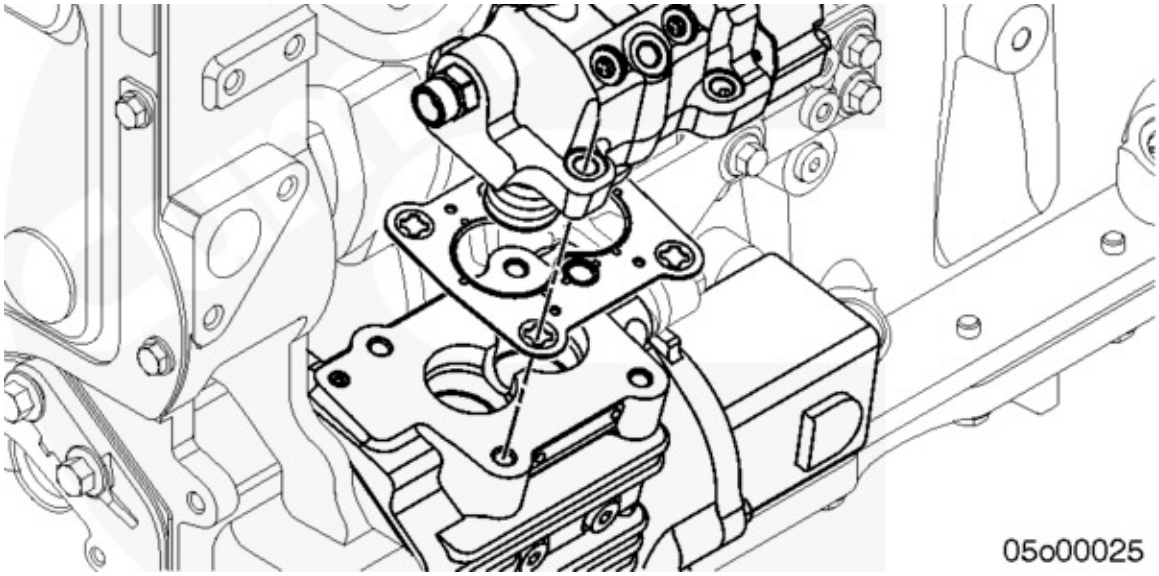
Do not use an air tool. The use of air tools can possibly damage the fuel pump.

Remove the four capscrews that attach the fuel pump head to the fuel pump camshaft housing.



Carefully lift the fuel pump head and gasket from the fuel pump camshaft housing. Be careful to keep the tappet springs attached to the fuel pump head. Place the fuel pump head on a clean surface. Discard the gasket.

Remove the fuel pump actuator housing. Refer to Procedure 005-228 in Section 5. (/qs3/pubsys2/xml/en/procedures/132/132-005-228-tr-mixar5.html)



Clean and Inspect for Reuse

Three Cylinder, Two Piston Pump

⚠ WARNING ⚠

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Special care **must** be taken to be sure these parts are kept extremely clean, if removed. Cover the camshaft housing with a clean shop towel while the head is removed.

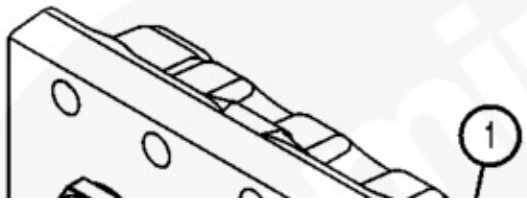
Do **not** use cleaning agents, other than contact cleaner, on pump components.

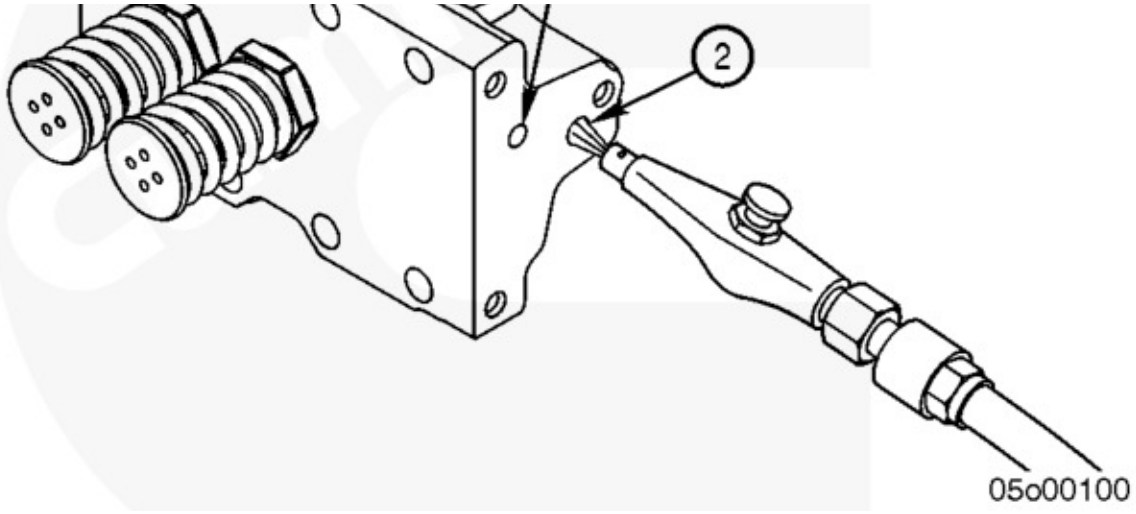
Note : Do **not** perform the following test without the springs and spring retainers installed.

With the springs and spring retainers installed, blow compressed air (at least 276 kPa [40 psi]) into the inlet (2).

Callout (1) is the outlet.

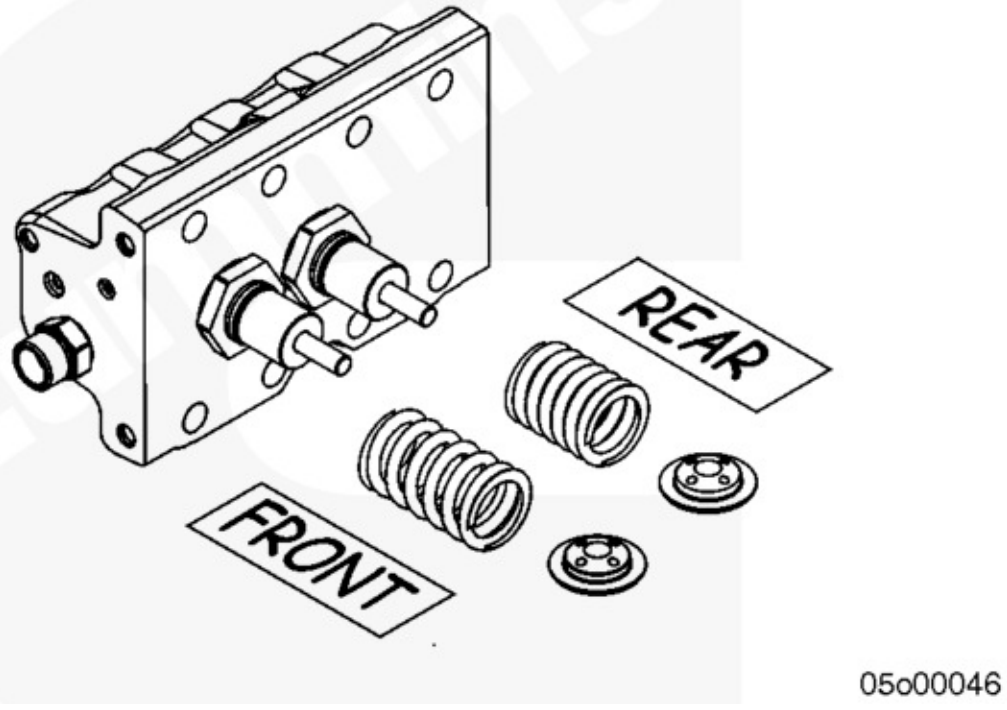
The plungers should extend. If the pumping plungers are stuck, replace the fuel pump head.





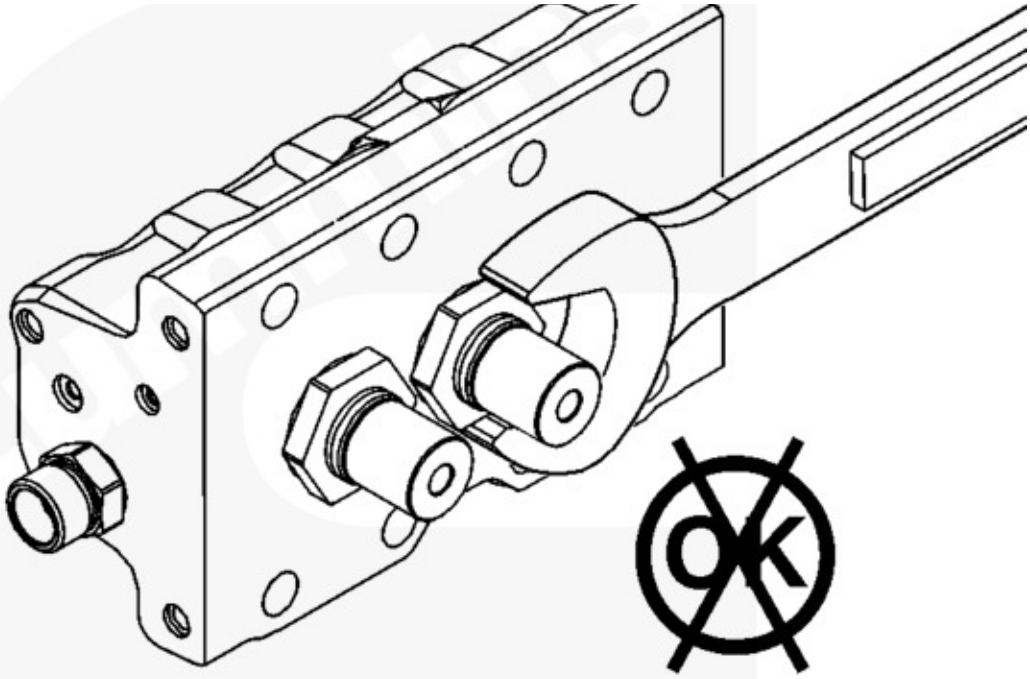
Remove the springs and spring retainers from the barrel retainers.

Make sure to keep track of which springs came from the front and the rear. It is recommended that these parts be installed in the same location, even if a new high-pressure pump head is installed.



⚠ CAUTION ⚠

Do not remove the barrel retainers. Damage to the pump head and barrel retainers will result.



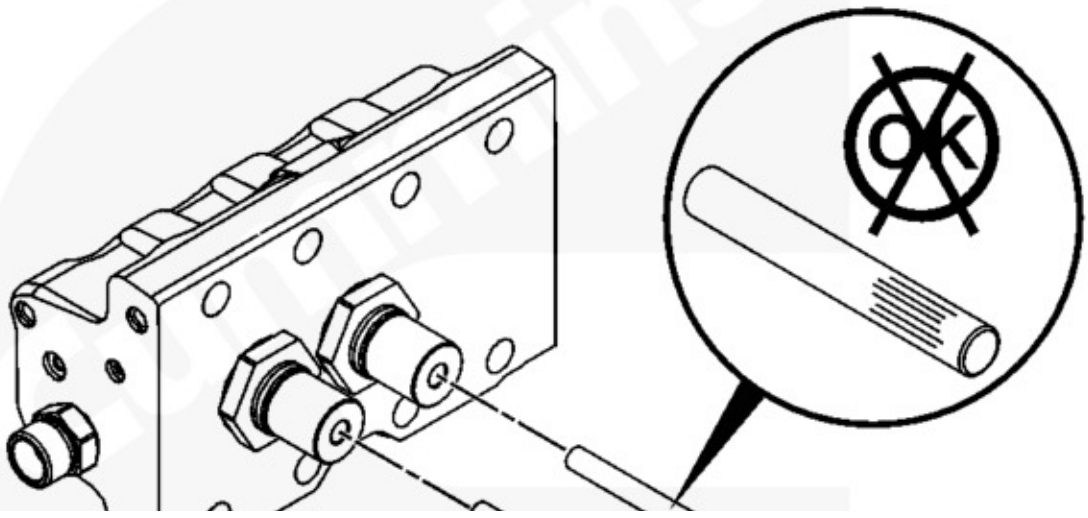
⚠ CAUTION ⚠

Each plunger must be installed in the same orientation and in the same barrel, or engine damage can result. Marking the bottoms of the plungers with a felt tip marker will help to make sure that correct orientation is maintained.

Remove and inspect the plungers. Slight discoloration or debris traces are acceptable. Deep scoring or dark discoloration **must not** be evident.

If scoring or scratches exist that can be felt, the fuel pump head **must** be replaced.

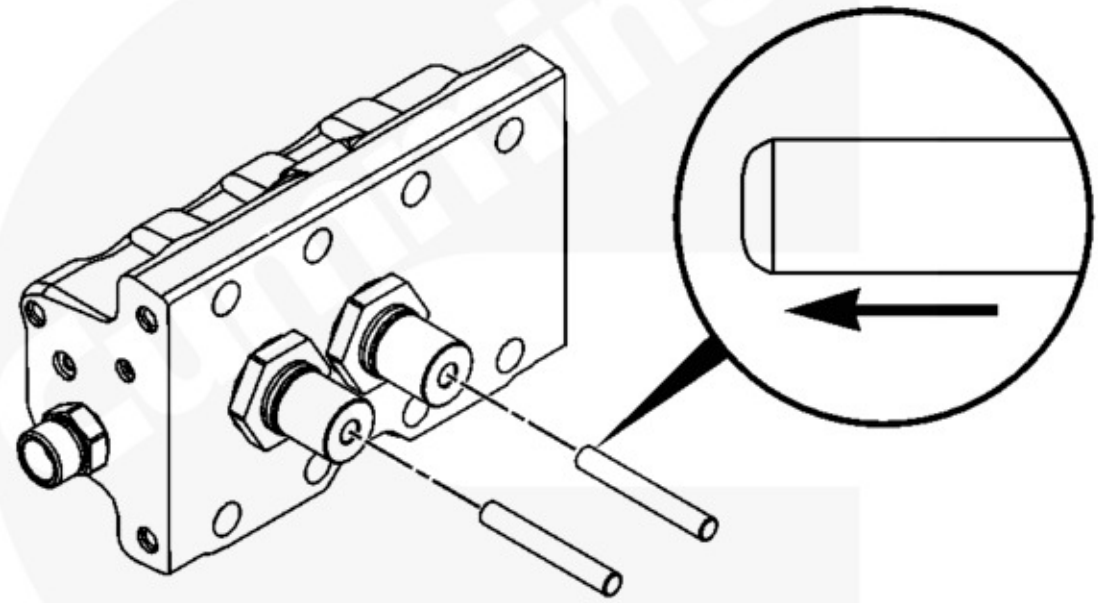
If the ceramic plungers are shattered, the fuel pump assembly **must** be replaced.



05o00050

Install the plungers into the barrel retainers.

Note : Fuel pump heads are built with asymmetrical pumping plungers. The crowned end of the pumping plunger **must** be installed into the barrel with the flat end toward the camshaft. If the plunger is installed in the wrong orientation, fuel pump head damage will result.



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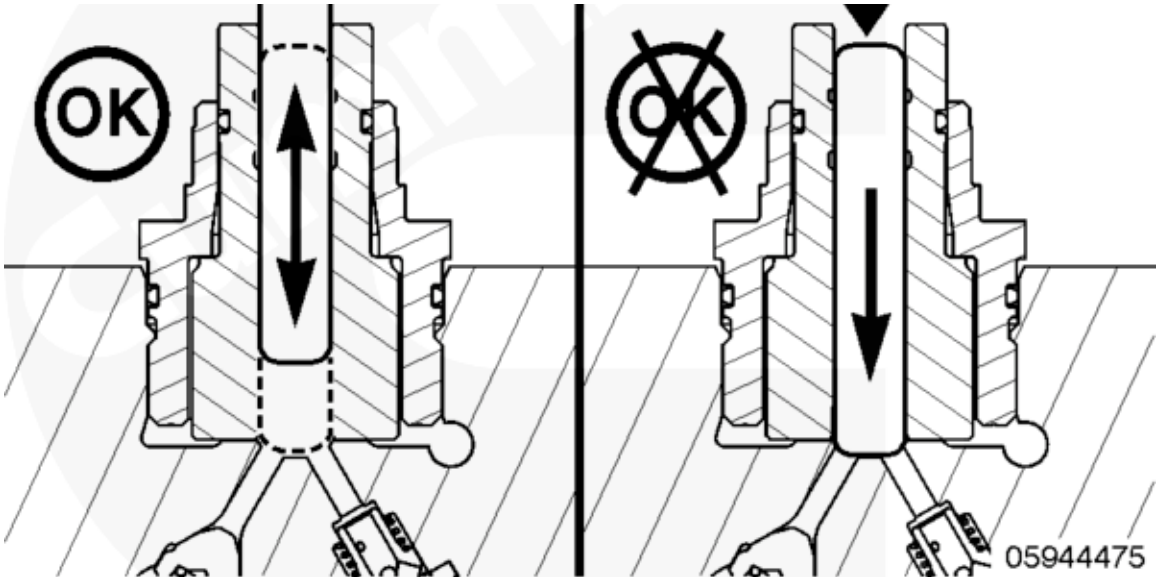
Use a finger to test the plunger action:

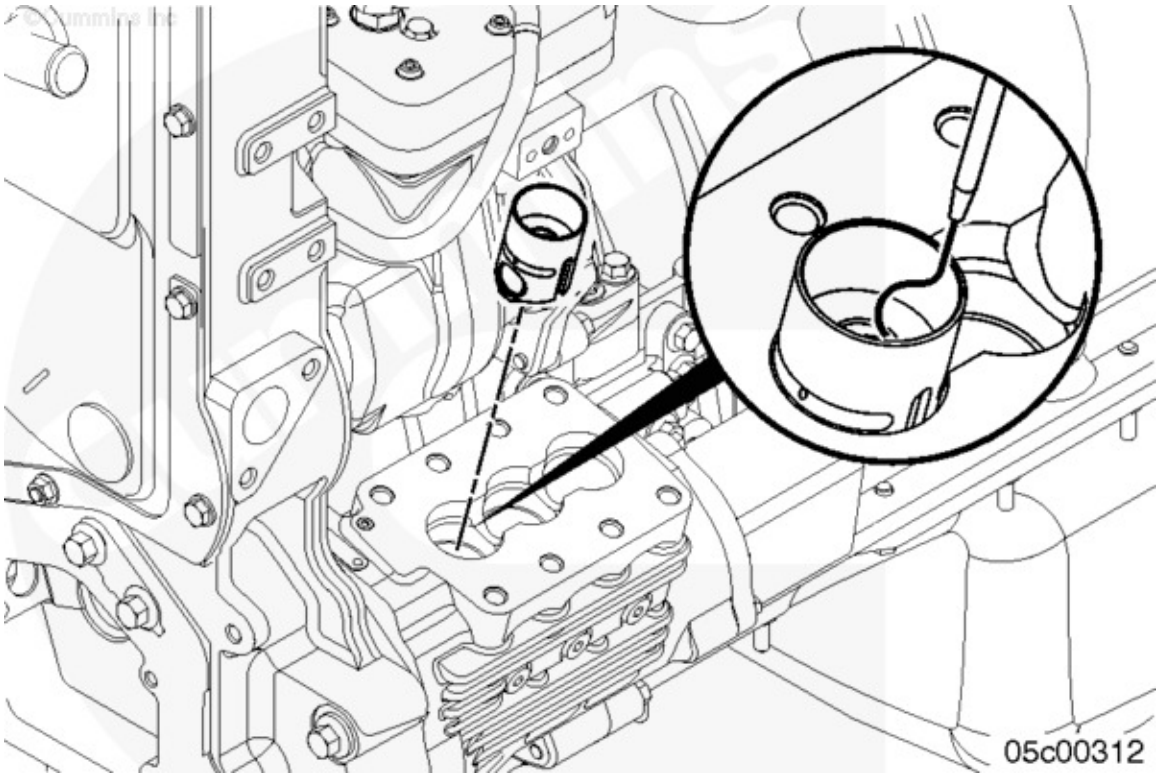
- Press the plunger halfway into the barrel quickly with a pumping motion
- Release it quickly.

If the check valves in the fuel pump head are good, the trapped air will cause the plunger to bounce or rebound. If the plunger falls to the bottom, one of the check valves in the fuel pump head may have malfunctioned.



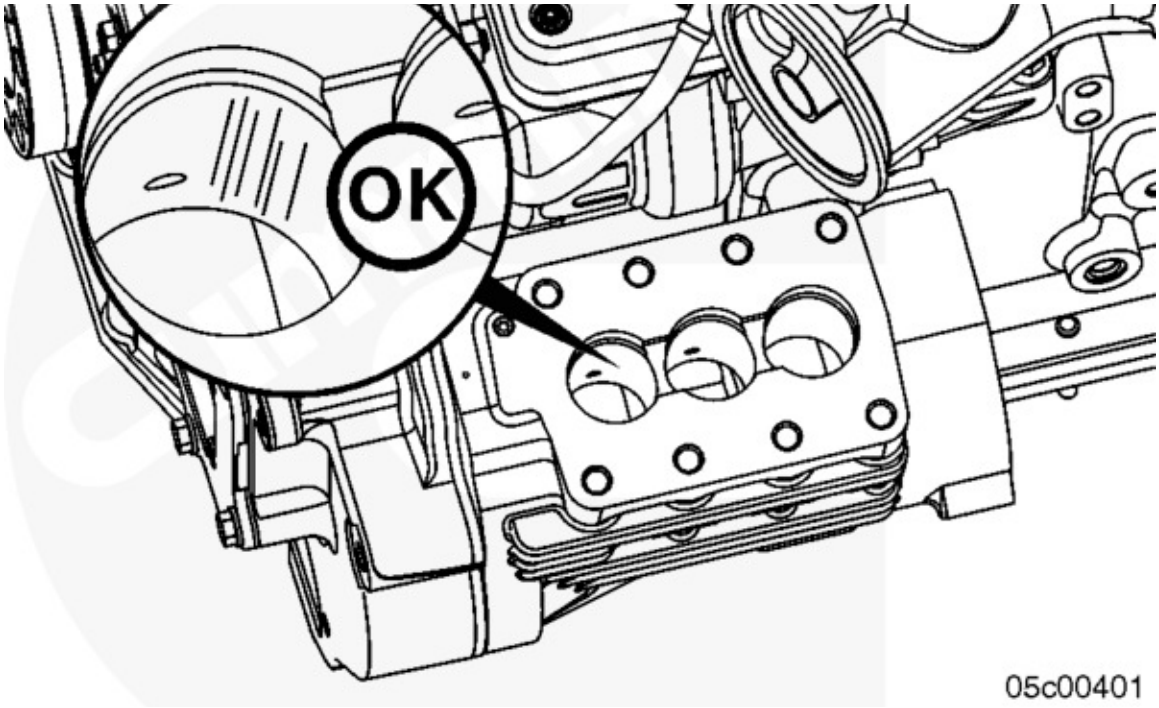
While the fuel pump head is removed, inspect the camshaft housing.

The tappets can be removed. Use an o-ring pick as the removal tool.

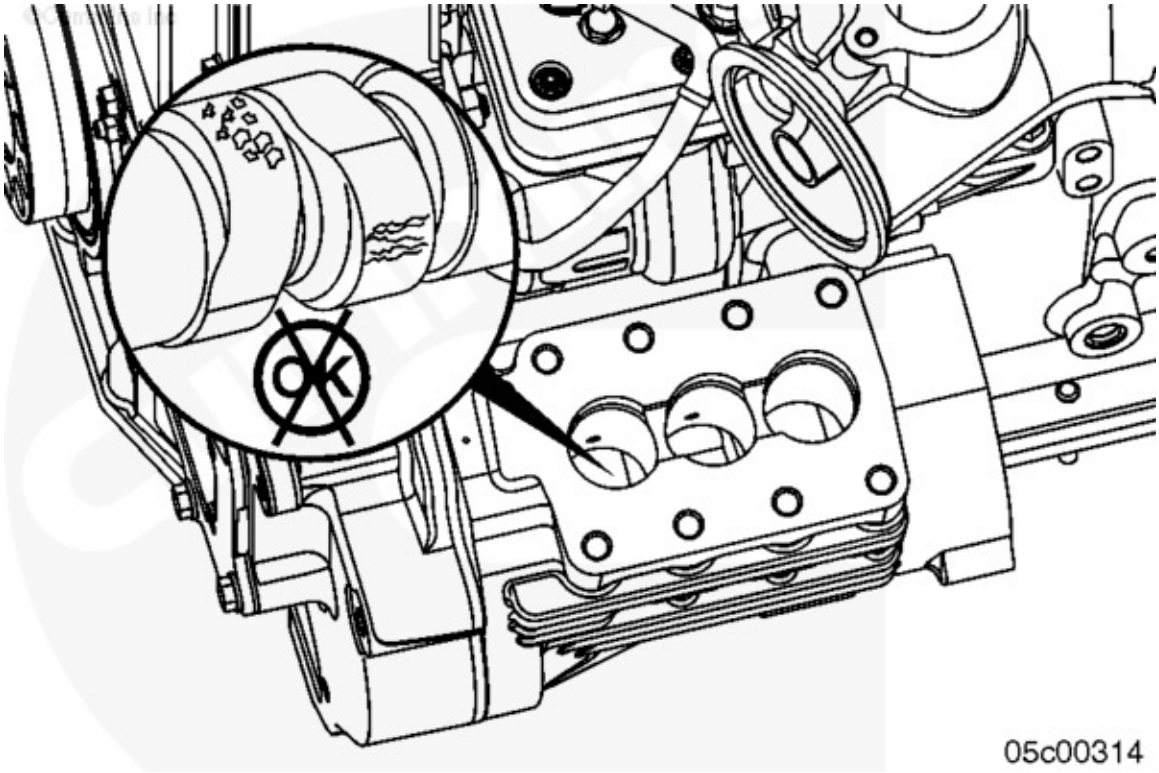


Normal operation creates vertical grooves in the cylinder bores of the fuel pump camshaft housing. These grooves are **not** an indication of a malfunction.

Camshaft housings with grooves are acceptable for reuse.



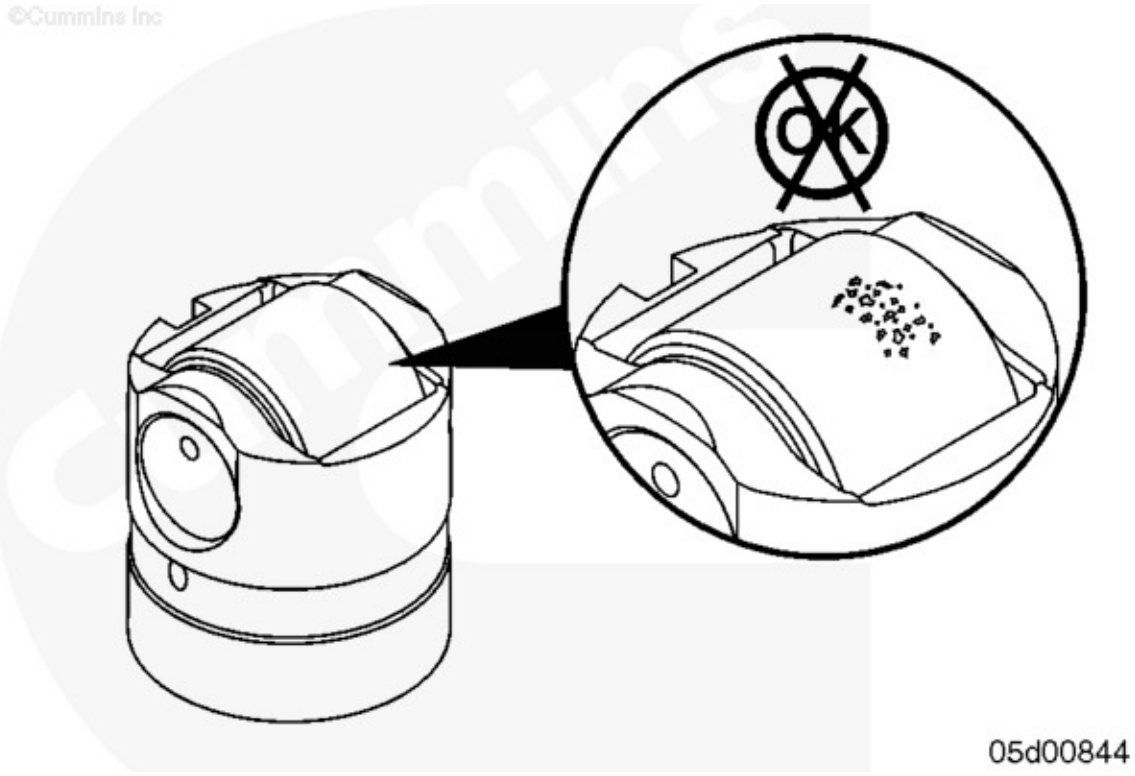
With the camshaft housing tappets removed, inspect the camshaft for wear.



Inspect the tappet rollers for wear.

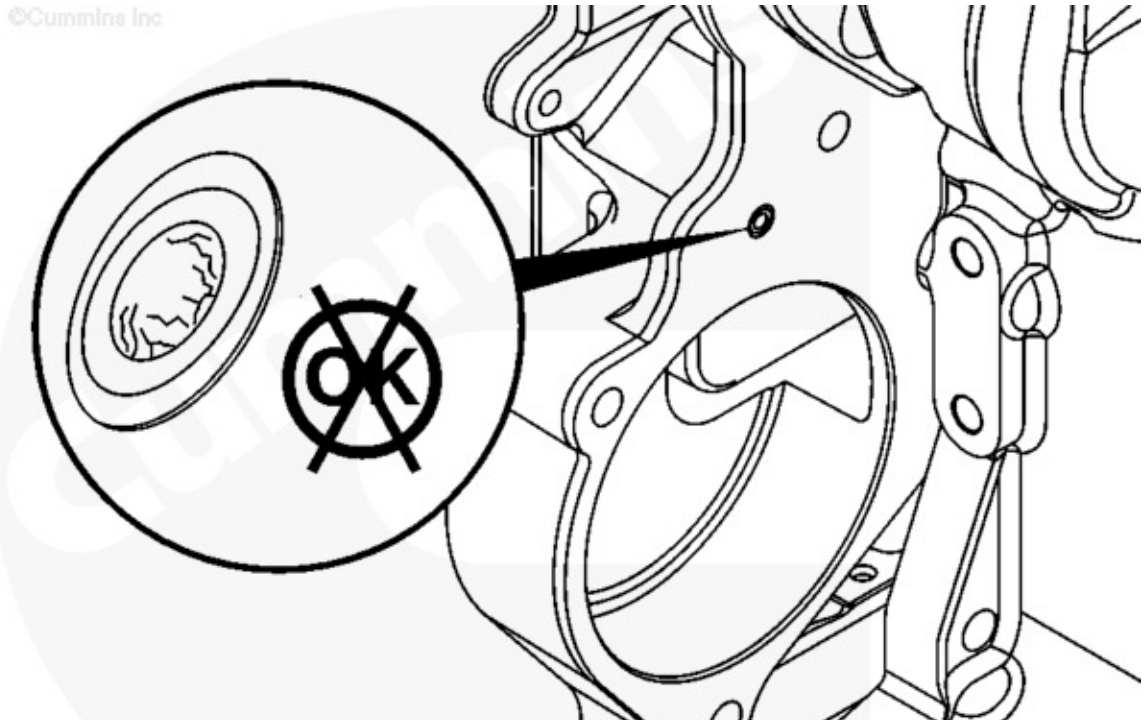
Normal operation creates bands around the circumference of the tappet roller. These bands are **not** an indicator of a malfunction. Tappet rollers with bands are acceptable for reuse.

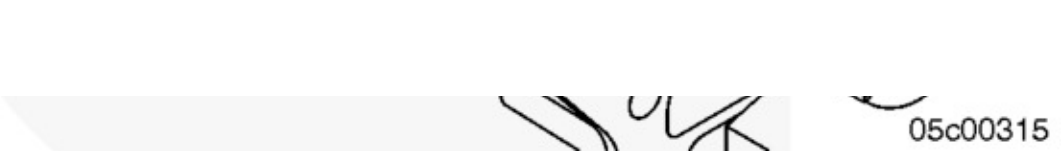
For fuel pump heads with ceramic plungers **only**, if damage to the tappet rollers is found, reference TSB140019.



If damage to the camshaft housing is observed, it is possible the fuel pump is **not** receiving adequate lubricating oil.

When replacing the fuel pump, inspect the gear housing to make sure no blockages exist in the oil supply to the fuel pump.





Two Cylinder Pump

⚠ WARNING ⚠

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Special care **must** be taken to be sure these parts are kept extremely clean if removed. Cover the camshaft housing with a clean shop towel while the head is removed.

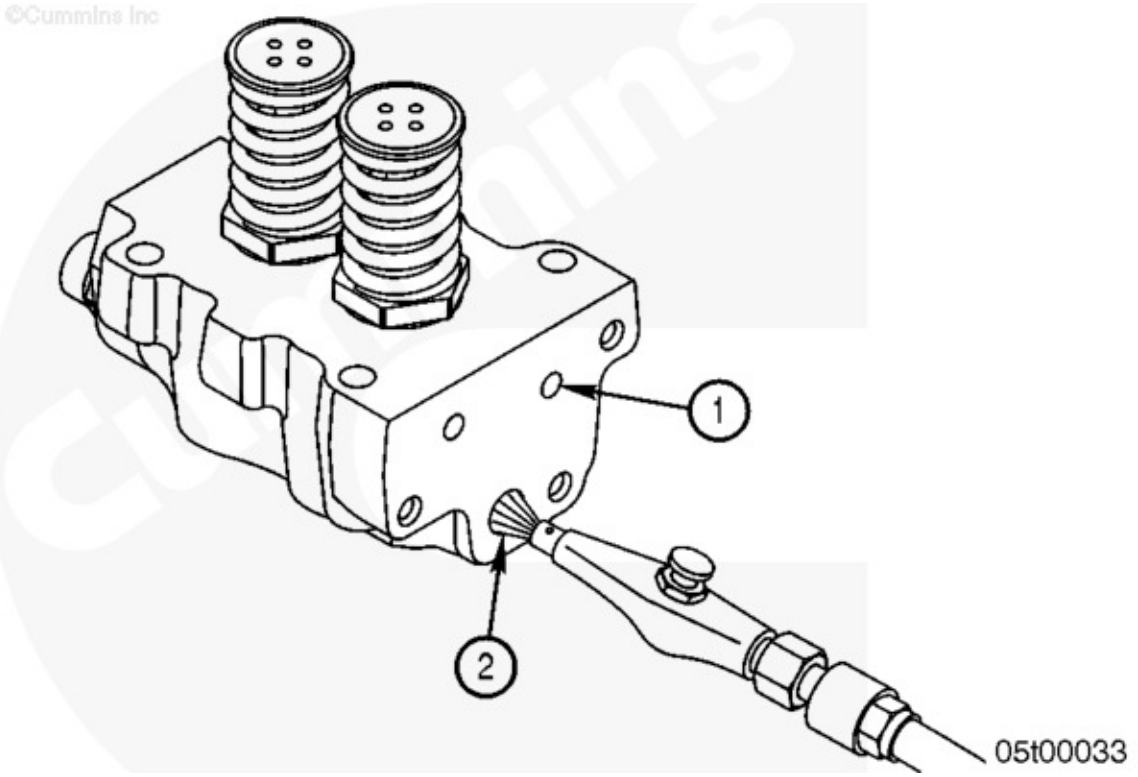
Do **not** use cleaning agents, other than contact cleaner, on pump components.

Note : Do **not** perform the following test without the springs and spring retainers installed.

With the springs and spring retainers installed, blow compressed air (at least 276 kPa [40 psi]) into the inlet (2).

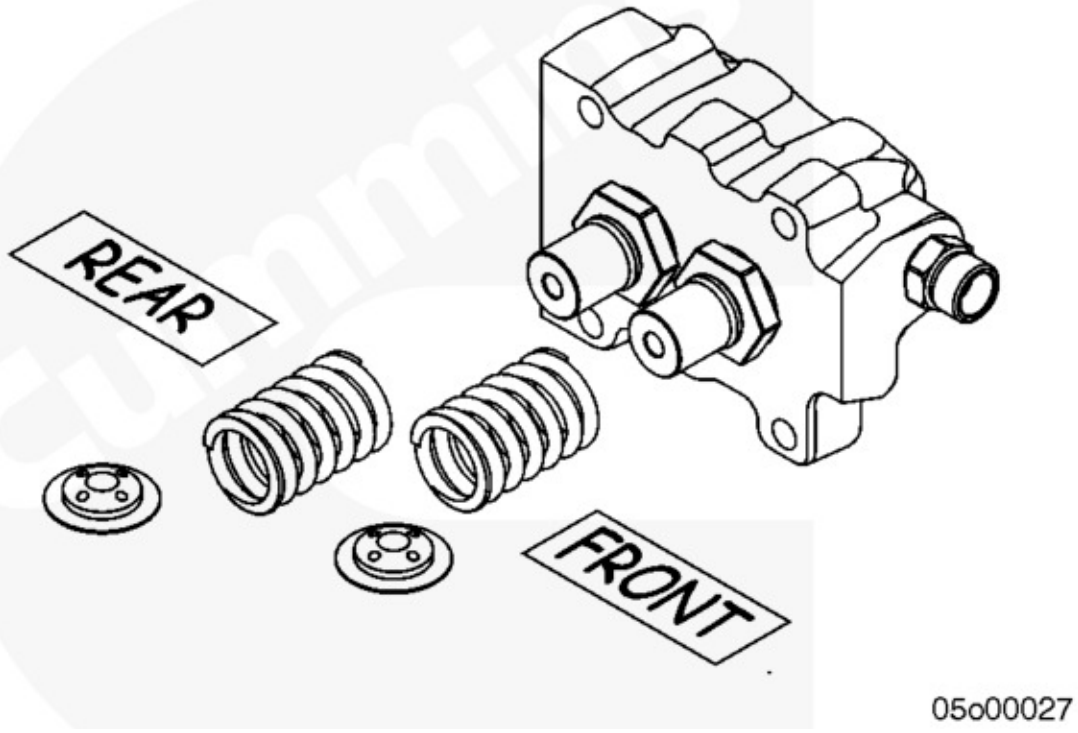
Callout (1) is the outlet.

The plungers should extend. If the pumping plungers are stuck, repair the fuel pump head. Install a new barrel and plunger assembly if needed. See the Rebuild section in this procedure.



Remove the springs and spring retainers from the barrel retainers.

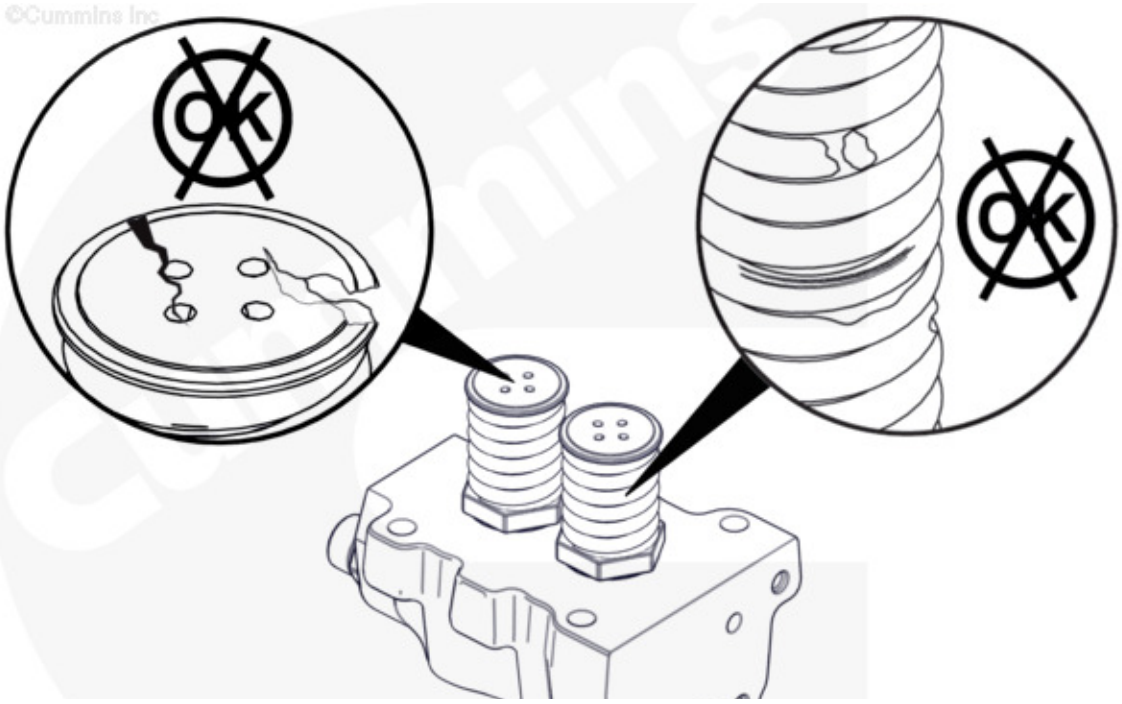
Make certain to keep track of which spring came from the front and rear. It is recommended that these parts be installed in the same location, even if a new high-pressure pump head is installed.

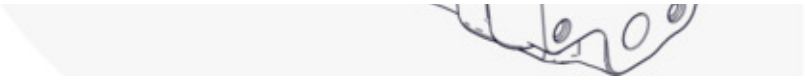


Inspect the barrel springs and spring retainers for cracks or significant wear.

Slight scoring or debris traces on the barrel spring retainer is acceptable.

If cracks, nicks, or debris generated malfunctions are present, the barrel and plunger assembly **must** be replaced.





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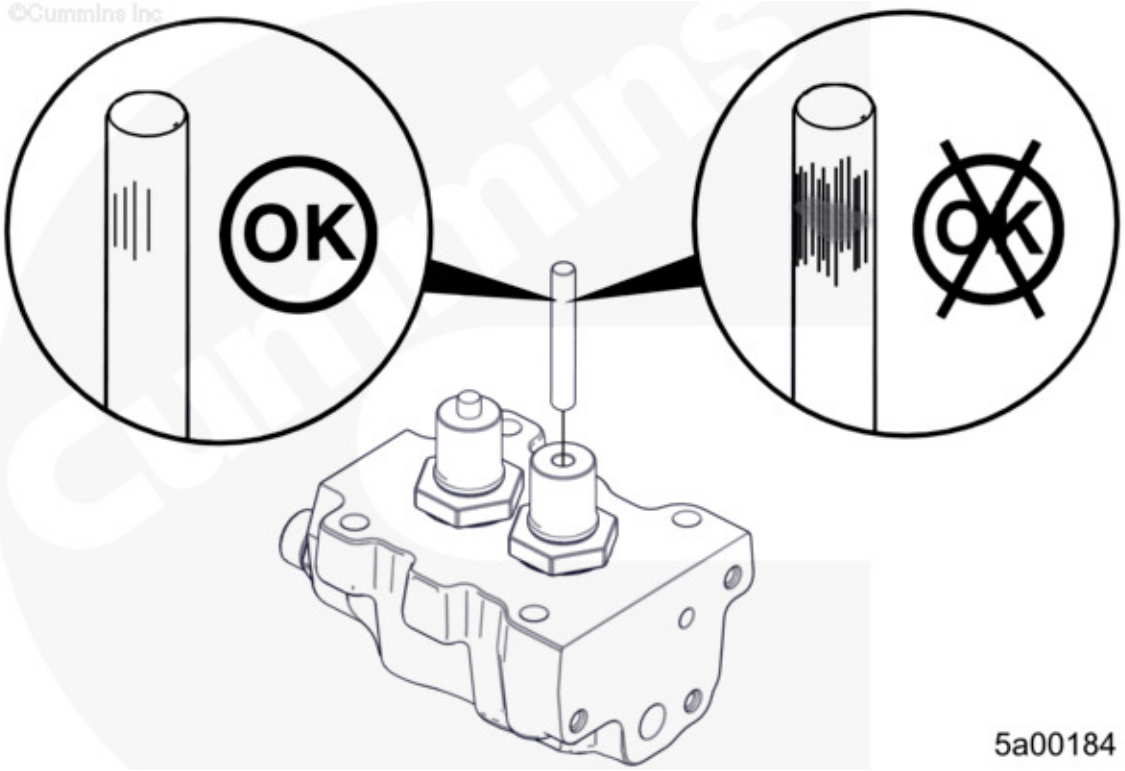
⚠ CAUTION ⚠

Each plunger must be installed in the same orientation and in the same barrel, or engine damage can result. Marking the bottoms of the plungers with a felt tip marker will help to make sure correct orientation is maintained.

For steel fuel pump plungers, slight discoloration or debris traces are acceptable. Deep scoring or dark discoloration should **not** be evident. If scoring or scratches exist that can be felt, the fuel pump head barrel and plunger assembly **must** be replaced. See the Rebuild section in this procedure.

If the ceramic plungers are shattered, the fuel pump assembly **must** be replaced.

Note : Some fuel pump heads are built with asymmetric pumping plungers. The crowned end of the pumping plunger **must** be installed into the barrel. If the plunger is installed in the wrong orientation, fuel pump head damage will result.



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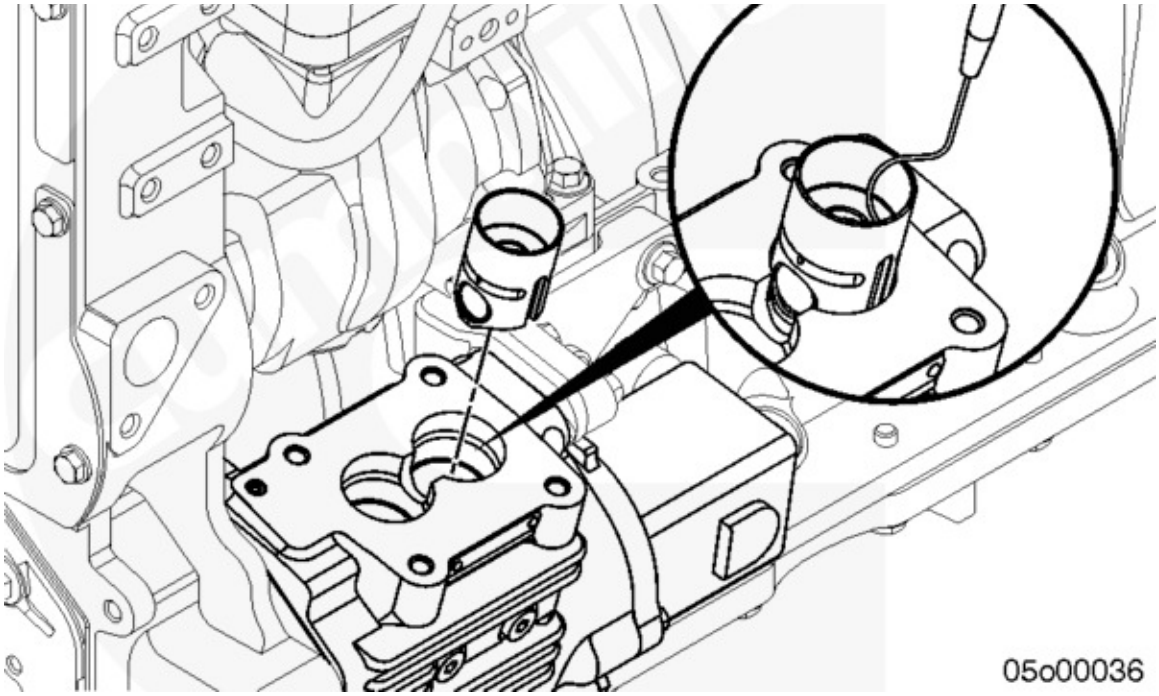
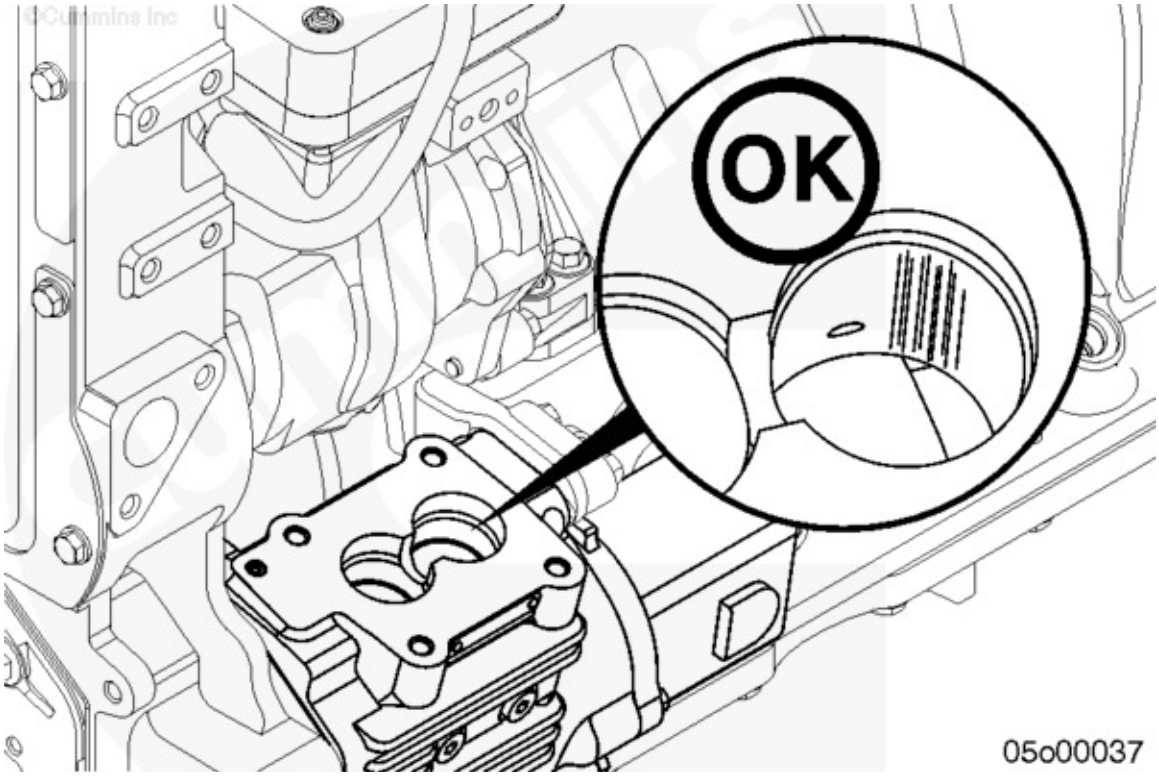
While the fuel pump head is removed, inspect the camshaft housing.

The tappets can be removed. Use an o-ring pick.

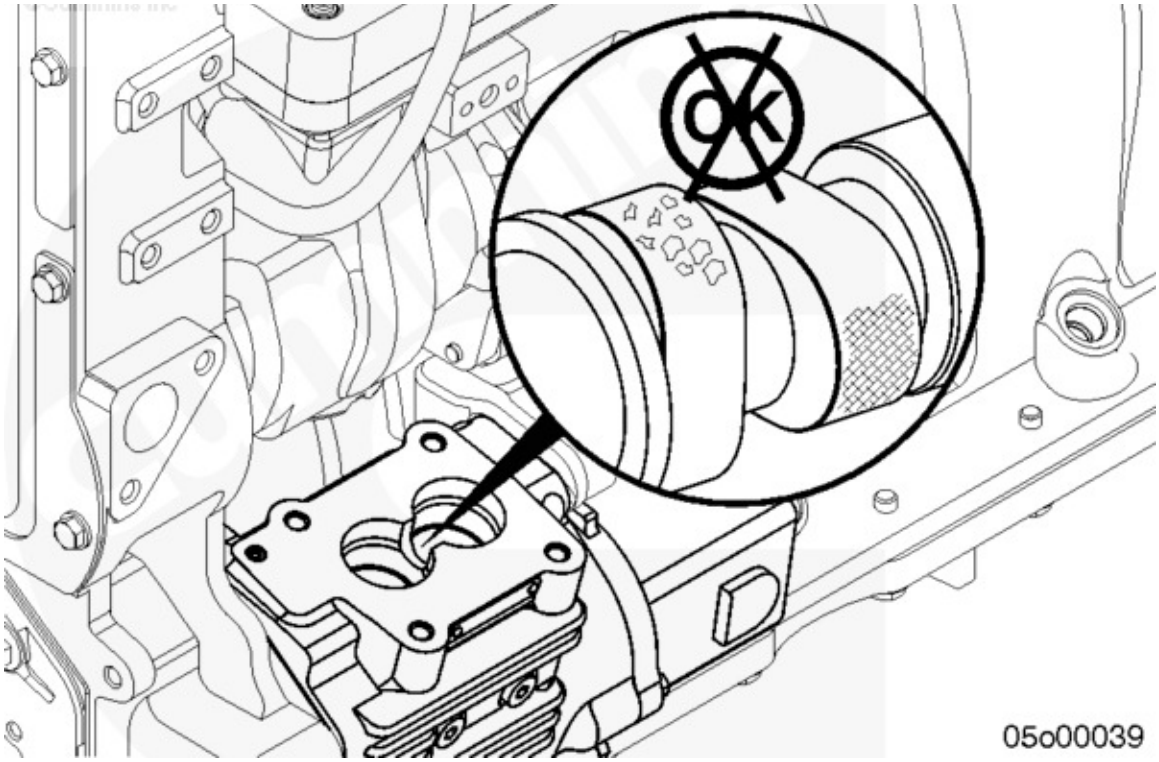


Normal operation creates vertical grooves in the cylinder bores of the fuel pump camshaft hosing. These grooves are **not** an indication of a malfunction.

Camshaft housings with grooves are acceptable for reuse.



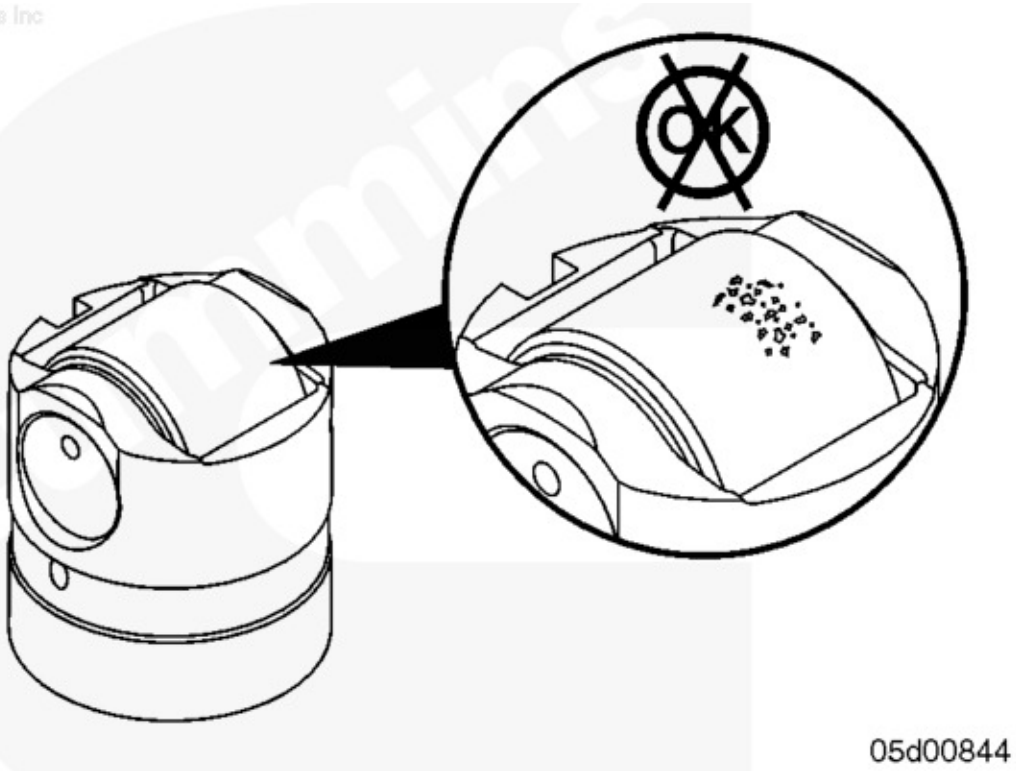
With the camshaft housing tappets removed, inspect the camshaft for wear.



Inspect the tappet rollers for wear.

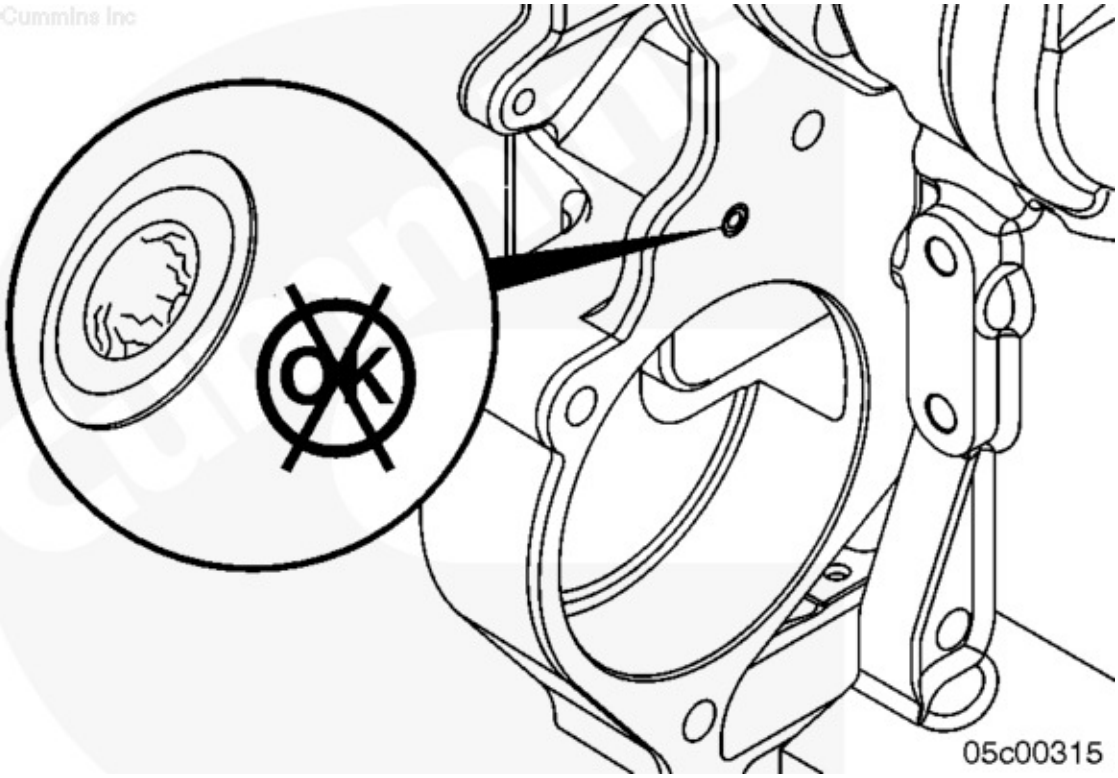
Normal operation creates bands around the circumference of the tappet roller. These bands are **not** an indicator of a malfunction. Tappet rollers with bands are acceptable for reuse.

If damage to the tappet rollers is found, see Technical Service Bulletin, Fuel Pump - Plunger and Tappet Roller Inspection and Repair, TSB140019.



If damage to the camshaft, tappets, or camshaft housing is observed, it is possible the fuel pump is **not** receiving adequate lubricating oil.

When replacing the fuel pump, inspect the gear housing to make sure no blockages exist in the oil supply to the fuel pump.

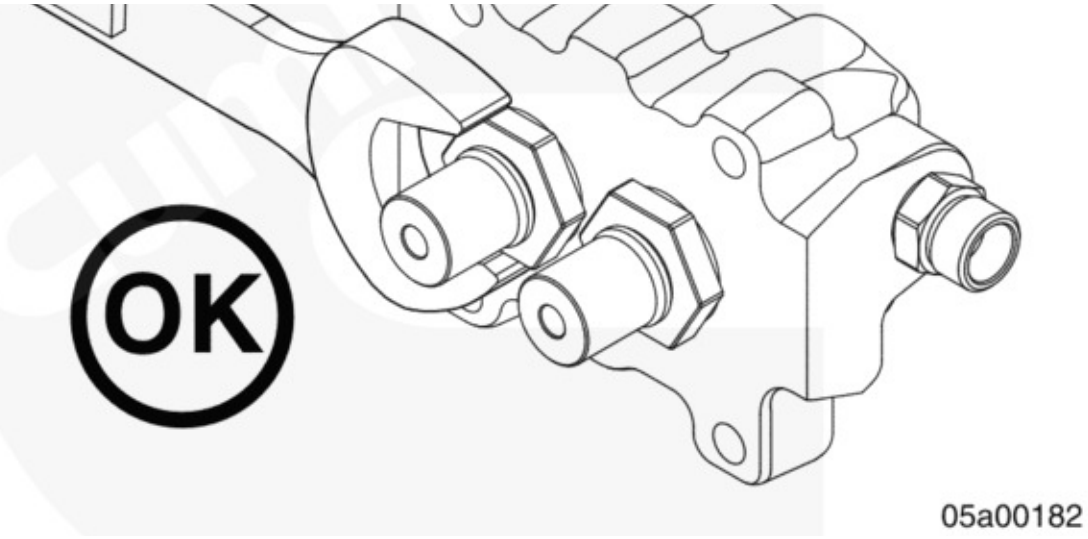


Rebuild

⚠ CAUTION ⚠

Unless the barrel and plunger assembly is being replaced, do not remove the barrel retainers. Damage to the pump head and barrel retainers will result.

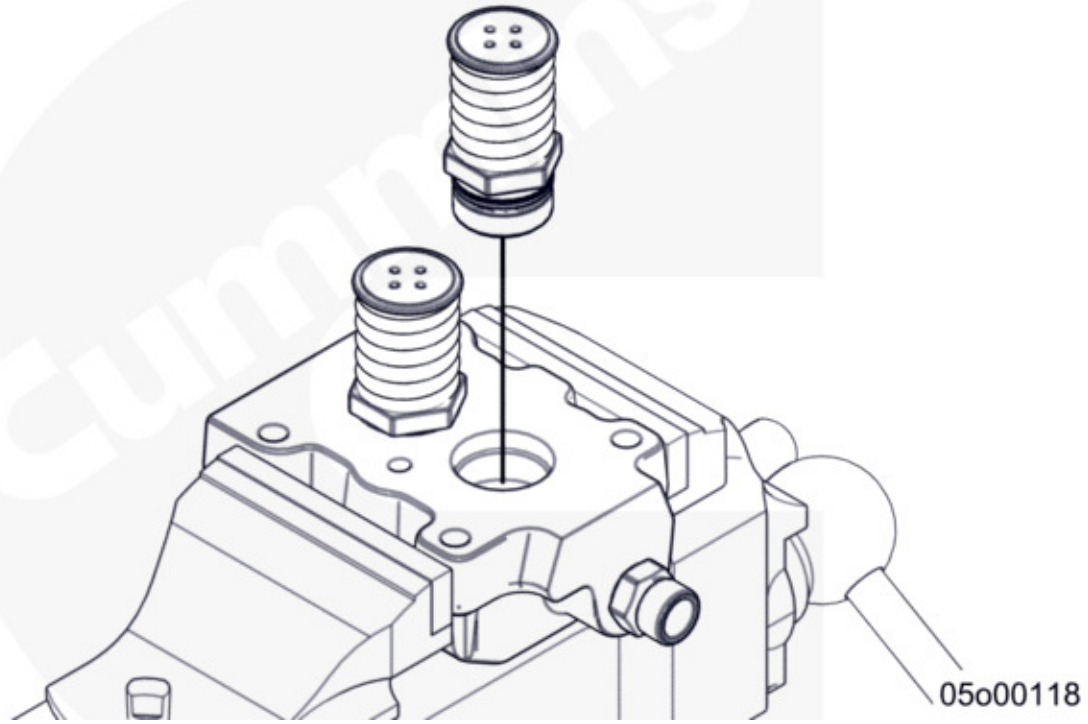
If the barrel retainer is removed, the barrel and plunger assembly **must** be replaced.



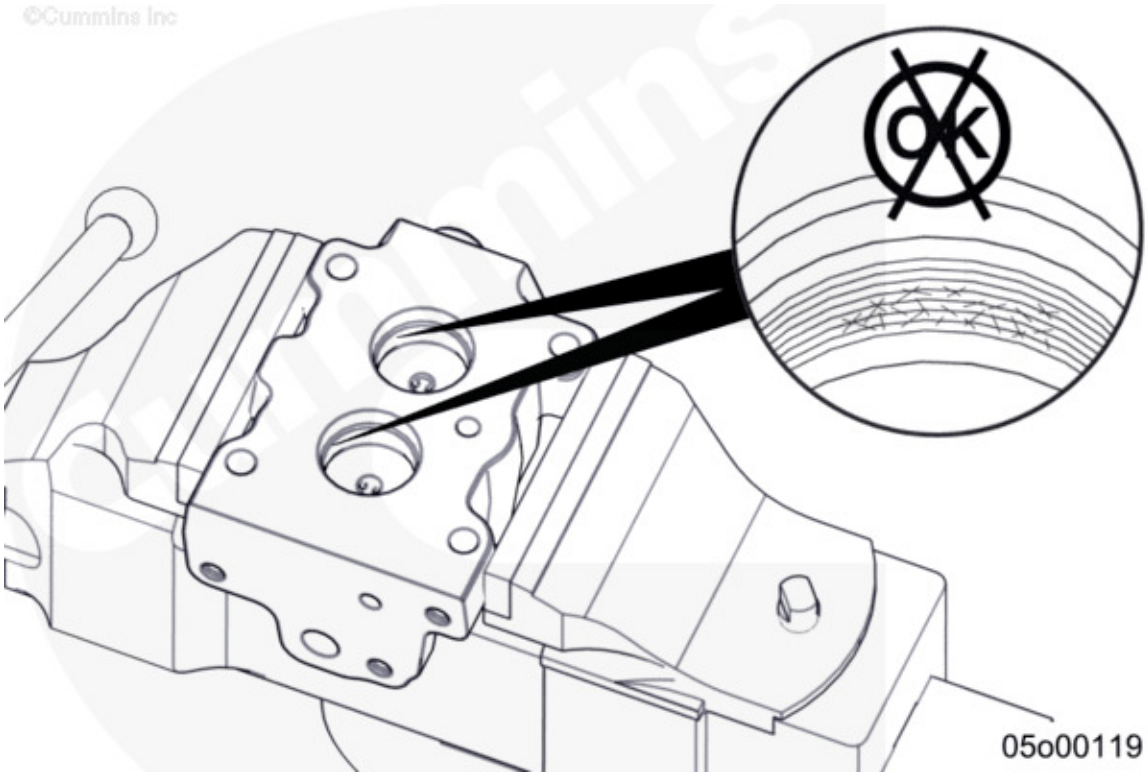
⚠ CAUTION ⚠

The fuel system is very sensitive to contamination. Engine damage can result if special care is not taken. Keep parts and other tools clean using a lint-free cloth.

- Secure the fuel pump head with the plungers facing up.
- Remove the barrels and plungers.
- A tall, thin-walled socket **must** be used for proper clearance between the two barrels.



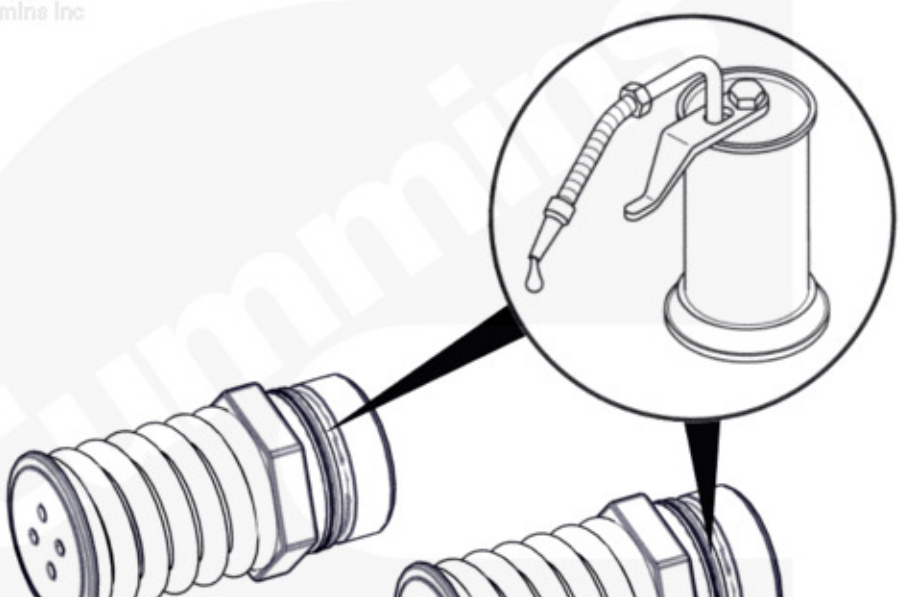
- Do **not** use cleaning agents other than contact cleaner, Part Number 3824510, or equivalent, on the fuel pump components.
- Inspect the barrel threads for shavings or debris.



⚠ CAUTION ⚠

Do not remove the new steel plunger from the barrel prior to installation. Installation of barrels without plungers will result in damage to the barrels.

- Lubricate the barrel threads and o-ring with clean engine oil.



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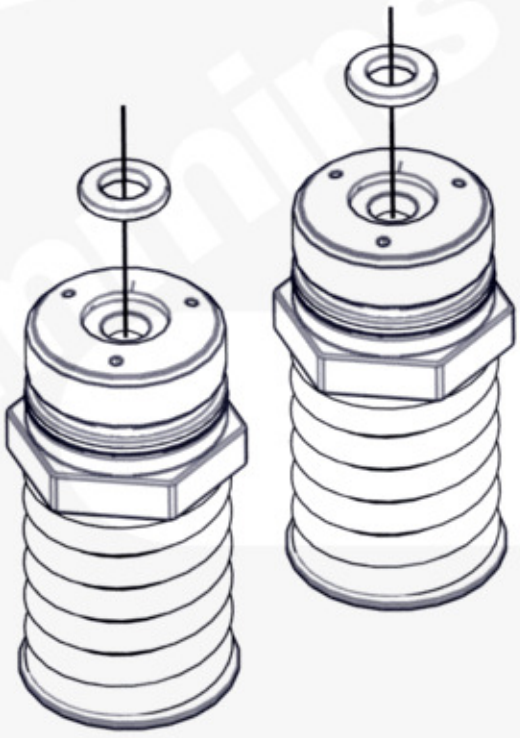
⚠ CAUTION ⚠

Proper installation of the sealing washer is critical to the proper functioning of the fuel pump head.

Place the sealing washer in the barrel.

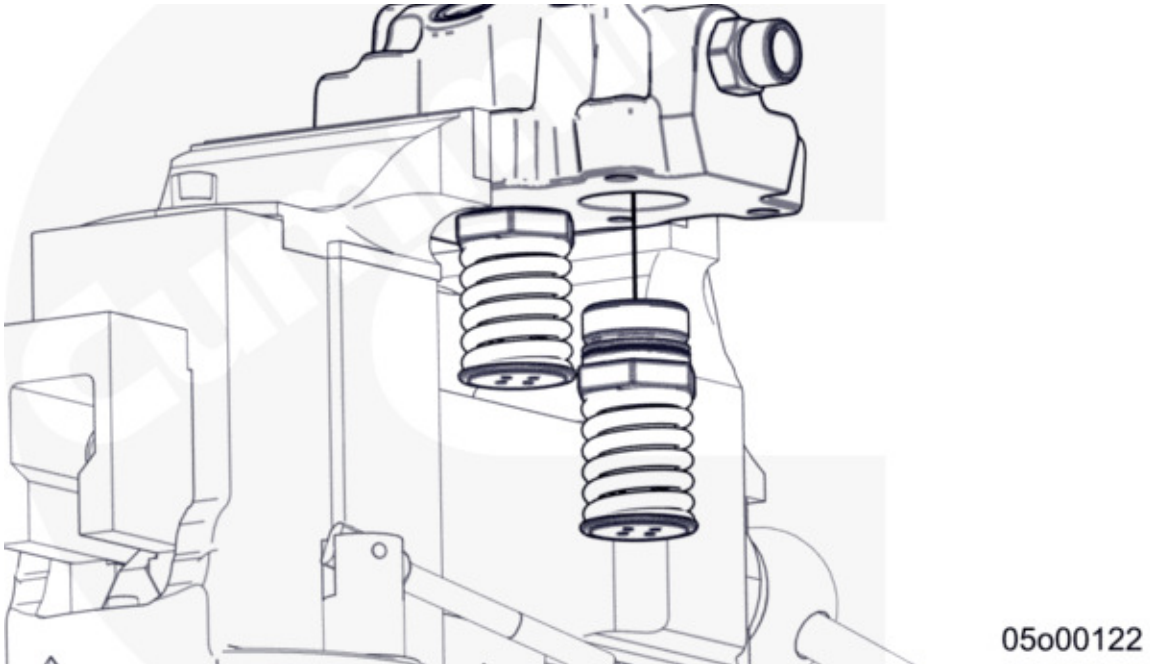


05o00121

⚠ CAUTION ⚠

Do not remove the barrel spring and spring retainer prior to installation. Keeping them in place will keep the plunger from falling out during installation.

- Offset and secure the fuel pump head, top facing up, with the barrel threads facing down.
- Install both barrel plunger assemblies hand-tight, overcoming o-ring resistance until the sealing washer is seated.



⚠ CAUTION ⚠

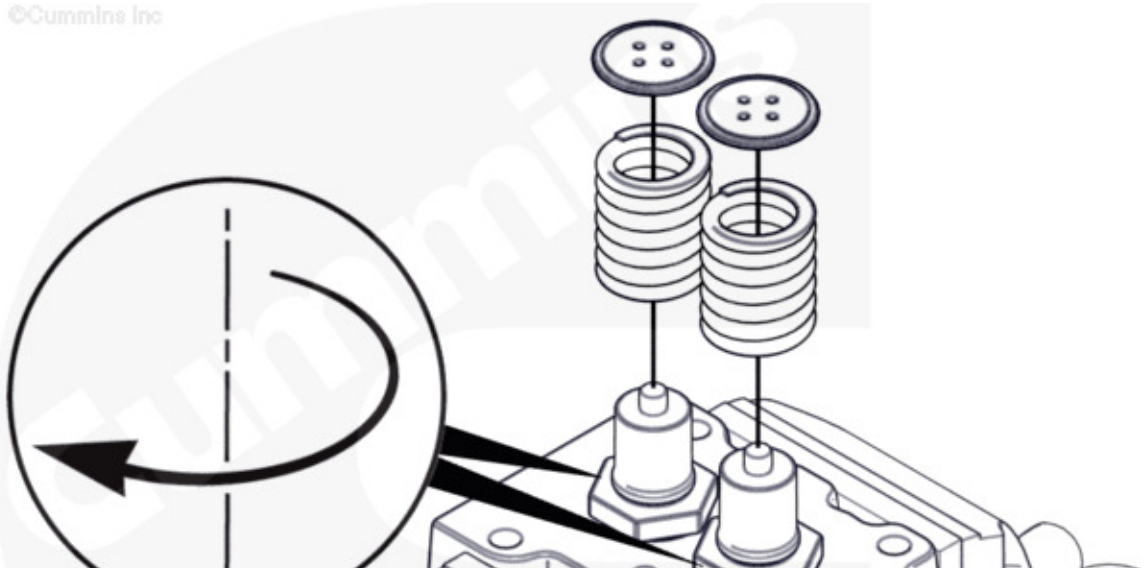
Proper installation of the barrel and plunger is critical to an accurate torque value. An inaccurate torque can result in over-crushing the sealing washer, cracking of the head, or fatigue malfunction of the washer.

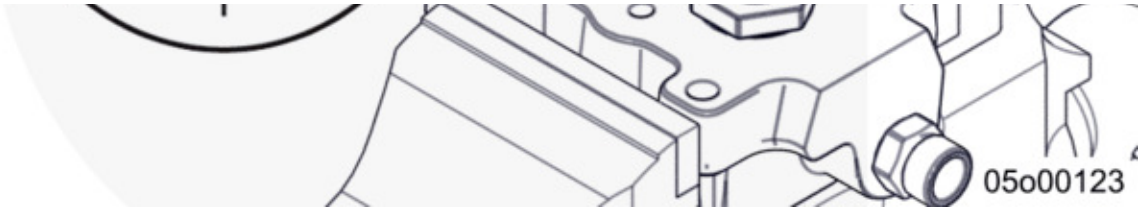
- Secure the fuel pump head with the barrel assemblies facing up.
- Remove the springs and spring retainers from the barrels to allow for socket clearance.

Tighten the barrels.

Torque Value:

1. 81 n•m [60 ft-lb]
2. Rotate 60 degrees.

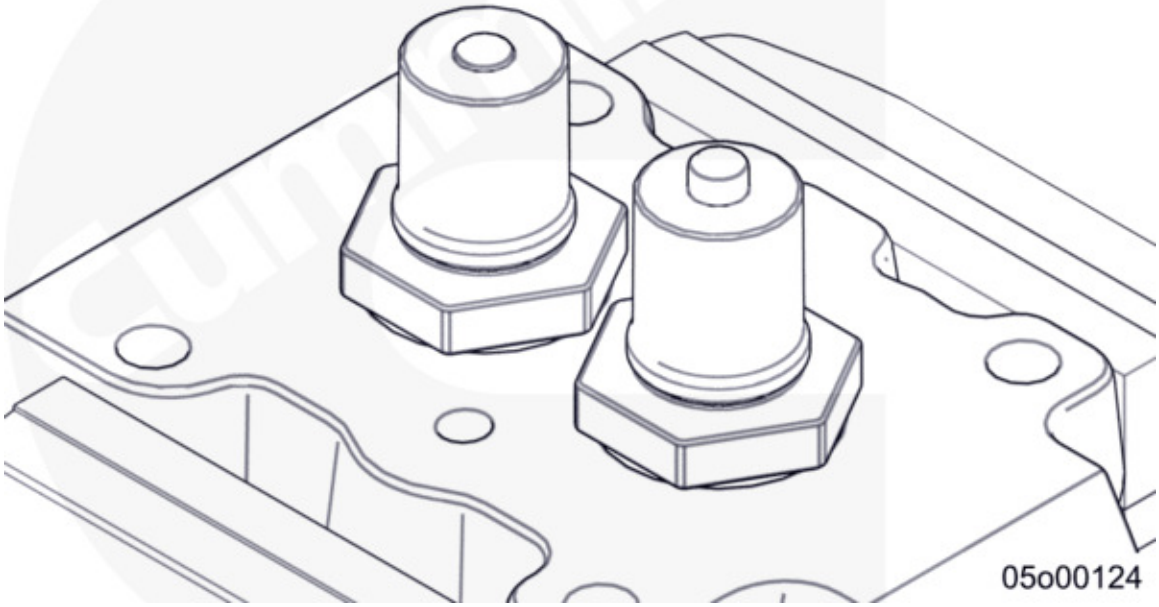




⚠ CAUTION ⚠

If the fuel pump barrel is overtightened, the sealing washer can be crushed.

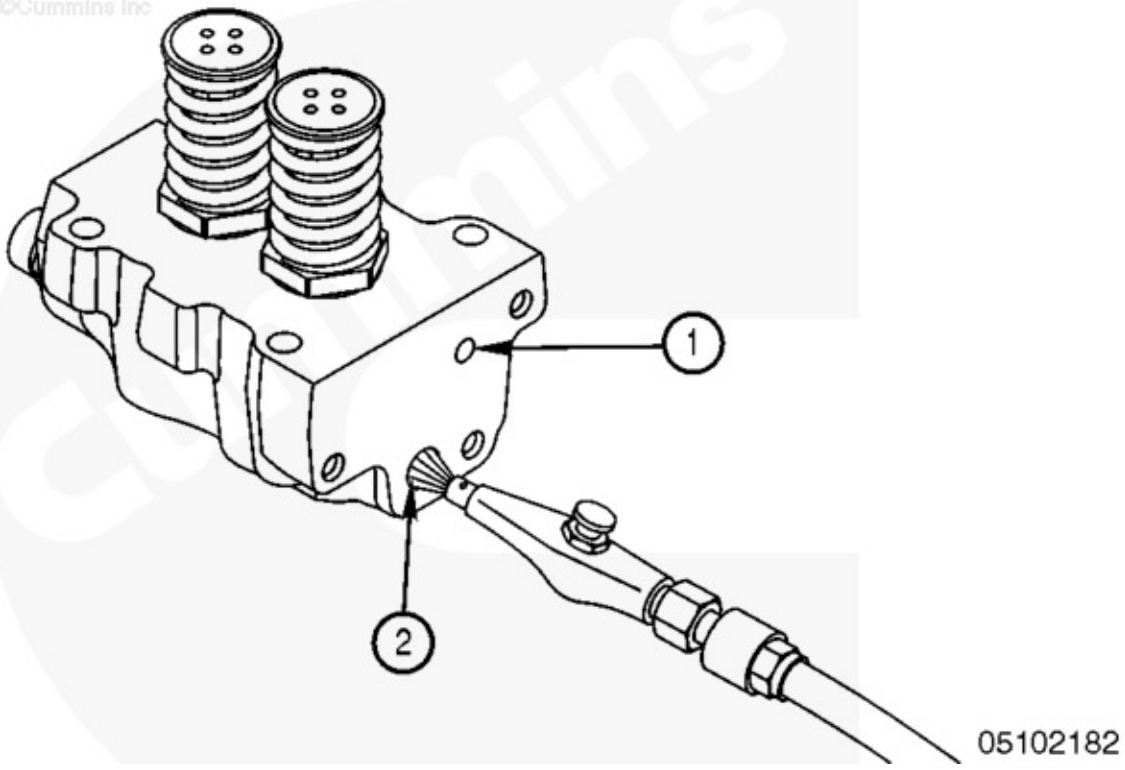
- The plunger **must** move freely in the barrel. If the plunger is stuck or is **not** able to be depressed completely, the barrel and plunger assembly **must** be replaced.



⚠ WARNING ⚠

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury

- With the springs and spring retainers installed, apply compressed air (at least 276 kPa [40 psi]) into the inlet (2).
- The outlet (1) is identified for clarity.
- The plungers should extend. If the pumping plungers are stuck, replace the barrel and plunger assembly.

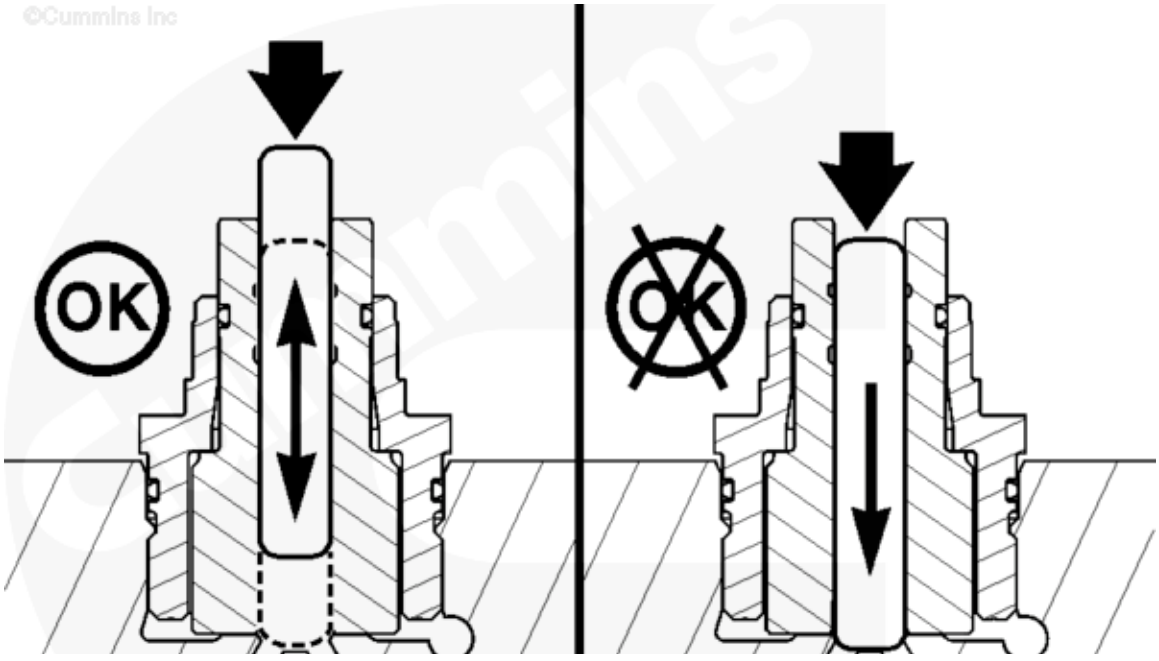


Use a finger to test the plunger action.

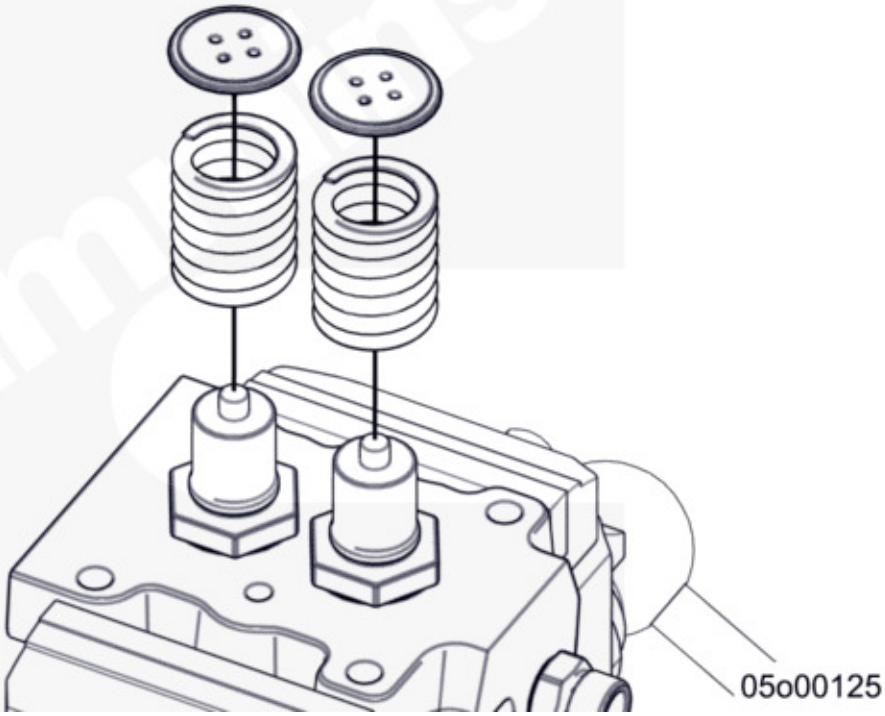
- Quickly press the fuel pump plunger halfway into the fuel pump barrel with a pumping motion.
- Release the fuel pump plunger quickly.

If the check valves in the fuel pump head are within specification, trapped air will cause the fuel pump plunger to bounce or rebound.

If the fuel pump plunger falls to the bottom, replace the fuel pump head; check valve(s) in the fuel pump head may have malfunctioned.



Install the springs and spring retainers.



Install

Three Cylinder, Two Piston Pump

⚠ CAUTION ⚠

Each tappet must be installed in the same orientation and in the same barrel from which it was removed. Failure to do so can result in engine damage. Marking the tops of the plungers with a felt tip marker will help to make sure that the correct orientation is maintained.

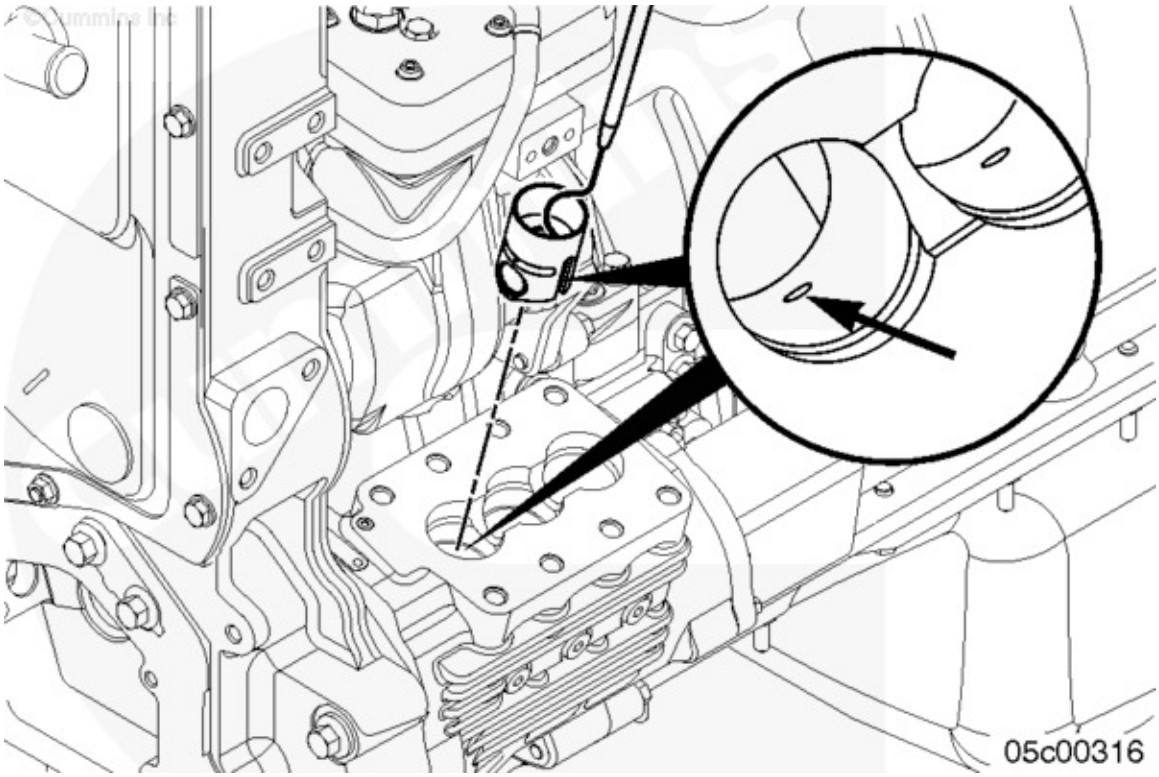
Install the tappets in the original tappet bores.

Make sure the tappets are installed in the original locations.

Make sure that the tappet guide pins engage the guide pin grooves.

Tappet guide pins **must** be aligned so that the guide pin flats are perpendicular to the fuel pump head mounting surface.

Rotate the guide pin to the appropriate position if the guide pin is misaligned.



If installing a new or rebuilt pump head, install the new tappet springs and retainers provided with the pump head.

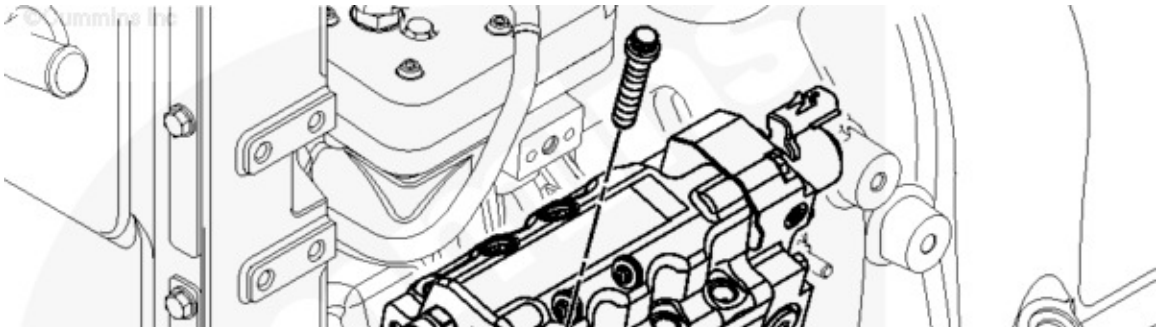
Place the high-pressure fuel pump head and a new gasket onto the high-pressure fuel pump camshaft housing.

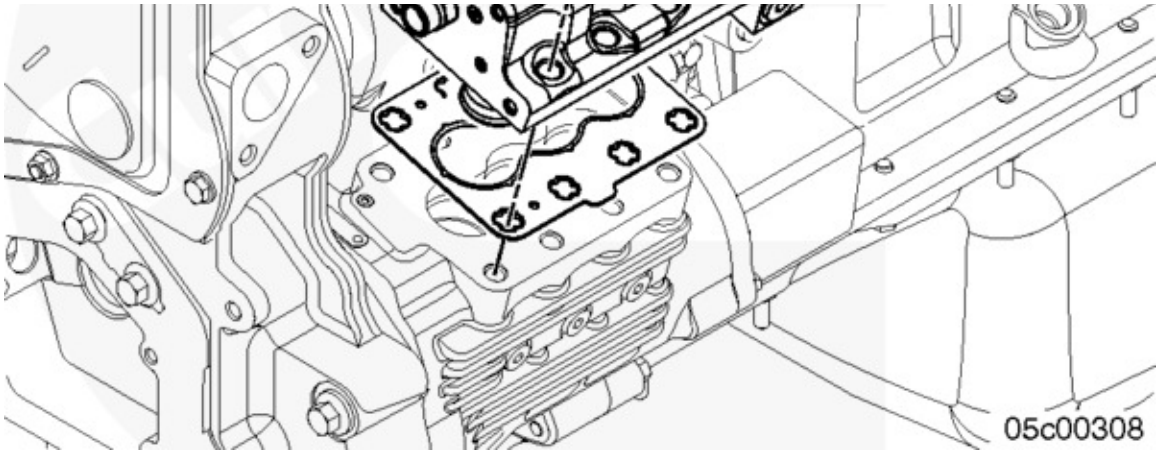
Draw the high-pressure fuel pump head down by alternately tightening the four outer high-pressure fuel pump head capscrews until the head just contacts the camshaft housing.

Install the four center fuel pump head capscrews until the head just contacts the camshaft housing.

Tighten the high-pressure pump fuel head capscrews to the final torque, starting from the center outward.

Torque Value: 68 n•m [50 ft-lb]





Two Cylinder Pump

⚠ CAUTION ⚠

Each tappet must be installed in the same orientation and in the same barrel from which it was removed. Failure to do so can result in engine damage. Marking the tops of the plungers with a felt tip marker will help to make sure that the correct orientation is maintained.

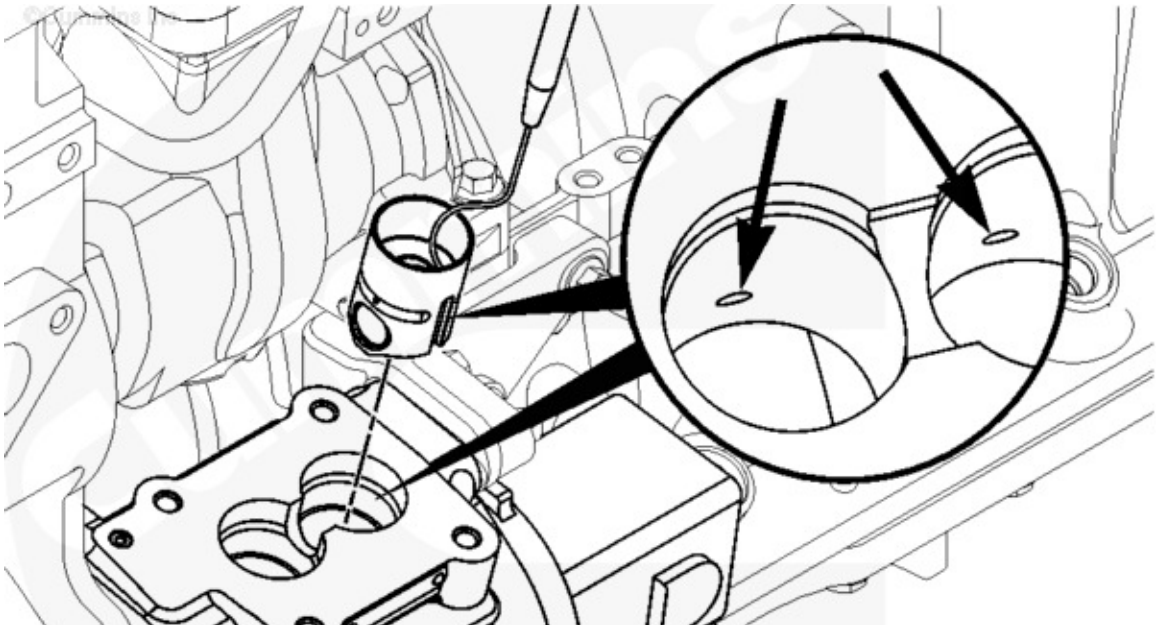
Install the tappets in the original tappet bores.

Make sure the tappets are installed in the original locations.

Make sure that the tappet guide pins engage the guide pin grooves.

Tappet guide pins **must** be aligned so that the guide pin flats are perpendicular to the fuel pump head mounting surface.

Rotate the guide pin to the appropriate position if the guide pin is misaligned.



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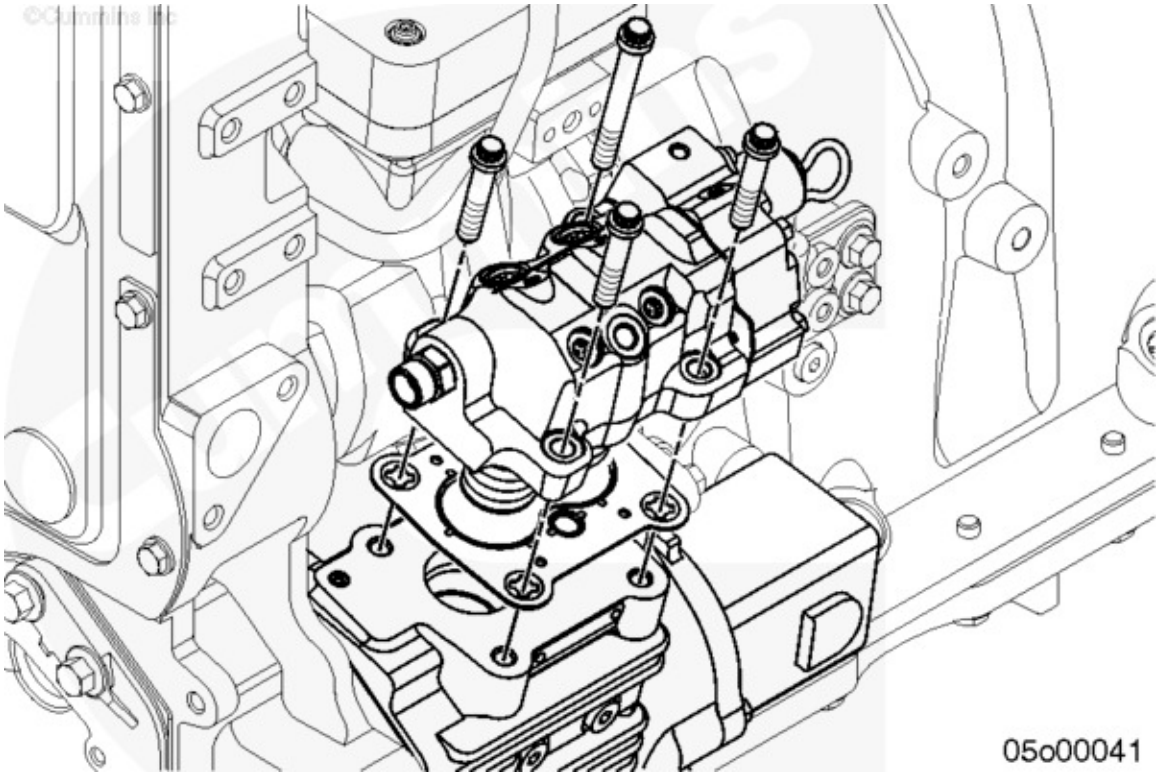
If installing a new or rebuilt pump head, install the new tappet springs and retainers provided with the pump head.

Place the high-pressure fuel pump head and a new gasket onto the high-pressure fuel pump camshaft housing.

Draw the high-pressure fuel pump head down by alternately tightening the four outer high-pressure fuel pump head capscrews until the head just contacts the camshaft housing.

Tighten the high-pressure pump fuel head capscrews to the final torque, starting from the center outward.

Torque Value: 68 n•m [50 ft-lb]



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Note :

Finishing Steps

⚠ WARNING ⚠

Batteries can emit explosive gases. To reduce the possibility of personal injury, always ventilate the compartment before servicing the batteries. To reduce the possibility of arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

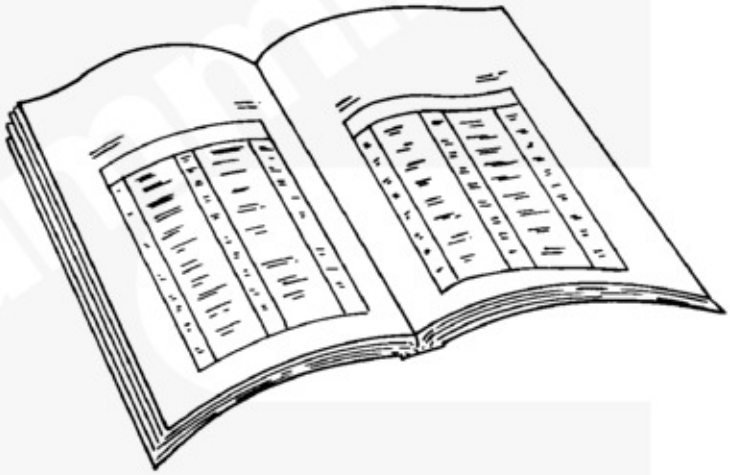
⚠ CAUTION ⚠

Hold banjo fittings while tightening the banjo bolt to prevent fitting rotation. Allowing the banjo fitting to rotate may damage the fuel line.

- Install the fuel pump actuator housing. Refer to Procedure 005-228 in Section 5. (/qs3/pubsys2/xml/en/procedures/132/132-005-228-tr-mixar5.html)
- Connect the fuel supply line to the fuel pump actuator housing. Return the marked banjo bolt to its original location. By **not** doing so, will result in system contamination. Refer to Procedure 006-024 in Section 6. (/qs3/pubsys2/xml/en/procedures/132/132-006-024-tr-mixar5.html)

Note : The fuel line from the ECM cooling plate to the high-pressure fuel pump contains a filter screen at the high-pressure fuel pump banjo fitting. The screen **must** be examined and cleaned, or the banjo bolt replaced, if the screen is damaged.

- Connect the fuel drain connection to the fuel pump actuator housing. Refer to Procedure 006-013 in Section 6. (/qs3/pubsys2/xml/en/procedures/132/132-006-013-tr-mixar5.html)
- Connect the fuel pump-to-rail fuel supply line to the fuel pump. Refer to Procedure 006-051 in Section 6. (/qs3/pubsys2/xml/en/procedures/132/132-006-051-tr-mixar5.html)
- Connect the engine harness to the fuel pump actuator.
- Connect the batteries. See equipment manufacturer service information.
- Start and operate the engine. Check for leaks.



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Last Modified: 13-Jun-2017