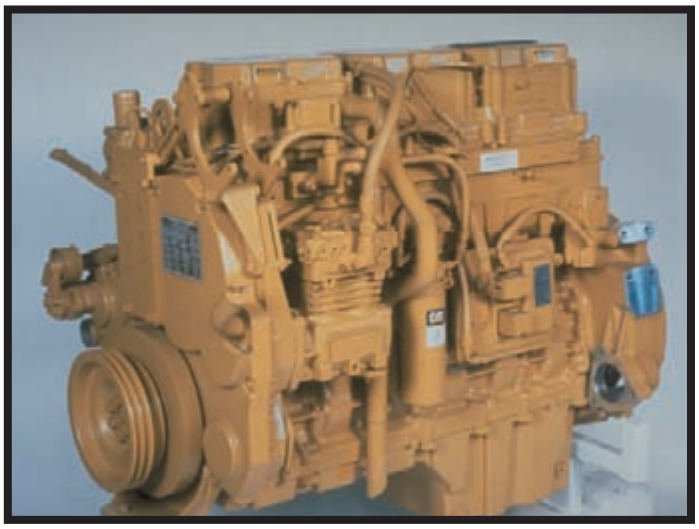
CATERPILLAR®

Caterpillar® Engine Service Training



Introduction to the

3176B Engine ESTMG

serial number prefix: 9CK

LERV0372

Audience:

Level II and III – Service personnel who are familiar with diesel engine operation, diagnostic equipment and procedures for testing and adjusting.

Background and Objectives:

This package contains information on the 3176B engine. Basic design features and system operations are covered.

After learning the information in this presentation, the service technician will be able to:

1. Locate and identify changes made to 3176B engine components

Estimated Time:

30 minutes

Additional Publications:

SERVICE MANUAL – SENR5585

Form No.	Title
SENR2995	Safety
SENR5586	Service Manual Contents
SENR3130	Torque Specifications
SENR5560-01	Specifications
SENR5561-01	Systems Operation, Testing & Adjusting
SENR5502	Supplement Rear PTO
REG00914	Service manual for TU-FLO Air Compressors
SENR5567-01	Disassembly & Assembly
SENR5582	3176B & 3406E Electronic Troubleshooting
SENR5574	3176B & 3406E Electrical Schematic
SEBU6645	Operation and Maintenance

OWNERS INFORMATION PACKAGE SEBU6705

SEBU6645	Operation and Maintenance
SELF5147	Warranty
LEKT4302	TEPS Directory

PARTS BOOK

SEBP2047

3176B Engine Lab Objective: The student will be able to demonstrate the proper technique for new service procedures for the 3176B engine.

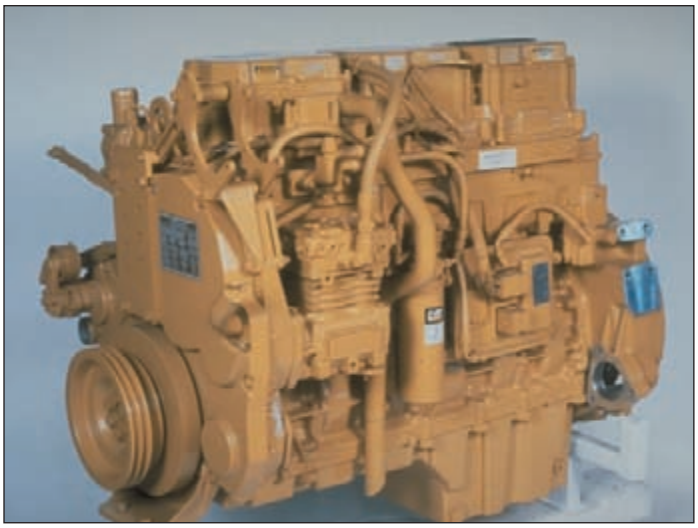
Literature Needed: 3176B Operation and Maintenance Manual SEBU6645

Hardware Needed: 3176B Engine

Time Required: 45 Minutes

Tasks Required by Instructor to Meet Objectives:

1. Lead the class through the fuel system priming procedure.



No. 1

Caterpillar 3176

Introduced in 1988, the 3176 has quickly demonstrated its ability to compete in the heavy-duty truck market. The state-of-the-art electronics combined with the Caterpillar's experience with four stroke diesel engines have made the 3176 truly a world class engine. At 1945 pounds (882 kg), the 3176 has the best weight to horsepower ratio in the industry.

The 3176B is the next generation in this engine series. This engine starts with the strengths established by the 3176 and refines the engine to enhance the fuel economy, performance, and reliability. Another concern for 1994 is the stringent EPA standards which the 3176B is able to meet without the need for after-treatment.

No. 2

Piston

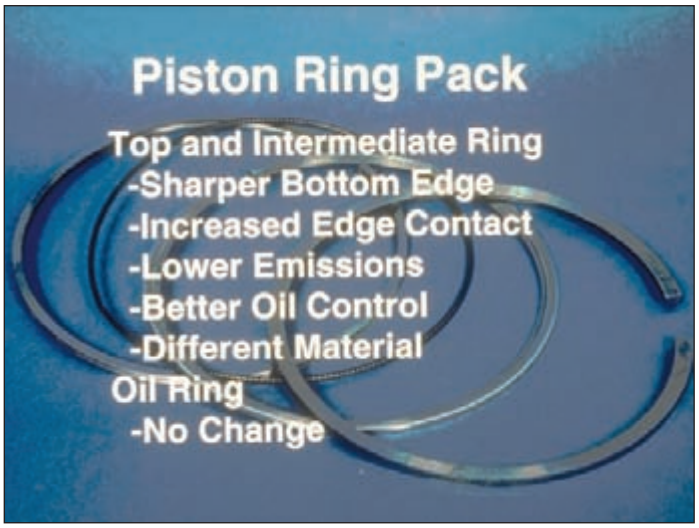
- **Piston Pins**
- **Teflon Plug**

Starting with the piston, we will look at the changes for the 3176B. The piston pin has been increased in length and the retaining rings used on the previous model are no longer used. Teflon plugs in the ends of the piston pin ride on the cylinder wall. The slight mark left on the wall of the cylinder by these plugs is normal and causes no problems in operation. If replacement is necessary, the plugs can be removed with a screwdriver.

No. 3

- **Two piece piston**
- **Forged steel crown**
- **Cast aluminum skirt**

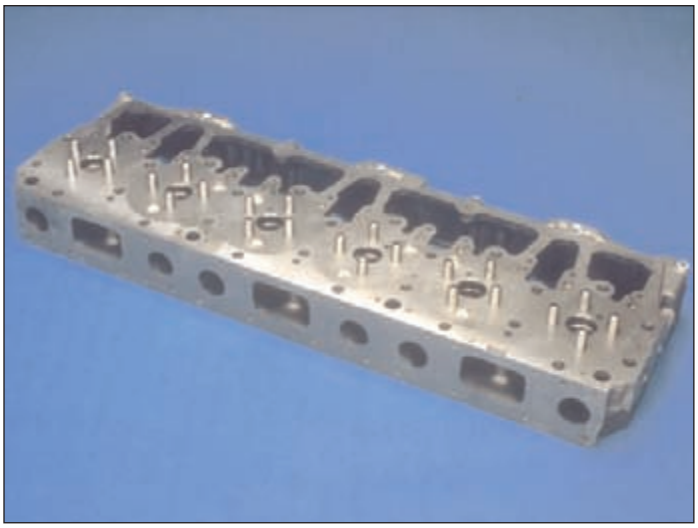
The two piece piston has a forged steel crown with a cast aluminum skirt.



No. 4

- **Piston Ring Pack**

The piston ring pack has changed. A sharper bottom edge and increased edge contact on the top and intermediate ring results in lower emissions and better oil control. The top ring is still plasma coated. The oil ring is the same as in previous 3176 engines.



No. 5

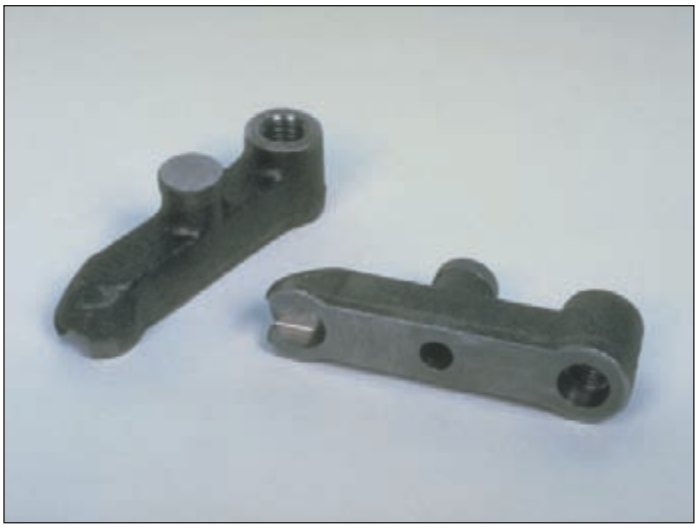
- **Valve Guides – Chamfer**

A chamfer has been added to the top of the valve guide to reduce the oil carryover into the cylinder.

No. 6

- **Roto coil**

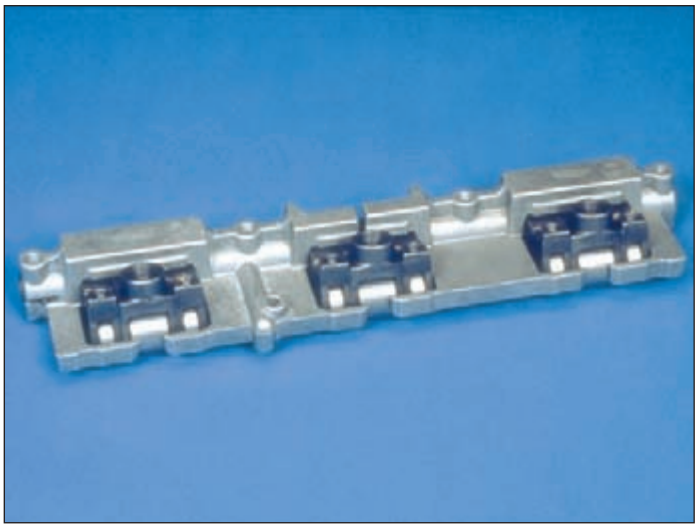
The roto coil on the valves has also been revised to increase reliability. This change helps to reduce the oil consumption and emissions particulates.



No. 7

- **Valve Bridge**

The valve bridge no longer has a dowel pin. Since the bridge now “floats” between the two valve stems, no adjustment is required.

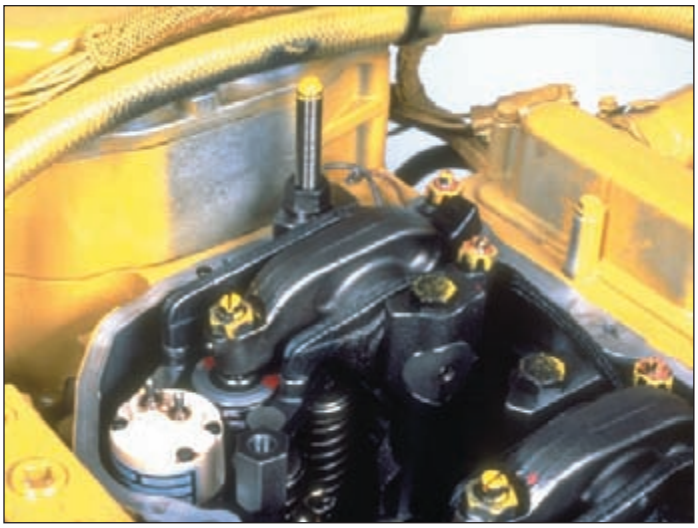


No. 8

- **Injector Roller Follower**
- **New Components:**
  - **Brackets**
  - **Shafts**
  - **Camshafts**
- **Retention Shelf**

Changes have also been made to the lifter and rocker mechanism. Due to the higher injector pressures, a wider injector roller follower is used. Although the lifter for both sets of valves remain the same, their position on the shaft needs to change to make room for the injector lifter. New brackets, shafts, and camshafts are also used for the 3176B to allow for this change in the injector lifters.

A retention shelf surrounds the injector push rod and retains it to protect the engine from damage in the event of an injector seizure.



No. 9

- **Rocker Shaft**
- **New Components:**
  - **Injector Rockers**
  - **Valve Rockers**
  - **Rocker Stand**

At the other end of the valve and injector train, the rocker shaft has increased in size. This requires the use of new injector rockers, valve rockers, and rocker stand.

No. 10

Electronic Unit Injector

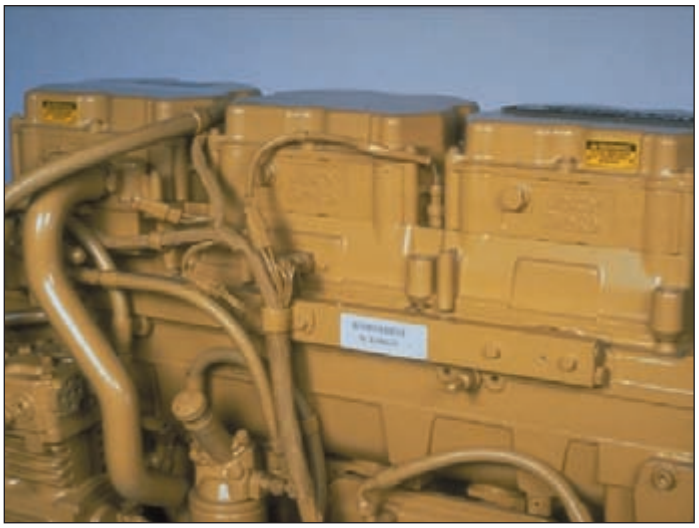
- **Eliminate fill port**
- **New Solenoid**
- **O-ring groove**

Some changes have been made to the Electronic Unit Injector (EUI) for the 3176B model. The new injector uses higher injection pressures utilizing a reduced orifice size. The fill port has been eliminated. Also the solenoid on the new EUI is non-metallic and has been redesigned to improve reliability. The O-ring groove has been lowered and the injector body has increased cone diameter also improving reliability. The fill port in the injector has been removed to improve emissions by reducing delivery and timing variability.

No. 11

- **Fill Port removed**
- **New priming procedure**

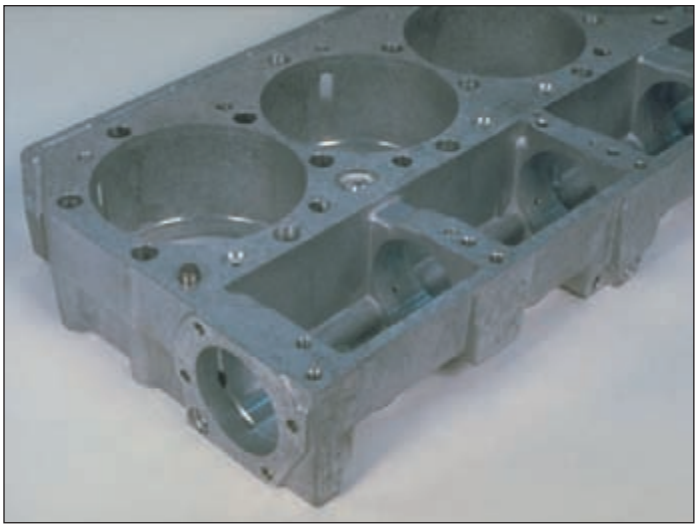
However, the removal of the fill port requires the use of a new priming procedure. To prime the low pressure system open the air bleed on the siphon block. Hand prime the pump to remove the air. Close the air bleed. hand prime the pump until the valve opens. When this happens, an audible click will be heard from the valve. Tighten the priming pump handle. The engine is now primed and can be started.



No. 12

- **Revised Spacer Block profile**
- **Revised Cylinder Head profile**

The spacer block and cylinder head profiles were changed to increase the area behind the head gasket fire ring to improve the head gasket reliability.



No. 13

- **Camshaft Support**

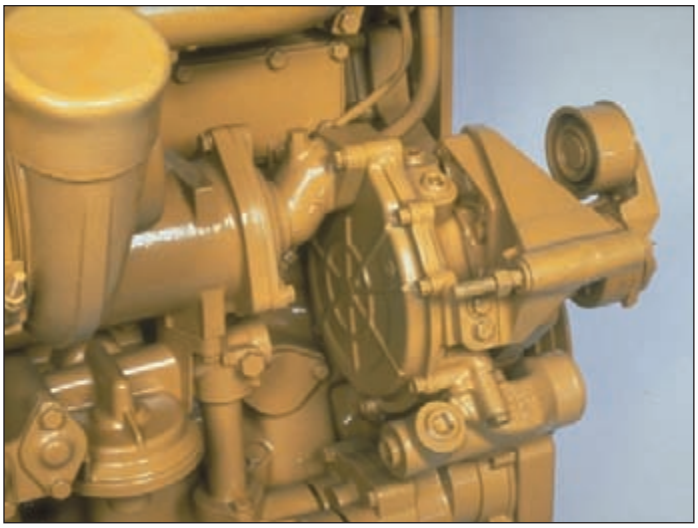
The aluminum material in the spacer block is similar to the material found in camshaft bushings in other engines. This eliminates the need for camshaft bushing. However, if these bores become damaged, cam bushings are available for field repairs.

No. 14

Fuel Transfer Pump

- **Cast iron**
- **Pressure Regulator**
- **Replaceable Roller Bearings**

The redesigned transfer pump is cast iron to improve durability and remanufacturability. In addition, the pressure regulator has been moved inside the pump. Previously the pressure regulator was located in the siphon block. The new pump uses replaceable roller bearings and is completely serviceable.



No. 15

- **Water Pump:**
  - **Cast Iron**
  - **20% increase in flow rate**
  - **Additional Return Line**
  - **Seal Changes**
- **New Alternator Bracket**

The water pump housing is now made of cast iron instead of aluminum. The 3176B water pump is larger, and has a 20% increase in flow rate. A higher by-pass flow provides for more efficient cab and accessory heating. An additional return line has also been added. Changes to the seal have been made that make the seal more debris resistant and prevent early leaks. the stationary ring face is now an alumina ceramic material and the rotary ring is made of sintered carbon.

This pump requires the use of a new alternator bracket.

No. 16

Turbocharger

- Turbine Housing
- Improved Response
- Larger Bearing
- Left Hand Threads

Changes have been made to the turbocharger. A different turbine housing, improved response, larger bearing, higher performance wheels, left-handed threads on the shaft are all changes made to the new 1993 turbocharger that is utilized on the 3176B engine.

No. 17

- **Cylinder Block**
  - **minor casting changes**

The cylinder block has had a minor casting change to accommodate the new ECM.

No. No. 18

- **Liner Band Seal**
- **Rectangular Seals - coolant and oil**
- **Rectangular Seal in Spacer Block**
- **Small Rectangular Seal**

A new liner band seal is used for the mid supported cylinder liner with high ring travel cooling. Rectangular seals are used to seal both the coolant and the oil. A rectangular seal, located in the spacer block, seats against the large outside diameter of the liner directly above the liner seat to seal coolant in the spacer block. A smaller d-shaped seal, located below the liner seat, seals the oil from seeping between the liner and block.

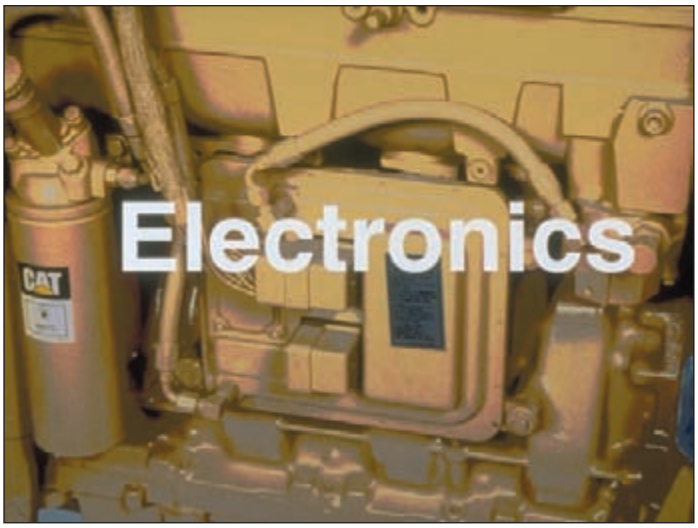
No. 19

- **Integrated Timing Ring** An integrated timing ring on the camshaft is also used.

No. 20

- **Valve Cover Base**

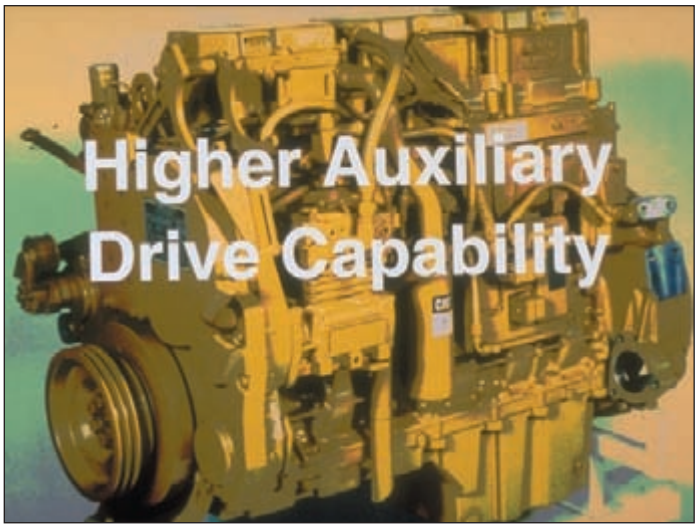
The valve cover base has been changed to accommodate a new wiring harness, 12 pin DT connector and atmospheric pressure sensor.



No. 21

- **Electronic Changes**

In addition to these changes incorporated into the mechanical portion of the 3176B, other changes have been made to the electronics of the engine. These changes are covered in the material covering the electronics for both the 3176B and the 3406E engines.



No. 22

- **Higher Auxiliary Drive Capability**

The idler gear was widened to increase the strength and allow for higher auxiliary drive capability such as hydraulic pumps.

No. 23

- **Two Optional Bypass Oil Filters**

The user now has a choice of two optional engine mounted bypass oil filters. The standard paper medial element filter is still available or a new centrifugal filter with disposable cartridges can be used.

QUIZ w/Answers

1. The 3176B Piston Pin uses teflon retainer plugs that are press fit using 30 PSI pressure to seat them.

   ☐ True

   ■ False Just install - liner wall holds in place

2. The piston ring pack on the 3176B has remained the same as the 3176.

   ☐ True

   ■ False Oil Ring same - change to edges on top & intermediate

3. The value bridge no longer has a dowel pin and floats on the two valve stems therefore the adjustment is now easier to set.

   ☐ True

   ■ False No adjustment necessary

4. The 3176B EUI uses higher injection pressures utilizing a reduced orifice size and the fill port and edge filter have also been eliminated.

   ■ True

   ☐ False

5. The aluminum spacer block uses copper clad bushings for the camshaft similar to those used in other engines.

   ☐ True

   ■ False No bushings required in a new aluminum spacer block

6. The redesigned cast iron transfer pump can be used to replace the original aluminum design.

   ■ True

   □ False

7. A different turbine housing, improved response, larger bearings, left-handed threads on the shaft are just some of the changes to the new 1993 Turbocharger used on the 3176B engine.

   ■ True

   □ False

8. The Camshaft drive gear and Timing ring are now integrated into one machined part number pressed onto the camshaft.

   ■ True

   □ False

9. The 3176B user has a choice of two optional engine mounted bypass oil filters.

   (List both) No adjustment necessary
   standard paper medial element filter,
   centrifugal filter

10. Priming the Fuel system after changing the fuel filter is no longer required.

    □ True

    ■ False More important than before
    special procedure

QUIZ

1. The 3176B Piston Pin uses teflon retainer plugs that are press fit using 30 PSI pressure to seat them.

   ☐ True

   ☐ False

2. The piston ring pack on the 3176B has remained the same as the 3176.

   ☐ True

   ☐ False

3. The value bridge no longer has a dowel pin and floats on the two valve stems therefore the adjustment is now easier to set.

   ☐ True

   ☐ False

4. The 3176B EUI uses higher injection pressures utilizing a reduced orifice size and the fill port and edge filter have also been eliminated.

   ☐ True

   ☐ False

5. The aluminum spacer block uses copper clad bushings for the camshaft similar to those used in other engines.

   ☐ True

   ☐ False

6. The redesigned cast iron transfer pump can be used to replace the original aluminum design.

   ☐ True

   ☐ False

7. A different turbine housing, improved response, larger bearings, left-handed threads on the shaft are just some of the changes to the new 1993 Turbocharger used on the 3176B engine.

   ☐ True

   ☐ False

8. The Camshaft drive gear and Timing ring are now integrated into one machined part number pressed onto the camshaft.

   ☐ True

   ☐ False

9. The 3176B user has a choice of two optional engine mounted bypass oil filters. (List both)

10. Priming the Fuel system after changing the fuel filter is no longer required.

    ☐ True

    ☐ False


CATERPILLAR®